Welcome to the

1999 Jeep® Grand Cherokee

Electronic Service Manual

Click on the logo to begin

DaimlerChrysler
International Operations

GROUP TAB LOCATOR

INTRODUCTION

CONTENTS

DESCRIPTION AND OPERATION

VEHICLE IDENTIFICATION NUMBER (VIN)

DESCRIPTION

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.

VEHICLE IDENTIFICATION NUMBER DECODING CHART

POSITION	INTERPRETATION	CODE = DESCRIPTION
1	Country of Origin	1 = United States
2	Make	J = Jeep
3	Vehicle Type	4 = MPV
4	Gross Vehicle Weight Rating	G = 5001-6000 lbs.
5	Vehicle Line	2= Grand Cherokee 4X2 (LHD) W = Grand Cherokee 4X4 (LHD)
6	Series	5 = Laredo 6 = Limited
7	Body Style	8 = 4dr Sport Utility
8	Engine	S = 4.0 Liter N = 4.7Liter
9	Check Digit	
10	Model Year	X = 1999
11	Assembly Plant	C = Jefferson Assembly
12 thru 17	Vehicle Build Sequence	

DESCRIPTION AND OPERATION (Continued)

VEHICLE SAFETY CERTIFICATION LABEL

DESCRIPTION

A vehicle safety certification label (Fig. 1) is attached to every Chrysler Corporation vehicle. The label certifies that the vehicle conforms to all applicable Federal Motor Vehicle Safety Standards. The label also lists:

- 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.
- Paint and Trim codes.
- Country of origin.

The label is located on the driver-side door shutface.

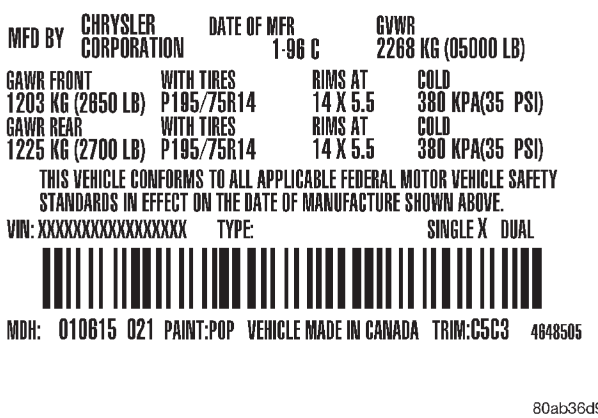


Fig. 1 Vehicle Safety Certification Label

BODY CODE PLATE

DESCRIPTION

A metal Body Code plate is located in the engine compartment and attached to the top of the right frame rail. The information listed on the plate (Fig. 2) is used for manufacturing and service purposes.

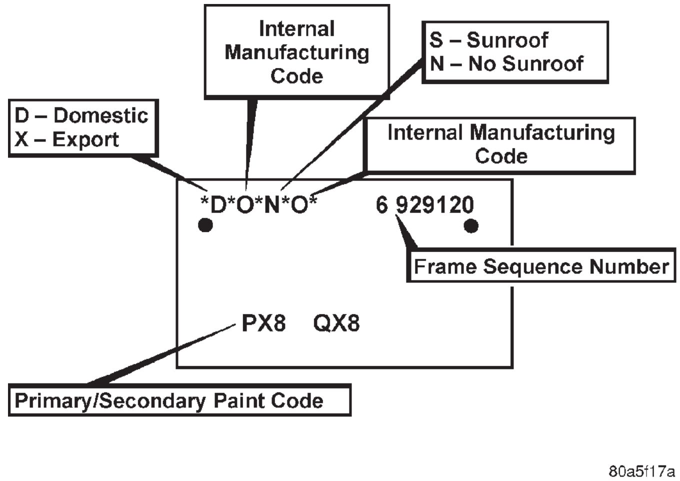


Fig. 2 Body Code Plate

SERVICE PROCEDURES

THREADED HOLE REPAIR

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

SPECIFICATIONS

INTERNATIONAL VEHICLE CONTROL AND DISPLAY SYMBOLS

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

FASTENER IDENTIFICATION

THREAD IDENTIFICATION

SAE and metric bolt/nut threads are not the same. The difference is described in the Thread Notation chart (Fig. 4).

SPECIFICATIONS (Continued)

INTERNATIONAL CONTROL AND DISPLAY SYMBOLS

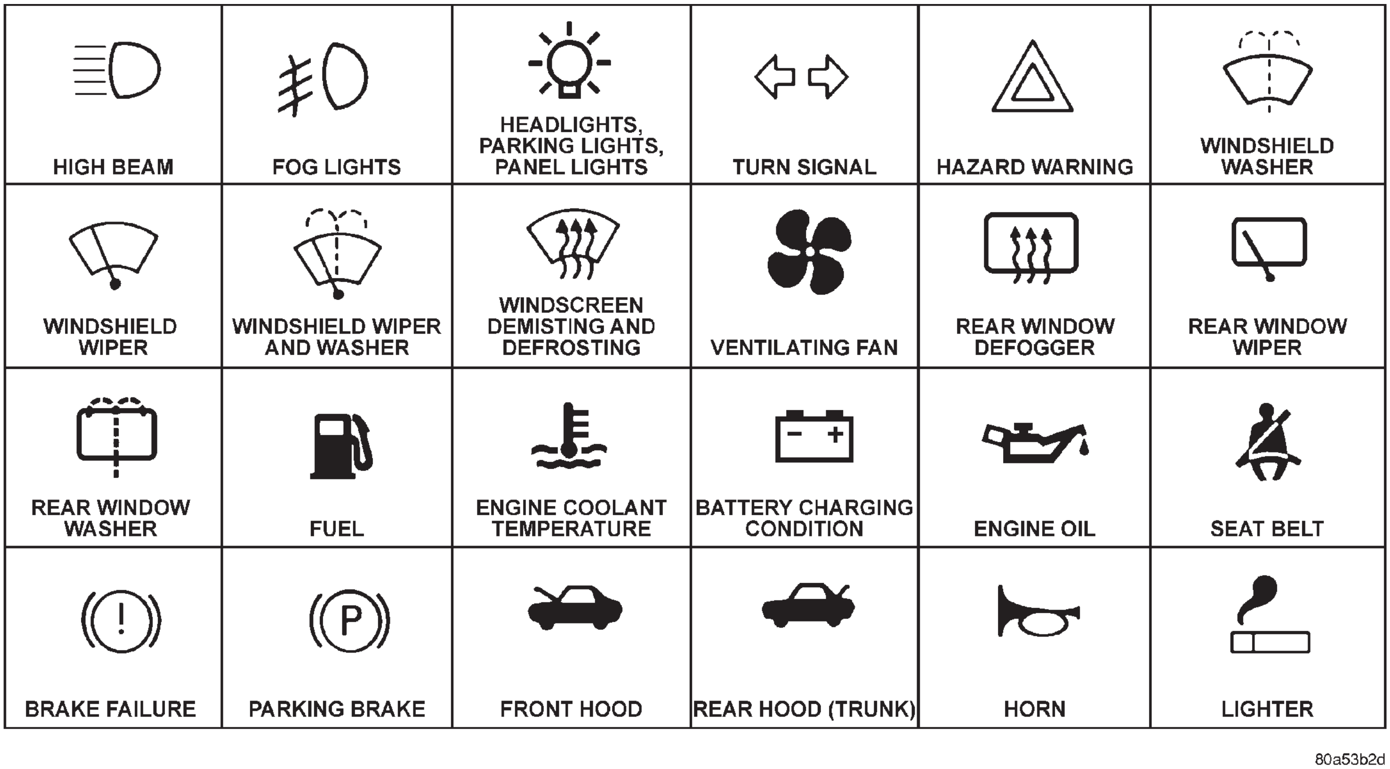


Fig. 3

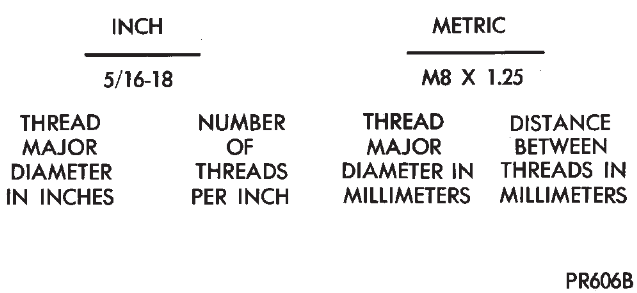


Fig. 4 Thread Notation Chart – SAE and Metric

GRADE/CLASS IDENTIFICATION

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

FASTENER USAGE

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

Figure art, specifications and torque references in this Service Manual are identified in metric and SAE format.

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

SPECIFICATIONS (Continued)

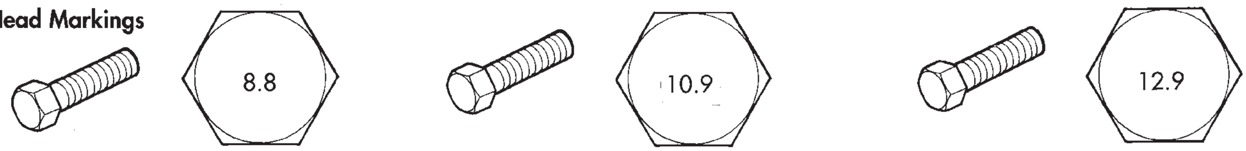
FASTENER IDENTIFICATION

Bolt Markings and Torque - Metric

Commercial Steel Class

	8.8	10.9	12.9

Bolt Head Markings

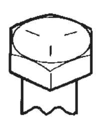


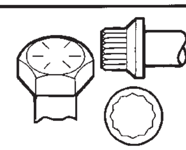
Body Size Diam. mm	8.8 Torque Cast Iron N•m	ft-lb	Aluminum N•m	ft-lb	10.9 Torque Cast Iron N•m	ft-lb	Aluminum N•m	ft-lb	12.9 Torque Cast Iron N•m	ft-lb	Aluminum N•m	ft-lb
6	9	5	7	4	14	9	11	7	14	9	11	7
7	14	9	11	7	18	14	14	11	23	18	18	14
8	25	18	18	14	32	23	25	18	36	27	28	21
10	40	30	30	25	60	45	45	35	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





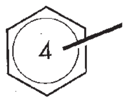
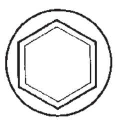
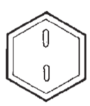
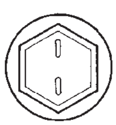
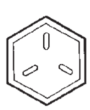
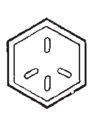
Body Size	Bolt Torque - Grade 5 Bolt: Cast Iron N•m	ft-lb	Aluminum N•m	ft-lb	Bolt Torque - Grade 8 Bolt: Cast Iron N•m	ft-lb	Aluminum N•m	ft-lb
1/4 - 20	9	7	8	6	15	11	12	9
- 28	12	9	9	7	18	13	14	10
5/16 - 18	20	15	16	12	30	22	24	18
- 24	23	17	19	14	33	24	25	19
3/8 - 16	40	30	25	20	55	40	40	30
- 24	40	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

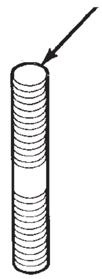
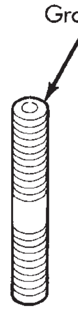
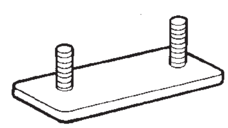
95IN-6

SPECIFICATIONS (Continued)

FASTENER STRENGTH

HOW TO DETERMINE BOLT STRENGTH

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

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

95IN-4

SPECIFICATIONS (Continued)

METRIC SYSTEM

The metric system is based on quantities of one, ten, one hundred, one thousand and one million (Fig. 5).

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

J901N-2

Fig. 5 Metric Prefixes

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

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

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		

J91IN-1

SPECIFICATIONS (Continued)

METRIC CONVERSION

in-lbs to N•m

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

N•m to in-lbs

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

ft-lbs to N•m

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

N•m to ft-lbs

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

in. to mm

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

mm to in.

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

J901N-10

SPECIFICATIONS (Continued)

TORQUE REFERENCES

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

TORQUE SPECIFICATIONS

SPECIFIED TORQUE FOR STANDARD BOLTS

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

INTRODUCTION

CONTENTS

DESCRIPTION AND OPERATION

VEHICLE IDENTIFICATION NUMBER (VIN)

DESCRIPTION

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.

VEHICLE IDENTIFICATION NUMBER DECODING CHART

POSITION	INTERPRETATION	CODE = DESCRIPTION
1	Country of Origin	1 = Austria
2	Make	J = Jeep
3	Vehicle Type	4 = MPV
4	Gross Vehicle Weight Rating	G = 5001-6000 lbs.
5	Vehicle Line	2 = Grand Cherokee 4X2 (LHD) W = Grand Cherokee 4X4 (LHD) 7 = Grand Cherokee 4X2 (RHD) 8 = Grand Cherokee 4X4 (RHD)
6	Series	5 = Laredo 6 = Limited
7	Body Style	8 = 4dr Sport Utility
8	Engine	S = 4.0L 6 cyl. (MPI) Unleaded N = 4.7L 8 cyl. (MPI) Unleaded 4 = 3.1L 5 cyl. Turbo Diesel V = 4.0L 6 cyl. (MPI) Leaded
9	Check Digit	
10	Model Year	X = 1999
11	Assembly Plant	Y = Steyr Assembly
12 thru 17	Vehicle Build Sequence	

DESCRIPTION AND OPERATION (Continued)

VEHICLE SAFETY CERTIFICATION LABEL

DESCRIPTION

A vehicle safety certification label (Fig. 1) is attached to every Chrysler Corporation vehicle. The label certifies that the vehicle conforms to all applicable Federal Motor Vehicle Safety Standards. The label also lists:

- 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.
- Paint and Trim codes.
- Country of origin.

The label is located on the driver-side door shutface.

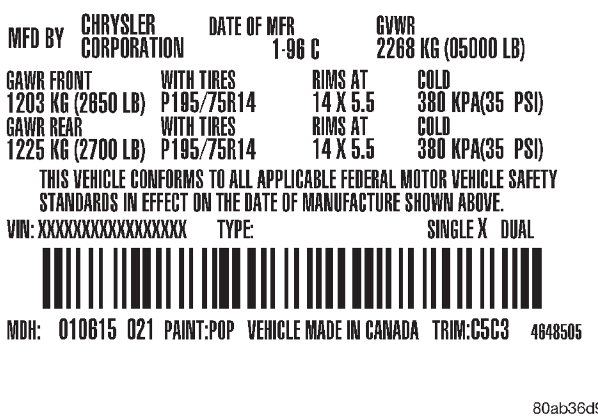


Fig. 1 Vehicle Safety Certification Label

BODY CODE PLATE

DESCRIPTION

A metal Body Code plate is located in the engine compartment and attached to the top of the right frame rail. The information listed on the plate (Fig. 2) is used for manufacturing and service purposes.

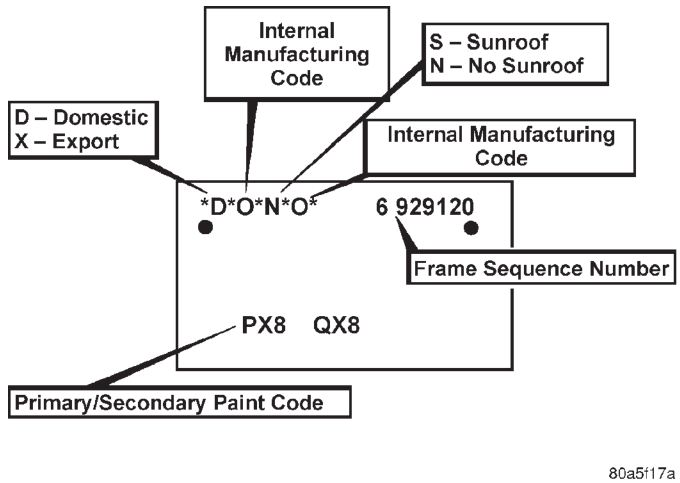


Fig. 2 Body Code Plate

SERVICE PROCEDURES

THREADED HOLE REPAIR

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

SPECIFICATIONS

INTERNATIONAL VEHICLE CONTROL AND DISPLAY SYMBOLS

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

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 10.9. The metric strength class identification number is imprinted on the head of the bolt. The higher the class number, the greater the bolt strength. Some metric nuts are imprinted with a single-digit strength class on the nut face. Refer to the Fastener Identification and Fastener Strength Charts.

INTERNATIONAL CONTROL AND DISPLAY SYMBOLS

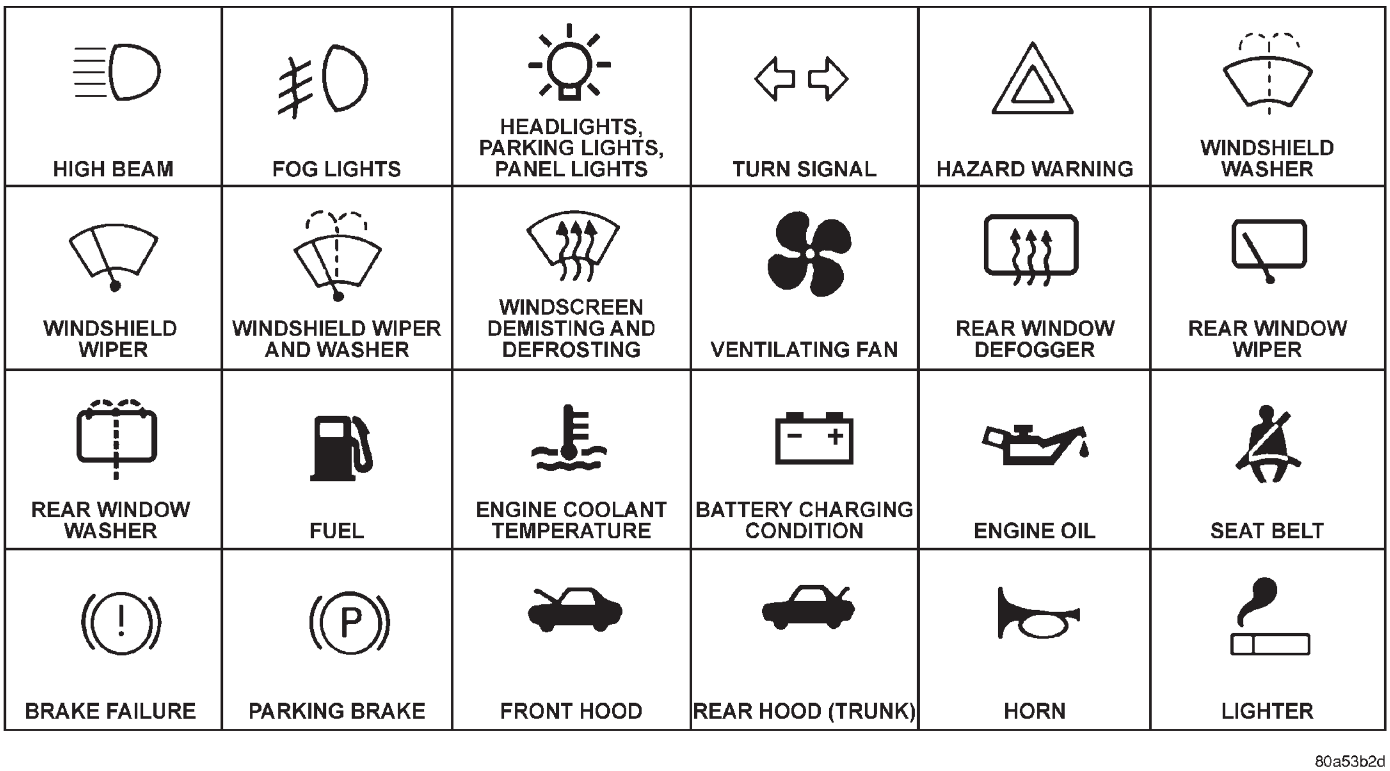


Fig. 3

FASTENER IDENTIFICATION

THREAD IDENTIFICATION

SAE and metric bolt/nut threads are not the same. The difference is described in the Thread Notation chart (Fig. 4).

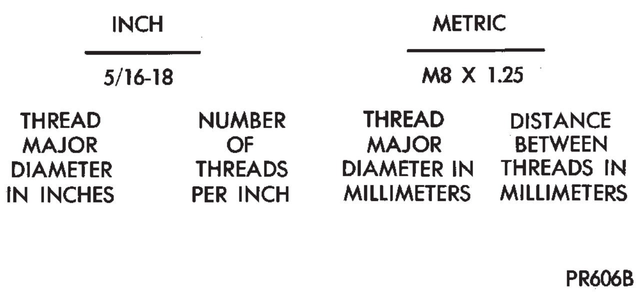


Fig. 4 Thread Notation Chart – SAE and Metric

FASTENER USAGE

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

Figure art, specifications and torque references in this Service Manual are identified in metric and SAE format.

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

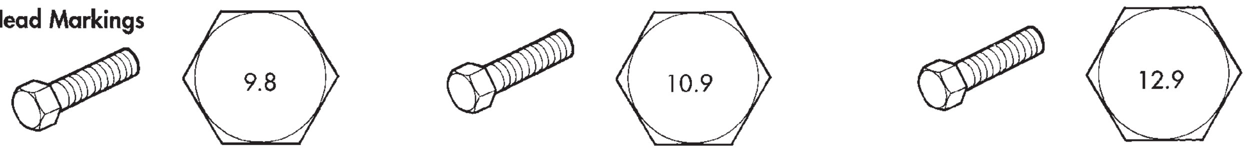
SPECIFICATIONS (Continued)

FASTENER IDENTIFICATION

Bolt Markings and Torque - Metric

Commercial Steel Class: 8.8 | 10.9 | 12.9

Bolt Head Markings

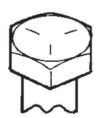


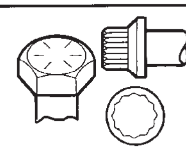
Body Size Diam.	8.8 Torque Cast Iron		8.8 Torque Aluminum		10.9 Torque Cast Iron		10.9 Torque Aluminum		12.9 Torque Cast Iron		12.9 Torque Aluminum	
mm	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb
6	9	5	7	4	14	9	11	7	14	9	11	7
7	14	9	11	7	18	14	14	11	23	18	18	14
8	25	18	18	14	32	23	25	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		Bolt Torque - Grade 5 Bolt Aluminum		Bolt Torque - Grade 8 Bolt Cast Iron		Bolt Torque - Grade 8 Bolt Aluminum	
	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	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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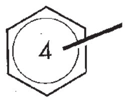
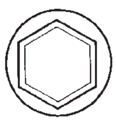
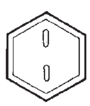
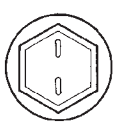
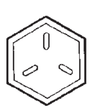
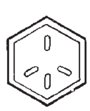
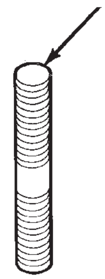
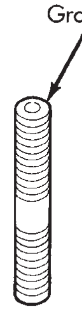
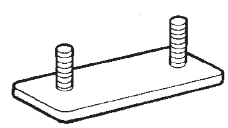
SPECIFICATIONS (Continued)

FASTENER STRENGTH

HOW TO DETERMINE BOLT STRENGTH

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

95IN-4

SPECIFICATIONS (Continued)

METRIC SYSTEM

The metric system is based on quantities of one, ten, one hundred, one thousand and one million (Fig. 5).

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

J901N-2

Fig. 5 Metric Prefixes

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

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

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		

J91IN-1

SPECIFICATIONS (Continued)

METRIC CONVERSION

in-lbs to N•m

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

N•m to in-lbs

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

ft-lbs to N•m

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

N•m to ft-lbs

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

in. to mm

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

mm to in.

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

J901N-10

SPECIFICATIONS (Continued)

TORQUE REFERENCES

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

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

LUBRICATION AND MAINTENANCE

CONTENTS

LUBRICANTS

INDEX

DESCRIPTION AND OPERATION

PARTS AND LUBRICANT RECOMMENDATIONS

DESCRIPTION

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

CLASSIFICATION OF LUBRICANTS

DESCRIPTION

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

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

SAE VISCOSITY RATING

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

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

Chrysler Corporation only recommends multiple grade engine oils.

API QUALITY CLASSIFICATION

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

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

Fig. 1 API Symbol

GEAR LUBRICANTS

SAE ratings also apply to multiple grade gear lubricants. In addition, API classification defines the lubricants usage. Such as API GL-5 and SAE 80W-90.

DESCRIPTION AND OPERATION (Continued)

LUBRICANTS AND GREASES

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

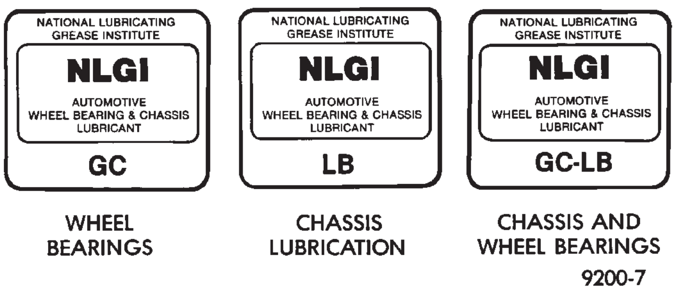


Fig. 2 NLGI Symbol

INTERNATIONAL SYMBOLS

DESCRIPTION

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

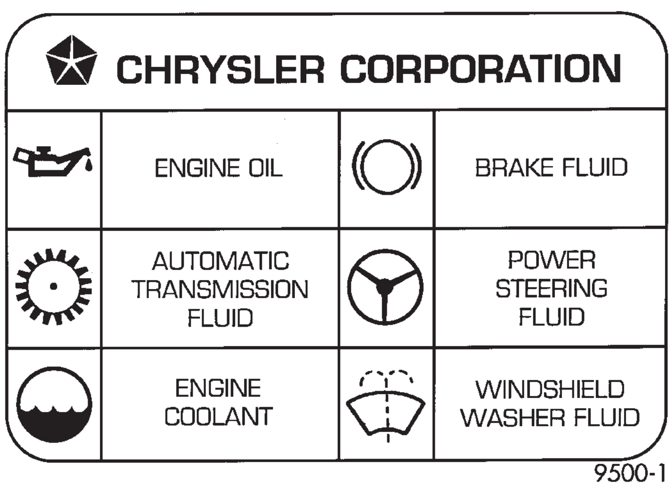


Fig. 3 International Symbols

FLUID FILL/CHECK LOCATIONS

DESCRIPTION

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

LUBRICATION POINT LOCATIONS

DESCRIPTION

Lubrication point locations are located in each applicable group.

SPECIFICATIONS

FLUID CAPACITIES

FUEL TANK

All	78 L (20.5 gal.)

ENGINE OIL W/FILTER CHANGE

4.0L	5.7 L (6.0 qts.)
4.7L	5.7 L (6.0 qts.)

COOLING SYSTEM

CAUTION: Vehicle may be equipped with long life coolant. Extended life coolant is identified by an orange color. Normal coolant is identified by a greenish color. It is recommended that the two types of coolant not be mixed.

4.0L	12.3 L (13.0 qts.)*
4.7L	12.3 L (13.0 qts.)*

*Includes 2.2 L (2.3 qts.) for coolant recovery bottle.

AUTOMATIC TRANSMISSION

Dry fill capacity. *

42RE	9.1-9.5L (19-20 pts.)
45RFE	13.33 L (28.0 pts.)

* Depending on type and size of internal cooler, length and inside diameter of cooler lines, or use of an auxiliary cooler, these figures may vary. Refer to Group 21, Transmission for proper fluid fill procedure.

TRANSFER CASE

242 NVG	1.4 L (3.0 pts.)
247 NVG	1.1 L (2.5 pts.)

FRONT AXLE

186 FBI	1.18 L (2.5 pts.)
186FBI‡	1.19L (2.51 pts.)

‡If the vehicle is equipped with VARI-LOK, include 0.07L (0.15 pts.) of friction modifier.

SPECIFICATIONS (Continued)

REAR AXLE

198 RBI* . . . . 1.6 L (3.5 pts.)
198RBI ‡ . . . . 1.78L (3.76 pts.)
226 RBA* . . . . 2.24 L (4.75 pts.)
226RBA ‡‡ . . . . 2.25L (4.75 pts.)

* If the vehicle is equipped with TRAC-LOK, include 0.11 L (0.25 pts.) of friction modifier.

‡ If the vehicle is equipped with a VARI-LOK, include 0.09L (0.19 pts.) of friction modifier.

‡‡ If the vehicle is equipped with a VARI-LOK, include 0.12L (0.25 pts.) of friction modifier.

NOTE: Vehicles with trailer tow, must use a synthetic lubricant. Refer to Group 3, Differential and Driveline for service procedures.

POWER STEERING

Power steering fluid capacities are dependent on engine/chassis options as well as steering gear/cooler options. Depending on type and size of internal cooler, length and inside diameter of cooler lines, or use of an auxiliary cooler, these capacities may vary. Refer to Section 19 of the service manual for proper fill and bleed procedures.

MAINTENANCE SCHEDULES

INDEX

DESCRIPTION AND OPERATION

MAINTENANCE SCHEDULES

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

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

Second is Schedule **"B"**. It is a schedule for vehicles that are operated under the following conditions:

- Frequent short trip driving less than 5 miles (8 km)
- Frequent driving in dusty conditions
- Extensive idling
- Trailer towing
- Sustained high speed operation
- Off road driving
- Desert operation
- Frequent starting and stopping
- Cold climate operation
- Commercial service

Use the schedule that best describes the driving conditions.

Where time and mileage are listed, follow the interval that occurs first.

EMISSION CONTROL SYSTEM MAINTENANCE

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

SPECIFICATIONS

UNSCHEDULED INSPECTION

AT EACH STOP FOR FUEL

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

ONCE A MONTH

- Check tire pressure (including spare) and look for unusual wear or damage.
- Inspect battery and clean and tighten terminals as required.
- Check fluid levels of coolant reservoir, power steering and transmission and add as needed.

AT EACH OIL CHANGE

- Inspect exhaust system.
- Inspect brake hoses.
- Rotate the tires at each oil change interval shown on Schedule—A (7,500 miles) or every other interval shown on Schedule—B (6,000 miles).
- Check coolant level, hoses and clamps.
- Lubricate suspension ball joints.
- After completion of off-road (4WD) operation, the underside of the vehicle should be thoroughly inspected. Examine threaded fasteners for looseness.

SCHEDULE—A

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

- Change engine oil.
- Replace engine oil filter.

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

- Change engine oil.
- Replace engine oil filter.
- Lubricate upper knuckle ball stud.

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

- Change engine oil.
- Replace engine oil filter.
- Inspect brake linings.

SPECIFICATIONS (Continued)

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

- Change engine oil.
- Replace engine oil filter.
- **Replace engine air cleaner element.**
- **Replace spark plugs.**
- Inspect and adjust drive belt (4.0L only).
- Drain and refill automatic transmission fluid and change filter.
- Drain and refill transfer case fluid.
- Lubricate upper knuckle ball stud.

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

- Change engine oil.
- Replace engine oil filter.

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

- Change engine oil.
- Replace engine oil filter.
- Inspect brake linings.
- Flush and replace engine coolant at 36 months, regardless of mileage.
- Lubricate upper knuckle ball stud.

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

- Change engine oil.
- Replace engine oil filter.
- Flush and replace engine coolant if not done at 36 months.

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

- Change engine oil.
- Replace engine oil filter.
- **Replace engine air cleaner element.**
- **Replace spark plugs.**
- **Inspect PCV valve and replace if necessary (4.7L only).***
- Inspect and adjust drive belt (4.0L only).
- Drain and refill automatic transmission fluid and change filter.
- Drain and refill transfer case fluid.
- Lubricate upper knuckle ball stud.

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

- Change engine oil.
- Replace engine oil filter.
- Inspect brake linings

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

- Change engine oil.
- Replace engine oil filter.
- Lubricate upper knuckle ball stud.
- Flush and replace engine coolant if it has been 30,000 miles (48 000 km) or 24 months since last change.

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

- Change engine oil.
- Replace engine oil filter.
- Flush and replace engine coolant if it has been 30,000 miles (48 000 km) or 24 months since last change.

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

- Change engine oil.
- Replace engine oil filter.
- **Replace engine air cleaner element.**
- **Replace spark plugs.**
- Inspect and adjust drive belt (4.0L only).
- Inspect and replace drive belt if needed (4.7L only).
- Drain and refill automatic transmission fluid and change filter.
- Drain and refill transfer case fluid.
- Inspect brake linings.
- Lubricate upper knuckle ball stud.

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

- Change engine oil.
- Replace engine oil filter.

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

- Change engine oil.
- Replace engine oil filter.
- Inspect and replace drive belt if not previously replaced (4.7L only).
- Flush and replace engine coolant if it has been 30,000 miles (48 000 km) or 24 months since last change.
- Lubricate upper knuckle ball stud.

112,500 Miles (180 000 km) or at 90 months

- Change engine oil.
- Replace engine oil filter.
- Inspect brake linings.
- Flush and replace engine coolant if it has been 30,000 miles (48 000 km) or 24 months since last change.

120,000 Miles (192 000 km) or at 96 months

- Change engine oil.
- Replace engine oil filter.
- **Replace engine air cleaner element.**
- **Replace spark plugs.**
- **Inspect PCV valve and replace if necessary (4.7L only).***
- Inspect and adjust drive belt (4.0L only).
- Inspect and replace drive belt if not previously replaced (4.7L only).
- Drain and refill automatic transmission fluid and change filter.
- Drain and refill transfer case fluid.

SPECIFICATIONS (Continued)

- Lubricate upper knuckle ball stud.

*This maintenance is recommended, but is not required to maintain warranty on the PCV valve.

IMPORTANT: Inspection and service should also be performed anytime a malfunction is observed or suspected.

SCHEDULE—B

3,000 Miles (5 000 km)
- Change engine oil.
- Replace engine oil filter.
- Lubricate steering linkage.

6,000 Miles (10 000 km)
- Change engine oil.
- Replace engine oil filter.
- Lubricate upper knuckle ball stud.

9,000 Miles (14 000 km)
- Change engine oil.
- Replace engine oil filter.

12,000 Miles (19 000 km)
- Change engine oil.
- Replace engine oil filter.
- Drain and refill automatic transmission fluid and change filter.
- Drain and refill front and rear axles.
- Inspect brake linings.
- Lubricate upper knuckle ball stud.

15,000 miles (24 000 km)
- Change engine oil.
- Replace engine oil filter.
- **Inspect engine air cleaner element, replace as necessary.**

18,000 Miles (29 000 km)
- Change engine oil.
- Replace engine oil filter.
- Lubricate upper knuckle ball stud.

21,000 Miles (34 000 km)
- Change engine oil.
- Replace engine oil filter.

24,000 Miles (38 000 km)
- Change engine oil.
- Replace engine oil filter.
- Drain and refill automatic transmission fluid and change filter.
- Drain and refill front and rear axles.
- Inspect brake linings.
- Lubricate upper knuckle ball stud.

27,000 Miles (43 000 km)
- Change engine oil.
- Replace engine oil filter.

30,000 Miles (48 000 km)
- Change engine oil.
- Replace engine oil filter.
- **Replace engine air cleaner element.**
- **Replace spark plugs.**
- Inspect and adjust drive belt (4.0L only).
- Drain and refill transfer case fluid.
- Lubricate upper knuckle ball stud.

33,000 Miles (53 000 km)
- Change engine oil.
- Replace engine oil filter.

36,000 Miles (58 000 km)
- Replace engine oil filter.
- Drain and refill automatic transmission fluid and change filter.
- Drain and refill front and rear axles.
- Inspect brake linings.
- Lubricate upper knuckle ball stud.

39,000 Miles (62 000 km)
- Change engine oil.
- Replace engine oil filter.

42,000 Miles (67 000 km)
- Change engine oil.
- Replace engine oil filter.
- Lubricate upper knuckle ball stud.

45,000 Miles (72 000 km)
- Change engine oil.
- Replace engine oil filter.
- **Inspect engine air cleaner element, replace as necessary.**

48,000 Miles (77 000 km)
- Change engine oil.
- Replace engine oil filter.
- Drain and refill automatic transmission fluid and change filter.
- Drain and refill front and rear axles.
- Inspect brake linings.
- Lubricate upper knuckle ball stud.

51,000 Miles (82 000 km)
- Change engine oil.
- Replace engine oil filter.
- Flush and replace engine coolant.

54,000 Miles (86 000 km)
- Change engine oil.
- Replace engine oil filter.
- Lubricate upper knuckle ball stud.

SPECIFICATIONS (Continued)

57,000 Miles (91 000 km)

- Change engine oil.
- Replace engine oil filter.

60,000 Miles (96 000 km)

- Change engine oil.
- Replace engine oil filter.
- **Replace engine air cleaner element.**
- **Inspect PCV valve and replace if necessary (4.7L only).***
- **Replace spark plugs.**
- Inspect and adjust drive belt (4.0L only).
- Drain and refill automatic transmission fluid and change filter.
- Drain and refill transfer case fluid.
- Drain and refill front and rear axles.
- Inspect brake linings.
- Lubricate upper knuckle ball stud.

63,000 Miles (101 000 km)

- Change engine oil.
- Replace engine oil filter.

66,000 Miles (106 000 km)

- Change engine oil.
- Replace engine oil filter.
- Lubricate upper knuckle ball stud.

69,000 Miles (110 000 km)

- Change engine oil.
- Replace engine oil filter.

72,000 Miles (115 000 km)

- Change engine oil.
- Replace engine oil filter.
- Drain and refill automatic transmission fluid and change filter.
- Drain and refill front and rear axles.
- Inspect brake linings.
- Lubricate upper knuckle ball stud.

75,000 Miles (120 000 km)

- Change engine oil.
- Replace engine oil filter.
- **Inspect engine air cleaner element, replace as necessary.**

78,000 Miles (125 000 km)

- Change engine oil.
- Replace engine oil filter.
- Lubricate upper knuckle ball stud.

81,000 Miles (130 000 km)

- Change engine oil.
- Replace engine oil filter.
- Flush and replace engine coolant.

84,000 miles (134 000 km)

- Change engine oil.
- Replace engine oil filter.
- Drain and refill automatic transmission fluid and change filter.
- Drain and refill front and rear axles.
- Inspect brake linings.
- Lubricate upper knuckle ball stud.

87,000 Miles (139 000 km)

- Change engine oil.
- Replace engine oil filter.

90,000 Miles (144 000 km)

- Change engine oil.
- Replace engine oil filter.
- **Replace engine air cleaner element.**
- **Replace spark plugs.**
- Inspect and adjust drive belt (4.0L only).
- Inspect and replace drive belt if necessary (4.7L only).
- Drain and refill transfer case fluid.
- Lubricate upper knuckle ball stud.

93,000 Miles (149 000 km)

- Change engine oil.
- Replace engine oil filter.

96,000 Miles (154 000 km)

- Change engine oil.
- Replace engine oil filter.
- Drain and refill automatic transmission fluid and change filter.
- Drain and refill front and rear axles.
- Inspect brake linings.
- Lubricate upper knuckle ball stud.

99,000 Miles (158 000 km)

- Change engine oil.
- Replace engine oil filter.

102,000 Miles (163 000 km)

- Change engine oil.
- Replace engine oil filter.
- Lubricate upper knuckle ball stud.

105,000 Miles (168 000 km)

- Change engine oil.
- Replace engine oil filter.
- **Inspect engine air cleaner element, replace as necessary.**
- Inspect and replace drive belt if not previously replaced (4.7L only).

SPECIFICATIONS (Continued)

108,000 Miles (173 000 km)

- Change engine oil.
- Replace engine oil filter.
- Drain and refill automatic transmission fluid and change filter.
- Drain and refill front and rear axles.
- Inspect brake linings.
- Lubricate upper knuckle ball stud.

111,000 Miles (178 000 km)

- Change engine oil.
- Replace engine oil filter.
- Flush and replace engine coolant.

114,000 Miles (182 000 km)

- Change engine oil.
- Replace engine oil filter.
- Lubricate upper knuckle ball stud.

117,000 Miles (187 000 km)

- Change engine oil.
- Replace engine oil filter.

120,000 Miles (192 000 km)

- Change engine oil.
- Replace engine oil filter.
- **Replace engine air cleaner element.**
- **Replace spark plugs.**
- Inspect and adjust drive belt (4.0L only).
- Inspect and replace drive belt if not previously replaced (4.7L only).
- Drain and refill automatic transmission fluid and change filter.
- Drain and refill transfer case fluid.
- Drain and refill front and rear axles.
- Inspect brake linings.
- Lubricate upper knuckle ball stud.

*This maintenance is recommended, but is not required to maintain warranty on the PCV valve.

IMPORTANT: Inspection and service should also be performed anytime a malfunction is observed or suspected.

JUMP STARTING, HOISTING AND TOWING

INDEX

SERVICE PROCEDURES

JUMP STARTING PROCEDURE

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

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

TO JUMP START A DISABLED VEHICLE:

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

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

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

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

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

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

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

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

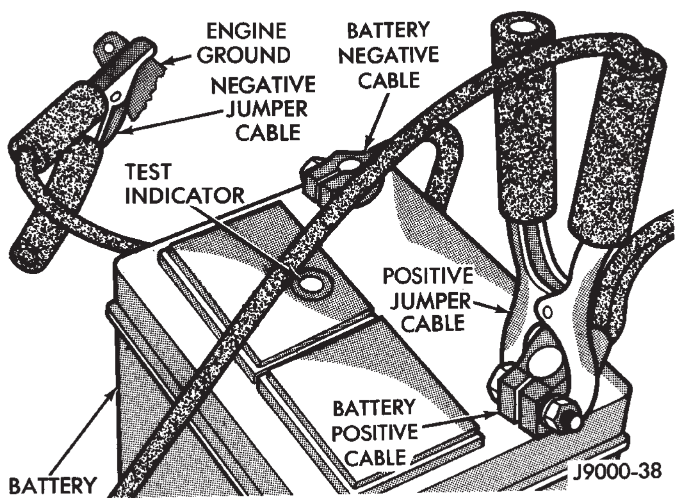


Fig. 1 Jumper Cable Clamp Connections

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

SERVICE PROCEDURES (Continued)

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

DISCONNECT CABLE CLAMPS AS FOLLOWS:

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

TOWING RECOMMENDATIONS

A vehicle equipped with SAE approved wheel lift-type towing equipment can be used to tow WJ vehicles. When towing a 4WD vehicle using a wheel-lift towing device, use tow dollies under the opposite end of the vehicle. A vehicle with flatbed device can also be used to transport a disabled vehicle (Fig. 2).

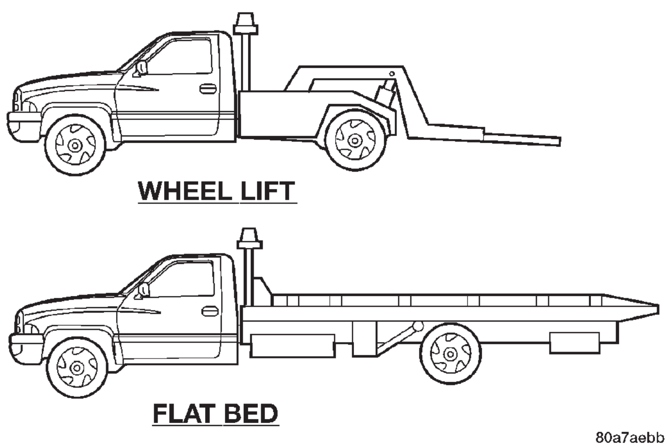


Fig. 2 Tow Vehicles With Approved Equipment

SAFETY PRECAUTIONS

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

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

GROUND CLEARANCE

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

A towed vehicle should be raised until lifted wheels are a minimum 100 mm (4 in) from the ground. Be sure there is adequate ground clearance at the opposite end of the vehicle, especially when towing over rough terrain or steep rises in the road. If necessary, remove the wheels from the lifted end of the vehicle and lower the vehicle closer to the ground, to increase the ground clearance at the opposite end of the vehicle. Install lug nuts on wheel attaching studs to retain brake drums.

FLAT-BED TOWING RAMP ANGLE

If a vehicle with flat-bed towing equipment is used, the approach ramp angle should not exceed 15 degrees.

TOWING WHEN KEYS ARE NOT AVAILABLE

When the vehicle is locked and keys are not available, use a flat bed hauler. A wheel-lift device can be used on 4WD vehicles provided **the trailing wheels are off the ground and positioned in tow dollies.**

TWO-WHEEL-DRIVE VEHICLE TOWING

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

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

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

SERVICE PROCEDURES (Continued)

TWO WHEEL DRIVE TOWING-REAR END LIFTED

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

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

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

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

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

TWO WHEEL DRIVE TOWING-FRONT END LIFTED

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

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

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

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

FOUR-WHEEL-DRIVE VEHICLE TOWING

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

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

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

FOUR WHEEL DRIVE TOWING—REAR END LIFTED

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

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

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

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

FOUR WHEEL DRIVE TOWING—FRONT END LIFTED

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

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

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

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

SERVICE PROCEDURES (Continued)

EMERGENCY TOW HOOKS

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

Some Jeep vehicles are equipped with front emergency tow hooks (Fig. 3). The tow hooks should be used for **EMERGENCY** purposes only.

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

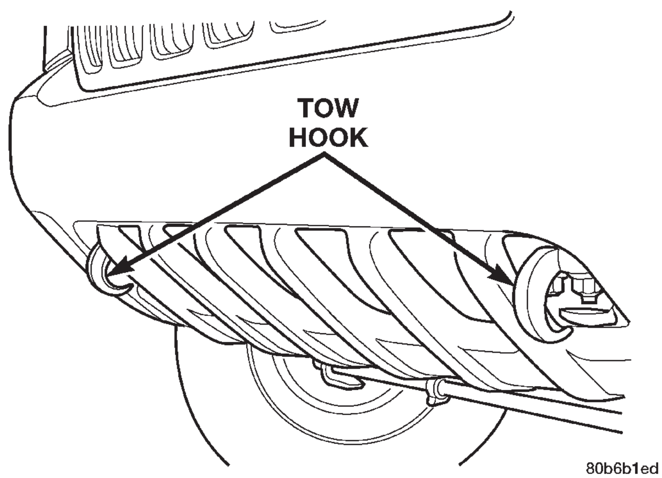


Fig. 3 Emergency Tow Hooks

HOISTING RECOMMENDATIONS

FLOOR JACK

When properly positioned, a floor jack can be used to lift a WJ vehicle (Fig. 4). Support the vehicle in the raised position with jack stands at the front and rear ends of the frame rails.

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

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

HOIST

A vehicle can be lifted with:

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

NOTE: When a frame-contact type hoist is used, verify that the lifting pads are positioned properly (Fig. 4).

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

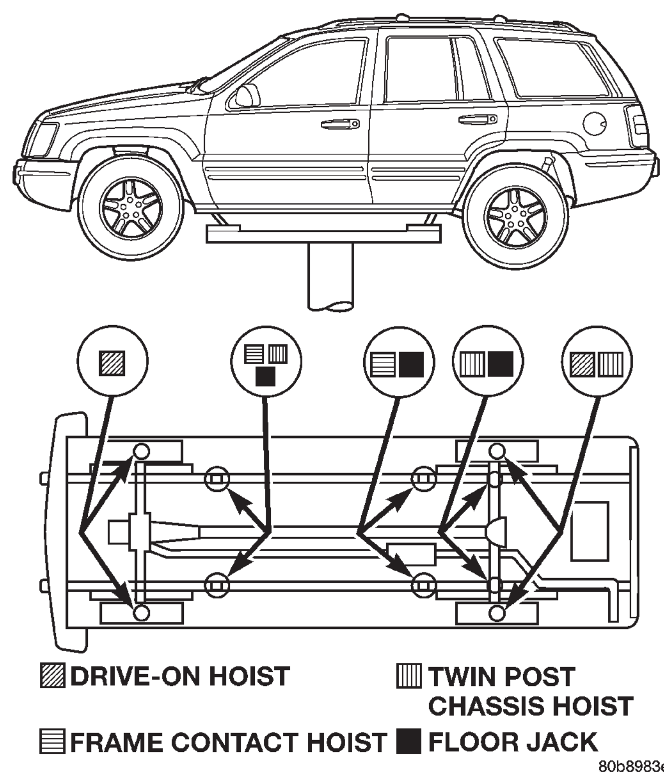


Fig. 4 Correct Vehicle Lifting Locations

SUSPENSION

CONTENTS

ALIGNMENT

INDEX

DESCRIPTION AND OPERATION

WHEEL ALIGNMENT

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 and toe position (Fig. 1).

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

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

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

NOTE: Periodic lubrication of the front suspension/steering system components may be required. Rubber bushings must never be lubricated. Refer to Group 0, Lubrication And Maintenance for the recommended maintenance schedule.

DESCRIPTION AND OPERATION (Continued)

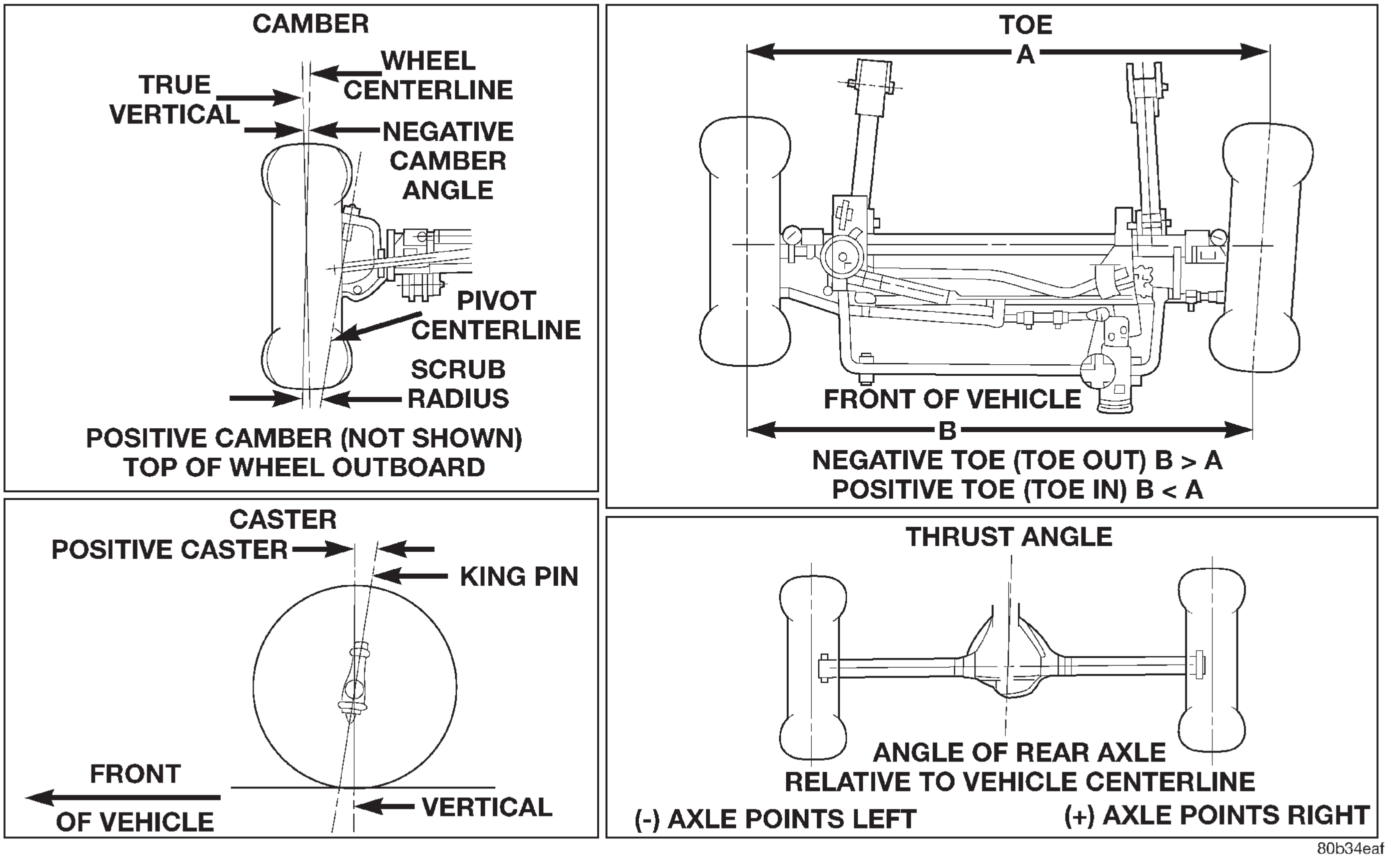


Fig. 1 Wheel Alignment Measurements

SERVICE PROCEDURES

PRE-ALIGNMENT

Before starting wheel alignment, the following inspection and necessary corrections must be completed. Refer to Suspension and Steering System Diagnosis Chart for additional information.

(1) Inspect tires for size and tread wear.

(2) Set tire air pressure.

(3) Inspect front wheel bearings for wear.

(4) Inspect front wheels for excessive radial or lateral runout and balance.

(5) Inspect ball studs, linkage pivot points and steering gear for looseness, roughness or binding.

(6) Inspect suspension components for wear and noise.

WHEEL ALIGNMENT

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.

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

CAMBER

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

CASTER

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

TOE POSITION

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

(1) Apply parking brakes.

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

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

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

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

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

SERVICE PROCEDURES (Continued)

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

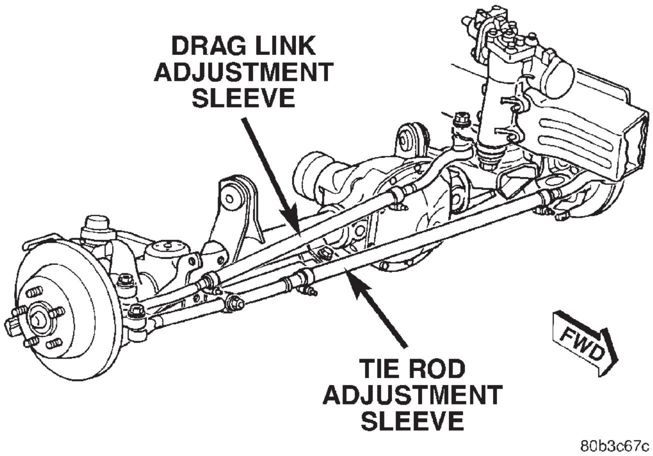


Fig. 2 Steering Linkage

STEERING WHEEL CENTERING

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

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

SPECIFICATIONS

ALIGNMENT

NOTE: Specifications are in degrees.

FRONT WHEELS - STANDARD SUSPENSION

ANGLE	PREFERRED	RANGE
CASTER	NA	+6.0° to +8.0°
CAMBER	NA	0° to −0.5°
TOE-IN (each wheel)	+0.125°	0° to +0.25°
Toe Differential Left to Right .05°		

FRONT WHEELS - UP-COUNTRY SUSPENSION

ANGLE	PREFERRED	RANGE
CASTER	NA	+5.5° to +7.5°
CAMBER	NA	0° to −0.5°
TOE-IN (each wheel)	+0.125°	0° to +0.25°
Toe Differential Left to Right .05°		

REAR AXLE

ANGLE	RANGE
CAMBER	0° to −0.5
THRUST ANGLE	± 0.25°
TOTAL TOE-IN	0° to +0.5°

FRONT SUSPENSION

INDEX

DESCRIPTION AND OPERATION

FRONT SUSPENSION

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

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

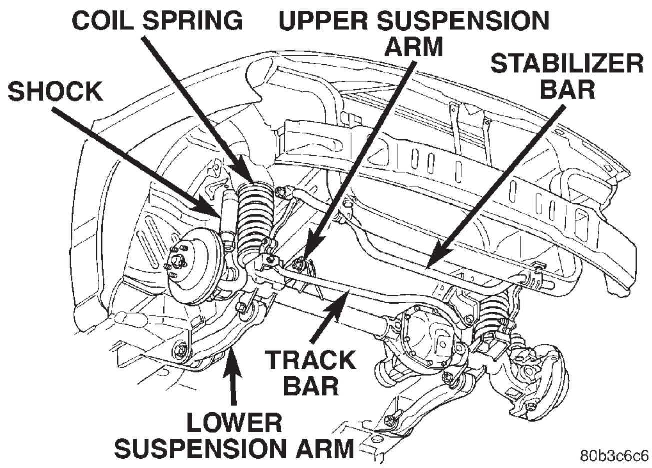


Fig. 1 Front Suspension

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

CAUTION: Suspension components with rubber bushings must be tightened with the vehicle at normal ride 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 will be affected and cause premature bushing wear.

SHOCK ABSORBERS

DESCRIPTION

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

OPERATION

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

DESCRIPTION AND OPERATION (Continued)

JOUNCE BUMPER

DESCRIPTION

They are mounted under the unibody rails to minimize transmission of noise to the passenger compartment.

OPERATION

The jounce bumpers are used to limit suspension travel in compression.

COIL SPRINGS AND ISOLATORS

DESCRIPTION

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 isolator made of rubber with a steel insert.

OPERATION

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

STEERING KNUCKLE

DESCRIPTION

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

OPERATION

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

LOWER SUSPENSION ARMS AND BUSHINGS

DESCRIPTION

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

OPERATION

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

UPPER SUSPENSION ARMS AND BUSHINGS

DESCRIPTION

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

OPERATION

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

STABILIZER BAR

DESCRIPTION

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

OPERATION

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.

TRACK BAR

DESCRIPTION

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

OPERATION

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

HUB/BEARING

DESCRIPTION

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

OPERATION

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

DIAGNOSIS AND TESTING

SUSPENSION AND STEERING SYSTEM

CONDITION	POSSIBLE CAUSES	CORRECTION
FRONT END NOISE	1. Loose or worn wheel bearings.	1. Adjust or replace wheel bearings.
	2. Loose or worn steering or suspension components.	2. Tighten or replace components as necessary.
EXCESSIVE PLAY IN STEERING	1. Loose or worn wheel bearings.	1. Adjust or replace wheel bearings.
	2. Loose or worn steering or suspension components.	2. Tighten or replace components as necessary.
	3. Loose or worn steering gear.	3. Adjust or replace steering gear.
FRONT WHEELS SHIMMY	1. Loose or worn wheel bearings.	1. Adjust or replace wheel bearings.
	2. Loose or worn steering or suspension components.	2. Tighten or replace components as necessary.
	3. Tires worn or out of balance.	3. Replace or balance tires.
	4. Alignment.	4. Align vehicle to specifications.
	5. Leaking steering dampener.	5. Replace steering dampener.
VEHICLE INSTABILITY	1. Loose or worn wheel bearings.	1. Adjust or replace wheel bearings.
	2. Loose or worn steering or suspension components.	2. Tighten or replace components as necessary.
	3. Tire pressure.	3. Adjust tire pressure.
	4. Alignment.	4. Align vehicle to specifications.
EXCESSIVE STEERING EFFORT	1. Loose or worn steering gear.	1. Adjust or replace steering gear.
	2. Power steering fluid low.	2. Add fluid and repair leak.
	3. Column coupler binding.	3. Replace coupler.
	4. Tire pressure.	4. Adjust tire pressure.
	5. Alignment.	5. Align vehicle to specifications.
VEHICLE PULLS TO ONE SIDE	1. Tire pressure.	1. Adjust tire pressure.
	2. Alignment.	2. Align vehicle to specifications.
	3. Loose, worn or bent steering/ suspension components.	3. Inspect, tighten or replace components as necessary.
	4. Radial tire lead.	4. Rotate or replace tire as necessary.
	5. Brake pull.	5. Repair brake as necessary.
	6. Weak or broken spring.	6. Replace spring.
KNOCKING, RATTLING OR SQUEAKING	1. Worn shock bushings.	1. Replace shock.
	2. Loose, worn or bent steering/ suspension components.	2. Inspect, tighten or replace components as necessary.
	3. Shock valve.	3. Replace shock.
IMPROPER TRACKING	1. Loose, worn or bent track bar.	1. Inspect, tighten or replace component as necessary.
	2. Loose, worn or bent steering/ suspension components.	2. Inspect, tighten or replace components as necessary.

REMOVAL AND INSTALLATION

SERVICE WARNINGS AND CAUTIONS

CAUTION: Suspension components with rubber bushings must be tightened with the vehicle at normal ride 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 will be affected and cause premature bushing wear.

SHOCK ABSORBER

REMOVAL

(1) Remove the nut, retainer and grommet from the shock stud in the engine compartment (Fig. 2).

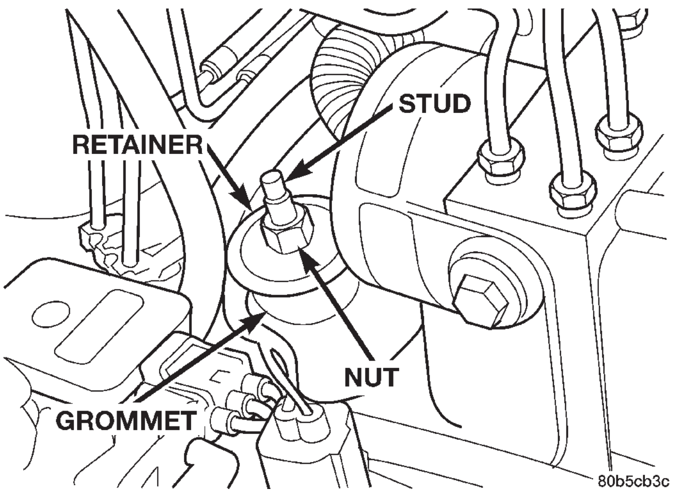


Fig. 2 Upper Shock Mounting

(2) Raise and support the front axle.

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

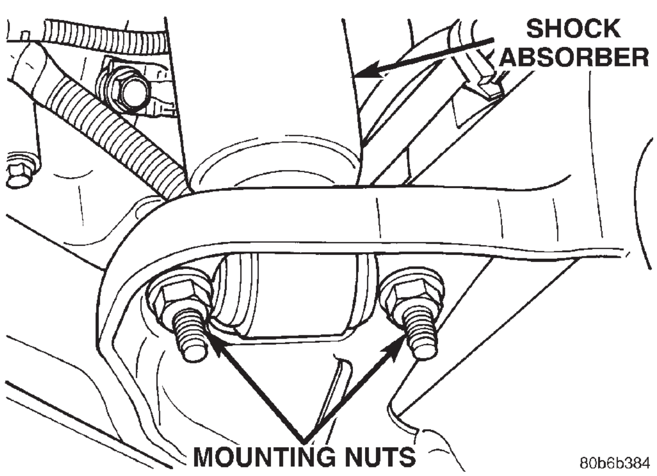


Fig. 3 Lower Shock Mounting

INSTALLATION

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

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

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

(4) Remove support and lower the vehicle.

(5) Install the upper grommet, retainer and nut on the stud in the engine compartment. Tighten the nut to 35 N·m (26 ft. lbs.).

COIL SPRINGS

REMOVAL

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

(2) Remove the wheel and tire assemblies.

(3) Remove stabilizer bar links mounting nuts and bolts from the axle brackets.

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

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

(6) Lower the axle until the spring is free from the upper mount and isolator (Fig. 4).

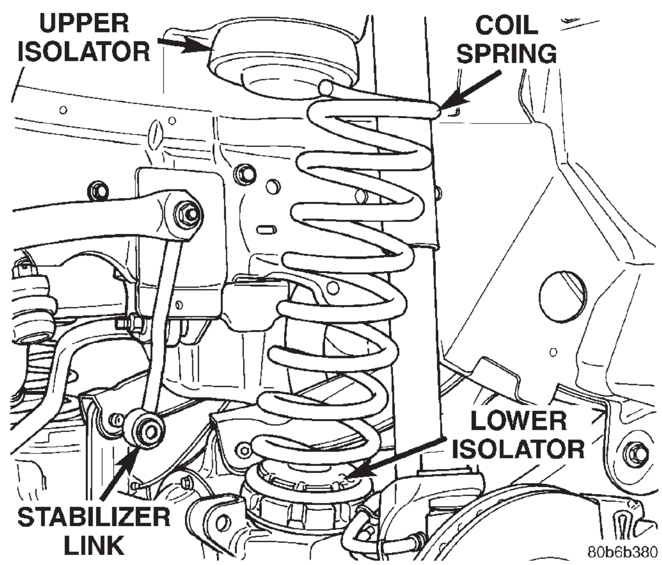


Fig. 4 Front Coil Spring

(7) Remove the spring from the vehicle.

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

INSTALLATION

(1) Install the upper isolator.

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

REMOVAL AND INSTALLATION (Continued)

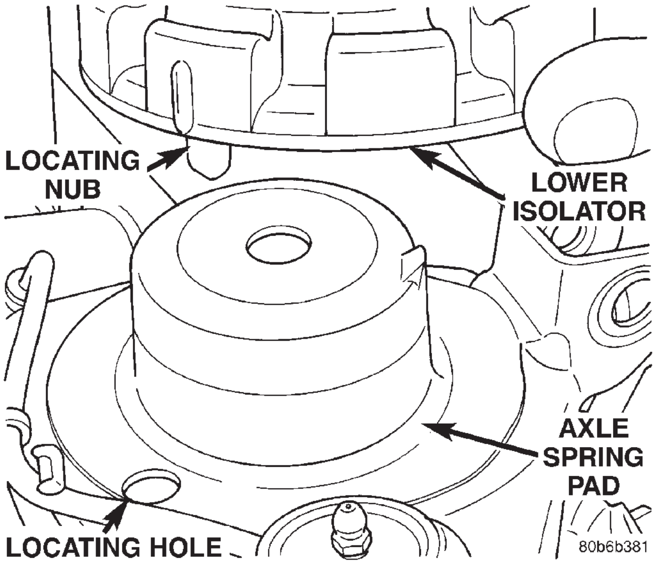


Fig. 5 Lower Isolator

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

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

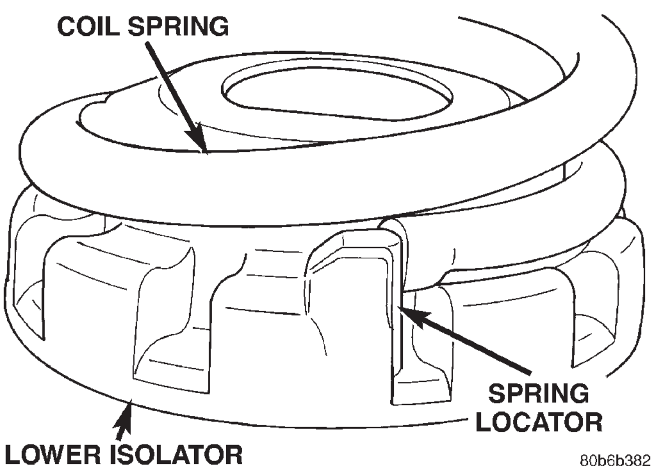


Fig. 6 Isolator Spring Locator

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

(5) Install the shock absorbers lower mounting nuts.

(6) Install the stabilizer bar link to the axle bracket and install the mounting bolts and nuts.

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

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

(8) Tighten all suspension components to proper torque.

(9) Install the wheel and tire assemblies.

(10) Remove support and lower vehicle.

STEERING KNUCKLE AND BALL JOINTS

KNUCKLE REMOVAL

(1) Raise and support the vehicle.

(2) Remove wheel and tire assembly.

(3) Remove hub bearing.

(4) Remove the axle, shaft refer to Group 3 Differential and Driveline.

(5) Remove the tie rod on left steering knuckle. Remove the tie rod and drag link on right steering knuckle.

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

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

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

UPPER BALL JOINT REPLACEMENT

(1) Position tools as shown to remove and install ball joint (Fig. 7).

LOWER BALL JOINT REPLACEMENT

(1) Position tools as shown to remove and install ball joint (Fig. 8).

KNUCKLE INSTALLATION

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

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

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

(4) Install the axle shaft, refer to Group 3 Differential and Driveline.

(5) Install the hub bearing.

(6) Install the tie rod on the left steering knuckle. Install the tie rod and drag link end on the right steering knuckle.

(7) Install wheel and tire assembly.

(8) Remove support and lower vehicle.

LOWER SUSPENSION ARM

REMOVAL

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

(2) Remove the lower suspension arm nut and bolt from the axle bracket (Fig. 9).

(3) Remove the nut and bolt from the frame rail bracket and remove the lower suspension arm (Fig. 9).

REMOVAL AND INSTALLATION (Continued)

1999 Jeep Grand Cherokee
Publication No. 81-370-9147
TSB 26-10-98 October, 1998

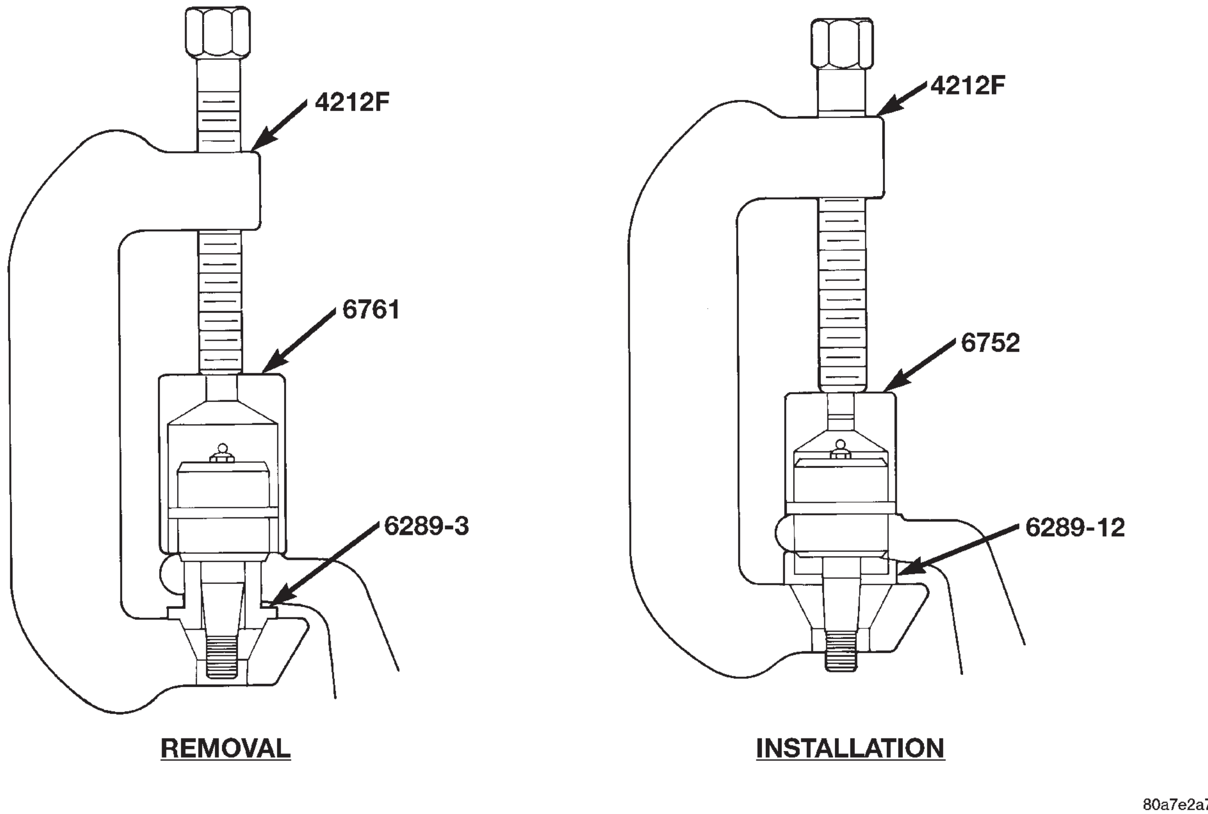


Fig. 7 Upper Ball Joint Remove/Install

INSTALLATION

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

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

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

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

(4) Remove support and lower the vehicle.

(5) With the vehicle on the ground tighten the axle bracket nut and the frame bracket bolt to 176 N·m (130 ft. lbs.).

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

UPPER SUSPENSION ARM

REMOVAL

(1) Raise vehicle and support the axle.

(2) Remove the upper suspension arm mounting nut and bolt (Fig. 10) from the axle bracket.

(3) Remove the nut and bolt (Fig. 10) at the frame rail and remove the upper suspension arm.

INSTALLATION

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

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

(3) Remove the supports and lower the vehicle.

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

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

REMOVAL AND INSTALLATION (Continued)

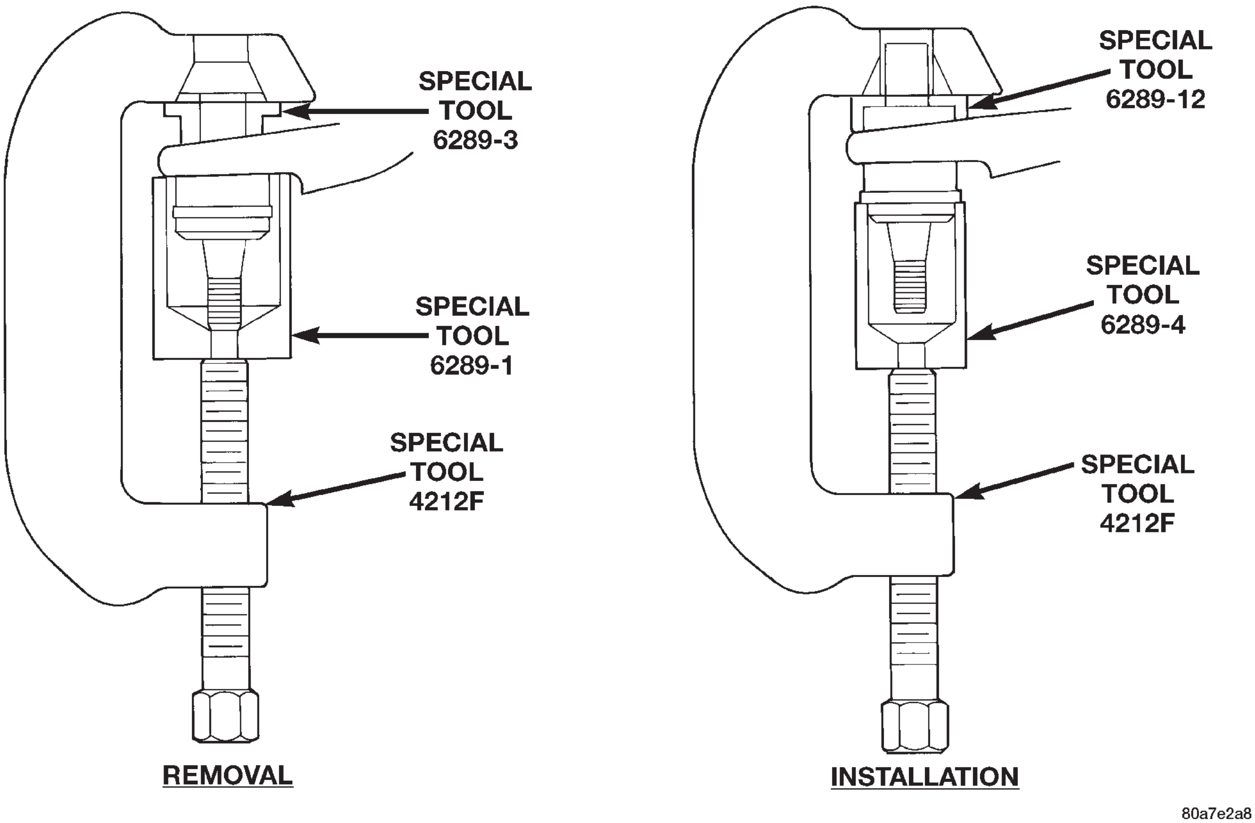


Fig. 8 Lower Ball Joint Remove/Install

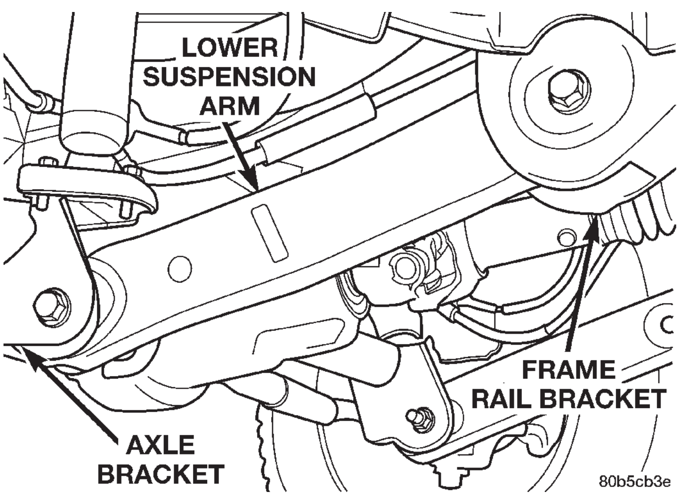


Fig. 9 Lower Suspension Arm

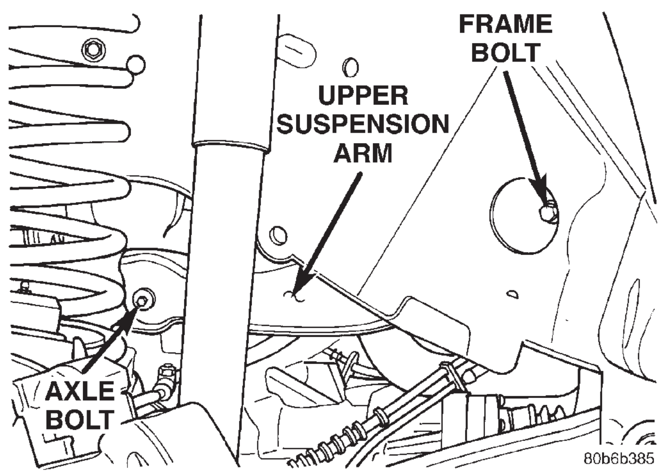


Fig. 10 Upper Suspension Arm

FRONT AXLE BUSHING

REMOVAL

(1) Remove the upper suspension arm from axle.

(2) Position Spacer 8279 over the axle bushing on a 4x2 vehicle and right side on a 4x4 vehicle.

(3) Place Receiver 7932-1 over flanged end of the bushing (Fig. 11).

(4) Place small end of Remover/Install 7932-2 against other side of the bushing.

(5) Install bolt 7604 through remover, bushing and receiver.

(6) Install Long Nut 7603 and tighten nut too pull bushing out of the axle bracket.

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

REMOVAL AND INSTALLATION (Continued)

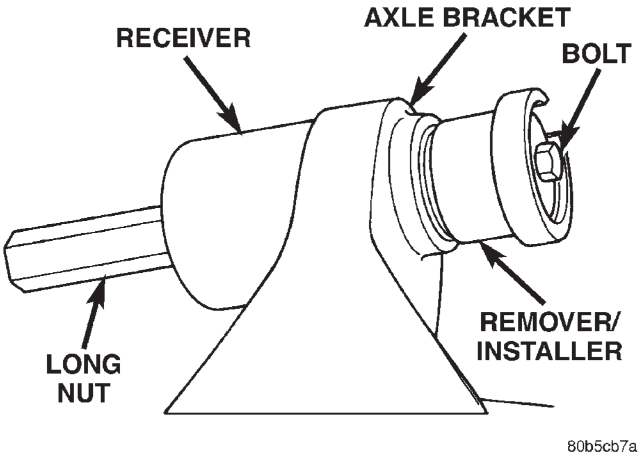


Fig. 11 Bushing Removal

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

INSTALLATION

(1) Place Receiver 7932-1on the other side of the axle bracket.

(2) Position new bushing up to the axle bracket., and large end of Remover/Install 7932-2 against the bushing (Fig. 12).

(3) Install bolt 7604 through receiver, bushing and installer.

(4) Install Long Nut 7603 and tighten nut to draw the bushing into the axle bracket.

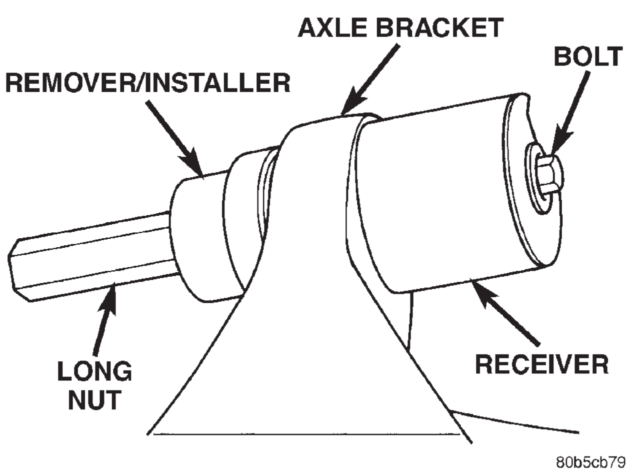


Fig. 12 Bushing Installation

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

STABILIZER BAR

REMOVAL

(1) Raise and support the vehicle.

(2) Remove link nuts and bolts (Fig. 13) and remove the links.

(3) Remove the stabilizer bar retainer bolts (Fig. 13) from the frame rails and remove the stabilizer bar.

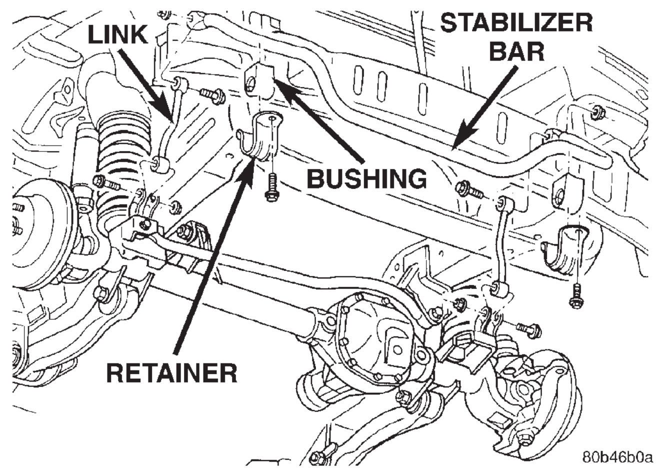


Fig. 13 Stabilizer Bar

INSTALLATION

(1) Position the stabilizer bar on the frame rail and install the retainers and bolts. Ensure the bar is centered with equal spacing on both sides. Tighten the bolts to 92 N·m (68 ft. lbs.).

(2) Install the links onto the stabilizer bar and axle brackets and install the bolts and nuts finger tight.

(3) Remove the supports and lower the vehicle.

(4) With the vehicle on the ground tighten the stabilizer bar link nuts to 106 N·m (78 ft. lbs.).

TRACK BAR

REMOVAL

(1) Raise and support the vehicle.

(2) Remove the nut and bolt from the frame rail bracket (Fig. 14).

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

INSTALLATION

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

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

REMOVAL AND INSTALLATION (Continued)

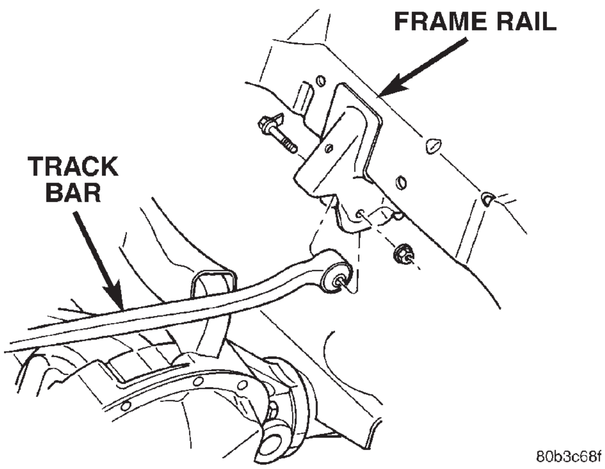


Fig. 14 Track Bar Frame Rail Bracket

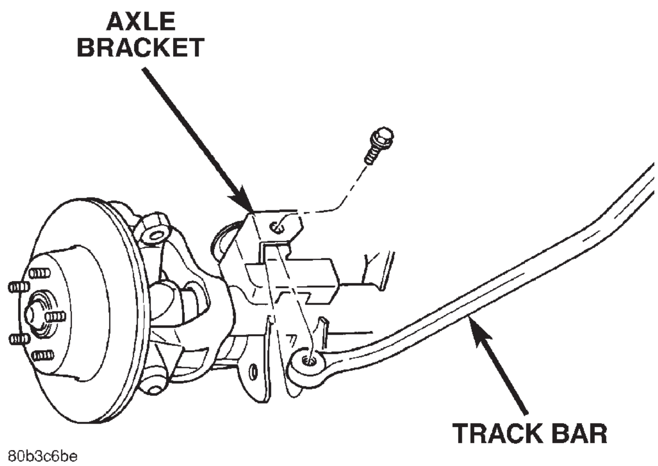


Fig. 15 Track Bar Axle Bracket

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

(3) Remove the supports and lower the vehicle.

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

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

HUB BEARING

REMOVAL

(1) Raise and support the vehicle.

(2) Remove the wheel and tire assembly.

(3) Remove the brake caliper, caliper anchor, rotor and ABS wheel speed sensor, refer to Group 5 Brakes.

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

(5) Remove the hub bearing mounting bolts from the back of the steering knuckle. Remove hub bearing (Fig. 16) from the steering knuckle and off the axle shaft.

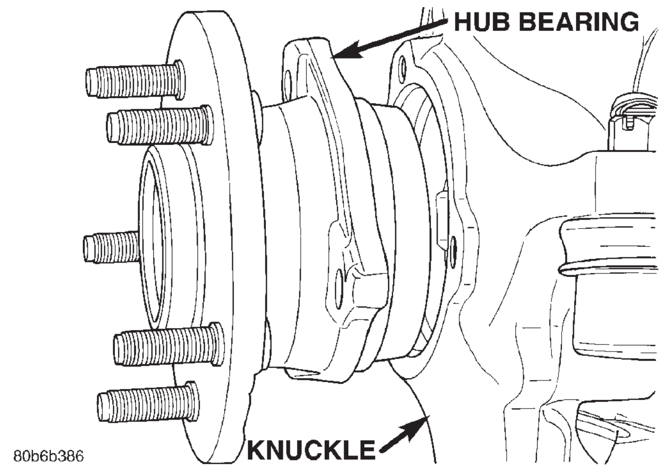


Fig. 16 Hub Bearing & Knuckle

INSTALLATION

(1) Install the hub bearing to the knuckle.

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

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

(4) Install the brake rotor, caliper anchor, caliper and ABS wheel speed sensor, refer to Group 5 Brakes.

(5) Install the wheel and tire assembly.

(6) Remove support and lower the vehicle.

WHEEL MOUNTING STUDS

CAUTION: Do not use a hammer to remove wheel studs.

REMOVAL

(1) Raise and support vehicle.

(2) Remove wheel and tire assembly.

(3) Remove brake caliper and rotor, refer to Group 5 Brakes for procedure.

(4) Remove stud from hub with Remover C-4150A (Fig. 17).

INSTALLATION

(1) Install new stud into hub flange.

(2) Install three washers onto stud, then install lug nut with the flat side of the nut against the washers.

(3) Tighten lug nut until the stud is pulled into the hub flange. Verify that the stud is properly seated into the flange.

1999 Jeep Grand Cherokee
Publication No. 81-370-9147
TSB 26-10-98 October, 1998

REMOVAL AND INSTALLATION (Continued)

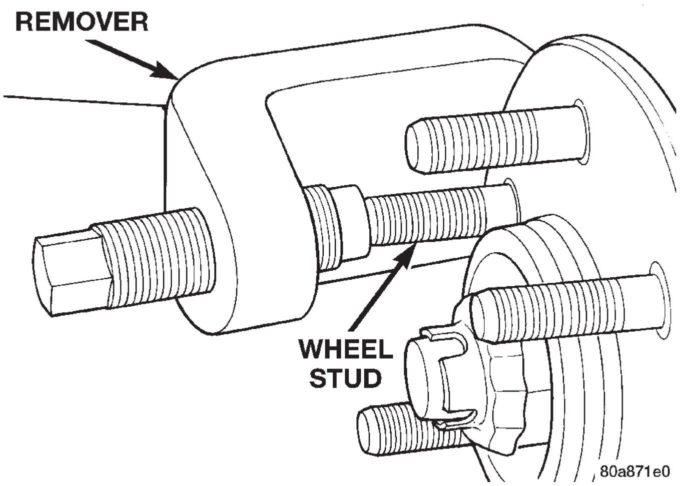


Fig. 17 Wheel Stud Removal

(4) Remove lug nut and washers.

(5) Install the brake rotor and caliper, refer to Group 5 Brakes for procedure.

(6) Install wheel and tire assembly, use new lug nut on stud or studs that were replaced.

(7) Remove support and lower vehicle.

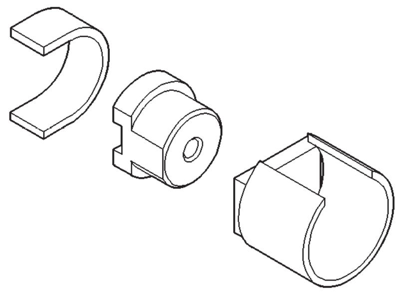
SPECIFICATIONS

TORQUE CHART

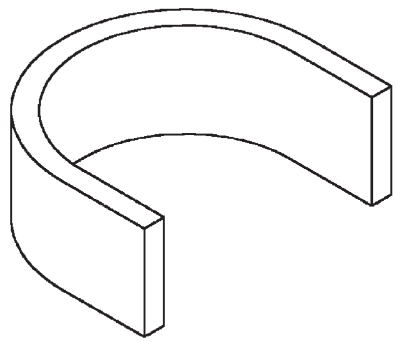
DESCRIPTION	TORQUE
Shock Absorber	
Upper Nut	35 N·m (26 ft. lbs.)
Lower Nuts	28 N·m (250 in. lbs.)
Suspension Arm Upper	
Axle Bracket Nut	61 N·m (45 ft. lbs.)
Frame Bracket Bolt	61 N·m (45 ft. lbs.)
Suspension Arm Lower	
Axle Bracket Nut	176 N·m (130 ft. lbs.)
Frame Bracket Bolt	176 N·m (130 ft. lbs.)
Stabilizer Bar	
Retainer Bolts	92 N·m (68 ft. lbs.)
Link Upper Nut	106 N·m (78 ft. lbs.)
Link Lower Nut	106 N·m (78 ft. lbs.)
Track Bar	
Frame Bracket Nut	108 N·m (80 ft. lbs.)
Axle Bracket Bolt	100 N·m (74 ft. lbs.)
Hub Bearing	
Knuckle Bolts	102 N·m (75 ft. lbs.)

SPECIAL TOOLS

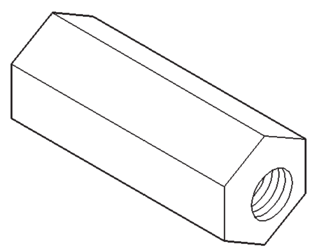
FRONT SUSPENSION



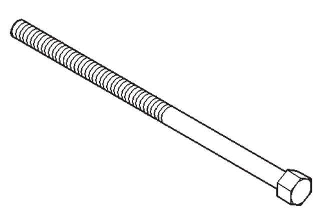
Remover/Installer Suspension Bushing 7932



Spacer 8279

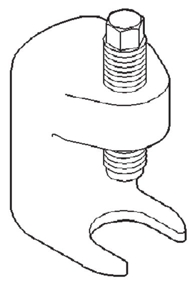


Nut, Long 7603

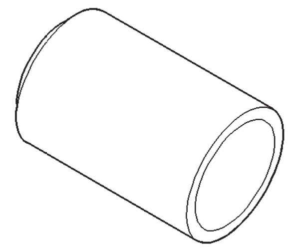


Bolt, Special 7604

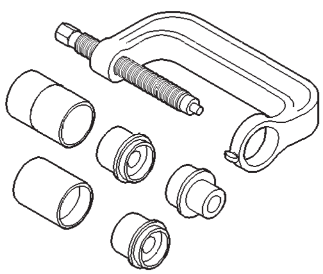
SPECIAL TOOLS (Continued)



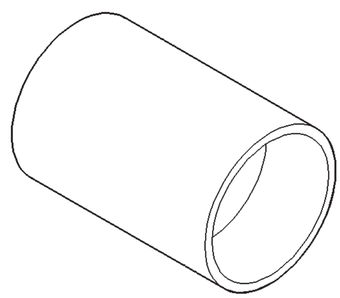
Remover C-4150A



Reciever 6761



Remover/Installer 6289



Installer 6752

REAR SUSPENSION

INDEX

DESCRIPTION AND OPERATION

REAR SUSPENSION

The rear suspension (Fig. 1) is comprised of :
- Drive axle
- Shock absorbers
- Coil springs
- Lower suspension arms
- Upper suspension arm
- Stabilizer bar

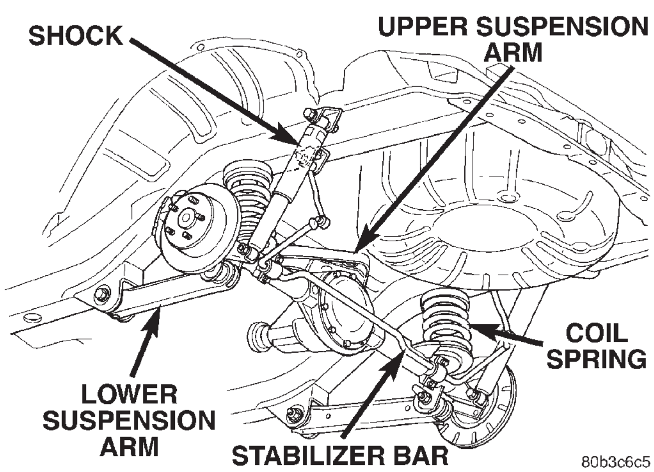


Fig. 1 Rear Suspension

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

SHOCK ABSORBERS

DESCRIPTION

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

OPERATION

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

JOUNCE BUMPERS

DESCRIPTION

The jounce bumpers are mounted inside the coil spring, between the axle and the frame rail, to minimize transmission of noise to the passenger compartment.

OPERATION

The jounce bumpers are used to limit suspension travel in compression.

COIL SPRINGS AND ISOLATORS

DESCRIPTION

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 isolator made of rubber with a steel insert. The isolators provide road noise isolation.

OPERATION

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

LOWER SUSPENSION ARMS AND BUSHINGS

DESCRIPTION

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

OPERATION

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

UPPER SUSPENSION ARM, BUSHINGS, AND BALL JOINT

DESCRIPTION

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

OPERATION

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

STABILIZER BAR AND LINKS

Inspect for broken or distorted stabilizer bar bushings, bushing retainers, and worn, damaged, or squeeking stabilizer bar to frame links. The stabilizer bar should also be inspected for signs of cracking or breaking.

DIAGNOSIS AND TESTING

REAR SUSPENSION

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

REMOVAL AND INSTALLATION

SERVICE WARNINGS AND CAUTIONS

CAUTION: Suspension components with rubber bushings must be tightened with the vehicle at normal ride 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 will be affected and cause premature bushing wear.

SHOCK ABSORBER

REMOVAL

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

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

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

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

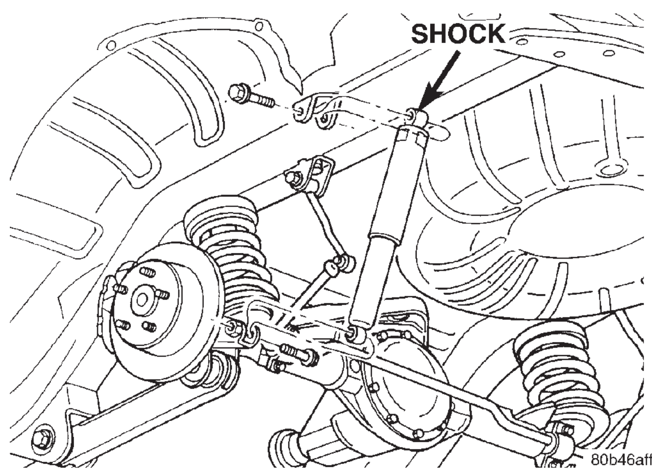


Fig. 2 Shock Absorber

INSTALLATION

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

REMOVAL AND INSTALLATION (Continued)

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

(3) Tighten the upper and lower mounting nuts to 92 N·m (68 ft. lbs.).

(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 the axle.

(2) Remove the wheel and tire assemblies.

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

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

(5) Lower the hydraulic jack and tilt the axle and remove the coil spring (Fig. 3).

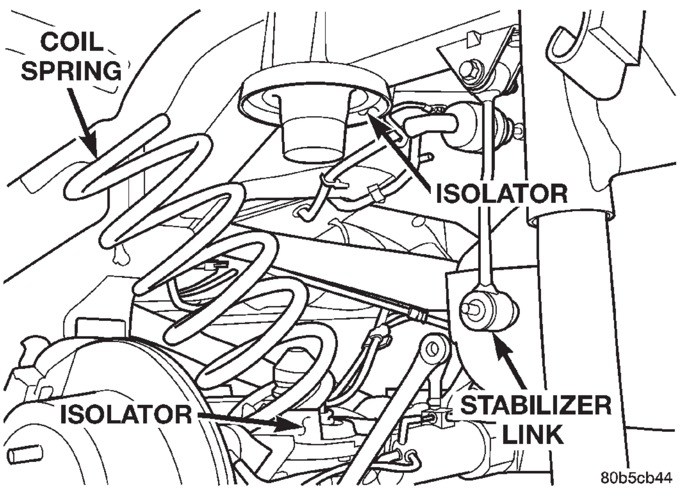


Fig. 3 Coil Spring

(6) Remove and inspect the upper and lower spring isolators (Fig. 3).

INSTALLATION

(1) Install the upper isolator.

(2) Install the lower isolator with the isolator locator nub in the axle pad hole (Fig. 4).

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

CAUTION: Ensure the spring is positioned on the lower isolator with the end of the spring coil against the isolator spring locator (Fig. 5).

(4) Raise the axle with the hydraulic jack.

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

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

(7) Install the wheel and tire assemblies.

(8) Remove the supports and lower the vehicle.

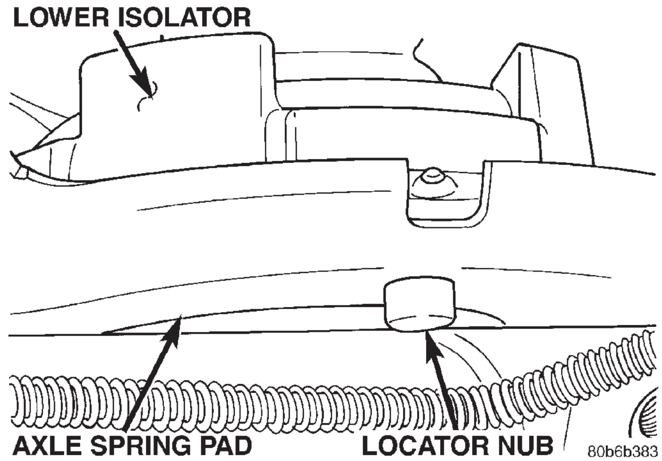


Fig. 4 Isolator Locator Nub

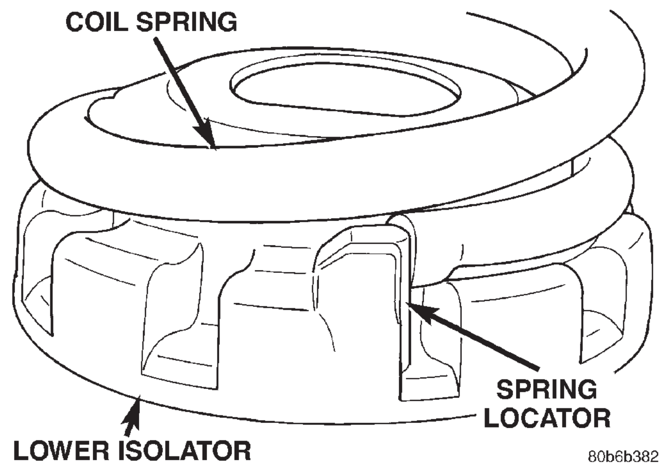


Fig. 5 Isolator Spring Locator - Typical

(9) Tighten the stabilizer bar links to specification.

LOWER SUSPENSION ARM

REMOVAL

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

(2) Remove the lower suspension arm nut and bolt from the axle bracket (Fig. 6).

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

INSTALLATION

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

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

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

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

1999 Jeep Grand Cherokee
Publication No. 81-370-9147
TSB 26-10-98 October, 1998

REMOVAL AND INSTALLATION (Continued)

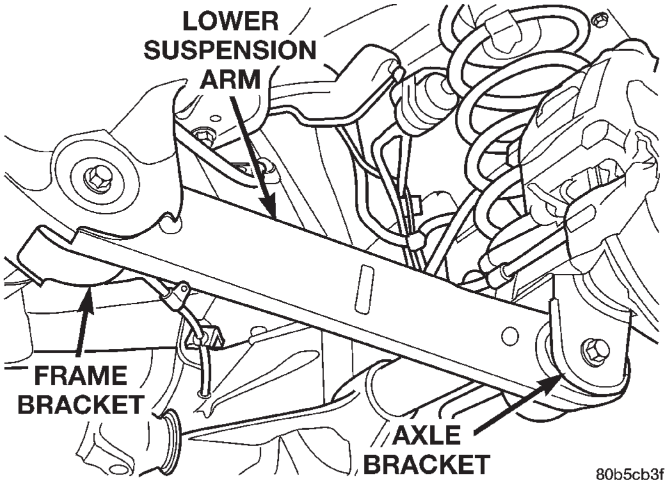


Fig. 6 Lower Suspension Arm

(4) Remove the supports and lower the vehicle.

(5) With the vehicle on the ground tighten the lower suspension arm nuts to 177 N·m (130 ft. lbs.).

UPPER SUSPENSION ARM

REMOVAL

(1) Raise and support the vehicle.

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

(3) Remove the park brake cables and brake hose from the arm (Fig. 7).

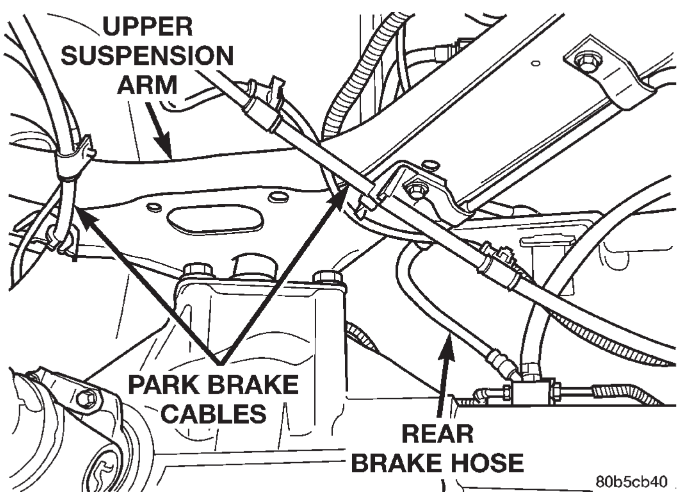


Fig. 7 Park Brake Cables And Brake Hose

(4) Remove the ball joint nut from the top of the upper suspension arm (Fig. 8).

(5) Separate ball joint from the arm with Remover 8278 (Fig. 9).

(6) Remove the upper suspension arm mounting bolts and remove the arm (Fig. 10).

INSTALLATION

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

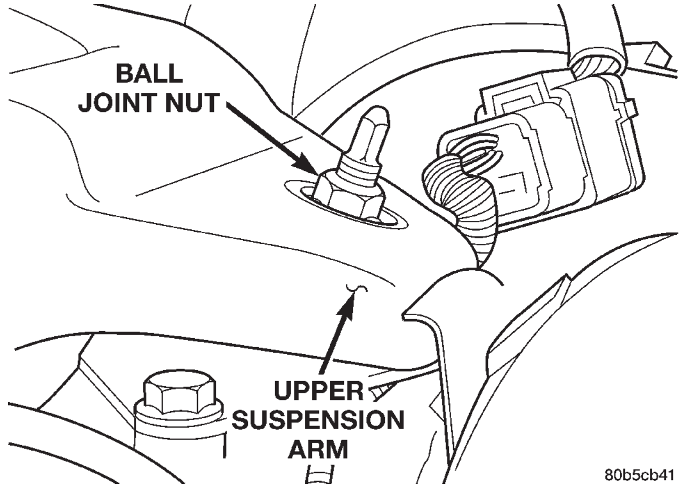


Fig. 8 Ball Joint Nut

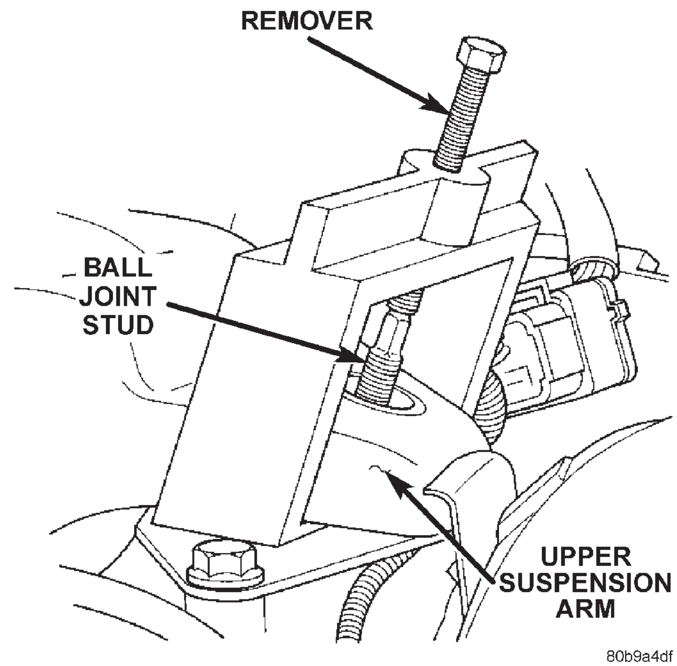


Fig. 9 Separate Ball Joint

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

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

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

(5) Remove the supports and lower the vehicle.

BALL JOINT

REMOVAL

(1) Raise and support the vehicle.

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

(3) Remove the ball joint nut from the top of the upper suspension arm (Fig. 11).

1999 Jeep Grand Cherokee
Publication No. 81-370-9147
TSB 26-10-98 October, 1998

REMOVAL AND INSTALLATION (Continued)

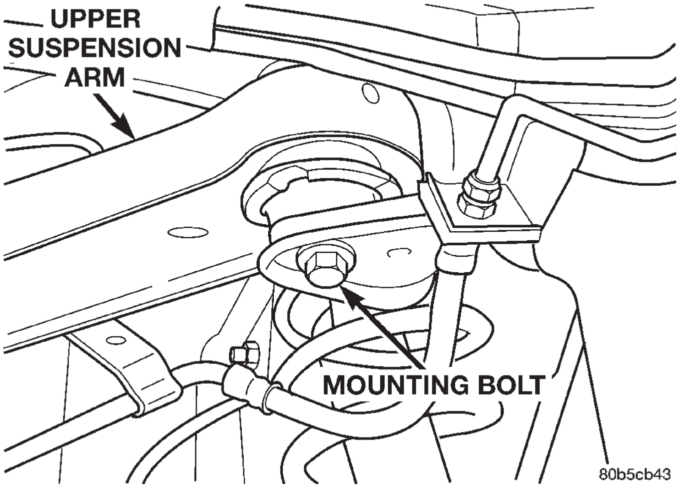


Fig. 10 Upper Suspension Arm Mounting Bolt

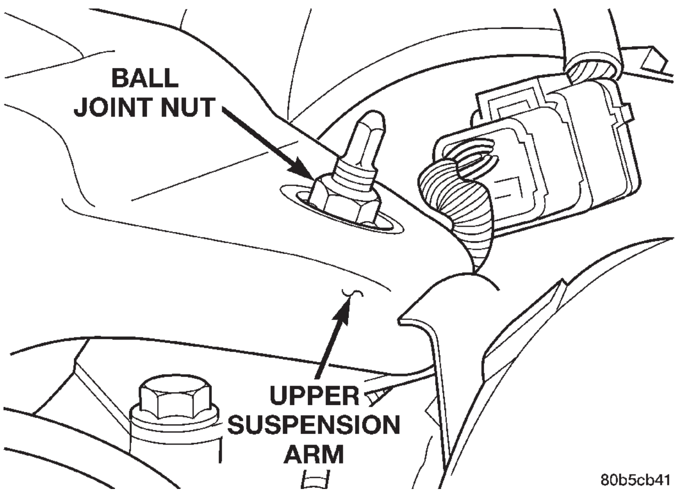


Fig. 11 Ball Joint Nut

(4) Separate ball joint from the arm with Remover 8278 (Fig. 12).

(5) Remove the ball joint mounting bolts (Fig. 13) from the differential housing.

(6) Remove the ball joint from the differential housing.

INSTALLATION

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

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

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

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

(5) Remove the supports and lower the vehicle.

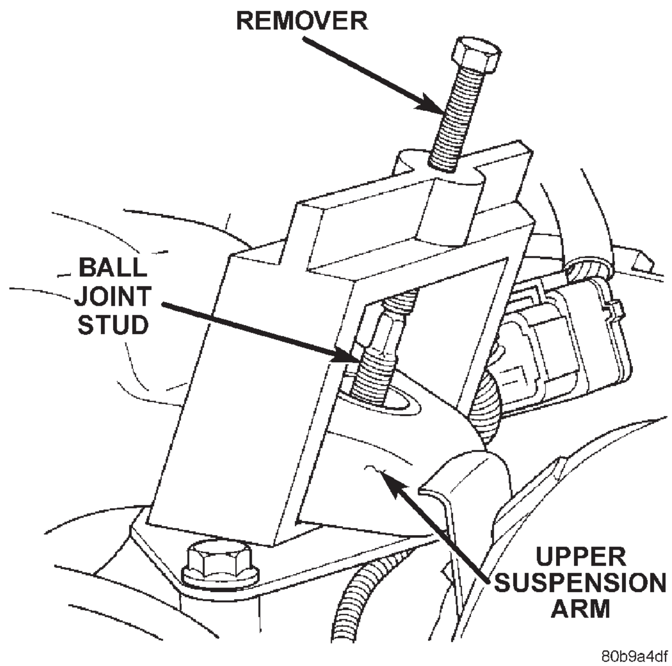


Fig. 12 Separate Ball Joint

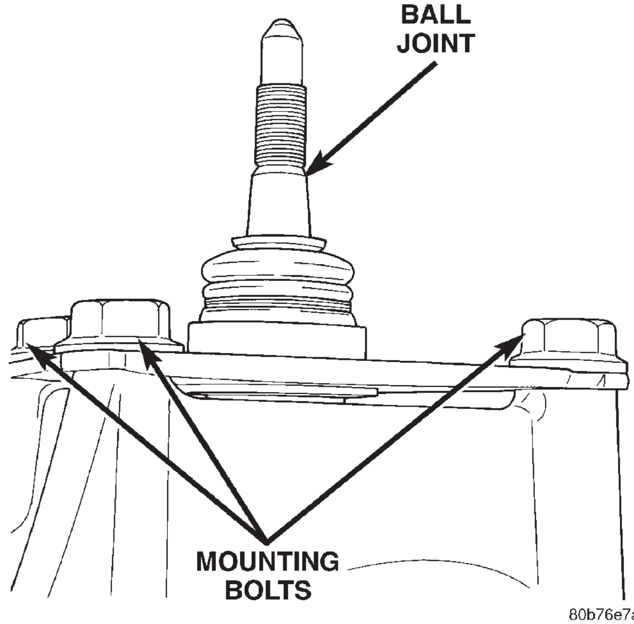


Fig. 13 Ball Joint Mounting Bolts

STABILIZER BAR

REMOVAL

(1) Raise and support the vehicle.

(2) Remove the stabilizer bar links from stabilizer bar and frame mount. (Fig. 14).

(3) Remove the stabilizer bar retainer bolts.

(4) Remove the stabilizer bar.

REMOVAL AND INSTALLATION (Continued)

1999 Jeep Grand Cherokee
Publication No. 81-370-9147
TSB 26-10-98 October, 1998

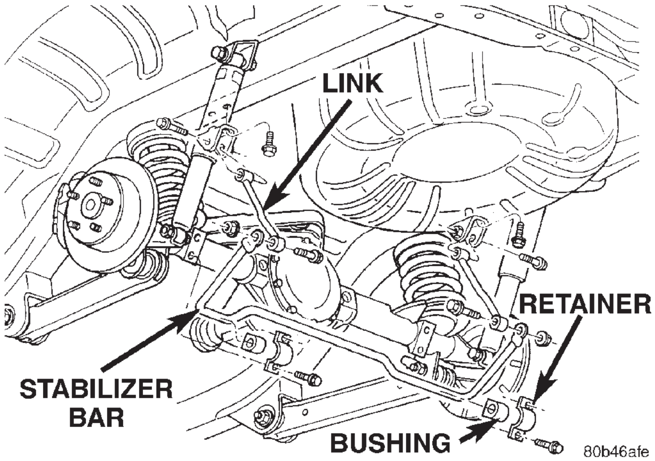


Fig. 14 Rear Stabilizer Bar

INSTALLATION

(1) Position the stabilizer bar on the axle and install the retainers 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 to the stabilizer bar and frame brackets.

(3) Tighten the nuts at the stabilizer bar to 54 N·m (40 ft. lbs.).

(4) Tighten the nuts at the frame brackets to 92 N·m (68 ft. lbs.).

(5) Remove support and lower the vehicle.

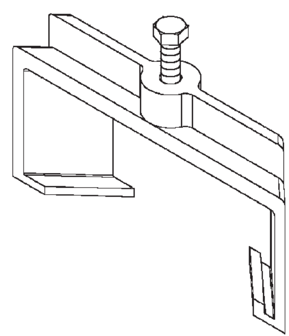
SPECIFICATIONS

TORQUE CHART

DESCRIPTION	TORQUE
Shock Absorber	
Upper Nut	92 N·m (68 ft. lbs.)
Lower Nut	92 N·m (68 ft. lbs.)
Suspension Arm Upper	
Ball Joint Nut	142 N·m (105 ft. lbs.)
Frame Bolts	100 N·m (74 ft. lbs.)
Ball Joint	
Plate Bolts	136 N·m (100 ft. lbs.)
Suspension Arms Lower	
Nuts	177 N·m (130 ft. lbs.)
Stabilizer Bar	
Retainer Bolts	54 N·m (40 ft. lbs.)
Bar Link Nut	54 N·m (40 ft. lbs.)
Bracket Link Nut	92 N·m (68 ft. lbs.)

SPECIAL TOOLS

REAR SUSPENSION



Remover 8278

DIFFERENTIAL AND DRIVELINE

CONTENTS

PROPELLER SHAFTS

INDEX

GENERAL INFORMATION

PROPELLER SHAFTS

The function of a propeller 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/transfer case 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 or Constant Velocity(CV) joints, which permit the propeller shaft to operate at different angles. A slip joint or CV joint 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 out of balance condition and vibration.

CAUTION: Use exact replacement parts for attaching the propeller shafts. This will ensure safe operation. The specified torque must always be applied when tightening the fasteners.

GENERAL INFORMATION (Continued)

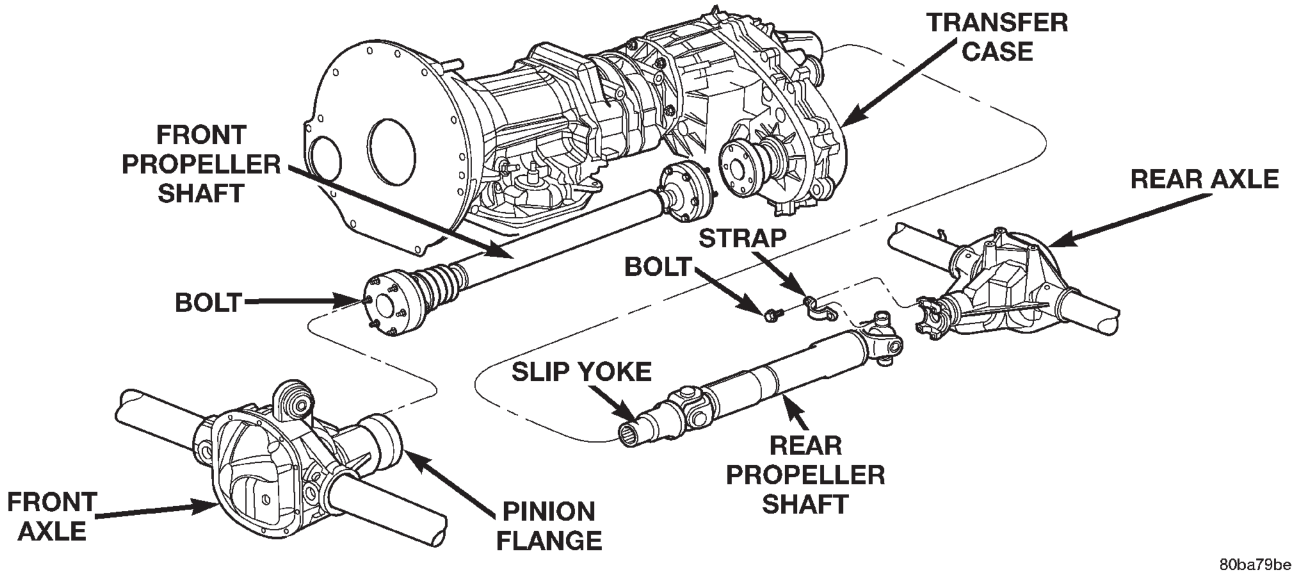


Fig. 1 Front & Rear Propeller Shafts

FRONT PROPELLER SHAFT

Only one style of front propeller shaft is used on WJ vehicles. The propeller shaft uses a Constant Velocity (CV) joint at both the axle and transfer case end of the propeller shaft. The CV joint at the axle end contracts and extends (plunges) as necessary to accomadate the variations in length necessary due to suspension travel. The CV joint at the transfer case end of the propeller shaft is fixed. The two CV joints are connected by a hollow tube shaft. The shaft length is not adjustable and does vary according to application.

PROPELLER SHAFT JOINTS

Two different types of propeller shaft joints are used in WJ vehicles (Fig. 2) and (Fig. 3). Neither of the joints are servicible. If worn or damaged, they must be replaced. If a vehicle has a damaged or worn Constant Velocity (CV) joint, or boot, the propeller shaft must be replaced.

PROPELLER SHAFT JOINT ANGLE

When two shafts come together at a common joint, the bend that is formed is called the operating angle. The larger the angle, the larger the amount of angular acceleration and deceleration of the joint. This speeding up and slowing down of the joint must be cancelled to produce a smooth power flow. This is done through the phasing of a propeller shaft and ensuring that the proper propeller shaft joint working angles are maintained.

A propeller shaft is properly phased when the yoke ends are in the same plane, or in line. A twisted shaft will make the yokes out of phase and cause a noticeable vibration.

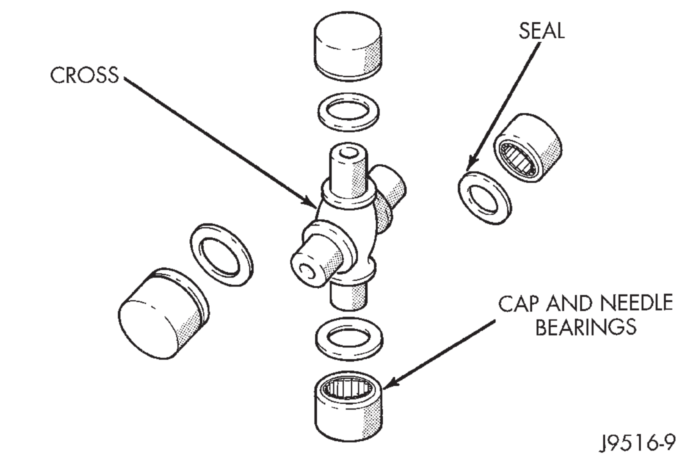


Fig. 2 Single Cardan U-Joint

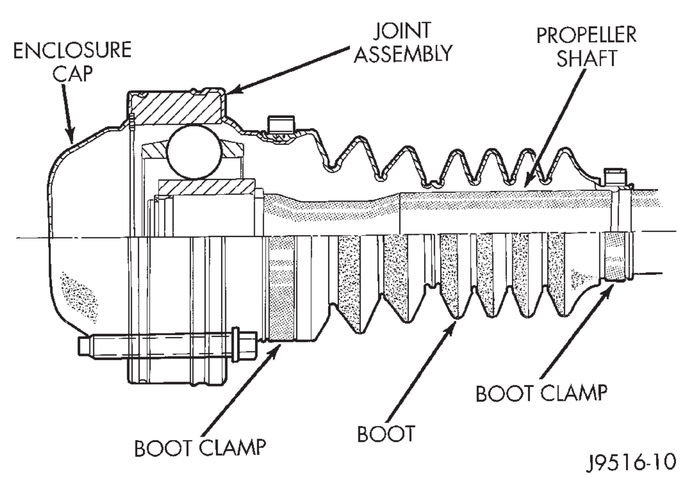


Fig. 3 Constant Velocity Joint

GENERAL INFORMATION (Continued)

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 (rpm) is the main factor in determining the maximum allowable operating angle. As a guide to the maximum normal operating angles refer to (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°

J9316-4

Fig. 4 Maximum Angles And Engine Speed

LUBRICATION

The factory installed universal joints are lubricated for the life of the vehicle and do not need lubrication. All universal joints should be inspected for leakage and damage each time the vehicle is serviced. If seal leakage or damage exists, the universal joint should be replaced.

The Constant Velocity joint should also be inspected each time the vehicle is serviced. The CV joint boot is designed to last the life of the vehicle and to keep the joint lubricated. If grease leakage or boot damage is found, the propeller shaft must be replaced.

PRECAUTIONS

Use the exact replacement parts when installing the propeller shafts. The use of the correct replacement parts helps to ensure safe operation. All fasteners must be torqued to the specified values for safe operation .

Also make alignment reference marks (Fig. 5) on the propeller shaft yoke and axle, or transmission, yoke prior to servicing. This helps to eliminate possible vibration.

CAUTION: Do not allow the propeller shaft to drop or hang from any propeller shaft joint during removal. Attach the propeller shaft to the vehicle underside with wire to prevent damage to the joints.

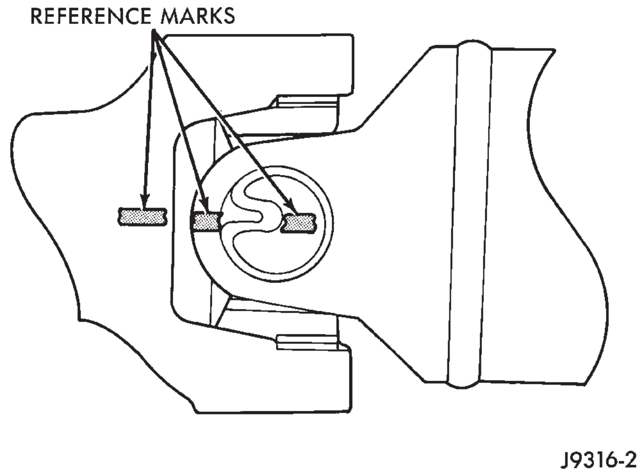


Fig. 5 Reference Marks on Yokes

CAUTION: It is very important to protect the external machined surface of the slip yoke from damage during and after propeller shaft removal. If the yoke is damaged, the transmission extension seal may be damaged and therefore cause a leak.

DIAGNOSIS AND TESTING

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.

Driveline vibration can also result from loose or damaged engine mounts. Refer to Group 9, Engines, for additional information.

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

UNBALANCE

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

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

(1) Raise the vehicle.

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

DIAGNOSIS AND TESTING (Continued)

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.

J9216-7

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

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

(5) Check the universal joint clamp screws torque.

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

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

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

(9) Install a screw clamp at position 1 (Fig. 6).

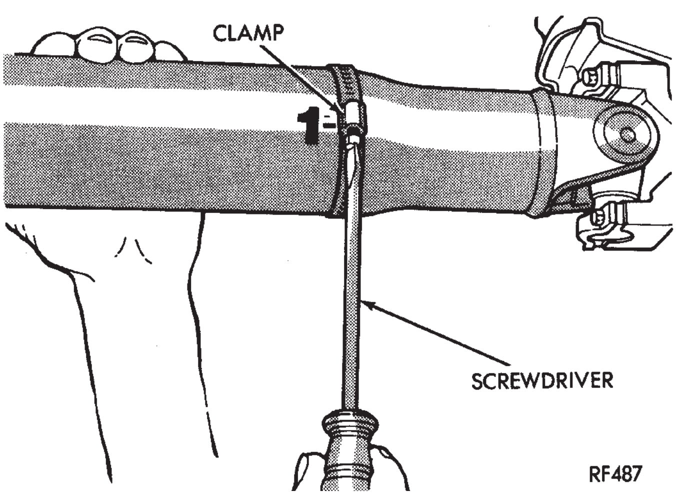


Fig. 6 Clamp Screw At Position 1

(10) 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.

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

(12) If the vibration decreased, install a second clamp (Fig. 7) and repeat the test.

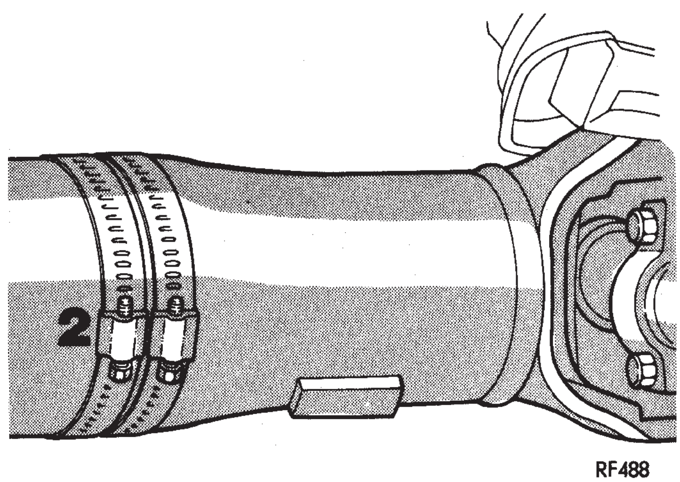


Fig. 7 Two Clamp Screws At The Same Position

DIAGNOSIS AND TESTING (Continued)

(13) If the additional clamp causes an additional vibration, separate the clamps (1/4 inch above and below the mark). Repeat the vibration test (Fig. 8).

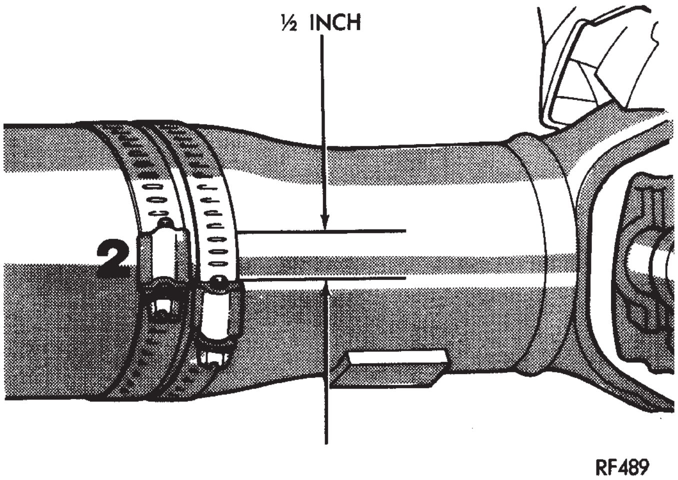


Fig. 8 Clamp Screws Separated

(14) 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.

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

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

RUNOUT

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

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

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

(4) Refer to Runout Specifications chart.

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

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

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

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

RUNOUT SPECIFICATIONS

Front of Shaft	0.020 in. (0.50 mm)
Center of Shaft	0.025 in. (0.63 mm)
Rear of Shaft	0.020 in. (0.50 mm)
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. For tube lengths under 30 inches, the maximum allowed runout is 0.020 in. (0.50 mm) for the full length of the tube.	

SERVICE PROCEDURES

DRIVELINE ANGLE MEASUREMENT PREPARATION

Before measuring universal joint angles, the following must be done;

- Inflate all tires to correct pressure.
- Check the angles in the same loaded or unloaded condition as when the vibration occurred. Propeller shaft angles change according to the amount of load in the vehicle.
- Check the condition of all suspension components and verify all fasteners are torqued to specifications.
- Check the condition of the engine and transmission mounts and verify all fasteners are torqued to specifications.

PROPELLER SHAFT ANGLE 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 any external bearing snap rings, if equipped, from universal joint so that the inclinometer base sits flat.

The same basic procedure applies to both the front propeller shafts and the rear propeller shaft. To obtain the front (output) angle on the CV front propeller shaft, the inclinometer is placed on the machined ring of the pinion flange. To obtain the propeller shaft angle measurement on the CV front propeller shaft, the inclinometer is placed on the propeller shaft tube.

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

Always make measurements from front to rear.

SERVICE PROCEDURES (Continued)

(2) Place Inclinometer on yoke bearing cap, or the pinion flange ring, (A) parallel to the shaft (Fig. 9). Center bubble in sight glass and record measurement.

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

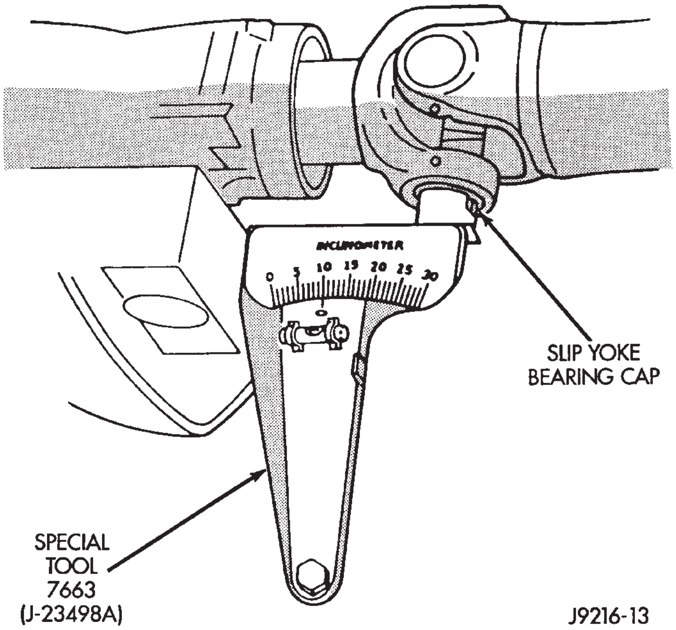


Fig. 9 Front (Output) Angle Measurement (A)

(3) Rotate propeller shaft 90 degrees and place Inclinometer on yoke bearing cap, or propeller shaft tube on CV propeller shaft, parallel to the shaft (Fig. 10). Center bubble in sight glass and record measurement. This measurement can also be taken at the rear end of the shaft.

This measurement will give you the propeller shaft angle (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 cap parallel to the shaft (Fig. 11). 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.

Refer to rules given below and the example in (Fig. 12) for additional information.

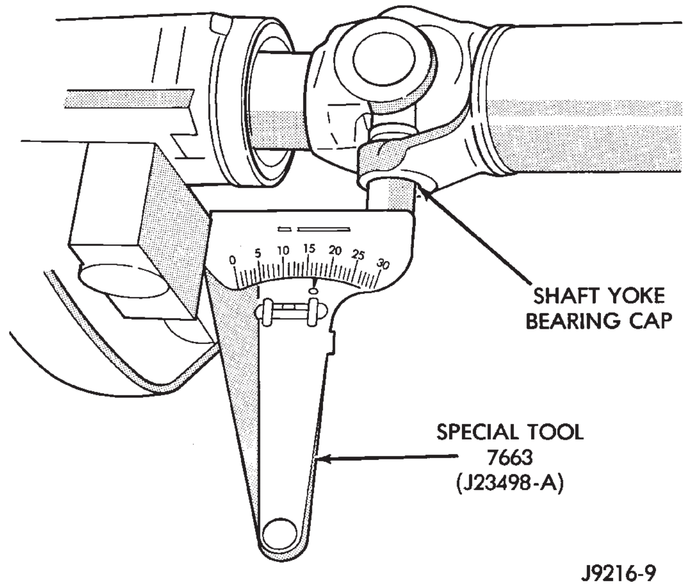


Fig. 10 Propeller Shaft Angle Measurement (C)

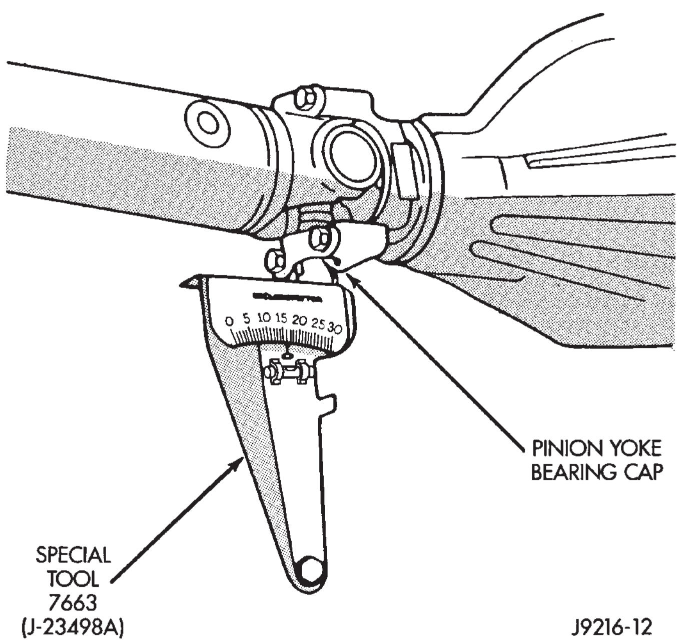


Fig. 11 Rear (Input) Angle Measurement (B)

- 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.

SERVICE PROCEDURES (Continued)

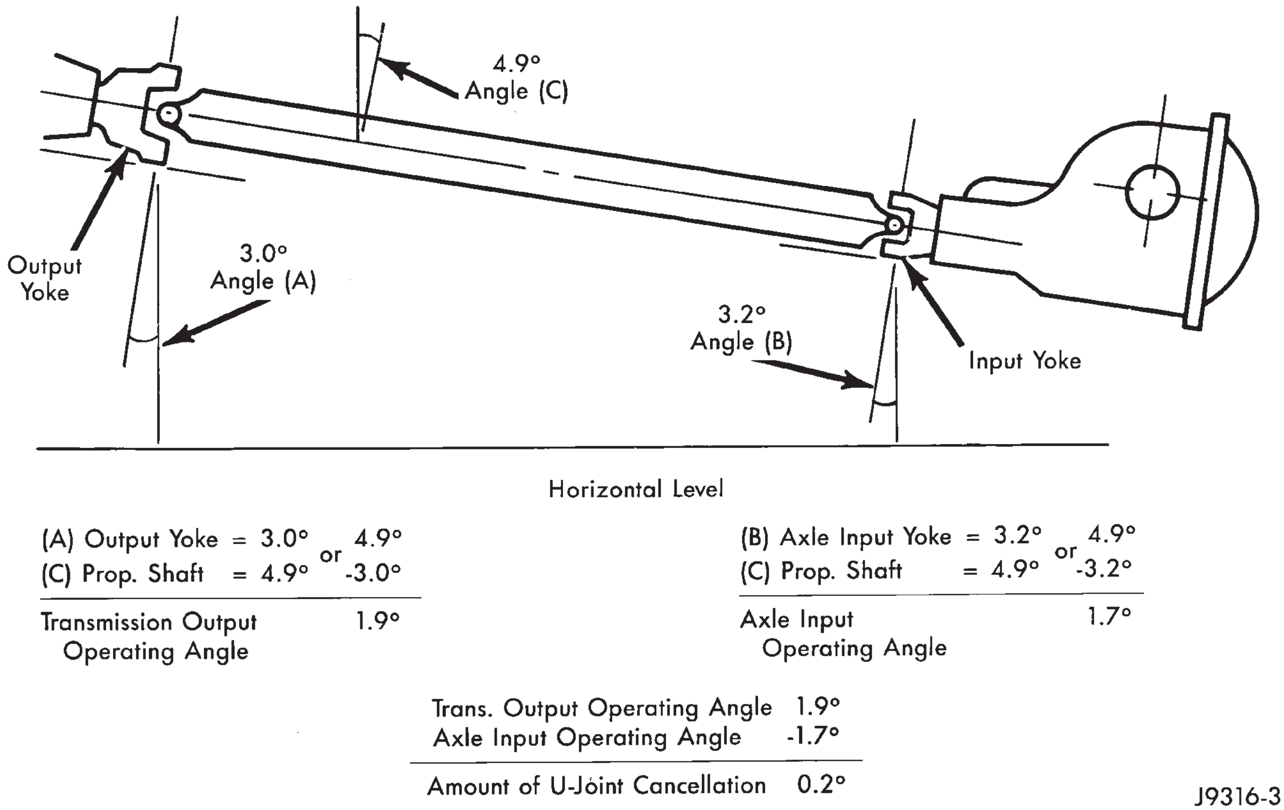


Fig. 12 Universal Joint Angle Example

REMOVAL AND INSTALLATION

FRONT PROPELLER SHAFT

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

REMOVAL

(1) Raise and support vehicle on safety stands.

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

(3) Using a suitable marker, mark a line across the companion flange at the transfer case and CV joint at the rear of the front propeller shaft for installation reference.

(4) Mark a line across the CV joint and the pinion companion flange for installation reference.

(5) Remove the bolts holding the front CV joint to the pinion companion flange.

(6) Remove the bolts holding the rear CV joint to the transfer case companion flange.

(7) Separate the rear CV joint from the transfer case companion flange.

(8) Push rear of propeller shaft upward to clear transfer case companion flange.

(9) Separate front CV joint from front axle.

(10) Separate propeller shaft from vehicle.

INSTALLATION

(1) Position front propeller shaft under vehicle with rear CV joint over the transfer case companion flange.

(2) Place front CV joint into the axle pinion companion flange. CV joint should rotate freely in the pinion flange.

(3) Align mark on the transfer case companion flange to the mark on the CV joint at the rear of the front propeller.

(4) Loosely install bolts to hold CV joint to transfer case companion flange.

(5) Align mark on front CV joint to the mark on the axle pinion companion flange.

(6) Install bolts to hold front CV joint to the axle pinion companion flange. Tighten bolts to 32 N·m (23.5 ft. lbs.).

(7) Tighten bolts to hold rear CV joint to the transfer case companion flange to 32 N·m (23.5 ft. lbs.).

(8) Lower vehicle and road test to verify repair.

REAR PROPELLER SHAFT

REMOVAL

(1) Raise and support vehicle on safety stands.

REMOVAL AND INSTALLATION (Continued)

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

(3) Using a suitable marker, mark a line across the axle pinion yoke and the propeller shaft yoke for installation reference.

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

(5) Slide the slip yoke off of the transmission, or transfer case, output shaft and remove the propeller shaft (Fig. 13).

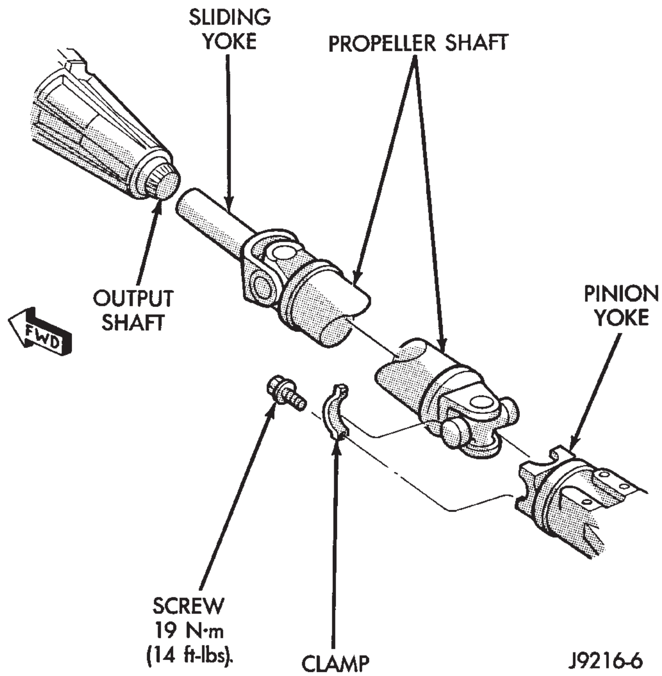


Fig. 13 Rear Propeller Shaft

INSTALLATION

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

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

(3) Position universal joint into pinion yoke.

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

(5) Lower the vehicle.

DISASSEMBLY AND ASSEMBLY

SINGLE CARDAN UNIVERSAL JOINT

DISASSEMBLY

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

(1) Remove the propeller shaft.

(2) Using a soft drift, tap the outside of the bearing cap assembly to loosen snap ring.

(3) Remove snap rings from both sides of yoke (Fig. 14).

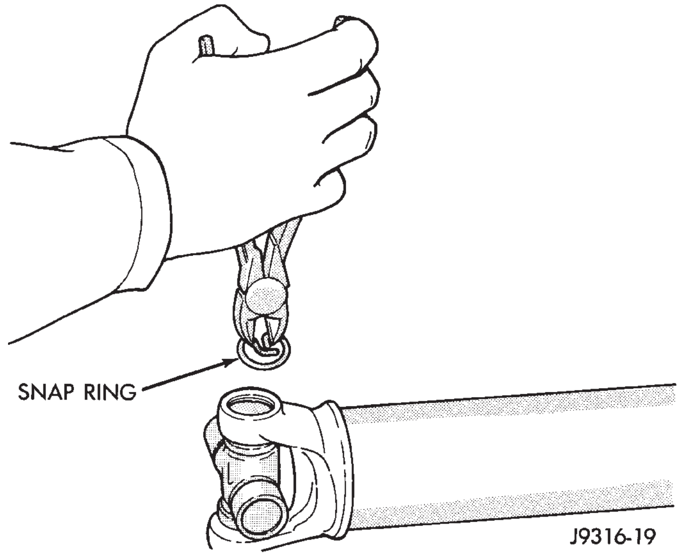


Fig. 14 Remove Snap Ring

(4) Set the yoke in an arbor press or vise with a socket whose inside diameter is large enough to receive the bearing cap positioned beneath the yoke.

(5) Position the yoke with the grease fitting, if equipped, pointing up.

(6) Place a socket with an outside diameter smaller than the upper bearing cap on the upper bearing cap and press the cap through the yoke to release the lower bearing cap (Fig. 15).

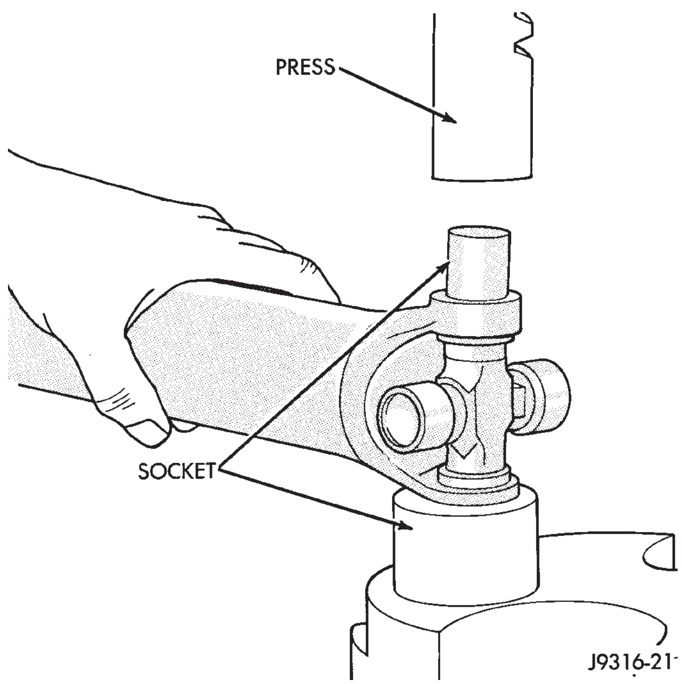


Fig. 15 Press Out Bearing

DISASSEMBLY AND ASSEMBLY (Continued)

(7) If the bearing cap will not pull out of the yoke by hand after pressing, tap the yoke ear near the bearing cap to dislodge the cap.

(8) To remove the opposite bearing cap, turn the yoke over and straighten the cross in the open hole. Then, carefully press the end of the cross until the remaining bearing cap can be removed (Fig. 16).

CAUTION: If the cross or bearing cap are not straight during installation, the bearing cap will score the walls of the yoke bore and damage can occur.

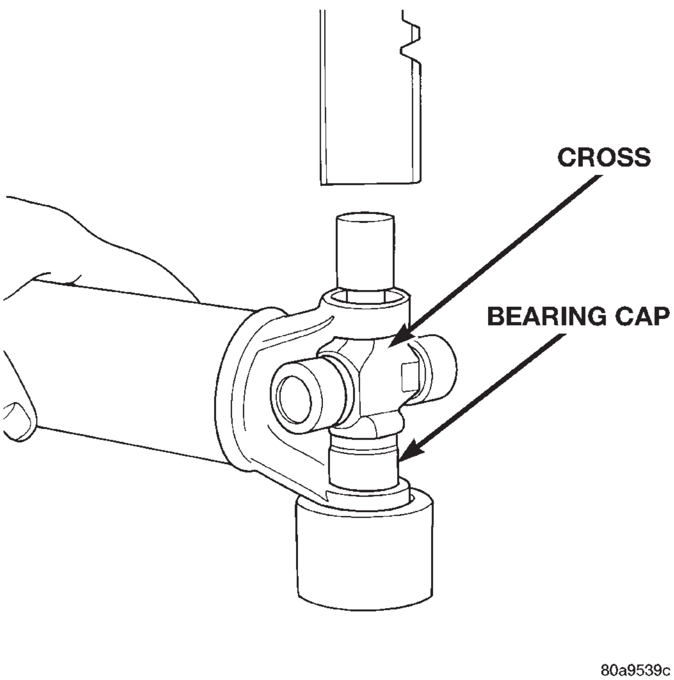


Fig. 16 Press Out Remaining Bearing

ASSEMBLY

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

(2) Position the cross in the yoke with its lube fitting, if equipped, pointing up (Fig. 17).

(3) Place a bearing cap over the trunnion and align the cap with the yoke bore (Fig. 18). Keep the needle bearings upright in the bearing assembly. A needle bearing lying at the bottom of the cap will prevent proper assembly.

(4) Press the bearing cap into the yoke bore enough to install a snap ring.

(5) Install a snap ring.

(6) Repeat Step 3 and Step 4 to install the opposite bearing cap. If the joint is stiff or binding, strike the yoke with a soft hammer to seat the needle bearings.

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

(8) Install the propeller shaft.

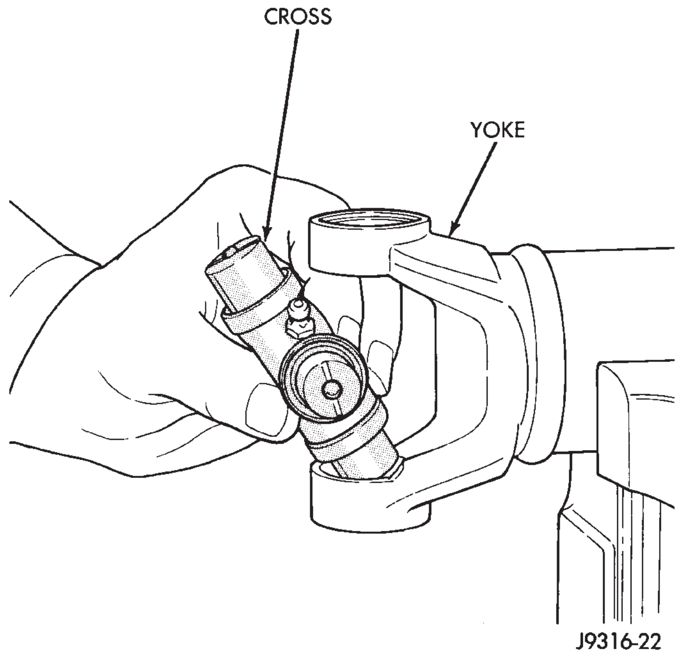


Fig. 17 Install Cross In Yoke

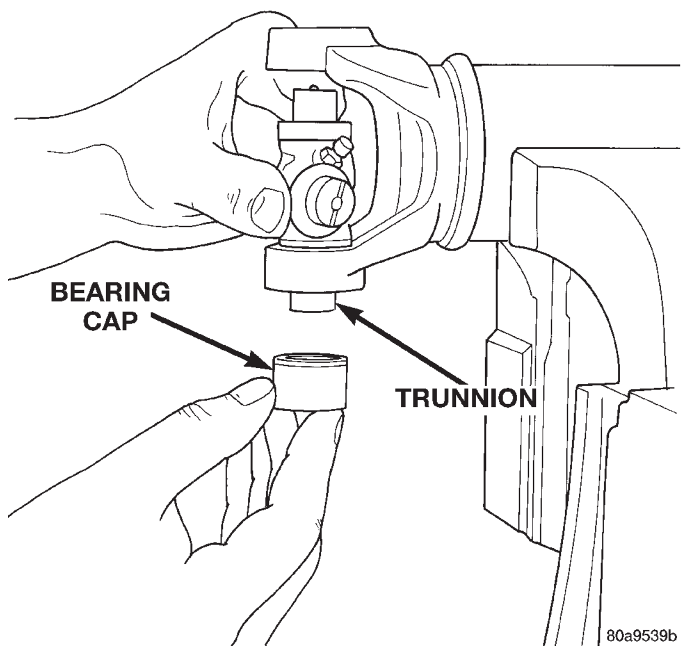


Fig. 18 Install Bearing On Trunnion

CLEANING AND INSPECTION

SINGLE CARDAN JOINT

(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 cap bores.

ADJUSTMENTS

FRONT PROPELLER SHAFT MEASUREMENT

This measurement is to be taken with the shaft installed and the vehicle at proper ride height.

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

(2) Measure the distance from the face of the CV joint cup to the end of the CV joint boot (Fig. 19).

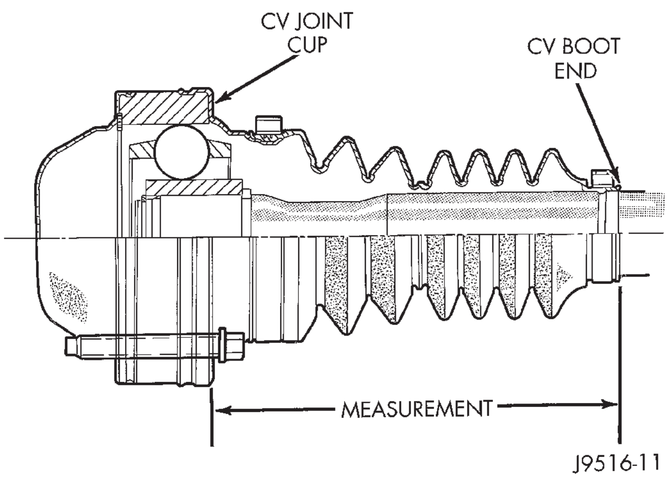


Fig. 19 Measurement

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

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

SPECIFICATIONS

TORQUE

FRONT PROPELLER SHAFT

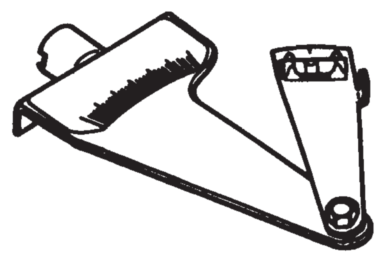
DESCRIPTION	TORQUE
Bolts, Transfer Case Companion Flange	32 N·m (23.5 ft. lbs.)
Bolts, Pinion Companion Flange	32 N·m (23.5 ft. lbs.)

REAR PROPELLER SHAFT

DESCRIPTION	TORQUE
Bolts, Rear Yoke	19 N·m (14 ft. lbs.)

SPECIAL TOOLS

PROPELLER SHAFT



Inclinometer—7663

186 FBI AXLE

INDEX

GENERAL INFORMATION

186 FBI AXLE

The 186 Front Beam-design Iron (FBI) axle consists of a cast iron differential housing with axle shaft tubes extending from either side. The tubes are pressed into the differential housing and welded.

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 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.

For vehicles with ABS brakes, the ABS wheel speed sensors are attached to the knuckle assemblies. The tone rings for the ABS system are pressed onto the axle shaft. **Do not damage ABS tone wheel or the sensor when removing axle shafts.**

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

The 186 FBI axle has the assembly part number and gear ratio listed on a tag. The tag is attached to the housing cover by a cover bolt. Build date identification codes are stamped on the cover side of the axle shaft tube.

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 (select thickness). 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.

GENERAL INFORMATION (Continued)

LUBRICANT SPECIFICATIONS

A multi–purpose, hypoid gear lubricant which conforms to the following specifications should be used. Mopar® Hypoid Gear Lubricant conforms to all of these specifications.

- The lubricant should have MIL–L–2105C and API GL 5 quality specifications.
- Lubricant is a thermally stable SAE 80W–90 gear lubricant.
- Lubricant for axles intended for heavy-duty or trailer tow use is SAE 75W–140 SYNTHETIC gear lubricant.

The 186 FBI, with a standard differential, axle lubricant capacity is 1.18 L (2.5 pts.). The 186 FBI, with a Vari-lok™ differential, axle lubricant capacity is 1.19 L (2.51 pts.), which includes friction modifier. Vari-lok™ equipped vehicles require the addition of 0.07L (0.15 pts.) of friction modifier.

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

DESCRIPTION AND OPERATION

STANDARD DIFFERENTIAL

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:

- The pinion gear rotates the ring gear
- The ring gear (bolted to the differential case) rotates the case
- The differential pinion gears (mounted on the pinion mate shaft in the case) rotate the side gears
- The 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. 1).

When turning corners, the outside wheel must travel a greater distance than the inside wheel to complete a turn. The difference must be compensated for to prevent the tires from scuffing and skidding through turns. To accomplish this, the differential allows the axle shafts to turn at unequal speeds (Fig. 2). In this instance, the input torque applied to the

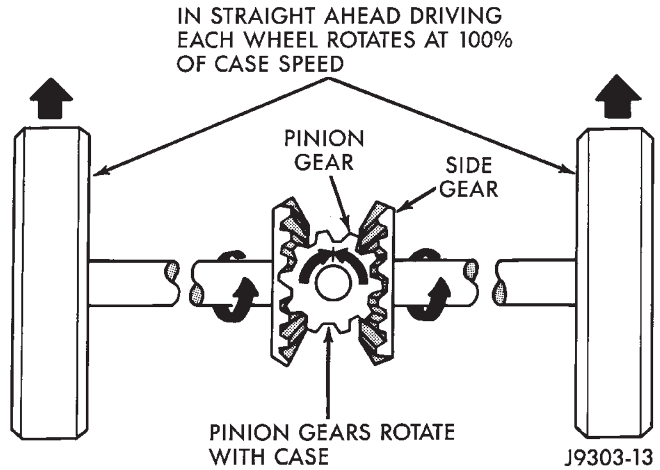


Fig. 1 Differential Operation—Straight Ahead Driving

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.

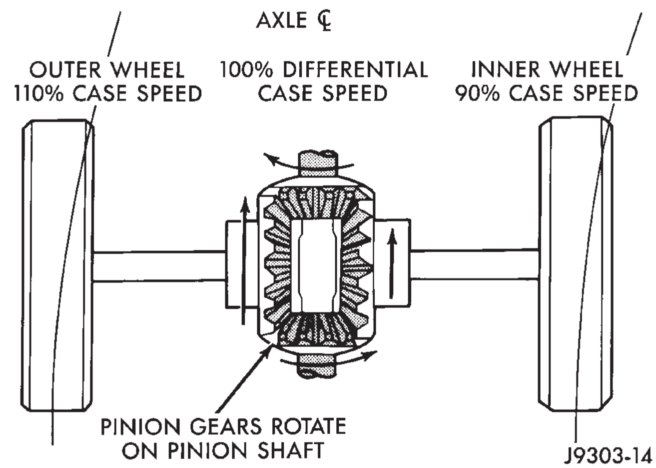


Fig. 2 Differential Operation—On Turns

VARI-LOK™ OPERATION

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

Vari-lok™ differentials are a speed-sensing torque transfer differential. Similiar to Trac-lok™ differentials, these differentials transfer torque to the wheel with the greater traction. Unlike typical differential systems, torque transfer is proportional to wheel speed difference rather than torque difference. Response can be tuned to driving conditions, enabling use of this system in the front axle. Both front and rear Vari-lok™ axle torque transfer characteristics are tuned to provide smooth operation. Except for the ability to maintain headway under low-traction conditions, operation is barely noticable to the driver.

DESCRIPTION AND OPERATION (Continued)

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

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

DIAGNOSIS AND TESTING

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.

Axle gear problem conditions are usually the result of:

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

Axle component breakage is most often the result of:

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

GEAR NOISE

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

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.
- Gear damage.

Differential side and pinion gears can be checked by turning the vehicle. They usually do not cause noise during straight–ahead driving when the gears are unloaded. The side gears are loaded during vehicle turns. 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 rear pinion bearing is the source of the noise. If the bearing noise is heard during a coast, the front pinion bearing is the source.

Worn or damaged differential bearings usually produce a low pitch noise. Differential bearing noise is similar to pinion bearing noise. 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.

DIAGNOSIS AND TESTING (Continued)

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

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 vibration 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 side gear/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.

DIAGNOSIS AND TESTING (Continued)

FRONT AXLES

DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
WHEEL NOISE	1. Wheel loose. 2. Faulty, brinelled wheel bearing.	1. Tighten loose nuts. 2. Faulty or brinelled bearings must be replaced.
AXLE SHAFT NOISE	1. Misaligned axle shaft tube. 2. Bent or sprung axle shaft. 3. End play in drive pinion bearings. 4. Excessive gear backlash between ring gear and pinion gear. 5. Improper adjustment of drive pinion gear shaft bearings. 6. Loose drive pinion gearshaft yoke nut. 7. Improper wheel bearing adjustment. 8. Scuffed gear tooth contact surfaces.	1. Inspect axle shaft tube alignment. Correct as necessary. 2. Replace bent or sprung axle shaft. 3. Refer to Drive Pinion Bearing Pre-Load Adjustment. 4. Check adjustment of ring gear backlash and pinion gear. Correct as necessary. 5. Adjust drive pinion shaft bearings. 6. Tighten drive pinion gearshaft yoke nut with specified torque. 7. Readjust as necessary. 8. If necessary, replace scuffed gears.
AXLE SHAFT BROKE	1. Misaligned axle shaft tube. 2. Vehicle overloaded. 3. Erratic clutch operation. 4. Grabbing clutch.	1. Replace broken axle shaft after correcting axle shaft tube alignment. 2. Replace broken axle shaft. Avoid excessive weight on vehicle. 3. Replace broken axle shaft after inspecting for other possible causes. Avoid erratic use of clutch. 4. Replace broken axle shaft. Inspect clutch and make necessary repairs or adjustments.
DIFFERENTIAL CASE CRACKED	1. Improper adjustment of differential bearings. 2. Excessive ring gear backlash. 3. Vehicle overloaded. 4. Erratic clutch operation.	1. Replace cracked case; examine gears and bearings for possible damage. At reassembly, adjust differential bearings properly. 2. Replace cracked case; examine gears and bearings for possible damage. At reassembly, adjust ring gear backlash properly. 3. Replace cracked case; examine gears and bearings for possible damage. Avoid excessive weight on vehicle. 4. Replace cracked case. After inspecting for other possible causes, examine gears and bearings for possible damage. Avoid erratic use of clutch.
DIFFERENTIAL GEARS SCORED	1. Insufficient lubrication. 2. Improper grade of lubricant. 3. Excessive spinning of one wheel/tire.	1. 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. 2. Replace scored gears. Inspect all gears and bearings for possible damage. Clean and refill differential housing to required capacity with proper lubricant. 3. Replace scored gears. Inspect all gears, pinion bores and shaft for damage. Service as necessary.
LOSS OF LUBRICANT	1. Lubricant level too high.	1. Drain excess lubricant by removing fill plug and allow lubricant to level at lower edge of fill plug hole.

J9503-3

DIAGNOSIS AND TESTING (Continued)

DIAGNOSIS – CONTINUED

CONDITION	POSSIBLE CAUSES	CORRECTION
LOSS OF LUBRICANT	2. Worn axle shaft seals. 3. Cracked differential housing. 4. Worn drive pinion gear shaft seal. 5. Scored and worn yoke. 6. Axle cover not properly sealed.	2. Replace worn seals. 3. Repair or replace housing as necessary. 4. Replace worn drive pinion gear shaft seal. 5. Replace worn or scored yoke and seal. 6. Remove cover and clean flange and reseal.
AXLE OVERHEATING	1. Lubricant level too low. 2. Incorrect grade of lubricant. 3. Bearings adjusted too tight. 4. Excessive gear wear. 5. Insufficient ring gear backlash.	1. Refill differential housing. 2. Drain, flush and refill with correct amount of the correct lubricant. 3. Readjust bearings. 4. Inspect gears for excessive wear or scoring. Replace as necessary. 5. Readjust ring gear backlash and inspect gears for possible scoring.
GEAR TEETH BROKE (RING GEAR AND PINION)	1. Overloading. 2. Erratic clutch operation. 3. Ice-spotted pavements. 4. Improper adjustments.	1. Replace gears. Examine other gears and bearings for possible damage. 2. Replace gears and examine the remaining parts for possible damage. Avoid erratic clutch operation. 3. Replace gears. Examine the remaining parts for possible damage. Replace parts as required. 4. Replace gears. Examine other parts for possible damage. Ensure ring gear backlash is correct.
AXLE NOISE	1. Insufficient lubricant. 2. Improper ring gear and drive pinion gear adjustment. 3. Unmatched ring gear and drive pinion gear. 4. Worn teeth on ring gear or drive pinion gear. 5. Loose drive pinion gear shaft bearings. 6. Loose differential bearings. 7. Misaligned or sprung ring gear. 8. Loose differential bearing cap bolts	1. Refill axle with correct amount of the proper lubricant. Also inspect for leaks and correct as necessary. 2. Check ring gear and pinion gear teeth contact pattern. 3. Remove unmatched ring gear and drive pinion gear. Replace with matched gear and drive pinion gear set. 4. Check teeth on ring gear and drive pinion gear for correct contact. If necessary, replace with new matched set. 5. Adjust drive pinion gearshaft bearing preload torque. 6. Adjust differential bearing preload torque. 7. Measure ring gear runout. 8. Tighten with specified torque

J9503-4

DIAGNOSIS AND TESTING (Continued)

VARI-LOK™ TEST

PRIMING

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

(2) Remove the axle fill plug.

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

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

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

TEST PROCEDURE

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

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

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

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

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

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

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

SERVICE PROCEDURES

LUBRICANT CHANGE

(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, or equivalent, to the housing cover (Fig. 3).

Install the housing cover within 5 minutes after applying the sealant.

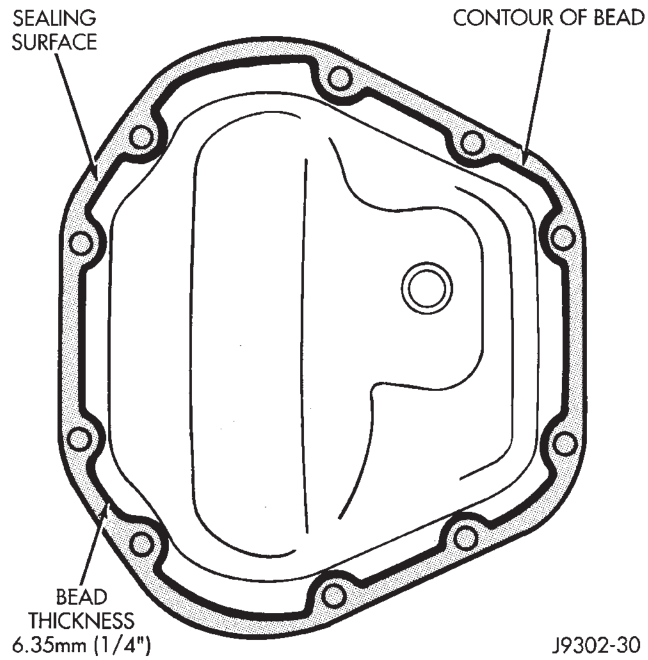


Fig. 3 Typical Housing Cover With Sealant

(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) For Vari-lok™ differentials, a quantity of Mopar® Trac-lok™ lubricant (friction modifier), or equivalent, must be added after repair service or a lubricant change. Refer to the Lubricant Specifications section of this group for the quantity necessary.

(9) Refill the differential with Mopar® Hypoid Gear Lubricant, or equivalent, to bottom of the fill plug hole. Refer to the Lubricant Specifications in this group for the quantity necessary.

(10) Install the fill hole plug and lower the vehicle. Tighten fill plug to 34 N·m (25 ft. lbs.).

(11) Vari-lok™ differential equipped 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.

REMOVAL AND INSTALLATION

DRIVE AXLE ASSEMBLY

REMOVAL

(1) Raise and support the vehicle.

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

(3) Secure axle to device.

(4) Remove the wheels and tires.

(5) Remove the brake rotors and calipers from the axle. Refer to Group 5, Brakes, for proper procedures.

REMOVAL AND INSTALLATION (Continued)

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

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

(8) Mark the propeller shaft and yoke, or pinion flange, for installation alignment reference.

(9) Remove propeller shaft.

(10) Disconnect stabilizer bar links at the axle.

(11) Disconnect shock absorbers from axle brackets.

(12) Disconnect track bar.

(13) Disconnect the tie rod and drag link from the steering knuckle. Refer to Group 2, Suspension, for proper procedures.

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

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

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

(17) Remove the coil springs from the axle.

INSTALLATION

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

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

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

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

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

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

(6) Connect the track bar to the axle bracket. Loosely install the bolt to hold the track bar to the axle bracket.

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

(8) Install the stabilizer bar links to the axle brackets. Tighten the nut to 95 N·m (70 ft. lbs.) torque.

(9) Install the drag link and tie rod to the steering knuckles. Refer to Group 2, Suspension, for proper procedures.

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

(11) Install the brake rotors and calipers. Refer to Group 5, Brakes, for the proper procedures.

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

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

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

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

(16) Check and fill axle lubricant. Refer to the Lubricant Specifications in this group for the quantity necessary.

(17) Install the wheel and tire assemblies.

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

(19) 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.

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

(21) Check the front wheel alignment.

AXLE SHAFT—CARDAN U-JOINT

Single cardan U–joint components 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.

REMOVAL

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

(1) Remove axle shaft.

(2) Remove the bearing cap retaining snap rings (Fig. 4).

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

(3) Locate a socket where the inside diameter 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.

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

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

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

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

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

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

REMOVAL AND INSTALLATION (Continued)

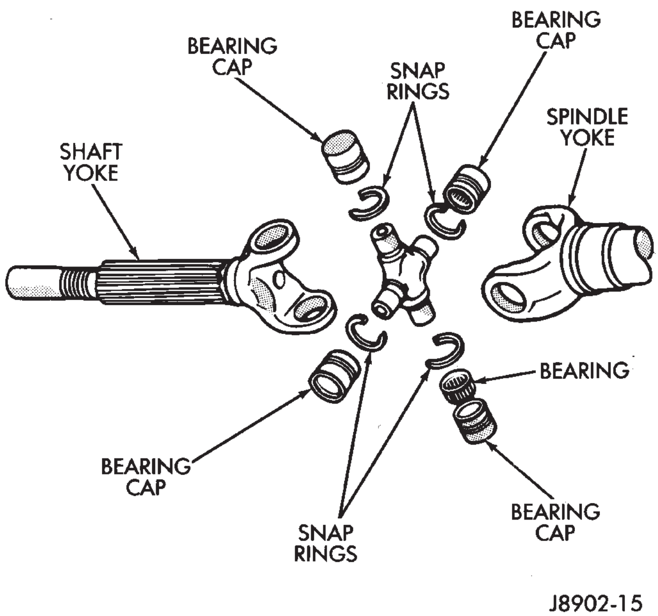


Fig. 4 Axle Shaft Outer U–Joint

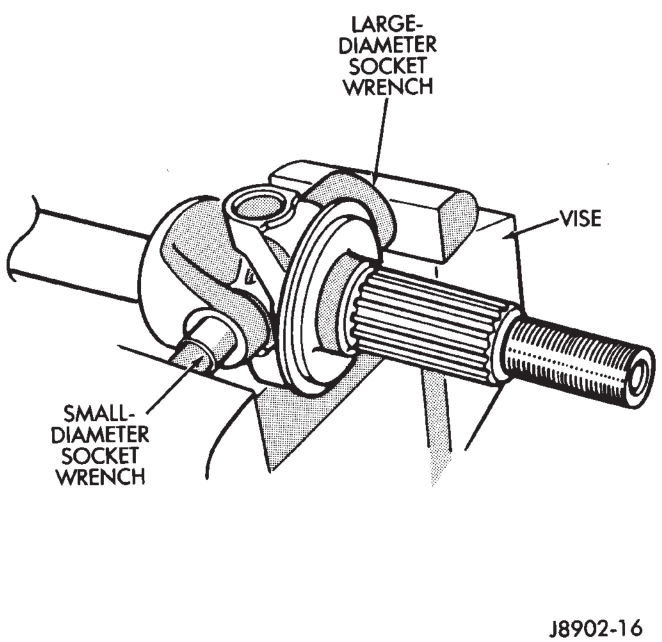


Fig. 5 Yoke Bearing Cap Removal

INSTALLATION

(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 axle shaft.

AXLE CONSTANT–VELOCITY (C/V) JOINT BOOT

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

REMOVAL

(1) Remove axle shaft.

(2) Remove large boot clamp retaining C/V joint sealing boot, to C/V joint housing and discard.

(3) Remove small clamp that retains outer C/V joint sealing boot to axle shaft and discard (Fig. 6).

(4) Remove sealing boot from outer C/V joint housing and slide it down and off the axle shaft.

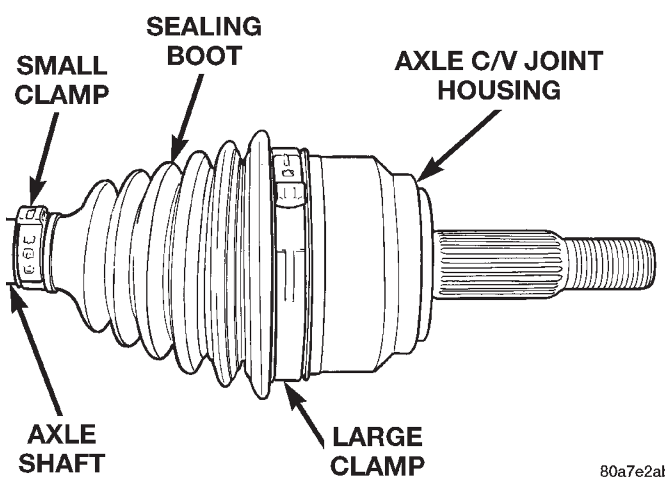


Fig. 6 Outer C/V Joint Seal Boot Clamps

(5) Thoroughly clean and inspect axle C/V joint assembly and axle shaft for any signs of excessive wear. **If any parts show signs of excessive wear, the axle shaft assembly will require replacement. Component parts of these axle shaft assemblies are not serviceable.**

INSTALLATION

(1) Slide new sealing boot large clamp over axle shaft and onto C/V joint.

(2) Slide the axle C/V joint sealing boot onto the axle shaft.

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

REMOVAL AND INSTALLATION (Continued)

(4) Install axle C/V joint boot small clamp evenly on sealing boot.

(5) Position axle C/V joint boot into retaining groove in axle C/V joint housing. Then, install large retaining clamp evenly on sealing boot.

(6) Clamp small sealing boot clamp onto axle shaft using Crimper C-4975-A. Place crimping tool C-4975-A over bridge of clamp (Fig. 7).

(7) Tighten nut on crimping tool C-4975-A until jaws on tool are closed completely together, face to face (Fig. 8).

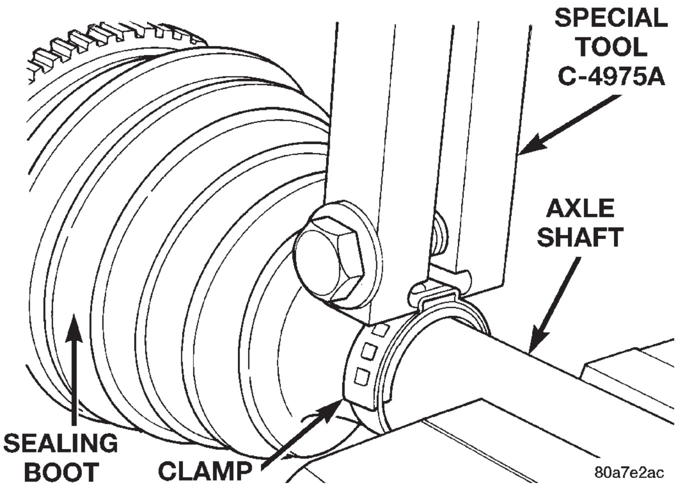


Fig. 7 Crimping Tool Installed On Boot Clamp

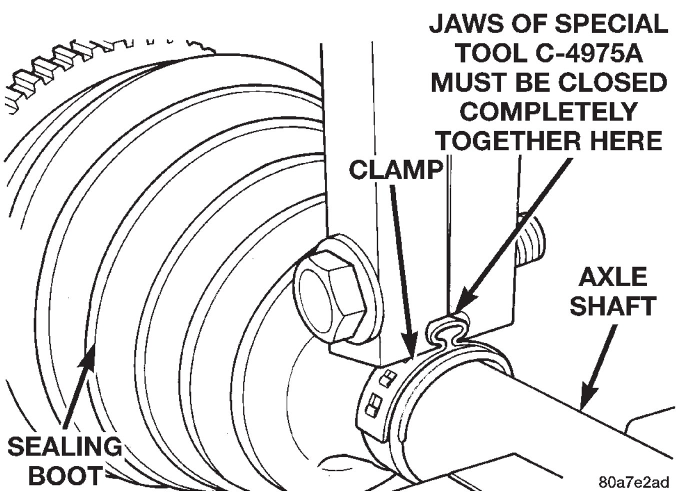


Fig. 8 Sealing Boot Retaining Clamp Installed

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

(8) Clamp large sealing boot clamp onto axle shaft using Crimper C-4975-A. Place crimping tool C-4975-A over bridge of clamp (Fig. 9).

(9) Tighten nut on crimping tool C-4975-A until jaws on tool are closed completely together, face to face.

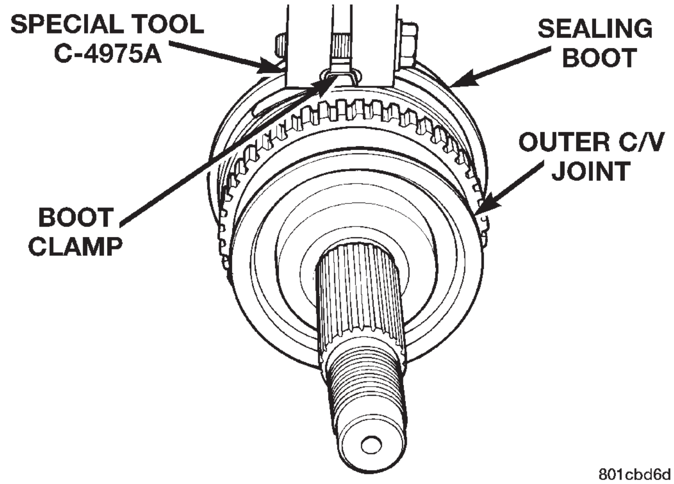


Fig. 9 Crimping Tool Installed On Large Boot Clamp

PINION SHAFT SEAL

REMOVAL

(1) Raise and support the vehicle.

(2) Remove wheel and tire assemblies.

(3) Remove brake rotors and calipers. Refer to Group 5, Brakes, for proper procedures.

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

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

(6) Rotate the pinion gear a minimum of ten times. Verify that the pinion rotates smoothly.

(7) Measure the amount of torque necessary to rotate the pinion gear with a (in. lbs.) dial-type torque wrench. Record the torque reading for installation reference.

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

(9) Use Remover C-452 and Wrench C-3281 to remove the pinion companion flange.

(10) Use Remover 7794-A and slide hammer to remove the pinion shaft seal (Fig. 10).

INSTALLATION

(1) Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with Installer C-3972-A and Handle C-4171 (Fig. 11).

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

REMOVAL AND INSTALLATION (Continued)

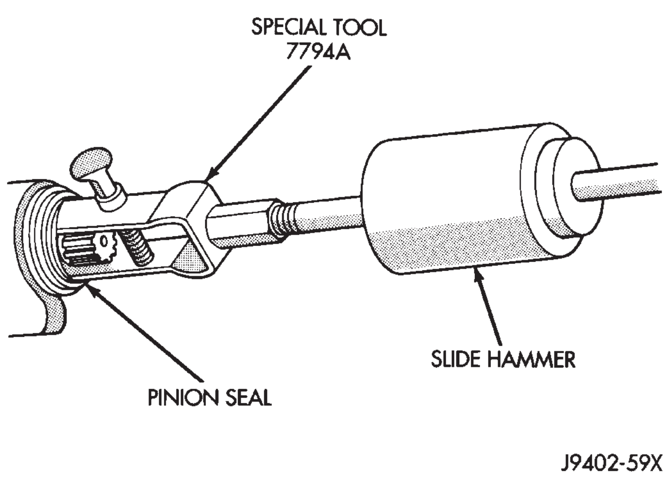


Fig. 10 Seal Removal

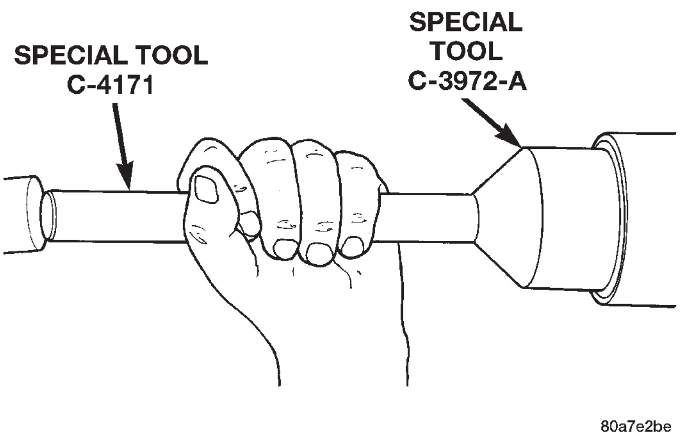


Fig. 11 Pinion Seal Installation

CAUTION: Do not exceed the minimum tightening torque when installing the pinion companion flange retaining nut at this point. Damage to collapsible spacer or bearings may result.

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

(4) Rotate the pinion a minimum of ten times. Verify that the pinion rotates smoothly. Rotate the pinion shaft using a (in. lbs.) torque wrench. Rotating torque should be equal to the reading recorded during removal, plus an additional 0.56 N·m (5 in. lbs.) (Fig. 12).

(5) If the rotating torque is low, use Holder 6958 to hold the pinion companion flange (Fig. 13), and tighten the pinion shaft nut in 6.8 N·m (5 ft. lbs.) increments until proper rotating torque is achieved.

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

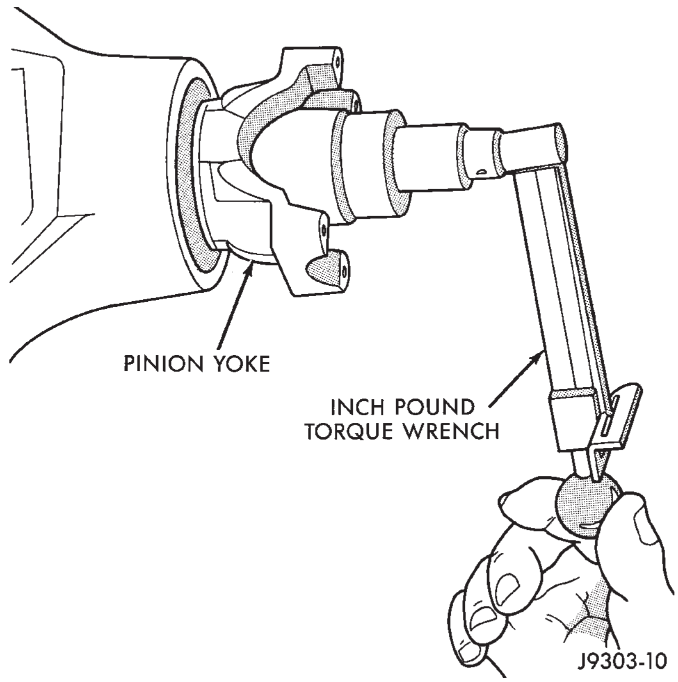


Fig. 12 Check Pinion Rotation Torque–Typical

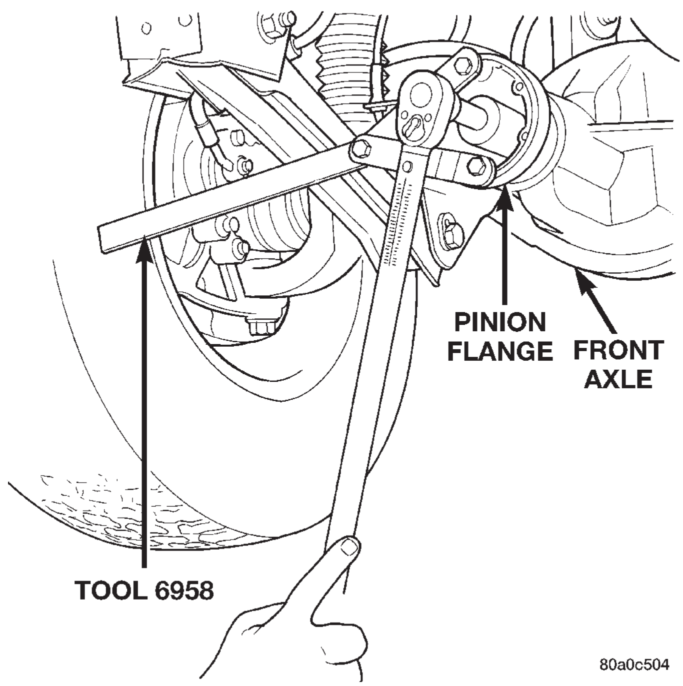


Fig. 13 Tightening Pinion Shaft Nut

(6) Align the installation reference marks on the propeller shaft and pinion companion flange and install the propeller shaft.

(7) Check and fill the gear lubricant. Refer to the Lubricant Specifications for gear lubricant requirements.

(8) Install the brake rotors and calipers. Refer to Group 5, Brakes, for proper procedures.

(9) Install wheel and tire assemblies.

(10) Lower the vehicle.

REMOVAL AND INSTALLATION (Continued)

COLLAPSIBLE SPACER

REMOVAL W/PINION INSTALLED

(1) Raise and support the vehicle.

(2) Remove wheel and tire assemblies.

(3) Remove brake rotors and calipers. Refer to Group 5, Brakes, for proper procedures.

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

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

(6) Rotate the pinion gear a minimum of ten times. Verify that the pinion rotates smoothly.

(7) Measure the amount of torque necessary to rotate the pinion gear with a (in. lbs.) dial-type torque wrench. Record the torque reading for installation reference.

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

(9) Use Remover C-452 and Wrench C-3281 to remove the pinion companion flange.

(10) Use Remover 7794-A and slide hammer to remove the pinion shaft seal (Fig. 14).

(11) Remove the front pinion bearing using a pair of suitable pick tools to pull the bearing straight off the pinion gear shaft. It may be necessary to lightly tap the end of the pinion gear with a rawhide or rubber mallet if the bearing becomes bound on the pinion shaft.

(12) Remove the collapsible spacer.

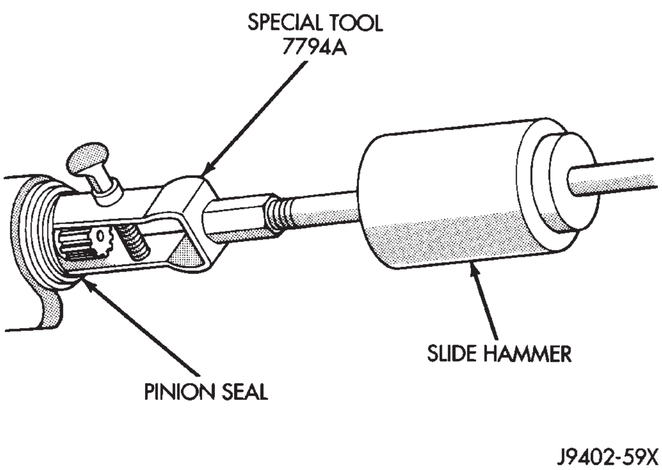


Fig. 14 Seal Removal

REMOVAL W/PINION REMOVED

(1) Raise and support the vehicle.

(2) Remove wheel and tire assemblies.

(3) Remove brake rotors and calipers. Refer to Group 5, Brakes, for proper procedures.

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

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

(6) Rotate the pinion gear a minimum of ten times. Verify that the pinion rotates smoothly.

(7) Measure the amount of torque necessary to rotate the pinion gear with a (in. lbs.) dial-type torque wrench. Record the torque reading for installation reference.

(8) Remove differential assembly from axle housing.

(9) Using Holder 6958 and a short length of 1 in. pipe to hold the pinion companion flange, remove the pinion nut and washer.

(10) Using Remover C-452 and Wrench C-3281, remove the pinion companion flange from pinion shaft.

(11) Remove the pinion gear from housing (Fig. 15). Catch the pinion with your hand to prevent it from falling and being damaged.

(12) Remove collapsible spacer from pinion shaft.

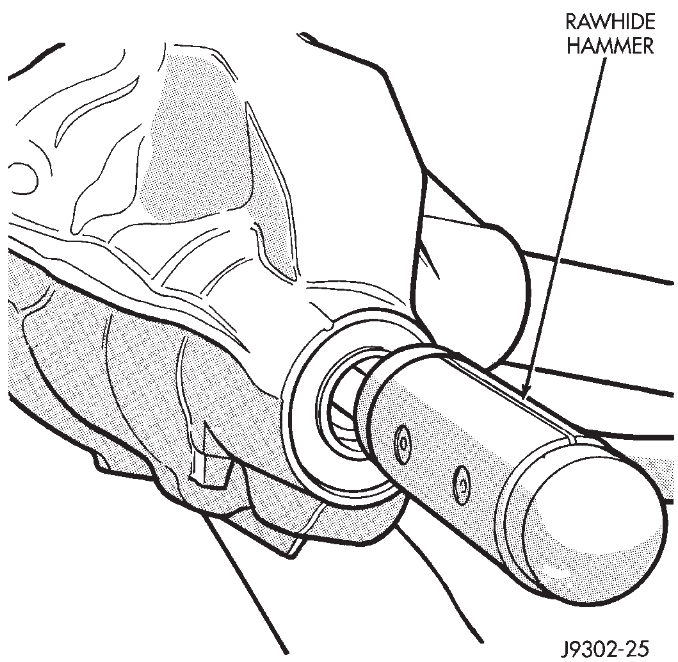


Fig. 15 Remove Pinion Gear

INSTALLATION

(1) Install a new collapsible preload spacer on pinion shaft (Fig. 16).

(2) If pinion gear was removed, install pinion gear in housing.

(3) Install pinion front bearing, if necessary.

(4) Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with Installer C-3972-A and Handle C-4171 (Fig. 17), if necessary.

(5) Install pinion companion flange with Installer W-162-D, Cup 8109, and Flange Holder 6958.

REMOVAL AND INSTALLATION (Continued)

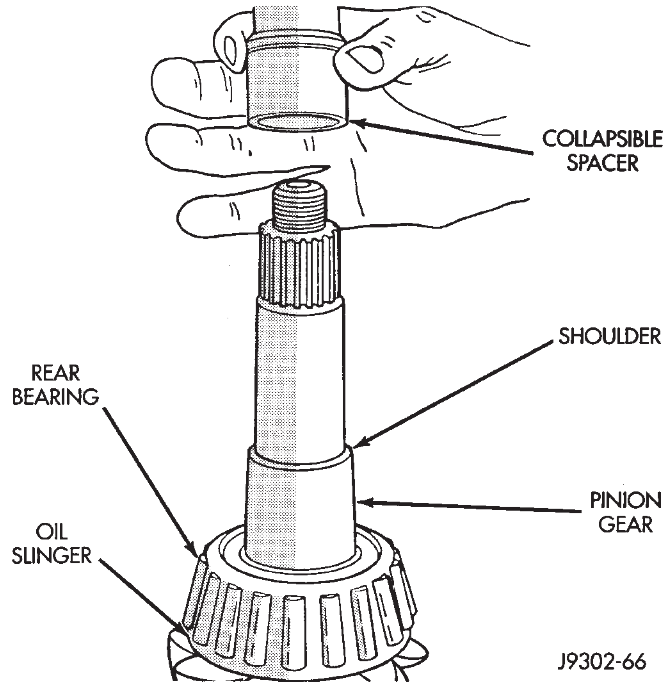


Fig. 16 Collapsible Preload Spacer

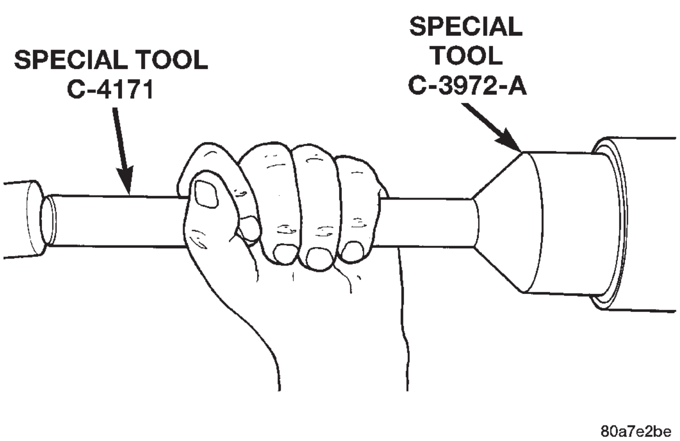


Fig. 17 Pinion Seal Installation

(6) If the original pinion bearings are being used, install differential assembly and axle shafts, if necessary.

NOTE: If new pinion bearings were installed, do not install the differential assembly and axle shafts until after the pinion bearing preload and rotating torque are set.

(7) Install the pinion washer and a new nut on the pinion gear. Tighten the nut to 217 N·m (160 ft. lbs.) minimum. **Do not overtighten.** Maximum torque is 353 N·m (260 ft. lbs.).

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

NOTE: If the spacer requires more than 353 N·m (260 ft. lbs.) of torque to crush, the collapsible spacer is defective and must be replaced.

(8) Using Flange Holder 6958, a short length of 1 in. pipe, and a torque wrench set at 353 N·m (260 ft. lbs.), crush collapsible spacer until bearing end play is taken up (Fig. 18).

(9) Slowly tighten the nut in 6.8 N·m (5 ft. lbs.) increments until the required rotating torque is achieved. Measure the rotating torque frequently to avoid over crushing the collapsible spacer (Fig. 19).

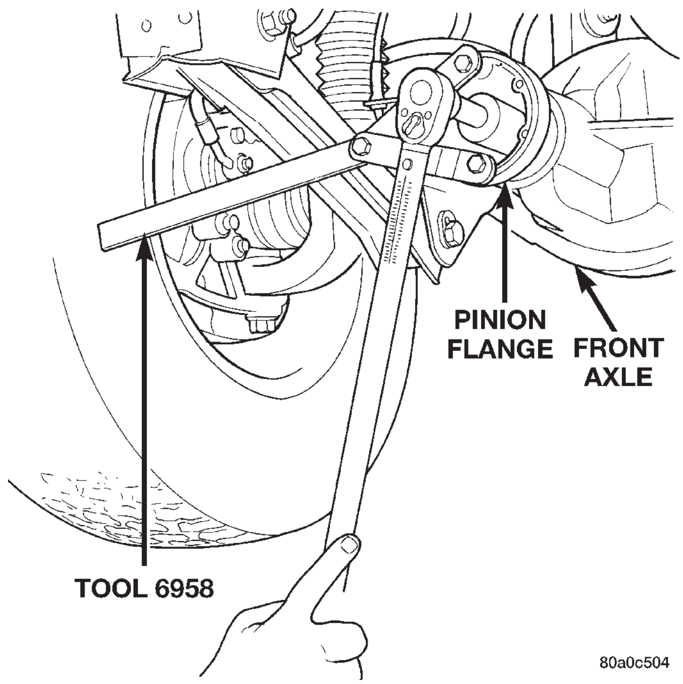


Fig. 18 Tightening Pinion Nut

(10) Rotate the pinion gear a minimum of ten times. Verify that the pinion rotates smoothly. Check rotating torque with an inch pound torque wrench (Fig. 19). The torque necessary to rotate the pinion gear should be:

- Original Bearings — The reading recorded during removal, plus an additional 0.56 N·m (5 in. lbs.).
- New Bearings — 2 to 5 N·m (15 to 35 in. lbs.).

(11) Install differential assembly and axle shafts, if necessary.

(12) Align marks made previously on pinion companion flange and propeller shaft and install propeller shaft.

(13) Install brake rotors and calipers. Refer to Group 5, Brakes, for proper procedures.

REMOVAL AND INSTALLATION (Continued)

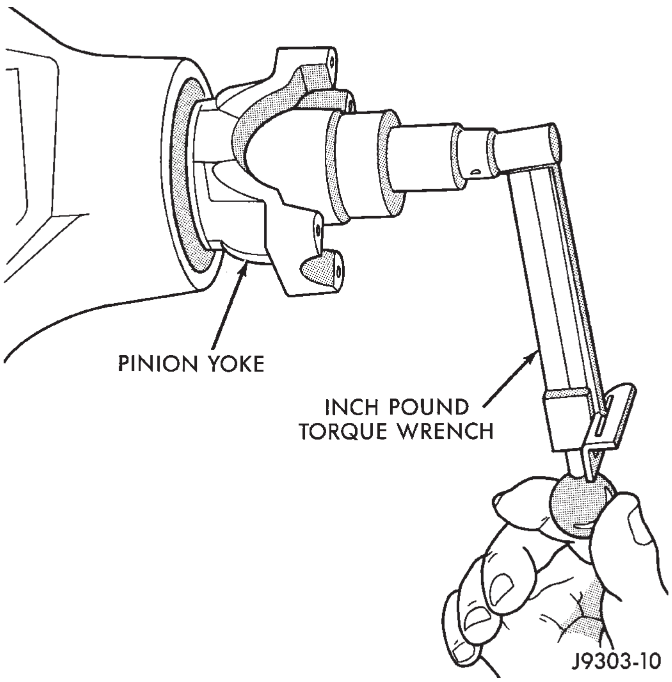


Fig. 19 Check Pinion Gear Rotation Torque—Typical

(14) Add gear lubricant, if necessary. Refer to Lubricant Specifications of this section for lubricant requirements.

(15) Install wheel and tire assemblies.

(16) Lower vehicle.

HUB BEARING AND AXLE SHAFT

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

REMOVAL

(1) Raise and support the vehicle.

(2) Remove the wheel and tire assembly.

(3) Remove the brake caliper and rotor. Refer to Group 5, Brakes, for proper procedures.

(4) Remove ABS wheel speed sensor, if necessary. Refer to Group 5, Brakes, for proper procedures.

(5) Remove the cotter pin, nut retainer, and axle hub nut (Fig. 20), if necessary.

(6) Remove the hub to knuckle bolts (Fig. 21).

(7) Remove the hub from the steering knuckle and axle shaft, if necessary.

(8) Remove hub bearing and axle shaft assembly (Fig. 22), or axle shaft from axle. **Avoid damaging the axle shaft oil seals in the axle housing.**

(9) Remove the brake rotor shield from the hub bearing or knuckle (Fig. 20).

INSTALLATION

(1) Thoroughly clean the axle shaft (Fig. 20) and apply a thin film of Mopar® Wheel Bearing Grease, or equivalent, to the shaft splines, seal contact surface, and hub bore.

(2) Install the brake rotor shield to the knuckle.

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

(4) Install the hub bearing, if necessary.

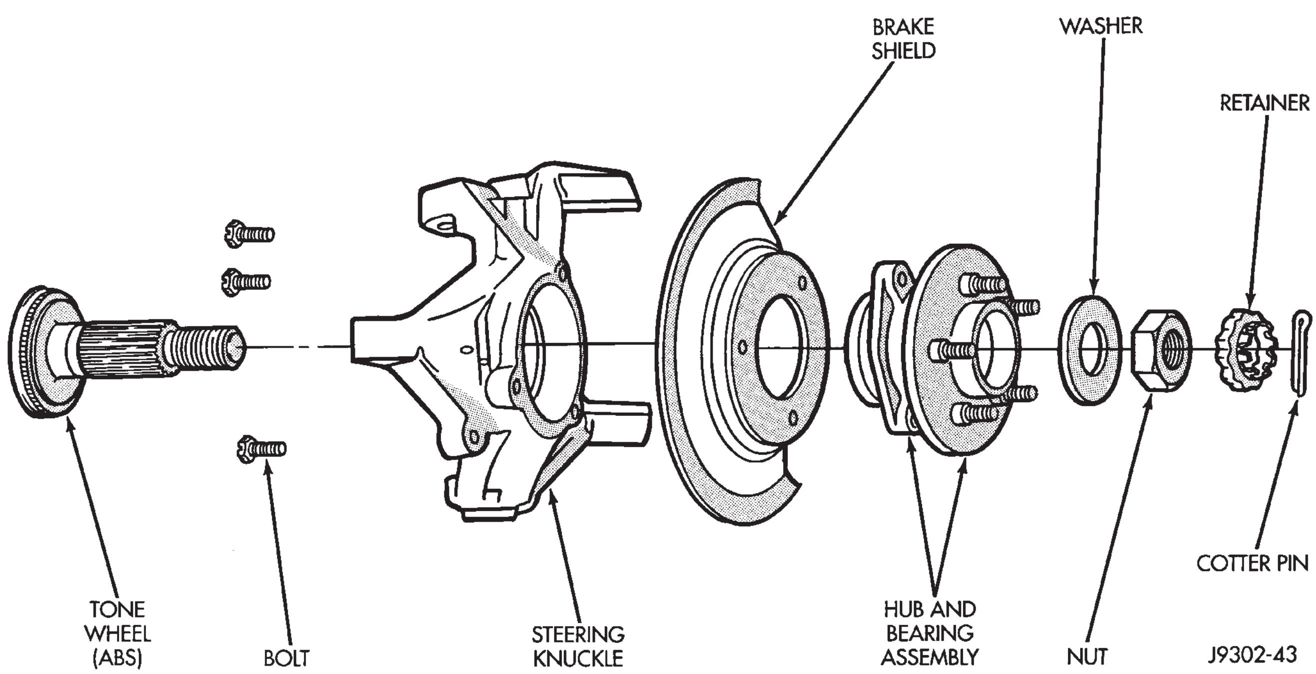


Fig. 20 Hub, Knuckle and Axle Shaft

REMOVAL AND INSTALLATION (Continued)

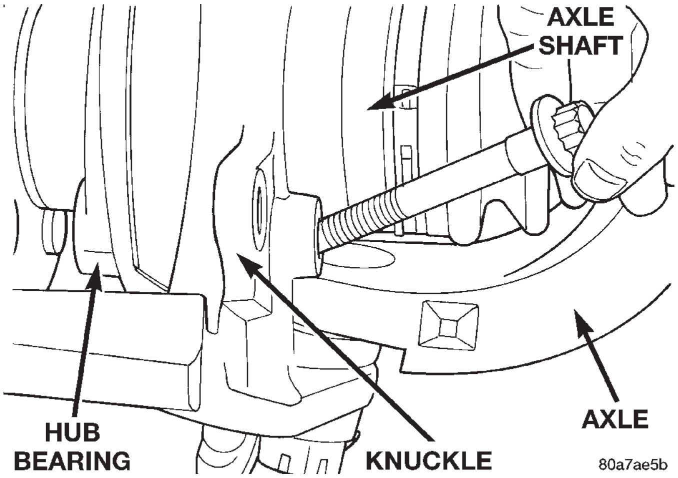


Fig. 21 Hub Bearing Bolts

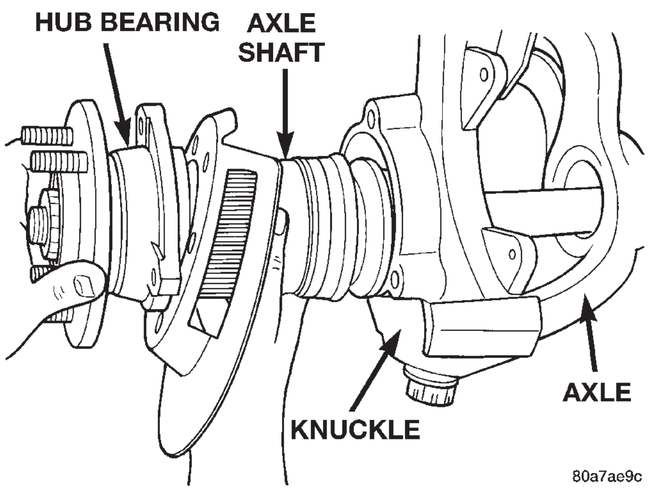


Fig. 22 Hub Bearing and Axle Assembly

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

(6) Install the hub washer and nut, if necessary. Tighten the hub nut to 237 N·m (175 ft. lbs.) torque. Install the nut retainer and a new cotter pin (Fig. 20).

(7) Install ABS wheel speed sensor, if necessary. Refer to Group 5, Brakes, for proper procedures.

(8) Install the brake rotor and caliper. Refer to Group 5, Brakes, for proper procedures.

(9) Install the wheel and tire assembly.

(10) Remove support and lower the vehicle.

AXLE BUSHING REPLACEMENT

Refer to Group 2, Suspension, for the proper axle bushing procedures.

DIFFERENTIAL

REMOVAL

(1) Raise and support vehicle.

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

(3) Remove the differential housing cover and allow fluid to drain.

(4) Remove hub bearings and axle shafts.

(5) Note the installation reference letters stamped on the bearing caps and housing machined sealing surface (Fig. 23).

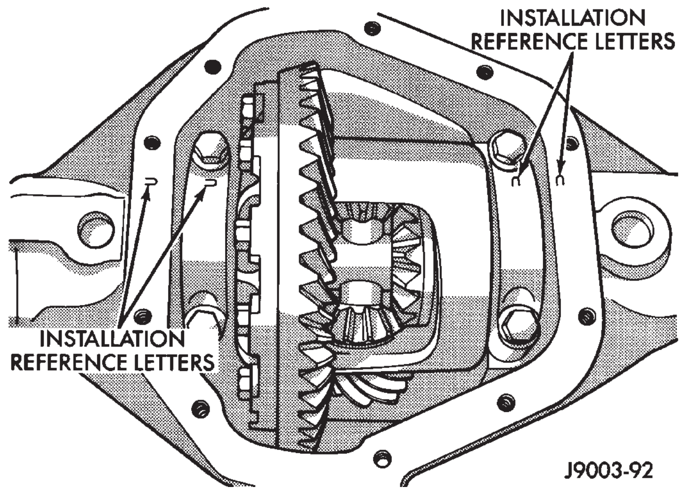


Fig. 23 Bearing Cap Identification

(6) Loosen the differential bearing cap bolts.

(7) Position Spreader W–129–B, utilizing some items from Adapter Kit 6987, with the tool dowel pins seated in the locating holes (Fig. 24). Install the holddown clamps and tighten the tool turnbuckle finger–tight.

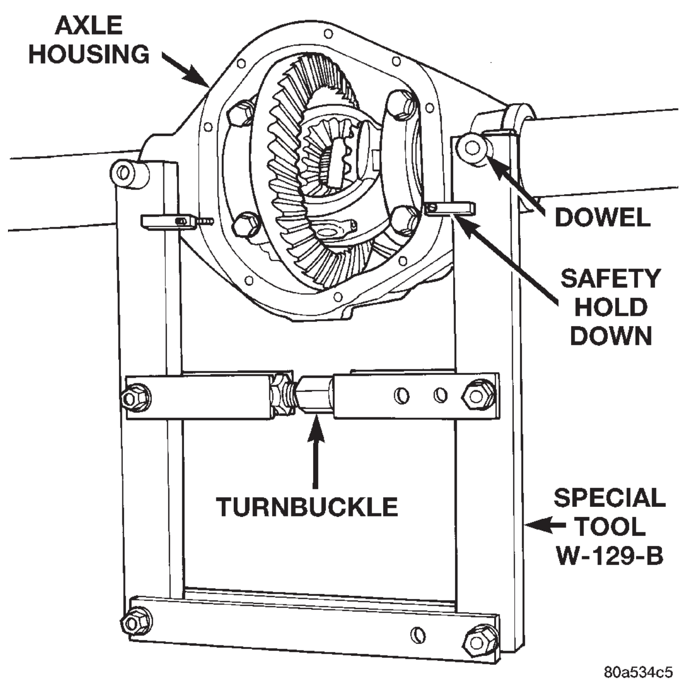


Fig. 24 Install Axle Housing Spreader

REMOVAL AND INSTALLATION (Continued)

(8) Install a Guide Pin C-3288-B at the left side of the differential housing. Attach Dial Indicator C-3339 to guide pin. Load the lever adapter against the opposite side of the housing (Fig. 25) and zero the indicator.

CAUTION: Do not spread over 0.50 mm (0.020 in). If the housing is over-spread, it could be distorted or damaged.

(9) Spread the housing enough to remove the differential case from the housing. Measure the distance with the dial indicator (Fig. 26).

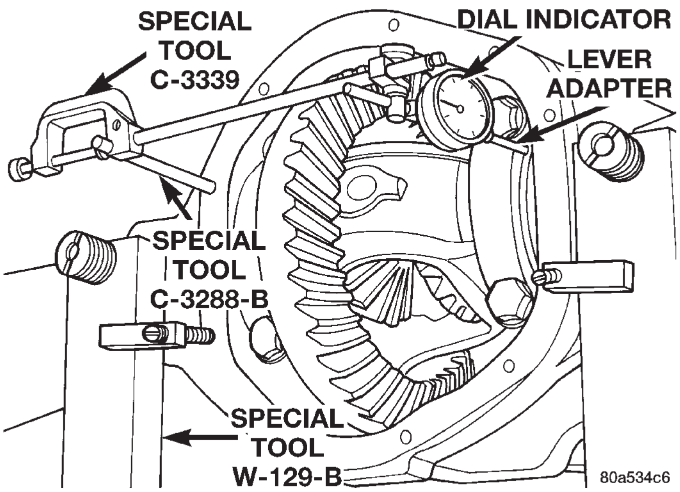


Fig. 25 Install Dial Indicator

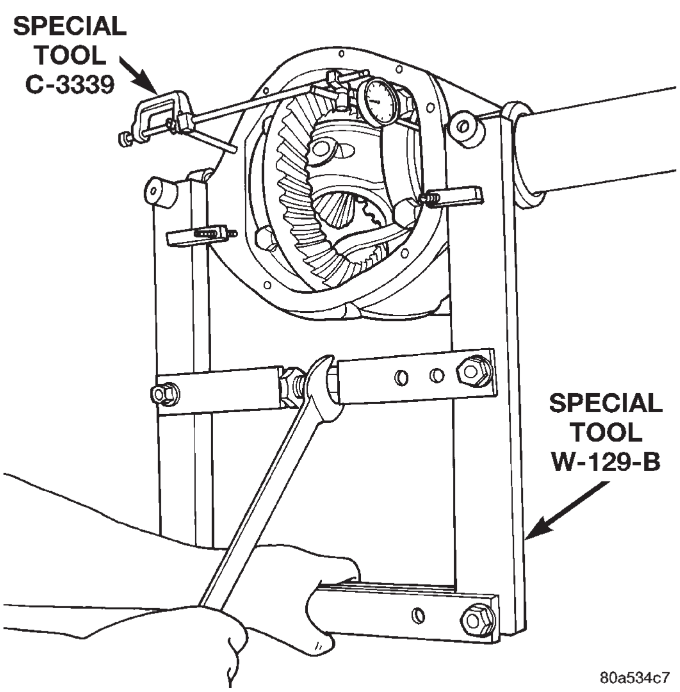


Fig. 26 Spread Axle Housing

(10) Remove the dial indicator.

(11) While holding the differential case in position, remove the differential bearing cap bolts and caps.

(12) Remove the differential from the housing. Ensure that the differential bearing cups remain in position on the differential bearings (Fig. 27).

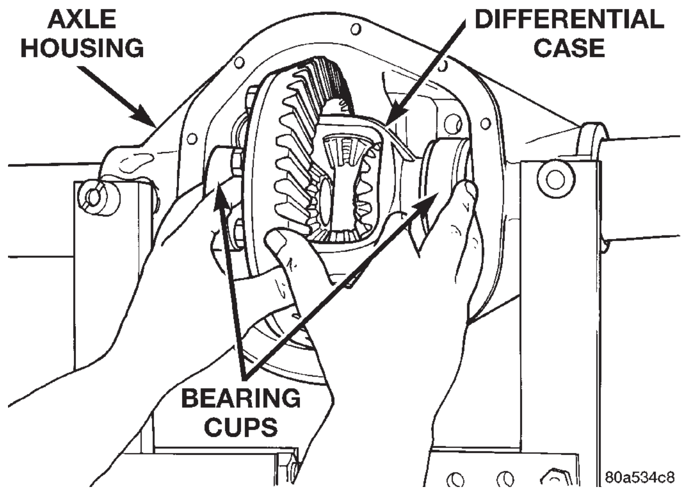


Fig. 27 Differential Case Removal

(13) Mark or tag the differential bearing cups to indicate which side of the differential they were removed from.

(14) Remove spreader from housing.

INSTALLATION

If replacement differential bearings or differential case are being installed, differential side bearing shim requirements may change. Refer to the Differential Bearing Preload and Gear Backlash procedures in this section to determine the proper shim selection.

(1) Position Spreader W-129-B, utilizing some items from Adapter Kit 6987, with the tool dowel pins seated in the locating holes (Fig. 28). Install the holddown clamps and tighten the tool turnbuckle finger–tight.

(2) Install a Guide Pin C-3288-B at the left side of the differential housing. Attach Dial Indicator C-3339 to guide pin. Load the lever adapter against the opposite side of the housing (Fig. 25) and zero the indicator.

CAUTION: Do not spread over 0.50 mm (0.020 in). If the housing is over-spread, it could be distorted or damaged.

(3) Spread the housing enough to install the case in the housing. Measure the distance with the dial indicator (Fig. 26).

(4) Remove the dial indicator.

(5) Install differential case in the housing. Ensure that the differential bearing cups remain in position on the differential bearings and that the pick-up opening of the Vari-lok™ plenum is at the bottom of

REMOVAL AND INSTALLATION (Continued)

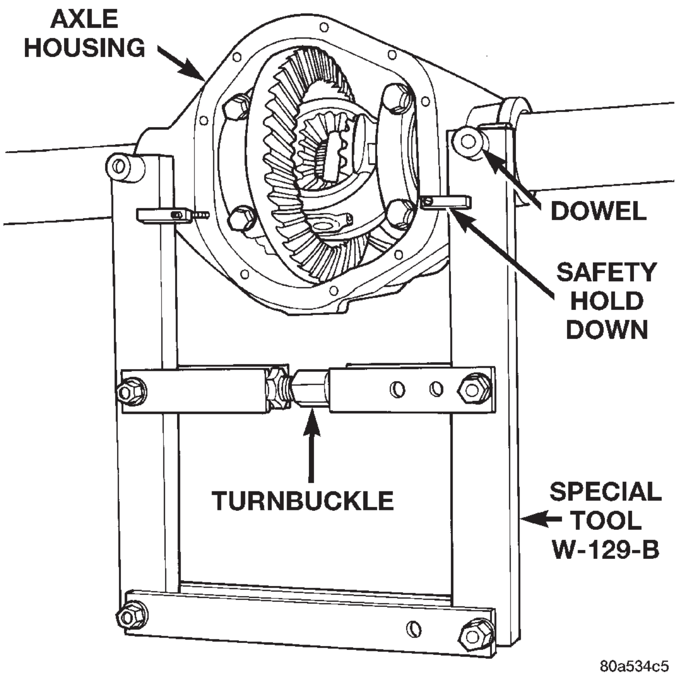


Fig. 28 Install Axle Housing Spreader

the housing. Tap the differential case to ensure the bearings cups are fully seated in the housing.

(6) Install the bearing caps at their original locations (Fig. 29).

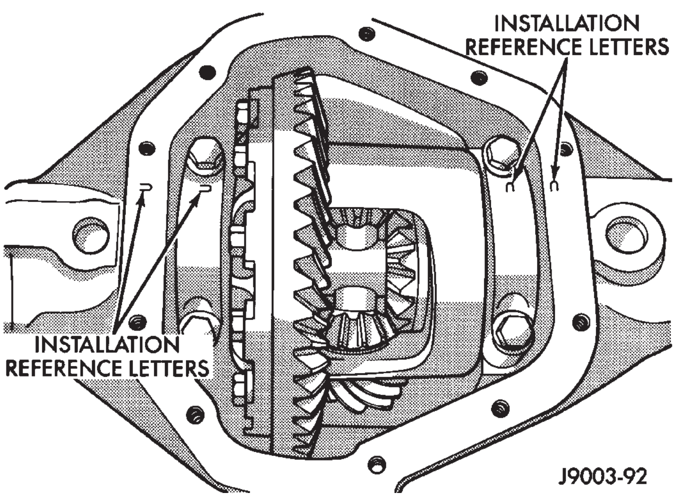


Fig. 29 Differential Bearing Cap Reference Letters

(7) Loosely install differential bearing cap bolts.

(8) Remove axle housing spreader.

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

(10) Install the hub bearings and axle shafts.

DIFFERENTIAL SIDE BEARINGS

REMOVAL

(1) Remove differential case from axle housing.

(2) Remove the bearings from the differential case with Puller/Press C-293-PA, Adapter Blocks 8352, and Plug SP-3289 (Fig. 30).

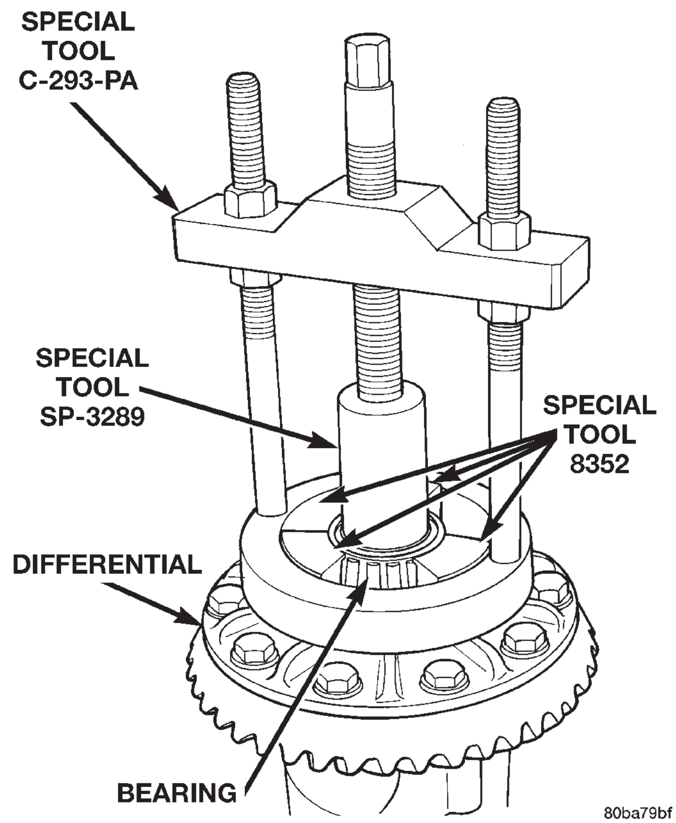


Fig. 30 Differential Bearing Removal

INSTALLATION

If replacement differential side bearings or differential case are being installed, differential side bearing shim requirements may change. Refer to the Differential Bearing Preload and Gear Backlash procedures in this section to determine the proper shim selection.

(1) Install differential side bearing shims onto differential case hubs.

CAUTION: Be sure that the Vari-lok™ plenum is fully seated against the differential case prior to installing the ring gear side differential bearing.

(2) Using Installer C-3716-A and Handle C-4171, install differential side bearings (Fig. 31).

(3) Install differential in axle housing.

VARI-LOK™ PLENUM

REMOVAL

(1) Remove differential case from axle housing.

REMOVAL AND INSTALLATION (Continued)

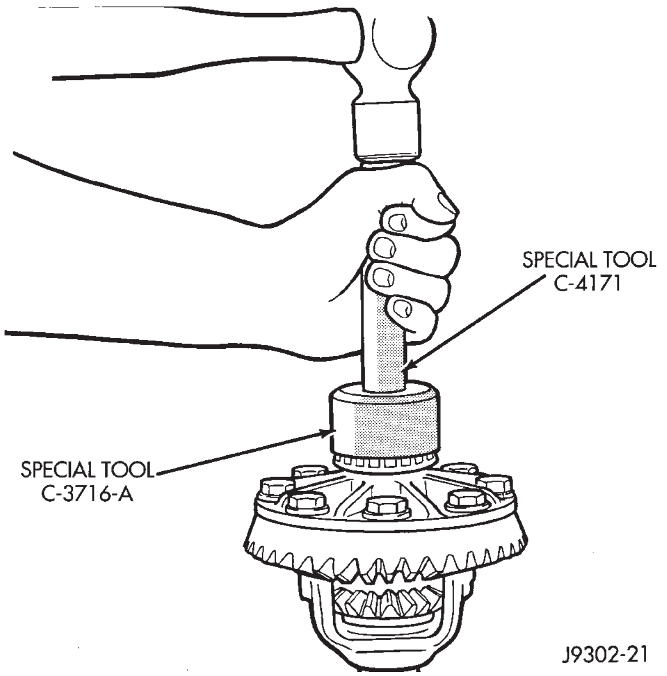


Fig. 31 Differential Side Bearing Installation

(2) Remove the bearing from the ring gear side of the differential case with Puller/Press C-293-PA, Adapter Blocks 8352, and Plug SP-3289 (Fig. 32).

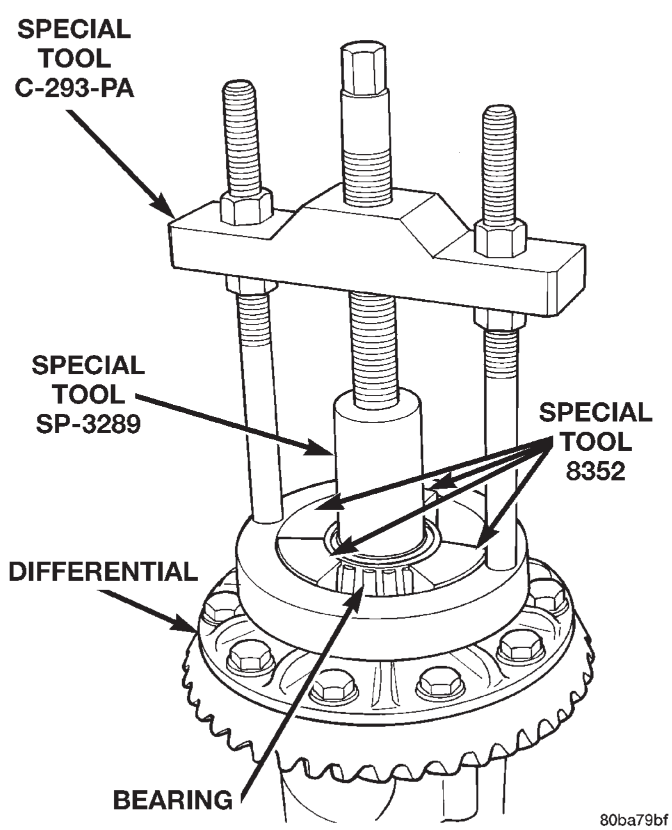


Fig. 32 Differential Bearing Removal

(3) Remove the Vari-lok™ plenum from the differential case hub.

WARNING: Do not touch the Vari-lok™ tuning reed valve located under the Vari-lok™ plenum on the differential case. The metal is very sensitive and the unit will not operate properly if the reed valve is disturbed.

INSTALLATION

If a replacement differential side bearing is being installed, differential side bearing shim requirements may change. Refer to the Differential Bearing Preload and Gear Backlash procedures in this section to determine the proper shim selection.

(1) Install a new Vari-lok™ plenum onto the differential case hub. The plenum is to be installed with the rubber seal toward the differential case and the raised metal tabs away from the differential case.

(2) Install differential side bearing shims onto differential case hub.

CAUTION: Be sure that the Vari-lok™ plenum is fully seated against the differential case prior to installing the ring gear side differential bearing.

(3) Using Installer C-3716-A and Handle C-4171, install differential side bearing (Fig. 33).

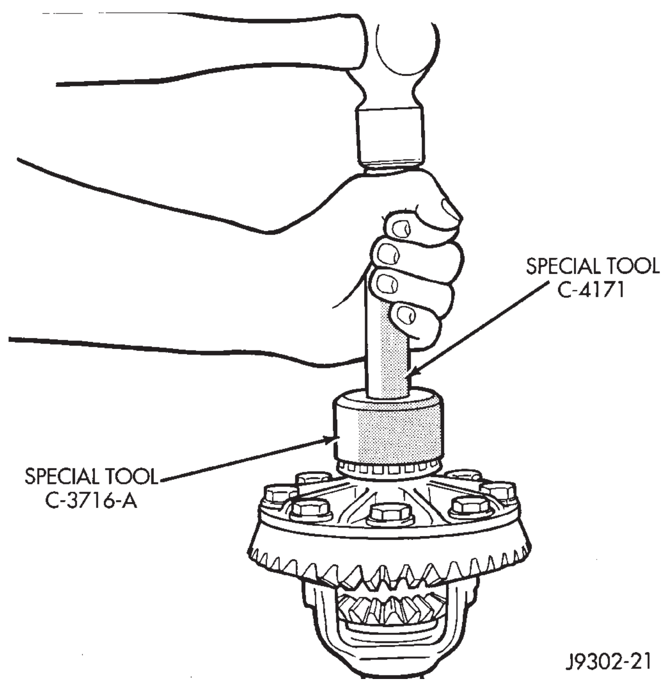


Fig. 33 Differential Side Bearing Installation

(4) Install differential in axle housing.

REMOVAL AND INSTALLATION (Continued)

AXLE SHAFT OIL SEAL

REMOVAL

(1) Raise and support vehicle.

(2) Remove differential assembly.

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

INSTALLATION

(1) Remove any sealer remaining from original seals.

(2) Remove sealer from axle tube to housing junction, if necessary.

(3) Install oil seals with Discs 8110 and Turnbuckle 6797 (Fig. 34). Tighten tool until disc bottoms in housing.

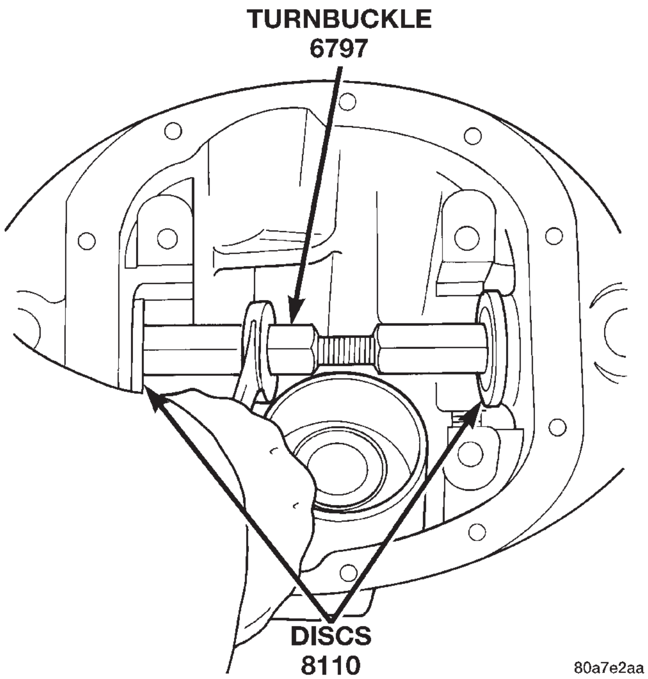


Fig. 34 Axle Seal Installation

(4) Install differential assembly.

PINION GEAR

NOTE: The ring and pinion gears are serviced as a matched set. Do not replace the pinion gear without replacing the ring gear.

REMOVAL

(1) Remove differential assembly from axle housing.

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

(3) Disconnect propeller shaft from pinion companion flange. Using suitable wire, tie propeller shaft to underbody.

(4) Using Holder 6958 to hold pinion companion flange, and a short length of 1 in. pipe, remove the pinion nut and washer (Fig. 35).

(5) Using Remover C–452 and Holder C-3281, remove the pinion companion flange from pinion shaft.

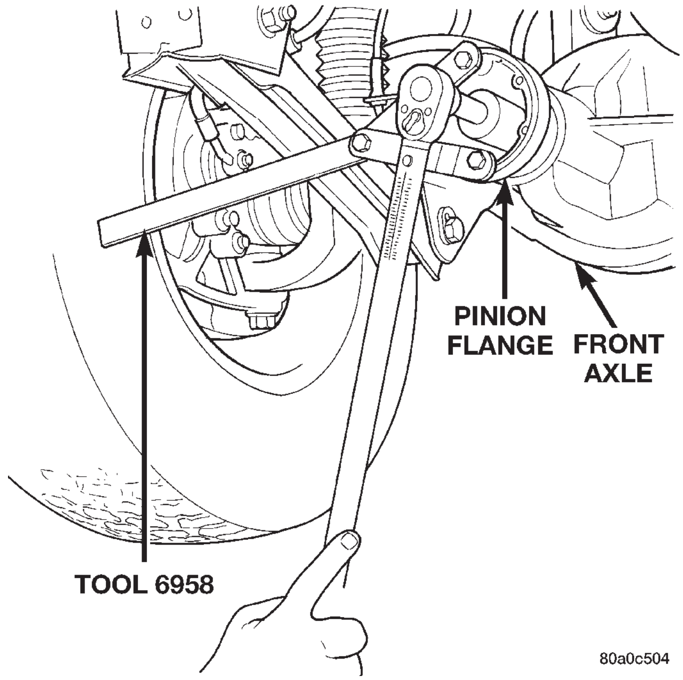


Fig. 35 Pinion Nut Removal

(6) Remove the pinion gear and collapsible spacer from housing (Fig. 36). Catch the pinion with your hand to prevent it from falling and being damaged.

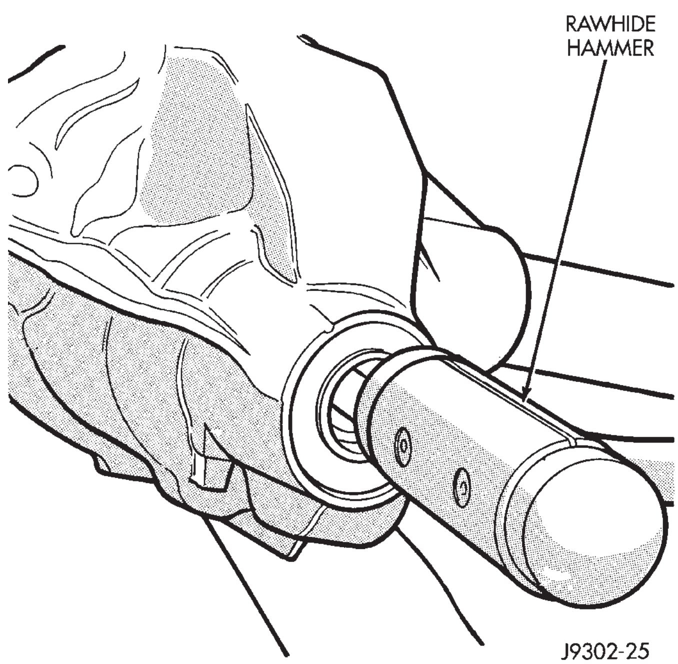


Fig. 36 Remove Pinion Gear

REMOVAL AND INSTALLATION (Continued)

(7) Remove the front pinion bearing cup, bearing, oil slinger, if equipped, and pinion seal with Remover C-4345 and Handle C–4171 (Fig. 37).

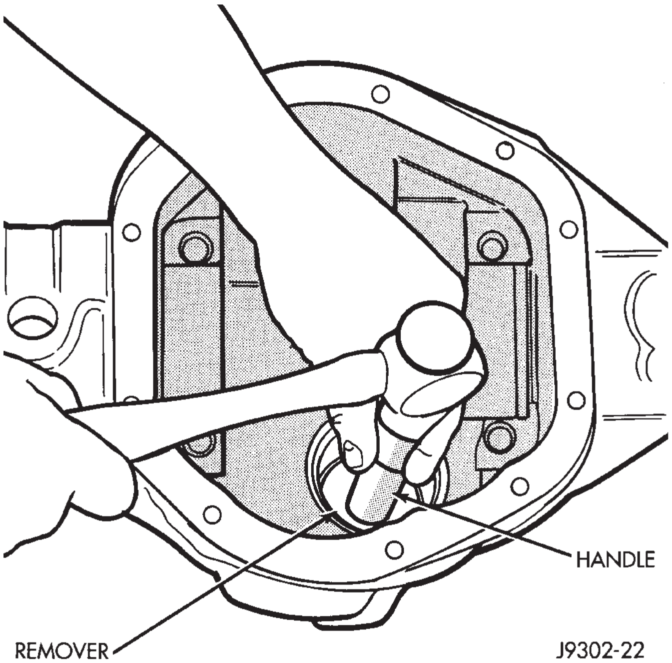


Fig. 37 Front Bearing Cup Removal

(8) Remove the rear pinion bearing cup from axle housing (Fig. 38). Use Remover D-149 and Handle C–4171.

(9) Remove the depth shims from rear pinion bearing cup bore in axle housing. Record the thickness of the depth shims.

NOTE: The pinion depth shims can be very thin. Verify that all shims have been removed before proceeding.

(10) Remove the collapsible preload spacer from pinion gear (Fig. 39).

(11) Remove the rear pinion bearing from the pinion with Puller/Press C–293-PA and Adapters C–293–39 (Fig. 40).

Place 4 adapter blocks so they do not damage the bearing cage.

INSTALLATION

NOTE: Pinion depth shims are placed between the rear pinion bearing cup and axle housing to achieve proper ring and pinion gear mesh. If the factory installed ring and pinion gears are reused, the pinion depth shim should not require replacement. Refer to Pinion Gear Depth to select the proper thickness shim before installing pinion gear.

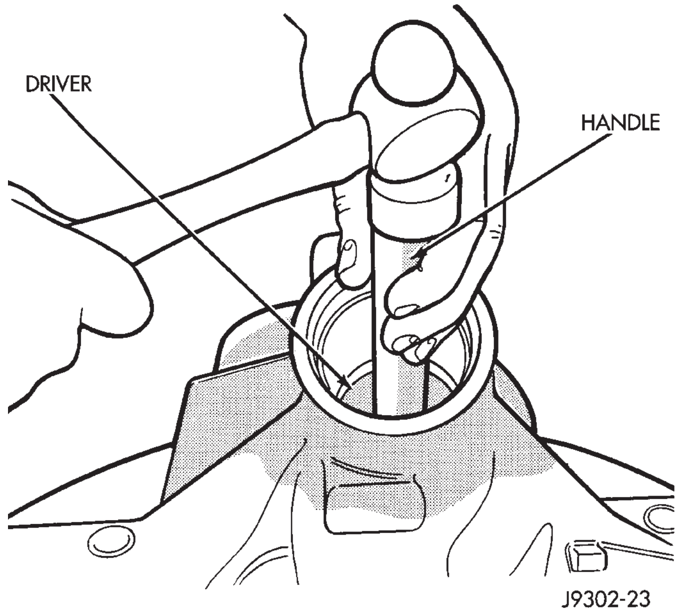


Fig. 38 Rear Bearing Cup Removal

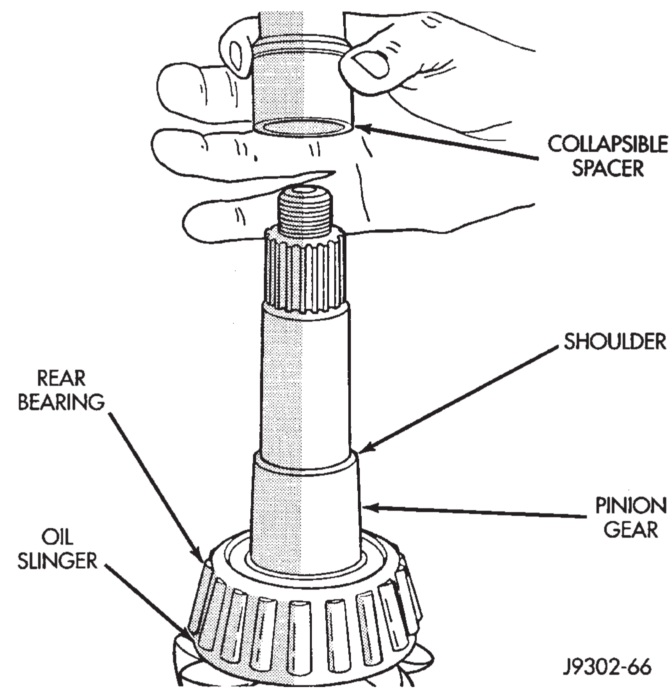


Fig. 39 Collapsible Spacer

(1) Place proper thickness depth shim in rear pinion bearing cup bore in the axle housing.

(2) Apply Mopar® Door Ease, or equivalent, stick lubricant to outside surface of rear pinion bearing cup. Install the bearing cup with Installer D-146 and Driver Handle C–4171 (Fig. 41). Verify cup is correctly seated.

(3) Apply Mopar® Door Ease, or equivalent, stick lubricant to outside surface of front pinion bearing cup. Install the bearing cup with Installer D-130 and Handle C–4171 (Fig. 42).

REMOVAL AND INSTALLATION (Continued)

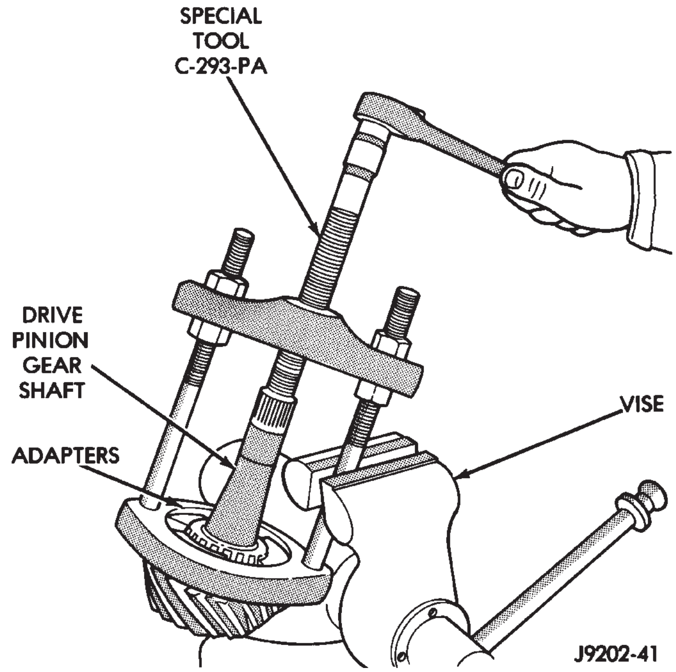


Fig. 40 Inner Bearing Removal

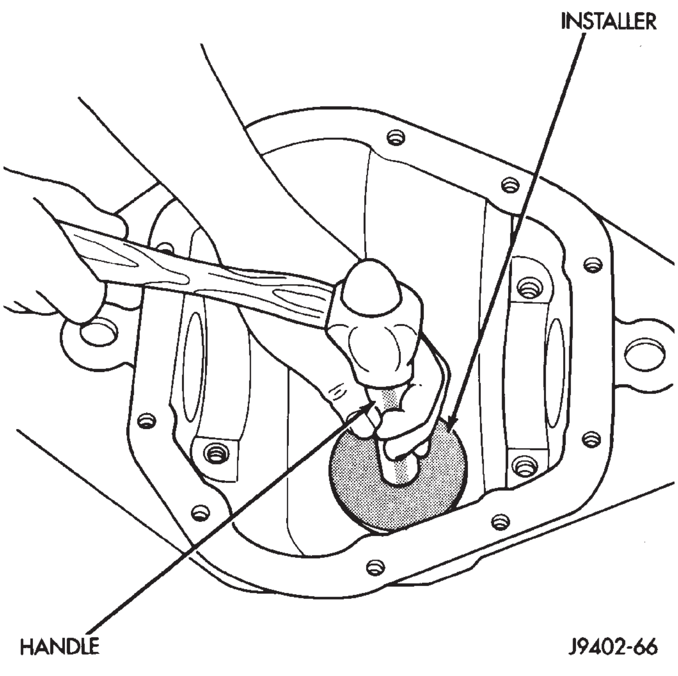


Fig. 41 Rear Pinion Bearing Cup Installation

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

(5) Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with Installer C-3972-A and Handle C–4171 (Fig. 43).

(6) Install the rear pinion bearing and oil slinger, if equipped, on the pinion gear with Installer W-262 and a shop press (Fig. 44).

(7) Install a new collapsible preload spacer on pinion shaft and install pinion gear in housing (Fig. 45).

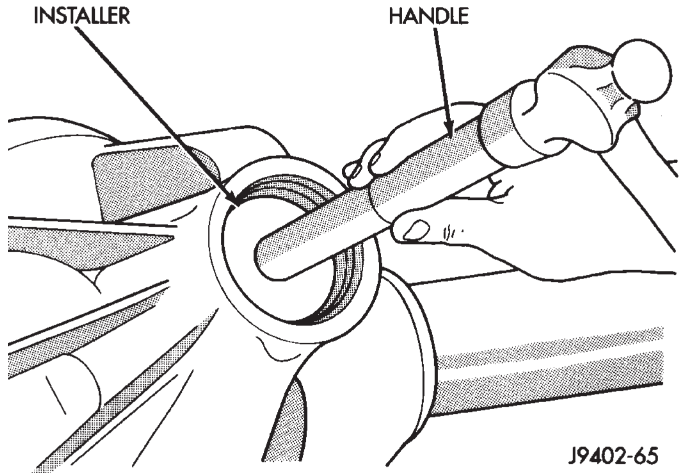


Fig. 42 Pinion Outer Bearing Cup Installation

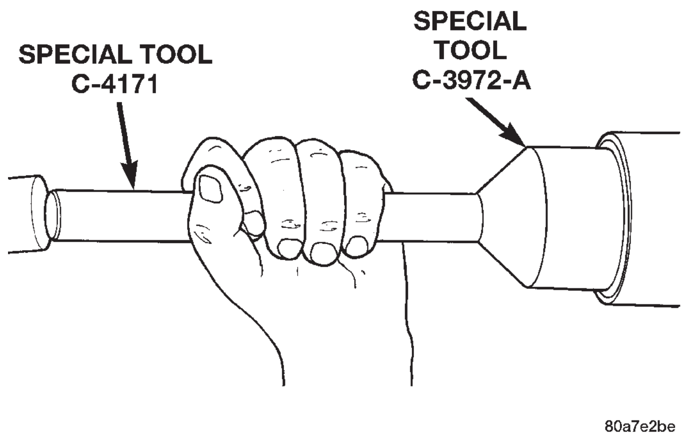


Fig. 43 Pinion Seal Installation

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

(9) Install the pinion washer and a new nut on the pinion gear. Tighten the nut to 216 N·m (160 ft. lbs.) minimum. **Do not over–tighten.** Maximum torque is 352 N·m (260 ft. lbs.).

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

NOTE: If the spacer requires more than 352 N·m (260 ft. lbs.) of torque to crush, the collapsible spacer is defective.

(10) Using Holder 6958, a short length of 1 in. pipe, and torque wrench (set at 352 N·m (260 ft.

REMOVAL AND INSTALLATION (Continued)

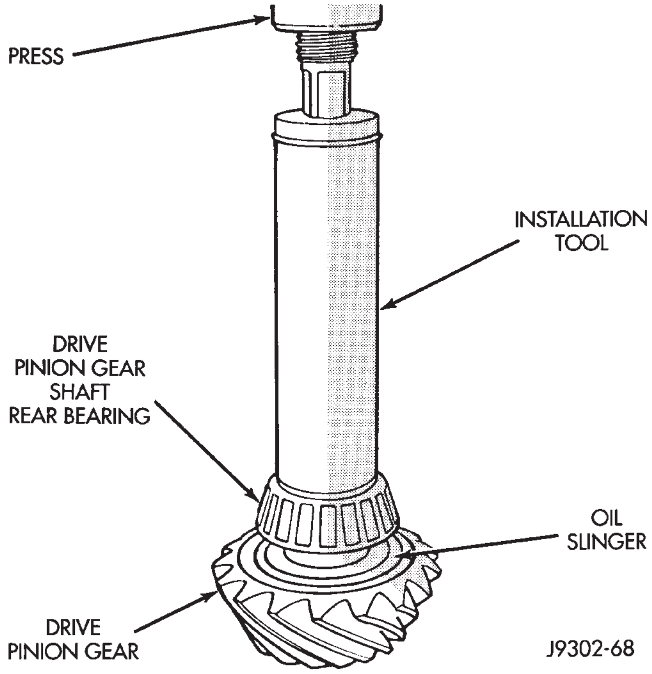


Fig. 44 Rear Pinion Bearing Installation

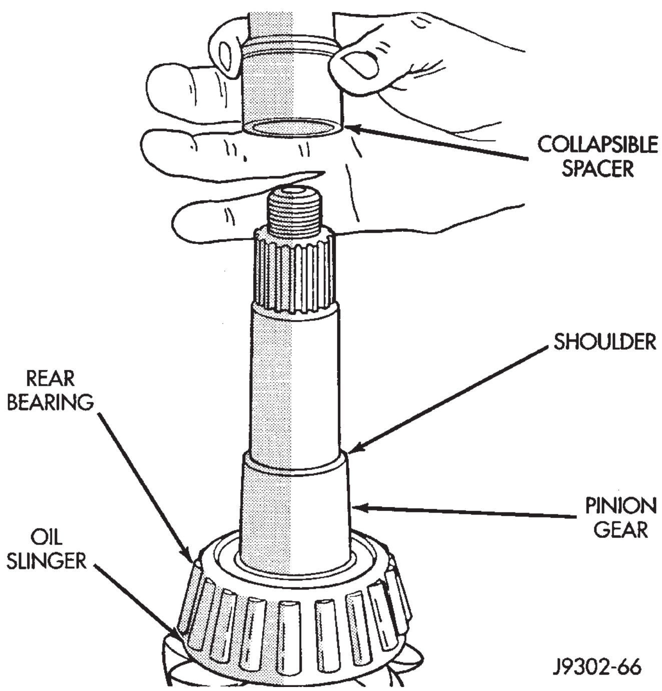


Fig. 45 Collapsible Preload Spacer

lbs.)), crush collapsible spacer until bearing end play is taken up (Fig. 46).

(11) Slowly tighten the nut in 6.8 N·m (5 ft. lb.) increments until the required rotating torque is achieved. Measure the rotating torque frequently to avoid over crushing the collapsible spacer (Fig. 47).

(12) Rotate the pinion a minimum of ten times. Verify that the pinion rotates smoothly. Check bearing rotating torque with an inch pound torque

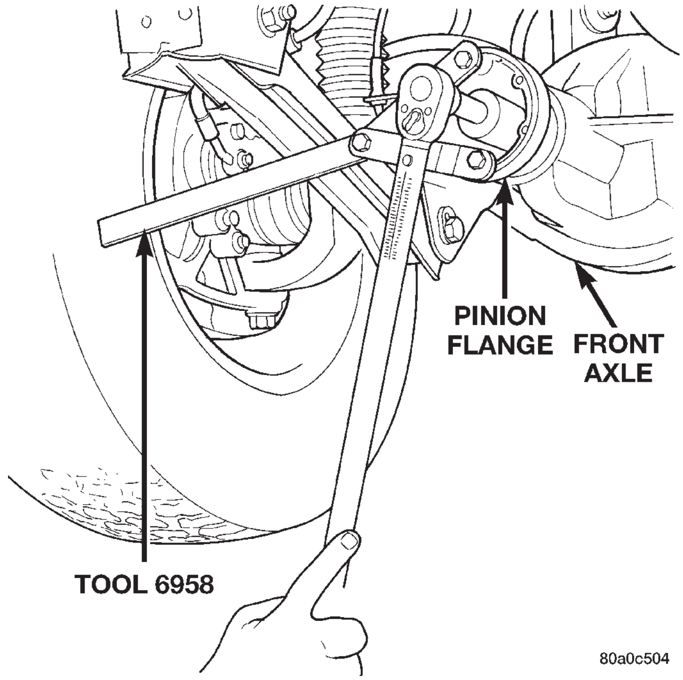


Fig. 46 Tightening Pinion Nut

wrench (Fig. 47). The torque necessary to rotate the pinion gear should be:

- Original Bearings — 1 to 3 N·m (10 to 20 in. lbs.).
- New Bearings — 2 to 5 N·m (15 to 35 in. lbs.).

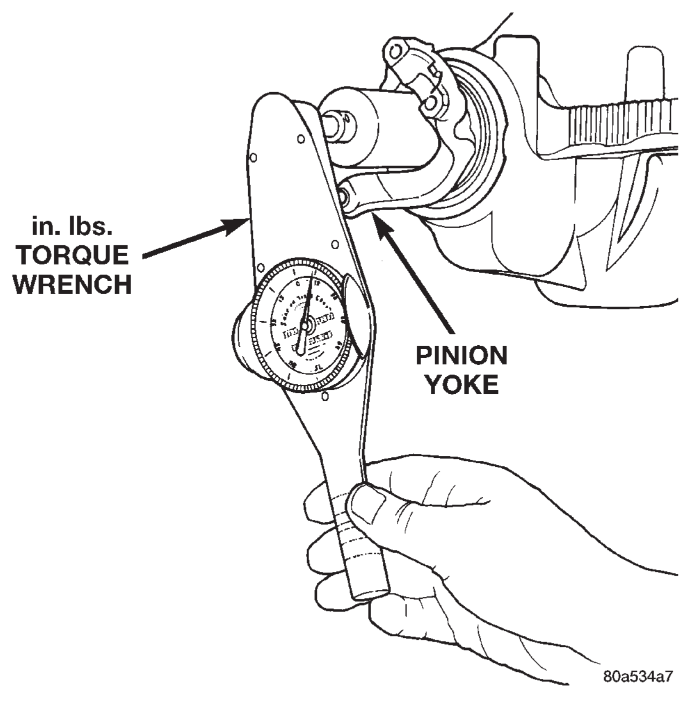


Fig. 47 Check Pinion Gear Rotation Torque-Typical

(13) Install differential assembly.

REMOVAL AND INSTALLATION (Continued)

RING GEAR

NOTE: The ring and pinion gears are service in a matched set. Do not replace the ring gear without replacing the pinion gear.

REMOVAL

(1) Remove differential from axle housing.

(2) Place differential case in a suitable vise with soft metal jaw protectors. (Fig. 48)

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

(4) Using a soft hammer, drive ring gear from differential case (Fig. 48).

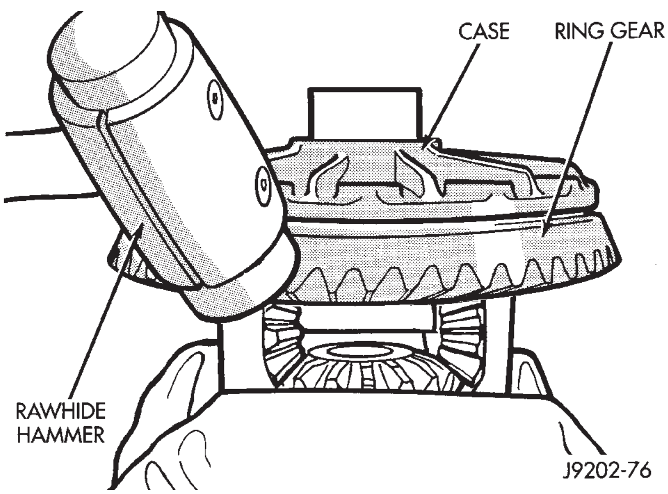


Fig. 48 Ring Gear Removal

INSTALLATION

CAUTION: Do not reuse the bolts that held the ring gear to the differential case. The bolts can fracture causing extensive damage.

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

(2) Invert the differential case in the vise.

(3) Install new ring gear bolts and alternately tighten to 95–122 N·m (70–90 ft. lbs.) torque (Fig. 49).

(4) Install differential in axle housing and verify gear mesh and contact pattern.

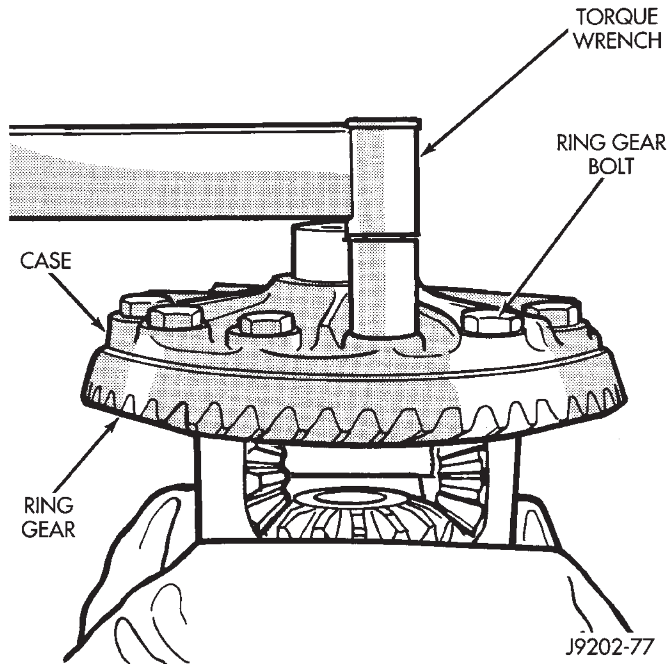


Fig. 49 Ring Gear Bolt Installation

DISASSEMBLY AND ASSEMBLY

STANDARD DIFFERENTIAL

DISASSEMBLY

(1) Remove the ring gear.

(2) Using a suitable roll pin punch, drive out the roll pin holding pinion gear mate shaft in the differential case (Fig. 50).

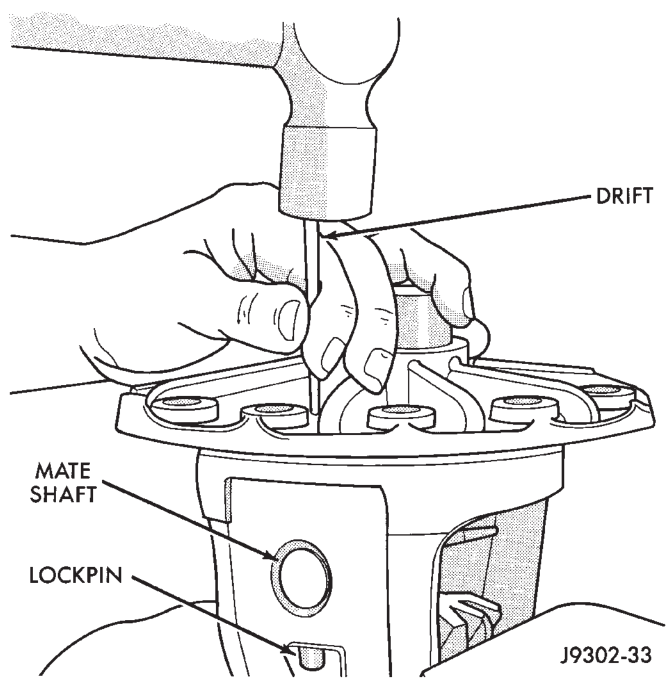


Fig. 50 Mate Shaft Roll Pin Removal

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

(4) Rotate differential side gears and remove the pinion mate gears and thrust washers (Fig. 51).

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

DISASSEMBLY AND ASSEMBLY (Continued)

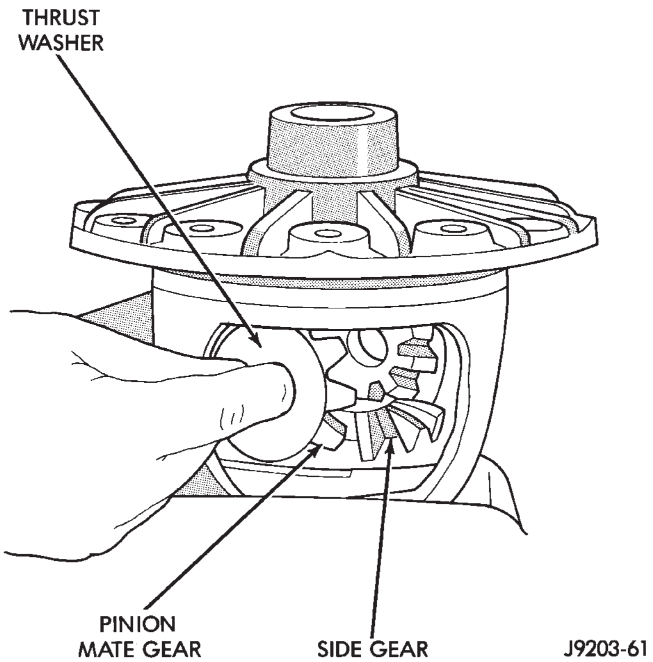


Fig. 51 Pinion Mate Gear Removal

ASSEMBLY

(1) Install the differential side gears and thrust washers.

(2) Install the pinion mate gears and thrust washers.

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

(4) Install the roll pin to hold the pinion mate shaft in the differential case (Fig. 52).

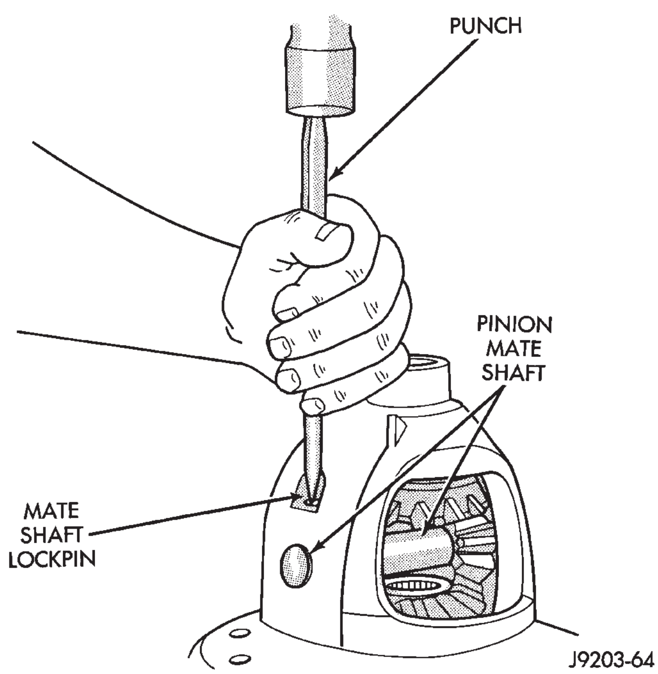


Fig. 52 Mate Shaft Roll Pin Installation

(5) Install the ring gear.

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

FINAL ASSEMBLY

(1) 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, or equivalent, on the housing cover (Fig. 53).

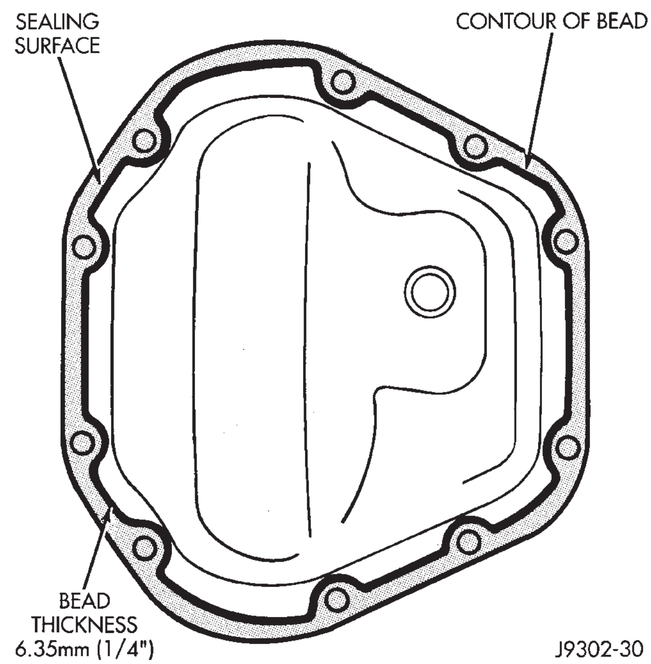


Fig. 53 Typical Housing Cover With Sealant

Install the housing cover within 5 minutes after applying the sealant.

(2) 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 lubricant foaming and overheating.

(3) Refill the differential housing with gear lubricant. Refer to the Lubricant Specifications section of this group for the gear lubricant requirements.

(4) Install the fill hole plug.

CLEANING AND INSPECTION

CARDAN U-JOINT

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.

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

CLEANING AND INSPECTION (Continued)

Replace the complete U–joint if any of the components are defective.

AXLE COMPONENTS

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, or dry with compressed air. DO NOT spin bearings with compressed air. **Cup and bearing must be replaced as matched sets only.**

Clean axle shaft tubes and oil channels in housing.

Inspect 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.

ADJUSTMENTS

PINION GEAR DEPTH

GENERAL 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. 54). 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 center line of the ring gear to the back face of the pinion is 92.08 mm (3.625 in.). The standard depth provides the best gear tooth contact pattern. Refer to Backlash and Contact Pattern Analysis paragraph in this section for additional information.

Compensation for pinion depth variance is achieved with select shims. The shims are placed behind the rear pinion bearing cup (Fig. 55).

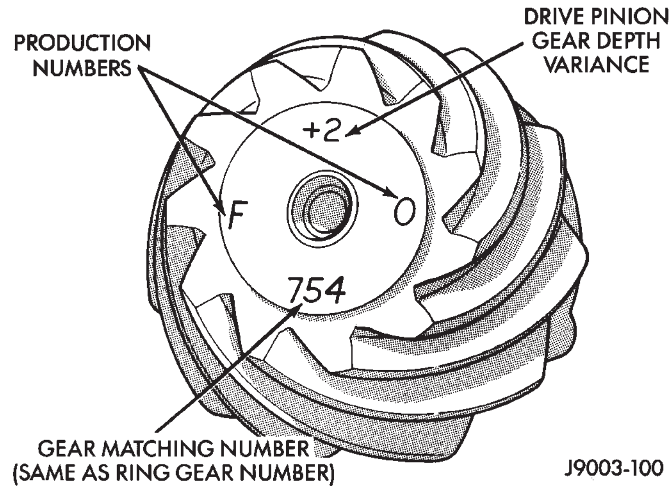


Fig. 54 Pinion Gear ID Numbers

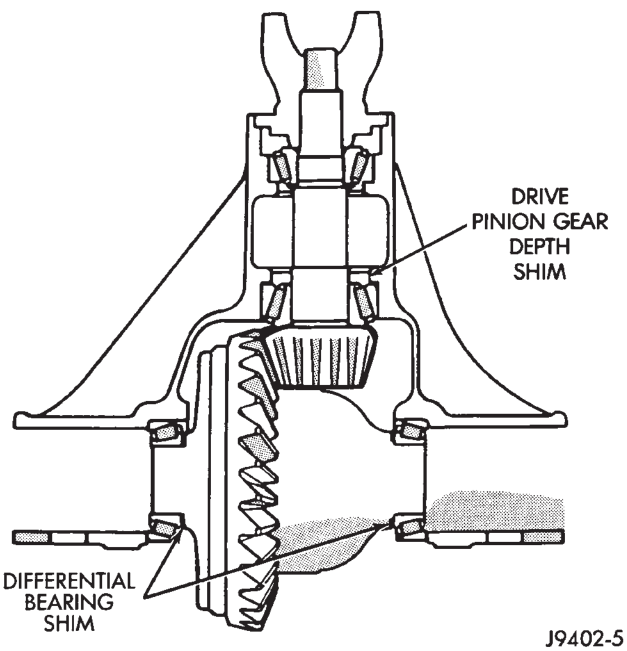


Fig. 55 Shim Locations

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

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

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

ADJUSTMENTS (Continued)

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

J8902-46

PINION DEPTH MEASUREMENT AND ADJUSTMENT

Measurements are taken with pinion bearing cups and pinion bearings installed in the axle housing without any shims placed behind the rear pinion bearing cup. Take measurements with Pinion Gauge Set 6774 and Dial Indicator C-3339 (Fig. 56).

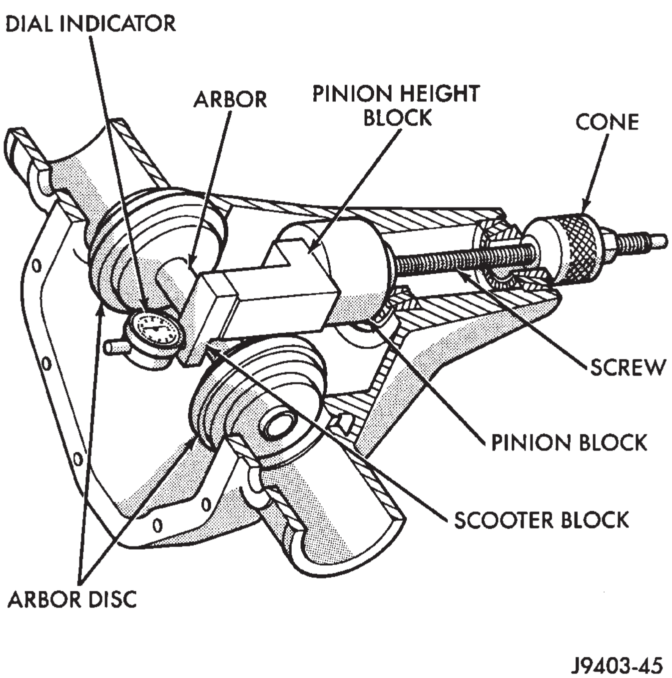


Fig. 56 Pinion Gear Depth Gauge Tools—Typical

(1) Assemble Pinion Height Block 6739, Pinion Block 6733, and rear pinion bearing onto Screw 6741 (Fig. 56).

(2) Insert assembled height gauge components, rear bearing and screw into axle housing through pinion bearing cups (Fig. 57).

(3) Install front pinion bearing cone and Cone-nut 6740 hand tight (Fig. 56).

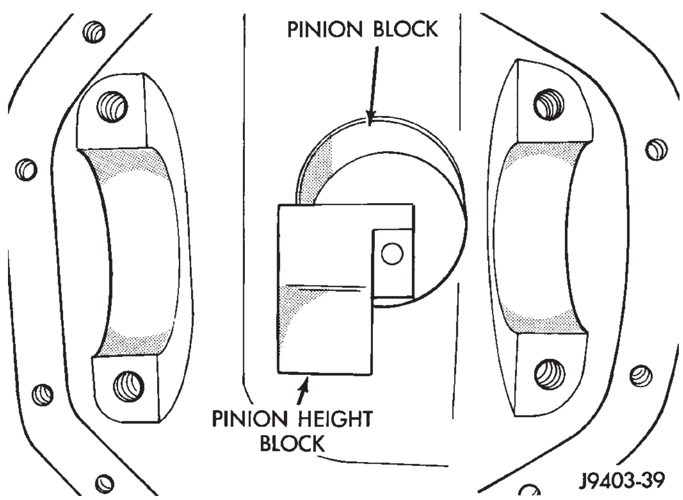


Fig. 57 Pinion Height Block—Typical

(4) Place Arbor Disc 6732 on Arbor D-115-3 in position in axle housing side bearing cradles (Fig. 58). Install differential bearing caps on Arbor Discs and tighten cap bolts to 41 N·m (30 ft. lbs.).

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

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

ADJUSTMENTS (Continued)

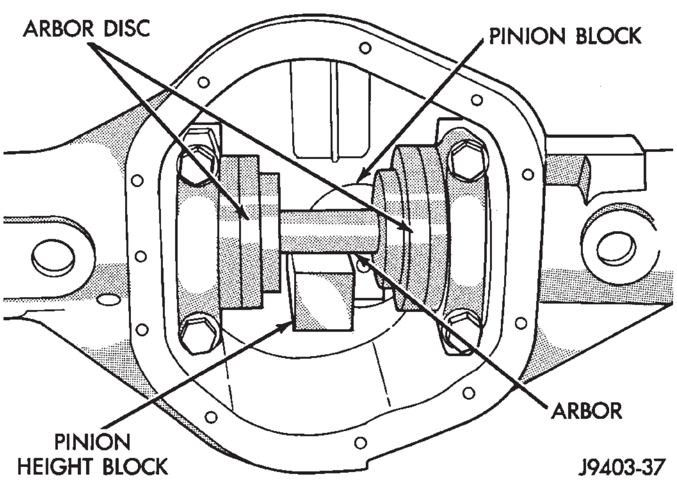


Fig. 58 Gauge Tools In Housing—Typical

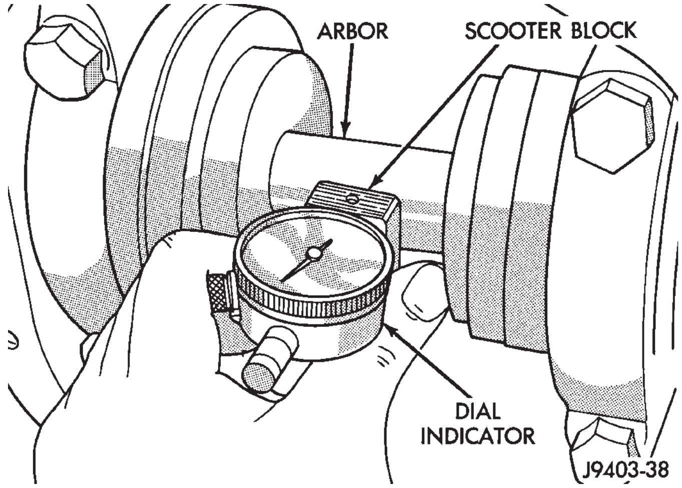


Fig. 59 Pinion Gear Depth Measurement—Typical

(6) Place Scooter Block/Dial Indicator in position in axle housing so dial probe and scooter block are flush against the rearward surface of the pinion height block (Fig. 56). Hold scooter block in place and zero the dial indicator face to the pointer. Tighten dial indicator face lock screw.

(7) With scooter block still in position against the pinion height block, slowly slide the dial indicator probe over the edge of the pinion height block.

(8) Slide the dial indicator probe across the gap between the pinion height block and the arbor bar with the scooter block against the pinion height block (Fig. 59). When the dial probe contacts the arbor bar, the dial pointer will turn clockwise. Bring dial pointer back to zero against the arbor bar, do not turn dial face. Continue moving the dial probe to the crest of the arbor bar and record the highest reading. If the dial indicator can not achieve the zero reading, the rear bearing cup or the pinion depth gauge set is not installed correctly.

(9) Select a shim equal to the dial indicator reading plus the drive pinion gear depth variance number etched in the face of the pinion gear (Fig. 54). For example, if the depth variance is –2, add +0.002 in. to the dial indicator reading.

NOTE: If an oil slinger is used behind the inner pinion bearing cone, deduct the thickness of the slinger from the dial indicator reading and use that total for shim selection.

DIFFERENTIAL BEARING PRELOAD AND GEAR BACKLASH

INTRODUCTION

Differential side bearing preload and gear backlash is achieved by selective shims positioned behind the differential side bearing cones. The proper shim thickness can be determined using slip-fit dummy bearings D-348 in place of the differential side bearings and a dial indicator C-3339. Before proceeding with the differential bearing preload and gear backlash measurements, measure the pinion gear depth and prepare the pinion gear for installation. Establishing proper pinion gear depth is essential to establishing gear backlash and tooth contact patterns. After the overall shim thickness to take up differential side play is measured, the pinion gear is installed, and the gear backlash shim thickness is measured. The overall shim thickness is the total of the dial indicator reading and the preload specification added together. The gear backlash measurement determines the thickness of the shim used on the ring gear side of the differential case. Subtract the gear backlash shim thickness from the total overall shim thickness and select that amount for the pinion gear side of the differential (Fig. 60). Differential shim measurements are performed with axle spreader W-129-B removed.

SHIM SELECTION

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

(1) Remove differential side bearings from differential case.

(2) Remove factory installed shims from differential case.

(3) Install ring gear on differential case and tighten bolts to specification.

(4) Install dummy side bearings D-348 on differential case.

(5) Install differential case in axle housing.

(6) Install the marked bearing caps in their correct positions. Install and snug the bolts (Fig. 61).

(7) Using a dead-blow type mallet, seat the differential dummy bearings to each side of the axle housing (Fig. 62) and (Fig. 63).

(8) Thread guide stud C-3288-B into rear cover bolt hole below ring gear (Fig. 64).

ADJUSTMENTS (Continued)

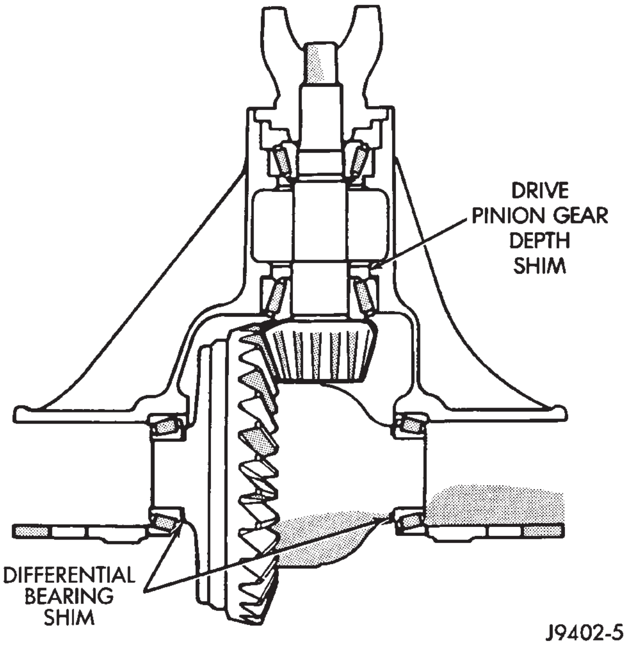


Fig. 60 Axle Adjustment Shim Locations

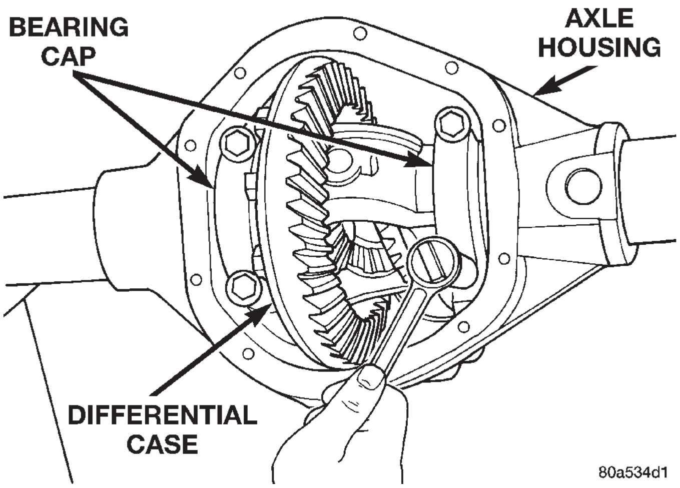


Fig. 61 Tighten Bolts Holding Bearing Caps

(9) Attach a dial indicator C-3339 to guide stud. Position the dial indicator plunger on a flat surface between the ring gear bolt heads (Fig. 64).

(10) Push and hold differential case to pinion gear side of axle housing (Fig. 65).

(11) Zero dial indicator face to pointer (Fig. 65).

(12) Push and hold differential case to ring gear side of the axle housing (Fig. 66).

(13) Record dial indicator reading (Fig. 66).

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

(15) Rotate dial indicator out of the way on the guide stud.

(16) Remove differential case and dummy bearings from axle housing.

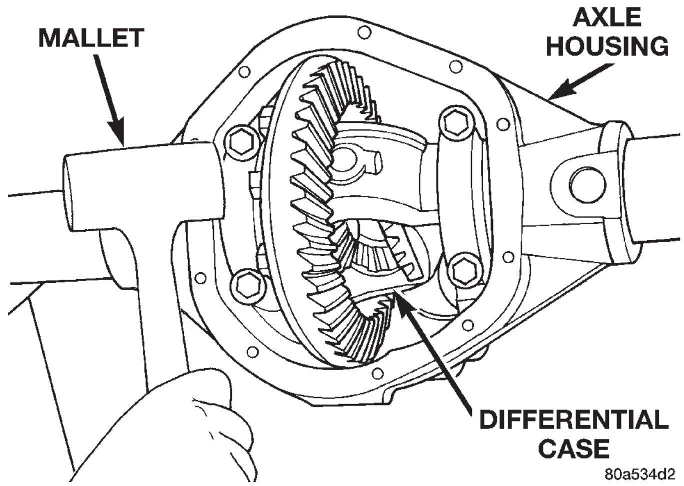


Fig. 62 Seat Pinion Gear Side Differential Dummy Side Bearing

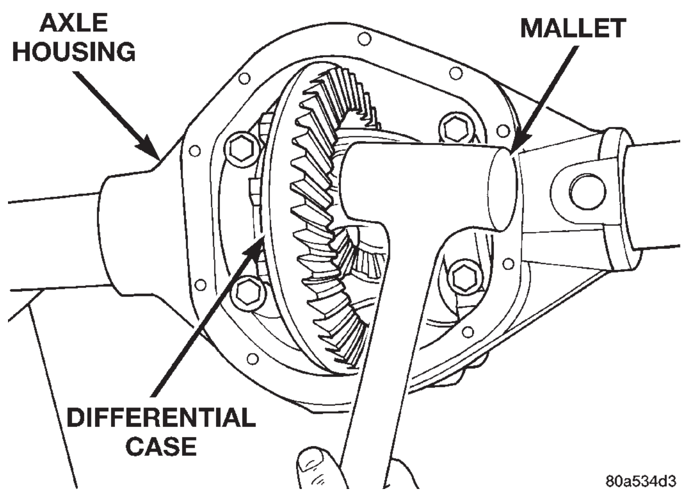


Fig. 63 Seat Ring Gear Side Differential Dummy Side Bearing

(17) Install the pinion gear in axle housing. Install the pinion yoke, or flange, and establish the correct pinion rotating torque. Record the value for use in setting the differential total torque to rotate.

(18) Install differential case and dummy bearings D-348 in axle housing (without shims), install bearing caps and tighten bolts snug .

(19) Seat ring gear side dummy bearing (Fig. 63).

(20) Position the dial indicator plunger on a flat surface between the ring gear bolt heads. (Fig. 64).

(21) Push and hold differential case toward pinion gear (Fig. 67).

(22) Zero dial indicator face to pointer (Fig. 67).

(23) Push and hold differential case to ring gear side of the axle housing (Fig. 68).

(24) Record dial indicator reading (Fig. 68).

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

ADJUSTMENTS (Continued)

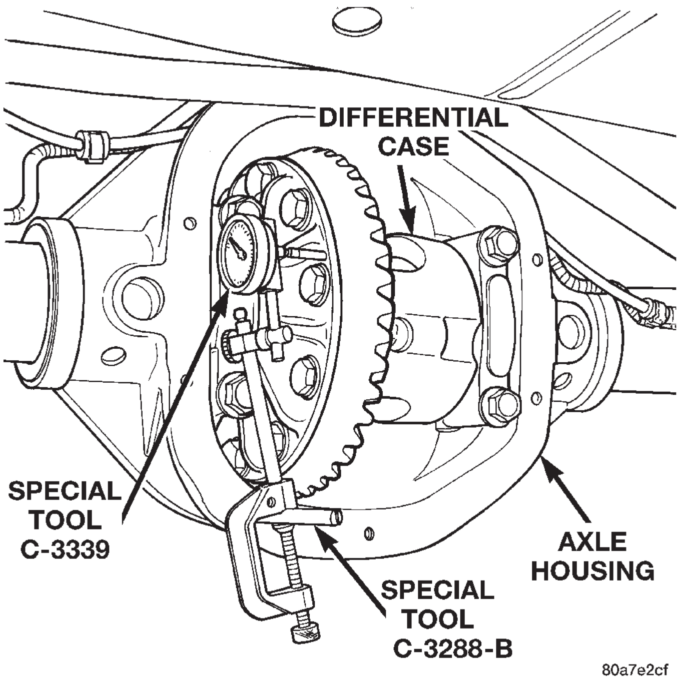


Fig. 64 Differential Side play Measurement

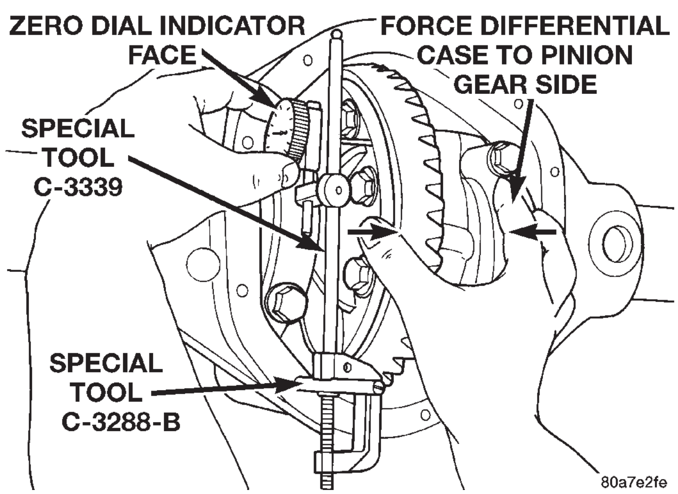


Fig. 65 Hold Differential Case and Zero Dial Indicator

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

(27) Rotate dial indicator out of the way on guide stud.

(28) Remove differential case and dummy bearings from axle housing.

(29) Install side bearing shims on differential case hubs.

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

(31) Install spreader W-129-B, utilizing some items from Adapter Set 6987, on axle housing and spread axle opening enough to receive differential case.

(32) Install differential case in axle housing.

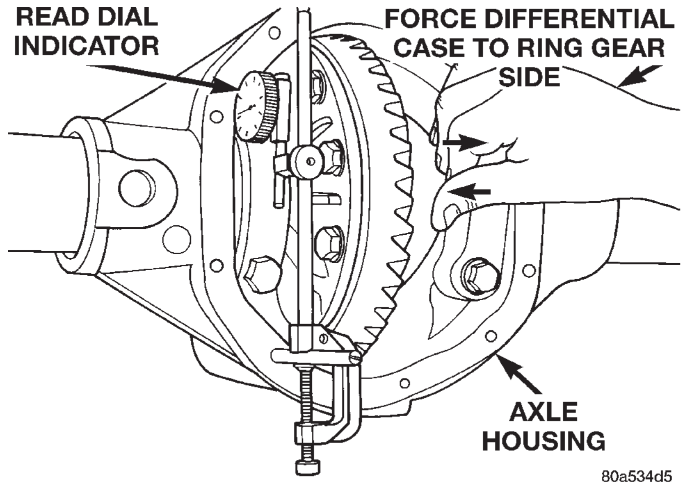


Fig. 66 Hold Differential Case and Read Dial Indicator

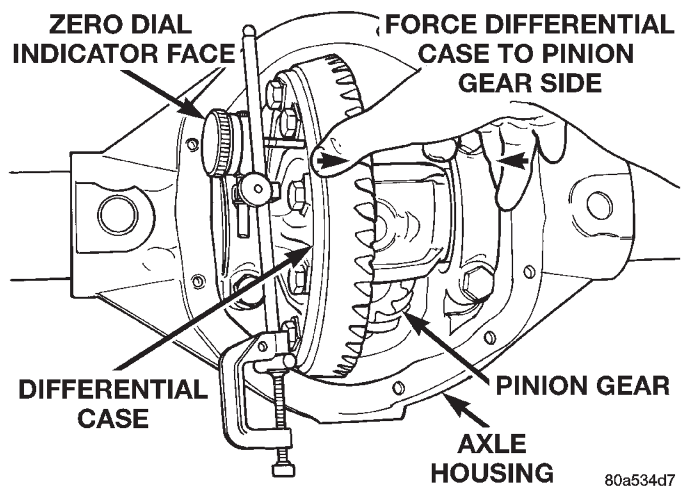


Fig. 67 Hold Differential Case and Zero Dial Indicator

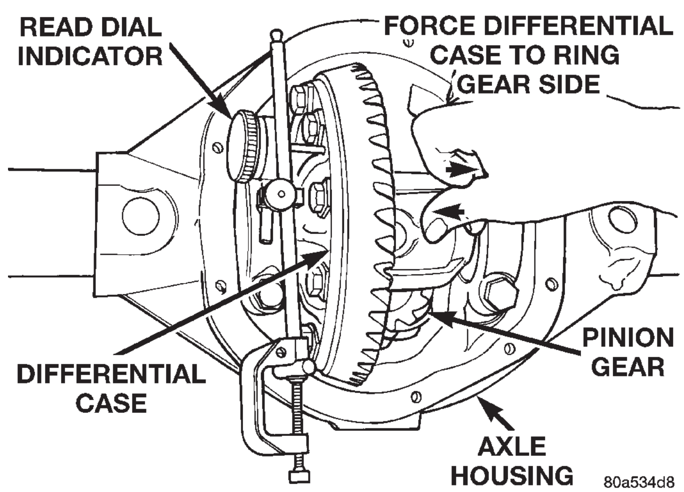


Fig. 68 Hold Differential Case and Read Dial Indicator

(33) Remove spreader from axle housing.

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

ADJUSTMENTS (Continued)

(35) Position the indicator plunger against a ring gear tooth (Fig. 69).

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

(37) Zero dial indicator face to pointer.

(38) Push and hold ring gear downward while not allowing the pinion gear to rotate. Dial indicator reading should be between 0.12 mm (0.005 in.) and 0.20 mm (0.008 in.). If backlash is not within specifications transfer the necessary amount of shim thickness from one side of the axle housing to the other (Fig. 70).

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

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

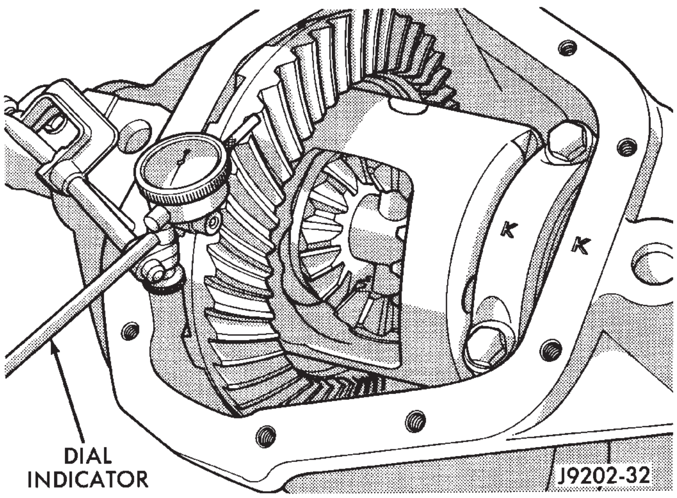


Fig. 69 Ring Gear Backlash Measurement

DIFFERENTIAL TOTAL TORQUE TO ROTATE

(1) Rotate the pinion a minimum of ten times to seat the differential bearings. Verify that the rotation is smooth and repeatable.

(2) While rotating the pinion at a slow steady rate, measure the differential total torque to rotate. Record the value.

(3) The differential total torque to rotate must be greater than the pinion torque to rotate plus 3 in.lbs..

(4) The differential total torque to rotate must be less than the pinion torque to rotate plus 11 in.lbs..

(5) If the differential total torque to is within these guidelines, assemble the remainder of the axle.

(6) If the differential total torque to rotate is less than the required value, increase the shim thickness on the ring and pinion gear sides of the differential equally.

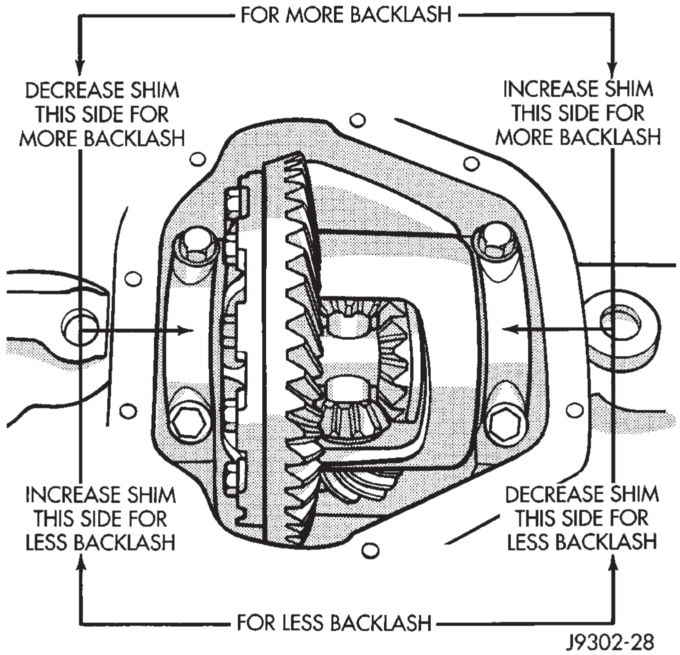


Fig. 70 Backlash Shim Adjustment

(7) If the differential total torque to rotate is greater than the required value, decrease the shim thickness on the ring and pinion gear sides of the differential equally.

(8) Remeasure the differential total torque to rotate.

GEAR CONTACT PATTERN ANALYSIS

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

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

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

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

The areas on the ring gear teeth with the greatest degree of contact against the pinion gear teeth will squeegee the compound to the areas with the least amount of contact. Note and compare patterns on the ring gear teeth to Gear Tooth Contact Patterns chart (Fig. 71) and adjust pinion depth and gear backlash as necessary.

ADJUSTMENTS (Continued)

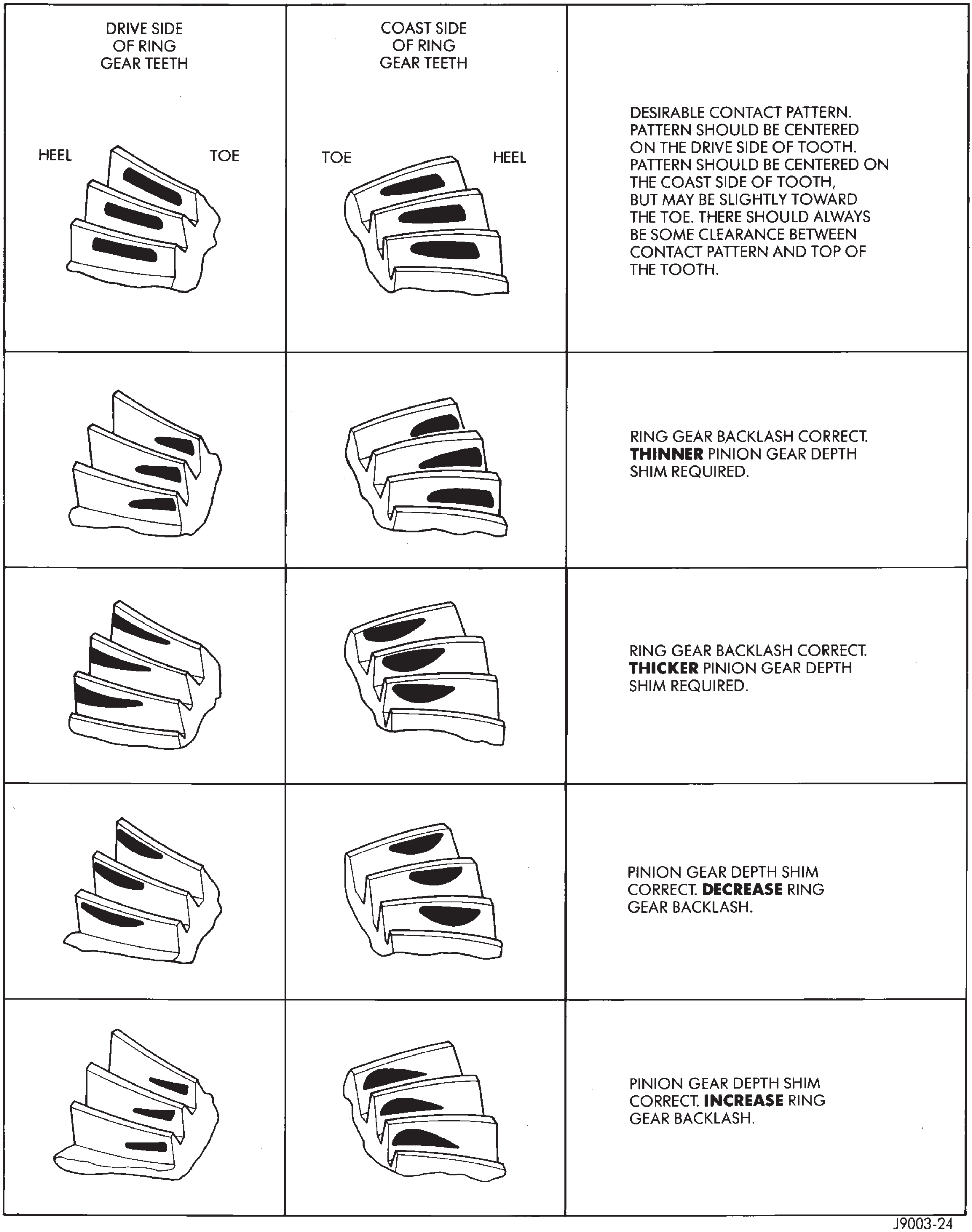


Fig. 71 Gear Tooth Contact Patterns

1999 WJ Service Manual
Publication No. 81-370-9147
TSB 26-01-00 January, 2000

SPECIFICATIONS

186 FBI AXLE

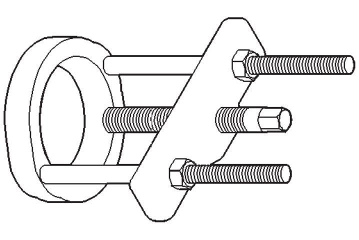
Axle Type . . . . Hypoid
Lubricant . . . . Synthetic 75W-140
Lube Capacity-w/o Vari-lok™ . . . . . . 1.18 L (2.5 pts.)
Lube Capacity-w/ Vari-lok™ . 1.19 L (2.51 pts.) total
Friction Modifier-Vari-lok™ only . . . 0.07L (0.15 pts.)
Axle Ratio 3.07, 3.55, 3.73, 4.10
Differential Side Gear
Clearance . . . . . . 0.12–0.20 mm (0.005–0.008 in.)
Ring Gear Diameter . . . . 18.59 cm (7.33 in.)
Backlash . . . . 0–0.15 mm (0.005–0.008 in.)
Pinion Std. Depth . . . . 92.1 mm (3.625 in.)
Pinion Bearing Rotating Torque . . . .
Original Bearings . . . . 1–2 N·m (10–20 in. lbs.)
New Bearings . . . . 1.5–4 N·m (15–35 in. lbs.)

TORQUE—186 FBI AXLE

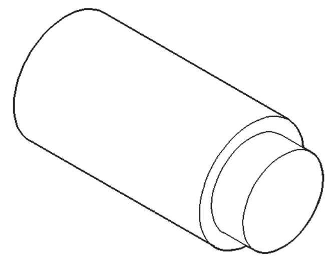
DESCRIPTION	TORQUE
Fill Hole Plug	34 N·m (25 ft. lbs.)
Diff. Cover Bolt	41 N·m (30 ft. lbs.)
Bearing Cap Bolt	61 N·m (45 ft. lbs.)
Ring Gear Bolt	95–122 N·m (70–90 ft. lbs.)
Axle Nut	237 N·m (175 ft. lbs.)
Hub Brg. Bolt	102 N·m (75 ft. lbs.)
Lower Ball Stud	108 N·m (80 ft. lbs.)
Upper Ball Stud	101 N·m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

SPECIAL TOOLS

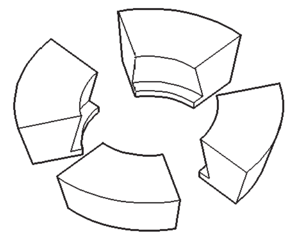
186 FBI AXLE



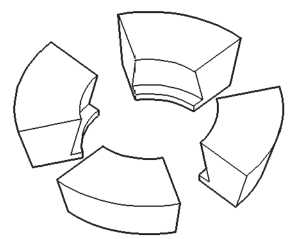
Puller—C-293-PA



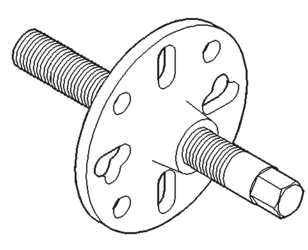
Plug—SP-3289



Adapter—8352

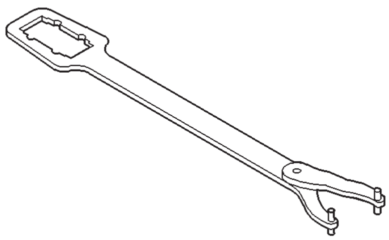


Adapter—C-293-39

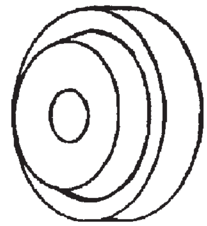


Puller—C-452

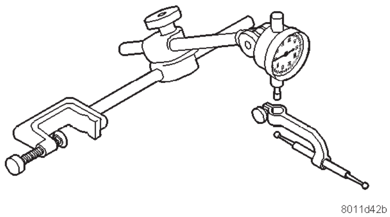
SPECIAL TOOLS (Continued)



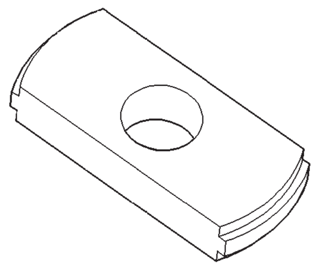
Wrench—C-3281



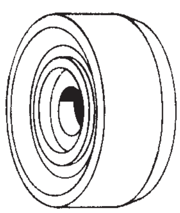
Installer—D-146



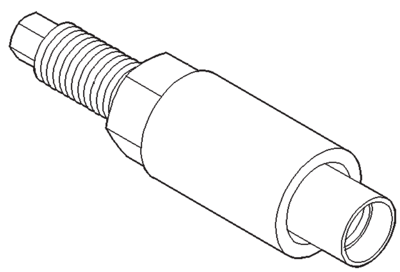
Dial Indicator—C-3339



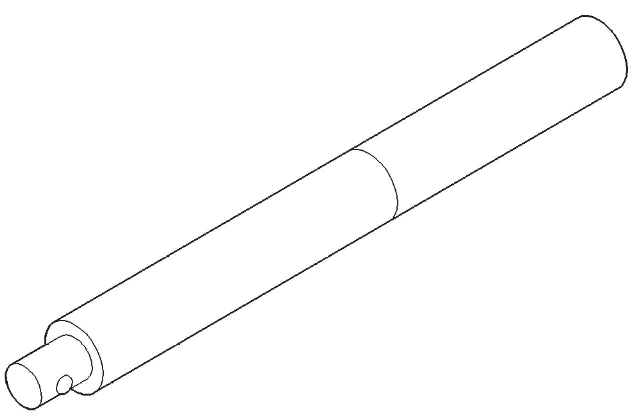
Remover—D-149



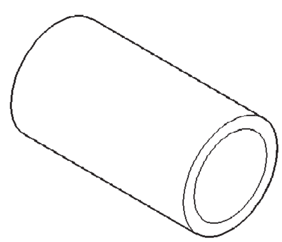
Driver—C-3716-A



Installer—W-162-D

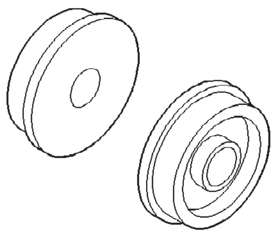


Handle—C-4171

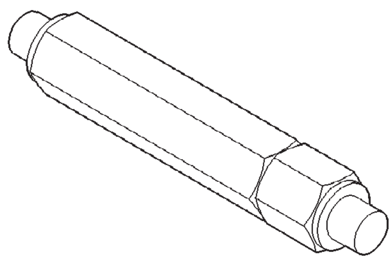


Cup—8109

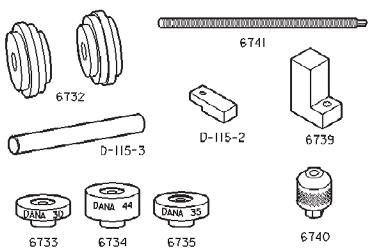
SPECIAL TOOLS (Continued)



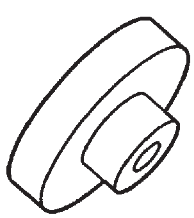
Installer Discs—8110



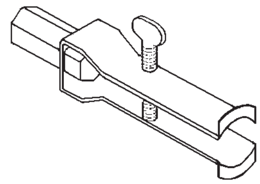
Turnbuckle—6797



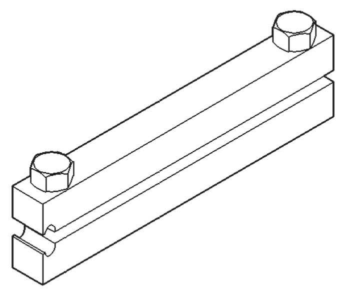
Tool Set, Pinion Depth—6774



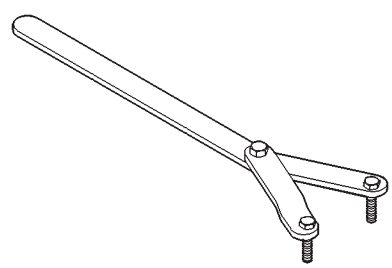
Gauge Block—6733



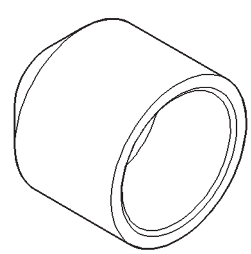
Puller—7794-A



Installer—C-4975-A

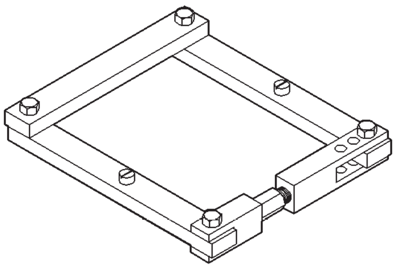


Spanner—6958

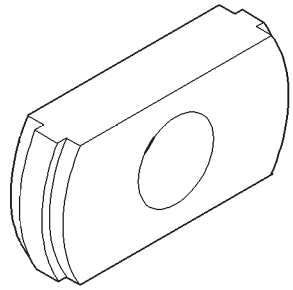


Installer—C-3972-A

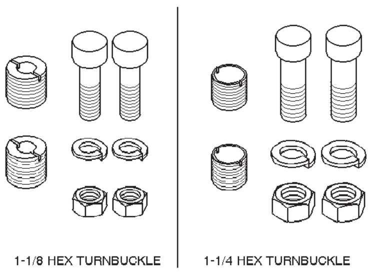
SPECIAL TOOLS (Continued)



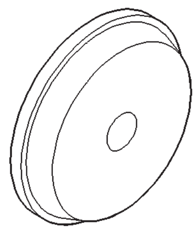
Spreader—W-129-B



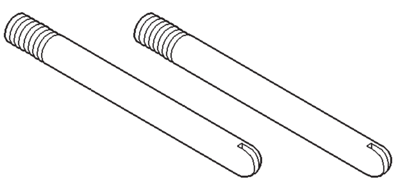
Remover—C-4345



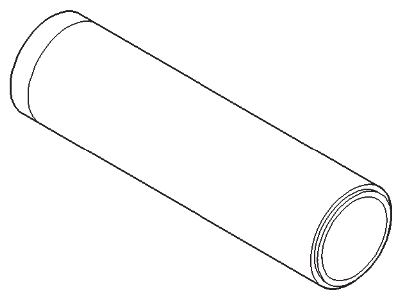
Adapter Kit—6987



Installer—D-130



Pilot Stud—C-3288-B



Installer—W-262

198 RBI AXLE

INDEX

GENERAL INFORMATION

198 RBI AXLE

The 198 Rear Beam-design Iron (RBI) axle housing has an iron center casting (differential housing) with axle shaft 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, hypoid gear design, housing has the centerline of the pinion set below the centerline of the ring gear.

The axle has a vent hose 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 cover provides a means for servicing the differential without removing the axle.

For vehicles equipped with ABS brakes, the axles have a tone ring pressed onto the axle shaft. Use care when removing axle shafts to ensure that the tone wheel or the wheel speed sensor are not damaged.

The 198 RBI axle has the assembly part number and gear ratio listed on a tag. The tag is attached to the differential housing by a cover bolt. Build date identification codes are stamped on the cover side of an axle shaft tube.

The differential case is a one-piece design. The differential pinion mate shaft is retained with a threaded pin. Differential bearing preload and ring gear backlash is adjusted by the use of selective spacer shims. Pinion bearing preload is set and maintained by the use of a collapsible spacer (Fig. 1).

LUBRICANT SPECIFICATIONS

A multi-purpose, hypoid gear lubricant which conforms to the following specifications should be used. Mopar® Hypoid Gear Lubricant conforms to all of these specifications.

- The lubricant should have MIL–L–2105C and API GL 5 quality specifications.
- Lubricant is a thermally stable SAE 80W–90 gear lubricant.
- Lubricant for axles intended for heavy-duty or trailer tow use is SAE 75W–140 SYNTHETIC gear lubricant.

GENERAL INFORMATION (Continued)

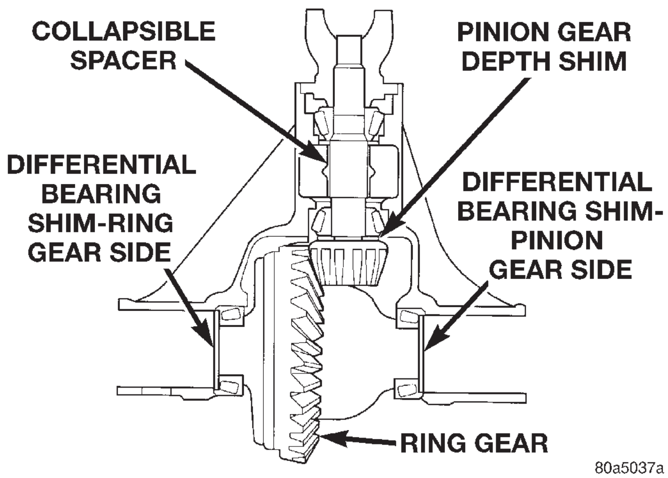


Fig. 1 Shim Locations

Trac-lok™ differentials require the addition of 0.11L (0.25 pts.) of friction modifier to the axle lubricant. The 198 RBI axle lubricant capacity for axles equipped with a standard or Trac-lok™ differential is 1.66L (3.50 pts.) total, including the friction modifier if necessary.

Vari-lok™ equipped axles require the addition of 0.09L (0.19 pts.) of friction modifier to the axle lubricant. The 198 RBI axle lubricant capacity for axles equipped with a Vari-lok™ differential is 1.78L (3.76 pts.) total, including the friction modifier.

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

DESCRIPTION AND OPERATION

STANDARD DIFFERENTIAL

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:

- The pinion gear rotates the ring gear
- The ring gear (bolted to the differential case) rotates the case
- The differential pinion gears (mounted on the pinion mate shaft in the case) rotate the side gears
- The 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. 2).

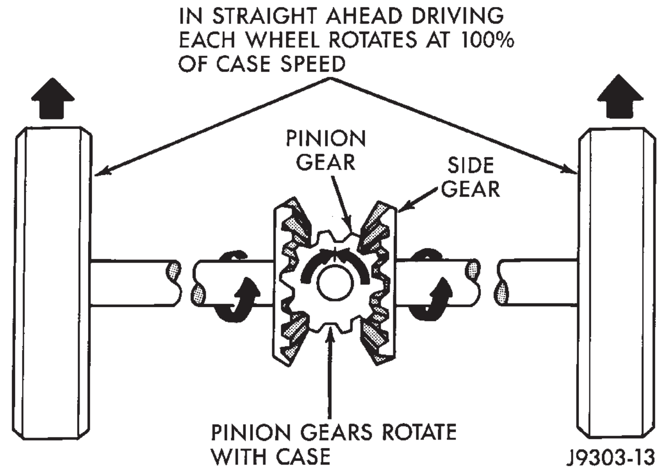


Fig. 2 Differential Operation—Straight Ahead Driving

When turning corners, the outside wheel must travel a greater distance than the inside wheel to complete a turn. The difference must be compensated for to prevent the tires from scuffing and skidding through turns. To accomplish this, the differential allows the axle shafts to turn at unequal speeds (Fig. 3). 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.

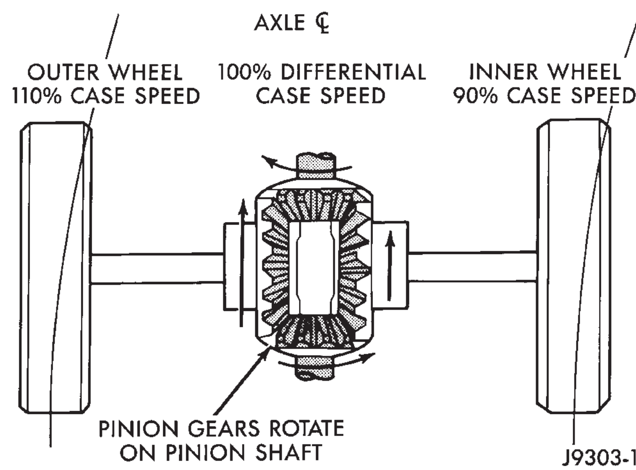


Fig. 3 Differential Operation—On Turns

VARI-LOK™ OPERATION

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

Vari-lok™ differentials are a speed-sensing torque transfer differential. Similiar to Trac-lok™ differentials, these differentials transfer torque to the wheel with the greater traction. Unlike typical differential systems, torque transfer is proportional to wheel speed difference rather than torque difference. Response can be tuned to driving conditions, enabling use of this system in the front axle. Both front and rear Vari-lok™ axle torque

DESCRIPTION AND OPERATION (Continued)

transfer characteristics are tuned to provide smooth operation. Except for the ability to maintain headway under low-traction conditions, operation is barely noticable to the driver.

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

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

TRAC-LOK™ OPERATION

In a conventional differential, 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 which contain multiple discs. The clutches will have radial grooves on the plates, and concentric grooves on the discs or bonded fiber material that is smooth in appearance.

In operation, the Trac-lok™ clutches are engaged by two concurrent forces. The first being the preload force exerted through Belleville spring washers within the clutch packs. The second is the separating forces generated by the side gears as torque is applied through the ring gear (Fig. 4).

The Trac-lok™ design provides the differential action needed for turning corners and for driving straight

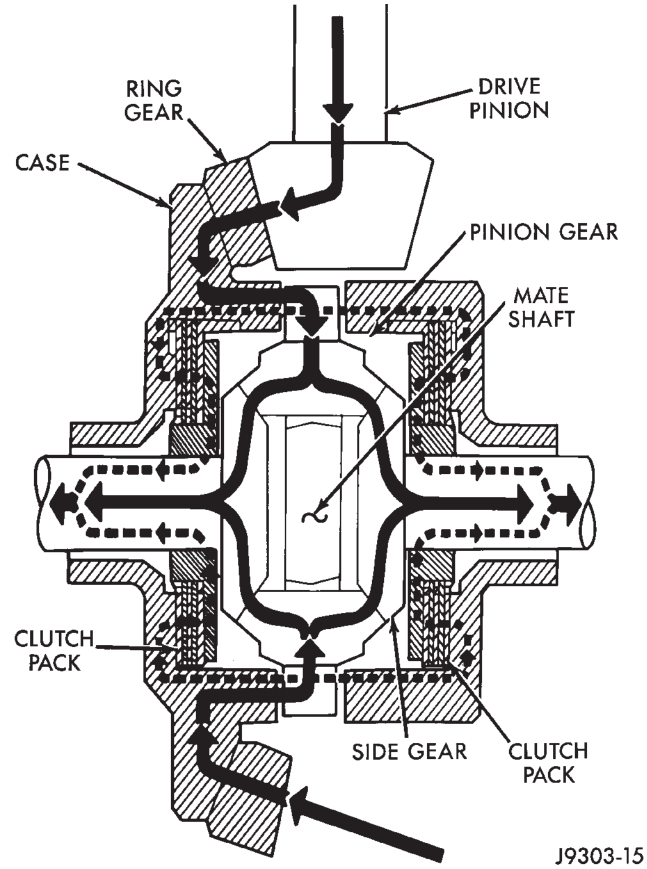


Fig. 4 Trac-lok™ Limited Slip Differential Operation

ahead during periods of unequal traction. 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.

DIAGNOSIS AND TESTING

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.

Axle gear problem conditions are usually the result of:
- Insufficient lubrication.
- Incorrect or contaminated lubricant.
- Overloading (excessive engine torque) or exceeding vehicle weight capacity.
- Incorrect clearance or backlash adjustment.

Axle component breakage is most often the result of:
- Severe overloading.

DIAGNOSIS AND TESTING (Continued)

- Insufficient lubricant.
- Incorrect lubricant.
- Improperly tightened components.

GEAR NOISE

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

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.
- Gear damage.

Differential side and pinion gears can be checked by turning the vehicle. They usually do not cause noise during straight–ahead driving when the gears are unloaded. The side gears are loaded during vehicle turns. 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 rear pinion bearing is the source of the noise. If the bearing noise is heard during a coast, the front pinion bearing is the source.

Worn or damaged differential bearings usually produce a low pitch noise. Differential bearing noise is similar to pinion bearing noise. 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(s).
- Worn or out–of–balance wheels.
- Loose wheel lug nuts.
- Worn U–joint(s).
- Loose/broken springs.
- Damaged axle shaft bearing(s).
- Loose pinion gear nut.
- Excessive pinion yoke run out.
- Bent axle shaft(s).

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 vibration 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 side gear/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.

TRAC–LOK™ DIFFERENTIAL NOISE

The most common problem is a chatter noise when turning corners. Before removing a 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 Mopar® Trac-lok™ Lubricant (friction modifier) should be added after repair service or during a lubricant change.

After changing the lubricant, drive the vehicle and make 10 to 12 slow, figure-eight turns. This maneuver will pump lubricant through the clutches. This will correct the condition in most instances. If the chatter persists, clutch damage could have occurred.

DIAGNOSIS AND TESTING (Continued)

DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSES	CORRECTION
WHEEL NOISE	1. Wheel loose. 2. Faulty, brinelled wheel bearing.	1. Tighten loose nuts. 2. Faulty or brinelled bearings must be replaced.
AXLE SHAFT NOISE	1. Misaligned axle shaft tube. 2. Bent or sprung axle shaft. 3. End play in drive pinion bearings. 4. Excessive gear backlash between ring gear and pinion gear. 5. Improper adjustment of drive pinion gear shaft bearings. 6. Loose drive pinion gearshaft yoke nut. 7. Improper wheel bearing adjustment. 8. Scuffed gear tooth contact surfaces.	1. Inspect axle shaft tube alignment. Correct as necessary. 2. Replace bent or sprung axle shaft. 3. Refer to Drive Pinion Bearing Pre-Load Adjustment. 4. Check adjustment of ring gear backlash and pinion gear. Correct as necessary. 5. Adjust drive pinion shaft bearings. 6. Tighten drive pinion gearshaft yoke nut with specified torque. 7. Readjust as necessary. 8. If necessary, replace scuffed gears.
AXLE SHAFT BROKE	1. Misaligned axle shaft tube. 2. Vehicle overloaded. 3. Erratic clutch operation. 4. Grabbing clutch.	1. Replace broken axle shaft after correcting axle shaft tube alignment. 2. Replace broken axle shaft. Avoid excessive weight on vehicle. 3. Replace broken axle shaft after inspecting for other possible causes. Avoid erratic use of clutch. 4. Replace broken axle shaft. Inspect clutch and make necessary repairs or adjustments.
DIFFERENTIAL CASE CRACKED	1. Improper adjustment of differential bearings. 2. Excessive ring gear backlash. 3. Vehicle overloaded. 4. Erratic clutch operation.	1. Replace cracked case; examine gears and bearings for possible damage. At reassembly, adjust differential bearings properly. 2. Replace cracked case; examine gears and bearings for possible damage. At reassembly, adjust ring gear backlash properly. 3. Replace cracked case; examine gears and bearings for possible damage. Avoid excessive weight on vehicle. 4. Replace cracked case. After inspecting for other possible causes, examine gears and bearings for possible damage. Avoid erratic use of clutch.
DIFFERENTIAL GEARS SCORED	1. Insufficient lubrication. 2. Improper grade of lubricant. 3. Excessive spinning of one wheel/tire.	1. 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. 2. Replace scored gears. Inspect all gears and bearings for possible damage. Clean and refill differential housing to required capacity with proper lubricant. 3. Replace scored gears. Inspect all gears, pinion bores and shaft for damage. Service as necessary.
LOSS OF LUBRICANT	1. Lubricant level too high.	1. Drain excess lubricant by removing fill plug and allow lubricant to level at lower edge of fill plug hole.

J9503-3

DIAGNOSIS AND TESTING (Continued)

DIAGNOSIS CHART – CONTINUED

CONDITION	POSSIBLE CAUSES	CORRECTION
LOSS OF LUBRICANT	2. Worn axle shaft seals. 3. Cracked differential housing. 4. Worn drive pinion gear shaft seal. 5. Scored and worn yoke. 6. Axle cover not properly sealed.	2. Replace worn seals. 3. Repair or replace housing as necessary. 4. Replace worn drive pinion gear shaft seal. 5. Replace worn or scored yoke and seal. 6. Remove cover and clean flange and reseal.
AXLE OVERHEATING	1. Lubricant level too low. 2. Incorrect grade of lubricant. 3. Bearings adjusted too tight. 4. Excessive gear wear. 5. Insufficient ring gear backlash.	1. Refill differential housing. 2. Drain, flush and refill with correct amount of the correct lubricant. 3. Readjust bearings. 4. Inspect gears for excessive wear or scoring. Replace as necessary. 5. Readjust ring gear backlash and inspect gears for possible scoring.
GEAR TEETH BROKE (RING GEAR AND PINION)	1. Overloading. 2. Erratic clutch operation. 3. Ice-spotted pavements. 4. Improper adjustments.	1. Replace gears. Examine other gears and bearings for possible damage. 2. Replace gears and examine the remaining parts for possible damage. Avoid erratic clutch operation. 3. Replace gears. Examine the remaining parts for possible damage. Replace parts as required. 4. Replace gears. Examine other parts for possible damage. Ensure ring gear backlash is correct.
AXLE NOISE	1. Insufficient lubricant. 2. Improper ring gear and drive pinion gear adjustment. 3. Unmatched ring gear and drive pinion gear. 4. Worn teeth on ring gear or drive pinion gear. 5. Loose drive pinion gear shaft bearings. 6. Loose differential bearings. 7. Misaligned or sprung ring gear. 8. Loose differential bearing cap bolts	1. Refill axle with correct amount of the proper lubricant. Also inspect for leaks and correct as necessary. 2. Check ring gear and pinion gear teeth contact pattern. 3. Remove unmatched ring gear and drive pinion gear. Replace with matched gear and drive pinion gear set. 4. Check teeth on ring gear and drive pinion gear for correct contact. If necessary, replace with new matched set. 5. Adjust drive pinion gearshaft bearing preload torque. 6. Adjust differential bearing preload torque. 7. Measure ring gear runout. 8. Tighten with specified torque

J9503-4

DIAGNOSIS AND TESTING (Continued)

TRAC–LOK™ TEST

WARNING: WHEN SERVICING VEHICLES WITH A TRAC–LOK™ DIFFERENTIAL DO NOT USE THE ENGINE TO TURN THE AXLE AND WHEELS. BOTH REAR WHEELS MUST BE RAISED AND THE VEHICLE SUPPORTED. A TRAC–LOK™ AXLE CAN EXERT ENOUGH FORCE IF ONE WHEEL IS IN CONTACT WITH A SURFACE TO CAUSE THE VEHICLE TO MOVE.

The differential can be tested without removing the differential case by measuring rotating torque. Make sure brakes are not dragging during this measurement.

(1) Place blocks in front and rear of both front wheels.

(2) Raise one rear wheel until it is completely off the ground.

(3) Engine off, transmission in neutral, and parking brake off.

(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. 5).

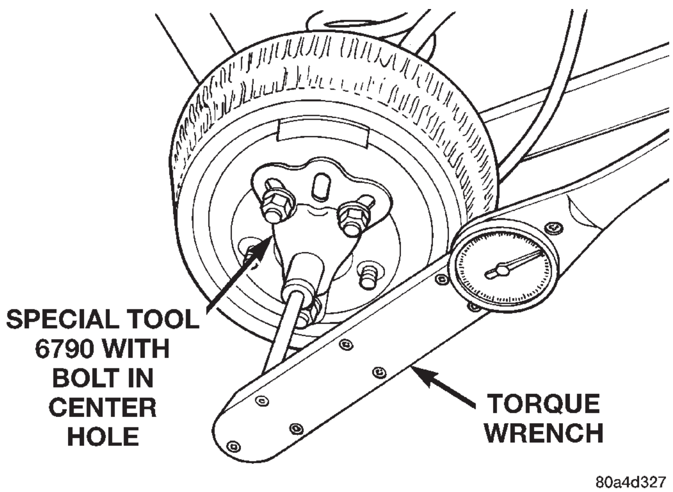


Fig. 5 Trac-lok™ Test —Typical

(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 serviced.

VARI-LOK™ TEST

PRIMING

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

(2) Remove the axle fill plug.

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

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

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

TEST PROCEDURE

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

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

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

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

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

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

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

SERVICE PROCEDURES

LUBRICANT CHANGE

(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 original sealant from the housing and cover surfaces.

(6) Apply a bead of Mopar® Silicone Rubber Sealant, or equivalent, to the housing cover (Fig. 6).

Install the housing cover within 5 minutes after applying the sealant.

(7) Install the cover and any identification tag. Tighten the cover bolts to 41 N·m (30 ft. lbs.) torque.

(8) For Trac–lok™ and Vari-lok™ differentials, a quantity of Mopar® Trac–lok™ lubricant (friction modifier), or equivalent, must be added after repair service or a lubricant change. Refer to the Lubricant Specifications section of this group for the quantity necessary.

(9) Fill differential with Mopar® Hypoid Gear Lubricant, or equivalent, to bottom of the fill plug hole. Refer to the Lubricant Specifications section of this group for the quantity necessary.

SERVICE PROCEDURES (Continued)

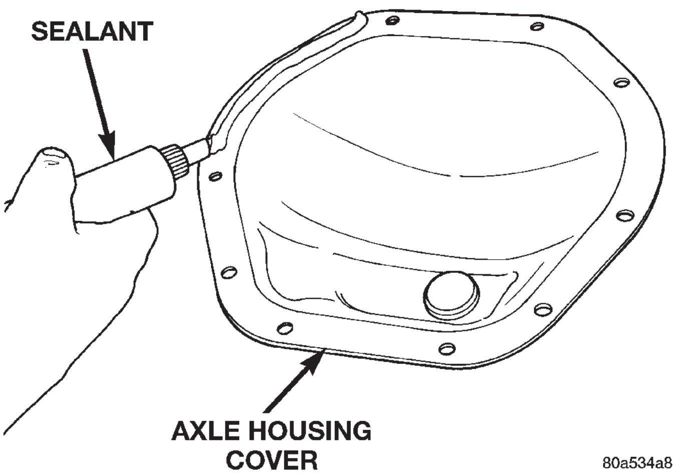


Fig. 6 Apply Sealant

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

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

(11) Trac–lok™ and Vari-lok™ differential equipped 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.

REMOVAL AND INSTALLATION

REAR AXLE

REMOVAL

(1) Raise and support the vehicle.

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

(3) Secure axle to device.

(4) Remove the wheels and tires.

(5) Remove the brake rotors and calipers from the axle. Refer to Group 5, Brakes, for proper procedures.

(6) Disconnect parking brake cables from brackets and lever.

(7) Remove wheel speed sensors, if necessary. Refer to Group 5, Brakes, for proper procedures.

(8) Disconnect the brake hose at the axle junction block. Do not disconnect the brake hydraulic lines at the calipers. Refer to Group 5, Brakes, for proper procedures.

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

(10) Mark the propeller shaft and yokes for installation alignment reference.

(11) Remove propeller shaft.

(12) Disconnect stabilizer bar links.

(13) Remove nut holding upper suspension arm to the rear axle ball joint.

(14) Using Remover 8278, separate the rear axle ball joint from the upper suspension arm (Fig. 7).

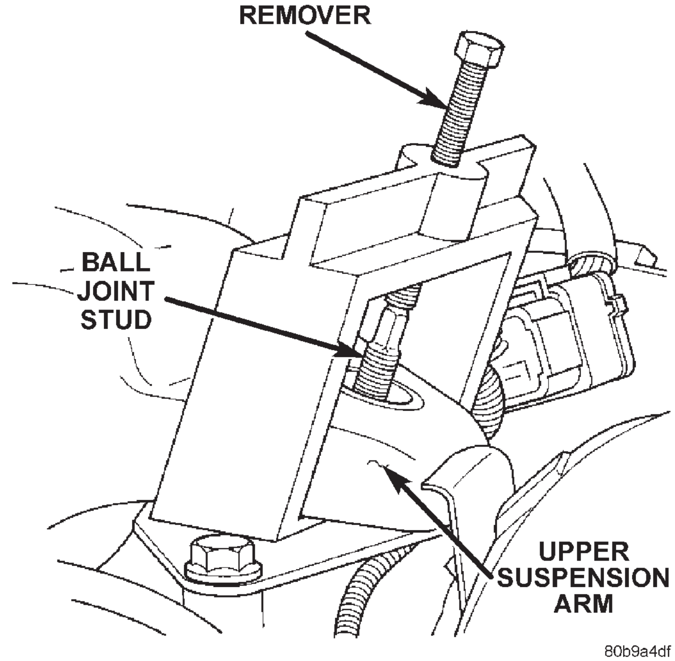


Fig. 7 Separate Rear Axle Ball Joint

(15) Disconnect shock absorbers from axle.

(16) Disconnect track bar.

(17) Disconnect lower suspension arms from the axle brackets.

(18) Separate the axle from the vehicle.

INSTALLATION

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

(1) Raise the axle with lifting device and align coil springs.

(2) Position the lower suspension arms on the axle brackets. Install nuts and bolts, do not tighten bolts at this time.

(3) Install the upper suspension arm to the rear axle ball joint.

(4) Install nut to hold the upper suspension arm to the rear axle ball joint. Torque the nut to 122 N·m (90 ft.lbs.) (Fig. 8).

(5) Install track bar and attachment bolts, do not tighten bolts at this time.

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

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

REMOVAL AND INSTALLATION (Continued)

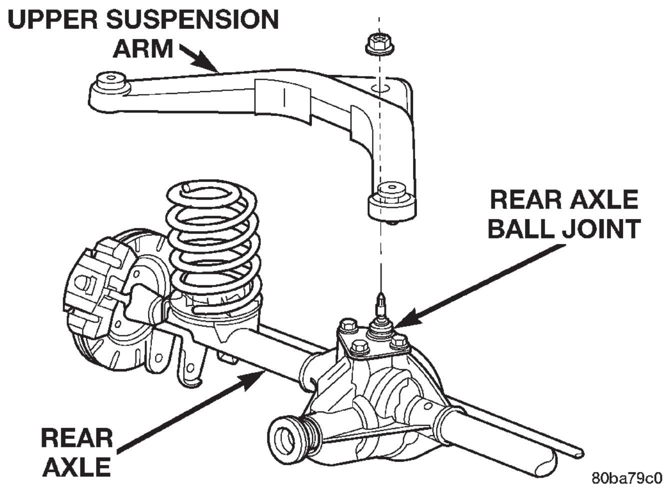


Fig. 8 Install Rear Ball Joint Nut

(8) Install the wheel speed sensors, if necessary. Refer to Group 5, Brakes, for proper procedures.

(9) Connect parking brake cable to brackets and lever.

(10) Install the brake rotors and calipers. Refer to Group 5, Brakes, for proper procedures.

(11) Connect the brake hose to the axle junction block. Refer to Group 5, Brakes, for proper procedures.

(12) Install axle vent hose.

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

(14) Install the wheels and tires.

(15) Add gear lubricant, if necessary. Refer to Lubricant Specifications in this section for lubricant requirements.

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

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

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

PINION SHAFT SEAL

REMOVAL

(1) Raise and support the vehicle.

(2) Remove wheel and tire assemblies.

(3) Remove the brake rotors and calipers. Refer to Group 5, Brakes, for proper procedures.

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

(5) Remove the propeller shaft from the yoke.

(6) Rotate the pinion gear a minimum of ten times. Verify that the pinion rotates smoothly.

(7) Measure the amount of torque necessary to rotate the pinion gear with a (in. lbs.) dial-type torque wrench. Record the torque reading for installation reference.

(8) Using a short piece of pipe and Holder 6958 to hold the pinion yoke, remove the pinion nut and washer (Fig. 9).

(9) Use Remover C–452 and Wrench C–3281 to remove the pinion yoke (Fig. 10).

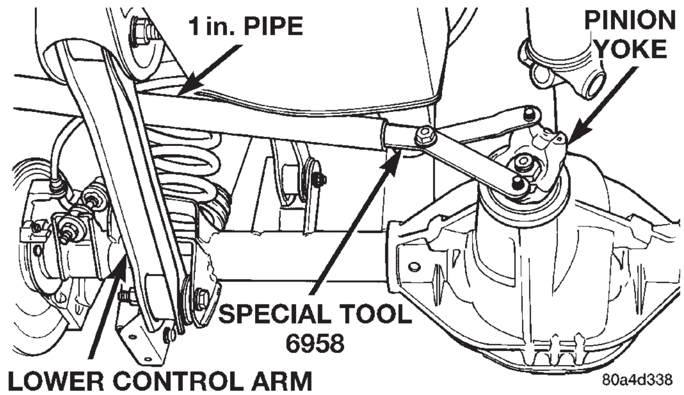


Fig. 9 Pinion Yoke Holder

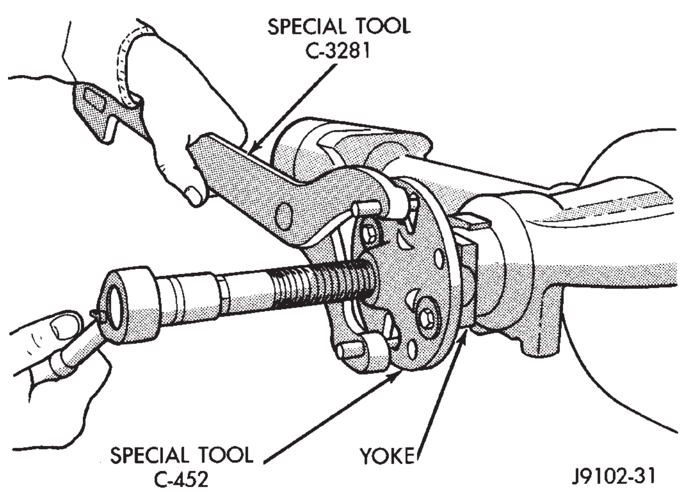


Fig. 10 Pinion Yoke Removal

(10) Use Remover 7794-A and slide hammer to remove the pinion gear seal (Fig. 11).

INSTALLATION

(1) Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with Installer C-3972-A and Handle C–4171 (Fig. 12).

(2) Install yoke on the pinion gear with Screw 8112, Cup 8109, and Holder 6958 (Fig. 13).

CAUTION: Do not exceed the minimum tightening torque when installing the pinion yoke at this point. Damage to the collapsible spacer or bearings may result.

(3) Install the yoke washer and a new nut on the pinion gear and tighten the pinion nut until there is zero bearing end-play.

REMOVAL AND INSTALLATION (Continued)

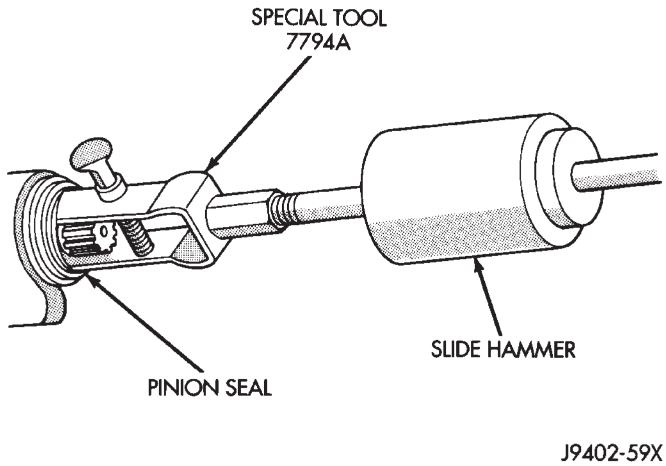


Fig. 11 Seal Removal

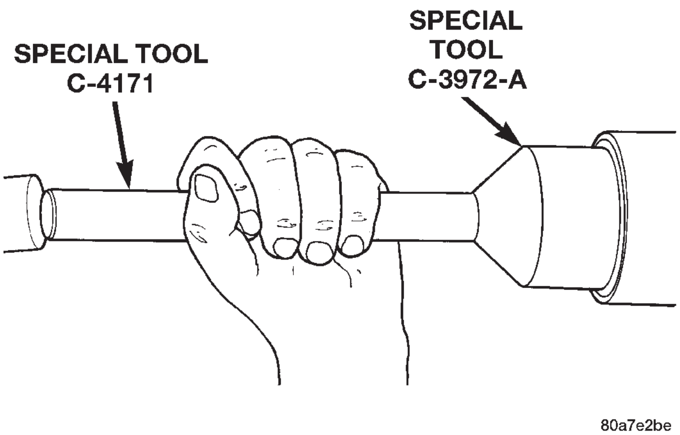


Fig. 12 Pinion Seal Installation

(4) Tighten the nut to 271 N·m (200 ft. lbs.).

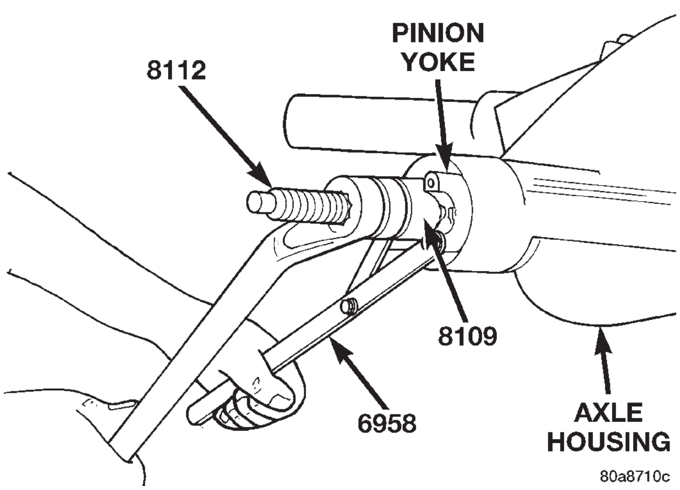


Fig. 13 Pinion Yoke Installation

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

(5) Rotate the pinion gear a minimum of ten times. Verify that the pinion rotates smoothly. Rotate the pinion shaft using a (in. lbs.) torque wrench. Rotating torque should be equal to the reading recorded during removal plus an additional 0.56 N·m (5 in. lbs.) (Fig. 14).

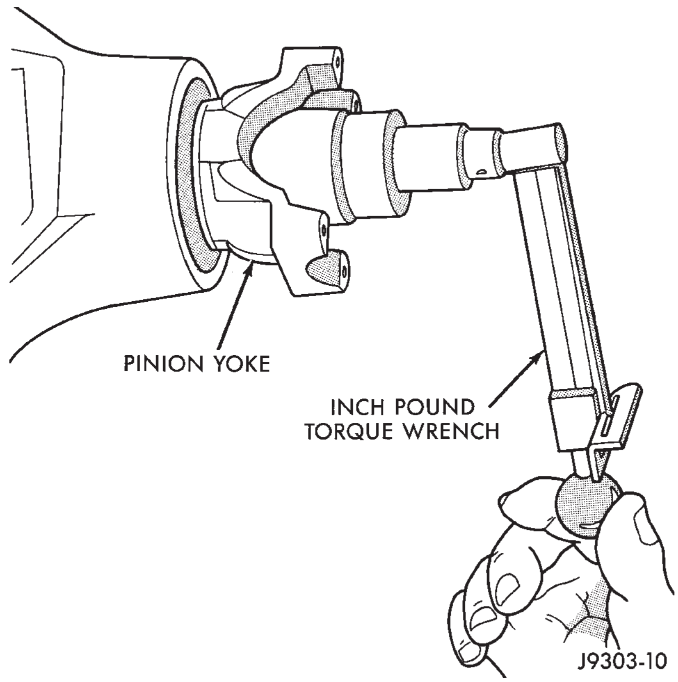


Fig. 14 Check Pinion Rotation Torque

(6) If the rotating torque is low, use Holder 6958 to hold the pinion yoke (Fig. 15), and tighten the pinion shaft nut in 6.8 N·m (5 ft. lbs.) increments until the proper rotating torque is achieved.

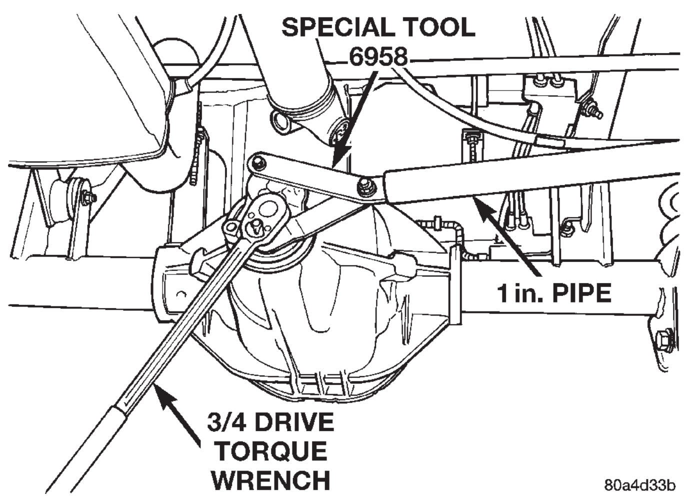


Fig. 15 Tightening Pinion Shaft Nut

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

REMOVAL AND INSTALLATION (Continued)

(7) Align the installation reference marks on the propeller shaft and yoke and install the propeller shaft.

(8) Add gear lubricant to the differential housing, if necessary. Refer to the Lubricant Specifications for gear lubricant requirements.

(9) Install the brake rotors and calipers. Refer to Group 5, Brakes, for proper procedures.

(10) Install wheel and tire assemblies.

(11) Lower the vehicle.

COLLAPSIBLE SPACER

REMOVAL W/PINION INSTALLED

(1) Raise and support the vehicle.

(2) Remove wheel and tire assemblies.

(3) Remove rear brake rotors and calipers. Refer to Group 5, Brakes, for proper procedures.

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

(5) Remove the propeller shaft from the yoke.

(6) Rotate the pinion gear a minimum of ten times. Verify that the pinion rotates smoothly.

(7) Measure the amount of torque necessary to rotate the pinion gear with a (in. lbs.) dial-type torque wrench. Record the torque reading for installation reference.

(8) Using a short piece of pipe and Holder 6958 to hold the pinion yoke, remove the pinion nut and washer (Fig. 16).

(9) Use Remover C-452 and Wrench C-3281 to remove the pinion yoke (Fig. 17).

(10) Use Remover 7794-A and slide hammer to remove the pinion shaft seal (Fig. 18).

(11) Remove the front pinion bearing using a pair of suitable pick tools to pull the bearing straight off the pinion gear shaft. It may be necessary to lightly tap the end of the pinion gear with a rawhide or rubber mallet if the bearing becomes bound on the pinion shaft.

(12) Remove the collapsible spacer.

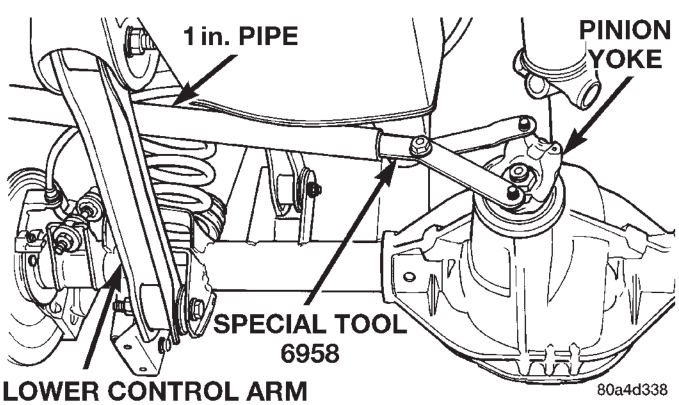


Fig. 16 Pinion Yoke Holder

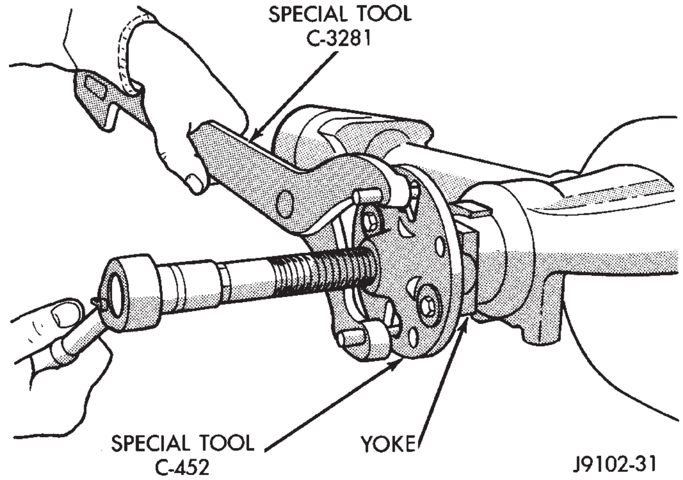


Fig. 17 Pinion Yoke Removal

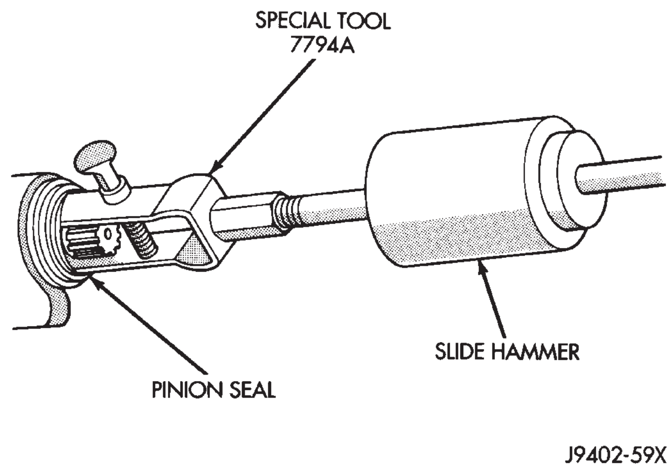


Fig. 18 Seal Removal

REMOVAL W/PINION REMOVED

(1) Raise and support the vehicle.

(2) Remove wheel and tire assemblies.

(3) Remove rear brake rotors and calipers. Refer to Group 5, Brakes, for proper procedures.

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

(5) Remove the propeller shaft from the yoke.

(6) Rotate the pinion gear a minimum of ten times. Verify that the pinion rotates smoothly.

(7) Measure the amount of torque necessary to rotate the pinion gear with a (in. lbs.) dial-type torque wrench. Record the torque reading for installation reference.

(8) Remove differential assembly from axle housing.

(9) Using Holder 6958 to hold yoke and a short length of 1 in. pipe, remove the pinion yoke nut and washer (Fig. 16).

(10) Using Remover C–452 and Wrench C–3281, remove the pinion yoke from pinion shaft (Fig. 17).

REMOVAL AND INSTALLATION (Continued)

(11) Remove the pinion gear from housing (Fig. 19). Catch the pinion with your hand to prevent it from falling and being damaged.

(12) Remove collapsible spacer from pinion shaft.

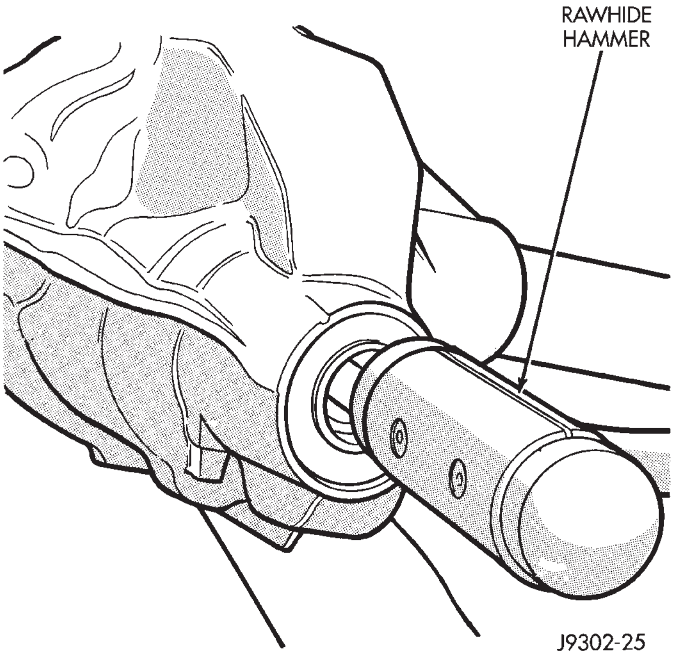


Fig. 19 Remove Pinion Gear

INSTALLATION

(1) Install a new collapsible preload spacer on pinion shaft (Fig. 20).

(2) If pinion gear was removed, install pinion gear in housing.

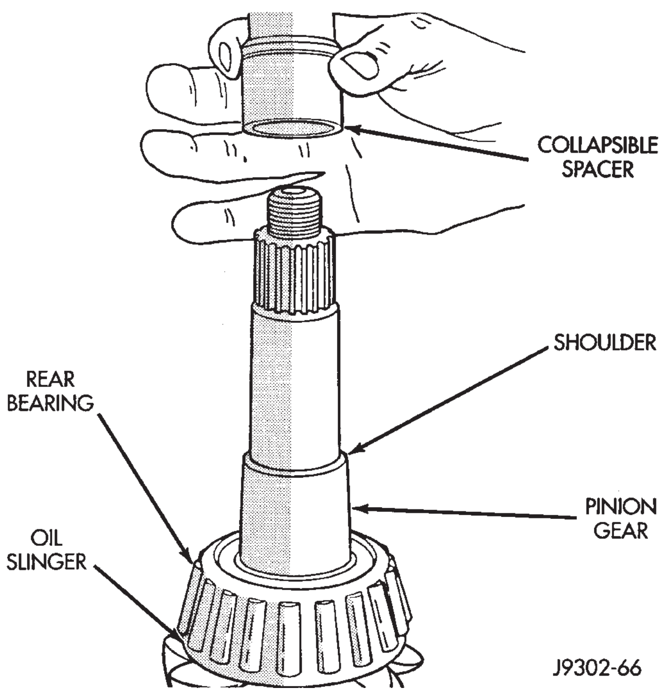


Fig. 20 Collapsible Preload Spacer

(3) Install pinion front bearing, if necessary.

(4) Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with Installer C-3972-A and Handle C–4171 (Fig. 21).

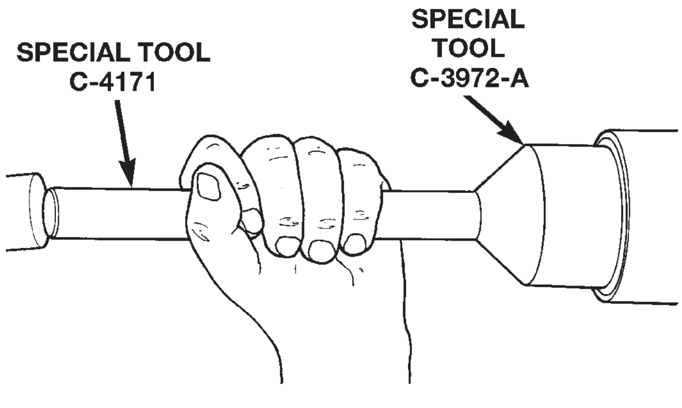


Fig. 21 Pinion Seal Installation

(5) Install yoke with Screw 8112, Cup 8109, and Holder 6958 (Fig. 22).

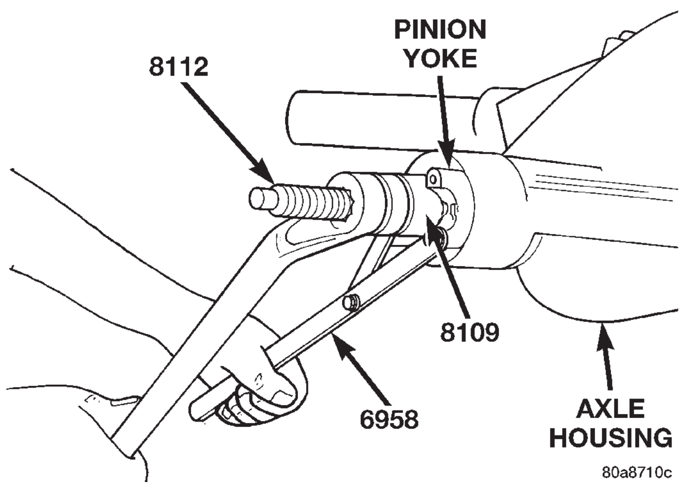


Fig. 22 Pinion Yoke Installation

(6) If the original pinion bearings are being used, install differential assembly and axle shafts, if necessary.

NOTE: If new pinion bearings were installed, do not install the differential assembly and axle shafts until after the pinion bearing preload and rotating torque are set.

(7) Install the yoke washer and a new nut on the pinion gear. Tighten the pinion nut until there is zero bearing end-play.

(8) Tighten the nut to 271 N·m (200 ft. lbs.).

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

REMOVAL AND INSTALLATION (Continued)

(9) Using yoke holder 6958, a short length of 1 in. pipe, and a torque wrench set at 474 N·m (350 ft. lbs.), crush collapsible spacer until bearing end play is taken up (Fig. 23).

NOTE: If more than 474 N·m (350 ft. lbs.) of torque is necessary to remove the bearing end play, the collapsible spacer is defective and must be replaced.

(10) Slowly tighten the nut in 6.8 N·m (5 ft. lbs.) increments until the required rotating torque is achieved. Measure the rotating torque frequently to avoid over crushing the collapsible spacer (Fig. 24).

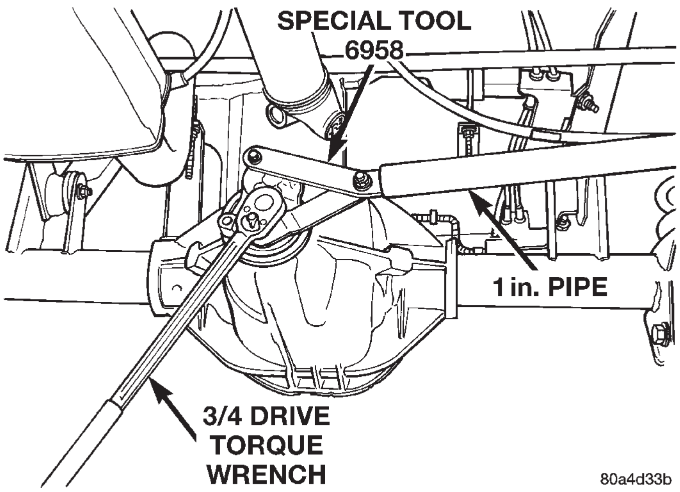


Fig. 23 Tightening Pinion Nut

(11) Rotate the pinion gear a minimum of ten times. Verify that the pinion rotates smoothly. Check rotating torque with an inch pound torque wrench (Fig. 24). The torque necessary to rotate the pinion gear should be:

- Original Bearings — The reading recorded during removal, plus an additional 0.56 N·m (5 in. lbs.).
- New Bearings — 2 to 5 N·m (15 to 35 in. lbs.).

(12) Install differential assembly and axle shafts, if necessary.

(13) Align marks made previously on yoke and propeller shaft and install propeller shaft.

(14) Install rear brake rotors and calipers. Refer to Group 5, Brakes, for proper procedures.

(15) Add gear lubricant, if necessary. Refer to Lubricant Specifications of this section for lubricant requirements.

(16) Install wheel and tire assemblies.

(17) Lower vehicle.

AXLE SHAFT

REMOVAL

(1) Raise and support vehicle. Ensure that the transmission is in neutral.

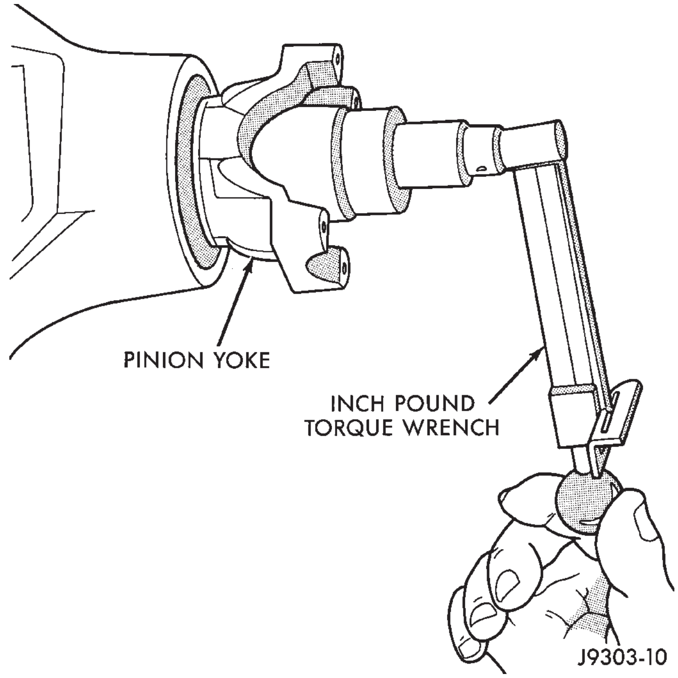


Fig. 24 Check Pinion Gear Rotation Torque

(2) Remove wheel and tire assembly.

(3) Remove brake caliper and rotor. Refer to Group 5, Brakes, for proper procedure.

(4) Through access hole in axle flange, remove nuts holding axle retainer plate to axle tube.

(5) Using Slide Hammer 7420, Adapter 6790, and suitable lug nuts, pull axle shaft from vehicle.

INSTALLATION

WARNING: Do not reuse the bolts and nuts that retained the axle shaft to axle tube flange. Used prevailing torque nuts can loosen, causing a dangerous condition.

(1) Insert axle into opening at end of axle tube.

(2) Align flat area on axle shaft retaining plate upward.

(3) Insert the retaining bolts into the axle tube flange and through the holes in the brake backing and axle shaft retaining plates.

(4) Install nuts to hold axle retaining plate to axle tube.

(5) Through access hole in axle flange, tighten nuts to 61 N·m (45 ft. lbs.).

(6) Install brake caliper and rotor. Refer to Group 5, Brakes, for proper procedures.

(7) Install wheel and tire.

(8) Check and fill the gear lubricant. Refer to the Lubricant Specifications for gear lubricant requirements.

(9) Lower vehicle.

REMOVAL AND INSTALLATION (Continued)

AXLE SHAFT SEAL AND BEARING

REMOVAL

(1) Remove axle shaft from vehicle.

(2) Using a 3/8 in. dia. drill bit, drill a shallow hole into soft steel axle bearing retaining ring (Fig. 25). If possible, use a drill depth stop to avoid marking axle.

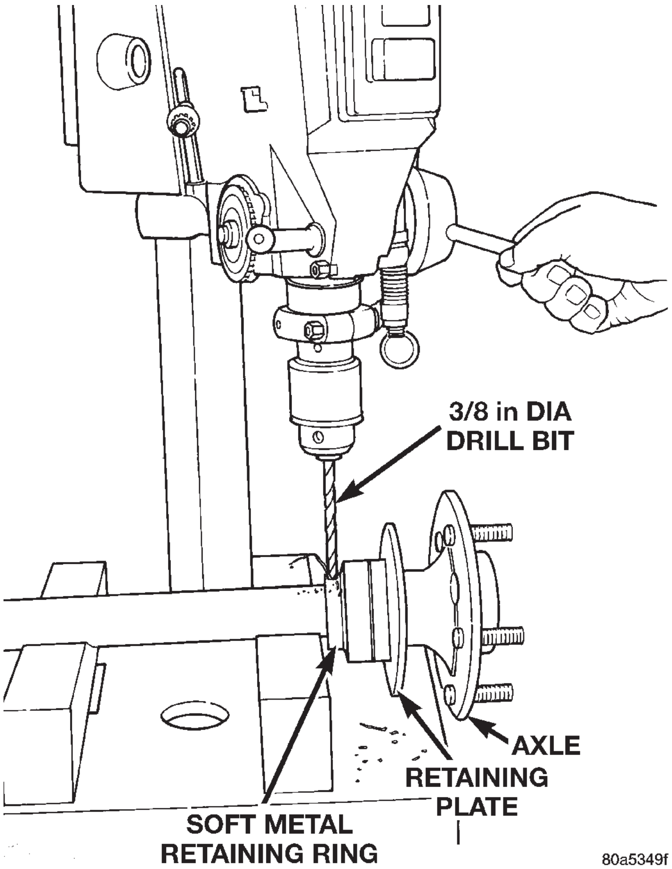


Fig. 25 Drill Retaining Ring

(3) Using a suitable cold chisel, cut retaining ring across drilled hole. (Fig. 26)

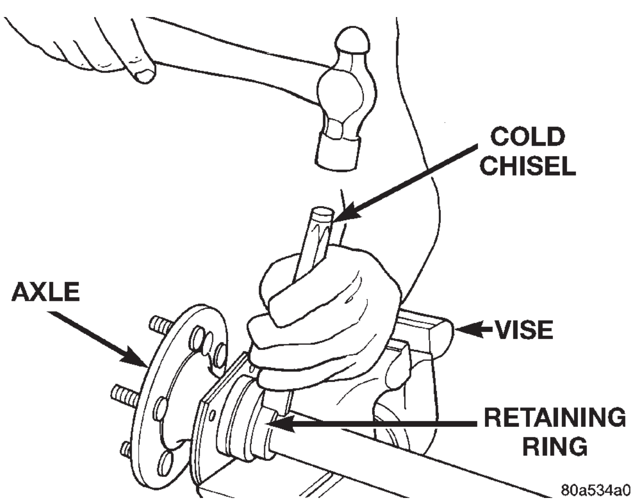


Fig. 26 Cut Retaining Ring

(4) Slide retaining ring from axle shaft.

(5) Using Splitter 1130 placed between the seal and bearing and a suitable Arbor Press, press unit bearing from axle shaft (Fig. 27).

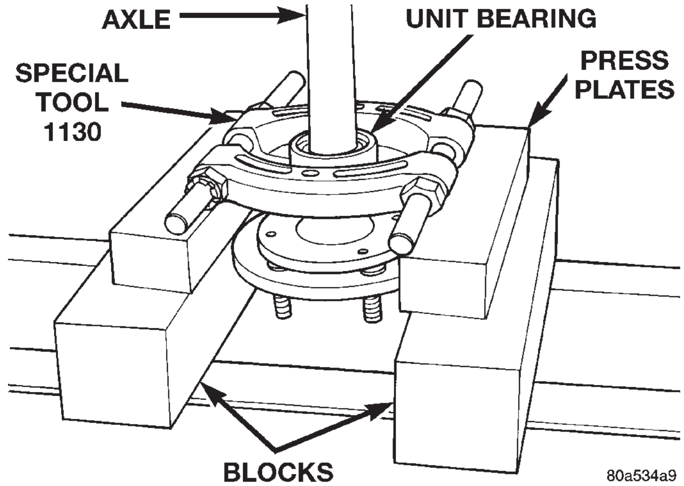


Fig. 27 Axle Bearing and Seal Remove

(6) Slide seal from axle.

(7) Slide retaining plate from axle shaft.

INSTALLATION

(1) Using a suitable straight edge, verify flatness of axle shaft retaining plate. Replace plate if warped.

(2) Install retaining plate on axle (Fig. 28).

(3) Apply a coat of multi-purpose grease on sealing surface of axle seal.

(4) Install seal on axle with cavity away from retaining plate (Fig. 28).

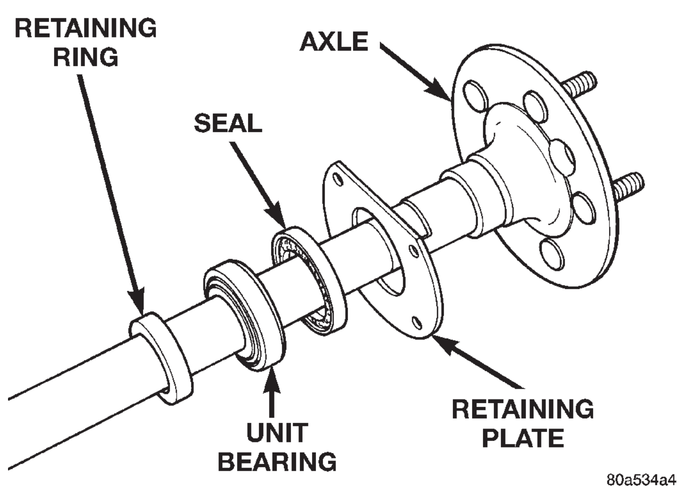


Fig. 28 Axle Bearing and Seal Components

(5) Lubricate bearing with Mopar® Wheel Bearing Grease, or equivalent. Wipe excess grease from outside of bearing.

(6) Slide bearing onto axle shaft with groove in outer surface toward seal (Fig. 28).

(7) Using Installer 7913 and shop press, press bearing onto axle shaft (Fig. 29).

REMOVAL AND INSTALLATION (Continued)

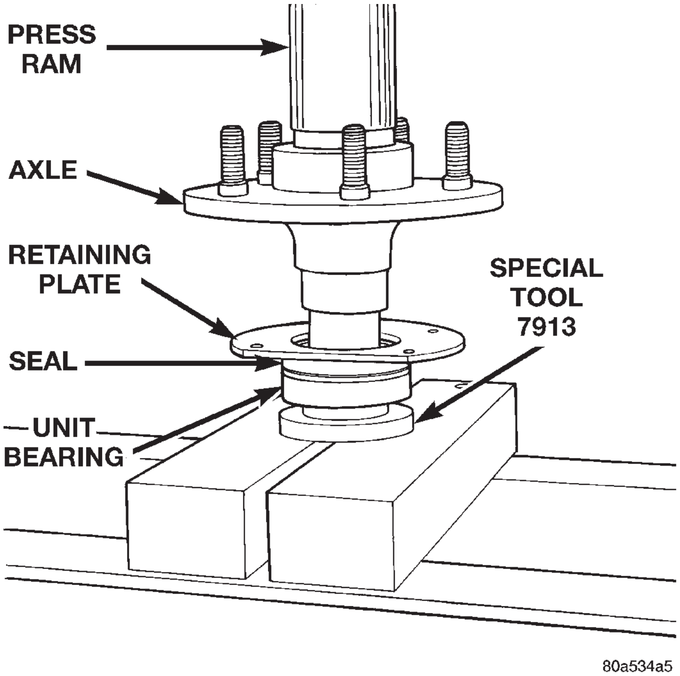


Fig. 29 Press Bearing On Axle

(8) Using Installer 7913 and shop press, press soft metal retaining ring onto axle shaft (Fig. 30).

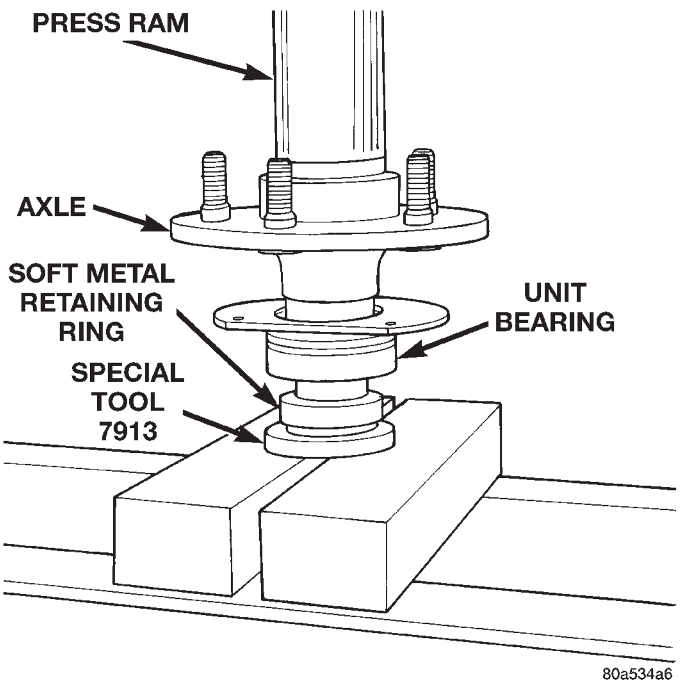


Fig. 30 Press Bearing Retaining Ring On Axle

(9) Install axle in vehicle.

DIFFERENTIAL

REMOVAL

(1) Raise and support vehicle.

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

(3) Remove the differential housing cover and allow fluid to drain.

(4) Remove axle shafts.

(5) Note the installation reference letters stamped on the bearing caps and housing machined sealing surface (Fig. 31).

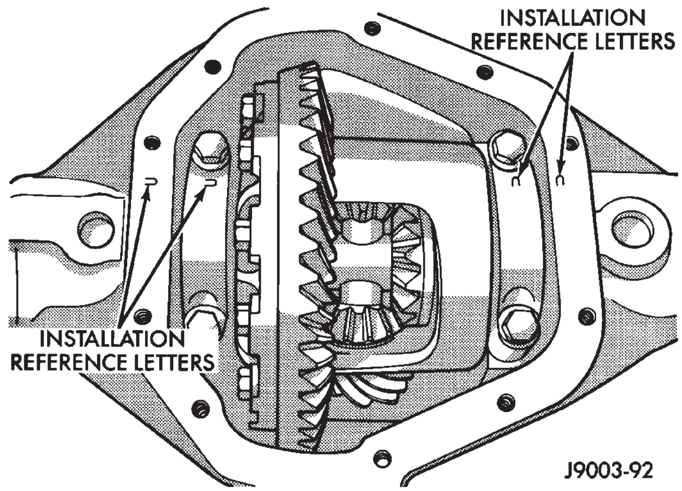


Fig. 31 Bearing Cap Identification

(6) Loosen the differential bearing cap bolts.

(7) Position Spreader W–129–B, utilizing some items from Adapter set 6987, with the tool dowel pins seated in the locating holes (Fig. 32). Install the hold-down clamps and tighten the tool turnbuckle finger–tight.

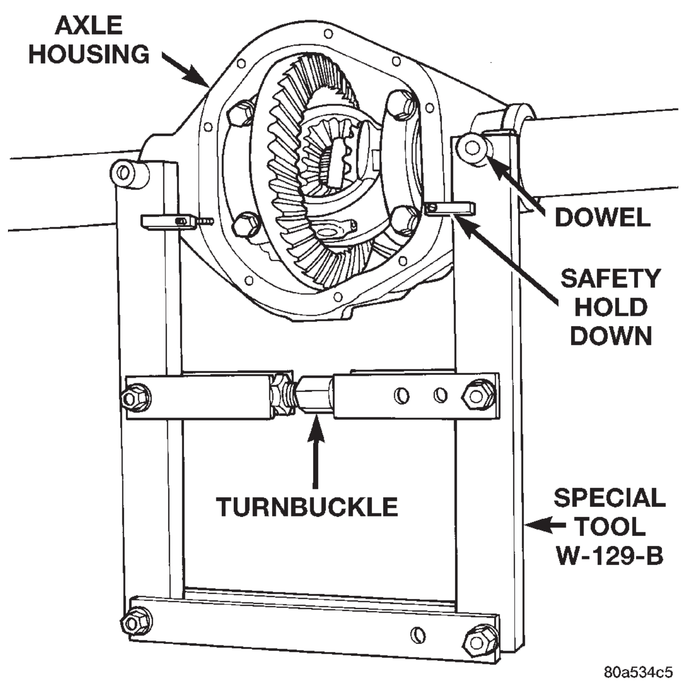


Fig. 32 Install Axle Housing Spreader

REMOVAL AND INSTALLATION (Continued)

(8) Install a Pilot Stud C-3288-B at the left side of the differential housing. Attach Dial Indicator C-3339 to pilot stud. Load the indicator plunger against the opposite side of the housing (Fig. 33) and zero the indicator.

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

(9) Spread the housing enough to remove the differential case from the housing. Measure the distance with the dial indicator (Fig. 34).

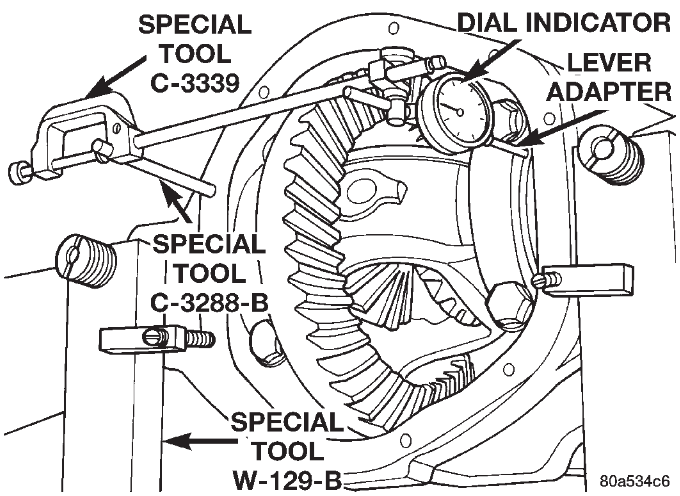


Fig. 33 Install Dial Indicator

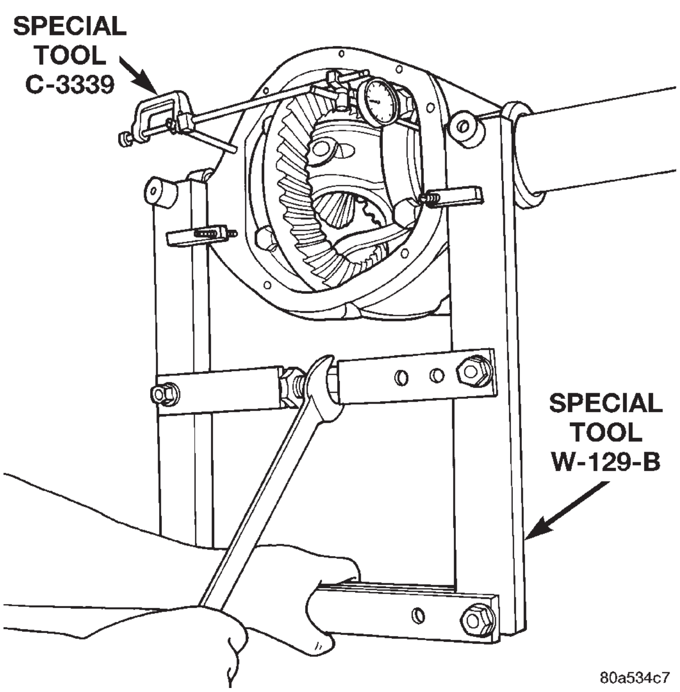


Fig. 34 Spread Axle Housing

(10) Remove the dial indicator.

(11) While holding the differential case in position, remove the differential bearing cap bolts and caps.

(12) Remove the differential from the housing. Ensure that the differential bearing cups remain in position on the differential bearings (Fig. 35).

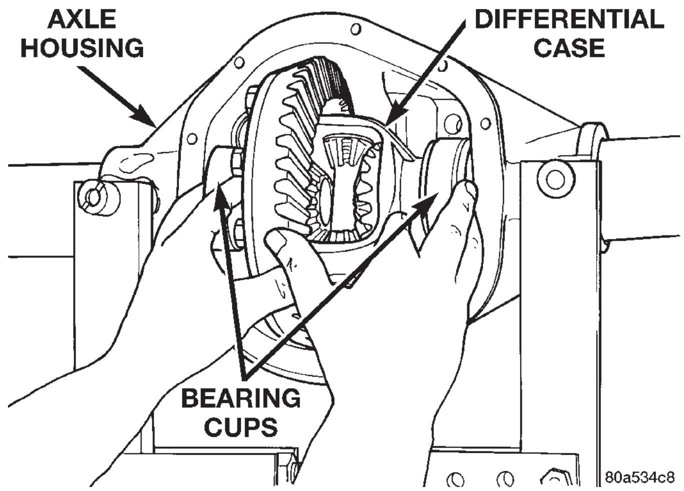


Fig. 35 Differential Case Removal

(13) Mark or tag the differential bearing cups to indicate which side of the differential they were removed from.

(14) Retrieve differential case preload shims from axle housing. Mark or tag the differential case preload shims to indicate which side of the differential they were removed from.

(15) Remove spreader from housing.

INSTALLATION

If replacement differential bearings or differential case are being installed, differential side bearing shim requirements may change. Refer to the Differential Bearing Preload and Gear Backlash procedures in this section to determine the proper shim selection.

(1) Position Spreader W–129–B, utilizing some items from Adapter set 6987, with the tool dowel pins seated in the locating holes (Fig. 36). Install the hold-down clamps and tighten the tool turnbuckle finger–tight.

(2) Install a Pilot Stud C-3288-B at the left side of the differential housing. Attach Dial Indicator C-3339 to pilot stud. Load the indicator plunger against the opposite side of the housing (Fig. 33) and zero the indicator.

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

(3) Spread the housing enough to install the case in the housing. Measure the distance with the dial indicator (Fig. 34).

(4) Remove the dial indicator.

REMOVAL AND INSTALLATION (Continued)

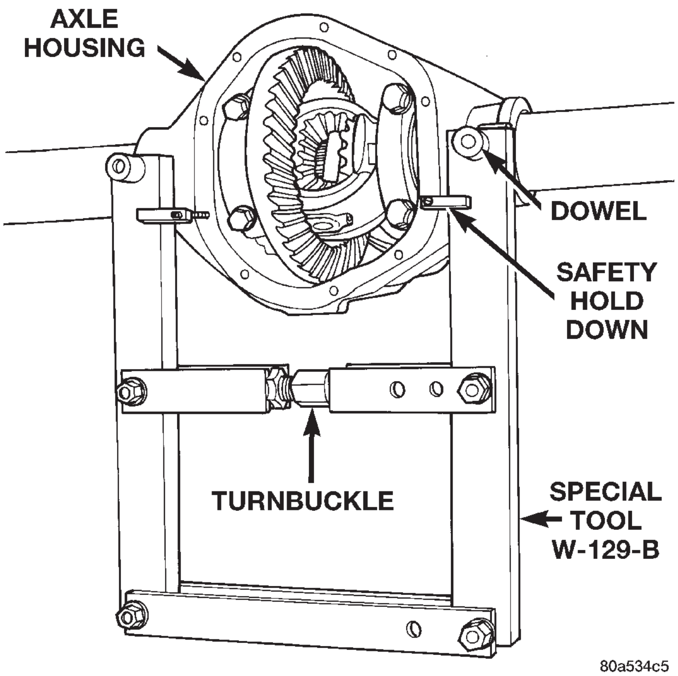


Fig. 36 Install Axle Housing Spreader

(5) Install differential case in the housing. Ensure that the differential bearing cups remain in position on the differential bearings and that the preload shims remain between the face of the bearing cup and the housing. Also verify that the pick-up opening of the Vari-lok™ plenum is at the bottom of the housing. Tap the differential case to ensure the bearings cups and shims are fully seated in the housing.

(6) Install the bearing caps at their original locations (Fig. 37).

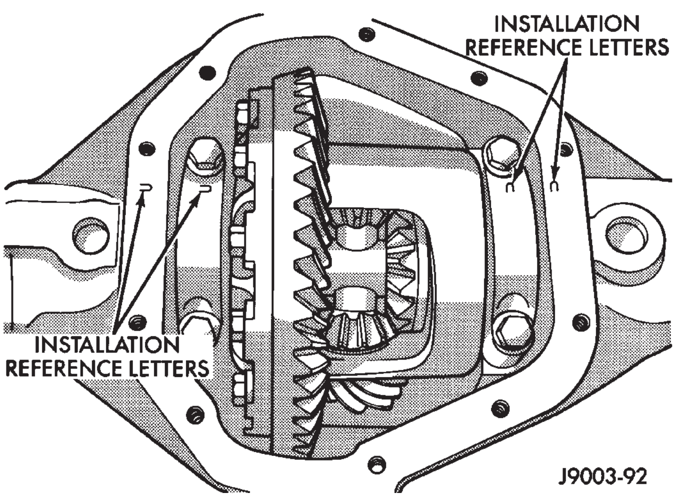


Fig. 37 Differential Bearing Cap Reference Letters

(7) Loosely install differential bearing cap bolts.

(8) Remove axle housing spreader.

(9) Tighten the bearing cap bolts to 77 N·m (57 ft. lbs.) torque.

(10) Install the axle shafts.

DIFFERENTIAL SIDE BEARINGS

REMOVAL

(1) Remove differential case from axle housing.

(2) Remove the bearings from the differential case with Puller/Press C-293-PA, Adapter Blocks 8352, and Plug SP-3289 (Fig. 38).

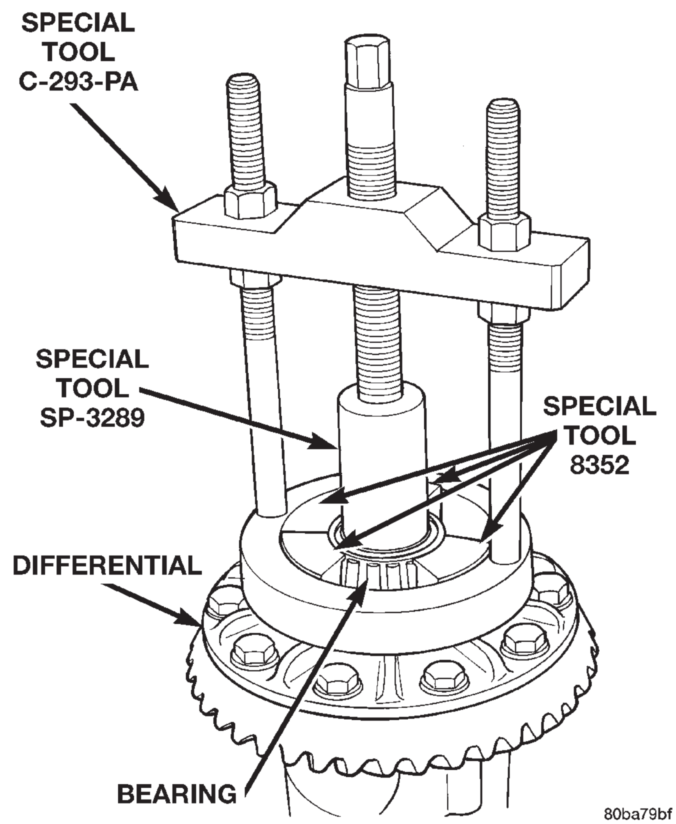


Fig. 38 Differential Bearing Removal

INSTALLATION

If replacement differential side bearings or differential case are being installed, differential side bearing shim requirements may change. Refer to the Differential Bearing Preload and Gear Backlash procedures in this section to determine the proper shim selection.

(1) Install differential side bearing shims onto differential case hubs.

CAUTION: Be sure that the Vari-lok™ plenum is fully seated against the differential case prior to installing the ring gear side differential bearing.

(2) Using Installer C-3716-A and Handle C-4171, install differential side bearings (Fig. 39).

(3) Install differential in axle housing.

REMOVAL AND INSTALLATION (Continued)

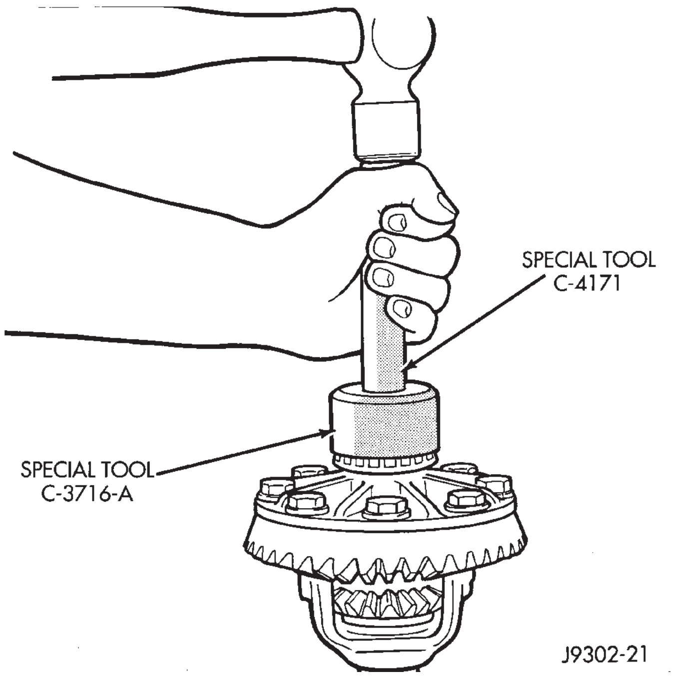


Fig. 39 Differential Side Bearing Installation

VARI-LOK™ PLENUM

REMOVAL

(1) Remove differential case from axle housing.

(2) Remove the bearing from the ring gear side of the differential case with Puller/Press C-293-PA, Adapter Blocks 8352, and Plug SP-3289 (Fig. 40).

(3) Remove the Vari-lok™ plenum from the differential case hub.

WARNING: Do not touch the Vari-lok™ tuning reed valve located under the Vari-lok™ plenum on the differential case. The metal is very sensitive and the unit will not operate properly if the reed valve is disturbed.

INSTALLATION

If a replacement differential side bearing is being installed, differential side bearing shim requirements may change. Refer to the Differential Bearing Preload and Gear Backlash procedures in this section to determine the proper shim selection.

(1) Install a new Vari-lok™ plenum onto the differential case hub. The plenum is to be installed with the rubber seal toward the differential case and the raised metal tabs away from the differential case.

CAUTION: Be sure that the Vari-lok™ plenum is fully seated against the differential case prior to installing the ring gear side differential bearing.

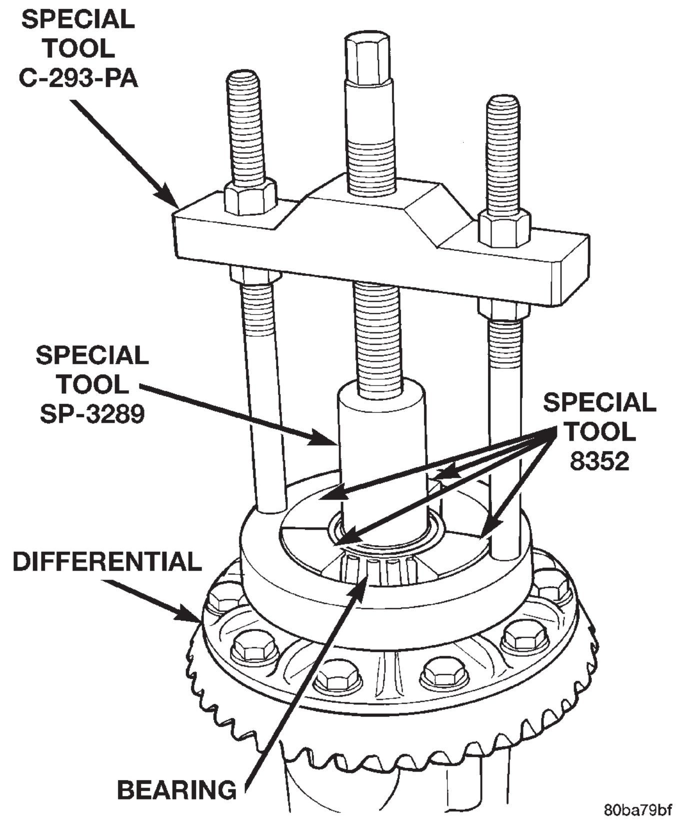


Fig. 40 Differential Bearing Removal

(2) Using Installer C-3716-A and Handle C-4171, install differential side bearing (Fig. 41).

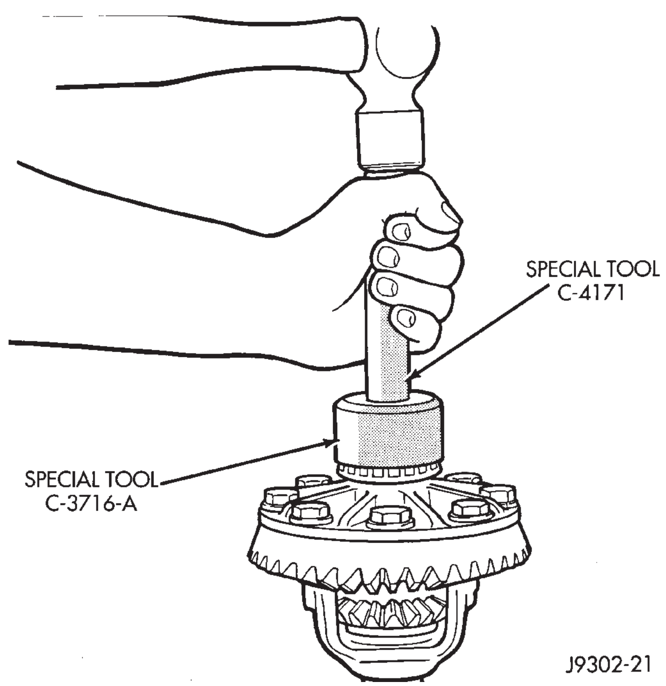


Fig. 41 Differential Side Bearing Installation

(3) Install differential in axle housing.

REMOVAL AND INSTALLATION (Continued)

RING GEAR

NOTE: The ring and pinion gears are service in a matched set. Do not replace the ring gear without replacing the pinion gear.

REMOVAL

(1) Remove differential from axle housing.

(2) Place differential case in a suitable vise with soft metal jaw protectors. (Fig. 42)

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

(4) Using a soft hammer, drive ring gear from differential case (Fig. 42).

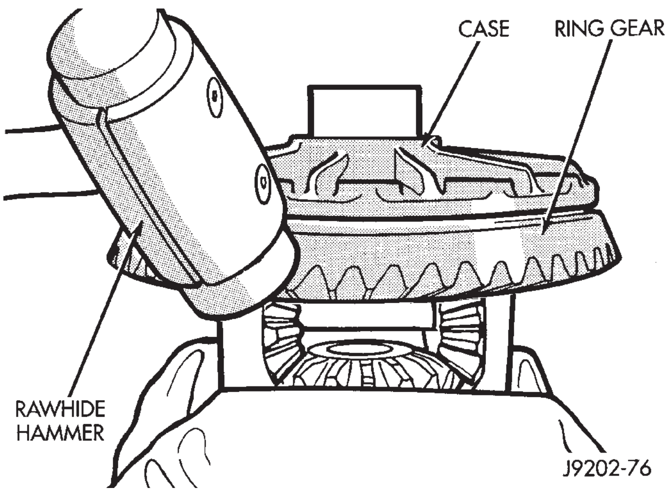


Fig. 42 Ring Gear Removal

INSTALLATION

CAUTION: Do not reuse the bolts that held the ring gear to the differential case. The bolts can fracture causing extensive damage.

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

(2) Invert the differential case in the vise.

(3) Install new ring gear bolts and alternately tighten to 129–142 N·m (95–105 ft. lbs.) torque (Fig. 43).

(4) Install differential in axle housing and verify gear mesh and contact pattern.

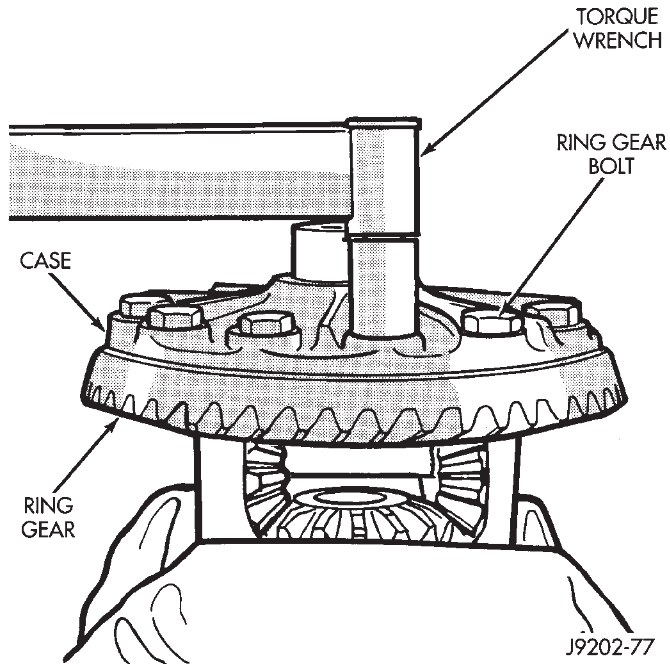


Fig. 43 Ring Gear Bolt Installation

PINION GEAR

NOTE: The ring and pinion gears are serviced in a matched set. Do not replace the pinion gear without replacing the ring gear.

REMOVAL

(1) Remove differential from the axle housing.

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

(3) Disconnect propeller shaft from pinion yoke. Using suitable wire, tie propeller shaft to underbody.

(4) Using Holder 6958 to hold yoke and a short length of 1 in. pipe, remove the pinion yoke nut and washer (Fig. 44).

(5) Using Remover C–452 and Wrench C–3281, remove the pinion yoke from pinion shaft (Fig. 45).

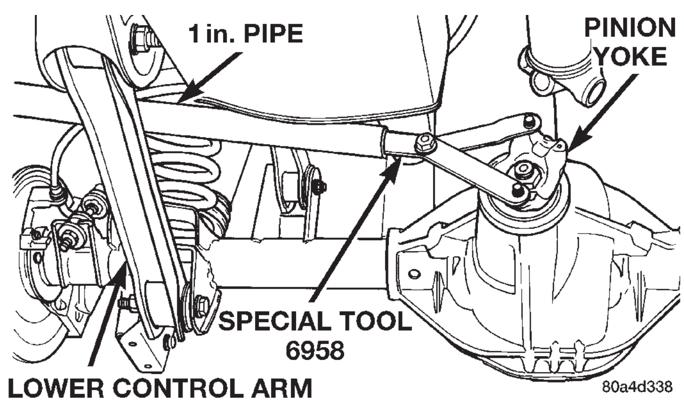


Fig. 44 Pinion Yoke Holder

(6) Remove the pinion gear from housing (Fig. 46). Catch the pinion with your hand to prevent it from falling and being damaged.

(7) Use Remover 7794-A and slide hammer to remove the pinion shaft seal (Fig. 47).

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

REMOVAL AND INSTALLATION (Continued)

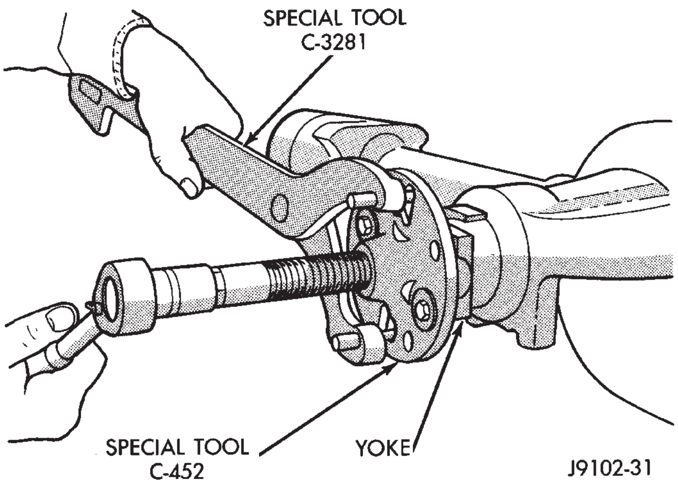


Fig. 45 Pinion Yoke Removal

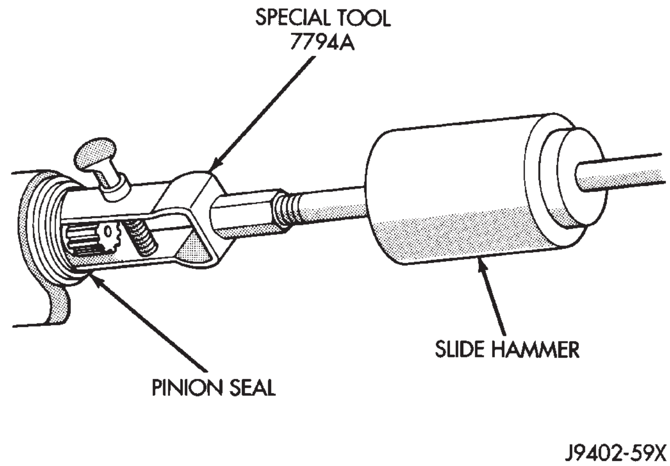


Fig. 47 Seal Removal

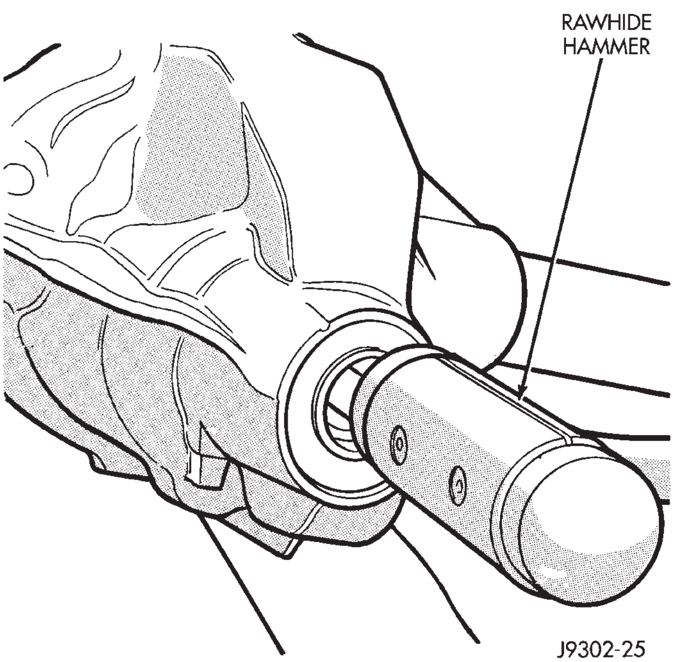


Fig. 46 Remove Pinion Gear

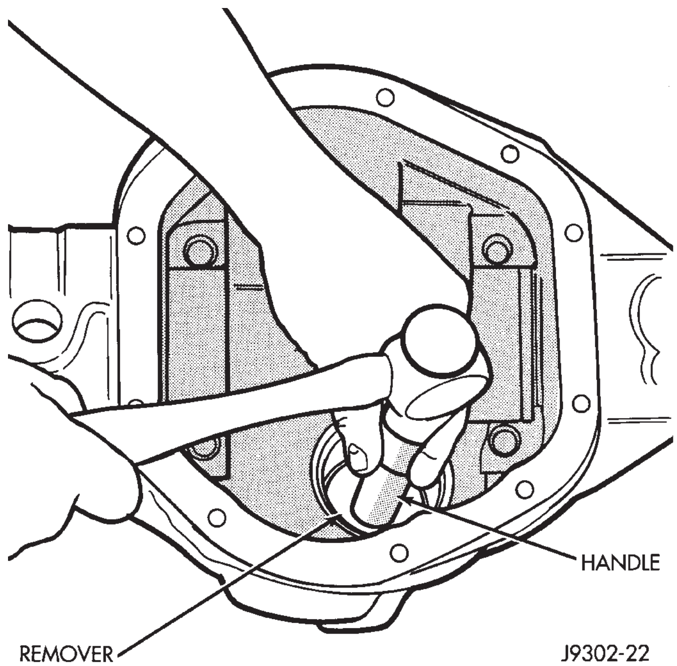


Fig. 48 Front Bearing Cup Removal

(9) Remove the front pinion bearing cup with Remover C-4345 and Handle C–4171 (Fig. 48).

(10) Remove the rear bearing cup from housing (Fig. 49). Use Remover D-149 and Handle C–4171.

(11) Remove the collapsible preload spacer (Fig. 50).

(12) Remove the rear bearing from the pinion with Puller/Press C-293-PA and Adapters C-293-40 (Fig. 51).

Place 4 adapter blocks so they do not damage the bearing cage.

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

INSTALLATION

(1) Apply Mopar® Door Ease, or equivalent, stick lubricant to outside surface of bearing cup.

(2) Install the pinion rear bearing cup with Installer D-146 and Driver Handle C–4171 (Fig. 52). Ensure cup is correctly seated.

(3) Apply Mopar® Door Ease, or equivalent, stick lubricant to outside surface of bearing cup.

(4) Install the pinion front bearing cup with Installer D–130 and Handle C–4171 (Fig. 53).

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

(6) Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with Installer C-3972-A and Handle C–4171 (Fig. 54).

REMOVAL AND INSTALLATION (Continued)

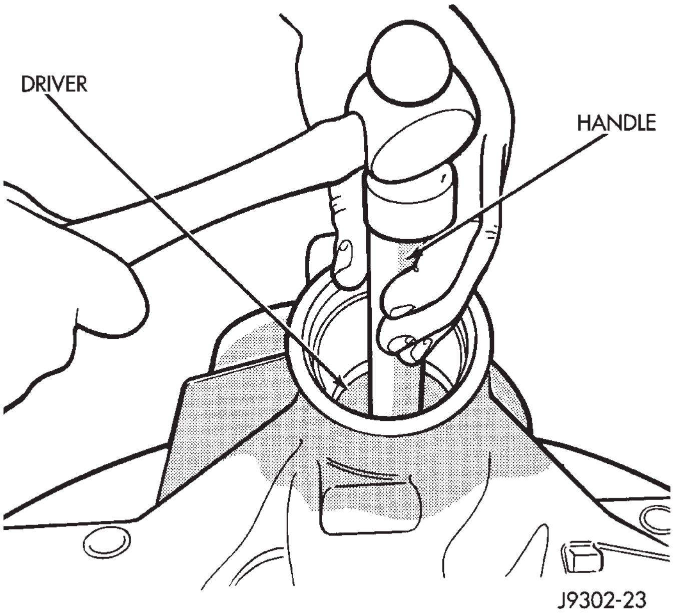


Fig. 49 Rear Bearing Cup Removal

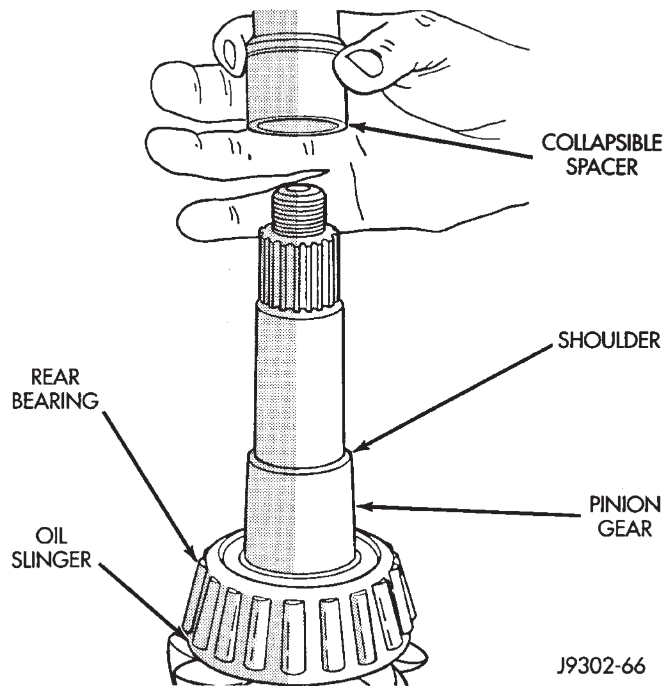


Fig. 50 Collapsible Spacer

NOTE: Pinion depth shims are placed between the rear pinion bearing cone and pinion gear to achieve proper ring and pinion gear mesh. If the factory installed ring and pinion gears are reused, the pinion depth shim should not require replacement. If required, refer to Pinion Gear Depth to select the proper thickness shim before installing rear pinion bearing.

(7) Place the proper thickness depth shim on the pinion gear.

(8) Install the rear bearing and slinger, if equipped, on the pinion gear with Installer W-262 (Fig. 55).

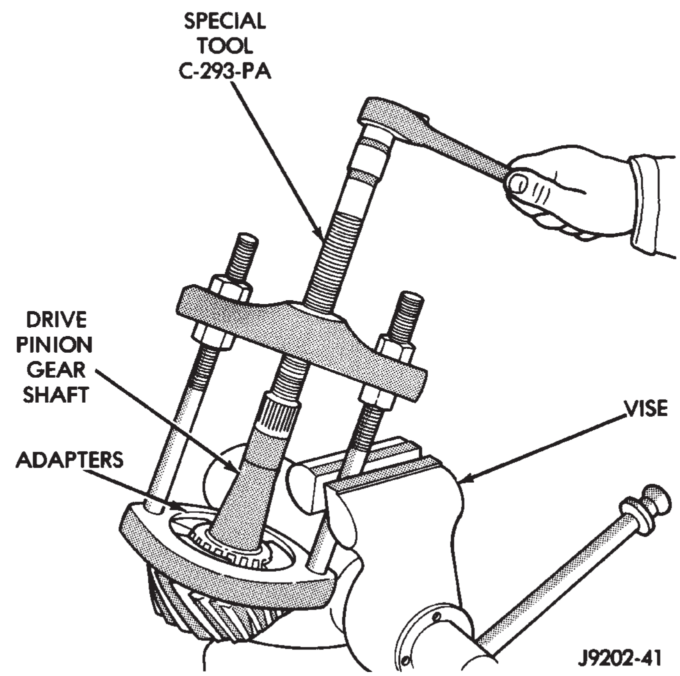


Fig. 51 Rear Bearing Removal

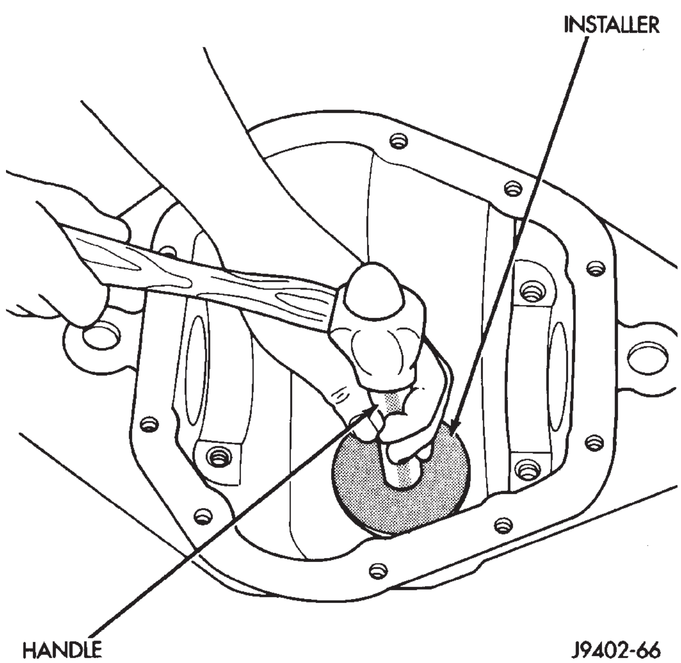


Fig. 52 Pinion Rear Bearing Cup Installation

(9) Install a new collapsible preload spacer on pinion shaft and install pinion gear in housing (Fig. 56).

(10) Install pinion gear in housing.

(11) Install yoke with Installer Screw 8112, Cup 8109, and holder 6958 (Fig. 57).

(12) Install the yoke washer and a new nut on the pinion gear and tighten the pinion nut until there is zero bearing end-play.

(13) Tighten the nut to 271 N·m (200 ft. lbs.).

REMOVAL AND INSTALLATION (Continued)

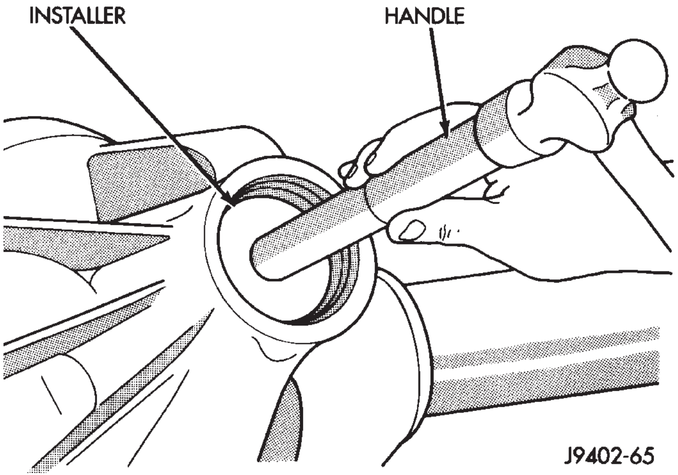


Fig. 53 Pinion Front Bearing Cup Installation

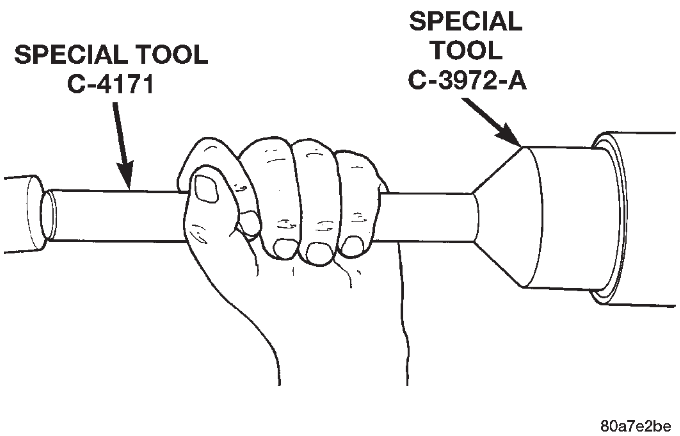


Fig. 54 Pinion Seal Installation

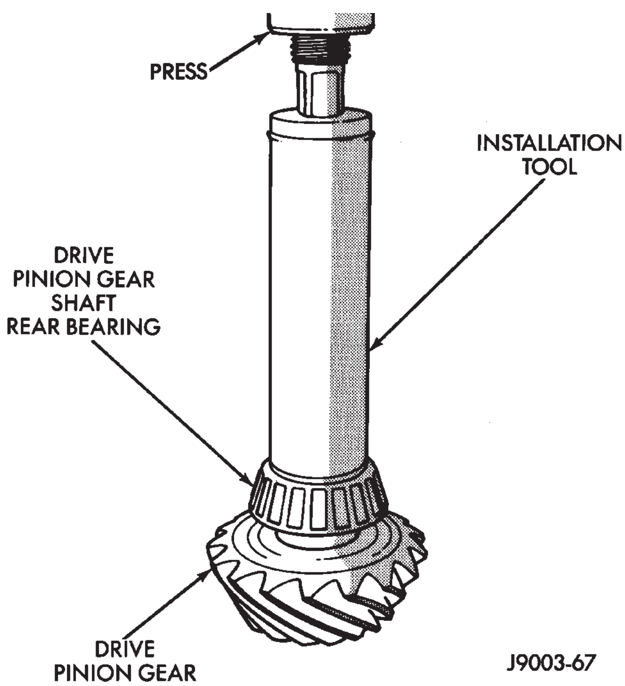


Fig. 55 Shaft Rear Bearing Installation

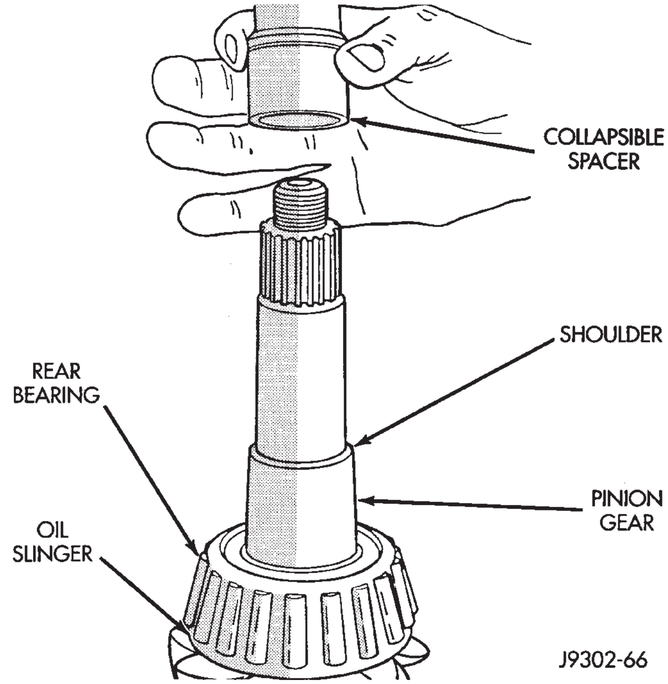


Fig. 56 Collapsible Preload Spacer

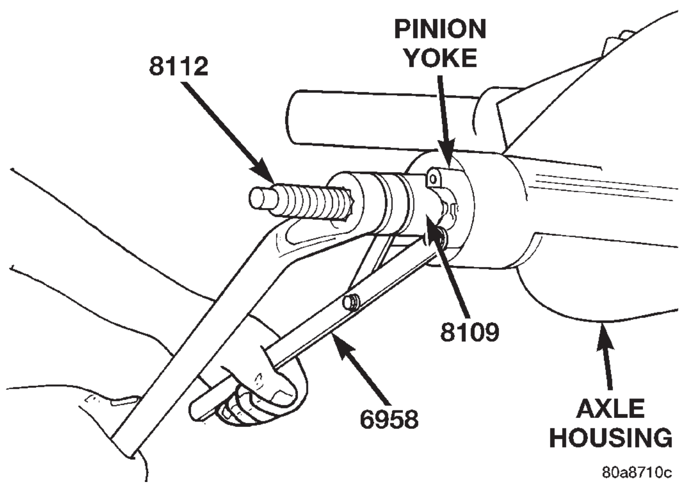


Fig. 57 Pinion Yoke Installation

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

(14) Using yoke holder 6958, a short length of 1 in. pipe, and a torque wrench set at 474 N·m (350 ft. lbs.), crush collapsible spacer until bearing end play is taken up (Fig. 58).

NOTE: If the spacer requires more than 474 N·m (350 ft. lbs.) torque to crush, the collapsible spacer is defective and must be replaced.

REMOVAL AND INSTALLATION (Continued)

(15) Slowly tighten the nut in 6.8 N·m (5 ft. lbs.) increments until the required rotating torque is achieved. Measure the rotating torque frequently to avoid over crushing the collapsible spacer (Fig. 59).

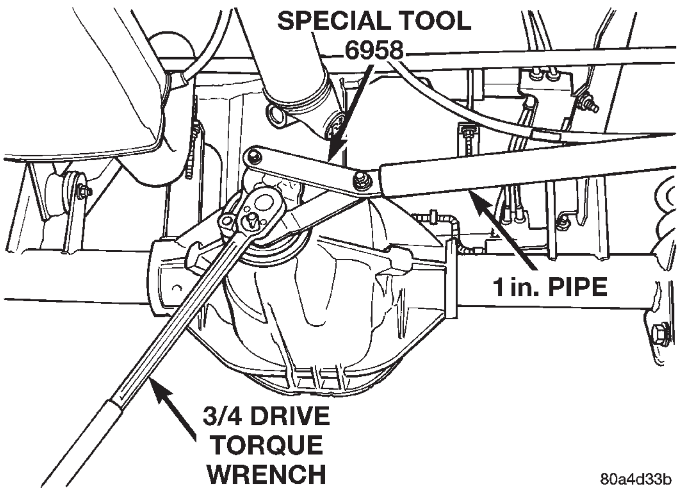


Fig. 58 Tightening Pinion Nut

(16) Rotate the pinion a minimum of ten times. Verify that the pinon rotates smoothly. Check bearing rotating torque with an inch pound torque wrench (Fig. 59). The torque necessary to rotate the pinion gear should be:

- Original Bearings — 1 to 3 N·m (10 to 20 in. lbs.).
- New Bearings — 2 to 5 N·m (15 to 35 in. lbs.).

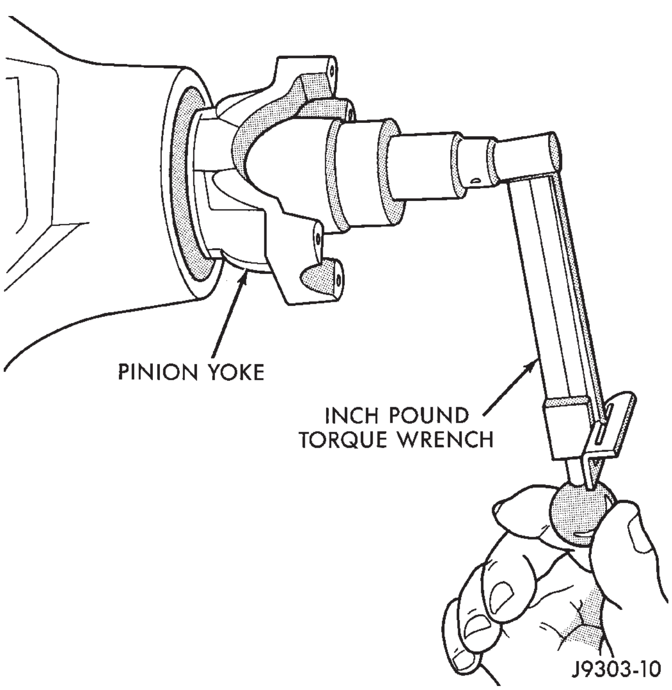


Fig. 59 Check Pinion Gear Rotating Torque

(17) Install differential in housing.

FINAL ASSEMBLY

(1) 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, or equivalent, on the housing cover (Fig. 60).

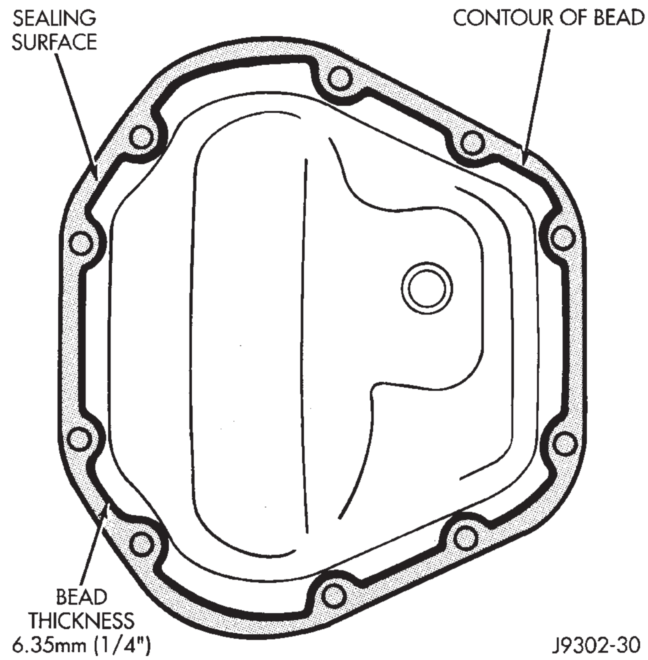


Fig. 60 Typical Housing Cover With Sealant

Install the housing cover within 5 minutes after applying the sealant.

(2) 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 lubricant foaming and overheating.

(3) Refill the differential housing with gear lubricant. Refer to the Lubricant Specifications section of this group for the gear lubricant requirements.

(4) Install the fill hole plug.

DISASSEMBLY AND ASSEMBLY

STANDARD DIFFERENTIAL

DISASSEMBLY

(1) Remove pinion gear mate shaft lock screw (Fig. 61).

(2) Remove pinion gear mate shaft.

(3) Rotate the differential side gears and remove the pinion mate gears and thrust washers (Fig. 62).

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

ASSEMBLY

(1) Install the differential side gears and thrust washers.

DISASSEMBLY AND ASSEMBLY (Continued)

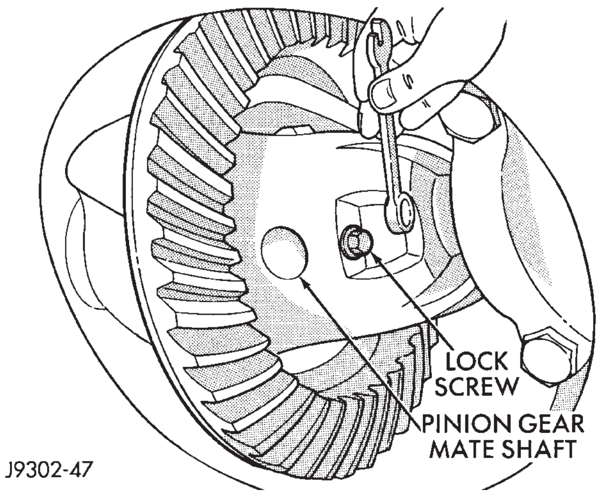


Fig. 61 Pinion Gear Mate Shaft Lock Screw

(2) Install the pinion mate gears and thrust washers.

(3) Install the pinion gear mate shaft.

(4) Align the hole in the pinion gear mate shaft with the hole in the differential case and install the pinion gear mate shaft lock screw.

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

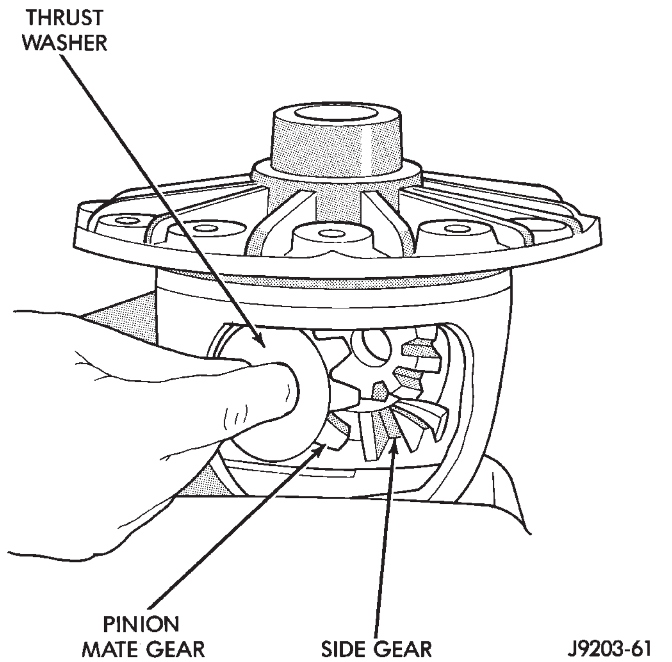


Fig. 62 Pinion Mate Gear Removal

TRAC-LOK™ DIFFERENTIAL

The Trac–lok™ differential components are illustrated in (Fig. 63). Refer to this illustration during repair service.

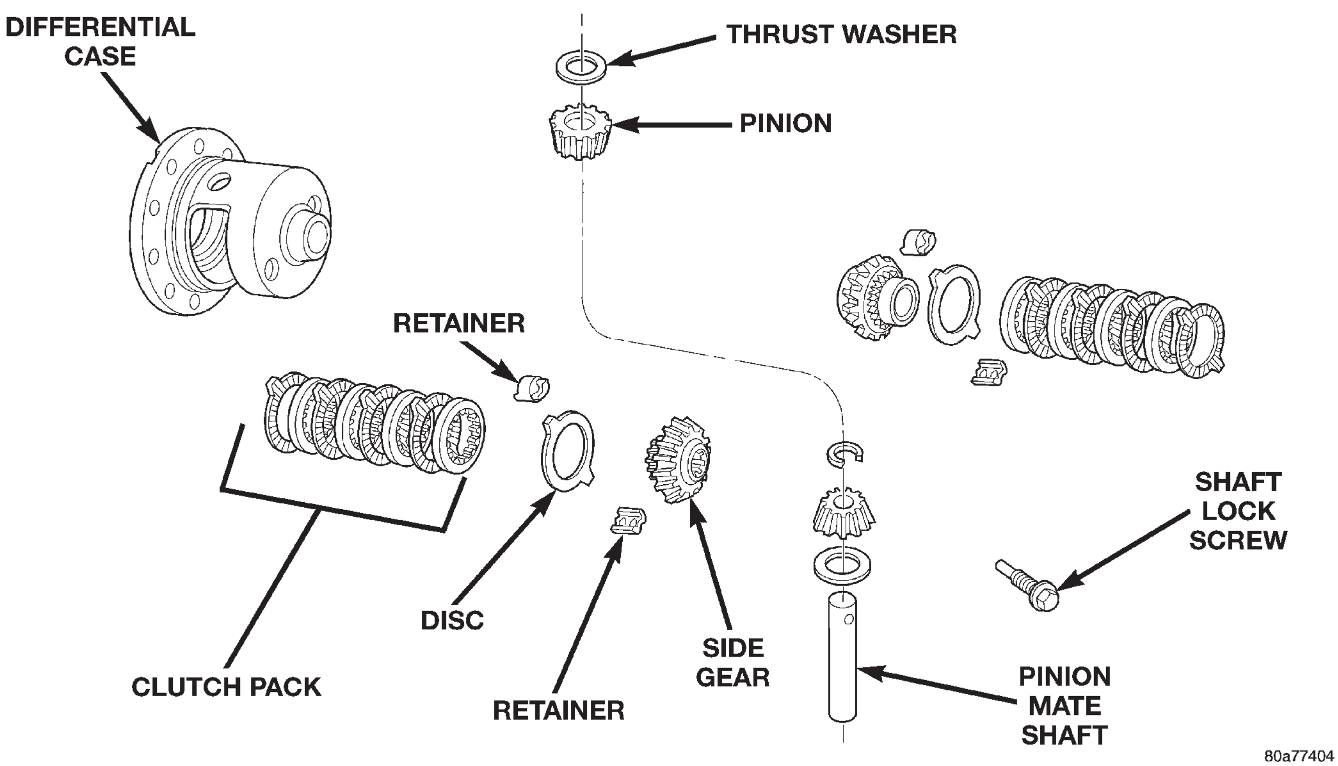


Fig. 63 Trac–lok™ Differential Components

DISASSEMBLY AND ASSEMBLY (Continued)

DISASSEMBLY

(1) Clamp Side Gear Holding Tool 6965 in a vise.

(2) Position the differential case on Side Gear Holding Tool 6965 (Fig. 64).

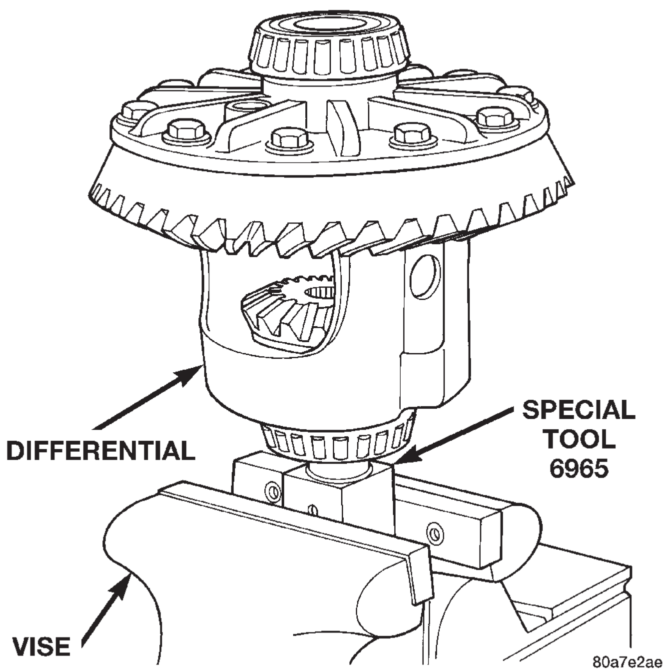


Fig. 64 Differential Case Holding Tool

(3) Remove ring gear, if necessary. Ring gear removal is necessary only if the ring gear is to be replaced. The Trac-lok™ differential can be serviced with the ring gear installed.

(4) Remove the pinion gear mate shaft lock screw (Fig. 65).

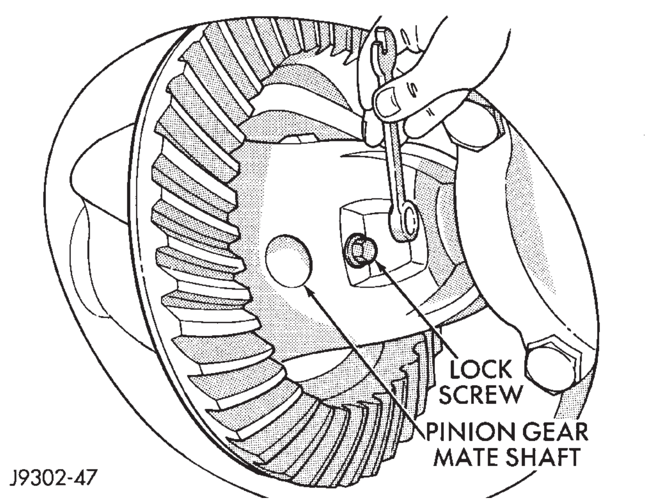


Fig. 65 Mate Shaft Lock Screw

(5) Remove the pinion gear mate shaft. If necessary, use a drift and hammer (Fig. 66).

(6) Install and lubricate Step Plate C-6960-3 (Fig. 67).

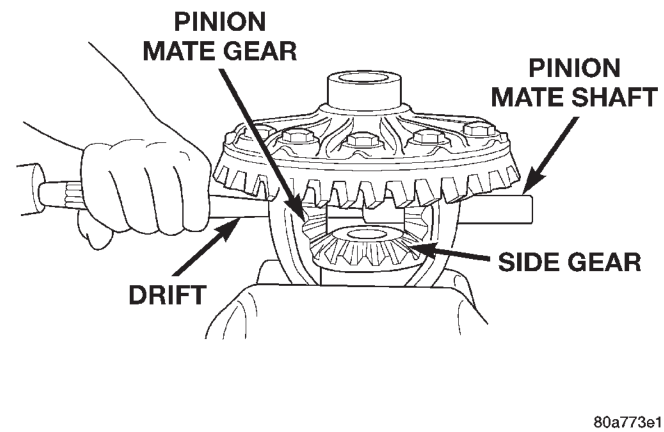


Fig. 66 Mate Shaft Removal

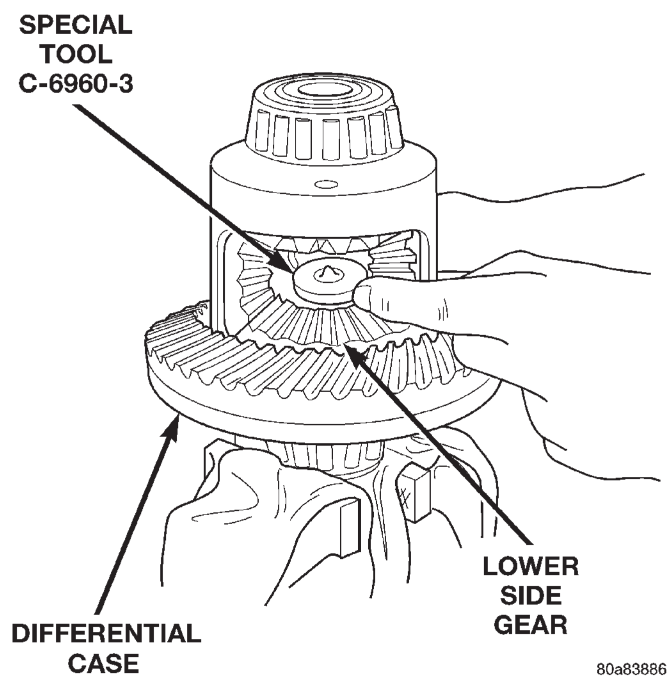


Fig. 67 Step Plate Tool Installation

(7) Assemble Threaded Adapter C-6960-1 into top side gear. Thread Forcing Screw C-6960-4 into adapter until it becomes centered in adapter plate.

(8) Position a small screw driver in slot of Threaded Adapter C-6960-1 (Fig. 68) to prevent adapter from turning.

(9) Tighten forcing screw tool 122 N·m (90 ft. lbs.) maximum to compress Belleville springs in clutch packs (Fig. 69).

(10) Using an appropriate size feeler gauge, remove thrust washers from behind the pinion gears (Fig. 70).

(11) Insert Turning Bar C-6960-2 in case (Fig. 71).

(12) Loosen the Forcing Screw C-6960-4 in small increments until the clutch pack tension is relieved

DISASSEMBLY AND ASSEMBLY (Continued)

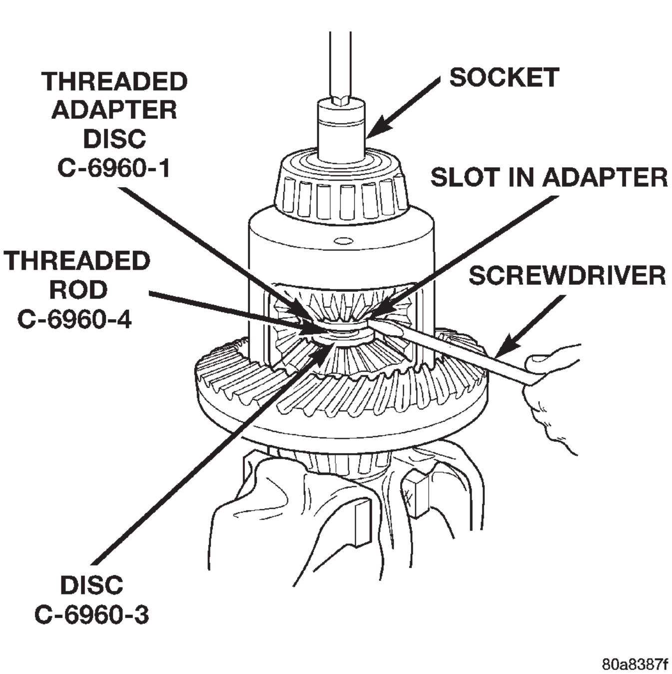


Fig. 68 Threaded Adapter Installation

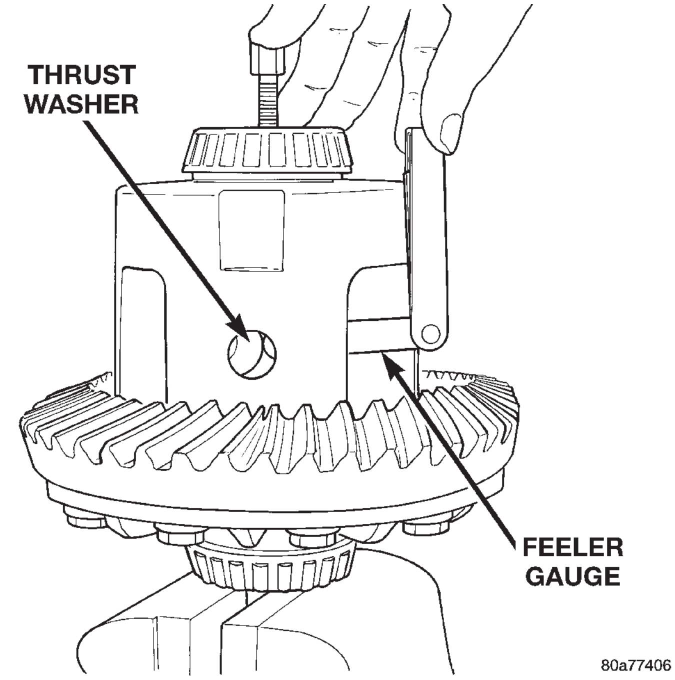


Fig. 70 Remove Pinion Gear Thrust Washer

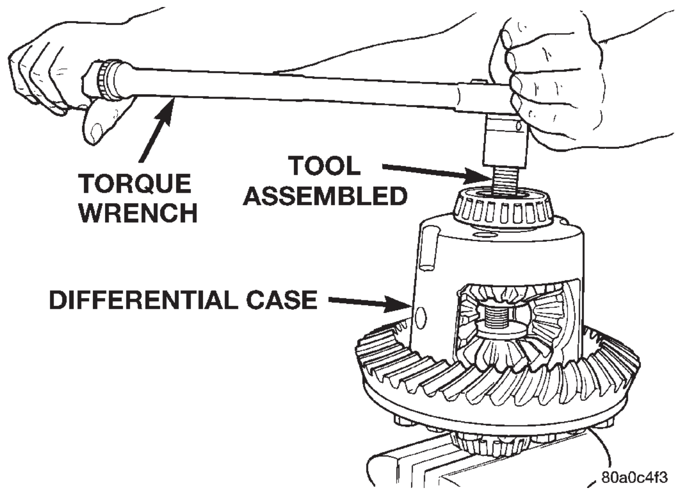


Fig. 69 Tighten Belleville Spring Compressor Tool

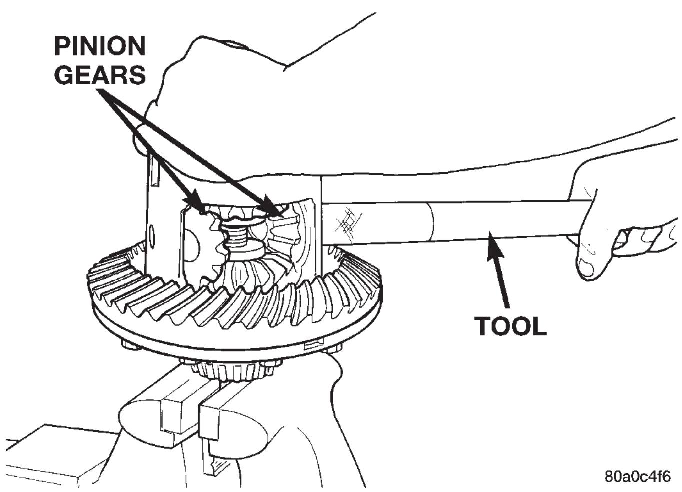


Fig. 71 Pinion Gear Removal

and the differential case can be turned using Turning Bar C-6960-2.

(13) Rotate differential case until the pinion gears can be removed.

(14) Remove pinion gears from differential case.

(15) Remove Forcing Screw C-6960-4, Step Plate C-6960-3, and Threaded Adapter C-6960-1.

(16) Remove top side gear, clutch pack retainer, and clutch pack. Keep plates in correct order during removal (Fig. 72).

(17) Remove differential case from Side Gear Holding Tool 6965. Remove side gear, clutch pack retainer, and clutch pack. Keep plates in correct order during removal.

ASSEMBLY

NOTE: 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 and secure disc packs with retaining clips (Fig. 73).

(2) Position assembled clutch disc packs on the side gear hubs.

(3) Install clutch pack and side gear in the ring gear side of the differential case (Fig. 74). **Be sure clutch pack retaining clips remain in position and are seated in the case pockets.**

DISASSEMBLY AND ASSEMBLY (Continued)

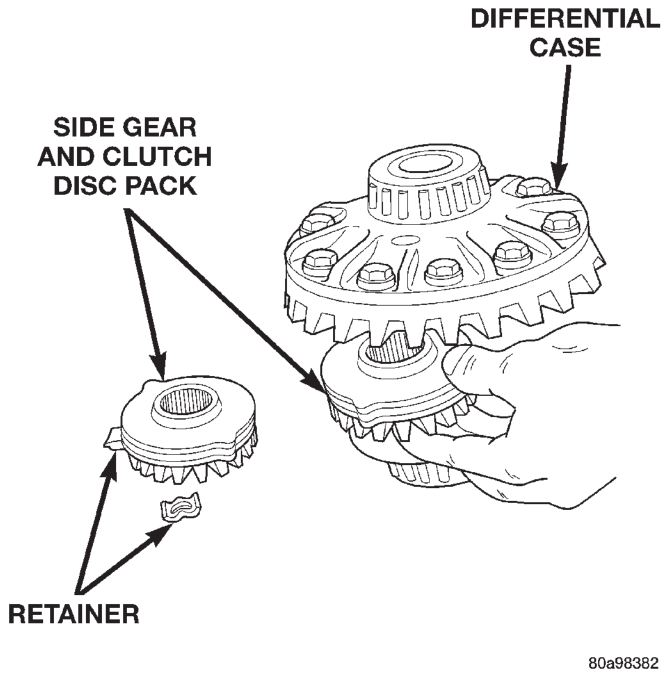


Fig. 72 Side Gear & Clutch Disc Removal

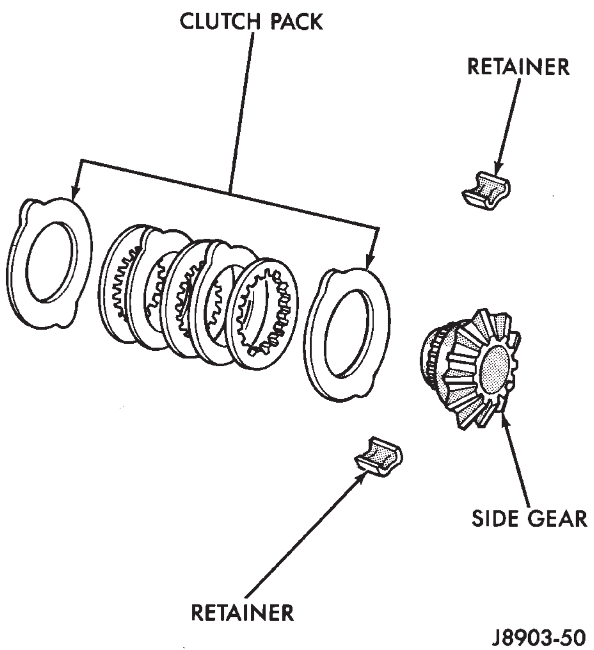


Fig. 73 Clutch Disc Pack

(4) Position the differential case on Side Gear Holding Tool 6965.

(5) Install lubricated Step Plate C-6960-3 in lower side gear (Fig. 75).

(6) Install the upper side gear and clutch disc pack (Fig. 75).

(7) Hold assembly in position. Insert Threaded Adapter C-6960-1 into top side gear.

(8) Insert Forcing Screw C-6960-4.

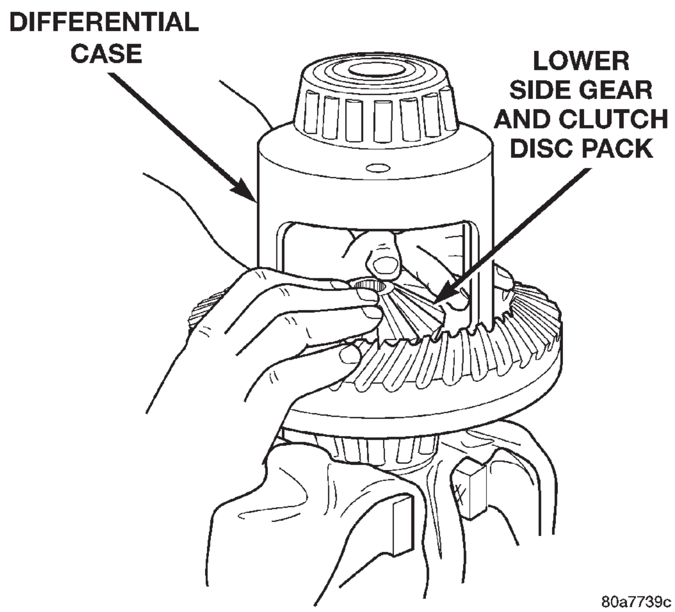


Fig. 74 Clutch Discs & Lower Side Gear Installation

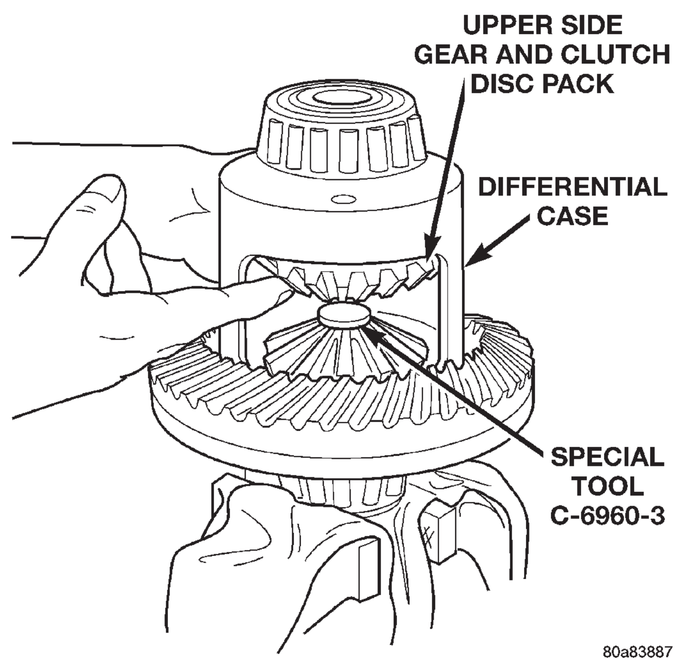


Fig. 75 Upper Side Gear & Clutch Disc Pack Installation

(9) Tighten forcing screw tool to slightly compress clutch discs.

(10) Place pinion gears in position in side gears and verify that the pinion mate shaft hole is aligned.

(11) Rotate case with Turning Bar C-6960-2 until the pinion mate shaft holes in pinion gears align with holes in case. It may be necessary to slightly tighten the forcing screw in order to install the pinion gears.

DISASSEMBLY AND ASSEMBLY (Continued)

(12) Tighten forcing screw to 122 N·m (90 ft. lbs.) maximum to compress the Belleville springs.

(13) Lubricate and install thrust washers behind pinion gears and align washers with a small screw driver. Insert mate shaft into each pinion gear to verify alignment.

(14) Remove Forcing Screw C-6960-4, Step Plate C-6960-3, and Threaded Adapter C-6960-1.

(15) Install pinion gear mate shaft and align holes in shaft and case.

(16) Install the pinion mate shaft lock screw finger tight to hold shaft during differential 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.

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

CLEANING AND INSPECTION

AXLE COMPONENTS

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, or dry with compressed air. DO NOT spin bearings with compressed air. **Cup and bearing must be replaced as matched sets only.**

Clean axle shaft tubes and oil channels in housing. Inspect 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.

TRAC-LOK™

Clean all components in cleaning solvent. Dry components with compressed air. Inspect clutch pack plates for wear, scoring or damage. Replace both clutch packs if any one component in either pack is damaged. Inspect side and pinion gears. Replace any gear that is worn, cracked, chipped or damaged. Inspect differential case and pinion shaft. Replace if worn or damaged.

PRESOAK PLATES AND DISC

Plates and discs with fiber coating (no grooves or lines) must be presoaked in Friction Modifier before assembly. Soak plates and discs for a minimum of 20 minutes.

ADJUSTMENTS

PINION GEAR DEPTH

GENERAL 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. 76). 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 center line of the ring gear to the back face of the pinion is 96.850 mm (3.813 in.). The standard depth provides the best teeth contact pattern. Refer to Backlash and Contact Pattern Analysis Paragraph in this section for additional information.

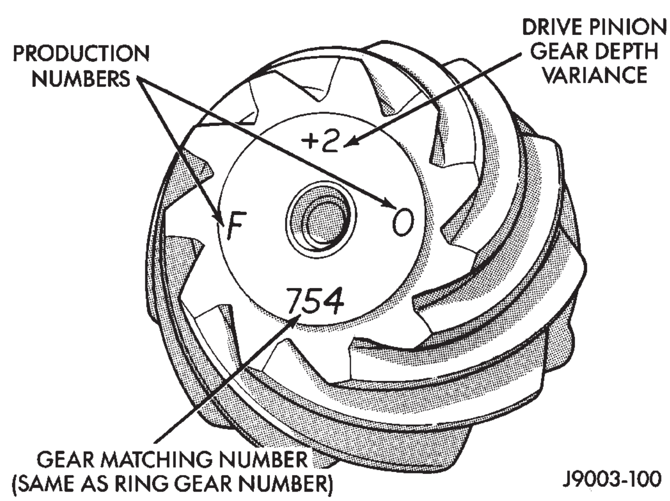


Fig. 76 Pinion Gear ID Numbers

Compensation for pinion depth variance is achieved with select shims. The shims are placed under the inner pinion bearing cone (Fig. 77).

If a new gear set is being installed, note the depth variance etched into both the original and replacement pinion gear. Add or subtract the thickness of the original depth shims to compensate for the differ-

ADJUSTMENTS (Continued)

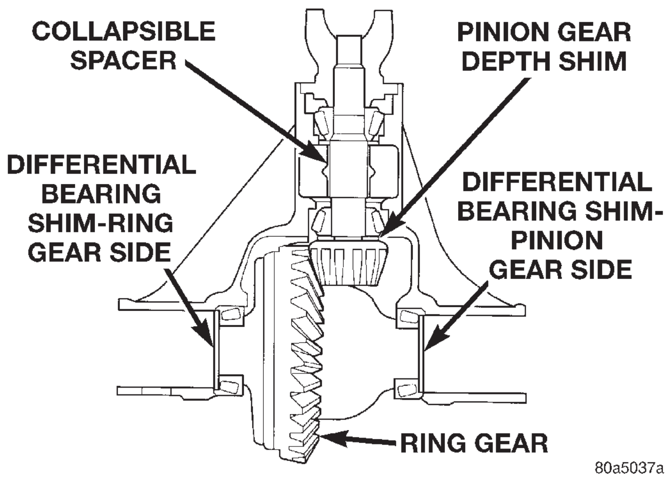


Fig. 77 Shim Locations

ence in the depth variances. Refer to the Depth Variance charts.

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

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

PINION DEPTH MEASUREMENT AND ADJUSTMENT

Measurements are taken with pinion cups and pinion bearings installed in housing. Take measurements with a Pinion Gauge Set, Pinion Block 6735, Arbor Discs 6732, and Dial Indicator C-3339 (Fig. 78).

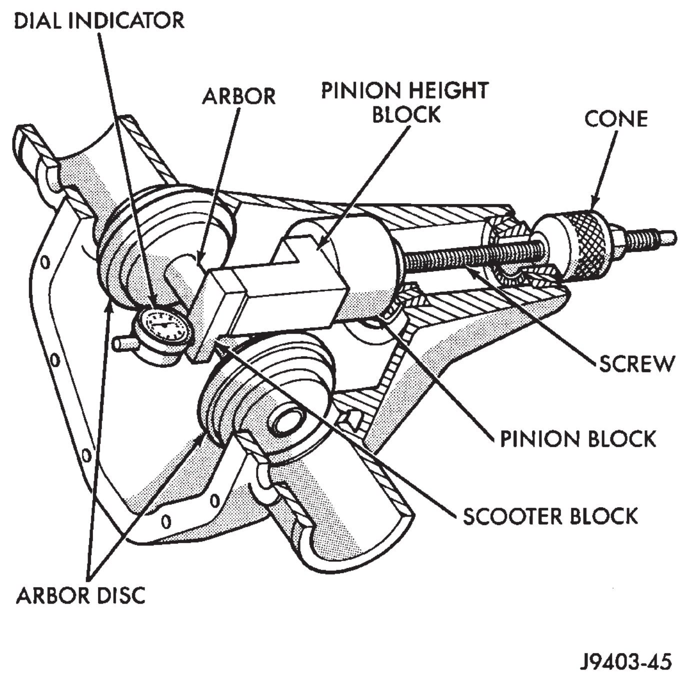


Fig. 78 Pinion Gear Depth Gauge Tools—Typical

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

J8902-46

ADJUSTMENTS (Continued)

(1) Assemble Pinion Height Block 6739, Pinion Block 6735, and rear pinion bearing onto Screw 6741 (Fig. 78).

(2) Insert assembled height gauge components, rear bearing and screw into axle housing through pinion bearing cups (Fig. 79).

(3) Install front pinion bearing and Cone 6740 hand tight (Fig. 78).

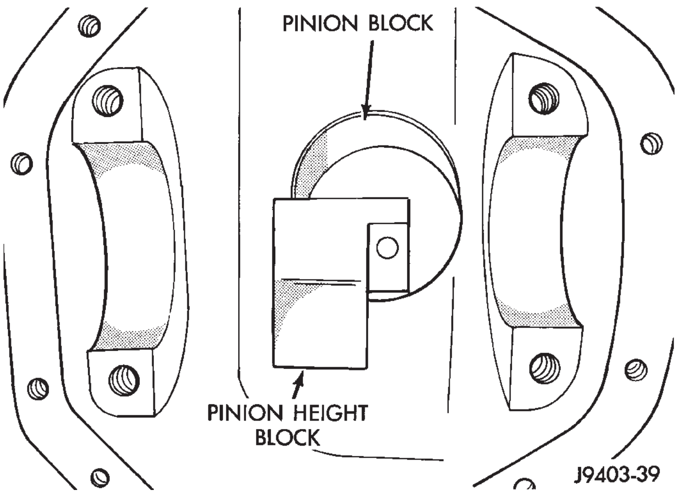


Fig. 79 Pinion Height Block—Typical

(4) Place Arbor Disc 6732 on Arbor D-115-3 in position in axle housing side bearing cradles (Fig. 80). Install differential bearing caps on Arbor Discs and tighten cap bolts. Refer to the Torque Specifications in this section.

NOTE: Arbor Discs 6732 have different step diameters to fit other axle sizes. Pick correct size step for axle being serviced.

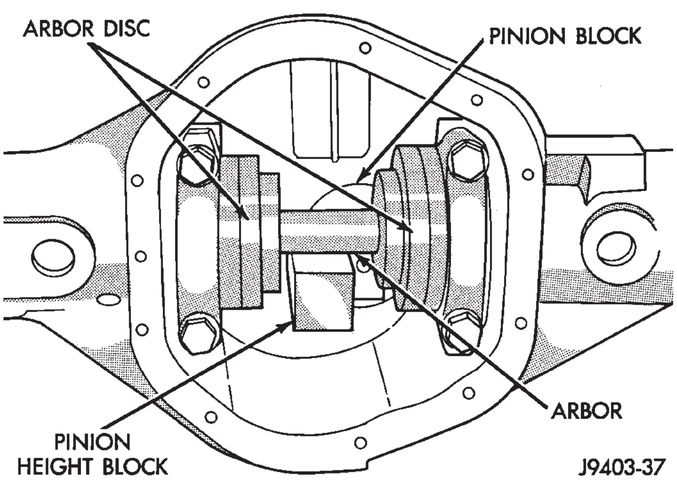


Fig. 80 Gauge Tools In Housing—Typical

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

(6) Place Scooter Block/Dial Indicator in position in axle housing so dial probe and scooter block are flush against the surface of the pinion height block. Hold scooter block in place and zero the dial indicator face to the pointer. Tighten dial indicator face lock screw.

(7) With scooter block still in position against the pinion height block, slowly slide the dial indicator probe over the edge of the pinion height block. Observe how many revolutions counterclockwise the dial pointer travels (approximately 0.125 in.) to the out-stop of the dial indicator.

(8) Slide the dial indicator probe across the gap between the pinion height block and the arbor bar with the scooter block against the pinion height block (Fig. 81). When the dial probe contacts the arbor bar, the dial pointer will turn clockwise. Bring dial pointer back to zero against the arbor bar, do not turn dial face. Continue moving the dial probe to the crest of the arbor bar and record the highest reading. If the dial indicator can not achieve the zero reading, the rear bearing cup or the pinion depth gauge set is not installed correctly.

(9) Select a shim equal to the dial indicator reading plus the drive pinion gear depth variance number etched in the face of the pinion gear (Fig. 76) using the opposite sign on the variance number. For example, if the depth variance is –2, add +0.002 in. to the dial indicator reading.

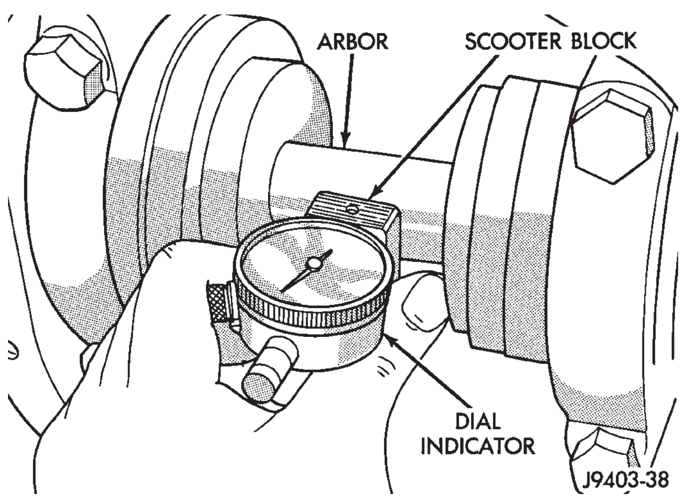


Fig. 81 Pinion Gear Depth Measurement—Typical

(10) Remove the pinion depth gauge components from the axle housing

DIFFERENTIAL BEARING PRELOAD AND GEAR BACKLASH

Differential side bearing preload and gear backlash is achieved by selective shims inserted between the bearing cup and the axle housing. The proper shim thickness can be determined using slip-fit dummy bearings D-348 in place of the differential side bearings and a dial indicator C-3339. Before proceeding with the differential bearing preload and gear backlash measure-

ADJUSTMENTS (Continued)

ments, measure the pinion gear depth and prepare the pinion gear for installation. Establishing proper pinion gear depth is essential to establishing gear backlash and tooth contact patterns. After the overall shim thickness to take up differential side play is measured, the pinion gear is installed, and the gear backlash shim thickness is measured. The overall shim thickness is the total of the dial indicator reading, starting point shim thickness, and the preload specification added together. The gear backlash measurement determines the thickness of the shim used on the ring gear side of the differential case. Subtract the gear backlash shim thickness from the total overall shim thickness and select that amount for the pinion gear side of the differential (Fig. 82).

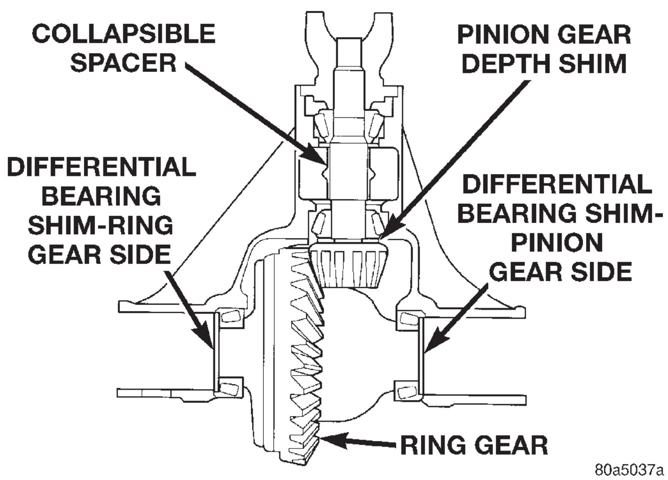


Fig. 82 Axle Adjustment Shim Locations

SHIM SELECTION

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

(1) Remove side bearings from differential case.

(2) Install ring gear, if necessary, on differential case and tighten bolts to specification.

(3) Install dummy side bearings D-348 on differential case.

(4) Install differential case in axle housing.

(5) Insert Dummy Shims 8107 (0.118 in. (3.0 mm)) starting point shims between the dummy bearing and the axle housing (Fig. 83).

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

(7) Using a dead-blow type mallet, seat the differential dummy bearings to each side of the axle housing (Fig. 84) and (Fig. 85).

(8) Thread guide stud C-3288-B into rear cover bolt hole below ring gear (Fig. 86).

(9) Attach dial indicator C-3339 to guide stud. Position the dial indicator plunger on a flat surface on a ring gear bolt head (Fig. 86).

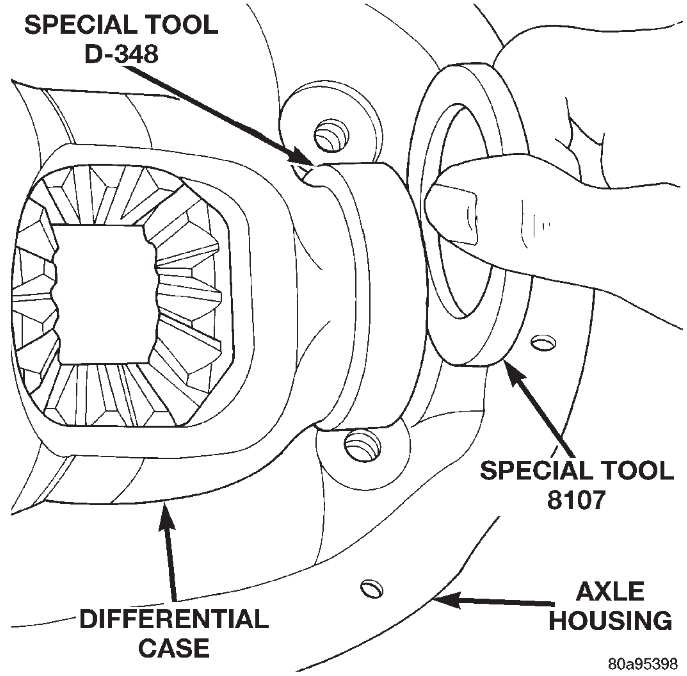


Fig. 83 Insert Starting Point Shims

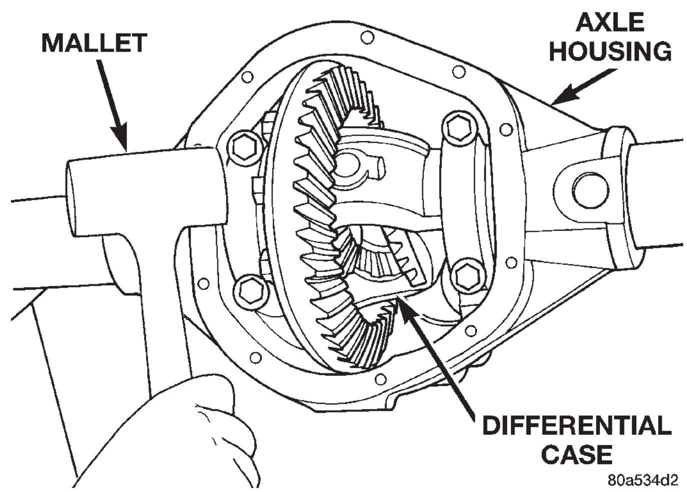


Fig. 84 Seat Pinion Gear Dummy Side Bearing

(10) Push firmly and hold differential case to pinion gear side of axle housing (Fig. 87).

(11) Zero dial indicator face to pointer.

(12) Push firmly and hold differential case to ring gear side of the axle housing (Fig. 88).

(13) Record dial indicator reading.

(14) Add the dial indicator reading to the starting point shim thickness to determine total shim thickness to achieve zero differential end play.

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

(16) Rotate dial indicator out of the way on guide stud.

ADJUSTMENTS (Continued)

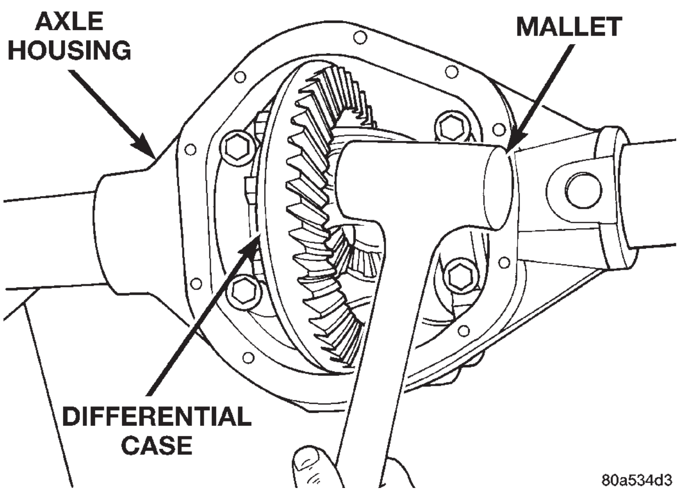


Fig. 85 Seat Ring Gear Side Dummy Bearing

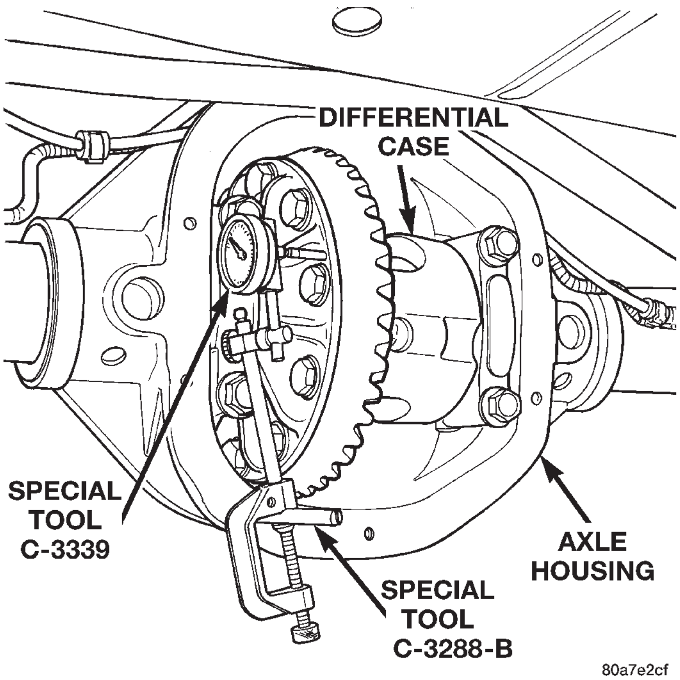


Fig. 86 Differential Side play Measurement

(17) Remove differential case, dummy bearings, and starting point shims from axle housing.

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

(19) Install differential case and dummy bearings in axle housing (without shims) and tighten retaining cap bolts.

(20) Position the dial indicator plunger on a flat surface between the ring gear bolt heads (Fig. 86).

(21) Push and hold differential case toward pinion gear.

(22) Zero dial indicator face to pointer.

(23) Push and hold differential case to ring gear side of the axle housing.

(24) Record dial indicator reading.

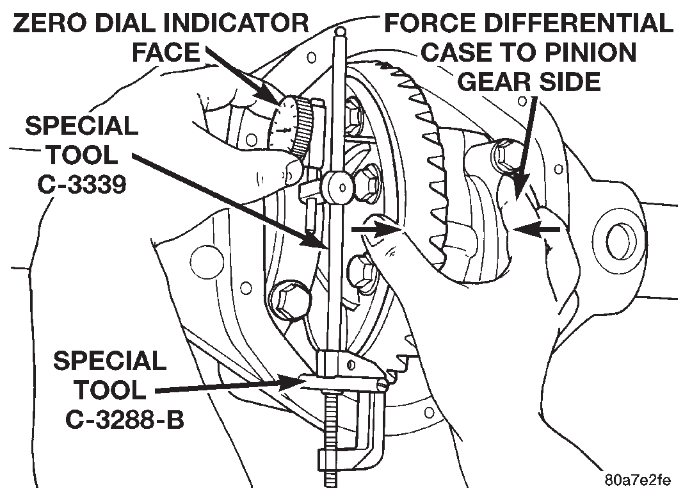


Fig. 87 Hold Differential Case and Zero Dial Indicator

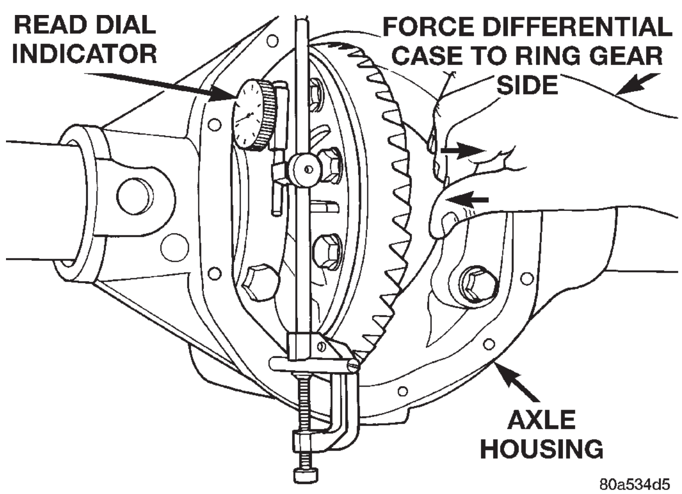


Fig. 88 Hold Differential Case and Read Dial Indicator

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

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

(27) Rotate dial indicator out of the way on guide stud.

(28) Remove differential case and dummy bearings from axle housing.

(29) Install new side bearing cones and cups on differential case.

(30) Install spreader W-129-B, utilizing some components of Adapter Set 6987, on axle housing and spread axle opening enough to receive differential case.

(31) Place side bearing shims in axle housing against axle tubes.

(32) Install differential case in axle housing.

ADJUSTMENTS (Continued)

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

(34) Position the indicator plunger against a ring gear tooth (Fig. 89).

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

(36) Zero dial indicator face to pointer.

(37) Push and hold ring gear downward while not allowing the pinion gear to rotate. Dial indicator reading should be between 0.12 mm (0.005 in.) and 0.20 mm (0.008 in.). If backlash is not within specifications transfer the necessary amount of shim thickness from one side of the differential housing to the other (Fig. 90).

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

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

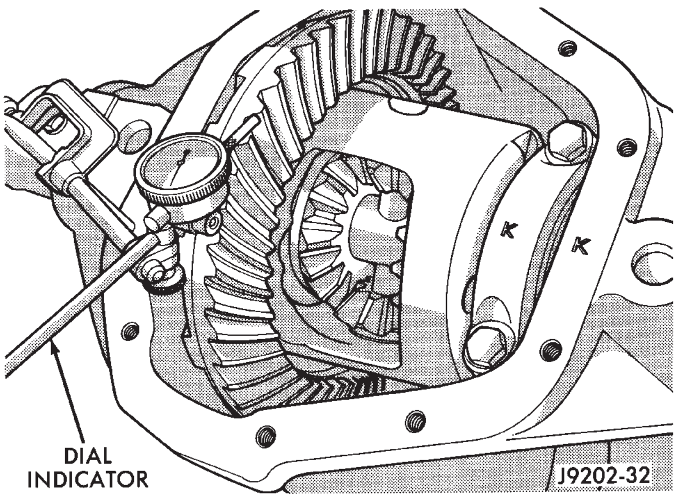


Fig. 89 Ring Gear Backlash Measurement

DIFFERENTIAL TOTAL TORQUE TO ROTATE

(1) Rotate the pinion a minimum of ten times to seat the differential bearings. Verify that the rotation is smooth and repeatable.

(2) While rotating the pinion at a slow steady rate, measure the differential total torque to rotate. Record the value.

(3) The differential total torque to rotate must be greater than the pinion torque to rotate plus 3 in.lbs..

(4) The differential total torque to rotate must be less than the pinion torque to rotate plus 11 in.lbs..

(5) If the differential total torque to is within these guidelines, assemble the remainder of the axle.

(6) If the differential total torque to rotate is less than the required value, increase the shim thickness on the ring and pinion gear sides of the differential equally.

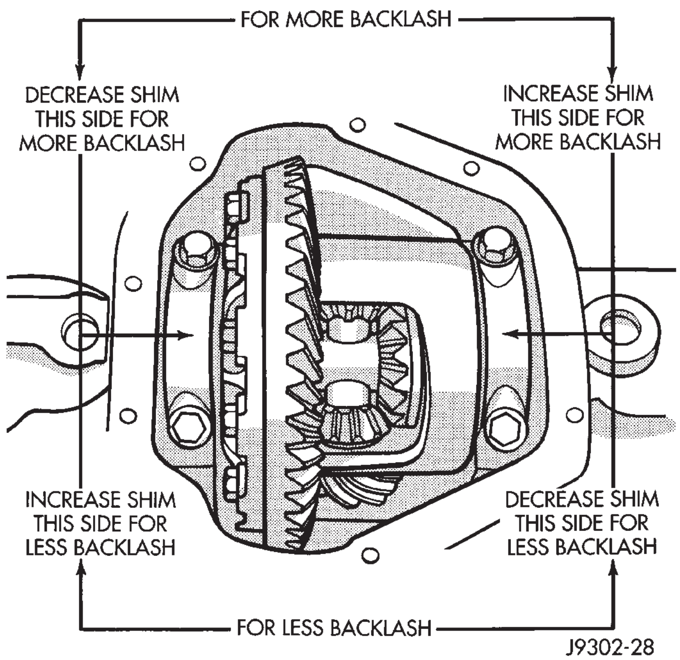


Fig. 90 Backlash Shim Adjustment

(7) If the differential total torque to rotate is greater than the required value, decrease the shim thickness on the ring and pinion gear sides of the differential equally.

(8) Remeasure the differential total torque to rotate.

GEAR CONTACT PATTERN ANALYSIS

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

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

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

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

The areas on the ring gear teeth with the greatest degree of contact against the pinion gear teeth will squeegee the compound to the areas with the least amount of contact. Note and compare patterns on the ring gear teeth to Gear Tooth Contact Patterns chart (Fig. 91) and adjust pinion depth and gear backlash as necessary.

ADJUSTMENTS (Continued)

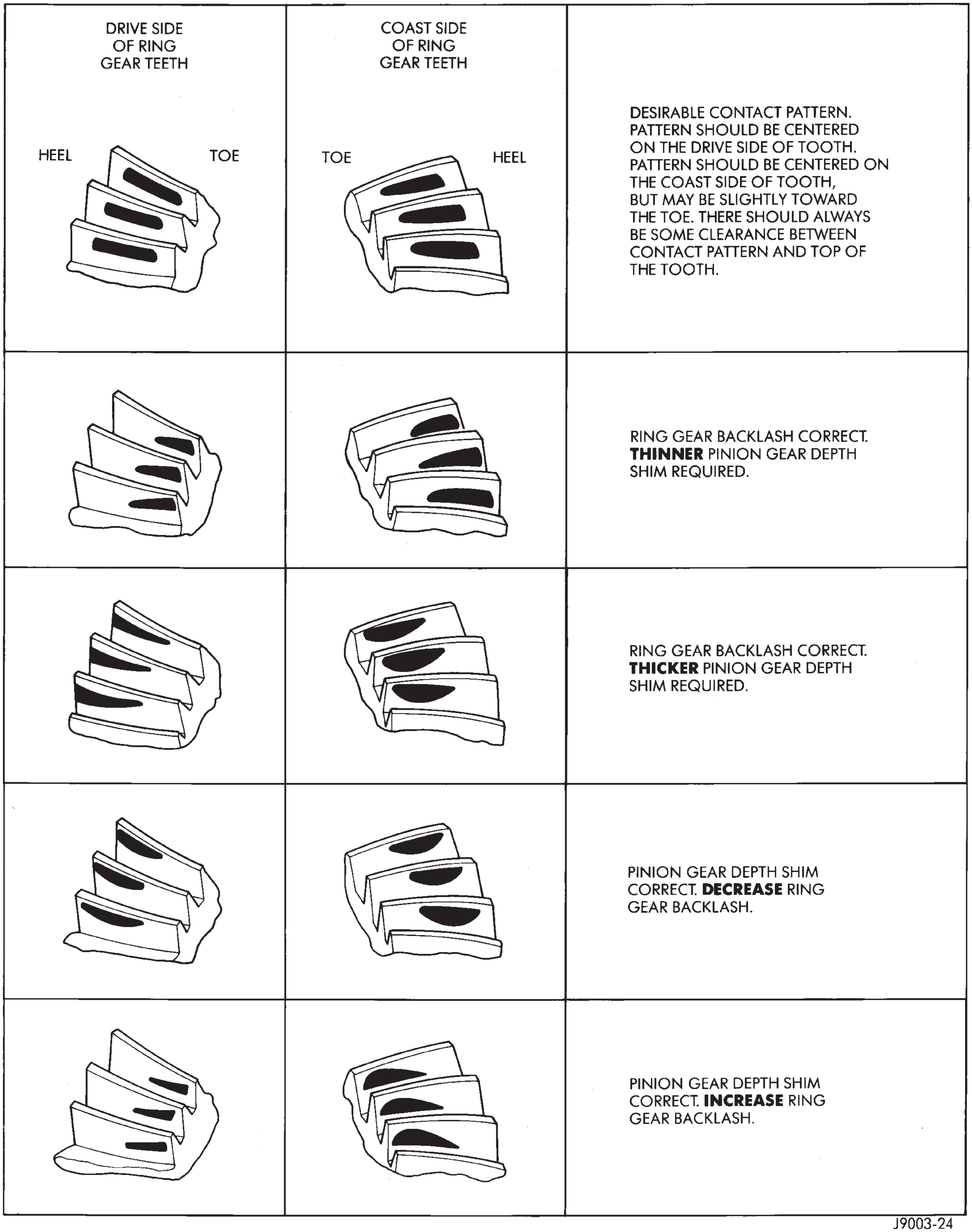


Fig. 91 Gear Tooth Contact Patterns

SPECIFICATIONS

198 RBI AXLE

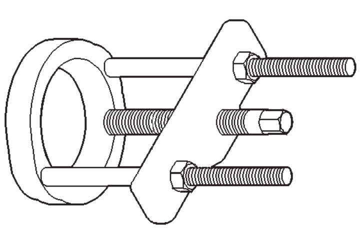
DESCRIPTION	SPECIFICATION
Axle Type	Semi–Floating Hypoid
Lubricant	SAE Thermally Stable 80W–90
Lubricant Trailer Tow	Synthetic 75W–140
Lube Capacity-w/o Vari-lok™	1.66 L (3.50 pts.) total
Lube Capacity-w/ Vari-lok™	1.78 L (3.76 pts.) total
Friction Modifier-w/ Trac-lok™	0.11 L (0.25 pts.)
Friction Modifier-w/ Vari-lok™	0.09 L (0.19 pts.)
Axle Ratios	3.07, 3.55, 3.73, 4.10
Differential Bearing Preload	0.1 mm (0.004 in.)
Differential Side Gear Clearance	0–0.15 mm (0–0.006 in.)
Ring Gear Diameter	19.8 cm (7.795 in.)
Ring Gear Backlash	0–0.15 mm (0.005–0.008 in.)
Pinion Std. Depth	92.08 mm (3.625 in.)
Pinion Bearing Preload-Original Bearings	1–2 N·m (10–20 in. lbs.)
Pinion Bearing Preload-New Bearings	1.5–4 N·m (15–35 in. lbs.)
Maximum Carrier Spread	0.51 mm (0.020 in.)

TORQUE—198 RBI AXLE

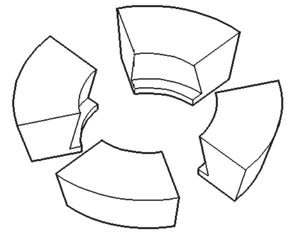
DESCRIPTION	TORQUE
Bolt, Diff. Cover	41 N·m (30 ft. lbs.)
Bolt, Bearing Cap	77 N·m (57 ft. lbs.)
Nut, Pinion	271–474 N·m (200–350 ft. lbs.)
Screw, Pinion Mate Shaft Lock	16.25 N·m (12 ft. lbs.)
Nuts, Axle Bearing Retainer Plate	61 N·m (45 ft. lbs.)
Bolt, Ring Gear	129–142 N·m (95–105 ft. lbs.)
Bolt, ABS Sensor	8 N·m (70 in. lbs.)

SPECIAL TOOLS

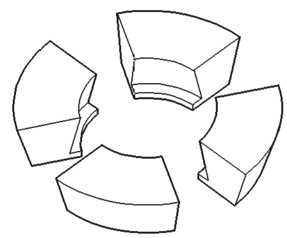
198 RBI AXLE



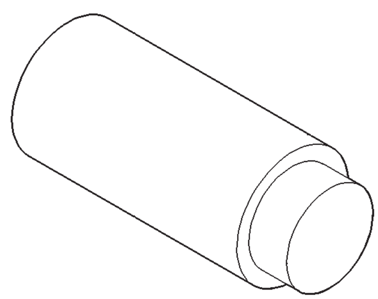
Puller—C-293-PA



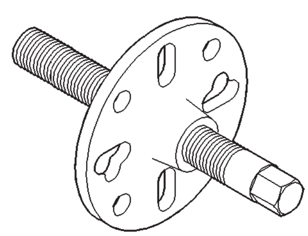
Adapter—8352



Adapter—C-293-40

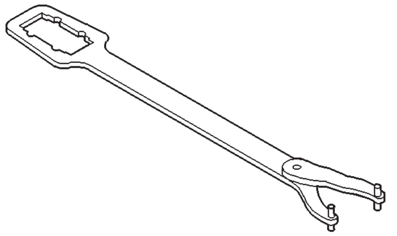


Plug—SP-3289

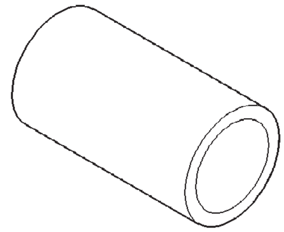


Puller—C-452

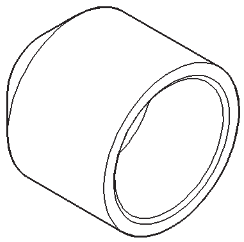
SPECIAL TOOLS (Continued)



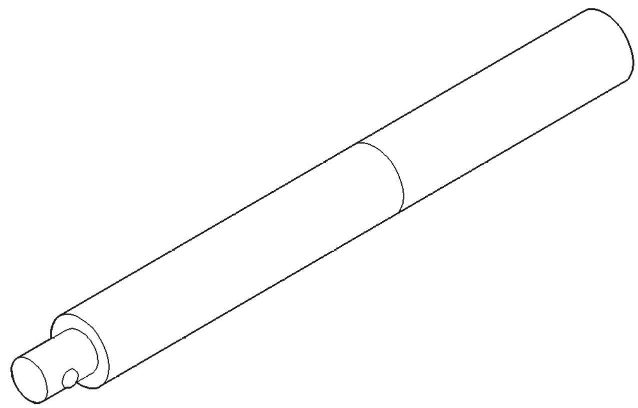
Wrench—C-3281



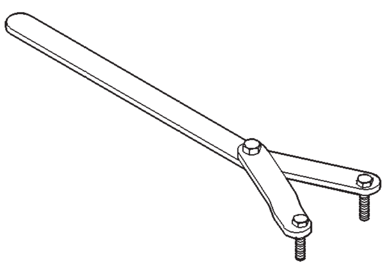
Cup—8109



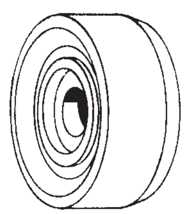
Installer—C-3972-A



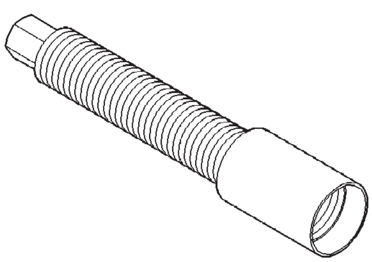
Handle—C-4171



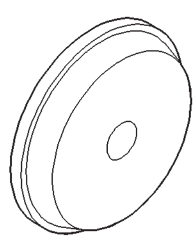
Spanner—6958



Driver—C-3716-A

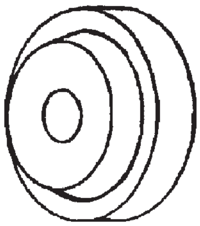


Installer Screw—8112

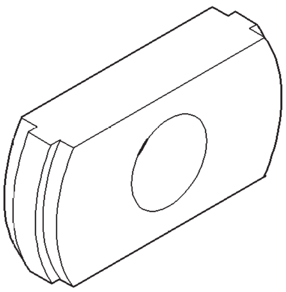


Installer—D-130

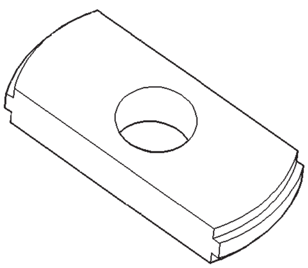
SPECIAL TOOLS (Continued)



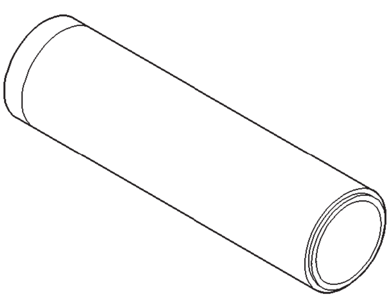
Installer—D-146



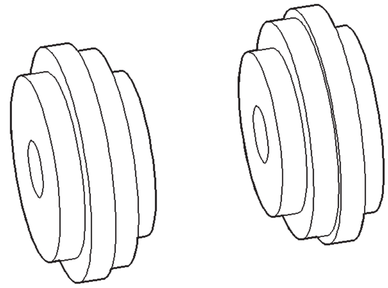
Remover—C-4345



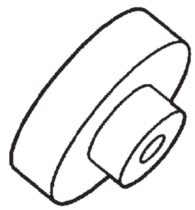
Remover—D-149



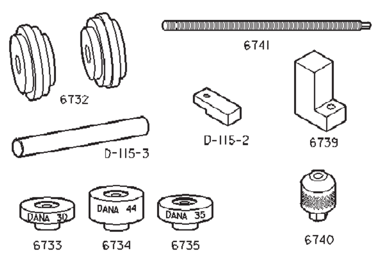
Installer—W-262



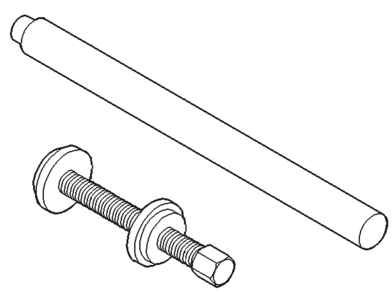
Disc, Axle Arbor—6732



Gauge Block—6735

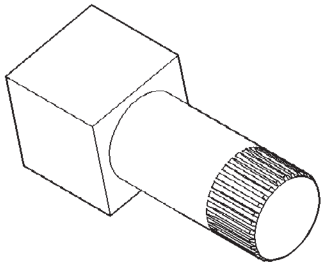


Tool Set, Pinion Depth—6774

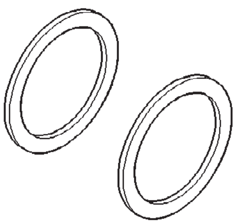


Trac-lok Tool Set—6960

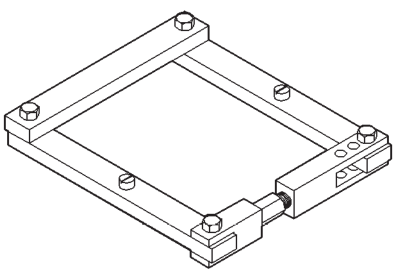
SPECIAL TOOLS (Continued)



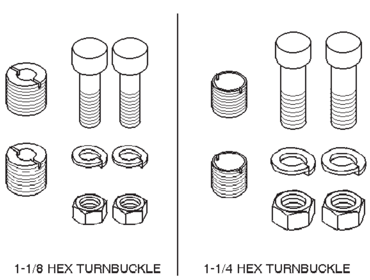
Holder—6965



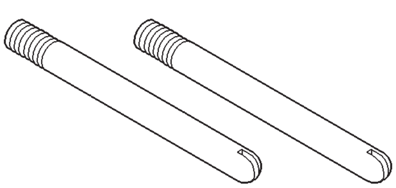
Starting Point Shim—8107



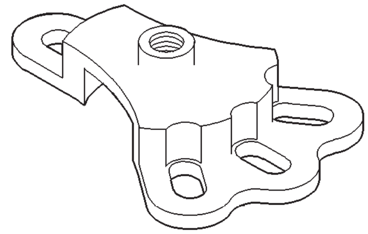
Spreader—W-129-B



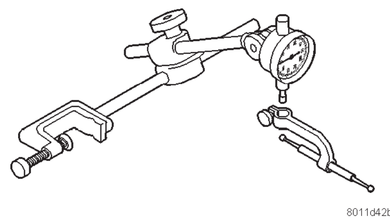
Adapter Kit—6987



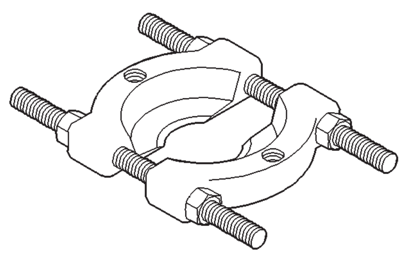
Guide Pin—C-3288-B



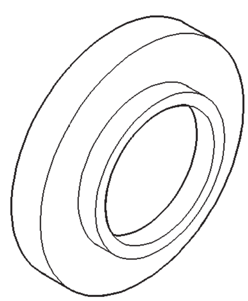
Hub Puller—6790



Dial Indicator—C-3339



Splitter, Bearing—1130



Installer, Gear/Bearing—7913-A

226 RBA AXLE

INDEX

GENERAL INFORMATION

226 RBA AXLE

The 226 Rear Beam-design Aluminum (RBA) axle housing has an aluminum center casting (differential housing) with axle shaft tubes extending from either side. The tubes are pressed into the differential housing to form a one–piece axle housing.

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

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

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

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

For vehicles equipped with ABS brakes, the axles have a tone ring pressed onto the axle shaft. Use care when removing axle shafts to ensure that the tone wheel or the wheel speed sensor are not damaged.

The 226 RBA axle has the assembly part number and gear ratio listed on a tag. The tag is attached to the differential housing by a cover bolt. Build date identification codes are stamped on the cover side of an axle shaft tube.

The differential case is a one-piece design. The differential pinion mate shaft is retained with a threaded pin. Differential bearing preload and ring gear backlash is adjusted by the use of selective spacer shims. Pinion bearing preload is set and maintained by the use of a collapsible spacer (Fig. 1).

LUBRICANT SPECIFICATIONS

A multi–purpose, hypoid gear lubricant which conforms to the following specifications should be used. Mopar® Hypoid Gear Lubricant conforms to all of these specifications.

- The lubricant should have MIL–L–2105C and API GL 5 quality specifications.
- Lubricant is a thermally stable SAE 80W–90 gear lubricant.
- Lubricant for axles intended for heavy-duty or trailer tow use is SAE 75W–140 SYNTHETIC gear lubricant.

GENERAL INFORMATION (Continued)

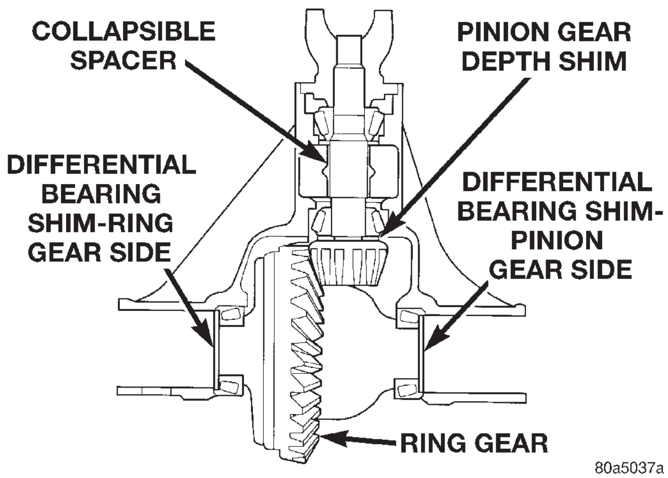


Fig. 1 Shim Locations

Trac-lok™ differentials require the addition of 0.11L (0.25 pts.) of friction modifier to the axle lubricant. The 226 RBA axle lubricant capacity is 2.24 L (4.75 pts.) total, including the friction modifier if necessary.

Vari-lok™ equipped axles require the addition of 0.12L (0.25 pts.) of friction modifier to the axle lubricant. The 226 RBA axle lubricant capacity for axles equipped with a Vari-lok™ differential is 2.25 L (4.75 pts.) total, including the friction modifier.

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

DESCRIPTION AND OPERATION

STANDARD DIFFERENTIAL

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:

- The pinion gear rotates the ring gear
- The ring gear (bolted to the differential case) rotates the case
- The differential pinion gears (mounted on the pinion mate shaft in the case) rotate the side gears
- The 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. 2).

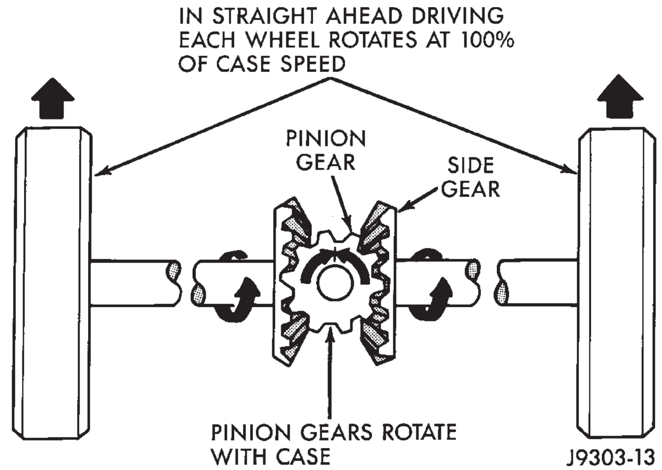


Fig. 2 Differential Operation—Straight Ahead Driving

When turning corners, the outside wheel must travel a greater distance than the inside wheel to complete a turn. The difference must be compensated for to prevent the tires from scuffing and skidding through turns. To accomplish this, the differential allows the axle shafts to turn at unequal speeds (Fig. 3). 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.

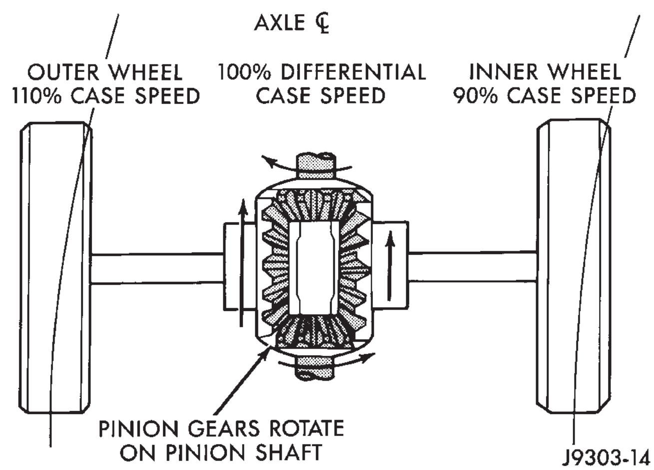


Fig. 3 Differential Operation—On Turns

VARI-LOK™ OPERATION

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

Vari-lok™ differentials are a speed-sensing torque transfer differential. Similiar to Trac-lok™ differentials, these differentials transfer torque to the wheel with the greater traction. Unlike typical differential systems, torque transfer is proportional to wheel speed difference rather than torque difference. Response can be tuned to driving conditions, enabling use of this system in the front axle. Both front and rear Vari-lok™ axle torque

DESCRIPTION AND OPERATION (Continued)

transfer characteristics are tuned to provide smooth operation. Except for the ability to maintain headway under low-traction conditions, operation is barely noticable to the driver.

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

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

TRAC-LOK™ OPERATION

In a conventional differential, 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 which contain multiple discs. The clutches will have radial grooves on the plates, and concentric grooves on the discs or bonded fiber material that is smooth in appearance.

In operation, the Trac-lok™ clutches are engaged by two concurrent forces. The first being the preload force exerted through Belleville spring washers within the clutch packs. The second is the separating forces generated by the side gears as torque is applied through the ring gear (Fig. 4).

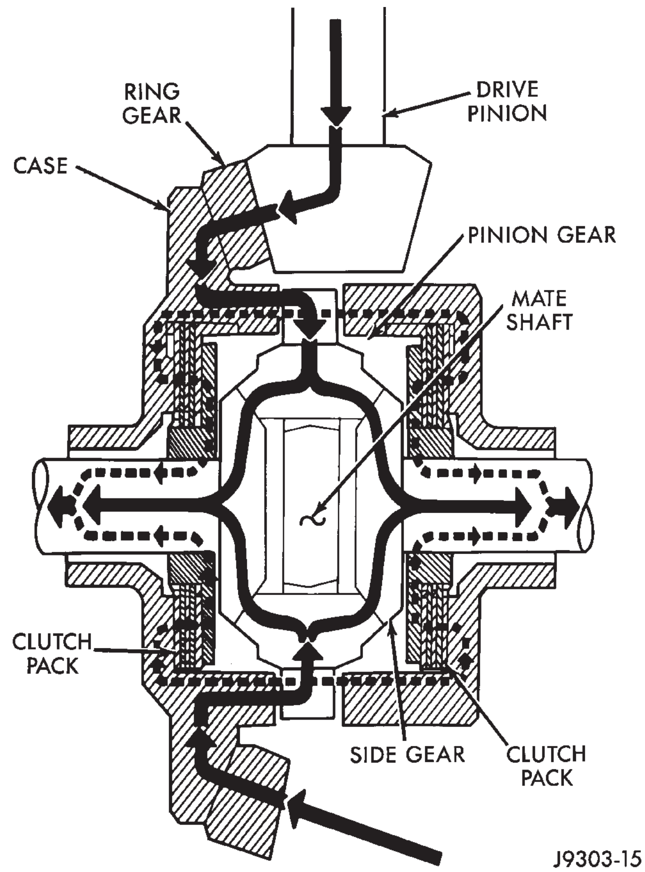


Fig. 4 Trac-lok™ Limited Slip Differential Operation

The Trac-lok™ design provides the differential action needed for turning corners and for driving straight ahead during periods of unequal traction. 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.

DIAGNOSIS AND TESTING

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.

Axle gear problem conditions are usually the result of:

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

DIAGNOSIS AND TESTING (Continued)

Axle component breakage is most often the result of:
- Severe overloading.
- Insufficient lubricant.
- Incorrect lubricant.
- Improperly tightened components.

GEAR NOISE

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

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.
- Gear damage.

Differential side and pinion gears can be checked by turning the vehicle. They usually do not cause noise during straight–ahead driving when the gears are unloaded. The side gears are loaded during vehicle turns. 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 rear pinion bearing is the source of the noise. If the bearing noise is heard during a coast, the front pinion bearing is the source.

Worn or damaged differential bearings usually produce a low pitch noise. Differential bearing noise is similar to pinion bearing noise. 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(s).
- Worn or out–of–balance wheels.
- Loose wheel lug nuts.
- Worn U–joint(s).
- Loose/broken springs.
- Damaged axle shaft bearing(s).
- Loose pinion gear nut.
- Excessive pinion yoke run out.
- Bent axle shaft(s).

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 vibration 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 side gear/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.

TRAC–LOK™ DIFFERENTIAL NOISE

The most common problem is a chatter noise when turning corners. Before removing a 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 Mopar® Trac-lok™ Lubricant (friction modifier) should be added after repair service or during a lubricant change.

After changing the lubricant, drive the vehicle and make 10 to 12 slow, figure-eight turns. This maneuver will pump lubricant through the clutches. This will correct the condition in most instances. If the chatter persists, clutch damage could have occurred.

DIAGNOSIS AND TESTING (Continued)

DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSES	CORRECTION
WHEEL NOISE	1. Wheel loose. 2. Faulty, brinelled wheel bearing.	1. Tighten loose nuts. 2. Faulty or brinelled bearings must be replaced.
AXLE SHAFT NOISE	1. Misaligned axle shaft tube. 2. Bent or sprung axle shaft. 3. End play in drive pinion bearings. 4. Excessive gear backlash between ring gear and pinion gear. 5. Improper adjustment of drive pinion gear shaft bearings. 6. Loose drive pinion gearshaft yoke nut. 7. Improper wheel bearing adjustment. 8. Scuffed gear tooth contact surfaces.	1. Inspect axle shaft tube alignment. Correct as necessary. 2. Replace bent or sprung axle shaft. 3. Refer to Drive Pinion Bearing Pre-Load Adjustment. 4. Check adjustment of ring gear backlash and pinion gear. Correct as necessary. 5. Adjust drive pinion shaft bearings. 6. Tighten drive pinion gearshaft yoke nut with specified torque. 7. Readjust as necessary. 8. If necessary, replace scuffed gears.
AXLE SHAFT BROKE	1. Misaligned axle shaft tube. 2. Vehicle overloaded. 3. Erratic clutch operation. 4. Grabbing clutch.	1. Replace broken axle shaft after correcting axle shaft tube alignment. 2. Replace broken axle shaft. Avoid excessive weight on vehicle. 3. Replace broken axle shaft after inspecting for other possible causes. Avoid erratic use of clutch. 4. Replace broken axle shaft. Inspect clutch and make necessary repairs or adjustments.
DIFFERENTIAL CASE CRACKED	1. Improper adjustment of differential bearings. 2. Excessive ring gear backlash. 3. Vehicle overloaded. 4. Erratic clutch operation.	1. Replace cracked case; examine gears and bearings for possible damage. At reassembly, adjust differential bearings properly. 2. Replace cracked case; examine gears and bearings for possible damage. At reassembly, adjust ring gear backlash properly. 3. Replace cracked case; examine gears and bearings for possible damage. Avoid excessive weight on vehicle. 4. Replace cracked case. After inspecting for other possible causes, examine gears and bearings for possible damage. Avoid erratic use of clutch.
DIFFERENTIAL GEARS SCORED	1. Insufficient lubrication. 2. Improper grade of lubricant. 3. Excessive spinning of one wheel/tire.	1. 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. 2. Replace scored gears. Inspect all gears and bearings for possible damage. Clean and refill differential housing to required capacity with proper lubricant. 3. Replace scored gears. Inspect all gears, pinion bores and shaft for damage. Service as necessary.
LOSS OF LUBRICANT	1. Lubricant level too high.	1. Drain excess lubricant by removing fill plug and allow lubricant to level at lower edge of fill plug hole.

J9503-3

DIAGNOSIS AND TESTING (Continued)

DIAGNOSIS CHART – CONTINUED

CONDITION	POSSIBLE CAUSES	CORRECTION
LOSS OF LUBRICANT	2. Worn axle shaft seals. 3. Cracked differential housing. 4. Worn drive pinion gear shaft seal. 5. Scored and worn yoke. 6. Axle cover not properly sealed.	2. Replace worn seals. 3. Repair or replace housing as necessary. 4. Replace worn drive pinion gear shaft seal. 5. Replace worn or scored yoke and seal. 6. Remove cover and clean flange and reseal.
AXLE OVERHEATING	1. Lubricant level too low. 2. Incorrect grade of lubricant. 3. Bearings adjusted too tight. 4. Excessive gear wear. 5. Insufficient ring gear backlash.	1. Refill differential housing. 2. Drain, flush and refill with correct amount of the correct lubricant. 3. Readjust bearings. 4. Inspect gears for excessive wear or scoring. Replace as necessary. 5. Readjust ring gear backlash and inspect gears for possible scoring.
GEAR TEETH BROKE (RING GEAR AND PINION)	1. Overloading. 2. Erratic clutch operation. 3. Ice-spotted pavements. 4. Improper adjustments.	1. Replace gears. Examine other gears and bearings for possible damage. 2. Replace gears and examine the remaining parts for possible damage. Avoid erratic clutch operation. 3. Replace gears. Examine the remaining parts for possible damage. Replace parts as required. 4. Replace gears. Examine other parts for possible damage. Ensure ring gear backlash is correct.
AXLE NOISE	1. Insufficient lubricant. 2. Improper ring gear and drive pinion gear adjustment. 3. Unmatched ring gear and drive pinion gear. 4. Worn teeth on ring gear or drive pinion gear. 5. Loose drive pinion gear shaft bearings. 6. Loose differential bearings. 7. Misaligned or sprung ring gear. 8. Loose differential bearing cap bolts	1. Refill axle with correct amount of the proper lubricant. Also inspect for leaks and correct as necessary. 2. Check ring gear and pinion gear teeth contact pattern. 3. Remove unmatched ring gear and drive pinion gear. Replace with matched gear and drive pinion gear set. 4. Check teeth on ring gear and drive pinion gear for correct contact. If necessary, replace with new matched set. 5. Adjust drive pinion gearshaft bearing preload torque. 6. Adjust differential bearing preload torque. 7. Measure ring gear runout. 8. Tighten with specified torque

J9503-4

DIAGNOSIS AND TESTING (Continued)

TRAC–LOK™ TEST

WARNING: WHEN SERVICING VEHICLES WITH A TRAC–LOK™ DIFFERENTIAL DO NOT USE THE ENGINE TO TURN THE AXLE AND WHEELS. BOTH REAR WHEELS MUST BE RAISED AND THE VEHICLE SUPPORTED. A TRAC–LOK™ AXLE CAN EXERT ENOUGH FORCE IF ONE WHEEL IS IN CONTACT WITH A SURFACE TO CAUSE THE VEHICLE TO MOVE.

The differential can be tested without removing the differential case by measuring rotating torque. Make sure brakes are not dragging during this measurement.

(1) Place blocks in front and rear of both front wheels.

(2) Raise one rear wheel until it is completely off the ground.

(3) Engine off, transmission in neutral, and parking brake off.

(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. 5).

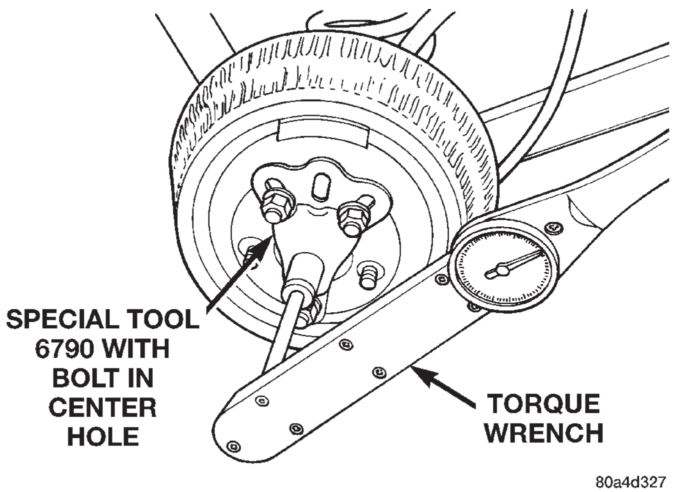


Fig. 5 Trac-lok™ Test —Typical

(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 serviced.

VARI-LOK™ TEST

PRIMING

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

(2) Remove the axle fill plug.

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

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

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

TEST PROCEDURE

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

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

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

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

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

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

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

SERVICE PROCEDURES

LUBRICANT CHANGE

(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 original sealant from the housing and cover surfaces.

(6) Apply a bead of Mopar® Silicone Rubber Sealant, or equivalent, to the housing cover (Fig. 6).

Install the housing cover within 5 minutes after applying the sealant.

(7) Install the cover and any identification tag. Tighten the cover bolts to 41 N·m (30 ft. lbs.) torque.

(8) For Trac–lok™ and Vari-lok™ differentials, a quantity of Mopar® Trac–lok™ lubricant (friction modifier), or equivalent, must be added after repair service or a lubricant change. Refer to the Lubricant Specifications section of this group for the quantity necessary.

(9) Fill differential with Mopar® Hypoid Gear Lubricant, or equivalent, to bottom of the fill plug hole. Refer to the Lubricant Specifications section of this group for the quantity necessary.

SERVICE PROCEDURES (Continued)

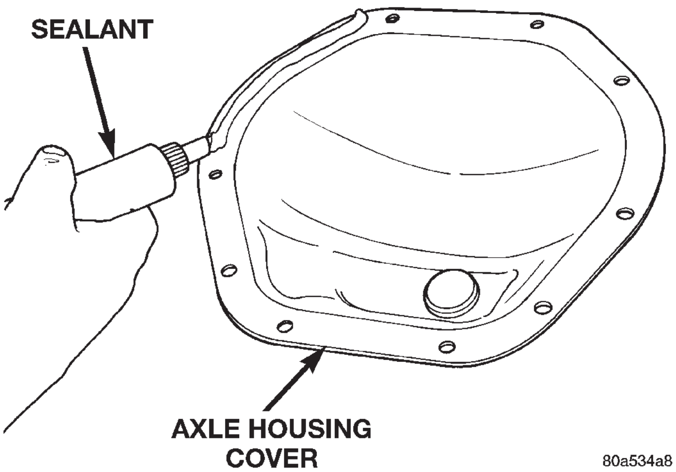


Fig. 6 Apply Sealant

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

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

(11) Trac–lok™ and Vari-lok™ differential equipped 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.

REMOVAL AND INSTALLATION

REAR AXLE

REMOVAL

(1) Raise and support the vehicle.

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

(3) Secure axle to device.

(4) Remove the wheels and tires.

(5) Remove the brake rotors and calipers from the axle. Refer to Group 5, Brakes, for proper procedures.

(6) Disconnect parking brake cables from brackets and lever.

(7) Remove wheel speed sensors, if necessary. Refer to Group 5, Brakes, for proper procedures.

(8) Disconnect the brake hose at the axle junction block. Do not disconnect the brake hydraulic lines at the calipers. Refer to Group 5, Brakes, for proper procedures.

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

(10) Mark the propeller shaft and yokes for installation alignment reference.

(11) Remove propeller shaft.

(12) Disconnect stabilizer bar links.

(13) Remove nut holding upper suspension arm to the rear axle ball joint.

(14) Using Remover 8278, separate the rear axle ball joint from the upper suspension arm (Fig. 7).

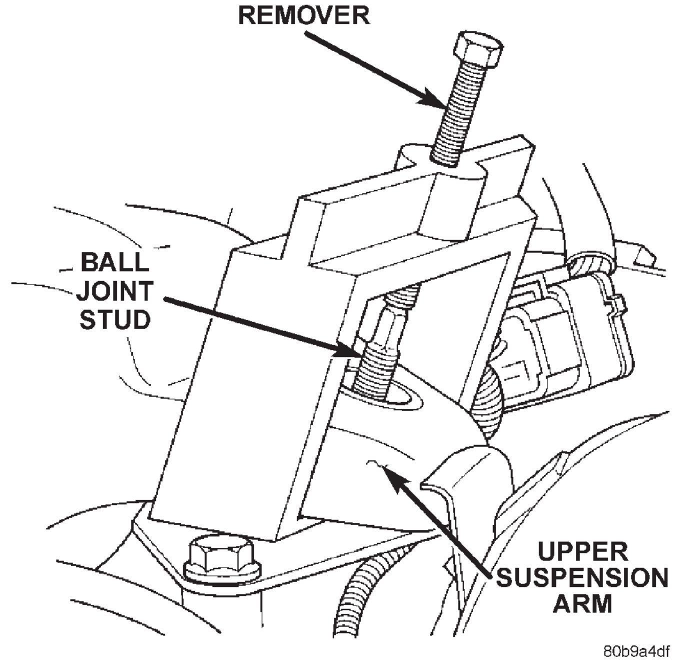


Fig. 7 Separate Rear Axle Ball Joint

(15) Disconnect shock absorbers from axle.

(16) Disconnect track bar.

(17) Disconnect lower suspension arms from the axle brackets.

(18) Separate the axle from the vehicle.

INSTALLATION

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

(1) Raise the axle with lifting device and align coil springs.

(2) Position the lower suspension arms on the axle brackets. Install nuts and bolts, do not tighten bolts at this time.

(3) Install the upper suspension arm to the rear axle ball joint.

(4) Install nut to hold the upper suspension arm to the rear axle ball joint. Torque the nut to 122 N·m (90 ft.lbs.) (Fig. 8).

(5) Install track bar and attachment bolts, do not tighten bolts at this time.

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

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

REMOVAL AND INSTALLATION (Continued)

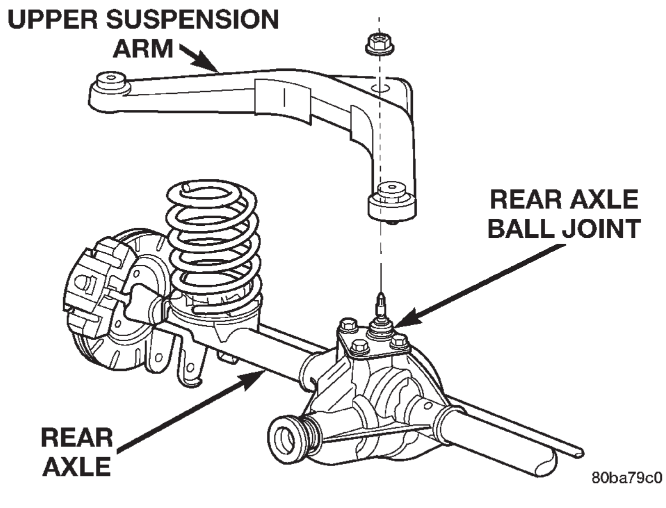


Fig. 8 Install Rear Ball Joint Nut

(8) Install the wheel speed sensors, if necessary. Refer to Group 5, Brakes, for proper procedures.

(9) Connect parking brake cable to brackets and lever.

(10) Install the brake rotors and calipers. Refer to Group 5, Brakes, for proper procedures.

(11) Connect the brake hose to the axle junction block. Refer to Group 5, Brakes, for proper procedures.

(12) Install axle vent hose.

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

(14) Install the wheels and tires.

(15) Add gear lubricant, if necessary. Refer to Lubricant Specifications in this section for lubricant requirements.

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

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

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

PINION SHAFT SEAL

REMOVAL

(1) Raise and support the vehicle.

(2) Remove wheel and tire assemblies.

(3) Remove rear brake rotors and calipers. Refer to Group 5, Brakes, for proper procedures.

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

(5) Remove the propeller shaft from the yoke.

(6) Rotate the pinion gear three or four times.

(7) Measure the amount of torque necessary to rotate the pinion gear with a (in. lbs.) dial-type torque wrench. Record the torque reading for installation reference.

(8) Using a short piece of pipe and Holder 6958 to hold the pinion yoke, remove the pinion nut and washer (Fig. 9).

(9) Use Remover C-452 and Wrench C-3281 to remove the pinion yoke (Fig. 10).

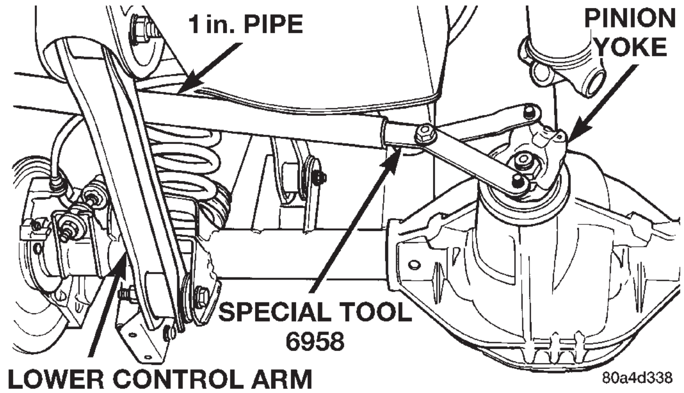


Fig. 9 Pinion Yoke Holder

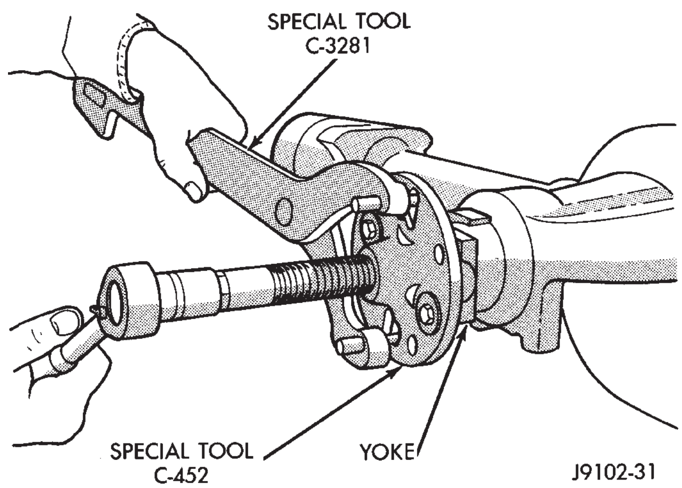


Fig. 10 Pinion Yoke Removal

(10) Use Remover 7794-A and slide hammer to remove the pinion shaft seal (Fig. 11).

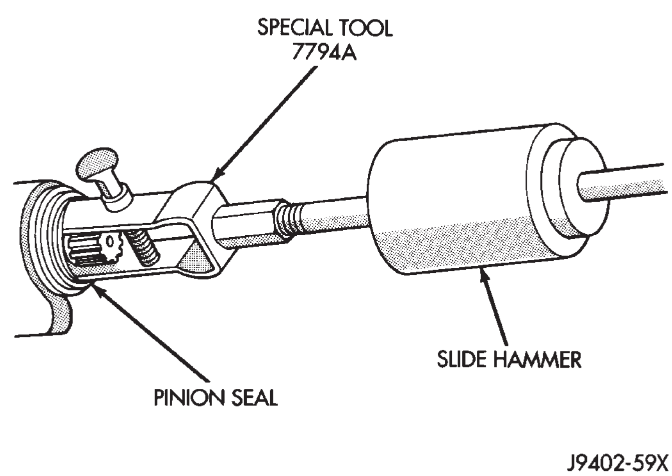


Fig. 11 Seal Removal

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with Installer C-3972-A and Handle C-4171 (Fig. 12).

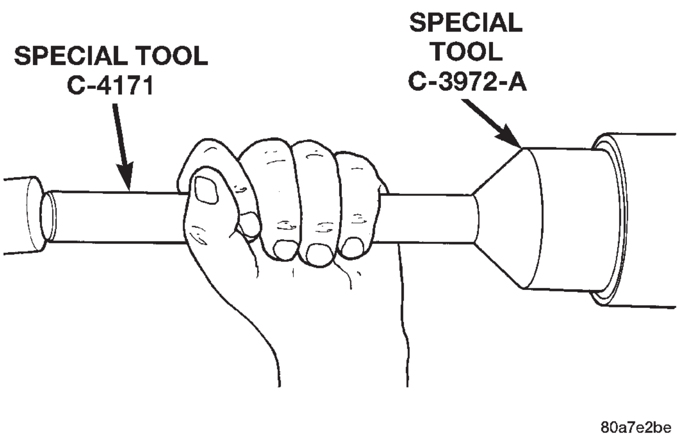


Fig. 12 Pinion Seal Installation

(2) Install yoke on the pinion gear with Installer C-3718 and Holder 6958 (Fig. 13).

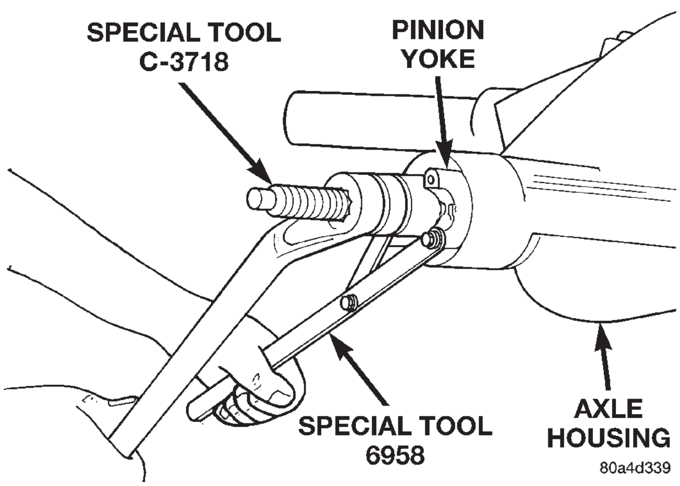


Fig. 13 Pinion Yoke Installation

CAUTION: Do not exceed the minimum tightening torque when installing the pinion yoke retaining nut at this point. Damage to collapsible spacer or bearings may result.

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

(4) Rotate the pinion a minimum of ten times. Verify that the pinion rotates smoothly. Rotate the pinion shaft using a (in. lbs.) torque wrench. Rotating resistance torque should be equal to the reading recorded during removal, plus an additional 0.56 N·m (5 in. lbs.) (Fig. 14).

(5) If the rotating torque is low, use Holder 6958 to hold the pinion yoke (Fig. 15), and tighten the pinion shaft nut in 6.8 N·m (5 ft. lbs.) increments until proper rotating torque is achieved.

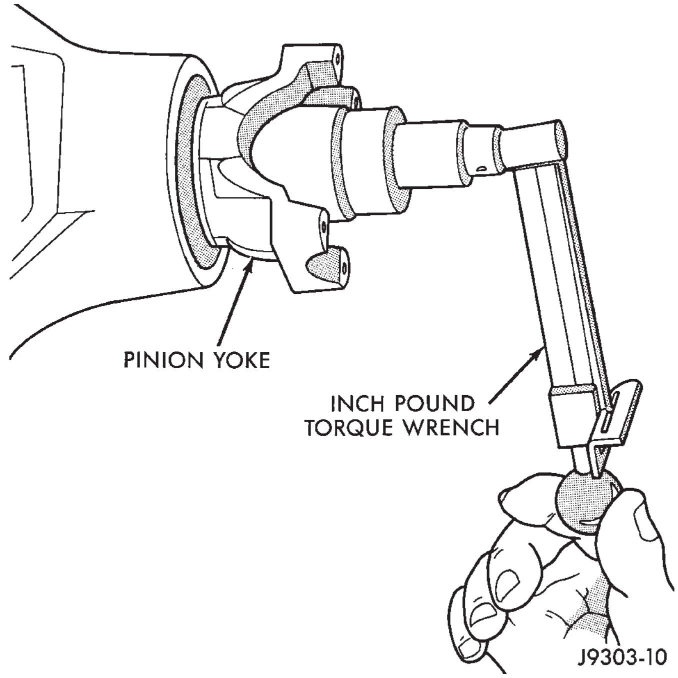


Fig. 14 Check Pinion Rotation Torque

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

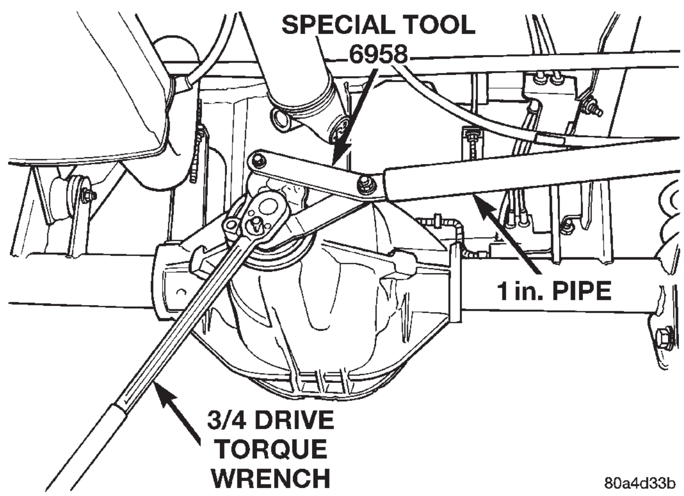


Fig. 15 Tightening Pinion Shaft Nut

(6) Align the installation reference marks on propeller shaft and yoke and install the propeller shaft.

(7) Add gear lubricant to the differential housing, if necessary. Refer to the Lubricant Specifications for gear lubricant requirements.

(8) Install brake rotors and calipers. Refer to Group 5, Brakes, for proper procedures.

(9) Install wheel and tire assemblies.

(10) Lower the vehicle.

COLLAPSIBLE SPACER

REMOVAL W/PINION INSTALLED

(1) Raise and support the vehicle.
(2) Remove wheel and tire assemblies.
(3) Remove rear brake rotors and calipers. Refer to Group 5, Brakes, for proper procedures.
(4) Mark the propeller shaft and pinion yoke for installation reference.
(5) Remove the propeller shaft from the yoke.
(6) Rotate the pinion gear a minimum of ten times. Verify that the pinion rotates smoothly.
(7) Measure the amount of torque necessary to rotate the pinion gear with a (in. lbs.) dial-type torque wrench. Record the torque reading for installation reference.
(8) Using a short piece of pipe and Holder 6958 to hold the pinion yoke, remove the pinion nut and washer (Fig. 16).
(9) Use Remover C-452 and Wrench C-3281 to remove the pinion yoke (Fig. 17).
(10) Use Remover 7794-A and slide hammer to remove the pinion shaft seal (Fig. 18).
(11) Remove the front pinion bearing using a pair of suitable pick tools to pull the bearing straight off the pinion gear shaft. It may be necessary to lightly tap the end of the pinion gear with a rawhide or rubber mallet if the bearing becomes bound on the pinion shaft.
(12) Remove the collapsible spacer.

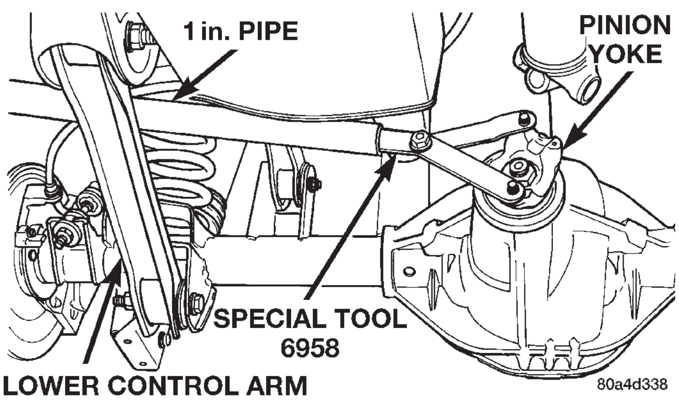


Fig. 16 Pinion Yoke Holder

REMOVAL W/PINION REMOVED

(1) Raise and support the vehicle.
(2) Remove wheel and tire assemblies.
(3) Remove rear brake rotors and calipers. Refer to Group 5, Brakes, for proper procedures.
(4) Mark the propeller shaft and pinion yoke for installation reference.
(5) Remove the propeller shaft from the yoke.

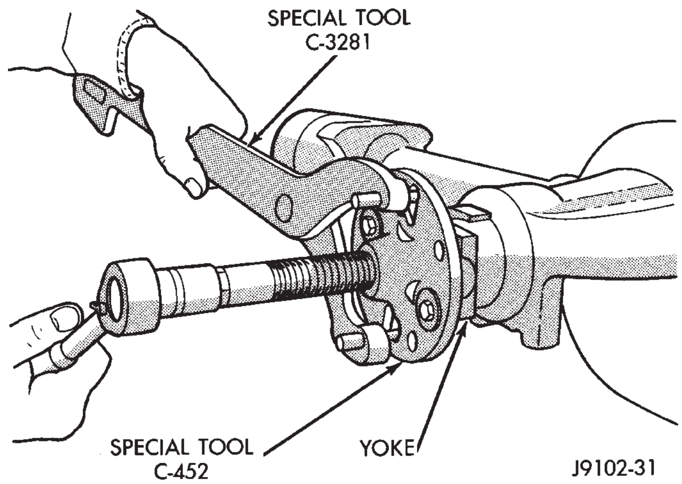


Fig. 17 Pinion Yoke Removal

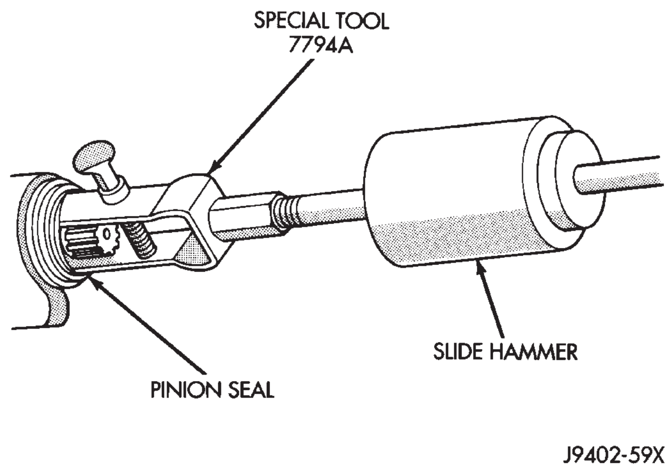


Fig. 18 Seal Removal

(6) Rotate the pinion gear a minimum of ten times. Verify that the pinion rotates smoothly.
(7) Measure the amount of torque necessary to rotate the pinion gear with a (in. lbs.) dial-type torque wrench. Record the torque reading for installation reference.
(8) Remove differential assembly from axle housing.
(9) Using Holder 6958 to hold yoke and a short length of 1 in. pipe, remove the pinion yoke nut and washer (Fig. 16).
(10) Using Remover C–452 and Wrench C–3281, remove the pinion yoke from pinion shaft (Fig. 17).
(11) Remove the pinion gear from housing (Fig. 19). Catch the pinion with your hand to prevent it from falling and being damaged.
(12) Remove collapsible spacer from pinion shaft.

INSTALLATION

(1) Install a new collapsible preload spacer on pinion shaft (Fig. 20).

REMOVAL AND INSTALLATION (Continued)

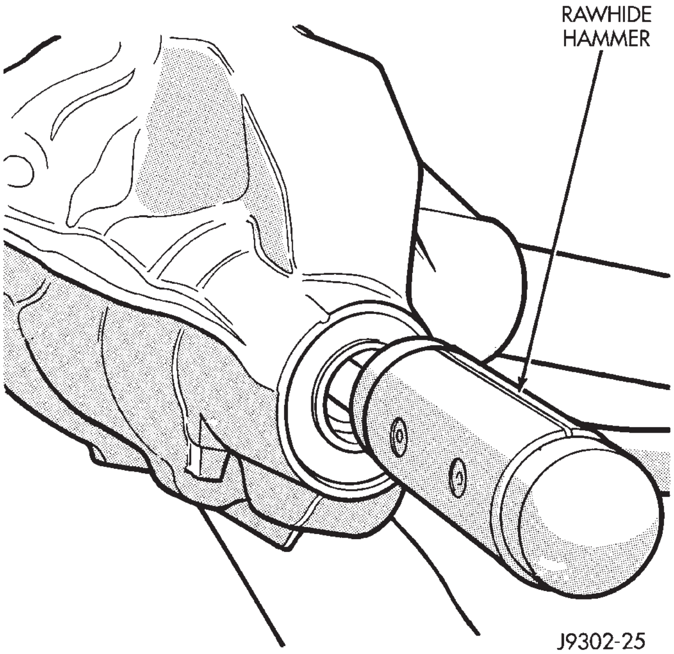


Fig. 19 Remove Pinion Gear

(2) If pinion gear was removed, install pinion gear in housing.

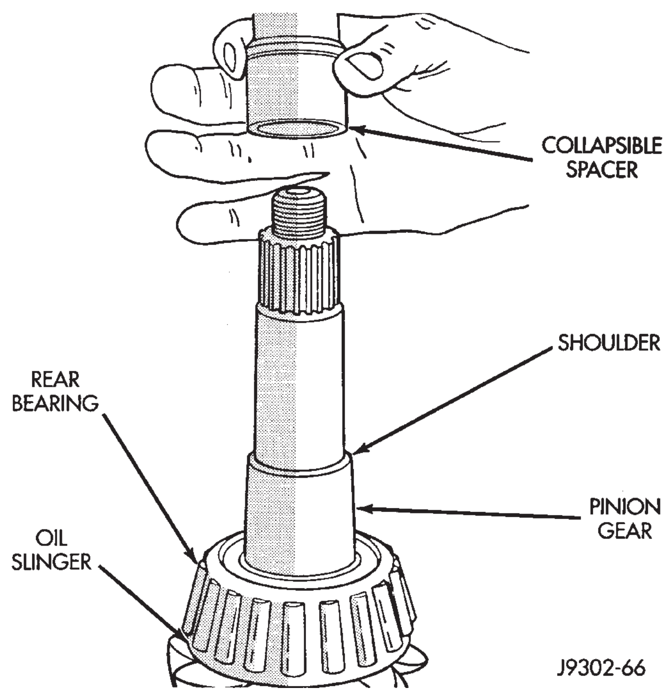


Fig. 20 Collapsible Preload Spacer

(3) Install pinion front bearing, if necessary.

(4) Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with Installer C-3972-A and Handle C–4171 (Fig. 21).

(5) Install yoke with Installer C–3718 and Holder 6958 (Fig. 22).

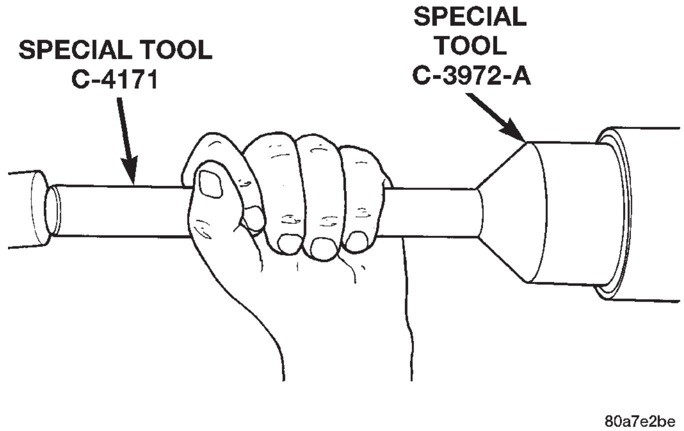


Fig. 21 Pinion Seal Installation

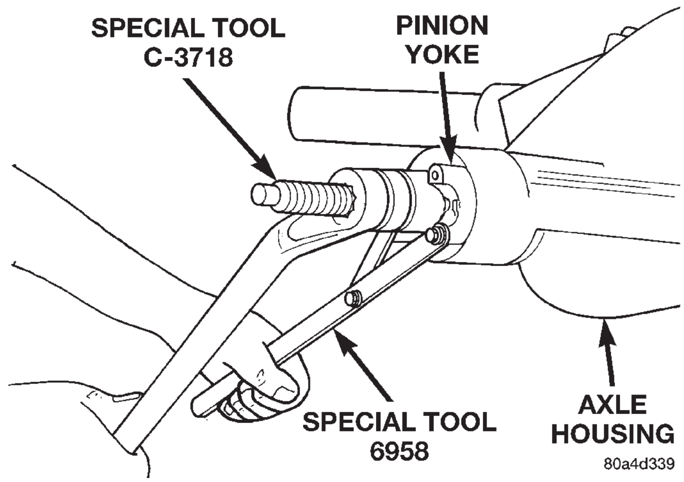


Fig. 22 Pinion Yoke Installation

(6) If the original pinion bearings are being used, install differential assembly and axle shafts, if necessary.

NOTE: If new pinion bearings were installed, do not install the differential assembly and axle shafts until after the pinion bearing preload and rotating torque are set.

(7) Install the yoke washer and a new nut on the pinion gear. Tighten the nut to 298 N·m (220 ft. lbs.) minimum. **Do not over–tighten.** Maximum torque is 380 N·m (280 ft. lbs.).

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

REMOVAL AND INSTALLATION (Continued)

NOTE: If the spacer requires more than 280 ft. lbs. torque to crush, the collapsible spacer is defective.

(8) Using yoke holder 6958, a short length of 1 in. pipe, and a torque wrench set at 380 N·m (280 ft. lbs.), crush collapsible spacer until bearing end play is taken up (Fig. 23).

(9) Slowly tighten the nut in 6.8 N·m (5 ft. lbs.) increments until the required rotating torque is achieved. Measure the rotating torque frequently to avoid over crushing the collapsible spacer (Fig. 24).

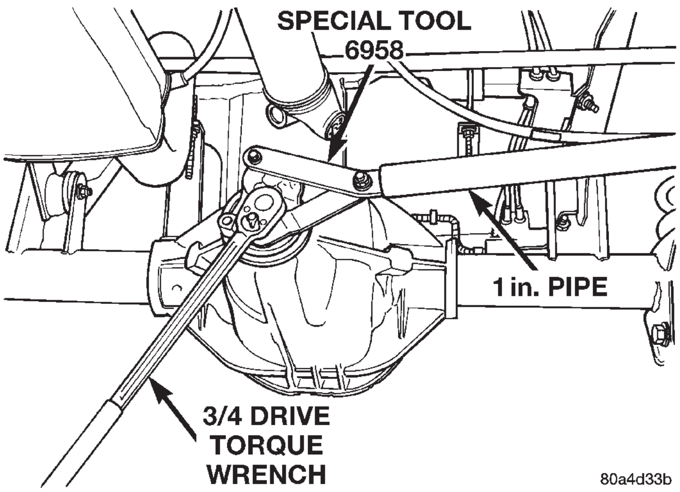


Fig. 23 Tightening Pinion Nut

(10) Rotate the pinion a minimum of ten times. Verify that the pinion rotates smoothly. Check rotating torque with an inch pound torque wrench (Fig. 24). The torque necessary to rotate the pinion gear should be:

- Original Bearings — The reading recorded during removal, plus an additional 0.56 N·m (5 in. lbs.).
- New Bearings — 2 to 5 N·m (20 to 40 in. lbs.).

(11) Install differential assembly and axle shafts, if necessary.

(12) Align marks made previously on yoke and propeller shaft and install propeller shaft.

(13) Install rear brake rotors and calipers. Refer to Group 5 Brakes, for proper procedures.

(14) Add gear lubricant, if necessary. Refer to Lubricant Specifications of this section for lubricant requirements.

(15) Install wheel and tire assemblies.

(16) Lower vehicle.

AXLE SHAFT

REMOVAL

(1) Raise and support vehicle. Ensure that the transmission is in neutral.

(2) Remove wheel and tire assembly.

(3) Remove brake caliper and rotor. Refer to Group 5, Brakes, for proper procedure.

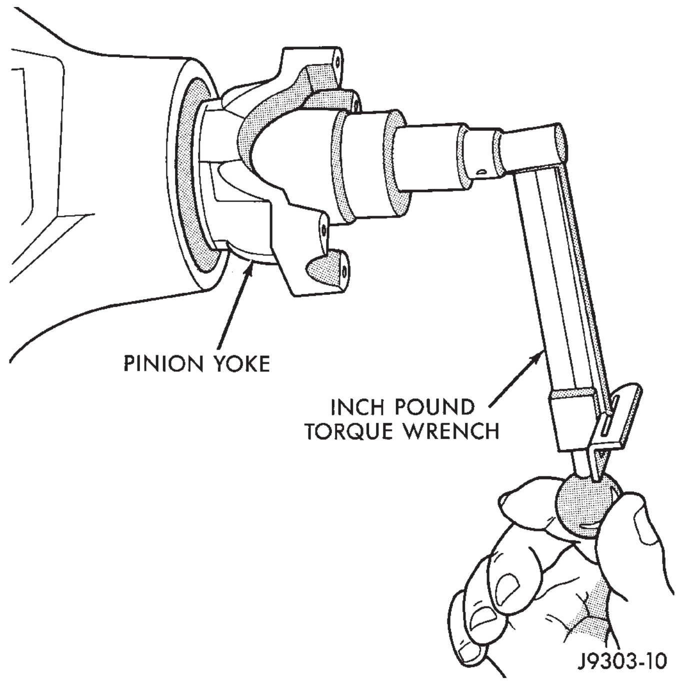


Fig. 24 Check Pinion Gear Rotation Torque

(4) Through access hole in axle flange, remove nuts holding axle retainer plate to axle tube.

(5) Using Slide Hammer 7420, Adapter 6790, and suitable lug nuts, pull axle shaft from vehicle.

INSTALLATION

WARNING: Do not reuse the bolts and nuts that retained the axle shaft to axle tube flange. Used prevailing torque nuts can loosen, causing a dangerous condition.

(1) Insert axle into opening at end of axle tube.

(2) Align flat area on axle shaft retaining plate upward.

(3) Insert the retaining bolts into the axle tube flange and through the holes in the brake backing and axle shaft retaining plates.

(4) Install nuts to hold axle retaining plate to axle tube.

(5) Through access hole in axle flange, tighten nuts to 61 N·m (45 ft. lbs.).

(6) Install brake caliper and rotor. Refer to Group 5, Brakes, for proper procedures.

(7) Install wheel and tire.

(8) Check and fill the gear lubricant. Refer to the Lubricant Specifications for gear lubricant requirements.

(9) Lower vehicle.

REMOVAL AND INSTALLATION (Continued)

AXLE SHAFT SEAL AND BEARING

REMOVAL

(1) Remove axle shaft from vehicle.

(2) Using a 3/8 in. dia. drill bit, drill a shallow hole into soft steel axle bearing retaining ring (Fig. 25). If possible, use a drill depth stop to avoid marking axle.

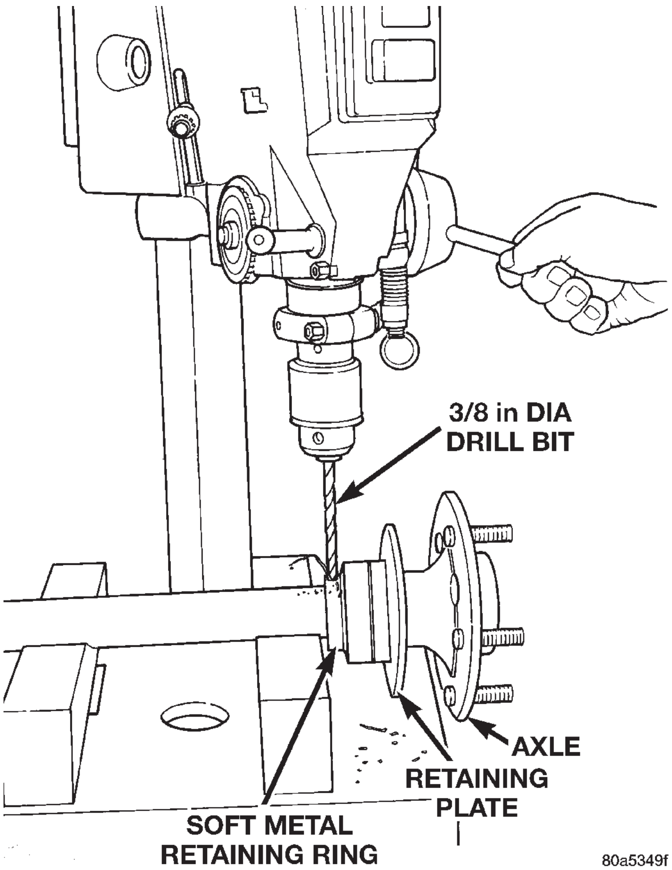


Fig. 25 Drill Retaining Ring

(3) Using a suitable cold chisel, cut retaining ring across drilled hole. (Fig. 26)

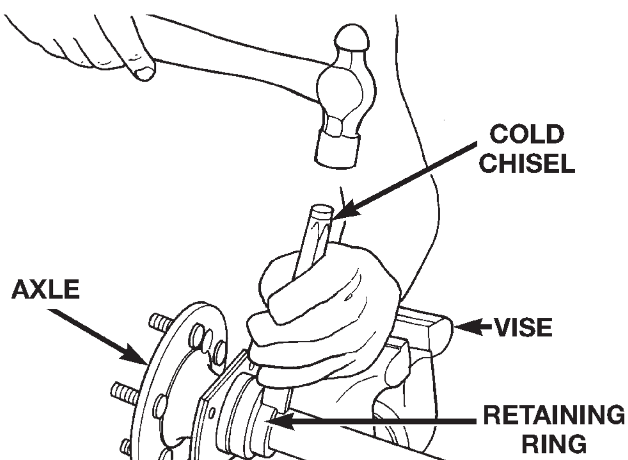


Fig. 26 Cut Retaining Ring

(4) Slide retaining ring from axle shaft.

(5) Using Splitter 1130 placed between the seal and bearing and a suitable Arbor Press, press unit bearing from axle shaft (Fig. 27).

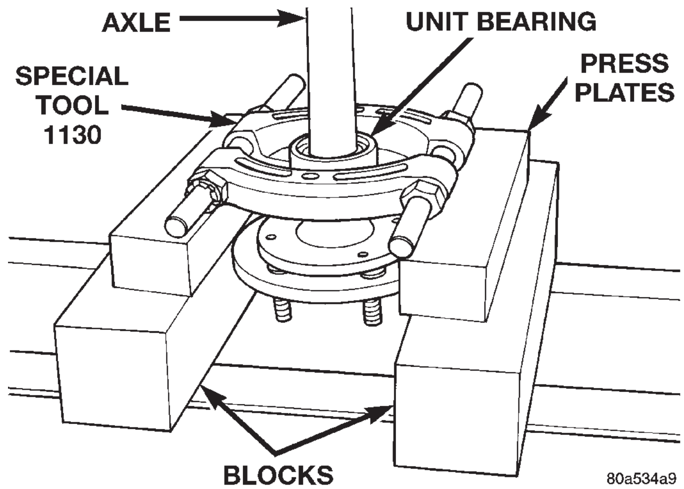


Fig. 27 Axle Bearing and Seal Remove

(6) Slide seal from axle.

(7) Slide retaining plate from axle shaft.

INSTALLATION

(1) Using a suitable straight edge, verify flatness of axle shaft retaining plate. Replace plate if warped.

(2) Install retaining plate on axle (Fig. 28).

(3) Apply a coat of multi-purpose grease on sealing surface of axle seal.

(4) Install seal on axle with cavity away from retaining plate (Fig. 28).

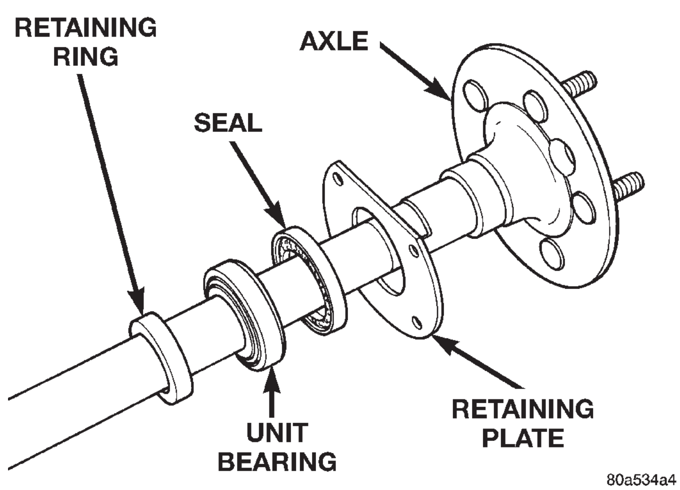


Fig. 28 Axle Bearing and Seal Components

(5) Lubricate bearing with Mopar® Wheel Bearing Grease, or equivalent. Wipe excess grease from outside of bearing.

(6) Slide bearing onto axle shaft with groove in outer surface toward seal (Fig. 28).

REMOVAL AND INSTALLATION (Continued)

(7) Using Installer 7913 and shop press, press bearing onto axle shaft (Fig. 29).

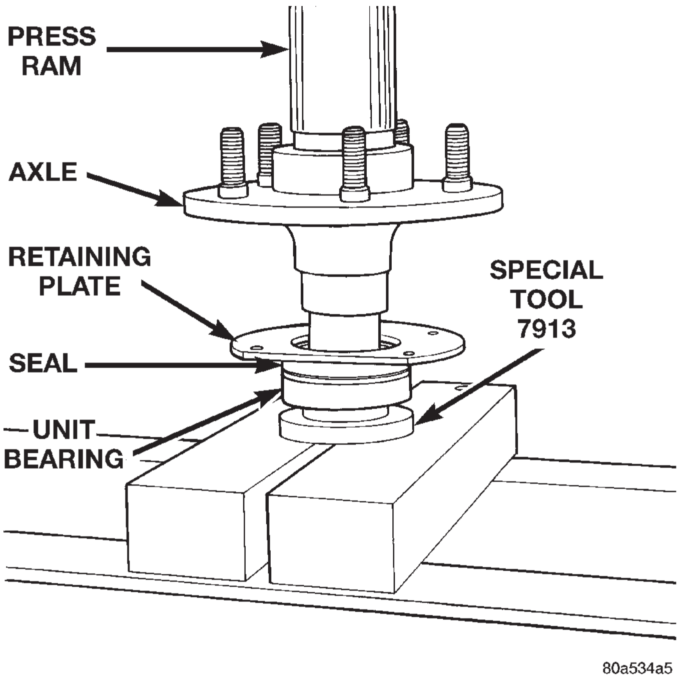


Fig. 29 Press Bearing On Axle

(8) Using Installer 7913 and shop press, press soft metal retaining ring onto axle shaft (Fig. 30).

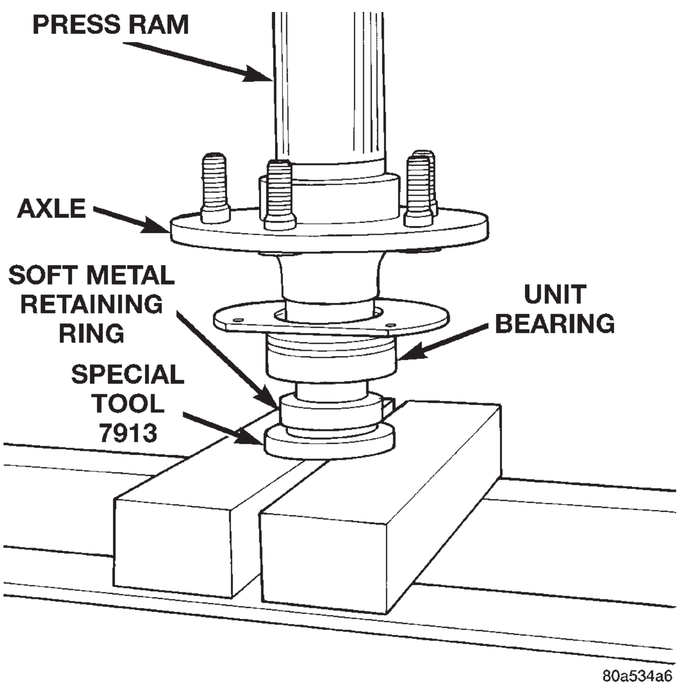


Fig. 30 Press Bearing Retaining Ring On Axle

(9) Install axle in vehicle.

DIFFERENTIAL

REMOVAL

(1) Raise and support vehicle.

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

(3) Remove the differential housing cover and allow fluid to drain.

(4) Remove axle shafts.

(5) Note the installation reference letters stamped on the bearing caps and housing machined sealing surface (Fig. 31).

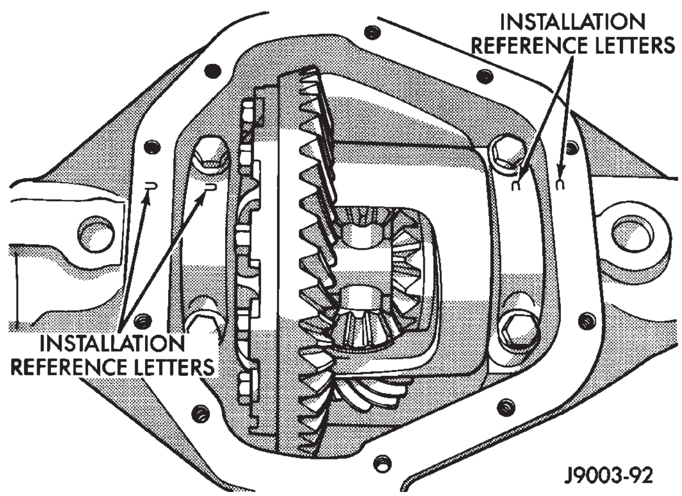


Fig. 31 Bearing Cap Identification

(6) Loosen the differential bearing cap bolts.

(7) Position Spreader W–129–B, utilizing some items from Adapter set 6987, with the tool dowel pins seated in the locating holes (Fig. 32). Install the hold-down clamps and tighten the tool turnbuckle finger–tight.

(8) Install a Pilot Stud C-3288-B at the left side of the differential housing. Attach Dial Indicator C-3339 to pilot stud. Load the indicator plunger against the opposite side of the housing (Fig. 33) and zero the indicator.

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

(9) Spread the housing enough to remove the differential case from the housing. Measure the distance with the dial indicator (Fig. 34).

(10) Remove the dial indicator.

(11) While holding the differential case in position, remove the differential bearing cap bolts and caps.

(12) Remove the differential from the housing. Ensure that the differential bearing cups remain in position on the differential bearings (Fig. 35).

REMOVAL AND INSTALLATION (Continued)

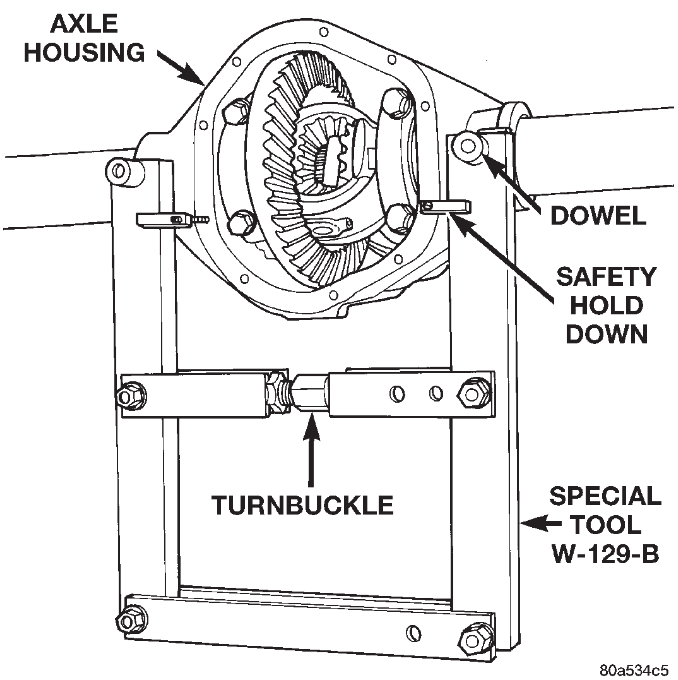


Fig. 32 Install Axle Housing Spreader

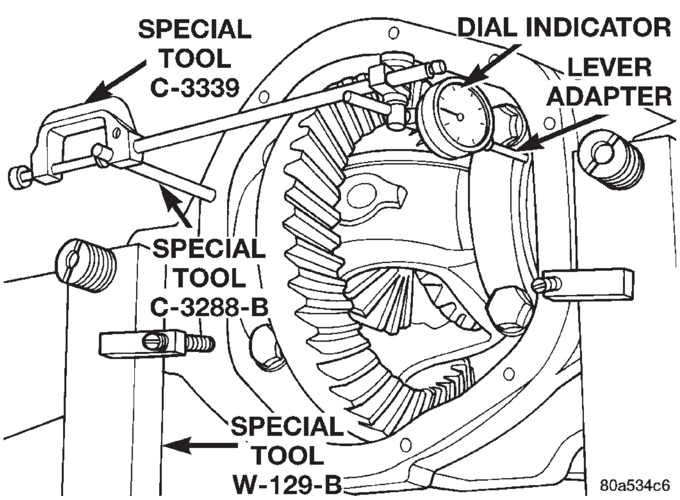


Fig. 33 Install Dial Indicator

(13) Mark or tag the differential bearing cups to indicate which side of the differential they were removed from.

(14) Retrieve differential case preload shims from axle housing. Mark or tag the differential case preload shims to indicate which side of the differential they were removed from.

(15) Remove spreader from housing.

INSTALLATION

If replacement differential bearings or differential case are being installed, differential side bearing shim requirements may change. Refer to the Differential Bearing Preload and Gear Backlash procedures in this section to determine the proper shim selection.

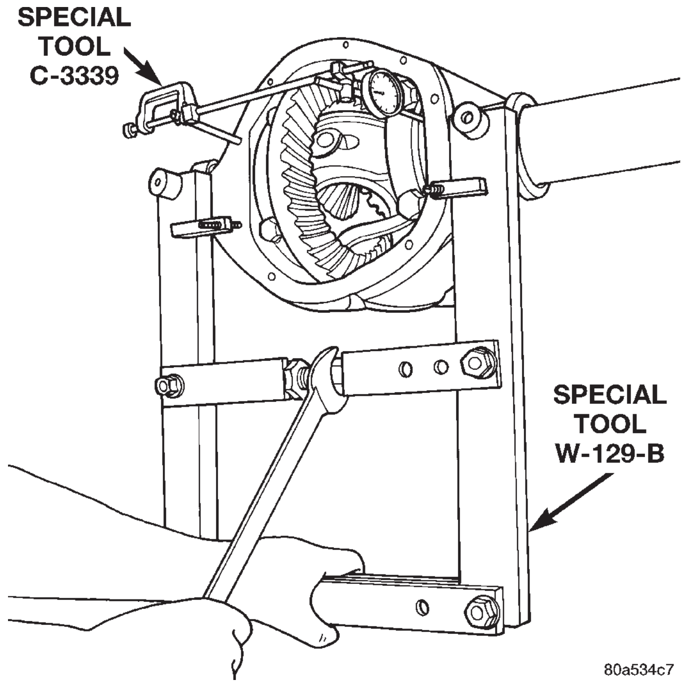


Fig. 34 Spread Axle Housing

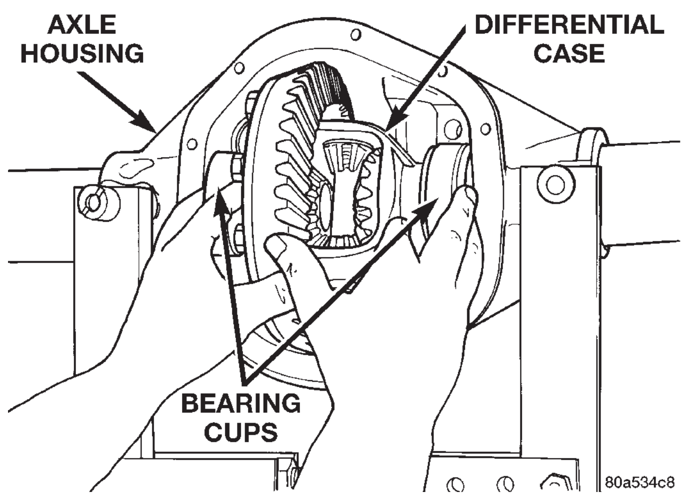


Fig. 35 Differential Case Removal

(1) Position Spreader W–129–B, utilizing some items from Adapter set 6987, with the tool dowel pins seated in the locating holes (Fig. 36). Install the hold-down clamps and tighten the tool turnbuckle finger–tight.

(2) Install a Pilot Stud C-3288-B at the left side of the differential housing. Attach Dial Indicator C-3339 to pilot stud. Load the indicator plunger against the opposite side of the housing (Fig. 33) and zero the indicator.

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

REMOVAL AND INSTALLATION (Continued)

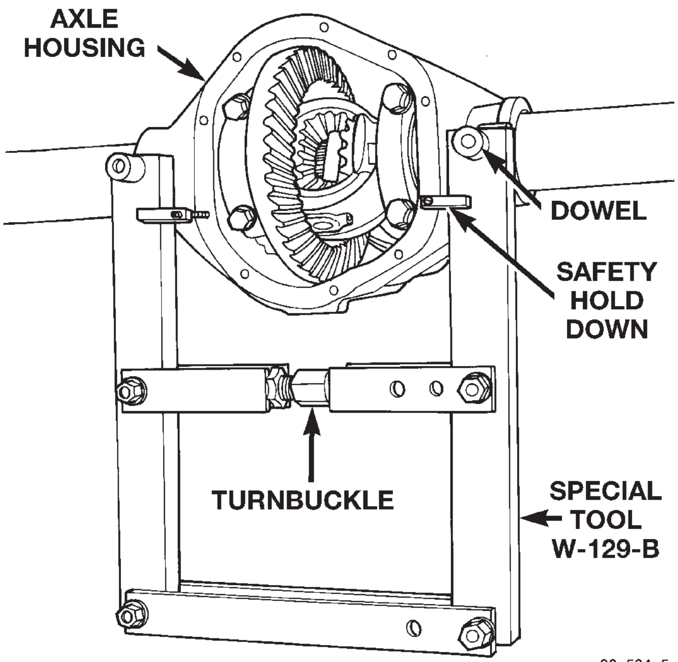


Fig. 36 Install Axle Housing Spreader

(3) Spread the housing enough to install the case in the housing. Measure the distance with the dial indicator (Fig. 34).

(4) Remove the dial indicator.

(5) Install differential case in the housing. Ensure that the differential bearing cups remain in position on the differential bearings and that the preload shims remain between the face of the bearing cup and the housing. Also verify that the pick-up opening of the Vari-lok™ plenum is at the bottom of the housing. Tap the differential case to ensure the bearings cups and shims are fully seated in the housing.

(6) Install the bearing caps at their original locations (Fig. 37).

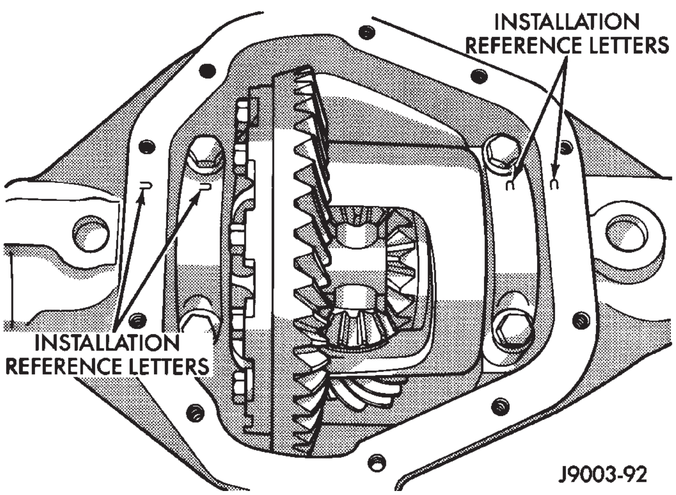


Fig. 37 Differential Bearing Cap Reference Letters

(7) Loosely install differential bearing cap bolts.

(8) Remove axle housing spreader.

(9) Tighten the bearing cap bolts to 77 N·m (57 ft. lbs.) torque.

(10) Install the axle shafts.

DIFFERENTIAL SIDE BEARINGS

REMOVAL

(1) Remove differential case from axle housing.

(2) Remove the bearings from the differential case with Puller/Press C-293-PA, Adapters 8353, and Plug C-293-3 (Fig. 38).

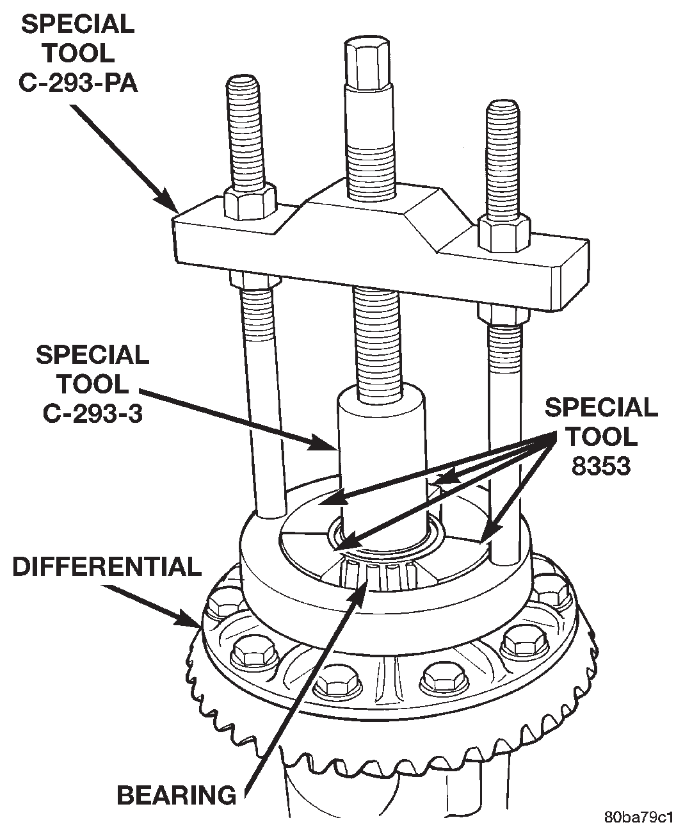


Fig. 38 Differential Bearing Removal

INSTALLATION

(1) Using tool C-4340 with handle C-4171, install differential side bearings (Fig. 39).

(2) Install differential case in axle housing.

VARI-LOK™ PLENUM

REMOVAL

(1) Remove differential case from axle housing.

(2) Remove the bearing from the ring gear side of the differential case with Puller/Press C-293-PA, Adapter Blocks 8353, and Plug C-293-3 (Fig. 40).

(3) Remove the Vari-lok™ plenum from the differential case hub.

REMOVAL AND INSTALLATION (Continued)

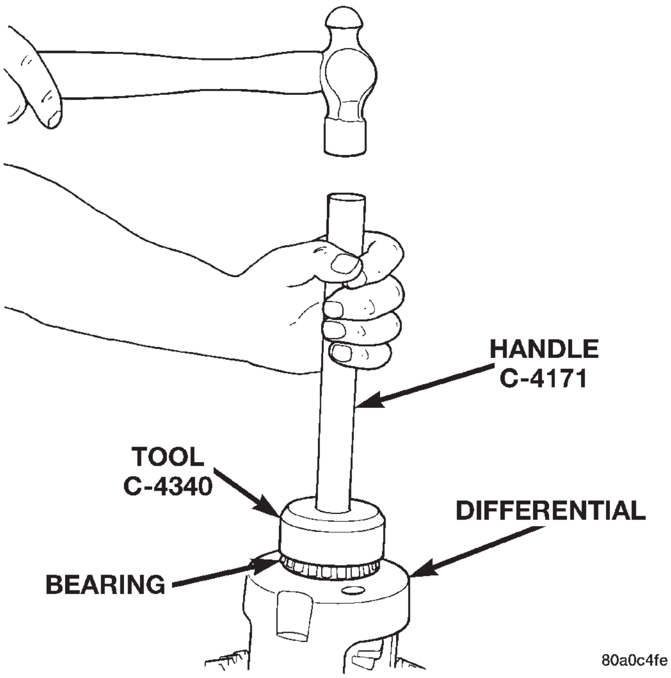


Fig. 39 Install Differential Side Bearings

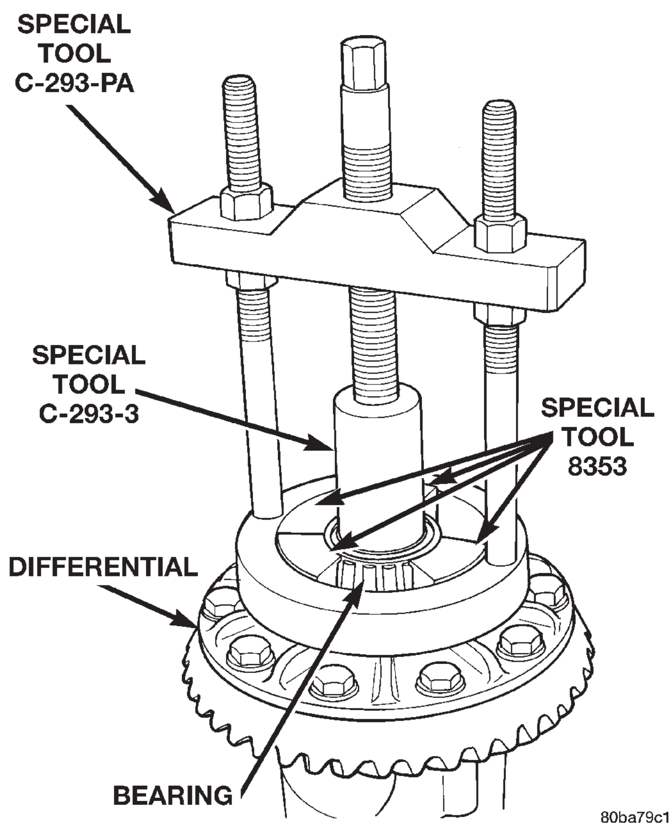


Fig. 40 Differential Bearing Removal

WARNING: Do not touch the Vari-lok™ tuning reed valve located under the Vari-lok™ plenum on the differential case. The metal is very sensitive and the unit will not operate properly if the reed valve is disturbed.

INSTALLATION

If a replacement differential side bearing is being installed, differential side bearing shim requirements may change. Refer to the Differential Bearing Preload and Gear Backlash procedures in this section to determine the proper shim selection.

(1) Install a new Vari-lok™ plenum onto the differential case hub. The plenum is to be installed with the rubber seal toward the differential case and the raised metal tabs away from the differential case.

CAUTION: Be sure that the Vari-lok™ plenum is fully seated against the differential case prior to installing the ring gear side differential bearing.

(2) Using Installer C-4340 and Handle C-4171, install differential side bearing (Fig. 41).

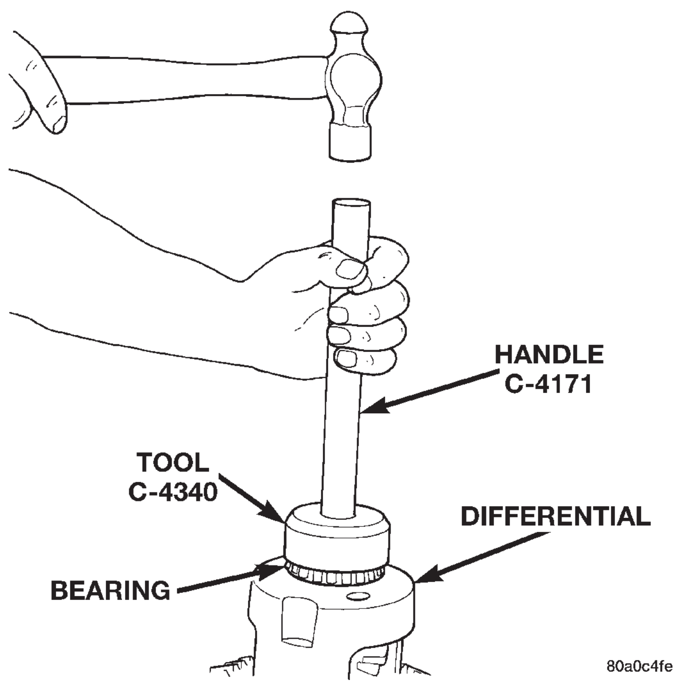


Fig. 41 Differential Side Bearing Installation

(3) Install differential in axle housing.

RING GEAR

NOTE: The ring and pinion gears are service in a matched set. Do not replace the ring gear without replacing the pinion gear.

REMOVAL

(1) Remove differential from axle housing.

REMOVAL AND INSTALLATION (Continued)

(2) Place differential case in a suitable vise with soft metal jaw protectors. (Fig. 42)

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

(4) Using a soft hammer, drive ring gear from differential case (Fig. 42).

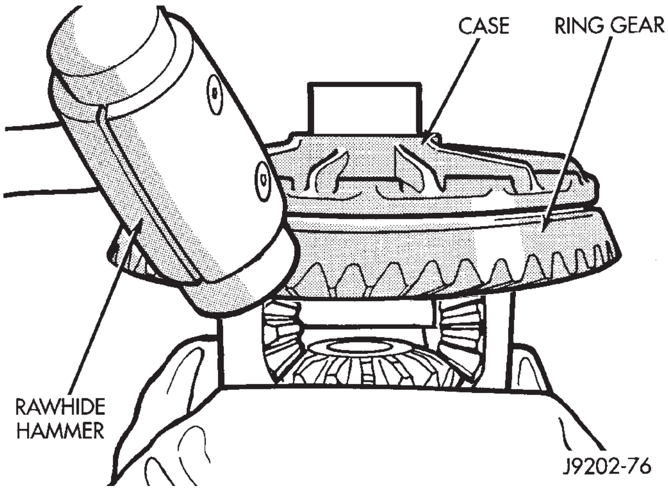


Fig. 42 Ring Gear Removal

INSTALLATION

CAUTION: Do not reuse the bolts that held the ring gear to the differential case. The bolts can fracture causing extensive damage.

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

(2) Invert the differential case in the vise.

(3) Install new ring gear bolts and alternately tighten to 95–122 N·m (70–90 ft. lbs.) torque (Fig. 43).

(4) Install differential in axle housing and verify gear mesh and contact pattern.

PINION GEAR

NOTE: The ring and pinion gears are service in a matched set. Do not replace the pinion gear without replacing the ring gear.

REMOVAL

(1) Remove differential assembly from axle housing.

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

(3) Disconnect propeller shaft from pinion yoke. Using suitable wire, tie propeller shaft to underbody.

(4) Using Holder 6958 to hold yoke and a short length of 1 in. pipe, remove the pinion yoke nut and washer (Fig. 44).

(5) Using Remover C-452 and Wrench C-3281, remove the pinion yoke from pinion shaft (Fig. 45).

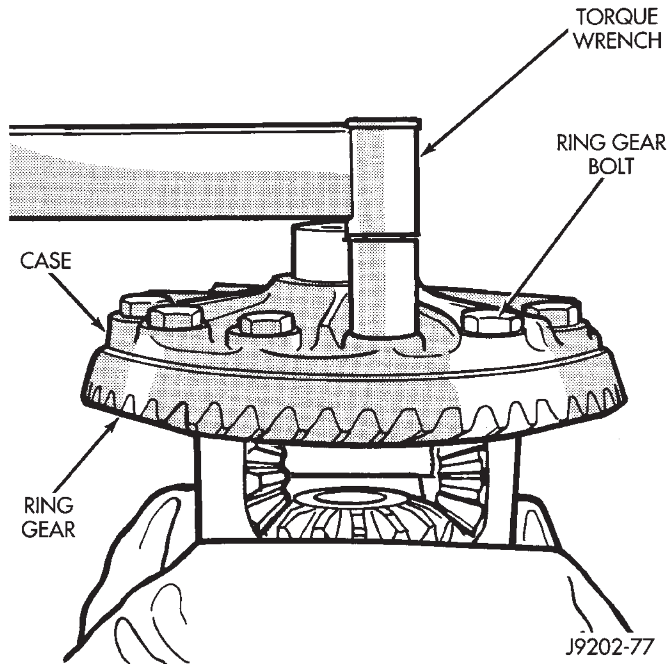


Fig. 43 Ring Gear Bolt Installation

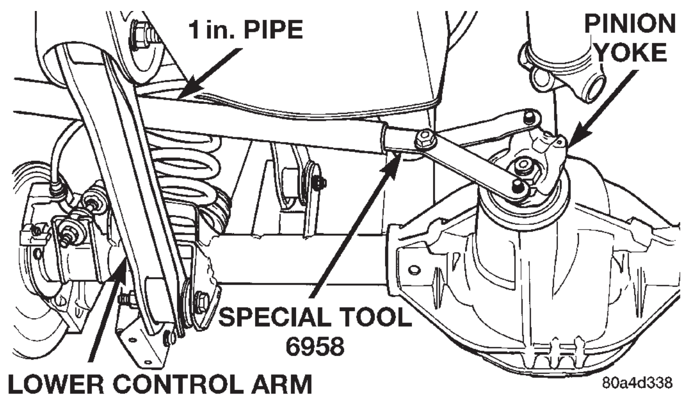


Fig. 44 Pinion Yoke Holder

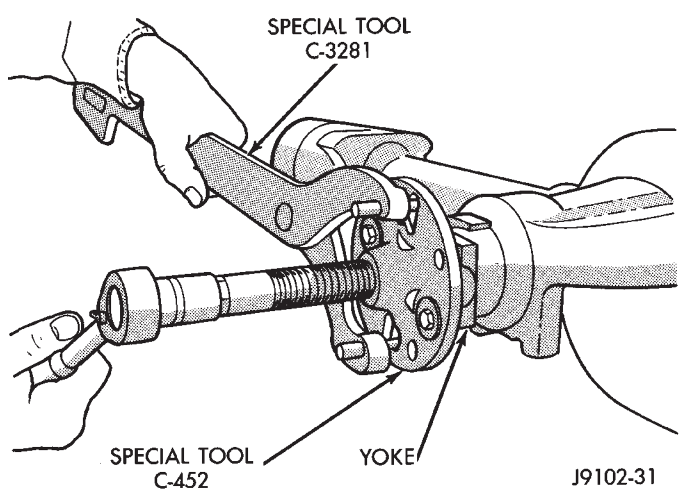


Fig. 45 Pinion Yoke Removal

REMOVAL AND INSTALLATION (Continued)

(6) Remove the pinion gear from housing (Fig. 46). Catch the pinion with your hand to prevent it from falling and being damaged.

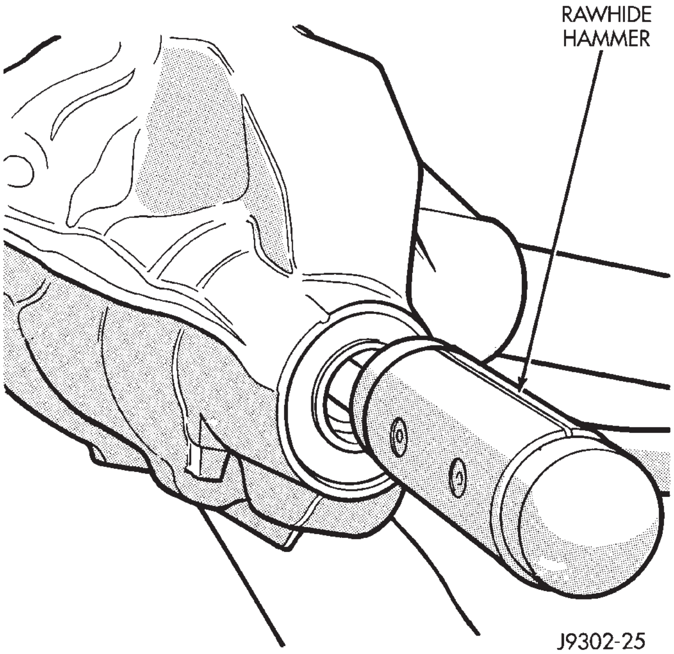


Fig. 46 Remove Pinion Gear

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

(8) Remove oil slinger, if equipped, and the front pinion bearing.

(9) Remove the front pinion bearing cup with Remover D-103 and Handle C-4171 (Fig. 47).

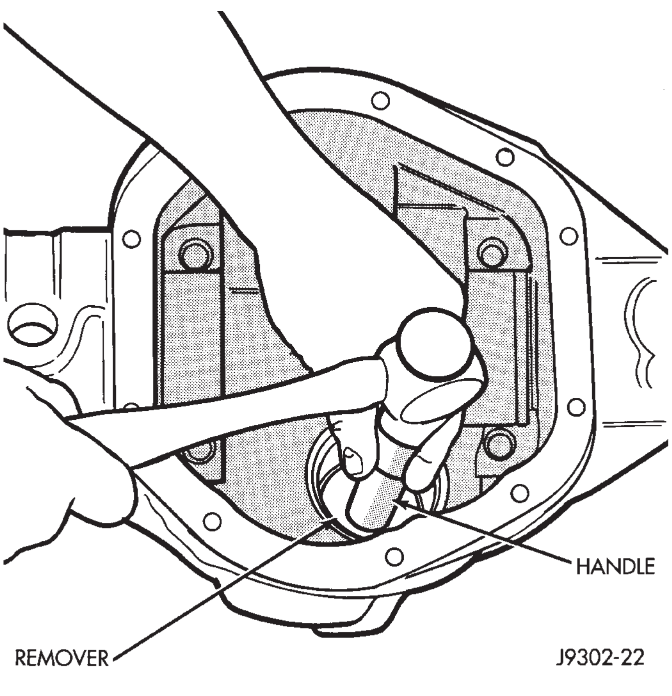


Fig. 47 Front Bearing Cup Removal

(10) Remove the rear bearing cup from housing (Fig. 48). Use Remover C-4307 and Handle C-4171.

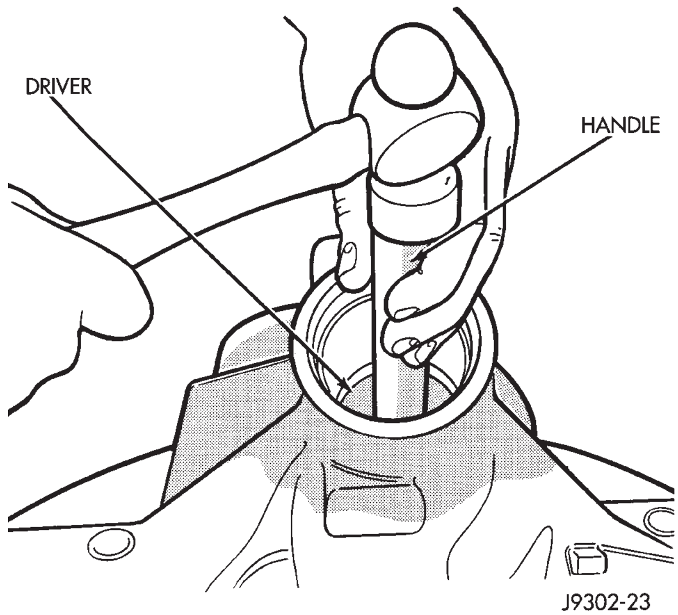


Fig. 48 Rear Bearing Cup Removal

(11) Remove the collapsible preload spacer (Fig. 49).

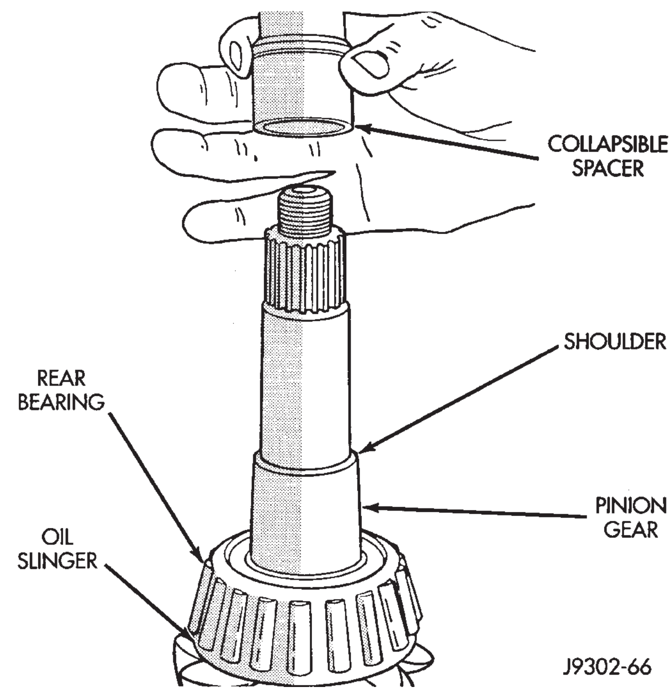


Fig. 49 Collapsible Spacer

(12) Remove the rear bearing from the pinion with Puller/Press C-293-PA and Adapters C-293-42 (Fig. 50).

Place 4 adapter blocks so they do not damage the bearing cage.

REMOVAL AND INSTALLATION (Continued)

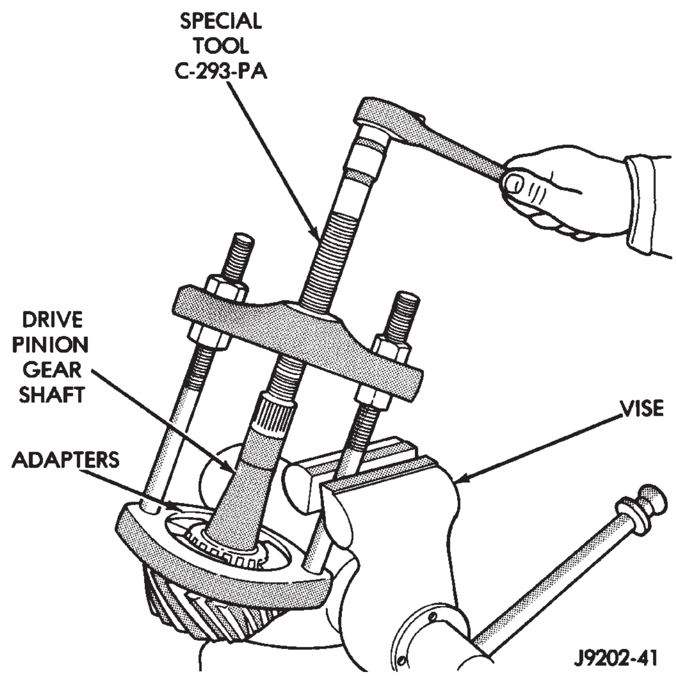


Fig. 50 Inner Bearing Removal

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

INSTALLATION

(1) Apply Mopar® Door Ease stick lubricant to outside surface of bearing cup. Install the pinion rear bearing cup with Installer C-4308 and Driver Handle C-4171 (Fig. 51). Ensure cup is correctly seated.

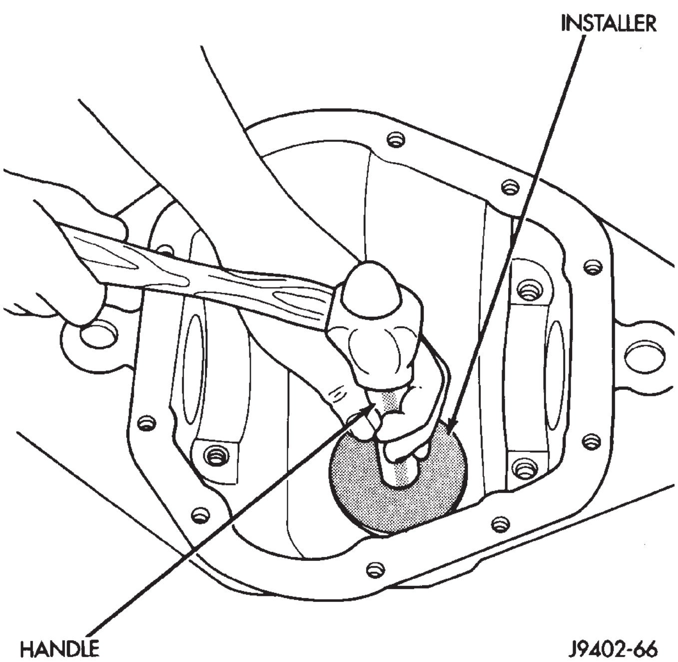


Fig. 51 Pinion Rear Bearing Cup Installation

(2) Apply Mopar® Door Ease stick lubricant to outside surface of bearing cup. Install the pinion front bearing cup with Installer D-129 and Handle C-4171 (Fig. 52).

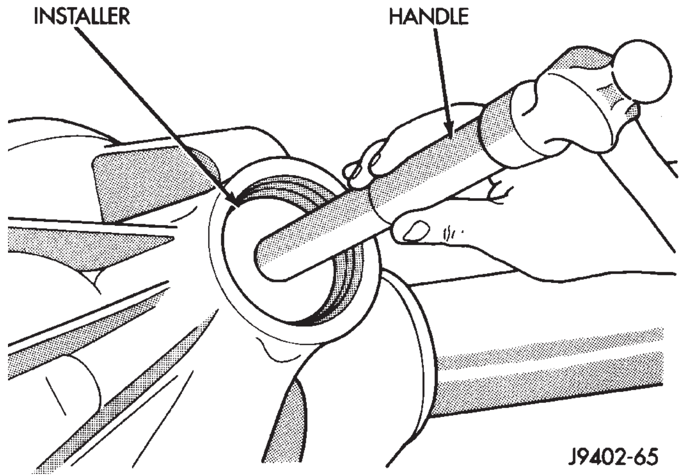


Fig. 52 Pinion Front Bearing Cup Installation

(3) Install pinion front bearing and oil slinger, if equipped. Apply a light coating of gear lubricant on the lip of pinion seal. Install seal with Installer C-3972-A and Handle C-4171 (Fig. 53).

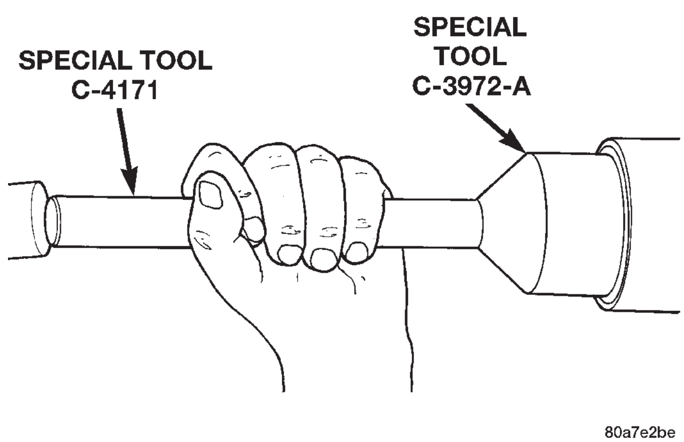


Fig. 53 Pinion Seal Installation

NOTE: Pinion depth shims are placed between the rear pinion bearing cone and pinion gear to achieve proper ring and pinion gear mesh. If the factory installed ring and pinion gears are reused, the pinion depth shim should not require replacement or adjustment. Refer to Pinion Gear Depth paragraph in this section to select the proper thickness shim before installing rear pinion bearing cone.

(4) Place the proper thickness pinion depth shim on the pinion gear.

(5) Install the rear bearing (and slinger if used) on the pinion gear with Installer 6448 (Fig. 54).

REMOVAL AND INSTALLATION (Continued)

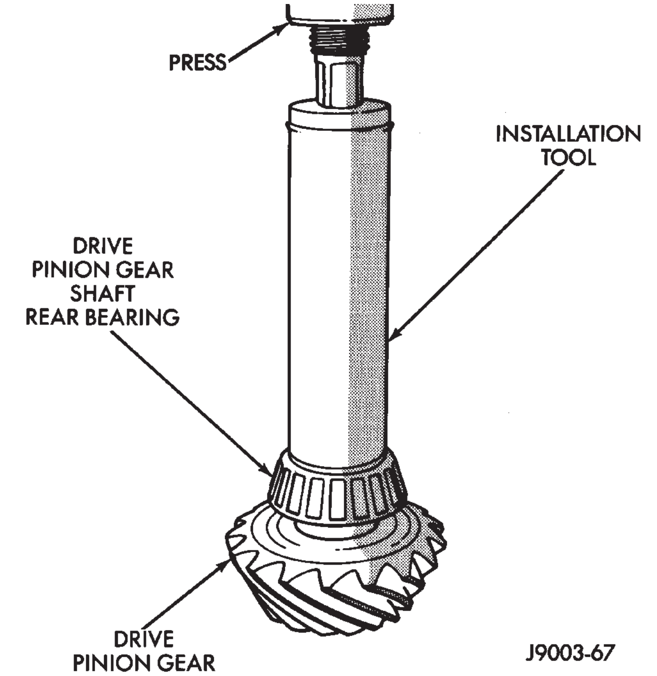


Fig. 54 Shaft Rear Bearing Installation

(6) Install a new collapsible preload spacer on pinion shaft (Fig. 55).

(7) Install pinion gear in housing.

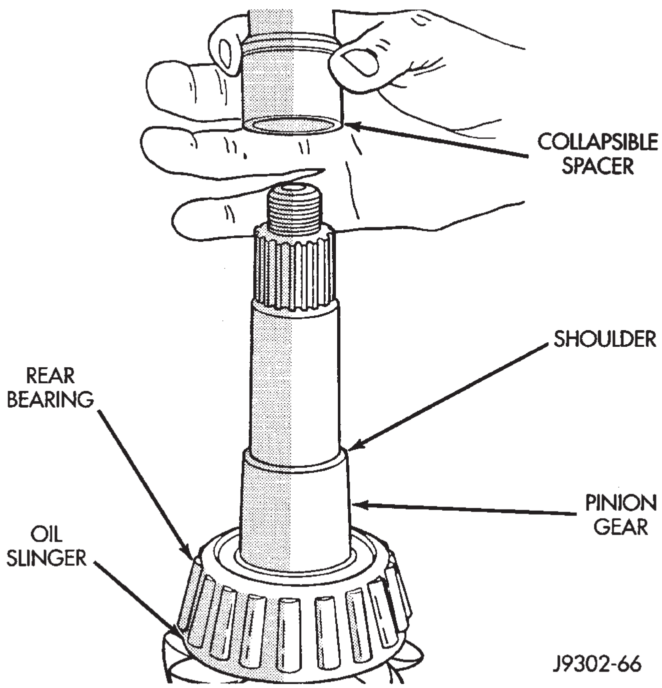


Fig. 55 Collapsible Preload Spacer

(8) Install yoke with Installer C-3718 and holder 6958 (Fig. 56).

(9) Install the yoke washer and a new nut on the pinion gear. Tighten the nut to 298 N·m (220 ft. lbs.) minimum. **Do not over-tighten.** Maximum torque is 380 N·m (280 ft. lbs.).

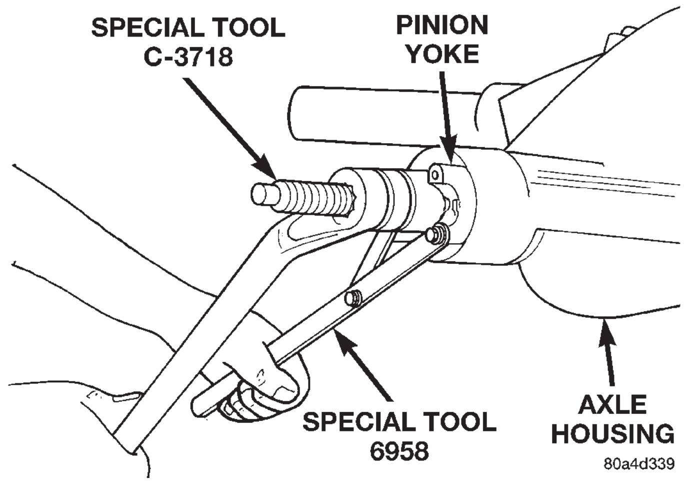


Fig. 56 Pinion Yoke Installation

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.

NOTE: If the spacer requires more than 280 ft. lbs. torque to crush, the collapsible spacer is defective.

(10) Using yoke holder 6958, a short length of 1 in. pipe, and a torque wrench set at 380 N·m (280 ft. lbs.), crush collapsible spacer until bearing end play is taken up (Fig. 57).

(11) Slowly tighten the nut in 6.8 N·m (5 ft. lbs.) increments until the rotating torque is achieved. Measure the rotating torque frequently to avoid over crushing the collapsible spacer (Fig. 58).

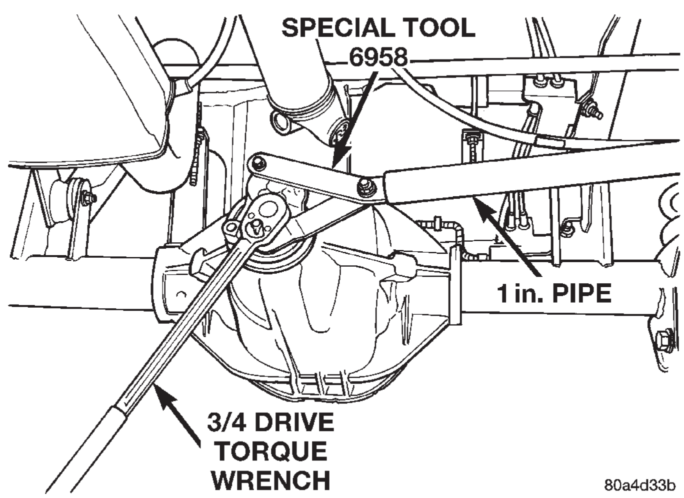


Fig. 57 Tightening Pinion Nut

(12) Rotate the pinion a minimum of ten times. Make sure that the pinion rotates smoothly. Check bearing rotating torque with an inch pound torque

REMOVAL AND INSTALLATION (Continued)

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 — 2.26 to 4.52 N·m (20 to 40 in. lbs.).

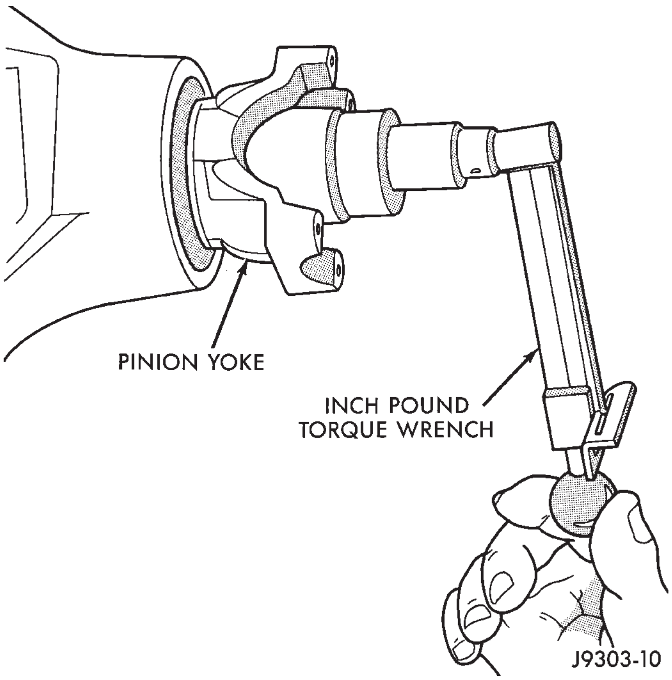


Fig. 58 Check Pinion Gear Rotation Torque

(13) Align previously made marks on yoke and propeller shaft and install propeller shaft.

(14) Install differential housing into the axle housing.

FINAL ASSEMBLY

(1) 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, or equivalent, on the housing cover (Fig. 59).

Install the housing cover within 5 minutes after applying the sealant.

(2) 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 lubricant foaming and overheating.

(3) Refill the differential housing with gear lubricant. Refer to the Lubricant Specifications section of this group for the gear lubricant requirements.

(4) Install the fill hole plug.

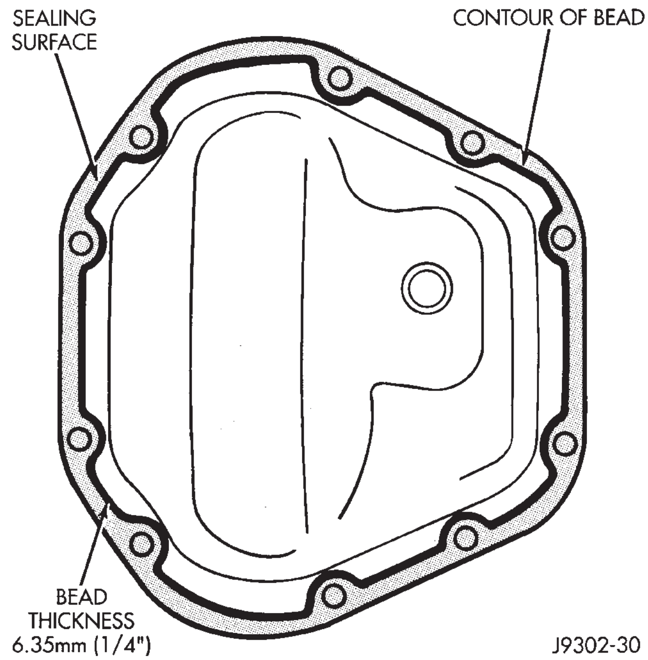


Fig. 59 Typical Housing Cover With Sealant

DISASSEMBLY AND ASSEMBLY

STANDARD DIFFERENTIAL

DISASSEMBLY

(1) Remove pinion gear mate shaft lock screw (Fig. 60).

(2) Remove pinion gear mate shaft.

(3) Rotate the differential side gears and remove the pinion mate gears and thrust washers (Fig. 61).

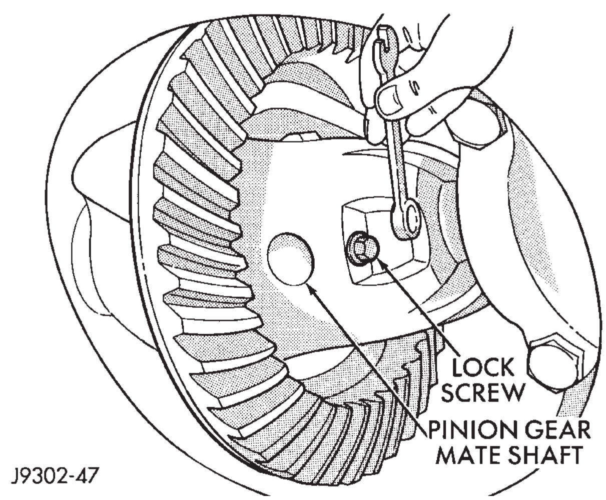


Fig. 60 Pinion Gear Mate Shaft Lock Screw

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

DISASSEMBLY AND ASSEMBLY (Continued)

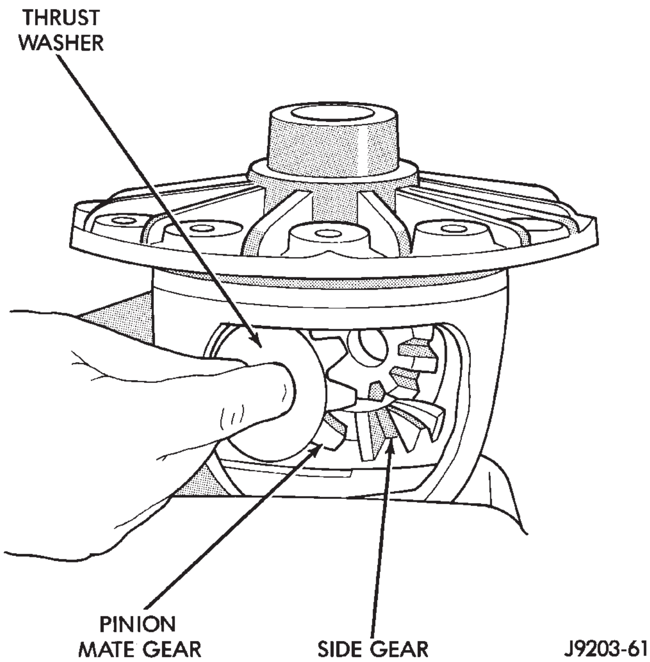


Fig. 61 Pinion Mate Gear Removal

ASSEMBLY

(1) Install the differential side gears and thrust washers.

(2) Install the pinion mate gears and thrust washers.

(3) Install the pinion gear mate shaft.

(4) Align the hole in the pinion gear mate shaft with the hole in the differential case and install the pinion gear mate shaft lock screw.

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

TRAC-LOK™ DIFFERENTIAL

The Trac–Lok™ differential components are illustrated in (Fig. 62). Refer to this illustration during repair service.

DISASSEMBLY

(1) Clamp Side Gear Holding Tool 6963–A in a vise.

(2) Position the differential case on Side Gear Holding Tool 6963-A (Fig. 63).

(3) Remove ring gear, if necessary. Ring gear removal is necessary only if the ring gear is to be replaced. The Trac-Lok™ differential can be serviced with the ring gear installed.

(4) Remove the pinion gear mate shaft lock screw (Fig. 64).

(5) Remove the pinion gear mate shaft. If necessary, use a drift and hammer (Fig. 65).

(6) Install and lubricate Step Plate C–4487–1 (Fig. 66).

(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.

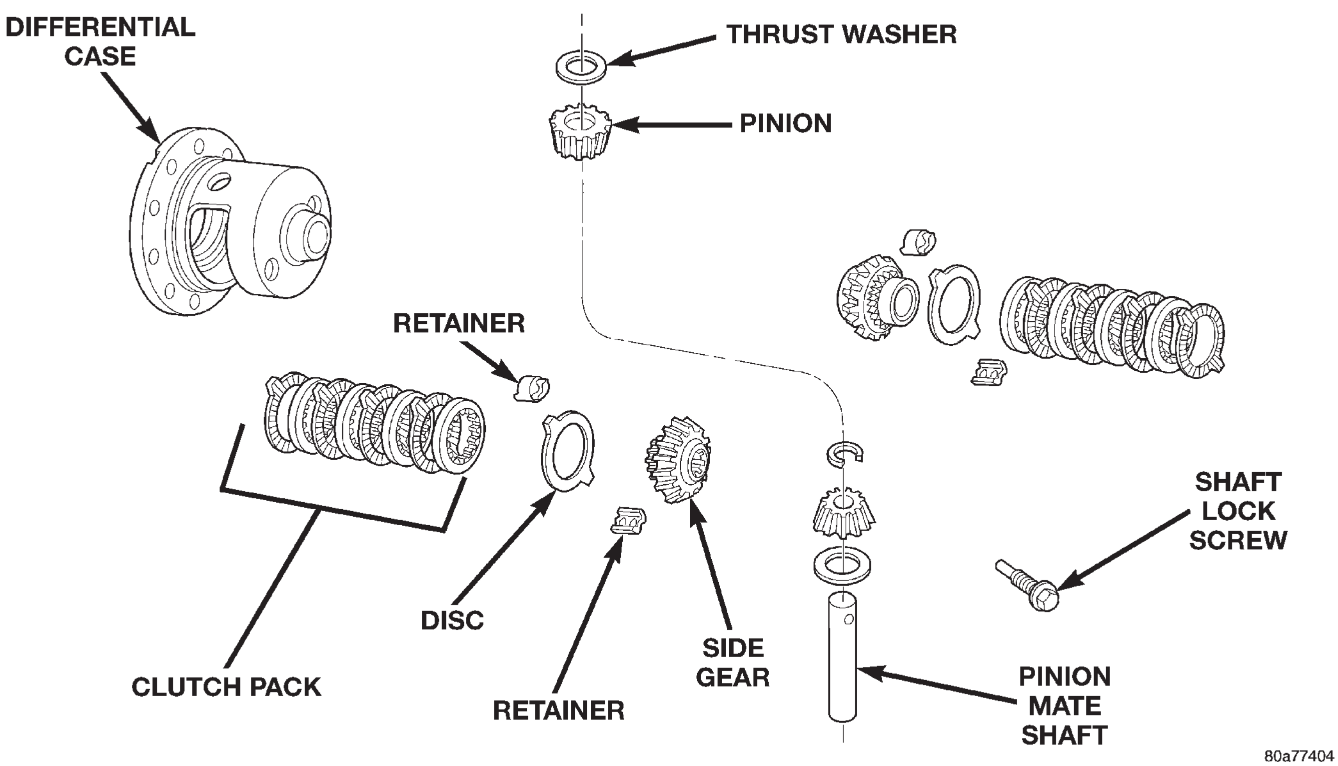


Fig. 62 Trac–Lok™ Differential Components

DISASSEMBLY AND ASSEMBLY (Continued)

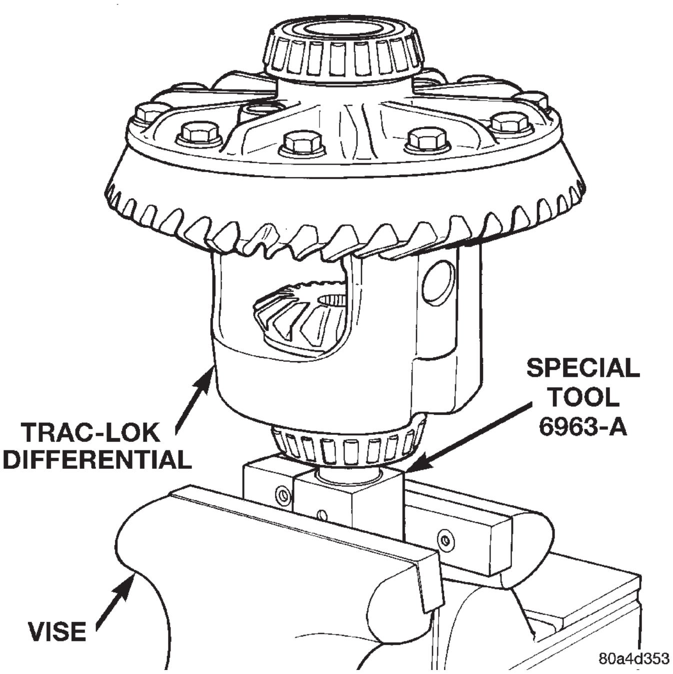


Fig. 63 Differential Case Holding Tool

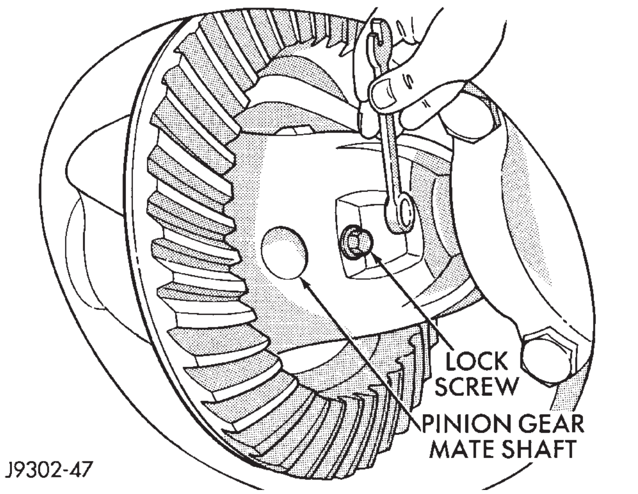


Fig. 64 Mate Shaft Lock Screw

(8) Position a small screw driver in slot of Threaded Adapter C–4487–3 (Fig. 67) to prevent adapter from turning.

(9) Tighten forcing screw tool 122 N·m (90 ft. lbs.) (maximum) to compress Belleville springs in clutch packs (Fig. 68).

(10) Using an appropriate size feeler gauge, remove thrust washers from behind the pinion gears (Fig. 69).

(11) Insert Turning Bar C–4487–4 in case (Fig. 70).

(12) Loosen the Forcing Screw C-4487-2 in small increments until the clutch pack tension is relieved and the differential case can be turned using Turning Bar C-4487-4.

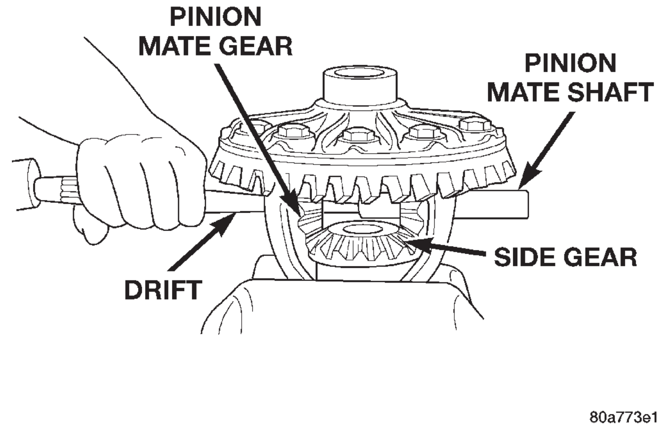


Fig. 65 Mate Shaft Removal

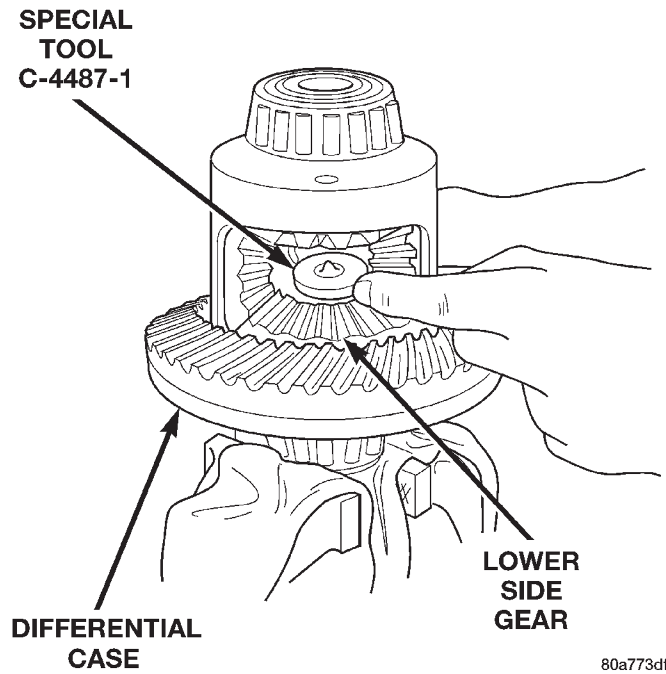


Fig. 66 Step Plate Tool Installation

(13) Rotate differential case until the pinion gears can be removed.

(14) Remove pinion gears from differential case.

(15) Remove Forcing Screw C–4487-2, Step Plate C-4487-1, and Threaded Adapter C-4487-3.

(16) Remove top side gear, clutch pack retainer, and clutch pack. Keep plates in correct order during removal (Fig. 71).

(17) Remove differential case from Side Gear Holding Tool 6963-A. Remove side gear, clutch pack retainer, and clutch pack. Keep plates in correct order during removal.

DISASSEMBLY AND ASSEMBLY (Continued)

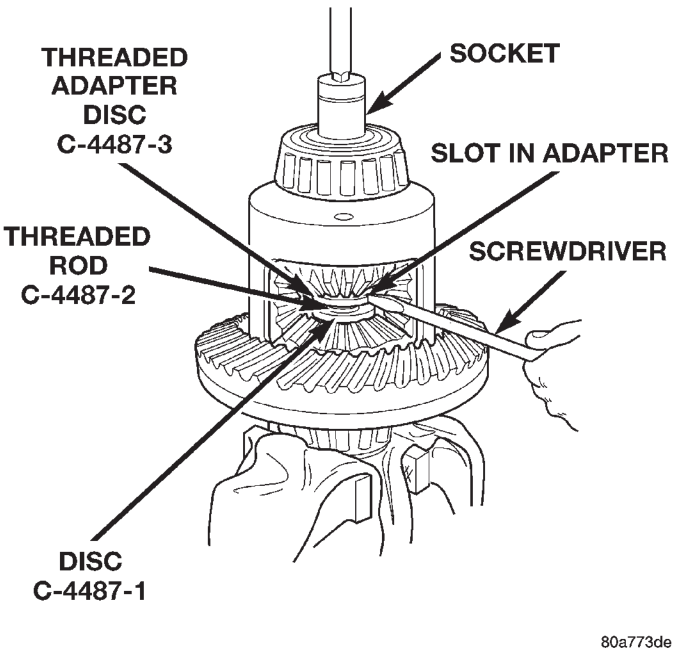


Fig. 67 Threaded Adapter Installation

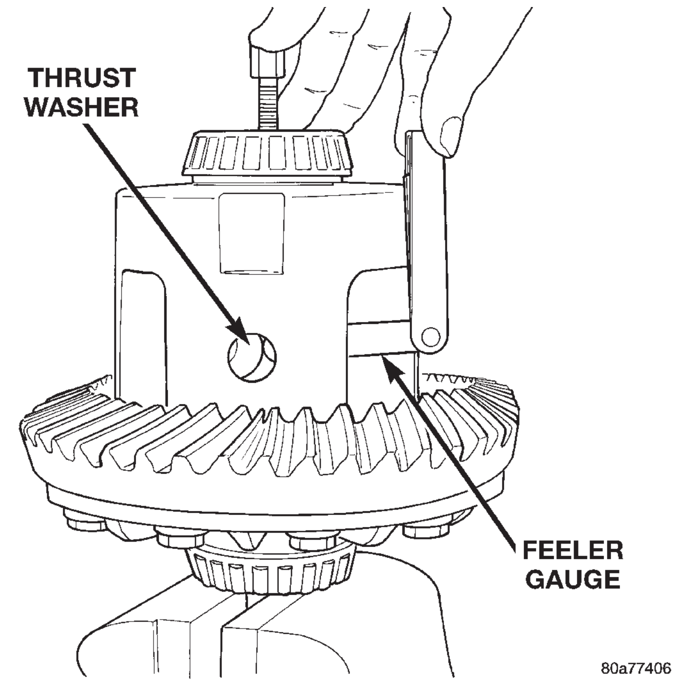


Fig. 69 Remove Pinion Gear Thrust Washer

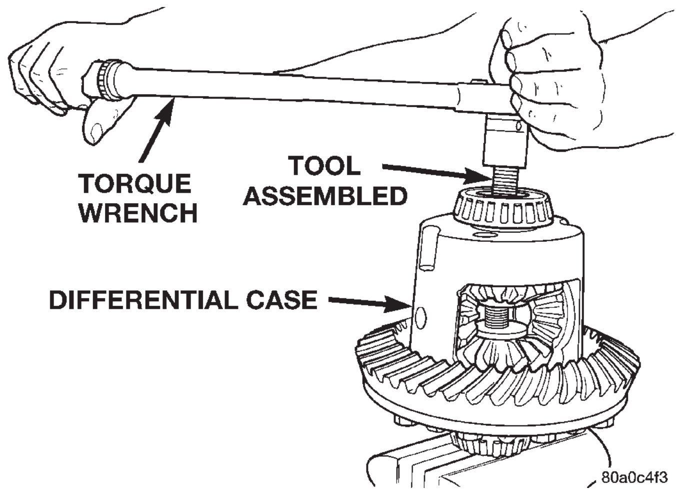


Fig. 68 Tighten Belleville Spring Compressor Tool

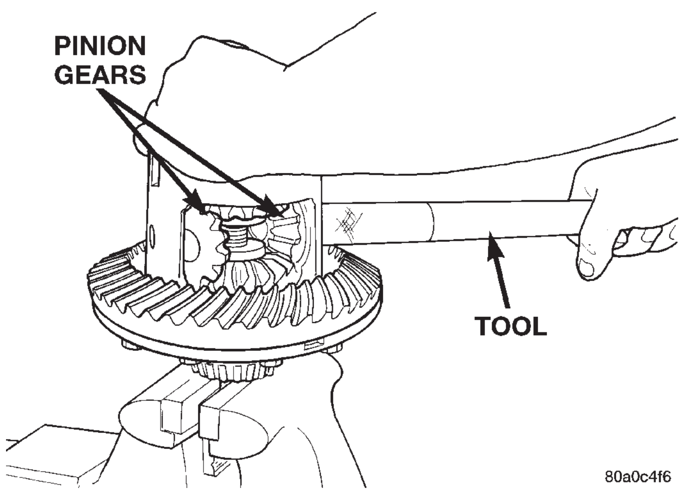


Fig. 70 Pinion Gear Removal

ASSEMBLY

NOTE: 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 and secure disc packs with retaining clips (Fig. 72).

(2) Position assembled clutch disc packs on the side gear hubs.

(3) Install clutch pack and side gear in the ring gear side of the differential case (Fig. 73). **Be sure clutch pack retaining clips remain in position and are seated in the case pockets.**

(4) Position the differential case on Side Gear Holding Tool 6963-A.

(5) Install lubricated Step Plate C–4487–1 on side gear (Fig. 74).

(6) Install the upper side gear and clutch disc pack (Fig. 74).

(7) Hold assembly in position. Insert Threaded Adapter C–4487–3 into top side gear.

(8) Insert Forcing Screw C–4487–2.

(9) Tighten forcing screw tool to slightly compress clutch discs.

(10) Place pinion gears in position in side gears and verify that the pinion mate shaft hole is aligned.

(11) Rotate case with Turning Bar C–4487–4 until the pinion mate shaft holes in pinion gears align with holes in case. It may be necessary to slightly

DISASSEMBLY AND ASSEMBLY (Continued)

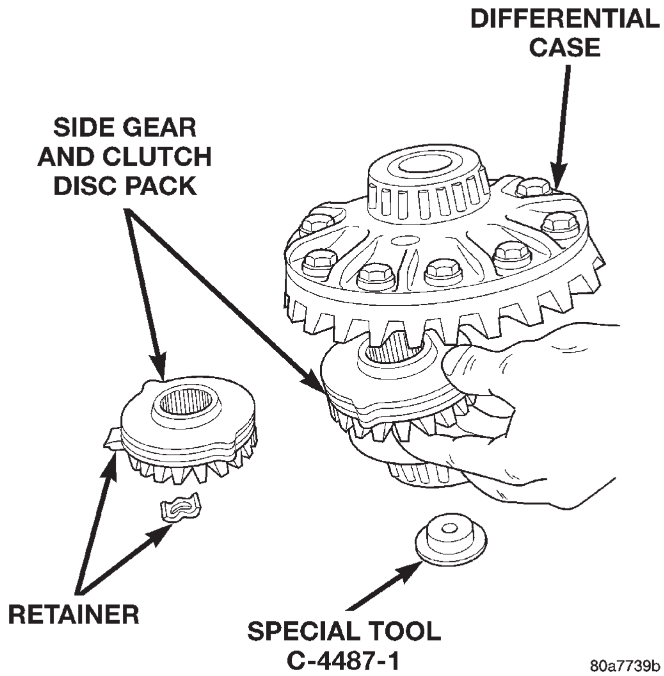


Fig. 71 Side Gear & Clutch Disc Removal

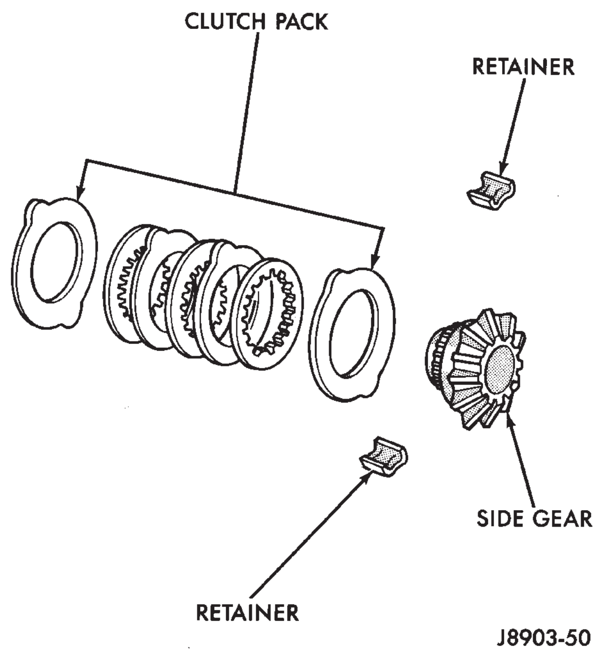


Fig. 72 Clutch Disc Pack

tighten the forcing screw in order to install the pinion gears.

(12) Tighten forcing screw to 122 N·m (90 ft. lbs.) to compress the Belleville springs.

(13) Lubricate and install thrust washers behind pinion gears and align washers with a small screw driver. Insert mate shaft into each pinion gear to verify alignment.

(14) Remove forcing screw, threaded adapter, and step plate.

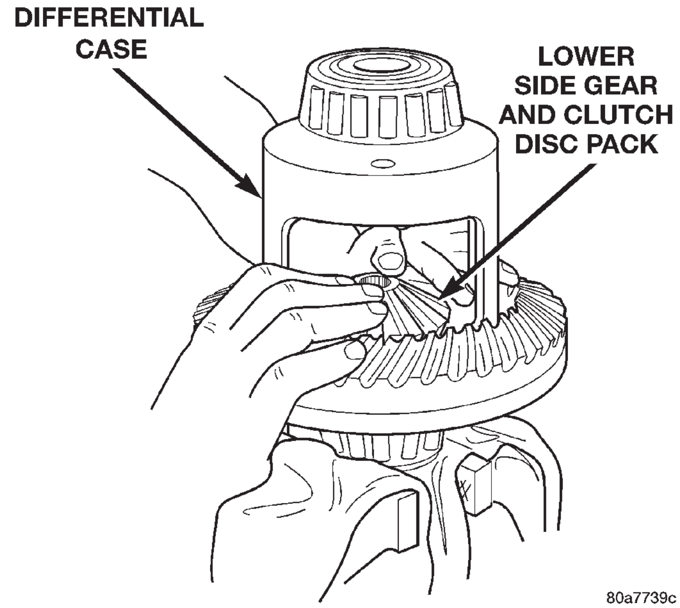


Fig. 73 Clutch Discs & Lower Side Gear Installation

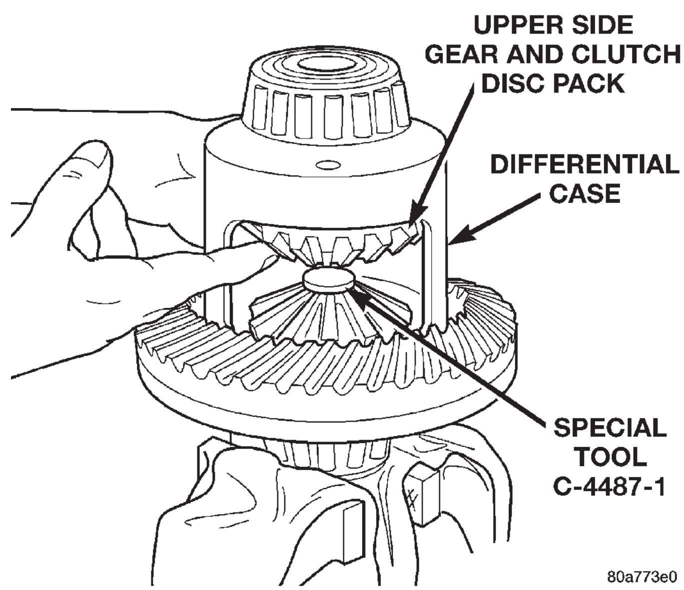


Fig. 74 Upper Side Gear & Clutch Disc Pack Installation

(15) Install pinion gear mate shaft and align holes in shaft and case.

(16) Install the pinion mate shaft lock screw finger tight to hold shaft during differential installation.

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

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

CLEANING AND INSPECTION

AXLE COMPONENTS

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, or dry with compressed air. DO NOT spin bearings with compressed air. **Cup and bearing must be replaced as matched sets only.**

Clean axle shaft tubes and oil channels in housing.

Inspect 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.

TRAC-LOK™

Clean all components in cleaning solvent. Dry components with compressed air. Inspect clutch pack plates for wear, scoring or damage. Replace both clutch packs if any one component in either pack is damaged. Inspect side and pinion gears. Replace any gear that is worn, cracked, chipped or damaged. Inspect differential case and pinion shaft. Replace if worn or damaged.

PRESOAK PLATES AND DISC

Plates and discs with fiber coating (no grooves or lines) must be presoaked in Friction Modifier before assembly. Soak plates and discs for a minimum of 20 minutes.

ADJUSTMENTS

PINION GEAR DEPTH

GENERAL 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. 75). 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 center line of the ring gear to the back face of the pinion is 109.52 mm (4.312 in.). The standard depth provides the best teeth contact pattern. Refer to Backlash and Contact Pattern Analysis Paragraph in this section for additional information.

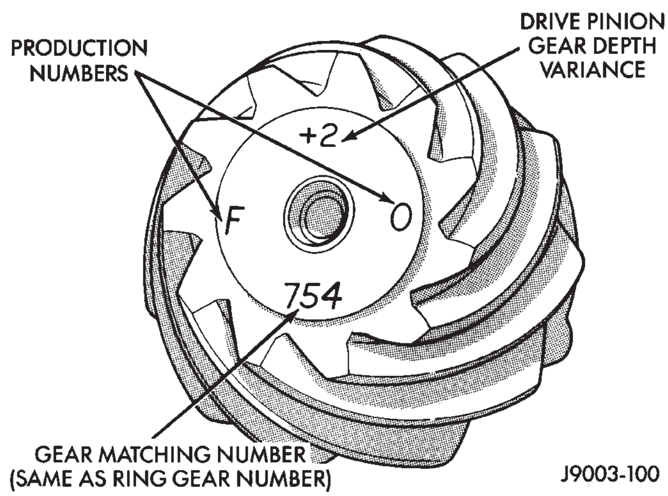


Fig. 75 Pinion Gear ID Numbers

Compensation for pinion depth variance is achieved with select shims. The shims are placed under the inner pinion bearing cone (Fig. 76).

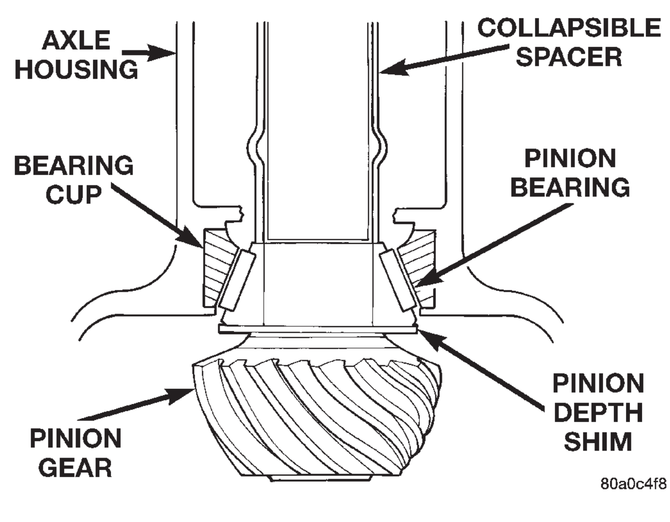


Fig. 76 Shim Locations

ADJUSTMENTS (Continued)

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

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

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

PINION DEPTH MEASUREMENT AND ADJUSTMENT

Measurements are taken with pinion cups and pinion bearings installed in housing. Take measurements with Pinion Gauge Set 6955, Dummy Bearing/ Arbor Disc Set 6956, and Dial Indicator C-3339 (Fig. 77).

(1) Assemble Pinion Height Block 6739, Pinion Block 8144, and rear pinion bearing onto Screw 6741 (Fig. 77).

(2) Insert assembled height gauge components, rear bearing and screw into axle housing through pinion bearing cups (Fig. 78).

(3) Install front pinion bearing and Cone 6740 hand tight (Fig. 77).

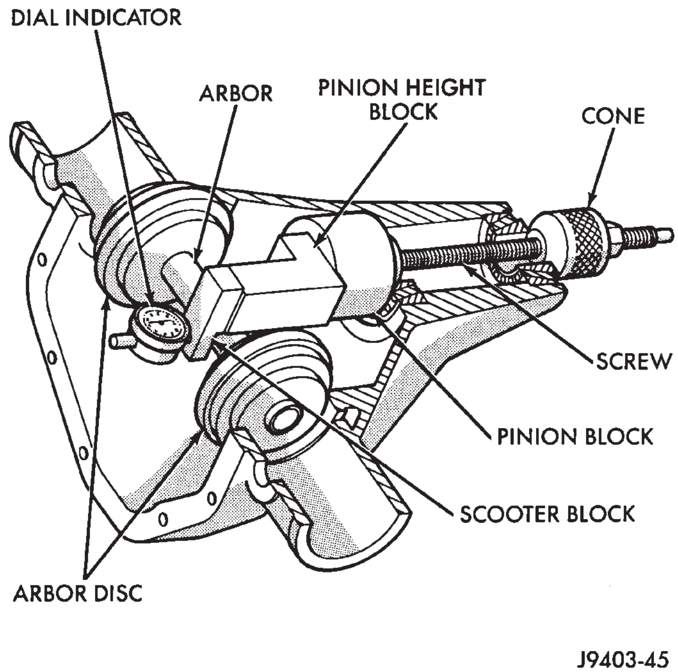


Fig. 77 Pinion Gear Depth Gauge Tools—Typical

(4) Place Arbor Disc 6927 on Arbor D-115-3 in position in axle housing side bearing cradles (Fig. 79). Install differential bearing caps on Arbor Discs and tighten cap bolts. Refer to the Torque Specifications in this section.

NOTE: Arbor Discs 6927 have different step diameters to fit other axle sizes. Pick correct size step for axle being serviced.

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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ADJUSTMENTS (Continued)

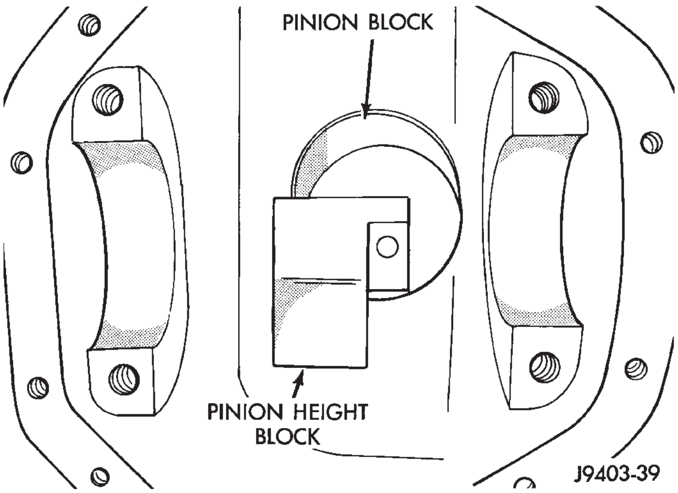


Fig. 78 Pinion Height Block—Typical

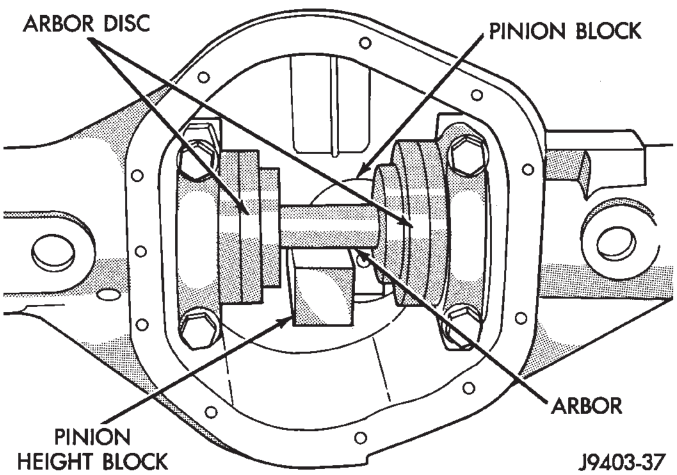


Fig. 79 Gauge Tools In Housing—Typical

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

(6) Place Scooter Block/Dial Indicator in position in axle housing so dial probe and scooter block are flush against the surface of the pinion height block. Hold scooter block in place and zero the dial indicator face to the pointer. Tighten dial indicator face lock screw.

(7) With scooter block still in position against the pinion height block, slowly slide the dial indicator probe over the edge of the pinion height block. Observe how many revolutions counterclockwise the dial pointer travels (approximately 0.125 in.) to the out-stop of the dial indicator.

(8) Slide the dial indicator probe across the gap between the pinion height block and the arbor bar with the scooter block against the pinion height block (Fig. 80). When the dial probe contacts the arbor bar, the dial pointer will turn clockwise. Bring dial pointer back to zero against the arbor bar, do not turn dial face. Continue moving the dial probe to the crest of the arbor bar and record the highest reading. If the dial indicator can not achieve the zero reading, the rear bearing cup or the pinion depth gauge set is not installed correctly.

(9) Select a shim equal to the dial indicator reading plus the drive pinion gear depth variance number etched in the face of the pinion gear (Fig. 75) using the opposite sign on the variance number. For example, if the depth variance is –2, add +0.002 in. to the dial indicator reading.

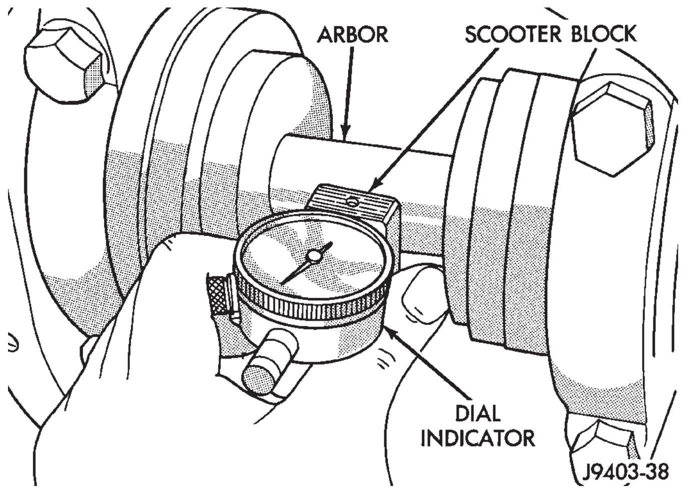


Fig. 80 Pinion Gear Depth Measurement—Typical

(10) Remove the pinion depth gauge components from the axle housing

DIFFERENTIAL BEARING PRELOAD AND GEAR BACKLASH

Differential side bearing preload and gear backlash is achieved by selective shims inserted between the bearing cup and the axle housing. The proper shim thickness can be determined using slip-fit dummy bearings 6929-A in place of the differential side bearings and a dial indicator C-3339. Before proceeding with the differential bearing preload and gear backlash measurements, measure the pinion gear depth and prepare the pinion gear for installation. Establishing proper pinion gear depth is essential to establishing gear backlash and tooth contact patterns. After the overall shim thickness to take up differential side play is measured, the pinion gear is installed, and the gear backlash shim thickness is measured. The overall shim thickness is the total of the dial indicator reading, starting point shim thickness, and the preload specification added together. The gear backlash measurement determines the thickness of the shim used on the ring gear side of the differential case. Subtract the gear backlash shim thickness from the total overall shim thickness and select that amount for the pinion gear side of the differential (Fig. 81).

ADJUSTMENTS (Continued)

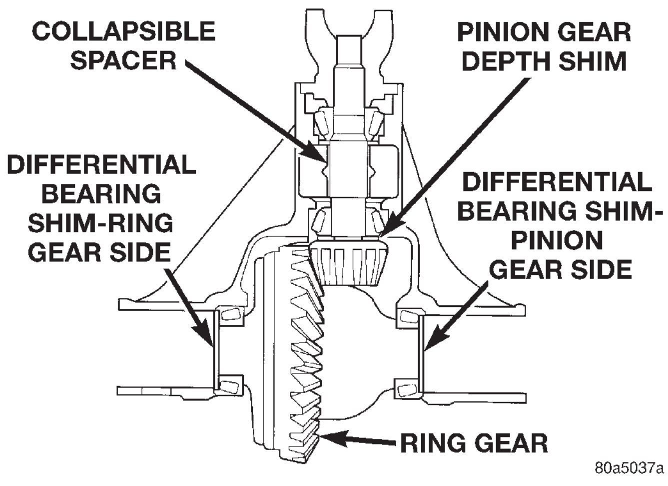


Fig. 81 Axle Adjustment Shim Locations

DIFFERENTIAL PRELOAD AND GEAR BACKLASH SHIM SELECTION

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

(1) Remove side bearings from differential case.

(2) Install ring gear on differential case and tighten bolts to specification.

(3) Install dummy side bearings 6929-A on differential case.

(4) Install differential case in axle housing.

(5) Insert Dummy Shim 8107 (0.118 in. (3.0 mm)) starting point shims between the dummy bearing and the axle housing on side of differential (Fig. 82).

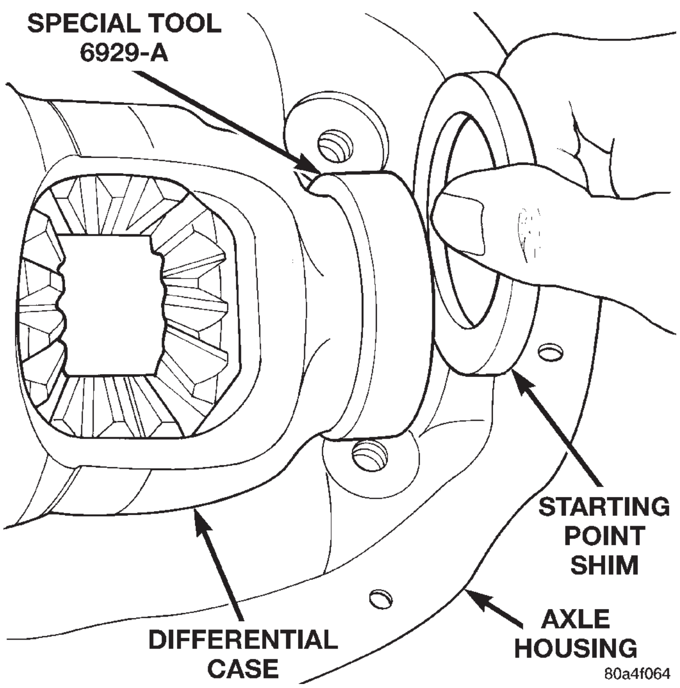


Fig. 82 Preload Measurement Starting Point Shim

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

(7) Using a dead-blow type mallet, seat the differential dummy bearings to each side of the axle housing (Fig. 83) and (Fig. 84).

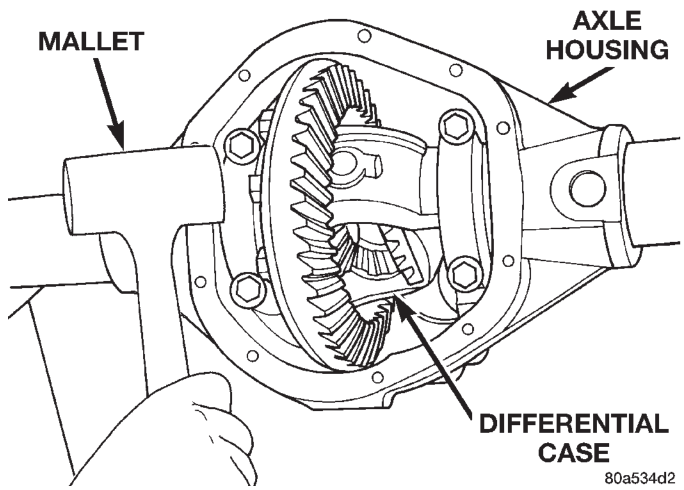


Fig. 83 Seat Pinion Gear Side Dummy Bearing

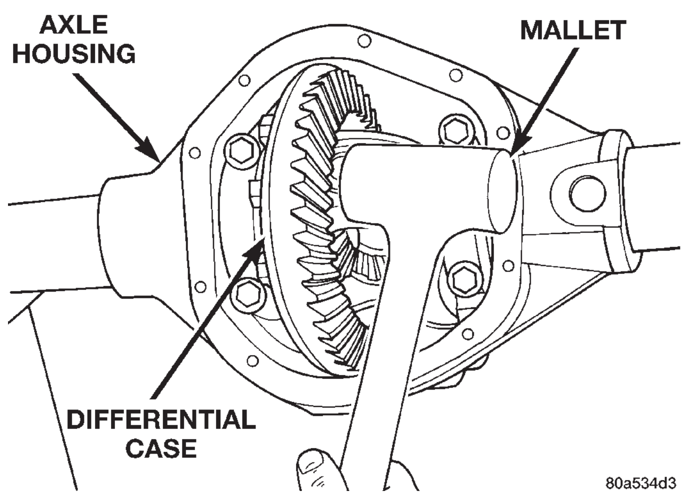


Fig. 84 Seat Ring Gear Side Dummy Bearing

(8) Thread guide stud C-3288-B into rear cover bolt hole below ring gear (Fig. 85).

(9) Attach dial indicator C-3339 to Guide Stud C-3288-B. Position the dial indicator plunger on a flat surface between the ring gear bolt heads (Fig. 85).

(10) Push and hold differential case to pinion gear side of axle housing.

(11) Zero dial indicator face to pointer (Fig. 86).

(12) Push and hold differential case to ring gear side of the axle housing.

(13) Record dial indicator reading (Fig. 87).

(14) Add the dial indicator reading to the starting point shim thickness to determine total shim thickness to achieve zero differential end play.

ADJUSTMENTS (Continued)

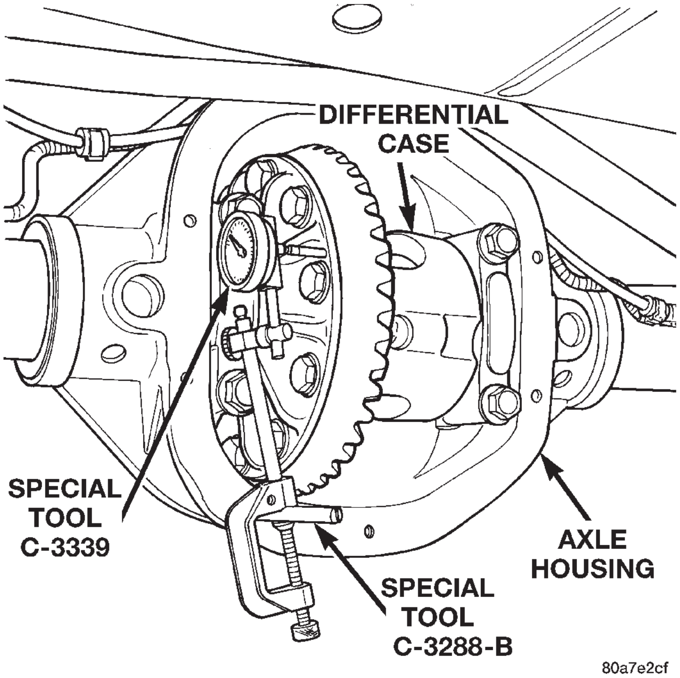


Fig. 85 Differential Side play Measurement

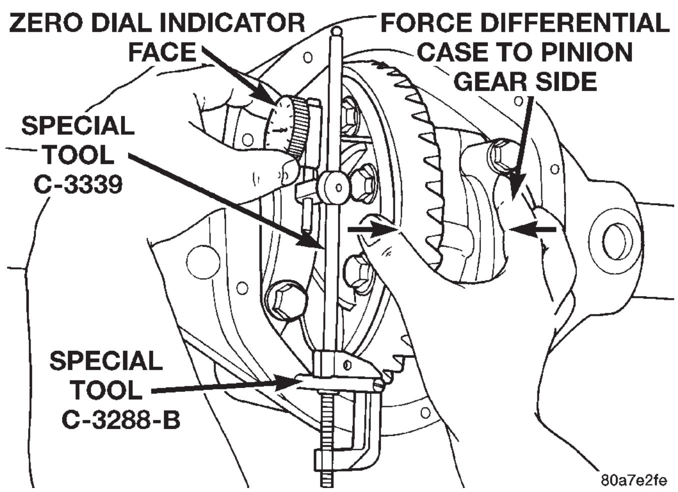


Fig. 86 Hold Differential Case and Zero Dial Indicator

(15) Add 0.001 in. (0.0254 mm) to the zero end play total. This new total represents the thickness of shims to compress, or preload the new bearings when the differential is installed.

(16) Rotate dial indicator out of the way on guide stud.

(17) Remove differential case, dummy bearings, and starting point shims from axle housing.

(18) Install pinion gear in axle housing. Install the yoke and establish the correct pinion rotating torque. Record the value of the pinion rotating torque for use in establishing the differential total torque to rotate.

(19) Install differential case and dummy bearings in axle housing with a dummy shim on only the ring

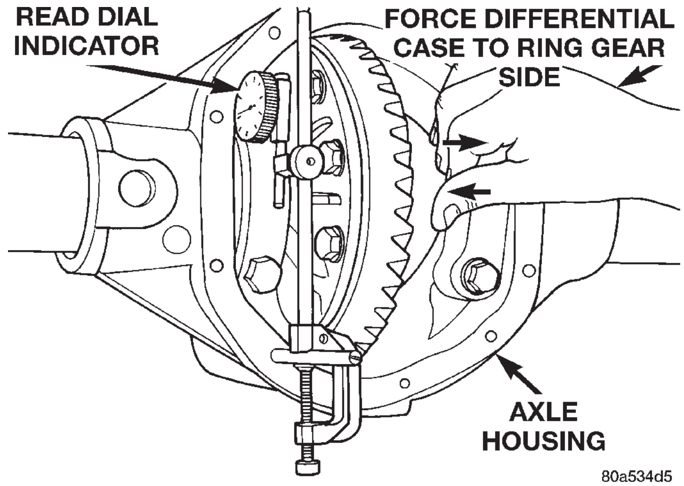


Fig. 87 Hold Differential Case and Read Dial Indicator

gear side of the differential and tighten retaining cap bolts snug.

(20) Position the dial indicator plunger on a flat surface between the ring gear bolt heads (Fig. 85).

(21) Push and hold differential case toward pinion gear.

(22) Zero dial indicator face to pointer.

(23) Push and hold differential case to ring gear side of the axle housing.

(24) Record dial indicator reading.

(25) Add the thickness of the dummy shim to the recorded dial indicator reading.

(26) Subtract 0.008 in. (0.2 mm) from the recorded value to compensate for backlash between ring and pinion gears. This total is the thickness of shim required to achieve proper backlash.

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

(28) Rotate dial indicator out of the way on guide stud.

(29) Remove differential case and dummy bearings from axle housing.

(30) Install new side bearing cones and cups on differential case.

(31) Install spreader W-129-B on axle housing and spread axle opening enough to receive differential case and side bearing shims.

(32) Place side bearing shims in axle housing against axle tube ends.

(33) Install differential case in axle housing.

(34) Remove spreader from axle housing.

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

(36) Position the indicator plunger against a ring gear tooth (Fig. 88).

ADJUSTMENTS (Continued)

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

(38) Zero dial indicator face to pointer.

(39) Push and hold ring gear downward while not allowing the pinion gear to rotate. Dial indicator reading should be between 0.12 mm (0.005 in.) and 0.20 mm (0.008 in.). If backlash is not within specifications transfer the necessary amount of shim thickness from one side of the axle housing to the other (Fig. 89).

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

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

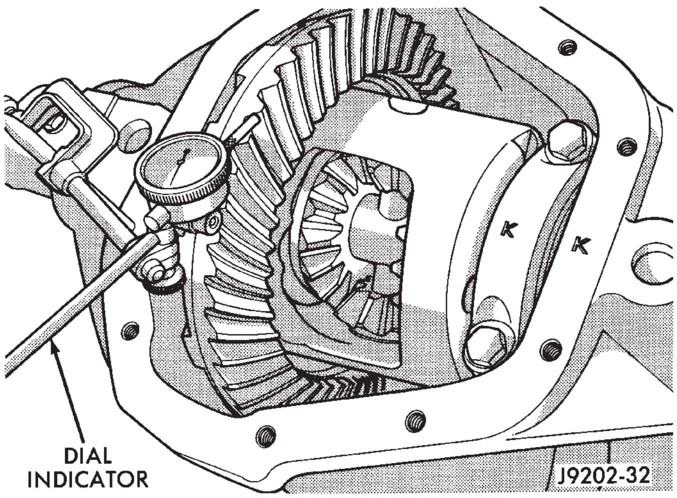


Fig. 88 Ring Gear Backlash Measurement

DIFFERENTIAL TOTAL TORQUE TO ROTATE

(1) Rotate the pinion a minimum of ten times to seat the differential bearings. Verify that the rotation is smooth and repeatable.

(2) While rotating the pinion at a slow steady rate, measure the differential total torque to rotate. Record the value.

(3) The differential total torque to rotate must be greater than the pinion torque to rotate plus 6 in.lbs..

(4) The differential total torque to rotate must be less than the pinion torque to rotate plus 13 in.lbs..

(5) If the differential total torque to is within these guidelines, assemble the remainder of the axle.

(6) If the differential total torque to rotate is less than the required value, increase the shim thickness on the ring and pinion gear sides of the differential equally.

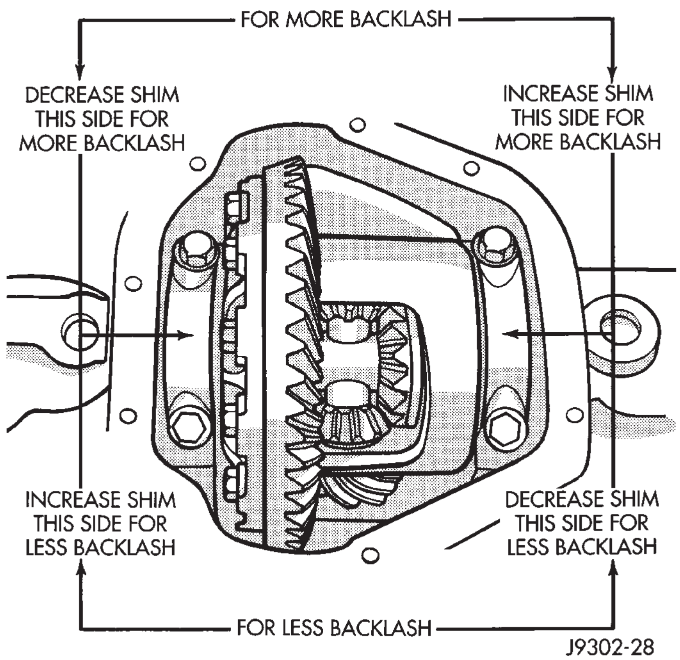


Fig. 89 Backlash Shim Adjustment

(7) If the differential total torque to rotate is greater than the required value, decrease the shim thickness on the ring and pinion gear sides of the differential equally.

(8) Remeasure the differential total torque to rotate.

GEAR CONTACT PATTERN ANALYSIS

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

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

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

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

The areas on the ring gear teeth with the greatest degree of contact against the pinion gear teeth will squeegee the compound to the areas with the least amount of contact. Note and compare patterns on the ring gear teeth to Gear Tooth Contact Patterns chart (Fig. 90) and adjust pinion depth and gear backlash as necessary.

ADJUSTMENTS (Continued)

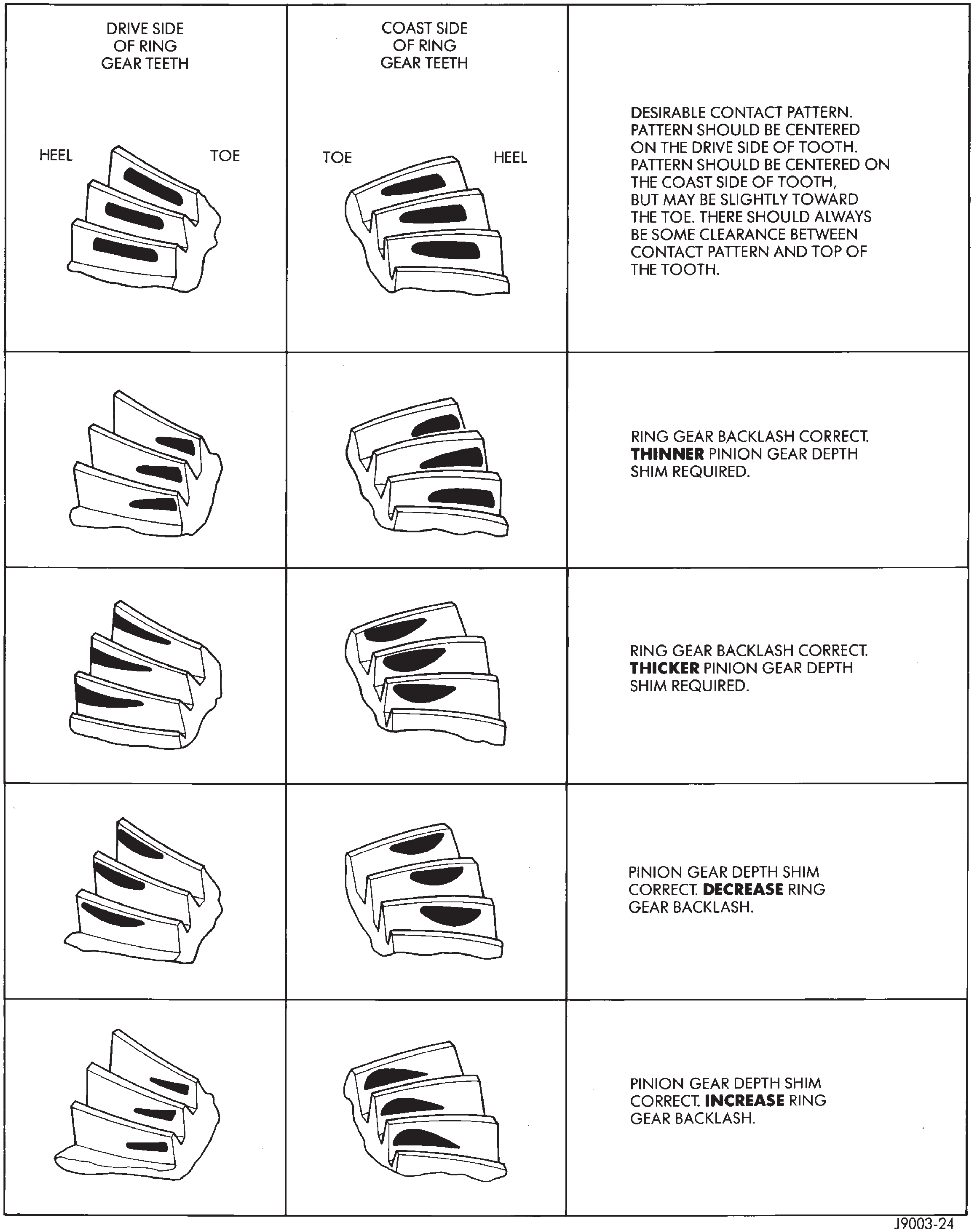


Fig. 90 Gear Tooth Contact Patterns

1999 WJ Service Manual
Publication No. 81-370-9147
TSB 26-01-00 January, 2000

SPECIFICATIONS

226 RBA AXLE

DESCRIPTION	SPECIFICATION
Axle Type	Semi–Floating Hypoid
Lubricant	SAE Thermally Stable 80W–90
Lubricant Trailer Tow	Synthetic 75W–140
Lube Capacity-w/o Vari-lok™	2.24 L (4.75 pts.)
Lube Capacity-w/ Vari-lok™	2.25 L (4.75 pts.)
Friction Modifier-w/ Trac-lok™	0.11 L (0.25 pts.)
Friction Modifier-w/ Vari-lok™	0.09 L (0.19 pts.)
Axle Ratios	3.55/3.73
Differential Bearing Preload	0.0254 mm (0.001 in.)
Differential Side Gear Clearance	0–0.15 mm (0–0.006 in.)
Ring Gear Diameter	226 mm (8.9 in.)
Ring Gear Backlash	0.13–0.20 mm (0.005–0.008 in.)
Pinion Std. Depth	109.52 mm (4.312 in.)
Pinion Bearing Preload-New Bearings	2.26–4.52 N·m (20–40 in. lbs.)
Pinion Bearing Preload-Original Bearings	1–3 N·m (10–20 in. lbs.)
Maximum Carrier Spread	0.38 mm (0.015 in.)

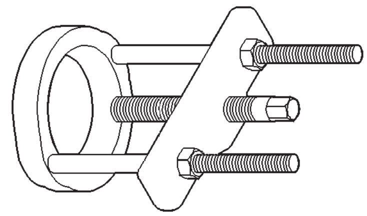
TORQUE—226 RBA AXLE

DESCRIPTION	TORQUE
Bolts, Diff. Cover	41 N·m (30 ft. lbs.)
Bolts, Diff. Bearing Cap	85 N·m (63 ft. lbs.)
Bolts, Ring Gear	108 N·m (80 ft. lbs.)
Screw, ABS Sensor	8 N·m (70 in. lbs.)
Screw, Pinion Gear Mate Shaft Lock	17.6 N·m (13 ft. lbs.)
Nuts, Axle Bearing Retainer Plate	61 N·m (45 ft. lbs.)
Nut, Pinion Gear—Minimum *	298 N·m (220 ft. lbs.)
Nut, Pinion Gear—Maximum *	380 N·m (280 ft. lbs.)

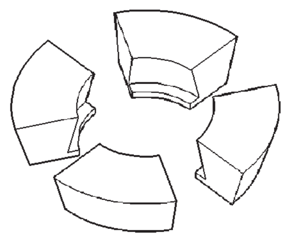
NOTE: *Refer to Pinion Gear Removal and Installation procedures for proper pinion nut tightening instructions. Do not exceed 380 N·m (280 ft. lbs.) during collapsible spacer crushing procedure.

SPECIAL TOOLS

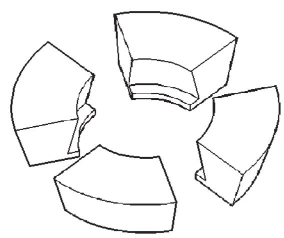
216 RBA AXLE



Puller Set—C-293-PA



Adapter—C-293-42



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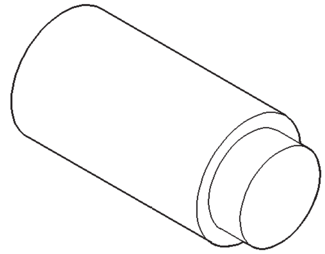
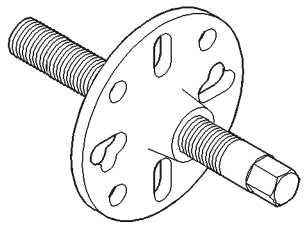
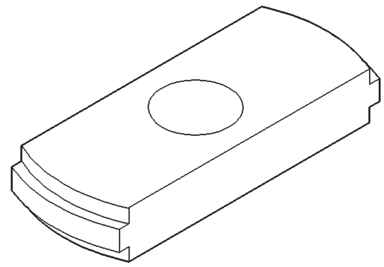


Extension—C-293-3

SPECIAL TOOLS (Continued)



Remover—C-452



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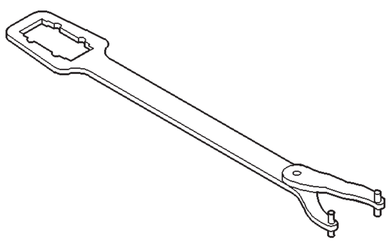
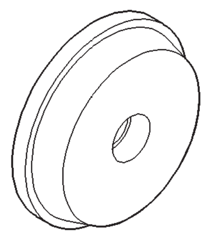
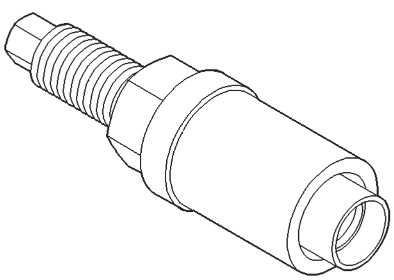


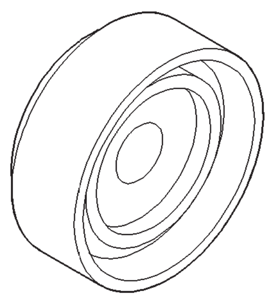
Holder—C-3281



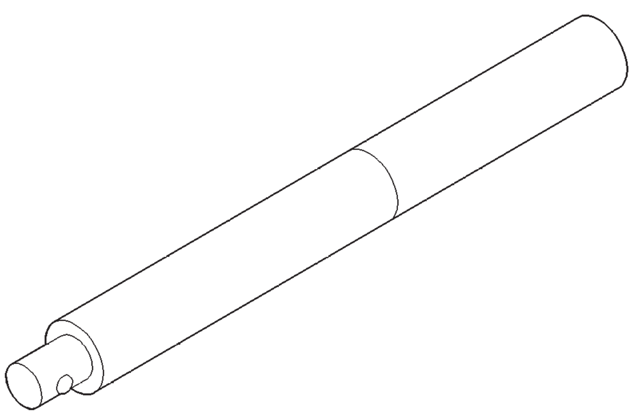
Installer—C-4308



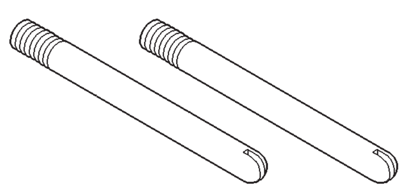
Installer—C-3718



Installer—C-4340

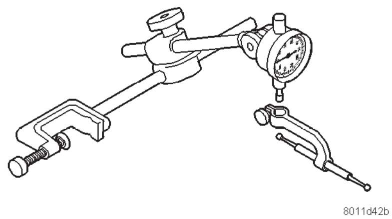


Handle—C-4171

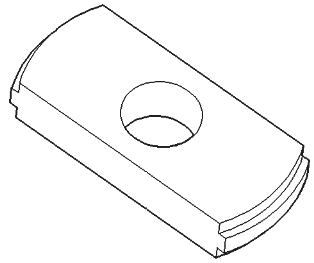


Guide Pin—C-3288-B

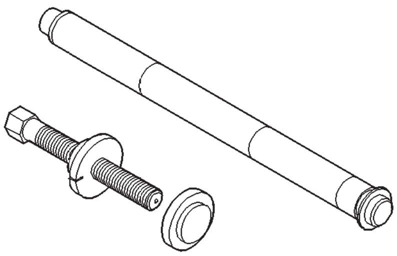
SPECIAL TOOLS (Continued)



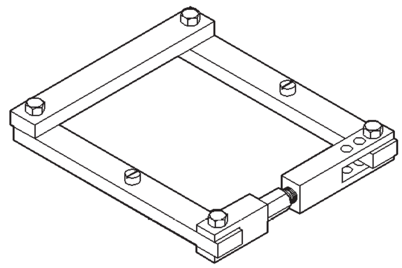
Dial Indicator—C-3339



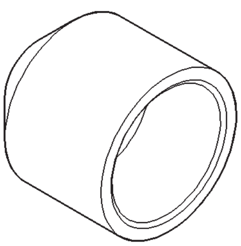
Remover—D-103



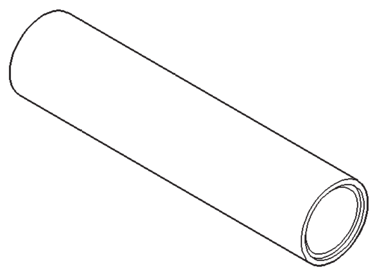
Trac-lok Tool Set—C-4487



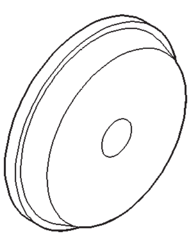
Spreader—W-129-B



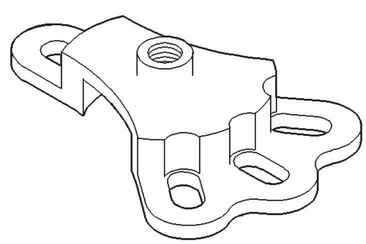
Installer—C-3972-A



Installer—6448

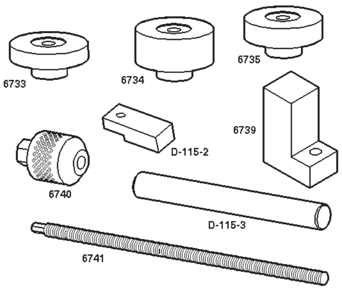


Installer—D-129

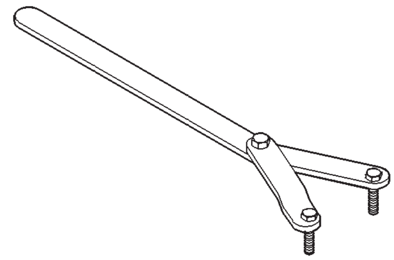


Adapter—6790

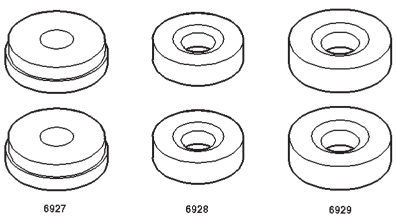
SPECIAL TOOLS (Continued)



Pinion Depth Set—6955



Holder—6958



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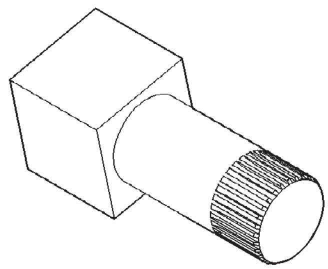
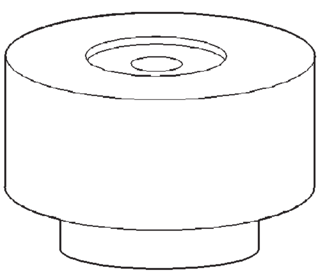
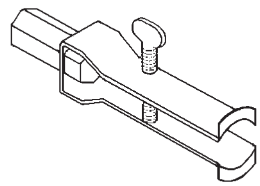


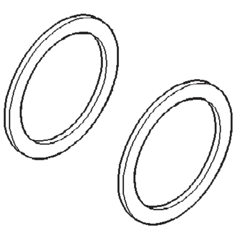
Holder—6963-A



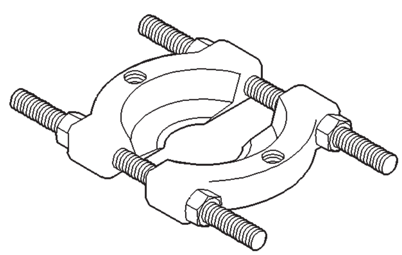
Gauge Block—8144



Remover—7794-A

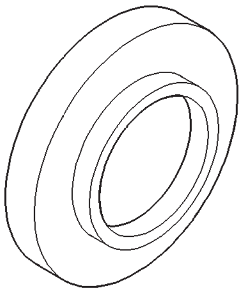


Starting Point Shim—8107



Splitter, Bearing—1130

SPECIAL TOOLS (Continued)



Installer, Gear/Bearing—7913-A

BRAKES

CONTENTS

BASE BRAKE SYSTEM

INDEX

DESCRIPTION AND OPERATION

BRAKE SYSTEM

All vehicles are equipped with power assist four-wheel disc Antilock Brakes (ABS).

Dual piston disc brake calipers are used on the front. Single piston disc brake calipers are used on the rear. Ventilated disc brake rotors are used on the front and solid rotors are used on 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 fluid level indicator is mounted to the side of the reservoir.

The braking force of the rear wheels is controlled by electronic brake distribution (EBD). The EBD functions like a rear proportioning valve. The EBD system uses the ABS system to control the slip of the rear wheels in partial braking range. The braking force of the rear wheels is controlled electronically by using the inlet and outlet valves located in the HCU.

Factory installed brake linings on all models consists of organic base material combined with metallic particles.

SERVICE WARNINGS & CAUTIONS

WARNING: DUST AND DIRT ACCUMULATING ON BRAKE PARTS DURING NORMAL USE MAY CONTAIN ASBESTOS FIBERS FROM AFTERMARKET LININGS. BREATHING EXCESSIVE CONCENTRATIONS OF ASBESTOS FIBERS CAN CAUSE SERIOUS BODILY HARM. EXERCISE CARE WHEN SERVICING BRAKE PARTS. DO NOT CLEAN BRAKE PARTS WITH COMPRESSED AIR OR BY DRY BRUSHING. USE A VACUUM CLEANER SPECIFICALLY DESIGNED FOR THE REMOVAL OF ASBESTOS FIBERS FROM BRAKE COMPONENTS. IF A SUITABLE VACUUM CLEANER IS NOT AVAILABLE, CLEANING SHOULD BE DONE WITH A WATER DAMPENED CLOTH. DO NOT SAND, OR GRIND BRAKE LINING UNLESS EQUIPMENT USED IS DESIGNED TO CONTAIN THE DUST RESIDUE. DISPOSE OF ALL RESIDUE CONTAINING ASBESTOS FIBERS IN SEALED BAGS OR CONTAINERS TO MINIMIZE EXPOSURE TO YOURSELF AND OTHERS. FOLLOW PRACTICES PRESCRIBED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION AND THE ENVIRONMENTAL PROTECTION AGENCY FOR THE HANDLING, PROCESSING, AND DISPOSITION OF DUST OR DEBRIS THAT MAY CONTAIN ASBESTOS FIBERS.

CAUTION: Never use gasoline, kerosene, alcohol, motor oil, transmission fluid, or any fluid containing mineral oil to clean the system components. These fluids damage rubber cups and seals. Use only fresh brake fluid or Mopar brake cleaner to clean or flush brake system components. These are the only cleaning materials recommended. If system contamination is suspected, check the fluid for dirt, discoloration, or separation into distinct layers. Also check the reservoir cap seal for distortion. Drain and flush the system with new brake fluid if contamination is suspected.

CAUTION: Use Mopar brake fluid, or an equivalent quality fluid meeting SAE/DOT standards J1703 and DOT 3. Brake fluid must be clean and free of contaminants. Use fresh fluid from sealed containers only to ensure proper antilock component operation.

CAUTION: Use Mopar multi-mileage or high temperature grease to lubricate caliper slide pins. Use multi-mileage grease or Dow G807 silicone grease on caliper slide pins to ensure proper operation.

BRAKE PEDAL

A suspended-type brake pedal is used, the pedal pivots on a shaft mounted in the pedal support bracket. The bracket is attached to the dash panel.

The brake pedal is a serviceable component. The pedal, pedal, pad bushings, shaft and pedal bracket are all replaceable parts.

BRAKE LAMP SWITCH

The plunger type brake lamp switch is mounted on a bracket attached to the brake pedal support. The switch can be adjusted when necessary.

ELECTRONIC BRAKE DISTRIBUTION

The electronic brake distribution (EBD) functions like a rear proportioning valve. The EBD system uses the ABS system to control the slip of the rear wheels in partial braking range. The braking force of the rear wheels is controlled electronically by using the inlet and outlet valves located in the HCU.

Upon entry into EBD the inlet valve for the rear brake circuit is switched on so that the fluid supply from the master cylinder is shut off. In order to decrease the rear brake pressure the outlet valve for the rear brake circuit is pulsed. This allows fluid to enter the low pressure accumulator (LPA) in the HCU resulting in a drop in fluid pressure to the rear brakes. In order to increase the rear brake pressure the outlet valve is switched off and the inlet valve is

DESCRIPTION AND OPERATION (Continued)

pulsed. This increases the pressure to the rear brakes. This will continue until the required slip difference is obtained. At the end of EBD braking (no brake application) the fluid in the LPA drains back to the master cylinder by switching on the outlet valve and draining through the inlet valve check valve. At the same time the inlet valve is switched on in case of another brake application.

The EBD will remain functional during many ABS fault modes. If the red and amber warning lamps are illuminated the EBD may have a fault.

RED BRAKE WARNING LAMP

A red warning lamp is used for the service brake portion of the hydraulic system. The lamp is located in the instrument cluster. The red warning light alerts the driver if the fluid level is low or the parking brakes are applied.

The lamp is turned on momentarily when the ignition switch is turn to the on position. This is a self test to verify the lamp is operational.

A red warning lamp with a amber warning lamp may indicate a electronic brake distribution fault.

POWER BRAKE BOOSTER

The booster assembly consists of a housing divided into separate chambers by two internal diaphragms. 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 in the booster. The primary push rod connects the booster to the brake pedal. The secondary push rod connects the booster to the master cylinder to stroke the cylinder pistons.

The atmospheric inlet valve is opened and closed by the primary push rod. Booster vacuum supply is

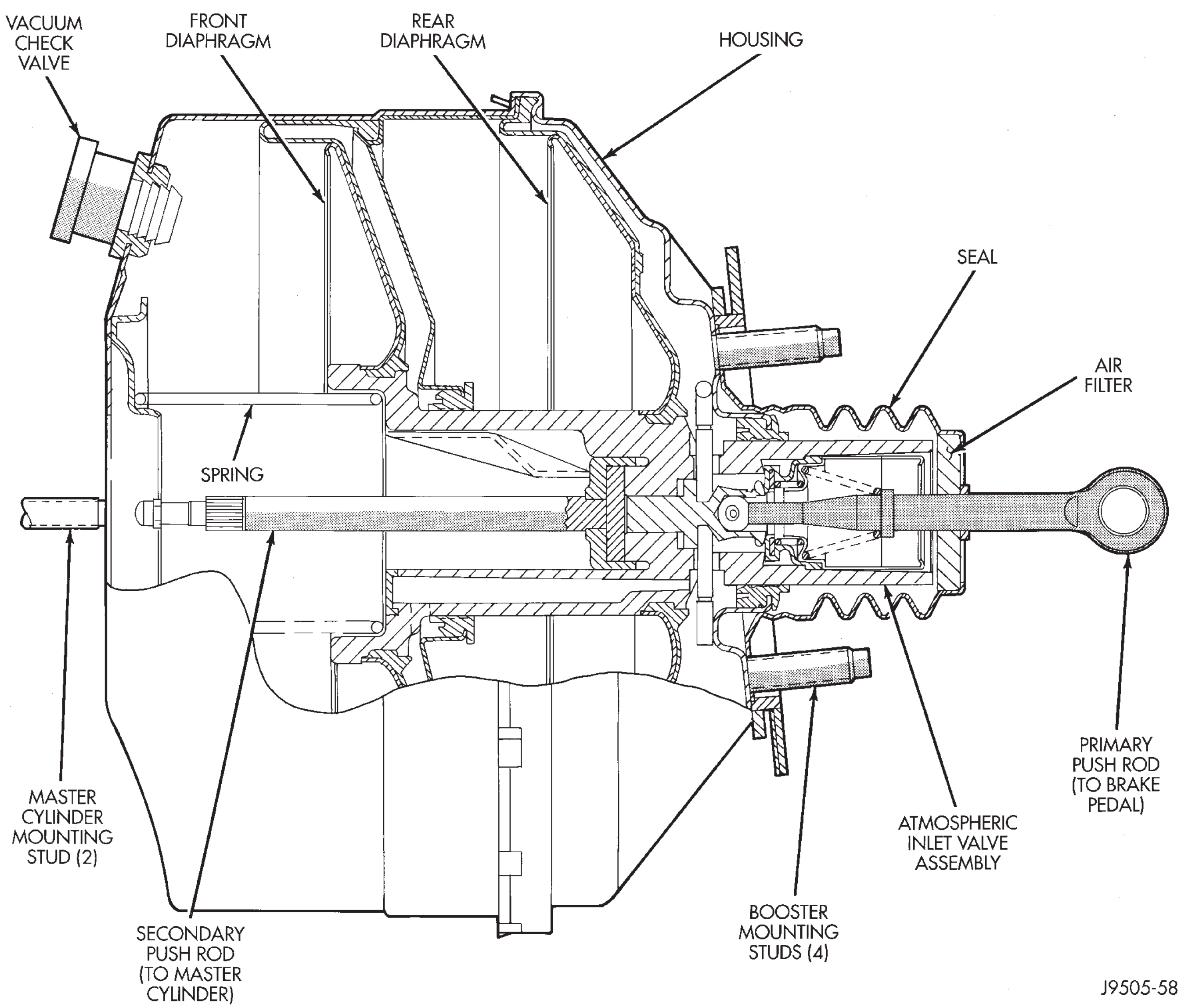


Fig. 1 Power Brake Booster–Typical

DESCRIPTION AND OPERATION (Continued)

through a hose attached to an intake manifold fitting at one end and to the booster check valve at the other. The vacuum check valve in the booster housing is a one-way device that prevents vacuum leak back.

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. 1).

The chamber areas forward of the booster diaphragms are exposed to vacuum from the intake manifold. The chamber areas to the rear of the diaphragms, are exposed to normal atmospheric pressure of 101.3 kilopascals (14.7 pounds/square in.).

Brake pedal application causes the primary push rod to open the atmospheric inlet valve. This exposes the area behind the diaphragms to atmospheric pressure. The resulting pressure differential provides the extra apply force for power assist.

The booster check valve, check valve grommet and booster seals are serviceable.

MASTER CYLINDER

The master cylinder body is made of aluminum and contains a primary and secondary piston assembly. The cylinder body including the piston assemblies are not serviceable. If diagnosis indicates an internal problem with the cylinder body, it must be replaced as an assembly. The master cylinder has a removable reservoir and fluid level indicator. The reservoir, reservoir grommets and fluid level switch are the only replaceable parts on the master cylinder.

FRONT DISC BRAKES

The calipers are twin piston type. The calipers are free to slide laterally on the anchor, this allows continuous compensation for lining wear.

When the brakes are applied fluid pressure is exerted against the caliper pistons. The fluid pressure is exerted equally and in all directions. This means pressure exerted against the caliper pistons and within the caliper bores will be equal (Fig. 2).

Fluid pressure applied to the pistons is transmitted directly to the inboard brake shoe. This forces the shoe lining against the inner surface of the disc brake rotor. At the same time, fluid pressure within the piston bores forces the caliper to slide inward on the slide pins. This action brings the outboard brake shoe lining into contact with the outer surface of the disc brake rotor.

Fluid pressure acting simultaneously on the pistons and caliper to produces a strong clamping action. When sufficient force is applied, friction will

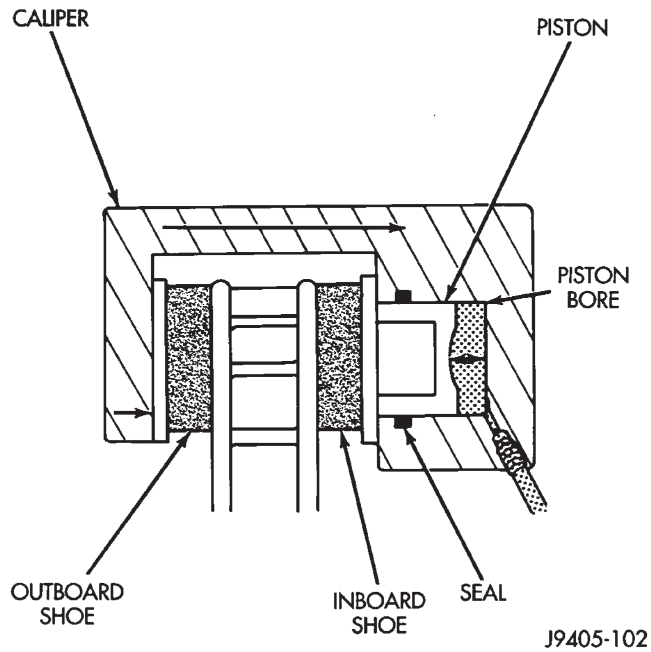


Fig. 2 Brake Caliper Operation

stop the rotors from turning and bring the vehicle to a stop.

Application and release of the brake pedal generates only a very slight movement of the caliper and pistons. Upon release of the pedal, the caliper and pistons return to a rest position. The brake shoes 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.

The caliper piston seals control the amount of piston extension needed to compensate for normal lining wear.

During brake application, the seals are deflected outward by fluid pressure and piston movement (Fig. 3). When the brakes (and fluid pressure) are released, the seals relax and retract the pistons.

The front outboard brake shoes have wear indicators.

REAR DISC BRAKES

The rear disc brakes consist of single piston floating-type calipers and solid rotors. The rear caliper is mounted on an anchor attached to an adapter attached the rear axle tube flange. The anchors are secured to the adapters with mounting bolts. The disc brake rotor splash shield is part of the adaptor. The disc brake rotor has a built in brake drum used for the parking brakes (Fig. 4). The parking brake shoes are mounted to the adaptor.

DESCRIPTION AND OPERATION (Continued)

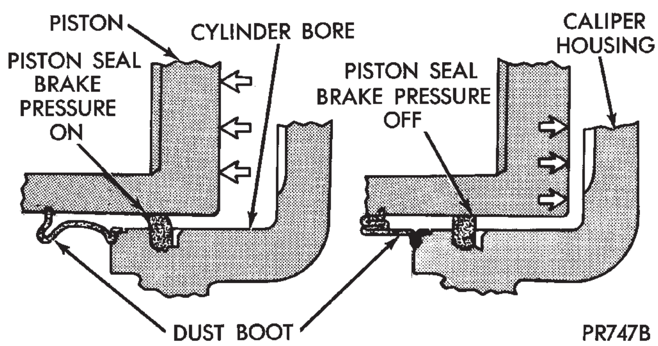


Fig. 3 Lining Wear Compensation By Piston Seal

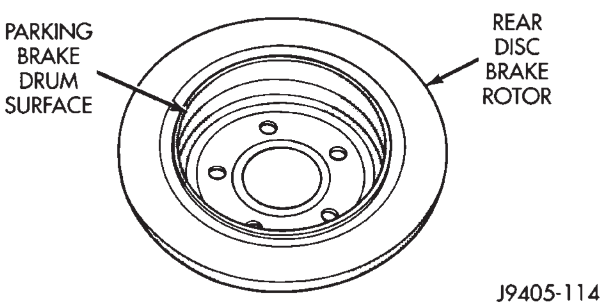


Fig. 4 Rear Disc Brake Rotor

PARKING BRAKES

The parking brakes operated by a automatic tensioner mechanism built into the hand lever and cable system. The front cable is connected to the hand lever and the equalizer. The rear cables attached to the equalizer and the parking brake shoe actuator.

A set of drum type brake shoes are used for parking brakes. The shoes are mounted to the rear disc brake adaptor. The parking brake drum is integrated into the rear disc brake rotor.

Parking brake cable adjustment is controlled by an automatic tensioner mechanism. The only adjustment if necessary is to the park brake shoes if the linings are worn.

BRAKE HOSES AND LINES

Flexible rubber hose is used at both front brakes, rear brakes and at the rear axle junction block. Double walled steel tubing is used. Double inverted style and ISO style flares are used on the brake lines.

DIAGNOSIS AND TESTING

BASE BRAKE SYSTEM

Base brake components consist of the brake shoes, calipers, rear park brake drums/rotors, front brake rotors, brake lines, master cylinder, booster, HCU and parking brake shoes.

Brake diagnosis involves determining if the problem is related to a mechanical, hydraulic, electrical or vacuum operated component.

The first diagnosis step is the preliminary check.

PRELIMINARY BRAKE CHECK

(1) Check condition of tires and wheels. Damaged wheels and worn, damaged, or underinflated tires can cause pull, shudder, vibration, and a condition similar to grab.

(2) 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.

(3) Inspect brake fluid level and condition. Note that the brake reservoir fluid level will decrease in proportion to normal lining wear. **Also note that brake fluid tends to darken over time. This is normal and should not be mistaken for contamination.**

(a) If fluid level is abnormally low, look for evidence of leaks at calipers, brake lines, master cylinder, and HCU.

(b) If fluid appears contaminated, drain out a sample to examine. System will have to be flushed if fluid is separated into layers, or contains a substance other than brake fluid. The system seals, cups, hoses, master cylinder, and HCU will also have to be replaced after flushing. Use clean brake fluid to flush the system.

(4) Check parking brake operation. Verify free movement and full release of cables and lever. Also note if vehicle was being operated with parking brake partially applied.

(5) Check brake pedal operation. Verify that pedal does not bind and has adequate free play. If pedal lacks free play, check pedal and power booster for being loose or for bind condition. Do not road test until condition is corrected.

(6) Check booster vacuum check valve and hose.

(7) If components checked appear OK, road test the vehicle.

ROAD TESTING

(1) If complaint involved low brake pedal, pump pedal and note if it comes back up to normal height.

(2) Check brake pedal response with transmission in neutral and engine running. Pedal should remain firm under constant foot pressure.

(3) During road test, make normal and firm brake stops in 25-40 mph range. Note faulty brake operation such as low pedal, hard pedal, fade, pedal pulsation, pull, grab, drag, noise, etc.

DIAGNOSIS AND TESTING (Continued)

(4) Attempt to stop the vehicle with the parking brake only (do not exceed 25 mph) and note grab, drag, noise, etc.

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 brake line, fitting, hose, or caliper. If leakage is severe, fluid will be evident at or around the leaking component.

Internal leakage (seal by-pass) in the master cylinder caused by worn or damaged piston cups, may also be the problem cause.

An internal leak in the ABS system may also be the problem with no visual fluid leak.

LOW PEDAL

If a low pedal is experienced, pump the pedal several times. If the pedal comes back up, the most likely causes are worn linings, rotors, or calipers are not sliding on the slide pins. The proper course of action is to inspect and replace all worn component and make the proper adjustments.

SPONGY PEDAL

A spongy pedal is most often caused by air in the system. However substandard brake hoses can cause a spongy pedal. The proper course of action is to bleed the system, and replace substandard quality brake hoses if suspected.

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 badly worn. The power booster, check valve, check valve seal/grommet or low vacuum could also cause a hard pedal or high pedal effort.

PEDAL PULSATION

Pedal pulsation is caused by components that are loose, or beyond tolerance limits.

The primary cause of pulsation are disc brake rotors with excessive lateral runout or thickness variation. Other causes are loose wheel bearings or calipers and worn, damaged tires.

NOTE: Some pedal pulsation may be felt during ABS activation.

BRAKE DRAG

Brake drag occurs when the lining is in constant contact with the rotor or drum. Drag can occur at one wheel, all wheels, fronts only, or rears only.

Drag is a product of incomplete brake release. Drag can be minor or severe enough to overheat the linings, rotors and park brake drums.

Minor drag will usually cause slight surface charring of the lining. It can also generate hard spots in rotors and park brake drums 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 the brake lining 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:

- Parking brake partially applied.
- Loose/worn wheel bearing.
- Seized caliper.
- Caliper binding.
- Loose caliper mounting.
- Mis-assembled components.
- Damaged brake lines.

If brake drag occurs at the front, rear or all wheels, the problem may be related to a blocked master cylinder return port, faulty power booster (binds-does not release) or the ABS system.

BRAKE FADE

Brake fade is usually a product of overheating caused by brake drag. However, brake overheating and resulting 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 mountain roads. Refer to the Brake Drag information in this section for causes.

BRAKE PULL

Front brake pull condition could result from:

- Contaminated lining in one caliper
- Seized caliper piston
- Binding caliper
- Loose caliper
- Rusty caliper slide surfaces
- Improper brake shoes
- Damaged rotor
- Wheel alignment.
- Tire pressure.

A worn, damaged wheel bearing or suspension component are further causes of pull. A damaged front tire (bruised, ply separation) can also cause pull.

A common and frequently misdiagnosed pull condition is where direction of pull changes after a few stops. The cause is a combination of brake drag followed by fade at one of the brake units.

As the dragging brake overheats, efficiency is so reduced that fade occurs. Since the opposite brake unit is still functioning normally, its braking effect is

DIAGNOSIS AND TESTING (Continued)

magnified. This causes pull to switch direction in favor of the normally functioning brake unit.

An additional point when diagnosing a change in pull condition concerns brake cool down. 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 DRAG OR PULL

Rear drag or pull may be caused by improperly adjusted park brake shoes or seized parking brake cables, contaminated lining, bent or binding shoes or improperly assembled components. This is particularly true when only one rear wheel is involved. However, when both rear wheels are affected, the master cylinder or ABS system could be at fault.

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 very lightly applied for a mile or two. However, if the lining is both soaked and dirt contaminated, cleaning and or replacement will be necessary.

BRAKE LINING CONTAMINATION

Brake lining contamination is mostly a product of leaking calipers or worn seals, driving through deep water puddles, or lining that has become covered with grease and grit during repair. Contaminated lining should be replaced to avoid further brake problems.

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.

NOTE: Propshaft angle can also cause vibration/ shudder.

Severely worn tires with very little tread left can produce a grab-like condition as the tire loses and recovers traction. Flat-spotted tires can cause vibration and generate shudder during brake operation. Tire damage such as a severe bruise, cut, ply separation, low air pressure can cause pull and vibration.

BRAKE NOISES

Some brake noise is common on some disc brakes during the first few stops after a vehicle has been parked overnight or stored. This is primarily due to the formation of trace corrosion (light rust) on metal surfaces. This light corrosion is typically cleared from the metal surfaces after a few brake applications causing the noise to subside.

BRAKE SQUEAK/SQUEAL

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 can also contribute to squeak. Dirt and foreign material embedded in the brake lining will also cause squeak/ squeal.

A very loud squeak or squeal is frequently a sign of severely worn brake lining. If the lining has worn through to the brake shoes in spots, metal-to-metal contact occurs. If the condition is allowed to continue, rotors may become so scored that replacement is necessary.

NOTE: The front outer brake shoes are equipped with a wear indicator. The indicator will produce an audible noise when it contacts the rotor surface.

BRAKE CHATTER

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.

THUMP/CLUNK NOISE

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.

BRAKE LAMP SWITCH

Brake lamp switch operation can be tested with an ohmmeter. The ohmmeter is used to check continuity between the pin terminals at different plunger positions (Fig. 5).

NOTE: The switch wire harness must be disconnected before testing switch continuity.

SWITCH CIRCUIT IDENTIFICATION

- Terminals 1 and 2 are for brake sensor circuit.
- Terminals 5 and 6 are for the stop lamp circuit.
- Terminals 3 and 4 are for the speed control circuit.

SWITCH CONTINUITY TEST

(1) Check continuity between terminal pins 5 and 6 as follows:

(a) Pull plunger all the way out to fully extended position.

DIAGNOSIS AND TESTING (Continued)

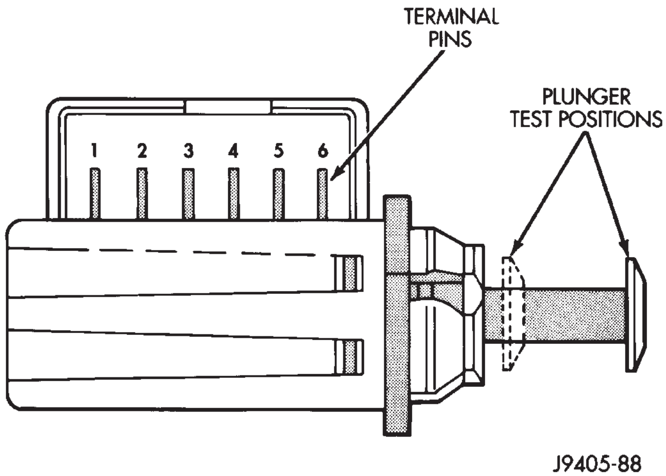


Fig. 5 Brake Lamp Switch Terminal Identification

(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 (switch is open).

RED BRAKE WARNING LAMP

The red warning lamp illuminates when the parking brake is applied or when the fluid level in the master cylinder is low. It will also illuminate at start up 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 brake hydraulic system for leaks.

A red warning lamp with a amber warning lamp may indicate a electronic brake distribution fault.

MASTER CYLINDER/POWER BOOSTER

NOTE: Inspect and repair any external fluid leaks before performing test.

(1) Start engine and check booster vacuum hose connections. A hissing noise indicates vacuum leak. Correct any vacuum leak before proceeding.

(2) Stop engine and shift transmission into Neutral.

(3) Pump brake pedal until all vacuum reserve in booster is depleted.

(4) Press and hold brake pedal under light foot pressure. The pedal should hold firm, if the pedal falls away the master cylinder or HCU may be faulty (internal leakage).

(5) Start engine and note pedal action. It should fall away slightly under light foot pressure then hold firm. If no pedal action is discernible, power booster, vacuum supply, or vacuum check valve is faulty. Proceed to the POWER BOOSTER VACUUM TEST.

(6) If the POWER BOOSTER VACUUM TEST passes, rebuild booster vacuum reserve as follows: Release brake pedal. Increase engine speed to 1500 rpm, close the throttle and turn off the engine.

(7) Wait a minimum of 90 seconds and try brake action again. Booster should provide two or more vacuum assisted pedal applications. If vacuum assist is not provided, some component of the booster is faulty.

POWER BOOSTER VACUUM TEST

(1) Connect vacuum gauge to booster check valve with short length of hose and T-fitting (Fig. 6).

(2) Start and run engine at curb idle speed for one minute.

(3) Observe the vacuum supply. If vacuum supply is not adequate, repair vacuum supply.

(4) Clamp hose shut between vacuum source and check valve.

(5) Stop engine and observe vacuum gauge.

(6) If vacuum drops more than one inch HG (33 millibars) within 15 seconds, booster diaphragm, check valve or check valve seal/grommet is faulty.

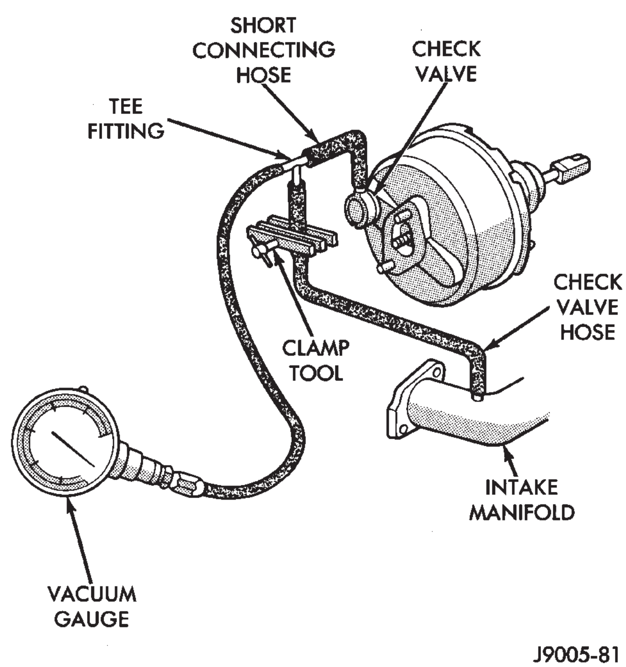


Fig. 6 Typical Booster Vacuum Test Connections

POWER BOOSTER CHECK VALVE TEST

(1) Disconnect vacuum hose from check valve.

DIAGNOSIS AND TESTING (Continued)

(2) Remove check valve and valve seal from booster.

(3) Use a hand operated vacuum pump for test.

(4) Apply 51-67 kPa (15-20 in.) vacuum at large end of check valve (Fig. 7).

(5) Vacuum should hold steady. If gauge on pump indicates vacuum loss, check valve or check valve seal/grommet is faulty and both should be replaced.

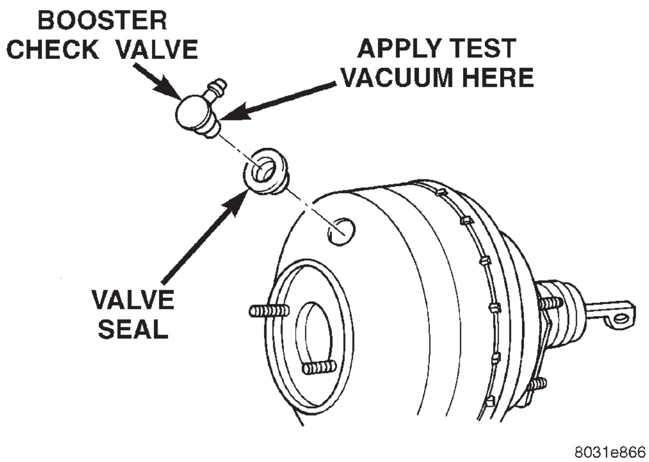


Fig. 7 Vacuum Check Valve And Seal

FRONT DISC BRAKE ROTOR

ROTOR MINIMUM THICKNESS

Rotor minimum usable thickness is 24.5 mm (0.964 in.). Do not 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.

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 approximately 19 mm (3/4 in.) from the rotor outer circumference for each measurement (Fig. 8).

Thickness should not **vary** by more than 0.0127 mm (0.0005 in.) from point to point on the rotor. Refinish or replace the rotor if necessary.

FRONT ROTOR LATERAL RUNOUT

Check rotor lateral runout whenever pedal pulsation, or rapid, uneven brake lining 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.

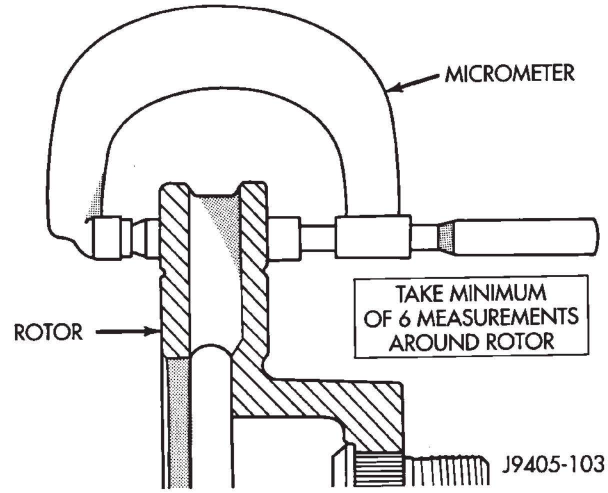


Fig. 8 Measuring Rotor Thickness Variation

Use a dial indicator to check lateral runout (Fig. 9).

Maximum allowable rotor lateral runout is 0.76 mm (0.003 in.).

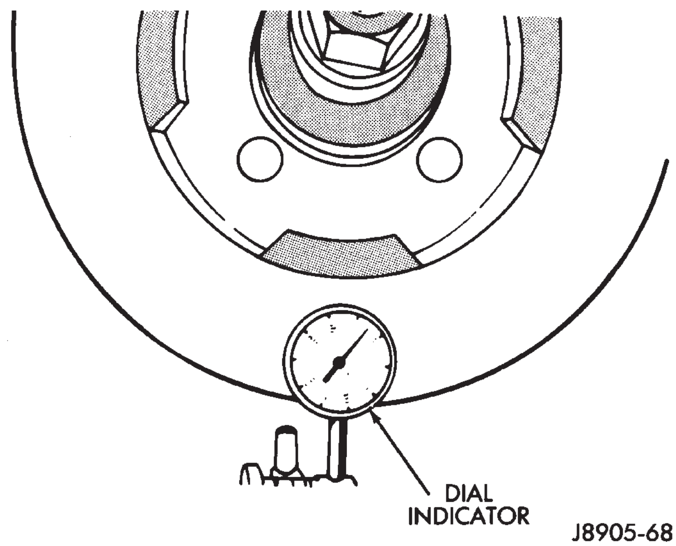


Fig. 9 Checking Rotor Lateral Runout

REAR DISC BRAKE ROTOR

ROTOR MINIMUM THICKNESS

Minimum usable thickness of the rear disc brake rotor is 8.5 mm (0.335 in.). The thickness specification is located on the center section of the rotor.

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.

DIAGNOSIS AND TESTING (Continued)

REAR 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 approximately 19 mm (3/4 in.) from the rotor outer circumference for each measurement (Fig. 8).

Thickness should not **vary** by more than 0.0127 mm (0.0005 in.) from point to point on the rotor. Refinish or replace the rotor if necessary.

REAR ROTOR LATERAL RUNOUT

Check rotor lateral runout whenever diagnosis indicates pedal pulsation and rapid, uneven brake lining wear.

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.

Use a dial indicator to check lateral runout (Fig. 9). Maximum allowable lateral runout is 0.76 mm (0.003 in.).

PARKING BRAKE

NOTE: Parking brake adjustment is controlled by an automatic cable tensioner and does not require adjustment. The only adjustment that may be necessary would be to the park brake shoes if they are worn.

The parking brake switch is in circuit with the red warning lamp in the dash. The switch will cause the lamp to illuminate only when the parking brakes are applied. If the lamp remains on after parking brake release, the switch or wires are faulty.

If the red lamp comes on a fault has occurred in the front or rear brake hydraulic system.

If the red warning lamp and yellow warning lamp come on, the electronic brake distribution may be at fault.

In most cases, the actual cause of an improperly functioning parking brake (too loose/too tight/won't hold), can be traced to a parking brake component.

NOTE: The leading cause of improper parking brake operation, is excessive clearance between the parking brake shoes and the shoe braking surface. Excessive clearance is a result of lining and/or drum wear, drum surface machined oversize.

Excessive parking brake lever travel (sometimes described as a loose lever or too loose condition), is the result of worn brake shoes, improper brake shoe adjustment, or improperly assembled brake parts.

A too loose condition can also be caused by inoperative or improperly assembled parking brake shoe 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:

- Brake shoe wear
- Drum surface (in rear rotor) machined oversize
- Front cable not secured to lever
- Rear cable not attached to actuator
- Rear cable seized
- Parking brake lever not seated
- Parking brake lever bind

BRAKE LINE AND HOSES

Flexible rubber hose is used at both front and rear brakes and at the rear axle junction block. Inspect the hoses whenever the brake system is serviced, at every engine oil change, or whenever the vehicle is in for service.

Inspect the hoses for surface cracking, scuffing, or worn spots. Replace any brake hose immediately if the fabric casing of the hose is exposed due to cracks or abrasions.

Also check brake hose installation. Faulty installation can result in kinked, twisted hoses, or contact with the wheels and tires or other chassis components. All of these conditions can lead to scuffing, cracking and eventual failure.

The steel brake lines should be inspected periodically for evidence of corrosion, twists, kinks, leaks, or other damage. Heavily corroded lines will eventually rust through causing leaks. In any case, corroded or damaged brake lines should be replaced.

Factory replacement brake lines and hoses are recommended to ensure quality, correct length and superior fatigue life. Care should be taken to make sure that brake line and hose mating surfaces are clean and free from nicks and burrs. Also remember that right and left brake hoses are not interchangeable.

Use new copper gaskets at all caliper connections. Be sure brake line connections are properly made (not cross threaded) and tightened to recommended torque.

BRAKE FLUID CONTAMINATION

Indications of fluid contamination are swollen or deteriorated rubber parts.

Swollen rubber parts indicate the presence of petroleum in the brake fluid.

To test for contamination, put a small amount of drained brake fluid in clear glass jar. If fluid separates into layers, there is mineral oil or other fluid contamination of the brake fluid.

DIAGNOSIS AND TESTING (Continued)

If brake fluid is contaminated, drain and thoroughly flush system. Replace master cylinder with reservoir, caliper seals, HCU and all hydraulic fluid hoses.

SERVICE PROCEDURES

BRAKE FLUID LEVEL

Always clean the master cylinder reservoir and cap before adding fluid. This will prevent dirt from falling in the reservoir and contaminating the brake fluid.

The reservoir has a MIN and a MAX mark on the side (Fig. 10) fill to the MAX mark.

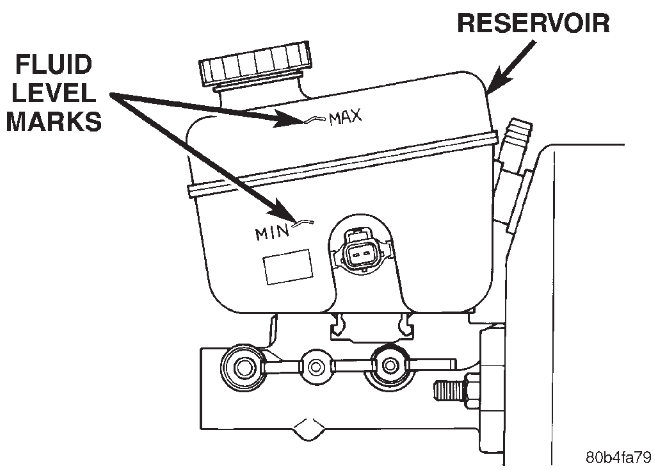


Fig. 10 Master Cylinder Fluid Level

MASTER CYLINDER BLEEDING

A new master cylinder should be bled before installation on the vehicle. Required bleeding tools include bleed tubes and a wood dowel to stroke the pistons. Bleed tubes can be fabricated from brake line.

BLEEDING PROCEDURE

(1) Mount master cylinder in vise with brass jaws.

(2) Attach bleed tubes to cylinder outlet ports. Then position each tube end into the bottom of the reservoir (Fig. 11).

(3) Fill reservoir with fresh brake fluid.

(4) Press cylinder pistons inward with wood dowel. Then release pistons and allow them to return under spring pressure. Continue bleeding operations until air bubbles are no longer visible in fluid.

BASE BRAKE BLEEDING

Use Mopar brake fluid, or an equivalent quality fluid meeting SAE J1703-F and DOT 3 standards only. Use fresh, clean fluid from a sealed container at all times.

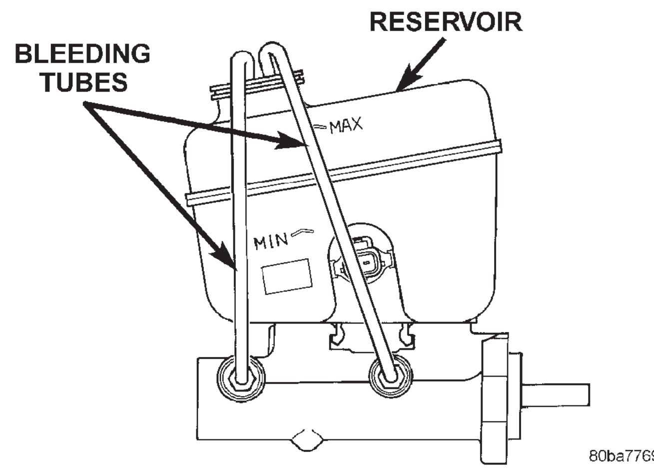


Fig. 11 Master Cylinder Bleeding

Do not pump the brake pedal at any time while bleeding. Air in the system will be compressed into small bubbles that are distributed throughout the hydraulic system. This will make additional bleeding operations necessary.

Do not allow the master cylinder to run out of fluid during bleed operations. An empty cylinder will allow additional air to be drawn into the system. Check the cylinder fluid level frequently and add fluid as needed.

Bleed only one brake component at a time in the following sequence:

- Master Cylinder
- Right Rear Wheel
- Left Rear Wheel
- Right Front Wheel
- Left Front Wheel

MANUAL BLEEDING

(1) Fill the master cylinder reservoir with brake fluid.

(2) If calipers are overhauled, open all caliper bleed screws. Then close each bleed screw as fluid starts to drip from it. Top off master cylinder reservoir once more before proceeding.

(3) Attach one end of bleed hose to bleed screw and insert opposite end in glass container partially filled with brake fluid (Fig. 12). Be sure end of bleed hose is immersed in fluid.

(4) Open up bleeder, then have a helper press down the brake pedal. Once the pedal is down close the bleeder. Repeat bleeding until fluid stream is clear and free of bubbles. Then move to the next wheel.

PRESSURE BLEEDING

Follow the manufacturers instructions carefully when using pressure equipment. Do not exceed the tank manufacturers pressure recommendations. Gen-

SERVICE PROCEDURES (Continued)

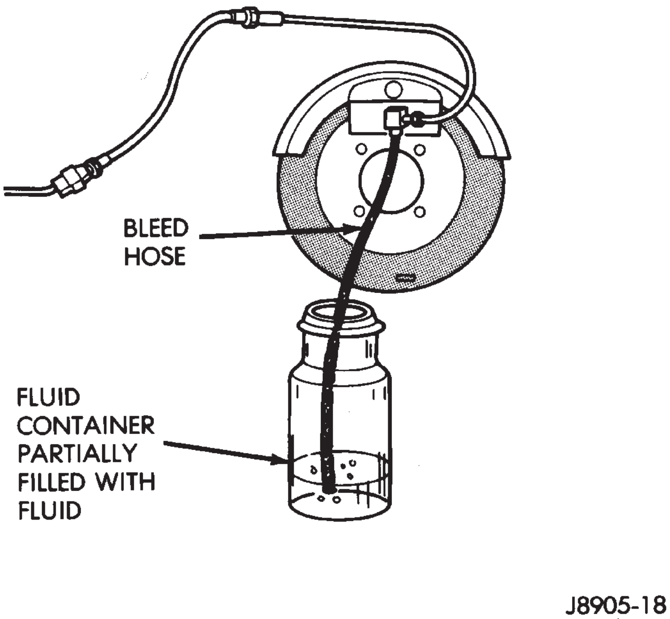


Fig. 12 Bleed Hose Setup

erally, a tank pressure of 51-67 kPa (15-20 psi) is sufficient for bleeding.

Fill the bleeder tank with recommended fluid and purge air from the tank lines before bleeding.

Do not pressure bleed without a proper master cylinder adapter. The wrong adapter can lead to leakage, or drawing air back into the system. Use adapter provided with the equipment or Adapter 6921.

DISC ROTOR MACHINING

The disc brake rotor can be machined if scored or worn. The lathe must machine both sides of the rotor simultaneously with dual cutter heads. The rotor mounting surface must be clean before placing on the lathe. Equipment capable of machining only one side at a time may produce a tapered rotor. A hub mounted on-vehicle lathe is recommended. This type of lathe trues the rotor to the vehicles hub/bearing.

CAUTION: Brake rotors that do not meet minimum thickness specifications before or after machining must be replaced.

BRAKE TUBE FLARING

A preformed metal brake tube is recommended and preferred for all repairs. However, double-wall steel tube can be used for emergency repair when factory replacement parts are not readily available.

Special bending tools are needed to avoid kinking or twisting of metal brake tubes. Special flaring tools are needed to make a double inverted flare or ISO flare (Fig. 13).

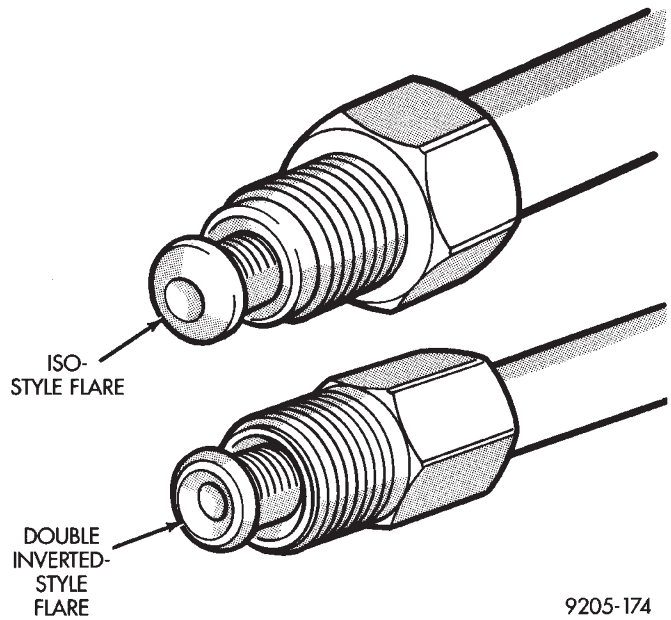


Fig. 13 Inverted Flare And ISO Flare

DOUBLE INVERTED FLARING

(1) Cut off damaged tube with Tubing Cutter.

(2) Ream cut edges of tubing to ensure proper flare.

(3) Install replacement tube nut on the tube.

(4) Insert tube in flaring tool.

(5) Place gauge form over the end of the tube.

(6) Push tubing through flaring tool jaws until tube contacts recessed notch in gauge that matches tube diameter.

(7) Tighten the tool bar on the tube

(8) Insert plug on gauge in the tube. Then swing compression disc over gauge and center tapered flaring screw in recess of compression disc (Fig. 14).

(9) Tighten tool handle until plug gauge is squarely seated on jaws of flaring tool. This will start the inverted flare.

(10) Remove the plug gauge and complete the inverted flare.

ISO FLARING

To make a ISO flare use Snap-On® Flaring Tool TFM-428 or equivalent.

(1) Cut off damaged tube with Tubing Cutter.

(2) Remove any burrs from the inside of the tube.

(3) Install tube nut on the tube.

(4) Position the tube in the flaring tool flush with the top of the tool bar (Fig. 15). Then tighten the tool bar on the tube.

(5) Install the correct size adaptor on the flaring tool yoke screw.

(6) Lubricate the adaptor.

SERVICE PROCEDURES (Continued)

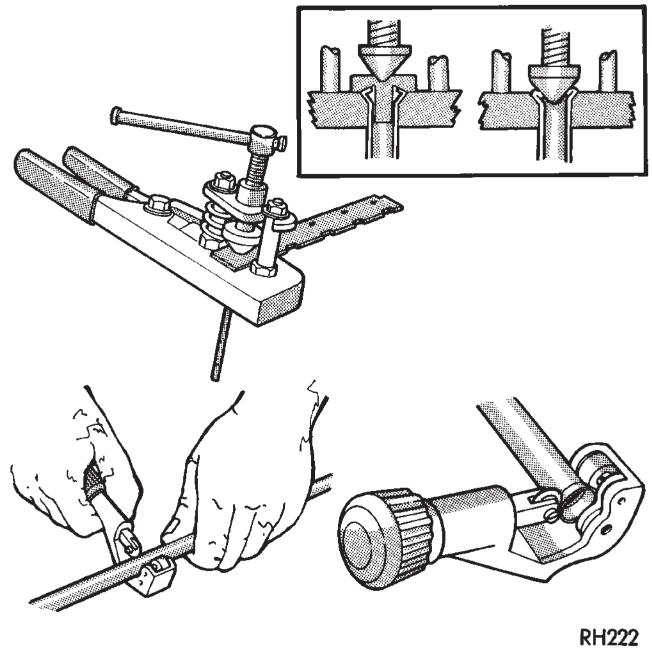


Fig. 14 Inverted Flare Tools

(7) Align the adaptor and yoke screw over the tube (Fig. 15).

(8) Turn the yoke screw in until the adaptor is squarely seated on the tool bar.

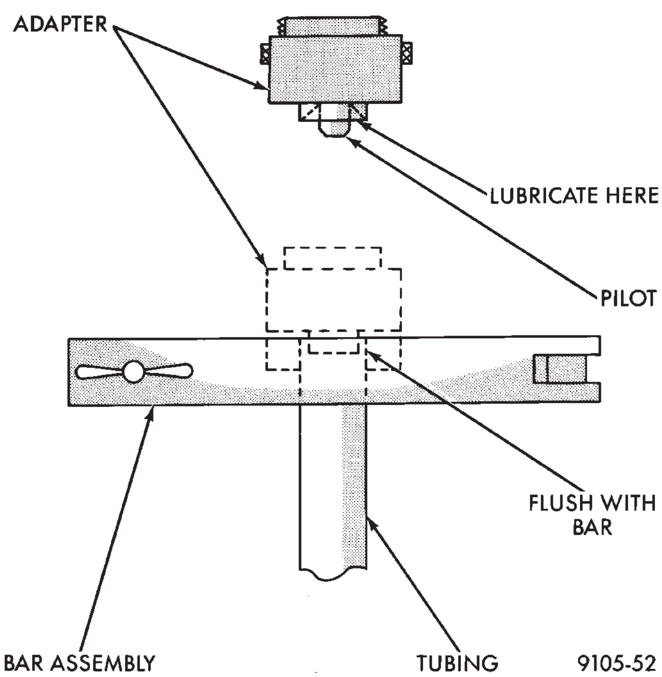


Fig. 15 ISO Flaring

REMOVAL AND INSTALLATION

BRAKE LAMP SWITCH

REMOVAL

(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 counter-clockwise direction to unlock switch retainer. Then pull switch rearward and out of bracket.

(4) Disconnect switch wire harness and remove switch from vehicle (Fig. 16).

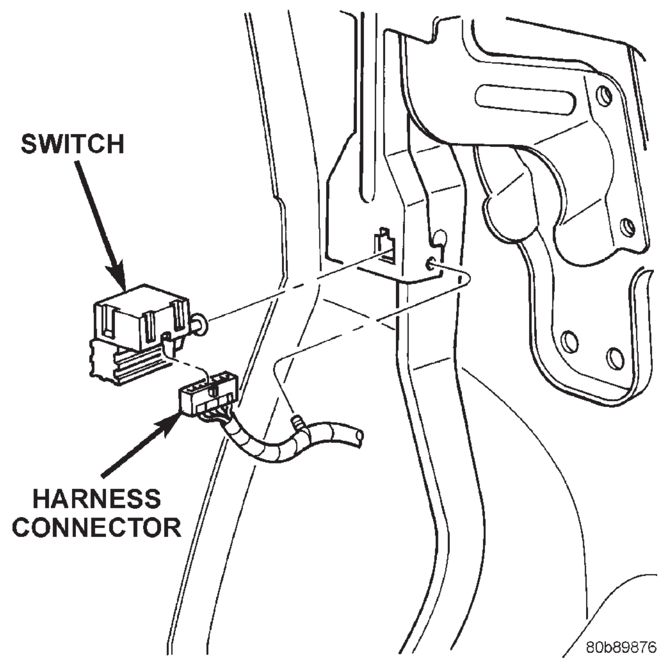


Fig. 16 Stop Lamp Switch

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 lightly rearward. Pedal will set plunger to correct position as pedal pushes plunger into switch body. Switch will make ratcheting sound as it self adjusts.

CAUTION: Booster damage may occur if the pedal pull exceeds 20 lbs.

REMOVAL AND INSTALLATION (Continued)

BRAKE PEDAL

REMOVAL

(1) Remove retainer clip that holds booster to pedal pin (Fig. 17).

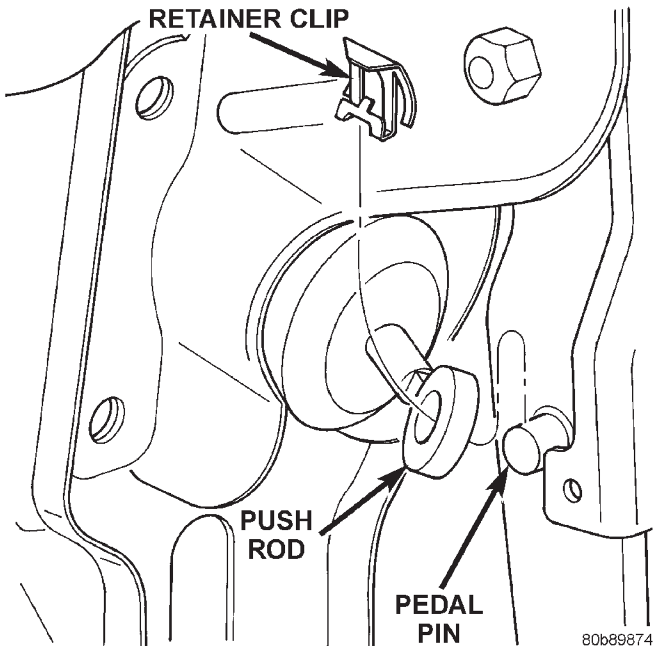


Fig. 17 Push Rod Retainer Clip

(2) Remove nut from pedal shaft.
(3) Slide pedal shaft out and remove brake pedal.
(4) Remove pedal bushings (Fig. 18) if they are to be replaced.

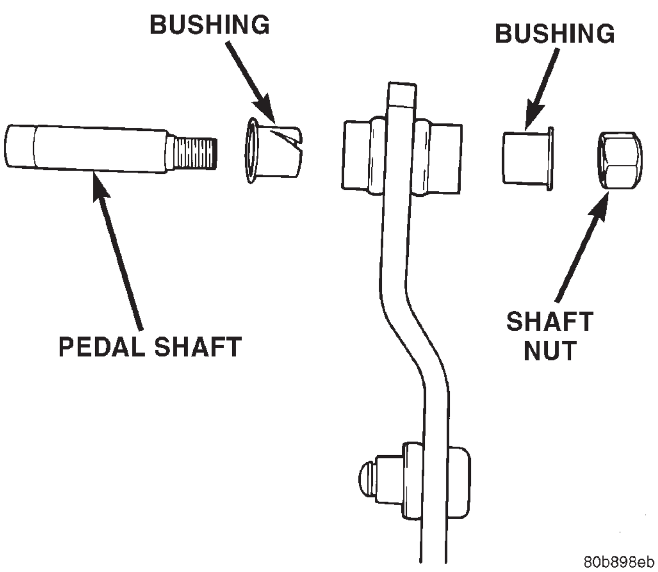


Fig. 18 Pedal Bushings

INSTALLATION

(1) Lubricate bushings, pedal shaft and pedal pin with Mopar multi-mileage grease.
(2) Install bushings into pedal.
(3) Position pedal in bracket and install pedal shaft in support and through pedal.
(4) Install new nut on pedal shaft and tighten to 27 N·m (20 ft. lbs.).

NOTE: Pedal shaft nut should not be reused.

(5) Install booster push rod on pedal pin and install retainer clip on pedal pin.
(6) Check and adjust stop lamp switch if necessary.

BRAKE FLUID LEVEL SENSOR

REMOVAL

(1) Remove the wire connector from the fluid level sensor.
(2) From the other side of the master cylinder reservoir release the sensor locking taps with a small screw driver.
(3) Pull the sensor out of the reservoir from the connector side of the sensor.

INSTALLATION

(1) Install the sensor with a new o-ring into the reservoir until the locking tabs are engaged.
(2) Install the wire connector to the fluid level sensor.

MASTER CYLINDER RESERVOIR

REMOVAL

(1) Remove reservoir cap and remove fluid with a **clean** suction gun.
(2) Remove the wire connector from the brake fluid level sensor.
(3) Insert the tool (Fig. 19) provided with the reservoir to release the reservoir retaining tabs.
(4) Pull the reservoir straight up out of the cylinder.
(5) Remove and discard grommets from the cylinder body.

INSTALLATION

(1) Lubricate new grommets with clean brake fluid. Install new grommets into the cylinder body.

CAUTION: Do not use tools to install the grommets. Tools may cut, or tear the grommets. Install the grommets using finger pressure only.

(2) Start reservoir in grommets then press the reservoir straight down to seat the reservoir into the cylinder grommets.

REMOVAL AND INSTALLATION (Continued)

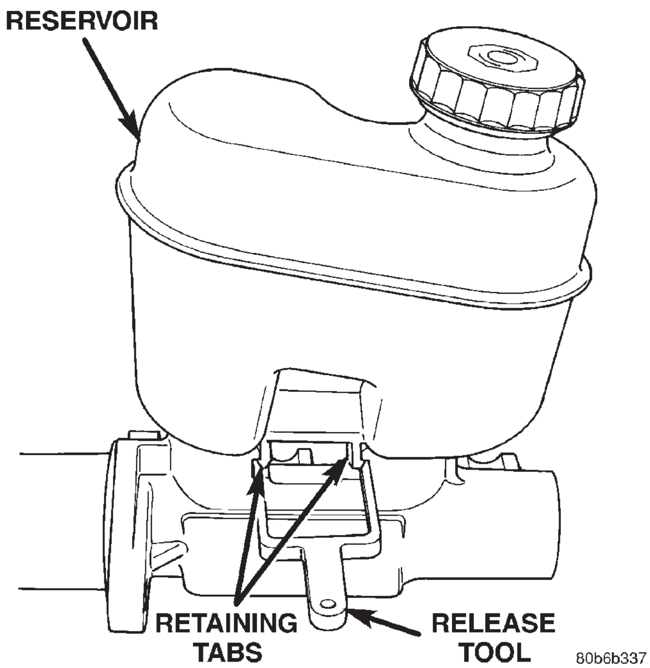


Fig. 19 Release Tool

CAUTION: Do not rock the reservoir during installation.

(3) Verify retaining tabs are seated.
(4) Install the wire connector to the brake fluid level sensor.
(5) Fill master cylinder.

MASTER CYLINDER

REMOVAL

(1) Remove the wire connector from the brake fluid level sensor.
(2) Remove brake lines from master cylinder.
(3) Remove nuts that attach master cylinder to booster studs (Fig. 20).
(4) Remove master cylinder from booster.

INSTALLATION

NOTE: Bleed new master cylinder on bench before installation, refer to Service Procedures.

(1) Have an assistant depress the brake pedal while guiding the master cylinder on the booster rod and mounting studs.

CAUTION: Do not depress brake pedal too hard and ensure the booster rod is in the master cylinder piston or booster/master cylinder damage will occur.

(2) Install master cylinder mounting nuts and tighten nuts to 25 N·m (18 lb. lbs.).

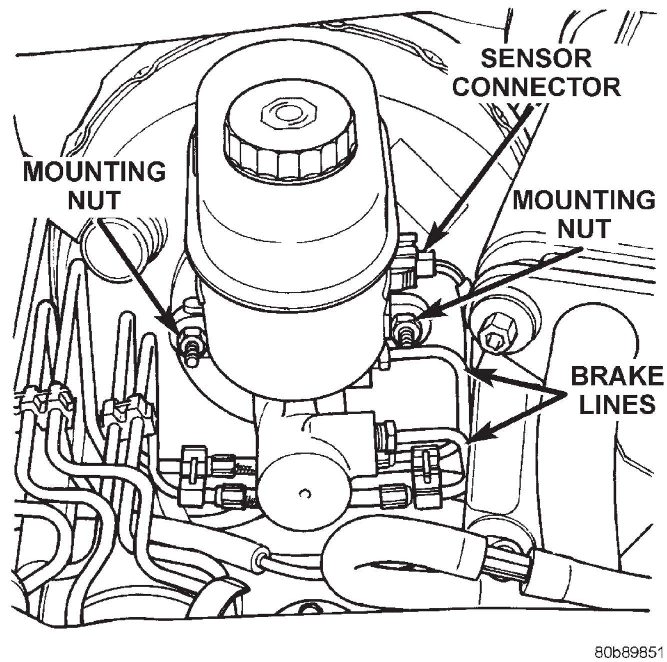


Fig. 20 Master Cylinder Mounting

NOTE: Use original or factory replacement nuts only.

(3) Install brake lines and tighten to 16 N·m (144 in. lbs.).
(4) Install fluid level sensor connector.
(5) Fill and bleed brake system.

POWER BRAKE BOOSTER

REMOVAL

(1) Remove the master cylinder.
(2) Disconnect vacuum hose at booster check valve.
(3) Remove retainer clip (Fig. 21) that holds booster push rod on pedal pin. Then slide push rod off pin.
(4) Remove four nuts (Fig. 22) that attach booster to dash panel.
(5) In engine compartment, slide booster forward, tilt it upward slightly, and remove it from engine compartment.

INSTALLATION

(1) Check condition of grommet that secures check valve in booster. Replace grommet if cut, torn, or loose.
(2) Install new booster dash seal.
(3) Align and position booster on engine compartment side of dash panel.
(4) Inside passenger compartment:
(a) Lubricate pedal pin Mopar multi-mileage grease.

REMOVAL AND INSTALLATION (Continued)

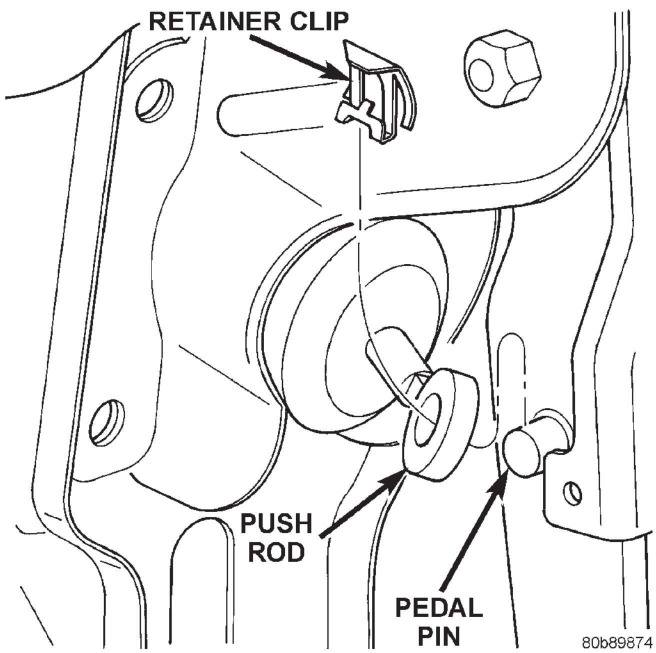


Fig. 21 Retainer Clip

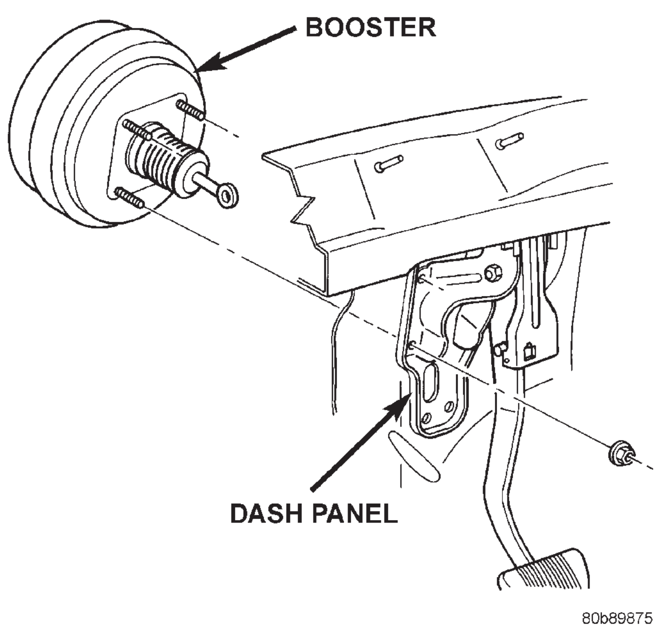


Fig. 22 Power Brake Booster Mounting

(b) Install booster attaching nuts on studs. Tighten attaching nuts to 39 N·m (29 ft. lbs.).

(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.

(6) Install the master cylinder with new gasket and nuts.

CAUTION: The master cylinder installation procedure must be perform as written or damage to the booster/master cylinder may occur.

(7) Fill and bleed brake system.

FRONT DISC BRAKE CALIPER

REMOVAL

(1) Raise and support vehicle.

(2) Remove front wheel and tire assembly.

(3) Drain small amount of fluid from master cylinder brake reservoir with **clean** suction gun.

(4) Bottom caliper pistons into the caliper by prying the caliper over (Fig. 23).

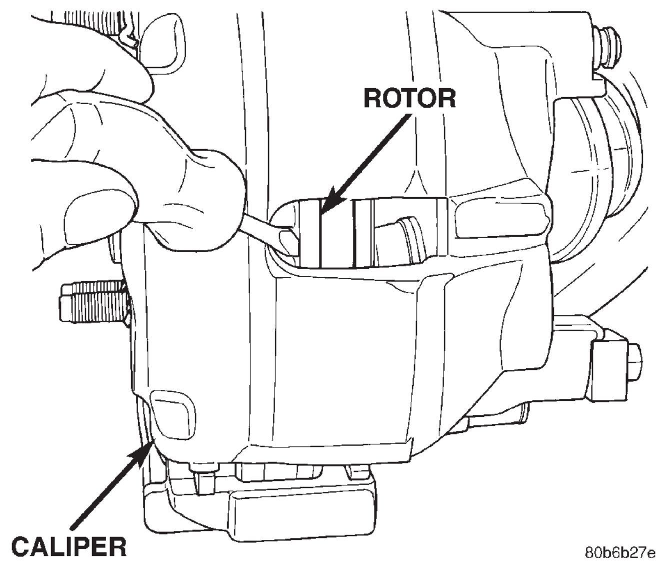


Fig. 23 Bottoming Caliper Piston

(5) Remove brake hose banjo bolt and gasket washers.

(6) Remove the caliper support spring by prying the spring out of the caliper (Fig. 24).

(7) Remove the caliper slide pin bushing caps and remove the slide pins (Fig. 25).

(8) Remove caliper from the anchor.

(9) Remove the inboard brake shoe (Fig. 26).

INSTALLATION

(1) Install the inboard brake shoe (Fig. 26).

(2) Lubricate the slide pins and slide pin bushings with Dow Corning® grease G807 or the grease provided with the caliper.

(3) Install the caliper on the anchor.

(4) Install the caliper slide pin and tighten to 29-41 N·m (21-30 ft. lbs.).

(5) Install the caliper slide pin bushing caps.

(6) Install the caliper support spring in the top end of the caliper and under the anchor. Then install other end into the lower caliper hole. Hold the spring

REMOVAL AND INSTALLATION (Continued)

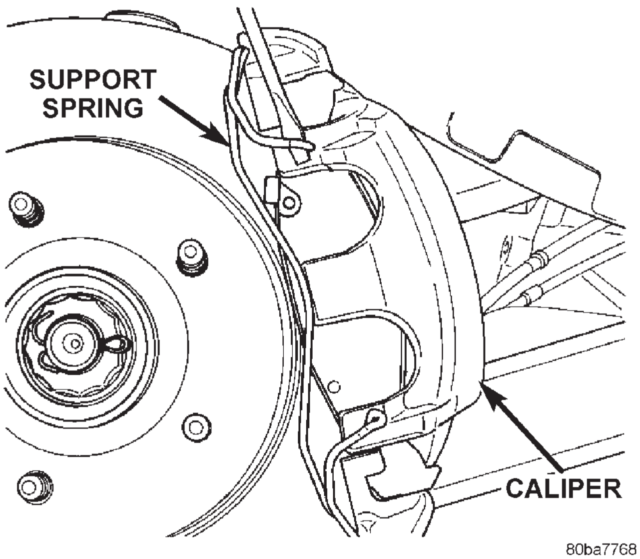


Fig. 24 Caliper Support Spring

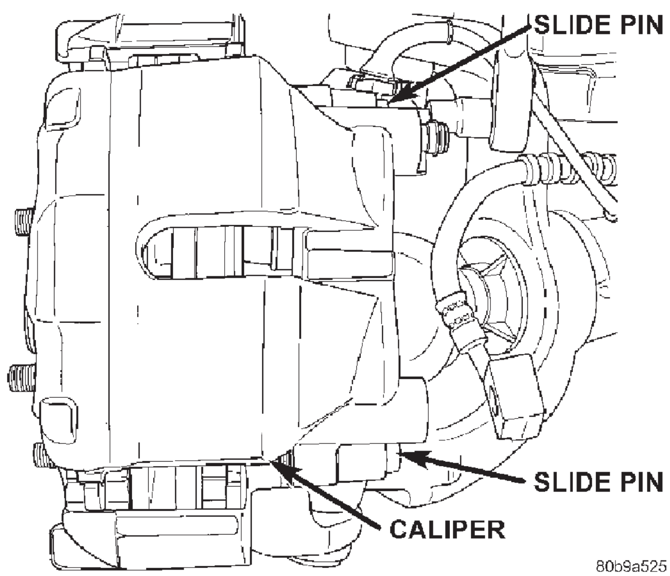


Fig. 25 Slide Pins

into the caliper hole with your thumb while prying the end of the spring out and down under the anchor with a screw drive.

(7) Install brake hose to caliper with **new gasket washers** and tighten banjo bolt to 31 N·m (23 ft. lbs.).

CAUTION: Verify brake hose is not twisted or kinked before tightening banjo bolt.

(8) Fill and bleed brake system.
(9) Install wheel and tire assemblies.
(10) Remove supports and lower vehicle.
(11) Verify brake fluid level.

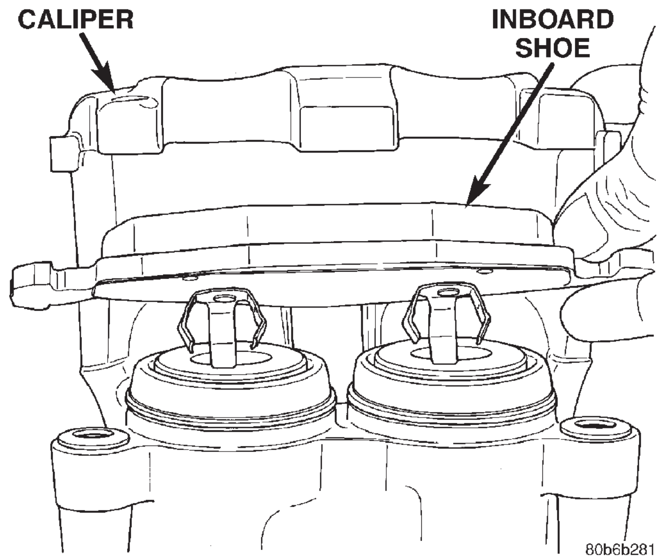


Fig. 26 Inboard Brake Shoe

FRONT DISC BRAKE SHOES

REMOVAL

(1) Raise and support vehicle.
(2) Remove wheel and tire assembly.
(3) Drain small amount of fluid from master cylinder brake reservoir with **clean** suction gun.
(4) Bottom caliper pistons into the caliper by prying the caliper over (Fig. 27).

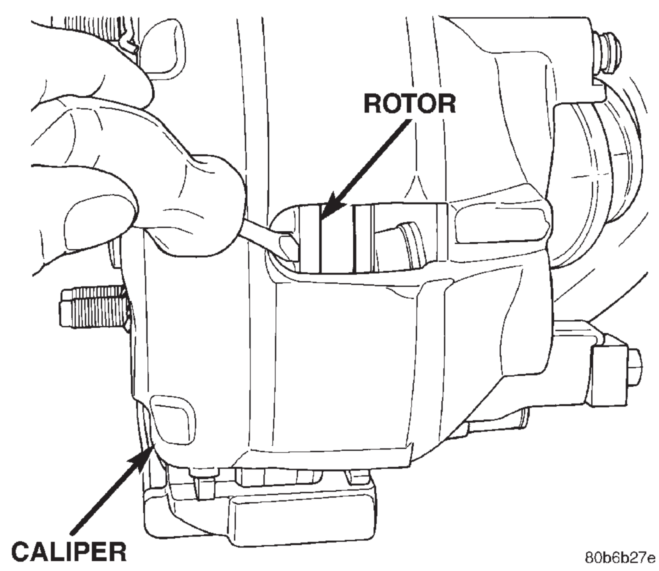


Fig. 27 Bottoming Caliper Piston

(5) Remove the caliper support spring by prying the spring out of the caliper (Fig. 28).
(6) Remove the caliper slide pin bushing caps and remove the slide pins (Fig. 29).
(7) Remove caliper from the anchor.

REMOVAL AND INSTALLATION (Continued)

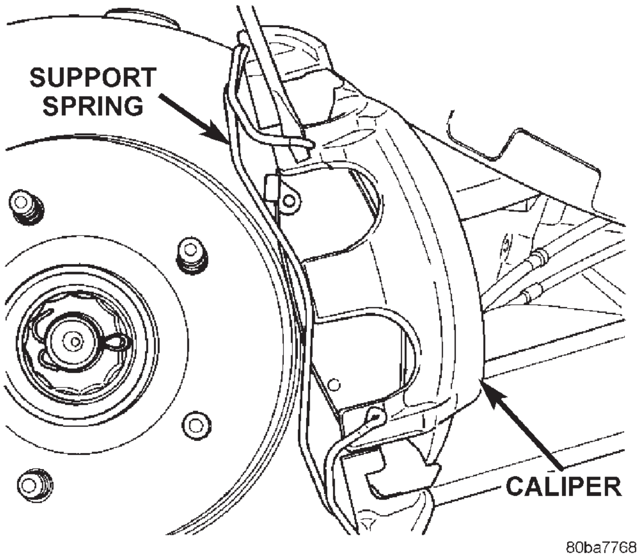


Fig. 28 Caliper Support Spring

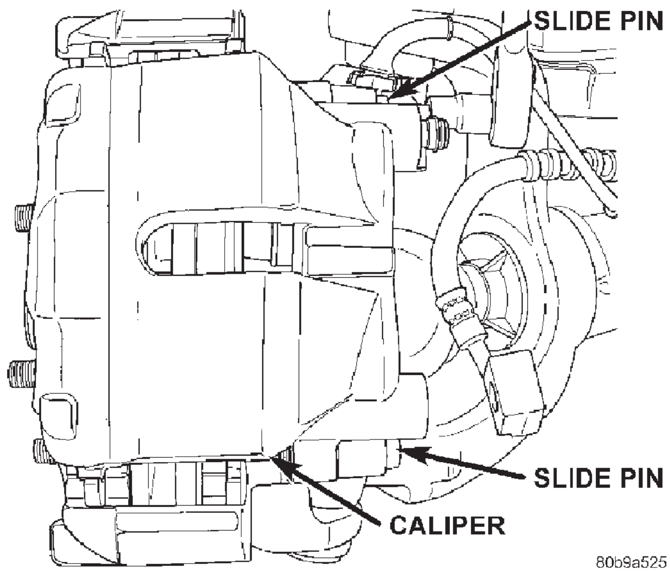


Fig. 29 Caliper Slide Pins

(8) Secure caliper to nearby suspension part with wire. **Do not allow brake hose to support caliper weight.**

(9) Remove the inboard brake shoe from the caliper (Fig. 30).

(10) Remove the outboard brake shoe (Fig. 31) from the caliper anchor.

INSTALLATION

(1) Install the inboard brake shoe onto the caliper (Fig. 30).

(2) Install the outboard shoe onto the caliper anchor (Fig. 31).

(3) Lubricate the slide pins and slide pin bushings with Dow Corning® grease G807 or the grease provided with the brake shoes.

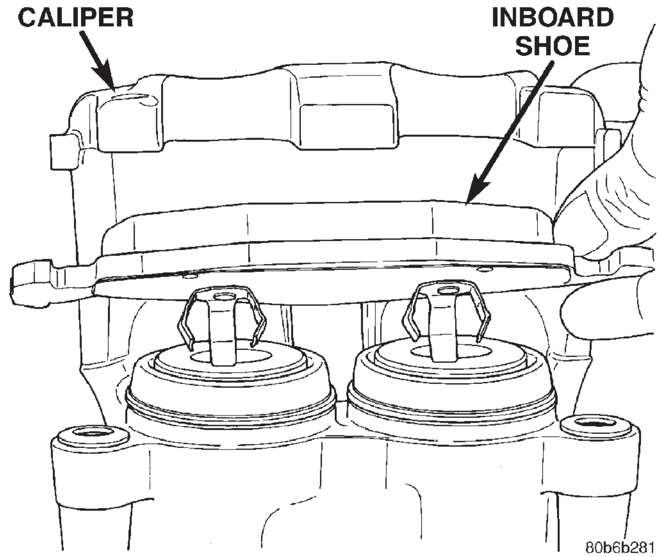


Fig. 30 Inboard Brake Shoe

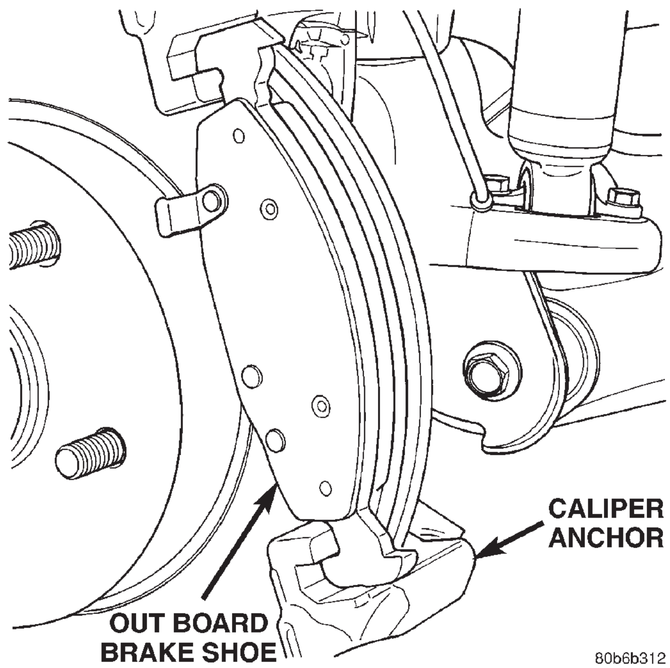


Fig. 31 Outboard Brake Shoe

(4) Install caliper on the caliper anchor.

(5) Install the caliper slide pin and tighten to 29-41 N·m (21-30 ft. lbs.).

(6) Install the caliper slide pin bushing caps.

(7) Install the caliper support spring in the top end of the caliper and under the anchor. Then install other end into the lower caliper hole. Hold the spring into the caliper hole with your thumb while prying the end of the spring out and down under the anchor with a screw drive.

(8) Install wheel and tire assembly.

(9) Remove support and lower vehicle.

REMOVAL AND INSTALLATION (Continued)

(10) Pump brake pedal until caliper pistons and brake shoes are seated.

(11) Fill brake fluid.

FRONT DISC BRAKE ROTOR

REMOVAL

(1) Raise and support the vehicle.

(2) Remove wheel and tire assembly.

(3) Remove the caliper anchor bolts (Fig. 32) and remove the caliper and anchor as an assembly from the steering knuckle.

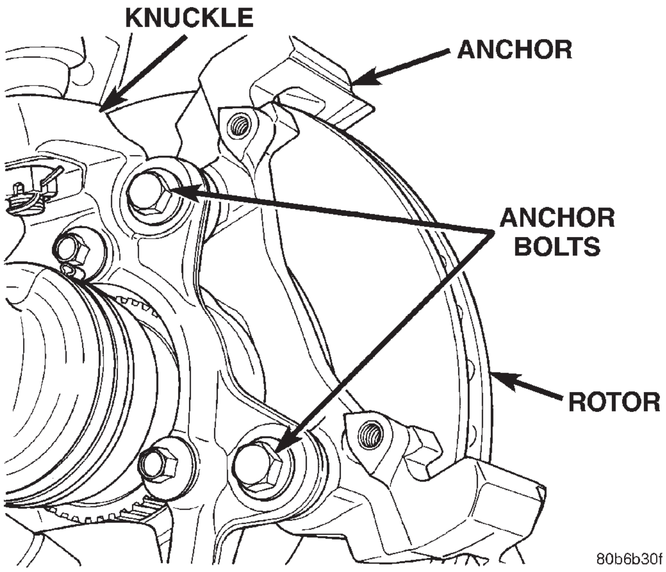


Fig. 32 Caliper Anchor Bolts

(4) Secure caliper anchor assembly to nearby suspension part with a wire. **Do not allow brake hose to support caliper weight.**

(5) Remove retainers securing rotor to hub studs.

(6) Remove rotor from hub.

INSTALLATION

(1) Install rotor on hub studs.

(2) Install the caliper anchor assembly on the knuckle. Install anchor bolts and tighten to 90-115 N·m (66-85 ft. lbs.).

(3) Install wheel and tire assembly.

(4) Remove support and lower the vehicle.

(5) Pump brake pedal to seat caliper pistons and brake shoes. Do not move vehicle until firm brake pedal is obtained.

REAR DISC BRAKE CALIPER

REMOVAL

(1) Raise and support vehicle.

(2) Remove rear wheel and tire assembly.

(3) Drain small amount of fluid from master cylinder brake reservoir with a **clean** suction gun.

(4) Bottom caliper pistons into the caliper by prying the caliper over (Fig. 33).

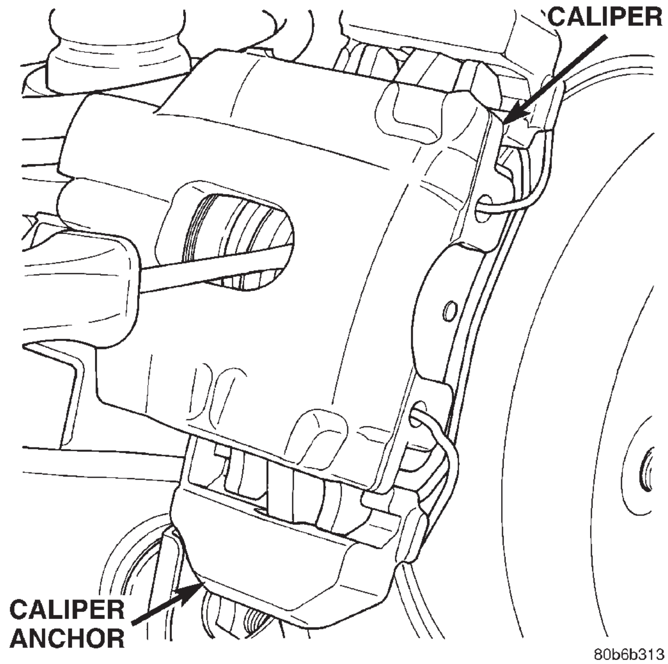


Fig. 33 Bottoming Caliper Piston

(5) Remove brake hose banjo bolt and discard gasket washers.

(6) Remove the caliper support spring by prying the spring out of the caliper (Fig. 34).

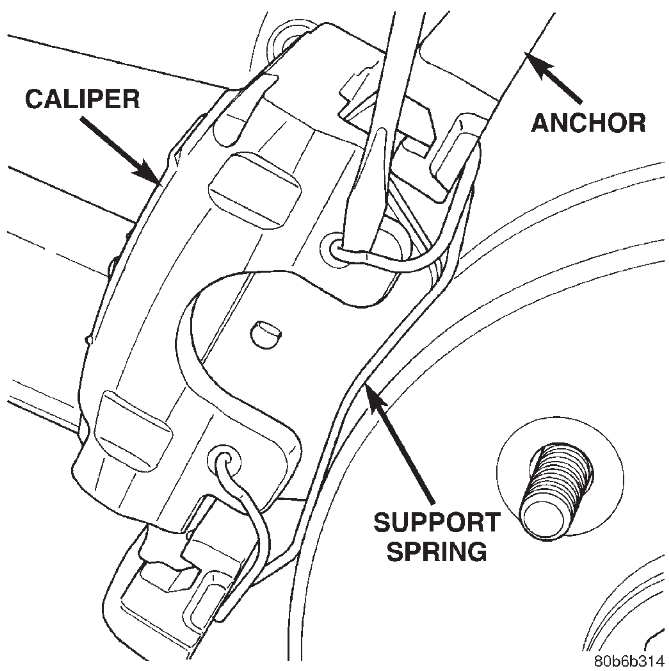


Fig. 34 Caliper Support Spring

REMOVAL AND INSTALLATION (Continued)

(7) Remove the caliper slide pin bushing caps and remove the slide pins (Fig. 35).

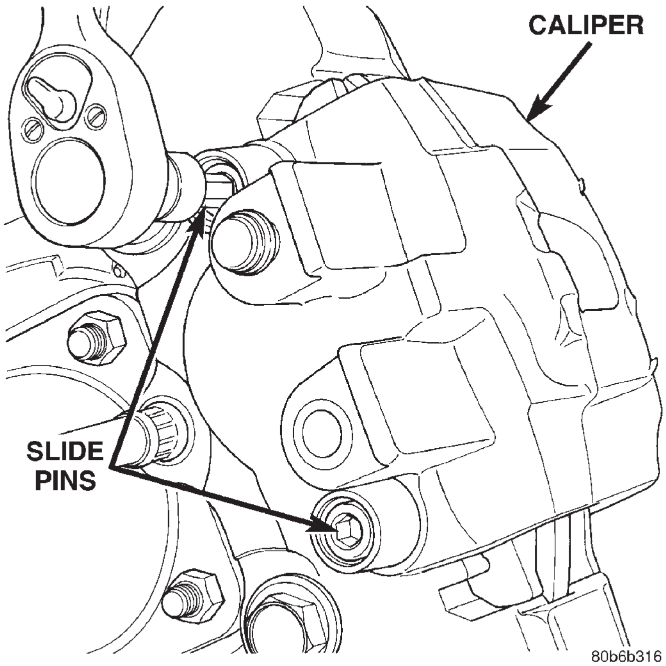


Fig. 35 Caliper Slide Pins

(8) Remove caliper from the anchor.
(9) Remove the inboard brake shoe (Fig. 36).

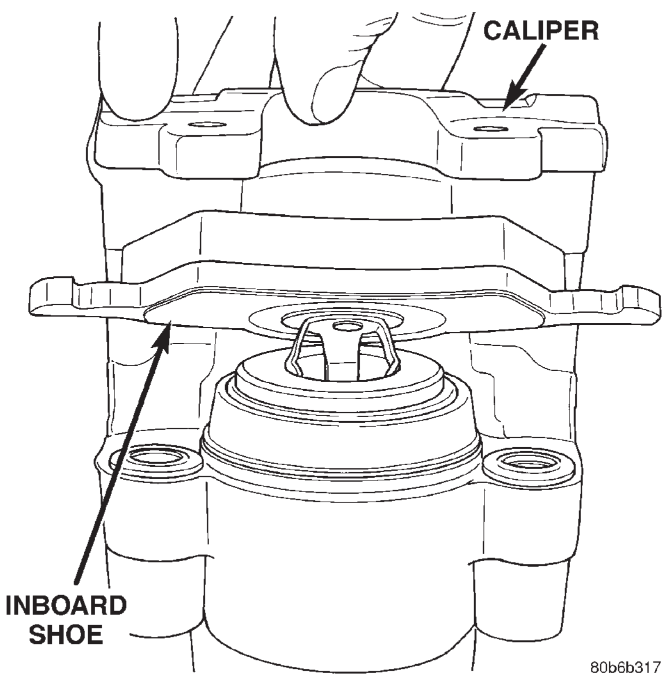


Fig. 36 Inboard Brake Shoe

INSTALLATION

(1) Install the inboard brake shoe (Fig. 36).
(2) Lubricate the slide pins and slide pin bushings with Dow Corning® grease G807 or the grease provided with the caliper.
(3) Install the caliper on the anchor.
(4) Install the caliper slide pin and tighten to 29-41 N·m (21-30 ft. lbs.).
(5) Install the caliper slide pin plugs.
(6) Install the caliper support spring in the top end of the caliper and under the anchor. Then install other end into the lower caliper hole. Hold the spring into the caliper hole with your thumb while prying the end of the spring out and down under the anchor with a screw drive.
(7) Install brake hose to caliper with **new** gasket washers and tighten banjo bolt to 31 N·m (23 ft. lbs.).

CAUTION: Verify brake hose is not twisted or kinked before tightening fitting bolt.

(8) Fill and bleed brake system.
(9) Install wheel and tire assemblies.
(10) Remove supports and lower vehicle.

REAR DISC BRAKE SHOES

REMOVAL

(1) Raise and support vehicle.
(2) Remove rear wheel and tire assembly.
(3) Drain small amount of fluid from master cylinder brake reservoir with a **clean** suction gun.
(4) Bottom caliper pistons into the caliper by prying the caliper over (Fig. 37).

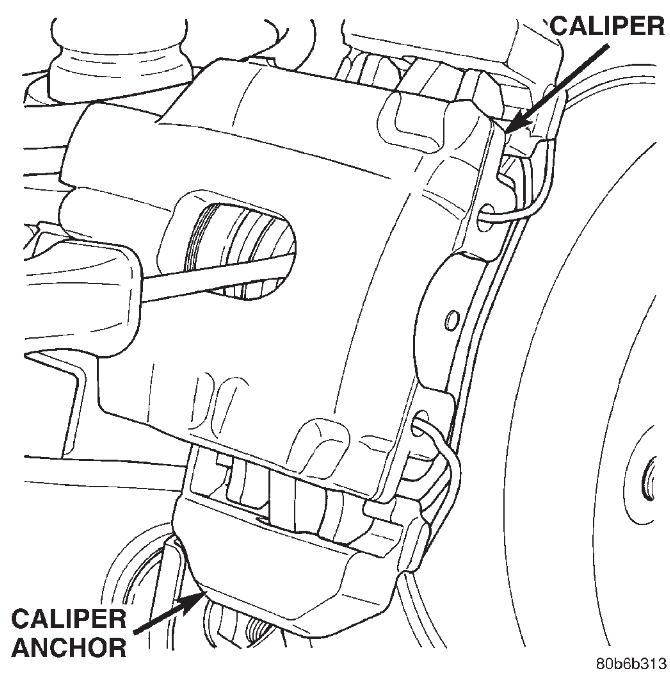


Fig. 37 Bottoming Caliper Piston

(5) Remove the caliper support spring by prying the spring out of the caliper (Fig. 38).
(6) Remove the caliper slide pin bushing caps and remove the slide pins (Fig. 39).

REMOVAL AND INSTALLATION (Continued)

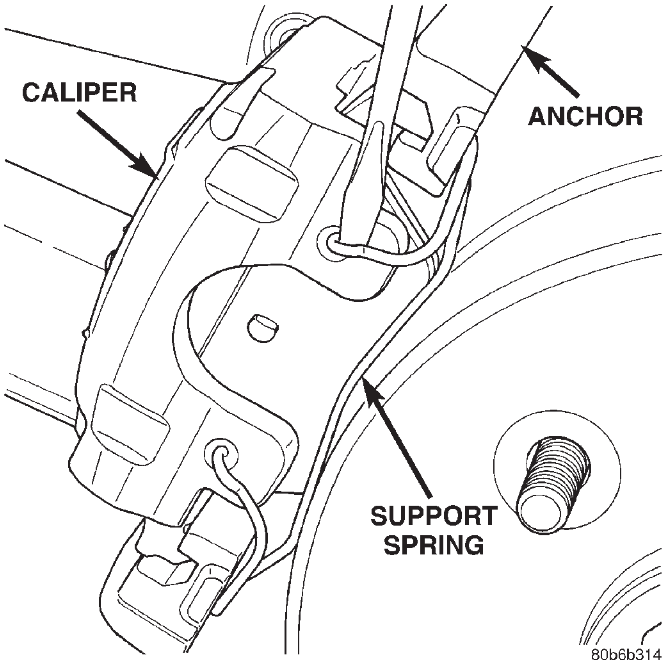


Fig. 38 Caliper Support Spring

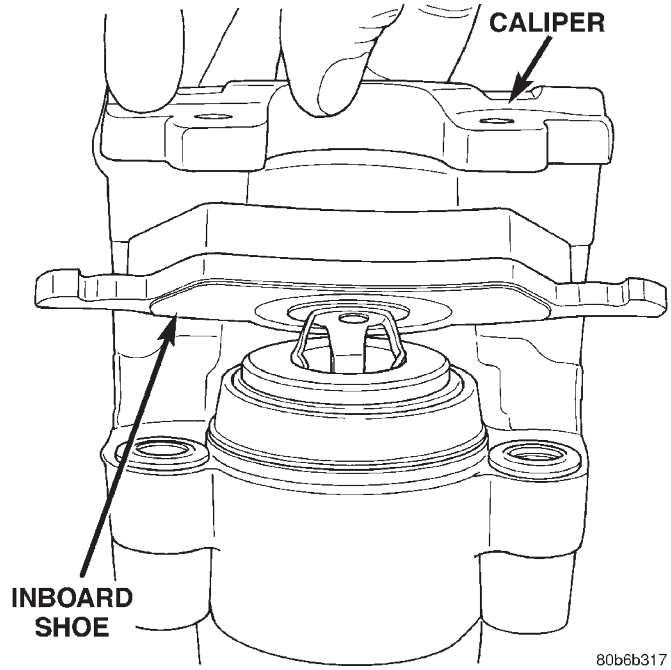


Fig. 40 Inboard Brake Shoe

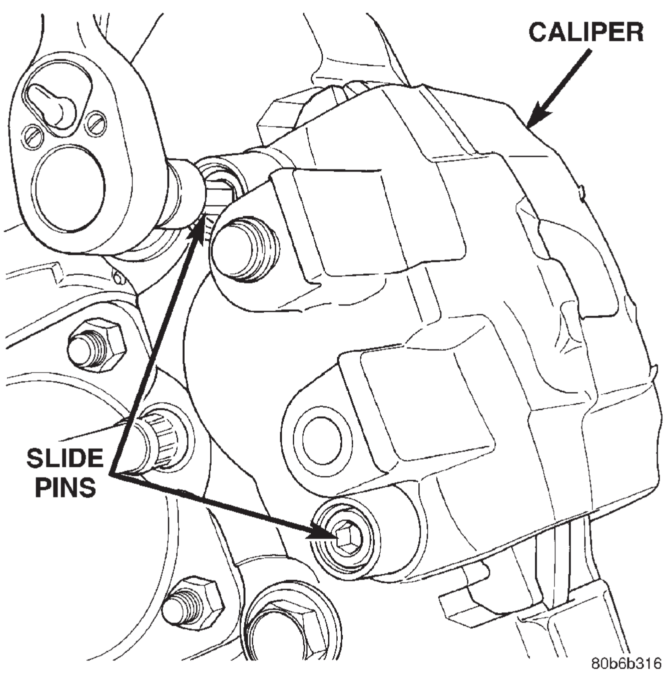


Fig. 39 Caliper Slide Pins

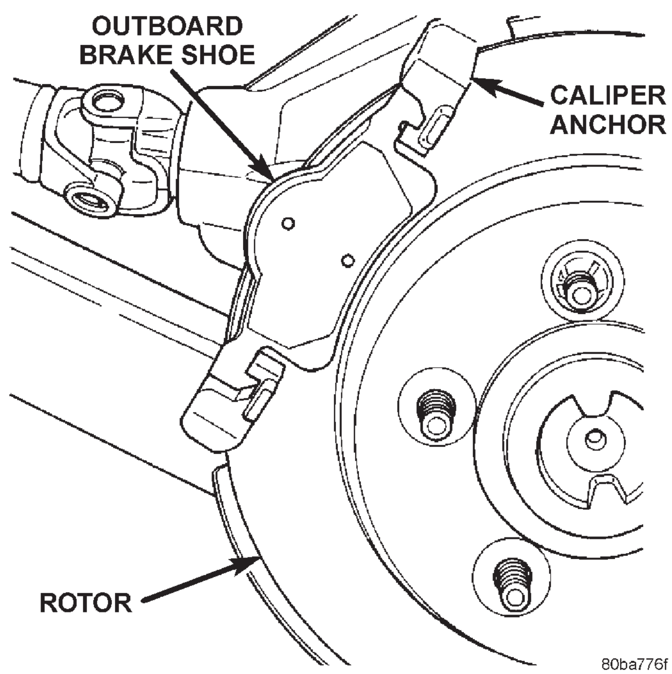


Fig. 41 Outboard Brake Shoe

(7) Remove caliper from the anchor.

(8) Secure caliper to nearby suspension part with wire. **Do not allow brake hose to support caliper weight.**

(9) Remove the inboard brake shoe from the caliper (Fig. 40).

(10) Remove outboard brake shoe (Fig. 41) from the caliper anchor.

INSTALLATION

(1) Install the inboard brake shoe onto the caliper (Fig. 40).

(2) Install the outboard brake shoe onto the caliper anchor (Fig. 41).

(3) Lubricate the slide pins and slide pin bushings with Dow Corning® grease G807 or the grease provided with the brake shoes.

(4) Install caliper on the anchor.

REMOVAL AND INSTALLATION (Continued)

(5) Install the caliper slide pin and tighten to 29-41 N·m (21-30 ft. lbs.).

(6) Install the caliper slide pin bushing caps.

(7) Install the caliper support spring in the top end of the caliper and under the anchor. Then install other end into the lower caliper hole. Hold the spring into the caliper hole with your thumb while prying the end of the spring out and down under the anchor with a screw drive.

(8) Install wheel and tire assembly.

(9) Remove support and lower vehicle.

(10) Pump brake pedal until caliper piston and brake shoes are seated.

(11) Fill brake fluid level if necessary.

REAR DISC BRAKE ROTOR

REMOVAL

(1) Raise and support the vehicle.

(2) Remove wheel and tire assembly.

(3) Remove the caliper anchor bolts (Fig. 42).

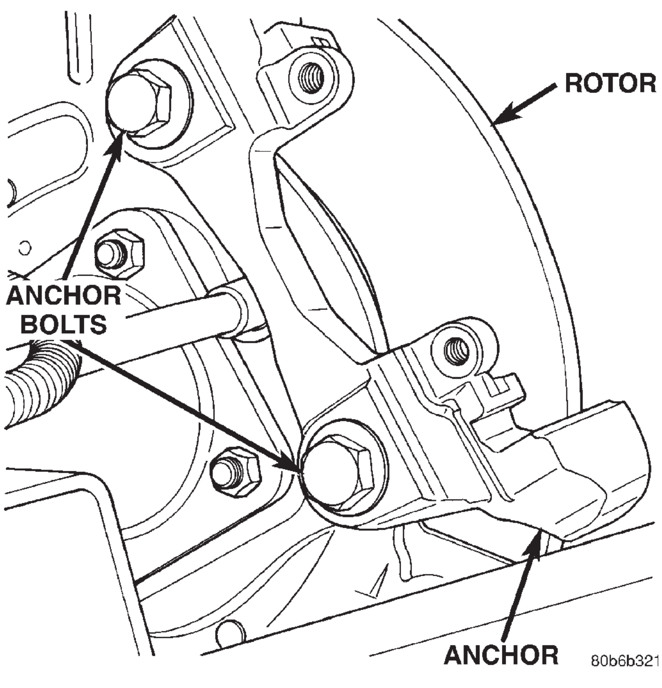


Fig. 42 Caliper Anchor Bolts

(4) Remove caliper and anchor as an assembly.

(5) Secure caliper anchor assembly to nearby suspension part with wire. **Do not allow brake hose to support caliper weight.**

(6) Remove retainers securing rotor to axle studs.

(7) Remove rotor off axle studs.

INSTALLATION

(1) Install rotor on axle studs.

(2) Install the caliper anchor assembly.

(3) Install anchor bolts and tighten to 90-115 N·m (66-85 ft. lbs.).

(4) Install wheel and tire assembly.

(5) Remove support and lower the vehicle.

(6) Pump brake pedal until caliper pistons and brake shoes are seated.

PARKING BRAKE LEVER

REMOVAL

(1) Remove center console, refer to Group 23 Body.

(2) Lift up rear seat and carpet covering the parking brake cables.

(3) Place a screw driver through the front cable eyelet (Fig. 43) and pry back on the front cable.

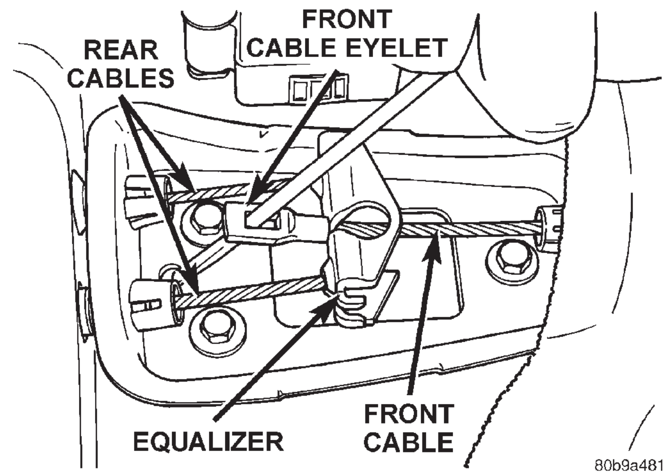


Fig. 43 Front Cable Eyelet

(4) Have an assistant pry down the lock out spring through the hole in the side of the park brake lever (Fig. 44) with a small screw driver. Then slowly release the front cable.

NOTE: Their should be slack in the cable if the lock out spring is engaged.

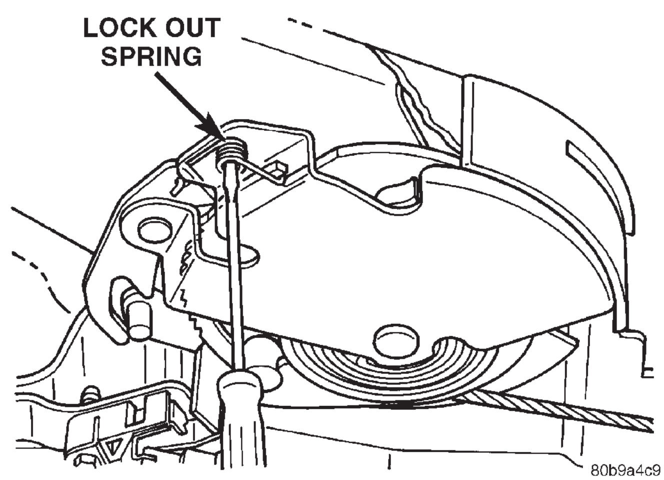


Fig. 44 Lock Out Spring

REMOVAL AND INSTALLATION (Continued)

(5) Disconnect parking brake switch wiring connector.

(6) Disengage front cable end from parking brake lever.

(7) Compress the cable retainer with a 13 mm wrench (Fig. 45) and remove the cable from the parking brake lever bracket.

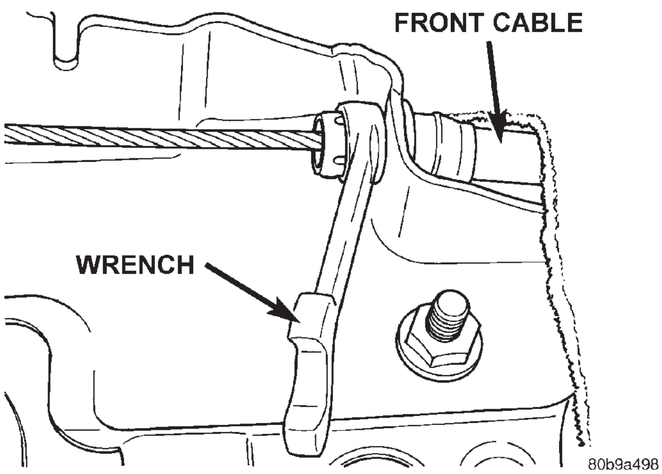


Fig. 45 Parking Brake Lever Bracket

(8) Remove the park brake lever mounting nuts and console bracket. (Fig. 46).

(9) Lift the lever assembly off the mounting studs and pull the front cable out of the lever bracket.

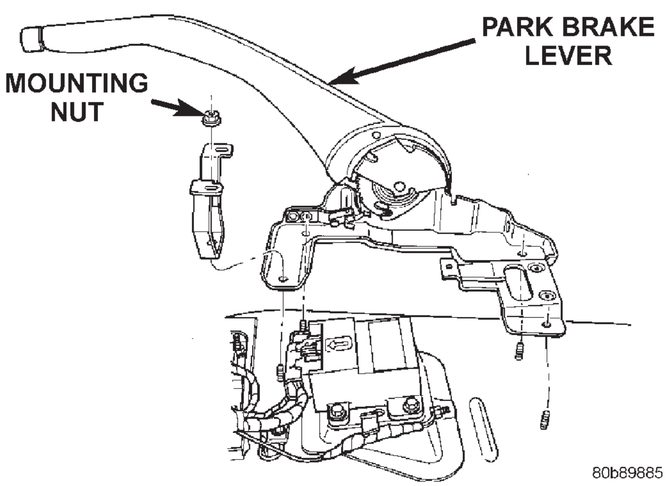


Fig. 46 Parking Brake Lever Mounting

INSTALLATION

(1) Install the lever assembly on the mounting studs while feeding the front cable into the lever bracket.

(2) Install the console bracket (Fig. 46) and mounting nuts.

(3) Engage the front cable end to the lever.

(4) Connect parking brake switch wire connector.

(5) Pull on the lever to release the lock out spring.

(6) Install center console, refer to Group 23 Body.

(7) Fold down the rear carpet cover and rear seat.

FRONT PARKING BRAKE CABLE

REMOVAL

(1) Remove center console, refer to Group 23 Body.

(2) Lift up rear seat and carpet covering the parking brake cables.

(3) Place a screw driver through the front cable eyelet (Fig. 47) and pry back on the front cable.

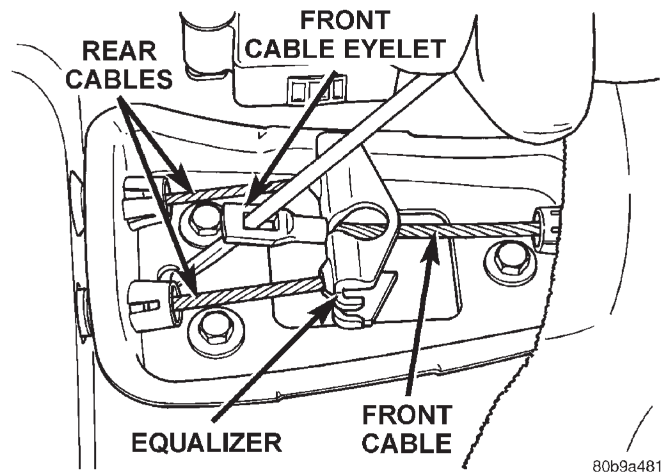


Fig. 47 Front Cable Eyelet

(4) Have an assistant pry down the lock out spring through the hole in the side of the park brake lever (Fig. 48) with a small screw driver. Then slowly release the front cable.

NOTE: Their should be slack in the cable if the lock out spring is engaged.

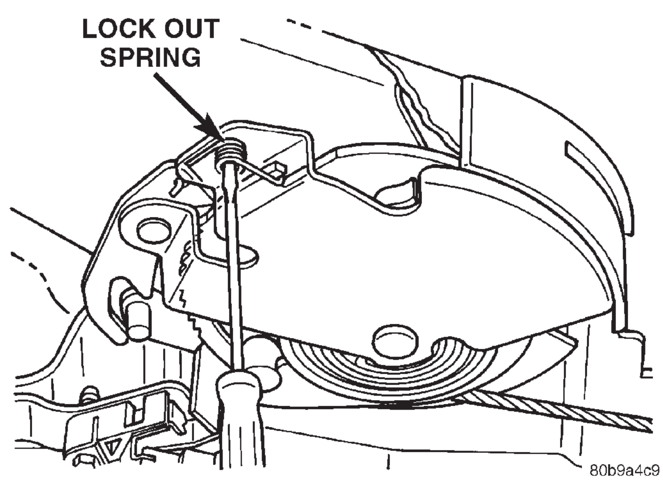


Fig. 48 Lock Out Spring

(5) Disengage front cable end from the equalizer (Fig. 49).

(6) Disengage front cable end from the parking brake lever.

(7) Remove the front carpet, refer to Group 23 Body.

REMOVAL AND INSTALLATION (Continued)

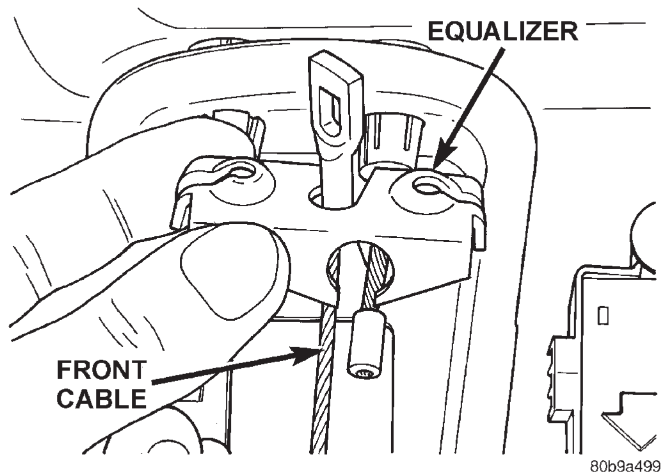


Fig. 49 Cable Equalizer

(8) Remove front cable retainer nuts (Fig. 50) from the floor pan.

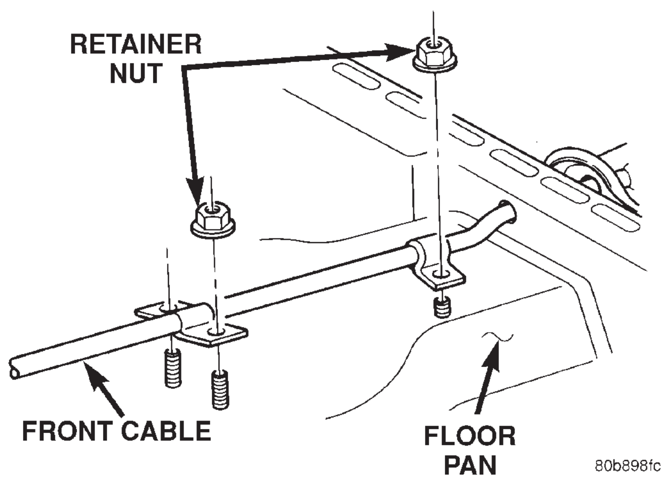


Fig. 50 Front Parking Brake Cable

(9) Compress the cable retainers with a 13 mm wrench (Fig. 51). Remove the cable from parking brake lever bracket and equalizer bracket.

INSTALLATION

(1) Install cable into the parking brake lever bracket and equalizer bracket.
(2) Install front cable to the floor pan and install retainer nuts.
(3) Engage front cable ends to the parking brake lever and equalizer.
(4) Install the front carpet, refer to Group 23 Body.
(5) Pull on the lever to release the lock out spring.
(6) Install center console, refer to Group 23 Body.
(7) Fold down the rear carpet cover and rear seat.

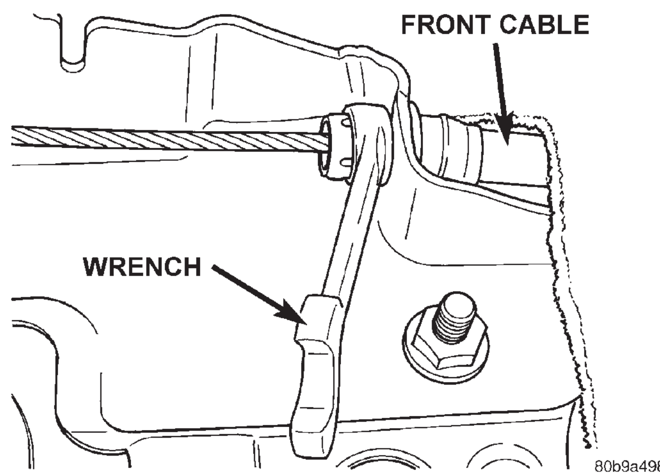


Fig. 51 Brake Lever Bracket

REAR PARKING BRAKE CABLES

REMOVAL

(1) Remove center console, refer to Group 23 Body.
(2) Lift up rear seat and carpet covering the parking brake cables.
(3) Place a screw driver through the front cable eyelet (Fig. 52) and pry back on the front cable.

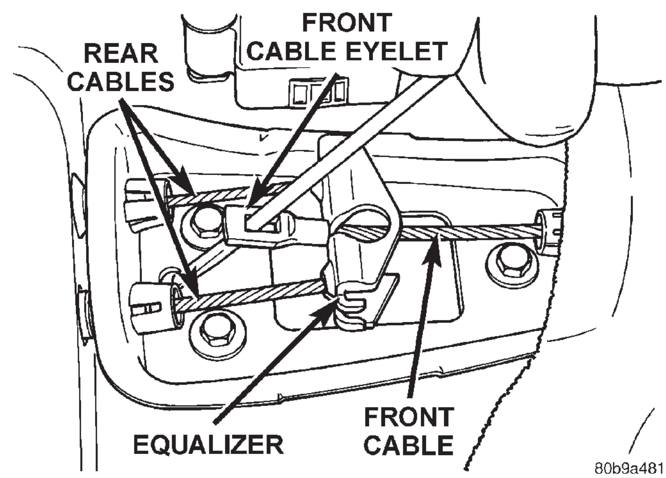


Fig. 52 Front Cable Eyelet

(4) Have an assistant pry down the lock out spring through the hole in the side of the park brake lever (Fig. 53) with a small screw driver. Then slowly release the front cable.

NOTE: Their should be slack in the cable if the lock out spring is engaged.

(5) Disengage rear cables ends from the equalizer.
(6) Compress the cable retainers with a 13 mm wrench (Fig. 54) and remove the cable from equalizer bracket.
(7) Raise and support the vehicle.

REMOVAL AND INSTALLATION (Continued)

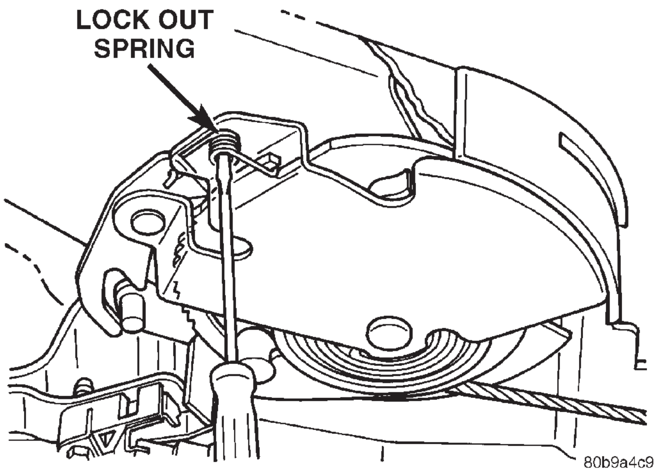


Fig. 53 Lock Out Spring

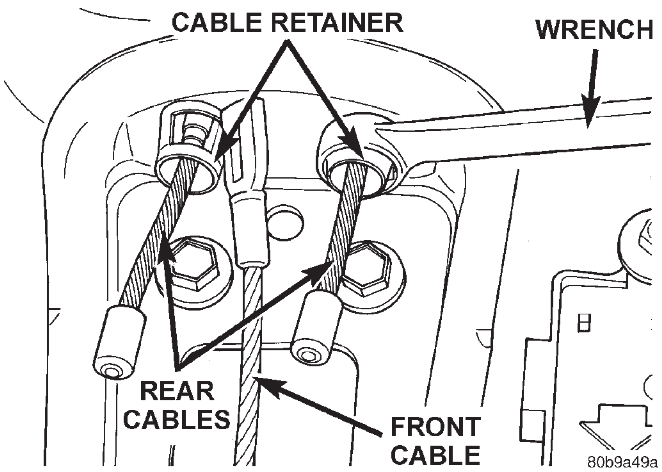


Fig. 54 Cable Retainers

(8) Remove the wheel and tire assemblies.

(9) Remove the brake calipers, caliper anchors and rotors.

(10) Remove the ABS sensor wiring harness (Fig. 55) from the rear brake cables.

(11) Remove the cable retainer bolts (Fig. 55) from the rear spring pads.

(12) Pull the cables out of the upper suspension arm brackets.

(13) Push the cable in and lift up the end of cable with a small screw driver to disengage the cable from the parking brake actuator (Fig. 56).

(14) Remove the cable from the vehicle.

INSTALLATION

(1) Install the cables through the caliper anchor mount. Then push the end of cable strand in to engage the cable end to the parking brake actuator.

(2) Feed the other end of the cables through the body and into the equalizer bracket (Fig. 57).

(3) Push the cables into the upper suspension arm brackets.

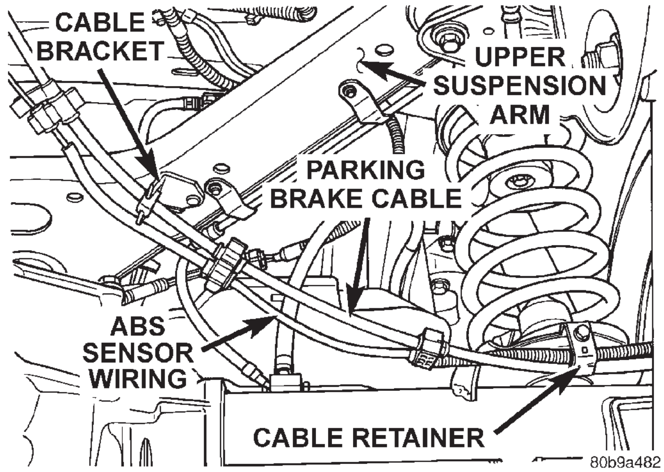


Fig. 55 Left Rear Parking Brake Cable

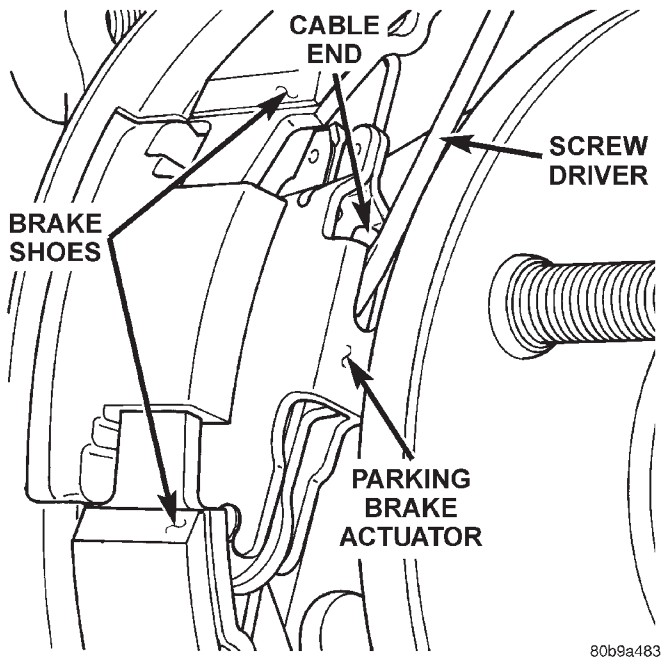


Fig. 56 Parking Brake Actuator

(4) Install the cable retainer bolts to the rear spring pads.

(5) Install the ABS sensor wiring harness to the rear brake cables.

(6) Install the rotors, caliper anchors and brake calipers.

(7) Install the wheel and tire assemblies.

(8) Remove support and lower the vehicle.

(9) Engage the cable ends into the parking brake equalizer.

(10) Pull on the lever to release the lock out spring.

(11) Install center console, refer to Group 23 Body.

(12) Fold down the rear carpet cover and rear seat.

(13) Verify parking brake operation.

REMOVAL AND INSTALLATION (Continued)

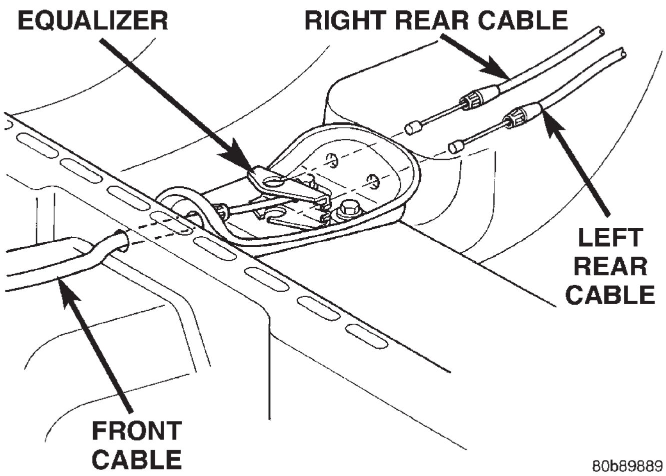


Fig. 57 Equalizer Bracket

PARKING BRAKE SHOES

REMOVAL

(1) Lock out park brake lever (Fig. 58).

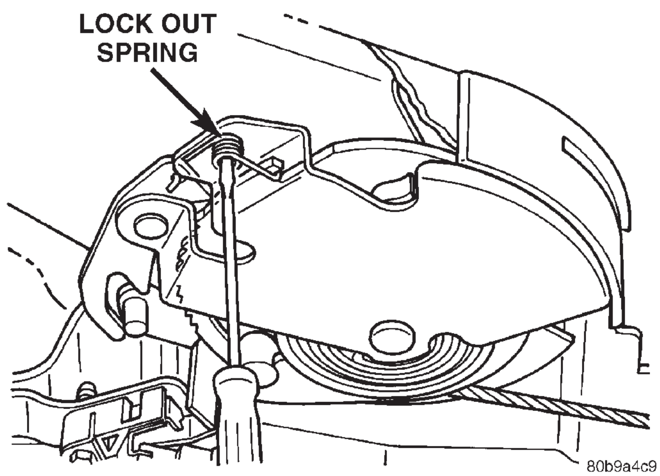


Fig. 58 Lock Out Spring

(2) Raise vehicle.
(3) Remove rear wheel and tire assembly.
(4) Remove caliper and anchor as an assembly.
(5) Remove rubber access plug from back of rear disc brake splash shield.
(6) If necessary retract parking brake shoes with brake adjuster tool (Fig. 59). Position tool at top of star wheel and rotate wheel downward in clockwise direction (while facing front of vehicle).
(7) Remove rotor from axle hub flange.
(8) Remove the lower shoe to shoe spring/adjuster spring with needle nose pliers (Fig. 60).
(9) Remove the upper shoe to shoe spring/return spring with brake pliers (Fig. 61).
(10) Remove shoe hold-down clips and pins (Fig. 62). Clip is held in place by pin which fits in clip notch. To remove clip, first push clip ends together

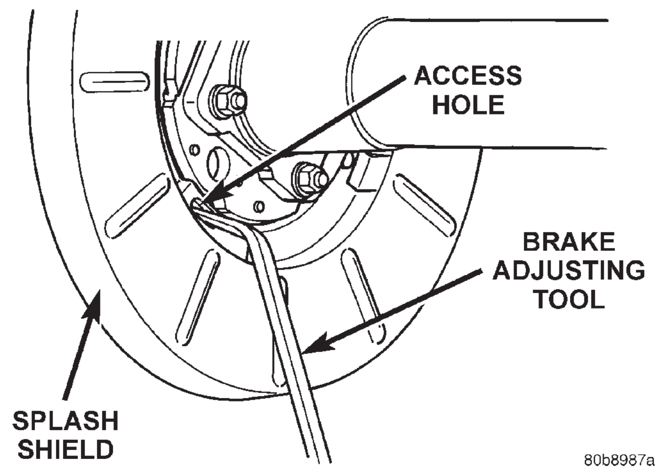


Fig. 59 Retracting Parking Brake Shoes

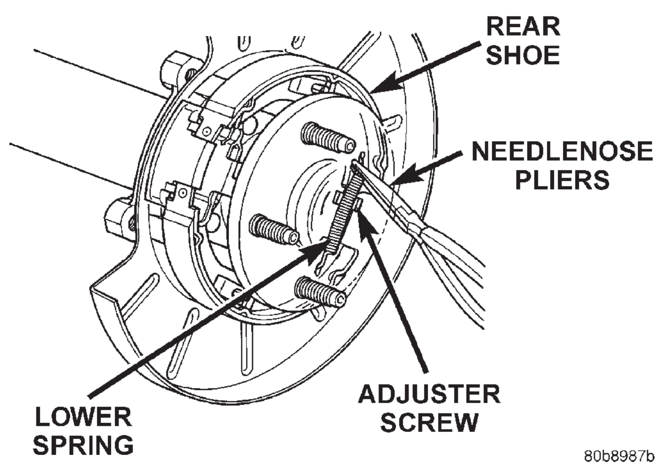


Fig. 60 Lower Spring

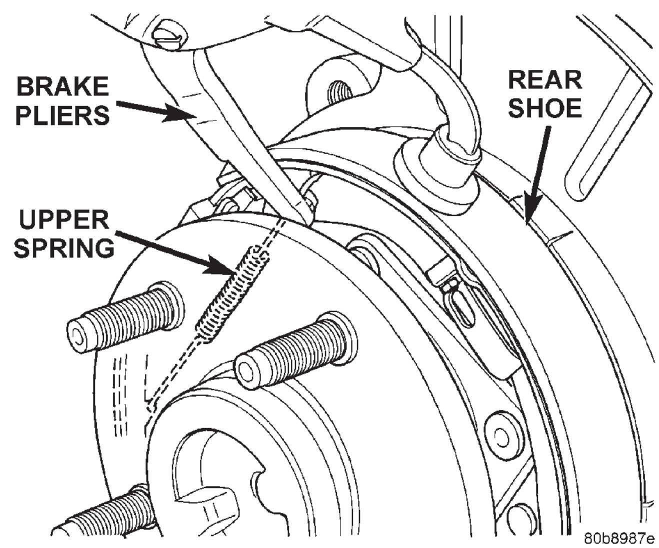


Fig. 61 Upper Spring

REMOVAL AND INSTALLATION (Continued)

and slide clip until head of pin clears narrow part of notch. Then remove clip and pin.

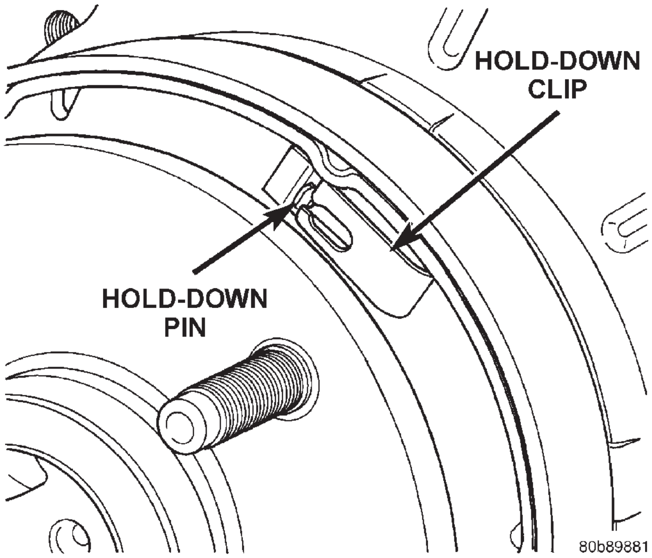


Fig. 62 Hold-Down Clip And Pin

(11) Remove shoes and adjuster.

INSTALLATION

(1) Install shoes on splash shield with hold down clips and pins. Be sure shoes are properly engaged in the park brake actuator.

(2) Lubricate and 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.

(3) Install lower shoe to shoe spring/adjuster spring. Needle nose pliers can be used to connect spring to each shoe.

(4) Install the upper shoe to shoe spring/return spring with brake pliers (Fig. 60).

(5) Install rotor and caliper anchor assembly.

(6) Install anchor bolts and tighten to 90-115 N·m (66-85 ft. lbs.).

(7) Actuate park brake lever to unlock the park brake system.

(8) Adjust parking brake shoes (Fig. 59).

(9) Install wheel and tire assembly.

(10) Lower vehicle and verify correct parking brake operation.

DISASSEMBLY AND ASSEMBLY

FRONT DISC BRAKE CALIPER

DISASSEMBLY

(1) Drain the brake fluid from caliper.

(2) C-clamp a block of wood over one piston (Fig. 63).

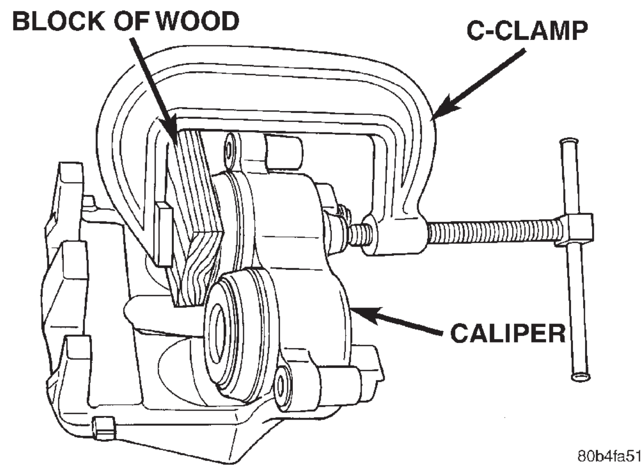


Fig. 63 C-Clamp One Piston

(3) Take another piece of wood and pad it with one-inch thickness of shop towels. Place this piece in the outboard shoe side of the caliper in front of the other piston. This will cushion and protect caliper piston during removal (Fig. 64).

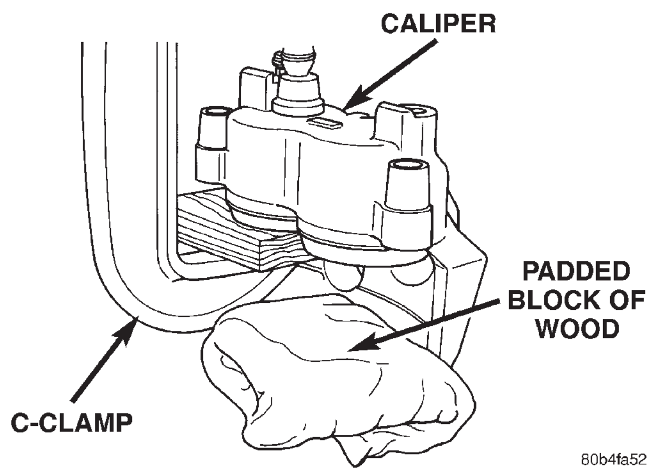


Fig. 64 Protect Caliper Piston

(4) To remove the caliper piston direct **short bursts of low pressure air** with a blow gun through the caliper brake hose port. Use only enough air pressure to ease the piston out.

CAUTION: Do not blow the piston out of the bore with sustained air pressure. This could result in a cracked piston.

WARNING: NEVER ATTEMPT TO CATCH THE PISTON AS IT LEAVES THE BORE. THIS COULD RESULT IN PERSONAL INJURY.

(5) Remove the C-clamp and block of wood from the caliper and clamp it over the dust boot of the

DISASSEMBLY AND ASSEMBLY (Continued)

first piston removed. This will seal the empty piston bore.

(6) Move the padded piece of wood in front of the other piston.

(7) Remove the second piston using the same procedure with **short bursts of low pressure air**.

(8) Remove piston dust boots with a suitable pry tool (Fig. 65) and discard.

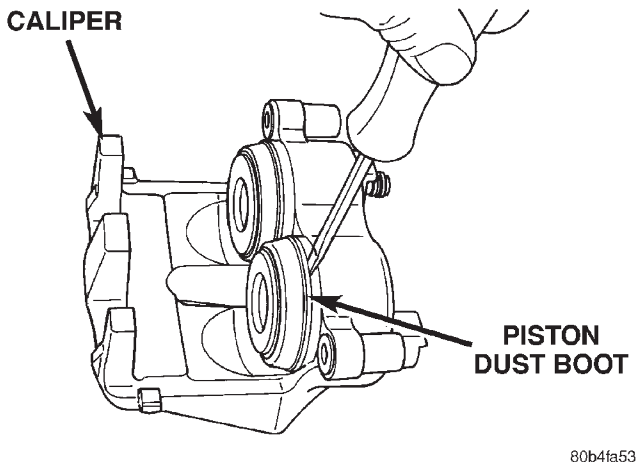


Fig. 65 Piston Dust Boot Removal

(9) Remove piston seals from caliper (Fig. 66) and discard.

CAUTION: Do not scratch piston bore while removing the seals.

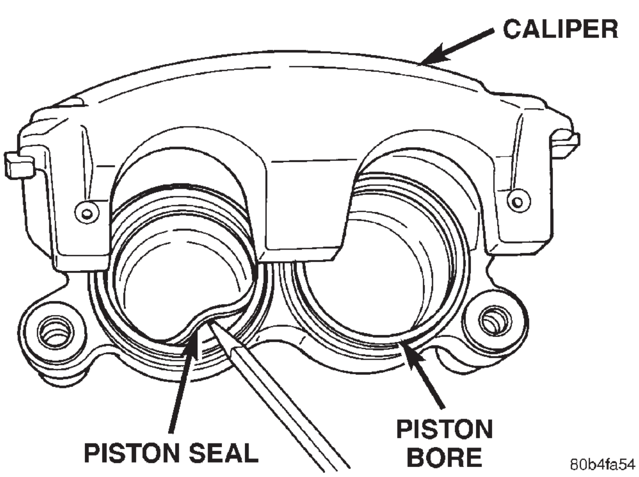


Fig. 66 Piston Seal

(10) Remove caliper slide pin bushings (Fig. 67).

(11) Remove caliper bleed screw.

ASSEMBLY

CAUTION: Dirt, oil, and solvents can damage caliper seals. Insure assembly area is clean and dry.

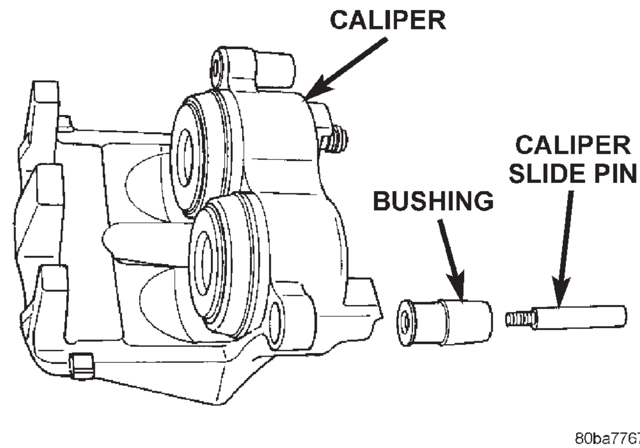


Fig. 67 Caliper Slide Pin Bushings

(1) Lubricate caliper pistons, piston seals and piston bores with clean brake fluid.

(2) Install new piston seals into seal groove with finger (Fig. 68).

NOTE: Verify seal is fully seated and not twisted.

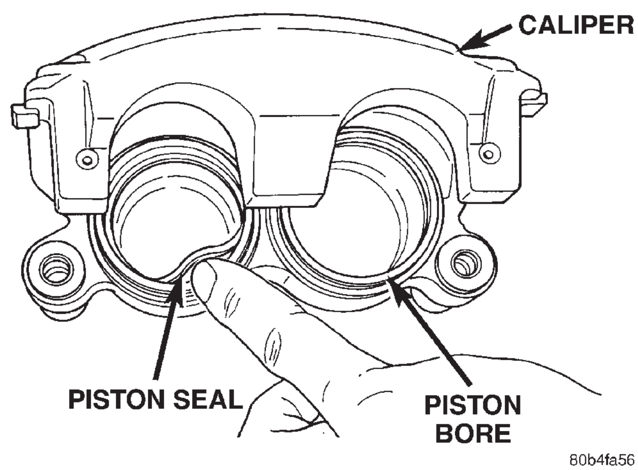


Fig. 68 Piston Seal

(3) Install new dust boot on caliper piston and seat boot lip into piston groove (Fig. 69).

(4) Stretch boot rearward to straighten boot folds, then move boot forward until folds snap into place.

(5) Install piston into caliper bore and press piston down to the bottom of the caliper bore by hand or with hammer handle (Fig. 70).

(6) Seat dust boot in caliper (Fig. 71) with Installer 8280 and Handle C-4171.

(7) Install the second piston and dust boot.

(8) Install caliper slide pin bushings into the caliper.

(9) Install caliper bleed screw.

DISASSEMBLY AND ASSEMBLY (Continued)

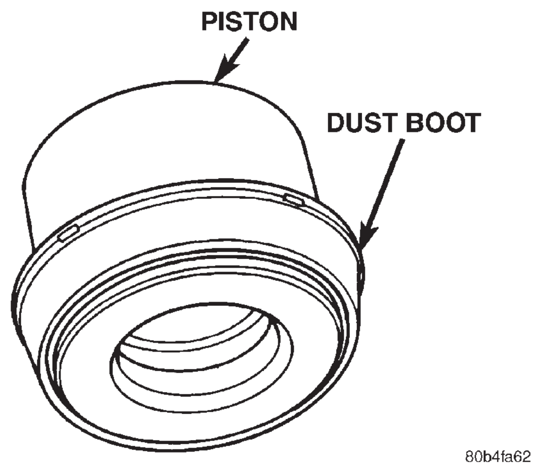


Fig. 69 Dust Boot On Piston

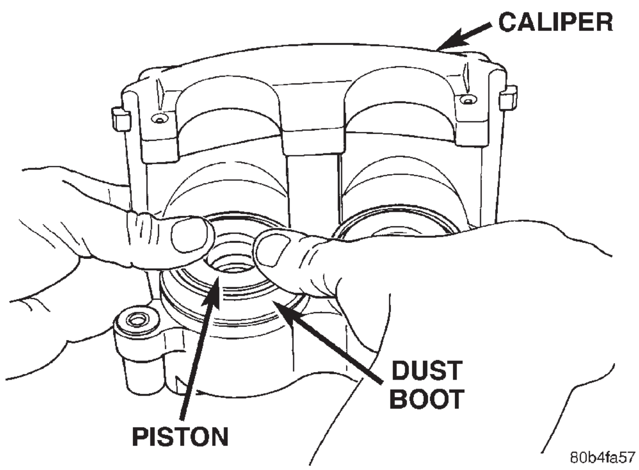


Fig. 70 Caliper Piston Installation

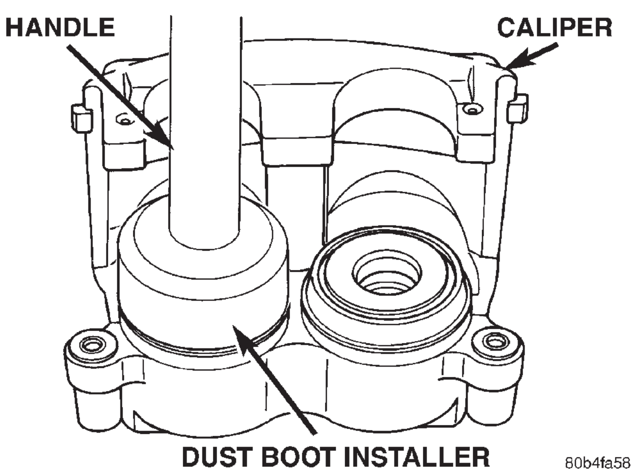


Fig. 71 Seating Dust Boot

REAR DISC BRAKE CALIPER

DISASSEMBLY

(1) Drain brake fluid out of caliper.

(2) Take a piece of wood and pad it with one-inch thickness of shop towels. Place this piece in the outboard shoe side of the caliper in front of the piston. This will cushion and protect caliper piston during removal (Fig. 72).

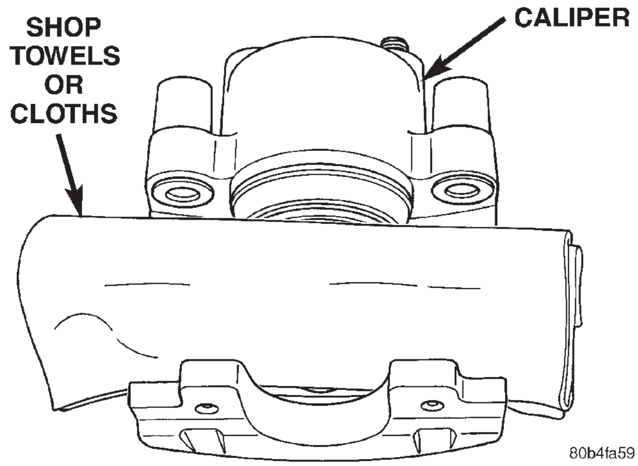


Fig. 72 Padding Caliper Interior

(3) To remove caliper piston direct **short bursts of low pressure air** with a blow gun through the caliper brake hose port (Fig. 73). Use only enough air pressure to ease the piston out.

CAUTION: Do not blow the piston out of the bore with sustained air pressure. This could result in a cracked piston.

WARNING: NEVER ATTEMPT TO CATCH THE PISTON AS IT LEAVES THE BORE. THIS MAY RESULT IN PERSONAL INJURY.

(4) Remove caliper piston dust boot with a suitable pry tool (Fig. 74) and discard.

(5) Remove piston seal from the caliper (Fig. 75) and discard.

CAUTION: Do not scratch the piston bore while removing the seal.

(6) Remove caliper slide pin bushings (Fig. 76).

(7) Remove caliper bleed screw.

ASSEMBLY

CAUTION: Dirt, oil, and solvents can damage caliper seals. Insure assembly area is clean and dry.

DISASSEMBLY AND ASSEMBLY (Continued)

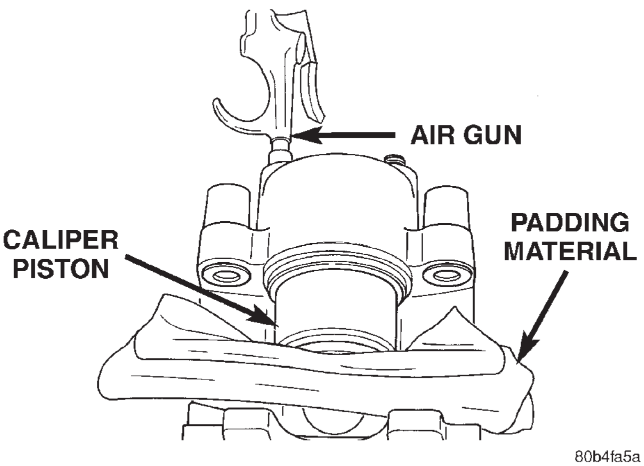


Fig. 73 Caliper Piston Removal

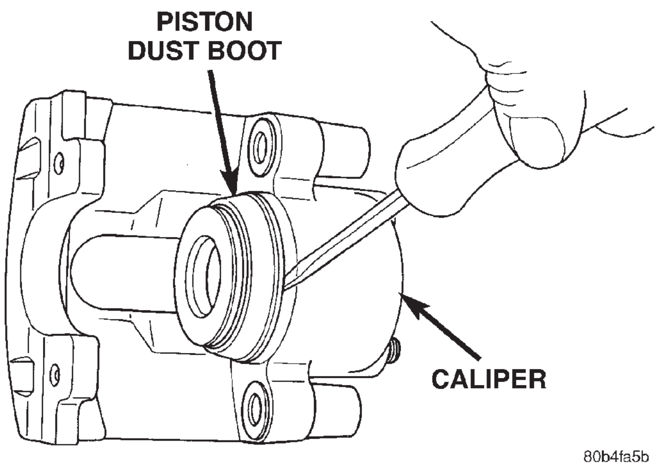


Fig. 74 Caliper Piston Dust Boot Removal

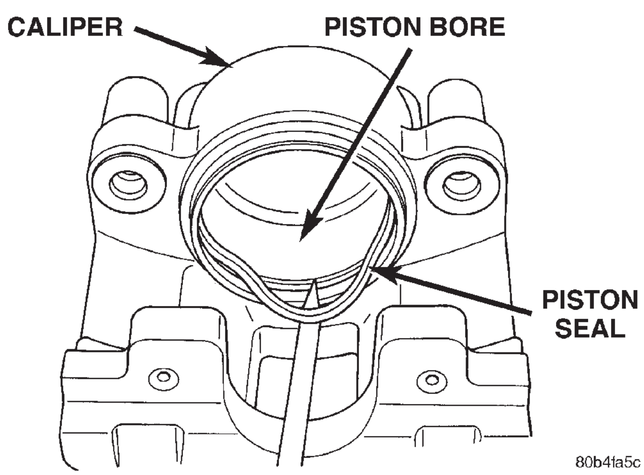


Fig. 75 Piston Seal Removal

(1) Lubricate caliper piston, piston seal and piston bore with clean brake fluid.

(2) Install new piston seal into seal groove with finger (Fig. 77).

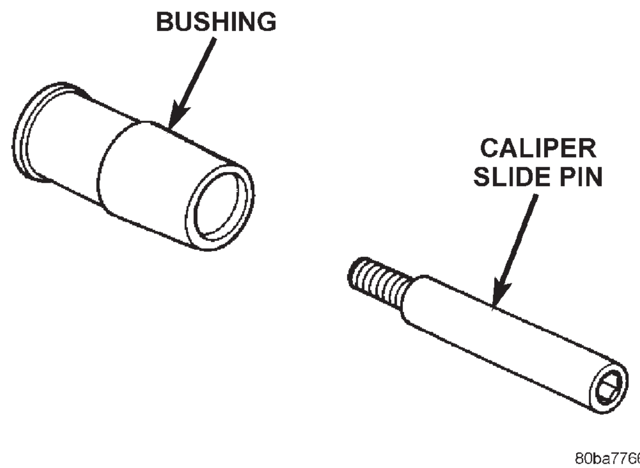


Fig. 76 Slide Pin And Bushing

NOTE: Verify seal is fully seated and not twisted.

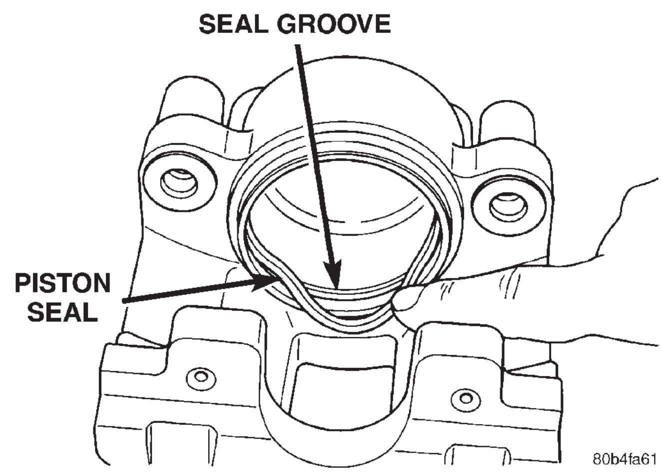


Fig. 77 Piston Seal Installation

(3) Install new dust boot on caliper piston and seat boot lip into piston groove (Fig. 78).

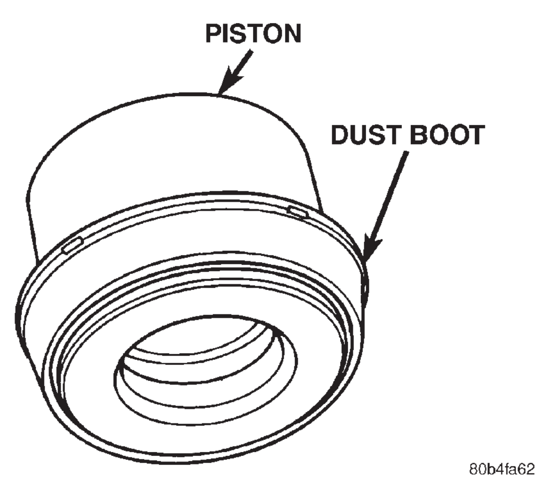


Fig. 78 Dust Boot On Piston

DISASSEMBLY AND ASSEMBLY (Continued)

(4) Stretch boot rearward to straighten boot folds, then move boot forward until folds snap into place.

(5) Install piston into caliper bore and press piston down to the bottom of the caliper bore by hand or with hammer handle (Fig. 79).

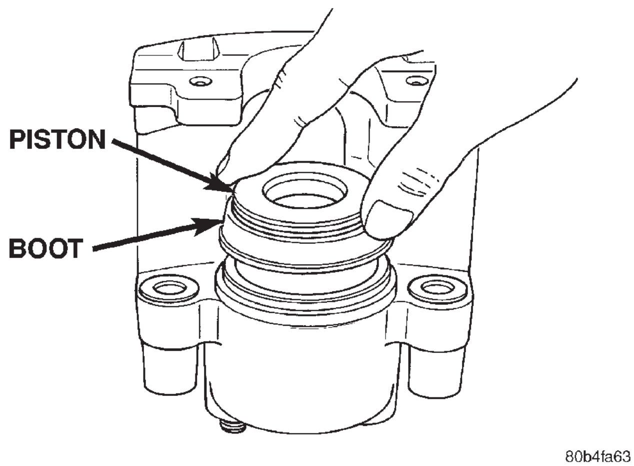


Fig. 79 Caliper Piston Installation

(6) Seat dust boot in caliper with Installer 8280 and Handle C-4171 (Fig. 80).

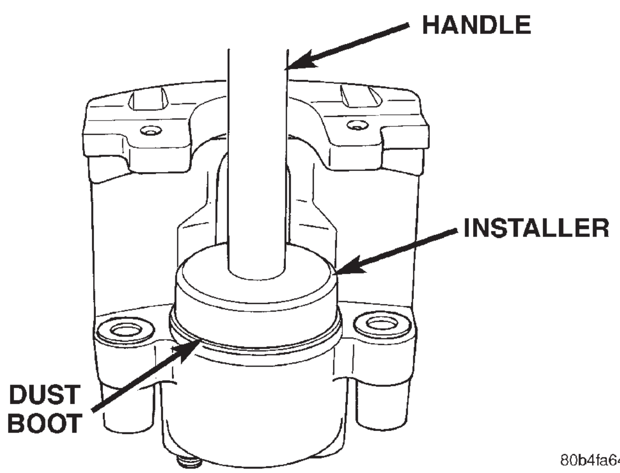


Fig. 80 Piston Dust Boot Installation

(7) Install caliper slide pin bushings into the caliper (Fig. 81).

(8) Install caliper bleed screw.

CLEANING AND INSPECTION

CALIPER

CLEANING

Clean the caliper components with clean brake fluid or brake clean only. Wipe the caliper and piston dry with lint free towels or use low pressure compressed air.

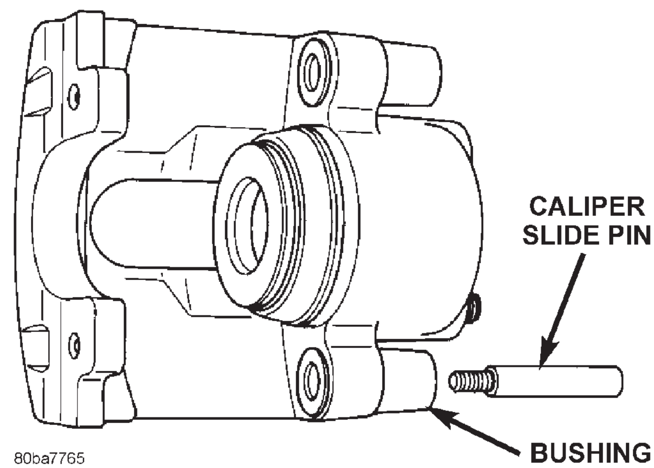


Fig. 81 Slide Pin And Bushing

CAUTION: Do not use gasoline, kerosene, thinner, or similar solvents. These products may leave a residue that could damage the piston and seal.

INSPECTION

The piston is made from a phenolic resin (plastic material) and should be smooth and clean.

The piston must be replaced if cracked or scored. Do not attempt to restore a scored piston surface by sanding or polishing.

CAUTION: If the caliper piston is replaced, install the same type of piston in the caliper. Never interchange phenolic resin and steel caliper pistons. The pistons, seals, seal grooves, caliper bore and piston tolerances are different.

The bore can be **lightly** polished with a brake hone to remove very minor surface imperfections (Fig. 82). The caliper should be replaced if the bore is severely corroded, rusted, scored, or if polishing would increase bore diameter more than 0.025 mm (0.001 inch).

ADJUSTMENTS

BRAKE LAMP SWITCH

(1) Press and hold brake pedal in applied position.

(2) Pull switch plunger all the way out to fully extended position.

(3) Release brake pedal. Then pull pedal lightly rearward. Pedal will set plunger to correct position as pedal pushes plunger into switch body. Switch will make ratcheting sound as it self adjusts.

CAUTION: Booster damage may occur if the pedal pull exceeds 20 lbs.

ADJUSTMENTS (Continued)

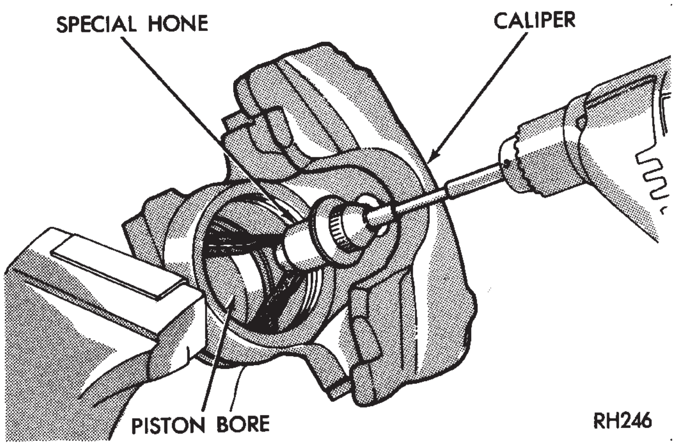


Fig. 82 Polishing Piston Bore

PARKING BRAKE SHOE

(1) Remove wheel and tire assemblies.

(2) Secure rotor with two wheel nuts.

(3) Remove rubber access plug from back of splash shield.

(4) Insert brake tool through access hole in splash shield (Fig. 83). Position tool at bottom of star wheel.

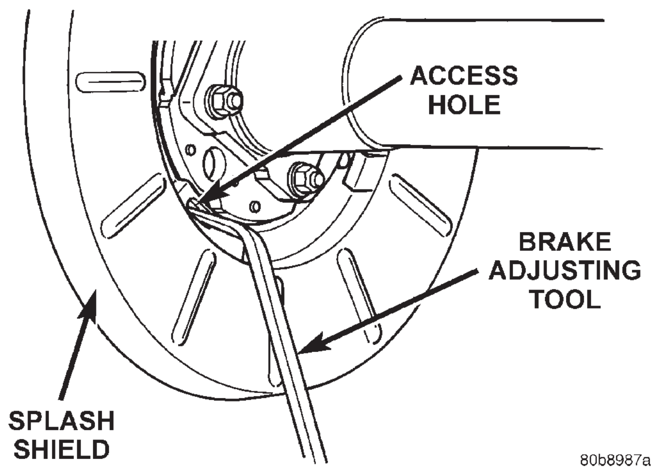


Fig. 83 Park Brake Shoe Adjustment

(5) Rotate star wheel upward in counterclockwise direction to expand shoes (while facing front of vehicle).

(6) Expand shoes until light drag is experienced. Then back off adjuster screw only enough to eliminate drag.

(7) Install plug in splash shield access hole.

(8) Install wheel and tire assemblies.

SPECIFICATIONS

BRAKE FLUID

The brake fluid used in this vehicle must conform to DOT 3 specifications and SAE J1703 standards. No other type of brake fluid is recommended or approved for usage in the vehicle brake system. Use only Mopar brake fluid or an equivalent from a tightly sealed container.

CAUTION: Never use reclaimed brake fluid or fluid from an container which has been left open. An open container will absorb moisture from the air and contaminate the fluid.

CAUTION: Never use any type of a petroleum-based fluid in the brake hydraulic system. Use of such type fluids will result in seal damage of the vehicle brake hydraulic system causing a failure of the vehicle brake system. Petroleum based fluids would be items such as engine oil, transmission fluid, power steering fluid, etc.

BRAKE COMPONENTS

Front Disc Brake Caliper
Type . . . . Floating
Pistons . . . . 48 mm (1.889 in.)
Front Disc Brake Rotor
Type . . . . Ventilated
Diameter . . . . 305 mm (12 in.)
Max. Runout . . . . 0.76 mm (0.003 in.)
Max. Thickness Variation . 0.0127 mm (0.0005 in.)
Min. Thickness . . . . 24.5 mm (0.9646 in.)
Rear Disc Brake Caliper
Type . . . . Floating
Piston . . . . 48 mm (1.889 in.)
Rear Disc Brake Rotor
Type . . . . Solid
Diameter . . . . 305 mm (12 in.)
Max. Runout . . . . 0.76 mm (0.003 in.)
Max. Thickness Variation . 0.0127 mm (0.0005 in.)
Min. Thickness . . . . 8.5 mm (0.335 in.)
Drum Max. Diameter . . . . . . 196 mm (7.7166 in.)
Brake Booster
Type . . . . Dual Diaphragm

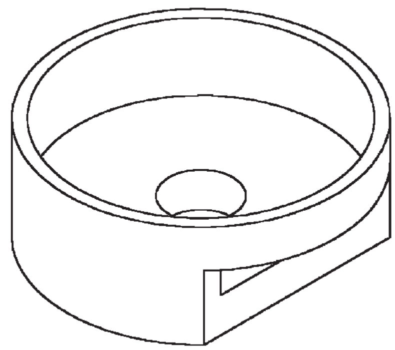
SPECIFICATIONS (Continued)

TORQUE CHART

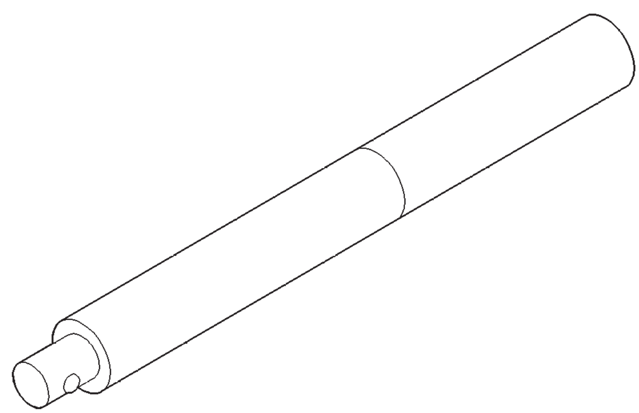
DESCRIPTION	TORQUE
Brake Pedal	
Support Bolt	23-34 N·m (17-25 ft. lbs.)
Pivot Nut	27-35 N·m (20-26 ft. lbs.)
Brake Booster	
Mounting Nuts	39 N·m (29 ft. lbs.)
Master Cylinder	
Mounting Nuts	25 N·m (18 ft. lbs.)
Primary Brake Line	16 N·m (144 in. lbs.)
Secondary Brake Line	16 N·m (144 in. lbs.)
Front Caliper	
Slide Pins	29-41 N·m (21-30 ft. lbs.)
Anchor Bolts	90-115 N·m (66-85 ft. lbs.)
Brake Hose Banjo Bolt	31 N·m (23 ft. lbs.)
Bleed Screw	16 N·m (144 in. lbs.)
Rear Caliper	
Slide Pins	29-41 N·m (21-30 ft. lbs.)
Anchor Bolts	90-115 N·m (66-85 ft. lbs.)
Brake Hose Banjo Bolt	31 N·m (23 ft. lbs.)
Bleed Screw	16 N·m (144 in. lbs.)

SPECIAL TOOLS

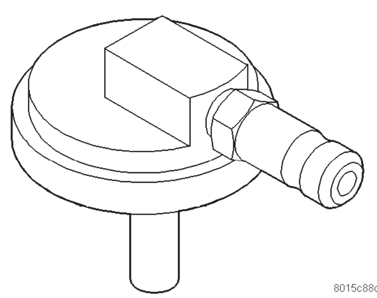
BASE BRAKES



Installer Caliper Dust Boot 8280



Handle C-4171



Adapter Pressure Bleeder 6921

ANTILOCK BRAKES

INDEX

DESCRIPTION AND OPERATION

ANTILOCK BRAKE SYSTEM

The antilock brake system (ABS) is an electronically operated, all wheel brake control system.

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 controller antilock brake unit operates the system components.

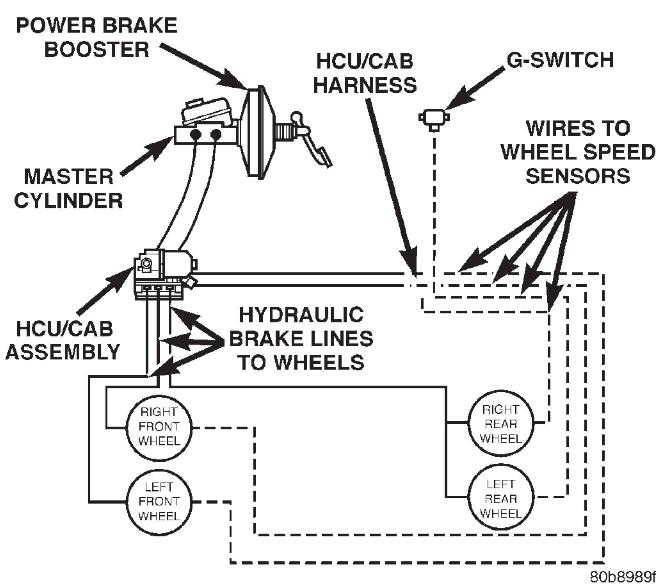


Fig. 1 Antilock Brake System

ABS system major components include:
- Controller Antilock Brakes (CAB)
- Hydraulic Control Unit (HCU)
- Wheel Speed Sensors (WSS)
- G-Switch
- ABS Warning Lamp

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 CAB 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 20 to 30 percent of actual vehicle speed during braking. Periods of high wheel slip occur when brake stops involve high pedal pressure and rate of vehicle deceleration.

Battery voltage is supplied to the CAB ignition terminal when the ignition switch is turned to Run position. The CAB 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 after the ignition switch is turned to Run position. The dynamic check occurs when vehicle road speed reaches approximately 30 kph (18 mph). During the dynamic check, the CAB briefly cycles the pump and solenoids to verify operation.

If an ABS component exhibits a fault during initialization, the CAB illuminates the amber warning lamp and registers a fault code in the microprocessor memory.

ELECTRONIC BRAKE DISTRIBUTION

The electronic brake distribution (EBD) functions like a rear proportioning valve. The EBD system uses the ABS system to control the slip of the rear wheels in partial braking range. The braking force of the rear wheels is controlled electronically by using the inlet and outlet valves located in the HCU.

DESCRIPTION AND OPERATION (Continued)

Upon entry into EBD the inlet valve for the rear brake circuit is switched on so that the fluid supply from the master cylinder is shut off. In order to decrease the rear brake pressure the outlet valve for the rear brake circuit is pulsed. This allows fluid to enter the low pressure accumulator (LPA) in the HCU resulting in a drop in fluid pressure to the rear brakes. In order to increase the rear brake pressure the outlet valve is switched off and the inlet valve is pulsed. This increases the pressure to the rear brakes. This will continue until the required slip difference is obtained. At the end of EBD braking (no brake application) the fluid in the LPA drains back to the master cylinder by switching on the outlet valve and draining through the inlet valve check valve. At the same time the inlet valve is switched on in case of another brake application.

The EBD will remain functional during many ABS fault modes. If the red and amber warning lamps are illuminated the EBD may have a fault.

ANTILOCK BRAKING

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 CAB 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. A speed sensor input signal indicating a high slip condition activates the CAB 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.

CONTROLLER ANTILOCK BRAKES

The CAB monitors wheel speed sensor inputs continuously while the vehicle is in motion. However, the CAB will not activate any ABS components as long as sensor inputs and the acceleration switch indicate normal braking.

The CAB is mounted to the HCU and operates the ABS system (Fig. 2) separate from other vehicle electrical circuits. CAB voltage source is through the ignition switch in the RUN position.

The CAB contains dual microprocessors. A logic block in each microprocessor receives identical sensor signals. These signals are processed and compared simultaneously.

The CAB 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.

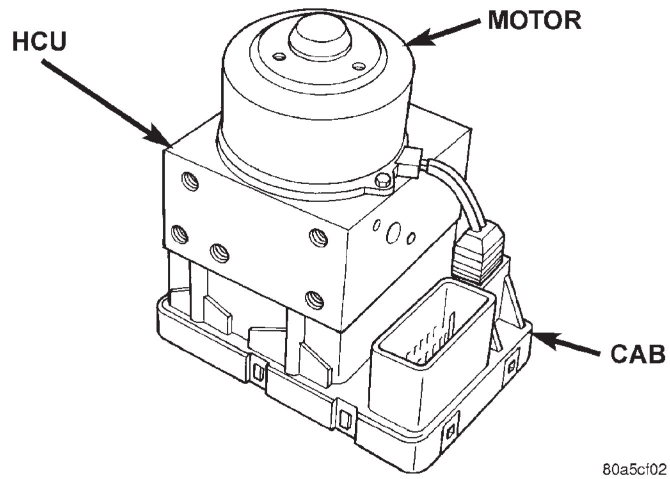


Fig. 2 Controller Antilock Brakes

HYDRAULIC CONTROL UNIT

The HCU consists of a valve body, pump motor, and wire harness (Fig. 2).

Accumulators in the valve body store extra fluid released to the system for ABS mode operation. The pump provides the fluid volume needed and is operated by a DC type motor. The motor is controlled by the CAB.

The valves modulate brake pressure during antilock braking and are controlled by the CAB.

The HCU provides three channel pressure control to the front and rear brakes. One channel controls the rear wheel brakes in tandem. The two remaining 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.

During normal braking, the HCU solenoid valves and pump are not activated. The master cylinder and power booster operate the same as a vehicle without an ABS brake system.

During antilock braking, solenoid valve pressure modulation occurs in three stages, pressure increase,

DESCRIPTION AND OPERATION (Continued)

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.

A pressure decrease cycle is initiated when speed sensor signals indicate high wheel slip at one or more wheels. At this point, the CAB closes the inlet then 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 CAB closes the outlet valve and begins a pressure increase or hold cycle as needed.

Pressure Hold

Both solenoid valves are closed in the pressure hold cycle. Fluid apply pressure in the control channel is maintained at a constant rate. The CAB maintains the hold cycle until sensor inputs indicate a pressure change is necessary.

Pressure Increase

The inlet valve is open and the outlet valve is closed during the pressure increase cycle. 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 SENSORS AND TONE WHEEL

A wheel speed sensor is used at each wheel. The front sensors are mounted to the steering knuckles. The rear sensors are mounted at the outboard end of the axle. Tone wheels are mounted to the outboard ends of the front and rear axle shafts. The gear type tone wheel serves as the trigger mechanism for each sensor.

The sensors convert wheel speed into a small digital signal. The CAB sends 12 volts to the sensors. The sensor has an internal magneto resistance bridge that alters the voltage and amperage of the signal circuit. This voltage and amperage is changed by magnetic induction when the toothed tone wheel passes the wheel speed sensor. This digital signal is sent to the CAB. The CAB measures the voltage and amperage of the digital signal for each wheel.

G-SWITCH

The G-switch (Fig. 3) is located under the rear seat. The switch is monitored by the CAB at all times. The switch contains three mercury switches which monitor vehicle deceleration rates (G-force). Sudden changes in deceleration rates trigger the switch, sending a signal to the CAB.

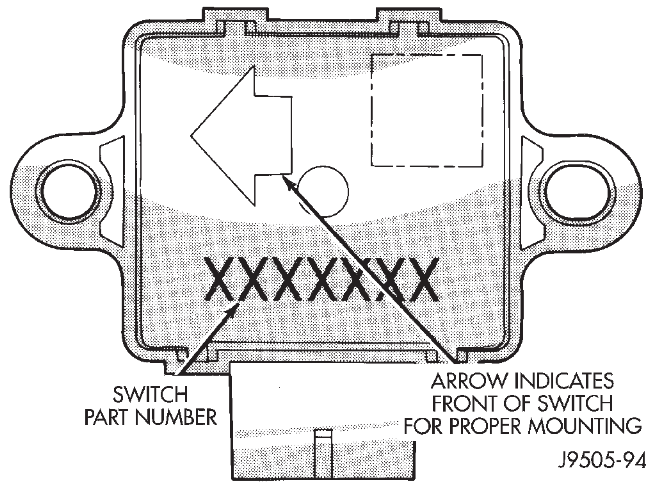


Fig. 3 G-Switch

ABS WARNING LAMP

The amber ABS warning lamp is located in the instrument cluster. The lamp illuminates at start-up to perform a self check. The lamp goes out when the self check program determines the system is operating normal. If an ABS component exhibits a fault the CAB will illuminate the lamp and register a trouble code in the microprocessor. The lamp is controlled by the CAB. The CAB controls the lamp sending a message to the instrument cluster.

A red warning lamp with a amber warning lamp may indicate a electronic brake distribution fault.

DIAGNOSIS AND TESTING

ANTILOCK BRAKES

The ABS brake system performs several self-tests every time the ignition switch is turned on and the vehicle is driven. The CAB monitors the systems input and output circuits to verify the system is operating correctly. If the on board diagnostic system senses that a circuit is malfunctioning the system will set a trouble code in its memory.

NOTE: An audible noise may be heard during the self-test. This noise should be considered normal.

NOTE: The MDS or DRB III scan tool is used to diagnose the ABS system. For additional information refer to the Antilock Brake section in Group 8W. For test procedures refer to the Chassis Diagnostic Manual.

SERVICE PROCEDURES

BLEEDING ABS BRAKE SYSTEM

ABS system bleeding requires conventional bleeding methods plus use of the DRB scan tool. The procedure involves performing a base brake bleeding, followed by use of the scan tool to cycle and bleed the HCU pump and solenoids. A second base brake bleeding procedure is then required to remove any air remaining in the system.

(1) Perform base brake bleeding. Refer to base brake section for procedure.

(2) Connect scan tool to the Data Link Connector.

(3) Select ANTILOCK BRAKES, followed by MISCELLANEOUS, then ABS BRAKES. Follow the instructions displayed. When scan tool displays TEST COMPLETE, disconnect scan tool and proceed.

(4) Perform base brake bleeding a second time. Refer to base brake section for procedure.

(5) Top off master cylinder fluid level and verify proper brake operation before moving vehicle.

REMOVAL AND INSTALLATION

CONTROLLER ANTILOCK BRAKES

REMOVAL

(1) Remove negative battery cable from the battery.

(2) Remove air cleaner housing refer to Group 14 Fuel System.

(3) Pull CAB harness connector release up and remove connector (Fig. 4).

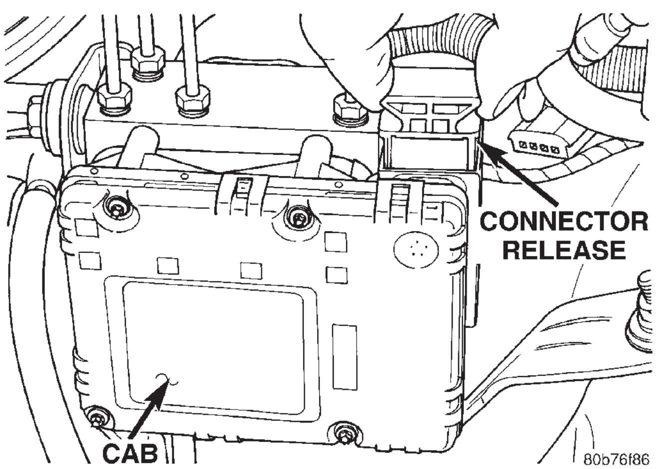


Fig. 4 CAB Connector Release

(4) Remove pump motor connector.

(5) Remove CAB mounting bolts (Fig. 5) and remove the CAB from the HCU.

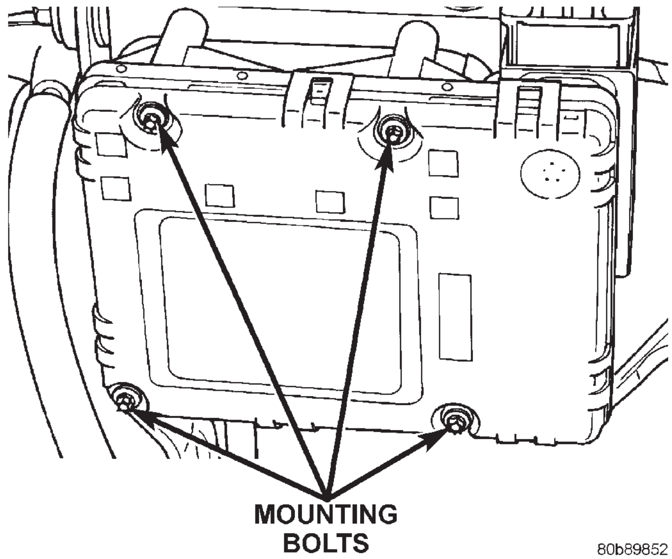


Fig. 5 CAB Mounting Bolts

INSTALLATION

(1) Install the CAB onto the HCU and tighten mounting bolts to 1.8 N·m (16 in. lbs.).

(2) Install pump motor connector.

(3) Install CAB harness connector and push down connector release.

(4) Install air cleaner housing.

(5) Install negative battery cable to the battery.

HYDRAULIC CONTROL UNIT/CONTROLLER ANTILOCK BRAKES

REMOVAL

(1) Remove negative battery cable from the battery.

(2) Remove air cleaner housing refer to Group 14 Fuel System.

(3) Pull CAB harness connector release up and remove connector (Fig. 6).

(4) Remove the brake lines from the HCU.

(5) Remove HCU/CAB side mounting bolt and two rear mounting bolts (Fig. 7).

(6) Remove HCU/CAB assembly from the vehicle.

INSTALLATION

(1) Install HCU/CAB assembly into the mounting bracket and tighten mounting bolts to 12 N·m (9 ft. lbs.).

(2) Install the brake lines to the HCU and tighten to 16 N·m (12 ft. lbs.).

(3) Install CAB harness connector and push down connector release.

(4) Install air cleaner housing.

(5) Install negative battery cable to the battery.

(6) Bleed base and ABS brake systems.

REMOVAL AND INSTALLATION (Continued)

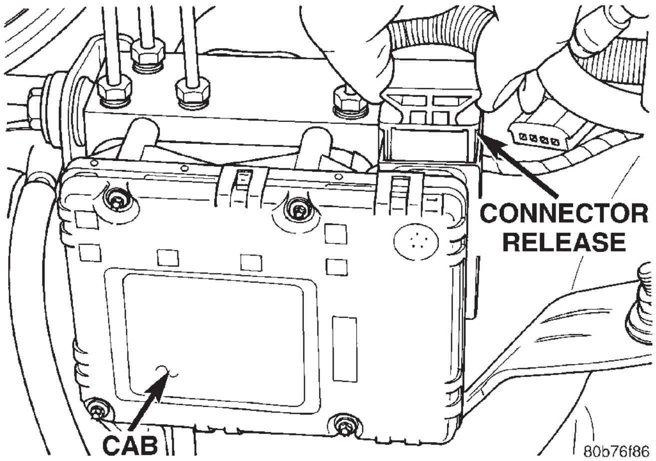


Fig. 6 CAB Connector Release

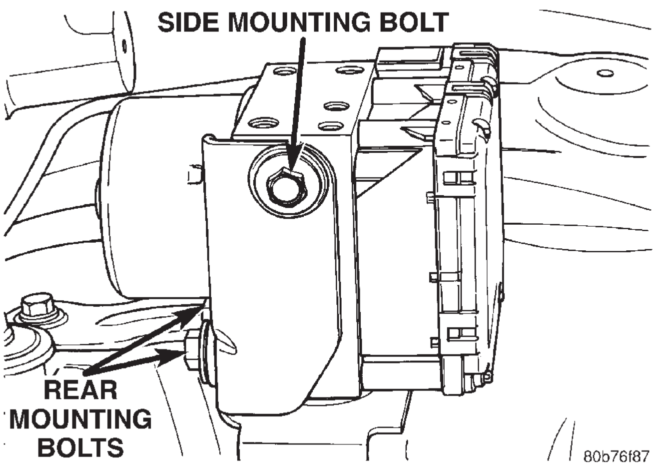


Fig. 7 HCU/CAB Assembly

FRONT WHEEL SPEED SENSOR

REMOVAL

(1) Raise and support vehicle.

(2) Remove front wheel sensor mounting bolt (Fig. 8).

(3) Remove the sensor from the steering knuckle.

(4) Disengage sensor wire from the brackets (Fig. 8) on the steering knuckle.

(5) Disconnect the sensor from the sensor harness (Fig. 9) and (Fig. 10).

(6) Remove sensor and wire.

INSTALLATION

(1) Install the sensor on the steering knuckle.

(2) Apply Mopar Lock N' Seal or Loctite® 242 to sensor mounting bolt. Use new sensor bolt if original bolt is worn or damaged.

(3) Install the sensor mounting bolt and tighten bolt to 12-14 N·m (106-124 in. lbs.).

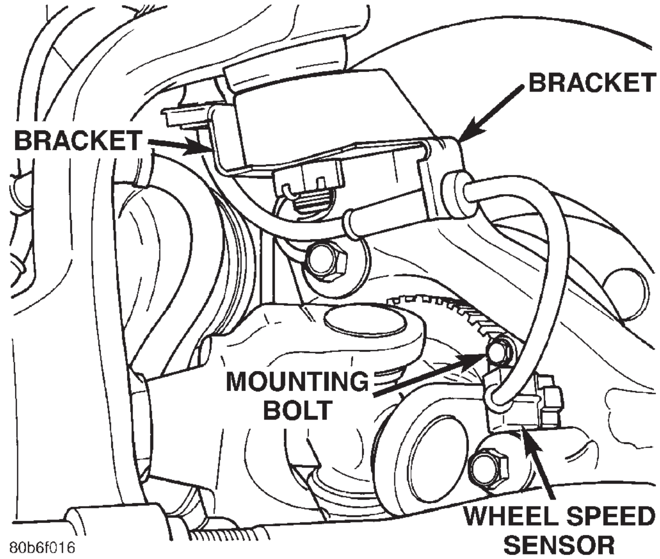


Fig. 8 Sensor Location

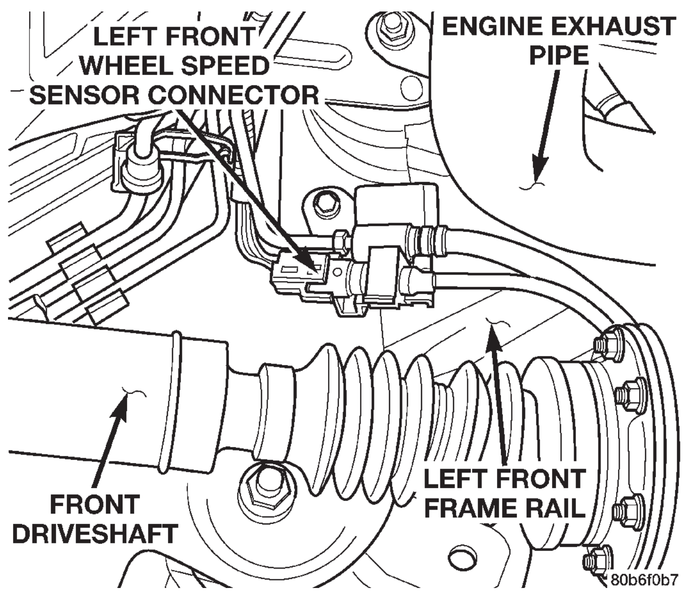


Fig. 9 Left Sensor Connector

(4) Engage grommets on sensor wire to the steering knuckle brackets.

(5) Connect sensor wire to harness connector.

(6) Check sensor wire routing. Be sure wire is clear of all chassis components and is not twisted or kinked at any spot.

(7) Remove support and lower vehicle.

REAR WHEEL SPEED SENSOR

REMOVAL

(1) Raise and fold rear seat forward. Then move carpeting aside for access to rear sensor connectors.

(2) Disconnect rear sensor wire at harness connectors (Fig. 11).

REMOVAL AND INSTALLATION (Continued)

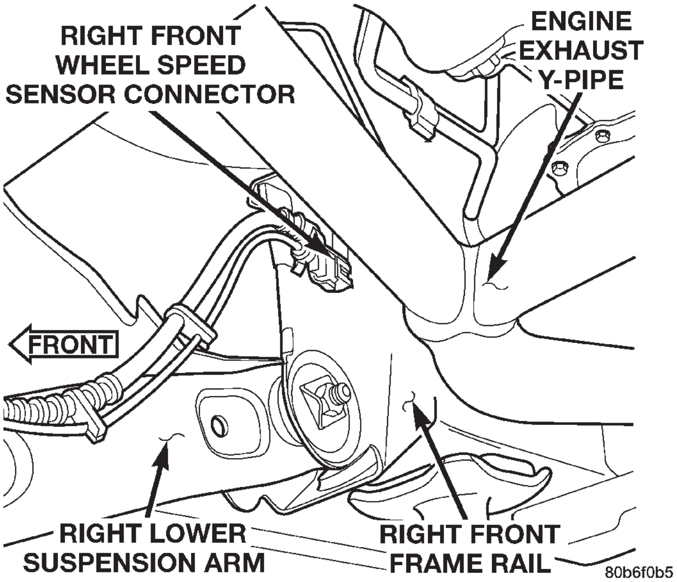


Fig. 10 Right Sensor Connector

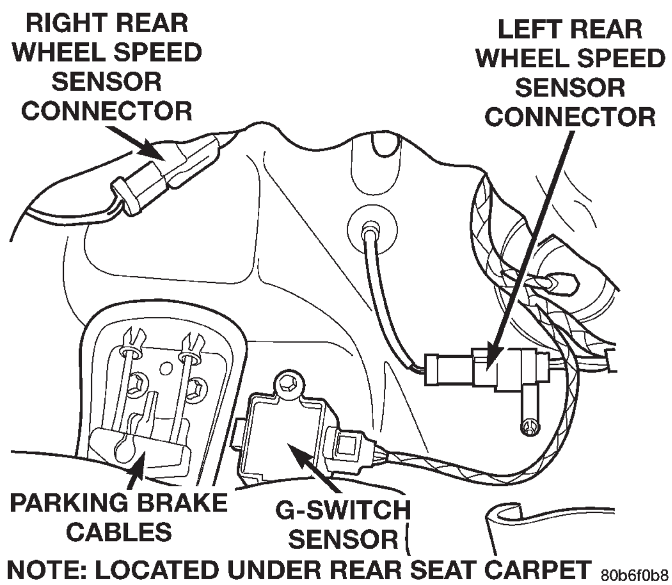


Fig. 11 Rear Sensor Connector

(3) Push sensor wires and grommets through floorpan holes.

(4) Raise and support the vehicle.

(5) Disengage sensor wire from axle and chassis brackets and from brake line retainers.

(6) Remove the sensor mounting bolt from the rear brake backing plate (Fig. 12).

(7) Remove sensor from the backing plate.

INSTALLATION

(1) Insert sensor through the backing plate (Fig. 13).

(2) Apply Mopar Lock N' Seal or Loctite 242 to original sensor bolt. Use new bolt if original is worn or damaged.

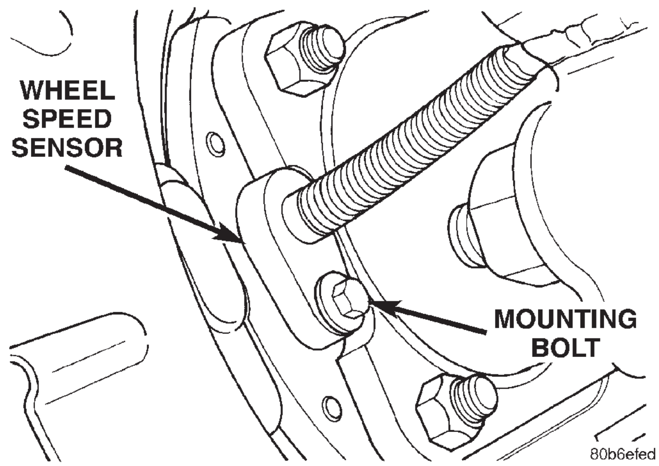


Fig. 12 Sensor Mounting Bolt

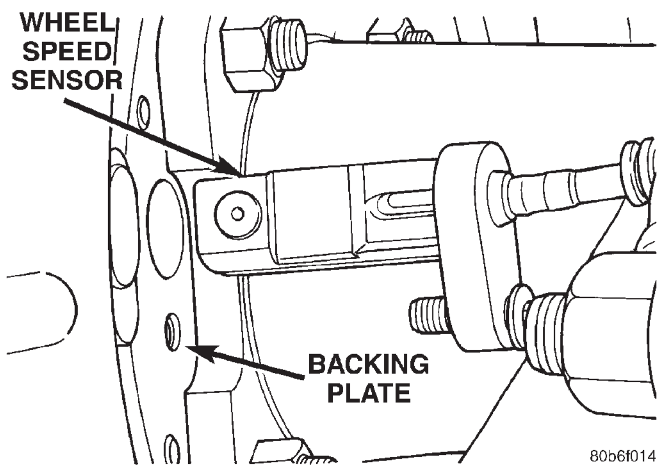


Fig. 13 Wheel Speed Sensor

(3) Tighten sensor bolt to 12-14 N·m (106-124 in. lbs.).

(4) Secure sensor wire in brackets and in retainers on rear brake lines. Verify that sensor wire is secure and clear of rotating components.

(5) Route sensor wires to rear seat area.

(6) Feed sensor wires through floorpan access hole and seat sensor grommets in floorpan.

(7) Remove support and lower the vehicle.

(8) Fold rear seat and carpet forward for access to sensor wires and connectors.

(9) Connect sensor wires to harness connectors.

(10) Reposition carpet and fold rear seat down.

G-SWITCH

REMOVAL

(1) Fold the rear seat bottom assembly up for access to the switch.

(2) Lift up the carpeting and disconnect switch harness (Fig. 14).

REMOVAL AND INSTALLATION (Continued)

(3) Remove the switch mounting bolts and remove the switch.

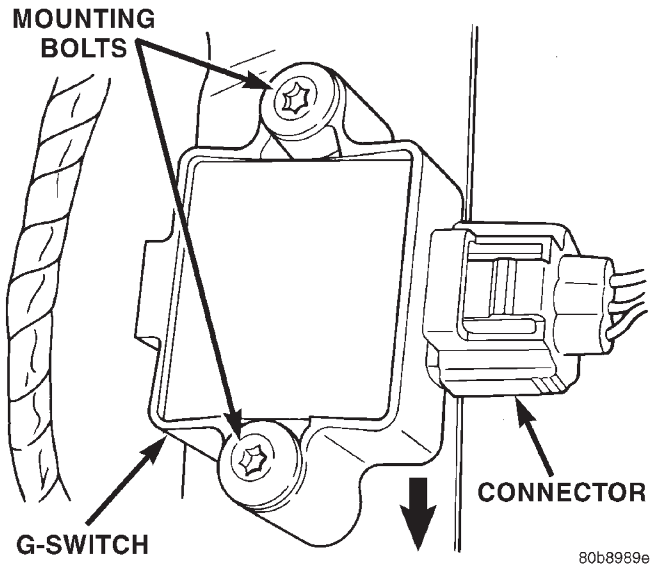


Fig. 14 G-Switch Mounting

INSTALLATION

CAUTION: The mercury switch (inside the G-Switch), will not function properly if the switch is installed incorrectly. Verify that the switch locating arrow is pointing to the front of the vehicle (Fig. 15).

(1) Note position of locating arrow on switch. Position switch so arrow faces forward.

(2) Install the switch and tighten mounting bolts to 5.6 N·m (50 in. lbs.).

(3) Connect harness to switch. Be sure harness connector is firmly seated.

(4) Place the carpet in position and fold the rear seat back down.

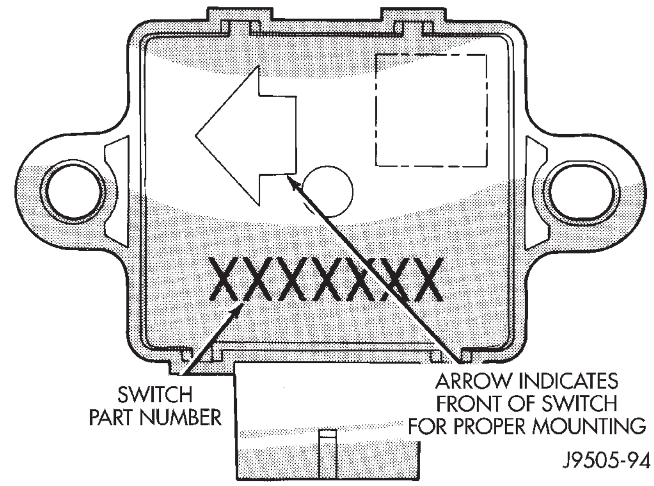


Fig. 15 G-Switch

SPECIFICATIONS

TORQUE CHART

DESCRIPTION	TORQUE
G-Sensor	
Sensor Bolt	5.6 N·m (50 in. lbs.)
Hydraulic Control Unit/Controller Antilock Brakes	
Mounting Bolts	12 N·m (9 ft. lbs.)
Brake Lines	16 N·m (144 in. lbs.)
CAB Screws	1.8 N·m (16 in. lbs.)
Wheel Speed Sensors	
Front Sensor Bolt	12-14 N·m (106-124 in. lbs.)
Rear Sensor Bolt	12-14 N·m (106-124 in. lbs.)

COOLING SYSTEM

CONTENTS

GENERAL INFORMATION

ENGINE ACCESSORY DRIVE BELTS

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.

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.

Vehicles equipped with the 4.7L engine receive a “max” cooling package which consists of a heavy duty radiator, a low disengaged fan viscous fan drive and an mechanical cooling fan. 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 (Fig. 1) consists of:

- A radiator
- Mechanical Cooling Fan
- Thermal viscous fan drive-Low disengaged
- Fan shroud
- Radiator pressure cap
- Thermostat
- Coolant reserve/overflow system
- Transmission oil cooler (if equipped with an automatic transmission)
- Coolant
- Water pump
- Hoses and hose clamps
- Accessory drive belt

SYSTEM COOLANT ROUTING

For cooling system routings refer to (Fig. 2) (Fig. 3).

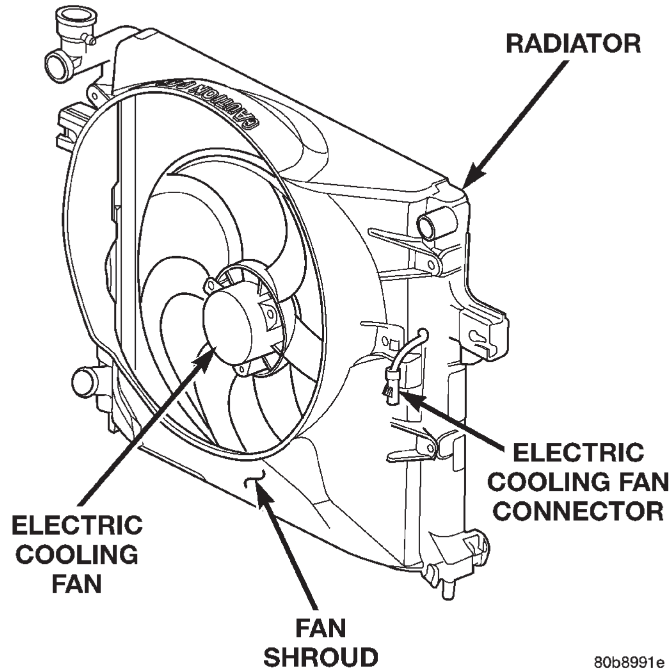


Fig. 1 Cooling Module with Electric Fan—4.0L and 4.7L

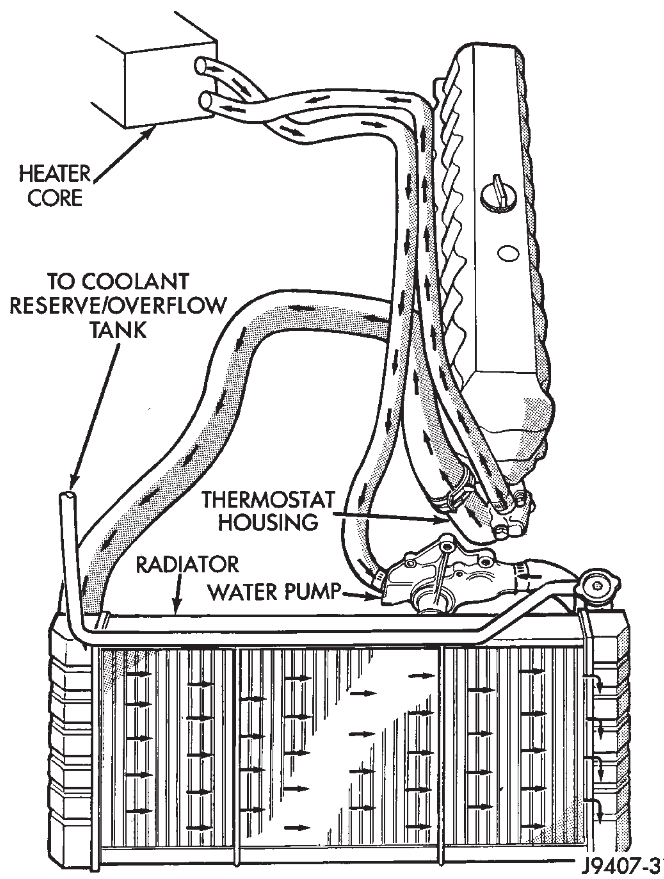


Fig. 2 Engine Cooling System—4.0L Engine—Typical

GENERAL INFORMATION (Continued)

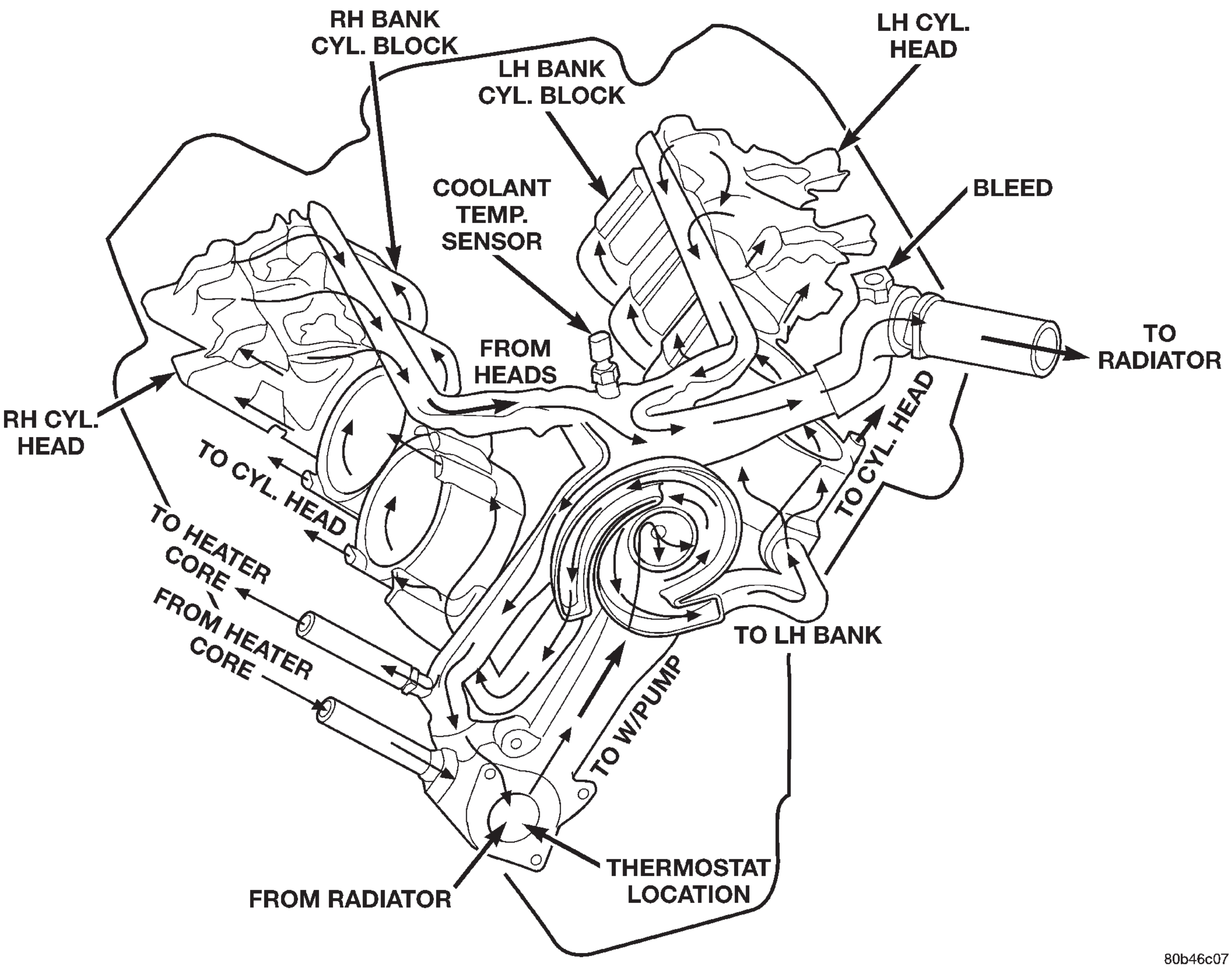


Fig. 3 Engine Cooling System 4.7L Engine—Typical

WATER PUMP BYPASS—4.7L

The 4.7L engine uses an internal water/coolant bypass system. The design uses galleries in the timing chain cover to circulate coolant during engine warm-up preventing the coolant from flowing through the radiator. The thermostat uses a stub shaft located at the rear of the thermostat (Fig. 4) to control flow through the bypass gallery. When the thermostat is in the closed position the bypass gallery is not obstructed allowing 100% flow. When the thermostat is in the open position the stub shaft enters the bypass gallery obstructing bypass coolant flow by 50%. This design allows the coolant to reach operating temperature quickly when cold, while adding extra cooling during normal temperature operation.

WATER PUMP BYPASS HOSE

4.0L ENGINE

REMOVAL

(1) Partially drain cooling system. Refer to Draining Cooling System in this group.

(2) 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. 5). SNAP-ON CLAMP TOOL (NUMBER HPC-20) MAY BE USED FOR LARGER CLAMPS. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

GENERAL INFORMATION (Continued)

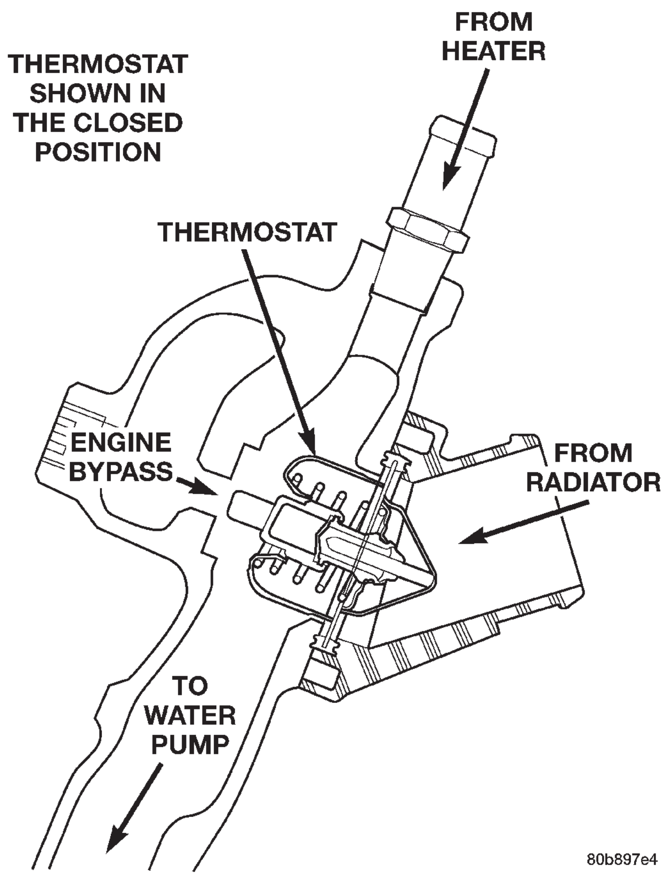


Fig. 4 Water/Coolant Bypass Flow and Thermostat—4.7L Engine

CAUTION: A number or letter is stamped into the tongue of constant tension clamps (Fig. 6). If replacement is necessary, use only an original equipment clamp with matching number or letter.

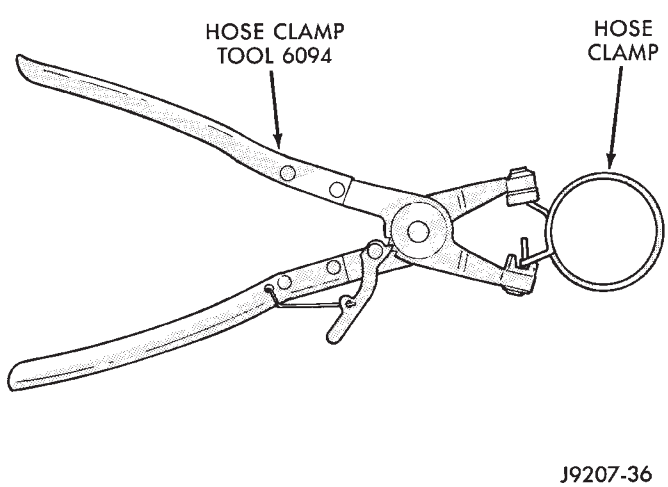


Fig. 5 Hose Clamp Tool—Typical

(3) Loosen both bypass hose clamps (Fig. 5) and position to center of hose. Remove hose from vehicle.

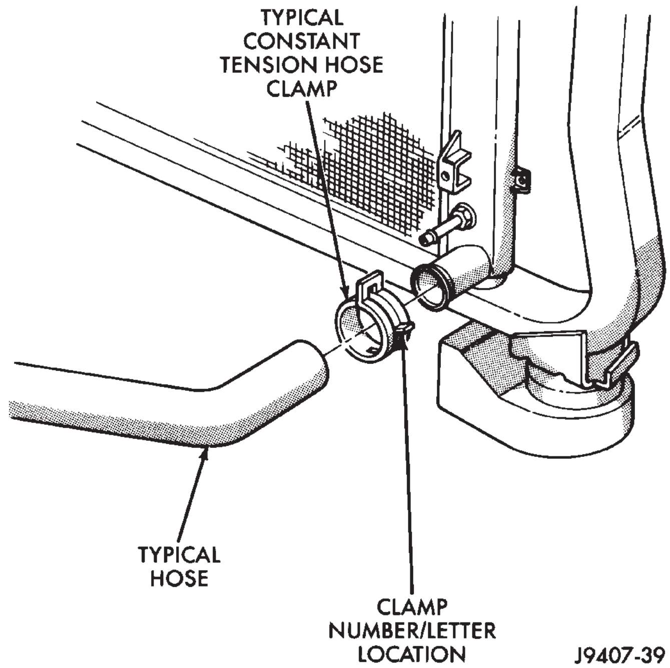


Fig. 6 Clamp Number/Letter Location

INSTALLATION

(1) Position bypass hose clamps (Fig. 5) to center of hose.

(2) Install bypass hose to engine.

(3) Secure both hose clamps (Fig. 5).

(4) Fill cooling system. Refer to Refilling the Cooling System in this group.

(5) Start and warm the engine. Check for leaks.

COOLANT

The cooling system is designed around the coolant. Coolant flows through the engine water jackets absorbing heat produced during engine operation. The 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.

RADIATOR

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.

DESCRIPTION AND OPERATION

AUTOMATIC TRANSMISSION OIL COOLERS

There are two types of automatic transmission oil coolers:

• 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.

• An internal high capacity/high efficiency cooler. This cooler is also an oil-to-coolant type which consists of plates mounted in the radiator outlet tank and is also supplied as optional equipment.

NOTE: IF A VEHICLE WITH THE TRAILER TOWING OPTION DOES NOT HAVE AN EXTERNAL AUXILIARY TRANSMISSION COOLER, THEN IT IS EQUIPPED WITH THE INTERNAL, HIGH-EFFICIENCY COOLER.

COOLANT RESERVOIR / 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 reservoir/overflow system has a radiator mounted pressurized cap, an overflow tube and a plastic coolant reservoir/overflow tank (Fig. 7) mounted to the right inner fender.

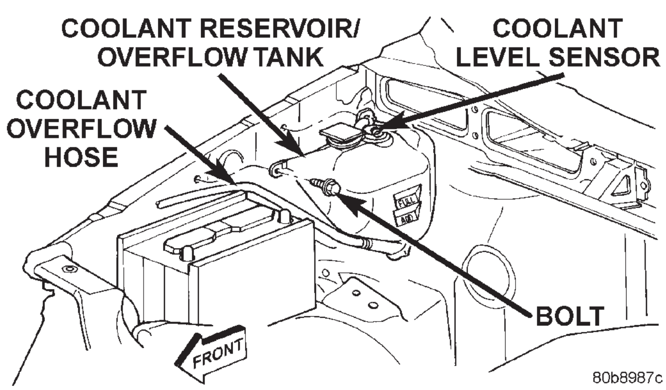


Fig. 7 Coolant Reservoir / Overflow Tank

ACCESSORY DRIVE BELT TENSION

Correct drive belt tension is required to ensure optimum performance of the belt driven engine accessories. If specified tension is not maintained, belt slippage may cause; engine overheating, lack of power steering assist, loss of air conditioning capacity, reduced generator output rate, and greatly reduced belt life.

4.0L and 4.7L ENGINES

It is not necessary to adjust belt tension on the 4.0L or 4.7L engines. These engines are equipped with an automatic belt tensioner. The tensioner maintains correct belt tension at all times. Due to use of this belt tensioner, do not attempt to use a belt tension gauge on 4.0L or 4.7L engines.

ENGINE BLOCK HEATER

An optional engine block heater (Fig. 8) (Fig. 9) is available with 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.

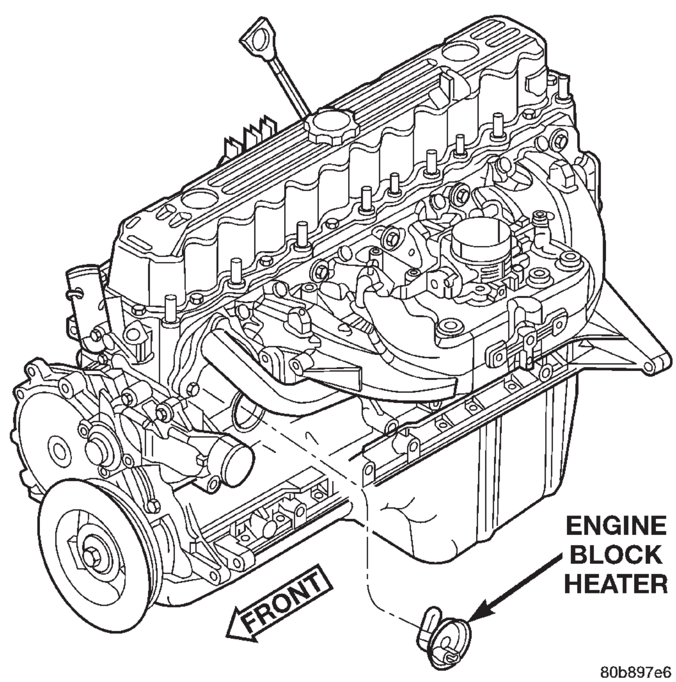


Fig. 8 Block Heater—4.0L

DESCRIPTION AND OPERATION (Continued)

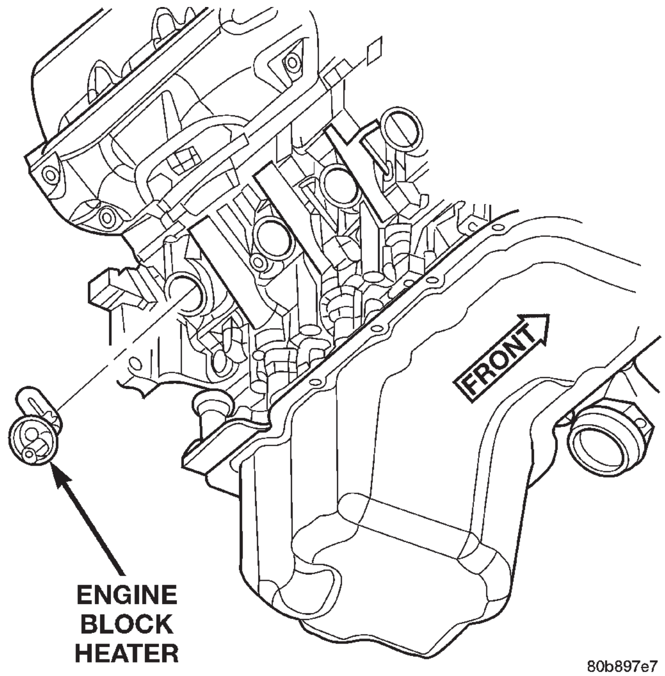


Fig. 9 Block Heater—4.7L

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.

THERMOSTAT

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. On the 4.7L engine the thermostat is designed to block the flow of the coolant bypass journal by 50% instead of completely blocking the flow. This design controls coolant temperature more accurately (Fig. 10).

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.

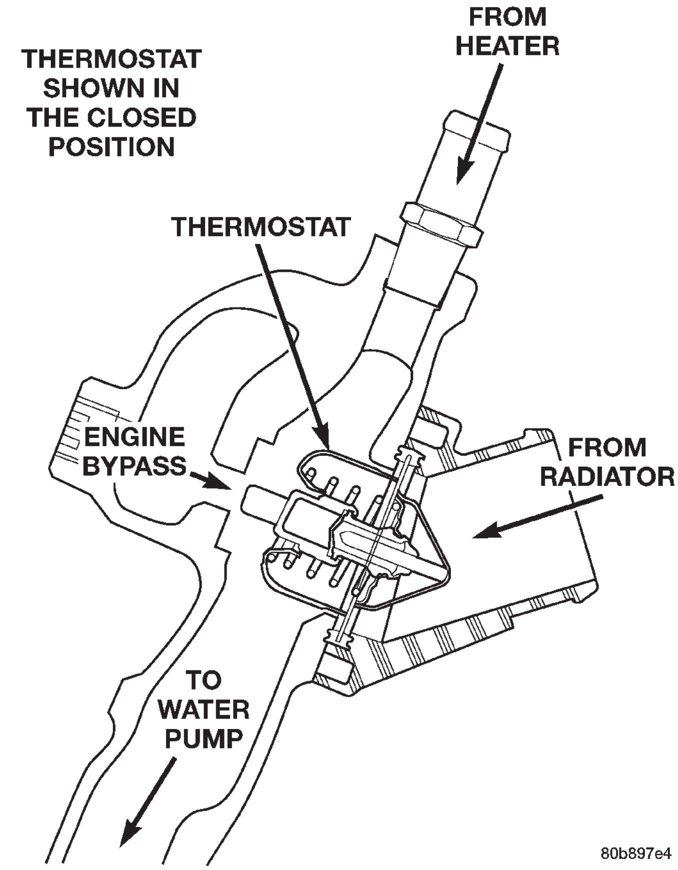


Fig. 10 Thermostat Cross Section View 4.7L

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 mileage 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.

COOLANT PERFORMANCE

ETHYLENE-GLYCOL MIXTURES

The required ethylene-glycol (antifreeze) and water mixture depends upon the climate and vehicle operating conditions. The recommended mixture of 50/50 ethylene-glycol and water will provide protection against freezing to -37 deg. C (-35 deg. F). The antifreeze concentration **must always** be a minimum of 44 percent, year-round in all climates. **If percentage is lower than 44 percent, engine parts may be eroded by cavitation, and cooling system components may be severely damaged by corrosion.** Maximum protection against freezing is provided

DESCRIPTION AND OPERATION (Continued)

with a 68 percent antifreeze concentration, which prevents freezing down to -67.7 deg. C (-90 deg. F). A higher percentage will freeze at a warmer temperature. Also, a higher percentage of antifreeze can cause the engine to overheat because the specific heat of antifreeze is lower than that of water.

100 Percent Ethylene-Glycol—Should Not Be Used in Chrysler Vehicles

Use of 100 percent ethylene-glycol will cause formation of additive deposits in the system, as the corrosion inhibitive additives in ethylene-glycol require the presence of water to dissolve. The deposits act as insulation, causing temperatures to rise to as high as 149 deg. C (300) deg. 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 deg. C (-8 deg. F).

Propylene-glycol Formulations—Should Not Be Used in Chrysler Vehicles

Propylene-glycol formulations do not meet Chrysler coolant specifications. It's overall effective temperature range is smaller than that of ethylene-glycol. The freeze point of 50/50 propylene-glycol and water is -32 deg. C (-26 deg. F). 5 deg. C higher than ethylene-glycol's freeze point. The boiling point (protection against summer boil-over) of propylene-glycol is 125 deg. C (257 deg. F) at 96.5 kPa (14 psi), compared to 128 deg. C (263 deg. F) for ethylene-glycol. Use of propylene-glycol can result in boil-over or freeze-up in Chrysler vehicles, which are designed for ethylene-glycol. Propylene glycol also has poorer heat transfer characteristics than ethylene glycol. This can increase cylinder head temperatures under certain conditions.

Propylene-glycol/Ethylene-glycol Mixtures—Should Not Be Used in Chrysler Vehicles

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

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

COOLANT SELECTION AND ADDITIVES

The presence of aluminum components in the cooling system requires strict corrosion protection. Maintain coolant at specified level with a mixture of ethylene-glycol based antifreeze and water. Chrysler Corporation recommends Mopar Antifreeze or equivalent. If coolant becomes contaminated or looses color, drain and flush cooling system and fill with correctly mixed solution.

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

RADIATOR PRESSURE CAP

All radiators are equipped with a pressure cap. This cap releases pressure at some point within a range of 124-to-145 kPa (18-to-21 psi). The pressure relief point (in pounds) is engraved on top of the cap (Fig. 11).

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. 11) contains a spring-loaded pressure relief valve. This valve opens when system pressure reaches the release range of 124-to-145 kPa (18-to-21 psi).

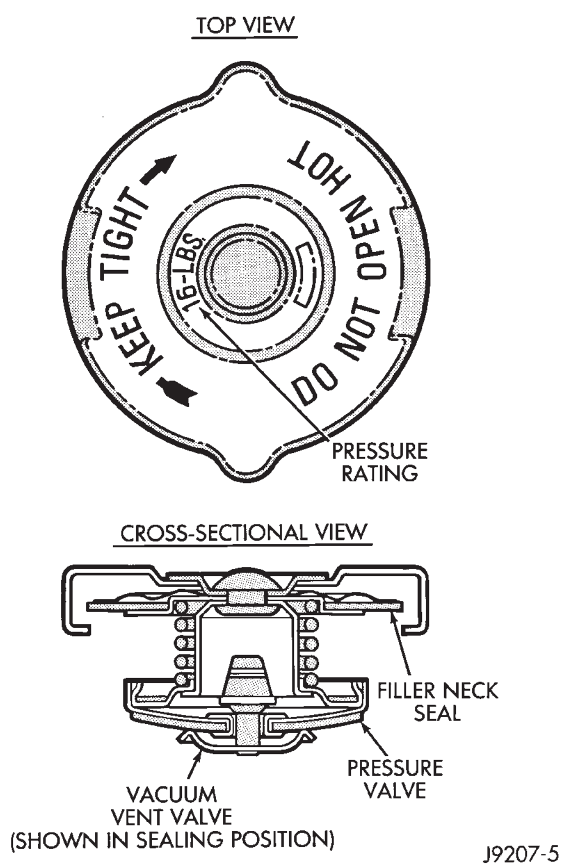


Fig. 11 Radiator Pressure Cap—Typical

DESCRIPTION AND OPERATION (Continued)

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.

WATER PUMP

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. 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.

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.

4.7L ENGINES: Both heater hoses are connected to fittings on the timing chain front cover. The water pump is also mounted directly to the timing chain cover and is equipped with a non serviceable integral pulley (Fig. 13).

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.

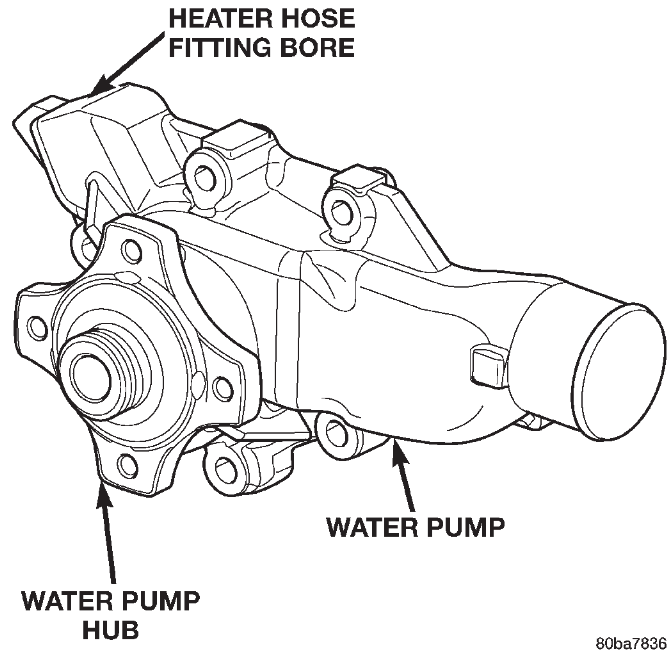


Fig. 12 Water Pump—4.0L

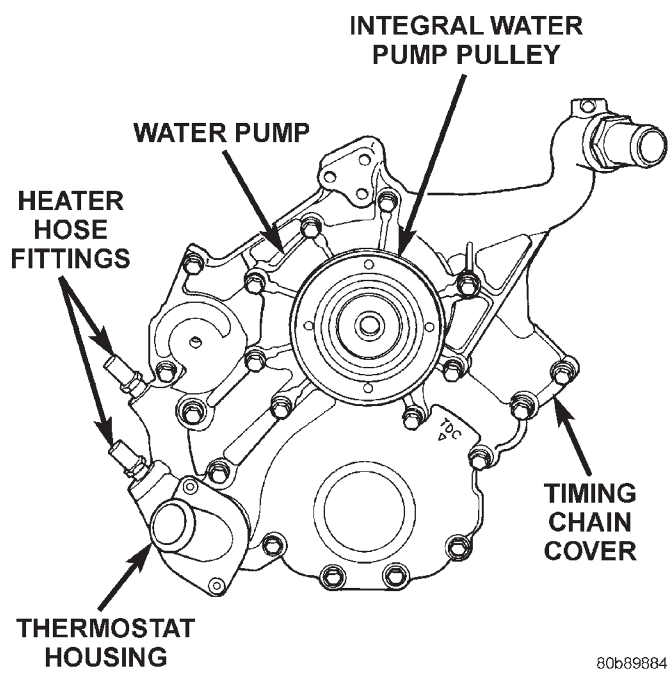


Fig. 13 Water Pump and Timing Chain Cover—4.7L

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. 14). SNAP-ON CLAMP TOOL (NUMBER HPC-20) MAY BE USED FOR LARGER CLAMPS. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

DESCRIPTION AND OPERATION (Continued)

CAUTION: A number or letter is stamped into the tongue of constant tension clamps (Fig. 15). If replacement is necessary, use only an original equipment clamp with matching number or letter.

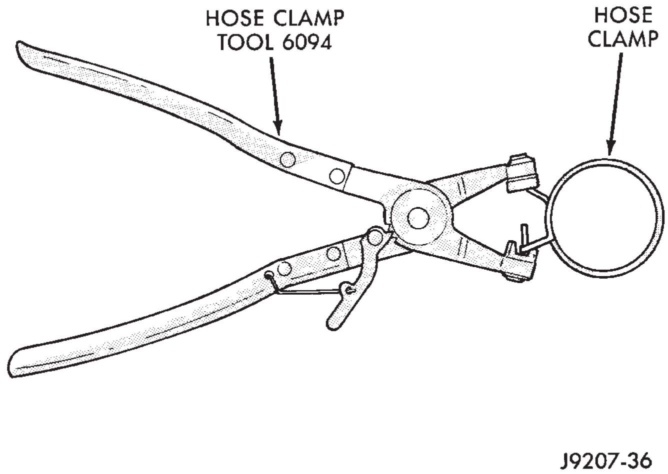


Fig. 14 Hose Clamp Tool—Typical

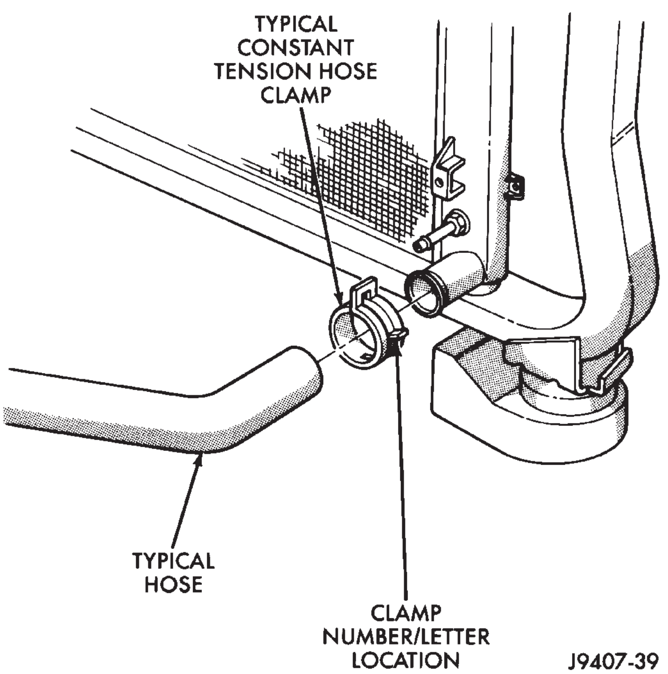


Fig. 15 Clamp Number/Letter Location

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.

When performing a hose inspection, inspect the radiator lower hose for proper position and condition of the internal spring.

VISCOUS FAN DRIVE

The thermal viscous fan drive (Fig. 16) 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.

On all 4.7L an electrical cooling fan located in the fan shroud aids in low speed cooling, It is designed to augment the viscous fan, However, it does not replace the viscous fan.

On the 4.0L engines an electric fan is standard and the viscous fan is added on trailer tow packages only.

A thermostatic bimetallic spring coil is located on the front face of the viscous fan drive unit (Fig. 16). 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.

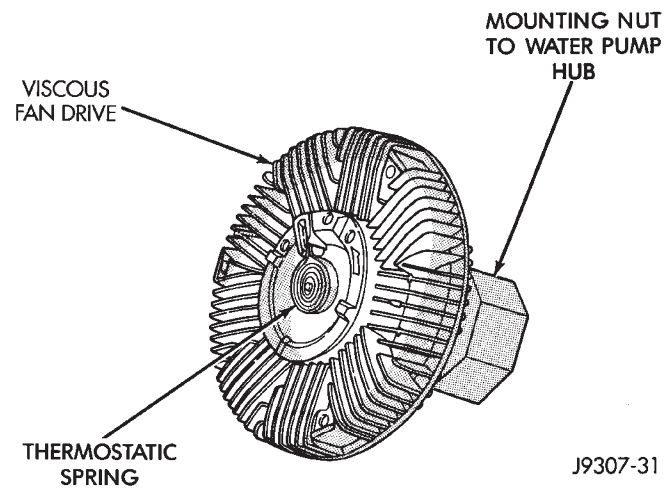


Fig. 16 Viscous Fan Drive—4.0L and 4.7L Engines—Typical

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.

DESCRIPTION AND OPERATION (Continued)

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

NOTE: It is normal for fan noise to be louder (roaring) when:

- The under hood 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.

DIAGNOSIS AND TESTING

ON-BOARD DIAGNOSTICS (OBD)

FOR CERTAIN COOLING SYSTEM COMPONENTS

The powertrain control module (PCM) has been programmed to monitor certain cooling system components:

NOTE: 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. 17).

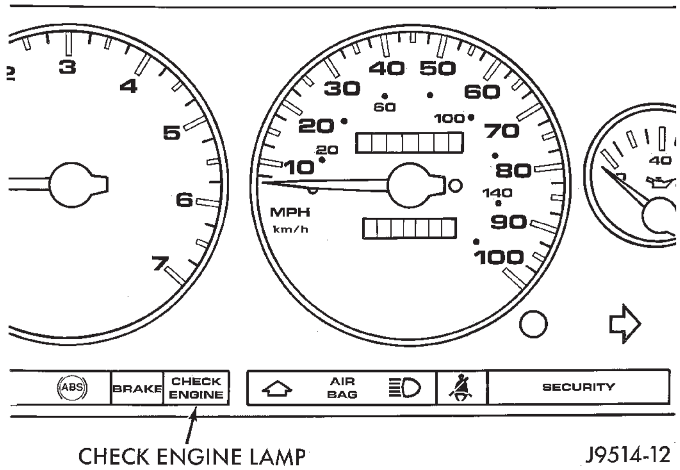


Fig. 17 Check Engine Lamp Location

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 25, Emission Control 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. 17).

They can also be displayed through the use of the Diagnostic Readout Box (DRB) scan tool. The DRB connects to the data link connector, left of the steering column above the brake pedal (Fig. 18). For operation of the DRB, refer to the appropriate Powertrain Diagnostic Procedures service manual.

EXAMPLES:

- If the lamp (Fig. 17) 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 dis-

DIAGNOSIS AND TESTING (Continued)

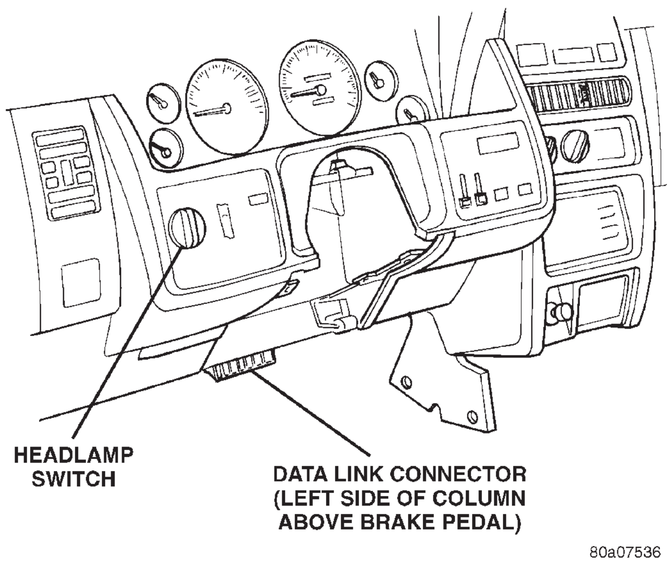


Fig. 18 Data Link Connector Location

connected 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.

WATER PUMP TESTS

LOOSE IMPELLER—4.0L and 4.7L

NOTE: Due to the design of the 4.0L and 4.7L engine water pumps, testing the pump for a loose impeller must be done by verifying coolant flow in the radiator. To accomplish this refer to the following procedure.

DO NOT WASTE reusable coolant. If solution is clean, drain coolant into a clean container for reuse.

(1) Drain coolant until the first row of cores is visible in the radiator.

(2) Leaving the radiator cap off, start the engine

(3) While looking into the radiator through the radiator fill neck, raise engine rpm to 2000 RPM. Observe the flow of coolant from the first row of cores.

(4) If there is no flow or very little flow visable, replace the water pump.

INSPECTING FOR INLET RESTRICTIONS

Inadequate heater performance may be caused by a metal casting restriction in the 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 heater hose inlet. On 4.7L engines this requires complete draining.

(2) Remove the heater hose.

(3) Inspect the inlet for metal casting flash or other restrictions.

NOTE: On 4.0L engines remove the pump from the engine before removing restriction to prevent contamination of the coolant with debris. Refer to Water Pump Removal in this section. On 4.7L engine remove the fitting from the timing chain cover, If the restriction is in the timing chain cover, remove the timing chain cover. Refer to Timing Chain Cover in Group 9 Engine, for procedure.

THERMOSTAT

ON-BOARD DIAGNOSTICS

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). Refer to the Diagnosis section of this group for other probable causes. For other DTC numbers, refer to On-Board Diagnostics in Group 25, Emission Control 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.

SERPENTINE DRIVE BELT DIAGNOSIS

When diagnosing serpentine drive belts, small cracks that run across ribbed surface of belt from rib

DIAGNOSIS AND TESTING (Continued)

to rib (Fig. 19), are considered normal. These are not a reason to replace belt. However, cracks running along a rib (not across) are **not** normal. Any belt with cracks running along a rib must be replaced (Fig. 19). Also replace belt if it has excessive wear, frayed cords or severe glazing.

Refer to the Serpentine Drive Belt Diagnosis charts for further belt diagnosis.

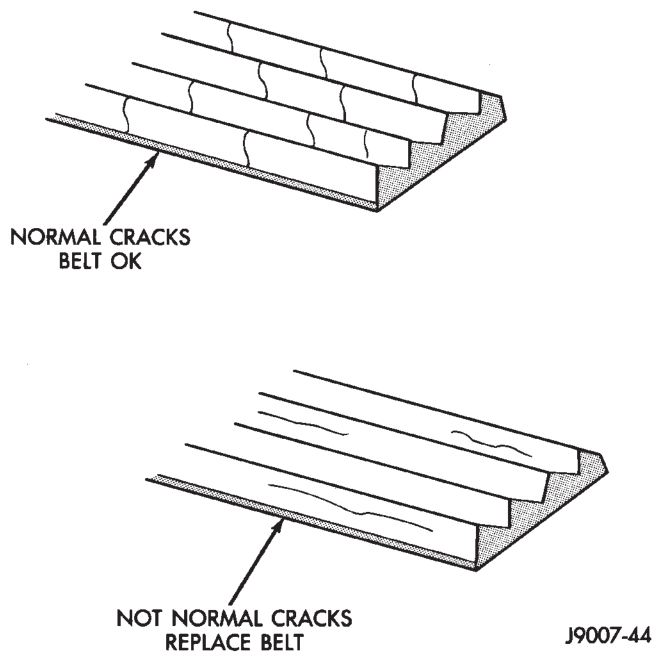


Fig. 19 Serpentine Accessory Drive Belt Wear Patterns

SERPENTINE DRIVE BELT DIAGNOSIS		
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.

DIAGNOSIS AND TESTING (Continued)

SERPENTINE DRIVE BELT DIAGNOSIS		
CONDITION	**POSSIBLE CAUSES**	**CORRECTION**
BELT SLIPS	1. Belt slipping because of insufficient tension.	1. Replace automatic belt tensioner.
	2. Incorrect belt.	2. Replace belt.
	3. Belt or pulley subjected to substance (belt dressing, oil ethylene glycol) that has reduced friction.	3. Replace belt and clean pulleys.
	4. Driven component bearing failure.	4. replace faulty component bearing.
	5. Belt glazed and hardened from heat and excessive slippage.	5. Replace belt.
"GROOVE JUMPING" (BELT DOES NOT MAINTAIN CORRECT POSITION ON PULLEY)	1. Belt tension either too high or too low.	1. Replace automatic belt tensioner.
	2. Incorrect belt.	2. Replace belt.
	3. Pulley(s) not within design tolerance.	3. Replace pulley(s).
	4. Foreign object(s) in grooves.	4. Remove foreign objects from grooves.
	5. Pulley misalignment.	5. Check and replace.
	6. Belt cord line is broken.	6. Replace belt.
BELT BROKEN (NOTE: IDENTIFY AND CORRECT PROBLEM BEFORE NEW BELT IS INSTALLED)	1. Excessive tension.	1. Replace belt and automatic belt tensioner.
	2. Incorrect belt.	2. Replace belt.
	3. Tensile member damaged during belt installation.	3. Replace belt.
	4. Severe misalignment.	4. Check and replace.
	5. Bracket, pulley, or bearing failure.	5. Replace defective component and belt.
NOISE (OBJECTIONABLE SQUEAL, SQUEAK, OR RUMBLE IS HEARD OR FELT WHILE DRIVE BELT IS IN OPERATION)	1. Belt slippage.	1. Replace belt or automatic belt tensioner.
	2. Bearing noise.	2. Locate and repair.
	3. Belt misalignment.	3. Replace belt.
	4. Belt-to-pulley mismatch.	4. Install correct belt.

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) RECENT SERVICE OR ACCIDENT REPAIR:

DIAGNOSIS AND TESTING (Continued)

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.
- Electric fan not functioning, (disconnected or damaged).

NOTE: If investigation reveals none of the previous items as a cause for an engine overheating complaint, refer to 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

COOLING SYSTEM DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSES	CORRECTION
TEMPERATURE GAUGE READS LOW	1. Has a Diagnostic Trouble Code (DTC) been set indicating a stuck open engine thermostat.	1. Refer to group 25, Emission Control Systems. Replace thermostat if necessary. If a Diagnostic Trouble Code (DTC) has not been set, the problem may be with the temperature gauge.
	2. Temperature gauge (if equipped) disconnected from 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. Defective temperature gauge (if equipped)	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.
	6. Electric fan functioning when not required.	6. Inspect electric fan for proper operation. Refer to Electric Cooling Fan in this section. Refer to Group 8W for electric cooling fan and relay circuit schematic data.

DIAGNOSIS AND TESTING (Continued)

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	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 18).
	2. Defective temperature gauge (if equipped)	2. Check gauge. Refer to Group 8E. Repair as necessary.
	3. Defective temperature warning lamp (if equipped)	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.
	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.

DIAGNOSIS AND TESTING (Continued)

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	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 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. Fuel or ignition system problems.	12. 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.
	13. Dragging brakes.	13. Check and correct as necessary. Refer to Group 5, Brakes in the manual text.
	14. Bug screen is being used reducing airflow.	14. Remove bug screen.
	15. Thermostat partially or completely shut. This is more prevalent of high mileage vehicles.	15. Check thermostat operation and replace as necessary. Refer to Thermostats in this group.
	16. Thermal viscous fan drive not operating properly.	16. Check fan drive operation and replace if necessary. Refer to Viscous Fan Drive in this group.
	17. Cylinder head gasket leaking.	17. Check for cylinder head gasket leaks. Refer to Testing Cooling System for Leaks in this group. For repair, refer to Group 9, Engines.
	18. Heater core leaking.	18. Check heater core for leaks. Refer to Group 24, Heating and Air Conditioning. Repair as necessary.
	19. Electric fan not functioning.	19. Inspect electric fan for proper operation. Refer to Electric Cooling Fan in this section. Refer to Group 8W for electric cooling fan and relay circuit schematic data.

DIAGNOSIS AND TESTING (Continued)

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 the 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 restarting 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.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
DETONATION OR PRE-IGNITION (NOT CAUSED BY IGNITION SYSTEM). GAUGE MAY OR MAY NOT BE READING HIGH	1. Engine overheating.	1. Check reason for overheating and repair as necessary.
	2. Freeze point of antifreeze not correct. Mixture is too rich or too lean.	2. Check antifreeze. Refer to the Coolant section of this group. Adjust antifreeze-to-water ratio as required.
HOSE OR HOSES COLLAPSED 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 interally blocked or plugged. Check for blockage and repair as necessary.
NOISY FAN	1. Fan blades loose.	1. Replace fan blade assembly. Refer to Cooling System Fans in this group.
	2. Fan blades striking a surrounding object.	2. Locate point of fan blade contact and repair as necessary.
	3. Air obstructions at radiator or air conditioning condenser.	3. Remove obstructions and/or clean debris or insects from radiator or A/C condenser.
	4. Thermal viscous fan drive has defective bearing.	4. Replace fan drive. Bearing is not serviceable. Refer to Viscous Fan Drive in this group.
	5. A certain amount of fan noise (roaring) may be evident from the thermal viscous fan drive. Some of this noise is normal.	5. Refer to Viscous Fan Drive in this group for an explanation of normal fan noise.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
INADEQUATE AIR CONDITIONER PERFORMANCE (COOLING SYSTEM SUSPECTED)	1. Radiator and/or A/C condenser is restricted, obstructed or dirty (insects, leaves etc.)	1. Remove restriction and/or clean as necessary. Refer to Radiator Cleaning in this group.
	2. Electric fan not functioning.	2. Inspect electric fan for proper operation. Refer to Electric Cooling Fan in this section.
	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).	3. Correct overheating condition. Refer to text in Group 7, Cooling.
	4. All models with 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.	4. Check for missing or damaged air seals and repair as necessary.
INADEQUATE HEATER PERFORMANCE. THERMOSTAT FAILED IN OPEN POSITION	1. Has a diagnostic trouble code (DTC) been set?	1. Refer to group 25, Emission Control System 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. 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.	5. 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.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
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. Engine running hot	2. Preform thermostat, water pump and fan test. Repair or replace as necessary.
	3. Cooling fan malfunctioning.	3. Refer to Cooling System Fan in this group for diagnosis. Repair as necessary
	4. Undercoating or other contaminate applied to cooling or exhaust system.	4. Clean as necessary.
	5. Engine may be running rich causing the catalytic converter 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) been set?	1. Refer to group 25, Emission Control System. 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.
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.

DIAGNOSIS AND TESTING (Continued)

RADIATOR COOLANT FLOW CHECK

NOTE: Due to the thermostat design used on the 4.7L engine this test only applies to the 4.0L engine.

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.

COOLING SYSTEM—TESTING 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 parts 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. 20).

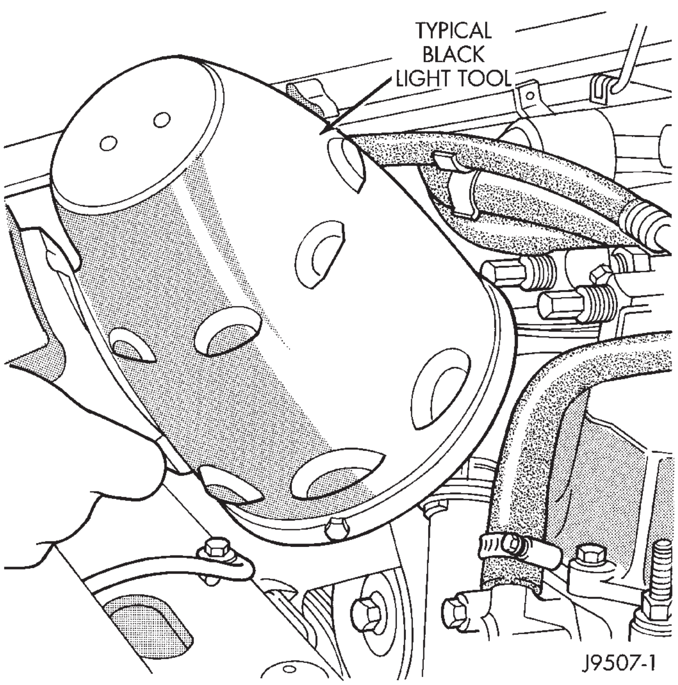


Fig. 20 Leak Detection Using Black Light—Typical

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 damaged, seating of pressure cap valve and tester seal will be affected. Replace cap if cams are damaged.

Attach pressure tester 7700 (or equivalent) to the radiator filler neck (Fig. 21).

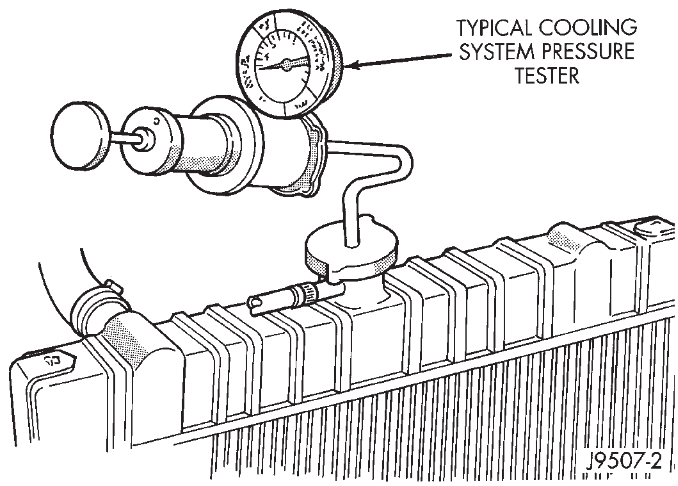


Fig. 21 Pressurizing System—Typical

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,

DIAGNOSIS AND TESTING (Continued)

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.

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.

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. Remove the accessory drive belt.

On 4.0L, Disconnect the radiator upper hose from the thermostat housing. Remove the housing and thermostat. Install the thermostat housing and hose.

On 4.7L, Disconnect the radiator lower hose from the thermostat housing. Remove the housing and thermostat. Install the thermostat housing and hose.

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.

VISCOUS FAN DRIVE

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 93° C (200° F). Fan drive **engagement** should have started to occur

DIAGNOSIS AND TESTING (Continued)

at between 91° to 96° C (195° to 205° 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 93° C (200° F), remove the plastic sheet. Fan drive **disengagement** should have started to occur at between 62° to 85° C (145° to 185° F). A definite **decrease** of fan flow noise (roaring) should be noticed. If not, replace the defective viscous fan drive unit.

ELECTRIC COOLING FAN

ELECTRIC COOLING FAN AND RELAY DIAGNOSIS

NOTE: Refer to Electrical Group 8W for electric cooling fan and relay circuit schematic.

The powertrain control module (PCM) will enter a diagnostic trouble code (DTC) in memory if it detects a problem in the auxiliary cooling fan relay or circuit. Refer to Group 25, Emission Control Systems for correct DTC retrieval procedures.

If the electric cooling fan is inoperative, check the 15A fuse in the junction block and the 40A fuse in the Power Distribution Center (PDC) with a 12 volt test lamp or DVOM. Refer to the inside of the PDC cover for the exact location of the fuse. If fuses are o.k., refer to Group 8W for electric cooling fan and relay circuit schematic.

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 124 to 145 kPa (18 to 21 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 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 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.

RADIATOR CAP—PRESSURE TESTING

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. 22).

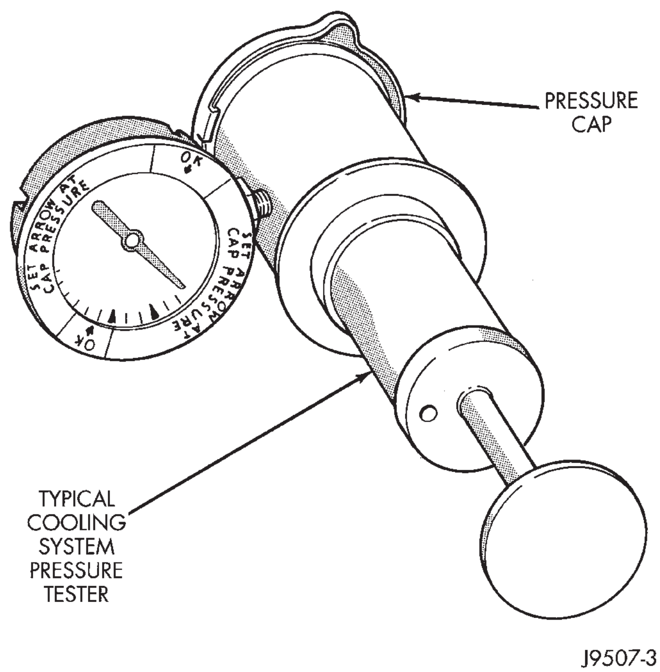


Fig. 22 Pressure Testing Radiator Pressure Cap—Typical

Operate the tester pump and observe the gauge pointer at its highest point. The cap release pressure should be 124 to 145 kPa (18 to 21 psi). The cap is satisfactory when the pressure holds steady. It is also good if it holds pressure within the 124 to 145 kPa (18 to 21 psi) range for 30 seconds or more. If the pointer drops quickly, replace the cap.

DIAGNOSIS AND TESTING (Continued)

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.

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.

SERVICE PROCEDURES

COOLANT LEVEL—ROUTINE CHECK

NOTE: 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.

COOLANT—ADDING ADDITIONAL

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 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.

SERVICE COOLANT LEVEL

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

DRAINING AND FILLING COOLING SYSTEM

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.
- 4.7L V-8 Engines: 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.

SERVICE PROCEDURES (Continued)

To drain the 4.0L 6-cylinder engine of coolant, remove the cylinder block drain plug located on the side of cylinder block (Fig. 23).

To drain the 4.7L V-8 engines of coolant, remove the cylinder block drain plugs located on the sides of cylinder block above the oil pan rail.

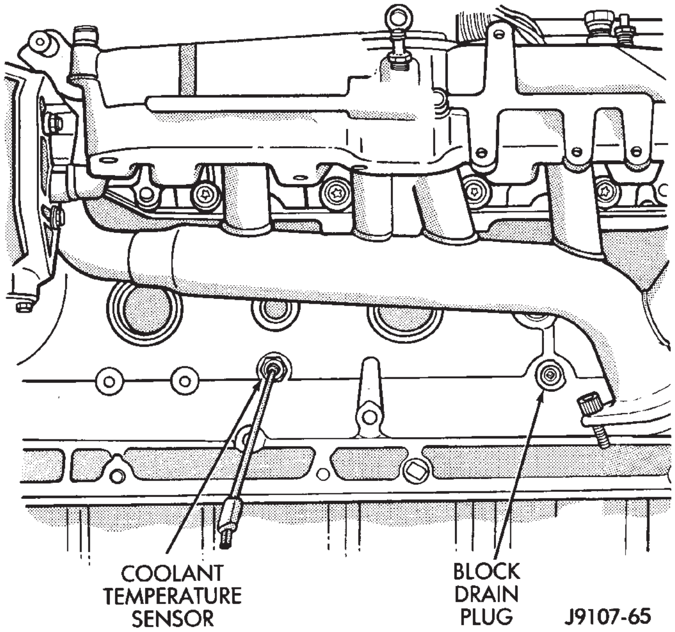


Fig. 23 Drain Plug—4.0L 6-Cylinder Engine

PARTIAL DRAINING

Use this procedure if the coolant is to be partially drained, such as for engine thermostat removal (4.0L engine only).

(1) With engine cold, slowly remove the radiator cap. 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.

• 4.7L V-8 Engines: 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) Remove the pipe plug labeled **COOLANT BLEED** 4.7L engines only. (Fig. 24)

(3) Fill system using a 50/50 mixture of ethylene-glycol antifreeze and low mineral content water. Fill radiator until coolant starts to come out of coolant bleed bore (4.7L engine only). install plug.

(4) Fill coolant reservoir to FULL mark.

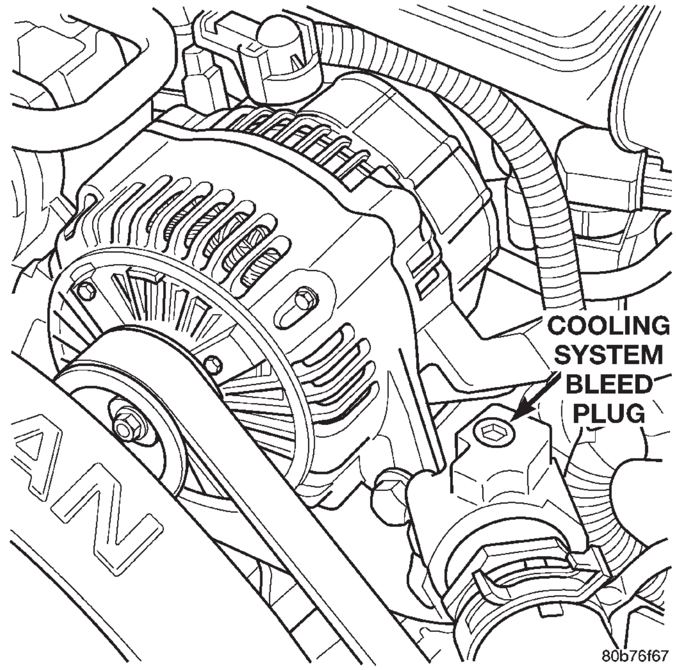


Fig. 24 Coolant Bleed Plug Location

(5) Install radiator cap and reservoir cap.

(6) Start engine and run at 3000 RPM for 10 seconds.

(7) Shut engine off.

(8) Remove radiator cap and bleed plug (4.7L engine only).

(9) Repete step 3.

(10) Apply Mopar® Thread Sealant to the bleed plug and install.

(11) Install the radiator cap.

COOLING SYSTEM—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.

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.

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.

SERVICE PROCEDURES (Continued)

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.

REMOVAL AND INSTALLATION

EXTERNAL TRANSMISSION OIL COOLER—AUXILIARY

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.

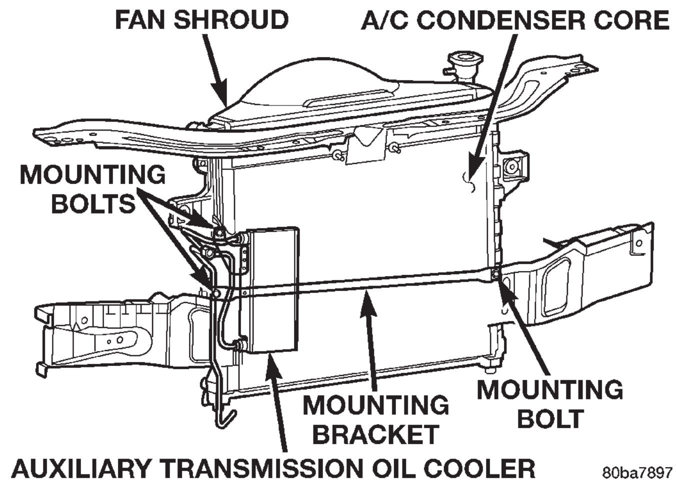


Fig. 25 Oil Cooler Mounting Brackets—Typical

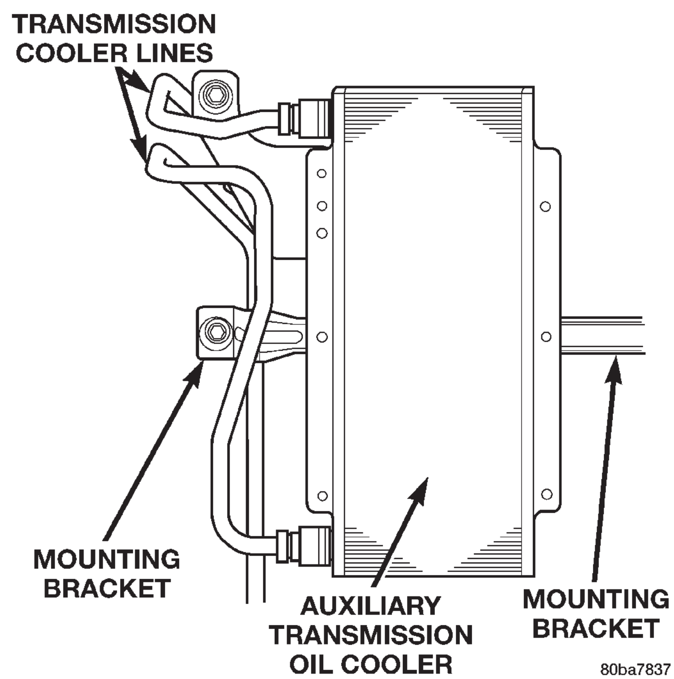


Fig. 26 Oil Cooler Hoses—Typical

(5) Remove two bracket bolts and three brace bolts (Fig. 25).

(6) Remove the retaining clip from the cooler lines (Fig. 25).

(7) Place a drain pan under the cooler.

(8) Disconnect the upper hose clamp at cooler line (Fig. 26). 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.

REMOVAL AND INSTALLATION (Continued)

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. 25).

(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.

WATER PUMP—4.0L ENGINE

CAUTION: If the water pump is replaced because of mechanical damage, the fan blades and viscous fan drive should also be inspected. These components could have been damaged due to excessive vibration.

REMOVAL

The water pump can be removed without discharging the air conditioning system (if equipped).

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.

(3) The thermal viscous fan drive is attached (threaded) to the water pump hub shaft. 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** Do not attempt to remove fan/viscous fan drive assembly from vehicle at this time.

(4) If water pump is being replaced, do not unbolt fan blade assembly from thermal viscous fan drive.

(5) Remove fan shroud-to-radiator nuts (Fig. 27). 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.

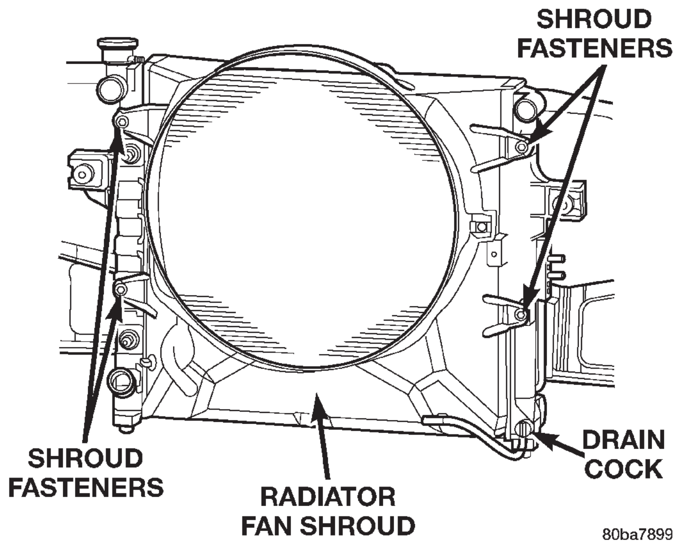


Fig. 27 Fan Shroud Mounting

(7) 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.

The drive belt is equipped with a spring loaded automatic belt tensioner. Relax tension from belt by rotating tensioner clockwise (as viewed from front) When all belt tension has been relaxed, remove accessory drive belt.

(8) Remove the idler pulley (located over the water pump).

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. 28) 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. 29). If replacement is necessary, use only an original equipment clamp with matching number or letter.

(9) Remove lower radiator hose from water pump. Remove heater hose from water pump fitting.

(10) Remove the five pump mounting bolts (Fig. 30) and remove pump from vehicle. Discard old gasket. Note that one of the five bolts is longer than the other bolts.

REMOVAL AND INSTALLATION (Continued)

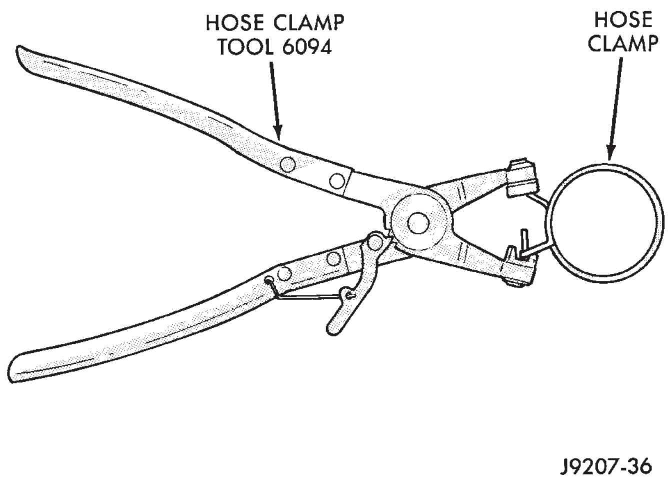


Fig. 28 Hose Clamp Tool—Typical

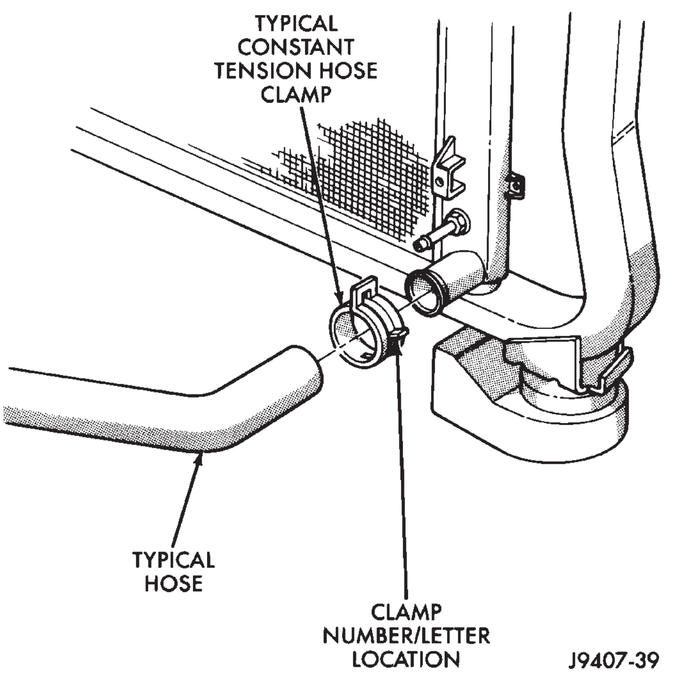


Fig. 29 Clamp Number/Letter Location

(11) If pump is to be replaced, the heater hose fitting must be removed. Note position of fitting before removal.

INSTALLATION

(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.

(3) Install the gasket and water pump. The silicone bead on the gasket should be facing the water pump. Also, 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.

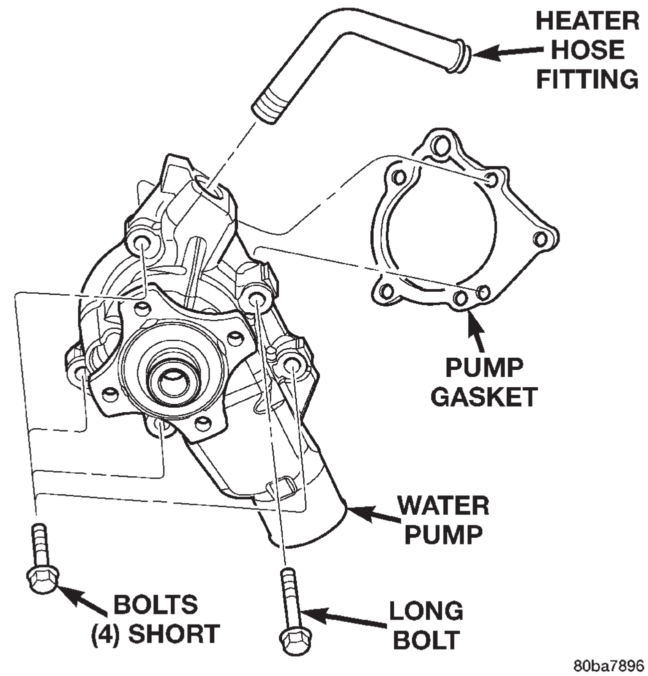


Fig. 30 Water Pump Remove/Install—Typical

(4) Connect the radiator and heater hoses to the water pump.

(5) Position water pump pulley to water pump hub.

(6) If equipped with a water pump mounted fan, install fan and four nuts to water pump hub. If not equipped with a water pump mounted fan, install four pump hub bolts. Tighten bolts (or nuts) to 27 N·m (20 ft. lbs.) torque.

(7) Install power steering pump.

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 the Belt Removal and Installtion in this group for appropriate belt routing. You may also refer to the Belt Routing Label in the vehicle engine compartment.

(8) Adjust accessory drive belt, refer to Accessory Drive Belt removal and installation in this group.

(9) Fill cooling system with coolant and check for leaks. Refer to Refilling Cooling System in this group.

(10) Connect battery cable to battery.

(11) Start and warm the engine. Check for leaks.

REMOVAL AND INSTALLATION (Continued)

WATER PUMP—4.7L ENGINE

The water pump on 4.7L 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 can be removed without discharging the air conditioning system (if equipped).

REMOVAL

(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. 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.** Using special tool spanner wrench 6958 with adapter pins 8346 and a suitable fan wrench loosen the fan drive (Fig. 31). Do not attempt to remove fan/viscous fan drive assembly from vehicle at this time.

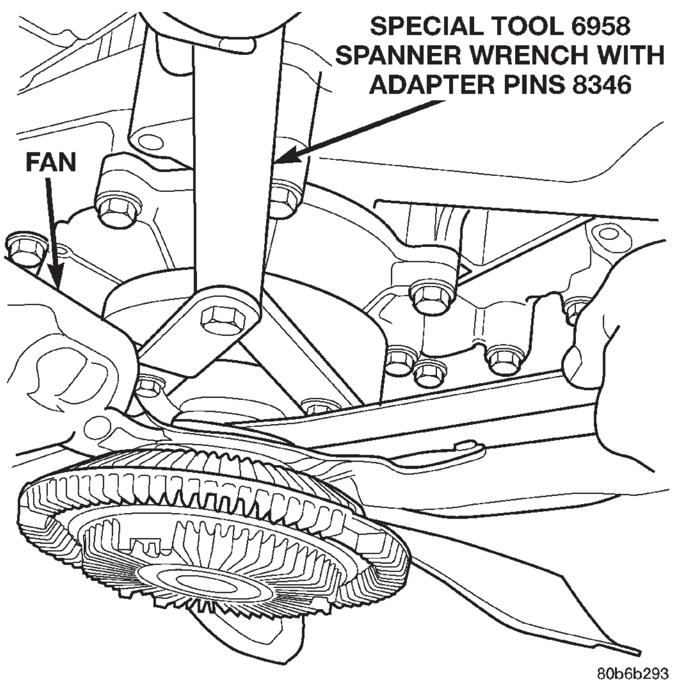


Fig. 31 Viscous Fan and Fan Drive 4.7L

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). 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. 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 from thermal viscous fan drive.

(5) Remove two fan shroud-to-radiator nuts (Fig. 32). Do not attempt to remove fan shroud at this time.

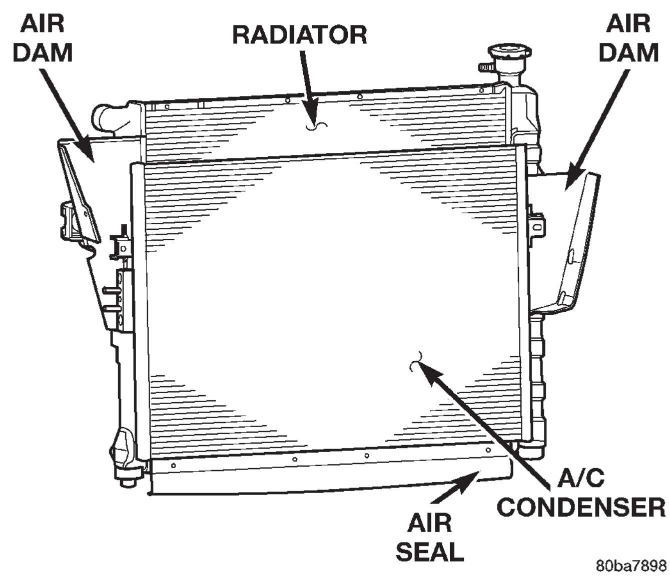


Fig. 32 Fan Shroud Nuts

(6) Remove fan shroud and fan blade/viscous fan drive assembly from vehicle as a complete unit.

(7) 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.

(8) **Do not** remove water pump pulley bolts at this time.

(9) Remove accessory drive belt as follows: The drive belt is equipped with a spring loaded automatic belt tensioner. Relax tension from belt by rotating tensioner clockwise (as viewed from front) (Fig. 33). When all belt tension has been relaxed, remove accessory drive belt.

REMOVAL AND INSTALLATION (Continued)

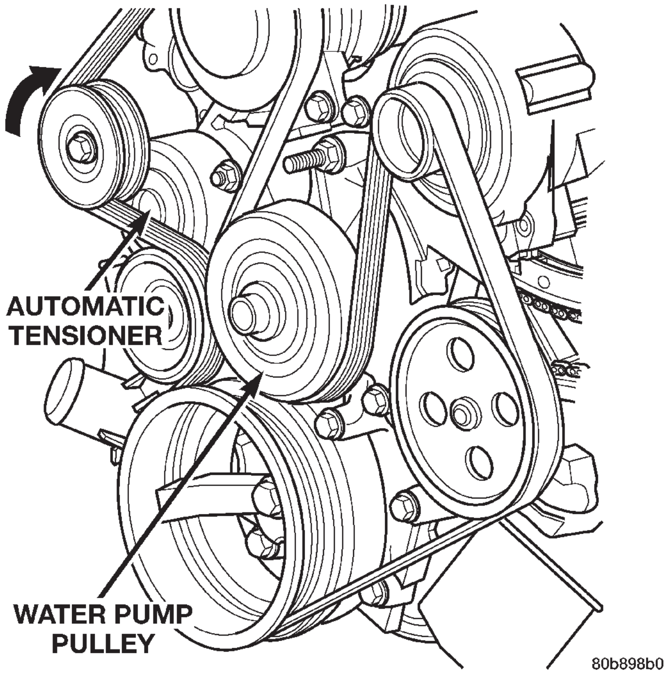


Fig. 33 Automatic Belt Tensioner—4.7L

(10) Remove lower radiator hose clamp and remove lower hose at water pump.

(11) Remove seven water pump mounting bolts and one stud bolt.

CAUTION: Do not pry water pump at timing chain case/cover. The machined surfaces may be damaged resulting in leaks.

(12) Remove water pump and gasket. Discard gasket.

INSTALLATION

(1) Clean gasket mating surfaces.

(2) Using a new gasket, position water pump and install mounting bolts as shown. (Fig. 34). Tighten water pump mounting bolts to 40 N·m (30 ft. lbs.) torque.

(3) Spin water pump to be sure that pump impeller does not rub against timing chain case/cover.

(4) Connect radiator lower hose to water pump.

(5) Relax tension from belt tensioner (Fig. 33). 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. 35) 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.

(6) Position fan shroud and fan blade/viscous fan drive assembly to vehicle as a complete unit.

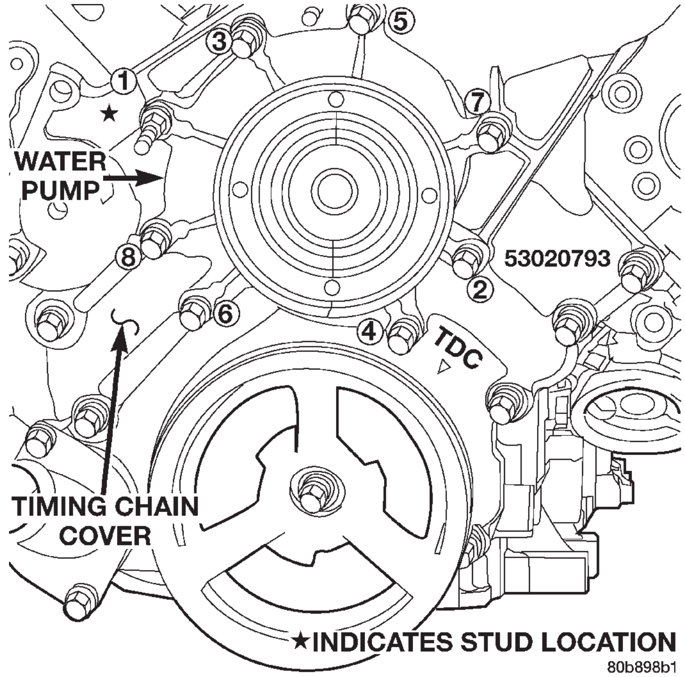


Fig. 34 Water Pump Installation—4.7L

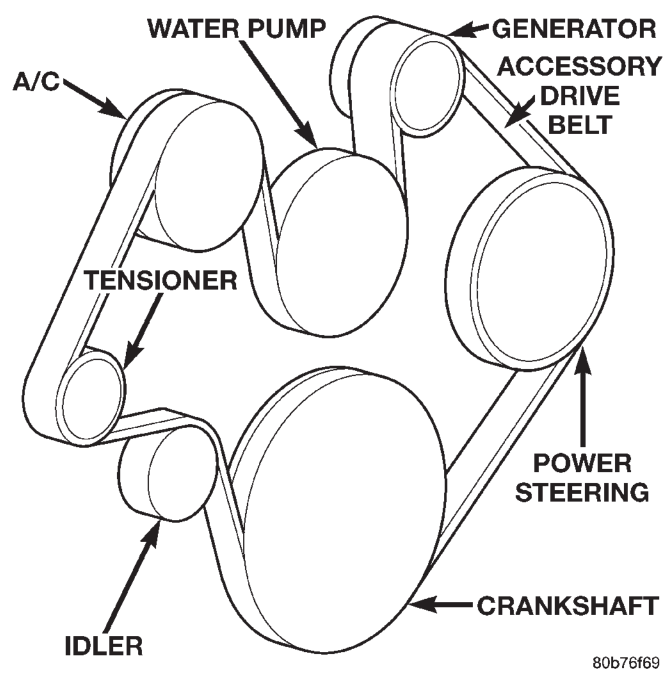


Fig. 35 Belt Routing 4.7L

(7) Be sure the upper and lower portions of the fan shroud are firmly connected. All air must flow through the radiator.

(8) Install two fan shroud-to-radiator nuts (Fig. 32).

(9) Be sure of at least 25 mm (1.0 inches) between tips of fan blades and fan shroud.

(10) Install fan blade/viscous fan drive assembly to water pump shaft.

REMOVAL AND INSTALLATION (Continued)

(11) Fill cooling system. Refer to Refilling the Cooling System in this group.

(12) Connect negative battery cable.

(13) Start and warm the engine. Check for leaks.

THERMOSTAT—4.0L ENGINE

REMOVAL

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. 5). 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. 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. 36). Discard old gasket.

(5) Clean the gasket mating surfaces.

INSTALLATION

(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. 37).

(b) Position thermostat in groove with arrow and air bleed hole on outer flange pointing up.

(2) Install replacement gasket and thermostat housing.

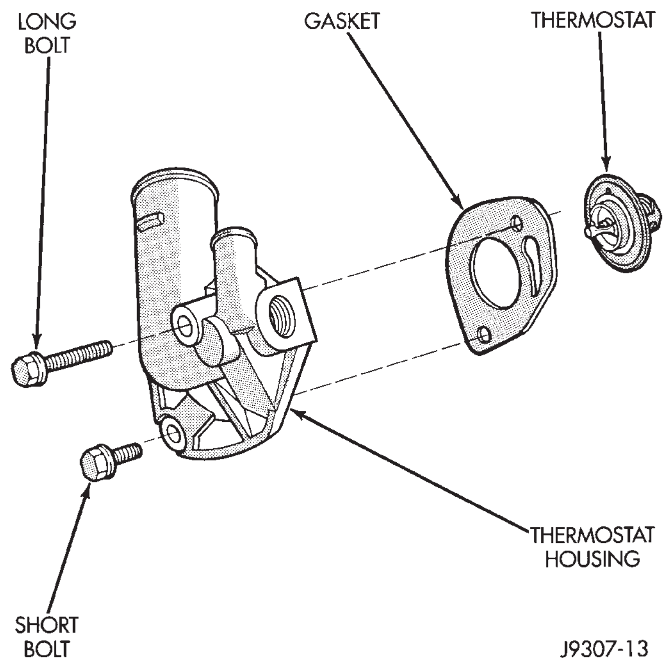


Fig. 36 Thermostat Removal/Installation—4.0L Engine

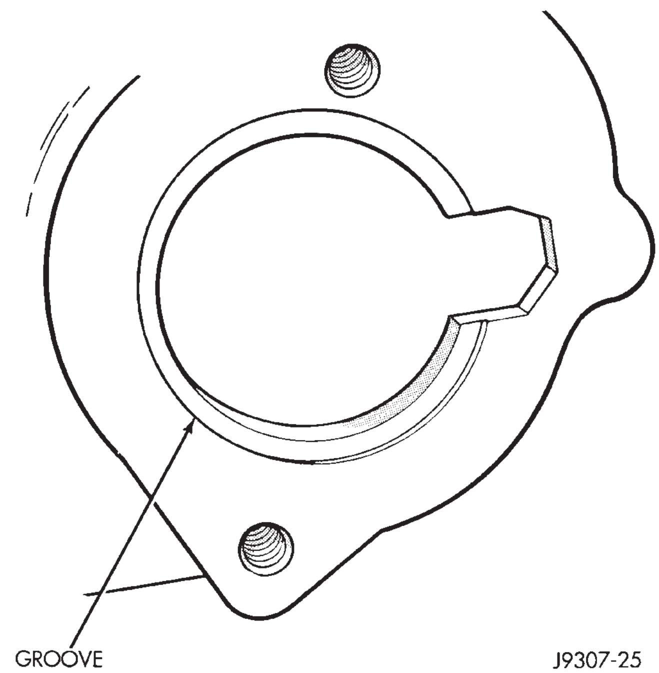


Fig. 37 Thermostat Recess—4.0L Engine

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.

(5) Install electrical connector to coolant temperature sensor.

REMOVAL AND INSTALLATION (Continued)

(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.

THERMOSTAT— 4.7L ENGINE

REMOVAL

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.

(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) Remove accessory drive belt (Fig. 38).

(4) Remove lower radiator hose clamp and lower radiator hose at thermostat housing.

(5) Remove thermostat housing mounting bolts, thermostat housing and thermostat (Fig. 39).

INSTALLATION

(1) Clean mating areas of timing chain cover and thermostat housing.

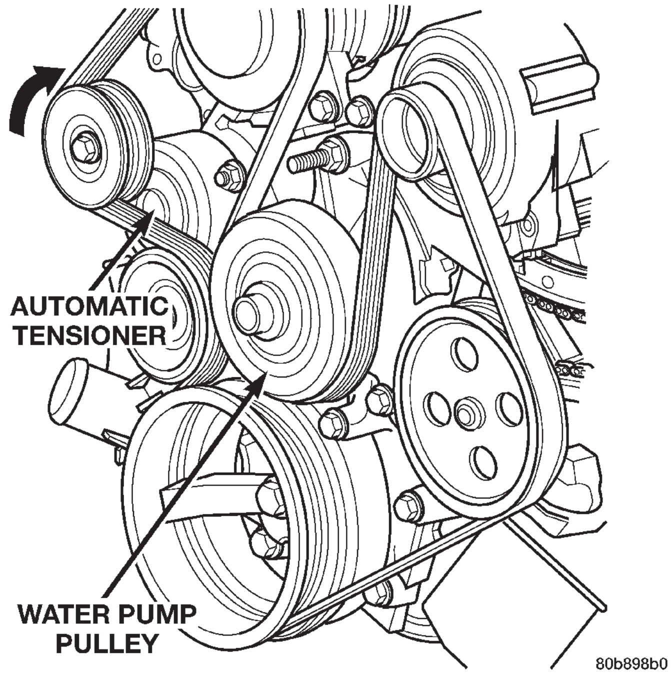


Fig. 38 Accessory Drive Belt and Tensioner 4.7L

(2) Install thermostat (spring side down) into recessed machined groove on timing chain cover (Fig. 39).

(3) Position thermostat housing on timing chain cover.

(4) Install two housing-to-timing chain cover bolts. Tighten bolts to 23 N·m (200 in. lbs.) torque.

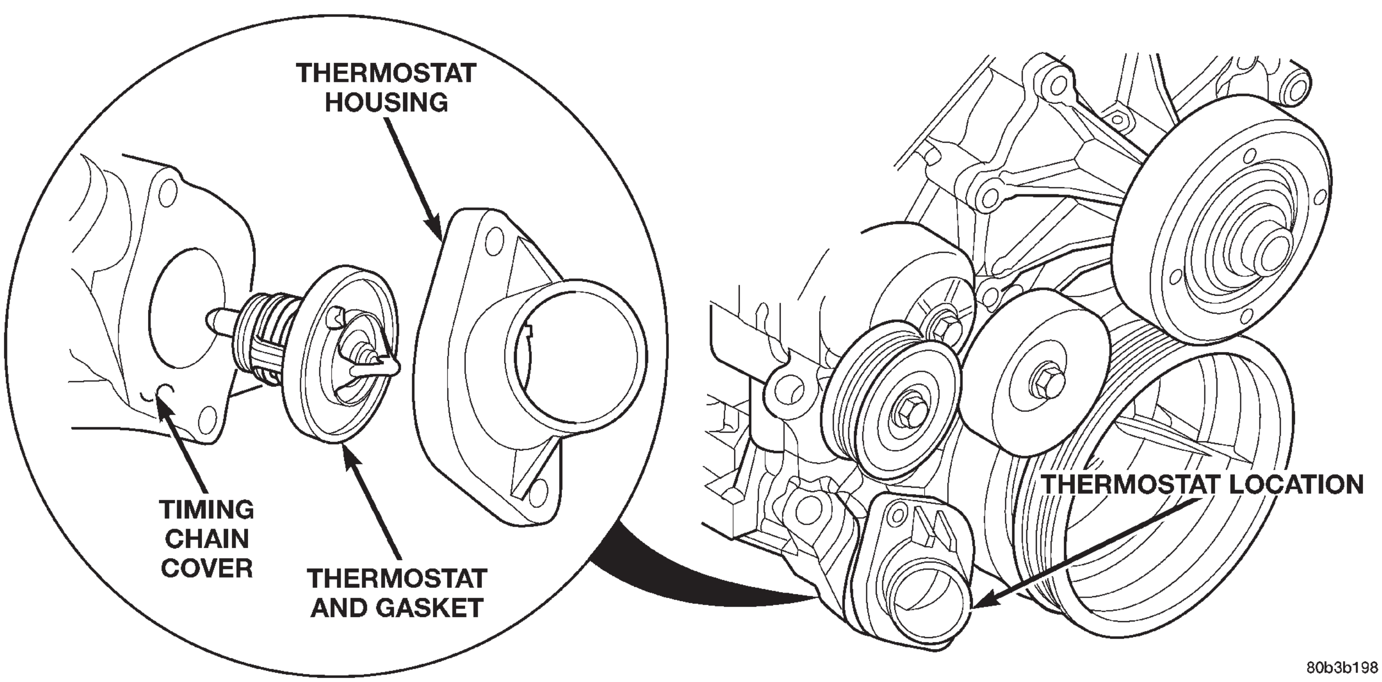


Fig. 39 Thermostat and Thermostat Housing 4.7L

1999 WJ Service Manual
Publication No. 81-370-9147
TSB 26-03-00 March, 2000

REMOVAL AND INSTALLATION (Continued)

CAUTION: Housing must be tightened evenly and thermostat must be centered into recessed groove in timimg chain cover. If not, it may result in a cracked housing, damaged timing chain cover threads or coolant leaks.

(5) Install lower radiator hose on thermostat housing.

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. 40) for correct 4.7L engine belt routing. Or, refer to the Belt Routing Label located in the engine compartment. The correct belt with correct length must be used.

(6) Position drive belt over all pulleys **except** water pump pulley (located between generator and A/C compressor) (Fig. 40).

(7) Attach a socket/wrench to pulley mounting bolt of automatic belt tensioner.

(8) Rotate socket/wrench clockwise. Place belt over water pump pulley. Let tensioner rotate back into place. Remove wrench. Be sure belt is properly seated on all pulleys (Fig. 38).

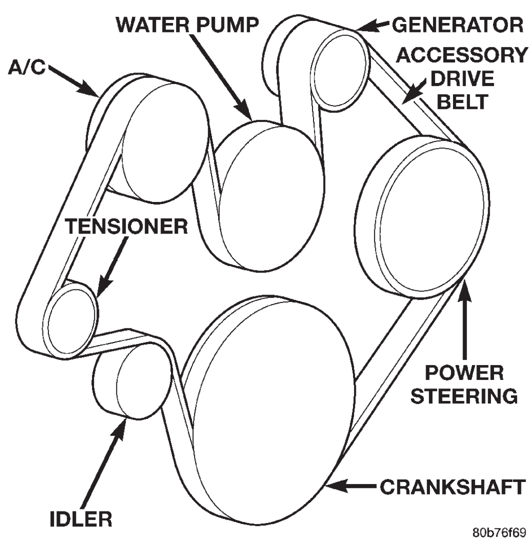


Fig. 40 Accessory Drive Belt Routing—4.7L

(9) Fill cooling system. Refer to Refilling Cooling System in this group.

(10) Connect negative battery cable to battery.

(11) Start and warm the engine. Check for leaks.

RADIATOR FAN SHROUD

REMOVAL

NOTE: The fan can not be removed seperate from the shroud. Both fan and shroud must be removed together.

(1) Using special tool 6958 Spanner Wrench and 8346 Adapters, remove the viscous fan from the water pump (Fig. 41).

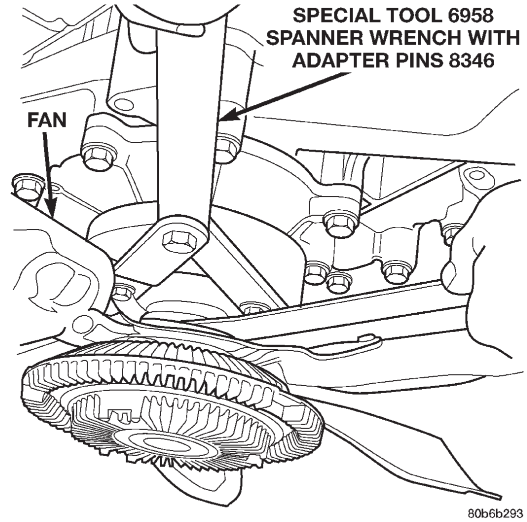


Fig. 41 Viscous Fan 4.7L Engine

(2) Gently lay fan into shroud.

(3) Disconnect the electrical connector for the electric fan, then disconnect connector from shroud (Fig. 41A).

(4) Disconnect transmission cooler line from retaining clip on fan shroud (Fig. 41A).

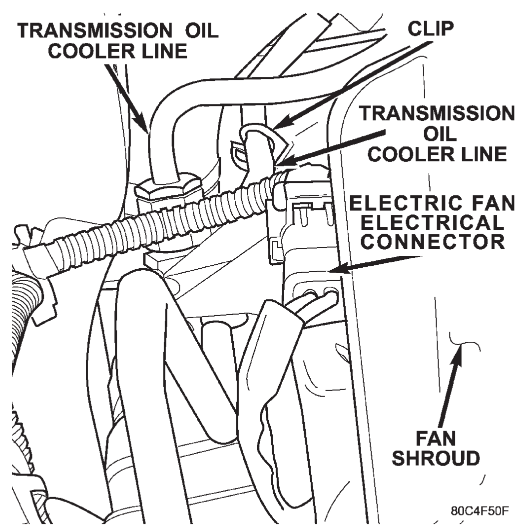


Fig. 41A Transmission Oil Cooler Line Retaining Clip and Electric Fan Electrical Connector

NOTE: The lower left side mounting bolt can only be accessed from under vehicle.

(5) Remove the mounting bolts form the shroud (Fig. 42).

(6) Remove the radiator core support.

(7) Remove the radiator mounting bolts.

(8) Gently pull radiator toward front of vehicle to provide clearance to remove fan shroud.

(9) Remove the shroud and fan from vehicle.

1999 WJ Service Manual
Publication No. 81-370-9147
TSB 26-03-00 March, 2000

REMOVAL AND INSTALLATION (Continued)

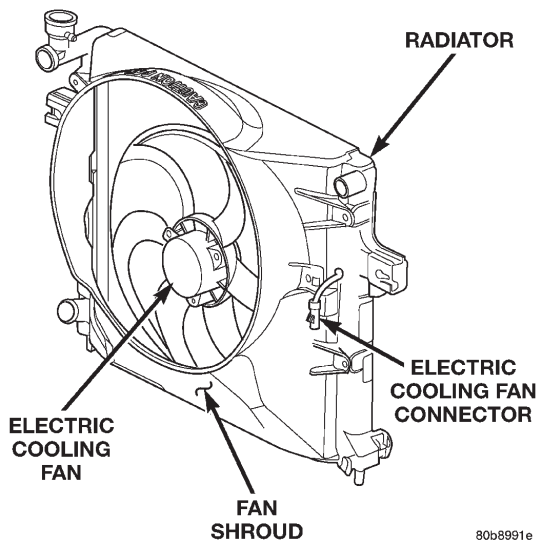


Fig. 42 Fan Shroud and Electric Fan 4.7L Engine

INSTALLATION

NOTE: The fan can not be installed seperate from the shroud. Both fan and shroud must be installed together.

(1) Carefully position the viscous fan into the shroud, then position the shroud and fan into the vehicle.
(2) Install radiator mounting bolts.
(3) Reconnect transmission oil cooler line to retaining clip (Fig. 41A).
(4) Install radiator core support.

NOTE: The lower left side mounting bolt can only be accessed from under vehicle.

(5) Install the mounting bolts into the shroud
(6) Attach the electrical connector onto the shroud, then connect the connector to the electric fan connector.
(7) Install the viscous fan onto the water pump. Using special tool 6958 Spanner Wrench and 8346 Adapters, tighten the viscous fan onto the water pump (Fig. 41)

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. 43). 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. 44). If replacement is necessary, use only an original equipment clamp with matching number or letter.

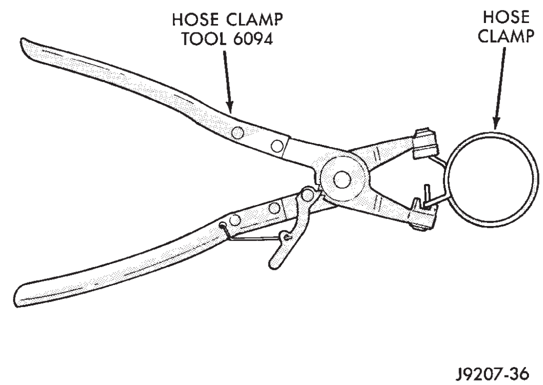


Fig. 43 Hose Clamp Tool—Typical

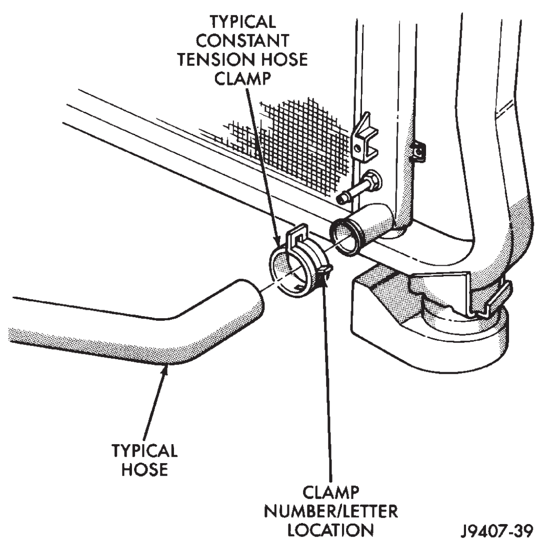


Fig. 44 Clamp Number/Letter Location—Typical

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. 45). 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.

REMOVAL AND INSTALLATION (Continued)

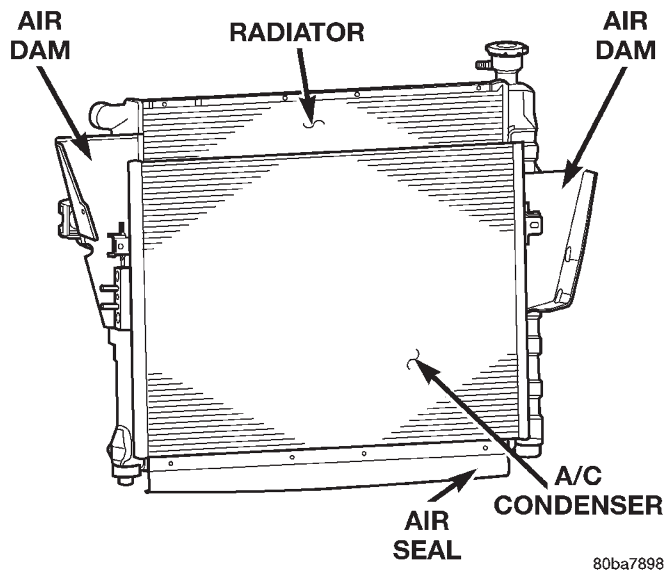


Fig. 45 Air Seals—Typical

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. 43). 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. 44). If replacement is necessary, use only an original equipment clamp with matching number or letter.

(2) Drain coolant from radiator. Refer to Draining Cooling System in this section.

NOTE: The 4.0L engine does not require special tool 6958 spanner wrench or 8346 adapters to remove the fan drive from the water pump.

(3) The thermal viscous fan drive is attached (threaded) to the water pump hub shaft. 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.** Using spanner wrench 6958 with adapters 8346 (4.7L engines only) and a 36 MM Fan Wrench (Fig. 46) loosen the fan drive/ fan blade. Drive belt removal is not necessary for removal of fan drive.

(4) Do not attempt to remove fan/viscous fan drive assembly from vehicle at this time.

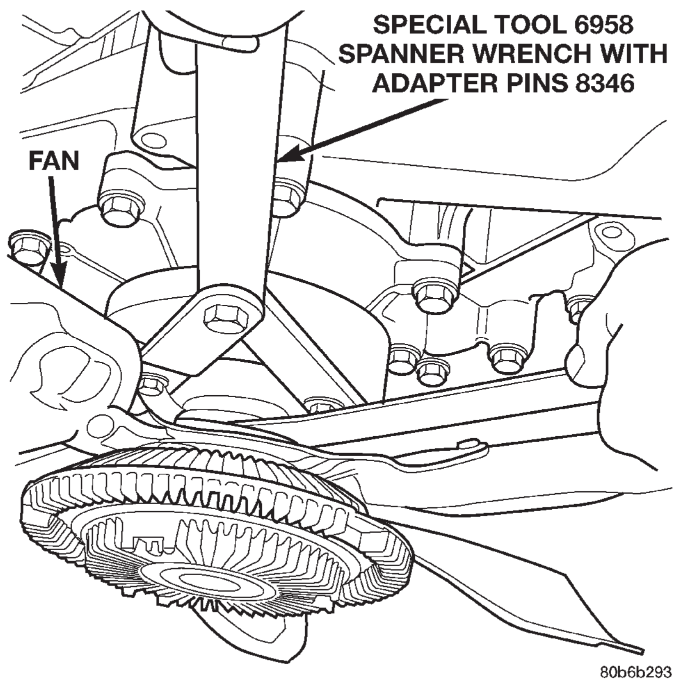


Fig. 46 Viscous Fan Drive 4.7L Engine

(5) Remove the front grill. Refer to Group 23 for procedure.

(6) Remove two radiator mounting bolts (Fig. 49) (Fig. 48).

(7) Disconnect both transmission cooler lines from radiator.

(8) Disconnect electric fan connector, then disconnect connector harness from shroud (all 4.7L engines and heavy cooling package 4.0L only) (Fig. 49) (Fig. 48).

(9) Disconnect the radiator upper and lower hoses (Fig. 49) (Fig. 48).

(10) Disconnect the overflow hose from radiator (Fig. 49) (Fig. 48).

(11) Remove the air inlet duct at the grill.

(12) The lower part of radiator is equipped with two alignment dowel pins (Fig. 47). They are located on the bottom of radiator tank and fit into rubber grommets. These rubber grommets are pressed into the radiator lower crossmember.

REMOVAL AND INSTALLATION (Continued)

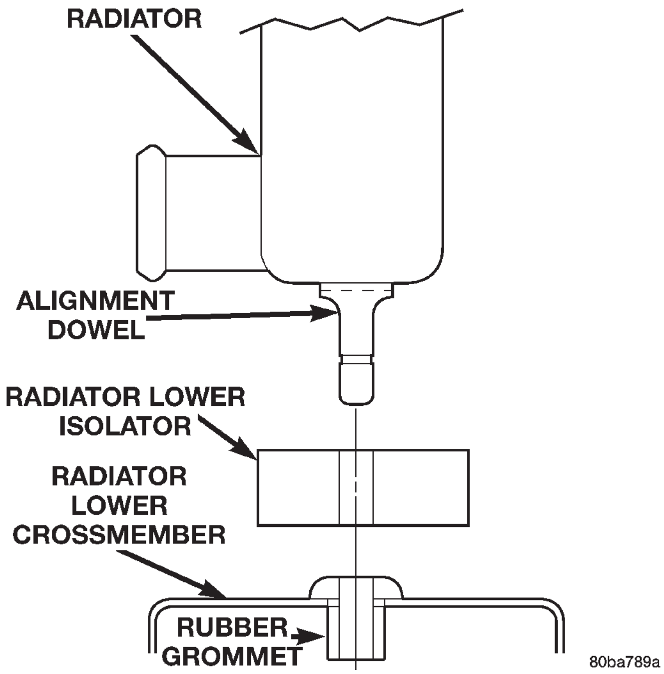


Fig. 47 Radiator Alignment Dowels

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.

(13) 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 right side of radiator. Do not cut or tear this seal.

(14) 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) (Fig. 49).

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. 45) 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.

(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. 47). Continue to guide the alignment dowels

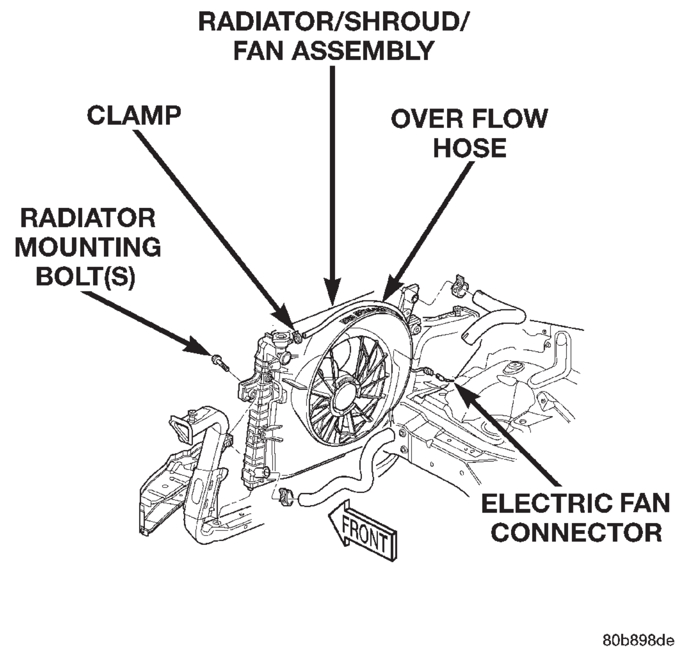


Fig. 48 Radiator, Shroud and Electric Fan—4.0L Engine

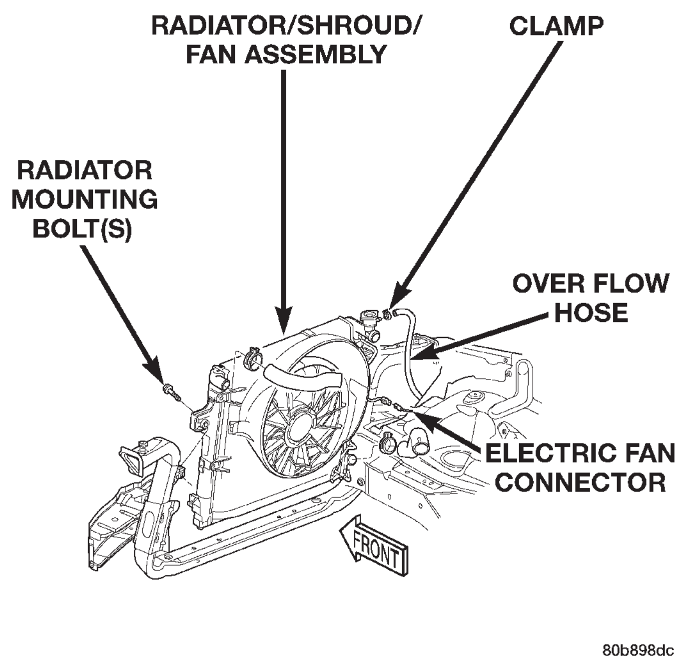


Fig. 49 Radiator, Shroud and Electric Fan—4.7L Engine

into the rubber grommets located in lower radiator crossmember. 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.

(2) Connect the radiator upper and lower hoses and hose clamps to radiator (Fig. 49).

REMOVAL AND INSTALLATION (Continued)

CAUTION: The tangs on the hose clamps must be positioned straight down.

(3) Install coolant reserve/overflow tank hose at radiator (Fig. 49) (Fig. 48).
(4) Connect both transmission cooler lines at the radiator (Fig. 49) (Fig. 48).
(5) Install both radiator mounting bolts (Fig. 49) (Fig. 48).
(6) Install air inlet duct at grill.
(7) Attach electric fan harness to shroud, then connect harness to connector (all 4.7L engines and heavy cooling 4.0L only) (Fig. 49) (Fig. 48).
(8) Install the grill. Refer to group 23, Body.
(9) Install the fan/viscous fan drive assembly to the water pump.
(10) Rotate the fan blades (by hand) and check for interference at fan shroud.
(11) Be sure of at least 25 mm (1.0 inch) between tips of fan blades and fan shroud.
(12) Fill cooling system.
(13) Connect battery cable at battery.
(14) Start and warm engine. Check for leaks.

WATER PUMP BYPASS HOSE

4.0L ENGINE

REMOVAL

(1) Partially drain cooling system. Refer to Draining Cooling System in this group.
(2) 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. 50). 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. 51). If replacement is necessary, use only an original equipment clamp with matching number or letter.

(3) Loosen both bypass hose clamps (Fig. 50) and position to center of hose. Remove hose from vehicle.

INSTALLATION

(1) Position bypass hose clamps (Fig. 50) to center of hose.
(2) Install bypass hose to engine.

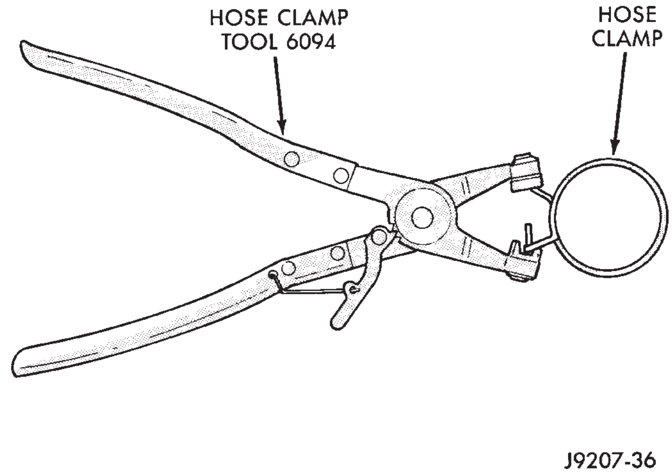


Fig. 50 Hose Clamp Tool—Typical

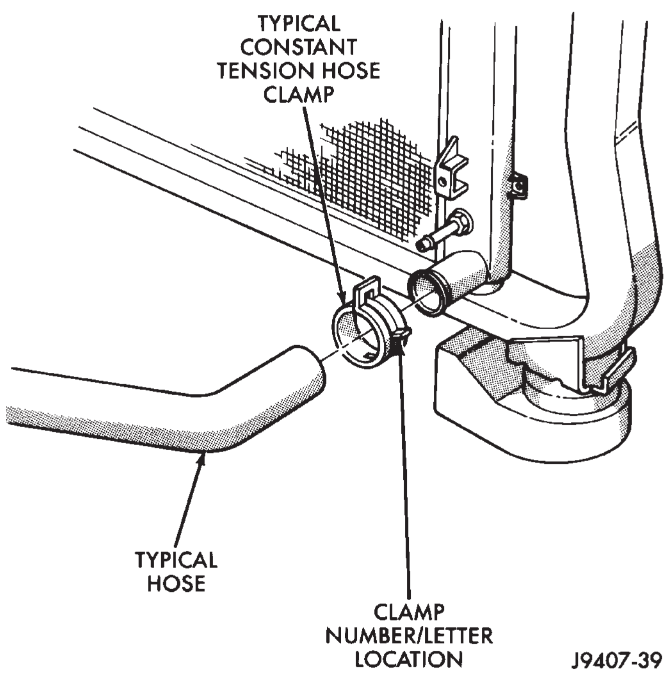


Fig. 51 Clamp Number/Letter Location

(3) Secure both hose clamps (Fig. 50).
(4) Fill cooling system. Refer to Refilling the Cooling System in this group.
(5) Start and warm the engine. Check for leaks.

ENGINE BLOCK HEATER

REMOVAL

(1) Disconnect negative battery cable from battery.
(2) Drain coolant from radiator. Refer to Draining and Filling Cooling System in this section.
(3) Raise vehicle.
(4) Remove engine cylinder block drain plug(s) located on the sides of cylinder block above the oil pan rail (Fig. 52) (Fig. 53).
(5) Remove power cord from block heater.

REMOVAL AND INSTALLATION (Continued)

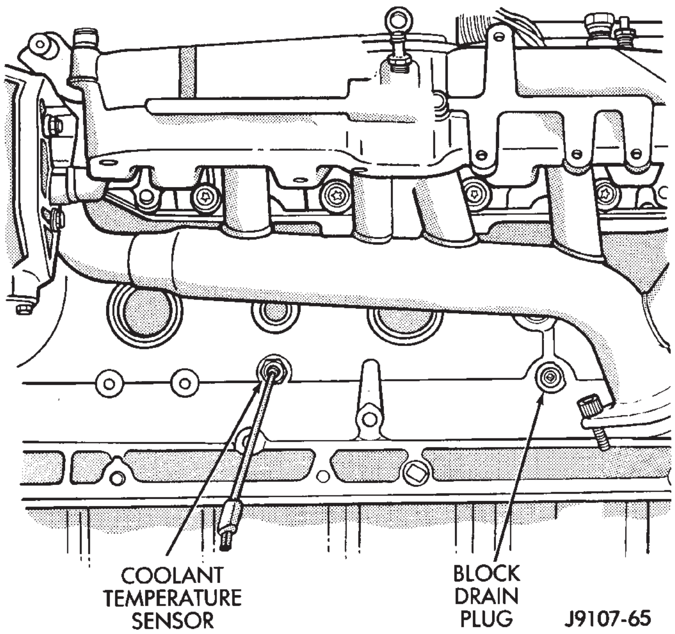


Fig. 52 Drain Plug—4.0L Engine

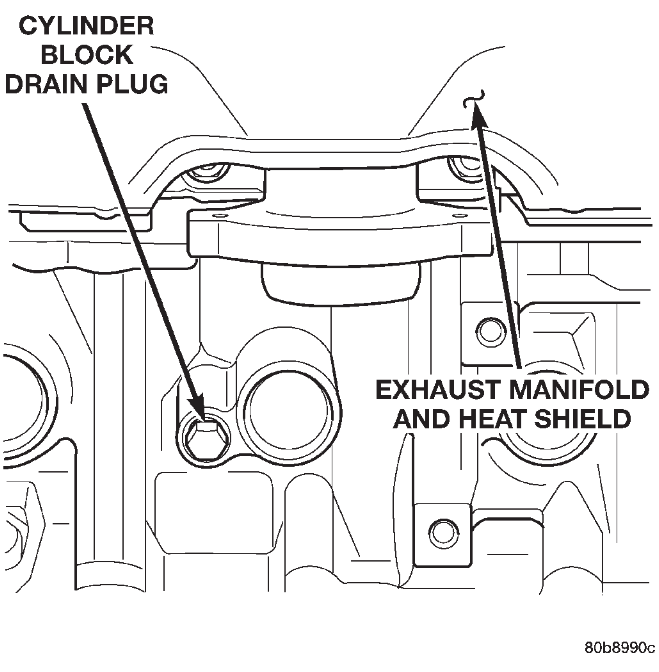


Fig. 53 Drain Plug—4.7L Engine

(6) Loosen screw at center of block heater. Remove heater assembly (Fig. 54) (Fig. 55).

INSTALLATION

(1) Thoroughly clean cylinder block core hole and block heater seat.

(2) Insert block heater assembly with element loop pointing at twelve o'clock (Fig. 54) (Fig. 55).

(3) With block heater fully seated, tighten center screw to 2 N·m (17 in. lbs.) torque.

(4) Fill cooling system with recommended coolant.

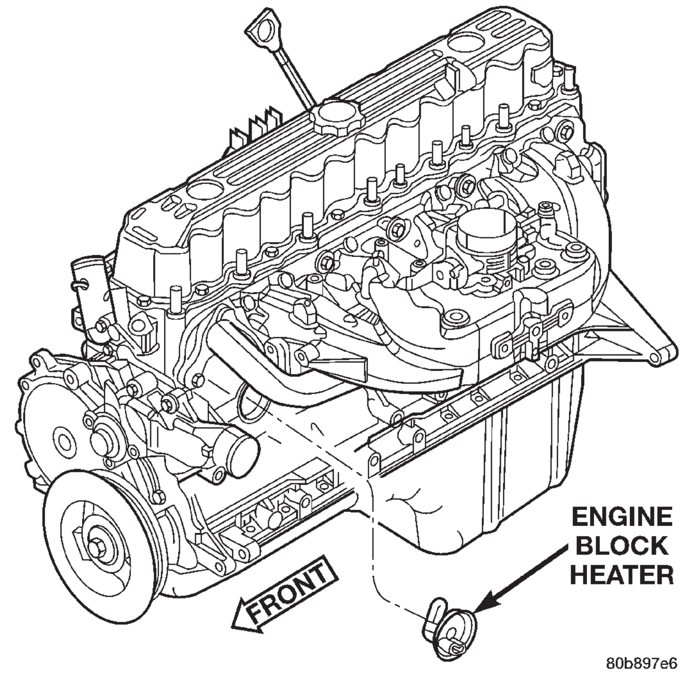


Fig. 54 Engine Block Heater—4.0L

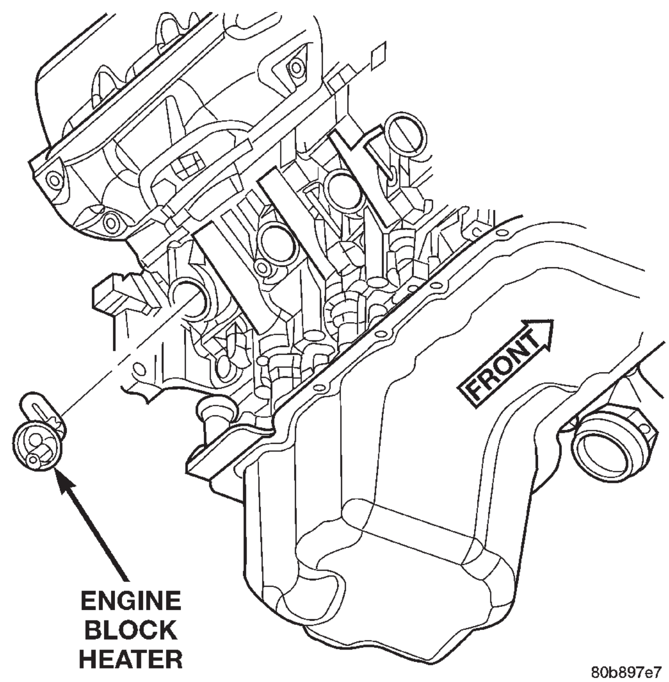


Fig. 55 Engine Block Heater—4.7L

(5) Start and warm the engine. Check for leaks.

ACCESSORY DRIVE BELT

NOTE: The belt routing schematics are published from the latest information available at the time of publication. If anything differs between these schematics and the Belt Routing Label, use the schematics on Belt Routing Label. This label is located in the engine compartment.

REMOVAL AND INSTALLATION (Continued)

REMOVAL

Belt tension is not adjustable. Belt adjustment is maintained by an automatic (spring load) belt tensioner.

(1) Disconnect negative battery cable from battery.

(2) Loosen belt tensioner and remove belt (Fig. 56) (Fig. 57).

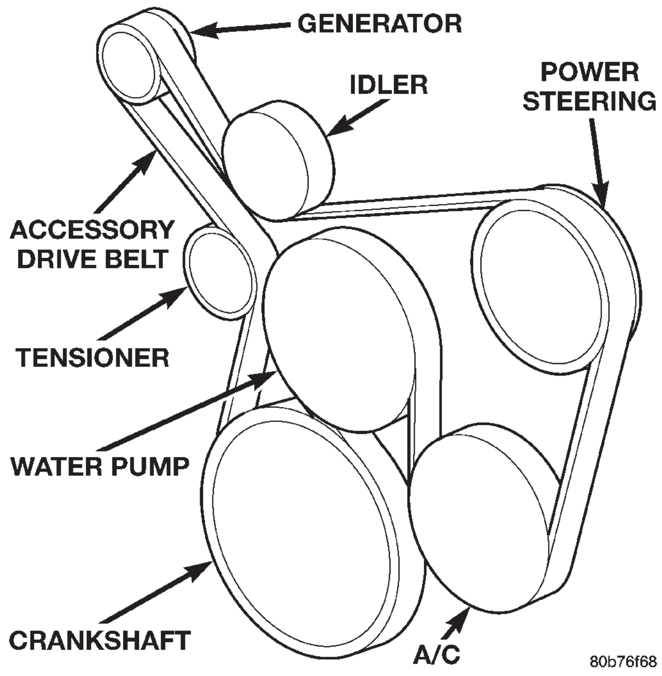


Fig. 56 Belt Routing—4.0L

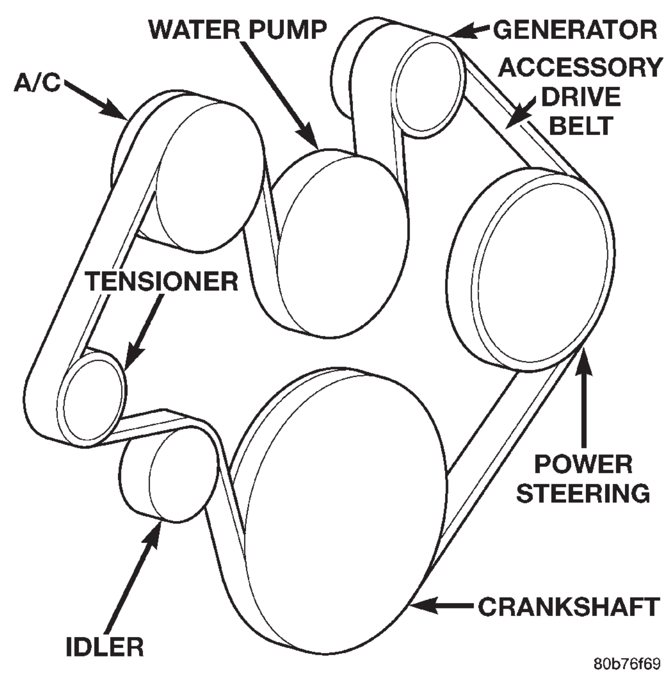


Fig. 57 Belt Routing—4.7L

INSTALLATION

(1) 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 (Fig. 56) (Fig. 57).

(2) Install new belt (Fig. 56) (Fig. 57).

(3) With the drive belt installed, inspect the belt wear indicator (Fig. 58). The gap between the tang and the housing stop (measurement A) must not exceed 24 mm (.94 inches). If the measurement exceeds this specification replace the serpentine accessory drive belt.

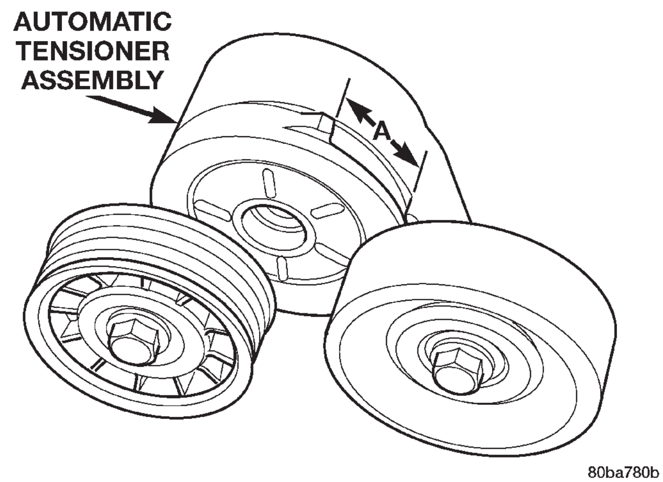


Fig. 58 Accessory Drive Belt Wear Indicator—4.7L Engine

AUTOMATIC BELT TENSIONER

NOTE: On 4.7L engines, the tensioner is equipped with an indexing tang on back of tensioner and an indexing stop on tensioner housing. If a new belt is being installed, tang must be within approximately 24 mm (.94 inches) of indexing stop. Belt is considered new if it has been used 15 minutes or less.

If the above 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

NOTE: A used belt should be replaced if tensioner indexing arrow has moved to the minmum tension indicator. Tensioner travel stops at this point.

REMOVAL AND INSTALLATION (Continued)

REMOVAL

(1) Remove accessory drive belt. Refer to Accessory Drive Belt in this group.

(2) Remove tensioner assembly from mounting bracket (Fig. 59).

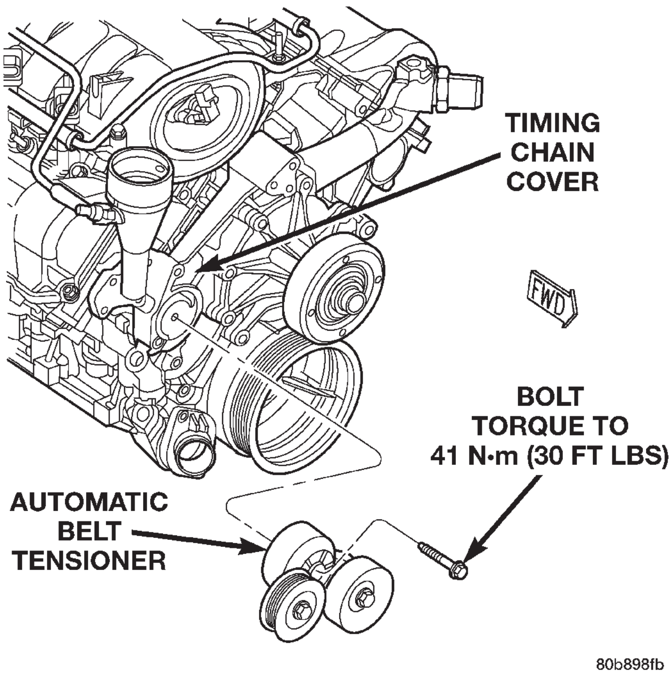


Fig. 59 Automatic Belt Tensioner—4.7L Engine

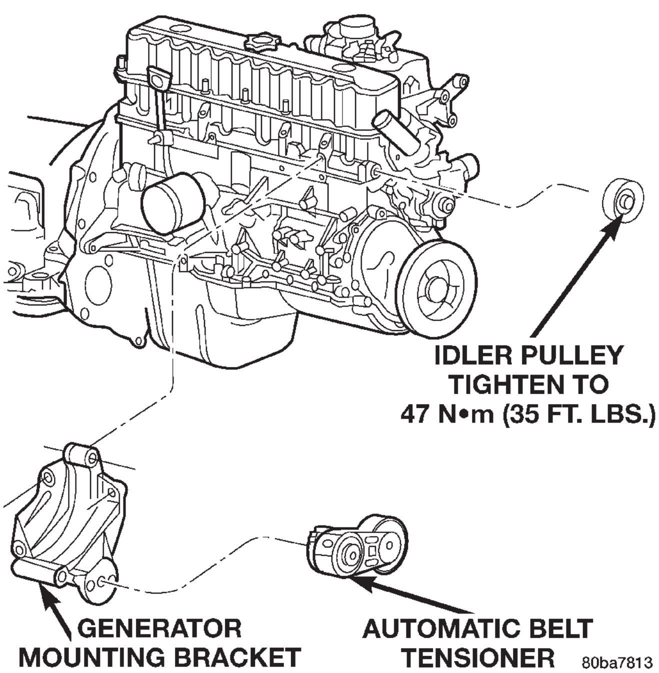


Fig. 60 Automatic Belt Tensioner—4.0L Engine

WARNING: BECAUSE OF HIGH SPRING PRESSURE, DO NOT ATTEMPT TO DISASSEMBLE AUTOMATIC TENSIONER. UNIT IS SERVICED AS AN ASSEMBLY (EXCEPT FOR PULLEY).

(3) 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. (4.0L Only)

CAUTION: To prevent damage to coil case, coil mounting bolts must be torqued.

(3) Install drive belt. Refer to Belt Removal/Installation in this group.

(4) Check belt indexing marks.

COOLING SYSTEM FAN

VISCOUS FAN

REMOVAL

(1) Disconnect negative battery cable from battery.

NOTE: The 4.0L engine does not require special tool 6958 spanner wrench or adapters 8346 to remove the fan drive.

(2) The thermal viscous fan drive/fan blade assembly is attached (threaded) to water pump hub shaft (Fig. 61). 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.** Using spanner wrench 6958 with adapter pins 8346 (4.7L engine only) and a suitable fan wrench loosen the fan drive (Fig. 62).

(3) Do not attempt to remove fan/viscous fan drive assembly from vehicle at this time.

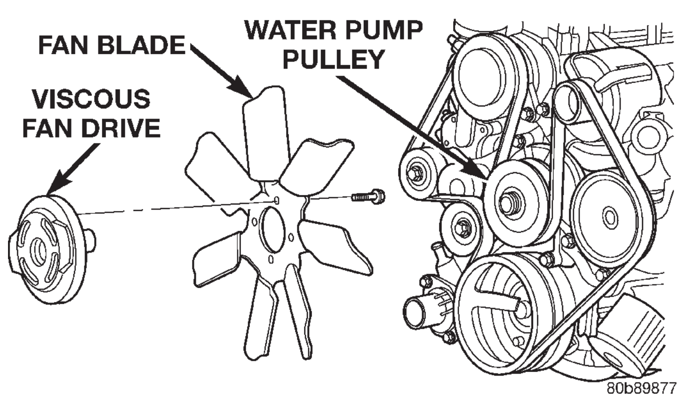


Fig. 61 Fan Blade/Viscous Fan Drive—4.7L V-8 Engines

REMOVAL AND INSTALLATION (Continued)

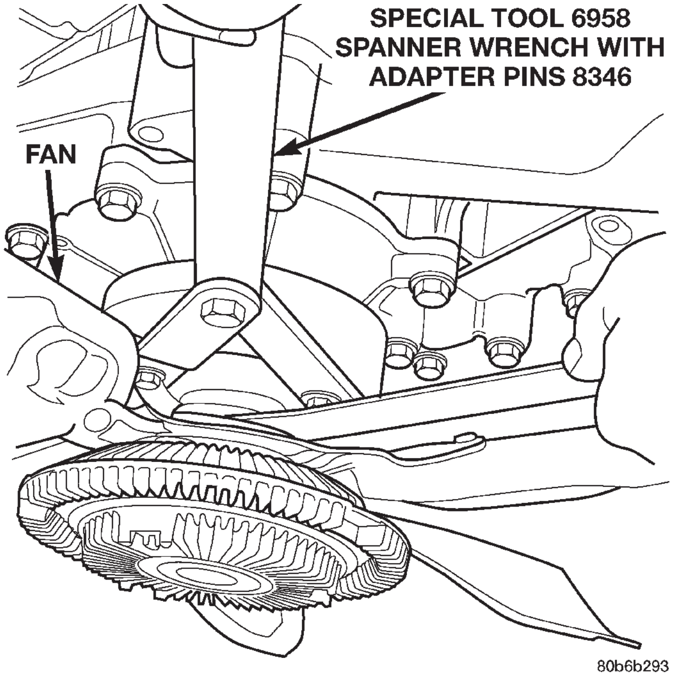


Fig. 62 Fan Blade and Drive—Removal

(4) Do not unbolt fan blade assembly from viscous fan drive at this time.

(5) Remove fan shroud-to-upper crossmember nuts.

(6) Remove fan shroud and fan blade/viscous fan drive assembly as a complete unit from vehicle.

(7) 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. This pulley is under spring tension.

(8) Remove four bolts securing fan blade assembly to viscous fan drive.

INSTALLATION

(1) Install fan blade assembly to viscous fan drive. Tighten bolts 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 (Fig. 62).

(5) Connect negative battery cable.

ELECTRIC FAN

The electric fan is only serviced as an assembly.

VISCOUS FAN DRIVE

REMOVAL/INSTALLATION

Refer to Cooling System Fan removal and installation procedures of the viscous fan drive unit procedures.

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.

CLEANING AND INSPECTION

RADIATOR CAP—INSPECTION

Visually inspect the pressure valve gasket on the cap. Replace cap if the gasket is swollen, torn or worn. Inspect the area around radiator filler neck for white deposits that indicate a leaking cap.

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.

VISCOUS FAN—INSPECTION

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.

CLEANING AND INSPECTION (Continued)

WATER PUMP—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 **(4.7L Only)**
- Impeller rubs either the pump body or the cylinder block **(4.0L Only)**

SPECIFICATIONS

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 cyl. eng.) **

- 12.3 L (13.0 quarts)

*4.7L (8 cyl. eng.) **

- 12.3 L (13.0 quarts)

* Includes coolant recovery bottle capacity

DRIVE BELT TENSION

4.0L (6 Cyl. eng.) 4.7L (V-8 eng.)

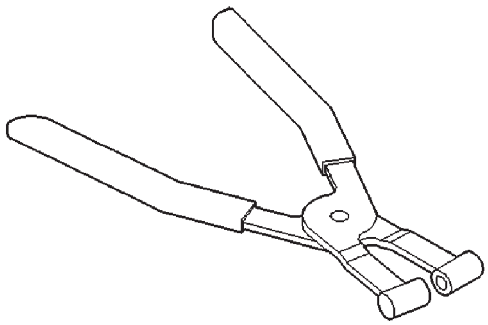
- Do not attempt to check belt tension with a tension gauge. System is equipped with an automatic tensioner. Refer to Automatic Belt Tensioner in this group

TORQUE SPECIFICATIONS

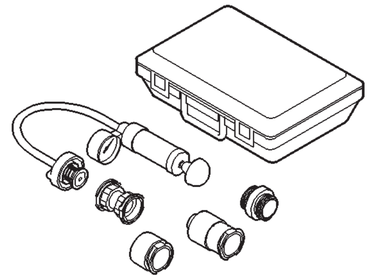
DESCRIPTION	TORQUE
Automatic Belt Tensioner to Mounting Bracket (4.0L)	
Bolts	67 N·m (50 ft. lbs.)
Automatic Belt Tensioner to Block (4.7L)	
Bolts	41 N·m (30 ft. lbs.)
Automatic Belt Tensioner Pulley (4.7L)	
Bolt	61 N·m (45 ft. lbs.)
Belt Tensioner Bracket to Block (4.0L)	
Bolts	47 N·m (35 ft. lbs.)
Belt Idler Pulley (4.0L)	
Fixed Pulley Bolt	47 N·m (35 ft. lbs.)
Belt Tensioner Pulley (4.0L)	
Bolt	47 N·m (35 ft. lbs.)
Block Heater (4.0L)	
Bolt	4 N·m (32 in. lbs.)
Block Heater (4.7L)	
Bolt	2 N·m (17 in. lbs.)
Fan Blade Assy. to Viscous Drive (4.0L)	
Bolts	23 N·m (200 in. lbs.)
Generator Mounting (4.0L)	
Bolts	57 N·m (42 ft. lbs.)
Radiator Upper Isolator to Crossmember	
Nuts	3 N·m (20 in. lbs.)
Radiator Upper Isolator to Radiator	
Nuts	4 N·m (36 in. lbs.)
Radiator Brace	
Bolts	10 N·m (90 in. lbs.)
Thermostat Housing	
Bolts	22 N·m (16 ft. lbs.)
Transmission Auxiliary Oil Cooler	
Bolts	10 N·m (90 in. lbs.)
Upper Radiator Crossmember to Body	
Bolts	10 N·m (90 in. lbs.)
Water Pump (4.0L)	
Bolts	23 N·m (17 ft. lbs.)
Water Pump (4.7L)	
Bolts	40 N·m (30 ft. lbs.)

SPECIAL TOOLS

COOLING



Pliers 6094



Pressure Tester 7700–A

COOLING SYSTEM

CONTENTS

GENERAL INFORMATION

COOLING SYSTEM

The cooling system regulates engine operating temperature. It allows the engine to reach normal operating temperature as quickly as possible, maintains normal operating temperature and prevents overheating.

The cooling system also provides a means of heating the passenger compartment. The cooling system is pressurized and uses a centrifugal water pump to circulate coolant throughout the system. A water manifold collects coolant from the cylinder heads. A separate and remotely mounted, pressurized coolant tank using a pressure/vent cap is used.

COOLING SYSTEM COMPONENTS

The cooling system consists of:

- Charge Air Cooler
- Electric Cooling Fan
- A brass-core radiator with plastic side tanks
- A radiator mounted fill vent valve
- A separate pressurized coolant tank
- A threaded-on, pressure/vent cap mounted to the coolant tank
- Cooling fan (mechanical)
- Thermal viscous fan drive
- Fan shroud
- Thermostat
- Coolant
- Low coolant level sensor
- Low coolant warning lamp
- Coolant temperature gauge
- Water pump
- Hoses and hose clamps

GENERAL INFORMATION (Continued)

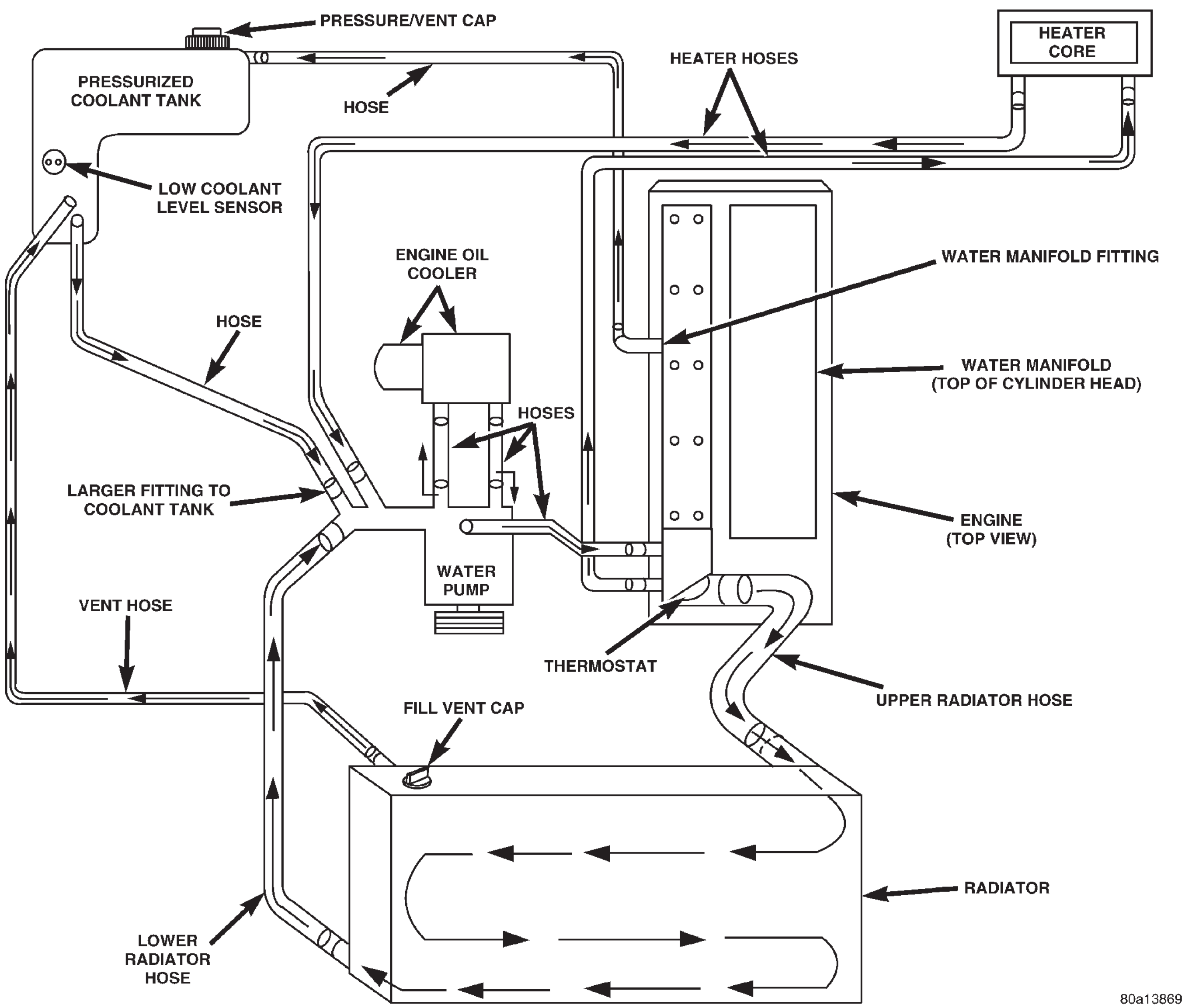


Fig. 1 Coolant Flow—3.1L Diesel Engine—Typical

COOLANT ROUTING

For cooling system flow routing, refer to (Fig. 1).

RADIATOR

The radiator used with the 3.1L diesel is constructed of a horizontal down-flow brass core with plastic side tanks.

CAUTION: Plastic tanks, while stronger than brass, are subject to damage by impact, such as wrenches.

ENGINE ACCESSORY DRIVE BELT

The accessory drive components are operated by a single, crankshaft driven, serpentine drive belt. An automatic belt tensioner is used to maintain correct belt tension at all times.

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.

COOLANT TANK

A pressurized, plastic coolant tank is used with the cooling system. This separate tank should be considered part of the radiator. The tank is located at the right-rear side of the engine compartment and is mounted as the highest point of the cooling system. This will allow any air or vapor exceeding the pressure/vent cap rating to escape through the cap. Coolant will flow through the tank at all times during engine operation whether the engine is cold or at

GENERAL INFORMATION (Continued)

normal operating temperature. The coolant tank is equipped with a threaded pressure/vent cap. Refer to Pressure/Vent Cap for additional information.

The low coolant level sensor is located on the bottom of the tank.

WATER PUMP

A centrifugal water pump circulates coolant through the water jackets, passages, water manifold, radiator core, pressurized coolant tank, cooling system hoses and heater core. The pump is driven from the engine crankshaft by a drive belt. The water pump is bolted to the water pump adapter (Fig. 2). The water pump adapter is bolted to the engine.

The water pump impeller is pressed onto the rear of a shaft that rotates in bearings pressed into the housing. The bottom of the housing is equipped with a small vent tube (Fig. 2) to allow seepage to escape. A drain hose is attached to this tube. The water pump seals are lubricated by the antifreeze in the coolant mixture. No additional lubrication is necessary.

A rubber o-ring (instead of a gasket) is used as a seal between the water pump and the water pump adapter (Fig. 2).

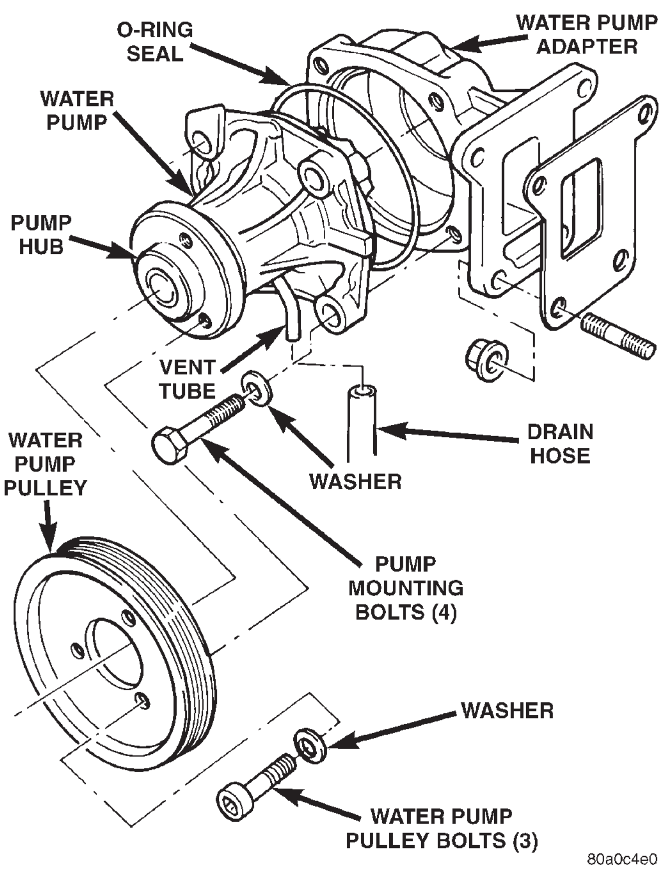


Fig. 2 Water Pump— Typical

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.

COOLANT

Coolant flows through the engine water jackets and water manifold absorbing heat produced during engine operation. The coolant carries heat to the radiator and heater core. Here it is transferred to the ambient air passing through the radiator and heater core fins.

LOW COOLANT LEVEL SENSOR

The low coolant level sensor checks for low coolant level in the coolant tank. A signal will be sent from this sensor to the powertrain control module (PCM). When the PCM determines low coolant level, the instrument panel mounted low coolant level warning lamp will be illuminated. The sensor is located on the front side of the coolant tank (Fig. 3). For information, refer to Group 8E, Instrument Panel and Gauges.

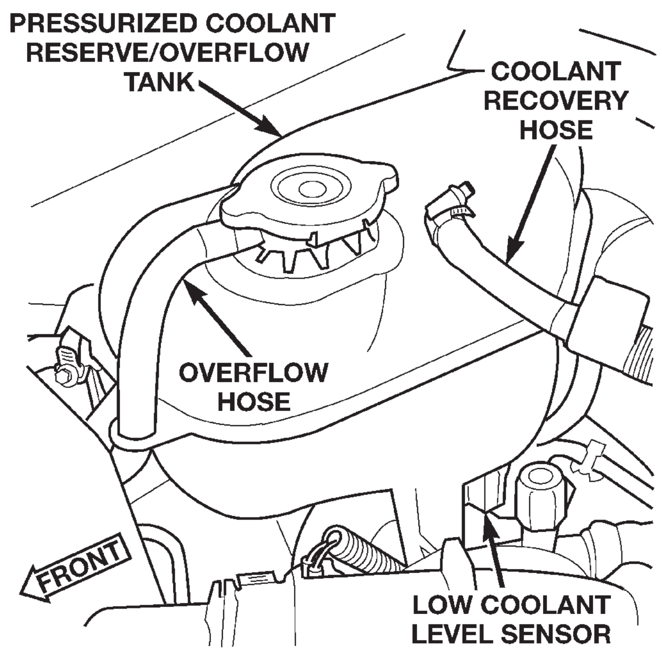


Fig. 3 Low Coolant Level Sensor

If this lamp is illuminated, it indicates the need for service.

DESCRIPTION AND OPERATION

THERMOSTAT

A pellet-type thermostat controls the operating temperature of the engine by controlling the amount of coolant flow to the radiator. The thermostat starts to open at 80°C (176°F). Above this temperature, coolant is allowed to flow to the radiator. This provides quick engine warmup and overall temperature control.

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.

RADIATOR PRESSURE CAP

All radiators are equipped with a pressure cap. This cap releases pressure at some point within a range of 124-to-145 kPa (18-to-21 psi). The pressure relief point (in pounds) is engraved on top of the cap (Fig. 4).

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. 4) contains a spring-loaded pressure relief valve. This valve opens when system pressure reaches the release range of 124-to-145 kPa (18-to-21 psi).

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.

COOLANT PERFORMANCE

ETHYLENE-GLYCOL MIXTURES

The required ethylene-glycol (antifreeze) and water mixture depends upon the climate and vehicle operating conditions. The recommended mixture of 50/50

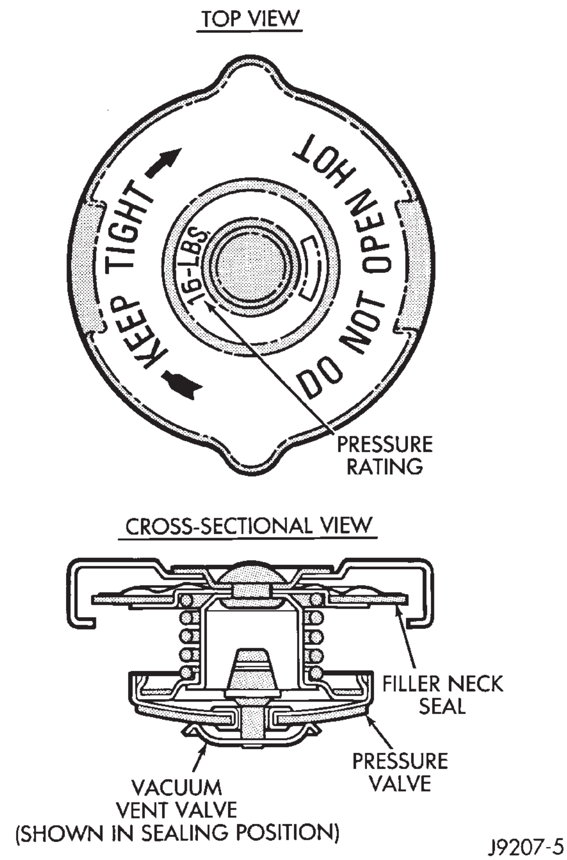


Fig. 4 Radiator Pressure Cap—Typical

ethylene-glycol and water will provide 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 than 44 percent, engine parts may be eroded by cavitation, and cooling system components may be severely damaged by corrosion.** 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 the specific heat of antifreeze is lower than that of water.

100 Percent Ethylene-Glycol—Should Not Be Used in Chrysler Vehicles

Use of 100 percent ethylene-glycol will cause formation of additive deposits in the system, as the corrosion inhibitive additives in ethylene-glycol require the presence of water to dissolve. The deposits act as insulation, causing temperatures 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).

DESCRIPTION AND OPERATION (Continued)

Propylene-glycol Formulations—Should Not Be Used in Chrysler Vehicles

Propylene-glycol formulations do not meet Chrysler coolant specifications. It's overall effective temperature range is smaller than that of ethylene-glycol. The freeze point of 50/50 propylene-glycol and water is -32°C (-26°F). 5°C higher than ethylene-glycol's freeze point. The boiling point (protection against summer boil-over) of propylene-glycol is 125°C (257°F) at 96.5 kPa (14 psi), compared to 128°C (263°F) for ethylene-glycol. Use of propylene-glycol can result in boil-over or freeze-up in Chrysler vehicles, which are designed for ethylene-glycol. Propylene glycol also has poorer heat transfer characteristics than ethylene glycol. This can increase cylinder head temperatures under certain conditions.

Propylene-glycol/Ethylene-glycol Mixtures—Should Not Be Used in Chrysler Vehicles

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

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

COOLING SYSTEM HOSES

Rubber hoses route coolant to and from the radiator, water manifold and heater core. Models equipped with air conditioning have a heater water control (shut-off) valve. This is located in-line with the heater core inlet and outlet hoses. It controls coolant flow to the heater core when the air conditioning system is in operation.

Radiator lower hoses are 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 (Fig. 5). ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps (Fig. 6). If replacement is necessary, use only an original equipment clamp with matching number or letter.

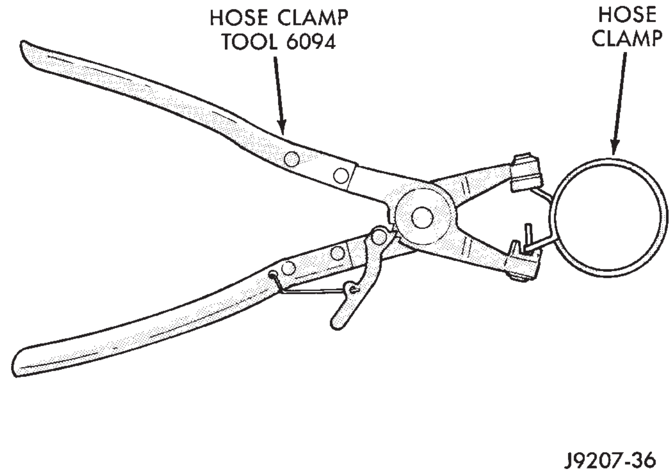


Fig. 5 Hose Clamp Tool

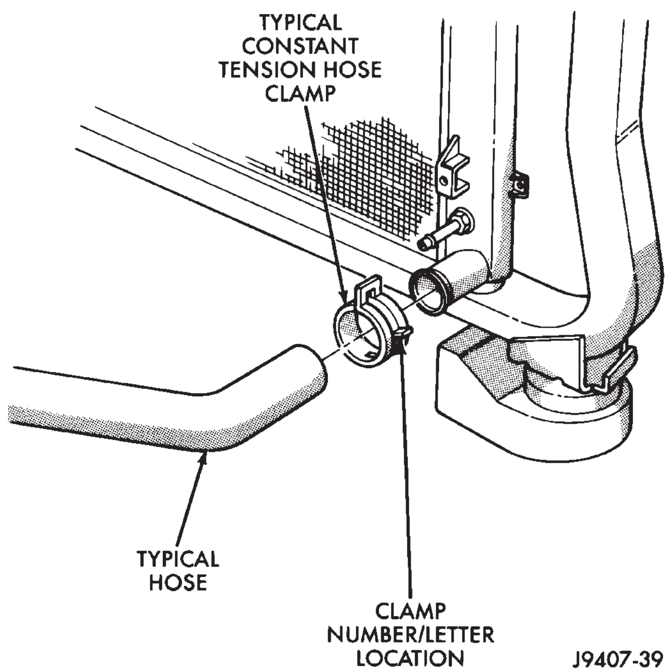


Fig. 6 Clamp Number/Letter Location

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.

DESCRIPTION AND OPERATION (Continued)

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 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.

VISCOUS FAN DRIVE

The thermal viscous fan drive (Fig. 7) is a silicone-fluid-filled coupling. It connects the fan blade assembly to the fan pulley. 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 bimetallic spring coil is located on the front face. 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.

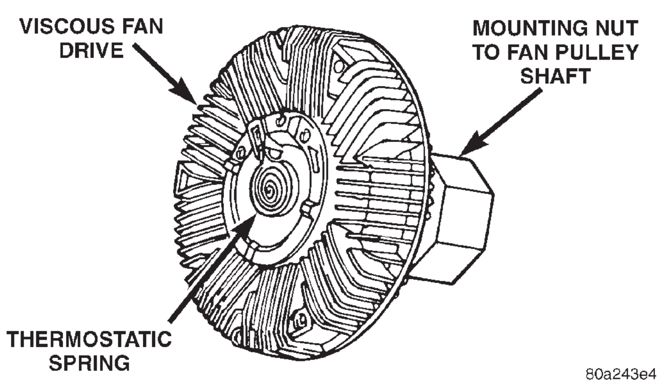


Fig. 7 Viscous Fan Drive

The viscous fan drive will only engage when sufficient heat is present. This is when the air flowing through the radiator core causes a reaction from 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: Some 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.

NOISE

NOTE: 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.

BELT TENSION

Correct accessory drive belt tension is required to be sure of optimum performance of belt driven engine accessories. If specified tension is not maintained, belt slippage may cause; engine overheating, lack of power steering assist, loss of air conditioning capacity, reduced generator output rate and greatly reduced belt life.

An automatic belt tensioner is used to maintain correct belt tension at all times. Do not attempt to check belt tension with a belt tension gauge on vehicles equipped with an automatic belt tensioner. Refer to Automatic Belt Tensioner in this group.

AUTOMATIC BELT TENSIONER

Drive belt tension is controlled by a spring loaded automatic belt tensioner located below and to the front of the engine oil filter (Fig. 8).

WARNING: BECAUSE OF HIGH SPRING PRESSURE, DO NOT ATTEMPT TO DISASSEMBLE THE AUTOMATIC BELT TENSIONER. UNIT IS SERVICED AS AN ASSEMBLY.

DESCRIPTION AND OPERATION (Continued)

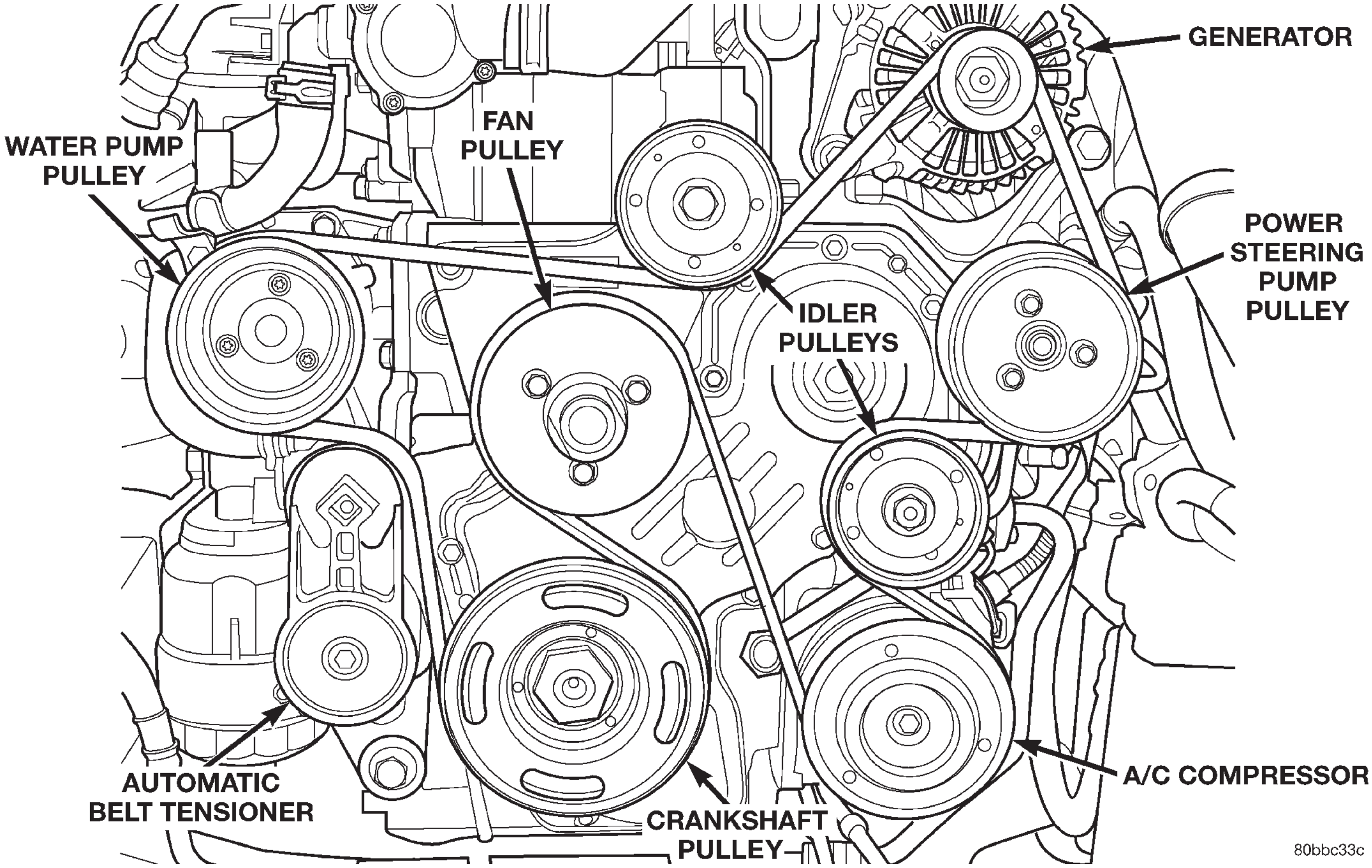


Fig. 8 Automatic Belt Tensioner Assembly

DIAGNOSIS AND TESTING

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) 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
- Brakes (possibly dragging)
- Changed parts (incorrect water pump)
- Reconditioned radiator or cooling system refilling (possibly under filled or air trapped in system).

NOTE: 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.

DIAGNOSIS AND TESTING (Continued)

COOLING SYSTEM DIAGNOSIS–DIESEL ENGINE

CONDITION	POSSIBLE CAUSES	CORRECTION
TEMPERATURE GAUGE READS LOW	1. Diesel engines, due to their inherent efficiency are slower to warm up than gasoline powered engines, and will operate at lower temperatures when the vehicle is unloaded. 2. Is the temperature gauge connected to the temperature gauge coolant sensor on the engine? 3. Is the temperature gauge operating OK? 4. Coolant level low in cold ambient temperatures accompanied with poor heater performance. 5. Improper operation of internal heater doors or heater controls.	1. The low gauge reading may be normal. Refer to thermostats in the manual text for information. See Thermostat Diagnosis - Diesel Engine. 2. Check, the engine temperature sensor connector in the engine compartment. Refer to Group 8E. Repair as necessary. 3. Check gauge operation. Refer to Group 8E. Repair as necessary. 4. Check coolant level in the coolant tank. Inspect system for leaks. Repair leaks as necessary. Refer to the Coolant section of the manual text for WARNINGS and precautions before removing the pressure cap. 5. Inspect heater and repair as necessary. Refer to Group 24, Heating and Air Conditioning for procedures.
TEMPERATURE GAUGE READS HIGH. 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. 2. Is temperature gauge reading correctly? 3. Coolant low in coolant tank and radiator? 4. Pressure cap not installed tightly. If cap is loose, boiling point of coolant will be lowered. Also refer to the following step 5. 5. Poor seals at pressure/vent cap. 6. Freeze point of antifreeze not correct. Mixture may be too rich.	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 16). 2. Check gauge. Refer to Group 8E. Repair as necessary. 3. Check for coolant leaks and repair as necessary. Refer to Testing Cooling System For Leaks in this group. 4. Tighten cap. 5. (a) Check condition of cap and cap seals. Refer to Pressure/Vent Cap. Replace cap if necessary. (b) Check condition of coolant tank filler neck. Make sure it does not leak pressure. 6. Check antifreeze. Refer to Coolant section of this group. Adjust antifreeze-to-water ratio as required.

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DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
TEMPERATURE GAUGE READS HIGH. COOLANT MAY OR MAY NOT BE LOST OR LEAKING FROM COOLING SYSTEM - CONT.	7. Coolant not flowing through system.	7. Check for coolant flow in coolant tank with engine warm and thermostat open. Coolant should be observed flowing through tank. If flow is not observed, determine reason for lack of flow and repair as necessary.
	8. Radiator or A/C condenser fins are dirty or clogged.	8. Clean insects or debris. Refer to Radiator Cleaning in this group.
	9. Radiator core is corroded or plugged.	9. Have radiator re-cored or replaced.
	10. Aftermarket A/C installed without proper A/C condenser.	10. Install proper A/C condenser.
	11. Dragging brakes.	11. Check and correct as necessary. Refer to Group 5, Brakes in the manual text.
	12. Non-factory bug screen is being used reducing airflow.	12. Only a factory approved screen may be used.
	13. Thermostat partially or completely shut. This is more prevalent on high mileage vehicles.	13. Check thermostat operation and replace as necessary. Refer to Thermostats in this group.
	14. Thermal viscous fan drive not operating properly.	14. Check fan drive operation and replace if necessary. Refer to Viscous Fan Drive in this group.
	15. Cylinder head gasket leaking.	15. Check for cylinder head gasket leaks. Refer to Testing Cooling System For Leaks in this group. For repair, refer to Group 9, Engines.
	16. Heater core leaking.	16. Check heater core for leaks. Refer to Group 24, Heating and Air Conditioning. Repair as necessary.
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. Fluctuation is also influenced by loads, outside temperature and extended idle time with diesel engines.	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 coolant tank (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.

J9507-71

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
TEMPERATURE GAUGE READING IS INCONSISTENT (FLUCTUATES, CYCLES OR IS ERRATIC), CONT'D.	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. TEMPERATURE GAUGE READING MAY BE ABOVE NORMAL BUT NOT HIGH. COOLANT LEVEL MAY BE HIGH IN COOLANT TANK	1. Pressure relief valve in pressure/vent cap is defective. 2. Major head gasket leak or cracked cylinder head.	1. Check condition of pressure/vent cap and cap seals. Refer to Pressure/Vent Caps in this group. Replace cap as necessary. 2. Refer to Engine group and repair 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.
HOSE OR HOSES COLLAPSE WHEN ENGINE IS COOLING	1. Vacuum created in cooling system on engine cool-down is not being relieved through pressure/vent cap.	1. Cap relief valve stuck. Refer to Pressure/Vent Cap in this group. Replace if necessary.
NOISY FAN	1. Fan blades loose.	1. Replace fan blade assembly. Refer to Cooling System Fans in this group.
	2. Fan blades striking a surrounding object.	2. Locate point of fan blade contact and repair as necessary.
	3. Air obstructions at radiator or air conditioning condenser.	3. Remove obstructions and/or clean debris or insects from radiator or A/C condenser.
	4. Thermal viscous fan drive has defective bearing.	4. Replace fan drive. Bearing is not serviceable. Refer to Viscous Fan Drive in this group.
	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.	5. Refer to Viscous Fan Drive in this group for an explanation of normal fan noise.

J9507-72

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
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. The cooling system is 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.
INADEQUATE HEATER PERFORMANCE. MAY BE ACCOMPANIED BY LOW GAUGE READING	1. Diesel engines, due to their inherent efficiency are slower to warm up than gasoline powered engines, and will operate at lower temperatures when the vehicle is unloaded. 2. Coolant level low. 3. Obstructions in heater hose fittings at engine. 4. Heater hose kinked. 5. 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.	1. The low gauge reading may be normal. Refer to Thermostats in the manual text for information. See Thermostat Diagnosis - Diesel Engine. 2. Refer to Testing Cooling System For Leaks in the manual text. Repair as necessary. 3. Remove heater hoses at both ends and check for obstructions. Repair as necessary. 4. Located kinked area and repair as necessary. 5. 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.

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DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
HEAT ODOR	1. Various heat shields are used at certain drive line components. One or more of these shields may be missing. 2. Is temperature gauge reading above the normal range? 3. Is cooling fan operating correctly? 4. Has undercoating been applied to any unnecessary component?	1. Locate missing shields and replace or repair as necessary. 2. Refer to the previous Temperature Gauge Reads High in these Diagnosis Charts. Repair as necessary. 3. Refer to Cooling System Fan in this group for diagnosis. Repair as necessary. 4. Clean undercoating as necessary.
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 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 HOT and COLD 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.

J9507-74

DIAGNOSIS AND TESTING (Continued)

THERMOSTAT

DIAGNOSIS

Diesel engines, due to their inherent efficiency are slower to warm up than gasoline powered engines, and will operate at lower temperatures when the vehicle is unloaded. Because of this, lower temperature gauge readings for diesel versus gasoline engines may, at times be normal.

TESTING

NOTE: The DRB scan tool cannot be used to monitor engine coolant temperature on the diesel engine.

(1) To determine if the thermostat is defective, it must be removed from the vehicle. Refer to Thermostats for removal and installation procedures.

(2) After the thermostat has been removed, examine the thermostat and inside of thermostat housing for contaminants. If contaminants are found, the thermostat may already be in a “stuck open” position. Flush the cooling system before replacing thermostat. Refer to Cooling System Cleaning/Reverse Flushing in this group for additional information.

(3) Place the thermostat into a container filled with water.

(4) Place the container on a hot plate or other suitable heating device.

(5) Place a commercially available radiator thermometer into the water.

(6) Apply heat to the water while observing the thermostat and thermometer.

(7) When the water temperature reaches 80°C (176°F) the thermostat should start to open (valve will start to move). If the valve starts to move before this temperature is reached, it is opening too early. Replace thermostat. The thermostat should be fully open (valve will stop moving) at approximately 89°C (192°F). If the valve is still moving after the water temperature reaches this temperature, it is opening too late. Replace thermostat.

(8) If the valve refuses to move at any time, replace thermostat.

VISCOUS FAN DRIVE

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.

The cooling system must be in good condition. This is checked prior to performing the following test. It also will ensure against excessively high coolant temperature.

WARNING: BE SURE OF ADEQUATE FAN BLADE CLEARANCE BEFORE DRILLING.

(1) Drill a 3.12-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) 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.

(4) 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.

(5) Start the engine and operate at 2400 rpm. Within ten minutes the air temperature (indicated on the dial thermometer) should be up to 93°C (200°F). Fan drive **engagement** should have started to occur at between 82° to 91°C (180° to 195°F). Engagement is distinguishable by a definite **increase** in fan flow noise (roaring).

(6) When the air temperature reaches 93°C (200°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.

DIAGNOSIS AND TESTING (Continued)

RADIATOR COOLANT FLOW CHECK

There is coolant flow through the coolant tank (bottle) before and after the thermostat opens.

CAUTION: Do not remove the vent valve to insert a temperature gauge thought the opening, coolant will spill out of the system and the engine will not be filled with coolant up to the heads. Major damage could happen if you run the engine in this condition.

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 parts 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 radiator pressure tester to determine if any external leaks exist (Fig. 9).

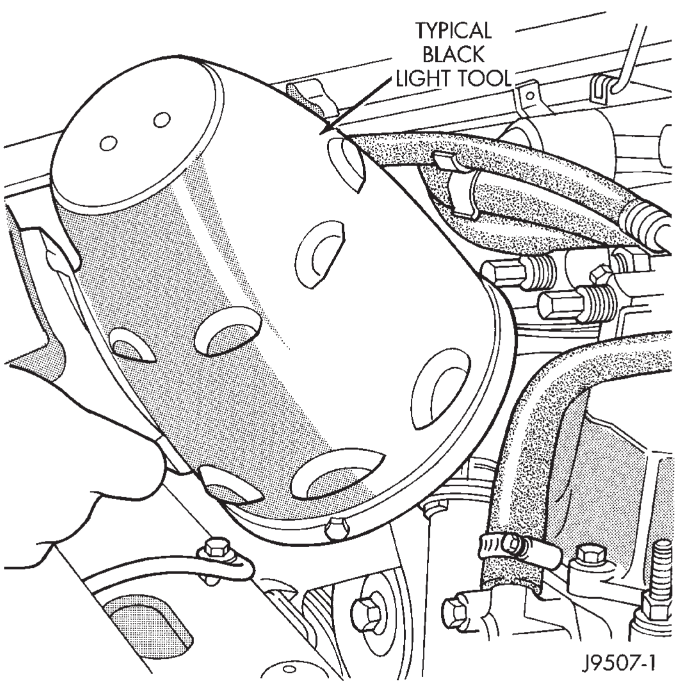

Fig. 9 Leak Detection Using Black Light—Typical

PRESSURE TESTER METHOD

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE SERIOUS INJURY BY SCALDING. NEVER REMOVE THE PRESSURE/VENT CAP OR PRESSURE TESTER WHEN THE COOLING SYSTEM IS HOT OR UNDER PRESSURE!

Allow the engine to cool sufficiently so that the system is not under pressure and carefully remove the pressure/vent cap from the filler neck. Warm the engine with the pressure/vent cap off to normal operating temperature. With the engine turned off attach the cooling system pressure tester and test the system as described below.

Recheck the system cold if the cause of coolant loss is not located during warm engine examination.

A two-piece, threaded adapter set (Fig. 10) must be used to adapt a standard pressure-type tester (Fig. 11) when testing either the coolant tank or pressure cap. Use Kent-Moore® adapter set number J-24460-92 or Snap-On® numbers TA-32 and TA-33. Attach one of the adapters to the coolant pressure tank neck. Adapter must first be threaded to tank. Attach pressure tester to adapter.

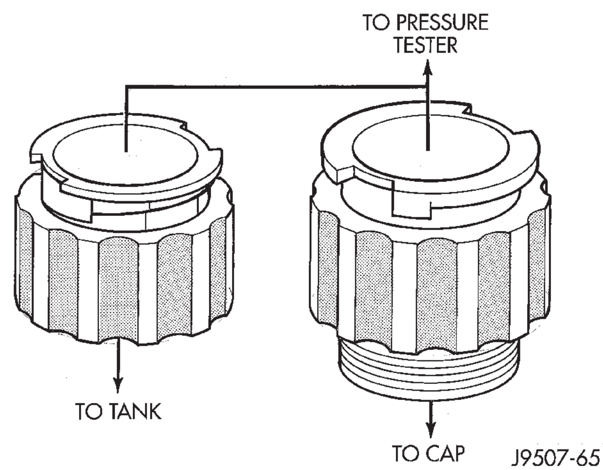

Fig. 10 Typical Pressure Tester Adapters

DIAGNOSIS AND TESTING (Continued)

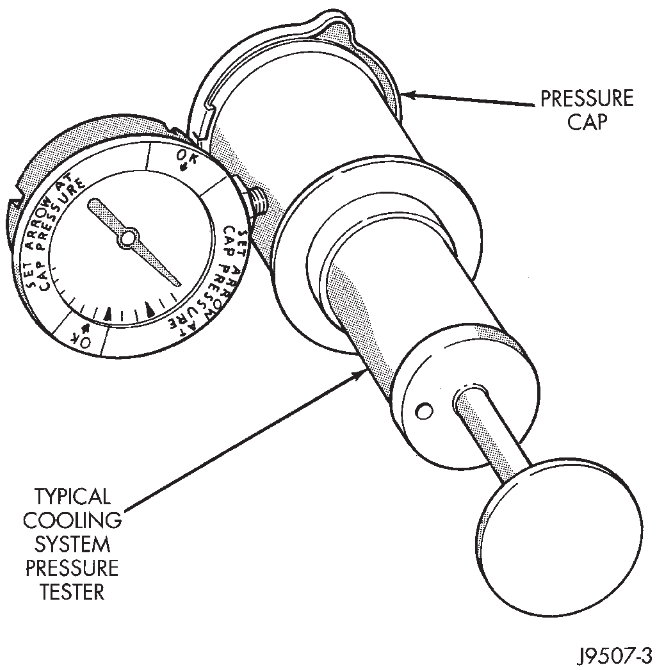

Fig. 11 Typical Cooling System Pressure Tester

Operate the tester pump to apply 103 kPa (15 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. Operate the engine without the pressure/vent cap on the coolant tank until thermostat opens.

Attach a radiator pressure tester to the tank 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 117 KPA (17 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.

PRESSURE/VENT CAP

PRESSURE TESTING

Remove the cap from the coolant tank. Be sure that sealing surfaces are clean. Moisten rubber gasket with water.

A two-piece, threaded adapter set (Fig. 10) must be used to adapt a standard pressure-type tester (Fig. 11) when testing either the coolant tank or pressure cap. Use Kent-Moore® adapter set number J-24460-92 or Snap-On® numbers TA-32 and TA-33. Attach the adapter to the cap. Adapter must first be threaded to cap. Attach pressure tester to adapter.

Operate the tester pump and observe the gauge pointer at its highest point. The cap release pressure should be 90-to-117 kPa (13-to-17 psi). The cap is satisfactory when the pressure holds steady. It is also good if it holds pressure within the 90-to-117 kPa (13-to-17 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/vent cap to confirm that cap needs replacement.

LOW COOLANT LEVEL- AERATION

CAUTION: Engine damage could occur if the coolant level is allowed to get this low. Always ensure that the coolant level is not below the add coolant mark. The baffles in the pressurized coolant tank (degasser bottle) will not allow you to see the fluid level. Check the coolant level through the pressurized coolant tank. For better visibility of the coolant level use a shop lamp to light the pressurized coolant tank and look through the pressurized coolant tank.

If the coolant level in the radiator drops below the top of radiator core tubes, air will enter the cooling system.

Low coolant level can cause the thermostat pellet to be suspended in air instead of coolant. This will cause the thermostat to open later, which in turn causes higher coolant temperature. Air trapped in the cooling system also reduces the amount of coolant circulating in the heater core resulting in low heat output.

BELT DIAGNOSIS

When diagnosing serpentine accessory drive belts, small cracks that run across the ribbed surface of the belt from rib to rib (Fig. 12), 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. 12). Also replace the belt if it has excessive wear, frayed cords or severe glazing.

Refer to the Serpentine Drive Belt Diagnosis chart for further belt diagnosis.

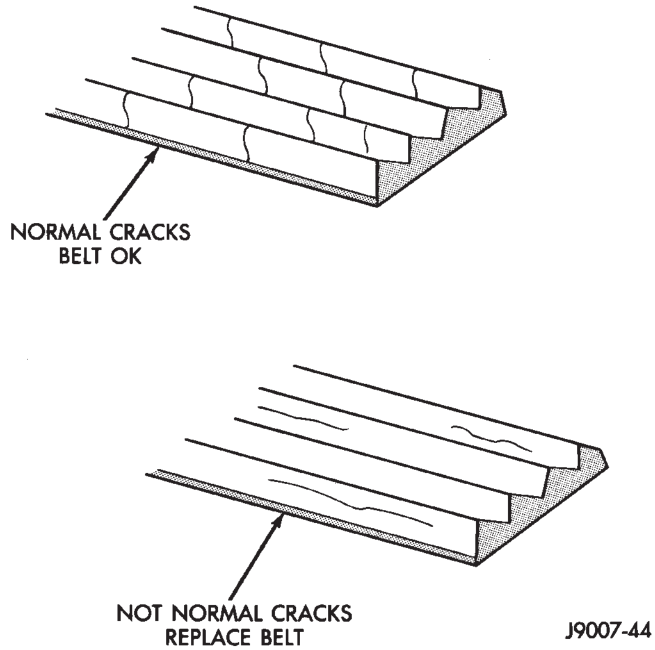

Fig. 12 Serpentine Belt Wear Patterns

DIAGNOSIS AND TESTING (Continued)

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.

J9507-27

SERPENTINE DRIVE BELT DIAGNOSIS

SERVICE PROCEDURES

COOLANT LEVEL CHECK

The coolant level is checked and adjusted at the pressurized coolant tank (Fig. 13). The tank is located at the right-rear side of the engine compartment and is mounted as the highest point of the cooling system. This will allow any air or vapor exceeding the pressure/vent cap rating to escape through the cap. The coolant tank is equipped with a threaded-on pressure/vent cap. Refer to Pressure/ Vent Cap for additional information.

A coolant reserve/overflow system with a separate tank is not used with the 3.1L diesel engine.

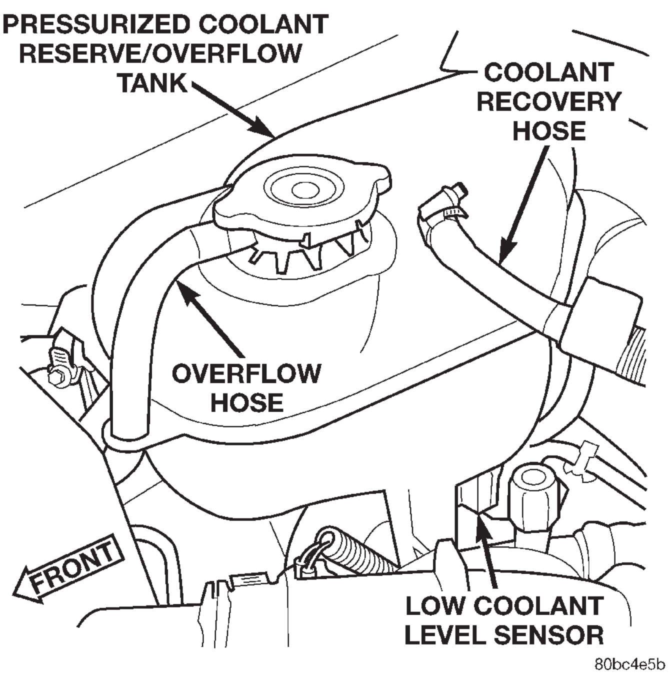

Fig. 13 Coolant Reservoir

CAUTION: Do not mix different types of engine coolant. Ethylene-Glycol, which is green in color is the only recommended engine coolant to be used in Chrysler vehicles.

(1) Add coolant into the coolant tank up to the COLD mark. **If possible, only add coolant when the engine is cold. Coolant level in a warm engine will be higher in the tank due to thermal expansion.**

(2) After the engine has been operated through a few heat-up and cool-down cycles, recheck the coolant level in the tank.

DRAINING COOLING SYSTEM

The cooling system is equipped with a pressurized coolant tank using a pressure/vent cap.

WARNING: DO NOT REMOVE THE CYLINDER BLOCK DRAIN-PLUG, THE COOLANT TANK CAP, THE RADIATOR FILL VENT VALVE, OR LOOSEN THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND PRESSURIZED. SERIOUS BURNS FROM THE COOLANT CAN OCCUR.

WARNING: IF VEHICLE HAS BEEN RUN RECENTLY, WAIT AT LEAST 15 MINUTES BEFORE REMOVING COOLANT TANK CAP. WITH A RAG, SQUEEZE THE UPPER RADIATOR HOSE TO CHECK IF SYSTEM IS UNDER PRESSURE. PLACE A RAG OVER THE CAP. VERY SLOWLY ROTATE THE CAP COUNTER-CLOCKWISE ALLOWING PRESSURE TO SLOWLY RELEASE. AFTER ALL PRESSURE HAS BEEN RELEASED, REMOVE THE COOLANT TANK CAP COMPLETELY.

DO NOT WASTE reusable coolant. If the solution is clean, drain the coolant into a clean container for reuse.

(1) Observe the previous **WARNINGS** and remove the coolant tank pressure/vent cap.

(2) The plastic radiator draincock is located on the bottom of the left radiator tank. It can be accessed from the bottom of vehicle.

(a) Attach one end of a 24 inch long X 1/4 inch ID drain-hose to the nipple below the radiator draincock.

(b) Put the other end of drain-hose into a clean container.

(c) Open the draincock (counterclockwise as viewed from left side of vehicle) and drain coolant from radiator.

(3) If the complete cooling system must be drained, raise the vehicle and remove the lower radiator hose. Refer to Flushing Cooling System in this group for more information.

REFILLING COOLING SYSTEM

The cooling system is equipped with a pressurized coolant tank using a pressure/vent cap. Refilling of the system is done through this tank.

NOTE: The radiator draincock is equipped with a rubber o-ring. Do not over tighten draincock.

(1) Tighten the radiator draincock and (if removed), the cylinder block drain-plug.

(2) Loosen the plastic radiator fill vent valve (unscrews counter- clockwise) from the radiator. The fill vent valve is located on the top of the right radiator tank.

SERVICE PROCEDURES (Continued)

CAUTION: Do not mix different types of engine coolant. Ethylene-Glycol, which is green in color is the only recommended engine coolant to be used in Chrysler vehicles.

(3) With the fill vent valve removed, proceed to fill the system using a 50/50 mixture of water and anti-freeze (Ethylene-Glycol) as described in the Coolant section of this group.

(4) Continue to fill the cooling system until coolant is observed escaping from the fill vent opening. When this occurs, install the fill vent valve. **The plastic fill vent valve is equipped with a rubber o-ring. Do not over tighten the fill vent valve.**

(5) Continue to fill the system until the coolant tank is full.

(6) Install and tighten the coolant tank pressure/ vent cap. **Do not use any type of tool when tightening the cap. Hand tighten only.**

(7) With the heater control unit in the HEAT position, operate engine with coolant tank cap tightened.

(8) After engine has reached normal operating temperature, shut engine off and allow it to cool.

(9) Remove coolant tank cap.

(10) Add coolant into the coolant tank up to the COLD mark. **If possible, only add coolant when the engine is cold. Coolant level in a warm engine will be higher in the tank due to thermal expansion.**

(11) After the engine has been operated through a few heat-up and cool-down cycles, recheck the coolant level in the tank.

COOLANT REPLACEMENT

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.

REMOVAL AND INSTALLATION

COOLING MODULE ASSEMBLY

The cooling module assembly includes the radiator, charge air cooler (intercooler) and the A/C condenser. To replace any one of these components, the entire assembly must be removed from the vehicle and then disassembled.

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 (Fig. 14). ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps (Fig. 15). If replacement is necessary, use only an original equipment clamp with matching number or letter.

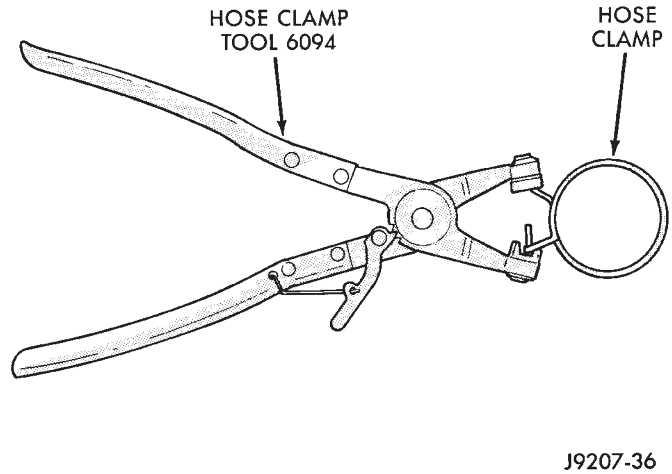

Fig. 14 Hose Clamp Tool

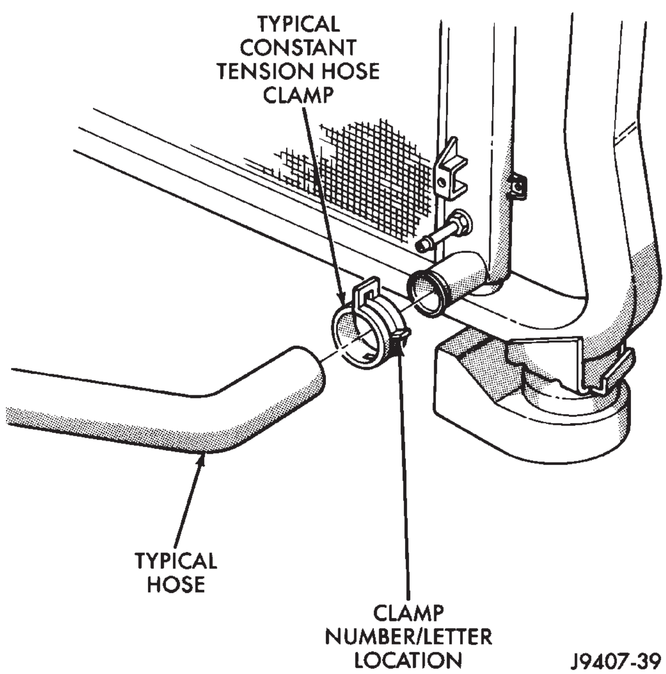

Fig. 15 Clamp Number/Letter Location

REMOVAL

WARNING: DO NOT REMOVE THE CYLINDER BLOCK DRAIN-PLUG, THE COOLANT TANK CAP, THE RADIATOR FILL VENT VALVE, OR LOOSEN THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND PRESSURIZED. SERIOUS BURNS FROM THE COOLANT CAN OCCUR.

REMOVAL AND INSTALLATION (Continued)

CAUTION: Before removing the cooling module assembly, note the location of each of the air seals. These seals are used to direct air through the condenser, radiator and charge air cooler. The air seals must be reinstalled in their proper locations in order for the air conditioning and engine cooling systems to perform as designed.

(1) Disconnect the negative battery cable.
(2) Raise the vehicle on the hoist.
(3) Remove the lower front splash shield.
(4) Drain the cooling system. Refer to Group 7, Cooling System for the procedure.
(5) Remove the lower radiator hose from the radiator (Fig. 16).

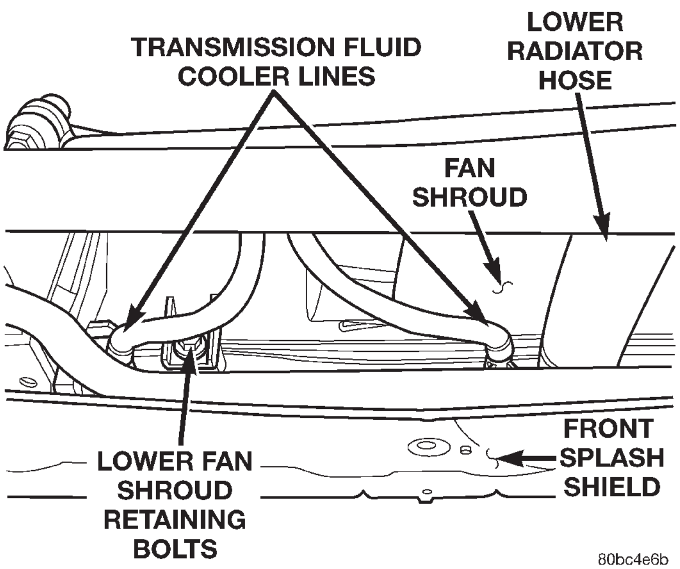

Fig. 16 Transmission Fluid Cooler Lines At Radiator

(6) Remove the (2) lower fan shroud retaining bolts (Fig. 16).
(7) Remove the transmission fluid cooler lines from the radiator (Fig. 16).
(8) Lower the vehicle from the hoist.
(9) Remove the intercooler inlet and outlet hoses from the intercooler (Fig. 17).
(10) Remove the right and left headlamp assemblies from the vehicle. Refer to Group 8L, Lamps for the procedure.
(11) Remove the front fascia. Refer to Group 13, Frame and Bumpers for the procedure.
(12) Disconnect the ambient temperature sensor and unclip the wire harness from the headlamp module mounting (HMM) assembly.
(13) Disconnect the right and left headlamp module wire harnesses at the 10-way connectors. Located just above the front bumper to the right and left of the A/C condenser.

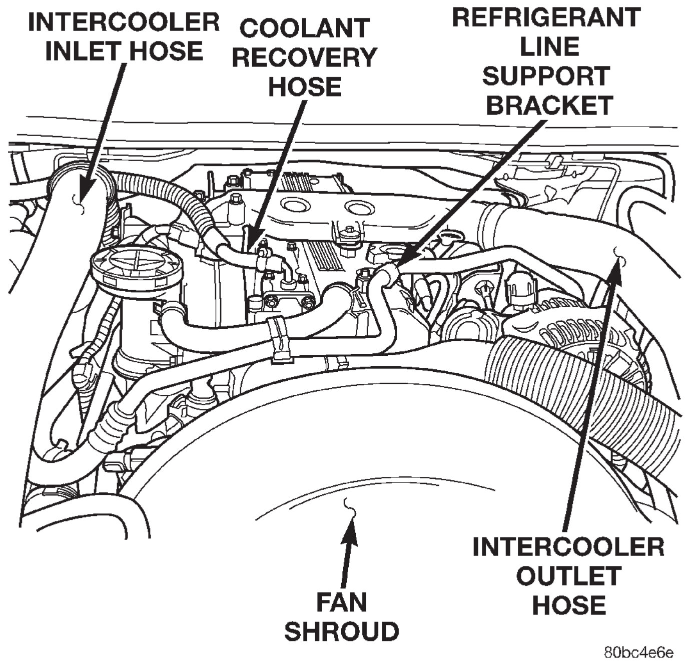

Fig. 17 Intercooler Hoses

(14) Remove the headlamp module mounting (HMM) assembly. Refer to Group 23, Body for the procedure.

NOTE: Mark the position of the hood latch in relation to its mounting bracket. This will aid in aligning the hood latch during reassembly.

(15) Remove the hood latch retaining fasteners and position it out of the way.
(16) Remove the hood latch support brackets from the vehicle.
(17) Remove the upper fan shroud retaining bolts.
(18) Remove the radiator closure pane from the vehicle. Refer to Group 23, Body for the procedure.
(19) Remove the viscous cooling fan and carefully set inside of the fan shroud.
(20) Remove the radiator overflow hose from the radiator and position out of the way.
(21) Remove the upper radiator hose from the radiator.
(22) Disconnect the electric radiator cooling fan electrical connector. Located under the intercooler outlet hose.
(23) If equipped, recover the refrigerant. Refer to Group 24, Heating and Air Conditioning for the procedure.
(24) Remove the intake air duct from the vehicle (Fig. 18).
(25) Remove the power steering cooler retaining bolts (Fig. 18) and position the cooler aside.
(26) Remove the suction and discharge lines from the A/C condenser assembly (Fig. 18).

REMOVAL AND INSTALLATION (Continued)

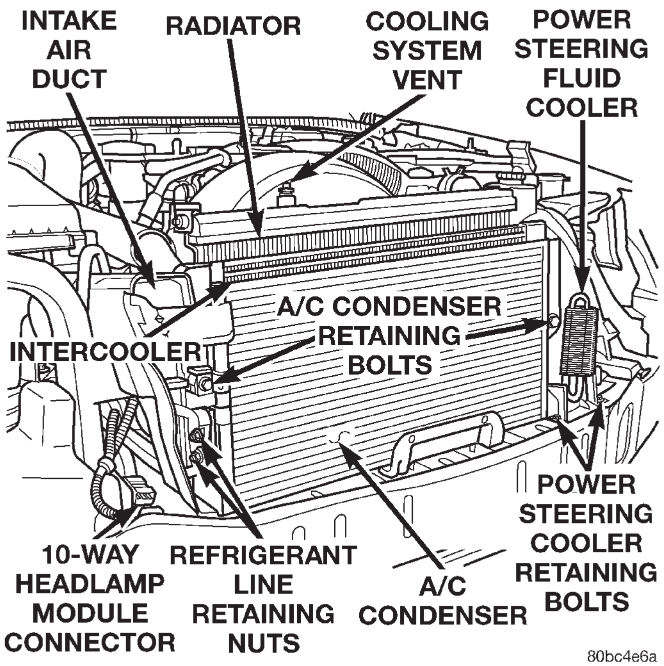

Fig. 18 Cooling Module Assembly

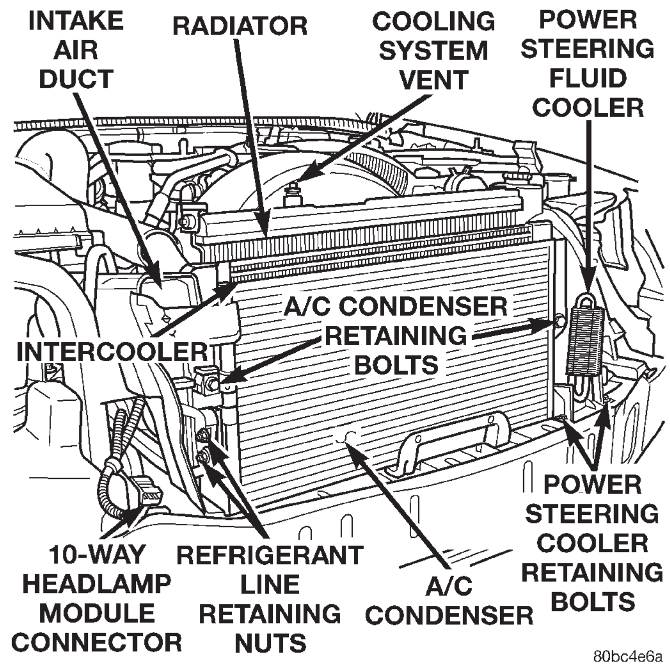

Fig. 19 Cooling Module Assembly

(27) Remove the fan shroud and both cooling fans as an assembly from the vehicle.

(28) Remove the cooling module assembly retaining bolts and remove the radiator, intercooler and A/C condenser from the vehicle.

CAUTION: Care must be taken not to damage the cooling core fins of the radiator and A/C condenser during removal, service and installation of the cooling module assembly. Reduced cooling capability will result.

(29) Place the assembly in a upright position on the bench or floor.

(30) Disassemble the cooling module by removing the retaining bolts for the component that requires replacement or inspection.

INSTALLATION

CAUTION: The bottom of the radiator is equipped with two alignment dowels that fit into holes in the lower radiator support panel. Rubber biscuits (insulators) are installed on these dowels. Be certain these biscuits are installed and in good condition prior to installing the cooling module assembly.

(1) Assemble the cooling module. Torque the retaining bolts to 30 N·m (22 ft. lbs.).

(2) Position the cooling module assembly and install the retaining bolts (Fig. 19). Torque the bolts to 41 N·m (30 ft. lbs.).

(3) Install the fan shroud, electric and viscous cooling fans as an assembly in the vehicle. Refer to Group 7, Cooling System - Cooling System Fan for the procedure.

(4) Install the suction and discharge refrigerant lines on the A/C condenser assembly (Fig. 19). Torque the retaining nuts to 28 N·m (21 ft. lbs.). Be certain the sealing gaskets are free of tears and well lubricated with R-134a Pag Oil.

(5) Position the power steering cooler and install the retaining bolts (Fig. 19).

(6) Charge the refrigerant system. Refer to Group 24, Heating and Air Conditioning for the procedure.

(7) Connect the electric radiator cooling fan electrical connector.

(8) Install the intake air duct on the vehicle (Fig. 19).

(9) Install the upper radiator hose on the radiator.

(10) Install the radiator overflow hose on the radiator.

(11) Install the intercooler inlet and outlet hoses on the intercooler (Fig. 20).

(12) Install the radiator closure panel on the vehicle. Refer to Group 23, Body for the procedure.

(13) Install the upper fan shroud retaining bolts. Torque the bolts to 15 N·m (132 in. lbs.).

(14) Install the hood latch support brackets and the hood latch on the vehicle.

(15) Install the headlamp module mounting (HMM) assembly. Refer to Group 23, Body for the procedure.

(16) Connect the right and left headlamp module wire harnesses at the 10-way connectors. Located just above the front bumper to the right and left of the a/c condenser.

REMOVAL AND INSTALLATION (Continued)

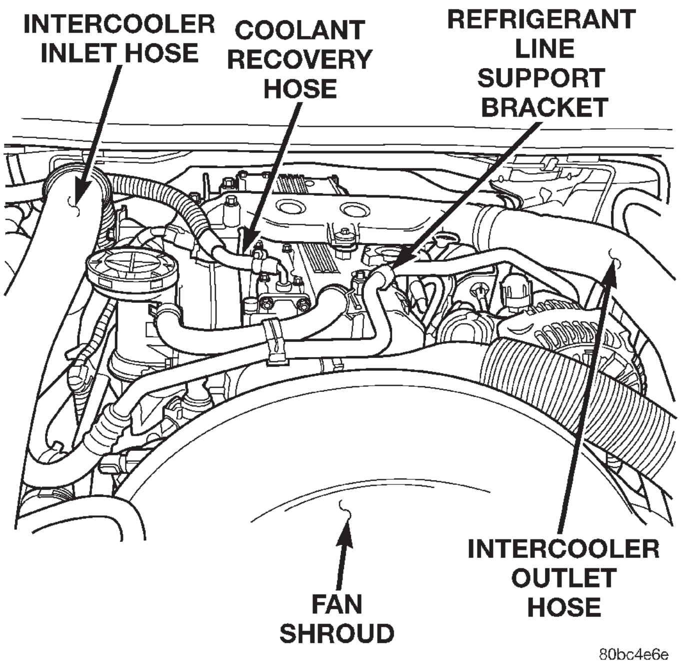

Fig. 20 Intercooler Hoses

(17) Connect the ambient temperature sensor and clip the wire harness on the headlamp module mounting assembly.

(18) Install the front fascia. Refer to Group 13, Frame and Bumpers for the procedure.

(19) Install the right and left headlamp assemblies on the vehicle. Refer to Group 8L, Lamps for the procedure.

(20) Raise the vehicle on the hoist.

(21) Install the (2) lower fan shroud retaining bolts. Torque bolts to 12 N·m (105 in. lbs.).

(22) Install the lower radiator hose on the radiator.

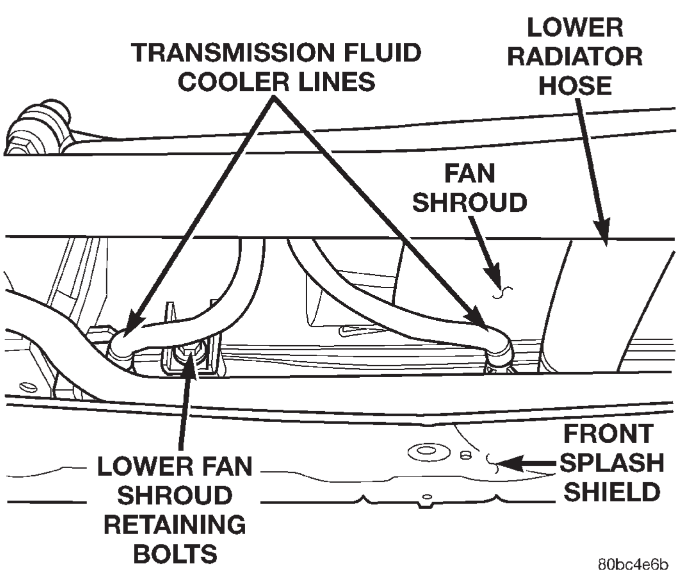

Fig. 21 Transmission Fluid Cooler Lines At Radiator

(23) Install the transmission fluid cooler lines on the radiator (Fig. 21).

(24) Install the lower front splash shield.

(25) Lower the vehicle on the hoist.

(26) Fill the cooling system. Refer to Group 7, Cooling System for the procedure.

(27) Connect the negative battery cable.

RADIATOR

The cooling module assembly includes the radiator, charge air cooler (intercooler) and the A/C condenser. To replace any one of these components, the entire assembly must be removed from the vehicle and then disassembled. Refer to the Cooling Module removal and installation procedure for replacement of the radiator.

FAN BLADE REMOVAL

FAN BLADE REMOVAL

Accessory drive belt removal is not necessary for fan blade or viscous fan drive removal.

(1) Disconnect negative battery cable from battery.

(2) The thermal viscous fan drive/fan blade assembly is attached (threaded) to the fan pulley shaft (Fig. 22). Remove fan blade/viscous fan drive assembly from fan pulley by turning mounting nut counterclockwise as viewed from front. Threads on viscous fan drive are **RIGHT HAND.** Snap-On® 36 MM Fan Wrenches (number SP346) can be used to turn the mounting nut and to hold the fan pulley from rotating.

(3) Do not attempt to remove fan/viscous fan drive assembly from vehicle at this time.

(4) Do not unbolt fan blade assembly from viscous fan drive at this time.

(5) Remove the fan shroud mounting bolts.

(6) Remove the fan shroud and fan blade/viscous fan drive assembly as a complete unit from vehicle.

(7) 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 attempt to remove the fan pulley bolts. The fan pulley is under tension from the drive belt.

(8) Remove four bolts securing fan blade assembly to viscous fan drive (Fig. 22).

FAN BLADE INSTALLATION

(1) Install fan blade assembly to viscous fan drive. Tighten bolts (Fig. 22) to 23 N·m (200 in. lbs.) torque.

(2) Position fan shroud and fan blade/viscous fan drive assembly to vehicle as a complete unit.

REMOVAL AND INSTALLATION (Continued)

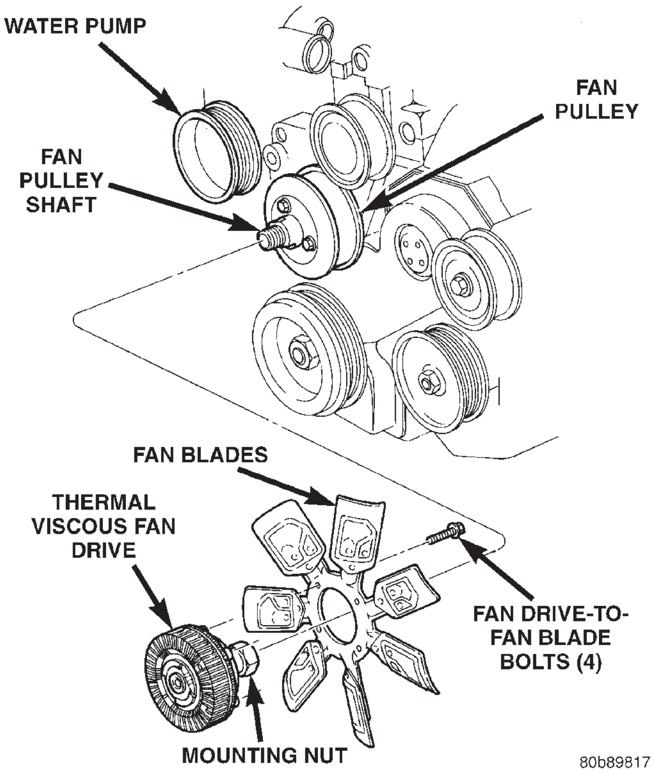

Fig. 22 Thermal Viscous Fan Drive and Blade Assembly

(3) Install and tighten fan shroud bolts to 3 N·m (31 in. lbs.) torque.

(4) Install fan blade/viscous fan drive assembly to fan pulley shaft (Fig. 22).

(5) Connect the negative battery cable.

VISCOUS FAN DRIVE

Refer to the FAN BLADE removal and installation procedure for replacement of the viscous fan drive.

The thermal viscous fan drive (Fig. 23) is a silicone-fluid-filled coupling. It connects the fan blade assembly to the fan pulley. 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 bimetallic spring coil is located on the front face. 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.

The viscous fan drive will only engage when sufficient heat is present. This is when the air flowing through the radiator core causes a reaction from the bimetallic coil. It then increases fan speed to provide the necessary additional engine cooling.

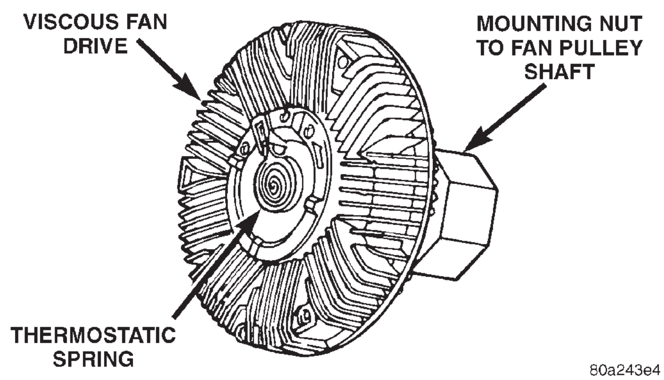

Fig. 23 Viscous Fan Drive

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.

NOISE

NOTE: 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.

THERMOSTAT

REMOVAL

WARNING: DO NOT REMOVE THE CYLINDER BLOCK DRAIN-PLUG, THE COOLANT TANK CAP, THE RADIATOR FILL VENT VALVE, OR LOOSEN THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND PRESSURIZED. SERIOUS BURNS FROM THE COOLANT CAN OCCUR.

REMOVAL AND INSTALLATION (Continued)

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. Refer to Draining Cooling System for the procedure.

WARNING: CONSTANT TENSION HOSE CLAMPS ARE USED ON MOST COOLING SYSTEM HOSES. WHEN REMOVING OR INSTALLING, USE ONLY TOOLS DESIGNED FOR SERVICING THIS TYPE OF CLAMP. ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps. If replacement is necessary, use only an original equipment clamp with matching number or letter.

(2) Remove the upper radiator hose from the thermostat housing.

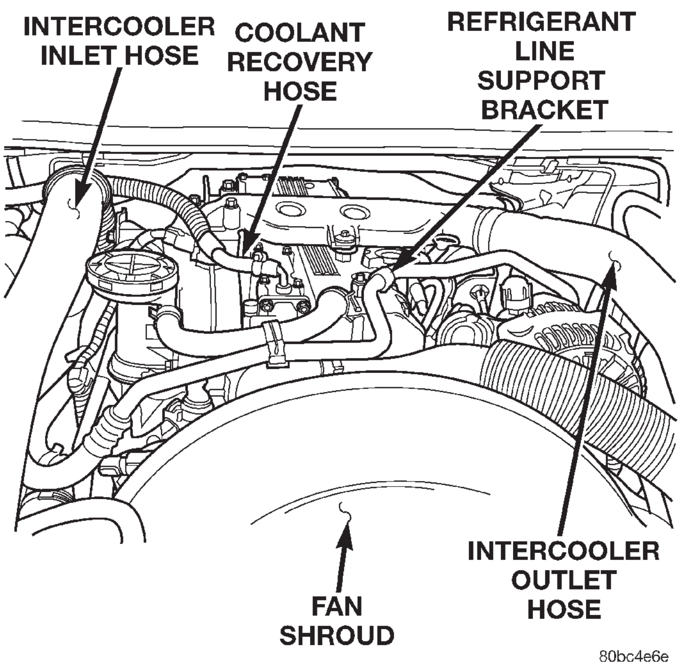

Fig. 24 Refrigerant Line Support Bracket Position & Orientation

(3) Remove the refrigerant line support bracket bolt from the cylinder head cover (Fig. 24).

(4) Remove the four thermostat housing bolts (Fig. 25).

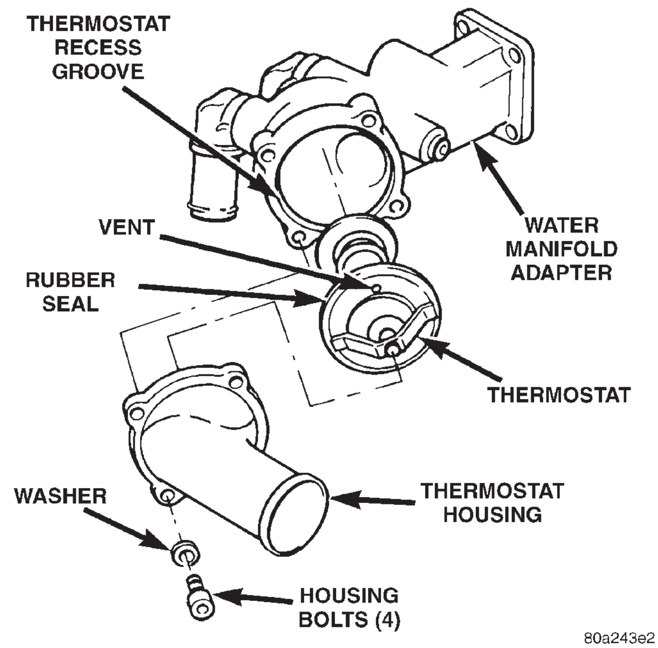

Fig. 25 Thermostat Removal/Installation

(5) Remove the thermostat housing from the water manifold.

(6) Remove the thermostat and rubber seal from the water manifold.

(7) Thoroughly clean the rubber seal mating surfaces.

INSTALLATION

(1) Install a new rubber seal around the outer lip of the thermostat (a notch is provided in the rubber seal). Do not apply any adhesive to this seal.

(2) Install the replacement thermostat and rubber seal as one assembly into the water manifold adapter (the pointed end of the thermostat should be facing towards the front of engine (Fig. 25). Observe the recess groove in the water manifold adapter. **Be sure the thermostat vent is in the 12 o'clock position (Fig. 25)**.

(3) Position the thermostat housing and four bolts to the water manifold.

CAUTION: Tightening the thermostat housing unevenly or with the thermostat out of its recess groove, may result in a cracked housing.

REMOVAL AND INSTALLATION (Continued)

(4) Tighten the four housing bolts to 11 N·m (98 in. lbs.) torque.

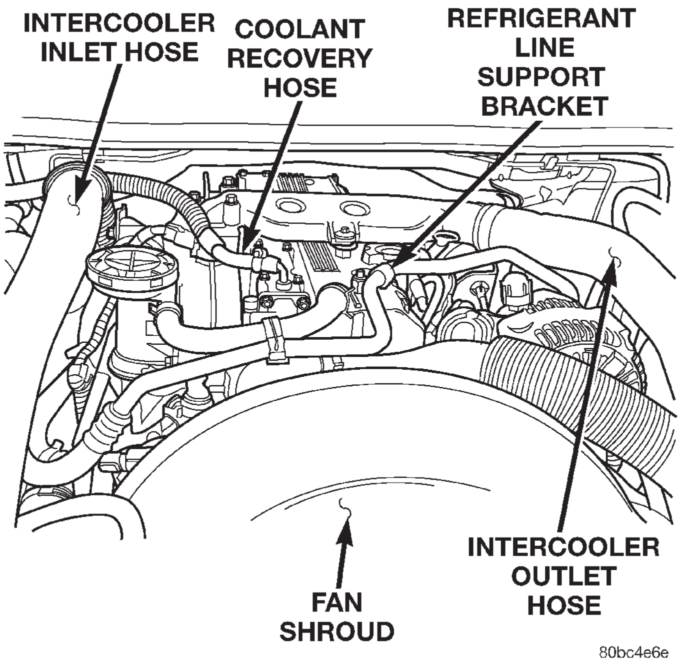

Fig. 26 Refrigerant Line Support Bracket Position & Orientation

(5) Install the refrigerant line support bracket (Fig. 26).

(6) Install the radiator hose on thermostat housing.

(7) Be sure that the radiator drain is tightly closed. Fill the cooling system to the correct level with the required coolant mixture. Refer to Refilling Cooling System in this group for procedures.

(8) Start the engine and check for leaks.

ACCESSORY DRIVE BELT

REMOVAL

(1) Disconnect the negative battery cable.

(2) Insert a 1/2 drive breaker bar or ratchet in the automatic belt tensioner pulley (Fig. 27). Rotate the pulley counter clockwise to relieve the belt tension and remove the belt from the vehicle.

INSTALLATION

(1) Position the belt on the accessory drive pulleys. Rotate tensioner pulley until belt can be installed in the original position (Fig. 28).

CAUTION: Be certain the belt is fully seated on all pulleys before restoring belt tension.

(2) Connect the negative battery cable.

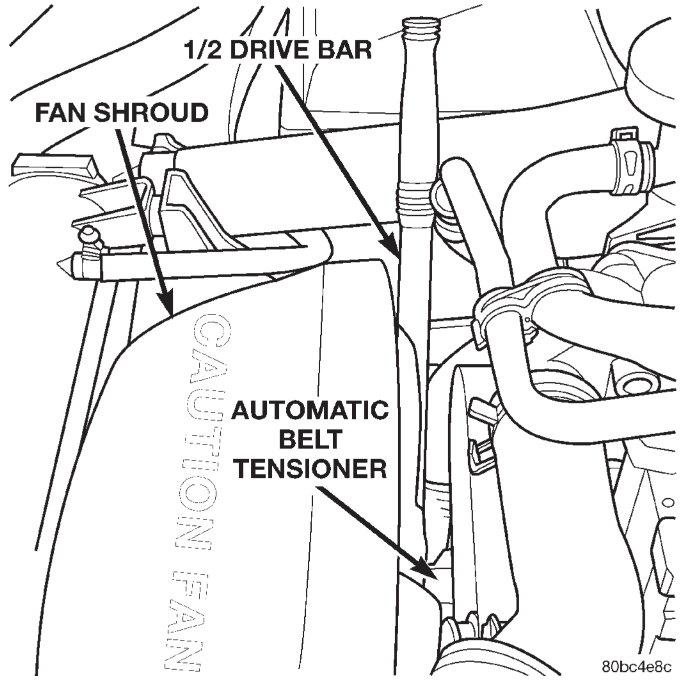

Fig. 27 Removing The Accessory Drive Belt

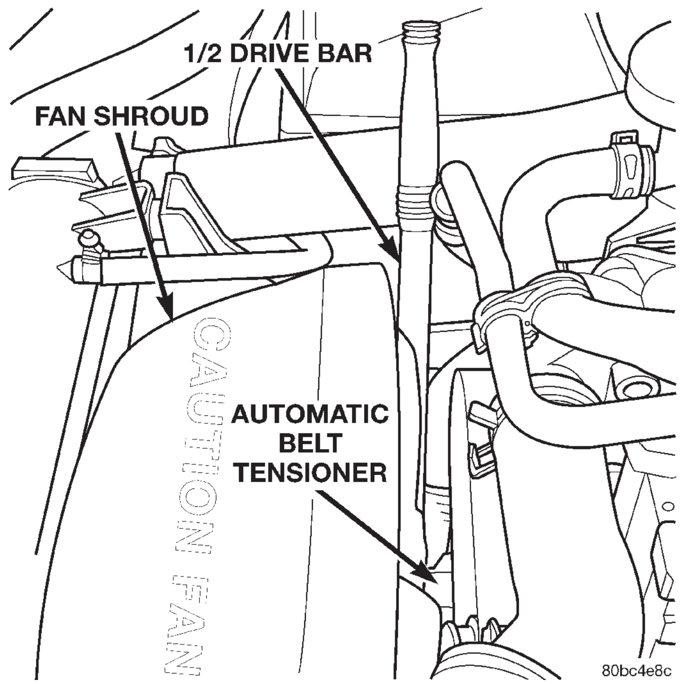

Fig. 28 Installing The Accessory Drive Belt

REMOVAL AND INSTALLATION (Continued)

AUTOMATIC BELT TENSIONER

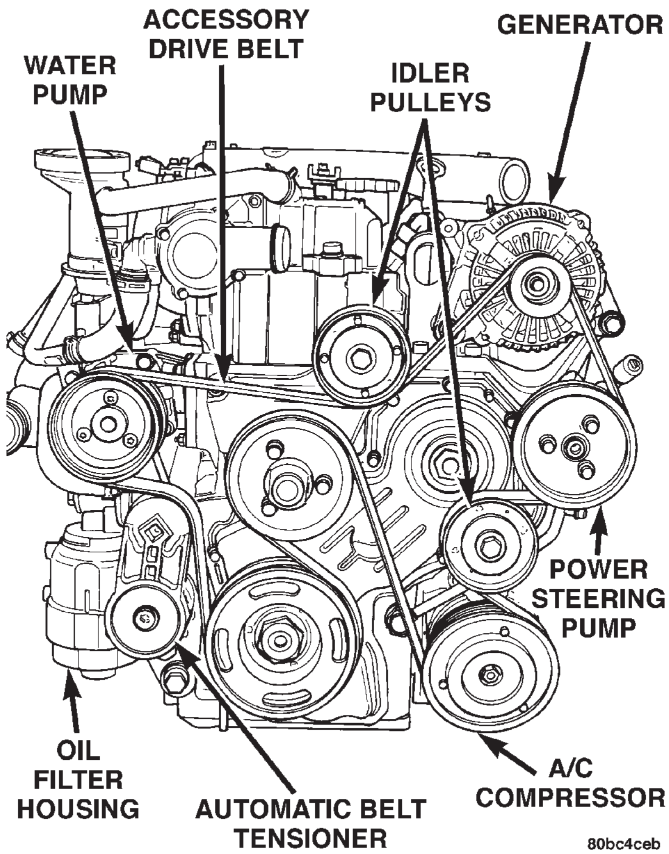

Fig. 29 3.1L Diesel Engine Accessory Drive

REMOVAL

(1) Raise the vehicle on the hoist.

(2) Remove the accessory drive belt from the belt tensioner. Refer to the removal and installation procedures in this group for the procedure.

(3) Remove the automatic belt tensioner retaining bolt and remove the tensioner from the vehicle.

INSTALLATION

(1) Position the belt tensioner on the mounting bracket. Be certain the tensioner mounted dowel pin is inserted in the corresponding hole in the mounting bracket. Install the retaining bolt and torque to 75 N·m (56 ft. lbs.).

(2) Install the accessory drive belt. Refer to the removal and installation procedures in this group for the procedure.

(3) Lower the vehicle on the hoist.

WATER PUMP

REMOVAL

WARNING: DO NOT REMOVE THE CYLINDER BLOCK DRAIN-PLUG, THE COOLANT TANK CAP, THE RADIATOR FILL VENT VALVE, OR LOOSEN THE RADIATOR DRAINCOCK WITH THE SYSTEM HOT AND PRESSURIZED. SERIOUS BURNS FROM THE COOLANT CAN OCCUR.

The water pump is serviced by replacing the pump and its impeller only. The water pump adapter (Fig. 30) does not have to be removed. The pump impeller is pressed on the rear of the pump shaft and bearing assembly. The pump is serviced only as a complete assembly with the impeller, housing, hub and bearing.

A rubber o-ring seal (instead of a gasket) is used as a seal between the water pump and the water pump adapter.

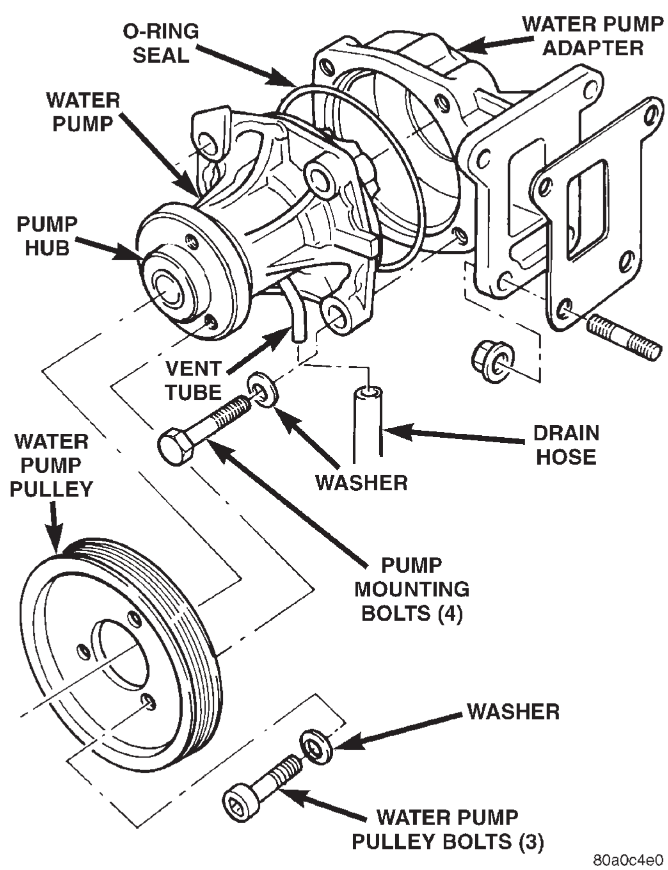

Fig. 30 WATER PUMP REMOVAL/INSTALL—TYPICAL

DO NOT WASTE reusable coolant. If the solution is clean, drain coolant into a clean container for reuse.

(1) Disconnect the negative battery cable.

(2) Raise the vehicle on a hoist.

REMOVAL AND INSTALLATION (Continued)

(3) Drain the cooling system. Refer to Draining Cooling System in this group.

(4) Lower the vehicle on the hoist.

(5) Loosen **but do not remove** the 3 water pump pulley bolts (Fig. 30).

(6) Remove the accessory drive belt from the water pump pulley. For procedures, refer to Belt Removal/ Installation in the Engine Accessory Drive Belt section of this group.

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 (Fig. 31). ALWAYS WEAR SAFETY GLASSES WHEN SERVICING CONSTANT TENSION CLAMPS.

CAUTION: A number or letter is stamped into the tongue of constant tension clamps (Fig. 32). If replacement is necessary, use only an original equipment clamp with matching number or letter.

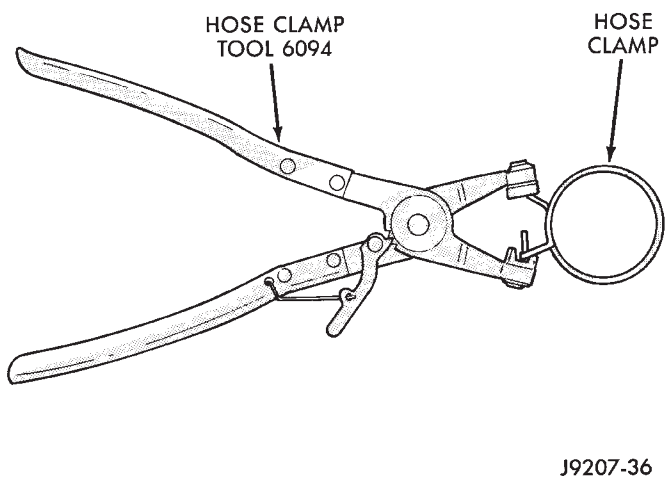

Fig. 31 Hose Clamp Tool

(7) Remove the (2) bolts retaining the coolant line assembly support bracket to the front of the water pump.

(8) Remove the (3) water pump pulley bolts (Fig. 30).

(9) Remove the water pump pulley from the water pump.

(10) Disconnect the drain hose from the vent tube at the bottom of water pump (Fig. 30).

(11) Remove the remaining (2) water pump mounting bolts (Fig. 30).

(12) Remove the water pump from engine.

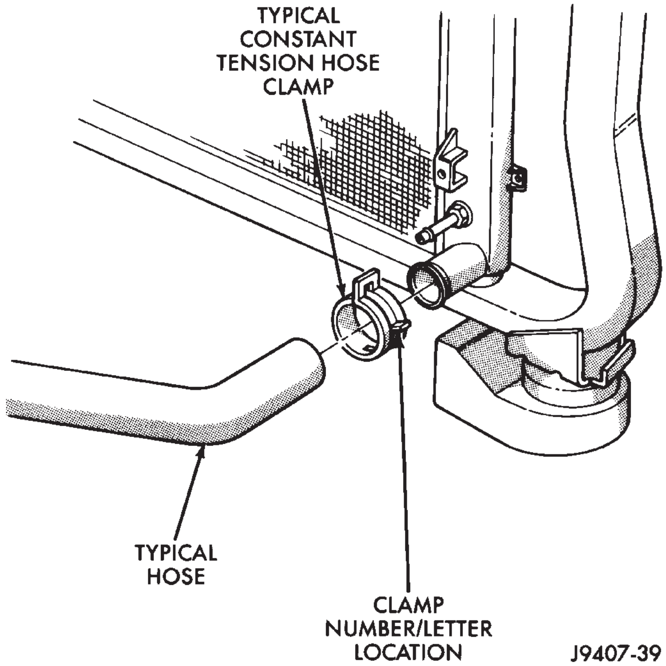

Fig. 32 Clamp Number/Letter Location

INSTALLATION

(1) Clean the o-ring mating surfaces. If the original pump is to be reinstalled, remove any deposits or other foreign material. Inspect the water pump, water pump adapter and water pump mating surfaces for erosion or damage from cavitation.

(2) Position a new rubber o-ring seal (Fig. 30) between the pump and pump adapter. Use petroleum jelly to hold the o-ring in place during installation.

(3) Position the pump on the engine.

(4) Install the (2) bolts retaining the coolant line assembly support bracket to the front of the water pump. Torque the bolts to 24 N·m (18 ft. lbs.).

(5) Install the remaining (2) water pump mounting bolts. Torque the bolts to 24 N·m (18 ft. lbs.).

(6) Install drain hose to vent tube at bottom of pump.

(7) Position the water pump pulley on the water pump.

(8) Install the water pump pulley bolts finger tight.

(9) Install the accessory drive belt. For procedures, refer to Belt Removal/Installation in the Engine Accessory Drive Belt section of this group.

(10) Torque the water pump pulley bolts to 24 N·m (18 ft. lbs.).

(11) Fill the cooling system with coolant and check for leaks. Refer to Refilling Cooling System in this group.

(12) Connect the negative battery cable.

(13) Start and warm the engine. Check for leaks.

CLEANING AND INSPECTION

WATER PUMP

INSPECTION

Replace the water pump assembly if it has any of the following conditions:

- The body is cracked or damaged.
- Water leaks from the shaft seal. This is evident by traces of coolant below the vent tube drain hose
- Loose or rough turning bearing.
- Impeller rubs either the water pump body or water pump adapter.

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.

FAN BLADE

INSPECTION

The fan cannot be repaired. If fan is damaged, it must be replaced. Inspect fan as follows:

(1) Remove fan blade and viscous fan drive as an assembly from the engine.

(2) Remove fan blade assembly from viscous fan drive unit (four bolts) (Fig. 33).

(3) Lay fan 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: DO NOT ATTEMPT TO BEND OR STRAIGHTEN FAN BLADES IF NOT WITHIN SPECIFICATIONS.

(4) Inspect fan assembly for cracks, bends, loose rivets or broken welds. Replace fan if any damage is found.

CAUTION: If fan blade assembly is replaced because of mechanical damage, the fan pulley bearing and viscous fan drive should also be inspected. These components could have been damaged due to excessive vibration.

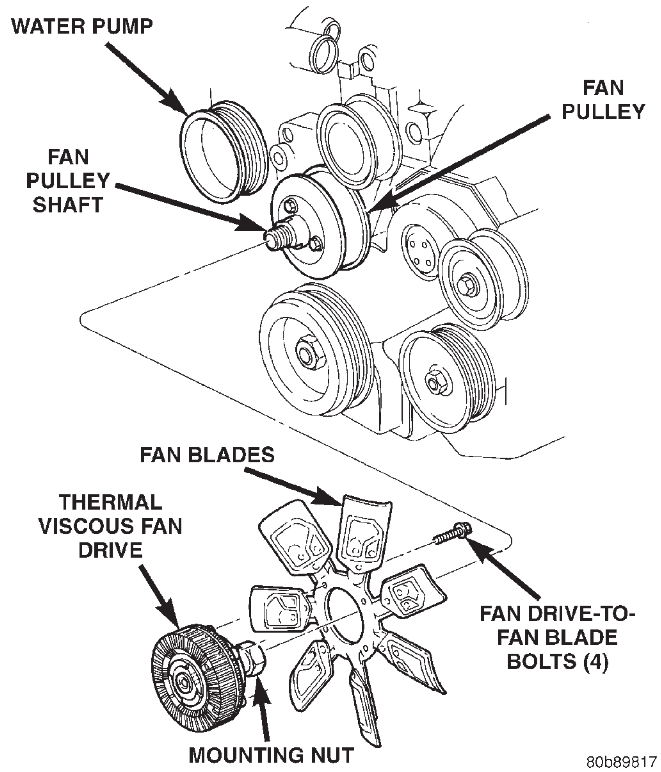

Fig. 33 Thermal Viscous Fan Drive and Blade Assembly

CAUTION: Some 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.

PRESSURE/VENT CAP

INSPECTION

Visually inspect the gasket on the cap. Replace cap if the gasket is swollen, torn or worn. Inspect the area around the coolant tank filler neck for white deposits that indicate a leaking cap.

The cap must be replaced by a similar threaded-on unit with the correct operating pressures if replacement is necessary.

COOLING SYSTEM CLEANING/REVERSE FLUSHING

CAUTION: The cooling system normally operates at 90-to-117 kPa (13-to-17 psi) pressure. Exceeding this pressure may damage the radiator or hoses.

CLEANING AND INSPECTION (Continued)

CLEANING

Drain cooling system and refill with water. Run engine with coolant tank pressure/vent 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 90-to-117 kPa (13-to-17 psi) pressure. Exceeding this pressure may damage the radiator or hoses.

Allow the coolant tank and 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.

CAUTION: Be sure that the heater water control valve is closed (heat off). This is done to prevent coolant flow with scale and other deposits from entering the heater core.

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 new replacement rubber seal. Refer to Thermostat Installation. 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.

SPECIFICATIONS

COOLING SYSTEM CAPACITY

3.1L Diesel Engine: 9.8 Liters (10.4 qts.)

THERMOSTAT

Starts to open at 80°C (176°F).

TORQUE SPECIFICATIONS

DESCRIPTION	TORQUE
Automatic Belt Tensioner-to-Mounting Bracket	
Bolt (1)	75 N·m
Automatic Belt Tensioner to Block	
Bolts (2)	120 N·m
Coolant Tank	
Cap	5 N·m
Fan Shroud-to-Radiator Mounting	
Bolts	3 N·m
Fan Blade-to-Thermal Viscous Fan Drive	
Bolts	23 N·m
Hose	
Clamps	4 N·m
Radiator-to-A/C Condenser Isolator	
Nuts	6 N·m
Thermal Viscous Fan Drive-to-Fan Hub	
Bolts	56 N·m
Thermostat Housing	
Bolts	11 N·m
Water Pump Mounting	
Bolts	24 N·m
Water Pump Pulley	
Bolts	24 N·m

BATTERY

CONTENTS

DESCRIPTION AND OPERATION

BATTERY

DESCRIPTION

A large capacity, low-maintenance storage battery is standard factory-installed equipment on this model. This battery is designed to provide a safe, efficient and reliable means of storing electrical energy in a chemical form. This means of energy storage allows the battery to produce the electrical energy required to operate the engine starting system, as well as to operate many of the other vehicle accessory systems for limited durations while the engine and/or the charging system are not operating.

The factory-installed low-maintenance battery 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 (Fig. 1). The chemical composition within the low-maintenance battery reduces battery gassing and water loss, at normal charge and discharge rates.

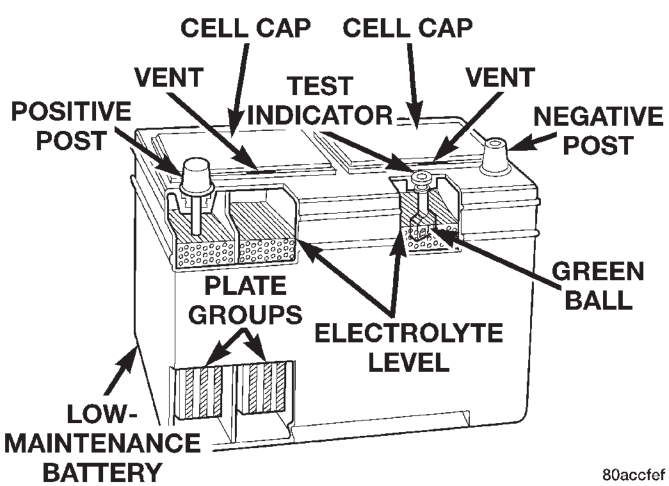

Fig. 1 Low-Maintenance Battery - Typical

Rapid loss of electrolyte can be caused by an overcharging condition. Be certain to diagnose the charging system before returning the vehicle to service. Refer to **Charging System** in the Diagnosis and Testing section of Group 8C - Charging System for more information.

The factory-installed battery also has a built-in test indicator (hydrometer). The color visible in the sight glass of the indicator will reveal the battery condition. Refer to **Built-In Test Indicator** in the Diagnosis and Testing section of this group for more information.

This group covers only the battery diagnostic and service procedures. For battery maintenance schedules and jump starting procedures, see the owner's manual in the vehicle glove box, or refer to **Maintenance Schedules** and **Jump Starting, Towing and Hoisting** in Group 0 - Lubrication and Maintenance. While battery charging can be considered a maintenance procedure, battery charging information is located in this group. This was done because the battery must be fully-charged before any diagnosis can be performed.

Group 8A covers the Battery, Group 8B covers the Starting Systems, and Group 8C covers the Charging System. We have separated these systems to make it easier to locate the information you are seeking within this Service Manual. However, when attempting to diagnose any of these systems, it is important that you keep their interdependency in mind.

The battery, starting, and charging systems in the vehicle operate with one another, and must be tested as a complete system. In order for the vehicle to start and charge properly, all of the components that are used in these systems must perform within specifications. 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, overcharging, or early battery failure must be diagnosed and corrected before a battery is replaced or returned to service.

DESCRIPTION AND OPERATION (Continued)

The diagnostic procedures used in each of these groups include the most basic conventional diagnostic methods, to the more sophisticated On-Board Diagnostics (OBD) built into the Powertrain Control Module (PCM). Use of an induction-type milliampere ammeter, volt/ohmmeter, battery charger, carbon pile rheostat (load tester), and 12-volt test lamp may be required.

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. Refer to **On-Board Diagnostic Test For Charging System** in the Diagnosis and Testing section of Group 8C - Charging System for more information.

OPERATION

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 six 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 an 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 slowly 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 the 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 battery discharging 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 the 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 electrical system of the vehicle. It absorbs most abnormal or transient voltages caused by the switching of any of the electrical components in the vehicle.

The battery is vented to release excess hydrogen gas that is created when the battery is being charged or discharged. However, even with these vents, the hydrogen gas can collect in or around the battery. If hydrogen gas is exposed to flame or sparks, it may ignite.

If the electrolyte level is low, the battery may 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 if the electrolyte level becomes low.

BATTERY SIZE AND RATINGS

The battery Group Size number, the Cold Cranking Amperage (CCA) rating, and the Reserve Capacity (RC) rating or Ampere-Hours (AH) rating can be found on the original equipment battery label. Be certain that a replacement battery has the correct Group Size number, as well as CCA, and RC or AH ratings that equal or exceed the original equipment specification for the vehicle being serviced.

Refer to **Battery Classifications and Ratings** in the Specifications section of this group for more information. Battery sizes and ratings are discussed in more detail below.

GROUP SIZE

The outside dimensions and terminal placement of the battery conform to standards established by the Battery Council International (BCI). Each battery is assigned a BCI Group Size number to help identify a correctly-sized replacement.

COLD CRANKING AMPERAGE

The Cold Cranking Amperage (CCA) rating specifies how much current (in amperes) the battery can deliver for thirty seconds at -18° C (0° F). Terminal voltage must not fall below 7.2 volts during or after the thirty second discharge period. 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 10.5 volts, at a discharge rate of 25

DESCRIPTION AND OPERATION (Continued)

amperes. 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.

AMPERE-HOURS

The Ampere-Hours (AH) rating specifies the current (in amperes) that a battery can deliver steadily for twenty hours, with the voltage in the battery not falling below 10.5 volts. This rating is also sometimes identified as the twenty-hour discharge rating.

MOUNTING

The battery is mounted to a molded plastic battery support located in the right front corner of the engine compartment. A U-nut is held in a formation on the inboard side of the battery support. Molded ledges near the bottom of the battery case sides are used to secure the battery in the support. First, the molded ledge on the outboard side of the battery case slides under a molded lip formation on the outboard side of the battery support. Then, a molded plastic hold down bracket is placed over the ledge on the inboard side of the battery case. Finally, a screw passes through a hole in the center of the hold down bracket and is threaded into the U-nut on the battery support, clamping the battery to the support.

The battery support is secured at the lower rear with a nut to a stud on the front wheelhouse extension panel, at the outboard side with a screw to the side cowl reinforcement panel, and at the front with a screw through a U-nut on a bracket of the radiator support. The battery support also includes three upright stanchions that are molded into the outboard side of the unit, which support the Power Distribution Center (PDC). Refer to **Power Distribution Center** in the Description and Operation section of Group 8O - Power Distribution Systems for more information on the PDC mounting.

A battery temperature sensor is snap-fit into a hole in the bottom of the battery support. Refer to **Battery Temperature Sensor** in the Description and Operation section of Group 8C - Charging System for more information on this component.

A two-piece molded plastic clam shell-type thermoguard unit encloses the sides of the battery case and helps to protect the battery from engine compartment temperature extremes. A single molded latch on each end of the thermoguard secures the unit around the battery. The thermoguard can only be removed or installed over the battery while the battery is removed from the vehicle.

When installing a battery, be certain that the hold down fastener is tightened to the proper specifications. Improper hold down fastener tightness, whether too loose or too tight, can result in damage to the battery, the hold down bracket, and/or the battery support. Refer to **Battery** in the Removal and Installation section of this group for the correct battery hold down fastener tightness specifications.

DIAGNOSIS AND TESTING

BATTERY

DIAGNOSIS

The battery, starting, and charging systems operate with one another, and 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 the Battery, Group 8B covers the Starting Systems, and Group 8C covers the Charging System. We have separated these systems to make it easier to locate the information you are seeking within this Service Manual. However, when attempting to diagnose any of these systems, it is important that you keep their interdependency in mind.

The diagnostic procedures used in these groups include the most basic conventional diagnostic methods, to the more sophisticated On-Board Diagnostics (OBD) built into the Powertrain Control Module (PCM). Use of an induction-type milliampere ammeter, volt/ohmmeter, battery charger, carbon pile rheostat (load tester), and 12-volt test lamp may be required.

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. Refer to **On-Board Diagnostic Test For Charging System** in the Diagnosis and Testing section of Group 8C - Charging System for more information.

The battery must be completely charged and the top, posts, and terminal clamps should be properly cleaned and inspected before diagnostic procedures are performed. Refer to **Battery** in the Removal and Installation section of this group for the proper battery cleaning and inspection procedures. Refer to **Battery Charging** in the Service Procedures section of this group for the proper charging procedures.

DIAGNOSIS AND TESTING (Continued)

WARNING:

• IF THE BATTERY SHOWS SIGNS OF FREEZING, LEAKING, LOOSE POSTS, OR LOW ELECTROLYTE LEVEL, DO NOT TEST, ASSIST-BOOST, OR CHARGE. THE BATTERY MAY ARC INTERNALLY AND EXPLODE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.

• EXPLOSIVE HYDROGEN GAS FORMS IN AND AROUND THE BATTERY. DO NOT SMOKE, USE FLAME, OR CREATE SPARKS NEAR THE BATTERY. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.

• THE BATTERY CONTAINS SULFURIC ACID, WHICH IS POISONOUS AND CAUSTIC. AVOID CONTACT WITH THE SKIN, EYES, OR CLOTHING. IN THE EVENT OF CONTACT, FLUSH WITH WATER AND CALL A PHYSICIAN IMMEDIATELY. KEEP OUT OF THE REACH OF CHILDREN.

• IF THE BATTERY IS EQUIPPED WITH REMOVABLE CELL CAPS, BE CERTAIN THAT EACH OF THE CELL CAPS IS IN PLACE AND TIGHT BEFORE THE BATTERY IS RETURNED TO SERVICE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT FROM LOOSE OR MISSING CELL CAPS.

The condition of a battery is determined by two criteria:

1. **State-Of-Charge** - This can be determined by checking the specific gravity of the battery electrolyte (built-in test indicator or hydrometer test), or by checking the 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.

First, determine the battery state-of-charge. This can be done in one of three ways. If the battery has a built-in test indicator, view the test indicator to determine the state-of-charge. If the battery has no test indicator, but has removable cell caps, perform the hydrometer test to determine the state-of-charge. If the cell caps are not removable, or a hydrometer is not available, perform the open-circuit voltage test to determine the state-of-charge.

The battery must be charged before proceeding with a load test if:

- The battery built-in test indicator has a black or dark color visible.
- The temperature corrected specific gravity of the battery electrolyte is less than 1.235.
- The battery open-circuit voltage is less than 12.4 volts.

A battery that will not accept a charge is faulty, and must be replaced. Further testing is not required. A fully-charged battery must be load tested to determine its cranking capacity. A battery that is fully-charged, but does not pass the load test, is faulty and must be replaced.

NOTE: Completely discharged batteries may take several hours to accept a charge. Refer to Battery Charging - Charging A Completely Discharged Battery in the Service Procedures section of this group for more information.

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 one-hour intervals, indicate no increase in the specific gravity.
- Open-circuit voltage is 12.4 volts or greater.

DIAGNOSIS AND TESTING (Continued)

Battery Diagnosis		
Condition	Possible Causes	Correction
The battery seems weak or dead when attempting to start the engine.	1. The battery has an incorrect size or rating for this vehicle. 2. The battery is physically damaged. 3. The battery terminal connections are loose or corroded. 4. The battery is discharged. 5. The electrical system ignition-off draw is excessive. 6. The battery is faulty. 7. The starting system is faulty. 8. The charging system is faulty.	1. Refer to Battery in the Specifications section of this group. Replace an incorrect battery with the correct battery. 2. Inspect the battery for loose terminal posts or a cracked and leaking case. Replace the battery, if damaged. 3. Refer to Voltage Drop Test in the Diagnosis and Testing section of this group. Clean and tighten the battery terminal connections, if required. 4. Determine the battery state-of-charge. Refer to Built-In Test Indicator, Hydrometer Test, or Open-Circuit Voltage Test in the Diagnosis and Testing section of this group. Charge the battery, if required. 5. Refer to Ignition-Off Draw Test in the Diagnosis and Testing section of this group. Repair the electrical system, if required. 6. Determine the battery cranking capacity. Refer to Load Test in the Diagnosis and Testing section of this group. Replace the battery, if required. 7. Determine if the starting system is performing to specifications. Refer to Starting System in the Diagnosis and Testing section of Group 8B - Starting Systems for more information. Repair the starting system, if required. 8. Determine if the charging system is performing to specifications. Refer to Charging System in the Diagnosis and Testing section of Group 8C - Charging System for more information. Repair the charging system, if required.
The battery state-of-charge cannot be maintained.	1. The battery has an incorrect size or rating for this vehicle. 2. The battery terminal connections are loose or corroded. 3. The generator drive belt is slipping. 4. The electrical system ignition-off draw is excessive. 5. The battery is faulty. 6. The starting system is faulty. 7. The charging system is faulty. 8. Electrical loads exceed the output of the charging system. 9. Slow driving or prolonged idling with high-amperage draw systems in use.	1. Refer to Battery in the Specifications section of this group. Replace an incorrect battery with the correct battery. 2. Refer to Voltage Drop Test in the Diagnosis and Testing section of this group. Clean and tighten the battery terminal connections, if required. 3. Refer to Accessory Drive Belt Diagnosis in the Diagnosis and Testing section of Group 7 - Cooling System for more information. Replace or adjust the generator drive belt, if required. 4. Refer to Ignition-Off Draw Test in the Diagnosis and Testing section of this group. Repair the electrical system, if required. 5. Determine the battery cranking capacity. Refer to Load Test in the Diagnosis and Testing section of this group. Replace the battery, if required. 6. Determine if the starting system is performing to specifications. Refer to Starting System in the Diagnosis and Testing section of Group 8B - Starting Systems for more information. Repair the starting system, if required. 7. Determine if the charging system is performing to specifications. Refer to Charging System in the Diagnosis and Testing section of Group 8C - Charging System for more information. Repair the charging system, if required. 8. Inspect the vehicle for aftermarket electrical equipment which might cause excessive electrical loads. 9. Advise the vehicle operator, as required.
The battery will not accept a charge.	1. The battery is faulty.	1. Refer to Battery Charging in the Service Procedures section of this group. Replace the faulty battery, if required.

DIAGNOSIS AND TESTING (Continued)

ABNORMAL BATTERY DISCHARGING

Any of the following conditions can result in abnormal battery discharging:

1. Corroded or loose battery posts and terminal clamps.
2. A loose or worn generator drive belt.
3. Electrical loads that exceed the output of the charging system. This can be 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. A faulty circuit or component causing excessive ignition-off draw. Refer to **Ignition-Off Draw Test** in the Diagnosis and Testing section of this group for more information.
6. A faulty or incorrect charging system component. Refer to **Charging System** in the Diagnosis and Testing section of Group 8C - Charging System for more information.
7. A faulty or incorrect battery.

TESTING

BUILT-IN TEST INDICATOR

A test indicator (hydrometer) built into the top of the battery case provides visual information for battery testing (Fig. 2). Like a hydrometer, the built-in test indicator measures the specific gravity of the electrolyte. The test indicator reveals the battery state-of-charge; however, it will not reveal the cranking capacity of the battery. A load test must be performed to determine the battery cranking capacity. Refer to **Load Test** in the Diagnosis and Testing section of this group for more information.

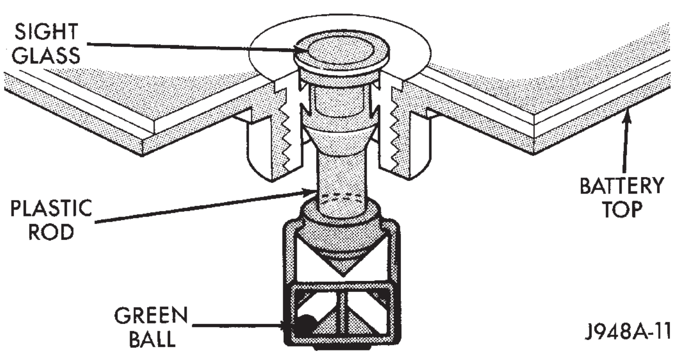

Fig. 2 Built-In Test Indicator

WARNING:

• IF THE BATTERY SHOWS SIGNS OF FREEZING, LEAKING, LOOSE POSTS, OR LOW ELECTROLYTE LEVEL, DO NOT TEST, ASSIST-BOOST, OR CHARGE. THE BATTERY MAY ARC INTERNALLY AND EXPLODE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.

• EXPLOSIVE HYDROGEN GAS FORMS IN AND AROUND THE BATTERY. DO NOT SMOKE, USE FLAME, OR CREATE SPARKS NEAR THE BATTERY. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.

• THE BATTERY CONTAINS SULFURIC ACID, WHICH IS POISONOUS AND CAUSTIC. AVOID CONTACT WITH THE SKIN, EYES, OR CLOTHING. IN THE EVENT OF CONTACT, FLUSH WITH WATER AND CALL A PHYSICIAN IMMEDIATELY. KEEP OUT OF THE REACH OF CHILDREN.

• IF THE BATTERY IS EQUIPPED WITH REMOVABLE CELL CAPS, BE CERTAIN THAT EACH OF THE CELL CAPS IS IN PLACE AND TIGHT BEFORE THE BATTERY IS RETURNED TO SERVICE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT FROM LOOSE OR MISSING CELL CAPS.

Before testing, visually inspect the battery for any damage (a cracked case or cover, loose posts, etc.) that would cause the battery to be faulty. In order to obtain correct indications from the built-in test indicator, it is important that the battery be level and have a clean sight glass. Additional light may be required to view the indicator. **Do not use open flame as a source of additional light.**

To read the built-in test indicator, look into the sight glass and note the color of the indicator (Fig. 3). The battery condition that each color indicates is described in the following list:

- **Green -** indicates 75% to 100% state-of-charge. The battery is adequately charged for further testing or return to use. If the starter will not crank for a minimum of fifteen seconds with a fully-charged battery, the battery must be load tested. Refer to **Load Test** in the Diagnosis and Testing section of this group for more information.
- **Black or Dark -** indicates 0% to 75% state-of-charge. The battery is inadequately charged and must be charged until a green indication is visible in the sight glass (12.4 volts or more), before the battery is tested further or returned to service. Refer to **Battery Charging** in the Service Procedures section of this group for more information. Also refer to **Abnormal Battery Discharging** in the Diagnosis and Testing section of this group for possible causes of the discharged condition.
- **Clear or Bright -** indicates a low electrolyte level. The electrolyte level in the battery is below the test indicator. A maintenance-free battery with non-removable cell caps must be replaced if the electrolyte level is low. Water must be added to a low-maintenance battery with removable cell caps before it is charged. Refer to **Battery Charging** in the Service Procedures section of this group for more information. A low electrolyte level may be caused by an overcharging condition. Refer to **Charging System**

DIAGNOSIS AND TESTING (Continued)

in the Diagnosis and Testing section of Group 8C - Charging System to diagnose an overcharging condition.

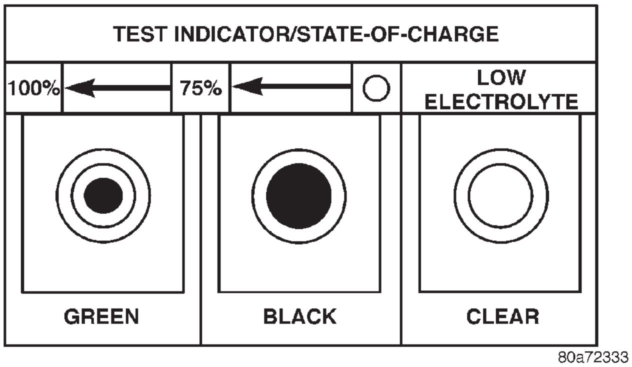

Fig. 3 Built-In Test Indicator Sight Glass

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 maintenance-free batteries with non-removable cell caps.** If the battery has non-removable cell caps, refer to **Built-In Test Indicator** or **Open-Circuit Voltage Test** in the Diagnosis and Testing section of this group.

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.

WARNING:

- **IF THE BATTERY SHOWS SIGNS OF FREEZING, LEAKING, LOOSE POSTS, OR LOW ELECTROLYTE LEVEL, DO NOT TEST, ASSIST-BOOST, OR CHARGE. THE BATTERY MAY ARC INTERNALLY AND EXPLODE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.**
- **EXPLOSIVE HYDROGEN GAS FORMS IN AND AROUND THE BATTERY. DO NOT SMOKE, USE FLAME, OR CREATE SPARKS NEAR THE BATTERY. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.**
- **THE BATTERY CONTAINS SULFURIC ACID, WHICH IS POISONOUS AND CAUSTIC. AVOID CONTACT WITH THE SKIN, EYES, OR CLOTHING. IN THE EVENT OF CONTACT, FLUSH WITH WATER AND CALL A PHYSICIAN IMMEDIATELY. KEEP OUT OF THE REACH OF CHILDREN.**
- **IF THE BATTERY IS EQUIPPED WITH REMOVABLE CELL CAPS, BE CERTAIN THAT EACH OF THE CELL CAPS IS IN PLACE AND TIGHT BEFORE THE BATTERY IS RETURNED TO SERVICE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT FROM LOOSE OR MISSING CELL CAPS.**

Before testing, visually inspect the battery for any damage (a cracked case or cover, loose posts, etc.) that would cause the battery to be faulty. Then remove the cell caps and check the electrolyte level. Add distilled water if the electrolyte level is below the top of the battery plates.

See the instructions provided by the manufacturer of the hydrometer for recommendations on the correct use of the hydrometer that you are using. Remove only enough electrolyte from the battery cell so that the float is off the bottom of the hydrometer barrel with pressure on the bulb released.

CAUTION: Exercise care when inserting the tip of the hydrometer into a cell to avoid damaging the plate separators. Damaged plate separators can cause early battery failure.

To read the hydrometer correctly, hold it with the top surface of the electrolyte at eye level (Fig. 4). 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.

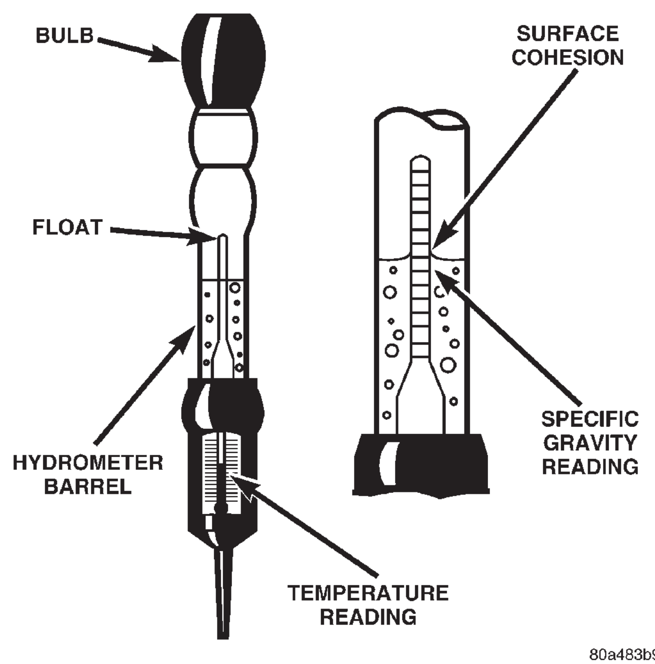

Fig. 4 Hydrometer - Typical

The correction factor is approximately a specific gravity value of 0.004, which may also be identified as four points of specific gravity. For each 5.5° C above 26.7° C (10° F above 80° F), add four points. For each 5.5° C below 26.7° C (10° F below 80° F), subtract four 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 factor is subtracted:1.240 - 0.028 = 1.212

The corrected specific gravity of the battery cell in this example is 1.212.

If the specific gravity of all cells is above 1.235, but the variation between cells is more than fifty 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 five amperes.

Continue charging the battery until three consecutive specific gravity tests, taken at one-hour intervals, are constant. If the cell specific gravity variation is more than fifty 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 the cell variation is less than fifty points (0.050), the battery may be load tested to determine its cranking capacity. Refer to **Load Test** in the Diagnosis and Testing section of this group for more information.

OPEN-CIRCUIT VOLTAGE TEST

A battery open-circuit voltage (no load) test will show the state-of-charge of a battery. This test can be used in place of the hydrometer test when a hydrometer is not available, or for maintenance-free batteries with non-removable cell caps.

WARNING:

- **IF THE BATTERY SHOWS SIGNS OF FREEZING, LEAKING, LOOSE POSTS, OR LOW ELECTROLYTE LEVEL, DO NOT TEST, ASSIST-BOOST, OR CHARGE. THE BATTERY MAY ARC INTERNALLY AND EXPLODE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.**
- **EXPLOSIVE HYDROGEN GAS FORMS IN AND AROUND THE BATTERY. DO NOT SMOKE, USE FLAME, OR CREATE SPARKS NEAR THE BATTERY. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.**
- **THE BATTERY CONTAINS SULFURIC ACID, WHICH IS POISONOUS AND CAUSTIC. AVOID CONTACT WITH THE SKIN, EYES, OR CLOTHING. IN THE EVENT OF CONTACT, FLUSH WITH WATER AND CALL A PHYSICIAN IMMEDIATELY. KEEP OUT OF THE REACH OF CHILDREN.**
- **IF THE BATTERY IS EQUIPPED WITH REMOVABLE CELL CAPS, BE CERTAIN THAT EACH OF THE CELL CAPS IS IN PLACE AND TIGHT BEFORE THE BATTERY IS RETURNED TO SERVICE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT FROM LOOSE OR MISSING CELL CAPS.**

Before proceeding with this test, completely charge the battery. Refer to **Battery Charging** in the Service Procedures section of this group for the proper battery charging procedures.

(1) Before measuring the open-circuit voltage, the surface charge must be removed from the battery. Turn on the head lamps for fifteen seconds, then allow up to five minutes for the battery voltage to stabilize.

(2) Disconnect and isolate both battery cables, negative cable first.

(3) Using a voltmeter connected to the battery posts (see the instructions provided by the manufacturer of the voltmeter), measure the open-circuit voltage (Fig. 5).

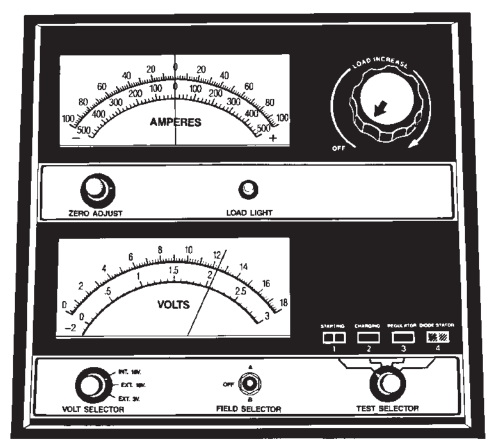

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Fig. 5 Testing Open-Circuit Voltage - Typical

See the Open-Circuit Voltage chart. This voltage reading will indicate the battery state-of-charge, but will not reveal its cranking capacity. If a battery has an open-circuit voltage reading of 12.4 volts or greater, it may be load tested to reveal its cranking capacity. Refer to **Load Test** in the Diagnosis and Testing section of this group for more information.

LOAD TEST

A battery load test will verify the battery cranking capacity. The test is based on the Cold Cranking Amperage (CCA) rating of the battery. See the label

DIAGNOSIS AND TESTING (Continued)

Open Circuit Voltage	
Open Circuit Volts	Charge Percentage
11.7 volts or less	0%
12.0 volts	25%
12.2 volts	50%
12.4 volts	75%
12.6 volts or more	100%

affixed to the battery case, or refer to **Battery Classifications and Ratings** in the Specifications section of this group for the CCA rating of the factory-installed battery.

WARNING:

- **IF THE BATTERY SHOWS SIGNS OF FREEZING, LEAKING, LOOSE POSTS, OR LOW ELECTROLYTE LEVEL, DO NOT TEST, ASSIST-BOOST, OR CHARGE. THE BATTERY MAY ARC INTERNALLY AND EXPLODE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.**
- **EXPLOSIVE HYDROGEN GAS FORMS IN AND AROUND THE BATTERY. DO NOT SMOKE, USE FLAME, OR CREATE SPARKS NEAR THE BATTERY. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.**
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Before proceeding with this test, completely charge the battery. Refer to **Battery Charging** in the Service Procedures section of this group for the proper battery charging procedures.

(1) Disconnect and isolate both battery cables, negative cable first. The battery top and posts should be clean.

(2) Connect a suitable volt-ammeter-load tester (Fig. 6) to the battery posts (Fig. 7). See the instructions provided by the manufacturer of the tester you are using. Check the open-circuit voltage (no load) of the battery. Refer to **Open-Circuit Voltage Test** in the Diagnosis and Testing section of this group for the test procedures. The battery open-circuit voltage must be 12.4 volts or greater.

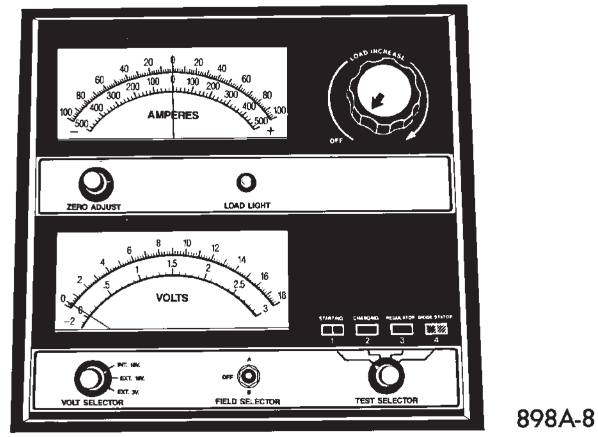


Fig. 6 Volt-Ammeter-Load Tester - Typical

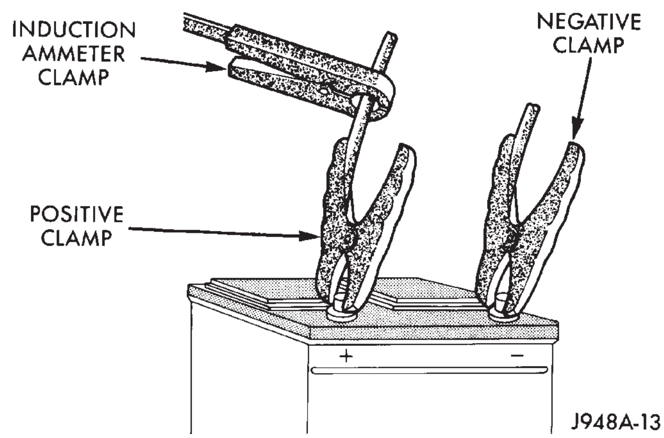


Fig. 7 Volt-Ammeter-Load Tester Connections - Typical

(3) Rotate the load control knob (carbon pile rheostat) to apply a 300 ampere load to the battery for fifteen seconds, then return the control knob to the Off position (Fig. 8). This will remove the surface charge from the battery.

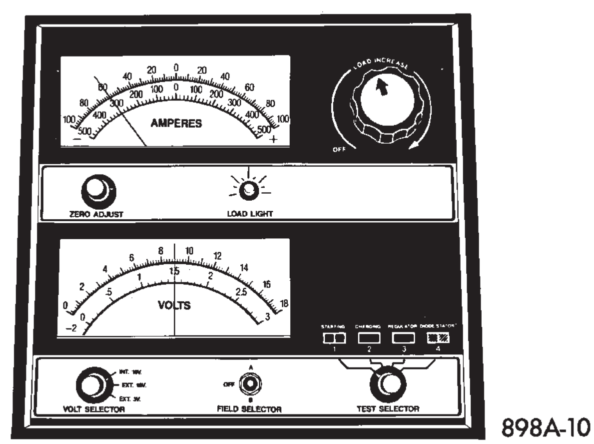
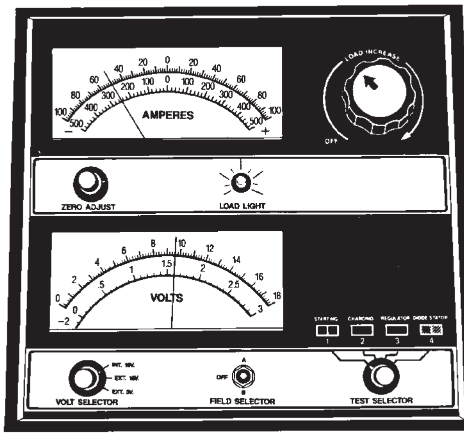


Fig. 8 Remove Surface Charge from Battery - Typical

DIAGNOSIS AND TESTING (Continued)

(4) Allow the battery to stabilize to open-circuit voltage. It may take up to five minutes for the battery voltage to stabilize.

(5) Rotate the load control knob to maintain a load equal to 50% of the CCA rating of the battery (Fig. 9). After fifteen seconds, record the loaded voltage reading, then return the load control knob to the Off position.



898A-11

Fig. 9 Load 50% CCA Rating - Note Voltage - Typical

(6) The voltage drop will vary with the battery temperature at the time of the load test. The battery temperature can be estimated by using the ambient temperature during the past several hours. If the battery has been charged, boosted, or loaded a few minutes prior to the test, the battery will be somewhat warmer. See the Load Test Temperature chart for the proper loaded voltage reading.

Load Test Temperature		
Minimum Voltage	Temperature	
	°F	°C
9.6 volts	70° and above	21° and above
9.5 volts	60°	16°
9.4 volts	50°	10°
9.3 volts	40°	4°
9.1 volts	30°	-1°
8.9 volts	20°	-7°
8.7 volts	10°	-12°
8.5 volts	0°	-18°

(7) If the voltmeter reading falls below 9.6 volts, at a minimum battery temperature of 21° C (70° F), the battery is faulty and must be replaced.

VOLTAGE DROP TEST

The voltage drop test will determine if there is excessive resistance in the battery terminal connections or the battery cables. When performing these tests, it is important to remember that the voltage drop is giving an indication of the resistance between the two points at which the voltmeter probes are attached.

Example: When testing the resistance of the battery positive cable, touch the voltmeter leads to the battery positive cable clamp and the cable connector at the starter solenoid. If you probe the battery positive terminal post and the cable connector at the starter solenoid, you are reading the combined voltage drop in the battery positive cable clamp-to-terminal post connection and the battery positive cable.

WARNING:

• IF THE BATTERY SHOWS SIGNS OF FREEZING, LEAKING, LOOSE POSTS, OR LOW ELECTROLYTE LEVEL, DO NOT TEST, ASSIST-BOOST, OR CHARGE. THE BATTERY MAY ARC INTERNALLY AND EXPLODE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.

• EXPLOSIVE HYDROGEN GAS FORMS IN AND AROUND THE BATTERY. DO NOT SMOKE, USE FLAME, OR CREATE SPARKS NEAR THE BATTERY. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.

• THE BATTERY CONTAINS SULFURIC ACID, WHICH IS POISONOUS AND CAUSTIC. AVOID CONTACT WITH THE SKIN, EYES, OR CLOTHING. IN THE EVENT OF CONTACT, FLUSH WITH WATER AND CALL A PHYSICIAN IMMEDIATELY. KEEP OUT OF THE REACH OF CHILDREN.

• IF THE BATTERY IS EQUIPPED WITH REMOVABLE CELL CAPS, BE CERTAIN THAT EACH OF THE CELL CAPS IS IN PLACE AND TIGHT BEFORE THE BATTERY IS RETURNED TO SERVICE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT FROM LOOSE OR MISSING CELL CAPS.

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:

- The battery is fully-charged. Refer to **Battery Charging** in the Service Procedures section of this group for more information.
- Fully engage the parking brake.
- If the vehicle is equipped with an automatic transmission, place the gearshift selector lever in the Park position. If the vehicle is equipped with a manual transmission, place the gearshift selector lever in the Neutral position and fully depress the clutch pedal.
- Unplug the Automatic ShutDown (ASD) relay to prevent the engine from starting. The ASD relay is located in the Power Distribution Center (PDC). Refer to the PDC label for ASD relay identification and location.

DIAGNOSIS AND TESTING (Continued)

(1) Connect the positive lead of the voltmeter to the battery negative terminal post. Connect the negative lead of the voltmeter to the battery negative cable clamp (Fig. 10). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If voltage is detected, correct the poor contact between the cable clamp and the terminal post.

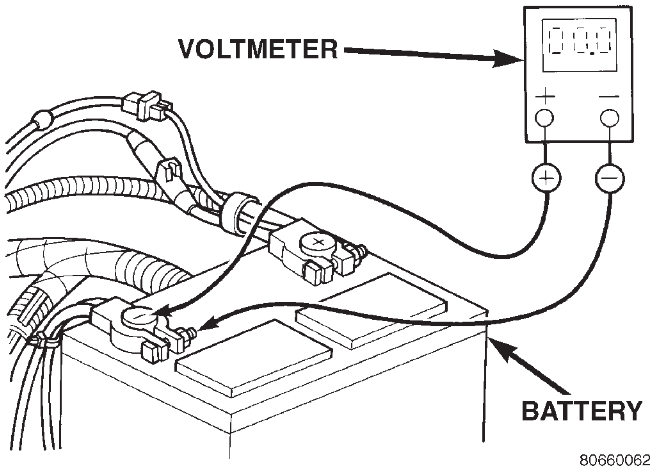


Fig. 10 Test Battery Negative Connection Resistance - Typical

(2) Connect the positive lead of the voltmeter to the battery positive terminal post. Connect the negative lead of the voltmeter to the battery positive cable clamp (Fig. 11). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If voltage is detected, correct the poor contact between the cable clamp and the terminal post.

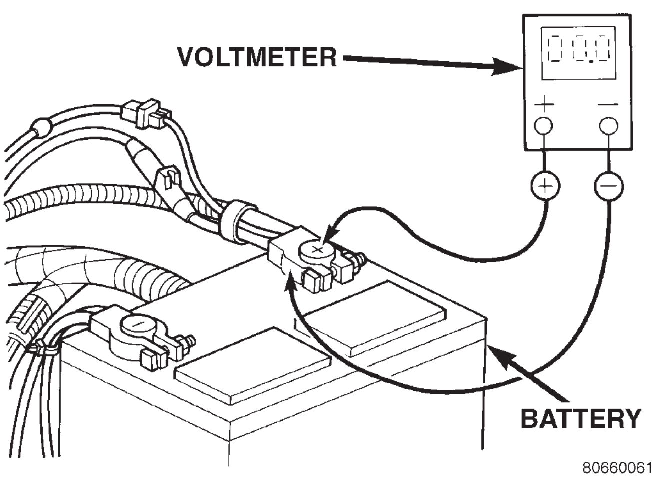


Fig. 11 Test Battery Positive Connection Resistance - Typical

(3) Connect the voltmeter to measure between the battery positive terminal post and the starter solenoid battery terminal stud (Fig. 12). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If the reading is above 0.2 volt, clean and tighten the battery cable connection at the solenoid. Repeat the test. If the reading is still above 0.2 volt, replace the faulty battery positive cable.

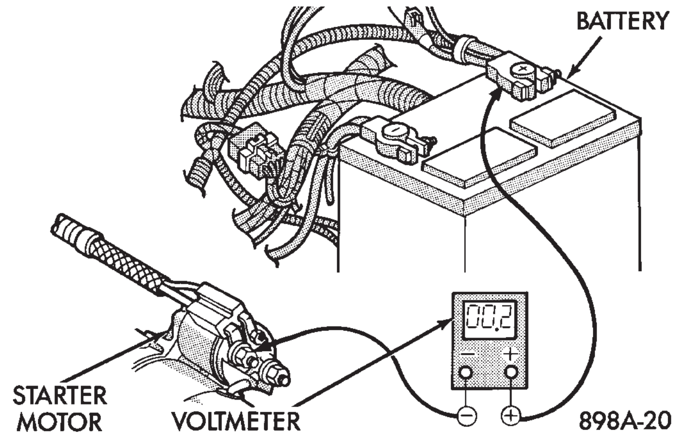


Fig. 12 Test Battery Positive Cable Resistance - Typical

(4) Connect the voltmeter to measure between the battery negative terminal post and a good clean ground on the engine block (Fig. 13). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If the reading is above 0.2 volt, clean and tighten the battery negative cable attachment on the engine block. Repeat the test. If the reading is still above 0.2 volt, replace the faulty battery negative cable.

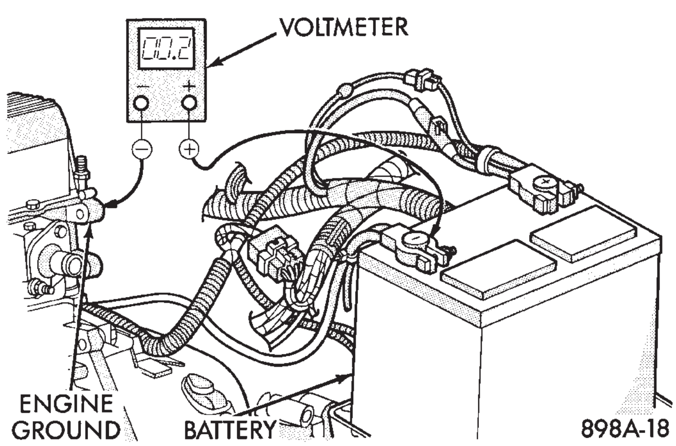


Fig. 13 Test Ground Circuit Resistance - Typical

IGNITION-OFF DRAW TEST

The term Ignition-Off Draw (IOD) identifies a normal condition where power is being drained from the battery with the ignition switch in the Off position. A normal vehicle electrical system will draw from five to thirty milliamperes (0.005 to 0.030 ampere) with the ignition switch in the Off position, and all non-ignition controlled circuits in proper working order. The thirty milliamperes are needed to enable the memory functions for the Powertrain Control Module (PCM), digital clock, electronically tuned radio, and

DIAGNOSIS AND TESTING (Continued)

other electronic modules which may vary with the vehicle equipment.

A vehicle that has not been operated for approximately twenty days, may discharge the battery to an inadequate level. When a vehicle will not be used for twenty days or more (stored), remove the IOD fuse from the junction block. This will reduce battery discharging.

Excessive IOD can be caused by:

- Electrical items left on
- Faulty or improperly adjusted switches
- Faulty or shorted electronic modules and components
- An internally shorted generator
- Intermittent shorts in the wiring.

If the IOD is over thirty milliamperes, the problem must be found and corrected before replacing a battery. In most cases, the battery can be charged and returned to service after the excessive IOD condition has been corrected.

(1) Verify that all electrical accessories are off. Turn off all lamps, remove the ignition key, and close all doors. If the vehicle is equipped with an illuminated entry system or an electronically tuned radio, allow the electronic timer function of these systems to automatically shut off (time out). This may take up to three minutes. If the vehicle is equipped with a 4.7L engine combined with a 45RFE electronic transmission, either remove the transmission fuse from the Power Distribution Center (PDC) or allow the electronic timer function of the Transmission Control Module (TCM) to automatically shut off (time out). This may take up to twenty minutes.

(2) Determine that the under-hood lamp is operating properly, then disconnect the lamp wire harness connector or remove the lamp bulb.

(3) Disconnect the battery negative cable.

(4) Set an electronic digital multi-meter to its highest amperage scale. Connect the multi-meter between the disconnected battery negative cable clamp and the battery negative terminal post. Make sure that the doors remain closed so that the illuminated entry system is not activated. The multi-meter amperage reading may remain high for up to three minutes (twenty minutes with the 45RFE transmission), or may not give any reading at all while set in the highest amperage scale, depending upon the electrical equipment on the vehicle. The multi-meter leads must be securely clamped to the battery negative cable clamp and the battery negative terminal post. If continuity between the battery negative terminal post and the negative cable clamp is lost during any part of the IOD test, the electronic timer function will be activated and all of the tests will have to be repeated.

(5) After about three minutes (twenty minutes with the 45RFE transmission), the high-amperage IOD reading on the multi-meter should become very low or nonexistent, depending upon the electrical equipment on the vehicle. If the amperage reading remains high, remove and replace each fuse or circuit breaker in the Power Distribution Center (PDC) and then in the junction block (refer to **Power Distribution Center** and **Junction Block** in the Component Index of Group 8W - Wiring Diagrams for fuse and circuit breaker identification) one at a time until the amperage reading becomes very low, or nonexistent. This will isolate each circuit and identify the source of the high-amperage IOD. If the amperage reading remains high after removing and replacing each fuse and circuit breaker, disconnect the wire harness from the generator. If the amperage reading now becomes very low or nonexistent, refer to **Charging System** in the Diagnosis and Testing section of Group 8C - Charging System to diagnose the condition. After the high-amperage IOD has been corrected, switch the multi-meter to progressively lower amperage scales and, if necessary, repeat the fuse and circuit breaker remove-and-replace process to identify and correct all sources of excessive IOD. It is now safe to select the lowest milliampere scale of the multi-meter to check the low-amperage IOD.

CAUTION: Do not open any doors, or turn on any electrical accessories with the lowest milliampere scale selected, or the multi-meter may be damaged.

(6) Observe the multi-meter reading. The low-amperage IOD should not exceed thirty milliamperes (0.030 ampere). If the draw exceeds thirty milliamperes, isolate each circuit using the fuse and circuit breaker remove-and-replace process. The multi-meter reading will drop to within the acceptable limit when the source of the excessive draw is disconnected. Repair this circuit as required; whether a wiring short, incorrect switch adjustment, or a component failure is at fault.

SERVICE PROCEDURES

BATTERY CHARGING

A battery is fully-charged when:

- All cells are gassing freely during battery charging.
- A green color is visible in the sight glass of the built-in test indicator.
- Three hydrometer tests, taken at one-hour intervals, indicate no increase in the temperature-corrected specific gravity.
- Open-circuit voltage is 12.4 volts or above.

SERVICE PROCEDURES (Continued)

WARNING:

• IF THE BATTERY SHOWS SIGNS OF FREEZING, LEAKING, LOOSE POSTS, OR LOW ELECTROLYTE LEVEL, DO NOT TEST, ASSIST-BOOST, OR CHARGE. THE BATTERY MAY ARC INTERNALLY AND EXPLODE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.

• EXPLOSIVE HYDROGEN GAS FORMS IN AND AROUND THE BATTERY. DO NOT SMOKE, USE FLAME, OR CREATE SPARKS NEAR THE BATTERY. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.

• THE BATTERY CONTAINS SULFURIC ACID, WHICH IS POISONOUS AND CAUSTIC. AVOID CONTACT WITH THE SKIN, EYES, OR CLOTHING. IN THE EVENT OF CONTACT, FLUSH WITH WATER AND CALL A PHYSICIAN IMMEDIATELY. KEEP OUT OF THE REACH OF CHILDREN.

• IF THE BATTERY IS EQUIPPED WITH REMOVABLE CELL CAPS, BE CERTAIN THAT EACH OF THE CELL CAPS IS IN PLACE AND TIGHT BEFORE THE BATTERY IS RETURNED TO SERVICE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT FROM LOOSE OR MISSING CELL CAPS.

CAUTION:

• Always disconnect and isolate the battery negative cable before charging a battery. Do not exceed sixteen volts while charging a battery. Damage to the vehicle electrical system components may result.

• Battery electrolyte will bubble inside the battery case during normal battery charging. Electrolyte boiling or being discharged from the battery vents indicates a battery overcharging condition. Immediately reduce the charging rate or turn off the charger to evaluate the battery condition. Damage to the battery may result from overcharging.

• The battery should not be hot to the touch. If the battery feels hot to the touch, turn off the charger and let the battery cool before continuing the charging operation. Damage to the battery may result.

Some battery chargers are equipped with polarity-sensing circuitry. This circuitry protects the charger and/or the battery from being damaged if they are 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. See the instructions provided by the manufacturer of the battery charger for details on how to bypass the polarity-sensing circuitry.

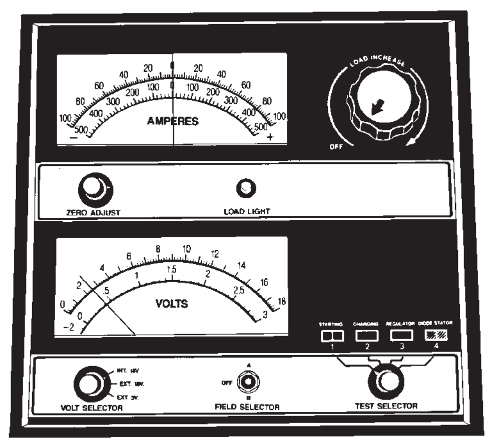
After the battery has been charged to 12.4 volts or greater, perform a load test to determine the battery cranking capacity. Refer to **Load Test** in the Diagnosis and Testing section of this group for the procedures. If the battery will endure a load test, return the battery to use. If the battery will not endure a load test, it is faulty and must be replaced.

Clean and inspect the battery hold downs, tray, terminals, posts, and top before completing service. Refer to **Battery** in the Removal and Installation section of this group for the proper cleaning and inspection procedures.

CHARGING A 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 the voltage at the battery posts with a voltmeter, accurate to 1/10 (0.10) volt (Fig. 14). If the reading is below ten 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 the ammeters built into many battery chargers.



898A-12

Fig. 14 Voltmeter Accurate to 1/10 Volt Connected - Typical

(2) Disconnect and isolate the battery negative cable. Connect the battery charger leads. Some battery chargers are equipped with polarity-sensing circuitry. This circuitry protects the charger and/or the battery from being damaged if they are 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. See the instructions provided by the manufacturer of the battery charger for details on how 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

SERVICE PROCEDURES (Continued)

current at various voltages is shown in the Charge Rate chart. If the charge current is still not measurable at the end of the charging time, the battery is faulty and must be replaced. If the charge current is measurable during the charging time, the battery may be good and the charging should be completed in the normal manner.

Charge Rate	
Voltage	Hours
16.0 volts maximum	up to 4 hours
14.0 to 15.9 volts	up to 8 hours
13.9 volts or less	up to 16 hours

CHARGING TIME REQUIRED

The time required to charge a battery will vary, depending upon the following factors:

- **Battery Capacity** - A completely discharged heavy-duty battery requires twice the charging time of a small capacity battery.
- **Temperature** - A longer time will be needed to charge a battery at -18° C (0° F) than at 27° C (80° F). When a fast charger is connected to a cold battery, the current accepted by the battery will be very low at first. As the battery warms, it will accept a higher charging current rate (amperage).
- **Charger Capacity** - A battery charger that supplies only five amperes will require a longer charging time. A battery charger that supplies twenty amperes or more will require a shorter charging time.
- **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.

WARNING: NEVER EXCEED TWENTY AMPERES WHEN CHARGING A COLD (-1° C or 30° F) BATTERY. THE BATTERY MAY ARC INTERNALLY AND EXPLODE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.

Battery Charging Timetable			
Charging Amperage	5 Amperes	10 Amperes	20 Amperes
Open Circuit Voltage	Hours Charging at 21° C (70° F)		
12.25 to 12.49	6 hours	3 hours	1.5 hours
12.00 to 12.24	10 hours	5 hours	2.5 hours
10.00 to 11.99	14 hours	7 hours	3.5 hours
*Below 10.00	18 hours	9 hours	4.5 hours
*Refer to Charging A Completely Discharged Battery			

REMOVAL AND INSTALLATION

BATTERY

REMOVAL

(1) Turn the ignition switch to the Off position. Be certain that all electrical accessories are turned off.

(2) Loosen the battery cable terminal clamp nuts and disconnect both battery cables, negative cable first. If necessary, use a puller to remove the terminal clamps from the battery posts (Fig. 15).

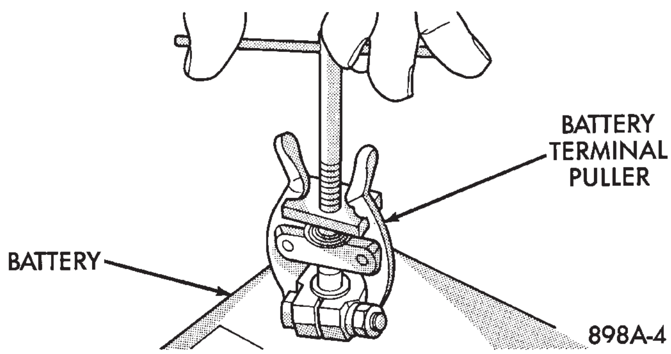


Fig. 15 Remove Battery Cable Terminal Clamp - Typical

(3) Inspect the battery cable terminal clamps for corrosion and damage. Remove any corrosion using a wire brush or a post and terminal cleaning tool, and a sodium bicarbonate (baking soda) and warm water cleaning solution (Fig. 16). Replace any battery cable that has damaged or deformed terminal clamps.

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 the battery hold down bracket screw (Fig. 17) and remove the bracket from the battery support.

(5) Remove the battery and thermoguard unit from the battery support.

REMOVAL AND INSTALLATION (Continued)

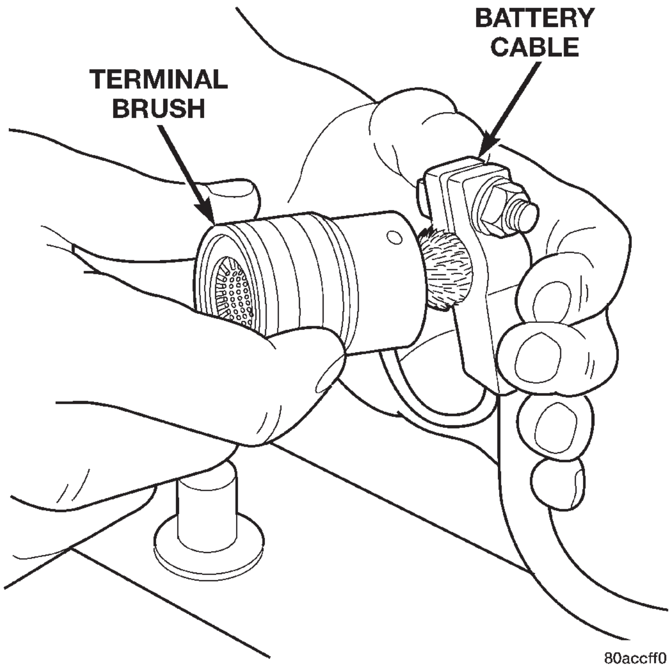


Fig. 16 Clean Battery Cable Terminal Clamp - Typical

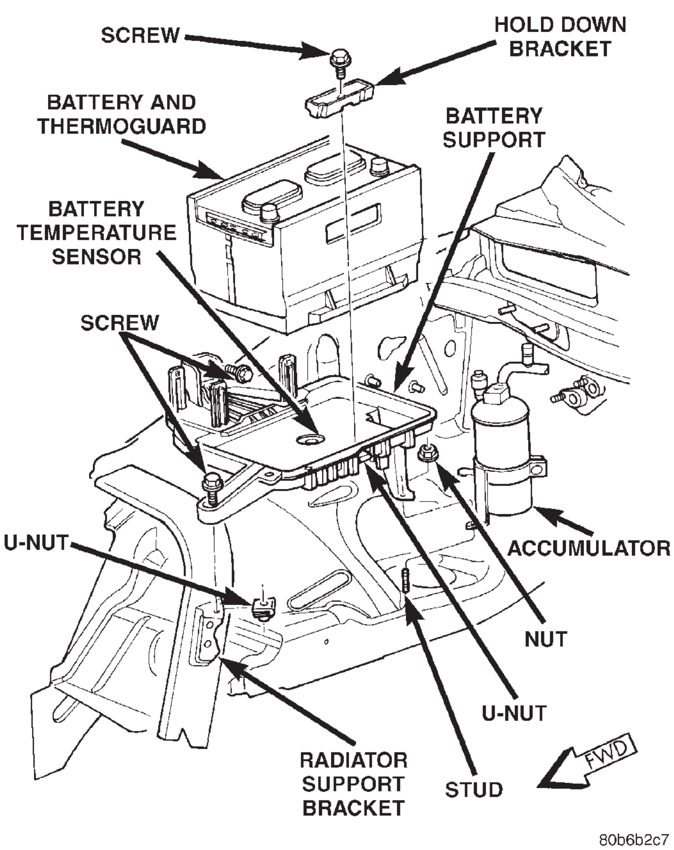


Fig. 17 Battery Remove/Install

(6) Inspect the battery support and the hold down bracket for damage. Clean the battery support and the hold down bracket with a sodium bicarbonate (baking soda) and warm water cleaning solution to remove any acid film. Replace any damaged parts.

(7) Release the latch on each end of the battery thermoguard (Fig. 18) and remove the thermoguard from the battery.

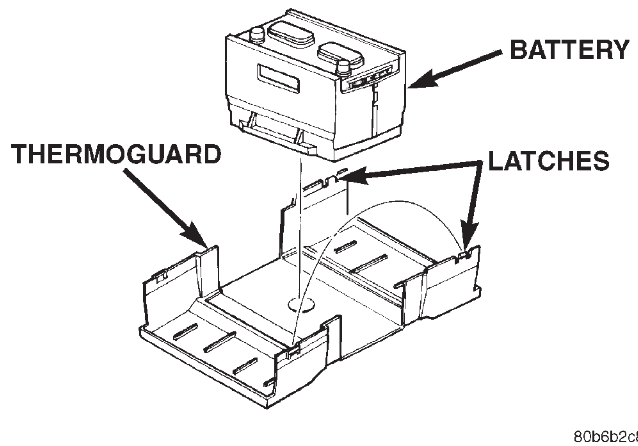


Fig. 18 Battery Thermoguard Remove/Install

(8) Inspect the battery thermoguard for damage. Clean the thermoguard using a sodium bicarbonate (baking soda) and warm water cleaning solution to remove any acid film. Replace any damaged parts.

(9) Inspect the battery case for cracks or other damage that could result in electrolyte leaks. Also, check the battery terminal posts for looseness. Batteries with damaged cases or loose posts must be replaced.

(10) Check the electrolyte level in the battery. Use a putty knife or another suitable wide flat-bladed tool to pry the cell caps off (Fig. 19). Do not use a screwdriver. Add distilled water to each cell until the liquid reaches the bottom of the vent well. **DO NOT OVERFILL.**

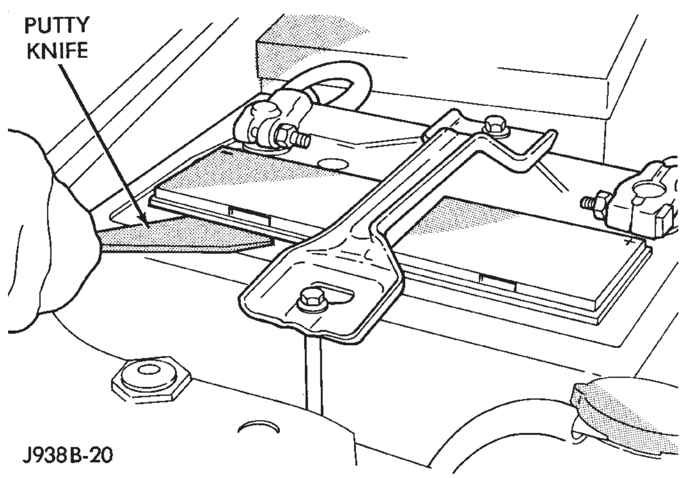


Fig. 19 Removing Battery Cell Caps - Typical

REMOVAL AND INSTALLATION (Continued)

(11) Inspect the battery built-in test indicator sight glass for an indication of the battery condition. If the battery is discharged, charge as required. Refer to **Built-In Test Indicator** in the Diagnosis and Testing section of this group for more information. Also refer to **Battery Charging** in the Service Procedures section of this group for more information.

(12) If the battery is to be reinstalled, clean the outside of the battery case and the top cover with a sodium bicarbonate (baking soda) and warm water cleaning solution to remove any acid film (Fig. 20). Rinse the battery with clean water. Ensure that the cleaning solution does not enter the battery cells through the vent holes. If the battery is being replaced, refer to **Battery Ratings and Classifications** in the Specifications section of this group. Confirm that the replacement battery is the correct size and has the correct ratings for the vehicle.

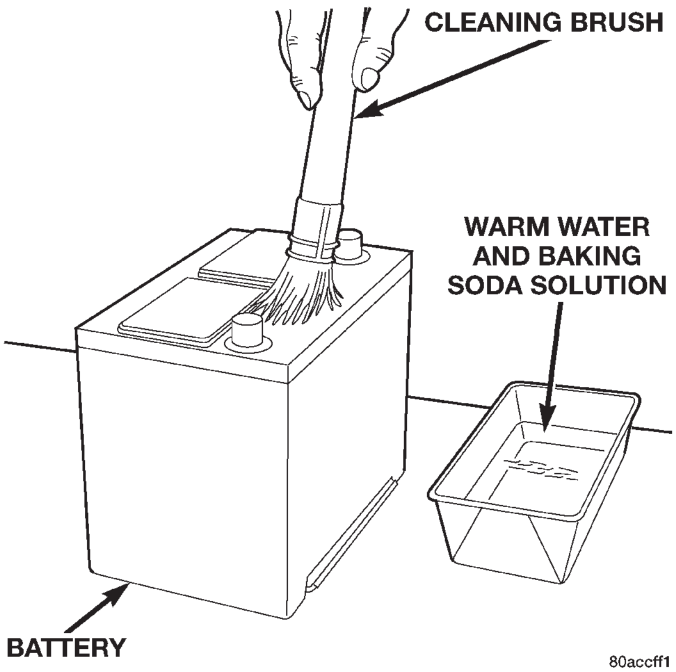


Fig. 20 Clean Battery - Typical

(13) Clean any corrosion from the battery terminal posts with a wire brush or a post and terminal cleaner, and a sodium bicarbonate (baking soda) and warm water cleaning solution (Fig. 21).

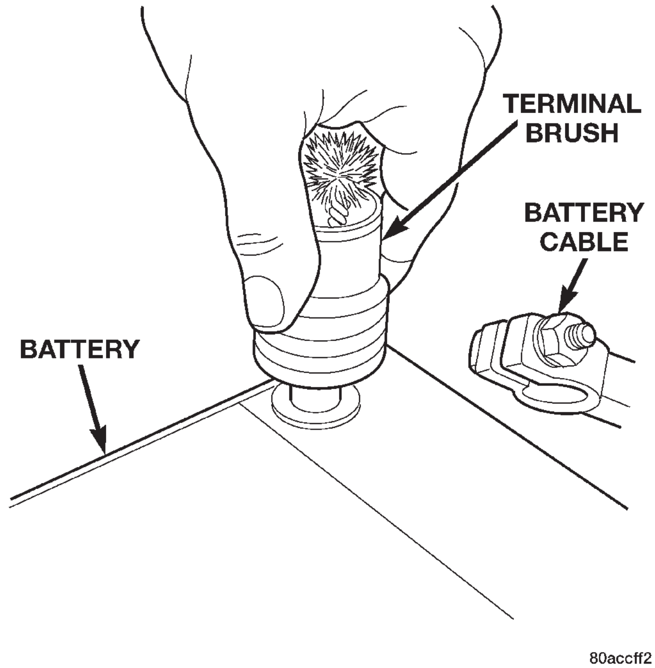


Fig. 21 Clean Battery Terminal Post - Typical

INSTALLATION

(1) Install the thermoguard over the battery case. Be certain that the latch on each end of the thermoguard is fully engaged.

(2) Position the battery and thermoguard unit in the battery support. Ensure that the positive and negative terminal posts are correctly positioned. The cable terminal clamps must reach the correct battery terminal post without stretching the cables (Fig. 22) or (Fig. 23).

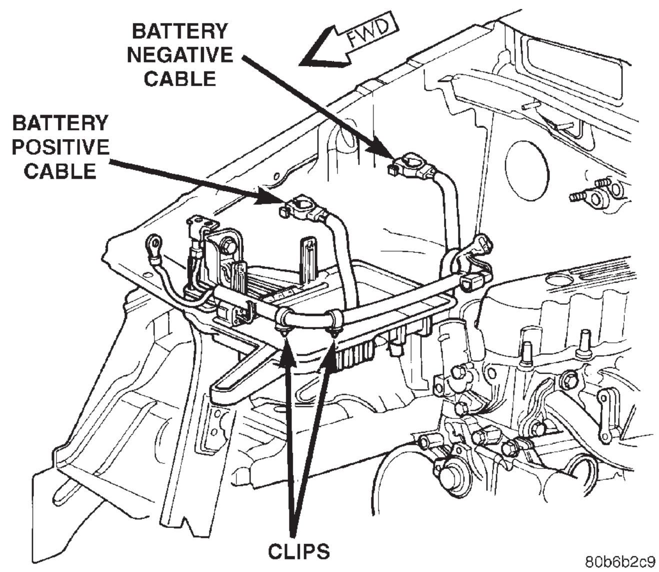


Fig. 22 Battery Cables - 4.0L Engine

(3) Be certain that the ledge on the outboard side of the battery case is engaged under the lip on the outboard side of the battery support, then loosely install the battery hold down bracket and screw. Be certain that the ledge on the bottom of the hold down bracket is oriented towards the inboard side of the battery case. Proper hold down bracket orientation can also be determined by noting the direction of the arrow-like formations of the molded reinforcing ribs on the top of the hold down bracket. These arrows should be pointed towards the battery.

REMOVAL AND INSTALLATION (Continued)

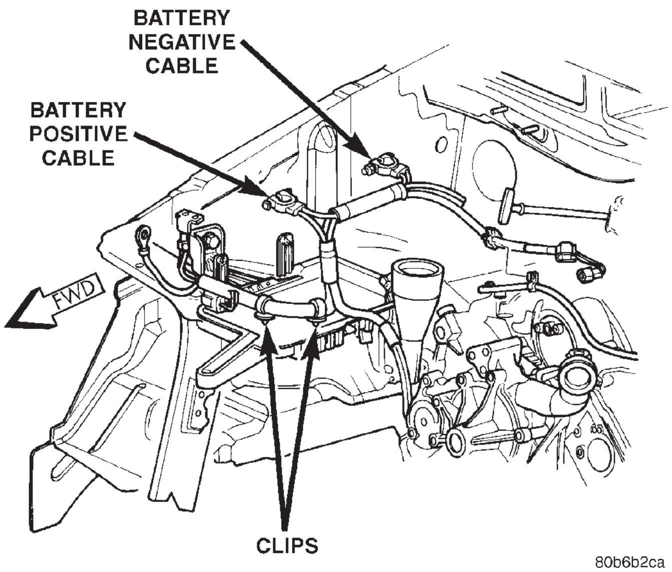


Fig. 23 Battery Cables - 4.7L Engine

(4) Once it is certain that the battery and the hold down bracket are properly positioned, tighten the hold down bracket screw to 3.3 N·m (30 in. lbs.). Improper hold down fastener tightness, whether too loose or too tight, can result in damage to the battery, the hold down bracket, and/or the battery support.

CAUTION: Be certain that the battery cables are connected to the correct battery terminals. Reverse polarity may damage electrical components.

(5) Connect and tighten the battery positive cable terminal clamp. Then connect and tighten the battery negative cable terminal clamp. Tighten both battery cable terminal clamp nuts to 8.5 N·m (75 in. lbs.).

(6) Apply a thin coating of petroleum jelly or chassis grease to the exposed surfaces of the battery cable terminal clamps and battery terminal posts.

SPECIFICATIONS

BATTERY

Battery Classifications and Ratings					
Part Number	BCI Group Size Classification	Cold Cranking Amperage	Reserve Capacity	Ampere-Hours	Load Test Amperage
56041113	65	625	120 Minutes	69	300

BATTERY

CONTENTS

GENERAL INFORMATION

INTRODUCTION

The battery stores, stabilizes, and delivers electrical current to operate various electrical systems in the vehicle (Fig. 1). The determination of whether a battery is good or bad is made by its ability to accept a charge. It also must supply high-amperage current for a long enough period to be able to start the vehicle. The capability of the battery to store electrical current comes from a chemical reaction. This reaction takes place between the sulfuric acid solution (electrolyte) and the lead +/- plates in each cell of the battery. As the battery discharges, the plates react with the acid from the electrolyte. When the charging system charges the battery, the water is converted to sulfuric acid in the battery. The concentration of acid in the electrolyte is measured as specific gravity using a hydrometer. The specific gravity indicates the battery's state-of-charge.

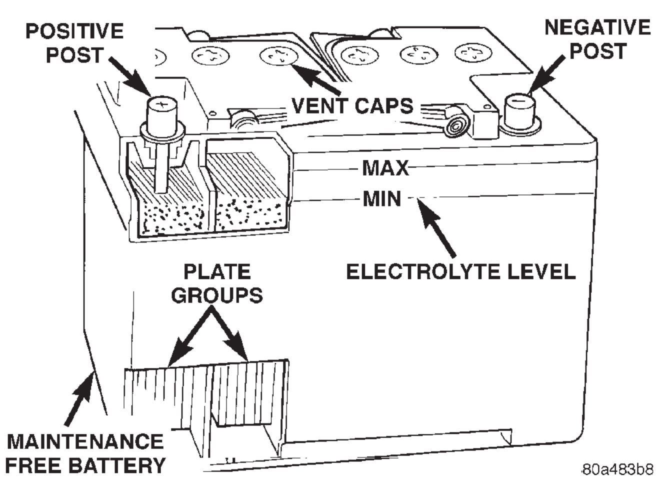


Fig. 1 Battery Construction

The battery is vented to release gases that are created when the battery is being charged and discharged.

The battery top, posts, and terminals should be cleaned when other under hood maintenance is performed.

The battery top, posts, cable clamps must be cleaned and battery must be completely charged before diagnostic procedures are performed.

SAFETY PRECAUTIONS AND WARNINGS

WARNING:

DO NOT ALLOW JUMPER CABLE CLAMPS TO TOUCH EACH OTHER WHEN CONNECTED TO A BOOSTER SOURCE.

DO NOT USE OPEN FLAME NEAR BATTERY.

REMOVE METALLIC JEWELRY WORN ON HANDS OR WRISTS TO AVOID INJURY BY ACCIDENTAL ARCING OF BATTERY CURRENT.

WHEN USING A HIGH OUTPUT BOOSTING DEVICE, DO NOT ALLOW THE DISABLED VEHICLE'S BATTERY TO EXCEED 16 VOLTS. PERSONAL INJURY OR DAMAGE TO ELECTRICAL SYSTEM CAN RESULT.

TO PROTECT THE HANDS FROM BATTERY ACID, A SUITABLE PAIR OF HEAVY DUTY RUBBER GLOVES, NOT THE HOUSEHOLD TYPE, SHOULD BE WORN WHEN REMOVING OR SERVICING A BATTERY. SAFETY GLASSES ALSO SHOULD BE WORN.

DESCRIPTION AND OPERATION

BATTERY IGNITION OFF DRAW (IOD)

A completely normal vehicle will have a small amount of current drain on the battery with the key out of the ignition. It can range from 5 to 25 milliamperes after all the modules time out. If a vehicle will not be operated for approximately a 20 days, the IOD fuse should be pulled to eliminate the vehicle electrical drain on the battery. The IOD fuse is located in the Power Distribution Center (PDC). Refer to the PDC cover for proper fuse.

CHARGING TIME REQUIRED

WARNING: NEVER EXCEED 20 AMPS WHEN CHARGING A BATTERY WITH A TEMPERATURE LESS THAN -1°C (30°F) . PERSONAL INJURY MAY RESULT.

The time required to charge a battery will vary depending upon the following factors.

SIZE OF BATTERY

A completely discharged large heavy-duty battery may require more recharging time than a completely discharged small capacity battery, refer to chart below for charging times.

OPEN CIRCUIT VOLTAGE	CHARGING AMPERAGE AT 70°F (21°C) *		
	5 AMPS	10 AMPS	20 AMPS
12.25 TO 12.49	6.0 HOURS	3.0 HOURS	1.5 HOURS
12.00 TO 12.24	10.0 HOURS	5.0 HOURS	2.5 HOURS
10.00 TO 11.99	14.0 HOURS	7.0 HOURS	3.5 HOURS
BELOW 10.00 (Refer to ″Charging A Completely Discharged Battery″)	18.0 HOURS	9.0 HOURS	4.5 HOURS
* Charging voltage not to exceed 16.0 volts			

TEMPERATURE

A longer time will be needed to charge a battery at -18°C (0°F) than at 27°C (80°F). When a fast charger is connected to a cold battery, current accepted by battery will be very low at first. In time, the battery will accept a higher rate as battery temperature warms.

CHARGER CAPACITY

A charger which can supply only five amperes will require a much longer period of charging than a charger that can supply 20 amperes or more.

STATE OF CHARGE

A completely discharged battery requires more charging time than a partially charged battery. Electrolyte is nearly pure water in a completely discharged battery. At first, the charging current amperage will be low. As water is converted back to sulfuric acid inside the battery, the current amp rate will rise. Also, the specific gravity of the electrolyte will rise. The electrolyte should be tested with a Hydrometer to check the specific gravity.

USING HYDROMETER

Before performing a hydrometer test, remove the battery caps and check the electrolyte level. Add distilled water as required. If any of the cells required distilled water, replace the battery caps and either charge the battery for one hour or remove the battery from the vehicle and rock the battery side to side 10 time at a 45° angle. The charging or the mechanical movement mixes the distilled water and electrolyte to produce an accurate hydrometer reading.

NOTE: Periodically disassemble the hydrometer and wash components with soap and water. Inspect the float for possible leaks. If the paper inside has turned brown, the float is defective.

Before testing, visually inspect the battery for any damage:
- Cracked container or cover
- Loose post
- Corrosion

and any other abnormality that would cause the battery to be unserviceable. To interpret the hydrometer correctly, hold it with the top surface of the electrolyte in the hydrometer at eye level.

DESCRIPTION AND OPERATION (Continued)

Disregard the curvature of the liquid where the surface rises against the float because of surface cohesion (Fig. 2). Remove only enough electrolyte from the battery to keep the float off the bottom of the hydrometer barrel with pressure on the bulb released. Keep the hydrometer in a vertical position while drawing the electrolyte into the hydrometer and observing the specific gravity. Exercise care when inserting the tip of the hydrometer into a cell to avoid damage to the separators. Damaged separators can cause premature battery failure.

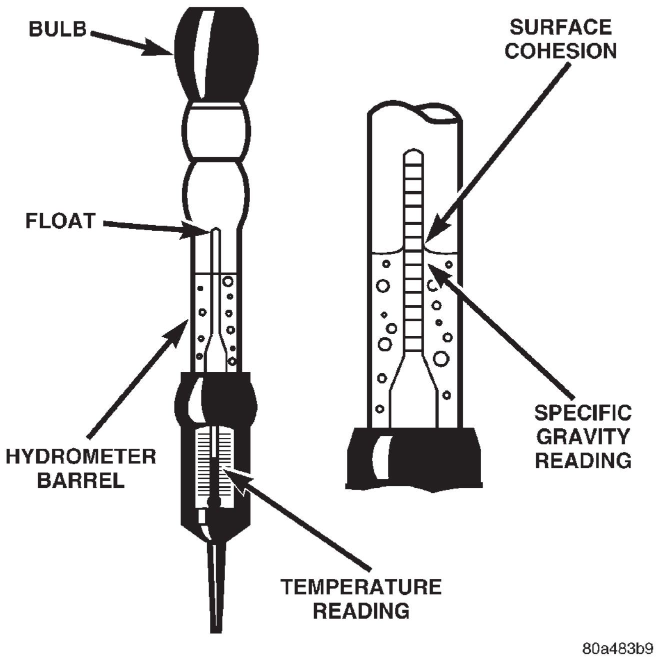


Fig. 2 Battery Hydrometer

Hydrometer floats are generally calibrated to indicate the specific gravity correctly only at one fixed temperature, 20°C (68°F). When testing the specific gravity at any other temperature, a correction factor is required, otherwise specific gravity readings will not indicate the true state of charge.

The correction factor is approximately a specific gravity value of 0.004, referred to as 4 points of specific gravity for every 5.5°C (10°F). If electrolyte temperature is below 20°C (68°F) you subtract. If the temperature is above 20°C (68°F) you add to the hydrometer reading. Always correct the specific gravity for temperature variation. Test the specific gravity of the electrolyte in each battery cell. Refer to the information with the Hydrometer.

Example 1:

- Hydrometer reading: 1.260
- Electrolyte temperature: -7°C (20°F)
- Subtract specific gravity: -0.019
- Correction specific gravity: 1.241

Example 2:

- Hydrometer reading: 1.225
- Electrolyte temperature: +38°C (100°F)
- Add specific gravity: +0.013
- Correction specific gravity: 1.238

A fully charged relatively new battery has a specific gravity reading of 1.285 plus 0.015 or minus 0.010.

If the specific gravity of all cells is above 1.235, but variation between cells is more than 50 points (0.050), it is an indication that the battery is unserviceable.

If the specific gravity of one or more cells is less than 1.235, recharge the battery at a rate of approximately 5 amperes. Continue charging until three consecutive specific gravity tests, taken at one-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 variation between cells is less than 50 points (0.050), the battery may be tested under heavy load.

DIAGNOSIS AND TESTING

BATTERY DISCHARGING

CAUSE OF BATTERY DISCHARGING

It is normal to have a small 5 to 25 milliamperes continuous electrical draw from the battery. This draw will take place with the ignition in the OFF position, and the courtesy, dome, storage compartments, and engine compartment lights OFF. The continuous draw is due to various electronic features or accessories that require electrical current with the ignition OFF to function properly. When a vehicle is not used over an extended period of approximately 20 days the IOD fuse should be disconnected. The fuse is located in the power distribution center. Disconnection of this fuse will reduce the level of battery discharge. Refer to Battery Diagnosis and Testing Chart and to the proper procedures.

DIAGNOSIS AND TESTING (Continued)

BATTERY DIAGNOSIS AND TESTING		
STEPS	POSSIBLE CAUSE	CORRECTION
VISUAL INSPECTION Check for possible damage to battery and clean battery.	(1) Corroded post(s) or terminal(s) (2) Loose terminal(s) (3) Loose battery post, Cracked battery cover or case, Leaks or Any other physical defects (4) Battery OK.	(1) Clean post(s) or terminal(s) (2) Clean and tighten (3) Replace Battery (4) Check state of charge. Refer to Hydrometer Test
PERFORM BATTERY HYDROMETER TEST	(1) 1.285 (2) 1.235 (3) A variation between cells of 0.050 or greater	(1) Battery is charged. Perform Battery 0pen Circuit Voltage Test (2) Perform Battery Charging procedure. (3) Replace Battery.
BATTERY OPEN CIRCUIT VOLTAGE TEST	(1) Battery is above 12.49 Volts (2) Battery is below 12.49 Volts.	(1) Perform the Battery Load Test. (2) Perform Battery Charging procedure.
BATTERY CHARGING	(1) Battery accepted Charge. (2) Battery will not accept charge	(1) Pass Hydrometer Test and perform Battery 0pen Circuit Voltage Test (2) Perform Charging a Completely Discharged Battery.
BATTERY LOAD TEST	(1) Acceptable minimum voltage. (2) Unacceptable minimum voltage	(1) Battery is OK to put in use, perform Battery Ignition Off Draw Test. (2) Replace Battery and perform Battery Ignition Off Draw Test.
CHARGING A COMPLETELY DISCHARGED BATTERY	(1) Battery accepted charge. (2) Battery will not accept charge.	(1) Pass Hyrometer Test and perform Battery 0pen Circuit Voltage Test. (2) Replace Battery.
IGNITION OFF DRAW TEST	(1) IOD is 5-25 Milliamperes. (2) IOD Exceeds 25 Milliamperes.	(1) Vehicle is normal. (2) Eliminate excess IOD draw.

ABNORMAL BATTERY DISCHARGING

- Corroded battery posts, cables or terminals.
- Loose or worn generator drive belt.
- Electrical loads that exceed the output of the charging system due to equipment or accessories installed after delivery.
- Slow driving speeds in heavy traffic conditions or prolonged idling with high-amperage electrical systems in use.
- Defective electrical circuit or component causing excess Ignition Off Draw (IOD). Refer to Battery Ignition Off Draw (IOD).
- Defective charging system.
- Defective battery.

BATTERY IGNITION OFF DRAW

High current draw on the battery with the ignition OFF will discharge a battery. After a dead battery is serviced the vehicle Ignition Off Draw (IOD) should be checked. Determine if a high current draw condition exists first check the vehicle with a test lamp.

(1) Verify that all electrical accessories are OFF.

- Remove key from ignition switch
- Turn off all lights
- Liftgate and glove box door is closed
- Sun visor vanity lights are OFF
- All doors are closed
- Allow the Illuminated Entry System to time out in approximately 30 seconds, if equipped.

(2) Disconnect battery negative cable (Fig. 3).

CAUTION: Always disconnect the meter before opening a door.

(3) Using an multimeter, that has least a milliampere range of 200 mA. Set meter to the highest mA range. Install meter between the battery negative cable and battery negative post. Carefully remove the

DIAGNOSIS AND TESTING (Continued)

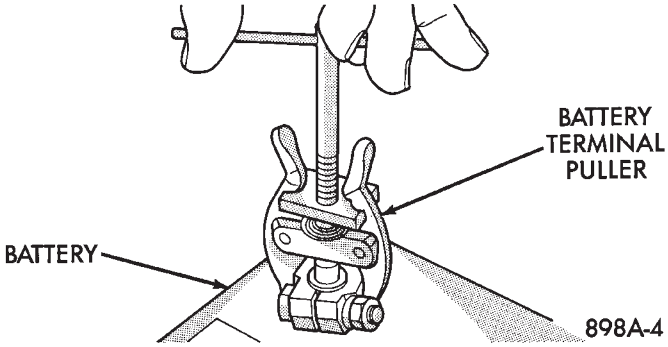


Fig. 3 Disconnect Battery Negative Cable

test lamp without disconnecting the meter. After all modules time-out the total vehicle IOD should be less than 25 milliamperes. If ignition off draw is more than 25 milliamperes go to Step 4.

(4) Each time the test lamp or milliampere meter is disconnected and connected, all electronic timer functions will be activated for approximately one minute. The Body Control Module (BCM) ignition off draw can reach 90 milliamperes.

(5) Remove the PDC fuses:

- Interior lamps
- Brake lamp
- IOD

(6) If there is any reading, with fuses removed there is a short circuit in the wiring. Refer to Group 8W, wiring diagrams. If reading is less than 25 mA go to Step 8.

(7) Install all fuses. After installing fuse, the current can reach 90 mA. After time-out the reading should not exceed 25 mA. If OK go to. If not, disconnect:

- Radio
- Body Control Module
- Remote Keyless Entry Module

(8) Disconnect one component at time, to see if any component is at fault. If the high reading is not eliminated there is a short circuit in the wiring. Refer to Group 8W, wiring diagrams.

(9) Remove interior and brake lamp fuses. Install the fuses. The milliampere reading should be 2-4 mA. If reading is higher than 4 mA:

(a) Disconnect PCM.

(b) If reading is OK, replace PCM.

(c) If reading does not change there is a short circuit to the PCM. Refer to Group 8W, Wiring Diagrams.

BATTERY LOAD TEST

A fully charged battery must have cranking capacity, to provide the starter motor and ignition system enough power to start the engine over a broad range of ambient temperatures. A battery load test will verify the actual cranking capability of the battery.

WARNING: IF BATTERY SHOWS SIGNS OF FREEZING, LEAKING, LOOSE POSTS, OR EXCESSIVELY LOW ELECTROLYTE LEVEL, DO NOT TEST. ACID BURNS OR AN EXPLOSIVE CONDITION MAY RESULT.

(1) Remove both battery cables, negative cable first. The battery top, cables and posts should be clean. Test battery with a hydrometer. If battery charge is low the charge battery. Refer to Battery Charging Procedures.

(2) Connect a Volt/Ammeter/Load tester to the battery posts (Fig. 4). Rotate the load control knob of the Carbon pile rheostat to apply a 300 amp load. Apply this load for 15 seconds to remove the surface charge from the battery, and return the control knob to off (Fig. 5).

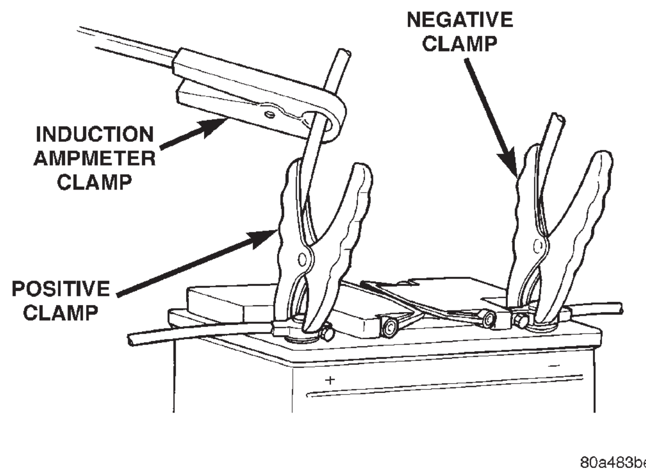


Fig. 4 Volt-Ammeter Load Tester Connections

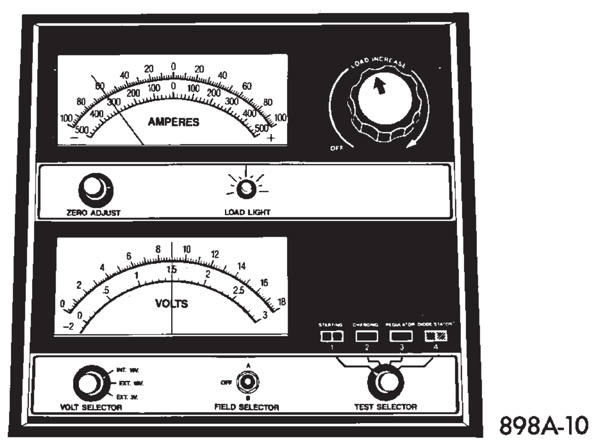


Fig. 5 Remove Surface Charge From Battery

(3) Allow the battery to stabilize for 2 minutes, and then verify open circuit voltage.

(4) Rotate the load control knob on the tester to maintain 50% of the battery cold crank rating for 15 seconds (Fig. 6). Record the loaded voltage reading

DIAGNOSIS AND TESTING (Continued)

and return the load control to off. Refer to the Battery Specifications at the rear of this Group.

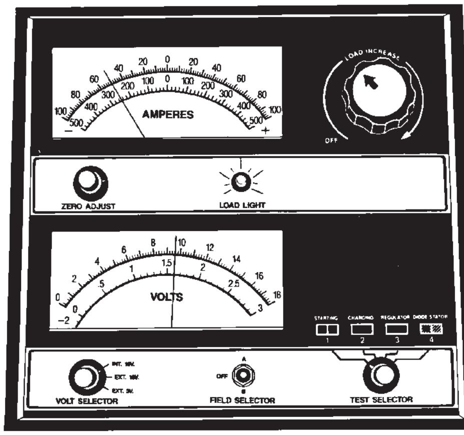


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Fig. 6 Load 50% Cold Crank Rating

(5) Voltage drop will vary according to battery temperature at the time of the load test. Battery temperature can be estimated by the temperature of exposure over the preceding several hours. If the battery has been charged or boosted a few minutes prior to the test, the battery would be slightly warmer. Refer to Load Test Voltage Chart for proper loaded voltage reading.

Load Test Temperature		
Minimum Voltage	Temperature	
	°F	°C
9.6 volts	70° and above	21° and above
9.5 volts	60°	16°
9.4 volts	50°	10°
9.3 volts	40°	4°
9.1 volts	30°	-1°
8.9 volts	20°	-7°
8.7 volts	10°	-12°
8.5 volts	0°	-18°

(6) If battery passes load test, it is in good condition and further tests are not necessary. If it fails load test, it should be replaced.

BATTERY OPEN CIRCUIT VOLTAGE TEST

An open circuit voltage no load test shows the state of charge of a battery and whether it is ready for a load test at 50 percent of the battery's cold crank rating. Refer to Battery Load Test. If a battery has open circuit voltage reading of 12.4 volts or greater, and will not pass the load test, replace the battery because it is defective. To test open circuit voltage, perform the following operation.

(1) Remove both battery cables, negative cable first. Battery top, cables and posts should be clean. If green dot is not visible in indicator, charge the battery. Refer to Battery Charging Procedures.

(2) Connect a Volt/Ammeter/Load tester to the battery posts (Fig. 4). Rotate the load control knob of the Carbon pile rheostat to apply a 300 amp load. Apply this load for 15 seconds to remove the surface charge from the battery, and return the control knob to off (Fig. 5).

(3) Allow the battery to stabilize for 2 minutes, and then verify the open circuit voltage (Fig. 7).

(4) This voltage reading will approximate the state of charge of the battery. It will not reveal battery cranking capacity (Fig. 8).

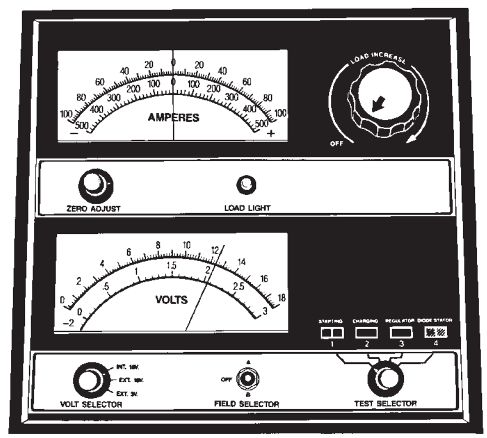

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Fig. 7 Testing Open Circuit Voltage

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%

928A-3

Fig. 8 Battery Open Circuit Voltage

SERVICE PROCEDURES

BATTERY CHARGING

WARNING: DO NOT CHARGE A BATTERY THAT HAS EXCESSIVELY LOW ELECTROLYTE LEVEL. BATTERY MAY SPARK INTERNALLY AND EXPLODE. EXPLOSIVE GASES FORM OVER THE BATTERY. DO NOT SMOKE, USE FLAME, OR CREATE SPARKS NEAR BATTERY. DO NOT ASSIST BOOST OR CHARGE A FROZEN BATTERY. BATTERY CASING MAY FRACTURE. BATTERY ACID IS POISON, AND MAY CAUSE SEVERE BURNS. BATTERIES CONTAIN SULFURIC ACID. AVOID CONTACT WITH SKIN, EYES, OR CLOTHING. IN THE EVENT OF CONTACT, FLUSH WITH WATER AND CALL PHYSICIAN IMMEDIATELY. KEEP OUT OF REACH OF CHILDREN.

CAUTION: Disconnect the battery NEGATIVE cable first (Fig. 3) before charging battery to avoid damage to electrical systems. Do not exceed 16.0 volts while charging battery. Refer to the instructions supplied with charging equipment

A battery is considered fully charged when it will meet all the following requirements.

- It has an open circuit voltage charge of at least 12.4 volts (Fig. 8).
- It passes the 15 second load test, refer to the Load Test Temperature chart.
- The specific gravity reading is 1.285 plus 0.015 or minus 0.010.

Battery electrolyte will bubble inside of battery case while being charged properly. If the electrolyte boils violently, or is discharged from the vent holes while charging, immediately reduce charging rate or turn off charger. Evaluate battery condition. Battery damage may occur if charging is excessive.

Some battery chargers are equipped with polarity sensing devices to protect the charger or battery from being damaged if improperly connected. If the battery state of charge is too low for the polarity sensor to detect, the sensor must be bypassed for charger to operate. Refer to operating instructions provided with battery charger being used.

CAUTION: Do not overcharge Battery.

Test the battery until the specific gravity reading is 1.285 plus 0.015 or minus 0.010.

After the battery has been charged to 12.4 volts or greater, perform a load test to determine cranking capacity. Refer to Battery Load Test in this Group. If the battery passes the load test, return the battery to use. If battery will not endure a load test, it must be replaced. Properly clean and inspect battery hold downs, tray, terminals, cables, posts, and top before completing service.

CHARGING COMPLETELY DISCHARGED BATTERY

The following procedure should be used to recharge a completely discharged battery. Unless procedure is properly followed, a good battery may be needlessly replaced.

OPEN CIRCUIT VOLTAGE	CHARGING AMPERAGE AT 70° F (21° C) *		
	5 AMPS	10 AMPS	20 AMPS
12.25 TO 12.49	6.0 HOURS	3.0 HOURS	1.5 HOURS
12.00 TO 12.24	10.0 HOURS	5.0 HOURS	2.5 HOURS
10.00 TO 11.99	14.0 HOURS	7.0 HOURS	3.5 HOURS
BELOW 10.00 (Refer to ″Charging A Completely Discharged Battery″)	18.0 HOURS	9.0 HOURS	4.5 HOURS
* Charging voltage not to exceed 16.0 volts			

SERVICE PROCEDURES (Continued)

(1) Measure the voltage at battery posts with a voltmeter accurate to 1/10 volt (Fig. 9). If below 10 volts, charge current will be low, and it could take some time before it accepts a current in excess of a few milliamperes. Such low current may not be detectable on amp meters built into many chargers.

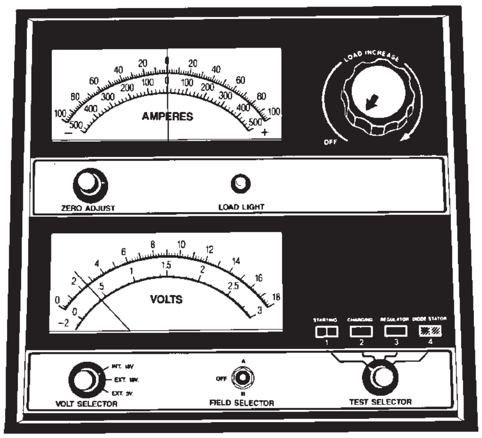

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Fig. 9 Voltmeter Accurate to 1/10 Volt (Connected)

(2) Connect charger leads. Some chargers feature polarity protection circuitry that prevents operation unless charger is connected to battery posts correctly. A completely discharged battery may not have enough voltage to activate this circuitry. This may happen even though the leads are connected properly.

(3) Battery chargers vary in the amount of voltage and current they provide. For the time required for the battery to accept measurable charger current at various voltages, refer to the battery charging time chart in this group. If charge current is still not measurable after 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.

CHECKING ELECTROLYTE LEVEL

The following procedure can be used to check the electrolyte level in the battery.

(1) Remove the battery caps (Fig. 10).

(2) Look through the battery cap holes to determine the level of the electrolyte in the battery. The electrolyte should be approximately 1 centimeter above the battery plates or until the hook inside the battery cap holes is covered. (Fig. 11).

(3) Add only distilled water or water without minerals to proper levels.

VISUAL INSPECTION

CAUTION: Do not allow baking soda solution to enter vent holes, as damage to battery can result.

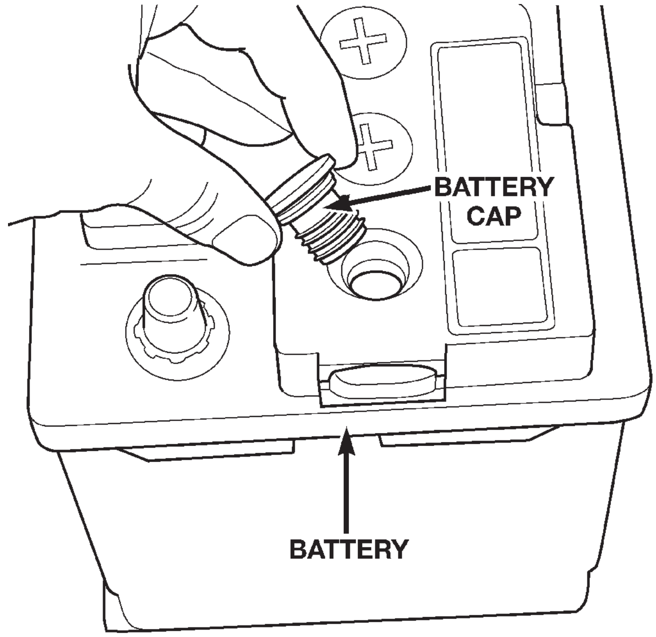

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Fig. 10 Battery Caps

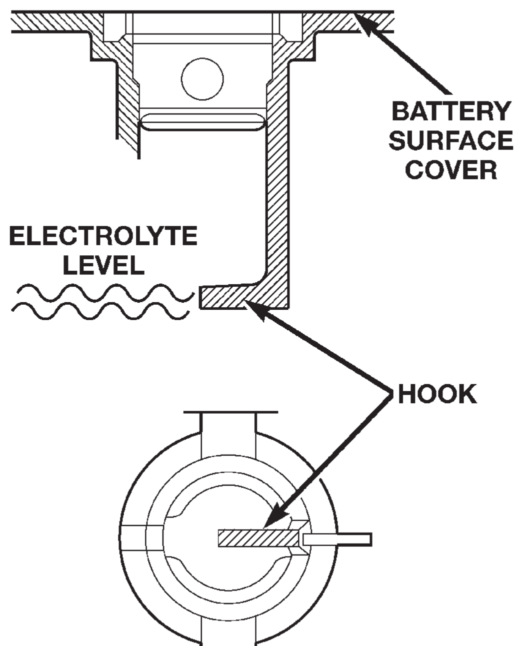

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Fig. 11 Hook Inside Battery Cap Holes

(1) Clean top of battery with a solution of warm water and baking soda.

(2) Apply soda solution with a bristle brush and allow to soak until acid deposits loosen (Fig. 12).

(3) Rinse soda solution from battery with clear water and blot battery dry with paper toweling. Dispose of toweling in a safe manner. Refer to the WARNINGS on top of battery.

SERVICE PROCEDURES (Continued)

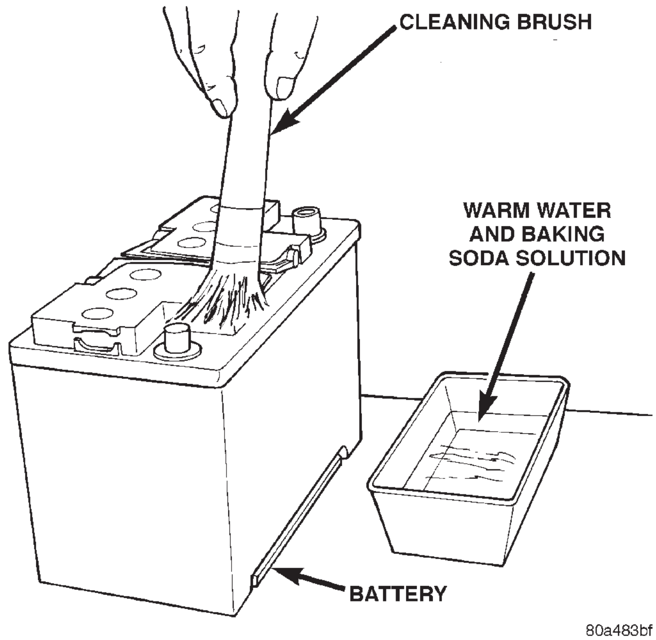


Fig. 12 Cleaning Battery

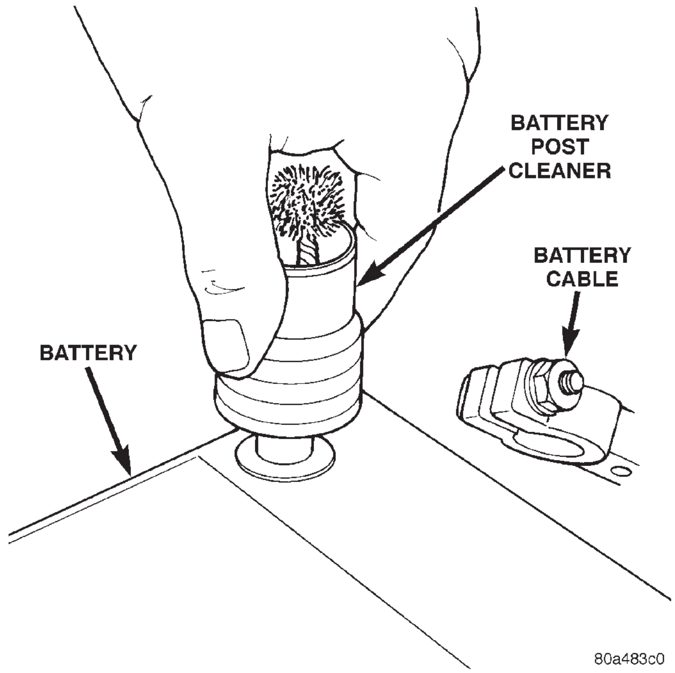


Fig. 13 Cleaning Battery Post

(4) Inspect battery case and cover for cracks, leakage or damaged hold down ledge. If battery is damaged replace it.

(5) Inspect battery tray for damage caused by acid from battery. If acid is present, clean area with baking soda solution.

(6) Clean battery posts with a battery post cleaning tool (Fig. 13).

(7) Clean battery cable clamps with a battery terminal cleaning tool (Fig. 14). Replace cables that are frayed or have broken clamps.

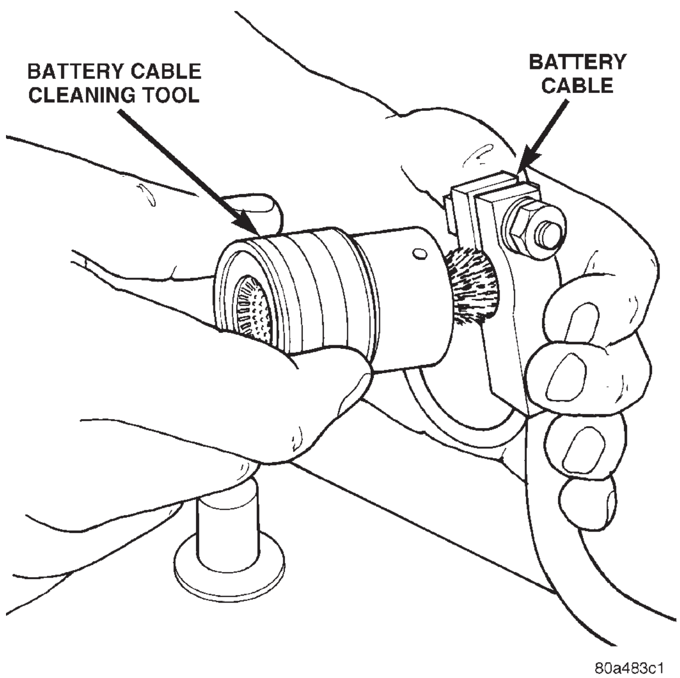


Fig. 14 Cleaning Battery Cable Terminal

SPECIFICATIONS

BATTERY SPECIFICATIONS

Reserve (Amps)	Cold Cranking Rating @ -17.8C (0.0F) DIN/BCI	Reserve Capacity MIN.
300 Amp	300/600 Amp	120 Minutes
335 Amp	420/670 Amp	110 Minutes

CRANKING RATING

The current battery can deliver for 30 seconds and maintain a terminal voltage of 7.2 volts or greater at specified temperature.

STARTING SYSTEMS

CONTENTS

DESCRIPTION AND OPERATION

STARTING SYSTEM

DESCRIPTION

An electrically operated engine starting system is standard factory-installed equipment on this model. The starting system is designed to provide the vehicle operator with a convenient, efficient and reliable means of cranking and starting the internal combustion engine used to power the vehicle and all of its accessory systems from within the safe and secure confines of the passenger compartment. See the owner's manual in the vehicle glove box for more information and instructions on the recommended use and operation of the factory-installed starting system.

The starting system consists of the following components:

- Battery
- Starter relay
- Starter motor (including an integral starter solenoid)
- Ignition switch
- Park/neutral position switch
- Wire harnesses and connections (including the battery cables).

This group provides complete service information for the starter motor and the starter relay. Complete service information for the other starting system components can be located as follows:

- Refer to **Battery** in the proper section of Group 8A - Battery for complete service information for the battery.
- Refer to **Ignition Switch and Key Lock Cylinder** in the proper section of Group 8D - Ignition System for complete service information for the ignition switch.
- Refer to **Park/Neutral Position Switch** in the proper section of Group 21 - Transmission for complete service information for the park/neutral position switch.
- Refer to the proper section of **Group 8W - Wiring Diagrams** for complete service information and circuit diagrams for the starting system wiring components.

Group 8A covers the Battery, Group 8B covers the Starting Systems, and Group 8C covers the Charging System. We have separated these systems to make it easier to locate the information you are seeking within this Service Manual. However, when attempting to diagnose any of these systems, it is important that you keep their interdependency in mind.

The battery, starting, and charging systems in the vehicle operate with one another, and must be tested as a complete system. In order for the vehicle to start and charge properly, all of the components that are used in these systems must perform within specifications.

The diagnostic procedures used in each of these groups include the most basic conventional diagnostic methods, to the more sophisticated On-Board Diagnostics (OBD) built into the Powertrain Control Module (PCM). Use of an induction-type milliampere ammeter, volt/ohmmeter, battery charger, carbon pile rheostat (load tester), and 12-volt test lamp may be required.

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. Refer to **On-Board Diagnostic Test For Charging System** in the Diagnosis and Testing section of Group 8C - Charging System for more information.

OPERATION

The starting system components form two separate circuits. A high-amperage feed circuit that feeds the starter motor between 150 and 350 amperes, and a low-amperage control circuit that operates on less than 20 amperes. The high-amperage feed circuit

DESCRIPTION AND OPERATION (Continued)

components include the battery, the battery cables, the contact disc portion of the starter solenoid, and the starter motor. The low-amperage control circuit components include the ignition switch, the park/neutral position switch, the starter relay, the electromagnetic windings of the starter solenoid, and the connecting wire harness components.

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 momentary Start position. The park/neutral position switch is installed in series between the starter relay coil ground terminal and ground. This normally open switch prevents the starter relay from being energized and the starter motor from operating unless the automatic transmission gear selector is in the Neutral or Park positions.

When the starter relay coil is 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 pull-in coil pulls in the solenoid plunger. The solenoid plunger pulls the shift lever in the starter motor. This engages the starter overrunning clutch and pinion gear with the starter ring gear on the automatic transmission torque converter drive plate.

As the solenoid plunger reaches the end of its travel, the solenoid contact disc completes the high-amperage starter feed circuit and energizes the solenoid plunger hold-in coil. 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 motor 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 plunger hold-in coil is de-energized.

When the solenoid plunger hold-in 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 starter ring gear.

Following are general descriptions of the major components in the starting system.

STARTER MOTOR

DESCRIPTION

The starter motors used for both the 4.0L and the 4.7L engines available in this model are very similar, but are not interchangeable. Both starter motors are mounted with two screws to the automatic transmission torque converter housing and are located on the right side of the engine.

Each of these starter motors incorporates several of the same features to create a reliable, efficient, compact, lightweight and powerful unit. The electric motors of both starters feature four electromagnetic field coils wound around four pole shoes, and four brushes contact the motor commutator. Both starter motors are rated at 1.4 kilowatts (about 1.9 horsepower) output at 12 volts.

Both of these starter motors are serviced only as a unit with their starter solenoids, and cannot be repaired. If either component is faulty or damaged, the entire starter motor and starter solenoid unit must be replaced.

OPERATION

These starter motors are equipped with a planetary gear reduction (intermediate transmission) system. The planetary gear reduction system consists of a gear that is integral to the output end of the electric motor armature shaft that is in continual engagement with a larger gear that is splined to the input end of the starter pinion gear shaft. 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 starter pinion gear to the starter ring gear.

The starter motors for both engines are activated by an integral heavy duty starter solenoid switch mounted to the overrunning clutch housing. This electromechanical switch connects and disconnects the feed of battery voltage to the starter motor and actuates a shift fork that engages and disengages the starter pinion gear with the starter ring gear.

Both starter motors use an overrunning clutch and starter pinion gear unit to engage and drive a starter ring gear that is integral to the torque converter drive plate mounted on the rear crankshaft flange.

DESCRIPTION AND OPERATION (Continued)

STARTER RELAY

DESCRIPTION

The starter relay is an electromechanical device that switches battery current to the pull-in coil of the starter solenoid when the ignition switch is turned to the Start position. The starter relay is located in the Power Distribution Center (PDC), in the engine compartment. See the fuse and relay layout label affixed to the inside surface of the PDC cover for starter relay identification and location.

The starter relay is a International Standards Organization (ISO) micro-relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions. The ISO micro-relay terminal functions are the same as a conventional ISO relay. However, the ISO micro-relay terminal pattern (or footprint) is different, the current capacity is lower, and the physical dimensions are smaller than those of the conventional ISO relay.

The starter relay cannot be repaired or adjusted and, if faulty or damaged, it must be replaced.

OPERATION

The ISO relay consists of an electromagnetic coil, a resistor or diode, and three (two fixed and one movable) electrical contacts. The movable (common feed) relay contact is held against one of the fixed contacts (normally closed) by spring pressure. When the electromagnetic coil is energized, it draws the movable contact away from the normally closed fixed contact, and holds it against the other (normally open) fixed contact.

When the electromagnetic coil is de-energized, spring pressure returns the movable contact to the normally closed position. The resistor or diode is connected in parallel with the electromagnetic coil in the relay, and helps to dissipate voltage spikes that are produced when the coil is de-energized.

DIAGNOSIS AND TESTING

STARTING SYSTEM

DIAGNOSIS

The battery, starting, and charging systems operate with one another, and 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 the Battery, Group 8B covers the Starting Systems, and Group 8C covers the Charging System. We have separated these systems to make it easier to locate the information you are seeking within this Service Manual. However, when attempting to diagnose any of these systems, it is important that you keep their interdependency in mind.

The diagnostic procedures used in these groups include the most basic conventional diagnostic methods, to the more sophisticated On-Board Diagnostics (OBD) built into the Powertrain Control Module (PCM). Use of an induction-type milliampere ammeter, volt/ohmmeter, battery charger, carbon pile rheostat (load tester), and 12-volt test lamp may be required.

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. Refer to **On-Board Diagnostic Test For Charging System** in the Diagnosis and Testing section of Group 8C - Charging System for more information.

DIAGNOSIS AND TESTING (Continued)

Starting System Diagnosis		
CONDITION	POSSIBLE CAUSE	CORRECTION
STARTER FAILS TO OPERATE.	1. Battery discharged or faulty. 2. Starting circuit wiring faulty. 3. Starter relay faulty. 4. Ignition switch faulty. 5. Park/Neutral position switch faulty or misadjusted. 6. Starter solenoid faulty. 7. Starter motor faulty.	1. Refer to Battery in the Diagnosis and Testing section of Group 8A - Battery. Charge or replace the battery, if required. 2. Refer to Starting System in Group 8W - Wiring Diagrams. Test and repair the starter feed and/or control circuits, if required. 3. Refer to Starter Relay in the Diagnosis and Testing section of this group. Replace the starter relay, if required. 4. Refer to Ignition Switch and Key Lock Cylinder in the Diagnosis and Testing section of Group 8D - Ignition System. Replace the ignition switch, if required. 5. Refer to Park/Neutral Position Switch in the Diagnosis and Testing section of Group 21 - Transmission. Replace the park/neutral position switch, if required. 6. Refer to Starter Motor in the Diagnosis and Testing section of this group. Replace the starter motor assembly, if required. 7. If all other starting system components and circuits test OK, replace the starter motor assembly.
STARTER ENGAGES, FAILS TO TURN ENGINE.	1. Battery discharged or faulty. 2. Starting circuit wiring faulty. 3. Starter motor faulty. 4. Engine seized.	1. Refer to Battery in the Diagnosis and Testing section of Group 8A - Battery. Charge or replace the battery, if required. 2. Refer to Starting System in Group 8W - Wiring Diagrams. Test and repair the starter feed and/or control circuits, if required. 3. If all other starting system components and circuits test OK, replace the starter motor assembly. 4. Refer to Engine Diagnosis in the Diagnosis and Testing section of Group 9 - Engine.
STARTER ENGAGES, SPINS OUT BEFORE ENGINE STARTS.	1. Starter ring gear faulty. 2. Starter motor faulty.	1. Refer to Starter Motor in the Removal and Installation section of this group. Remove the starter motor to inspect the starter ring gear. Replace the starter ring gear, if required. 2. If all other starting system components and circuits test OK, replace the starter motor assembly.
STARTER DOES NOT DISENGAGE.	1. Starter motor improperly installed. 2. Starter relay faulty. 3. Ignition switch faulty. 4. Starter motor faulty.	1. Refer to Starter Motor in the Removal and Installation section of this group. Tighten the starter mounting hardware to the correct tightness specifications. 2. Refer to Starter Relay in the Diagnosis and Testing section of this group. Replace the starter relay, if required. 3. Refer to Ignition Switch and Key Lock Cylinder in the Diagnosis and Testing section of Group 8D - Ignition System. Replace the ignition switch, if required. 4. If all other starting system components and circuits test OK, replace the starter motor assembly.

DIAGNOSIS AND TESTING (Continued)

INSPECTION

For complete circuit diagrams, refer to **Starting System** in the Contents of Group 8W - Wiring Diagrams. Before removing any unit from the starting system for repair or diagnosis, perform the following inspections:

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

- **Battery** - Visually inspect the battery for indications of physical damage and loose or corroded cable connections. Determine the state-of-charge and cranking capacity of the battery. Charge or replace the battery, if required. Refer to **Battery** in the proper section of Group 8A - Battery for complete service information for the battery.
- **Ignition Switch** - Visually inspect the ignition switch for indications of physical damage and loose or corroded wire harness connections. Refer to **Ignition Switch and Key Lock Cylinder** in the proper section of Group 8D - Ignition System for complete service information for the ignition switch.
- **Park/Neutral Position Switch** - Visually inspect the park/neutral position switch for indications of physical damage and loose or corroded wire harness connections. Refer to **Park/Neutral Position Switch** in the proper section of Group 21 - Transmission for complete service information for the park/neutral position switch.
- **Starter Relay** - Visually inspect the starter relay for indications of physical damage and loose or corroded wire harness connections.
- **Starter Motor** - Visually inspect the starter motor for indications of physical damage and loose or corroded wire harness connections.
- **Starter Solenoid** - Visually inspect the starter solenoid for indications of physical damage and loose or corroded wire harness connections.
- **Wiring** - Visually inspect the wire harnesses for damage. Repair or replace any faulty wiring, as required. Refer to the proper section of **Group 8W - Wiring Diagrams** for complete service information and circuit diagrams for the starting system wiring components.

TESTING

COLD CRANKING TEST

For complete circuit diagrams, refer to **Starting System** in the Contents of Group 8W - Wiring Diagrams. The battery must be fully-charged and load-tested before proceeding. Refer to **Battery** in the Diagnosis and Testing section of Group 8A - Battery for the procedures.

(1) Connect a suitable volt-ampere tester to the battery terminals (Fig. 1). See the instructions provided by the manufacturer of the volt-ampere tester being used.

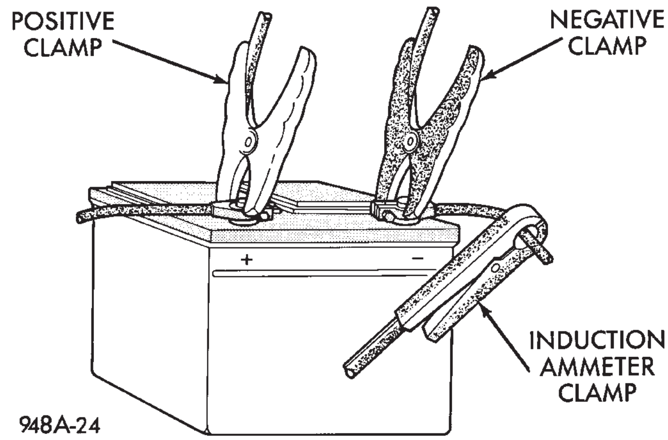


Fig. 1 Volts-Amps Tester Connections - Typical

(2) Fully engage the parking brake.

(3) Place the automatic transmission gearshift selector lever in the Park position.

(4) Verify that all lamps and accessories are turned off.

(5) To prevent the engine from starting, remove the Automatic ShutDown (ASD) relay. The ASD relay is located in the Power Distribution Center (PDC), in the engine compartment. Refer to the fuse and relay layout label affixed to the underside of the PDC cover for ASD relay identification and location.

(6) Rotate and hold the ignition switch in the Start position. Note the cranking voltage and current (amperage) draw readings shown on the volt-ampere tester.

(a) If the voltage reads below 9.6 volts, refer to **Starter Motor** in the Diagnosis and Testing section of this group. If the starter motor is OK, refer to **Engine Diagnosis** in the Diagnosis and Testing section of Group 9 - Engine for further testing of the engine. If the starter motor is not OK, replace the faulty starter motor.

(b) If the voltage reads above 9.6 volts and the current (amperage) draw reads below specifications, refer to **Feed Circuit Test** in this section.

DIAGNOSIS AND TESTING (Continued)

(c) If the voltage reads 12.5 volts or greater and the starter motor does not turn, refer to **Control Circuit Testing** in this section.

(d) If the voltage reads 12.5 volts or greater and the starter motor turns very slowly, refer to **Feed Circuit Test** in this section.

NOTE: A cold engine will increase the starter current (amperage) draw reading, and reduce the battery voltage reading.

FEED CIRCUIT TEST

The starter feed circuit test (voltage drop method) will determine if there is excessive resistance in the high-amperage feed circuit. For complete circuit diagrams, refer to **Starting System** in the Contents of Group 8W - Wiring Diagrams.

When performing these tests, it is important to remember that the voltage drop is giving an indication of the resistance between the two points at which the voltmeter probes are attached.

Example: When testing the resistance of the battery positive cable, touch the voltmeter leads to the battery positive cable clamp and the cable connector at the starter solenoid. If you probe the battery positive terminal post and the cable connector at the starter solenoid, you are reading the combined voltage drop in the battery positive cable clamp-to-terminal post connection and the battery positive cable.

The following operation will require a voltmeter accurate to 1/10 (0.10) volt. Before performing the tests, be certain that the following procedures are accomplished:

- Battery is fully-charged and load-tested. Refer to **Battery** in the Diagnosis and Testing section of Group 8A - Battery for the procedures.
- Fully engage the parking brake.
- Place the automatic transmission gearshift selector lever in the Park position.
- Verify that all lamps and accessories are turned off.
- To prevent the engine from starting, remove the Automatic ShutDown (ASD) relay. The ASD relay is located in the Power Distribution Center (PDC), in the engine compartment. Refer to the fuse and relay layout label affixed to the underside of the PDC cover for ASD relay identification and location.

(1) Connect the positive lead of the voltmeter to the battery negative terminal post. Connect the negative lead of the voltmeter to the battery negative cable clamp (Fig. 2). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If voltage is detected, correct the poor contact between the cable clamp and the terminal post.

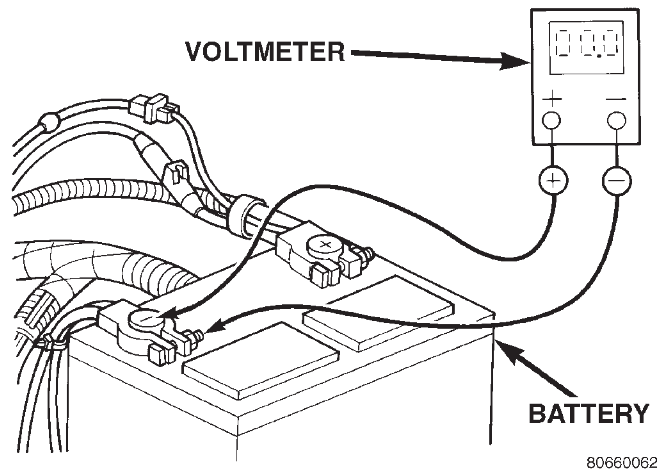


Fig. 2 Test Battery Negative Connection Resistance - Typical

(2) Connect the positive lead of the voltmeter to the battery positive terminal post. Connect the negative lead of the voltmeter to the battery positive cable clamp (Fig. 3). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If voltage is detected, correct the poor contact between the cable clamp and the terminal post.

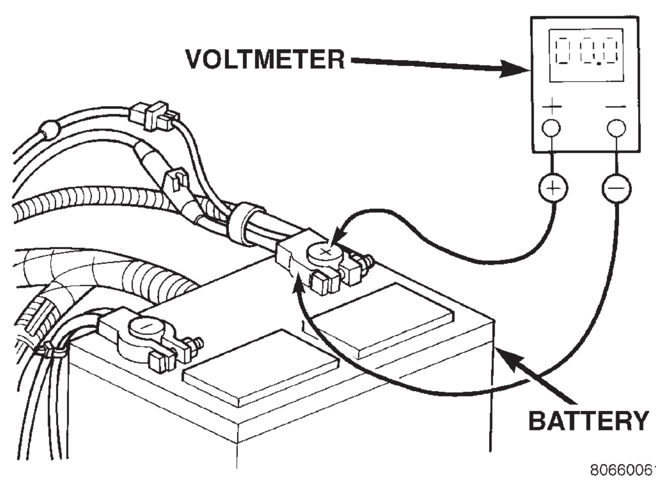


Fig. 3 Test Battery Positive Connection Resistance - Typical

(3) Connect the voltmeter to measure between the battery positive terminal post and the starter solenoid battery terminal stud (Fig. 4). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If the reading is above 0.2 volt, clean and tighten the battery cable connection at the solenoid. Repeat the test. If the reading is still above 0.2 volt, replace the faulty battery positive cable.

(4) Connect the voltmeter to measure between the battery negative terminal post and a good clean ground on the engine block (Fig. 5). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If the reading is above 0.2 volt, clean and tighten the battery negative cable attachment on the engine block. Repeat the test. If the reading is still above 0.2 volt, replace the faulty battery negative cable.

DIAGNOSIS AND TESTING (Continued)

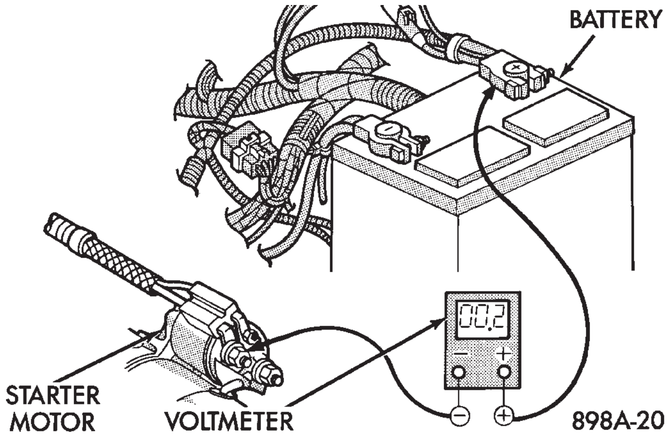


Fig. 4 Test Battery Positive Cable Resistance - Typical

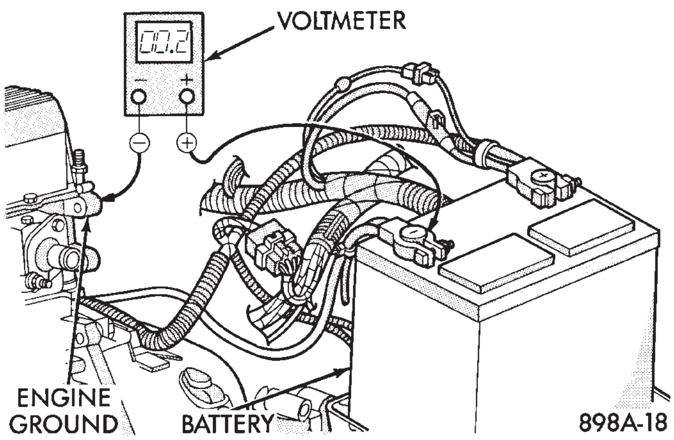


Fig. 5 Test Ground Circuit Resistance - Typical

(5) Connect the positive lead of the voltmeter to the starter housing. Connect the negative lead of the voltmeter to the battery negative terminal post (Fig. 6). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If the reading is above 0.2 volt, correct the poor starter to engine block ground contact.

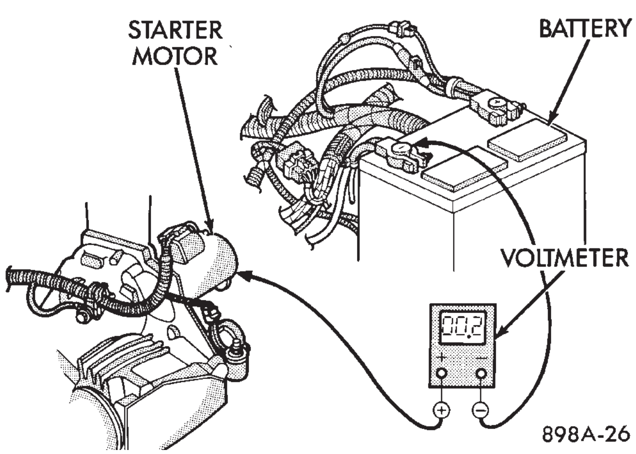


Fig. 6 Test Starter Ground - Typical

If the resistance tests detect no feed circuit problems, refer to **Starter Motor** in the Diagnosis and Testing section of this group.

CONTROL CIRCUIT TESTING

The starter control circuit components should be tested in the order in which they are listed, as follows:

- **Starter Relay** - Refer to **Starter Relay** in the Diagnosis and Testing section of this group for the procedures.
- **Starter Solenoid** - Refer to **Starter Motor** in the Diagnosis and Testing section of this group for the procedures.
- **Ignition Switch** - Refer to **Ignition Switch and Key Lock Cylinder** in the Diagnosis and Testing section of Group 8D - Ignition System for the procedures.
- **Park/Neutral Position Switch** - Refer to **Park/Neutral Position Switch** in the Diagnosis and Testing section of Group 21 - Transmission for the procedures.
- **Wire harnesses and connections** - Refer to **Starting System** in the Contents of Group 8W - Wiring Diagrams for complete circuit diagrams.

STARTER MOTOR

Correct starter motor operation can be confirmed by performing the following free running bench test. This test can only be performed with the starter motor removed from the vehicle. Refer to **Starting System** in the Specifications section of this group for the starter motor specifications.

(1) Remove the starter motor from the vehicle. Refer to **Starter Motor** in the Removal and Installation section of this group for the procedures.

(2) Mount the starter motor securely in a soft-jawed bench vise. The vise jaws should be clamped on the mounting flange of the starter motor. Never clamp on the starter motor by the field frame.

(3) Connect a suitable volt-ampere tester and a 12-volt battery to the starter motor in series, and set the ammeter to the 100 ampere scale. See the instructions provided by the manufacturer of the volt-ampere tester being used.

(4) Install a jumper wire from the solenoid terminal to the solenoid battery terminal. The starter motor should operate. If the starter motor fails to operate, replace the faulty starter motor assembly.

(5) Adjust the carbon pile load of the tester to obtain the free running test voltage. Refer to **Starting System** in the Specifications section of this group for the starter motor free running test voltage specifications.

(6) Note the reading on the ammeter and compare this reading to the free running test maximum

DIAGNOSIS AND TESTING (Continued)

amperage draw. Refer to **Starting System** in the Specifications section of this group for the starter motor free running test maximum amperage draw specifications.

(7) If the ammeter reading exceeds the maximum amperage draw specification, replace the faulty starter motor assembly.

STARTER SOLENOID

This test can only be performed with the starter motor removed from the vehicle.

(1) Remove the starter motor from the vehicle. Refer to **Starter Motor** in the Removal and Installation section of this group for the procedures.

(2) Disconnect the wire from the solenoid field coil terminal.

(3) Check for continuity between the solenoid terminal and the solenoid field coil terminal with a continuity tester (Fig. 7). There should be continuity. If OK, go to Step 4. If not OK, replace the faulty starter motor assembly.

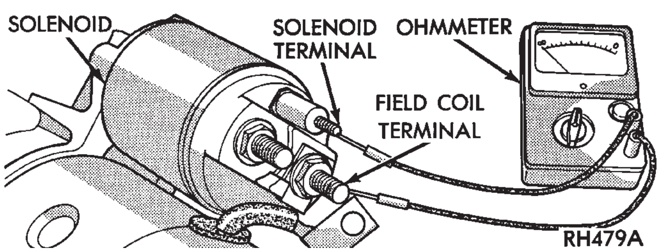


Fig. 7 Continuity Test Between Solenoid Terminal and Field Coil Terminal - Typical

(4) Check for continuity between the solenoid terminal and the solenoid case (Fig. 8). There should be continuity. If not OK, replace the faulty starter motor assembly.

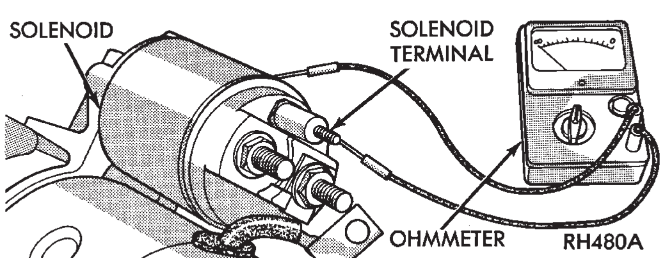


Fig. 8 Continuity Test Between Solenoid Terminal and Solenoid Case - Typical

STARTER RELAY

The starter relay (Fig. 9) is located in the Power Distribution Center (PDC), in the engine compartment. Refer to the fuse and relay layout label affixed to the underside of the PDC cover for starter relay identification and location. For complete circuit diagrams, refer to **Starting System** in the Contents of Group 8W - Wiring Diagrams.

(1) Remove the starter relay from the PDC. Refer to **Starter Relay** in the Removal and Installation section of this group for the procedures.

(2) A relay in the de-energized position should have continuity between terminals 87A and 30, and no continuity between terminals 87 and 30. If OK, go to Step 3. If not OK, replace the faulty relay.

(3) Resistance between terminals 85 and 86 (electromagnet) should be 75 $\pm$ 5 ohms. If OK, go to Step 4. If not OK, replace the faulty relay.

(4) 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, perform the Relay Circuit Test that follows. If not OK, replace the faulty relay.

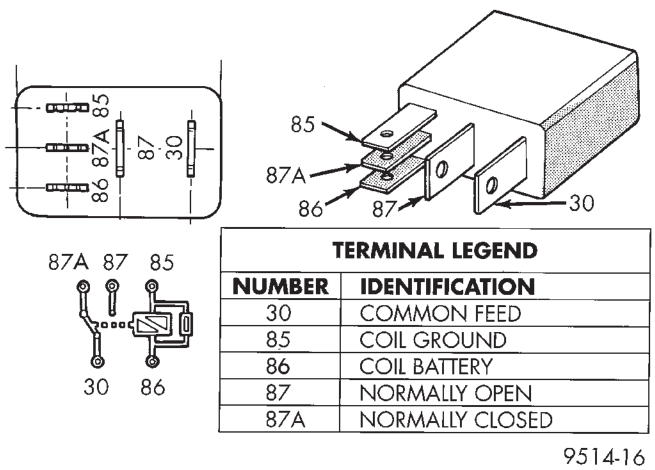


Fig. 9 Starter Relay

RELAY CIRCUIT TEST

(1) The relay common feed terminal cavity (30) is connected to battery voltage and should be hot at all times. If OK, go to Step 2. If not OK, repair the open circuit to the fuse in the PDC as required.

(2) The relay normally closed terminal (87A) is connected to terminal 30 in the de-energized position, but is not used for this application. Go to Step 3.

(3) The relay normally open terminal (87) is connected to the common feed terminal (30) in the energized position. This terminal supplies battery voltage to the starter solenoid field coils. There should be continuity between the cavity for relay terminal 87 and the starter solenoid terminal at all times. If OK, go to Step 4. If not OK, repair the open circuit to the starter solenoid as required.

(4) The coil battery terminal (86) is connected to the electromagnet in the relay. It is energized when the ignition switch is held in the Start position. Check for battery voltage at the cavity for relay terminal 86 with the ignition switch in the Start position, and no voltage when the ignition switch is released to the On position. If OK, go to Step 5. If

DIAGNOSIS AND TESTING (Continued)

not OK, check for an open or short circuit to the ignition switch and repair, if required. If the circuit to the ignition switch is OK, refer to **Ignition Switch and Key Lock Cylinder** in the Diagnosis and Testing section of Group 8D - Ignition System for testing of the ignition switch.

(5) The coil ground terminal (85) is connected to the electromagnet in the relay. It is grounded through the park/neutral position switch only when the gearshift selector lever is in the Park or Neutral positions. Check for continuity to ground at the cavity for relay terminal 85. If not OK, check for an open or short circuit to the park/neutral position switch and repair, if required. If the circuit to the park/neutral position switch is OK, refer to **Park/Neutral Position Switch** in the Diagnosis and Testing section of Group 21 - Transmission for testing of the park/neutral position switch.

REMOVAL AND INSTALLATION

STARTER MOTOR

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Raise and support the vehicle.

(3) Remove the lower (forward facing) mounting screw securing the starter motor to the automatic transmission torque converter housing (Fig. 10) or (Fig. 11).

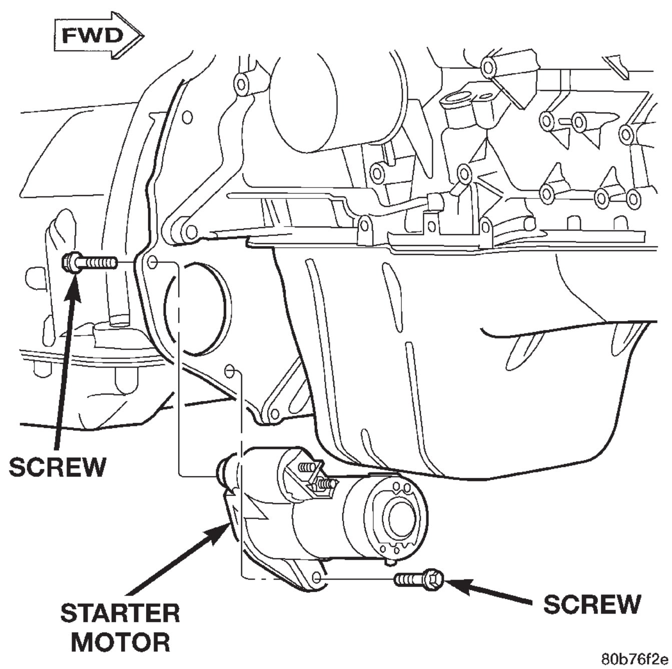


Fig. 10 Starter Motor Remove/Install - 4.0L Engine

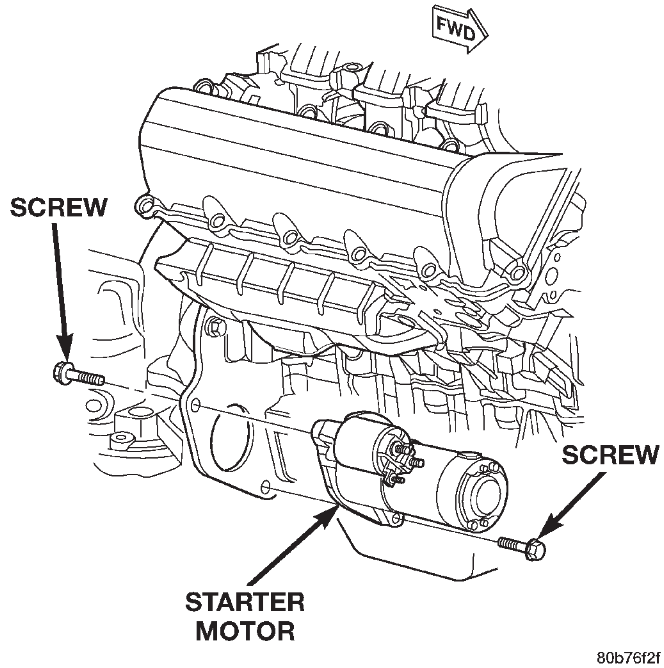


Fig. 11 Starter Motor Remove/Install - 4.7L Engine

(4) While supporting the starter motor with one hand, use the other hand to remove the upper (rear facing) mounting screw securing the starter motor to the automatic transmission torque converter housing.

(5) Lower the starter motor from the front of the automatic transmission torque converter housing far enough to access and remove the nut that secures the battery cable eyelet to the solenoid battery terminal (Fig. 12) or (Fig. 13). Always support the starter motor during this process, do not let the starter motor hang from the wire harness.

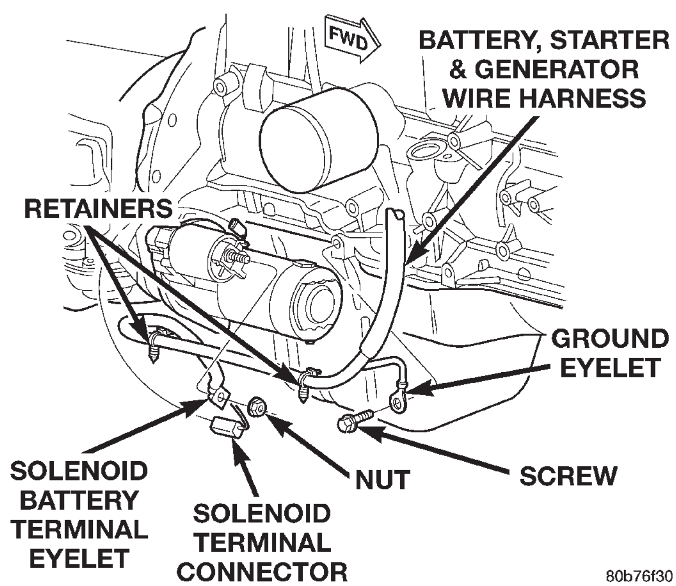


Fig. 12 Starter Wire Harness Remove/Install - 4.0L Engine

REMOVAL AND INSTALLATION (Continued)

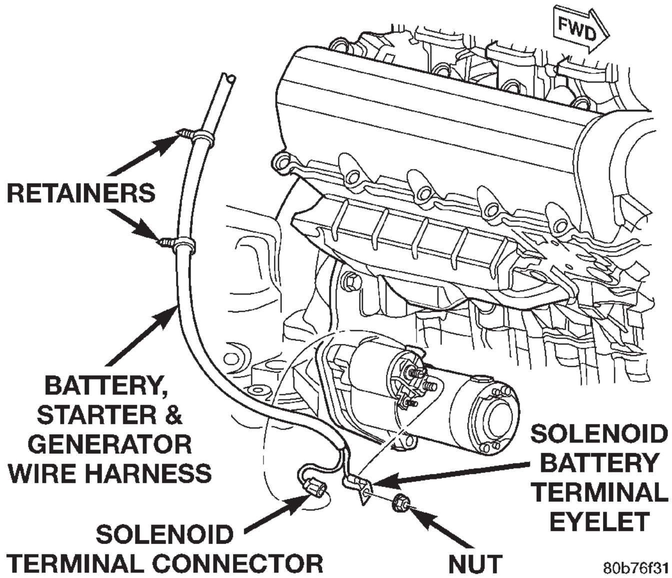


Fig. 13 Starter Wire Harness Remove/Install - 4.7L Engine

(6) Remove the battery cable eyelet from the solenoid battery terminal. Always support the starter motor during this process, do not let the starter motor hang from the wire harness.

(7) Disconnect the solenoid terminal wire harness connector from the connector receptacle on the starter solenoid. Always support the starter motor during this process, do not let the starter motor hang from the wire harness.

(8) Remove the starter motor from the engine compartment.

INSTALLATION

(1) Position the starter motor in the engine compartment.

(2) Reconnect the solenoid terminal wire harness connector to the connector receptacle on the starter solenoid. Always support the starter motor during this process, do not let the starter motor hang from the wire harness.

(3) Install the battery cable eyelet onto the solenoid battery terminal. Always support the starter motor during this process, do not let the starter motor hang from the wire harness.

(4) Install and tighten the nut that secures the battery cable eyelet to the solenoid battery terminal. Tighten the nut to 10.2 N·m (90 in. lbs.). Always support the starter motor during this process, do not let the starter motor hang from the wire harness.

(5) Position the starter motor to the front of the automatic transmission torque converter housing and loosely install both the upper and lower mounting screws.

(6) Tighten the lower (forward facing) starter motor mounting screw. On 4.0L engines, tighten the screw to 41 N·m (30 ft. lbs.). On 4.7L engines, tighten the screw to 54 N·m (40 ft. lbs.).

(7) Tighten the upper (rearward facing) starter mounting screw. Tighten the screw to 54 N·m (40 ft. lbs.).

(8) Lower the vehicle.

(9) Reconnect the battery negative cable.

STARTER RELAY

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the cover from the Power Distribution Center (PDC) (Fig. 14).

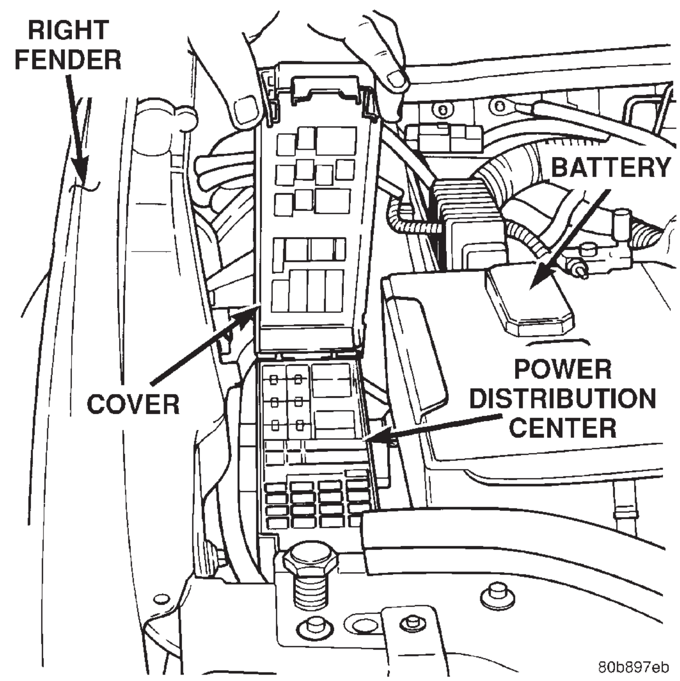


Fig. 14 Power Distribution Center

(3) Refer to the fuse and relay layout label affixed to the underside of the PDC cover for starter relay identification and location.

(4) Remove the starter relay from the PDC.

INSTALLATION

(1) Refer to the fuse and relay layout label affixed to the underside of the PDC cover for the proper starter relay location.

(2) Position the starter relay in the proper receptacle in the PDC.

(3) Align the starter relay terminals with the terminal cavities in the PDC receptacle.

(4) Push down firmly on the starter relay until the terminals are fully seated in the terminal cavities in the PDC receptacle.

(5) Install the cover onto the PDC.

(6) Connect the battery negative cable.

SPECIFICATIONS

STARTING SYSTEM

Starter Motor and Solenoid	
Manufacturer	Mitsubishi
Engine Application	4.0L, 4.7L
Power Rating	1.4 Kilowatt (1.9 Horsepower)
Voltage	12 Volts
Number of Fields	4
Number of Poles	4
Number of Brushes	4
Drive Type	Planetary Gear Reduction
Free Running Test Voltage	11.2 Volts
Free Running Test Maximum Amperage Draw	90 Amperes
Free Running Test Minimum Speed	2400 rpm
Solenoid Closing Maximum Voltage Required	7.8 Volts
*Cranking Amperage Draw Test	160 Amperes
*Test at operating temperature. Cold engine, tight (new) engine, or heavy oil will increase starter amperage draw.	

STARTING SYSTEMS

CONTENTS

REMOVAL AND INSTALLATION

STARTER MOTOR (LHD DIESEL)

REMOVAL

WARNING: DISCONNECT THE NEGATIVE BATTERY CABLE BEFORE REMOVING THE B+ SUPPLY WIRE FROM THE STARTER SOLENOID. FAILURE TO DO SO CAN RESULT IN PERSONAL INJURY OR DAMAGE TO THE VEHICLE ELECTRICAL SYSTEM.

(1) Open the hood and disconnect the negative battery.
(2) Raise the vehicle on a hoist.
(3) Disconnect the starter motor electrical.

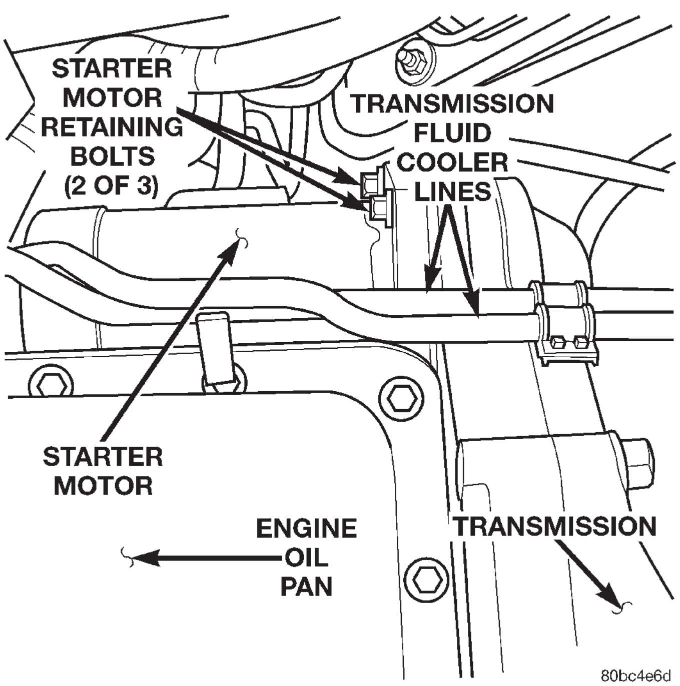


Fig. 1 Starter Motor Position & Orientation

(4) Remove the (3) starter motor retaining bolts (Fig. 1) and remove the starter from the vehicle.

INSTALLATION

(1) Position the starter motor on the engine and install the (3) starter motor retaining bolts. Torque the bolts to 27 N·m (20 ft. lbs.) (Fig. 2).

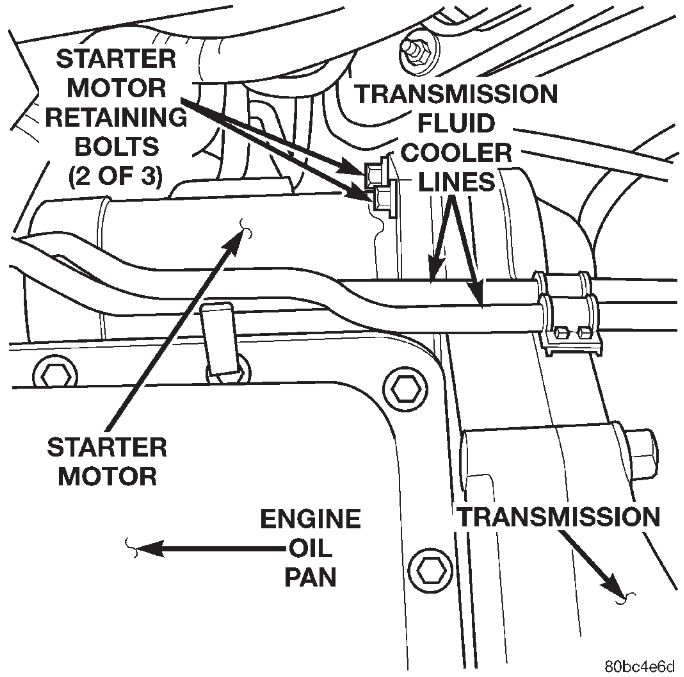


Fig. 2 Starter Motor Position & Orientation

(2) Connect the starter motor electrical connectors. Torque B+ terminal nut to 27 N·m (20 ft. lbs.).
(3) Lower the vehicle on a hoist.
(4) Connect the negative battery cable.

STARTER RELAY

(1) Disconnect and isolate the battery negative cable.
(2) Remove the cover from the Power Distribution Center (PDC).
(3) Refer to the label on the PDC for starter relay identification and location.
(4) Unplug the starter relay from the PDC.

REMOVAL AND INSTALLATION (Continued)

(5) Install the starter relay by aligning the relay terminals with the cavities in the PDC and pushing the relay firmly into place.

(6) Install the PDC cover.
(7) Connect the battery negative cable.
(8) Test the relay operation.

SPECIFICATIONS

STARTING SYSTEM

Starter and Solenoid	
Engine Application	3.1L Diesel
Power Rating	2.2 Kilowatt
Voltage	12 Volts
Number of Fields	4
Number of Poles	4
Number of Brushes	4
Drive Type	Planetary Gear Reduction
Free Running Test Voltage	11.5 Volts
Free Running Test Maximum Amperage Draw	160 Amperes
Free Running Test Minimum Speed	5500 rpm
Solenoid Closing Maximum Voltage	7.8 Volts
*Cranking Amperage Draw test	350 Amperes
*Test at operating temperature. Cold engine, tight (new) engine, or heavy oil will increase starter amperage draw.	

TORQUE SPECIFICATIONS

DESCRIPTION	TORQUE
Stater Motor (B+) Terminal	27 N·m (20 ft. lbs.)
Starter Motor Retaining Bolts	27 N·m (20 ft. lbs.)

CHARGING SYSTEM

CONTENTS

DESCRIPTION AND OPERATION

CHARGING SYSTEM

DESCRIPTION

The charging system consists of:

- Generator
- Electronic Voltage Regulator (EVR) circuitry within the Powertrain Control Module (PCM)
- Ignition switch (refer to Group 8D, Ignition System for information)
- Battery (refer to Group 8A, Battery for information)
- Battery temperature sensor
- Generator Lamp (if equipped)
- Check Gauges Lamp (if equipped)
- Voltmeter (refer to Group 8E, Instrument Panel and Gauges for information)
- Wiring harness and connections (refer to Group 8W, Wiring for information)

OPERATION

The charging system is turned on and off with the ignition switch. The system is on when the engine is running and the ASD relay is energized. When the ASD relay is on, voltage is supplied to the ASD relay sense circuit at the PCM. This voltage is connected through the PCM and supplied to one of the generator field terminals (Gen. Source +) at the back of the generator.

The amount of DC current produced by the generator is controlled by the EVR (field control) circuitry contained within the PCM. This circuitry is connected in series with the second rotor field terminal and ground.

A battery temperature sensor, located in the battery tray housing, is used to sense battery temperature. This temperature data, along with data from monitored line voltage, is used by the PCM to vary the battery charging rate. This is done by cycling the ground path to control the strength of the rotor magnetic field. The PCM then compensates and regulates generator current output accordingly.

All vehicles are equipped with On-Board Diagnostics (OBD). All OBD-sensed systems, including EVR (field control) circuitry, are monitored by the PCM. Each monitored circuit is assigned a Diagnostic Trouble Code (DTC). The PCM will store a DTC in electronic memory for certain failures it detects. Refer to On-Board Diagnostics in Group 25, Emission Control System for more DTC information.

The Check Gauges Lamp (if equipped) monitors: **charging system voltage,** engine coolant temperature and engine oil pressure. If an extreme condition is indicated, the lamp will be illuminated. This is done as reminder to check the three gauges. The signal to activate the lamp is sent via the CCD bus circuits. The lamp is located on the instrument panel. Refer to Group 8E, Instrument Panel and Gauges for additional information.

GENERATOR

DESCRIPTION

The generator is belt-driven by the engine using a serpentine type drive belt. It is serviced only as a complete assembly. If the generator fails for any reason, the entire assembly must be replaced.

OPERATION

As the energized rotor begins to rotate within the generator, the spinning magnetic field induces a current into the windings of the stator coil. Once the generator begins producing sufficient current, it also provides the current needed to energize the rotor.

DESCRIPTION AND OPERATION (Continued)

The Y type stator winding connections deliver the induced AC current to 3 positive and 3 negative diodes for rectification. From the diodes, rectified DC current is delivered to the vehicle electrical system through the generator battery terminal.

Although the generators appear the same externally, different generators with different output ratings are used on this vehicle. Be certain that the replacement generator has the same output rating and part number as the original unit. Refer to Generator Ratings in the Specifications section at the back of this group for amperage ratings and part numbers.

Noise emitting from the generator may be caused by: worn, loose or defective bearings; a loose or defective drive pulley; incorrect, worn, damaged or misadjusted fan drive belt; loose mounting bolts; a misaligned drive pulley or a defective stator or diode.

BATTERY TEMPERATURE SENSOR

DESCRIPTION

The battery temperature sensor is attached to the battery tray located under the battery.

OPERATION

The battery temperature sensor is used to determine the battery temperature and control battery charging rate. This temperature data, along with data from monitored line voltage, is used by the PCM to vary the battery charging rate. System voltage will be higher at colder temperatures and is gradually reduced at warmer temperatures.

ELECTRONIC VOLTAGE REGULATOR

DESCRIPTION

The Electronic Voltage Regulator (EVR) is not a separate component. It is actually a voltage regulating circuit located within the Powertrain Control Module (PCM). The EVR is not serviced separately. If replacement is necessary, the PCM must be replaced.

OPERATION

The amount of DC current produced by the generator is controlled by EVR circuitry contained within the PCM. This circuitry is connected in series with the generators second rotor field terminal and its ground.

Voltage is regulated by cycling the ground path to control the strength of the rotor magnetic field. The EVR circuitry monitors system line voltage and battery temperature (refer to Battery Temperature Sensor for more information). It then compensates and regulates generator current output accordingly. Also refer to Charging System Operation for additional information.

DIAGNOSIS AND TESTING

CHARGING SYSTEM

The following procedures may be used to diagnose the charging system if:

- the generator lamp (if equipped) is illuminated with the engine running
- the voltmeter (if equipped) does not register properly
- an undercharged or overcharged battery condition occurs.

Remember that an undercharged battery is often caused by:

- accessories being left on with the engine not running
- a faulty or improperly adjusted switch that allows a lamp to stay on. See Ignition-Off Draw Test in Group 8A, Battery for more information.

INSPECTION

To perform a complete test of the charging system, refer to the appropriate Powertrain Diagnostic Procedures service manual and the DRB scan tool. Perform the following inspections before attaching the scan tool.

(1) Inspect the battery condition. Refer to Group 8A, Battery for procedures.

(2) 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.

(3) Inspect all fuses in both the fuseblock and Power Distribution Center (PDC) for tightness in receptacles. They should be properly installed and tight. Repair or replace as required.

(4) Inspect generator mounting bolts for tightness. Replace or tighten bolts if required. Refer to the Generator Removal/Installation section of this group for torque specifications.

(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 automatic belt tensioner (if equipped). Refer to Group 7, Cooling System for information.

(7) Inspect generator electrical connections at generator field, battery output, and ground terminal (if equipped). Also check generator ground wire connection at engine (if equipped). They should all be clean and tight. Repair as required.

DIAGNOSIS AND TESTING (Continued)

BATTERY TEMPERATURE SENSOR

To perform a complete test of this sensor and its circuitry, refer to the appropriate Powertrain Diagnostic Procedures manual. To test the sensor only, refer to the following:

(1) The sensor is located under the battery and is attached to the battery tray (Fig. 1). The engine wiring harness plugs directly into the bottom the sensor

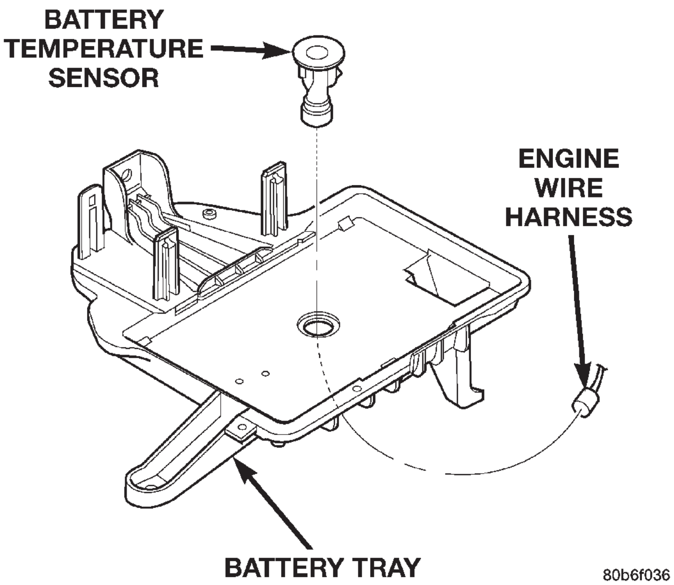


Fig. 1 Battery Temperature Sensor Location

(2) Remove sensor and disconnect it from engine harness. Refer to Battery Temperature Sensor Removal/Installation.

(3) Attach ohmmeter leads to wire terminals at bottom of sensor.

(4) At room temperature of 25° C (75–80° F), an ohmmeter reading of 9,000 (9K) to 11,000 (11K) ohms should be observed.

(5) If reading is above or below specification, replace sensor.

ON-BOARD DIAGNOSTIC TEST FOR CHARGING SYSTEM

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 On-Board Diagnostic (OBD) system. Some circuits are checked continuously and some are checked only under certain conditions.

For DTC information, refer to Diagnostic Trouble Codes in Group 25, Emission Control System. This will include a complete list of DTC's including DTC's for the charging system.

REMOVAL AND INSTALLATION

GENERATOR

REMOVAL

WARNING: DISCONNECT NEGATIVE CABLE FROM BATTERY BEFORE REMOVING BATTERY OUTPUT WIRE (B+ WIRE) FROM GENERATOR. FAILURE TO DO SO CAN RESULT IN INJURY OR DAMAGE TO ELECTRICAL SYSTEM.

(1) Disconnect negative battery cable at battery.

(2) Remove generator drive belt. Refer to Group 7, Cooling System for procedure.

(3) Unsnap cable protector cover from B+ mounting stud (Fig. 2).

(4) Disconnect (unsnap) 2–wire field connector at rear of generator (Fig. 2).

(5) Remove generator mounting bolts (Fig. 3) or (Fig. 4).

(6) Remove generator from vehicle.

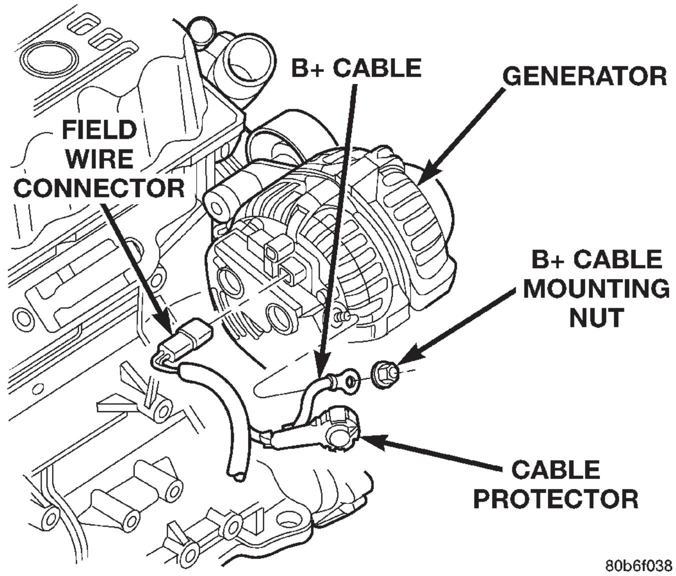


Fig. 2 Generator B+ Cable and Field Wire Connections (Typical—4.0L Engine Shown)

INSTALLATION

(1) Position generator to engine and install mounting bolts.

(2) Tighten generator mounting bolts as follows:

• Vertical mounting bolt 4.7L engine—55 N·m (40 ft. lbs.)

• Long horizontal mounting bolt 4.7L engine—55 N·m (40 ft. lbs.)

• Short horizontal mounting bolt 4.7L engine—74 N·m (55 ft. lbs.)

• Generator mounting bolts 4.0L engine—56 N·m (41 ft. lbs.)

REMOVAL AND INSTALLATION (Continued)

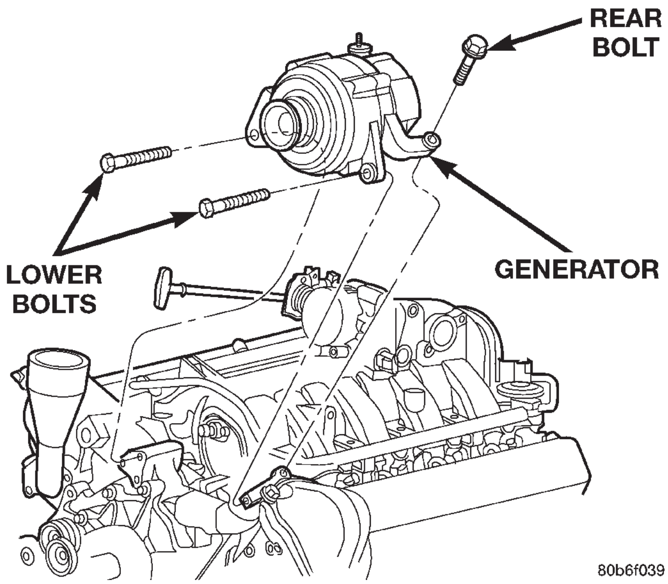


Fig. 3 Remove/Install Generator—4.7L V-8 Engine

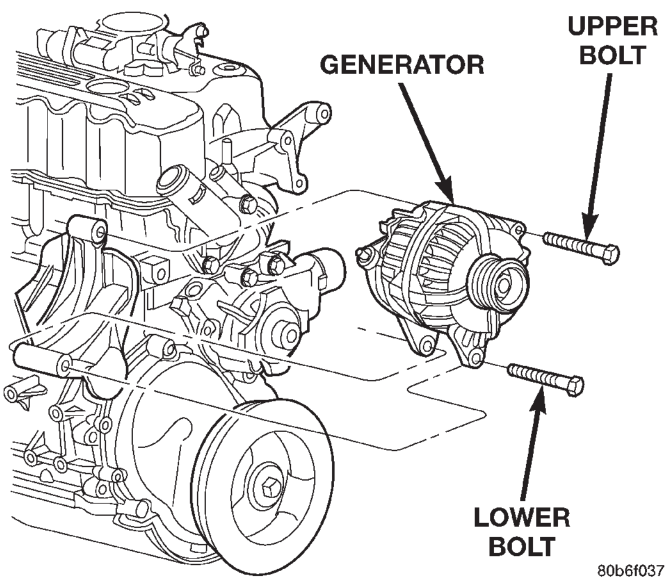


Fig. 4 Remove/Install Generator—4.0L 6–Cylinder Engine

- B+ terminal nut—8.5 N·m (75 in. lbs.)

(3) Snap 2–wire field connector into rear of generator.

(4) Snap cable protector cover to B+ mounting stud.

CAUTION: Never force a belt over a pulley rim using a screwdriver. The synthetic fiber of the belt can 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 belt routing label in engine compartment, or refer to Belt Schematics in Group 7, Cooling System.

(5) Install generator drive belt. Refer to Group 7, Cooling System for procedure.

(6) Install negative battery cable to battery.

BATTERY TEMPERATURE SENSOR

The battery temperature sensor is located under the vehicle battery (Fig. 5) and is attached to a mounting hole on the battery tray.

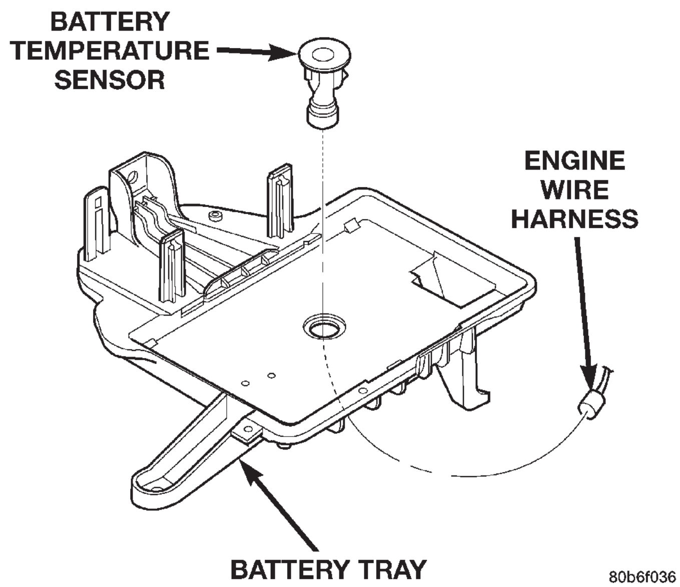


Fig. 5 Battery Temperature Sensor Location

REMOVAL

(1) Remove battery. Refer to Group 8A, Battery for procedures.

(2) Remove battery tray.

(3) Pull sensor up from battery tray and disconnect engine wire harness.

(4) Remove sensor from battery tray.

INSTALLATION

(1) Position sensor into mounting hole and attach wiring harness.

(2) Press sensor into top of battery tray.

(3) Install battery. Refer to Group 8A, Battery for procedures.

SPECIFICATIONS

GENERATOR RATINGS

TYPE	PART NUMBER	RATED SAE AMPS	ENGINES	MINIMUM TEST AMPS
BOSCH	56041322	136	4.0L 6-Cylinder	100
DENSO	56041324	136	4.7L V-8	100

TORQUE CHART

Description	Torque
Generator Mounting Bolts—4.0L 6–Cylinder Engine	56 N·m (41 ft. lbs.)
Generator Vertical Mounting Bolt—4.7L V–8 Engine	55 N·m (40 ft. lbs.)
Generator (long) Horizontal Mounting Bolt—4.7L V–8 Engine	55 N·m (40 ft. lbs.)
Generator (short) Horizontal Mounting Bolt—4.7L V–8 Engine	74 N·m (55 ft. lbs.)
Generator B+ Terminal Nut	8.5 N·m (75 in. lbs.)

CHARGING SYSTEM

CONTENTS

GENERAL INFORMATION

INTRODUCTION

The generator assembly is serviced as a complete assembly. If the generator should be faulty, replace the entire assembly. The only serviceable part is the drive pulley.

REMOVAL AND INSTALLATION

GENERATOR

REMOVAL

WARNING: DISCONNECT THE NEGATIVE BATTERY CABLE BEFORE REMOVING THE GENERATOR OUTPUT WIRE FROM THE GENERATOR. FAILURE TO DO SO CAN RESULT IN PERSONAL INJURY OR DAMAGE TO THE VEHICLE ELECTRICAL SYSTEM.

(1) Open the hood and disconnect the negative battery cable.

(2) Remove the accessory drive belt from the generator pulley (Fig. 1). Refer to Group 7, Cooling System for the procedure.

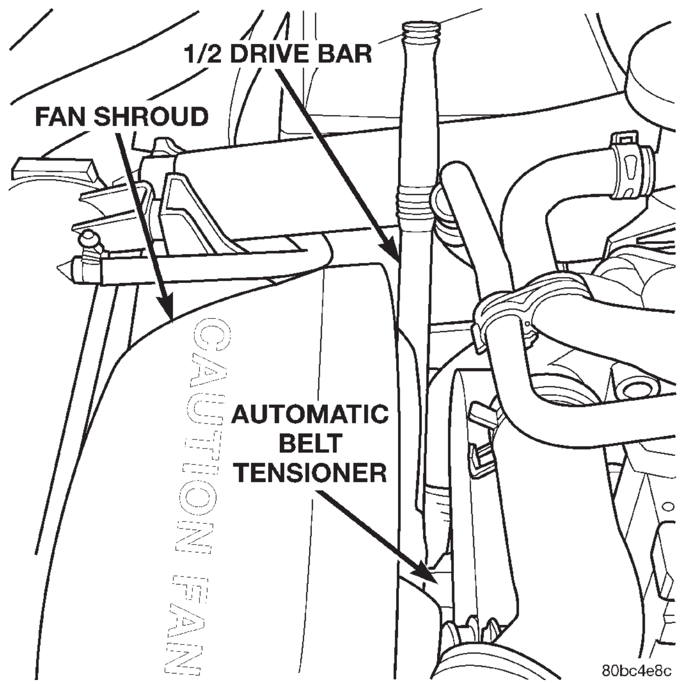


Fig. 1 Removing The Accessory Drive Belt

(3) Remove the B+ generator output wire cap and remove the wire from the terminal (Fig. 2).

REMOVAL AND INSTALLATION (Continued)

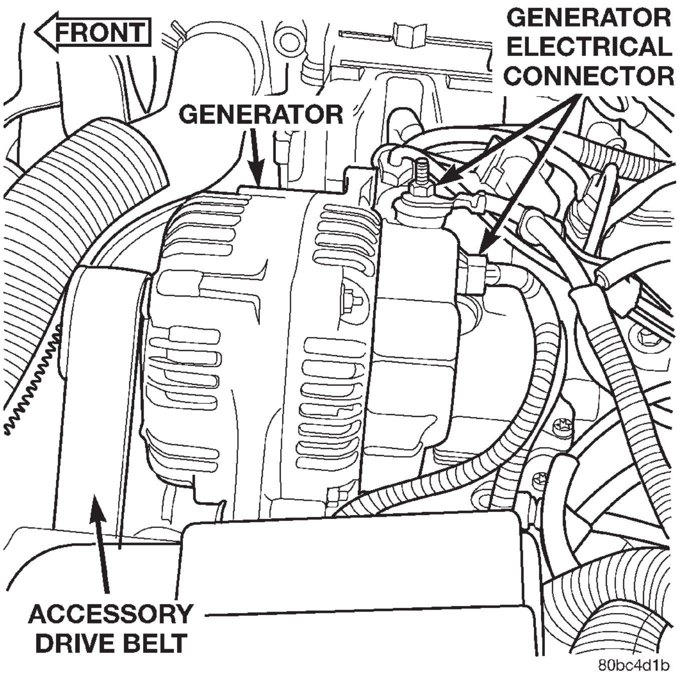


Fig. 2 Generator Electrical

(4) Disconnect the generator field wire connector from the rear of the generator (Fig. 2).

(5) Remove the generator retaining bolts (Fig. 3) and remove the generator from the vehicle.

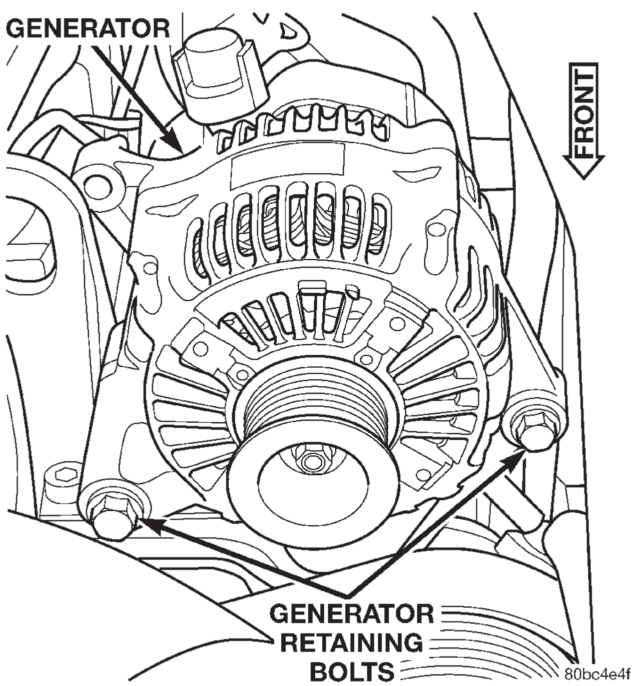


Fig. 3 Generator Retaining Bolts

INSTALLATION

(1) Position the generator and install the retaining bolts (Fig. 4). Torque the bolts to 40 N·m (30 ft. lbs.).

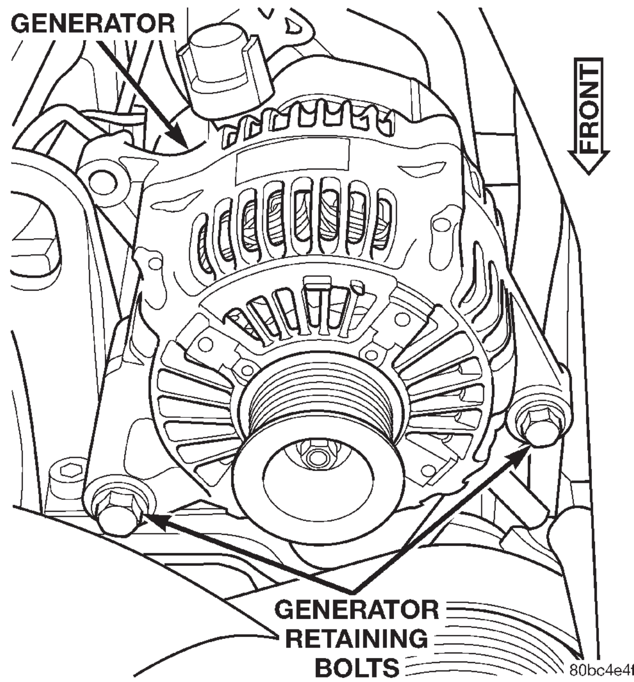


Fig. 4 Generator Retaining Bolts

(2) Connect the generator field wire connector on the rear of the generator (Fig. 5).

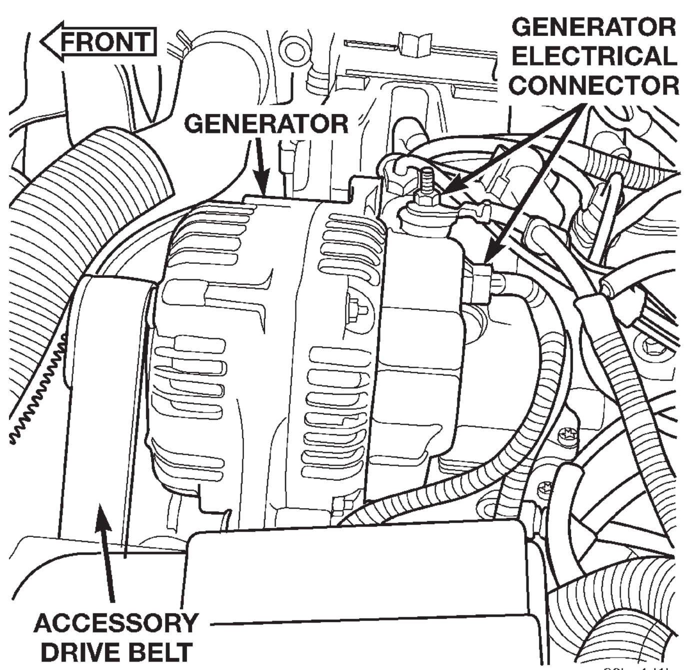


Fig. 5 Generator Electrical

REMOVAL AND INSTALLATION (Continued)

(3) Install the B+ generator output wire and torque to 8.5 N·m (75 in. lbs.) (Fig. 5). Install the terminal cap.

(4) Install the accessory drive belt (Fig. 6). Refer to Group 7, Cooling System for the procedure.

(5) Connect the negative battery cable.

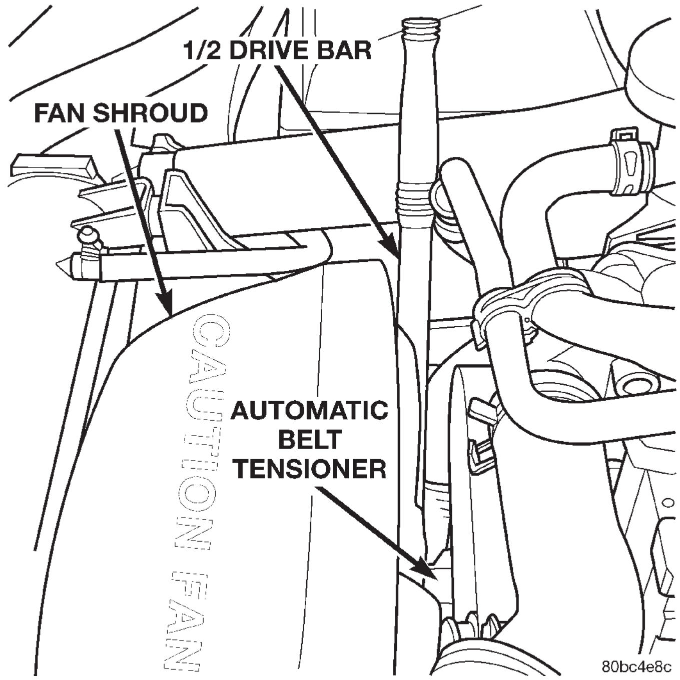


Fig. 6 Installing The Accessory Drive Belt

IGNITION SYSTEM

CONTENTS

DESCRIPTION AND OPERATION

IGNITION SYSTEM

DESCRIPTION

Two different ignition systems are used. One type of system is for the 4.0L 6–cylinder engine. The other is for the 4.7L V-8 engine.

OPERATION

The 4.0L 6–cylinder engine uses a one-piece coil rail containing three independent coils. Although cylinder firing order is the same as 4.0L engines of previous years, spark plug firing is not. The 3 coils dual-fire the spark plugs on cylinders 1–6, 2–5 and/or 3–4. When one cylinder is being fired (on compression stroke), the spark to the opposite cylinder is being wasted (on exhaust stroke). The one-piece coil bolts directly to the cylinder head. Rubber boots seal the secondary terminal ends of the coils to the top of all 6 spark plugs. One electrical connector (located at the rear end of the coil rail) is used for all three coils.

The 4.7L V-8 engine uses 8 dedicated and individually fired coil for each spark plug. Each coil is mounted directly to the top of each spark plug. A separate electrical connector is used for each coil.

Because of coil design, spark plug cables (secondary cables) are not used on either engine. A **distributor is not used** with either the 4.0L or 4.7L engines.

The ignition system is controlled by the powertrain control module (PCM) on all engines.

The ignition system consists of:

- Spark Plugs
- Ignition Coil(s)
- Powertrain Control Module (PCM)
- Crankshaft Position Sensor
- Camshaft Position Sensor
- The MAP, TPS, IAC and ECT also have an effect on the control of the ignition system.

DESCRIPTION AND OPERATION (Continued)

POWERTRAIN CONTROL MODULE (PCM)

DESCRIPTION

The Powertrain Control Module (PCM) is located in the engine compartment behind the coolant overflow tank (Fig. 1).

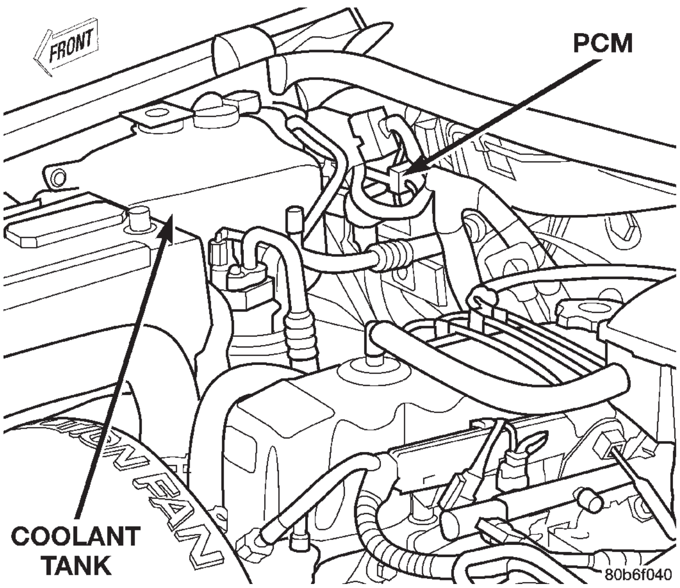


Fig. 1 Powertrain Control Module (PCM) Location

OPERATION

The ignition system is controlled by the PCM.

The PCM opens and closes the ignition coil ground circuit to operate the ignition coil(s). This is done to adjust ignition timing, both initial (base) and advance, and 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 temperature, manifold absolute pressure and throttle position.

SPARK PLUGS

DESCRIPTION

Both the 4.0L 6–cylinder and the 4.7L V-8 engine use resistor type spark plugs. 4.7L V-8 engines are equipped with “fired in suppressor seal” type spark plugs using a copper core ground electrode.

Because of the use of an aluminum cylinder head on the 4.7L engine, spark plug torque is very critical.

To prevent possible pre-ignition and/or mechanical engine damage, the correct type/heat range/number spark plug must be used.

OPERATION

Plugs on both engines have resistance values ranging from 6,000 to 20,000 ohms (when checked with at least a 1000 volt spark plug tester). **Do not use an ohmmeter to check the resistance values of the spark plugs. Inaccurate readings will result.** 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. A single plug displaying an abnormal condition indicates that a problem exists in the corresponding cylinder. Replace spark plugs at the intervals recommended in Group O, Lubrication and Maintenance.

Spark plugs that have low mileage may be cleaned and reused if not otherwise defective, carbon or oil fouled. Also refer to Spark Plug Conditions.

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.

IGNITION COIL—4.0L ENGINE

DESCRIPTION

A one-piece coil rail assembly containing three individual coils is used on the 4.0L 6–cylinder engine (Fig. 2). The coil rail must be replaced as one assembly. The bottom of the coil is equipped with 6 individual rubber boots (Fig. 2) to seal the 6 spark plugs to the coil. Inside each rubber boot is a spring. The spring is used for a mechanical contact between the coil and the top of the spark plug. These rubber boots and springs are a permanent part of the coil and are not serviced separately.

(1) The coil is bolted directly to the cylinder head (Fig. 3). One electrical connector (located at rear of coil) is used for all three coils.

OPERATION

Although cylinder firing order is the same as 4.0L Jeep engines of previous years, spark plug firing is not. The 3 coils dual-fire the spark plugs on cylinders 1–6, 2–5 and/or 3–4. When one cylinder is being fired (on compression stroke), the spark to the opposite cylinder is being wasted (on exhaust stroke).

Battery voltage is supplied to the three ignition coils 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

DESCRIPTION AND OPERATION (Continued)

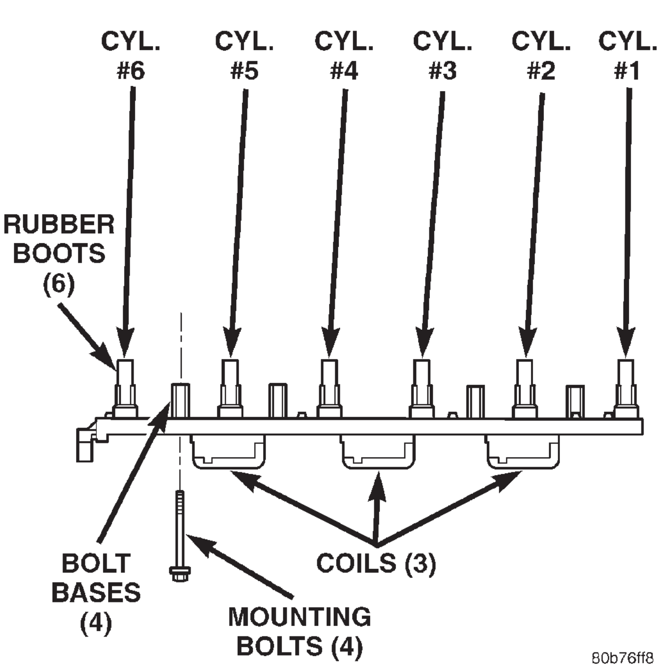


Fig. 2 Ignition Coil Assembly—4.0L 6–Cylinder Engine

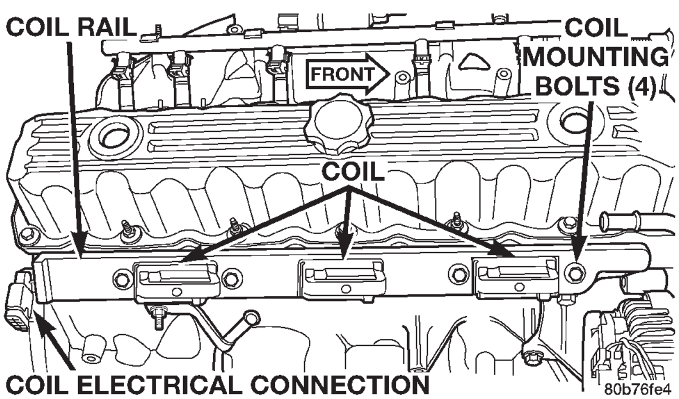


Fig. 3 Coil Location—4.0L Engine

and vibration resistance that allows the ignition coil to be mounted on the engine.

Because of coil design, spark plug cables (secondary cables) are not used. The cables are integral within the coil rail.

IGNITION COIL—4.7L ENGINE

DESCRIPTION

The 4.7L V–8 engine uses 8 dedicated, and individually fired coil (Fig. 4) for each spark plug. Each coil is mounted directly to the top of each spark plug (Fig. 5).

OPERATION

Battery voltage is supplied to the 8 ignition coils from the ASD relay. The Powertrain Control Module

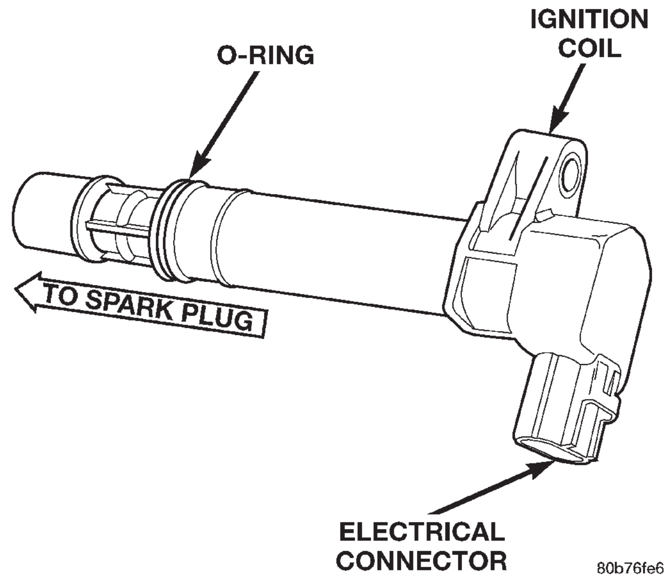


Fig. 4 Ignition Coil—4.7L Engine

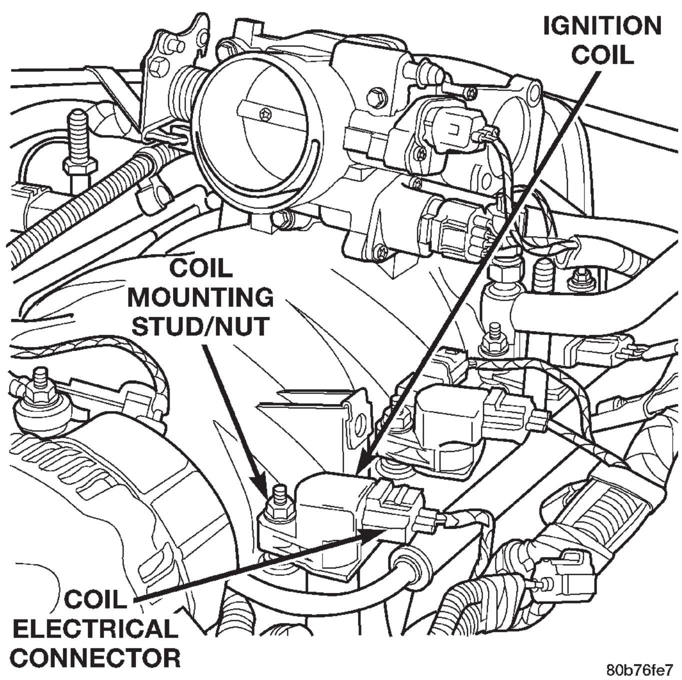


Fig. 5 Ignition Coil Location—4.7L Engine

(PCM) opens and closes each ignition coil ground circuit at a determined time 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.

Because of coil design, spark plug cables (secondary cables) are not used.

DESCRIPTION AND OPERATION (Continued)

AUTOMATIC SHUTDOWN (ASD) RELAY

DESCRIPTION

The ASD relay is located in the Power Distribution Center (PDC). Refer to label on PDC cover for relay location.

OPERATION

As one of its functions, the ASD relay will supply battery voltage to the ignition coil(s). The ground circuit to operate the ASD relay is controlled by the Powertrain Control Module (PCM). The PCM regulates ASD relay operation by switching its ground circuit on-and-off.

CRANKSHAFT POSITION SENSOR—4.0L ENGINE

DESCRIPTION

The Crankshaft Position Sensor (CKP) is mounted to the transmission bellhousing at the left/rear side of the engine block (Fig. 6).

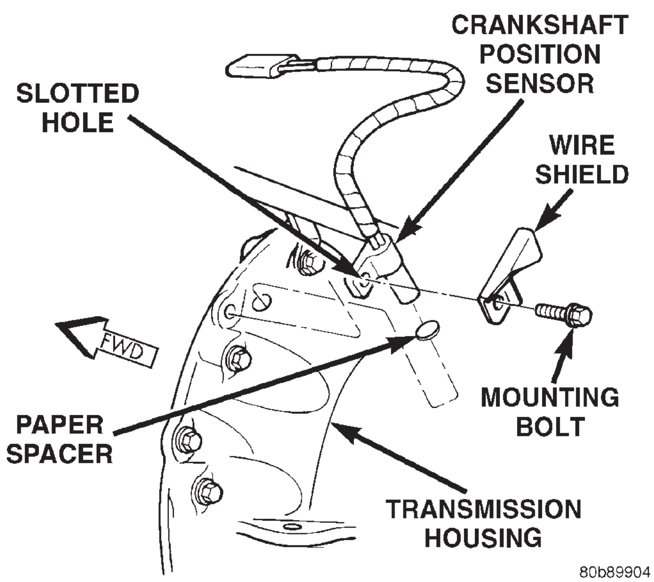


Fig. 6 CKP Sensor Location—4.0L 6-Cyl. Engine

OPERATION

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 position. 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.

On 4.0L 6-cylinder engines, the flywheel/drive plate has 3 sets of four notches 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 3 sets of four pulses generated.

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.

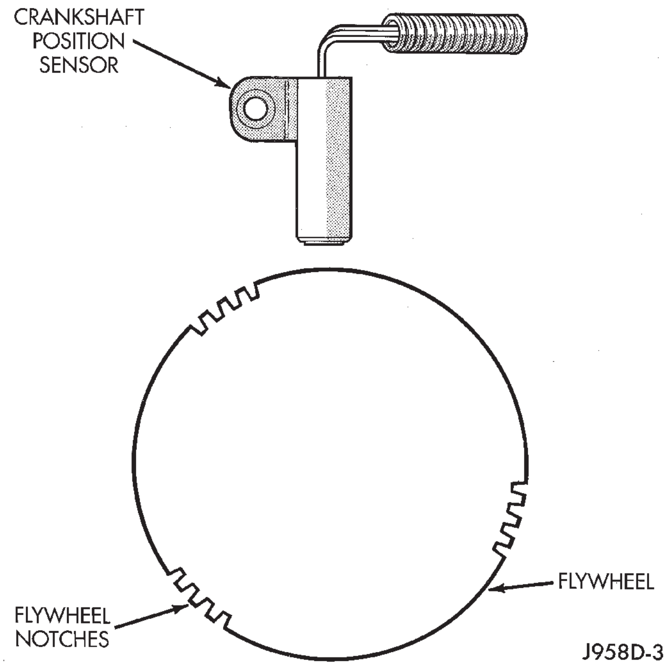


Fig. 7 CKP Sensor Operation—4.0L 6-Cyl. Engine

CRANKSHAFT POSITION SENSOR—4.7L ENGINE

DESCRIPTION

The Crankshaft Position Sensor (CKP) is mounted into the engine block above the starter motor (Fig. 8).

OPERATION

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 position. 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.

DESCRIPTION AND OPERATION (Continued)

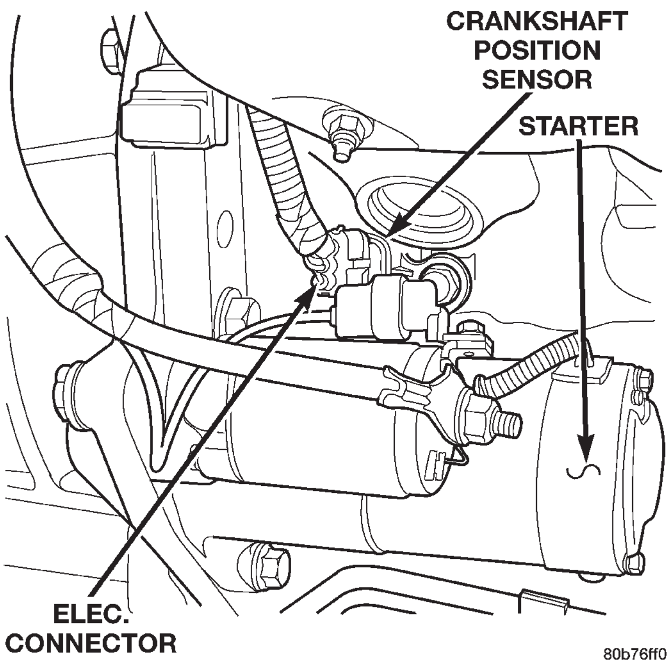


Fig. 8 CKP Sensor Location—4.7L V–8 Engine

On the 4.7L V–8 engine, a tonewheel is bolted to the engine crankshaft (Fig. 9). This tonewheel has sets of notches at its outer edge (Fig. 9).

The notches cause a pulse to be generated when they pass under the sensor. The pulses are the input to the PCM.

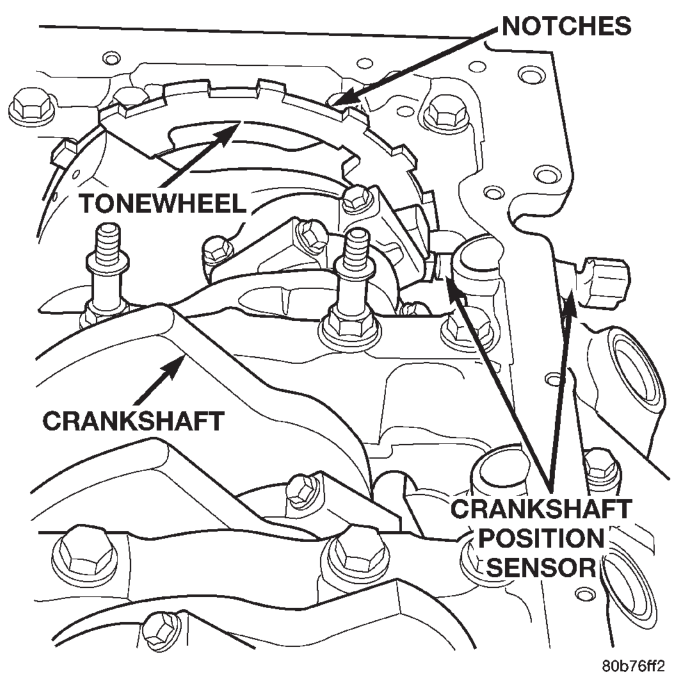


Fig. 9 CKP Sensor Operation and Tonewheel—4.7L V–8 Engine

CAMSHAFT POSITION SENSOR—4.0L ENGINE

DESCRIPTION

The Camshaft Position Sensor (CMP) on the 4.0L 6–cylinder engine is bolted to the top of the oil pump drive shaft assembly (Fig. 10). The sensor and drive shaft assembly is located on the right side of the engine near the oil filter (Fig. 11).

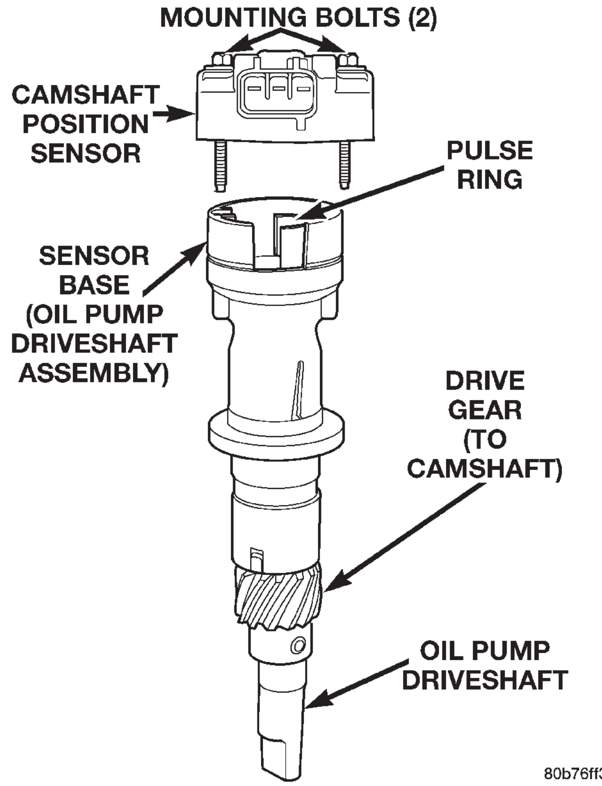


Fig. 10 CMP and Oil Pump Drive Shaft—4.0L Engine

OPERATION

The CMP sensor contains a hall effect device called a sync signal generator to generate a fuel sync signal. This sync signal generator detects a rotating pulse ring (shutter) on the oil pump drive shaft (Fig. 10). 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.

DESCRIPTION AND OPERATION (Continued)

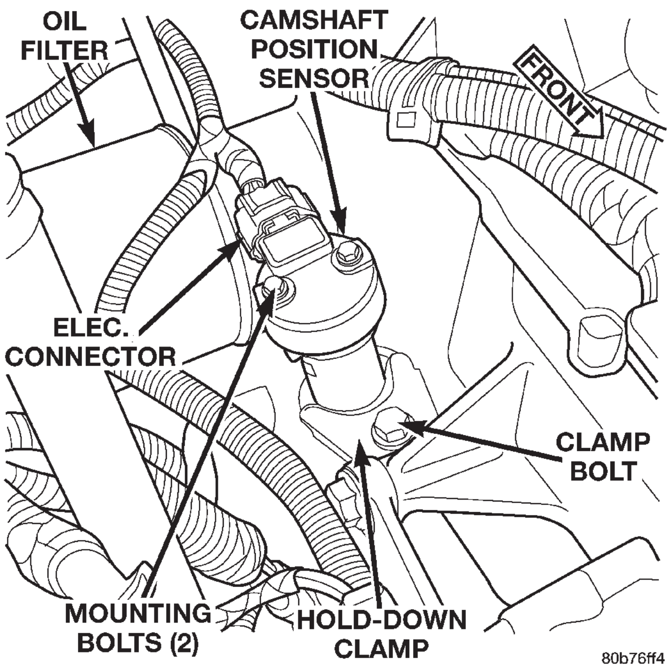


Fig. 11 CMP Location—4.0L Engine

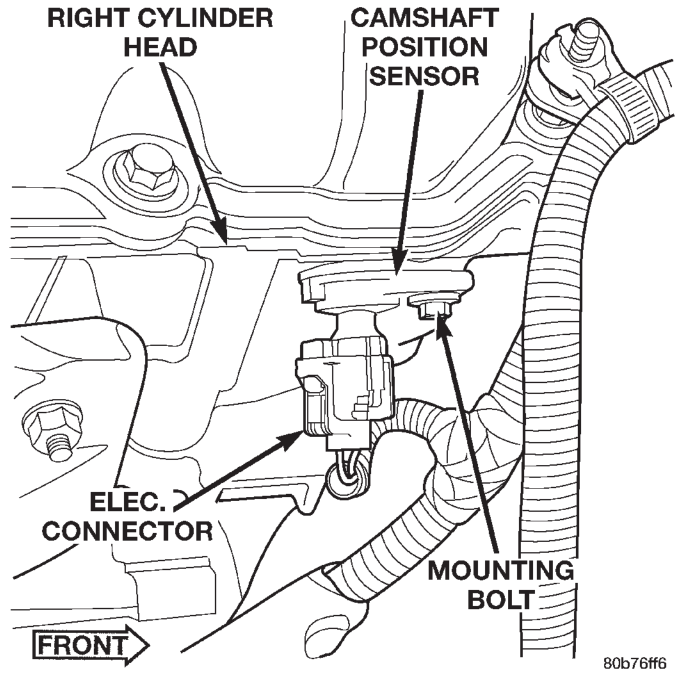


Fig. 12 CMP Location—4.7L Engine

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.

CAMSHAFT POSITION SENSOR—4.7L ENGINE

DESCRIPTION

The Camshaft Position Sensor (CMP) on the 4.7L V–8 engine is bolted to the front/top of the right cylinder head (Fig. 12).

OPERATION

The CMP sensor contains a hall effect device called a sync signal generator to generate a fuel sync signal. This sync signal generator detects notches located on a tonewheel. The tonewheel is located at the front of the camshaft for the right cylinder head (Fig. 13). As the tonewheel rotates, the notches pass through the sync signal generator. The pattern of the notches (viewed counter-clockwise from front of engine) is: 1 notch, 2 notches, 3 notches, 3 notches, 2 notches 1 notch, 3 notches and 1 notch. The signal from the CMP sensor 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.

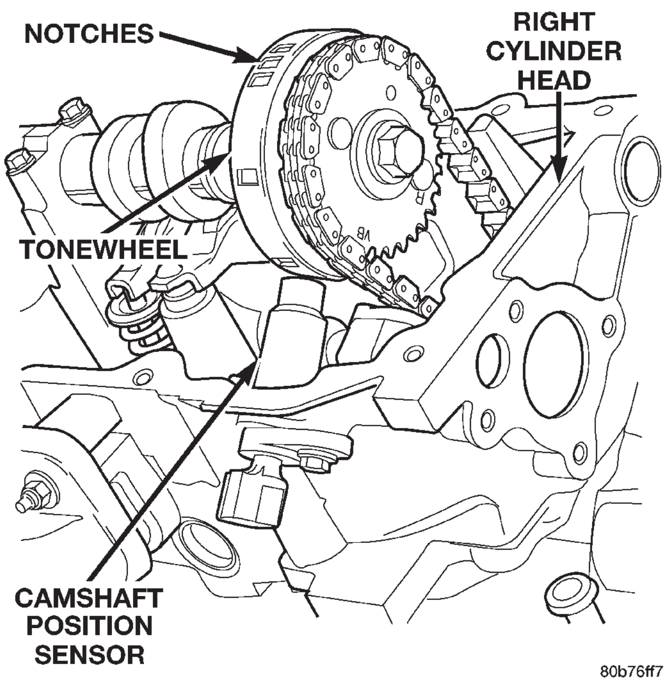


Fig. 13 CMP Sensor and Tonewheel—4.7L Engine

IGNITION SWITCH AND KEY LOCK CYLINDER

DESCRIPTION

The electrical ignition switch is located on the steering column. It is used as the main on/off switching device for most electrical components. The mechanical key lock cylinder is used to engage/disengage the electrical ignition switch.

OPERATION

Vehicles equipped with an automatic transmission and a floor mounted shifter: a cable connects the interlock device within the steering column assembly, to the transmission floor shift lever. This interlock device is used to lock the transmission

DESCRIPTION AND OPERATION (Continued)

shifter in the PARK position when the key lock cylinder is in the LOCKED or ACCESSORY position. The interlock device within the steering column is not serviceable. If repair is necessary, the steering column assembly must be replaced. Refer to Group 19, Steering for procedures. The shifter interlock cable can be adjusted or replaced. Refer to Group 21, Transmissions for procedures.

Vehicles equipped with an automatic transmission and a steering column mounted shifter: an interlock device is located within the steering column. This interlock device is used to lock the transmission shifter in the PARK position when the key lock cylinder is in the LOCKED or ACCESSORY position. The interlock device within the steering column is not serviceable. If repair is necessary, the steering column assembly must be replaced. Refer to Group 19, Steering for procedures.

Vehicles equipped with a manual transmission and a floor mounted shifter: a lever is located on the steering column behind the ignition key lock cylinder. The lever must be manually operated to allow rotation of the ignition key lock cylinder for key removal (turning switch to off position). The lever mechanism is not serviced separately. If repair is necessary, the steering column assembly must be replaced. Refer to Group 19, Steering for procedures.

DIAGNOSIS AND TESTING

IGNITION COIL TEST—4.0L ENGINE

To perform a complete test of the ignition coil rail assembly including the three coils and their circuitry, refer to the DRB scan tool. Also refer to the appropriate Powertrain Diagnostics Procedures manual. To do an individual test of the coil assembly only, refer to the following:

Inspect the ignition coil for cracks and for any arcing. Arcing at the secondary end will carbonize the rubber spark plug boots, which if it is reconnected, may cause the coil to fail. Replace coil if any cracks or arcing is found.

(1) Disconnect coil primary electrical connector by pushing slide tab upward (Fig. 14). After slide tab has been positioned upward, push in on secondary release lock (Fig. 14) on side of connector and pull connector from coil.

One of the 4 coil primary pins is used as a common battery feed (+) to all coils. The other 3 pins are used for (-) coil control for each individual coil. The coils are paired for cylinders 1–6, 2–5 and 3–4. Test the resistance (in ohms) of the primary side of the coil by attaching an ohmmeter across the battery feed (+) to any of the other (–) 3 pins. For pin identification, refer to Wiring Diagrams. Refer to the IGNITION COIL RESISTANCE—4.0L ENGINE chart for resistance values. Replace coil if resistance values are incorrect.

The secondary circuit cannot be checked using an ohmmeter.

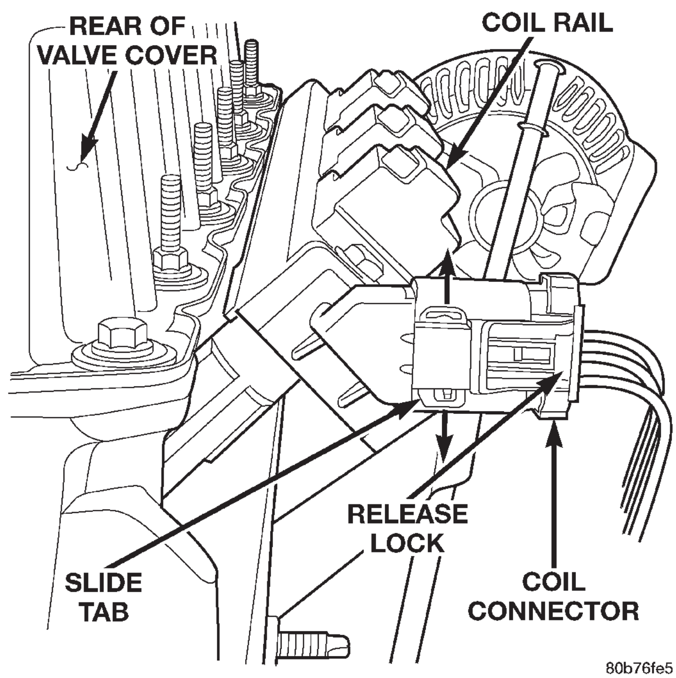


Fig. 14 Ignition Coil Connector Removal—4.0L 6–Cylinder Engine

IGNITION COIL RESISTANCE—4.0L ENGINE

PRIMARY RESISTANCE AT 21-27°C (70-80°F)
0.71 - 0.88 Ohms

IGNITION COIL TEST—4.7L ENGINE

To perform a complete test of the 8 ignition coils and their circuitry, refer to the DRB scan tool. Also refer to the appropriate Powertrain Diagnostics Procedures manual. To do an individual test of the coil only, refer to the following:

Inspect the ignition coil for cracks and for any arcing. Arcing at the secondary end will carbonize the

DIAGNOSIS AND TESTING (Continued)

rubber spark plug boot, which if it is reconnected, may cause the coil to fail. Replace coil if any cracks or arcing is found.

Test the resistance (in ohms) of the primary side of the coil by attaching an ohmmeter across the two pins at the electrical connector end of the coil (Fig. 15). Refer to the IGNITION COIL RESISTANCE—4.7L ENGINE chart for resistance values. Replace coil if resistance values are incorrect.

Test the resistance (in ohms) of the secondary side of the coil by attaching an ohmmeter from either of the two primary pins to the spring inside the rubber boot at the spark plug opening. Refer to the IGNITION COIL RESISTANCE—4.7L ENGINE chart for resistance values. Replace coil if resistance values are incorrect.

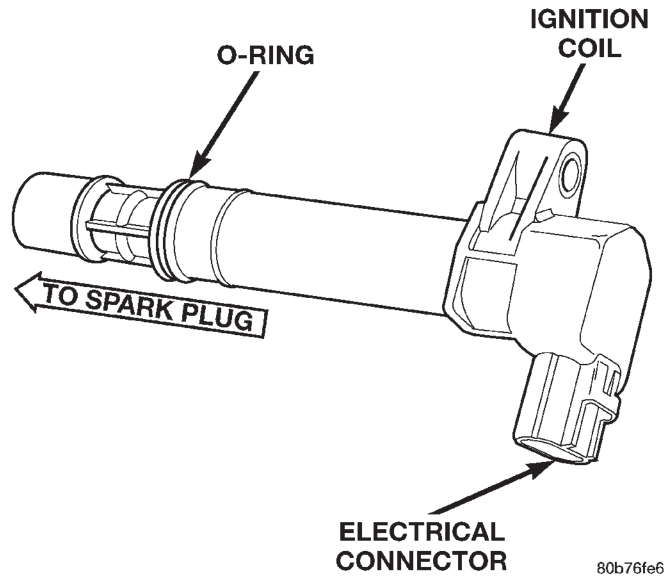


Fig. 15 Ignition Coil—4.7L V-8 Engine

IGNITION COIL RESISTANCE—4.7L ENGINE

PRIMARY RESISTANCE AT 21-27°C (70-80°F)	SECONDARY RESISTANCE AT 21-27°C (70-80°F)
0.6 - 0.9 Ohms	6,000 - 9,000 Ohms

SPARK PLUG CONDITIONS

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. 16). There will not be evidence of electrode burning. Gap growth will not average more than approximately 0.025 mm (.001 in) per 3200 km (2000 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.

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 may be 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. 16). A dry, black deposit on one or two plugs in a set may be caused by sticking valves

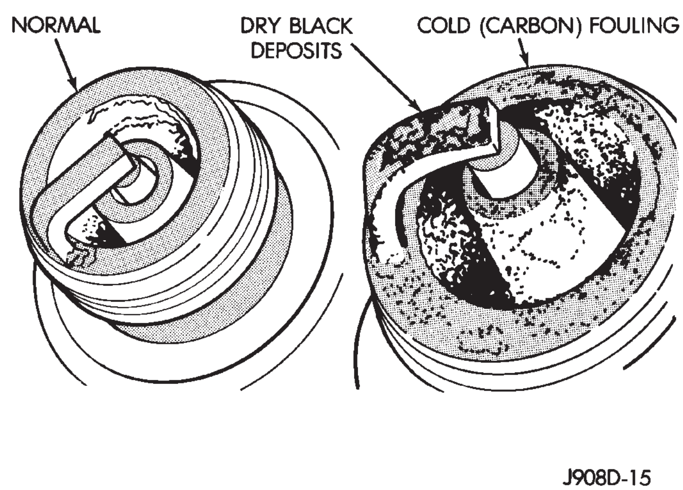


Fig. 16 Normal Operation and Cold (Carbon) Fouling

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

DIAGNOSIS AND TESTING (Continued)

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. 17), evaluate engine condition for the cause of oil entry into that particular combustion chamber.

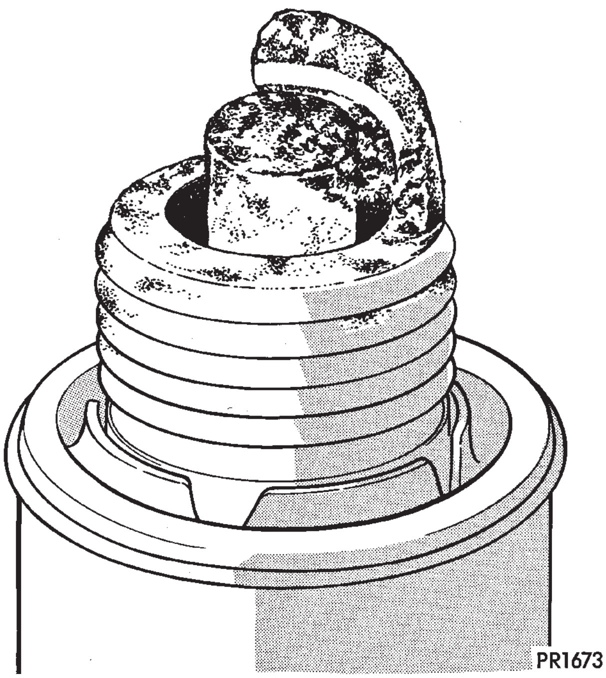


Fig. 17 Oil or Ash Encrusted

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. 18). 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. 19). They may appear to be harmful, but this is a normal condition caused by chemical additives in certain fuels. These additives are designed to change the chemical nature of deposits and decrease spark plug misfire tendencies. Notice that accumulation on the ground electrode and shell area may be heavy, but the deposits are easily removed. Spark plugs with scavenger deposits can be considered nor-

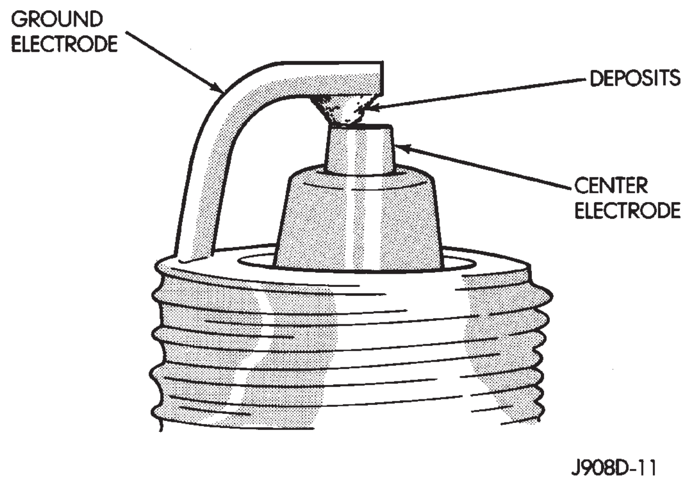


Fig. 18 Electrode Gap Bridging

mal in condition and can be cleaned using standard procedures.

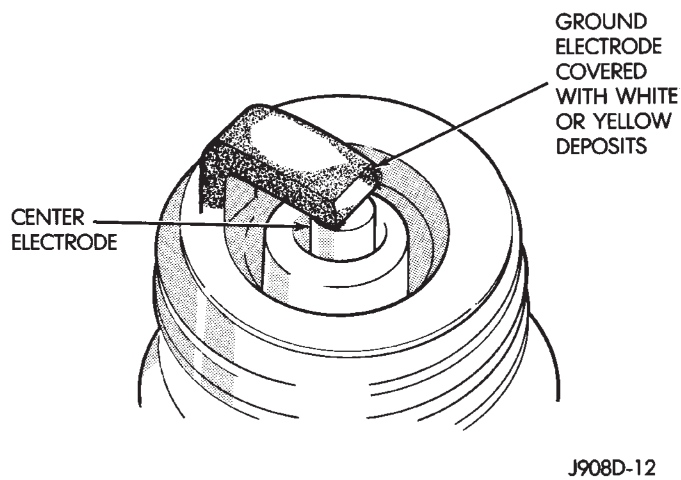


Fig. 19 Scavenger Deposits

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. 20). Spark plugs with this condition must be replaced.

PRE-IGNITION DAMAGE

Pre-ignition damage is usually caused by excessive combustion chamber temperature. The center electrode dissolves first and the ground electrode dissolves somewhat latter (Fig. 21). Insulators appear relatively deposit free. Determine if the spark plug 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.

DIAGNOSIS AND TESTING (Continued)

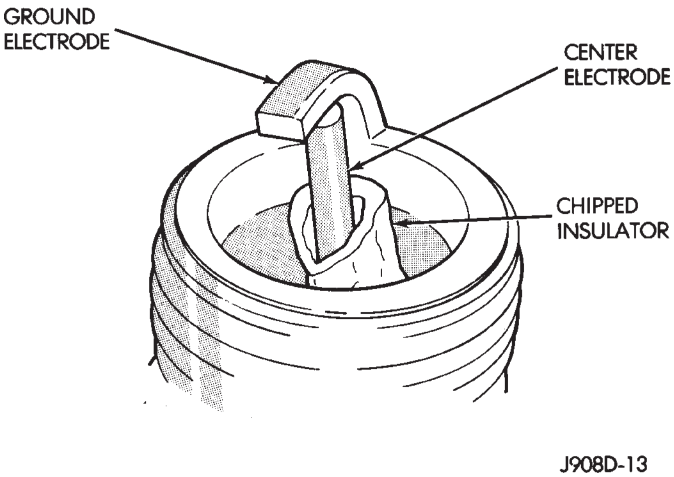


Fig. 20 Chipped Electrode Insulator

Spark plugs are designed to operate within specific temperature ranges. This depends upon the thickness and length of the center electrodes porcelain insulator.)

CAUTION: If the engine is equipped with copper core ground electrode spark plugs, they must be replaced with the same type/number spark plug as the original. If another spark plug is substituted, pre-ignition will result.

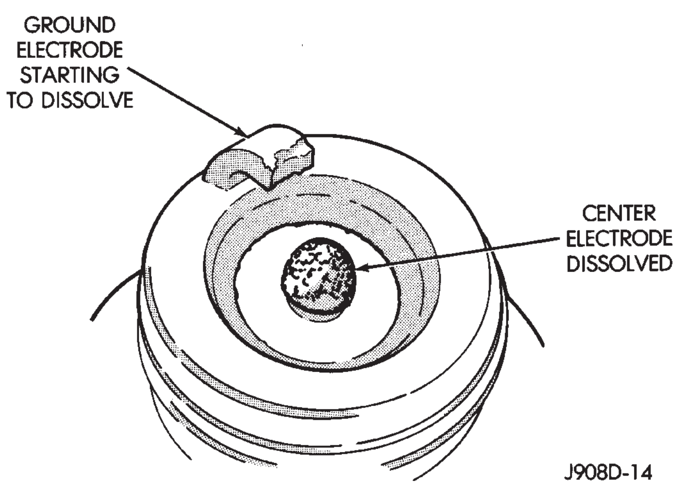


Fig. 21 Pre-ignition Damage

SPARK PLUG OVERHEATING

Overheating is indicated by a white or gray center electrode insulator that also appears blistered (Fig. 22). The increase in electrode gap will be considerably in excess of 0.001 inch per 2000 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.

CAUTION: If the engine is equipped with copper core ground electrode spark plugs, they must be replaced with the same type/number spark plug as the original. If another spark plug is substituted, pre-ignition will result.

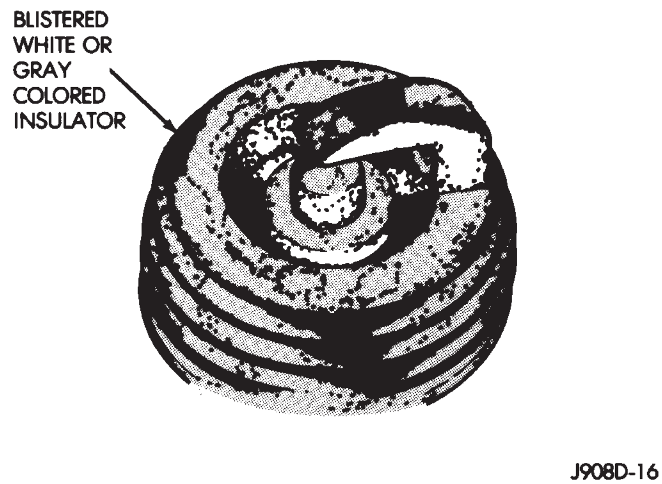


Fig. 22 Spark Plug Overheating

REMOVAL AND INSTALLATION

SPARK PLUGS

REMOVAL

On the 4.0L 6–cylinder engine, the spark plugs are located below the coil rail assembly. On the 4.7L V–8 engine, each individual spark plug is located under each ignition coil.

(1) 4.0L 6–Cylinder Engine: Prior to removing spark plug, spray compressed air around spark plug hole and area around spark plug. This will help prevent foreign material from entering combustion chamber.

(2) 4.7L V–8 Engine: Prior to removing spark plug, spray compressed air around base of ignition coil at cylinder head. This will help prevent foreign material from entering combustion chamber.

(3) On the 4.0L engine the coil rail assembly must be removed to gain access to any/all spark plug. Refer to Ignition Coil Removal/Installation. On the 4.7L V-8 engine each individual ignition coil must be removed to gain access to each spark plug. Refer to Ignition Coil Removal/Installation.

(4) Remove spark plug from cylinder head using a quality socket with a rubber or foam insert.

(5) Inspect spark plug condition. Refer to Spark Plug Conditions.

REMOVAL AND INSTALLATION (Continued)

CLEANING

The plugs may be cleaned using commercially available spark plug cleaning equipment. After cleaning, file center electrode flat with a small point file or jewelers file before adjusting gap.

CAUTION: Never use a motorized wire wheel brush to clean spark plugs. Metallic deposits will remain on spark plug insulator and will cause plug misfire.

ADJUSTMENT

Check spark plug gap with a gap gauge tool. If the gap is not correct, adjust it by bending ground electrode (Fig. 23). **Never attempt to adjust gap by bending center electrode.**

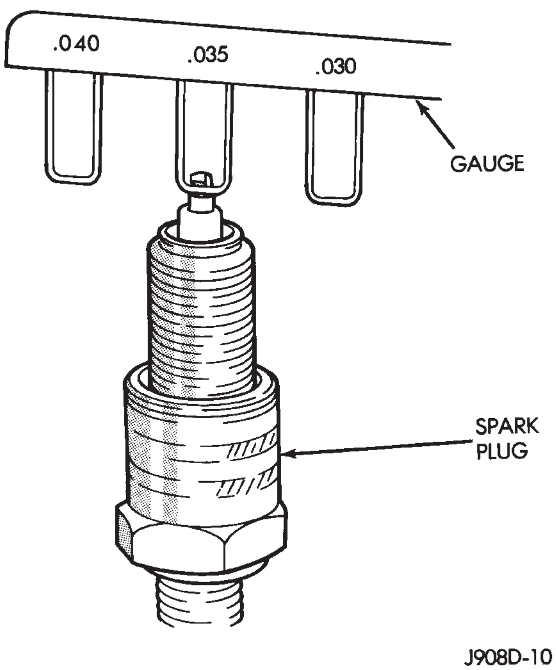


Fig. 23 Setting Spark Plug Gap—Typical

INSTALLATION

CAUTION: The 4.7L V–8 engine is equipped with copper core ground electrode spark plugs. They must be replaced with the same type/number spark plug as the original. If another spark plug is substituted, pre-ignition will result.

Special care should be taken when installing spark plugs into cylinder head spark plug wells. Be sure plugs do not drop into plug wells as ground straps may be bent resulting in a change in plug gap, or electrodes can be damaged.

Always tighten spark plugs to specified torque. Over tightening can cause distortion resulting in a change in spark plug gap or a cracked porcelain insulator.

(1) Start spark plug into cylinder head by hand to avoid cross threading.

(2) 4.0L 6–Cylinder Engine: Tighten spark plugs to 35-41 N·m (26-30 ft. lbs.) torque.

(3) 4.7L V–8 Engine: Tighten spark plugs to 27 N·m (20 ft. lbs.) torque.

(4) Install ignition coil(s). Refer to Ignition Coil Removal/Installation.

IGNITION COIL—4.0L ENGINE

REMOVAL

A one-piece coil rail assembly containing three individual coils is used on the 4.0L engine (Fig. 24). The coil rail must be replaced as one assembly. The bottom of the coil is equipped with 6 individual rubber boots (Fig. 24) to seal the 6 spark plugs to the coil. Inside each rubber boot is a spring. The spring is used for an electrical contact between the coil and the top of the spark plug. These rubber boots and springs are a permanent part of the coil and are not serviced separately.

(1) The coil is bolted directly to the cylinder head. Remove 4 coil mounting bolts (Fig. 25).

(2) Carefully pry up coil assembly from spark plugs. Do this by prying alternately at each end of coil until rubber boots have disengaged from all spark plugs. If boots will not release from spark plugs, use a commercially available spark plug boot removal tool. Twist and loosen a few boots from a few spark plugs to help remove coil.

(3) After coil has cleared spark plugs, position coil for access to primary electrical connector. Disconnect connector from coil by pushing slide tab upward (Fig. 26). After slide tab has been positioned upward, push in on secondary release lock (Fig. 26) on side of connector and pull connector from coil.

(4) Remove coil from vehicle.

INSTALLATION

(1) Position ignition coil rubber boots to all spark plugs. Push down on coil assembly until bolt bases have contacted cylinder head

(2) Install 4 coil mounting bolts. Loosely tighten 4 bolts just enough to allow bolt bases to contact cylinder head. Do a final tightening of each bolt in steps down to 29 N·m (250 in. lbs.) torque. Do not apply full torque to any bolt first.

(3) Connect engine harness connector to coil by snapping into position. Move slide tab downward (Fig. 26) for a positive lock.

REMOVAL AND INSTALLATION (Continued)

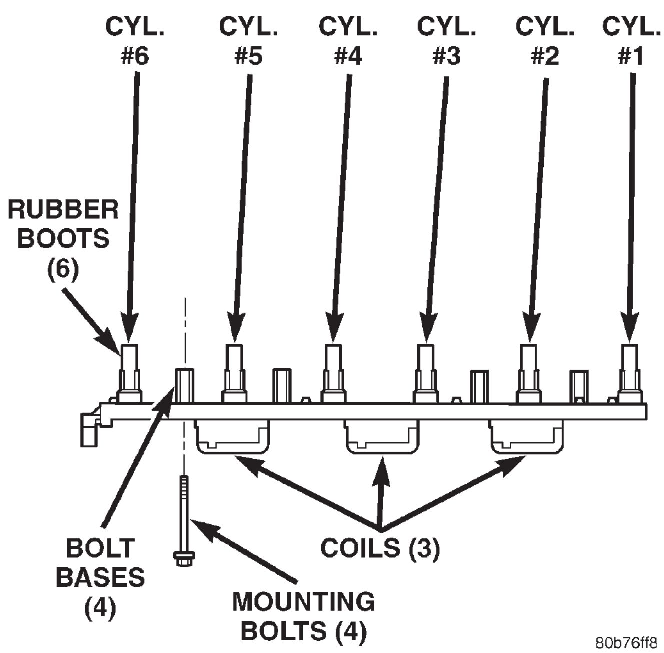


Fig. 24 Ignition Coil Assembly—4.0L 6–Cylinder Engine

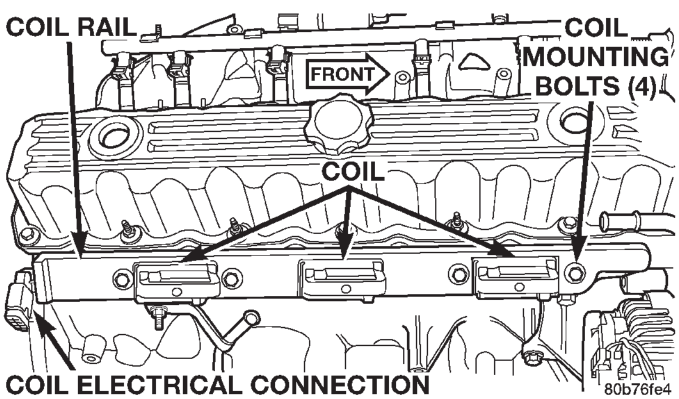


Fig. 25 Ignition Coil Rail Location—4.0L 6–Cylinder Engine

IGNITION COIL—4.7L ENGINE

REMOVAL

An individual ignition coil is used for each spark plug (Fig. 27). The coil fits into machined holes in the cylinder head. A mounting stud/nut secures each coil to the top of the intake manifold (Fig. 28). The bottom of the coil is equipped with a rubber boot to seal the spark plug to the coil. Inside each rubber boot is a spring. The spring is used for a mechanical contact between the coil and the top of the spark plug. These rubber boots and springs are a permanent part of the coil and are not serviced separately. An o-ring (Fig. 27) is used to seal the coil at the opening into the cylinder head.

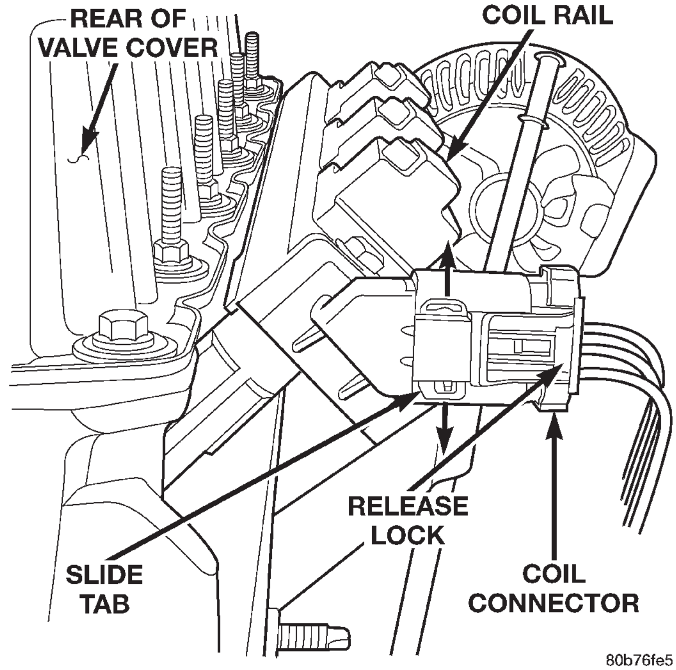


Fig. 26 Ignition Coil Electrical Connector—4.0L 6–Cylinder Engine

(1) Depending on which coil is being removed, the throttle body air intake tube or intake box may need to be removed to gain access to coil.

(2) Disconnect electrical connector (Fig. 28) from coil by pushing downward on release lock on top of connector and pull connector from coil.

(3) Clean area at base of coil with compressed air before removal.

(4) Remove coil mounting nut from mounting stud (Fig. 28).

(5) Carefully pull up coil from cylinder head opening with a slight twisting action.

(6) Remove coil from vehicle.

INSTALLATION

(1) Using compressed air, blow out any dirt or contaminants from around top of spark plug.

(2) Clean coil o-ring but do not apply any lubricant.

(3) Position ignition coil into cylinder head opening and push onto spark plug. Do this while guiding coil base over mounting stud.

(4) Install mounting stud nut and tighten to 8 N·m (70 in. lbs.) torque.

(5) Connect electrical connector to coil by snapping into position.

(6) If necessary, install throttle body air tube or box.

REMOVAL AND INSTALLATION (Continued)

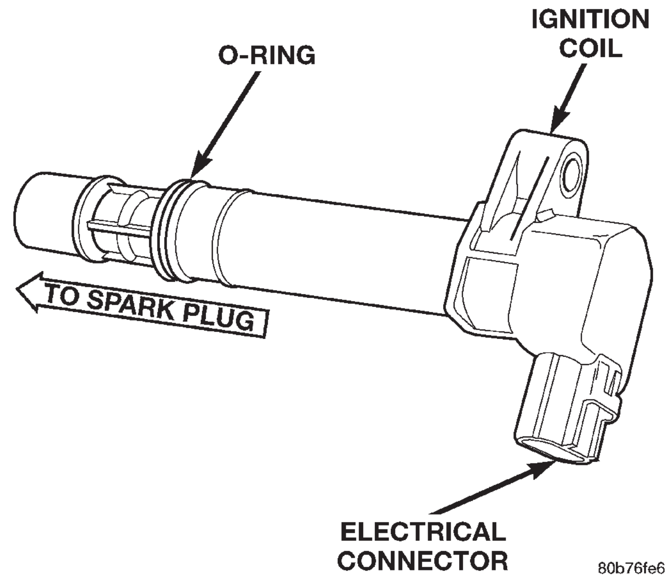


Fig. 27 Ignition Coil—4.7L V–8 Engine

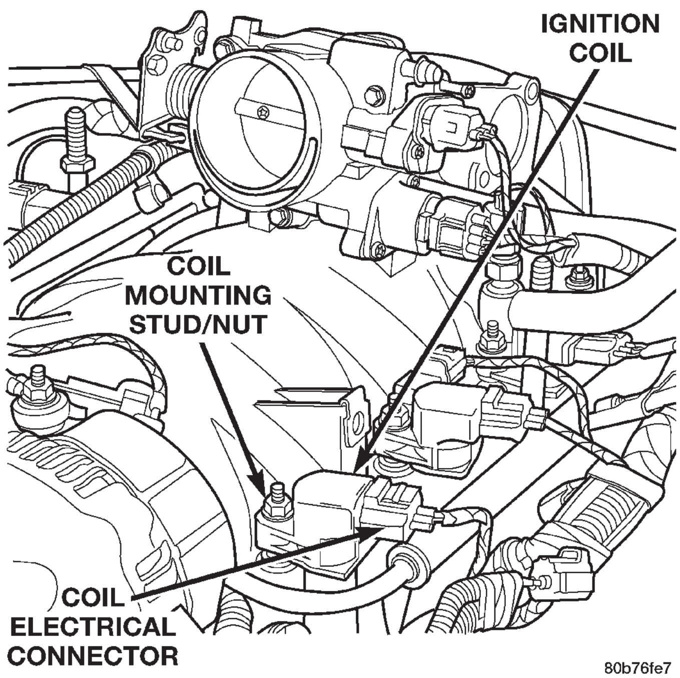


Fig. 28 Ignition Coil Location—4.7L V–8 Engine

CRANKSHAFT POSITION SENSOR—4.0L ENGINE

The Crankshaft Position (CKP) sensor is mounted to the transmission bellhousing at the left/rear side of the engine block (Fig. 29). The sensor **is adjustable** and is attached with one bolt. A wire shield/ router is attached to the sensor (Fig. 29).

REMOVAL

(1) Disconnect sensor pigtail harness (3–way connector) from main engine wiring harness.

(2) Remove sensor mounting bolt.

(3) Remove wire shield and sensor.

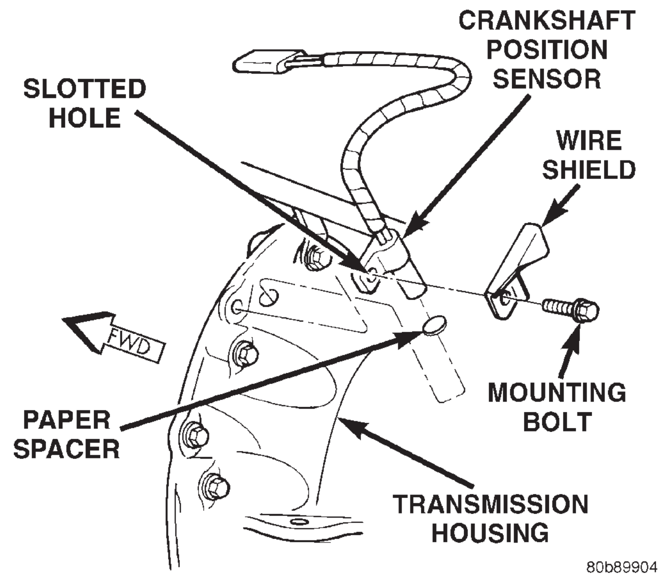


Fig. 29 CKP Sensor—4.0L 6-Cylinder Engine

INSTALLATION

4.0L engines with automatic transmission:

New replacement sensors will be equipped with a paper spacer glued to bottom of sensor. If installing (returning) a **used** sensor to vehicle, a new paper spacer must be installed to bottom of sensor. This spacer will be ground off the first time engine is started. If spacer is not used, sensor will be broken the first time engine is started.

(1) New Sensors: Be sure paper spacer is installed to bottom of sensor. If not, obtain spacer PN05252229.

(2) Used Sensors: Clean bottom of sensor and install spacer PN05252229.

(3) Install sensor into transmission bellhousing hole.

(4) Position sensor wire shield to sensor (Fig. 29).

(5) Push sensor against flywheel/drive plate. With sensor pushed against flywheel/drive plate, tighten mounting bolt to 7 N·m (60 in. lbs.) torque.

(6) Route sensor wiring harness into wire shield.

(7) Connect sensor pigtail harness electrical connector to main wiring harness.

CRANKSHAFT POSITION SENSOR—4.7L V-8 ENGINE

REMOVAL

The Crankshaft Position (CKP) sensor is bolted to the side of the engine cylinder block above the starter motor (Fig. 30). It is positioned into a machined hole at the side of the engine block.

(1) Remove starter motor. Refer to Starter Removal/Installation.

REMOVAL AND INSTALLATION (Continued)

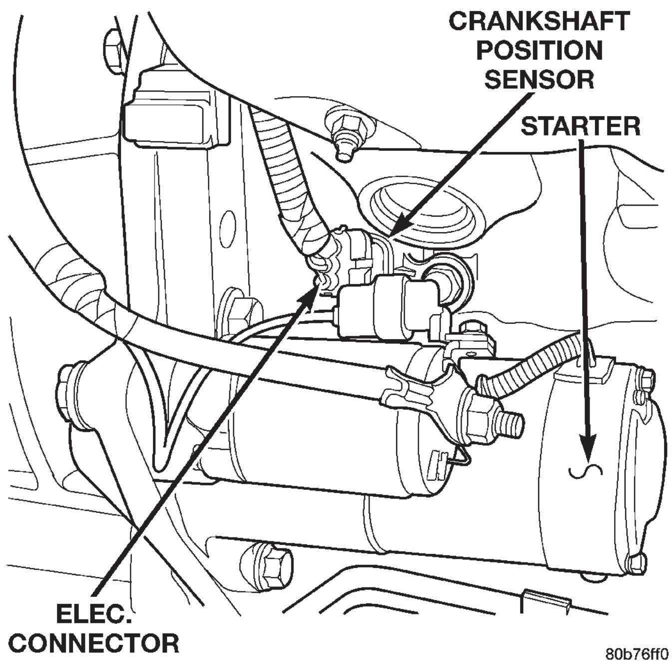


Fig. 30 CKP Sensor Location—4.7L V–8 Engine

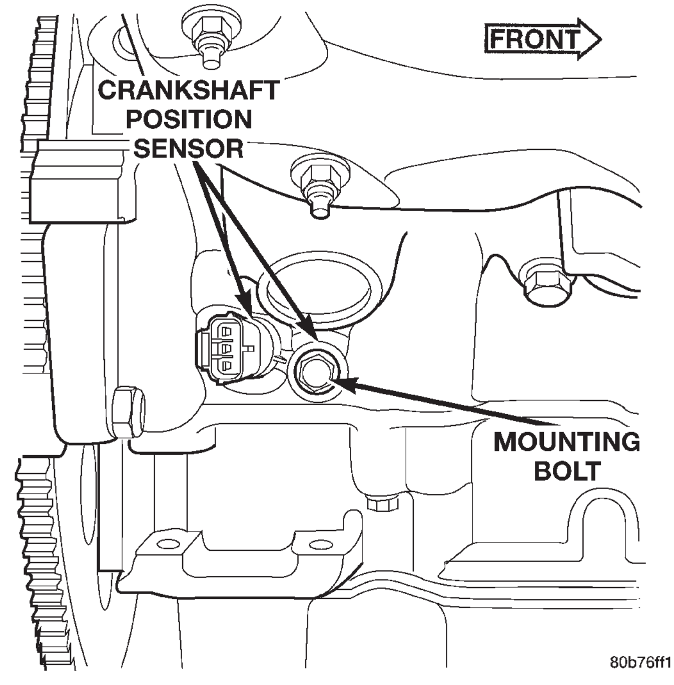


Fig. 31 CKP Sensor Removal/Installation—4.7L V–8 Engine

(2) Disconnect CKP electrical connector at sensor (Fig. 30).

(3) Remove CKP mounting bolt (Fig. 31).

(4) Carefully pry sensor from cylinder block in a rocking action with two small screwdrivers.

(5) Remove sensor from vehicle.

(6) Check condition of sensor o-ring.

INSTALLATION

(1) Clean out machined hole in engine block.

(2) Apply a small amount of engine oil to sensor o-ring.

(3) Install sensor into engine block with a slight rocking action. Do not twist sensor into position as damage to o-ring may result.

CAUTION: Before tightening sensor mounting bolt, be sure sensor is completely flush to cylinder block. If sensor is not flush, damage to sensor mounting tang may result.

(4) Install mounting bolt and tighten to 28 N·m (21 ft. lbs.) torque.

(5) Connect electrical connector to sensor.

(6) Install starter motor. Refer to Starter Removal/Installation.

CAMSHAFT POSITION SENSOR—4.0L ENGINE

The Camshaft Position Sensor (CMP) on the 4.0L 6–cylinder engine is bolted to the top of the oil pump drive shaft assembly (Fig. 32). The sensor and drive shaft assembly is located on the right side of the engine near the oil filter (Fig. 33).

The rotational position of oil pump drive determines fuel synchronization only. It does not determine ignition timing.

NOTE: Do not attempt to rotate the oil pump drive to modify ignition timing.

Two different procedures are needed for removal and installation. The first procedure will detail removal and installation of the sensor only. The second procedure will detail removal and installation of the sensor and oil pump drive shaft assembly. The second procedure is to be used if the engine has been disassembled.

An internal oil seal is used in the drive shaft housing that prevents engine oil at the bottom of the sensor. The seal is not serviceable.

REMOVAL—SENSOR ONLY

(1) Disconnect electrical connector at CMP sensor (Fig. 33).

(2) Remove 2 sensor mounting bolts (Fig. 32) or (Fig. 33).

(3) Remove sensor from oil pump drive.

INSTALLATION—SENSOR ONLY

(1) Install sensor to oil pump drive.

(2) Install 2 sensor mounting bolts and tighten to 2 N·m (15 in. lbs.) torque.

(3) Connect electrical connector to CMP sensor.

REMOVAL AND INSTALLATION (Continued)

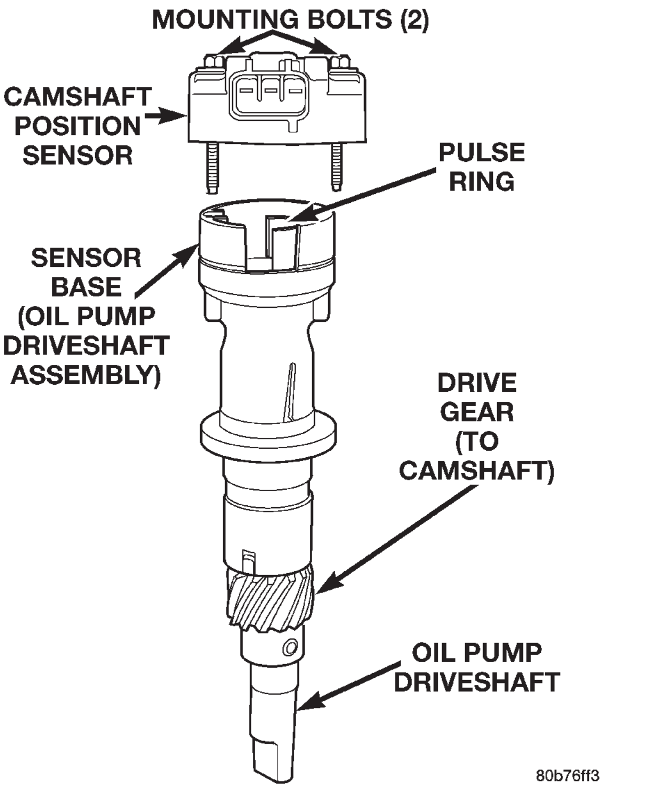


Fig. 32 CMP and Oil Pump Drive Shaft—4.0L Engine

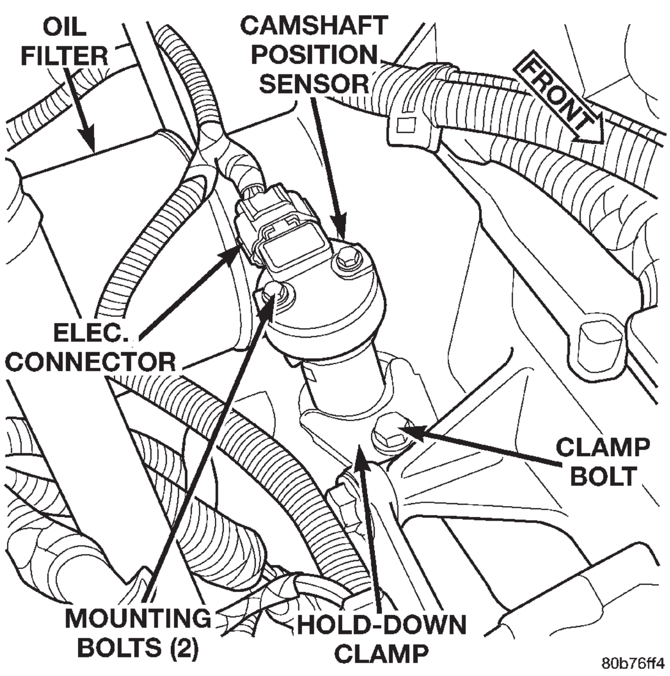


Fig. 33 CMP Location—4.0L Engine

REMOVAL—OIL PUMP DRIVE AND SENSOR

If the CMP and oil pump drive are to be removed and installed, do not allow engine crankshaft or camshaft to rotate. CMP sensor relationship will be lost.

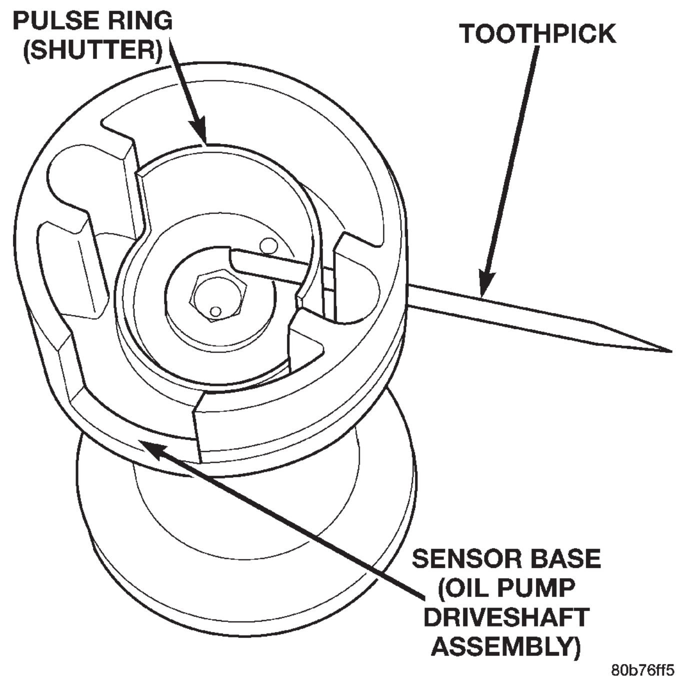


Fig. 34 CMP Pulse Ring Alignment—4.0L Engine

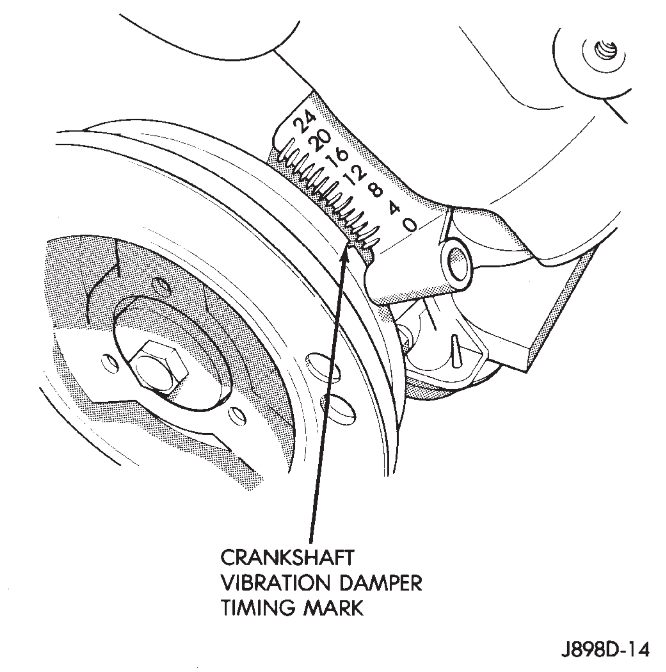


Fig. 35 Align Timing Marks—4.0L Engine

(1) Disconnect electrical connector at CMP sensor (Fig. 33).

(2) Remove 2 sensor mounting bolts (Fig. 32) or (Fig. 33).

(3) Remove sensor from oil pump drive.

(4) Before proceeding to next step, mark and note rotational position of oil pump drive in relationship to engine block. After installation, the CMP sensor should face rear of engine 0°.

(5) Remove hold-down bolt and clamp (Fig. 33).

REMOVAL AND INSTALLATION (Continued)

(6) While pulling assembly from engine, note direction and position of pulse ring (Fig. 32). After removal, look down into top of oil pump and note direction and position of slot at top of oil pump gear.

(7) Remove and discard old oil pump drive-to-engine block gasket.

INSTALLATION—OIL PUMP DRIVE AND SENSOR

(1) Clean oil pump drive mounting hole area of engine block.

(2) Install new oil pump drive-to-engine block gasket.

(3) Temporarily install a toothpick or similar tool through access hole at side of oil pump drive housing. Align toothpick into mating hole on pulse ring (Fig. 34).

(4) Install oil pump drive into engine while aligning into slot on oil pump. Rotate oil pump drive back to its original position and install hold-down clamp and bolt. Finger tighten bolt. Do not do a final tightening of bolt at this time.

(5) If engine crankshaft or camshaft has been rotated, such as during engine tear-down, CMP sensor relationship must be reestablished.

(a) Remove ignition coil rail assembly. Refer to Ignition Coil Removal/Installation.

(b) Remove cylinder number 1 spark plug.

(c) Hold a finger over the open spark plug hole. Rotate engine at vibration dampener bolt until compression (pressure) is felt.

(d) Slowly continue to rotate engine. Do this until timing index mark on vibration damper pulley aligns with top dead center (TDC) mark (0 degree) on timing degree scale (Fig. 35). Always rotate engine in direction of normal rotation. Do not rotate engine backward to align timing marks.

(e) Install oil pump drive into engine while aligning into slot on oil pump. If pump drive will not drop down flush to engine block, the oil pump slot is not aligned. Remove oil pump drive and align slot in oil pump to shaft at bottom of drive. Install into engine. Rotate oil pump drive back to its original position and install hold-down clamp and bolt. Finger tighten bolt. Do not do a final tightening of bolt at this time.

(f) Remove toothpick from housing.

(6) Install sensor to oil pump drive. After installation, the CMP sensor should face rear of engine 0°.

(7) Install 2 sensor mounting bolts and tighten to 2 N·m (15 in. lbs.) torque.

(8) Connect electrical connector to CMP sensor.

(9) If removed, install spark plug and ignition coil rail.

To verify correct rotational position of oil pump drive, the DRB scan tool must be used.

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.

(10) Connect DRB scan tool to data link connector. The data link connector is located in passenger compartment, below and to left of steering column.

(11) Gain access to SET SYNC screen on DRB.

(12) Follow directions on DRB screen and start engine. Bring to operating temperature (engine must be in “closed loop” mode).

(13) With engine running at **idle speed**, the words IN RANGE should appear on screen along with 0°. This indicates correct position of oil pump drive.

(14) If a plus (+) or a minus (-) is displayed next to degree number, and/or the degree displayed is not zero, loosen but do not remove hold-down clamp bolt. Rotate oil pump drive until IN RANGE appears on screen. Continue to rotate oil pump drive until achieving as close to 0° as possible.

The degree scale on SET SYNC screen of 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 oil pump drive will have no effect on ignition timing. All ignition timing values are controlled by powertrain control module (PCM).

(15) Tighten hold-down clamp bolt to 23 N·m (17 ft. lbs.) torque.

CAMSHAFT POSITION SENSOR—4.7L ENGINE

The Camshaft Position Sensor (CMP) on the 4.7L V–8 engine is bolted to the front/top of the right cylinder head (Fig. 36).

REMOVAL

It is easier to remove/install sensor from under vehicle.

(1) Raise and support vehicle.

(2) Disconnect electrical connector at CMP sensor (Fig. 36).

(3) Remove sensor mounting bolt (Fig. 36).

(4) Carefully pry sensor from cylinder head in a rocking action with two small screwdrivers.

(5) Check condition of sensor o-ring.

INSTALLATION

(1) Clean out machined hole in cylinder head.

(2) Apply a small amount of engine oil to sensor o-ring.

(3) Install sensor into cylinder head with a slight rocking action. Do not twist sensor into position as damage to o-ring may result.

REMOVAL AND INSTALLATION (Continued)

1999 Jeep Grand Cherokee WJ
Publication No. 81-370-9147
TSB 26-12-98 December, 1998

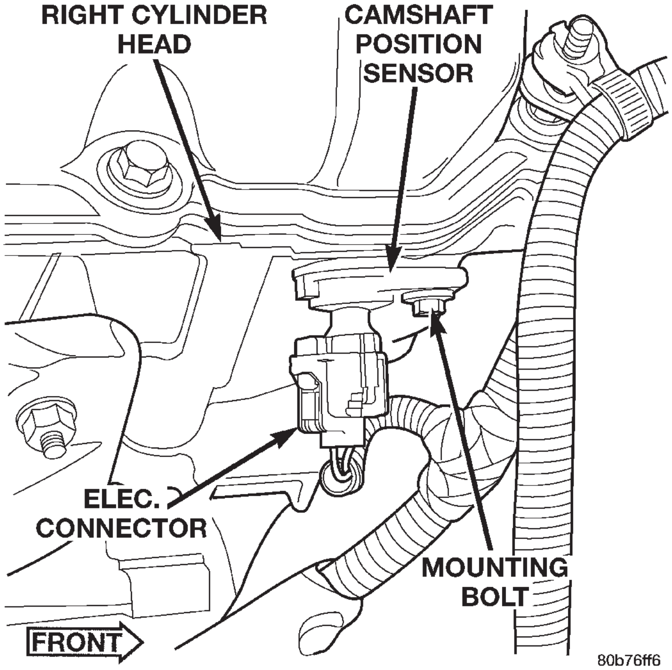


Fig. 36 CMP Location—4.7L Engine

CAUTION: Before tightening sensor mounting bolt, be sure sensor is completely flush to cylinder head. If sensor is not flush, damage to sensor mounting tang may result.

(4) Install mounting bolt and tighten to 12 N·m (106 in. lbs.) torque.

(5) Connect electrical connector to sensor.

(6) Lower vehicle.

IGNITION SWITCH AND KEY CYLINDER

The ignition key must be in key lock cylinder for cylinder removal.

REMOVAL

If removing **key lock cylinder only,** refer to first 6 steps. If removing **ignition switch only,** refer to steps 1 and 2 and proceed to steps 7 through 13.

(1) Disconnect negative cable from battery.

(2) Place transmission shifter in PARK position.

(3) Place tilt steering wheel in full up position.

(4) A retaining pin (Fig. 37) is located at bottom of key lock cylinder housing.

(5) Rotate key to RUN position.

(6) Press in on retaining pin while pulling key cylinder from housing. After removal, note position of alignment tang at end of cylinder. When installing lock cylinder, key must be rotated back to RUN position.

(7) Remove steering column lower opening cover. Refer to Steering Column Opening Cover in Group 8E, Instrument Panel.

(8) Remove upper and lower covers (shrouds) from steering column (Fig. 38).

(9) Remove upper fixed column shroud (2 screws) (Fig. 39).

(10) Remove SKIM (Sentry Key Immobilizer Module) (1 screw) (Fig. 40).

(11) Disconnect electrical connectors at switch.

(12) Remove ignition switch mounting screw (Fig. 41). Use tamper proof torx bit (Snap-On® TTXR10E or equivalent) to remove screw.

(13) Using needle-nose pliers, squeeze both switch lock tabs (Fig. 42) and gently pull switch away from column. **Do not rotate key lock cylinder when ignition switch is being removed or has been removed from steering column.**

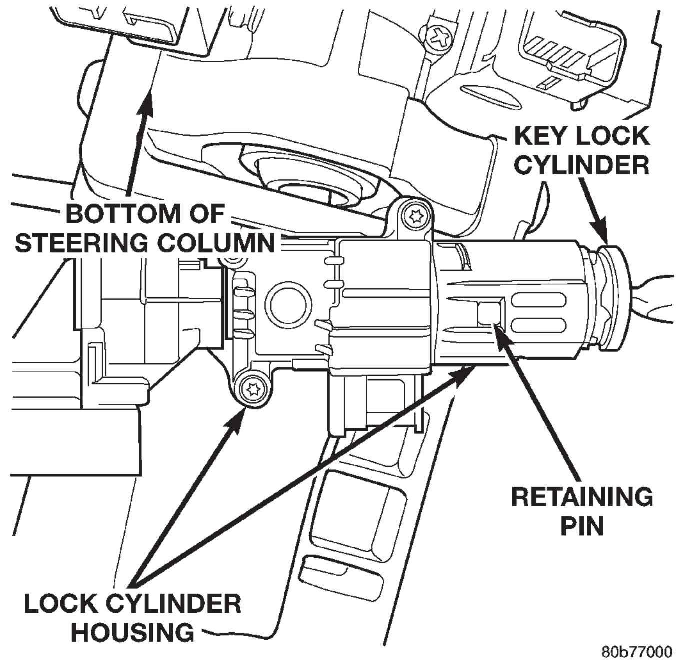


Fig. 37 Retaining Pin

INSTALLATION

If installing **key lock cylinder only,** refer to steps 1 through 4 then proceed to steps 10 through 14. If installing **ignition switch only,** refer to steps 5 through 14.

(1) Be sure transmission shifter is still in PARK position.

(2) Rotate key in lock cylinder to RUN position.

(3) Install key cylinder into housing by aligning retaining pin into retaining pin slot. Push key cylinder into housing until retaining pin engages. After pin engages, rotate key to OFF or LOCK position.

(4) Check for proper retention of key cylinder by attempting to pull cylinder from housing.

(5) Place ignition switch into opening on steering column housing. If switch will not fit into housing, do not force it. Remove switch from housing and rotate

REMOVAL AND INSTALLATION (Continued)

1999 Jeep Grand Cherokee WJ
Publication No. 81-370-9147
TSB 26-12-98 December, 1998

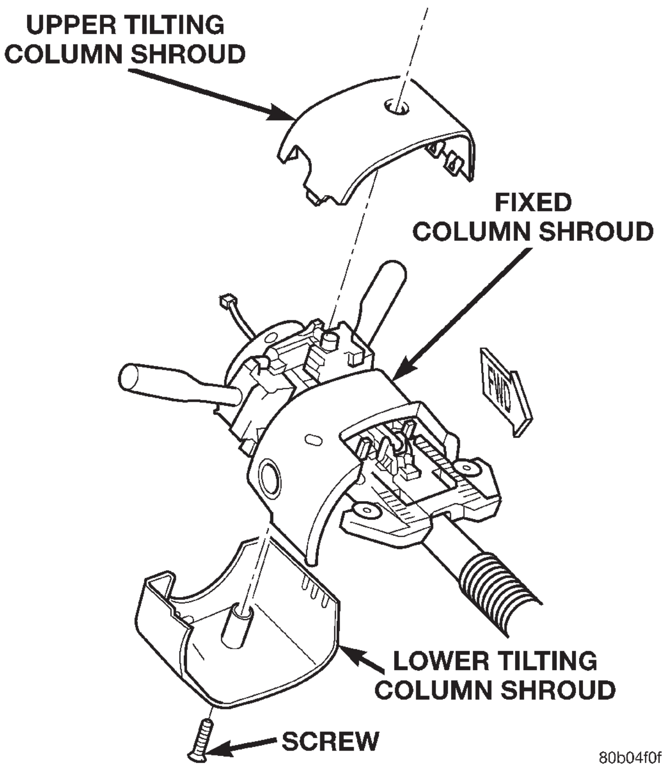


Fig. 38 Shroud Removal/Installation

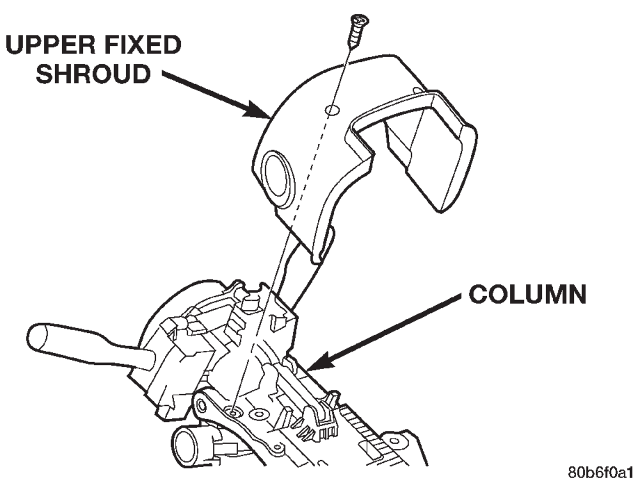


Fig. 39 Fixed Column Shroud Removal/Installation

key cylinder (slightly) for alignment. Push switch into column housing until 2 lock tabs have engaged.

(6) Install ignition switch mounting screw. Tighten screw to 3 N·m (30 in. lbs.) torque.

(7) Connect electrical connectors to ignition switch. Make sure that switch locking tabs are fully seated in wiring connectors.

(8) Install SKIM (Sentry Key Immobilizer Module) (1 screw). Tighten screw to 3 N·m (30 in. lbs.) torque.

(9) Install steering column covers (shrouds).

(10) Connect negative cable to battery.

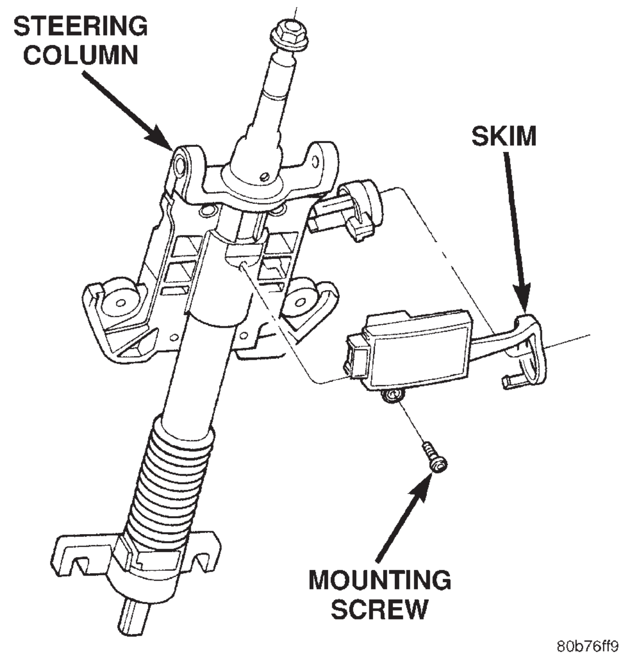


Fig. 40 Sentry Key Immobilizer Module and Mounting Screw

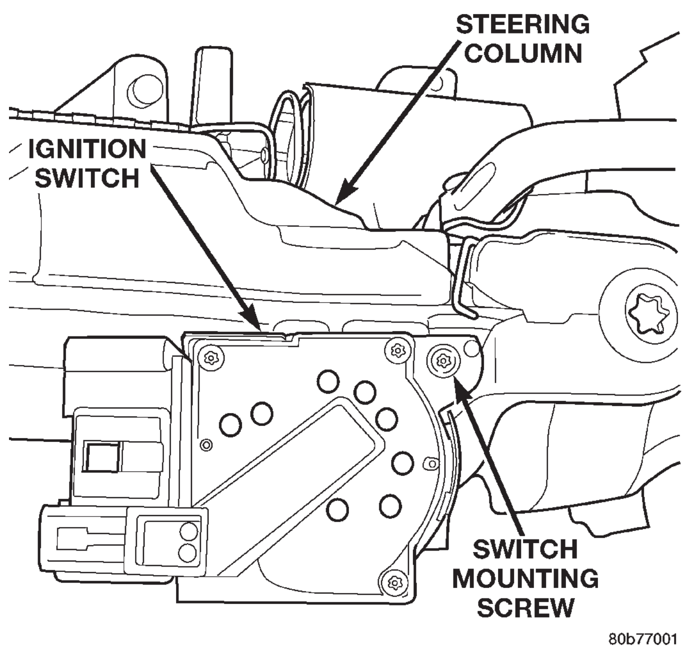


Fig. 41 Ignition Switch Mounting Screw

(11) Shifter should lock in PARK position when key is in LOCK position. Shifter should unlock when key rotated to ON position.

(12) With engine running, shifter should not be unable to be moved from PARK position until brake pedal has been depressed.

(13) Check for proper operation of ignition switch in ACCESSORY, LOCK, OFF, ON, RUN, and START positions.

REMOVAL AND INSTALLATION (Continued)

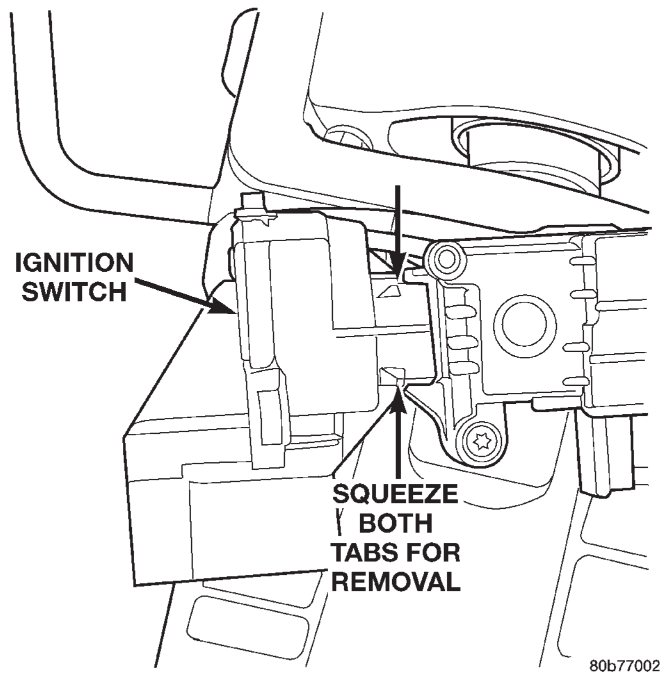


Fig. 42 Ignition Switch Lock Tabs

(14) Steering wheel should lock when key is in LOCK position. Rotate steering wheel to verify. Steering wheel should unlock when key is rotated to ON position.

SHIFTER/IGNITION INTERLOCK

On models equipped with an automatic transmission, a cable connects the ignition switch with the floor shift lever. The shifter will be locked in the PARK position when the ignition key is in the LOCK or ACCESSORY positions. The cable can be adjusted or replaced. Refer to Group 21, Transmissions for procedures. The ignition interlock device within the steering column is not serviceable. If service is necessary, the steering column must be replaced. Refer to Group 19, Steering for procedures.

SPECIFICATIONS

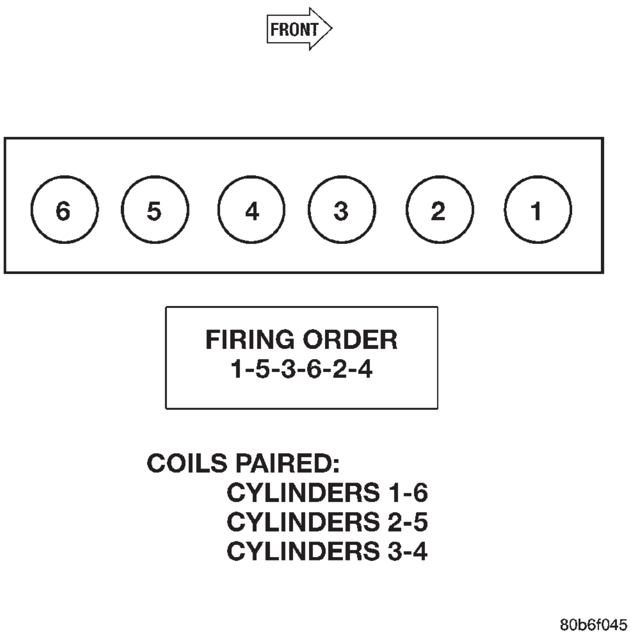
IGNITION TIMING

All ignition timing functions are controlled by the Powertrain Control Module (PCM). Mechanical adjustments are not needed and can’t be made.

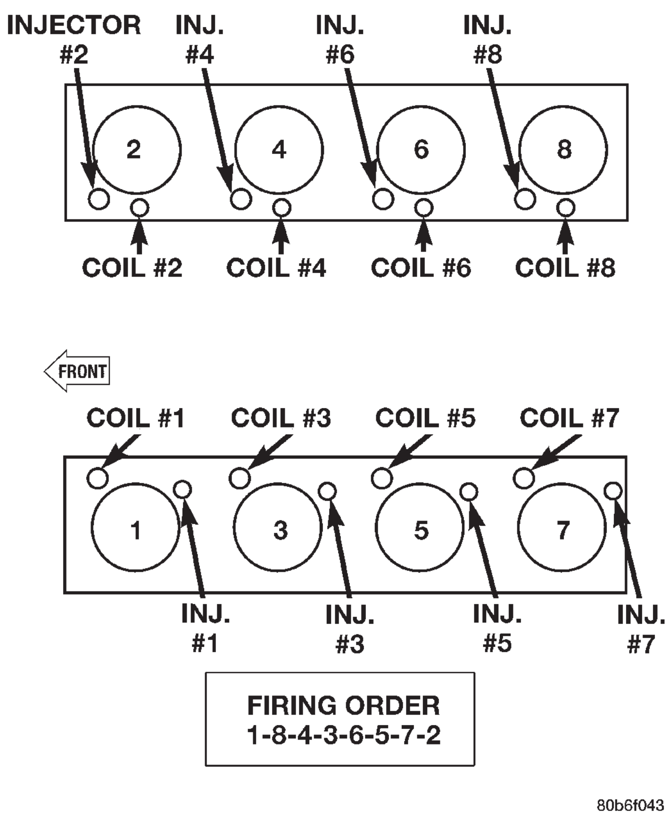
On the 4.0L 6–cylinder engine, do not attempt to rotate the oil pump drive to adjust timing. This adjustment is used for fuel synchronization after camshaft position sensor replacement.

SPECIFICATIONS (Continued)

ENGINE FIRING ORDER—4.0L 6-CYLINDER ENGINE



ENGINE FIRING ORDER—4.7L V-8 ENGINE



SPARK PLUGS

ENGINE	PLUG TYPE	ELECTRODE GAP
4.0L 6-CYL.	RC12ECC	0.89 mm (.035 in.)
4.7L V-8	RC12MCC4	1.01 mm (.040 in.)

IGNITION COIL RESISTANCE—4.0L ENGINE

PRIMARY RESISTANCE 21-27°C (70-80°F)
0.71 - 0.88 Ohms

IGNITION COIL RESISTANCE—4.7L V-8 ENGINE

PRIMARY RESISTANCE 21-27°C (70-80°F)	SECONDARY RESISTANCE 21-27°C (70-80°F)
0.6 - 0.9 Ohms	6,000 - 9,000 Ohms

TORQUE CHART

DESCRIPTION	TORQUE
Crankshaft Position Sensor Bolts—4.0L Engine	7 N·m (60 in. lbs.)
Crankshaft Position Sensor Bolt—4.7L V-8 Engine	28 N·m (21 ft. lbs.)
Camshaft Position Sensor–to–base bolts—4.0L Engine	28 N·m (15 in. lbs.)
Camshaft Position Sensor Bolt—4.7L V-8 Engine	12 N·m (106 in. lbs.)
Oil Pump Drive Hold-down Bolt—4.0L Engine	23 N·m (17 ft. lbs.)
Ignition Coil Rail Mounting Bolts—4.0L Engine	29 N·m (250 in. lbs.)
Ignition Coil Mounting Nut—4.7L V-8 Engine	8 N·m (70 in. lbs.)
Spark Plugs—4.0L Engine	35–41 N·m (26–30 ft. lbs.)
Spark Plugs—4.7L V-8 Engine	27 N·m (20 ft. lbs.)

INSTRUMENT PANEL SYSTEMS

CONTENTS

DESCRIPTION AND OPERATION

INSTRUMENT PANEL SYSTEM

DESCRIPTION

The instrument panel serves as the command center of the vehicle, which necessarily makes it a very complex unit. The instrument panel is designed to house the controls and monitors for standard and optional powertrains, climate control systems, audio systems, lighting systems, safety systems and many other comfort or convenience items. The instrument panel is also designed so that all of the various controls can be safely reached and the monitors can be easily viewed by the vehicle operator when driving, while still allowing relative ease of access to each of these items for service. See the owner's manual in the vehicle glove box for more information on the features, use and operation of all of the instrument panel components and systems.

This group is responsible for covering service information for the vehicle instrument panel systems. However, complete service information coverage for all of the systems and components housed in the instrument panel in a single section of the service manual would not be practical. Therefore, the service information for any component will be found in the group designated to cover the vehicle system that the

DESCRIPTION AND OPERATION (Continued)

component belongs to, even though the component is mounted on or in the instrument panel. If you cannot locate a listing for the component or system you are servicing in the table of contents for this group, or if you are uncertain as to which vehicle system a component belongs to, it is suggested that you refer to the alphabetical **Component and System Index** found at the back of this service manual.

INSTRUMENT PANEL

DESCRIPTION

Structural support for the instrument panel in this vehicle is accomplished through the use of a molded plastic structural panel and demister air flow duct assembly. The front and rear halves of this structural duct are molded from a blend of polycarbonate and ABS plastics, which gives these components excellent strength and impact resistance. The two halves of this structural duct are vibration welded together.

The structural duct provides integral mounting surfaces for the instrument cluster and other instrument panel-mounted equipment such as the passenger side airbag module, the radio, the heater and air conditioner controls, the glove compartment latch strikers and hinges, the instrument panel steering column support bracket, and the junction block. The structural duct also features integral vacuum and electrical harness routing troughs. All of these integral features help to reduce the total component part requirements, which reduces assembly complexity and potential buzzes, squeaks and rattles. At the same time, these features make the structural duct-based instrument panel more suitable for recycling by minimizing the number of parts to be removed.

A patented feature of the construction of this instrument panel has the heater and air conditioner housing unit and the steering column secured to the structural duct and installed into the vehicle as a unit during vehicle assembly. This feature helps to improve vehicle quality by allowing the instrument panel, heater and air conditioner housing unit and the steering column to be assembled and tested outside the vehicle prior to installation, which is easier and more reliable than in-car assembly and testing. This feature also adds a floor panel mounting point to the instrument panel unit, which provides additional stiffness and system integrity.

A foam-padded cast vinyl instrument panel top pad covers the instrument panel structural duct. This surface is designed to deform upon impact without breaking, while also providing a luxurious feel. The top pad features a grained outer surface and two shallow molded depressions on the top, which can serve as trays to store various small objects. A unique anti-skid texture molded into the top pad surface in the bottom of these depressions will help to prevent objects from shifting in the trays while the vehicle is being driven. The top pad conceals an integral top-hinged steel passenger side airbag door, which is located between the two panel duct air outlets above the glove box. The top pad also features a raised hood formation over the instrument cluster area, which helps to block light reflections from the windshield onto the cluster lens in the daytime, and light reflections from the cluster onto the windshield at night.

The center stack area of the instrument panel features two snap-on bezels. The upper bezel has two integral center panel duct air outlets and conceals the radio and upper heater and air conditioner control mounting hardware. The lower bezel conceals the lower heater and air conditioner control mounting hardware and includes a concealed integral storage bin, which features a push-push latching mechanism and viscous-damped hinges. Pushing in on the face of the bin releases the latch and the bin opens by itself. The lower bezel also houses the two switches for the optional heated driver and passenger front seats, as well as two accessory power outlets. The accessory power outlet to the passenger side of the storage bin is covered by a pivoting door when not in use. The accessory power outlet to the driver side of the storage bin is covered by a snap-in plastic cap when not in use. If the optional smoker's package is ordered, a removable ash receiver is inserted in the storage bin and a cigar lighter is inserted in the driver side accessory power outlet.

The hinged bin-type glove box in the passenger side of the instrument panel features a recessed paddle-operated latch handle that is offset towards the driver side of the vehicle for easier access. The glove box latching mechanism features two bolt-type latches that engage a striker located on each side of the glove box opening for increased strength and integrity. Three molded hook formations on the lower edge of the glove box door are engaged with and pivot on three hinge pins integral to the lower edge of the structural duct. The glove box door also serves as the passenger side knee blocker. A honeycomb structure between the inner and outer glove box door panels helps to absorb the impact load and distribute it to the instrument panel structural duct.

The steering column opening cover serves as the driver side knee blocker. This molded plastic cover has an integral ribbed plastic liner concealed behind it, for increased strength and integrity. The steering column opening cover transfers impact loads through a stamped and welded instrument panel steering column bracket to the cast magnesium instrument panel steering column support bracket, which is

DESCRIPTION AND OPERATION (Continued)

secured to and distributes the impact load to the instrument panel structural duct.

Modular instrument panel construction allows all of the gauges and controls to be serviced from the front of the instrument panel. In addition, most of the instrument panel electrical or heating and air conditioning components can be accessed without complete instrument panel removal. However, if necessary, the instrument panel unit can be removed from the vehicle as an assembly.

INSTRUMENT CLUSTER

DESCRIPTION

A single instrument cluster is offered on this model. This cluster is an Electro-Mechanical Instrument Cluster (EMIC) module that utilizes integrated circuitry and information carried on the Programmable Communications Interface (PCI) data bus network for control of all gauges and many of the indicator lamps. This cluster also incorporates a digital Vacuum Fluorescent Display (VFD) for the odometer/trip odometer display functions. Some variations of this cluster exist due to optional equipment and regulatory requirements.

This instrument cluster includes the following gauges:

- Coolant temperature gauge
- Fuel gauge
- Odometer and trip odometer
- Oil pressure gauge
- Speedometer
- Tachometer
- Voltmeter.

This cluster also includes provisions for the following indicator lamps:

- Airbag indicator lamp
- Anti-lock brake system lamp
- Brake warning lamp
- Check gauges lamp
- Cruise-on indicator lamp
- Fog lamps-on indicator lamp
- Headlamp high beam indicator lamp
- Low fuel warning lamp
- Malfunction indicator (Check Engine) lamp
- Overdrive-off indicator lamp
- Part-time four-wheel drive indicator lamp (Selec-Trac)
- Seat belt reminder lamp
- Sentry Key Immobilizer System (SKIS) indicator lamp
- Transmission oil temperature warning lamp
- Turn signal indicator lamps.

This instrument cluster features circuitry that has a self-diagnostic actuator test capability, which will test each of the PCI data bus message-controlled functions of the cluster by lighting the appropriate indicator lamps (except for the airbag indicator lamp), sweeping the gauge needles from their respective minimum to their maximum readings, and stepping the odometer display sequentially from all zeros through all nines. See the proper Diagnostic Procedures manual for more information on this function.

The instrument cluster circuitry also sends chime tone requests over the PCI data bus to the Body Control Module (BCM) when it monitors certain conditions or inputs. The BCM replaces the chime or buzzer module. Refer to **Chime Warning System** in the Description and Operation section of Group 8U - Chime/Buzzer Warning Systems for more information on this feature.

This vehicle also offers several customer programmable features, which allows the selection of several optional electronic features to suit individual preferences. Refer to **ELECTRONIC VEHICLE INFORMATION CENTER PROGRAMMING** in the Service Procedures section of Group 8V - Overhead Console Systems for more information on the customer programmable feature options. Customer programmable feature options affecting the EMIC module include:

- **Low Fuel Chime -** Allows the option of having a single chime sound as an audible alert whenever the instrument cluster low fuel warning lamp lights, or having no audible alert.

The instrument cluster component parts for this model are available for service. The cluster lens, hood and mask unit, the major gauges and the minor gauge sets, the trip odometer reset knob, the cluster housing with electronic circuit board and rear housing cover, and the incandescent lamp bulbs and bulb holders are available for service replacement.

OPERATION

All of the gauges and many of the indicator lamps in this instrument cluster are controlled by a microprocessor that is located on the instrument cluster electronic circuit board. The instrument cluster microprocessor uses internal programming, messages received over the Programmable Communications Interface (PCI) data bus network, and a few hard wired inputs to perform its many gauge and indicator lamp control functions. The PCI data bus network allows the sharing of sensor information. This practice helps to reduce wire harness complexity, internal controller hardware and component sensor current loads.

The instrument cluster microprocessor smooths the input data using algorithms to provide gauge readings that are accurate, stable and responsive to operating conditions. These algorithms are designed to provide gauge readings during normal operation that

DESCRIPTION AND OPERATION (Continued)

are consistent with customer expectations. However, when abnormal conditions exist, such as low or high battery voltage, low oil pressure or high coolant temperature, the algorithm drives the gauge pointer to an extreme position and the microprocessor turns on the Check Gauges indicator lamp to provide a distinct visual indication of a problem to the vehicle operator. The instrument cluster circuitry also sends chime tone requests over the PCI data bus to the Body Control Module (BCM) when it monitors certain conditions or inputs to provide the vehicle operator with an audible alert.

This instrument cluster also features a six-digit vacuum-fluorescent odometer and trip odometer display, which is integral to the cluster electronic circuit board. This display is toggled between the odometer and trip odometer functions by a push button on the face of the cluster. Pressing and holding the button depressed when the trip odometer reading is displayed will reset the trip odometer reading to zero. The instrument cluster microprocessor remembers which function was active when the ignition switch is turned to the off position, and returns the display to that function when the ignition is turned on again.

GAUGE

With the ignition switch in the On or Start positions, voltage is supplied to all gauges through the instrument cluster electronic circuit board. With the ignition switch in the Off position, voltage is not supplied to the gauges. The gauges do not accurately indicate any vehicle condition unless the ignition switch is in the On or Start positions.

All of the instrument cluster gauges, except the odometer and trip 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 is changed by the instrument cluster electronic circuitry in response to messages received on the Programmable Communications Interface (PCI) data bus network.

The gauge needle moves as the movable permanent magnet aligns itself to the changing magnetic fields created around it by the electromagnets. The instrument cluster circuitry is programmed to move all of the gauge needles back to the low end of their respective scales after the ignition switch is turned to the Off position.

INDICATOR LAMP

Indicator lamps are located in the instrument cluster and are served by the cluster circuit board and connectors. Many of the indicator lamps in the instrument cluster are controlled by the instrument cluster circuitry in response to messages received over the Programmable Communications Interface (PCI) data bus network.

The part-time four-wheel drive indicator lamp and turn signal indicator lamps are hard wired. The seat belt reminder lamp is controlled by the instrument cluster programming. The brake warning lamp is controlled by a hard wired input from the park brake switch and by PCI data bus messages from the Controller Anti-lock Brake (CAB). The instrument cluster circuitry uses PCI data bus messages from the Powertrain Control Module (PCM), Airbag Control Module (ACM), Body Control Module (BCM) and CAB to control all of the remaining indicator lamps.

The indicator lamps in the instrument cluster use incandescent bulbs and holders. Each incandescent indicator lamp has a replaceable bulb and bulb holder.

CLUSTER ILLUMINATION LAMP

The instrument cluster features incandescent illumination lamp bulbs. The illumination intensity of these bulbs and of the vacuum-fluorescent electronic display are controlled by the instrument cluster microprocessor based upon dimming messages received from the Body Control Module (BCM) over the Programmable Communications Interface (PCI) data bus. The BCM uses inputs from the headlamp and panel dimmer switches on the left (lighting) multi-function switch control stalk and internal programming to decide what dimming message is required. The BCM then sends the proper dimming messages to the instrument cluster over the PCI data bus.

The BCM also sends the proper panel lamps dimming level messages over the PCI data bus to control the dimming levels of the various vacuum fluorescent displays. All modules on the PCI data bus with vacuum fluorescent displays (instrument cluster, radio, electronic vehicle information center) receive these messages and adjust their dimming levels to match that of the incandescent cluster illumination bulbs located in the instrument cluster.

Vehicles equipped with the Auto Headlamps option have an automatic parade mode. In this mode, the BCM uses an input from the auto headlamp light sensor to determine the ambient light levels. If the BCM decides that the exterior lighting is turned on

DESCRIPTION AND OPERATION (Continued)

in the daylight, it overrides the selected panel dimmer switch signal by sending a message over the PCI data bus to illuminate all vacuum fluorescent displays at full brightness for easier visibility in daytime light levels. The automatic parade mode has no effect on the incandescent bulb dimming levels.

Each of the cluster illumination lamps is located on the instrument cluster circuit board. Each cluster illumination lamp has a replaceable bulb and bulb holder.

BODY CONTROL MODULE

DESCRIPTION

A Body Control Module (BCM) is used on this model to control and integrate many of the electronic features and functions of the vehicle. The BCM is concealed below the driver side end of the instrument panel in the passenger compartment, where it is mounted to the dash panel side of the junction block with four screws. The BCM has two external connector receptacles that receive connections from the instrument panel wire harness. The BCM also has a connector concealed on the back side of the unit that joins it directly to the circuitry within the junction block.

The BCM contains a central processing unit and interfaces with other electronic modules in the vehicle on the Programmable Communications Interface (PCI) data bus network. The PCI data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, reduce internal controller hardware, and reduce component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities.

Some of the functions and features that the BCM supports or controls, include:

- Chimes
- Automatic headlamp control
- Headlamp delay
- Headlamps on with ignition off and driver door open warning
- Key in ignition with ignition off and driver door open warning
- Automatic funeral or parade mode
- Panel lamp dimming
- Vehicle Theft Security System (VTSS)
- Illuminated entry
- Heated rear window and heated outside mirror control
- Intermittent wipe control
- Monitoring and transmitting rear door, liftgate, and liftgate flip-up glass ajar data
- Monitoring and transmitting outside ambient temperature data
- Monitoring and transmitting air conditioning select switch data
- Courtesy lamp time-out
- Door lock inhibit
- Electronic odometer and trip odometer
- Brake warning lamp
- Check gauges lamp
- High beam indicator lamp
- Seatbelt reminder lamp and chime
- Speed sensitive intermittent wipe
- Fog lamp control
- Electro-Mechanical Instrument Cluster
- BCM diagnostic support
- Electronic Vehicle Information Center (EVIC) support
- Customer programmable features, including:
- Auto door locks
- Horn chirp upon door lock with Remote Keyless Entry (RKE)
- Low fuel warning chime
- Headlights on with wipers (with auto headlamps only)

For diagnosis of the BCM or the PCI data bus, the use of a DRB scan tool and the proper Diagnostic Procedures manual are recommended. The BCM can only be serviced by an authorized electronic warranty repair station. Refer to the latest version of the Chrysler Corporation Warranty Policies and Procedures manual for a current listing of authorized electronic repair stations.

OPERATION

The functions and features provided by the BCM are possible because of its hard wired inputs and outputs, as well as the resources it shares with other electronic modules in the vehicle through its communication over the PCI data bus network. The BCM uses its internal programming and all of these inputs to decide which functions it should perform and both the standard and optional features it should provide. Refer to **ELECTRONIC VEHICLE INFORMATION CENTER PROGRAMMING** in the Service Procedures section of Group 8V - Overhead Console Systems for more information on the customer programmable feature options.

INSTRUMENT PANEL CIGAR LIGHTER

DESCRIPTION

A cigar lighter receptacle is standard equipment on this model. On models equipped with the optional Smoker's Package, the cigar lighter knob and heating element are included. On models without the Smoker's Package, the cigar lighter receptacle is equipped with a snap fit plastic cap and is treated as an extra accessory power outlet. The cigar lighter receptacle is

DESCRIPTION AND OPERATION (Continued)

installed in the instrument panel center lower bezel, which is located near the bottom of the instrument panel center stack area, below the heater and air conditioner controls. The cigar lighter base is secured by a snap fit within the center lower bezel.

The cigar lighter receptacle, plastic cap and the knob and heating element unit are available for service replacement. These components cannot be repaired and, if faulty or damaged, they must be replaced.

OPERATION

The cigar lighter consists of two major components: a knob and heating element unit, and the cigar lighter base or receptacle shell. The receptacle shell is connected to ground, and an insulated contact in the bottom of the shell is connected to battery current. The cigar lighter receives battery voltage from a fuse in the junction block through the cigar lighter relay only when the ignition switch is in the Accessory or On positions. Refer to **Cigar Lighter Relay** in the Description and Operation section of this group for more information on this component.

The cigar lighter knob and heating element are encased within a spring-loaded housing, which also features a sliding protective heat shield. When the knob and heating element are inserted in the receptacle shell, the heating element resistor coil is grounded through its housing to the receptacle shell. If the cigar lighter knob is pushed inward, the heat shield slides up toward the knob exposing the heating element, and the heating element extends from the housing toward the insulated contact in the bottom of the receptacle shell.

Two small spring-clip retainers are located on either side of the insulated contact inside the bottom of the receptacle shell. These clips engage and hold the heating element against the insulated contact long enough for the resistor coil to heat up. When the heating element is engaged with the contact, battery current can flow through the resistor coil to ground, causing the resistor coil to heat.

When the resistor coil becomes sufficiently heated, excess heat radiates from the heating element causing the spring-clips to expand. Once the spring-clips expand far enough to release the heating element, the spring-loaded housing forces the knob and heating element to pop back outward to their relaxed position. When the cigar lighter knob and element are pulled out of the receptacle shell, the protective heat shield slides downward on the housing so that the heating element is recessed and shielded around its circumference for safety.

CIGAR LIGHTER RELAY

DESCRIPTION

The cigar lighter relay is an electromechanical device that switches fused battery current to the cigar lighter when the ignition switch is turned to the Accessory or On positions. The cigar lighter relay is located in the junction block, below the driver side of the instrument panel in the passenger compartment.

The cigar lighter relay is a International Standards Organization (ISO) relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions.

The cigar lighter relay cannot be repaired or adjusted and, if faulty or damaged, it must be replaced.

OPERATION

The ISO relay consists of an electromagnetic coil, a resistor or diode, and three (two fixed and one movable) electrical contacts. The movable (common feed) relay contact is held against one of the fixed contacts (normally closed) by spring pressure. When the electromagnetic coil is energized, it draws the movable contact away from the normally closed fixed contact, and holds it against the other (normally open) fixed contact.

When the electromagnetic coil is de-energized, spring pressure returns the movable contact to the normally closed position. The resistor or diode is connected in parallel with the electromagnetic coil in the relay, and helps to dissipate voltage spikes that are produced when the coil is de-energized.

INSTRUMENT PANEL POWER OUTLET

DESCRIPTION

An accessory power outlet is standard equipment on this model. The power outlet is installed in the instrument panel center lower bezel, which is located near the bottom of the instrument panel center stack area, below the heater and air conditioner controls. The power outlet base is secured by a snap fit within the center lower bezel. A hinged door with an over-center spring flips closed to conceal and protect the power outlet base when the power outlet is not being used, and flips open below the center lower bezel while the power outlet is in use.

The power outlet receptacle unit and the power outlet door are each available for service replacement.

DESCRIPTION AND OPERATION (Continued)

OPERATION

The power outlet base or receptacle shell is connected to ground, and an insulated contact in the bottom of the shell is connected to battery current. The power outlet receives battery voltage from a fuse in the junction block at all times.

While the power outlet is very similar to a cigar lighter base unit, it does not include the two small spring-clip retainers inside the bottom of the receptacle shell that are used to secure the cigar lighter heating element to the insulated contact.

DIAGNOSIS AND TESTING

INSTRUMENT CLUSTER

Following are tests that will help to diagnose the hard wired components and circuits of the Electro-Mechanical Instrument Cluster (EMIC). However, these tests may not prove conclusive in the diagnosis of this unit. In order to obtain conclusive testing of the EMIC, the Programmable Communications Interface (PCI) data bus network and all of the electronic modules that provide inputs to, or receive outputs from the EMIC must be checked.

The most reliable, efficient, and accurate means to diagnose the EMIC requires the use of a DRB scan tool and the proper Diagnostic Procedures manual. The DRB scan tool can provide confirmation that the PCI data bus is functional, that all of the electronic modules are sending and receiving the proper messages on the PCI data bus, and that the EMIC is receiving the proper hard wired inputs to perform its many functions.

All of the gauges and many of the indicator lamps in the instrument cluster are controlled by messages received by the EMIC circuitry on the PCI data bus. Only the part-time four-wheel drive indicator lamp and the turn signal indicator lamps are hard wired in the instrument cluster.

The brake warning lamp receives a hard wired input from the park brake switch, but is also controlled by PCI data bus messages from the Controller Anti-lock Brake (CAB).

For complete circuit diagrams, refer to **Instrument Cluster** in the Contents of Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Check the fused B(+) fuse in the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Check for battery voltage at the fused B+ fuse in the junction block. If OK, go to Step 3. If not OK, repair the open fused B(+) circuit to the Power Distribution Center (PDC) fuse as required.

(3) Check the fused ignition switch output (run/start) fuse in the junction block. If OK, go to Step 4. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(4) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (start/run) fuse in the junction block. If OK, go to Step 5. If not OK, repair the open fused ignition switch output (start/run) circuit to the ignition switch as required.

(5) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the instrument cluster as described in this group. Reconnect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the instrument panel wire harness connector for the instrument cluster. If OK, go to Step 6. If not OK, repair the open fused B(+) circuit to the junction block fuse as required.

(6) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (start/run) circuit cavity of the instrument panel wire harness connector for the instrument cluster. If OK, go to Step 7. If not OK, repair the open fused ignition switch output (start/run) circuit to the junction block fuse as required.

(7) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Probe each of the ground circuit cavities of the instrument panel wire harness connector for the instrument cluster. Check for continuity to a good ground. There should be continuity. If OK, use a DRB scan tool and the proper Diagnostic Procedures manual for diagnosis of the instrument cluster circuitry and the PCI data bus. If not OK, repair the open ground circuit(s) to ground as required.

HARD WIRED LAMP DIAGNOSIS

Each of the lamps found in this section depends upon a hard wired circuit input to the instrument cluster for proper operation. The following procedures will help to diagnose conditions that may cause an inoperative hard wired lamp circuit condition.

DIAGNOSIS AND TESTING (Continued)

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

BRAKE WARNING LAMP

The diagnosis found here addresses an inoperative brake warning lamp condition. If the brake warning lamp stays on with the ignition switch in the On position and the park brake released, or comes on while driving, refer to **Antilock Brakes** in the Diagnosis and Testing section of Group 5 - Brakes for further diagnosis. If no brake system problem is found, the following procedure will help locate a short or open circuit, or a faulty switch. For complete circuit diagrams, refer to **Instrument Cluster** in the Contents of Group 8W - Wiring Diagrams.

(1) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Disconnect the wire harness connector at the park brake switch. With the park brake released, check for continuity between the park brake switch terminal and a good ground. There should be no continuity. If OK, go to Step 2. If not OK, adjust or replace the faulty park brake switch.

(2) Remove the instrument cluster and disconnect the instrument panel wire harness connector from the instrument cluster. Check for continuity between the red brake warning indicator driver circuit cavity of the instrument panel wire harness connector for the instrument cluster and a good ground. There should be no continuity. If OK, go to Step 3. If not OK, repair the shorted red brake warning indicator driver circuit as required.

(3) Check for continuity between the red brake warning indicator driver circuit cavities of the instrument wire harness connector for the instrument cluster and the brake warning switch wire harness connector. There should be continuity. If OK, replace the faulty bulb. If not OK, repair the open red brake warning indicator driver circuit as required.

FOUR-WHEEL DRIVE INDICATOR LAMP - PART TIME

The diagnosis found here addresses an inoperative four-wheel drive indicator lamp condition. If the problem being diagnosed is related to lamp accuracy, be certain to confirm that the problem is with the lamp or switch and not with a damaged or inoperative transfer case or transfer case linkage. Refer to **NV242 Diagnosis** in the Diagnosis and Testing section of Group 21 - Transmission for more information. If no transfer case problem is found, the following procedure will help locate a short or open in the indicator lamp circuit. For complete circuit diagrams, refer to **Instrument Cluster** in the Contents of Group 8W - Wiring Diagrams.

(1) Check the fused ignition switch output (run/start) fuse in the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run/start) fuse in the junction block. If OK, go to Step 3. If not OK, repair the open fused ignition switch output (run/start) circuit to the ignition switch as required.

(3) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Disconnect the transfer case switch wire harness connector. Check for continuity between the ground circuit cavity of the transfer case switch wire harness connector and a good ground. There should be continuity. If OK, go to Step 4. If not OK, repair the open ground circuit to ground as required.

(4) Connect the battery negative cable. Turn the ignition switch to the On position. Install a jumper wire between the part time four wheel drive indicator lamp driver circuit cavity of the transfer case switch wire harness connector and a good ground. The part time four-wheel drive indicator lamp should light. If OK, replace the faulty transfer case switch. If not OK, go to Step 5.

(5) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the instrument cluster. With the transfer case switch wire harness connector still disconnected, check for continuity between the part time four wheel drive indicator lamp driver circuit cavity of the instrument panel wire harness connector for the instrument cluster and a good ground. There should be no continuity. If OK, go to Step 6. If not OK, repair the shorted part time four wheel drive indicator lamp driver circuit as required.

(6) Check for continuity between the part time four wheel drive indicator lamp driver circuit cavities of the instrument panel wire harness connector for the instrument cluster and the transfer case switch wire harness connector. There should be continuity. If OK, replace the faulty bulb. If not OK, repair the open part time four wheel drive indicator lamp driver circuit as required.

TURN SIGNAL INDICATOR LAMP

The diagnosis found here addresses an inoperative turn signal indicator lamp condition. For any other turn signal problem, refer to **Turn Signal and Hazard Warning Systems** in the Diagnosis and Testing

DIAGNOSIS AND TESTING (Continued)

section of Group 8J - Turn Signal and Hazard Warning Systems for further diagnosis. If no turn signal or hazard warning system problem is found, the following procedure will help locate a short or open in the indicator lamp circuit. For complete circuit diagrams, refer to **Instrument Cluster** in the Contents of Group 8W - Wiring Diagrams.

(1) Disconnect and isolate the battery negative cable. Remove the instrument cluster and disconnect the instrument panel wire harness connector from the instrument cluster connector receptacle.

(2) Connect the battery negative cable. Activate the hazard warning system by moving the hazard warning switch button to the On position. Check for battery voltage at the inoperative (right or left) turn signal circuit cavity of the instrument panel wire harness connector for the instrument cluster. There should be a switching (on and off) battery voltage signal. If OK, replace the faulty (right or left) indicator lamp bulb. If not OK, repair the open (right or left) turn signal circuit to the electronic combination flasher in the junction block as required.

BODY CONTROL MODULE

In order to obtain conclusive testing of the Body Control Module (BCM), all of the electronic modules that provide inputs to, or receive outputs from the BCM must also be checked. The most reliable, efficient, and accurate means to diagnose the BCM requires the use of a DRB scan tool and the proper Diagnostic Procedures manual. The DRB scan tool can provide confirmation that the Programmable Communications Interface (PCI) data bus network is functional, that all of the electronic modules are sending and receiving the proper messages on the PCI data bus, and that the BCM is receiving the proper hard wired inputs and relaying the proper hard wired outputs to perform its many functions.

Refer to **Body Control Module** in the Contents of Group 8W - Wiring Diagrams for complete circuit diagrams.

INSTRUMENT PANEL CIGAR LIGHTER

For complete circuit diagrams, refer to **Horn/Cigar Lighter/Power Outlet** in the Contents of Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Check the fused B(+) fuse in the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Turn the ignition switch to the On position. Check for battery voltage at the fused B(+) fuse in the junction block. If OK, go to Step 3. If not OK, refer to **Cigar Lighter Relay** in the Diagnosis and Testing section of this group.

(3) Remove the cigar lighter knob and element from the cigar lighter receptacle shell. Check for continuity between the inside circumference of the cigar lighter receptacle shell and a good ground. there should be continuity. If OK, go to Step 4. If not OK, go to Step 5.

(4) Turn the ignition switch to the On position. Check for battery voltage at the insulated contact located at the back of the cigar lighter receptacle shell. If OK, replace the faulty cigar lighter knob and element. If not OK, go to Step 5.

(5) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the instrument panel center lower bezel. Check for continuity between the ground circuit cavity of the cigar lighter wire harness connector and a good ground. There should be continuity. If OK, go to Step 6. If not OK, repair the open ground circuit to ground as required.

(6) Connect the battery negative cable. Turn the ignition switch to the Accessory or On positions. Check for battery voltage at the fused B(+) circuit cavity of the cigar lighter wire harness connector. If OK, replace the faulty cigar lighter receptacle. If not OK, repair the open fused B(+) circuit to the junction block fuse as required.

CIGAR LIGHTER RELAY

The cigar lighter relay (Fig. 1) is located in the junction block, below the driver side end of the instrument panel in the passenger compartment. For complete circuit diagrams, refer to **Horn/Cigar Lighter/Power Outlet** in the Contents of Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

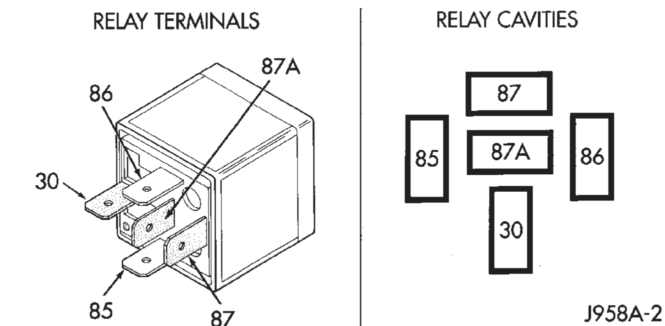
DIAGNOSIS AND TESTING (Continued)

(1) Remove the cigar lighter relay from the junction block. Refer to **Cigar Lighter Relay** in the Removal and Installation section of this group for the procedures.

(2) A relay in the de-energized position should have continuity between terminals 87A and 30, and no continuity between terminals 87 and 30. If OK, go to Step 3. If not OK, replace the faulty relay.

(3) Resistance between terminals 85 and 86 (electromagnet) should be 75 ± 5 ohms. If OK, go to Step 4. If not OK, replace the faulty relay.

(4) 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, perform the Relay Circuit Test that follows. If not OK, replace the faulty relay.



TERMINAL LEGEND	
NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

Fig. 1 Cigar Lighter Relay

RELAY CIRCUIT TEST

(1) The relay common feed terminal cavity (30) of the junction block is connected to battery voltage and should be hot at all times. Check for battery voltage at the fused B(+) circuit cavity in the junction block receptacle for the cigar lighter relay. If OK, go to Step 2. If not OK, repair the fused B(+) circuit to the Power Distribution Center (PDC) fuse as required.

(2) The relay normally closed terminal (87A) is connected to terminal 30 in the de-energized position, but is not used for this application. Go to Step 3.

(3) The relay normally open terminal (87) is connected to the common feed terminal (30) in the energized position. This terminal supplies battery voltage to the fused B(+) fuse in the junction block that feeds the cigar lighter when the relay is energized by the ignition switch. There should be continuity between the junction block cavity for relay terminal 87 and the fused B(+) fuse in the junction block at all times. If OK, go to Step 4. If not OK, repair the open fused B(+) circuit to the junction block fuse as required.

(4) The coil ground terminal (85) is connected to the electromagnet in the relay. It receives battery feed to energize the cigar lighter relay when the ignition switch is in the Accessory or On positions. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (acc/run) circuit cavity for relay terminal 85 in the junction block receptacle for the cigar lighter relay. If OK, go to Step 5. If not OK, repair the open fused ignition switch output (acc/run) circuit to the ignition switch as required.

(5) The coil battery terminal (86) is connected to the electromagnet in the relay. The junction block cavity for this terminal should have continuity to ground at all times. If not OK, repair the open ground circuit to ground as required.

INSTRUMENT PANEL POWER OUTLET

For complete circuit diagrams, refer to **Horn/Cigar Lighter/Power Outlet** in the Contents of Group 8W - Wiring Diagrams.

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(1) Check the fused B(+) fuse in the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Check for battery voltage at the fused B(+) fuse in the junction block. If OK, go to Step 3. If not OK, repair the open fused B(+) circuit to the Power Distribution Center (PDC) fuse as required.

(3) Open the power outlet door. Check for continuity between the inside circumference of the power outlet receptacle and a good ground. There should be continuity. If OK, go to Step 4. If not OK, go to Step 5.

(4) Check for battery voltage at the insulated contact located at the back of the power outlet receptacle. If not OK, go to Step 5.

(5) Disconnect and isolate the battery negative cable. Remove the instrument panel center lower bezel. Check for continuity between the ground circuit cavity of the power outlet wire harness connector and a good ground. There should be continuity. If OK, go to Step 6. If not OK, repair the open ground circuit to ground as required.

(6) Connect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the

DIAGNOSIS AND TESTING (Continued)

power outlet wire harness connector. If OK, replace the faulty power outlet receptacle. If not OK, repair the open fused B(+) circuit to the junction block fuse as required.

REMOVAL AND INSTALLATION

INSTRUMENT PANEL FUSE COVER

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Pull down on the rear edge (nearest the rear of the vehicle) of the instrument panel fuse cover until the rear latches unsnap from the tabs on the lower junction block housing and the side latch unsnaps from the tab on the instrument panel steering column support bracket outboard of the 16-way data link connector (Fig. 2).

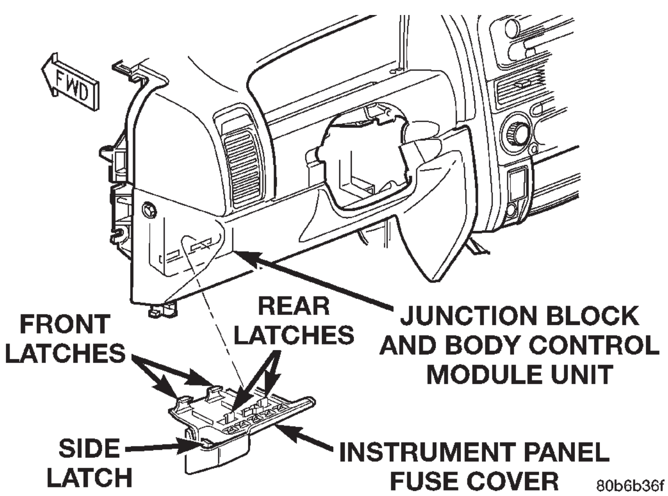

Fig. 2 Instrument Panel Fuse Cover Remove/Install

(3) Move the instrument panel fuse cover towards the front of the vehicle to disengage the front latches from the mounting slots in the lower housing of the body control module.

(4) Remove the fuse cover from under the instrument panel.

INSTALLATION

(1) Position the two front latches of the instrument panel fuse cover within the two locator channel formations on the bottom of the body control module housing (Fig. 3).

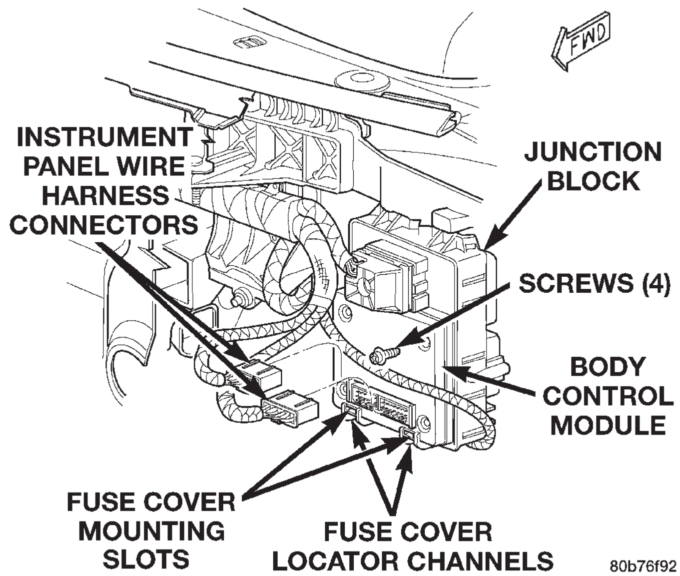

Fig. 3 Instrument Panel Fuse Cover Locator Channels

(2) While applying a slight upward pressure to the instrument panel fuse cover over the front latches, slowly slide the front latches through the locator channels toward the front of the vehicle until the latches exit the front of the locator channels. This will locate the front latches at the mounting slots in the lower housing of the body control module.

(3) Apply a slight rearward pressure on the instrument panel fuse cover to engage the front latches in the mounting slots in the lower housing of the body control module.

(4) Swing the rear edge (nearest the rear of the vehicle) of the instrument panel fuse cover up toward the junction block.

(5) Press firmly upward on the instrument panel fuse cover over the rear latches until the latches snap into place over the tabs on the lower edge of the junction block housing.

(6) Press firmly upward on the 16-way data link connector cover formation of the instrument panel fuse cover until the side latch snaps into place over the tab on the outboard side of the instrument panel steering column support bracket.

(7) Reconnect the battery negative cable.

REMOVAL AND INSTALLATION (Continued)

BODY CONTROL MODULE

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument panel fuse cover from the bottom of the junction block and body control module unit. Refer to **Instrument Panel Fuse Cover** in the Removal and Installation section of this group for the procedures.

(3) Reach under the instrument panel and behind the junction block to disconnect the two instrument panel wire harness connectors from the body control module connector receptacles (Fig. 4).

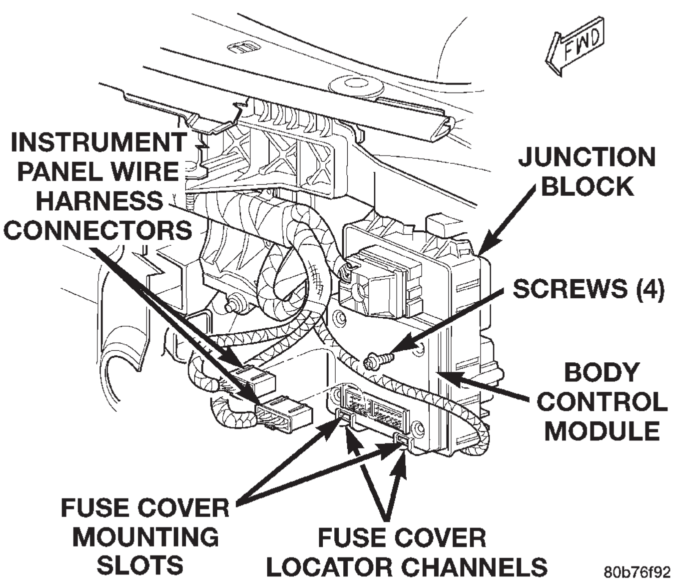

Fig. 4 Body Control Module Remove/Install

(4) Remove the four screws (Torx T-20) that secure the body control module to the junction block.

(5) Pull the body control module straight out from the junction block until the integral connector is completely disengaged.

(6) Remove the body control module from under the instrument panel.

INSTALLATION

(1) Reach under the instrument panel and behind the junction block to position the body control module to its mounting location on the junction block.

(2) Align the integral connector terminal pins of the body control module with the integral connector receptacle on the junction block.

(3) Firmly and evenly squeeze the body control module and the junction block together until the integral connector is fully engaged.

(4) Install and tighten the four screws that secure the body control module to the junction block. Tighten the screws to 2.2 N·m (20 in. lbs.).

(5) Reconnect the two instrument panel wire harness connectors to the body control module connector receptacles.

(6) Install the instrument panel fuse cover to the bottom of the junction block and body control module unit. Refer to **Instrument Panel Fuse Cover** in the Removal and Installation section of this group for the procedures.

(7) Reconnect the battery negative cable.

INSTRUMENT PANEL DRIVER SIDE COURTESY LAMP BRACKET

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REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument panel fuse cover from the bottom of the junction block and body control module unit. Refer to **Instrument Panel Fuse Cover** in the Removal and Installation section of this group for the procedures.

(3) Reach under the steering column opening cover to access and remove the screw that secures the courtesy lamp to the lower end of the instrument panel bracket near the inboard side of the junction block (Fig. 5).

(4) Remove the courtesy lamp from the lower end of the instrument panel driver side courtesy lamp bracket.

(5) Reach under the steering column opening cover to access and remove the screw that secures the courtesy lamp bracket and the inboard side of the junc-

REMOVAL AND INSTALLATION (Continued)

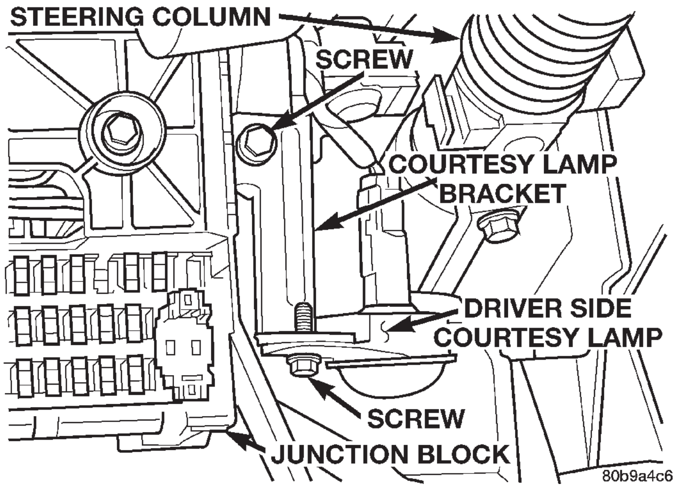

Fig. 5 Instrument Panel Driver Side Courtesy Lamp Bracket Remove/Install

tion block to the instrument panel steering column support bracket.

(6) Remove the driver side courtesy lamp bracket from under the instrument panel.

INSTALLATION

(1) Reach under the instrument panel to position the upper end of the driver side courtesy lamp bracket to the instrument panel steering column support bracket.

(2) Install and tighten the screw that secures the courtesy lamp bracket and the inboard side of the junction block to the instrument panel steering column support bracket. Tighten the screw to 2.2 N·m (20 in. lbs.).

(3) Position the courtesy lamp to the lower end of the instrument panel driver side courtesy lamp bracket.

(4) Install and tighten the screw that secures the courtesy lamp to the lower end of the instrument panel driver side courtesy lamp bracket. Tighten the screw to 2.2 N·m (20 in. lbs.).

(5) Install the instrument panel fuse cover to the bottom of the junction block and body control module unit. Refer to **Instrument Panel Fuse Cover** in the Removal and Installation section of this group for the procedures.

(6) Reconnect the battery negative cable.

INSTRUMENT PANEL DRIVER SIDE BEZEL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Using a trim stick or another suitable wide flat-bladed tool, gently pry the edges of the driver side bezel up and away from the instrument panel far enough to disengage the two snap clips from their receptacles (Fig. 6).

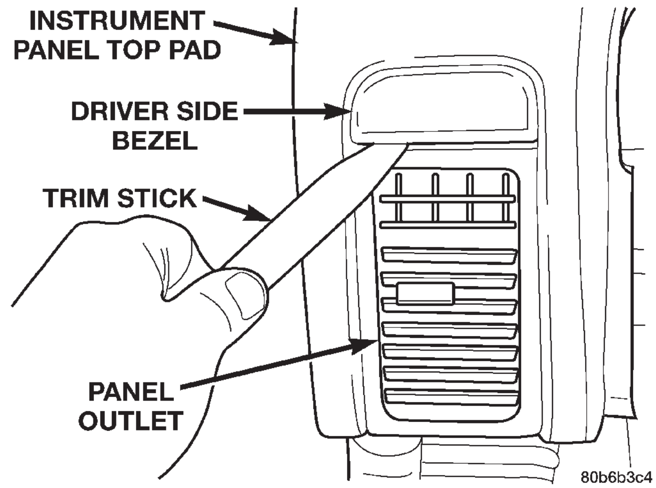

Fig. 6 Instrument Panel Driver Side Bezel Remove/Install

(3) Remove the driver side bezel from the instrument panel top pad.

INSTALLATION

(1) Position the driver side bezel to the instrument panel top pad.

(2) Align the snap clips on the driver side bezel with the receptacles in the instrument panel top pad.

(3) Press firmly on the instrument panel driver side bezel over the snap clip locations until each of the snap clips is fully engaged in its receptacle.

(4) Reconnect the battery negative cable.

CLUSTER BEZEL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL AND INSTALLATION (Continued)

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Place the tilt steering wheel in its fully lowered position.

(3) Using a trim stick or another suitable wide flat-bladed tool, gently pry each of the four corners of the cluster bezel away from the instrument panel far enough to disengage the four snap clips from their receptacles (Fig. 7).

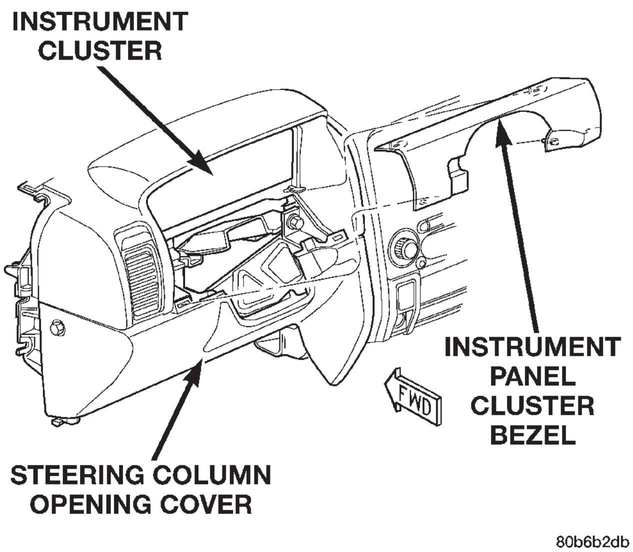

Fig. 7 Cluster Bezel Remove/Install

(4) Being certain not to scratch the instrument cluster lens with the two snap clips on the lower edge of the cluster bezel, roll the top of the cluster bezel rearward over the top of the steering column to remove it from the instrument panel.

INSTALLATION

(1) Being certain not to scratch the instrument cluster lens with the two snap clips on the lower edge of the cluster bezel, slide the lower edge of the cluster bezel forward and down over the top of the steering column to position it on the instrument panel.

(2) Align the two snap clips on the lower edge of the cluster bezel with the receptacles on the instrument panel.

(3) Press firmly on the cluster bezel over each of the lower snap clip locations until each of the snap clips is fully engaged in its receptacle.

(4) Align the two receptacles on the upper edge of the cluster bezel with the snap clips on the instrument panel.

(5) Press firmly on the cluster bezel over each of the upper snap clip locations until each of the snap clips is fully engaged in its receptacle.

(6) Reconnect the battery negative cable.

STEERING COLUMN OPENING COVER

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REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the fuse cover from the junction block under the instrument panel. Refer to **Instrument Panel Fuse Cover** in the Removal and Installation section of this group for the procedures.

(3) Remove the cluster bezel from the instrument panel. Refer to **Cluster Bezel** in the Removal and Installation section of this group for the procedures.

(4) Remove the one screw that secures the outboard end of the steering column opening cover to the U-nut on the instrument panel top pad (Fig. 8).

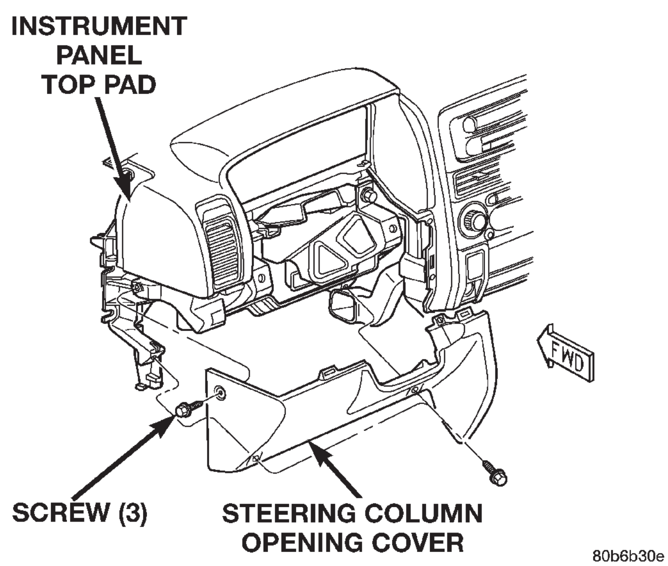

Fig. 8 Steering Column Opening Cover Remove/Install

(5) Remove the two screws that secure the lower edge of the steering column opening cover to the U-nuts on the instrument panel steering column support bracket.

(6) Pull the steering column opening cover rearward to disengage the three snap clips (one outboard

REMOVAL AND INSTALLATION (Continued)

and two inboard that secure it to the instrument panel.

(7) Remove the steering column opening cover from the instrument panel.

INSTALLATION

(1) Position the steering column opening cover to the instrument panel.

(2) Align the three snap clips on the steering column opening cover with the receptacles on the instrument panel.

(3) Press firmly on the steering column opening cover over the snap clip locations until each of the snap clips is fully engaged in its receptacle.

(4) Install and tighten the two screws that secure the lower edge of the steering column opening cover to the instrument panel steering column support bracket. Tighten the screws to 2.2 N·m (20 in. lbs.).

(5) Install and tighten the one screw that secures the outboard end of the steering column opening cover to the U-nut on the instrument panel top pad. Tighten the screw to 2.2 N·m (20 in. lbs.).

(6) Install the cluster bezel onto the instrument panel. Refer to **Cluster Bezel** in the Removal and Installation section of this group for the procedures.

(7) Install the fuse cover onto the junction block under the instrument panel. Refer to **Instrument Panel Fuse Cover** in the Removal and Installation section of this group for the procedures.

(8) Reconnect the battery negative cable.

INSTRUMENT PANEL STEERING COLUMN BRACKET

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the steering column opening cover from the instrument panel. Refer to **Steering Column Opening Cover** in the Removal and Installation section of this group for the procedures.

(3) Remove the four screws that secure the steering column bracket to the instrument panel steering column support bracket (Fig. 9).

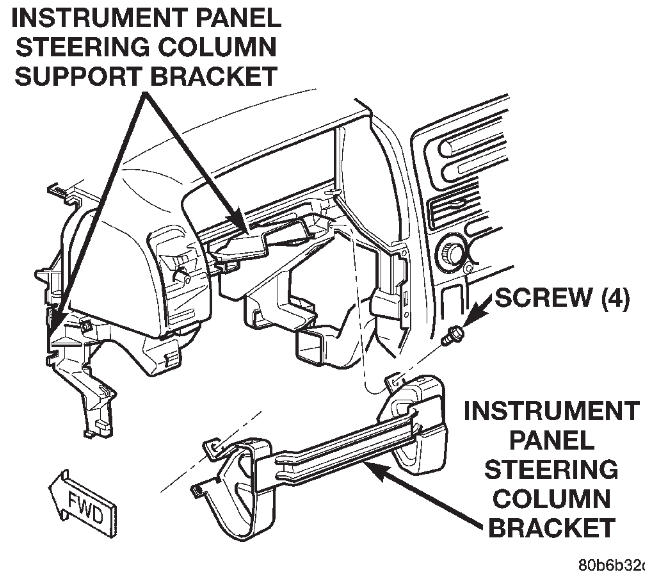

Fig. 9 Instrument Panel Steering Column Bracket Remove/Install

(4) Remove the steering column bracket from the instrument panel steering column support bracket.

INSTALLATION

(1) Position the steering column bracket to the instrument panel steering column support bracket.

(2) Install and tighten the four screws that secure the steering column bracket to the instrument panel steering column support bracket. Tighten the screws to 11.8 N·m (105 in. lbs.).

(3) Install the steering column opening cover. Refer to **Steering Column Opening Cover** in the Removal and Installation section of this group for the procedures.

(4) Reconnect the battery negative cable.

INSTRUMENT CLUSTER

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REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the cluster bezel from the instrument panel. Refer to **Cluster Bezel** in the Removal and Installation section of this group for the procedures.

REMOVAL AND INSTALLATION (Continued)

(3) Remove the two screws that secure the upper mounting tabs of the instrument cluster to the underside of the instrument cluster hood formation of the instrument panel top pad.

(4) Remove the two screws that secure the lower mounting tabs of the instrument cluster to the instrument panel structural duct.

(5) Pull the upper mounting tabs of the instrument cluster downward, then pull the instrument cluster rearward far enough to access the instrument panel wire harness connector (Fig. 10).

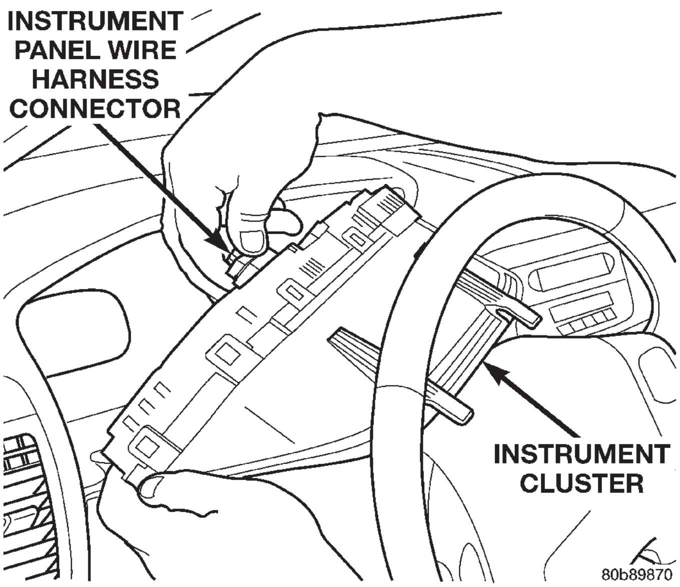

Fig. 10 Instrument Cluster Remove/Install

(6) Disconnect the one instrument panel wire harness connector from the connector receptacle on the back of the instrument cluster housing.

(7) Remove the instrument cluster from the instrument panel.

INSTALLATION

(1) Position the instrument cluster to the instrument panel.

(2) Reconnect the one instrument panel wire harness connector to the connector receptacle on the back of the instrument cluster housing.

(3) Position the lower mounting tabs of the instrument cluster to the mounting holes on the instrument panel structural duct, then tilt the top of the instrument cluster forward until the upper mounting tabs are positioned to the mounting holes on the underside of the instrument cluster hood formation of the instrument panel top pad.

(4) Install and tighten the two screws that secure the upper mounting tabs of the instrument cluster to the underside of the instrument cluster hood formation of the instrument panel top pad. Tighten the screws to 2.2 N·m (20 in. lbs.).

(5) Install and tighten the two screws that secure the lower mounting tabs of the instrument cluster to the instrument panel structural duct. Tighten the screws to 2.2 N·m (20 in. lbs.).

(6) Install the cluster bezel onto the instrument panel. Refer to **Cluster Bezel** in the Removal and Installation section of this group for the procedures.

(7) Reconnect the battery negative cable.

INSTRUMENT CLUSTER COMPONENTS

Many of the components for the instrument cluster used in this vehicle are serviced individually. The serviced components include: the trip odometer reset knob, the instrument cluster indicator lamp and illumination lamp bulbs (including the integral bulb holders), the major gauges (the speedometer and the tachometer) the minor gauge sets (the fuel gauge/voltmeter set and the coolant temperature gauge/oil pressure gauge set), the instrument cluster housing rear cover, and the instrument cluster housing (including the trip odometer reset switch stem and the instrument cluster electronic circuit board). Following are the service procedures for the instrument cluster components.

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REMOVAL

TRIP ODOMETER RESET KNOB

(1) Pull the trip odometer reset knob off of the tip of the trip odometer reset switch stem, which protrudes through the face of the cluster lens to the right of the speedometer (Fig. 12).

CLUSTER BULB

This procedure applies to each of the cluster illumination lamp (five) or indicator lamp (up to 22) bulb and bulb holder units. However, the illumination lamps and the indicator lamps use different bulb and bulb holder unit sizes. They must never be interchanged. Be certain that any bulb holder removed from the electronic circuit board is reinstalled in the correct position. Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the instrument cluster, the electronic circuit board and/or the gauges.

REMOVAL AND INSTALLATION (Continued)

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument cluster from the instrument panel. Refer to **Instrument Cluster** in the Removal and Installation section of this group for the procedures.

(3) Turn the bulb holder counterclockwise about sixty degrees on the cluster electronic circuit board (Fig. 11).

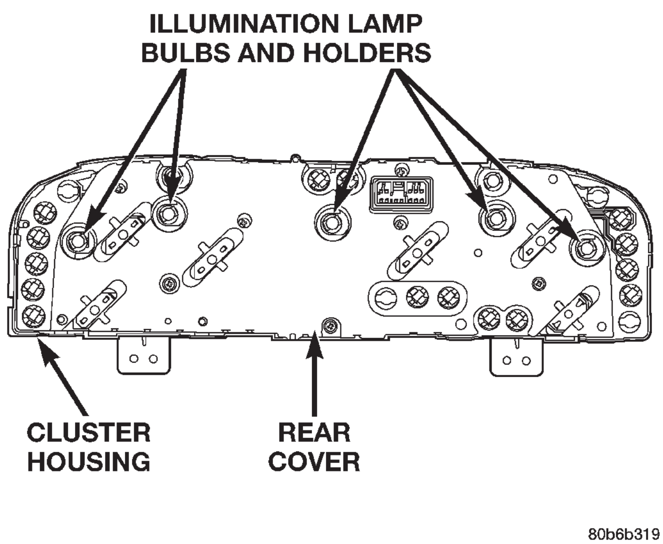

Fig. 11 Cluster Bulb Locations

(4) Pull the bulb and bulb holder straight back to remove it from the bulb mounting hole in the cluster electronic circuit board.

CLUSTER LENS, HOOD AND MASK

(1) Disconnect and isolate the battery negative cable.

(2) Remove the knob from the trip odometer reset switch stem. Refer to **Instrument Cluster Components - Trip Odometer Reset Knob** in the Removal and Installation section of this group for the procedures.

(3) Remove the instrument cluster from the instrument panel. Refer to **Instrument Cluster** in the Removal and Installation section of this group for the procedures.

(4) Work around the perimeter of the cluster housing to disengage each of the eight latches that secure the cluster lens, hood and mask unit to the cluster housing (Fig. 12).

(5) Gently pull the cluster lens, hood and mask unit away from the cluster housing.

CLUSTER HOUSING REAR COVER

(1) Disconnect and isolate the battery negative cable.

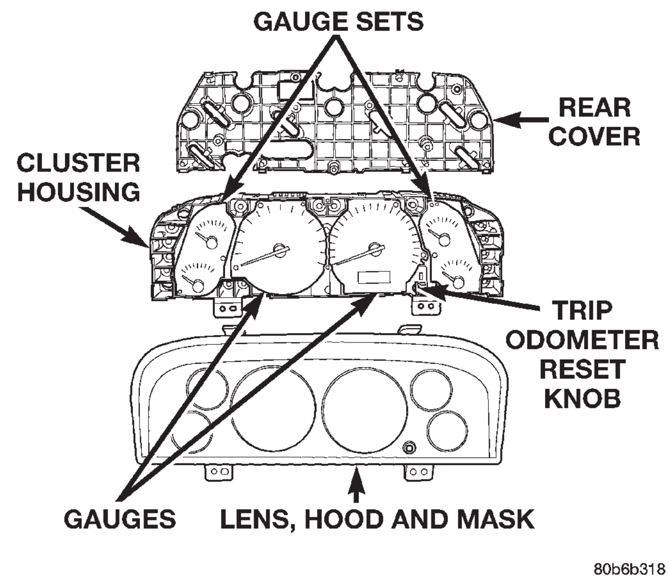

Fig. 12 Instrument Cluster Components

(2) Remove the instrument cluster from the instrument panel. Refer to **Instrument Cluster** in the Removal and Installation section of this group for the procedures.

(3) Remove the seven screws that secure the rear cover to the back of the cluster housing (Fig. 13).

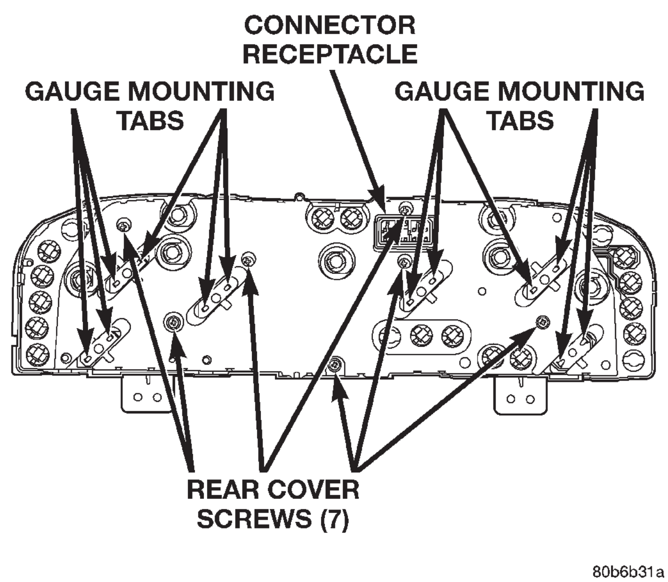

Fig. 13 Cluster Housing Rear Cover Screws

(4) Disengage the latches (two on top, four on the bottom) that secure the upper and lower edges of the rear cover to the top and bottom of the cluster housing.

(5) Remove the rear cover from the back of the cluster housing.

REMOVAL AND INSTALLATION (Continued)

GAUGE

(1) Disconnect and isolate the battery negative cable.

(2) Remove the knob from the trip odometer reset switch stem. Refer to **Instrument Cluster Components - Trip Odometer Reset Knob** in the Removal and Installation section of this group for the procedures.

(3) Remove the instrument cluster from the instrument panel. Refer to **Instrument Cluster** in the Removal and Installation section of this group for the procedures.

(4) Remove the cluster lens, hood and mask unit from the cluster housing. Refer to **Instrument Cluster Components - Cluster Lens, Hood and Mask** in the Removal and Installation section of this group for the procedures.

(5) Remove the rear cover from the cluster housing. Refer to **Instrument Cluster Components - Cluster Housing Rear Cover** in the Removal and Installation section of this group for the procedures.

(6) From the rear of the cluster housing, carefully straighten the small metal mounting tabs (two for each major gauge, and four for each minor gauge set) that secure the gauge or gauge set to the cluster electronic circuit board (Fig. 13).

(7) From the front of the cluster housing, carefully pull the gauge or gauge set straight out of the gauge mounting cavity(ies) in the cluster housing.

CLUSTER HOUSING

(1) Disconnect and isolate the battery negative cable.

(2) Remove the knob from the trip odometer reset switch stem. Refer to **Instrument Cluster Components - Trip Odometer Reset Knob** in the Removal and Installation section of this group for the procedures.

(3) Remove the instrument cluster from the instrument panel. Refer to **Instrument Cluster** in the Removal and Installation section of this group for the procedures.

(4) Remove all of the cluster illumination lamp and indicator lamp bulb and bulb holder units from the electronic circuit board. Refer to **Instrument Cluster Components - Cluster Bulbs** in the Removal and Installation section of this group for the procedures.

(5) Remove the cluster lens, hood and mask unit from the cluster housing. Refer to **Instrument Cluster Components - Cluster Lens, Hood and Mask** in the Removal and Installation section of this group for the procedures.

(6) Remove the rear cover from the cluster housing. Refer to **Instrument Cluster Components - Cluster Housing Rear Cover** in the Removal and Installation section of this group for the procedures.

(7) Remove all of the cluster gauges and gauge sets from the cluster housing. Refer to **Instrument Cluster Components - Gauge** in the Removal and Installation section of this group for the procedures.

INSTALLATION

TRIP ODOMETER RESET KNOB

(1) Push the knob onto the tip of the trip odometer reset switch stem, which protrudes through the face of the cluster lens to the right of the speedometer.

CLUSTER BULB

This procedure applies to each of the cluster illumination lamp (five) or indicator lamp (up to 22) bulb and bulb holder units. However, the illumination lamps and the indicator lamps use different bulb and bulb holder unit sizes. They must never be interchanged. Be certain that any bulb holder removed from the electronic circuit board is reinstalled in the correct position.

CAUTION: Always use the correct bulb size and type for replacement. An incorrect bulb size or type may overheat and cause damage to the instrument cluster, the electronic circuit board and/or the gauges.

(1) Insert the bulb and bulb holder straight into the correct bulb mounting hole in the cluster electronic circuit board.

(2) With the bulb holder fully seated against the cluster electronic circuit board, turn the bulb holder clockwise about sixty degrees to lock it into place.

(3) Install the instrument cluster into the instrument panel. Refer to **Instrument Cluster** in the Removal and Installation section of this group for the procedures.

(4) Reconnect the battery negative cable.

CLUSTER LENS, HOOD AND MASK

(1) Align the cluster lens, hood and mask unit with the cluster housing.

(2) Press firmly and evenly on the cluster lens, hood and mask unit to install it onto the cluster housing.

(3) Work around the perimeter of the cluster housing to be certain that each of the eight latches that secure the cluster lens, hood and mask unit to the cluster housing is fully engaged.

(4) Install the instrument cluster into the instrument panel. Refer to **Instrument Cluster** in the Removal and Installation section of this group for the procedures.

REMOVAL AND INSTALLATION (Continued)

(5) Install the knob onto the trip odometer reset switch stem. Refer to **Instrument Cluster Components - Trip Odometer Reset Knob** in the Removal and Installation section of this group for the procedures.

(6) Reconnect the battery negative cable.

CLUSTER HOUSING REAR COVER

(1) Position the rear cover to the back of the cluster housing.

(2) Press firmly and evenly on the rear cover until each of the latches (two on top, four on the bottom) that secure the upper and lower edges of the rear cover to the top and bottom of the cluster housing is fully engaged.

(3) Install and tighten the seven screws that secure the rear cover to the back of the cluster housing. Tighten the screws to 2.2 N·m (20 in. lbs.).

(4) Install the instrument cluster into the instrument panel. Refer to **Instrument Cluster** in the Removal and Installation section of this group for the procedures.

(5) Reconnect the battery negative cable.

GAUGE

(1) From the front of the cluster housing, carefully align the gauge or gauge set with the connector pins in the bottom of the gauge mounting cavity(ies) in the cluster housing.

(2) From the front of the cluster housing, press firmly and evenly on the gauge or gauge set to install it onto the connector pins and into the gauge mounting cavity(ies) in the cluster housing.

(3) From the rear of the cluster housing, be certain that the small metal mounting tabs (two for each major gauge, and four for each minor gauge set) that secure the gauge or gauge set are protruding through the mounting holes in the cluster electronic circuit board.

(4) From the rear of the cluster housing, carefully bend over the small metal mounting tabs (two for each major gauge, and four for each minor gauge set) to secure the gauge or gauge set to the cluster electronic circuit board.

(5) Install the rear cover onto the cluster housing. Refer to **Instrument Cluster Components - Cluster Housing Rear Cover** in the Removal and Installation section of this group for the procedures.

(6) Install the cluster lens, hood and mask unit onto the cluster housing. Refer to **Instrument Cluster Components - Cluster Lens, Hood and Mask** in the Removal and Installation section of this group for the procedures.

(7) Install the instrument cluster into the instrument panel. Refer to **Instrument Cluster** in the Removal and Installation section of this group for the procedures.

(8) Install the knob onto the trip odometer reset switch stem. Refer to **Instrument Cluster Components - Trip Odometer Reset Knob** in the Removal and Installation section of this group for the procedures.

(9) Reconnect the battery negative cable.

CLUSTER HOUSING

(1) Install all of the cluster gauges and gauge sets into the cluster housing. Refer to **Instrument Cluster Components - Gauge** in the Removal and Installation section of this group for the procedures.

(2) Install the rear cover onto the cluster housing. Refer to **Instrument Cluster Components - Cluster Housing Rear Cover** in the Removal and Installation section of this group for the procedures.

(3) Install the cluster lens, hood and mask unit onto the cluster housing. Refer to **Instrument Cluster Components - Cluster Lens, Hood and Mask** in the Removal and Installation section of this group for the procedures.

(4) Install all of the cluster illumination lamp and indicator lamp bulb and bulb holder units into the electronic circuit board. Refer to **Instrument Cluster Components - Cluster Bulbs** in the Removal and Installation section of this group for the procedures.

(5) Install the instrument cluster into the instrument panel. Refer to **Instrument Cluster** in the Removal and Installation section of this group for the procedures.

(6) Install the knob onto the trip odometer reset switch stem. Refer to **Instrument Cluster Components - Trip Odometer Reset Knob** in the Removal and Installation section of this group for the procedures.

(7) Reconnect the battery negative cable.

INSTRUMENT PANEL CENTER UPPER BEZEL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

REMOVAL AND INSTALLATION (Continued)

(2) Using a trim stick or another suitable wide flat-bladed tool, gently pry each of the four corners of the center upper bezel away from the instrument panel far enough to disengage the four snap clips from their receptacles (Fig. 14).

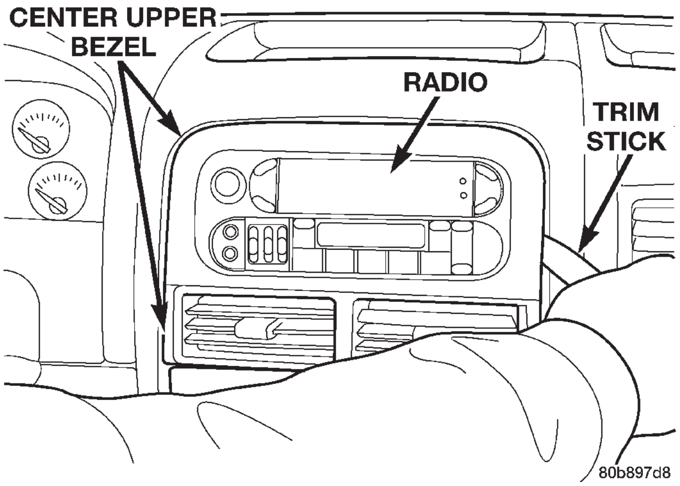

Fig. 14 Instrument Panel Center Upper Bezel Remove/Install

(3) Remove the center upper bezel from the instrument panel.

INSTALLATION

(1) Position the center upper bezel to the instrument panel.

(2) Align the four snap clips on the center upper bezel with the receptacles in the instrument panel top pad.

(3) Press firmly on the center upper bezel over each of the snap clip locations until each of the snap clips is fully engaged in its receptacle.

(4) Reconnect the battery negative cable.

INSTRUMENT PANEL CENTER LOWER BEZEL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Using a trim stick or another suitable wide flat-bladed tool, gently pry each of the four corners of the center lower bezel away from the instrument panel far enough to disengage the four snap clips from their receptacles (Fig. 15).

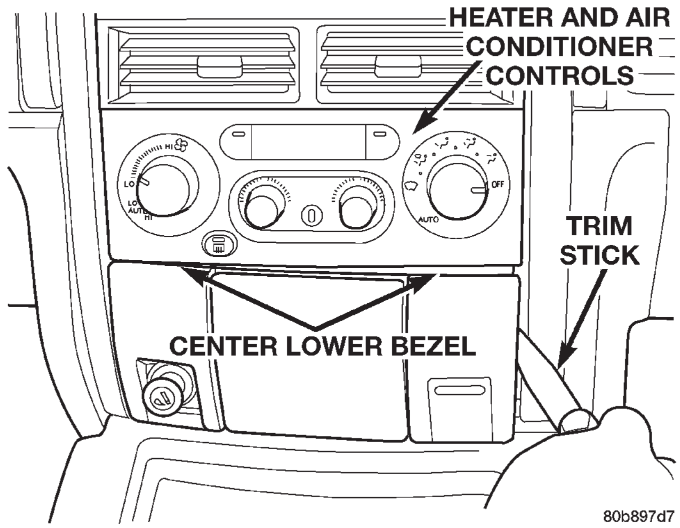

Fig. 15 Instrument Panel Center Lower Bezel Remove/Install

(3) Pull the center lower bezel away from the instrument panel far enough to access the instrument panel wire harness connectors.

(4) Squeeze the mounting legs of the ash receiver lamp hood and remove it from the rectangular hole in the ash receiver flame shield.

(5) If the vehicle is so equipped, disconnect the instrument panel wire harness connectors from the connector receptacles of the two heated seat switches.

(6) Disconnect the instrument panel wire harness connectors from the connector receptacles of the cigar lighter and the accessory power outlet.

(7) Remove the center lower bezel from the instrument panel.

INSTALLATION

(1) Position the center lower bezel to the instrument panel.

(2) Reconnect the instrument panel wire harness connectors to the connector receptacles of the cigar lighter and the accessory power outlet.

(3) If the vehicle is so equipped, reconnect the instrument panel wire harness connectors to the connector receptacles of the two heated seat switches.

(4) Squeeze the mounting legs of the ash receiver lamp hood and install it into the rectangular hole in the ash receiver flame shield.

(5) Align the two lower snap clips on the center lower bezel with the receptacles in the instrument panel top pad.

(6) Press firmly on the center lower bezel over each of the lower snap clip locations until each of the snap clips is fully engaged in its receptacle.

REMOVAL AND INSTALLATION (Continued)

(7) Align the two upper snap clips on the center lower bezel with the receptacles in the instrument panel top pad.

(8) Press firmly on the center lower bezel over each of the upper snap clip locations until each of the snap clips is fully engaged in its receptacle.

(9) Reconnect the battery negative cable.

INSTRUMENT PANEL CIGAR LIGHTER AND POWER OUTLET

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the center lower bezel from the instrument panel. Refer to **Instrument Panel Center Lower Bezel** in the Removal and Installation section of this group for the procedures.

(3) Pull the cigar lighter knob and element or the protective cap out of the cigar lighter receptacle base, or open the power outlet door in the instrument panel center lower bezel.

(4) Look inside the cigar lighter or power outlet receptacle base and note the position of the rectangular retaining bosses of the mount that secures the receptacle base to the instrument panel center lower bezel (Fig. 16).

(5) Insert a pair of external snap ring pliers into the cigar lighter or power outlet receptacle base and engage the tips of the pliers with the retaining bosses of the mount.

(6) Squeeze the pliers to disengage the mount retaining bosses from the receptacle base and, using a gentle rocking motion, pull the pliers and the receptacle base out of the mount.

(7) Remove the cigar lighter or power outlet mount from the instrument panel center lower bezel.

INSTALLATION

(1) Install the cigar lighter or power outlet mount into the instrument panel center lower bezel.

(2) Align the splines on the outside of the cigar lighter or power outlet receptacle base connector receptacle with the grooves on the inside of the mount.

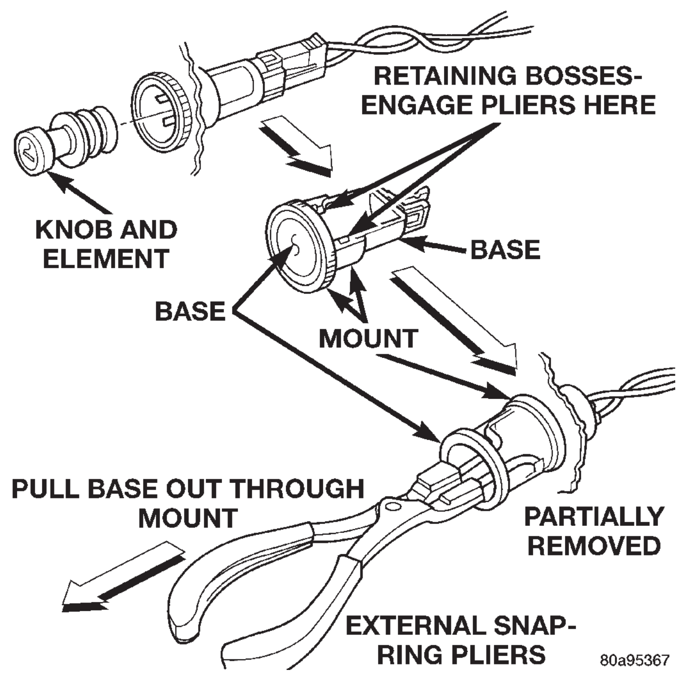

Fig. 16 Cigar Lighter and Power Outlet Remove/Install - Typical

(3) Press firmly on the cigar lighter or power outlet receptacle base until the retaining bosses of the mount are fully engaged in their receptacles.

(4) Install the cigar lighter knob and element or the protective cap into the cigar lighter receptacle base, or close the power outlet door in the instrument panel center lower bezel.

(5) Install the center lower bezel onto the instrument panel. Refer to **Instrument Panel Center Lower Bezel** in the Removal and Installation section of this group for the procedures.

(6) Reconnect the battery negative cable.

CIGAR LIGHTER RELAY

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the steering column opening cover from the instrument panel. Refer to **Steering Column Opening Cover** in the Removal and Installa-

REMOVAL AND INSTALLATION (Continued)

tion section of Group 8E - Instrument Panel Systems for the procedures.

(3) The cigar lighter relay is located on the left side of the combination flasher in the junction block (Fig. 17).

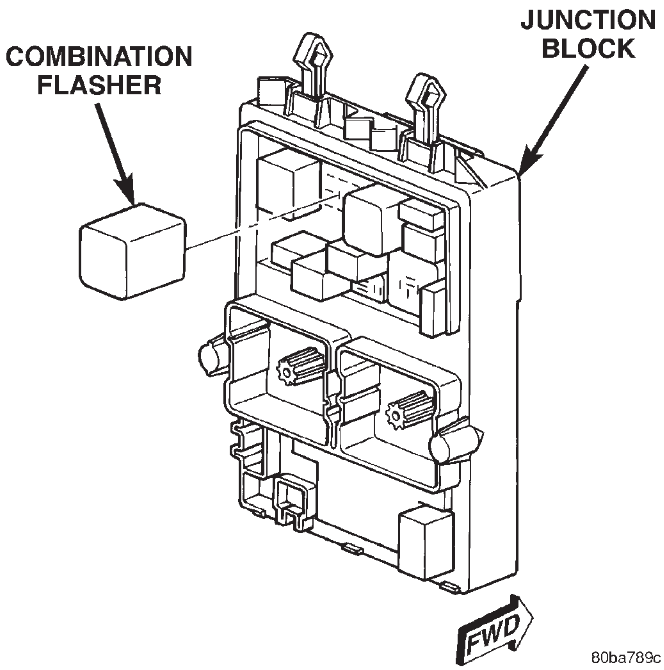

Fig. 17 Junction Block

(4) Remove the cigar lighter relay from the junction block.

INSTALLATION

(1) Position the cigar lighter relay in the proper receptacle in the junction block.

(2) Align the cigar lighter relay terminals with the terminal cavities in the junction block receptacle.

(3) Push in firmly on the cigar lighter relay until the terminals are fully seated in the terminal cavities in the junction block receptacle.

(4) Install the steering column opening cover onto the instrument panel. Refer to **Steering Column Opening Cover** in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(5) Reconnect the battery negative cable.

INSTRUMENT PANEL POWER OUTLET DOOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the center lower bezel from the instrument panel. Refer to **Instrument Panel Center Lower Bezel** in the Removal and Installation section of this group for the procedures.

(3) With the power outlet door in the open position, carefully spread the power outlet door hinge arms far enough to disengage the pivot pins from the pivots on the back side of the center lower bezel (Fig. 18).

NOTE: The power outlet door is more easily serviced while in the open position. The illustration shows the door in the closed position for additional visibility of the assist spring orientation and anchor point details.

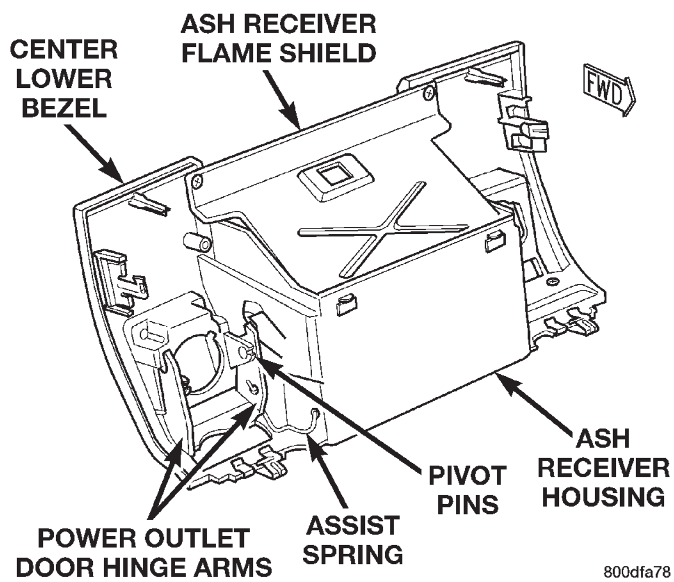

Fig. 18 Instrument Panel Power Outlet Door Remove/Install

(4) Disengage the stepped ends of the assist spring from the anchor holes in the inboard power outlet door hinge arm and in the side of the ash receiver housing.

(5) Remove the power outlet door from the instrument panel center lower bezel.

INSTALLATION

(1) Position the power outlet door to the instrument panel center lower bezel.

(2) Engage the stepped ends of the assist spring with the anchor holes in the inboard power outlet

REMOVAL AND INSTALLATION (Continued)

door hinge arm and in the side of the ash receiver housing.

(3) With the power outlet door in the open position, carefully spread the power outlet door hinge arms far enough to engage the pivot pins with the pivots on the back side of the lower center bezel.

(4) Install the center lower bezel into the instrument panel. Refer to **Instrument Panel Center Lower Bezel** in the Removal and Installation section of this group for the procedures.

(5) Reconnect the battery negative cable.

INSTRUMENT PANEL TO CENTER FLOOR TUNNEL BRACKET

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REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the front bin from the floor console. Refer to **Floor Console** in the Removal and Installation section of Group 23 - Body for the procedures.

(3) Reach through the front bin opening of the floor console to access and disengage the instrument panel wire harness retainer from the mounting hole on the driver side of the instrument panel to center floor tunnel bracket.

(4) Remove the two screws that secure the instrument panel to center floor tunnel bracket to the instrument panel (Fig. 19).

(5) Remove the two nuts that secure the instrument panel to center floor tunnel bracket to the studs on the floor panel transmission tunnel.

(6) Remove the center floor tunnel bracket from the instrument panel and the floor panel transmission tunnel studs.

INSTALLATION

(1) Position the instrument panel to center floor tunnel bracket over the floor panel transmission tunnel studs and slide it up against the instrument panel.

(2) Install and tighten the two nuts that secure the instrument panel to center floor tunnel bracket to the studs on the floor panel transmission tunnel. Tighten the nuts to 11.3 N·m (100 in. lbs.).

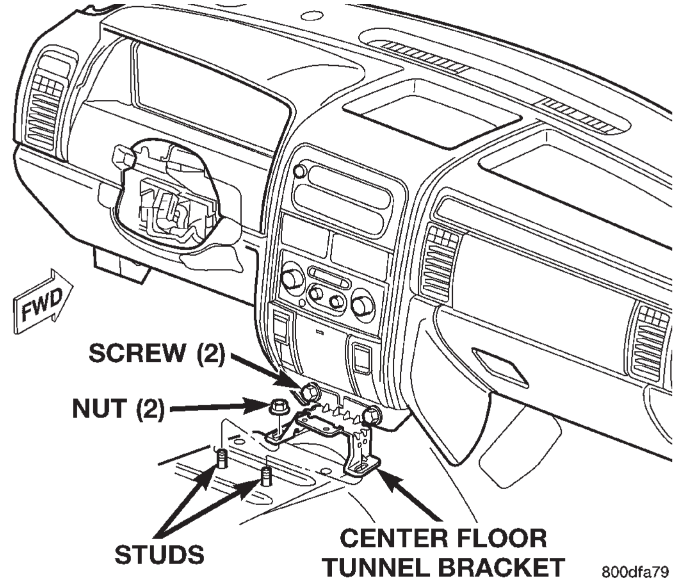

Fig. 19 Instrument Panel to Center Floor Tunnel Bracket Remove/Install

(3) Install and tighten the two screws that secure the instrument panel to center floor tunnel bracket to the instrument panel. Tighten the screws to 11.3 N·m (100 in. lbs.).

(4) Reach through the front bin opening of the floor console to access and engage the instrument panel wire harness retainer with the mounting hole on the driver side of the instrument panel to center floor tunnel bracket.

(5) Install the front bin into the floor console. Refer to **Floor Console** in the Removal and Installation section of Group 23 - Body for the procedures.

(6) Reconnect the battery negative cable.

GLOVE BOX

The glove box on this model can be rolled down beyond the stop bumpers in order to access many components for service, without complete glove box removal. Refer to Roll Down for this procedure. The glove box can also be removed from the instrument panel completely. Refer to Removal for this procedure.

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REMOVAL AND INSTALLATION (Continued)

ROLL DOWN

(1) Disconnect and isolate the battery negative cable.

(2) Open the glove box until the integral stops on the back edge of the glove box bin are resting against the rubber stop bumpers in the upper glove box opening reinforcement.

(3) Reach into the glove box and with the middle finger of each hand, deflect the rubber flap of the two glove box stop bumpers on the upper glove box opening reinforcement toward the front of the vehicle.

(4) With the glove box stop bumpers deflected, roll the glove box door downward until the integral stops on the back edge of the glove box bin pass through the rubber stop bumper openings in the upper glove box opening reinforcement (Fig. 20).

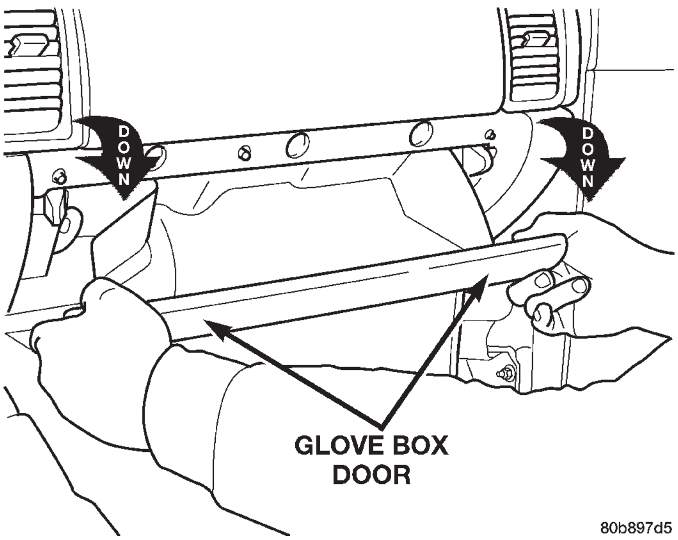

Fig. 20 Glove Box Roll Down

(5) The rubber stop bumpers will be deflected automatically by the integral stops on the back of the glove box when the glove box is rolled back up into the instrument panel.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Roll the glove box down from the instrument panel. Refer to **Glove Box - Roll Down** in the Removal and Installation section of this group for the procedures.

NOTE: Be certain to use care not to damage or remove the glove box hinge bumpers on the lower instrument panel glove box opening reinforcement when removing the glove box from the instrument panel.

(3) Firmly grip both ends of the glove box door, then twist and pull the door as necessary to disengage the inboard hinge hook from the inboard hinge pin on the instrument panel and reorient the hook to the underside of the hinge pin (Fig. 21).

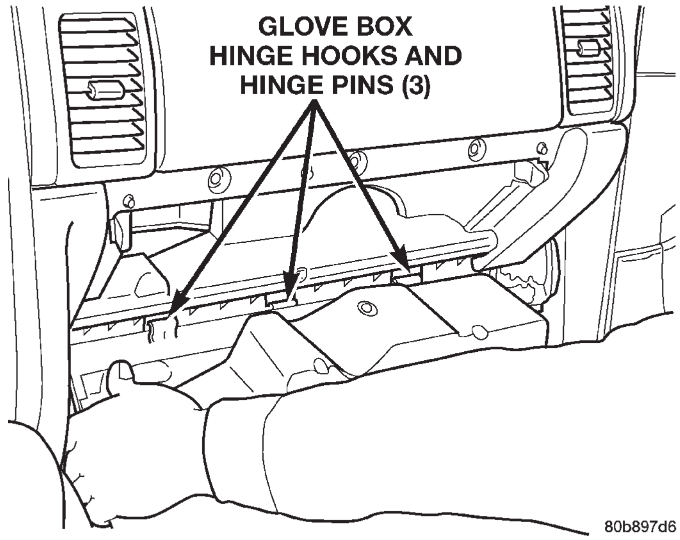

Fig. 21 Glove Box Remove/Install

(4) Raise the glove box door until it is perpendicular to the instrument panel.

(5) Twist the door slightly in the counterclockwise direction and use a jiggling action to disengage the remaining two hinge hooks from their respective hinge pins on the instrument panel.

(6) Remove the glove box from the instrument panel.

INSTALLATION

NOTE: Be certain to use care not to damage or remove the glove box hinge bumpers on the lower instrument panel glove box opening reinforcement when installing the glove box onto the instrument panel.

(1) Position the glove box to the instrument panel with the outboard hinge hook oriented over the outboard hinge pin and the center hinge hook oriented under the center hinge pin.

(2) Raise the glove box door until it is perpendicular to the instrument panel.

(3) Firmly grip both ends of the glove box door and twist the door slightly in the clockwise direction to engage the inboard glove box hinge hook over the inboard hinge pin on the instrument panel.

(4) Roll the glove box back up into the instrument panel. Refer to **Glove Box - Roll Down** in the Removal and Installation section of this group for the procedures.

(5) Reconnect the battery negative cable.

REMOVAL AND INSTALLATION (Continued)

GLOVE BOX LATCH

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REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Roll down the glove box from the instrument panel. Refer to **Glove Box - Roll Down** in the Removal and Installation section of this group for the procedures.

(3) Remove the three screws that secure the glove box latch to the inner glove box door (Fig. 22).

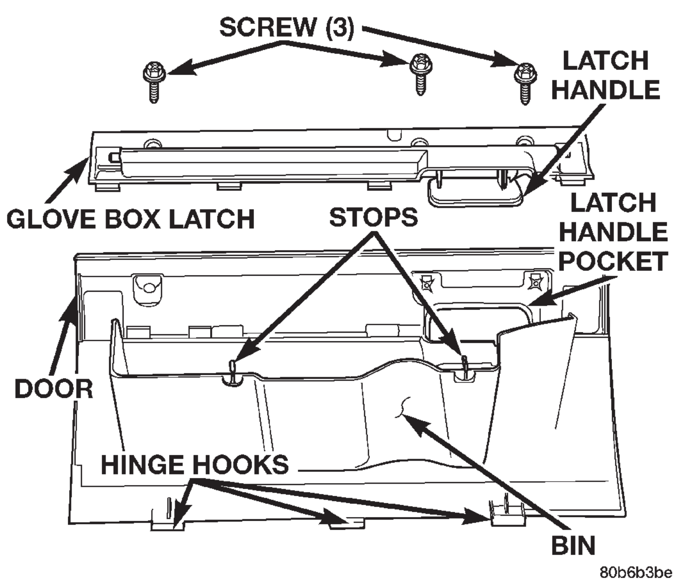


Fig. 22 Glove Box Latch Remove/Install

(4) Lift up on the latch handle on the outer glove box door far enough to loosen the latch assembly on the inner glove box door.

(5) Remove the latch unit from the inner glove box door.

INSTALLATION

(1) Position the latch unit to the inner glove box door.

(2) Guide the latch handle into the latch handle pocket on the outer glove box door.

(3) Install and tighten the three screws that secure the glove box latch to the inner glove box door. Tighten the screws to 2.2 N·m (20 in. lbs.).

(4) Roll the glove box back up into the instrument panel. Refer to **Glove Box - Roll Down** in the Removal and Installation section of this group for the procedures.

(5) Reconnect the battery negative cable.

INSTRUMENT PANEL END CAP

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Open the glove box.

(3) Remove the one screw that secures the outboard end of the end cap to the instrument panel top pad (Fig. 23).

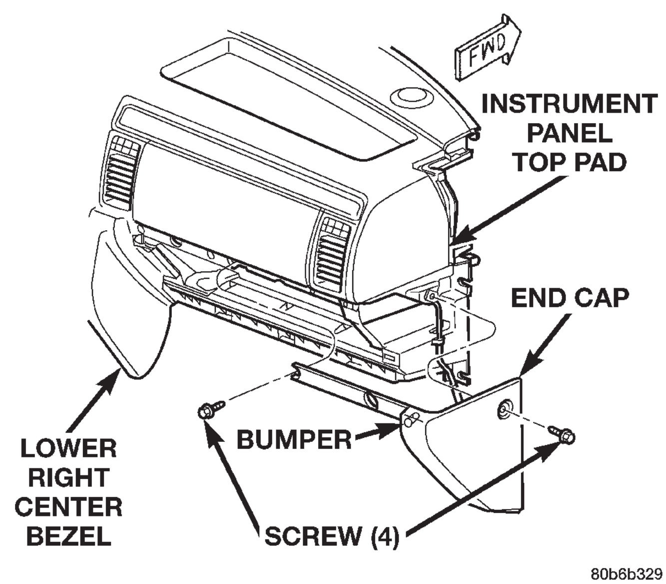


Fig. 23 Instrument Panel End Cap Remove/Install

(4) Remove the three screws that secure the end cap to the instrument panel glove box opening.

(5) Pull the end cap straight back from the instrument panel to disengage the one snap clip that secures it to the receptacle in the instrument panel structural duct.

(6) Remove the end cap from the instrument panel.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Be certain that the glove box catch bumper is installed in the mounting hole nearest the outboard end of the end cap extension over the instrument panel upper glove box opening reinforcement.

(2) Position the end cap to the instrument panel. Be certain that the end of the end cap extension near the center of the upper glove box opening reinforcement is positioned underneath the end of the extension from the lower right center bezel.

(3) Align the snap clip on the end cap with the receptacle on the instrument panel structural duct.

(4) Press firmly on the instrument panel end cap over the snap clip location until the snap clip is fully engaged in its receptacle.

(5) Install and tighten the three screws that secure the end cap to the instrument panel glove box opening. Tighten the screws to 2.2 N·m (20 in. lbs.).

(6) Install and tighten the one screw that secures the outboard end of the end cap to the instrument panel top pad. Tighten the screw to 2.2 N·m (20 in. lbs.).

(7) Close the glove box.

(8) Reconnect the battery negative cable.

INSTRUMENT PANEL LOWER RIGHT CENTER BEZEL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Open the glove box.

(3) Remove the three screws that secure the lower right center bezel to the instrument panel glove box opening (Fig. 24).

(4) Pull the lower right center bezel straight back from the instrument panel to disengage the two snap clips that secure it to the receptacles in the instrument panel top pad.

(5) Remove the lower right center bezel from the instrument panel.

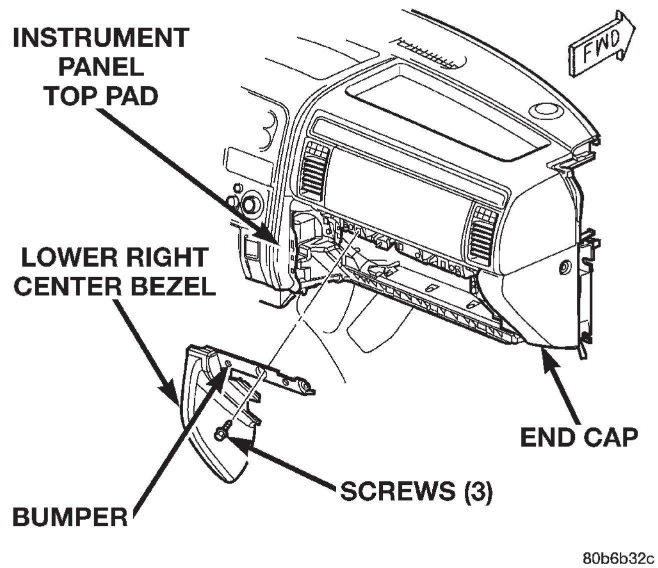


Fig. 24 Instrument Panel Lower Right Center Bezel Remove/Install

INSTALLATION

(1) Be certain that the glove box catch bumper is installed in the mounting hole nearest the inboard end of the lower right center bezel extension over the instrument panel upper glove box opening reinforcement.

(2) Position the lower right center bezel to the instrument panel. Be certain that the end of the lower right center bezel extension near the center of the upper glove box opening reinforcement is positioned on top of the end of the extension from the end cap.

(3) Align the snap clips on the lower right center bezel with the receptacles in the instrument panel top pad.

(4) Press firmly on the lower right center bezel over each of the snap clip locations until the snap clips are fully engaged in their receptacles.

(5) Install and tighten the three screws that secure the lower right center bezel to the instrument panel glove box opening. Tighten the screws to 2.2 N·m (20 in. lbs.).

(6) Close the glove box.

(7) Reconnect the battery negative cable.

GLOVE BOX LATCH STRIKER

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL AND INSTALLATION (Continued)

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) If the inboard glove box latch striker is being serviced, remove the lower right center bezel from the instrument panel. Refer to **Instrument Panel Lower Right Center Bezel** in the Removal and Installation section of this group for the procedures. If the outboard glove box latch striker is being serviced, remove the end cap from the instrument panel. Refer to **Instrument Panel End Cap** in the Removal and Installation section of this group for the procedures.

(3) Remove the one screw that secures the upper mounting flange of the glove box latch striker to the instrument panel structural duct at either side of the glove box opening (Fig. 25).

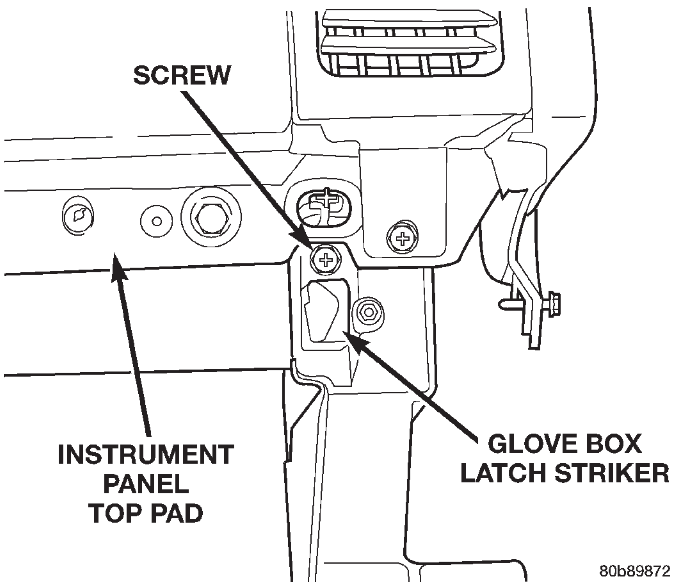


Fig. 25 Glove Box Latch Striker Remove/Install

(4) Pull the upper mounting flange of the glove box latch striker downward to disengage the hook formation on the lower end of the striker from the mounting hole in the instrument panel structural duct.

(5) Remove the glove box latch striker from the instrument panel.

INSTALLATION

(1) Position the glove box latch striker to the instrument panel.

(2) Engage the hook formation on the lower end of the glove box latch striker in the mounting hole in the instrument panel structural duct.

(3) Roll the upper mounting flange of the glove box latch striker upward until it is flush with the instrument panel structural duct on either side of the glove box opening.

(4) Install and tighten the screw that secures the upper mounting flange of the glove box latch striker to the instrument panel structural duct. Tighten the screw to 2.2 N·m (20 in. lbs.).

(5) If the inboard glove box latch striker was serviced, install the lower right center bezel onto the instrument panel. Refer to **Instrument Panel Lower Right Center Bezel** in the Removal and Installation section of this group for the procedures. If the outboard glove box latch striker was serviced, install the end cap onto the instrument panel. Refer to **Instrument Panel End Cap** in the Removal and Installation section of this group for the procedures.

(6) Reconnect the battery negative cable.

GLOVE BOX LAMP AND SWITCH

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Roll down the glove box from the instrument panel. Refer to **Glove Box - Roll Down** in the Removal and Installation section of this group for the procedures.

(3) Remove the lower right center bezel from the instrument panel. Refer to **Instrument Panel Lower Right Center Bezel** in the Removal and Installation section of this group for the procedures.

(4) Reach through the glove box opening and behind the glove box opening upper reinforcement in the instrument panel to access and depress the retaining latches on the top and bottom of the glove box lamp and switch housing.

(5) While holding the retaining latches depressed, push the glove box lamp and switch out through the mounting hole in the instrument panel glove box opening upper reinforcement (Fig. 26).

(6) Pull the glove box lamp and switch out from the mounting hole far enough to access the wire harness connector.

(7) Disconnect the instrument panel wire harness connector from the glove box lamp and switch connector receptacle.

(8) Remove the glove box lamp and switch from the instrument panel.

REMOVAL AND INSTALLATION (Continued)

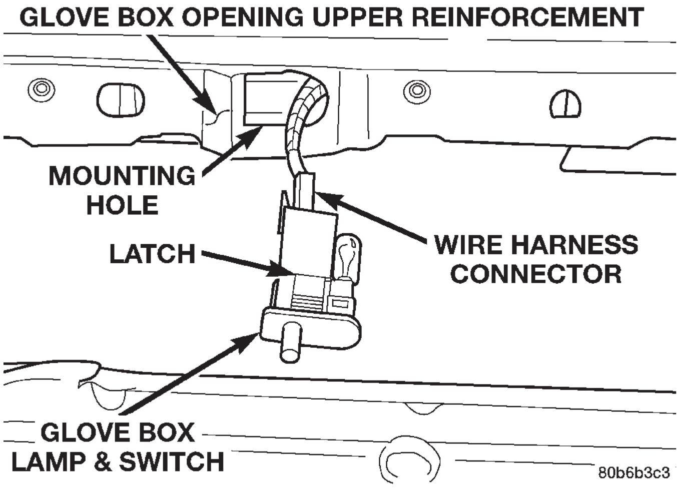


Fig. 26 Glove Box Lamp and Switch Remove/Install

INSTALLATION

(1) Position the glove box lamp and switch to the instrument panel.

(2) Reconnect the instrument panel wire harness connector to the glove box lamp and switch connector receptacle.

(3) Feed the instrument panel wire harness back into the glove box lamp and switch mounting hole in the glove box opening upper reinforcement.

(4) Align the glove box lamp and switch housing with the mounting hole in the instrument panel glove box opening upper reinforcement.

(5) Push the glove box lamp and switch into the mounting hole in the instrument panel glove box opening upper reinforcement until the retaining latches are fully engaged.

(6) Install the lower right center bezel onto the instrument panel. Refer to **Instrument Panel Lower Right Center Bezel** in the Removal and Installation section of this group for the procedures.

(7) Roll the glove box back up into the instrument panel. Refer to **Glove Box - Roll Down** in the Removal and Installation section of this group for the procedures.

(8) Reconnect the battery negative cable.

INSTRUMENT PANEL TOP COVER

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Using a trim stick or another suitable wide flat-bladed tool, gently pry the rear edge (farthest from the windshield) of the top cover up and away from the instrument panel far enough to disengage the four snap clip retainers from their receptacles in the instrument panel top pad (Fig. 27).

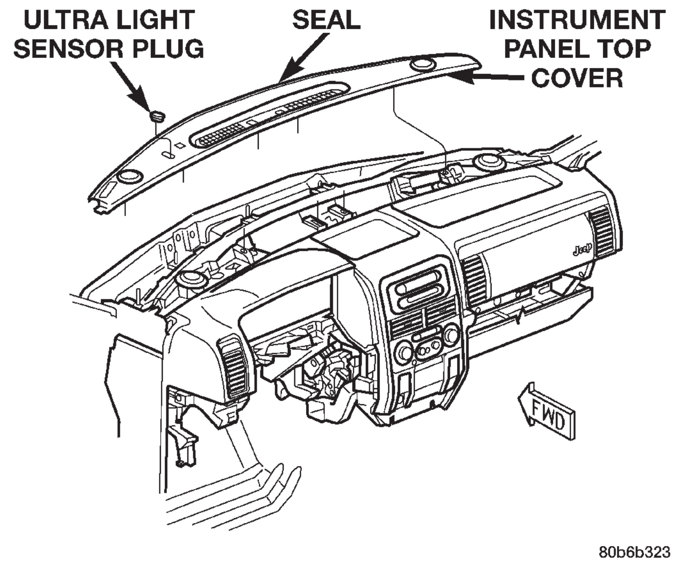


Fig. 27 Instrument Panel Top Cover Remove/Install

(3) Remove the top cover from the instrument panel.

INSTALLATION

(1) If the vehicle is not equipped with the optional ultra light sensor, be certain that the ultra light sensor plug is installed in the hole to the left of the driver side defroster outlet in the instrument panel top cover.

(2) Before installing the top cover to the instrument panel top pad, be certain that the rubber top cover seal is properly positioned on the forward edge of the top cover panel.

(3) Position the top cover on the instrument panel top pad.

(4) Align the four snap clips on the top cover with the snap clip receptacles in the instrument panel top pad.

(5) Press firmly downward on the top cover over each of the four snap clip locations until each of the snap clips is fully seated in their receptacles in the instrument panel top pad.

(6) Reconnect the battery negative cable.

REMOVAL AND INSTALLATION (Continued)

INSTRUMENT PANEL TOP PAD

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the trim from the right and left A-pillars. Refer to **A-Pillar Trim** in the Removal and Installation section of Group 23 - Body for the procedures.

(3) Remove the top cover from the instrument panel. Refer to **Instrument Panel Top Cover** in the Removal and Installation section of this group for the procedures.

(4) Remove the four nuts that secure the instrument panel top pad to the studs on the dash panel near the windshield fence line (Fig. 28).

(5) If the vehicle is so equipped, remove the speakers from the instrument panel top pad. Refer to **Instrument Panel Speakers** in the Removal and Installation section of Group 8F - Audio Systems for the procedures.

(6) If the vehicle is so equipped, disengage the retainer that secures each of the two instrument panel wire harness speaker takeouts to the mounting hole in the instrument panel top pad. Tuck the loose ends of the wire harness speaker takeouts down the defroster ducts to keep them out of the way for the remainder of the procedure.

(7) If the vehicle is so equipped, remove the two screws that secure the security set lamp/ultra light sensor unit to the instrument panel top pad just outboard of the left defroster outlet. Move the security set lamp/ultra light sensor unit towards the windshield to keep it out of the way for the remainder of the procedure.

(8) Remove the cluster bezel from the instrument panel. Refer to **Cluster Bezel** in the Removal and Installation section of this group for the procedures.

(9) Remove the instrument cluster from the instrument panel. Refer to **Instrument Cluster** in the Removal and Installation section of this group for the procedures.

(10) Remove the steering column opening cover from the instrument panel. Refer to **Steering Column Opening Cover** in the Removal and Installation section of this group for the procedures.

(11) Roll the glove box down from the instrument panel. Refer to **Glove Box - Roll Down** in the Removal and Installation section of this group for the procedures.

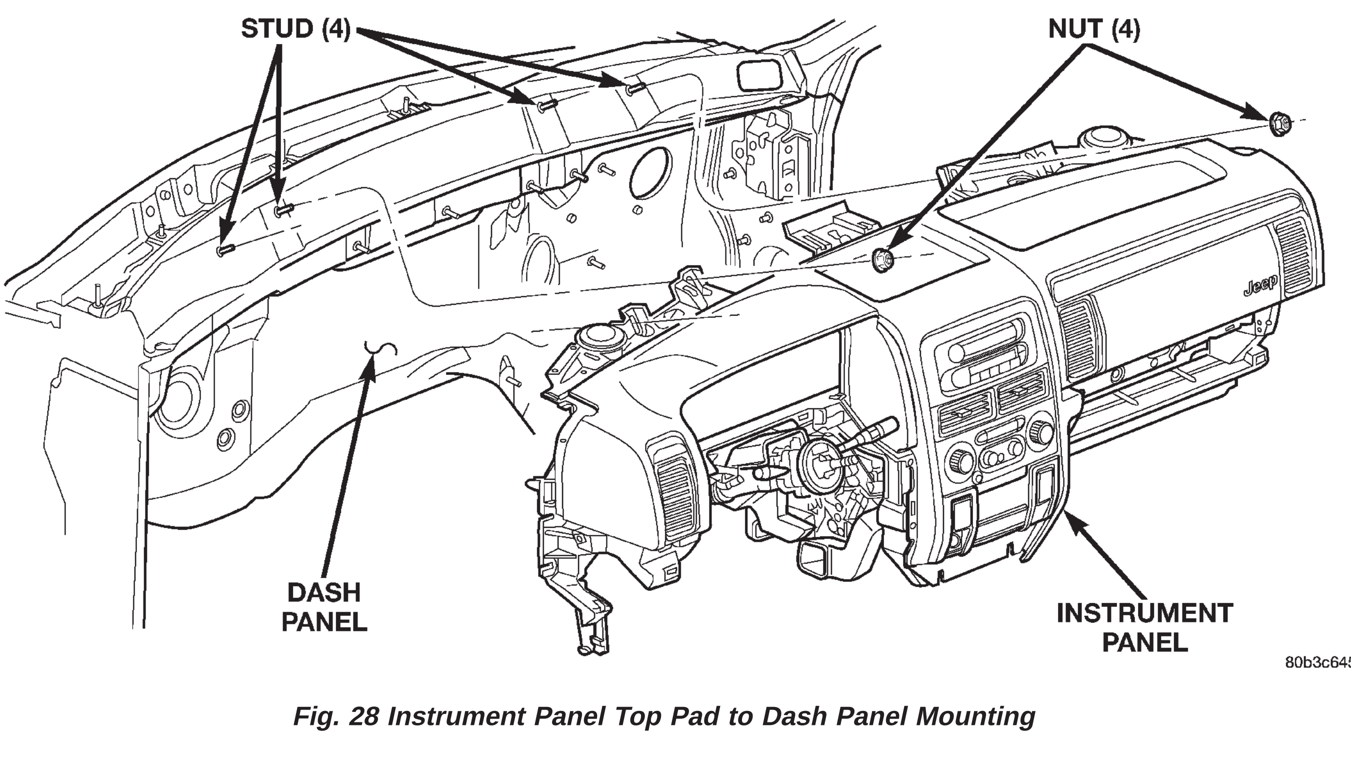


Fig. 28 Instrument Panel Top Pad to Dash Panel Mounting

REMOVAL AND INSTALLATION (Continued)

(12) Remove the end cap from the passenger side lower outboard end of the instrument panel. Refer to **Instrument Panel End Cap** in the Removal and Installation section of this group for the procedures.

(13) Remove the lower right center bezel from the instrument panel. Refer to **Instrument Panel Lower Right Center Bezel** in the Removal and Installation section of this group for the procedures.

(14) Remove the glove box lamp and switch from the instrument panel. Refer to **Glove Box Lamp and Switch** in the Removal and Installation section of this group for the procedures.

(15) Remove the two large screws on the glove box opening upper reinforcement that secure the top pad to the instrument panel structural duct (Fig. 29).

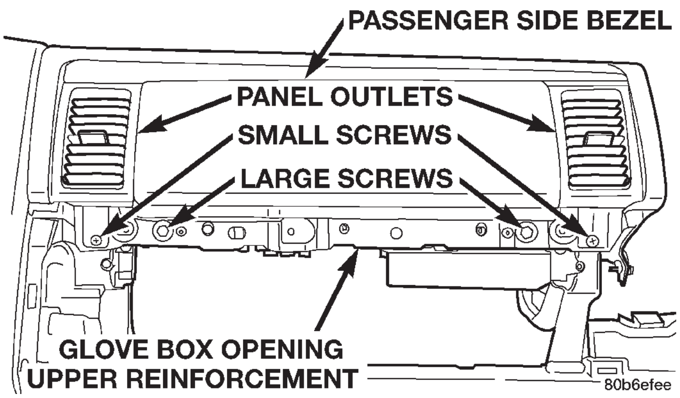


Fig. 29 Instrument Panel Top Pad to Glove Box Opening Mounting

(16) Remove the two small screws on the glove box opening upper reinforcement that secure the panel outlets to the instrument panel structural duct.

(17) Remove the center upper bezel from the instrument panel. Refer to **Instrument Panel Center Upper Bezel** in the Removal and Installation section of this group for the procedures.

(18) Remove the center lower bezel from the instrument panel. Refer to **Instrument Panel Center Lower Bezel** in the Removal and Installation section of this group for the procedures.

(19) Remove the four screws that secure the radio to the instrument panel structural support. Pull the radio out of the instrument panel far enough to access the screws that secure the top pad to the instrument panel structural duct.

(20) Remove the four screws that secure the heater-A/C control to the instrument panel structural duct. Pull the heater-A/C control out of the instrument panel far enough to access the screws that secure the top pad to the instrument panel structural duct.

(21) Remove all of the screws that secure the perimeter of the top pad to the instrument panel structural duct.

(22) Remove the front bin from the floor console. Refer to **Floor Console** in the Removal and Installation section of Group 23 - Body for the procedures.

(23) Reach through the front bin opening of the floor console to access and remove the two screws that secure the center floor tunnel bracket to the instrument panel.

(24) Reach through the front bin opening of the floor console to access and loosen the two nuts that secure the center floor tunnel bracket to the studs on the floor panel transmission tunnel.

(25) Slide the center floor tunnel bracket rearward in the vehicle far enough to disengage the locating hole in the lower flange of the top pad from the locating pin on the instrument panel structural duct (Fig. 30).

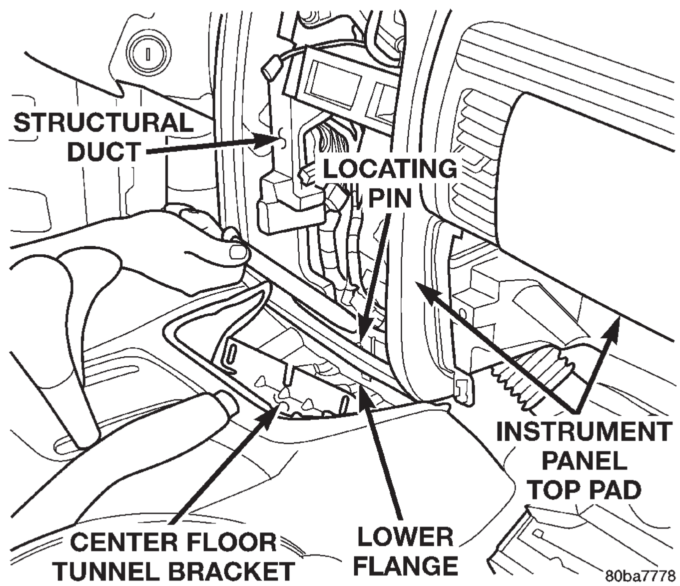


Fig. 30 Instrument Panel Top Pad Remove/Install

(26) Remove the instrument panel top pad from the instrument panel structural duct.

INSTALLATION

If the top pad is being replaced with a new unit, be certain to transfer or install the panel outlets and the passenger side bezel to the new unit before it is installed on the instrument panel structural duct. Refer to **Ducts and Outlets** in the Removal and Installation section of Group 24 - Heating and Air Conditioning for the panel outlet service procedures. Refer to **Instrument Panel Passenger Side Bezel** in the Removal and Installation section of this group for the passenger side bezel service procedures.

(1) Position the instrument panel top pad over the instrument panel structural duct and the studs on the dash panel near the windshield fence line.

(2) Route the instrument panel wire harness take-out for the glove box lamp and switch unit to the

REMOVAL AND INSTALLATION (Continued)

switch mounting hole in the upper glove box opening reinforcement.

(3) Reach through the front bin opening of the floor console to engage the locating hole in the lower flange of the top pad with the locating pin on the instrument panel structural duct.

(4) Reach through the front bin opening of the floor console to slide the center floor tunnel bracket forward in the vehicle far enough to capture the lower flange of the top pad between the bracket and the structural duct.

(5) Reach through the front bin opening of the floor console to install and tighten the two screws that secure the center floor tunnel bracket to the instrument panel. Tighten the screws to 11.8 N·m (105 in. lbs.).

(6) Reach through the front bin opening of the floor console to access and tighten the two nuts that secure the center floor tunnel bracket to the studs on the floor panel transmission tunnel. Tighten the nuts to 11.8 N·m (105 in. lbs.).

(7) Install the front bin into the floor console. Refer to **Floor Console** in the Removal and Installation section of Group 23 - Body for the procedures.

(8) Install and tighten all of the screws that secure the perimeter of the top pad to the instrument panel structural duct. Tighten the screws to 2.2 N·m (20 in. lbs.).

(9) Install and tighten the four screws that secure the heater-A/C control to the instrument panel structural support. Tighten the screws to 2.2 N·m (20 in. lbs.).

(10) Install and tighten the four screws that secure the radio to the instrument panel structural support. Tighten the screws to 2.2 N·m (20 in. lbs.).

(11) Install the center lower bezel onto the instrument panel. Refer to **Instrument Panel Center Lower Bezel** in the Removal and Installation section of this group for the procedures.

(12) Install the center upper bezel onto the instrument panel. Refer to **Instrument Panel Center Upper Bezel** in the Removal and Installation section of this group for the procedures.

(13) Install and tighten the two large screws on the glove box opening upper reinforcement that secure the top pad to the instrument panel structural duct. Tighten the screws to 11.8 N·m (105 in. lbs.).

(14) Install and tighten the two small screws on the glove box opening upper reinforcement that secure the panel outlets to the instrument panel structural duct. Tighten the screws to 2.2 N·m (20 in. lbs.).

(15) Install the glove box lamp and switch into the instrument panel. Refer to **Glove Box Lamp and Switch** in the Removal and Installation section of this group for the procedures.

(16) Install the lower right center bezel onto the instrument panel. Refer to **Instrument Panel Lower Right Center Bezel** in the Removal and Installation section of this group for the procedures.

(17) Install the end cap onto the instrument panel. Refer to **Instrument Panel End Cap** in the Removal and Installation section of this group for the procedures.

(18) Roll the glove box back up into the instrument panel. Refer to **Glove Box - Roll Down** in the Removal and Installation section of this group for the procedures.

(19) Install the steering column opening cover onto the instrument panel. Refer to **Steering Column Opening Cover** in the Removal and Installation section of this group for the procedures.

(20) Install the instrument cluster into the instrument panel. Refer to **Instrument Cluster** in the Removal and Installation section of this group for the procedures.

(21) Install the cluster bezel onto the instrument panel. Refer to **Cluster Bezel** in the Removal and Installation section of this group for the procedures.

(22) If the vehicle is so equipped, position the security set lamp/ultra light sensor unit to the instrument panel top pad just outboard of the left defroster outlet. Install and tighten the two screws that secure it there. Tighten the screws to 2.2 N·m (20 in. lbs.).

(23) If the vehicle is so equipped, engage the retainer that secures each of the two instrument panel wire harness speaker takeouts to the mounting hole in the instrument panel top pad.

(24) If the vehicle is so equipped, install the speakers onto the instrument panel top pad. Refer to **Instrument Panel Speakers** in the Removal and Installation section of Group 8F - Audio Systems for the procedures.

(25) Install and tighten the four nuts that secure the instrument panel top pad to the studs on the dash panel near the windshield fence line. Tighten the nuts to 11.8 N·m (105 in. lbs.).

(26) Install the top cover onto the instrument panel. Refer to **Instrument Panel Top Cover** in the Removal and Installation section of this group for the procedures.

(27) Install the trim onto the right and left A-pillars. Refer to **A-Pillar Trim** in the Removal and Installation section of Group 23 - Body for the procedures.

(28) Reconnect the battery negative cable.

REMOVAL AND INSTALLATION (Continued)

INSTRUMENT PANEL PASSENGER SIDE BEZEL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the top pad from the instrument panel. Refer to **Instrument Panel Top Pad** in the Removal and Installation section of this group for the procedures.

(3) From the underside of the top pad, remove the four screws from the top of the passenger side airbag door that secure the passenger side bezel to the instrument panel (Fig. 31).

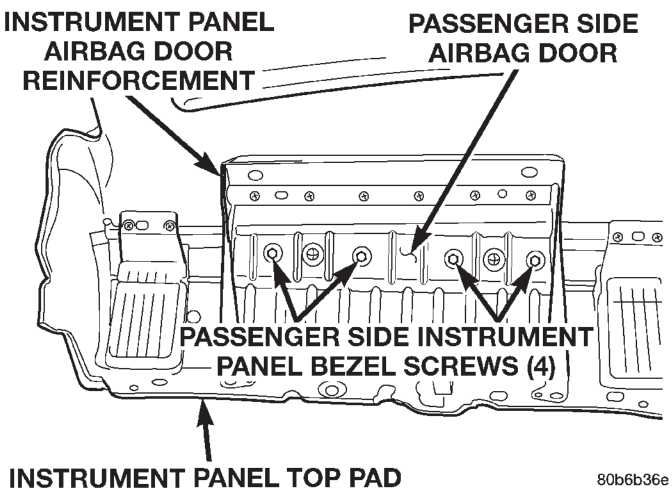


Fig. 31 Instrument Panel Passenger Side Bezel Remove/Install

(4) Remove the passenger side bezel from the instrument panel top pad.

INSTALLATION

(1) Position the passenger side bezel to the instrument panel top pad.

(2) From the underside of the top pad, install and tighten the four screws through the top of the passenger side airbag door that secure the passenger side bezel to the instrument panel. Tighten the screws to 11.8 N·m (105 in. lbs.).

(3) Install the top pad onto the instrument panel. Refer to **Instrument Panel Top Pad** in the Removal and Installation section of this group for the procedures.

(4) Reconnect the battery negative cable.

INSTRUMENT PANEL ASSEMBLY

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

NOTE: Before starting this procedure, be certain to turn the steering wheel until the front wheels are in the straight-ahead position.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the trim from the right and left A-pillars. Refer to **A-Pillar Trim** in the Removal and Installation section of Group 23 - Body for the procedures.

(3) Remove the top cover from the instrument panel. Refer to **Instrument Panel Top Cover** in the Removal and Installation section of this group for the procedures.

(4) Remove the four nuts that secure the instrument panel to the studs on the dash panel near the windshield fence line (Fig. 32).

(5) Remove the scuff plates from the right and left front door sills. Refer to **Front Door Scuff Plate** in the Removal and Installation section of Group 23 - Body for the procedures.

(6) Remove the trim panels from the right and left inner cowl sides. Refer to **Front Door Scuff Plate** in the Removal and Installation section of Group 23 - Body for the procedures.

(7) Remove the console from the floor panel transmission tunnel. Refer to **Floor Console** in the Removal and Installation section of Group 23 - Body for the procedures.

(8) Remove the fuse cover from the junction block. Refer to **Instrument Panel Fuse Cover** in the Removal and Installation section of this group for the procedures.

REMOVAL AND INSTALLATION (Continued)

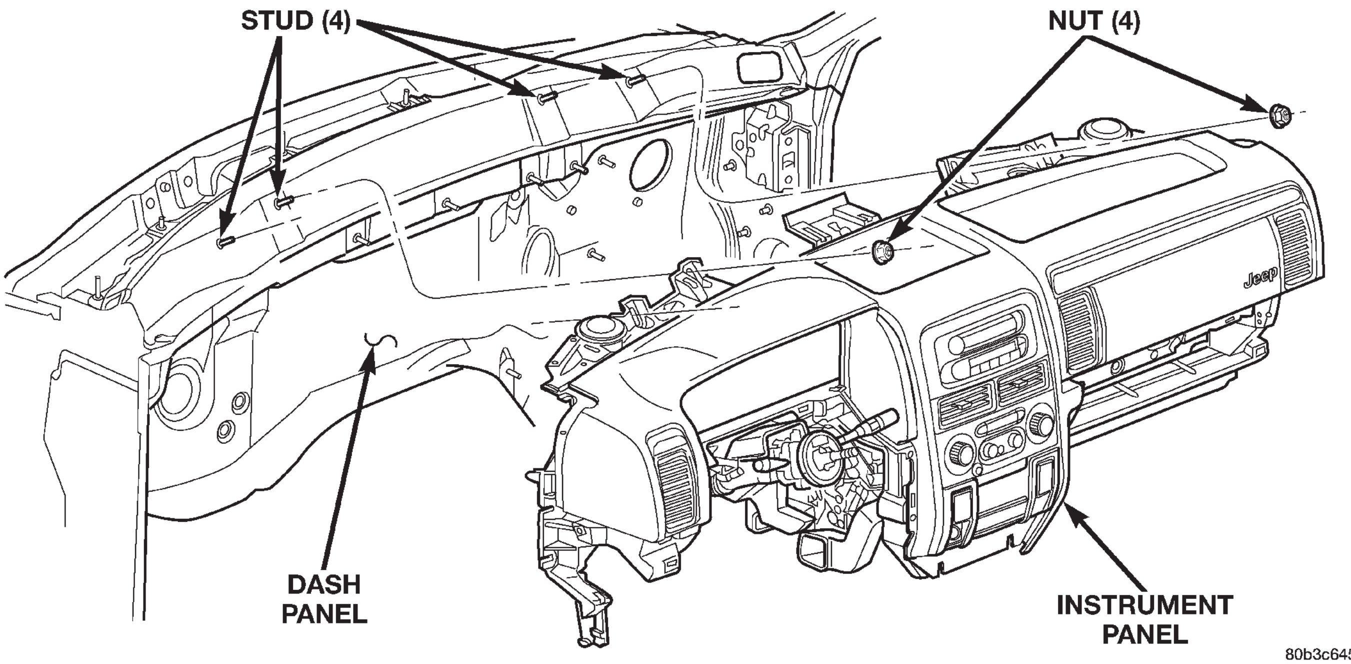


Fig. 32 Instrument Panel to Dash Panel Mounting

(9) Remove the cluster bezel from the instrument panel. Refer to **Cluster Bezel** in the Removal and Installation section of this group for the procedures.

(10) Remove the steering column opening cover from the instrument panel. Refer to **Steering Column Opening Cover** in the Removal and Installation section of this group for the procedures.

(11) Remove the steering column bracket from the instrument panel steering column support bracket. Refer to **Instrument Panel Steering Column Bracket** in the Removal and Installation section of this group for the procedures.

(12) Remove the screw that secures the lower tilting steering column shroud to the steering column multifunction switch mounting housing (Fig. 33).

(13) Unsnap the two halves of the tilting steering column shroud from each other and remove both halves from the steering column.

(14) Disconnect the instrument panel wire harness connectors from the following steering column components (Fig. 34):

- the two lower clockspring connector receptacles
- the left multifunction switch receptacle
- the right multifunction switch receptacle
- the two ignition switch receptacles
- the shifter interlock solenoid receptacle
- if the vehicle is so equipped, the Sentry Key Immobilizer Module (SKIM) receptacle.

(15) Turn the ignition switch to the On position, then release and remove the shifter interlock cable connector from the ignition lock housing receptacle.

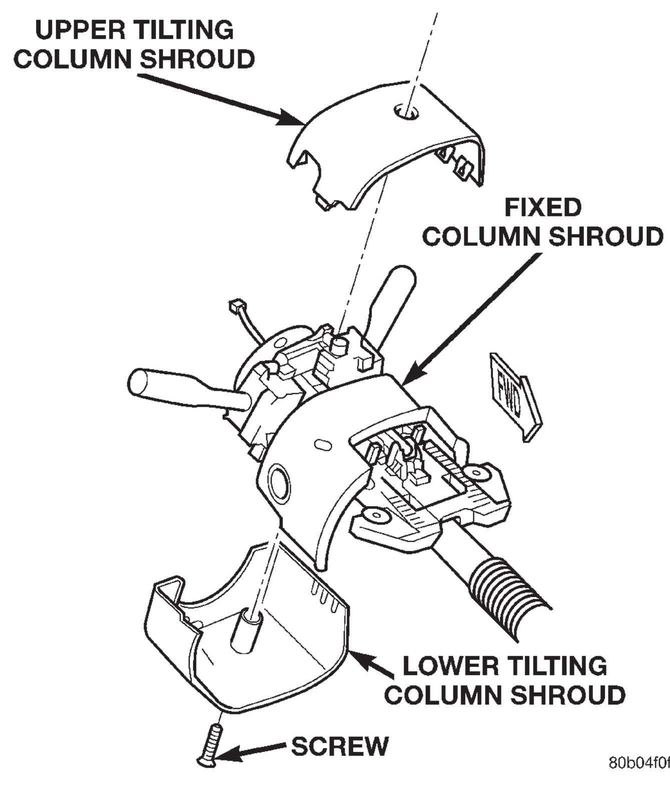


Fig. 33 Steering Column Shrouds Remove/Install

(16) Turn the ignition switch back to the Lock position to prevent steering wheel rotation and the loss of clockspring centering following steering column removal.

REMOVAL AND INSTALLATION (Continued)

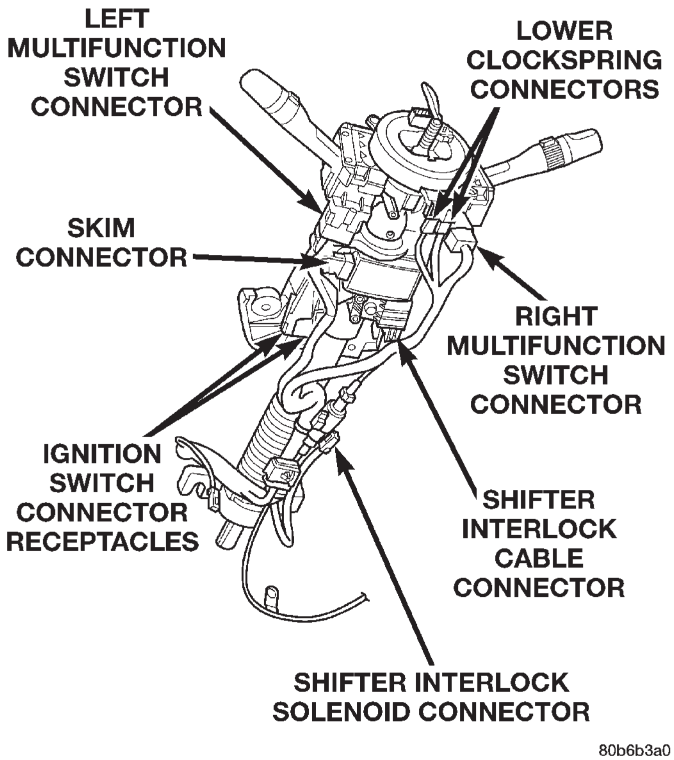


Fig. 34 Steering Column Connections

(17) Remove the bolt that secures the coupler to the lower steering column shaft (Fig. 35).

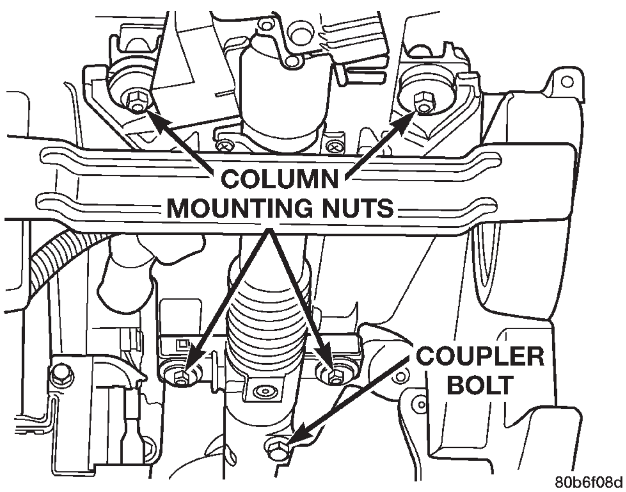


Fig. 35 Steering Column Mounting

(18) Remove the four nuts that secure the steering column to the studs on the instrument panel steering column support bracket.

(19) Remove the steering column from the instrument panel. Be certain that the steering wheel is locked and secured from rotation to prevent the loss of clockspring centering.

(20) Disconnect the left and right body wire harness bulkhead connectors, the Ignition Off Draw (IOD) wire harness connector and the fused B(+) wire harness connector from the connector receptacles of the junction block (Fig. 36).

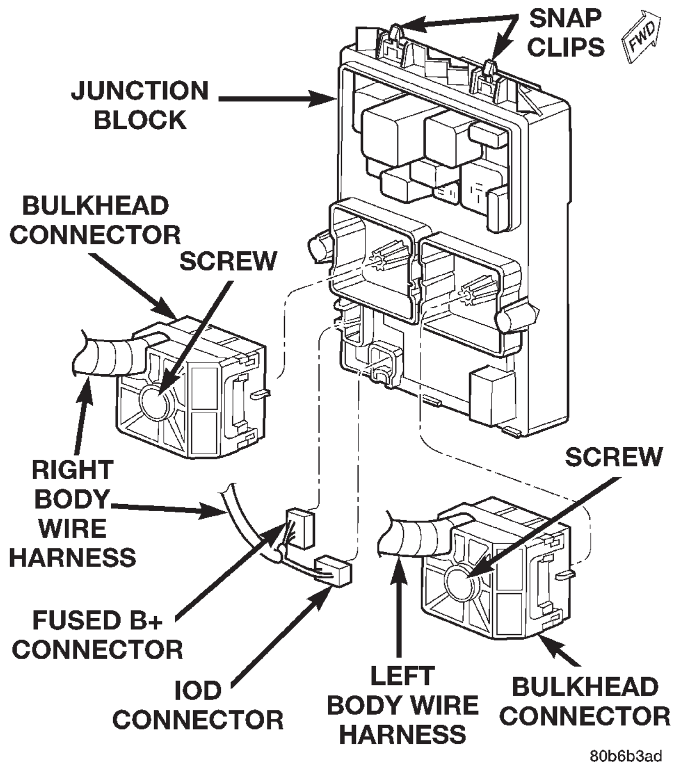


Fig. 36 Junction Block Connections

(21) Disconnect the instrument panel wire harness connectors from the following floor panel transmission tunnel components (Fig. 37):

- the airbag control module connector receptacle
- the park brake switch terminal
- the transmission shifter connector receptacle.

(22) Remove the two nuts that secure the instrument panel wire harness ground eyelets to the studs on the floor panel transmission tunnel in front of and behind the airbag control module.

(23) Disengage the retainers that secure the instrument panel wire harness to the floor panel transmission tunnel.

(24) Remove the instrument panel to center floor tunnel bracket from the instrument panel and the floor panel transmission tunnel. Refer to **Instrument Panel to Center Floor Tunnel Bracket** in the Removal and Installation section of this group for the procedures.

(25) Remove the one screw that secures the driver side floor duct to the heater and air conditioner housing near the driver side of the floor panel transmission tunnel and remove the duct from the housing.

REMOVAL AND INSTALLATION (Continued)

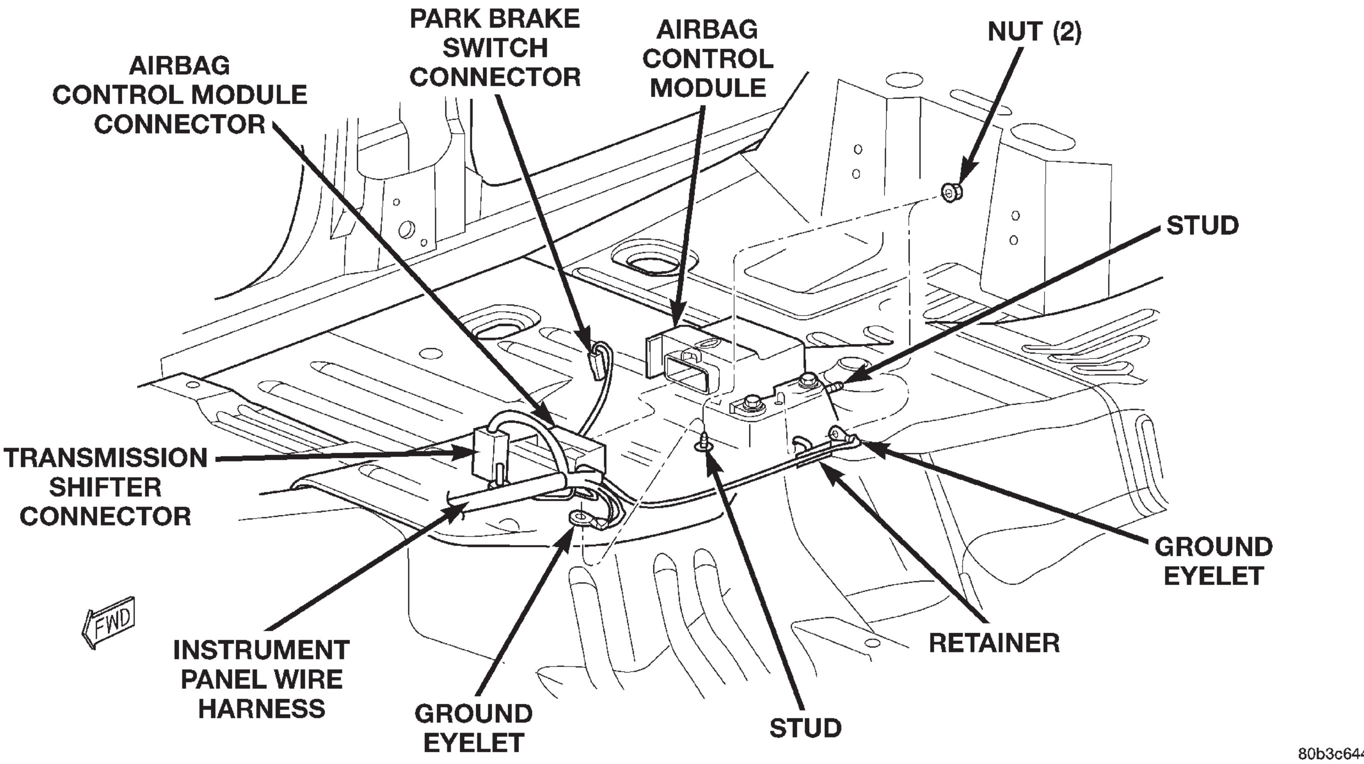


Fig. 37 Floor Panel Transmission Tunnel Connections

(26) If the vehicle is equipped with the manual heating and air conditioning system, disconnect the vacuum harness connector located near the driver side of the floor panel transmission tunnel behind the driver side floor duct.

(27) Remove the one screw that secures the instrument panel steering column support bracket to the driver side end of the heater and air conditioner housing (Fig. 38).

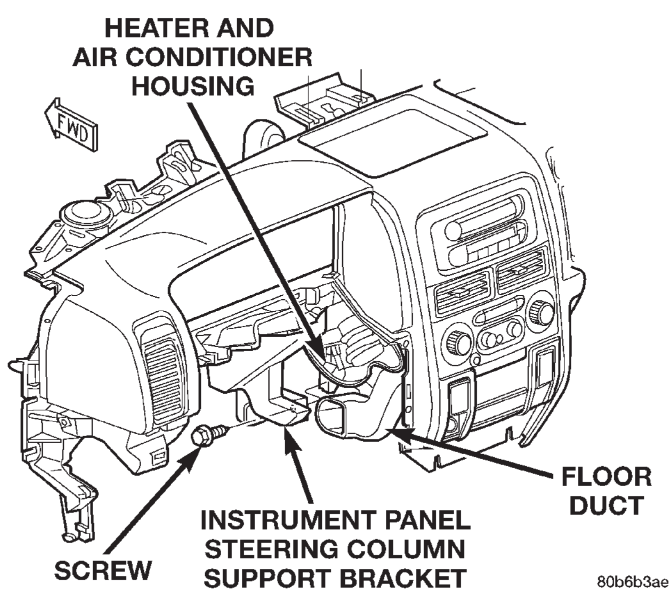


Fig. 38 Driver Side Instrument Panel to Heater-A/C Housing Mounting

(28) Remove the one screw that secures the instrument panel steering column support bracket to the intermediate bracket on the driver side dash panel (Fig. 39).

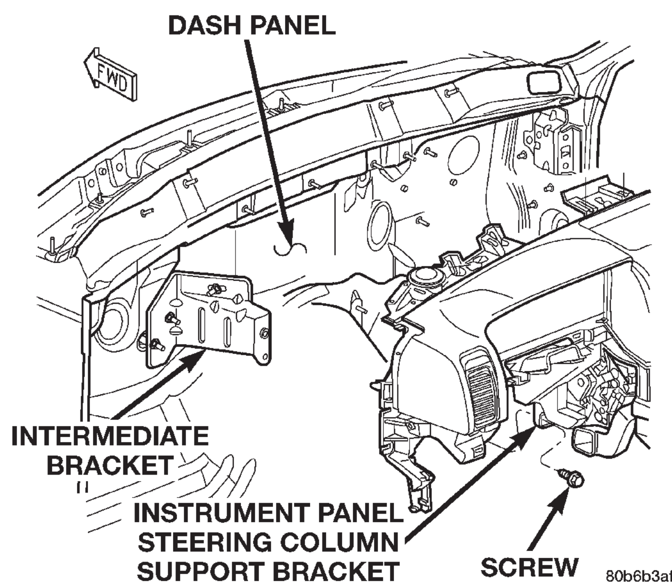


Fig. 39 Instrument Panel to Intermediate Bracket Mounting

REMOVAL AND INSTALLATION (Continued)

(29) Remove the nut that secures the instrument panel steering column support bracket to the stud on the driver side cowl plenum panel (Fig. 40).

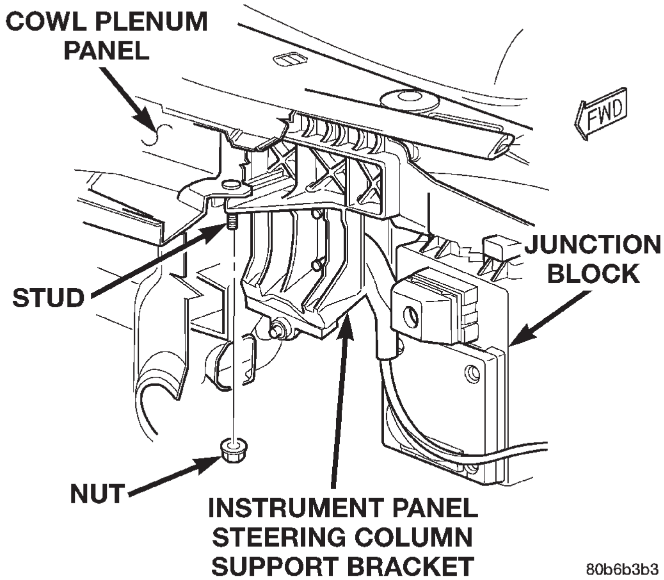


Fig. 40 Instrument Panel to Cowl Plenum Mounting

(30) Remove the two screws that secure the instrument panel to the driver side cowl side inner panel (Fig. 41).

(31) Remove the end cap from the instrument panel. Refer to **Instrument Panel End Cap** in the Removal and Installation section of this group for the procedures.

(32) Remove the lower right center bezel from the instrument panel. Refer to **Instrument Panel Lower Right Center Bezel** in the Removal and Installation section of this group for the procedures.

(33) Disconnect the instrument panel wire harness bulkhead connector from the lower cavity of the inline connector on the passenger side cowl side inner panel (Fig. 42).

(34) Disconnect the two halves of the radio antenna coaxial cable connector near the right cowl side inner panel under the end of the instrument panel.

(35) Disconnect the two instrument panel wire harness connectors from the two heater and air conditioner housing connectors located near the blower motor on the passenger side end of the housing (Fig. 43).

(36) Remove the two screws that secure the passenger side instrument panel structural duct to the heater and air conditioner housing (Fig. 44).

(37) Remove the two screws that secure the instrument panel to the passenger side cowl side inner panel (Fig. 45).

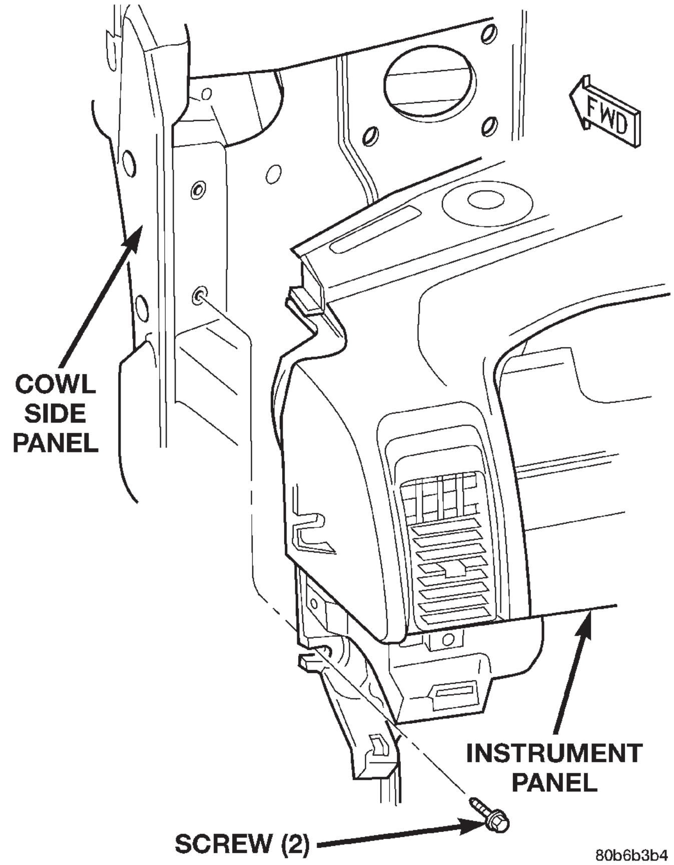


Fig. 41 Instrument Panel to Driver Side Cowl Side Inner Panel Mounting

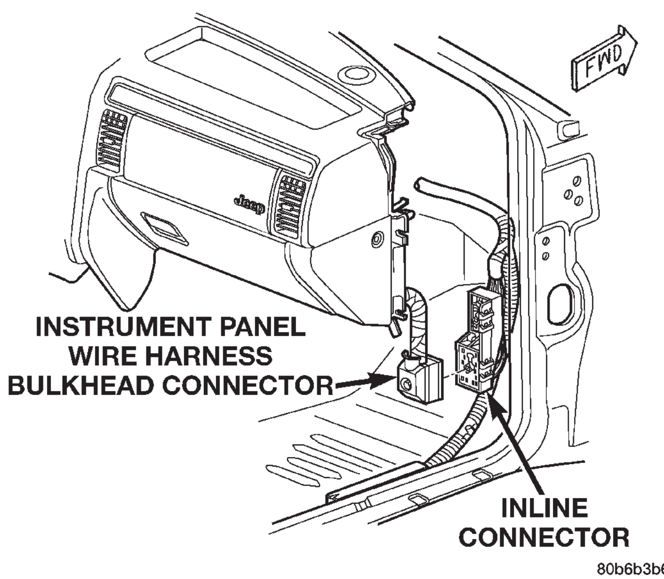


Fig. 42 Instrument Panel Passenger Side Bulkhead Connection

REMOVAL AND INSTALLATION (Continued)

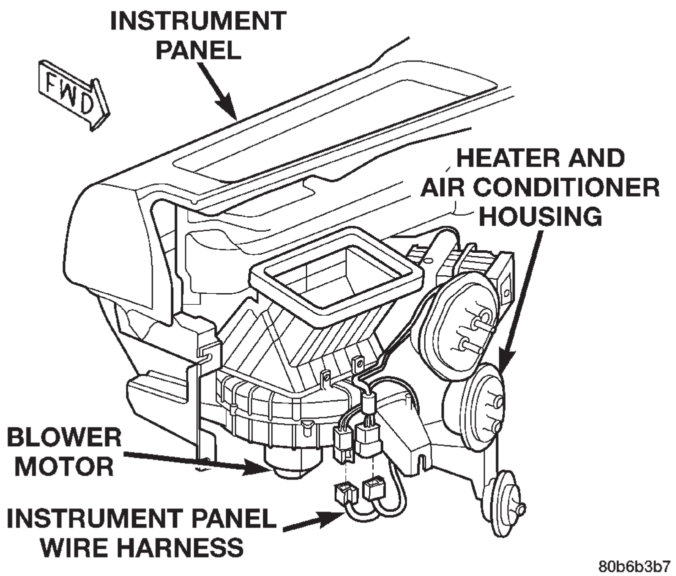


Fig. 43 Heater and Air Conditioner Housing Connections

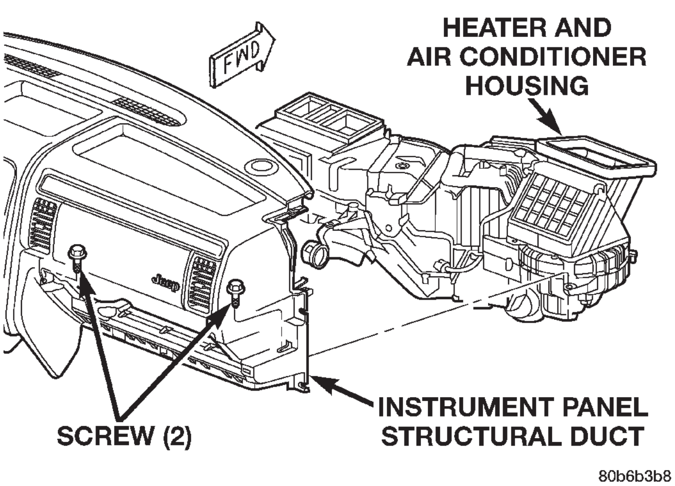


Fig. 44 Passenger Side Instrument Panel to Heater-A/C Housing Mounting

(38) With the aid of an assistant, lift the instrument panel assembly upward off of the studs on the dash panel near the windshield fence line and to disengage the molded plastic hook formations on the instrument panel structural duct from the guide holes at each cowl side inner panel.

(39) Pull the instrument panel rearward from the dash panel and the cowl side inner panels and remove it through the driver side front door of the vehicle.

INSTALLATION

(1) Prior to installing the instrument panel into the vehicle, loosen the three nuts that secure the instrument panel intermediate bracket and the accelerator pedal assembly to the studs on the dash panel.

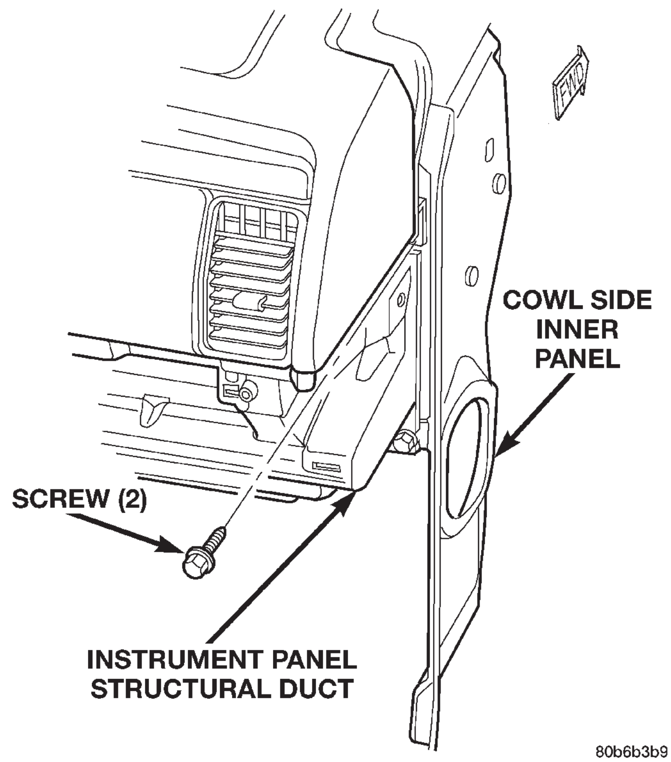


Fig. 45 Instrument Panel to Passenger Side Cowl Side Inner Panel Mounting

(2) With the aid of an assistant, load the instrument panel assembly through the driver side front door of the vehicle and hang it on the studs on the dash panel near the windshield fence line.

(3) Be certain that the molded plastic hook formations on the instrument panel structural duct are inserted into and seated in the guide holes at each cowl side inner panel.

(4) Loosely install the two screws that secure each end of the instrument panel to the cowl side inner panels.

(5) Install and tighten the two screws that secure the passenger side instrument panel structural duct to the heater and air conditioner housing. Tighten the screws to 11.8 N·m (105 in. lbs.).

(6) Install and tighten the one screw that secures the instrument panel steering column support bracket to the driver side end of the heater and air conditioner housing. Tighten the screw to 11.8 N·m (105 in. lbs.).

(7) Tighten the two screws that secure each end of the instrument panel to the cowl side inner panels. Tighten the screws to 11.8 N·m (105 in. lbs.).

(8) Install and tighten the one screw that secures the instrument panel steering column support bracket to the intermediate bracket on the driver side dash panel. Tighten the screw to 11.3 N·m (100 in. lbs.).

REMOVAL AND INSTALLATION (Continued)

(9) Tighten the three nuts that secure the instrument panel intermediate bracket and the accelerator pedal assembly to the studs on the dash panel. Tighten the nuts to 11.3 N·m (100 in. lbs.).

(10) Install and tighten the four nuts that secure the instrument panel to the studs on the dash panel near the windshield fence line. Tighten the nuts to 11.8 N·m (105 in. lbs.).

(11) Install and tighten the nut that secures the instrument panel steering column support bracket to the stud on the driver side cowl plenum panel. Tighten the nut to 28.2 N·m (250 in. lbs.).

(12) Install the instrument panel to center floor tunnel bracket onto the instrument panel and the floor panel transmission tunnel. Refer to **Instrument Panel to Center Floor Tunnel Bracket** in the Removal and Installation section of this group for the procedures.

(13) Reconnect the two instrument panel wire harness connectors to the two heater and air conditioner housing connectors located near the blower motor on the passenger side end of the housing.

(14) Reconnect the two halves of the radio antenna coaxial cable connector near the right cowl side inner panel under the end of the instrument panel.

(15) Reconnect the instrument panel wire harness bulkhead connector to the lower cavity of the inline connector on the passenger side cowl side inner panel and tighten the connector screw. Tighten the screw to 4 N·m (36 in. lbs.).

(16) Install the lower right center bezel onto the instrument panel. Refer to **Instrument Panel Lower Right Center Bezel** in the Removal and Installation section of this group for the procedures.

(17) Install the end cap onto the instrument panel. Refer to **Instrument Panel End Cap** in the Removal and Installation section of this group for the procedures.

(18) If the vehicle is equipped with the manual heating and air conditioning system, reconnect the vacuum harness connector located near the driver side of the floor panel transmission tunnel behind the driver side floor duct.

(19) Position the driver side floor duct to the heater and air conditioner housing near the driver side of the floor panel transmission tunnel.

(20) Install and tighten the one screw that secures the driver side floor duct to the heater and air conditioner housing near the driver side of the floor panel transmission tunnel. Tighten the screw to 2.2 N·m (20 in. lbs.).

(21) Route the instrument panel wire harness to the floor panel transmission tunnel and engage the retainers that secure the harness to the mounting brackets on the tunnel.

(22) Install the instrument panel wire harness ground eyelets to the studs on the floor panel transmission tunnel in front of and behind the airbag control module and secure the eyelets with nuts. Tighten the nuts to 7.3 N·m (65 in. lbs.).

(23) Reconnect the instrument panel wire harness connectors to the following floor panel transmission tunnel components:

- the airbag control module connector receptacle
- the park brake switch terminal
- the transmission shifter connector receptacle.

(24) Reconnect the left and right body wire harness bulkhead connectors, the Ignition Off Draw (IOD) wire harness connector and the fused B+ wire harness connector to the connector receptacles of the junction block. Tighten the bulkhead connector screws. Tighten the screws to 4 N·m (36 in. lbs.).

(25) Engage the lower steering column shaft with the steering shaft coupler and position the steering column to the mounting studs on the instrument panel steering column support bracket.

(26) Install and tighten the four nuts that secure the steering column to the studs on the instrument panel steering column support bracket. Tighten the nuts to 11.8 N·m (105 in. lbs.).

(27) Install and tighten the bolt that secures the coupler to the lower steering column shaft. Tighten the bolt to 49 N·m (36 ft. lbs.).

(28) Turn the ignition switch to the On position, then install the shifter interlock cable connector into the ignition lock housing receptacle.

(29) Reconnect the instrument panel wire harness connectors to the following steering column components (Fig. 34):

- the two lower clockspring connector receptacles
- the left multifunction switch receptacle
- the right multifunction switch receptacle
- the two ignition switch receptacles
- the shifter interlock solenoid receptacle
- if the vehicle is so equipped, the Sentry Key Immobilizer Module (SKIM) receptacle.

(30) Position the lower tilting steering column shroud to the steering column multifunction switch mounting housing, then install and tighten the screw that secures the shroud to the housing. Tighten the screw to 1.9 N·m (17 in. lbs.).

(31) Position the upper tilting steering column shroud over the steering column. Align the upper and lower shrouds with each other and snap the two halves together.

(32) Install the steering column bracket onto the instrument panel steering column support bracket. Refer to **Instrument Panel Steering Column Bracket** in the Removal and Installation section of this group for the procedures.

REMOVAL AND INSTALLATION (Continued)

(33) Install the steering column opening cover onto the instrument panel. Refer to **Steering Column Opening Cover** in the Removal and Installation section of this group for the procedures.

(34) Install the cluster bezel onto the instrument panel. Refer to **Cluster Bezel** in the Removal and Installation section of this group for the procedures.

(35) Install the fuse cover onto the junction block. Refer to **Instrument Panel Fuse Cover** in the Removal and Installation section of this group for the procedures.

(36) Install the console onto the floor panel transmission tunnel. Refer to **Floor Console** in the Removal and Installation section of Group 23 - Body for the procedures.

(37) Install the trim panels onto the right and left inner cowl sides. Refer to **Front Door Scuff Plate** in the Removal and Installation section of Group 23 - Body for the procedures.

(38) Install the scuff plates onto the right and left front door sills. Refer to **Front Door Scuff Plate** in the Removal and Installation section of Group 23 - Body for the procedures.

(39) Install the top cover onto the instrument panel. Refer to **Instrument Panel Top Cover** in the Removal and Installation section of this group for the procedures.

(40) Install the trim onto the right and left A-pillars. Refer to **A-Pillar Trim** in the Removal and Installation section of Group 23 - Body for the procedures.

(41) Reconnect the battery negative cable.

INSTRUMENT PANEL C-CHANNEL COVER BRACKET

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument panel from the vehicle. Refer to **Instrument Panel Assembly** in the Removal and Installation section of this group for the procedures.

(3) Place the instrument panel top down on a suitable work surface. Be certain to take the proper precautions to protect the top of the instrument panel from any possible cosmetic damage.

(4) Disengage the radio antenna coaxial cable retainer from the mounting hole in the instrument panel wire harness mounting tab on the passenger side outboard end of the instrument panel C-channel cover bracket.

(5) Remove the screw that secures the instrument panel wire harness mounting tab on the passenger side outboard end of the instrument panel C-channel cover bracket (Fig. 46).

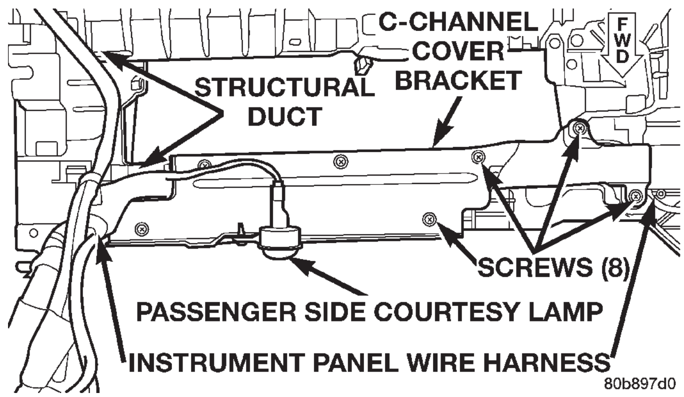


Fig. 46 Instrument Panel C-Channel Cover Bracket Remove/Install

(6) Remove the screw that secures the passenger side courtesy lamp to the lower tab of instrument panel C-channel cover bracket.

(7) Remove the eight screws that secure the C-channel cover bracket to the instrument panel structural duct.

(8) Remove the C-channel cover bracket from the instrument panel structural duct.

INSTALLATION

(1) Position the C-channel cover bracket to the instrument panel structural duct.

(2) Install and tighten the eight screws that secure the C-channel cover bracket to the instrument panel structural duct. Tighten the screws to 2.2 N·m (20 in. lbs.).

(3) Position the passenger side courtesy lamp to the lower tab of instrument panel C-channel cover bracket.

(4) Install and tighten the screw that secures the passenger side courtesy lamp to the lower tab of instrument panel C-channel cover bracket. Tighten the screw to 2.2 N·m (20 in. lbs.).

(5) Position the instrument panel wire harness mounting tab to the passenger side outboard end of the instrument panel C-channel cover bracket.

(6) Install and tighten the screw that secures the instrument panel wire harness mounting tab to the passenger side outboard end of the instrument panel

REMOVAL AND INSTALLATION (Continued)

C-channel cover bracket. Tighten the screw to 2.2 N·m (20 in. lbs.).

(7) Engage the radio antenna coaxial cable retainer in the mounting hole in the instrument panel wire harness mounting tab on the passenger side outboard end of the instrument panel C-channel cover bracket.

(8) Install the instrument panel into the vehicle. Refer to **Instrument Panel Assembly** in the Removal and Installation section of this group for the procedures.

(9) Reconnect the battery negative cable.

INSTRUMENT PANEL INTERMEDIATE BRACKET

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the accelerator pedal assembly from the shoulder studs on the dash panel. Refer to **Accelerator Pedal** in the Removal and Installation section of Group 14 - Fuel System for the procedures.

(3) Remove the instrument panel from the vehicle. Refer to **Instrument Panel Assembly** in the Removal and Installation section of this group for the procedures.

(4) Remove the one nut that secures the instrument panel intermediate bracket to the stud on the dash panel (Fig. 47).

(5) Remove the instrument panel intermediate bracket from the two shoulder studs and the one stud on the dash panel.

INSTALLATION

(1) Position the instrument panel intermediate bracket to the two shoulder studs and the one stud on the dash panel.

(2) Loosely install the one nut that secures the instrument panel intermediate bracket to the one stud on the dash panel.

(3) Install the instrument panel into the vehicle. Refer to **Instrument Panel Assembly** in the Removal and Installation section of this group for the procedures.

(4) Install the accelerator pedal assembly onto the shoulder studs on the dash panel. Refer to **Accelerator Pedal** in the Removal and Installation section of Group 14 - Fuel System for the procedures.

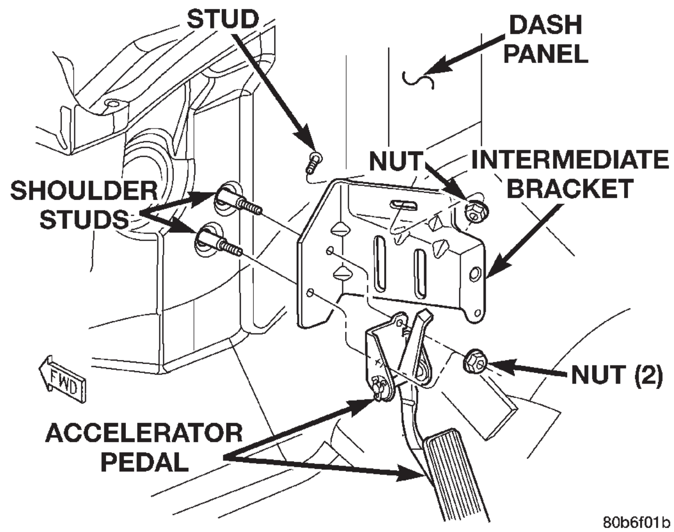


Fig. 47 Instrument Panel Intermediate Bracket Remove/Install

(5) Reconnect the battery negative cable.

INSTRUMENT PANEL PLENUM BRACKET

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument panel from the vehicle. Refer to **Instrument Panel Assembly** in the Removal and Installation section of this group for the procedures.

(3) Place the instrument panel top down on a suitable work surface. Be certain to take the proper precautions to protect the top of the instrument panel from any possible cosmetic damage.

(4) Remove the one screw that secures the plenum bracket to the instrument panel steering column support bracket (Fig. 48).

(5) Remove the plenum bracket from the instrument panel steering column support bracket.

INSTALLATION

(1) Position the plenum bracket to the instrument panel steering column support bracket.

REMOVAL AND INSTALLATION (Continued)

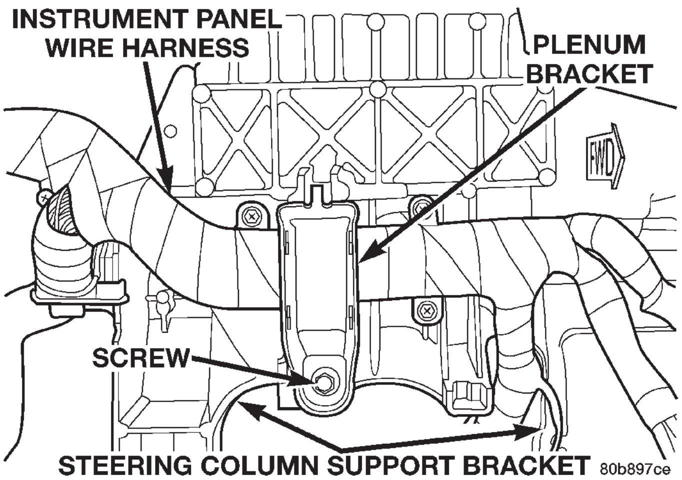


Fig. 48 Instrument Panel Plenum Bracket Remove/Install

(2) Install and tighten the one screw that secures the plenum bracket to the instrument panel steering column support bracket. Tighten the screw to 11.8 N·m (105 in. lbs.).

(3) Install the instrument panel into the vehicle. Refer to **Instrument Panel Assembly** in the Removal and Installation section of this group for the procedures.

(4) Reconnect the battery negative cable.

INSTRUMENT PANEL STEERING COLUMN SUPPORT BRACKET

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument cluster from the instrument panel. Refer to **Instrument Cluster** in the Removal and Installation section of this group for the procedures.

(3) Remove the instrument panel plenum bracket from the steering column support bracket. Refer to **Instrument Panel Plenum Bracket** in the Removal and Installation section of this group for the procedures.

(4) Remove the three screws that secure the instrument panel wire harness mounting tabs to the back of the steering column support bracket.

(5) Remove the two screws that secure the 16-way data link connector to the instrument panel steering column support bracket and remove the connector from the bracket (Fig. 49).

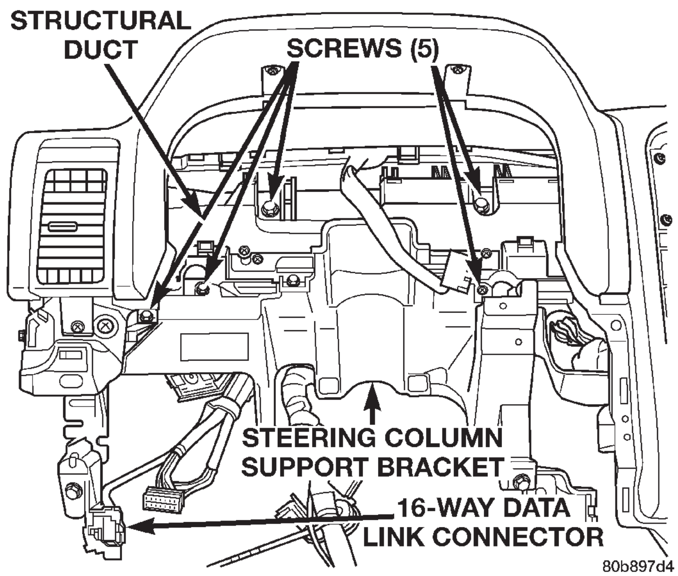


Fig. 49 Instrument Panel Steering Column Support Bracket Remove/Install

(6) Remove the junction block and the body control module from the instrument panel steering column support bracket as a unit, but do not disconnect any of the instrument panel wire harness connectors from the unit. Refer to **Junction Block** in the Removal and Installation section of Group 8O - Power Distribution Systems for the procedures.

(7) From the face of the instrument panel, remove the five screws that secure the steering column support bracket to the instrument panel structural duct.

(8) Remove the steering column support bracket from the instrument panel structural duct.

INSTALLATION

(1) Position the steering column support bracket to the instrument panel structural duct.

(2) From the face of the instrument panel, install and tighten the five screws that secure the steering column support bracket to the instrument panel structural duct. Tighten the screws to 11.8 N·m (105 in. lbs.).

(3) Position the instrument panel wire harness mounting tabs to the back of the steering column support bracket.

(4) Install and tighten the three screws that secure the instrument panel wire harness mounting tabs to the back of the steering column support bracket. Tighten the screws to 2.2 N·m (20 in. lbs.).

(5) Install the instrument panel plenum bracket onto the steering column support bracket. Refer to **Instrument Panel Plenum Bracket** in the Removal and Installation section of this group for the procedures.

(6) Install the junction block and the body control module onto the instrument panel steering column support bracket as a unit. Refer to **Junction Block** in the Removal and Installation section of Group 8O - Power Distribution Systems for the procedures.

(7) Position the 16-way data link connector to the instrument panel steering column support bracket.

(8) Install and tighten the two screws that secure the 16-way data link connector to the instrument panel steering column support bracket. Tighten the screws to 2.2 N·m (20 in. lbs.).

(9) Install the instrument cluster onto the instrument panel. Refer to **Instrument Cluster** in the Removal and Installation section of this group for the procedures.

(10) Reconnect the battery negative cable.

INSTRUMENT PANEL STRUCTURAL DUCT

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument panel from the vehicle. Refer to **Instrument Panel Assembly** in the Removal and Installation section of this group for the procedures.

(3) Place the instrument panel on a suitable work surface. Be certain to take the proper precautions to protect the instrument panel from any possible cosmetic damage.

(4) Remove all of the individual components that are secured to the instrument panel structural duct as described in this service manual.

INSTALLATION

(1) Install all of the individual components that were removed from the instrument panel structural duct as described in this service manual.

(2) Install the instrument panel into the vehicle. Refer to **Instrument Panel Assembly** in the Removal and Installation section of this group for the procedures.

(3) Reconnect the battery negative cable.

INSTRUMENT PANEL SYSTEMS

CONTENTS

REMOVAL AND INSTALLATION

HEADLAMP LEVELING SWITCH

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect the negative battery cable.
(2) Position the tilt steering wheel in its fully lowered position.

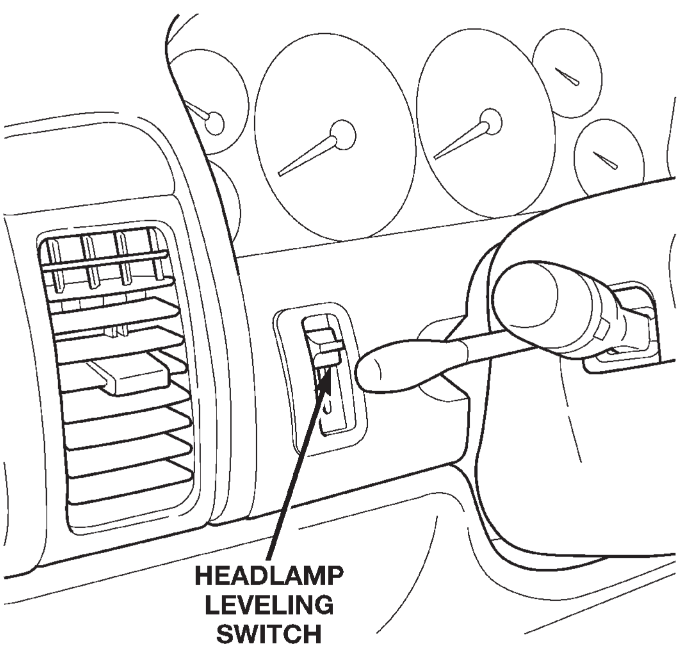


Fig. 1 Headlamp Leveling Switch Position & Orientation

(3) Using a trim stick or another suitable wide flat-bladed tool, gently pry each of the four corners of the cluster bezel away from the instrument panel far enough to disengage the four retaining clips.
(4) Reach behind the cluster bezel to disconnect the headlamp leveling switch electrical connector.
(5) Remove the cluster bezel from the vehicle and depress the switch retaining tabs to remove it from the bezel.

INSTALLATION

(1) Insert the headlamp switch electrical connector through the hole in the cluster bezel.
(2) Install the instrument panel cluster bezel on the I.P.
(3) Connect the headlamp leveling switch electrical connector.

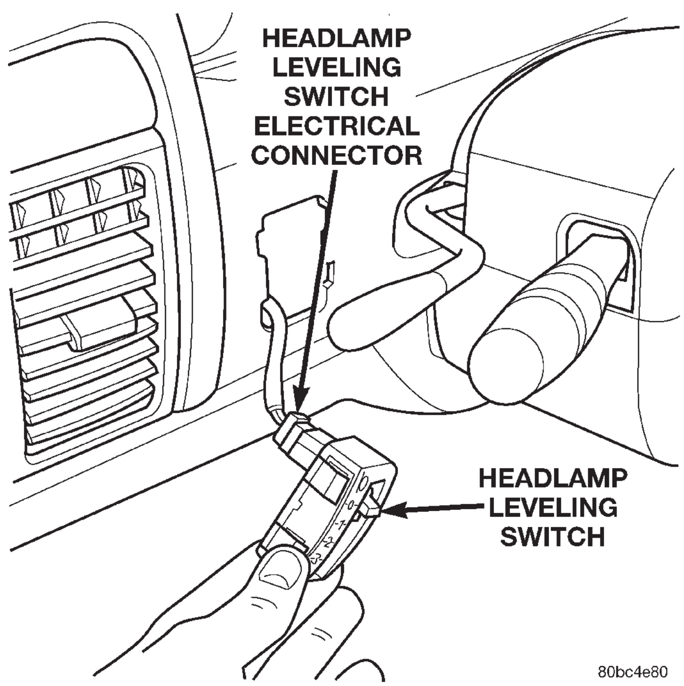


Fig. 2 Installing Headlamp Leveling Switch

(4) Verify switch operation.
(5) Push the headlamp switch straight into the cluster bezel until retaining tabs lock it in place.

REMOVAL AND INSTALLATION (Continued)

REAR FOG LAMP SWITCH

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

For the removal and installation procedure of the rear fog lamp switch. Refer to the turn signal switch removal and installation procedure in Group 8J, Turn Signal and Hazard Warning Systems.

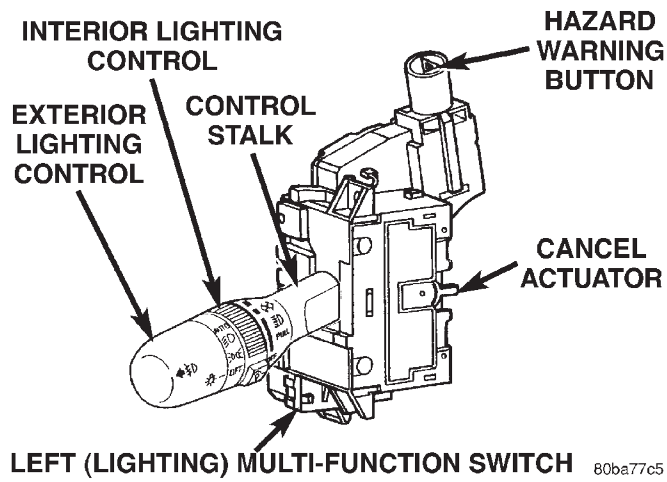


Fig. 3 Lighting Multi-Function Switch

AUDIO SYSTEMS

CONTENTS

DESCRIPTION AND OPERATION

AUDIO SYSTEM

DESCRIPTION

An audio system is standard factory-installed equipment on this model. The standard equipment audio system includes an AM/FM/cassette (RAS sales code) radio receiver, and speakers in six locations. Several combinations of radio receivers and speaker systems are offered as optional equipment on this model. The audio system uses an ignition switched source of battery current so that the system will only operate when the ignition switch is in the On or Accessory positions.

A Compact Disc (CD) changer with a ten disc magazine, remote radio switches with six functions mounted to the backs of the steering wheel spokes, and a memory system that automatically stores and recalls up to twenty radio station presets (ten AM and ten FM) and the last station listened to for two drivers are optional factory-installed equipment on this model. Refer to **Memory System** in the Memory System section of Group 8R - Power Seat Systems for more information on the memory system.

The audio system includes the following components:

- Antenna
- Compact disc changer (available with RBN sales code radio receivers only)
- Power amplifier (with premium speaker system only)
- Radio noise suppression components
- Radio receiver
- Remote radio switches
- Speakers

Certain functions and features of the audio system rely upon resources shared with other electronic modules in the vehicle over the Programmable Communications Interface (PCI) data bus network. The PCI data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, internal controller hardware, and component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities. For diagnosis of these electronic modules or of the PCI data bus network, the use of a DRB scan tool and the proper Diagnostic Procedures manual are recommended.

The other electronic modules that may affect audio system operation are as follows:

- **Body Control Module (BCM)** - Refer to **Body Control Module** in the Description and Operation section of Group 8E - Instrument Panel Systems for more information.
- **Driver Door Module (DDM)** - Refer to **Door Module** in the Power Lock System section of Group 8P - Power Lock Systems for more information.

DESCRIPTION AND OPERATION (Continued)

- **Passenger Door Module (PDM)** - Refer to **Door Module** in the Power Lock System section of Group 8P - Power Lock Systems for more information.

Refer to **Audio System** in the Contents of Group 8W - Wiring Diagrams for complete circuit diagrams. Following are general descriptions of the remaining major components in the standard and optional factory-installed audio systems.

OPERATION

On vehicles that are equipped with the optional remote radio switches, the BCM receives hard wired resistor multiplexed inputs from the remote radio switches. The programming in the BCM allows it to process those inputs and send the proper messages to the radio receiver over the PCI data bus to control the radio volume up or down, station seek up or down, preset station advance, and mode advance functions.

On vehicles equipped with the optional memory system, when the DDM receives a Driver 1 or Driver 2 memory recall input from the memory switch on the driver side front door trim panel or a memory recall message from the Remote Keyless Entry (RKE) receiver in the PDM, the DDM sends a memory recall message back to the radio receiver over the PCI data bus to recall the radio station presets and last station listened to information.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of each of the available audio systems.

RADIO RECEIVER

DESCRIPTION

Available factory-installed radio receivers for this model include an AM/FM/cassette (RAS sales code), an AM/FM/cassette/3-band graphic equalizer with CD changer control feature (RBN sales code), or an AM/FM/CD/cassette/3-band graphic equalizer (RAZ sales code). All factory-installed radio receivers, except the RAS sales code, can communicate on the Programmable Communications Interface (PCI) data bus network through a separate wire harness connector. All factory-installed receivers are stereo Electronically Tuned Radios (ETR) and include an electronic digital clock function.

These radio receivers can only be serviced by an authorized radio repair station. See the latest Warranty Policies and Procedures manual for a current listing of authorized radio repair stations.

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 battery current when the ignition switch is in the Off position, including the clock. The IOD fuse is removed to prevent battery discharge during vehicle storage.

When removing or installing the IOD fuse, it is important that the ignition switch be in the Off position. Failure to place the ignition switch in the Off position can cause the radio display to become scrambled when the IOD fuse is removed and replaced. Removing and replacing the IOD fuse again, with the ignition switch in the Off position, will correct the scrambled display condition.

The IOD fuse should be checked if the radio or clock displays are inoperative. The IOD fuse is located in the Power Distribution Center (PDC). Refer to the fuse layout label on the underside of the PDC cover for IOD fuse identification and location.

OPERATION

The radio receiver operates on ignition switched battery current that is available only when the ignition switch is in the On or Accessory positions. The electronic digital clock function of the radio operates on fused battery current supplied through the IOD fuse, regardless of the ignition switch position.

For more information on the features, setting procedures, and control functions for each of the available factory-installed radio receivers, see the owner's manual in the vehicle glove box. For complete circuit diagrams, refer to **Audio System** in the Contents of Group 8W - Wiring Diagrams.

COMPACT DISC CHANGER

DESCRIPTION

A factory-installed Compact Disc (CD) changer featuring a ten-CD magazine is an available option on this model when it is also equipped with the premium speaker package and a radio receiver including the CD controls feature. The CD changer is mounted in the cargo area of the passenger compartment on the right rear quarter panel. It is concealed behind a molded plastic bin with an integral hinged and latching lid that matches the interior trim of the vehicle.

The CD changer is connected to a take out from the right body wire harness and receives both ground and radio-switched battery current through the radio receiver. The controls on the radio receiver operate the CD changer through messages sent over the Programmable Communications Interface (PCI) data bus network. The two-channel audio outputs of the CD changer are hard wired back to the radio receiver, which then outputs the signal through four channels to the power amplifier. For diagnosis of the messaging functions of the radio receiver and the CD

DESCRIPTION AND OPERATION (Continued)

changer, or of the PCI data bus, a DRB scan tool and the proper Diagnostic Procedures manual are required.

The CD changer can only be serviced by an authorized radio repair station. See the latest Warranty Policies and Procedures manual for a current listing of authorized radio repair stations. For complete circuit diagrams, refer to **Audio System** in the Contents of Group 8W - Wiring Diagrams.

OPERATION

The CD changer will only operate when the ignition switch is in the On or Accessory positions, and the radio is turned on. For more information on the features, loading procedures and radio control functions for the operation of the CD changer, see the owner's manual in the vehicle glove box.

REMOTE RADIO SWITCH

DESCRIPTION

Remote radio control switches are included on models equipped with the optional leather-wrapped steering wheel. The two rocker-type switch units (Fig. 1) are mounted in the upper spoke covers of the rear (instrument panel side) steering wheel trim cover. The switch unit on the left side is the seek switch and has seek up, seek down, and preset station advance switch functions. The switch unit on the right side is the volume control switch and has volume up, volume down, and mode advance switch functions.

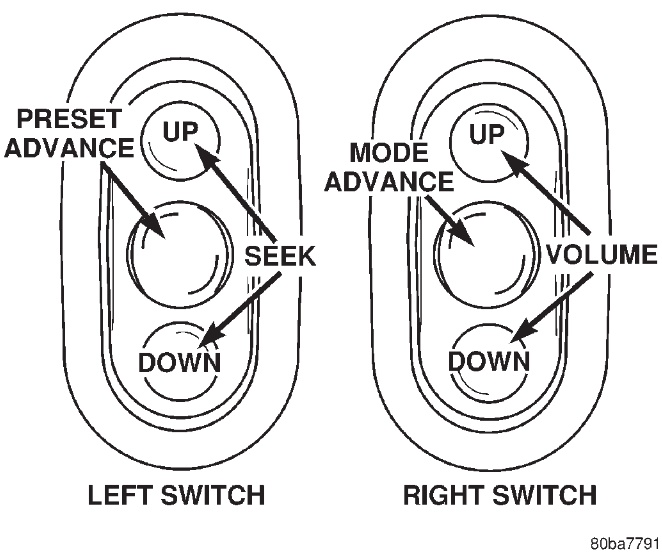


Fig. 1 Remote Radio Switches

The two remote radio switch units are each retained in a mounting hole located on opposite sides of the rear steering wheel trim cover by four integral snap features. A plastic bracket on the back of each switch unit provides additional support for the unit by extending towards the center of the steering wheel where it is clamped between the steering wheel armature and the steering wheel rear trim cover mounting boss by the trim cover mounting screw.

The two remote radio switch units share a common steering wheel wire harness with the vehicle speed control switches. The steering wheel wire harness is connected to the instrument panel wire harness through the clockspring. Refer to **Clockspring** in the Description and Operation section of Group 8M - Passive Restraint Systems for more information on this component.

For complete circuit diagrams, refer to **Audio System** in the Contents of Group 8W - Wiring Diagrams.

OPERATION

The six switches in the two remote radio switch units are normally open, resistor multiplexed momentary switches that are hard wired to the Body Control Module (BCM) through the clockspring. The BCM sends a five volt reference signal to both switch units on one circuit, and senses the status of all of the switches by reading the voltage drop on a second circuit.

When the BCM senses an input (voltage drop) from any one of the remote radio switches, it sends the proper switch status messages on the Programmable Communication Interface (PCI) data bus network to the radio receiver. The electronic circuitry within the radio receiver is programmed to respond to these remote radio switch status messages by adjusting the radio settings as requested. For diagnosis of the BCM or the PCI data bus, the use of a DRB scan tool and the proper Diagnostic Procedures manual are recommended.

For more information on the features and control functions for each of the remote radio switches, see the owner's manual in the vehicle glove box.

SPEAKER SYSTEM

DESCRIPTION

STANDARD

The standard equipment speaker system includes speakers in six locations. One 6.4 centimeter (2.50 inch) diameter tweeter is installed on each end of the instrument panel top pad. One 15.2 by 22.9 centimeter (6 by 9 inch) full-range speaker is located in each front door. There is also one full-range 16.5 centimeter (6.5 inch) diameter full-range speaker located in each rear door.

DESCRIPTION AND OPERATION (Continued)

PREMIUM

The optional premium speaker system features six Infinity model speakers in six locations. Each of the standard speakers is replaced with Infinity model speakers. One 6.4 centimeter (2.50 inch) diameter Infinity tweeter is installed on each end of the instrument panel top pad. One 15.2 by 22.9 centimeter (6 by 9 inch) Infinity woofer is located in each front door. There is also one full-range 16.5 centimeter (6.5 inch) diameter Infinity full-range speaker located in each rear door. The premium speaker system also includes an additional Infinity power amplifier. The total available power of the premium speaker system is about 180 watts.

OPERATION

STANDARD

Each of the two tweeters and four full-range speakers used in the standard speaker system is driven by the amplifier that is integral to the factory-installed radio receiver. For complete circuit diagrams, refer to **Audio System** in the Contents of Group 8W - Wiring Diagrams.

PREMIUM

The six Infinity speakers used in the premium speaker system are all driven by the radio receiver through an Infinity power amplifier. For complete circuit diagrams, refer to **Audio System** in the Contents of Group 8W - Wiring Diagrams.

POWER AMPLIFIER

DESCRIPTION

Models equipped with the Infinity premium speaker package have a separate power amplifier unit. This power amplifier is rated at 180 watts output. The power amplifier unit is mounted to the rear floor panel under the passenger side rear seat cushion. The power amplifier unit can be accessed for service by unlatching and tilting the passenger side rear seat cushion forward.

The power amplifier unit should be checked if there is no sound output noted from the speakers. For diagnosis of the power amplifier, refer to **Speaker** in the Diagnosis and Testing section of this group. The power amplifier cannot be repaired or adjusted and, if faulty or damaged, the unit must be replaced.

OPERATION

The power amplifier is energized by a fused 12 volt output from the radio receiver whenever the radio is turned on. The power amplifier receives the sound signal inputs for four speaker channels from the radio receiver, then sends the amplified speaker outputs for each of those channels to the six Infinity speakers. For complete circuit diagrams, refer to **Audio System** in the Contents of Group 8W - Wiring Diagrams.

ANTENNA

DESCRIPTION

All models use a fixed-length stainless steel rod-type antenna mast, installed on the right front fender of the vehicle. The antenna mast has a spiral groove cut down its length to reduce wind noise. 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 receiver chassis.

The antenna coaxial cable has an additional disconnect, located near the passenger side cowl side inner panel behind the lower instrument panel reinforcement. This additional disconnect allows the instrument panel assembly to be removed and installed without removing the radio receiver.

The factory-installed Electronically Tuned Radios (ETR) automatically compensate for radio antenna trim. Therefore, no antenna trimmer adjustment is required or possible when replacing the radio receiver or the antenna.

RADIO NOISE SUPPRESSION

DESCRIPTION

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 part of the radio receiver.

External suppression devices that are used on this vehicle to control RFI or EMI noise include the following:

- Radio antenna base ground
- Radio receiver chassis ground wire or strap
- Engine-to-body ground strap(s)
- Resistor-type spark plugs
- Radio suppression-type secondary ignition wiring.

For more information on the spark plugs and secondary ignition components, refer to **Ignition System** in the Description and Operation section of Group 8D - Ignition System.

DIAGNOSIS AND TESTING

AUDIO SYSTEM

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

AUDIO SYSTEM DIAGNOSIS		
CONDITION	POSSIBLE CAUSE	CORRECTION
NO AUDIO	1. Fuse faulty. 2. Radio connector faulty. 3. Wiring faulty. 4. Ground faulty. 5. Radio faulty. 6. Speakers faulty. 7. Amplifier faulty (if equipped).	1. Check radio fuses in junction block. Replace faulty fuses, if required. 2. Check for loose or corroded radio connections. Repair, if required. 3. Check for battery voltage at radio connector. Repair wiring, if required. 4. Check for continuity between radio chassis and a known good ground. There should be continuity. Repair ground, if required. 5. Refer to Radio in the Diagnosis and Testing section of this group. 6. Refer to Speaker in the Diagnosis and Testing section of this group. 7. Refer to Speaker in the Diagnosis and Testing section of this group.
NO DISPLAY	1. Fuse faulty. 2. Radio connector faulty. 3. Wiring faulty. 4. Ground faulty. 5. Radio faulty.	1. Check radio fuses in junction block. Replace faulty fuses, if required. 2. Check for loose or corroded radio connections. Repair, if required. 3. Check for battery voltage at radio connector. Repair wiring, if required. 4. Check for continuity between radio chassis and a known good ground. There should be continuity. Repair ground, if required. 5. Refer to Radio in the Diagnosis and Testing section of this group.
CLOCK WILL NOT KEEP SET TIME	1. Fuse faulty. 2. Radio connector faulty. 3. Wiring faulty. 4. Ground faulty. 5. Radio faulty.	1. Check ignition-off draw fuse. Replace faulty fuse, if required. 2. Check for loose or corroded radio connections. Repair, if required. 3. Check for battery voltage at radio connector. Repair wiring, if required. 4. Check for continuity between radio chassis and a known good ground. There should be continuity. Repair ground, if required. 5. Refer to Radio in the Diagnosis and Testing section of this group.

DIAGNOSIS AND TESTING (Continued)

AUDIO SYSTEM DIAGNOSIS		
CONDITION	POSSIBLE CAUSE	CORRECTION
POOR RADIO RECEPTION	1. Antenna faulty. 2. Ground faulty. 3. Radio faulty. 4. Faulty EMI or RFI noise suppression.	1. Refer to Antenna in the Diagnosis and Testing section of this group. 2. Check for continuity between radio chassis and a known good ground. There should be continuity. Repair ground, if required. 3. Refer to Radio in the Diagnosis and Testing section of this group. 4. Refer to Radio Frequency Interference in the Diagnosis and Testing section of this group.
NO/POOR TAPE OPERATION	1. Faulty tape. 2. Foreign objects behind tape door. 3. Dirty cassette tape head. 4. Faulty tape deck.	1. Insert known good tape and test operation. 2. Remove foreign objects and test operation. 3. Clean head with Mopar Cassette Head Cleaner. 4. Exchange or replace radio, if required.
NO COMPACT DISC OPERATION	1. Faulty CD. 2. Foreign material on CD. 3. Condensation on CD or optics. 4. Faulty CD player.	1. Insert known good CD and test operation. 2. Clean CD and test operation. 3. Allow temperature of vehicle interior to stabilize and test operation. 4. Exchange or replace radio, if required.
NO COMPACT DISC CHANGER OPERATION	1. Faulty CD. 2. Foreign material on CD. 3. Condensation on CD or optics. 4. CD changer connector faulty. 5. Wiring faulty. 6. PCI data bus faulty. 7. CD changer faulty.	1. Insert known good CD and test operation. 2. Clean CD and test operation. 3. Allow temperature of vehicle interior to stabilize and test operation. 4. Check for loose or corroded CD changer connections. Repair, if required. 5. Refer to Compact Disc Changer in the Diagnosis and Testing section of this group. 6. Use DRB scan tool and the Diagnostic Procedures manual to test PCI data bus. Repair, if required. 7. Refer to Compact Disc Changer in the Diagnosis and Testing section of this group.

RADIO RECEIVER

If the vehicle is equipped with the optional remote radio switches located on the steering wheel and the problem being diagnosed is related to one of the symptoms listed below, be certain to check the remote radio switches and circuits. Refer to **Remote Radio Switch** in the Diagnosis and Testing section of this group prior to attempting radio diagnosis or repair.

- Stations changing with no remote radio switch input
- Radio memory presets not working properly
- Volume changes with no remote radio switch input
- Remote radio switch buttons taking on other functions
- CD player skipping tracks
- Mode (AM, FM, CD, CD changer) changes with no remote radio switch input
- Remote radio switch inoperative.

For complete circuit diagrams, refer to **Audio System** in the Contents of Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

DIAGNOSIS AND TESTING (Continued)

CAUTION: The speaker output of the radio receiver is a “floating ground” system. Do not allow any speaker lead to short to ground, as damage to the radio receiver may result.

(1) Check the fused B(+) fuse in the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Check for battery voltage at the fused B(+) fuse in the junction block. If OK, go to Step 3. If not OK, repair the open fused B(+) circuit to the Power Distribution Center (PDC) fuse as required.

(3) Check the fused ignition switch output (acc/run) fuse in the junction block. If OK, go to Step 4. If not OK, repair the shorted circuit or component as required and replace the faulty fuse(s).

(4) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (acc/run) fuse in the junction block. If OK, go to Step 5. If not OK, repair the open fused ignition switch output (acc/run) circuit to the ignition switch as required.

(5) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the radio receiver from the instrument panel, but do not disconnect the wire harness connectors. Check for continuity between the radio receiver chassis and a good ground. There should be continuity. If OK, go to Step 6. If not OK, repair the open ground circuit to ground as required.

(6) Test the radio receiver antenna. Refer to **Antenna** in the Diagnosis and Testing section of this group. If OK, go to Step 7. If not OK, replace the faulty antenna or coaxial cable as required.

(7) Connect the battery negative cable. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (acc/run) circuit cavity of the left (gray) radio wire harness connector. If OK, go to Step 8. If not OK, repair the open fused ignition switch output (acc/run) circuit to the junction block fuse as required.

(8) Turn the ignition switch to the Off position. Check for battery voltage at the fused B(+) circuit cavity of the left (gray) radio wire harness connector. If OK, replace the faulty radio receiver. If not OK, repair the open fused B(+) circuit to the junction block fuse as required.

COMPACT DISC CHANGER

Following are tests that will help to diagnose the hard wired components and circuits of the Compact Disc (CD) changer unit. However, these tests may not prove conclusive in the diagnosis of this unit. In order to obtain conclusive testing of the CD changer unit, the Programmable Communications Interface (PCI) data bus network, the CD changer unit, the radio receiver unit and any other electronic modules that provide inputs to, or receive outputs from the audio system must be checked.

The most reliable, efficient, and accurate means to diagnose the CD changer messaging functions requires the use of a DRB scan tool and the proper Diagnostic Procedures manual. The DRB scan tool can provide confirmation that the PCI data bus is functional, that all of the electronic modules in the vehicle are sending and receiving the proper messages on the PCI data bus, and that the CD changer and the radio receiver are receiving the proper PCI messages to perform their audio system functions.

For complete circuit diagrams, refer to **Audio System** in the Contents of Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

COMPACT DISC CHANGER INOPERATIVE

(1) Turn the ignition switch to the On position. Turn the radio receiver on and check its operation. If OK, go to Step 2. If not OK, refer to **Radio Receiver** in the Diagnosis and Testing section of this group.

(2) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Disconnect the right body wire harness connector from the CD changer connector receptacle. Check for continuity between the power ground (Z17) circuit of the right body wire harness connector for the CD changer and a good ground. There should be continuity. If OK, go to Step 3. If not OK, repair the open power ground circuit to the radio receiver as required.

(3) Reconnect the battery negative cable. Check for battery voltage at the B(+) circuit cavity of the right body wire harness connector for the CD changer. If OK, go to Step 4. If not OK, go to Step 5.

(4) Turn the ignition switch to the On position. Check for battery voltage at the ignition switch output circuit cavity of the right body wire harness connector for the CD changer. If OK, use a DRB scan tool and the proper Diagnostic Procedures manual for further diagnosis. If not OK, go to Step 6.

(5) Disconnect and isolate the battery negative cable. Remove the radio receiver from the instrument panel. Disconnect the DIN cable connector (C4) from the radio receiver, but do not disconnect the other

DIAGNOSIS AND TESTING (Continued)

wire harness connectors. Reconnect the battery negative cable. Check for battery voltage at the B(+) circuit cavity of the DIN connector receptacle on the radio receiver. If OK, repair the open B(+) circuit to the CD changer as required. If not OK, check for a shorted B(+) circuit to the CD changer and repair as required, then replace the faulty radio receiver.

(6) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the radio receiver from the instrument panel. Disconnect the DIN cable connector (C4) from the radio receiver, but do not disconnect the other wire harness connectors. Reconnect the battery negative cable. Turn the ignition switch to the On position. Check for battery voltage at the ignition switch output circuit cavity of the DIN connector receptacle on the radio receiver. If OK, repair the open ignition switch output circuit to the CD changer as required. If not OK, check for a shorted ignition switch output circuit to the CD changer and repair as required, then replace the faulty radio receiver.

NO SOUND OR ONLY ONE CHANNEL SOUND FROM CD

(1) Turn the ignition switch to the On position. Turn the radio receiver on and check its audio output operation. If OK, go to Step 2. If not OK, refer to **Speaker** in the Diagnosis and Testing section of this group.

(2) Disconnect and isolate the battery negative cable. Disconnect the right body wire harness connector from the CD changer connector receptacle. Remove the radio receiver from the instrument panel. Disconnect the DIN cable connector (C4) from the radio receiver. Check for continuity between the audio ground (Z4) circuit cavity of the right body wire harness connector for the CD changer and a good ground. There should be no continuity. If OK, go to Step 3. If not OK, repair the shorted audio ground (Z4) circuit as required.

(3) Check for continuity between the audio ground (Z4) circuit cavity of the right body wire harness connector for the CD changer and the audio ground (Z4) circuit pin of the DIN cable connector for the radio receiver. There should be continuity. If OK, go to Step 4. If not OK, repair the open audio ground (Z4) circuit as required.

(4) Check for continuity between the audio out right circuit cavity of the right body wire harness connector for the CD changer and a good ground. There should be no continuity. If OK, go to Step 5. If not OK, repair the shorted audio out right circuit as required.

(5) Check for continuity between the audio out right circuit cavity of the right body wire harness connector for the CD changer and the audio out right circuit pin of the DIN cable connector for the radio receiver. There should be continuity. If OK, go to Step 6. If not OK, repair the open audio out right circuit as required.

(6) Check for continuity between the audio out left circuit cavity of the right body wire harness connector for the CD changer and a good ground. There should be no continuity. If OK, go to Step 7. If not OK, repair the shorted audio out left circuit as required.

(7) Check for continuity between the audio out left circuit cavity of the right body wire harness connector for the CD changer and the audio out left circuit pin of the DIN cable connector for the radio receiver. There should be continuity. If OK, replace the faulty CD change. If not OK, repair the open audio out left circuit as required.

REMOTE RADIO SWITCH

For complete circuit diagrams, refer to **Audio System** in the Contents of Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable. Remove the remote radio switch(es) (Fig. 2) from the steering wheel.

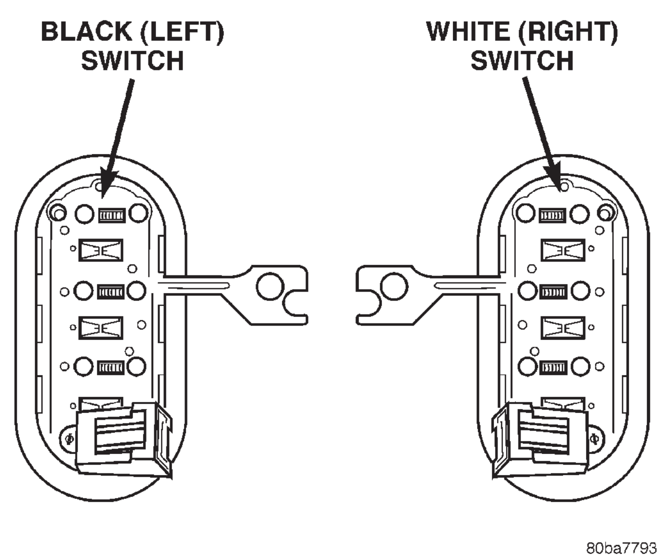


Fig. 2 Remote Radio Switches

DIAGNOSIS AND TESTING (Continued)

(2) Use an ohmmeter to check the switch resistances as shown in the Remote Radio Switch Test chart. If the remote radio switch resistances check OK, go to Step 3. If not OK, replace the faulty switch.

Remote Radio Switch Test		
Switch	Switch Position	Resistance
Right (White)	Volume Up	1.210 Kilohms
Right (White)	Volume Down	3.010 Kilohms
Right (White)	Mode Advance	0.0511 Kilohms
Left (Black)	Seek Up	0.261 Kilohms
Left (Black)	Seek Down	0.681 Kilohms
Left (Black)	Pre-Set Station Advance	0.162 Kilohms

(3) Reconnect the battery negative cable. Turn the ignition switch to the On position. Check for 5 volts at the radio control mux circuit cavities of the steering wheel wire harness connectors for both remote radio switches. If OK, go to Step 4. If not OK, repair the open or shorted radio control mux circuit to the Body Control Module (BCM) as required.

(4) Disconnect and isolate the battery negative cable. Disconnect the 22-way instrument panel wire harness connector from the BCM. Check for continuity between the remote radio switch ground circuit cavities of the steering wheel wire harness connectors for both remote radio switches and a good ground. There should be no continuity. If OK, go to Step 5. If not OK, repair the shorted remote radio switch ground circuit to the BCM as required.

(5) Check for continuity between the remote radio switch ground circuit cavities of the steering wheel wire harness connectors for both remote radio switches and the 22-way instrument panel wire harness connector for the BCM. There should be continuity. If OK, refer to the proper Diagnostic Procedures manual to test the BCM and the PCI data bus. If not OK, repair the open remote radio switch ground circuit as required.

SPEAKER

For complete circuit diagrams, refer to **Audio System** in the Contents of Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

CAUTION: The speaker output of the radio is a “floating ground” system. Do not allow any speaker lead to short to ground, as damage to the radio may result.

(1) Turn the ignition switch to the On position. Turn the radio receiver on. Adjust the balance and fader controls to check the performance of each individual speaker. Note the speaker locations that are not performing correctly. Go to Step 2.

(2) Turn the radio receiver off. Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the radio receiver from the instrument panel. If the vehicle is equipped with the Infinity speaker package, also disconnect the wire harness connectors at the power amplifier. Check both the speaker feed (+) circuit and return (–) circuit cavities for the inoperative speaker location(s) at the radio receiver wire harness connectors for continuity to ground. In each case, there should be no continuity. If OK, go to Step 3. If not OK, repair the shorted speaker feed (+) and/or return (–) circuit(s) to the speaker as required.

(3) If the vehicle is equipped with the Infinity speaker package, go to Step 6. If the vehicle is equipped with the standard speaker system, check the resistance between the speaker feed (+) circuit and return (–) circuit cavities of the radio receiver wire harness connectors for the inoperative speaker location(s). The meter should read between 2 and 12 ohms (speaker resistance). If OK, go to Step 4. If not OK, go to Step 5.

(4) Install a known good radio receiver. Connect the battery negative cable. Turn the ignition switch to the On position. Turn on the radio receiver and test the speaker operation. If OK, replace the faulty radio receiver. If not OK, turn the radio receiver off, turn the ignition switch to the Off position, disconnect and isolate the battery negative cable, remove the test radio receiver, and go to Step 5.

(5) Disconnect the wire harness connector at the inoperative speaker. Check for continuity between the speaker feed (+) circuit cavities of the radio receiver wire harness connector and the speaker wire harness connector. Repeat the check between the speaker return (–) circuit cavities of the radio receiver wire harness connector and the speaker wire harness connector. In each case, there should be continuity. If OK, replace the faulty speaker. If not OK,

DIAGNOSIS AND TESTING (Continued)

repair the open speaker feed (+) and/or return (–) circuit(s) as required.

(6) For each inoperative speaker location, check for continuity between the speaker feed (+) circuit cavities of the radio receiver wire harness connectors and the power amplifier wire harness connectors. Repeat the check for each inoperative speaker location between the speaker return (–) circuit cavities of the radio receiver wire harness connectors and the power amplifier wire harness connectors. In each case, there should be continuity. If OK, go to Step 7. If not OK, repair the open speaker feed (+) and/or return (–) circuit(s) as required.

(7) Check for continuity between the two ground circuit cavities of the power amplifier wire harness connector and a good ground. There should be continuity. If OK, go to Step 8. If not OK, repair the open ground circuit(s) to ground as required.

(8) Check the fused B(+) fuse for the power amplifier in the junction block. If OK, go to Step 9. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(9) Install the radio receiver. Connect the battery negative cable. Check for battery voltage at the fused B(+) fuse for the power amplifier in the junction block. If OK, go to Step 10. If not OK, repair the open fused B(+) circuit to the Power Distribution Center (PDC) fuse as required.

(10) Check for battery voltage at the two fused B(+) circuit cavities of the power amplifier wire harness connector. If OK, go to Step 11. If not OK, repair the open fused B(+) circuit(s) to the power amplifier fuse in the junction block as required.

(11) Turn the ignition switch to the On position. Turn the radio receiver on. Check for battery voltage at the enable signal to amplifier circuit cavity of the power amplifier wire harness connector. If OK, go to Step 12. If not OK, repair the open enable signal to amplifier circuit to the radio receiver as required.

(12) Turn the radio receiver off. Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. For each inoperative speaker location, check both the amplified feed (+) circuit and the amplified return (–) circuit cavities of the power amplifier wire harness connectors for continuity to ground. In each case there should be no continuity. If OK, go to Step 13. If not OK, repair the shorted amplified feed (+) and/or amplified return (–) circuit(s) to the speaker as required.

(13) For each inoperative speaker location, check the resistance between the amplified feed (+) circuit and the amplified return (–) circuit cavities of the power amplifier wire harness connectors. The meter should read between 2 and 12 ohms (speaker resistance). If OK, replace the faulty power amplifier. If not OK, go to Step 14.

(14) Disconnect the speaker wire harness connector at the inoperative speaker. Check for continuity between the amplified feed (+) circuit cavities of the speaker wire harness connector and the power amplifier wire harness connector. Repeat the check between the amplified return (–) circuit cavities of the speaker wire harness connector and the power amplifier wire harness connector. In each case there should be continuity. If OK, replace the faulty speaker. If not OK, repair the open amplified feed (+) and/or amplified return (–) circuit(s) as required.

POWER AMPLIFIER

The power amplifier unit should be checked if there is no sound output noted from the speakers. For diagnosis of the power amplifier, refer to **Speaker** in the Diagnosis and Testing section of this group. For complete circuit diagrams, refer to **Audio System** in the Contents of Group 8W - Wiring Diagrams.

ANTENNA

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

The following four tests are used to diagnose the antenna with an ohmmeter:

- **Test 1 -** Mast to ground test
- **Test 2 -** Tip-of-mast to tip-of-conductor test
- **Test 3 -** Body ground to battery ground test
- **Test 4 -** Body ground to coaxial shield test.

The ohmmeter test lead connections for each test are shown in Antenna Tests (Fig. 3).

NOTE: This model has a special coating on the antenna mast which is not electrically conductive. Remove the antenna mast from the antenna base before attempting to perform Tests 1 and 2.

NOTE: This model has a two-piece antenna coaxial cable. Tests 2 and 4 must be conducted in two steps to isolate a coaxial cable problem; from the coaxial cable connection under the right end of the instrument panel near the inboard side of the glove box opening to the antenna base, and then from the coaxial cable connection to the radio chassis connection.

DIAGNOSIS AND TESTING (Continued)

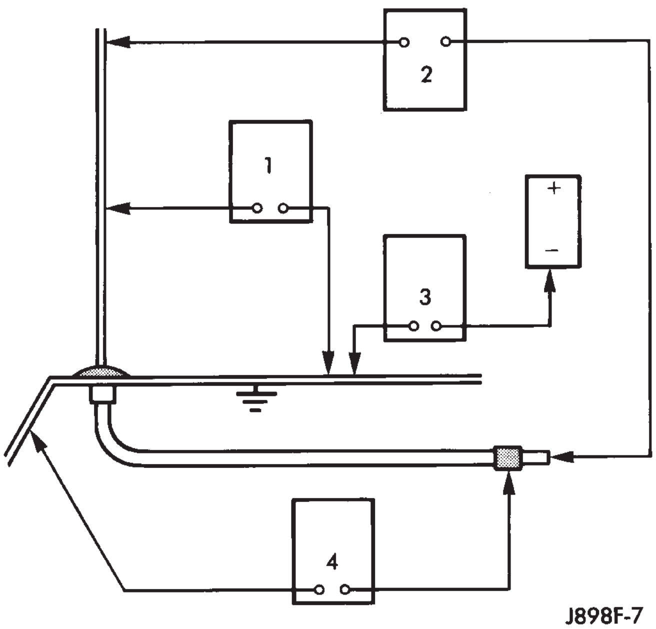


Fig. 3 Antenna Tests

TEST 1

Test 1 determines if the antenna mast is insulated from the base. Proceed as follows:

(1) Disconnect the antenna coaxial cable connector from the radio receiver chassis and isolate. Remove the antenna mast from the antenna base.

(2) Insert one ohmmeter test lead into the socket for the antenna mast in the center of the antenna base. Connect the other test lead to the perimeter of the antenna base. Check for continuity.

(3) There should be no continuity. If continuity is found, replace the faulty or damaged antenna base and cable assembly.

TEST 2

Test 2 checks the antenna for an open circuit as follows:

(1) Disconnect the antenna coaxial cable connector from the radio receiver chassis. Remove the antenna mast from the antenna base.

(2) Insert one ohmmeter test lead into the socket for the antenna mast in the center of the antenna base. Connect the other test lead to the center pin of the antenna coaxial cable connector.

(3) Continuity should exist (the ohmmeter should only register a fraction of an ohm). High or infinite resistance indicates damage to the base and cable assembly. Replace the faulty base and cable, if required.

TEST 3

Test 3 checks the condition of the vehicle body ground connection. This test should be performed with the battery positive cable removed from the battery. Disconnect both battery cables, the negative cable first. Reconnect the battery negative cable and perform the test as follows:

(1) Connect one ohmmeter test lead to the vehicle fender. Connect the other test lead to the battery negative terminal post.

(2) The resistance should be less than one ohm.

(3) If the resistance is more than one ohm, check the braided ground strap(s) connected to the engine and the vehicle body for being loose, corroded, or damaged. Repair the ground strap connections, if required.

TEST 4

Test 4 checks the condition of the ground between the antenna base and the vehicle body as follows:

(1) Connect one ohmmeter test lead to the vehicle fender. Connect the other test lead to the outer crimp on the antenna coaxial cable connector.

(2) The resistance should be less then one ohm.

(3) If the resistance is more then one ohm, clean and/or tighten the antenna base to fender mounting hardware.

RADIO FREQUENCY INTERFERENCE

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

For complete circuit diagrams, see Group 8W - Wiring Diagrams. Inspect the ground paths and connections at the following locations:

- Blower motor
- Electric fuel pump
- Engine-to-body ground strap(s)
- Generator
- Ignition module
- Radio antenna base ground
- Radio receiver chassis ground wire or strap
- Wiper motor.

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 any ground circuit, clean, tighten, or repair the ground circuits or connections to ground as required before considering any component replacement.

DIAGNOSIS AND TESTING (Continued)

For service and inspection of secondary ignition components, refer to the Diagnosis and Testing section of Group 8D - Ignition Systems. Inspect the following secondary ignition system components:

- Distributor cap and rotor
- Ignition coil
- Spark plugs
- Spark plug wire routing and condition.

Reroute the spark plug wires or replace the faulty components as required.

If the source of the RFI or EMI noise is identified as two-way mobile radio or telephone equipment, check the equipment installation for the following:

- Power connections should be made directly to the battery, and fused as closely to the battery as possible.
- The antenna should be mounted on the roof or toward the rear of the vehicle. Remember that magnetic antenna mounts on the roof panel can adversely affect the operation of an overhead console compass, if the vehicle is so equipped.
- The antenna cable should be fully shielded coaxial cable, should be as short as is practical, and should be routed away from the factory-installed vehicle wire harnesses whenever possible.
- The antenna and cable must be carefully matched to ensure a low Standing Wave Ratio (SWR).

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.

REMOVAL AND INSTALLATION

RADIO RECEIVER

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the center upper bezel from the instrument panel. Refer to **Instrument Panel Center Upper Bezel** in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(3) Remove the four screws that secure the radio receiver to the instrument panel (Fig. 4).

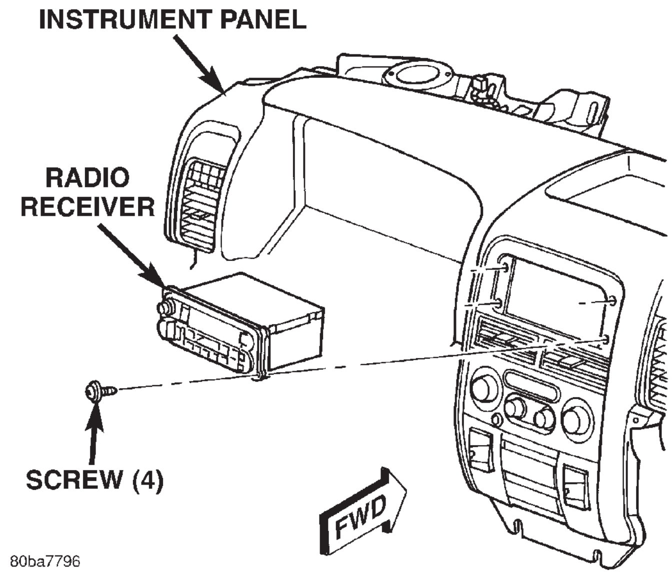


Fig. 4 Radio Remove/Install

(4) Pull the radio receiver out from the instrument panel far enough to access the instrument panel wire harness connectors and the antenna coaxial cable connector.

(5) Disconnect the instrument panel wire harness connectors and the antenna coaxial cable connector from the receptacles on the rear of the radio receiver.

(6) Remove the radio receiver from the instrument panel.

INSTALLATION

(1) Position the radio receiver to the instrument panel.

(2) Reconnect the instrument panel wire harness connectors and the antenna coaxial cable connector to the receptacles on the rear of the radio receiver.

(3) Position the radio receiver into the mounting hole in the instrument panel.

(4) Install and tighten the four screws that secure the radio receiver to the instrument panel. Tighten the screws to 2.2 N·m (20 in. lbs.).

(5) Install the center upper bezel onto the instrument panel. Refer to **Instrument Panel Center Upper Bezel** in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(6) Reconnect the battery negative cable.

REMOVAL AND INSTALLATION (Continued)

COMPACT DISC CHANGER

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Release the latch and open the lid of the compact disc changer storage bin on the right side quarter trim panel (Fig. 5).

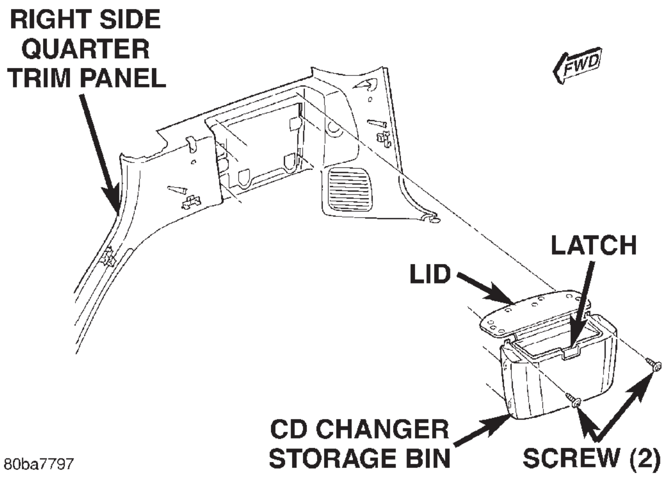


Fig. 5 Compact Disc Changer Storage Bin Remove/ Install

(3) Remove the two screws that secure the top of compact disc changer storage bin to the right side quarter trim panel.

(4) Grasp the bottom of the compact disc changer storage bin firmly with both hands and lift it upwards to disengage the four hook formations that secure the bin from the right side quarter trim panel.

(5) Remove the compact disc changer storage bin from the right side quarter trim panel.

(6) Disconnect the right body wire harness connector from the connector receptacle on the forward end of the compact disc changer (Fig. 6).

(7) Remove the four nuts that secure the compact disc changer to the four studs on the right side quarter inner panel.

(8) Remove the compact disc changer from the right side quarter inner panel.

INSTALLATION

(1) Position the compact disc changer onto the four studs on the right side quarter inner panel.

(2) Install and tighten the four nuts that secure the compact disc changer to the four studs on the right side quarter inner panel. Tighten the nuts to 6.8 N·m (60 in. lbs.).

(3) Reconnect the right body wire harness connector to the connector receptacle on the forward end of the compact disc changer.

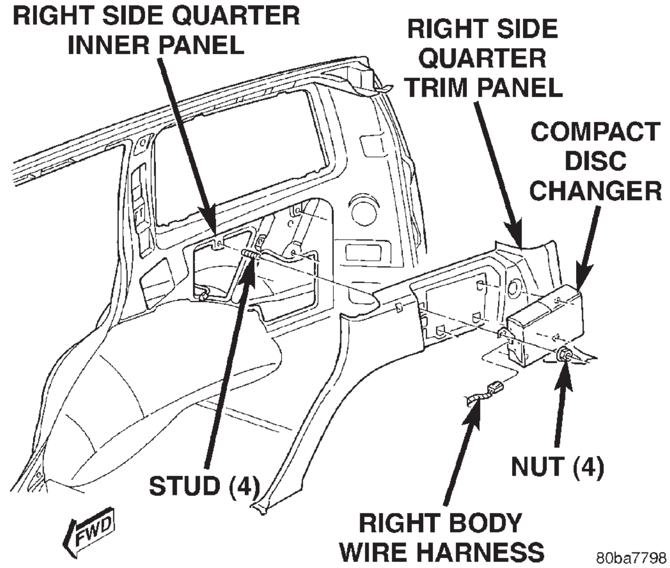


Fig. 6 Compact Disc Changer Remove/Install

(4) Position the compact disc changer storage bin onto the right side quarter trim panel.

(5) Align the four hook formations on the compact disc changer storage bin with the slots in the right side quarter trim panel.

(6) Using both hands push the compact disc changer storage bin firmly and evenly toward the right side quarter trim panel far enough to engage the hooks on the bin with the slots in the panel.

(7) Using both hands push the compact disc changer storage bin firmly and evenly downward far enough to align the screw holes in the bin with the mounting holes in the right side quarter trim panel.

(8) Install and tighten the two screws that secure the top of the compact disc changer storage bin to the right side quarter trim panel. Tighten the screws to 1.7 N·m (15 in. lbs.).

(9) Close the lid of the compact disc changer storage bin.

(10) Reconnect the battery negative cable.

REMOTE RADIO SWITCH

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL AND INSTALLATION (Continued)

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the driver side airbag module from the steering wheel. Refer to **Driver Side Airbag Module** in the Removal and Installation section of Group 8M - Passive Restraint Systems for the procedures.

(3) Remove the speed control switch located on the same side of the steering wheel as the remote radio switch that is being serviced. Refer to **Speed Control Switches** in the Removal and Installation section of Group 8H - Speed Control System for the procedures.

(4) Disconnect the steering wheel wire harness connector from the connector receptacle of the remote radio switch (Fig. 7).

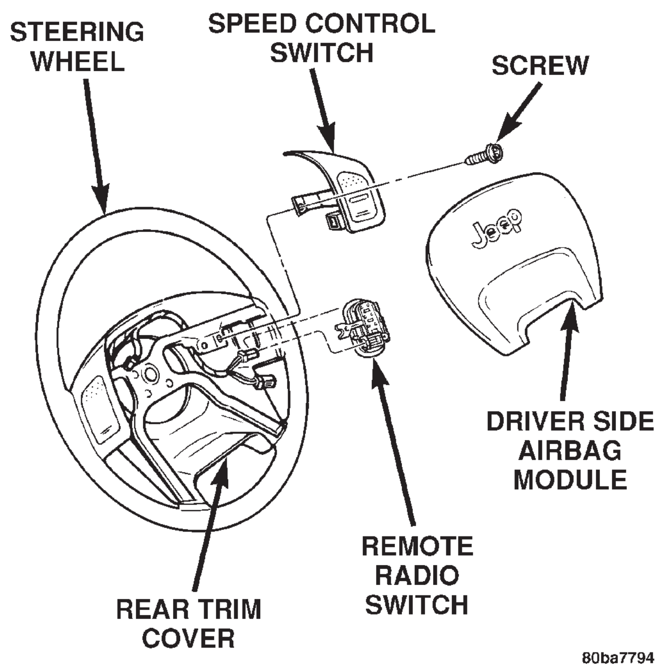


Fig. 7 Remote Radio Switches Remove/Install

(5) From the inside of the steering wheel rear trim cover, press firmly and evenly outward on the back of the switch to disengage the four snap features that secure the switch to the inside of the mounting hole.

(6) From the outside of the steering wheel rear trim cover, remove the remote radio switch from the trim cover mounting hole.

INSTALLATION

(1) Position the remote radio switch to the mounting hole on the outside of the steering wheel rear trim cover. Be certain that the connector receptacle is oriented toward the bottom of the switch and pointed toward the center of the steering wheel.

(2) Press firmly and evenly on the remote radio switch until each of the switch snap features is fully engaged in the mounting hole of the steering wheel rear trim cover.

(3) Reconnect the steering wheel wire harness connector to the connector receptacle of the remote radio switch.

(4) Install the speed control switch onto the steering wheel. Refer to **Speed Control Switches** in the Removal and Installation section of Group 8H - Speed Control System for the procedures.

(5) Install the driver side airbag module onto the steering wheel. Refer to **Driver Side Airbag Module** in the Removal and Installation section of Group 8M - Passive Restraint Systems for the procedures.

(6) Reconnect the battery negative cable.

SPEAKER

REMOVAL

INSTRUMENT PANEL SPEAKER

(1) Disconnect and isolate the battery negative cable.

(2) Remove the top cover from the instrument panel. Refer to **Instrument Panel Top Cover** in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(3) Disconnect the instrument panel wire harness connector from the speaker wire harness connector (Fig. 8).

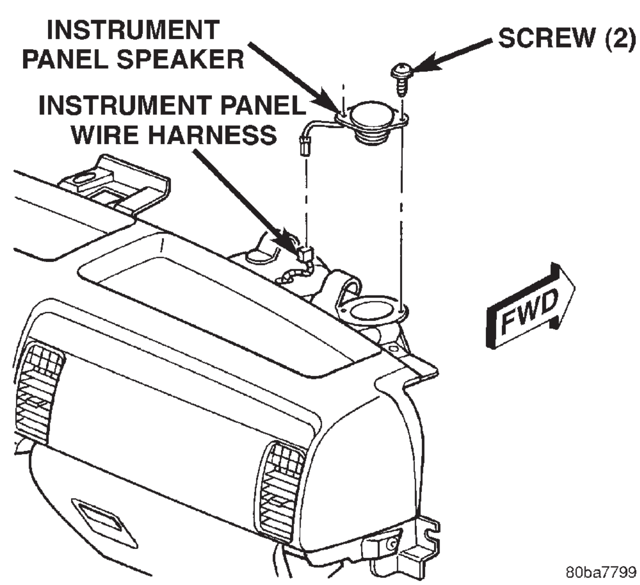


Fig. 8 Instrument Panel Speaker Remove/Install

(4) Remove the two screws that secure the speaker to the top of the instrument panel.

(5) Remove the speaker from the top of instrument panel.

REMOVAL AND INSTALLATION (Continued)

FRONT DOOR SPEAKER

(1) Disconnect and isolate the battery negative cable.

(2) Remove the trim panel from the front door. Refer to **Front Door Trim Panel** in the Removal and Installation section of Group 23 - Body for the procedures.

(3) Remove the four screws that secure the speaker to the front door inner panel (Fig. 9).

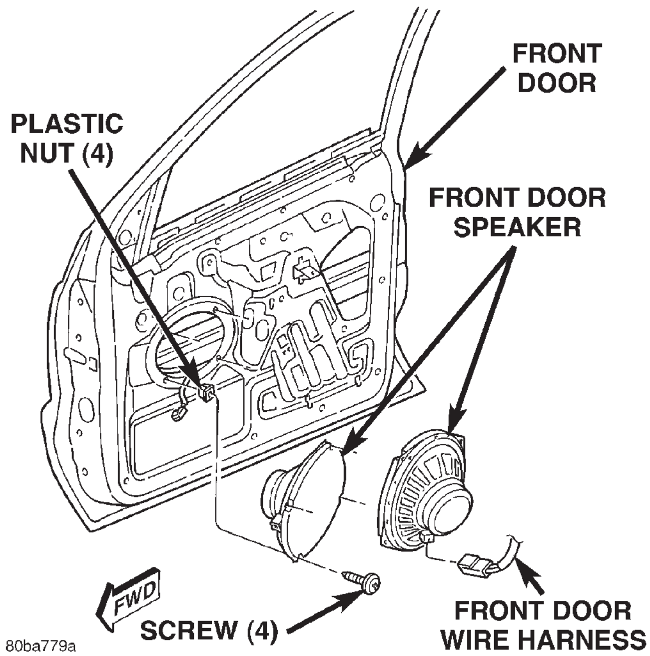


Fig. 9 Front Door Speaker Remove/Install

(4) Pull the speaker away from the front door inner door panel far enough to access the front door wire harness connector.

(5) Disconnect the front door wire harness connector from the speaker connector receptacle.

(6) Remove the speaker from the front door inner panel.

REAR DOOR SPEAKER

(1) Disconnect and isolate the battery negative cable.

(2) Remove the trim panel from the rear door. Refer to **Rear Door Trim Panel** in the Removal and Installation section of Group 23 - Body for the procedures.

(3) Remove the three screws that secure the speaker to the rear door inner panel (Fig. 10).

(4) Pull the speaker away from the rear door inner panel far enough to access the rear door wire harness connector.

(5) Disconnect the rear door wire harness connector from the speaker connector receptacle.

(6) Remove the speaker from the rear door inner panel.

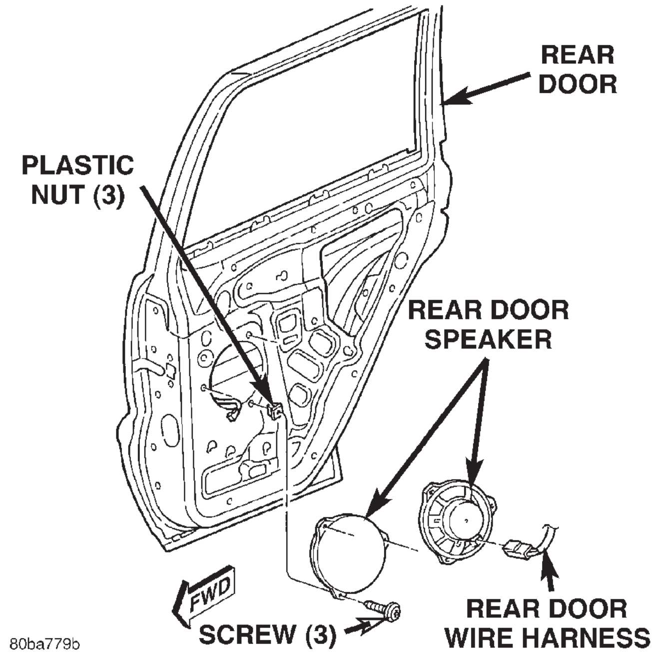


Fig. 10 Rear Door Speaker Remove/Install

INSTALLATION

INSTRUMENT PANEL SPEAKER

(1) Position the speaker onto the top of the instrument panel.

(2) Install and tighten the two screws that secure the speaker to the top of the instrument panel. Tighten the screws to 2.2 N·m (20 in. lbs.).

(3) Reconnect the instrument panel wire harness connector to the speaker wire harness connector.

(4) Install the top cover onto the instrument panel. Refer to **Instrument Panel Top Cover** in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(5) Reconnect the battery negative cable.

FRONT DOOR SPEAKER

(1) Position the speaker to the front door inner panel.

(2) Reconnect the front door wire harness connector to the speaker connector receptacle.

(3) Position the speaker onto the front door inner door panel.

(4) Install and tighten the four screws that secure the speaker to the front door inner panel. Tighten the screws to 2.2 N·m (20 in. lbs.).

(5) Install the trim panel onto the front door. Refer to **Front Door Trim Panel** in the Removal and Installation section of Group 23 - Body for the procedures.

(6) Reconnect the battery negative cable.

REMOVAL AND INSTALLATION (Continued)

REAR DOOR SPEAKER

(1) Position the speaker to the rear door inner panel.

(2) Reconnect the rear door wire harness connector to the speaker connector receptacle.

(3) Position the speaker onto the rear door inner panel.

(4) Install and tighten the three screws that secure the speaker to the rear door inner panel. Tighten the screws to 2.2 N·m (20 in. lbs.).

(5) Install the trim panel onto the rear door. Refer to **Rear Door Trim Panel** in the Removal and Installation section of Group 23 - Body for the procedures.

(6) Reconnect the battery negative cable.

POWER AMPLIFIER

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Unlatch and lift the right rear seat cushion to the upright position.

(3) Disconnect the two right body wire harness connectors from the connector receptacles on the right end of the power amplifier (Fig. 11).

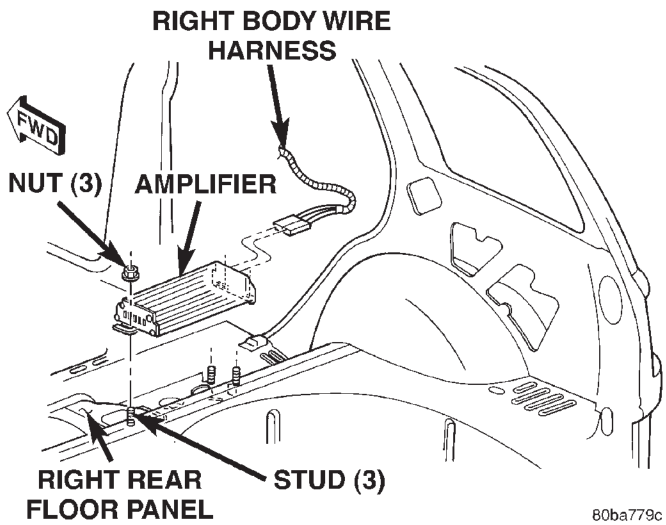


Fig. 11 Power Amplifier Remove/Install

(4) Remove the three nuts that secure the power amplifier to the three studs on the floor panel.

(5) Remove the power amplifier from the three floor panel studs.

INSTALLATION

(1) Position the power amplifier onto the three floor panel studs.

(2) Install and tighten the three nuts that secure the power amplifier to the three studs on the floor panel. Tighten the nuts to 11.8 N·m (105 in. lbs.).

(3) Reconnect the two right body wire harness connectors to the connector receptacles on the right end of the power amplifier.

(4) Lower the right rear seat cushion to the floor panel.

(5) Reconnect the battery negative cable.

ANTENNA

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

ANTENNA BASE AND LEAD

(1) Disconnect and isolate the battery negative cable.

(2) Remove the scuff plate from the right front door sill. Refer to **Front Door Scuff Plate** in the Removal and Installation section of Group 23 - Body for the procedures.

(3) Remove the trim panel from the right inner cowl side. Refer to **Front Door Scuff Plate** in the Removal and Installation section of Group 23 - Body for the procedures.

(4) Reach under the passenger side of the instrument panel near the right cowl side inner panel to disconnect the antenna coaxial cable connector by pulling it apart while twisting the metal connector halves (Fig. 12). Do not pull on the cable.

(5) Remove the lower rear half of the inner liner from the right front fender wheel house. Refer to **Front Fender** in the Removal and Installation section of Group 23 - Body for the procedures.

(6) Reach through the rear of the right front fender wheel house opening to access and unseat the antenna lead grommet from the hole in the right cowl side outer panel.

(7) Pull the antenna lead coaxial cable and connector out of the passenger compartment and into the right front fender wheel house through the hole in the right cowl side outer panel.

REMOVAL AND INSTALLATION (Continued)

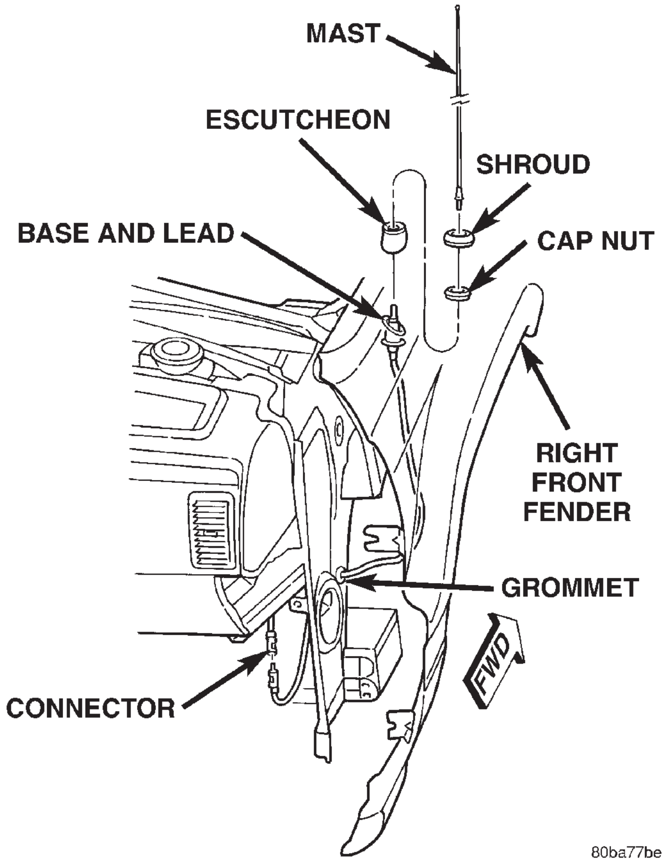


Fig. 12 Antenna Base and Lead Remove/Install

(8) Unscrew the antenna mast from the antenna base (Fig. 13).

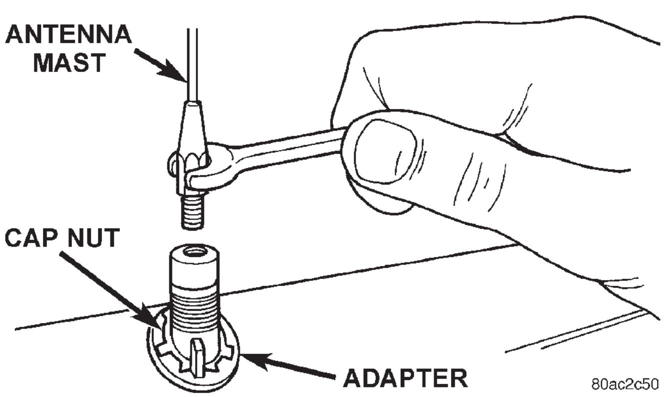


Fig. 13 Antenna Mast Remove/Install - Typical

(9) Remove the plastic shroud from the antenna base cap nut.

(10) Remove the antenna base cap nut using an antenna nut wrench (Special Tool C-4816) (Fig. 14).

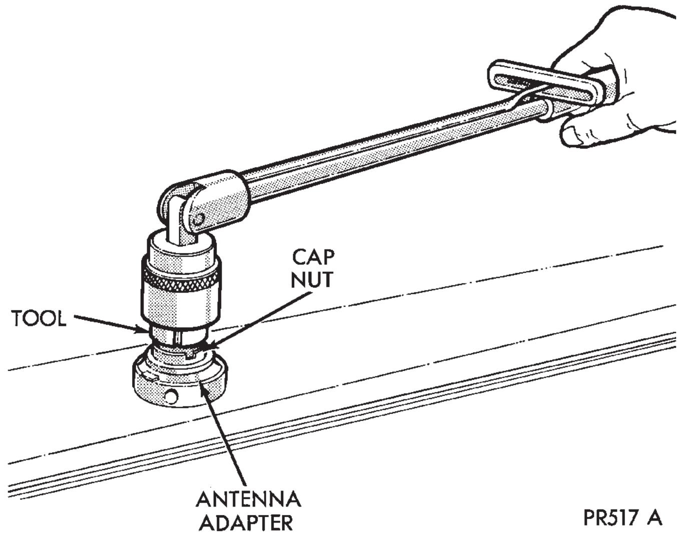


Fig. 14 Antenna Base Cap Nut Remove/Install - Typical

(11) Remove the antenna escutcheon from the antenna base on the top of the right front fender.

(12) Lower the antenna base from the mounting hole in the top of the right front fender.

(13) Remove the antenna base and lead from the rear of the right front fender wheel house opening.

INSTRUMENT PANEL ANTENNA CABLE

(1) Disconnect and isolate the battery negative cable.

(2) Remove the scuff plate from the right front door sill. Refer to **Front Door Scuff Plate** in the Removal and Installation section of Group 23 - Body for the procedures.

(3) Remove the trim panel from the right inner cowl side. Refer to **Front Door Scuff Plate** in the Removal and Installation section of Group 23 - Body for the procedures.

(4) Reach under the passenger side of the instrument panel near the right cowl side inner panel to disconnect the antenna coaxial cable connector by pulling it apart while twisting the metal connector halves. Do not pull on the cable.

(5) Disengage the antenna cable retainer from the mounting hole in the wire harness mounting tab under the passenger side end of the instrument panel.

(6) Remove the radio receiver from the instrument panel. Refer to **Radio Receiver** in the Removal and Installation section of this group for the procedures.

(7) Remove the passenger side airbag module from the instrument panel. Refer to **Passenger Side Airbag Module** in the Removal and Installation section of Group 8M - Passive Restraint Systems for the procedures.

REMOVAL AND INSTALLATION (Continued)

(8) Disengage the antenna cable retainer from the mounting hole in the top of the radio mount on the instrument panel structural duct (Fig. 15).

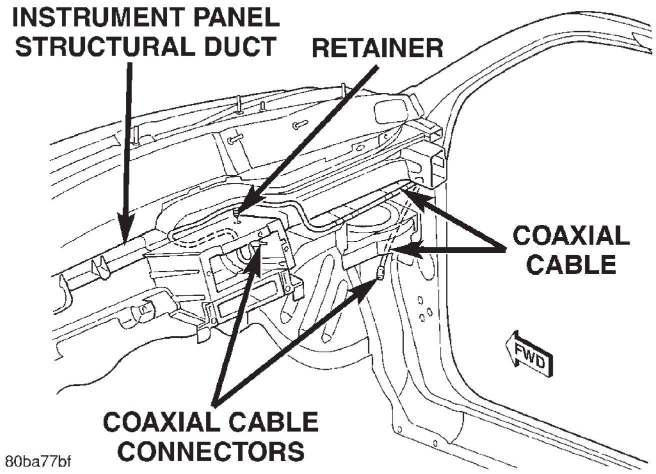


Fig. 15 Instrument Panel Antenna Cable Routing

(9) Disengage the antenna cable from the locator tabs on the top of the instrument panel structural duct above the glove box opening.

(10) Remove the antenna cable from the instrument panel.

INSTALLATION

ANTENNA BASE AND LEAD

(1) Position the antenna base and lead into the rear of the right front fender wheel house opening.

(2) Insert the antenna base into the mounting hole in the top of the right front fender.

(3) Install the antenna escutcheon onto the antenna base on the top of the right front fender.

(4) Install and tighten the antenna base cap nut using an antenna nut wrench (Special Tool C-4816). Tighten the cap nut to 6.8 N·m (60 in. lbs.).

(5) Install the plastic shroud onto the antenna base cap nut.

(6) Install and tighten the antenna mast onto the antenna base. Tighten the antenna mast to 3.3 N·m (30 in. lbs.).

(7) Reach through the rear of the right front fender wheel house opening to access and insert the antenna lead coaxial cable and connector into the passenger compartment through the hole in the right cowl side outer panel.

(8) From the right front fender wheel house, seat the antenna lead grommet into the hole in the right cowl side outer panel.

(9) Install the lower rear half of the inner liner into the right front fender wheel house. Refer to **Front Fender** in the Removal and Installation section of Group 23 - Body for the procedures.

(10) Reach under the passenger side of the instrument panel near the right cowl side inner panel to reconnect the antenna coaxial cable connector halves.

(11) Install the trim panel onto the right inner cowl side. Refer to **Front Door Scuff Plate** in the Removal and Installation section of Group 23 - Body for the procedures.

(12) Install the scuff plate onto the right front door sill. Refer to **Front Door Scuff Plate** in the Removal and Installation section of Group 23 - Body for the procedures.

(13) Reconnect the battery negative cable.

INSTRUMENT PANEL ANTENNA CABLE

(1) Position the antenna cable onto the instrument panel.

(2) Engage the antenna cable with the locator tabs on the top of the instrument panel structural duct above the glove box opening.

(3) Engage the antenna cable retainer into the mounting hole in the top of the radio mount on the instrument panel structural duct.

(4) Install the passenger side airbag module onto the instrument panel. Refer to **Passenger Side Airbag Module** in the Removal and Installation section of Group 8M - Passive Restraint Systems for the procedures.

(5) Install the radio receiver onto the instrument panel. Refer to **Radio Receiver** in the Removal and Installation section of this group for the procedures.

(6) Engage the antenna cable retainer into the mounting hole in the wire harness mounting tab under the passenger side end of the instrument panel.

(7) Reach under the passenger side of the instrument panel near the right cowl side inner panel to reconnect the antenna coaxial cable connector halves.

(8) Install the trim panel onto the right inner cowl side. Refer to **Front Door Scuff Plate** in the Removal and Installation section of Group 23 - Body for the procedures.

(9) Install the scuff plate onto the right front door sill. Refer to **Front Door Scuff Plate** in the Removal and Installation section of Group 23 - Body for the procedures.

(10) Reconnect the battery negative cable.

REMOVAL AND INSTALLATION (Continued)

RADIO NOISE SUPPRESSION COMPONENTS

REMOVAL

ENGINE-TO-BODY GROUND STRAP

(1) Remove the screw that secures the engine-to-body ground strap eyelet to the lower plenum panel (Fig. 16) or (Fig. 17).

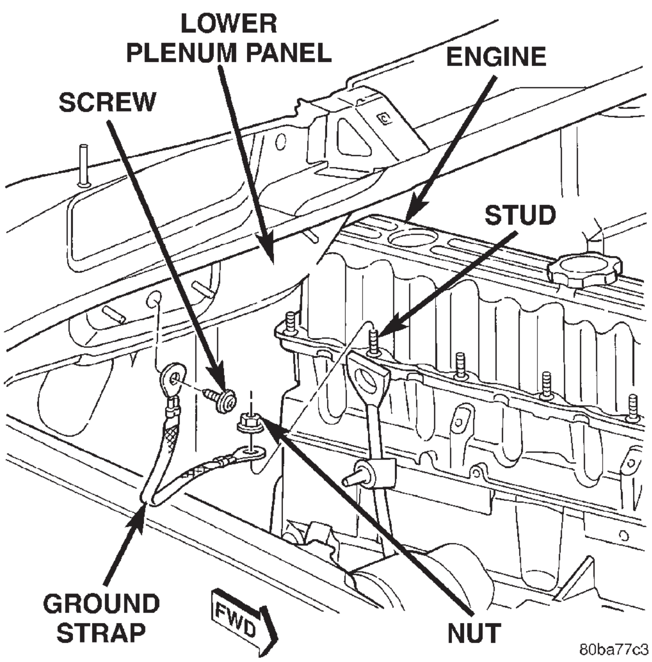


Fig. 16 Engine-To-Body Ground Strap Remove/ Install - 4.0L Engine

(2) On models with a 4.0L engine, remove the nut that secures the engine-to-body ground strap eyelet to the stud on the right rear side of the engine cylinder head.

(3) On models with a 4.7L engine, remove the two nuts that secure the engine-to-body ground strap eyelets to the studs on the right and left rear sides of the engine intake manifold.

(4) Remove the engine-to-body ground strap eyelet(s) from the stud(s) on the engine.

(5) Remove the engine-to-body ground strap from the engine compartment.

INSTALLATION

ENGINE-TO-BODY GROUND STRAP

(1) Position the engine-to-body ground strap into the engine compartment.

(2) Install the engine-to-body ground strap eyelet(s) onto the stud(s) on the engine.

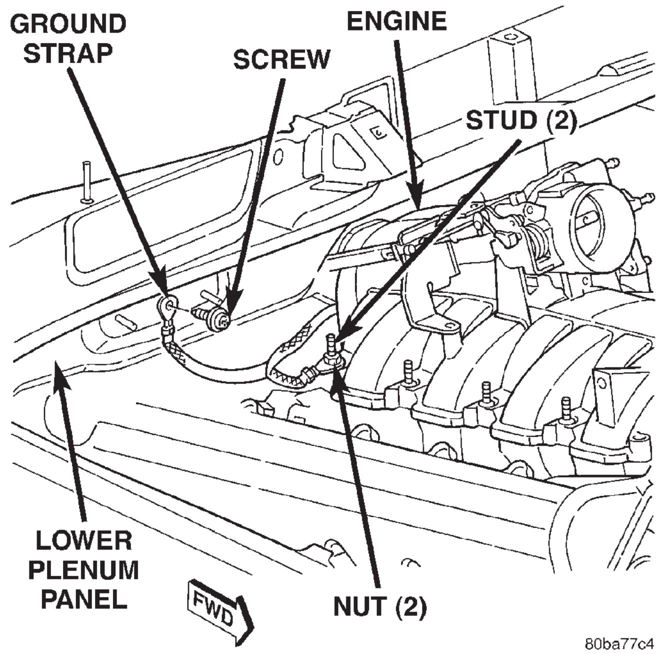


Fig. 17 Engine-To-Body Ground Strap Remove/ Install - 4.7L Engine

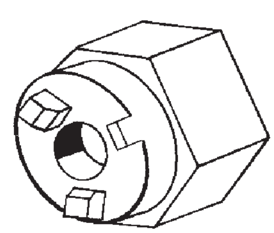
(3) On models with a 4.0L engine, install and tighten the nut that secures the engine-to-body ground strap eyelet to the stud on the right rear side of the engine cylinder head. Tighten the nut to 5.6 N·m (50 in. lbs.).

(4) On models with a 4.7L engine, install and tighten the two nuts that secure the engine-to-body ground strap eyelets to the studs on the right and left rear sides of the engine intake manifold. Tighten the nuts to 11.3 N·m (100 in. lbs.).

(5) Install and tighten the screw that secures the engine-to-body ground strap eyelet to the lower plenum panel. Tighten the screw to 4.5 N·m (40 in. lbs.).

SPECIAL TOOLS

AUDIO SYSTEMS



Antenna Nut Wrench C-4816

HORN SYSTEMS

CONTENTS

DESCRIPTION AND OPERATION

HORN SYSTEM

DESCRIPTION

A dual-note electric horn system is standard factory-installed equipment on this model. The standard equipment horn system features one low-note horn unit and one high-note horn unit. The horn system allows the vehicle operator to provide an audible warning of the presence or approach of the vehicle to pedestrians and the drivers of other vehicles in near proximity. The horn system uses a non-switched source of battery current so that the system will remain functional, regardless of the ignition switch position.

The horn system can also be activated by the Body Control Module (BCM). The BCM is programmed to activate the horns in order to provide the following features:

- Remote Keyless Entry (RKE) system lock request audible verification (customer programmable)
- RKE system panic mode audible alert
- Vehicle Theft Security System (VTSS) audible alarm.

This vehicle also offers several customer programmable features, which allows the selection of several optional electronic features to suit individual preferences. Refer to **ELECTRONIC VEHICLE INFORMATION CENTER PROGRAMMING** in the Service Procedures section of Group 8V - Overhead Console Systems for more information on the customer programmable feature options. Customer programmable feature options affecting the horn system include:

- **Sound Horn on Lock** - Allows the option of having the horn sound a short chirp as an audible verification that the RKE system received a valid Lock request from the RKE transmitter, or having no audible verification.

The horn system includes the following components:

- Clockspring
- Horns
- Horn relay
- Horn switch

Certain functions and features of the horn system rely upon resources shared with other electronic modules in the vehicle over the Programmable Communications Interface (PCI) data bus network. The PCI data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, internal controller hardware, and component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities. For diagnosis of these electronic modules or of the PCI data bus network, the use of a DRB scan tool and the proper Diagnostic Procedures manual are recommended.

The other electronic modules that may affect horn system operation are as follows:

- **Body Control Module (BCM)** - Refer to **Body Control Module** in the Description and Operation section of Group 8E - Instrument Panel Systems for more information.
- **Electronic Vehicle Information Center (EVIC)** - Refer to **Electronic Vehicle Information Center** in the Description and Operation section of Group 8V - Overhead Console Systems for more information.

Refer to **Clockspring** in the Description and Operation section of Group 8M - Passive Restraint Systems for more information on this component. Refer to **Horn/Cigar Lighter/Power Outlet** in the Contents of Group 8W - Wiring Diagrams for complete circuit diagrams. Following are general descriptions of the remaining major components in the horn system.

DESCRIPTION AND OPERATION (Continued)

OPERATION

The horn system is activated by a horn switch concealed beneath the driver side airbag module trim cover in the center of the steering wheel. Depressing the center of the driver side airbag module trim cover closes the horn switch. Closing the horn switch activates the horn relay. The activated horn relay then switches the battery current needed to energize the horns.

The BCM can also activate the horn system by energizing the horn relay through a single hard wired output circuit. The BCM energizes and de-energizes the horn relay in response to internal programming as well as message inputs received over the Programmable Communications Interface (PCI) data bus network. The BCM can energize the horn relay for a single chirp (RKE lock request), or for extended operation (RKE panic mode and VTSS alarm mode).

Refer to the owner's manual in the vehicle glove box for more information on the features, use and operation of the horn system.

HORN SWITCH

DESCRIPTION

A center-blow, normally open, resistive membrane-type horn switch is secured in a plastic tray that is inserted in a pocket sewn on the front of the driver side airbag retainer strap. The horn switch is concealed behind the driver side airbag module trim cover in the center of the steering wheel. The switch consists of two plastic membranes, one that is flat and one that is slightly convex. These two membranes are secured to each other around the perimeter. Inside the switch, the centers of the facing surfaces of these membranes each has a grid made with an electrically conductive material applied to it. One of the grids is connected to a circuit that provides it with continuity to ground at all times. The grid of the other membrane is connected to the horn relay control circuit.

The steering wheel and steering column must be properly grounded in order for the horn switch to function properly. The horn switch and plastic tray are serviced as a unit. If the horn switch is damaged or faulty, or if the driver side airbag is deployed, the horn switch and tray must be replaced as a unit.

OPERATION

When the center area of the driver side airbag trim cover is depressed, the electrically conductive grids on the facing surfaces of the horn switch membranes contact each other, closing the switch circuit. The completed horn switch circuit provides a ground for the control coil side of the horn relay, which activates the relay. When the horn switch is released, the resistive tension of the convex membrane separates the two electrically conductive grids and opens the switch circuit.

HORN RELAY

DESCRIPTION

The horn relay is a electromechanical device that switches battery current to the horn when the horn switch grounds the relay coil. The horn relay is located in the Power Distribution Center (PDC) in the engine compartment. If a problem is encountered with a continuously sounding horn, it can usually be quickly resolved by removing the horn relay from the PDC until further diagnosis is completed. See the fuse and relay layout label affixed to the inside surface of the PDC cover for horn relay identification and location.

The horn relay is a International Standards Organization (ISO) micro-relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions. The ISO micro-relay terminal functions are the same as a conventional ISO relay. However, the ISO micro-relay terminal pattern (or footprint) is different, the current capacity is lower, and the physical dimensions are smaller than those of the conventional ISO relay.

The horn relay cannot be repaired or adjusted and, if faulty or damaged, it must be replaced.

OPERATION

The ISO relay consists of an electromagnetic coil, a resistor or diode, and three (two fixed and one movable) electrical contacts. The movable (common feed) relay contact is held against one of the fixed contacts (normally closed) by spring pressure. When the electromagnetic coil is energized, it draws the movable contact away from the normally closed fixed contact, and holds it against the other (normally open) fixed contact.

When the electromagnetic coil is de-energized, spring pressure returns the movable contact to the normally closed position. The resistor or diode is connected in parallel with the electromagnetic coil in the relay, and helps to dissipate voltage spikes that are produced when the coil is de-energized.

DESCRIPTION AND OPERATION (Continued)

HORN

DESCRIPTION

The dual electromagnetic diaphragm-type horns are standard equipment on this model. Both horns are secured to a mounting bracket. The mounting bracket is secured with a screw to the back side of the right extension of the radiator closure assembly, just ahead of the right front wheel house and below the front wheel house extension. The two horns are connected in parallel. Each horn is grounded through its wire harness connector and circuit to an eyelet secured to the right inner fender shield near the battery, and receives battery feed through the closed contacts of the horn relay.

The horns cannot be repaired or adjusted and, if faulty or damaged, they must be individually replaced.

OPERATION

Within the two halves of the molded plastic horn housing are a flexible diaphragm, a plunger, an electromagnetic coil and a set of contact points. The diaphragm is secured in suspension around its perimeter by the mating surfaces of the horn housing. The plunger is secured to the center of the diaphragm and extends into the center of the electromagnet. The contact points control the current flow through the electromagnet.

When the horn is energized, electrical current flows through the closed contact points to the electromagnet. The resulting electromagnetic field draws the plunger and diaphragm toward it until that movement mechanically opens the contact points. When the contact points open, the electromagnetic field collapses allowing the plunger and diaphragm to return to their relaxed positions and closing the contact points again. This cycle continues repeating at a very rapid rate producing the vibration and movement of air that creates the sound that is directed through the horn outlet.

DIAGNOSIS AND TESTING

HORN SWITCH

For complete circuit diagrams, refer to **Horn/Cigar Lighter/Power Outlet** in the Contents of Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable. Remove the steering column opening cover from the instrument panel.

(2) Check for continuity between the metal steering column jacket and a good ground. There should be continuity. If OK, go to Step 3. If not OK, refer to **Steering Column** in the Removal and Installation section of Group 19 - Steering for proper installation of the steering column.

(3) Remove the driver side airbag module from the steering wheel. Disconnect the horn switch wire harness connectors from the driver side airbag module.

(4) Remove the horn relay from the Power Distribution Center (PDC). Check for continuity between the steering column half of the horn switch feed wire harness connector and a good ground. There should be no continuity. If OK, go to Step 5. If not OK, repair the shorted horn relay control circuit to the horn relay in the PDC as required.

(5) Check for continuity between the steering column half of the horn switch feed wire harness connector and the horn relay control circuit cavity for the horn relay in the PDC. There should be continuity. If OK, go to Step 6. If not OK, repair the open horn relay control circuit to the horn relay in the PDC as required.

(6) Check for continuity between the horn switch feed wire and the horn switch ground wire on the driver side airbag module. There should be no continuity. If OK, go to Step 7. If not OK, replace the faulty horn switch.

(7) Depress the center of the driver side airbag module trim cover and check for continuity between the horn switch feed wire and the horn switch ground wire on the driver side airbag module. There should now be continuity. If not OK, replace the faulty horn switch.

HORN RELAY

The horn relay (Fig. 1) is located in the Power Distribution Center (PDC) between the battery and the right inner fender shield on the passenger side of the engine compartment. If a problem is encountered with a continuously sounding horn, it can usually be quickly resolved by removing the horn relay from the PDC until further diagnosis is completed. See the fuse and relay layout label affixed to the inside surface of the PDC cover for horn relay identification and location. For complete circuit diagrams, refer to **Horn/Cigar Lighter/Power Outlet** in the Contents of Group 8W - Wiring Diagrams.

DIAGNOSIS AND TESTING (Continued)

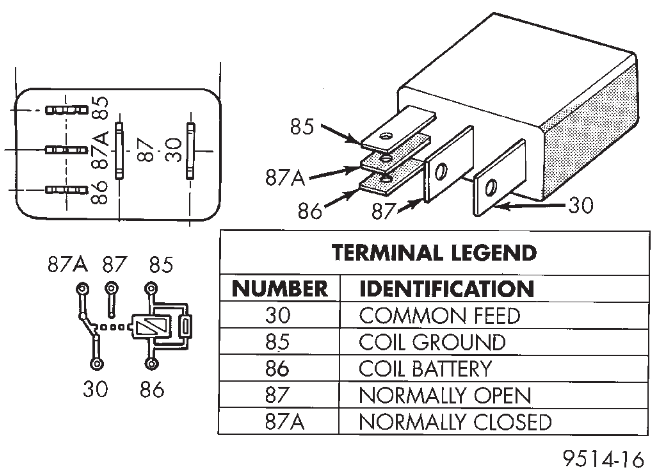
WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Remove the horn relay from the PDC. Refer to **Horn Relay** in the Removal and Installation section of this group for the procedures.

(2) A relay in the de-energized position should have continuity between terminals 87A and 30, and no continuity between terminals 87 and 30. If OK, go to Step 3. If not OK, replace the faulty relay.

(3) Resistance between terminals 85 and 86 (electromagnet) should be 75 ± 5 ohms. If OK, go to Step 4. If not OK, replace the faulty relay.

(4) 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, perform the Relay Circuit Test that follows. If not OK, replace the faulty relay.



TERMINAL LEGEND	
NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

Fig. 1 Horn Relay

RELAY CIRCUIT TEST

(1) The relay common feed terminal cavity (30) is connected to battery voltage and should be hot at all times. If OK, go to Step 2. If not OK, repair the open circuit to the fuse in the PDC as required.

(2) The relay normally closed terminal (87A) is connected to terminal 30 in the de-energized position, but is not used for this application. Go to Step 3.

(3) The relay normally open terminal (87) is connected to the common feed terminal (30) in the energized position. This terminal supplies battery voltage to the horn(s). There should be continuity between the cavity for relay terminal 87 and the horn relay output circuit cavity of each horn wire harness connector at all times. If OK, go to Step 4. If not OK, repair the open circuit to the horn(s) as required.

(4) The coil battery terminal (86) is connected to the electromagnet in the relay. It is connected to battery voltage and should be hot at all times. Check for battery voltage at the cavity for relay terminal 86. If OK, go to Step 5. If not OK, repair the open circuit to the fuse in the PDC as required.

(5) The coil ground terminal (85) is connected to the electromagnet in the relay. It is grounded through the horn switch when the horn switch is depressed. The horn relay coil ground terminal can also be grounded by the Body Control Module (BCM) in response to certain inputs related to the RKE system or the Vehicle Theft Security System. Check for continuity to ground at the cavity for relay terminal 85. There should be continuity with the horn switch depressed, and no continuity with the horn switch released. If not OK, refer to **Horn Switch** in the Diagnosis and Testing section of this group.

HORN

For complete circuit diagrams, refer to **Horn/Cigar Lighter/Power Outlet** in the Contents of Group 8W - Wiring Diagrams.

(1) Disconnect the wire harness connector(s) from the horn connector receptacle(s). Measure the resistance between the ground circuit cavity of the horn(s) wire harness connector(s) and a good ground. There should be no measurable resistance. If OK, go to Step 2. If not OK, repair the open ground circuit to ground as required.

(2) Check for battery voltage at the horn relay output circuit cavity of the horn(s) wire harness connector(s). There should be zero volts. If OK, go to Step 3. If not OK, repair the shorted horn relay output circuit or replace the faulty horn relay as required.

(3) Depress the horn switch. There should now be battery voltage at the horn relay output circuit cavity of the horn(s) wire harness connector(s). If OK, replace the faulty horns. If not OK, repair the open horn relay output circuit to the horn relay as required.

REMOVAL AND INSTALLATION

HORN SWITCH

WARNING:

• ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

• THE HORN SWITCH IS INTEGRAL TO THE DRIVER SIDE AIRBAG MODULE. SERVICE OF THIS COMPONENT SHOULD BE PERFORMED ONLY BY CHRYSLER-TRAINED AND AUTHORIZED DEALER SERVICE TECHNICIANS. FAILURE TO TAKE THE PROPER PRECAUTIONS OR TO FOLLOW THE PROPER PROCEDURES COULD RESULT IN ACCIDENTAL, INCOMPLETE, OR IMPROPER AIRBAG DEPLOYMENT AND POSSIBLE OCCUPANT INJURIES.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the trim cover from the driver side airbag module. Refer to **Driver Side Airbag Module Trim Cover** in the Removal and Installation section of Group 8M - Passive Restraint Systems for the procedures.

(3) Remove the horn switch and tray as a unit from the pouch on the retaining strap of the driver side airbag module (Fig. 2).

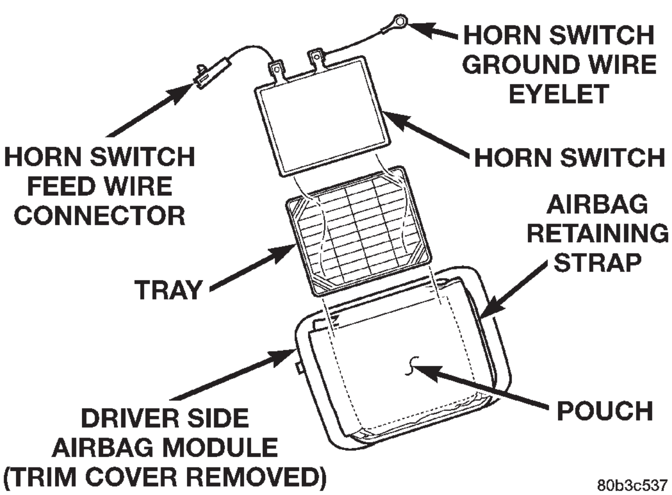


Fig. 2 Horn Switch Remove/Install

INSTALLATION

(1) Install the horn switch and tray as a unit into the pouch on the retaining strap of the driver side airbag module. Be certain that the tray is facing the airbag module, that the horn switch is facing the trim cover, that the horn switch feed wire is on the left, and that the horn switch ground wire is on the right.

(2) Install the trim cover onto the driver side airbag module. Refer to **Driver Side Airbag Module Trim Cover** in the Removal and Installation section of Group 8M - Passive Restraint Systems for the procedures.

(3) Reconnect the battery negative cable.

HORN RELAY

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the cover from the Power Distribution Center (PDC) (Fig. 3).

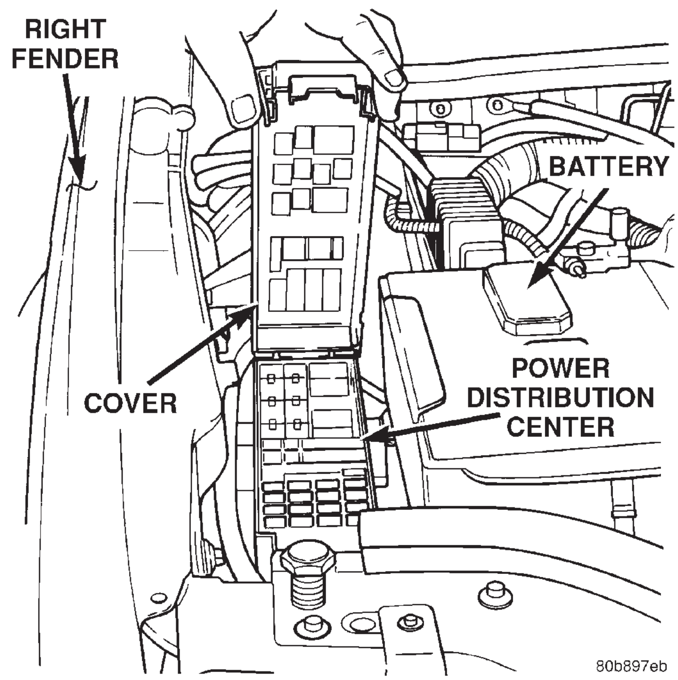


Fig. 3 Power Distribution Center

(3) See the fuse and relay layout label affixed to the underside of the PDC cover for horn relay identification and location.

(4) Remove the horn relay from the PDC.

INSTALLATION

(1) See the fuse and relay layout label affixed to the underside of the PDC cover for the proper horn relay location.

REMOVAL AND INSTALLATION (Continued)

(2) Position the horn relay in the proper receptacle in the PDC.

(3) Align the horn relay terminals with the terminal cavities in the PDC receptacle.

(4) Push down firmly on the horn relay until the terminals are fully seated in the terminal cavities in the PDC receptacle.

(5) Install the cover onto the PDC.

(6) Reconnect the battery negative cable.

HORN

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Raise and support the vehicle.

(3) Remove the lower front half of the inner liner from the right front fender wheel house. Refer to **Front Fender** in the Removal and Installation section of Group 23 - Body for the procedures.

(4) Reach through the front of the right front fender wheel house opening to access and disconnect the two right headlamp and dash wire harness connectors from the horn connector receptacles (Fig. 4).

(5) Remove the screw that secures the horn mounting bracket to the right extension of the radiator closure assembly.

(6) Remove both horns and the mounting bracket from the right extension of the radiator closure assembly as a unit.

INSTALLATION

(1) Position both horns and the mounting bracket onto the right extension of the radiator closure assembly as a unit.

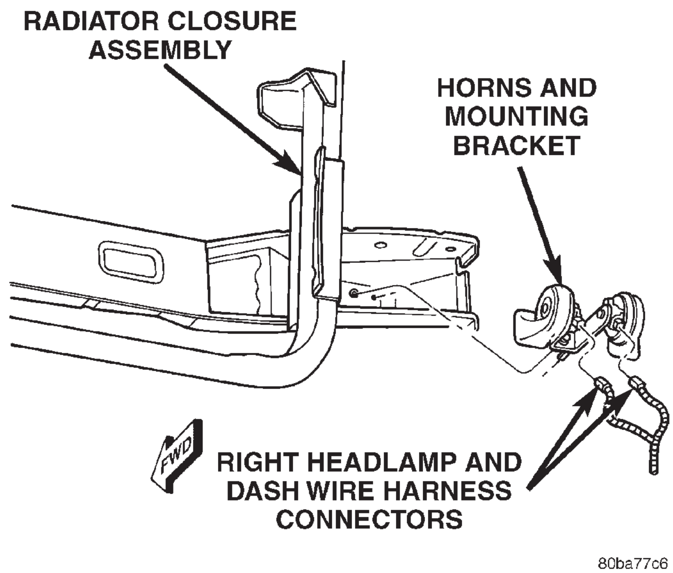


Fig. 4 Horns Remove/Install

(2) Install and tighten the screw that secures the horn mounting bracket to the right extension of the radiator closure assembly. Tighten the screw to 16.9 N·m (150 in. lbs.).

(3) Reconnect the two right headlamp and dash wire harness connectors to the horn connector receptacles.

(4) Install the lower front half of the inner liner to the right front fender wheel house. Refer to **Front Fender** in the Removal and Installation section of Group 23 - Body for the procedures.

(5) Lower the vehicle.

(6) Reconnect the battery negative cable.

SPEED CONTROL SYSTEM

CONTENTS

DESCRIPTION AND OPERATION

SPEED CONTROL SYSTEM

DESCRIPTION

The speed control system is electronically controlled and vacuum operated. Electronic control of the speed control system is integrated into the Powertrain Control Module (PCM). The controls consist of two steering wheel mounted switches. The switches are labeled: ON/OFF, RES/ACCEL, SET, COAST, and CANCEL.

The system is designed to operate at speeds above 30 mph (50 km/h).

WARNING: THE USE OF SPEED CONTROL IS NOT RECOMMENDED WHEN DRIVING CONDITIONS DO NOT PERMIT MAINTAINING A CONSTANT SPEED, SUCH AS IN HEAVY TRAFFIC OR ON ROADS THAT ARE WINDING, ICY, SNOW COVERED, OR SLIPPERY.

OPERATION

When speed control is selected by depressing the ON switch, the PCM allows a set speed to be stored in PCM RAM for speed control. To store a set speed, depress the SET switch while the vehicle is moving at a speed between 35 and 85 mph. In order for the speed control to engage, the brakes cannot be applied, nor can the gear selector be indicating the transmission is in Park or Neutral.

The speed control can be disengaged manually by:
- Stepping on the brake pedal
- Depressing the OFF switch
- Depressing the CANCEL switch.

NOTE: Depressing the OFF switch or turning off the ignition switch will erase the set speed stored in the PCM.

For added safety, the speed control system is programmed to disengage for any of the following conditions:
- An indication of Park or Neutral
- An rapid increase rpm (indicates that the clutch has been disengaged)
- Excessive engine rpm (indicates that the transmission may be in a low gear)
- The speed signal increases at a rate of 10 mph per second (indicates that the coefficient of friction between the road surface and tires is extremely low)
- The speed signal decreases at a rate of 10 mph per second (indicates that the vehicle may have decelerated at an extremely high rate)

Once the speed control has been disengaged, depressing the RES/ACCEL switch (when speed is greater than 30 mph) restores the vehicle to the target speed that was stored in the PCM.

While the speed control is engaged, the driver can increase the vehicle speed by depressing the RES/ACCEL switch. The new target speed is stored in the

DESCRIPTION AND OPERATION (Continued)

PCM when the RES/ACCEL is released. The PCM also has a ″tap-up″ feature in which vehicle speed increases at a rate of approximately 2 mph for each momentary switch activation of the RES/ACCEL switch.

A "tap down" feature is used to decelerate without disengaging the speed control system. To decelerate from an existing recorded target speed, momentarily depress the COAST switch. For each switch activation, speed will be lowered approximately 1 mph.

SPEED CONTROL SERVO

DESCRIPTION

The servo unit consists of a solenoid valve body, a vacuum servo and the mounting bracket.

OPERATION

The Powertrain Control Module (PCM) controls the solenoid valve body. The solenoid valve body controls the application and release of vacuum to the diaphragm of the vacuum servo. A cable connects the servo with the throttle linkage. The servo unit cannot be repaired and is serviced only as a complete assembly.

SPEED CONTROL SOLENOID CIRCUITS

OPERATION

When all of the speed control parameters are met, and the SET button is pressed, the PCM actuates the vent solenoid and "duty-cycles" the vacuum solenoid to open the throttle and bring the vehicle up to target speed. When the vehicle is at target speed, it will actuate the vent solenoid with the vacuum solenoid de-activated to maintain the vehicle at target speed. When the vehicle is above target speed, the PCM will "duty-cycle" the vent solenoid with the vacuum solenoid still de-activated to close the throttle to return to target speed.

SPEED CONTROL SWITCHES

DESCRIPTION

Two separate speed control switch modules are mounted on the steering wheel to the left and right side of the driver's airbag module. The two switch modules are labeled: ON·OFF, SET, RES·ACCEL, CANCEL and COAST. 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 individual switch fails, the switch module must be replaced.

OPERATION

Within the two switch modules, five **momentary** contact switches, supporting seven different speed control functions are used (an eighth function using a diagnostic resistor is used for diagnostic purposes). The outputs from these switches are filtered into one input. The Powertrain Control Module (PCM) determines which output has been applied through **resistive multiplexing.** The input circuit voltage is measured by the PCM to determine which switch function has been selected.

A speed control indicator lamp, located on the instrument panel cluster is energized by the PCM via the J1850 PCI Bus circuits. This occurs when speed control system power has been turned ON, and the engine is running.

STOP LAMP SWITCH

DESCRIPTION

The switch is mounted on the brake pedal mounting bracket under the instrument panel.

OPERATION

Vehicles equipped with the speed control option use a dual function stop lamp switch. The PCM monitors the state of the dual function stop lamp switch. Refer to the Brake section for more information on stop lamp switch service and adjustment procedures.

SERVO CABLE

DESCRIPTION

The speed control servo cable is connected between the speed control vacuum servo diaphragm and the throttle body control linkage.

OPERATION

This cable causes the throttle control linkage to open or close the throttle valve in response to movement of the vacuum servo diaphragm.

POWERTRAIN CONTROL MODULE

DESCRIPTION

The Powertrain Control Module (PCM) is located in the engine compartment.

OPERATION

The speed control electronic control circuitry is integrated into the PCM. 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 certain failures it detects. See

DESCRIPTION AND OPERATION (Continued)

On-Board Diagnostic Test For Speed Control System in this group for more information. The PCM cannot be repaired and must be replaced if faulty.

VACUUM RESERVOIR

DESCRIPTION

The vacuum reservoir is a plastic storage tank connected to an engine vacuum source by vacuum lines.

OPERATION

The vacuum reservoir is used to supply the vacuum needed to maintain proper speed control operation when engine vacuum drops, such as in climbing a grade while driving. A one-way check valve is used in the vacuum line between the reservoir and the vacuum source. This check valve is used to trap engine vacuum in the reservoir. On certain vehicle applications, this reservoir is shared with the heating/air-conditioning system. The vacuum reservoir cannot be repaired and must be replaced if faulty.

DIAGNOSIS AND TESTING

ROAD TEST

Perform a vehicle road test to verify reports of speed control system malfunction. The road test should include attention to the speedometer. Speedometer operation should be smooth and without flutter at all speeds.

Flutter in the speedometer indicates a problem which might cause surging in the speed control system. The cause of any speedometer problems should be corrected before proceeding. Refer to Group 8E, Instrument Panel and Gauges for speedometer diagnosis.

If a road test verifies a system problem and the speedometer operates properly, check for:

- A Diagnostic Trouble Code (DTC). If a DTC exists, conduct tests per the Powertrain Diagnostic Procedures service manual.
- A misadjusted brake (stop) lamp switch. This could also cause an intermittent problem.
- Loose, damaged or corroded electrical connections at the servo. Corrosion should be removed from electrical terminals and a light coating of Mopar MultiPurpose Grease, or equivalent, applied.
- Leaking vacuum reservoir.
- Loose or leaking vacuum hoses or connections.
- Defective one-way vacuum check valve.
- Secure attachment of both ends of the speed control servo cable.
- Smooth operation of throttle linkage and throttle body air valve.
- Failed speed control servo. Do the servo vacuum test.

CAUTION: When test probing for voltage or continuity at electrical connectors, care must be taken not to damage connector, terminals or seals. If these components are damaged, intermittent or complete system failure may occur.

ON-BOARD DIAGNOSTIC TEST FOR SPEED CONTROL 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.

For DTC information, refer to Diagnostic Trouble Codes in Group 25, Emission Control System. This will include a complete list of DTC's including DTC's for the speed control system.

SPEED CONTROL SWITCHES

To perform a complete test of the speed control switch circuits, refer to the appropriate Powertrain Diagnostic Procedures manual.

STOP LAMP SWITCH

For continuity checks and switch adjustment, refer to Group 5, Brakes.

VACUUM SUPPLY TEST

(1) Disconnect vacuum hose at speed control servo and install a vacuum gauge into the disconnected hose.

(2) Start engine and observe gauge at idle. Vacuum gauge should read at least ten inches of mercury.

(3) If vacuum is less than ten inches of mercury, determine source of leak. Check vacuum line to engine for leaks. Also check actual engine intake manifold vacuum. If manifold vacuum does not meet this requirement, check for poor engine performance and repair as necessary.

(4) If vacuum line to engine is not leaking, check for leak at vacuum reservoir. To locate and gain access to reservoir, refer to Vacuum Reservoir Removal/Installation in this group. Disconnect vacuum line at reservoir and connect a hand-operated vacuum pump to reservoir fitting. Apply vacuum. Reservoir vacuum should not bleed off. If vacuum is being lost, replace reservoir.

DIAGNOSIS AND TESTING (Continued)

(5) Verify operation of one-way check valve and check it for leaks.

(a) Locate one-way check valve. The valve is located in vacuum line between vacuum reservoir and engine vacuum source. Disconnect vacuum hoses (lines) at each end of valve.

(b) Connect a hand-operated vacuum pump to reservoir end of check valve. Apply vacuum. Vacuum should not bleed off. If vacuum is being lost, replace one-way check valve.

(c) Connect a hand-operated vacuum pump to vacuum source end of check valve. Apply vacuum. Vacuum should flow through valve. If vacuum is not flowing, replace one-way check valve. Seal the fitting at opposite end of valve with a finger and apply vacuum. If vacuum will not hold, diaphragm within check valve has ruptured. Replace valve.

SPEED CONTROL SERVO

For complete speed control system diagnosis, including the speed control servo, refer to the appropriate Powertrain Diagnostic Procedures manual.

OVERSHOOT/UNDERSHOOT FOLLOWING SPEED CONTROL SET

If the operator repeatedly presses and releases the set button with their foot off of the accelerator (a "lift foot set" to begin speed control operation), the vehicle may accelerate and exceed the desired set speed by up to 5 MPH (8 km/h) and then decelerate to less than the desired set speed before finally achieving the desired set speed.

The Speed Control has an adaptive strategy that compensates for vehicle-to-vehicle variations in speed control cable lengths. When the speed control is set with the vehicle operators foot off of the accelerator pedal, the speed control thinks there is excessive speed control cable slack and adapts. If the lift foot sets are continually used, the speed control overshoot/undershoot condition will develop.

To "unlearn" the overshoot/undershoot condition, the vehicle operator has to press and release the set button while maintaining the desired set speed with the accelerator pedal (not decelerating or accelerating), and then turn the cruise control switch to the OFF position (or press the CANCEL button if equipped) after waiting 10 seconds. This procedure must be performed approximately 10–15 times to completely unlearn the overshoot/undershoot condition.

REMOVAL AND INSTALLATION

SPEED CONTROL SERVO

REMOVAL

The speed control servo is attached to a bracket. The bracket and servo assembly are located below the battery tray.

(1) Disconnect negative battery cable at battery.

(2) Disconnect positive battery cable at battery.

(3) Remove air cleaner housing at top of throttle body and disconnect servo cable at throttle body. Refer to Servo Cable Removal/Installation for procedures.

(4) Remove battery from battery tray.

(5) Disconnect wiring at battery tray.

(6) Disconnect positive battery cable at Power Distribution Center (PDC).

(7) Loosen PDC at battery tray.

(8) Remove battery tray (3 bolts). While removing battery tray, disconnect battery temperature sensor electrical connector at sensor.

(9) Disconnect vacuum line at servo vacuum hose fitting (Fig. 1).

(10) Disconnect electrical connector at servo (Fig. 1).

If servo and mounting bracket are being removed as one assembly, remove two mounting nuts (Fig. 1). These are located above right-front tire. Remove inner fender clips and pry inner fender back slightly to gain access to mounting nuts.

(11) If servo is being removed from its mounting bracket, remove 2 mounting nuts holding servo cable sleeve to bracket (Fig. 2).

(12) Pull speed control cable sleeve and servo away from servo mounting bracket to expose cable retaining clip (Fig. 2) and remove clip. Note: The servo mounting bracket displayed in (Fig. 2) is a typical bracket and may/may not be applicable to this model vehicle.

(13) Remove servo from mounting bracket or, remove servo and mounting bracket as one assembly.

INSTALLATION

(1) Position servo to mounting bracket.

(2) Align hole in cable connector with hole in servo pin. Install cable-to-servo retaining clip.

(3) Insert servo mounting studs through holes in servo mounting bracket.

(4) Install servo cable mounting nuts (Fig. 2) and tighten to 8.5 N·m (75 in. lbs.) torque. If servo and bracket is being installed as one assembly, install 2 mounting nuts (Fig. 1) and tighten to 23 N·m (200 in. lbs.) torque.

(5) Connect vacuum line at servo.

(6) Connect electrical connector at servo.

REMOVAL AND INSTALLATION (Continued)

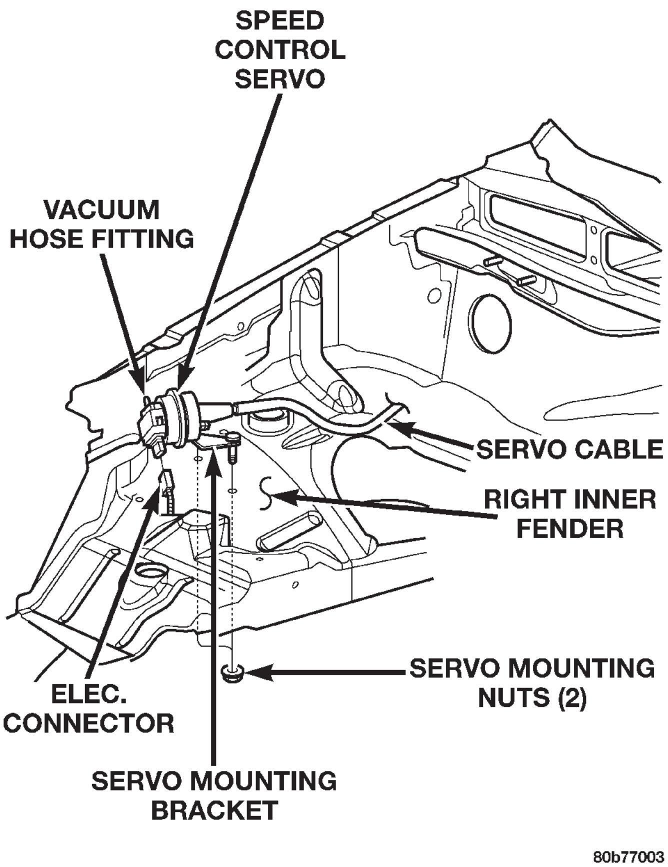


Fig. 1 Speed Control Servo Location

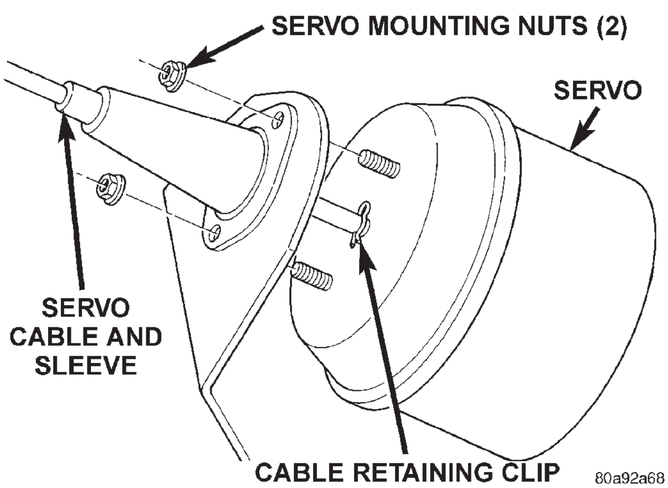


Fig. 2 Servo Cable Clip Remove/Install—Typical

(7) Connect servo cable to throttle body. Refer to Servo Cable Removal/Installation in this group.

(8) Install battery tray and battery temperature sensor.

(9) Connect wiring to battery tray.

(10) Install battery to battery tray.

(11) Connect positive battery cable to Power Distribution Center (PDC).

(12) Connect positive battery cable to battery.

(13) Connect negative battery cable to battery.

(14) Before starting engine, operate accelerator pedal to check for any binding.

SPEED CONTROL SWITCHES

REMOVAL

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. THEN WAIT TWO MINUTES FOR SYSTEM CAPACITOR TO DISCHARGE BEFORE FURTHER SYSTEM SERVICE. FAILURE TO DO THIS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE INJURY.

(1) Disconnect and isolate negative battery cable.

(2) Remove airbag module. Refer to Group 8M, Passive Restraint Systems for procedures.

(3) Remove electrical connector at switch.

(4) Remove switch-to-steering wheel mounting screw (Fig. 3).

(5) Remove switch.

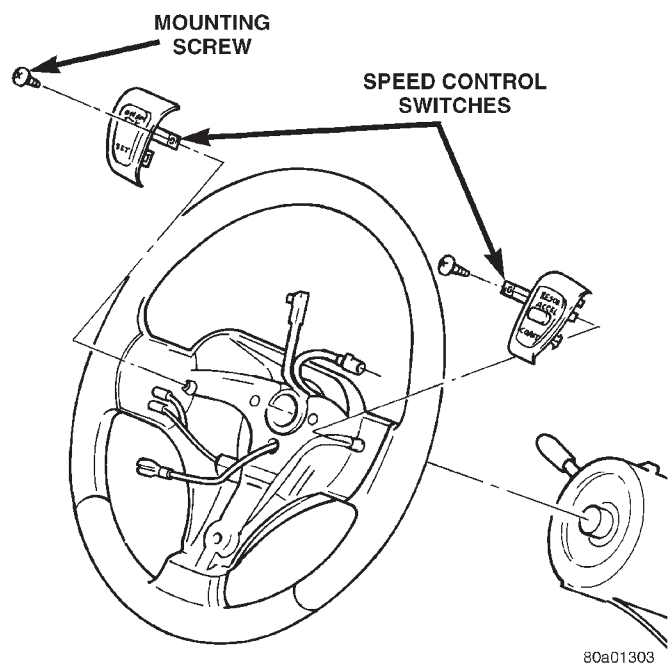


Fig. 3 Speed Control Switches

INSTALLATION

(1) Install switch and mounting screw.

(2) Tighten screw to 1.5 N·m (15 in. lbs.) torque.

(3) Install electrical connector to switch.

(4) Install airbag module. Refer to Group 8M, Passive Restraint Systems for procedures.

(5) Connect negative battery cable.

REMOVAL AND INSTALLATION (Continued)

STOP LAMP SWITCH

Refer to Stop Lamp Switch in Group 5, Brakes for removal/installation and adjustment procedures.

SERVO CABLE—4.0L ENGINE

REMOVAL

(1) Disconnect negative battery cable at battery.

(2) Remove air box housing from throttle body.

(3) Using finger pressure only, remove speed control cable connector at throttle body bellcrank pin by pushing connector off bellcrank pin towards drivers side of vehicle (Fig. 4). **DO NOT try to pull connector off perpendicular to the bellcrank pin. Connector will be broken.**

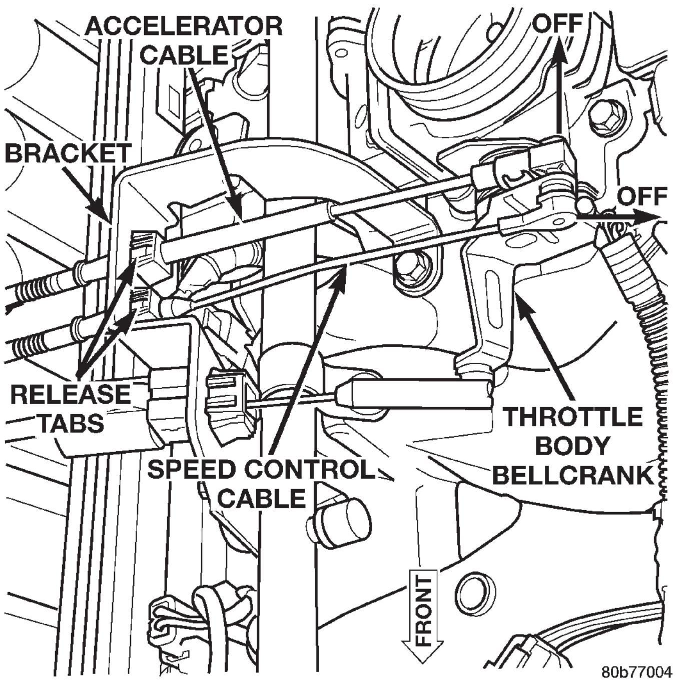


Fig. 4 Speed Control Cable at Bell Crank—4.0L Engine

(4) Remove cable from cable guide at top of valve cover.

(5) Squeeze 2 release tabs (Fig. 4) on sides of cable at bracket and push cable out of bracket.

(6) Remove servo cable from servo. Refer to Speed Control Servo Removal/Installation in this group.

INSTALLATION

(1) Install end of cable to speed control servo. Refer to Speed Control Servo removal and installation in this group.

(2) Install cable into mounting bracket (snaps in).

(3) Install speed control cable connector at throttle body bellcrank pin (snaps on).

(4) Connect negative battery cable at battery.

(5) Before starting engine, operate accelerator pedal to check for any binding.

SERVO CABLE—4.7L V-8 ENGINE

REMOVAL

(1) Disconnect negative battery cable at battery.

(2) Remove air box housing from throttle body.

The accelerator cable must be partially removed to gain access to speed control cable.

(3) Using finger pressure only, disconnect accelerator cable connector at throttle body bellcrank pin by pushing connector off bellcrank pin towards front of vehicle (Fig. 5). **DO NOT try to pull connector off perpendicular to the bellcrank pin. Connector will be broken.**

(4) Lift accelerator cable from top of cable cam (Fig. 5).

(5) Press tab (Fig. 6) to release plastic cable mount from bracket. **Press on tab only enough to release cable from bracket. If tab is pressed too much, it will be broken.** Slide plastic mount (Fig. 6) towards passenger side of vehicle to remove cable from bracket.

(6) Using finger pressure only, disconnect speed control cable connector at throttle body bellcrank pin by pushing connector off bellcrank pin towards front of vehicle (Fig. 5). **DO NOT try to pull connector off perpendicular to the bellcrank pin. Connector will be broken.**

(7) Slide speed control cable plastic mount towards passenger side of vehicle to remove cable from bracket (Fig. 7).

(8) Remove servo cable from servo. Refer to Speed Control Servo Removal/Installation in this group.

INSTALLATION

(1) Install end of cable to speed control servo. Refer to Speed Control Servo Removal/Installation.

(2) Slide speed control cable plastic mount into bracket.

(3) Install speed control cable connector onto throttle body bellcrank pin (snaps on).

(4) Slide accelerator cable plastic mount into bracket. Continue sliding until tab (Fig. 6) is aligned to hole in mounting bracket.

(5) Route accelerator cable over top of cable cam (Fig. 5).

(6) Install accelerator cable connector onto throttle body bellcrank pin (snaps on).

(7) Install air box housing to throttle body.

(8) Connect negative battery cable at battery.

(9) Before starting engine, operate accelerator pedal to check for any binding.

REMOVAL AND INSTALLATION (Continued)

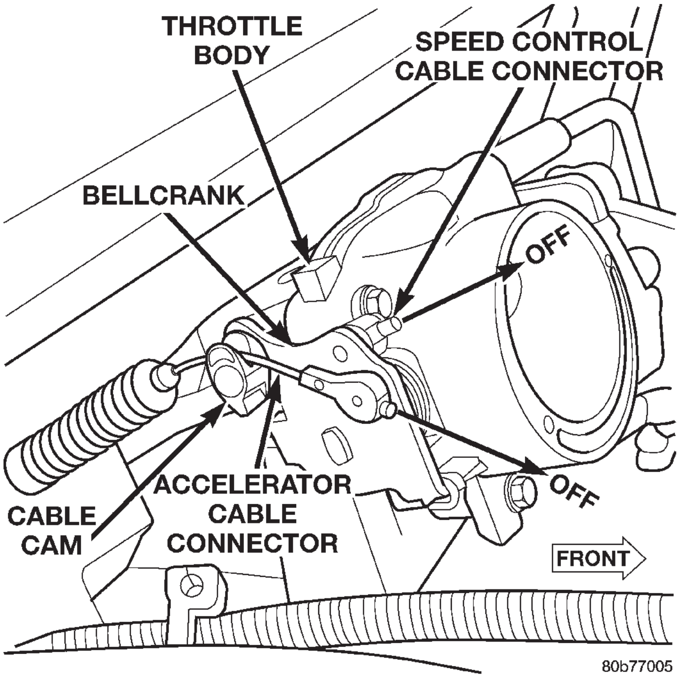


Fig. 5 Cable Connectors at Bell Crank—4.7L V-8 Engine

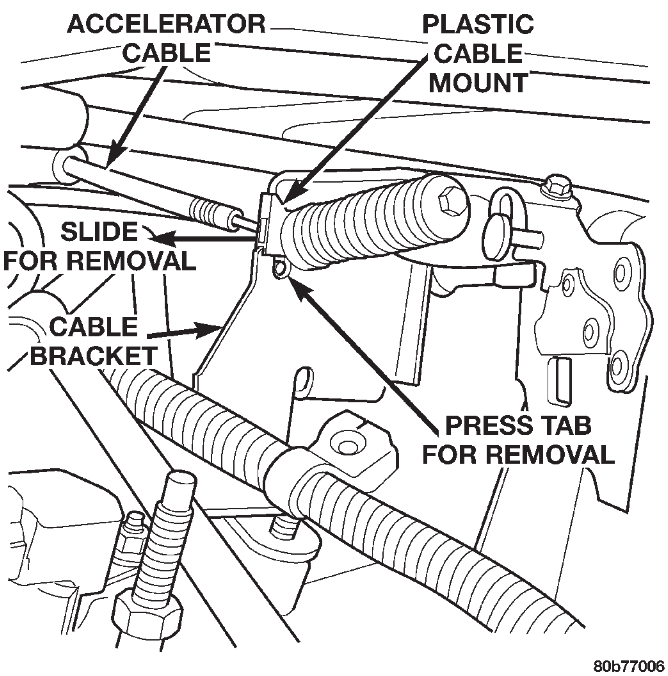


Fig. 6 Accelerator Cable Release Tab—4.7L V-8 Engine

VACUUM RESERVOIR

The vacuum reservoir is located in the right/front corner of the vehicle behind the front bumper fascia (Fig. 8).

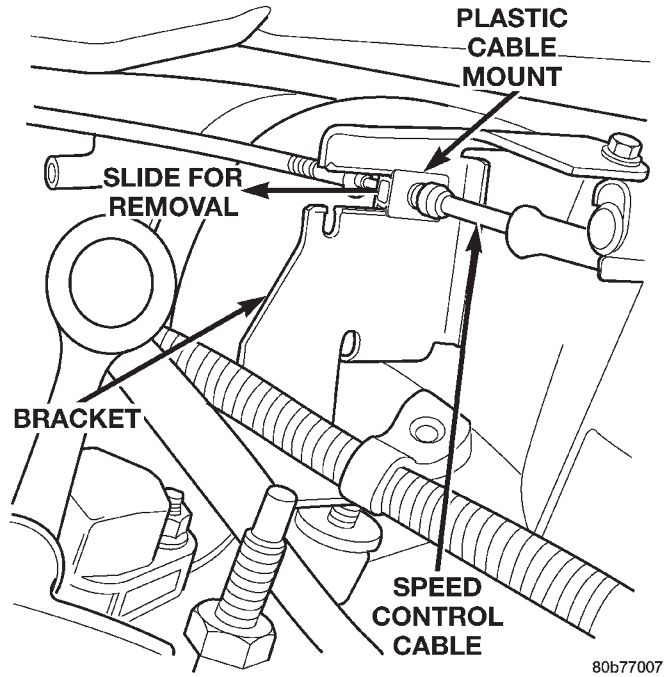


Fig. 7 Speed Control Cable at Bracket—4.7L V-8 Engine

REMOVAL

(1) Remove front bumper and grill assembly.

(2) Remove 1 support bolt near front of reservoir (Fig. 8).

(3) Remove 2 reservoir mounting bolts.

(4) Remove reservoir from vehicle to gain access to vacuum hose (Fig. 9). Disconnect vacuum hose from reservoir fitting at rear of reservoir.

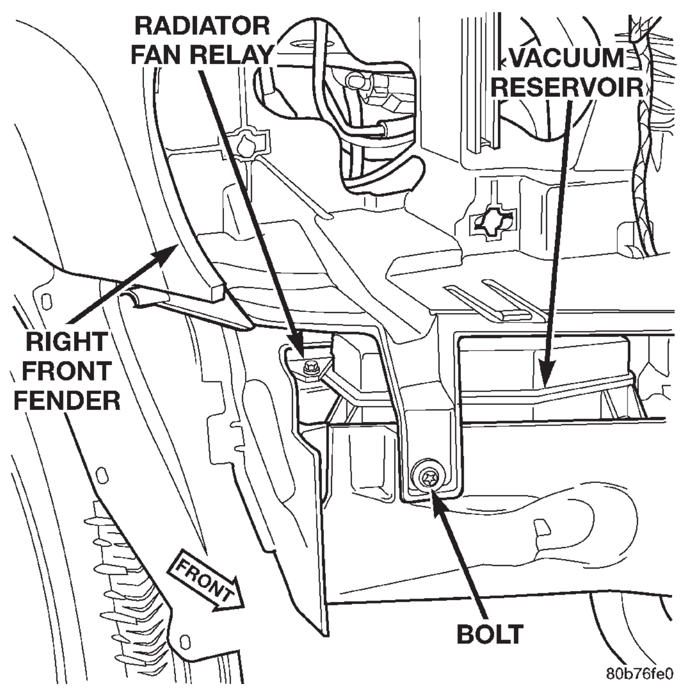


Fig. 8 Vacuum Reservoir Location

REMOVAL AND INSTALLATION (Continued)

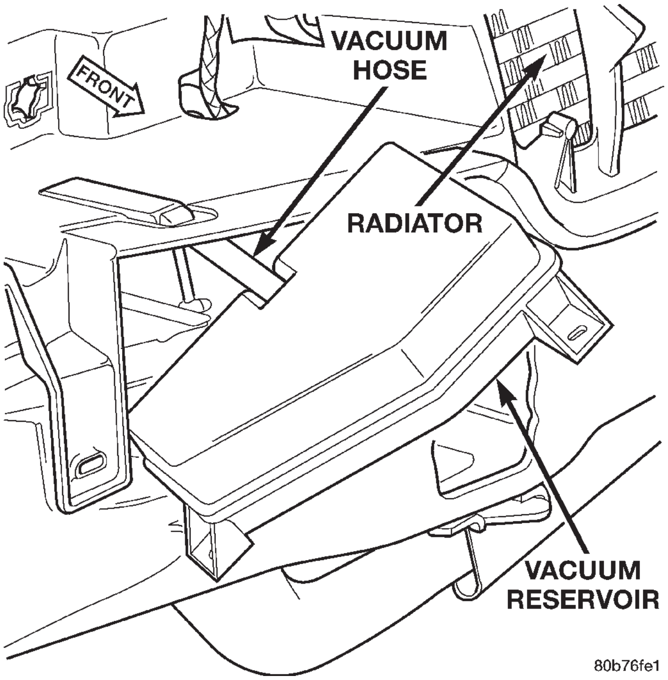


Fig. 9 Vacuum Reservoir Removal/Installation

INSTALLATION

(1) Connect vacuum hose to reservoir.

(2) Install reservoir and tighten 2 bolts to 3 N·m (25 in. lbs.) torque.

(3) Install front bumper and grill assembly.

SPECIFICATIONS

TORQUE CHART

Description	Torque
Servo Mounting Bracket-to-Servo Nuts	8.5 N·m (75 in. lbs.)
Servo Mounting Bracket-to-Body Nuts	23 N·m (200 in. lbs.)
Switch Module Mounting Screws	.6–1 N·m (6–9 in. lbs.)
Vacuum Reservoir Mounting Bolts	3 N·m (25 in. lbs.)

TURN SIGNAL AND HAZARD WARNING SYSTEMS

CONTENTS

DESCRIPTION AND OPERATION

TURN SIGNAL SYSTEM

DESCRIPTION

A turn signal system is standard factory-installed safety equipment on this model. The turn signal system allows the vehicle operator to provide the drivers of other vehicles in near proximity with an optical indication of his intention to perform a turning maneuver or to change traffic lanes. The turn signal system uses ignition switched battery current, and will operate only when the ignition switch is in the On position.

Vehicles equipped with the optional Electronic Vehicle Information Center (EVIC) have a Turn Signal On warning feature. This feature is designed to provide the driver with both visual and audible reminders when a turn signal has been left turned on for an extended period. Refer to **Electronic Vehicle Information Center** in the Description and Operation section of Group 8V - Overhead Console Systems for more information on the EVIC features.

The turn signal system includes the following components:

- Combination flasher
- Front side marker lamps
- Turn signal cancelling cam
- Turn signal indicator lamps
- Turn signal lamps
- Turn signal switch.

Refer to **Lamp** in the proper section of Group 8L - Lamps for more information on the exterior turn signal lamps. Refer to **Instrument Cluster** in the proper section of Group 8E - Instrument Panel Systems for more information on the turn signal indicator lamps. Following are general descriptions of the major components in the turn signal system. For complete circuit diagrams, refer to **Turn Signals** in the Contents of Group 8W - Wiring Diagrams.

OPERATION

With the ignition switch in the On or Accessory position, and the turn signal (left or lighting multi-function) switch control stalk moved up (right turn) or down (left turn), the turn signal system is activated. When the turn signal system is activated, the circuitry of the turn signal switch and the combination flasher will cause the selected (right or left) turn signal indicator lamp, front park/turn signal lamp, front side marker lamp, and rear tail/stop/turn signal lamp to flash on and off. If the exterior lighting is turned off, the front park/turn signal lamp and the front side marker lamp will flash in unison. If the exterior lighting is turned on, the front park/turn signal lamp and the front side marker lamp will flash alternately.

The EVIC module uses turn signal status messages from the Electro-Mechanical Instrument Cluster (EMIC) module and distance messages from the Powertrain Control Module (PCM) received over the Programmable Communications Interface (PCI) data bus network to determine when the Turn Signal On warning should be activated. The EMIC receives a hard wired input from the combination flasher to determine the proper turn signal status message to send. If a turn signal is left on for more than about 1.6 kilometers (1 mile) of driving distance, the EVIC will display the Turn Signal On message and will send a request to the Body Control Module (BCM) over the PCI data bus for two sets of three chime tones to sound.

DESCRIPTION AND OPERATION (Continued)

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the turn signal system.

HAZARD WARNING SYSTEM

DESCRIPTION

A hazard warning system is standard factory-installed safety equipment on this model. The hazard warning system allows the vehicle operator to provide the drivers of other vehicles in near proximity an optical indication that the vehicle is disabled or is an obstacle to traffic flow. Unlike the turn signal system, the hazard warning system uses a non-switched source of battery current so that the system will operate regardless of the ignition switch position.

The hazard warning system can also be activated by the Body Control Module (BCM). The BCM is programmed to activate the hazard warning system lamps in order to provide the following features:

- Remote Keyless Entry (RKE) system lock and unlock request optical verification (customer programmable)
- RKE system panic mode optical alert
- Vehicle Theft Security System (VTSS) optical alarm.

This vehicle also offers several customer programmable features, which allows the selection of several optional electronic features to suit individual preferences. Refer to **ELECTRONIC VEHICLE INFORMATION CENTER PROGRAMMING** in the Service Procedures section of Group 8V - Overhead Console Systems for more information on the customer programmable feature options. Customer programmable feature options affecting the hazard warning system include:

- **Flash Lights with Lock** - Allows the option of having the lights flash as an optical verification that the RKE system received a valid Lock request or Unlock request from the RKE transmitter, or having no optical verification.

The hazard warning system includes the following components:

- Combination flasher
- Front side marker lamps
- Hazard warning switch
- Turn signal indicator lamps
- Turn signal lamps.

Certain functions and features of the horn system rely upon resources shared with other electronic modules in the vehicle over the Programmable Communications Interface (PCI) data bus network. The PCI data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, internal controller hardware, and component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities. For diagnosis of these electronic modules or of the PCI data bus network, the use of a DRB scan tool and the proper Diagnostic Procedures manual are recommended.

The other electronic modules that may affect hazard warning system operation are as follows:

- **Body Control Module (BCM)** - Refer to **Body Control Module** in the Description and Operation section of Group 8E - Instrument Panel Systems for more information.
- **Electronic Vehicle Information Center (EVIC)** - Refer to **Electronic Vehicle Information Center** in the Description and Operation section of Group 8V - Overhead Console Systems for more information.

Refer to **Lamp** in the proper section of Group 8L - Lamps for more information on the exterior turn signal lamps. Refer to **Instrument Cluster** in the proper section of Group 8E - Instrument Panel Systems for more information on the turn signal indicator lamps. Following are general descriptions of the major components in the hazard warning system. For complete circuit diagrams, refer to **Turn Signals** in the Contents of Group 8W - Wiring Diagrams.

OPERATION

With the hazard warning switch in the On position, the hazard warning system is activated. When the hazard warning system is activated, the circuitry of the hazard warning switch and the combination flasher will cause both the right side and the left side turn signal indicator lamps, front park/turn signal lamps, front side marker lamps and rear tail/stop/turn signal lamps to flash on and off. If the exterior lamps are turned off, the front park/turn signal lamps and the front side marker lamps will flash in unison. If the exterior lamps are turned on, the front park/turn signal lamps and the front side marker lamps will flash alternately.

The BCM can also activate the hazard warning system lamps by energizing the electronic combination flasher through a single hard wired output circuit. The BCM energizes and de-energizes the combination flasher in response to internal programming as well as message inputs received over the Programmable Communications Interface (PCI) data bus network. The BCM can energize the combination flasher for a single flash (RKE lock request), several flashes (RKE unlock request), or for extended operation (RKE panic mode and VTSS alarm mode).

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the hazard warning system.

DESCRIPTION AND OPERATION (Continued)

TURN SIGNAL SWITCH AND HAZARD WARNING SWITCH

DESCRIPTION

The turn signal and hazard warning switches are integral to the left (lighting) multi-function switch unit, which is secured to the left side of the multi-function switch mounting housing at the top of the steering column (Fig. 1). The only visible parts of the left multi-function switch are the control stalk that extends from the left side of the steering column, and the hazard warning switch push button that protrudes from the top of the steering column. The left multi-function switch control stalk has both nomenclature and international control symbols on it, which identify its many functions. The hazard warning switch push button is identified with a double triangle, which is the international control symbol for hazard warning. The remainder of the left multi-function switch is concealed beneath the steering column shrouds.

The left multi-function switch also contains circuitry for the following functions:

- Exterior lighting control, including:
- Fog lamps
- Park lamps
- Headlamps
- Auto headlamps (if equipped)
- Headlamp beam selection
- Headlamp optical horn.
- Interior lighting control, including:
- Interior lamps defeat
- Interior lamps on
- Panel lamps dimming.

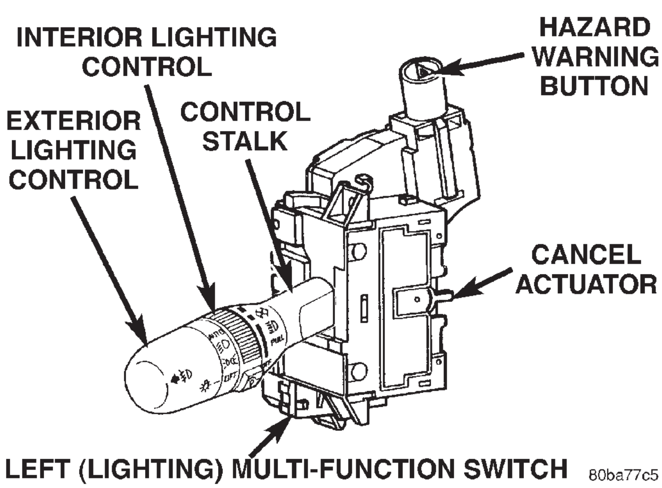


Fig. 1 Left (Lighting) Multi-Function Switch

The information contained in this group addresses only the left multi-function switch turn signal and hazard warning functions. For information relative to the other systems that are controlled by and circuits that are integral to the left multi-function switch, see the group in this service manual that covers that system. However, the turn signal and hazard warning switches cannot be repaired. If these switches or any other circuit or component of the left multi-function switch unit is faulty or damaged, the entire left multi-function switch unit must be replaced.

OPERATION

TURN SIGNAL SWITCH

The left multi-function switch control stalk that extends from the left side of the steering column just below the steering wheel is moved up or down to activate the turn signal switch. When the control stalk is moved in the upward direction, the right turn signal switch circuitry is activated; and, when the control stalk is moved in the downward direction, the left turn signal switch circuitry is activated. The turn signal switch has a detent position in each direction that provides turn signals with automatic cancellation, and an intermediate momentary position in each direction that provides turn signals only until the left multi-function switch control stalk is released.

When the turn signal switch is in a detent position, it is turned off by one of two lobes of the turn signal cancelling cam, which is located beneath the clockspring mechanism within the multi-function switch mounting housing on the steering column. Turning the steering wheel causes the turn signal cancelling cam lobes to contact a cancel actuator in the left multi-function switch, and the turn signal switch automatically returns to the off position.

HAZARD WARNING SWITCH

The hazard warning switch is controlled by the hazard warning switch push button. Push the switch button in to unlatch the switch and activate the hazard warning system, and push in on the button again to latch the switch and turn the system off. When the hazard warning switch is latched (hazard warning off), the push button will be in a lowered position on the top of the steering column shroud; and, when the hazard warning switch is unlatched (hazard warning on), the push button will be in a raised position.

DESCRIPTION AND OPERATION (Continued)

TURN SIGNAL CANCELLING CAM

DESCRIPTION

The turn signal cancelling cam is concealed within the multi-function switch mounting housing on the top of the steering column below the steering wheel and the clockspring mechanism. The turn signal cancelling cam consists of a molded plastic hub and disc unit with two integral lobes. The upper lobe of the turn signal cancelling cam has a hole that is used to align it with another hole in the back of the multi-function switch mounting housing. The inside diameter of the turn signal cancelling cam hub has an integral metal-reinforced plastic key that locks the unit to a keyway in the upper steering column shaft.

The upper surface of the turn signal cancelling cam features three holes, two round and one oblong. These holes engage and key the cam unit to three matching pins in the hub of the clockspring mechanism. The hub of the clockspring and the turn signal cancelling cam lobes rotate with the steering wheel. The centered clockspring housing is then secured to the multi-function switch mounting housing over the top of the turn signal cancelling cam. The multi-function switch mounting housing is secured to the steering column and remains stationary.

The turn signal cancelling cam cannot be repaired. If faulty or damaged, it must be replaced. Refer to **Clockspring** in the Removal and Installation section of Group 8M - Passive Restraint Systems for the clockspring service procedures.

OPERATION

The turn signal cancelling cam has two lobes molded into it. When the turn signals are activated by moving the left multi-function switch control stalk to a detent position, a turn signal cancel actuator is extended from the inside surface of the multi-function switch housing toward the turn signal cancelling cam. When the steering wheel is rotated during a turning maneuver, one of the two turn signal cancelling cam lobes will contact the turn signal cancel actuator, releasing the left multi-function switch control stalk from its detent and cancelling the turn signal event.

COMBINATION FLASHER

DESCRIPTION

The combination flasher is a smart relay that functions as both the turn signal system and the hazard warning system flasher. The combination flasher contains active electronic Integrated Circuitry (IC) elements. This flasher is designed to handle the current flow requirements of the factory-installed lighting. If supplemental lighting is added to the turn signal lamp circuits, such as when towing a trailer with lights, the combination flasher will automatically try to compensate to keep the flash rate the same.

The combination flasher is located in the junction block, under the left end of the instrument panel in the passenger compartment. Because of the active electronic elements within the combination flasher, it cannot be tested with conventional automotive electrical test equipment. If the combination flasher is believed to be faulty, test the turn signal system and hazard warning system circuits as described in this group. Then replace the combination flasher with a known good unit to confirm system operation.

The combination flasher cannot be repaired or adjusted and, if faulty or damaged, it must be replaced. Refer to **Turn Signals** in the Contents of Group 8W - Wiring Diagrams for complete circuit diagrams.

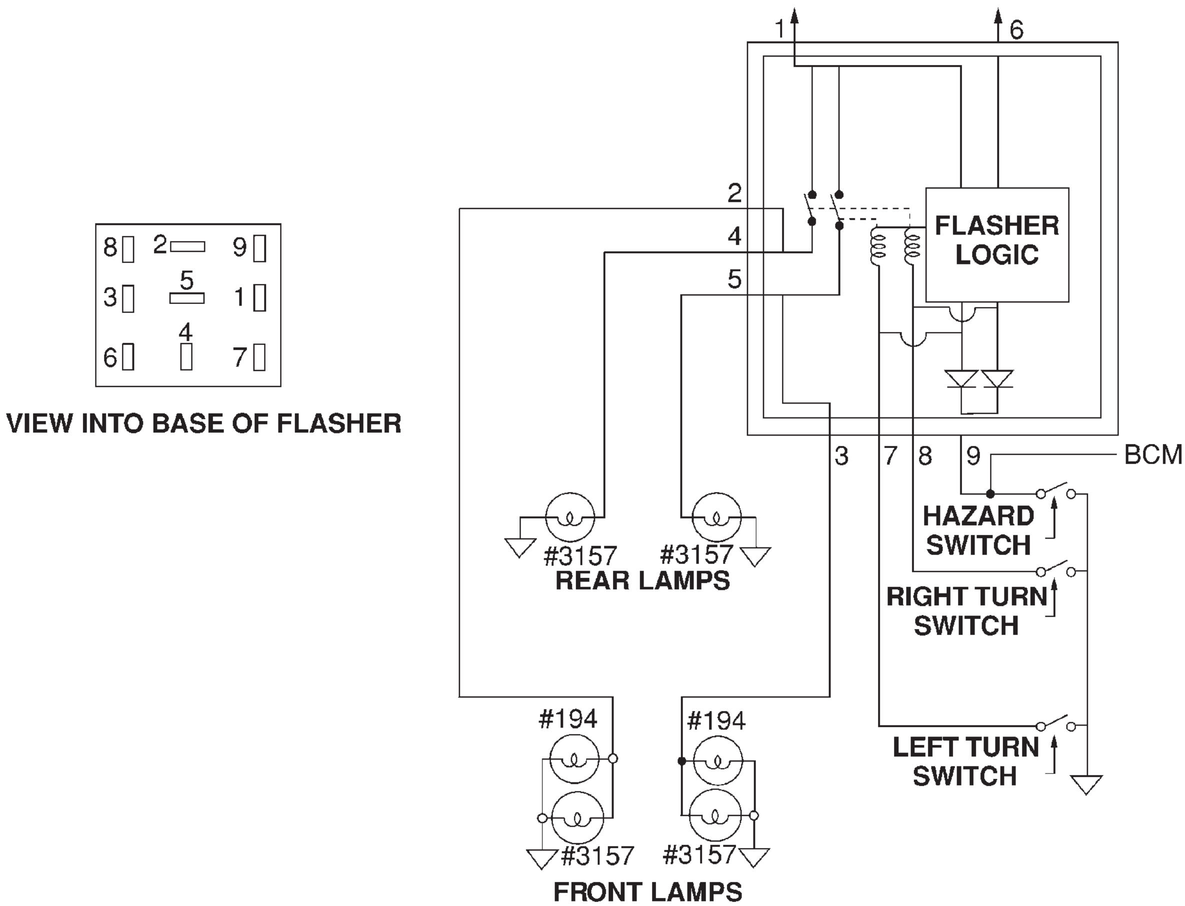
OPERATION

The combination flasher has nine blade-type terminals intended for the following inputs and outputs: fused B(+), fused ignition switch output, left turn switch sense, right turn switch sense, hazard switch sense, left front turn signal circuit, right front turn signal circuit, left rear turn signal circuit and right rear turn signal circuit. Constant battery voltage is supplied to the flasher so that it can perform the hazard warning function, and ignition switched battery voltage is supplied for the turn signal function. However, when the flasher is idle no current is drawn through the module. The unit does not become active until it is provided a signal ground from the turn signal switch, hazard warning switch or the Body Control Module (BCM).

The IC within the combination flasher (Fig. 2) contains the logic that controls the flasher operation and the flash rate. Typical flash rate is about ninety flashes per minute. When a bulb is burnt out, or when a circuit for a lamp is open, the turn signal flash rate will increase to a minimum of 180 flashes per minute. However, an open lamp circuit or burnt out bulb does not change the hazard warning flash rate.

Turn signal inputs that actuate the combination flasher are low current grounds, each drawing a maximum of 300 milliamperes. The turn signal inputs are provided to the flasher through the junction block by the turn signal (left multi-function) switch on the steering column. The hazard warning signal input is a low current ground drawing a maximum of 600 milliamperes. The hazard warning input can be provided through the junction block by the hazard warning (left multi-function) switch on the steering column, or by the BCM on the back of the junction block.

DESCRIPTION AND OPERATION (Continued)



COMBINATION FLASHER CIRCUITS		
CAVITY	CIRCUIT	FUNCTION
1	L25	Fused B(+)
2	L61	Left Front Turn Signal
3	L60	Right Front Turn Signal
4	L63	Left Rear Turn Signal
5	L62	Right Rear Turn Signal
6	F22	Fused Ignition Switch Output
7	L305	Left Turn Switch Sense
8	L302	Right Turn Switch Sense
9	L91	Hazard Switch Sense

80b46cc6

Fig. 2 Combination Flasher

DIAGNOSIS AND TESTING

TURN SIGNAL AND HAZARD WARNING SYSTEMS

For complete circuit diagrams, refer to **Turn Signals** in the Contents of Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Turn the ignition switch to the On position. Activate the turn signal switch by moving the left multi-function switch control stalk up (right turn) and/or down (left turn). Observe the turn signal indicator lamp(s) in the instrument cluster. If the flash rate is very high, check for a turn signal bulb that is not lit or is very dimly lit. Repair the circuits to that lamp or replace the faulty bulb, as required. Test the operation of the turn signal system again. If the turn signal indicator(s) fail to light, go to Step 2.

(2) Turn the ignition switch to the Off position. Check the fused B(+) fuse in the junction block. If OK, go to Step 3. If not OK, repair the shorted circuit or component as required and replace the faulty fuse(s).

(3) Check for battery voltage at the fused B(+) fuse in the junction block. If OK, go to Step 4. If not OK, repair the open fused B(+) circuit to the Power Distribution Center (PDC) fuse as required.

(4) Check the fused ignition switch output (run) fuse in the junction block. If OK, go to Step 5. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(5) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run) fuse in the junction block. If OK, go to Step 6. If not OK, repair the open fused ignition switch (run) circuit to the ignition switch as required.

(6) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the combination flasher from the junction block and replace it with a known good unit. Connect the battery negative cable. Test the operation of the turn signal and hazard warning systems. If OK, discard the faulty combination flasher. If not OK, remove the test flasher and go to Step 7.

(7) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run) circuit cavity for the combination flasher in the junction block. If OK, go to Step 8. If not OK, repair the open fused ignition switch output (run) circuit to the junction block fuse as required.

(8) Turn the ignition switch to the Off position. Check for battery voltage at the fused B(+) circuit cavity for the combination flasher in the junction block. If OK, go to Step 9. If not OK, repair the open fused B(+) circuit to the junction block fuse as required.

(9) Disconnect and isolate the battery negative cable. Disconnect the instrument panel wire harness connector from the turn signal and hazard warning (left multi-function) switch connector receptacle. Check for continuity between the ground circuit cavity of the instrument panel wire harness connector for the left multi-function switch and a good ground. There should be continuity. If OK, go to Step 10. If not OK, repair the open ground circuit to ground as required.

(10) Check for continuity between the hazard switch sense circuit cavity of the instrument panel wire harness connector for the left multi-function switch and a good ground. There should be no continuity. If OK, go to Step 11. If not OK, repair the shorted hazard switch sense circuit as required.

(11) Check for continuity between the hazard switch sense circuit cavities of the junction block for the combination flasher and the instrument panel wire harness connector for the left multi-function switch. There should be continuity. If OK, go to Step 12. If not OK, repair the open hazard switch sense circuit as required.

(12) Check for continuity between the left turn switch sense circuit cavity of the instrument panel wire harness connector for the left multi-function switch and a good ground. There should be no continuity. If OK, go to Step 13. If not OK, repair the shorted left turn switch sense circuit as required.

(13) Check for continuity between the left turn switch sense circuit cavities of the junction block for the combination flasher and the instrument panel wire harness connector for the left multi-function switch. There should be continuity. If OK, go to Step 14. If not OK, repair the open left turn switch sense circuit as required.

(14) Check for continuity between the right turn switch sense circuit cavity of the instrument panel wire harness connector for the left multi-function switch and a good ground. There should be no continuity. If OK, go to Step 15. If not OK, repair the shorted right turn switch sense circuit as required.

(15) Check for continuity between the right turn switch sense circuit cavities of the junction block for the combination flasher and the instrument panel wire harness connector for the left multi-function

DIAGNOSIS AND TESTING (Continued)

switch. There should be continuity. If OK, refer to **Turn Signal and Hazard Warning Switch** in the Diagnosis and Testing section of this group to test the left multi-function switch. If not OK, repair the open right turn switch sense circuit as required.

TURN SIGNAL AND HAZARD WARNING SWITCH

The turn signal and hazard warning switches are integral to the left multi-function switch. Refer to **Turn Signal and Hazard Warning Systems** in the Diagnosis and Testing section of this group before testing the left multi-function switch. For complete circuit diagrams, refer to **Turn Signals** in the Contents of Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

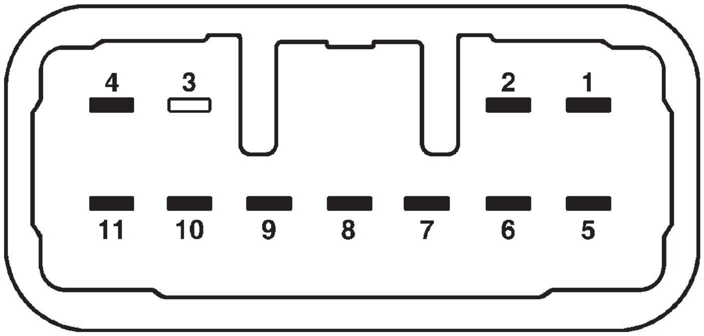
(1) Disconnect and isolate the battery negative cable.

(2) Disconnect the instrument panel wire harness connector from the left multi-function switch connector receptacle.

(3) Using an ohmmeter, perform the continuity and resistance tests at the terminals in the switch connector receptacle as shown in the Left Multi-Function Switch Test chart (Fig. 3).

(4) If the left multi-function switch fails any of the continuity or resistance tests, replace the faulty left multi-function switch unit as required.

DIAGNOSIS AND TESTING (Continued)



LEFT (LIGHTING) MULTI-FUNCTION SWITCH			
TURN SIGNAL AND HAZARD WARNING SWITCH TESTS			
SWITCH POSITION		CONTINUITY BETWEEN	
TURN	HAZARD		
Neutral	Off	No Related Continuity	
Left	Off	Pins 2 & 8	
Right	Off	Pins 2 & 7	
Neutral	On	Pins 2 & 9	
EXTERIOR LIGHTING SWITCH TESTS			
SWITCH POSITION	CONTINUITY BETWEEN	RESISTANCE BETWEEN	RESISTANCE RANGE (OHMS)
Off	—	Pins 4 & 11	3743 - 3824
Park Lamps On	—	Pins 4 & 11	901 - 926
Head Lamps On	—	Pins 4 & 11	345 - 358
Auto Headlamps On	—	Pins 4 & 11	74 - 81
Fog Lamps	Pins 1 & 2	—	—
Optical Horn	Pins 2 & 5	—	—
High Beam	Pins 2 & 6	—	—
INTERIOR LIGHTING SWITCH TESTS			
SWITCH POSITION	CONTINUITY BETWEEN	RESISTANCE BETWEEN	RESISTANCE RANGE (OHMS)
Dome Lamp Disable On	—	Pins 4 & 9	63 - 70
Panel Lamps Dimming Position 1	—	Pins 4 & 9	198 - 208
Dimming Position 2	—	Pins 4 & 9	551 - 569
Dimming Position 3	—	Pins 4 & 9	905 - 929
Dimming Position 4	—	Pins 4 & 9	1258 - 1290
Dimming Position 5	—	Pins 4 & 9	1611 - 1651
Dimming Position 6	—	Pins 4 & 9	1965 - 2011
Parade Mode On	—	Pins 4 & 9	3534 - 3611
Dome Lamp Enable On	—	Pins 4 & 9	7811 - 7974

80b46c78

Fig. 3 Left Multi-Function Switch Test

REMOVAL AND INSTALLATION

COMBINATION FLASHER

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the steering column opening cover from the instrument panel. Refer to **Steering Column Opening Cover** in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(3) Remove the combination flasher from the junction block (Fig. 4).

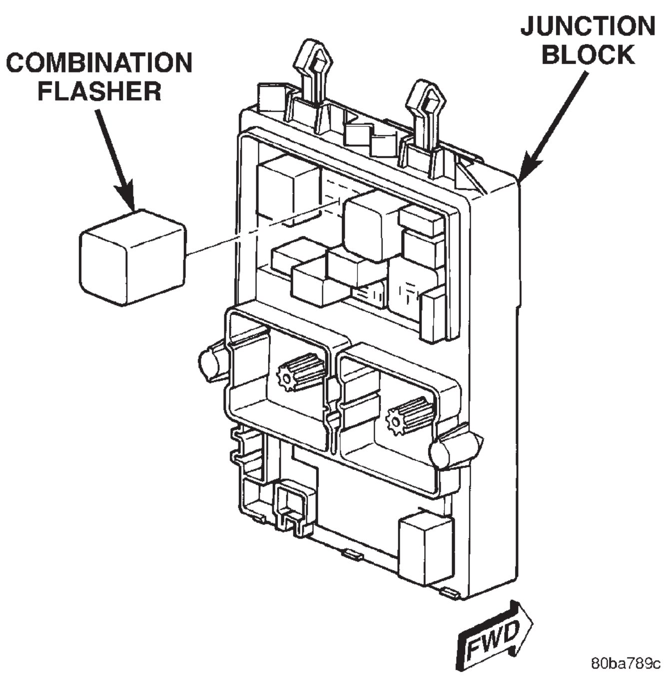


Fig. 4 Combination Flasher

INSTALLATION

(1) Position the combination flasher in the proper receptacle in the junction block.

(2) Align the combination flasher terminals with the terminal cavities in the junction block receptacle.

(3) Push in firmly on the combination flasher until the terminals are fully seated in the terminal cavities in the junction block receptacle.

(4) Install the steering column opening cover onto the instrument panel. Refer to **Steering Column Opening Cover** in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(5) Reconnect the battery negative cable.

TURN SIGNAL AND HAZARD WARNING SWITCH

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the screw that secures the lower tilting steering column shroud to the steering column multi-function switch mounting housing (Fig. 5).

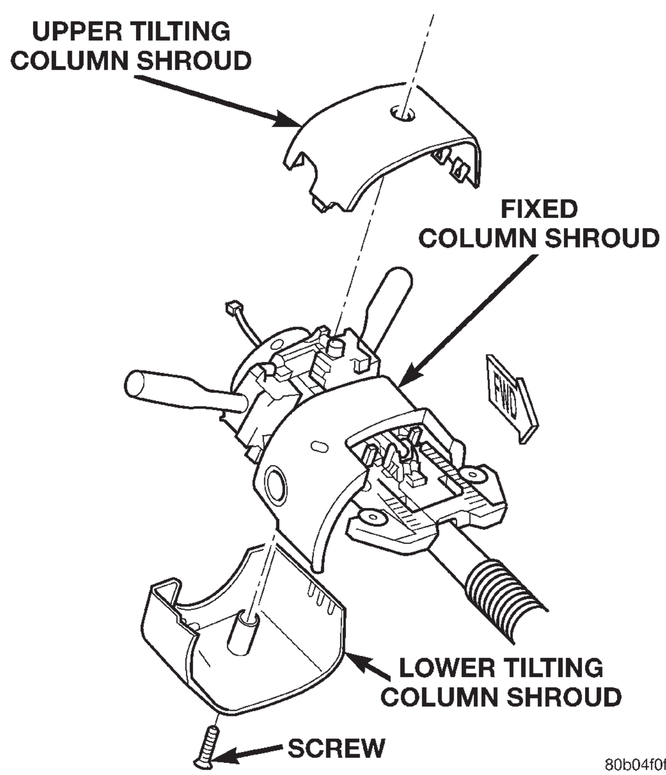


Fig. 5 Steering Column Shrouds Remove/Install

REMOVAL AND INSTALLATION (Continued)

(3) Unsnap the two halves of the tilting steering column shroud from each other and remove both halves from the steering column.

(4) Disconnect the instrument panel wire harness connector from the turn signal and hazard warning (left multi-function) switch connector receptacle.

(5) Remove the two screws that secure the left multi-function switch to the multi-function switch mounting housing (Fig. 6).

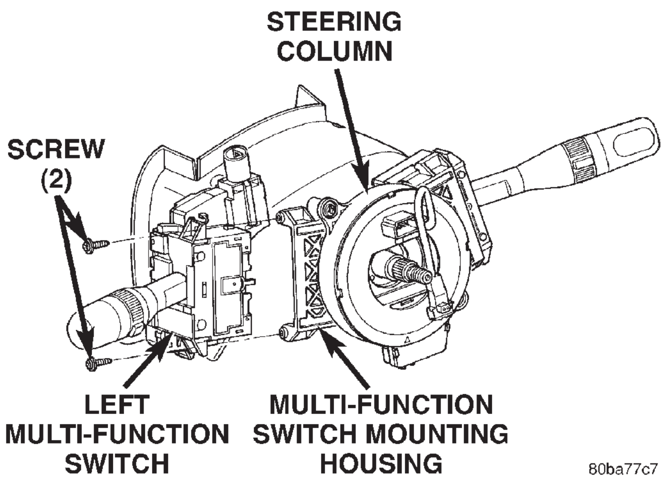


Fig. 6 Left Multi-Function Switch Remove/Install

(6) Remove the left multi-function switch from the multi-function switch mounting housing.

INSTALLATION

(1) Position the left multi-function switch onto the multi-function switch mounting housing.

(2) Install and tighten the two screws that secure the left multi-function switch to the multi-function switch mounting housing. Tighten the screws to 2.5 N·m (22 in. lbs.).

(3) Reconnect the instrument panel wire harness connector to the left multi-function switch connector receptacle.

(4) Position the lower tilting steering column shroud to the underside of the steering column.

(5) Install and tighten the screw that secures the lower tilting steering column shroud to the multi-function switch mounting housing. Tighten the screw to 1.9 N·m (17 in. lbs.).

(6) Position the upper tilting column shroud over the steering column with the hazard warning switch button inserted through the hole in the upper surface of the shroud. Align the upper tilting steering column shroud to the lower shroud and snap the two shroud halves together.

(7) Reconnect the battery negative cable.

TURN SIGNAL CANCELLING CAM

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

NOTE: Before starting this procedure, be certain to turn the steering wheel until the front wheels are in the straight-ahead position.

(1) Place the front wheels in the straight-ahead position.

(2) Remove the driver side airbag module from the steering wheel. Refer to **Driver Side Airbag Module** in the Removal and Installation section of Group 8M - Passive Restraint Systems for the procedures.

(3) Disconnect the steering wheel wire harness connector from the upper clockspring connector receptacle, which is located between the two upper spokes of the armature within the hub cavity of the steering wheel.

(4) Remove the nut that secures the steering wheel armature to the steering column upper shaft, which is located within the hub cavity of the steering wheel.

(5) Pull the steering wheel off of the steering column upper shaft spline using a two-jawed puller (Special Tool C-3894-A) (Fig. 7). When installing the puller onto the steering wheel, be certain that each jaw of the puller is seated in the pocket that is cast into the underside of the steering wheel armature on each side of the hub (Fig. 8). Also, if the clockspring is to be reused, be certain not to damage or deform the clockspring case when positioning the jaws of the puller below the steering wheel armature hub.

(6) Remove the screw that secures the lower tilting steering column shroud to the steering column multi-function switch mounting housing (Fig. 9).

(7) Unsnap the two halves of the tilting steering column shroud from each other and remove both halves from the steering column.

(8) Disconnect the instrument panel wire harness connectors from the lower clockspring connector receptacles, the right multi-function switch connector receptacle and the left multi-function switch connector receptacle.

REMOVAL AND INSTALLATION (Continued)

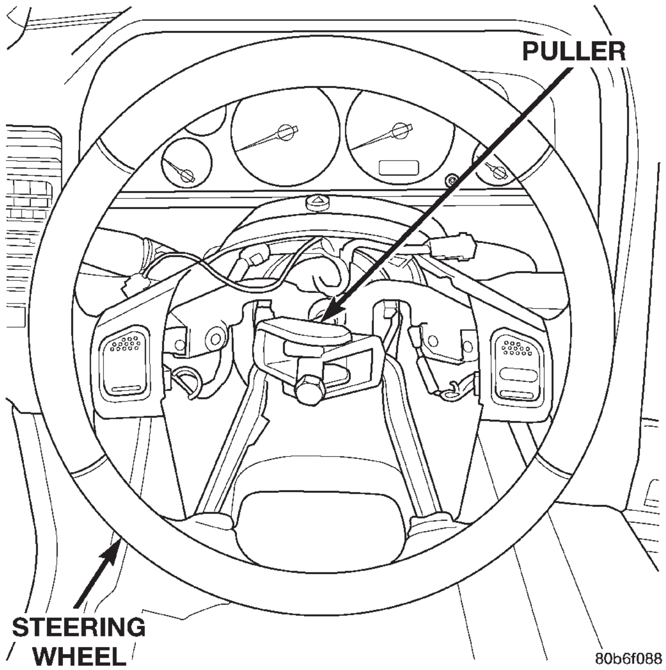


Fig. 7 Steering Wheel Remove/Install

Fig. 8 Steering Wheel Armature Pockets

(9) From the underside of the steering column, remove the one screw that secures the multi-function switch mounting housing to the top of the column housing (Fig. 10).

(10) Pull the multi-function switch mounting housing, the clockspring and both multi-function switches from the top of the steering column as a unit (Fig. 11).

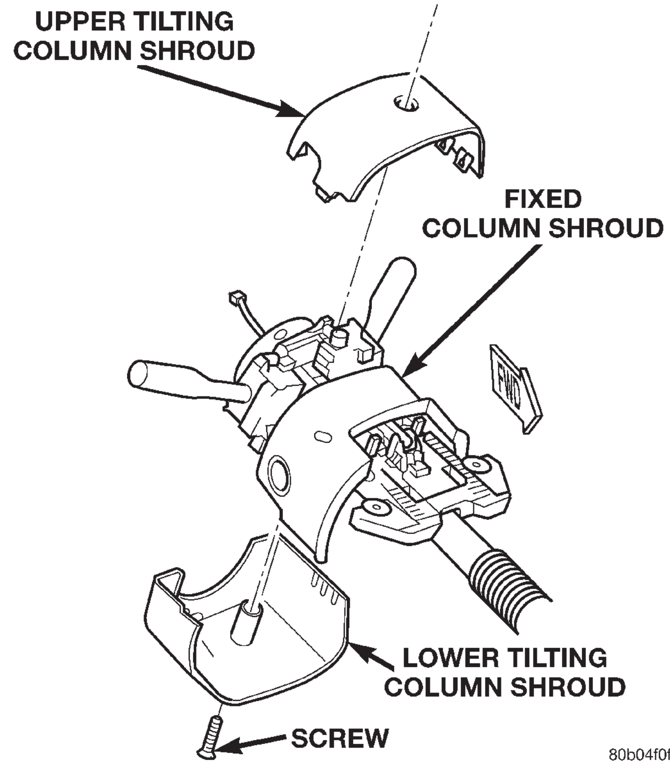


Fig. 9 Steering Column Shrouds Remove/Install

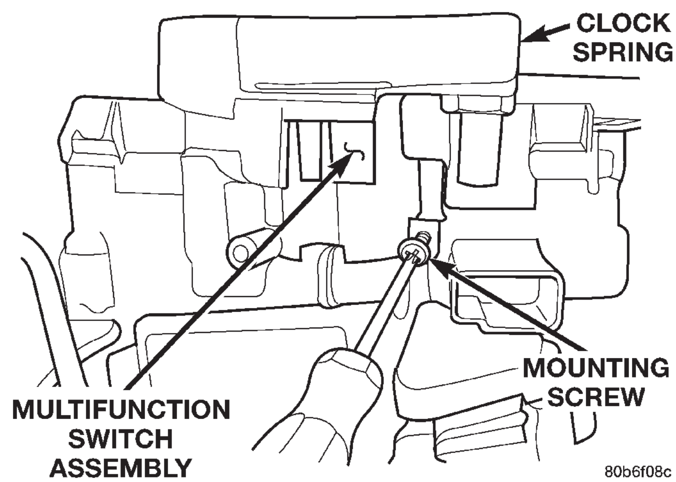


Fig. 10 Multi-Function Switch Mounting Housing Screw Remove/Install

(11) Remove the two screws that secure the clockspring case to the multi-function switch mounting housing (Fig. 12).

(12) Remove the clockspring from the multi-function switch mounting housing.

(13) Remove the turn signal cancelling cam and plastic washer from the multi-function switch mounting housing.

REMOVAL AND INSTALLATION (Continued)

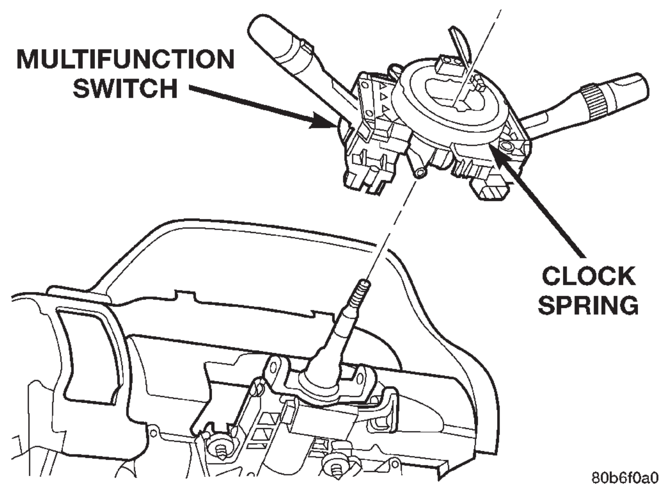


Fig. 11 Multi-Function Switch Mounting Housing Remove/install

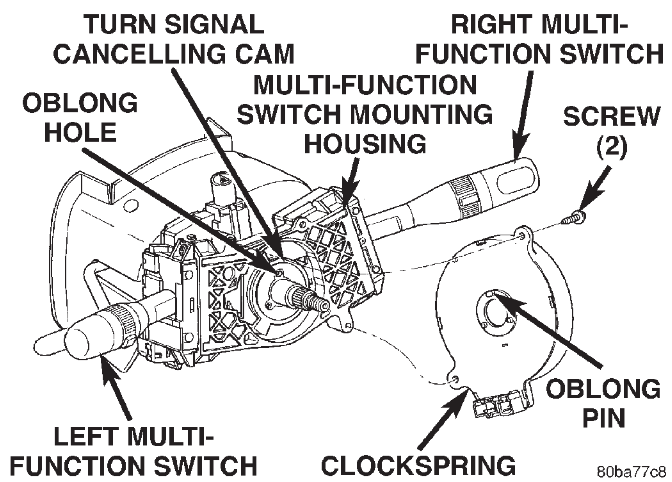


Fig. 12 Clockspring Remove/Install

INSTALLATION

If the clockspring is not properly centered in relation to the steering wheel, steering shaft and steering gear, it may be damaged. Refer to **Clockspring Centering** in the Adjustments section of Group 8M - Passive Restraint Systems before installing or reinstalling a clockspring.

NOTE: Before starting this procedure, be certain that the front wheels are still in the straight-ahead position.

(1) Install the plastic washer over the three legs on the back of the turn signal cancelling cam.

(2) Install the turn signal cancelling cam into the multi-function switch mounting housing. Be certain that the stepped ends of the three legs on the back of the cam are engaged behind the flange at the top of the multi-function switch mounting housing center hub.

(3) Rotate the turn signal cancelling cam in the multi-function switch mounting housing until the alignment hole in the one cam lobe is aligned with the alignment hole in the back of the housing. The oblong hole in the hub of the cam should now be at the top, and the locating tab in the hub of the cam should be at the bottom (Fig. 13).

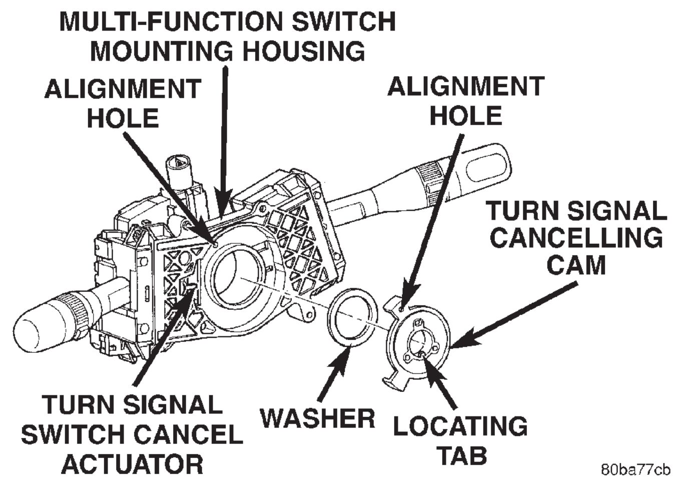


Fig. 13 Turn Signal Cancelling Cam Alignment

(4) slide the clockspring down over the steering column upper shaft.

(5) While holding the centered clockspring hub and case stationary in relationship to each other, align and seat the three pins in the clockspring hub with the three holes in the hub of the turn signal cancelling cam. It should be noted that when the clockspring is properly centered the uppermost pin in the clockspring hub is an oblong pin, and it will only fit in the oblong hole in the hub of the turn signal cancelling cam.

(6) Align and seat the one pin and the two mounting holes on the clockspring case to their respective holes in the multi-function switch mounting housing.

(7) Install and tighten the two clockspring mounting screws. Tighten the screws to 2.5 N·m (22 in. lbs.).

(8) Position the multi-function switch mounting housing, the clockspring and both multi-function switches onto the top of the steering column as a unit. The locating tab in the hub of the turn signal cancelling cam must be engaged with the alignment groove in the bottom of the upper steering column shaft.

(9) From the underside of the steering column, install and tighten the one screw that secures the multi-function switch mounting housing to the top of the column housing. Tighten the screw to 1.9 N·m (17 in. lbs.).

REMOVAL AND INSTALLATION (Continued)

(10) Reconnect the instrument panel wire harness connectors to the lower clockspring connector receptacles, the right multi-function switch connector receptacle and the left multi-function switch connector receptacle.

(11) Position the lower tilting steering column shroud to the steering column.

(12) Install and tighten the screw that secures the shroud to the multi-function switch mounting housing. Tighten the screw to 1.9 N·m (17 in. lbs.).

(13) Position the upper tilting column shroud to the steering column with the hazard warning switch button inserted through the hole in the upper surface of the shroud. Align the upper tilting steering column shroud to the lower shroud and snap the two shroud halves together.

(14) Install the steering wheel to the steering column upper shaft. Be certain to index the alignment splines in the hub of the steering wheel armature with the splines on the shaft. Pull the clockspring wire harness through the hole between the two upper steering wheel armature spokes.

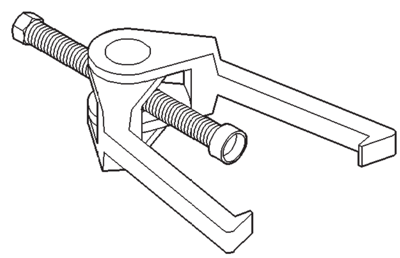
(15) Install and tighten the steering wheel mounting nut. Tighten the nut to 47 N·m (420 in. lbs.). Be certain not to pinch the wire harnesses between the steering wheel and the nut.

(16) Reconnect the steering wheel wire harness connector to the upper clockspring connector receptacle, which is located between the two upper spokes of the armature within the hub cavity of the steering wheel.

(17) Install the driver side airbag module onto the steering wheel. Refer to **Driver Side Airbag Module** in the Removal and Installation section of Group 8M - Passive Restraint Systems for the procedures.

SPECIAL TOOLS

TURN SIGNAL AND HAZARD WARNING SYSTEMS



Puller C-3894-A

WIPER AND WASHER SYSTEMS

CONTENTS

DESCRIPTION AND OPERATION

WINDSHIELD WIPER AND WASHER SYSTEM

DESCRIPTION

An electrically operated intermittent windshield wiper and washer system is standard factory-installed safety equipment on this model. The driver controls all front and rear wiper and washer system functions with the switches that are integral to the wiper and washer (right multi-function) switch mounted on the right side of the steering column. The windshield wiper and washer systems receive ignition switched battery current through a fuse and a circuit breaker in the junction block, and will operate only when the ignition switch is in the Accessory or On positions.

The intermittent wiper system allows the driver to select from two continuous wiper speeds, five intermittent wipe delay periods or a mist mode. This system also has a wipe-after-wash feature that operates the wipers for as long as the washer pump is energized, then provides about three additional sweeps of the wipers after the washer pump is de-energized. The intermittent wipe mode delay times are speed sensitive. Above about sixteen kilometers-per-hour (ten miles-per-hour) the delay is driver adjustable from about one-half second to about eighteen seconds. Below about sixteen kilometers-per-hour (ten miles-per-hour) the delay times are doubled, from about one second to about thirty-six seconds.

The windshield washer system shares its washer reservoir with the rear washer system, but has its own dedicated washer pump and plumbing. The front washer pump is mounted lower in the reservoir than the rear washer pump so that when the washer fluid level becomes low the front washers will continue to operate after the rear washer pump has run dry. Vehicles equipped with the optional Electronic Vehicle Information Center (VIC) have a low washer fluid warning feature that will give the driver an indication when the washer fluid needs to be replenished.

This vehicle also offers several customer programmable features, which allows the selection of several optional electronic features to suit individual preferences. Refer to **ELECTRONIC VEHICLE INFORMATION CENTER PROGRAMMING** in the Service Procedures section of Group 8V - Overhead Console Systems for more information on the customer programmable feature options.

A customer programmable feature option affecting the windshield wiper and washer system is: **Head-**

DESCRIPTION AND OPERATION (Continued)

lamps On With Wipers - This feature is only available on models that are also equipped with the Auto Headlamps option. If this feature is enabled, the headlamps will turn on automatically when the windshield wipers are turned on; and, if the headlamps were turned on automatically when the wipers were turned on, they will turn off automatically when the wipers are turned off.

The windshield wiper and washer system includes the following components:

- Washer fluid level sensor
- Washer reservoir and pump
- Windshield washer nozzle and plumbing
- Windshield wiper arm and blade
- Windshield wiper motor, linkage and pivot module
- Wiper and washer (right multi-function) switch
- Wiper high/low relay
- Wiper on/off relay.

Certain functions and features of the windshield wiper and washer systems rely upon resources shared with other electronic modules in the vehicle over the Programmable Communications Interface (PCI) data bus network. The PCI data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, internal controller hardware, and component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities. For diagnosis of these electronic modules or of the PCI data bus network, the use of a DRB scan tool and the proper Diagnostic Procedures manual are recommended.

The other electronic modules that may affect windshield wiper and washer system operation are as follows:

- **Body Control Module (BCM)** - Refer to **Body Control Module** in the Description and Operation section of Group 8E - Instrument Panel Systems for more information.
- **Electronic Vehicle Information Center (EVIC)** - Refer to **Electronic Vehicle Information Center** in the Description and Operation section of Group 8V - Overhead Console Systems for more information.
- **Powertrain Control Module (PCM)** - Refer to **Powertrain Control Module** in the Description and Operation section of Group 14 - Fuel System for more information.

Refer to **Wipers** in the Contents of Group 8W - Wiring Diagrams for complete circuit diagrams. Following are general descriptions of the major components in the windshield wiper and washer systems.

OPERATION

The vehicle operator selects the desired windshield wiper and washer system functions using the wiper and washer (right multi-function) switch, which is located on the right side of the steering column. The right multi-function switch provides hard wired resistor multiplexed inputs to the BCM for all wiper system functions, except for the high speed wiper motor operation. The high speed wiper motor windings are activated by the wiper high/low relay when the relay control coil is energized through a direct hard wired circuit from the right multi-function switch.

The BCM also is provided with hard wired input from the wiper motor park switch and the windshield washer pump control circuit, along with message inputs received over the PCI data bus from other electronic modules in the vehicle. The BCM uses these inputs and its internal programming to control all other windshield wiper system functions. The BCM controls the low speed wiper motor windings through control outputs to and through the wiper on/off relay. The BCM uses this control of the low speed wiper motor windings to provide the low speed, intermittent, mist, wipe-after-wash and park functions for the windshield wiper system.

The windshield washer system is controlled by a direct hard wired battery current feed from the right multi-function switch to the front washer pump. The BCM monitors this circuit through a hard wired input so that it can provide low speed wiper operation to coincide with washer pump operation and the wipe-after-wash feature.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the windshield wiper and washer systems.

REAR WIPER AND WASHER SYSTEM

DESCRIPTION

An electrically operated intermittent rear wiper and washer system is standard factory-installed equipment on this model. The driver controls all front and rear wiper and washer system functions with the switches that are integral to the wiper and washer (right multi-function) switch mounted on the right side of the steering column. The rear wiper and washer systems are controlled by ignition switched battery current through a fuse in the junction block, and will operate only when the ignition switch is in the Accessory or On positions.

The intermittent rear wiper and washer system allows the driver to select from a continuous fixed-cycle wipe or an intermittent wipe mode. This system also has a wipe-after-wash feature that operates the rear wiper for as long as the washer pump is energized, then provides about three additional sweeps of the wiper after the washer pump is de-energized. The intermittent wipe mode delay time has a fixed delay interval of about five to eight seconds between sweeps.

DESCRIPTION AND OPERATION (Continued)

The rear wiper motor module operates on a separate non-switched battery current feed through a fuse in the junction block. The rear wiper motor parks the rear wiper blade off of the glass if the ignition switch has been turned off while the rear wiper blade was still on the glass. The rear wiper motor also monitors the liftgate and liftgate flip-up glass ajar switch circuits, and will park the rear wiper blade off of the glass any time it senses that the liftgate or the liftgate flip-up glass are ajar. These features ensure that the rear wiper blade will not interfere with or be damaged by the operation of the liftgate or liftgate flip-up glass. Refer to **Liftgate Ajar Switch** and **Liftgate Flip-Up Glass Ajar Switch** in the Vehicle Theft Security System section of Group 8Q - Vehicle Theft/Security Systems for more information on these switches.

The rear washer system shares the washer reservoir of the windshield washer system, but has its own dedicated washer pump and plumbing. The front washer pump is mounted lower in the reservoir than the rear washer pump so that when the washer fluid level becomes low the front washers will continue to operate after the rear washer pump has run dry. Vehicles equipped with the optional Electronic Vehicle Information Center (VIC) have a low washer fluid warning feature that will give the driver an indication when the washer fluid needs to be replenished.

The rear wiper and washer system includes the following components:

- Washer reservoir and pump
- Wiper and washer (right multi-function) switch
- Rear washer nozzle and plumbing
- Rear wiper arm and blade
- Rear wiper arm park ramp
- Rear wiper motor module.

Refer to **Wipers** in the Contents of Group 8W - Wiring Diagrams for complete circuit diagrams. Following are general descriptions of the major components in the windshield wiper and washer systems.

OPERATION

The vehicle operator selects the desired rear wiper and washer system functions using the wiper and washer (right multi-function) switch, which is located on the right side of the steering column. The right multi-function switch provides direct hard wired battery current feeds to the rear wiper module for all rear wiper and washer system functions, and a direct hard wired battery current feed to the rear washer pump for the washer system function.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the rear wiper and washer systems.

REAR WIPER ARM AND BLADE

DESCRIPTION

All Grand Cherokee models have a single 30.48 centimeter (12 inch) rear wiper blade with a non-replaceable rubber element (squeegee). The center of the wiper blade has a molded plastic pivot block with an integral latch that is secured in a U-shaped formation on the end of the wiper arm.

The spring-loaded wiper arm features an over-center hinge. The spring tension of the wiper arm controls the pressure applied to the wiper blade on the glass. The over-center hinge allows the blade to stand off of the liftgate for easy snow removal and cleaning of the glass and squeegee.

The rear wiper arm is secured by a nut to the threaded studs of the rear wiper motor output shaft near the base of the liftgate flip-up glass. A molded plastic cap on the end of the wiper arm pivots and snaps over the end of the arm for a neat appearance. When the rear wiper arm is in its park position, an integral molded plastic support in the middle of the arm is positioned on a molded rubber park ramp on the liftgate. The wiper arm support and the park ramp also provide an alignment reference to ensure accurate rear wiper arm and blade installation.

Caution should be exercised to protect the rubber wiper blade squeegee from any petroleum-based cleaners or contaminants, which will rapidly deteriorate the rubber. Also, wiper squeegees exposed to the elements for a long time tend to lose their wiping effectiveness.

Periodic cleaning of the wiper blade squeegee is suggested to remove deposits of salt and road film. The wiper blades, arm, and rear glass should be cleaned with a sponge or cloth and windshield washer fluid, a mild detergent, or a non-abrasive cleaner. If the squeegee is damaged, worn, or contaminated the wiper blade should be replaced.

The wiper blade and wiper arm are available for service replacement. The wiper arm and wiper blade cannot be adjusted or repaired. If they are faulty or damaged, they must be replaced.

OPERATION

When the wiper blade is moved back and forth across the rear glass, the rubber squeegee of the wiper blade clears the glass of rain, snow and other materials that can obstruct visibility. The spring loaded hinge of the wiper arm determines the pressure applied to the wiper blade on the glass. The multiple bridge formations of the wiper blade help to distribute the wiper arm spring pressure evenly over the length of the squeegee, and allow the squeegee to conform to the contour of the glass.

DESCRIPTION AND OPERATION (Continued)

REAR WASHER NOZZLE AND PLUMBING

DESCRIPTION

The rear washer system plumbing begins at the washer pump near the bottom of the washer reservoir below the left front wheel house extension and between the left inner and outer fenders. The washer reservoir hose is routed from the washer pump up along the washer reservoir filler neck into the engine compartment. Just rearward of the washer reservoir filler neck in the engine compartment an in-line connector joins the hose to the engine compartment hose. The engine compartment hose is routed along the top of the left front fender wheel house to the dash panel. This hose passes through a grommeted hole in the dash panel into the passenger compartment.

Below the instrument panel in the passenger compartment near the left cowl side inner panel, an in-line connector joins the engine compartment hose to the A-pillar hose. The A-pillar hose is routed up the left A-pillar to the headliner. At the headliner, an in-line connector joins the A-pillar hose to the headliner hose. The headliner hose is routed above the headliner and along the left roof side rail to the rear of the vehicle. At the rear of the vehicle, the headliner hose is routed above the headliner and along the upper liftgate opening panel toward the right side of the vehicle. The headliner hose then passes through a grommeted hole in the upper liftgate opening panel and through another grommeted hole into the upper inner liftgate panel to the rear washer nozzle.

The rear washer nozzle is a fluidic type unit that includes an integral check valve. The nozzle has a rubber seal on the back of it and is snapped into a hole in the liftgate outer panel above the liftgate flip-up glass. The washer nozzle is not adjustable. The washer nozzles and hose fittings cannot be repaired and, if faulty or damaged, they must be replaced. The headliner washer hose is integral to the headliner unit and, if faulty or damaged, the headliner unit must be replaced. The remaining hoses for the rear washer system are serviceable.

OPERATION

Pressurized washer fluid is fed through the washer system plumbing to the rear washer nozzle by the rear washer pump on the washer reservoir. The fluidic rear nozzle helps to disperse a fine and even spray over a wide area of the rear glass. The integral rear washer nozzle check valve prevents the washer fluid from draining from the nozzle back to the reservoir or from leaking out of the nozzle after washer operation is complete.

REAR WIPER MOTOR MODULE

DESCRIPTION

The rear wiper motor module is secured with two screws and an integral bracket to two keyed holes in the liftgate inner panel, below the liftgate flip-up glass opening and behind the liftgate trim panel. The motor output shaft passes through the liftgate outer panel where a gasket, bezel and nut seal and secure the output shaft to the liftgate outer panel. A molded plastic nut cover snaps onto the bezel to conceal the nut and improve appearance.

The rear wiper motor module is a self-contained unit. The module contains the wiper motor, transmission, linkage and integral rear wiper system electronic logic and controls. The electronic controls for the motor include an electronic speed control that speeds the wiper blade near the center of the glass, but slows the wiper blade during directional reversals at each end of the wipe pattern and during wiper blade off of the glass parking for quieter operation.

The rear wiper motor module cannot be repaired or adjusted. If faulty or damaged, the entire rear wiper motor module unit must be replaced.

OPERATION

The rear wiper motor module receives non-switched battery current through a fuse in the junction block and is grounded at all times. The module also receives external control inputs from the wiper and washer (right multi-function) switch and the liftgate/liftgate flip-up glass ajar switch circuits. The rear wiper motor module electronic control logic uses these inputs, its internal inputs and its programming to provide continuous wipe, delay wipe, wipe-after-wash and off of the glass wiper blade parking.

WASHER FLUID LEVEL SENSOR

DESCRIPTION

The washer fluid level sensor is mounted near the bottom of the washer reservoir on the forward facing side. A barbed nipple on the sensor is press-fit into a rubber grommet seal installed in the mounting hole on the washer reservoir. The washer fluid level sensor uses a pivoting float to monitor the fluid level in the washer reservoir. The pivoting float opens and closes the switch contacts in the sensor.

The washer fluid level sensor cannot be adjusted or repaired and, if faulty or damaged, the sensor unit must be replaced.

OPERATION

The washer fluid level sensor is hard wired directly to the Body Control Module (BCM). The BCM sends

DESCRIPTION AND OPERATION (Continued)

five volts to the sensor on a single circuit. When the washer fluid level is at or above the float level in the reservoir, the internal switch contacts of the sensor are open. When the washer fluid level in the reservoir falls below the float of the sensor, the float changes position and closes the internal switch contacts of the sensor to ground.

When the BCM senses ground on the circuit, it is programmed to send low washer fluid messages to the Electronic Vehicle Information Center (EVIC) over the Programmable Communications Interface (PCI) data bus. The EVIC is programmed to respond to this message by displaying the Washer Fluid Low warning and sending a chime request message back to the BCM over the PCI data bus. Then the BCM generates an audible chime tone warning.

WASHER RESERVOIR AND PUMP

DESCRIPTION

A single washer fluid reservoir is used for both the windshield and rear washer systems. The washer fluid reservoir is concealed behind the inner fender liner ahead of the left front wheel. The reservoir is secured to the inner fender shield, between the inner and outer fender panels. The washer reservoir filler neck extends upward through a hole in the left front wheelhouse extension into the engine compartment. The washer fluid reservoir has a snap-fit filler cap with a rubber seal. The cap hinges on and is secured to a molded-in hook formation on the rear of the reservoir filler neck. The reservoir also has a provision for a washer fluid level sensor on the forward facing side of the reservoir body.

Each of the two washer pump and motor units has a permanently lubricated and sealed motor coupled to a rotor-type pump. The two washer pump and motor units have a barbed nipple on the inlet side of the pump, which is installed through a rubber grommet seal inserted in a hole near the bottom of the outboard side of the washer reservoir. A smaller barbed nipple on the outlet side of the pump is connected to the washer hose.

Both the washer reservoir and the washer pump and motor units cannot be repaired. If they are faulty or damaged, they must be replaced. The washer reservoir, the grommet seals, the filler cap and the two washer pump and motor units are all available for service replacement.

OPERATION

Washer fluid is gravity-fed from the washer reservoir to the washer pump inlet. One brush of the washer pump motor is grounded at all times. When the washer switch is actuated, battery current is provided to the other brush, energizing the washer pump motor. When the washer pump motor is energized, it spins the pump rotor which pressurizes the washer fluid and forces it out the pump outlet nipple and through the washer plumbing to the washer nozzle(s).

WINDSHIELD WASHER NOZZLE AND PLUMBING

DESCRIPTION

The windshield washer system plumbing begins at the washer pump near the bottom of the washer reservoir below the left front wheel house extension and between the left inner and outer fenders. The washer reservoir hose is routed from the washer pump up along the washer reservoir filler neck into the engine compartment. Just rearward of the washer reservoir filler neck in the engine compartment an in-line connector joins the hose to the engine compartment hose. The engine compartment hose is routed along the top of the left front fender wheel house to the plenum panel. This hose passes through a grommeted hole in the plenum panel into the cowl plenum.

On the left side of the cowl plenum, an in-line connector joins the engine compartment hose to the cowl grille cover hose. The cowl grille cover hose is routed through routing clips on the underside of the cowl grille cover to a wye fitting. The cowl grille cover hose is connected to one nipple on the wye fitting and the two washer nozzle hoses are connected to the other two wye fitting nipples. The washer nozzle hoses are routed along the underside of the cowl grille cover to the two washer nozzles.

The two windshield washer nozzles are fluidic type units. The nozzles are snapped into holes in the cowl grille cover near the base of the windshield. The washer nozzles are not adjustable. The wye fitting contains an integral check valve. The washer nozzles, wye fitting and hose fittings cannot be repaired and, if faulty or damaged, they must be replaced. The washer hoses for the windshield washer system are serviceable.

OPERATION

Pressurized washer fluid is fed through the washer system plumbing to the windshield washer nozzles by the front washer pump on the washer reservoir. The fluidic washer nozzles help to disperse a fine and even spray over a wide area of the windshield glass. The integral wye fitting check valve prevents the washer fluid from draining from the nozzles back to the reservoir or from leaking out of the nozzles after washer operation is complete.

DESCRIPTION AND OPERATION (Continued)

WINDSHIELD WIPER ARM AND BLADE

DESCRIPTION

All Grand Cherokee models have two 50.8 centimeter (20 inch) long windshield wiper blades with non-replaceable rubber elements (squeegees). The center of the wiper blade has a molded plastic pivot block with an integral latch that is secured in a U-shaped formation on the end of the wiper arm.

The spring-loaded wiper arms feature over-center hinges. The spring tension of the wiper arm controls the pressure applied to the wiper blade on the glass. The over-center hinges allow the blades to stand off of the glass for easy snow removal and cleaning of the glass and squeegees.

The windshield wiper arms are secured by a nut to the threaded studs on the two wiper pivots near the base of the windshield. A molded plastic cap fits over the nut for a neat appearance. Alignment marks molded into the windshield near the base of the glass ensure accurate wiper arm and blade installation.

Caution should be exercised to protect the rubber wiper blade squeegees from any petroleum-based cleaners or contaminants, which will rapidly deteriorate the rubber. Also, wiper squeegees exposed to the elements for a long time tend to lose their wiping effectiveness.

Periodic cleaning of the wiper blade squeegees is suggested to remove deposits of salt and road film. The wiper blades, arms, and windshield glass should be cleaned with a sponge or cloth and windshield washer fluid, a mild detergent, or a non-abrasive cleaner. If the squeegees are damaged, worn, or contaminated the wiper blades should be replaced.

The wiper blades and wiper arms are available for service replacement. The wiper arms and wiper blades cannot be adjusted or repaired. If they are faulty or damaged, they must be replaced.

OPERATION

When the wiper blades are moved back and forth across the windshield glass, the rubber squeegees of the wiper blade clear the glass of rain, snow and other materials that can obstruct visibility. The spring loaded hinges of the wiper arms determine the pressure applied to the wiper blade on the glass. The multiple bridge formations of the wiper blade help to distribute the wiper arm spring pressure evenly over the length of the squeegee, and allow the squeegee to conform to the contour of the glass.

WINDSHIELD WIPER MOTOR, PIVOT AND LINKAGE MODULE

DESCRIPTION

The windshield wiper motor, pivot and linkage module is secured with four screws through rubber isolators to the cowl plenum panel beneath the cowl plenum cover/grille panel. The two-speed permanent magnet windshield wiper motor has an integral transmission and park switch. The park switch opens and closes as the wiper motor operates. When the wipers are up off the base of the windshield, the park switch is closed; and, when the wipers are near the base of the windshield (parked), the park switch is open. The wiper motor is secured below the center of the module bracket with three screws. The wiper motor output shaft passes through a clearance hole, where a nut secures the wiper motor crank arm to the motor output shaft above the module bracket.

The two wiper pivots are secured at the ends of the module bracket. The two wiper pivot lever arms and the wiper motor crank arm each have ball studs on their ends. The motor crank arm ball stud is the longer of the three. Two drive links connect the motor crank arm to the pivot lever arms. The passenger side drive link has a plastic socket-type bushing on each end. The driver side drive link has a plastic socket-type bushing on one end, and a plastic sleeve-type bushing on the other end. The socket-type bushing on one end of each drive link is snap-fit over the ball stud on the lever arm of its respective pivot. The driver side drive link sleeve-type bushing end is then fit over the motor crank arm ball stud, and the other socket-type bushing of the passenger side drive link is snap-fit over the exposed end of the motor crank arm ball stud.

The wiper motor, pivots, linkage, bushings, motor crank arm and mounting bracket are only serviced as a complete unit. If any part of this unit is faulty or damaged, the entire wiper motor pivot and linkage module must be replaced.

OPERATION

The windshield wiper motor speed is controlled by current flow to the proper set of brushes. When the wiper motor is turned on, the park switch provides the Body Control Module (BCM) with a pulse signal that allows the BCM wiper system logic to monitor the number and frequency of the wipe cycles. When the wiper motor is turned off, the closed park switch (wipers up) provides battery voltage to the wiper motor until the park switch opens (wipers down or parked). The wiper motor crank arm, linkage and pivots convert the rotary action of the wiper motor output shaft to the back and forth wiping motion of the wiper arms and blades.

DESCRIPTION AND OPERATION (Continued)

WIPER SWITCH AND WASHER SWITCH

DESCRIPTION

All of the windshield and rear wiper and washer system switches are integral to the right (wiper) multi-function switch unit, which is secured to the right side of the multi-function switch mounting housing at the top of the steering column (Fig. 1). The only visible part of the right multi-function switch is the control stalk that extends from the right side of the steering column. The right multi-function switch control stalk has both nomenclature and international control symbols on it, which identify its many functions. The remainder of the right multi-function switch is concealed beneath the steering column shrouds.

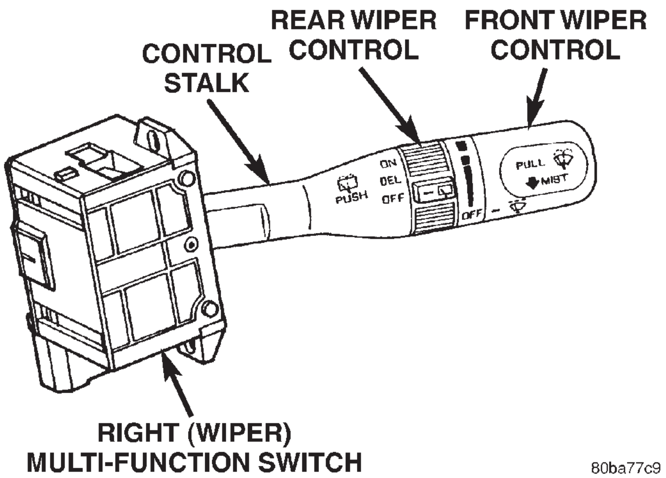


Fig. 1 Right (Wiper) Multi-Function Switch

The wiper and washer system switches cannot be repaired. If these switches or any other circuit or component of the right multi-function switch unit is faulty or damaged, the entire right multi-function switch unit must be replaced.

OPERATION

A rotary switch knob on the end of the right multi-function switch control stalk is rotated to select the desired windshield wiper continuous speed setting or one of five intermittent wipe mode delay intervals. The control stalk is pulled toward the driver to activate the windshield washer system. The control stalk is moved downward to activate the windshield wiper mist function.

A rotary switch ring on the right multi-function switch stalk just below the windshield wiper switch knob controls the rear wiper system functions. The switch ring is rotated to select the rear wiper delay or continuous wipe modes. The control stalk is pushed away from the driver, toward the instrument panel to activate the rear washer system.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the wiper and washer (right multi-function) switches.

WIPER HIGH/LOW RELAY

DESCRIPTION

The wiper high/low relay is a electromechanical device that switches battery current from the wiper motor low speed coil windings to the high speed coil windings when the wiper and washer (right multi-function) switch grounds the relay coil. The wiper high/low relay is located in the Power Distribution Center (PDC) in the engine compartment. See the fuse and relay layout label affixed to the inside surface of the PDC cover for wiper high/low relay identification and location.

The wiper high/low relay is a International Standards Organization (ISO) micro-relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions. The ISO micro-relay terminal functions are the same as a conventional ISO relay. However, the ISO micro-relay terminal pattern (or footprint) is different, the current capacity is lower, and the physical dimensions are smaller than those of the conventional ISO relay.

The wiper high/low relay cannot be repaired or adjusted and, if faulty or damaged, it must be replaced.

OPERATION

The ISO relay consists of an electromagnetic coil, a resistor or diode, and three (two fixed and one movable) electrical contacts. The movable (common feed) relay contact is held against one of the fixed contacts (normally closed) by spring pressure. When the electromagnetic coil is energized, it draws the movable contact away from the normally closed fixed contact, and holds it against the other (normally open) fixed contact.

When the electromagnetic coil is de-energized, spring pressure returns the movable contact to the normally closed position. The resistor or diode is connected in parallel with the electromagnetic coil in the relay, and helps to dissipate voltage spikes that are produced when the coil is de-energized.

WIPER ON/OFF RELAY

DESCRIPTION

The wiper on/off relay is a electromechanical device that switches battery current to the wiper high/low relay when the Body Control Module (BCM) grounds the relay coil. The wiper on/off relay is located in the

DESCRIPTION AND OPERATION (Continued)

Power Distribution Center (PDC) in the engine compartment. See the fuse and relay layout label affixed to the inside surface of the PDC cover for wiper on/off relay identification and location.

The wiper on/off relay is a International Standards Organization (ISO) micro-relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions. The ISO micro-relay terminal functions are the same as a conventional ISO relay. However, the ISO micro-relay terminal pattern (or footprint) is different, the current capacity is lower, and the physical dimensions are smaller than those of the conventional ISO relay.

The wiper on/off relay cannot be repaired or adjusted and, if faulty or damaged, it must be replaced.

OPERATION

The ISO relay consists of an electromagnetic coil, a resistor or diode, and three (two fixed and one movable) electrical contacts. The movable (common feed) relay contact is held against one of the fixed contacts (normally closed) by spring pressure. When the electromagnetic coil is energized, it draws the movable contact away from the normally closed fixed contact, and holds it against the other (normally open) fixed contact.

When the electromagnetic coil is de-energized, spring pressure returns the movable contact to the normally closed position. The resistor or diode is connected in parallel with the electromagnetic coil in the relay, and helps to dissipate voltage spikes that are produced when the coil is de-energized.

DIAGNOSIS AND TESTING

WINDSHIELD WIPER SYSTEM

Following are tests that will help to diagnose the hard wired components and circuits of the windshield wiper system. However, these tests may not prove conclusive in the diagnosis of this system. In order to obtain conclusive testing of the windshield wiper system, the Programmable Communications Interface (PCI) data bus network and all of the electronic modules that provide inputs to, or receive outputs from the windshield wiper system components must be checked.

The most reliable, efficient, and accurate means to diagnose the windshield wiper system requires the use of a DRB scan tool and the proper Diagnostic Procedures manual. The DRB scan tool can provide confirmation that the PCI data bus is functional, that all of the electronic modules are sending and receiving the proper messages on the PCI data bus, and that the wiper on/off and wiper high/low relays are being sent the proper hard wired outputs by the Body Control Module (BCM) for them to perform their windshield wiper system functions.

For complete circuit diagrams, refer to **Wipers** in the Contents of Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Check the fused ignition switch output (run/accessory) fuse in the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run/accessory) fuse in the junction block. If OK, go to Step 3. If not OK, repair the open fused ignition switch output (run/accessory) circuit to the ignition switch as required.

(3) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Disconnect the instrument panel wire harness connector from the wiper and washer (right multi-function) switch connector receptacle. Connect the battery negative cable. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output circuit cavity of the instrument panel wire harness connector for the wiper and washer switch. If OK, go to Step 4. If not OK, repair the open circuit to the junction block fuse as required.

(4) Disconnect the 22-way instrument panel wire harness connector from the Body Control Module (BCM). Check for continuity between the windshield wiper switch return circuit cavity of the instrument panel wire harness connector for the wiper and washer switch and a good ground. There should be no continuity. If OK, go to Step 5. If not OK, repair the shorted windshield wiper switch return circuit to the BCM as required.

(5) Check for continuity between the windshield wiper switch return circuit cavities of the instrument panel wire harness connector for the wiper and washer switch and the 22-way instrument panel wire harness connector for the BCM. There should be continuity. If OK, go to Step 6. If not OK, repair the open windshield wiper switch return circuit to the BCM as required.

(6) Check for continuity between the windshield wiper switch mux circuit cavity of the instrument

DIAGNOSIS AND TESTING (Continued)

panel wire harness connector for the wiper and washer switch and a good ground. There should be no continuity. If OK, go to Step 7. If not OK, repair the shorted windshield wiper switch mux circuit to the BCM as required.

(7) Check for continuity between the windshield wiper switch mux circuit cavities of the instrument panel wire harness connector for the wiper and washer switch and the 22-way instrument panel wire harness connector for the BCM. There should be continuity. If OK, reconnect the 22-way instrument panel wire harness connector to the BCM connector receptacle and go to Step 8. If not OK, repair the open windshield wiper switch mux circuit to the BCM as required.

(8) Refer to **Wiper and Washer Switch** in the Diagnosis and Testing section of this group. If the wiper and washer switch tests OK, reconnect the instrument panel wire harness connector to the wiper and washer switch connector receptacle and go to Step 9. If the wiper and washer switch does not test OK, replace the faulty wiper and washer switch.

(9) If the problem being diagnosed is that the wiper blades do not park, but all other functions are OK, go to Step 10. If the problem being diagnosed is that the wipers will operate in low speed when an intermittent delay is selected and the wiper blades do not park, go to Step 11. If the problem being diagnosed is no wiper operation in any mode, go to Step 14. If the problem being diagnosed is that the wipers will not operate in high speed, go to Step 18.

(10) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Backprobe the fused ignition switch output (V6) circuit cavity of the left headlamp and dash wire harness connector at the windshield wiper motor. Reconnect the battery negative cable. Turn the ignition switch to the On position. Check for battery voltage. If OK, go to Step 11. If not OK, repair the open fused ignition switch output (V6) circuit to the junction block wiper system circuit breaker as required.

(11) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Disconnect the left headlamp and dash wire harness connector from the windshield wiper motor connector receptacle. Disconnect the 52-way (C2) instrument panel wire harness connector from the junction block connector receptacle. Check for continuity between the wiper park switch sense circuit cavity of the left headlamp and dash wire harness connector for the windshield wiper motor and a good ground. There should be no continuity. If OK, go to Step 12. If not OK, repair the shorted wiper park switch sense circuit as required.

(12) Check for continuity between the wiper park switch sense circuit cavities of the left headlamp and dash wire harness connector for the windshield wiper motor and the 52-way (C2) instrument panel wire harness connector for the junction block. There should be continuity. If OK reconnect the 52-way (C2) instrument panel wire harness connector to the junction block connector receptacle and go to Step 13. If not OK, repair the open wiper park switch sense circuit as required.

(13) Reconnect the left headlamp and dash wire harness connector to the windshield wiper motor connector receptacle. Reconnect the battery negative cable. Turn the ignition switch to the On position. Backprobe the wiper park switch sense circuit cavity of the left headlamp and dash wire harness connector at the windshield wiper motor. Check for battery voltage. With the wiper switch in the Low or High position, the meter should switch between battery voltage and zero volts. Turn the wiper switch to the Off position and the meter should read battery voltage until the wiper blades park, and then read a steady zero volts. If OK, use a DRB scan tool and the proper Diagnostic Procedures manual to diagnose the BCM. If not OK, replace the faulty windshield wiper motor.

(14) Backprobe the ground circuit cavity of the left headlamp and dash wire harness connector at the windshield wiper motor. Check for continuity to a good ground. There should be continuity. If OK, go to Step 15. If not OK, repair the open ground circuit to ground as required.

(15) Remove the wiper system circuit breaker from the junction block. Reconnect the battery negative cable. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run/accessory) cavity for the wiper system circuit breaker in the junction block. If OK, go to Step 16. If not OK, repair the open fused ignition switch output (run/accessory) circuit to the ignition switch as required.

(16) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Install the wiper system circuit breaker in the junction block. Reconnect the battery negative cable. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (V6) circuit cavity for the wiper system circuit breaker in the junction block. If OK, go to Step 17. If not OK, replace the faulty wiper system circuit breaker.

(17) Refer to **Wiper On/Off Relay** in the Diagnosis and Testing section of this group. If the wiper on/off relay tests OK, go to Step 18. If the wiper on/off relay does not test OK, replace the faulty wiper on/off relay.

(18) Refer to **Wiper High/Low Relay** in the Diagnosis and Testing section of this group. If the wiper

DIAGNOSIS AND TESTING (Continued)

high/low relay tests OK, replace the faulty windshield wiper motor. If the wiper on/off relay does not test OK, replace the faulty wiper high/low relay.

REAR WIPER SYSTEM

For complete circuit diagrams, refer to **Wipers** in the Contents of Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Check that the interior lighting switch on the control stalk of the left multi-function switch is not in the dome lamp disable position. Open the liftgate. The interior lamps should light. Close all four doors, the liftgate and the liftgate flip-up glass. Note whether the interior lamps remain lighted. They should turn off after about thirty seconds. If OK, go to Step 2. If not OK, go to Step 9.

(2) Check the fused B(+) fuse in the junction block. If OK, go to Step 3. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(3) Check for battery voltage at the fused B(+) fuse in the junction block. If OK, go to Step 4. If not OK, repair the open fused B(+) circuit to the Power Distribution Center (PDC) fuse as required.

(4) Check the fused ignition switch output (run/accessory) fuse in the junction block. If OK, go to Step 5. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(5) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run/accessory) fuse in the junction block. If OK, turn the ignition switch to the Off position and go to Step 6. If not OK, repair the open fused ignition switch output (run/accessory) circuit to the ignition switch as required.

(6) Disconnect and isolate the battery negative cable. Disconnect the instrument panel wire harness connector from the wiper and washer (right multi-function) switch connector receptacle. Reconnect the battery negative cable. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run/accessory) circuit cavity of the instrument panel wire harness connector for the wiper and washer switch. If OK, go to Step 7. If not OK, repair the open fused ignition switch output (run/accessory) circuit to the junction block fuse as required.

(7) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Refer to **Wiper and Washer Switch** in the Diagnosis and Testing section of this group. If the wiper and washer switch tests OK, reconnect the instrument panel wire harness connector to the wiper and washer switch connector receptacle and go to Step 8. If the wiper and washer switch does not test OK, replace the faulty wiper and washer switch.

(8) Remove the liftgate inner trim panel. Disconnect the liftgate wire harness connector from the rear wiper motor module connector receptacle. Check for continuity between the ground circuit cavity of the liftgate wire harness connector for the rear wiper motor module and a good ground. There should be continuity. If OK, go to Step 9. If not OK, repair the open ground circuit to ground as required.

(9) Check for continuity between the liftgate ajar switch sense circuit cavity of the liftgate wire harness connector for the rear wiper motor module and a good ground. There should be continuity with the liftgate and/or the liftgate flip-up glass open, and no continuity with the liftgate and the liftgate flip-up glass closed. If OK, go to Step 10. If not OK, repair the liftgate and/or the liftgate flip-up glass ajar circuits as required.

(10) Reconnect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the liftgate wire harness connector for the rear wiper motor module. If OK, go to Step 11. If not OK, repair the open fused B(+) circuit to the junction block fuse as required.

(11) Turn the ignition switch to the On position. Turn the rear wiper switch to the Delay position. Check for battery voltage at the rear wiper motor intermittent control circuit cavity of the liftgate wire harness connector for the rear wiper motor module. If OK, go to Step 12. If not OK, repair the open rear wiper motor intermittent control circuit to the wiper and washer switch as required.

(12) Turn the rear wiper switch to the On position. Check for battery voltage at the rear wiper motor control circuit cavity of the liftgate wire harness connector for the rear wiper motor module. If OK, replace the faulty rear wiper motor module. If not OK, repair the open rear wiper motor control circuit to the wiper and washer switch as required.

WASHER SYSTEM

WINDSHIELD

The diagnosis found here addresses an inoperative windshield washer system or wipe-after-wash feature. If the washer pump operates, but no washer fluid is emitted from the washer nozzles, be certain to check the fluid level in the reservoir. Check for ice

DIAGNOSIS AND TESTING (Continued)

or other foreign material in the reservoir, and for pinched, disconnected, broken, or incorrectly routed washer system plumbing. For complete circuit diagrams, refer to **Wipers** in the Contents of Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Turn the ignition switch to the On position. Turn the windshield wiper switch to the Low or High speed position. Check whether the windshield wipers operate. If OK, go to Step 2. If not OK, refer to **Windshield Wiper System** in the Diagnosis and Testing section of this group.

(2) Turn the wiper switch to the Off position. Actuate the windshield washer switch. The washer pump should operate and the windshield wipers should operate for about three sweep cycles after the switch is released before they park. If the wipers are OK, but the washers are not, go to Step 3. If the washers are OK, but the wipers are not, go to Step 5.

(3) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Disconnect the left headlamp and dash wire harness connector from the front washer pump connector receptacle. Check for continuity between the ground circuit cavity of the left headlamp and dash wire harness connector for the front washer pump and a good ground. There should be continuity. If OK, go to Step 4. If not OK, repair the open ground circuit to ground as required.

(4) Reconnect the battery negative cable. Turn the ignition switch to the On position. With the windshield washer switch activated, check for battery voltage at the washer pump control switch output circuit cavity of the left headlamp and dash wire harness connector for the front washer pump. If OK, replace the faulty washer pump. If not OK, repair the open washer pump control switch output circuit to the wiper and washer (right multi-function) switch as required.

(5) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Disconnect the 22-way instrument panel wire harness connector from the Body Control Module (BCM) connector receptacle. Reconnect the battery negative cable. Turn the ignition switch to the On position. With the windshield washer switch activated, check for battery voltage at the washer pump control switch output circuit cavity of the 22-way instrument panel wire harness connector for the BCM. If OK, use a DRB scan tool and the proper Diagnostic Procedures manual to diagnose the BCM. If not OK, repair the open washer pump control switch output circuit to the wiper and washer (right multi-function) switch as required.

REAR

The diagnosis found here addresses an inoperative rear washer system. If the washer pump operates, but no washer fluid is emitted from the washer nozzles, be certain to check the fluid level in the reservoir. Check for ice or other foreign material in the reservoir, and for pinched, disconnected, broken, or incorrectly routed washer system plumbing. For complete circuit diagrams, refer to **Wipers** in the Contents of Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Turn the ignition switch to the On position. Turn the rear wiper switch to the On position. Check whether the rear wiper system is operating. If OK, go to Step 2. If not OK, refer to **Rear Wiper System** in the Diagnosis and Testing section of this group.

(2) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Disconnect the left headlamp and dash wire harness connector from the rear washer pump connector receptacle. Check for continuity between the ground circuit cavity of the left headlamp and dash wire harness connector for the rear washer pump and a good ground. There should be continuity. If OK, go to Step 3. If not OK, repair the open ground circuit to ground as required.

(3) Connect the battery negative cable. Turn the ignition switch to the On position. With the rear washer switch actuated, check for battery voltage at the rear washer motor control circuit cavity of the left headlamp and dash wire harness connector for the rear washer pump. If OK, replace the faulty rear washer pump. If not OK, repair the open rear washer motor control circuit to the wiper and washer (right multi-function) switch as required.

DIAGNOSIS AND TESTING (Continued)

WIPER AND WASHER SWITCH

The windshield and rear wiper switches and the windshield and rear washer switches are integral to the right multi-function switch. Refer to **Windshield Wiper System** or **Rear Wiper System** in the Diagnosis and Testing section of this group before testing the right multi-function switch. For complete circuit diagrams, refer to **Wipers** in the Contents of Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Disconnect the instrument panel wire harness connector from the right multi-function switch connector receptacle.

(3) Using an ohmmeter, perform the continuity and resistance tests at the terminals in the switch connector receptacle as shown in the Right Multi-Function Switch Test chart (Fig. 2).

(4) If the right multi-function switch fails any of the continuity or resistance tests, replace the faulty right multi-function switch unit as required.

WIPER HIGH/LOW RELAY

The wiper high/low relay (Fig. 3) is located in the Power Distribution Center (PDC) between the battery and the fender on the right side of the engine compartment. See the fuse and relay layout label affixed to the inside surface of the PDC cover for wiper high/low relay identification and location. For complete circuit diagrams, refer to **Wipers** in the Contents of Group 8W - Wiring Diagrams.

(1) Remove the wiper high/low relay from the PDC. Refer to **Wiper Relays** in the Removal and Installation section of this group for the procedures.

(2) A relay in the de-energized position should have continuity between terminals 87A and 30, and no continuity between terminals 87 and 30. If OK, go to Step 3. If not OK, replace the faulty relay.

(3) Resistance between terminals 85 and 86 (electromagnet) should be 75 ± 5 ohms. If OK, go to Step 4. If not OK, replace the faulty relay.

(4) 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, perform the Relay Circuit Test that follows. If not OK, replace the faulty relay.

RELAY CIRCUIT TEST

(1) The relay common feed terminal cavity (30) is connected to the common feed terminal of the wiper on/off relay. When the wiper high/low relay is de-energized, this terminal connects the wiper on/off relay output circuit to the windshield wiper motor low speed coil. When the wiper high/low relay is energized, this terminal connects the wiper on/off relay output circuit to the windshield wiper motor high speed coil. There should be continuity between the cavity for terminal 30 of the wiper high/low relay and the cavity for terminal 30 of the wiper on/off relay at all times. If OK, go to Step 2. If not OK, repair the open wiper on/off relay output circuit to the common feed terminal cavity for the wiper on/off relay in the PDC as required.

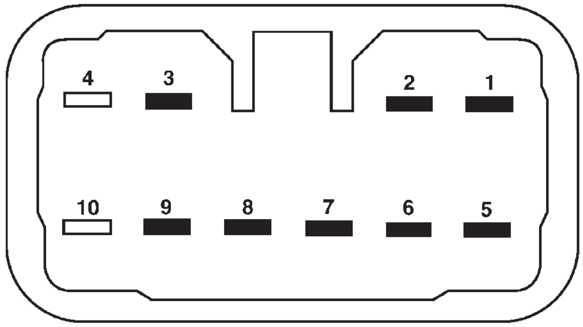
(2) The relay normally closed terminal (87A) is connected to the wiper high/low relay low speed output circuit. There should be continuity between the cavity for terminal 87A of the wiper high/low relay and the wiper high/low relay low speed output circuit terminal cavity of the windshield wiper motor connector at all times. If OK, go to Step 3. If not OK, repair the open wiper high/low relay low speed output circuit to the windshield wiper motor as required.

(3) The relay normally open terminal (87) is connected to the wiper high/low relay high speed output circuit. There should be continuity between the cavity for terminal 87 of the wiper high/low relay and the wiper high/low relay high speed output circuit terminal cavity of the windshield wiper motor connector at all times. If OK, go to Step 4. If not OK, repair the open wiper high/low relay high speed output circuit to the windshield wiper motor as required.

(4) The coil battery terminal (86) is connected to the wiper high/low relay control circuit. There should be battery voltage at the cavity for terminal 86 of the wiper high/low relay when the ignition switch is in the On or Accessory positions and the wiper switch is in the High position. If OK, go to Step 5. If not OK, repair the open wiper high/low relay control circuit to the wiper and washer (right multi-function) switch as required.

(5) The coil ground terminal (85) is connected to the ground circuit and should be grounded at all times. Check for continuity between the cavity for terminal 85 of the wiper high/low relay and a good ground. If OK, refer to **Wiper On/Off Relay** in the Diagnosis and Testing section of this group. If not OK, repair the open ground circuit to ground as required.

DIAGNOSIS AND TESTING (Continued)



RIGHT (WIPER) MULTI-FUNCTION SWITCH			
FRONT WIPERS SWITCH TESTS			
SWITCH POSITION	CONTINUITY BETWEEN	RESISTANCE BETWEEN	RESISTANCE RANGE (OHMS)
Off	—	Pins 7 & 8	4286-4379
Intermittent Wipe Position 1	—	Pins 7 & 8	1445-1480
Intermittent Wipe Position 2	—	Pins 7 & 8	847- 870
Intermittent Wipe Position 3	—	Pins 7 & 8	556- 573
Intermittent Wipe Position 4	—	Pins 7 & 8	367- 380
Intermittent Wipe Position 5	—	Pins 7 & 8	218-229
Low Speed	—	Pins 7 & 8	99-106
High Speed	Pins 1 & 9	Pins 7 & 8	99-106
Mist	—	Pins 7 & 8	49-56
Wash	Pins 1 & 3	—	—

REAR WIPER SWITCH TESTS			
SWITCH POSITION	CONTINUITY BETWEEN	RESISTANCE BETWEEN	RESISTANCE RANGE (OHMS)
Off	—	—	—
Delay	Pins 1 & 6	—	—
On	Pins 1 & 5	—	—
Wash	Pins 1 & 5 & 6	—	—

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Fig. 2 Right Multi-Function Switch Test

DIAGNOSIS AND TESTING (Continued)

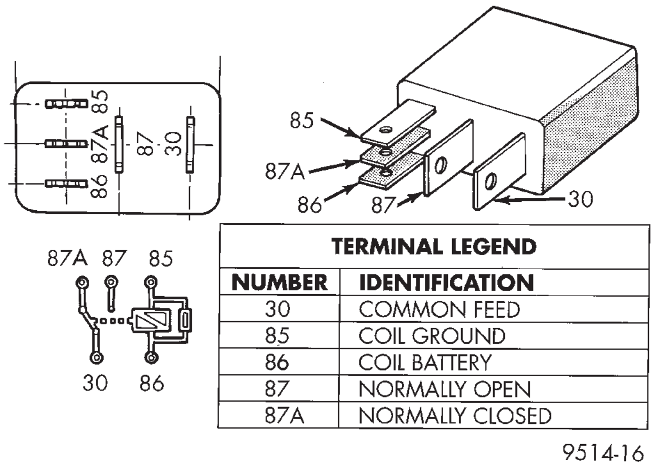


Fig. 3 Wiper High/Low Relay

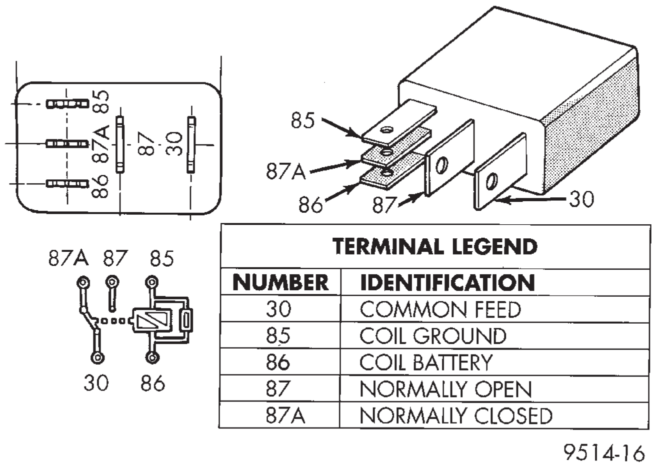


Fig. 4 Wiper On/Off Relay

WIPER ON/OFF RELAY

The wiper on/off relay (Fig. 4) is located in the Power Distribution Center (PDC) between the battery and the fender on the right side of the engine compartment. See the fuse and relay layout label affixed to the inside surface of the PDC cover for wiper on/off relay identification and location. For complete circuit diagrams, refer to **Wipers** in the Contents of Group 8W - Wiring Diagrams.

(1) Remove the wiper on/off relay from the PDC. Refer to **Wiper Relays** in the Removal and Installation section of this group for the procedures.

(2) A relay in the de-energized position should have continuity between terminals 87A and 30, and no continuity between terminals 87 and 30. If OK, go to Step 3. If not OK, replace the faulty relay.

(3) Resistance between terminals 85 and 86 (electromagnet) should be 75 ± 5 ohms. If OK, go to Step 4. If not OK, replace the faulty relay.

(4) 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, perform the Relay Circuit Test that follows. If not OK, replace the faulty relay.

RELAY CIRCUIT TEST

(1) The relay common feed terminal cavity (30) is connected to the common feed terminal of the wiper high/low relay. When the wiper on/off relay is de-energized, this terminal connects the wiper park switch sense circuit to the wiper high/low relay. When the wiper on/off relay is energized, this terminal connects the fused ignition switch output from the wiper system circuit breaker to the wiper high/low relay. There should be continuity between the cavity for terminal 30 of the wiper on/off relay and the cavity for terminal 30 of the wiper high/low relay at all times. If OK, go to Step 2. If not OK, repair the open wiper on/off relay output circuit to the common feed terminal cavity for the wiper high/low relay in the PDC as required.

(2) The relay normally closed terminal (87A) is connected to the wiper park switch sense circuit. There should be continuity between the cavity for terminal 87A of the wiper on/off relay and the wiper park switch sense circuit cavity of the windshield wiper motor connector at all times. If OK, go to Step 3. If not OK, repair the open wiper park switch sense circuit to the windshield wiper motor as required.

(3) The relay normally open terminal (87) is connected to the fused ignition switch output circuit. There should be battery voltage at the cavity for terminal 87 of the wiper on/off relay when the ignition switch is in the On or Accessory positions. If OK, go to Step 4. If not OK, repair the open fused ignition switch output circuit to the wiper system circuit breaker in the junction block as required.

(4) The coil battery terminal (86) is also connected to the fused ignition switch output circuit. There should be battery voltage at the cavity for terminal 86 of the wiper on/off relay when the ignition switch is in the On or Accessory positions. If OK, go to Step 5. If not OK, repair the open fused ignition switch output circuit to the wiper system circuit breaker in the junction block as required.

(5) The coil ground terminal (85) is connected to the wiper on/off relay control circuit. It is grounded by the Body Control Module (BCM) to energize the wiper on/off relay. There should be continuity between the cavity for terminal 85 of the wiper on/off relay and the wiper on/off relay control circuit cavity of the 26-way instrument panel wire harness connector for the BCM at all times. If OK, use a DRB scan tool and the proper Diagnostic Procedures manual to diagnose the BCM. If not OK, repair the open wiper on/off relay control circuit to the BCM as required.

REMOVAL AND INSTALLATION

WIPER BLADE

REMOVAL

WINDSHIELD

(1) Lift the wiper arm and blade off of the windshield glass until the wiper arm hinge is in its over-center position.

(2) Depress the latch release tab located on the bottom of the plastic wiper blade pivot block near the center of the blade and at the end of the wiper arm (Fig. 5).

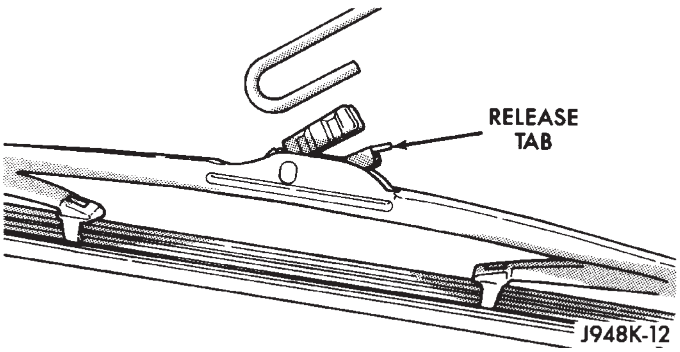


Fig. 5 Wiper Blade Remove/Install - Typical

(3) Slide the wiper blade down the wiper arm towards the wiper pivot at the base of the windshield.

(4) Push the lower end of the wiper blade away from the underside of the wiper arm far enough for the plastic wiper blade pivot block to clear the hook formation on the end of the arm.

(5) Disengage the wiper blade from the wiper arm.

REAR

(1) Disengage the rear wiper arm support from the rubber rear wiper arm park ramp on the right side of the liftgate just below the flip-up glass.

(2) Lift the wiper arm and blade away from the liftgate until the wiper arm hinge is in its over-center position.

(3) Depress the latch release tab located on the bottom of the plastic wiper blade pivot block near the center of the blade and at the end of the wiper arm (Fig. 5).

(4) Slide the wiper blade down the wiper arm towards the rear wiper motor output shaft below the center of the liftgate flip-up glass.

(5) Push the lower end of the wiper blade away from the underside of the wiper arm far enough for the plastic wiper blade pivot block to clear the hook formation on the end of the arm.

(6) Disengage the wiper blade from the wiper arm.

INSTALLATION

WINDSHIELD

(1) Position the wiper blade to the underside of the wiper arm.

NOTE: The notched retainer end of the wiper element should always be oriented towards the end of the wiper blade that is nearest to the wiper pivot.

(2) Engage the wiper blade pivot block with the hook formation on the end of the wiper arm.

(3) Slide the wiper blade up the wiper arm towards the hook formation until the plastic pivot block latch has fully engaged. Latch engagement will be accompanied by an audible click.

(4) Lower the wiper arm and blade gently onto the windshield glass.

REAR

(1) Position the wiper blade to the underside of the wiper arm.

NOTE: The notched retainer end of the wiper element should always be oriented towards the end of the wiper blade that is nearest to the rear wiper motor output shaft.

(2) Engage the wiper blade pivot block with the hook formation on the end of the wiper arm.

(3) Slide the wiper blade up the wiper arm towards the hook formation until the plastic pivot block latch has fully engaged. Latch engagement will be accompanied by an audible click.

(4) Lower the wiper arm and blade gently onto the liftgate rear wiper arm park ramp.

WIPER ARM

REMOVAL

WINDSHIELD

(1) Carefully pry the plastic nut cap off of the pivot end of the wiper arm (Fig. 6).

(2) Remove the nut that secures the wiper arm to the wiper pivot shaft.

(3) Use a battery terminal puller to disengage the wiper arm from the wiper pivot shaft splines (Fig. 7).

(4) Remove the wiper arm and blade from the base of the windshield.

REMOVAL AND INSTALLATION (Continued)

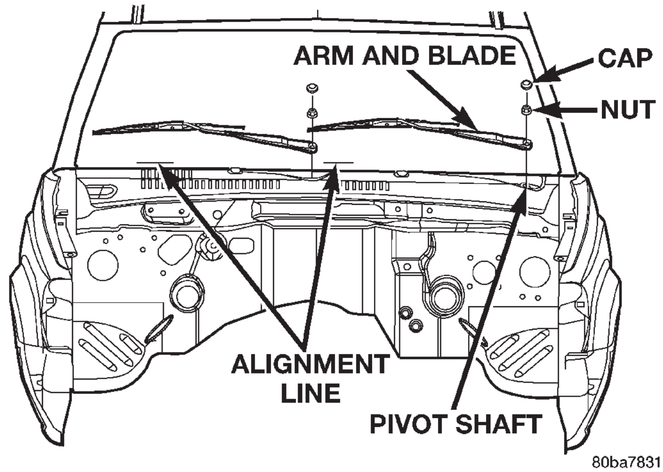


Fig. 6 Wiper Arm Remove/Install

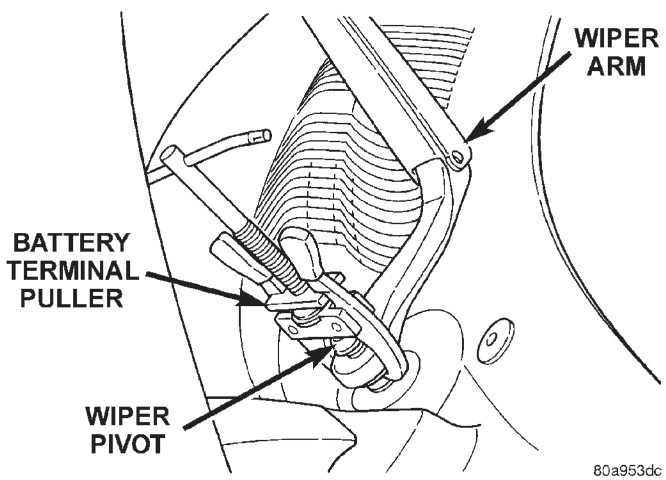


Fig. 7 Wiper Arm Puller - Typical

REAR

(1) Unsnap the rear wiper arm pivot cover by lifting it at the rear wiper motor output shaft end of the arm (Fig. 8).

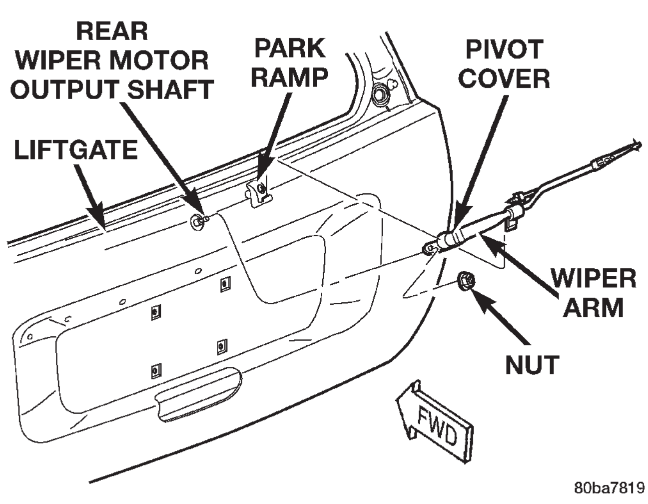


Fig. 8 Rear Wiper Arm Remove/Install

(2) Remove the nut that secures the wiper arm to the rear wiper motor output shaft.

(3) Use a battery terminal puller to disengage the wiper arm from the rear wiper motor output shaft splines (Fig. 7).

(4) Remove the rear wiper arm and blade from the liftgate.

INSTALLATION

WINDSHIELD

NOTE: Always install the wiper arm and blade with the wiper motor in the Park position.

(1) Place the wiper arm and blade onto the base of the windshield with the pivot hole on the end of the arm positioned over the wiper pivot shaft.

(2) Align the lower edge of the blade with the wiper alignment lines located in the lower edge of the windshield glass (Fig. 6).

(3) With the wiper blade aligned, push the pivot hole on the end of the wiper arm down over the wiper pivot shaft.

(4) Install and tighten the nut that secures the wiper arm to the wiper pivot shaft. Tighten the nut to 23.7 N·m (210 in. lbs.).

(5) Operate the wipers with the windshield glass wet, then turn the wiper switch to the Off position. Check for correct wiper blade alignment and readjust if required.

(6) Install the plastic nut cap onto the wiper arm pivot nut.

REAR

NOTE: Always install the wiper arm and blade with the wiper motor in the Park position.

(1) Place the wiper arm and blade onto the liftgate with the wiper arm support positioned on the park ramp and the pivot hole on the end of the arm positioned over the rear wiper motor output shaft.

(2) Position the ridge of the wiper arm support on the liftgate park ramp in the Installation Position (Fig. 9).

(3) With the wiper arm in the Installation Position, push the pivot hole on the end of the wiper arm down over the rear wiper motor output shaft.

(4) Install and tighten the nut that secures the wiper arm to the rear wiper motor output shaft. Tighten the nut to 18 N·m (160 in. lbs.).

(5) Close the rear wiper pivot cover back over the rear wiper arm mounting nut.

(6) Lift the rear wiper arm and blade away from the liftgate park ramp and place the wiper arm support in the Park Position (Fig. 9).

REMOVAL AND INSTALLATION (Continued)

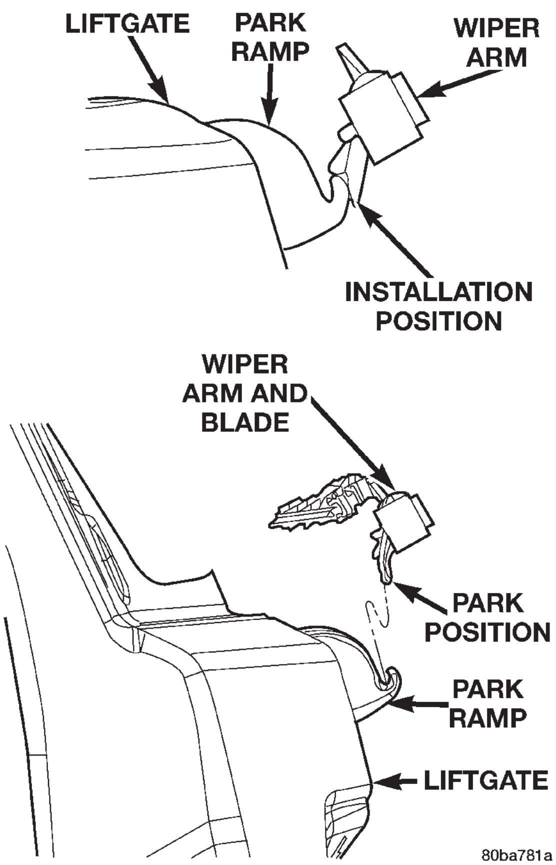


Fig. 9 Rear Wiper Arm Installation

REAR WIPER ARM PARK RAMP

REMOVAL

(1) Disengage the rear wiper arm support from the rubber rear wiper arm park ramp on the right side of the liftgate just below the flip-up glass.

(2) Lift the wiper arm and blade away from the liftgate until the wiper arm hinge is in its over-center position.

(3) Remove the screw that secures the park ramp to the liftgate (Fig. 10).

(4) Remove the rear wiper arm park ramp from the liftgate.

INSTALLATION

(1) Position the rear wiper arm park ramp onto the liftgate.

(2) Install and tighten the screw that secures the park ramp to the liftgate. Tighten the screw to 6.8 N·m (60 in. lbs.).

(3) Lower the wiper arm and blade gently onto the liftgate rear wiper arm park ramp.

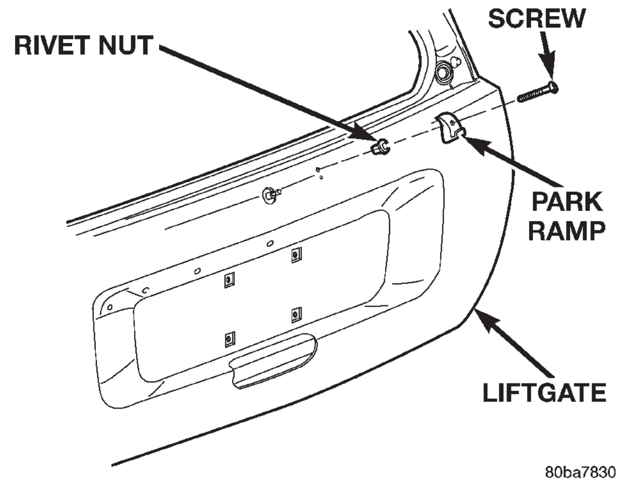


Fig. 10 Rear Wiper Arm Park Ramp Remove/Install

WINDSHIELD WIPER MOTOR, PIVOT AND LINKAGE MODULE

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the wiper arms from the wiper pivots. Refer to **Wiper Arm** in the Removal and Installation section of this group for the procedures.

(3) Open the hood and pull the hood to plenum seal off of the forward flanges of the cowl grille cover and the plenum panel.

(4) Remove the six plastic nuts (2 short and 4 long) that secure the cowl grille cover to the studs on the cowl top panel near the base of the windshield (Fig. 11).

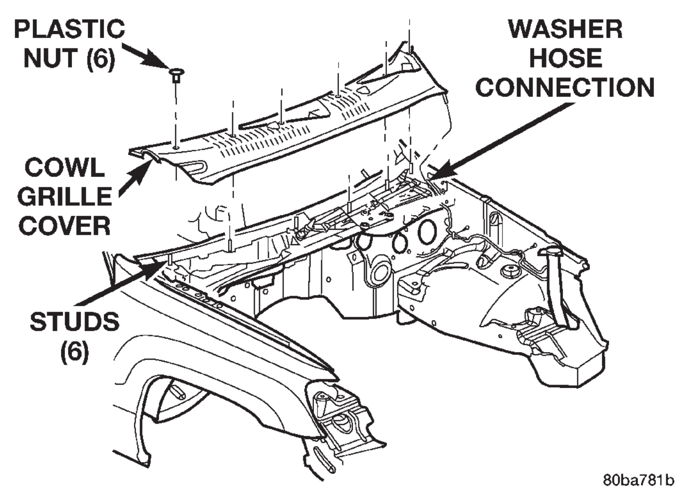


Fig. 11 Cowl Grille Cover Remove/Install

REMOVAL AND INSTALLATION (Continued)

(5) Lift the left end of the cowl grille cover off of the cowl plenum panel far enough to access the windshield washer plumbing.

(6) Disconnect the windshield washer supply hose at the in-line connector.

(7) Remove the cowl grille cover from the cowl plenum and cowl top panels through the opening between the hood and the windshield.

(8) Remove the four screws that secure the wiper motor, pivot and linkage module to the cowl plenum panel (Fig. 12).

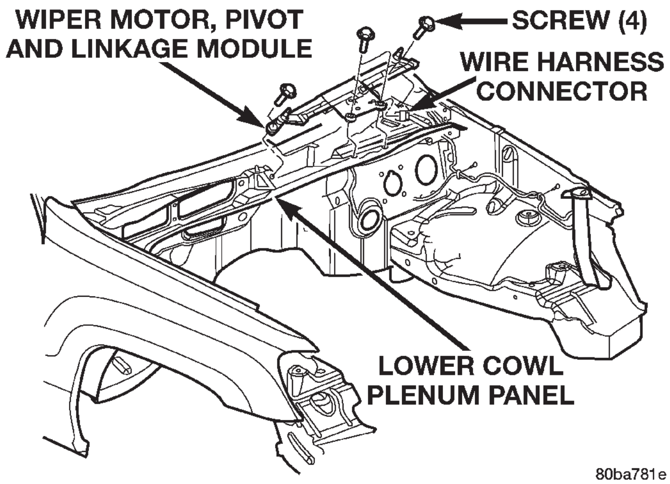


Fig. 12 Wiper Motor, Pivot and Linkage Module Remove/Install

(9) Lift the left end of the wiper motor, pivot and linkage module far enough to access the wiper motor wire harness connector.

(10) Disconnect the left headlamp and dash wire harness connector from the wiper motor connector receptacle.

(11) Remove the wiper motor, pivot and linkage module from the cowl plenum.

INSTALLATION

(1) Position the wiper motor, pivot and linkage module into the cowl plenum.

(2) Lift the left end of the wiper motor, pivot and linkage module far enough to access the wiper motor wire harness connector.

(3) Reconnect the left headlamp and dash wire harness connector to the wiper motor connector receptacle.

(4) Loosely install one of the wiper motor, pivot and linkage module mounting screws to the mounting hole near the pivot on the right end of the module to locate the module in the plenum.

(5) Working from left to right, install and tighten the four screws that secure the wiper motor, pivot and linkage module to the cowl plenum panel. Tighten the screws to 8 N·m (72 in. lbs.).

(6) Position the cowl grille cover onto the cowl plenum and cowl top panels through the opening between the hood and the windshield.

(7) Lift the left end of the cowl grille cover off of the cowl plenum panel far enough to access the windshield washer plumbing.

(8) Reconnect the windshield washer supply hose at the in-line connector.

(9) Install the six plastic nuts that secure the cowl grille cover to the studs on the cowl top panel near the base of the windshield. These nuts are to be installed by pushing them onto the studs in the following sequence:

(a) First, install the short nuts to the third stud from the right, then the second stud from the left.

(b) Next, install long nuts to the right outboard stud, then the left outboard stud.

(c) Finally, install the two remaining long nuts to the third stud from the left, then the second stud from the right.

(10) Starting at the ends and working toward the center, push the hood to plenum seal onto the forward flanges of the cowl grille cover and the plenum panel.

(11) Install the wiper arms onto the wiper pivots. Refer to **Wiper Arm** in the Removal and Installation section of this group for the procedures.

(12) Reconnect and isolate the battery negative cable.

REAR WIPER MOTOR MODULE

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) From the outside of the liftgate, remove the rear wiper arm from the rear wiper motor output shaft. Refer to **Wiper Arm** in the Removal and Installation section of this group for the procedures.

(3) Use a door trim panel removal tool to gently pry at the base of the nut cover where it meets the wiper motor output shaft bezel and grommet on the outer liftgate panel until it unsnaps from the rear wiper motor output shaft (Fig. 13). Be certain to use proper caution to protect the outer liftgate panel and its paint finish from damage during this procedure.

(4) Remove the nut that secures the rear wiper motor output shaft to the outer liftgate panel.

(5) Remove the bezel and gasket from the rear wiper motor output shaft.

(6) Remove the trim panel from the inside of the liftgate. Refer to **Liftgate Trim Panel** in the Removal and Installation section of Group 23 - Body for the procedures.

REMOVAL AND INSTALLATION (Continued)

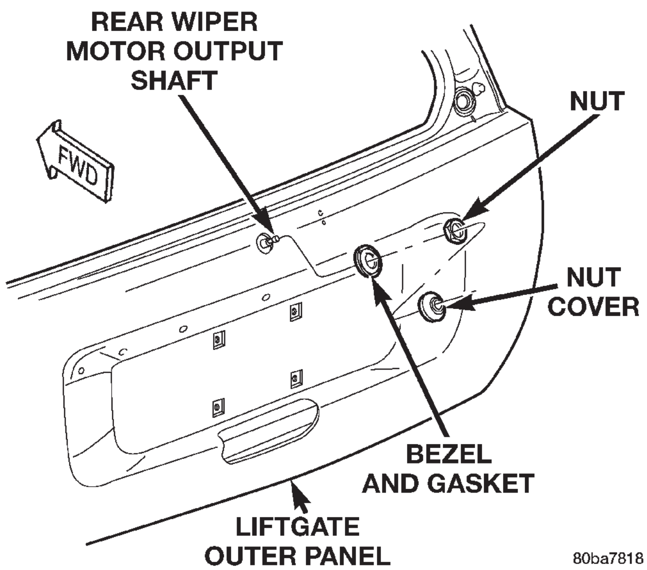


Fig. 13 Rear Wiper Motor Output Shaft Remove/Install

(7) Disconnect the liftgate wire harness connector from the rear wiper motor module connector receptacle (Fig. 14).

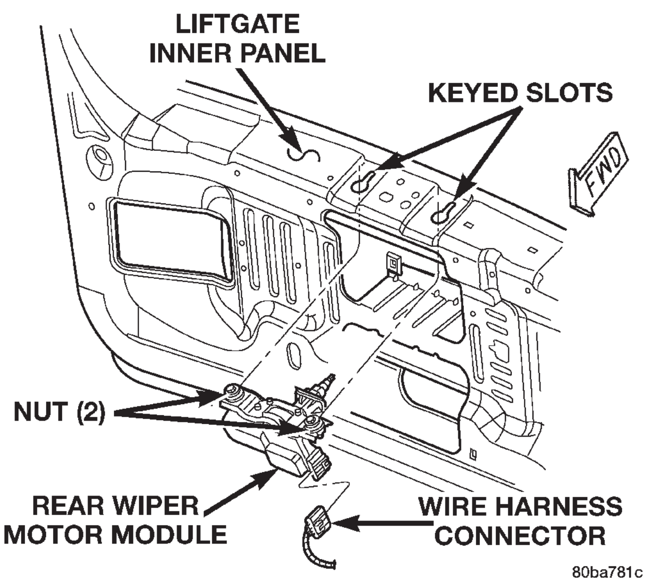


Fig. 14 Rear Wiper Motor Module Remove/Install

(8) Loosen the two nuts that secure the rear wiper motor mounting bracket to the liftgate inner panel.

(9) Slide the rear wiper motor module and mounting bracket forward far enough to disengage the mounting nuts from the keyed holes in the liftgate inner panel.

(10) Remove the rear wiper motor module from the liftgate inner panel.

INSTALLATION

(1) Position the rear wiper motor module to the liftgate inner panel.

(2) Insert the rear wiper motor output shaft through the hole in the liftgate outer panel and engage the mounting nuts in the keyed holes in the liftgate inner panel.

(3) From the outside of the liftgate, center the rear wiper motor output shaft in the liftgate outer panel mounting hole and install the gasket and bezel over the centered shaft.

(4) Install and tighten the nut that secures the rear wiper motor output shaft to the outer liftgate panel. Tighten the nut to 4.8 N·m (43 in. lbs.).

(5) From the inside of the liftgate, install and tighten the two nuts that secure the rear wiper motor mounting bracket to the liftgate inner panel. Tighten the nuts to 5.3 N·m (47 in. lbs.).

(6) Reconnect the liftgate wire harness connector to the rear wiper motor module connector receptacle.

(7) Install the trim panel onto the inside of the liftgate. Refer to **Liftgate Trim Panel** in the Removal and Installation section of Group 23 - Body for the procedures.

(8) From the outside of the liftgate, press the nut cover firmly and evenly over the rear wiper motor output shaft bezel using thumb pressure until it snaps into place.

(9) Install the rear wiper arm onto the rear wiper motor output shaft. Refer to **Wiper Arm** in the Removal and Installation section of this group for the procedures.

(10) Reconnect the battery negative cable.

WIPER AND WASHER SWITCH

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL AND INSTALLATION (Continued)

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the screw that secures the lower tilting steering column shroud to the steering column multi-function switch mounting housing (Fig. 15).

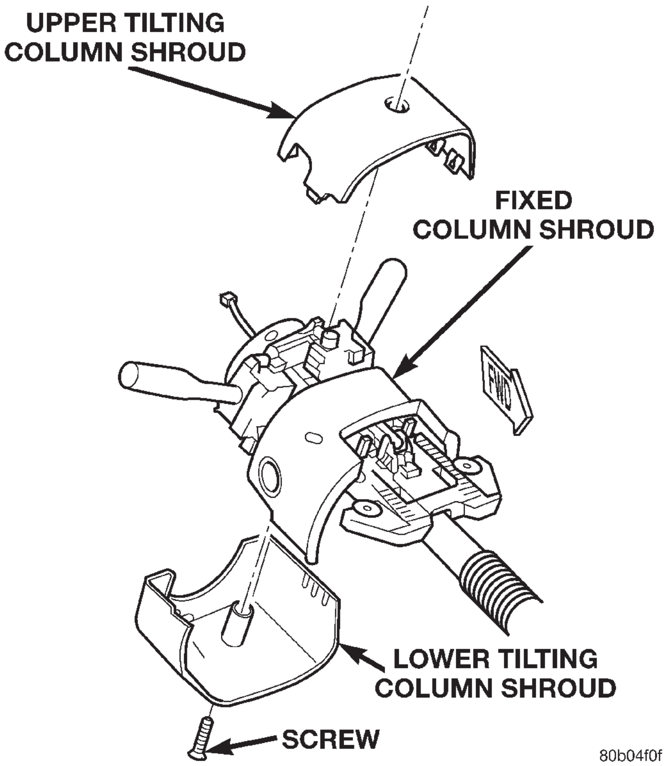


Fig. 15 Steering Column Shrouds Remove/Install

(3) Unsnap the two halves of the tilting steering column shroud from each other and remove both halves from the steering column.

(4) Disconnect the instrument panel wire harness connector from the wiper and washer (right multi-function) switch connector receptacle.

(5) Remove the two screws that secure the right multi-function switch to the multi-function switch mounting housing (Fig. 16).

(6) Remove the right multi-function switch from the multi-function switch mounting housing.

INSTALLATION

(1) Position the right multi-function switch onto the multi-function switch mounting housing.

(2) Install and tighten the two screws that secure the right multi-function switch to the multi-function switch mounting housing. Tighten the screws to 2.5 N·m (22 in. lbs.).

(3) Reconnect the instrument panel wire harness connector to the right multi-function switch connector receptacle.

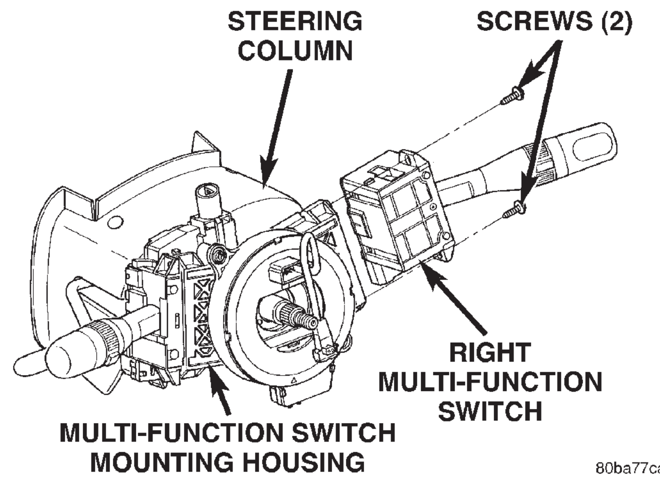


Fig. 16 Right Multi-Function Switch Remove/Install

(4) Position the lower tilting steering column shroud to the underside of the steering column.

(5) Install and tighten the screw that secures the lower tilting steering column shroud to the multi-function switch mounting housing. Tighten the screw to 1.9 N·m (17 in. lbs.).

(6) Position the upper tilting column shroud over the steering column with the hazard warning switch button inserted through the hole in the upper surface of the shroud. Align the upper tilting steering column shroud to the lower shroud and snap the two shroud halves together.

(7) Reconnect the battery negative cable.

WIPER RELAYS

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the cover from the Power Distribution Center (PDC) (Fig. 17).

(3) See the fuse and relay layout label affixed to the underside of the PDC cover for wiper high/low relay and wiper on/off relay identification and location.

(4) Remove the wiper high/low relay or wiper on/off relay from the PDC.

INSTALLATION

(1) See the fuse and relay layout label affixed to the underside of the PDC cover for the proper wiper high/low relay or wiper on/off relay location.

(2) Position the wiper high/low relay or wiper on/off relay in the proper receptacle in the PDC.

(3) Align the wiper high/low relay or wiper on/off relay terminals with the terminal cavities in the PDC receptacle.

REMOVAL AND INSTALLATION (Continued)

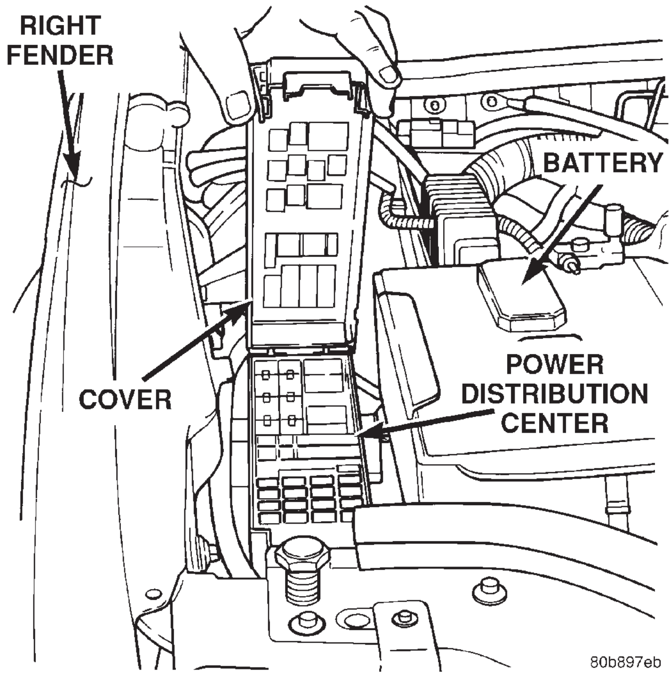


Fig. 17 Power Distribution Center

(4) Push down firmly on the wiper high/low relay or wiper on/off relay until the terminals are fully seated in the terminal cavities in the PDC receptacle.

(5) Install the cover onto the PDC.

(6) Reconnect the battery negative cable.

WASHER NOZZLE AND PLUMBING

REMOVAL

WINDSHIELD

This procedure can be used to remove either of the two windshield washer nozzles or the combination wye fitting/check valve unit.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the wiper arms from the wiper pivots. Refer to **Wiper Arm** in the Removal and Installation section of this group for the procedures.

(3) Open the hood and pull the hood to plenum seal off of the forward flanges of the cowl grille cover and the plenum panel.

(4) Remove the six plastic nuts (2 short and 4 long) that secure the cowl grille cover to the studs on the cowl top panel near the base of the windshield (Fig. 18).

(5) Lift the left end of the cowl grille cover off of the cowl plenum panel far enough to access the windshield washer plumbing.

(6) Disconnect the windshield washer supply hose at the in-line connector.

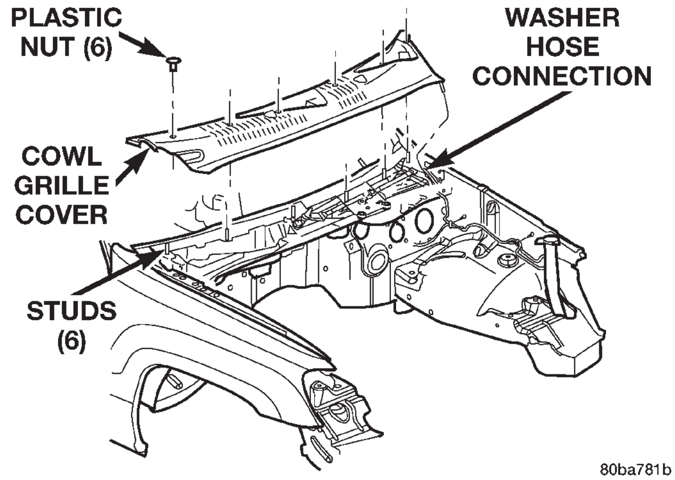


Fig. 18 Cowl Grille Cover Remove/Install

(7) Remove the cowl grille cover from the cowl plenum and cowl top panels through the opening between the hood and the windshield.

(8) From the underside of the cowl grille cover, disconnect the washer hose(s) from the barbed nipple(s) of the windshield washer nozzle(s) or the combination wye fitting/check valve unit.

(9) The combination wye fitting/check valve unit can now be removed from cowl grille cover. To remove the windshield washer nozzles from the cowl grille cover, go to Step 10.

(10) From the underside of the cowl grille cover, release the latches of the windshield washer nozzle and push the nozzle out through the mounting hole to the top side of the cowl grille cover.

REAR

The headliner washer hose (Fig. 19) is serviced only as a unit with the headliner. If this washer hose is damaged or faulty, the headliner unit must be replaced. The remaining washer hoses for the rear washer nozzle plumbing are available for service replacement. The check valve for the rear washer nozzle is integral to the nozzle.

(1) Using a trim stick or another suitable wide flat-bladed tool, gently pry at the sides of the rear washer nozzle to release the latches that secure it to the liftgate outer panel.

(2) Pull the rear washer nozzle out from the liftgate outer panel far enough to access the washer supply hose (Fig. 20).

(3) Disconnect the washer supply hose from the barbed nipple of the rear washer nozzle.

(4) Remove the rear washer nozzle from the liftgate.

REMOVAL AND INSTALLATION (Continued)

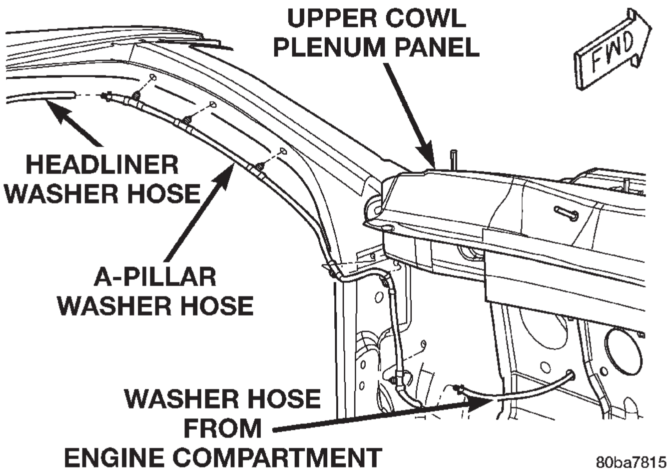


Fig. 19 Rear Washer Nozzle Plumbing

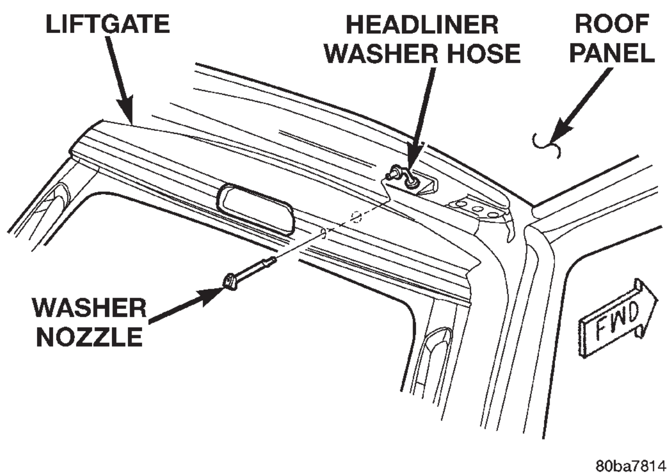


Fig. 20 Rear Washer Nozzle Remove/Install

INSTALLATION

WINDSHIELD

(1) From the top side of the cowl grille cover, insert the nipple end of the windshield washer nozzle through the mounting hole in the cowl grille cover.

(2) Push firmly and evenly on the top of the windshield washer nozzle until the latches snap into place on the underside of the cowl grille cover.

(3) From the underside of the cowl grille cover, reconnect the washer hose(s) to the barbed nipple(s) of the windshield washer nozzle(s) or the combination wye fitting/check valve unit.

(4) Install the washer hoses for the windshield washer nozzles or the combination wye fitting/check valve unit into their routing clips on the underside of the cowl grille cover.

(5) Position the cowl grille cover onto the cowl plenum and cowl top panels through the opening between the hood and the windshield.

(6) Lift the left end of the cowl grille cover off of the cowl plenum panel far enough to access the windshield washer plumbing.

(7) Reconnect the windshield washer supply hose at the in-line connector.

(8) Install the six plastic nuts that secure the cowl grille cover to the studs on the cowl top panel near the base of the windshield. These nuts are to be installed by pushing them onto the studs in the following sequence:

(a) First, install the short nuts to the third stud from the right, then the second stud from the left.

(b) Next, install long nuts to the right outboard stud, then the left outboard stud.

(c) Finally, install the two remaining long nuts to the third stud from the left, then the second stud from the right.

(9) Starting at the ends and working toward the center, push the hood to plenum seal onto the forward flanges of the cowl grille cover and the plenum panel.

(10) Install the wiper arms onto the wiper pivots. Refer to **Wiper Arm** in the Removal and Installation section of this group for the procedures.

(11) Reconnect and isolate the battery negative cable.

REAR

(1) Position the rear washer nozzle to the liftgate.

(2) Reconnect the washer supply hose to the barbed nipple of the rear washer nozzle.

(3) Insert the rear washer nozzle supply hose and nipple into the mounting hole in the liftgate outer panel.

(4) Push firmly and evenly on the rear washer nozzle until the latches snap into place on the inside of the liftgate outer panel mounting hole.

WASHER PUMP

REMOVAL

The windshield and rear washer pumps can be removed from the washer reservoir without removing the reservoir from the vehicle. The same procedure is used to remove either washer pump and motor unit.

(1) Disconnect and isolate the battery negative cable.

(2) Raise and support the vehicle.

(3) Remove the liner from the left front fender wheel house. Refer to **Front Fender** in the Removal and Installation section of Group 23 - Body for the procedures.

(4) Disconnect the left headlamp and dash wire harness connector from the inoperative windshield or rear washer pump connector receptacle (Fig. 21).

REMOVAL AND INSTALLATION (Continued)

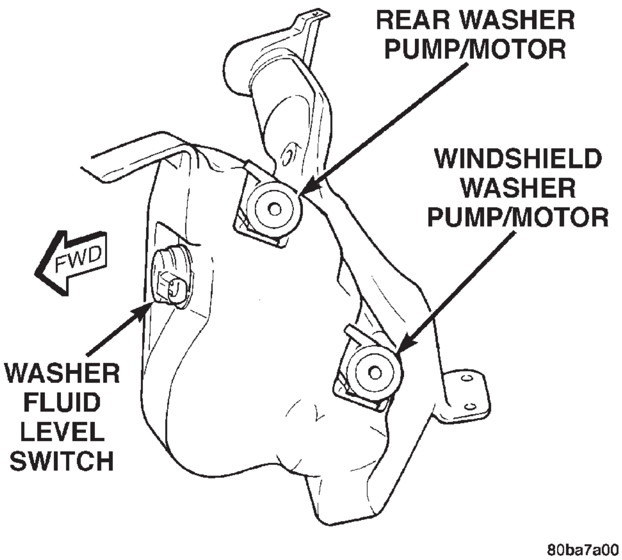


Fig. 21 Washer Pumps (Viewed from Bottom of Reservoir)

(5) Disconnect the washer hose from the barbed outlet nipple of the inoperative washer pump and allow the washer fluid to drain into a clean container for reuse.

(6) Using a trim stick or another suitable wide flat-bladed tool, gently pry the barbed inlet nipple of the washer pump out of the rubber grommet seal in the reservoir. Care must be taken not to damage the reservoir.

(7) Remove the rubber grommet seal from the washer pump mounting hole in the washer reservoir and discard.

INSTALLATION

(1) Install a new rubber grommet seal into the washer pump mounting hole in the washer reservoir. Always use a new rubber grommet seal on the reservoir.

(2) Position the barbed inlet nipple of the washer pump into the rubber grommet seal in the reservoir.

(3) Press firmly and evenly on the washer pump until the barbed inlet nipple is fully seated in the rubber grommet seal in the washer reservoir mounting hole.

(4) Reconnect the washer hose to the barbed outlet nipple of the washer pump.

(5) Reconnect the left headlamp and dash wire harness connector to the windshield or rear washer pump connector receptacle.

(6) Install the liner into the left front fender wheel house. Refer to **Front Fender** in the Removal and Installation section of Group 23 - Body for the procedures.

(7) Lower the vehicle.

(8) Fill the washer reservoir with the washer fluid drained from the reservoir during the removal procedure.

(9) Reconnect the battery negative cable.

WASHER RESERVOIR

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the liner from the left front fender wheel house. Refer to **Front Fender** in the Removal and Installation section of Group 23 - Body for the procedures.

(3) Remove the air cleaner housing from the top of the left front fender wheel house. Refer to **Air Cleaner Housing** in the Removal and Installation section of Group 14 - Fuel System for the procedures.

(4) Disconnect the two washer reservoir washer hoses from the two engine compartment washer hoses at the in-line connectors located on the top of the left front fender wheel house (Fig. 22).

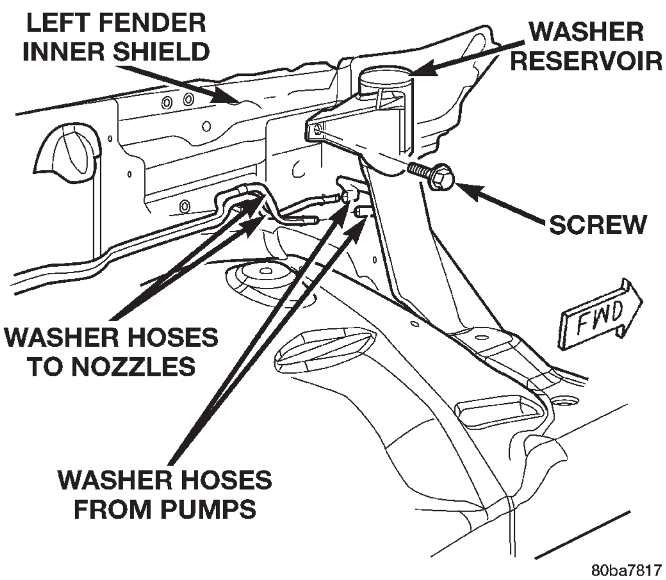


Fig. 22 Washer Reservoir Filler Neck Mounting

(5) Open the washer reservoir filler cap and unsnap the filler cap hinge from the hook on the filler neck.

(6) Remove the one screw that secures the washer reservoir filler neck to the left inner fender shield.

(7) Raise and support the vehicle.

REMOVAL AND INSTALLATION (Continued)

(8) Disconnect the left headlamp and dash wire harness connectors from the two washer pump connector receptacles (Fig. 23).

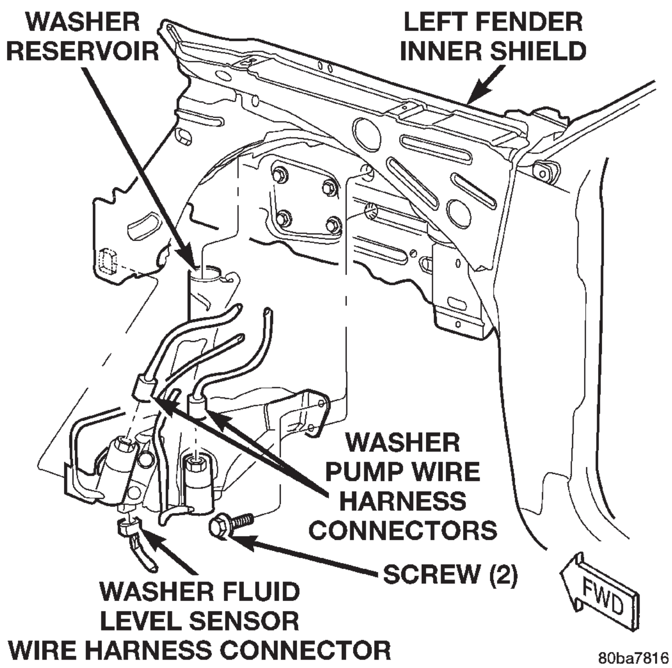


Fig. 23 Washer Reservoir Remove/Install

(9) Remove the two screws that secure the inboard mounting tab of the washer reservoir to the left inner wheel house.

(10) Pull the bottom of the washer reservoir rearward far enough to access the washer fluid level sensor wire harness connector on the front of the reservoir.

(11) Disconnect the left headlamp and dash wire harness connector from the washer fluid level sensor connector receptacle.

(12) Pull the bottom of the washer reservoir rearward far enough to disengage the outboard mounting tab from the mounting slot on the inner fender shield.

(13) Rotate the washer reservoir far enough so that the inboard mounting tab clears the front suspension components, then lower the reservoir far enough to remove the filler neck from the engine compartment.

(14) Remove the washer reservoir from the left front fender wheel house.

INSTALLATION

(1) Position the washer reservoir into the left front fender wheel house.

(2) Raise the washer reservoir filler neck through the hole in the left front fender wheelhouse extension into the engine compartment and orient the inboard mounting tab over the top of the front suspension components.

(3) Pull the bottom of the washer reservoir rearward far enough to engage the outboard mounting tab with the mounting slot on the inner fender shield.

(4) Pull the bottom of the washer reservoir rearward far enough to access the washer fluid level sensor connector receptacle on the front of the reservoir.

(5) Reconnect the left headlamp and dash wire harness connector to the washer fluid level sensor connector receptacle.

(6) Install and tighten the two screws that secure the inboard mounting tab of the washer reservoir to the left inner wheel house. Tighten the screws to 7.4 N·m (66 in. lbs.).

(7) Reconnect the left headlamp and dash wire harness connectors to the two washer pump connector receptacles.

(8) Lower the vehicle.

(9) Install and tighten the one screw that secures the washer reservoir filler neck to the left inner fender shield. Tighten the screw to 7.4 N·m (66 in. lbs.).

(10) Install the washer reservoir filler cap hinge onto the hook on the filler neck and close the cap.

(11) Reconnect the two washer reservoir washer hoses to the two engine compartment washer hoses at the in-line connectors located on the top of the left front fender wheel house.

(12) Install the air cleaner housing onto the top of the left front fender wheel house. Refer to **Air Cleaner Housing** in the Removal and Installation section of Group 14 - Fuel System for the procedures.

(13) Install the liner into the left front fender wheel house. Refer to **Front Fender** in the Removal and Installation section of Group 23 - Body for the procedures.

(14) Reconnect the battery negative cable.

WASHER FLUID LEVEL SENSOR

REMOVAL

The washer fluid level sensor can be removed from the washer reservoir without removing the reservoir from the vehicle.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the one screw that secures the washer reservoir filler neck to the left inner fender shield.

(3) Raise and support the vehicle.

(4) Remove the liner from the left front fender wheel house. Refer to **Front Fender** in the Removal and Installation section of Group 23 - Body for the procedures.

(5) Disconnect the washer hose from the barbed outlet nipple of the rearmost (windshield) washer

REMOVAL AND INSTALLATION (Continued)

pump and allow the washer fluid to drain into a clean container for reuse.

(6) Remove the two screws that secure the inboard mounting tab of the washer reservoir to the left inner wheel house.

(7) Pull the bottom of the washer reservoir rearward far enough to access the washer fluid level sensor wire harness connector on the front of the reservoir.

(8) Disconnect the left headlamp and dash wire harness connector from the washer fluid level sensor connector receptacle.

(9) Using a trim stick or another suitable wide flat-bladed tool, gently pry the barbed nipple of the washer fluid level sensor out of the rubber grommet seal on the front of the reservoir (Fig. 24). Care must be taken not to damage the reservoir.

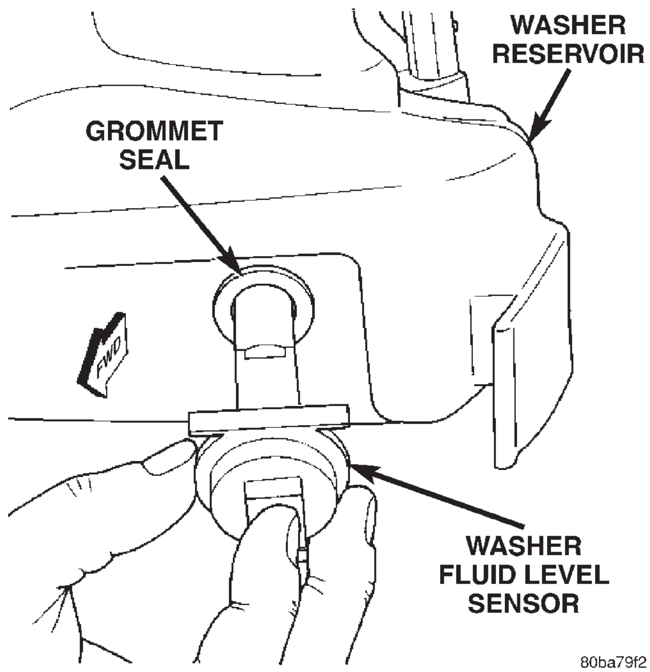


Fig. 24 Washer Fluid Level Sensor Remove/Install

(10) Remove the washer fluid level sensor and float from the washer reservoir.

(11) Remove the rubber grommet seal from the washer fluid level sensor mounting hole in the washer reservoir and discard.

INSTALLATION

(1) Install a new rubber grommet seal into the washer fluid level sensor mounting hole in the front of the washer reservoir. Always use a new rubber grommet seal on the reservoir.

(2) Position the float of the washer fluid level sensor through the rubber grommet seal in the washer reservoir. The connector receptacle of the washer fluid level sensor should be pointed downward.

(3) Press firmly and evenly on the washer fluid level sensor until the barbed nipple is fully seated in the rubber grommet seal in the washer reservoir mounting hole.

(4) Reconnect the left headlamp and dash wire harness connector to the washer fluid level sensor connector receptacle.

(5) Reconnect the washer hose to the barbed outlet nipple of the washer pump.

(6) Install and tighten the two screws that secure the inboard mounting tab of the washer reservoir to the left inner wheel house. Tighten the screws to 7.4 N·m (66 in. lbs.).

(7) Install the liner into the left front fender wheel house. Refer to **Front Fender** in the Removal and Installation section of Group 23 - Body for the procedures.

(8) Lower the vehicle.

(9) Install and tighten the one screw that secures the washer reservoir filler neck to the left inner fender shield. Tighten the screw to 7.4 N·m (66 in. lbs.).

(10) Fill the washer reservoir with the washer fluid drained from the reservoir during the removal procedure.

(11) Reconnect the battery negative cable.

LAMPS

CONTENTS

LAMP DIAGNOSIS

INDEX

DIAGNOSIS AND TESTING

DIAGNOSTIC PROCEDURES

WARNING: EYE PROTECTION SHOULD BE USED WHEN SERVICING GLASS COMPONENTS. PERSONAL INJURY CAN RESULT.

CAUTION: Do not touch the glass of halogen bulbs with fingers or other possibly oily surface, reduced bulb life will result.

Do not use bulbs with higher candle power than indicated in the Bulb Application table at the end of this group. Damage to lamp and/or Daytime Running Lamp Module can result.

Do not use fuses, circuit breakers or relays having greater amperage value than indicated on the fuse panel or in the Owners Manual.

When a vehicle experiences problems with the headlamp system, verify the condition of the battery connections, fuses, charging system, headlamp bulbs, wire connectors, relay, high beam switch, dimmer switch, and headlamp switch. Refer to Group 8W, Wiring Diagrams for component locations and circuit information.

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 and coat the inside of the socket lightly with Mopar Multi-Purpose Grease or equivalent.

When it is necessary to remove components to service another, it should not be necessary to apply excessive force or bend a component to remove it. Before damaging a trim component, verify hidden fasteners or captured edges are not holding the component in place.

DIAGNOSIS AND TESTING (Continued)

SYSTEM DIAGNOSIS

HEADLAMP

CONDITION	POSSIBLE CAUSES	CORRECTION
HEADLAMPS ARE DIM WITH ENGINE IDLING OR IGNITION TURNED OFF	1. Loose or corroded battery cables.	1. Clean and secure battery cable clamps and posts.
	2. Loose or worn generator drive belt.	2. Adjust or replace generator drive belt.
	3. Charging system output too low.	3. Test and repair charging system, refer to Group 8A,
	4. Battery has insufficient charge.	4. Test battery state-of -charge, refer to Group 8A.
	5. Battery is sulfated or shorted.	5. Load test battery, refer to Group 8A.
	6. Poor lighting circuit Z1-ground.	6. Test for voltage drop across Z1-ground locations, refer to Group 8W.
	7. Both headlamp bulbs defective.	7. Replace both headlamp bulbs.
HEADLAMP BULBS BURN OUT FREQUENTLY	1. Charging system output too high.	1. Test and repair charging system, refer to Group 8A.
	2. Loose or corroded terminals or splices in circuit.	2. Inspect and repair all connectors and splices, refer to Group 8W.
HEADLAMPS ARE DIM WITH ENGINE RUNNING ABOVE IDLE*	1. Charging system output too low.	1. Test and repair charging system, refer to Group 8A.
	2. Poor lighting circuit Z1-ground.	2. Test for voltage drop across Z1-ground locations, refer to Group 8W.
	3. High resistance in headlamp circuit.	3. Test amperage draw of headlamp circuit.
	4. Both headlamp bulbs defective.	4. Replace both headlamp bulbs.
HEADLAMPS FLASH RANDOMLY	1. Poor lighting circuit Z1-ground.	1. Test for voltage drop across Z1-ground locations, refer to Group 8W.
	2. High resistance in headlamp circuit.	2. Test amperage draw of headlamp circuit. Should not exceed 30 amps.
	3. Loose or corroded terminals or splices in circuit.	3.. Inspect and repair all connectors and splices, refer to Group 8W.
HEADLAMPS DO NOT ILLUMINATE	1. No voltage to headlamps.	1. Repair open headlamp circuit, refer to Group 8W.
	2. No Z1-ground at headlamps.	2. Repair circuit ground, refer to Group 8W.
	3. Faulty headlamp switch.	3. Refer to BCM diagnostics.
	4. Blown fuse for headlamps.	4. Replace fuse refer to Group 8W.
	5. Broken connector terminal or wire splice in headlamp circuit.	5. Repair connector terminal or wire splice.
	6. Both headlamp bulbs defective.	6. Replace both headlamp bulbs.
*Canada vehicles must have lamps ON.		

DIAGNOSIS AND TESTING (Continued)

FOG LAMP

CONDITION	POSSIBLE CAUSES	CORRECTION
FOG LAMPS ARE DIM WITH ENGINE IDLING OR IGNITION TURNED OFF.	1. Loose or corroded battery cables.	1. Clean and secure battery cable clamps and posts.
	2. Loose or worn generator drive belt.	2. Adjust or replace generator drive belt.
	3. Charging system output too low.	3. Test and repair charging system. Refer to Group 8A,
	4. Battery has insufficient charge.	4. Test battery state-of -charge. Refer to Group 8A.
	5. Battery is sulfated or shorted.	5. Load test battery. Refer to Group 8A.
	6. Poor lighting circuit Z1-ground.	6. Test for voltage drop across Z1-ground locations. Refer to Group 8W.
FOG LAMP BULBS BURN OUT FREQUENTLY	1. Charging system output too high.	1. Test and repair charging system. Refer to Group 8A.
	2. Loose or corroded terminals or splices in circuit.	2. Inspect and repair all connectors and splices. Refer to Group 8W.
FOG LAMPS ARE DIM WITH ENGINE RUNNING ABOVE IDLE	1. Charging system output too low.	1. Test and repair charging system. Refer to Group 8A.
	2. Poor lighting circuit Z1-ground.	2. Test for voltage drop across Z1-ground locations. Refer to Group 8W.
	3. High resistance in fog lamp circuit.	3. Test amperage draw of fog lamp circuit.
FOG LAMPS FLASH RANDOMLY	1. Poor lighting circuit Z1-ground.	1. Test for voltage drop across Z1-ground locations. Refer to Group 8W.
	2. High resistance in fog lamp circuit.	2. Test amperage draw of fog lamp circuit.
	3. Faulty multifunction switch.	3. Refer to Group 8W BCM diagnostics.
	4. Loose or corroded terminals or splices in circuit.	4. Inspect and repair all connectors and splices. Refer to Group 8W.
FOG LAMPS DO NOT ILLUMINATE	1. Blown fuse for fog lamp.	1. Replace fuse. Refer to Group 8W.
	2. No Z1-ground at fog lamps.	2. Repair circuit ground. Refer to Group 8W.
	3. Faulty multifunction switch.	3. Refer to Group 8W BCM diagnostics.
	4. Broken connector terminal or wire splice in fog lamp circuit.	4. Repair connector terminal or wire splice.
	5. Defective or burned out bulb.	5. Replace bulb.

DIAGNOSIS AND TESTING (Continued)

DAYTIME RUNNING LAMP

CONDITION	POSSIBLE CAUSES	CORRECTION
DAYTIME RUNNING LAMPS DO NOT WORK	1. Poor connection at DRL module. 2. Parking brake engaged. 3. Parking brake circuit shorted to ground. 4. Headlamp circuit shorted to ground. 5. Defective DRL relay. 6.Body controller not programed with Canadain country code. 7. DRL relay is missing. 8. Blown fuse for DRL.	1. Secure connector on DRL module. 2. Disengage parking brake. 3.Check cluster telltale,refer to Group 8W. 4.Refer to Group 8W. 5. Replace DRL relay. 6. Check country code. 7. Install DRL relay. 8. Replace fuse refer to Group 8W.
Clicking or chattering when DRL is on.	1. Mechanical relay is installed in the junction block.	1. Ensure that the DRL relay is installed in the proper socket in junction block, and that no mechanical relay exists in the low beam socket.

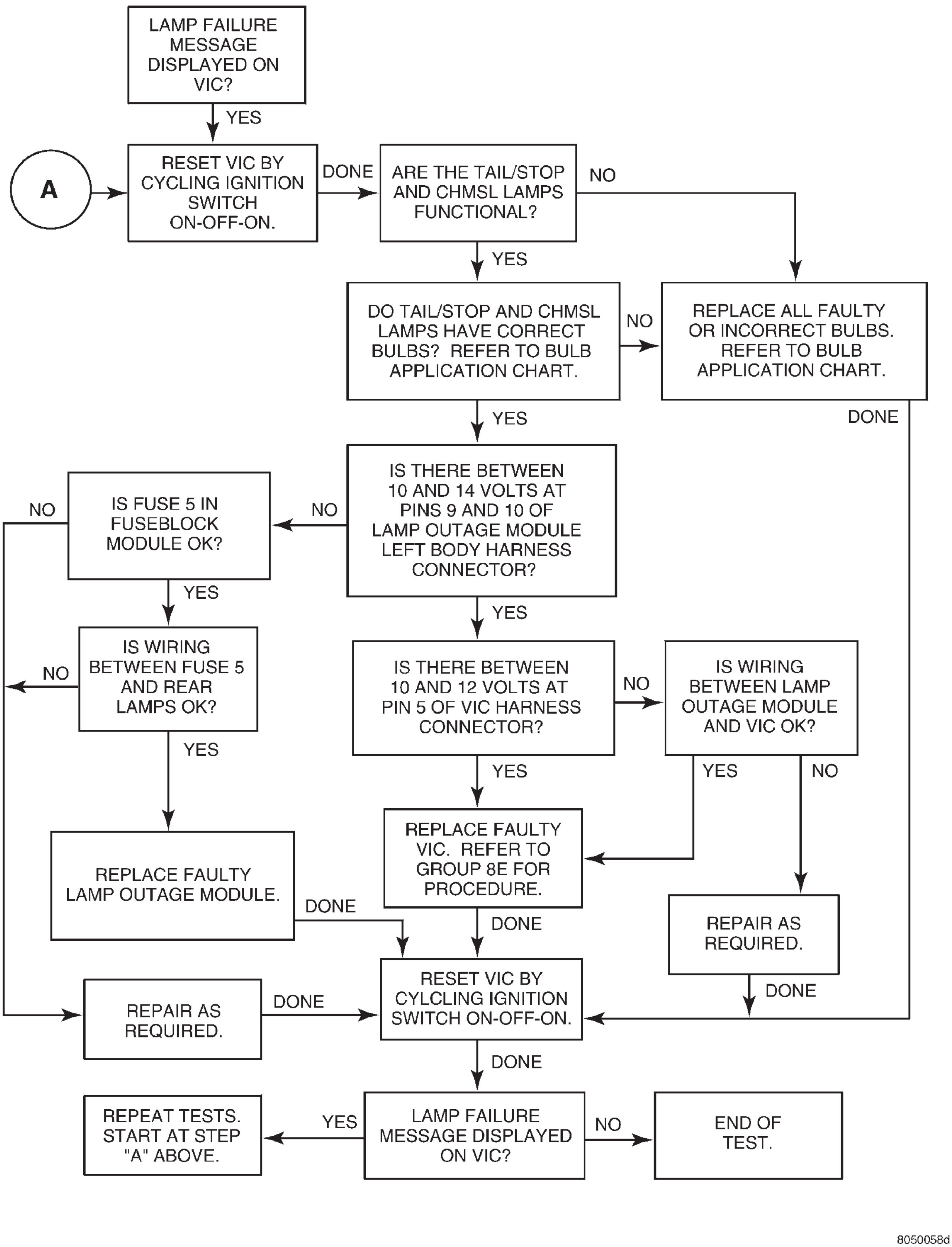
LAMP OUTAGE MODULE

NOTE: The Lamp Outage Module contains an internal circuit breaker. When the module senses an overload it will trip the circuit breaker and illuminate a failure in the Vehicle Information Center (VIC). The circuit breaker will reset once the vehicle is turned off for approximately 60 seconds. Continuous tripping of the circuit breaker may indicate a circuit problem.

AUTO HEADLAMP SENSOR (AHL)

There are no faults set in the Body Control Module (BCM) for a bad or missing AHL Sensor. Symptom of a missing sensor or unconnected sensor would be that the Headlamps and Parklamps turn on when the vehicle is started and there is a high level of ambient light present (ie. daytime). Auto headlamps should not function in the presence of daylight.

DIAGNOSIS AND TESTING (Continued)



1999 Jeep Grand Cherokee WJ
Publication No. 81-370-9147
TSB 26-12-98 December, 1998

HEADLAMP ALIGNMENT

INDEX

DESCRIPTION AND OPERATION

HEADLAMP ALIGNMENT

DESCRIPTION

Headlamps can be aligned using the screen method provided in this section.

SERVICE PROCEDURES

LAMP ALIGNMENT SCREEN PREPARATION

(1) Position vehicle on a level surface perpendicular to a flat wall 7.62 meters (25 ft) away from front of headlamp lens (Fig. 1).
(2) If necessary, tape a line on the floor 7.62 meters (25 ft) away from and parallel to the wall.
(3) Measure from the floor up 1.27 meters (5 ft) and tape a line on the wall at the centerline of the vehicle. Sight along the centerline of the vehicle (from rear of vehicle forward) to verify accuracy of the line placement.
(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.

VEHICLE PREPARATION FOR LAMP ALIGNMENT

(1) Verify headlamp dimmer switch and high beam indicator operation.
(2) Correct defective components that could hinder proper lamp alignment.
(3) Verify proper tire inflation.
(4) Clean lamp 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 ADJUSTMENT

A properly aimed low beam will project the top edge of the beam intensity pattern on the screen from 25 mm (1 in.) above to 75 mm (3 in.) below headlamp centerline. The side-to-side left edge of the beam intensity pattern should be from 50 mm (2 in.) left to 50 mm (2 in.) right of headlamp centerline (Fig. 2).
(1) Clean front of the headlamps.
(2) Place headlamps on LOW beam.
(3) Cover front of the headlamp that is not being adjusted.
(4) Turn adjustment screw (Fig. 3) and (Fig. 4) until the top edge of the beam intensity pattern is positioned within 25 mm (1 in.) above or 75 mm (3 in.) below the headlamp horizontal centerline.
(5) Cover front of the headlamp and adjust the other headlamp beam as instructed below.
(6) Rotate the adjustment screw until the top edge of the beam intensity pattern is positioned within 25 mm (1 in.) above or 75 mm (3 in.) below the headlamp horizontal centerline.

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. 5).
Rotate the adjustment screw to adjust beam height (Fig. 6).

SERVICE PROCEDURES (Continued)

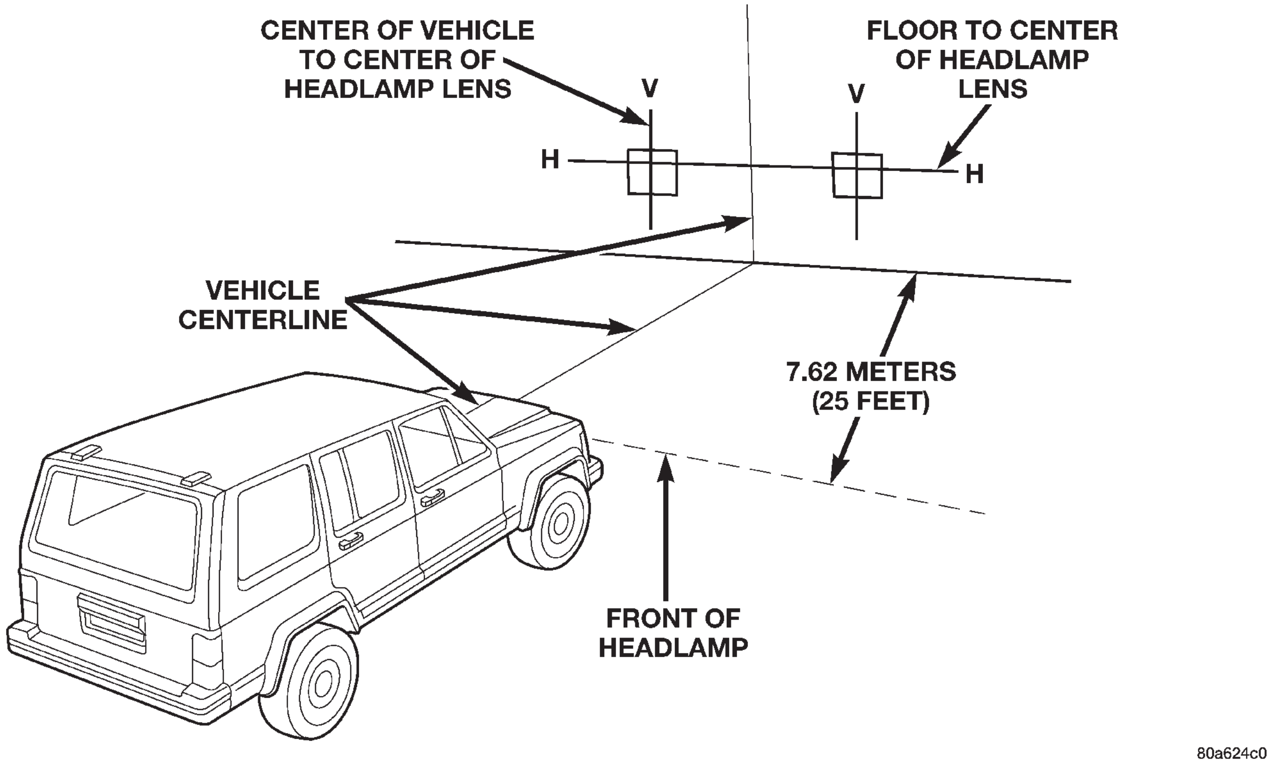


Fig. 1 Headlamp Alignment Screen—Typical

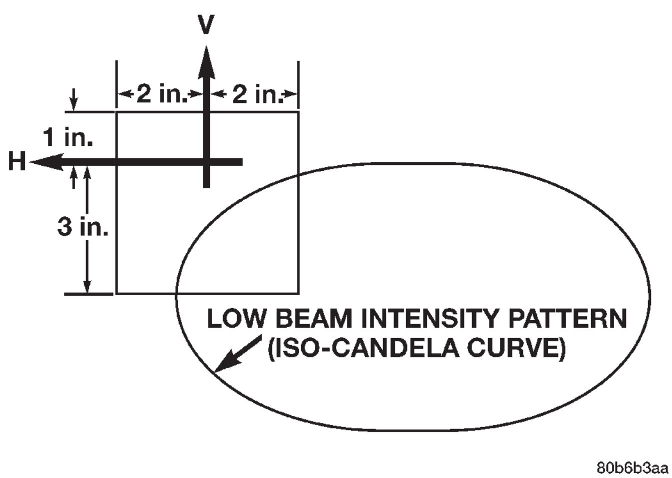


Fig. 2 Low Beam Pattern

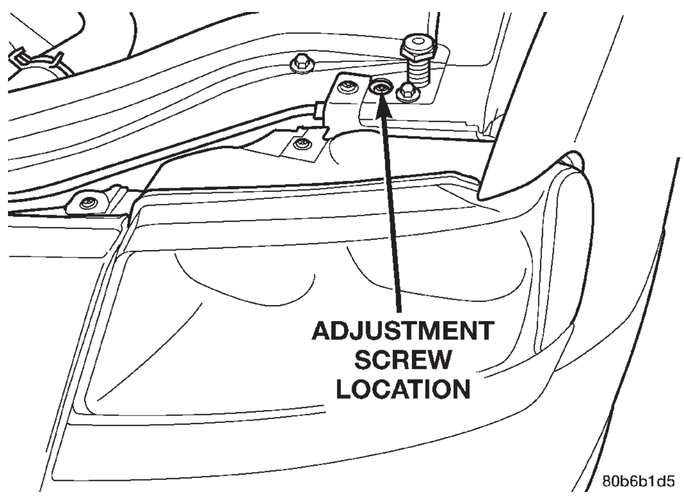


Fig. 3 Headlamp Beam Adjustment Screw

SERVICE PROCEDURES (Continued)

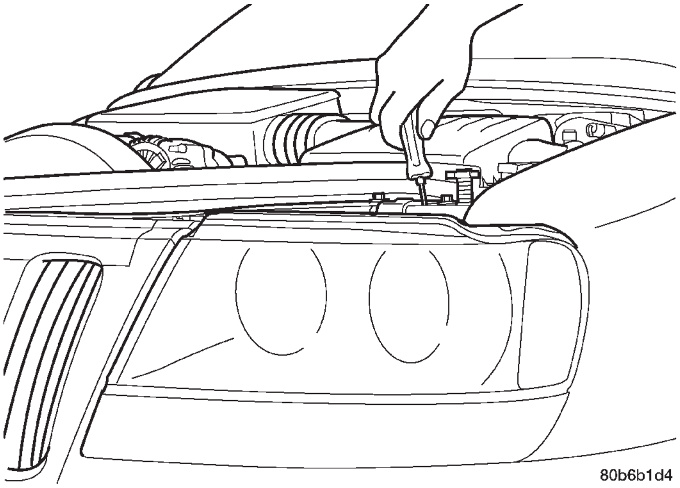


Fig. 4 Headlamp Beam Adjustment

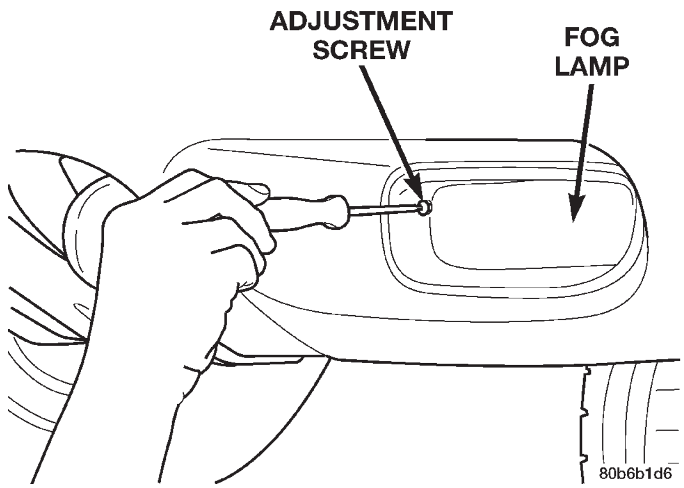


Fig. 6 Fog Lamp Adjustment

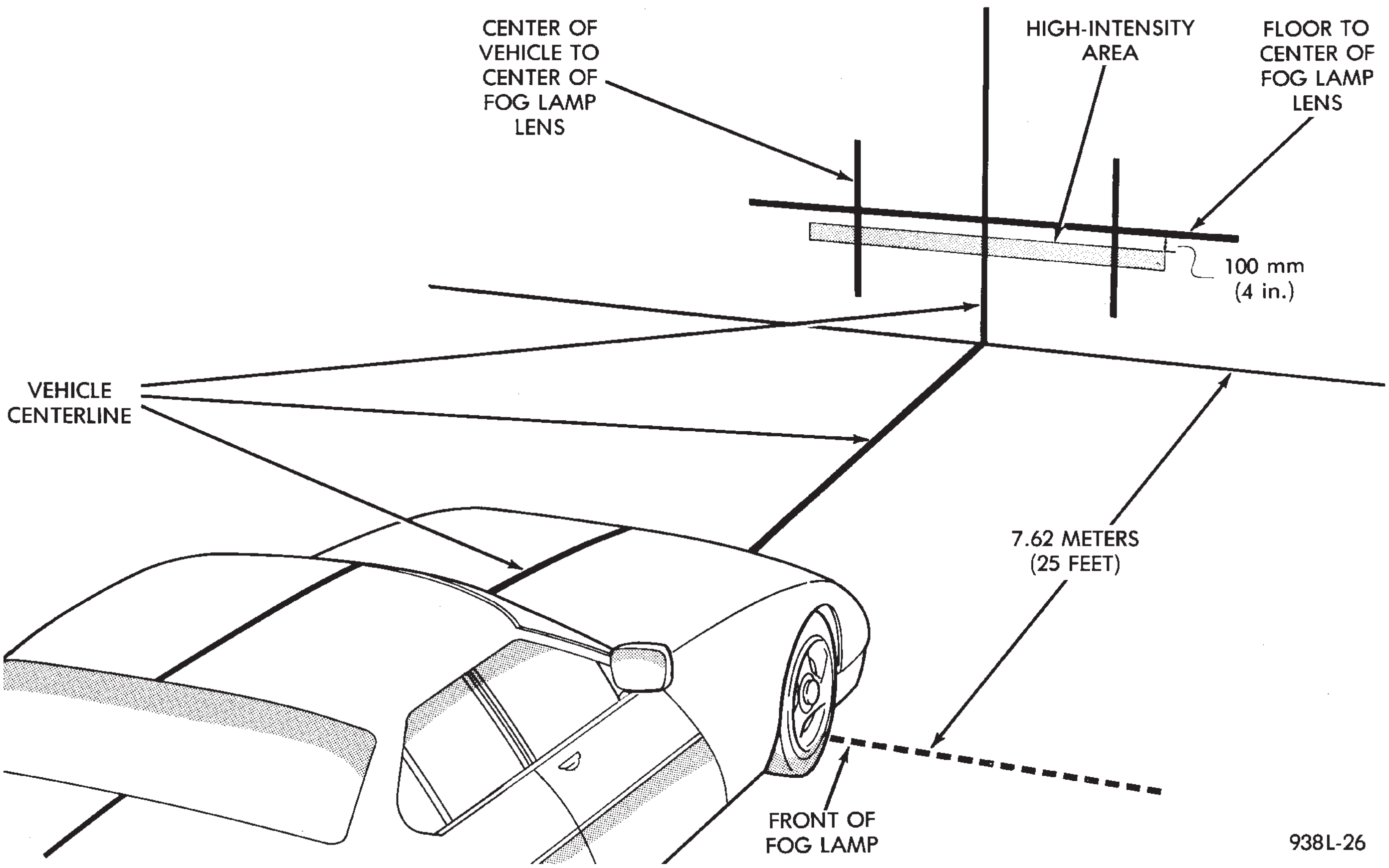


Fig. 5 Fog Lamp Alignment—Typical

1999 Jeep Grand Cherokee WJ
Publication No. 81-370-9147
TSB 26-12-98 December, 1998

LAMP BULB SERVICE

INDEX

REMOVAL AND INSTALLATION

HEADLAMP BULB

REMOVAL

(1) Remove headlamp.

(2) Turn bulb socket one quarter turn counter clockwise.

(3) Remove socket from lamp (Fig. 1).

(4) Pull bulb from socket.

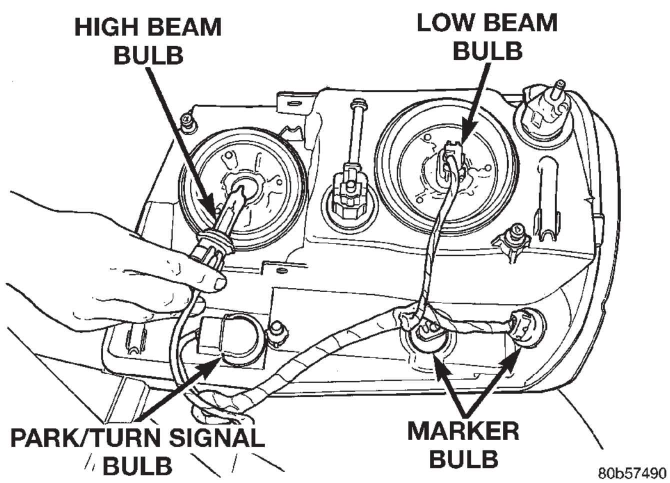


Fig. 1 Headlamp Bulb

INSTALLATION

CAUTION: Do not touch the bulb glass with fingers or other oily surfaces. Reduced bulb life will result.

(1) Position bulb into socket and push into place.

(2) Position bulb socket in headlamp and turn bulb socket one quarter turn clockwise.

(3) Install headlamp.

FOG LAMP BULB

REMOVAL

(1) Disconnect fog lamp harness connector.

(2) Rotate bulb socket 1/4 turn counter clockwise.

(3) Remove bulb socket from lamp (Fig. 2).

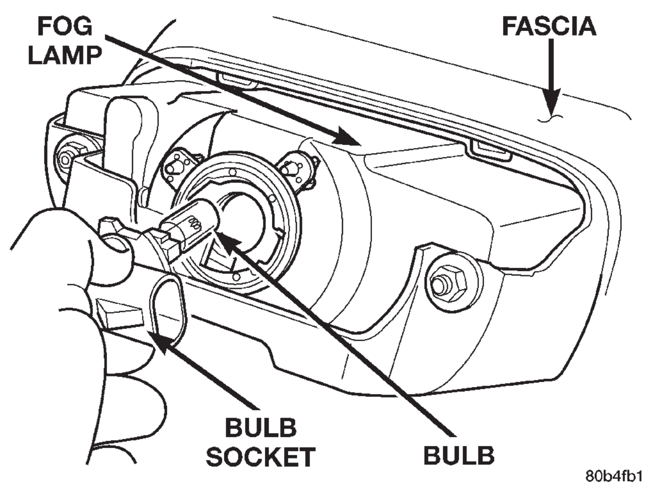


Fig. 2 Fog Lamp Bulb

INSTALLATION

CAUTION: Do not touch the bulb glass with fingers or other oily surfaces. Reduced bulb life will result.

(1) Position bulb socket in fog lamp.

(2) Rotate bulb socket 1/4 turn clockwise.

(3) Connect fog lamp harness connector.

FRONT TURN SIGNAL BULB

REMOVAL

(1) Remove headlamp module.

REMOVAL AND INSTALLATION (Continued)

(2) Rotate turn signal bulb socket 1/4 turn counter clockwise (Fig. 1).
(3) Remove bulb socket from module.
(4) Pull bulb from socket.

INSTALLATION

(1) Press bulb into socket.
(2) Position bulb socket in module.
(3) Rotate turn signal bulb socket 1/4 turn clockwise.
(4) Install headlamp module.

PARK LAMP BULB

REMOVAL

(1) Remove the headlamp module. Refer to Headlamp Removal/Installation procedure.
(2) Rotate the headlamp module to access the bulb sockets (Fig. 1).
(3) Remove the park lamp socket.
(4) Grasp the bulb and remove from socket.

INSTALLATION

(1) Engage the bulb in the lamp socket.
(2) Install the lamp socket into the headlamp module.
(3) Install the headlamp module on the vehicle.

FRONT SIDE MARKER LAMP BULB

REMOVAL

(1) Remove headlamp module.
(2) Rotate side marker bulb socket 1/4 turn counter clockwise (Fig. 1).
(3) Remove bulb socket from module.
(4) Pull bulb from socket.

INSTALLATION

(1) Press bulb into socket.
(2) Position bulb socket in module.
(3) Rotate side marker bulb socket 1/4 turn clockwise.
(4) Install headlamp module.

TAIL, STOP, TURN SIGNAL AND BACK-UP LAMP BULBS

The stop, turn signal, back-up, and side marker lamp bulbs are incorporated into the tail lamp.

REMOVAL

(1) Remove tail lamp.
(2) Grasp bulb socket and rotate counterclockwise.
(3) Separate socket from lamp
(4) Pull bulb from socket (Fig. 3).

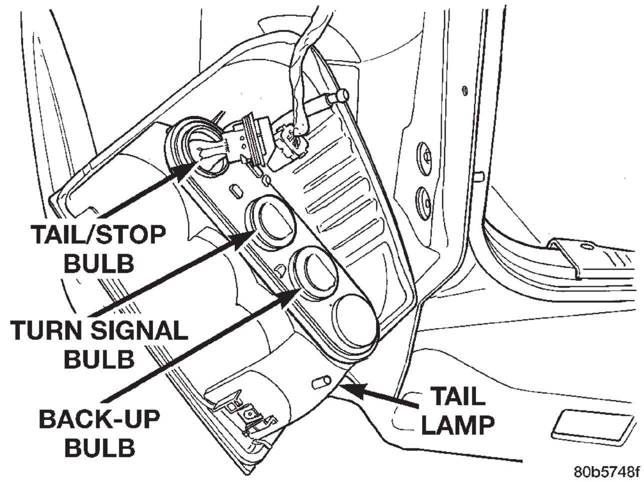


Fig. 3 Tail Lamp Bulbs

INSTALLATION

(1) Position bulb in socket and push into place.
(2) Position bulb socket in lamp and rotate clockwise.
(3) Install lamp.

BACK-UP LAMP BULB

REMOVAL

(1) Remove tail lamp.
(2) Grasp bulb socket and rotate counterclockwise.
(3) Separate socket from lamp
(4) Pull bulb from socket (Fig. 3).

INSTALLATION

(1) Position bulb in socket and push into place.
(2) Position bulb socket in lamp and rotate clockwise.
(3) Install lamp.

REAR SIDE MARKER LAMP BULB

REMOVAL

(1) Remove the tail lamp assembly.
(2) Remove the bulb socket from the lamp (Fig. 3).
(3) Grasp the bulb and remove.

INSTALLATION

(1) Install the bulb in the socket.
(2) Install the bulb socket in the lamp.
(3) Position the tail lamp assembly on the vehicle. Install the screws.

LICENSE PLATE LAMP BULB

REMOVAL

(1) Remove lamp assembly from liftgate lamp module.

REMOVAL AND INSTALLATION (Continued)

(2) Rotate bulb socket counterclockwise to disconnect bulb socket from lamp.

(3) Remove bulb from socket.

INSTALLATION

(1) Install bulb in socket.

(2) Install socket and bulb assembly in lamp housing.

(3) Install lamp assembly in liftgate lamp module.

CENTER HIGH MOUNTED STOP LAMP (CHMSL) BULB

REMOVAL

(1) Remove screws attaching lamp housing to liftgate.

(2) Rotate bulb socket 1/4 turn and pull from housing (Fig. 4).

(3) Grasp bulb and pull from socket.

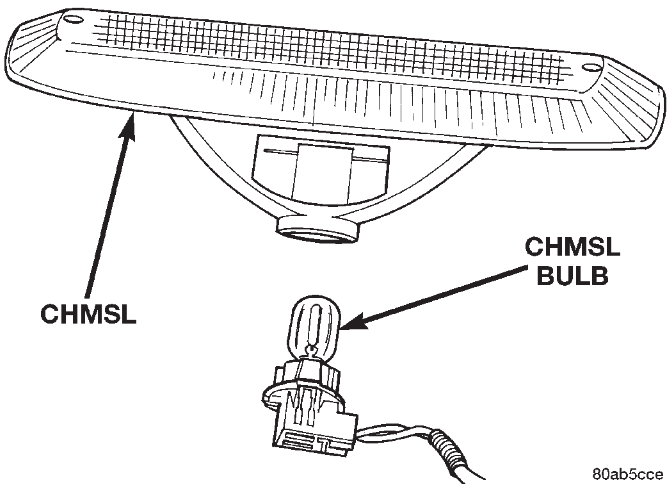


Fig. 4 CHMSL Bulb

INSTALLATION

(1) Push bulb into socket.

(2) Position socket in lamp and rotate 1/4 turn.

(3) Install screws attaching the lamp housing to liftgate.

UNDERHOOD LAMP BULB

REMOVAL

(1) Insert a small flat blade in access slot between lamp base and lamp lens.

(2) Pry lamp lens upward and remove lamp lens (Fig. 5).

(3) Depress bulb terminal inward (Fig. 6) to release bulb.

INSTALLATION

(1) Engage replacement bulb wire loop to terminal closest to lamp base wire connector.

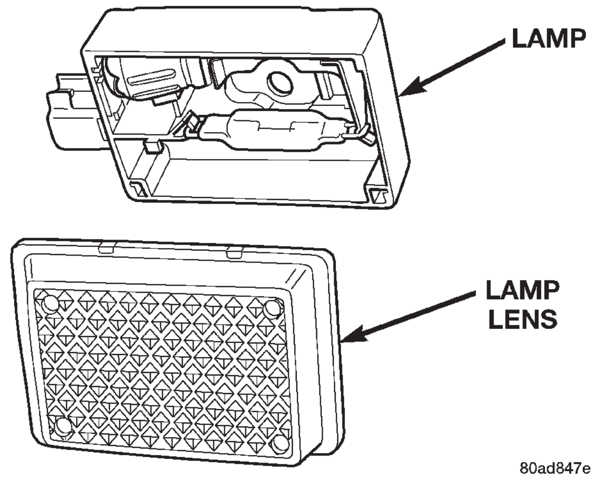


Fig. 5 Underhood Lamp Lens

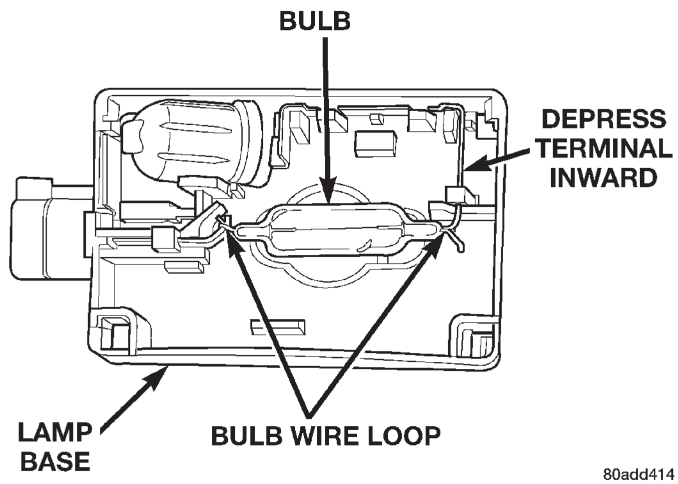


Fig. 6 Underhood Lamp Bulb

(2) Depress opposite terminal inward and engage remaining bulb wire loop.

(3) Position lamp lens on lamp base and press into place.

DOOR COURTESY LAMP BULB

REMOVAL

(1) Remove door trim panel. Refer to Group 23, Body Components for service procedures.

(2) Remove bulb socket from lamp.

(3) Pull bulb from socket.

INSTALLATION

(1) Position bulb in socket and press into place.

(2) Install bulb socket in lamp.

(3) Install door trim panel.

REMOVAL AND INSTALLATION (Continued)

VISOR VANITY LAMP BULB

REMOVAL

(1) Using a small flat blade, carefully pry each corner of the lens out of the lamp.
(2) Separate the lens from the lamp.
(3) Grasp the bulb and pull out.

INSTALLATION

(1) Position the bulb in the socket and push in place.
(2) Position the lens on the lamp and snap into place.

DOME/READING LAMP BULB

REMOVAL

(1) Rotate the grab handle down.
(2) Remove the screws retaining the grab handle/dome lens.
(3) Remove grab handle/lens from module.
(4) Remove bulb from lamp terminals.

INSTALLATION

(1) Insert bulb into lamp terminals.
(2) Position the grab handle/lens on lamp module.
(3) Install the screws retaining the grab handle/lens to the lamp module.

OVERHEAD CONSOLE READING LAMP BULB

REMOVAL

(1) Remove the overhead console.
(2) Rotate the console until the bulb is visible (Fig. 7).
(3) Grasp the bulb and remove from the socket.

INSTALLATION

(1) Push the bulb into the bulb socket.
(2) Install the console on the headliner and roof panel.
(3) Align the screw hole and install the screw.

CARGO LAMP BULB

REMOVAL

(1) Using a small flat blade, pry forward corners of lamp lens from lamp.
(2) Pull bulb from lamp (Fig. 8).

INSTALLATION

(1) Position bulb in lamp and press into place.

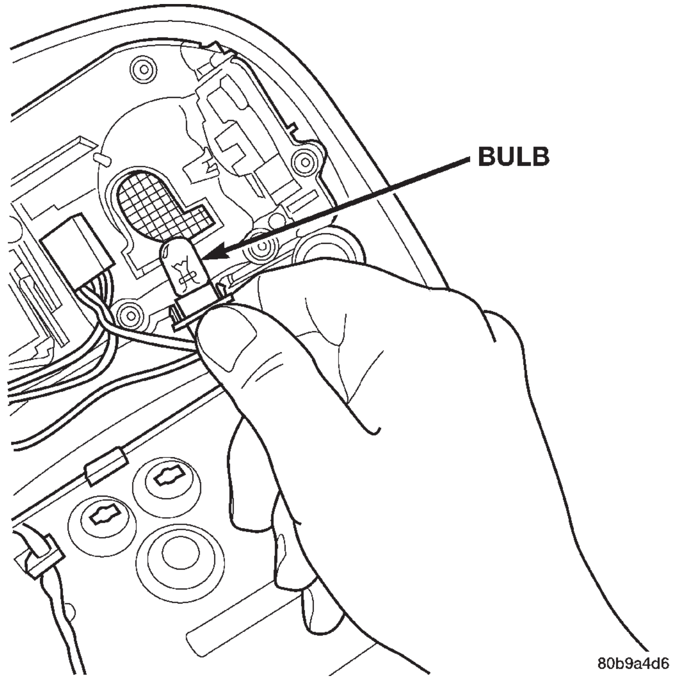


Fig. 7 Overhead Console Reading Lamp Bulb

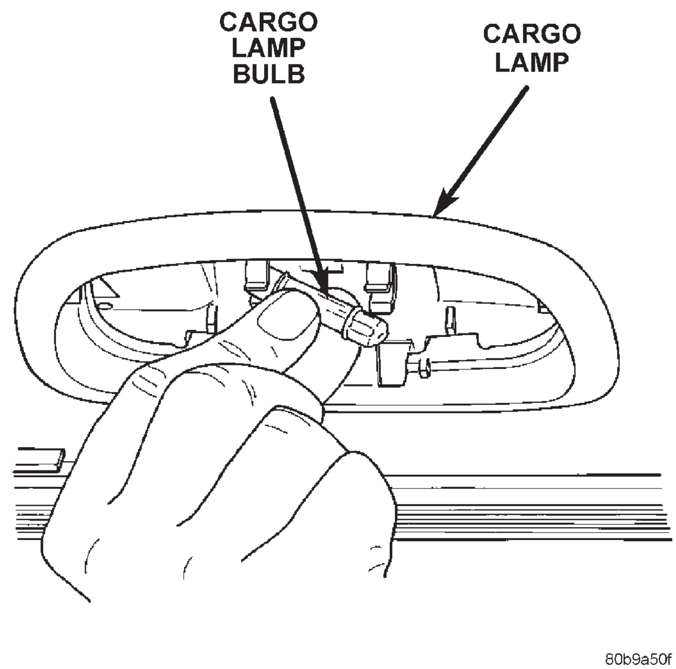


Fig. 8 Cargo Lamp Bulb

(2) Position lamp lens on lamp and press into place.

LAMP SERVICE

INDEX

REMOVAL AND INSTALLATION

HEADLAMP

REMOVAL

(1) Remove jack screw attaching top of headlamp to headlamp mounting module (Fig. 1).

(2) Grasp upper inboard and lower outboard corners of headlamp (Fig. 2) and forcefully pull headlamp outward.

(3) Remove all bulb sockets from headlamp module.

(4) Separate headlamp from vehicle.

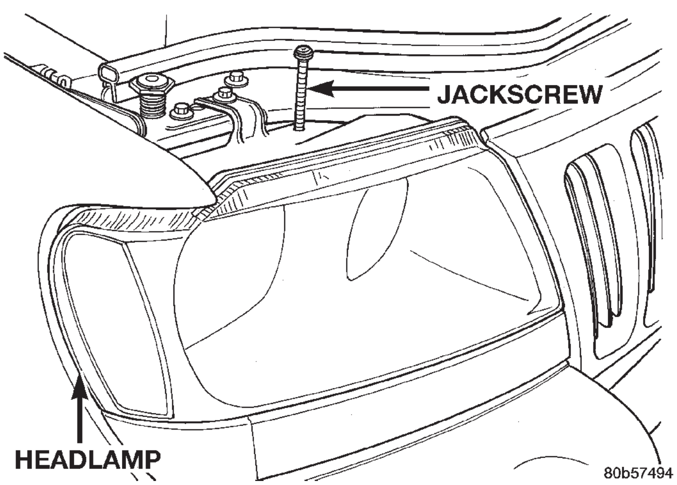


Fig. 1 Headlamp Jackscrew

INSTALLATION

CAUTION: Do not touch the bulb glass with fingers or other oily surfaces. Reduced bulb life will result.

(1) Install all bulb sockets in headlamp module.

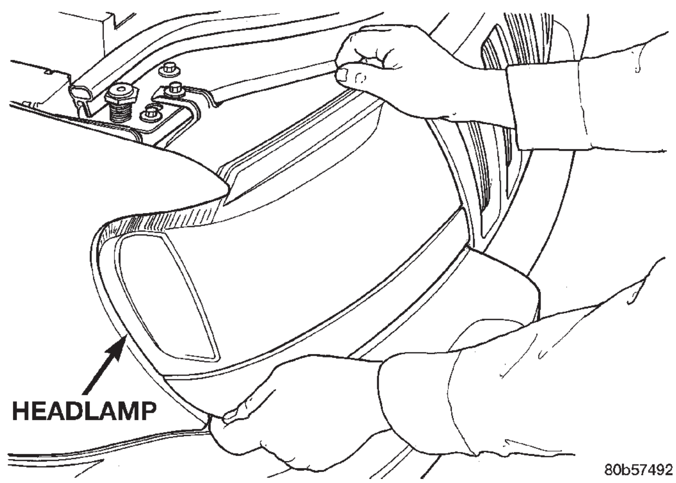


Fig. 2 Headlamp Removal

(2) Position headlamp on vehicle and align ball studs with sockets.

(3) Forcefully push headlamp inward to secure ball studs with sockets.

(4) Install jack screw attaching top of headlamp to headlamp mounting module.

FOG LAMP

REMOVAL

(1) Disengage fog lamp electrical connector.

(2) Remove nuts attaching fog lamp to fascia (Fig. 3).

(3) Separate fog lamp from vehicle.

INSTALLATION

(1) Position fog lamp in fascia.

(2) Install nuts attaching fog lamp to fascia.

(3) Engage fog lamp electrical connector.

(4) Align fog lamp, if necessary.

REMOVAL AND INSTALLATION (Continued)

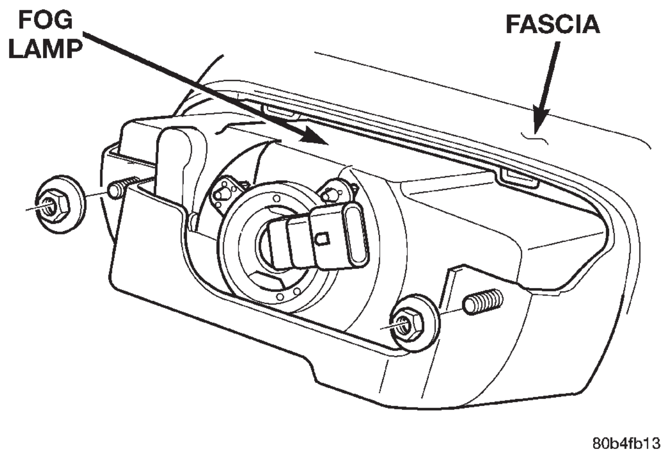


Fig. 3 Fog Lamp

FRONT TURN SIGNAL LAMP

The front turn signal lamp is incorporated in the headlamp module. If the front turn signal lamp is damaged or is in need of service, replace the headlamp module.

PARK LAMP

The park lamp is integral with the headlamp module and not serviced as a separate unit.

FRONT SIDE MARKER LAMP

The front side marker lamp is incorporated in the headlamp module. If the front side marker lamp is damaged or is in need of service, replace the headlamp module.

BACK-UP LAMP

The back-up lamp is incorporated in the tail lamp assembly. Refer to Tail Lamp Removal and Installation for service procedures.

TAIL, STOP, TURN SIGNAL, BACK-UP, AND SIDE MARKER LAMP

The stop, turn signal, back-up, and side marker lamps are incorporated in the tail lamp.

REMOVAL

(1) Remove screws attaching lamp to body (Fig. 4).
(2) Grasp lamp and pull from body to disengage alignment pin.
(3) Disconnect lamp wire harness connector.
(4) Separate lamp from vehicle.

INSTALLATION

(1) Position lamp at vehicle.
(2) Connect lamp wire harness connector.
(3) Align pin with retainer and press lamp inward to engage.

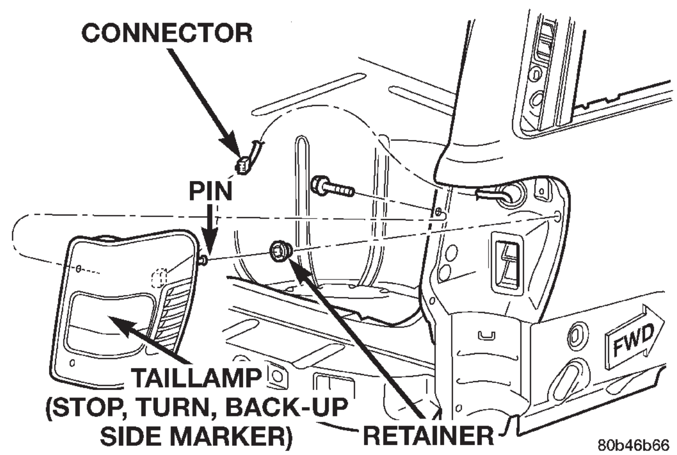


Fig. 4 Tail Lamp

(4) Install screws attaching lamp to body.

REAR SIDE MARKER LAMP

NOTE: The rear side marker lamp is incorporated into the tail lamp assembly. Refer to tail lamp removal for proper service procedures.

LICENSE PLATE LAMP

REMOVAL

(1) Remove the screws attaching lamp assembly to liftgate (Fig. 5).
(2) Pull the lamp assembly away from the sheetmetal at extreme outboard edges to disengage the push pins.
(3) Separate lamp assembly harness wiring connector.
(4) Remove lamp.

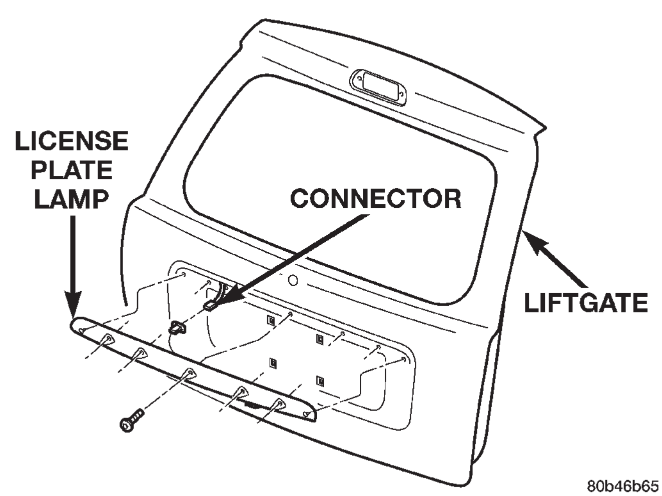


Fig. 5 License Plate Lamp Housing

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Connect bulb harness to lamp assembly.

(2) Position lamp assembly on liftgate and press outboard fasteners in place.

(3) Install screws in lamp assembly.

CENTER HIGH MOUNTED STOP LAMP (CHMSL)

REMOVAL

(1) Remove screws attaching CHMSL to liftgate (Fig. 6).

(2) Disconnect wire harness connector.

(3) Separate CHMSL from vehicle.

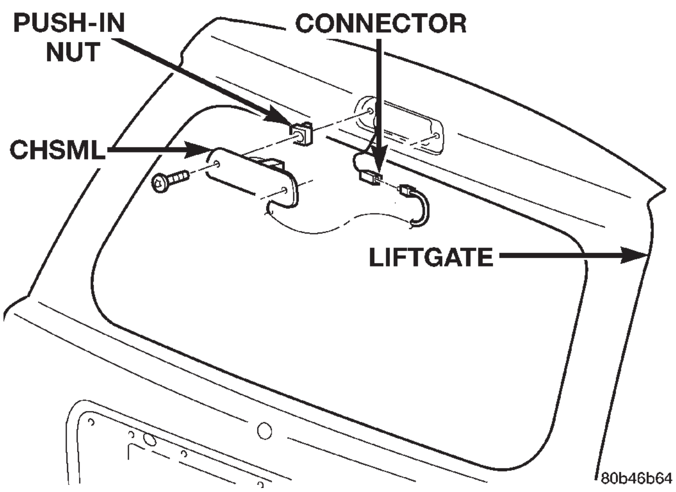


Fig. 6 Center High Mounted Stop lamp

INSTALLATION

(1) Connect wire harness connector.

(2) Position CHMSL on liftgate.

(3) Install screws attaching CHMSL to liftgate.

UNDERHOOD LAMP

REMOVAL

(1) Disconnect wire harness connector from lamp.

(2) Remove lamp lens.

(3) Remove bulb.

(4) Remove screw attaching underhood lamp to inner hood panel (Fig. 7).

(5) Separate underhood lamp from vehicle.

INSTALLATION

(1) Install bulb.

(2) Install lamp lens.

(3) Position underhood lamp on hood inner panel.

(4) Install screw attaching lamp base to inner hood panel.

(5) Fold lamp housing over and firmly press onto base to snap into place.

(6) Connect wire harness connector to lamp.

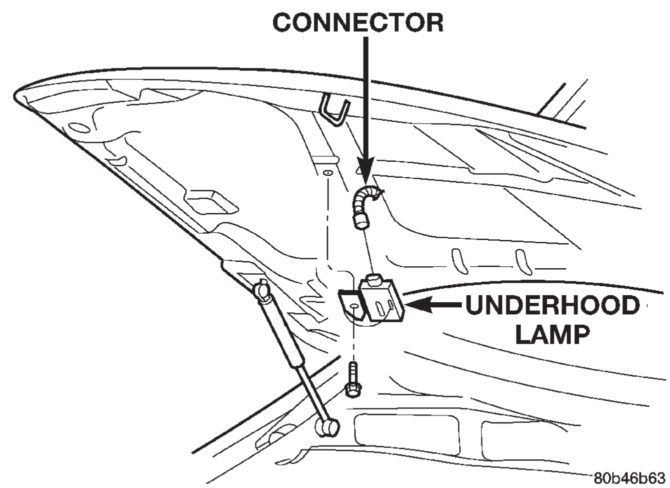


Fig. 7 Underhood Lamp

DOOR COURTESY LAMP

REMOVAL

(1) Remove door trim panel. See Group 23 Body Systems for proper service procedures.

(2) Disengage electrical connectors.

(3) Depress locking tabs and remove lamp module.

(4) Remove bulb socket.

INSTALLATION

(1) Install bulb socket in lamp module.

(2) Align lamp module with door trim panel opening.

(3) Snap lamp module into place.

(4) Install door panel.

VISOR VANITY LAMP

REMOVAL

(1) Fold down visor.

(2) Using a small flat blade, and staring at the base of the lamp assembly, carefully pry the base of the lamp from the visor.

(3) Disconnect the vanity lamp visor and remove the lamp from the vehicle.

INSTALLATION

(1) Position the lamp at the visor and connect the wire connector.

(2) Press the lamp in place.

READING LAMP

The reading lamp is serviced in the Dome/Reading Lamp section, or the Overhead Console Reading Lamp section.

REMOVAL AND INSTALLATION (Continued)

DOME /READING LAMP

REMOVAL

It will be necessary to partially remove the headliner to remove the bulb socket.

(1) Remove the screws holding the grab handle/lens assembly to the headliner and roof panel.

(2) Lower the headliner as needed. Refer to Group 23, Body Components for service procedure.

(3) Seperate the lamp socket from the headliner and roof panel.

(4) Disconnect the wire connector.

INSTALLATION

(1) Position the lamp socket on the headliner and roof panel.

(2) Connect the wire harness.

(3) Install the headliner.

(4) Position the grab handle/lens on the lamp module.

(5) Install the screws retaining the grab handle/lens into the lamp socket.

CARGO LAMP

REMOVAL

(1) Using a small flat blade, pry forward corners of lamp lens from lamp (Fig. 8).

(2) Separate lens from lamp.

(3) Using a trim stick, pry front and rear edges of lamp from headliner.

(4) Disconnect lamp connector from lamp.

(5) Separate lamp from headliner.

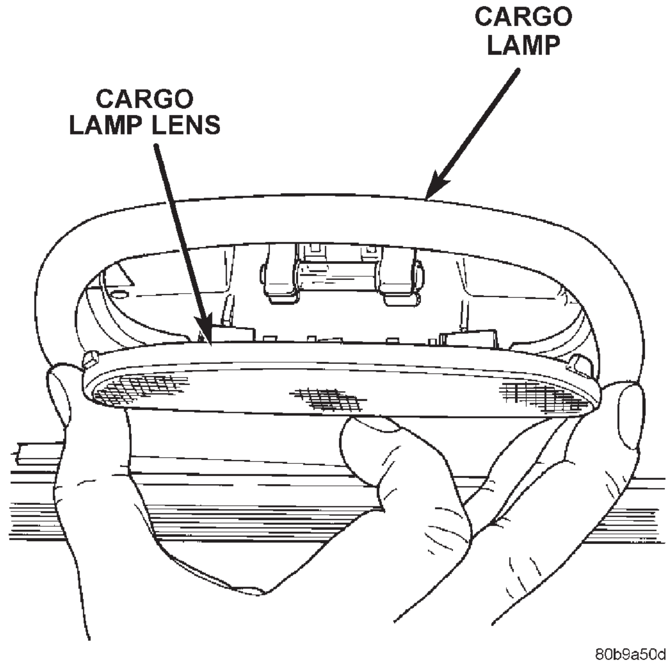


Fig. 8 Cargo Lamp

INSTALLATION

(1) Position lamp at headliner.

(2) Connect lamp connector to lamp.

(3) Position lamp in headliner.

(4) Position lens on lamp and press into place.

LAMP SYSTEMS

INDEX

DESCRIPTION AND OPERATION

AUTO HEADLAMP SENSOR

DESCRIPTION

The auto headlamp sensor is the key sensor for the auto headlamp system. The sensor needs real sunlight to properly register the light level. When auto headlamps are enabled indoors, the headlamps may be turned on. The sensor is located in the center of the defroster grille at the base of the windshield.

DAYTIME RUNNING LAMP MODULE

DESCRIPTION

WJ vehicles built for use in Canada are equipped with a Daytime Running Lamp System (DRL). The DRL system operates the headlamp at 50% illumination with the headlamp switch OFF, park brake released and the ignition in the RUN position. The Daytime Running Lamp Module is located in the junction block under the instrument panel.

OPERATION

The DRL system is controlled by the Daytime Running Lamp Module. The DRL module overrides the headlamp switch when the headlamps are turned OFF. The headlamps operate normally when the headlamps are turned ON.

REMOVAL AND INSTALLATION

AUTO HEADLAMP SENSOR

REMOVAL

(1) Remove instrument panel top cover. Refer to Group 8E, Instrument Panel for service procedures.

(2) Remove screw attaching auto headlamp sensor to instrument panel (Fig. 1).

(3) Disengage harness connector from auto headlamp sensor.

(4) Separate auto headlamp sensor from instrument panel.

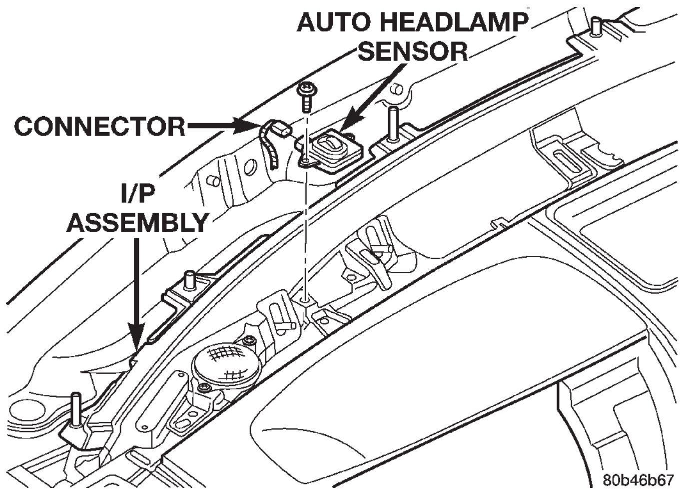


Fig. 1 Auto Headlamp Sensor

INSTALLATION

(1) Position auto headlamp sensor on instrument panel.

(2) Engage harness connector to auto headlamp sensor.

(3) Install screw attaching auto headlamp sensor to instrument panel.

(4) Install instrument panel top cover. Refer to Group 8E, Instrument Panel for service procedures.

DAYTIME RUNNING LAMP MODULE

REMOVAL

(1) Lower the junction block to access the daytime running lamp module. Refer to Group 80, Power Distribution Center for service procedures.

(2) Pull the module from the junction block.

INSTALLATION

(1) Position the module in the junction block and press to secure.

(2) Install the junction block. Refer to Group 80, Power Distribution Center for service procedures.

BULB APPLICATION

INDEX

SPECIFICATIONS

EXTERIOR LAMPS

CAUTION: Do not use bulbs that have a higher candle power than the bulb listed in the Bulb Application Table. Damage to lamp can result. Do not touch halogen bulbs with fingers or other oily surfaces. Bulb life will be reduced.

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.

LAMP	BULB
Back-up	3157
Center High Mounted Stop Lamp	921
Fog lamp	H3
Front Turn Signal	3157/3157NA
Front Side Marker	194/194NA
High Beam	9005
Low Beam	9006
License Plate	168
Tail/Stop	3157
Rear Turn Signal	3157
Underhood Lamp	105

INTERIOR LAMPS

CAUTION: Do not use bulbs that have a higher candle power than the bulb listed in the Bulb Application Table. Damage to lamp can result.

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.

LAMP	BULB
A/C Heater	not serviced
Ash Receiver	161
Climate Control	74
Passenger Assist Handle	214–2
Front Reading	192
Glove Compartment	194
Telltale/Hazard Lamp	74
Heater	not serviced
Overhead Console	192
Radio	ASC
Rear Cargo	214-2
Under Panel Courtesy	906
Cluster Illumination	103
Sunvisor Vanity	Chrysler p/n 6501966

LAMPS

CONTENTS

LAMP BULB SERVICE

INDEX

REMOVAL AND INSTALLATION

CENTER HIGH MOUNTED STOPLIGHT BULB

REMOVAL

(1) Remove the (2) screws retaining the center high mounted stop lamp to the rear liftgate.

(2) Pull the lamp from the rear liftgate, rotate the bulb socket 1/4 turn and pull from lamp housing (Fig. 1).

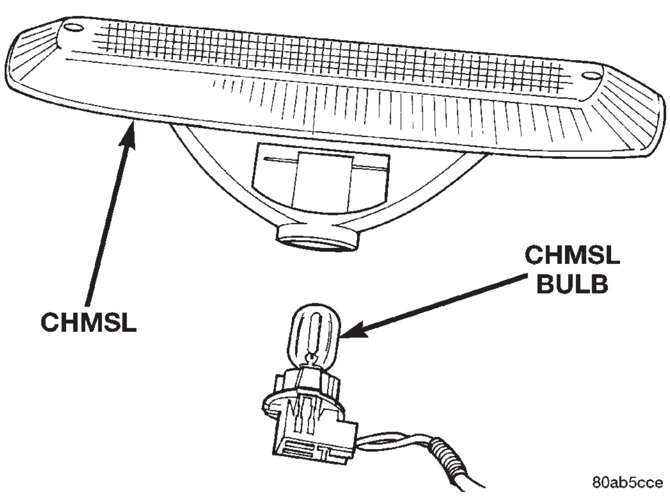


Fig. 1 Center High Mounted Stop Lamp

(3) Pull the bulb straight from its socket.

INSTALLATION

(1) Install the bulb in its socket.

(2) Verify lamp operation.

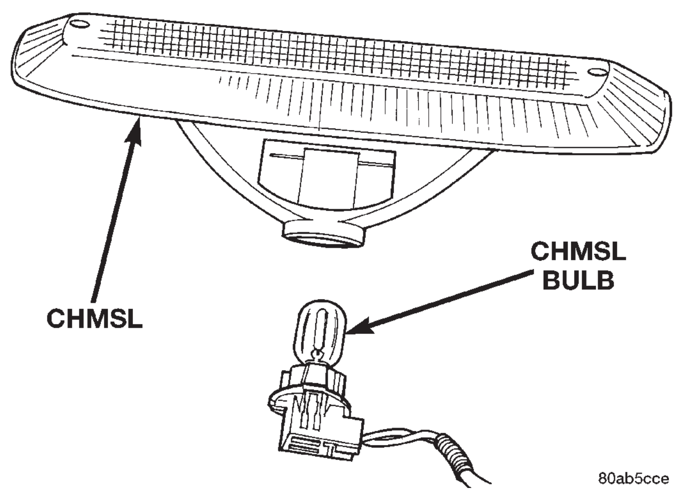


Fig. 2 Center High Mounted Stop Lamp

(3) Install the lamp socket in the lamp housing (Fig. 2).

(4) Install the lamp housing in the rear liftgate and install the retaining screws.

REMOVAL AND INSTALLATION (Continued)

FRONT TURN SIGNAL LAMP BULB

REMOVAL

(1) Remove the appropriate headlamp from the vehicle. Refer to the headlamp removal and installation procedure in this group.

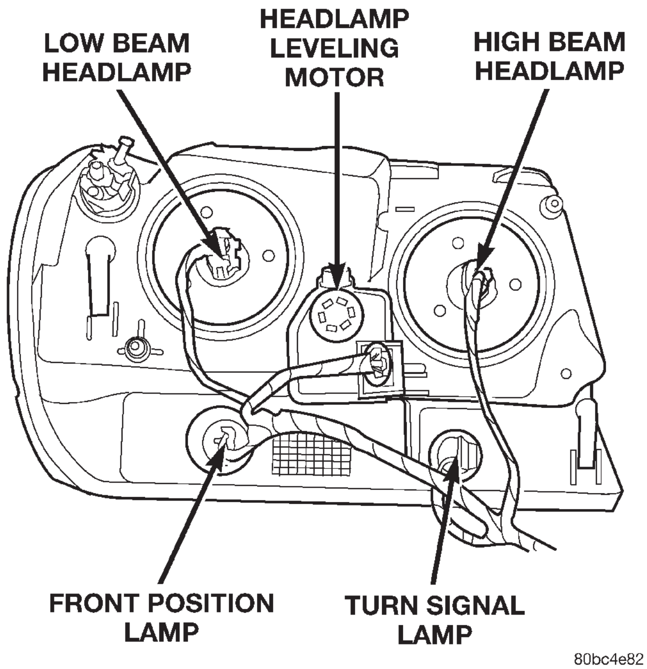


Fig. 3 Headlamp Assembly

(2) Rotate the turn signal lamp socket counterclockwise and pull straight from the headlamp assembly.

(3) Pull the front turn signal lamp bulb straight from its socket.

INSTALLATION

(1) Install the front turn signal lamp bulb in its socket.

(2) Verify lamp operation.

(3) Install the turn signal lamp socket in the headlamp.

(4) Install the headlamp in the vehicle. Refer to the headlamp removal and installation procedure in this group.

FRONT POSITION LAMP BULB

REMOVAL

(1) Remove the appropriate headlamp from the vehicle. Refer to the headlamp removal and installation procedure in this group.

(2) Rotate the front position lamp socket counterclockwise and pull straight from the headlamp assembly.

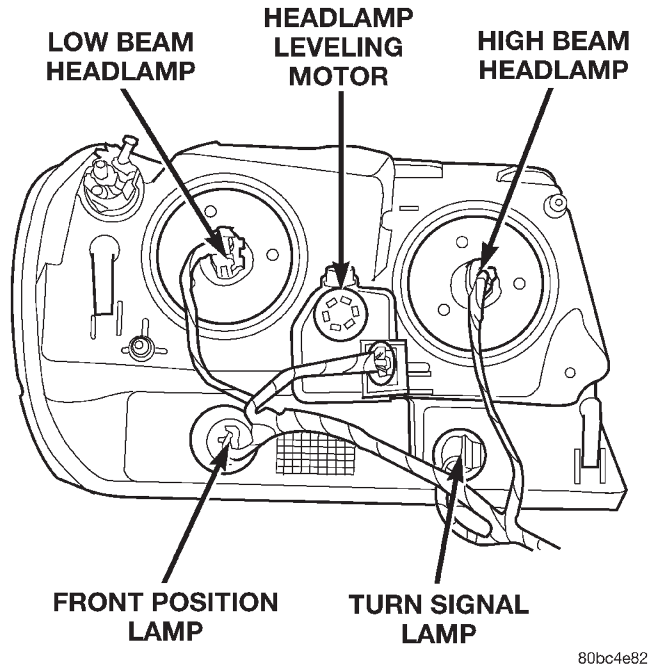


Fig. 4 Headlamp Assembly

(3) Pull the front position lamp bulb straight from its socket.

INSTALLATION

(1) Install the front position lamp bulb in its socket.

(2) Verify lamp operation.

(3) Install the front position lamp socket in the headlamp.

(4) Install the headlamp in the vehicle. Refer to the headlamp removal and installation procedure in this group.

FRONT FOG LAMP BULB

The front fog lamp bulb cannot be serviced separately from the fog lamp assembly. If the fog lamp bulb is burnt out or damaged the entire fog lamp assembly must be serviced. Refer to Front Fog Lamp removal and installation under Lamp Service for the procedure.

HIGHBEAM / LOWBEAM HEADLAMP BULBS

REMOVAL

(1) Remove the appropriate headlamp from the vehicle. Refer to Headlamp removal and installation in Lamp Service for the procedure.

(2) Disconnect the electrical connector from the headlamp bulb.

(3) Rotate the bulb 1/4 turn counter-clockwise and pull straight from the headlamp assembly.

REMOVAL AND INSTALLATION (Continued)

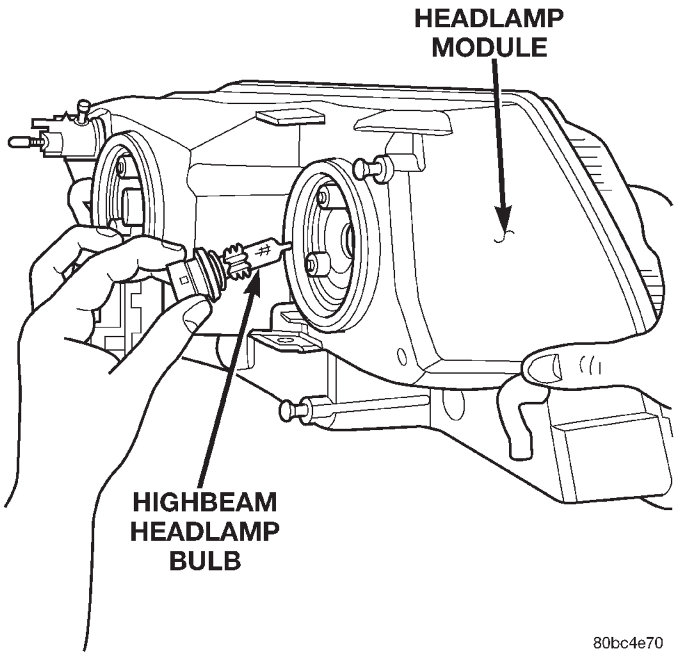


Fig. 5 Highbeam Headlamp Bulb

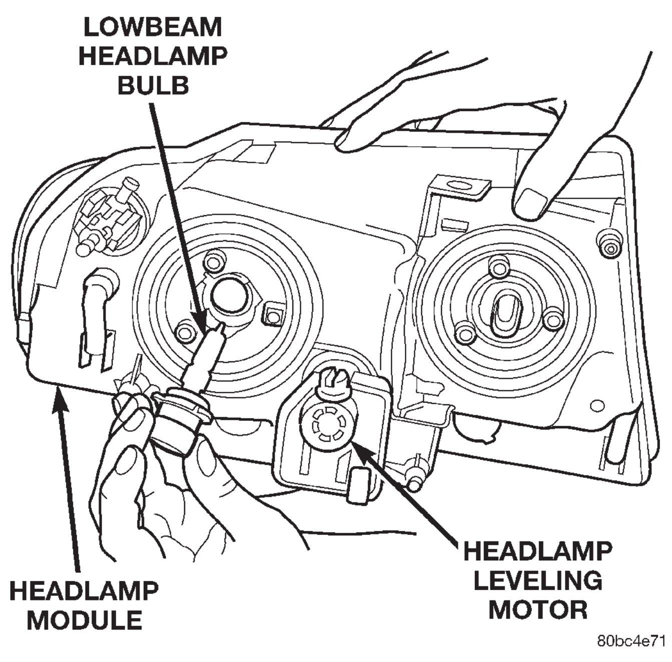


Fig. 6 Lowbeam Headlamp Bulb

INSTALLATION

CAUTION: Do not touch the bulb glass with fingers or other oily surfaces. Reduced bulb life will result.

(1) Install the bulb in the headlamp assembly.

(2) Connect the headlamp electrical connector.

(3) Verify lamp operation.

(4) Install the headlamp in the vehicle. Refer to Headlamp removal and installation in Lamp Service for the procedure.

LICENSE PLATE LAMP BULBS

REMOVAL

(1) Remove the rear license plate lamp retaining screw (Fig. 7).

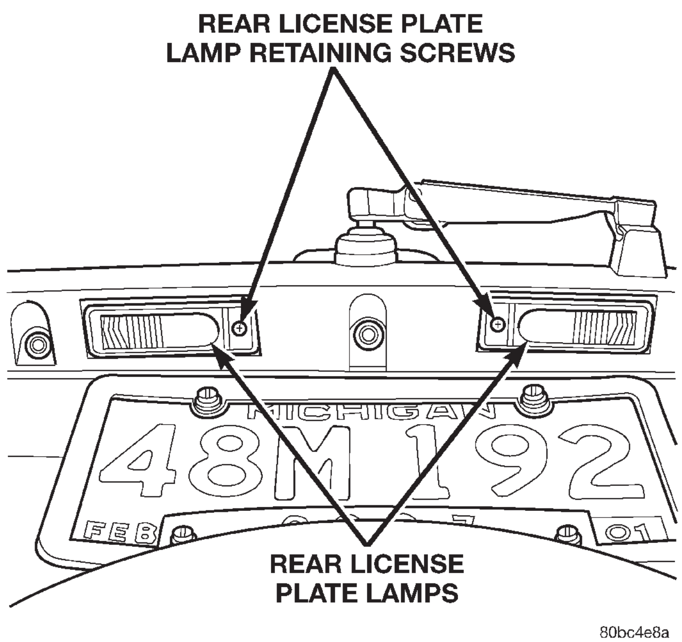


Fig. 7 Rear License Plate Lamps

(2) Pull the lamp from the rear liftgate, rotate the lamp counter clockwise and pull straight from the lamp socket.

(3) Pull the lamp bulb straight from its socket.

INSTALLATION

(1) Install the bulb in its socket.

(2) Verify lamp operation.

(3) Install the lamp on its socket.

(4) Position the lamp in the rear liftgate and install the retaining screw (Fig. 8).

SIDE REPEATER LAMP BULB

REMOVAL

(1) Using a flat bladed pry tool, gently depress the upper plastic retaining clip (Fig. 9) and pull the side repeater lamp from the front fender.

CAUTION: Care must be taken not to damage the lamp or the vehicle's paint during service of the side repeater lamp or bulb. The lamp or bulb can also be serviced by pulling the wheel well trim back to access the rear of the lamp assembly.

(2) Rotate the lamp socket counter-clockwise and pull straight from the side repeater lamp (Fig. 10).

REMOVAL AND INSTALLATION (Continued)

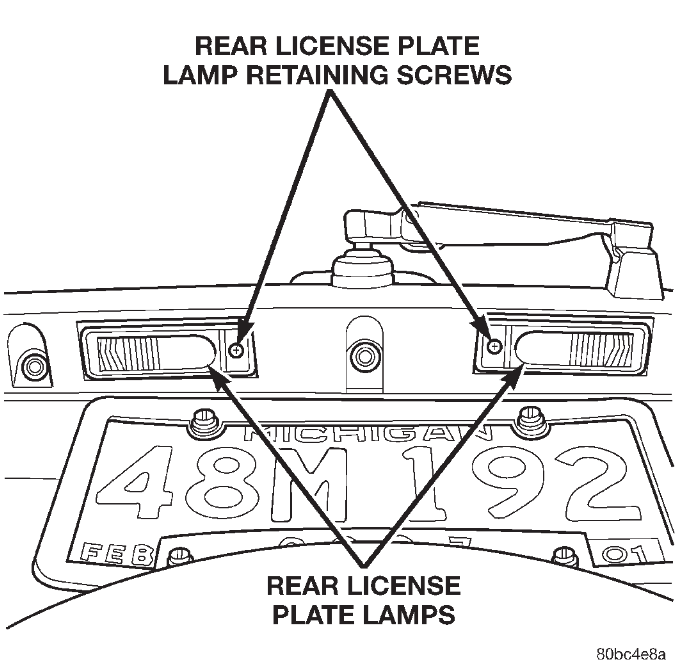


Fig. 8 Rear License Plate Lamps

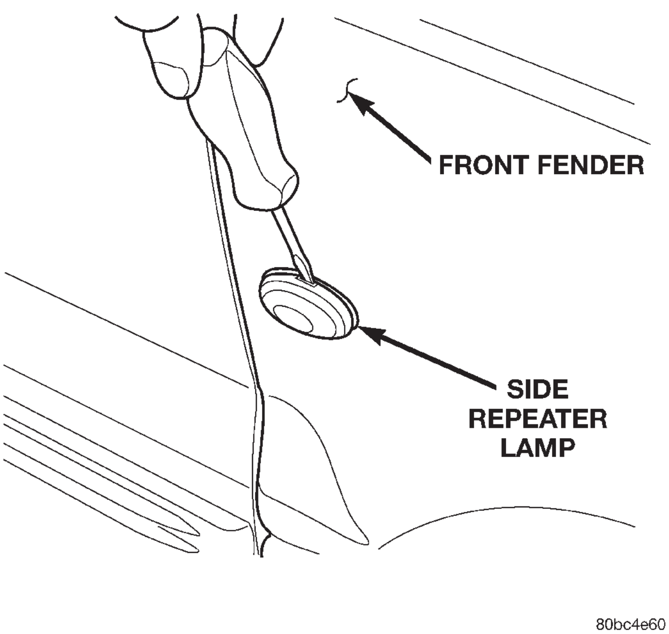


Fig. 9 Removing Side Repeater Lamp

(3) Rotate the bulb counter-clockwise and pull straight from its socket (Fig. 11).

INSTALLATION

(1) Install the bulb in its socket (Fig. 12).

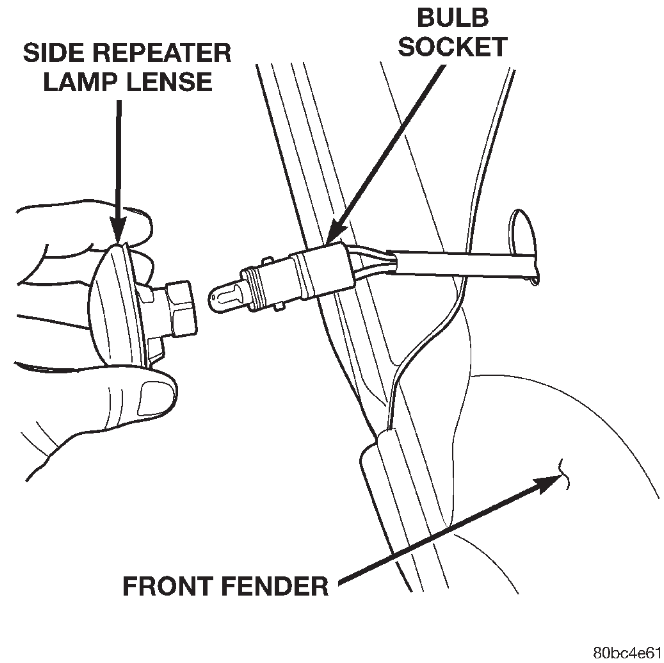


Fig. 10 Side Repeater Lamp

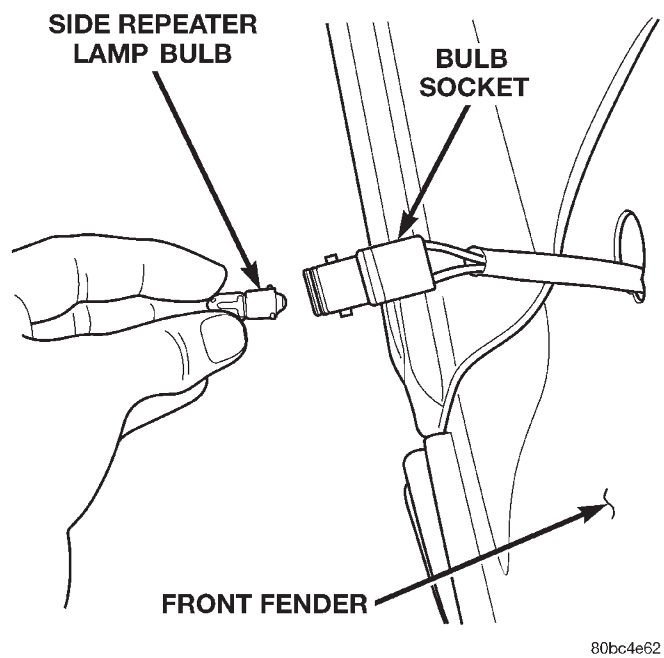


Fig. 11 Side Repeater Lamp Bulb

(2) Verify lamp operation.

(3) Install the side repeater lamp socket in the side repeater lamp (Fig. 13).

(4) Push the side repeater lamp in the front fender until it snaps in place.

REMOVAL AND INSTALLATION (Continued)

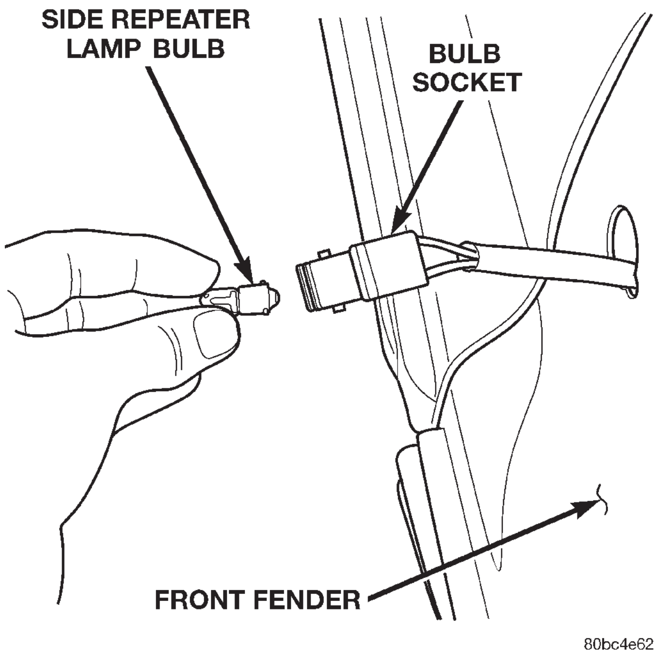


Fig. 12 Side Repeater Lamp Bulb

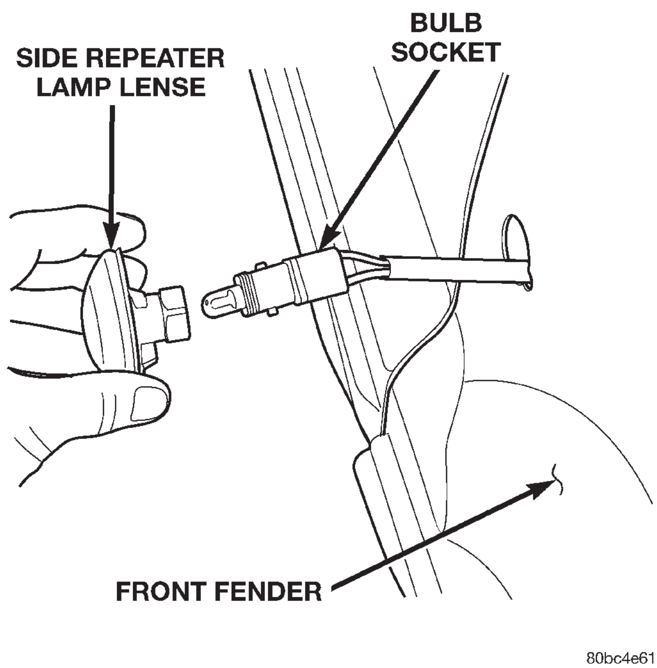


Fig. 13 Side Repeater Lamp

TAIL LAMP, REAR TURN SIGNAL, BACKUP AND REAR FOG LAMP BULBS

REMOVAL

(1) Open the liftgate and remove the (2) tail lamp retaining screws (Fig. 14).

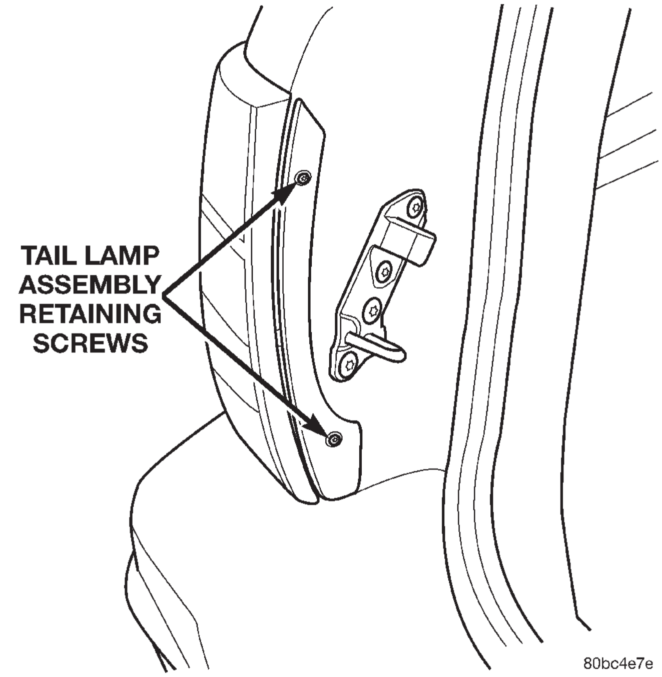


Fig. 14 Tail Lamp Retaining Screws

(2) Position tail lamp trim panel as shown (Fig. 15).

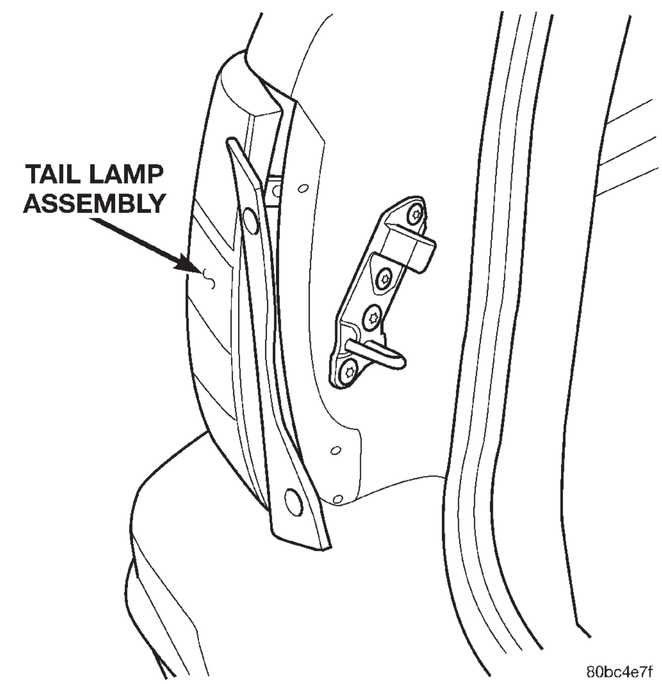


Fig. 15 Tail Lamp Trim Panel

(3) Grasp the tail lamp and pull straight from the vehicle body to unsnap the mounting studs.

(4) Remove the appropriate lamp socket from the tail lamp assembly (Fig. 16) by rotating counter clockwise and pulling straight out (Fig. 17).

REMOVAL AND INSTALLATION (Continued)

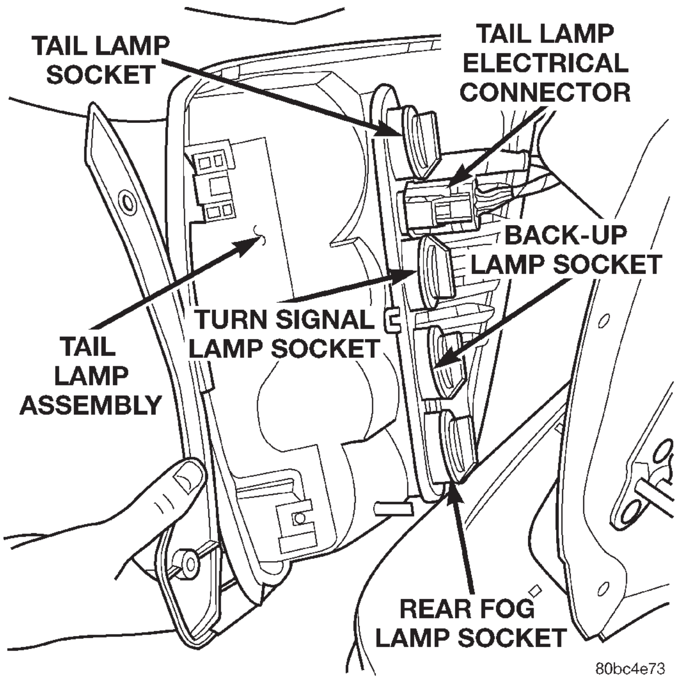


Fig. 16 Tail Lamp Bulb Locations

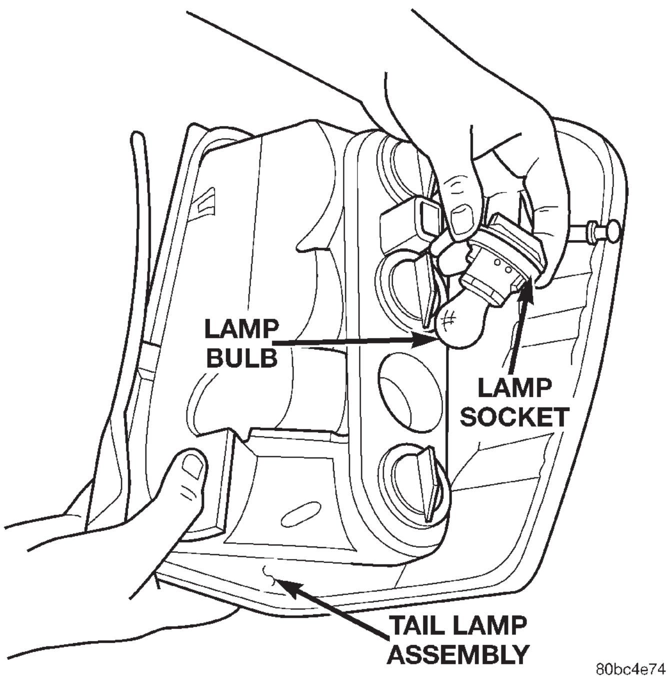


Fig. 17 Tail Lamp Socket Removal

(5) Remove the lamp bulb from its socket by pulling straight out (Fig. 18).

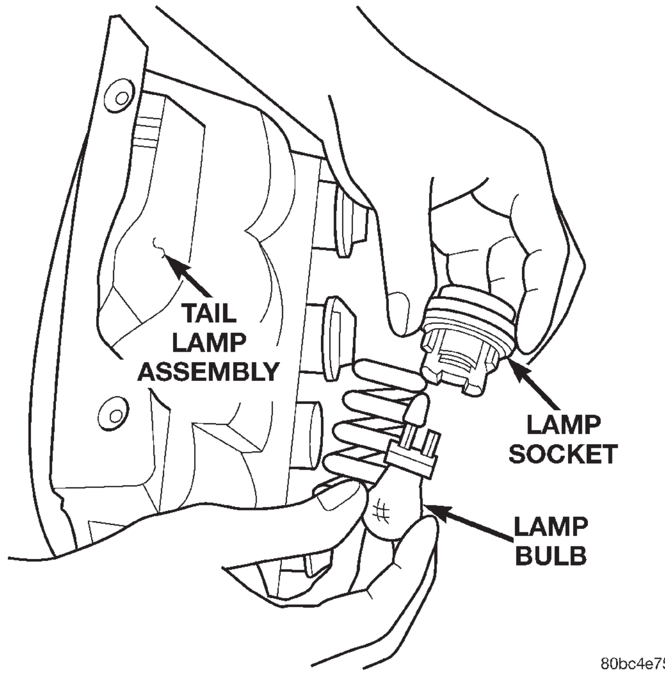


Fig. 18 Tail Lamp Bulb Removal

INSTALLATION

(1) Install the bulb in its socket (Fig. 19).

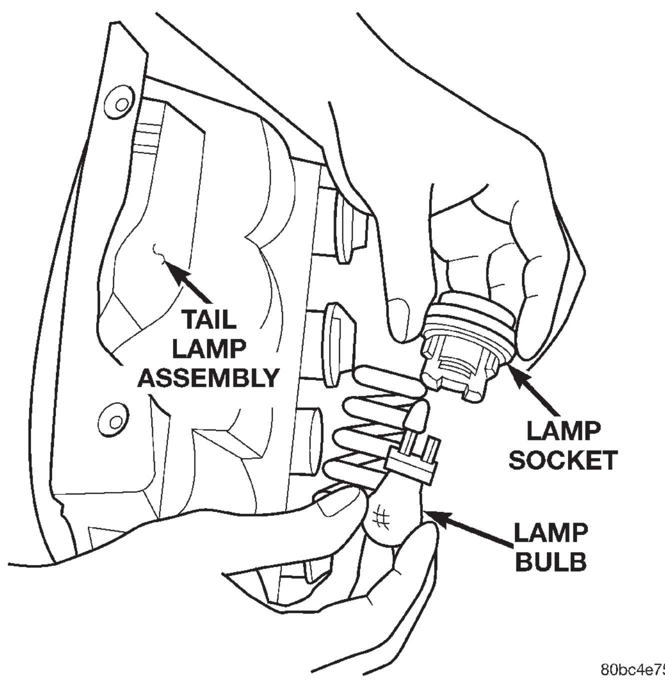


Fig. 19 Tail Lamp Bulb Installation

REMOVAL AND INSTALLATION (Continued)

(2) Install the lamp socket in the tail lamp assembly (Fig. 20).

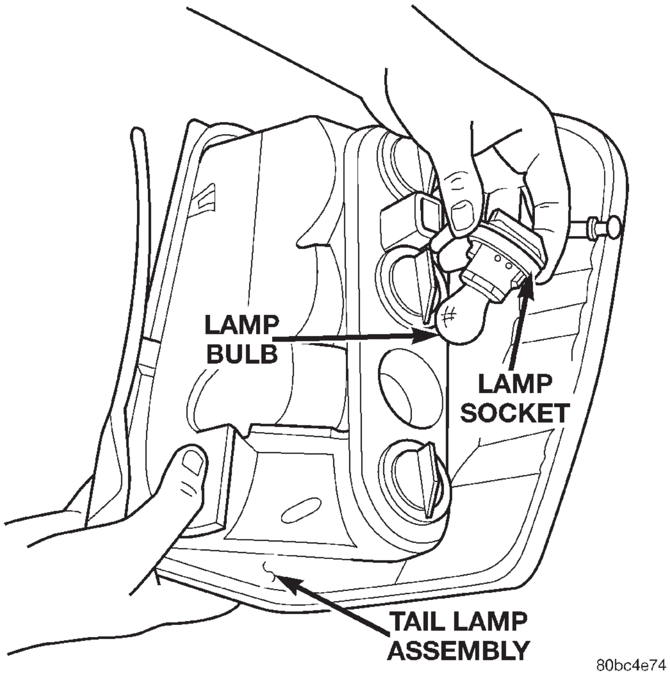


Fig. 20 Tail Lamp Socket Installation

(3) Verify lamp operation.

(4) Position the tail lamp, trim panel and install the retaining screws (Fig. 21).

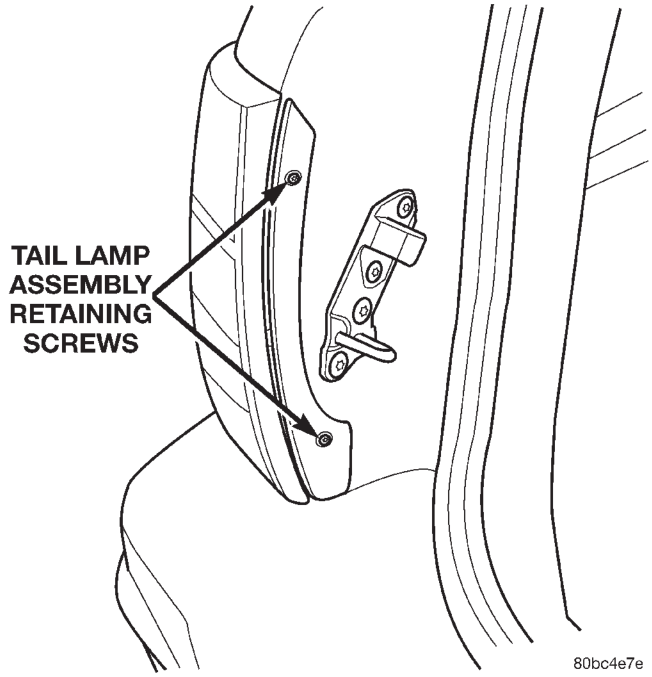


Fig. 21 Tail Lamp Retaining Screws

LAMP SERVICE

INDEX

REMOVAL AND INSTALLATION

CENTER HIGH MOUNTED STOPLAMP

REMOVAL

(1) Remove the (2) screws retaining the center high mounted stop lamp to the rear liftgate.

(2) Pull the lamp from the rear liftgate, rotate the bulb socket 1/4 turn and pull from lamp housing (Fig. 1).

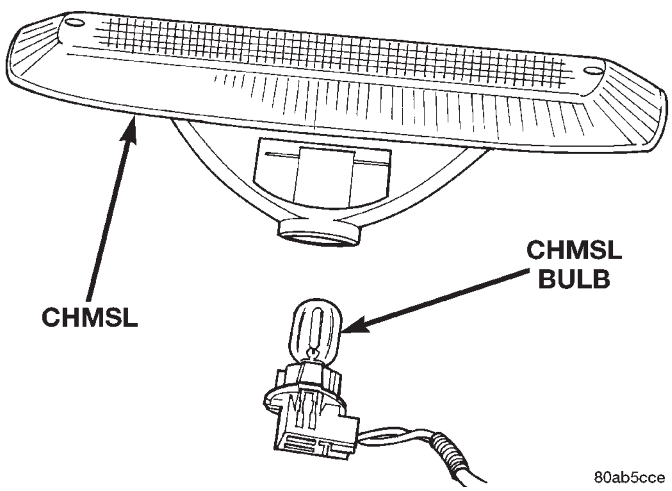


Fig. 1 Center High Mounted Stop Lamp

INSTALLATION

(1) Install the lamp socket in the lamp housing.

(2) Position the lamp housing in the rear liftgate and install the retaining screws.

HEADLAMP

REMOVAL

(1) Open the hood and remove the headlamp retaining jackscrew (Fig. 2).

(2) Grasp the corners of the headlamp and forcefully pull the headlamp outward (Fig. 3). This will unsnap the left and right mounting studs from the headlamp mounting module.

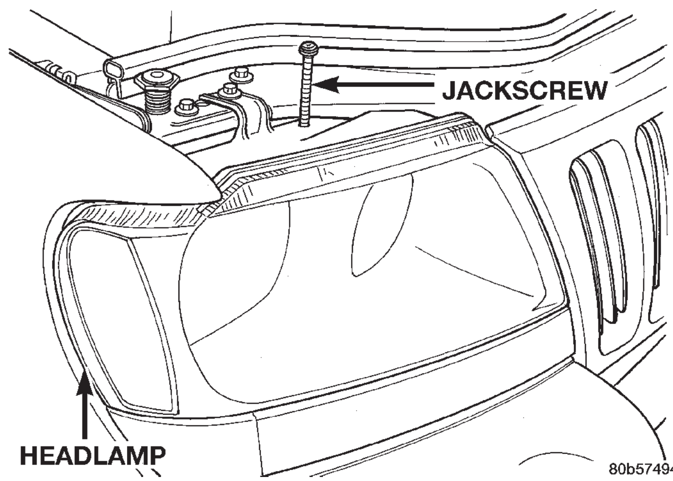


Fig. 2 Headlamp Retaining Fastener

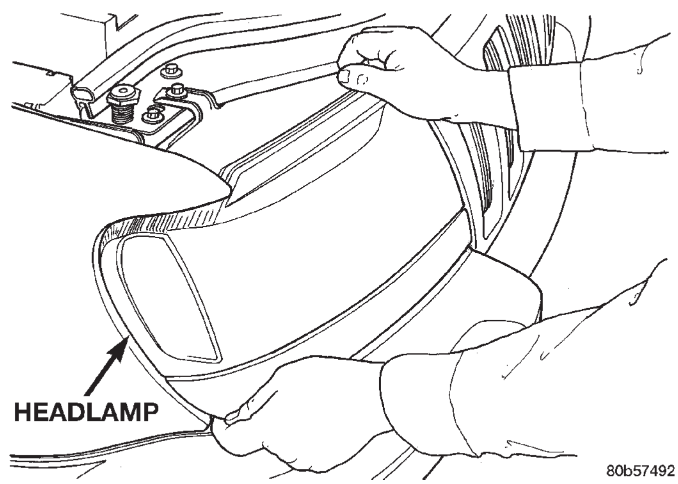


Fig. 3 Removing The Headlamp

CAUTION: Do not touch the bulb glass with fingers or other oily surfaces. Reduced bulb life will result.

(3) Pull the headlamp assembly out far enough to access and remove the bulb sockets from the head-

REMOVAL AND INSTALLATION (Continued)

lamp. Remove the sockets by rotating counter-clockwise and pulling straight from the headlamp.

(4) Remove the headlamp from the vehicle.

INSTALLATION

(1) Position the headlamp and install the bulb and socket assemblies.

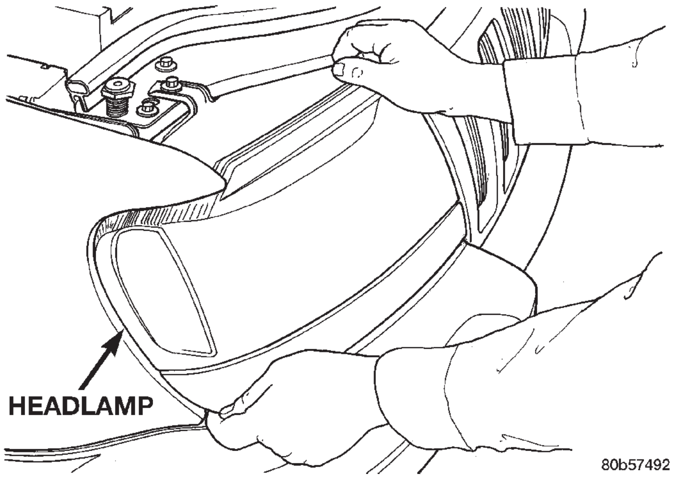


Fig. 4 Installing The Headlamp

(2) Align the headlamp mounting studs with the corresponding holes in the headlamp mounting module (HMM). Forcefully push the headlamp in to secure both of the ball and socket connections (Fig. 4).

(3) Position the headlamp and install the retaining jackscrew (Fig. 5).

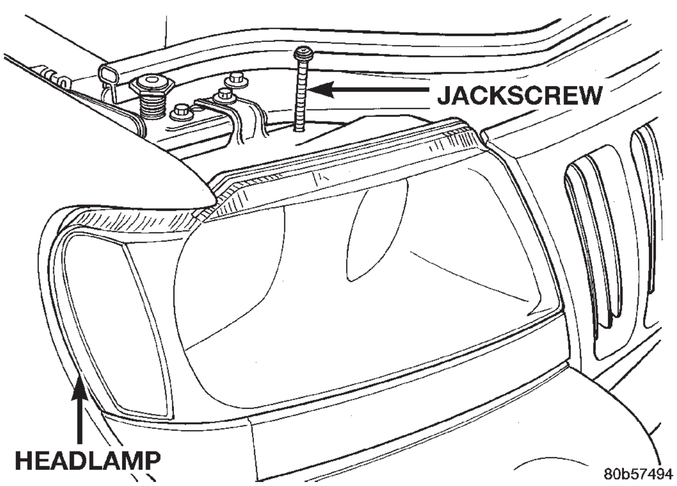


Fig. 5 Headlamp Retaining Fastener

HEADLAMP LEVELING MOTOR

The headlamp leveling motor cannot be serviced separately from the headlamp assembly. If the headlamp leveling motor is found to be defective the entire headlamp assembly must be replaced. Refer to Headlamp removal and installation in Lamp Service for the procedure.

FRONT FOG LAMP

REMOVAL

(1) Raise the vehicle on a hoist or position a creeper under the front of the vehicle.

(2) Remove the pushpin securing the wheel well trim to the front fascia.

(3) Working behind the front fascia, disconnect the fog lamp electrical connector.

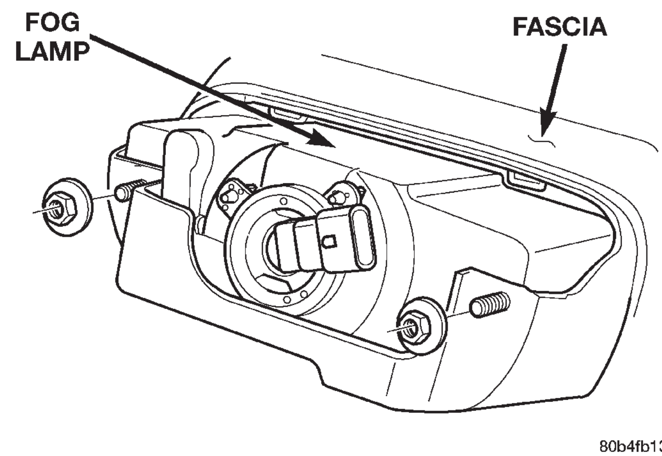


Fig. 6 Front Fog Lamp

(4) Remove the (2) fog lamp retaining nuts (Fig. 6).

(5) Remove the fog lamp from the fascia.

INSTALLATION

(1) Position the fog lamp in the fascia and install the retaining nuts (Fig. 7).

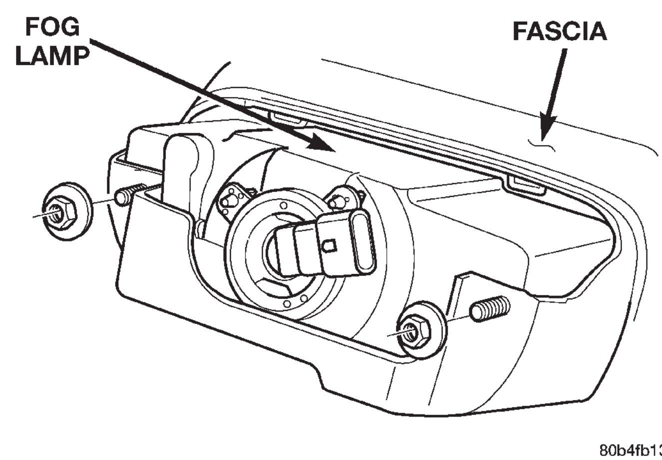


Fig. 7 Front Fog Lamp

(2) Connect the fog lamp electrical connector.

(3) Verify lamp operation.

(4) Install the pushpin securing the wheel well trim to the front fascia.

REMOVAL AND INSTALLATION (Continued)

(5) Adjust the front fog lamp if necessary. Refer to Fog Lamp Adjustment in this group for the procedure.

FRONT POSITION LAMP

The front position lamp is incorporated in the headlamp assembly. Refer to the Headlamp removal and installation procedure for service of the front position lamp.

FRONT TURN SIGNAL LAMP

The front turn signal lamp is incorporated in the headlamp assembly. Refer to the Headlamp removal and installation procedure for service of the front turn signal lamp.

REAR FOG LAMP

The rear fog lamp is incorporated in the tail lamp assembly. Refer to the Tail lamp removal and installation procedure for service of the rear fog lamp.

SIDE REPEATER LAMP

REMOVAL

(1) Using a flat bladed pry tool, gently depress the upper plastic retaining clip (Fig. 8) and pull the side repeater lamp from the front fender.

CAUTION: Care must be taken not to damage the lamp or the vehicle's paint during service of the side repeater lamp or bulb. The lamp or bulb can also be serviced by pulling the wheel well trim back to access the rear of the lamp assembly.

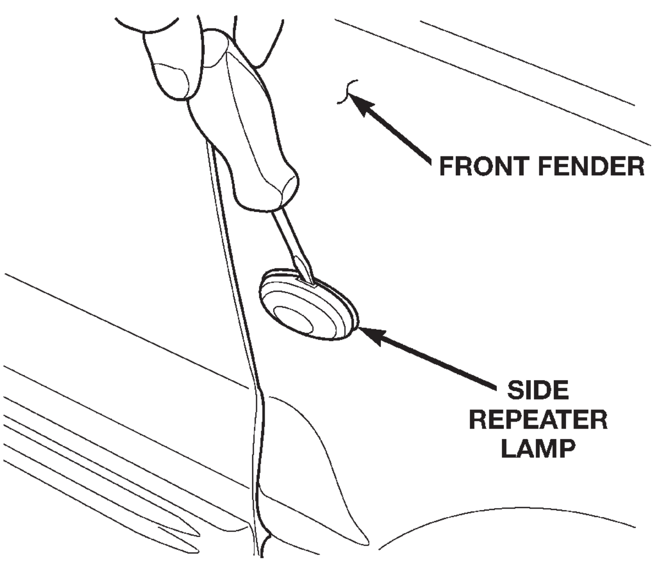


Fig. 8 Removing Side Repeater Lamp

(2) Rotate the lamp socket counter-clockwise and pull straight from the side repeater lamp (Fig. 9).

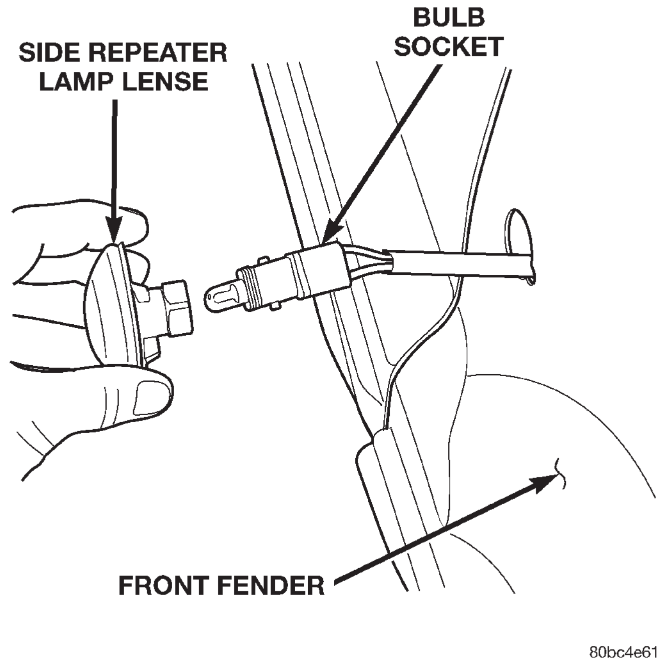


Fig. 9 Side Repeater Lamp

INSTALLATION

(1) Install the side repeater lamp socket in the side repeater lamp (Fig. 10).

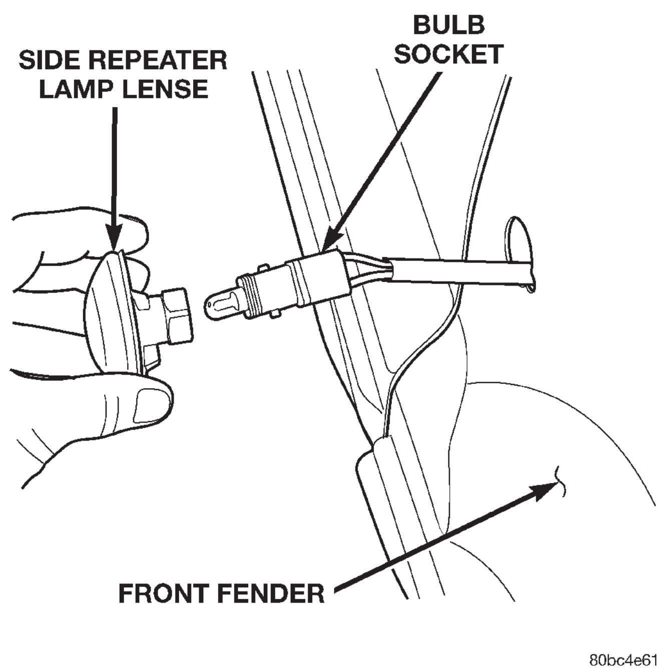


Fig. 10 Side Repeater Lamp

(2) Push the side repeater lamp in the front fender until it snaps in place.

REMOVAL AND INSTALLATION (Continued)

TAIL LAMP, REAR TURN SIGNAL, BACKUP AND REAR FOG LAMP BULBS

REMOVAL

(1) Open the liftgate and remove the (2) tail lamp retaining screws (Fig. 11).

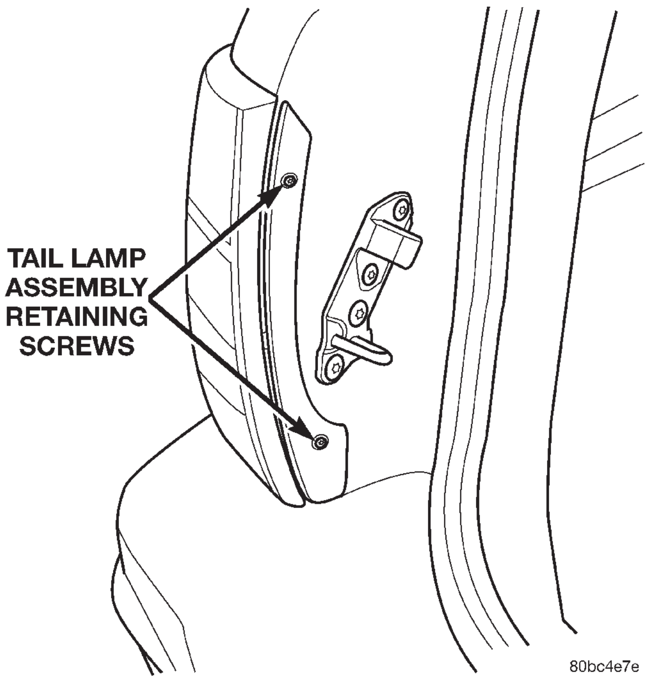


Fig. 11 Tail Lamp Retaining Screws

(2) Position tail lamp trim panel as shown (Fig. 12).

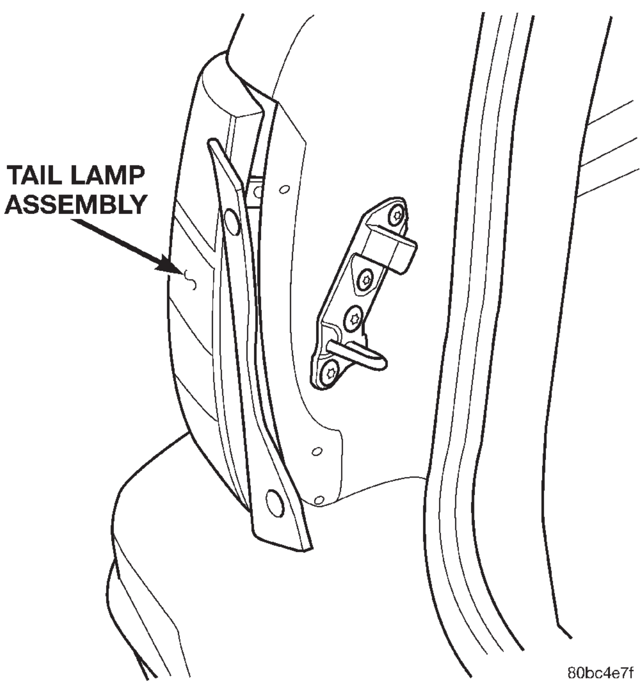


Fig. 12 Tail Lamp Trim Panel

(3) Grasp the tail lamp and pull straight from the vehicle body to unsnap the mounting studs.

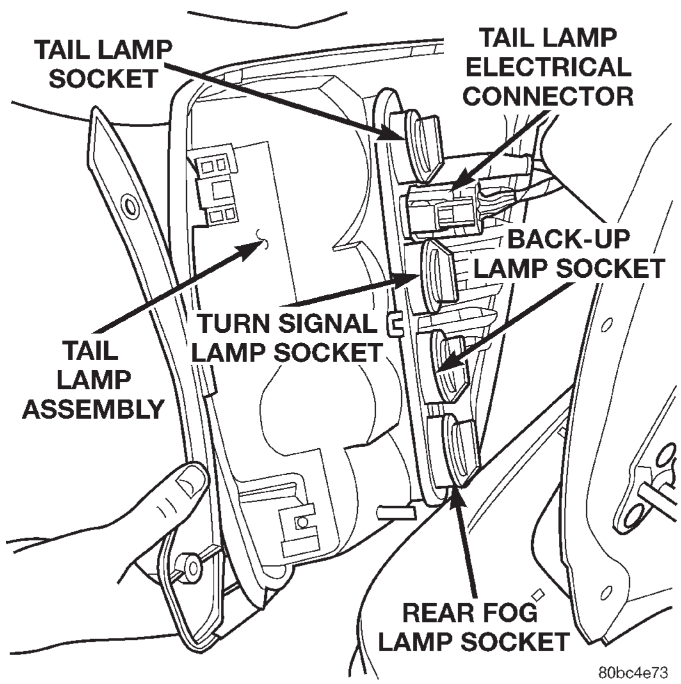


Fig. 13 Tail Lamp Bulb Locations

(4) Remove all lamp sockets from the tail lamp assembly (Fig. 13) by rotating counter clockwise and pulling straight out (Fig. 14).

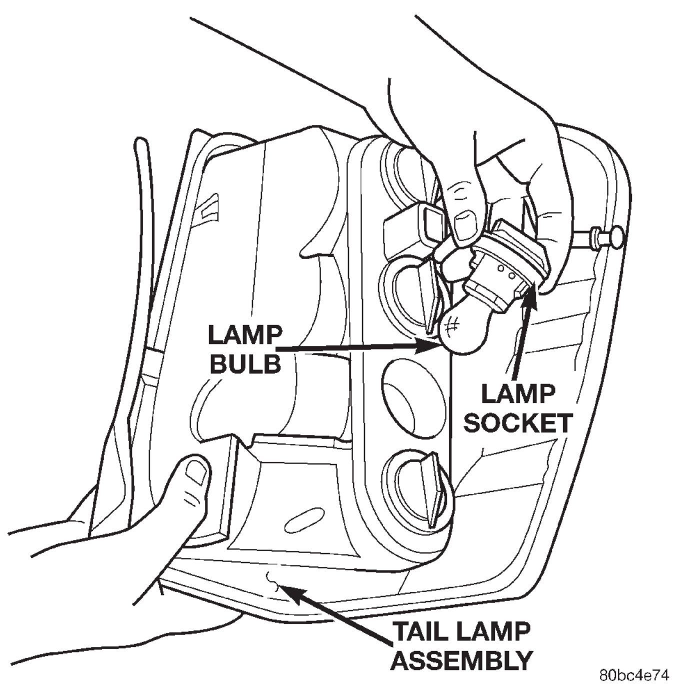


Fig. 14 Tail Lamp Socket Removal

INSTALLATION

(1) Install the lamp sockets in the tail lamp assembly (Fig. 15).

REMOVAL AND INSTALLATION (Continued)

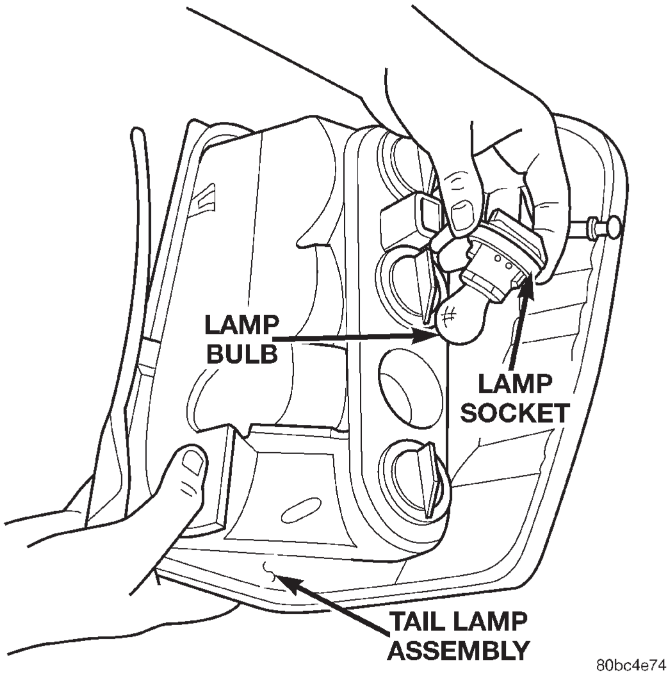


Fig. 15 Tail Lamp Socket Installation

(2) Position the tail lamp, trim panel and install the retaining screws (Fig. 16).

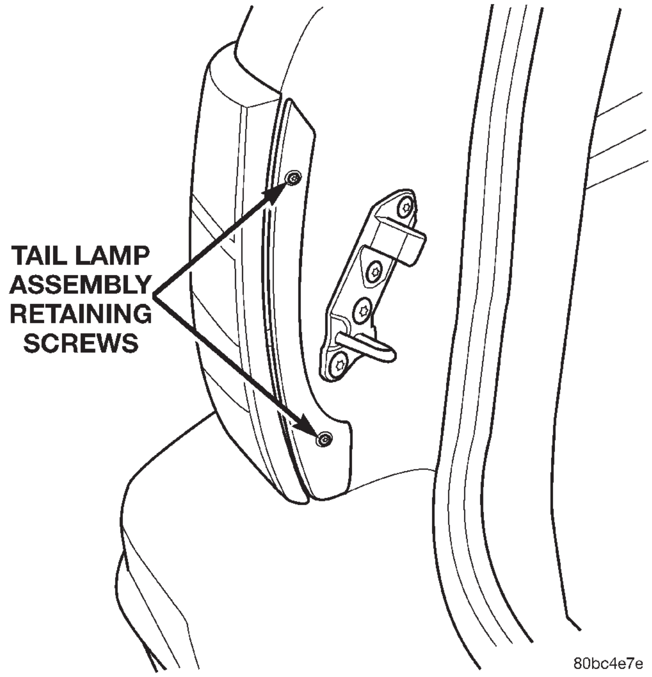


Fig. 16 Tail Lamp Retaining Screws

BULB APPLICATION

INDEX

GENERAL INFORMATION

INTRODUCTION

The following Bulb Application Tables list 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 the bulb listed in the Bulb Application Table. Damage to lamp can result.

Do not touch halogen bulbs with fingers or other possibly oily surfaces. Bulb life will be reduced.

If a halogen bulb is contaminated with oil, clean bulb with denatured alcohol or ammonia based solvent.

SPECIFICATIONS

EXTERIOR LAMPS

LAMP	BULB
Lowbeam Headlamp	9006XS
Highbeam Headlamp	9005XS
Center High Mounted Stop	W16W
Front Position	W5W
Side Repeater / Turn Signal	37R
Rear License Plate	W5W
Front Turn Signal	P214W
Tail/Stop	P27/7W
Rear Turn Signal	P27/7W
Back-up	P27/7W
Rear Fog Lamp	P27/7W

INTERIOR LAMPS

LAMP	BULB
ABS	PC194
Airbag	PC194
Ash Tray	161
Brake Warning System Indicator	PC194
Cigar Lighter	203
Climate Controls	203
Console Gear Selector	161
Dome Light	578
Glove Box	194
High Beam Indicator	PC194
Ignition Key	161
Instrument Cluster	PC194
Rear Cargo	912
Seat Belt Indicator	PC74
Service Engine Soon	PC194
Turn Signal Indicator	PC194
Underhood	105
Visor Vanity	6501966
Volts Indicator	PC74

PASSIVE RESTRAINT SYSTEMS

CONTENTS

DESCRIPTION AND OPERATION

AIRBAG SYSTEM

DESCRIPTION

A dual front airbag system is standard factory-installed safety equipment on this model. Both the driver and passenger side airbag modules are certified to new federal regulations, which allows them to deploy with less force than prior airbags. The primary passenger restraints in this vehicle are the standard equipment factory-installed seat belts, which require active use by the vehicle occupants. The airbag system is a supplemental passive restraint that was designed and is intended to enhance the protection for the front seat occupants of the vehicle **only** when used in conjunction with the seat belts. See the owner's manual in the vehicle glove box for more information on the features, use and operation of all of the factory-installed passenger restraints, including the airbag system.

The dual front airbag system consists of the following components:

- Airbag Control Module (ACM)
- Airbag indicator lamp
- Clockspring
- Driver and passenger side airbag modules (including the airbag inflators)
- Driver and passenger side knee blockers
- Wire harness and connections.

This group provides complete service information for the ACM, both airbag modules, and the clockspring. Complete service information for the other airbag system components can be located as follows:

- Refer to **Instrument Cluster** in the proper section of Group 8E - Instrument Panel Systems for complete service information for the airbag indicator lamp.
- Refer to **Steering Column Opening Cover** and **Instrument Panel Steering Column Bracket** in the Removal and Installation section of Group 8E - Instrument Panel Systems for complete service information on the driver side knee blocker.
- Refer to **Glove Box** in the Removal and Installation section of Group 8E - Instrument Panel Systems for complete service information on the passenger side knee blocker.
- Refer to **Airbag System** in the Contents of Group 8W - Wiring Diagrams for complete service information and circuit diagrams for the airbag system wiring components.

See the proper Diagnostic Procedures manual to test or diagnose a problem with any component of the airbag system.

OPERATION

The airbag system electrical circuits are continuously monitored and controlled by a microprocessor and software contained within the Airbag Control Module (ACM). The ACM also contains an impact sensor and a safing sensor, which are monitored by the ACM to determine when an impact occurs that is severe enough to require airbag system protection. When a frontal impact is severe enough, the ACM initiates the inflator units of both airbag modules to deploy the airbags.

DESCRIPTION AND OPERATION (Continued)

An airbag indicator lamp in the instrument cluster lights for about six to eight seconds as a bulb test each time the ignition switch is turned to the On position. Following the bulb test, the airbag indicator lamp is turned on or off by the ACM to indicate the status of the airbag system. If the airbag indicator lamp comes on at any time other than during the bulb test, it indicates that there is a problem in the airbag system circuits. Such a problem may cause the airbags not to deploy when required, or to deploy when not required.

The driver side airbag module includes an inflatable airbag and an inflator unit behind a trim cover in the hub area of the steering wheel. The passenger side airbag module includes a second inflatable airbag and an inflator unit behind an airbag door in the instrument panel above the glove box.

During a frontal vehicle impact, the knee blockers work in concert with properly adjusted seat belts to restrain the driver and front seat passenger in the proper position for an airbag deployment. The knee blockers also work to absorb and distribute the crash energy from the driver and front seat passenger to the structure of the instrument panel. The driver side knee blocker is integral to the instrument panel steering column opening cover, but receives additional support from a stamped and welded metal bracket located directly behind the steering column opening cover and mounted to the instrument panel steering column support bracket. The passenger side knee blocker is integral to the glove box door.

Following are general descriptions of the major components in the airbag system.

WARNING:

- **THE AIRBAG SYSTEM IS A SENSITIVE, COMPLEX ELECTROMECHANICAL UNIT. BEFORE ATTEMPTING TO DIAGNOSE OR SERVICE ANY AIRBAG SYSTEM OR RELATED STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENTS YOU MUST FIRST DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE. THEN WAIT TWO MINUTES FOR THE 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.**
- **THE DRIVER SIDE 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. THE PASSENGER AIRBAG MODULE CONTAINS ARGON GAS PRESSURIZED TO OVER 2500 PSI. DO NOT ATTEMPT TO DISMANTLE AN AIRBAG MODULE OR TAMPER WITH ITS INFLATOR. DO NOT PUNCTURE, INCINERATE, OR BRING INTO CONTACT WITH ELECTRICITY. DO NOT STORE AT TEMPERATURES EXCEEDING 93° C (200° F).**
- **REPLACE AIRBAG SYSTEM COMPONENTS ONLY WITH PARTS SPECIFIED IN THE CHRYSLER MOPAR PARTS CATALOG. SUBSTITUTE PARTS MAY APPEAR INTERCHANGEABLE, BUT INTERNAL DIFFERENCES MAY RESULT IN INFERIOR OCCUPANT PROTECTION.**
- **THE FASTENERS, SCREWS, AND BOLTS ORIGINALLY USED FOR THE AIRBAG SYSTEM COMPONENTS HAVE SPECIAL COATINGS AND ARE SPECIFICALLY DESIGNED FOR THE AIRBAG SYSTEM. THEY MUST NEVER BE REPLACED WITH ANY SUBSTITUTES. ANY TIME A NEW FASTENER IS NEEDED, REPLACE IT WITH THE CORRECT FASTENERS PROVIDED IN THE SERVICE PACKAGE OR SPECIFIED IN THE CHRYSLER MOPAR PARTS CATALOG.**
- **WHEN A STEERING COLUMN HAS AN AIRBAG MODULE ATTACHED, NEVER PLACE THE COLUMN ON THE FLOOR OR ANY OTHER SURFACE WITH THE STEERING WHEEL OR AIRBAG MODULE FACE DOWN.**

DRIVER SIDE AIRBAG MODULE

DESCRIPTION

The driver side airbag module protective trim cover is the most visible part of the driver side airbag system. The driver side airbag module is mounted directly to the steering wheel. Located under the airbag module trim cover are the horn switch, the folded airbag cushion, and the airbag cushion supporting components. The resistive membrane-type horn switch is secured within a plastic tray inserted in a sewn fabric pouch on the airbag cushion retaining strap between the trim cover and the folded airbag cushion.

The driver side airbag module cannot be repaired, and must be replaced if deployed or in any way damaged. The driver side airbag module trim cover and the horn switch are available for service replacement.

OPERATION

The driver side airbag module includes a stamped metal housing to which the cushion and an inflator unit are attached and sealed. The conventional pyrotechnic-type inflator assembly is mounted to studs on the back of the airbag module housing. 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. Following an airbag deployment, the airbag cushion

DESCRIPTION AND OPERATION (Continued)

quickly deflates by venting this gas towards the instrument panel through the porous fabric material used on the steering wheel side of the airbag cushion.

The protective trim cover is fitted to the front of the airbag module and forms a decorative cover in the center of the steering wheel. The inside of the trim cover has locking blocks molded into it that engage a lip on the airbag module metal housing. Two stamped metal retainers then fit over the inflator mounting studs on the back of the airbag module housing and are engaged in slots on the inside of the cover, securely locking the trim cover into place. The trim cover will split at predetermined breakout lines, then fold back out of the way along with the horn switch and tray unit upon airbag deployment.

PASSENGER SIDE AIRBAG MODULE

DESCRIPTION

The instrument panel top pad is the most visible part of the passenger side airbag system. Located under the instrument panel top pad are the steel airbag door, the passenger side airbag cushion and the airbag cushion supporting components.

The passenger side airbag module includes an extruded aluminum housing within which the cushion and inflator are mounted and sealed. Two stamped metal brackets, one on each end of the housing, enclose the cushion and inflator and also serve as the mounting brackets for the module.

Following a passenger side airbag deployment, the passenger side airbag module and the instrument panel top pad must be replaced. If inspection reveals that the passenger side airbag module mounting points on the instrument panel structural duct have been cracked or damaged, the instrument panel assembly must also be replaced. The passenger side airbag module cannot be repaired, and must be replaced if deployed or in any way damaged.

OPERATION

The hybrid-type inflator assembly includes a small canister of highly compressed argon gas. 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. Following an airbag deployment, the airbag cushion quickly deflates by venting this gas through the porous fabric material used on each end panel of the airbag cushion.

The passenger side airbag module is secured with screws to the instrument panel structural duct beneath the instrument panel top pad and above the glove box opening. The instrument panel top pad above the glove box opening conceals the steel airbag door and a predetermined hinge line beneath its decorative cover. Upon airbag deployment, the top pad will bend at the hinge line and the door will fold back out of the way onto the top of the instrument panel.

AIRBAG CONTROL MODULE

DESCRIPTION

The Airbag Control Module (ACM) is secured with screws to a mount that is welded onto the floor panel transmission tunnel underneath the center floor console in the passenger compartment of the vehicle. The ACM contains an electronic microprocessor, an electronic impact sensor, an electromechanical safing sensor, and an energy storage capacitor.

The ACM cannot be repaired or adjusted and, if damaged or faulty, it must be replaced.

OPERATION

The microprocessor in the ACM contains the airbag system logic. The airbag system logic includes On-Board Diagnostics (OBD), and the ability to control the airbag indicator lamp by communicating with the instrument cluster circuitry over the Programmable Communication Interface (PCI) data bus. The microprocessor continuously monitors all of the airbag system electrical circuits to determine the system readiness. If the ACM detects a monitored system fault, it sends messages to the instrument cluster over the PCI data bus to turn on the airbag indicator lamp. Refer to **Instrument Cluster** in the proper section of Group 8E - Instrument Panel Systems for more information on the airbag indicator lamp.

One electronic impact sensor is used in this airbag system. The impact sensor is an accelerometer that senses the rate of vehicle deceleration, which provides verification of the direction and severity of an impact. The impact sensor is calibrated for the specific vehicle, and is only serviced as a unit with the ACM. A pre-programmed decision algorithm in the ACM microprocessor determines when the deceleration rate as signaled by the impact sensor indicates an impact that is severe enough to require airbag system protection. When the programmed conditions are met, the ACM sends an electrical signal to deploy the airbags.

In addition to the electronic impact sensor, there is an electromechanical sensor within the ACM called a safing sensor. The safing sensor is a normally open series switch located in the airbag deployment circuit of the ACM. This sensor detects impact energy of a lesser magnitude than the electronic impact sensor, and must be closed in order for the airbags to deploy.

The ACM also contains an energy-storage capacitor. This capacitor stores enough electrical energy to deploy the airbags for up to one second following a

DESCRIPTION AND OPERATION (Continued)

battery disconnect or failure during an impact. The purpose of the capacitor is to provide backup airbag system protection in case there is a loss of battery power supply to the ACM.

CLOCKSPRING

DESCRIPTION

The clockspring assembly is mounted with two screws to the multi-function switch mounting housing near the top of the steering column behind the steering wheel. The clockspring is used to maintain a continuous electrical circuit between the fixed instrument panel wire harness connector on the steering column and several electrical components that rotate with the steering wheel. The rotating components include the driver side airbag module, the horn switch, the vehicle speed control switches and, if the vehicle is so equipped, the remote radio switches.

The clockspring cannot be repaired. If the clockspring is faulty, damaged, or if the driver side airbag has been deployed, the clockspring must be replaced.

OPERATION

The clockspring assembly consists of a plastic case which contains a flat, ribbon-like, electrically conductive tape that winds and unwinds like a clockspring with the steering wheel rotation. The electrically conductive tape consists of several fine gauge copper wire leads sandwiched between two narrow strips of plastic film.

Like the clockspring in a timepiece, the clockspring tape has travel limits and can be damaged by being wound too tightly. To prevent this from occurring, the clockspring is centered when it is installed on the steering column. Centering the clockspring indexes the clockspring tape to other steering components so that it can operate within its designed travel limits. However, if the clockspring is removed for service or if the steering column is disconnected from the steering gear allowing the clockspring tape to change position relative to the other steering components, it must be re-centered following completion of the service or it may be damaged. Refer to **Clockspring Centering** in the Adjustments section of this group for the proper centering procedures.

Service replacement clocksprings are shipped precentered and with a locking pin installed. This locking pin should not be removed until the clockspring has been installed on the steering column. If the locking pin is removed before the clockspring is installed on a steering column, the locking pin cannot be reinstalled and the clockspring centering procedure must be performed.

DIAGNOSIS AND TESTING

AIRBAG SYSTEM

A DRB scan tool is required for diagnosis of the airbag system. See the proper Diagnostic Procedures manual for more information.

(1) Connect the DRB scan tool to the 16-way data link wire harness connector. The connector is located on the driver side lower edge of the instrument panel, outboard of the steering column (Fig. 1).

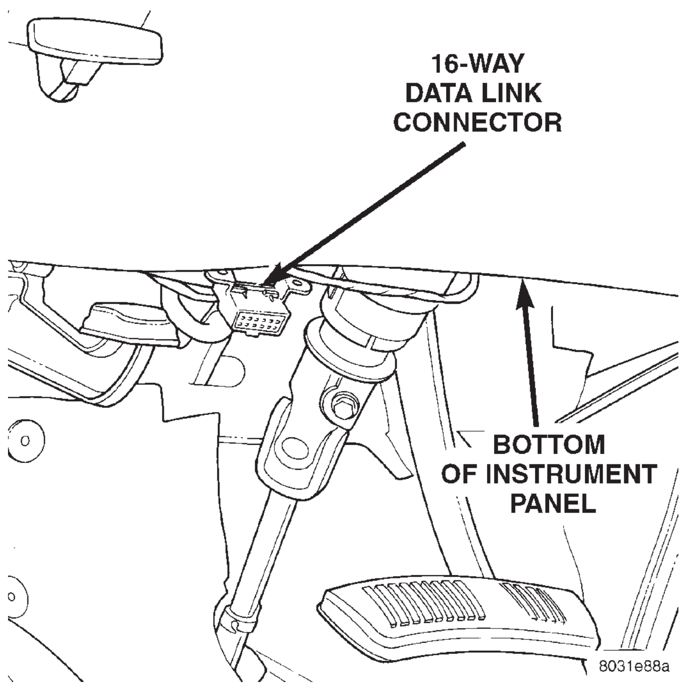


Fig. 1 16-Way Data Link Connector - Typical

(2) Turn the ignition switch to the On position. Exit the vehicle with the DRB. Be certain that the DRB contains the latest version of the proper DRB software.

(3) Using the DRB, read and record the active Diagnostic Trouble Code (DTC) data.

(4) Read and record any stored DTC data.

(5) See the proper Diagnostic Procedures manual if any DTC is found in Step 3 or Step 4.

(6) After completing the necessary repairs, try to erase the stored DTC data. If any problems remain, the stored DTC data will not erase. See the proper Diagnostic Procedures manual for the procedures to diagnose any active/stored DTC that will not erase.

(7) With the ignition switch still in the On position, check to be certain that nobody is in the vehicle.

(8) From outside of the vehicle (away from the airbags in case of an accidental deployment) turn the ignition switch to the Off position for about ten seconds, and then back to the On position. Observe the airbag indicator lamp in the instrument cluster. It should light for six to eight seconds, and then go out. This indicates that the airbag system is functioning normally.

DIAGNOSIS AND TESTING (Continued)

NOTE: If the airbag indicator lamp fails to light, or lights and stays on, there is an airbag system malfunction. See the proper Diagnostic Procedures manual to diagnose the problem.

SERVICE PROCEDURES

AIRBAG SYSTEM

NON-DEPLOYED

At no time should any source of electricity be permitted near the inflator on the back of an airbag module. When carrying a non-deployed airbag module, the trim cover or airbag side of the module should be pointed away from the body to minimize injury in the event of an accidental deployment. If the module is placed on a bench or any other surface, the trim cover or airbag side of the module should be face up to minimize movement in the event of an accidental deployment.

In addition, the airbag system should be disarmed whenever any steering wheel, steering column, or instrument panel components require diagnosis or service. Failure to observe this warning could result in accidental airbag deployment and possible personal injury. Refer to **Group 8E - Instrument Panel Systems** for additional service procedures on the instrument panel components. Refer to **Group 19 - Steering** for additional service procedures on the steering wheel and steering column components.

DISPOSAL OF NON-DEPLOYED AIRBAG MODULES

All damaged or faulty and non-deployed driver side or passenger side airbag modules which are replaced on vehicles are to be returned. If an airbag module assembly is faulty or damaged and non-deployed, refer to the parts return list in the current Chrysler Corporation Warranty Policies and Procedures manual for the proper handling and disposal procedures.

DEPLOYED

Any vehicle which is to be returned to use after an airbag deployment, must have both airbag modules, the clockspring, and the instrument panel top pad replaced. These components will be damaged or weakened as a result of an airbag deployment, which may or may not be obvious during a visual inspection, and are not intended for reuse.

Other vehicle components should be closely inspected, but are to be replaced only as required by the extent of the visible damage incurred.

STORAGE

An 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 an airbag module on a surface with its trim cover or airbag side facing up, to minimize movement in case of an accidental deployment.

CLEANUP PROCEDURE

Following an airbag system deployment, the vehicle interior will contain a powdery residue. This residue consists primarily of harmless particulate by-products of the small pyrotechnic charge used to initiate the airbag deployment propellant. However, this residue will also contain traces of sodium hydroxide powder, a chemical by-product of the propellant material that is used to generate the nitrogen gas that inflates the airbag. Since sodium hydroxide 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. 2).

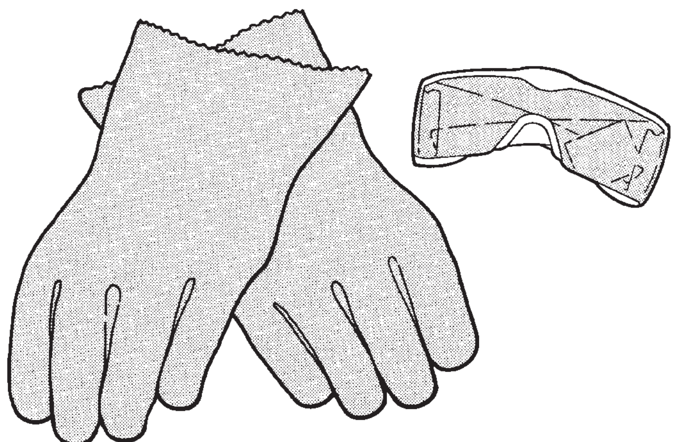


Fig. 2 Wear Safety Glasses and Rubber Gloves - Typical

WARNING: 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.

Begin the cleanup by removing the airbag modules from the vehicle. Refer to **Driver Side Airbag Module** and **Passenger Side Airbag Module** in the Removal and Installation section of this group for the procedures.

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 a non-cleaned area.

SERVICE PROCEDURES (Continued)

Be sure to vacuum the heater and air conditioning outlets as well (Fig. 3). Run the heater and air conditioner blower on the lowest speed setting and vacuum any powder expelled from the outlets. You may need to vacuum the interior of the vehicle a second time to recover all of the powder.

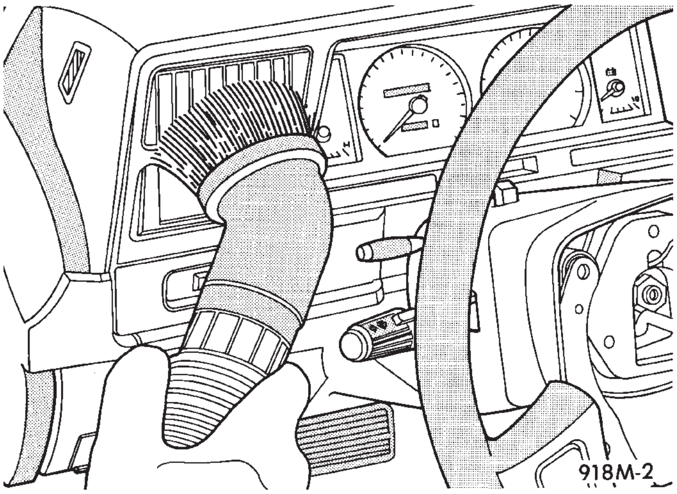


Fig. 3 Vacuum Heater and A/C Outlets - Typical

Place the deployed airbag modules in your vehicular scrap pile.

REMOVAL AND INSTALLATION

DRIVER SIDE AIRBAG MODULE

The following procedure is for replacement of a faulty or damaged driver side airbag module. If the driver side airbag has been deployed, the clockspring must also be replaced. Refer to **Clockspring** in the Removal and Installation section of this group for the additional service procedures for the clockspring.

WARNING:

- **THE AIRBAG SYSTEM IS A SENSITIVE, COMPLEX ELECTROMECHANICAL UNIT. BEFORE ATTEMPTING TO DIAGNOSE OR SERVICE ANY AIRBAG SYSTEM OR RELATED STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENTS YOU MUST FIRST DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE. THEN WAIT TWO MINUTES FOR THE 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.**
- **WHEN REMOVING A DEPLOYED AIRBAG MODULE, RUBBER GLOVES, EYE PROTECTION, AND A LONG-SLEEVED SHIRT SHOULD BE WORN. THERE MAY BE DEPOSITS ON THE AIRBAG MODULE AND OTHER INTERIOR SURFACES. IN LARGE DOSES, THESE DEPOSITS MAY CAUSE IRRITATION TO THE SKIN AND EYES.**

REMOVAL

(1) Disconnect and isolate the battery negative cable. If either of the airbags has not been deployed, wait two minutes for the system capacitor to discharge before further service.

(2) From the underside of the steering wheel, remove the two screws that secure the driver side airbag module to the steering wheel (Fig. 4).

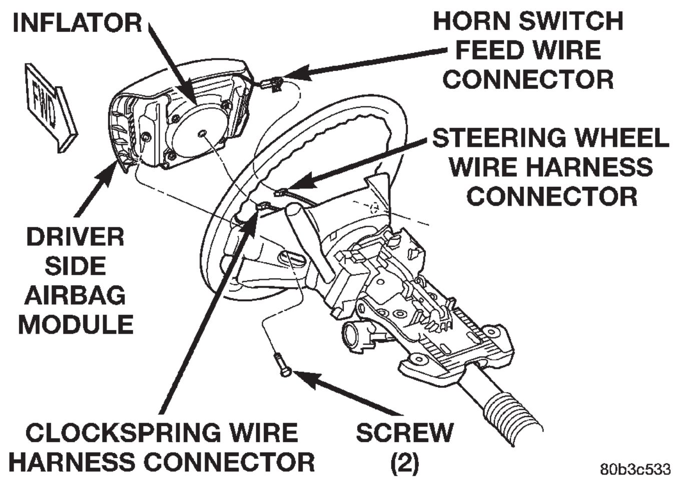


Fig. 4 Driver Side Airbag Module Remove/Install

(3) Pull the airbag module away from the steering wheel far enough to access the two wire harness connectors on the back of the airbag module.

(4) Disconnect the steering wheel wire harness connector from the horn switch feed wire connector, which is secured to the upper trim cover retainer on the back of the airbag module.

(5) The clockspring airbag wire harness connector is a tight snap-fit into the airbag module connector receptacle, which is located on the airbag inflator on the back of the airbag module. Firmly grasp and pull or gently pry on the clockspring airbag wire harness connector to disconnect it from the airbag module. **Do not pull on the clockspring wire harness to disengage the connector from the airbag module connector receptacle.**

(6) Remove the driver side airbag module from the steering wheel.

(7) If the driver side airbag has been deployed, the clockspring must be replaced. Refer to **Clockspring** in the Removal and Installation section of this group for the clockspring service procedures.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

WARNING:

• USE EXTREME CARE TO PREVENT ANY FOREIGN MATERIAL FROM ENTERING THE DRIVER SIDE AIRBAG MODULE, OR BECOMING ENTRAPPED BETWEEN THE AIRBAG CUSHION AND THE DRIVER SIDE AIRBAG TRIM COVER. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.

• THE DRIVER SIDE AIRBAG MODULE TRIM COVER MUST NEVER BE PAINTED. REPLACEMENT TRIM COVERS ARE SERVICED IN THE ORIGINAL COLORS. PAINT MAY CHANGE THE WAY IN WHICH THE MATERIAL OF THE TRIM COVER RESPONDS TO AN AIRBAG DEPLOYMENT. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.

(1) When installing the driver side airbag module, reconnect the clockspring airbag wire harness connector to the airbag module connector receptacle by pressing straight in on the connector. You can be certain that the connector is fully engaged by listening carefully for a distinct audible click as the connector snaps into place.

(2) Reconnect the steering wheel wire harness connector to the horn switch feed wire connector, which is secured to the upper trim cover retainer on the back of the airbag module.

(3) Carefully position the driver side airbag module in the steering wheel. Be certain that the steering wheel and clockspring wire harnesses in the steering wheel hub area are not pinched between the airbag module and the steering wheel.

(4) From the underside of the steering wheel, install and tighten the two driver side airbag module mounting screws. Tighten the screws to 10.2 N·m (90 in. lbs.).

(5) Do not reconnect the battery negative cable at this time. Refer to **Airbag System** in the Diagnosis and Testing section of this group for the proper procedures.

DRIVER SIDE AIRBAG MODULE TRIM COVER

WARNING:

• THE AIRBAG SYSTEM IS A SENSITIVE, COMPLEX ELECTROMECHANICAL UNIT. BEFORE ATTEMPTING TO DIAGNOSE OR SERVICE ANY AIRBAG SYSTEM OR RELATED STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENTS YOU MUST FIRST DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE. THEN WAIT TWO MINUTES FOR THE 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.

• THE HORN SWITCH IS INTEGRAL TO THE DRIVER SIDE AIRBAG MODULE. SERVICE OF THIS COMPONENT SHOULD BE PERFORMED ONLY BY CHRYSLER-TRAINED AND AUTHORIZED DEALER SERVICE TECHNICIANS. FAILURE TO TAKE THE PROPER PRECAUTIONS OR TO FOLLOW THE PROPER PROCEDURES COULD RESULT IN ACCIDENTAL, INCOMPLETE, OR IMPROPER AIRBAG DEPLOYMENT AND POSSIBLE OCCUPANT INJURIES.

REMOVAL

(1) Disconnect and isolate the battery negative cable. If either of the airbags has not been deployed, wait two minutes for the system capacitor to discharge before further service.

(2) Remove the driver side airbag module from the steering wheel. Refer to **Driver Side Airbag Module** in the Removal and Installation section of this group for the procedures.

(3) Remove the four nuts that secure the upper and lower trim cover retainers to the studs on the back of the driver side airbag housing (Fig. 5).

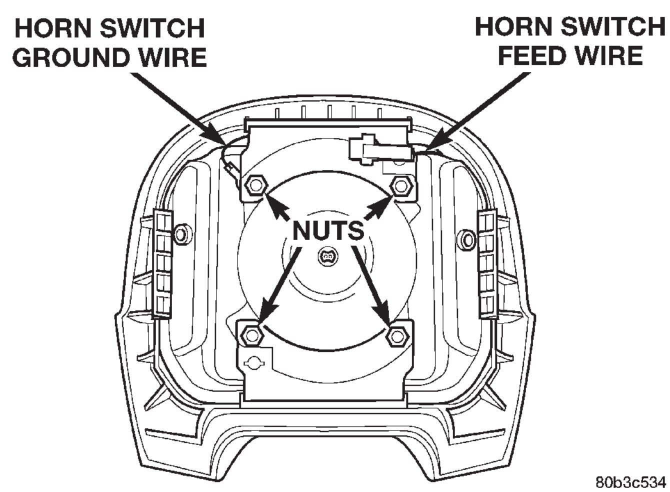


Fig. 5 Driver Side Airbag Trim Cover Retainer Nuts Remove/Install

(4) Remove the upper and lower trim cover retainers from the airbag housing studs (Fig. 6).

(5) Disengage the horn switch feed wire connector retainer from the mounting hole in the upper trim cover retainer.

(6) Remove the horn switch ground wire eyelet from the upper airbag housing stud.

REMOVAL AND INSTALLATION (Continued)

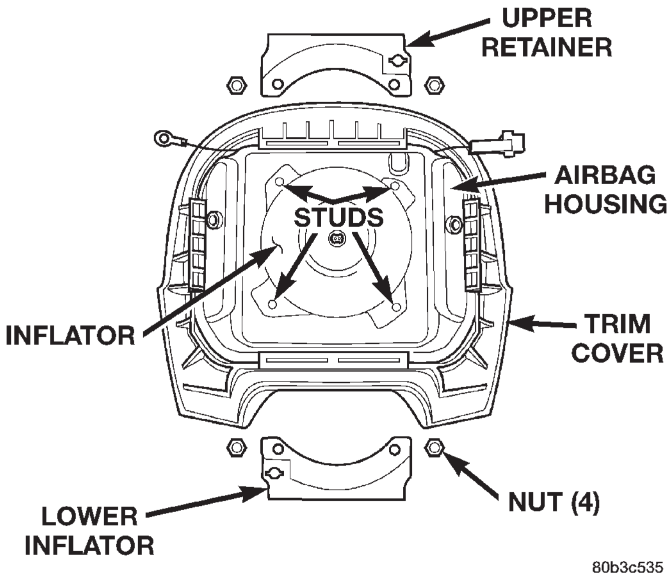


Fig. 6 Driver Side Airbag Trim Cover Retainers Remove/Install

(7) Disengage the four trim cover locking blocks from the lip around the outside edge of the driver side airbag housing and remove the housing from the cover (Fig. 7).

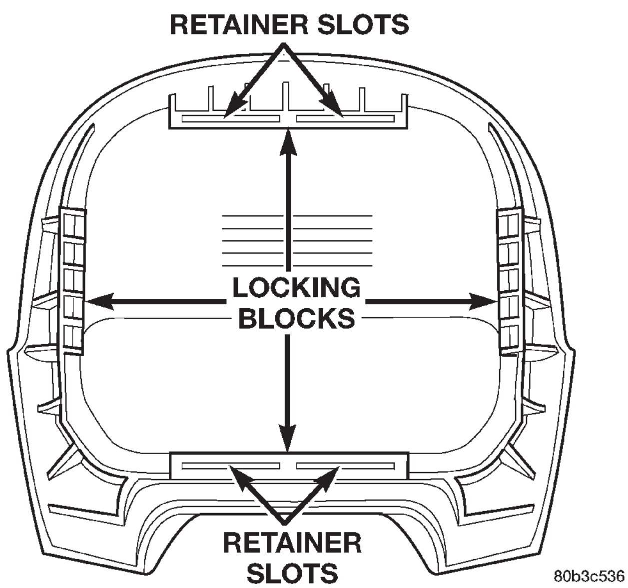


Fig. 7 Driver Side Airbag Trim Cover Remove/Install

INSTALLATION

WARNING:

• USE EXTREME CARE TO PREVENT ANY FOREIGN MATERIAL FROM ENTERING THE DRIVER SIDE AIRBAG MODULE, OR BECOMING ENTRAPPED BETWEEN THE AIRBAG CUSHION AND THE DRIVER SIDE AIRBAG TRIM COVER. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.

• THE DRIVER SIDE AIRBAG MODULE TRIM COVER MUST NEVER BE PAINTED. REPLACEMENT TRIM COVERS ARE SERVICED IN THE ORIGINAL COLORS. PAINT MAY CHANGE THE WAY IN WHICH THE MATERIAL OF THE TRIM COVER RESPONDS TO AN AIRBAG DEPLOYMENT. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.

NOTE: If the horn switch and tray have been removed from the sewn pouch in the airbag cushion retaining strap, be certain that they are properly reinstalled with the horn switch feed wire and ground wire properly oriented before assembling the trim cover onto the airbag module. Refer to Horn Switch in the Removal and Installation section of Group 8G - Horn Systems for more information.

(1) Carefully position the driver side airbag module in the trim cover. Be certain that the horn switch feed and ground wires are not pinched between the airbag housing and the trim cover locking blocks.

(2) Engage the upper and lower trim cover locking blocks with the lip of the driver side airbag housing, then engage the locking blocks on each side of the trim cover with the lip of the housing. Be certain that each of the locking blocks is fully engaged on the lip of the airbag housing (Fig. 8).

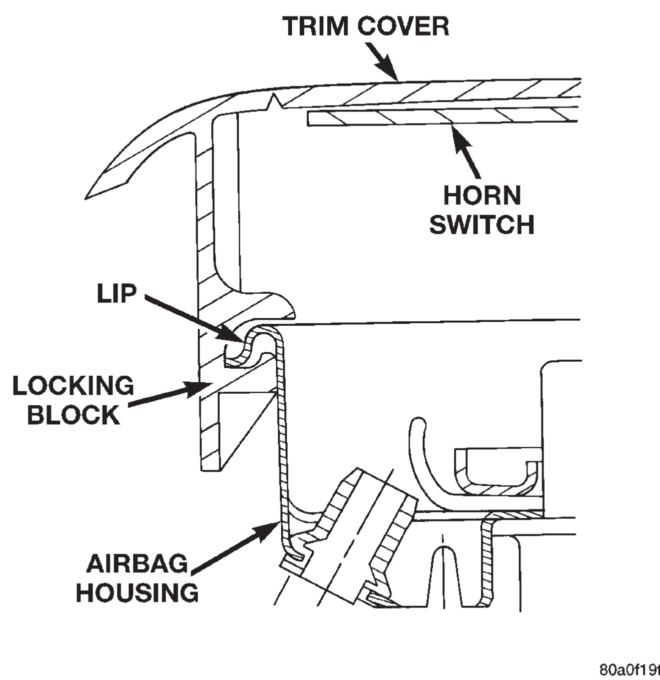


Fig. 8 Driver Side Airbag Trim Cover Locking Blocks Engaged

REMOVAL AND INSTALLATION (Continued)

(3) Install the horn switch ground wire eyelet over the upper airbag housing stud.

(4) Install the upper and lower airbag trim cover retainers over the airbag housing studs. Be certain that the tabs on each retainer are engaged in the retainer slots of the upper and lower trim cover locking blocks (Fig. 7).

(5) Install and tighten the trim cover retainer mounting nuts on the airbag housing studs. Tighten the nuts to 6.8 N·m (60 in. lbs.).

(6) Install the horn switch feed wire connector retainer into the mounting hole in the upper trim cover retainer.

(7) Install the driver side airbag module onto the steering wheel. Refer to **Driver Side Airbag Module** in the Removal and Installation section of this group for the procedures.

PASSENGER SIDE AIRBAG MODULE

The following procedure is for replacement of a faulty or damaged passenger side airbag module. If the passenger side airbag has been deployed, the instrument panel structural duct must be inspected and the instrument panel top pad must be replaced. Refer to **Instrument Panel Top Pad** in the Removal and Installation section of Group 8E - Instrument Panel Systems for the additional service procedures for the instrument panel top pad. If inspection of the instrument panel structural duct reveals any damage around the mounting points for the passenger side airbag module, the instrument panel assembly must be replaced. Refer to **Instrument Panel Assembly** in the Removal and Installation section of Group 8E - Instrument Panel Systems for the additional service procedures for the instrument panel assembly.

WARNING:

- **THE AIRBAG SYSTEM IS A SENSITIVE, COMPLEX ELECTROMECHANICAL UNIT. BEFORE ATTEMPTING TO DIAGNOSE OR SERVICE ANY AIRBAG SYSTEM OR RELATED STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENTS YOU MUST FIRST DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE. THEN WAIT TWO MINUTES FOR THE 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.**
- **WHEN REMOVING A DEPLOYED AIRBAG MODULE, RUBBER GLOVES, EYE PROTECTION, AND A LONG-SLEEVED SHIRT SHOULD BE WORN. THERE MAY BE DEPOSITS ON THE AIRBAG MODULE AND OTHER INTERIOR SURFACES. IN LARGE DOSES, THESE DEPOSITS MAY CAUSE IRRITATION TO THE SKIN AND EYES.**

REMOVAL

(1) Disconnect and isolate the battery negative cable. If either of the airbags has not been deployed, wait two minutes for the system capacitor to discharge before further service.

(2) Remove the top pad from the instrument panel. Refer to **Instrument Panel Top Pad** in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(3) Disconnect the instrument panel wire harness connector from the passenger side airbag module wire harness connector, which is secured to the outside of the outboard airbag module end bracket.

(4) Remove the two screws that secure the two airbag module end bracket front mounting tabs to the front of the instrument panel structural duct (Fig. 9).

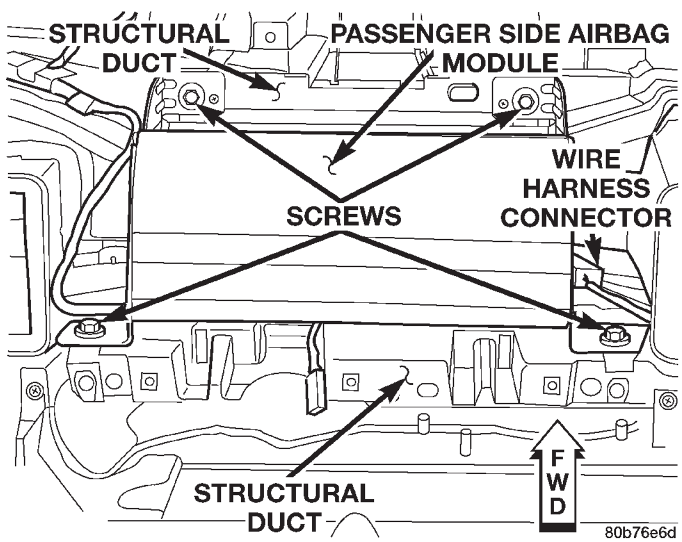


Fig. 9 Passenger Side Airbag Module Remove/Install

(5) Remove the two screws that secure the two airbag module end bracket rear mounting tabs to the rear of the structural duct, just above the instrument panel upper glove box opening reinforcement.

(6) Remove the passenger side airbag module from the instrument panel.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

WARNING:

- **USE EXTREME CARE TO PREVENT ANY FOREIGN MATERIAL FROM ENTERING THE PASSENGER SIDE AIRBAG MODULE, OR BECOMING ENTRAPPED BETWEEN THE AIRBAG CUSHION AND THE INSTRUMENT PANEL TOP COVER. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.**
- **THE INSTRUMENT PANEL TOP COVER MUST NEVER BE PAINTED. REPLACEMENT TOP COVERS ARE SERVICED IN THE ORIGINAL COLORS. PAINT MAY CHANGE THE WAY IN WHICH THE MATERIAL OF THE TOP COVER RESPONDS TO AN AIRBAG DEPLOYMENT. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.**

(1) Carefully position the passenger side airbag module onto the instrument panel structural duct.

(2) Install and tighten the four screws that secure the passenger side airbag module to the instrument panel structural duct. Tighten the screws to 11.8 N·m (105 in. lbs.).

(3) Reconnect the instrument panel wire harness connector to the passenger side airbag module wire harness connector, which is secured to the outside of the outboard airbag module end bracket. Be certain that the airbag module wire harness connector is fully engaged and latched.

(4) Install the top pad onto the instrument panel. Refer to **Instrument Panel Top Pad** in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(5) Do not reconnect the battery negative cable at this time. Refer to **Airbag System** in the Diagnosis and Testing section of this group for the proper procedures.

AIRBAG CONTROL MODULE

WARNING:

- **THE AIRBAG CONTROL MODULE CONTAINS THE IMPACT SENSOR, WHICH ENABLES THE SYSTEM TO DEPLOY THE AIRBAG. BEFORE ATTEMPTING TO DIAGNOSE OR SERVICE ANY AIRBAG SYSTEM OR RELATED STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENTS YOU MUST FIRST DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE. THEN WAIT TWO MINUTES FOR THE 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.**
- **NEVER STRIKE OR KICK THE AIRBAG CONTROL MODULE, AS IT CAN DAMAGE THE IMPACT SENSOR OR AFFECT ITS CALIBRATION. IF AN AIRBAG CONTROL MODULE IS ACCIDENTALLY DROPPED DURING SERVICE, THE MODULE MUST BE SCRAPPED AND REPLACED WITH A NEW UNIT. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN ACCIDENTAL, INCOMPLETE, OR IMPROPER AIRBAG DEPLOYMENT AND POSSIBLE OCCUPANT INJURIES.**

REMOVAL

(1) Disconnect and isolate the battery negative cable. If either of the airbags has not been deployed, wait two minutes for the system capacitor to discharge before further service.

(2) Remove the center floor console from the floor panel transmission tunnel. Refer to **Floor Console** in the Removal and Installation section of Group 23 - Body for the procedures.

(3) Remove the nut that secures the center console bracket to the stud on the floor panel transmission tunnel in front of the Airbag Control Module (ACM) (Fig. 10).

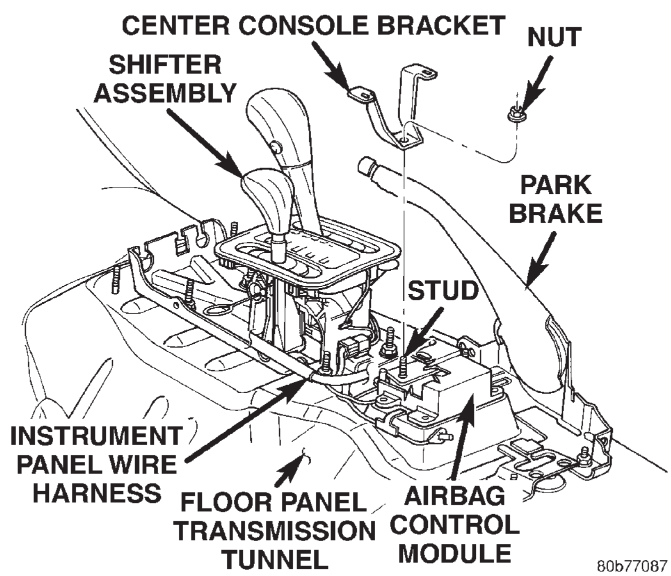


Fig. 10 Center Console Bracket Remove/Install

(4) Remove the center console bracket from the stud on the floor panel transmission tunnel.

(5) Disconnect the instrument panel wire harness connector from the ACM. To disconnect the instrument panel wire harness connector from the ACM (Fig. 11):

(a) Slide the red Connector Position Assurance (CPA) lock on the top of the connector toward the left side of the vehicle.

REMOVAL AND INSTALLATION (Continued)

(b) Depress the connector latch tab and pull the connector straight away from the ACM connector receptacle.

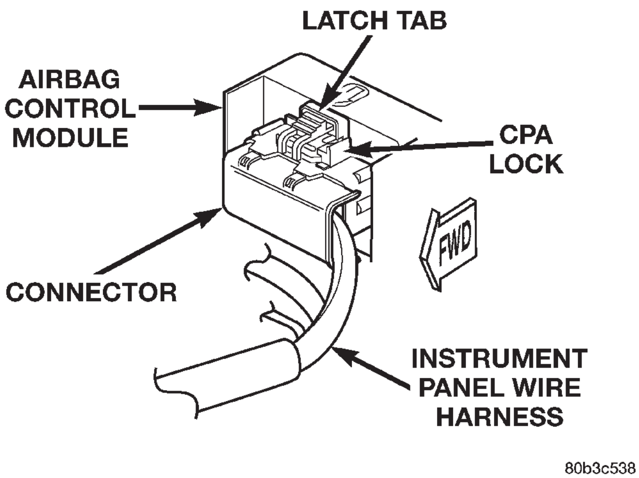


Fig. 11 Airbag Control Module Wire Harness Connector

(6) Remove the four screws that secure the ACM to the mount that is welded onto the floor panel transmission tunnel (Fig. 12).

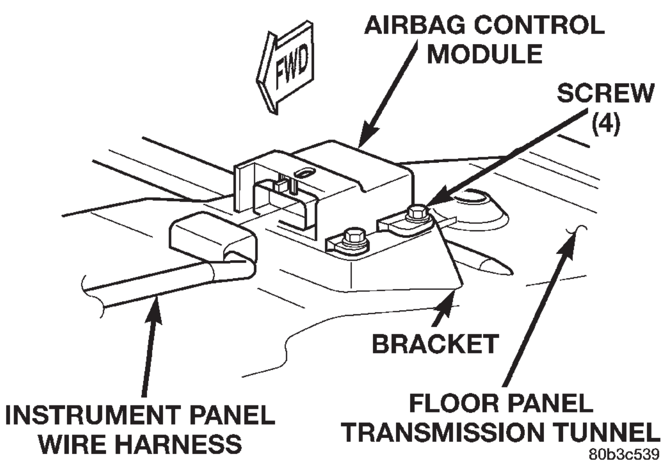


Fig. 12 Airbag Control Module Remove/Install

(7) Remove the ACM from the mount on the floor panel transmission tunnel.

INSTALLATION

(1) Carefully position the ACM to the mount that is welded onto the floor panel transmission tunnel. The bottom of the ACM housing is keyed. When the ACM is correctly positioned the bottom of the housing will fit flush with the mount, and the arrow on the ACM housing will be pointed forward in the vehicle.

(2) Install and tighten the four screws that secure the ACM to the mount that is welded onto the floor panel transmission tunnel. Tighten the screws to 7.9 N·m (70 in. lbs.).

(3) Reconnect the instrument panel wire harness connector to the ACM connector receptacle. Be certain that the connector latch and the red CPA lock are fully engaged (Fig. 11).

(4) Install the center console bracket onto the stud on the floor panel transmission tunnel in front of the ACM.

(5) Install and tighten the nut that secures the center console bracket to the stud on the floor panel transmission tunnel. Tighten the nut to 28.2 N·m (250 in. lbs.).

(6) Install the center floor console onto the floor panel transmission tunnel. Refer to **Floor Console** in the Removal and Installation section of Group 23 - Body for the procedures.

(7) Do not reconnect the battery negative cable at this time. Refer to **Airbag System** in the Diagnosis and Testing section of this group for the proper procedures.

CLOCKSPRING

The clockspring cannot be repaired. It must be replaced if faulty or damaged, or if the driver side airbag has been deployed.

WARNING: THE AIRBAG SYSTEM IS A SENSITIVE, COMPLEX ELECTROMECHANICAL UNIT. BEFORE ATTEMPTING TO DIAGNOSE OR SERVICE ANY AIRBAG SYSTEM OR RELATED STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENTS YOU MUST FIRST DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE. THEN WAIT TWO MINUTES FOR THE 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.

REMOVAL

NOTE: Before starting this procedure, be certain to turn the steering wheel until the front wheels are in the straight-ahead position.

(1) Place the front wheels in the straight-ahead position.

(2) Remove the driver side airbag module from the steering wheel. Refer to **Driver Side Airbag Module** in the Removal and Installation section of this group for the procedures.

(3) Disconnect the steering wheel wire harness connector from the upper clockspring connector

REMOVAL AND INSTALLATION (Continued)

receptacle, which is located between the two upper spokes of the armature within the hub cavity of the steering wheel.

(4) Remove the nut that secures the steering wheel armature to the steering column upper shaft, which is located within the hub cavity of the steering wheel.

(5) Pull the steering wheel off of the steering column upper shaft spline using a two-jawed puller (Special Tool C-3894-A) (Fig. 13). When installing the puller onto the steering wheel, be certain that each jaw of the puller is seated in the pocket that is cast into the underside of the steering wheel armature on each side of the hub (Fig. 14). Also, if the clockspring is to be reused, be certain not to damage or deform the clockspring case when positioning the jaws of the puller below the steering wheel armature hub.

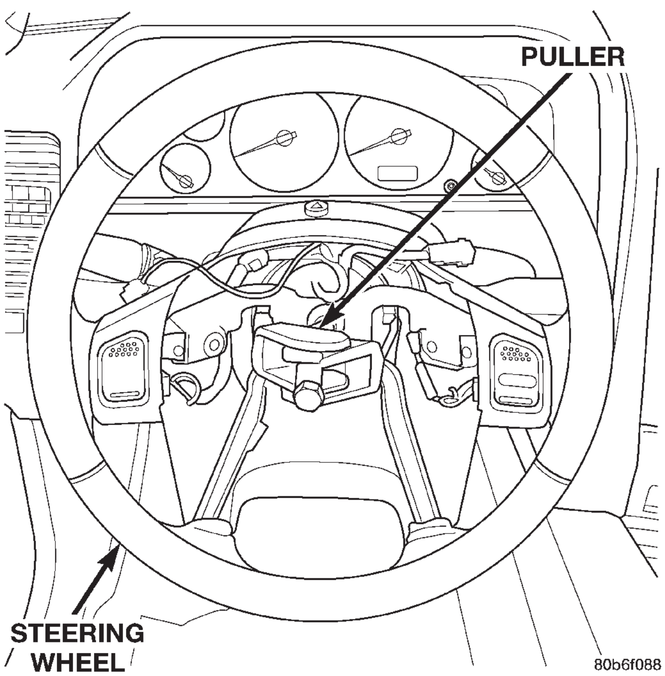


Fig. 13 Steering Wheel Remove/Install

(6) Remove the screw that secures the lower tilting steering column shroud to the steering column multi-function switch mounting housing (Fig. 15).

(7) Unsnap the two halves of the tilting steering column shroud from each other and remove both halves from the steering column.

(8) Disconnect the two instrument panel wire harness connectors from the lower clockspring connector receptacles.

(9) Remove the two screws that secure the clockspring case to the multi-function switch mounting housing (Fig. 16).

(10) Remove the clockspring from the steering column by sliding the clockspring hub up and off of the steering column upper shaft. The clockspring cannot be repaired. It must be replaced if faulty or damaged, or if the driver side airbag has been deployed.

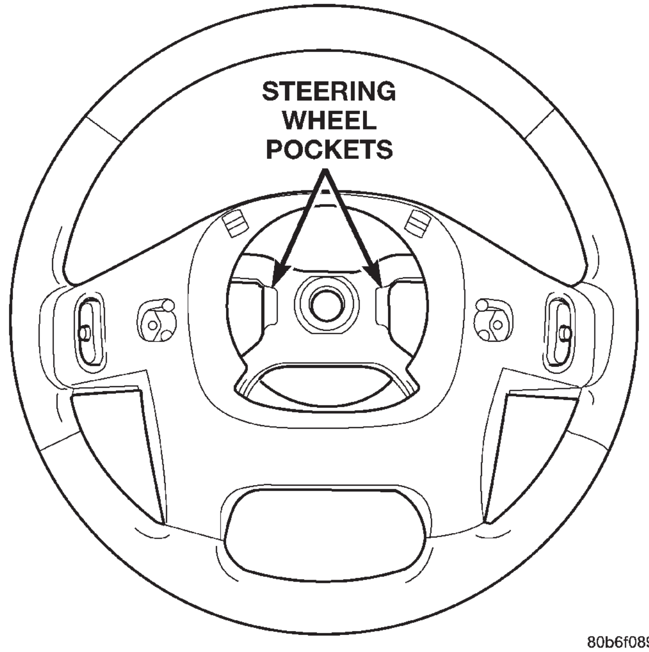


Fig. 14 Steering Wheel Armature Pockets

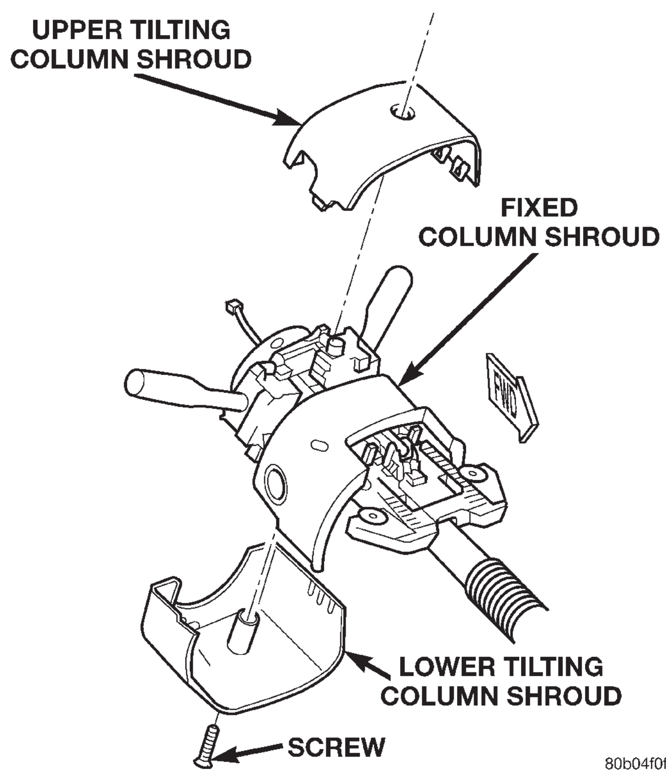


Fig. 15 Steering Column Shrouds Remove/Install

INSTALLATION

If the clockspring is not properly centered in relation to the steering wheel, steering shaft and steering gear, it may be damaged. Refer to **Clockspring Centering** in the Adjustments section of this group before installing or reinstalling a clockspring.

REMOVAL AND INSTALLATION (Continued)

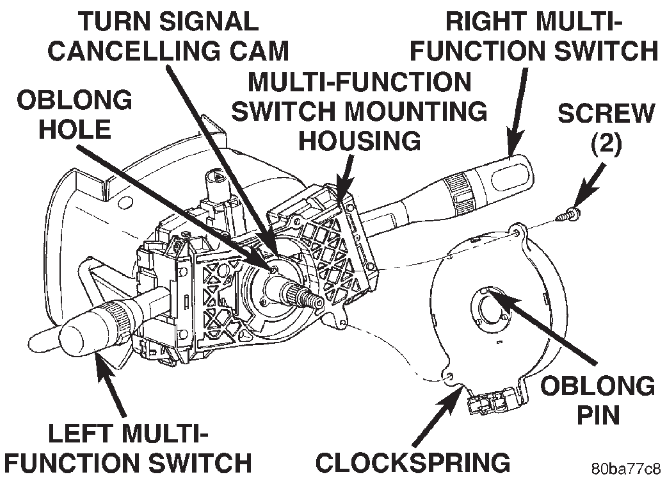


Fig. 16 Clockspring Remove/Install

Service replacement clocksprings are shipped pre-centered and with a locking pin installed. This locking pin should not be removed until the clockspring has been installed on the steering column. If the locking pin is removed before the clockspring is installed on a steering column, the locking pin cannot be reinstalled and the clockspring centering procedure must be performed.

NOTE: Before starting this procedure, be certain that the front wheels are still in the straight-ahead position.

(1) While holding the centered clockspring hub and case stationary in relationship to each other, slide the clockspring down over the steering column upper shaft.

(2) Align and seat the three pins in the clockspring hub with the three holes in the hub of the turn signal cancelling cam. It should be noted that when the clockspring is properly centered the uppermost pin in the clockspring hub is an oblong pin, and it will only fit in the oblong hole in the hub of the turn signal cancelling cam.

(3) Align and seat the one pin and the two mounting holes on the clockspring case to their respective holes in the multi-function switch mounting housing.

(4) Install and tighten the two clockspring mounting screws. Tighten the screws to 2.5 N·m (22 in. lbs.).

(5) Reconnect the two instrument panel wire harness connectors to the lower clockspring connector receptacles.

(6) Position the lower tilting steering column shroud to the steering column (Fig. 15). Install and tighten the screw that secures the shroud to the multi-function switch mounting housing. Tighten the screw to 1.9 N·m (17 in. lbs.).

(7) Position the upper tilting column shroud to the steering column with the hazard warning switch button inserted through the hole in the upper surface of the shroud. Align the upper tilting steering column shroud to the lower shroud and snap the two shroud halves together.

(8) Install the steering wheel to the steering column upper shaft. Be certain to index the alignment splines in the hub of the steering wheel armature with the splines on the shaft. Pull the clockspring wire harness through the hole between the two upper steering wheel armature spokes.

(9) Install and tighten the steering wheel mounting nut. Tighten the nut to 47 N·m (420 in. lbs.). Be certain not to pinch the wire harnesses between the steering wheel and the nut.

(10) Reconnect the steering wheel wire harness connector to the upper clockspring connector receptacle, which is located between the two upper spokes of the armature within the hub cavity of the steering wheel.

(11) Install the driver side airbag module onto the steering wheel. Refer to **Driver Side Airbag Module** in the Removal and Installation section of this group for the procedures.

ADJUSTMENTS

CLOCKSPRING CENTERING

The clockspring is designed to wind and unwind when the steering wheel is rotated, but is only designed to rotate the same number of turns (about five complete rotations) as the steering wheel can be turned from stop to stop. Centering the clockspring indexes the clockspring tape to other steering components so that it can operate within its designed travel limits. The rotor of a centered clockspring can be rotated two and one-half turns in either direction from the centered position, without damaging the clockspring tape.

However, if the clockspring is removed for service or if the steering column is disconnected from the steering gear, the clockspring tape can change position relative to the other steering components. The clockspring must then be re-centered following completion of the service or the clockspring tape may be damaged.

Service replacement clocksprings are shipped pre-centered and with a locking pin installed. This locking pin should not be removed until the clockspring has been installed on the steering column. If the locking pin is removed before the clockspring is installed on a steering column, the locking pin cannot be reinstalled and the clockspring centering procedure must be performed.

ADJUSTMENTS (Continued)

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NOTE: Before starting this procedure, be certain to turn the steering wheel until the front wheels are in the straight-ahead position.

(1) Place the front wheels in the straight-ahead position.

(2) Remove the clockspring from the steering column. Refer to **Clockspring** in the Removal and Installation section of this group for the procedures.

(3) Hold the clockspring case in one hand so that it is oriented as it would be when it is installed on the steering column.

(4) Use your other hand to rotate the clockspring hub clockwise to the end of its travel. **Do not apply excessive torque.**

(5) From the end of the clockwise travel, rotate the hub about two and one-half turns counterclockwise. It should be noted that when the clockspring is properly centered the arrows on the clockspring hub label and the clockspring case should be aligned (Fig. 17), and the uppermost pin in the clockspring hub should be an oblong pin.

(6) The clockspring is now centered. Secure the clockspring hub to the clockspring case to maintain clockspring centering until it is reinstalled on the steering column.

(7) The front wheels should still be in the straight-ahead position. Install the clockspring onto the steering column. Refer to **Clockspring** in the Removal and Installation section of this group for the procedures.

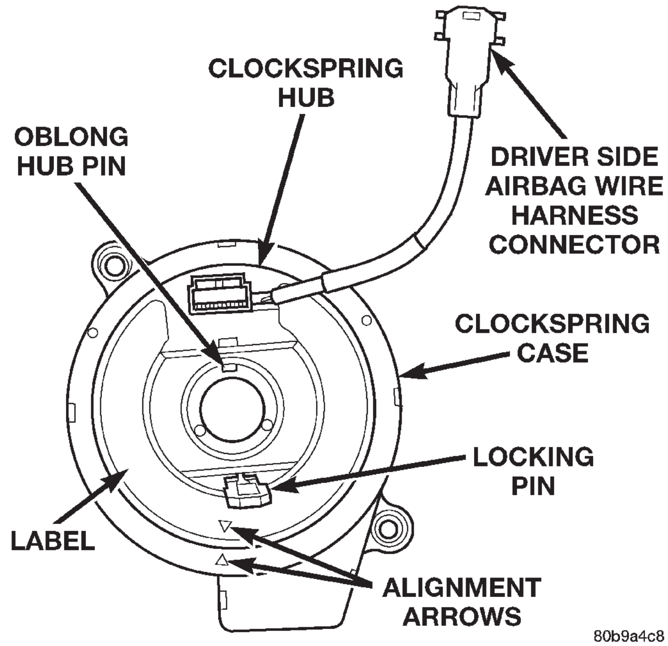
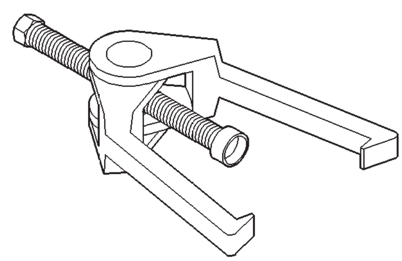


Fig. 17 Clockspring Alignment Arrows

SPECIAL TOOLS

PASSIVE RESTRAINT SYSTEMS



Puller C-3894-A

ELECTRICALLY HEATED SYSTEMS

CONTENTS

REAR WINDOW DEFOGGER SYSTEM

INDEX

DESCRIPTION AND OPERATION

REAR WINDOW DEFOGGER SYSTEM

DESCRIPTION

An electrically heated rear window defogger and electrically heated outside rear view mirrors are standard factory-installed equipment on this model. When the rear window defogger system is turned on, electric heater grids on the liftgate flip-up glass and behind both outside rear view mirror glasses are energized. These electric heater grids produce heat to help clear the rear window glass and the outside rear view mirrors of ice, snow, or fog. The rear window defogger system control circuit uses ignition switched battery current, so the system will only operate when the ignition switch is in the On position.

This group covers the following components of the rear window defogger system:

- Outside mirror heating grid
- Rear glass heating grid
- Rear window defogger relay
- Rear window defogger switch.

Certain functions and features of the rear window defogger system rely upon resources shared with other electronic modules in the vehicle over the Programmable Communications Interface (PCI) data bus network. The PCI data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, internal controller hardware, and component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities. For diagnosis of these electronic modules or of the PCI data bus network, the use of a DRB scan tool and the proper Diagnostic Procedures manual are recommended.

The other electronic modules that may affect power lock system operation are as follows:

- **Body Control Module (BCM)** - Refer to **Body Control Module** in the Description and Operation section of Group 8E - Instrument Panel Systems for more information.
- **Driver Door Module (DDM)** - Refer to **Door Module** in the Power Lock System section of Group 8P - Power Lock Systems.
- **Passenger Door Module (PDM)** - Refer to **Door Module** in the Power Lock System section of Group 8P - Power Lock Systems.

Refer to **Rear Window Defogger** and **Power Mirrors** in the Contents of Group 8W - Wiring Diagrams for complete circuit diagrams. Following are general descriptions of the major components in the power lock system.

DESCRIPTION AND OPERATION (Continued)

OPERATION

The rear window defogger system is controlled by a momentary switch that is integral to the heating and air conditioning control unit located in the center stack area of the instrument panel. A Light-Emitting Diode (LED) in the switch button will light to indicate when the rear window defogger system is turned on. The BCM, which contains the rear window defogger system timer and control logic, monitors the status of the defogger switch through a hard-wired input. The BCM then sends control outputs through a hard wired circuit to energize or de-energize the defogger relay.

The electrically heated outside rear view mirror heating grids are also controlled by the rear window defogger switch. When the BCM receives an input from the switch, it also sends a defogger switch status message to the DDM and the PDM over the PCI data bus. The DDM and PDM respond to the defogger switch status messages by energizing or de-energizing the battery current feed to their respective outside rear view mirror heating grids.

The rear window defogger system will be automatically turned off after a programmed time interval of about ten minutes. After the initial time interval has expired, if the defogger switch is turned on again during the same ignition cycle, the defogger system will automatically turn off after about five minutes. The defogger system will automatically shut off if the ignition switch is turned to the Off position, or it can be turned off manually by depressing the rear window defogger switch again.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the rear window defogger system.

OUTSIDE MIRROR HEATING GRID

DESCRIPTION

Electrically heated outside rear view mirrors are standard equipment on this model. These mirrors feature an electric heating grid located behind the mirror glass of each power operated outside rear view mirror. These heating grids consist of a single resistor wire routed in a grid-like pattern and captured between two thin sheets of plastic. When electrical current is passed through the resistor wire, it produces enough heat energy to clear the outside mirror glass of ice, snow or fog. Battery current is directed to the outside mirror heating grid only when the rear window defogger switch is in the On position.

If the outside mirror heating grids and the rear window heating grid are all inoperative, refer to **Rear Window Defogger System** in the Diagnosis and Testing section of this group for diagnosis. If the outside mirror heating grids are inoperative, but the rear window heating grid is operating as designed, refer to **Power Mirror** in the Diagnosis and Testing section of Group 8T - Power Mirror Systems for diagnosis of the outside mirror heating grids.

The heating grid behind each outside mirror glass cannot be repaired and, if faulty or damaged, the entire power mirror unit must be replaced. Refer to **Power Mirror** in the Removal and Installation section of Group 8T - Power Mirror Systems for the service procedures.

OPERATION

The outside mirror heating grids are energized and de-energized by the Driver Door Module (DDM) and the Passenger Door Module (PDM) based upon the rear window defogger switch status. The Body Control Module (BCM) monitors the rear window defogger switch. When the BCM receives an input from the switch, it sends a defogger switch status message to the DDM and the PDM over the Programmable Communications Interface data bus. The DDM and PDM respond to the defogger switch status messages by energizing or de-energizing the battery current feed to their respective outside rear view mirror heating grids.

REAR GLASS HEATING GRID

DESCRIPTION

The electrically heated rear window glass is standard equipment on this model. The liftgate flip-up 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. These grid lines and the bus bars comprise a parallel electrical circuit. A spade type terminal near the top of each bus bar accept the connectors from the two coiled liftgate wire harness take outs.

The grid lines and bus bars are highly resistant to abrasion. However, it is possible for an open circuit 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 when cleaning the glass or removing foreign materials, decals, or stickers from the glass. 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 terminals. Refer to **Rear Glass Heating Grid Repair** in the Service Procedures section of this group for the repair procedures.

DESCRIPTION AND OPERATION (Continued)

OPERATION

The rear glass heating grid is energized and de-energized by the rear window defogger relay. The Body Control Module (BCM) monitors the rear window defogger switch. When the BCM receives an input from the switch, it energizes or de-energizes the rear window defogger relay through a hard wired control output. The rear defogger relay switches fused battery current to the rear window grid lines through the bus bars. The grid lines heat the rear window glass to clear the surface of ice, snow or fog. Protection for the rear glass heating grid circuit is provided by a fuse in the Power Distribution Center (PDC).

REAR WINDOW DEFOGGER SWITCH

DESCRIPTION

The rear window defogger switch is integral to the heating and air conditioning control unit, which is located in the instrument panel center stack below the radio receiver. This momentary switch provides a hard wired ground signal to the Body Control Module (BCM) each time it is depressed. A Light Emitting Diode (LED) in the push button for the rear window defogger switch illuminates to indicate when the rear window defogger system is turned on.

The rear window defogger switch and the rear window defogger switch LED indicator cannot be repaired and, if faulty or damaged, the entire heating and air conditioning control unit must be replaced. Refer to **Heater-A/C Control** in the Removal and Installation section of Group 24 - Heating and Air Conditioning for the service procedures.

OPERATION

When the rear window defogger switch push button is depressed, it momentarily closes the rear window defogger switch sense circuit for the BCM to ground. The BCM monitors the rear window defogger switch sense circuit. Each time the BCM rear window defogger timer and logic circuitry sees another input from the switch, it toggles a control output to the rear window defogger relay. Energizing the rear window defogger relay provides electrical current to the rear window defogger grid and to the LED indicator in the switch, which lights to indicate when the defogger system is turned on. A dedicated fuse in the junction block protects the rear window defogger relay output circuit to the LED indicator.

REAR WINDOW DEFOGGER RELAY

DESCRIPTION

The rear window defogger relay is an electromechanical device that switches fused battery current to the rear glass heating grid and the Light-Emitting Diode (LED) indicator of the rear window defogger switch, when the Body Control Module (BCM) rear window defogger timer and logic circuitry grounds the relay coil. The rear window defogger relay is located in the junction block, under the left end of the instrument panel in the passenger compartment.

The rear window defogger relay is a International Standards Organization (ISO) relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions.

The rear window defogger relay cannot be repaired or adjusted and, if faulty or damaged, it must be replaced.

OPERATION

The ISO relay consists of an electromagnetic coil, a resistor or diode, and three (two fixed and one movable) electrical contacts. The movable (common feed) relay contact is held against one of the fixed contacts (normally closed) by spring pressure. When the electromagnetic coil is energized, it draws the movable contact away from the normally closed fixed contact, and holds it against the other (normally open) fixed contact.

When the electromagnetic coil is de-energized, spring pressure returns the movable contact to the normally closed position. The resistor or diode is connected in parallel with the electromagnetic coil in the relay, and helps to dissipate voltage spikes that are produced when the coil is de-energized.

DIAGNOSIS AND TESTING

REAR WINDOW DEFOGGER SYSTEM

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

For complete circuit diagrams, refer to **Rear Window Defogger** in the Contents of Group 8W - Wiring Diagrams. The operation of the electrically heated rear window defogger system can be confirmed in one of the following manners:

1. Turn the ignition switch to the On position. While monitoring the instrument panel voltmeter, depress the rear window defogger switch to the On position. When the rear window defogger switch is turned On, a distinct voltmeter needle deflection should be noted.

DIAGNOSIS AND TESTING (Continued)

2. Turn the ignition switch to the On position. Depress the rear window defogger switch to the On position. The rear window defogger operation can be checked by feeling the rear window or outside rear view mirror glass. A distinct difference in temperature between the grid lines and the adjacent clear glass or the mirror glass can be detected within three to four minutes of operation.

3. Using a 12-volt DC voltmeter, contact the rear glass heating grid terminal A (right side) with the negative lead, and terminal B (left side) with the positive lead (Fig. 1). The voltmeter should read battery voltage.

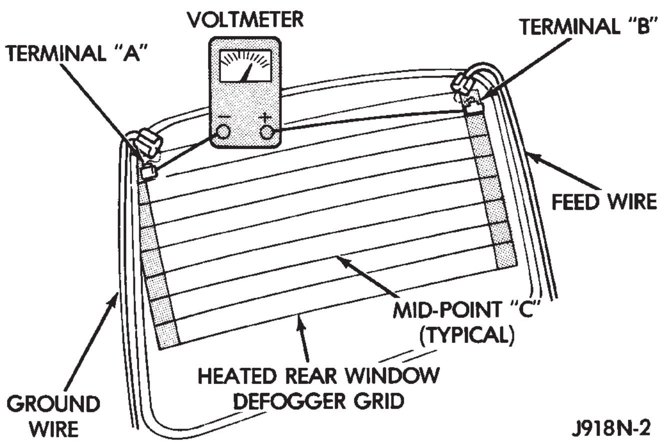


Fig. 1 Rear Window Glass Grid Test

The above checks will confirm rear window defogger system operation. Illumination of the rear window defogger switch LED indicator means that there is battery current available at the output of the rear window defogger relay, but does not confirm that battery current is reaching the rear glass heating grid lines.

If the rear window defogger system does not operate, the problem should be isolated in the following manner:

(1) Confirm that the ignition switch is in the On position.

(2) Ensure that the rear glass heating grid feed and ground terminals are connected to the glass. Confirm that the ground wire has continuity to ground.

(3) Check the fused B(+) fuse in the Power Distribution Center (PDC). The fuse must be tight in its receptacles and all electrical connections must be secure.

When the above steps have been completed and the rear glass heating grid is still inoperative, one or more of the following is faulty:

- Rear window defogger switch
- Rear window defogger relay
- Body Control Module (BCM)
- 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).

When the above steps have been completed and the heated mirror glass heating grid is still inoperative, one or more of the following is faulty:

- Body Control Module (BCM)
- Programmable Communications Interface (PCI) data bus
- Driver Door Module (DDM) or Passenger Door Module (PDM)
- Outside rear view mirror heating grids.

If turning the rear window defogger system on produces a severe voltmeter deflection, check for a short circuit between the rear window defogger relay output and the rear glass heating grid.

REAR GLASS HEATING GRID

For complete circuit diagrams, refer to **Rear Window Defogger** in the Contents of Group 8W - Wiring Diagrams. To detect breaks in the rear glass heating grid lines, the following procedure is required:

(1) Turn the ignition switch to the On position. Turn the rear window defogger system on. The rear window defogger switch LED indicator should light. If OK, go to Step 2. If not OK, refer to **Rear Window Defogger Relay** in the Diagnosis and Testing section of this group.

(2) Using a 12-volt DC voltmeter, contact the rear glass heating grid vertical bus bar on the right side of the vehicle with the negative lead. With the positive lead, contact the rear glass heating grid vertical bus bar on the left side of the vehicle. The voltmeter should read battery voltage. If OK, go to Step 3. If not OK, repair the open rear window defogger relay output circuit to the rear window defogger relay as required.

(3) With the positive voltmeter lead still contacting the rear glass heating grid vertical bus bar on the left side of the vehicle, move the negative lead of the voltmeter to a good body ground point. The voltage reading should not change. If OK, go to Step 4. If not OK, repair the ground circuit to ground as required.

(4) Connect the negative lead of the voltmeter to the right side bus bar and touch each grid line at midpoint C with the positive lead. A reading of approximately six volts indicates a line is good. A reading of zero volts indicates a break in the grid line between midpoint C and the left side rear glass heating grid bus bar. A reading of ten to fourteen volts indicates a break between midpoint C and the right side rear heating grid bus bar. Move the positive lead on the grid line towards the break and the voltage reading will change as soon as the break is crossed.

REAR WINDOW DEFOGGER SWITCH

For complete circuit diagrams, refer to **Rear Window Defogger** in the Contents of Group 8W - Wiring Diagrams.

DIAGNOSIS AND TESTING (Continued)

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable. Remove the heater and air conditioner control unit from the instrument panel and disconnect the 11-way (manual temperature control) or 16-way (automatic zone control) instrument panel wire harness connector from the heater and air conditioner control receptacle.

(2) Check for continuity between the ground circuit cavity of the 11-way or 16-way instrument panel wire harness connector for the heater and air conditioner control and a good ground. There should be continuity. If OK, go to Step 3. If not OK, repair the open ground circuit to ground as required.

(3) Connect two jumper wires to the heater and air conditioner control 11-way or 16-way connector receptacle. Connect one jumper from the ground circuit terminal in the 11-way or 16-way heater and air conditioner control connector receptacle to a good ground. Connect the other jumper from the fused rear window defogger relay output circuit terminal of the 11-way or 16-way connector receptacle to a 12-volt battery feed. The rear window defogger switch LED indicator should light. If OK, go to Step 4. If not OK, replace the faulty heater and air conditioner control unit.

(4) Check for continuity between the ground circuit and rear window defogger switch sense circuit terminals of the 11-way or 16-way heater and air conditioner control connector receptacle. There should be momentary continuity as the rear window defogger switch push button is depressed, and then no continuity. If OK, go to Step 5. If not OK, replace the faulty heater and air conditioner control unit.

(5) Disconnect the 22-way instrument panel wire harness connector from the Body Control Module (BCM) connector receptacle. Check for continuity between the rear window defogger switch sense circuit cavity of the 11-way or 16-way instrument panel wire harness connector for the heater and air conditioner control and a good ground. There should be no continuity. If OK, go to Step 6. If not OK, repair the shorted rear window defogger switch sense circuit as required.

(6) Check for continuity between the rear window defogger switch sense circuit cavities of the 11-way or 16-way instrument panel wire harness connector for the heater and air conditioner control and the 22-way instrument panel wire harness connector for the BCM. There should be continuity. If OK, refer to **Rear Window Defogger Relay** in the Diagnosis and Testing section of this group. If not OK, repair the open rear window defogger switch sense circuit as required.

REAR WINDOW DEFOGGER RELAY

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

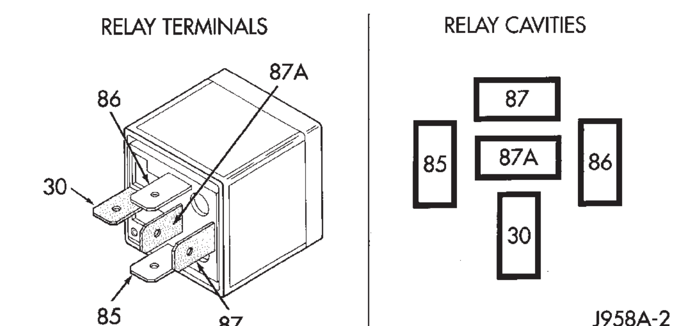
RELAY TEST

The rear window defogger relay (Fig. 2) is located in the junction block, under the left end of the instrument panel in the passenger compartment. Remove the rear window defogger relay from the junction block to perform the following tests:

(1) A relay in the de-energized position should have continuity between terminals 87A and 30, and no continuity between terminals 87 and 30. If OK, go to Step 2. If not OK, replace the faulty relay.

(2) Resistance between terminals 85 and 86 (electromagnet) should be 75 ± 10 ohms. If OK, go to Step 3. If not OK, replace the 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, refer to **Relay Circuit Test** in the Diagnosis and Testing section of this group. If not OK, replace the faulty relay.



TERMINAL LEGEND	
NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

Fig. 2 Rear Window Defogger Relay

DIAGNOSIS AND TESTING (Continued)

RELAY CIRCUIT TEST

(1) The relay common feed terminal cavity (30) is connected to battery voltage and should be hot at all times. If OK, go to Step 2. If not OK, repair the open fused B(+) circuit to the Power Distribution Center (PDC) fuse as required.

(2) The relay normally closed terminal (87A) is connected to terminal 30 in the de-energized position, but is not used for this application. Go to Step 3.

(3) The relay normally open terminal (87) is connected to the common feed terminal (30) in the energized position. This terminal supplies battery voltage to the rear glass heating grid and to the fuse in the junction block that feeds the rear window defogger switch LED indicator. There should be continuity between the cavity for relay terminal 87 and the rear glass heating grid and the rear window defogger switch LED indicator at all times. If OK, go to Step 4. If not OK, repair the open rear window defogger relay output circuit as required.

(4) The coil battery terminal (86) is connected to the electromagnet in the relay. It is connected to battery voltage and should be hot at all times. Check for battery voltage at the cavity for relay terminal 86. If OK, go to Step 5. If not OK, repair the open fused B(+) circuit to the PDC fuse as required.

(5) The coil ground terminal (85) is connected to the electromagnet in the relay. This terminal is provided with ground by the Body Control Module (BCM) rear window defogger timer and logic circuitry to energize the defogger relay. There should be continuity to the rear window defogger relay control circuit cavity of the 22-way instrument panel wire harness connector for the BCM. If OK, use a DRB scan tool and the proper Diagnostic Procedures manual to test the BCM. If not OK, repair the open rear window defogger relay control circuit as required.

SERVICE PROCEDURES

REAR GLASS HEATING GRID REPAIR

Repair of the rear glass heating grid lines, bus bars, and terminals can be accomplished using a Mopar Rear Window Defogger Repair Kit (Part Number 4267922) or equivalent.

WARNING: MATERIALS CONTAINED IN THE REPAIR KIT MAY CAUSE SKIN OR EYE IRRITATION. THE KIT CONTAINS EPOXY RESIN AND AMINE TYPE HARDENER, WHICH ARE HARMFUL IF SWALLOWED. AVOID CONTACT WITH THE SKIN AND EYES. FOR SKIN CONTACT, WASH THE AFFECTED AREAS WITH SOAP AND WATER. FOR CONTACT WITH THE EYES, FLUSH WITH PLENTY OF WATER. DO NOT TAKE INTERNALLY. IF TAKEN INTERNALLY, INDUCE VOMITING AND CALL A PHYSICIAN IMMEDIATELY. USE WITH ADEQUATE VENTILATION. DO NOT USE NEAR FIRE OR FLAME. CONTAINS FLAMMABLE SOLVENTS. KEEP OUT OF THE REACH OF CHILDREN.

(1) Mask the repair area on the inside of the rear glass so that the conductive epoxy can be applied neatly. Extend the epoxy application onto the rear glass heating grid bus bar or grid line on each side of the break (Fig. 3).

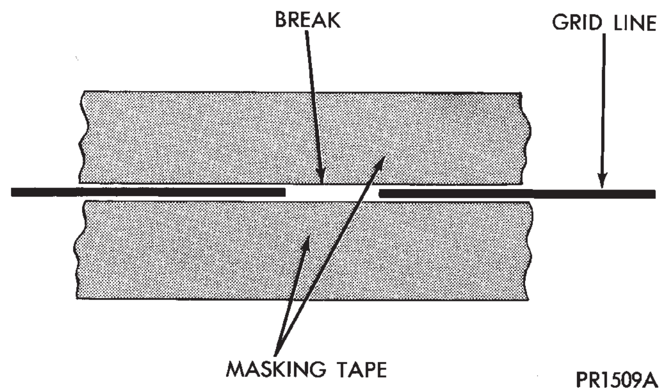


Fig. 3 Grid Line Repair - Typical

(2) Follow the instructions in the repair kit for preparing the damaged area.

(3) Remove the package separator clamp and mix the two conductive epoxy components thoroughly within the packaging. Fold the package in half and cut the center corner to dispense the epoxy.

(4) For rear glass heating grid line repairs, mask the area to be repaired with masking tape or a template.

(5) Apply the epoxy through the slit in the masking tape or template. Overlap both ends of the break by at least 19 millimeters (0.75 inch).

(6) For a rear glass heating grid terminal replacement, mask the adjacent areas so the epoxy can be extended onto the adjacent grid line as well as onto the bus bar. Apply a thin layer of epoxy to the area where the terminal was previously fastened and onto the adjacent grid line.

(7) Apply a thin layer of conductive epoxy to the terminal and place it in the proper location on the rear glass heating grid bus bar. To prevent the terminal from moving while the epoxy is curing, it must be wedged or clamped.

(8) Carefully remove the masking tape or template.

CAUTION: Do not allow the glass surface to exceed 204° C (400° F) or the glass may fracture.

(9) Allow the epoxy to cure for 24 hours at room temperature, or use a heat gun with a 260° to 371° C (500° to 700° F) range for fifteen minutes. Hold the

SERVICE PROCEDURES (Continued)

heat gun approximately 25.4 centimeters (10 inches) from the repair.

(10) After the conductive epoxy is properly cured, remove the wedge or clamp from the terminal. Do not attach the wire harness connectors until the curing process is complete.

(11) Check the operation of the rear glass heating grid.

REMOVAL AND INSTALLATION

REAR WINDOW DEFOGGER RELAY

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the steering column opening cover from the instrument panel. Refer to **Steering Column Opening Cover** in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(3) The rear window defogger relay is located on the right side of the combination flasher in the junction block (Fig. 4).

(4) Remove the rear window defogger relay from the junction block.

INSTALLATION

(1) Position the rear window defogger relay in the proper receptacle in the junction block.

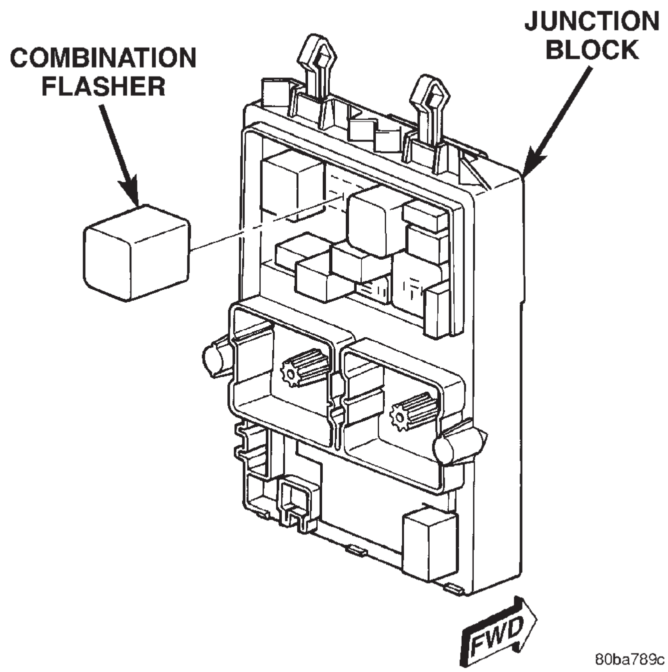


Fig. 4 Junction Block

(2) Align the rear window defogger relay terminals with the terminal cavities in the junction block receptacle.

(3) Push in firmly on the rear window defogger relay until the terminals are fully seated in the terminal cavities in the junction block receptacle.

(4) Install the steering column opening cover onto the instrument panel. Refer to **Steering Column Opening Cover** in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(5) Reconnect the battery negative cable.

HEATED SEAT SYSTEM

INDEX

DESCRIPTION AND OPERATION

HEATED SEAT SYSTEM

DESCRIPTION

Individually controlled driver and passenger side electrically heated front seats are available factory-installed optional equipment on this model, when it is also equipped with the power seat option. The heated seat system allows both the driver and the front seat passenger the option to select one of two seat heating ranges, Low or High, or to turn the individual seat heaters Off using the heated seat switches located in the center lower bezel near the bottom of the instrument panel center stack. The heated seat switch circuit operates on ignition switched battery current supplied through a fuse in the junction block, only when the ignition switch is in the On position.

This group covers the following components of the heated seat system:

- Heated seat elements and sensors
- Heated seat module (or memory heated seat module)
- Heated seat switches.

The heated seat system also relies upon resources shared with other electronic modules in the vehicle over the Programmable Communications Interface (PCI) data bus network. The PCI data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, internal controller hardware, and component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities. For diagnosis of these electronic modules or of the PCI data bus network, the use of a DRB scan tool and the proper Diagnostic Procedures manual are recommended.

The electronic modules that may affect heated seat system operation are as follows:

- **Body Control Module (BCM)** - Refer to **Body Control Module** in the Description and Operation section of Group 8E - Instrument Panel Systems for more information.
- **Heated Seat Module (HSM)** - Refer to **Heated Seat Module** in the Description and Operation section of this group for more information.
- **Memory Heated Seat Module (MHSM)** - If the vehicle is equipped with the Memory System, refer to **Memory Seat Module** in the Memory System section of Group 8R - Power Seat Systems for more information.

Refer to **Power Seats Premium I/III** in the Contents of Group 8W - Wiring Diagrams for complete circuit diagrams. Following are general descriptions of the major components in the heated seat system.

OPERATION

The heated seat system will only operate when the ignition switch is in the On position, and the surface temperature at the front seat heating element sensors is below the designed temperature set points of the system. The heated seat system will not operate in ambient temperatures greater than about 41° C (105° F). The front seat heating elements and sensors are hard wired to the Heated Seat Module (HSM) or the Memory Heated Seat Module (MHSM).

The heated seat switches are hard wired to the Body Control Module (BCM). The BCM monitors the heated seat switch inputs, then sends heated seat switch status messages to the HSM or MHSM over the Programmable Communications Interface (PCI) data bus. The HSM or MHSM contains the control logic for the heated seat system. The HSM or MHSM responds to the heated seat switch status messages, ignition switch status messages, and the front seat heating element sensor inputs by controlling the output to the front seat heating elements through integral solid-state relays.

When a seat heater is turned on, the sensor located on the seat cushion electric heater element

DESCRIPTION AND OPERATION (Continued)

provides the HSM or MHSM with an input indicating the surface temperature of the seat cushion. If the surface temperature input is below the temperature set point for the selected Low or High heated seat switch position, the HSM or MHSM energizes the integral relay, which supplies battery current to the heating elements in the seat cushion and back. When the sensor input indicates the correct temperature set point has been achieved, the HSM or MHSM de-energizes the relay. The HSM or MHSM will continue to cycle the relay as needed to maintain the temperature set point.

The HSM or MHSM and the seat heater elements operate on non-switched battery current supplied through the power seat circuit breaker in the junction block. However, the HSM or MHSM will automatically turn off the heating elements if it detects an open in the sensor circuit, a short in the heating element circuit causing an excessive current draw, or when the ignition switch is turned to the Off position.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the heated seat system.

HEATED SEAT SWITCH

DESCRIPTION

The heated seat switches are mounted in the center lower bezel, which is located near the bottom of the instrument panel center stack. The two three-position rocker-type switches, one switch for each front seat, provide a resistor multiplexed signal to the Body Control Module (BCM) through separate hard wired circuits. Each switch has an Off, Low, and High position so that both the driver and the front seat passenger can select a preferred seat heating mode. Each switch has two Light-Emitting Diodes (LED), one each for the Low position and the High position, which light to indicate that the heater for the seat that the switch controls is turned on. Each switch is also back lit by a replaceable incandescent bulb.

The heated seat switches and their LEDs cannot be repaired. If either switch or LED is faulty or damaged, the entire switch unit must be replaced. The incandescent switch illumination bulb and bulb holder units are available for service replacement.

OPERATION

There are three positions that can be selected with each of the heated seat switches: Off, Low, or High. When the top of the switch rocker is fully depressed, the High position is selected and the high position LED indicator illuminates. When the bottom of the switch rocker is fully depressed, the Low position is selected and the low position LED indicator illuminates. When the switch rocker is moved to its neutral position, Off is selected and both LED indicators are extinguished.

Both switches provide separate resistor multiplexed hard wire inputs to the BCM to indicate the selected switch position. The BCM monitors the switch inputs and sends heated seat switch status messages to the Heated Seat Module (HSM) or the Memory Heated Seat Module (MHSM) over the Programmable Communications Interface (PCI) data bus. The HSM or MHSM responds to the heated seat switch status messages by controlling the output to the seat heater elements of the selected seat. The Low heat position set point is about 38° C (100° F), and the High heat position set point is about 41° C (105° F).

HEATED SEAT MODULE

DESCRIPTION

There are two different electronic modules that can be used in the optional heated seat system. The Heated Seat Module (HSM) is used on vehicles that are not equipped with the optional Memory System. The Memory Heated Seat Module (MHSM) is used on vehicles that are equipped with the optional Memory System and the optional heated seat system. A third electronic module, the Memory Seat Module (MSM), is used on vehicles equipped with the Memory System without the optional heated seat system. Refer to **Memory System** in the Memory System section of Group 8R - Power Seat Systems for more information on the memory system option.

All three modules are packaged in an identical molded plastic housing which is mounted on a bracket that is located between the power seat track and the seat cushion frame under the forward edge of the driver side front seat cushion. The HSM or MHSM is used to control all of the heated seat system functions for both front seats. The HSM or MHSM contains a central processing unit and interfaces with other electronic modules in the vehicle on the Programmable Communications Interface (PCI) data bus network.

For diagnosis of the HSM, MHSM or the PCI data bus, a DRB scan tool and the proper Diagnostic Procedures manual are recommended. The HSM or MHSM cannot be repaired and, if faulty or damaged, it must be replaced.

OPERATION

The HSM or MHSM receives message inputs from the BCM over the PCI data bus and hard wired inputs from the front seat heating element sensors through the element return circuits. The program-

DESCRIPTION AND OPERATION (Continued)

ming in the HSM or MHSM allows it to process the information from these inputs and send control outputs to the integral solid state relays to regulate the flow of battery current and the temperature of the front seat heating elements.

HEATED SEAT ELEMENT AND SENSOR

DESCRIPTION

The heated seat system includes two seat heating elements in each front seat, one for the seat cushion and the other for the seat back. The two elements for each seat are connected in series with the Heated Seat Module (HSM) or the Memory Heated Seat Module (MHSM). The temperature sensor is a Negative Temperature Coefficient (NTC) thermistor. One temperature sensor is used for each seat, and it is located on the seat cushion heating element.

The seat heating elements are sewn into the seat cushion cover trim and seat back cover trim units. The heated seat elements and the temperature sensor cannot be adjusted or repaired and, if faulty or damaged, the seat cushion cover trim unit or seat back cover trim unit must be replaced. Refer to **Bucket Seat Cushion Cover** or **Bucket Seat Back Cover** in the Removal and Installation section of Group 23 - Body for the seat cushion cover trim and seat back cover trim service procedures.

OPERATION

The heated seat elements resist the flow of electrical current. When battery current is passed through the elements, the energy lost by the resistance of the elements to the current flow is released in the form of heat. The temperature sensor is a NTC thermistor. When the temperature of the seat cushion cover rises, the resistance of the sensor decreases. The HSM or MHSM supplies a five-volt current to one side of each sensor, and monitors the voltage drop through the sensor on a return circuit. The MSM or MHSM uses this temperature sensor input to monitor the temperature of the seat, and regulates the current flow to the seat heating elements accordingly.

DIAGNOSIS AND TESTING

HEATED SEAT SYSTEM

Following are tests that will help to diagnose the components and circuits that are hard wired inputs or outputs of the heated seat system. However, these tests may not prove conclusive in the diagnosis of this system. In order to obtain conclusive testing of the heated seat system, the Programmable Communications Interface (PCI) data bus network and all of the electronic modules that provide inputs to, or receive outputs from the heated seat system components must be checked.

The most reliable, efficient, and accurate means to diagnose the heated seat system requires the use of a DRB scan tool and the proper Diagnostic Procedures manual. The DRB scan tool can provide confirmation that the PCI data bus is functional, that all of the electronic modules are sending and receiving the proper messages on the PCI data bus, and that the Heated Seat Module (HSM) or Memory Heated Seat Module (MHSM) is receiving the proper hard wired inputs and relaying the proper hard wired outputs to perform its heated seat system functions.

For complete circuit diagrams, refer to **Power Seats Premium I/III** in the Contents of Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

PRELIMINARY TEST

Before testing the individual components in the heated seat system, check the following:

- If the heated seat switch LED indicators do not light with the ignition switch in the On position and the heated seat switch in the Low or High position, check the fused ignition switch output (run) fuse in the junction block. If OK, refer to **Heated Seat Switch** in the Diagnosis and Testing section of this group. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.
- If the heated seat switch LED indicators light, but the heating elements do not heat, check the power seat circuit breaker in the junction block. If OK, refer to **Heated Seat Element** in the Diagnosis and Testing section of this group. If not OK, replace the faulty power seat circuit breaker.

HEATED SEAT SWITCH

For complete circuit diagrams, refer to **Power Seats Premium I/III** in the Contents of Group 8W - Wiring Diagrams.

DIAGNOSIS AND TESTING (Continued)

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Check the fused ignition switch output (run) fuse in the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run) fuse in the junction block. If OK, go to Step 3. If not OK, repair the open fused ignition switch output (run) circuit to the ignition switch as required.

(3) Disconnect and isolate the battery negative cable. Remove the lower center bezel from the instrument panel and disconnect the instrument panel wire harness connectors from both heated seat switch connector receptacles. Check for continuity between the ground circuit cavity of the instrument panel wire harness connector for the inoperative heated seat switch(es) and a good ground. There should be continuity. If OK, go to Step 4. If not OK, repair the open ground circuit to ground as required.

(4) Reconnect the battery negative cable. Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run) circuit cavity of the instrument panel wire harness connector for the inoperative heated seat switch(es). If OK, turn the ignition switch to the Off position, disconnect and isolate the battery negative cable, and go to Step 5. If not OK, repair the open fused ignition switch output (run) circuit to the junction block fuse as required.

(5) Test the heated seat switch(es) (Fig. 1) as shown in the Heated Seat Switch Test chart. If OK, go to Step 6. If not OK, replace the faulty heated seat switch(es).

(6) Disconnect the 22-way instrument panel wire harness connector from the Body Control Module (BCM) connector receptacle. Check for continuity between the seat heater switch sensor ground circuit cavity of the instrument panel wire harness connector for the inoperative heated seat switch(es) and a good ground. There should be no continuity. If OK, go to Step 7. If not OK, repair the shorted seat heater switch sensor ground circuit as required.

(7) Check for continuity between the seat heater switch sensor ground circuit cavities of the instrument panel wire harness connector for the in operative heated seat switch(es) and the 22-way instrument panel wire harness connector for the BCM. There should be continuity. If OK, go to Step 8. If not OK, repair the open seat heater switch sensor ground circuit as required.

(8) Check for continuity between the seat heater switch mux circuit cavity of the instrument panel wire harness connector for the inoperative heated seat switch and a good ground. There should be no continuity. If OK, go to Step 9. If not OK, repair the shorted seat heater switch mux circuit as required.

(9) Check for continuity between the seat heater switch mux circuit cavity of the instrument panel wire harness connector for the inoperative heated seat switch and the 22-way instrument panel wire harness connector for the BCM. There should be continuity. If OK, use a DRB scan tool and the proper Diagnostic Procedures manual to test the BCM. If not OK, repair the open seat heater switch mux circuit as required.

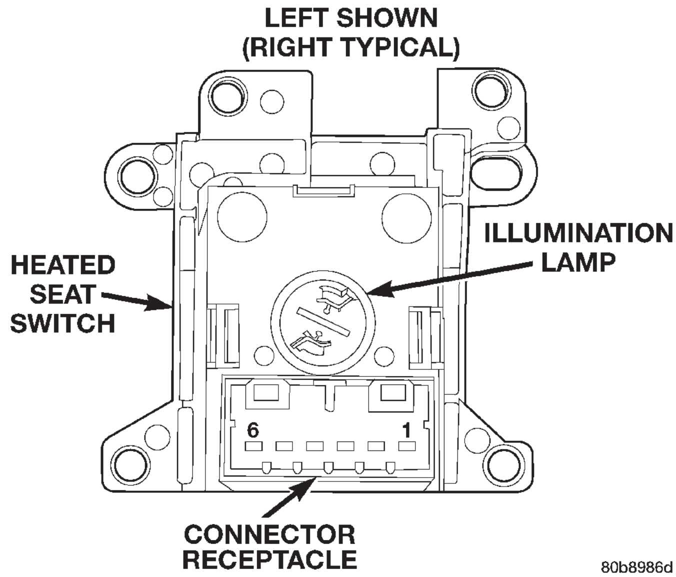


Fig. 1 Heated Seat Switch

HEATED SEAT SWITCH TEST		
SWITCH POSITION	RESISTANCE BETWEEN	RESISTANCE (OHMS)
Off	Pin 1 & 6	60
Low	Pin 1 & 6	1435
High	Pin 1 & 6	370
All resistance values are ±1%.		

HEATED SEAT MODULE

Before testing the heated seat module, test the heated seat switch, the heated seat elements, and the heated seat sensor. Refer to **Heated Seat Switch**, **Heated Seat Element** and **Heated Seat Sensor** in the Diagnosis and Testing section of this group. If

DIAGNOSIS AND TESTING (Continued)

testing of the heated seat switch, elements, and sensor reveals no problems, proceed as follows. For complete circuit diagrams, refer to **Power Seat Premium I/III** in the Contents of Group 8W - Wiring Diagrams.

(1) Disconnect and isolate the battery negative cable. Disconnect both power seat wire harness connectors from the Heated Seat Module (HSM) or Memory Heated Seat Module (MHSM). Check for continuity between each of the two Z1 ground circuit cavities of the C2 power seat wire harness connector for the HSM or MHSM and a good ground. There should be continuity. If OK, go to Step 2. If not OK, repair the open ground circuit to ground as required.

(2) Check for continuity between the Z2 ground circuit cavity of the C1 power seat wire harness connector for the HSM or MHSM and a good ground. There should be continuity. If OK, go to Step 3. If not OK, repair the open ground circuit to ground as required.

(3) Reconnect the battery negative cable. Check for battery voltage at each of the two fused B(+) circuit cavities of the C2 power seat wire harness connector for the HSM or MHSM. If OK, use a DRB scan tool and the proper Diagnostic Procedures manual to test the HSM or MHSM. If not OK, repair the open fused B(+) circuit to the power seat circuit breaker in the junction block as required.

HEATED SEAT ELEMENT

For complete circuit diagrams, refer to **Power Seats Premium I/III** in the Contents of Group 8W - Wiring Diagrams.

(1) Disconnect and isolate the battery negative cable. Disconnect the 4-way heated seat cushion element wire harness connector from the power seat wire harness. The power seat wire harness connectors for the seat cushion and seat back heating elements are secured to a bracket located under the rear edge of the seat cushion frame.

(2) Check for continuity between the seat heater B(+) driver circuit cavity of the 4-way heated seat cushion element wire harness connector and the seat cushion frame. There should be no continuity. If OK, go to Step 3. If not OK, replace the faulty seat cushion cover trim and element unit.

(3) Check for continuity between the seat heater B(+) driver circuit and the heated seat driver circuit cavities of the 4-way heated seat cushion element wire harness connector. There should be continuity. If OK, go to Step 4. If not OK, replace the faulty seat cushion cover trim and element unit.

(4) Disconnect the C2 connector of the power seat wire harness from the Heated Seat Module (HSM) or Memory Heated Seat Module (MHSM) connector receptacle. Check for continuity between the seat heater B(+) driver circuit cavity of the 4-way power seat wire harness connector for the heated seat cushion element and the seat cushion frame. There should be no continuity. If OK, go to Step 5. If not OK, repair the shorted seat heater B(+) driver circuit as required.

(5) Check for continuity between the seat heater B(+) driver circuit cavities of the 4-way power seat wire harness connector for the heated seat cushion element and the C2 power seat wire harness connector for the HSM or MHSM. There should be continuity. If OK, go to Step 6. If not OK, repair the open seat heater B(+) driver circuit as required.

(6) Disconnect the 2-way heated seat back element wire harness connector from the power seat wire harness. The power seat wire harness connectors for the seat cushion heating element and the seat back heating element are secured to a bracket located under the rear edge of the seat cushion frame.

(7) Check for continuity between the heated seat driver circuit cavity of the 2-way power seat wire harness connector for the heated seat back element and the seat cushion frame. There should be no continuity. If OK, go to Step 8. If not OK, repair the shorted heated seat driver circuit as required.

(8) Check for continuity between the heated seat driver circuit cavities of the 2-way power seat wire harness connector for the heated seat back element and the 4-way power seat wire harness connector for the heated seat cushion element. There should be continuity. If OK, go to Step 9. If not OK, repair the open heated seat driver circuit as required.

(9) Check for continuity between the heated seat driver circuit cavity of the 2-way heated seat back element wire harness connector and the seat cushion frame. There should be no continuity. If OK, go to Step 10. If not OK, replace the faulty seat back cover trim and element unit.

(10) Check for continuity between the driver seat heater ground circuit cavity of the 2-way power seat wire harness connector for the heated seat back element and the seat cushion frame. There should be no continuity. If OK, go to Step 11. If not OK, repair the shorted driver seat heater ground circuit as required.

(11) Check for continuity between the driver seat heater ground circuit cavities of the 2-way power seat wire harness connector for the heated seat back element and the C2 power seat wire harness connector for the HSM or MHSM. There should be continuity. If OK, refer to **Heated Seat Sensor** in the Diagnosis and Testing section of this group. If not OK, repair the open driver seat heater ground circuit as required.

DIAGNOSIS AND TESTING (Continued)

HEATED SEAT SENSOR

For complete circuit diagrams, refer to **Power Seats Premium I/III** in the Contents of Group 8W - Wiring Diagrams.

(1) Disconnect and isolate the battery negative cable. Disconnect the 4-way heated seat cushion element wire harness connector from the power seat wire harness. The power seat wire harness connectors for the seat cushion and seat back heating elements are secured to a bracket located under the rear edge of the seat cushion frame.

(2) Check for continuity between the seat sensor 5V supply circuit cavity of the 4-way heated seat cushion element wire harness connector and the seat cushion frame. There should be no continuity. If OK, go to Step 3. If not OK, replace the faulty seat cushion cover trim and element unit.

(3) Using an ohmmeter, check the resistance between the seat sensor 5V supply circuit and the seat temperature sensor input circuit cavities of the 4-way heated seat cushion element wire harness connector. The sensor resistance should be between 2 kilohms and 200 kilohms. If OK, go to Step 4. If not OK, replace the faulty seat cushion cover trim and element unit.

(4) Disconnect the C1 connector of the power seat wire harness from the Heated Seat Module (HSM) or Memory Heated Seat Module (MHSM) connector receptacle. Check for continuity between the seat sensor 5V supply circuit cavity of the 4-way power seat wire harness connector for the heated seat cushion element and the seat cushion frame. There should be no continuity. If OK, go to Step 5. If not OK, repair the shorted seat sensor 5V supply circuit as required.

(5) Check for continuity between the seat sensor 5V supply circuit cavities of the 4-way power seat wire harness connector for the heated seat cushion element and the C1 power seat wire harness connector for the HSM or MHSM. There should be continuity. If OK, go to Step 6. If not OK, repair the open seat sensor 5V supply circuit as required.

(6) Check for continuity between the seat temperature sensor input circuit cavity of the 4-way power seat wire harness connector for the heated seat cushion element and the seat cushion frame. There should be no continuity. If OK, go to Step 7. If not OK, repair the shorted seat temperature sensor input circuit as required.

(7) Check for continuity between the seat temperature sensor input circuit cavities of the 4-way power seat wire harness connector for the heated seat cushion element and the C1 power seat wire harness connector for the HSM or MHSM. There should be continuity. If OK, refer to **Heated Seat Module** in the Diagnosis and Testing section of this group. If not OK, repair the open seat temperature sensor input circuit as required.

REMOVAL AND INSTALLATION

HEATED SEAT SWITCH

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the center lower bezel from the instrument panel. Refer to **Instrument Panel Center Lower Bezel** in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(3) Remove the four screws that secure the heated seat switch to the back of the instrument panel center lower bezel (Fig. 2).

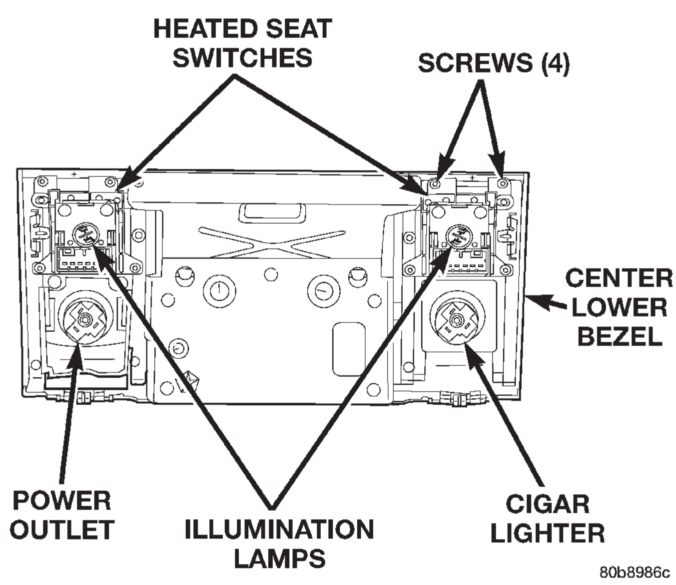


Fig. 2 Heated Seat Switch Remove/Install

(4) Remove the heated seat switch from the back of the instrument panel center lower bezel.

INSTALLATION

(1) Position the heated seat switch onto the back of the instrument panel center lower bezel.

REMOVAL AND INSTALLATION (Continued)

(2) Install and tighten the four screws that secure the heated seat switch to the back of the instrument panel center lower bezel. Tighten the screws to 1.5 N·m (13 in. lbs.).

(3) Install the center lower bezel onto the instrument panel. Refer to **Instrument Panel Center Lower Bezel** in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(4) Reconnect the battery negative cable.

HEATED SEAT MODULE

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the driver side front bucket seat from the power seat track unit. Refer to **Bucket Seat Track Adjuster** in the Removal and Installation section of Group 23 - Body for the procedures.

(3) Lift the heated seat module and its mounting bracket off of the two forward studs on the upper mounting rails of the power seat track and move the unit away from the seat far enough to access the power seat wire harness connectors (Fig. 3).

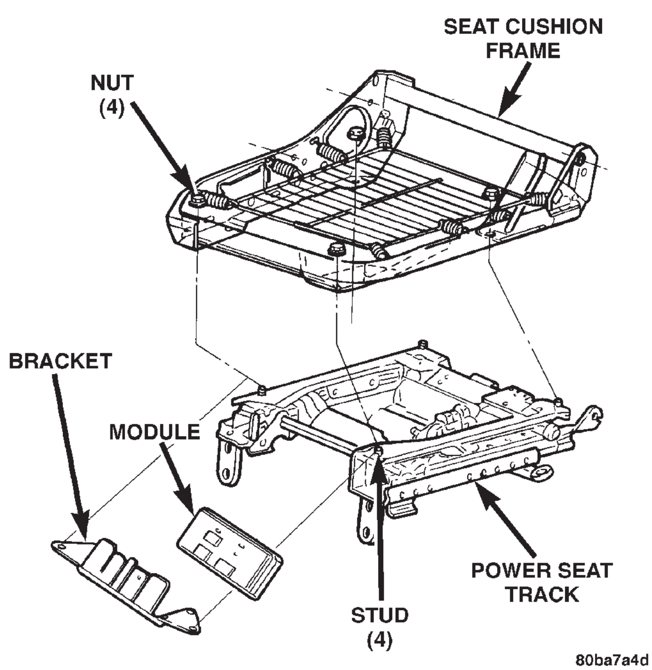


Fig. 3 Heated Seat Module Remove/Install

(4) Disconnect the two power seat wire harness connectors from the heated seat module connector receptacles.

(5) There are two snap clips that are molded into the lower side of the heated seat module which help to secure the module to the riser portion of the stepped mounting bracket. Using a trim stick or another suitable wide flat-bladed tool, gently pry each of the two snap clips while pulling the module away from the mounting bracket.

(6) Slide the heated seat module off of the two mounting bracket slide tabs.

INSTALLATION

(1) Slide the heated seat module onto the two mounting bracket slide tabs. Be certain that the two snap clips that are molded into the lower side of the heated seat module are fully engaged in the holes in riser portion of the stepped mounting bracket.

(2) Position the heated seat module and mounting bracket unit to the front of the power seat track unit.

(3) Reconnect the two power seat wire harness connectors to the heated seat module connector receptacles.

(4) Position the heated seat module mounting bracket over the two forward studs on the upper mounting rails of the power seat track.

(5) Install the driver side front bucket seat onto the power seat track unit. Refer to **Bucket Seat Track Adjuster** in the Removal and Installation section of Group 23 - Body for the procedures.

(6) Reconnect the battery negative cable.

NOTE: If the vehicle is equipped with the optional Memory System, following installation, it will be necessary to initialize the Memory Heated Seat Module (MHSM). In order to function properly, the MHSM must “learn” the sensor values of each of the power seat motor position transducers in each of the adjuster hard stop positions. This is done by performing the “Reset Guard Band” procedure using a DRB scan tool and the proper Diagnostic Procedures manual.

WARNING: THE “RESET GUARD BAND” PROCEDURE WILL CAUSE THE DRIVER SIDE FRONT SEAT TO AUTOMATICALLY ADJUST TO EACH OF ITS TRAVEL LIMITS. BE CERTAIN THAT NO ONE IS SEATED IN THE VEHICLE AND THAT THERE IS NOTHING IN THE VEHICLE THAT WILL OBSTRUCT SEAT MOVEMENT. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN PERSONAL INJURIES AND/OR VEHICLE DAMAGE.

POWER DISTRIBUTION SYSTEMS

CONTENTS

DESCRIPTION AND OPERATION

POWER DISTRIBUTION SYSTEM

DESCRIPTION

This group covers the various standard and optional power distribution components used on this model. Refer to Group 8W - Wiring Diagrams for complete circuit diagrams of the various power distribution components.

The power distribution system for this vehicle is designed to provide safe, reliable, and centralized distribution of the electrical current required to operate all of the many standard and optional factory-installed electrical and electronic powertrain, chassis, safety, comfort and convenience systems. At the same time, these systems were designed to provide convenient to access centralized locations for conducting diagnosis of faulty circuits, and for sourcing the additional current requirements of many aftermarket vehicle accessory and convenience items.

These power distribution systems also incorporate various types of circuit control and protection features, including:

- Blade-type fuses
- Cartridge fuses
- Fusible links
- Automatic resetting circuit breakers
- Relays
- Flashers
- Circuit splice blocks.

The power distribution system for this vehicle consists of the following components:

- Power Distribution Center (PDC)
- Junction Block (JB)
- Rear Power Outlet.

Following are general descriptions of the major components in the power distribution system. See the owner's manual in the vehicle glove box for more information on the features, use and operation of all of the power distribution system components.

POWER DISTRIBUTION CENTER

DESCRIPTION

All of the electrical current distributed throughout this vehicle is directed through the standard equipment Power Distribution Center (PDC) (Fig. 1). The molded plastic PDC housing is located in the right front corner of the engine compartment, between the battery and the right front inner fender shield. The PDC housing has a molded plastic cover that includes two integral latches at the front and a pivot hook at the back. The PDC cover is easily opened or removed for service access and has a convenient fuse and relay layout map integral to the inside surface of the cover to ensure proper component identification.

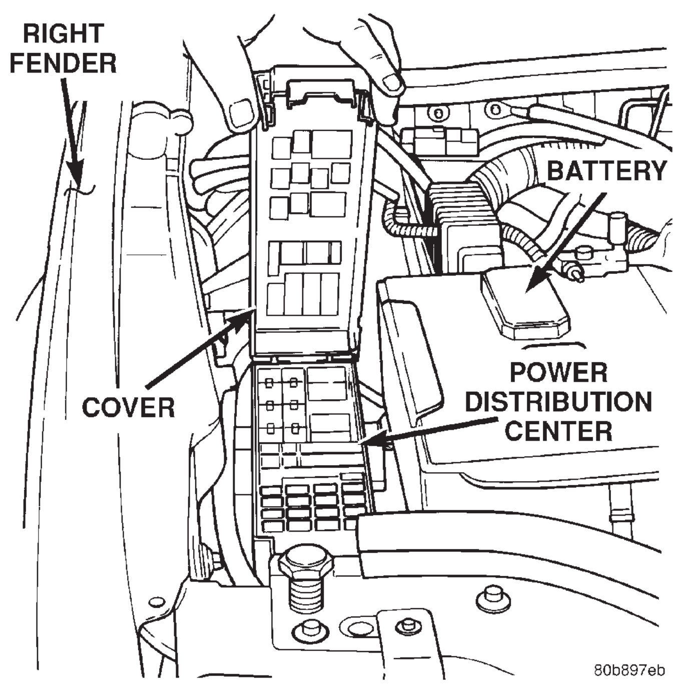


Fig. 1 Power Distribution Center

DESCRIPTION AND OPERATION (Continued)

The PDC housing is secured in the engine compartment at three points. Integral mounts on both sides of the PDC housing engage and latch to stanchions that are integral to the molded plastic battery tray. The PDC cover is unlatched and opened to access the battery/generator cable connection studs. The PDC is integral to the right headlamp and dash wire harness, which exits from the bottom of the PDC housing.

All of the current from the battery/generator cable connections enters the PDC through a single two-holed eyelet that is secured with two nuts to the two PDC studs just inside the front end of the PDC housing. The PDC houses up to fifteen maxi-type cartridge fuses, which replace all in-line fusible links. The PDC also houses up to thirteen blade-type mini fuses, and up to ten International Standards Organization (ISO) relays (two standard-type and eight micro-type). Internal connection of all of the PDC circuits is accomplished by an intricate combination of hard wiring and bus bars. Refer to **Power Distribution** in the Contents of Group 8W - Wiring Diagrams for complete circuit diagrams.

The cartridge fuses, blade-type fuses and relays are available for service replacement. The PDC unit cannot be repaired and is only serviced as a unit with the right headlamp and dash wire harness. If the internal circuits or the PDC housing are faulty or damaged, the right headlamp and dash wire harness unit must be replaced.

JUNCTION BLOCK

DESCRIPTION

An electrical Junction Block (JB) is concealed beneath the driver side of the instrument panel in the passenger compartment of the vehicle. The molded plastic JB housing has integral mounting brackets that are secured with two screws and two snap retainers to the instrument panel steering column support bracket behind the instrument panel steering column opening cover. A molded plastic instrument panel fuse cover is secured to the bottom of the junction block and the 16-way data link connector tab of the steering column support bracket by five integral latches. The instrument panel fuse cover can be removed for service of the junction block fuses and has a fuse puller and spare fuses located on the back of the cover (Fig. 2). Refer to **Instrument Panel Fuse Cover** in the Removal and Installation section of Group 8E - Instrument Panel Systems for more information on this component.

The JB combines the functions previously provided by a separate fuseblock module and relay center,

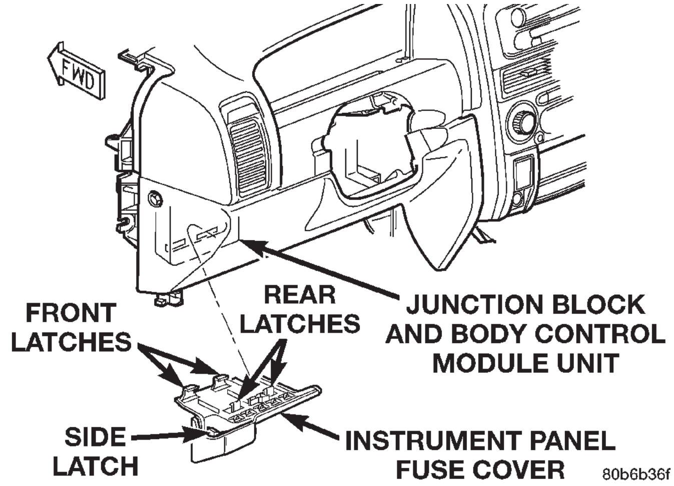


Fig. 2 Junction Block

serves to simplify and centralize numerous electrical components, as well as to distribute electrical current to many of the accessory systems in the vehicle. It also eliminates the need for numerous splice connections. The JB also incorporates an integral connector and mounting for the Body Control Module (BCM). The BCM is secured with four screws directly to the dash panel side of the JB. Refer to **Body Control Module** in the Description and Operation section of Group 8E - Instrument Panel Systems for more information on this component.

All of the circuits entering and leaving the JB do so through up to five wire harness connectors, which are connected to the JB through integral connector receptacles molded into the JB housing. There are also two separate wire harness connections to connector receptacles that are integral to the BCM. The JB houses up to thirty-three blade-type mini fuses, up to two blade-type automatic resetting circuit breakers, the electronic combination flasher, the Daytime Running Lamp (DRL) module (Canada only) and up to twelve International Standards Organization (ISO) relays (three standard-type and nine micro-type). Internal connection of all of the JB circuits is accomplished by a printed circuit board. Refer to **Junction Block** in the Contents of Group 8W - Wiring Diagrams for complete circuit diagrams.

The fuses, circuit breakers, flasher, DRL module and relays are available for service replacement. The BCM is also available for separate service replacement. The JB unit cannot be repaired and is only serviced as an assembly. If any internal circuit or if the JB housing is faulty or damaged, the entire JB unit must be replaced.

DESCRIPTION AND OPERATION (Continued)

REAR POWER OUTLET

DESCRIPTION

A rear accessory power outlet is optional equipment on this model. The power outlet is installed in the lower right quarter trim panel near the right liftgate opening pillar in the cargo area of the vehicle. The power outlet base and mount are secured by a snap fit within the quarter trim panel. A plastic protective cap snaps into the power outlet base when the power outlet is not being used, and hangs from the power outlet base mount by an integral bail strap while the power outlet is in use.

The power outlet receptacle unit and the accessory power outlet protective cap are available for service. The power outlet receptacle cannot be repaired and, if faulty or damaged, it must be replaced.

OPERATION

The power outlet base or receptacle shell is connected to ground, and an insulated contact in the bottom of the shell is connected to battery current. The power outlet receives battery voltage from a fuse in the Junction Block (JB) at all times.

While the power outlet is very similar to a cigar lighter base unit, it does not include the two small spring-clip retainers inside the bottom of the receptacle shell that are used to secure the cigar lighter heating element to the insulated contact.

DIAGNOSIS AND TESTING

REAR POWER OUTLET

For complete circuit diagrams, refer to **Horn/Cigar Lighter** in the Contents of Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Check the fused B(+) fuse in the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Check for battery voltage at the fused B(+) fuse in the junction block. If OK, go to Step 3. If not OK, repair the open fused B(+) circuit to the Power Distribution Center (PDC) as required.

(3) Remove the plastic protective cap from the power outlet receptacle. Check for continuity between the inside circumference of the power outlet receptacle and a good ground. There should be continuity. If OK, go to Step 4. If not OK, go to Step 5.

(4) Check for battery voltage at the insulated contact located at the back of the power outlet receptacle. If not OK, go to Step 5.

(5) Disconnect and isolate the battery negative cable. Remove the rear power outlet from the right quarter trim panel. Check for continuity between the ground circuit cavity of the power outlet wire harness connector and a good ground. There should be continuity. If OK, go to Step 6. If not OK, repair the open ground circuit to ground as required.

(6) Connect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the power outlet wire harness connector. If OK, replace the faulty power outlet receptacle base. If not OK, repair the open fused B(+) circuit to the junction block fuse as required.

REMOVAL AND INSTALLATION

POWER DISTRIBUTION CENTER

The Power Distribution Center (PDC) is serviced as a unit with the right headlamp and dash wire harness. If any internal circuit of the PDC or if the PDC housing is faulty or damaged, the entire PDC and the right headlamp and dash wire harness unit must be replaced.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Disconnect each of the right headlamp and dash wire harness connectors. Refer to **Connector Locations** in the Contents of Group 8W - Wiring Diagrams for more information on the locations of the affected connectors.

(3) Remove all of the fasteners that secure each of the right headlamp and dash wire harness ground eyelets to the vehicle body and chassis components. Refer to **Connector Locations** in the Contents of Group 8W - Wiring Diagrams for more information on the ground eyelet locations.

(4) Disengage each of the retainers that secure the right headlamp and dash wire harness to the vehicle body and chassis components. Refer to **Connector Locations** in the Contents of Group 8W - Wiring Diagrams for more information on the retainer locations.

(5) Unlatch and open the PDC cover.

REMOVAL AND INSTALLATION (Continued)

(6) Remove the two nuts that secure the two-hole eyelet of the battery wire harness PDC take outs to the studs on the PDC (Fig. 3).

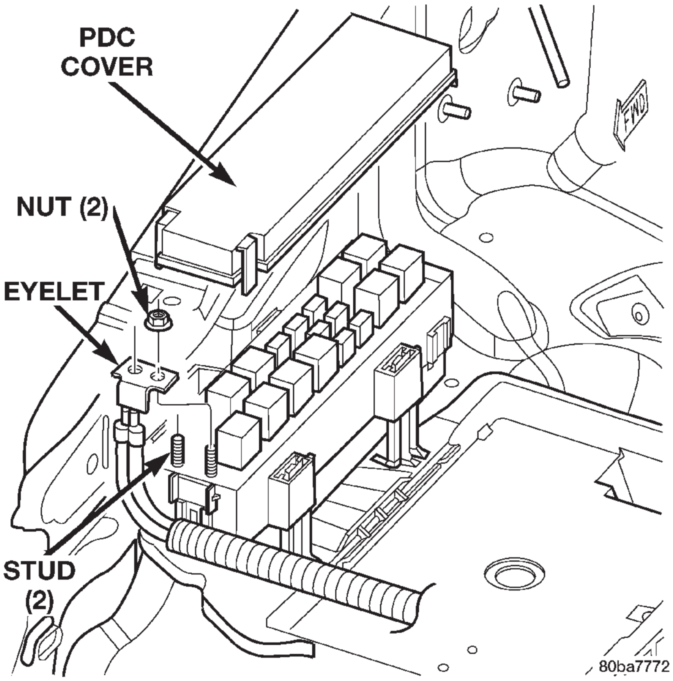


Fig. 3 Power Distribution Center Connections

(7) Remove the battery wire harness PDC take out eyelet from the PDC studs.

(8) Disengage the latches on the PDC housing mounts from the tabs on the PDC mounting stanchions on the battery tray, and pull the PDC housing upward to disengage the mounts from the stanchions (Fig. 4).

(9) Remove the PDC and the headlamp and dash wire harness from the engine compartment as a unit.

INSTALLATION

(1) Position the PDC and the headlamp and dash wire harness unit in the engine compartment.

(2) Engage the mounts on the PDC housing with the stanchions of the battery tray and push the unit downward until the mount latches engage the mounting tabs on the stanchions.

(3) Install the eyelet of the battery wire harness PDC take outs onto the two PDC studs.

(4) Install and tighten the nuts that secure the eyelet of the battery wire harness PDC take outs onto the PDC studs. Tighten the nuts to 11.3 N·m (100 in. lbs.).

(5) Engage each of the retainers that secure the right headlamp and dash wire harness to the vehicle body and chassis components. Refer to **Connector Locations** in the Contents of Group 8W - Wiring Diagrams for more information on the retainer locations.

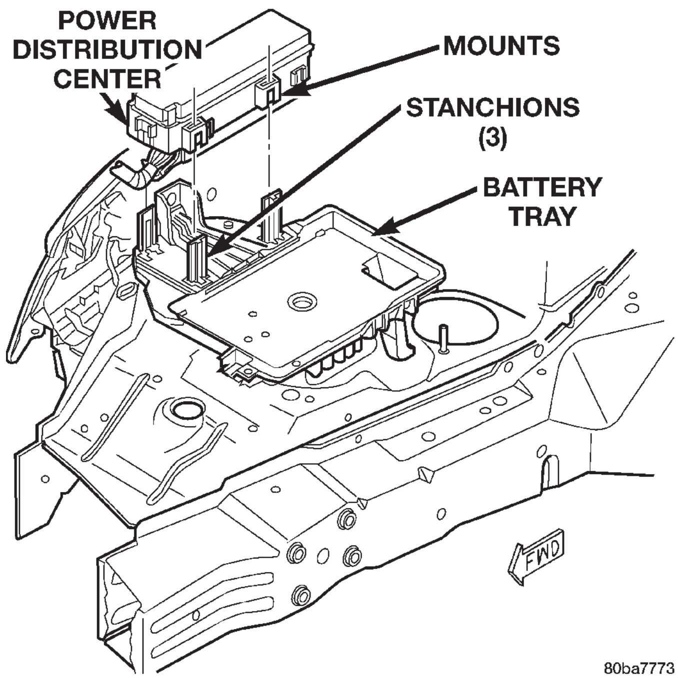


Fig. 4 Power Distribution Center Remove/Install

(6) Install all of the fasteners that secure each of the right headlamp and dash wire harness ground eyelets to the vehicle body and chassis components. Refer to **Connector Locations** in the Contents of Group 8W - Wiring Diagrams for more information on the ground eyelet locations.

(7) Reconnect each of the right headlamp and dash wire harness connectors. Refer to **Connector Locations** in the Contents of Group 8W - Wiring Diagrams for more information on the locations of the affected connectors. For connectors with screws, tighten the screws to 4.3 N·m (38 in. lbs.).

(8) Reconnect the battery negative cable.

JUNCTION BLOCK

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the fuse cover from the bottom of the junction block. Refer to **Instrument Panel Fuse Cover** in the Removal and Installation section of

REMOVAL AND INSTALLATION (Continued)

Group 8E - Instrument Panel Systems for the procedures.

(3) Remove the steering column opening cover from the instrument panel. Refer to **Steering Column Opening Cover** in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(4) Reach behind the junction block to disconnect the two instrument panel wire harness connectors from the Body Control Module connector receptacles near the bottom of the junction block (Fig. 5).

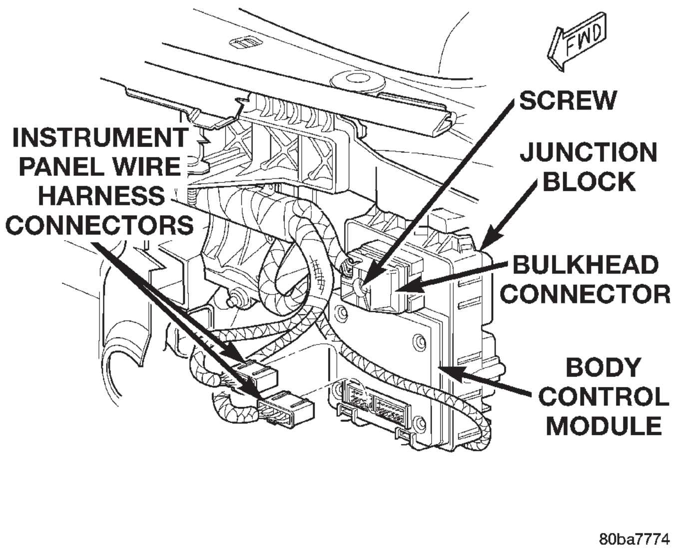


Fig. 5 Junction Block Connections

(5) Reach behind the junction block to remove the screw that secures the instrument panel wire harness bulkhead connector to the connector receptacle near the top of the junction block and disconnect the connector.

(6) Disconnect the fused B(+) and the IOD wire harness connectors from the connector receptacles near the bottom of the junction block (Fig. 6).

(7) Remove the screws that secure the right and left body wire harness bulkhead connectors to the connector receptacles near the center of the junction block and disconnect the connectors.

(8) Remove the two screws that secure the junction block to the instrument panel steering column support bracket (Fig. 7).

(9) To disengage the two snap clips that secure the top of the junction block to the instrument panel steering column support bracket, grasp the bottom of the junction block firmly with both hands and pull it downward sharply.

(10) Remove the junction block from the instrument panel steering column support bracket.

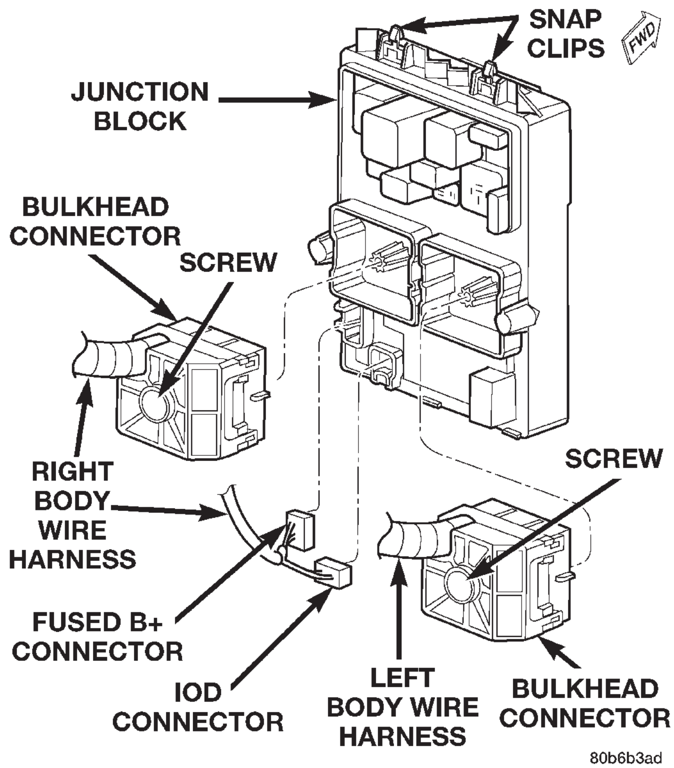


Fig. 6 Junction Block Connections

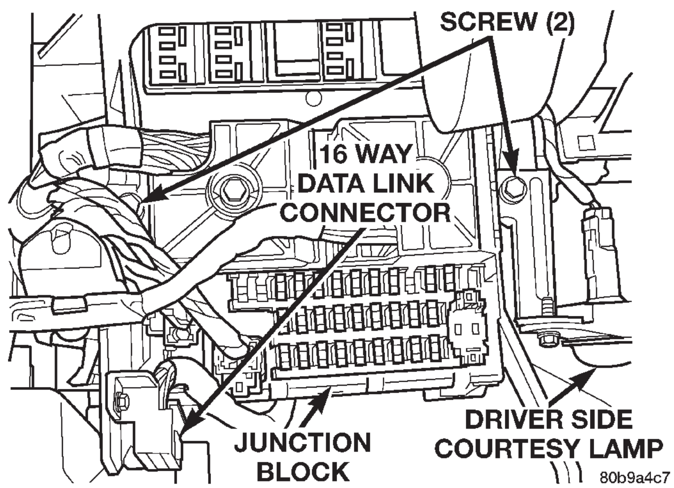


Fig. 7 Junction Block Remove/Install

INSTALLATION

NOTE: If the Junction Block (JB) is being replaced with a new unit, be certain to transfer each of the optional fuses, circuit breakers and relays from the old JB to the proper cavities of the new JB. Refer to Junction Block in the Contents of Group 8W - Wiring Diagrams for the proper JB cavity assignments. The Body Control Module (BCM) must also be transferred to the new JB. Refer to Body Control Module in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

REMOVAL AND INSTALLATION (Continued)

(1) Position the junction block into its mounting location on the instrument panel steering column support bracket.

(2) Align the snap clips at the top of the junction block with the mounting holes in the instrument panel steering column support bracket.

(3) Grasp the bottom of the junction block firmly with both hands and push it upward sharply to engage the two snap clips that secure the top of the junction block to the instrument panel steering column support bracket.

(4) Install and tighten the two screws that secure the junction block to the instrument panel steering column support bracket. Tighten the screws to 2.2 N·m (20 in. lbs.).

(5) Reconnect the right and left body wire harness bulkhead connectors to the connector receptacles near the center of the junction block.

(6) Install and tighten the screws that secure the right and left body wire harness bulkhead connectors to the connector receptacles near the center of the junction block. Tighten the screws to 2.2 N·m (20 in. lbs.).

(7) Reconnect the fused B(+) and the IOD wire harness connectors to the connector receptacles near the bottom of the junction block.

(8) Reach behind the junction block to reconnect the instrument panel wire harness bulkhead connector to the connector receptacle near the top of the junction block.

(9) Install and tighten the screw that secures the instrument panel wire harness bulkhead connector to the connector receptacle near the top of the junction block. Tighten the screw to 2.2 N·m (20 in. lbs.).

(10) Reach behind the junction block to reconnect the two instrument panel wire harness connectors to the Body Control Module connector receptacles near the bottom of the junction block.

(11) Install the steering column opening cover onto the instrument panel. Refer to **Steering Column Opening Cover** in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(12) Install the fuse cover onto the bottom of the junction block. Refer to **Instrument Panel Fuse Cover** in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(13) Reconnect the battery negative cable.

REAR POWER OUTLET

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Pull the protective cap out of the power outlet receptacle base (Fig. 8).

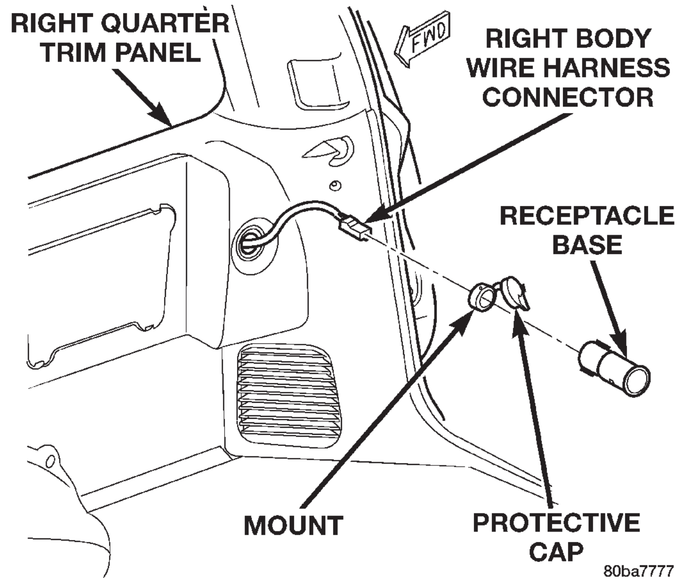


Fig. 8 Rear Power Outlet Remove/Install

(3) Look inside the power outlet receptacle base and note the position of the rectangular retaining bosses of the mount that secures the receptacle base to the right quarter trim panel (Fig. 9).

(4) Insert a pair of external snap ring pliers into the power outlet receptacle base and engage the tips of the pliers with the retaining bosses of the mount.

(5) Squeeze the pliers to disengage the mount retaining bosses from the receptacle base and, using a gentle rocking motion, pull the pliers and the receptacle base out of the mount.

(6) Pull the power outlet receptacle base away from the right quarter trim panel far enough to access the wire harness connector.

(7) Disconnect the right body wire harness connector from the power outlet receptacle base connector receptacle.

(8) Remove the power outlet mount from the right quarter trim panel.

INSTALLATION

(1) Align the splines on the outside of the power outlet receptacle base connector receptacle with the grooves on the inside of the mount.

REMOVAL AND INSTALLATION (Continued)

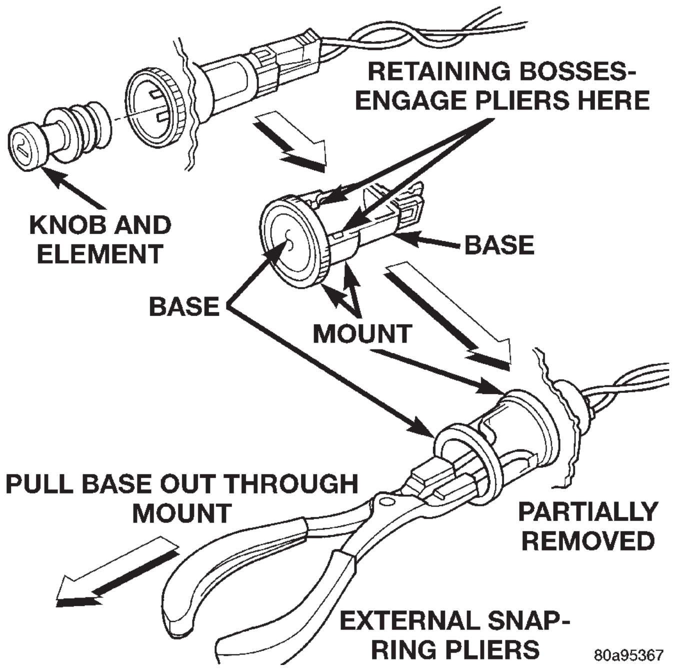


Fig. 9 Power Outlet Remove/Install - Typical

(2) Insert the power outlet receptacle base about half way through the mount.

(3) Reconnect the right body wire harness connector to the power outlet receptacle base connector receptacle.

(4) Insert the power outlet receptacle base and mount into the right quarter trim panel as a unit until the mount is seated flush against the trim panel.

(5) Press firmly on the power outlet receptacle base until the retaining bosses of the mount are fully engaged in their receptacles.

(6) Install the protective cap into the power outlet receptacle base.

(7) Reconnect the battery negative cable.

POWER LOCK SYSTEMS

CONTENTS

POWER LOCK SYSTEM

INDEX

DESCRIPTION AND OPERATION

POWER LOCK SYSTEM

DESCRIPTION

A power operated door and liftgate lock system is standard factory-installed equipment on this model. The power lock system allows all of the doors and the liftgate to be locked or unlocked electrically by operating a switch on either front door trim panel. The power lock system receives non-switched battery current through a fuse in the Power Distribution Center (PDC), so that the power locks remain operational, regardless of the ignition switch position.

The power lock system for this vehicle also has a door lock inhibit feature, which prevents the power lock system from being energized with a power door lock switch if a front door is open with the key in the ignition and/or the exterior lamps are on. However, the locks can still be operated manually, with a key or energized with the RKE transmitter.

This vehicle also offers several customer programmable features, which allows the selection of several optional electronic features to suit individual preferences. Refer to **ELECTRONIC VEHICLE INFORMATION CENTER PROGRAMMING** in the Service Procedures section of Group 8V - Overhead Console Systems for more information on the customer programmable feature options. Customer programmable feature options affecting the power door lock system include:

- **Auto Door Locks -** Automatically locks all of the vehicle doors and the liftgate when the vehicle reaches a speed of about 24 kilometers-per-hour (15 miles-per-hour).
- **Auto Unlock on Exit -** Automatically unlocks all of the vehicle doors and the liftgate when the driver side front door is opened, if the vehicle is stopped and the transmission gear selector is in the Park or Neutral positions. This feature is linked to the Auto Door Locks feature, and will only occur one time following each Auto Door Lock event.

The power lock system for this vehicle can also be operated remotely using the standard equipment Remote Keyless Entry (RKE) system radio frequency transmitters. Refer to **Remote Keyless Entry System** in the Remote Keyless Entry System section of this group for more information on the RKE system.

This group covers the following components of the power lock system:

- Driver Door Module (DDM)
- Passenger Door Module (PDM)
- Power lock motors
- Power lock switches.

DESCRIPTION AND OPERATION (Continued)

Certain functions and features of the power lock system rely upon resources shared with other electronic modules in the vehicle over the Programmable Communications Interface (PCI) data bus network. The PCI data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, internal controller hardware, and component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities. For diagnosis of these electronic modules or of the PCI data bus network, the use of a DRB scan tool and the proper Diagnostic Procedures manual are recommended.

The other electronic modules that may affect power lock system operation are as follows:

- **Body Control Module (BCM)** - Refer to **Body Control Module** in the Description and Operation section of Group 8E - Instrument Panel Systems for more information.
- **Electronic Vehicle Information Center (EVIC)** - Refer to **Electronic Vehicle Information Center** in the Description and Operation section of Group 8V - Overhead Console Systems for more information.
- **Powertrain Control Module (PCM)** - Refer to **Powertrain Control Module** in the Description and Operation section of Group 14 - Fuel System for more information.

Refer to **Power Door Locks** in the Contents of Group 8W - Wiring Diagrams for complete circuit diagrams. Following are general descriptions of the major components in the power lock system.

OPERATION

The Passenger Door Module (PDM) contains the power door lock control logic and a power lock switch. The Driver Door Module (DDM) contains a power lock switch and controls the output to the driver side front door power lock motor, while the PDM controls the output to the power lock motors for the remaining doors and the liftgate.

When the power lock switch on the DDM is used to lock or unlock the doors, the DDM sends a control output to the driver side front door power lock motor and sends lock or unlock request messages to the PDM over the Programmable Communications Interface (PCI) data bus. The PDM responds to these messages by sending control outputs to the power lock motors of the remaining doors and the liftgate. When the power lock switch on the PDM is used to lock or unlock the doors, the PDM sends control outputs to the power lock motors in the passenger side front door, both rear doors and the liftgate, then sends lock or unlock request messages to the DDM over the Programmable Communications Interface (PCI) data bus. The DDM responds to these messages by sending control outputs to the power lock motor of the driver side front door.

In order to support the auto door locks and unlock on exit features, if enabled, the power lock system logic in the PDM needs to know the door ajar switch status, vehicle speed, and transmission gear selector lever position. The passenger side front door ajar switch is the only hard wired input to the PDM. The PDM obtains the remaining information from messages it receives from other electronic modules over the PCI data bus network.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the power lock system.

POWER LOCK SWITCH

DESCRIPTION

The power lock motors are controlled by a two-way momentary switch mounted on the trim panel of each front door. Each power lock switch is illuminated by a Light-Emitting Diode (LED) that is integral to the switch paddle.

The driver side front door power lock switch is integral to the Driver Door Module (DDM), and the passenger side front door power lock switch is integral to the Passenger Door Module (PDM). The power lock switches and their lamps cannot be adjusted or repaired and, if faulty or damaged, the entire DDM or PDM unit must be replaced.

OPERATION

The front door power lock switches provide a lock and unlock signal to the door module circuitry. The Driver Door Module (DDM) circuitry controls the output to the driver side front door power lock motor, while the Passenger Door Module (PDM) circuitry controls the output to the passenger side front door, both rear door and the liftgate power lock motors.

When the DDM-integrated power lock switch is actuated, the DDM circuitry sends control outputs to the driver side front door power lock motor and sends a message to the PDM over the Programmable Communications Interface (PCI) data bus to control the output to the passenger side front door, both rear door and the liftgate power lock motors. When the PDM-integrated power lock switch is actuated, the PDM circuitry sends control outputs to the passenger side front door, both rear door and the liftgate power lock motors and sends a message to the DDM over the Programmable Communications Interface (PCI) data bus to control the output to the driver side front door power lock motor.

Each power lock switch is illuminated by a Light-Emitting Diode (LED) when the ignition switch is

DESCRIPTION AND OPERATION (Continued)

turned to the On position. See the owner's manual in the vehicle glove box for more information on the features, use and operation of the power lock switches.

DOOR MODULE

DESCRIPTION

A Driver Door Module (DDM) and a Passenger Door Module (PDM) are used on this model to control and integrate many of the electronic features and functions of the vehicle. The door modules are mounted to the inside surface of the trim panel on each front door. The only visible parts of the door modules are the switches and the bezel that are located on the outside of each front door trim panel. Each door module houses both the front power lock and power window switches. The DDM also houses individual switches for each passenger door power window, a power window lockout switch and the power mirror switch. The remainder of both door modules is concealed behind the front door trim panels.

The DDM and PDM each contain a central processing unit and interface with each other, as well as with other electronic modules in the vehicle over the Programmable Communications Interface (PCI) data bus network. The PCI data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, reduce internal controller hardware, and reduce component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities.

The circuitry of the door modules controls the following hard wired outputs:

- Door and liftgate power lock motors
- Front and rear door power window motors
- Front door courtesy lamps
- Power mirror control and heating
- Rear door power window switch control and illumination.

The door modules also receive the following hard wired inputs:

- Front door ajar switch
- Front door power window switches
- Memory switch (with the Memory System option only)
- Power lock switches
- Power mirror position potentiometers (with the Memory System option only)
- Power mirror switches
- Power window lockout switch.

In addition, the DDM contains the program logic for the optional Memory System, while the PDM contains the program logic and the receiver for the standard Remote Keyless Entry (RKE) System. Refer to **Memory System** in the Memory System section of Group 8R - Power Seat Systems for more information on the features of the Memory System. Refer to **Remote Keyless Entry System** in the Remote Keyless Entry System section of this group for more information on the features of the RKE system.

For diagnosis of the DDM, PDM, or the PCI data bus network, a DRB scan tool and the proper Diagnostic Procedures manual are recommended. The DDM and the PDM cannot be adjusted or repaired and, if damaged or faulty, they must be replaced.

OPERATION

The functions and features provided by the door modules are possible because of their hard wired inputs and outputs, as well as the resources they share with each other and with the other electronic modules in the vehicle through their communication over the PCI data bus network. The door modules use their internal programming and all of these inputs to decide which functions they should perform and both the standard and optional features they should provide. Refer to **ELECTRONIC VEHICLE INFORMATION CENTER PROGRAMMING** in the Service Procedures section of Group 8V - Overhead Console Systems for more information on the customer programmable feature options.

POWER LOCK MOTOR

DESCRIPTION

Power operated front door, rear door and liftgate locking mechanisms are standard equipment on this model. The lock mechanisms are actuated by a reversible electric motor mounted within each door and the liftgate. The power lock motors for the doors are integral to the door latch units. The liftgate power lock motor is a separate unit secured to the latch brainplate near the center of the liftgate and operates the liftgate latch lock mechanism through a connecting linkage rod.

The power lock motors for the four doors cannot be adjusted or repaired and, if faulty or damaged, the entire door latch unit must be replaced. The liftgate power lock motor cannot be adjusted or repaired and, if faulty or damaged, the entire liftgate latch brainplate unit must be replaced.

OPERATION

The driver side front door power lock motor is controlled by the Driver Door Module (DDM). The remaining power door lock motors and the liftgate power lock motor are controlled by the Passenger Door Module (PDM). A positive and negative battery connection to the two motor terminals will cause the power lock motor plunger to move in one direction.

DESCRIPTION AND OPERATION (Continued)

Reversing the current through these same two connections will cause the power lock motor plunger to move in the opposite direction.

DIAGNOSIS AND TESTING

POWER LOCK SYSTEM

Following are tests that will help to diagnose the hard wired components and circuits of the power lock system. However, these tests may not prove conclusive in the diagnosis of this system. In order to obtain conclusive testing of the power lock system, the Programmable Communications Interface (PCI) data bus network and all of the electronic modules that provide inputs to, or receive outputs from the power lock system components must be checked.

The most reliable, efficient, and accurate means to diagnose the power lock system requires the use of a DRB scan tool and the proper Diagnostic Procedures manual. The DRB scan tool can provide confirmation that the PCI data bus is functional, that all of the electronic modules are sending and receiving the proper messages on the PCI data bus, and that the power lock motors are being sent the proper hard wired outputs by the door modules for them to perform their power lock system functions.

For complete circuit diagrams, refer to **Power Door Locks** in the Contents of Group 8W - Wiring Diagrams.

PRELIMINARY DIAGNOSIS

As a preliminary diagnosis for the power lock system, note the system operation while you actuate both the Lock and Unlock functions with the power lock switches and with the Remote Keyless Entry (RKE) transmitter. Then, proceed as follows:

- If the entire power lock system fails to function with either the power lock switches or the RKE transmitter, check the fused B(+) fuse in the Power Distribution Center. If the fuse is OK, refer to **Door Module** in the Diagnosis and Testing section of this group.
- If the power lock system functions with both power lock switches, but not with the RKE transmitter, refer to **Remote Keyless Entry System** in the Remote Keyless Entry System section of this group.
- If the power lock system functions with the RKE transmitter, but not with one or both power lock switches, refer to **Door Module** in the Diagnosis and Testing section of this group.
- If the driver side power lock switch operates only the driver side front door power lock motor, but all other power lock motors operate with the passenger side power lock switch or the RKE transmitter, use a DRB scan tool and the proper Diagnostic Procedures manual to diagnose the Programmable Communications Interface (PCI) data bus.
- If only one power lock motor to operate with both power lock switches and the RKE transmitter, refer to **Power Lock Motor** in the Diagnosis and Testing section of this group.

DOOR MODULE

NOTE: The following tests may not prove conclusive in the diagnosis of this component. The most reliable, efficient, and accurate means to diagnose this system involves the use of a DRB scan tool and the proper Diagnostic Procedures manual.

Remember, the Driver Door Module (DDM) circuitry controls the output to the driver side front door power lock motor. The Passenger Door Module (PDM) circuitry controls the output to the power lock motors for the remaining doors and the liftgate. For complete circuit diagrams, refer to **Power Door Locks** in the Contents of Group 8W - Wiring Diagrams.

(1) Disconnect and isolate the battery negative cable. Remove the front door trim panel. Go to Step 2.

(2) Check the 15-way door wire harness connector for the door module to see that it is fully seated in the door module connector receptacle. If OK, go to Step 3. If not OK, install the door wire harness connector in the door module connector receptacle properly.

(3) Disconnect the 15-way door wire harness connector for the door module from the door module connector receptacle. Check for continuity between the ground circuit cavity of the 15-way door wire harness connector for the door module and a good ground. There should be continuity. If OK, go to Step 4. If not OK, repair the open ground circuit to ground as required.

(4) Connect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the 15-way door wire harness connector for the door module. If OK, go to Step 5. If not OK, repair the open fused B(+) circuit to the Power Distribution Center (PDC) fuse as required.

(5) Disconnect and isolate the battery negative cable. Check for continuity between the door lock driver circuit cavity of the 15-way door wire harness connector for the door module and a good ground. Repeat the check for the door unlock driver circuit. In each case there should be no continuity. If OK, go to Step 6. If not OK, repair the shorted door lock or unlock driver circuit as required.

(6) Disconnect the door or liftgate wire harness connector from the inoperative power lock motor wire harness connector. Check for continuity between the

DIAGNOSIS AND TESTING (Continued)

door lock driver circuit cavities in the door or liftgate wire harness connector for the inoperative power lock motor and the 15-way door wire harness connector for the door module. Repeat the check for the door unlock driver circuit. In each case, there should be continuity. If OK, go to Step 7. If not OK, repair the open door lock or unlock driver circuit as required.

(7) Reconnect the 15-way door wire harness connector to the door module connector receptacle. Connect the battery negative cable. Go to Step 8.

(8) Connect the probes of a reversible DC digital voltmeter to the door lock and unlock driver circuit cavities of the door or liftgate wire harness connector for the inoperative power lock motor. Observe the voltmeter while actuating the power lock switch in the lock and unlock directions. There should be a short 12-volt voltage spike as the switch is moved to both the lock and unlock positions, and no voltage in the neutral position. If OK, refer to **Power Lock Motor** in the Diagnosis and Testing section of this group. If not OK, replace the faulty door module.

POWER LOCK MOTOR

Remember, the Driver Door Module (DDM) circuitry controls the output to the driver side front door power lock motor. The Passenger Door Module (PDM) circuitry controls the output to the power lock motors for the remaining doors and the liftgate. For complete circuit diagrams, refer to **Power Door Locks** in the Contents of Group 8W - Wiring Diagrams.

(1) Check each power lock motor for correct operation while moving the power lock switch to both the Lock and Unlock positions. If all of the power lock motors are inoperative, go to Step 2. If one power lock motor is inoperative, go to Step 3.

(2) If all of the power lock motors except the driver side front door are inoperative, the problem may be caused by one shorted motor. Disconnecting a shorted power lock motor from the power lock circuit will allow the good power lock motors to operate. Disconnect each PDM-controlled power lock motor wire harness connector, one at a time, and recheck both the lock and unlock functions by operating the power lock switch. If all of the PDM-controlled power lock motors are still inoperative after the above test, check for a short or open circuit between the power lock motors and the PDM. If disconnecting one power lock motor causes the other motors to become functional, go to Step 3 to test the power lock motor that was last disconnected.

(3) Once it is determined which power lock motor is inoperative, that motor can be tested as follows. Disconnect the door or liftgate wire harness connector at the inoperative power lock motor. Apply 12 volts to the lock and unlock driver circuit cavities of the power lock motor connector to check its operation in one direction. Reverse the polarity to check the operation in the other direction. If OK, repair the shorted or open circuits to the DDM or PDM as required. If not OK, replace the faulty power lock motor.

REMOVAL AND INSTALLATION

DOOR MODULE

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the trim panel from the front door. Refer to **Front Door Trim Panel** in the Removal and Installation section of Group 23 - Body for the procedures.

(3) Remove the five screws that secure the door module to the back of the front door trim panel (Fig. 1).

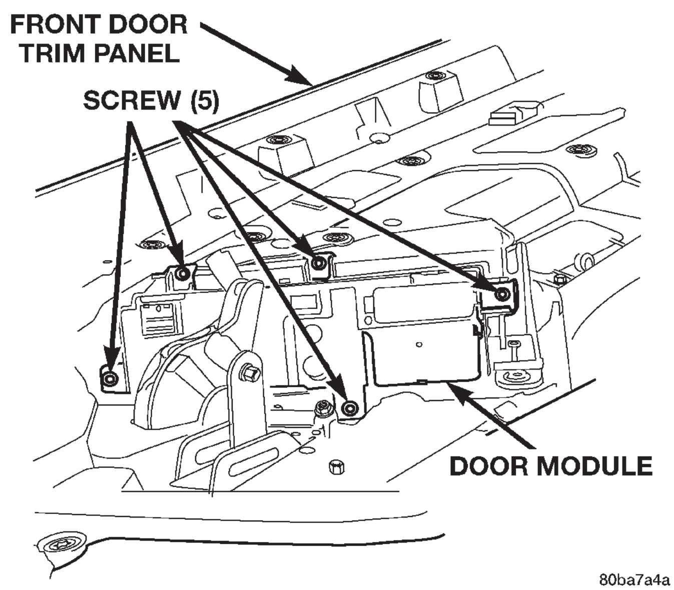


Fig. 1 Door Module Remove/Install

(4) Remove the door module from the front door trim panel.

INSTALLATION

(1) Position the door module to the front door trim panel.

(2) Install and tighten the five screws that secure the door module to the back of the front door trim panel. Tighten the screws to 2.2 N·m (20 in. lbs.).

(3) Install the trim panel onto the front door. Refer to **Front Door Trim Panel** in the Removal and Installation section of Group 23 - Body for the procedures.

(4) Reconnect the battery negative cable.

LIFTGATE FLIP-UP GLASS POWER RELEASE SYSTEM

INDEX

DESCRIPTION AND OPERATION

LIFTGATE FLIP-UP GLASS POWER RELEASE SYSTEM

DESCRIPTION

A power operated liftgate flip-up glass release system is standard factory installed equipment on this model. The liftgate flip-up glass power release system allows the flip-up glass latch to be released electrically by depressing a switch located on the bottom of the liftgate license plate lamp housing unit, above the license plate on the outside of the liftgate.

The liftgate flip-up glass release system operates on non-switched battery current supplied through a fuse in the junction block so that the system remains functional, regardless of the ignition switch position. However, a limit switch that is integral to the liftgate latch actuator unit opens to prevent the flip-up glass latch from being actuated when the liftgate latch is locked.

The liftgate flip-up glass power release system includes the following components:

- Liftgate flip-up glass limit switch
- Liftgate flip-up glass release motor
- Liftgate flip-up glass release switch.

Refer to **Power Door Locks** in the Contents of Group 8W - Wiring Diagrams for complete circuit diagrams.

OPERATION

When the liftgate mounted flip-up glass release switch is depressed, battery current is directed to the electric release motor that is integral to the flip-up glass latch located inside the liftgate. When the release motor is energized the latch releases and the flip-up glass can be opened. A liftgate flip-up glass limit switch is integral to the liftgate latch actuator mechanism. The limit switch automatically enables or disables the liftgate flip-up glass power release circuitry, depending upon the position of the liftgate latch lock mechanism. When the liftgate latch is unlocked, the limit switch closes and battery current is available at the release switch. When the liftgate latch is locked, the limit switch opens, and the release switch is disabled.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the liftgate flip-up glass power release system.

DIAGNOSIS AND TESTING

LIFTGATE FLIP-UP GLASS POWER RELEASE SYSTEM

For complete circuit diagrams, refer to **Power Door Locks** in Group 8W - Wiring Diagrams.

(1) Check the fused B(+) fuse in the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Check for battery voltage at the fused B(+) fuse in the junction block. If OK, go to Step 3. If not OK, repair the open fused B(+) circuit to the Power Distribution Center (PDC) as required.

(3) Disconnect the liftgate wire harness connector from the liftgate flip-up glass limit switch. Check for battery voltage at the fused B(+) circuit cavity of the liftgate wire harness connector for the flip-up glass limit switch. If OK, go to Step 4. If not OK, repair the open fused B(+) circuit to the junction block fuse as required.

(4) Check for continuity between the two terminals of the liftgate flip-up glass limit switch. There should be continuity with the liftgate latch unlocked, and no continuity with the latch locked. If OK, go to Step 5. If not OK, replace the faulty liftgate flip-up glass limit switch (liftgate latch actuator unit).

(5) Disconnect the liftgate wire harness connector from the liftgate flip-up glass release switch. With the liftgate latch unlocked, check for battery voltage at the liftgate flip-up glass limit switch output circuit cavity of the liftgate wire harness connector for the

DIAGNOSIS AND TESTING (Continued)

release switch. If OK, go to Step 6. If not OK, repair the open liftgate flip-up glass limit switch output circuit to the limit switch as required.

(6) Check for continuity between the two terminals of the liftgate flip-up glass release switch. There should be no continuity. Depress the switch, there should now be continuity. If OK, go to Step 7. If not OK, replace the faulty liftgate flip-up glass release switch.

(7) Disconnect the liftgate wire harness connector from the liftgate flip-up glass latch motor. Check for continuity between the ground circuit cavity of the liftgate wire harness connector for the latch motor and a good ground. There should be continuity. If OK, go to Step 8. If not OK, repair the open ground circuit to ground as required.

(8) With the liftgate latch unlocked and the flip-up glass release switch depressed, check for battery voltage at the liftgate flip-up glass release switch output circuit cavity of the liftgate wire harness connector for the latch motor. If OK, replace the faulty liftgate flip-up glass latch. If not OK, repair the open liftgate flip-up glass release switch output circuit to the release switch as required.

REMOVAL AND INSTALLATION

LIFTGATE FLIP-UP GLASS POWER RELEASE SYSTEM COMPONENTS

Service procedures for the various components used in the liftgate flip-up glass power release system can be found in the proper group as follows:

- **Liftgate flip-up glass limit switch** - Refer to **Liftgate Latch** in the Removal and Installation section of Group 23 - Body for the service procedures.
- **Liftgate flip-up glass release motor** - Refer to **Flip-Up Glass Latch** in the Removal and Installation section of Group 23 - Body for the service procedures.
- **Liftgate flip-up glass release switch** - Refer to **License Plate Lamp Housing** in the Removal and Installation section of Group 23 - Body for the service procedures.

REMOTE KEYLESS ENTRY SYSTEM

INDEX

DESCRIPTION AND OPERATION

REMOTE KEYLESS ENTRY SYSTEM

DESCRIPTION

A Radio Frequency (RF) type Remote Keyless Entry (RKE) system is standard factory-installed equipment on this model. The RKE system allows the use of a remote battery-powered radio transmitter to control the power lock system. The RKE receiver operates on non-switched battery current through a fuse in the Power Distribution Center (PDC), so that the system remains operational, regardless of the ignition switch position.

In addition to Lock and Unlock buttons, the RKE transmitters are also equipped with a Panic button. If the Panic button on the RKE transmitter is depressed, the horn will sound and the exterior lights will flash on the vehicle for about three minutes, or until the Panic button is depressed a second time. A vehicle speed of about 24 kilometers-per-hour (15 miles-per-hour) will also cancel the panic event.

The RKE system can also perform other functions on this vehicle. If the vehicle is equipped with the optional Vehicle Theft Security System (VTSS), the RKE transmitter will arm the VTSS when the Lock button is depressed, and disarm the VTSS when the Unlock button is depressed. If the vehicle is equipped with the optional Memory System, each of the two numbered and color-coded RKE transmitters can be used to recall the stored driver side front seat position, both outside power rear view mirror positions, and the radio station presets for the two assigned drivers. Refer to **Vehicle Theft Security System** in the Vehicle Theft Security System section of Group 8Q - Vehicle Theft Security Systems for more information on the VTSS features. Refer to **Memory System** in the Memory System section of Group 8R - Power Seat Systems for more information on the Memory System features.

The RKE system includes two transmitters when the vehicle is shipped from the factory, but the system can retain the vehicle access codes of up to four transmitters. The transmitter codes are retained in the RKE receiver memory, even if the battery is disconnected. If an RKE transmitter is faulty or lost, new transmitter vehicle access codes can be programmed into the system using a DRB scan tool and the proper Diagnostic Procedures manual.

This vehicle also offers several customer programmable features, which allows the selection of several optional electronic features to suit individual preferences. Refer to **ELECTRONIC VEHICLE INFORMATION CENTER PROGRAMMING** in the Service Procedures section of Group 8V - Overhead Console Systems for more information on the customer programmable feature options. Customer programmable feature options affecting the RKE system include:

- **Remote Unlock** - Allows the option of having only the driver side front door unlock when the RKE transmitter Unlock button is depressed the first time and the remaining doors and the liftgate unlock when the button is depressed a second time, or having all doors and the liftgate unlock upon the first depression of the RKE transmitter Unlock button.
- **Remote Linked to Memory** - If the vehicle is equipped with the Memory System, this feature allows the option of having the RKE transmitter Unlock button activate the recall of the stored settings, or having the recall function assigned solely to the memory switch on the driver side front door trim panel.
- **Sound Horn on Lock** - Allows the option of having the horn sound a short chirp as an audible verification that the RKE system received a valid Lock request from the RKE transmitter, or having no audible verification.
- **Flash Lights with Lock** - Allows the option of having the lights flash as an optical verification that the RKE system received a valid Lock request or

DESCRIPTION AND OPERATION (Continued)

Unlock request from the RKE transmitter, or having no optical verification.

This group covers the following components of the RKE system:

- RKE receiver
- RKE transmitter.

Certain functions and features of the RKE system rely upon resources shared with other electronic modules in the vehicle over the Programmable Communications Interface (PCI) data bus network. The PCI data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, internal controller hardware, and component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities. For diagnosis of these electronic modules or of the PCI data bus network, the use of a DRB scan tool and the proper Diagnostic Procedures manual are recommended.

The other electronic modules that may affect RKE system operation are as follows:

- **Body Control Module (BCM)** - Refer to **Body Control Module** in the Description and Operation section of Group 8E - Instrument Panel Systems for more information.
- **Driver Door Module (DDM)** - Refer to **Door Module** in the Power Lock System section of this group for more information.
- **Electronic Vehicle Information Center (EVIC)** - Refer to **Electronic Vehicle Information Center** in the Description and Operation section of Group 8V - Overhead Console Systems for more information.
- **Passenger Door Module (PDM)** - Refer to **Door Module** in the Power Lock System section of this group for more information.
- **Powertrain Control Module (PCM)** - Refer to **Powertrain Control Module** in the Description and Operation section of Group 14 - Fuel System for more information.

Refer to **Power Door Locks** in the Contents of Group 8W - Wiring Diagrams for complete circuit diagrams. Following are general descriptions of the major components in the RKE system.

COMBINATION FLASHER

The combination flasher is a smart relay that functions as both the turn signal system and the hazard warning system flasher. The combination flasher contains active electronic Integrated Circuitry (IC) elements. This flasher can be energized by the BCM to flash all of the park/turn signal/front side marker lamps as an optical alert for the RKE panic function and, if the Flash Lights with Lock programmable feature is enabled, as an optical verification for the RKE lock event. Refer to **Combination Flasher** in the proper section of Group 8J - Turn Signal and Hazard Warning Systems for diagnosis and service of this component.

HORN RELAY

The horn relay is a electromechanical device that switches battery current to the horn when the horn switch grounds the relay coil. The horn relay is located in the Power Distribution Center (PDC) in the engine compartment. This relay can be energized by the BCM to sound the horns as an audible alert for the RKE panic function and, if the Sound Horn on Lock programmable feature is enabled, as an audible verification for the RKE lock event. Refer to **Horn Relay** in the proper section of Group 8G - Horn Systems for diagnosis and service of this component.

LOW BEAM HEADLAMP RELAY

The low beam headlamp relay is a electromechanical device that switches battery current to the headlamp low beams when the BCM grounds the relay coil. The low beam headlamp relay is located in the junction block in the passenger compartment. This relay can be energized by the BCM to flash the headlamp low beams as an optical alert for the RKE panic function. Refer to **Low Beam Headlamp Relay** in the proper section of Group 8L - Lamps for diagnosis and service of this component.

OPERATION

The Passenger Door Module (PDM) contains the RKE system control logic and the RKE receiver. When the RKE receiver recognizes a Lock, Unlock or Panic message from a valid RKE transmitter, the RKE receiver provides that input to the PDM. The PDM circuitry and programming responds by sending the proper messages to the other electronic modules over the Programmable Communications Interface (PCI) data bus.

When an RKE lock message is received, the doors and the liftgate lock, the interior lighting is turned off, the horn chirps (if this feature is enabled), the exterior lamps flash (if this feature is enabled) and, if the vehicle is so equipped, the Vehicle Theft Security System (VTSS) is armed. When an RKE unlock message is received, the driver side front door (or all doors and the liftgate if this feature is enabled) unlock, the interior lighting is turned on and, if the vehicle is so equipped, the VTSS is disarmed. If the vehicle is equipped with the Memory System and the RKE Linked to Memory feature is enabled, the RKE unlock message also recalls the driver seat, outside mirror and radio settings assigned to the RKE transmitter that sent the unlock signal.

DESCRIPTION AND OPERATION (Continued)

When an RKE panic message is received, the driver side front door (or all doors and the liftgate if this feature is enabled) unlock, the interior lighting is turned on and, if the vehicle is so equipped, the VTSS is disarmed. The panic message will also cause the exterior lamps (including the headlights) to flash, and the horn to pulse for about three minutes, or until a second panic message is received. A vehicle speed of about 24 kilometers-per-hour (15 miles-per-hour) will also cancel the panic event.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the RKE system.

REMOTE KEYLESS ENTRY TRANSMITTER

DESCRIPTION

The Remote Keyless Entry (RKE) system Radio Frequency (RF) transmitter is equipped with three buttons, labeled Lock, Unlock, and Panic. It is also equipped with a key ring and is designed to serve as a key fob. The operating range of the transmitter radio signal is up to 10 meters (30 feet) from the RKE receiver.

Each RKE transmitter has a different vehicle access code, which must be programmed into the memory of the RKE receiver in the vehicle in order to operate the RKE system. Two transmitters are provided with the vehicle, but the RKE receiver can retain the access codes of up to four transmitters in its memory. Refer to **Remote Keyless Entry Transmitter Programming** in the Service Procedures section of this group for more information on programming additional transmitters for the RKE system.

In addition, the RKE transmitters for vehicles equipped with the optional Memory System are color-coded and have a number "1" or "2" molded into the transmitter case to coincide with the "Driver 1 (Black)" and "Driver 2 (Gray)" buttons of the memory switch on the driver side front door trim panel. These transmitters must also have their access codes programmed into the RKE receiver so that they coincide with the "Driver 1" and "Driver 2" buttons of the memory switch. Refer to **Memory System** in the Memory System section of Group 8R - Power Seat Systems for more information on the Memory System features.

The transmitter operates on two Panasonic CR2016 (or equivalent) batteries. Typical battery life is from one to two years. The transmitter cannot be repaired and, if faulty or damaged, it must be replaced.

OPERATION

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the RKE transmitters.

REMOTE KEYLESS ENTRY RECEIVER

DESCRIPTION

The Remote Keyless Entry (RKE) receiver is a radio frequency unit contained in the Passenger Door Module (PDM). The PDM also contains the program logic circuitry for the RKE system. The PDM is secured with screws to the back of the trim panel inside the passenger side front door. The RKE receiver has a memory function to retain the vehicle access codes of up to four RKE transmitters. The receiver is designed to retain the transmitter codes in memory, even if the battery is disconnected.

For diagnosis of the RKE receiver, the PDM, the DDM, or the Programmable Communications Interface (PCI) data bus a DRB scan tool and the proper Diagnostic Procedures manual are recommended. The RKE receiver is only serviced as a unit with the PDM and, if faulty or damaged, the entire PDM unit must be replaced.

OPERATION

The RKE receiver is energized by one of three messages from the RKE transmitter; Unlock, Lock, or Panic. The PDM circuitry responds to these messages to lock or unlock the power lock motors that it controls. The PDM circuitry also puts Lock, Unlock, and Panic messages on the PCI data bus. These messages will result in the Driver Door Module (DDM) locking or unlocking the driver side front door, and the other electronic modules in the vehicle responding as their programming dictates.

DIAGNOSIS AND TESTING

REMOTE KEYLESS ENTRY SYSTEM

Following are tests that will help to diagnose the Remote Keyless Entry (RKE) system. However, these tests may not prove conclusive in the diagnosis of this system. In order to obtain conclusive testing of the RKE system, the Programmable Communications Interface (PCI) data bus network and all of the electronic modules that provide inputs to, or receive outputs from the RKE system components must be checked.

The most reliable, efficient, and accurate means to diagnose the RKE system requires the use of a DRB scan tool and the proper Diagnostic Procedures manual. The DRB scan tool can provide confirmation that the PCI data bus is functional, that all of the elec-

DIAGNOSIS AND TESTING (Continued)

tronic modules are sending and receiving the proper messages on the PCI data bus, and that the RKE receiver is being sent the proper radio frequency signals by the RKE transmitters to perform its RKE system functions.

For complete circuit diagrams, refer to **Power Door Locks** in the Contents of Group 8W - Wiring Diagrams.

PRELIMINARY DIAGNOSIS

As a preliminary diagnosis for the RKE system, note the system operation while you actuate both the Lock and Unlock functions with the power lock switches and with the Remote Keyless Entry (RKE) transmitter. Then, proceed as follows:

- If the entire power lock system fails to function with either the power lock switches or the RKE transmitter, check the fused B(+) fuse in the Power Distribution Center. If the fuse is OK, refer to **Door Module** in the Power Lock System section of this group.
- If the power lock system functions with both power lock switches, but not with the RKE transmitter, refer to **Remote Keyless Entry Transmitter** in the Diagnosis and Testing section of this group.
- If the driver side power lock switch operates only the driver side front door power lock motor, but all other power lock motors operate with the passenger side power lock switch or the RKE transmitter, use a DRB scan tool and the proper Diagnostic Procedures manual to diagnose the Programmable Communications Interface (PCI) data bus.

If the problem being diagnosed involves only the Sound Horn on Lock or the Flash Lights with Locks features, be certain that these programmable features are enabled. If the features are enabled and the service horn and turn signals still operate, the Body Control Module (BCM) and the PCI data bus must be tested. For diagnosis of the BCM or the PCI data bus, the use of a DRB scan tool and the proper Diagnostic Procedures manual are recommended.

REMOTE KEYLESS ENTRY TRANSMITTER

(1) Replace the Remote Keyless Entry (RKE) transmitter batteries. Refer to **Remote Keyless Entry Transmitter Battery Replacement** in the Service Procedures section of this group. Test each of the transmitter functions. If OK, discard the faulty batteries. If not OK, go to Step 2.

(2) Program the suspect RKE transmitter and another known good transmitter into the RKE receiver. Use a DRB scan tool, as described in the proper Diagnostic Procedures manual. Refer to **Remote Keyless Entry Transmitter Programming** in the Service Procedures section of this group.

(3) Test the RKE system operation with both transmitters. If both transmitters fail to operate the power lock system, use a DRB scan tool and the proper Diagnostic Procedures manual for further diagnosis of the RKE system. If the known good transmitter operates the power locks and the suspect transmitter does not, replace the faulty transmitter.

NOTE: Be certain to perform the Remote Keyless Entry Transmitter Programming procedure again following this test. This procedure will erase the access code of the test transmitter from the RKE receiver.

SERVICE PROCEDURES

REMOTE KEYLESS ENTRY TRANSMITTER BATTERY REPLACEMENT

The Remote Keyless Entry (RKE) transmitter case snaps open and shut for battery access. To replace the RKE transmitter batteries:

(1) Using a trim stick or a thin coin, gently pry at the notch in the center seam of the RKE transmitter case halves near the key ring until the two halves unsnap.

(2) Lift the back half of the transmitter case off of the RKE transmitter.

(3) Remove the two batteries from the RKE transmitter.

(4) Replace the two batteries with new Panasonic CR2016, or their equivalent. Be certain that the batteries are installed with their polarity correctly oriented.

(5) Align the two RKE transmitter case halves with each other, and squeeze them firmly and evenly together until they snap back into place.

NOTE: The RKE system for this model uses a rolling code security strategy. This strategy requires that synchronization be maintained between the RKE transmitter and the RKE receiver. RKE transmitter battery removal or replacement can cause a loss of synchronization. If the RKE receiver fails to respond to the RKE transmitter following battery removal or replacement, depress and release the RKE transmitter Unlock button repeatedly while listening carefully for the power door locks in the vehicle to cycle. After between five and eight presses of the Unlock button, the power door locks should cycle, indicating that re-synchronization has occurred.

SERVICE PROCEDURES (Continued)

REMOTE KEYLESS ENTRY TRANSMITTER PROGRAMMING

To program the Remote Keyless Entry (RKE) transmitter access codes into the RKE receiver in the Passenger Door Module (PDM) requires the use of a DRB scan tool. Refer to the proper Diagnostic Procedures manual for more information.

VEHICLE THEFT/SECURITY SYSTEMS

CONTENTS

VEHICLE THEFT SECURITY SYSTEM

INDEX

DESCRIPTION AND OPERATION

VEHICLE THEFT SECURITY SYSTEM

DESCRIPTION

The Vehicle Theft Security System (VTSS) is an available factory-installed option on this model. The VTSS is designed to provide perimeter protection against unauthorized use or tampering by monitoring the vehicle doors, the liftgate, the liftgate flip-up glass and the ignition system. If unauthorized use or tampering is detected, the system responds by sounding the horn and flashing the exterior lamps.

The VTSS also includes the Sentry Key Immobilizer System (SKIS). The SKIS includes a steering column-mounted control module and antenna unit as well as a transponder in each ignition key. If the SKIS module does not recognize the ignition key transponder, it prevents the engine from running. Refer to **Sentry Key Immobilizer System** in the Sentry Key Immobilizer System section of this group for more information on the SKIS.

The VTSS includes the following components:

- Auto headlamp light sensor/VTSS Light Emitting Diode (LED)
- Body Control Module (BCM)
- Combination flasher
- Door ajar switch
- Driver cylinder lock switch
- Horn relay
- Liftgate ajar switch
- Liftgate flip-up glass ajar switch
- Low beam headlamp relay

Certain functions and features of the VTSS rely upon resources shared with other electronic modules in the vehicle over the Programmable Communications Interface (PCI) data bus network. The PCI data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, internal controller hardware, and component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities. For diagnosis of these electronic modules or of the PCI data bus network, the use of a DRB scan tool and the proper Diagnostic Procedures manual are recommended.

The other electronic modules that may affect VTSS operation are as follows:

- **Body Control Module (BCM)** - Refer to **Body Control Module** in the Description and Operation section of Group 8E - Instrument Panel Systems for more information.

DESCRIPTION AND OPERATION (Continued)

- **Driver Door Module (DDM)** - Refer to **Door Module** in the Power Lock System section of Group 8P - Power Lock Systems for more information.
- **Passenger Door Module (PDM)** - Refer to **Door Module** in the Power Lock System section of Group 8P - Power Lock Systems for more information.

Refer to **Vehicle Theft Security System** in the Contents of Group 8W - Wiring Diagrams for complete circuit diagrams. Following are general descriptions of the features and major components of the VTSS.

COMBINATION FLASHER

The combination flasher is a smart relay that functions as both the turn signal system and the hazard warning system flasher. The combination flasher contains active electronic Integrated Circuitry (IC) elements. This flasher can be energized by the BCM to flash all of the park/turn signal/front side marker lamps as an optical alert for the VTSS alarm function. Refer to **Combination Flasher** in the proper section of Group 8J - Turn Signal and Hazard Warning Systems for diagnosis and service of this component.

HORN RELAY

The horn relay is a electromechanical device that switches battery current to the horn when the horn switch grounds the relay coil. The horn relay is located in the Power Distribution Center (PDC) in the engine compartment. This relay can be energized by the BCM to sound the horns as an audible alert for the VTSS alarm function. Refer to **Horn Relay** in the proper section of Group 8G - Horn Systems for diagnosis and service of this component.

LOW BEAM HEADLAMP RELAY

The low beam headlamp relay is a electromechanical device that switches battery current to the headlamp low beams when the BCM grounds the relay coil. The low beam headlamp relay is located in the junction block in the passenger compartment. This relay can be energized by the BCM to flash the headlamp low beams as an optical alert for the VTSS alarm function. Refer to **Low Beam Headlamp Relay** in the proper section of Group 8L - Lamps for diagnosis and service of this component.

OPERATION

A Body Control Module (BCM) is used on this model to control and integrate many of the electronic functions and features included in the VTSS. In the VTSS, the BCM receives inputs indicating the status of the door ajar switch, the driver cylinder lock switch, the ignition switch, the liftgate ajar switch, and the liftgate flip-up glass ajar switch. The programming in the BCM allows it to process the information from all of these inputs and send control outputs to energize or de-energize the combination flasher, the horn relay, the low beam headlamp relay, and the auto headlamp light sensor/VTSS Light Emitting Diode (LED).

Refer to the owner's manual in the vehicle glove box for more information on the features, use and operation of the vehicle theft security system.

ENABLING

The Vehicle Theft Security System (VTSS) features are provided by the BCM located in the passenger compartment. The BCM must have the VTSS functions electronically enabled in order for the VTSS to perform as designed. The logic in the BCM keeps its VTSS features dormant until it is enabled using a DRB scan tool. The VTSS features of the BCM are enabled on vehicles equipped with the VTSS option at the factory, but a service replacement BCM must be enabled by the dealer with a DRB scan tool anytime the BCM is replaced with a new unit. See the proper Diagnostic Procedures manual for more information on enabling the BCM VTSS feature.

ARMING

Passive arming of the VTSS occurs when the vehicle is exited with the key removed from the ignition switch, the headlamps are turned off, and the doors are locked while they are open using the power lock switch. The power lock switch will not function if the key is in the ignition switch or the headlamps are on with the driver side front door open. The VTSS will not arm if the driver side front door is locked using the key in the lock cylinder or using the mechanical lock button.

Active arming of the VTSS occurs when the Remote Keyless Entry (RKE) transmitter is used to lock the vehicle, even if the doors and/or the liftgate are open when the RKE transmitter Lock button is depressed. However, the VTSS arming will not be complete until all of the doors and the liftgate are closed. Refer to **Remote Keyless Entry System** in the Remote Keyless Entry System section of Group 8P - Power Lock Systems for more information on the RKE system components.

Following successful passive or active VTSS arming, the VTSS LED on the top of the instrument panel will flash rapidly for about fifteen seconds after the illuminated entry system times out. This indicates that VTSS arming is in progress. Once the fifteen second arming function is successfully completed, the set lamp will flash at a slower rate to indicate that the VTSS is armed.

DESCRIPTION AND OPERATION (Continued)

DISARMING

Passive disarming of the VTSS occurs when the vehicle is unlocked using the key to unlock the driver side front door. Active disarming of the VTSS occurs when the vehicle is unlocked by depressing the Unlock button of the Remote Keyless Entry (RKE) transmitter. Refer to **Remote Keyless Entry System** in the Remote Keyless Entry System section of Group 8P - Power Lock Systems for more information on the RKE system components. Once the alarm has been activated (horn sounding and exterior lamps flashing), either disarming method will also deactivate the alarm.

Depressing the Panic button on the RKE transmitter will also disarm the VTSS, but the horn will sound and the exterior lamps will flash for about three minutes as part of the Panic feature function. Refer to **Power Lock System** in the Power Lock System section of Group 8P - Power Lock Systems for more information on the Panic feature.

POWER-UP MODE

When the armed VTSS senses that the battery has been disconnected and reconnected, it enters its power-up mode. In the power-up mode the alarm system remains armed following a battery failure or disconnect. If the VTSS was armed prior to a battery disconnect or failure, the system will have to be actively or passively disarmed after the battery is reconnected.

The power-up mode will also apply if the battery goes dead while the system is armed, and battery jump-starting is attempted. The VTSS will be armed until the alarm system has been actively or passively disarmed.

TAMPER ALERT

The VTSS tamper alert will sound the horn three times upon disarming, if the alarm was triggered and has since timed-out (about eighteen minutes). This feature alerts the vehicle operator that the VTSS was activated while the vehicle was unattended.

DOOR AJAR SWITCH

DESCRIPTION

The door ajar switches are concealed within and integral to the door latch units. The front door ajar switches are actuated by the front door latch mechanisms, and are hard wired between a body ground and the Driver Door Module (DDM) or the Passenger Door Module (PDM) through the front door wire harnesses. The rear door ajar switches are actuated by the rear door latch mechanisms, and are hard wired between a body ground and the Body Control Module (BCM) through the rear door and body wire harnesses.

The door ajar switches cannot be adjusted or repaired and, if faulty or damaged, the door latch unit must be replaced. Refer to **Front Door Latch** or **Rear Door Latch** in the Removal and Installation section of Group 23 - Body for the service procedures. For complete circuit diagrams, refer to **Vehicle Theft Security System** in the Contents of Group 8W - Wiring Diagrams.

OPERATION

The front door ajar switches close a path to ground for the DDM or the PDM when a front door is opened, and opens the ground path when a front door is closed. The rear door ajar switches close a path to ground for the BCM when a rear door is opened, and opens the ground path when a rear door is closed. The DDM, PDM, or BCM reads the switch status through an internal pull-up, then sends the proper switch status messages to other electronic modules over the Programmable Communications Interface (PCI) data bus network. The door ajar switch status message is used by the BCM as an input for Vehicle Theft Security System (VTSS) operation.

DRIVER CYLINDER LOCK SWITCH

DESCRIPTION

The driver cylinder lock switch is integral to the key lock cylinder inside the driver side front door. The driver cylinder lock switch is a normally-open momentary switch that is hard wired between a body ground and the Driver Door Module (DDM) through the front door wire harness, and closes a path to ground through an internal resistor when the lock cylinder is rotated to the unlock position.

The driver cylinder lock switch cannot be adjusted or repaired and, if faulty or damaged, the driver side front door lock cylinder must be replaced. Refer to **Front Door Lock Cylinder** in the Removal and Installation section of Group 23 - Body for the service procedures. For complete circuit diagrams, refer to **Vehicle Theft Security System** in the Contents of Group 8W - Wiring Diagrams.

OPERATION

The driver cylinder lock switch is actuated by the key lock cylinder when the key is inserted in the lock cylinder and turned to the unlock position. The driver cylinder lock switch closes a path to ground through an internal resistor for the DDM when the driver door key lock cylinder is in the lock or unlock position, and opens the ground path when the lock cylinder is in the neutral position. The DDM reads the switch status through an internal pull-up, then

DESCRIPTION AND OPERATION (Continued)

sends the proper switch status messages to other electronic modules over the Programmable Communications Interface (PCI) data bus network. The driver cylinder lock switch unlock status message is used by the BCM as an input for Vehicle Theft Security System (VTSS) operation.

LIFTGATE AJAR SWITCH

DESCRIPTION

The two liftgate ajar switches are concealed within and integral to the two liftgate latch units in the liftgate. The liftgate ajar switches are actuated by the liftgate latch mechanisms, and are hard wired in parallel along with the liftgate flip-up glass ajar switch between a body ground, the Body Control Module (BCM) and the rear wiper motor module through the liftgate and body wire harnesses.

The liftgate ajar switches cannot be adjusted or repaired and, if faulty or damaged, the liftgate latch unit must be replaced. Refer to **Liftgate Latch** in the Removal and Installation section of Group 23 - Body for the service procedures. For complete circuit diagrams, refer to **Vehicle Theft Security System** in the Contents of Group 8W - Wiring Diagrams.

OPERATION

Each of the liftgate ajar switches can close a path to ground for the BCM when the liftgate is opened, and opens the ground path when the liftgate is closed. The BCM reads the switch status through an internal pull-up, then sends the proper switch status messages to other electronic modules over the Programmable Communications Interface (PCI) data bus network. The liftgate ajar switch status message is used by the BCM as an input for Vehicle Theft Security System (VTSS) operation.

LIFTGATE FLIP-UP GLASS AJAR SWITCH

DESCRIPTION

The liftgate flip-up glass ajar switch is concealed within and integral to the liftgate flip-up glass latch unit in the liftgate. The liftgate flip-up glass ajar switch is actuated by the liftgate flip-up glass latch mechanism, and is hard wired in parallel with the two liftgate ajar switches between a body ground, the Body Control Module (BCM) and the rear wiper motor module through the liftgate and body wire harnesses.

The liftgate flip-up glass ajar switch cannot be adjusted or repaired and, if faulty or damaged, the liftgate flip-up glass latch unit must be replaced. Refer to **Liftgate Flip-Up Glass Latch** in the Removal and Installation section of Group 23 - Body for the service procedures. For complete circuit diagrams, refer to **Vehicle Theft Security System** in the Contents of Group 8W - Wiring Diagrams.

OPERATION

The liftgate flip-up glass ajar switch can close a path to ground for the BCM when the liftgate flip-up glass is opened, and opens the ground path when the liftgate flip-up glass is closed. The BCM reads the switch status through an internal pull-up, then sends the proper switch status messages to other electronic modules over the Programmable Communications Interface (PCI) data bus network. The liftgate flip-up glass ajar switch status message is used by the BCM as an input for Vehicle Theft Security System (VTSS) operation.

VEHICLE THEFT SECURITY SYSTEM LIGHT EMITTING DIODE

DESCRIPTION

The Vehicle Theft Security System (VTSS) Light Emitting Diode (LED) is a red light-emitting diode that is integral to the auto headlamp light sensor, which is mounted on top of the instrument panel near the driver side defroster outlet. The LED is connected to fused battery current at all times and is hard wired to the Body Control Module (BCM) through the instrument panel wire harness.

The VTSS LED cannot be adjusted or repaired and, if faulty or damaged, auto headlamp light sensor/VTSS LED unit must be replaced. Refer to **Auto Headlamp Sensor** in the Removal and Installation section of Group 8L - Lamps for the service procedures. For complete circuit diagrams, refer to **Vehicle Theft Security System** in the Contents of Group 8W - Wiring Diagrams.

OPERATION

The VTSS LED gives a visible indication of the VTSS arming status. One side of the LED is connected to battery current at all times. The other side of the LED is hard wired to the BCM, which controls the operation of the LED by switching this side of the circuit to ground. When the VTSS arming is in progress, the BCM will flash the LED rapidly on and off for about fifteen seconds. When the VTSS has been successfully armed, the BCM will flash the LED on and off continually at a much slower rate until the VTSS is disarmed.

DIAGNOSIS AND TESTING

VEHICLE THEFT SECURITY SYSTEM

In order to obtain conclusive testing of the Vehicle Theft Security System (VTSS), the Body Control

DIAGNOSIS AND TESTING (Continued)

Module (BCM) and all of the electronic modules that provide inputs to, or receive outputs from the VTSS components must be checked. The most reliable, efficient, and accurate means to diagnose the VTSS requires the use of a DRB scan tool and the proper Diagnostic Procedures manual. The DRB scan tool can provide confirmation that the Programmable Communications Interface (PCI) data bus network is functional, that all of the electronic modules are sending and receiving the proper messages on the PCI data bus, and that the BCM is receiving the proper hard wired inputs and relaying the proper hard wired outputs to perform its VTSS functions.

See the proper Diagnostic Procedures manual and the Vehicle Theft Security System menu item on the DRB scan tool for the procedures. Refer to **Vehicle Theft Security System** in the Contents of Group 8W - Wiring Diagrams for complete circuit diagrams.

REMOVAL AND INSTALLATION

VEHICLE THEFT SECURITY SYSTEM COMPONENTS

Service procedures for the various components used in the Vehicle Theft Security System (VTSS) can be found in the proper group as follows:

- **Auto headlamp light sensor/VTSS Light Emitting Diode (LED)** - Refer to **Auto Headlamp Sensor** in the Removal and Installation section of Group 8L - Lamps for the service procedures.
- **Body Control Module (BCM)** - Refer to **Body Control Module** in the Removal and Installation section of Group 8E - Instrument Panel Systems for the service procedures.
- **Combination flasher** - Refer to **Combination Flasher** in the Removal and Installation section of Group 8J - Turn Signal and Hazard Warning Systems for the service procedures.
- **Door ajar switch** - Refer to **Front Door Latch** or **Rear Door Latch** in the Removal and Installation section of Group 23 - Body for the service procedures.
- **Driver cylinder lock switch** - Refer to **Front Door Lock Cylinder** in the Removal and Installation section of Group 23 - Body for the service procedures.
- **Horn relay** - Refer to **Horn Relay** in the Removal and Installation section of Group 8G - Horn Systems for the service procedures.
- **Liftgate ajar switch** - Refer to **Liftgate Latch** in the Removal and Installation section of Group 23 - Body for the service procedures.
- **Liftgate flip-up glass ajar switch** - Refer to **Liftgate Flip-Up Glass Latch** in the Removal and Installation section of Group 23 - Body for the service procedures.
- **Low beam headlamp relay** - Refer to **Low Beam Headlamp Relay** in the Removal and Installation section of Group 8L - Lamps for the service procedures.

SENTRY KEY IMMOBILIZER SYSTEM

INDEX

DESCRIPTION AND OPERATION

SENTRY KEY IMMOBILIZER SYSTEM

DESCRIPTION

The Sentry Key Immobilizer System (SKIS) is standard factory-installed equipment for this model when it is also equipped with the Vehicle Theft Security System (VTSS). The SKIS is designed to provide passive protection against unauthorized vehicle use by preventing the engine from operating while the system is armed. Following are some general descriptions of the features and components of the SKIS.

The SKIS includes the following components:

- Sentry Key Immobilizer Module (SKIM)
- Sentry Key Immobilizer System indicator lamp
- Sentry Key transponder

Certain functions and features of the SKIS rely upon resources shared with other electronic modules in the vehicle over the Programmable Communications Interface (PCI) data bus network. The PCI data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, internal controller hardware, and component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities. For diagnosis of these electronic modules or of the PCI data bus network, the use of a DRB scan tool and the proper Diagnostic Procedures manual are recommended.

The other electronic modules that may affect SKIS operation are as follows:

- **Body Control Module (BCM)** - Refer to **Body Control Module** in the Description and Operation section of Group 8E - Instrument Panel Systems for more information.
- **Electro-Mechanical Instrument Cluster (EMIC)** - Refer to **Instrument Cluster** in the Description and Operation section of Group 8E - Instrument Panel Systems for more information.
- **Powertrain Control Module (PCM)** - Refer to **Powertrain Control Module** in the Description and Operation section of Group 14 - Fuel System for more information.

Refer to **Fuel/Ignition System** in the Contents of Group 8W - Wiring Diagrams for complete circuit diagrams. Following are general descriptions of the features and major components of the SKIS.

OPERATION

The SKIS uses a Radio Frequency (RF) transceiver and electronically coded Sentry Key transponders to verify that a valid key is inserted in the ignition switch lock cylinder. If the SKIS recognizes the key as valid, it sends messages to the PCM that will allow the engine to run. If the SKIS does not recognize a valid key, the engine will not run. While the engine starting system will operate and the engine may initially start and run up to about 800 revolutions-per-minute on residual fuel pressure, the vehicle cannot be driven without a valid Sentry Key transponder.

The SKIS includes two valid Sentry Key transponders from the factory. If the customer wishes, additional non-coded blank Sentry Keys are available. These blank keys can be cut to match a valid ignition key, but the engine will not run unless the key transponder is also programmed to the vehicle. The SKIS will recognize no more than eight valid Sentry Key transponders at any one time.

The SKIS performs a self-test each time the ignition switch is turned to the On position, and will store Diagnostic Trouble Codes (DTCs) if a system malfunction is detected. The SKIS can be diagnosed, and any stored DTC can be retrieved using a DRB scan tool as described in the proper Diagnostic Procedures manual.

DESCRIPTION AND OPERATION (Continued)

See the owner's manual in the vehicle glove box for more information on the use and operation of the SKIS.

SENTRY KEY IMMOBILIZER MODULE

DESCRIPTION

The Sentry Key Immobilizer Module (SKIM) contains a Radio Frequency (RF) transceiver and a central processing unit, which includes the Sentry Key Immobilizer System (SKIS) program logic. The SKIS programming enables the SKIM to program and retain in memory the codes of at least two, but no more than eight electronically coded Sentry Key transponders. The SKIS programming also enables the SKIM to communicate over the Programmable Communications Interface (PCI) data bus network with the Powertrain Control Module (PCM), the Electro-Mechanical Instrument Cluster (EMIC), the Body Control Module (BCM) and/or the DRB scan tool.

The SKIM transmits and receives RF signals through a tuned antenna enclosed within a molded plastic ring formation that is integral to the SKIM housing. When the SKIM is properly installed on the steering column, the antenna ring is oriented around the circumference of the ignition lock cylinder housing. This antenna ring must be located within eight millimeters (0.31 inches) of the Sentry Key in order to ensure proper RF communication between the SKIM and the Sentry Key transponder.

For added system security, each SKIM is programmed with a unique "Secret Key" code and a security code. The SKIM keeps the "Secret Key" code in memory and sends the code over the PCI data bus to the PCM, which also keeps this code in its memory. The SKIM also sends the "Secret Key" code to each of the programmed Sentry Key transponders. The security code is used by the assembly plant to access the SKIS for initialization, or by the dealer technician to access the system for service. The SKIM also stores in its memory the Vehicle Identification Number (VIN), which it learns through a PCI data bus message from the PCM during initialization.

The SKIM and the PCM both use software that includes a rolling code algorithm strategy, which helps to reduce the possibility of unauthorized SKIS disarming. The rolling code algorithm ensures security by preventing an override of the SKIS through the unauthorized substitution of the SKIM or the PCM. However, the use of this strategy also means that replacement of either the SKIM or the PCM units will require a system initialization procedure to restore system operation.

For diagnosis or initialization of the SKIM and the PCM, a DRB scan tool and the proper Diagnostic Procedures manual are required. The SKIM cannot be repaired and, if faulty or damaged, the unit must be replaced.

OPERATION

When the ignition switch is turned to the On or Start positions, the SKIM transmits an RF signal to excite the Sentry Key transponder. The SKIM then listens for a return RF signal from the transponder of the Sentry Key that is inserted in the ignition lock cylinder. If the SKIM receives an RF signal with valid "Secret Key" and transponder identification codes, the SKIM sends a "valid key" message to the PCM over the PCI data bus. If the SKIM receives an invalid RF signal or no response, it sends "invalid key" messages to the PCM. The PCM will enable or disable engine operation based upon the status of the SKIM messages.

The SKIM also sends messages to the EMIC over the PCI data bus network to control the SKIS indicator lamp. The SKIM sends messages to the EMIC to turn the lamp on for about three seconds when the ignition switch is turned to the On position as a bulb test. After completion of the bulb test, the SKIM sends bus messages to keep the lamp off for a duration of about one second. Then the SKIM sends messages to turn the lamp on or off based upon the results of the SKIS self-tests. If the SKIS indicator lamp comes on and stays on after the bulb test, it indicates that the SKIM has detected a system malfunction and/or that the SKIS has become inoperative.

If the SKIM detects an invalid key when the ignition switch is turned to the On position, it sends messages to the EMIC to flash the SKIS indicator lamp. The SKIM can also send messages to the EMIC to flash the lamp and to the BCM to generate a single audible chime tone. These functions serve as an indication to the customer that the SKIS has been placed in its "Customer Learn" programming mode. See Sentry Key Immobilizer System Transponder Programming in this group for more information on the "Customer Learn" programming mode.

SENTRY KEY IMMOBILIZER TRANSPONDER

DESCRIPTION

The Sentry Key Immobilizer System (SKIS) uses a transponder that is integral to each of the two ignition keys that are supplied with the vehicle when it is shipped from the factory. The transponder chip is insulated within a nylon mount inserted in the head of the key, and invisible beneath a molded rubber cap (Fig. 1). For ease of identification, the molded rubber cap of ignition keys with a transponder are gray in color, while ignition keys without a transponder have a black cap.

DESCRIPTION AND OPERATION (Continued)

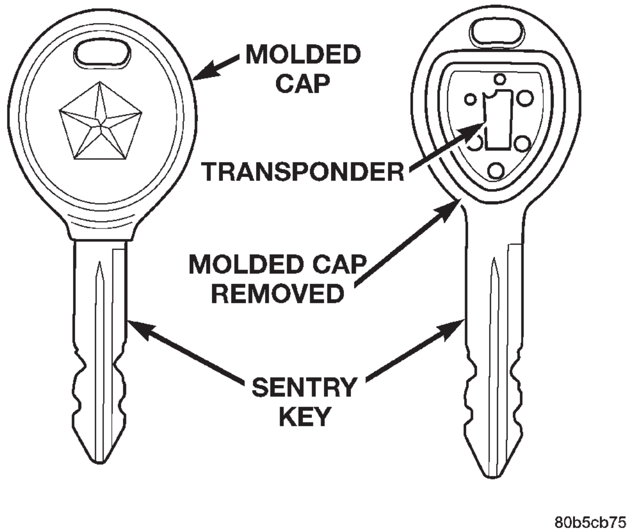


Fig. 1 Sentry Key Immobilizer Transponder

The Sentry Key transponder cannot be repaired and, if faulty or damaged, it must be replaced.

OPERATION

Each Sentry Key transponder has a unique transponder identification code programmed into it by the manufacturer. The Sentry Key Immobilizer Module (SKIM) has a unique “Secret Key” code programmed into it by the manufacturer. When a Sentry Key transponder is programmed into the memory of the SKIM, the SKIM learns the transponder identification code from the transponder, and the transponder learns the “Secret Key” code from the SKIM. Each of these codes is stored within the transponder and in the nonvolatile memory of the SKIM. Therefore, blank keys for the SKIS must be programmed by and into the SKIM, in addition to being cut to match the mechanical coding of the ignition lock cylinder. Refer to **Sentry Key Immobilizer System Transponder Programming** in the Service Procedures section of this group for more information.

The Sentry Key transponder is within the range of the SKIM transceiver antenna ring when it is inserted in the ignition lock cylinder. When the ignition switch is turned to the Start or On positions, the SKIM transceiver issues a Radio Frequency (RF) signal that excites the transponder chip. The transponder chip responds by issuing an RF signal containing its transponder identification code and the “Secret Key” code. The SKIM transceiver compares the transponder codes with the codes stored in its memory to determine whether a valid key is in the ignition lock cylinder.

SENTRY KEY IMMOBILIZER SYSTEM INDICATOR LAMP

DESCRIPTION

The Sentry Key Immobilizer System (SKIS) indicator lamp gives an indication when the SKIS is faulty or when the vehicle has been immobilized due to the use of an invalid ignition key. The lamp is controlled by the Electro-Mechanical Instrument Cluster (EMIC) circuitry based upon messages received from the Sentry Key Immobilizer Module (SKIM) over the Programmable Communications Interface (PCI) data bus network.

The SKIS indicator lamp uses a replaceable incandescent bulb and bulb holder on the EMIC electronic circuit board. If the SKIS indicator lamp comes on and stays on after the bulb test function, diagnosis of the SKIS and the PCI data bus should be performed with a DRB scan tool and the proper Diagnostic Procedures manual.

OPERATION

The SKIM sends messages to the EMIC over the PCI data bus to turn the lamp on for about three seconds when the ignition switch is turned to the On position as a bulb test. After completion of the bulb test, the SKIM sends PCI data bus messages to keep the lamp off for a duration of about one second. Then the SKIM sends messages to the instrument cluster circuitry to turn the lamp on or off based upon the results of the SKIS self-tests. If the SKIS indicator lamp comes on and stays on after the bulb test, it indicates that the SKIM has detected a system malfunction and/or that the SKIS has become inoperative.

If the SKIM detects an invalid key when the ignition switch is turned to the On position, it sends messages to the instrument cluster to flash the SKIS indicator lamp. The SKIM can also send messages to the instrument cluster to flash the lamp and to the Body Control Module (BCM) to generate a single audible chime tone. These functions serve as an indication to the customer that the SKIS has been placed in its “Customer Learn” programming mode. Refer to **Sentry Key Immobilizer System Transponder Programming** in the Service Procedures section of this group for more information on the “Customer Learn” programming mode.

DIAGNOSIS AND TESTING

SENTRY KEY IMMOBILIZER SYSTEM

In order to obtain conclusive testing of the Sentry Key Immobilizer System (SKIS), the Sentry Key Immobilizer Module (SKIM) and all of the electronic

DIAGNOSIS AND TESTING (Continued)

modules that provide inputs to, or receive outputs from the SKIM must be checked. The most reliable, efficient, and accurate means to diagnose the SKIS requires the use of a DRB scan tool and the proper Diagnostic Procedures manual. The DRB scan tool can provide confirmation that the Programmable Communications Interface (PCI) data bus network is functional and that all of the electronic modules are sending and receiving the proper messages on the PCI data bus for the SKIM to perform its SKIS functions.

See the proper Diagnostic Procedures manual and the Vehicle Theft Security System menu item on the DRB scan tool for the procedures. Refer to **Fuel/Ignition System** in the Contents of Group 8W - Wiring Diagrams for complete circuit diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Check the fused B(+) fuse in the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Check for battery voltage at the fused B(+) fuse in the junction block. If OK, go to Step 3. If not OK, repair the open fused B(+) circuit to the Power Distribution Center (PDC) fuse as required.

(3) Check the fused ignition switch output (run/start) fuse in the junction block. If OK, go to Step 4. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(4) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run/start) fuse in the junction block. If OK, go to Step 5. If not OK, repair the open fused ignition switch output (run/start) circuit to the ignition switch as required.

(5) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Disconnect the instrument panel wire harness connector from the Sentry Key Immobilizer Module (SKIM) connector receptacle. Check for continuity between the ground circuit cavity of the instrument panel wire harness connector for the SKIM and a good ground. There should be continuity. If OK, go to Step 6. If not OK, repair the open ground circuit to ground as required.

(6) Connect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the instrument panel wire harness connector for the SKIM. If OK, go to Step 7. If not OK, repair the open fused B(+) circuit to the junction block fuse as required.

(7) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run/start) circuit cavity of the instrument panel wire harness connector for the SKIM. If OK, use a DRB scan tool and the proper Diagnostic Procedures manual to complete the diagnosis of the SKIS. If not OK, repair the open fused ignition switch output (run/start) circuit to the junction block fuse as required.

SERVICE PROCEDURES

SENTRY KEY IMMOBILIZER SYSTEM TRANSPONDER PROGRAMMING

Two programmed Sentry Key transponders are included with the Sentry Key Immobilizer System (SKIS) when it is shipped from the factory. The Sentry Key Immobilizer Module (SKIM) can be programmed to recognize up to six additional transponders, for a total of eight Sentry Keys. The following “Customer Learn” programming procedure for the programming of additional transponders requires access to at least two of the valid Sentry Keys. If two valid Sentry Keys are not available, Sentry Key programming will require the use of a DRB scan tool and the proper Diagnostic Procedures manual.

CUSTOMER LEARN

(1) Obtain the additional Sentry Key transponder blank(s) that are to be programmed for the vehicle. Cut the additional Sentry Key transponder blanks to match the ignition lock cylinder mechanical key codes.

(2) Insert one of the two valid Sentry Key transponders into the ignition switch and turn the ignition switch to the On position.

(3) After the ignition switch has been in the On position for about three seconds, but no more than fifteen seconds later, cycle the ignition switch back to the Off position. Replace the first valid Sentry Key in the ignition lock cylinder with the second valid Sentry Key and turn the ignition switch back to the On position.

(4) About ten seconds after the completion of Step 3, the SKIS indicator lamp will start to flash and a single audible chime tone will sound to indicate that the system has entered the “Customer Learn” programming mode.

(5) Within about fifty seconds of entering the “Customer Learn” programming mode, turn the ignition

SERVICE PROCEDURES (Continued)

switch to the Off position, replace the valid Sentry Key with a blank Sentry Key transponder, and turn the ignition switch back to the On position.

(6) About ten seconds after the completion of Step 5, a single audible chime tone will sound and the SKIS indicator lamp will stop flashing and stay on solid for about three seconds to indicate that the blank Sentry Key transponder has been successfully programmed. The SKIS will immediately return to normal system operation following exit from the “Customer Learn” programming mode.

(7) Go back to Step 2 and repeat this process for each additional Sentry Key transponder blank to be programmed.

If any of the above steps is not completed in the proper sequence, or within the allotted time, the SKIS will automatically exit the “Customer Learn” programming mode. The SKIS will also automatically exit the “Customer Learn” programming mode if it sees a non-blank Sentry Key transponder when it should see a blank, if it has already programmed eight valid Sentry Keys, or if the ignition switch is turned to the Off position for more than about fifty seconds.

REMOVAL AND INSTALLATION

SENTRY KEY IMMOBILIZER MODULE

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the steering column opening cover from the instrument panel. Refer to **Steering Column Opening Cover** in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(3) Disconnect the instrument panel wire harness connector from the Sentry Key Immobilizer Module (SKIM) connector receptacle.

(4) Remove the one screw that secures the SKIM to the bottom of the steering column housing between the ignition switch and the ignition lock cylinder (Fig. 2).

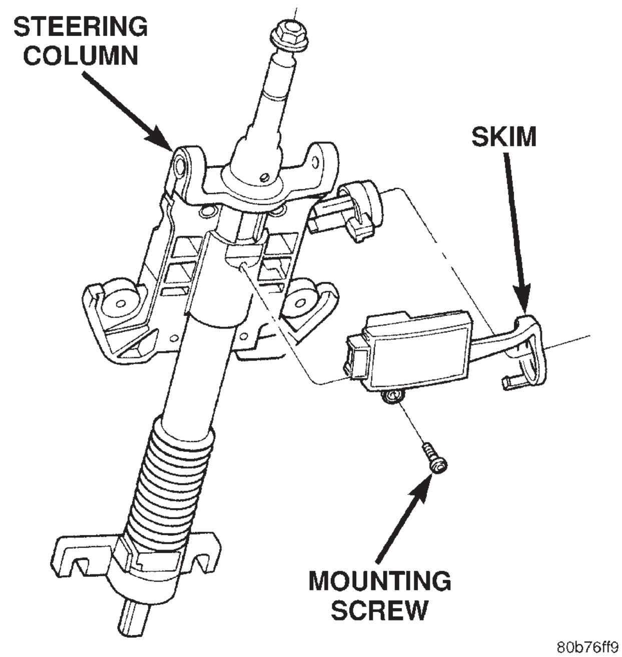


Fig. 2 Sentry Key Immobilizer Module Remove/ Install

(5) Pull the lower right side of the fixed column shroud away from the ignition lock cylinder far enough to disengage the antenna ring of the SKIM from around the ignition lock cylinder housing.

(6) Remove the SKIM from the steering column.

INSTALLATION

(1) Position the SKIM under the steering column.

(2) Pull the lower right side of the fixed column shroud away from the ignition lock cylinder far enough to engage the antenna ring of the SKIM around the ignition lock cylinder housing.

(3) Install and tighten the one screw that secures the SKIM to the bottom of the steering column housing between the ignition switch and the ignition lock cylinder. Tighten the screw to 3.4 N·m (30 in lbs.).

(4) Reconnect the instrument panel wire harness connector to the SKIM connector receptacle.

(5) Install the steering column opening cover onto the instrument panel. Refer to **Steering Column Opening Cover** in the Removal and Installation section of Group 8E - Instrument Panel Systems for the procedures.

(6) Reconnect the battery negative cable.

POWER SEAT SYSTEMS

CONTENTS

POWER SEAT SYSTEM

INDEX

DESCRIPTION AND OPERATION

POWER SEAT SYSTEM

DESCRIPTION

Driver and passenger power front seats are an available factory-installed option for this vehicle. The power seat system option allows the driver and front seat passenger to electrically adjust their seating positions for optimum control and comfort using the power seat switches located on the outboard seat cushion side shield of each front seat. The power seat system receives battery current through a fuse in the Power Distribution Center (PDC) and a circuit breaker in the junction block so that the power seats remain operational, regardless of the ignition switch position.

Two power seat options are offered on this vehicle, depending upon the model. They are as follows:

- **Six-way power seat** - This power seat is an available option on Laredo models equipped with cloth-trimmed seats and includes a six-way adjustable seat cushion track with manual seat back recliners.
- **Ten-way power seat** - This power seat option is standard on Limited models and optional on Laredo models with leather-trimmed seats. This option includes a six-way adjustable seat cushion track with power seat back recliners and power lumbar supports.

The ten-way power seat is also available with the heated seat system option on both Laredo and Limited models; and, on Limited models only, there is a standard equipment memory system that automatically positions the power seat for two different drivers. Refer to **Heated Seat System** in the Heated Seat System section of Group 8N - Electrically Heated Systems for more information on the heated seat option. Refer to **Memory System** in the Memory System section of this group for more information on the memory system.

The power seat system includes the following components:

- Power lumbar adjuster (ten-way power seat only)
- Power lumbar switch (ten-way power seat only)
- Power seat recliner (ten-way power seat only)
- Power seat switch
- Power seat track.

Refer to **Power Seat** in the Contents of Group 8W - Wiring Diagrams for complete circuit diagrams. Following are general descriptions of the major components in the power seat system.

DESCRIPTION AND OPERATION (Continued)

OPERATION

The power seat system allows the driver and/or front passenger seating positions to be adjusted electrically and independently using the separate power seat switches found on the outboard seat cushion side shield of each front seat. See the owner's manual in the vehicle glove box for more information on the features, use and operation of the power seat system.

POWER LUMBAR ADJUSTER

DESCRIPTION

The ten-way power seat option includes an electrically operated lumbar support mechanism. The only visible evidence of this option is the separate power lumbar switch control paddle that is located on the outboard seat cushion side shield, just forward of the other power seat switch control knobs. The power lumbar adjuster and motor are concealed beneath the seat back trim cover and padding, where they are secured to a molded plastic back panel and to the seat back frame (Fig. 1).

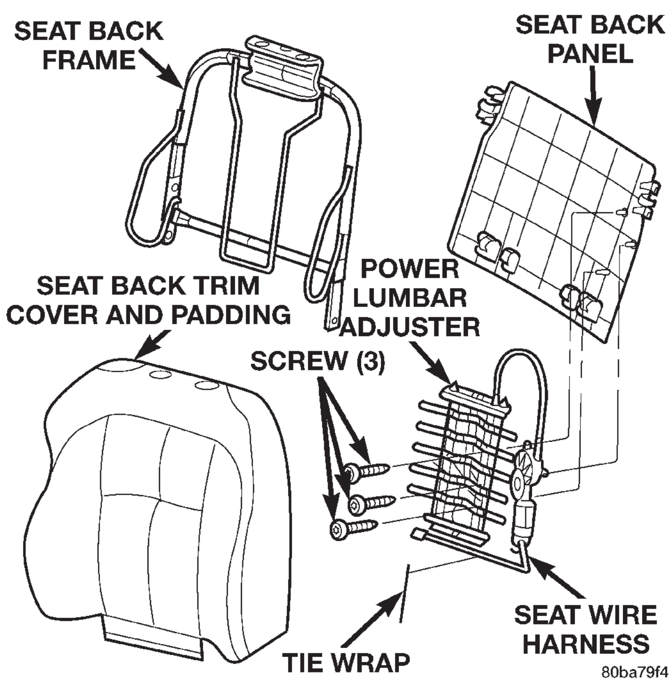


Fig. 1 Power Lumbar Adjuster

The power lumbar adjuster cannot be repaired, and is serviced only as a unit with the seat back frame. If the power lumbar adjuster or the seat back frame are damaged or faulty, the entire seat back frame unit must be replaced. Refer to **Bucket Seat Back** in the Removal and Installation section of Group 23 - Body for the seat back frame service procedures.

OPERATION

The power lumbar adjuster mechanism includes a reversible electric motor that is secured to the inboard side of the seat back panel and is connected to a worm-drive gearbox. The motor and gearbox operate the lumbar adjuster mechanism in the center of the seat back by extending and retracting a cable that actuates a lever. The action of this lever compresses or relaxes a grid of spring steel slats. The more this grid is compressed, the more it bows outward against the center of the seat back padding, providing additional lumbar support.

POWER LUMBAR SWITCH

DESCRIPTION

The ten-way power seat option includes an electrically operated lumbar support mechanism. A single two-way momentary power lumbar switch is located on the outboard seat cushion side shield of each front seat, just forward of the other power seat switches. The power lumbar switch is secured to the back of the seat cushion side shield with two screws, and the switch paddle protrudes through a hole to the outside of the shield. The switch paddle is located in a shallow depression molded into the outer surface of the seat cushion side shield that helps to shroud it from unintentional actuation when entering or leaving the vehicle.

The power lumbar switches cannot be adjusted or repaired and, if faulty or damaged, they must be replaced.

OPERATION

When the power lumbar switch paddle is actuated, a battery feed and a ground path are applied through the switch contacts to the power lumbar adjuster motor. The motor operates to move the lumbar adjuster through its drive unit in the selected direction until the switch is released, or until the travel limit of the adjuster is reached. When the switch is moved in the opposite direction, the battery feed and ground path to the motor are reversed through the switch contacts. This causes the motor to run in the opposite direction.

The power lumbar switch should not be held applied in either direction after the adjuster has reached its travel limit. The power lumbar adjuster motor contains a self-resetting circuit breaker to protect it from overload. However, consecutive or frequent resetting of the circuit breaker must not be allowed to continue, or the motor may be damaged.

DESCRIPTION AND OPERATION (Continued)

POWER SEAT RECLINER

DESCRIPTION

The ten-way power seat option includes an electrically operated seat back recliner mechanism. The only visible evidence of this option is the separate power seat recliner switch control knob that is located on the outboard seat cushion side shield, just behind the other power seat switch control knob. The power seat recliner switch is integral to the ten-way power seat switch unit, but is actuated with a separate switch knob.

The power seat recliner unit is mounted in the place of a seat hinge on the outboard side of the seat (Fig. 2). The upper hinge plate of the power seat recliner mechanism is secured with two screws to the seat back frame and is concealed beneath the seat back trim cover and padding. The lower hinge plate and the motor and drive unit of the power seat recliner mechanism is secured with two screws to the seat cushion frame, and is concealed by the outboard seat cushion side shield.

The power seat recliner cannot be repaired. If the unit is faulty or damaged, it must be replaced. Refer to **Bucket Seat Recliner** in the Removal and Installation section of Group 23 - Body for the service procedures.

OPERATION

The power seat recliner includes a reversible electric motor that is secured to the lower hinge plate of the recliner unit. The motor is connected to a gearbox that moves the upper hinge plate of the power seat recliner through a screw-type drive unit. The driver side power seat recliner motor used on models equipped with the optional memory system also has a position potentiometer integral to the motor assembly, which electronically monitors the motor position.

POWER SEAT SWITCH

DESCRIPTION

Two different power seat switches are used on this vehicle, depending upon the optional power seat system installed in the vehicle. The six-way power seats are each equipped with a switch featuring three switch control knobs ganged together on the outboard seat cushion side shield (Fig. 3). The ten-way power seats are each equipped with a switch featuring two knobs ganged together on the outboard seat cushion side shield (Fig. 4).

The switch units for both power seat types are secured to the back of the seat cushion side shield with two screws. However, the control knobs for the six-way power seat switch unit remain installed during switch unit removal and installation, while both knobs for the ten-way power seat switch unit must be removed.

The individual switches in both power seat switch units cannot be repaired. If one switch is damaged or

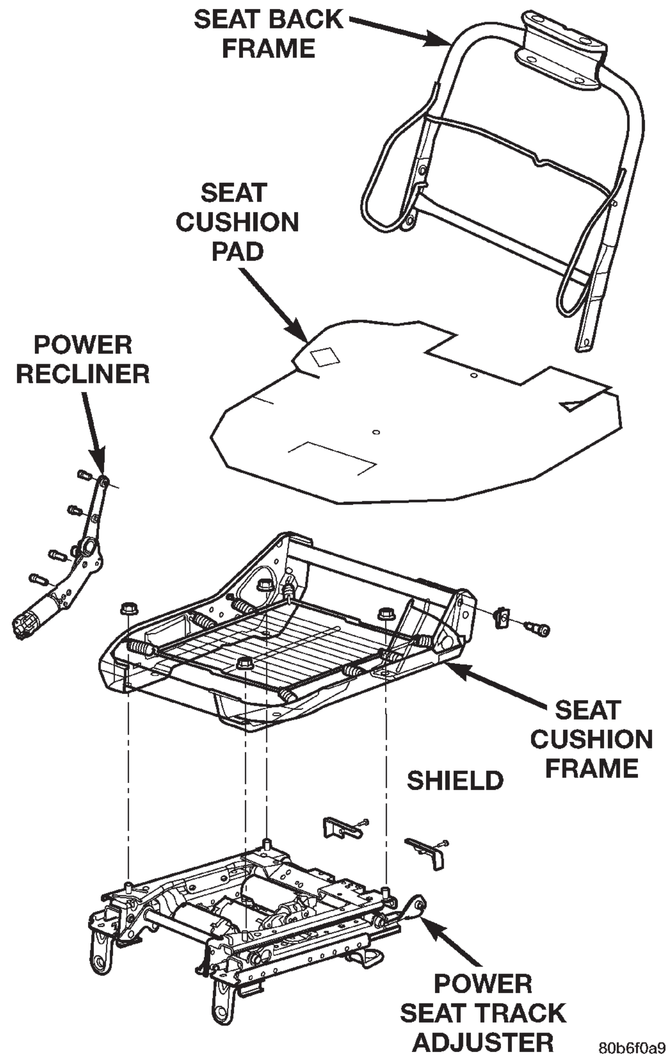


Fig. 2 Power Seat Recliner and Track

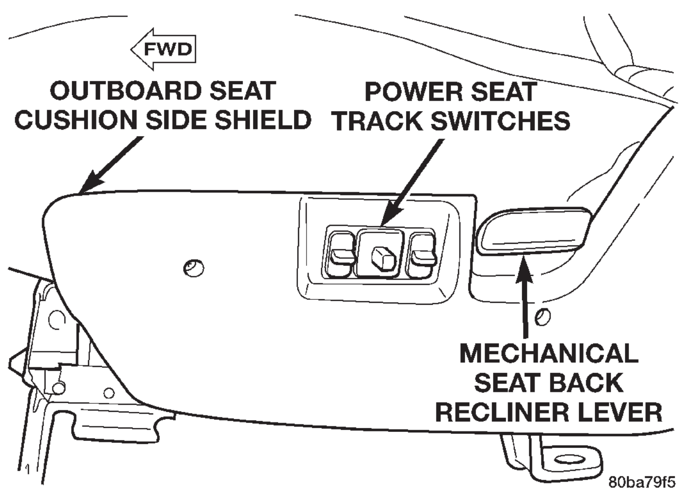


Fig. 3 Six-Way Power Seat Switches

DESCRIPTION AND OPERATION (Continued)

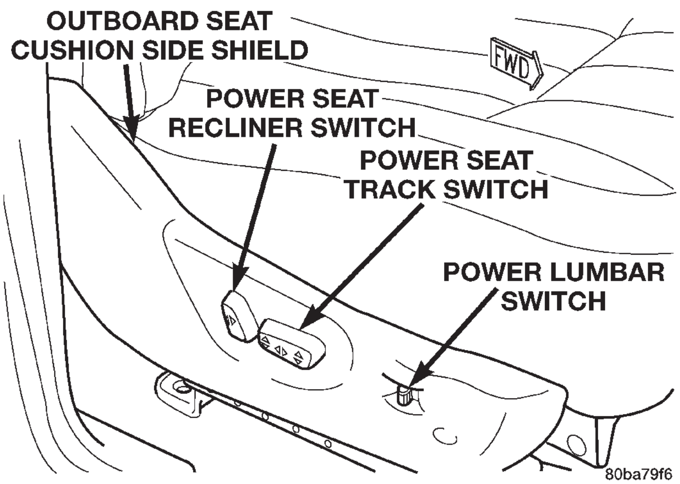


Fig. 4 Ten-Way Power Seat Switches

faulty, the entire power seat switch unit must be replaced.

OPERATION

The power seat tracks of both the six-way and the ten-way power seat systems can be adjusted in six different ways using the power seat switches. The ten-way system has the additional power seat recliner switch integral to the power seat switch and also has a separate, stand-alone switch to control the power lumbar adjuster. See the owner's manual in the vehicle glove box for more information on the power seat switch functions and the seat adjusting procedures.

When a power switch control knob or knobs are actuated, a battery feed and a ground path are applied through the switch contacts to the power seat track or recliner adjuster motor. The selected adjuster motor operates to move the seat track or recliner through its drive unit in the selected direction until the switch is released, or until the travel limit of the adjuster is reached. When the switch is moved in the opposite direction, the battery feed and ground path to the motor are reversed through the switch contacts. This causes the adjuster motor to run in the opposite direction.

No power seat switch should be held applied in any direction after the adjuster has reached its travel limit. The power seat adjuster motors each contain a self-resetting circuit breaker to protect them from overload. However, consecutive or frequent resetting of the circuit breaker must not be allowed to continue, or the motor may be damaged.

POWER SEAT TRACK

DESCRIPTION

Both the six-way and the ten-way power seat options include a single electrically operated power seat track unit located under each front bucket seat. The power seat track unit replaces the standard equipment manual seat tracks. The lower half of the power seat track is secured at the front with two screws to the floor panel seat cross member, and at the rear with two screws to the floor panel. Four nuts secure the bottom of the seat cushion frame to four studs on the upper half of the power seat track unit.

The power seat track unit cannot be repaired, and is serviced only as a complete unit. If any component in this unit is faulty or damaged, the entire power seat track unit must be replaced. Refer to **Bucket Seat Track Adjuster** in the Removal and Installation section of Group 23 - Body for the service procedures.

OPERATION

The power seat track unit includes three reversible electric motors that are secured to the upper half of the track unit (Fig. 5). Each motor moves the seat adjuster through a combination of worm-drive gearboxes and screw-type drive units. Each of the three driver side power seat track motors used on models equipped with the optional memory system also has a position potentiometer integral to the motor assembly, which electronically monitors the motor position.

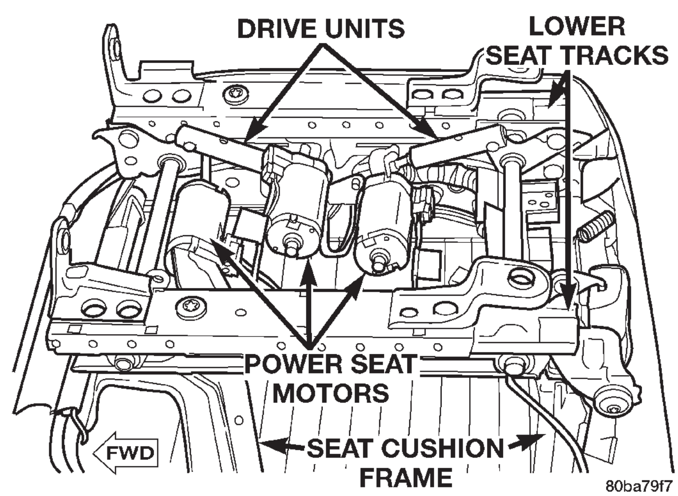


Fig. 5 Power Seat Track - Typical

The front and rear of the seat are operated by two separate vertical adjustment motors. These motors can be operated independently of each other, tilting the entire seat assembly forward or rearward; or, they can be operated in unison by selecting the proper power seat switch functions, which will raise or lower the entire seat assembly. The third motor is the horizontal adjustment motor, which moves the seat track in the forward and rearward directions.

DIAGNOSIS AND TESTING

POWER SEAT SYSTEM

Following are tests that will help to diagnose the hard wired components and circuits of the power seat system. However, if the vehicle is also equipped with the optional memory system, these tests may not prove conclusive in the diagnosis of the driver side power seat. In order to obtain conclusive testing of the driver side power seat with the memory system option, the Programmable Communications Interface (PCI) data bus network and all of the electronic modules that provide inputs to, or receive outputs from the memory system components must be checked.

The most reliable, efficient, and accurate means to diagnose the driver side power seat with the memory system option requires the use of a DRB scan tool and the proper Diagnostic Procedures manual. The DRB scan tool can provide confirmation that the PCI data bus is functional, that all of the electronic modules are sending and receiving the proper messages on the PCI data bus, and that the memory system is receiving the proper hard wired inputs and relaying the proper hard wired outputs to perform its driver side power seat functions.

Before any testing of the power seat system is attempted, the battery should be fully-charged and all of the power seat system wire harness connections and pins cleaned and tightened to ensure proper circuit continuity and ground paths. For complete circuit diagrams, refer to **Power Seat** in the Contents of Group 8W - Wiring Diagrams.

With the dome lamp on, apply the power seat switch in the direction of the failure. If the dome lamp dims, the seat may be jamming. Check under and behind the seat for binding or obstructions. If the dome lamp does not dim, proceed with testing of the individual components and circuits.

POWER LUMBAR ADJUSTER

Actuate the power lumbar switch to move the power lumbar adjuster in each direction. The power lumbar adjuster should move in both directions. It should be noted that the power lumber adjuster normally operates very quietly and exhibits little visible movement. If the power lumbar adjuster fails to operate in only one direction, move the adjuster a short distance in the opposite direction and test again to be certain that the adjuster is not at its travel limit. If the power lumbar adjuster still fails to operate in only one direction, refer to **Power Lumbar Switch** in the Diagnosis and Testing section of this group. If the power lumbar adjuster fails to operate in either direction, perform the following tests. For complete circuit diagrams, refer to **Power Seat** in the Contents of Group 8W - Wiring Diagrams.

(1) Check the power seat circuit breaker in the junction block. If OK, go to Step 2. If not OK, replace the faulty power seat circuit breaker.

(2) Check for battery voltage at the power seat circuit breaker in the junction block. If OK, go to Step 3. If not OK, repair the open fused B(+) circuit to the fuse in the Power Distribution Center as required.

(3) Remove the outboard seat cushion side shield from the seat. Disconnect the seat wire harness connector from the power lumbar switch connector receptacle. Check for battery voltage at the fused B(+) circuit cavity of the power seat wire harness connector for the power lumbar switch. If OK, go to Step 4. If not OK, repair the open fused B(+) circuit to the power seat circuit breaker in the junction block as required.

(4) Check for continuity between the ground circuit cavity of the power seat wire harness connector for the power lumbar switch and a good ground. There should be continuity. If OK, go to Step 5. If not OK, repair the open ground circuit to ground as required.

(5) Test the power lumbar switch. Refer to **Power Lumbar Switch** in the Diagnosis and Testing section of this group. If the switch tests OK, test the circuits of the power seat wire harness between the power lumbar adjuster motor and the power lumbar switch for shorts or opens. If the circuits check OK, replace the faulty seat back frame assembly. If the circuits are not OK, repair the power seat wire harness as required.

POWER LUMBAR SWITCH

For complete circuit diagrams, refer to **Power Seat** in the Contents of Group 8W - Wiring Diagrams.

(1) Disconnect and isolate the battery negative cable.

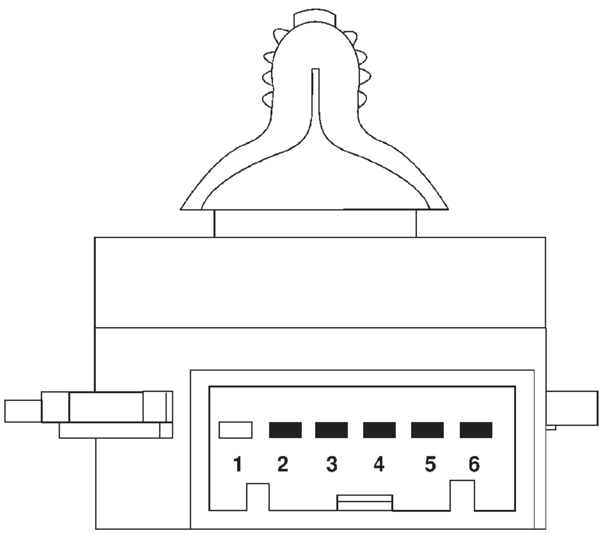
(2) Remove the power lumbar switch from the outboard seat cushion side shield. Refer to **Power Lumbar Switch** in the Removal and Installation section of this group for the procedures.

(3) Use an ohmmeter to test the continuity of the power lumbar switch in each switch position. See the Power Lumbar Switch Continuity chart (Fig. 6). If OK, refer to **Power Lumbar Adjuster** in the Diagnosis and Testing section of this group. If not OK, replace the faulty power lumbar switch.

POWER SEAT RECLINER

Following are tests that will help to diagnose the hard wired components and circuits of the power seat system. However, if the vehicle is also equipped with the optional memory system, these tests may not prove conclusive in the diagnosis of the driver side power seat. In order to obtain conclusive testing of

DIAGNOSIS AND TESTING (Continued)



POWER LUMBAR SWITCH		
LEFT SWITCH POSITION	RIGHT SWITCH POSITION	CONTINUITY BETWEEN
Off	Off	2-4, 3-5
Forward	Rearward	3-5, 4-6
Rearward	Forward	2-4, 3-6

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Fig. 6 Power Lumbar Switch Continuity

the driver side power seat with the memory system option, the Programmable Communications Interface (PCI) data bus network and all of the electronic modules that provide inputs to, or receive outputs from the memory system components must be checked.

The most reliable, efficient, and accurate means to diagnose the driver side power seat with the memory system option requires the use of a DRB scan tool and the proper Diagnostic Procedures manual. The DRB scan tool can provide confirmation that the PCI data bus is functional, that all of the electronic modules are sending and receiving the proper messages on the PCI data bus, and that the memory system is receiving the proper hard wired inputs and relaying the proper hard wired outputs to perform its driver side power seat functions.

Actuate the power seat recliner switch to move the power seat recliner adjuster in each direction. The power seat recliner adjuster should move in both directions. If the power seat recliner adjuster fails to operate in only one direction, move the adjuster a short distance in the opposite direction and test again to be certain that the adjuster is not at its travel limit. If the power seat recliner adjuster still fails to operate in only one direction, refer to **Power Seat Switch** in the Diagnosis and Testing section of this group. If the power recliner adjuster fails to operate in either direction, perform the following tests. For complete circuit diagrams, refer to **Power Seat** in the Contents of Group 8W - Wiring Diagrams.

(1) Check the power seat circuit breaker in the junction block. If OK, go to Step 2. If not OK, replace the faulty power seat circuit breaker.

(2) Check for battery voltage at the power seat circuit breaker in the junction block. If OK, go to Step 3. If not OK, repair the open fused B(+) circuit to the fuse in the Power Distribution Center as required.

(3) Remove the outboard seat cushion side shield from the seat. Disconnect the seat wire harness connector from the power seat switch connector receptacle. Check for battery voltage at the fused B(+) circuit cavity of the power seat wire harness connector for the power seat switch. If OK, go to Step 4. If not OK, repair the open fused B(+) circuit to the power seat circuit breaker in the junction block as required.

(4) Check for continuity between the ground circuit cavity of the power seat wire harness connector for the power seat switch and a good ground. There should be continuity. If OK, go to Step 5. If not OK, repair the open ground circuit to ground as required.

(5) Test the power seat switch. Refer to **Power Seat Switch** in the Diagnosis and Testing section of this group. If the switch tests OK, test the circuits of the power seat wire harness between the power seat recliner adjuster motor and the power seat switch for shorts or opens. If the circuits check OK, replace the faulty power seat recliner unit. If the circuits are not OK, repair the power seat wire harness as required.

POWER SEAT SWITCH

Following are tests that will help to diagnose the hard wired components and circuits of the power seat system. However, if the vehicle is also equipped with the optional memory system, these tests may not prove conclusive in the diagnosis of the driver side power seat. In order to obtain conclusive testing of the driver side power seat with the memory system option, the Programmable Communications Interface (PCI) data bus network and all of the electronic modules that provide inputs to, or receive outputs from the memory system components must be checked.

The most reliable, efficient, and accurate means to diagnose the driver side power seat with the memory system option requires the use of a DRB scan tool and the proper Diagnostic Procedures manual. The DRB scan tool can provide confirmation that the PCI data bus is functional, that all of the electronic modules are sending and receiving the proper messages

DIAGNOSIS AND TESTING (Continued)

on the PCI data bus, and that the memory system is receiving the proper hard wired inputs and relaying the proper hard wired outputs to perform its driver side power seat functions.

For complete circuit diagrams, refer to **Power Seat** in the Contents of Group 8W - Wiring Diagrams.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the power seat switch from the outboard seat cushion side shield. Refer to **Power Seat Switch** in the Removal and Installation section of this group for the procedures.

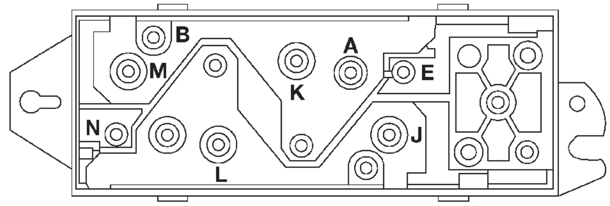
(3) Use an ohmmeter to test the continuity of the power seat switch in each switch position. See the Power Seat Switch Continuity chart (Fig. 7) or (Fig. 8). If OK, refer to **Power Seat Track** or **Power Seat Recliner** in the Diagnosis and Testing section of this group. If not OK, replace the faulty power seat switch unit.

POWER SEAT TRACK

Following are tests that will help to diagnose the hard wired components and circuits of the power seat system. However, if the vehicle is also equipped with the optional memory system, these tests may not prove conclusive in the diagnosis of the driver side power seat. In order to obtain conclusive testing of the driver side power seat with the memory system option, the Programmable Communications Interface (PCI) data bus network and all of the electronic modules that provide inputs to, or receive outputs from the memory system components must be checked.

The most reliable, efficient, and accurate means to diagnose the driver side power seat with the memory system option requires the use of a DRB scan tool and the proper Diagnostic Procedures manual. The DRB scan tool can provide confirmation that the PCI data bus is functional, that all of the electronic modules are sending and receiving the proper messages on the PCI data bus, and that the memory system is receiving the proper hard wired inputs and relaying the proper hard wired outputs to perform its driver side power seat functions.

Actuate the power seat switch to move all three power seat track adjusters in each direction. The power seat track adjusters should move in each of the selected directions. If a power seat track adjuster fails to operate in only one direction, move the adjuster a short distance in the opposite direction and test again to be certain that the adjuster is not at its travel limit. If the power seat track adjuster still fails to operate in only one direction, refer to **Power Seat Switch** in the Diagnosis and Testing section of this group. If the power seat track adjuster fails to operate in more than one direction, perform the following tests. For complete circuit diagrams, refer to **Power Seat** in the Contents of Group 8W - Wiring Diagrams.



LEFT SIDE SHOWN
(ROTATE 180° FOR RIGHT SIDE)

POWER SEAT SWITCH		
LEFT SWITCH POSITION	RIGHT SWITCH POSITION	CONTINUITY BETWEEN
OFF	OFF	B-N, B-J, B-M, B-E, B-L, B-K
VERTICAL UP	VERTICAL DOWN	A-J, A-N, B-M, B-E
VERTICAL DOWN	VERTICAL UP	A-E, A-M, B-N, B-J
HORIZONTAL FORWARD	HORIZONTAL FORWARD	A-K, B-L
HORIZONTAL REARWARD	HORIZONTAL REARWARD	A-L, B-K
FRONT TILT UP	FRONT TILT DOWN	A-J, B-E
FRONT TILT DOWN	FRONT TILT UP	A-E, B-J
REAR TILT UP	REAR TILT DOWN	A-N, B-M
REAR TILT DOWN	REAR TILT UP	A-M, B-N

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Fig. 7 Six-Way Power Seat Switch Continuity

(1) Check the power seat circuit breaker in the junction block. If OK, go to Step 2. If not OK, replace the faulty power seat circuit breaker.

(2) Check for battery voltage at the power seat circuit breaker in the junction block. If OK, go to Step 3. If not OK, repair the open fused B(+) circuit to the fuse in the Power Distribution Center as required.

(3) Remove the outboard seat cushion side shield from the seat. Disconnect the seat wire harness connector from the power seat switch connector receptacle. Check for battery voltage at the fused B(+) circuit cavity of the power seat wire harness connector for the power seat switch. If OK, go to Step 4. If not OK, repair the open fused B(+) circuit to the power seat circuit breaker in the junction block as required.

DIAGNOSIS AND TESTING (Continued)

SWITCH POSITION	CONTINUITY BETWEEN PINS LEFT SEAT	RIGHT SEAT
OFF	PIN 1 to 2 PIN 1 to 3 PIN 1 to 4 PIN 1 to 6 PIN 1 to 7 PIN 1 to 8 PIN 1 to 9 PIN 1 to 10	PIN 1 to 2 PIN 1 to 3 PIN 1 to 4 PIN 1 to 6 PIN 1 to 7 PIN 1 to 8 PIN 1 to 9 PIN 1 to 10
FRONT RISER UP	PIN 1 to 10 PIN 5 to 7	PIN 1 to 7 PIN 5 to 10
FRONT RISER DOWN	PIN 1 to 7 PIN 5 to 10	PIN 1 to 10 PIN 5 to 7
CENTER SWITCH FORWARD	PIN 1 to 3 PIN 5 to 6	PIN 1 to 3 PIN 5 to 6
CENTER SWITCH REARWARD	PIN 1 to 6 PIN 3 to 5	PIN 1 to 6 PIN 3 to 5
REAR RISER UP	PIN 1 to 9 PIN 5 to 8	PIN 1 to 8 PIN 5 to 9
REAR RISER DOWN	PIN 1 to 8 PIN 5 to 9	PIN 1 to 9 PIN 5 to 8
RECLINER UP	PIN 1 to 4 PIN 2 to 5	PIN 1 to 4 PIN 2 to 5
RECLINER DOWN	PIN 1 to 2 PIN 4 to 5	PIN 1 to 2 PIN 4 to 5

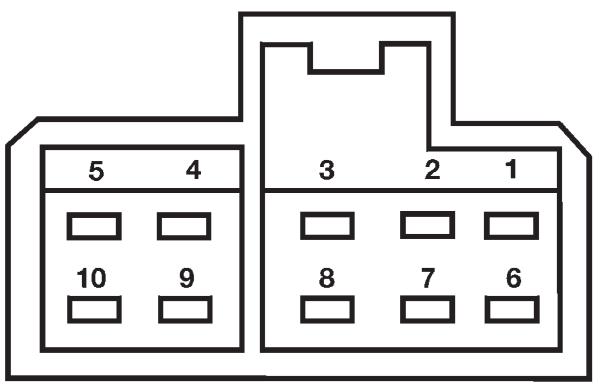


Fig. 8 Ten-Way Power Seat Switch Continuity

(4) Check for continuity between the ground circuit cavity of the power seat wire harness connector for the power seat switch and a good ground. There should be continuity. If OK, go to Step 5. If not OK, repair the open ground circuit to ground as required.

(5) Test the power seat switch. Refer to **Power Seat Switch** in the Diagnosis and Testing section of this group. If the switch tests OK, test the circuits of the power seat wire harness between the inoperative power seat track adjuster motor and the power seat switch for shorts or opens. If the circuits check OK, replace the faulty power seat track unit. If the circuits are not OK, repair the power seat wire harness as required.

REMOVAL AND INSTALLATION

POWER LUMBAR SWITCH

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the three screws that secure the outboard seat cushion side shield to the seat cushion frame.

(3) Pull the outboard seat cushion side shield away from the seat cushion frame far enough to access the power lumbar switch wire harness connector.

(4) Disconnect the power seat wire harness connector from the power lumbar switch connector receptacle (Fig. 9).

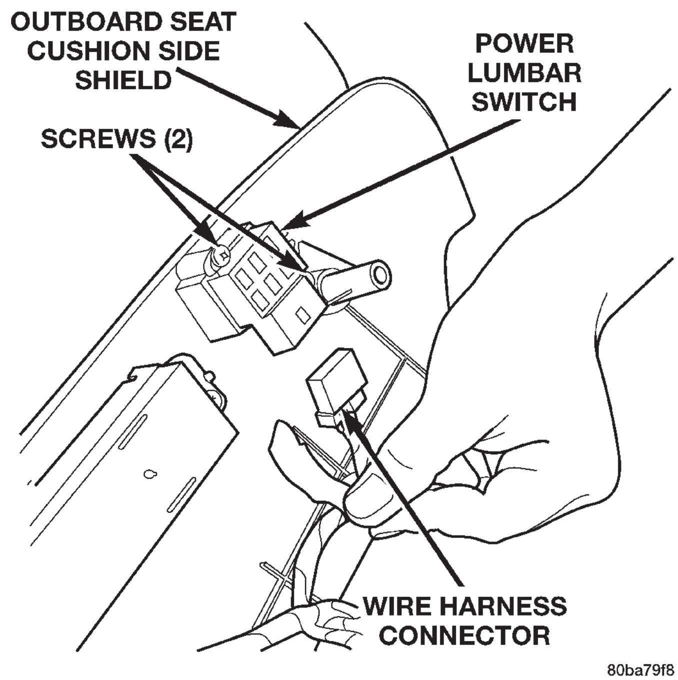


Fig. 9 Power Lumbar Switch Remove/Install

(5) Remove the two screws that secure the power lumbar switch to the inside of the outboard seat cushion side shield.

(6) Remove the power lumbar switch from the outboard seat cushion side shield.

INSTALLATION

(1) Position the power lumbar switch onto the outboard seat cushion side shield.

(2) Install and tighten the two screws that secure the power lumbar switch to the inside of the outboard seat cushion side shield. Tighten the screws to 1.5 N·m (14 in. lbs.).

(3) Reconnect the power seat wire harness connector to the power lumbar switch connector receptacle.

REMOVAL AND INSTALLATION (Continued)

(4) Position the outboard seat cushion side shield onto the seat cushion frame

(5) Install and tighten the three screws that secure the outboard seat cushion side shield to the seat cushion frame. Tighten the screws to 1.5 N·m (14 in. lbs.).

(6) Reconnect the battery negative cable.

POWER SEAT SWITCH

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) On models with the ten-way power seat system only, using a trim stick or another suitable wide flat-bladed tool, gently pry the power seat and power recliner switch knobs off of the switch stems.

(3) Remove the three screws that secure the outboard seat cushion side shield to the seat cushion frame.

(4) Pull the outboard seat cushion side shield away from the seat cushion frame far enough to access the power seat switch wire harness connector.

(5) Disconnect the power seat wire harness connector from the power seat switch connector receptacle.

(6) Remove the two screws that secure the power seat switch to the inside of the outboard seat cushion side shield (Fig. 10) or (Fig. 11).

(7) Remove the power seat switch from the outboard seat cushion side shield.

INSTALLATION

(1) Position the power seat switch onto the outboard seat cushion side shield.

(2) Install and tighten the two screws that secure the power seat switch to the inside of the outboard seat cushion side shield. Tighten the screws to 1.5 N·m (14 in. lbs.).

(3) Reconnect the power seat wire harness connector to the power seat switch connector receptacle.

(4) Position the outboard seat cushion side shield onto the seat cushion frame

(5) Install and tighten the three screws that secure the outboard seat cushion side shield to the seat cushion frame. Tighten the screws to 1.5 N·m (14 in. lbs.).

(6) On models with the ten-way power seat system only, position the power seat and power recliner switch knobs onto the switch stems and push on them firmly and evenly until they snap into place.

(7) Reconnect the battery negative cable.

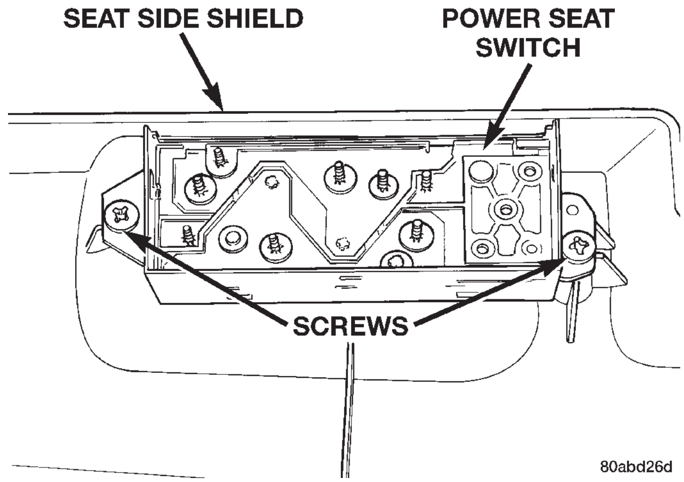


Fig. 10 Six-Way Power Seat Switches Remove/Install

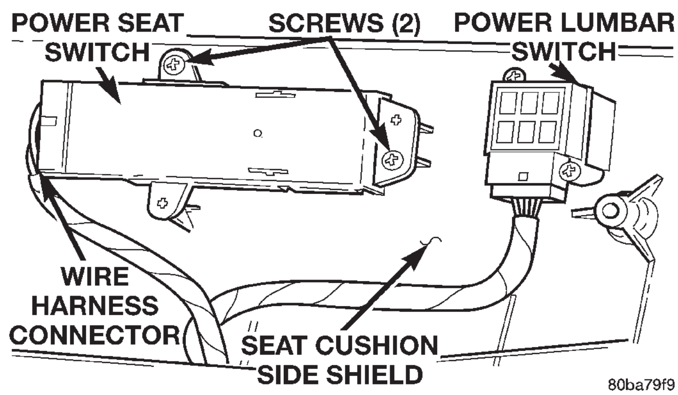


Fig. 11 Ten-Way Power Seat Switches Remove/Install

MEMORY SYSTEM

INDEX

DESCRIPTION AND OPERATION

MEMORY SYSTEM

DESCRIPTION

An electronic memory system is standard equipment on the Limited model. The memory system is able to store and recall the driver side power seat positions (including the power recliner position), and both outside power mirror positions for two drivers. For vehicles with a radio connected to the Programmable Communications Interface (PCI) data bus network, the memory system is also able to store and recall up to twenty - ten AM and ten FM - radio station presets for two drivers. The memory system also will store and recall the last station listened to for each driver, even if it is not one of the twenty preset stations.

The memory system will automatically return to all of these settings when the corresponding numbered and color-coded button (Driver 1 - Black, or Driver 2 - Gray) of the memory switch on the driver side front door trim panel is depressed, or when the doors are unlocked using the corresponding numbered and color-coded (Driver 1 - Black, or Driver 2 - Gray) Remote Keyless Entry (RKE) transmitter. A customer programmable feature of the memory system allows the RKE recall of memory features to be disabled in cases where there are more than two drivers of the vehicle.

The memory system also has a customer programmable easy exit feature that will move the driver seat rearward 55 millimeters (two inches) or to the end of its travel, whichever occurs first, when the key is removed from the ignition switch lock cylinder.

A Memory Seat Module (MSM) or Memory Heated Seat Module (MHSM) are used on this model to control and integrate the many electronic functions and features included in the memory system. On vehicles equipped with the heated seat system option, the MHSM also controls the functions and features of that system.

The memory system includes the following components:

- Memory seat module (or memory heated seat module)
- Memory switch
- Position potentiometers on both outside power mirrors
- Position potentiometers on the driver side power seat track and power seat recliner motors.
- Radio receiver (if PCI data bus capable).

Certain functions and features of the memory system rely upon resources shared with other electronic modules in the vehicle over the Programmable Communications Interface (PCI) data bus network. The PCI data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, internal controller hardware, and component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities. For diagnosis of these electronic modules or of the PCI data bus network, the use of a DRB scan tool and the proper Diagnostic Procedures manual are recommended.

The other electronic modules that may affect memory system operation are as follows:

- **Body Control Module (BCM)** - Refer to **Body Control Module** in the Description and Operation section of Group 8E - Instrument Panel Systems for more information.
- **Driver Door Module (DDM)** - Refer to **Door Module** in the Power Lock System section of Group 8P - Power Lock Systems for more information.
- **Electronic Vehicle Information Center (EVIC)** - Refer to **Electronic Vehicle Information Center** in the Description and Operation section of Group 8V - Overhead Console Systems for more information.
- **Passenger Door Module (PDM)** - Refer to **Door Module** in the Power Lock System section of

DESCRIPTION AND OPERATION (Continued)

Group 8P - Power Lock Systems for more information.

- **Powertrain Control Module (PCM)** - Refer to **Powertrain Control Module** in the Description and Operation section of Group 14 - Fuel System for more information.
- **Radio Receiver** - Refer to **Radio Receiver** in the Description and Operation section of Group 8F - Audio Systems for more information.

Refer to **Heated Seat System** in the Heated Seat System section of Group 8N - Electrically Heated Systems for more information on this system. Refer to **Remote Keyless Entry System** in Group 8P - Power Lock Systems for more information on the RKE system. Refer to **Power Mirror** in the Outside Power Mirrors section of Group 8T - Power Mirror Systems for more information on the mirror position potentiometers. Refer to **Power Seat Track** and **Power Seat Recliner** in the Power Seat System section of this group for more information on the driver side power seat position potentiometers.

Refer to **Power Seat** in the Contents of Group 8W - Wiring Diagrams for complete circuit diagrams. Following are general descriptions of the remaining major components in the factory-installed memory system.

OPERATION

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the memory system. For diagnosis of the MSM, the PCI data bus, or the other electronic modules on the PCI data bus that provide inputs and outputs for the memory system, the use of a DRB scan tool and the proper Diagnostic Procedures manual are recommended.

DRIVER AND PASSENGER DOOR MODULES

The Driver Door Module (DDM) monitors the memory switch through a hard wired circuit. It also monitors the unlock messages from the Remote Keyless Entry (RKE) receiver in the Passenger Door Module (PDM) sent over the Programmable Communications Interface (PCI) data bus. The DDM is programmed to send memory recall messages and memory system status messages over the PCI data bus to the other electronic modules when it detects a memory recall request.

Refer to **Door Module** in the Power Lock System section of Group 8P - Power Lock Systems for more information on the DDM and PDM.

ELECTRONIC VEHICLE INFORMATION CENTER

The Electronic Vehicle Information Center (EVIC) serves as the user interface for the memory system. It displays memory system status messages and provides the user with the means for enabling and disabling the many customer programmable features available on the vehicle, including those for the memory system.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the EVIC. Refer to **Electronic Vehicle Information Center** in the Description and Operation section of Group 8V - Overhead Console Systems for more information on the EVIC.

MEMORY SEAT MODULE

DESCRIPTION

All Limited models are equipped with a standard memory system. However, there are two versions of the Memory Seat Module (MSM). The standard version of the MSM is used on vehicles that are not equipped with the optional heated seat system. A Memory Heated Seat Module (MHSM) is used on vehicles that are equipped with the heated seat system option. A third module, the Heated Seat Module (HSM), does not have any memory system capabilities and is only available on Laredo models that are equipped with an optional heated seat system. Refer to **Heated Seat System** in the Heated Seat System section of Group 8N - Electrically Heated Systems for more information on the heated seat system option.

All three modules are packaged in an identical molded plastic housing which is mounted on a bracket that is located between the power seat track and the seat cushion frame under the forward edge of the driver side front seat cushion. The MSM or MHSM is used to control all of the driver side power seat memory functions and features. The MSM or MHSM contains a central processing unit and interfaces with other electronic modules in the vehicle on the Programmable Communications Interface (PCI) data bus network.

For diagnosis of the MSM, MHSM or the PCI data bus, a DRB scan tool and the proper Diagnostic Procedures manual are recommended. The MSM or MHSM cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

OPERATION

The MSM receives hard wired inputs from the power seat switch and the potentiometers on each of the driver side power seat motors. The MSM receives messages over the PCI data bus from the Driver Door Module (DDM) (memory switch status), the Powertrain Control Module (PCM) (vehicle speed status), and the Body Control Module (seat belt switch status). The programming in the MSM allows it to process the information from these inputs and send control outputs to each of the driver side power seat

DESCRIPTION AND OPERATION (Continued)

motors. The MSM will prevent the seat memory recall function from being initiated if the driver side seat belt is buckled, if the transmission gear selector lever is not in the Park or Neutral positions, or if the vehicle is moving.

MEMORY SWITCH

DESCRIPTION

Vehicles equipped with the memory system have a memory switch mounted to the driver side front door trim panel. This switch is used to set and recall all of the memory system settings for up to two drivers. The memory switch is a resistor multiplexed unit that is hard wired to the Driver Door Module (DDM), which is also located on the driver side front door trim panel. The DDM sends out the memory system set and recall requests to the other electronic modules over the Programmable Communications Interface (PCI) data bus.

The memory switch cannot be adjusted or repaired and, if faulty or damaged, it must be replaced. For complete circuit diagrams, refer to **Power Mirror** in the Contents of Group 8W - Wiring Diagrams.

OPERATION

The memory switch has three momentary switch buttons labeled Set, 1 and 2. The Driver 1 and Driver 2 buttons are back-lit with Light-Emitting Diodes (LED) for visibility, and are also color-coded to coincide with the color-coded Driver 1 and Driver 2 Remote Keyless Entry (RKE) transmitters. The Driver 1 memory switch button and RKE transmitter are black, and the Driver 2 memory switch button and RKE transmitter are gray. The memory switch Set button also has an LED that will illuminate and flash to indicate that the memory system is in the set mode. This LED will automatically be extinguished when a set request has been successfully completed.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the memory switch. For diagnosis of the memory switch, the DDM or the PCI data bus, the use of a DRB scan tool and the proper Diagnostic Procedures manual are recommended.

DIAGNOSIS AND TESTING

MEMORY SYSTEM

Following are tests that will help to diagnose the components and circuits that provide hard wired inputs to the memory system. However, these tests may not prove conclusive in the diagnosis of this system. In order to obtain conclusive testing of the memory system, the Programmable Communications Interface (PCI) data bus network and all of the electronic modules that provide inputs to, or receive outputs from the memory system components must be checked.

The most reliable, efficient, and accurate means to diagnose the memory system requires the use of a DRB scan tool and the proper Diagnostic Procedures manual. The DRB scan tool can provide confirmation that the PCI data bus is functional, that all of the electronic modules are sending and receiving the proper messages on the PCI data bus, and that the memory system is receiving the proper hard wired inputs and relaying the proper hard wired outputs to perform its functions.

MEMORY SWITCH

For complete circuit diagrams, refer to **Power Mirrors** in the Contents of Group 8W - Wiring Diagrams.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the driver side front door trim panel. Refer to **Front Door Trim Panel** in the Removal and Installation section of this group for the procedures.

(3) Disconnect the memory switch wire harness connector from the driver door module connector receptacle.

(4) Use an ohmmeter to test the resistances of the memory switch in each switch position. See the Memory Switch Test chart (Fig. 1). If OK, refer to **Memory System** in the Diagnosis and Testing section of this group. If not OK, replace the faulty memory switch.

REMOVAL AND INSTALLATION

MEMORY SEAT MODULE

REMOVAL

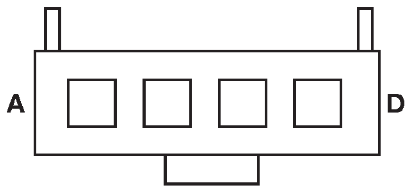
(1) Disconnect and isolate the battery negative cable.

(2) Remove the driver side front bucket seat from the power seat track unit. Refer to **Bucket Seat Track Adjuster** in the Removal and Installation section of Group 23 - Body for the procedures.

(3) Lift the memory seat module and its mounting bracket off of the two forward studs on the upper mounting rails of the power seat track and move the unit away from the seat far enough to access the power seat wire harness connectors (Fig. 2).

(4) Disconnect the two power seat wire harness connectors from the memory seat module connector receptacles.

REMOVAL AND INSTALLATION (Continued)



MEMORY SWITCH		
SWITCH POSITION	RESISTANCE BETWEEN	RESISTANCE RANGE (OHMS)
NEUTRAL	A & D	14000 ±1%
MEMORY 1 (BLACK)	A & B	4600 ±1%
MEMORY 2 (GRAY)	A & B	1700 ±1%
SET	A & B	300 ±1%

80ba79fa

Fig. 1 Memory Switch Test

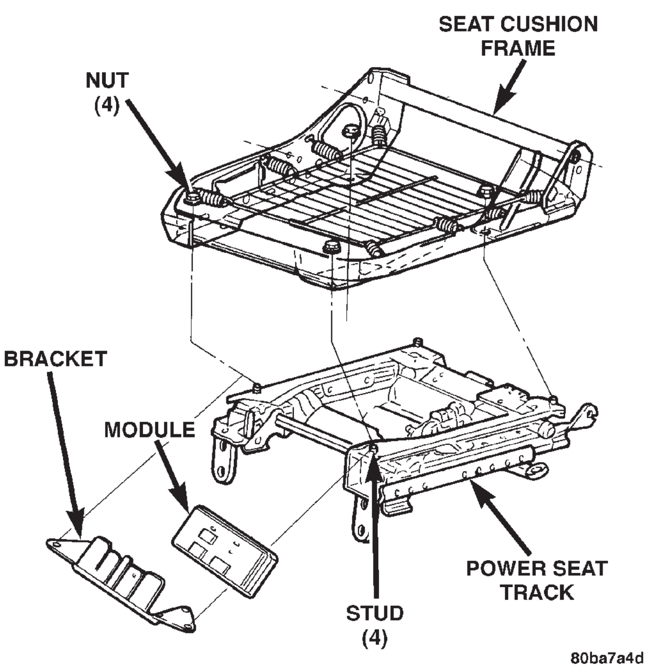


Fig. 2 Memory Seat Module Remove/Install

(5) There are two snap clips that are molded into the lower side of the memory seat module which help to secure the module to the riser portion of the stepped mounting bracket. Using a trim stick or another suitable wide flat-bladed tool, gently pry each of the two snap clips while pulling the module away from the mounting bracket.

(6) Slide the memory seat module off of the two mounting bracket slide tabs.

INSTALLATION

(1) Slide the memory seat module onto the two mounting bracket slide tabs. Be certain that the two snap clips that are molded into the lower side of the memory seat module are fully engaged in the holes in riser portion of the stepped mounting bracket.

(2) Position the memory seat module and mounting bracket unit to the front of the power seat track unit.

(3) Reconnect the two power seat wire harness connectors to the memory seat module connector receptacles.

(4) Position the memory seat module mounting bracket over the two forward studs on the upper mounting rails of the power seat track.

(5) Install the driver side front bucket seat onto the power seat track unit. Refer to **Bucket Seat Track Adjuster** in the Removal and Installation section of Group 23 - Body for the procedures.

(6) Reconnect the battery negative cable.

NOTE: Following installation, it will be necessary to initialize the Memory Seat Module (MSM) or Memory Heated Seat Module (MHSM). In order to function properly, the MSM or MHSM must "learn" the sensor values of each of the power seat motor position transducers in each of the adjuster hard stop positions. This is done by performing the "Reset Guard Band" procedure using a DRB scan tool and the proper Diagnostic Procedures manual.

WARNING: THE "RESET GUARD BAND" PROCEDURE WILL CAUSE THE DRIVER SIDE FRONT SEAT TO AUTOMATICALLY ADJUST TO EACH OF ITS TRAVEL LIMITS. BE CERTAIN THAT NO ONE IS SEATED IN THE VEHICLE AND THAT THERE IS NOTHING IN THE VEHICLE THAT WILL OBSTRUCT SEAT MOVEMENT. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN PERSONAL INJURIES AND/OR VEHICLE DAMAGE.

MEMORY SWITCH

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the trim panel from the driver side front door. Refer to **Front Door Trim Panel** in the Removal and Installation section of Group 23 - Body for the procedures.

REMOVAL AND INSTALLATION (Continued)

(3) Disconnect the memory switch wire harness connector from the driver door module connector receptacle.

(4) Remove the two screws that secure the memory switch to the back of the driver side front door trim panel.

(5) Remove the memory switch from the back of the driver side front door trim panel.

INSTALLATION

(1) Position the memory switch onto the back of the driver side front door trim panel.

(2) Install and tighten the two screws that secure the memory switch to the back of the driver side front door trim panel. Tighten the screws to 2.2 N·m (20 in. lbs.).

(3) Reconnect the memory switch wire harness connector to the driver door module connector receptacle.

(4) Install the trim panel onto the driver side front door. Refer to **Front Door Trim Panel** in the Removal and Installation section of Group 23 - Body for the procedures.

(5) Reconnect the battery negative cable.

POWER WINDOW SYSTEMS

CONTENTS

DESCRIPTION AND OPERATION

POWER WINDOW SYSTEM

DESCRIPTION

Power operated driver side and passenger side front and rear door windows are standard factory-installed equipment on this model. The power window system allows each of the door windows to be raised or lowered electrically by operating a switch on the trim panel for that door. Additionally, the master switches on the driver side front door trim panel allow of the windows to be operated from the driver seat position. A power window lockout switch on the driver side front door trim panel will allow the driver to disable all of the passenger door window switches.

The power window system operates on ignition switched battery current supplied through a fuse in the junction block, only when the ignition switch is in the On position. However, a unique feature of this system will allow the power windows to be operated for up to forty-five seconds after the ignition switch is turned to the Off position, or until a front door is opened, whichever occurs first.

An auto-down feature allows the driver side front door window to be lowered all the way, even if the window switch is released. The driver side front door window switch must be depressed in the down direction to a second detent to begin an auto-down event. Depressing the switch again in any direction will stop the window movement and cancel the auto-down event.

This group covers the following components of the power window system:

- Power window switches
- Power window motors.

Certain functions and features of the power window system rely upon resources shared with other electronic modules in the vehicle over the Programmable Communications Interface (PCI) data bus network. The PCI data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, internal controller hardware, and component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities. For diagnosis of these electronic modules or of the PCI data bus network, the use of a DRB scan tool and the proper Diagnostic Procedures manual are recommended.

The other electronic modules that may affect power window system operation are as follows:

- **Body Control Module (BCM)** - Refer to **Body Control Module** in the Description and Operation section of Group 8E - Instrument Panel Systems for more information.
- **Driver Door Module (DDM)** - Refer to **Door Module** in the Power Lock System section of Group 8P - Power Lock Systems for more information.
- **Passenger Door Module (PDM)** - Refer to **Door Module** in the Power Lock System section of Group 8P - Power Lock Systems for more information.

This group covers diagnosis and service of only the electrical components in the power window system. For service of mechanical components, such as the regulator, lift plate, window tracks, or glass refer to Group 23 - Body. Refer to **Power Windows** in the Contents of Group 8W - Wiring Diagrams for complete circuit diagrams. Following are general descriptions of the major components in the power window system.

OPERATION

The power window system includes the Driver Door Module (DDM) and Passenger Door Module (PDM), which are mounted in their respective front door, the rear door power window switches mounted on the rear doors, and the power window motors mounted to the window regulator in each door. The DDM houses four master power window switches, the

DESCRIPTION AND OPERATION (Continued)

power window lockout switch and the control logic for the driver side front and rear door power windows. The PDM houses the passenger side front door power window switch and the control logic for the passenger side front and rear door power windows.

When a master power window switch on the DDM is used to operate a passenger side power window, the DDM sends the window positioning messages to the PDM over the Programmable Communications Interface (PCI) data bus. The PDM responds to these messages by sending control outputs to move the passenger side power window motors. In addition, when the power window lockout switch in the DDM is actuated to disable power window operation, this is accomplished through a lockout message sent to the PDM over the PCI data bus.

The Body Control Module (BCM) also supports and controls certain features of the power window system. The BCM receives a hard wired input from the ignition switch. The programming in the BCM allows it to process the information from this input and send ignition switch status messages to the DDM and the PDM over the PCI data bus. The DDM and PDM use this information and hard wired inputs from the front door ajar switches to control the lighting of the power window switch lamps, and to control the operation of the power window after ignition-off feature.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the power window system.

POWER WINDOW SWITCH

DESCRIPTION

The power window motors are controlled by a two-way momentary switch mounted on the trim panel of each passenger door, and four two-way momentary switches on the driver side front door trim panel. The driver side front door trim panel also has a two-position power window lockout switch. Each power window switch, except the lockout switch, is illuminated by a Light-Emitting Diode (LED) that is integral to the switch paddle.

The front door power window switches and the power window lockout switch are integral to the Driver Door Module (DDM) or Passenger Door Module (PDM), respectively. The front door power window switches and their lamps cannot be adjusted or repaired and, if faulty or damaged, the entire DDM or PDM unit must be replaced. The rear door power window switches and their lamps cannot be adjusted or repaired but, if faulty or damaged, only the affected rear door power window switch must be replaced. Refer to **Door Module** in the Power Lock System section of Group 8P - Power Lock Systems for the DDM and PDM service procedures.

OPERATION

The front door power window switches provide an up or down (or lock and unlock signal in the case of the lockout switch) to the door module circuitry. The Driver Door Module (DDM) circuitry controls the output to the driver side front and rear door power window motors, and supplies electrical current as required for the stand-alone operation of the driver side rear door power window switch. The Passenger Door Module (PDM) circuitry controls the output to the passenger side front and rear door power window motors, and supplies electrical current as required for the stand-alone operation of the passenger side rear door power window switch.

When a DDM-integrated master power window switch for a passenger side window is actuated, or when the power window lockout switch is actuated to disable the passenger door power windows, the DDM circuitry sends a message to the PDM over the Programmable Communications Interface (PCI) data bus to control the output to that power window motor(s).

The power window switch for the driver side front door power window has two detent positions in the Down direction. The first detent provides normal power window down operation. If this switch is depressed to the second detent, the Auto Down circuitry of the DDM is activated. The Auto-Down circuitry will automatically move the driver side front door window to its fully lowered position, even if the power window switch is released. The Auto-Down event will be automatically cancelled and the window movement will be stopped if the DDM circuitry detects a second input from the driver side front door power window switch, in either direction.

Each power window switch, except the lockout switch, is illuminated by a Light-Emitting Diode (LED) when the ignition switch is turned to the On position. However, when the lockout switch is placed in the Lock position, the LED for the locked-out front and rear passenger door power window switches is turned off.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the power window switches.

POWER WINDOW MOTOR

DESCRIPTION

Power operated front and rear door windows are standard equipment on this model. Each door has a permanent magnet reversible electric motor with an integral right angle gearbox mechanism that operates the window regulator. In addition, each power

DESCRIPTION AND OPERATION (Continued)

window motor is equipped with an integral self-resetting circuit breaker to protect the motor from overloads.

(1) The power window motor gearbox housing is secured to the window regulator drum housing with screws. The window regulators used in all four doors are single vertical post cable-and-drum type. A molded plastic slider guided by the post is driven by the regulator cables. The slider raises and lowers the window glass through a steel lift plate attachment. Front and rear glass channels within each door guide and stabilize each end of the glass.

The power window motor and gearbox assembly cannot be repaired and, if faulty or damaged, the entire power window motor and gearbox unit must be replaced. The window regulators are available for service. Refer to **Front Door Window Regulator** or **Rear Door Window Regulator** in the Removal and Installation section of Group 23 - Body for the regulator service procedures.

OPERATION

A positive and negative battery connection to the two motor terminals will cause the power window motor to rotate in one direction. Reversing the current through these same two connections will cause the motor to rotate in the opposite direction.

When the power window motor operates, it rotates the regulator cable drum through its gearbox. The window regulator cable drum is connected through two cables to the plastic slider on the vertical post. As the cable drum rotates, it lets cable out on one side of the drum, and takes cable in on the other side of the drum. The changes in cable length move the slider up or down the vertical post, raising or lowering the window glass.

If the window regulator or window glass bind, encounter obstructions, or reach their travel limits it overloads the power window motor. The overloading condition causes the power window motor self-resetting circuit breaker to open, which stops the motor from running.

DIAGNOSIS AND TESTING

POWER WINDOW SYSTEM

Following are tests that will help to diagnose the hard wired components and circuits of the power window system. However, these tests may not prove conclusive in the diagnosis of this system. In order to obtain conclusive testing of the power window system, the Programmable Communications Interface (PCI) data bus network and all of the electronic modules that provide inputs to, or receive outputs from the power window system components must be checked.

The most reliable, efficient, and accurate means to diagnose the power window system requires the use of a DRB scan tool and the proper Diagnostic Procedures manual. The DRB scan tool can provide confirmation that the PCI data bus is functional, that all of the electronic modules are sending and receiving the proper messages on the PCI data bus, and that the power window motors are being sent the proper hard wired outputs by the door modules for them to perform their power window system functions.

For complete circuit diagrams, refer to **Power Windows** in the Contents of Group 8W - Wiring Diagrams.

ALL WINDOWS INOPERATIVE

(1) Check the operation of the power lock switch on the driver side front door. If all of the doors lock and unlock, but none of the power windows operate, use a DRB scan tool and the proper Diagnostic Procedures manual to check the Body Control Module (BCM), the Driver Door Module (DDM) and the PCI data bus for proper operation. If not OK, go to Step 2.

(2) Check the operation of the power lock switch on the passenger side front door. If the passenger doors lock and unlock, but the driver side front door does not, go to Step 5. If all of the power locks and power windows are inoperative from both front doors, go to Step 3.

(3) Check the fused B(+) fuse in the Power Distribution Center (PDC). If OK, go to Step 4. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(4) Check for battery voltage at the fused B(+) fuse in the PDC. If OK, go to Step 5. If not OK, repair the open fused B(+) circuit to the battery as required.

(5) Disconnect and isolate the battery negative cable. Remove the trim panel from the driver side front door. Disconnect the 15-way door wire harness connector from the DDM connector receptacle. Check for continuity between the ground circuit cavity of the 15-way door wire harness connector for the DDM and a good ground. There should be continuity. If OK, go to Step 6. If not OK, repair the open ground circuit to ground as required.

(6) Reconnect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the 15-way door wire harness connector for the DDM. If OK, replace the faulty DDM. If not OK, repair the open fused B(+) circuit to the fuse in the PDC as required.

PASSENGER SIDE FRONT AND REAR WINDOWS INOPERATIVE

If the driver side front and rear power windows operate, but the passenger side front and rear do not,

DIAGNOSIS AND TESTING (Continued)

use a DRB scan tool and the proper Diagnostic Procedures manual to check the PCI data bus for proper operation.

ONE WINDOW INOPERATIVE

The window glass and regulator mechanism must be free to slide up and down for the power window motor to function properly. If the window glass and regulator is not free to move up and down, the motor will overload and trip the integral circuit breaker. To determine if the window glass and regulator are free, disconnect the regulator plate from the glass. Then slide the window up and down by hand.

There is an alternate method to check if the window glass and regulator mechanism is free. Position the glass between the up and down stops. Then, shake the glass in the door. Check that the glass can be moved slightly from side to side, front to rear, and up and down. Then check that the glass is not bound tight in the tracks.

If the window glass and regulator mechanism is free, refer to **Door Module** in the Diagnosis and Testing section of this group. If the glass is not free, inspect the window glass mounting and operating hardware for damage or improperly installed components. Refer to **Group 23 - Body** to check for proper installation or damage of the window glass mounting and operating hardware.

DOOR MODULE

NOTE: The following tests may not prove conclusive in the diagnosis of this component. The most reliable, efficient, and accurate means to diagnose this component requires the use of a DRB scan tool and the proper Diagnostic Procedures manual.

If the problem being diagnosed is a rear door window that does not operate from the rear door switch, but does operate from the master switch on the driver side front door, refer to **Rear Door Power Window Switch** in the Diagnosis and Testing section of this group. If the problem is a passenger side front or rear window that operates from the switch on that door, but does not operate from the master switch on the driver side front door, use a DRB scan tool and the proper Diagnostic Procedures manual to diagnose the circuitry of both door modules and the PCI data bus. For complete circuit diagrams, refer to **Power Windows** in Group 8W - Wiring Diagrams.

(1) Disconnect and isolate the battery negative cable. Remove the trim panel from the front door, but do not disconnect the door wire harness connectors from the door module. Go to Step 2.

(2) Check the 15-way door wire harness connector for the door module to see that it is fully seated in the door module connector receptacle. If OK, go to Step 3. If not OK, properly connect the 15-way door wire harness connector for the door module to the door module connector receptacle.

(3) Disconnect the 15-way door wire harness connector from the door module connector receptacle. Check for continuity between the ground circuit cavity of the 15-way door wire harness connector for the door module and a good ground. There should be continuity. If OK, go to Step 4. If not OK, repair the open ground circuit to ground as required.

(4) Connect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the 15-way door wire harness connector for the door module. If OK, go to Step 5. If not OK, repair the open fused B(+) circuit to the fuse in the Power Distribution Center (PDC) as required.

(5) If the inoperative window is on a front door, go to Step 6. If the inoperative window is on a rear door go to Step 9.

(6) Disconnect and isolate the battery negative cable. Disconnect the door wire harness connector from the inoperative power window motor wire harness connector. Check for continuity between the front window driver up circuit cavity of the 15-way door wire harness connector for the door module and a good ground. Repeat the check for the front window driver down circuit. In each case there should be no continuity. If OK, go to Step 7. If not OK, repair the shorted front window driver up or down circuit as required.

(7) Check for continuity between the front window driver up circuit cavities of the 15-way door wire harness connector for the door module and the door wire harness connector for the power window motor. Repeat the check for the front window driver down circuit. In each case there should be continuity. If OK, go to Step 8. If not OK, repair the open front window driver up or down circuit as required.

(8) Reconnect the 15-way door wire harness connector back into the door module connector receptacle. Connect the battery negative cable. Connect the probes of a reversible DC digital voltmeter to the door wire harness connector for the power window motor. Observe the voltmeter while actuating the switch for that window in the up and down directions. There should be battery voltage for as long as the switch is held in both the up and down positions, and no voltage in the neutral position. If OK, refer to **Power Window Motor** in the Diagnosis and Testing section of this group. If not OK, replace the faulty door module.

(9) Check the rear door power window switch continuity. Refer to **Rear Door Power Window Switch** in the Diagnosis and Testing section of this group. If OK, go to Step 10. If not OK, replace the faulty rear door power window switch.

DIAGNOSIS AND TESTING (Continued)

(10) Disconnect and isolate the battery negative cable. Reconnect the door wire harness connector to the rear door power window switch. Disconnect the door wire harness connector from the inoperative power window motor wire harness connector. Check for continuity between the rear window driver up circuit cavity of the 15-way door wire harness connector for the door module and a good ground. Repeat the check for the rear window driver down circuit. In each case there should be no continuity. If OK, go to Step 11. If not OK, repair the shorted rear window driver up or down circuit as required.

(11) Check for continuity between the rear window driver up circuit cavities of the 15-way door wire harness connector for the door module and the power window motor wire harness connector. Repeat the check for the rear window driver down circuit. In each case there should be continuity. If OK, go to Step 12. If not OK, repair the open rear window driver up or down circuit as required.

NOTE: The door module feeds battery current to both terminals of the rear door power window motors when the power window lockout switch is in the Unlock position, until the master window switch on the driver side front door is actuated. The door module feeds ground to both terminals of the rear door power window motor when the power window lockout switch is in the Lock position, until the master window switch on the driver side front door is actuated.

(12) Reconnect the 15-way door wire harness connector for the door module to the door module connector receptacle. Connect the battery negative cable. Check for battery voltage at each cavity in the door wire harness connector for the power window motor. Each cavity should have battery voltage when the power window switch is in the neutral position. Each cavity should also have battery voltage in one other switch position, either up or down, and zero volts with the switch in the opposite position. If OK, refer to **Power Window Motor** in the Diagnosis and Testing section of this group. If not OK, replace the faulty door module.

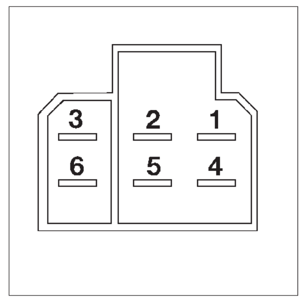
REAR DOOR POWER WINDOW SWITCH

The diagnosis found here applies only to the rear door power window switches. For diagnosis of the front door power window switches, refer to **Power Window System - Door Module** in the Diagnosis and Testing section of this group. If the problem being diagnosed is an inoperative power window switch illumination lamp, but the power window switch operates as designed, replace the faulty rear door power window switch. For complete circuit diagrams, refer to **Power Windows** in Group 8W - Wiring Diagrams.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the power window switch from the rear door trim panel. Refer to **Rear Door Power Window Switch** in the Removal and Installation section of this group.

(3) Check the rear door power window switch continuity as shown in the Rear Door Power Window Switch Continuity chart (Fig. 1). If OK, refer to **Power Window Motor** in the Diagnosis and Testing section of this group. If not OK, replace the faulty rear door power window switch.



SWITCH POSITION	CONTINUITY BETWEEN
LED	3 AND 6
OFF	1 AND 2
OFF	4 AND 5
FORWARD	1 AND 2
FORWARD	5 AND 6
REARWARD	2 AND 6
REARWARD	4 AND 5

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Fig. 1 Rear Door Power Window Switch Continuity

POWER WINDOW MOTOR

Before you proceed with this diagnosis, confirm proper switch operation. Refer to **Power Window System - Door Module** or **Rear Door Power Window Switch** in the Diagnosis and Testing section of this group. For complete circuit diagrams, refer to **Power Windows** in Group 8W - Wiring Diagrams.

(1) Remove the trim panel from the door with the inoperative power window. Refer to **Front Door Trim Panel** or **Rear Door Trim Panel** in the Removal and Installation section of Group 23 - Body for the procedures.

(2) Disconnect the door wire harness connector from the power window motor wire harness connector. Apply battery current to one cavity of the power window motor wire harness connector, and apply ground to the other cavity of the connector. The power window motor should operate in one direction.

DIAGNOSIS AND TESTING (Continued)

Remember, if the window is in the full up or full down position, the motor will not operate in that direction by design. If OK, go to Step 3. If not OK, replace the faulty power window motor.

(3) Reverse the battery and ground connections to the two cavities of the power window motor wire harness connector. The power window motor should now operate in the other direction. Remember, if the window is in the full up or full down position, the motor will not operate in that direction by design. If OK, go to Step 4. If not OK, replace the faulty power window motor.

(4) If the power window motor operates in both directions, check the operation of the window glass and regulator mechanism through its complete up and down travel. There should be no binding or sticking of the window glass or regulator mechanism through the entire travel range. If not OK, refer to **Group 23 - Body** to check for proper installation or damage of the window glass mounting and operating hardware.

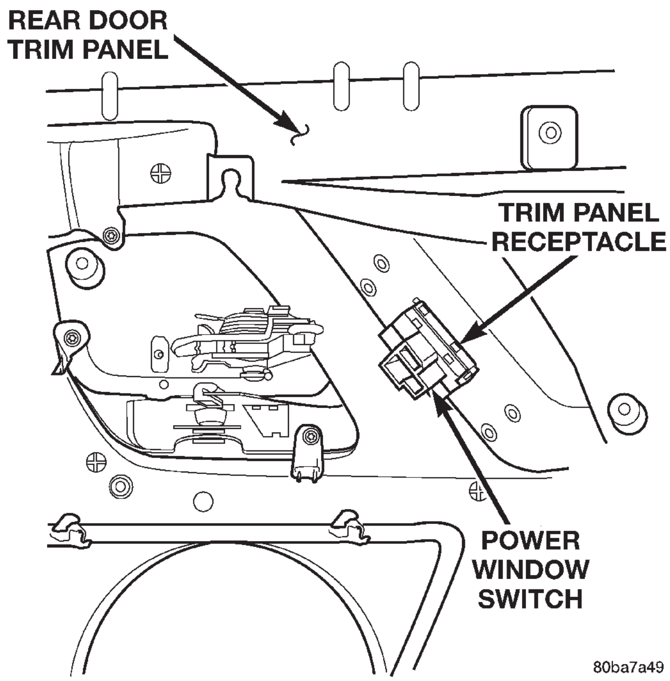


Fig. 2 Rear Door Power Window Switch Remove/Install

REMOVAL AND INSTALLATION

REAR DOOR POWER WINDOW SWITCH

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the trim panel from the rear door. Refer to **Rear Door Trim Panel** in the Removal and Installation section of Group 23 - Body for the procedures.

(3) Using a trim stick or another suitable wide flat-bladed tool, gently pry the sides of the switch receptacle on the back of the rear door trim panel away from the perimeter of the power window switch to release the switch from the receptacle (Fig. 2).

(4) Remove the power window switch from the rear door trim panel switch receptacle.

INSTALLATION

(1) Position the power window switch to the rear door trim panel switch receptacle.

(2) Press firmly and evenly on the back of the power window switch until it snaps into rear door trim panel switch receptacle.

(3) Install the trim panel onto the rear door. Refer to **Rear Door Trim Panel** in the Removal and Installation section of Group 23 - Body for the procedures.

(4) Reconnect the battery negative cable.

POWER WINDOW MOTOR

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the window regulator from the door. Refer to **Front Door Window Regulator** or **Rear Door Window Regulator** in the Removal and Installation section of Group 23 - Body for the procedures.

(3) Place the window regulator on a suitable work surface and remove the screws that secure the power window motor to the window regulator.

(4) Remove the power window motor from the window regulator.

INSTALLATION

(1) Position the power window motor onto the window regulator.

(2) Install and tighten the screws that secure the power window motor to the window regulator. Tighten the screws to 9 N·m (80 in. lbs.).

(3) Install the window regulator onto the door. Refer to **Front Door Window Regulator** or **Rear Door Window Regulator** in the Removal and Installation section of Group 23 - Body for the procedures.

(4) Reconnect the battery negative cable.

POWER MIRROR SYSTEMS

CONTENTS

OUTSIDE POWER MIRRORS

INDEX

DESCRIPTION AND OPERATION

POWER MIRROR SYSTEM

DESCRIPTION

Driver and passenger side power operated outside rear view mirrors are standard factory-installed equipment on this model. The power mirror system allows the driver to adjust both outside mirrors electrically from the driver seat position by operating a switch on the driver side front door trim panel. The power mirror system receives non-switched battery current through a fuse in the Power Distribution Center (PDC) so that the power mirrors remain operational, regardless of the ignition switch position.

The standard equipment power operated outside rear view mirrors are also equipped with the heated mirror system, which will only operate when the ignition switch is in the On position and the rear window defogger switch is turned on. When the rear window defogger switch is in the On position, electric heater grids on the rear window glass and behind both outside rear view mirror glasses are energized. These electric heater grids produce heat to help clear the rear window glass and outside rear view mirrors of ice, snow, or fog. Refer to **Outside Mirror Heating Grid** in the Rear Window Defogger System section of Group 8N - Electrically Heated Systems for more information on this feature.

A driver side automatic dimming outside mirror that dims the mirror to reduce the glare of bright lights approaching the vehicle from behind, and a memory system that automatically positions the power mirrors for two different drivers are optional factory-installed equipment on this model. Refer to **Automatic Dimming Outside Mirror** in the Inside Power Mirrors section of this group for more information on the automatic dimming outside mirror. Refer to **Memory System** in the Memory System section of Group 8R - Power Seat Systems for more information on the memory system.

This group covers the following components of the power mirror system:

- Power mirrors
- Power mirror switch.

Certain functions and features of the power mirror system rely upon resources shared with other electronic modules in the vehicle over the Programmable Communications Interface (PCI) data bus network. The PCI data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, internal controller hardware, and component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities. For diagnosis of these electronic modules or of the PCI data bus network, the use of a DRB scan tool and the proper Diagnostic Procedures manual are recommended.

DESCRIPTION AND OPERATION (Continued)

The other electronic modules that may affect power mirror system operation are as follows:

- **Body Control Module (BCM)** - Refer to **Body Control Module** in the Description and Operation section of Group 8E - Instrument Panel Systems for more information.
- **Driver Door Module (DDM)** - Refer to **Door Module** in the Power Lock System section of Group 8P - Power Lock Systems for more information.
- **Passenger Door Module (PDM)** - Refer to **Door Module** in the Power Lock System section of Group 8P - Power Lock Systems for more information.

Refer to **Power Mirrors** in the Contents of Group 8W - Wiring Diagrams for complete circuit diagrams. Following are general descriptions of the major components in the power mirror system.

OPERATION

The Driver Door Module (DDM) and the Passenger Door Module (PDM) each contain the power mirror control logic for the mirror on its respective door. The DDM also houses the power mirror switch. Each door module controls the positioning of its respective outside mirror through hard wired outputs to that mirror. When the power mirror switch on the DDM is used to position the passenger side outside mirror, the DDM sends mirror positioning messages to the PDM over the Programmable Communications Interface (PCI) data bus. The PDM responds to these messages by sending control outputs to move the passenger side mirror accordingly.

Both the PDM and DDM respond to the defogger switch status messages sent by the Body Control Module (BCM) over the PCI data bus to control the electric heater grids of their respective mirrors. Refer to **Outside Mirror Heating Grid** in the Rear Window Defogger System section of Group 8N - Electrically Heated Systems for more information on this feature.

On models equipped with the optional memory system, each door module also receives a hard wired input from the two power mirror motor position potentiometers that are integral to each power mirror. Each door module then stores the Driver 1 and Driver 2 mirror position information for its respective mirror. When the DDM receives a Driver 1 or Driver 2 memory recall message from the memory switch on the driver side front door trim panel or from the Remote Keyless Entry (RKE) receiver in the PDM, the DDM positions the driver side mirror and sends a memory recall message back to the PDM over the PCI data bus to position the passenger side mirror.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the power mirror system.

POWER MIRROR

DESCRIPTION

Mechanically folding, power operated outside rear view mirrors are standard equipment on this model. Each power mirror housing contains two electric motors, two drive mechanisms, an electric heating grid, the mirror glass case and the mirror glass. One motor and drive controls mirror up-and-down (vertical) movement, and the other controls right-and-left (horizontal) movement. If the vehicle is equipped with the optional memory system, each mirror head also contains two position potentiometers. One position potentiometer monitors the vertical mirror motor, and the other monitors the horizontal mirror motor.

An optional driver side automatic dimming mirror is able to automatically change its reflectance level. This mirror is controlled by the circuitry of the automatic day/night inside rear view mirror. A thin layer of electrochromic material between two pieces of conductive glass make up the face of the mirror. Refer to **Automatic Dimming Outside Mirror** in the Inside Power Mirrors section of this group for more information on this feature.

The power mirror unit cannot be repaired. Only the mirror glass and glass case are serviced separately. The replacement mirror glass is supplied with an instruction sheet that details the recommended replacement procedure. If any other component of the power mirror unit is faulty or damaged, the entire power mirror unit must be replaced.

OPERATION

Each of the two outside power mirrors includes two reversible electric motors that are secured within the power mirror housing. Each motor moves the mirror case and glass through an integral drive unit. When a power mirror motor is supplied with battery current and ground, it moves the mirror case and glass through its drive unit in one direction. When the battery current and ground feeds to the motor are reversed, it moves the mirror case and glass in the opposite direction.

The power mirrors are equipped with a standard equipment electric heating grid that is applied to the back of each outside rear view mirror glass. When an electrical current is passed through the resistor wire of the heating grid, it warms the mirror glass. Refer to **Outside Mirror Heating Grid** in the Rear Window Defogger System section of Group 8N - Electrically Heated Systems for more information on the operation of the heated mirrors and the rear window defogger system.

If the driver side mirror is equipped with the automatic dimming outside mirror option, two photocell

DESCRIPTION AND OPERATION (Continued)

sensors on the inside rear view mirror are used to monitor light levels and adjust the reflectance of both the inside and driver side outside mirrors. This change in reflectance helps to reduce the glare of headlamps approaching the vehicle from the rear. Refer to **Automatic Dimming Outside Mirror** in the Inside Power Mirrors section of this group for more information on this feature.

If the vehicle is equipped with the optional memory system, the Driver Door Module (DDM) and the Passenger Door Module (PDM) store the mirror position information as monitored through the mirror motor position potentiometers. When the memory system requests a recall of the stored mirror position, the DDM and the PDM are able to duplicate the stored mirror positions by moving the mirror motors until the potentiometer readings match the stored values.

POWER MIRROR SWITCH

DESCRIPTION

Both the right and left power outside mirrors are controlled by a single multi-function switch unit located on the driver side front door trim panel. The power mirror switch unit includes a three-position rocker selector switch and four momentary directional push button switches.

The power mirror switch unit is integral to the Driver Door Module (DDM). The power mirror switch cannot be repaired or adjusted and, if faulty or damaged, the entire DDM unit must be replaced. Refer to **Door Module** in the Power Lock System section of Group 8P - Power Lock Systems for the DDM service procedures.

OPERATION

The power mirror selector switch is moved right (right mirror control), left (left mirror control), or center to turn the power outside mirror system off. When the selector switch is in the right mirror control or left mirror control position, one of the four directional control buttons is depressed to control movement of the selected mirror up, down, right, or left. When the selector switch is in the Off position, depressing any of the directional switches will not change either mirror position.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the power mirror switches.

DIAGNOSIS AND TESTING

POWER MIRROR SYSTEM

Following are tests that will help to diagnose the hard wired components and circuits of the power mirror system. However, these tests may not prove conclusive in the diagnosis of this system. In order to obtain conclusive testing of the power mirror system, the Programmable Communications Interface (PCI) data bus network and all of the electronic modules that provide inputs to, or receive outputs from the power mirror system components must be checked.

The most reliable, efficient, and accurate means to diagnose the power mirror system requires the use of a DRB scan tool and the proper Diagnostic Procedures manual. The DRB scan tool can provide confirmation that the PCI data bus is functional, that all of the electronic modules are sending and receiving the proper messages on the PCI data bus, that the power mirror motors are being sent the proper hard wired outputs, and that the mirror position potentiometers are returning the proper outputs to the door modules for them to perform their power mirror system functions.

POWER MIRROR

For complete circuit diagrams, refer to **Power Mirrors** in the Contents of Group 8W - Wiring Diagrams.

BOTH MIRRORS INOPERATIVE

(1) Check the operation of the power lock switch on the driver side front door. If all of the doors lock and unlock, replace the faulty Driver Door Module (DDM). If not OK, go to Step 2.

(2) Check the operation of the power lock switch on the passenger side front door. If all of the doors lock and unlock, replace the faulty DDM. If not OK, go to Step 3.

(3) Check the fused B(+) fuse in the Power Distribution Center (PDC). If OK, go to Step 4. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(4) Check for battery voltage at the fused B(+) fuse in the PDC. If OK, go to Step 5. If not OK, repair the open fused B(+) circuit to the battery as required.

(5) Disconnect and isolate the battery negative cable. Remove the trim panel from the driver side front door. Disconnect the 15-way door wire harness connector from the DDM connector receptacle. Check for continuity between the ground circuit cavity of the 15-way door wire harness connector for the DDM and a good ground. There should be continuity. If OK, go to Step 6. If not OK, repair the open ground circuit to ground as required.

DIAGNOSIS AND TESTING (Continued)

(6) Reconnect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the 15-way door wire harness connector for the DDM. If OK, replace the faulty DDM. If not OK, repair the open fused B(+) circuit to the fuse in the PDC as required.

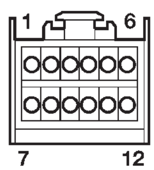
ONE MIRROR INOPERATIVE

(1) If the one inoperative mirror is on the passenger side, go to Step 2. If the one inoperative mirror is on the driver side, go to Step 3.

(2) Check if the passenger front door will lock and unlock using the power lock switch on the driver side front door. If OK, go to Step 3. If not OK, go to Step 6.

(3) Disconnect and isolate the battery negative cable. Remove the trim panel from the front door. Disconnect the 12-way mirror wire harness connector from the door wire harness connector.

(4) Using two jumper wires, test the mirror as shown in the Mirror Test chart (Fig. 1). If the mirror tests OK, go to Step 5. If the mirror does not test OK, replace the faulty mirror.



POWER MIRROR TEST		
APPLY 12 VOLTS TO:	APPLY GROUND TO:	MIRROR REACTION
DRIVER SIDE		
6	12	LEFT
12	6	RIGHT
11	12	UP
12	11	DOWN
PASSENGER SIDE		
1	7	LEFT
7	1	RIGHT
8	7	UP
7	8	DOWN

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Fig. 1 Mirror Test

(5) Disconnect the 12-way door wire harness connector from the door module connector receptacle. Check all of the circuits of the door wire harness between the connector for the mirror and the connector for the door module for opens or shorts. If all of the circuits are OK, replace the faulty door module. If any of the circuits are not OK, repair the open or shorted circuit(s) as required.

(6) Use a DRB scan tool and the proper Diagnostic Procedures manual to test and repair the faulty Programmable Communications Interface (PCI) data bus communication between the two door modules.

NO MIRROR HEAT

If both mirror heaters are inoperative, refer to **Outside Mirror Heating Grid** in the Rear Window Defogger System section of Group 8N - Electrically Heated Systems.

(1) Disconnect and isolate the battery negative cable. Remove the front door trim panel on the side of the inoperative mirror heater.

(2) Disconnect the 12-way door wire harness connector from the door module connector receptacle. Check for continuity between the heater switched ground circuit cavity and the heater 12V supply circuit cavity of the 12-way door wire harness connector for the door module. There should be continuity. If OK, use a DRB scan tool and the proper Diagnostic Procedures manual to test the door module and the PCI data bus. If not OK, replace the faulty power mirror unit.

NO MIRROR DIMMING (Driver Side Only)

(1) Test the operation of the automatic day/night mirror. Refer to **Automatic Day/Night Mirror** in the Inside Power Mirrors section of this group. If OK, go to Step 2. If not OK, repair the automatic day/night mirror unit as required.

(2) Disconnect and isolate the battery negative cable. Remove the driver side front door trim panel.

(3) Disconnect the door wire harness connector from the power mirror wire harness connector. Connect a voltmeter between the electrochromatic (+) and electrochromatic (–) circuit cavities of the door wire harness connector for the power mirror. Turn on the automatic day/night mirror system while observing the voltmeter. A voltmeter reading of 1.45 ± 0.05 volts indicates a proper dimming signal is being received at the door wire harness connector for the power mirror. If OK, replace the faulty power mirror. If not OK, repair the shorted or open electrochromatic (+) or electrochromatic (–) circuit(s) to the automatic day/night mirror as required.

DIAGNOSIS AND TESTING (Continued)

NO MIRROR MEMORY

For diagnosis of the memory system, the use of a DRB scan tool and the proper Diagnostic Procedures manual are recommended. Refer to **Memory System** in the Memory System section of Group 8P - Power Seat Systems.

REMOVAL AND INSTALLATION

POWER MIRROR

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the trim panel from the front door. Refer to **Front Door Trim Panel** in the Removal and Installation section of Group 23 - Body for the procedures.

(3) Disconnect the power mirror wire harness connector from the door wire harness connector (Fig. 2).

(4) Remove the mirror flag seal from the inner door panel.

(5) Remove the three nuts that secure the power mirror mounting studs to the door flag.

(6) Remove the power mirror from the outside of the door.

INSTALLATION

(1) Position the power mirror onto the outside of the door.

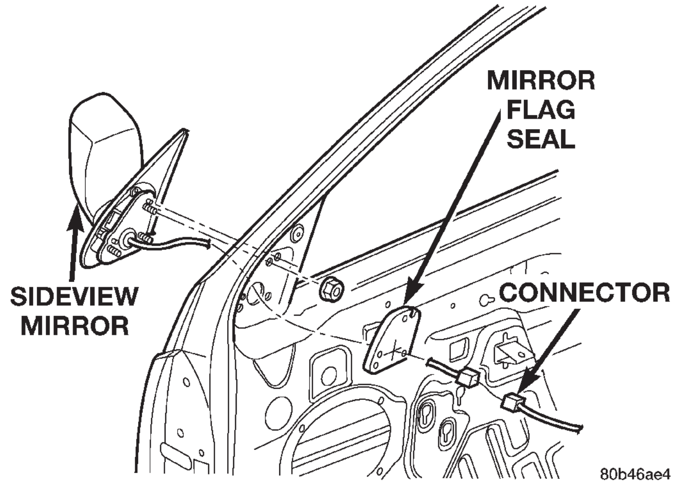


Fig. 2 Power Mirror Remove/Install

(2) Install and tighten the three nuts that secure the power mirror mounting studs to the door flag. Tighten the nuts to 7.4 N·m (65 in. lbs.).

(3) Install the mirror flag seal onto the inner door panel.

(4) Reconnect the power mirror wire harness connector to the door wire harness connector.

(5) Install the trim panel onto the front door. Refer to **Front Door Trim Panel** in the Removal and Installation section of Group 23 - Body for the procedures.

(6) Reconnect the battery negative cable.

INSIDE POWER MIRRORS

INDEX

DESCRIPTION AND OPERATION

AUTOMATIC DAY/NIGHT MIRROR SYSTEM

DESCRIPTION

An automatic day/night mirror system is an available factory-installed option on this model. The automatic dimming inside day/night rear view mirror system is a completely self-contained unit that replaces the standard equipment inside rear view mirror. This system will automatically change the reflectance of the inside rear view mirror to protect the driver from the unwanted headlight glare of trailing vehicles while driving at night. The automatic day/night inside mirror receives ignition switched battery current through a fuse in the junction block, and will only operate when the ignition switch is in the On position.

Vehicles equipped with the automatic day/night mirror system are also available with an optional factory-installed automatic dimming outside rear view mirror for the driver side of the vehicle. Refer to **Automatic Dimming Outside Mirror** in the Description and Operation section of this group for more information on this option.

The automatic day/night mirror sensitivity cannot be repaired or adjusted. If any component of this unit is faulty or damaged, the entire automatic day/night inside rear view mirror unit must be replaced. Refer to **Automatic Day/Night Mirror** in the Component Index of Group 8W - Wiring Diagrams for complete circuit diagrams.

OPERATION

The automatic day/night mirror switch allows the driver a manual control of whether the automatic dimming feature is operational. This switch is a momentary rocker-type switch located on the lower rear-facing surface of the mirror housing. When Auto is selected, a Light-Emitting Diode (LED) on the mirror housing just to the right of the switch illuminates to indicate that automatic day/night mirror is turned on. When Off is selected, the LED is turned off. The mirror also senses the backup lamp circuit, and will automatically disable its self-dimming feature whenever the transmission gear selector is in the Reverse position.

A thin layer of electrochromatic material between two pieces of conductive glass make up the face of the mirror. Two photocell sensors are used to monitor light levels and adjust the reflectance of the mirror. The ambient photocell sensor faces forward, to detect the outside light levels. The headlamp sensor is located on the mirror housing just to the left of the switch and facing rearward, to detect the light level received at the rear window side of the mirror. When the difference between the two light levels becomes too great (the light level received at the rear of the mirror is much higher than that at the front of the mirror), the mirror begins to darken.

On models with an optional driver side automatic dimming outside mirror, the signal to control the dimming of that mirror is generated by the automatic day/night inside rear view mirror circuitry. That signal is then delivered to the driver side outside rear view mirror on a hard wired circuit.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the automatic day/night mirror system.

AUTOMATIC DIMMING OUTSIDE MIRROR

DESCRIPTION

An automatic dimming outside rear view mirror is an available factory-installed option for the driver side of the vehicle, if the vehicle is also equipped with the automatic day/night inside rear view mirror. The automatic dimming outside mirror is completely controlled by the circuitry of the automatic day/night inside rear view mirror. The automatic dimming outside mirror will automatically change the reflectance of the driver side outside rear view mirror to protect the driver from the unwanted headlight glare of trailing vehicles while driving at night. The auto-

DESCRIPTION AND OPERATION (Continued)

matic dimming outside mirror will only operate when the ignition switch is in the On position.

The automatic dimming outside mirror sensitivity cannot be repaired or adjusted. If any component of this unit is faulty or damaged, the entire automatic dimming outside mirror unit must be replaced. Refer to **Power Mirror** in the Outside Power Mirrors section of this group for diagnosis and service of the automatic dimming outside mirror. Refer to **Automatic Day/Night Mirror** in the Component Index of Group 8W - Wiring Diagrams for complete circuit diagrams.

OPERATION

The automatic dimming outside mirror is operated by the same controls and circuitry as the automatic day/night mirror. When the automatic day/night mirror is turned on or off, the automatic dimming outside mirror is likewise turned on or off. Like in the automatic day/night mirror, a thin layer of electrochromatic material between two pieces of conductive glass make up the face of the automatic dimming outside mirror. However, the signal to control the dimming of the outside mirror is generated by the automatic day/night inside rear view mirror circuitry.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the automatic dimming outside mirror.

DIAGNOSIS AND TESTING

AUTOMATIC DAY/NIGHT MIRROR

For complete circuit diagrams, refer to **Automatic Day/Night Mirror** in the Component Index of Group 8W - Wiring Diagrams.

(1) Check the fused ignition switch output (run/start) fuse in the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run/start) fuse in the junction block. If OK, go to Step 3. If not OK, repair the open fused ignition switch output (run/start) circuit to the ignition switch as required.

(3) Disconnect the overhead wire harness connector from the automatic day/night mirror connector receptacle. Check for battery voltage at the fused ignition switch output (run/start) circuit cavity of the overhead wire harness connector for the automatic day/night mirror. If OK, go to Step 4. If not OK, repair the open fused ignition switch output (run/start) circuit to the fuse in the junction block as required.

(4) Turn the ignition switch to the Off position. Check for continuity between the ground circuit cavity of the overhead wire harness connector for the automatic day/night mirror and a good ground. There should be continuity. If OK, go to Step 5. If not OK, repair the open ground circuit to ground as required.

(5) Turn the ignition switch to the On position. Set the parking brake. Place the transmission gear selector lever in the Reverse position. Check for battery voltage at the backup lamp switch output circuit cavity of the overhead wire harness connector for the automatic day/night mirror. If OK, reconnect the overhead wire harness connector to the automatic day/night mirror connector receptacle and go to Step 6. If not OK, repair the open backup lamp switch output circuit as required.

(6) Place the transmission gear selector lever in the Neutral position. Place the automatic day/night mirror switch in the Auto (LED next to the switch is lighted) position (Fig. 1). Cover the forward facing ambient photocell sensor to keep out any ambient light.

NOTE: The ambient photocell sensor must be covered completely, so that no light reaches the sensor. Use a finger pressed tightly against the sensor, or cover the sensor completely with electrical tape.

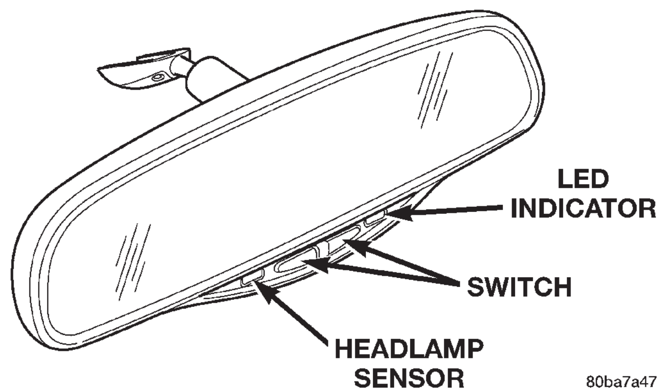


Fig. 1 Automatic Day/Night Mirror

(7) Shine a light into the rearward facing headlamp photocell sensor. The automatic day/night mirror should darken. If OK, go to Step 8. If not OK, replace the faulty automatic day/night mirror unit.

(8) With the mirror darkened, place the transmission gear selector lever in the Reverse position. The automatic day/night mirror should return to its normal reflectance. If not OK, replace the faulty automatic day/night mirror unit.

REMOVAL AND INSTALLATION

AUTOMATIC DAY/NIGHT MIRROR

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Disconnect the overhead wire harness connector from the automatic day/night mirror connector receptacle (Fig. 2).

(3) Remove the screw that secures the automatic day/night mirror to the support button on the windshield.

(4) Slide the automatic day/night mirror mounting base upwards far enough to clear the support button on the windshield.

(5) Remove the automatic day/night mirror from the support button on the windshield.

INSTALLATION

(1) Position the automatic day/night mirror above the support button on the windshield.

(2) Slide the automatic day/night mirror mounting base downwards over the support button on the windshield.

(3) Install and tighten the screw that secures the automatic day/night mirror to the support button on the windshield. Tighten the screw to 1.7 N·m (15 in. lbs.).

(4) Reconnect the overhead wire harness connector to the automatic day/night mirror connector receptacle.

(5) Reconnect the battery negative cable.

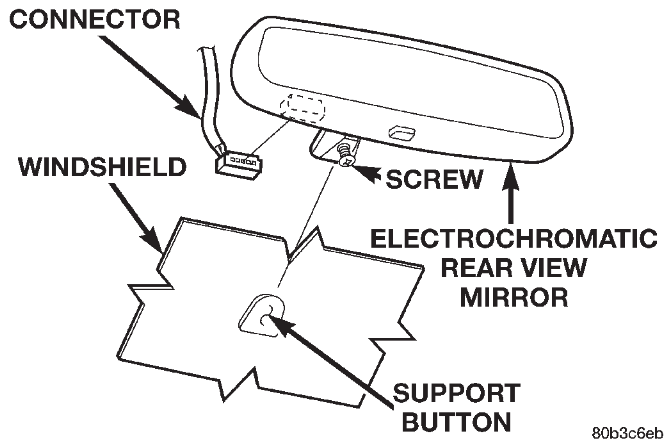


Fig. 2 Automatic Day/Night Mirror Remove/Install

CHIME/BUZZER WARNING SYSTEMS

CONTENTS

DESCRIPTION AND OPERATION

CHIME WARNING SYSTEM

DESCRIPTION

A chime warning system is standard factory-installed equipment on this model. The chime warning system is designed to provide an audible warning or feedback of various conditions that may require the attention or awareness of the vehicle operator. The chime warning system has access to both non-switched and ignition switched sources of battery current so that some audible warnings may occur at any time, while others may only occur with the ignition switch in the On or Accessory positions.

A Body Control Module (BCM) is used on this model to control and integrate many of the electronic functions and features included on the vehicle. One of the functions and features that the BCM supports is the chime warning system. The BCM contains a chime tone generator and control logic to perform the functions of the chime warning system. The BCM contains a central processing unit and interfaces with other modules in the vehicle on the Programmable Communications Interface (PCI) data bus network.

The chime warning system includes the following components:

- Body Control Module (BCM)
- Driver door ajar switch
- Driver seat belt switch
- Key-in ignition switch.

Refer to **Body Control Module** in the Description and Operation section of Group 8E - Instrument Panel Systems for more information on this component. Refer to **Body Control Module** in the Contents of Group 8W - Wiring Diagrams for complete circuit diagrams. Following are general descriptions of the remaining major components in the factory-installed chime warning system.

OPERATION

The chime warning system provides an audible indication to the vehicle operator under the following conditions:

- **Fasten Seat Belt Reminder -** If the driver side seat belt is not fastened with the ignition switch in the On position, a chime will sound for about six seconds.
- **Head Lamps On Warning -** If the head or park lamps are left on with the ignition switch Off and the driver side front door open, a chime will sound.
- **Key In Ignition Warning -** If the driver side front door is open while the key is in the ignition switch lock cylinder, a chime will sound.
- **Tactile Beep Support -** A beep tone is generated as audible confirmation that an Electronic Vehicle Information Center (EVIC) button was completely depressed, and/or that certain Sentry Key Immobilizer System (SKIS) functions have been completed.
- **Warning Indicator Chime -** An audible alert to the vehicle operator that supplements certain visual warning indications displayed by the Electro-Mechanical Instrument Cluster (EMIC) and/or the Electronic Vehicle Information Center (EVIC).

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the chime warning system.

The BCM uses hard wired inputs, internal programming, and PCI data bus chime request message inputs to decide when a chime tone is required. This group only covers the diagnosis and service of the hard wired inputs used by the BCM to determine that a chime tone should be generated. For diagnosis of the BCM, the PCI data bus, or the other electronic

DESCRIPTION AND OPERATION (Continued)

modules on the PCI data bus that send chime request messages to the BCM, the use of a DRB scan tool and the proper Diagnostic Procedures manual are recommended.

Refer to **Body Control Module** in the Removal and Installation section of Group 8E - Instrument Panel Systems for the BCM service procedures. The BCM can only be serviced by an authorized electronic repair station. See the latest version of the Chrysler Corporation Warranty Policies and Procedures manual for a current listing of authorized electronic repair stations.

DRIVER DOOR MODULE

The Driver Door Module (DDM) monitors the driver door ajar switch through a hard wired circuit. The DDM is programmed to send driver door ajar messages over the Programmable Communications Interface (PCI) data bus to the Body Control Module (BCM) and the Electronic Vehicle Information Center when it detects that the driver door is ajar. The BCM and the EVIC are programmed to determine if any other monitored vehicle conditions are present that will require a chime tone (BCM) or chime tone request message (EVIC) to be generated.

Refer to **Door Module** in the Description and Operation section of Group 8P - Power Lock Systems for more information on the DDM. Refer to **Body Control Module** in the Description and Operation section of Group 8E - Instrument Panel Systems for more information on this component. Refer to **Electronic Vehicle Information Center** in the Description and Operation section of Group 8V - Overhead Console Systems for more information on this component.

ELECTRO-MECHANICAL INSTRUMENT CLUSTER

The Electro-Mechanical Instrument Cluster (EMIC) is also supported by the chime warning system. The EMIC is programmed to send chime request messages over the Programmable Communications Interface (PCI) data bus to the Body Control Module (BCM) when it detects the following conditions:

- Airbag indicator lamp illuminated
- Anti-lock Brake System (ABS) lamp illuminated
- Check gauges lamp illuminated for one of the following conditions:
- Charging system voltage high or low
- Engine coolant temperature high
- Engine coolant temperature critical
- Engine oil pressure low
- Low fuel warning lamp illuminated (customer programmable)
- Malfunction indicator (Check Engine) lamp illuminated
- Transmission oil temperature warning lamp illuminated.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the EMIC. Refer to **Instrument Cluster** in the Description and Operation section of Group 8E - Instrument Panel Systems for more information on the EMIC.

ELECTRONIC VEHICLE INFORMATION CENTER

The Electronic Vehicle Information Center (EVIC) uses the chime warning system for two different kinds of support. In addition to requesting chime tones from the Body Control Module (BCM) as tactile beep support, the EVIC is programmed to send chime request messages over the Programmable Communications Interface (PCI) data bus when it detects the following conditions:

- **Door Ajar Warning** - A door is ajar above a critical speed [about 16 kilometers-per-hour (10 miles-per-hour) for the driver side front door, or about 5 kilometers-per-hour (3 miles-per-hour) for any other door].
- **Liftgate Ajar Warning** - The liftgate or liftgate flip-up glass is ajar above a critical speed [about 5 kilometers-per-hour (3 miles-per-hour)].
- **Low Coolant Level Warning** - The coolant level in the engine coolant reservoir is low.
- **Perform Service Alert** - An audible alert that a "Perform Service" reminder message is being displayed by the EVIC.
- **Turn Signal On Warning** - A turn signal remains on for about 1.6 kilometers (one mile) with no decrease in speed or throttle opening
- **Washer Fluid Low Warning** - The fluid level in the washer reservoir is low.

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the EVIC. Refer to **Electronic Vehicle Information Center** in the Description and Operation section of Group 8V - Overhead Console Systems for more information on the EVIC.

SENTRY KEY IMMOBILIZER SYSTEM

The Sentry Key Immobilizer System (SKIS) also uses tactile beep support from the chime warning system. The Sentry Key Immobilizer Module (SKIM) is programmed to send chime request messages over the Programmable Communications Interface (PCI) data bus to the Body Control Module (BCM) to provide audible confirmation that:

- The SKIM has been successfully placed in the Customer Learn mode.
- A new Sentry key transponder has been successfully programmed by the SKIM.

DESCRIPTION AND OPERATION (Continued)

See the owner's manual in the vehicle glove box for more information on the features, use and operation of the SKIS. Refer to **Sentry Key Immobilizer System** in the Description and Operation section of Group 8Q - Vehicle Theft/Security Systems for more information on the SKIS.

DRIVER DOOR AJAR SWITCH

DESCRIPTION

The driver door ajar switch is concealed within and integral to the driver side front door latch unit. The driver door ajar switch is actuated by the front door latch mechanism, and is hard wired between a body ground and the Driver Door Module (DDM) through the driver side front door wire harness.

The driver door ajar switch cannot be adjusted or repaired and, if faulty or damaged, the driver side front door latch unit must be replaced. Refer to **Front Door Latch** in the Removal and Installation section of Group 23 - Body for the service procedures. Refer to **Door Module** in the Power Lock System section of Group 8P - Power Lock Systems for more information on this component. For complete circuit diagrams, refer to **Interior Lighting** in the Contents of Group 8W - Wiring Diagrams.

OPERATION

The driver door ajar switch closes a path to ground for the DDM when the driver side front door is opened, and opens the ground path when the driver side front door is closed. The DDM reads the switch status through an internal pull-up, then sends the proper switch status messages to other electronic modules over the Programmable Communications Interface (PCI) data bus network. The driver door ajar switch status message is used by the Body Control Module (BCM) as an input for chime warning system operation.

DRIVER SEAT BELT SWITCH

DESCRIPTION

The driver seat belt switch is concealed within and integral to the driver seat belt buckle-half unit. The driver seat belt switch is actuated by the seat belt buckle mechanism, and is hard wired between a body ground and the Body Control Module (BCM) through the left body wire harness with manual seats, or through the driver side power seat and left body wire harnesses with power seats.

The driver seat belt switch cannot be adjusted or repaired and, if faulty or damaged, the entire driver seat belt buckle-half unit must be replaced. Refer to **Front Shoulder Belt/Buckle** in the Removal and Installation section of Group 23 - Body for the service procedures. Refer to **Body Control Module** in the Description and Operation section of Group 8E - Instrument Panel Systems for more information on this component. For complete circuit diagrams, refer to **Body Control Module** in the Contents of Group 8W - Wiring Diagrams.

OPERATION

The driver seat belt switch closes a path to ground for the BCM when the tip-half of the driver seat belt is not fastened to the buckle-half, and opens the ground path when the two halves of the seat belt are fastened. The BCM monitors the driver seat belt switch status through an internal pull-up, then sends the proper switch status messages to other electronic modules over the Programmable Communications Interface (PCI) data bus network. The driver seat belt switch status is also used by the BCM as an input for chime warning system operation.

KEY-IN IGNITION SWITCH

DESCRIPTION

The key-in ignition switch is concealed within and integral to the ignition switch, which is mounted on the steering column. The key-in ignition switch is actuated by the ignition lock cylinder mechanism, and is hard wired between a body ground and the Body Control Module (BCM) through the instrument panel wire harness.

The key-in ignition switch cannot be adjusted or repaired and, if faulty or damaged, the entire ignition switch unit must be replaced. Refer to **Ignition Switch and Key Cylinder** in the Removal and Installation section of Group 8D - Ignition Systems for the service procedures. Refer to **Body Control Module** in the Description and Operation section of Group 8E - Instrument Panel Systems for more information on this component. For complete circuit diagrams, refer to **Body Control Module** in the Contents of Group 8W - Wiring Diagrams.

OPERATION

The key-in ignition switch closes a path to ground for the BCM when the ignition key is inserted in the ignition lock cylinder, and opens the ground path when the key is removed from the ignition lock cylinder. The BCM monitors the key-in ignition switch status through an internal pull-up, then sends the proper switch status messages to other electronic modules over the Programmable Communications Interface (PCI) data bus network. The key-in ignition switch status is also used by the BCM as an input for chime warning system operation.

DESCRIPTION AND OPERATION (Continued)

HEADLAMP SWITCH

DESCRIPTION

The headlamp switch is integral to the exterior lighting switch, which is part of the left (lighting) multi-function switch unit located on the left side of the steering column. A knob on the end of the left multi-function switch control stalk controls all of the exterior lighting switch functions. The exterior lighting switch is hard wired to the Body Control Module (BCM) through the instrument panel wire harness.

The exterior lighting switch cannot be adjusted or repaired and, if faulty or damaged, the entire left multi-function switch unit must be replaced. Refer to **Turn Signal and Hazard Warning Switch** in the Removal and Installation section of Group 8J - Turn Signal and Hazard Warning Systems for the service procedures. Refer to **Body Control Module** in the Description and Operation section of Group 8E - Instrument Panel Systems for more information on this component. For complete circuit diagrams, refer to **Body Control Module** in the Contents of Group 8W - Wiring Diagrams.

OPERATION

The exterior lighting switch uses a hard wired five volt reference circuit from the BCM, resistor multiplexing and a hard wired switch output circuit in the instrument panel wire harness to provide the BCM with a zero to five volt signal that indicates the status of all of the exterior lighting switch settings. The BCM then uses control outputs to energize the headlamp and park lamp relays that activate the exterior lighting circuits.

The BCM monitors the exterior lighting switch status, then sends the proper switch status messages to other electronic modules over the Programmable Communications Interface (PCI) data bus network. The exterior lighting switch status is also used by the BCM as an input for chime warning system operation.

DIAGNOSIS AND TESTING

CHIME WARNING SYSTEM

Following are tests that will help to diagnose the components and circuits that provide hard wired inputs to the chime warning system. However, these tests may not prove conclusive in the diagnosis of this system. In order to obtain conclusive testing of the chime warning system, the Programmable Communications Interface (PCI) data bus network and all of the electronic modules that provide inputs to, or receive outputs from the chime warning system components must be checked.

The most reliable, efficient, and accurate means to diagnose the chime warning system requires the use of a DRB scan tool and the proper Diagnostic Procedures manual. The DRB scan tool can provide confirmation that the PCI data bus is functional, that the Body Control Module (BCM) is sending and receiving the proper messages on the PCI data bus, and that the BCM is receiving the proper hard wired inputs to perform its chime warning system functions.

DRIVER DOOR AJAR SWITCH

The driver door ajar switch is hard wired to the Driver Door Module (DDM). The DDM communicates the switch status to the other electronic modules in the vehicle on the Programmable Communications Interface (PCI) data bus network. Be certain that the PCI data bus is functional before attempting diagnosis of the driver door ajar switch. A simple test to confirm PCI data bus operation is to operate the passenger side power mirror. If the passenger side power mirror does not operate, use a DRB scan tool and the proper Diagnostic Procedures manual to test the operation of the PCI data bus and the DDM. If the passenger side power mirror operates, the following test will diagnose a faulty driver door ajar switch and circuits. For complete circuit diagrams, refer to **Interior Lighting** in the Contents of Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Check that the interior lighting switch on the control stalk of the left multi-function switch is not in the dome lamp disable position. Open the driver side front door and note whether the interior lamps light. They should light. If OK, refer to Key-In Ignition Switch in the Diagnosis and Testing section of this group for further diagnosis of the chime warning system. If not OK, go to Step 2.

(2) Disconnect and isolate the battery negative cable. Remove the trim panel from the driver side front door and disconnect the 4-way door wire harness connector from the front door latch connector receptacle. Check for continuity between the ground circuit cavity of the 4-way door wire harness connector for the front door latch and a good ground. There should be continuity. If OK, go to Step 3. If not OK, repair the ground circuit to ground as required.

DIAGNOSIS AND TESTING (Continued)

(3) Disconnect the white 15-way door wire harness connector from the Driver Door Module (DDM) connector receptacle. Check for continuity between the driver door ajar switch sense circuit of the white 15-way door wire harness connector for the DDM and a good ground. There should be no continuity. If OK, go to Step 4. If not OK, repair the shorted driver door ajar switch sense circuit as required.

(4) Check for continuity between the driver door ajar switch sense circuit cavities of the white 15-way door wire harness connector for the DDM and the 4-way door wire harness connector for the front door latch. There should be continuity. If OK, go to Step 5. If not OK, repair the open driver door ajar switch sense circuit as required.

(5) Check for continuity between the ground circuit terminal and the driver door ajar switch sense circuit terminal of the front door latch connector receptacle. There should be continuity with the driver side front door open, and no continuity with the door closed. If OK, use a DRB scan tool and the proper Diagnostic Procedures manual to test the operation of the PCI data bus and the DDM. If not OK, replace the faulty driver side front door latch unit.

DRIVER SEAT BELT SWITCH

For complete circuit diagrams, refer to **Body Control Module** in the Contents of Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable. Disconnect the left body wire harness (manual seat), or the driver side power seat wire harness (power seat) from the driver seat belt switch wire harness connector located under the driver side front seat cushion. Check for continuity between the seat belt switch sense circuit and the ground circuit cavities in the seat belt switch wire harness connector. There should be continuity with the driver side seat belt tip-half and buckle-half unfastened, and no continuity with tip-half and buckle-half fastened. If OK, go to Step 2. If not OK, replace the faulty driver side seat belt buckle-half unit.

(2) Check for continuity between the ground circuit cavity in the left body wire harness connector (manual seat), or the driver side power seat wire harness connector (power seat) for the driver seat belt switch and a good ground. There should be continuity. If OK, go to Step 3. If not OK, repair the open ground circuit to ground as required.

(3) Disconnect the 52-way left body wire harness connector from the junction block. Check for continuity between the seat belt switch sense circuit cavity in the left body wire harness connector (manual seat), or the driver side power seat wire harness connector (power seat) for the driver seat belt switch and a good ground. There should be no continuity. If OK, go to Step 4. If not OK, repair the shorted seat belt switch sense circuit as required.

(4) Check for continuity between the seat belt switch sense circuit cavities in the left body wire harness connector (manual seat), or the driver side power seat wire harness connector (power seat) for the driver seat belt switch and the 52-way left body wire harness connector for the junction block. There should be continuity. If OK, use a DRB scan tool and the proper Diagnostic Procedures manual to test the BCM. If not OK, repair the open seat belt switch sense circuit as required.

KEY-IN IGNITION SWITCH

For complete circuit diagrams, refer to **Body Control Module** in the Contents of Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable. Disconnect the instrument panel wire harness connector from the key-in ignition switch connector receptacle on the ignition switch. Check for continuity between the key-in ignition switch sense and ground terminals of the key-in ignition switch connector receptacle. There should be continuity with the key inserted in the ignition lock cylinder, and no continuity with the key removed from the ignition lock cylinder. If OK, go to Step 2. If not OK, replace the faulty ignition switch unit.

(2) Check for continuity between the ground circuit cavity of the instrument panel wire harness connector for the key-in ignition switch and a good ground. There should be continuity. If OK, go to Step 3. If not OK, repair the open ground circuit to ground as required.

DIAGNOSIS AND TESTING (Continued)

(3) Disconnect the gray 26-way instrument panel wire harness connector from the Body Control Module (BCM) connector receptacle. Check for continuity between the key-in ignition switch sense circuit cavity of the instrument panel wire harness connector for the key-in ignition switch and a good ground. There should be no continuity. If OK, go to Step 4. If not OK, repair the shorted key-in ignition switch sense circuit as required.

(4) Check for continuity between the key-in ignition switch sense circuit cavities of the instrument panel wire harness connector for the key-in ignition switch and the gray 26-way instrument panel wire harness connector for the BCM. There should be continuity. If OK, use a DRB scan tool and the proper Diagnostic Procedures manual to test the BCM. If not OK, repair the open key-in ignition switch sense circuit as required.

HEADLAMP SWITCH

Before testing the headlamp switch, turn on the exterior lighting and open the driver side front door. If the exterior lamps of the vehicle operate, but there is no chime warning issued with the driver side front door open, refer to **Driver Door Ajar Switch** in the Diagnosis and Testing section of this group. If the exterior lamps of the vehicle are inoperative, but the chime warning is issued, refer to **Lamp Diagnosis** in the Diagnosis and Testing section of Group 8L - Lamps.

If the exterior lamps and the chime warning are both inoperative, test the left (lighting) multi-function switch. Refer to **Turn Signal and Hazard Warning Switch** in the Diagnosis and Testing section of Group 8J - Turn Signal and Hazard Warning Systems to test the left (lighting) multi-function switch. If the left (lighting) multi-function switch tests OK, proceed as follows. The following tests will help to locate a short or open in the hard wired circuits between the left (lighting) multi-function switch and the Body Control Module (BCM). For complete circuit diagrams, refer to **Body Control Module** in the Contents of Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable. Disconnect the instrument panel wire harness connector from the left multi-function switch connector receptacle. Disconnect the gray 26-way instrument panel wire harness connector from the Body Control Module (BCM). Check for continuity between the headlamp switch mux circuit cavity of the instrument panel wire harness connector for the left multi-function switch and a good ground. There should be no continuity. If OK, go to Step 2. If not OK, repair the shorted headlamp switch mux circuit as required.

(2) Check for continuity between the headlamp switch mux circuit cavities of the instrument panel wire harness connector for the left multi-function switch and the gray 26-way instrument panel wire harness connector for the BCM. There should be continuity. If OK, go to Step 3. If not OK, repair the open headlamp switch mux circuit as required.

(3) Check for continuity between the headlamp switch return circuit cavity of the instrument panel wire harness connector for the left multi-function switch and a good ground. There should be no continuity. If OK, go to Step 4. If not OK, repair the shorted headlamp switch return circuit as required.

(4) Check for continuity between the headlamp switch return circuit cavities of the instrument panel wire harness connector for the left multi-function switch and the gray 26-way instrument panel wire harness connector for the BCM. There should be continuity. If OK, use a DRB scan tool and the proper Diagnostic Procedures manual to test the BCM. If not OK, repair the open headlamp switch return circuit as required.

REMOVAL AND INSTALLATION

CHIME WARNING SYSTEM SWITCHES

Service procedures for the various hard wired switches used in the chime warning system can be found in the proper group as follows:

- **Driver door ajar switch** - Refer to **Front Door Latch** in the Removal and Installation section of Group 23 - Body for the service procedures.
- **Driver seat belt switch** - Refer to **Front Shoulder Belt/Buckle** in the Removal and Installation section of Group 23 - Body for the service procedures.
- **Headlamp switch** - Refer to **Turn Signal and Hazard Warning Switch** in the Removal and Installation section of Group 8J - Turn Signal and Hazard Warning Systems for the service procedures.
- **Key-in ignition switch** - Refer to **Ignition Switch and Key Cylinder** in the Removal and Installation section of Group 8D - Ignition Systems for the service procedures.

OVERHEAD CONSOLE SYSTEMS

CONTENTS

DESCRIPTION AND OPERATION

OVERHEAD CONSOLE

DESCRIPTION

An overhead console is standard factory-installed equipment on Limited models, and an available option on Laredo models. The overhead console includes the Electronic Vehicle Information Center (EVIC) and two reading and courtesy lamps (Fig. 1). On vehicles equipped with a power sunroof option, the overhead console also houses the power sunroof switch between the two reading and courtesy lamps. The overhead console is mounted with one screw and two snap-clips to a molded plastic retainer bracket located above the headliner. The retainer bracket is secured with adhesive to the inside surface of the roof panel.

Following are general descriptions of the major components used in the overhead console. Refer to **Overhead Console** in the Contents of Group 8W - Wiring Diagrams for complete circuit diagrams.

OPERATION

See the owner's manual in the vehicle glove box for more information on the use and operation of the various overhead console features.

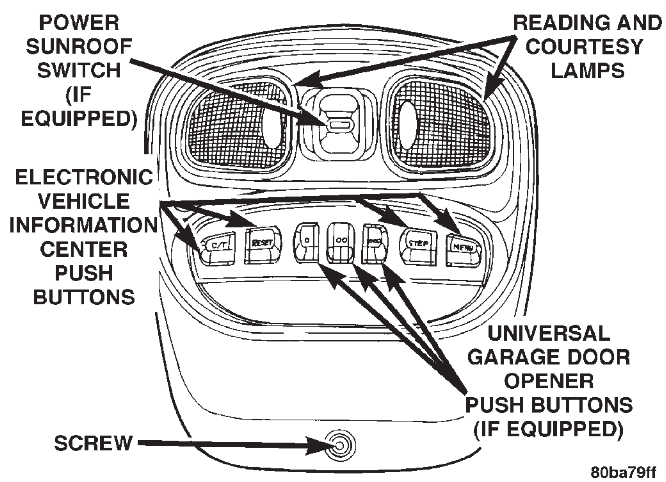


Fig. 1 Overhead Console

ELECTRONIC VEHICLE INFORMATION CENTER

DESCRIPTION

The Electronic Vehicle Information Center (EVIC) is located in the overhead console on models equipped with this option. Two versions of the EVIC module are available on the Grand Cherokee. These two versions are identical except that the standard equipment unit for the Limited model includes an integral three-push button Universal Garage Door Opener (UGDO) transceiver. Both EVIC modules feature a large Vacuum Fluorescent Display (VFD) screen for displaying information, and four back-lit push button function switches labeled C/T (compass/thermometer), RESET, STEP, and MENU. The VFD

DESCRIPTION AND OPERATION (Continued)

screen can also display a vehicle graphic that is used for door and liftgate ajar indications and to show if a turn signal has been left on. The EVIC messages and displays are coordinated with warning indicators in the instrument cluster to avoid duplication.

The EVIC module contains a central processing unit and interfaces with other electronic modules in the vehicle over the Programmable Communications Interface (PCI) data bus network. The PCI data bus network allows the sharing of sensor information. This helps to reduce wire harness complexity, reduce internal controller hardware, and reduce component sensor current loads. At the same time, this system provides increased reliability, enhanced diagnostics, and allows the addition of many new feature capabilities.

The EVIC includes the features of the compass mini-trip computer used on prior Grand Cherokee models, including the following display options:

- **Compass and thermometer** - provides the outside temperature and one of eight compass readings to indicate the direction the vehicle is facing.
- **Average fuel economy** - shows the average fuel economy since the last trip computer reset.
- **Distance to empty** - shows the estimated distance that can be travelled with the fuel remaining in the fuel tank. This estimated distance is computed using the average miles-per-gallon from the last 30 gallons of fuel used.
- **Instant fuel economy** - shows the present fuel economy based upon the current vehicle distance and fuel used information.
- **Trip distance** - shows the distance travelled since the last trip computer reset.
- **Elapsed time** - shows the accumulated ignition-on time since the last trip computer reset.
- **Distance to service** - shows the distance remaining until the next scheduled service interval.
- **Blank screen** - the EVIC compass/thermometer/trip computer VFD is turned off.

The EVIC also includes many features not available with prior compass mini-trip computers. The EVIC is capable of displaying the following warning messages, which are accompanied by an audible announcement consisting of a series of beep tones:

- **TURN SIGNALS ON (with vehicle graphic)** - Indicates that a turn signal has remained on for about 1.6 kilometers (one mile) with no decrease in speed or throttle opening.
- **PERFORM SERVICE** - Indicates that a customer programmable service interval distance has been reached.
- **DOOR AJAR (one or more, with vehicle graphic)** - Indicates that a door is open or not fully closed.
- **LIFTGATE AJAR (with vehicle graphic)** - Indicates that the liftgate or the liftgate flip-up glass is open or not fully closed.
- **COOLANT LEVEL LOW (with vehicle graphic)** - Indicates that the coolant level in the engine coolant reservoir is low.
- **WASHER FLUID LOW (with vehicle graphic)** - Indicates that the fluid level in the washer fluid reservoir is low.

The EVIC “Menu” push button provides the vehicle operator with a user interface, which allows the selection of several optional customer programmable electronic features to suit individual preferences. Refer to **ELECTRONIC VEHICLE INFORMATION CENTER PROGRAMMING** in the Service Procedures section of this group for more information on the customer programmable feature options.

If the vehicle is equipped with the optional memory system, the EVIC will display the following memory system messages:

- **MEMORY #X POSITION SET (X = Driver 1 or Driver 2)** - This message appears in the EVIC display each time the memory system is successfully programmed. It is accompanied by an audible announcement chime tone.
- **MEMORY SYSTEM DISABLED** - The memory system is automatically disabled while the driver side seat belt is fastened and/or while the vehicle is moving. This message appears in the EVIC display as a reminder when a memory switch push button is depressed while the memory system is disabled. If the REMOTE LINKED TO MEMORY customer programmable feature has been selected, this message will also appear when the Unlock button of the Remote Keyless Entry (RKE) transmitter is depressed while the memory system is disabled.

If the vehicle is equipped with the optional Universal Garage Door Opener (UGDO) transceiver, the EVIC will also display messages and an icon indicating when the UGDO transceiver is being trained, which of the three transmitter buttons is transmitting, and when the transceiver is cleared.

Data input for all EVIC functions, including VFD dimming level, is received through PCI data bus messages. The EVIC module uses its internal programming and all of its data inputs to calculate and display the requested data. If the data displayed is incorrect, perform the self-diagnostic tests as described in this group. If these tests prove inconclusive, the use of a DRB scan tool and the proper Diagnostic Procedures manual are recommended for further testing of the EVIC module and the PCI data bus.

The EVIC module cannot be repaired, and is available for service only as a unit. This unit includes the push button switches and the plastic module and dis-

DESCRIPTION AND OPERATION (Continued)

play lens. If any of these components is faulty or damaged, the complete EVIC module must be replaced. The incandescent bulbs used for EVIC push button back-lighting are available for service replacement.

COMPASS

While in the compass/thermometer mode, 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). The self-calibrating compass unit requires no adjusting in normal use. The only calibration that may prove necessary is to drive the vehicle in three complete circles, on level ground, in not less than forty-eight seconds. This will reorient the compass unit to its vehicle.

The compass 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 overhead console assembly to the roof header can also affect compass operation. If the vehicle roof should become magnetized, the demagnetizing and calibration procedures found in this group may be required to restore proper compass operation.

THERMOMETER

The thermometer displays the outside ambient temperature in whole degrees. The temperature display can be toggled from Fahrenheit to Celsius by selecting the desired U.S./Metric option from the customer programmable features as described in **ELECTRONIC VEHICLE INFORMATION CENTER PROGRAMMING** in the Service Procedures section of this group. The displayed temperature is not an instant reading of conditions, but an average temperature. It may take the thermometer display several minutes to respond to a major temperature change, such as driving out of a heated garage into winter temperatures.

When the ignition switch is turned to the Off position, the last displayed temperature reading stays in the Body Control Module (BCM) unit memory. When the ignition switch is turned to the On position again, the EVIC will display the memory temperature for one minute; then update the display to the current average temperature reading within five minutes.

The thermometer function is supported by an ambient temperature sensor. The sensor is mounted outside the passenger compartment near the front and center of the vehicle, and is hard wired to the Body Control Module (BCM). The BCM sends temperature status messages to the EVIC module over the PCI data bus network. The ambient temperature sensor is available as a separate service item.

OPERATION

The EVIC has access to both non-switched and ignition switched sources of battery current so that some of its features remain operational at any time, while others may only operate with the ignition switch in the On position. When the ignition switch is turned to the On position, the EVIC module VFD will return to the last function being displayed before the ignition was turned to the Off position.

The compass/thermometer display is the normal EVIC display. With the ignition switch in the On position, momentarily depressing and releasing the C/T (compass/thermometer) push button switch will cause the EVIC to return to the compass/thermometer/trip computer display mode from any other mode. While in the compass/thermometer/trip computer display mode, momentarily depressing and releasing the Step push button will step through the available trip computer display options.

The EVIC trip computer features several functions that can be reset. The functions that can be reset are: average fuel economy, trip odometer and elapsed time. With the ignition switch in the On position and with one of the functions of the trip computer that can be reset currently displayed, depressing the Reset push button twice within three seconds will perform a global reset, and all of the trip computer information that can be reset will be reset to zero. With the ignition switch in the On position and the function that is to be reset currently displayed, momentarily depressing and releasing the Reset push button once will perform a local reset, and only the value of the displayed function will be reset to zero. A global or local reset will only occur if the function currently displayed is a function that can be reset. The distance to service function can also be reset using the local reset method, but it will reset back to the Service Interval distance that is set in the EVIC programmable features mode. Refer to **ELECTRONIC VEHICLE INFORMATION CENTER PROGRAMMING** in the Service Procedures section of this group for more information on setting the Service Interval.

For more information on the features, control functions and setting procedures for the EVIC module, see the owner's manual in the vehicle glove box.

DESCRIPTION AND OPERATION (Continued)

UNIVERSAL GARAGE DOOR OPENER

DESCRIPTION

The Grand Cherokee Limited model has a Universal Garage Door Opener (UGDO) transceiver as standard factory-installed equipment. The UGDO transceiver is integral to the Electronic Vehicle Information Center (EVIC), which is located in the overhead console. The only visible component of the UGDO are the three transmitter push buttons centered between the four EVIC push buttons located just rearward of the EVIC display screen in the overhead console. The three UGDO transmitter push buttons are identified with one, two or three raised tactile bumps so that they be easily identified by sight or by feel.

Each of the three UGDO transmitter push buttons controls an independent radio transmitter channel. Each of these three channels can be trained to transmit a different radio frequency signal for the remote operation of garage door openers, motorized gate openers, home or office lighting, security systems or just about any other device that can be equipped with a radio receiver in the 286 to 399 MegaHertz (MHz) frequency range for remote operation. The UGDO is capable of operating systems using either rolling code or non-rolling code technology.

The EVIC module displays messages and a small house-shaped icon with one, two or three dots corresponding to the three transmitter buttons to indicate the status of the UGDO. The EVIC messages are:

- **Cleared Channels** - Indicates that all of the transmitter codes stored in the UGDO have been successfully cleared.
- **Training** - Indicates that the UGDO is in its transmitter learning mode.
- **Trained** - Indicates that the UGDO has successfully acquired a new transmitter code.
- **Transmit** - Indicates that a trained UGDO transmitter button has been depressed and that the UGDO is transmitting.

The UGDO cannot be repaired, and is available for service only as a unit with the EVIC module. This unit includes the push button switches and the plastic module and display lens. If any of these components is faulty or damaged, the complete EVIC module must be replaced.

OPERATION

The UGDO operates on a non-switched source of battery current so the unit will remain functional, regardless of the ignition switch position. For more information on the features, programming procedures and operation of the UGDO, see the owner's manual in the vehicle glove box.

OVERHEAD CONSOLE READING AND COURTESY LAMP

DESCRIPTION

The overhead console in this vehicle is equipped with two individual reading and courtesy lamps. The lamp lenses are the only visible components of these lamps. The reading and courtesy lamp lenses are mounted near the rear of the overhead console housing. Each lamp has its own switch, bulb, reflector and lens; but both lamps share a common lamp housing within the overhead console.

The overhead console reading and courtesy lamps operate on battery current that is provided at all times, regardless of the ignition switch position. The ground feed for the lamps is switched through the integral reading and courtesy lamp switches or through the door jamb switches. Each lamp is designed and aimed to provide illumination that will be directed only to that side of the vehicle on which the lamp is located.

The reading and courtesy lamp lenses and the lamp housing and reflector unit are serviced only as a unit with the overhead console housing. If either of the lamp lenses or the lamp housing is faulty or damaged, the overhead console housing unit must be replaced. The reading and courtesy lamp switches, bulb holders and wiring are only available as part of the overhead console wire harness. If either of the lamp switches or bulb holders is faulty or damaged, the overhead console wire harness unit must be replaced.

For service of the reading and courtesy lamp bulbs, refer to **Overhead Console Reading Lamp Bulbs** in the Removal and Installation section of Group 8L - Lamps. For diagnosis of the reading and courtesy lamps, refer to **Lamp Diagnosis** in the Diagnosis and Testing section of Group 8L - Lamps. For complete circuit diagrams, refer to **Overhead Console** in the Contents of Group 8W - Wiring Diagrams.

OPERATION

All reading and courtesy lamps located in the overhead console are activated by the door jamb switches. When all of the doors are closed, these lamps can be individually activated by depressing the corresponding lens. When any door is open, depressing the lamp lenses to activate the lamp switches will not turn the lamps off.

See the owner's manual in the vehicle glove box for more information on the use and operation of the overhead console reading and courtesy lamps.

DESCRIPTION AND OPERATION (Continued)

AMBIENT TEMPERATURE SENSOR

DESCRIPTION

Ambient air temperature is monitored by the Electronic Vehicle Information Center (EVIC) through ambient temperature messages received from the Body Control Module (BCM) over the Programmable Communications Interface (PCI) data bus network. The BCM receives a hard wired input from the ambient temperature sensor. The ambient temperature sensor is a variable resistor mounted to a bracket that is secured with a screw to the right side of the headlamp mounting module grille opening, behind the radiator grille and in front of the engine compartment.

Refer to **Body Control Module** in the Description and Operation section of Group 8E - Instrument Panel Systems for more information on the BCM. For complete circuit diagrams, refer to **Body Control Module** in the Contents of Group 8W - Wiring Diagrams. The ambient temperature sensor cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

OPERATION

The ambient temperature sensor is a variable resistor that operates on a five-volt reference signal sent to it by the BCM. The resistance in the sensor changes as temperature changes, changing the temperature sensor signal circuit voltage to the BCM. Based upon the resistance in the sensor, the BCM senses a specific voltage on the temperature sensor signal circuit, which it is programmed to correspond to a specific temperature. The BCM then sends the proper ambient temperature messages to the EVIC over the PCI data bus.

DIAGNOSIS AND TESTING

ELECTRONIC VEHICLE INFORMATION CENTER

If the problem with the Electronic Vehicle Information Center (EVIC) is an “Open Circuit” or “Short Circuit” shown in the compass/thermometer display, refer to **Ambient Temperature Sensor** in the Diagnosis and Testing section of this group. If the problem with the EVIC is an inaccurate or scrambled display, refer to **Self-Diagnostic Test** in the Diagnosis and Testing section of this group. If the problem with the EVIC is incorrect Vacuum Fluorescent Display (VFD) dimming levels, use a DRB scan tool and the proper Diagnostic Procedures manual to test for the correct dimming message inputs being received from the Body Control Module (BCM) over the Programmable Communications Interface (PCI) data bus. If the problem is a no-display condition, use the following procedures. For complete circuit diagrams, refer to **Overhead Console** in the Contents of Group 8W - Wiring Diagrams.

(1) Check the fused B(+) fuse in the junction block. If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Check for battery voltage at the fused B(+) fuse in the junction block. If OK, go to Step 3. If not OK, repair the open fused B(+) circuit to the fused B(+) fuse in the PDC as required.

(3) Check the fused ignition switch output (run/start) fuse in the junction block. If OK, go to Step 4. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(4) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run/start) fuse in the junction block. If OK, go to Step 5. If not OK, repair the open fused ignition switch output (run/start) circuit to the ignition switch as required.

(5) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the overhead console. Check for continuity between the ground circuit cavity of the roof wire harness connector for the EVIC module and a good ground. There should be continuity. If OK, go to Step 6. If not OK, repair the open ground circuit to ground as required.

(6) Connect the battery negative cable. Check for battery voltage at the fused B(+) circuit cavity of the roof wire harness connector for the EVIC module. If OK, go to Step 7. If not OK, repair the open fused B(+) circuit to the fused B(+) fuse in the junction block as required.

(7) Turn the ignition switch to the On position. Check for battery voltage at the fused ignition switch output (run/start) circuit cavity of the roof wire harness connector for the EVIC module. If OK, refer to **Self-Diagnostic Test** in the Diagnosis and Testing section of this group for further diagnosis of the EVIC module and the PCI data bus. If not OK, repair the open fused ignition switch output (run/start) circuit to the fuse in the junction block as required.

SELF-DIAGNOSTIC TEST

A self-diagnostic test is used to determine that the EVIC module is operating properly, and that all PCI data bus messages are being received for initial operation. Initiate the self-diagnostic test as follows:

(1) With the ignition switch in the Off position, simultaneously depress and hold the C/T button and the Reset button.

(2) Turn the ignition switch to the On position.

DIAGNOSIS AND TESTING (Continued)

(3) Continue to hold both buttons depressed until the EVIC software version information is displayed, then release both buttons.

(4) Following completion of these tests, the EVIC module will display one of the following messages:

a. **Pass Self Test** - Momentarily depress and release the Reset button to return to the compass/thermometer/trip computer display mode. The EVIC module is working properly.

b. **Failed Self Test** - The EVIC module has an internal failure. The EVIC module is faulty and must be replaced.

c. **Failed J1850 Communication** - The EVIC module is not receiving proper message input through the PCI data bus. This can result from one or more faulty electronic modules in the vehicle, or from a faulty PCI data bus. The use of a DRB scan tool and the proper Diagnostic Procedures manual are required for further diagnosis.

NOTE: If the compass functions, but accuracy is suspect, it may be necessary to perform a variation adjustment. This procedure allows the compass unit to accommodate variations in the earth's magnetic field strength, based on geographic location. Refer to Compass Variation Adjustment in the Service Procedures section of this group.

NOTE: If the compass reading displays dashes, and only "CAL" appears in the display, demagnetizing may be necessary to remove excessive residual magnetic fields from the vehicle. Refer to Compass Demagnetizing in the Service Procedures section of this group.

UNIVERSAL GARAGE DOOR OPENER

If the Universal Garage Door Opener (UGDO) is inoperative, but the Electronic Vehicle Information Center (EVIC) is operating normally, see the owner's manual in the vehicle glove box for instructions on training the UGDO. Retrain the UGDO with a known good transmitter as instructed in the owner's manual and test the UGDO operation again. If the unit is still inoperative, replace the faulty UGDO and EVIC module as a unit. If both the UGDO and the EVIC module are inoperative, refer to **Electronic Vehicle Information Center** in the Diagnosis and Testing section of this group for further diagnosis. For complete circuit diagrams, refer to **Overhead Console** in the Contents of Group 8W - Wiring Diagrams.

AMBIENT TEMPERATURE SENSOR

The thermometer function is supported by the ambient temperature sensor, a wiring circuit, the Body Control Module (BCM), the Programmable Communications Interface (PCI) data bus, and a portion of the Electronic Vehicle Information Center (EVIC) module. If any portion of the ambient temperature sensor circuit fails, the BCM will self-diagnose the circuit. A "Short Circuit" message will appear in the EVIC display in place of the temperature when the sensor is exposed to temperatures above 55° C (131° F), or if the sensor circuit is shorted. An "Open Circuit" message will appear in the EVIC display in place of the temperature when the sensor is exposed to temperatures below –40° C (–40° F), or if the sensor circuit is open.

The ambient temperature sensor circuit can also be diagnosed using the following Sensor Test, and Sensor Circuit Test. If the temperature sensor and circuit are confirmed to be OK, but the temperature display is inoperative or incorrect, refer to **Electronic Vehicle Information Center** in the Diagnosis and Testing section of this group. For complete circuit diagrams, refer to **Body Control Module** in the Contents of Group 8W - Wiring Diagrams.

SENSOR TEST

(1) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Disconnect the ambient temperature sensor wire harness connector.

(2) Measure the resistance of the ambient temperature sensor. At –40° C (–40° F), the sensor resistance is 336 kilohms. At 55° C (140° F), the sensor resistance is 2.488 kilohms. The sensor resistance should read between these two values. If OK, refer to **Sensor Circuit Test** in the Diagnosis and Testing section of this group. If not OK, replace the faulty ambient temperature sensor.

SENSOR CIRCUIT TEST

(1) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Disconnect the ambient temperature sensor wire harness connector and the 22-way Body Control Module (BCM) wire harness connector.

(2) Connect a jumper wire between the two terminals in the body half of the ambient temperature sensor wire harness connector.

(3) Check for continuity between the sensor return circuit and the ambient temperature sensor signal circuit cavities of the 22-way BCM wire harness connector. There should be continuity. If OK, go to Step 4. If not OK, repair the open sensor return circuit or ambient temperature sensor signal circuit to the ambient temperature sensor as required.

(4) Remove the jumper wire from the body half of the ambient temperature sensor wire harness connector. Check for continuity between the sensor

DIAGNOSIS AND TESTING (Continued)

return circuit cavity of the 22-way BCM wire harness connector and a good ground. There should be no continuity. If OK, go to Step 5. If not OK, repair the shorted sensor return circuit as required.

(5) Check for continuity between the ambient temperature sensor signal circuit cavity of the 22-way BCM wire harness connector and a good ground. There should be no continuity. If OK, refer to **Electronic Vehicle Information Center** in the Diagnosis and Testing section of this group. If not OK, repair the shorted ambient temperature sensor signal circuit as required.

SERVICE PROCEDURES

ELECTRONIC VEHICLE INFORMATION CENTER PROGRAMMING

EVIC PROGRAMMING MODE

The Electronic Vehicle Information Center (EVIC) provides the vehicle operator with a user interface, which allows the selection of several optional customer programmable electronic features to suit individual preferences. The EVIC must be placed into its programming mode in order to view or change the programmable features. To enter the EVIC programming mode and to view or change the selected programmable features options, proceed as follows:

(1) Turn the ignition switch to the On position.

(2) Depress and release the Menu push button. The first item in the programmable features menu list will appear in the EVIC display.

(3) Momentarily depress and release the Menu push button to step through the programmable features list. Each programmable feature and its currently selected option will appear on the EVIC display in the sequence shown in the Programmable Features list that follows.

(4) Momentarily depress and release the Step push button to step through the available options for the programmable feature being displayed.

(5) The option that last appears in the display with a programmable feature before exiting the programming mode, becomes the newly selected programmable feature option.

(6) The EVIC exits the programming mode and returns to its normal operating mode when the C/T push button is depressed or when the end of the programmable features menu list is reached, whichever occurs first.

PROGRAMMABLE FEATURES

- **LANGUAGE? -** The options include English, Francaise, Deutsch, Italiana, or Espanol. The default is English. All EVIC display nomenclature, including the trip computer functions, warning messages and the programmable features appear in the selected language.
- **DISPLAY U.S. OR METRIC? -** The options include U.S. and M. The default is U.S. This feature toggles the trip computer temperature, fuel economy and odometer display readings between U.S. and metric units of measure. It also changes the odometer display in the instrument cluster.
- **AUTO DOOR LOCKS? -** The options include Yes and No. The default is Yes. When Yes is selected, all doors and the liftgate lock automatically when vehicle speed reaches 25 kilometers-per-hour (15 miles-per-hour). If YES is selected, a second programmable feature appears, **AUTO UNLOCK ON EXIT?** - The options again include Yes and No. The default is No. When Yes is selected, following each Auto Door Lock event all doors and the liftgate will automatically unlock when the driver door is opened, if the vehicle is stopped and the transmission gear selector is in Park or Neutral. The Auto Door Unlock event will only occur once following each Auto Door Lock event.
- **REMOTE UNLOCK -** The options include Driver Door 1st and All Doors. The default is Driver Door 1st. When Diver Door 1st is selected, only the driver door unlocks when the Unlock button of the Remote Keyless Entry (RKE) transmitter is depressed once. The Unlock button of the RKE transmitter must be depressed twice to unlock all doors and the liftgate. When All Doors is selected, all doors and the liftgate unlock when the Unlock button of the RKE transmitter is depressed once.
- **REMOTE LINKED TO MEMORY? -** This programmable feature only applies to vehicles equipped with the optional memory system. The options include Yes and No. The default is No. When Yes is selected, the memory system will recall the Driver 1 or Driver 2 memory settings assigned to the RKE transmitter being used to unlock the vehicle. When No is selected, the memory system will only recall memory settings when the Driver 1 or Driver 2 push buttons of the memory switch on the driver side front door trim panel are depressed.
- **SOUND HORN ON LOCK? -** The options include Yes and No. The default is No. When Yes is selected, a short horn chirp will provide an audible confirmation when the RKE receiver recognizes a valid Lock signal from an RKE transmitter. When No is selected, no horn chirp will occur with the RKE Lock event. This feature may be selected independent of the **FLASH LIGHTS WITH LOCKS?** programmable feature.
- **FLASH LIGHTS WITH LOCKS? -** The options include Yes and No. The default is Yes. When Yes is selected, a single flash of the hazard warning

SERVICE PROCEDURES (Continued)

lamps will provide an optical confirmation when the RKE receiver recognizes a valid Lock signal from an RKE transmitter, and two flashes of the same lamps will occur when the RKE receiver recognizes a valid Unlock signal from an RKE transmitter. When No is selected, no lamp flash will occur with the RKE Lock or Unlock event. This feature may be selected independent of the **SOUND HORN ON LOCK?** programmable feature.

- **HEADLAMP DELAY = -** The options include Off, 30 Sec, 60 Sec, and 90 Sec. The default is 90 Sec. When a time interval is selected, the headlamps will remain on for that length of time when the headlamps are turned off after the ignition is turned off, or if the Auto mode is selected on vehicles with the Auto Headlamps option. When Off is selected, the headlamp delay feature is disabled.
- **HEADLAMPS ON WITH WIPERS? -** This programmable feature only applies to vehicles equipped with the optional Auto Headlamps. The options include Yes and No. The default is Yes. When Yes is selected, the headlamps will turn on automatically when the windshield wipers are turned on. The headlamps will turn off when the wipers are turned off, as long as the headlamp switch is in the Auto or Off positions. When No is selected, the headlamps will only turn on if manually selected or if the Auto mode is selected and the outside ambient light levels dictate that they should be on.
- **SERVICE INTV. = -** The options include from 1000 to 12000 kilometers in 1000 kilometer increments (2000 to 7500 miles in 500 mile increments). The default is 12000 kilometers (7500 miles). The selected distance becomes the interval at which the Perform Service warning message will be displayed by the EVIC. If a new distance is selected, a second programmable feature appears, **RESET SERVICE DISTANCE? -** The options include No and Yes. The default is Yes. When Yes is selected, the accumulated distance since the last previous Perform Service warning message will be reset to zero because the service interval has been changed. When No is selected, the distance until the next Perform Service warning message is reduced by the accumulated distance since the last previous message.
- **LOW FUEL CHIME? -** The options include Yes and No. The default is Yes. When Yes is selected, a single chime will sound as an audible alert whenever the instrument cluster low fuel warning lamp lights. The chime will sound only once per ignition cycle. When No is selected, only the low fuel warning lamp in the instrument cluster will light and no chime will sound.
- **EASY EXIT SEAT? -** This programmable feature only applies to vehicles equipped with the optional memory system. The options include Yes and No. The default is No. When Yes is selected, the driver seat moves rearward about 55 millimeters (two inches) or to the farthest rearward position, whichever comes first, when the key is removed from the ignition switch lock cylinder. This provides additional ease for exiting from the vehicle. The seat will automatically return to the memory system setting position when the Driver 1 or Driver 2 button of the memory switch on the door panel is depressed or, if the **REMOTE LINKED TO MEMORY** programmable feature is enabled, when the RKE Unlock button is depressed. While not automatic, an easy entry feature can be obtained by enabling the **EASY EXIT SEAT** feature and disabling the **REMOTE LINKED TO MEMORY** feature. Then the **EASY EXIT SEAT** feature will move the seat back, but the RKE unlock event will not reposition the seat. Thus, the seat remains positioned for easy entry, and the memory switch on the door panel can be depressed after entering the vehicle to return the seat to the desired memory position.

COMPASS VARIATION ADJUSTMENT

Compass variance, also known as magnetic declination, is the difference in angle between magnetic north and true geographic north. In some geographic locations, the difference between magnetic and geographic north is great enough to cause the compass to give false readings. If this problem occurs, the compass variance setting may need to be changed.

To set the compass variance:

(1) Using the Variance Settings map, find your geographic location and note the zone number (Fig. 2).

(2) Turn the ignition switch to the On position. If the compass/thermometer data is not currently being displayed, momentarily depress and release the C/T push button to reach the compass/thermometer display.

(3) Depress the Reset push button and hold the button down until “VARIANCE = XX” appears in the display. This takes about five seconds.

(4) Release the Reset push button. “VARIANCE =XX ” will remain in the display. “XX” equals the current variance zone setting.

(5) Momentarily depress and release the Step push button to step through the zone numbers, until the zone number for your geographic location appears in the display.

(6) Momentarily depress and release the Reset push button to enter the displayed zone number into the EVIC module memory.

(7) Confirm that the correct directions are now indicated by the compass.

SERVICE PROCEDURES (Continued)

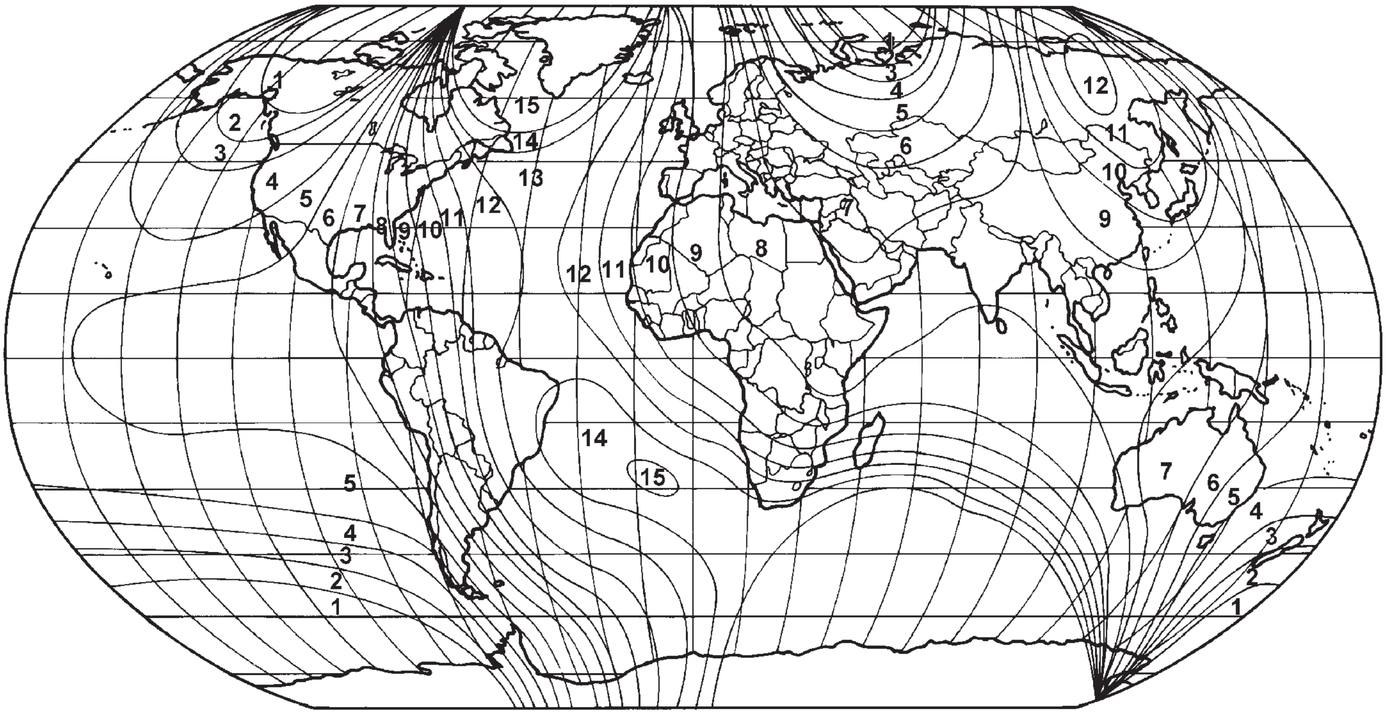


Fig. 2 Variance Settings

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 electronic compass unit features a self-calibrating design, which simplifies the calibration procedure. This feature automatically updates the compass calibration while the vehicle is being driven. This allows the compass unit to compensate for small changes in the residual magnetism that the vehicle may acquire during normal use. If the compass readings appear to be erratic or out of calibration, perform the following calibration procedure. Also, new service replacement Electronic Vehicle Information Center (EVIC) modules must have their compass calibrated using this procedure. Do not attempt to calibrate the compass near large metal objects such as other vehicles, large buildings, or bridges; or, near overhead or underground power lines.

NOTE: Whenever the compass is calibrated manually, the variance number must also be reset. Refer to Compass Variation Adjustment in the Service Procedures section of this group.

Calibrate the compass manually as follows:

(1) Turn the ignition switch to the On position. If the compass/thermometer data is not currently being displayed, momentarily depress and release the C/T push button to reach the compass/thermometer display.

(2) Depress the Reset push button and hold the button down until “CAL” appears in the display. This takes about ten seconds, and appears about five seconds after “VARIANCE = XX” is displayed.

(3) Release the Reset push button.

(4) Drive the vehicle on a level surface, away from large metal objects and power lines, through three or more complete circles at between five and eight kilometers-per-hour (three and five miles-per-hour) in not less than 48 seconds. The “CAL” message will disappear from the display to indicate that the compass is now calibrated.

NOTE: If the “CAL” message remains in the display, either there is excessive magnetism near the compass, or the unit is faulty. Repeat the calibration procedure one more time.

NOTE: If the wrong direction is still indicated in the compass display, the area selected for calibration may be too close to a strong magnetic field. Repeat the calibration procedure in another location.

SERVICE PROCEDURES (Continued)

COMPASS DEMAGNETIZING

A degaussing tool (Special Tool 6029) is used to demagnetize, or degauss, the overhead console forward mounting screw and the roof panel above the overhead console. Equivalent units must be rated as continuous duty for 110/115 volts and 60 Hz. They must also have a field strength of over 350 gauss at 7 millimeters (0.25 inch) beyond the tip of the probe.

To demagnetize the roof panel and the overhead console forward mounting screw, proceed as follows:

(1) Be certain that the ignition switch is in the Off position, before you begin the demagnetizing procedure.

(2) Connect the degaussing tool to an electrical outlet, while keeping the tool at least 61 centimeters (2 feet) away from the compass unit.

(3) Slowly approach the head of the overhead console forward mounting screw with the degaussing tool connected.

(4) Contact the head of the screw with the plastic coated tip of the degaussing tool for about two seconds.

(5) With the degaussing tool still energized, slowly back it away from the screw. When the tip of the tool is at least 61 centimeters (2 feet) from the screw head, disconnect the tool.

(6) Place a piece of paper approximately 22 by 28 centimeters (8.5 by 11 inches), oriented on the vehicle lengthwise from front to rear, on the center line of the roof at the windshield header (Fig. 3). The purpose of the paper is to protect the roof panel from scratches, and to define the area to be demagnetized.

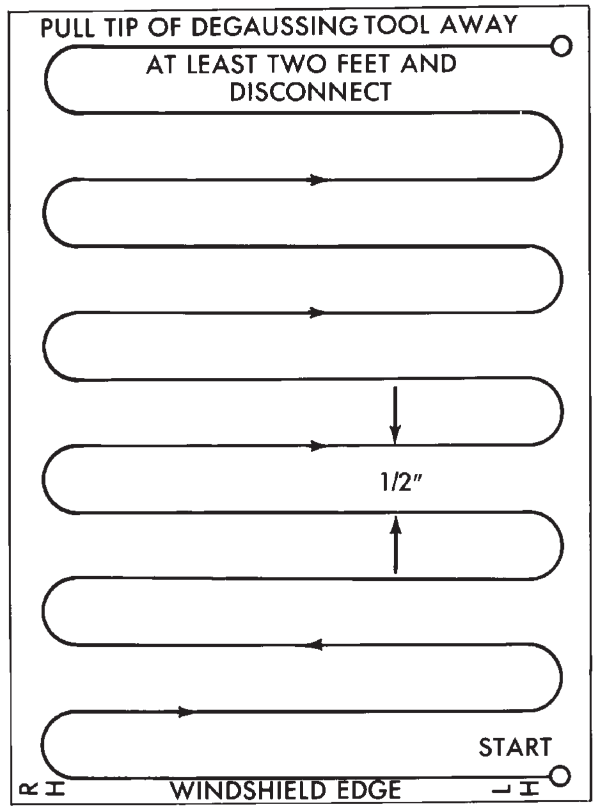
(7) Connect the degaussing tool to an electrical outlet, while keeping the tool at least 61 centimeters (2 feet) away from the compass unit.

(8) Slowly approach the center line of the roof panel at the windshield header, with the degaussing tool connected.

(9) Contact the roof panel with the plastic coated tip of the degaussing tool. Be sure that the template is in place to avoid scratching the roof panel. Using a slow, back-and-forth sweeping motion, and allowing 13 millimeters (0.50 inch) between passes, move the tool at least 11 centimeters (4 inches) to each side of the roof center line, and 28 centimeters (11 inches) back from the windshield header.

(10) With the degaussing tool still energized, slowly back it away from the roof panel. When the tip of the tool is at least 61 centimeters (2 feet) from the roof panel, disconnect the tool.

(11) Calibrate the compass and adjust the compass variance. Refer to **Compass Variation Adjustment** and **Compass Calibration** in the Service Procedures section of this group for the procedures.



J908E-27

Fig. 3 Roof Demagnetizing Pattern

REMOVAL AND INSTALLATION

OVERHEAD CONSOLE

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the screw that secures the front of the overhead console to the front of the overhead console retainer bracket.

(3) Insert the fingertips of both hands between the headliner and the sides of the overhead console housing in the area near the reading and courtesy lamps.

(4) Pull downward on the sides of the overhead console housing firmly and evenly to disengage the two snap clips that secure the rear of the unit from their receptacles in the overhead console retainer bracket.

(5) Lower the overhead console from the headliner far enough to access the wire harness connectors.

(6) Disconnect the roof wire harness connectors from the Electronic Vehicle Information Center connector receptacle, the reading and courtesy lamp wire harness connector and, if the vehicle is so equipped, from the back of the power sunroof switch.

(7) Remove the overhead console from the headliner.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Position the overhead console near the mounting location on the headliner.

(2) Reconnect the roof wire harness connectors to the Electronic Vehicle Information Center connector receptacle, the reading and courtesy lamp wire harness connector and, if the vehicle is so equipped, to the back of the power sunroof switch.

(3) Align the two snap clips on the rear of the overhead console housing with their receptacles in the overhead console retainer bracket.

(4) Push upward firmly and evenly on the sides of the overhead console housing over both of the snap clip locations until each of the two snap clips is fully engaged with its receptacle in the overhead console retainer bracket.

(5) Install and tighten the screw that secures the front of the overhead console housing to the overhead console retainer bracket. Tighten the screw to 1.2 N·m (10 in. lbs.).

(6) Reconnect the battery negative cable.

ELECTRONIC VEHICLE INFORMATION CENTER

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the overhead console from the headliner. Refer to **Overhead Console** in the Removal and Installation section of this group for the procedures.

(3) Remove the four screws that secure the Electronic Vehicle Information Center (EVIC) module to the overhead console housing (Fig. 4).

(4) Remove the EVIC module from the overhead console housing.

INSTALLATION

(1) Position the EVIC module onto the overhead console housing.

(2) Install and tighten the four screws that secure the EVIC module to the overhead console housing. Tighten the screws to 0.9 N·m (8 in. lbs.).

(3) Install the overhead console onto the headliner. Refer to **Overhead Console** in the Removal and Installation section of this group for the procedures.

(4) Reconnect the battery negative cable.

NOTE: If a new compass mini-trip computer has been installed, the compass will have to be calibrated and the variance set. Refer to Compass Variation Adjustment and Compass Calibration in the Service Procedures section of this group for the procedures.

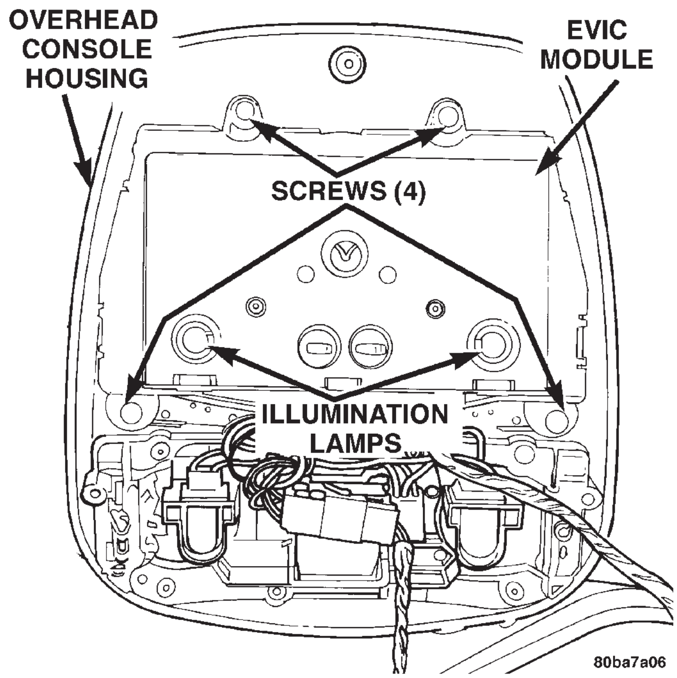


Fig. 4 Electronic Vehicle Information Center Remove/Install

AMBIENT TEMPERATURE SENSOR

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Locate the ambient temperature sensor, on the right side of the radiator opening in the headlamp mounting module, behind the grille (Fig. 5).

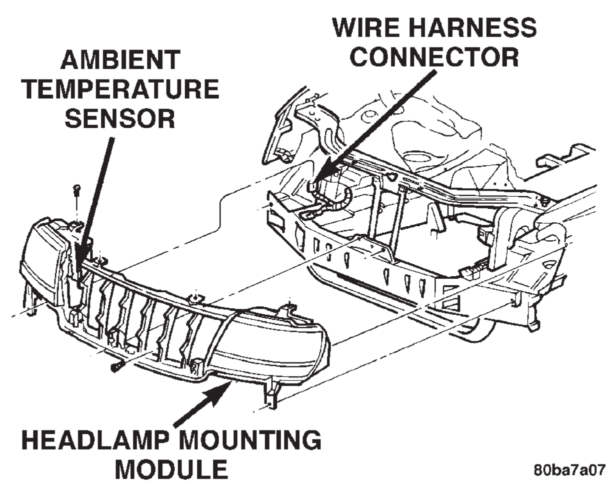


Fig. 5 Ambient Temperature Sensor Remove/Install

(3) Remove the radiator grille fascia and insert from the headlamp mounting module. Refer to **Grille** in the Removal and Installation section of Group 23 - Body for the procedures.

(4) Disconnect the wire harness connector from the ambient temperature sensor connector receptacle.

REMOVAL AND INSTALLATION (Continued)

(5) Remove the one screw that secures the ambient temperature sensor bracket to the headlamp mounting module.

(6) Remove the ambient temperature sensor from the headlamp mounting module.

INSTALLATION

(1) Position the ambient temperature sensor onto the radiator yoke.

(2) Install and tighten the one screw that secures the ambient temperature sensor bracket to the radiator yoke. Tighten the screw to 2.2 N·m (20 in. lbs.).

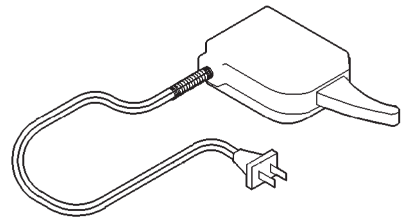
(3) Reconnect the wire harness connector to the ambient temperature sensor connector receptacle.

(4) Install the radiator grille fascia and insert onto the headlamp mounting module. Refer to **Grille** in the Removal and Installation section of Group 23 - Body for the procedures.

(5) Reconnect the battery negative cable.

SPECIAL TOOLS

OVERHEAD CONSOLE SYSTEMS



Degaussing Tool 6029

WIRING DIAGRAMS

CONTENTS

8W-01 GENERAL INFORMATION

INDEX

DESCRIPTION AND OPERATION

INTRODUCTION

Chrysler wiring diagrams are designed to provide information regarding the vehicles wiring content. In order to effectively use Chrysler wiring diagrams to diagnose and repair a Chrysler vehicle, it is important to understand all of their features and characteristics.

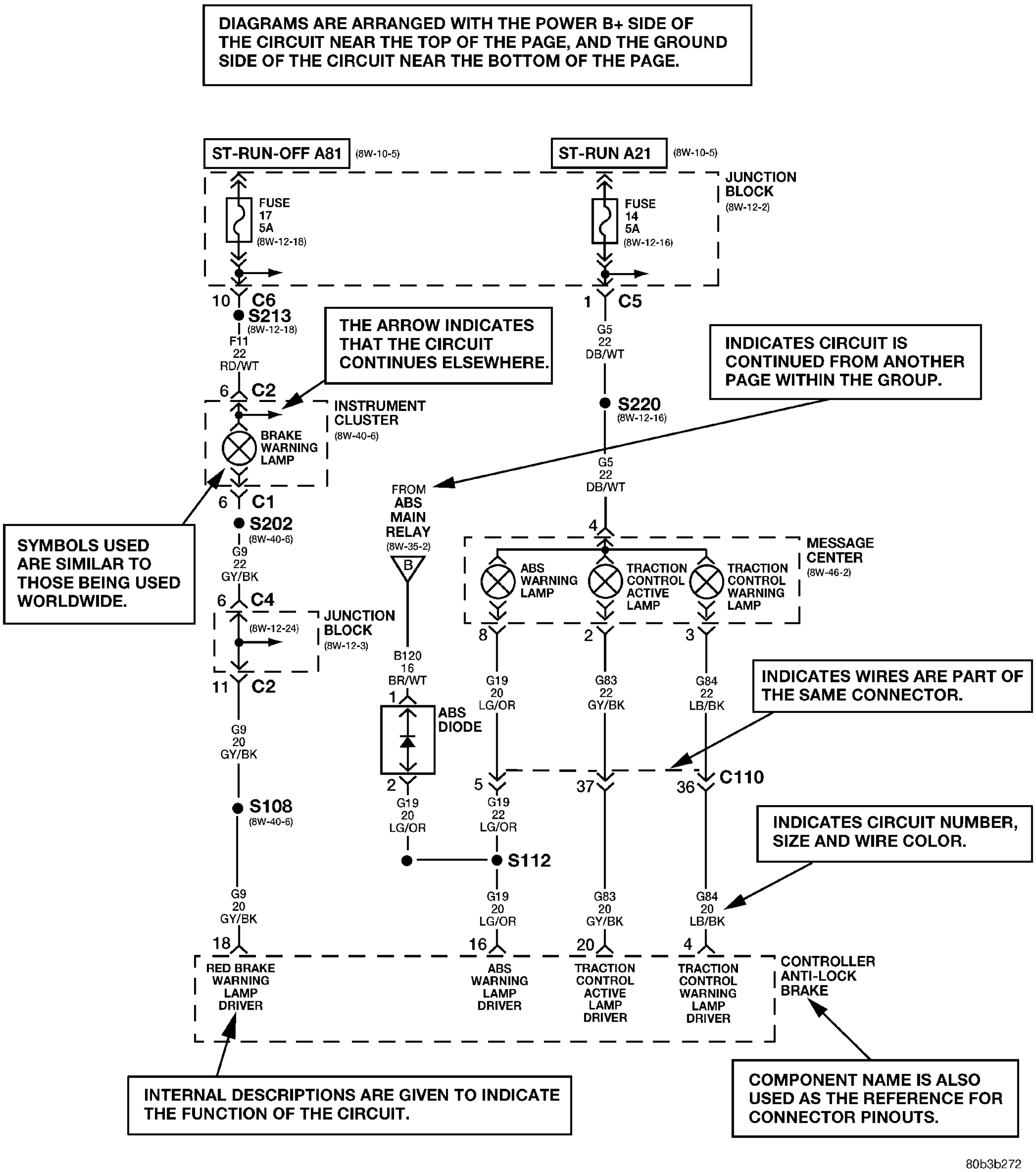
Diagrams are arranged such that the power (B+) side of the circuit is placed near the top of the page, and the ground (B-) side of the circuit is placed near the bottom of the page.

All switches, components, and modules are shown in the at rest position with the doors closed and the key removed from the ignition.

Components are shown two ways. A solid line around a component indicates that the component is complete. A dashed line around a component indicates that the component being shown is not complete. Incomplete components have a reference number to indicate the page where the component is shown complete.

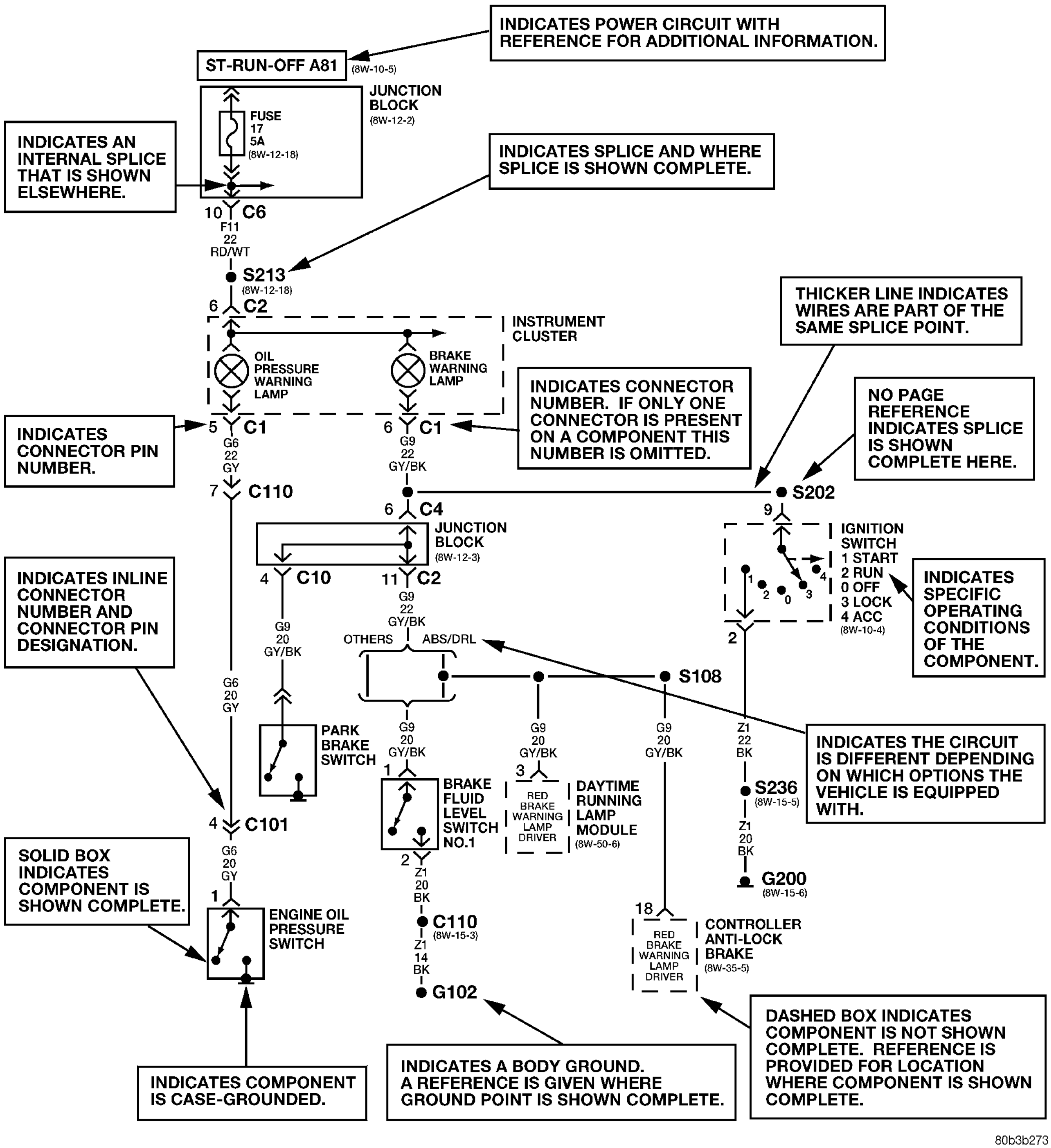
It is important to realize that no attempt is made on the diagrams to represent components and wiring as they appear on the vehicle. For example, a short piece of wire is treated the same as a long one. In addition, switches and other components are shown as simply as possible, with regard to function only.

DESCRIPTION AND OPERATION (Continued)



The System shown here is an EXAMPLE ONLY. It does not represent the actual circuit shown in the WIRING DIAGRAM SECTION.

DESCRIPTION AND OPERATION (Continued)



The System shown here is an EXAMPLE ONLY. It does not represent the actual circuit shown in the WIRING DIAGRAM SECTION.

DESCRIPTION AND OPERATION (Continued)

CIRCUIT INFORMATION

Each wire shown in the diagrams contains a code which identifies the main circuit, part of the main circuit, gage of wire, and color (Fig. 1).

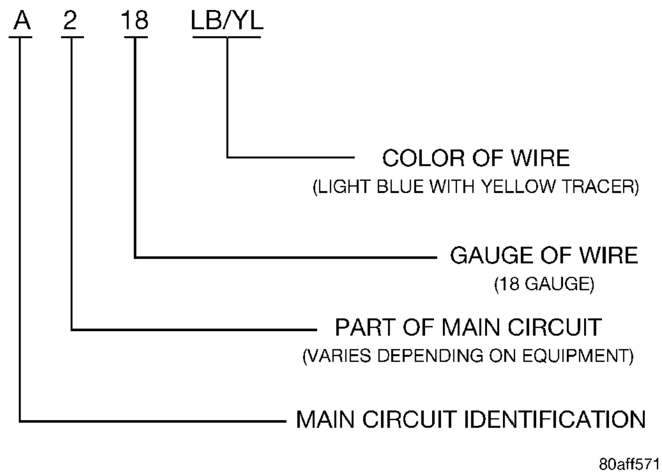


Fig. 1 Wire Code Identification

WIRE COLOR CODE CHART

COLOR CODE	COLOR	STANDARD TRACER COLOR
BL	BLUE	WT
BK	BLACK	WT
BR	BROWN	WT
DB	DARK BLUE	WT
DG	DARK GREEN	WT
GY	GRAY	BK
LB	LIGHT BLUE	BK
LG	LIGHT GREEN	BK
OR	ORANGE	BK
PK	PINK	BK or WT
RD	RED	WT
TN	TAN	WT
VT	VIOLET	WT
WT	WHITE	BK
YL	YELLOW	BK
*	WITH TRACER	

CIRCUIT FUNCTIONS

All circuits in the diagrams use an alpha/numeric code to identify the wire and its function. To identify which circuit code applies to a system, refer to the Circuit Identification Code Chart. This chart shows the main circuits only and does not show the secondary codes that may apply to some models.

CIRCUIT IDENTIFICATION CODE CHART

CIRCUIT	FUNCTION
A	BATTERY FEED
B	BRAKE CONTROLS
C	CLIMATE CONTROLS
D	DIAGNOSTIC CIRCUITS
E	DIMMING ILLUMINATION CIRCUITS
F	FUSED CIRCUITS
G	MONITORING CIRCUITS (GAUGES)
H	OPEN
I	NOT USED
J	OPEN
K	POWERTRAIN CONTROL MODULE
L	EXTERIOR LIGHTING
M	INTERIOR LIGHTING
N	NOT USED
O	NOT USED
P	POWER OPTION (BATTERY FEED)
Q	POWER OPTIONS (IGNITION FEED)
R	PASSIVE RESTRAINT
S	SUSPENSION/STEERING
T	TRANSMISSION/TRANSAXLE/ TRANSFER CASE
U	OPEN
V	SPEED CONTROL, WIPER/WASHER
W	OPEN
X	AUDIO SYSTEMS
Y	OPEN
Z	GROUNDS

DESCRIPTION AND OPERATION (Continued)

SECTION IDENTIFICATION

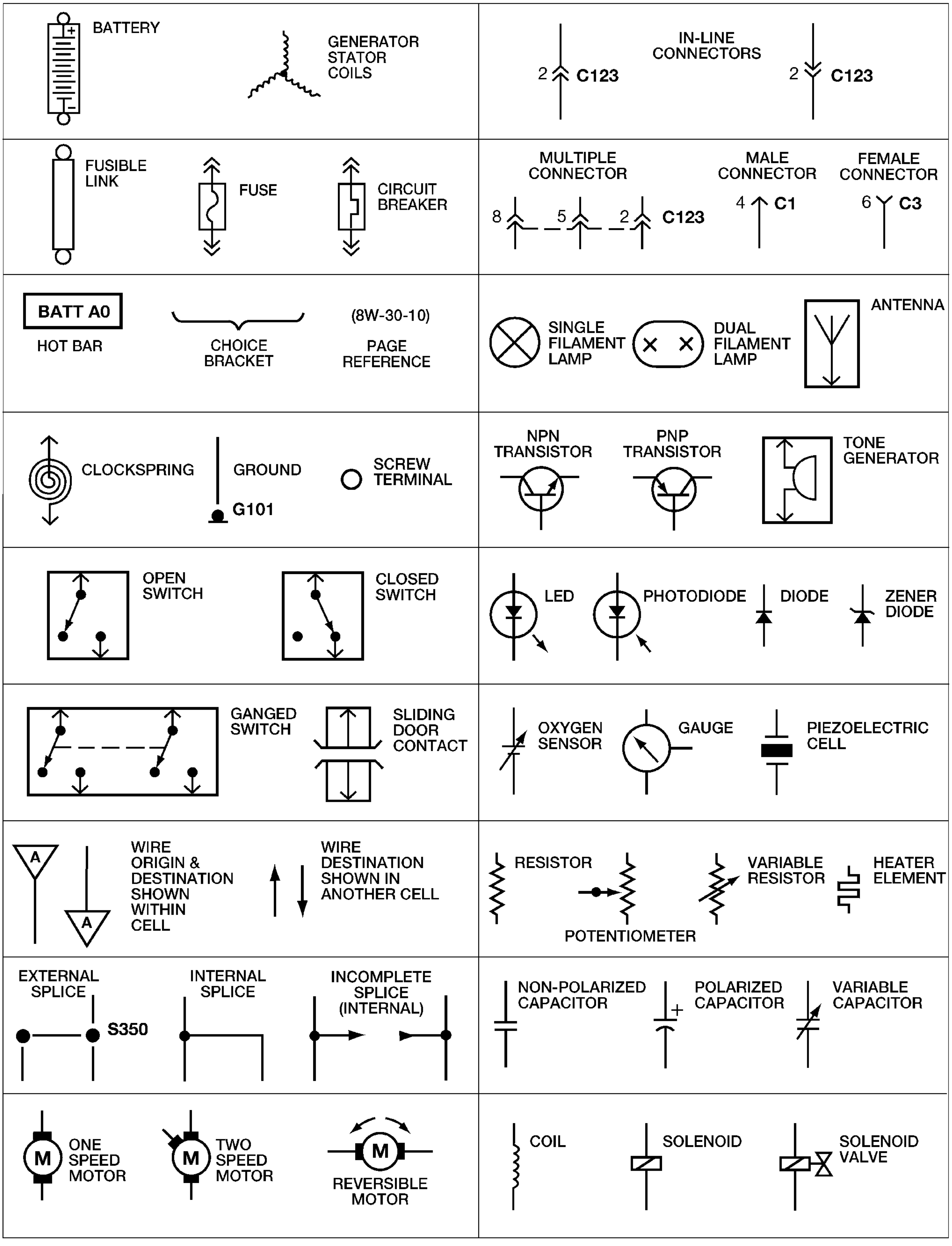
The wiring diagrams are grouped into individual sections. If a component is most likely found in a particular group, it will be shown complete (all wires, connectors, and pins) within that group. For example, the Auto Shutdown Relay is most likely to be found in Group 30, so it is shown there complete. It can, however, be shown partially in another group if it contains some associated wiring.

SYMBOLS

International symbols are used throughout the wiring diagrams. These symbols are consistent with those being used around the world

GROUP	TOPIC
8W-01 thru 8W-09	General Information and Diagram Overview
8W-10 thru 8W-19	Main Sources of Power and Vehicle Grounding
8W-20 thru 8W-29	Starting and Charging
8W-30 thru 8W-39	Powertrain/Drivetrain Systems
8W-40 thru 8W-49	Body Electrical items and A/C
8W-50 thru 8W-59	Exterior Lighting, Wipers, and Trailer Tow
8W-60 thru 8W-69	Power Accessories
8W-70	Splice Information
8W-80	Connector Pin Outs
8W-90	Connector Locations (including grounds)
8W-95	Splice Locations

DESCRIPTION AND OPERATION (Continued)



Wiring Diagram Symbols

DESCRIPTION AND OPERATION (Continued)

TERMINOLOGY

This a list of terms with there definitions used in the wiring diagrams.

Built-Up-Export	Vehicles Built For Sale In Markets Other Than North America
Except-Built-Up-Export	Vehicles Built For Sale In North America
LHD	Left Hand Drive Vehicles
RHD	Right Hand Drive Vehicles
ATX	Automatic Transmission-Front Wheel Drive
MTX	Manual Transmission-Front Wheel Drive
AT	Automatic Transmission-Rear Wheel Drive
MT	Manual Transmission-Rear Wheel Drive
SOHC	Single Over Head Cam Engine
DOHC	Dual Over Head Cam Engine

CONNECTOR INFORMATION

CAUTION: Not all connectors are serviced. Some connectors are serviced only with a harness. A typical example might be the Supplemental Restraint System connectors. Always check parts availability before attempting a repair.

IDENTIFICATION

In-line connectors are identified by a number, as follows:

- In-line connectors located on the **engine compartment harness** are **C100** series numbers.
- Connectors located on the **instrument panel harness** are **C200** series numbers.
- Connectors located on the **body harness** are **C300** series numbers.
- **Jumper harness connectors** are **C400** series numbers.
- **Grounds and ground connectors** are identified with a **"G"** and follow the same series numbering as the in-line connector.

Component connectors are identified by the component name instead of a number (Fig. 2). Multiple connectors on a component use a C1, C2, etc. identifier (Fig. 3).

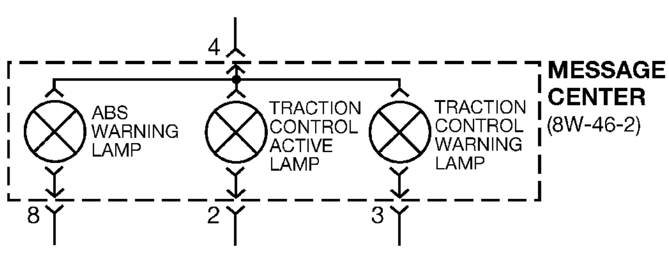


Fig. 2 Component Identification

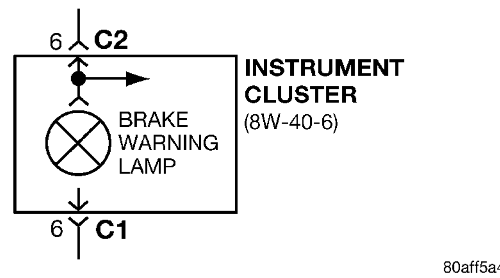


Fig. 3 Connector Identification

LOCATIONS

Section 8W-90 contains connector/ground location illustrations. The illustrations contain the connector name (or number)/ground number and component identification. Connector/ground location charts in Section 8W-90 reference the illustration number for components and connectors.

Section 8W-80 shows each connector and the circuits involved with that connector. The connectors are identified using the name/number on the Diagram pages.

SPLICE LOCATIONS

Splice Location charts in Section 8W-70 show the entire splice, and provide references to other sections the splice serves.

Section 8W-95 contains illustrations that show the general location of the splices in each harness. The illustrations show the splice by number, and provide a written location.

NOTES, CAUTIONS, and WARNINGS

Throughout this group additional important information is presented in three ways; Notes, Cautions, and Warnings.

NOTES are used to help describe how switches or components operate to complete a particular circuit. They are also used to indicate different conditions that may appear on the vehicle. For example, an up-to and after condition.

CAUTIONS are used to indicate information that could prevent making an error that may damage the vehicle.

WARNINGS provide information to prevent personal injury and vehicle damage. Below is a list of general warnings that should be followed any time a vehicle is being serviced.

WARNING: ALWAYS WEAR SAFETY GLASSES FOR EYE PROTECTION.

WARNING: USE SAFETY STANDS ANYTIME A PROCEDURE REQUIRES BEING UNDER A VEHICLE.

DESCRIPTION AND OPERATION (Continued)

WARNING: BE SURE THAT THE IGNITION SWITCH ALWAYS IS IN THE OFF POSITION, UNLESS THE PROCEDURE REQUIRES IT TO BE ON.

WARNING: SET THE PARKING BRAKE WHEN WORKING ON ANY VEHICLE. AN AUTOMATIC TRANSMISSION SHOULD BE IN PARK. A MANUAL TRANSMISSION SHOULD BE IN NEUTRAL.

WARNING: OPERATE THE ENGINE ONLY IN A WELL-VENTILATED AREA.

WARNING: KEEP AWAY FROM MOVING PARTS WHEN THE ENGINE IS RUNNING, ESPECIALLY THE FAN AND BELTS.

WARNING: TO PREVENT SERIOUS BURNS, AVOID CONTACT WITH HOT PARTS SUCH AS THE RADIATOR, EXHAUST MANIFOLD(S), TAIL PIPE, CATALYTIC CONVERTER, AND MUFFLER.

WARNING: DO NOT ALLOW FLAME OR SPARKS NEAR THE BATTERY. GASES ARE ALWAYS PRESENT IN AND AROUND THE BATTERY.

WARNING: ALWAYS REMOVE RINGS, WATCHES, LOOSE HANGING JEWELRY, AND LOOSE CLOTHING.

TAKE OUTS

The abbreviation T/O is used in the component location section to indicate a point in which the wiring harness branches out to a component.

ELECTROSTATIC DISCHARGE (ESD) SENSITIVE DEVICES

All ESD sensitive components are solid state and a symbol (Fig. 4) is used to indicate this. When handling any component with this symbol comply with the following procedures to reduce the possibility of electrostatic charge build up on the body and inadvertent discharge into the component. If it is not known whether the part is ESD sensitive, assume that it is.

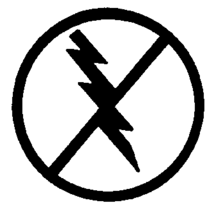
(1) Always touch a known good ground before handling the part. This should be repeated while handling the part and more frequently after sliding across a seat, sitting down from a standing position, or walking a distance.

(2) Avoid touching electrical terminals of the part, unless instructed to do so by a written procedure.

(3) When using a voltmeter, be sure to connect the ground lead first.

(4) Do not remove the part from its protective packing until it is time to install the part.

(5) Before removing the part from its package, ground the package to a known good ground on the vehicle.



948W-193

Fig. 4 Electrostatic Discharge Symbol

DIAGNOSIS AND TESTING

TROUBLESHOOTING TOOLS

When diagnosing a problem in an electrical circuit there are several common tools necessary. These tools are listed and explained below.

• Jumper Wire - This is a test wire used to connect two points of a circuit. It can be used to bypass an open in a circuit.

WARNING: NEVER USE A JUMPER WIRE ACROSS A LOAD, SUCH AS A MOTOR, CONNECTED BETWEEN A BATTERY FEED AND GROUND.

• Voltmeter - Used to check for voltage on a circuit. Always connect the black lead to a known good ground and the red lead to the positive side of the circuit.

CAUTION: Most of the electrical components used in today's vehicle are solid state. When checking voltages in these circuits use a meter with a 10-megohm or greater impedance rating.

• Ohmmeter - Used to check the resistance between two points of a circuit. Low or no resistance in a circuit means good continuity.

CAUTION: - Most of the electrical components used in today's vehicle are Solid State. When checking resistance in these circuits use a meter with a 10-megohm or greater impedance rating. In addition, make sure the power is disconnected from the circuit. Circuits that are powered up by the vehicle electrical system can cause damage to the equipment and provide false readings.

DIAGNOSIS AND TESTING (Continued)

• Probing Tools - These tools are used for probing terminals in connectors (Fig. 5). Select the proper size tool from Special Tool Package 6807, and insert it into the terminal being tested. Use the other end of the tool to insert the meter probe.

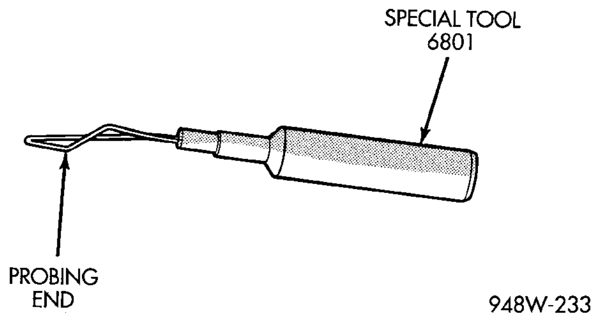


Fig. 5 Probing Tool

INTERMITTENT AND POOR CONNECTIONS

Most intermittent electrical problems are caused by faulty electrical connections or wiring. It is also possible for a sticking component or relay to cause a problem. Before condemning a component or wiring assembly check the following items.

- Connectors are fully seated
- Spread terminals, or terminal push out
- Terminals in the wiring assembly are fully seated into the connector/component and locked in position
- Dirt or corrosion on the terminals. Any amount of corrosion or dirt could cause an intermittent problem
- Damaged connector/component casing exposing the item to dirt and moisture
- Wire insulation that has rubbed through causing a short to ground
- Some or all of the wiring strands broken inside of the insulation covering.
- Wiring broken inside of the insulation

TROUBLESHOOTING TESTS

Before beginning any tests on a vehicles electrical system use the Wiring Diagrams and study the circuit. Also refer to the Troubleshooting Wiring Problems in this section.

TESTING FOR VOLTAGE POTENTIAL

(1) Connect the ground lead of a voltmeter to a known good ground (Fig. 6).

(2) Connect the other lead of the voltmeter to the selected test point. The vehicle ignition may need to be turned ON to check voltage. Refer to the appropriate test procedure.

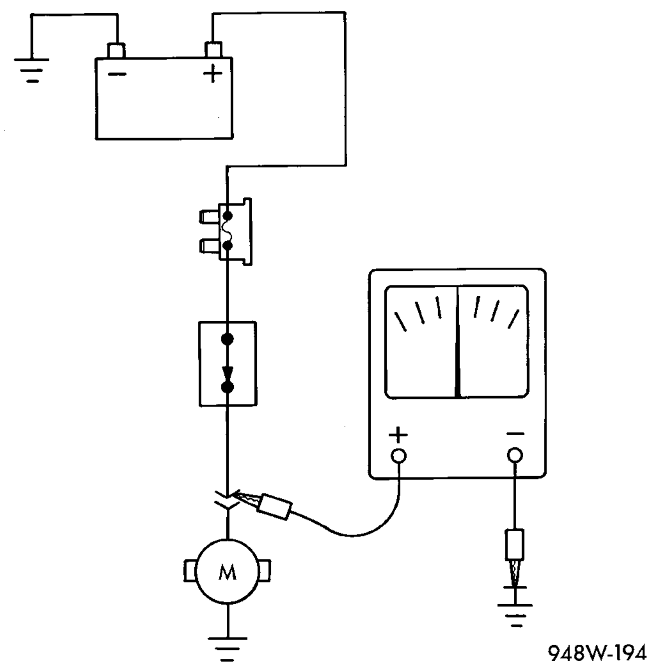


Fig. 6 Testing for Voltage Potential

TESTING FOR CONTINUITY

(1) Remove the fuse for the circuit being checked or, disconnect the battery.

(2) Connect one lead of the ohmmeter to one side of the circuit being tested (Fig. 7).

(3) Connect the other lead to the other end of the circuit being tested. Low or no resistance means good continuity.

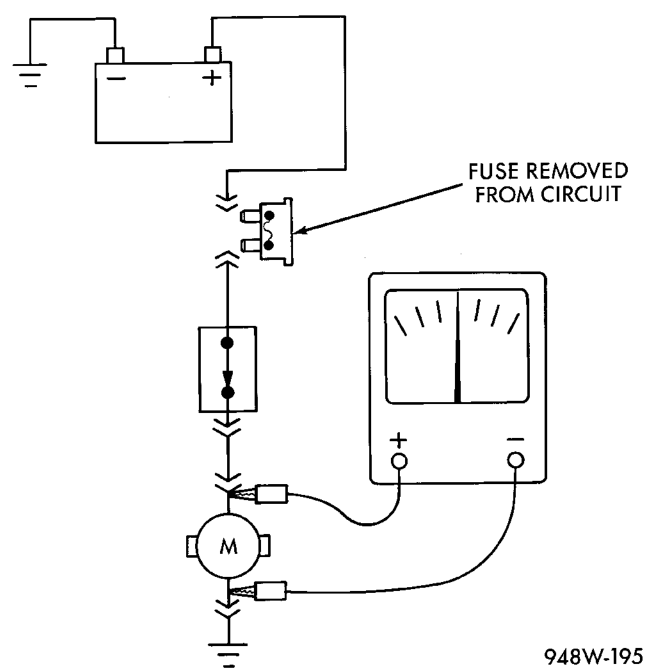


Fig. 7 Testing for Continuity

DIAGNOSIS AND TESTING (Continued)

TESTING FOR A SHORT TO GROUND

(1) Remove the fuse and disconnect all items involved with the fuse.

(2) Connect a test light or a voltmeter across the terminals of the fuse.

(3) Starting at the fuse block, wiggle the wiring harness about six to eight inches apart and watch the voltmeter/test lamp.

(4) If the voltmeter registers voltage or the test lamp glows, there is a short to ground in that general area of the wiring harness.

TESTING FOR A SHORT TO GROUND ON FUSES POWERING SEVERAL LOADS

(1) Refer to the wiring diagrams and disconnect or isolate all items on the suspected fused circuits.

(2) Replace the blown fuse.

(3) Supply power to the fuse by turning ON the ignition switch or re-connecting the battery.

(4) Start connecting the items in the fuse circuit one at a time. When the fuse blows the circuit with the short to ground has been isolated.

TESTING FOR A VOLTAGE DROP

(1) Connect the positive lead of the voltmeter to the side of the circuit closest to the battery (Fig. 8).

(2) Connect the other lead of the voltmeter to the other side of the switch or component.

(3) Operate the item.

(4) The voltmeter will show the difference in voltage between the two points.

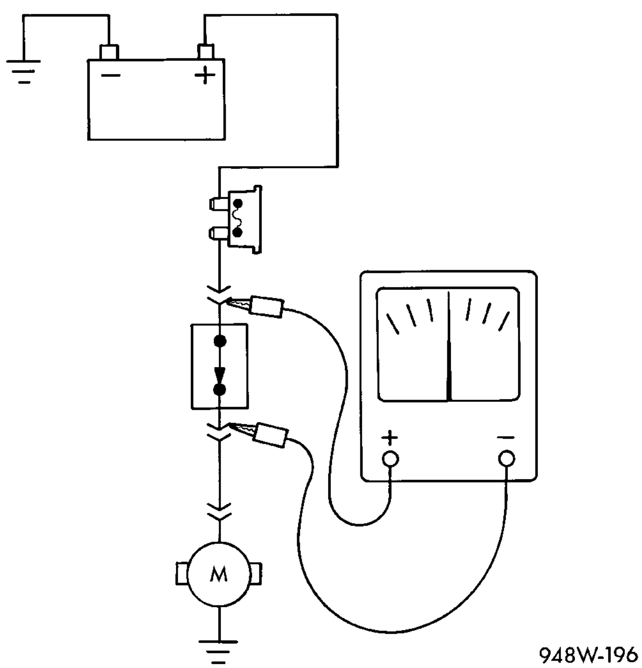


Fig. 8 Testing for Voltage Drop

TROUBLESHOOTING WIRING PROBLEMS

When troubleshooting wiring problems there are six steps which can aid in the procedure. The steps are listed and explained below. Always check for non-factory items added to the vehicle before doing any diagnosis. If the vehicle is equipped with these items, disconnect them to verify these add-on items are not the cause of the problem.

(1) Verify the problem.

(2) Verify any related symptoms. Do this by performing operational checks on components that are in the same circuit. Refer to the wiring diagrams.

(3) Analyze the symptoms. Use the wiring diagrams to determine what the circuit is doing, where the problem most likely is occurring and where the diagnosis will continue.

(4) Isolate the problem area.

(5) Repair the problem.

(6) Verify proper operation. For this step check for proper operation of all items on the repaired circuit. Refer to the wiring diagrams.

SERVICE PROCEDURES

WIRING REPAIR

When replacing or repairing a wire, it is important that the correct gage be used as shown in the wiring diagrams. The wires must also be held securely in place to prevent damage to the insulation.

(1) Disconnect battery negative cable.

(2) Remove 1 inch of insulation from each end of the wire.

(3) Place a piece of heat shrink tubing over one side of the wire. Make sure the tubing will be long enough to cover and seal the entire repair area.

(4) Spread the strands of the wire apart on each part of the exposed wire (example 1) (Fig. 9).

(5) Push the two ends of wire together until the strands of wire are close to the insulation (example 2) (Fig. 9).

(6) Twist the wires together (example 3) (Fig. 9).

(7) Solder the connection together using rosin core type solder only. **Do not use acid core solder.**

(8) Center the heat shrink tubing over the joint, and heat using a heat gun. Heat the joint until the tubing is tightly sealed and sealant comes out of both ends of the tubing.

(9) Secure the wire to the existing ones to prevent chafing or damage to the insulation.

(10) Connect battery and test all affected systems.

TERMINAL/CONNECTOR REPAIR-MOLEX CONNECTORS

(1) Disconnect battery.

SERVICE PROCEDURES (Continued)

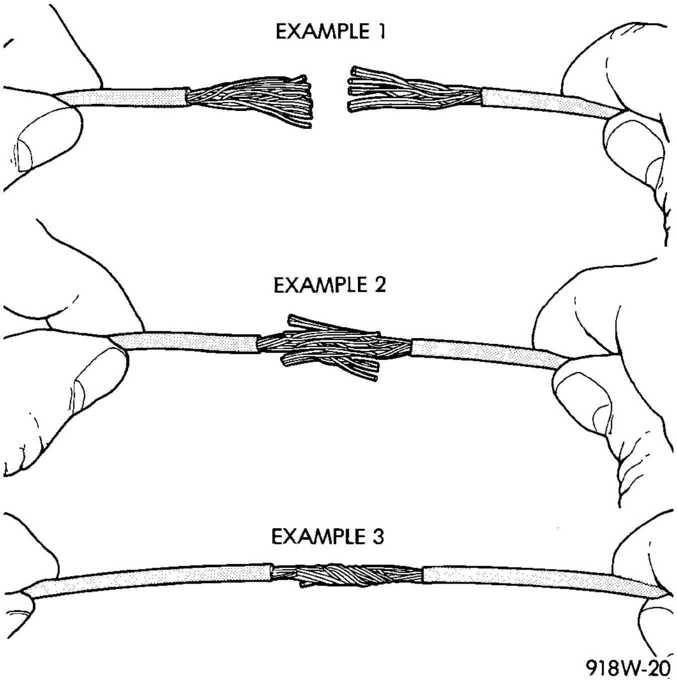


Fig. 9 Wire Repair

(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. 10).

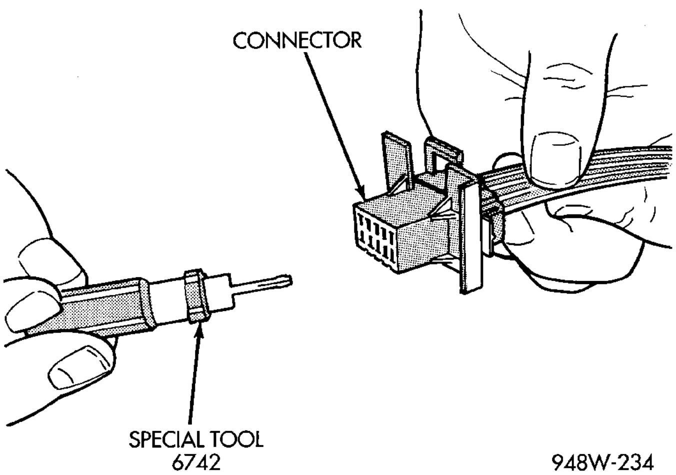


Fig. 10 Molex Connector Repair

(4) Using special tool 6742 release the locking fingers on the terminal (Fig. 11).

(5) Pull on the wire to remove it from the connector.

(6) Repair or replace the connector or terminal, as necessary.

TERMINAL/CONNECTOR REPAIR—THOMAS AND BETTS CONNECTORS

(1) Disconnect battery.

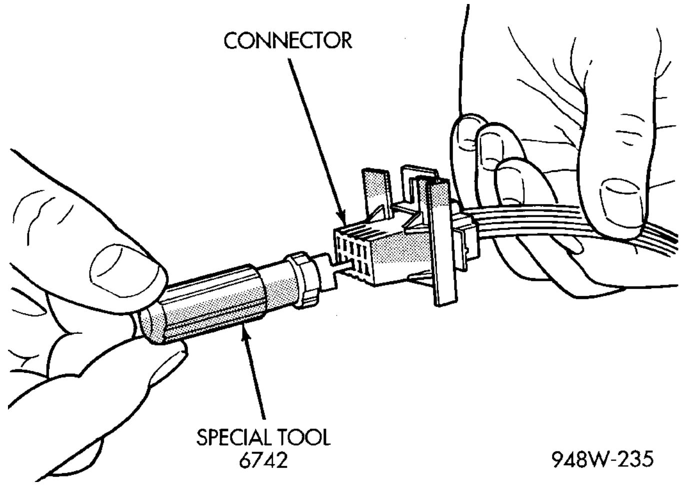


Fig. 11 Using Special Tool 6742

(2) Disconnect the connector from its mating half/component.

(3) Push in the two lock tabs on the side of the connector (Fig. 12).

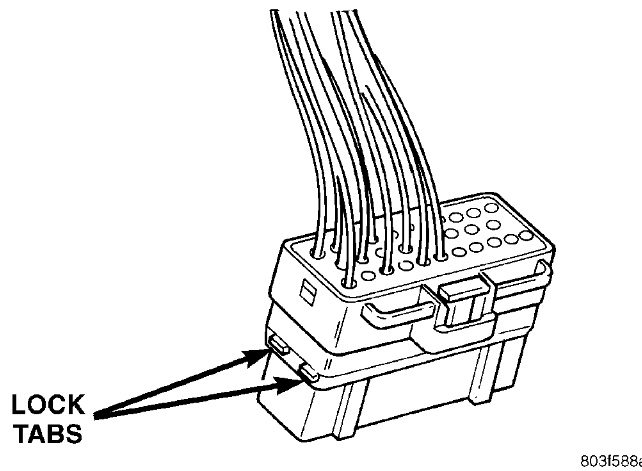


Fig. 12 Thomas and Betts Connector Lock Release Tabs

(4) Insert the probe end of special tool 6934 into the back of the connector cavity (Fig. 13).

(5) Grasp the wire and tool 6934 and slowly remove the wire and terminal from the connector.

(6) Repair or replace the terminal.

(7) Install the wire and terminal in the connector. Fully seat the terminal in the connector.

(8) Push in the single lock tab on the side of the connector (Fig. 14).

TERMINAL/CONNECTOR REPAIR- AUGAT CONNECTORS

(1) Disconnect battery.

(2) Disconnect the connector from its mating half/component.

SERVICE PROCEDURES (Continued)

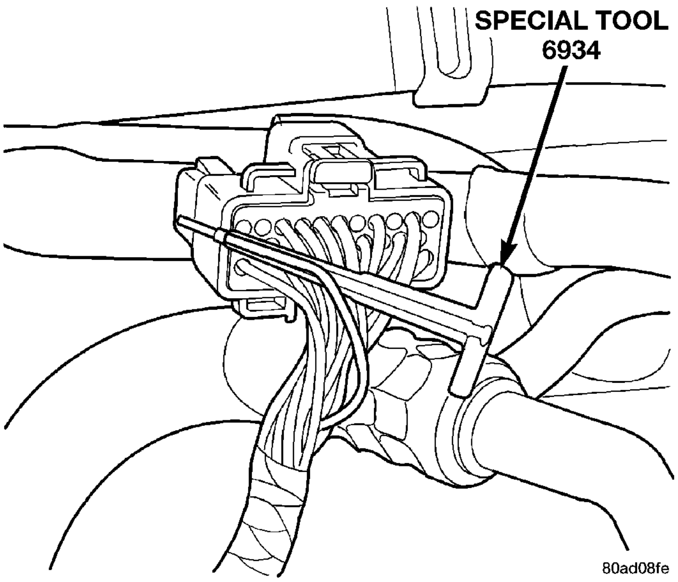


Fig. 13 Removing Wire Terminal

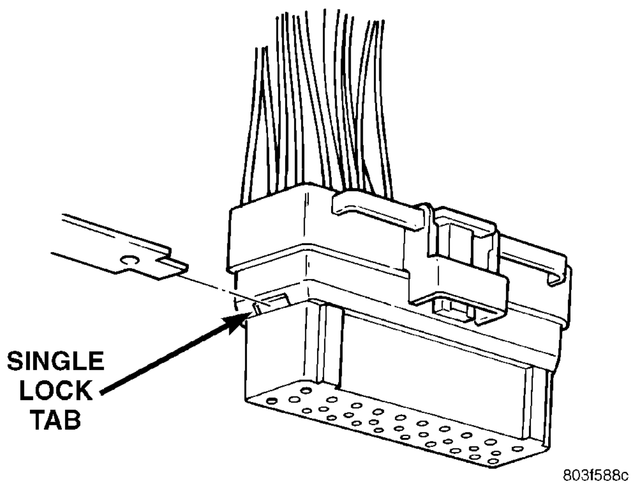


Fig. 14 Single Lock Tab

(3) Push down on the yellow connector locking tab to release the terminals (Fig. 15).

(4) Using special tool 6932, push the terminal to remove it from the connector (Fig. 16).

(5) Repair or replace the connector or terminal as necessary.

(6) When re-assembling the connector, the locking wedge must be placed in the locked position to prevent terminal push out.

CONNECTOR REPLACEMENT

(1) Disconnect battery.

(2) Disconnect the connector that is to be repaired from its mating half/component.

(3) Remove the connector locking wedge, if required (Fig. 17).

(4) Position the connector locking finger away from the terminal using the proper pick from special tool

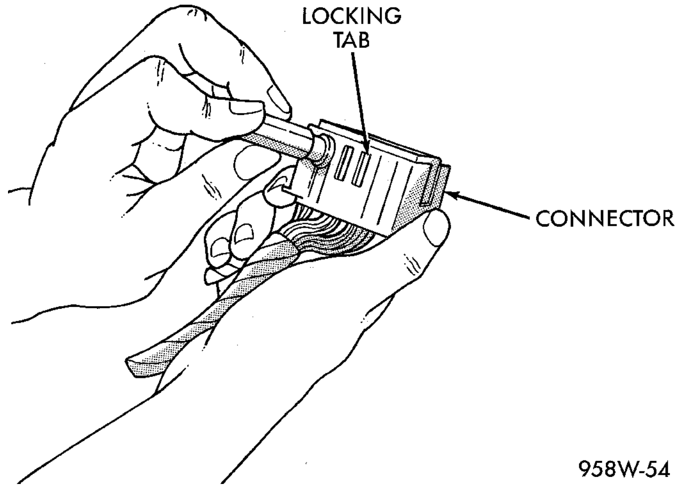


Fig. 15 Augat Connector Repair

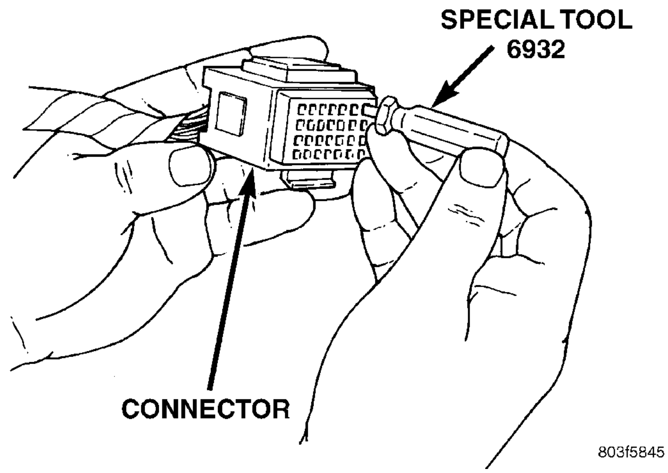


Fig. 16 Using Special Tool 6932

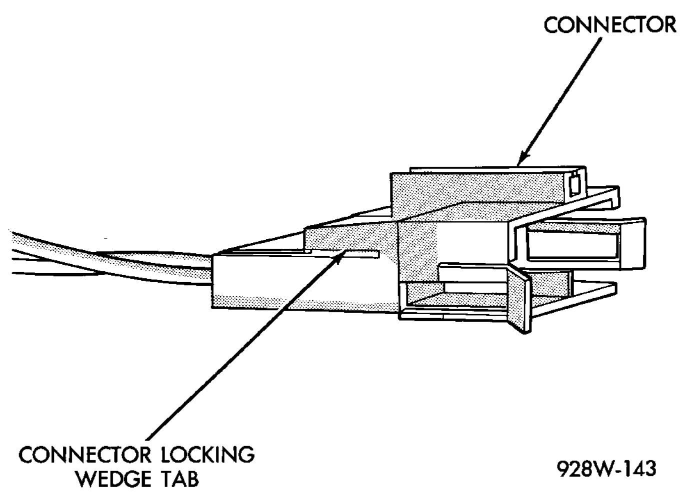


Fig. 17 Connector Locking Wedge

kit 6680. Pull on the wire to remove the terminal from the connector (Fig. 18) (Fig. 19).

(5) Reset the terminal locking tang, if it has one.

SERVICE PROCEDURES (Continued)

(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.

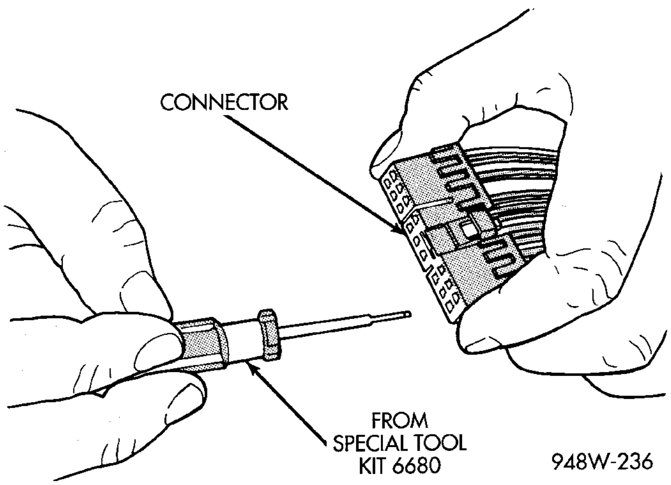


Fig. 18 Terminal Removal

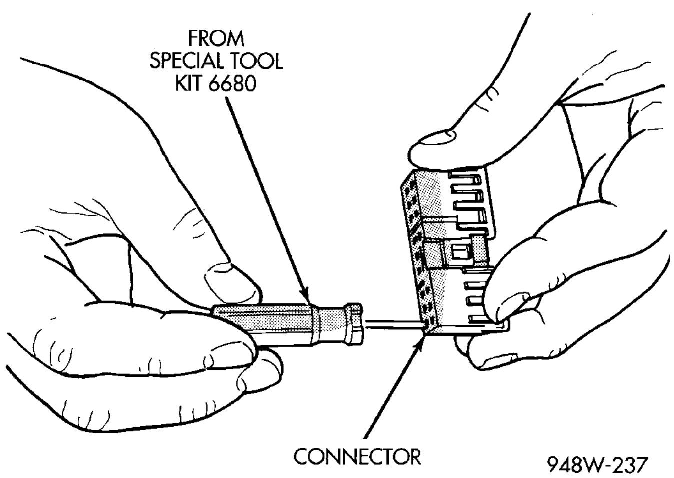


Fig. 19 Terminal Removal Using Special Tool

CONNECTOR AND TERMINAL REPLACEMENT

(1) Disconnect battery.

(2) Disconnect the connector (that is to be repaired) from its mating half/component.

(3) Cut off the existing wire connector directly behind the insulator. Remove six inches of tape from the harness.

(4) Stagger cut all wires on the harness side at 1/2 inch intervals (Fig. 20).

(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. 20).

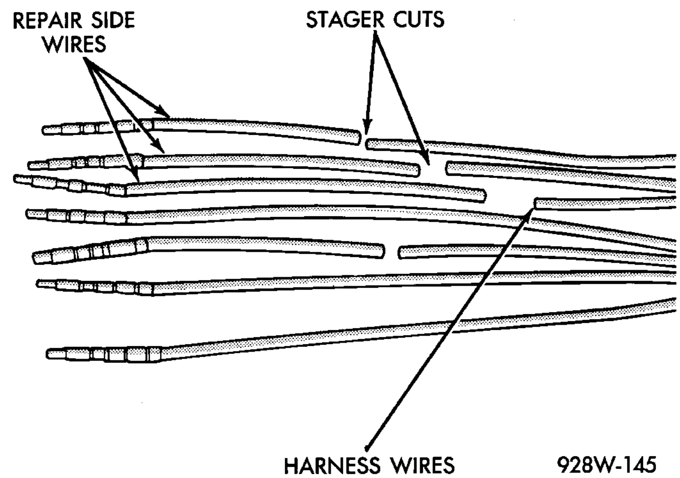


Fig. 20 Stagger Cutting Wires

(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.

(10) Push the two ends of wire together until the strands of wire are close to the insulation.

(11) Twist the wires together.

(12) Solder the connection together using rosin core type solder only. **Do not use acid core solder.**

(13) Center the heat shrink tubing over the joint and heat using a heat gun. Heat the joint until the tubing is tightly sealed and sealant comes out of both ends of the tubing.

(14) Repeat steps 8 through 13 for each wire.

(15) Re-tape the wire harness starting 1-1/2 inches behind the connector and 2 inches past the repair.

(16) Re-connect the repaired connector.

(17) Connect the battery, and test all affected systems.

TERMINAL REPLACEMENT

(1) Disconnect battery.

(2) Disconnect the connector being repaired from its mating half. Remove connector locking wedge, if required (Fig. 21).

(3) Remove connector locking wedge, if required (Fig. 21).

(4) Position the connector locking finger away from the terminal using the proper pick from special tool

SERVICE PROCEDURES (Continued)

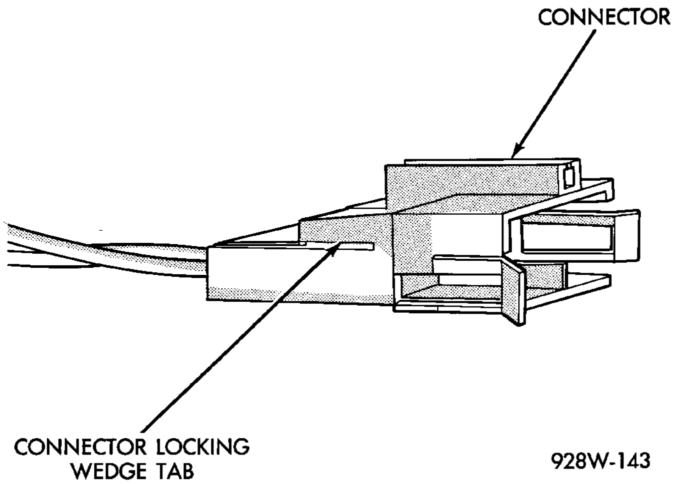


Fig. 21 Connector Locking Wedge Tab (Typical)

kit 6680. Pull on the wire to remove the terminal from the connector (Fig. 22) (Fig. 23).

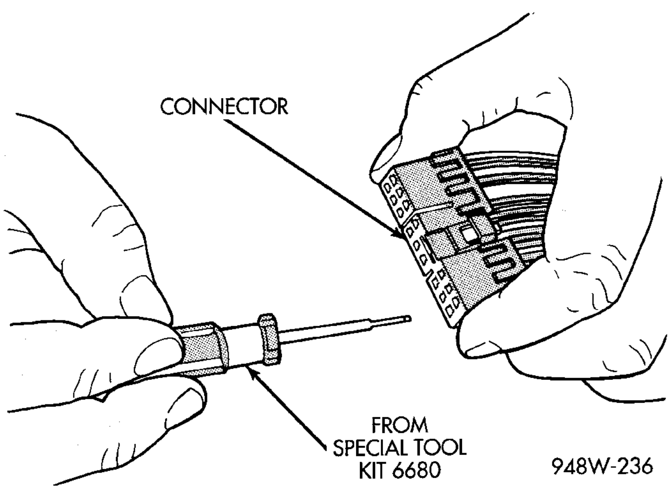


Fig. 22 Terminal Removal

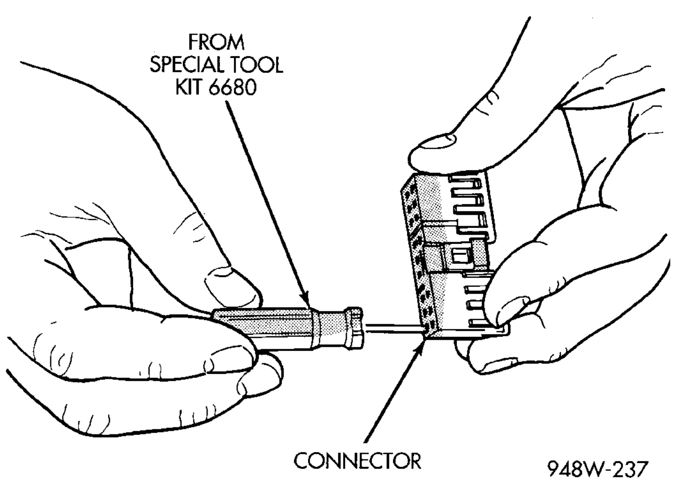


Fig. 23 Terminal Removal Using Special Tool

(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.

(11) Push the two ends of wire together until the strands of wire are close to the insulation.

(12) Twist the wires together.

(13) Solder the connection together using rosin core type solder only. **Do not use acid core solder.**

(14) Center the heat shrink tubing over the joint and heat using a heat gun. Heat the joint until the tubing is tightly sealed and sealant comes out of both ends of the tubing.

(15) Insert the repaired wire into the connector.

(16) Install the connector locking wedge, if required, and reconnect the connector to its mating half/component.

(17) Re-tape the wire harness starting 1-1/2 inches behind the connector and 2 inches past the repair.

(18) Connect battery, and test all affected systems.

DIODE REPLACEMENT

(1) Disconnect the battery.

(2) Locate the diode in the harness, and remove the protective covering.

(3) Remove the diode from the harness, pay attention to the current flow direction (Fig. 24).

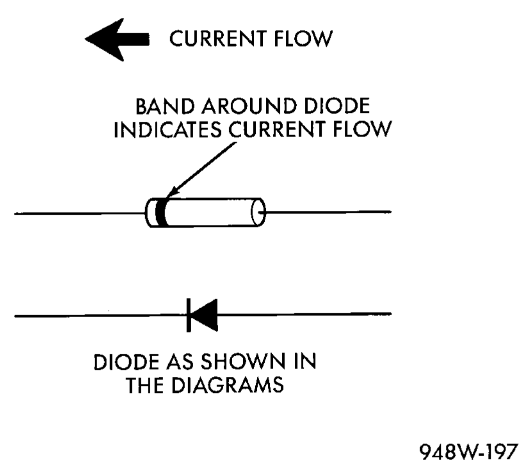


Fig. 24 Diode Identification

(4) Remove the insulation from the wires in the harness. Only remove enough insulation to solder in the new diode.

SERVICE PROCEDURES (Continued)

(5) Install the new diode in the harness, making sure current flow is correct. If necessary refer to the appropriate wiring diagram for current flow.

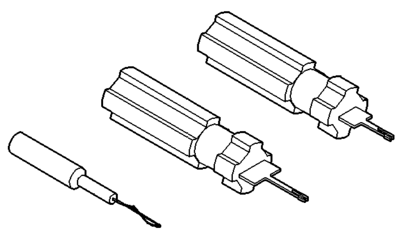
(6) Solder the connection together using rosin core type solder only. **Do not use acid core solder.**

(7) Tape the diode to the harness using electrical tape making, sure the diode is completely sealed from the elements.

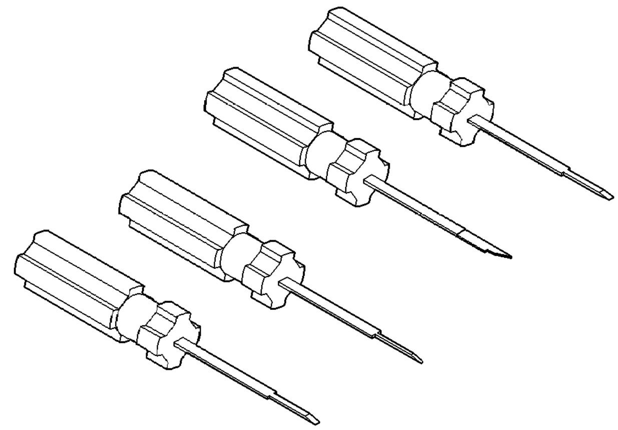
(8) Re-connect the battery, and test affected systems.

SPECIAL TOOLS

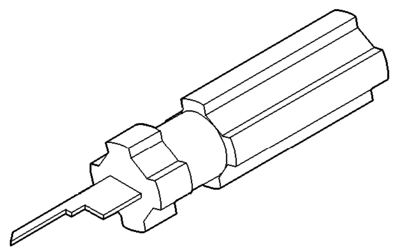
WIRING/TERMINAL



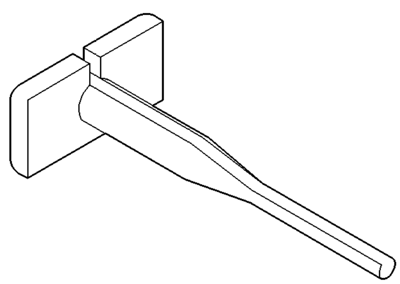
Probing Tool Package 6807



Terminal Pick 6680



Terminal Removing Tool 6932

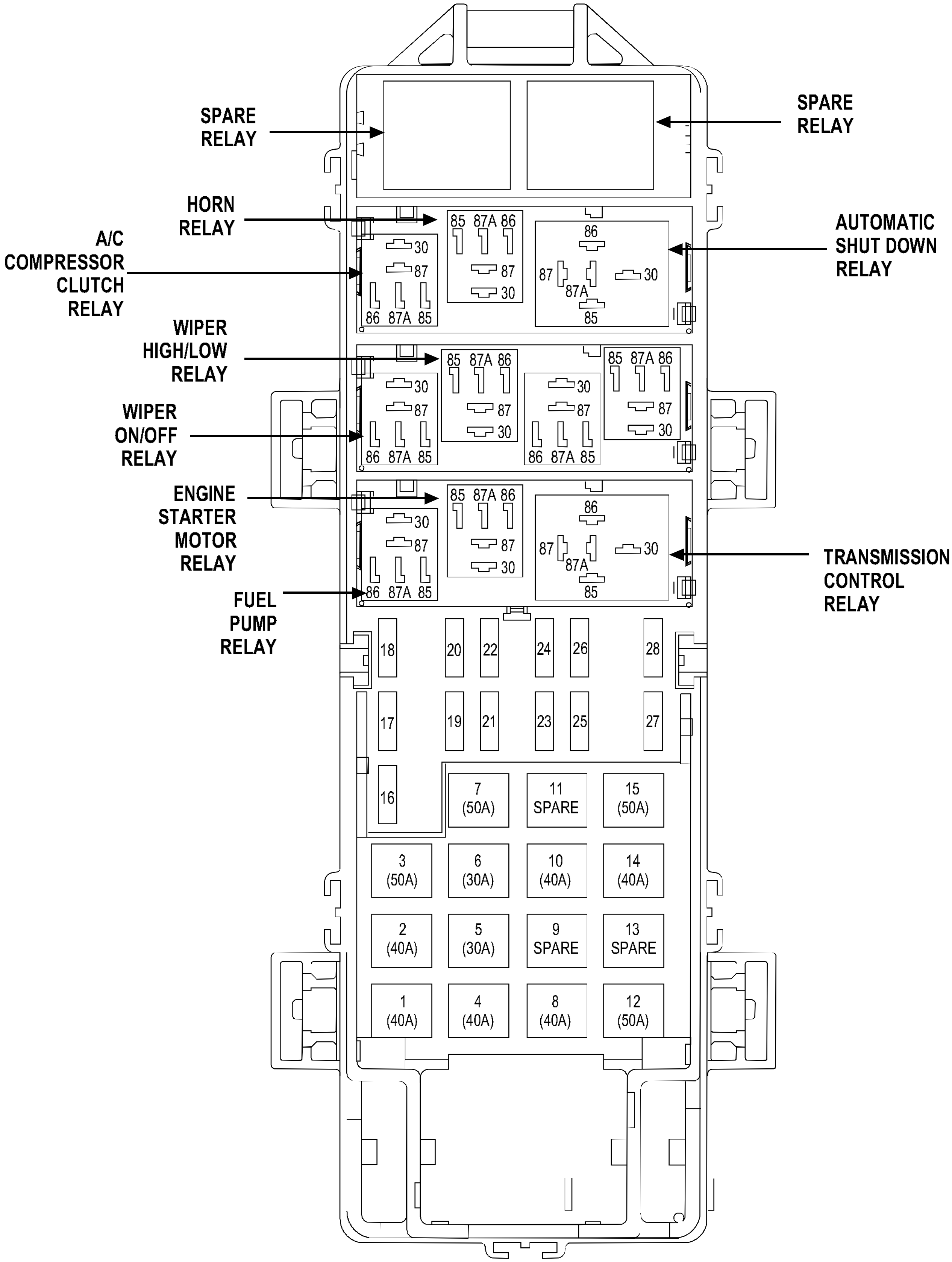


Terminal Removing Tool 6934

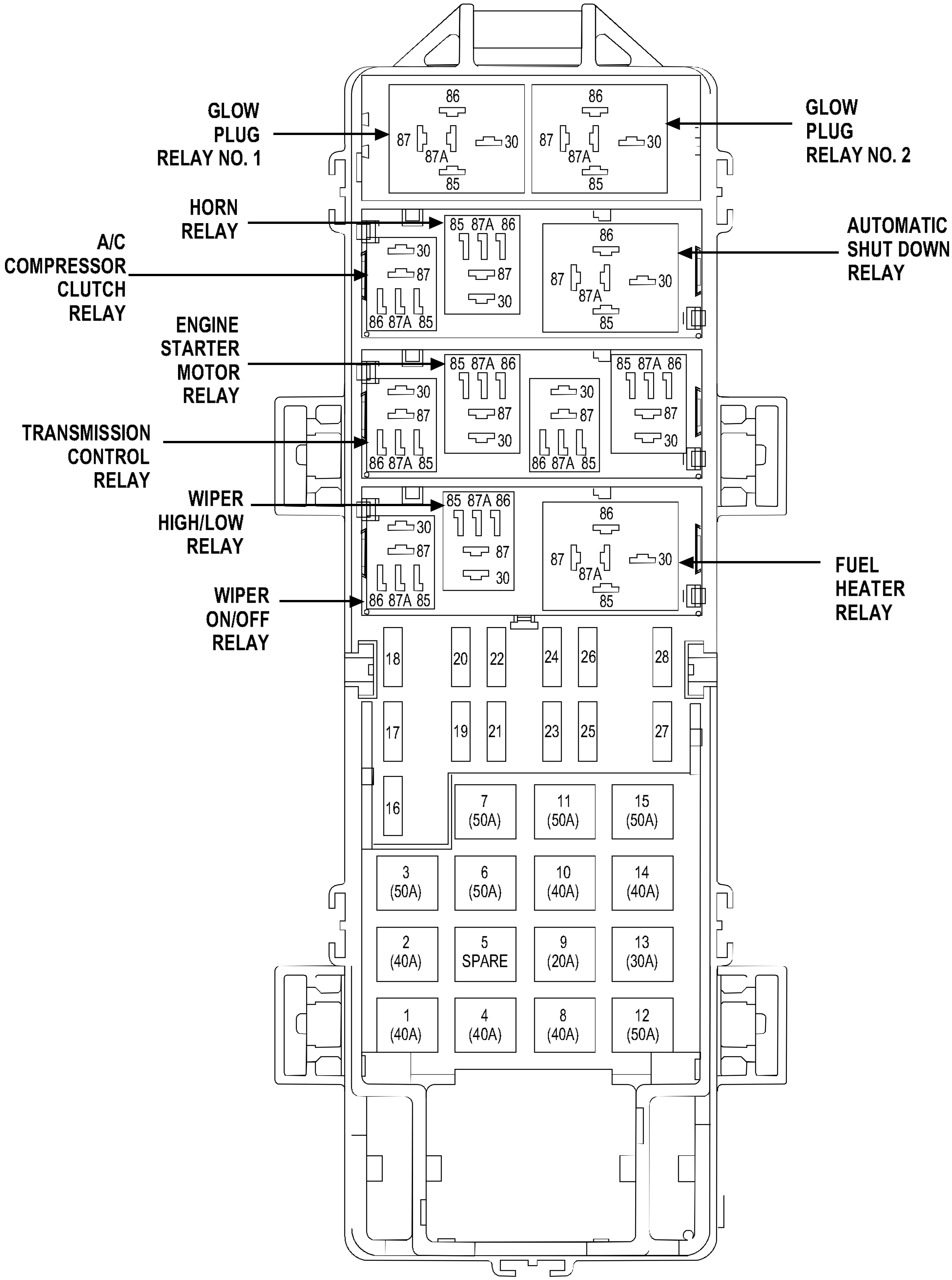
8W-02 COMPONENT INDEX

8W-10 POWER DISTRIBUTION

POWER DISTRIBUTION CENTER



POWER DISTRIBUTION CENTER



FUSES

FUSE NO.	AMPS	FUSED CIRCUIT	FEED CIRCUIT
1	40A	C1 12DG	A0 6RD
2	40A	A149 12RD/TN	A0 6RD
3	50A	A145 10WT/RD	A0 6RD
4	40A	A10 12RD/DG	A0 6RD
5	30A	A30 14RD/WT A30 14RD/WT	A0 6RD
6	30A	A14 14RD/DG	A0 6RD
7	50A	A147 10RD/GY	A0 6RD
8	40A	A1 12RD	A0 6RD
9	-	-	-
10	40A	A16 12GY	A0 6RD
11	-	-	-
12	50A	A146 10OR/WT	A0 6RD
13	-	-	-
14	40A	A2 12PK/BK	A0 6RD
15	50A	A148 10PK/WT	A0 6RD
16	10A	F142 18OR/DG F142 18OR/DG	A142 14DG/OR
17	-	-	-
18	15A	F62 18RD F62 18RD	A0 6RD
19	10A	A7 14RD/BK	A0 6RD
20	-	-	-
21	15A	A17 18RD/BK	A0 6RD
22	-	-	-
23	-	-	-
24	20A	A62 16VT/WT	A0 6RD
25	20A	A20 12RD/DB	A0 6RD
26	15A	F42 18DG/LG F42 18DG/LG	A142 14DG/OR
27	-	-	-
28	15A	T60 18BR	T16 14RD

FUSES

FUSE NO.	AMPS	FUSED CIRCUIT	FEED CIRCUIT
1	40A	C1 12DG	A0 6RD
2	40A	A149 12RD/TN	A0 6RD
3	50A	A145 10WT/RD	A0 6RD
4	40A	A10 12RD/DG	A0 6RD
5	-	-	-
6	50A	A105 10DB/RD	A0 6RD
7	50A	A147 10RD/GY	A0 6RD
8	40A	A1 12RD	A0 6RD
9	20A	A12 16TN/RD	A0 6RD
10	40A	A16 12GY	A0 6RD
11	50A	A110 10VT/RD	A0 6RD
12	50A	A146 10OR/WT	A0 6RD
13	30A	A14 14RD/WT	A0 6RD
14	40A	A2 12PK/BK	A0 6RD
15	50A	A148 10PK/WT	A0 6RD
16	10A	F15 18DB/WT	A142 14DG/OR
17	-	-	-
18	15A	F62 18RD F62 18RD	A0 6RD
19	10A	-	-
20	-	-	-
21	15A	A17 18RD/BK	A0 6RD
22	-	-	-
23	-	-	-
24	15A	A14 16RD/WT A14 16RD/WT	A0 6RD
25	20A	A20 12RD/DB	A0 6RD
26	15A	F42 18DG/LG	A142 14DG/OR
27	-	-	-
28	-	-	-

A/C COMPRESSOR CLUTCH RELAY

CAVITY	CIRCUIT	FUNCTION
30	A17 18RD/BK	FUSED B(+)
85	F99 20OR ●	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
	F15 20DB/WT ▲	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
	F15 18DB/WT ▲	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
86	C13 18DB/OR	A/C COMPRESSOR CLUTCH RELAY CONTROL
87	C2 18DB/YL	A/C COMPRESSOR CLUTCH RELAY OUTPUT
87A	-	-

AUTOMATIC SHUT DOWN RELAY

CAVITY	CIRCUIT	FUNCTION
30	A14 14RD/WT ▲	FUSED B(+)
30	A14 14RD/DG ●	FUSED B(+)
85	A14 14RD/WT ▲	FUSED B(+)
	A14 14RD/WT ▲	FUSED B(+)
	F991 20OR/DB ●	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
	F991 20OR/DB ●	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
86	K51 18DB/YL	AUTOMATIC SHUT DOWN RELAY CONTROL
87	A142 14DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
87A	-	-

ENGINE STARTER MOTOR RELAY

CAVITY	CIRCUIT	FUNCTION
30	A1 12RD	FUSED B(+)
85	F45 20YL/RD ●	FUSED IGNITION SWITCH OUTPUT (ST)
	F45 20YL/RD	FUSED IGNITION SWITCH OUTPUT (ST)
86	T24 20BR/YL	ENGINE STARTER MOTOR RELAY CONTROL
87	T40 12LG	ENGINE STARTER MOTOR RELAY OUTPUT
87A	-	-

▲ DIESEL
● GAS

FUEL HEATER RELAY (DIESEL)

CAVITY	CIRCUIT	FUNCTION
30	A12 16TN/RD	FUSED B(+)
85	F99 20OR	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
	F99 20OR	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
86	Z1 20BK	GROUND
87	A93 16RD/BK	FUEL HEATER RELAY OUTPUT
87A	-	-

FUEL PUMP RELAY (GAS)

CAVITY	CIRCUIT	FUNCTION
30	A62 16VT/WT	FUSED B(+)
85	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
86	K31 18BR	FUEL PUMP RELAY CONTROL
87	A141 16DG/BK	FUEL PUMP RELAY OUTPUT
87A	-	-

GLOW PLUG RELAY NO. 1 (DIESEL)

CAVITY	CIRCUIT	FUNCTION
30	A105 10DB/RD	FUSED B(+)
85	F15 20DB/WT	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
	F15 20DB/WT	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
86	K152 20WT	GLOW PLUG RELAY NO. 1 CONTROL
87	K154 10GY	GLOW PLUG RELAY NO. 1 OUTPUT
87A	-	-

GLOW PLUG RELAY NO. 2 (DIESEL)

CAVITY	CIRCUIT	FUNCTION
30	A110 10VT/RD	FUSED B(+)
85	F15 20DB/WT	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
	F15 20DB/WT	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
86	K252 20LB/WT	GLOW PLUG RELAY NO. 2 CONTROL
87	K254 10GY/YL	GLOW PLUG RELAY NO. 2 OUTPUT
87A	-	-

HORN RELAY

CAVITY	CIRCUIT	FUNCTION
30	F62 18RD	FUSED B(+)
85	F62 18RD	FUSED B(+)
86	X4 20GY/OR	HORN RELAY CONTROL
87	X2 18DG/RD ●	HORN RELAY OUTPUT
	X2 18DG/RD	HORN RELAY OUTPUT
87A	-	-

TRANSMISSION CONTROL RELAY (DIESEL)

CAVITY	CIRCUIT	FUNCTION
30	A14 16RD/WT	FUSED B(+)
85	K125 18WT/DB	GENERATOR SOURCE (+)
	K125 18WT/DB	GENERATOR SOURCE (+)
86	K30 20PK/YL	TRANSMISSION CONTROL RELAY CONTROL
87	T60 18BR	TRANSMISSION CONTROL RELAY OUTPUT
87A	-	-

TRANSMISSION CONTROL RELAY (GAS)

CAVITY	CIRCUIT	FUNCTION
30	A30 14RD/WT	FUSED B(+)
85	K210 18BK/YL	● ● GROUND
		▲ ▲ GENERATOR SOURCE
86	K30 20PK/YL	TRANSMISSION CONTROL RELAY CONTROL
87	T16 14RD	TRANSMISSION CONTROL RELAY OUTPUT
	T16 14RD	TRANSMISSION CONTROL RELAY OUTPUT
87A	-	-

● GAS
● ● 4.7L
▲ ▲ 4.0L

J998W-19 WG001008

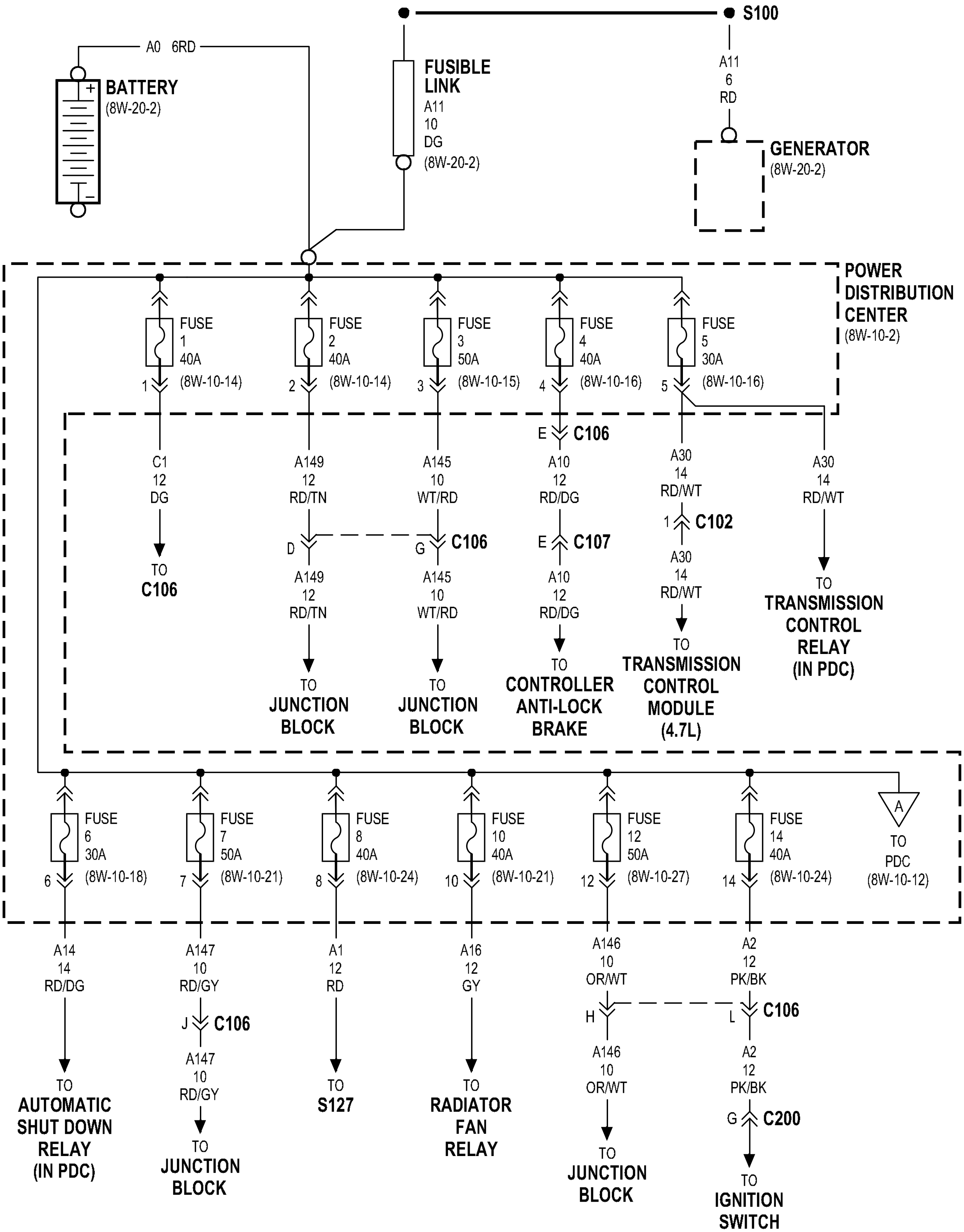
WIPER HIGH/LOW RELAY

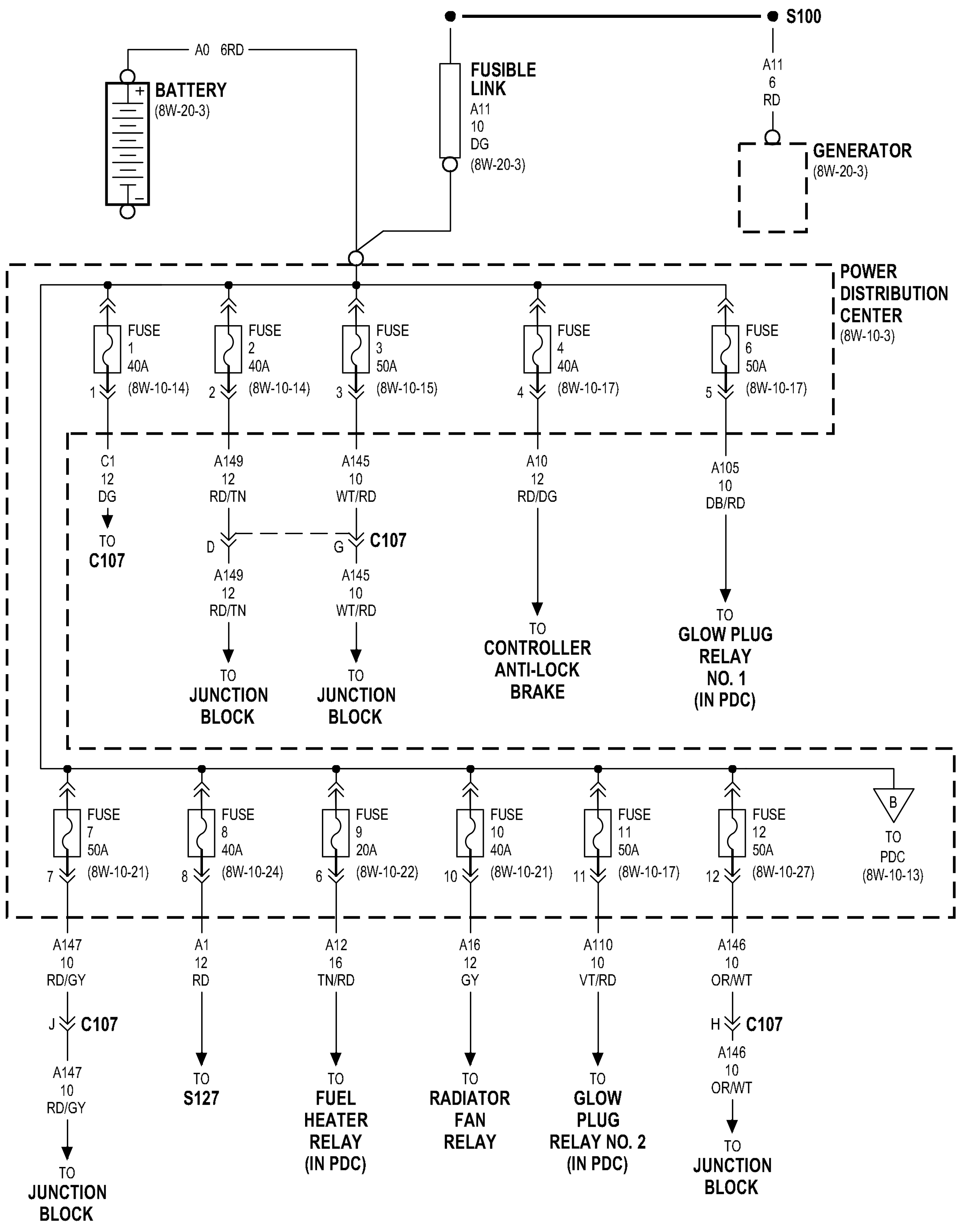
CAVITY	CIRCUIT	FUNCTION
30	V60 16YL/DG	WIPER ON/OFF RELAY OUTPUT
85	Z1 20BK	GROUND
86	V16 20VT	WIPER HIGH/LOW RELAY CONTROL
87	V4 16RD/YL	WIPER HIGH/LOW RELAY HIGH SPEED OUTPUT
87A	V3 16BR/WT	WIPER HIGH/LOW RELAY LOW SPEED OUTPUT

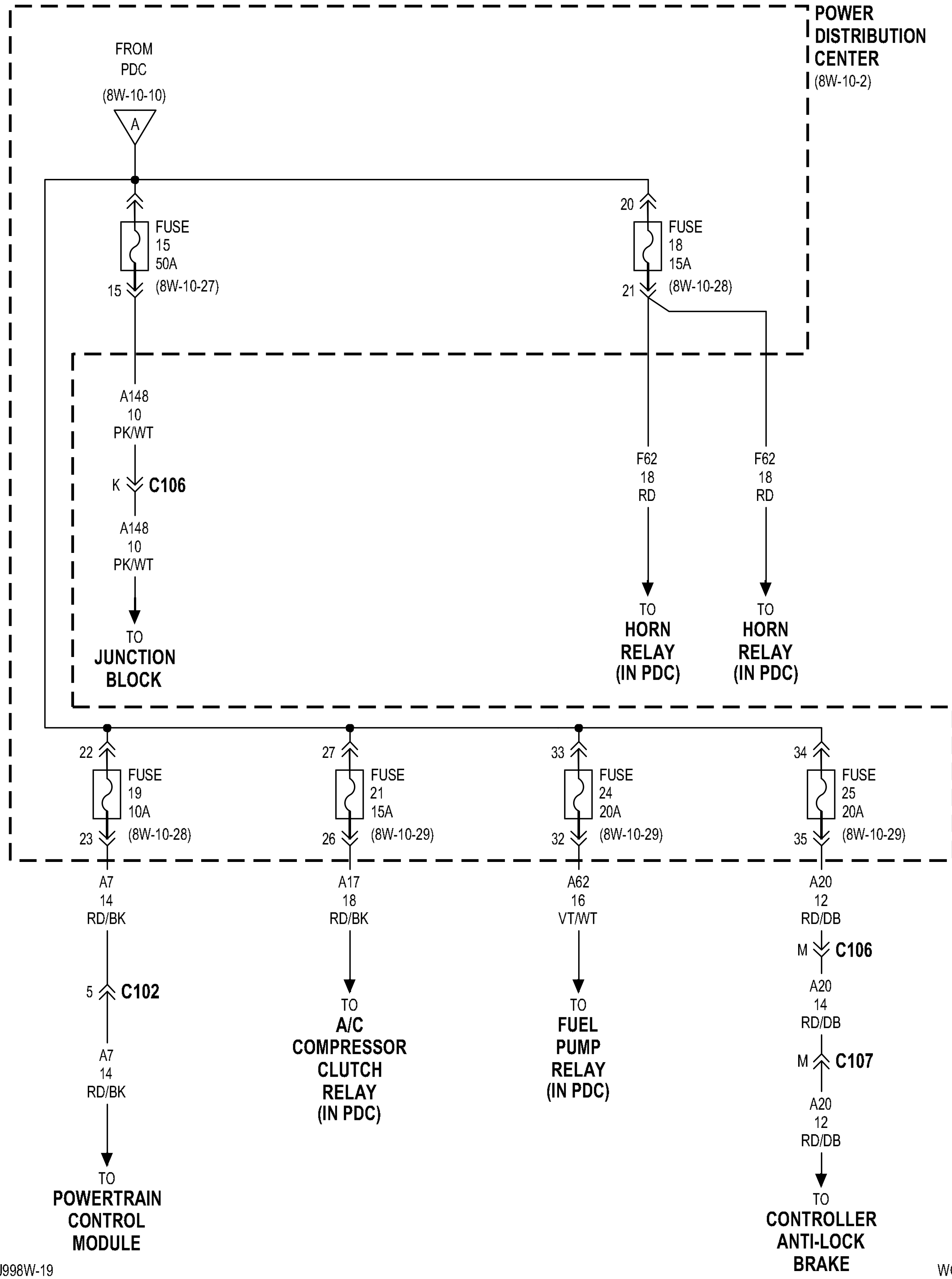
WIPER ON/OFF RELAY

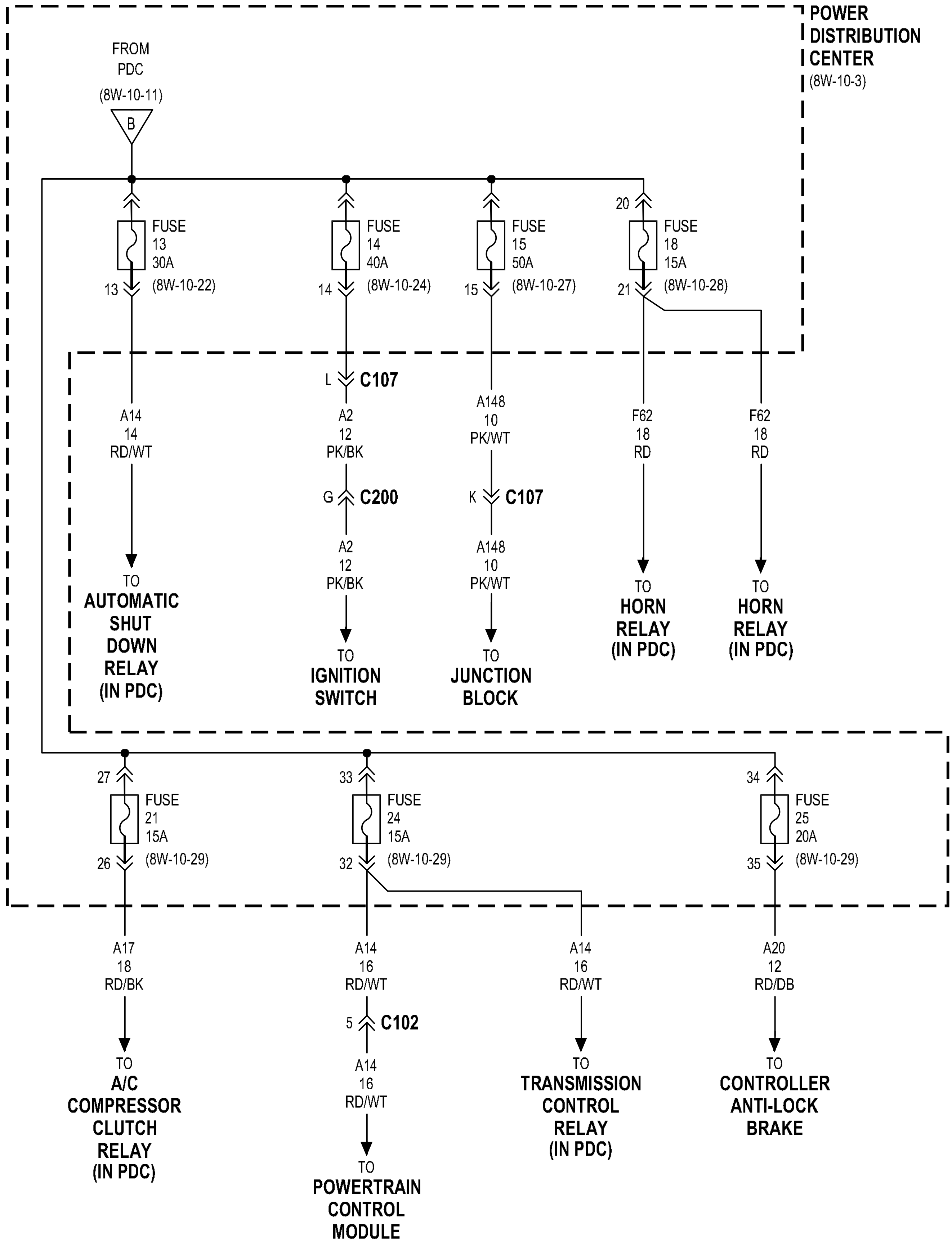
CAVITY	CIRCUIT	FUNCTION
30	V60 16YL/DG	WIPER ON/OFF RELAY OUTPUT
85	V14 20RD/VT	WIPER ON/OFF RELAY CONTROL
86	V6 16DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
	V6 16DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
87	V6 16DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
	V6 16DB •	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
87A	V55 16TN/RD	WIPER PARK SWITCH SENSE
	V55 16TN/RD •	WIPER PARK SWITCH SENSE

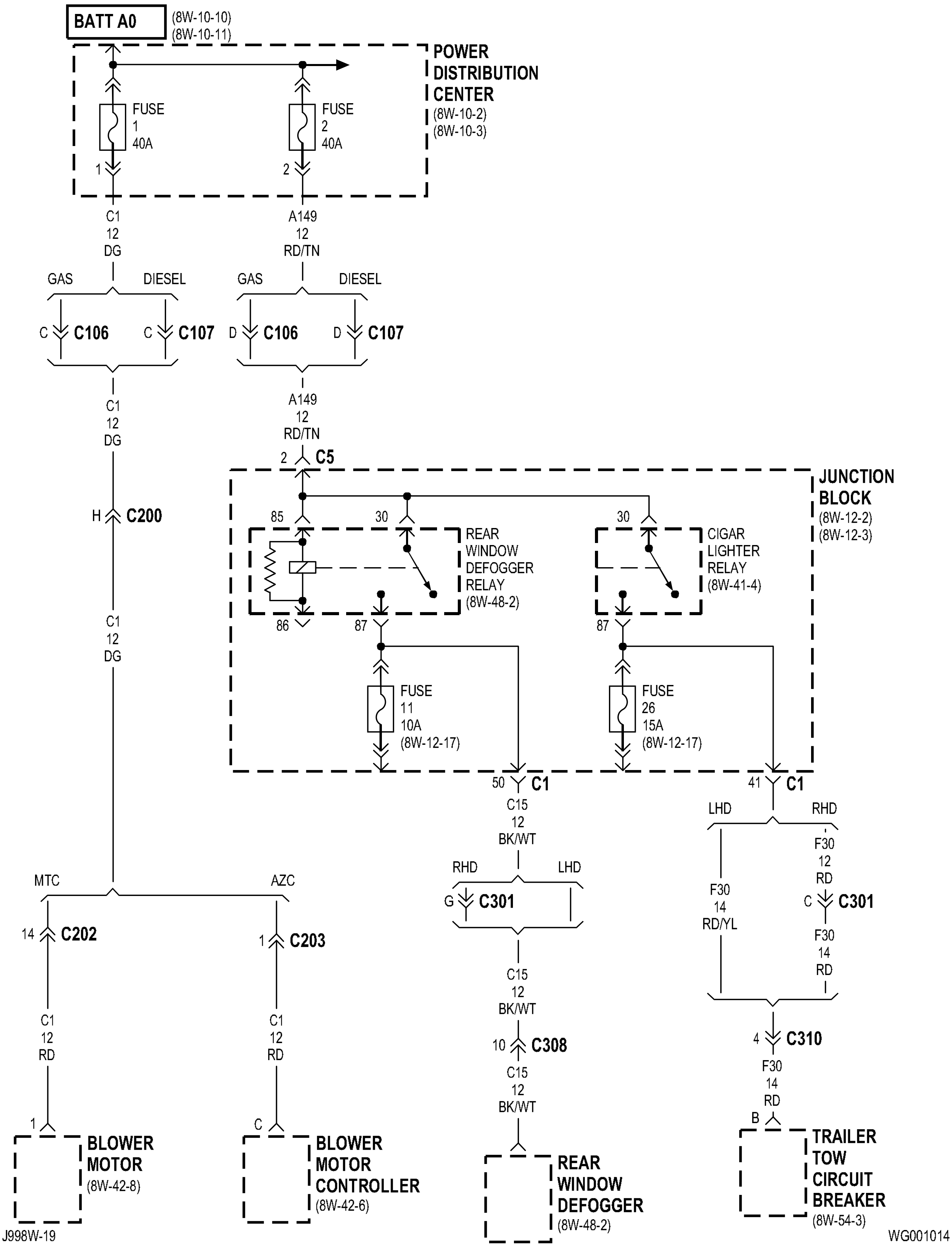
• DIESEL

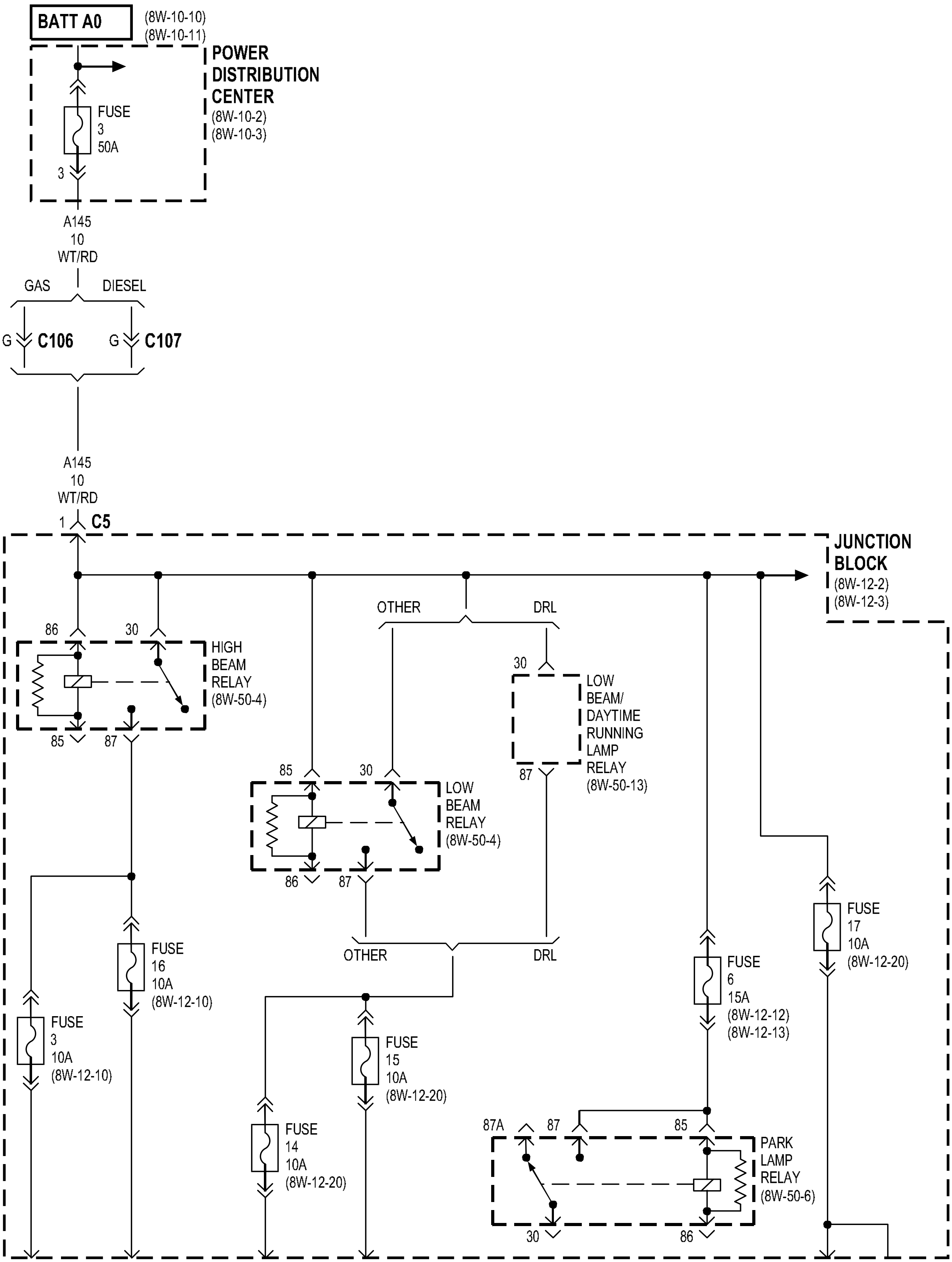

S100
A0 6RD
BATTERY
(8W-20-2)
FUSIBLE LINK
A11
10
DG
(8W-20-2)
A11
6
RD
GENERATOR
(8W-20-2)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 1 40A (8W-10-14)
FUSE 2 40A (8W-10-14)
FUSE 3 50A (8W-10-15)
FUSE 4 40A (8W-10-16)
FUSE 5 30A (8W-10-16)
C1 12 DG
TO C106
A149 12 RD/TN
D
A149 12 RD/TN
TO JUNCTION BLOCK
A145 10 WT/RD
G C106
A145 10 WT/RD
TO JUNCTION BLOCK
E C106
A10 12 RD/DG
E C107
A10 12 RD/DG
TO CONTROLLER ANTI-LOCK BRAKE
A30 14 RD/WT
1 C102
A30 14 RD/WT
TO TRANSMISSION CONTROL MODULE (4.7L)
A30 14 RD/WT
TO TRANSMISSION CONTROL RELAY (IN PDC)
FUSE 6 30A (8W-10-18)
FUSE 7 50A (8W-10-21)
FUSE 8 40A (8W-10-24)
FUSE 10 40A (8W-10-21)
FUSE 12 50A (8W-10-27)
FUSE 14 40A (8W-10-24)
A
TO PDC (8W-10-12)
A14 14 RD/DG
TO AUTOMATIC SHUT DOWN RELAY (IN PDC)
A147 10 RD/GY
J C106
A147 10 RD/GY
TO JUNCTION BLOCK
A1 12 RD
TO S127
A16 12 GY
TO RADIATOR FAN RELAY
A146 10 OR/WT
H
A146 10 OR/WT
TO JUNCTION BLOCK
A2 12 PK/BK
L C106
A2 12 PK/BK
G C200
TO IGNITION SWITCH

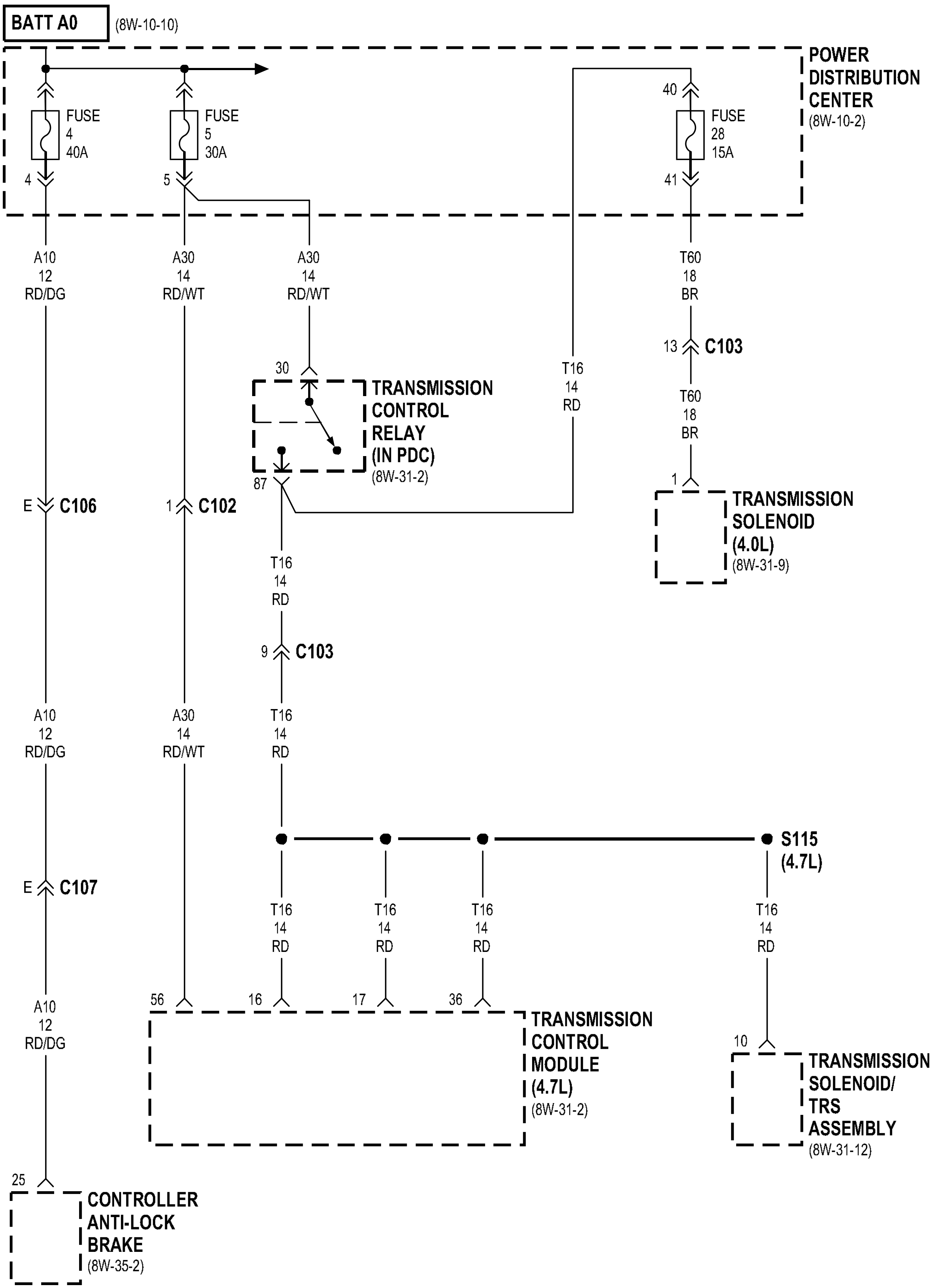

S100
A0 6RD
BATTERY
(8W-20-3)
FUSIBLE LINK
A11
10
DG
(8W-20-3)
A11
6
RD
GENERATOR
(8W-20-3)
POWER DISTRIBUTION CENTER
(8W-10-3)
FUSE 1 40A (8W-10-14)
FUSE 2 40A (8W-10-14)
FUSE 3 50A (8W-10-15)
FUSE 4 40A (8W-10-17)
FUSE 6 50A (8W-10-17)
C1 12 DG
TO C107
A149 12 RD/TN
A145 10 WT/RD
D
G
C107
A149 12 RD/TN
A145 10 WT/RD
TO JUNCTION BLOCK
TO JUNCTION BLOCK
A10 12 RD/DG
TO CONTROLLER ANTI-LOCK BRAKE
A105 10 DB/RD
TO GLOW PLUG RELAY NO. 1 (IN PDC)
FUSE 7 50A (8W-10-21)
FUSE 8 40A (8W-10-24)
FUSE 9 20A (8W-10-22)
FUSE 10 40A (8W-10-21)
FUSE 11 50A (8W-10-17)
FUSE 12 50A (8W-10-27)
B
TO PDC (8W-10-13)
A147 10 RD/GY
J
C107
A147 10 RD/GY
TO JUNCTION BLOCK
A1 12 RD
TO S127
A12 16 TN/RD
TO FUEL HEATER RELAY (IN PDC)
A16 12 GY
TO RADIATOR FAN RELAY
A110 10 VT/RD
TO GLOW PLUG RELAY NO. 2 (IN PDC)
A146 10 OR/WT
H
C107
A146 10 OR/WT
TO JUNCTION BLOCK


POWER
DISTRIBUTION
CENTER
(8W-10-2)
FROM
PDC
(8W-10-10)
A
FUSE
15
50A
(8W-10-27)
15
20
FUSE
18
15A
21
(8W-10-28)
A148
10
PK/WT
K
C106
A148
10
PK/WT
TO
JUNCTION
BLOCK
F62
18
RD
F62
18
RD
TO
HORN
RELAY
(IN PDC)
TO
HORN
RELAY
(IN PDC)
22
FUSE
19
10A
23
(8W-10-28)
27
FUSE
21
15A
26
(8W-10-29)
33
FUSE
24
20A
32
(8W-10-29)
34
FUSE
25
20A
35
(8W-10-29)
A7
14
RD/BK
5
C102
A7
14
RD/BK
TO
POWERTRAIN
CONTROL
MODULE
A17
18
RD/BK
TO
A/C
COMPRESSOR
CLUTCH
RELAY
(IN PDC)
A62
16
VT/WT
TO
FUEL
PUMP
RELAY
(IN PDC)
A20
12
RD/DB
M
C106
A20
14
RD/DB
M
C107
A20
12
RD/DB
TO
CONTROLLER
ANTI-LOCK
BRAKE

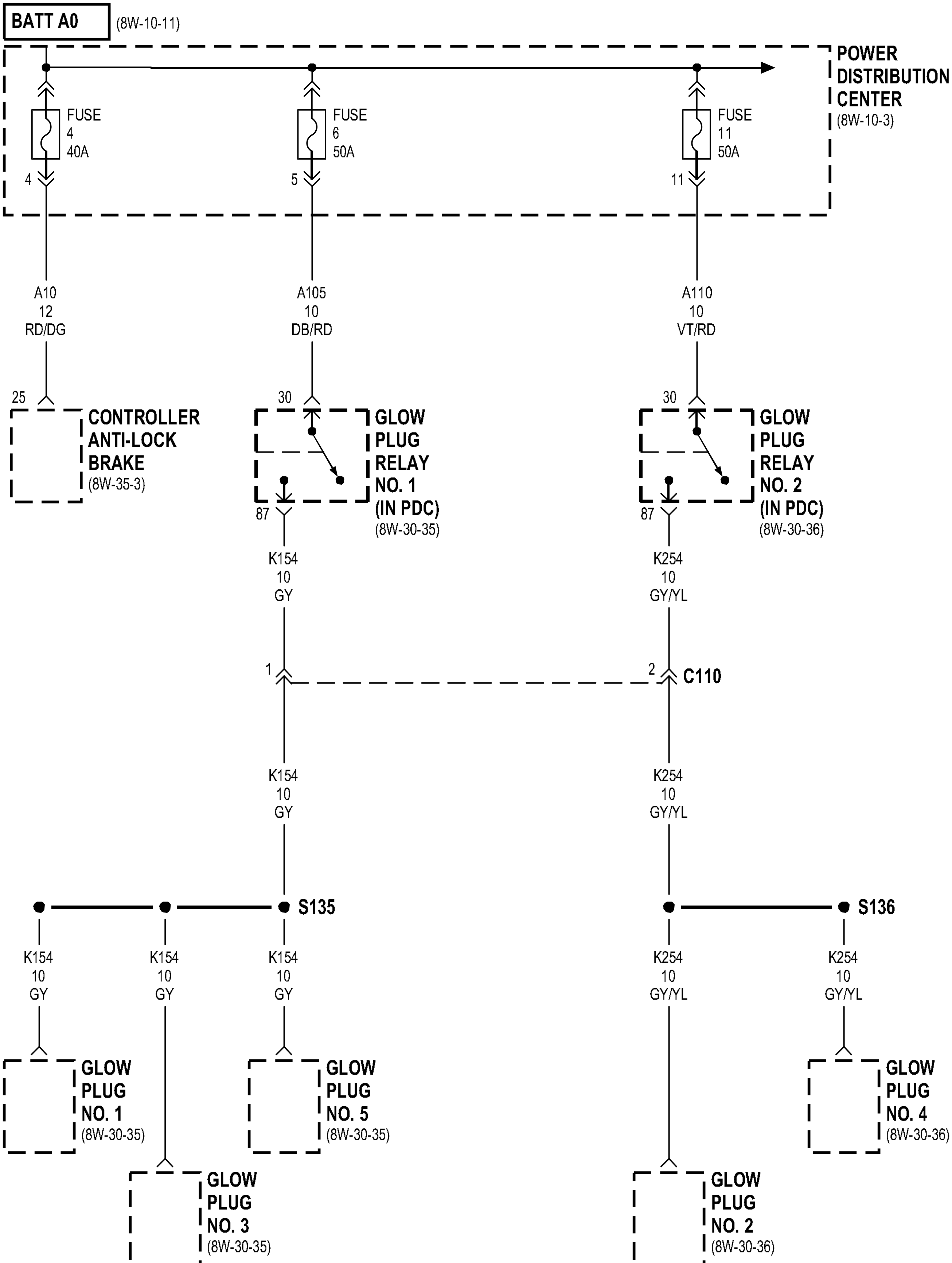

POWER
DISTRIBUTION
CENTER
(8W-10-3)
FROM
PDC
(8W-10-11)
B
FUSE
13
30A
(8W-10-22)
13
FUSE
14
40A
(8W-10-24)
14
FUSE
15
50A
(8W-10-27)
15
20
FUSE
18
15A
(8W-10-28)
21
L
C107
A14
14
RD/WT
A2
12
PK/BK
G
C200
A2
12
PK/BK
A148
10
PK/WT
K
C107
A148
10
PK/WT
F62
18
RD
F62
18
RD
TO
AUTOMATIC
SHUT
DOWN
RELAY
(IN PDC)
TO
IGNITION
SWITCH
TO
JUNCTION
BLOCK
TO
HORN
RELAY
(IN PDC)
TO
HORN
RELAY
(IN PDC)
27
FUSE
21
15A
(8W-10-29)
26
33
FUSE
24
15A
(8W-10-29)
32
34
FUSE
25
20A
(8W-10-29)
35
A17
18
RD/BK
A14
16
RD/WT
5
C102
A14
16
RD/WT
A14
16
RD/WT
A20
12
RD/DB
TO
A/C
COMPRESSOR
CLUTCH
RELAY
(IN PDC)
TO
POWERTRAIN
CONTROL
MODULE
TO
TRANSMISSION
CONTROL
RELAY
(IN PDC)
TO
CONTROLLER
ANTI-LOCK
BRAKE


BATT A0
(8W-10-10)
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
(8W-10-3)
FUSE 1 40A
FUSE 2 40A
C1 12 DG
A149 12 RD/TN
GAS
DIESEL
C106
C107
C5
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
REAR WINDOW DEFOGGER RELAY
(8W-48-2)
CIGAR LIGHTER RELAY
(8W-41-4)
85
30
86
87
FUSE 11 10A (8W-12-17)
FUSE 26 15A (8W-12-17)
C200
C1
C15 12 BK/WT
RHD
LHD
C301
C308
F30 12 RD
F30 14 RD/YL
F30 14 RD
C310
MTC
AZC
C202
C203
C1 12 RD
BLOWER MOTOR
(8W-42-8)
BLOWER MOTOR CONTROLLER
(8W-42-6)
REAR WINDOW DEFOGGER
(8W-48-2)
TRAILER TOW CIRCUIT BREAKER
(8W-54-3)
J998W-19

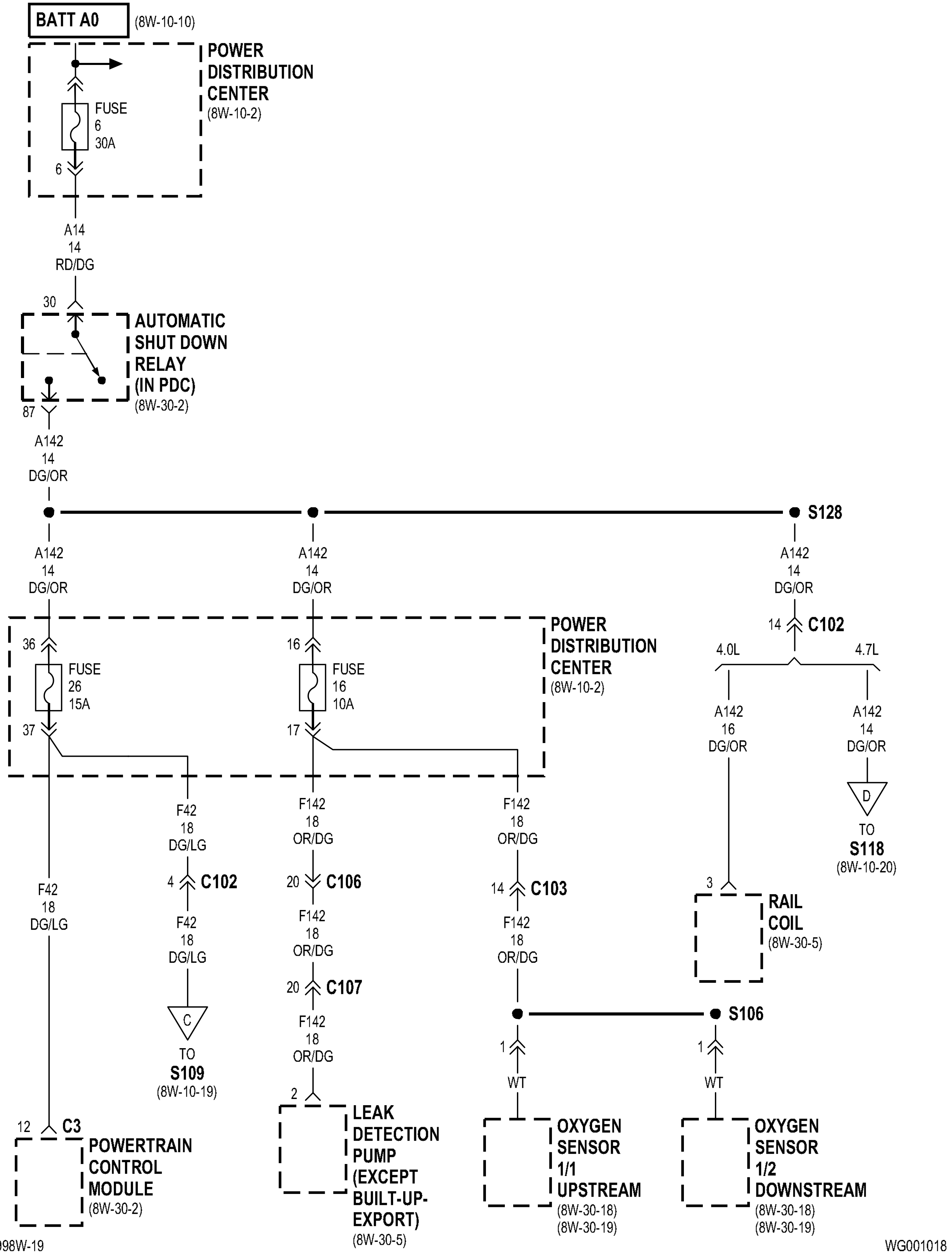

BATT A0
(8W-10-10)
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
(8W-10-3)
FUSE 3 50A
3
A145 10 WT/RD
GAS
DIESEL
G C106
G C107
A145 10 WT/RD
1 C5
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
86
30
HIGH BEAM RELAY (8W-50-4)
85
87
OTHER
DRL
30
LOW BEAM/ DAYTIME RUNNING LAMP RELAY (8W-50-13)
87
85
30
LOW BEAM RELAY (8W-50-4)
86
87
OTHER
DRL
FUSE 17 10A (8W-12-20)
FUSE 16 10A (8W-12-10)
FUSE 6 15A (8W-12-12) (8W-12-13)
FUSE 3 10A (8W-12-10)
FUSE 15 10A (8W-12-20)
FUSE 14 10A (8W-12-20)
87A
87
85
PARK LAMP RELAY (8W-50-6)
30
86

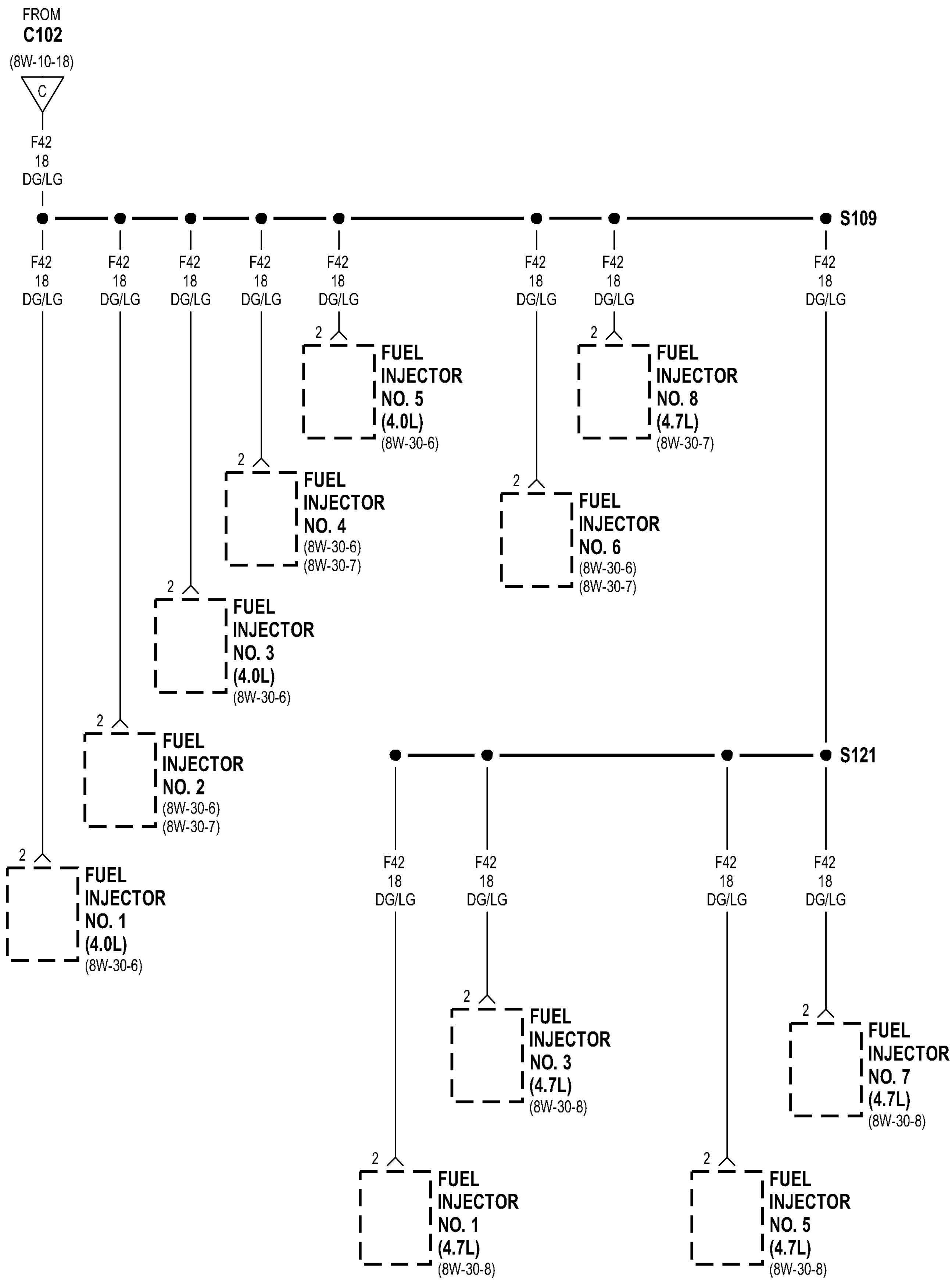


BATT A0
(8W-10-10)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 4 40A
FUSE 5 30A
FUSE 28 15A
4
5
40
41
A10 12 RD/DG
A30 14 RD/WT
A30 14 RD/WT
T60 18 BR
13 C103
T60 18 BR
30
TRANSMISSION CONTROL RELAY (IN PDC)
(8W-31-2)
87
T16 14 RD
1
TRANSMISSION SOLENOID (4.0L)
(8W-31-9)
E C106
1 C102
T16 14 RD
9 C103
T16 14 RD
A10 12 RD/DG
A30 14 RD/WT
S115 (4.7L)
E C107
T16 14 RD
T16 14 RD
T16 14 RD
T16 14 RD
A10 12 RD/DG
56
16
17
36
TRANSMISSION CONTROL MODULE (4.7L)
(8W-31-2)
10
TRANSMISSION SOLENOID/ TRS ASSEMBLY
(8W-31-12)
25
CONTROLLER ANTI-LOCK BRAKE
(8W-35-2)


BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-3)
FUSE 4 40A
FUSE 6 50A
FUSE 11 50A
4
5
11
A10 12 RD/DG
A105 10 DB/RD
A110 10 VT/RD
25
CONTROLLER ANTI-LOCK BRAKE
(8W-35-3)
30
87
GLOW PLUG RELAY NO. 1 (IN PDC)
(8W-30-35)
GLOW PLUG RELAY NO. 2 (IN PDC)
(8W-30-36)
K154 10 GY
K254 10 GY/YL
1
2
C110
S135
S136
GLOW PLUG NO. 1
(8W-30-35)
GLOW PLUG NO. 5
(8W-30-35)
GLOW PLUG NO. 3
(8W-30-35)
GLOW PLUG NO. 4
(8W-30-36)
GLOW PLUG NO. 2
(8W-30-36)

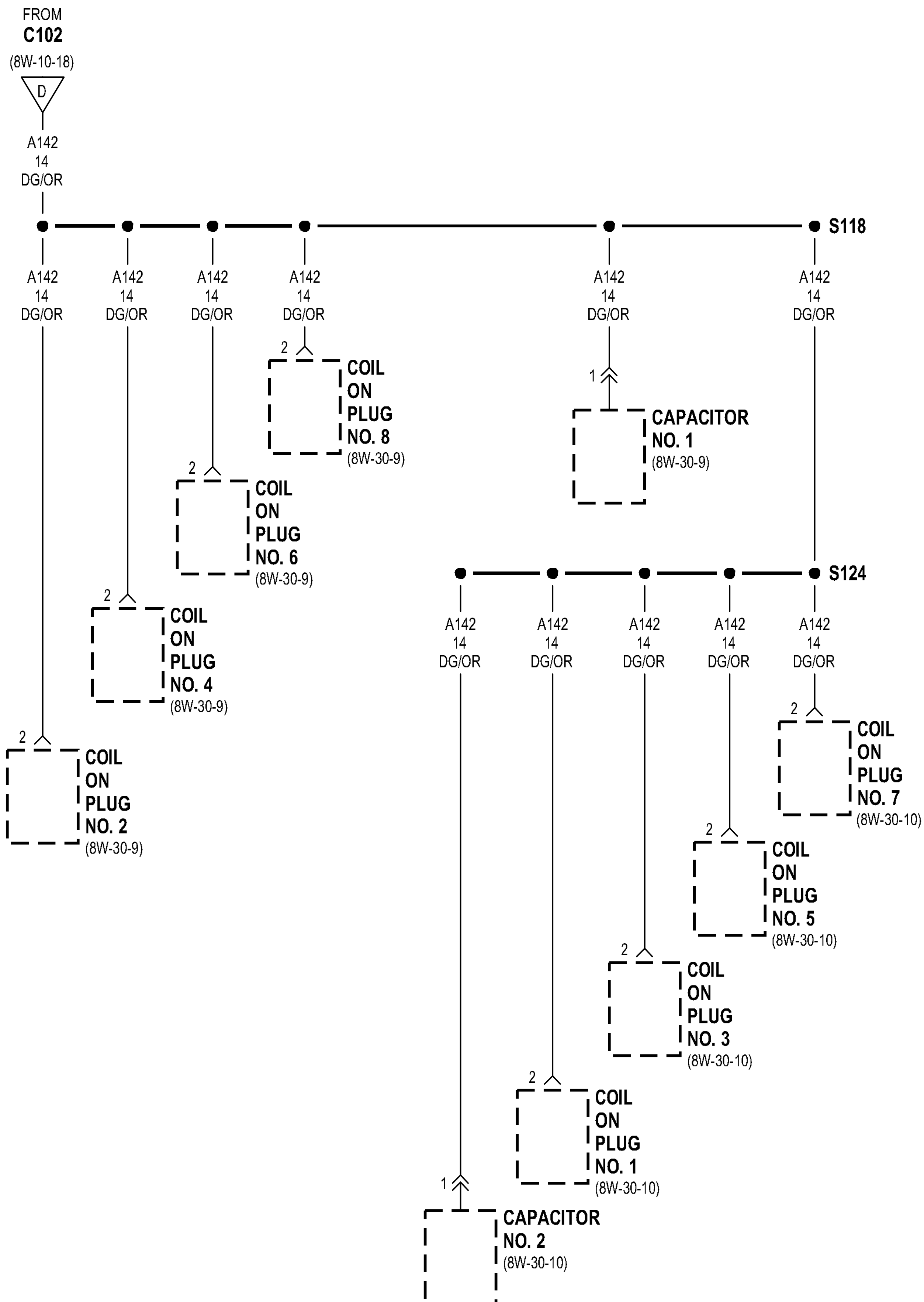
GAS

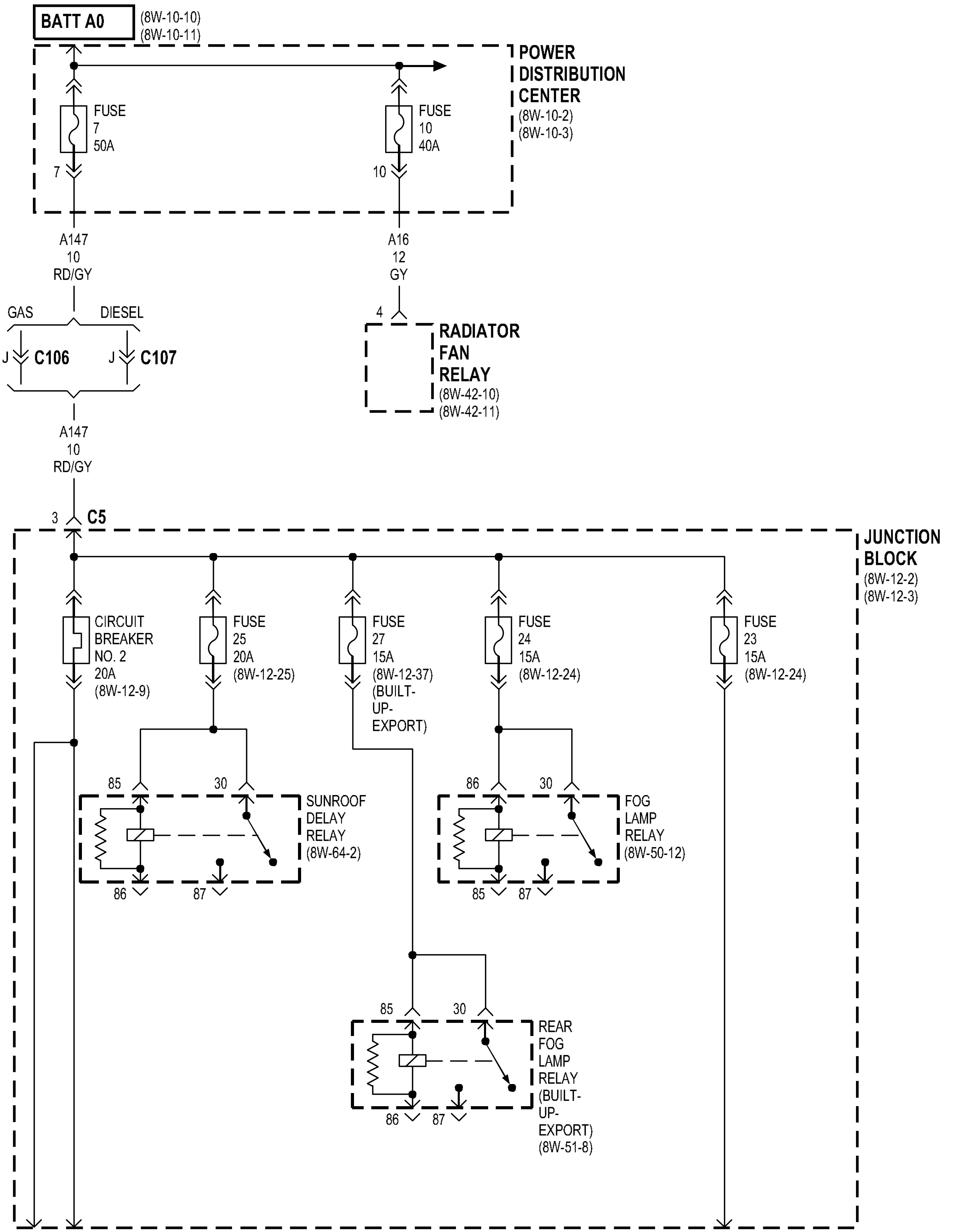

BATT A0
(8W-10-10)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 6 30A
6
A14 14 RD/DG
30
AUTOMATIC SHUT DOWN RELAY (IN PDC)
(8W-30-2)
87
A142 14 DG/OR
S128
A142 14 DG/OR
A142 14 DG/OR
A142 14 DG/OR
36
16
FUSE 26 15A
FUSE 16 10A
37
17
POWER DISTRIBUTION CENTER
(8W-10-2)
14 C102
4.0L
4.7L
A142 16 DG/OR
A142 14 DG/OR
D
TO S118
(8W-10-20)
F42 18 DG/LG
F42 18 DG/LG
F142 18 OR/DG
F142 18 OR/DG
4 C102
20 C106
14 C103
F42 18 DG/LG
F142 18 OR/DG
F142 18 OR/DG
3
RAIL COIL
(8W-30-5)
20 C107
F142 18 OR/DG
C
TO S109
(8W-10-19)
S106
1
1
WT
WT
2
12 C3
POWERTRAIN CONTROL MODULE
(8W-30-2)
LEAK DETECTION PUMP (EXCEPT BUILT-UP-EXPORT)
(8W-30-5)
OXYGEN SENSOR 1/1 UPSTREAM
(8W-30-18)
(8W-30-19)
OXYGEN SENSOR 1/2 DOWNSTREAM
(8W-30-18)
(8W-30-19)

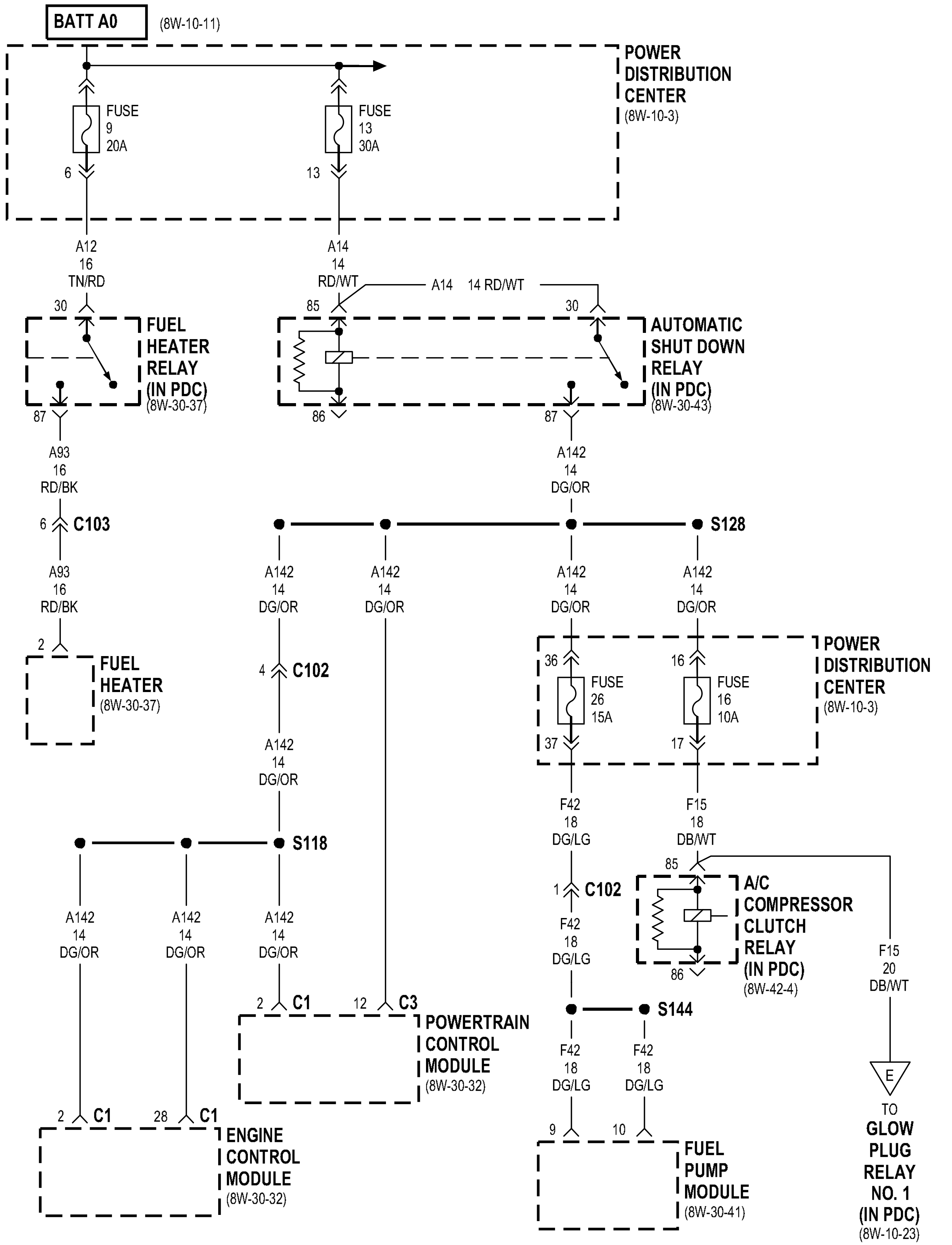


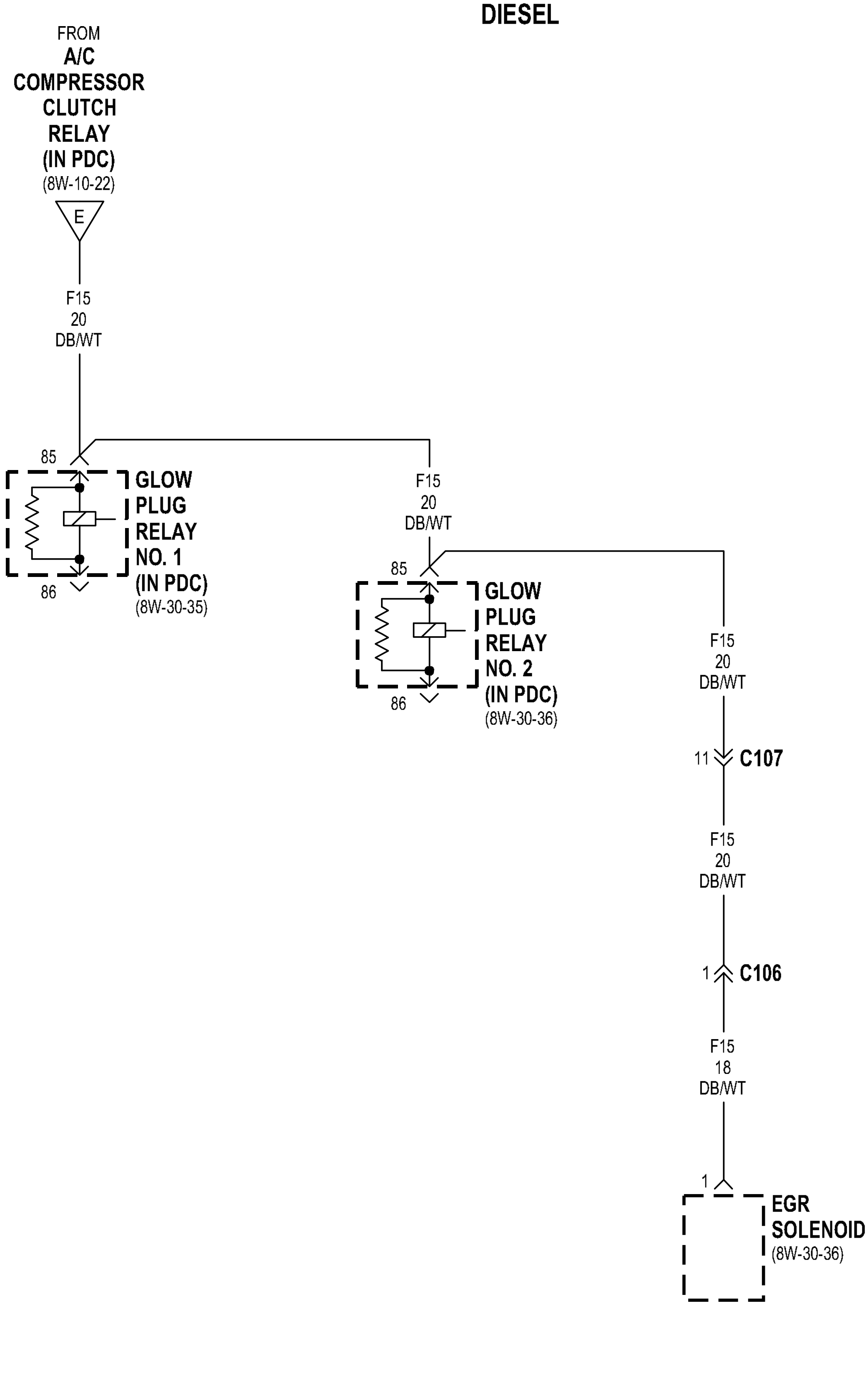
FROM
C102
(8W-10-18)
C
F42
18
DG/LG
S109
F42
18
DG/LG
2
FUEL
INJECTOR
NO. 5
(4.0L)
(8W-30-6)
2
FUEL
INJECTOR
NO. 8
(4.7L)
(8W-30-7)
2
FUEL
INJECTOR
NO. 4
(8W-30-6)
(8W-30-7)
2
FUEL
INJECTOR
NO. 6
(8W-30-6)
(8W-30-7)
2
FUEL
INJECTOR
NO. 3
(4.0L)
(8W-30-6)
2
FUEL
INJECTOR
NO. 2
(8W-30-6)
(8W-30-7)
S121
2
FUEL
INJECTOR
NO. 1
(4.0L)
(8W-30-6)
2
FUEL
INJECTOR
NO. 3
(4.7L)
(8W-30-8)
2
FUEL
INJECTOR
NO. 7
(4.7L)
(8W-30-8)
2
FUEL
INJECTOR
NO. 1
(4.7L)
(8W-30-8)
2
FUEL
INJECTOR
NO. 5
(4.7L)
(8W-30-8)

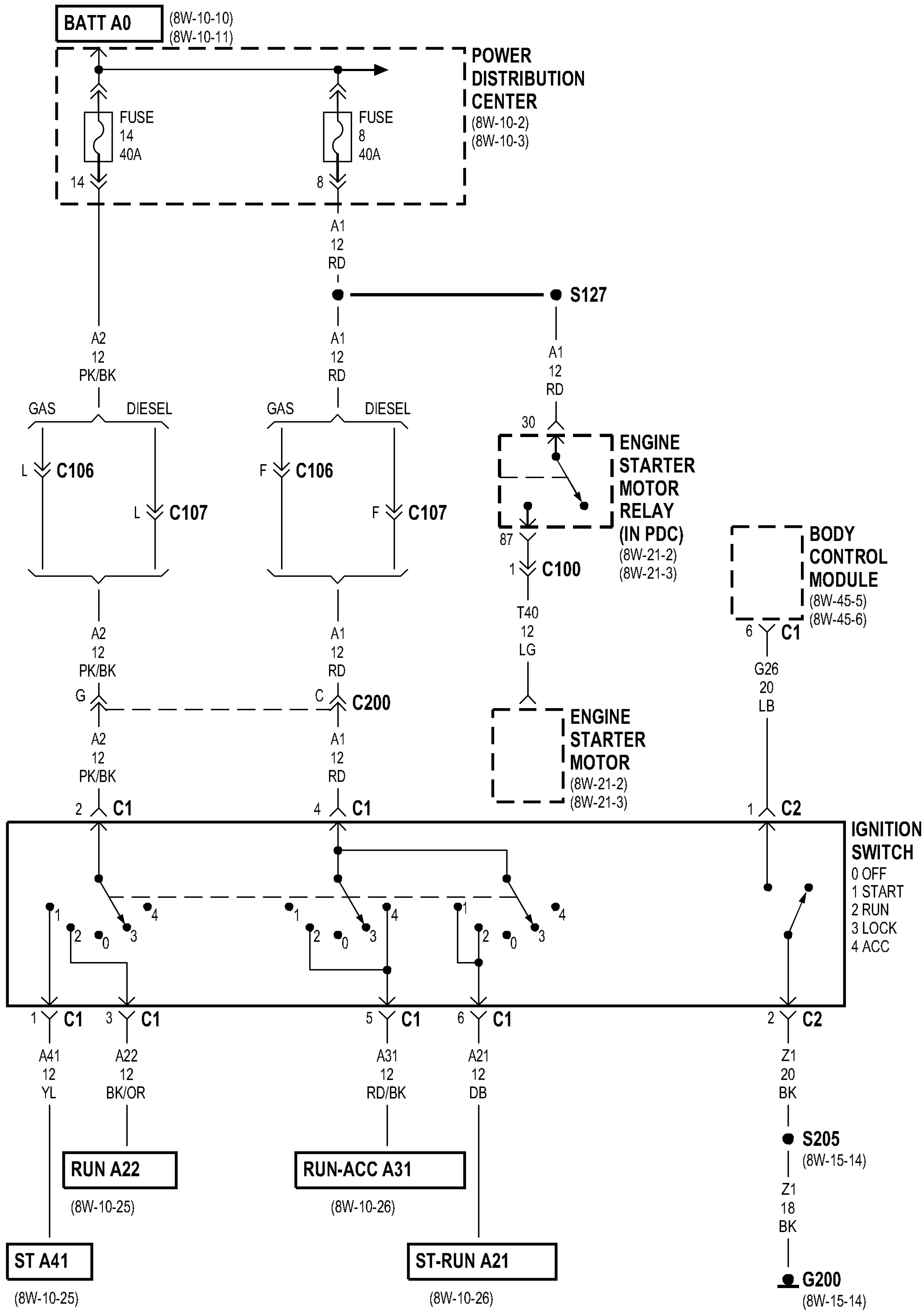
4.7L


FROM
C102
(8W-10-18)
D
A142
14
DG/OR
S118
S124
COIL ON PLUG NO. 8
(8W-30-9)
COIL ON PLUG NO. 6
(8W-30-9)
COIL ON PLUG NO. 4
(8W-30-9)
COIL ON PLUG NO. 2
(8W-30-9)
CAPACITOR NO. 1
(8W-30-9)
COIL ON PLUG NO. 7
(8W-30-10)
COIL ON PLUG NO. 5
(8W-30-10)
COIL ON PLUG NO. 3
(8W-30-10)
COIL ON PLUG NO. 1
(8W-30-10)
CAPACITOR NO. 2
(8W-30-10)

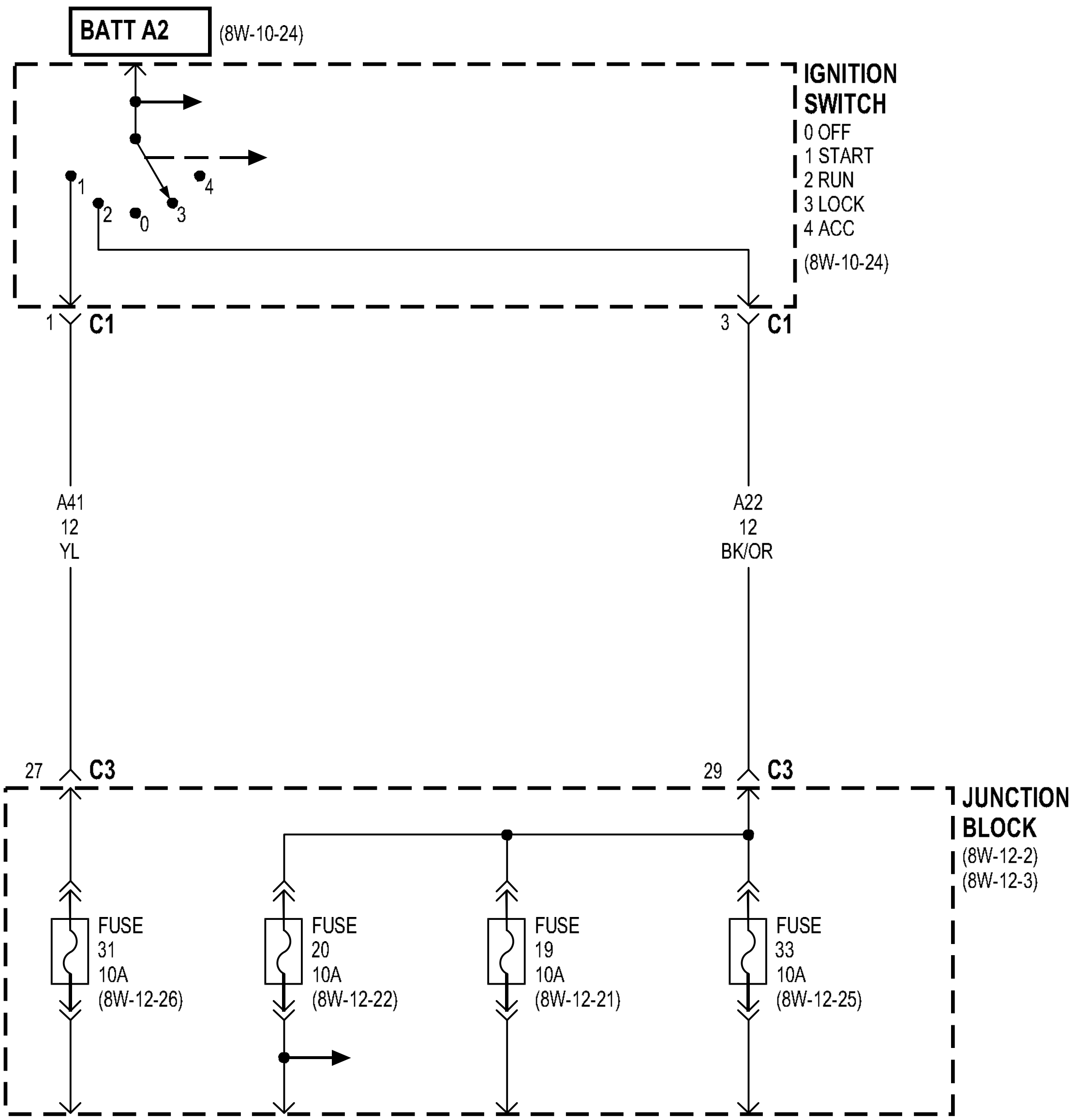

BATT A0
(8W-10-10)
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
(8W-10-3)
FUSE 7 50A
7
FUSE 10 40A
10
A147 10 RD/GY
A16 12 GY
GAS
DIESEL
J C106
J C107
4
RADIATOR FAN RELAY
(8W-42-10)
(8W-42-11)
A147 10 RD/GY
3 C5
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
CIRCUIT BREAKER NO. 2 20A (8W-12-9)
FUSE 25 20A (8W-12-25)
FUSE 27 15A (8W-12-37) (BUILT-UP-EXPORT)
FUSE 24 15A (8W-12-24)
FUSE 23 15A (8W-12-24)
85
30
SUNROOF DELAY RELAY (8W-64-2)
86
87
86
30
FOG LAMP RELAY (8W-50-12)
85
87
85
30
REAR FOG LAMP RELAY (BUILT-UP-EXPORT) (8W-51-8)
86
87

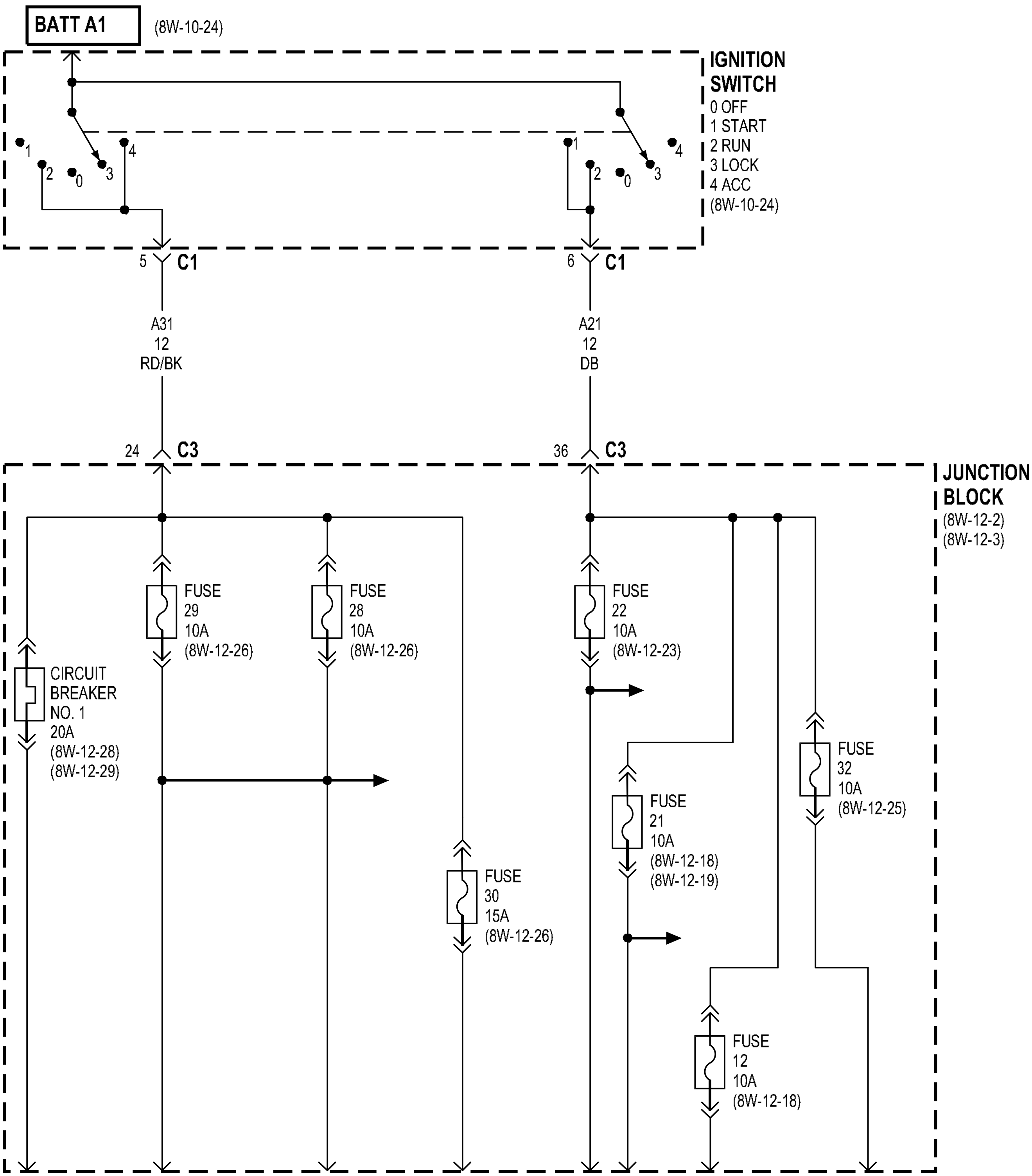

BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-3)
FUSE 9 20A
FUSE 13 30A
6
13
A12 16 TN/RD
A14 14 RD/WT
A14 14 RD/WT
30
85
30
FUEL HEATER RELAY (IN PDC)
(8W-30-37)
AUTOMATIC SHUT DOWN RELAY (IN PDC)
(8W-30-43)
87
86
87
A93 16 RD/BK
A142 14 DG/OR
6 C103
S128
A93 16 RD/BK
A142 14 DG/OR
A142 14 DG/OR
A142 14 DG/OR
A142 14 DG/OR
2
FUEL HEATER
(8W-30-37)
4 C102
36
16
FUSE 26 15A
FUSE 16 10A
POWER DISTRIBUTION CENTER
(8W-10-3)
37
17
A142 14 DG/OR
F42 18 DG/LG
F15 18 DB/WT
S118
85
A/C COMPRESSOR CLUTCH RELAY (IN PDC)
(8W-42-4)
1 C102
A142 14 DG/OR
A142 14 DG/OR
A142 14 DG/OR
F42 18 DG/LG
86
F15 20 DB/WT
S144
2 C1
12 C3
POWERTRAIN CONTROL MODULE
(8W-30-32)
F42 18 DG/LG
F42 18 DG/LG
E
TO GLOW PLUG RELAY NO. 1 (IN PDC)
(8W-10-23)
2 C1
28 C1
ENGINE CONTROL MODULE
(8W-30-32)
9
10
FUEL PUMP MODULE
(8W-30-41)


FROM
A/C
COMPRESSOR
CLUTCH
RELAY
(IN PDC)
(8W-10-22)
E
F15
20
DB/WT
85
GLOW
PLUG
RELAY
NO. 1
(IN PDC)
(8W-30-35)
86
F15
20
DB/WT
85
GLOW
PLUG
RELAY
NO. 2
(IN PDC)
(8W-30-36)
86
F15
20
DB/WT
11
C107
F15
20
DB/WT
1
C106
F15
18
DB/WT
1
EGR
SOLENOID
(8W-30-36)

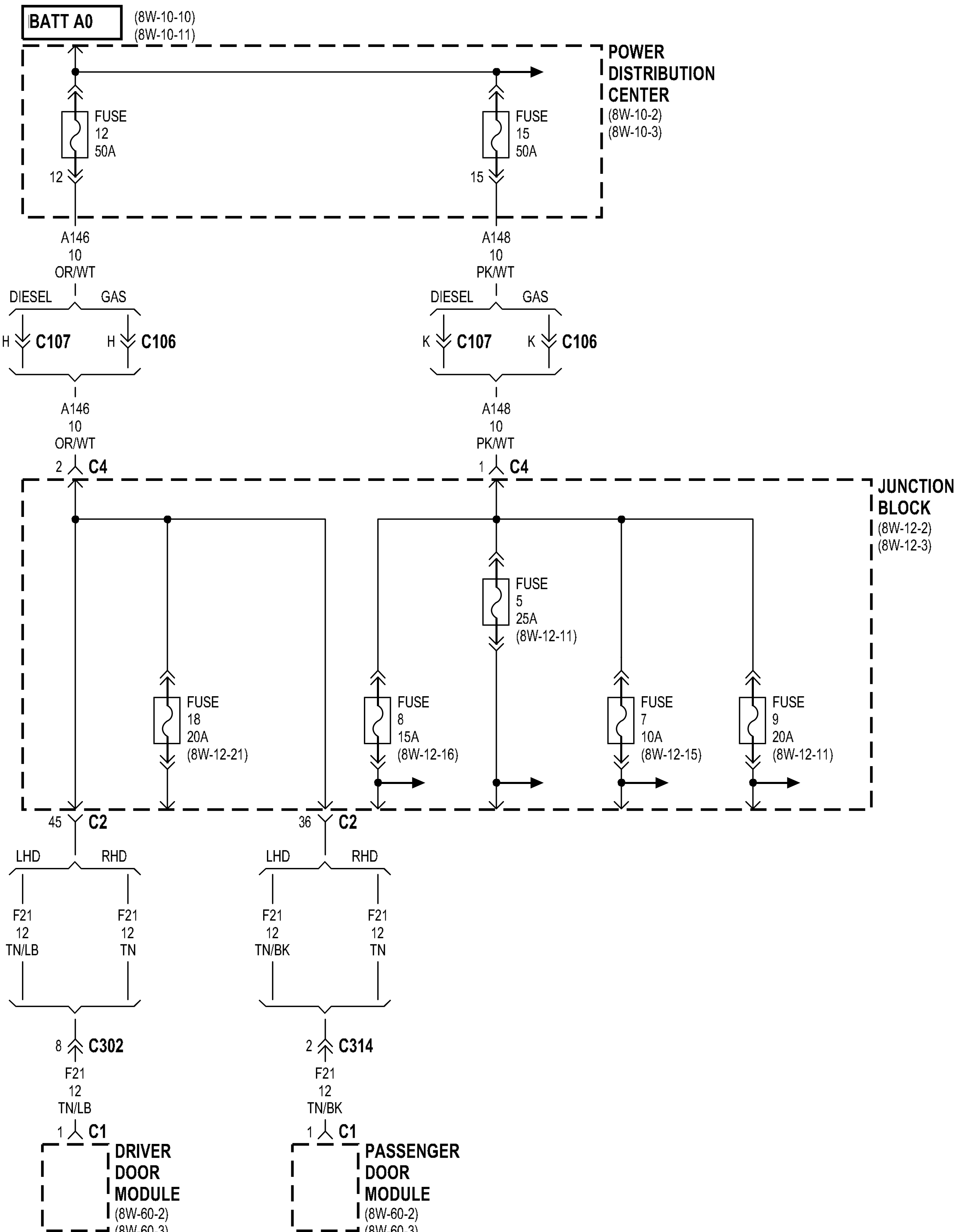


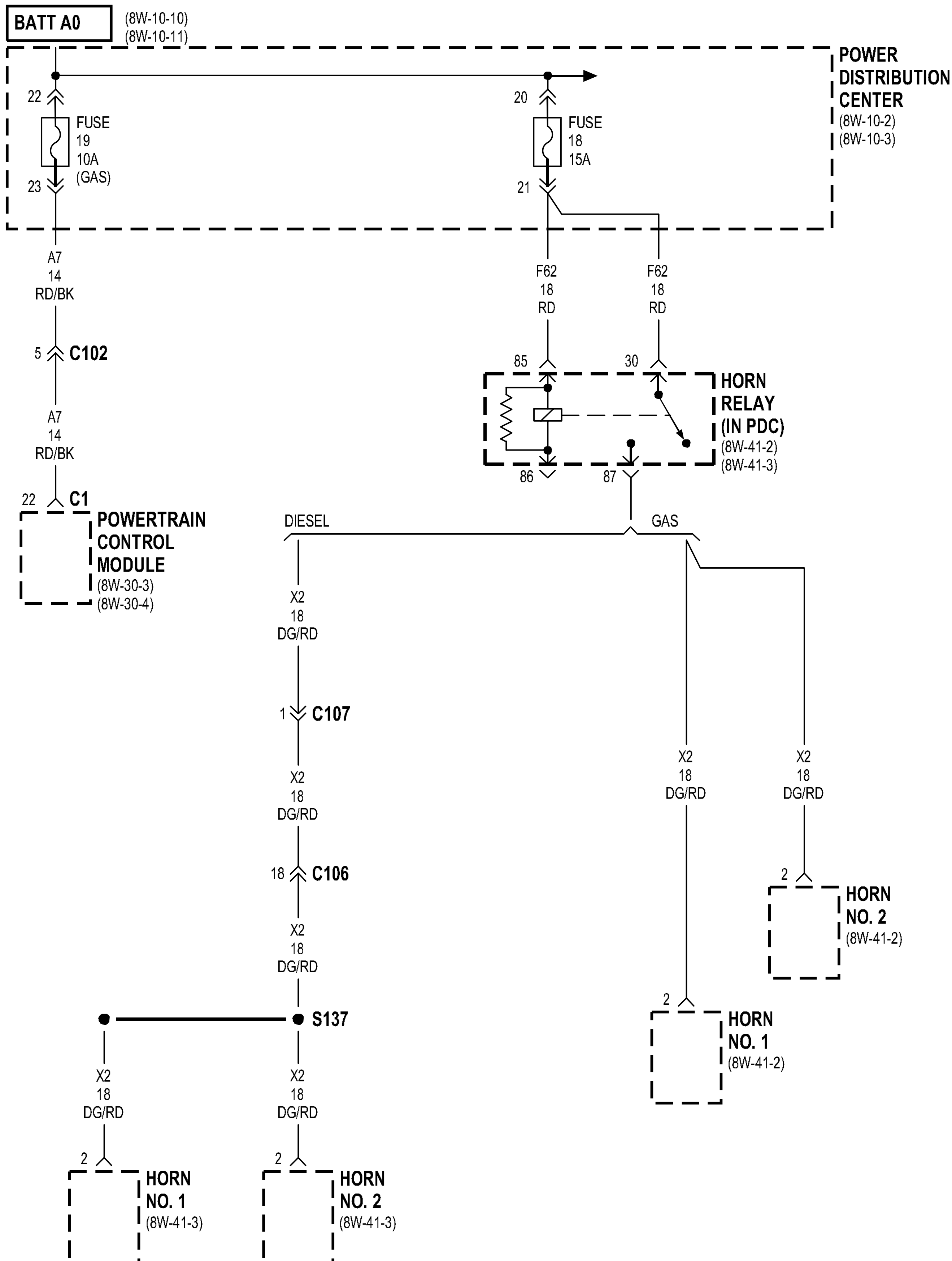
BATT A0
(8W-10-10)
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
(8W-10-3)
FUSE 14 40A
FUSE 8 40A
14
8
A1 12 RD
S127
A2 12 PK/BK
A1 12 RD
A1 12 RD
GAS
DIESEL
GAS
DIESEL
L C106
L C107
F C106
F C107
30
ENGINE STARTER MOTOR RELAY (IN PDC)
(8W-21-2)
(8W-21-3)
87
1 C100
T40 12 LG
BODY CONTROL MODULE
(8W-45-5)
(8W-45-6)
6 C1
G26 20 LB
A2 12 PK/BK
A1 12 RD
G
C
C200
A2 12 PK/BK
A1 12 RD
ENGINE STARTER MOTOR
(8W-21-2)
(8W-21-3)
2 C1
4 C1
1 C2
IGNITION SWITCH
0 OFF
1 START
2 RUN
3 LOCK
4 ACC
1 C1
3 C1
5 C1
6 C1
2 C2
A41 12 YL
A22 12 BK/OR
A31 12 RD/BK
A21 12 DB
Z1 20 BK
S205
(8W-15-14)
Z1 18 BK
RUN A22
(8W-10-25)
RUN-ACC A31
(8W-10-26)
ST A41
(8W-10-25)
ST-RUN A21
(8W-10-26)
G200
(8W-15-14)


BATT A2
(8W-10-24)
IGNITION SWITCH
0 OFF
1 START
2 RUN
3 LOCK
4 ACC
(8W-10-24)
1
2
0
3
4
1 C1
3 C1
A41
12
YL
A22
12
BK/OR
27 C3
29 C3
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
31
10A
(8W-12-26)
FUSE
20
10A
(8W-12-22)
FUSE
19
10A
(8W-12-21)
FUSE
33
10A
(8W-12-25)

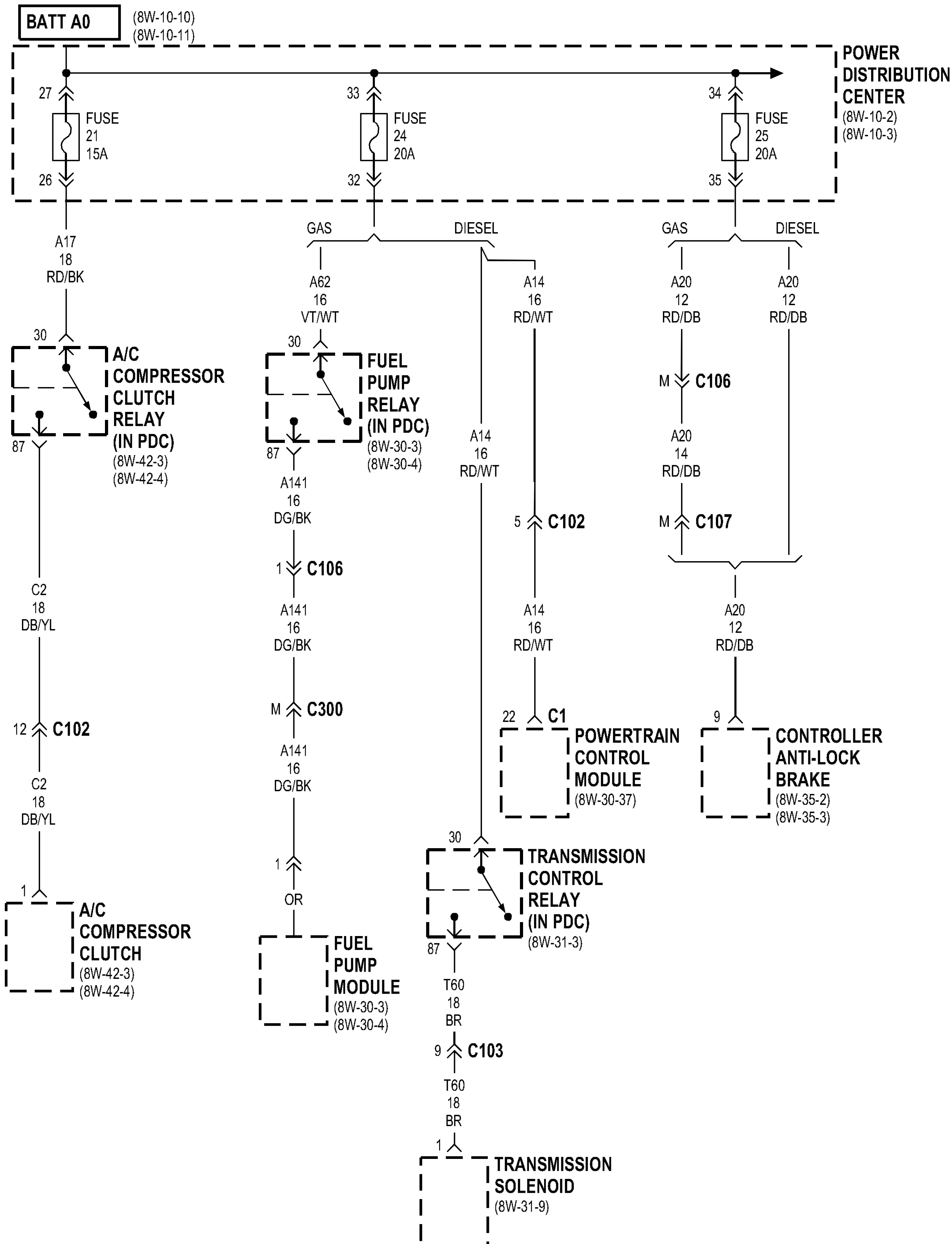


BATT A1
(8W-10-24)
IGNITION SWITCH
0 OFF
1 START
2 RUN
3 LOCK
4 ACC
(8W-10-24)
1
2
0
3
4
5 C1
6 C1
A31
12
RD/BK
A21
12
DB
24 C3
36 C3
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
CIRCUIT BREAKER NO. 1
20A
(8W-12-28)
(8W-12-29)
FUSE
29
10A
(8W-12-26)
FUSE
28
10A
(8W-12-26)
FUSE
30
15A
(8W-12-26)
FUSE
22
10A
(8W-12-23)
FUSE
21
10A
(8W-12-18)
(8W-12-19)
FUSE
32
10A
(8W-12-25)
FUSE
12
10A
(8W-12-18)


BATT A0
(8W-10-10)
(8W-10-11)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
(8W-10-3)
FUSE
12
50A
12
FUSE
15
50A
15
A146
10
OR/WT
DIESEL
GAS
H
C107
H
C106
A148
10
PK/WT
DIESEL
GAS
K
C107
K
C106
A146
10
OR/WT
2
C4
A148
10
PK/WT
1
C4
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
5
25A
(8W-12-11)
FUSE
18
20A
(8W-12-21)
FUSE
8
15A
(8W-12-16)
FUSE
7
10A
(8W-12-15)
FUSE
9
20A
(8W-12-11)
45
C2
36
C2
LHD
RHD
LHD
RHD
F21
12
TN/LB
F21
12
TN
F21
12
TN/BK
F21
12
TN
8
C302
2
C314
F21
12
TN/LB
F21
12
TN/BK
1
C1
1
C1
DRIVER
DOOR
MODULE
(8W-60-2)
(8W-60-3)
PASSENGER
DOOR
MODULE
(8W-60-2)
(8W-60-3)

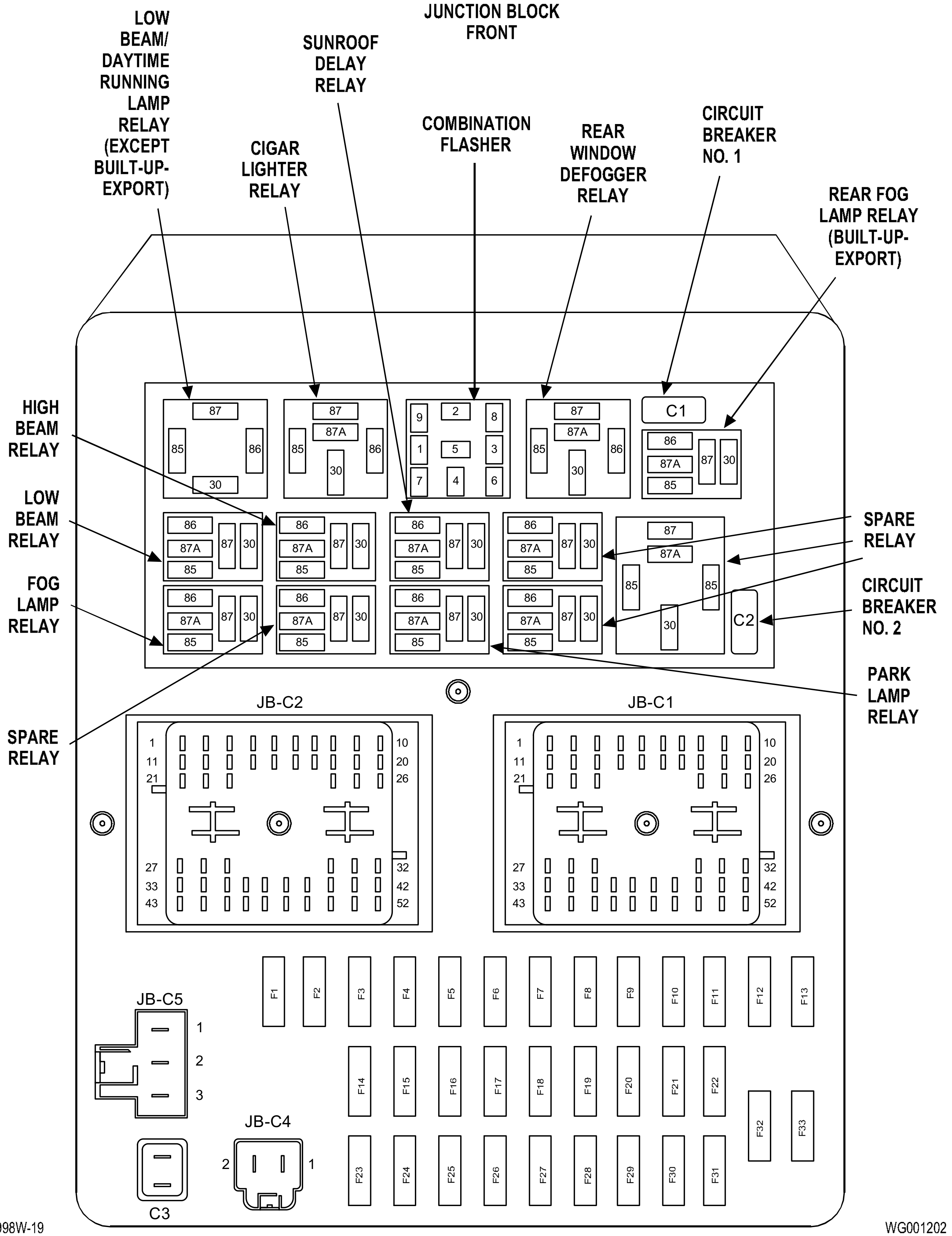


BATT A0
(8W-10-10)
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
(8W-10-3)
22
FUSE 19 10A (GAS)
23
20
FUSE 18 15A
21
A7 14 RD/BK
5 C102
A7 14 RD/BK
22 C1
POWERTRAIN CONTROL MODULE
(8W-30-3)
(8W-30-4)
F62 18 RD
F62 18 RD
85
30
HORN RELAY (IN PDC)
(8W-41-2)
(8W-41-3)
86
87
DIESEL
GAS
X2 18 DG/RD
1 C107
X2 18 DG/RD
18 C106
X2 18 DG/RD
S137
X2 18 DG/RD
X2 18 DG/RD
2
HORN NO. 1
(8W-41-3)
2
HORN NO. 2
(8W-41-3)
X2 18 DG/RD
X2 18 DG/RD
2
HORN NO. 2
(8W-41-2)
2
HORN NO. 1
(8W-41-2)



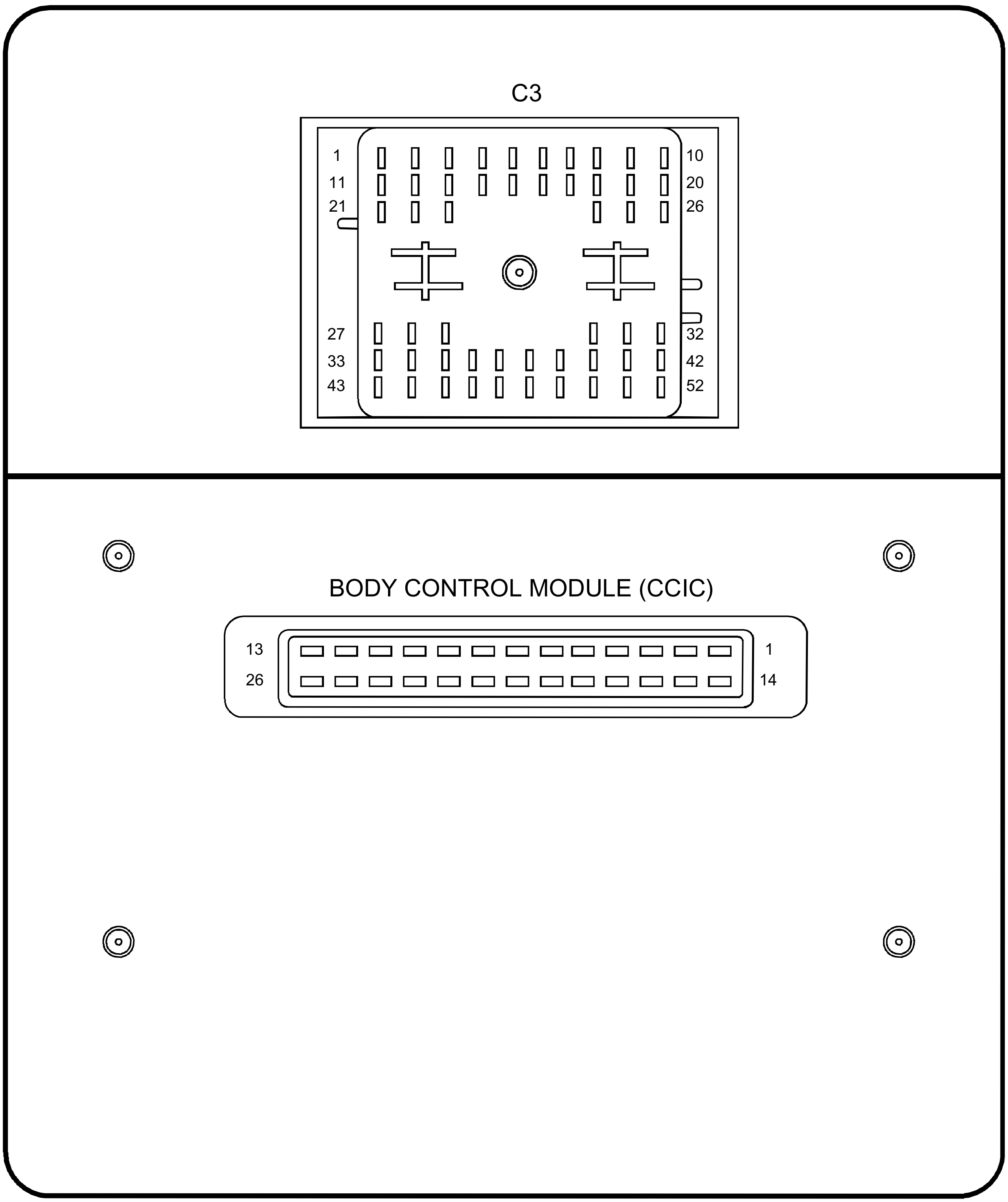
BATT A0
(8W-10-10)
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
(8W-10-3)
27
FUSE 21 15A
26
33
FUSE 24 20A
32
34
FUSE 25 20A
35
A17 18 RD/BK
GAS
DIESEL
A62 16 VT/WT
A14 16 RD/WT
A20 12 RD/DB
30
A/C COMPRESSOR CLUTCH RELAY (IN PDC)
(8W-42-3)
(8W-42-4)
87
FUEL PUMP RELAY (IN PDC)
(8W-30-3)
(8W-30-4)
A141 16 DG/BK
M C106
A20 14 RD/DB
5 C102
M C107
1 C106
C2 18 DB/YL
12 C102
M C300
22 C1
POWERTRAIN CONTROL MODULE
(8W-30-37)
9
CONTROLLER ANTI-LOCK BRAKE
(8W-35-2)
(8W-35-3)
1
OR
A/C COMPRESSOR CLUTCH
(8W-42-3)
(8W-42-4)
FUEL PUMP MODULE
(8W-30-3)
(8W-30-4)
TRANSMISSION CONTROL RELAY (IN PDC)
(8W-31-3)
T60 18 BR
9 C103
TRANSMISSION SOLENOID
(8W-31-9)

8W-12 JUNCTION BLOCK



J998W-19 WG001202

JUNCTION BLOCK
BACK



FUSES

FUSE	AMPS	FUSED CIRCUIT	FEED CIRCUIT
1	-	-	-
2	-	-	-
3	10A	L33 18RD	INTERNAL
4	15A	INTERNAL	INTERNAL
5	25A	INTERNAL	INTERNAL
6	15A	INTERNAL	INTERNAL
7	10A	INTERNAL	INTERNAL
8	15A	INTERNAL	INTERNAL
9	20A	INTERNAL	INTERNAL
10	-	-	-
11	10A	C15 20BK/WT	INTERNAL
12	10A	F991 20OR/DB	INTERNAL
13	-	-	-
14	10A	L43 18VT	INTERNAL
15	10A	L44 18VT/RD	INTERNAL
16	10A	L34 18RD/OR	INTERNAL
17	10A	INTERNAL	INTERNAL
18	20A	L50 16WT/TN	INTERNAL
19	10A	F20 18DB/PK	INTERNAL
20	10A	INTERNAL	INTERNAL
21	10A	INTERNAL	INTERNAL
22	10A	INTERNAL	INTERNAL
23	15A	F32 20PK/DB	INTERNAL
24	15A	INTERNAL	INTERNAL
25	20A	INTERNAL	INTERNAL
26	15A	F30 18RD	INTERNAL
27 •	15A	INTERNAL	INTERNAL
28	10A	INTERNAL	INTERNAL
29	10A	INTERNAL	INTERNAL
30	15A	•• X12 18RD/WT	INTERNAL
		■ X12 16WT/RD	INTERNAL
31	10A	F45 20YL/RD	A41 12YL
32	10A	F14 18LG/YL	INTERNAL
33	10A	F23 18DB/YL	INTERNAL

• BUILT-UP-EXPORT ■ LHD

•• RHD

J998W-19 WG001204

CIRCUIT BREAKERS

C.B.	AMPS	FUSED CIRCUIT	FUSED CIRCUIT
1	20A	INTERNAL	INTERNAL
2	20A	INTERNAL	INTERNAL
3	-	-	-

BODY CONTROL MODULE

CAVITY	CIRCUIT	FUNCTION
1	L308	PARK LAMP RELAY CONTROL
2	L26	FOG LAMP RELAY CONTROL
3	Q29	SUNROOF DELAY RELAY CONTROL
4	L307	LOW BEAM RELAY CONTROL
5	G5	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
6	X4	HORN RELAY CONTROL
7	-	-
8	-	-
9	L11	HIGH BEAM RELAY CONTROL
10	L91	HAZARD SWITCH SENSE
11	C80	REAR WINDOW DEFOGGER RELAY CONTROL
12	Z2	GROUND
13	L96	REAR FOG LAMP RELAY CONTROL
14	L7	PARK LAMP RELAY OUTPUT
15	Z1	GROUND
16	M2	COURTESY LAMP DRIVER
17	-	-
18	-	-
19	M20	COURTESY LAMP DRIVER
20	V55	WIPER PARK SWITCH SENSE
21	G78	LIFTGATE AJAR SWITCH SENSE
22	G10	SEAT BELT SWITCH SENSE
23	G77	DOOR AJAR SWITCH SENSE
24	G73	LIFTGATE COURTESY DISABLE
25	V23	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
26	M1	FUSED B(+)

CIGAR LIGHTER RELAY

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B(+)
85	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
86	INTERNAL	GROUND
87	INTERNAL	CIGAR LIGHTER RELAY OUTPUT
87A	-	

FOG LAMP RELAY

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B(+)
85	INTERNAL	FOG LAMP RELAY CONTROL
86	INTERNAL	FUSED B(+)
87	INTERNAL	FOG LAMP RELAY OUTPUT
87A	-	-

HIGH BEAM RELAY

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B(+)
85	INTERNAL	HIGH BEAM RELAY CONTROL
86	INTERNAL	FUSED B(+)
87	INTERNAL	HIGH BEAM RELAY OUTPUT
87A	-	-

LOW BEAM/ DAYTIME RUNNING LAMP RELAY (EXCEPT BUILT-UP-EXPORT)

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B(+)
85	INTERNAL	GROUND
86	INTERNAL	RELAY CONTROL
87	INTERNAL	RELAY OUTPUT
87A	-	-

LOW BEAM RELAY

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B(+)
85	INTERNAL	FUSED B(+)
86	INTERNAL	LOW BEAM RELAY CONTROL
87	INTERNAL	LOW BEAM RELAY OUTPUT
87A	-	-

PARK LAMP RELAY

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	PARK LAMP RELAY OUTPUT
85	INTERNAL	FUSED B(+)
86	INTERNAL	PARK LAMP RELAY CONTROL
87	INTERNAL	FUSED B(+)
87A	INTERNAL	GROUND

REAR FOG LAMP RELAY (BUILT-UP-EXPORT)

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B(+)
85	INTERNAL	FUSED B(+)
86	INTERNAL	REAR FOG LAMP RELAY CONTROL
87	L95 18DG/YL	REAR FOG LAMP RELAY OUTPUT
87A	-	-

REAR WINDOW DEFOGGER RELAY

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B(+)
85	INTERNAL	FUSED B(+)
86	INTERNAL	REAR WINDOW DEFOGGER RELAY CONTROL
87	INTERNAL	REAR WINDOW DEFOGGER RELAY OUTPUT
87A	-	-

SUNROOF DELAY RELAY

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B(+)
85	INTERNAL	FUSED B(+)
86	INTERNAL	SUNROOF DELAY RELAY CONTROL
87	Q30 16TN	SUNROOF DELAY RELAY OUTPUT
87A	-	-

COMBINATION FLASHER

CAVITY	CIRCUIT	FUNCTION
1	INTERNAL	FUSED B(+)
2	INTERNAL	LEFT TURN SIGNAL
3	INTERNAL	RIGHT TURN SIGNAL
4	L63 18DG/RD	LEFT TURN SIGNAL
5	L62 18BR/RD •	RIGHT TURN SIGNAL
5	L62 20BR/RD ••	RIGHT TURN SIGNAL
6	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN)
7	L305 18LB/WT ••	LEFT TURN SWITCH SENSE
7	L305 20LB/WT •	LEFT TURN SWITCH SENSE
8	L302 18LB/YL ••	RIGHT TURN SWITCH SENSE
8	L302 20LB/YL •	RIGHT TURN SWITCH SENSE
9	INTERNAL	HAZARD SWITCH SENSE

• LHD
•• RHD

J998W-19

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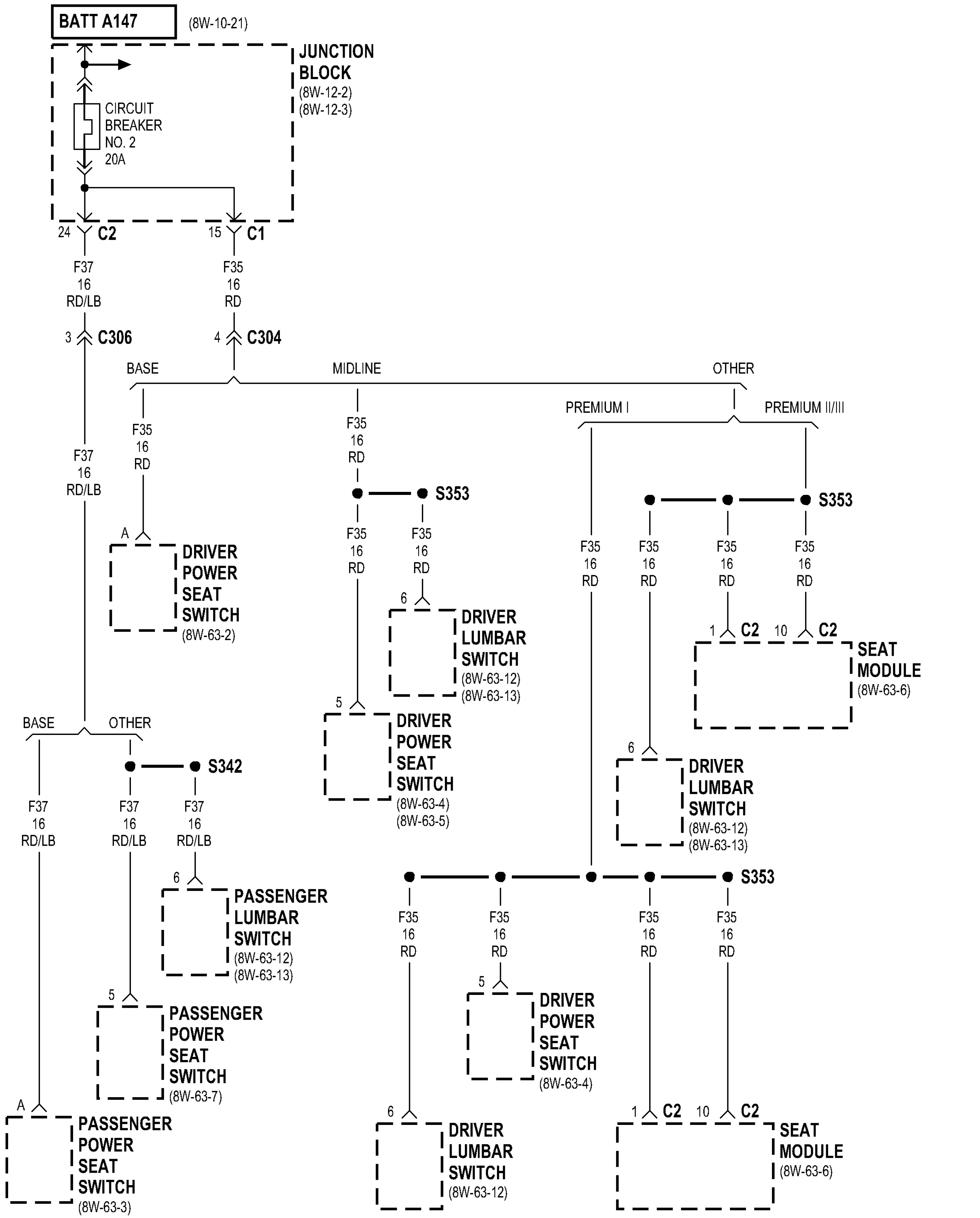
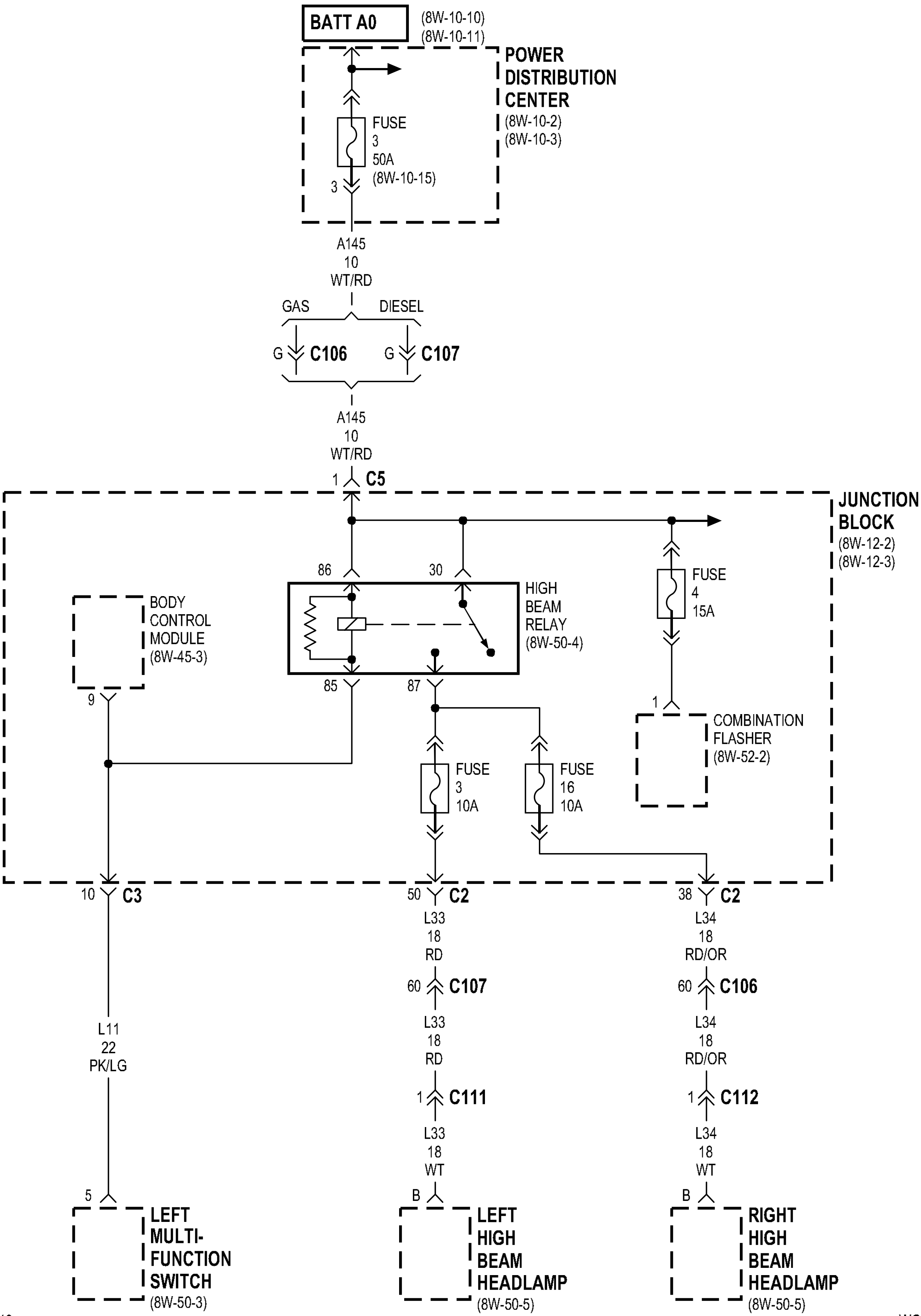
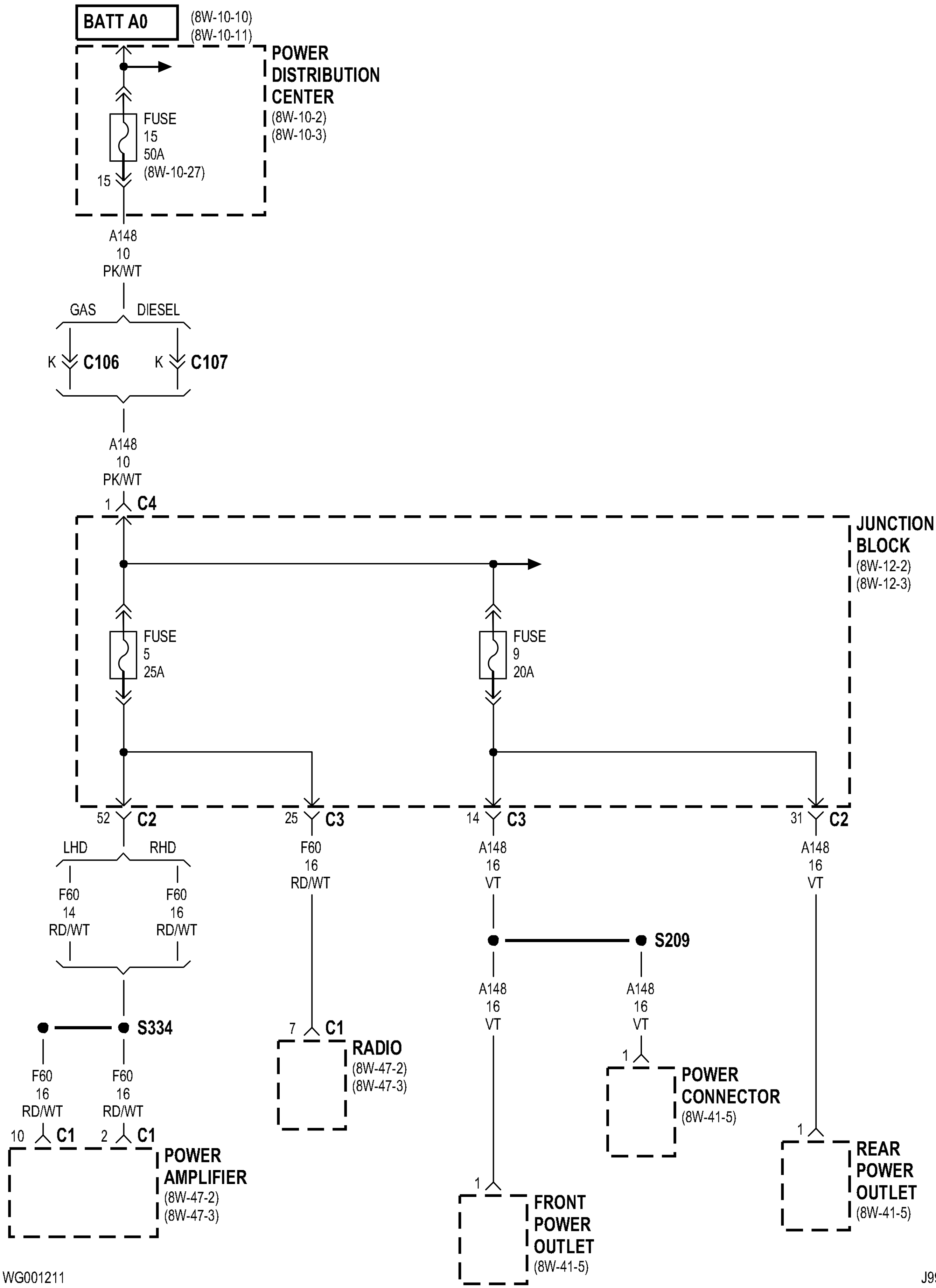


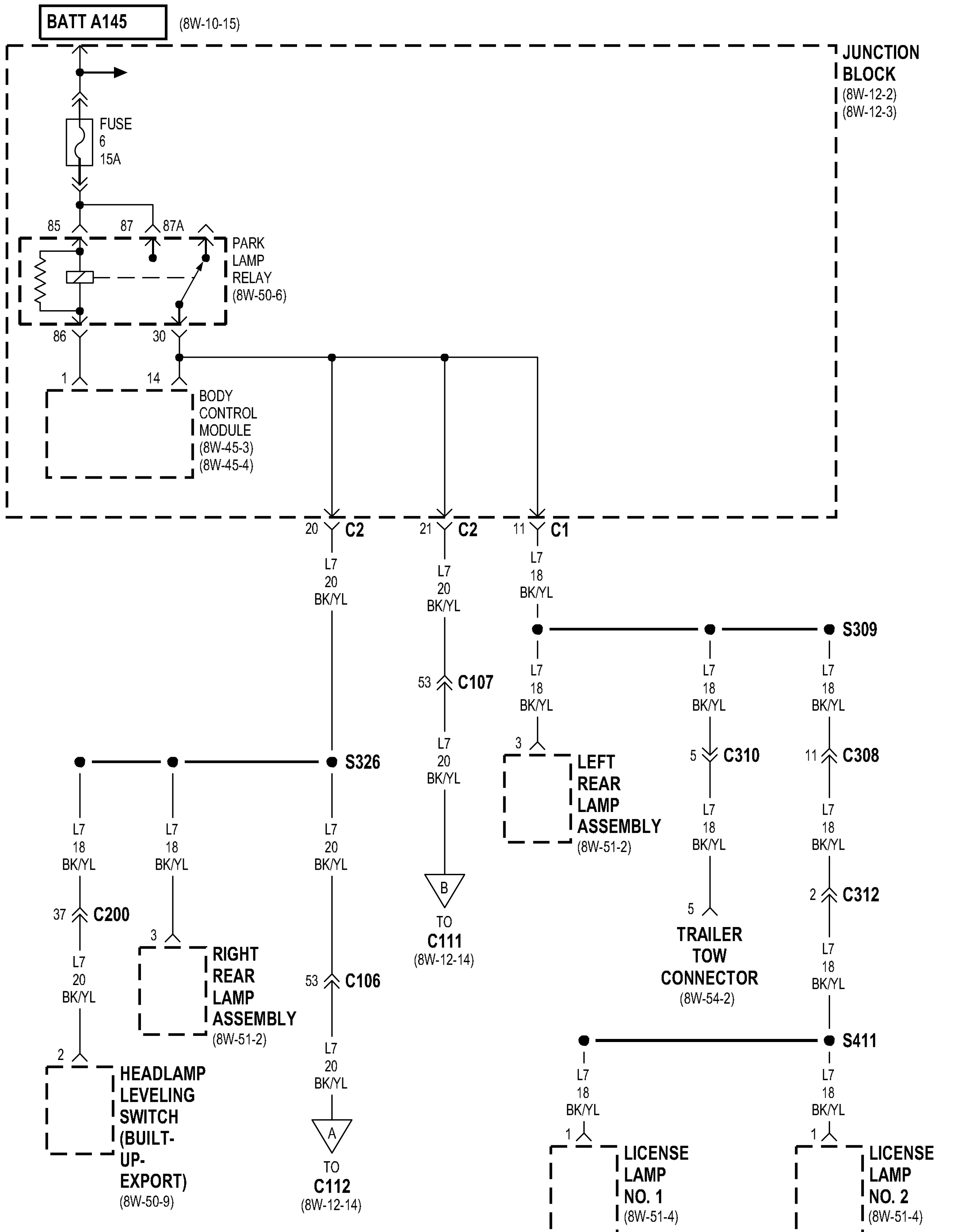
BATT A147
(8W-10-21)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
CIRCUIT BREAKER NO. 2 20A
24 C2
15 C1
F37 16 RD/LB
F35 16 RD
3 C306
4 C304
BASE
MIDLINE
OTHER
PREMIUM I
PREMIUM II/III
S353
S342
A
DRIVER POWER SEAT SWITCH
(8W-63-2)
6
DRIVER LUMBAR SWITCH
(8W-63-12)
(8W-63-13)
5
DRIVER POWER SEAT SWITCH
(8W-63-4)
(8W-63-5)
1 C2
10 C2
SEAT MODULE
(8W-63-6)
PASSENGER LUMBAR SWITCH
(8W-63-12)
(8W-63-13)
PASSENGER POWER SEAT SWITCH
(8W-63-7)
PASSENGER POWER SEAT SWITCH
(8W-63-3)
DRIVER POWER SEAT SWITCH
(8W-63-4)
DRIVER LUMBAR SWITCH
(8W-63-12)


BATT A0
(8W-10-10)
(8W-10-11)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
(8W-10-3)
FUSE
3
50A
(8W-10-15)
3
A145
10
WT/RD
GAS
DIESEL
G
C106
G
C107
A145
10
WT/RD
1
C5
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
86
30
HIGH
BEAM
RELAY
(8W-50-4)
FUSE
4
15A
BODY
CONTROL
MODULE
(8W-45-3)
9
85
87
1
COMBINATION
FLASHER
(8W-52-2)
FUSE
3
10A
FUSE
16
10A
10
C3
50
C2
38
C2
L33
18
RD
L34
18
RD/OR
60
C107
60
C106
L11
22
PK/LG
L33
18
RD
L34
18
RD/OR
1
C111
1
C112
L33
18
WT
L34
18
WT
5
B
B
LEFT
MULTI-
FUNCTION
SWITCH
(8W-50-3)
LEFT
HIGH
BEAM
HEADLAMP
(8W-50-5)
RIGHT
HIGH
BEAM
HEADLAMP
(8W-50-5)

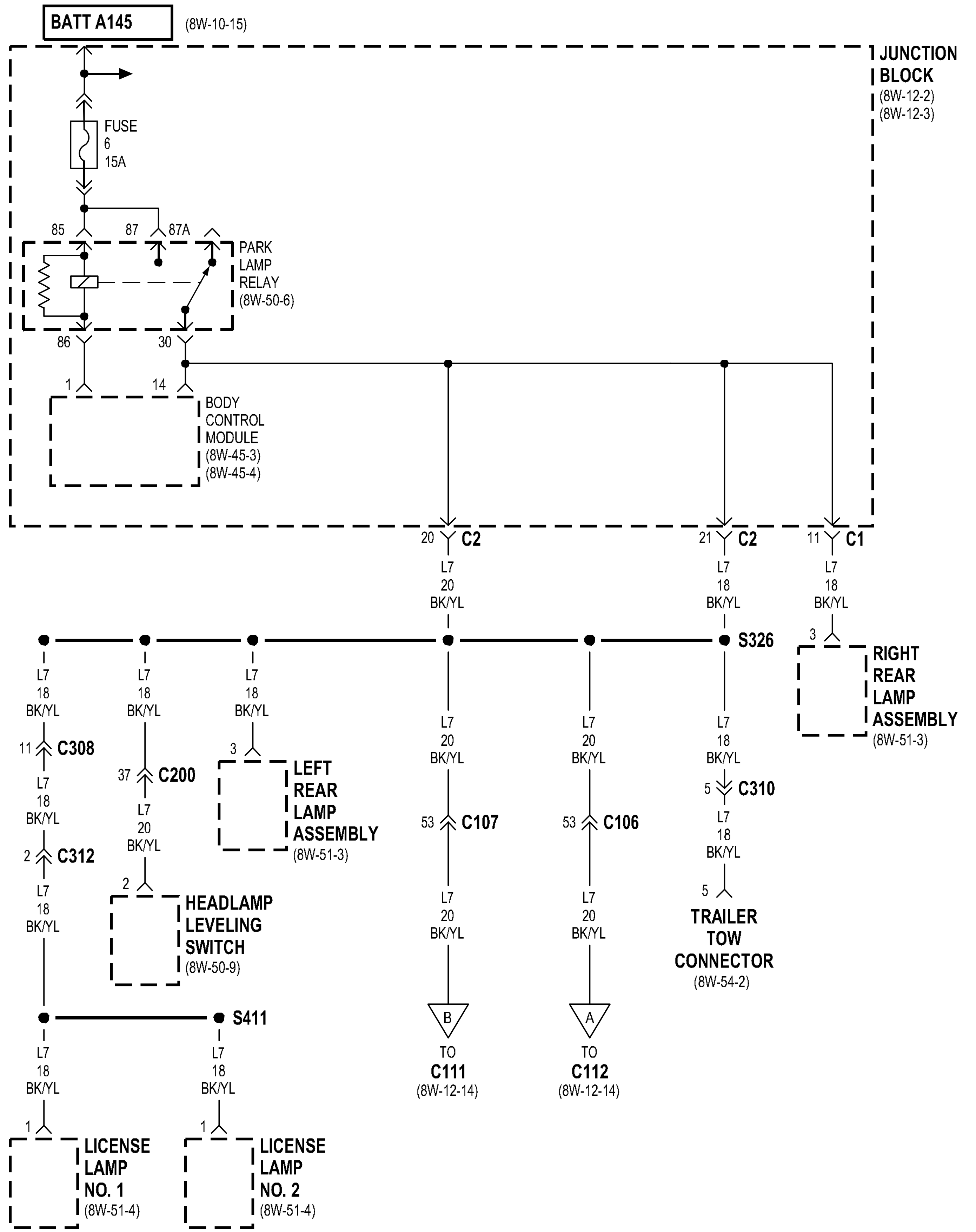


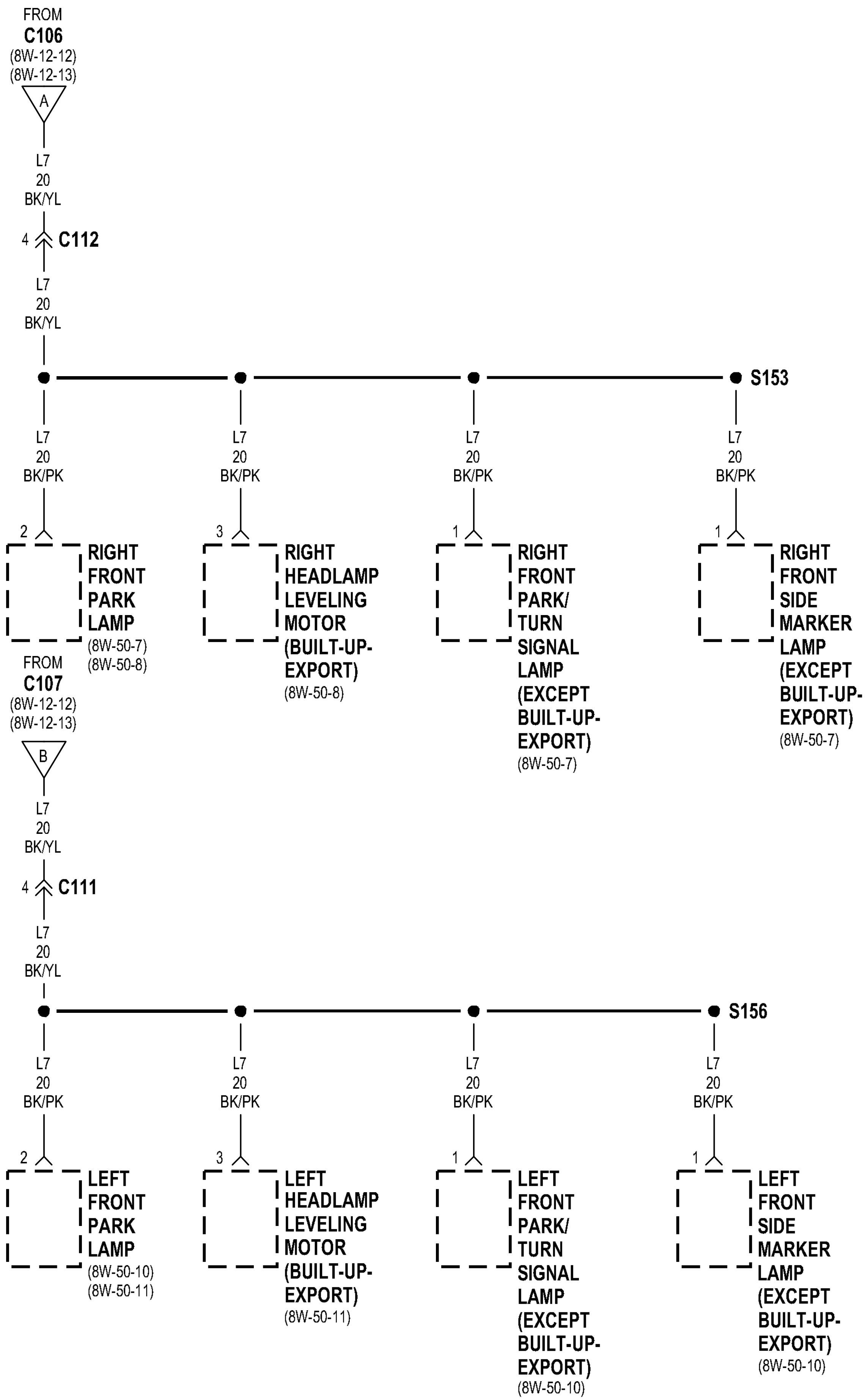
BATT A0
(8W-10-10)
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
(8W-10-3)
FUSE 15 50A
(8W-10-27)
15
A148 10 PK/WT
GAS
DIESEL
K C106
K C107
A148 10 PK/WT
1 C4
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 5 25A
FUSE 9 20A
52 C2
25 C3
14 C3
31 C2
LHD
RHD
F60 14 RD/WT
F60 16 RD/WT
F60 16 RD/WT
A148 16 VT
A148 16 VT
S334
S209
A148 16 VT
A148 16 VT
F60 16 RD/WT
F60 16 RD/WT
7 C1
RADIO
(8W-47-2)
(8W-47-3)
1
POWER CONNECTOR
(8W-41-5)
10 C1
2 C1
POWER AMPLIFIER
(8W-47-2)
(8W-47-3)
1
REAR POWER OUTLET
(8W-41-5)
1
FRONT POWER OUTLET
(8W-41-5)

LHD

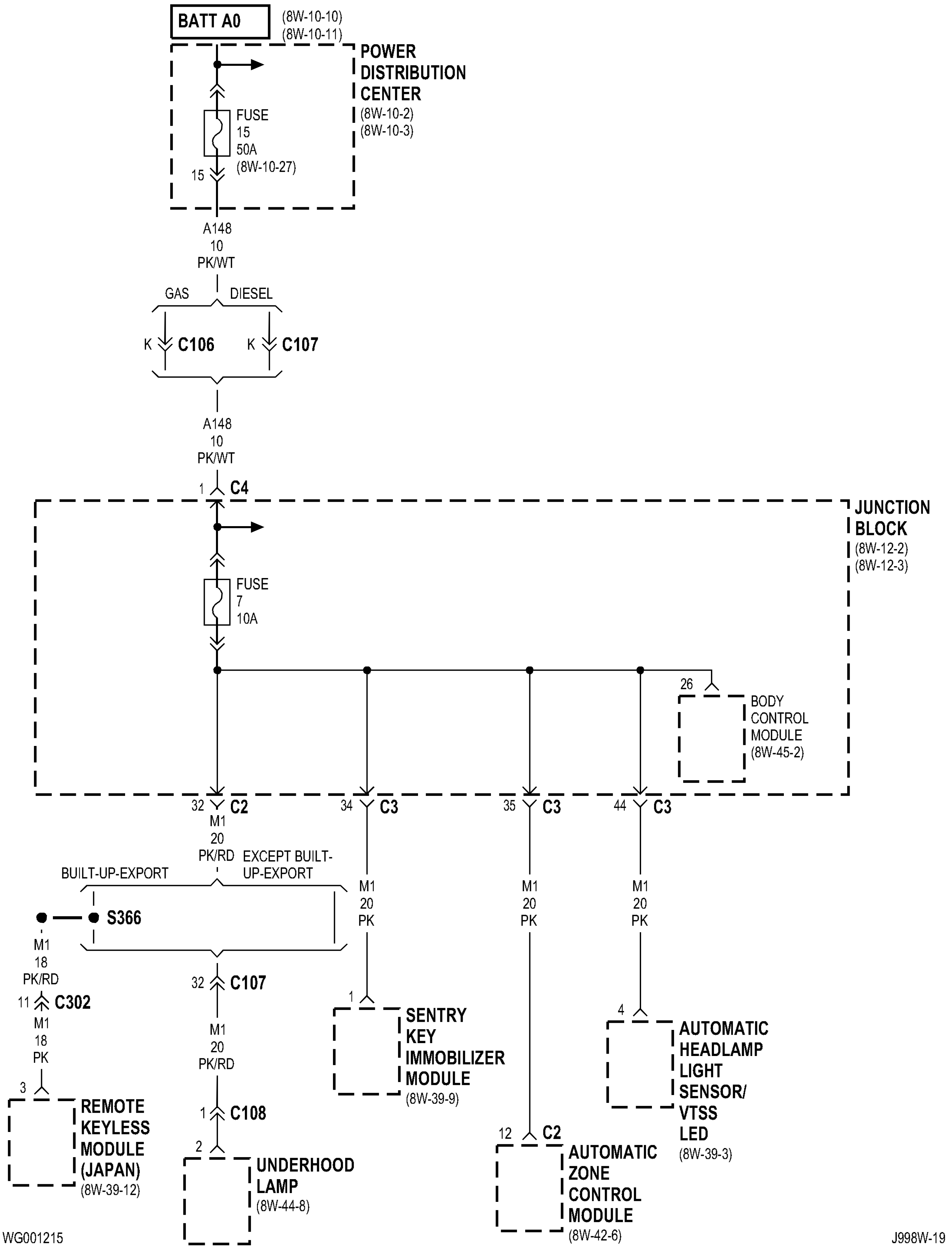


BATT A145
(8W-10-15)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
6
15A
85
87
87A
PARK LAMP RELAY
(8W-50-6)
86
30
1
14
BODY CONTROL MODULE
(8W-45-3)
(8W-45-4)
20 C2
21 C2
11 C1
L7
20
BK/YL
L7
18
BK/YL
S309
53 C107
S326
3
LEFT REAR LAMP ASSEMBLY
(8W-51-2)
5 C310
11 C308
37 C200
3
RIGHT REAR LAMP ASSEMBLY
(8W-51-2)
B
TO
C111
(8W-12-14)
5
TRAILER TOW CONNECTOR
(8W-54-2)
2 C312
53 C106
2
HEADLAMP LEVELING SWITCH (BUILT-UP-EXPORT)
(8W-50-9)
S411
A
TO
C112
(8W-12-14)
1
LICENSE LAMP NO. 1
(8W-51-4)
1
LICENSE LAMP NO. 2
(8W-51-4)

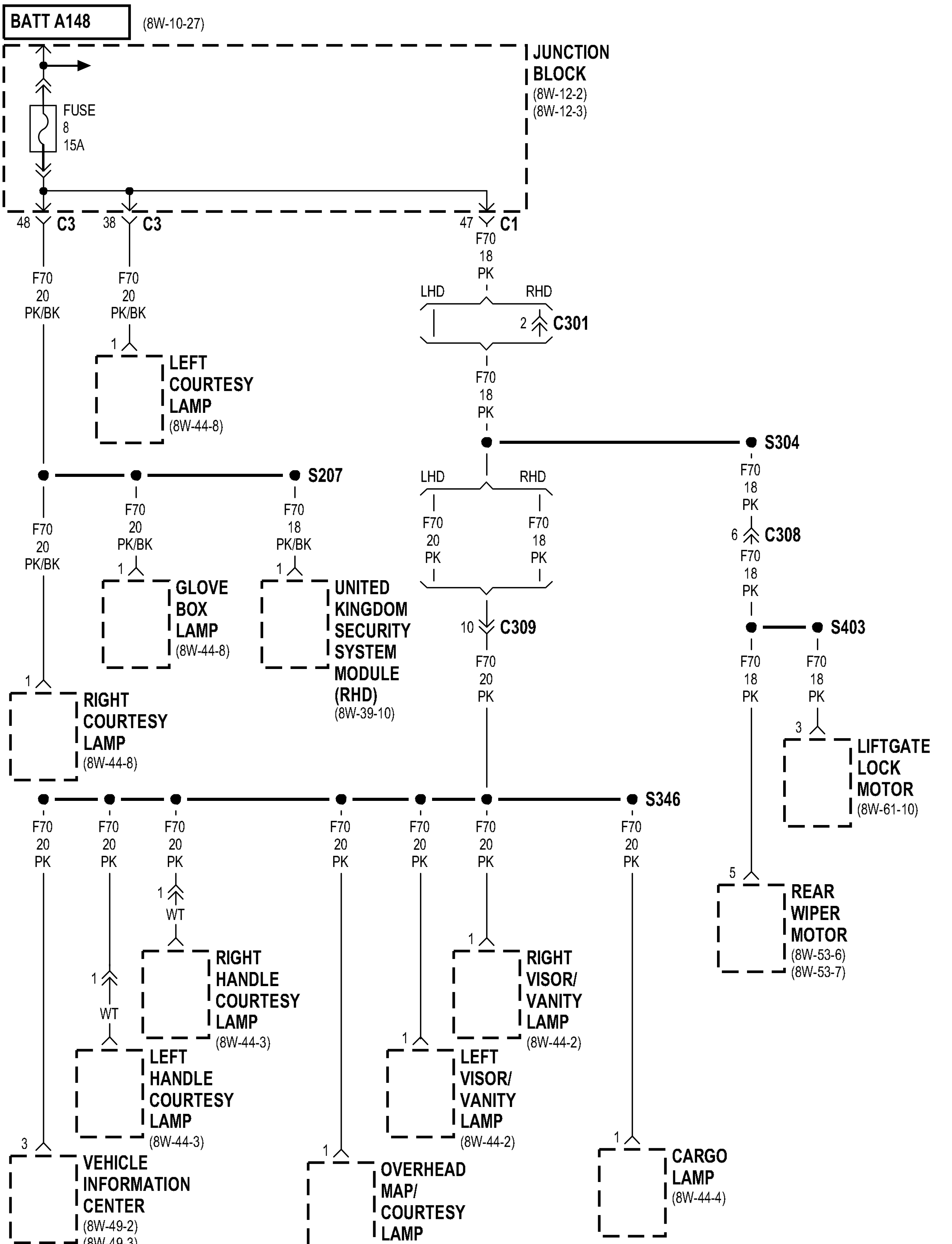

BATT A145
(8W-10-15)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
6
15A
85
87
87A
PARK LAMP RELAY
(8W-50-6)
86
30
1
14
BODY CONTROL MODULE
(8W-45-3)
(8W-45-4)
20 C2
21 C2
11 C1
L7
20
BK/YL
L7
18
BK/YL
S326
3
RIGHT REAR LAMP ASSEMBLY
(8W-51-3)
11 C308
37 C200
3
LEFT REAR LAMP ASSEMBLY
(8W-51-3)
53 C107
53 C106
5 C310
2 C312
2
HEADLAMP LEVELING SWITCH
(8W-50-9)
5
TRAILER TOW CONNECTOR
(8W-54-2)
S411
B
TO C111
(8W-12-14)
A
TO C112
(8W-12-14)
1
LICENSE LAMP NO. 1
(8W-51-4)
1
LICENSE LAMP NO. 2
(8W-51-4)

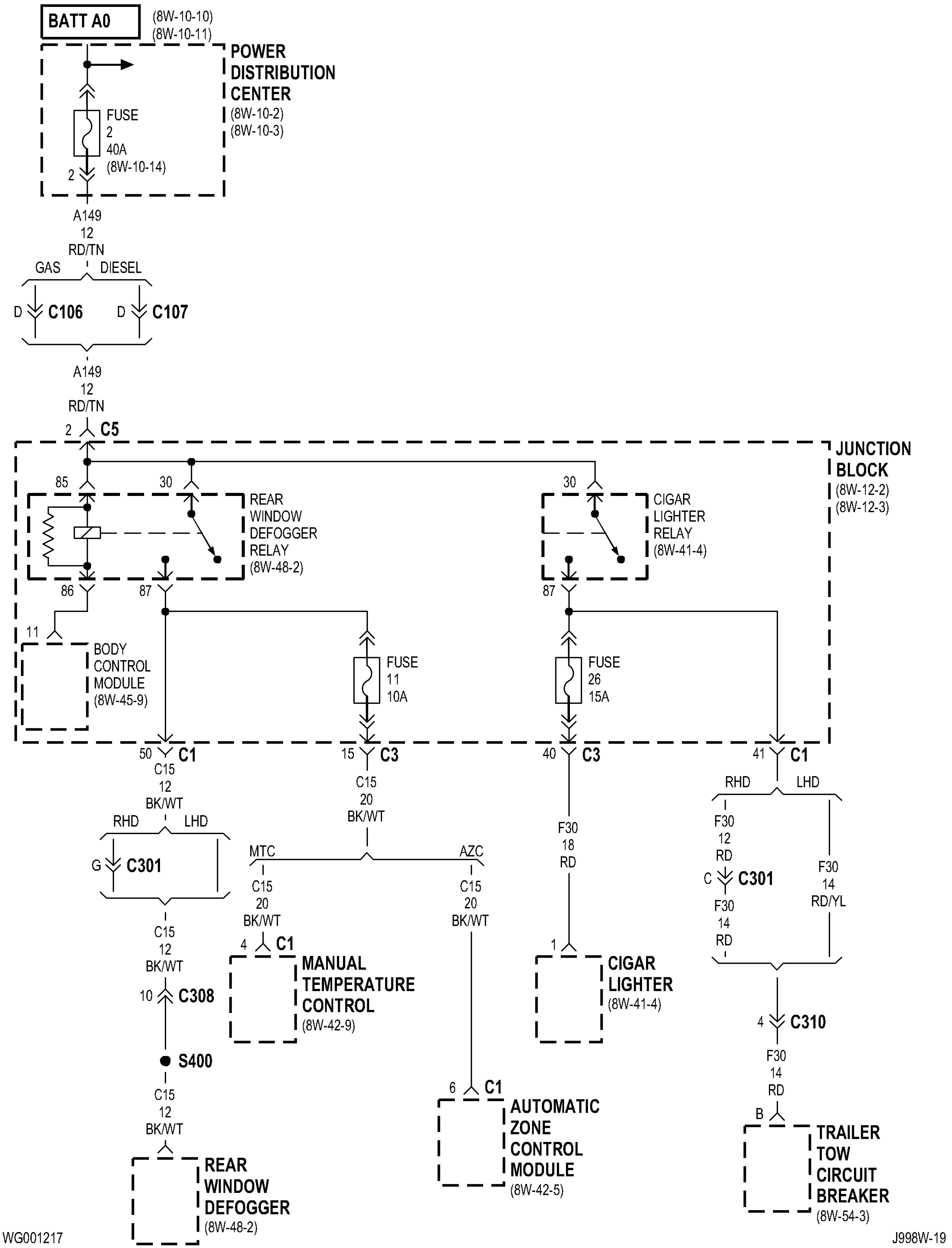


J998W-19 WG001214



WG001215 J998W-19


BATT A148
(8W-10-27)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 8 15A
48 C3
38 C3
47 C1
F70 20 PK/BK
F70 18 PK
LHD
RHD
2 C301
LEFT COURTESY LAMP
(8W-44-8)
S304
S207
F70 18 PK/BK
6 C308
GLOVE BOX LAMP
(8W-44-8)
UNITED KINGDOM SECURITY SYSTEM MODULE (RHD)
(8W-39-10)
F70 20 PK
10 C309
S403
RIGHT COURTESY LAMP
(8W-44-8)
LIFTGATE LOCK MOTOR
(8W-61-10)
S346
WT
RIGHT HANDLE COURTESY LAMP
(8W-44-3)
REAR WIPER MOTOR
(8W-53-6)
(8W-53-7)
RIGHT VISOR/ VANITY LAMP
(8W-44-2)
LEFT HANDLE COURTESY LAMP
(8W-44-3)
LEFT VISOR/ VANITY LAMP
(8W-44-2)
VEHICLE INFORMATION CENTER
(8W-49-2)
(8W-49-3)
OVERHEAD MAP/ COURTESY LAMP
(8W-44-3)
CARGO LAMP
(8W-44-4)



WG001217

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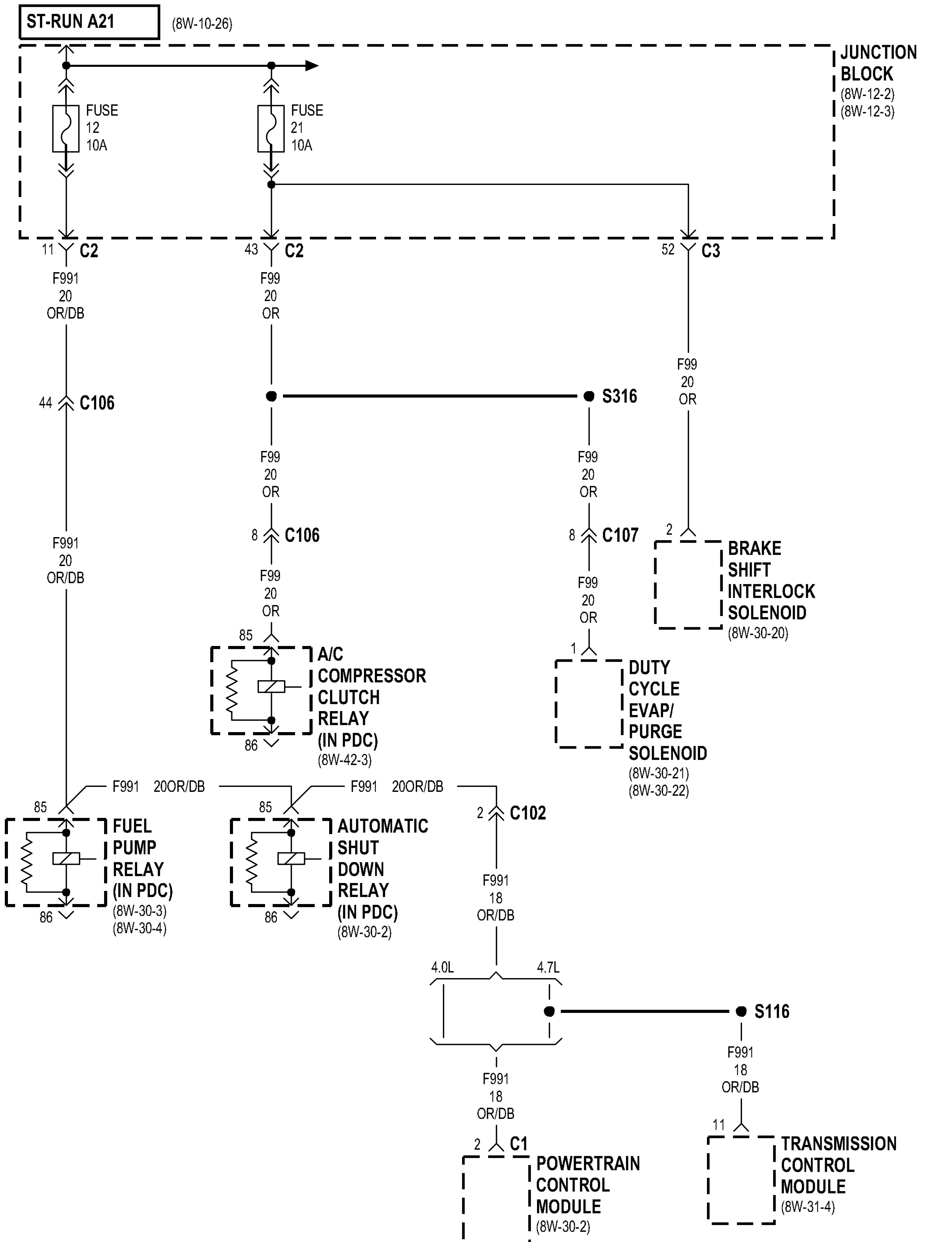
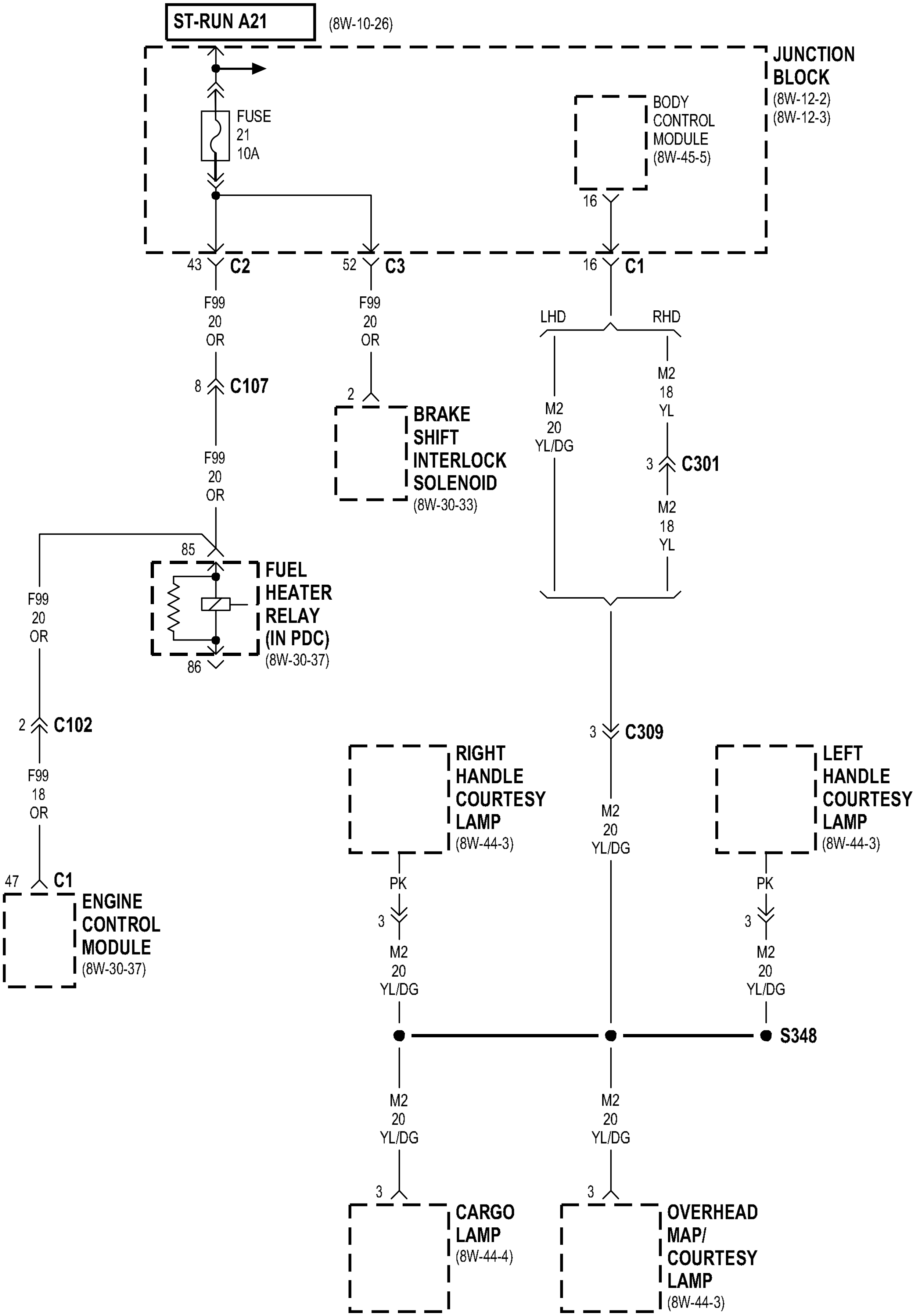
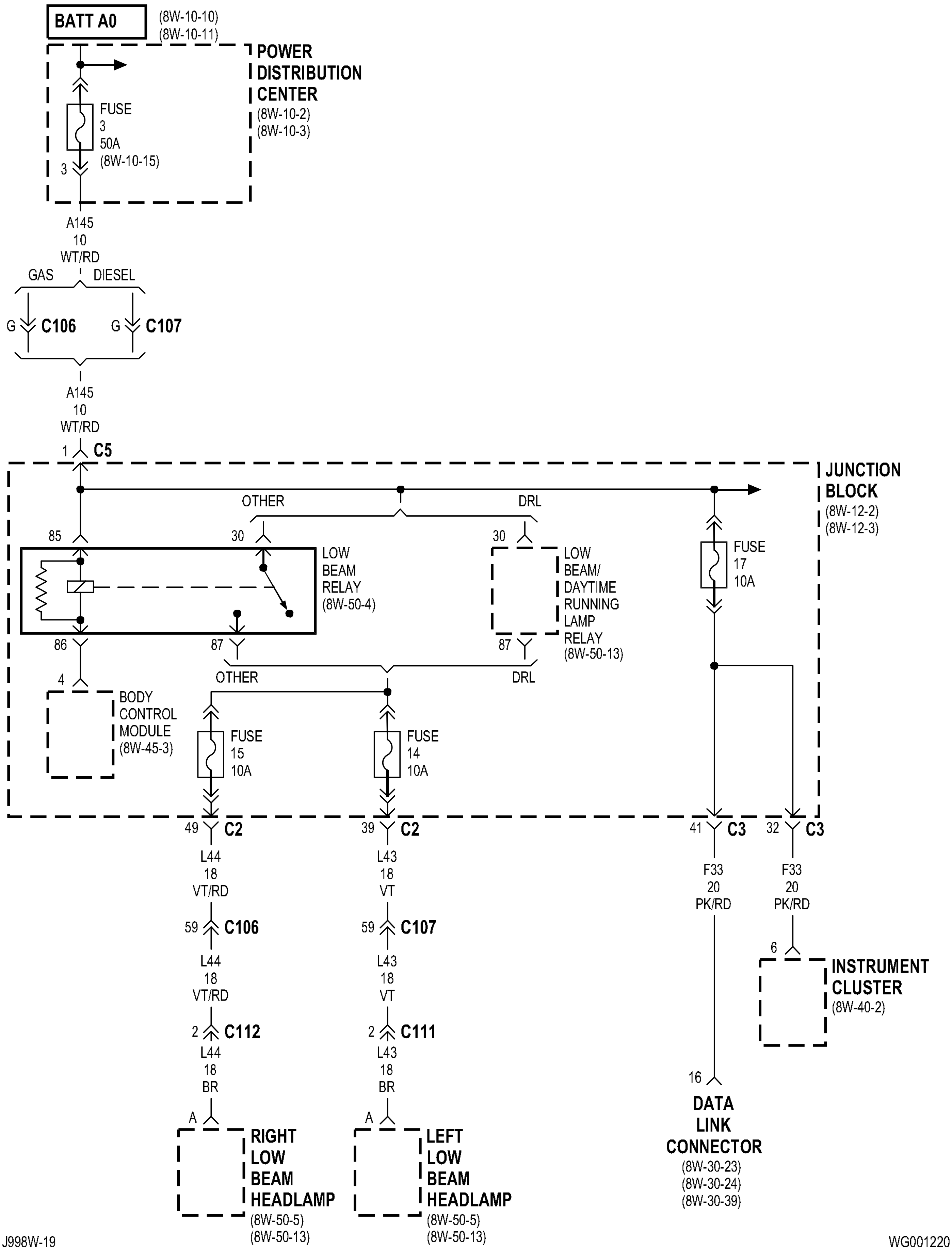
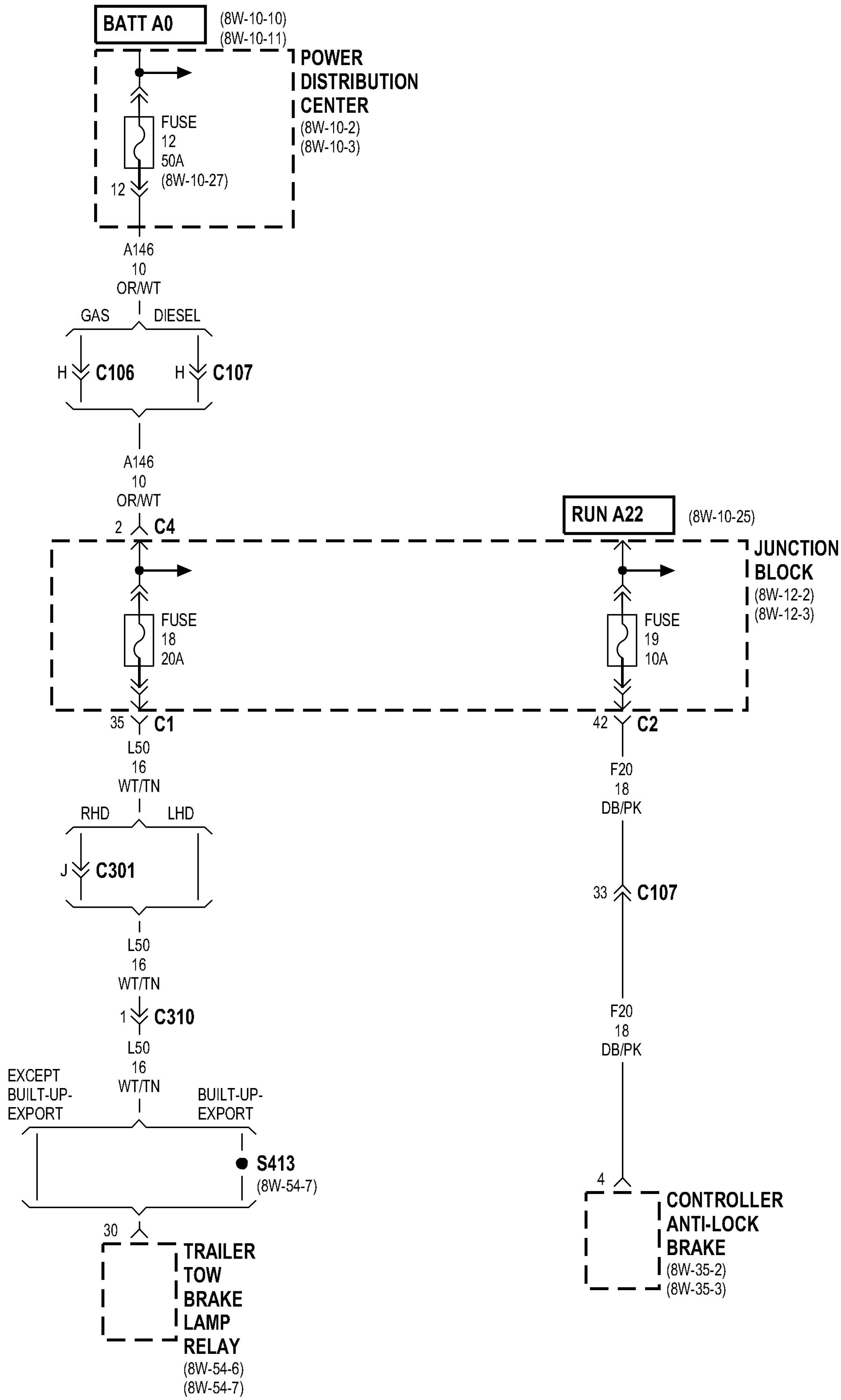
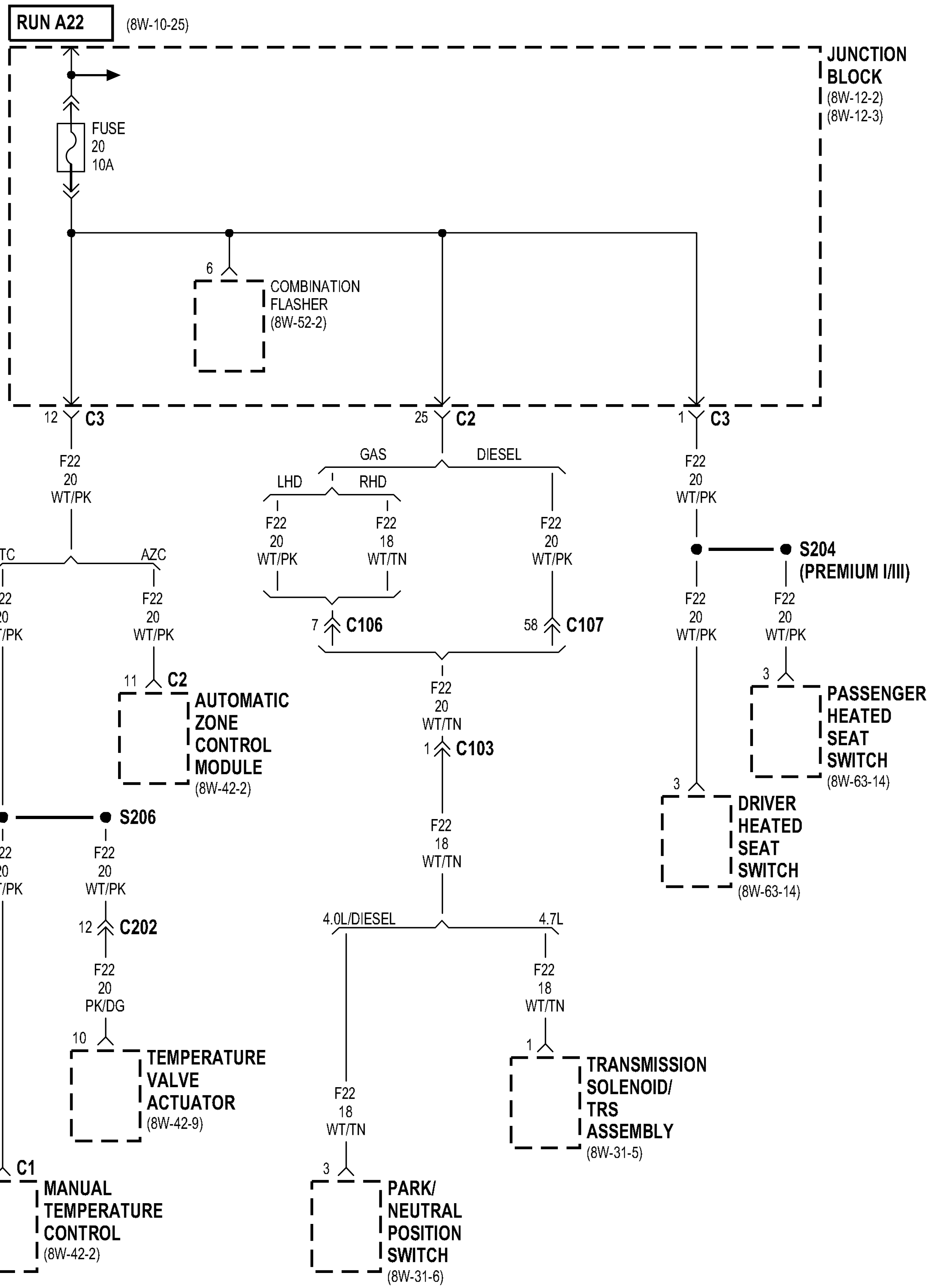

ST-RUN A21
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 12 10A
FUSE 21 10A
11 C2
43 C2
52 C3
F991 20 OR/DB
F99 20 OR
44 C106
S316
8 C106
8 C107
2
BRAKE SHIFT INTERLOCK SOLENOID
(8W-30-20)
85
A/C COMPRESSOR CLUTCH RELAY (IN PDC)
(8W-42-3)
86
1
DUTY CYCLE EVAP/ PURGE SOLENOID
(8W-30-21)
(8W-30-22)
F991 20OR/DB
FUEL PUMP RELAY (IN PDC)
(8W-30-3)
(8W-30-4)
AUTOMATIC SHUT DOWN RELAY (IN PDC)
(8W-30-2)
2 C102
F991 18 OR/DB
4.0L
4.7L
S116
2 C1
POWERTRAIN CONTROL MODULE
(8W-30-2)
11
TRANSMISSION CONTROL MODULE
(8W-31-4)

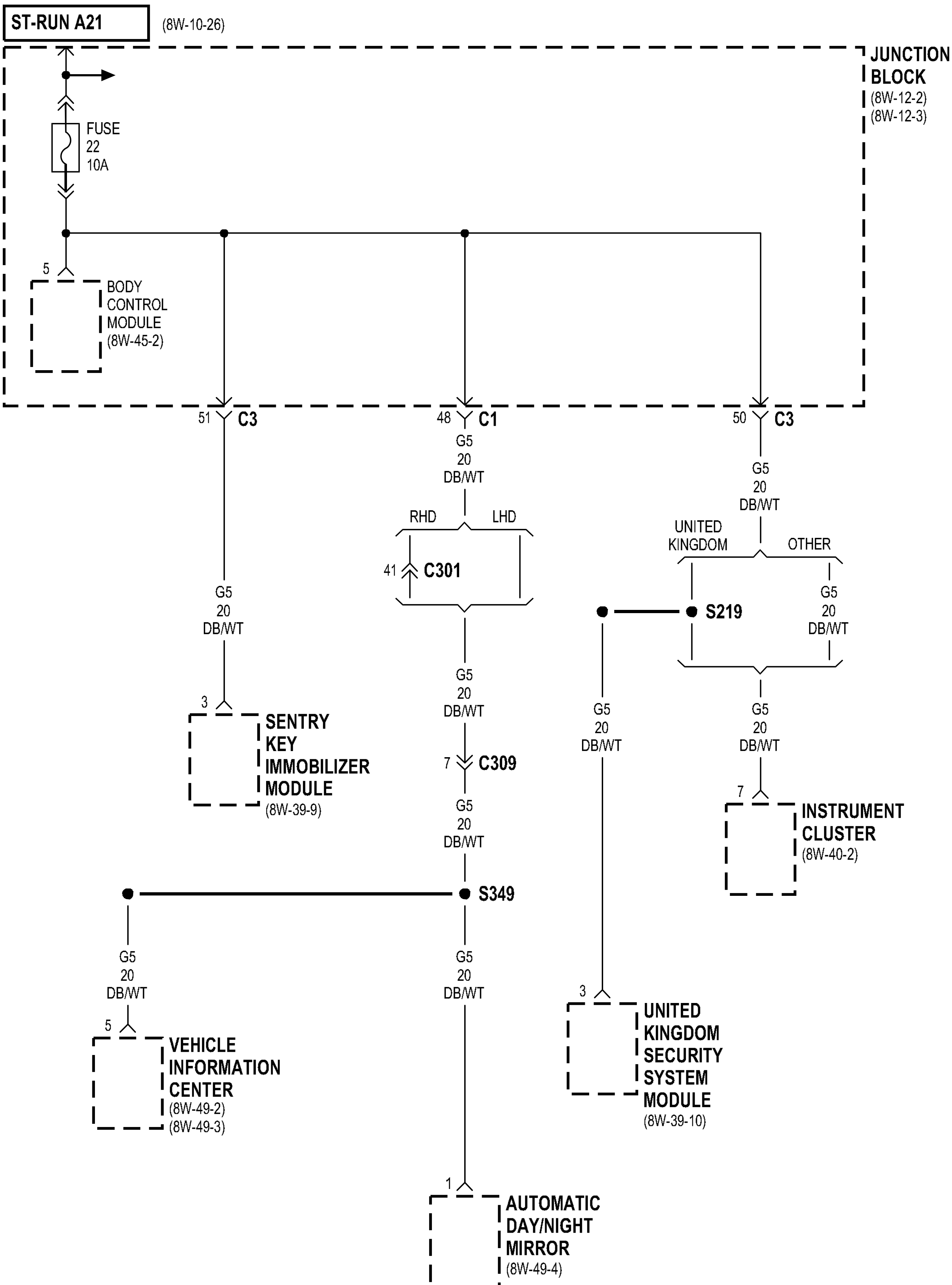

ST-RUN A21
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 21 10A
BODY CONTROL MODULE
(8W-45-5)
16
43 C2
52 C3
16 C1
F99 20 OR
F99 20 OR
LHD
RHD
M2 20 YL/DG
M2 18 YL
8 C107
2
BRAKE SHIFT INTERLOCK SOLENOID
(8W-30-33)
3 C301
M2 18 YL
F99 20 OR
85
FUEL HEATER RELAY (IN PDC)
(8W-30-37)
86
F99 20 OR
2 C102
F99 18 OR
47 C1
ENGINE CONTROL MODULE
(8W-30-37)
3 C309
RIGHT HANDLE COURTESY LAMP
(8W-44-3)
M2 20 YL/DG
LEFT HANDLE COURTESY LAMP
(8W-44-3)
PK
3
M2 20 YL/DG
PK
3
M2 20 YL/DG
S348
M2 20 YL/DG
M2 20 YL/DG
3
CARGO LAMP
(8W-44-4)
3
OVERHEAD MAP/ COURTESY LAMP
(8W-44-3)

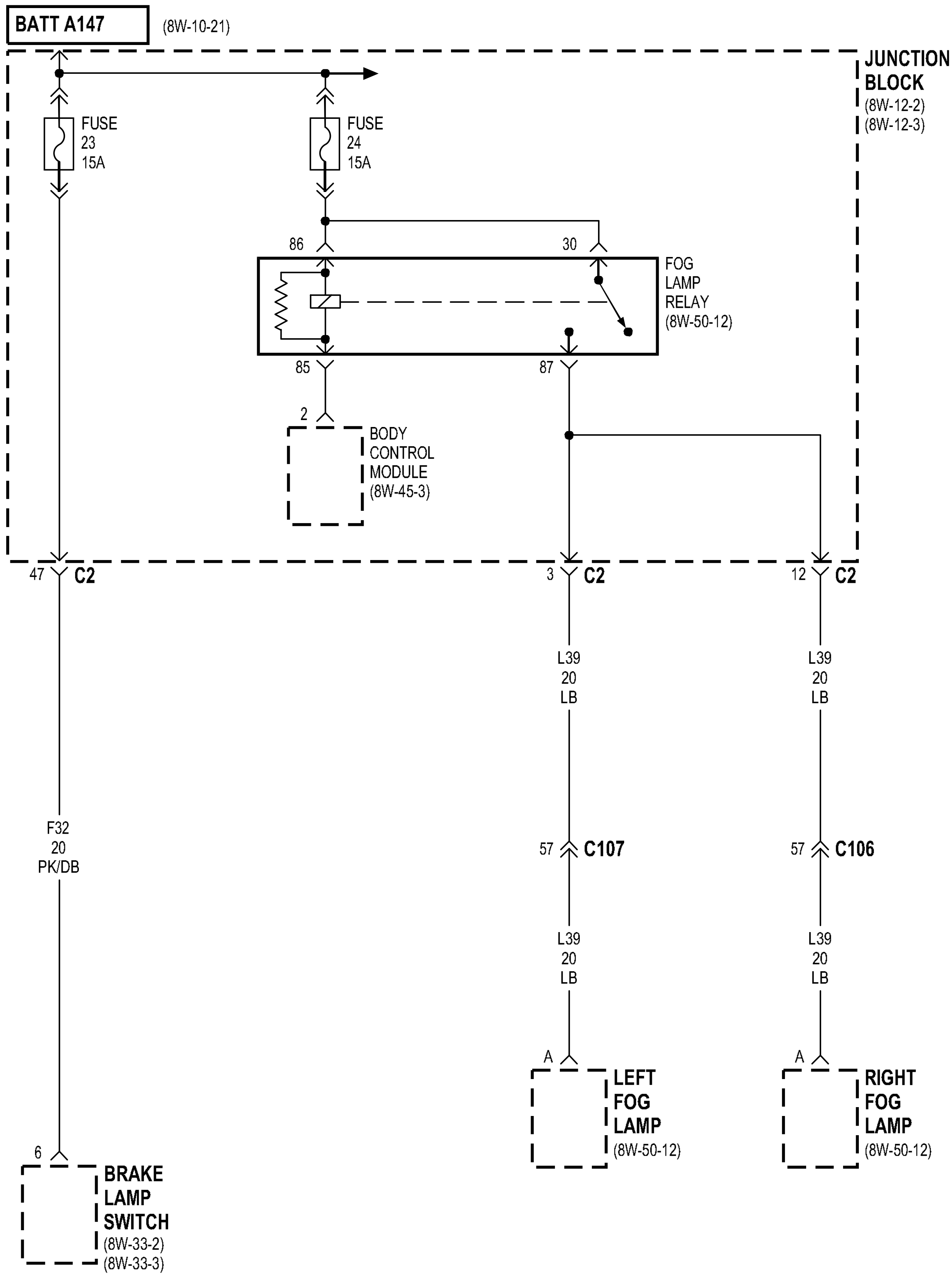

BATT A0
(8W-10-10)
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
(8W-10-3)
FUSE 3 50A
(8W-10-15)
3
A145 10 WT/RD
GAS
DIESEL
G C106
G C107
A145 10 WT/RD
1 C5
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
OTHER
DRL
85
30
30
LOW BEAM RELAY
(8W-50-4)
LOW BEAM/ DAYTIME RUNNING LAMP RELAY
(8W-50-13)
FUSE 17 10A
86
87
87
OTHER
DRL
4
BODY CONTROL MODULE
(8W-45-3)
FUSE 15 10A
FUSE 14 10A
49 C2
39 C2
41 C3
32 C3
L44 18 VT/RD
L43 18 VT
F33 20 PK/RD
F33 20 PK/RD
59 C106
59 C107
6
INSTRUMENT CLUSTER
(8W-40-2)
L44 18 VT/RD
L43 18 VT
2 C112
2 C111
L44 18 BR
L43 18 BR
16
DATA LINK CONNECTOR
(8W-30-23)
(8W-30-24)
(8W-30-39)
A
A
RIGHT LOW BEAM HEADLAMP
(8W-50-5)
(8W-50-13)
LEFT LOW BEAM HEADLAMP
(8W-50-5)
(8W-50-13)

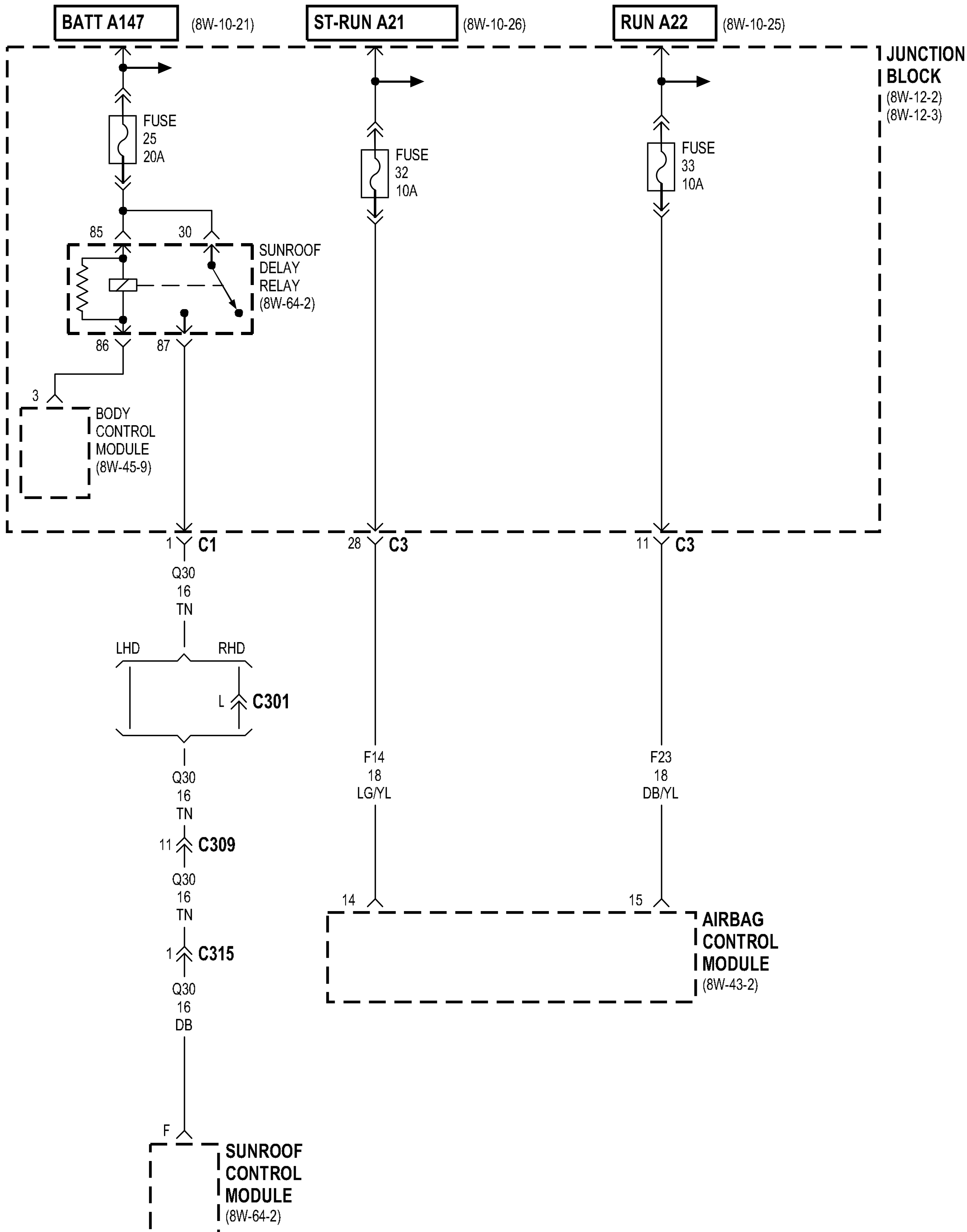

BATT A0
(8W-10-10)
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
(8W-10-3)
FUSE
12
50A
(8W-10-27)
12
A146
10
OR/WT
GAS
DIESEL
H
C106
H
C107
A146
10
OR/WT
2
C4
RUN A22
(8W-10-25)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
18
20A
FUSE
19
10A
35
C1
42
C2
L50
16
WT/TN
RHD
LHD
J
C301
F20
18
DB/PK
33
C107
L50
16
WT/TN
1
C310
F20
18
DB/PK
L50
16
WT/TN
EXCEPT BUILT-UP-EXPORT
BUILT-UP-EXPORT
S413
(8W-54-7)
4
CONTROLLER ANTI-LOCK BRAKE
(8W-35-2)
(8W-35-3)
30
TRAILER TOW BRAKE LAMP RELAY
(8W-54-6)
(8W-54-7)

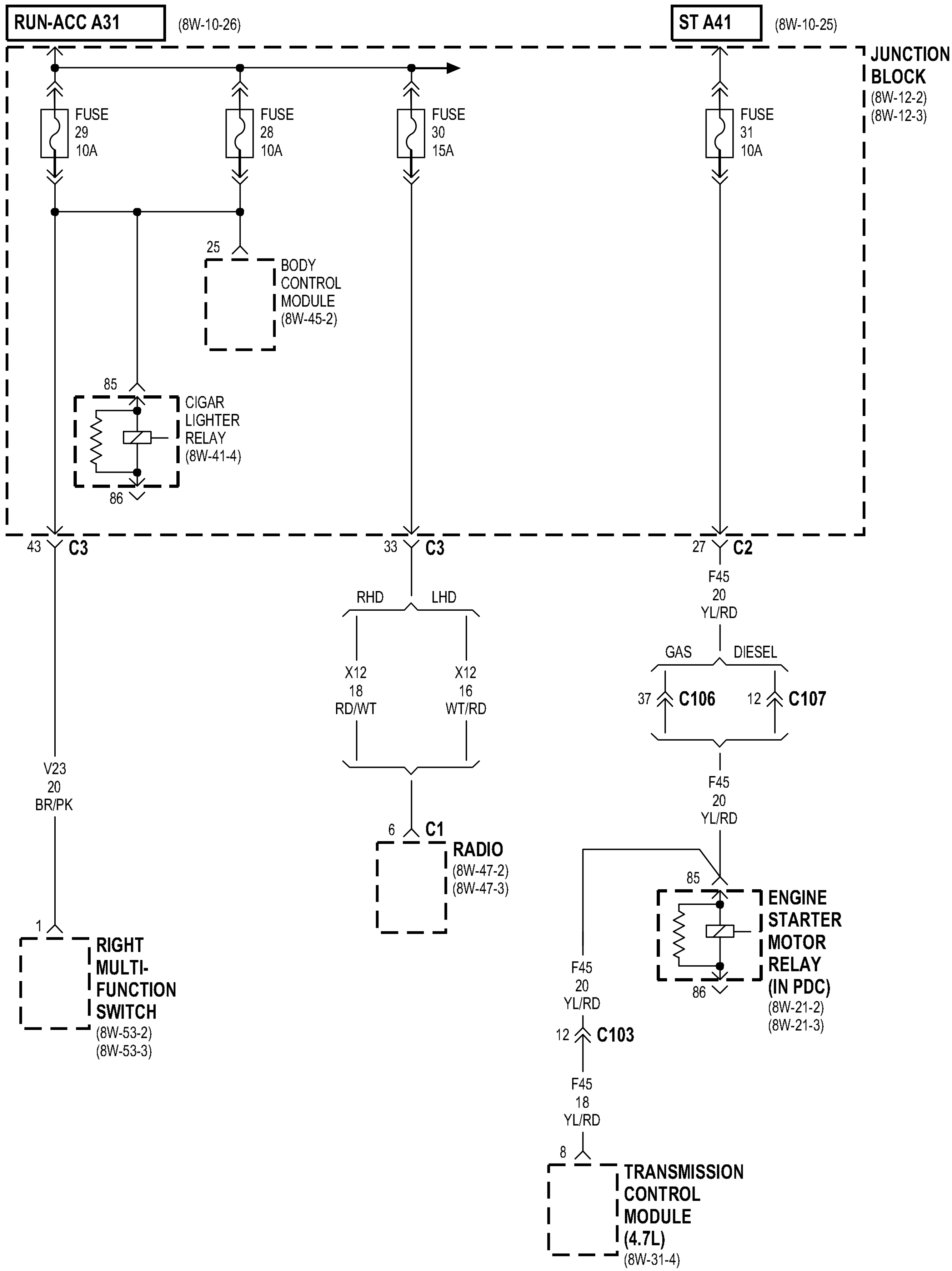


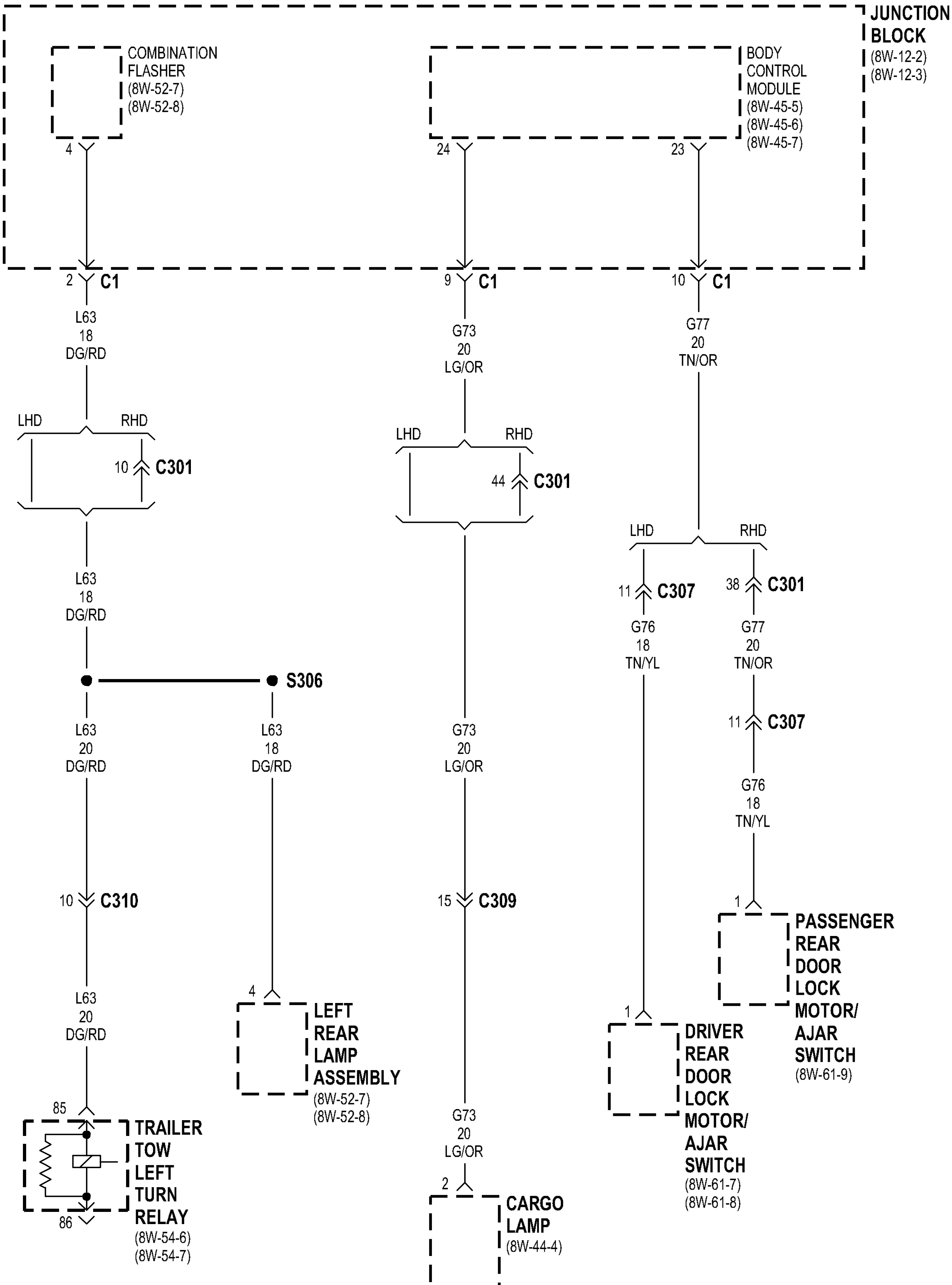
RUN A22
(8W-10-25)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
20
10A
6
COMBINATION FLASHER
(8W-52-2)
12
C3
25
C2
1
C3
F22
20
WT/PK
GAS
DIESEL
LHD
RHD
MTC
AZC
F22
20
WT/PK
F22
18
WT/TN
S204
(PREMIUM I/III)
7
C106
58
C107
11
C2
AUTOMATIC ZONE CONTROL MODULE
(8W-42-2)
F22
20
WT/TN
1
C103
3
PASSENGER HEATED SEAT SWITCH
(8W-63-14)
3
DRIVER HEATED SEAT SWITCH
(8W-63-14)
S206
F22
18
WT/TN
4.0L/DIESEL
4.7L
12
C202
F22
20
PK/DG
10
TEMPERATURE VALVE ACTUATOR
(8W-42-9)
1
TRANSMISSION SOLENOID/ TRS ASSEMBLY
(8W-31-5)
6
C1
MANUAL TEMPERATURE CONTROL
(8W-42-2)
3
PARK/ NEUTRAL POSITION SWITCH
(8W-31-6)


ST-RUN A21
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
22
10A
5
BODY CONTROL MODULE
(8W-45-2)
51
C3
48
C1
50
C3
G5
20
DB/WT
RHD
LHD
41
C301
UNITED KINGDOM
OTHER
S219
3
SENTRY KEY IMMOBILIZER MODULE
(8W-39-9)
7
C309
7
INSTRUMENT CLUSTER
(8W-40-2)
S349
5
VEHICLE INFORMATION CENTER
(8W-49-2)
(8W-49-3)
3
UNITED KINGDOM SECURITY SYSTEM MODULE
(8W-39-10)
1
AUTOMATIC DAY/NIGHT MIRROR
(8W-49-4)

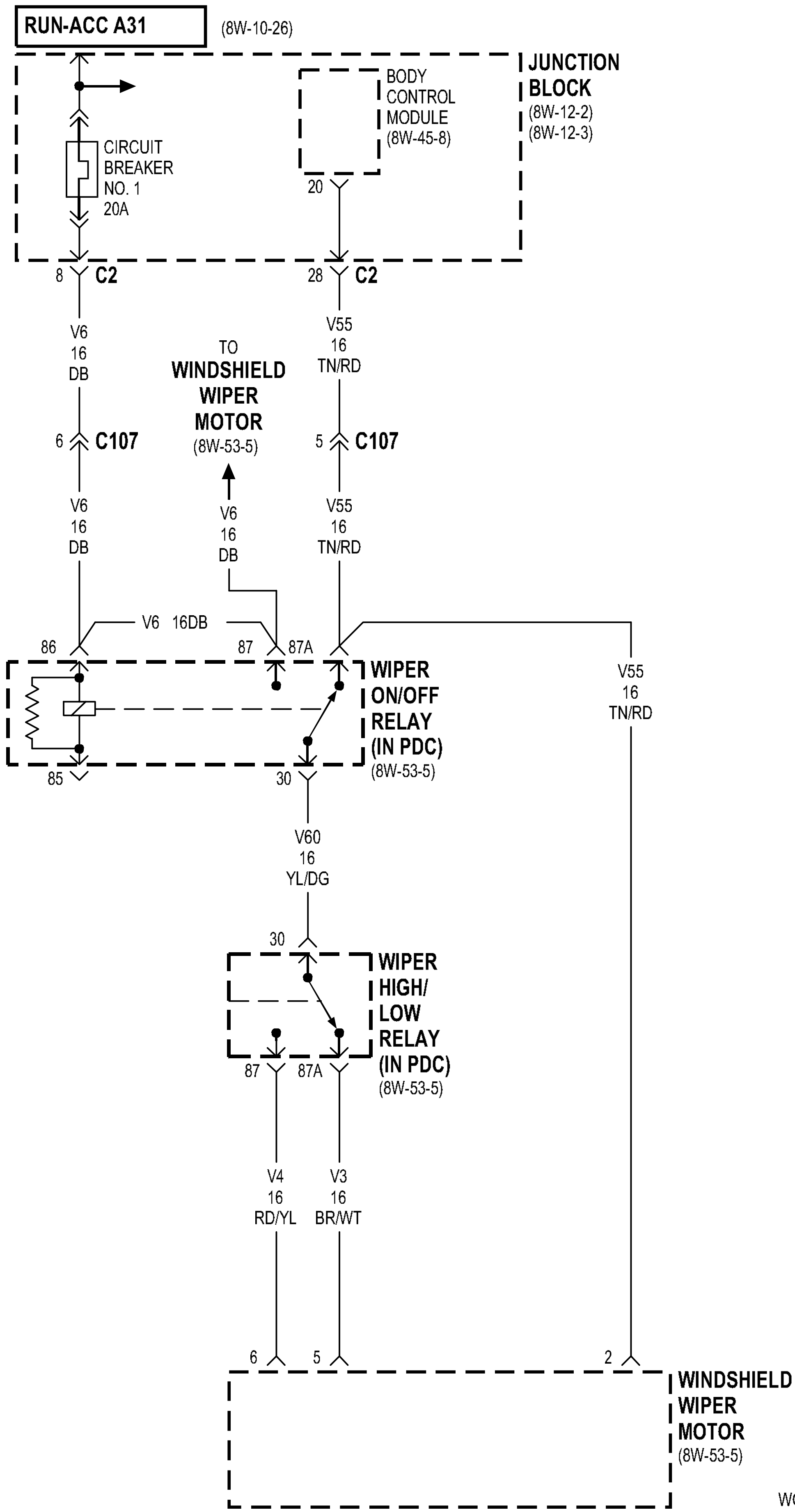

BATT A147
(8W-10-21)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
23
15A
FUSE
24
15A
86
30
FOG
LAMP
RELAY
(8W-50-12)
85
87
2
BODY
CONTROL
MODULE
(8W-45-3)
47
C2
3
C2
12
C2
L39
20
LB
L39
20
LB
F32
20
PK/DB
57
C107
57
C106
L39
20
LB
L39
20
LB
A
LEFT
FOG
LAMP
(8W-50-12)
A
RIGHT
FOG
LAMP
(8W-50-12)
6
BRAKE
LAMP
SWITCH
(8W-33-2)
(8W-33-3)

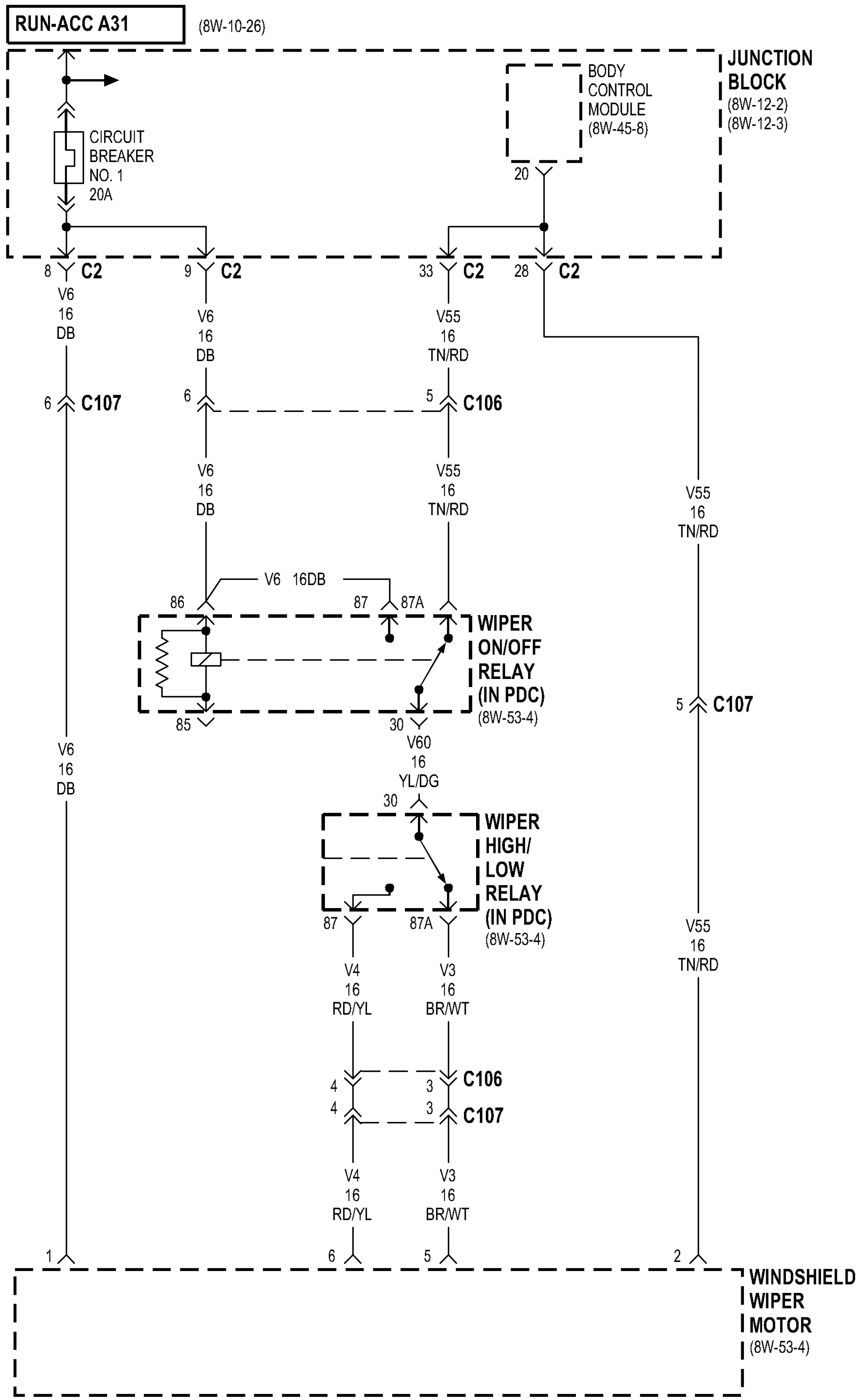

BATT A147
(8W-10-21)
ST-RUN A21
(8W-10-26)
RUN A22
(8W-10-25)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
25
20A
FUSE
32
10A
FUSE
33
10A
85
30
SUNROOF
DELAY
RELAY
(8W-64-2)
86
87
3
BODY
CONTROL
MODULE
(8W-45-9)
1
C1
28
C3
11
C3
Q30
16
TN
LHD
RHD
L
C301
Q30
16
TN
11
C309
Q30
16
TN
1
C315
Q30
16
DB
F14
18
LG/YL
F23
18
DB/YL
14
15
AIRBAG
CONTROL
MODULE
(8W-43-2)
F
SUNROOF
CONTROL
MODULE
(8W-64-2)

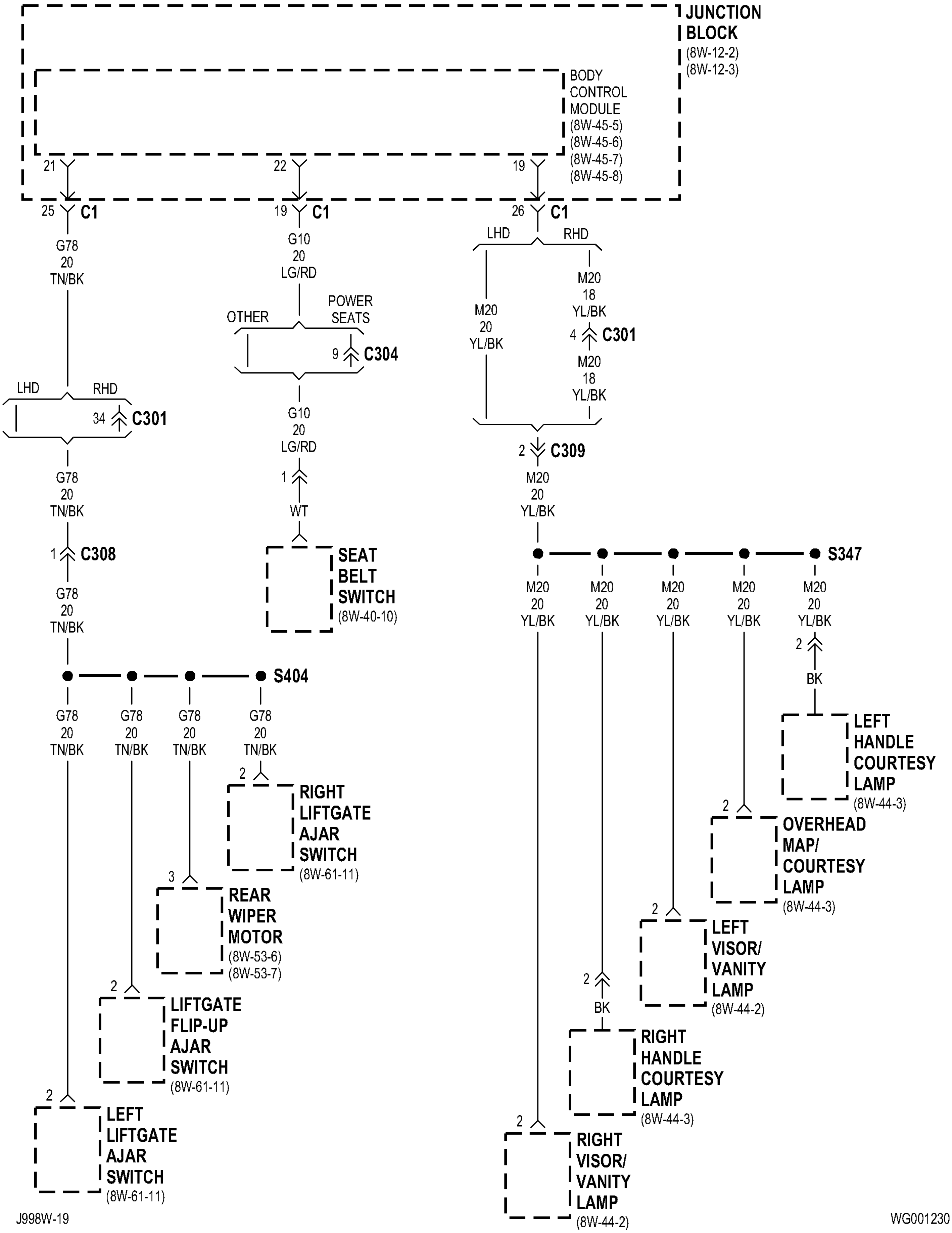

RUN-ACC A31
(8W-10-26)
ST A41
(8W-10-25)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
29
10A
FUSE
28
10A
FUSE
30
15A
FUSE
31
10A
25
BODY
CONTROL
MODULE
(8W-45-2)
85
CIGAR
LIGHTER
RELAY
(8W-41-4)
86
43
C3
33
C3
27
C2
F45
20
YL/RD
RHD
LHD
X12
18
RD/WT
X12
16
WT/RD
GAS
DIESEL
37
C106
12
C107
F45
20
YL/RD
V23
20
BR/PK
6
C1
RADIO
(8W-47-2)
(8W-47-3)
85
ENGINE
STARTER
MOTOR
RELAY
(IN PDC)
(8W-21-2)
(8W-21-3)
86
F45
20
YL/RD
12
C103
F45
18
YL/RD
1
RIGHT
MULTI-
FUNCTION
SWITCH
(8W-53-2)
(8W-53-3)
8
TRANSMISSION
CONTROL
MODULE
(4.7L)
(8W-31-4)


JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
COMBINATION FLASHER
(8W-52-7)
(8W-52-8)
BODY CONTROL MODULE
(8W-45-5)
(8W-45-6)
(8W-45-7)
4
24
23
2 C1
9 C1
10 C1
L63 18 DG/RD
G73 20 LG/OR
G77 20 TN/OR
LHD
RHD
10 C301
44 C301
11 C307
38 C301
G76 18 TN/YL
G77 20 TN/OR
11 C307
G76 18 TN/YL
L63 18 DG/RD
S306
L63 20 DG/RD
L63 18 DG/RD
G73 20 LG/OR
10 C310
15 C309
L63 20 DG/RD
4
LEFT REAR LAMP ASSEMBLY
(8W-52-7)
(8W-52-8)
1
PASSENGER REAR DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-9)
1
DRIVER REAR DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-7)
(8W-61-8)
85
86
TRAILER TOW LEFT TURN RELAY
(8W-54-6)
(8W-54-7)
G73 20 LG/OR
2
CARGO LAMP
(8W-44-4)

DIESEL


RUN-ACC A31
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
BODY CONTROL MODULE
(8W-45-8)
CIRCUIT BREAKER NO. 1 20A
20
8 C2
28 C2
V6 16 DB
V55 16 TN/RD
TO WINDSHIELD WIPER MOTOR
(8W-53-5)
6 C107
5 C107
V6 16 DB
V55 16 TN/RD
V6 16 DB
V6 16DB
86
87
87A
WIPER ON/OFF RELAY (IN PDC)
(8W-53-5)
V55 16 TN/RD
85
30
V60 16 YL/DG
30
WIPER HIGH/ LOW RELAY (IN PDC)
(8W-53-5)
87
87A
V4 16 RD/YL
V3 16 BR/WT
6
5
2
WINDSHIELD WIPER MOTOR
(8W-53-5)


RUN-ACC A31
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
BODY CONTROL MODULE
(8W-45-8)
20
CIRCUIT BREAKER NO. 1
20A
8 C2
9 C2
33 C2
28 C2
V6
16
DB
V55
16
TN/RD
6 C107
6
5 C106
V6 16DB
86
87
87A
85
30
WIPER ON/OFF RELAY (IN PDC)
(8W-53-4)
5 C107
V60
16
YL/DG
30
WIPER HIGH/ LOW RELAY (IN PDC)
(8W-53-4)
87
87A
V4
16
RD/YL
V3
16
BR/WT
4
3 C106
4
3 C107
1
6
5
2
WINDSHIELD WIPER MOTOR
(8W-53-4)



J998W-19

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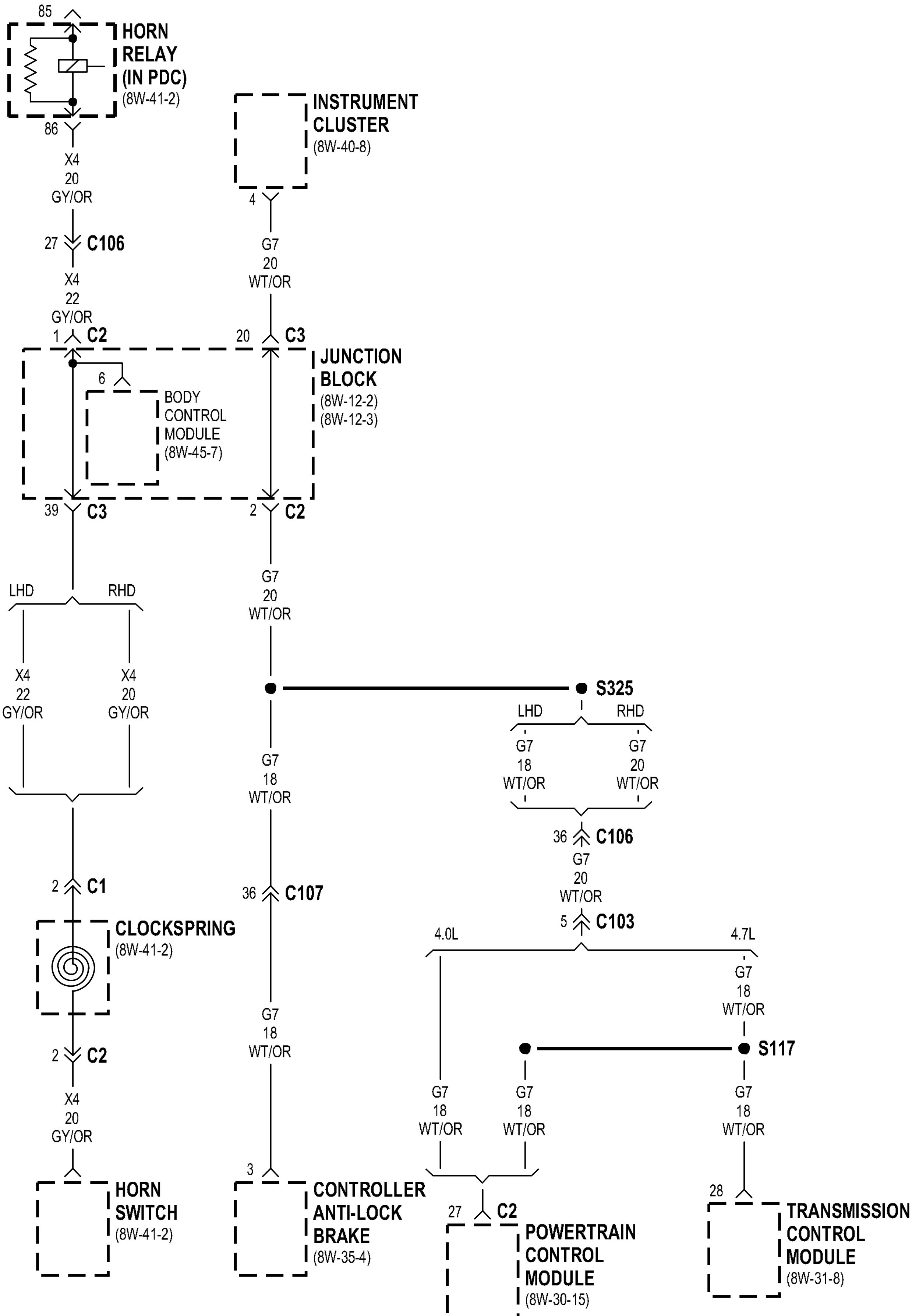
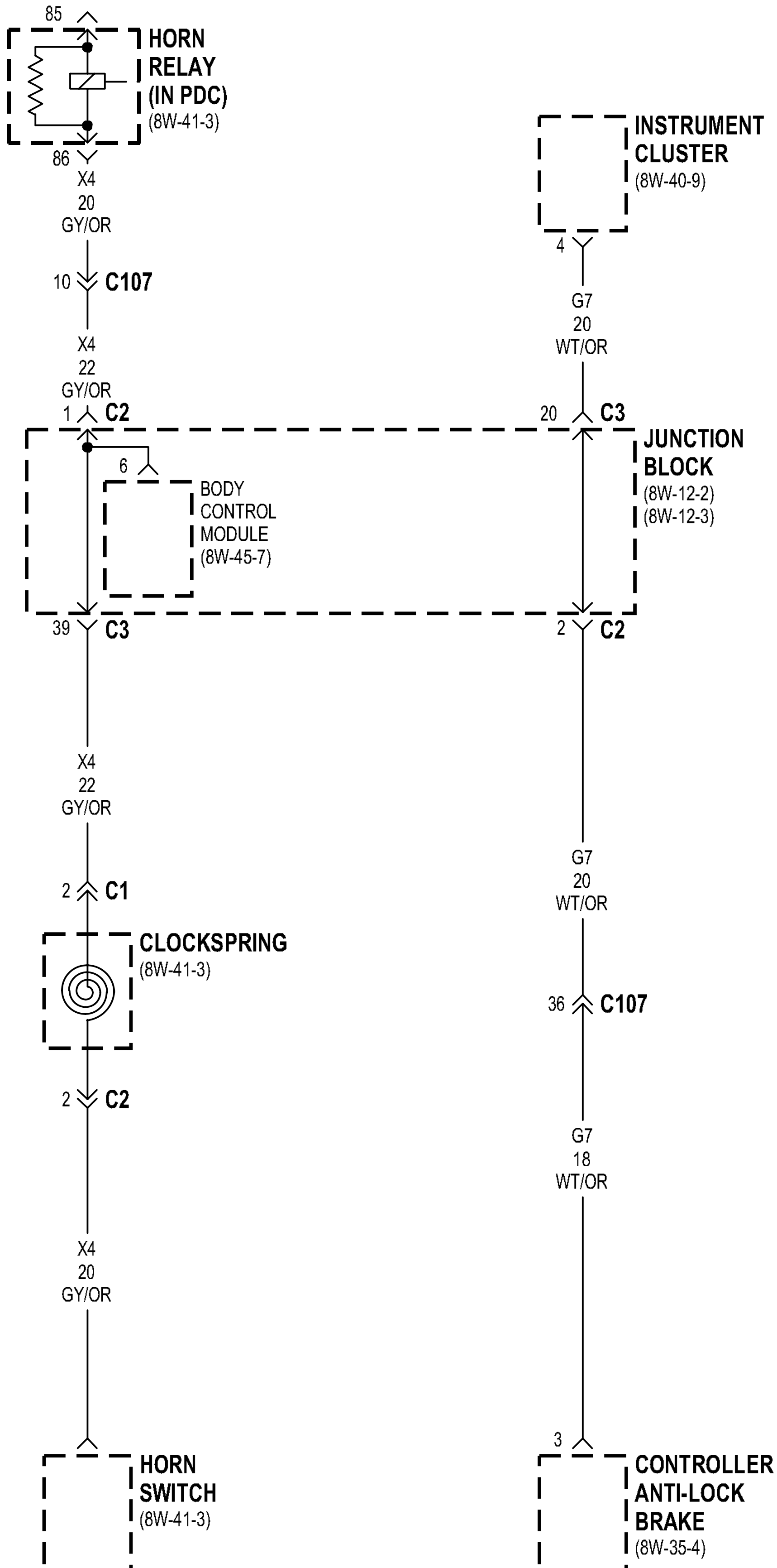
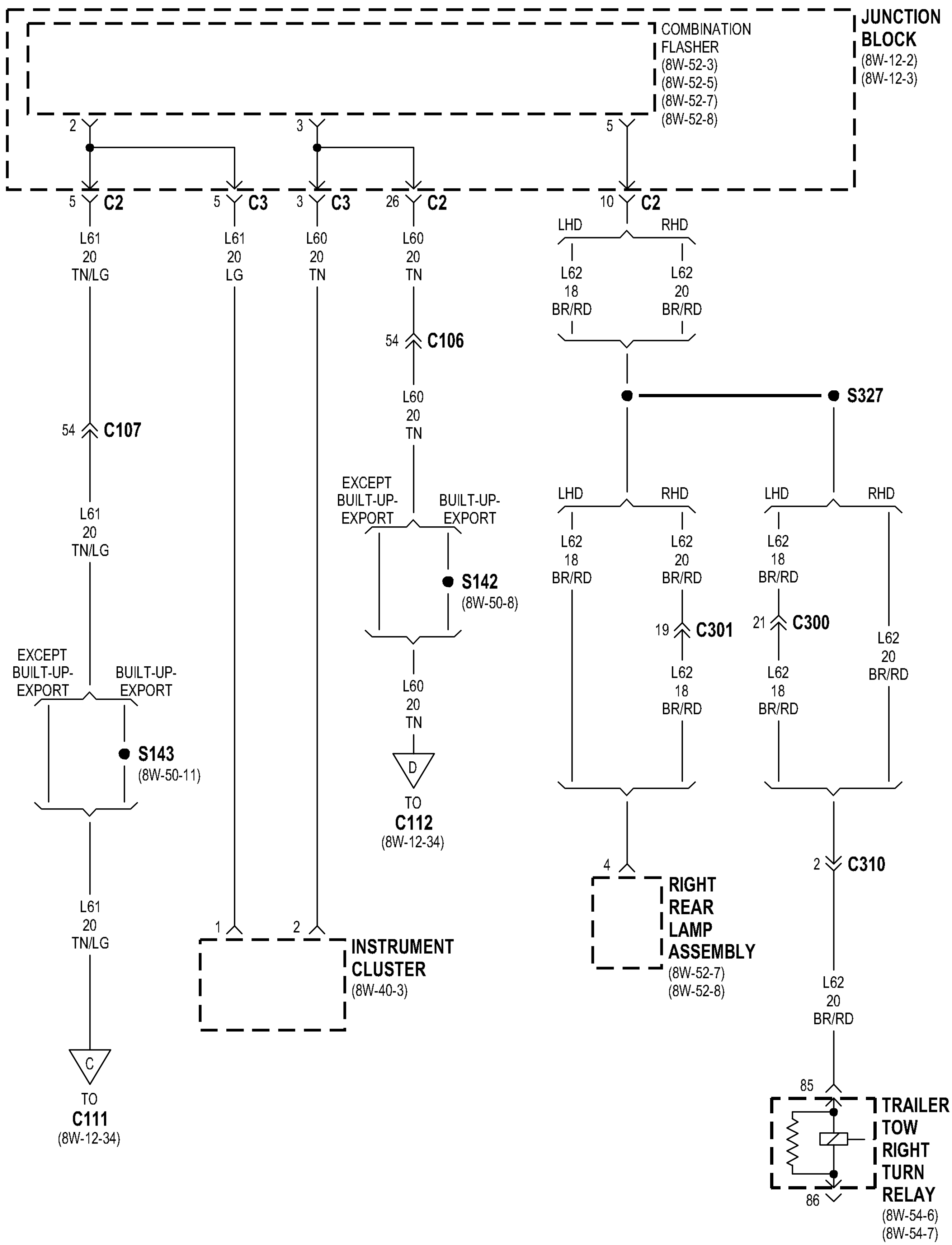
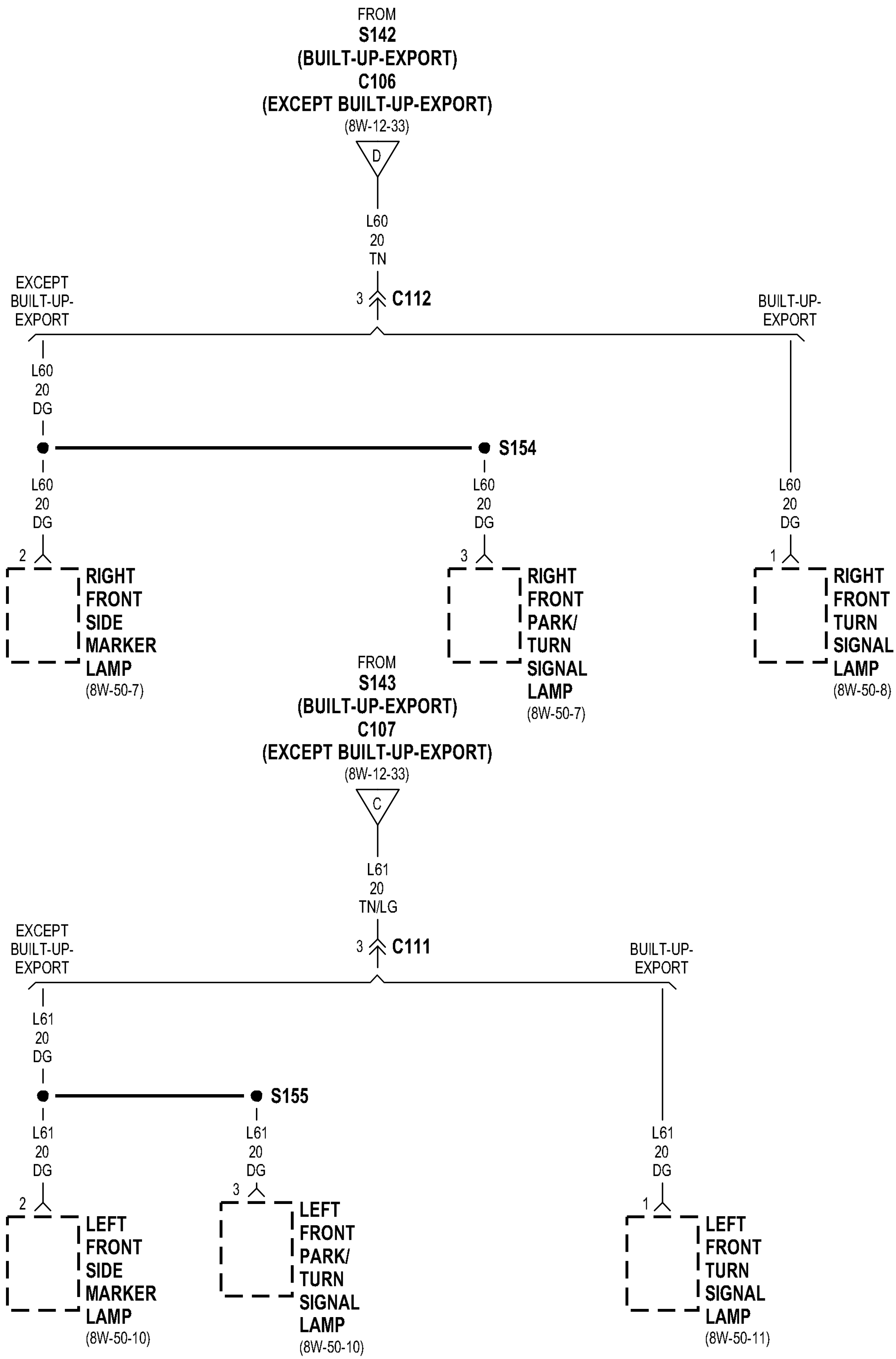
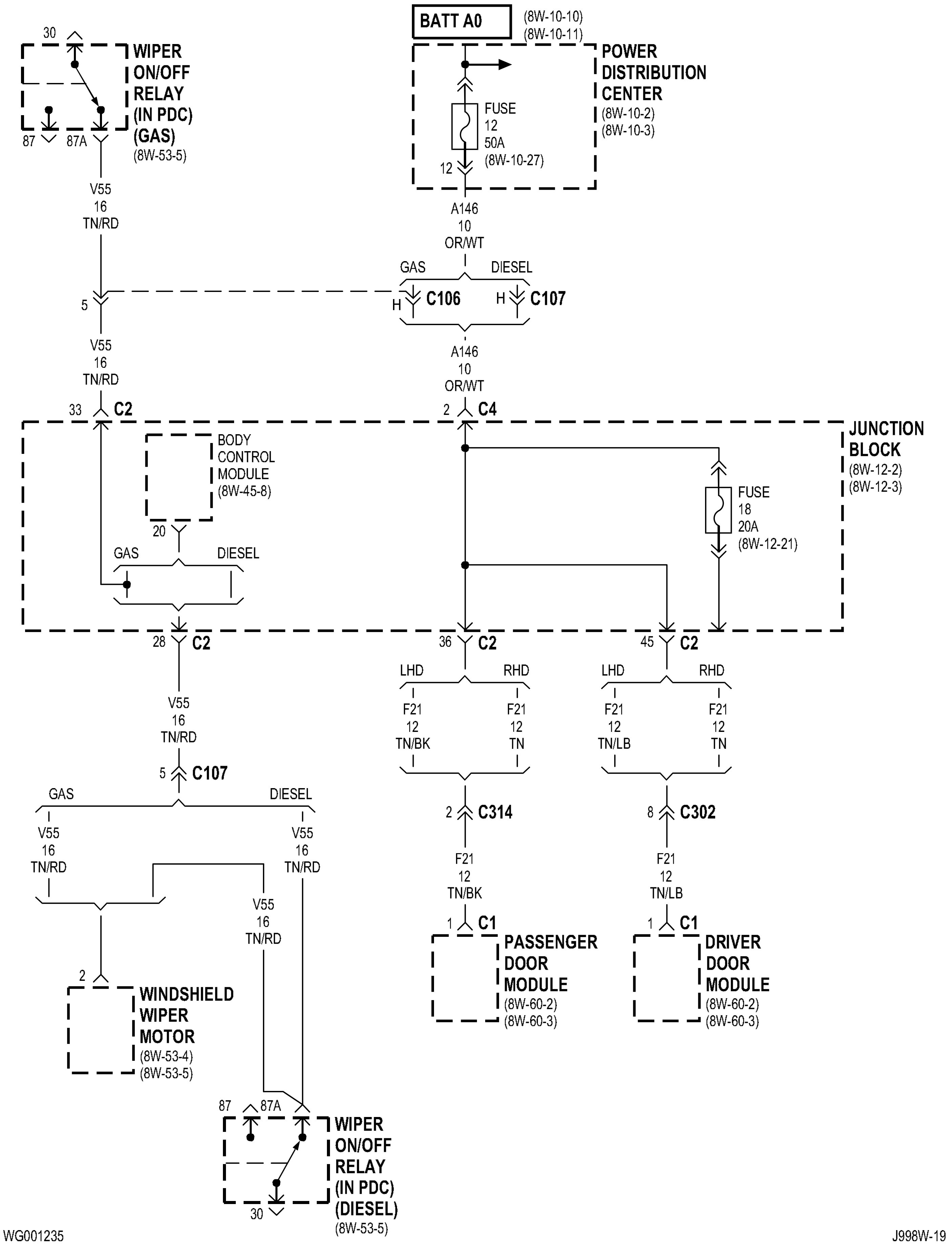

85
HORN
RELAY
(IN PDC)
(8W-41-2)
86
X4
20
GY/OR
27
C106
X4
22
GY/OR
1
C2
INSTRUMENT
CLUSTER
(8W-40-8)
4
G7
20
WT/OR
20
C3
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
6
BODY
CONTROL
MODULE
(8W-45-7)
39
C3
2
C2
G7
20
WT/OR
LHD
RHD
X4
22
GY/OR
X4
20
GY/OR
S325
LHD
RHD
G7
18
WT/OR
G7
20
WT/OR
G7
18
WT/OR
36
C106
G7
20
WT/OR
2
C1
36
C107
5
C103
4.0L
4.7L
CLOCKSPRING
(8W-41-2)
G7
18
WT/OR
G7
18
WT/OR
S117
2
C2
X4
20
GY/OR
G7
18
WT/OR
G7
18
WT/OR
G7
18
WT/OR
3
28
27
C2
HORN
SWITCH
(8W-41-2)
CONTROLLER
ANTI-LOCK
BRAKE
(8W-35-4)
POWERTRAIN
CONTROL
MODULE
(8W-30-15)
TRANSMISSION
CONTROL
MODULE
(8W-31-8)

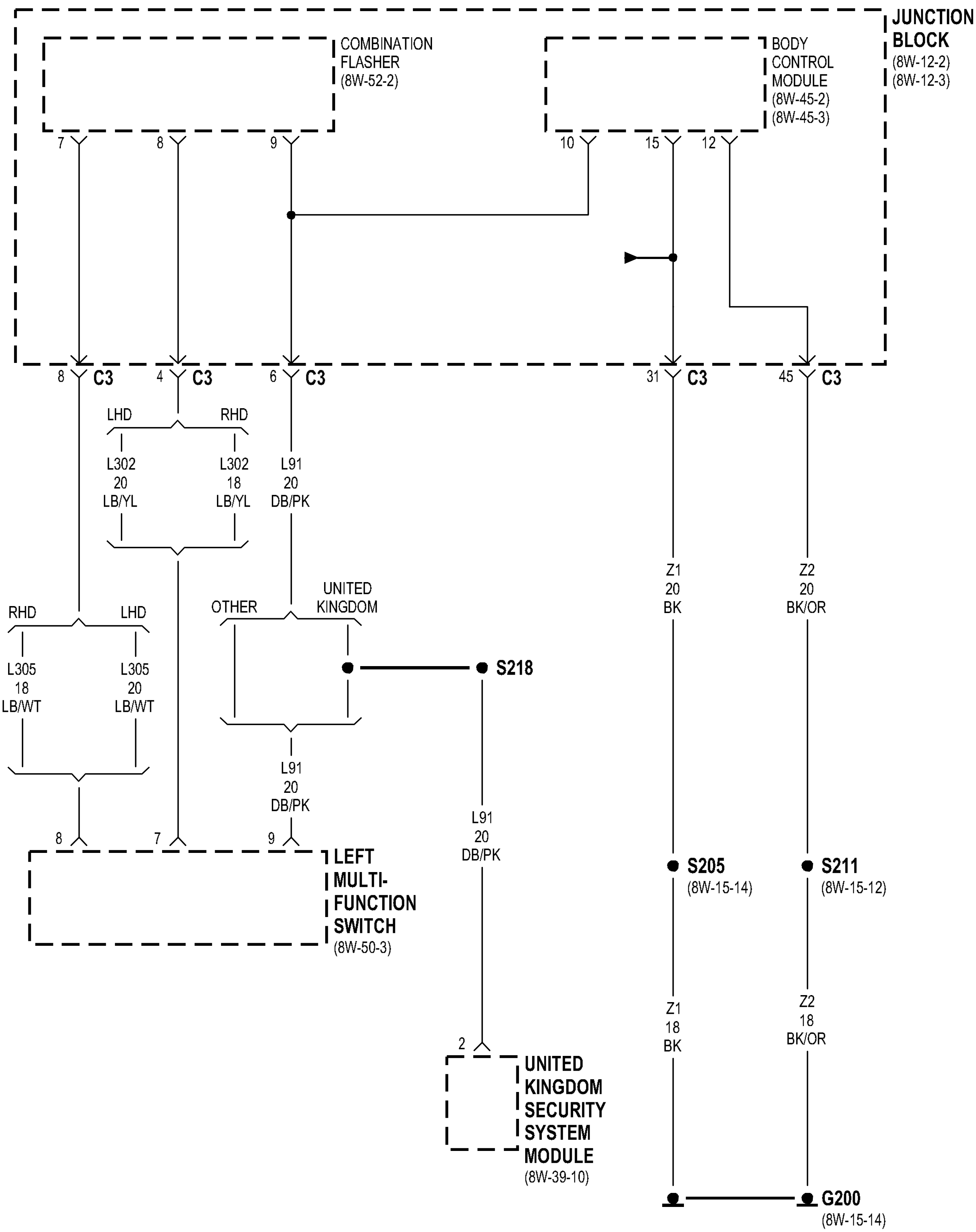

85
HORN
RELAY
(IN PDC)
(8W-41-3)
86
X4
20
GY/OR
10
C107
X4
22
GY/OR
1
C2
6
BODY
CONTROL
MODULE
(8W-45-7)
39
C3
X4
22
GY/OR
2
C1
CLOCKSPRING
(8W-41-3)
2
C2
X4
20
GY/OR
HORN
SWITCH
(8W-41-3)
INSTRUMENT
CLUSTER
(8W-40-9)
4
G7
20
WT/OR
20
C3
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
2
C2
G7
20
WT/OR
36
C107
G7
18
WT/OR
3
CONTROLLER
ANTI-LOCK
BRAKE
(8W-35-4)


JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
COMBINATION FLASHER
(8W-52-3)
(8W-52-5)
(8W-52-7)
(8W-52-8)
2
3
5
5 C2
5 C3
3 C3
26 C2
10 C2
L61 20 TN/LG
L61 20 LG
L60 20 TN
L60 20 TN
LHD
RHD
L62 18 BR/RD
L62 20 BR/RD
54 C106
L60 20 TN
S327
54 C107
L61 20 TN/LG
EXCEPT BUILT-UP-EXPORT
BUILT-UP-EXPORT
S142
(8W-50-8)
L60 20 TN
D
TO
C112
(8W-12-34)
LHD
RHD
L62 18 BR/RD
L62 20 BR/RD
19 C301
L62 18 BR/RD
LHD
RHD
L62 18 BR/RD
21 C300
L62 18 BR/RD
L62 20 BR/RD
EXCEPT BUILT-UP-EXPORT
BUILT-UP-EXPORT
S143
(8W-50-11)
L61 20 TN/LG
C
TO
C111
(8W-12-34)
1
2
INSTRUMENT CLUSTER
(8W-40-3)
4
RIGHT REAR LAMP ASSEMBLY
(8W-52-7)
(8W-52-8)
2 C310
L62 20 BR/RD
85
86
TRAILER TOW RIGHT TURN RELAY
(8W-54-6)
(8W-54-7)

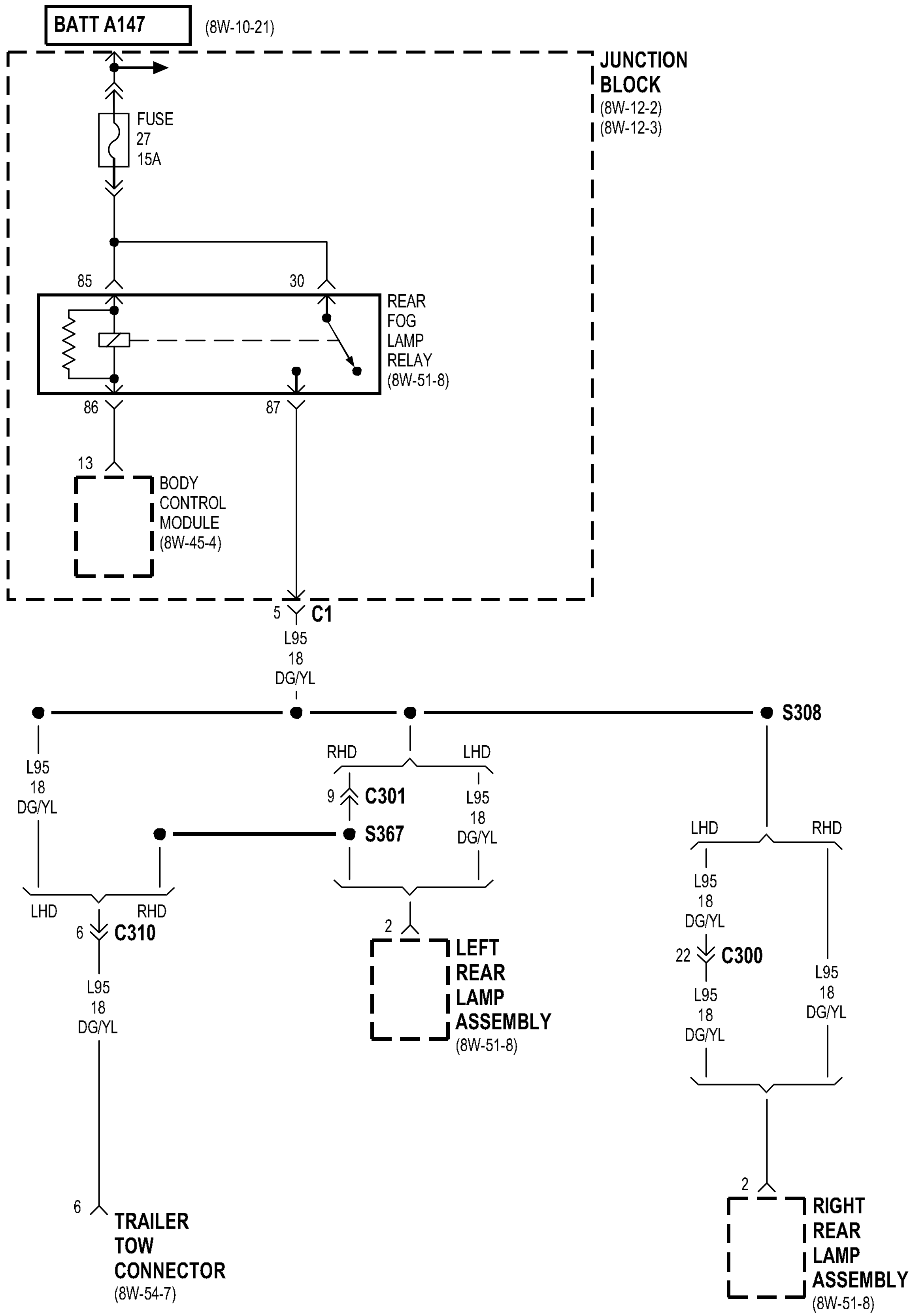

FROM
S142
(BUILT-UP-EXPORT)
C106
(EXCEPT BUILT-UP-EXPORT)
(8W-12-33)
D
L60
20
TN
3
C112
EXCEPT
BUILT-UP-
EXPORT
BUILT-UP-
EXPORT
L60
20
DG
S154
L60
20
DG
L60
20
DG
L60
20
DG
2
RIGHT
FRONT
SIDE
MARKER
LAMP
(8W-50-7)
3
RIGHT
FRONT
PARK/
TURN
SIGNAL
LAMP
(8W-50-7)
1
RIGHT
FRONT
TURN
SIGNAL
LAMP
(8W-50-8)
FROM
S143
(BUILT-UP-EXPORT)
C107
(EXCEPT BUILT-UP-EXPORT)
(8W-12-33)
C
L61
20
TN/LG
3
C111
EXCEPT
BUILT-UP-
EXPORT
BUILT-UP-
EXPORT
L61
20
DG
S155
L61
20
DG
L61
20
DG
L61
20
DG
2
LEFT
FRONT
SIDE
MARKER
LAMP
(8W-50-10)
3
LEFT
FRONT
PARK/
TURN
SIGNAL
LAMP
(8W-50-10)
1
LEFT
FRONT
TURN
SIGNAL
LAMP
(8W-50-11)



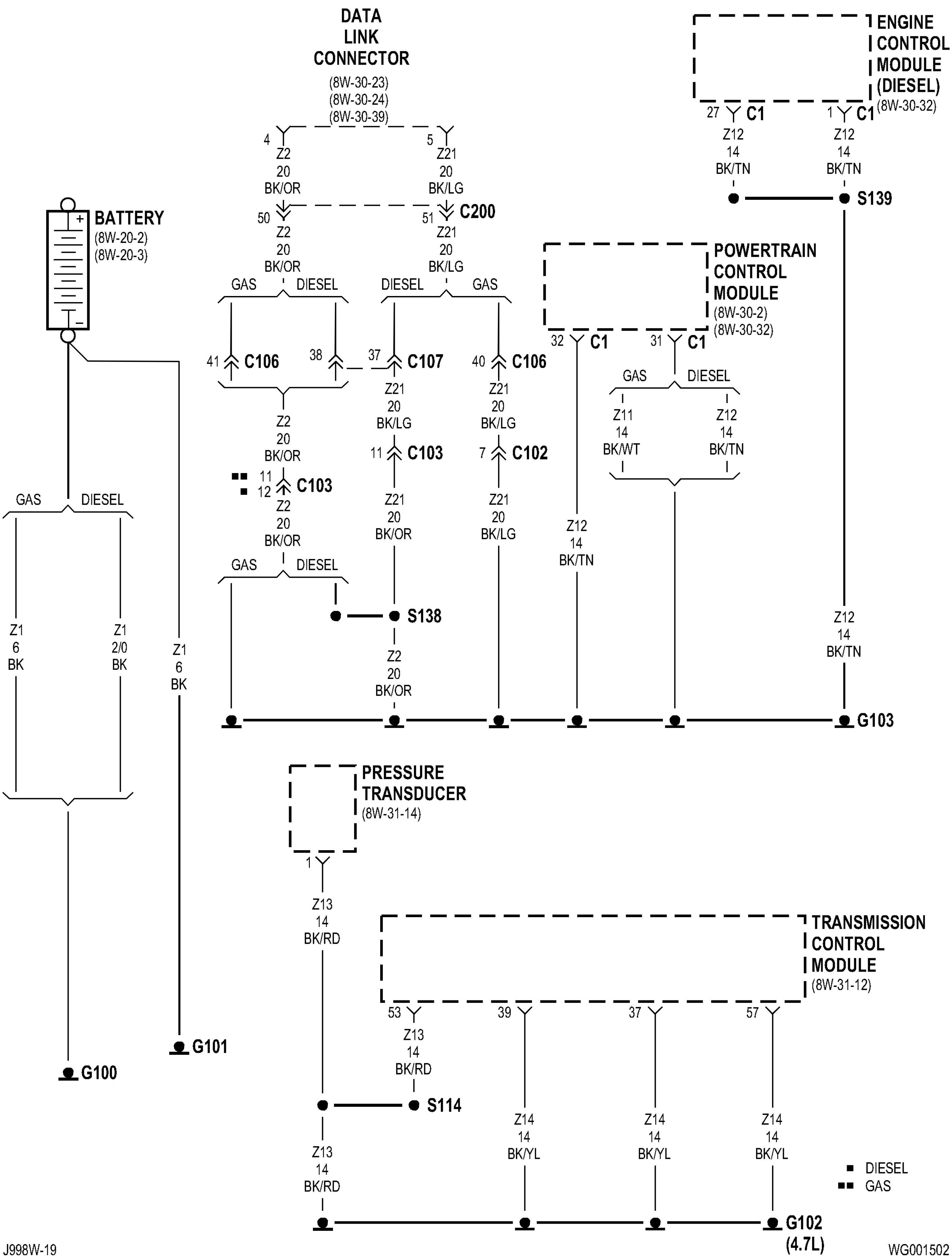
BATT A0
(8W-10-10)
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
(8W-10-3)
FUSE 12 50A (8W-10-27)
12
WIPER ON/OFF RELAY (IN PDC) (GAS)
(8W-53-5)
30
87
87A
V55 16 TN/RD
A146 10 OR/WT
GAS
DIESEL
5
H C106
H C107
33 C2
2 C4
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
BODY CONTROL MODULE
(8W-45-8)
20
FUSE 18 20A (8W-12-21)
28 C2
36 C2
45 C2
LHD
RHD
F21 12 TN/BK
F21 12 TN
F21 12 TN/LB
5 C107
2 C314
8 C302
1 C1
PASSENGER DOOR MODULE
(8W-60-2)
(8W-60-3)
DRIVER DOOR MODULE
(8W-60-2)
(8W-60-3)
2
WINDSHIELD WIPER MOTOR
(8W-53-4)
(8W-53-5)
WIPER ON/OFF RELAY (IN PDC) (DIESEL)
(8W-53-5)

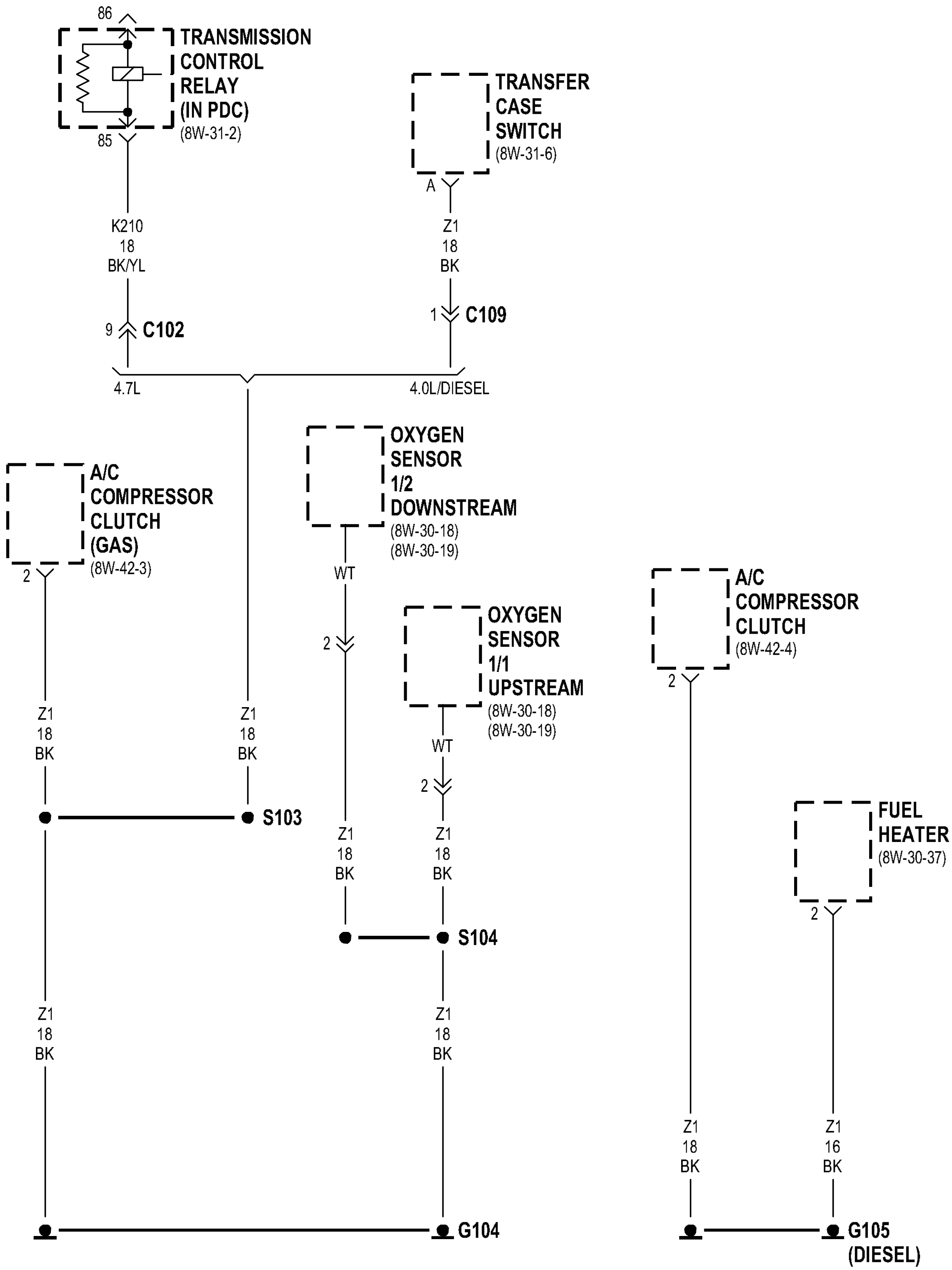


JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
COMBINATION FLASHER
(8W-52-2)
BODY CONTROL MODULE
(8W-45-2)
(8W-45-3)
7
8
9
10
15
12
8 C3
4 C3
6 C3
31 C3
45 C3
LHD
RHD
L302
20
LB/YL
L302
18
LB/YL
L91
20
DB/PK
Z1
20
BK
Z2
20
BK/OR
RHD
LHD
L305
18
LB/WT
L305
20
LB/WT
OTHER
UNITED KINGDOM
S218
L91
20
DB/PK
L91
20
DB/PK
8
7
9
LEFT MULTI-FUNCTION SWITCH
(8W-50-3)
S205
(8W-15-14)
S211
(8W-15-12)
Z1
18
BK
Z2
18
BK/OR
2
UNITED KINGDOM SECURITY SYSTEM MODULE
(8W-39-10)
G200
(8W-15-14)


BATT A147
(8W-10-21)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 27 15A
85
30
REAR FOG LAMP RELAY
(8W-51-8)
86
87
13
BODY CONTROL MODULE
(8W-45-4)
5 C1
L95 18 DG/YL
S308
RHD
LHD
9 C301
S367
L95 18 DG/YL
LHD
RHD
6 C310
L95 18 DG/YL
2
LEFT REAR LAMP ASSEMBLY
(8W-51-8)
22 C300
6
TRAILER TOW CONNECTOR
(8W-54-7)
2
RIGHT REAR LAMP ASSEMBLY
(8W-51-8)

8W-15 GROUND DISTRIBUTION


DATA LINK CONNECTOR
(8W-30-23)
(8W-30-24)
(8W-30-39)
ENGINE CONTROL MODULE (DIESEL)
(8W-30-32)
BATTERY
(8W-20-2)
(8W-20-3)
C200
S139
POWERTRAIN CONTROL MODULE
(8W-30-2)
(8W-30-32)
C1
C106
C107
C103
C102
GAS
DIESEL
Z1 6 BK
Z1 2/0 BK
Z2 20 BK/OR
Z21 20 BK/LG
Z21 20 BK/OR
Z11 14 BK/WT
Z12 14 BK/TN
S138
G103
PRESSURE TRANSDUCER
(8W-31-14)
TRANSMISSION CONTROL MODULE
(8W-31-12)
Z13 14 BK/RD
Z14 14 BK/YL
S114
G100
G101
G102 (4.7L)
■ DIESEL
■■ GAS



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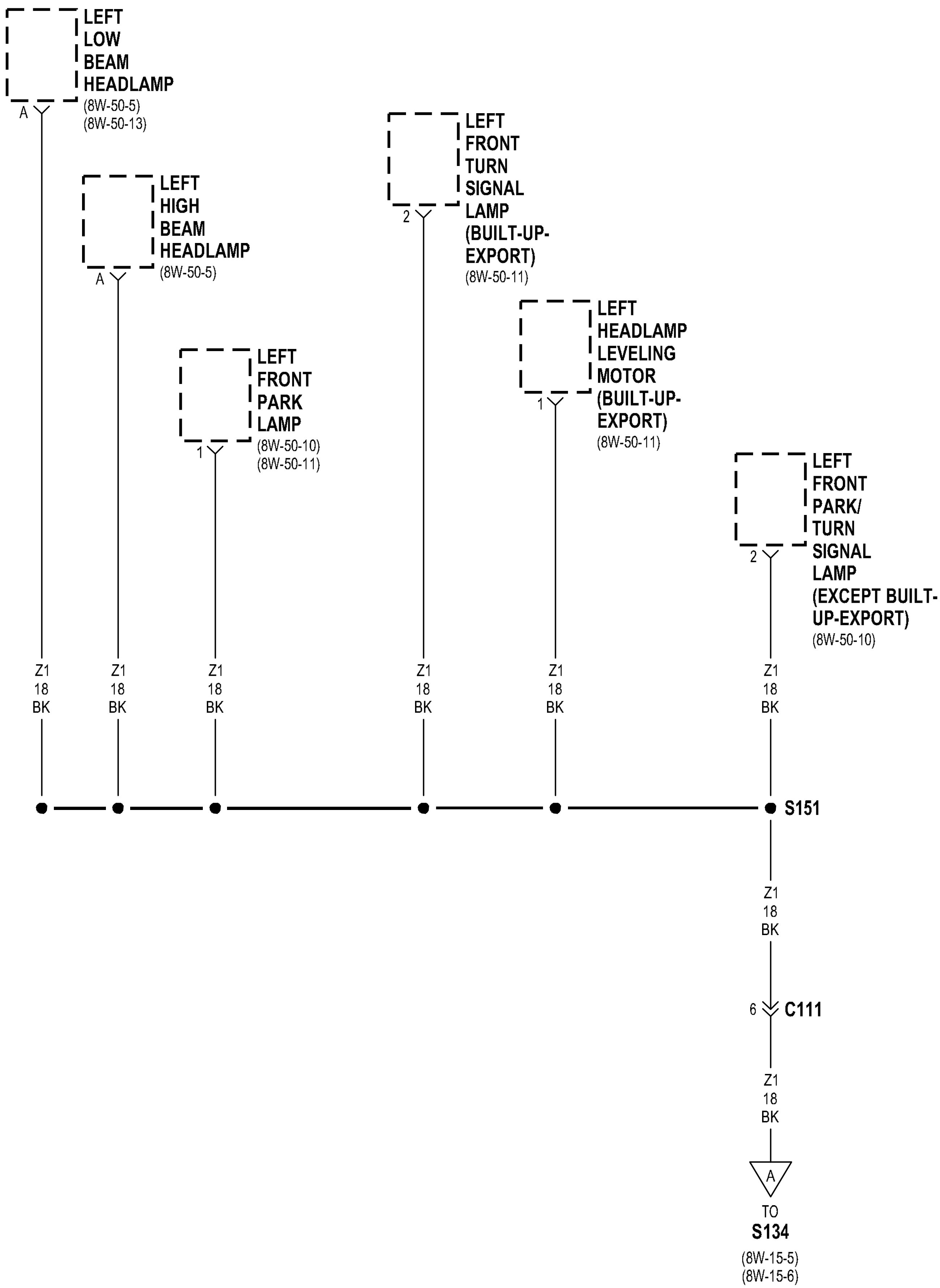
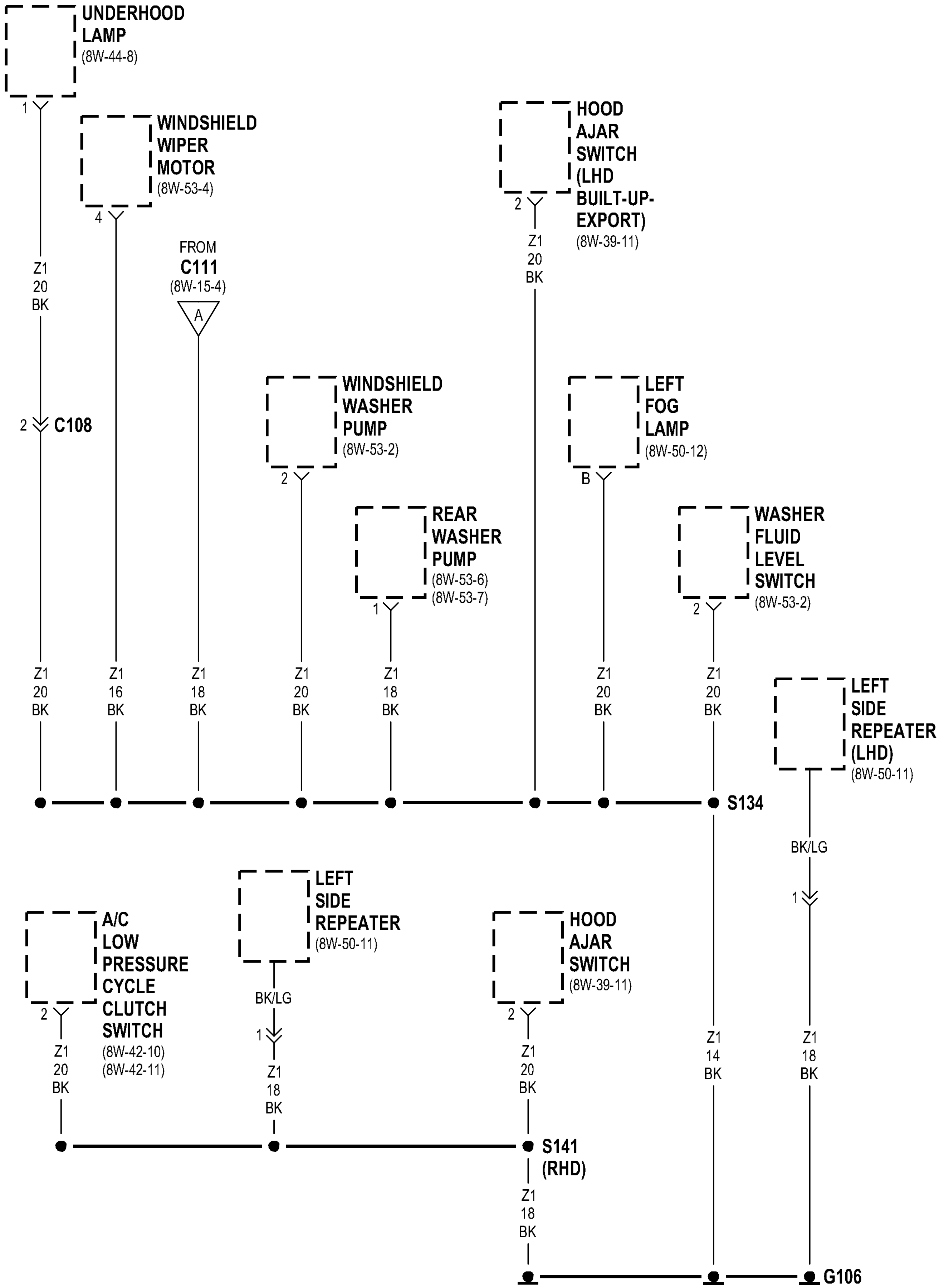
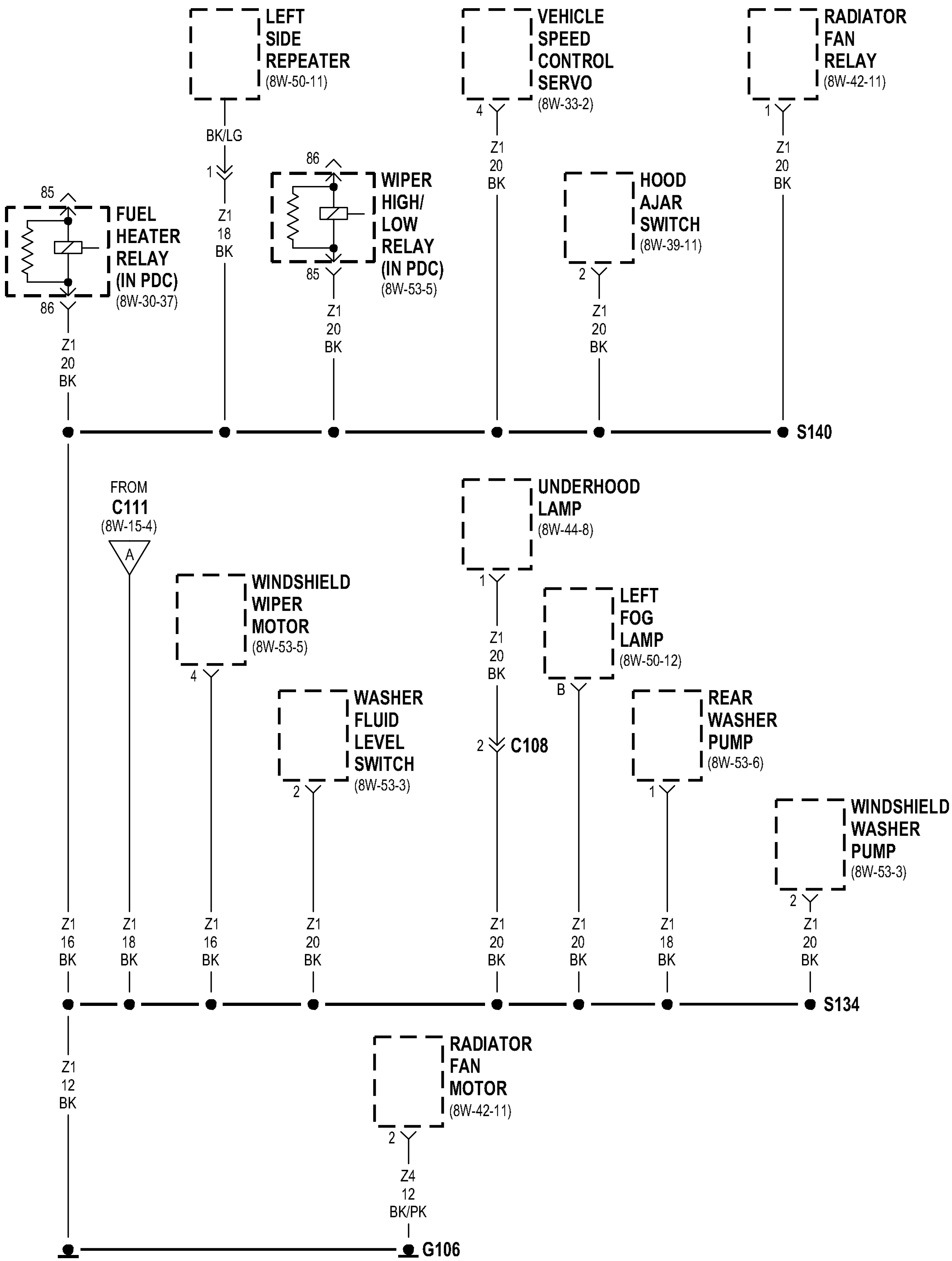
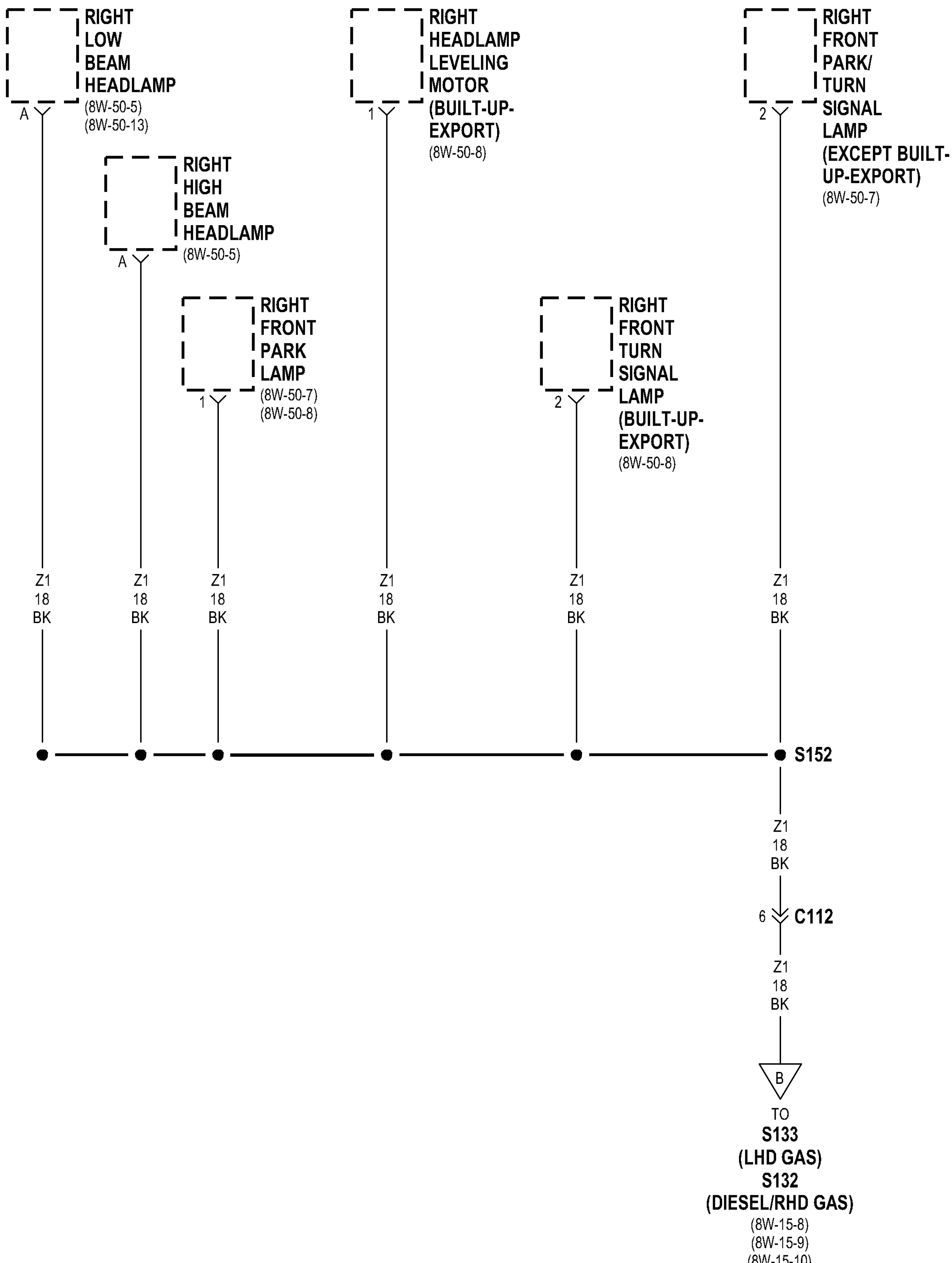
J998W-19

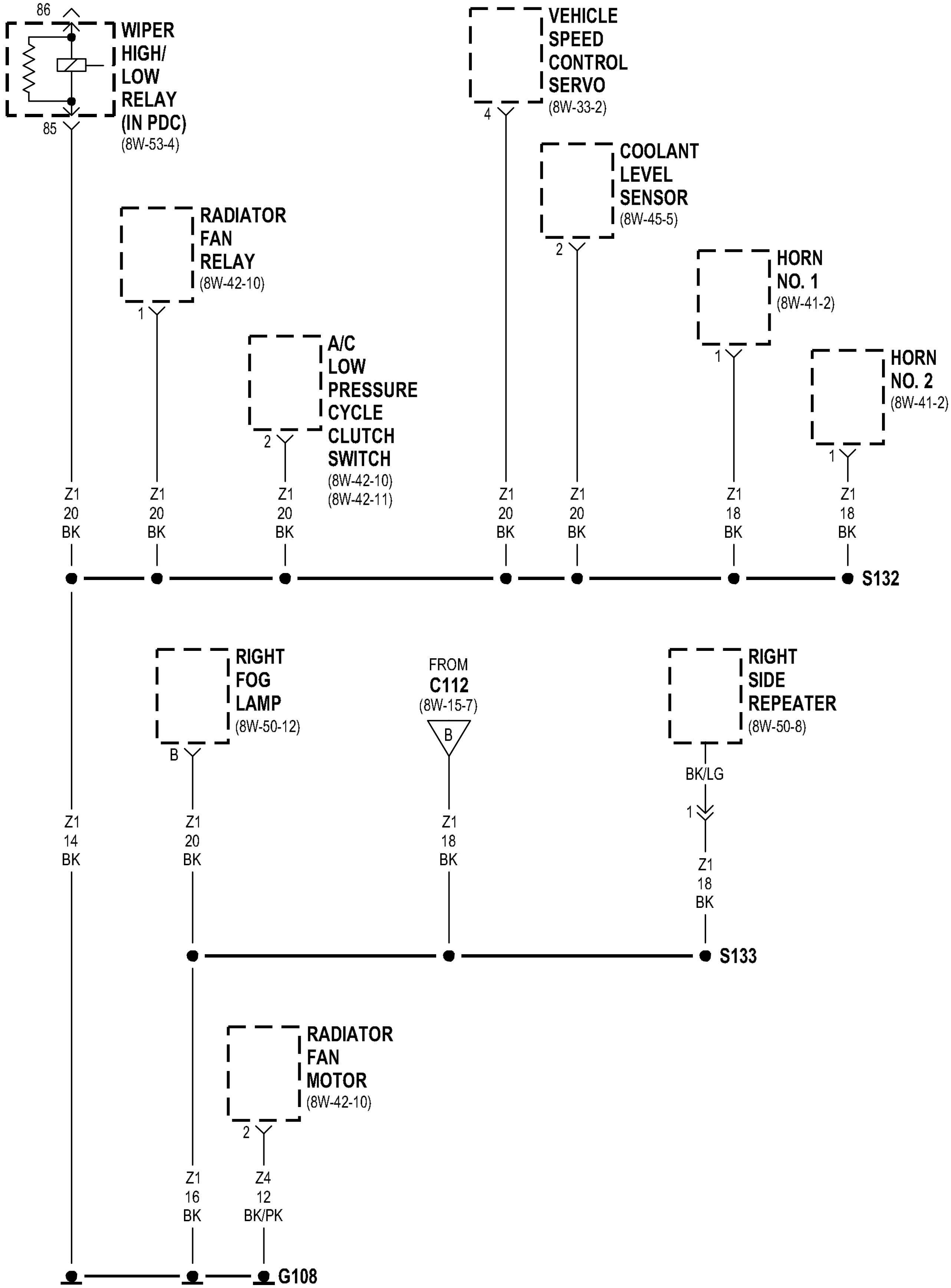

LEFT
LOW
BEAM
HEADLAMP
(8W-50-5)
(8W-50-13)
A
LEFT
HIGH
BEAM
HEADLAMP
(8W-50-5)
A
LEFT
FRONT
PARK
LAMP
(8W-50-10)
(8W-50-11)
1
LEFT
FRONT
TURN
SIGNAL
LAMP
(BUILT-UP-
EXPORT)
(8W-50-11)
2
LEFT
HEADLAMP
LEVELING
MOTOR
(BUILT-UP-
EXPORT)
(8W-50-11)
1
LEFT
FRONT
PARK/
TURN
SIGNAL
LAMP
(EXCEPT BUILT-
UP-EXPORT)
(8W-50-10)
2
Z1
18
BK
S151
6
C111
A
TO
S134
(8W-15-5)
(8W-15-6)

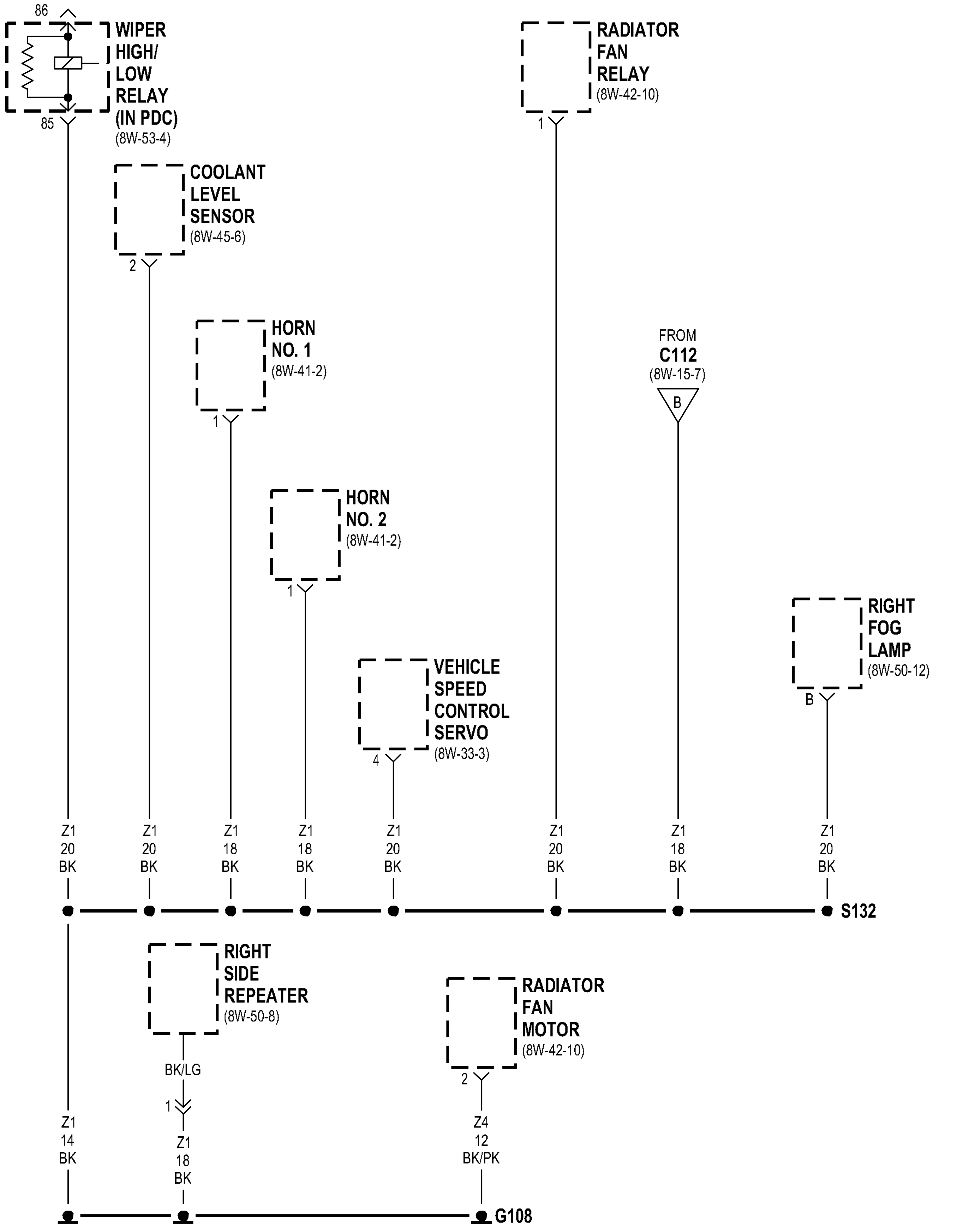

UNDERHOOD LAMP (8W-44-8)
WINDSHIELD WIPER MOTOR (8W-53-4)
FROM C111 (8W-15-4)
A
HOOD AJAR SWITCH (LHD BUILT-UP-EXPORT) (8W-39-11)
WINDSHIELD WASHER PUMP (8W-53-2)
LEFT FOG LAMP (8W-50-12)
REAR WASHER PUMP (8W-53-6) (8W-53-7)
WASHER FLUID LEVEL SWITCH (8W-53-2)
LEFT SIDE REPEATER (LHD) (8W-50-11)
C108
Z1 20 BK
Z1 16 BK
Z1 18 BK
Z1 14 BK
BK/LG
S134
A/C LOW PRESSURE CYCLE CLUTCH SWITCH (8W-42-10) (8W-42-11)
LEFT SIDE REPEATER (8W-50-11)
HOOD AJAR SWITCH (8W-39-11)
S141 (RHD)
G106

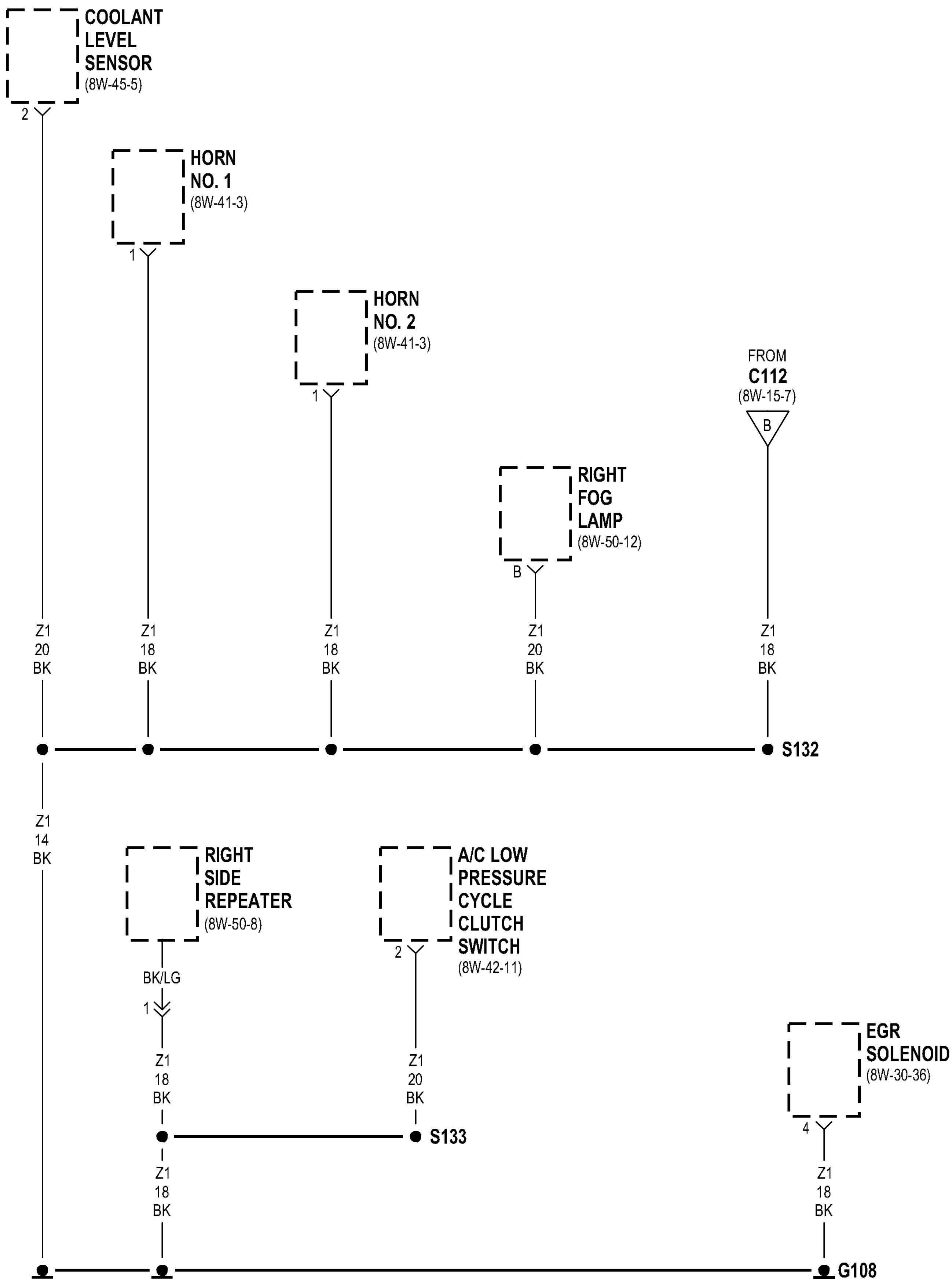
DIESEL

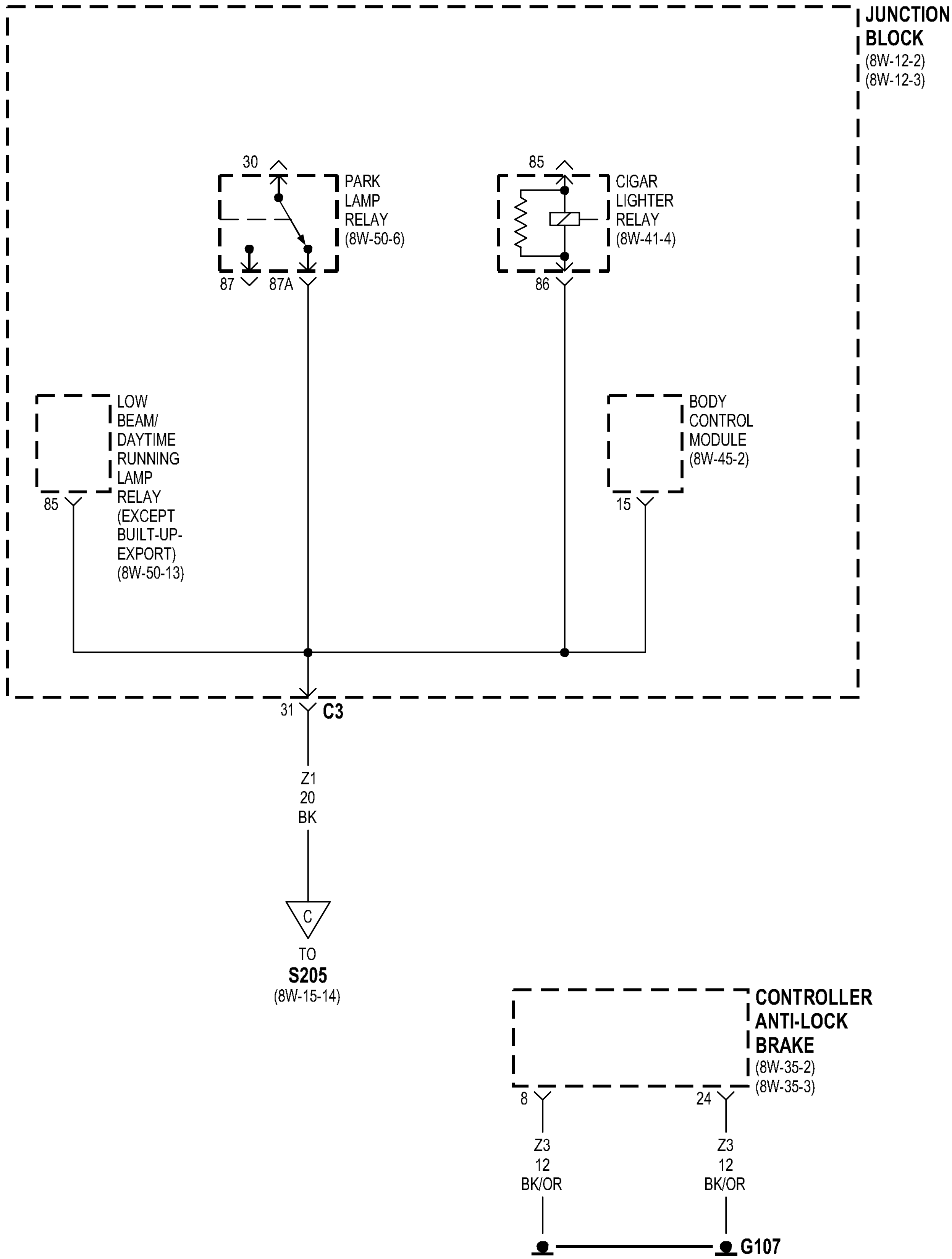

LEFT SIDE REPEATER
(8W-50-11)
BK/LG
1
Z1
18
BK
VEHICLE SPEED CONTROL SERVO
(8W-33-2)
4
Z1
20
BK
RADIATOR FAN RELAY
(8W-42-11)
1
Z1
20
BK
85
FUEL HEATER RELAY (IN PDC)
(8W-30-37)
86
Z1
20
BK
86
WIPER HIGH/ LOW RELAY (IN PDC)
(8W-53-5)
85
Z1
20
BK
HOOD AJAR SWITCH
(8W-39-11)
2
Z1
20
BK
S140
FROM
C111
(8W-15-4)
A
UNDERHOOD LAMP
(8W-44-8)
1
Z1
20
BK
2
C108
WINDSHIELD WIPER MOTOR
(8W-53-5)
4
LEFT FOG LAMP
(8W-50-12)
B
WASHER FLUID LEVEL SWITCH
(8W-53-3)
2
REAR WASHER PUMP
(8W-53-6)
1
WINDSHIELD WASHER PUMP
(8W-53-3)
2
Z1
16
BK
Z1
18
BK
Z1
16
BK
Z1
20
BK
Z1
20
BK
Z1
20
BK
Z1
18
BK
Z1
20
BK
S134
Z1
12
BK
RADIATOR FAN MOTOR
(8W-42-11)
2
Z4
12
BK/PK
G106

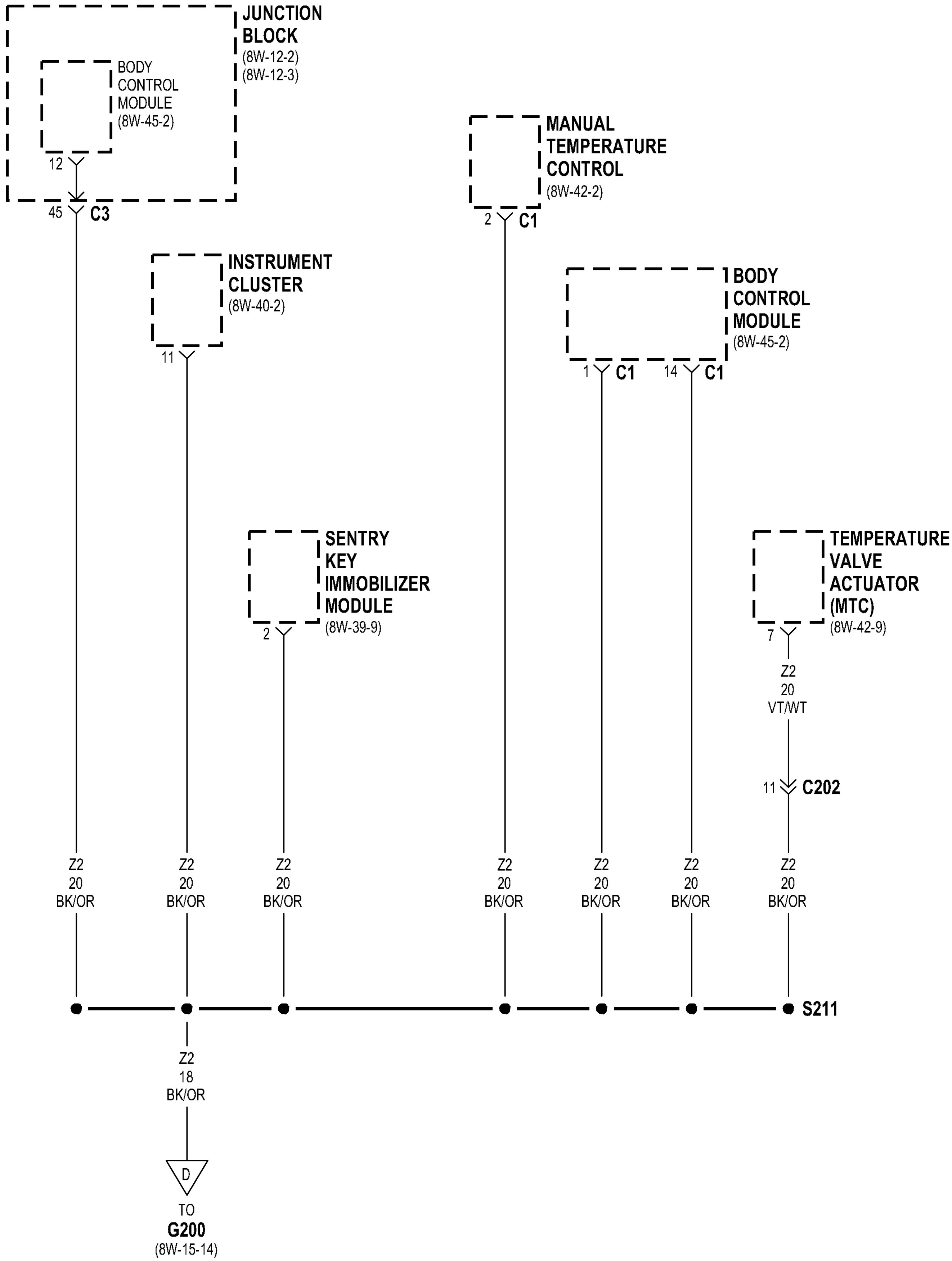

RIGHT LOW BEAM HEADLAMP
(8W-50-5)
(8W-50-13)
A
RIGHT HIGH BEAM HEADLAMP
(8W-50-5)
A
RIGHT FRONT PARK LAMP
(8W-50-7)
(8W-50-8)
1
RIGHT HEADLAMP LEVELING MOTOR (BUILT-UP-EXPORT)
(8W-50-8)
1
RIGHT FRONT TURN SIGNAL LAMP (BUILT-UP-EXPORT)
(8W-50-8)
2
RIGHT FRONT PARK/ TURN SIGNAL LAMP (EXCEPT BUILT-UP-EXPORT)
(8W-50-7)
2
Z1 18 BK
S152
6
C112
B
TO
S133
(LHD GAS)
S132
(DIESEL/RHD GAS)
(8W-15-8)
(8W-15-9)
(8W-15-10)

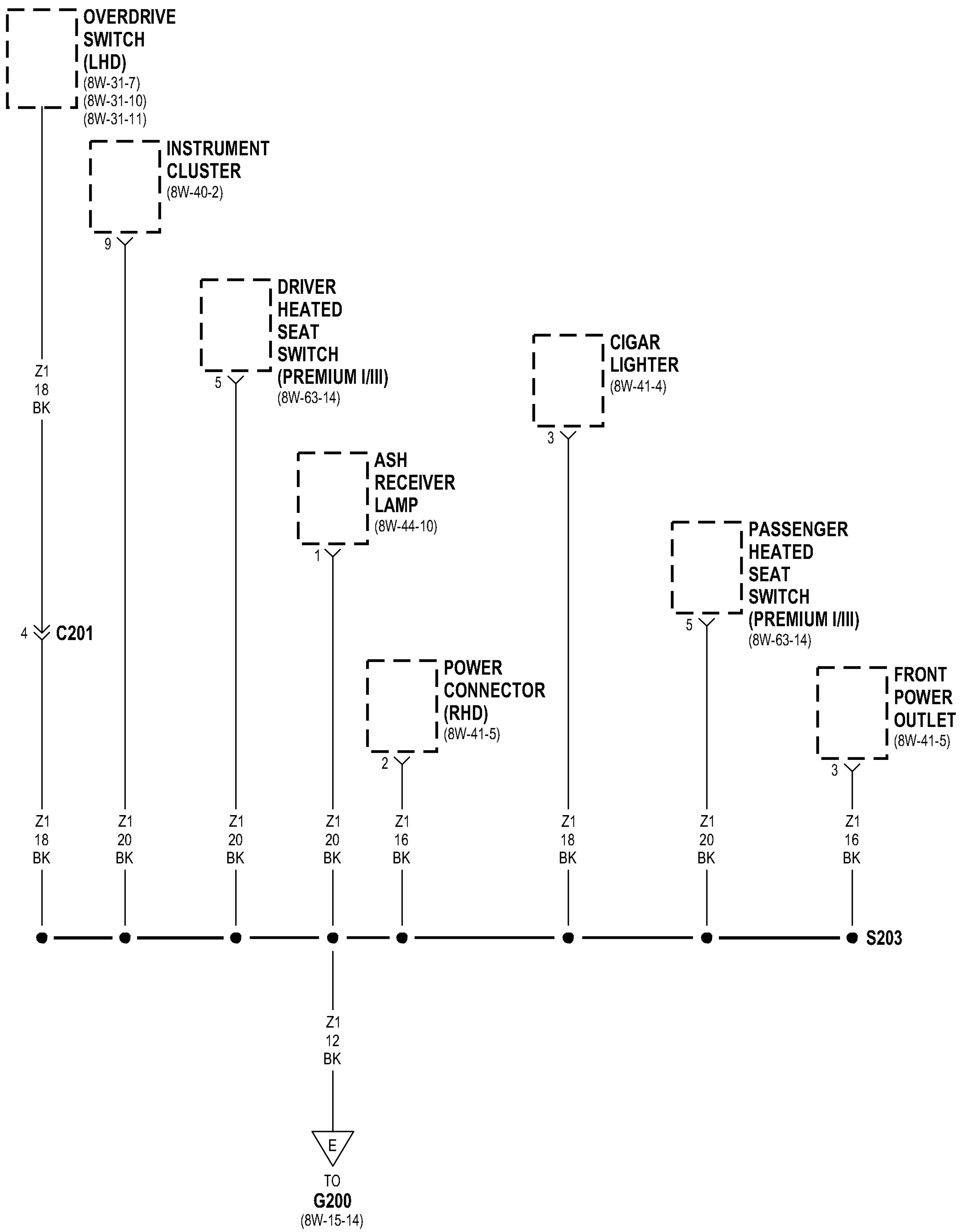

86
85
WIPER HIGH/ LOW RELAY (IN PDC)
(8W-53-4)
RADIATOR FAN RELAY
(8W-42-10)
1
A/C LOW PRESSURE CYCLE CLUTCH SWITCH
(8W-42-10)
(8W-42-11)
2
VEHICLE SPEED CONTROL SERVO
(8W-33-2)
4
COOLANT LEVEL SENSOR
(8W-45-5)
2
HORN NO. 1
(8W-41-2)
1
HORN NO. 2
(8W-41-2)
1
Z1 20 BK
Z1 20 BK
Z1 20 BK
Z1 20 BK
Z1 20 BK
Z1 18 BK
Z1 18 BK
S132
RIGHT FOG LAMP
(8W-50-12)
B
FROM C112
(8W-15-7)
B
RIGHT SIDE REPEATER
(8W-50-8)
BK/LG
1
Z1 14 BK
Z1 20 BK
Z1 18 BK
Z1 18 BK
S133
RADIATOR FAN MOTOR
(8W-42-10)
2
Z1 16 BK
Z4 12 BK/PK
G108

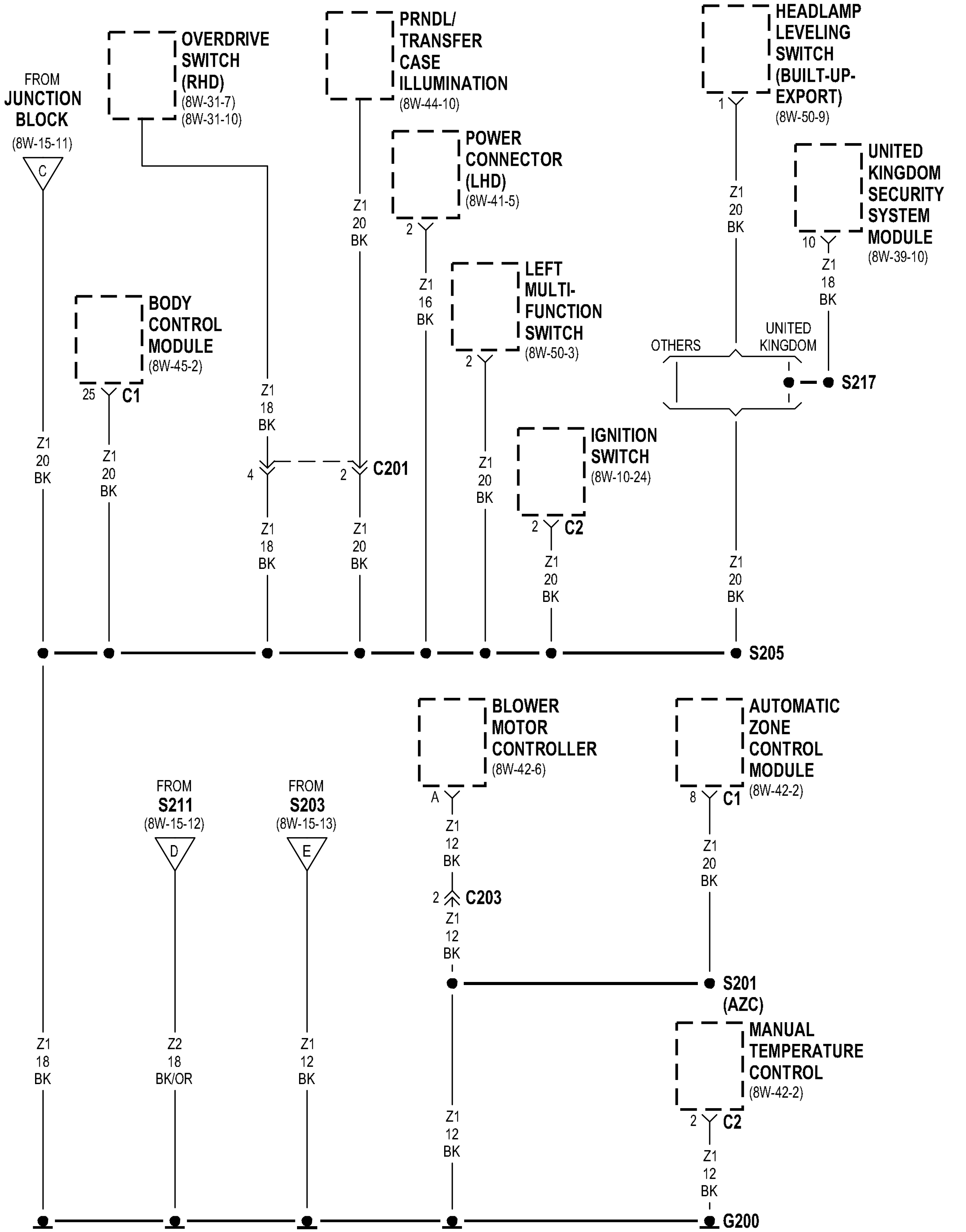

86
WIPER HIGH/ LOW RELAY (IN PDC)
(8W-53-4)
85
COOLANT LEVEL SENSOR
(8W-45-6)
2
HORN NO. 1
(8W-41-2)
1
HORN NO. 2
(8W-41-2)
1
VEHICLE SPEED CONTROL SERVO
(8W-33-3)
4
RADIATOR FAN RELAY
(8W-42-10)
1
FROM
C112
(8W-15-7)
B
RIGHT FOG LAMP
(8W-50-12)
B
Z1 20 BK
Z1 20 BK
Z1 18 BK
Z1 18 BK
Z1 20 BK
Z1 20 BK
Z1 18 BK
Z1 20 BK
S132
RIGHT SIDE REPEATER
(8W-50-8)
BK/LG
1
RADIATOR FAN MOTOR
(8W-42-10)
2
Z1 14 BK
Z1 18 BK
Z4 12 BK/PK
G108


COOLANT LEVEL SENSOR
(8W-45-5)
2
HORN NO. 1
(8W-41-3)
1
HORN NO. 2
(8W-41-3)
1
FROM
C112
(8W-15-7)
B
RIGHT FOG LAMP
(8W-50-12)
B
Z1 20 BK
Z1 18 BK
Z1 18 BK
Z1 20 BK
Z1 18 BK
S132
Z1 14 BK
RIGHT SIDE REPEATER
(8W-50-8)
BK/LG
1
A/C LOW PRESSURE CYCLE CLUTCH SWITCH
(8W-42-11)
2
EGR SOLENOID
(8W-30-36)
4
Z1 18 BK
Z1 20 BK
S133
Z1 18 BK
Z1 18 BK
G108

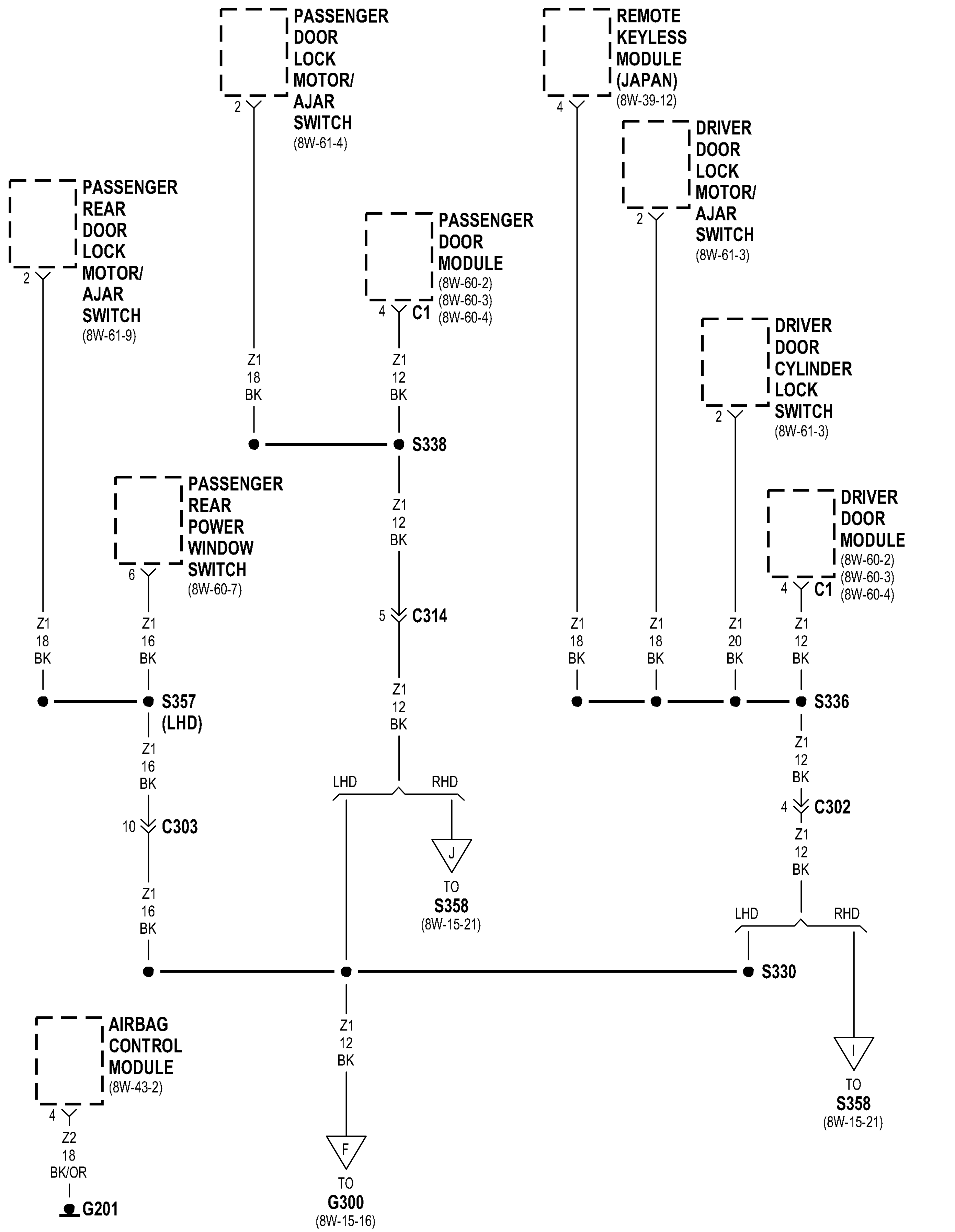

JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
30
PARK LAMP RELAY
(8W-50-6)
87
87A
85
CIGAR LIGHTER RELAY
(8W-41-4)
86
LOW BEAM/ DAYTIME RUNNING LAMP RELAY (EXCEPT BUILT-UP-EXPORT)
(8W-50-13)
85
BODY CONTROL MODULE
(8W-45-2)
15
31
C3
Z1
20
BK
C
TO
S205
(8W-15-14)
CONTROLLER ANTI-LOCK BRAKE
(8W-35-2)
(8W-35-3)
8
24
Z3
12
BK/OR
Z3
12
BK/OR
G107


JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
BODY CONTROL MODULE
(8W-45-2)
12
45 C3
INSTRUMENT CLUSTER
(8W-40-2)
11
SENTRY KEY IMMOBILIZER MODULE
(8W-39-9)
2
MANUAL TEMPERATURE CONTROL
(8W-42-2)
2 C1
BODY CONTROL MODULE
(8W-45-2)
1 C1
14 C1
TEMPERATURE VALVE ACTUATOR (MTC)
(8W-42-9)
7
Z2 20 VT/WT
11 C202
Z2 20 BK/OR
Z2 20 BK/OR
Z2 20 BK/OR
Z2 20 BK/OR
Z2 20 BK/OR
Z2 20 BK/OR
Z2 20 BK/OR
S211
Z2 18 BK/OR
D
TO
G200
(8W-15-14)


OVERDRIVE
SWITCH
(LHD)
(8W-31-7)
(8W-31-10)
(8W-31-11)
INSTRUMENT
CLUSTER
(8W-40-2)
9
DRIVER
HEATED
SEAT
SWITCH
(PREMIUM I/III)
(8W-63-14)
5
CIGAR
LIGHTER
(8W-41-4)
3
Z1
18
BK
ASH
RECEIVER
LAMP
(8W-44-10)
1
PASSENGER
HEATED
SEAT
SWITCH
(PREMIUM I/III)
(8W-63-14)
5
4
C201
POWER
CONNECTOR
(RHD)
(8W-41-5)
2
FRONT
POWER
OUTLET
(8W-41-5)
3
Z1
18
BK
Z1
20
BK
Z1
20
BK
Z1
20
BK
Z1
16
BK
Z1
18
BK
Z1
20
BK
Z1
16
BK
S203
Z1
12
BK
E
TO
G200
(8W-15-14)

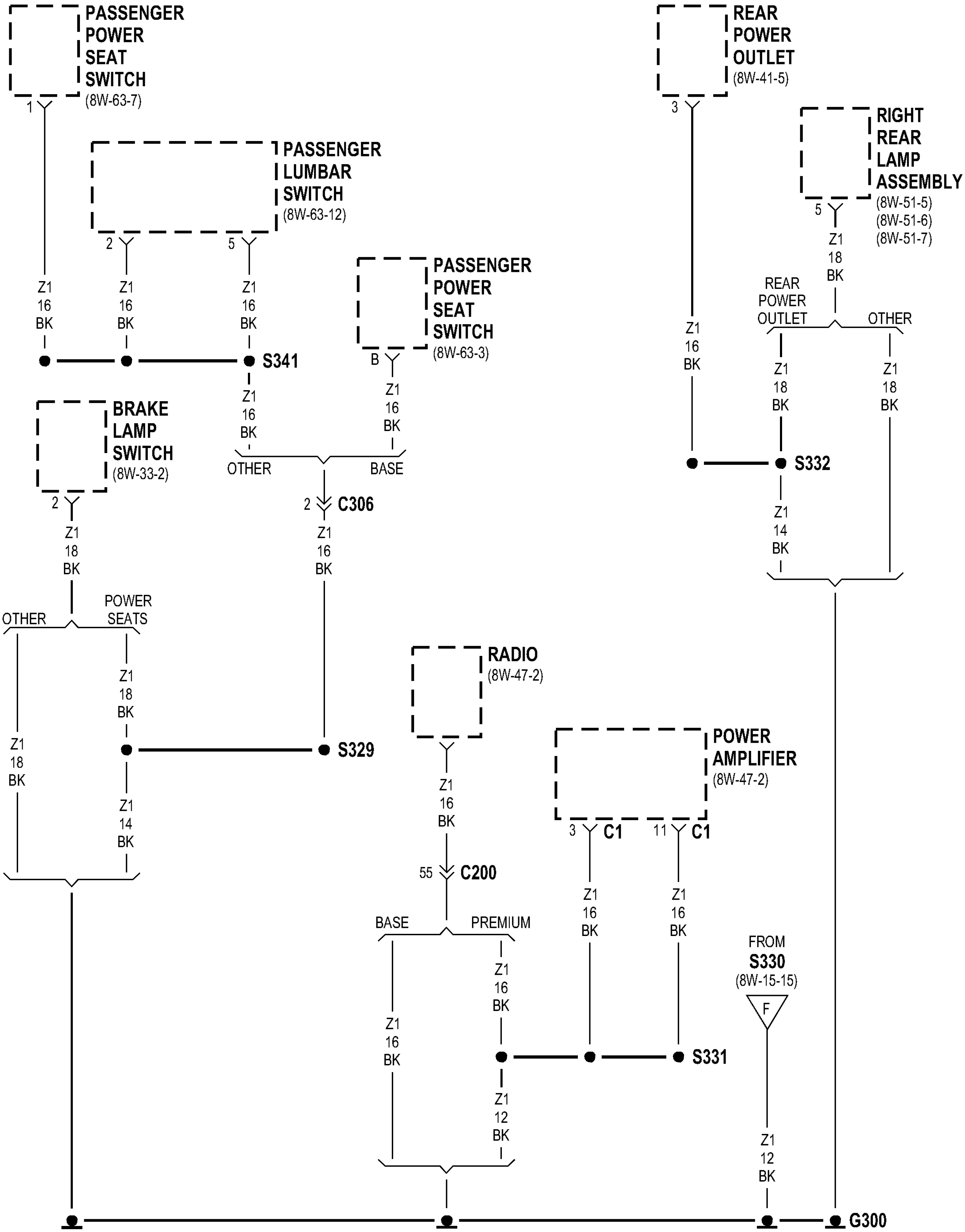


FROM
JUNCTION
BLOCK
(8W-15-11)
C
OVERDRIVE
SWITCH
(RHD)
(8W-31-7)
(8W-31-10)
PRNDL/
TRANSFER
CASE
ILLUMINATION
(8W-44-10)
POWER
CONNECTOR
(LHD)
(8W-41-5)
HEADLAMP
LEVELING
SWITCH
(BUILT-UP-
EXPORT)
(8W-50-9)
UNITED
KINGDOM
SECURITY
SYSTEM
MODULE
(8W-39-10)
BODY
CONTROL
MODULE
(8W-45-2)
25 C1
LEFT
MULTI-
FUNCTION
SWITCH
(8W-50-3)
OTHERS
UNITED
KINGDOM
S217
C201
IGNITION
SWITCH
(8W-10-24)
2 C2
Z1
20
BK
Z1
18
BK
Z1
16
BK
S205
BLOWER
MOTOR
CONTROLLER
(8W-42-6)
AUTOMATIC
ZONE
CONTROL
MODULE
(8W-42-2)
8 C1
FROM
S211
(8W-15-12)
D
FROM
S203
(8W-15-13)
E
Z1
12
BK
2 C203
S201
(AZC)
MANUAL
TEMPERATURE
CONTROL
(8W-42-2)
2 C2
Z2
18
BK/OR
G200



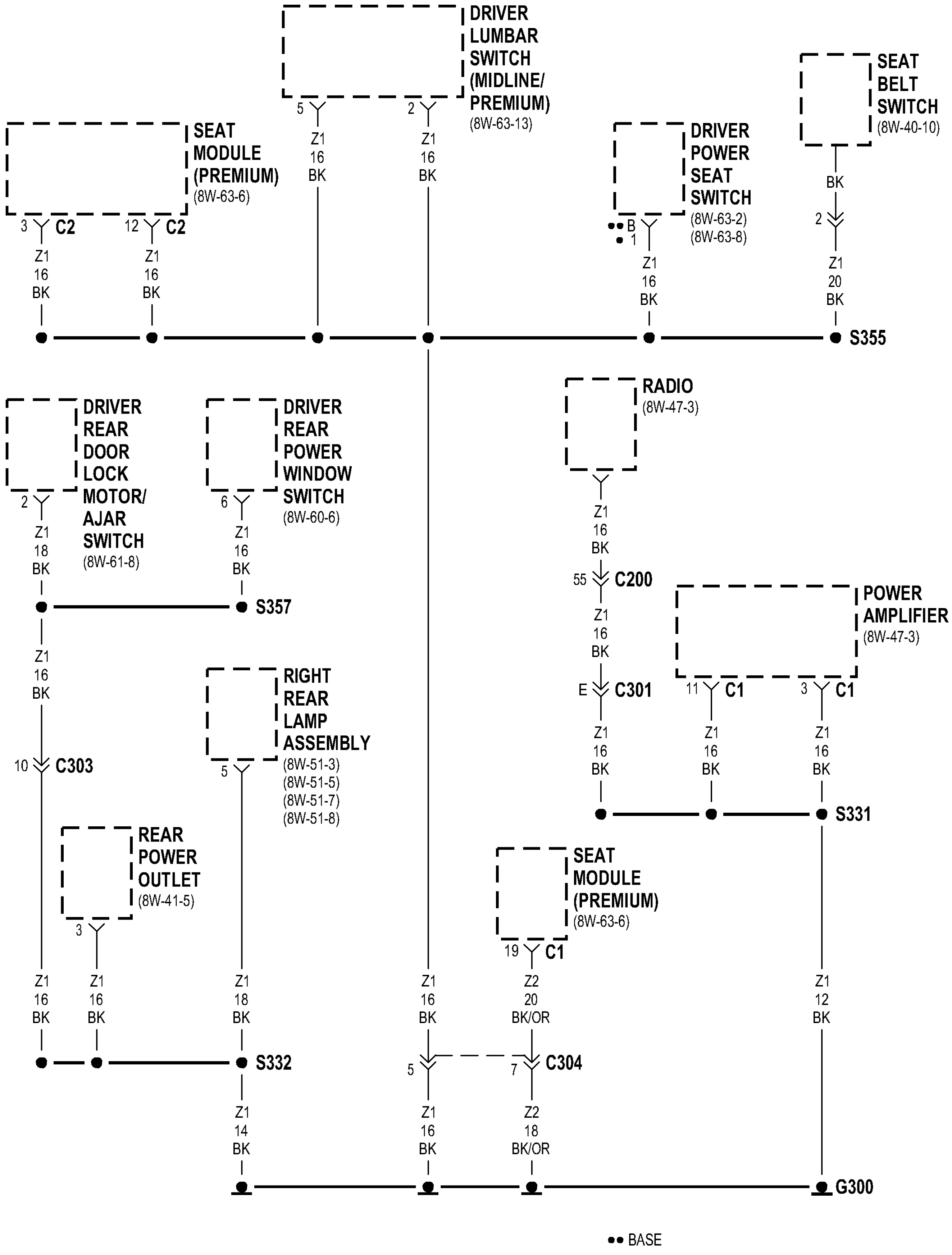
WG001515 J998W-19

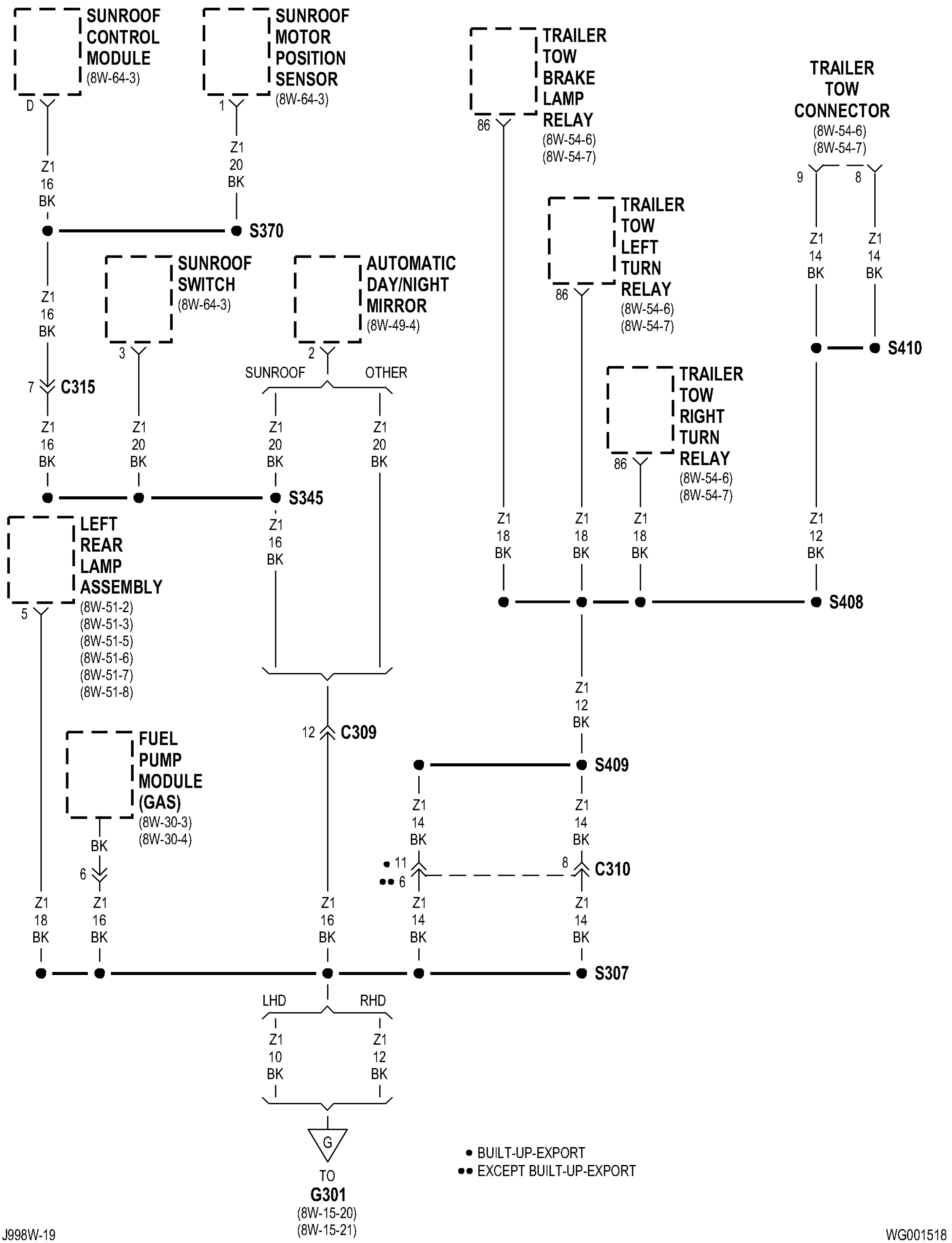
LHD

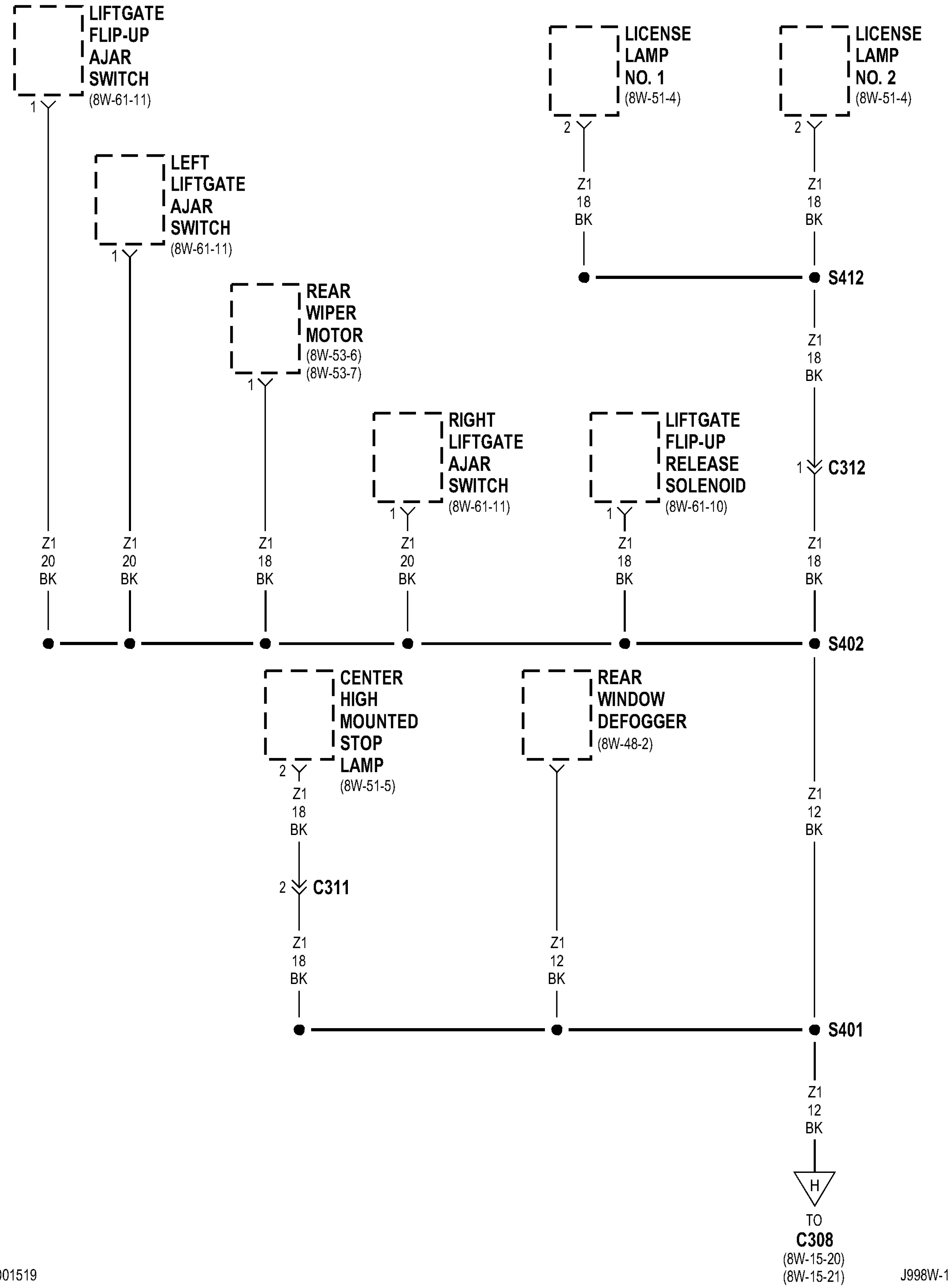


PASSENGER POWER SEAT SWITCH (8W-63-7)
1
PASSENGER LUMBAR SWITCH (8W-63-12)
2
5
Z1 16 BK
Z1 16 BK
Z1 16 BK
S341
Z1 16 BK
PASSENGER POWER SEAT SWITCH (8W-63-3)
B
Z1 16 BK
OTHER
BASE
2
C306
Z1 16 BK
BRAKE LAMP SWITCH (8W-33-2)
2
Z1 18 BK
OTHER
POWER SEATS
Z1 18 BK
Z1 18 BK
S329
Z1 14 BK
RADIO (8W-47-2)
Z1 16 BK
55
C200
BASE
PREMIUM
Z1 16 BK
Z1 16 BK
Z1 12 BK
POWER AMPLIFIER (8W-47-2)
3
C1
11
C1
Z1 16 BK
Z1 16 BK
S331
REAR POWER OUTLET (8W-41-5)
3
Z1 16 BK
RIGHT REAR LAMP ASSEMBLY (8W-51-5) (8W-51-6) (8W-51-7)
5
Z1 18 BK
REAR POWER OUTLET
OTHER
Z1 18 BK
Z1 18 BK
S332
Z1 14 BK
FROM S330 (8W-15-15)
F
Z1 12 BK
G300

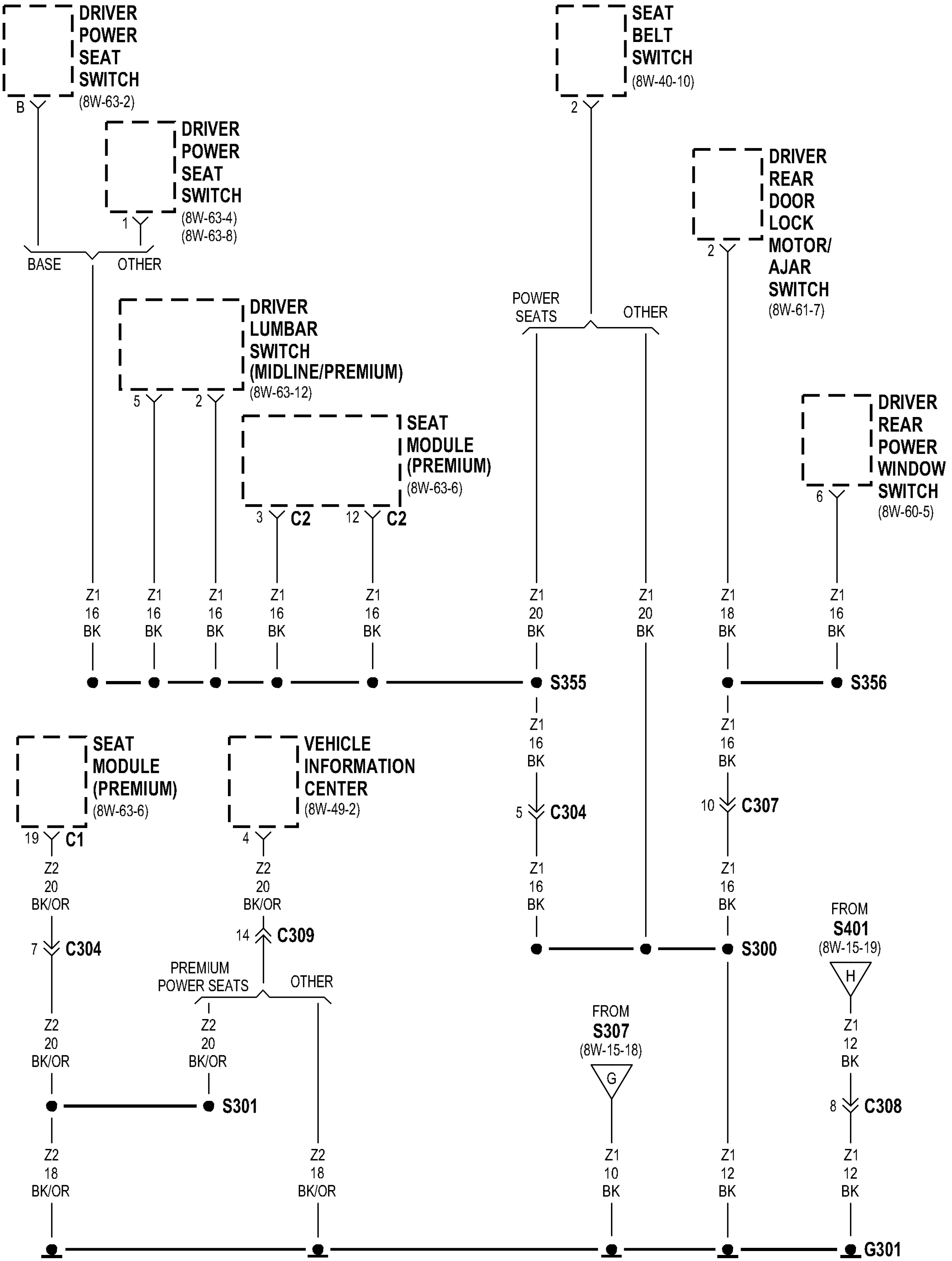
RHD


DRIVER LUMBAR SWITCH (MIDLINE/ PREMIUM)
(8W-63-13)
SEAT BELT SWITCH
(8W-40-10)
SEAT MODULE (PREMIUM)
(8W-63-6)
DRIVER POWER SEAT SWITCH
(8W-63-2)
(8W-63-8)
3 C2
12 C2
5
2
B
1
Z1 16 BK
Z1 20 BK
BK
S355
DRIVER REAR DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-8)
DRIVER REAR POWER WINDOW SWITCH
(8W-60-6)
RADIO
(8W-47-3)
Z1 18 BK
S357
55 C200
POWER AMPLIFIER
(8W-47-3)
E C301
11 C1
3 C1
10 C303
RIGHT REAR LAMP ASSEMBLY
(8W-51-3)
(8W-51-5)
(8W-51-7)
(8W-51-8)
S331
REAR POWER OUTLET
(8W-41-5)
SEAT MODULE (PREMIUM)
(8W-63-6)
19 C1
Z2 20 BK/OR
Z1 12 BK
S332
5
7 C304
Z1 14 BK
Z2 18 BK/OR
G300
BASE
MIDLINE/PREMIUM

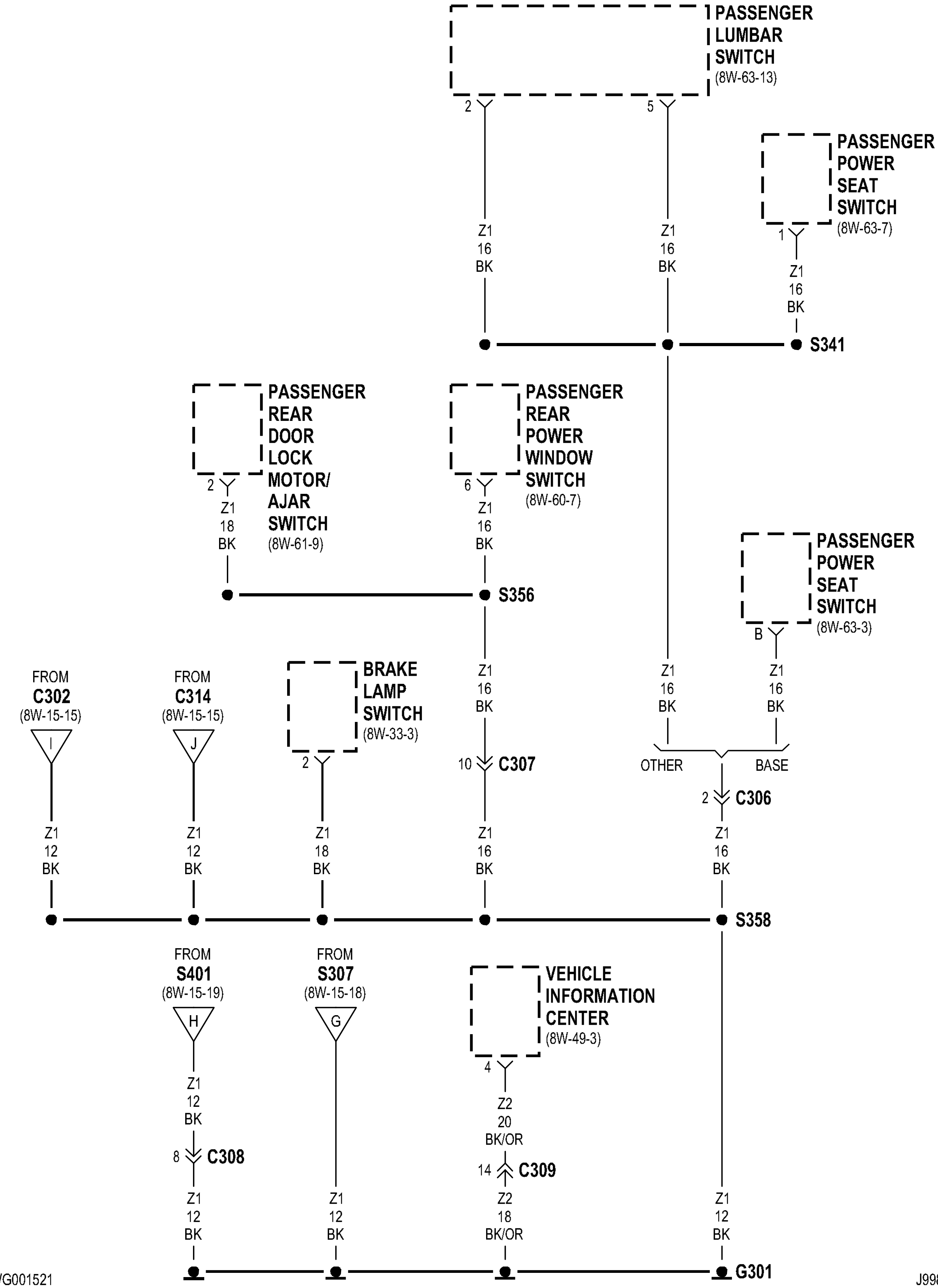

SUNROOF CONTROL MODULE
(8W-64-3)
SUNROOF MOTOR POSITION SENSOR
(8W-64-3)
TRAILER TOW BRAKE LAMP RELAY
(8W-54-6)
(8W-54-7)
TRAILER TOW CONNECTOR
(8W-54-6)
(8W-54-7)
TRAILER TOW LEFT TURN RELAY
(8W-54-6)
(8W-54-7)
S370
S410
SUNROOF SWITCH
(8W-64-3)
AUTOMATIC DAY/NIGHT MIRROR
(8W-49-4)
SUNROOF
OTHER
C315
TRAILER TOW RIGHT TURN RELAY
(8W-54-6)
(8W-54-7)
S345
LEFT REAR LAMP ASSEMBLY
(8W-51-2)
(8W-51-3)
(8W-51-5)
(8W-51-6)
(8W-51-7)
(8W-51-8)
S408
C309
FUEL PUMP MODULE (GAS)
(8W-30-3)
(8W-30-4)
S409
C310
S307
LHD
RHD
Z1 16 BK
Z1 20 BK
Z1 18 BK
Z1 14 BK
Z1 12 BK
Z1 10 BK
G
TO
G301
(8W-15-20)
(8W-15-21)
• BUILT-UP-EXPORT
•• EXCEPT BUILT-UP-EXPORT


LIFTGATE FLIP-UP AJAR SWITCH
(8W-61-11)
1
LEFT LIFTGATE AJAR SWITCH
(8W-61-11)
1
REAR WIPER MOTOR
(8W-53-6)
(8W-53-7)
1
RIGHT LIFTGATE AJAR SWITCH
(8W-61-11)
1
LIFTGATE FLIP-UP RELEASE SOLENOID
(8W-61-10)
1
LICENSE LAMP NO. 1
(8W-51-4)
2
LICENSE LAMP NO. 2
(8W-51-4)
2
Z1 18 BK
Z1 18 BK
S412
Z1 18 BK
1 C312
Z1 20 BK
Z1 20 BK
Z1 18 BK
Z1 20 BK
Z1 18 BK
Z1 18 BK
S402
CENTER HIGH MOUNTED STOP LAMP
(8W-51-5)
2
Z1 18 BK
2 C311
Z1 18 BK
REAR WINDOW DEFOGGER
(8W-48-2)
Z1 12 BK
Z1 12 BK
S401
Z1 12 BK
H
TO C308
(8W-15-20)
(8W-15-21)

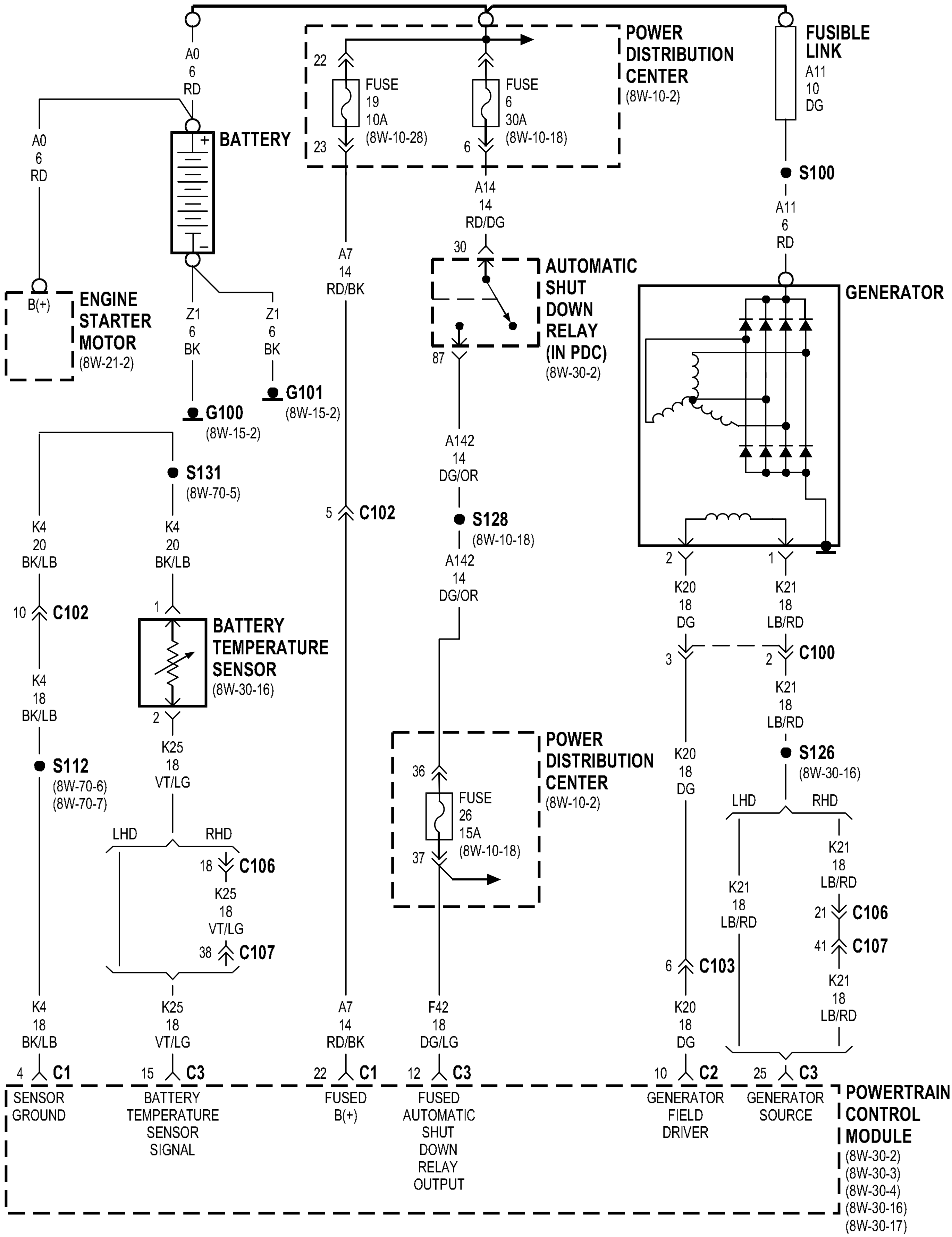
LHD

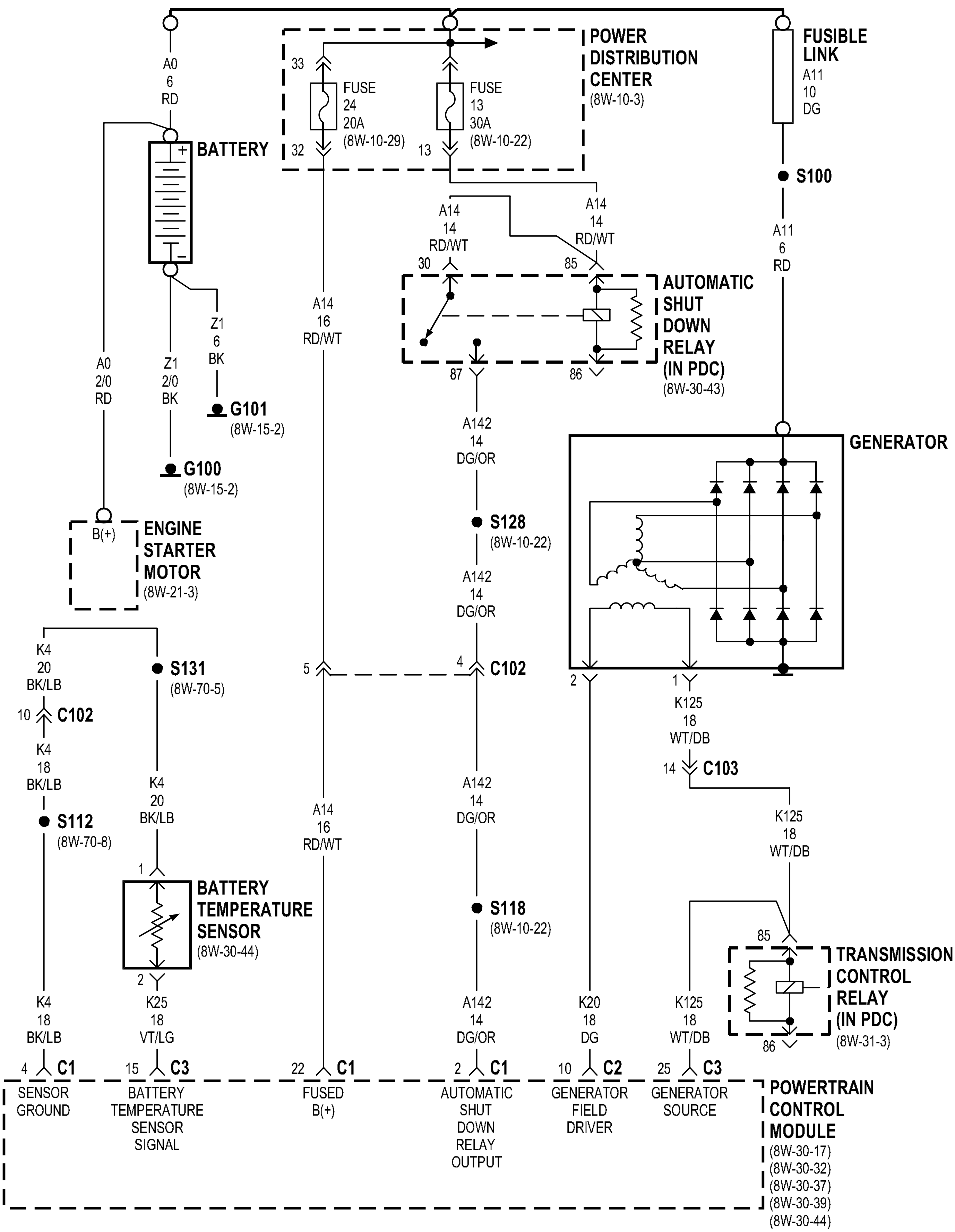

DRIVER POWER SEAT SWITCH (8W-63-2)
DRIVER POWER SEAT SWITCH (8W-63-4) (8W-63-8)
BASE
OTHER
DRIVER LUMBAR SWITCH (MIDLINE/PREMIUM) (8W-63-12)
SEAT MODULE (PREMIUM) (8W-63-6)
C2
SEAT BELT SWITCH (8W-40-10)
POWER SEATS
OTHER
DRIVER REAR DOOR LOCK MOTOR/ AJAR SWITCH (8W-61-7)
DRIVER REAR POWER WINDOW SWITCH (8W-60-5)
Z1 16 BK
Z1 20 BK
Z1 18 BK
S355
S356
C304
C307
SEAT MODULE (PREMIUM) (8W-63-6)
C1
VEHICLE INFORMATION CENTER (8W-49-2)
Z2 20 BK/OR
C309
PREMIUM POWER SEATS
OTHER
S300
FROM S401 (8W-15-19)
FROM S307 (8W-15-18)
Z1 12 BK
C308
S301
Z2 18 BK/OR
Z1 10 BK
G301

RHD

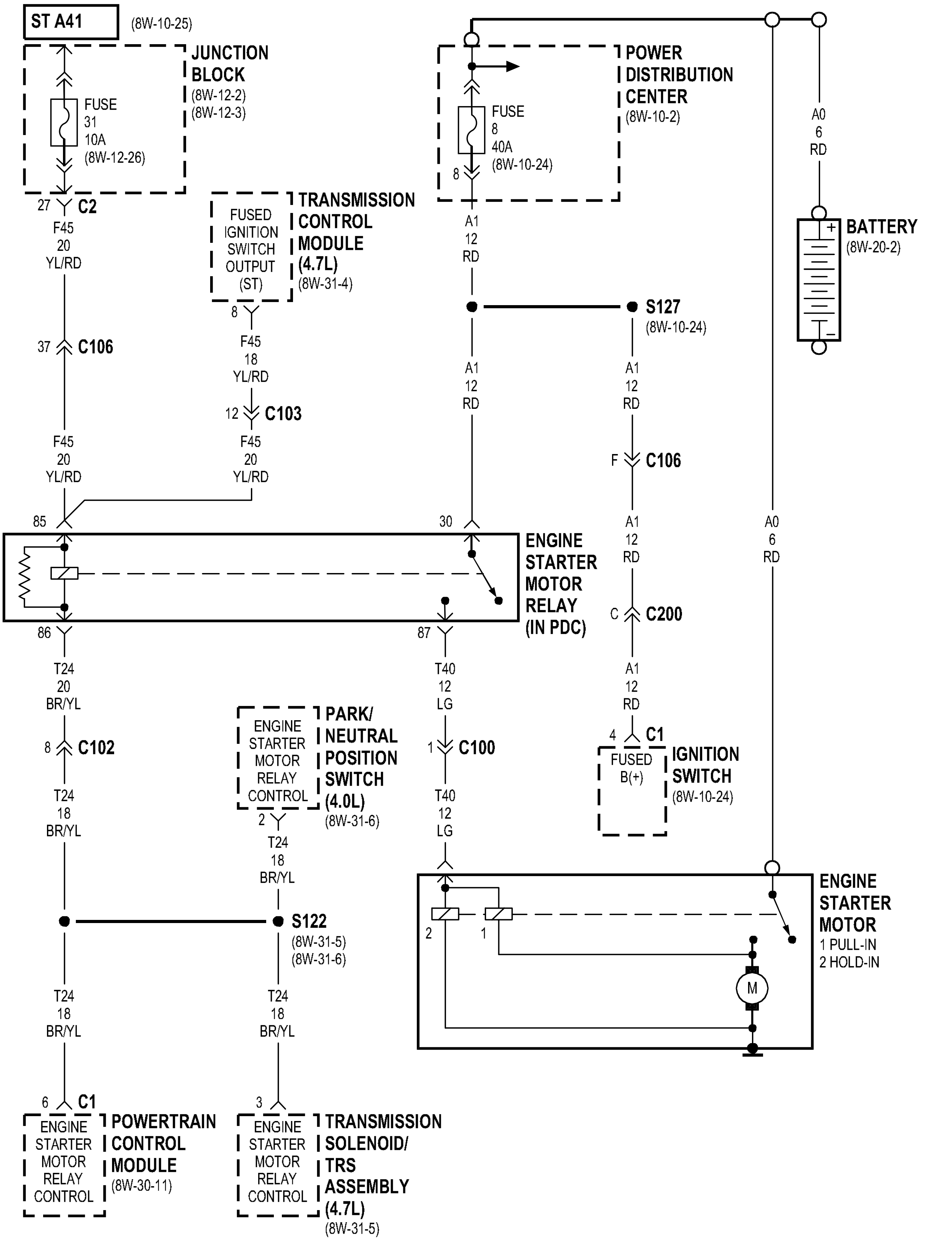

PASSENGER LUMBAR SWITCH (8W-63-13)
2
5
Z1 16 BK
Z1 16 BK
PASSENGER POWER SEAT SWITCH (8W-63-7)
1
Z1 16 BK
S341
PASSENGER REAR DOOR LOCK MOTOR/ AJAR SWITCH (8W-61-9)
2
Z1 18 BK
PASSENGER REAR POWER WINDOW SWITCH (8W-60-7)
6
Z1 16 BK
S356
PASSENGER POWER SEAT SWITCH (8W-63-3)
B
Z1 16 BK
Z1 16 BK
OTHER
BASE
2
C306
FROM C302 (8W-15-15)
I
FROM C314 (8W-15-15)
J
BRAKE LAMP SWITCH (8W-33-3)
2
Z1 16 BK
10
C307
Z1 12 BK
Z1 12 BK
Z1 18 BK
Z1 16 BK
Z1 16 BK
S358
FROM S401 (8W-15-19)
H
FROM S307 (8W-15-18)
G
VEHICLE INFORMATION CENTER (8W-49-3)
4
Z1 12 BK
8
C308
Z2 20 BK/OR
14
C309
Z1 12 BK
Z1 12 BK
Z2 18 BK/OR
Z1 12 BK
G301

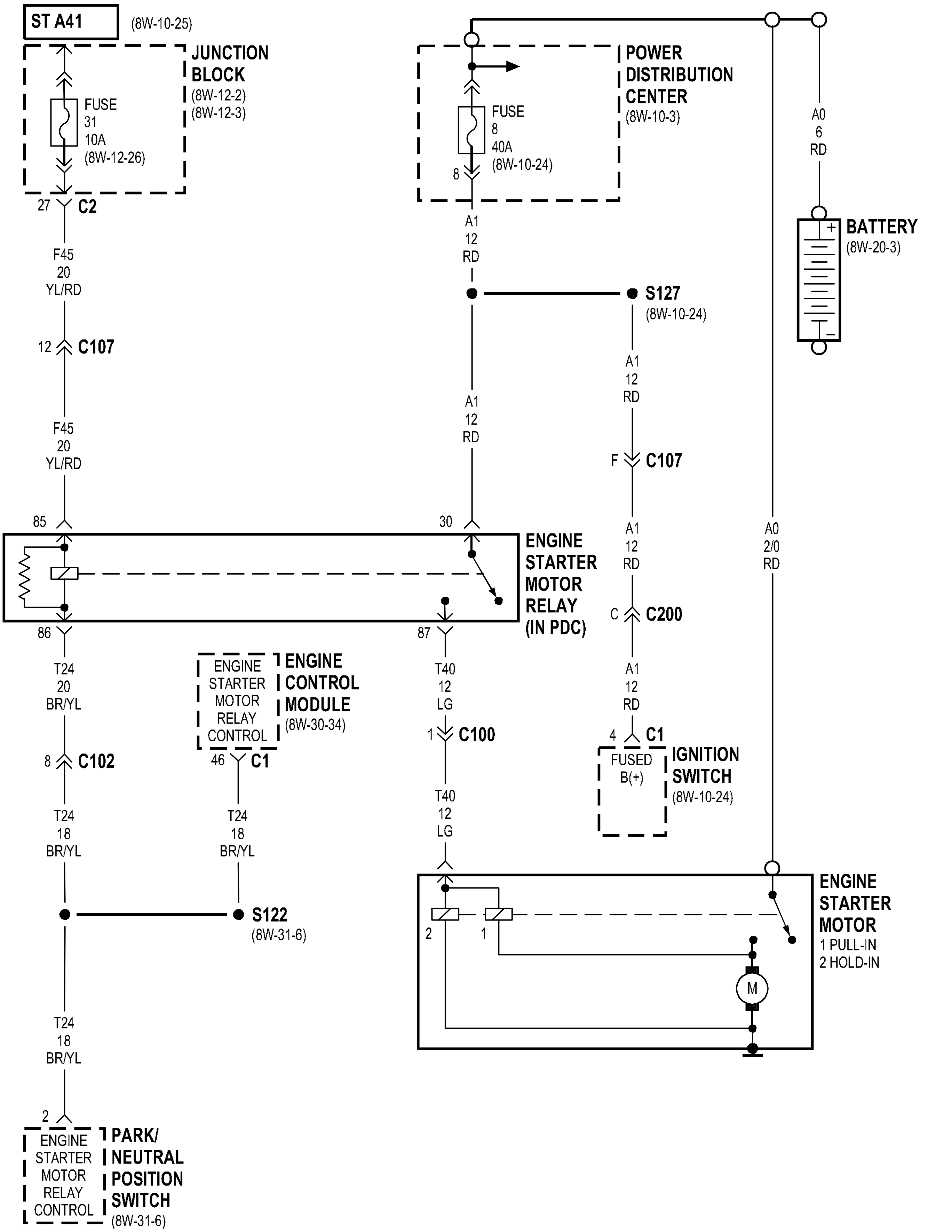
8W-20 CHARGING SYSTEM


A0
6
RD
BATTERY
A0
6
RD
B(+)
ENGINE STARTER MOTOR
(8W-21-2)
Z1
6
BK
Z1
6
BK
G100
(8W-15-2)
G101
(8W-15-2)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE
19
10A
(8W-10-28)
FUSE
6
30A
(8W-10-18)
22
23
6
A7
14
RD/BK
5 C102
A14
14
RD/DG
30
AUTOMATIC SHUT DOWN RELAY (IN PDC)
(8W-30-2)
87
A142
14
DG/OR
S128
(8W-10-18)
A142
14
DG/OR
FUSIBLE LINK
A11
10
DG
S100
A11
6
RD
GENERATOR
2
1
K20
18
DG
K21
18
LB/RD
3
2 C100
K21
18
LB/RD
S126
(8W-30-16)
K20
18
DG
LHD
RHD
K21
18
LB/RD
21 C106
41 C107
K21
18
LB/RD
K21
18
LB/RD
6 C103
K20
18
DG
S131
(8W-70-5)
K4
20
BK/LB
K4
20
BK/LB
10 C102
K4
18
BK/LB
S112
(8W-70-6)
(8W-70-7)
1
BATTERY TEMPERATURE SENSOR
(8W-30-16)
2
K25
18
VT/LG
LHD
RHD
18 C106
K25
18
VT/LG
38 C107
K4
18
BK/LB
K25
18
VT/LG
POWER DISTRIBUTION CENTER
(8W-10-2)
36
FUSE
26
15A
(8W-10-18)
37
A7
14
RD/BK
F42
18
DG/LG
4 C1
15 C3
22 C1
12 C3
10 C2
25 C3
SENSOR GROUND
BATTERY TEMPERATURE SENSOR SIGNAL
FUSED B(+)
FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
GENERATOR FIELD DRIVER
GENERATOR SOURCE
POWERTRAIN CONTROL MODULE
(8W-30-2)
(8W-30-3)
(8W-30-4)
(8W-30-16)
(8W-30-17)

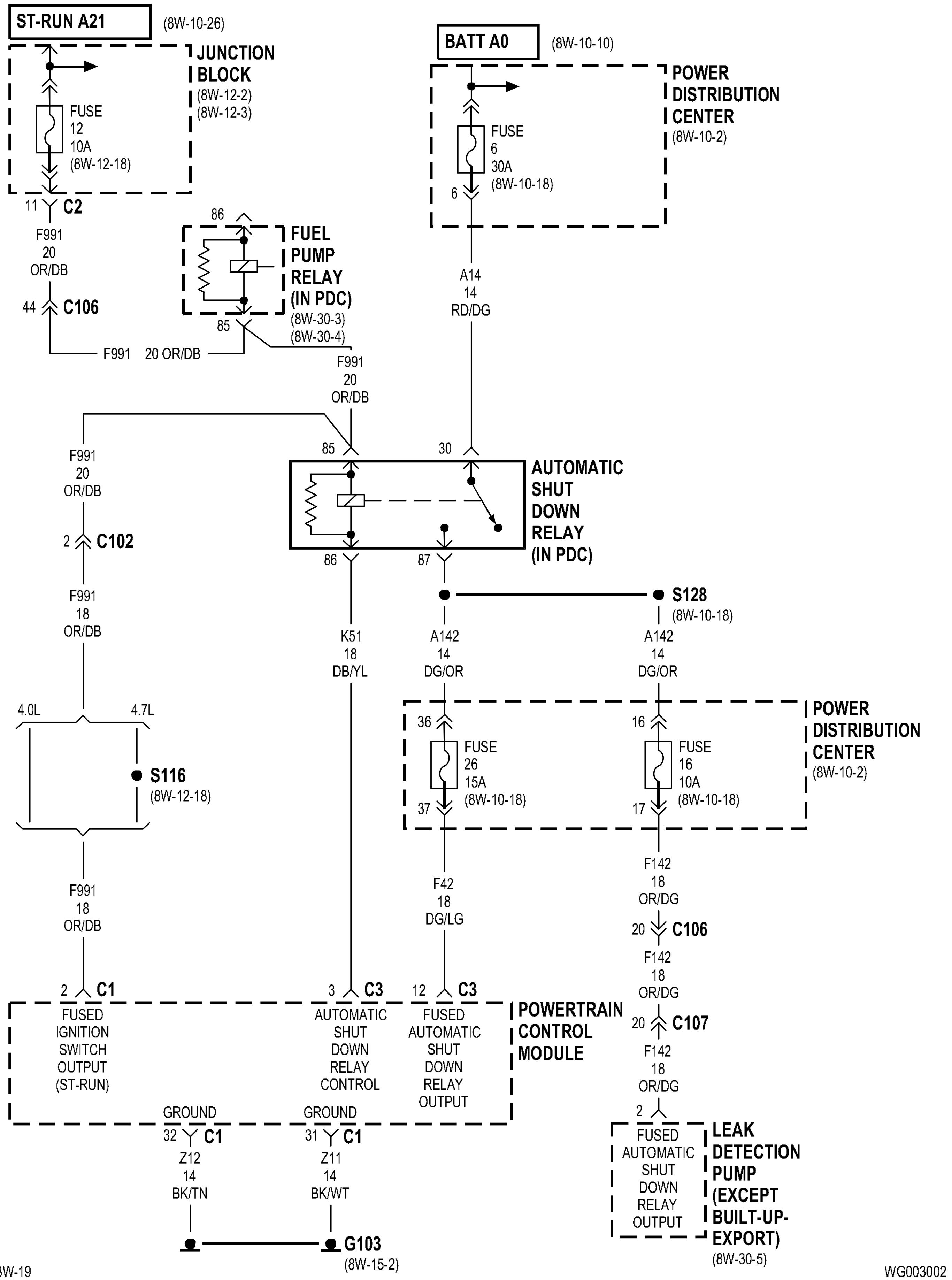

A0
6
RD
BATTERY
POWER
DISTRIBUTION
CENTER
(8W-10-3)
33
FUSE
24
20A
(8W-10-29)
32
FUSE
13
30A
(8W-10-22)
13
FUSIBLE
LINK
A11
10
DG
S100
A11
6
RD
A14
14
RD/WT
30
A14
14
RD/WT
85
AUTOMATIC
SHUT
DOWN
RELAY
(IN PDC)
(8W-30-43)
87
86
Z1
6
BK
G101
(8W-15-2)
A0
2/0
RD
Z1
2/0
BK
G100
(8W-15-2)
A14
16
RD/WT
A142
14
DG/OR
S128
(8W-10-22)
A142
14
DG/OR
GENERATOR
B(+)
ENGINE
STARTER
MOTOR
(8W-21-3)
K4
20
BK/LB
S131
(8W-70-5)
10
C102
K4
18
BK/LB
S112
(8W-70-8)
K4
20
BK/LB
5
4
C102
2
1
K125
18
WT/DB
14
C103
K125
18
WT/DB
A14
16
RD/WT
A142
14
DG/OR
S118
(8W-10-22)
1
BATTERY
TEMPERATURE
SENSOR
(8W-30-44)
2
85
TRANSMISSION
CONTROL
RELAY
(IN PDC)
(8W-31-3)
86
K4
18
BK/LB
K25
18
VT/LG
A142
14
DG/OR
K20
18
DG
K125
18
WT/DB
4 C1
15 C3
22 C1
2 C1
10 C2
25 C3
SENSOR
GROUND
BATTERY
TEMPERATURE
SENSOR
SIGNAL
FUSED
B(+)
AUTOMATIC
SHUT
DOWN
RELAY
OUTPUT
GENERATOR
FIELD
DRIVER
GENERATOR
SOURCE
POWERTRAIN
CONTROL
MODULE
(8W-30-17)
(8W-30-32)
(8W-30-37)
(8W-30-39)
(8W-30-44)

8W-21 STARTING SYSTEM

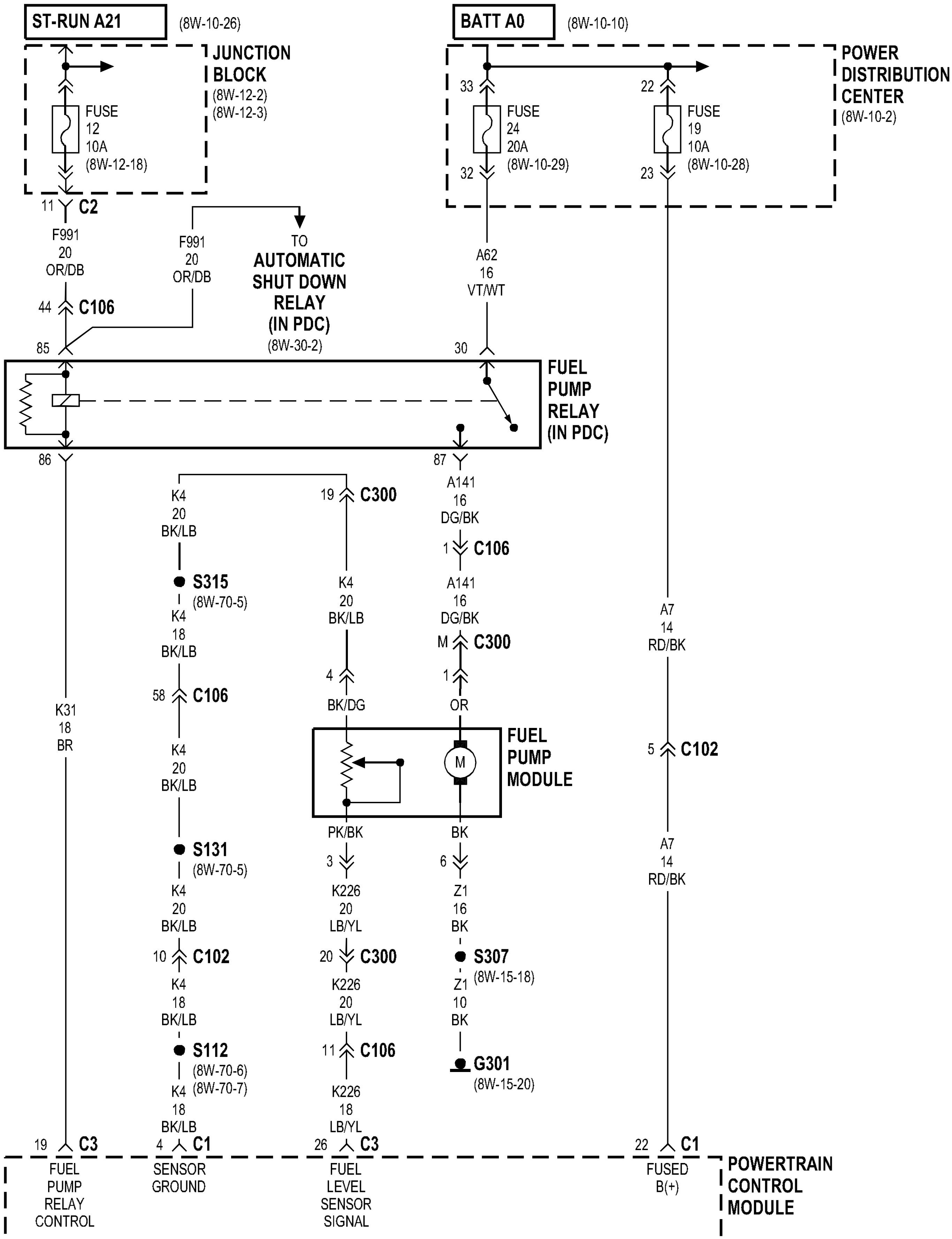

ST A41
(8W-10-25)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 31 10A (8W-12-26)
27 C2
F45 20 YL/RD
37 C106
F45 20 YL/RD
FUSED IGNITION SWITCH OUTPUT (ST)
TRANSMISSION CONTROL MODULE (4.7L)
(8W-31-4)
8
F45 18 YL/RD
12 C103
F45 20 YL/RD
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 8 40A (8W-10-24)
8
A1 12 RD
S127
(8W-10-24)
A1 12 RD
A1 12 RD
F C106
A1 12 RD
C C200
A1 12 RD
A0 6 RD
BATTERY
(8W-20-2)
A0 6 RD
85
30
ENGINE STARTER MOTOR RELAY (IN PDC)
86
87
T24 20 BR/YL
8 C102
T24 18 BR/YL
ENGINE STARTER MOTOR RELAY CONTROL
PARK/ NEUTRAL POSITION SWITCH (4.0L)
(8W-31-6)
2
T24 18 BR/YL
S122
(8W-31-5)
(8W-31-6)
T40 12 LG
1 C100
T40 12 LG
4 C1
FUSED B(+)
IGNITION SWITCH
(8W-10-24)
ENGINE STARTER MOTOR
1 PULL-IN
2 HOLD-IN
2
1
M
T24 18 BR/YL
T24 18 BR/YL
6 C1
ENGINE STARTER MOTOR RELAY CONTROL
POWERTRAIN CONTROL MODULE
(8W-30-11)
3
ENGINE STARTER MOTOR RELAY CONTROL
TRANSMISSION SOLENOID/ TRS ASSEMBLY (4.7L)
(8W-31-5)

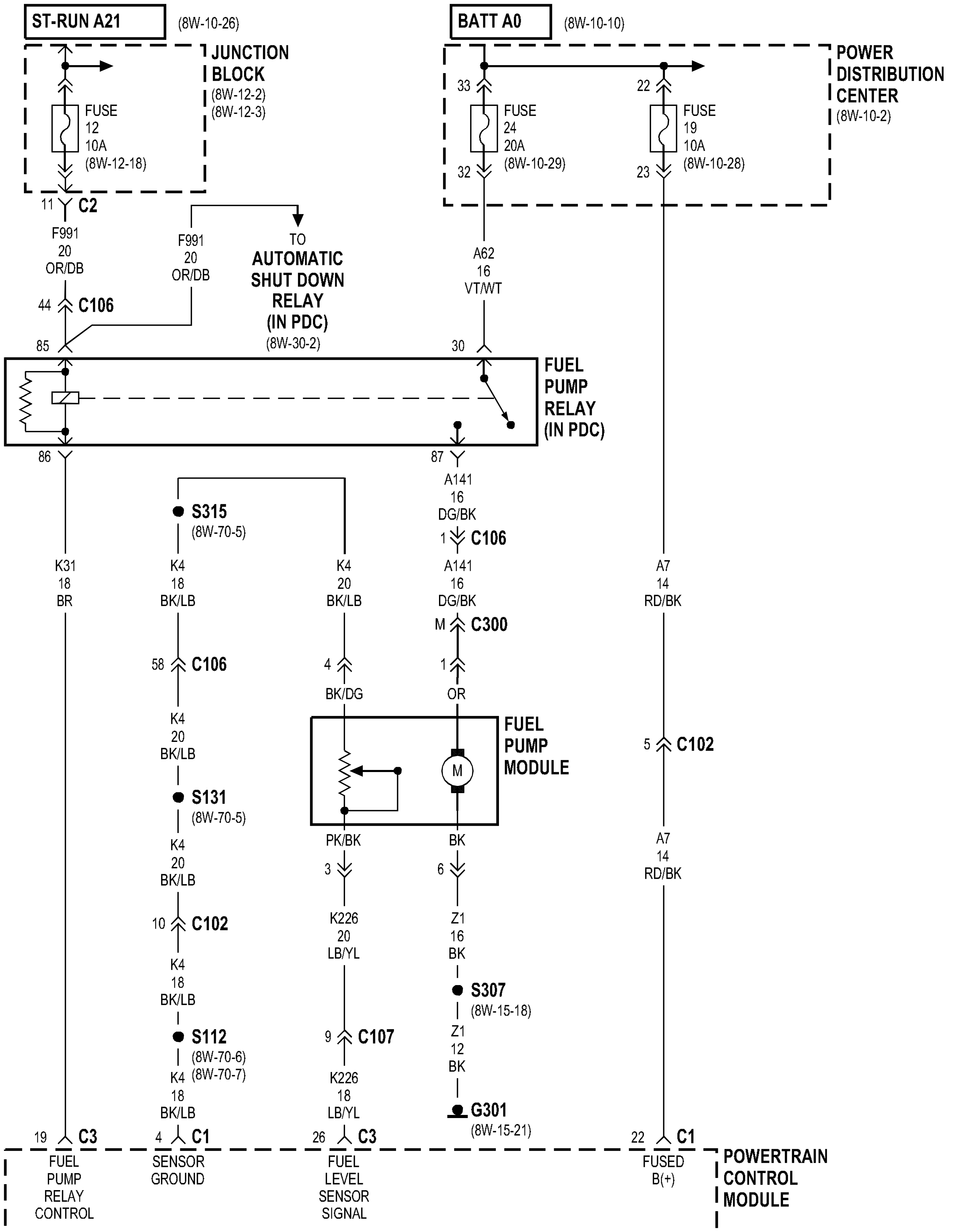

ST A41
(8W-10-25)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
31
10A
(8W-12-26)
27
C2
F45
20
YL/RD
12
C107
F45
20
YL/RD
85
86
T24
20
BR/YL
8
C102
T24
18
BR/YL
ENGINE STARTER MOTOR RELAY CONTROL
ENGINE CONTROL MODULE
(8W-30-34)
46
C1
T24
18
BR/YL
S122
(8W-31-6)
T24
18
BR/YL
2
ENGINE STARTER MOTOR RELAY CONTROL
PARK/ NEUTRAL POSITION SWITCH
(8W-31-6)
POWER DISTRIBUTION CENTER
(8W-10-3)
FUSE
8
40A
(8W-10-24)
8
A1
12
RD
S127
(8W-10-24)
A1
12
RD
A1
12
RD
F
C107
A1
12
RD
C
C200
A1
12
RD
4
C1
FUSED B(+)
IGNITION SWITCH
(8W-10-24)
30
87
ENGINE STARTER MOTOR RELAY (IN PDC)
T40
12
LG
1
C100
T40
12
LG
A0
6
RD
BATTERY
(8W-20-3)
A0
2/0
RD
2
1
M
ENGINE STARTER MOTOR
1 PULL-IN
2 HOLD-IN

8W-30 FUEL/IGNITION SYSTEM

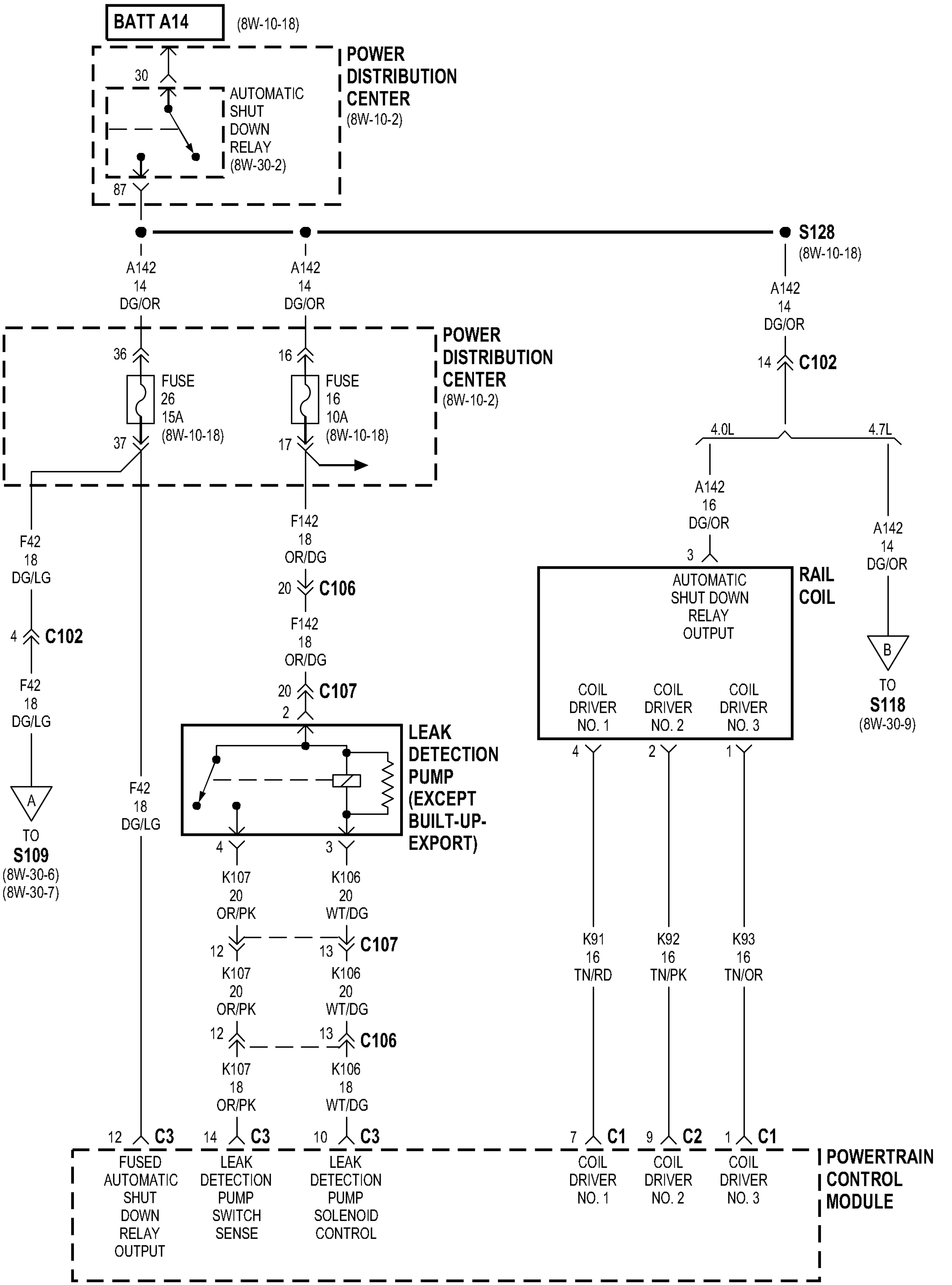

ST-RUN A21
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 12 10A (8W-12-18)
11 C2
F991 20 OR/DB
44 C106
F991 20 OR/DB
86
FUEL PUMP RELAY (IN PDC)
(8W-30-3)
(8W-30-4)
85
F991 20 OR/DB
BATT A0
(8W-10-10)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 6 30A (8W-10-18)
6
A14 14 RD/DG
F991 20 OR/DB
85
30
AUTOMATIC SHUT DOWN RELAY (IN PDC)
2 C102
86
87
S128
(8W-10-18)
F991 18 OR/DB
K51 18 DB/YL
A142 14 DG/OR
A142 14 DG/OR
4.0L
4.7L
S116
(8W-12-18)
36
FUSE 26 15A (8W-10-18)
37
16
FUSE 16 10A (8W-10-18)
17
POWER DISTRIBUTION CENTER
(8W-10-2)
F991 18 OR/DB
F42 18 DG/LG
F142 18 OR/DG
20 C106
F142 18 OR/DG
20 C107
F142 18 OR/DG
2 C1
3 C3
12 C3
FUSED IGNITION SWITCH OUTPUT (ST-RUN)
AUTOMATIC SHUT DOWN RELAY CONTROL
FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
POWERTRAIN CONTROL MODULE
GROUND
GROUND
32 C1
31 C1
Z12 14 BK/TN
Z11 14 BK/WT
G103
(8W-15-2)
2
FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
LEAK DETECTION PUMP (EXCEPT BUILT-UP-EXPORT)
(8W-30-5)

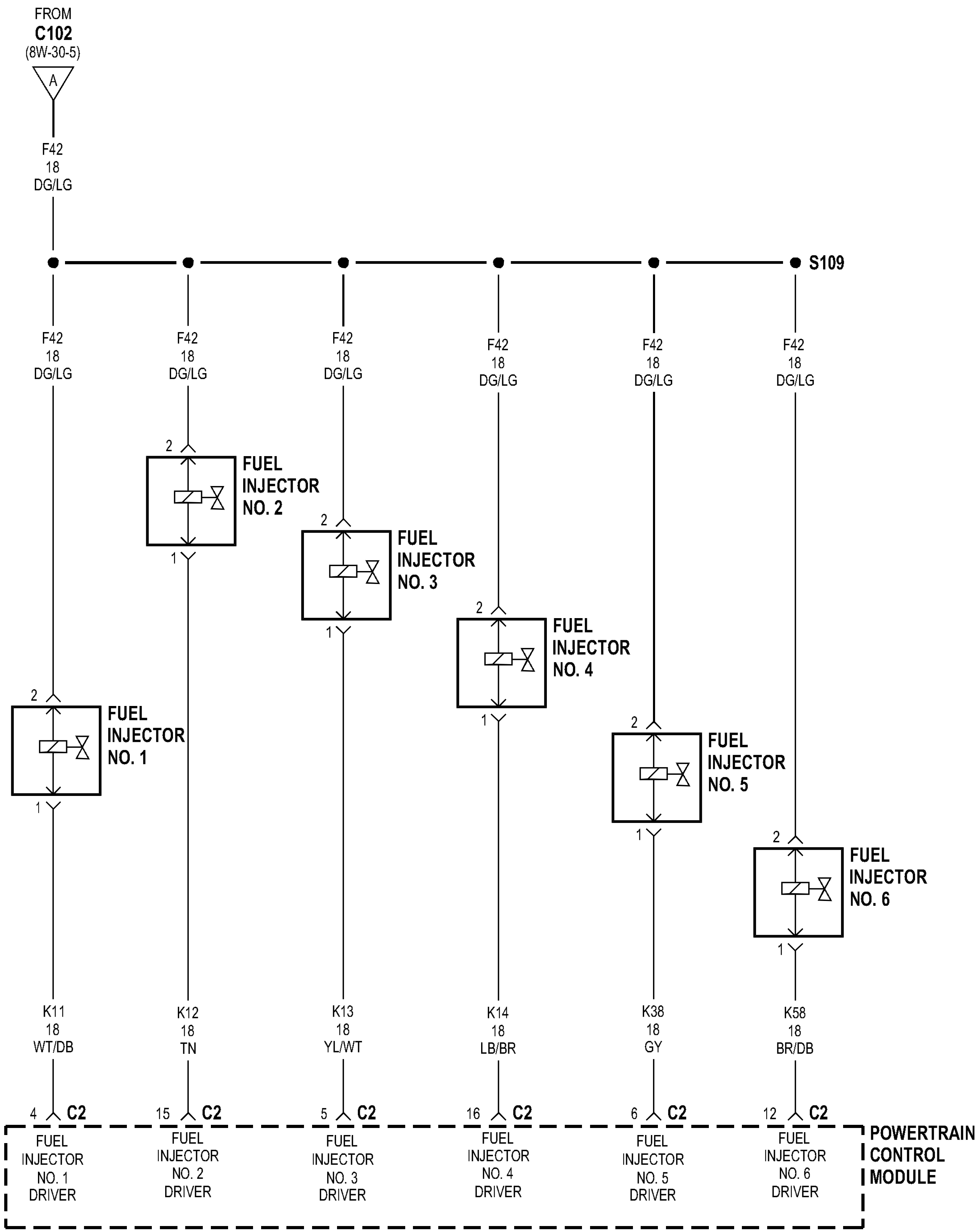
LHD GAS

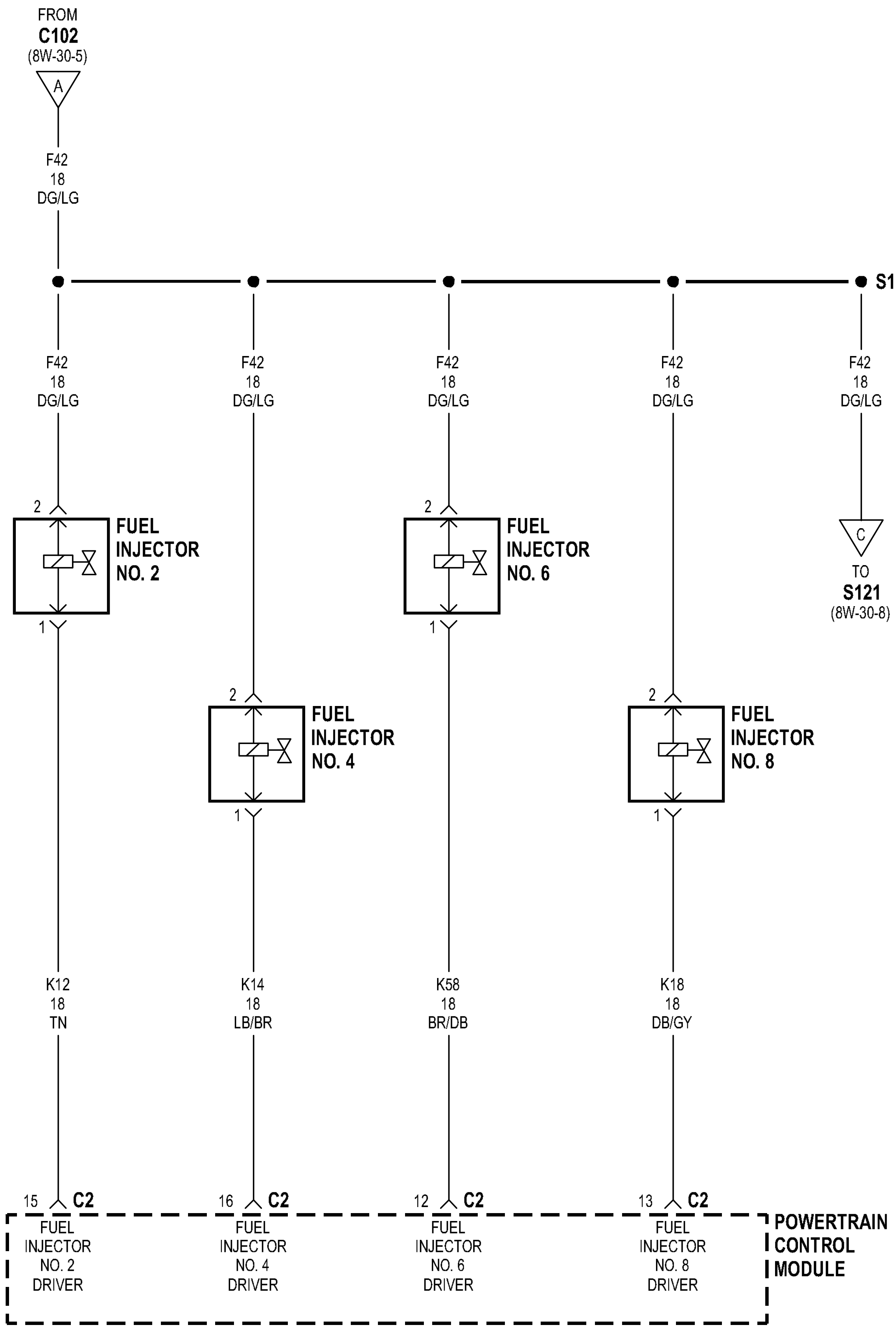

ST-RUN A21
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 12 10A (8W-12-18)
11 C2
F991 20 OR/DB
F991 20 OR/DB
TO AUTOMATIC SHUT DOWN RELAY (IN PDC)
(8W-30-2)
44 C106
85
BATT A0
(8W-10-10)
POWER DISTRIBUTION CENTER
(8W-10-2)
33
FUSE 24 20A (8W-10-29)
32
22
FUSE 19 10A (8W-10-28)
23
A62 16 VT/WT
30
FUEL PUMP RELAY (IN PDC)
86
87
K31 18 BR
K4 20 BK/LB
S315 (8W-70-5)
K4 18 BK/LB
58 C106
K4 20 BK/LB
S131 (8W-70-5)
K4 20 BK/LB
10 C102
K4 18 BK/LB
S112 (8W-70-6) (8W-70-7)
K4 18 BK/LB
19 C300
K4 20 BK/LB
4
BK/DG
FUEL PUMP MODULE
M
PK/BK
3
K226 20 LB/YL
20 C300
K226 20 LB/YL
11 C106
K226 18 LB/YL
A141 16 DG/BK
1 C106
A141 16 DG/BK
M C300
1
OR
BK
6
Z1 16 BK
S307 (8W-15-18)
Z1 10 BK
G301 (8W-15-20)
A7 14 RD/BK
5 C102
A7 14 RD/BK
19 C3
4 C1
26 C3
22 C1
FUEL PUMP RELAY CONTROL
SENSOR GROUND
FUEL LEVEL SENSOR SIGNAL
FUSED B(+)
POWERTRAIN CONTROL MODULE



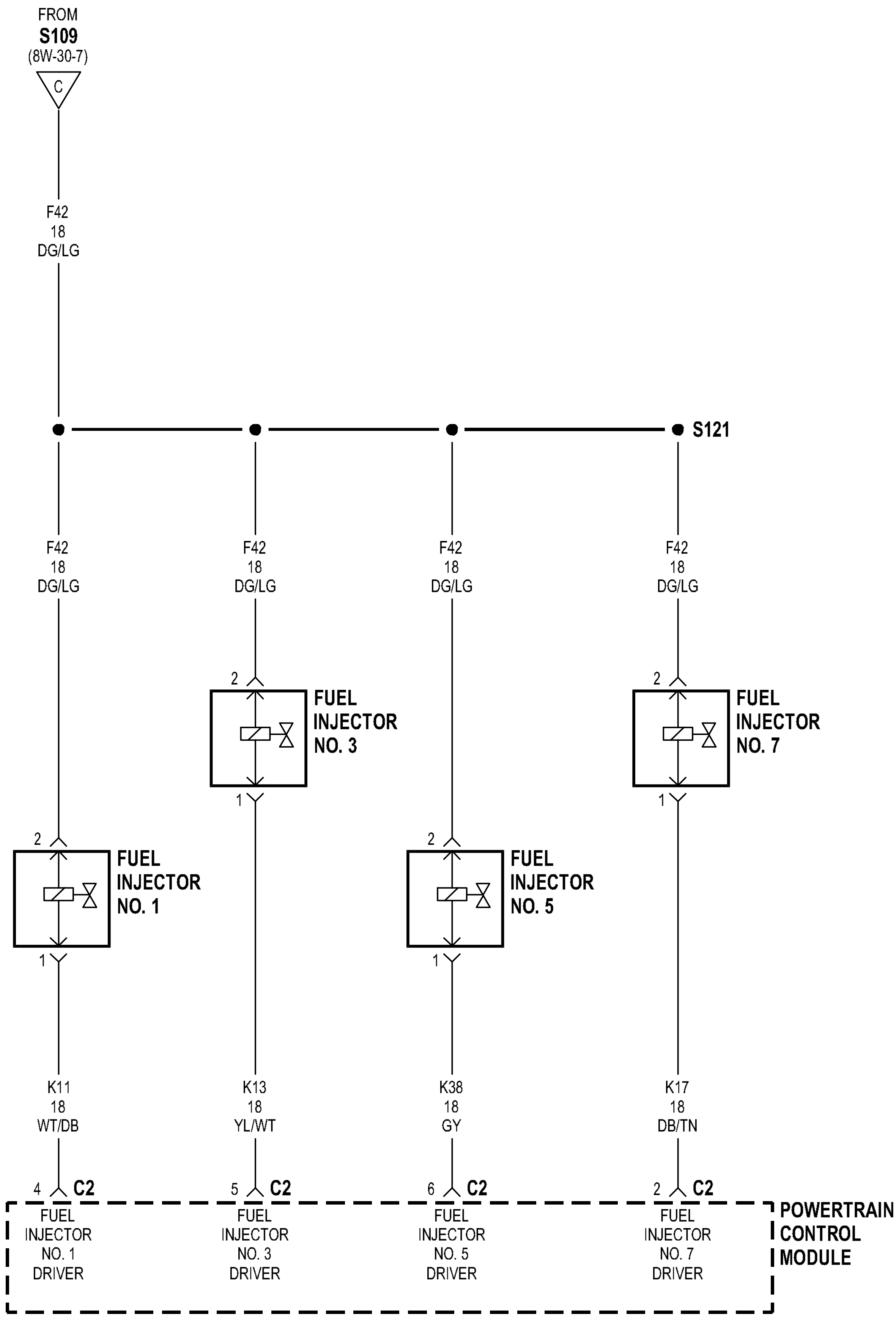
ST-RUN A21
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
12
10A
(8W-12-18)
11 C2
F991
20
OR/DB
44 C106
F991
20
OR/DB
TO
AUTOMATIC SHUT DOWN RELAY (IN PDC)
(8W-30-2)
BATT A0
(8W-10-10)
POWER DISTRIBUTION CENTER
(8W-10-2)
33
FUSE
24
20A
(8W-10-29)
32
22
FUSE
19
10A
(8W-10-28)
23
A62
16
VT/WT
85
30
FUEL PUMP RELAY (IN PDC)
86
87
A141
16
DG/BK
1 C106
A141
16
DG/BK
M C300
1
OR
S315
(8W-70-5)
K31
18
BR
K4
18
BK/LB
K4
20
BK/LB
58 C106
K4
20
BK/LB
S131
(8W-70-5)
K4
20
BK/LB
10 C102
K4
18
BK/LB
S112
(8W-70-6)
(8W-70-7)
K4
18
BK/LB
4
BK/DG
FUEL PUMP MODULE
M
PK/BK
3
K226
20
LB/YL
9 C107
K226
18
LB/YL
BK
6
Z1
16
BK
S307
(8W-15-18)
Z1
12
BK
G301
(8W-15-21)
A7
14
RD/BK
5 C102
A7
14
RD/BK
19 C3
4 C1
26 C3
22 C1
FUEL PUMP RELAY CONTROL
SENSOR GROUND
FUEL LEVEL SENSOR SIGNAL
FUSED B(+)
POWERTRAIN CONTROL MODULE

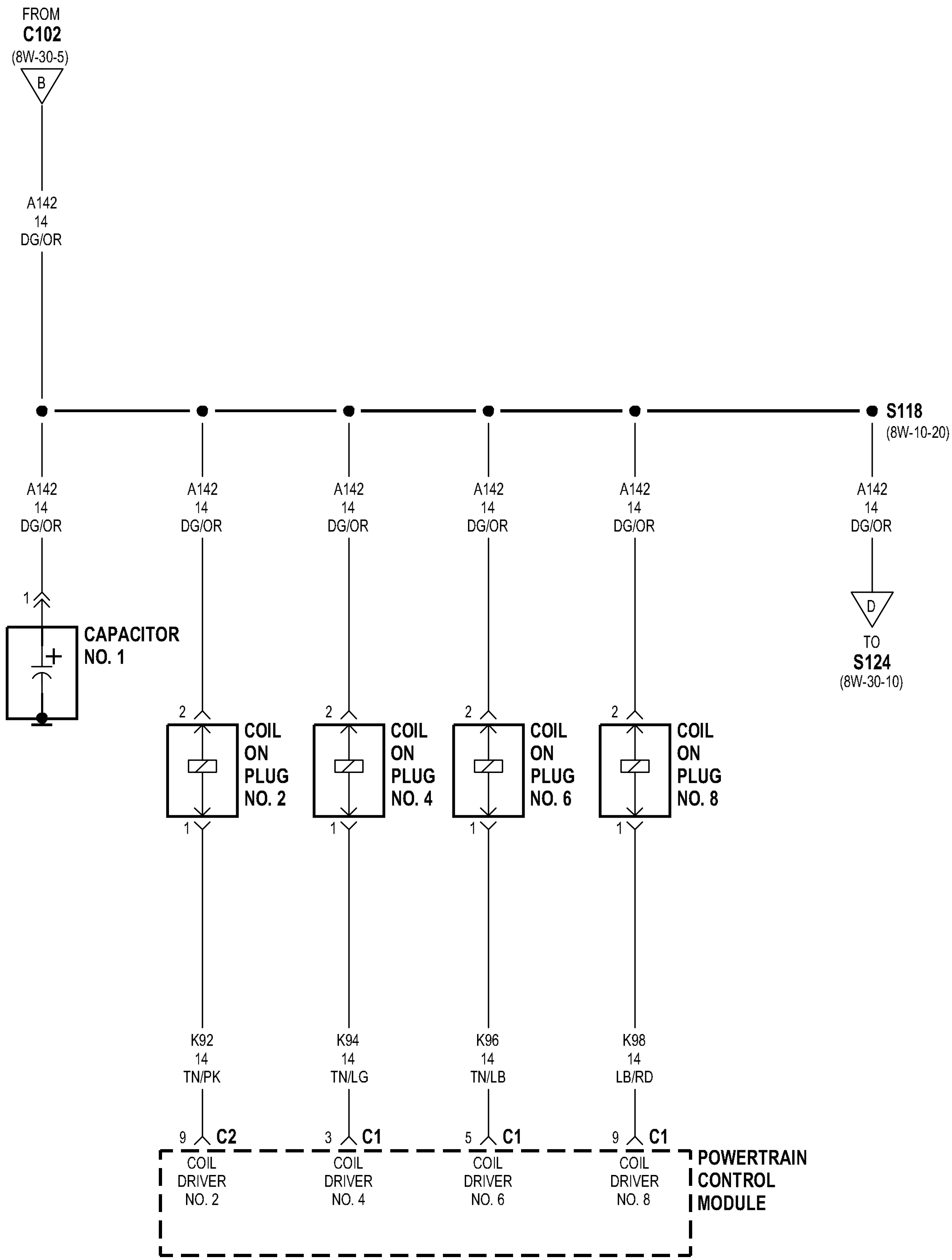

BATT A14
(8W-10-18)
POWER DISTRIBUTION CENTER
(8W-10-2)
30
AUTOMATIC SHUT DOWN RELAY
(8W-30-2)
87
S128
(8W-10-18)
A142
14
DG/OR
A142
14
DG/OR
A142
14
DG/OR
14
C102
POWER DISTRIBUTION CENTER
(8W-10-2)
36
FUSE 26 15A
(8W-10-18)
37
16
FUSE 16 10A
(8W-10-18)
17
4.0L
4.7L
A142
16
DG/OR
A142
14
DG/OR
3
RAIL COIL
AUTOMATIC SHUT DOWN RELAY OUTPUT
COIL DRIVER NO. 1
COIL DRIVER NO. 2
COIL DRIVER NO. 3
B
TO S118
(8W-30-9)
F142
18
OR/DG
20
C106
F142
18
OR/DG
20
C107
2
LEAK DETECTION PUMP (EXCEPT BUILT-UP-EXPORT)
F42
18
DG/LG
4
C102
F42
18
DG/LG
A
TO S109
(8W-30-6)
(8W-30-7)
F42
18
DG/LG
4
3
K107
20
OR/PK
K106
20
WT/DG
12
13
C107
K107
20
OR/PK
K106
20
WT/DG
12
13
C106
K107
18
OR/PK
K106
18
WT/DG
4
2
1
K91
16
TN/RD
K92
16
TN/PK
K93
16
TN/OR
12
C3
14
C3
10
C3
7
C1
9
C2
1
C1
FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
LEAK DETECTION PUMP SWITCH SENSE
LEAK DETECTION PUMP SOLENOID CONTROL
COIL DRIVER NO. 1
COIL DRIVER NO. 2
COIL DRIVER NO. 3
POWERTRAIN CONTROL MODULE

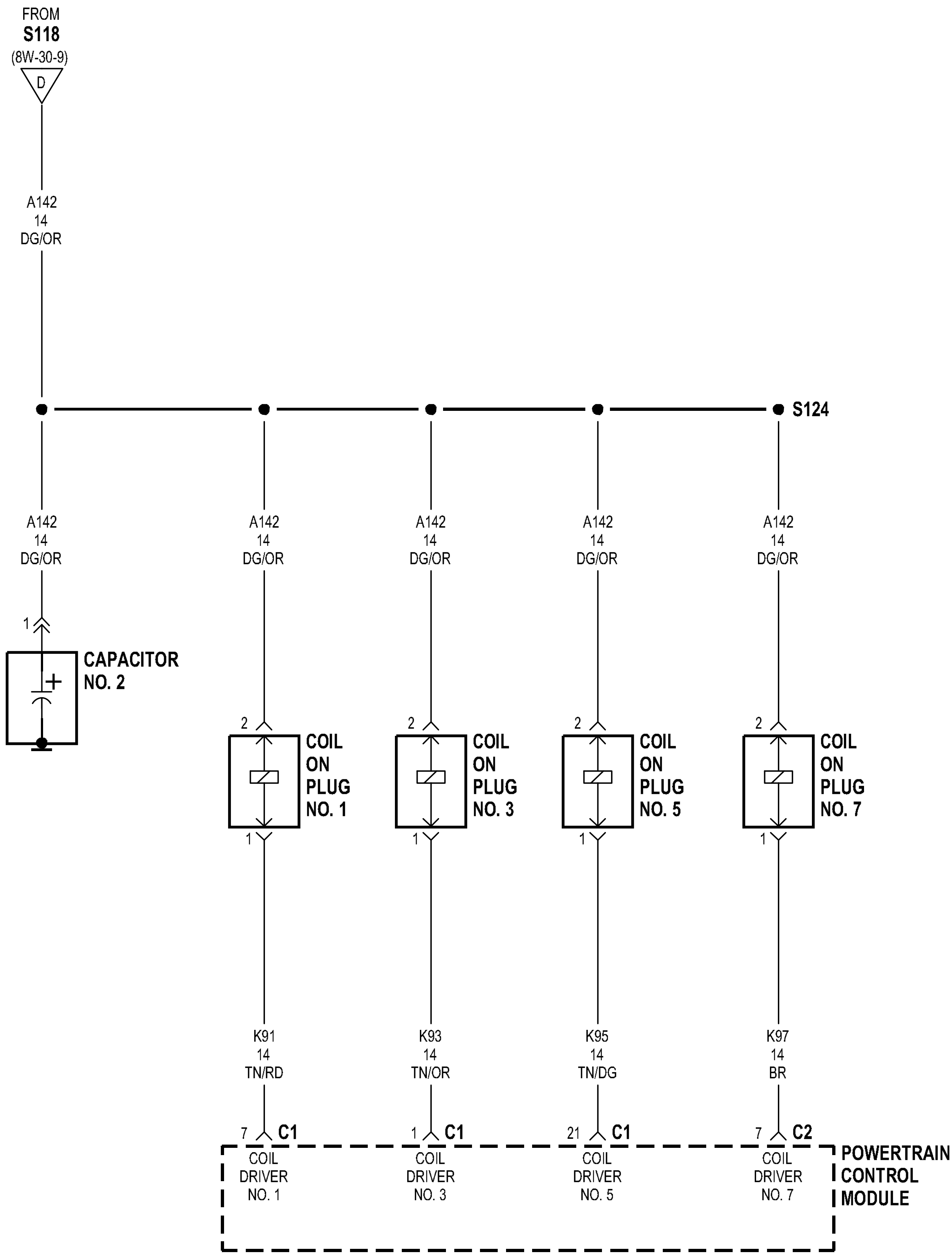

FROM
C102
(8W-30-5)
A
F42
18
DG/LG
S109
F42
18
DG/LG
FUEL
INJECTOR
NO. 1
FUEL
INJECTOR
NO. 2
FUEL
INJECTOR
NO. 3
FUEL
INJECTOR
NO. 4
FUEL
INJECTOR
NO. 5
FUEL
INJECTOR
NO. 6
K11
18
WT/DB
K12
18
TN
K13
18
YL/WT
K14
18
LB/BR
K38
18
GY
K58
18
BR/DB
4 C2
15 C2
5 C2
16 C2
6 C2
12 C2
FUEL INJECTOR NO. 1 DRIVER
FUEL INJECTOR NO. 2 DRIVER
FUEL INJECTOR NO. 3 DRIVER
FUEL INJECTOR NO. 4 DRIVER
FUEL INJECTOR NO. 5 DRIVER
FUEL INJECTOR NO. 6 DRIVER
POWERTRAIN
CONTROL
MODULE

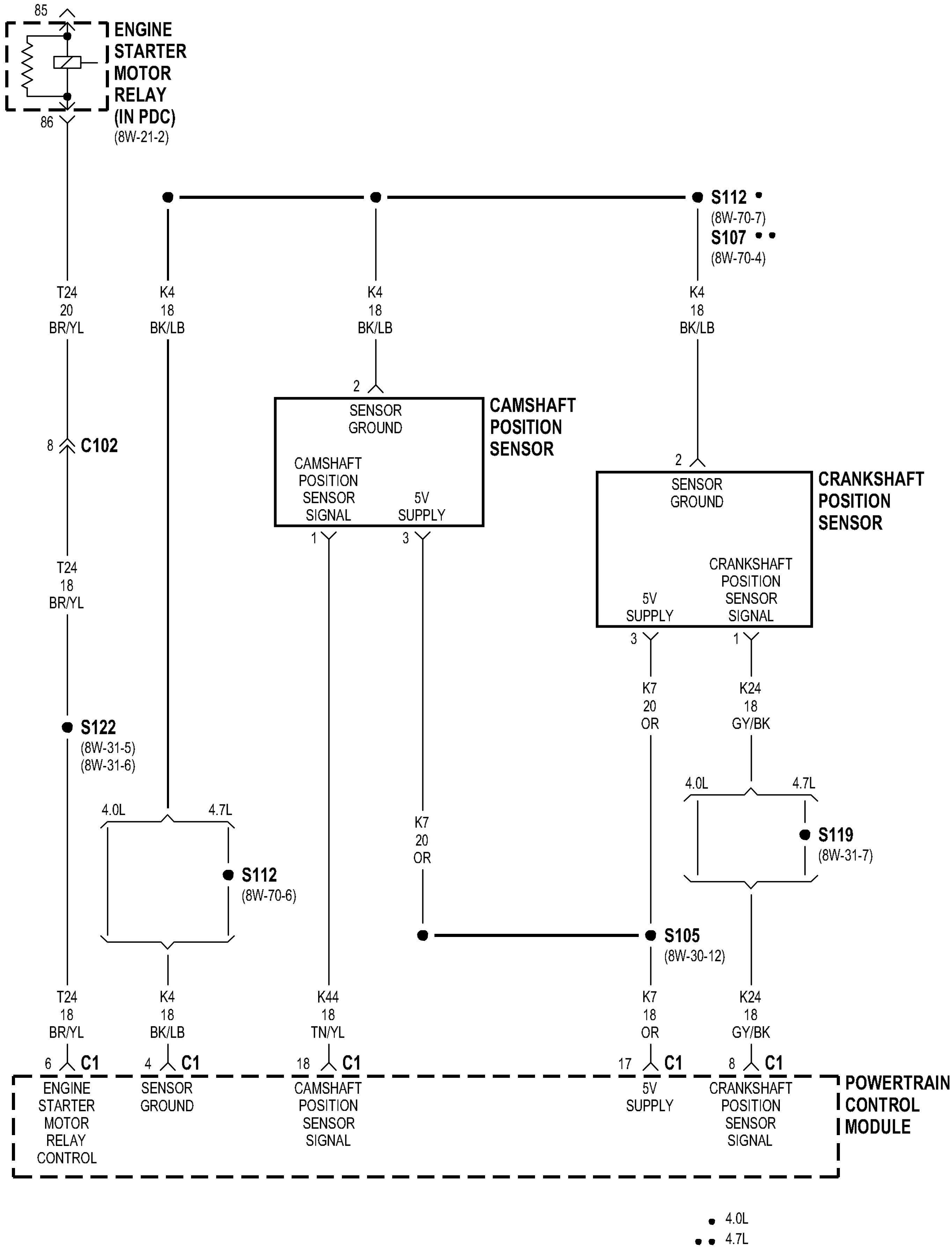


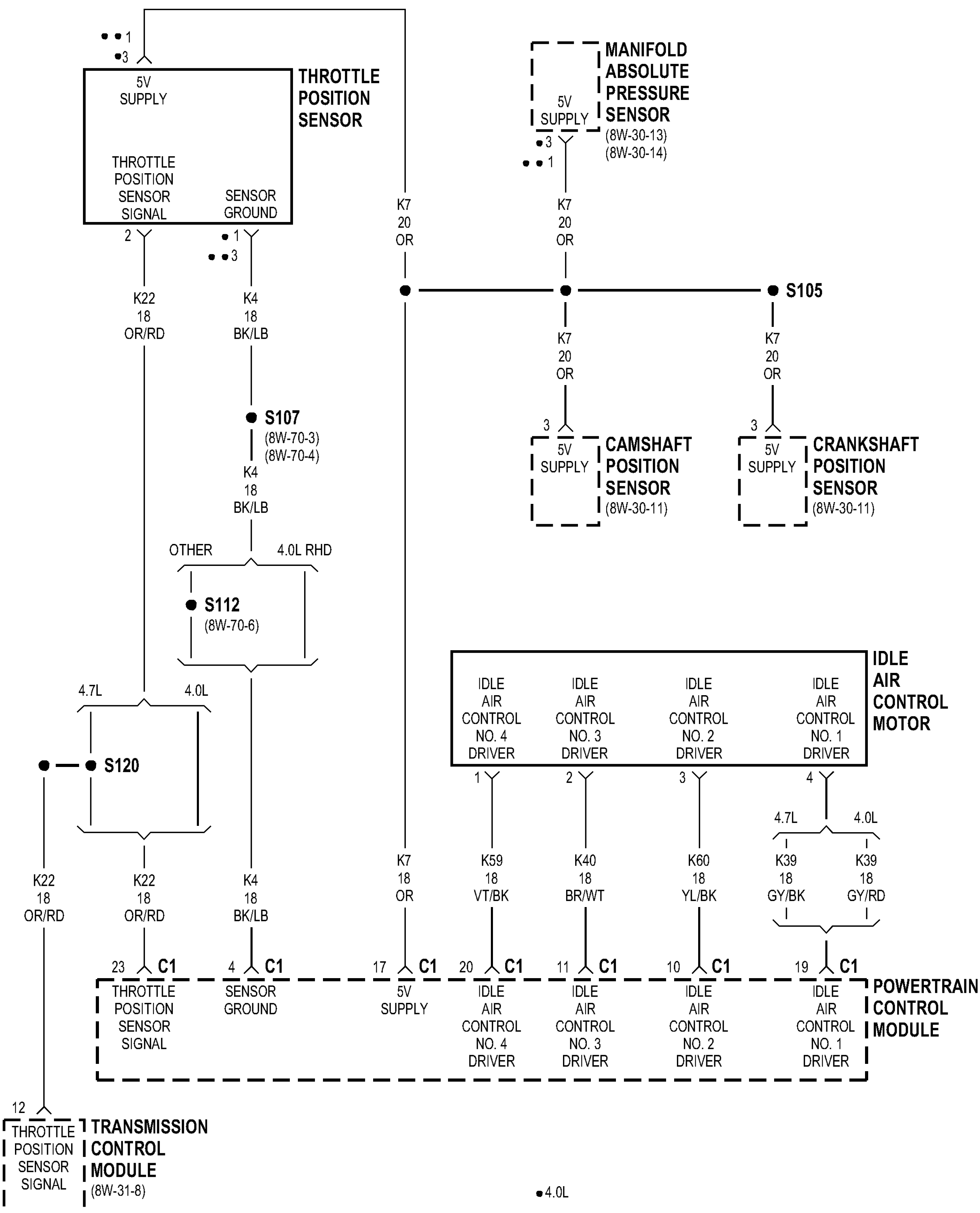
FROM
C102
(8W-30-5)
A
F42
18
DG/LG
S109
F42
18
DG/LG
F42
18
DG/LG
F42
18
DG/LG
F42
18
DG/LG
F42
18
DG/LG
2
1
FUEL
INJECTOR
NO. 2
2
1
FUEL
INJECTOR
NO. 6
C
TO
S121
(8W-30-8)
2
1
FUEL
INJECTOR
NO. 4
2
1
FUEL
INJECTOR
NO. 8
K12
18
TN
K14
18
LB/BR
K58
18
BR/DB
K18
18
DB/GY
15 C2
16 C2
12 C2
13 C2
FUEL
INJECTOR
NO. 2
DRIVER
FUEL
INJECTOR
NO. 4
DRIVER
FUEL
INJECTOR
NO. 6
DRIVER
FUEL
INJECTOR
NO. 8
DRIVER
POWERTRAIN
CONTROL
MODULE

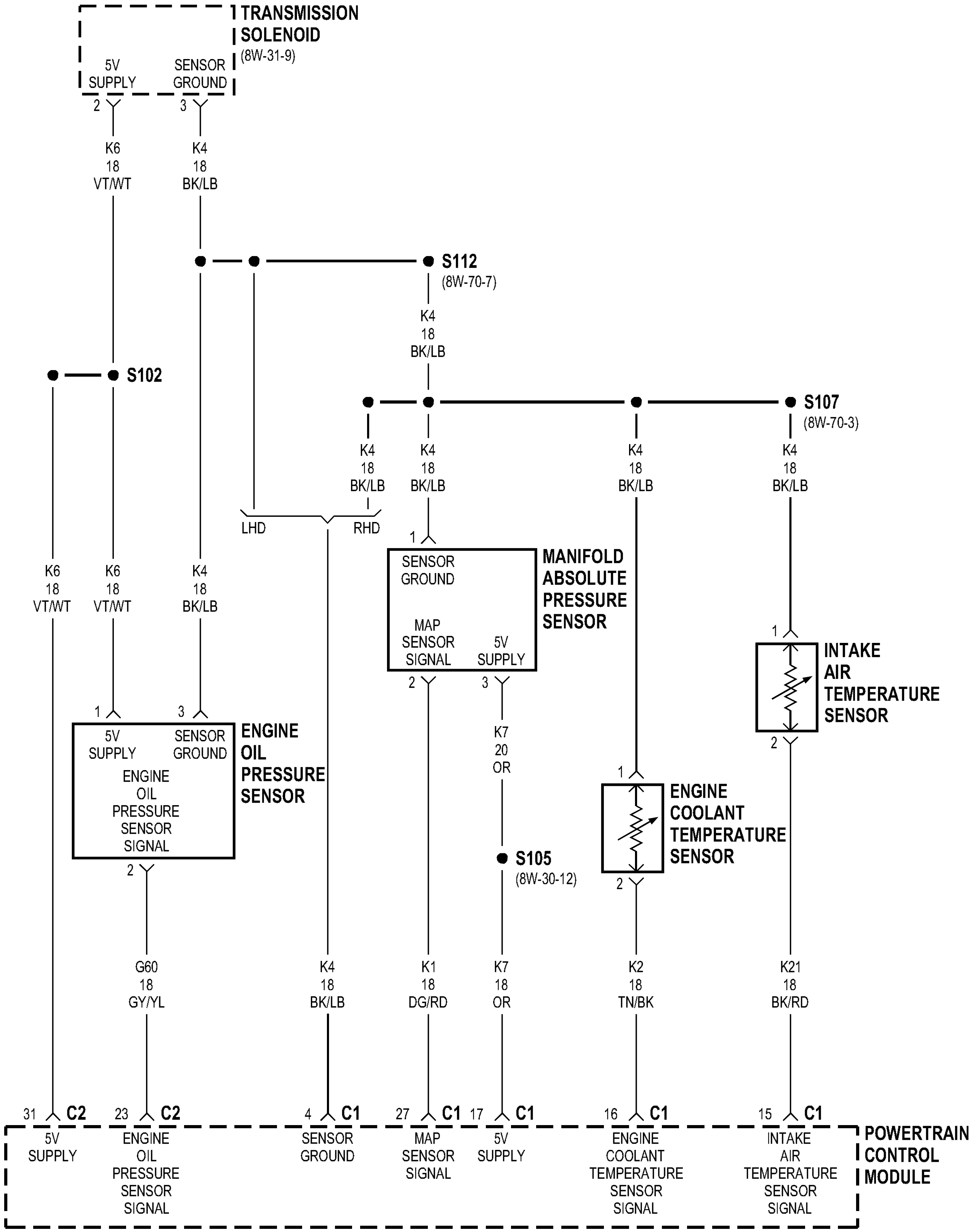

FROM
S109
(8W-30-7)
C
F42
18
DG/LG
S121
F42
18
DG/LG
F42
18
DG/LG
F42
18
DG/LG
F42
18
DG/LG
2
FUEL INJECTOR NO. 3
1
2
FUEL INJECTOR NO. 7
1
2
FUEL INJECTOR NO. 1
1
2
FUEL INJECTOR NO. 5
1
K11
18
WT/DB
K13
18
YL/WT
K38
18
GY
K17
18
DB/TN
4 C2
5 C2
6 C2
2 C2
FUEL INJECTOR NO. 1 DRIVER
FUEL INJECTOR NO. 3 DRIVER
FUEL INJECTOR NO. 5 DRIVER
FUEL INJECTOR NO. 7 DRIVER
POWERTRAIN CONTROL MODULE

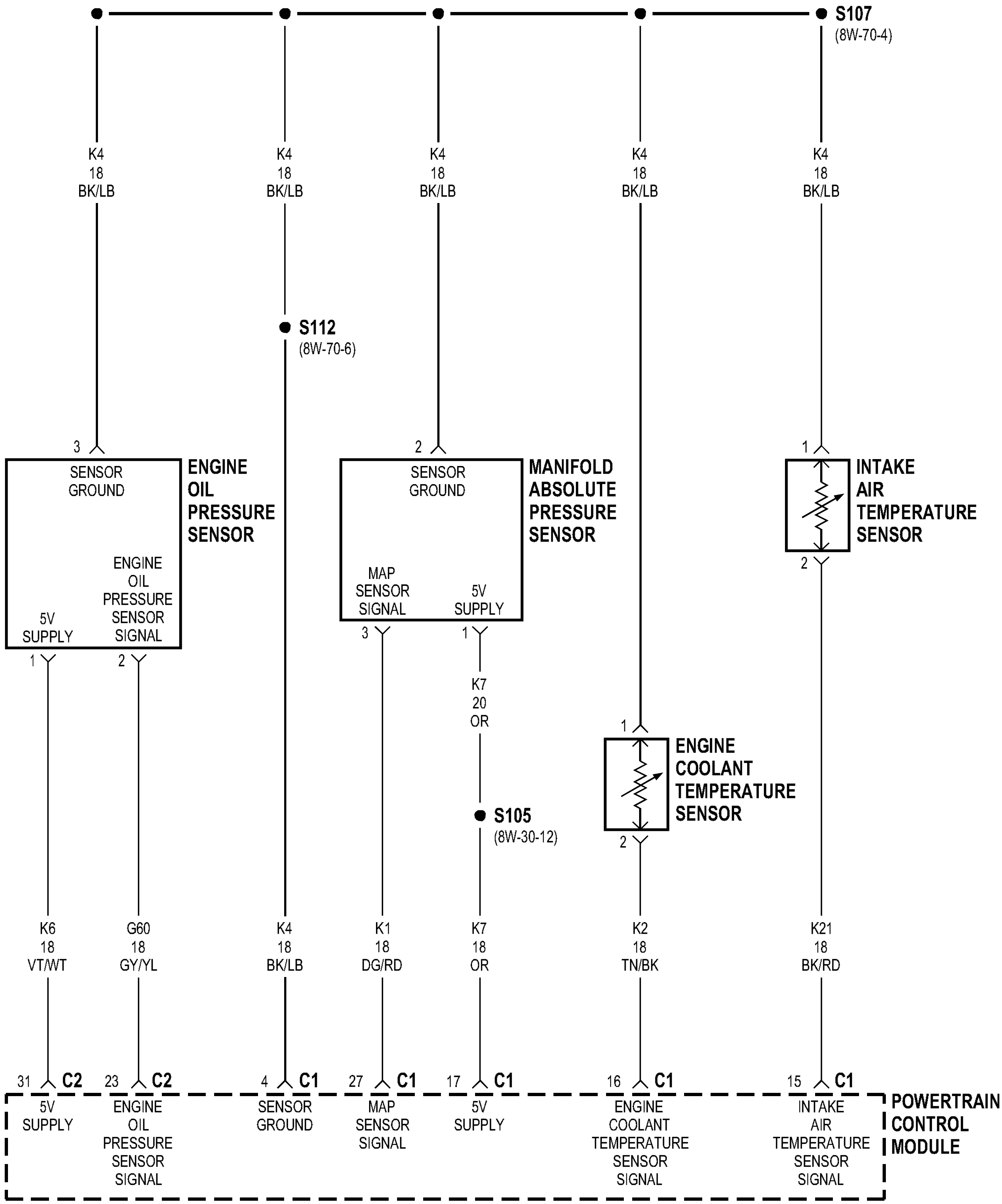

FROM
C102
(8W-30-5)
B
A142
14
DG/OR
S118
(8W-10-20)
A142
14
DG/OR
1
CAPACITOR
NO. 1
D
TO
S124
(8W-30-10)
2
1
COIL
ON
PLUG
NO. 2
COIL
ON
PLUG
NO. 4
COIL
ON
PLUG
NO. 6
COIL
ON
PLUG
NO. 8
K92
14
TN/PK
K94
14
TN/LG
K96
14
TN/LB
K98
14
LB/RD
9 C2
3 C1
5 C1
9 C1
COIL
DRIVER
NO. 2
COIL
DRIVER
NO. 4
COIL
DRIVER
NO. 6
COIL
DRIVER
NO. 8
POWERTRAIN
CONTROL
MODULE

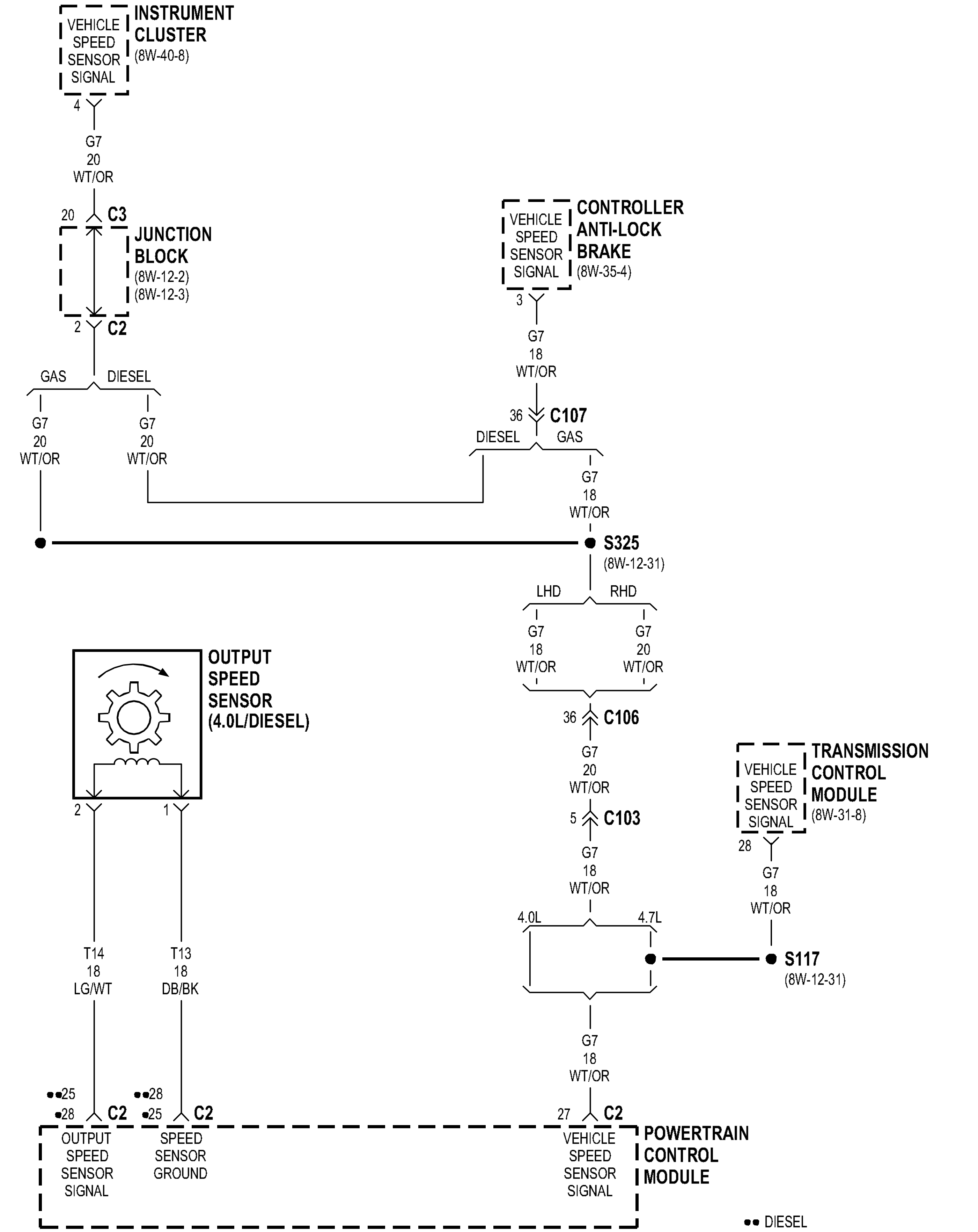

FROM
S118
(8W-30-9)
D
A142
14
DG/OR
S124
A142 14 DG/OR
1
CAPACITOR NO. 2
2
COIL ON PLUG NO. 1
COIL ON PLUG NO. 3
COIL ON PLUG NO. 5
COIL ON PLUG NO. 7
1
K91 14 TN/RD
K93 14 TN/OR
K95 14 TN/DG
K97 14 BR
7 C1
1 C1
21 C1
7 C2
COIL DRIVER NO. 1
COIL DRIVER NO. 3
COIL DRIVER NO. 5
COIL DRIVER NO. 7
POWERTRAIN CONTROL MODULE

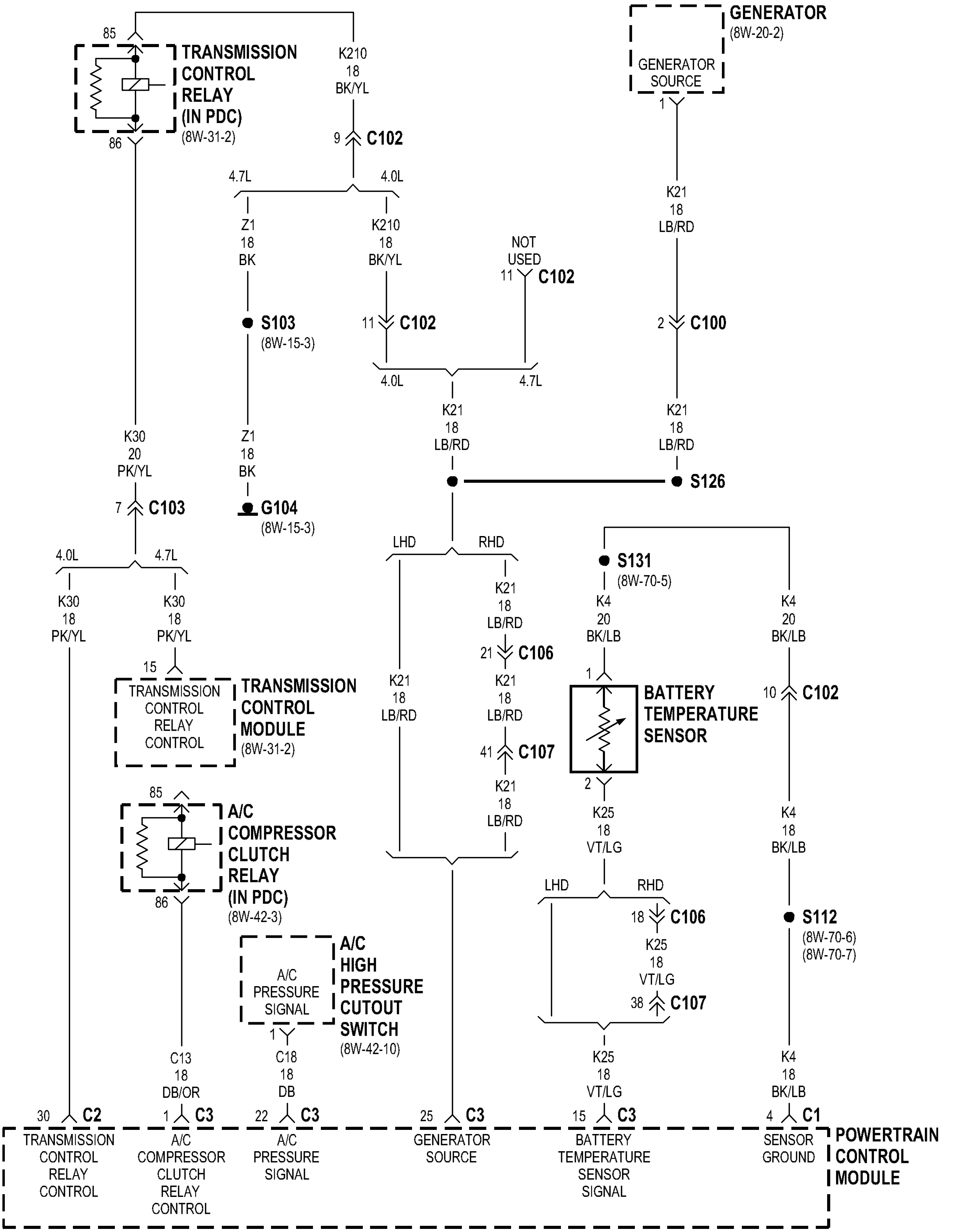

85
ENGINE STARTER MOTOR RELAY (IN PDC)
(8W-21-2)
86
S112 •
(8W-70-7)
S107 • •
(8W-70-4)
T24 20 BR/YL
K4 18 BK/LB
K4 18 BK/LB
K4 18 BK/LB
2
SENSOR GROUND
CAMSHAFT POSITION SENSOR SIGNAL
5V SUPPLY
CAMSHAFT POSITION SENSOR
1
3
8
C102
2
SENSOR GROUND
CRANKSHAFT POSITION SENSOR SIGNAL
5V SUPPLY
CRANKSHAFT POSITION SENSOR
3
1
T24 18 BR/YL
K7 20 OR
K24 18 GY/BK
S122
(8W-31-5)
(8W-31-6)
4.0L
4.7L
S112
(8W-70-6)
K7 20 OR
4.0L
4.7L
S119
(8W-31-7)
S105
(8W-30-12)
T24 18 BR/YL
K4 18 BK/LB
K44 18 TN/YL
K7 18 OR
K24 18 GY/BK
6 C1
4 C1
18 C1
17 C1
8 C1
ENGINE STARTER MOTOR RELAY CONTROL
SENSOR GROUND
CAMSHAFT POSITION SENSOR SIGNAL
5V SUPPLY
CRANKSHAFT POSITION SENSOR SIGNAL
POWERTRAIN CONTROL MODULE
• 4.0L
• • 4.7L

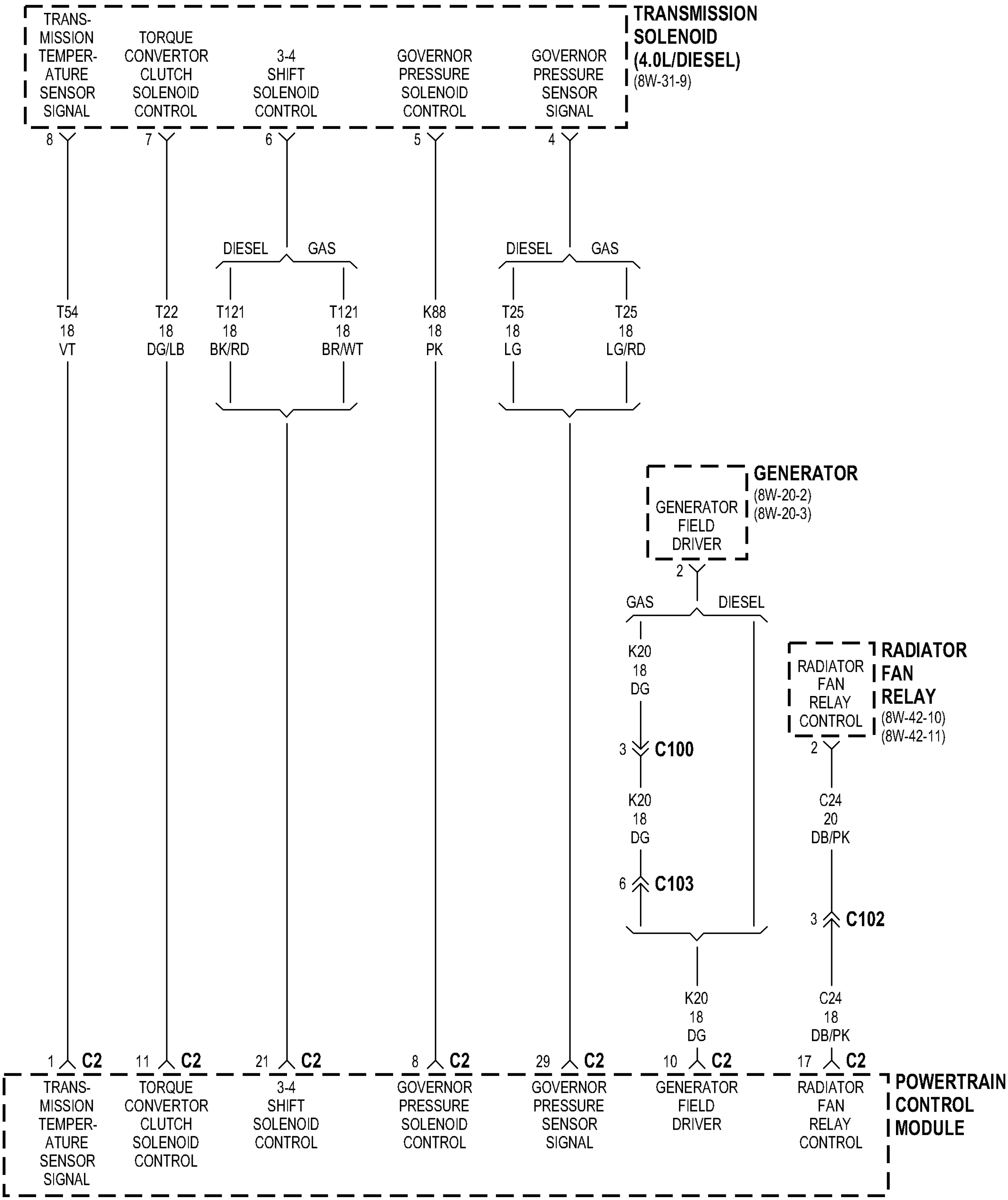

THROTTLE POSITION SENSOR
5V SUPPLY
THROTTLE POSITION SENSOR SIGNAL
SENSOR GROUND
MANIFOLD ABSOLUTE PRESSURE SENSOR
(8W-30-13)
(8W-30-14)
K7 20 OR
S105
K22 18 OR/RD
K4 18 BK/LB
S107
(8W-70-3)
(8W-70-4)
OTHER
4.0L RHD
S112
(8W-70-6)
CAMSHAFT POSITION SENSOR
(8W-30-11)
CRANKSHAFT POSITION SENSOR
(8W-30-11)
4.7L
4.0L
S120
IDLE AIR CONTROL MOTOR
IDLE AIR CONTROL NO. 4 DRIVER
IDLE AIR CONTROL NO. 3 DRIVER
IDLE AIR CONTROL NO. 2 DRIVER
IDLE AIR CONTROL NO. 1 DRIVER
K7 18 OR
K59 18 VT/BK
K40 18 BR/WT
K60 18 YL/BK
K39 18 GY/BK
K39 18 GY/RD
C1
POWERTRAIN CONTROL MODULE
TRANSMISSION CONTROL MODULE
(8W-31-8)
●4.0L
●●4.7L


TRANSMISSION SOLENOID
(8W-31-9)
5V SUPPLY
SENSOR GROUND
2
3
K6
18
VT/WT
K4
18
BK/LB
S112
(8W-70-7)
K4
18
BK/LB
S102
S107
(8W-70-3)
LHD
RHD
1
SENSOR GROUND
MAP SENSOR SIGNAL
5V SUPPLY
MANIFOLD ABSOLUTE PRESSURE SENSOR
2
3
K7
20
OR
S105
(8W-30-12)
INTAKE AIR TEMPERATURE SENSOR
ENGINE COOLANT TEMPERATURE SENSOR
5V SUPPLY
SENSOR GROUND
ENGINE OIL PRESSURE SENSOR SIGNAL
ENGINE OIL PRESSURE SENSOR
G60
18
GY/YL
K4
18
BK/LB
K1
18
DG/RD
K7
18
OR
K2
18
TN/BK
K21
18
BK/RD
31 C2
23 C2
4 C1
27 C1
17 C1
16 C1
15 C1
5V SUPPLY
ENGINE OIL PRESSURE SENSOR SIGNAL
SENSOR GROUND
MAP SENSOR SIGNAL
5V SUPPLY
ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
INTAKE AIR TEMPERATURE SENSOR SIGNAL
POWERTRAIN CONTROL MODULE

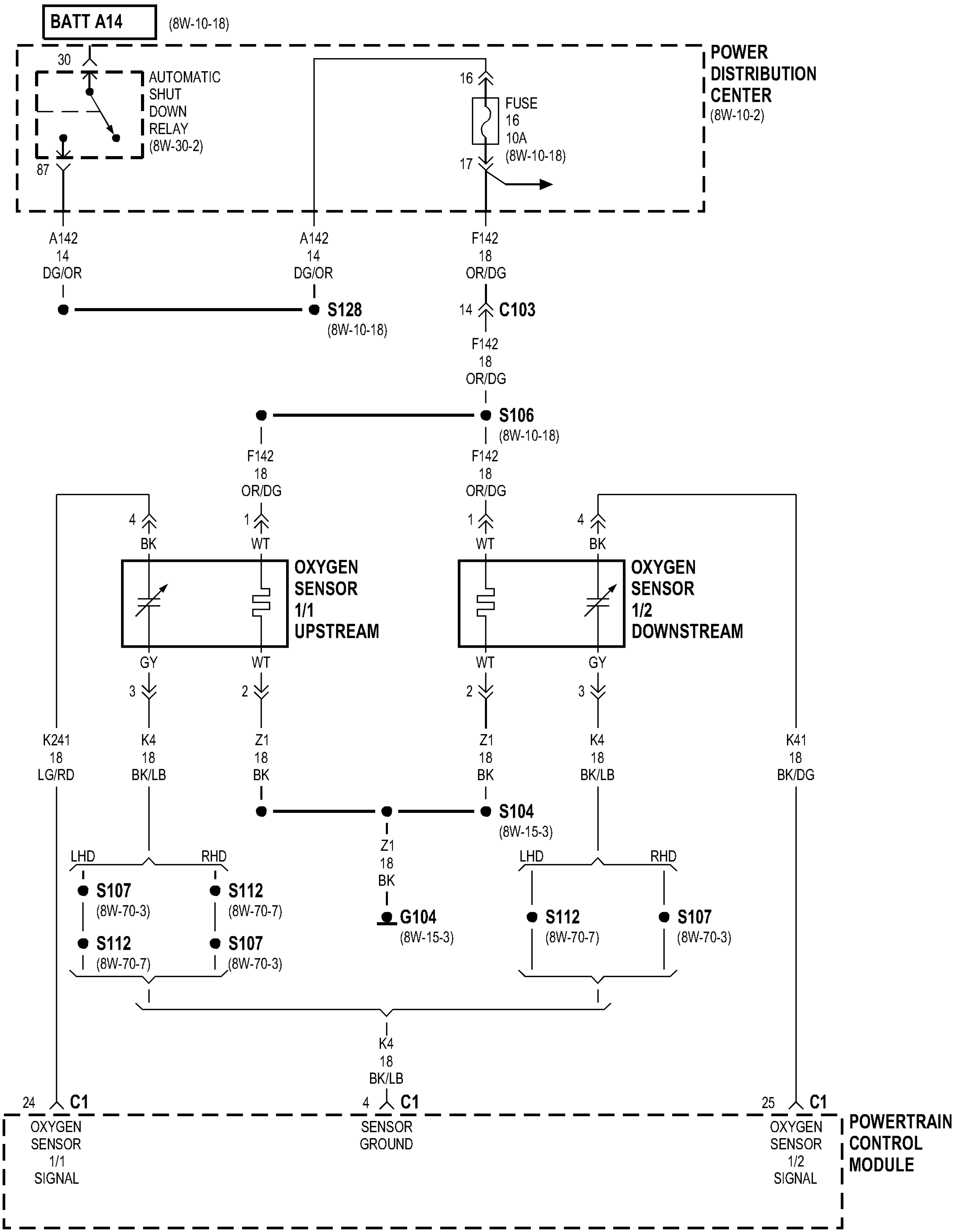

S107
(8W-70-4)
K4
18
BK/LB
S112
(8W-70-6)
ENGINE
OIL
PRESSURE
SENSOR
SENSOR
GROUND
5V
SUPPLY
ENGINE
OIL
PRESSURE
SENSOR
SIGNAL
MANIFOLD
ABSOLUTE
PRESSURE
SENSOR
MAP
SENSOR
SIGNAL
INTAKE
AIR
TEMPERATURE
SENSOR
K7
20
OR
S105
(8W-30-12)
ENGINE
COOLANT
TEMPERATURE
SENSOR
K6
18
VT/WT
G60
18
GY/YL
K1
18
DG/RD
K7
18
OR
K2
18
TN/BK
K21
18
BK/RD
31 C2
23 C2
4 C1
27 C1
17 C1
16 C1
15 C1
ENGINE
COOLANT
TEMPERATURE
SENSOR
SIGNAL
INTAKE
AIR
TEMPERATURE
SENSOR
SIGNAL
POWERTRAIN
CONTROL
MODULE

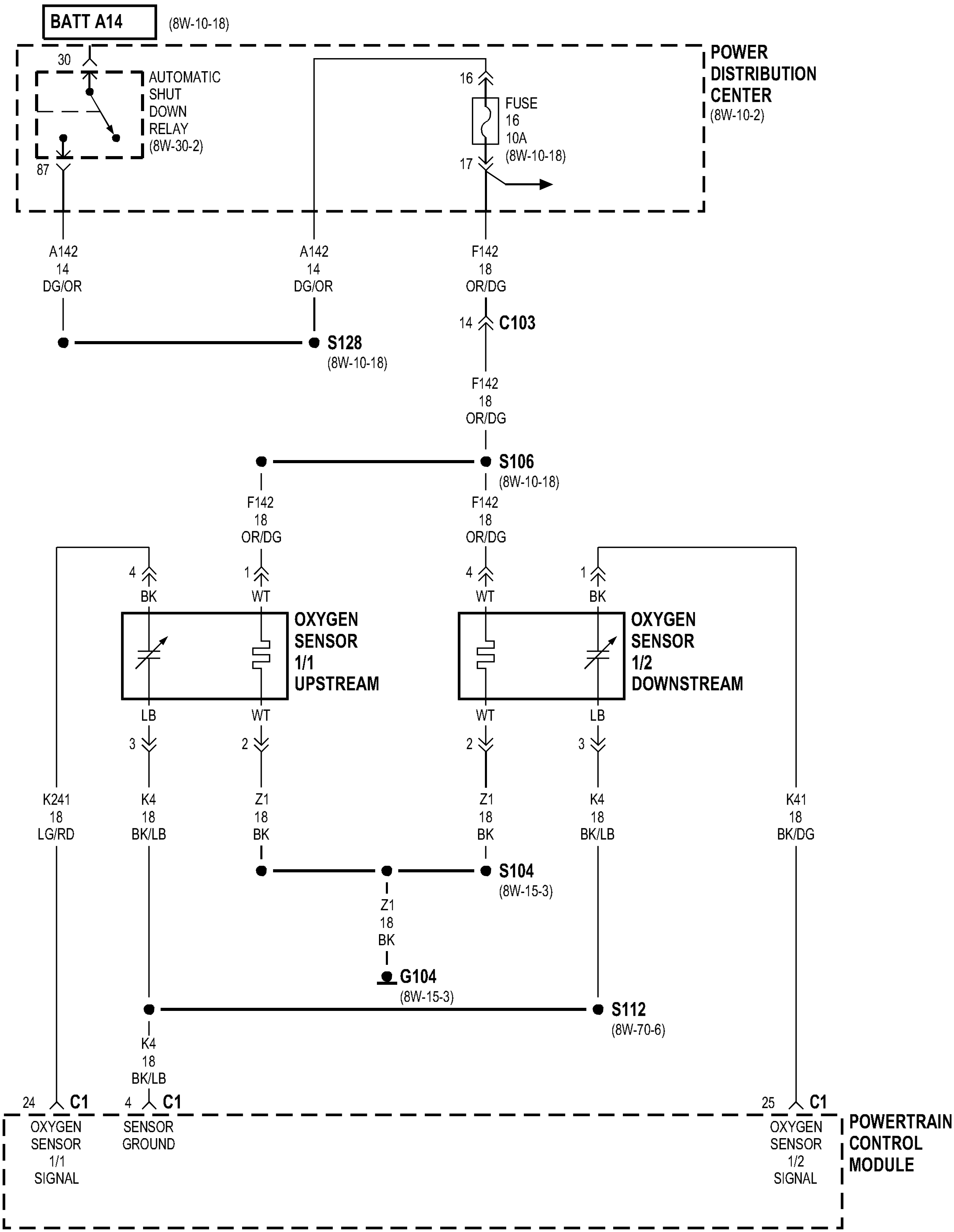

VEHICLE SPEED SENSOR SIGNAL
INSTRUMENT CLUSTER
(8W-40-8)
4
G7
20
WT/OR
20
C3
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
2
C2
GAS
DIESEL
G7
20
WT/OR
G7
20
WT/OR
VEHICLE SPEED SENSOR SIGNAL
CONTROLLER ANTI-LOCK BRAKE
(8W-35-4)
3
G7
18
WT/OR
36
C107
DIESEL
GAS
G7
18
WT/OR
S325
(8W-12-31)
LHD
RHD
G7
18
WT/OR
G7
20
WT/OR
36
C106
G7
20
WT/OR
5
C103
G7
18
WT/OR
4.0L
4.7L
OUTPUT SPEED SENSOR (4.0L/DIESEL)
2
1
T14
18
LG/WT
T13
18
DB/BK
VEHICLE SPEED SENSOR SIGNAL
TRANSMISSION CONTROL MODULE
(8W-31-8)
28
G7
18
WT/OR
S117
(8W-12-31)
G7
18
WT/OR
••25
•28
C2
••28
•25
C2
27
C2
OUTPUT SPEED SENSOR SIGNAL
SPEED SENSOR GROUND
VEHICLE SPEED SENSOR SIGNAL
POWERTRAIN CONTROL MODULE
•• DIESEL
• 4.0L

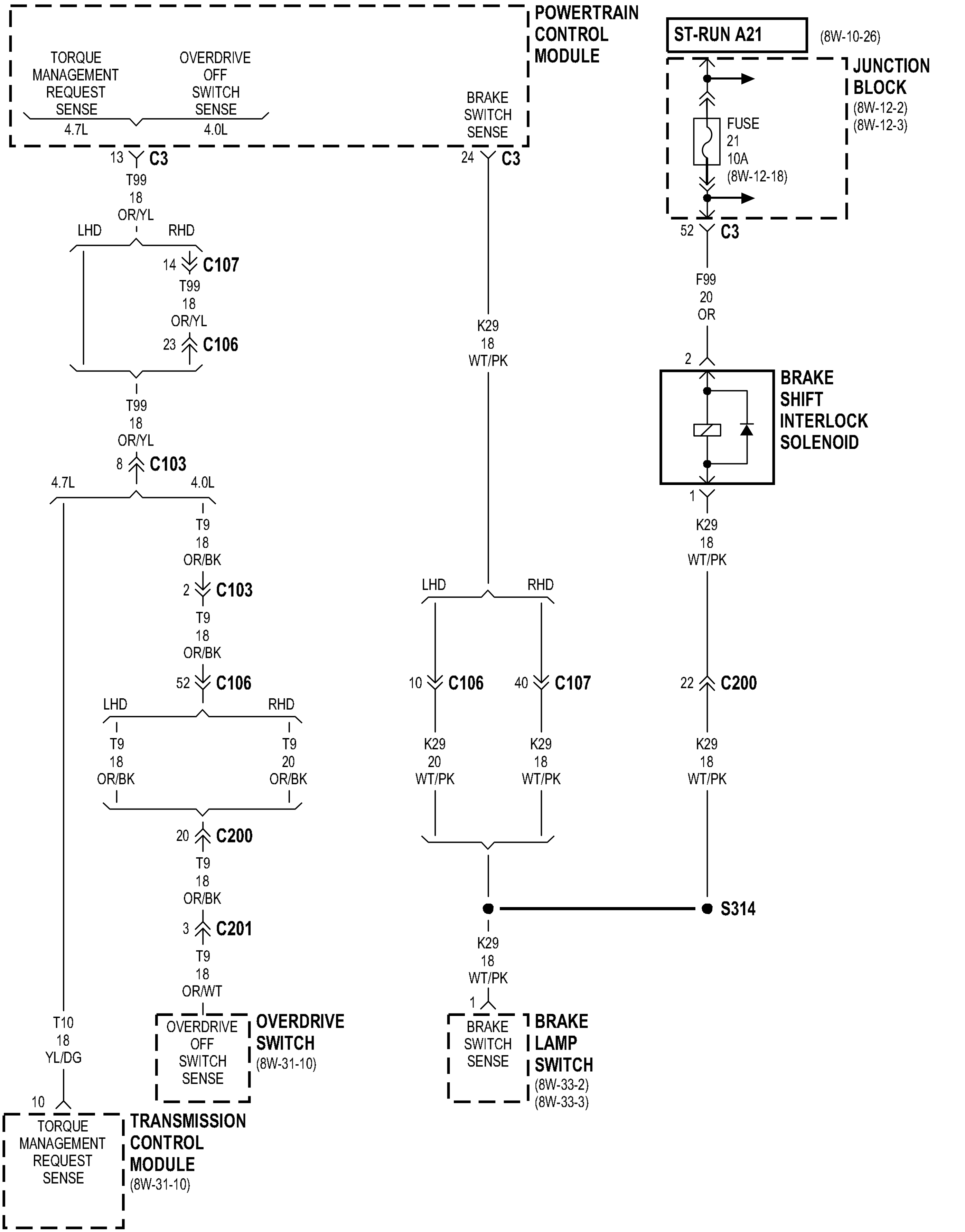

TRANSMISSION CONTROL RELAY (IN PDC)
(8W-31-2)
85
86
K210
18
BK/YL
9 C102
4.7L
4.0L
Z1
18
BK
S103
(8W-15-3)
G104
(8W-15-3)
K210
18
BK/YL
11 C102
NOT USED
11 C102
GENERATOR
(8W-20-2)
GENERATOR SOURCE
1
K21
18
LB/RD
2 C100
K21
18
LB/RD
S126
K30
20
PK/YL
7 C103
4.0L
4.7L
K30
18
PK/YL
15
TRANSMISSION CONTROL RELAY CONTROL
TRANSMISSION CONTROL MODULE
(8W-31-2)
LHD
RHD
21 C106
41 C107
S131
(8W-70-5)
K4
20
BK/LB
1
BATTERY TEMPERATURE SENSOR
2
K25
18
VT/LG
10 C102
S112
(8W-70-6)
(8W-70-7)
18 C106
38 C107
A/C COMPRESSOR CLUTCH RELAY (IN PDC)
(8W-42-3)
A/C PRESSURE SIGNAL
A/C HIGH PRESSURE CUTOUT SWITCH
(8W-42-10)
C13
18
DB/OR
C18
18
DB
30 C2
1 C3
22 C3
25 C3
15 C3
4 C1
TRANSMISSION CONTROL RELAY CONTROL
A/C COMPRESSOR CLUTCH RELAY CONTROL
A/C PRESSURE SIGNAL
GENERATOR SOURCE
BATTERY TEMPERATURE SENSOR SIGNAL
SENSOR GROUND
POWERTRAIN CONTROL MODULE

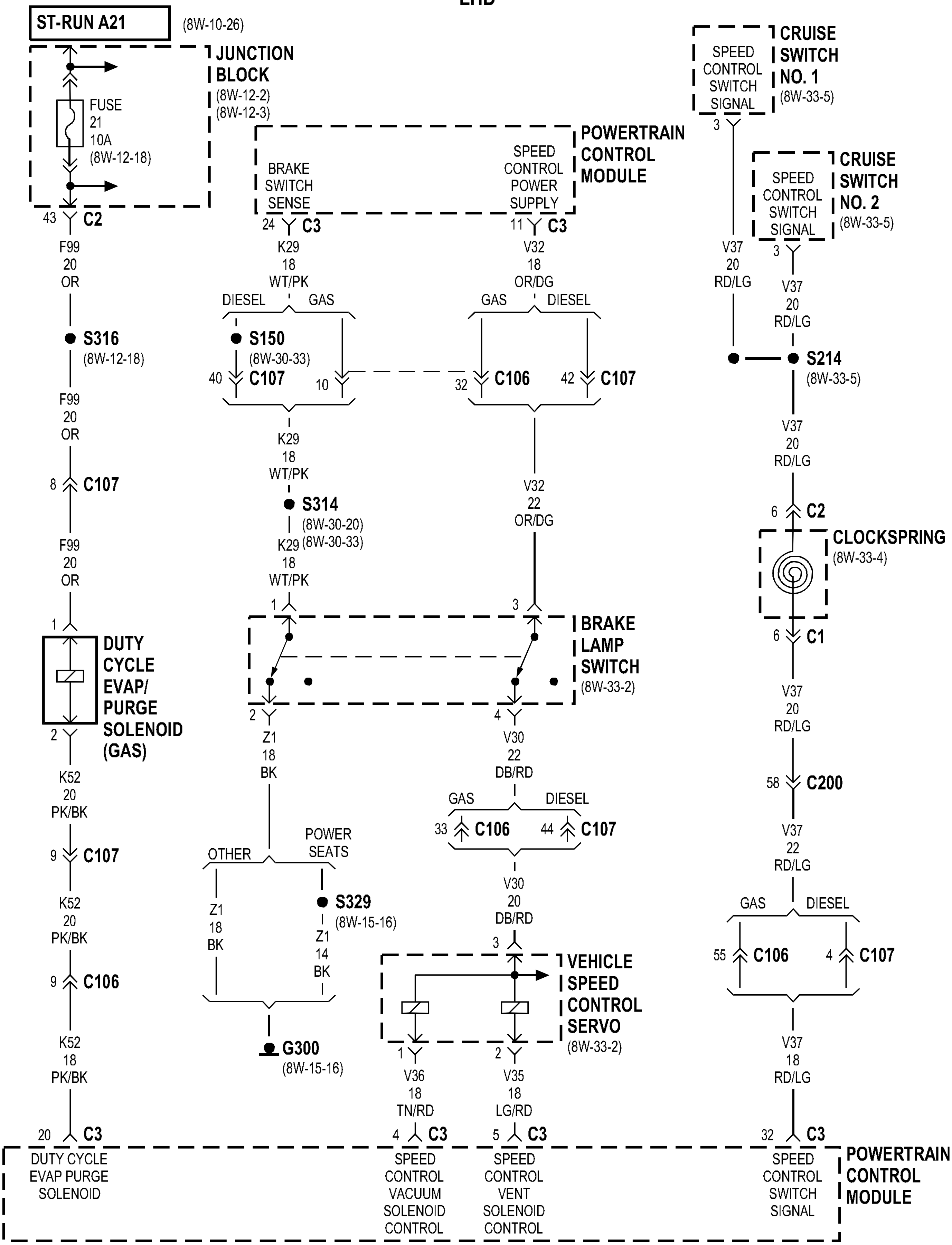


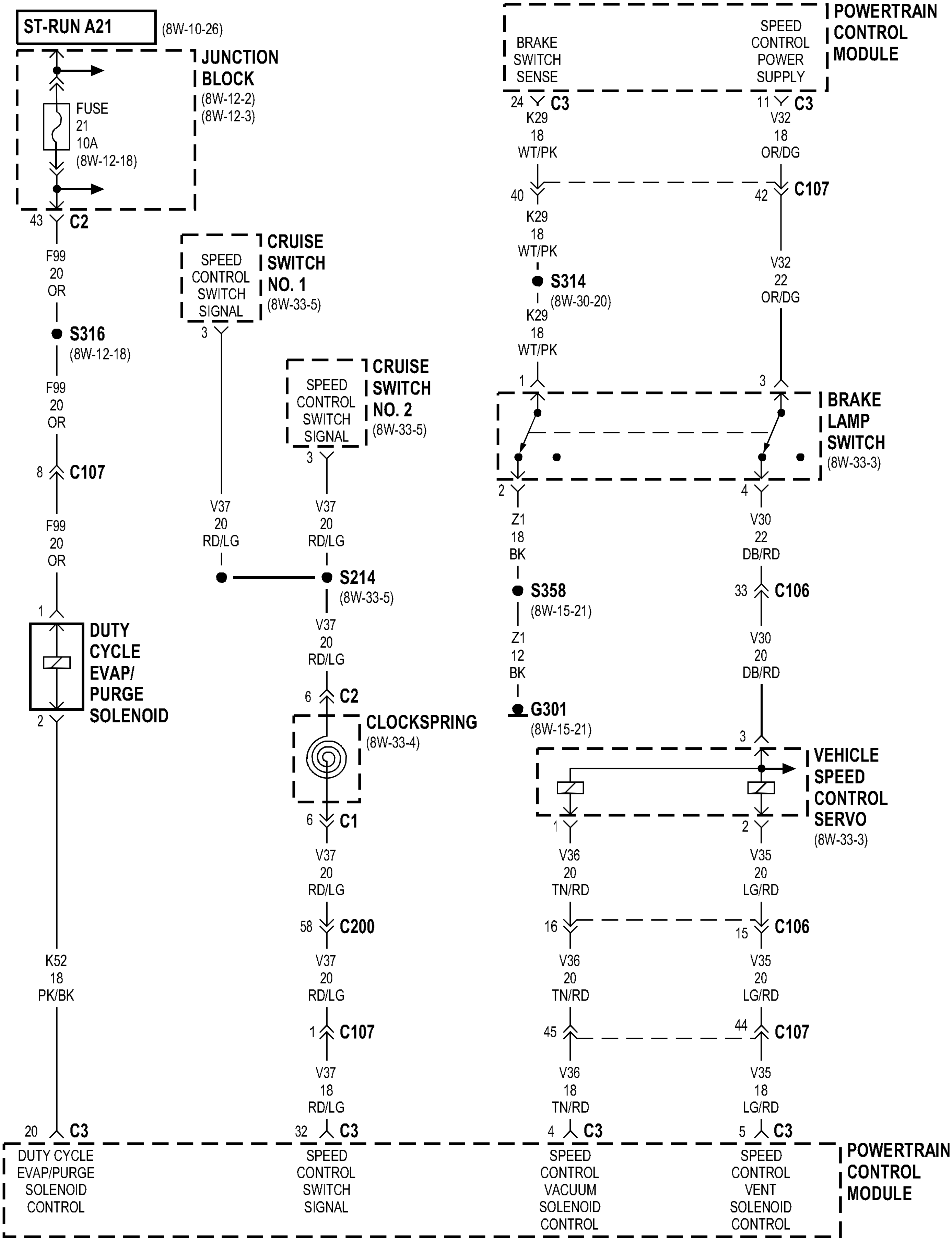
TRANSMISSION SOLENOID (4.0L/DIESEL)
(8W-31-9)
TRANS-MISSION TEMPER-ATURE SENSOR SIGNAL
TORQUE CONVERTOR CLUTCH SOLENOID CONTROL
3-4 SHIFT SOLENOID CONTROL
GOVERNOR PRESSURE SOLENOID CONTROL
GOVERNOR PRESSURE SENSOR SIGNAL
8
7
6
5
4
DIESEL
GAS
DIESEL
GAS
T54 18 VT
T22 18 DG/LB
T121 18 BK/RD
T121 18 BR/WT
K88 18 PK
T25 18 LG
T25 18 LG/RD
GENERATOR
(8W-20-2)
(8W-20-3)
GENERATOR FIELD DRIVER
2
GAS
DIESEL
K20 18 DG
3 C100
K20 18 DG
6 C103
K20 18 DG
RADIATOR FAN RELAY
(8W-42-10)
(8W-42-11)
RADIATOR FAN RELAY CONTROL
2
C24 20 DB/PK
3 C102
C24 18 DB/PK
1 C2
11 C2
21 C2
8 C2
29 C2
10 C2
17 C2
POWERTRAIN CONTROL MODULE
TRANS-MISSION TEMPER-ATURE SENSOR SIGNAL
TORQUE CONVERTOR CLUTCH SOLENOID CONTROL
3-4 SHIFT SOLENOID CONTROL
GOVERNOR PRESSURE SOLENOID CONTROL
GOVERNOR PRESSURE SENSOR SIGNAL
GENERATOR FIELD DRIVER
RADIATOR FAN RELAY CONTROL

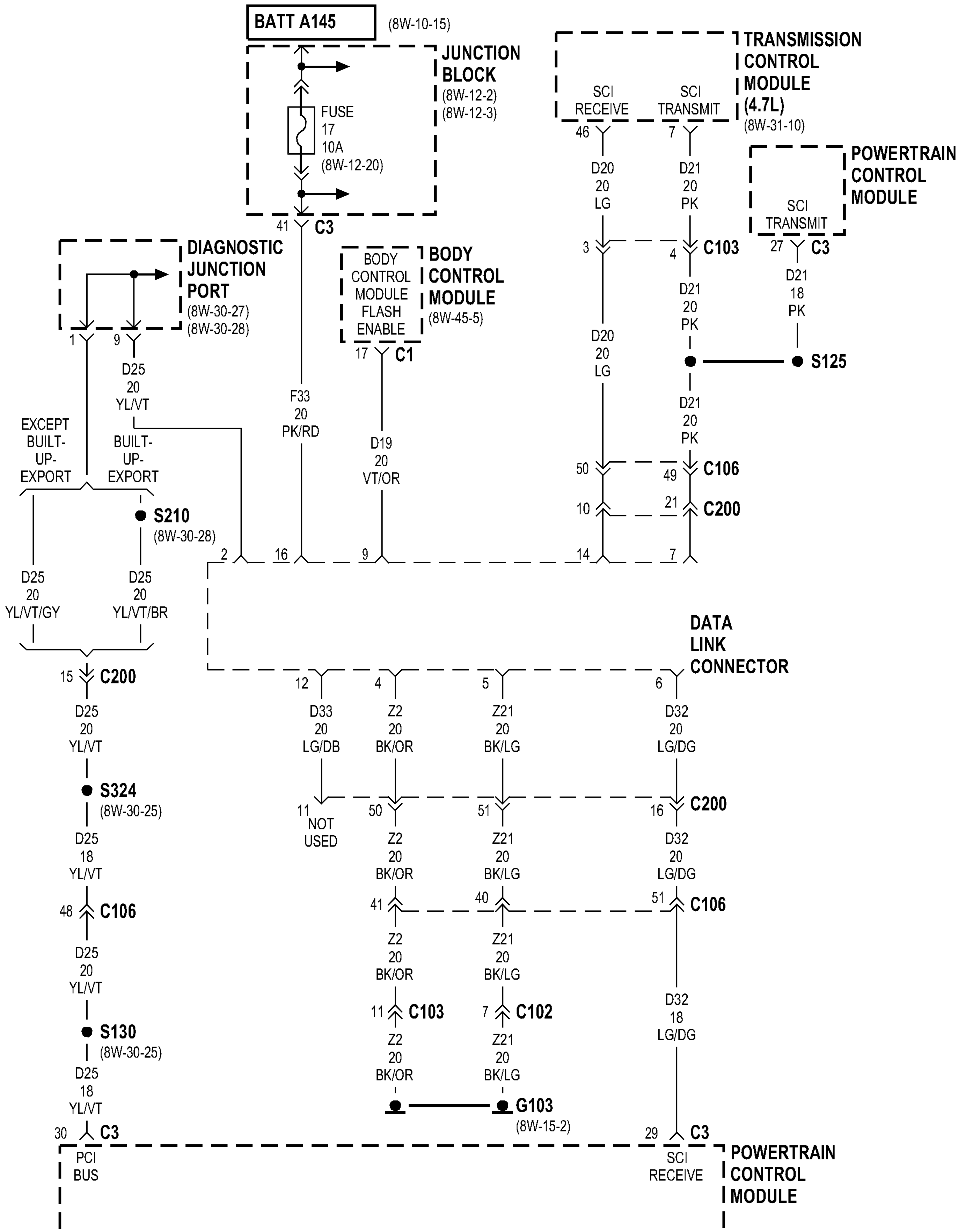

BATT A14
(8W-10-18)
30
AUTOMATIC
SHUT
DOWN
RELAY
(8W-30-2)
87
16
FUSE
16
10A
(8W-10-18)
17
POWER
DISTRIBUTION
CENTER
(8W-10-2)
A142
14
DG/OR
A142
14
DG/OR
F142
18
OR/DG
S128
(8W-10-18)
14
C103
F142
18
OR/DG
S106
(8W-10-18)
F142
18
OR/DG
F142
18
OR/DG
4
BK
1
WT
1
WT
4
BK
OXYGEN
SENSOR
1/1
UPSTREAM
OXYGEN
SENSOR
1/2
DOWNSTREAM
GY
WT
WT
GY
3
2
2
3
K241
18
LG/RD
K4
18
BK/LB
Z1
18
BK
Z1
18
BK
K4
18
BK/LB
K41
18
BK/DG
S104
(8W-15-3)
LHD
RHD
S107
(8W-70-3)
S112
(8W-70-7)
S112
(8W-70-7)
S107
(8W-70-3)
Z1
18
BK
G104
(8W-15-3)
LHD
RHD
S112
(8W-70-7)
S107
(8W-70-3)
K4
18
BK/LB
24
C1
4
C1
25
C1
OXYGEN
SENSOR
1/1
SIGNAL
SENSOR
GROUND
OXYGEN
SENSOR
1/2
SIGNAL
POWERTRAIN
CONTROL
MODULE

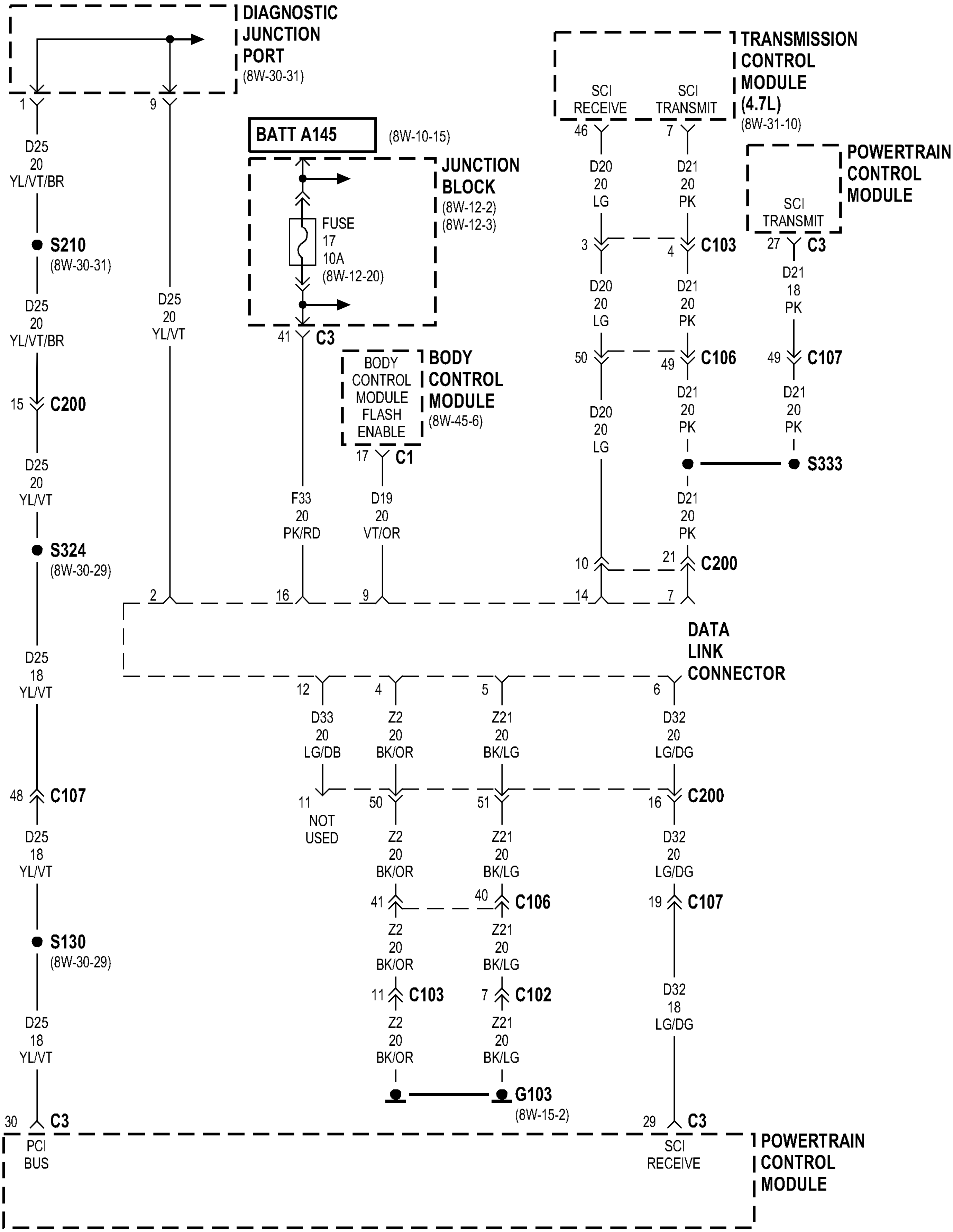

BATT A14
(8W-10-18)
POWER DISTRIBUTION CENTER
(8W-10-2)
30
AUTOMATIC SHUT DOWN RELAY
(8W-30-2)
87
16
FUSE 16 10A
(8W-10-18)
17
A142 14 DG/OR
A142 14 DG/OR
F142 18 OR/DG
14
C103
S128
(8W-10-18)
F142 18 OR/DG
S106
(8W-10-18)
F142 18 OR/DG
F142 18 OR/DG
4
BK
1
WT
4
WT
1
BK
OXYGEN SENSOR 1/1 UPSTREAM
OXYGEN SENSOR 1/2 DOWNSTREAM
LB
WT
WT
LB
3
2
2
3
K241 18 LG/RD
K4 18 BK/LB
Z1 18 BK
Z1 18 BK
K4 18 BK/LB
K41 18 BK/DG
S104
(8W-15-3)
Z1 18 BK
G104
(8W-15-3)
S112
(8W-70-6)
K4 18 BK/LB
24 C1
4 C1
25 C1
OXYGEN SENSOR 1/1 SIGNAL
SENSOR GROUND
OXYGEN SENSOR 1/2 SIGNAL
POWERTRAIN CONTROL MODULE

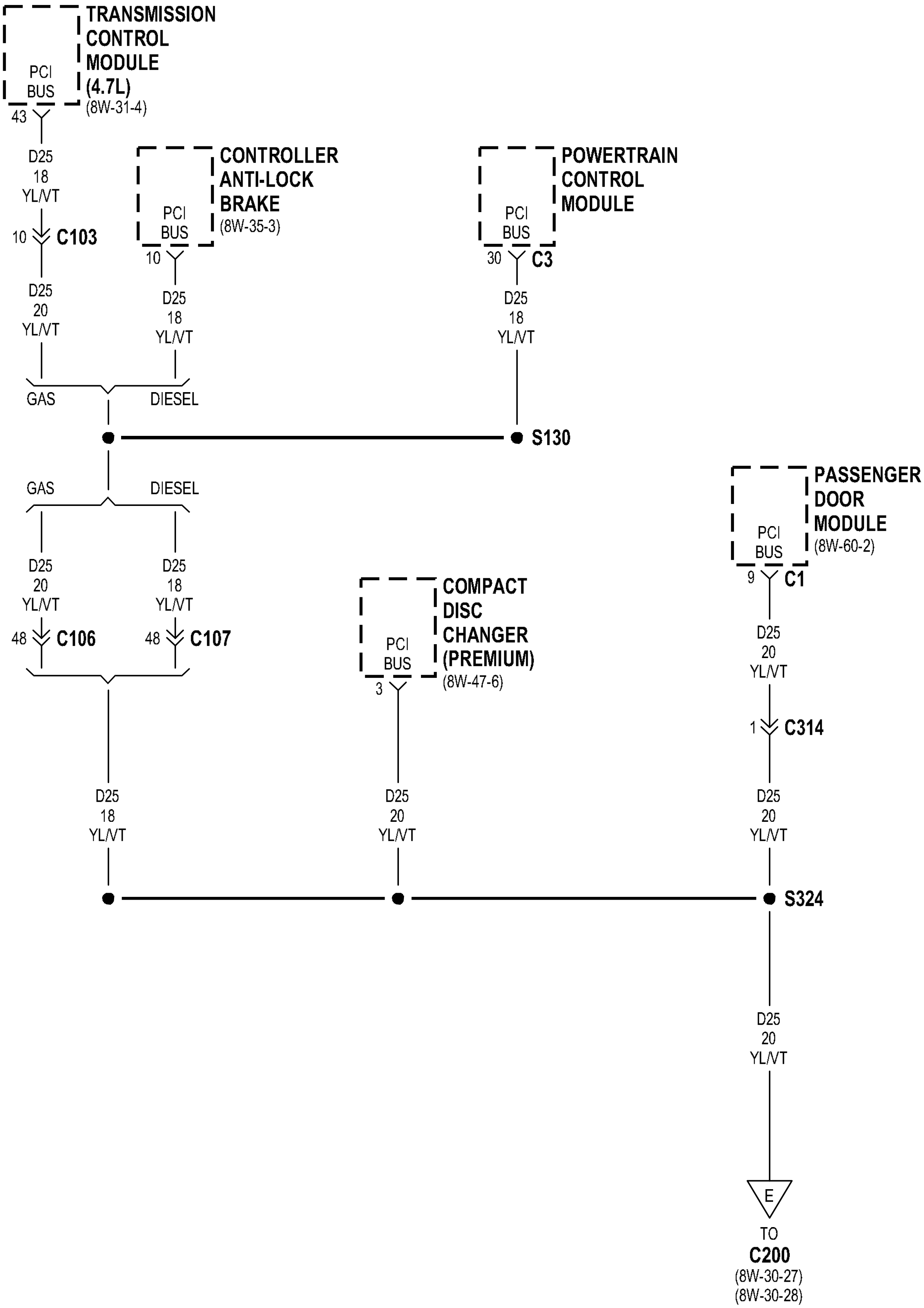

POWERTRAIN CONTROL MODULE
TORQUE MANAGEMENT REQUEST SENSE
4.7L
OVERDRIVE OFF SWITCH SENSE
4.0L
BRAKE SWITCH SENSE
13 C3
24 C3
T99 18 OR/YL
LHD
RHD
14 C107
T99 18 OR/YL
23 C106
T99 18 OR/YL
8 C103
4.7L
4.0L
T9 18 OR/BK
2 C103
T9 18 OR/BK
52 C106
LHD
RHD
T9 18 OR/BK
T9 20 OR/BK
20 C200
T9 18 OR/BK
3 C201
T9 18 OR/WT
OVERDRIVE OFF SWITCH SENSE
OVERDRIVE SWITCH
(8W-31-10)
T10 18 YL/DG
10
TORQUE MANAGEMENT REQUEST SENSE
TRANSMISSION CONTROL MODULE
(8W-31-10)
K29 18 WT/PK
LHD
RHD
10 C106
40 C107
K29 20 WT/PK
K29 18 WT/PK
K29 18 WT/PK
1
BRAKE SWITCH SENSE
BRAKE LAMP SWITCH
(8W-33-2)
(8W-33-3)
ST-RUN A21
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 21 10A (8W-12-18)
52 C3
F99 20 OR
2
BRAKE SHIFT INTERLOCK SOLENOID
1
K29 18 WT/PK
22 C200
K29 18 WT/PK
S314

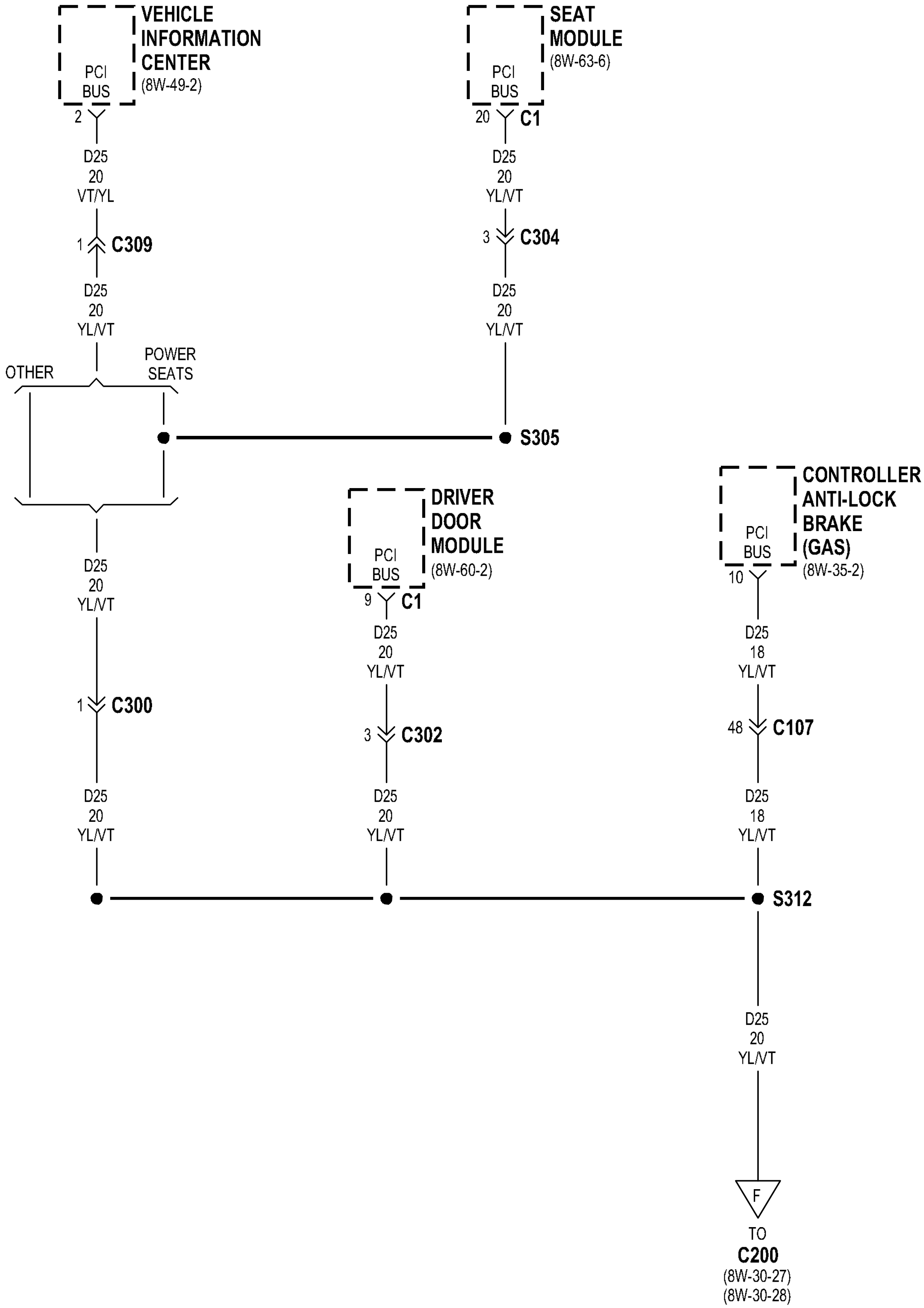

ST-RUN A21
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 21 10A
(8W-12-18)
43 C2
F99 20 OR
S316
(8W-12-18)
F99 20 OR
8 C107
F99 20 OR
1
DUTY CYCLE EVAP/ PURGE SOLENOID (GAS)
2
K52 20 PK/BK
9 C107
K52 20 PK/BK
9 C106
K52 18 PK/BK
20 C3
POWERTRAIN CONTROL MODULE
BRAKE SWITCH SENSE
SPEED CONTROL POWER SUPPLY
24 C3
11 C3
K29 18 WT/PK
DIESEL
GAS
S150
(8W-30-33)
40 C107
10
K29 18 WT/PK
S314
(8W-30-20)
(8W-30-33)
K29 18 WT/PK
V32 18 OR/DG
GAS
DIESEL
32 C106
42 C107
V32 22 OR/DG
1
3
BRAKE LAMP SWITCH
(8W-33-2)
2
4
Z1 18 BK
OTHER
POWER SEATS
Z1 18 BK
S329
(8W-15-16)
Z1 14 BK
G300
(8W-15-16)
V30 22 DB/RD
GAS
DIESEL
33 C106
44 C107
V30 20 DB/RD
3
VEHICLE SPEED CONTROL SERVO
(8W-33-2)
1
2
V36 18 TN/RD
V35 18 LG/RD
4 C3
5 C3
CRUISE SWITCH NO. 1
(8W-33-5)
SPEED CONTROL SWITCH SIGNAL
3
CRUISE SWITCH NO. 2
(8W-33-5)
SPEED CONTROL SWITCH SIGNAL
3
V37 20 RD/LG
V37 20 RD/LG
S214
(8W-33-5)
V37 20 RD/LG
6 C2
CLOCKSPRING
(8W-33-4)
6 C1
V37 20 RD/LG
58 C200
V37 22 RD/LG
GAS
DIESEL
55 C106
4 C107
V37 18 RD/LG
32 C3
DUTY CYCLE EVAP PURGE SOLENOID
SPEED CONTROL VACUUM SOLENOID CONTROL
SPEED CONTROL VENT SOLENOID CONTROL
SPEED CONTROL SWITCH SIGNAL
POWERTRAIN CONTROL MODULE

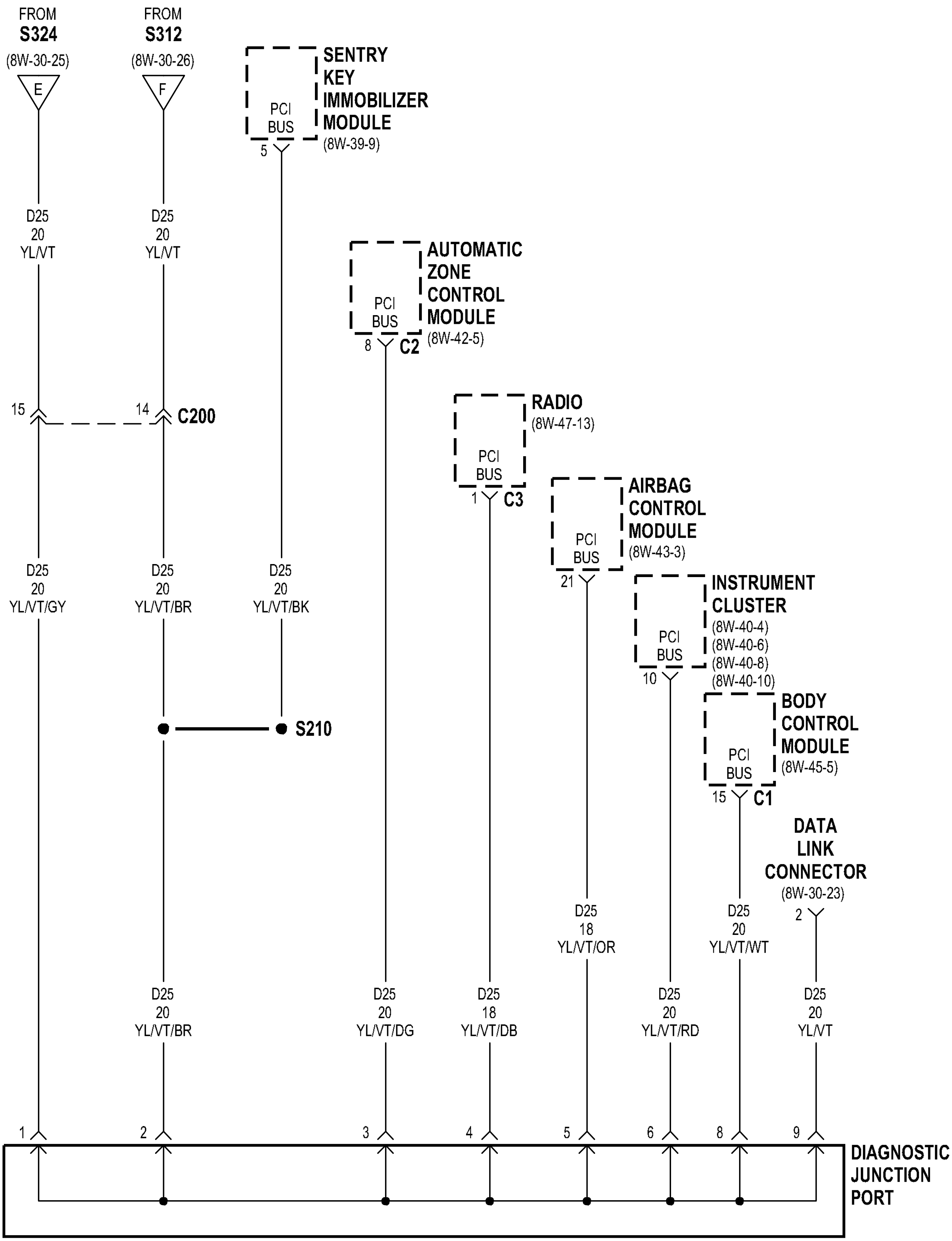

ST-RUN A21
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 21 10A (8W-12-18)
43 C2
F99 20 OR
S316
(8W-12-18)
F99 20 OR
8 C107
F99 20 OR
1
DUTY CYCLE EVAP/ PURGE SOLENOID
2
K52 18 PK/BK
20 C3
SPEED CONTROL SWITCH SIGNAL
CRUISE SWITCH NO. 1
(8W-33-5)
3
V37 20 RD/LG
SPEED CONTROL SWITCH SIGNAL
CRUISE SWITCH NO. 2
(8W-33-5)
3
V37 20 RD/LG
S214
(8W-33-5)
V37 20 RD/LG
6 C2
CLOCKSPRING
(8W-33-4)
6 C1
V37 20 RD/LG
58 C200
V37 20 RD/LG
1 C107
V37 18 RD/LG
32 C3
BRAKE SWITCH SENSE
SPEED CONTROL POWER SUPPLY
POWERTRAIN CONTROL MODULE
24 C3
K29 18 WT/PK
11 C3
V32 18 OR/DG
40
42 C107
K29 18 WT/PK
S314
(8W-30-20)
K29 18 WT/PK
V32 22 OR/DG
1
3
BRAKE LAMP SWITCH
(8W-33-3)
2
4
Z1 18 BK
S358
(8W-15-21)
Z1 12 BK
G301
(8W-15-21)
V30 22 DB/RD
33 C106
V30 20 DB/RD
3
VEHICLE SPEED CONTROL SERVO
(8W-33-3)
1
2
V36 20 TN/RD
V35 20 LG/RD
16
15 C106
V36 20 TN/RD
V35 20 LG/RD
45
44 C107
V36 18 TN/RD
V35 18 LG/RD
4 C3
5 C3
DUTY CYCLE EVAP/PURGE SOLENOID CONTROL
SPEED CONTROL SWITCH SIGNAL
SPEED CONTROL VACUUM SOLENOID CONTROL
SPEED CONTROL VENT SOLENOID CONTROL
POWERTRAIN CONTROL MODULE

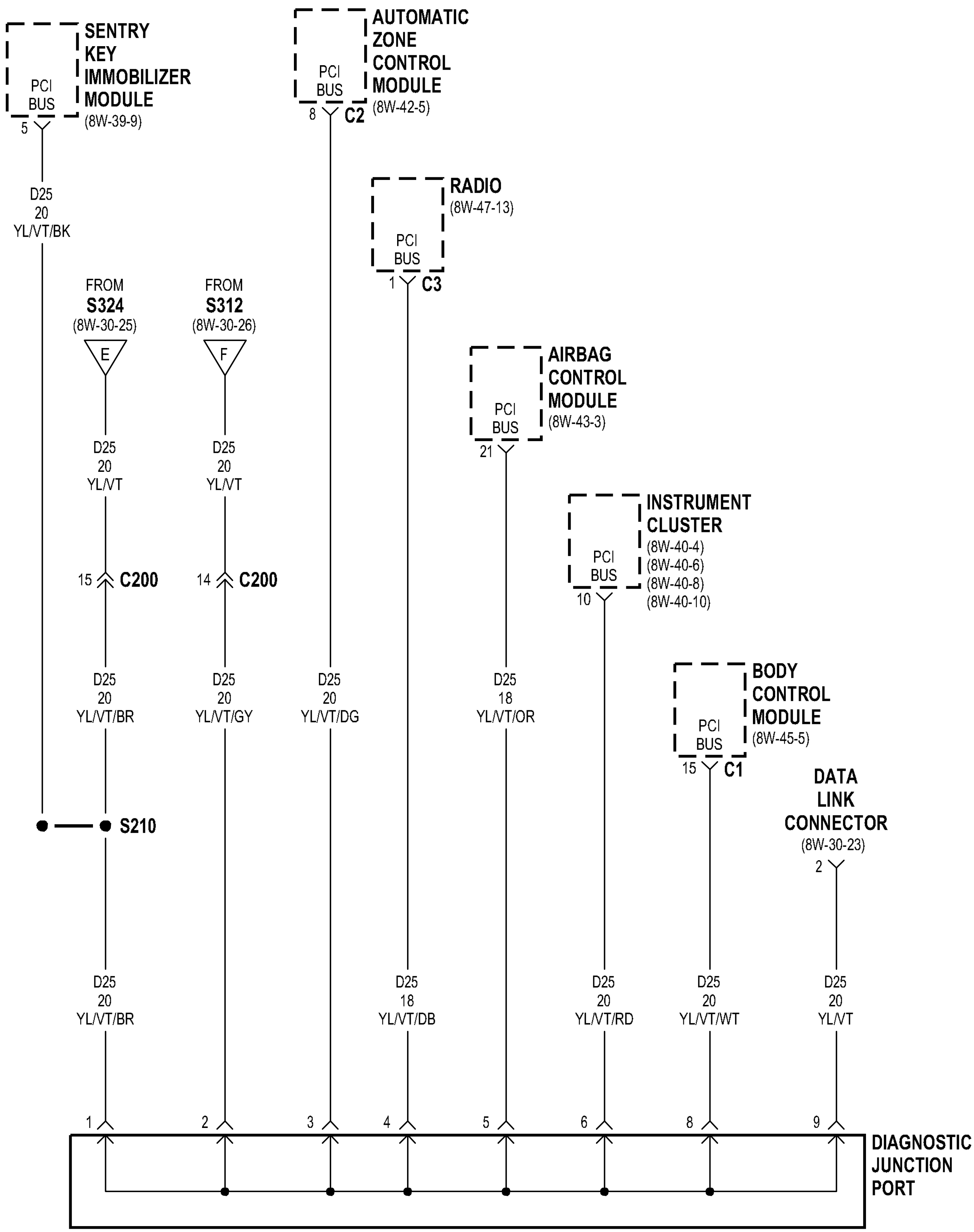

BATT A145
(8W-10-15)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 17 10A (8W-12-20)
41 C3
F33 20 PK/RD
TRANSMISSION CONTROL MODULE (4.7L)
(8W-31-10)
SCI RECEIVE
SCI TRANSMIT
46
7
D20 20 LG
D21 20 PK
3
4
C103
POWERTRAIN CONTROL MODULE
SCI TRANSMIT
27 C3
D21 18 PK
S125
DIAGNOSTIC JUNCTION PORT
(8W-30-27)
(8W-30-28)
1
9
D25 20 YL/VT
EXCEPT BUILT-UP-EXPORT
BUILT-UP-EXPORT
S210
(8W-30-28)
BODY CONTROL MODULE FLASH ENABLE
BODY CONTROL MODULE
(8W-45-5)
17 C1
D19 20 VT/OR
50
49
C106
10
21
C200
2
16
9
14
7
D25 20 YL/VT/GY
D25 20 YL/VT/BR
DATA LINK CONNECTOR
15 C200
12
4
5
6
D33 20 LG/DB
Z2 20 BK/OR
Z21 20 BK/LG
D32 20 LG/DG
11 NOT USED
50
51
16 C200
D25 20 YL/VT
S324
(8W-30-25)
D25 18 YL/VT
48 C106
41
40
51 C106
D25 20 YL/VT
S130
(8W-30-25)
D32 18 LG/DG
11 C103
7 C102
G103
(8W-15-2)
D25 18 YL/VT
30 C3
29 C3
PCI BUS
SCI RECEIVE
POWERTRAIN CONTROL MODULE

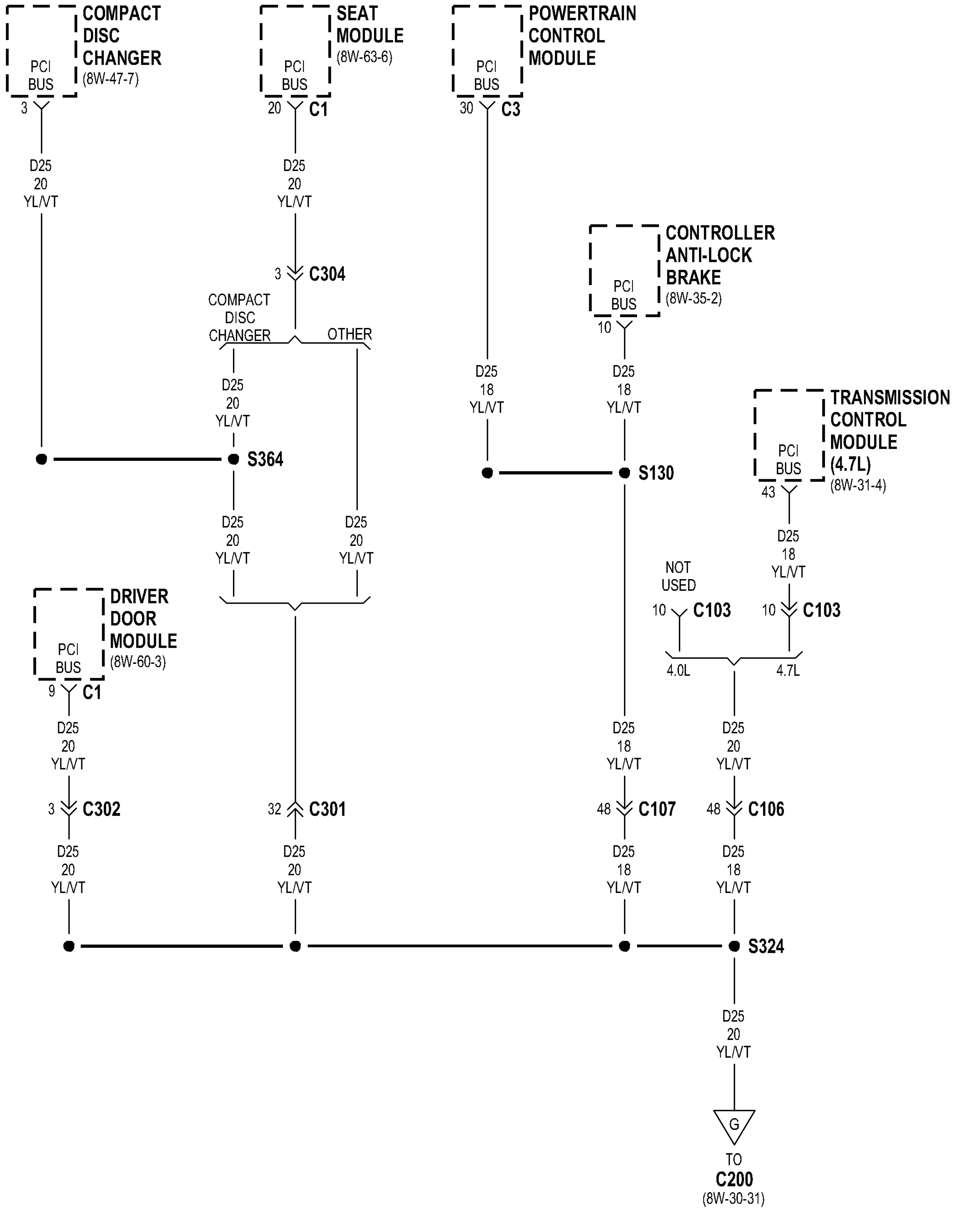

DIAGNOSTIC JUNCTION PORT
(8W-30-31)
1
9
D25 20 YL/VT/BR
S210
(8W-30-31)
D25 20 YL/VT/BR
D25 20 YL/VT
15 C200
D25 20 YL/VT
S324
(8W-30-29)
D25 18 YL/VT
48 C107
D25 18 YL/VT
S130
(8W-30-29)
D25 18 YL/VT
30 C3
PCI BUS
BATT A145
(8W-10-15)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 17 10A
(8W-12-20)
41 C3
F33 20 PK/RD
BODY CONTROL MODULE FLASH ENABLE
BODY CONTROL MODULE
(8W-45-6)
17 C1
D19 20 VT/OR
TRANSMISSION CONTROL MODULE (4.7L)
(8W-31-10)
SCI RECEIVE
SCI TRANSMIT
46
7
D20 20 LG
D21 20 PK
3
4 C103
D20 20 LG
D21 20 PK
50
49 C106
D20 20 LG
D21 20 PK
POWERTRAIN CONTROL MODULE
SCI TRANSMIT
27 C3
D21 18 PK
49 C107
D21 20 PK
S333
D21 20 PK
10
21 C200
2
16
9
14
7
DATA LINK CONNECTOR
12
4
5
6
D33 20 LG/DB
Z2 20 BK/OR
Z21 20 BK/LG
D32 20 LG/DG
11 NOT USED
50
51
16 C200
Z2 20 BK/OR
Z21 20 BK/LG
D32 20 LG/DG
41
40 C106
19 C107
Z2 20 BK/OR
Z21 20 BK/LG
11 C103
7 C102
Z2 20 BK/OR
Z21 20 BK/LG
D32 18 LG/DG
G103
(8W-15-2)
29 C3
SCI RECEIVE
POWERTRAIN CONTROL MODULE

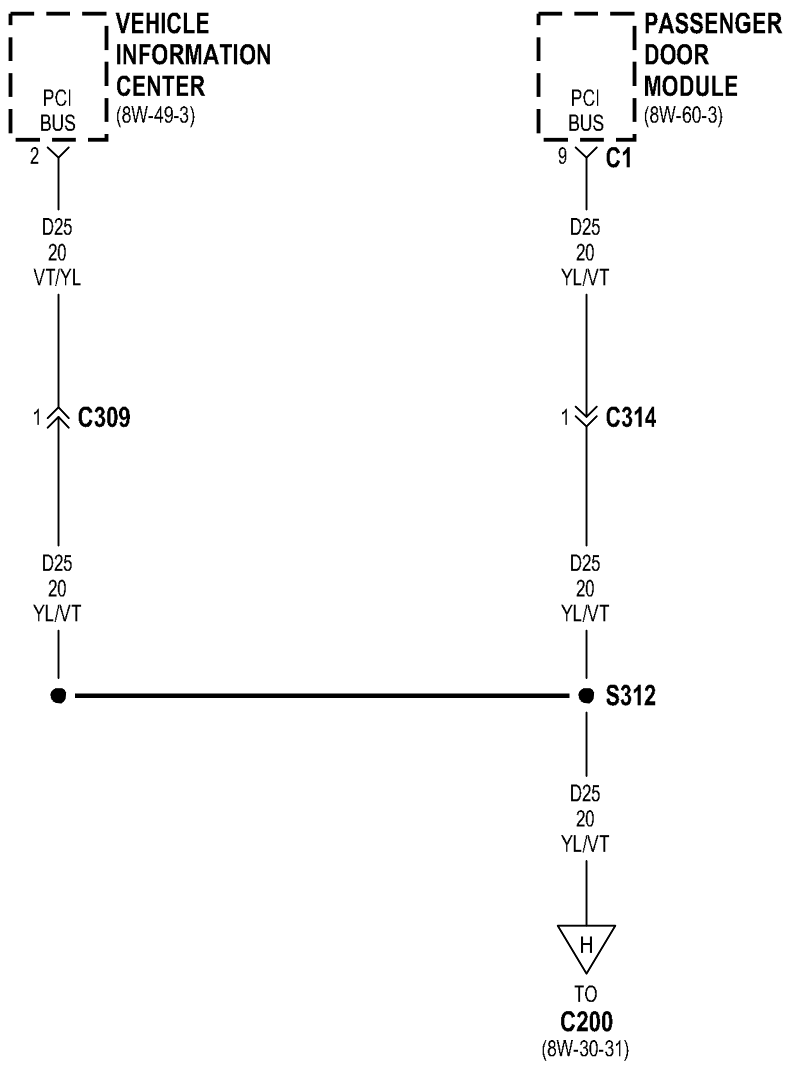

TRANSMISSION
CONTROL
MODULE
(4.7L)
(8W-31-4)
PCI
BUS
43
D25
18
YL/VT
10
C103
D25
20
YL/VT
CONTROLLER
ANTI-LOCK
BRAKE
(8W-35-3)
PCI
BUS
10
D25
18
YL/VT
POWERTRAIN
CONTROL
MODULE
PCI
BUS
30
C3
D25
18
YL/VT
GAS
DIESEL
S130
GAS
DIESEL
D25
20
YL/VT
48
C106
D25
18
YL/VT
48
C107
COMPACT
DISC
CHANGER
(PREMIUM)
(8W-47-6)
PCI
BUS
3
PASSENGER
DOOR
MODULE
(8W-60-2)
PCI
BUS
9
C1
D25
20
YL/VT
1
C314
D25
18
YL/VT
D25
20
YL/VT
D25
20
YL/VT
S324
D25
20
YL/VT
E
TO
C200
(8W-30-27)
(8W-30-28)

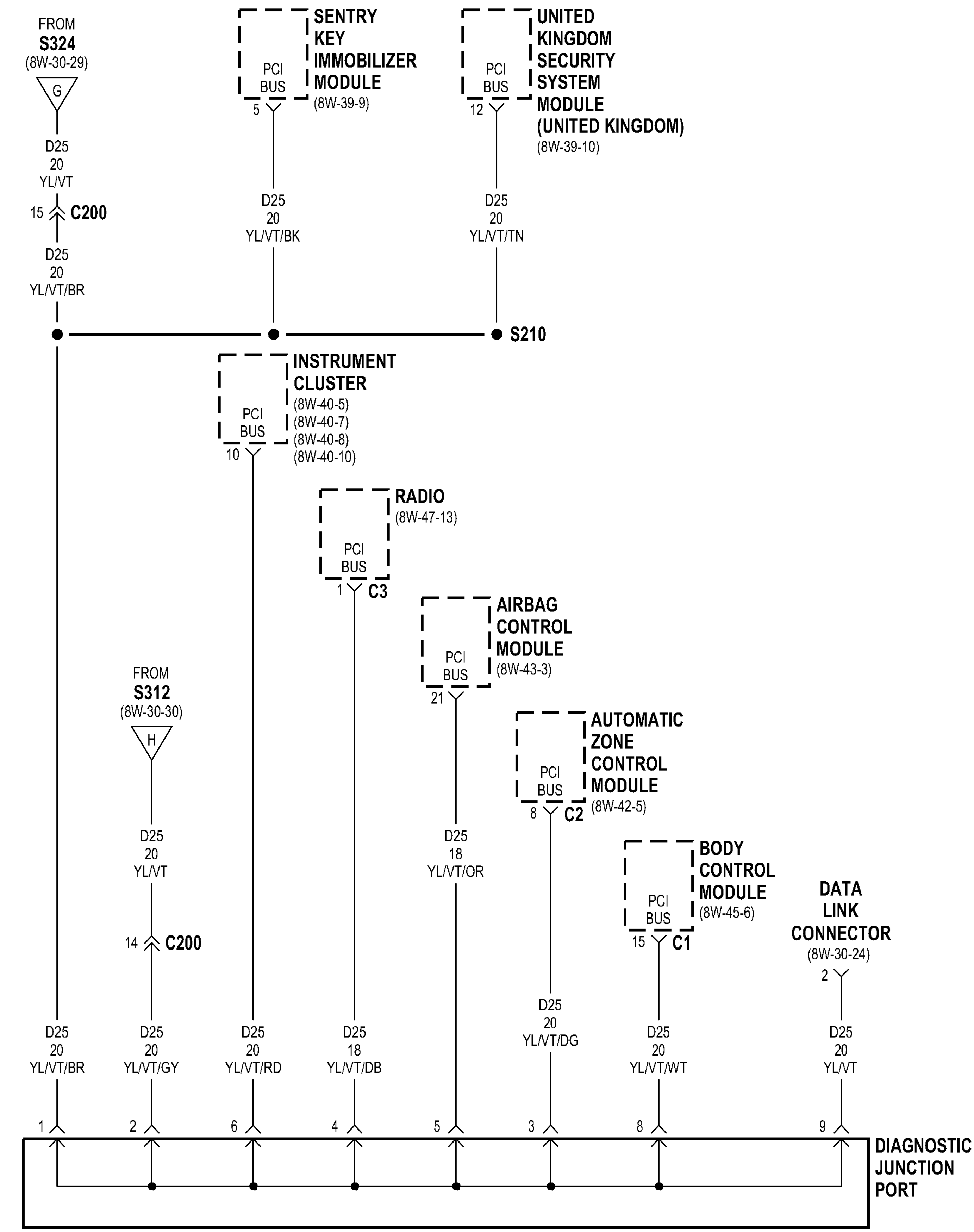

VEHICLE
INFORMATION
CENTER
(8W-49-2)
PCI
BUS
2
D25
20
VT/YL
1
C309
D25
20
YL/VT
OTHER
POWER
SEATS
D25
20
YL/VT
1
C300
D25
20
YL/VT
SEAT
MODULE
(8W-63-6)
PCI
BUS
20
C1
D25
20
YL/VT
3
C304
D25
20
YL/VT
S305
DRIVER
DOOR
MODULE
(8W-60-2)
PCI
BUS
9
C1
D25
20
YL/VT
3
C302
D25
20
YL/VT
CONTROLLER
ANTI-LOCK
BRAKE
(GAS)
(8W-35-2)
PCI
BUS
10
D25
18
YL/VT
48
C107
D25
18
YL/VT
S312
D25
20
YL/VT
F
TO
C200
(8W-30-27)
(8W-30-28)

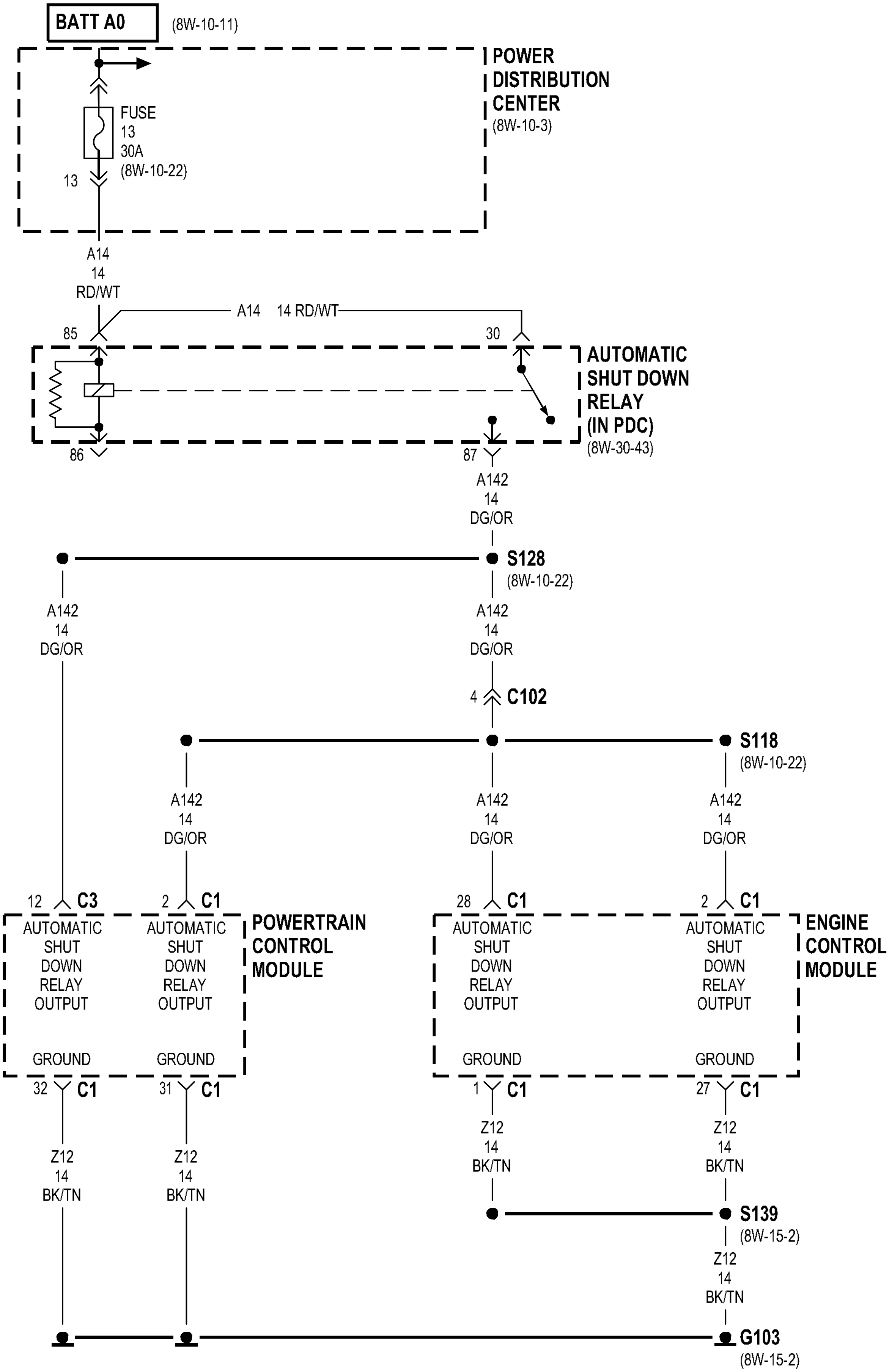

FROM
S324
(8W-30-25)
E
FROM
S312
(8W-30-26)
F
SENTRY KEY IMMOBILIZER MODULE
(8W-39-9)
PCI BUS
5
D25 20 YL/VT
D25 20 YL/VT
AUTOMATIC ZONE CONTROL MODULE
(8W-42-5)
PCI BUS
8
C2
15
14
C200
RADIO
(8W-47-13)
PCI BUS
1
C3
AIRBAG CONTROL MODULE
(8W-43-3)
PCI BUS
21
D25 20 YL/VT/GY
D25 20 YL/VT/BR
D25 20 YL/VT/BK
INSTRUMENT CLUSTER
(8W-40-4)
(8W-40-6)
(8W-40-8)
(8W-40-10)
PCI BUS
10
S210
BODY CONTROL MODULE
(8W-45-5)
PCI BUS
15
C1
DATA LINK CONNECTOR
(8W-30-23)
2
D25 18 YL/VT/OR
D25 20 YL/VT/WT
D25 20 YL/VT/BR
D25 20 YL/VT/DG
D25 18 YL/VT/DB
D25 20 YL/VT/RD
D25 20 YL/VT
1
2
3
4
5
6
8
9
DIAGNOSTIC JUNCTION PORT

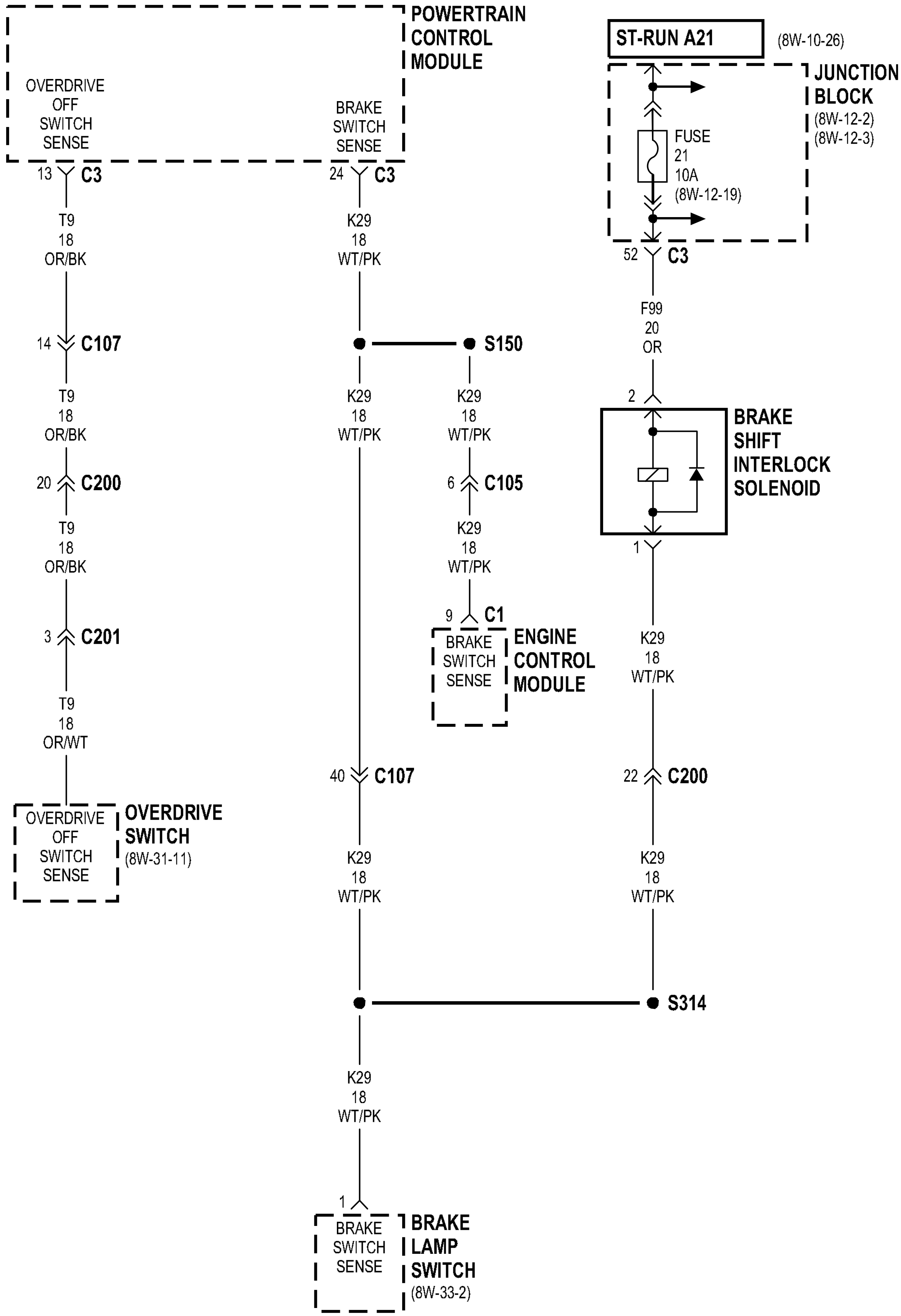

SENTRY KEY IMMOBILIZER MODULE
(8W-39-9)
PCI BUS
5
D25 20 YL/VT/BK
AUTOMATIC ZONE CONTROL MODULE
(8W-42-5)
PCI BUS
8 C2
RADIO
(8W-47-13)
PCI BUS
1 C3
FROM S324 (8W-30-25)
E
FROM S312 (8W-30-26)
F
D25 20 YL/VT
D25 20 YL/VT
15 C200
14 C200
AIRBAG CONTROL MODULE
(8W-43-3)
PCI BUS
21
INSTRUMENT CLUSTER
(8W-40-4)
(8W-40-6)
(8W-40-8)
(8W-40-10)
PCI BUS
10
D25 20 YL/VT/BR
D25 20 YL/VT/GY
D25 20 YL/VT/DG
D25 18 YL/VT/OR
BODY CONTROL MODULE
(8W-45-5)
PCI BUS
15 C1
DATA LINK CONNECTOR
(8W-30-23)
2
S210
D25 20 YL/VT/BR
D25 18 YL/VT/DB
D25 20 YL/VT/RD
D25 20 YL/VT/WT
D25 20 YL/VT
1 2 3 4 5 6 8 9
DIAGNOSTIC JUNCTION PORT

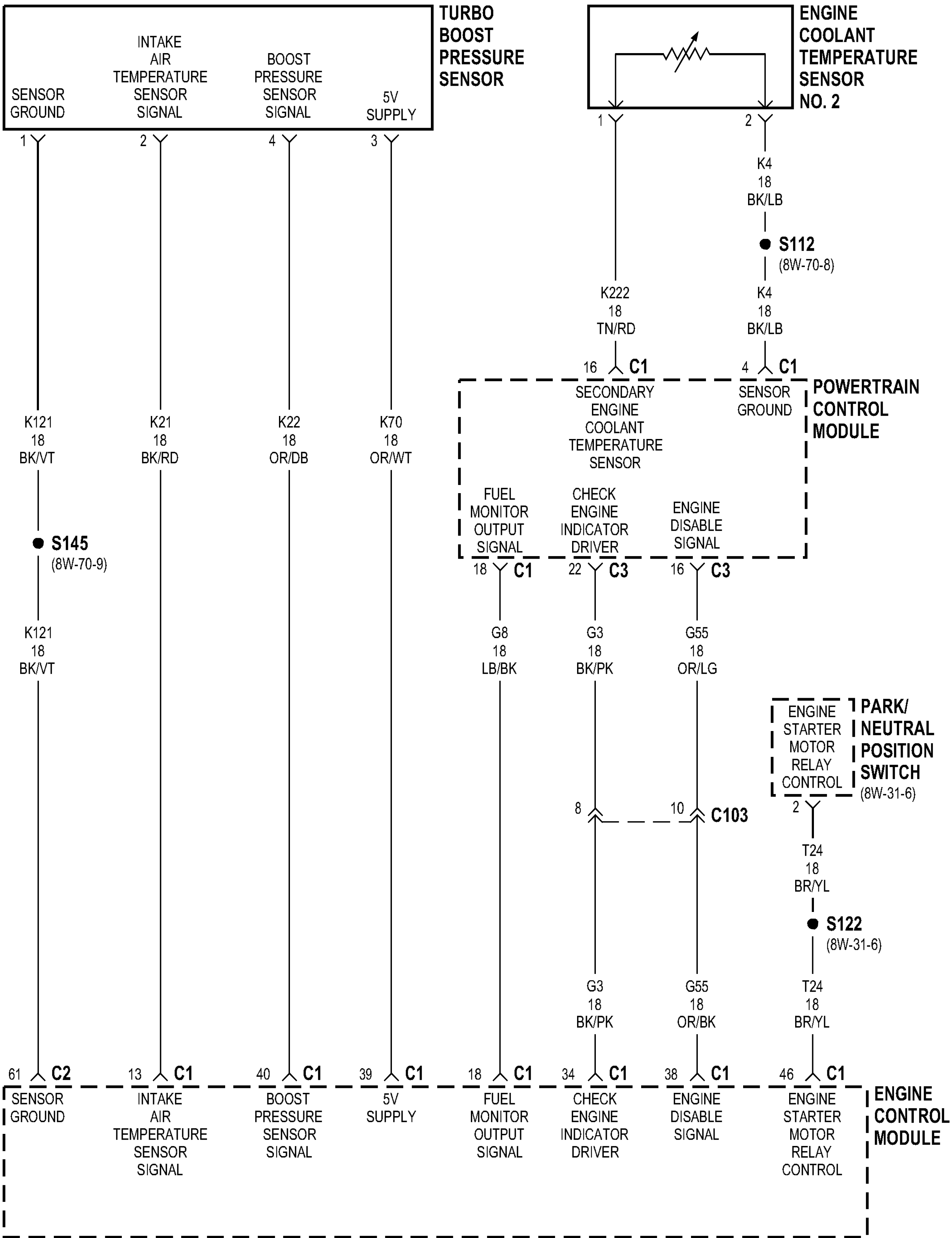

COMPACT DISC CHANGER
(8W-47-7)
PCI BUS
3
D25 20 YL/VT
SEAT MODULE
(8W-63-6)
PCI BUS
20 C1
D25 20 YL/VT
3 C304
COMPACT DISC CHANGER
OTHER
D25 20 YL/VT
S364
D25 20 YL/VT
D25 20 YL/VT
POWERTRAIN CONTROL MODULE
PCI BUS
30 C3
D25 18 YL/VT
CONTROLLER ANTI-LOCK BRAKE
(8W-35-2)
PCI BUS
10
D25 18 YL/VT
S130
TRANSMISSION CONTROL MODULE (4.7L)
(8W-31-4)
PCI BUS
43
D25 18 YL/VT
NOT USED
10 C103
10 C103
4.0L
4.7L
DRIVER DOOR MODULE
(8W-60-3)
PCI BUS
9 C1
D25 20 YL/VT
3 C302
D25 20 YL/VT
32 C301
D25 20 YL/VT
D25 18 YL/VT
48 C107
D25 18 YL/VT
D25 20 YL/VT
48 C106
D25 18 YL/VT
S324
D25 20 YL/VT
G
TO
C200
(8W-30-31)

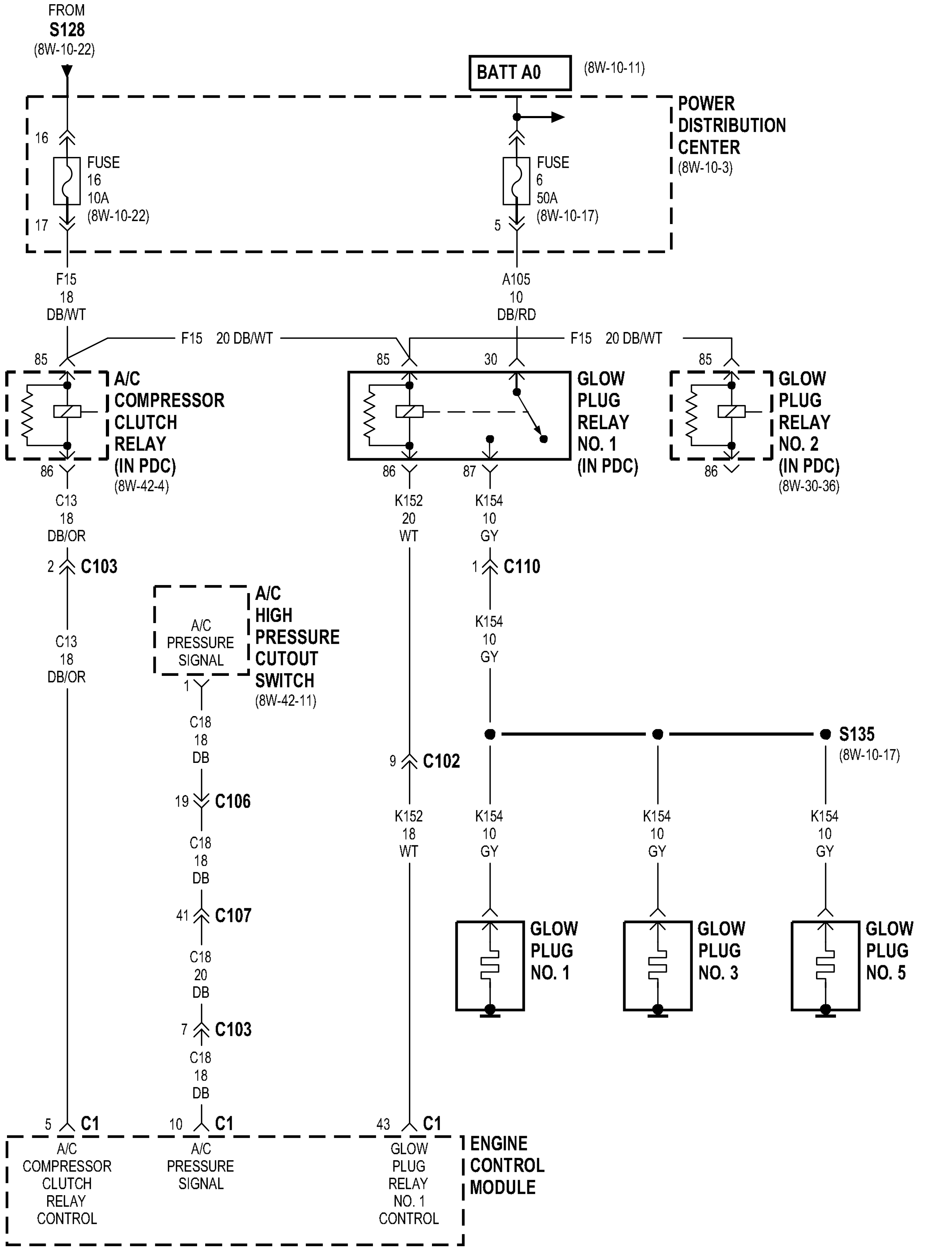

VEHICLE
INFORMATION
CENTER
(8W-49-3)
PCI
BUS
2
D25
20
VT/YL
1
C309
D25
20
YL/VT
PASSENGER
DOOR
MODULE
(8W-60-3)
PCI
BUS
9
C1
D25
20
YL/VT
1
C314
D25
20
YL/VT
S312
D25
20
YL/VT
H
TO
C200
(8W-30-31)

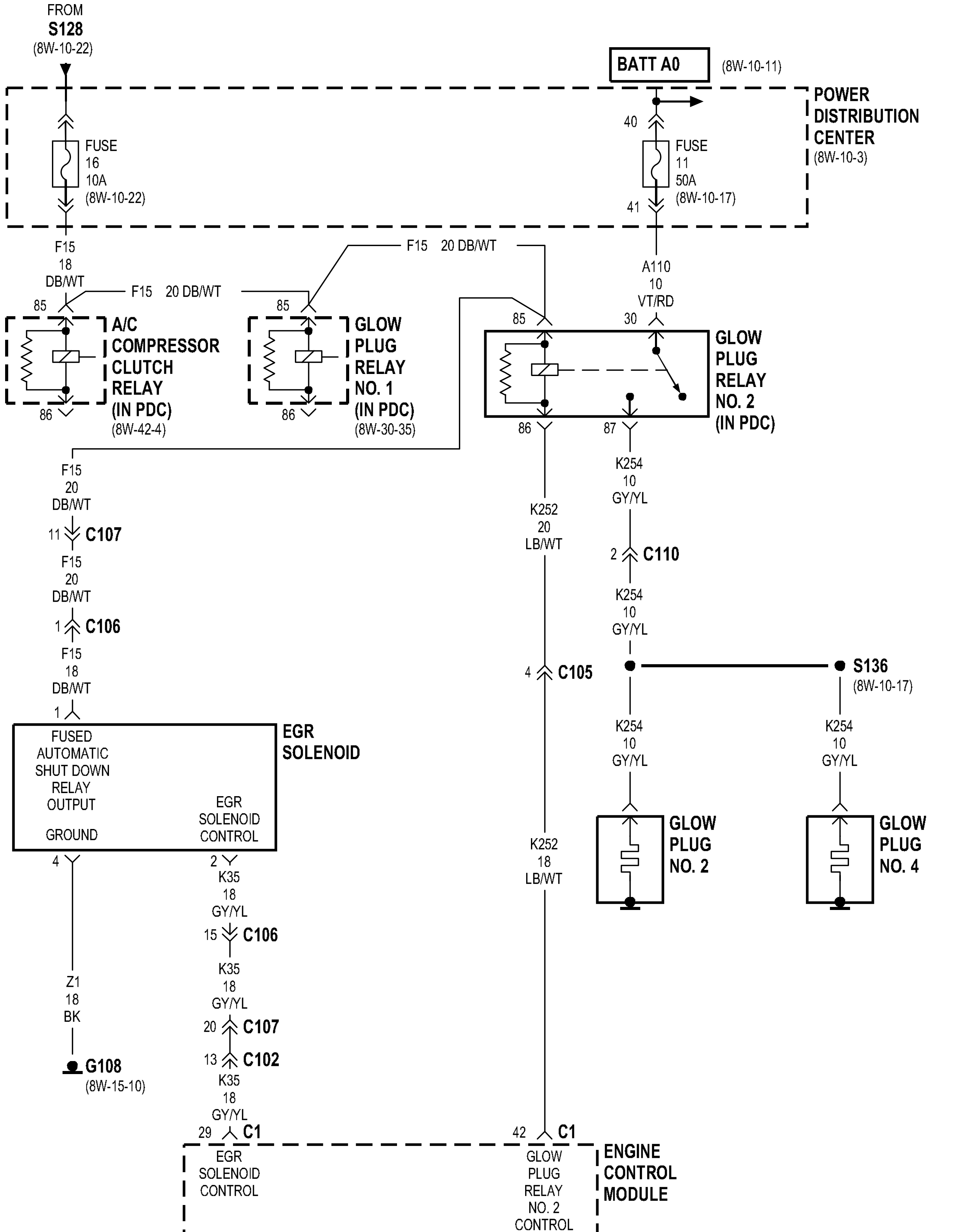

FROM
S324
(8W-30-29)
G
D25
20
YL/VT
15 C200
D25
20
YL/VT/BR
SENTRY KEY IMMOBILIZER MODULE
(8W-39-9)
PCI BUS
5
D25
20
YL/VT/BK
UNITED KINGDOM SECURITY SYSTEM MODULE (UNITED KINGDOM)
(8W-39-10)
PCI BUS
12
D25
20
YL/VT/TN
S210
INSTRUMENT CLUSTER
(8W-40-5)
(8W-40-7)
(8W-40-8)
(8W-40-10)
PCI BUS
10
RADIO
(8W-47-13)
PCI BUS
1 C3
AIRBAG CONTROL MODULE
(8W-43-3)
PCI BUS
21
D25
18
YL/VT/OR
AUTOMATIC ZONE CONTROL MODULE
(8W-42-5)
PCI BUS
8 C2
D25
20
YL/VT/DG
BODY CONTROL MODULE
(8W-45-6)
PCI BUS
15 C1
FROM
S312
(8W-30-30)
H
D25
20
YL/VT
14 C200
DATA LINK CONNECTOR
(8W-30-24)
2
D25 20 YL/VT/BR
D25 20 YL/VT/GY
D25 20 YL/VT/RD
D25 18 YL/VT/DB
D25 20 YL/VT/WT
D25 20 YL/VT
1
2
6
4
5
3
8
9
DIAGNOSTIC JUNCTION PORT

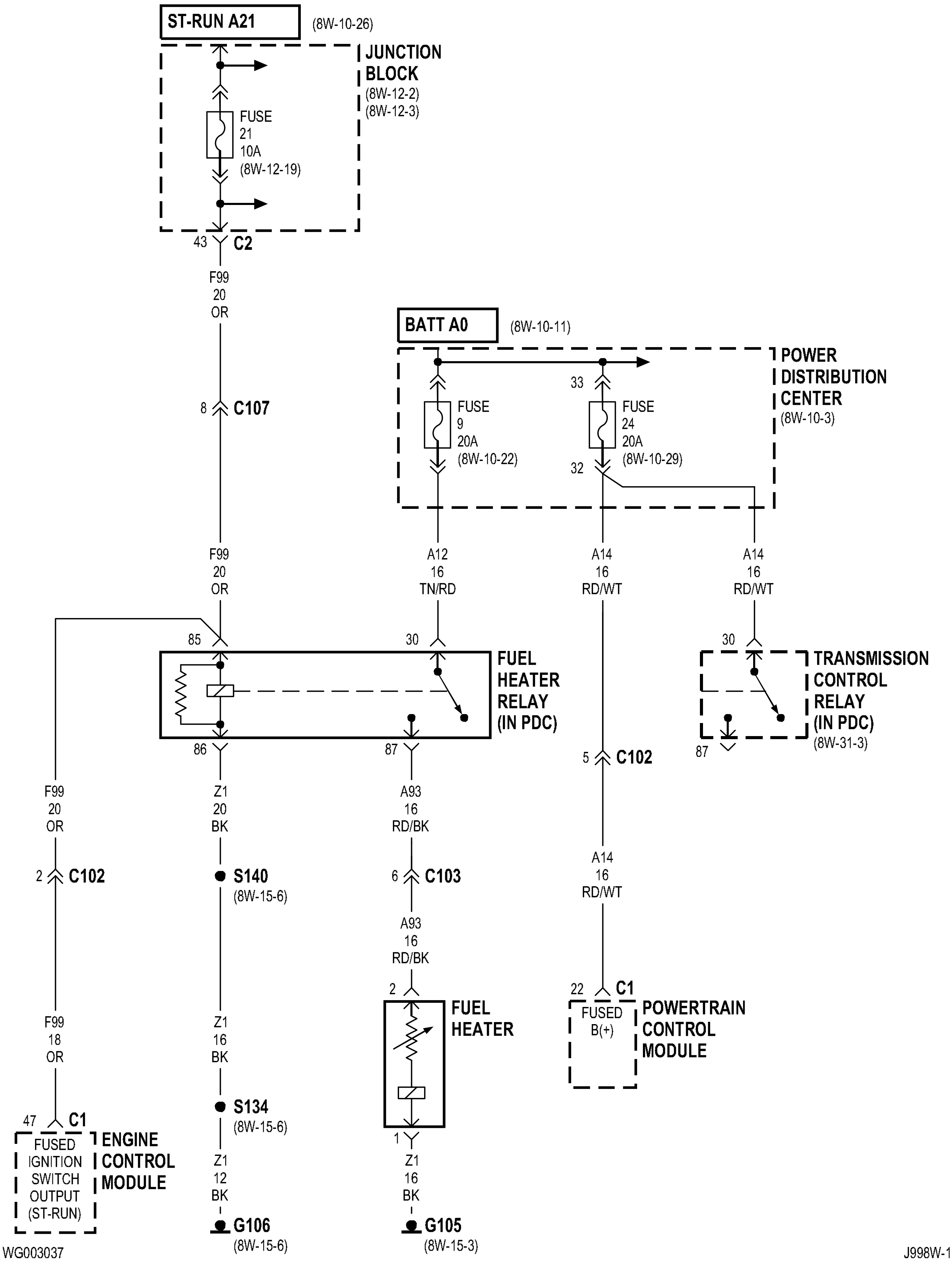

BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-3)
FUSE
13
30A
(8W-10-22)
13
A14
14
RD/WT
A14 14 RD/WT
85
30
AUTOMATIC SHUT DOWN RELAY (IN PDC)
(8W-30-43)
86
87
A142
14
DG/OR
S128
(8W-10-22)
A142
14
DG/OR
A142
14
DG/OR
4
C102
S118
(8W-10-22)
A142
14
DG/OR
A142
14
DG/OR
A142
14
DG/OR
12
C3
2
C1
28
C1
2
C1
AUTOMATIC SHUT DOWN RELAY OUTPUT
AUTOMATIC SHUT DOWN RELAY OUTPUT
POWERTRAIN CONTROL MODULE
AUTOMATIC SHUT DOWN RELAY OUTPUT
AUTOMATIC SHUT DOWN RELAY OUTPUT
ENGINE CONTROL MODULE
GROUND
GROUND
GROUND
GROUND
32
C1
31
C1
1
C1
27
C1
Z12
14
BK/TN
Z12
14
BK/TN
Z12
14
BK/TN
Z12
14
BK/TN
S139
(8W-15-2)
Z12
14
BK/TN
G103
(8W-15-2)

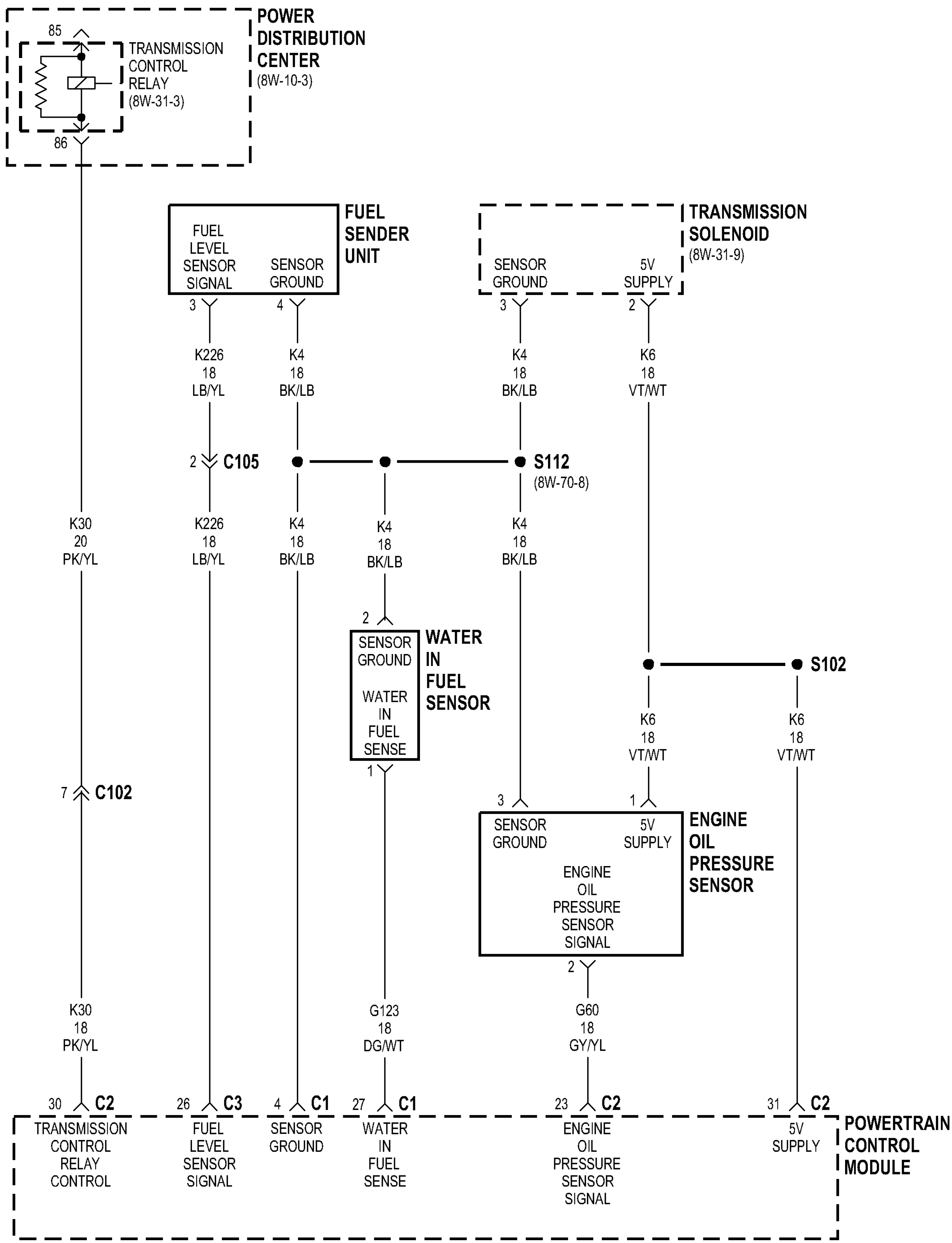

POWERTRAIN CONTROL MODULE
OVERDRIVE OFF SWITCH SENSE
BRAKE SWITCH SENSE
13 C3
24 C3
T9 18 OR/BK
K29 18 WT/PK
14 C107
S150
T9 18 OR/BK
K29 18 WT/PK
K29 18 WT/PK
20 C200
6 C105
T9 18 OR/BK
K29 18 WT/PK
9 C1
BRAKE SWITCH SENSE
ENGINE CONTROL MODULE
3 C201
T9 18 OR/WT
OVERDRIVE OFF SWITCH SENSE
OVERDRIVE SWITCH
(8W-31-11)
40 C107
K29 18 WT/PK
S314
K29 18 WT/PK
1
BRAKE SWITCH SENSE
BRAKE LAMP SWITCH
(8W-33-2)
ST-RUN A21
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 21 10A (8W-12-19)
52 C3
F99 20 OR
2
BRAKE SHIFT INTERLOCK SOLENOID
1
K29 18 WT/PK
22 C200
K29 18 WT/PK


TURBO BOOST PRESSURE SENSOR
SENSOR GROUND
INTAKE AIR TEMPERATURE SENSOR SIGNAL
BOOST PRESSURE SENSOR SIGNAL
5V SUPPLY
ENGINE COOLANT TEMPERATURE SENSOR NO. 2
K4 18 BK/LB
S112 (8W-70-8)
K222 18 TN/RD
K4 18 BK/LB
16 C1
4 C1
POWERTRAIN CONTROL MODULE
SECONDARY ENGINE COOLANT TEMPERATURE SENSOR
SENSOR GROUND
K121 18 BK/VT
K21 18 BK/RD
K22 18 OR/DB
K70 18 OR/WT
FUEL MONITOR OUTPUT SIGNAL
CHECK ENGINE INDICATOR DRIVER
ENGINE DISABLE SIGNAL
S145 (8W-70-9)
18 C1
22 C3
16 C3
K121 18 BK/VT
G8 18 LB/BK
G3 18 BK/PK
G55 18 OR/LG
PARK/ NEUTRAL POSITION SWITCH (8W-31-6)
ENGINE STARTER MOTOR RELAY CONTROL
C103
T24 18 BR/YL
S122 (8W-31-6)
G3 18 BK/PK
G55 18 OR/BK
T24 18 BR/YL
61 C2
13 C1
40 C1
39 C1
18 C1
34 C1
38 C1
46 C1
ENGINE CONTROL MODULE
SENSOR GROUND
INTAKE AIR TEMPERATURE SENSOR SIGNAL
BOOST PRESSURE SENSOR SIGNAL
5V SUPPLY
FUEL MONITOR OUTPUT SIGNAL
CHECK ENGINE INDICATOR DRIVER
ENGINE DISABLE SIGNAL
ENGINE STARTER MOTOR RELAY CONTROL

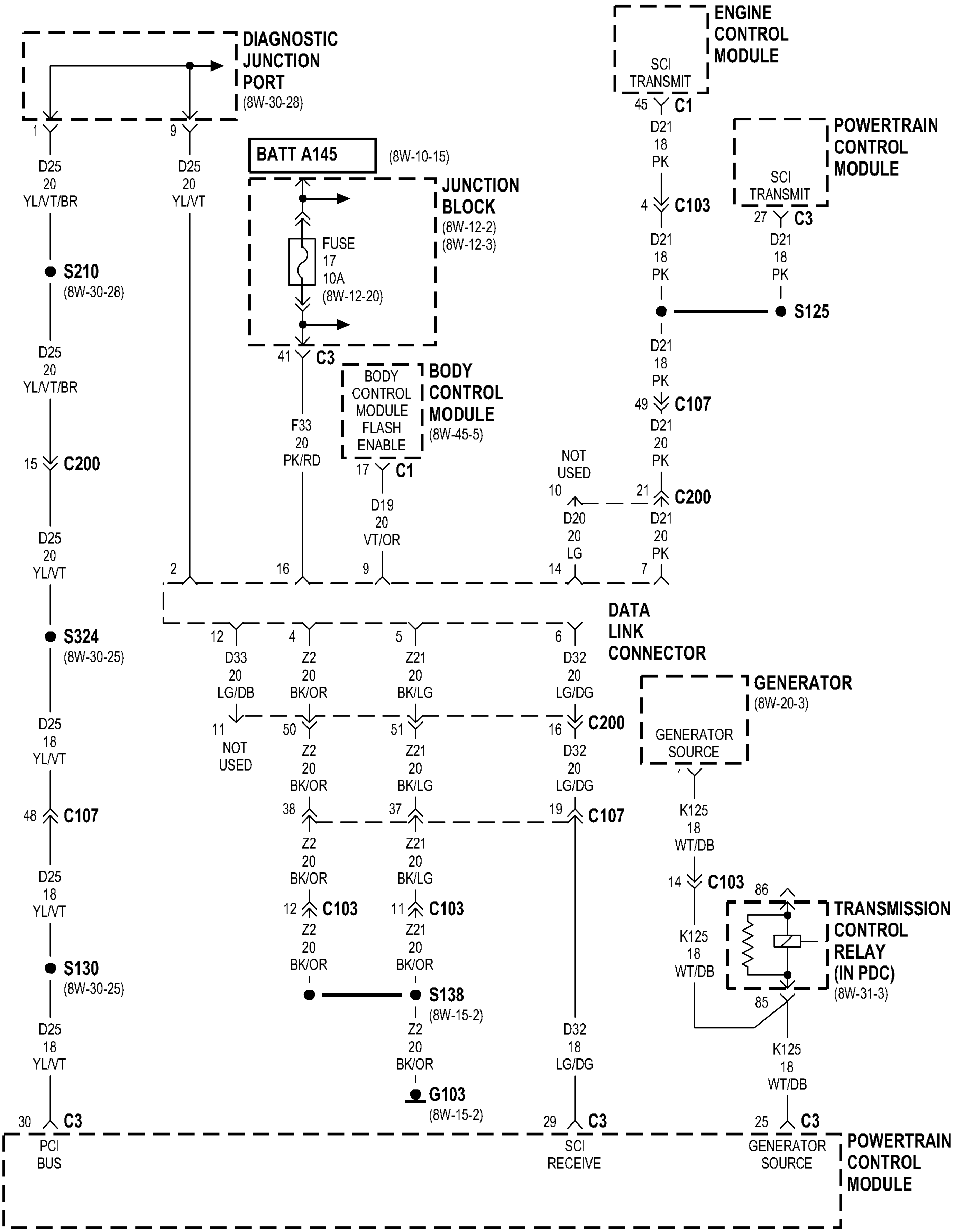

FROM
S128
(8W-10-22)
BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-3)
16
FUSE
16
10A
(8W-10-22)
17
FUSE
6
50A
(8W-10-17)
5
F15
18
DB/WT
A105
10
DB/RD
F15 20 DB/WT
F15 20 DB/WT
85
A/C COMPRESSOR CLUTCH RELAY (IN PDC)
(8W-42-4)
86
85
30
GLOW PLUG RELAY NO. 1 (IN PDC)
86
87
85
GLOW PLUG RELAY NO. 2 (IN PDC)
(8W-30-36)
86
C13
18
DB/OR
2 C103
C13
18
DB/OR
K152
20
WT
K154
10
GY
1 C110
K154
10
GY
A/C PRESSURE SIGNAL
A/C HIGH PRESSURE CUTOUT SWITCH
(8W-42-11)
1
C18
18
DB
19 C106
C18
18
DB
41 C107
C18
20
DB
7 C103
C18
18
DB
9 C102
K152
18
WT
S135
(8W-10-17)
K154
10
GY
K154
10
GY
K154
10
GY
GLOW PLUG NO. 1
GLOW PLUG NO. 3
GLOW PLUG NO. 5
5 C1
10 C1
43 C1
A/C COMPRESSOR CLUTCH RELAY CONTROL
A/C PRESSURE SIGNAL
GLOW PLUG RELAY NO. 1 CONTROL
ENGINE CONTROL MODULE


FROM
S128
(8W-10-22)
BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-3)
FUSE 16 10A (8W-10-22)
40
FUSE 11 50A (8W-10-17)
41
F15 18 DB/WT
F15 20 DB/WT
A110 10 VT/RD
85
86
A/C COMPRESSOR CLUTCH RELAY (IN PDC)
(8W-42-4)
GLOW PLUG RELAY NO. 1 (IN PDC)
(8W-30-35)
30
87
GLOW PLUG RELAY NO. 2 (IN PDC)
F15 20 DB/WT
11 C107
1 C106
F15 18 DB/WT
K252 20 LB/WT
K254 10 GY/YL
2 C110
4 C105
S136
(8W-10-17)
1
EGR SOLENOID
FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
GROUND
EGR SOLENOID CONTROL
4
2
K35 18 GY/YL
15 C106
20 C107
13 C102
Z1 18 BK
G108
(8W-15-10)
K252 18 LB/WT
GLOW PLUG NO. 2
GLOW PLUG NO. 4
29 C1
42 C1
EGR SOLENOID CONTROL
GLOW PLUG RELAY NO. 2 CONTROL
ENGINE CONTROL MODULE


ST-RUN A21
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
21
10A
(8W-12-19)
43
C2
F99
20
OR
BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-3)
33
FUSE
9
20A
(8W-10-22)
FUSE
24
20A
(8W-10-29)
32
8
C107
F99
20
OR
A12
16
TN/RD
A14
16
RD/WT
A14
16
RD/WT
85
30
FUEL HEATER RELAY (IN PDC)
30
TRANSMISSION CONTROL RELAY (IN PDC)
(8W-31-3)
86
87
87
5
C102
F99
20
OR
Z1
20
BK
A93
16
RD/BK
2
C102
S140
(8W-15-6)
6
C103
A14
16
RD/WT
A93
16
RD/BK
2
FUEL HEATER
22
C1
FUSED B(+)
POWERTRAIN CONTROL MODULE
F99
18
OR
Z1
16
BK
47
C1
FUSED IGNITION SWITCH OUTPUT (ST-RUN)
ENGINE CONTROL MODULE
S134
(8W-15-6)
1
Z1
12
BK
Z1
16
BK
G106
(8W-15-6)
G105
(8W-15-3)



85
TRANSMISSION CONTROL RELAY (8W-31-3)
86
POWER DISTRIBUTION CENTER
(8W-10-3)
FUEL LEVEL SENSOR SIGNAL
SENSOR GROUND
FUEL SENDER UNIT
SENSOR GROUND
5V SUPPLY
TRANSMISSION SOLENOID
(8W-31-9)
K226 18 LB/YL
K4 18 BK/LB
K6 18 VT/WT
C105
S112
(8W-70-8)
K30 20 PK/YL
SENSOR GROUND
WATER IN FUEL SENSE
WATER IN FUEL SENSOR
S102
C102
ENGINE OIL PRESSURE SENSOR SIGNAL
ENGINE OIL PRESSURE SENSOR
K30 18 PK/YL
G123 18 DG/WT
G60 18 GY/YL
C2
C3
C1
TRANSMISSION CONTROL RELAY CONTROL
FUEL LEVEL SENSOR SIGNAL
WATER IN FUEL SENSE
ENGINE OIL PRESSURE SENSOR SIGNAL
5V SUPPLY
POWERTRAIN CONTROL MODULE



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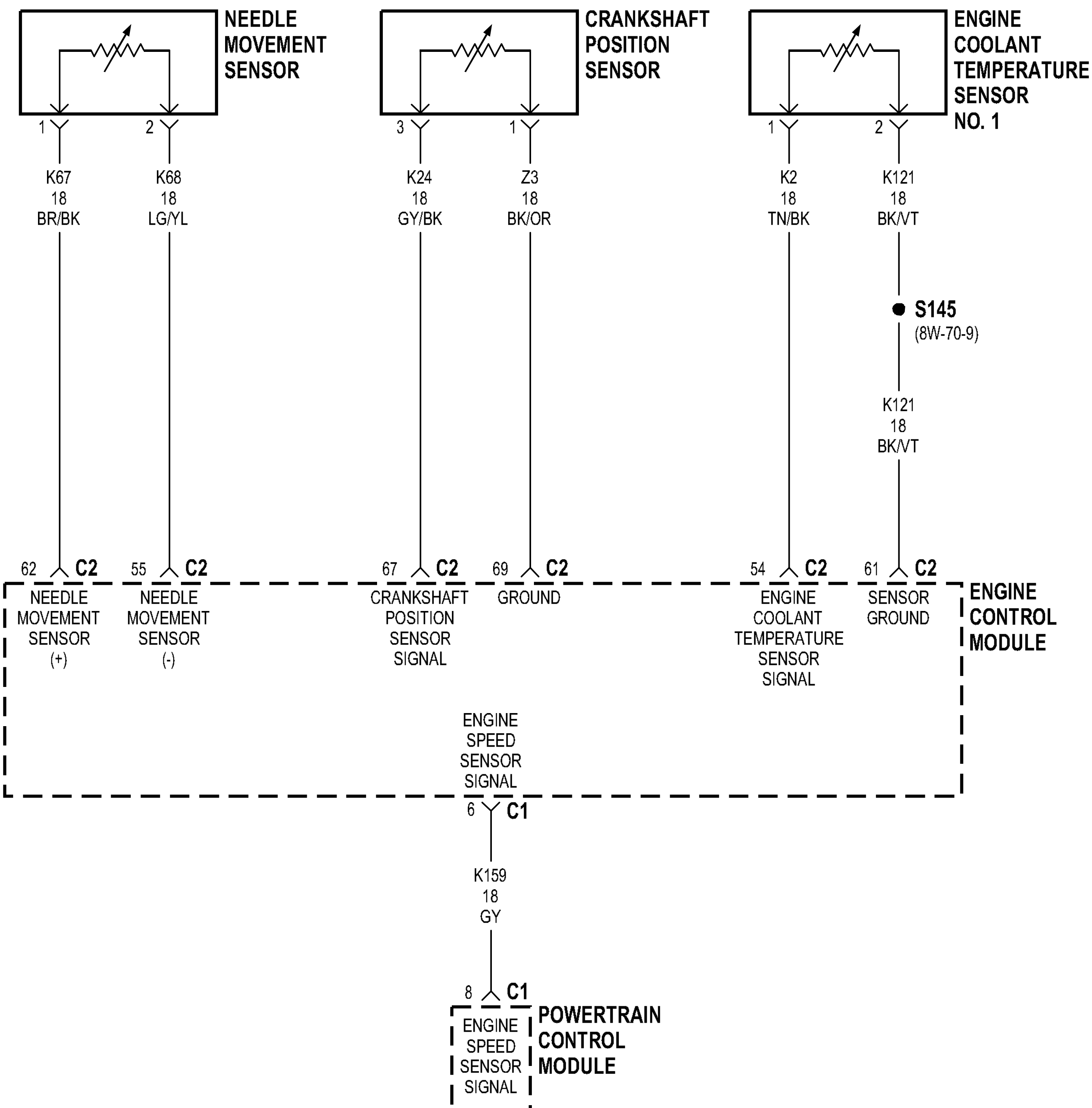
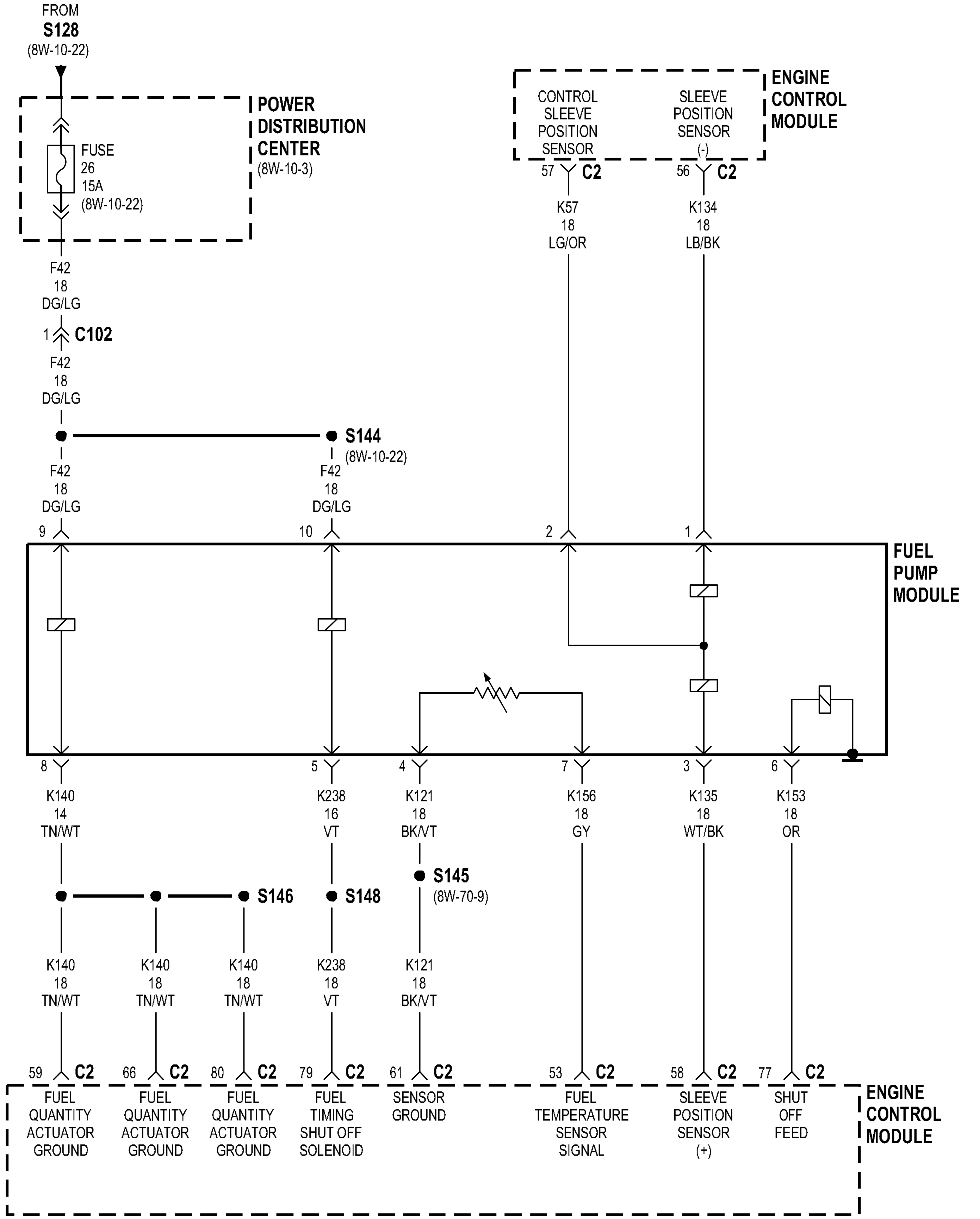
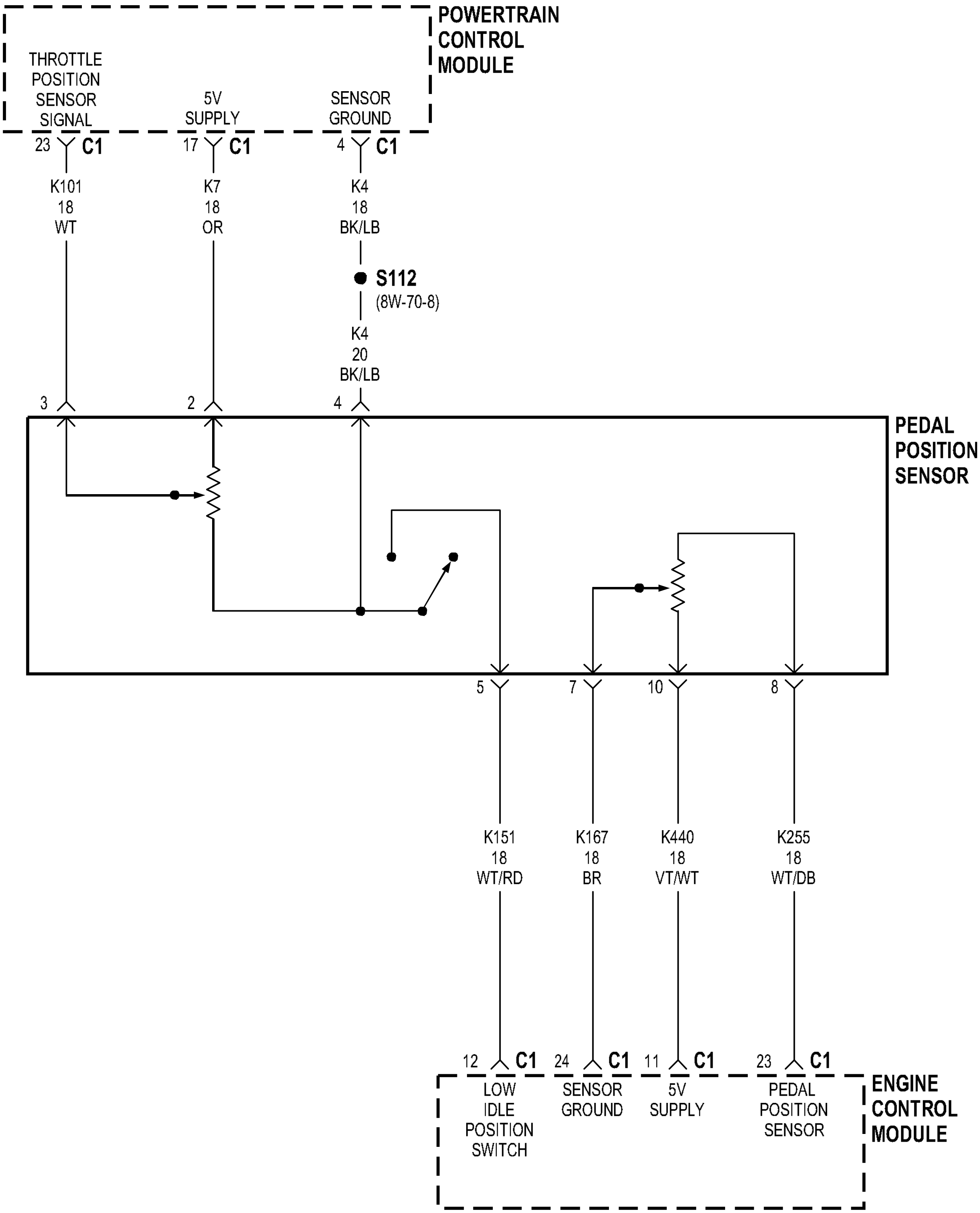
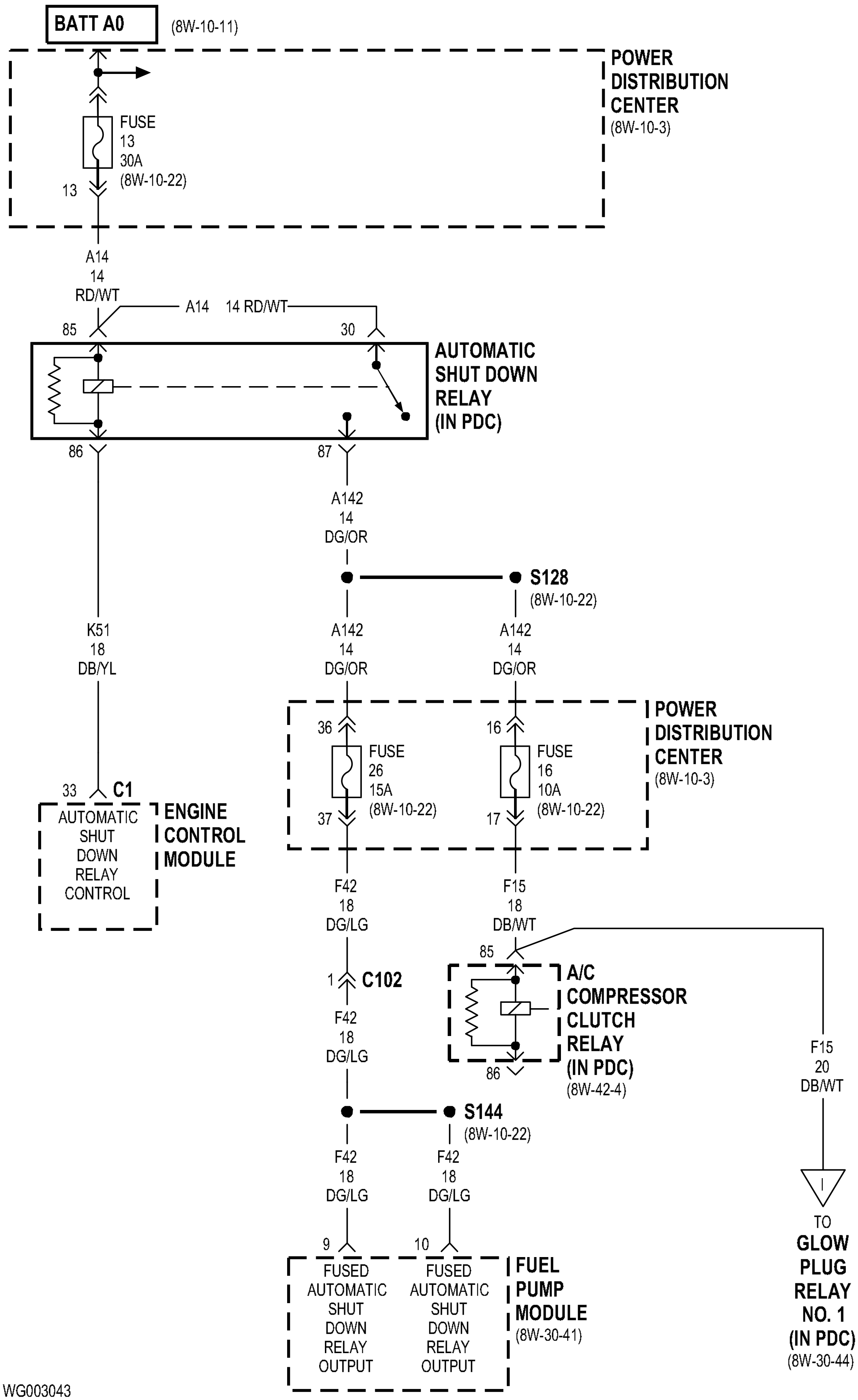
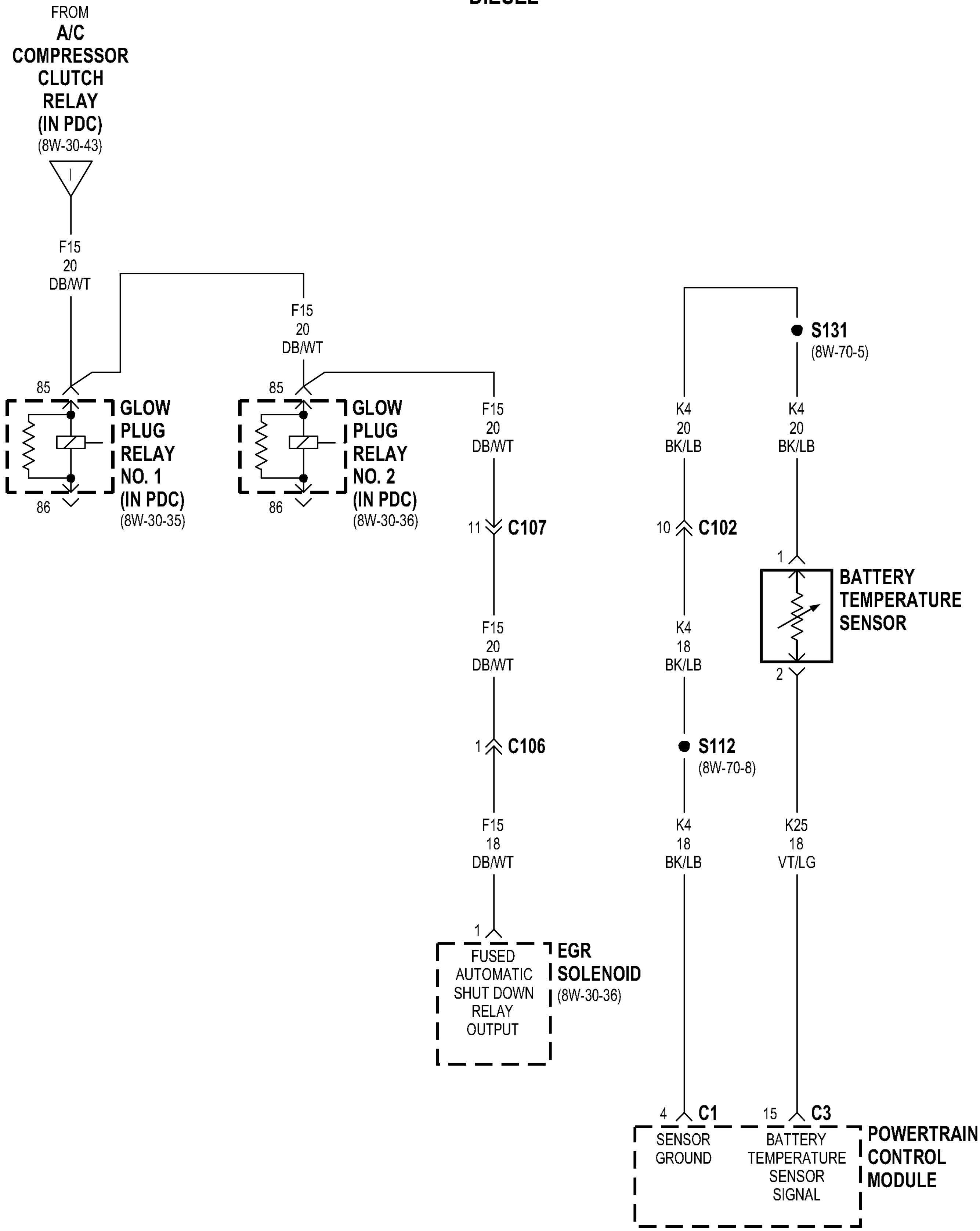

NEEDLE MOVEMENT SENSOR
CRANKSHAFT POSITION SENSOR
ENGINE COOLANT TEMPERATURE SENSOR NO. 1
1
2
3
1
1
2
K67
18
BR/BK
K68
18
LG/YL
K24
18
GY/BK
Z3
18
BK/OR
K2
18
TN/BK
K121
18
BK/VT
S145
(8W-70-9)
K121
18
BK/VT
62 C2
55 C2
67 C2
69 C2
54 C2
61 C2
NEEDLE MOVEMENT SENSOR (+)
NEEDLE MOVEMENT SENSOR (-)
CRANKSHAFT POSITION SENSOR SIGNAL
GROUND
ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
SENSOR GROUND
ENGINE CONTROL MODULE
ENGINE SPEED SENSOR SIGNAL
6 C1
K159
18
GY
8 C1
ENGINE SPEED SENSOR SIGNAL
POWERTRAIN CONTROL MODULE

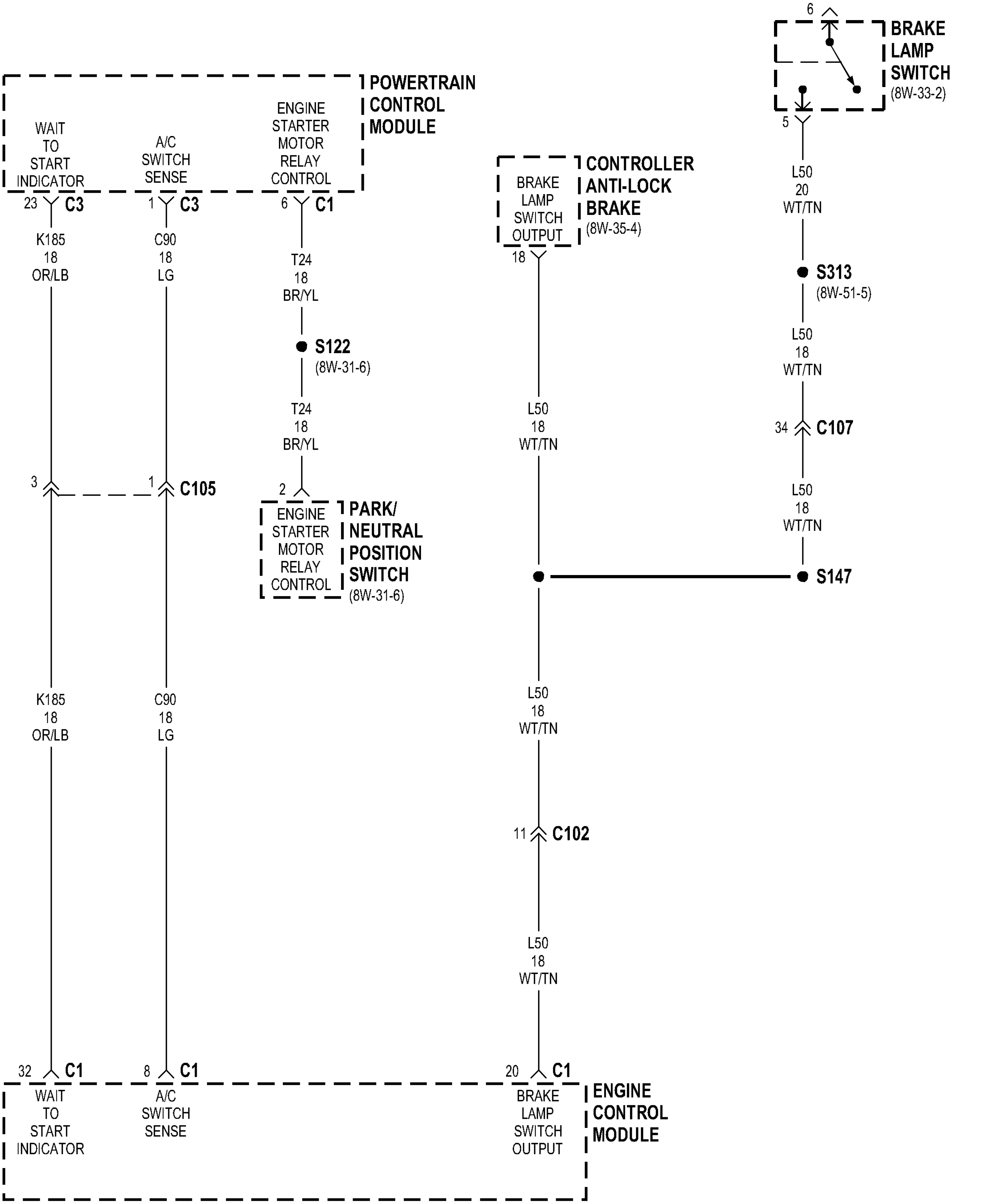


FROM
S128
(8W-10-22)
POWER
DISTRIBUTION
CENTER
(8W-10-3)
FUSE
26
15A
(8W-10-22)
F42
18
DG/LG
1
C102
F42
18
DG/LG
S144
(8W-10-22)
F42
18
DG/LG
F42
18
DG/LG
ENGINE
CONTROL
MODULE
CONTROL
SLEEVE
POSITION
SENSOR
SLEEVE
POSITION
SENSOR
(-)
57
C2
56
C2
K57
18
LG/OR
K134
18
LB/BK
9
10
2
1
FUEL
PUMP
MODULE
8
5
4
7
3
6
K140
14
TN/WT
K238
16
VT
K121
18
BK/VT
K156
18
GY
K135
18
WT/BK
K153
18
OR
S146
S148
S145
(8W-70-9)
K140
18
TN/WT
K140
18
TN/WT
K140
18
TN/WT
K238
18
VT
K121
18
BK/VT
59
C2
66
C2
80
C2
79
C2
61
C2
53
C2
58
C2
77
C2
FUEL
QUANTITY
ACTUATOR
GROUND
FUEL
QUANTITY
ACTUATOR
GROUND
FUEL
QUANTITY
ACTUATOR
GROUND
FUEL
TIMING
SHUT OFF
SOLENOID
SENSOR
GROUND
FUEL
TEMPERATURE
SENSOR
SIGNAL
SLEEVE
POSITION
SENSOR
(+)
SHUT
OFF
FEED
ENGINE
CONTROL
MODULE

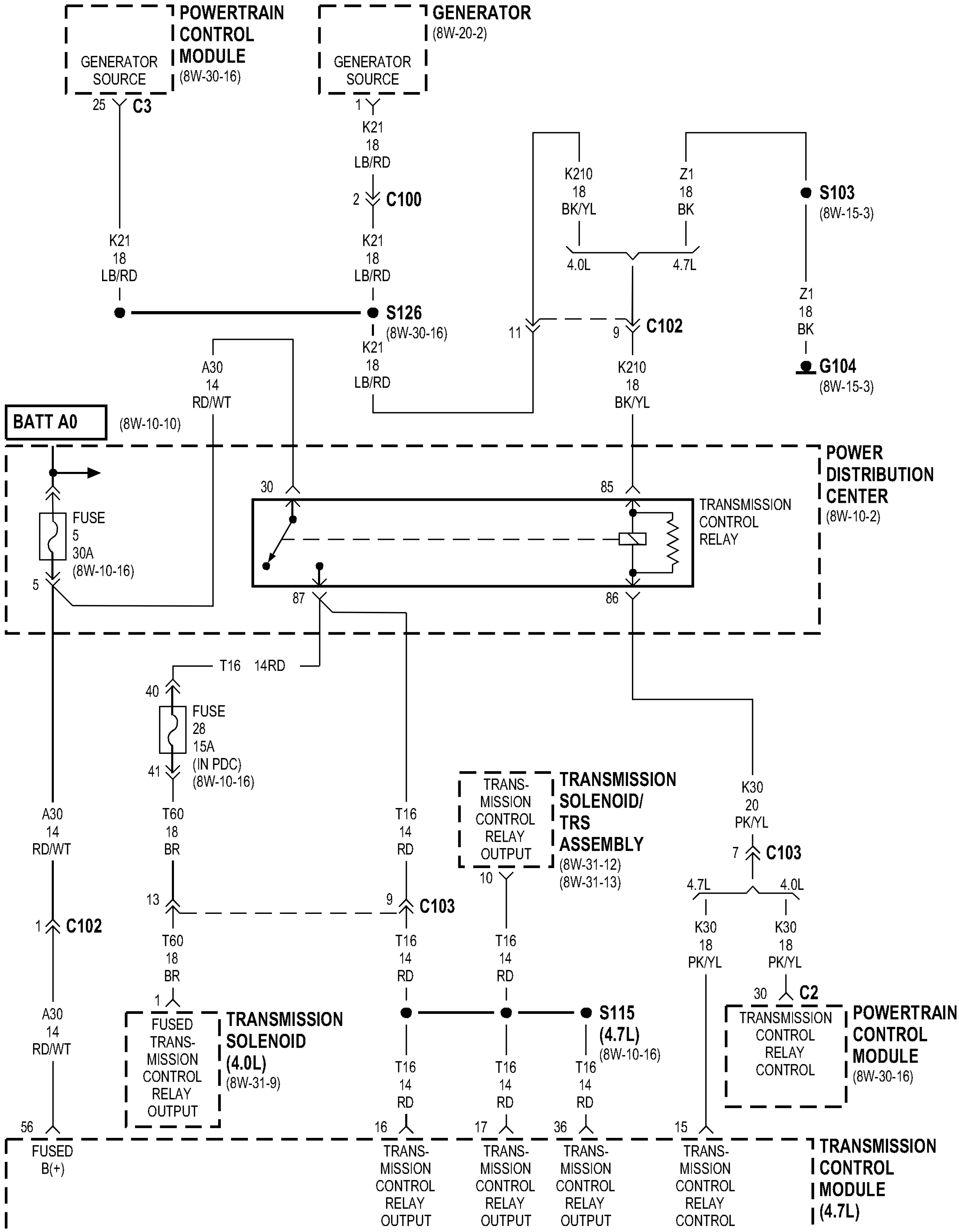

POWERTRAIN CONTROL MODULE
THROTTLE POSITION SENSOR SIGNAL
5V SUPPLY
SENSOR GROUND
23 C1
17 C1
4 C1
K101 18 WT
K7 18 OR
K4 18 BK/LB
S112
(8W-70-8)
K4 20 BK/LB
3
2
4
PEDAL POSITION SENSOR
5
7
10
8
K151 18 WT/RD
K167 18 BR
K440 18 VT/WT
K255 18 WT/DB
12 C1
24 C1
11 C1
23 C1
LOW IDLE POSITION SWITCH
SENSOR GROUND
5V SUPPLY
PEDAL POSITION SENSOR
ENGINE CONTROL MODULE

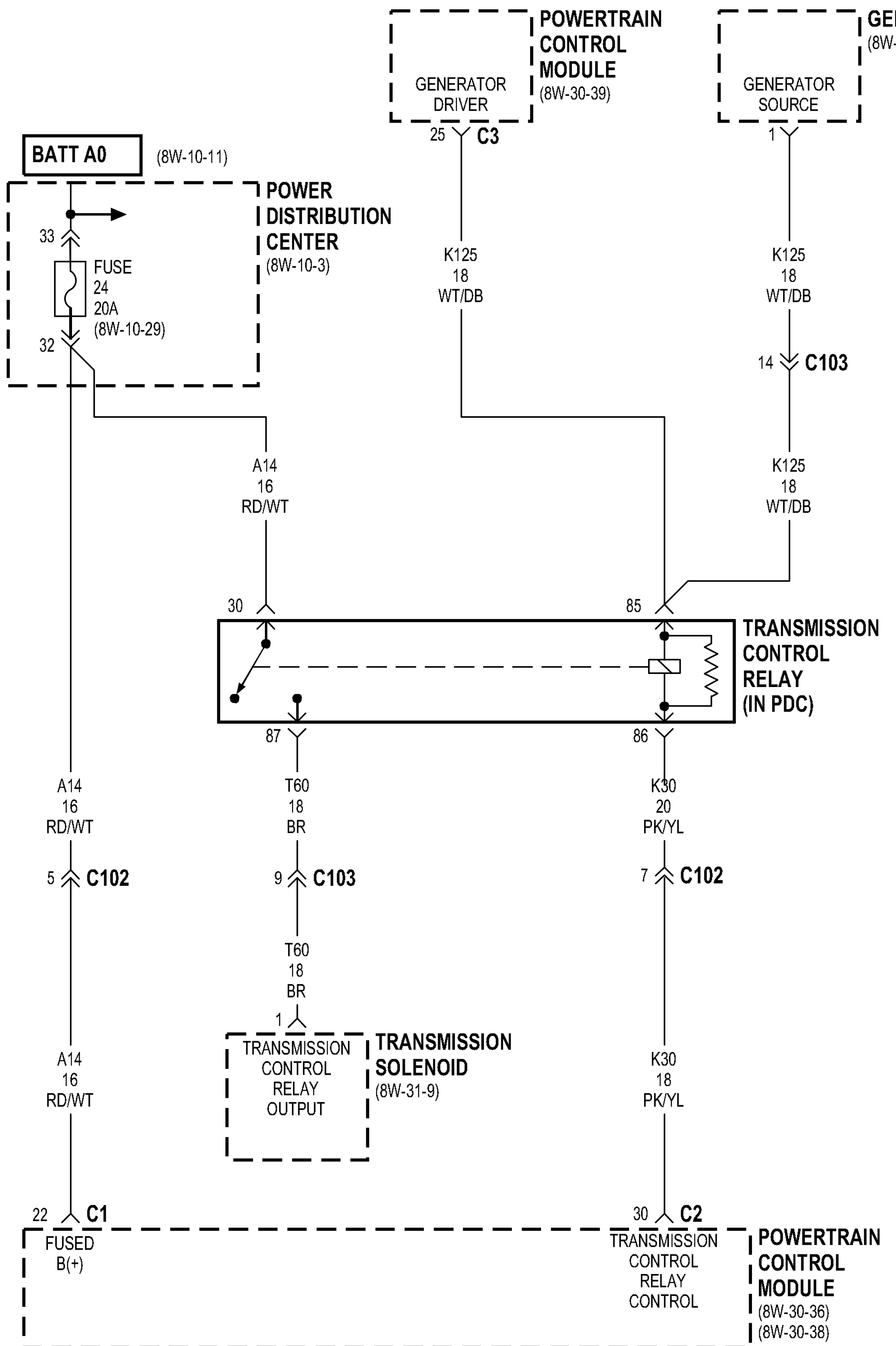

BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-3)
FUSE 13 30A (8W-10-22)
13
A14 14 RD/WT
A14 14 RD/WT
85
30
AUTOMATIC SHUT DOWN RELAY (IN PDC)
86
87
A142 14 DG/OR
S128
(8W-10-22)
K51 18 DB/YL
A142 14 DG/OR
A142 14 DG/OR
POWER DISTRIBUTION CENTER
(8W-10-3)
36
FUSE 26 15A (8W-10-22)
37
16
FUSE 16 10A (8W-10-22)
17
33
C1
AUTOMATIC SHUT DOWN RELAY CONTROL
ENGINE CONTROL MODULE
F42 18 DG/LG
F15 18 DB/WT
1
C102
85
A/C COMPRESSOR CLUTCH RELAY (IN PDC)
(8W-42-4)
86
F42 18 DG/LG
F15 20 DB/WT
S144
(8W-10-22)
F42 18 DG/LG
F42 18 DG/LG
9
10
FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
FUEL PUMP MODULE
(8W-30-41)
I
TO GLOW PLUG RELAY NO. 1 (IN PDC)
(8W-30-44)


FROM
A/C COMPRESSOR CLUTCH RELAY (IN PDC)
(8W-30-43)
I
F15
20
DB/WT
F15
20
DB/WT
85
86
GLOW PLUG RELAY NO. 1 (IN PDC)
(8W-30-35)
85
86
GLOW PLUG RELAY NO. 2 (IN PDC)
(8W-30-36)
F15
20
DB/WT
11
C107
F15
20
DB/WT
1
C106
F15
18
DB/WT
1
FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
EGR SOLENOID
(8W-30-36)
S131
(8W-70-5)
K4
20
BK/LB
K4
20
BK/LB
10
C102
K4
18
BK/LB
S112
(8W-70-8)
K4
18
BK/LB
1
2
BATTERY TEMPERATURE SENSOR
K25
18
VT/LG
4
C1
15
C3
SENSOR GROUND
BATTERY TEMPERATURE SENSOR SIGNAL
POWERTRAIN CONTROL MODULE


6
BRAKE
LAMP
SWITCH
(8W-33-2)
5
L50
20
WT/TN
S313
(8W-51-5)
L50
18
WT/TN
34
C107
L50
18
WT/TN
S147
POWERTRAIN
CONTROL
MODULE
WAIT
TO
START
INDICATOR
A/C
SWITCH
SENSE
ENGINE
STARTER
MOTOR
RELAY
CONTROL
23
C3
1
C3
6
C1
K185
18
OR/LB
C90
18
LG
T24
18
BR/YL
S122
(8W-31-6)
T24
18
BR/YL
CONTROLLER
ANTI-LOCK
BRAKE
(8W-35-4)
BRAKE
LAMP
SWITCH
OUTPUT
18
L50
18
WT/TN
3
1
C105
2
ENGINE
STARTER
MOTOR
RELAY
CONTROL
PARK/
NEUTRAL
POSITION
SWITCH
(8W-31-6)
K185
18
OR/LB
C90
18
LG
L50
18
WT/TN
11
C102
L50
18
WT/TN
32
C1
8
C1
20
C1
WAIT
TO
START
INDICATOR
A/C
SWITCH
SENSE
BRAKE
LAMP
SWITCH
OUTPUT
ENGINE
CONTROL
MODULE

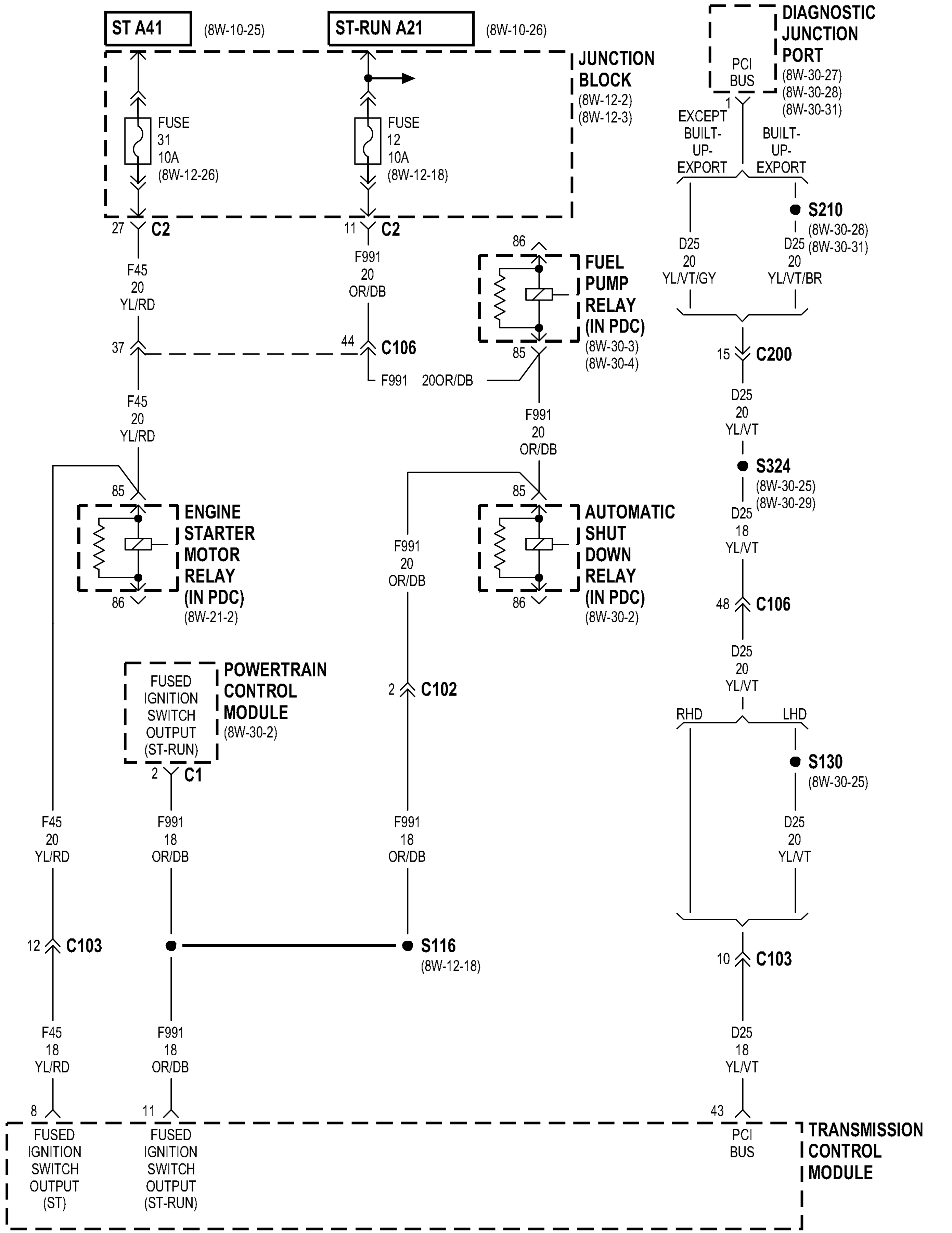
8W-31 TRANSMISSION CONTROL SYSTEM

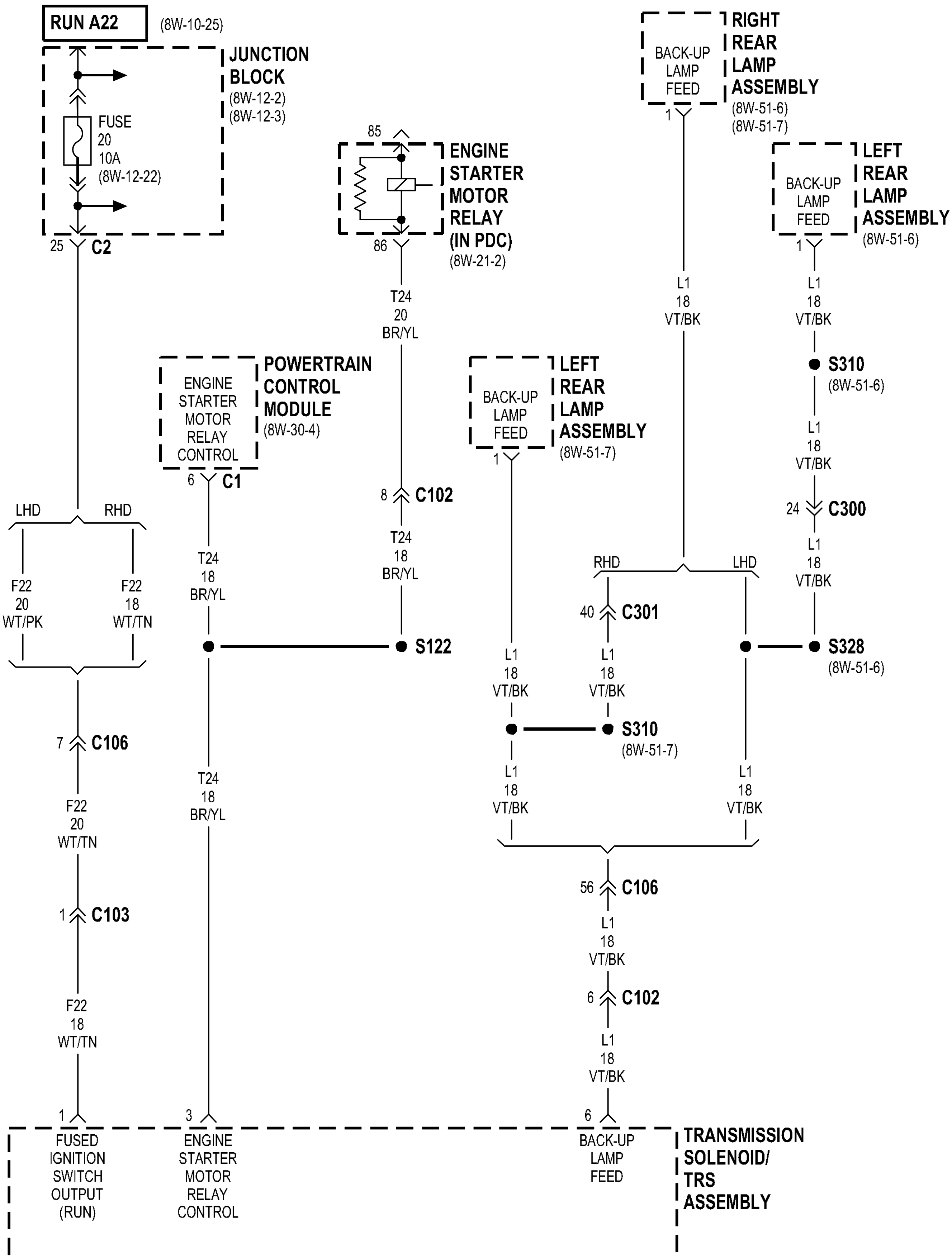

POWERTRAIN CONTROL MODULE
(8W-30-16)
GENERATOR SOURCE
25 C3
GENERATOR
(8W-20-2)
GENERATOR SOURCE
1
K21 18 LB/RD
2 C100
K21 18 LB/RD
K21 18 LB/RD
S126
(8W-30-16)
K21 18 LB/RD
K210 18 BK/YL
Z1 18 BK
4.0L
4.7L
S103
(8W-15-3)
Z1 18 BK
G104
(8W-15-3)
11
9 C102
K210 18 BK/YL
A30 14 RD/WT
BATT A0
(8W-10-10)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 5 30A (8W-10-16)
5
30
85
TRANSMISSION CONTROL RELAY
87
86
T16 14RD
40
FUSE 28 15A (IN PDC) (8W-10-16)
41
A30 14 RD/WT
T60 18 BR
T16 14 RD
TRANS-MISSION CONTROL RELAY OUTPUT
TRANSMISSION SOLENOID/ TRS ASSEMBLY
(8W-31-12) (8W-31-13)
10
K30 20 PK/YL
7 C103
4.7L
4.0L
1 C102
13
9 C103
T60 18 BR
T16 14 RD
T16 14 RD
K30 18 PK/YL
K30 18 PK/YL
30 C2
1
A30 14 RD/WT
FUSED TRANS-MISSION CONTROL RELAY OUTPUT
TRANSMISSION SOLENOID (4.0L)
(8W-31-9)
S115 (4.7L)
(8W-10-16)
T16 14 RD
T16 14 RD
T16 14 RD
TRANSMISSION CONTROL RELAY CONTROL
POWERTRAIN CONTROL MODULE
(8W-30-16)
56
16
17
36
15
FUSED B(+)
TRANS-MISSION CONTROL RELAY OUTPUT
TRANS-MISSION CONTROL RELAY OUTPUT
TRANS-MISSION CONTROL RELAY OUTPUT
TRANS-MISSION CONTROL RELAY CONTROL
TRANSMISSION CONTROL MODULE (4.7L)

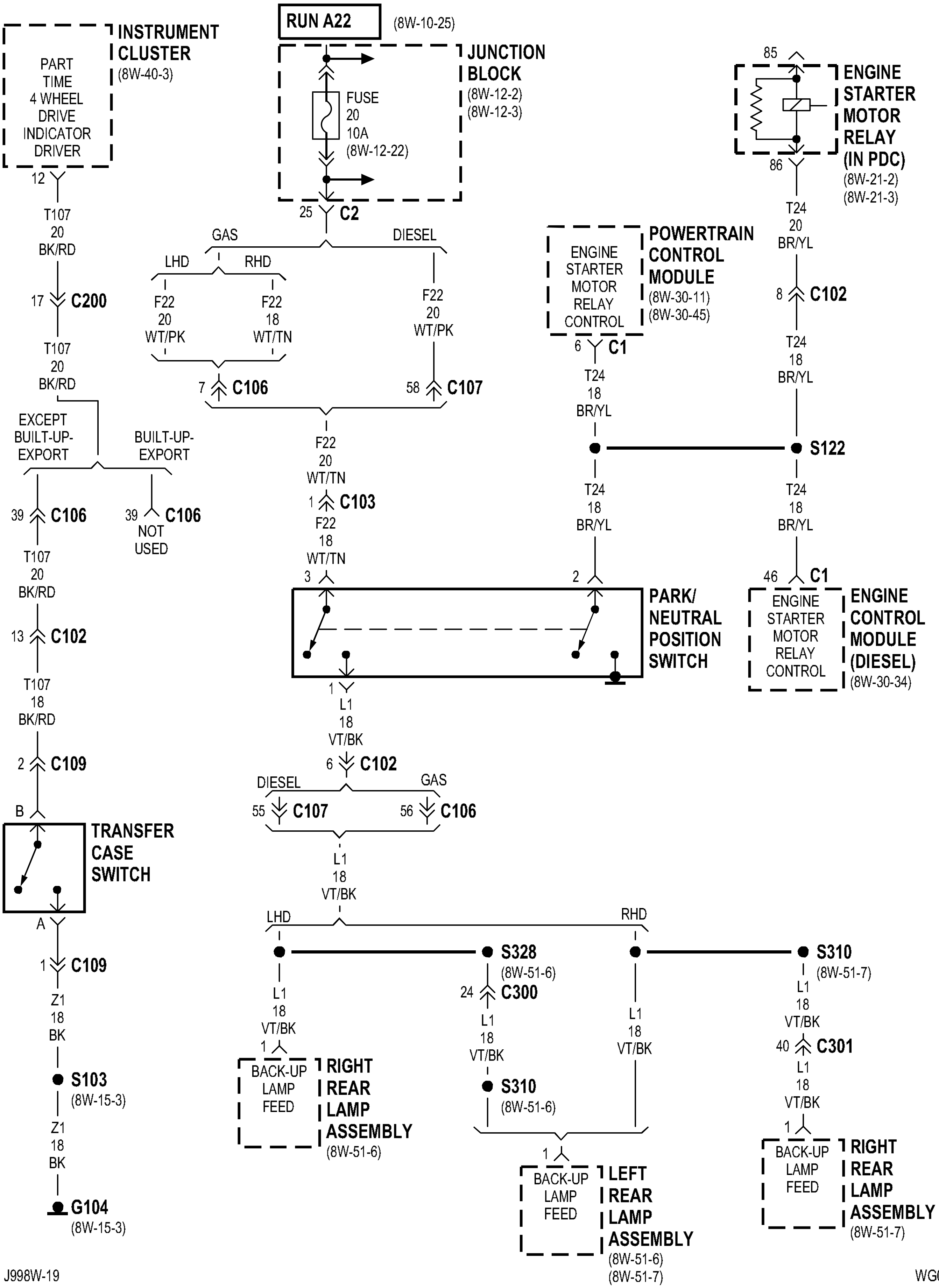


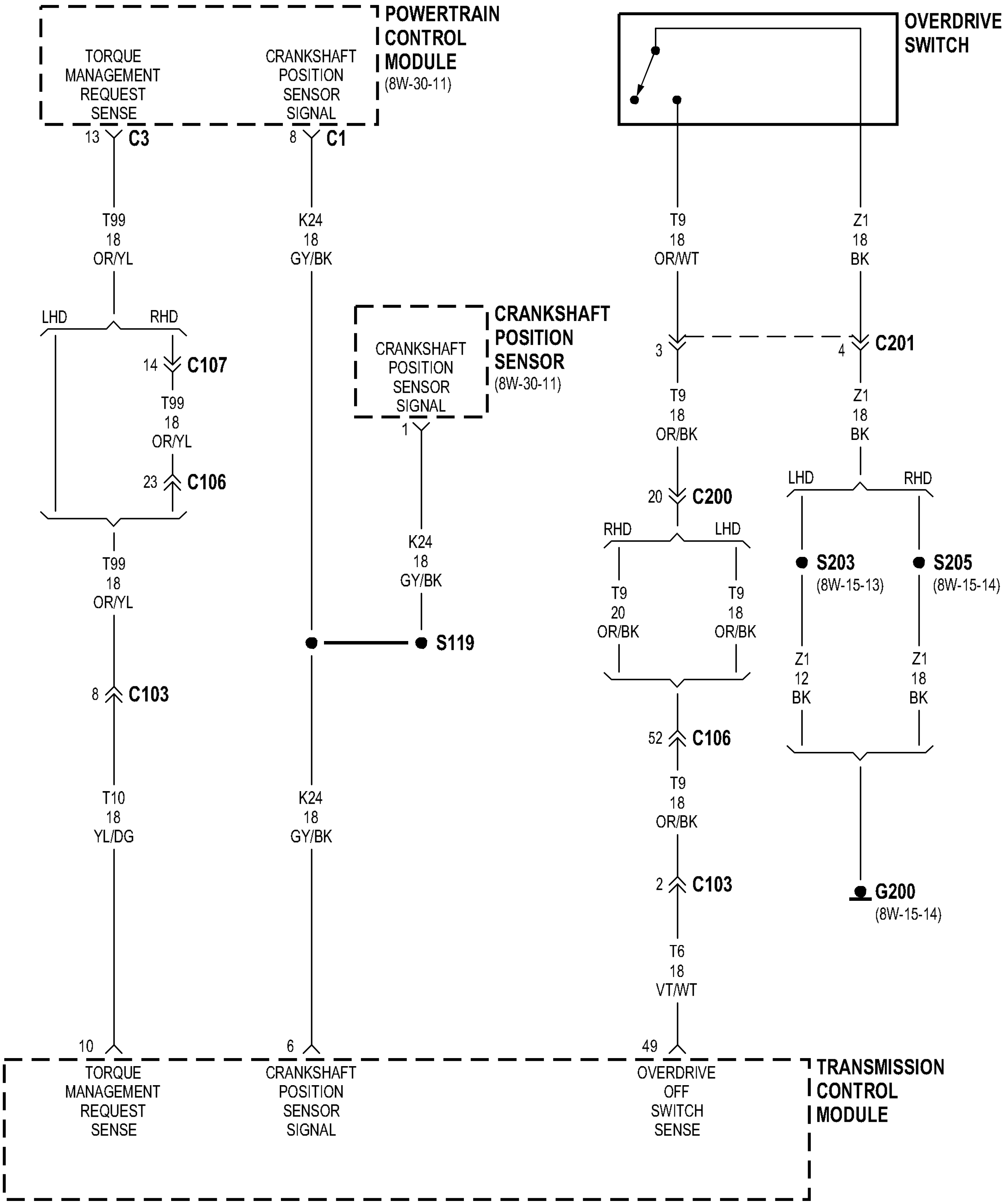
POWERTRAIN CONTROL MODULE
(8W-30-39)
GENERATOR DRIVER
25 C3
GENERATOR
(8W-20-3)
GENERATOR SOURCE
1
BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-3)
33
FUSE
24
20A
(8W-10-29)
32
K125
18
WT/DB
K125
18
WT/DB
14 C103
K125
18
WT/DB
A14
16
RD/WT
30
85
TRANSMISSION CONTROL RELAY (IN PDC)
87
86
A14
16
RD/WT
T60
18
BR
K30
20
PK/YL
5 C102
9 C103
7 C102
T60
18
BR
1
TRANSMISSION CONTROL RELAY OUTPUT
TRANSMISSION SOLENOID
(8W-31-9)
A14
16
RD/WT
K30
18
PK/YL
22 C1
30 C2
FUSED B(+)
TRANSMISSION CONTROL RELAY CONTROL
POWERTRAIN CONTROL MODULE
(8W-30-36)
(8W-30-38)

4.7L

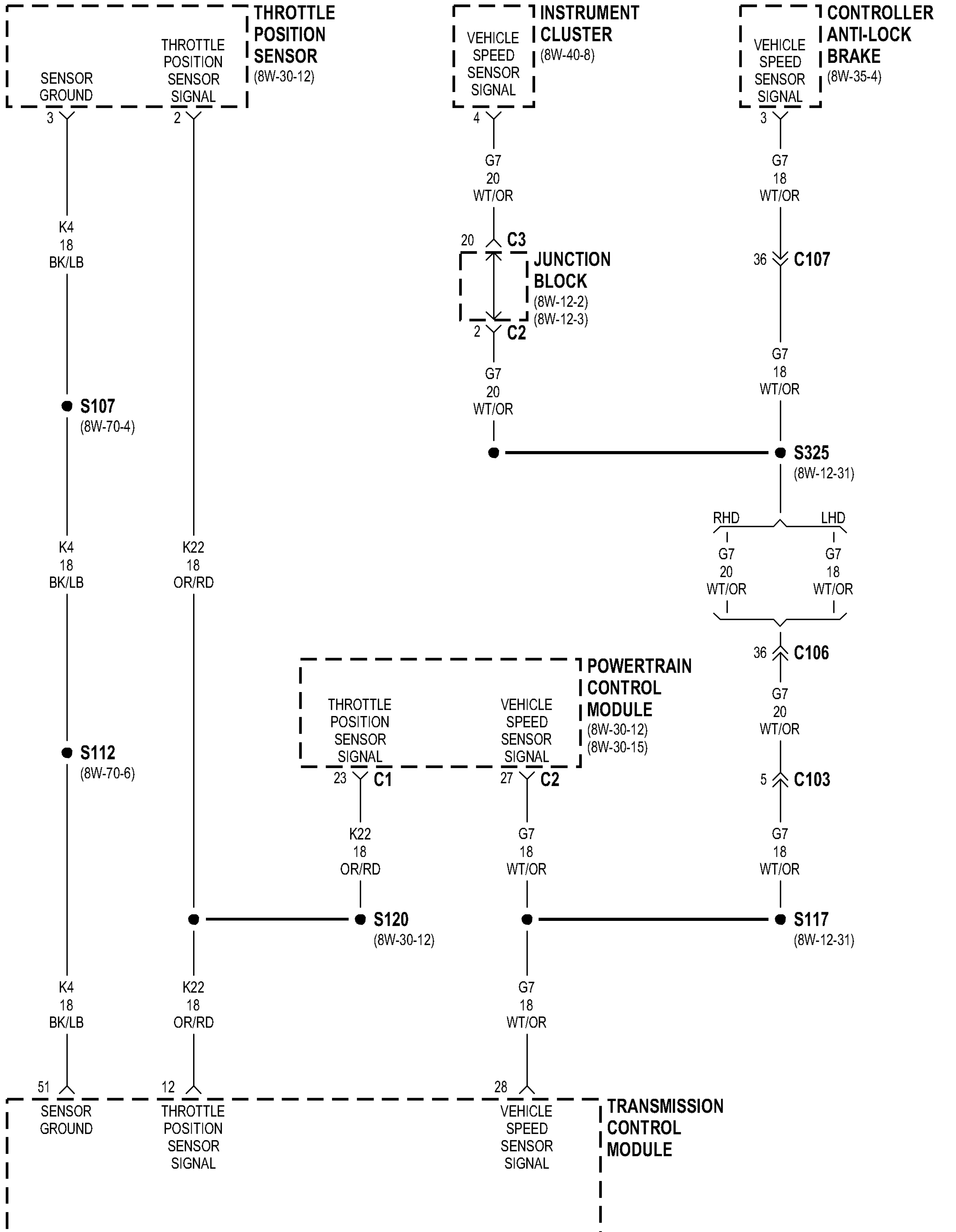

ST A41
(8W-10-25)
ST-RUN A21
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 31 10A (8W-12-26)
FUSE 12 10A (8W-12-18)
27 C2
11 C2
F45 20 YL/RD
F991 20 OR/DB
37
44 C106
F991 20OR/DB
DIAGNOSTIC JUNCTION PORT
(8W-30-27)
(8W-30-28)
(8W-30-31)
PCI BUS
1
EXCEPT BUILT-UP-EXPORT
BUILT-UP-EXPORT
S210
(8W-30-28)
(8W-30-31)
D25 20 YL/VT/GY
D25 20 YL/VT/BR
15 C200
D25 20 YL/VT
S324
(8W-30-25)
(8W-30-29)
D25 18 YL/VT
48 C106
D25 20 YL/VT
RHD
LHD
S130
(8W-30-25)
D25 20 YL/VT
10 C103
D25 18 YL/VT
86
FUEL PUMP RELAY (IN PDC)
(8W-30-3)
(8W-30-4)
85
F991 20 OR/DB
85
AUTOMATIC SHUT DOWN RELAY (IN PDC)
(8W-30-2)
86
85
ENGINE STARTER MOTOR RELAY (IN PDC)
(8W-21-2)
86
F991 20 OR/DB
POWERTRAIN CONTROL MODULE
(8W-30-2)
FUSED IGNITION SWITCH OUTPUT (ST-RUN)
2 C1
2 C102
F45 20 YL/RD
F991 18 OR/DB
F991 18 OR/DB
12 C103
S116
(8W-12-18)
F45 18 YL/RD
F991 18 OR/DB
8
11
43
FUSED IGNITION SWITCH OUTPUT (ST)
FUSED IGNITION SWITCH OUTPUT (ST-RUN)
PCI BUS
TRANSMISSION CONTROL MODULE


RUN A22
(8W-10-25)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
20
10A
(8W-12-22)
25 C2
LHD
RHD
F22
20
WT/PK
F22
18
WT/TN
7 C106
F22
20
WT/TN
1 C103
F22
18
WT/TN
ENGINE STARTER MOTOR RELAY CONTROL
POWERTRAIN CONTROL MODULE
(8W-30-4)
6 C1
T24
18
BR/YL
85
86
ENGINE STARTER MOTOR RELAY (IN PDC)
(8W-21-2)
T24
20
BR/YL
8 C102
T24
18
BR/YL
S122
T24
18
BR/YL
BACK-UP LAMP FEED
RIGHT REAR LAMP ASSEMBLY
(8W-51-6)
(8W-51-7)
1
L1
18
VT/BK
BACK-UP LAMP FEED
LEFT REAR LAMP ASSEMBLY
(8W-51-6)
1
L1
18
VT/BK
S310
(8W-51-6)
L1
18
VT/BK
24 C300
L1
18
VT/BK
BACK-UP LAMP FEED
LEFT REAR LAMP ASSEMBLY
(8W-51-7)
1
RHD
LHD
40 C301
L1
18
VT/BK
S328
(8W-51-6)
S310
(8W-51-7)
56 C106
6 C102
1
3
6
FUSED IGNITION SWITCH OUTPUT (RUN)
ENGINE STARTER MOTOR RELAY CONTROL
BACK-UP LAMP FEED
TRANSMISSION SOLENOID/ TRS ASSEMBLY


RUN A22
(8W-10-25)
INSTRUMENT CLUSTER
(8W-40-3)
PART TIME 4 WHEEL DRIVE INDICATOR DRIVER
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 20 10A (8W-12-22)
85
ENGINE STARTER MOTOR RELAY (IN PDC)
86
(8W-21-2)
(8W-21-3)
12
T107 20 BK/RD
25 C2
GAS
DIESEL
LHD
RHD
F22 20 WT/PK
F22 18 WT/TN
F22 20 WT/PK
17 C200
T107 20 BK/RD
7 C106
58 C107
POWERTRAIN CONTROL MODULE
(8W-30-11)
(8W-30-45)
ENGINE STARTER MOTOR RELAY CONTROL
6 C1
T24 18 BR/YL
T24 20 BR/YL
8 C102
T24 18 BR/YL
S122
EXCEPT BUILT-UP-EXPORT
BUILT-UP-EXPORT
39 C106
39 C106
NOT USED
F22 20 WT/TN
1 C103
F22 18 WT/TN
T24 18 BR/YL
T24 18 BR/YL
T107 20 BK/RD
13 C102
T107 18 BK/RD
2 C109
B
TRANSFER CASE SWITCH
A
1 C109
Z1 18 BK
S103
(8W-15-3)
Z1 18 BK
G104
(8W-15-3)
3
2
PARK/ NEUTRAL POSITION SWITCH
46 C1
ENGINE STARTER MOTOR RELAY CONTROL
ENGINE CONTROL MODULE (DIESEL)
(8W-30-34)
1
L1 18 VT/BK
6 C102
DIESEL
GAS
55 C107
56 C106
L1 18 VT/BK
LHD
RHD
S328
(8W-51-6)
S310
(8W-51-7)
24 C300
L1 18 VT/BK
L1 18 VT/BK
L1 18 VT/BK
L1 18 VT/BK
40 C301
L1 18 VT/BK
1
BACK-UP LAMP FEED
RIGHT REAR LAMP ASSEMBLY
(8W-51-6)
S310
(8W-51-6)
1
BACK-UP LAMP FEED
LEFT REAR LAMP ASSEMBLY
(8W-51-6)
(8W-51-7)
1
BACK-UP LAMP FEED
RIGHT REAR LAMP ASSEMBLY
(8W-51-7)


POWERTRAIN CONTROL MODULE
(8W-30-11)
TORQUE MANAGEMENT REQUEST SENSE
CRANKSHAFT POSITION SENSOR SIGNAL
13 C3
8 C1
T99 18 OR/YL
K24 18 GY/BK
LHD
RHD
14 C107
T99 18 OR/YL
23 C106
CRANKSHAFT POSITION SENSOR
(8W-30-11)
CRANKSHAFT POSITION SENSOR SIGNAL
1
K24 18 GY/BK
S119
T99 18 OR/YL
8 C103
T10 18 YL/DG
K24 18 GY/BK
OVERDRIVE SWITCH
T9 18 OR/WT
Z1 18 BK
3
4 C201
T9 18 OR/BK
Z1 18 BK
20 C200
RHD
LHD
T9 20 OR/BK
T9 18 OR/BK
S203
(8W-15-13)
S205
(8W-15-14)
Z1 12 BK
Z1 18 BK
52 C106
T9 18 OR/BK
2 C103
T6 18 VT/WT
G200
(8W-15-14)
10
6
49
TORQUE MANAGEMENT REQUEST SENSE
CRANKSHAFT POSITION SENSOR SIGNAL
OVERDRIVE OFF SWITCH SENSE
TRANSMISSION CONTROL MODULE

4.7L



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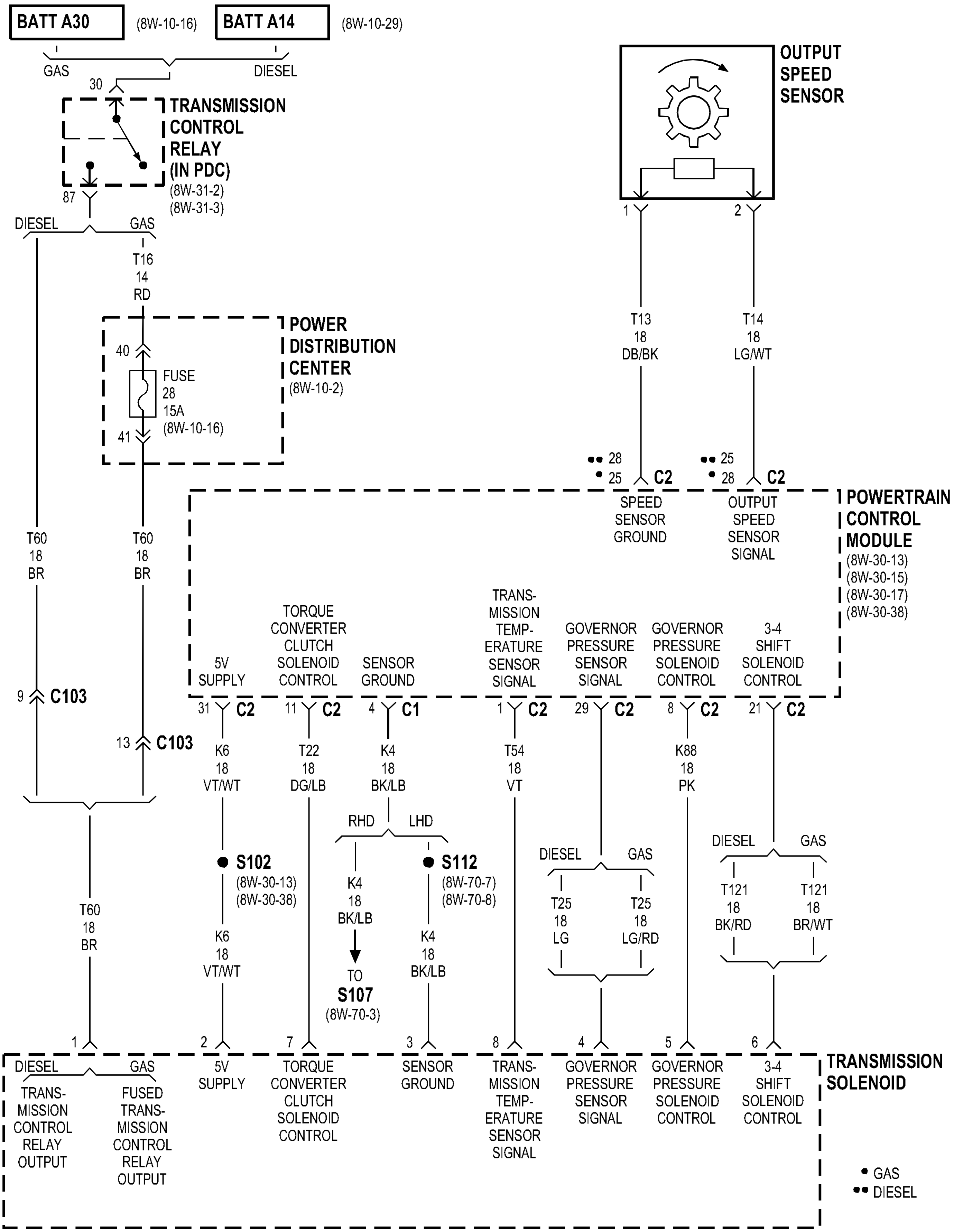
4.0L/DIESEL



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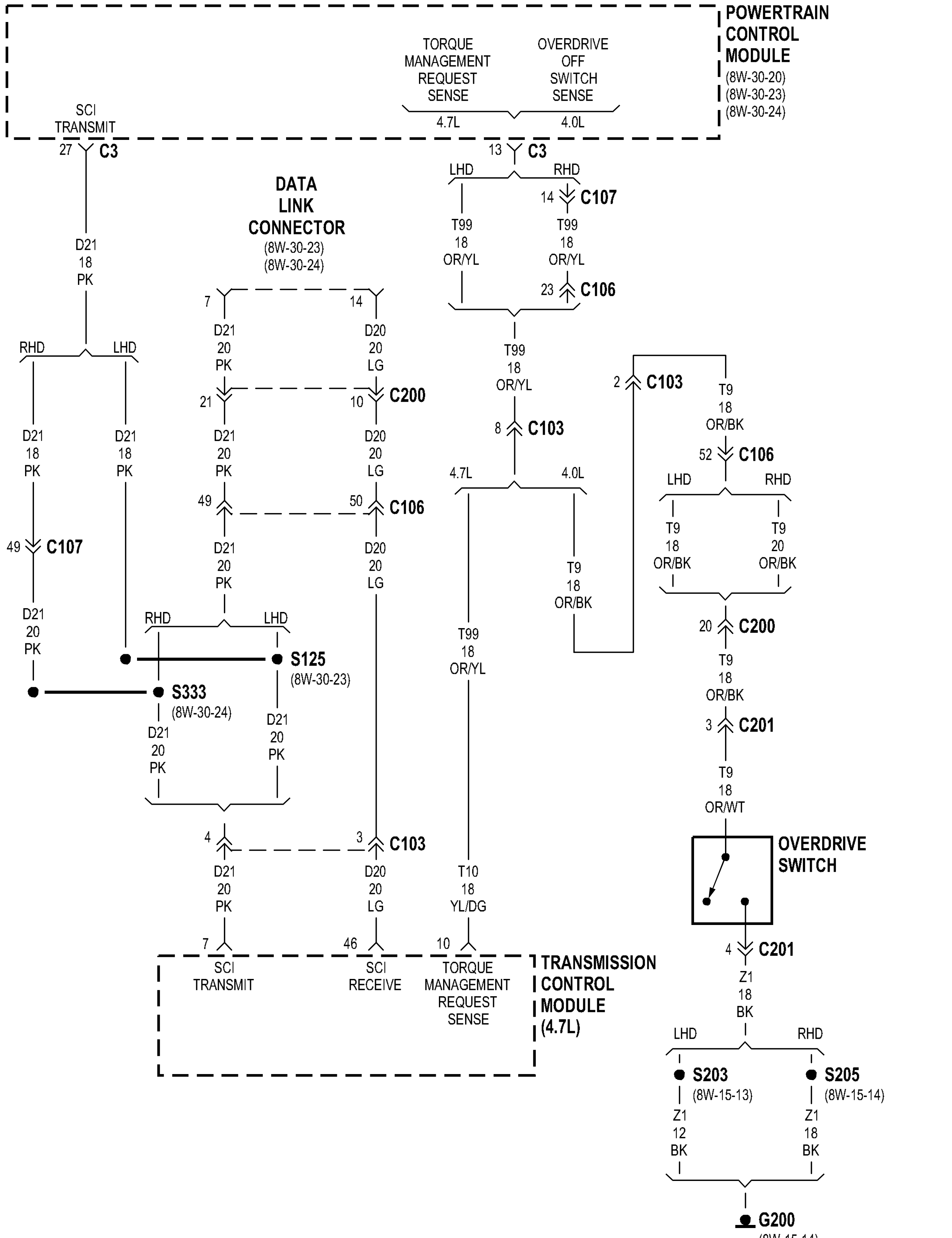
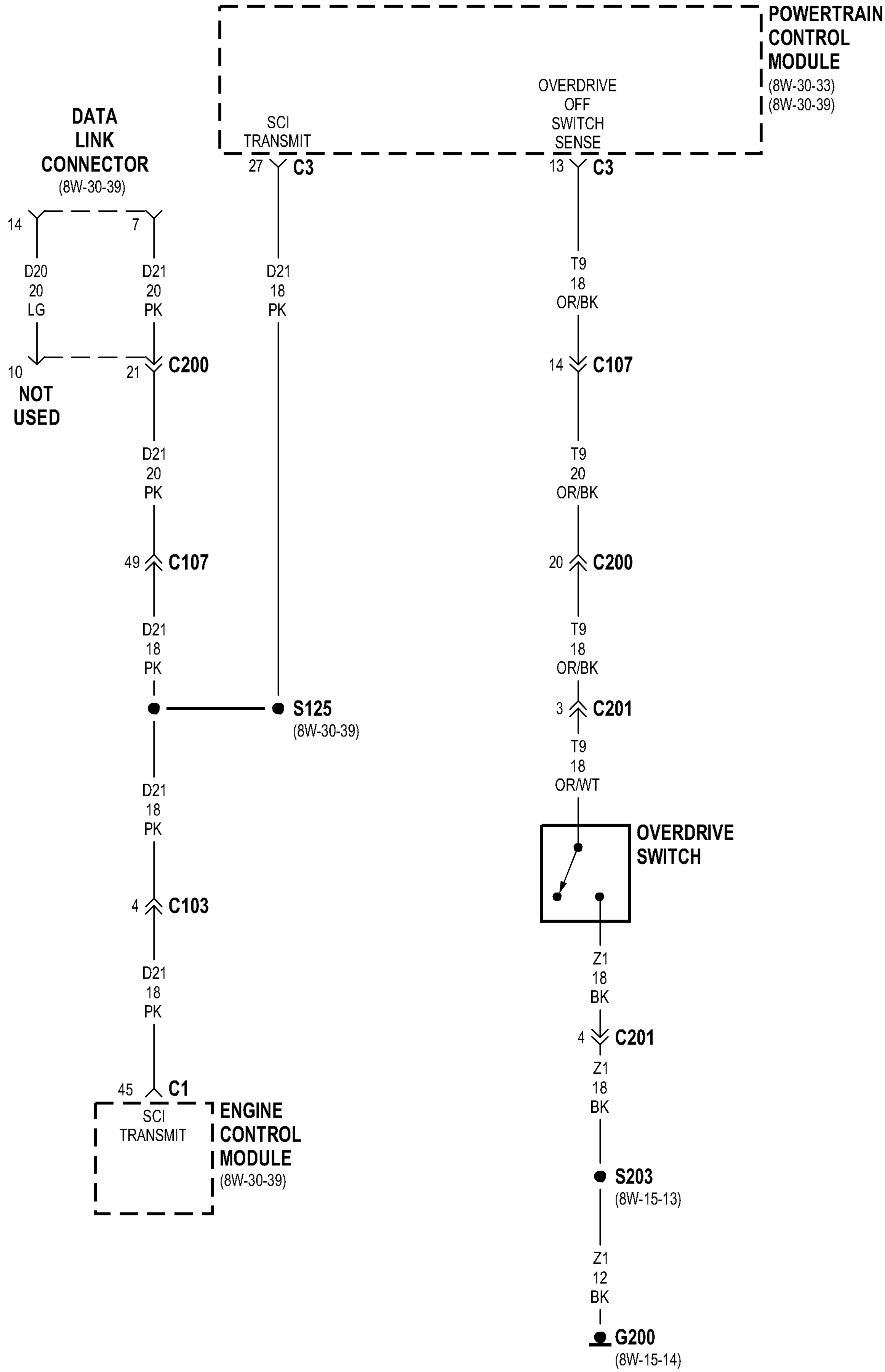
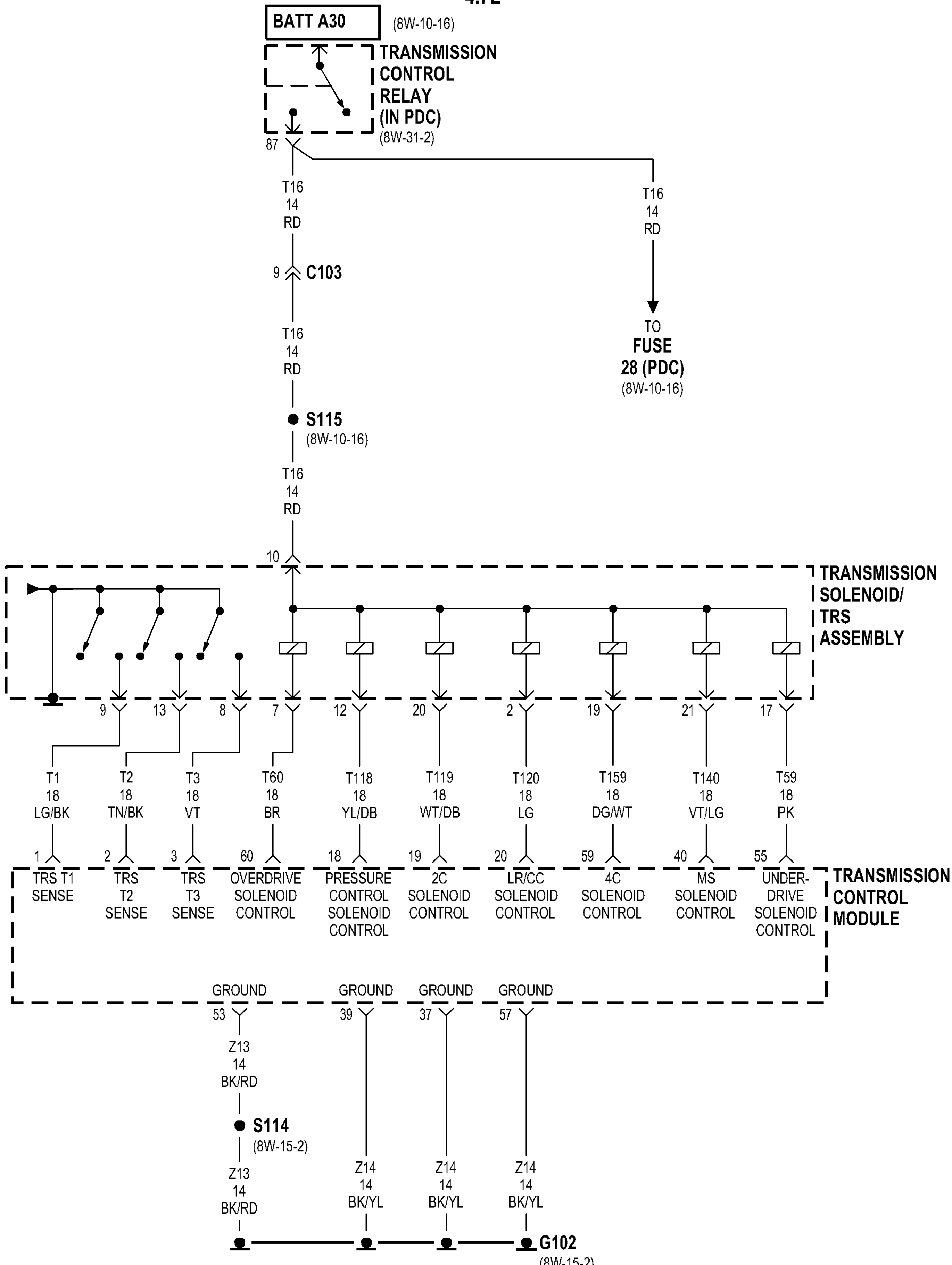
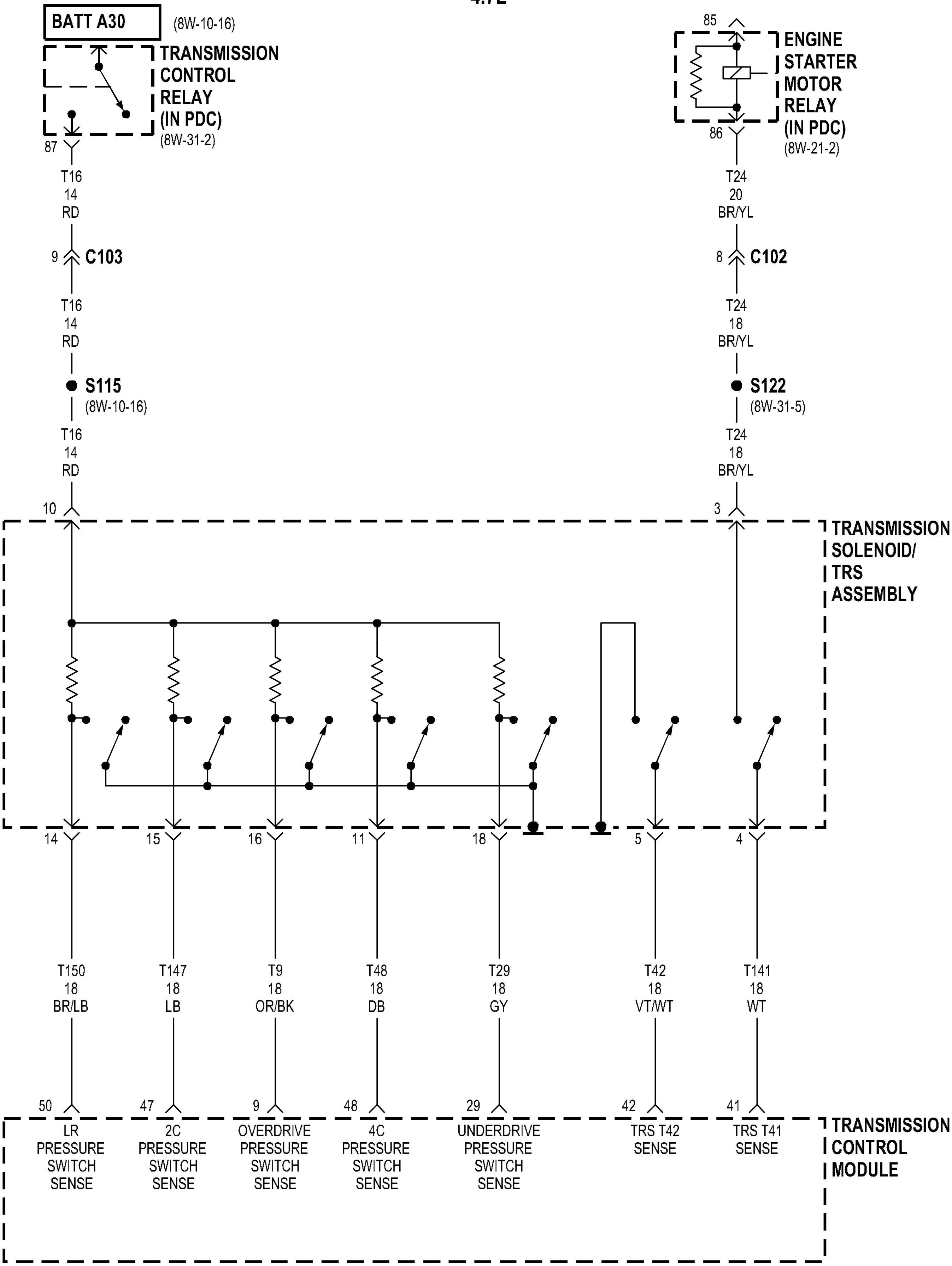

POWERTRAIN CONTROL MODULE
(8W-30-20)
(8W-30-23)
(8W-30-24)
TORQUE MANAGEMENT REQUEST SENSE
OVERDRIVE OFF SWITCH SENSE
4.7L
4.0L
SCI TRANSMIT
27 C3
13 C3
LHD
RHD
14 C107
T99 18 OR/YL
23 C106
DATA LINK CONNECTOR
(8W-30-23)
(8W-30-24)
D21 18 PK
7
14
D21 20 PK
D20 20 LG
21
10 C200
RHD
LHD
D21 18 PK
49
50 C106
49 C107
D21 20 PK
D20 20 LG
RHD
LHD
S125
(8W-30-23)
S333
(8W-30-24)
4
3 C103
7
46
10
SCI TRANSMIT
SCI RECEIVE
TORQUE MANAGEMENT REQUEST SENSE
TRANSMISSION CONTROL MODULE (4.7L)
8 C103
4.7L
4.0L
T99 18 OR/YL
T10 18 YL/DG
T9 18 OR/BK
2 C103
T9 18 OR/BK
52 C106
LHD
RHD
T9 18 OR/BK
T9 20 OR/BK
20 C200
3 C201
T9 18 OR/WT
OVERDRIVE SWITCH
4 C201
Z1 18 BK
LHD
RHD
S203
(8W-15-13)
S205
(8W-15-14)
Z1 12 BK
Z1 18 BK
G200
(8W-15-14)

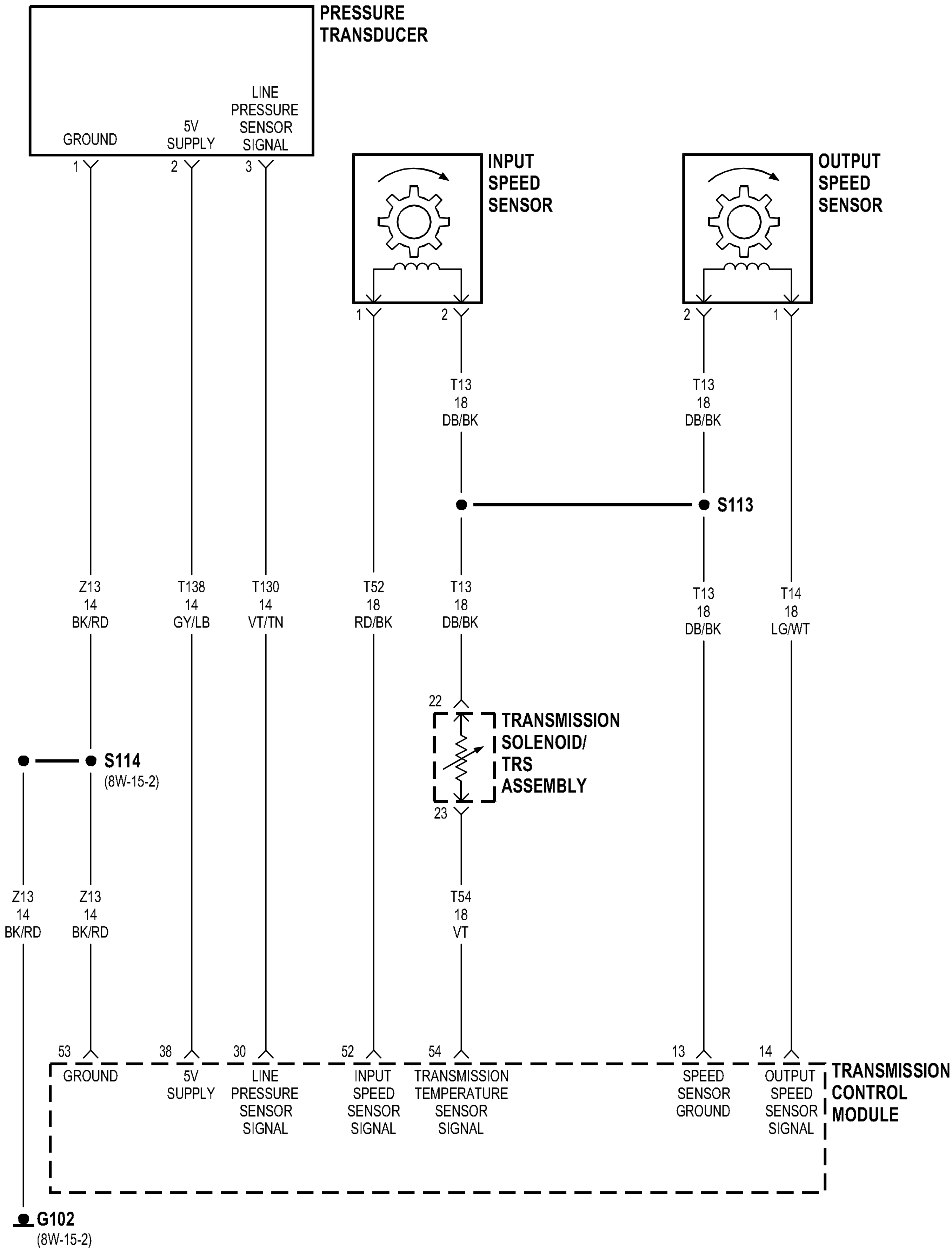

POWERTRAIN CONTROL MODULE
(8W-30-33)
(8W-30-39)
SCI TRANSMIT
27 C3
OVERDRIVE OFF SWITCH SENSE
13 C3
DATA LINK CONNECTOR
(8W-30-39)
14
7
D20 20 LG
D21 20 PK
10
NOT USED
21 C200
D21 20 PK
49 C107
D21 18 PK
D21 18 PK
S125
(8W-30-39)
D21 18 PK
4 C103
D21 18 PK
45 C1
SCI TRANSMIT
ENGINE CONTROL MODULE
(8W-30-39)
T9 18 OR/BK
14 C107
T9 20 OR/BK
20 C200
T9 18 OR/BK
3 C201
T9 18 OR/WT
OVERDRIVE SWITCH
Z1 18 BK
4 C201
Z1 18 BK
S203
(8W-15-13)
Z1 12 BK
G200
(8W-15-14)

4.7L


BATT A30
(8W-10-16)
TRANSMISSION CONTROL RELAY (IN PDC)
(8W-31-2)
87
T16 14 RD
9 C103
T16 14 RD
TO FUSE 28 (PDC)
(8W-10-16)
S115
(8W-10-16)
10
TRANSMISSION SOLENOID/ TRS ASSEMBLY
9 13 8 7 12 20 2 19 21 17
T1 18 LG/BK
T2 18 TN/BK
T3 18 VT
T60 18 BR
T118 18 YL/DB
T119 18 WT/DB
T120 18 LG
T159 18 DG/WT
T140 18 VT/LG
T59 18 PK
1 2 3 60 18 19 20 59 40 55
TRS T1 SENSE
TRS T2 SENSE
TRS T3 SENSE
OVERDRIVE SOLENOID CONTROL
PRESSURE CONTROL SOLENOID CONTROL
2C SOLENOID CONTROL
LR/CC SOLENOID CONTROL
4C SOLENOID CONTROL
MS SOLENOID CONTROL
UNDER-DRIVE SOLENOID CONTROL
TRANSMISSION CONTROL MODULE
GROUND GROUND GROUND GROUND
53 39 37 57
Z13 14 BK/RD
S114
(8W-15-2)
Z13 14 BK/RD
Z14 14 BK/YL
Z14 14 BK/YL
Z14 14 BK/YL
G102
(8W-15-2)

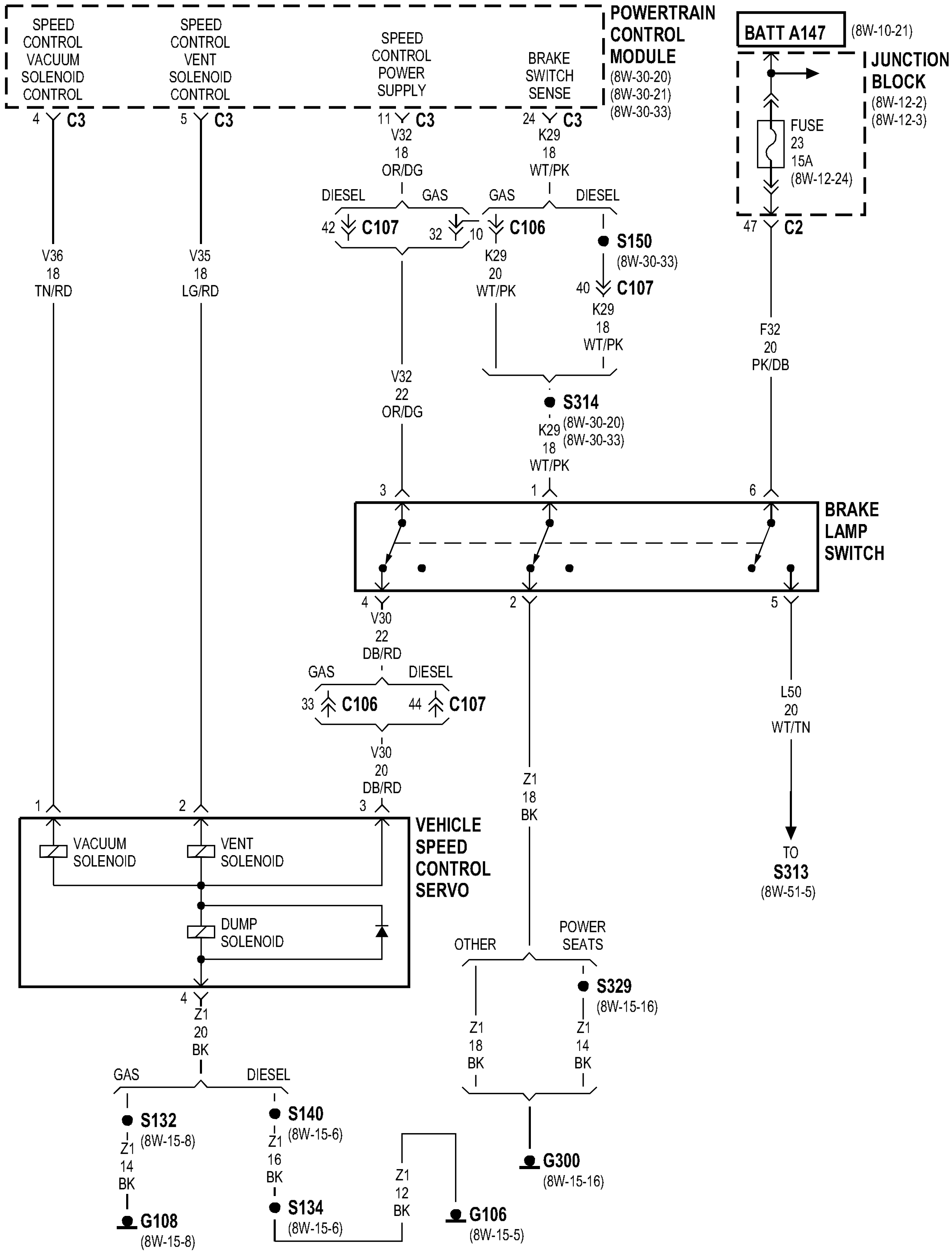
4.7L


BATT A30
(8W-10-16)
TRANSMISSION CONTROL RELAY (IN PDC)
(8W-31-2)
87
T16
14
RD
9
C103
T16
14
RD
S115
(8W-10-16)
T16
14
RD
10
85
ENGINE STARTER MOTOR RELAY (IN PDC)
(8W-21-2)
86
T24
20
BR/YL
8
C102
T24
18
BR/YL
S122
(8W-31-5)
T24
18
BR/YL
3
TRANSMISSION SOLENOID/ TRS ASSEMBLY
14
15
16
11
18
5
4
T150
18
BR/LB
T147
18
LB
T9
18
OR/BK
T48
18
DB
T29
18
GY
T42
18
VT/WT
T141
18
WT
50
47
9
48
29
42
41
LR PRESSURE SWITCH SENSE
2C PRESSURE SWITCH SENSE
OVERDRIVE PRESSURE SWITCH SENSE
4C PRESSURE SWITCH SENSE
UNDERDRIVE PRESSURE SWITCH SENSE
TRS T42 SENSE
TRS T41 SENSE
TRANSMISSION CONTROL MODULE


PRESSURE
TRANSDUCER
GROUND
5V
SUPPLY
LINE
PRESSURE
SENSOR
SIGNAL
1
2
3
INPUT
SPEED
SENSOR
OUTPUT
SPEED
SENSOR
1
2
2
1
T13
18
DB/BK
T13
18
DB/BK
S113
Z13
14
BK/RD
T138
14
GY/LB
T130
14
VT/TN
T52
18
RD/BK
T13
18
DB/BK
T13
18
DB/BK
T14
18
LG/WT
22
TRANSMISSION
SOLENOID/
TRS
ASSEMBLY
23
S114
(8W-15-2)
Z13
14
BK/RD
Z13
14
BK/RD
T54
18
VT
53
38
30
52
54
13
14
GROUND
5V
SUPPLY
LINE
PRESSURE
SENSOR
SIGNAL
INPUT
SPEED
SENSOR
SIGNAL
TRANSMISSION
TEMPERATURE
SENSOR
SIGNAL
SPEED
SENSOR
GROUND
OUTPUT
SPEED
SENSOR
SIGNAL
TRANSMISSION
CONTROL
MODULE
G102
(8W-15-2)

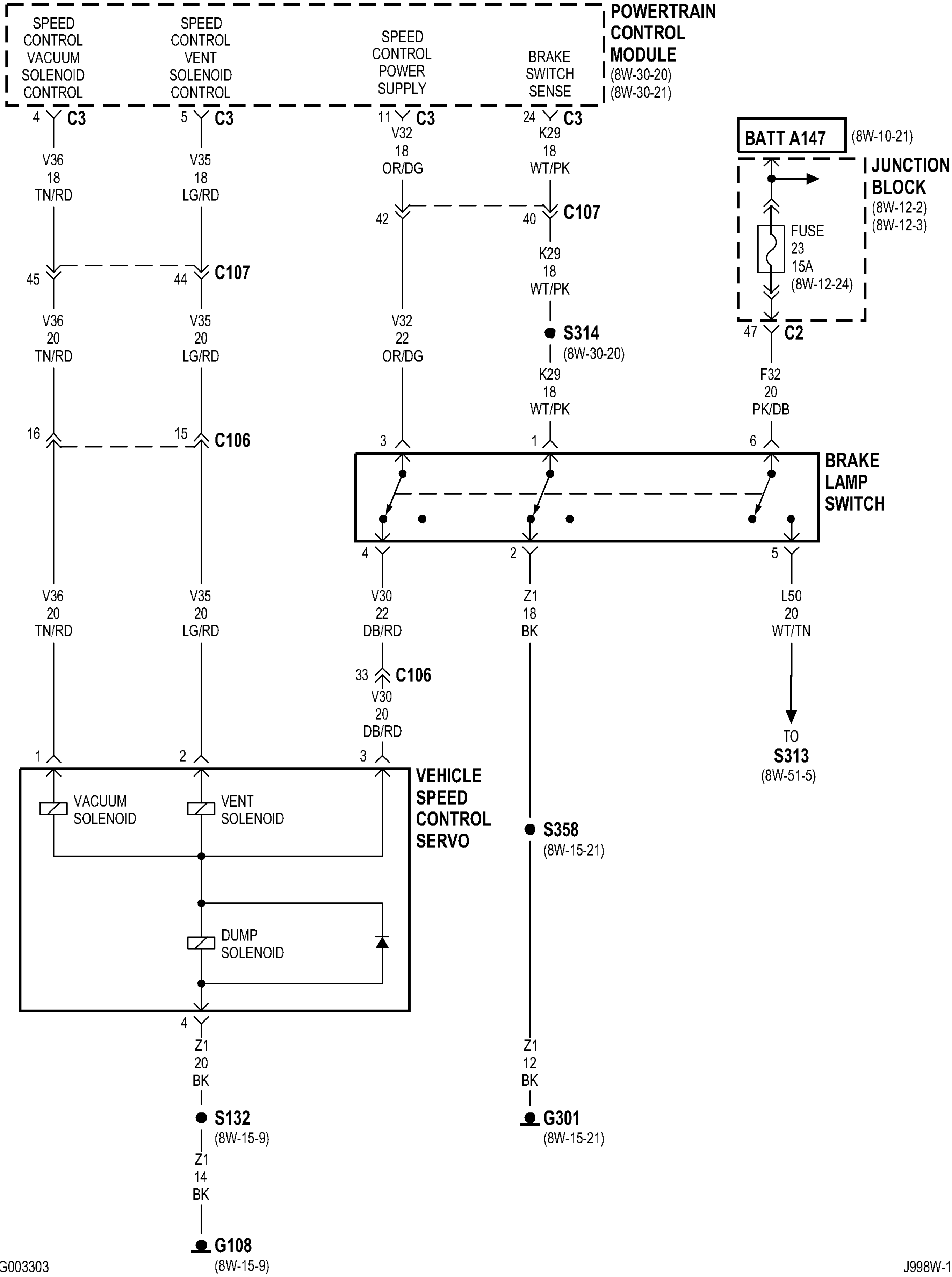
8W-33 VEHICLE SPEED CONTROL

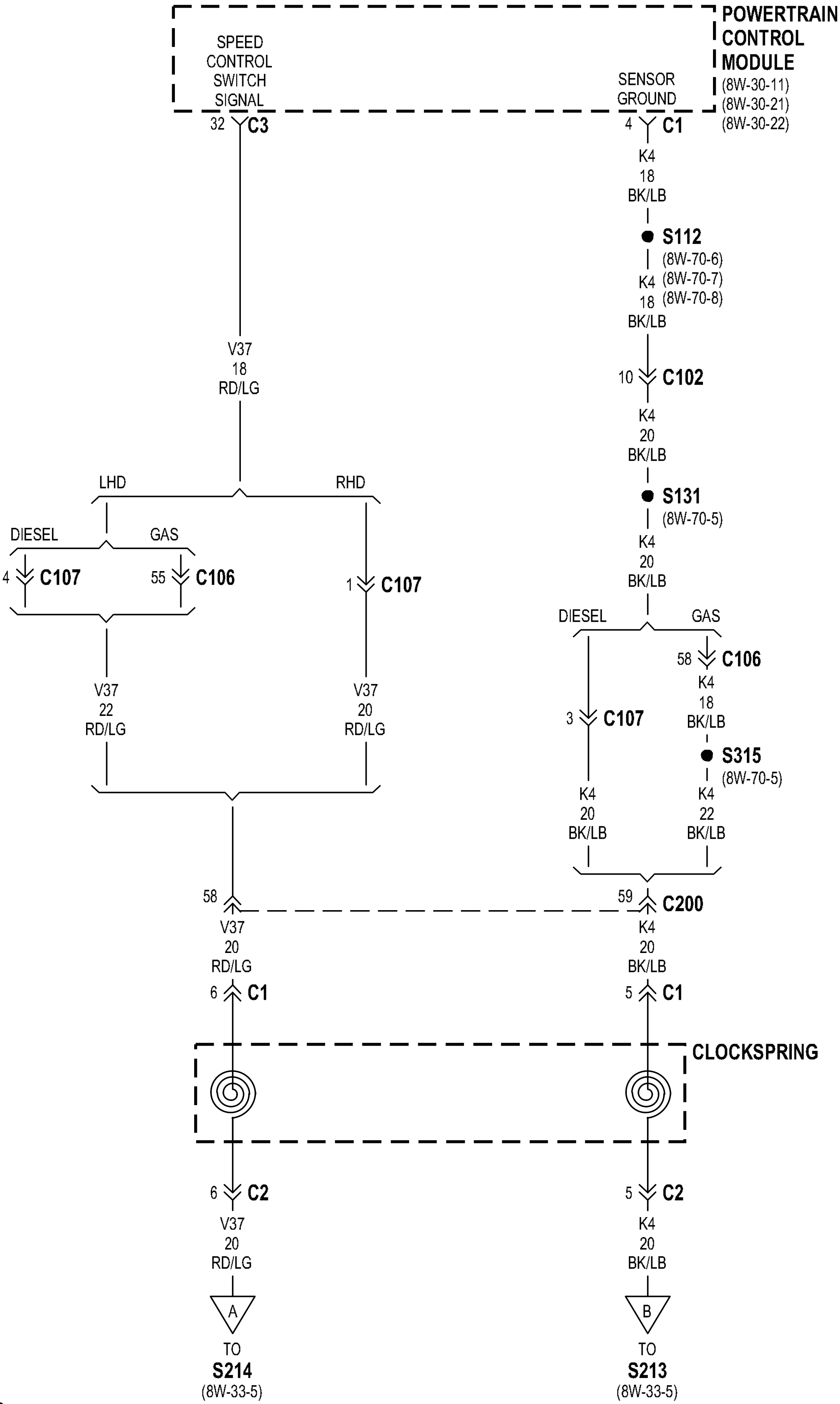
LHD



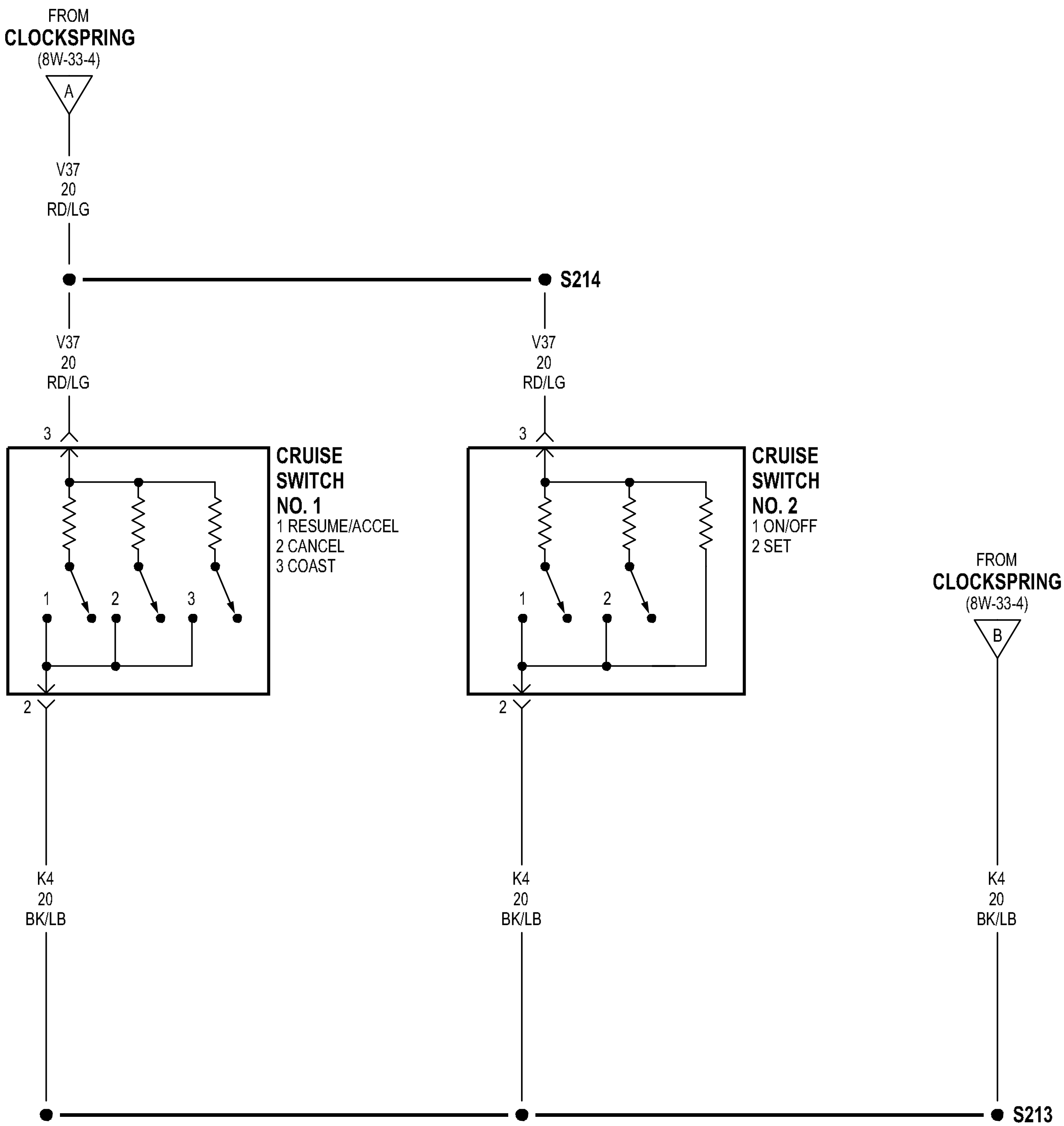
SPEED CONTROL VACUUM SOLENOID CONTROL
SPEED CONTROL VENT SOLENOID CONTROL
SPEED CONTROL POWER SUPPLY
BRAKE SWITCH SENSE
POWERTRAIN CONTROL MODULE
(8W-30-20)
(8W-30-21)
(8W-30-33)
BATT A147
(8W-10-21)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
23
15A
(8W-12-24)
47 C2
4 C3
5 C3
11 C3
24 C3
V32 18 OR/DG
K29 18 WT/PK
DIESEL
GAS
GAS
DIESEL
42 C107
32
10 C106
S150
(8W-30-33)
V36 18 TN/RD
V35 18 LG/RD
K29 20 WT/PK
40 C107
K29 18 WT/PK
F32 20 PK/DB
V32 22 OR/DG
S314
(8W-30-20)
(8W-30-33)
K29 18 WT/PK
3
1
6
BRAKE LAMP SWITCH
4
2
5
V30 22 DB/RD
GAS
DIESEL
33 C106
44 C107
V30 20 DB/RD
L50 20 WT/TN
Z1 18 BK
1
2
3
VACUUM SOLENOID
VENT SOLENOID
DUMP SOLENOID
VEHICLE SPEED CONTROL SERVO
TO
S313
(8W-51-5)
OTHER
POWER SEATS
S329
(8W-15-16)
4
Z1 20 BK
Z1 18 BK
Z1 14 BK
GAS
DIESEL
S132
(8W-15-8)
Z1 14 BK
S140
(8W-15-6)
Z1 16 BK
S134
(8W-15-6)
Z1 12 BK
G108
(8W-15-8)
G106
(8W-15-5)
G300
(8W-15-16)

8W-33 VEHICLE SPEED CONTROL
RHD

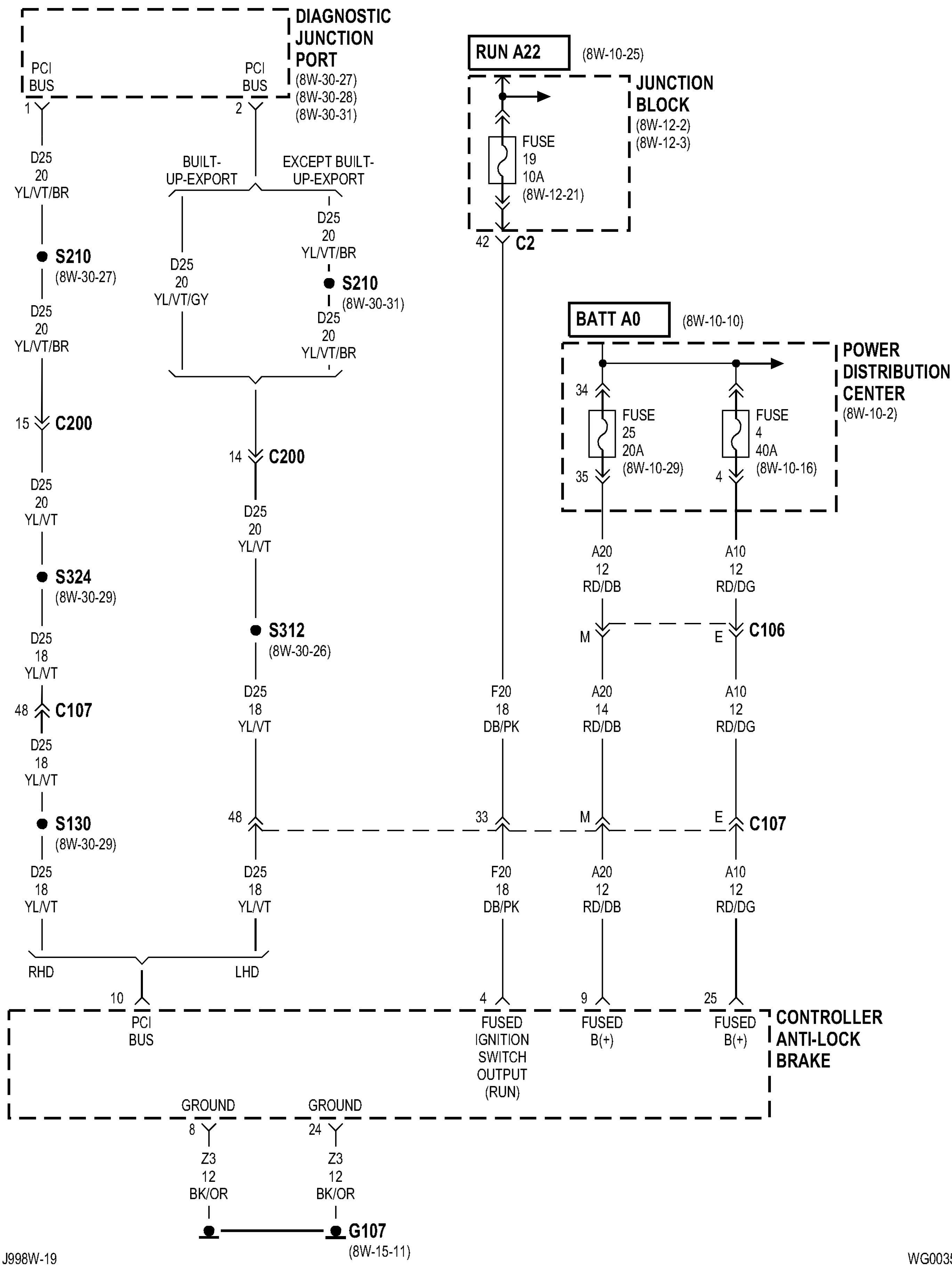


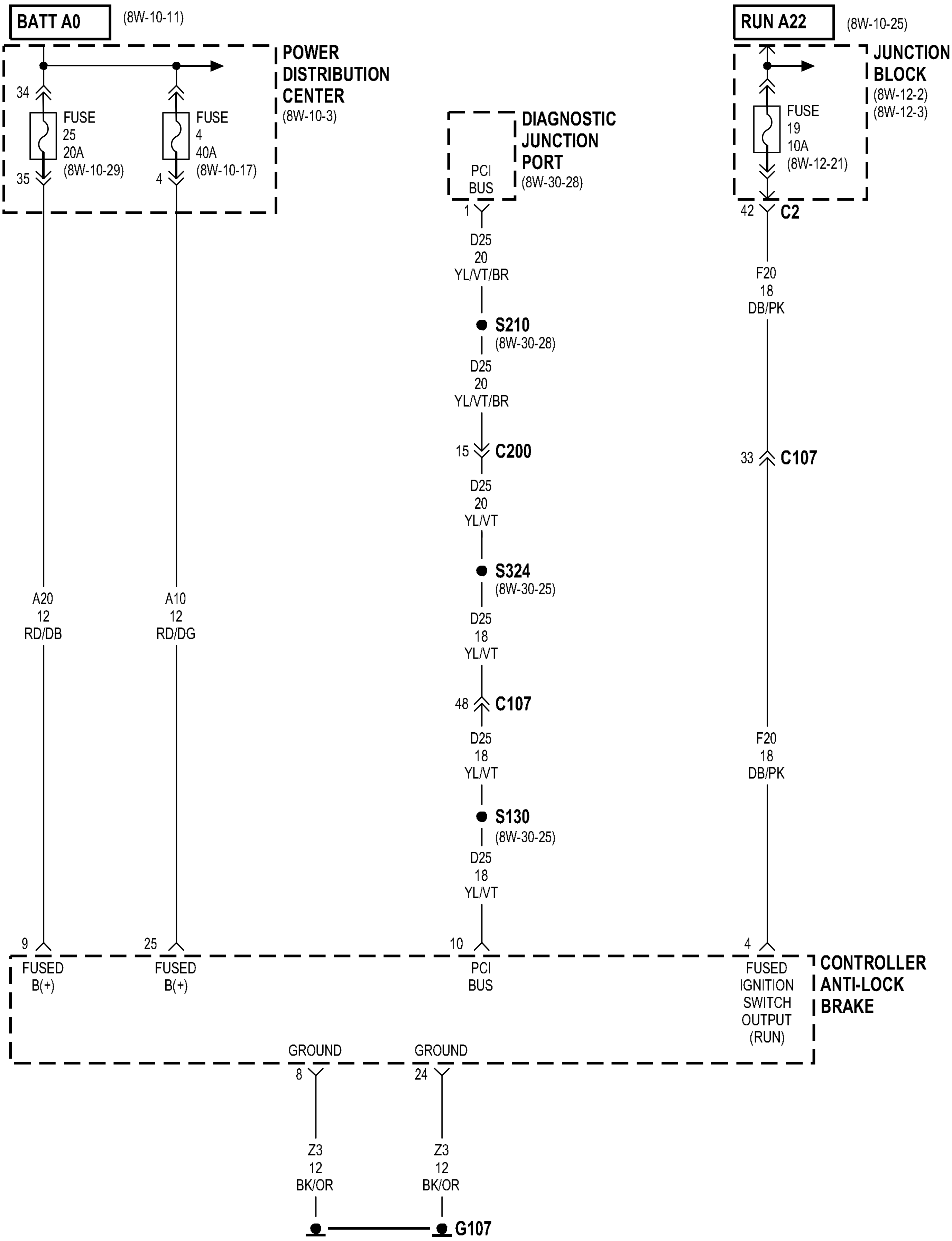


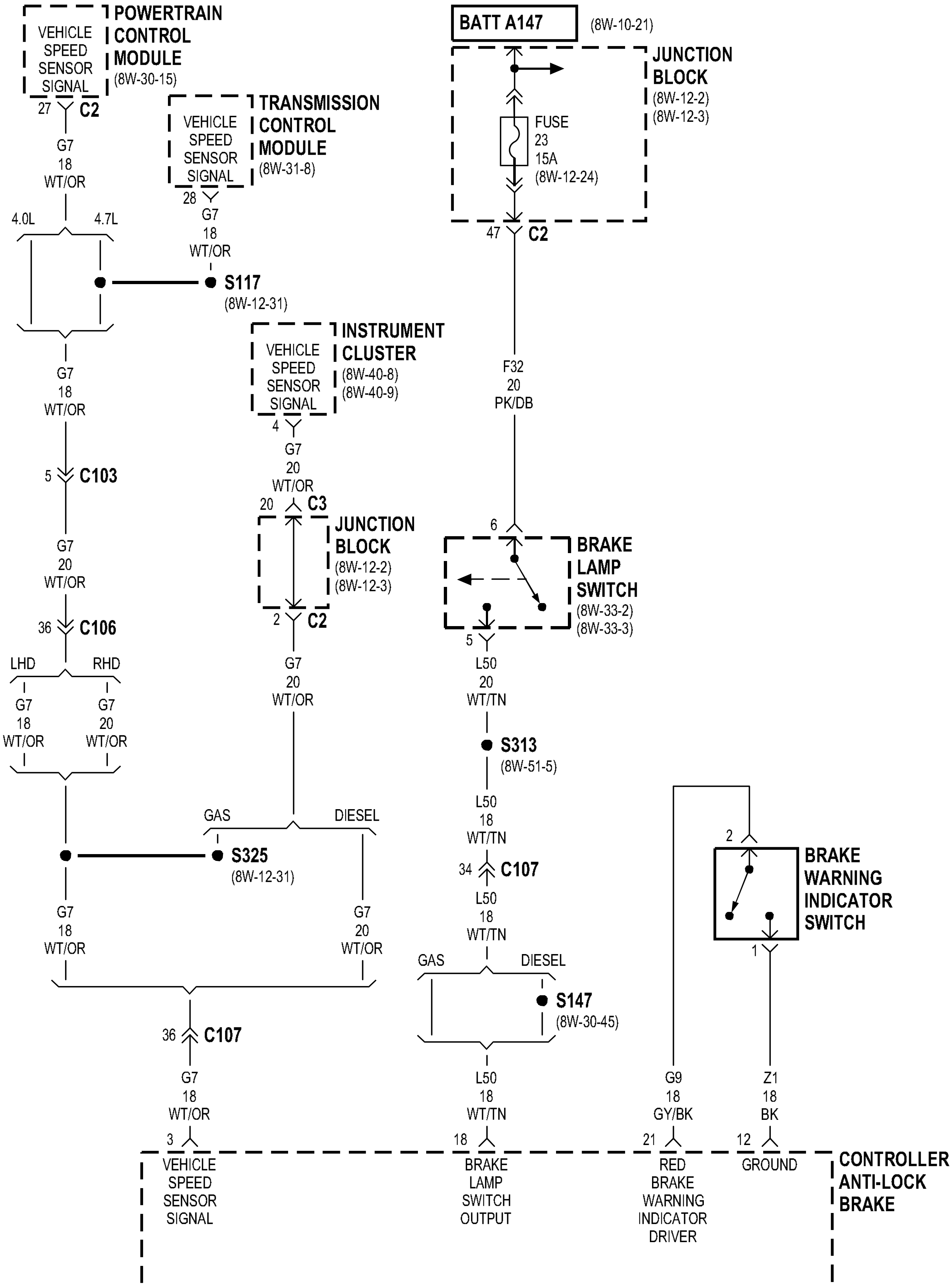
POWERTRAIN CONTROL MODULE
(8W-30-11)
(8W-30-21)
(8W-30-22)
SPEED CONTROL SWITCH SIGNAL
32 C3
SENSOR GROUND
4 C1
K4 18 BK/LB
S112
(8W-70-6)
(8W-70-7)
(8W-70-8)
K4 18 BK/LB
10 C102
K4 20 BK/LB
S131
(8W-70-5)
K4 20 BK/LB
DIESEL
GAS
58 C106
K4 18 BK/LB
S315
(8W-70-5)
3 C107
K4 20 BK/LB
K4 22 BK/LB
V37 18 RD/LG
LHD
RHD
DIESEL
GAS
4 C107
55 C106
1 C107
V37 22 RD/LG
V37 20 RD/LG
58
59 C200
V37 20 RD/LG
K4 20 BK/LB
6 C1
5 C1
CLOCKSPRING
6 C2
5 C2
V37 20 RD/LG
K4 20 BK/LB
A
B
TO S214 (8W-33-5)
TO S213 (8W-33-5)

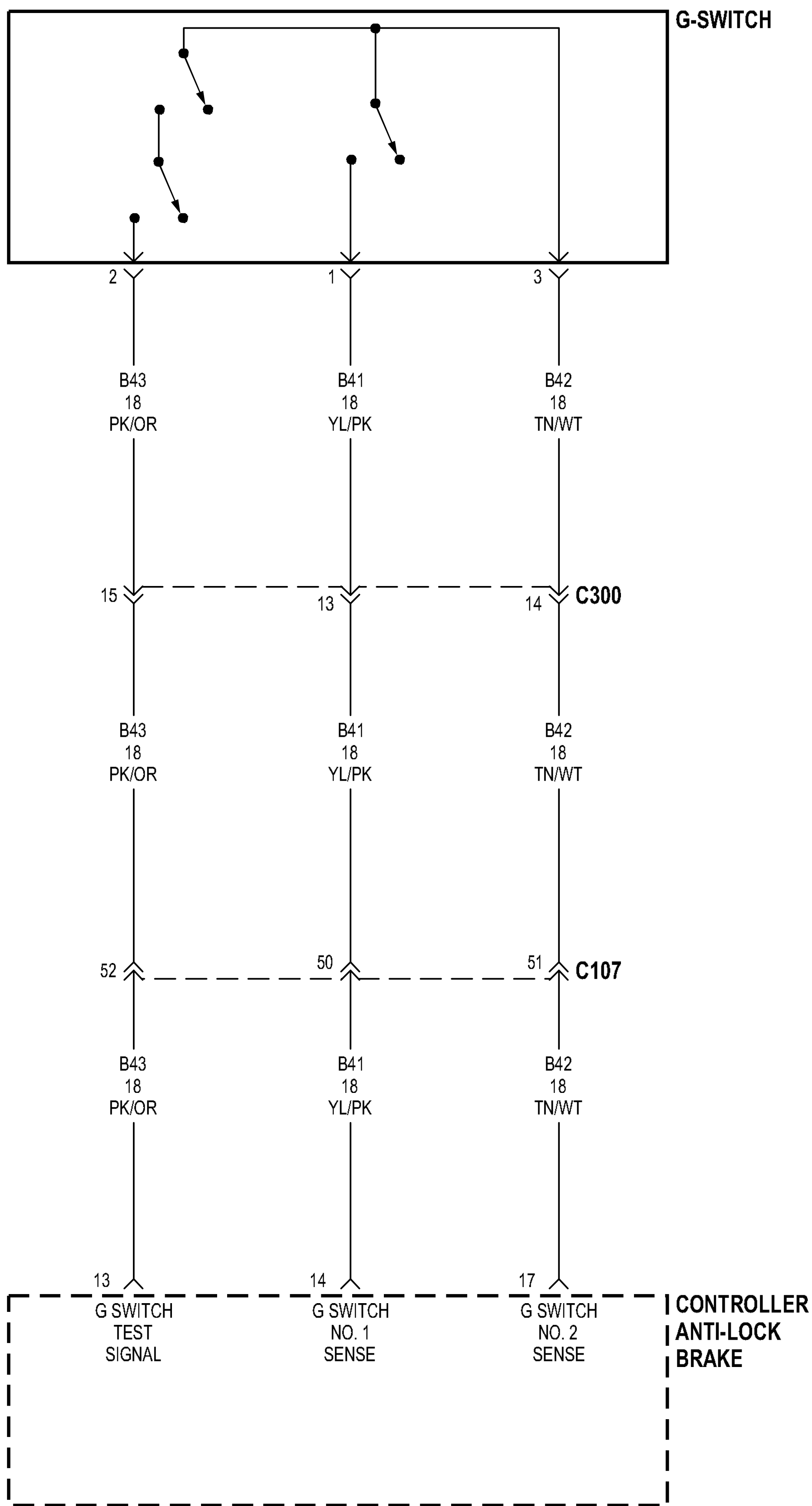

FROM
CLOCKSPRING
(8W-33-4)
A
V37
20
RD/LG
S214
V37
20
RD/LG
V37
20
RD/LG
3
3
CRUISE
SWITCH
NO. 1
1 RESUME/ACCEL
2 CANCEL
3 COAST
1
2
3
2
CRUISE
SWITCH
NO. 2
1 ON/OFF
2 SET
1
2
2
FROM
CLOCKSPRING
(8W-33-4)
B
K4
20
BK/LB
K4
20
BK/LB
K4
20
BK/LB
S213

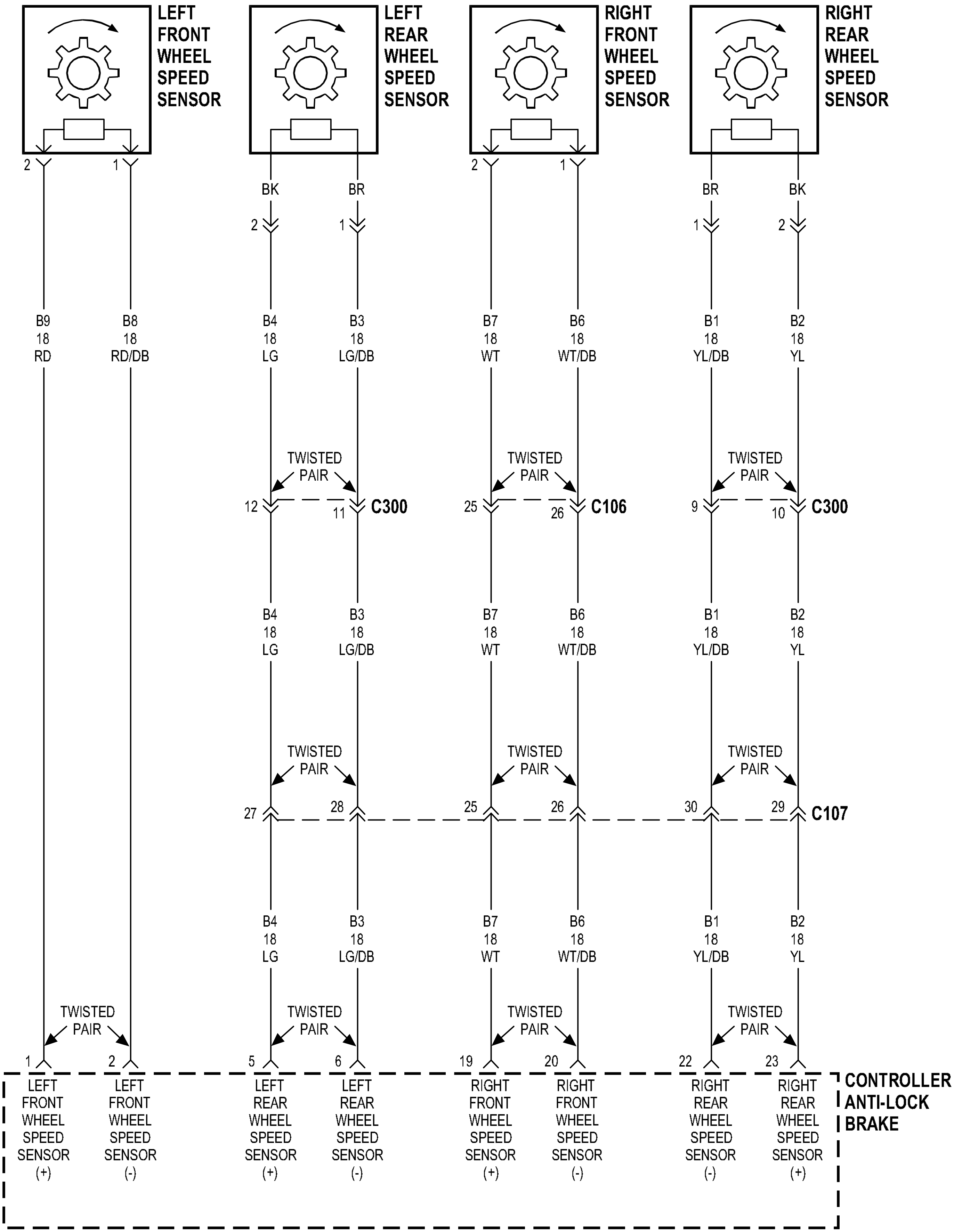
8W-35 ANTI-LOCK BRAKES


DIAGNOSTIC JUNCTION PORT
(8W-30-27)
(8W-30-28)
(8W-30-31)
PCI BUS
PCI BUS
1
2
D25 20 YL/VT/BR
BUILT-UP-EXPORT
EXCEPT BUILT-UP-EXPORT
D25 20 YL/VT/BR
S210 (8W-30-27)
D25 20 YL/VT/GY
S210 (8W-30-31)
D25 20 YL/VT/BR
D25 20 YL/VT/BR
D25 20 YL/VT/BR
15 C200
14 C200
D25 20 YL/VT
D25 20 YL/VT
S324 (8W-30-29)
S312 (8W-30-26)
D25 18 YL/VT
48 C107
D25 18 YL/VT
D25 18 YL/VT
S130 (8W-30-29)
D25 18 YL/VT
D25 18 YL/VT
RHD
LHD
RUN A22 (8W-10-25)
JUNCTION BLOCK (8W-12-2) (8W-12-3)
FUSE 19 10A (8W-12-21)
42 C2
BATT A0 (8W-10-10)
POWER DISTRIBUTION CENTER (8W-10-2)
34
FUSE 25 20A (8W-10-29)
35
FUSE 4 40A (8W-10-16)
4
A20 12 RD/DB
A10 12 RD/DG
M
E C106
F20 18 DB/PK
A20 14 RD/DB
A10 12 RD/DG
48
33
M
E C107
F20 18 DB/PK
A20 12 RD/DB
A10 12 RD/DG
10
4
9
25
PCI BUS
FUSED IGNITION SWITCH OUTPUT (RUN)
FUSED B(+)
FUSED B(+)
CONTROLLER ANTI-LOCK BRAKE
GROUND
GROUND
8
24
Z3 12 BK/OR
Z3 12 BK/OR
G107 (8W-15-11)

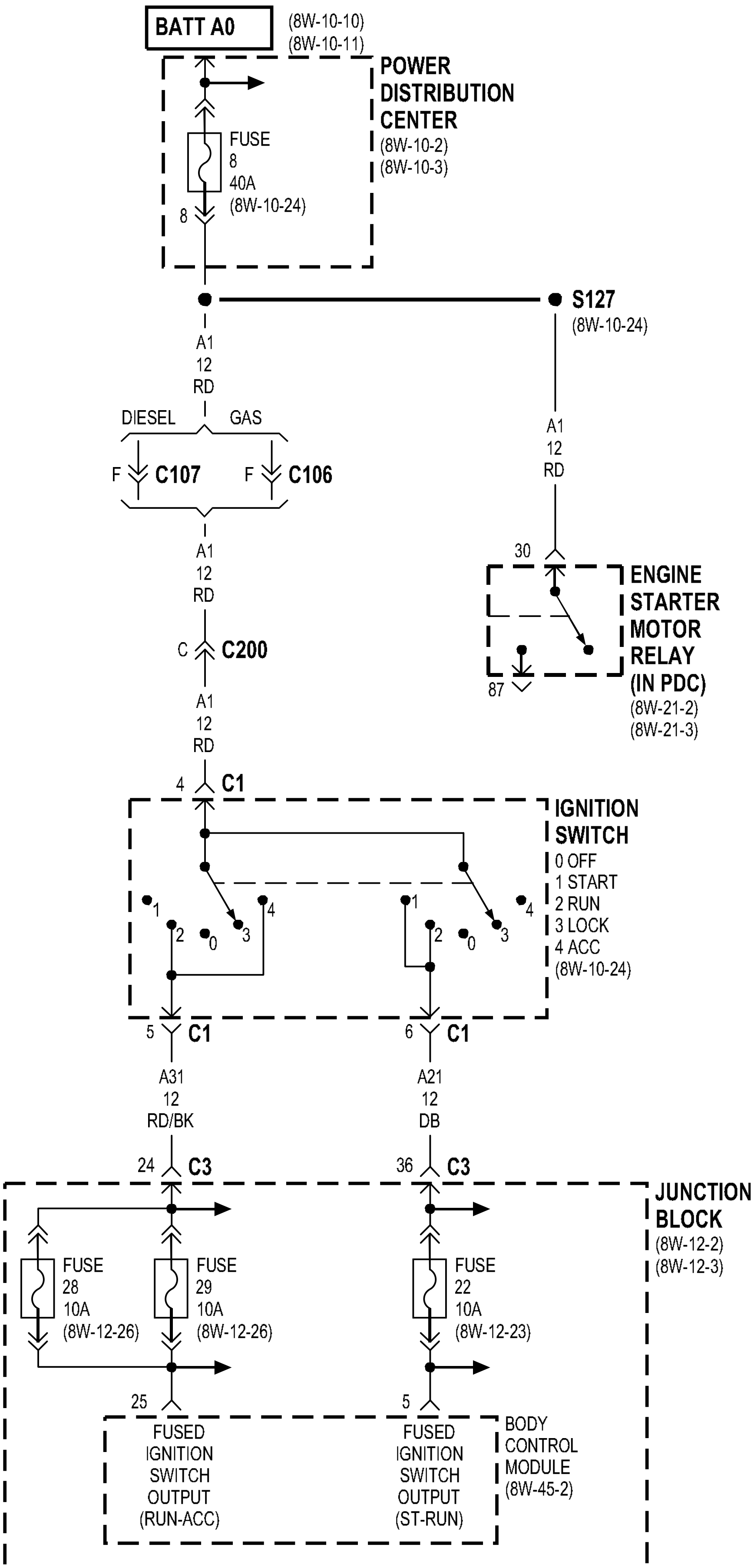

BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-3)
34
FUSE 25 20A (8W-10-29)
35
FUSE 4 40A (8W-10-17)
4
DIAGNOSTIC JUNCTION PORT
(8W-30-28)
PCI BUS
1
RUN A22
(8W-10-25)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 19 10A (8W-12-21)
42
C2
D25 20 YL/VT/BR
S210
(8W-30-28)
D25 20 YL/VT/BR
15
C200
D25 20 YL/VT
S324
(8W-30-25)
D25 18 YL/VT
48
C107
D25 18 YL/VT
S130
(8W-30-25)
D25 18 YL/VT
F20 18 DB/PK
33
C107
F20 18 DB/PK
A20 12 RD/DB
A10 12 RD/DG
9
25
10
4
FUSED B(+)
FUSED B(+)
PCI BUS
FUSED IGNITION SWITCH OUTPUT (RUN)
CONTROLLER ANTI-LOCK BRAKE
GROUND
8
GROUND
24
Z3 12 BK/OR
Z3 12 BK/OR
G107
(8W-15-11)

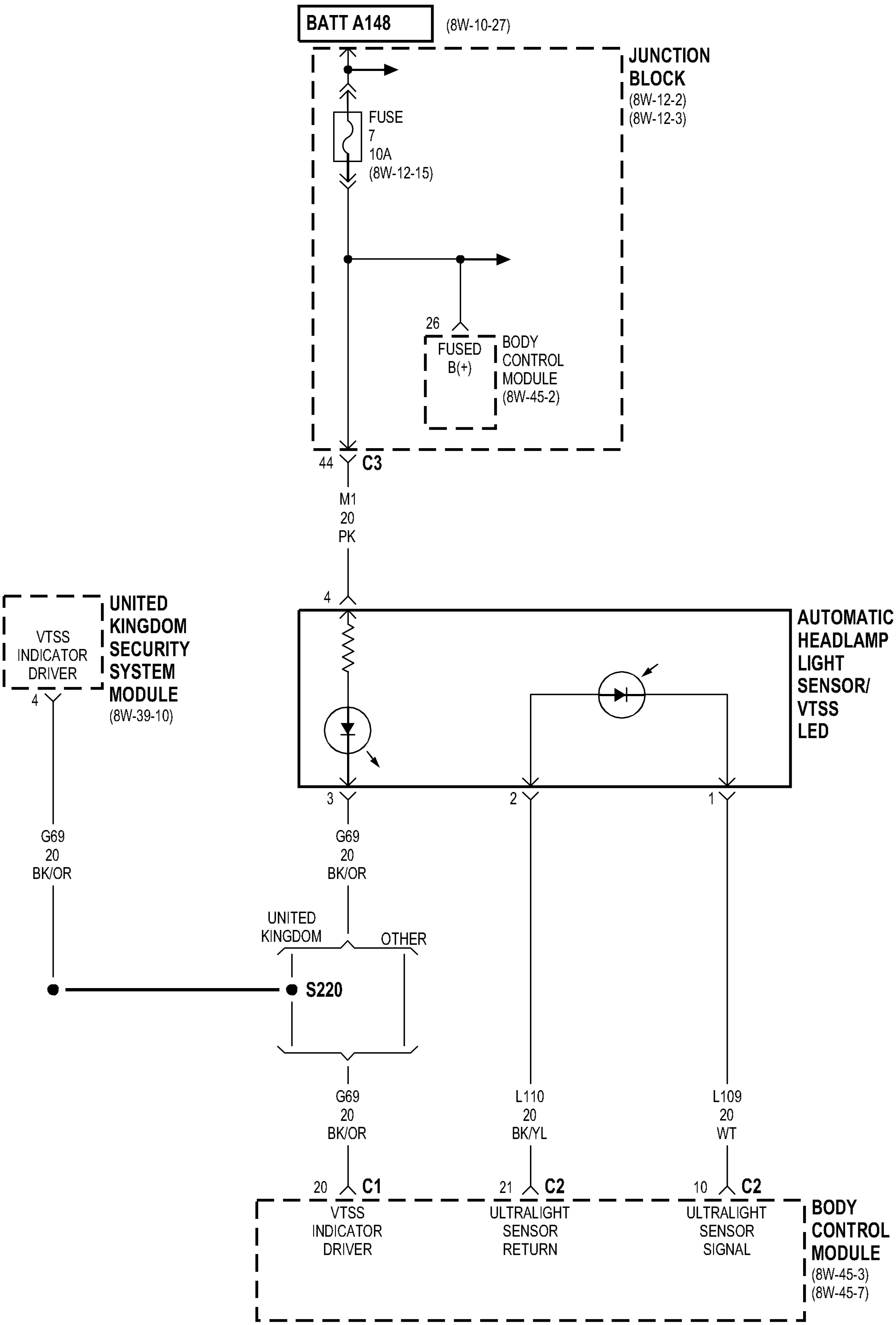

POWERTRAIN CONTROL MODULE (8W-30-15)
VEHICLE SPEED SENSOR SIGNAL
27 C2
G7 18 WT/OR
TRANSMISSION CONTROL MODULE (8W-31-8)
VEHICLE SPEED SENSOR SIGNAL
28
4.0L
4.7L
S117 (8W-12-31)
INSTRUMENT CLUSTER (8W-40-8) (8W-40-9)
4
G7 20 WT/OR
5 C103
36 C106
20 C3
JUNCTION BLOCK (8W-12-2) (8W-12-3)
2 C2
LHD
RHD
G7 20 WT/OR
GAS
DIESEL
S325 (8W-12-31)
36 C107
BATT A147 (8W-10-21)
JUNCTION BLOCK (8W-12-2) (8W-12-3)
FUSE 23 15A (8W-12-24)
47 C2
F32 20 PK/DB
6
BRAKE LAMP SWITCH (8W-33-2) (8W-33-3)
5
L50 20 WT/TN
S313 (8W-51-5)
L50 18 WT/TN
34 C107
S147 (8W-30-45)
2
BRAKE WARNING INDICATOR SWITCH
1
G9 18 GY/BK
Z1 18 BK
3
18
21
12
VEHICLE SPEED SENSOR SIGNAL
BRAKE LAMP SWITCH OUTPUT
RED BRAKE WARNING INDICATOR DRIVER
GROUND
CONTROLLER ANTI-LOCK BRAKE

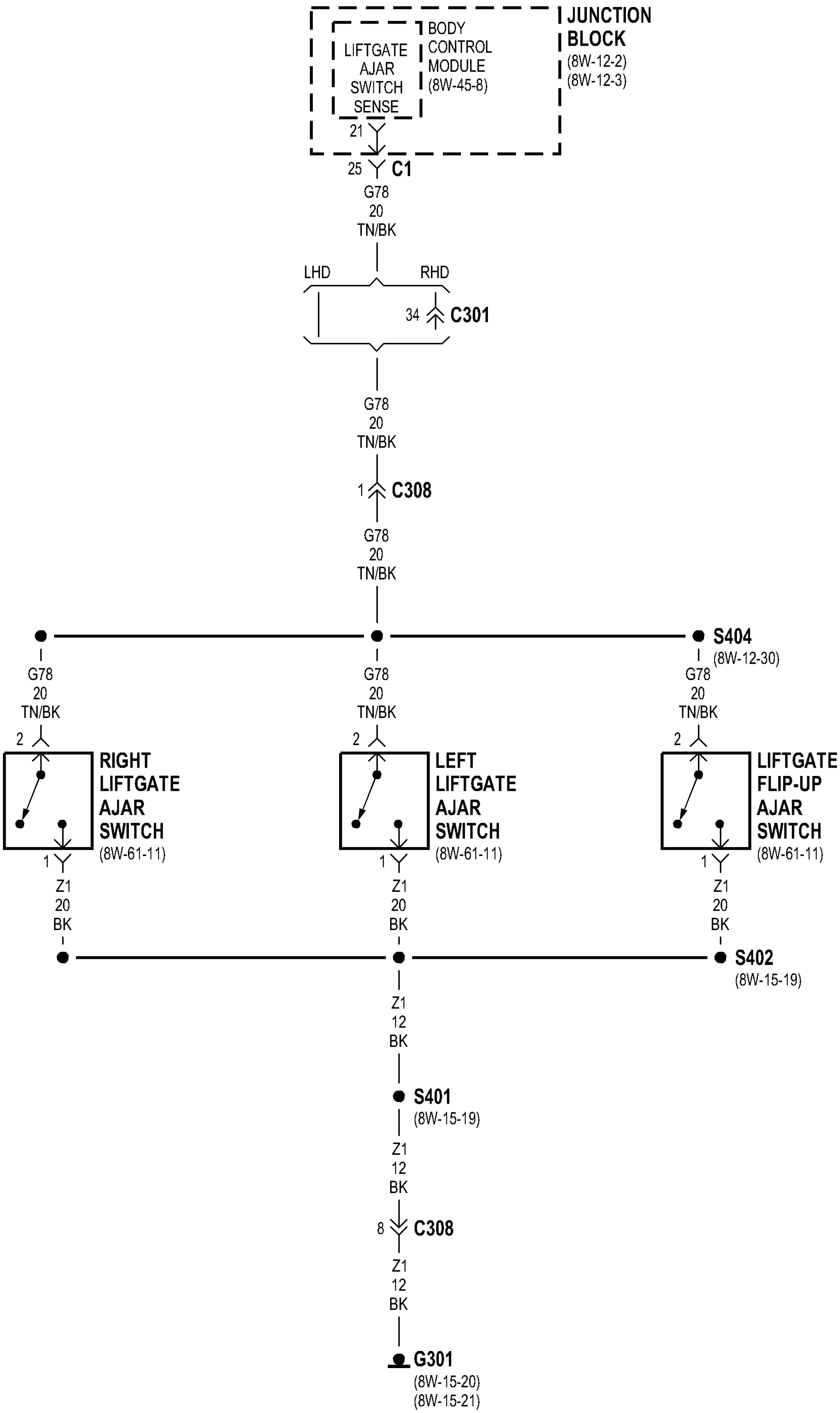

G-SWITCH
2
1
3
B43
18
PK/OR
B41
18
YL/PK
B42
18
TN/WT
15
13
14
C300
B43
18
PK/OR
B41
18
YL/PK
B42
18
TN/WT
52
50
51
C107
B43
18
PK/OR
B41
18
YL/PK
B42
18
TN/WT
13
14
17
G SWITCH
TEST
SIGNAL
G SWITCH
NO. 1
SENSE
G SWITCH
NO. 2
SENSE
CONTROLLER
ANTI-LOCK
BRAKE

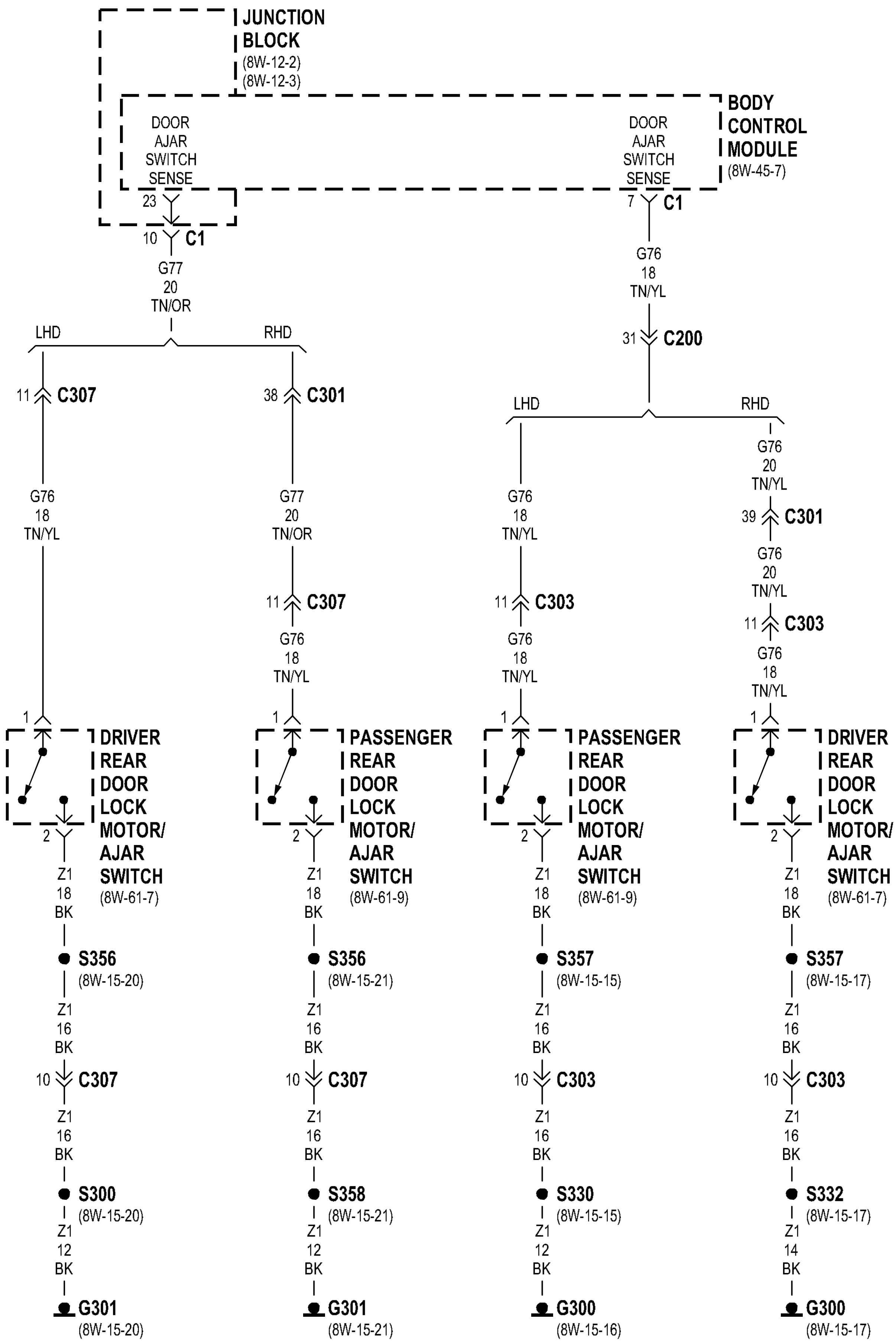

LEFT FRONT WHEEL SPEED SENSOR
LEFT REAR WHEEL SPEED SENSOR
RIGHT FRONT WHEEL SPEED SENSOR
RIGHT REAR WHEEL SPEED SENSOR
2
1
BK
BR
2
1
2
1
BR
BK
1
2
B9 18 RD
B8 18 RD/DB
B4 18 LG
B3 18 LG/DB
B7 18 WT
B6 18 WT/DB
B1 18 YL/DB
B2 18 YL
TWISTED PAIR
12
11
C300
25
26
C106
9
10
C300
27
28
25
26
30
29
C107
1
2
5
6
19
20
22
23
LEFT FRONT WHEEL SPEED SENSOR (+)
LEFT FRONT WHEEL SPEED SENSOR (-)
LEFT REAR WHEEL SPEED SENSOR (+)
LEFT REAR WHEEL SPEED SENSOR (-)
RIGHT FRONT WHEEL SPEED SENSOR (+)
RIGHT FRONT WHEEL SPEED SENSOR (-)
RIGHT REAR WHEEL SPEED SENSOR (-)
RIGHT REAR WHEEL SPEED SENSOR (+)
CONTROLLER ANTI-LOCK BRAKE

8W-39 VEHICLE THEFT SECURITY SYSTEM


BATT A0
(8W-10-10)
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
(8W-10-3)
FUSE
8
40A
(8W-10-24)
8
S127
(8W-10-24)
A1
12
RD
DIESEL
GAS
F
C107
F
C106
A1
12
RD
C
C200
A1
12
RD
A1
12
RD
30
ENGINE STARTER MOTOR RELAY (IN PDC)
(8W-21-2)
(8W-21-3)
87
4
C1
IGNITION SWITCH
0 OFF
1 START
2 RUN
3 LOCK
4 ACC
(8W-10-24)
5
C1
6
C1
A31
12
RD/BK
A21
12
DB
24
C3
36
C3
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
28
10A
(8W-12-26)
FUSE
29
10A
(8W-12-26)
FUSE
22
10A
(8W-12-23)
25
5
FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
FUSED IGNITION SWITCH OUTPUT (ST-RUN)
BODY CONTROL MODULE
(8W-45-2)

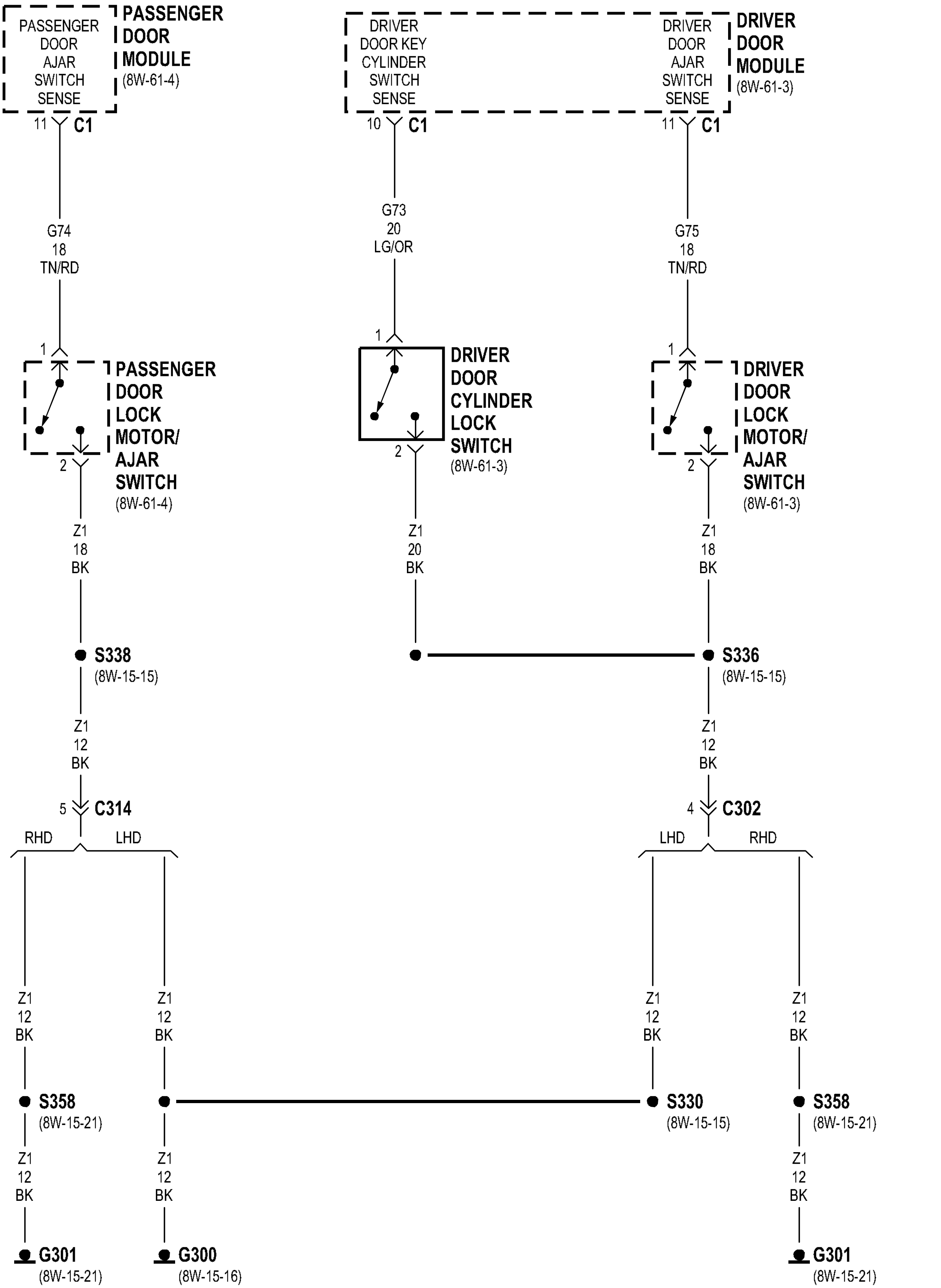

BATT A148
(8W-10-27)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
7
10A
(8W-12-15)
26
FUSED B(+)
BODY CONTROL MODULE
(8W-45-2)
44
C3
M1
20
PK
4
UNITED KINGDOM SECURITY SYSTEM MODULE
VTSS INDICATOR DRIVER
4
(8W-39-10)
AUTOMATIC HEADLAMP LIGHT SENSOR/ VTSS LED
3
2
1
G69
20
BK/OR
G69
20
BK/OR
UNITED KINGDOM
OTHER
S220
G69
20
BK/OR
L110
20
BK/YL
L109
20
WT
20
C1
21
C2
10
C2
VTSS INDICATOR DRIVER
ULTRALIGHT SENSOR RETURN
ULTRALIGHT SENSOR SIGNAL
BODY CONTROL MODULE
(8W-45-3)
(8W-45-7)


JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
BODY CONTROL MODULE
(8W-45-8)
LIFTGATE AJAR SWITCH SENSE
21
25
C1
G78
20
TN/BK
LHD
RHD
34
C301
G78
20
TN/BK
1
C308
G78
20
TN/BK
S404
(8W-12-30)
G78
20
TN/BK
2
RIGHT LIFTGATE AJAR SWITCH
(8W-61-11)
LEFT LIFTGATE AJAR SWITCH
(8W-61-11)
LIFTGATE FLIP-UP AJAR SWITCH
(8W-61-11)
1
Z1
20
BK
S402
(8W-15-19)
Z1
12
BK
S401
(8W-15-19)
Z1
12
BK
8
C308
Z1
12
BK
G301
(8W-15-20)
(8W-15-21)

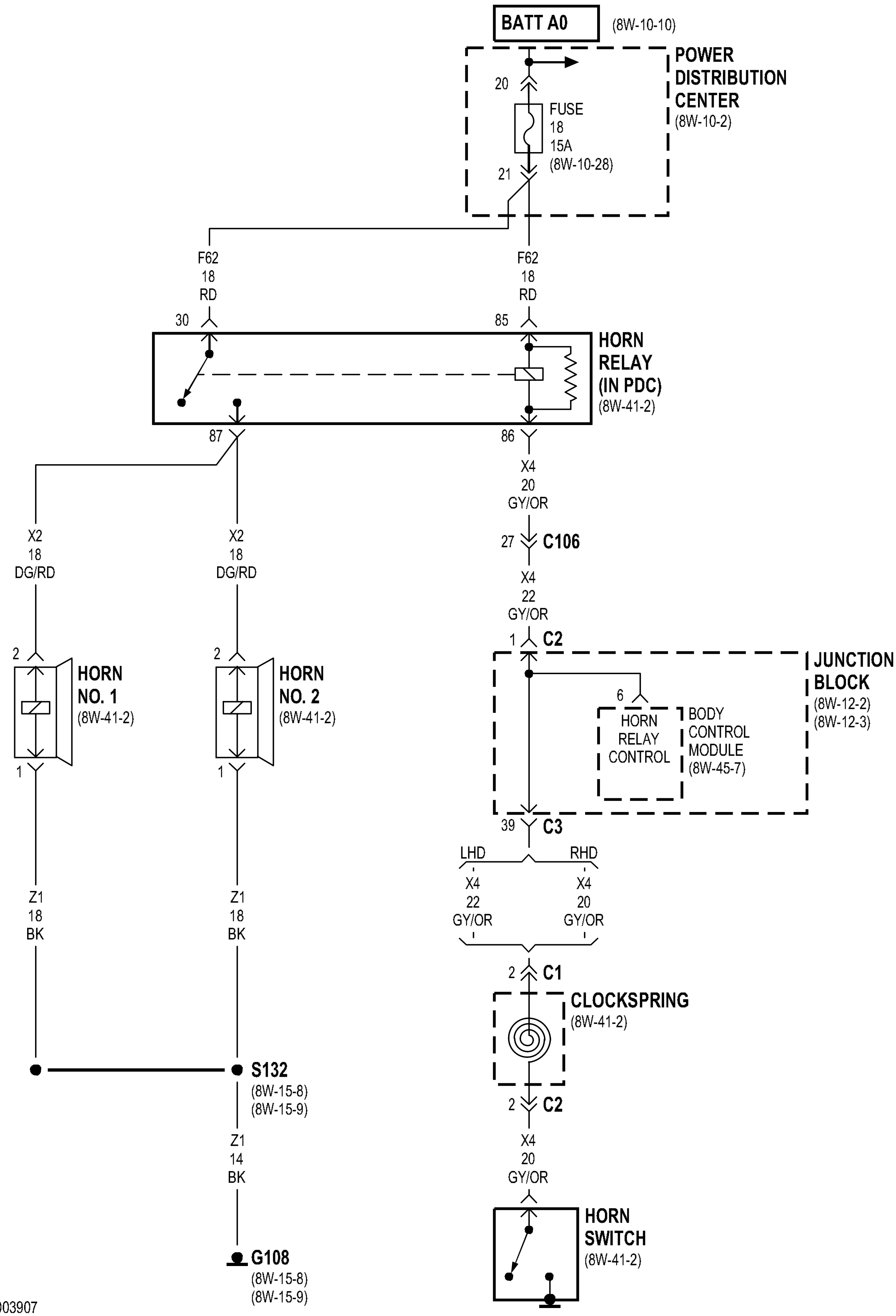


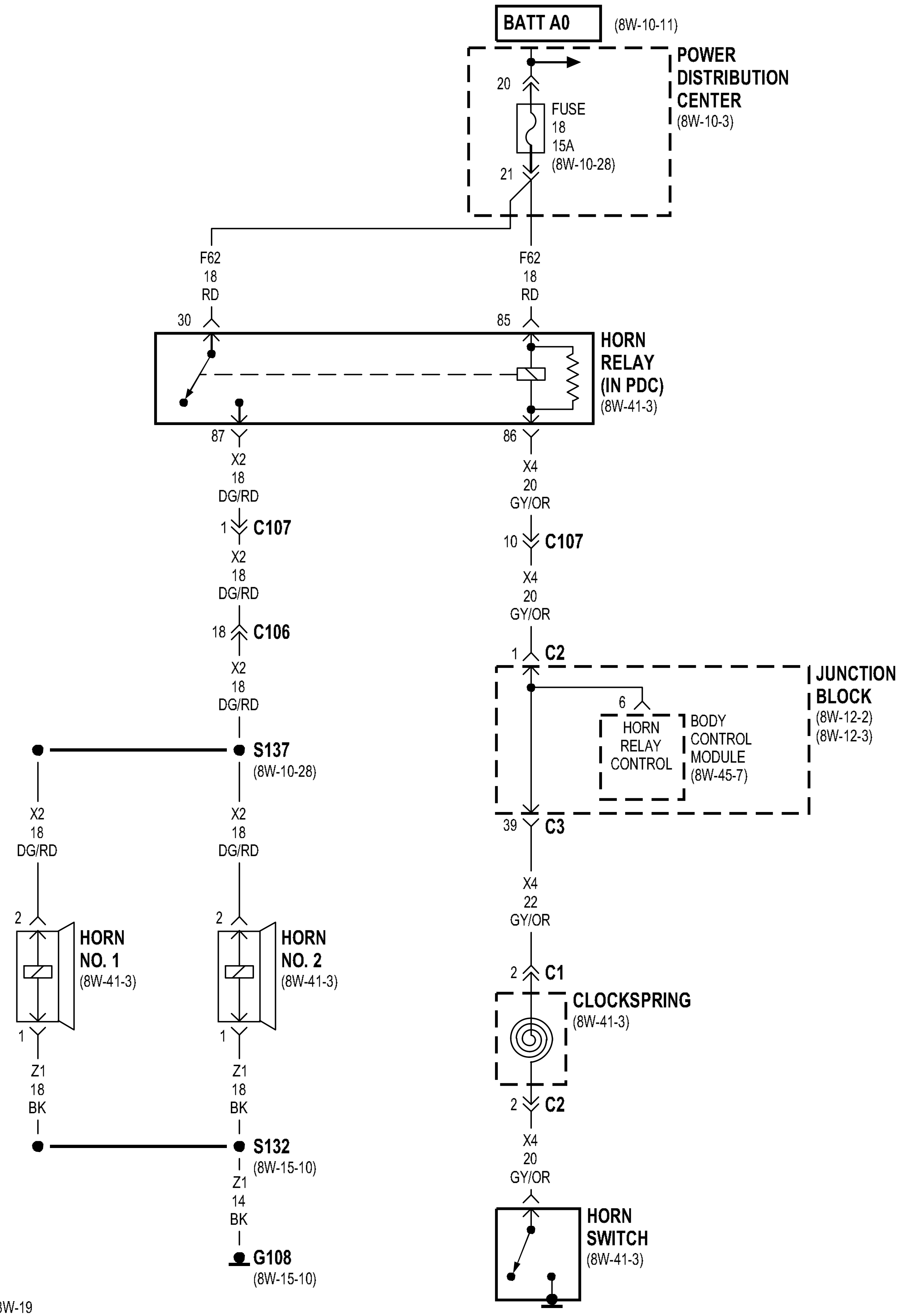
WG003905

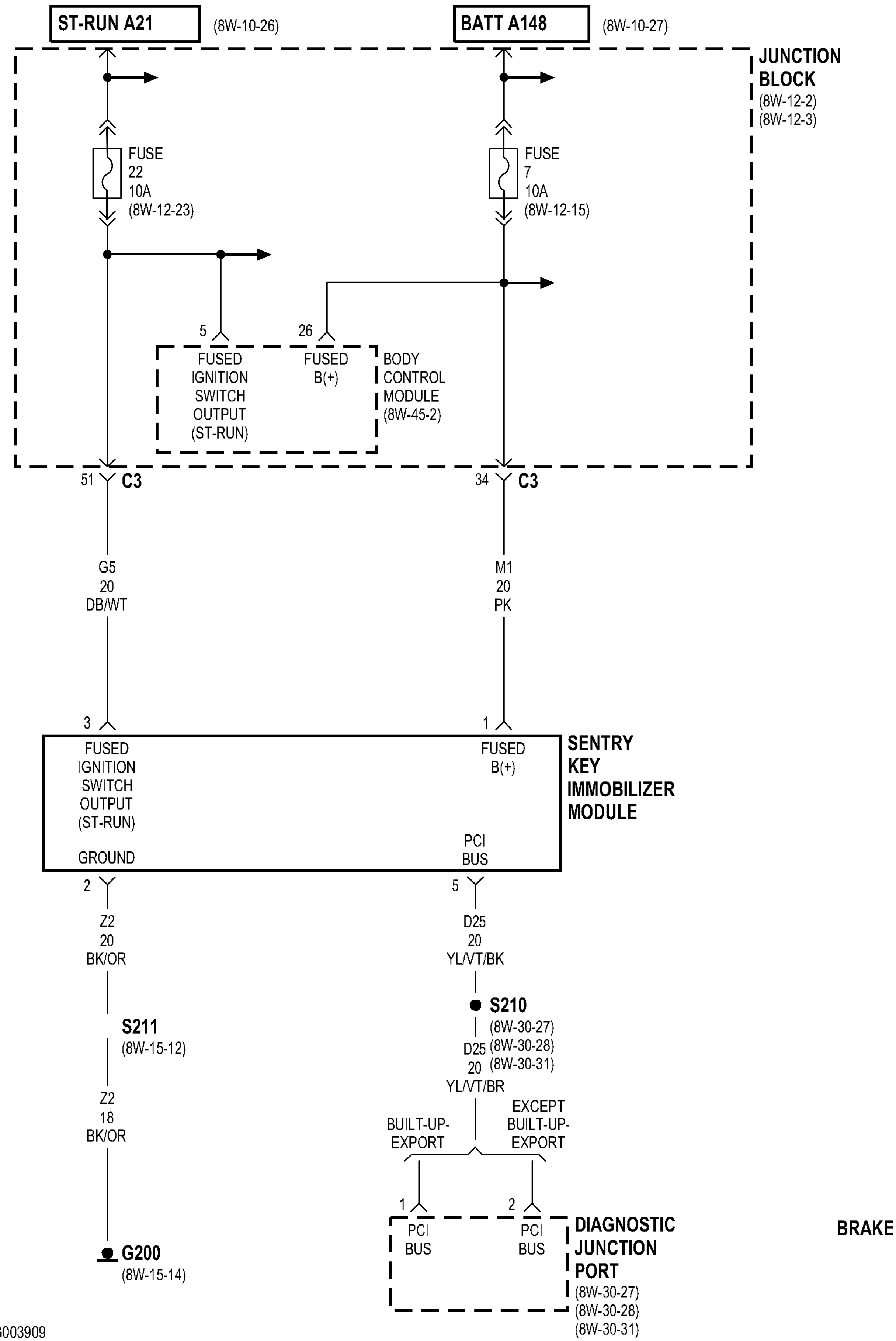
J998W-19



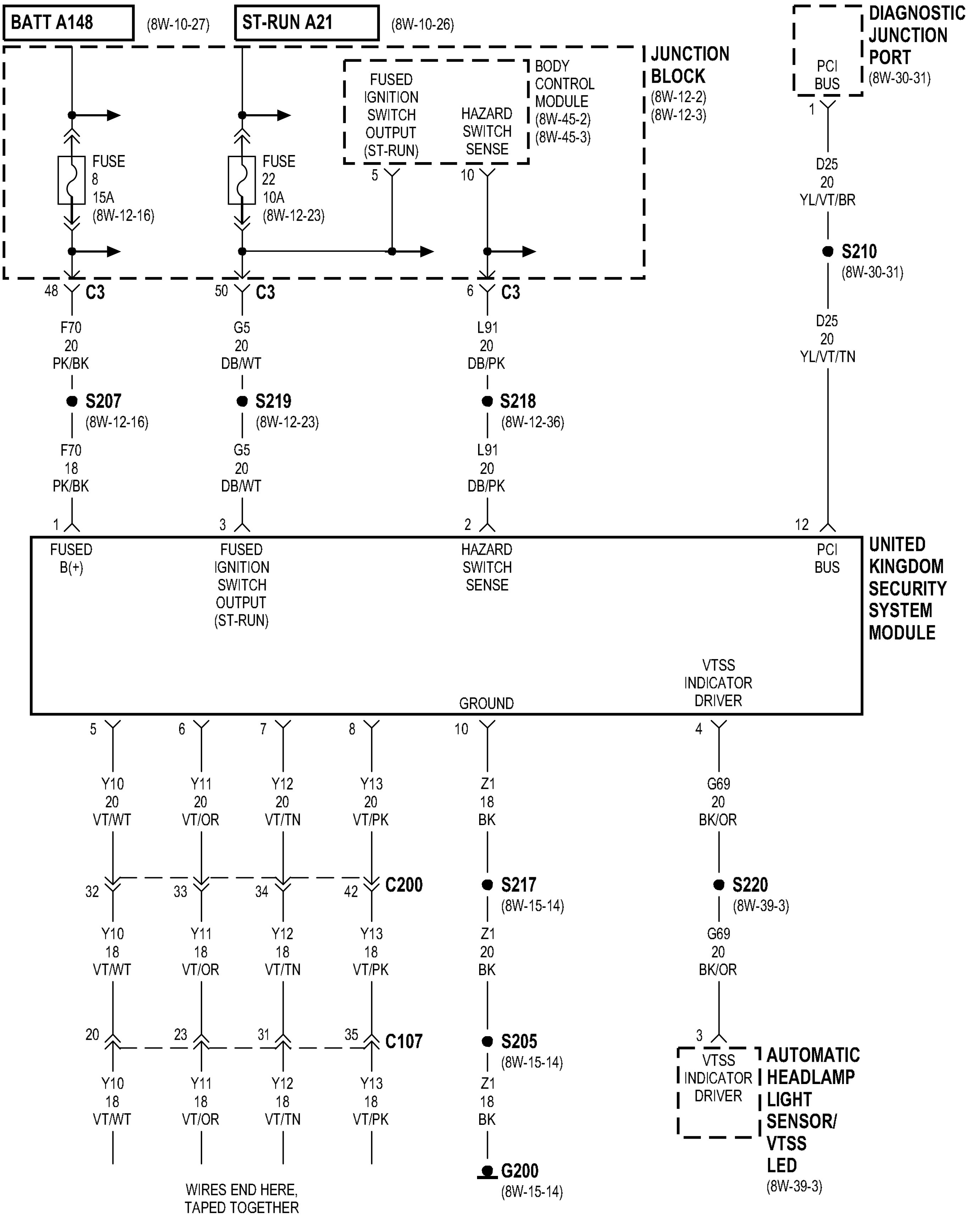
J998W-19 WG003906


BATT A0
(8W-10-10)
POWER
DISTRIBUTION
CENTER
(8W-10-2)
20
FUSE
18
15A
(8W-10-28)
21
F62
18
RD
F62
18
RD
30
85
HORN
RELAY
(IN PDC)
(8W-41-2)
87
86
X4
20
GY/OR
27
C106
X4
22
GY/OR
1
C2
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
6
HORN
RELAY
CONTROL
BODY
CONTROL
MODULE
(8W-45-7)
39
C3
LHD
RHD
X4
22
GY/OR
X4
20
GY/OR
2
C1
CLOCKSPRING
(8W-41-2)
2
C2
X4
20
GY/OR
HORN
SWITCH
(8W-41-2)
X2
18
DG/RD
X2
18
DG/RD
2
HORN
NO. 1
(8W-41-2)
1
2
HORN
NO. 2
(8W-41-2)
1
Z1
18
BK
Z1
18
BK
S132
(8W-15-8)
(8W-15-9)
Z1
14
BK
G108
(8W-15-8)
(8W-15-9)

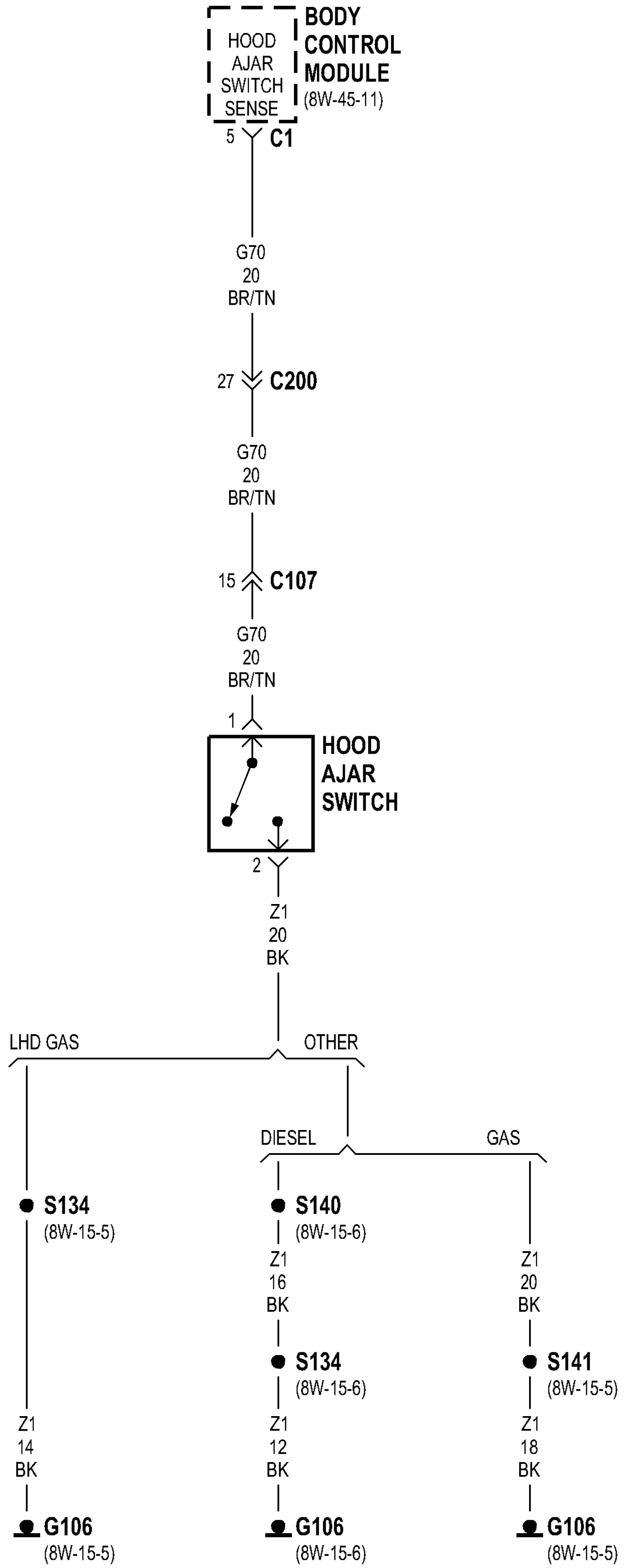

BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-3)
20
FUSE
18
15A
(8W-10-28)
21
F62
18
RD
F62
18
RD
30
85
HORN RELAY (IN PDC)
(8W-41-3)
87
86
X2
18
DG/RD
1
C107
X4
20
GY/OR
10
C107
X2
18
DG/RD
X4
20
GY/OR
18
C106
1
C2
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
6
HORN RELAY CONTROL
BODY CONTROL MODULE
(8W-45-7)
X2
18
DG/RD
S137
(8W-10-28)
39
C3
X2
18
DG/RD
X4
22
GY/OR
2
HORN NO. 1
(8W-41-3)
2
HORN NO. 2
(8W-41-3)
2
C1
CLOCKSPRING
(8W-41-3)
1
1
Z1
18
BK
Z1
18
BK
2
C2
X4
20
GY/OR
S132
(8W-15-10)
Z1
14
BK
HORN SWITCH
(8W-41-3)
G108
(8W-15-10)

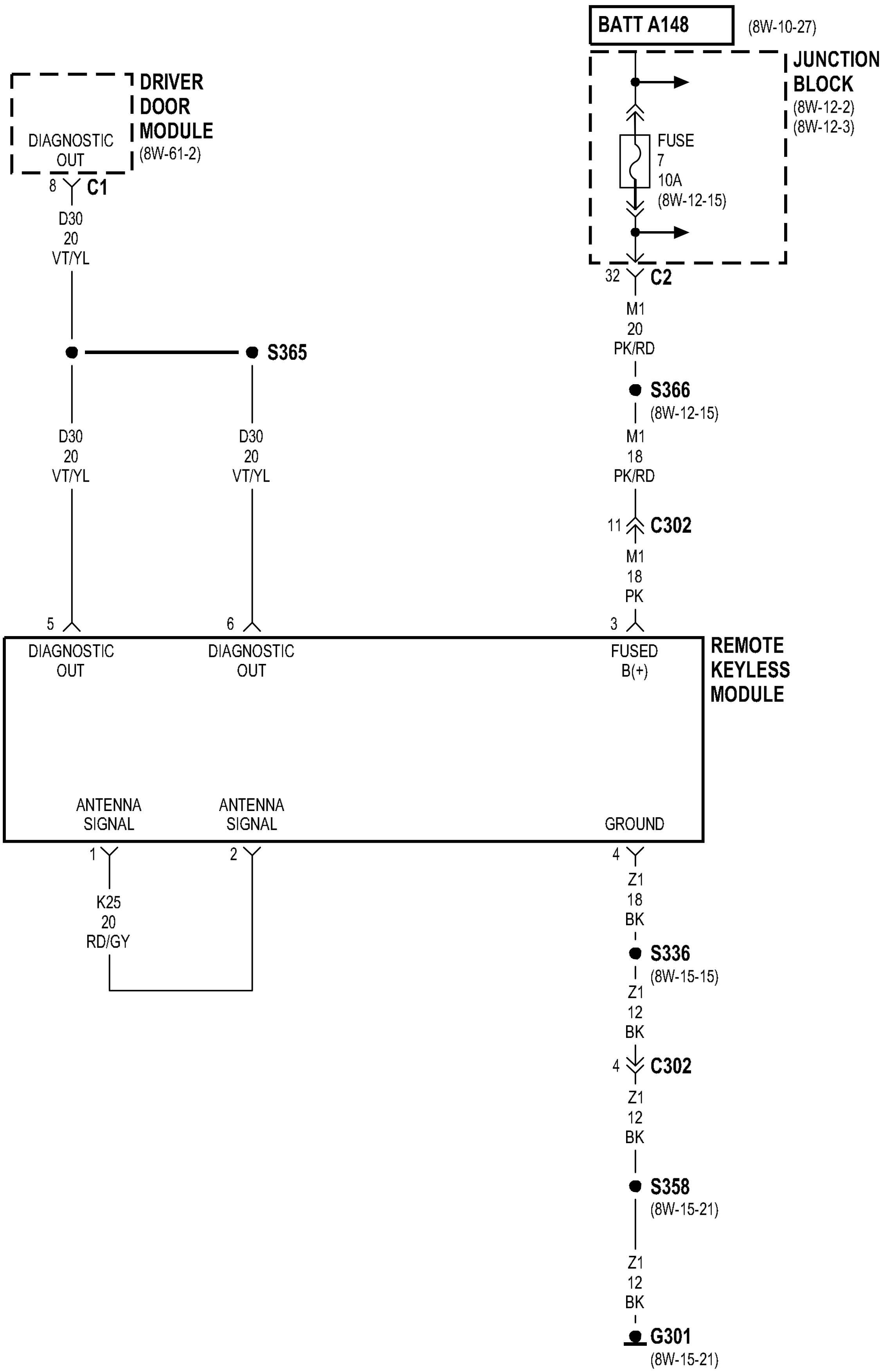

ST-RUN A21
(8W-10-26)
BATT A148
(8W-10-27)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 22 10A (8W-12-23)
FUSE 7 10A (8W-12-15)
5
26
FUSED IGNITION SWITCH OUTPUT (ST-RUN)
FUSED B(+)
BODY CONTROL MODULE (8W-45-2)
51 C3
34 C3
G5 20 DB/WT
M1 20 PK
3
1
FUSED IGNITION SWITCH OUTPUT (ST-RUN)
FUSED B(+)
GROUND
PCI BUS
SENTRY KEY IMMOBILIZER MODULE
2
5
Z2 20 BK/OR
D25 20 YL/VT/BK
S211
(8W-15-12)
S210
(8W-30-27)
(8W-30-28)
(8W-30-31)
D25 20 YL/VT/BR
Z2 18 BK/OR
BUILT-UP-EXPORT
EXCEPT BUILT-UP-EXPORT
1
2
PCI BUS
PCI BUS
DIAGNOSTIC JUNCTION PORT
(8W-30-27)
(8W-30-28)
(8W-30-31)
G200
(8W-15-14)
BRAKE

UNITED KINGDOM RHD

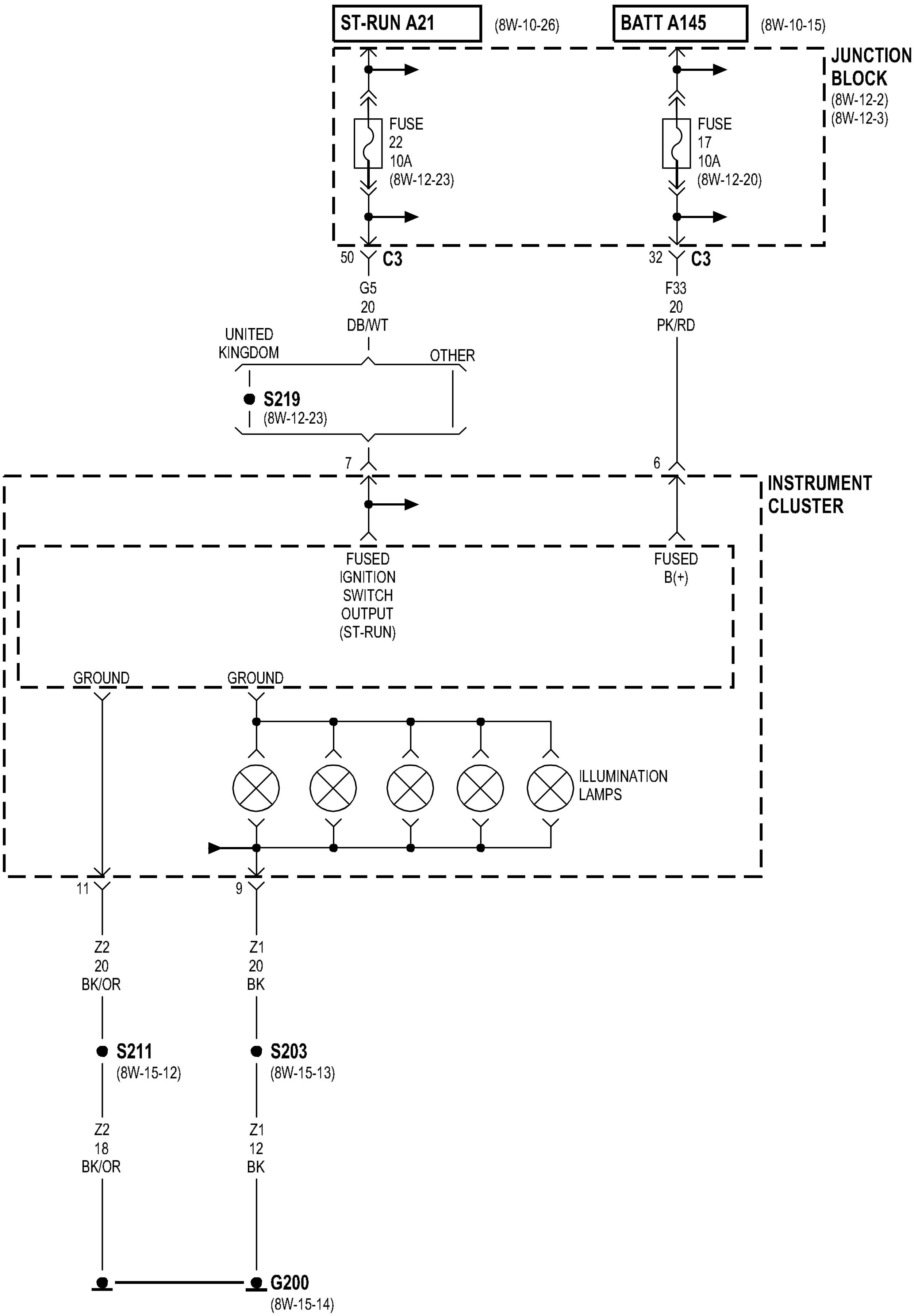


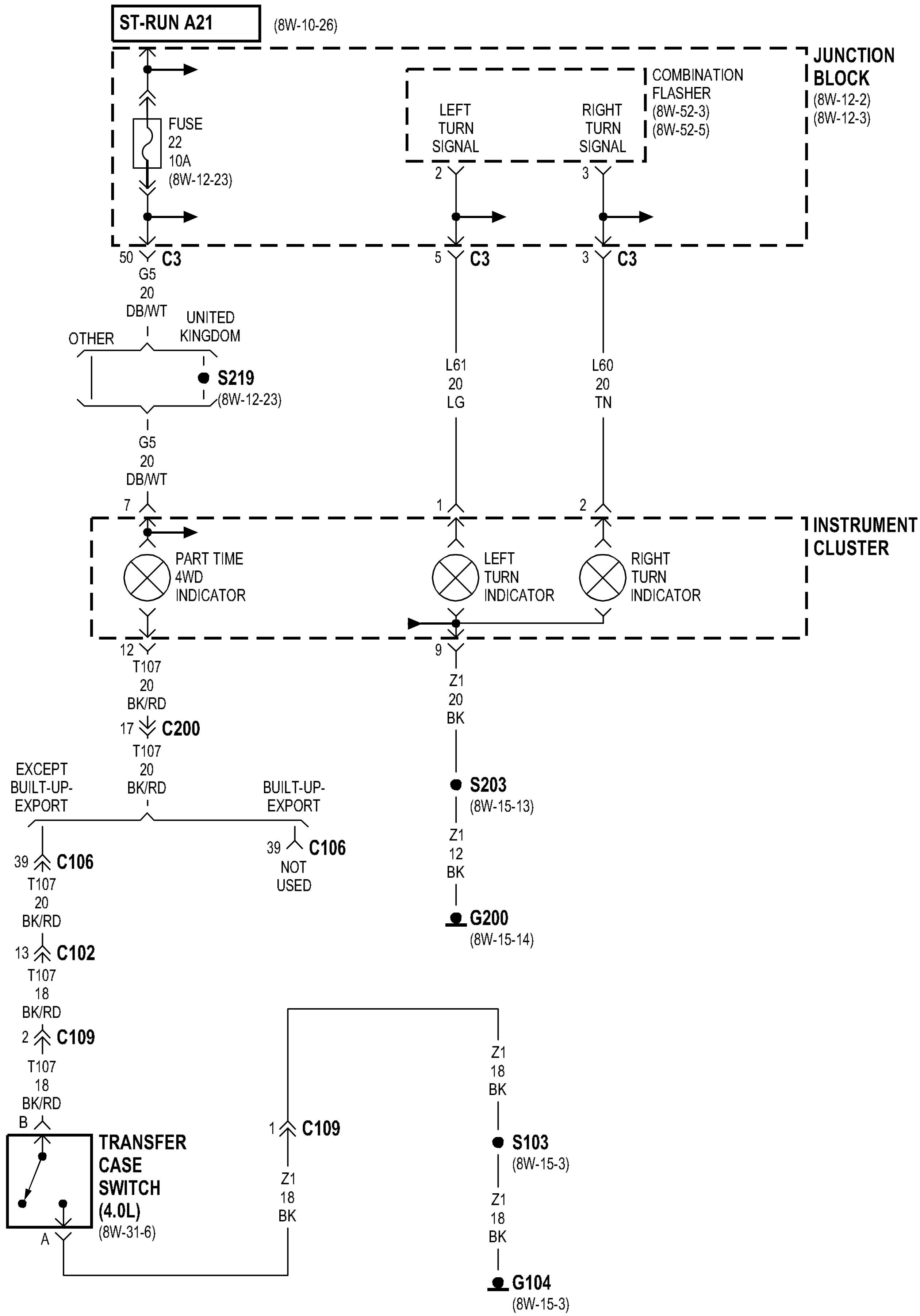
BUILT-UP-EXPORT



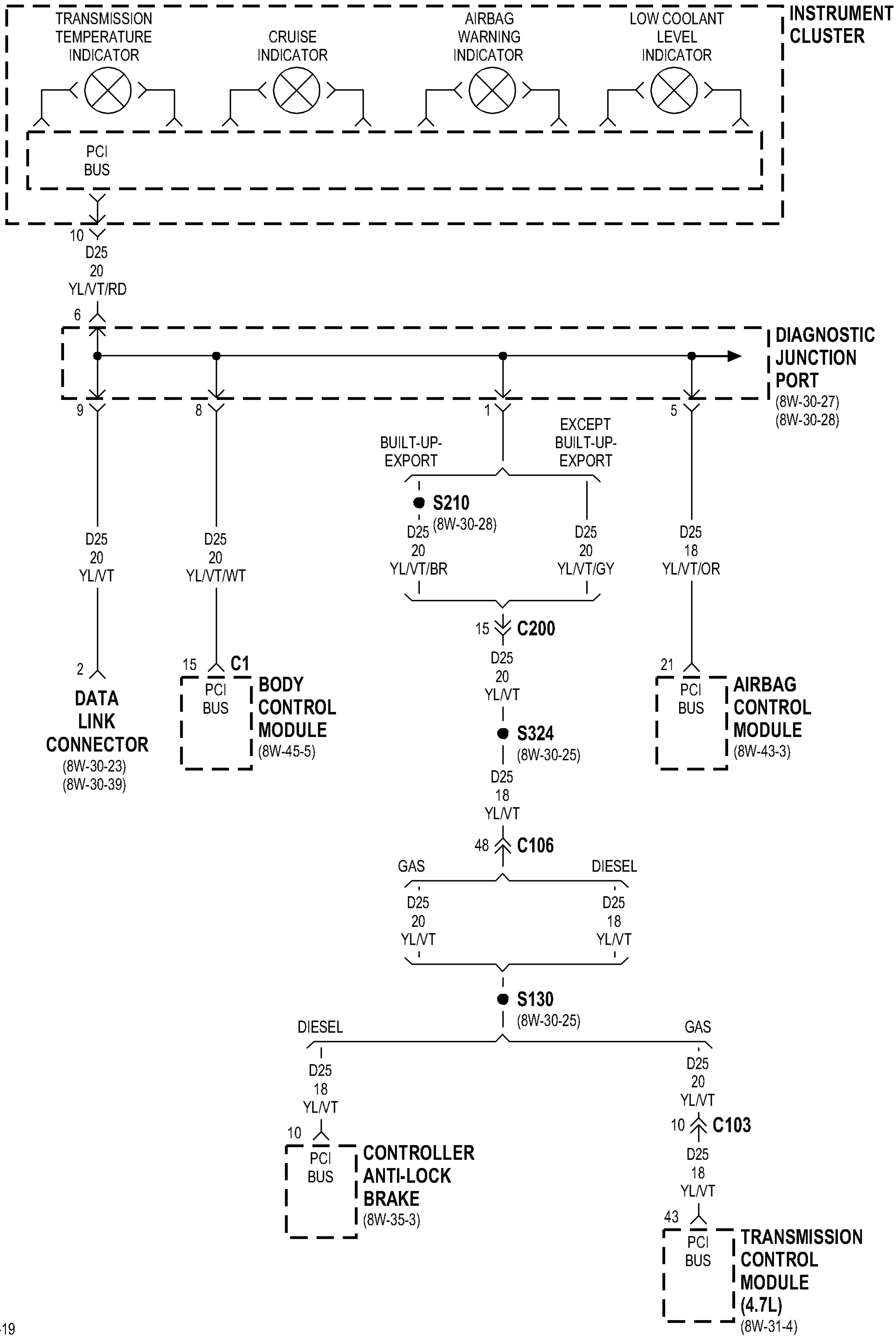

BATT A148
(8W-10-27)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
7
10A
(8W-12-15)
DRIVER DOOR MODULE
(8W-61-2)
DIAGNOSTIC OUT
8
C1
D30
20
VT/YL
S365
32
C2
M1
20
PK/RD
S366
(8W-12-15)
M1
18
PK/RD
11
C302
M1
18
PK
D30
20
VT/YL
D30
20
VT/YL
5
6
3
DIAGNOSTIC OUT
DIAGNOSTIC OUT
FUSED B(+)
REMOTE KEYLESS MODULE
ANTENNA SIGNAL
ANTENNA SIGNAL
GROUND
1
2
4
K25
20
RD/GY
Z1
18
BK
S336
(8W-15-15)
Z1
12
BK
4
C302
Z1
12
BK
S358
(8W-15-21)
Z1
12
BK
G301
(8W-15-21)

8W-40 INSTRUMENT CLUSTER

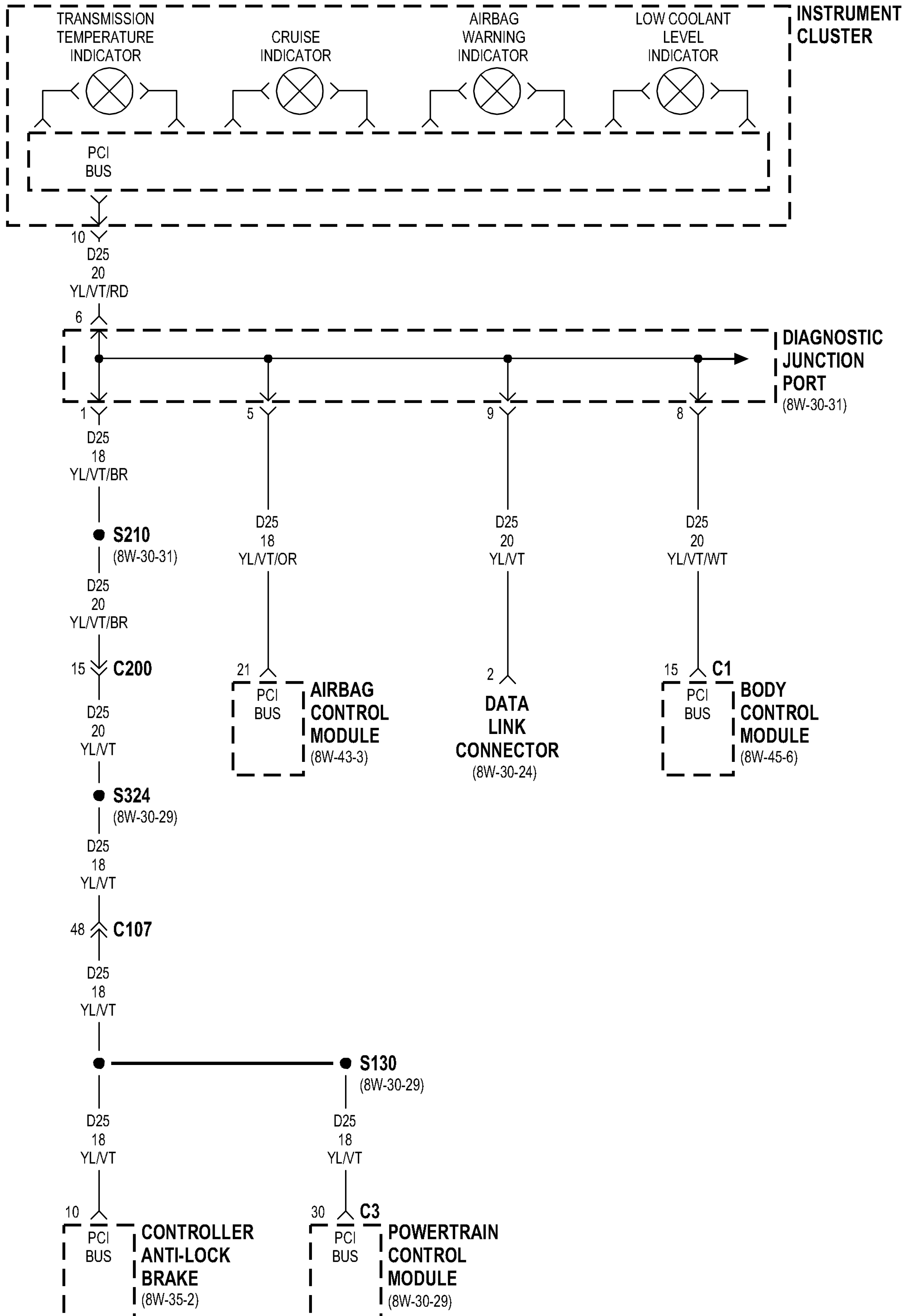

ST-RUN A21
(8W-10-26)
BATT A145
(8W-10-15)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
22
10A
(8W-12-23)
FUSE
17
10A
(8W-12-20)
50
C3
32
C3
G5
20
DB/WT
F33
20
PK/RD
UNITED KINGDOM
OTHER
S219
(8W-12-23)
7
6
INSTRUMENT CLUSTER
FUSED IGNITION SWITCH OUTPUT (ST-RUN)
FUSED B(+)
GROUND
GROUND
ILLUMINATION LAMPS
11
9
Z2
20
BK/OR
Z1
20
BK
S211
(8W-15-12)
S203
(8W-15-13)
Z2
18
BK/OR
Z1
12
BK
G200
(8W-15-14)


ST-RUN A21
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
COMBINATION FLASHER
(8W-52-3)
(8W-52-5)
LEFT TURN SIGNAL
RIGHT TURN SIGNAL
FUSE
22
10A
(8W-12-23)
2
3
50 C3
5 C3
3 C3
G5
20
DB/WT
OTHER
UNITED KINGDOM
S219
(8W-12-23)
L61
20
LG
L60
20
TN
G5
20
DB/WT
7
1
2
INSTRUMENT CLUSTER
PART TIME 4WD INDICATOR
LEFT TURN INDICATOR
RIGHT TURN INDICATOR
12
T107
20
BK/RD
9
Z1
20
BK
17 C200
T107
20
BK/RD
S203
(8W-15-13)
Z1
12
BK
G200
(8W-15-14)
EXCEPT BUILT-UP-EXPORT
BUILT-UP-EXPORT
39 C106
NOT USED
39 C106
T107
20
BK/RD
13 C102
T107
18
BK/RD
2 C109
T107
18
BK/RD
B
TRANSFER CASE SWITCH (4.0L)
(8W-31-6)
A
1 C109
Z1
18
BK
Z1
18
BK
S103
(8W-15-3)
Z1
18
BK
G104
(8W-15-3)

LHD

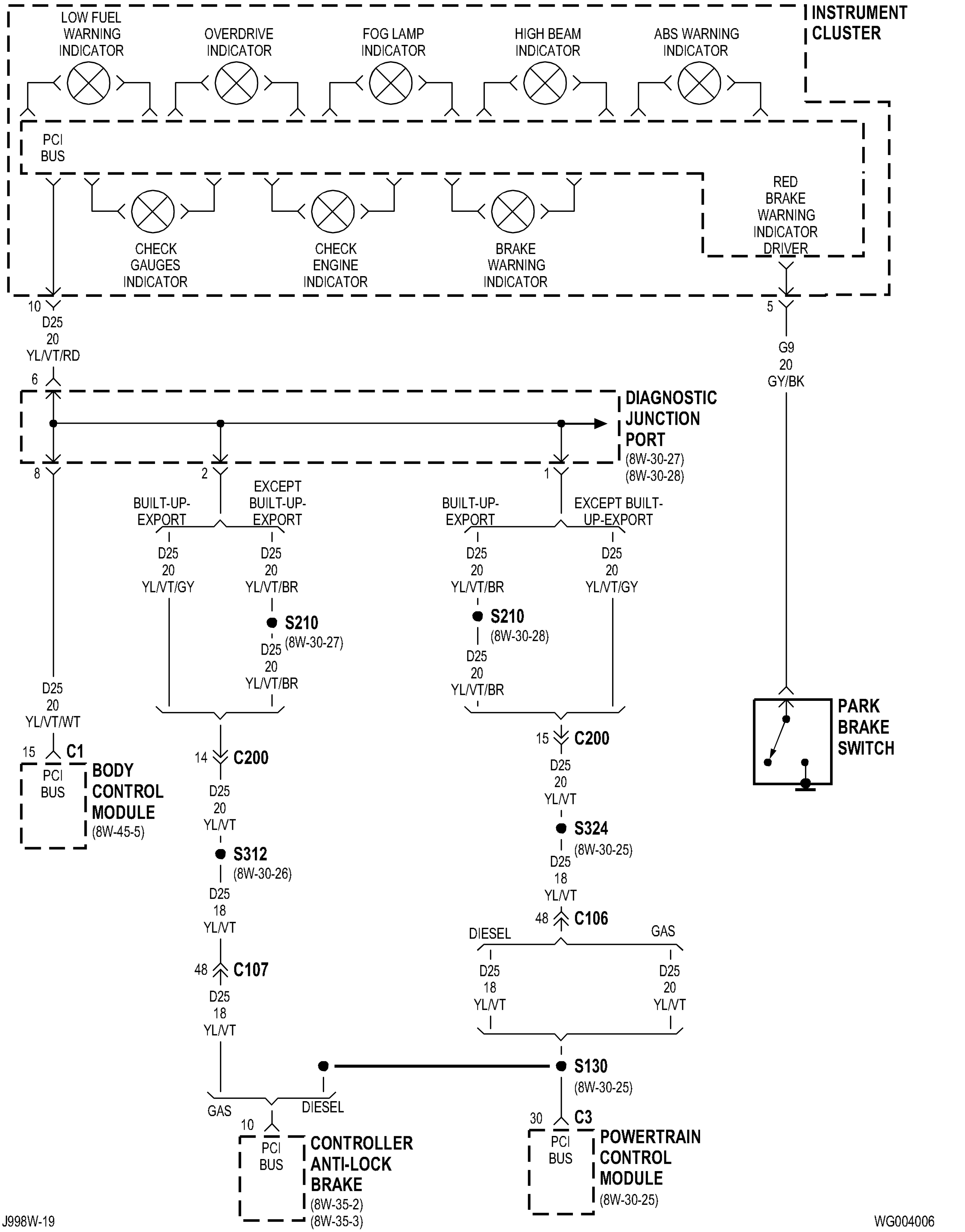

INSTRUMENT CLUSTER
TRANSMISSION TEMPERATURE INDICATOR
CRUISE INDICATOR
AIRBAG WARNING INDICATOR
LOW COOLANT LEVEL INDICATOR
PCI BUS
10
D25
20
YL/VT/RD
6
DIAGNOSTIC JUNCTION PORT
(8W-30-27)
(8W-30-28)
9
8
1
5
BUILT-UP-EXPORT
EXCEPT BUILT-UP-EXPORT
S210
(8W-30-28)
D25
20
YL/VT
D25
20
YL/VT/WT
D25
20
YL/VT/BR
D25
20
YL/VT/GY
D25
18
YL/VT/OR
15
C200
D25
20
YL/VT
S324
(8W-30-25)
D25
18
YL/VT
48
C106
2
DATA LINK CONNECTOR
(8W-30-23)
(8W-30-39)
15
C1
PCI BUS
BODY CONTROL MODULE
(8W-45-5)
21
PCI BUS
AIRBAG CONTROL MODULE
(8W-43-3)
GAS
DIESEL
D25
20
YL/VT
D25
18
YL/VT
S130
(8W-30-25)
DIESEL
GAS
D25
18
YL/VT
D25
20
YL/VT
10
C103
D25
18
YL/VT
10
PCI BUS
CONTROLLER ANTI-LOCK BRAKE
(8W-35-3)
43
PCI BUS
TRANSMISSION CONTROL MODULE (4.7L)
(8W-31-4)

RHD

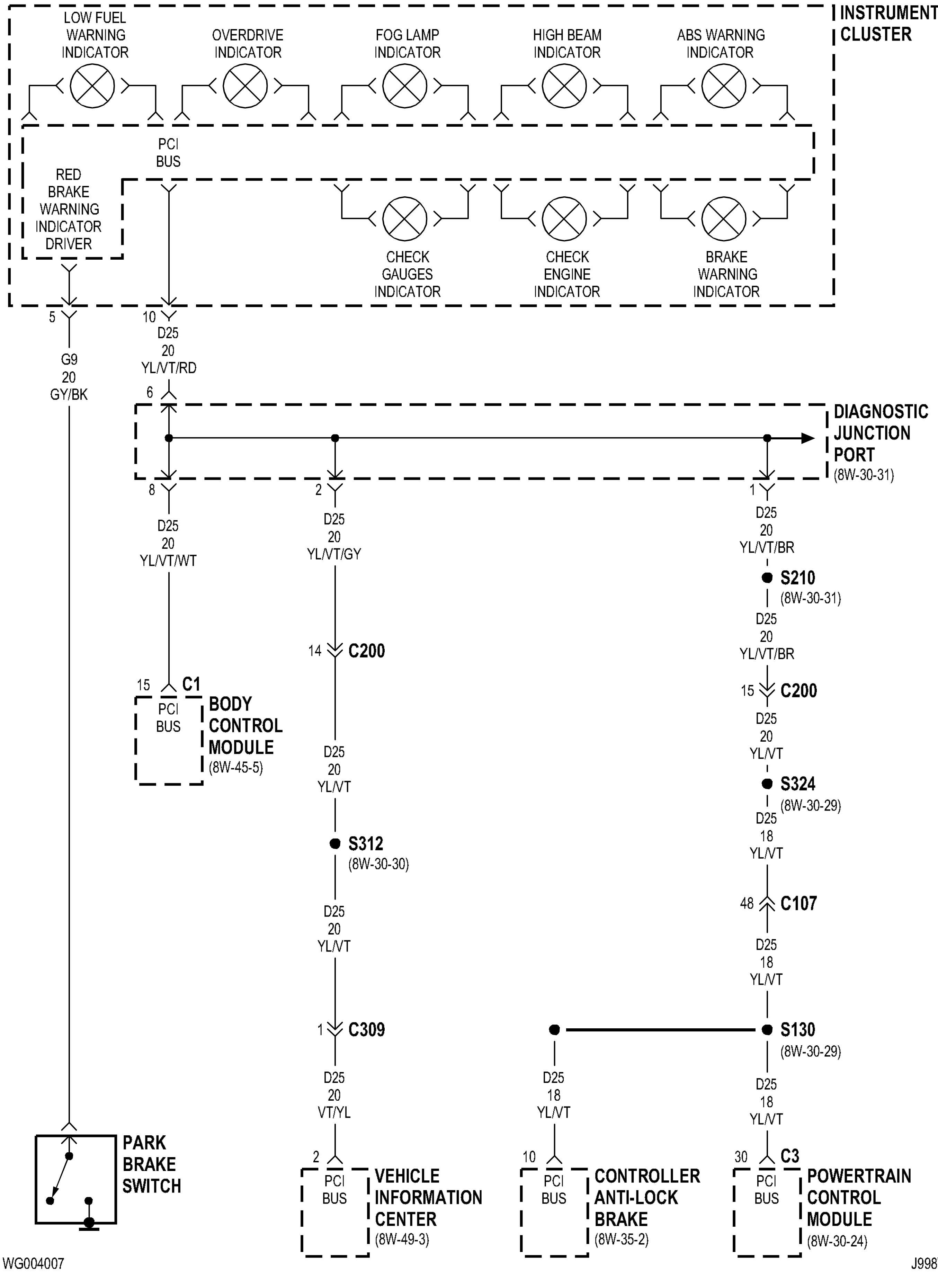


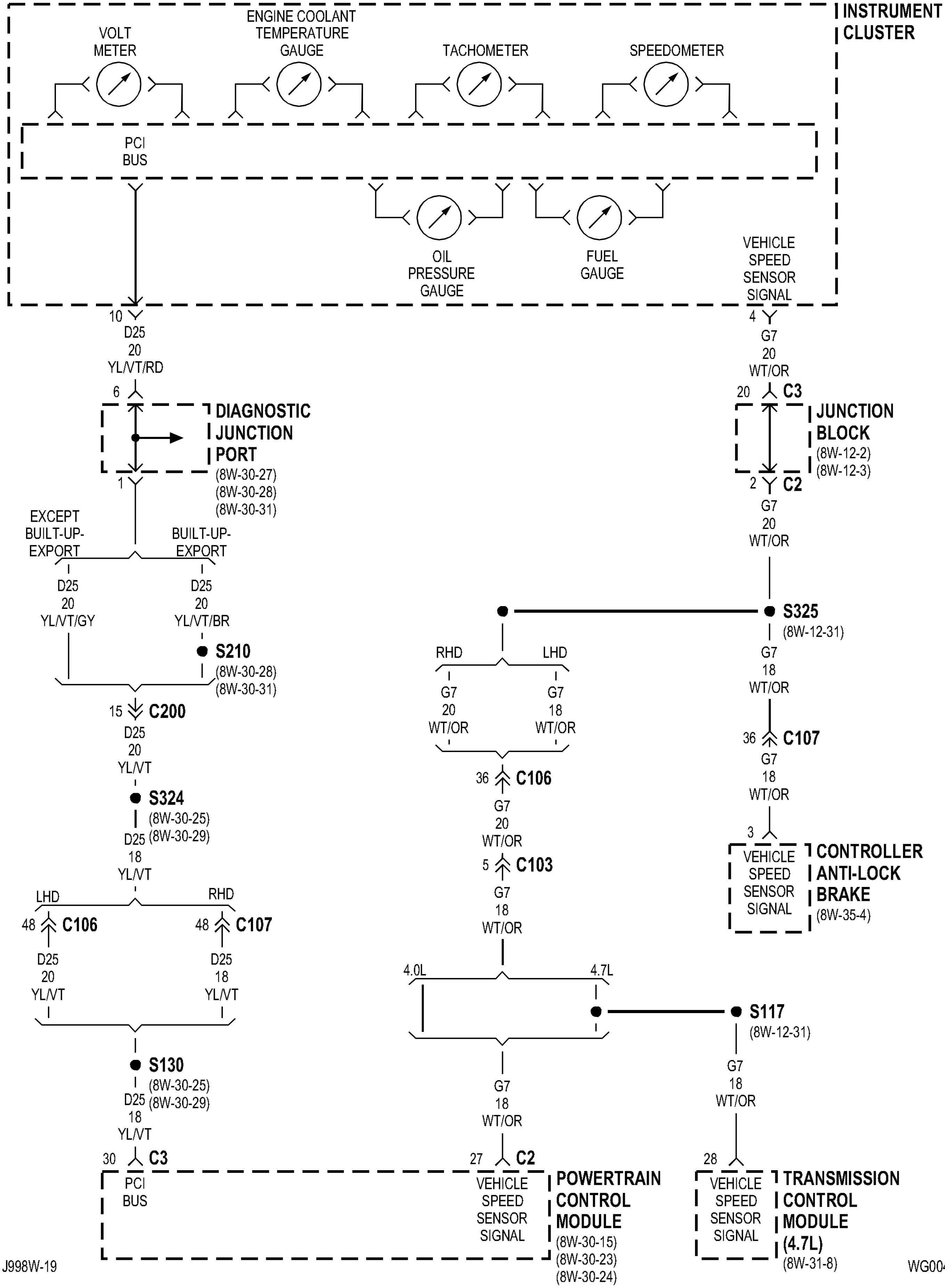
WG004005 J998W-19

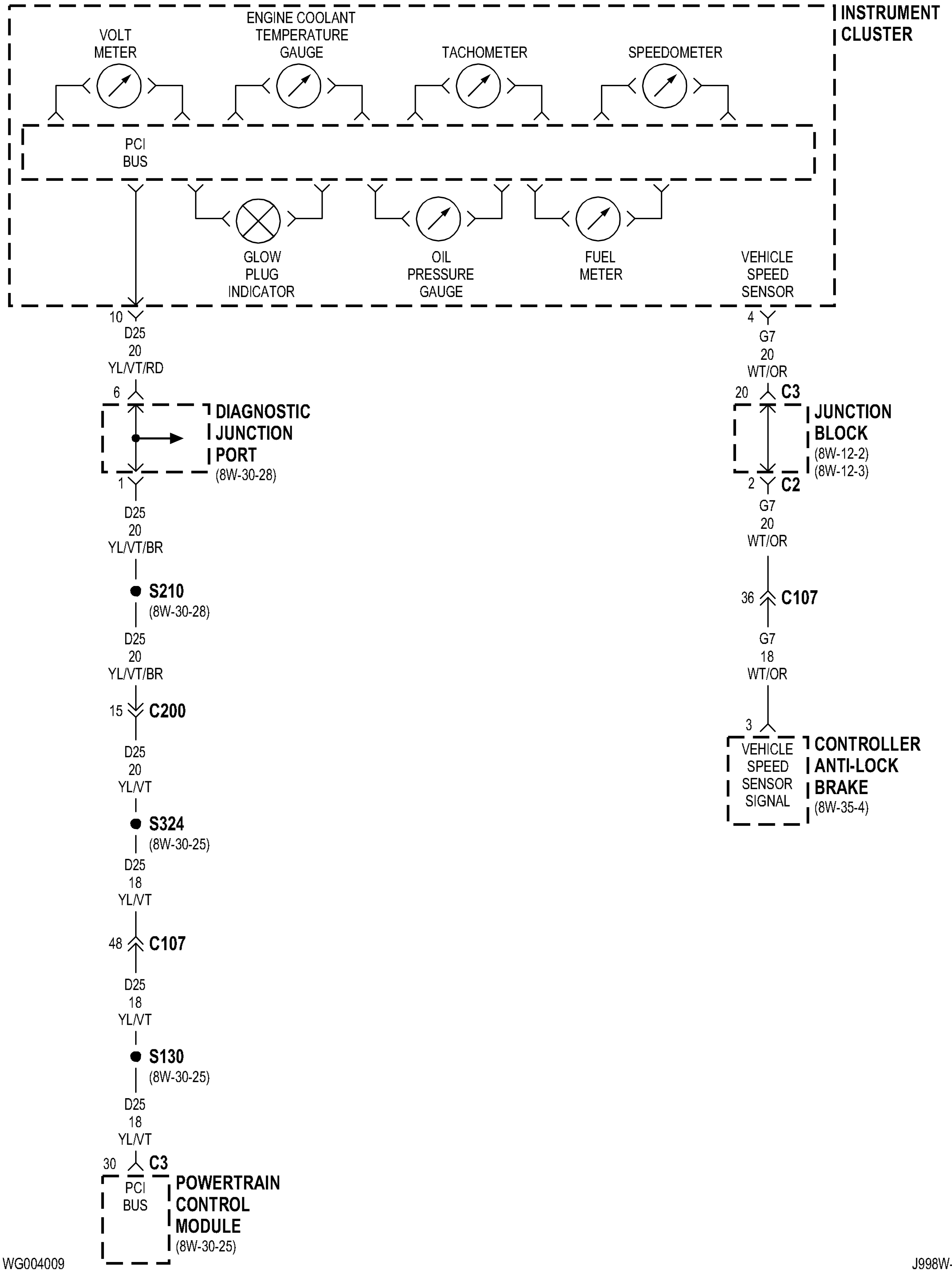
LHD

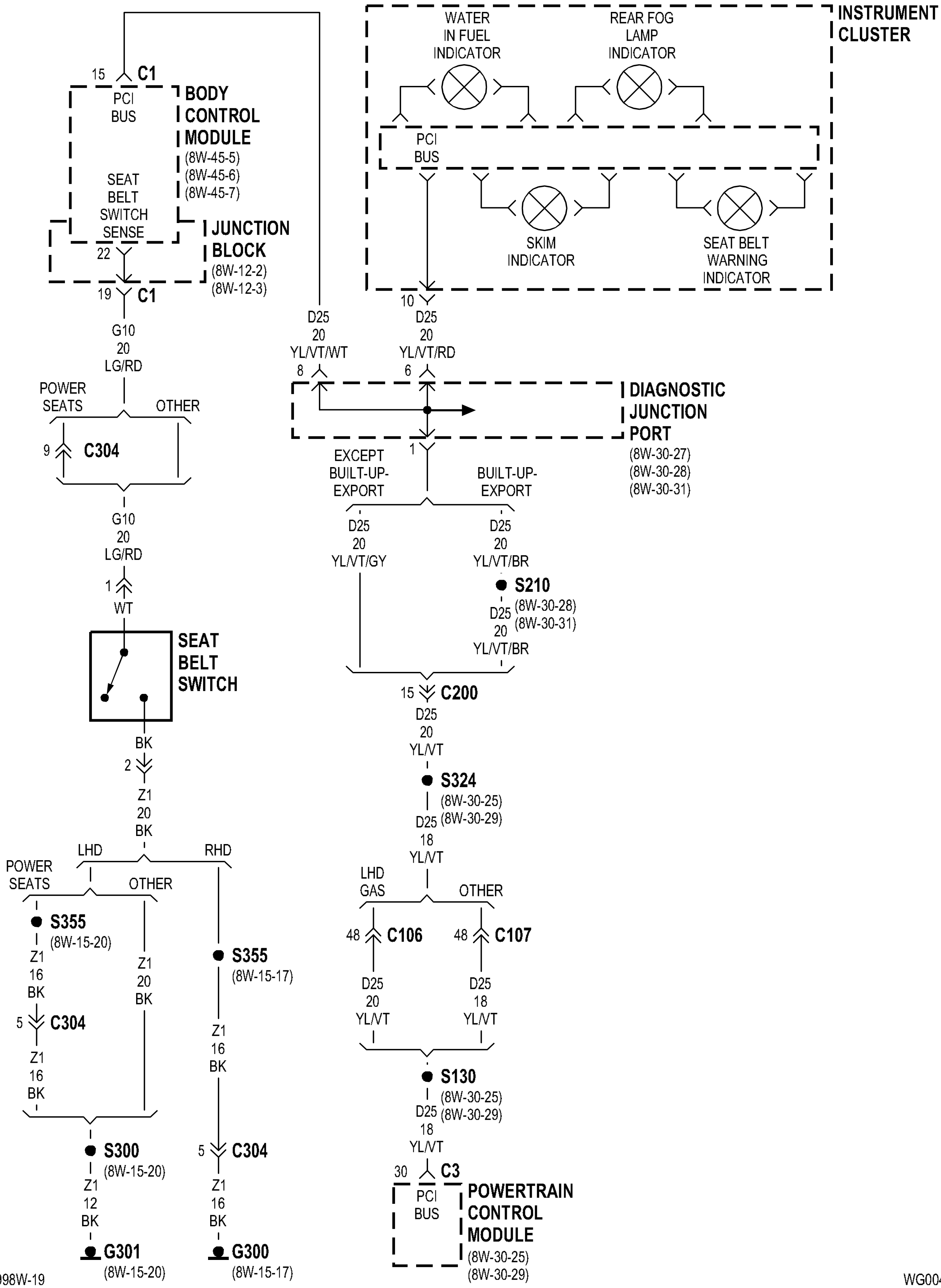


INSTRUMENT CLUSTER
LOW FUEL WARNING INDICATOR
OVERDRIVE INDICATOR
FOG LAMP INDICATOR
HIGH BEAM INDICATOR
ABS WARNING INDICATOR
PCI BUS
CHECK GAUGES INDICATOR
CHECK ENGINE INDICATOR
BRAKE WARNING INDICATOR
RED BRAKE WARNING INDICATOR DRIVER
10
D25
20
YL/VT/RD
5
G9
20
GY/BK
6
DIAGNOSTIC JUNCTION PORT
(8W-30-27)
(8W-30-28)
8
2
1
BUILT-UP-EXPORT
EXCEPT BUILT-UP-EXPORT
BUILT-UP-EXPORT
EXCEPT BUILT-UP-EXPORT
D25
20
YL/VT/GY
D25
20
YL/VT/BR
D25
20
YL/VT/BR
D25
20
YL/VT/GY
S210
(8W-30-27)
D25
20
YL/VT/BR
S210
(8W-30-28)
D25
20
YL/VT/BR
D25
20
YL/VT/WT
PARK BRAKE SWITCH
15
C1
PCI BUS
BODY CONTROL MODULE
(8W-45-5)
14
C200
15
C200
D25
20
YL/VT
D25
20
YL/VT
S312
(8W-30-26)
S324
(8W-30-25)
D25
18
YL/VT
D25
18
YL/VT
48
C106
DIESEL
GAS
D25
18
YL/VT
D25
20
YL/VT
48
C107
D25
18
YL/VT
S130
(8W-30-25)
GAS
DIESEL
10
PCI BUS
CONTROLLER ANTI-LOCK BRAKE
(8W-35-2)
(8W-35-3)
30
C3
PCI BUS
POWERTRAIN CONTROL MODULE
(8W-30-25)


INSTRUMENT CLUSTER
LOW FUEL WARNING INDICATOR
OVERDRIVE INDICATOR
FOG LAMP INDICATOR
HIGH BEAM INDICATOR
ABS WARNING INDICATOR
PCI BUS
RED BRAKE WARNING INDICATOR DRIVER
CHECK GAUGES INDICATOR
CHECK ENGINE INDICATOR
BRAKE WARNING INDICATOR
5
G9
20
GY/BK
10
D25
20
YL/VT/RD
6
DIAGNOSTIC JUNCTION PORT
(8W-30-31)
8
D25
20
YL/VT/WT
15
C1
PCI BUS
BODY CONTROL MODULE
(8W-45-5)
2
D25
20
YL/VT/GY
14
C200
D25
20
YL/VT
S312
(8W-30-30)
D25
20
YL/VT
1
C309
D25
20
VT/YL
2
PCI BUS
VEHICLE INFORMATION CENTER
(8W-49-3)
1
D25
20
YL/VT/BR
S210
(8W-30-31)
D25
20
YL/VT/BR
15
C200
D25
20
YL/VT
S324
(8W-30-29)
D25
18
YL/VT
48
C107
D25
18
YL/VT
S130
(8W-30-29)
D25
18
YL/VT
10
PCI BUS
CONTROLLER ANTI-LOCK BRAKE
(8W-35-2)
D25
18
YL/VT
30
C3
PCI BUS
POWERTRAIN CONTROL MODULE
(8W-30-24)
PARK BRAKE SWITCH


INSTRUMENT CLUSTER
VOLT METER
ENGINE COOLANT TEMPERATURE GAUGE
TACHOMETER
SPEEDOMETER
PCI BUS
OIL PRESSURE GAUGE
FUEL GAUGE
VEHICLE SPEED SENSOR SIGNAL
10
D25 20 YL/VT/RD
6
DIAGNOSTIC JUNCTION PORT
(8W-30-27)
(8W-30-28)
(8W-30-31)
1
EXCEPT BUILT-UP-EXPORT
BUILT-UP-EXPORT
D25 20 YL/VT/GY
D25 20 YL/VT/BR
S210
(8W-30-28)
(8W-30-31)
15 C200
D25 20 YL/VT
S324
(8W-30-25)
(8W-30-29)
D25 18 YL/VT
LHD
RHD
48 C106
48 C107
D25 20 YL/VT
D25 18 YL/VT
S130
(8W-30-25)
(8W-30-29)
D25 18 YL/VT
30 C3
PCI BUS
4
G7 20 WT/OR
20 C3
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
2 C2
G7 20 WT/OR
S325
(8W-12-31)
G7 18 WT/OR
36 C107
G7 18 WT/OR
3
VEHICLE SPEED SENSOR SIGNAL
CONTROLLER ANTI-LOCK BRAKE
(8W-35-4)
RHD
LHD
G7 20 WT/OR
G7 18 WT/OR
36 C106
G7 20 WT/OR
5 C103
G7 18 WT/OR
4.0L
4.7L
S117
(8W-12-31)
G7 18 WT/OR
G7 18 WT/OR
27 C2
VEHICLE SPEED SENSOR SIGNAL
POWERTRAIN CONTROL MODULE
(8W-30-15)
(8W-30-23)
(8W-30-24)
28
VEHICLE SPEED SENSOR SIGNAL
TRANSMISSION CONTROL MODULE (4.7L)
(8W-31-8)

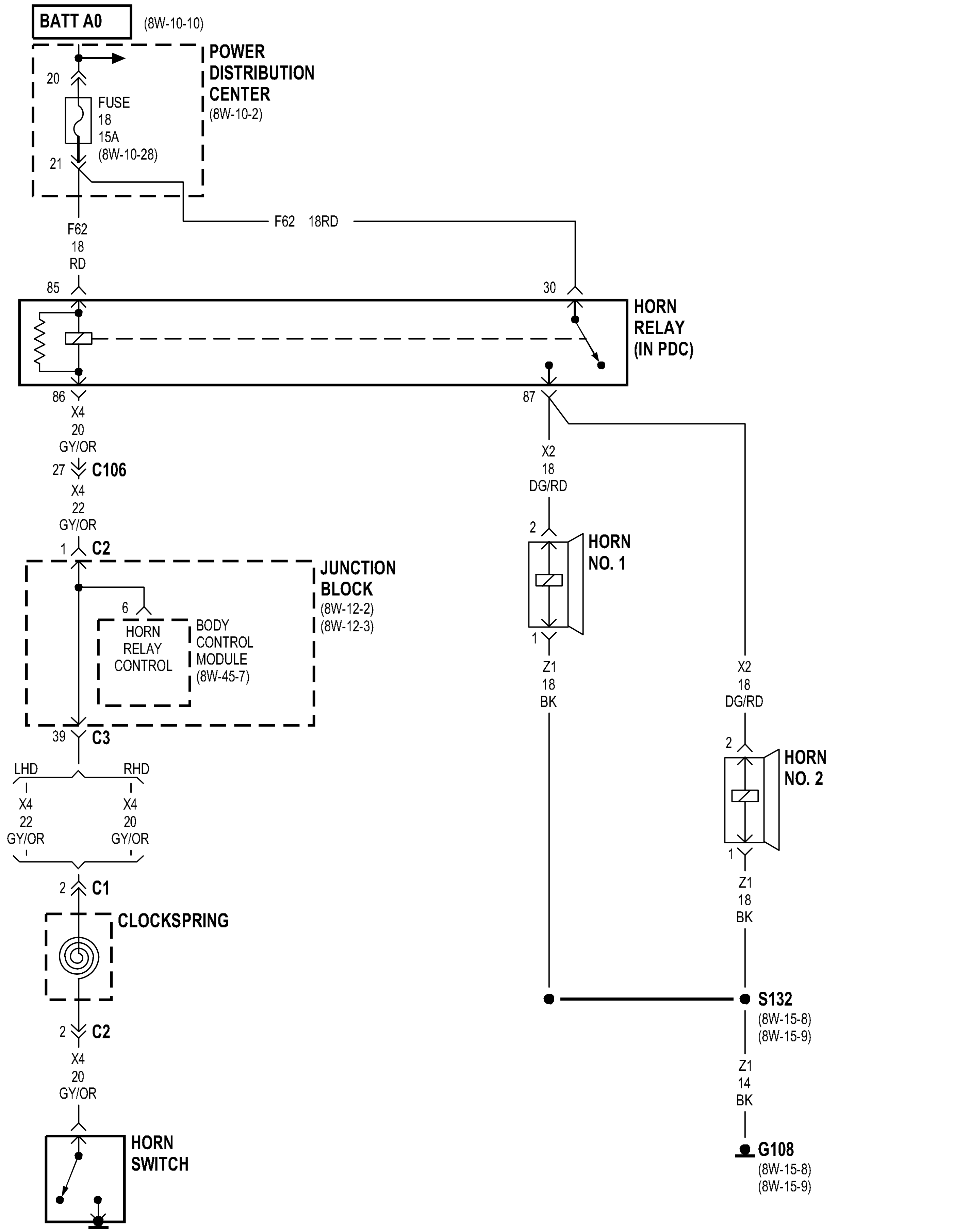

INSTRUMENT CLUSTER
VOLT METER
ENGINE COOLANT TEMPERATURE GAUGE
TACHOMETER
SPEEDOMETER
PCI BUS
GLOW PLUG INDICATOR
OIL PRESSURE GAUGE
FUEL METER
VEHICLE SPEED SENSOR
10
D25
20
YL/VT/RD
6
DIAGNOSTIC JUNCTION PORT
(8W-30-28)
1
D25
20
YL/VT/BR
S210
(8W-30-28)
D25
20
YL/VT/BR
15
C200
D25
20
YL/VT
S324
(8W-30-25)
D25
18
YL/VT
48
C107
D25
18
YL/VT
S130
(8W-30-25)
D25
18
YL/VT
30
C3
PCI BUS
POWERTRAIN CONTROL MODULE
(8W-30-25)
4
G7
20
WT/OR
20
C3
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
2
C2
G7
20
WT/OR
36
C107
G7
18
WT/OR
3
VEHICLE SPEED SENSOR SIGNAL
CONTROLLER ANTI-LOCK BRAKE
(8W-35-4)

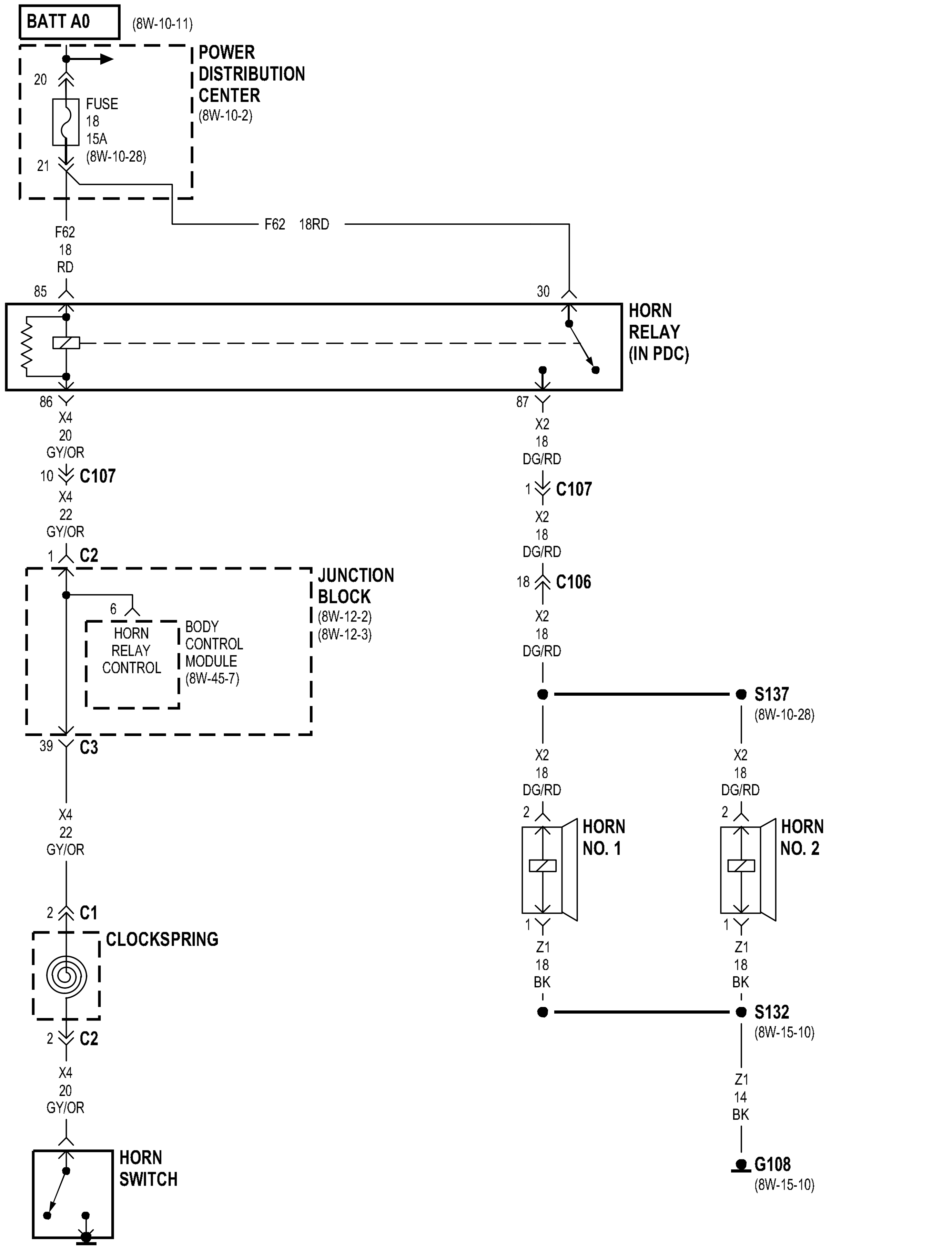


J998W-19

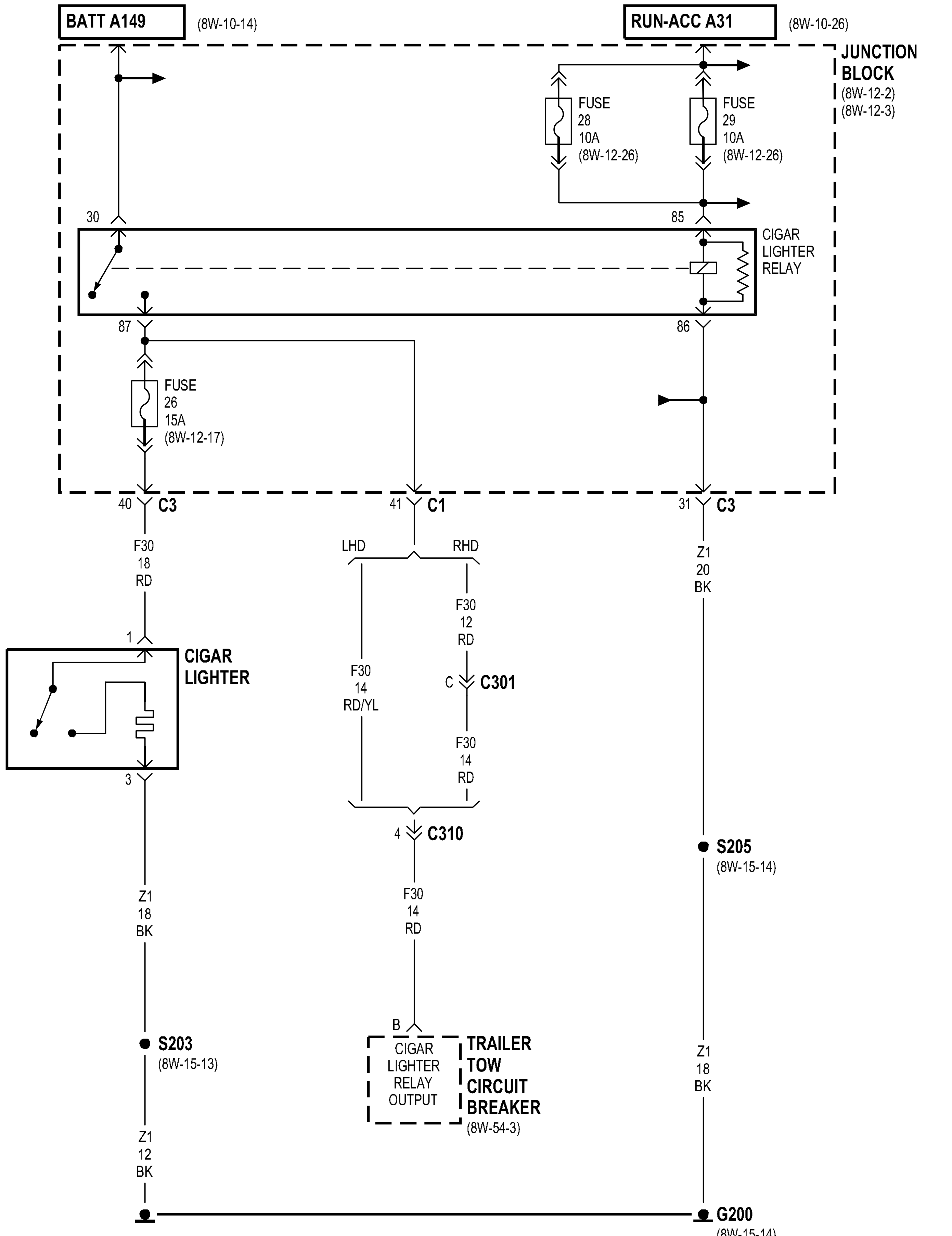
WG004010

8W-41 HORN/CIGAR LIGHTER/POWER OUTLET

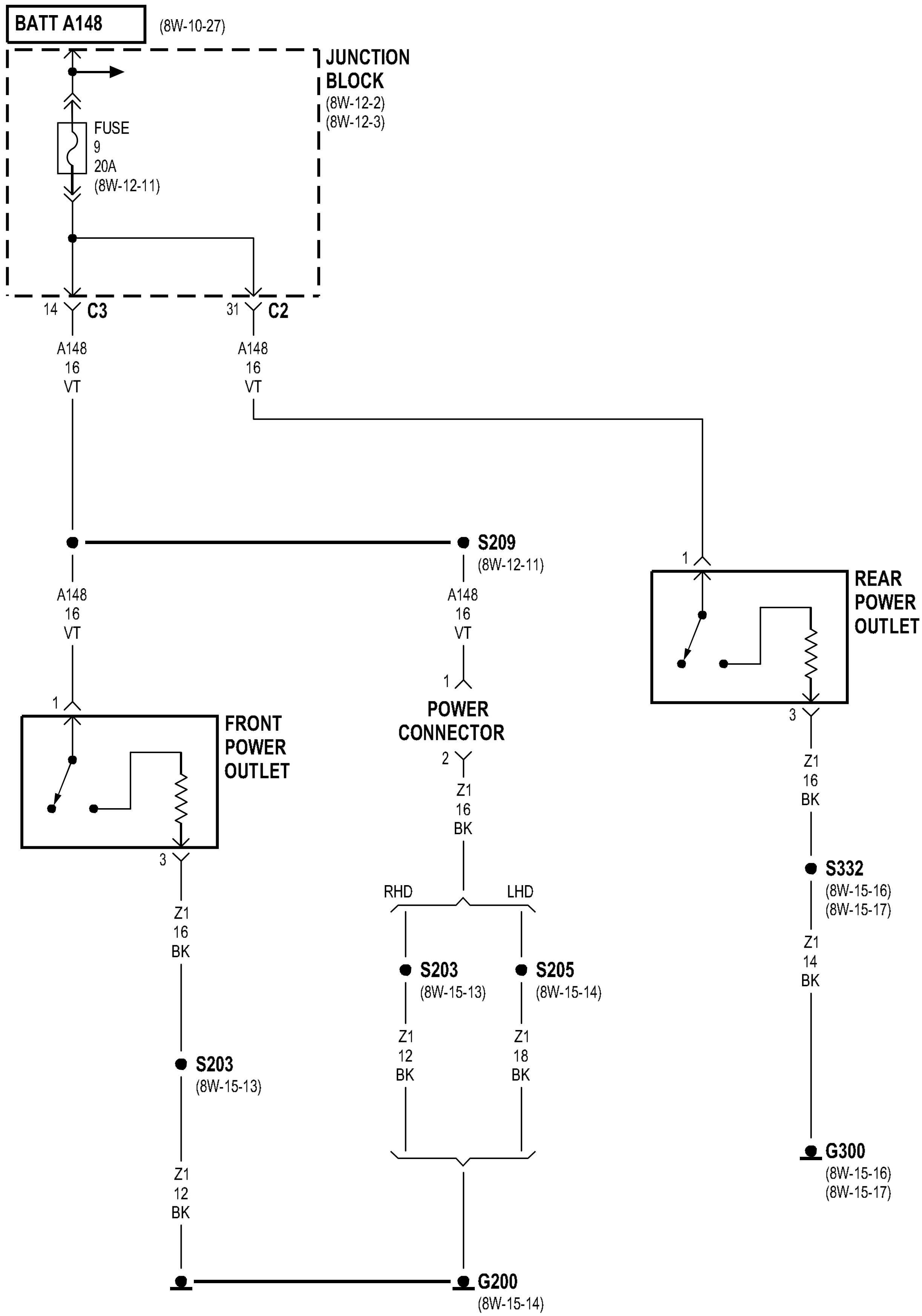

BATT A0
(8W-10-10)
POWER DISTRIBUTION CENTER
(8W-10-2)
20
FUSE
18
15A
(8W-10-28)
21
F62
18
RD
F62 18RD
85
30
HORN RELAY (IN PDC)
86
87
X4
20
GY/OR
27
C106
X4
22
GY/OR
X2
18
DG/RD
2
HORN NO. 1
1
C2
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
6
HORN RELAY CONTROL
BODY CONTROL MODULE
(8W-45-7)
Z1
18
BK
X2
18
DG/RD
39
C3
LHD
RHD
X4
22
GY/OR
X4
20
GY/OR
2
HORN NO. 2
1
C1
CLOCKSPRING
Z1
18
BK
S132
(8W-15-8)
(8W-15-9)
C2
X4
20
GY/OR
Z1
14
BK
HORN SWITCH
G108
(8W-15-8)
(8W-15-9)



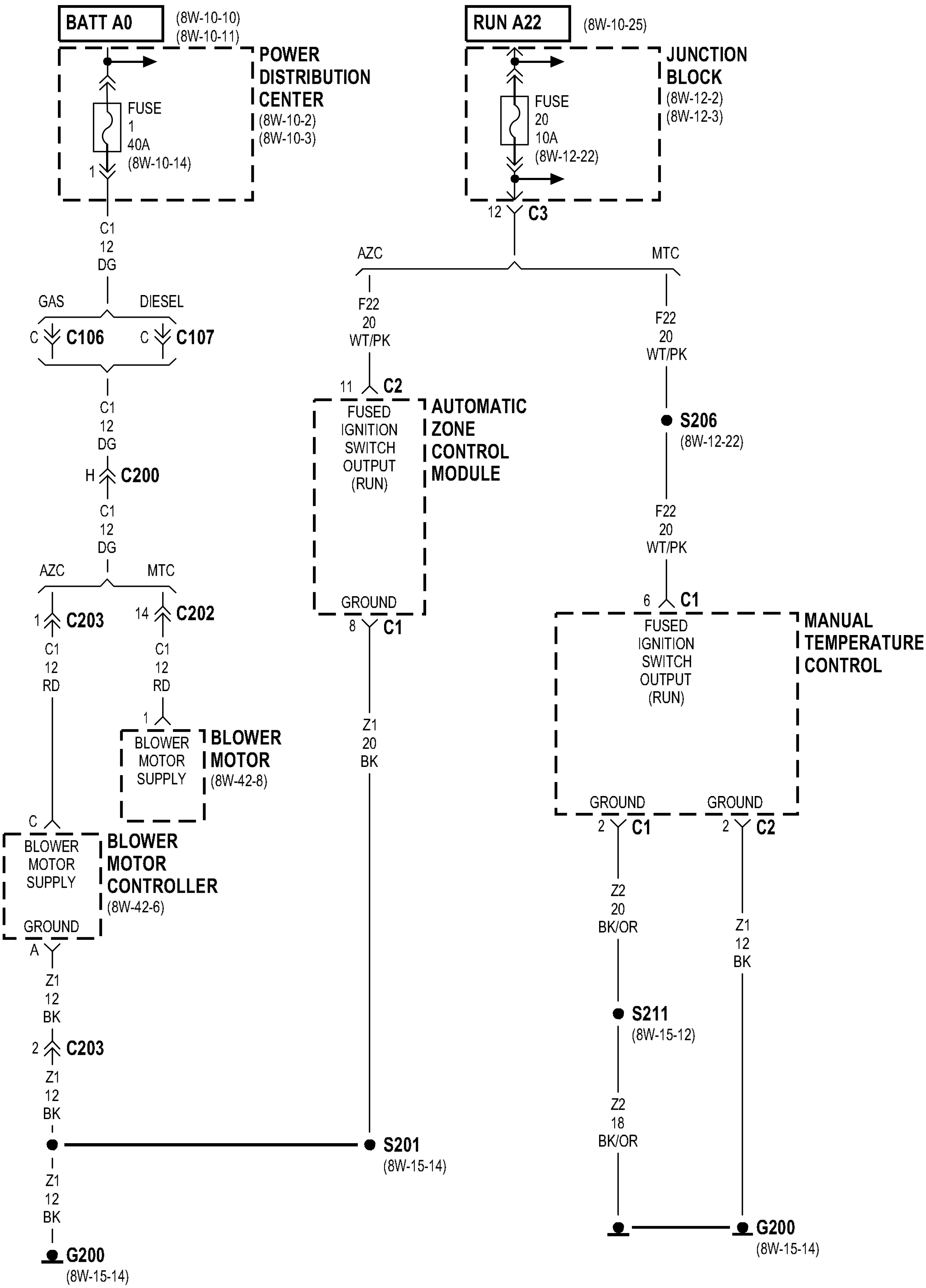
BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
20
FUSE
18
15A
(8W-10-28)
21
F62
18
RD
F62 18RD
85
30
HORN RELAY (IN PDC)
86
87
X4
20
GY/OR
10
C107
X4
22
GY/OR
1
C2
X2
18
DG/RD
1
C107
X2
18
DG/RD
18
C106
X2
18
DG/RD
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
6
HORN RELAY CONTROL
BODY CONTROL MODULE
(8W-45-7)
39
C3
S137
(8W-10-28)
X2
18
DG/RD
X2
18
DG/RD
X4
22
GY/OR
2
HORN NO. 1
2
HORN NO. 2
2
C1
CLOCKSPRING
1
Z1
18
BK
1
Z1
18
BK
S132
(8W-15-10)
2
C2
X4
20
GY/OR
Z1
14
BK
HORN SWITCH
G108
(8W-15-10)

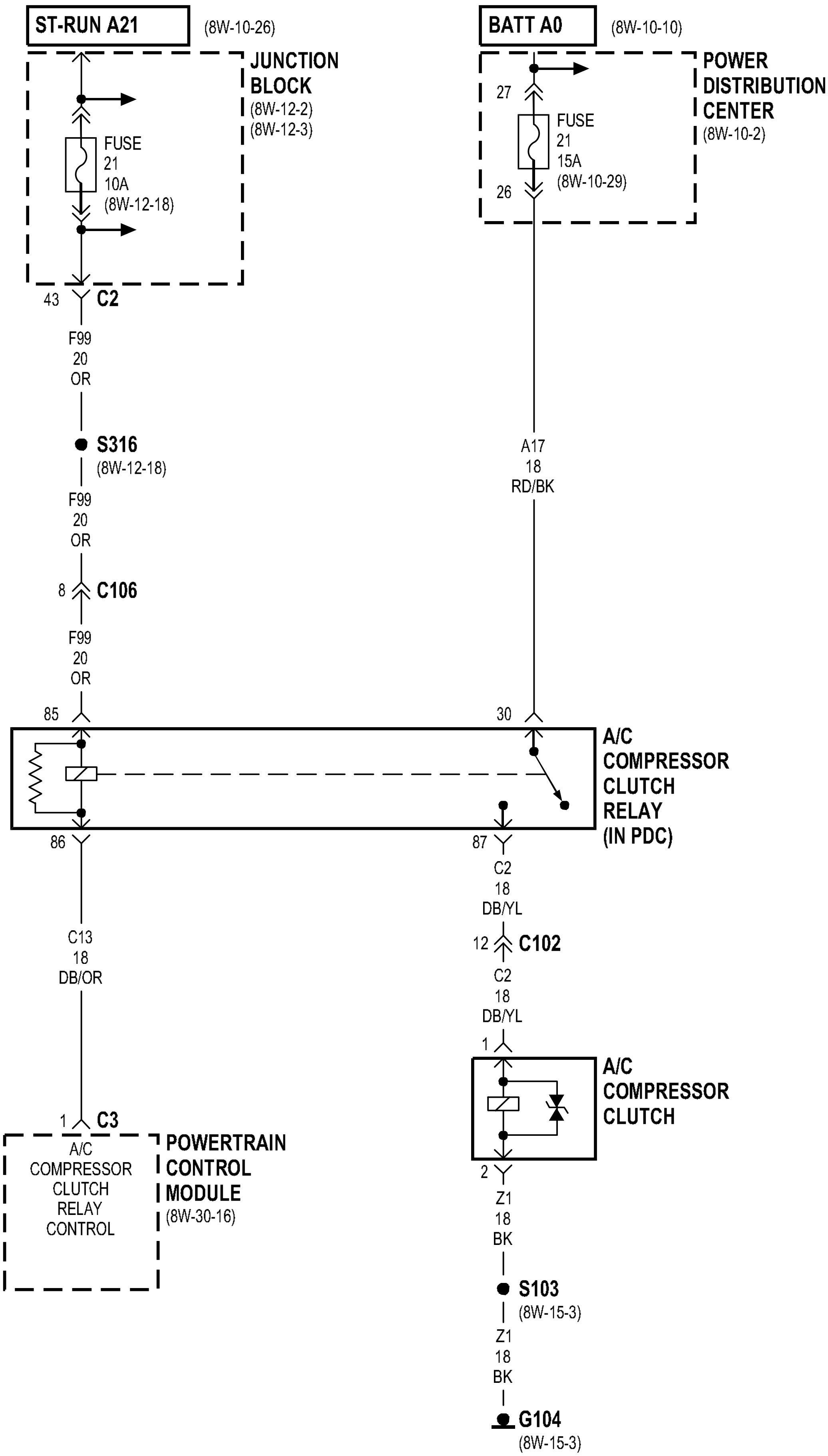


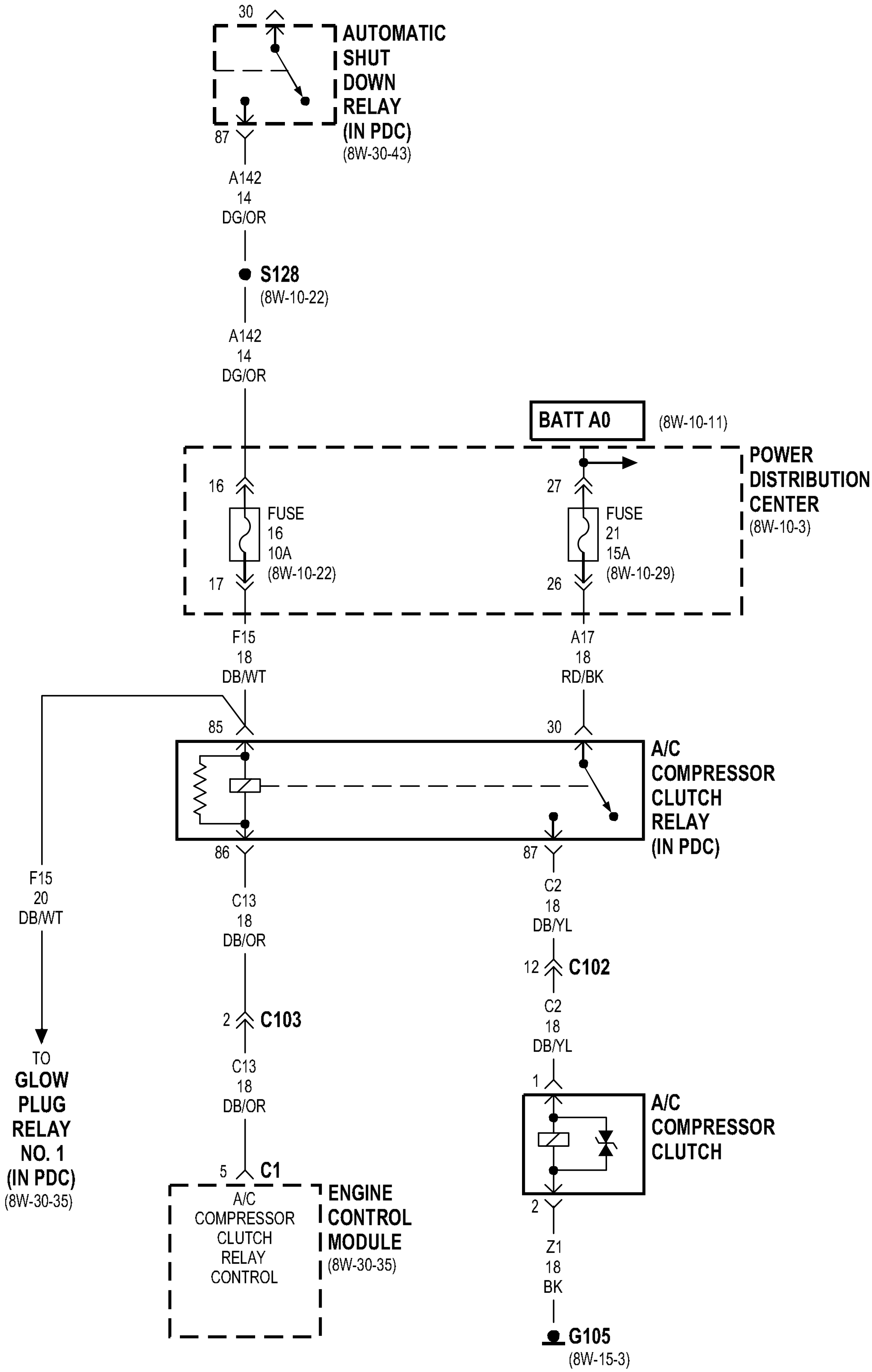
BATT A149
(8W-10-14)
RUN-ACC A31
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 28 10A (8W-12-26)
FUSE 29 10A (8W-12-26)
30
85
CIGAR LIGHTER RELAY
87
86
FUSE 26 15A (8W-12-17)
40 C3
41 C1
31 C3
F30 18 RD
LHD
RHD
F30 12 RD
Z1 20 BK
1
CIGAR LIGHTER
F30 14 RD/YL
C C301
F30 14 RD
3
4 C310
S205
(8W-15-14)
Z1 18 BK
F30 14 RD
B
CIGAR LIGHTER RELAY OUTPUT
TRAILER TOW CIRCUIT BREAKER
(8W-54-3)
S203
(8W-15-13)
Z1 18 BK
Z1 12 BK
G200
(8W-15-14)

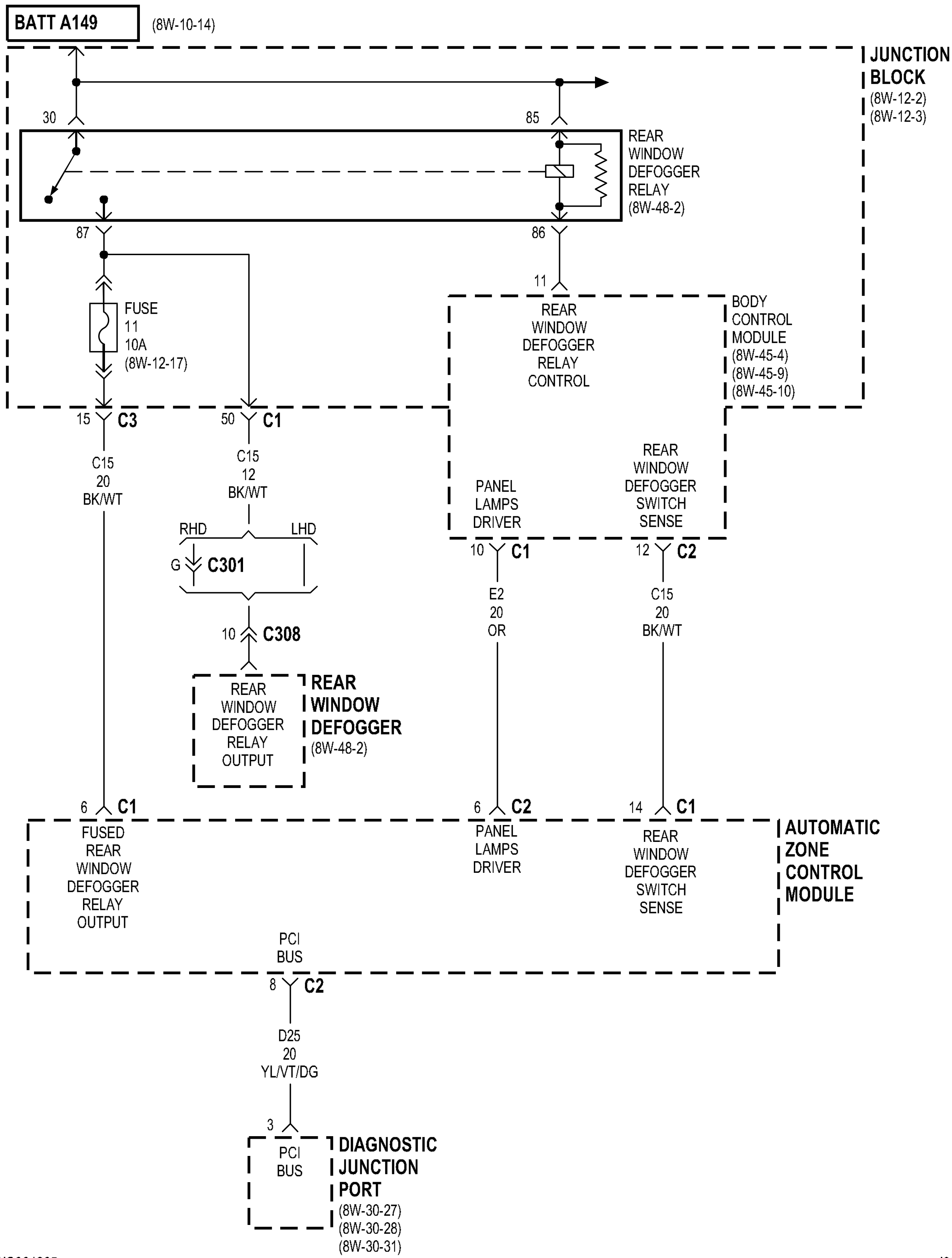

BATT A148
(8W-10-27)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
9
20A
(8W-12-11)
14
C3
31
C2
A148
16
VT
A148
16
VT
S209
(8W-12-11)
A148
16
VT
A148
16
VT
1
POWER
CONNECTOR
2
Z1
16
BK
RHD
LHD
S203
(8W-15-13)
S205
(8W-15-14)
Z1
12
BK
Z1
18
BK
1
FRONT
POWER
OUTLET
3
Z1
16
BK
S203
(8W-15-13)
Z1
12
BK
G200
(8W-15-14)
1
REAR
POWER
OUTLET
3
Z1
16
BK
S332
(8W-15-16)
(8W-15-17)
Z1
14
BK
G300
(8W-15-16)
(8W-15-17)

8W-42 AIR CONDITIONING-HEATER

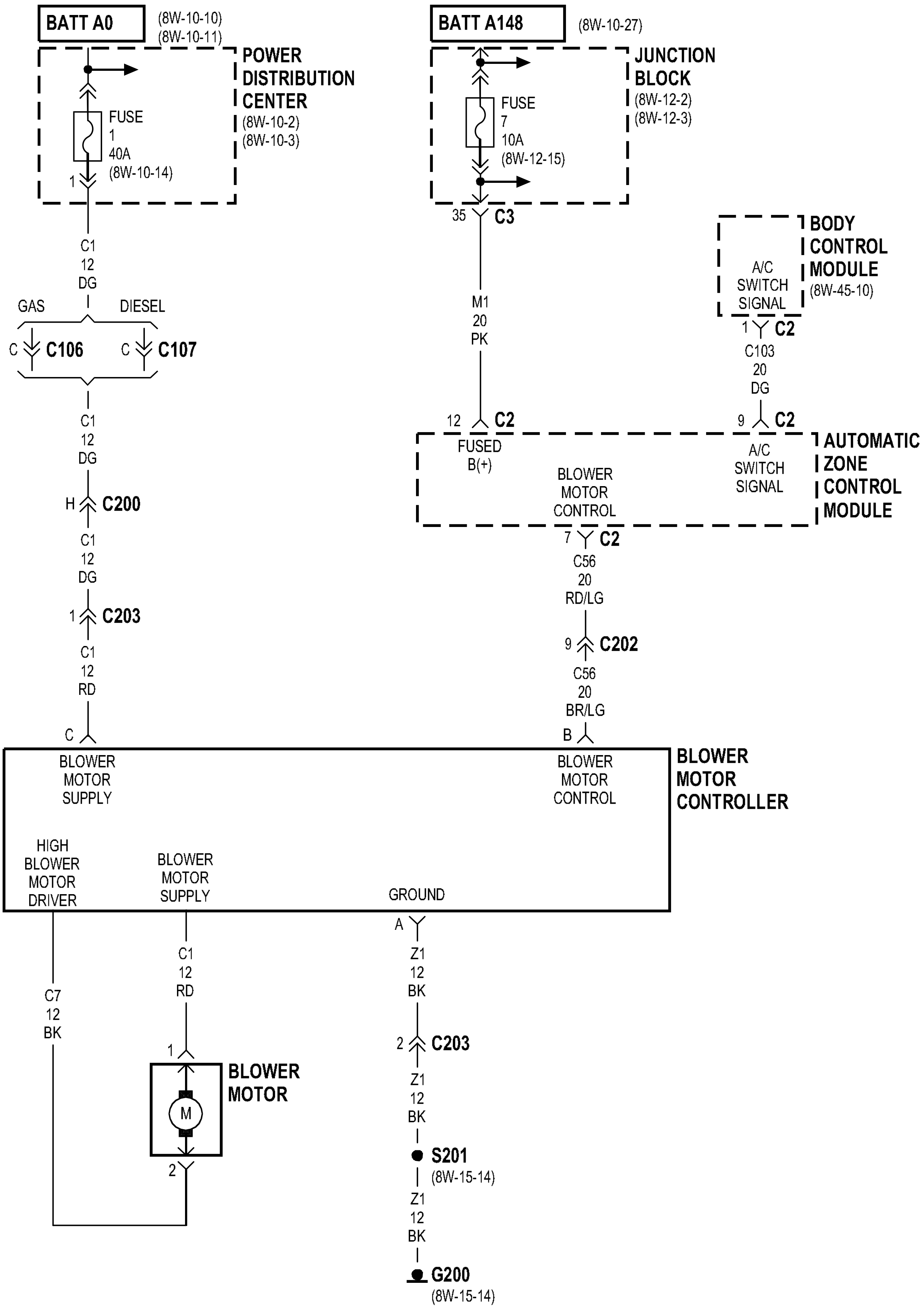

BATT A0
(8W-10-10)
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
(8W-10-3)
FUSE 1 40A (8W-10-14)
1
C1 12 DG
GAS
DIESEL
C C106
C C107
C1 12 DG
H C200
C1 12 DG
AZC
MTC
1 C203
14 C202
C1 12 RD
C1 12 RD
1
BLOWER MOTOR SUPPLY
BLOWER MOTOR
(8W-42-8)
C
BLOWER MOTOR SUPPLY
GROUND
BLOWER MOTOR CONTROLLER
(8W-42-6)
A
Z1 12 BK
2 C203
Z1 12 BK
Z1 12 BK
G200
(8W-15-14)
RUN A22
(8W-10-25)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 20 10A (8W-12-22)
12 C3
AZC
MTC
F22 20 WT/PK
11 C2
FUSED IGNITION SWITCH OUTPUT (RUN)
GROUND
AUTOMATIC ZONE CONTROL MODULE
8 C1
Z1 20 BK
S201
(8W-15-14)
F22 20 WT/PK
S206
(8W-12-22)
F22 20 WT/PK
6 C1
FUSED IGNITION SWITCH OUTPUT (RUN)
MANUAL TEMPERATURE CONTROL
GROUND
GROUND
2 C1
2 C2
Z2 20 BK/OR
S211
(8W-15-12)
Z2 18 BK/OR
Z1 12 BK
G200
(8W-15-14)

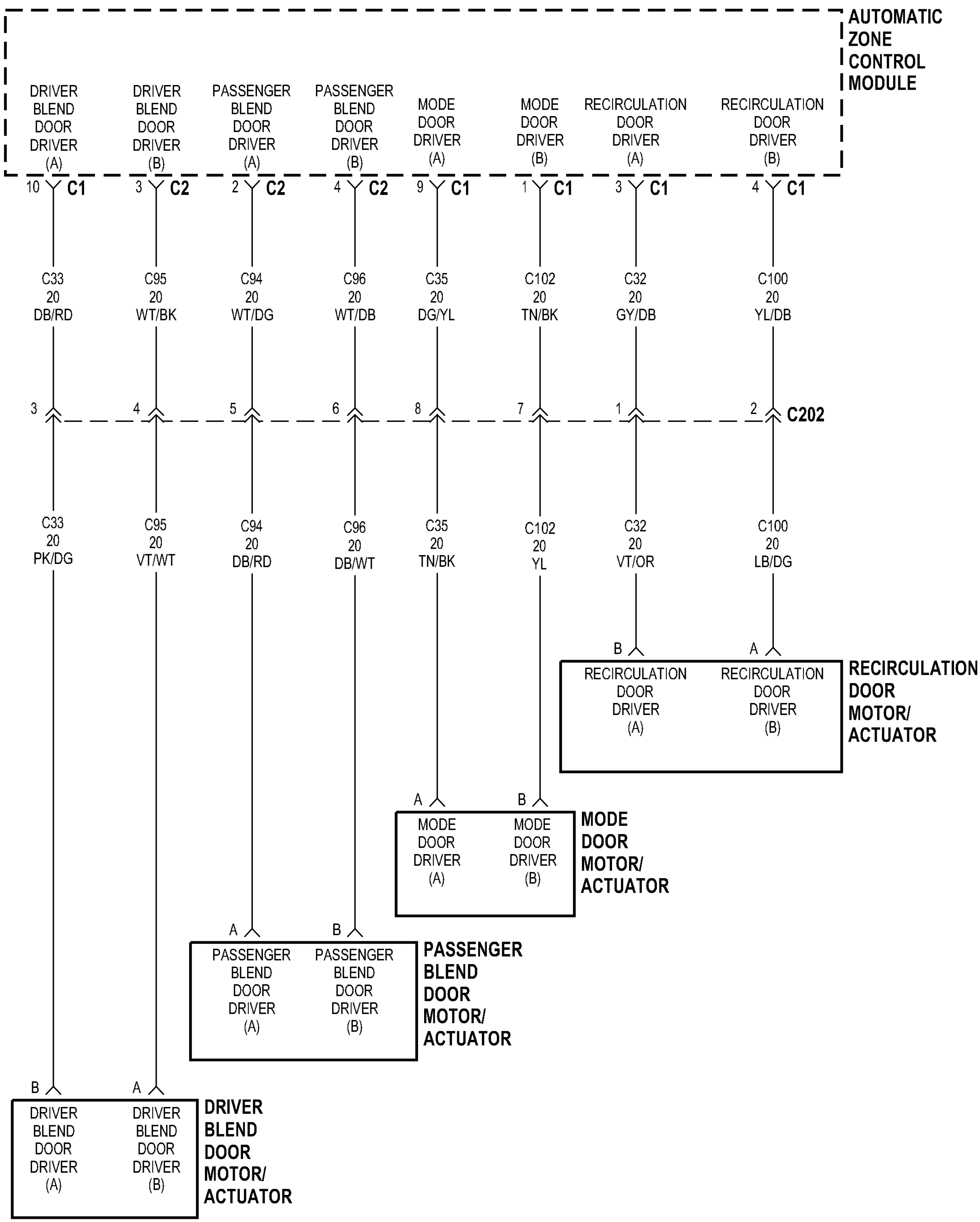

ST-RUN A21
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
21
10A
(8W-12-18)
43
C2
F99
20
OR
S316
(8W-12-18)
F99
20
OR
8
C106
F99
20
OR
85
86
C13
18
DB/OR
1
C3
A/C COMPRESSOR CLUTCH RELAY CONTROL
POWERTRAIN CONTROL MODULE
(8W-30-16)
BATT A0
(8W-10-10)
POWER DISTRIBUTION CENTER
(8W-10-2)
27
FUSE
21
15A
(8W-10-29)
26
A17
18
RD/BK
30
A/C COMPRESSOR CLUTCH RELAY (IN PDC)
87
C2
18
DB/YL
12
C102
C2
18
DB/YL
1
A/C COMPRESSOR CLUTCH
2
Z1
18
BK
S103
(8W-15-3)
Z1
18
BK
G104
(8W-15-3)


30
AUTOMATIC SHUT DOWN RELAY (IN PDC)
(8W-30-43)
87
A142
14
DG/OR
S128
(8W-10-22)
A142
14
DG/OR
BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-3)
16
FUSE
16
10A
(8W-10-22)
17
27
FUSE
21
15A
(8W-10-29)
26
F15
18
DB/WT
A17
18
RD/BK
85
30
A/C COMPRESSOR CLUTCH RELAY (IN PDC)
86
87
F15
20
DB/WT
C13
18
DB/OR
C2
18
DB/YL
12
C102
C2
18
DB/YL
2
C103
C13
18
DB/OR
TO
GLOW PLUG RELAY NO. 1 (IN PDC)
(8W-30-35)
1
A/C COMPRESSOR CLUTCH
5
C1
A/C COMPRESSOR CLUTCH RELAY CONTROL
ENGINE CONTROL MODULE
(8W-30-35)
2
Z1
18
BK
G105
(8W-15-3)

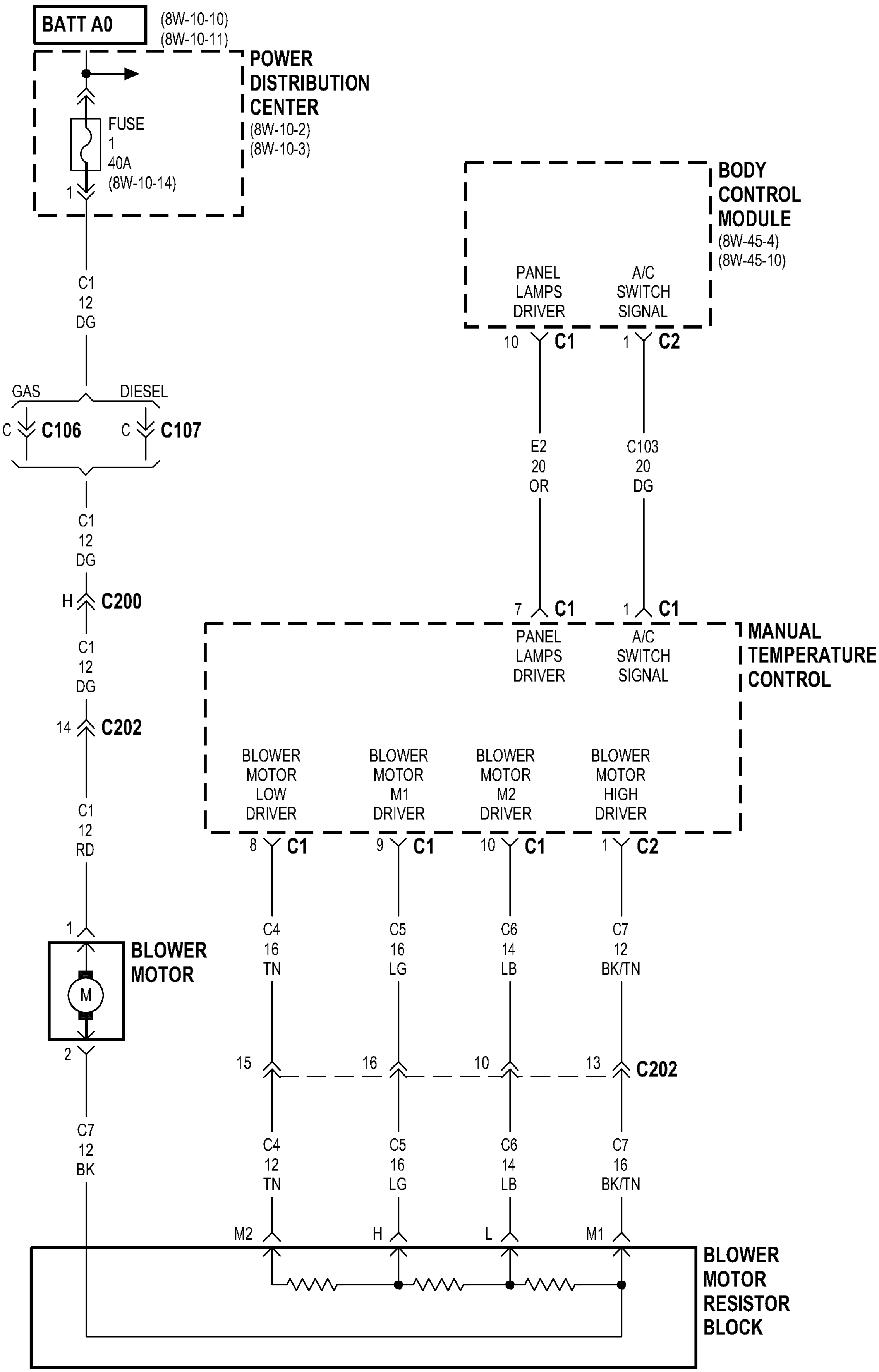

BATT A149
(8W-10-14)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
30
85
REAR WINDOW DEFOGGER RELAY
(8W-48-2)
87
86
11
FUSE
11
10A
(8W-12-17)
REAR WINDOW DEFOGGER RELAY CONTROL
BODY CONTROL MODULE
(8W-45-4)
(8W-45-9)
(8W-45-10)
15
C3
50
C1
C15
20
BK/WT
C15
12
BK/WT
PANEL LAMPS DRIVER
REAR WINDOW DEFOGGER SWITCH SENSE
RHD
LHD
G
C301
10
C1
12
C2
E2
20
OR
C15
20
BK/WT
10
C308
REAR WINDOW DEFOGGER RELAY OUTPUT
REAR WINDOW DEFOGGER
(8W-48-2)
6
C1
6
C2
14
C1
FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
PANEL LAMPS DRIVER
REAR WINDOW DEFOGGER SWITCH SENSE
AUTOMATIC ZONE CONTROL MODULE
PCI BUS
8
C2
D25
20
YL/VT/DG
3
PCI BUS
DIAGNOSTIC JUNCTION PORT
(8W-30-27)
(8W-30-28)
(8W-30-31)

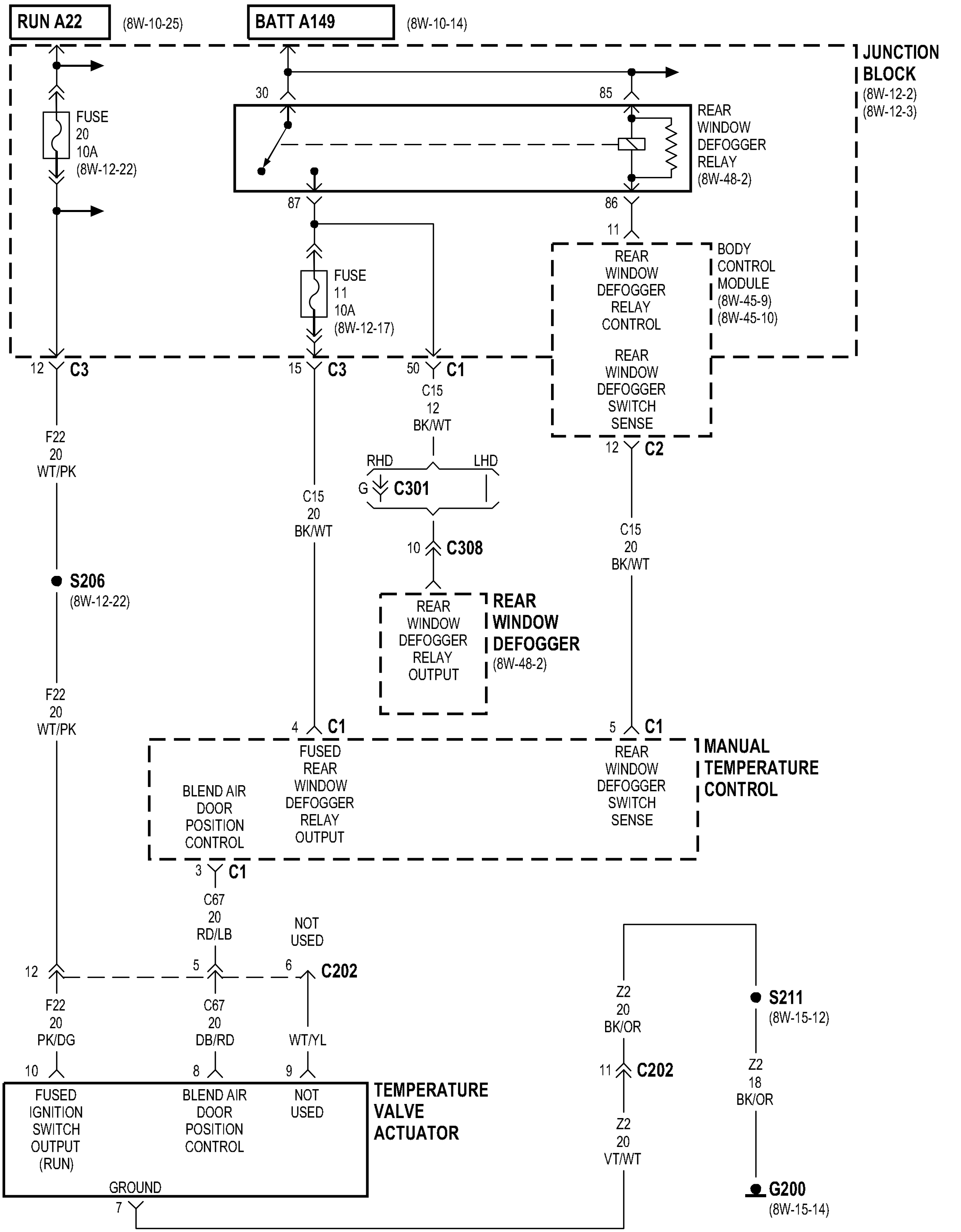
AZC

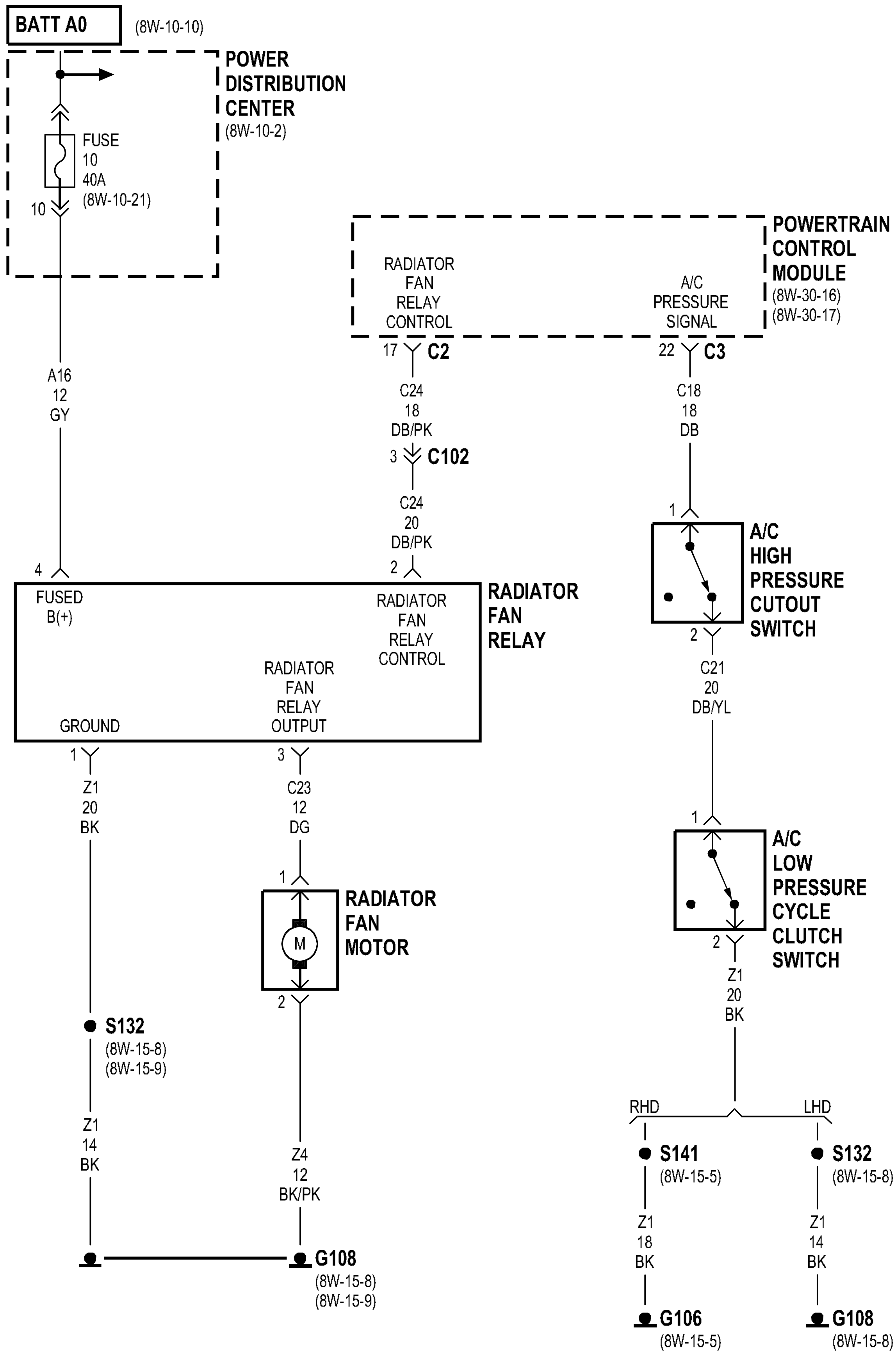

BATT A0
(8W-10-10)
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
(8W-10-3)
FUSE
1
40A
(8W-10-14)
1
C1
12
DG
GAS
DIESEL
C
C106
C
C107
C1
12
DG
H
C200
C1
12
DG
1
C203
C1
12
RD
C
BATT A148
(8W-10-27)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
7
10A
(8W-12-15)
35
C3
M1
20
PK
BODY CONTROL MODULE
(8W-45-10)
A/C SWITCH SIGNAL
1
C2
C103
20
DG
12
C2
9
C2
FUSED B(+)
BLOWER MOTOR CONTROL
A/C SWITCH SIGNAL
AUTOMATIC ZONE CONTROL MODULE
7
C2
C56
20
RD/LG
9
C202
C56
20
BR/LG
B
BLOWER MOTOR SUPPLY
BLOWER MOTOR CONTROL
BLOWER MOTOR CONTROLLER
HIGH BLOWER MOTOR DRIVER
BLOWER MOTOR SUPPLY
GROUND
A
Z1
12
BK
2
C203
Z1
12
BK
S201
(8W-15-14)
Z1
12
BK
G200
(8W-15-14)
C7
12
BK
C1
12
RD
1
M
BLOWER MOTOR
2

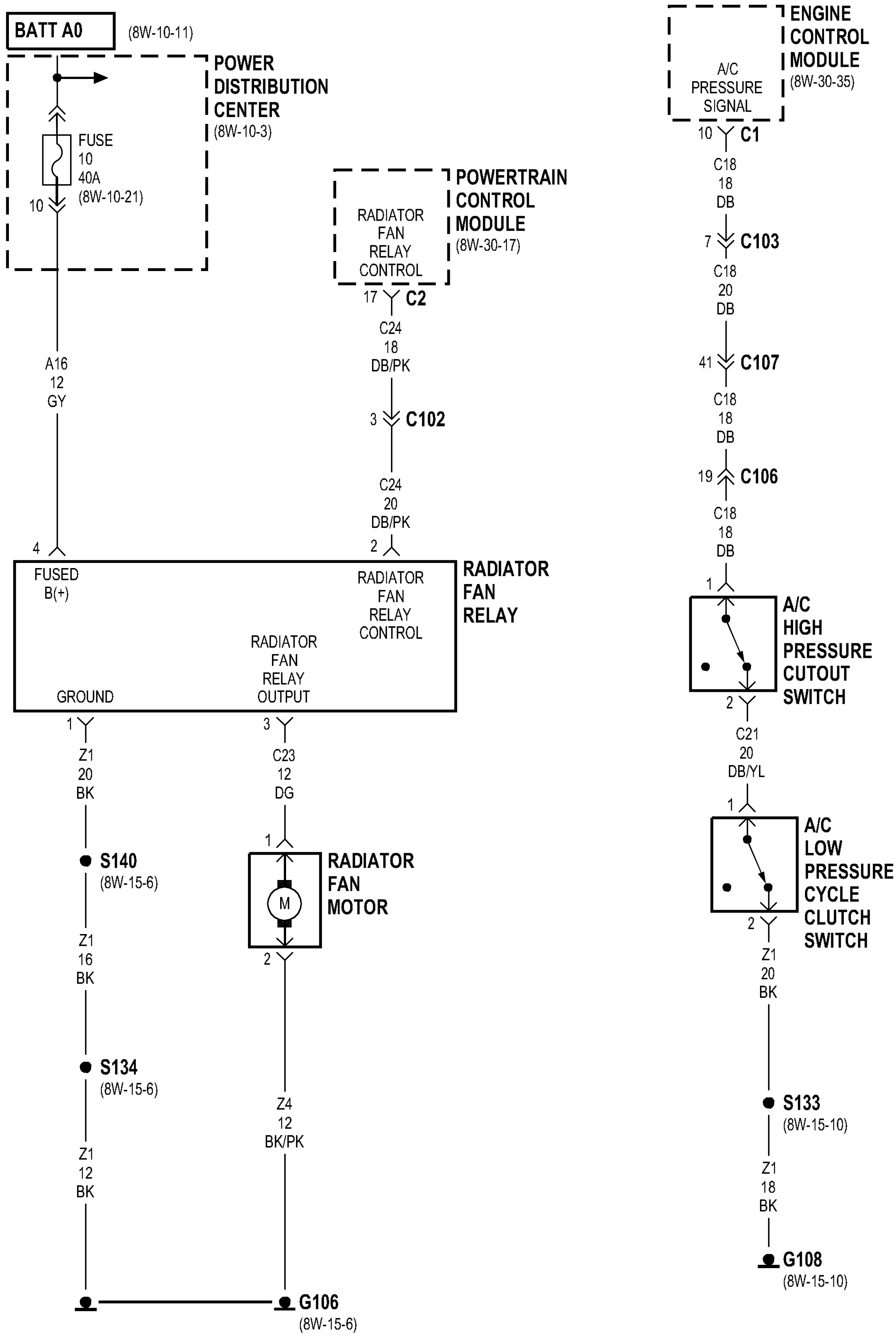

AUTOMATIC ZONE CONTROL MODULE
DRIVER BLEND DOOR DRIVER (A)
DRIVER BLEND DOOR DRIVER (B)
PASSENGER BLEND DOOR DRIVER (A)
PASSENGER BLEND DOOR DRIVER (B)
MODE DOOR DRIVER (A)
MODE DOOR DRIVER (B)
RECIRCULATION DOOR DRIVER (A)
RECIRCULATION DOOR DRIVER (B)
10 C1
3 C2
2 C2
4 C2
9 C1
1 C1
3 C1
4 C1
C33 20 DB/RD
C95 20 WT/BK
C94 20 WT/DG
C96 20 WT/DB
C35 20 DG/YL
C102 20 TN/BK
C32 20 GY/DB
C100 20 YL/DB
3
4
5
6
8
7
1
2
C202
C33 20 PK/DG
C95 20 VT/WT
C94 20 DB/RD
C96 20 DB/WT
C35 20 TN/BK
C102 20 YL
C32 20 VT/OR
C100 20 LB/DG
B
A
RECIRCULATION DOOR DRIVER (A)
RECIRCULATION DOOR DRIVER (B)
RECIRCULATION DOOR MOTOR/ ACTUATOR
A
B
MODE DOOR DRIVER (A)
MODE DOOR DRIVER (B)
MODE DOOR MOTOR/ ACTUATOR
A
B
PASSENGER BLEND DOOR DRIVER (A)
PASSENGER BLEND DOOR DRIVER (B)
PASSENGER BLEND DOOR MOTOR/ ACTUATOR
B
A
DRIVER BLEND DOOR DRIVER (A)
DRIVER BLEND DOOR DRIVER (B)
DRIVER BLEND DOOR MOTOR/ ACTUATOR

MTC


BATT A0
(8W-10-10)
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-2)
(8W-10-3)
FUSE
1
40A
(8W-10-14)
1
C1
12
DG
GAS
DIESEL
C
C106
C
C107
C1
12
DG
H
C200
C1
12
DG
14
C202
C1
12
RD
1
BLOWER MOTOR
M
2
C7
12
BK
BODY CONTROL MODULE
(8W-45-4)
(8W-45-10)
PANEL LAMPS DRIVER
A/C SWITCH SIGNAL
10
C1
1
C2
E2
20
OR
C103
20
DG
7
C1
1
C1
MANUAL TEMPERATURE CONTROL
PANEL LAMPS DRIVER
A/C SWITCH SIGNAL
BLOWER MOTOR LOW DRIVER
BLOWER MOTOR M1 DRIVER
BLOWER MOTOR M2 DRIVER
BLOWER MOTOR HIGH DRIVER
8
C1
9
C1
10
C1
1
C2
C4
16
TN
C5
16
LG
C6
14
LB
C7
12
BK/TN
15
16
10
13
C202
C4
12
TN
C5
16
LG
C6
14
LB
C7
16
BK/TN
M2
H
L
M1
BLOWER MOTOR RESISTOR BLOCK

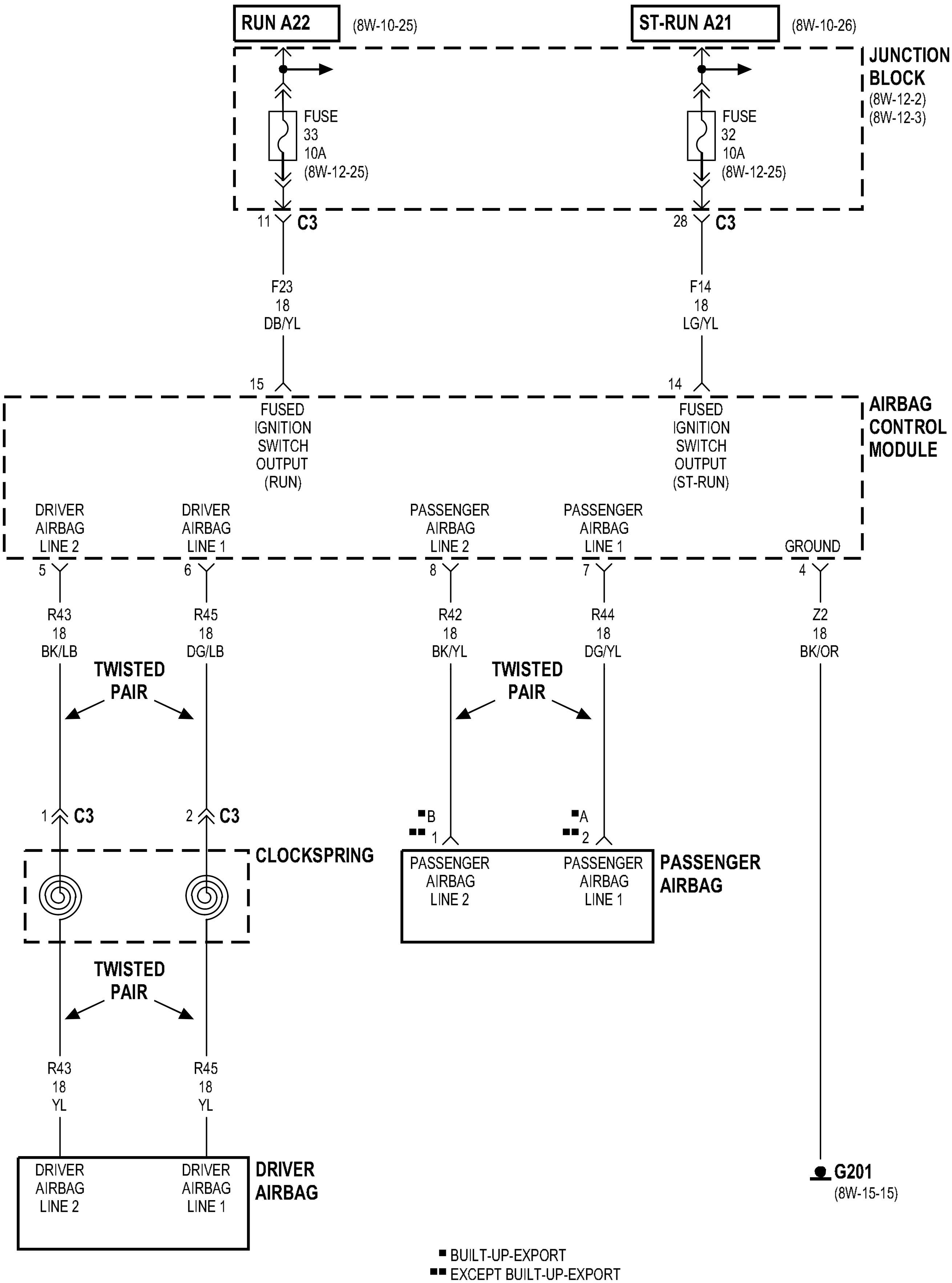

RUN A22
(8W-10-25)
BATT A149
(8W-10-14)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
20
10A
(8W-12-22)
30
85
REAR WINDOW DEFOGGER RELAY
(8W-48-2)
87
86
11
FUSE
11
10A
(8W-12-17)
REAR WINDOW DEFOGGER RELAY CONTROL
REAR WINDOW DEFOGGER SWITCH SENSE
BODY CONTROL MODULE
(8W-45-9)
(8W-45-10)
12 C3
15 C3
50 C1
C15
12
BK/WT
12 C2
F22
20
WT/PK
C15
20
BK/WT
RHD
LHD
G C301
10 C308
C15
20
BK/WT
S206
(8W-12-22)
REAR WINDOW DEFOGGER RELAY OUTPUT
REAR WINDOW DEFOGGER
(8W-48-2)
F22
20
WT/PK
4 C1
5 C1
BLEND AIR DOOR POSITION CONTROL
FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
REAR WINDOW DEFOGGER SWITCH SENSE
MANUAL TEMPERATURE CONTROL
3 C1
C67
20
RD/LB
NOT USED
12
5
6
C202
F22
20
PK/DG
C67
20
DB/RD
WT/YL
Z2
20
BK/OR
S211
(8W-15-12)
11 C202
Z2
18
BK/OR
10
8
9
FUSED IGNITION SWITCH OUTPUT (RUN)
BLEND AIR DOOR POSITION CONTROL
NOT USED
TEMPERATURE VALVE ACTUATOR
GROUND
7
Z2
20
VT/WT
G200
(8W-15-14)

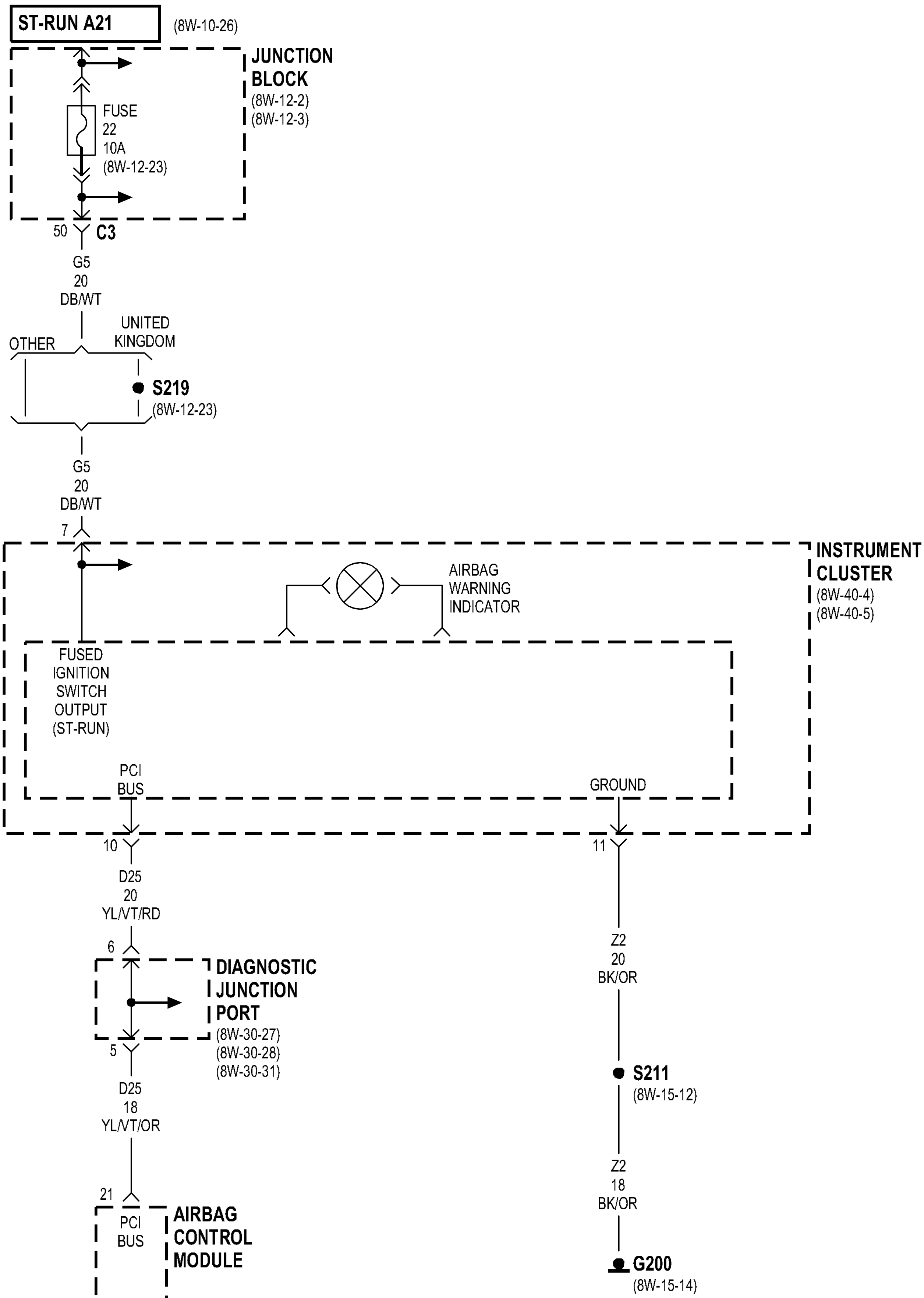

BATT A0
(8W-10-10)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE
10
40A
(8W-10-21)
10
A16
12
GY
POWERTRAIN CONTROL MODULE
(8W-30-16)
(8W-30-17)
RADIATOR FAN RELAY CONTROL
A/C PRESSURE SIGNAL
17 C2
22 C3
C24
18
DB/PK
3 C102
C24
20
DB/PK
C18
18
DB
4
2
FUSED B(+)
RADIATOR FAN RELAY CONTROL
RADIATOR FAN RELAY OUTPUT
GROUND
RADIATOR FAN RELAY
1
A/C HIGH PRESSURE CUTOUT SWITCH
2
C21
20
DB/YL
1
A/C LOW PRESSURE CYCLE CLUTCH SWITCH
2
Z1
20
BK
1
3
Z1
20
BK
C23
12
DG
1
M
RADIATOR FAN MOTOR
2
S132
(8W-15-8)
(8W-15-9)
Z1
14
BK
Z4
12
BK/PK
G108
(8W-15-8)
(8W-15-9)
RHD
LHD
S141
(8W-15-5)
S132
(8W-15-8)
Z1
18
BK
Z1
14
BK
G106
(8W-15-5)
G108
(8W-15-8)



BATT A0
(8W-10-11)
POWER DISTRIBUTION CENTER
(8W-10-3)
FUSE 10 40A
(8W-10-21)
10
A16 12 GY
4
POWERTRAIN CONTROL MODULE
(8W-30-17)
RADIATOR FAN RELAY CONTROL
17 C2
C24 18 DB/PK
3 C102
C24 20 DB/PK
2
RADIATOR FAN RELAY
FUSED B(+)
RADIATOR FAN RELAY CONTROL
RADIATOR FAN RELAY OUTPUT
GROUND
1
3
Z1 20 BK
C23 12 DG
S140
(8W-15-6)
Z1 16 BK
S134
(8W-15-6)
Z1 12 BK
1
RADIATOR FAN MOTOR
M
2
Z4 12 BK/PK
G106
(8W-15-6)
ENGINE CONTROL MODULE
(8W-30-35)
A/C PRESSURE SIGNAL
10 C1
C18 18 DB
7 C103
C18 20 DB
41 C107
C18 18 DB
19 C106
C18 18 DB
1
A/C HIGH PRESSURE CUTOUT SWITCH
2
C21 20 DB/YL
1
A/C LOW PRESSURE CYCLE CLUTCH SWITCH
2
Z1 20 BK
S133
(8W-15-10)
Z1 18 BK
G108
(8W-15-10)

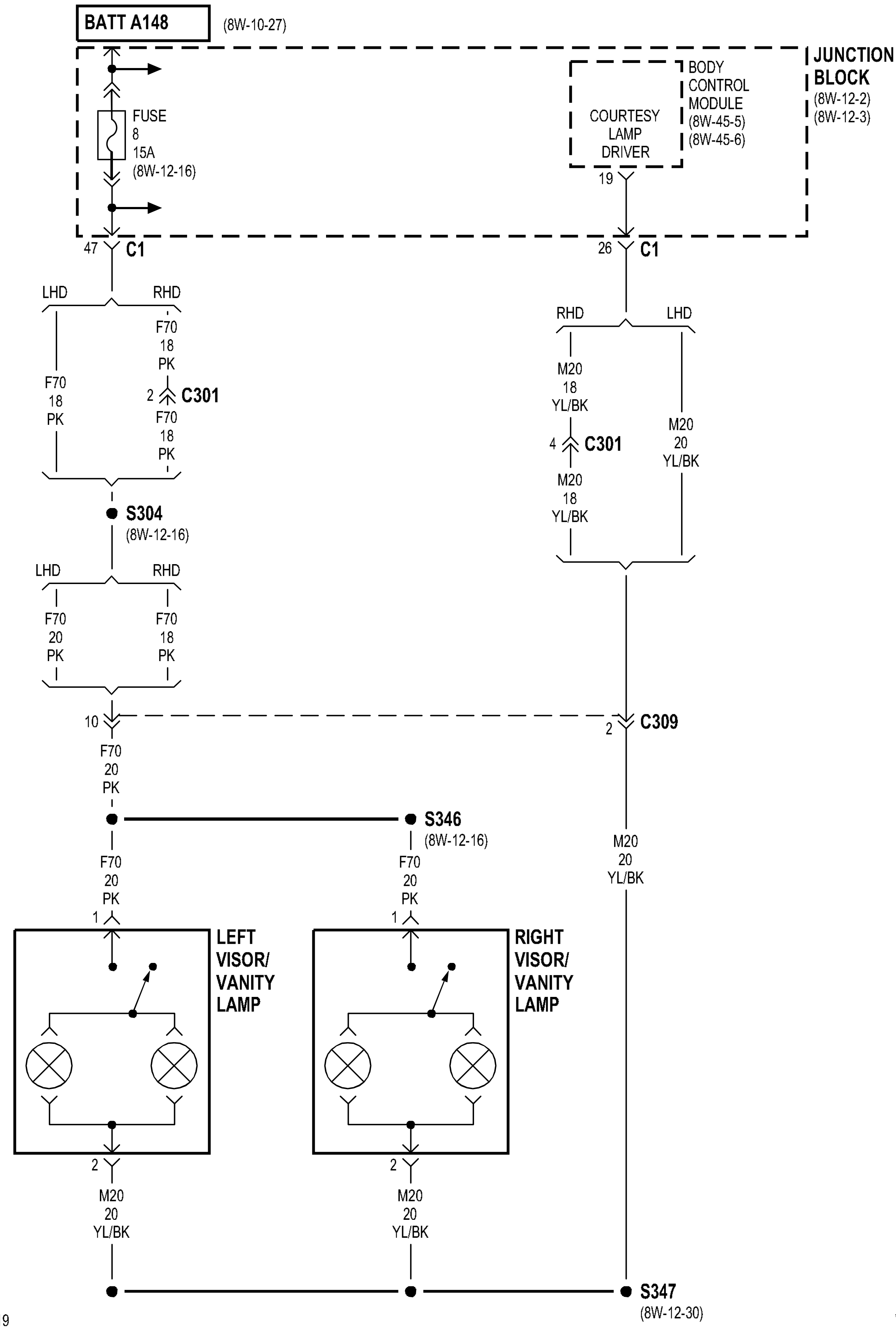
8W-43 AIRBAG SYSTEM

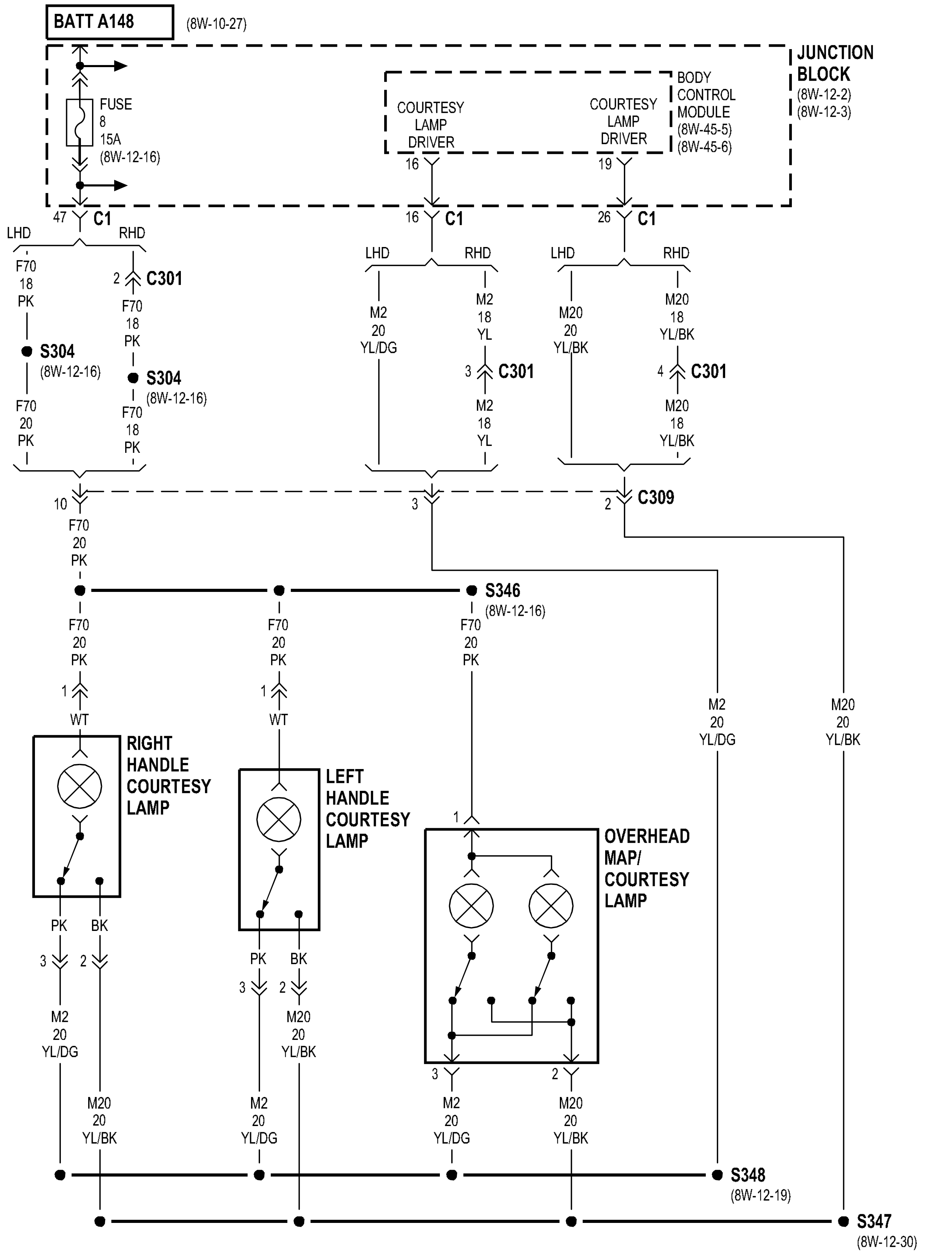

RUN A22
(8W-10-25)
ST-RUN A21
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 33 10A (8W-12-25)
FUSE 32 10A (8W-12-25)
11 C3
28 C3
F23 18 DB/YL
F14 18 LG/YL
15
14
AIRBAG CONTROL MODULE
FUSED IGNITION SWITCH OUTPUT (RUN)
FUSED IGNITION SWITCH OUTPUT (ST-RUN)
DRIVER AIRBAG LINE 2
DRIVER AIRBAG LINE 1
PASSENGER AIRBAG LINE 2
PASSENGER AIRBAG LINE 1
GROUND
5
6
8
7
4
R43 18 BK/LB
R45 18 DG/LB
R42 18 BK/YL
R44 18 DG/YL
Z2 18 BK/OR
TWISTED PAIR
TWISTED PAIR
1 C3
2 C3
■B ■■1
■A ■■2
CLOCKSPRING
PASSENGER AIRBAG LINE 2
PASSENGER AIRBAG LINE 1
PASSENGER AIRBAG
TWISTED PAIR
R43 18 YL
R45 18 YL
DRIVER AIRBAG LINE 2
DRIVER AIRBAG LINE 1
DRIVER AIRBAG
G201
(8W-15-15)
■ BUILT-UP-EXPORT
■■ EXCEPT BUILT-UP-EXPORT

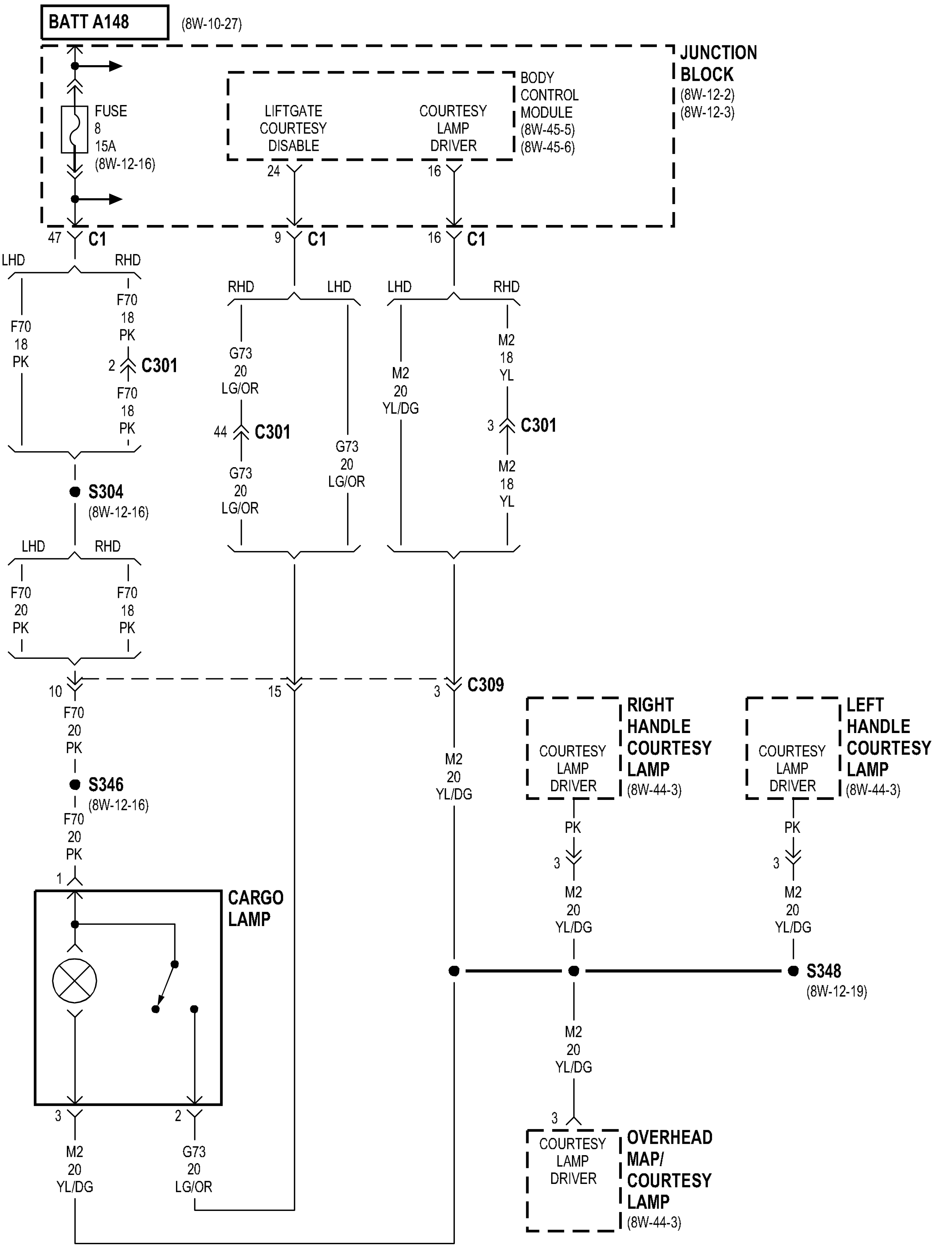

ST-RUN A21
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 22 10A
(8W-12-23)
50 C3
G5 20 DB/WT
OTHER
UNITED KINGDOM
S219
(8W-12-23)
G5 20 DB/WT
7
INSTRUMENT CLUSTER
(8W-40-4)
(8W-40-5)
AIRBAG WARNING INDICATOR
FUSED IGNITION SWITCH OUTPUT (ST-RUN)
PCI BUS
GROUND
10
11
D25 20 YL/VT/RD
6
DIAGNOSTIC JUNCTION PORT
(8W-30-27)
(8W-30-28)
(8W-30-31)
5
D25 18 YL/VT/OR
21
PCI BUS
AIRBAG CONTROL MODULE
Z2 20 BK/OR
S211
(8W-15-12)
Z2 18 BK/OR
G200
(8W-15-14)

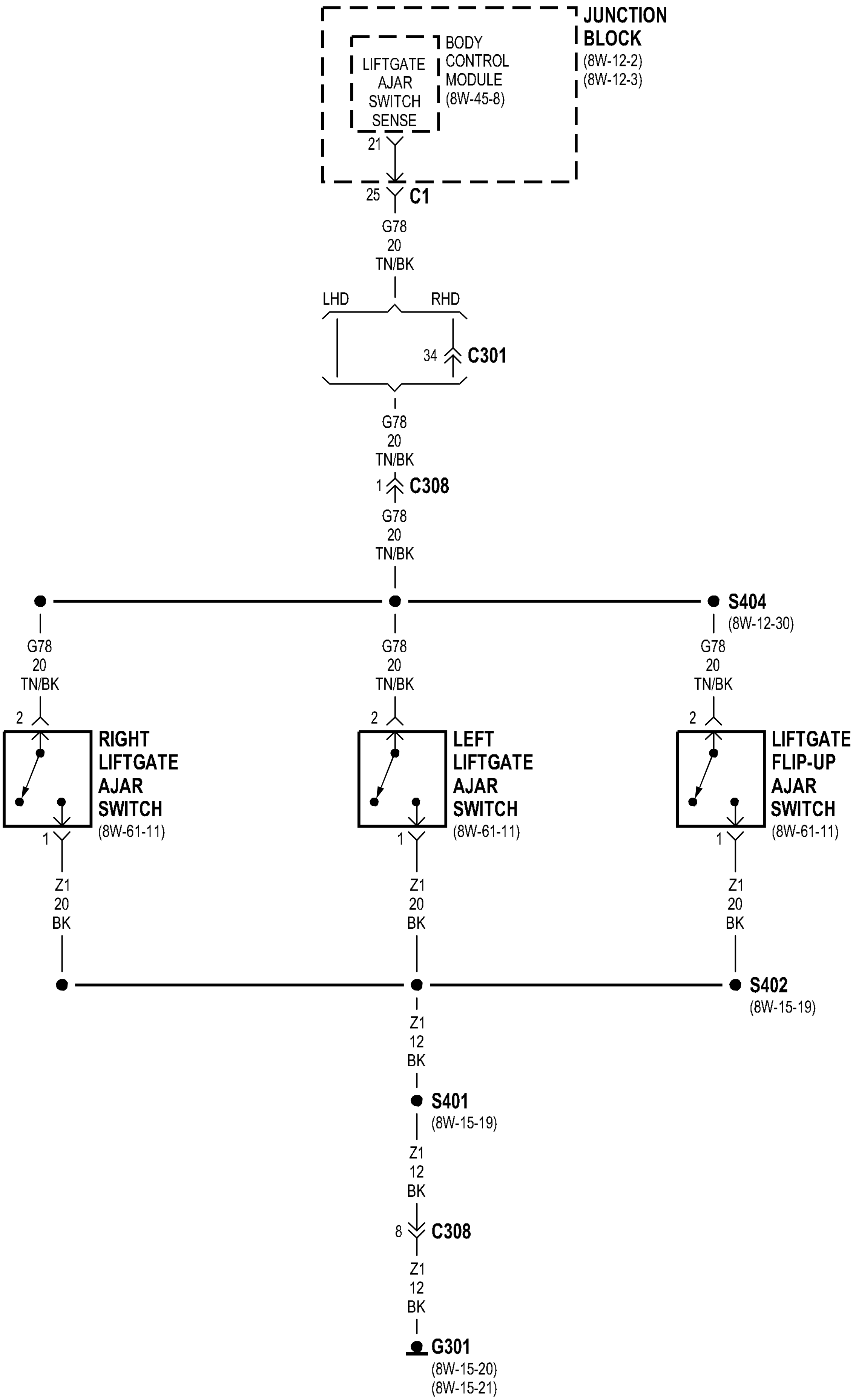
WG004303

8W-44 INTERIOR LIGHTING

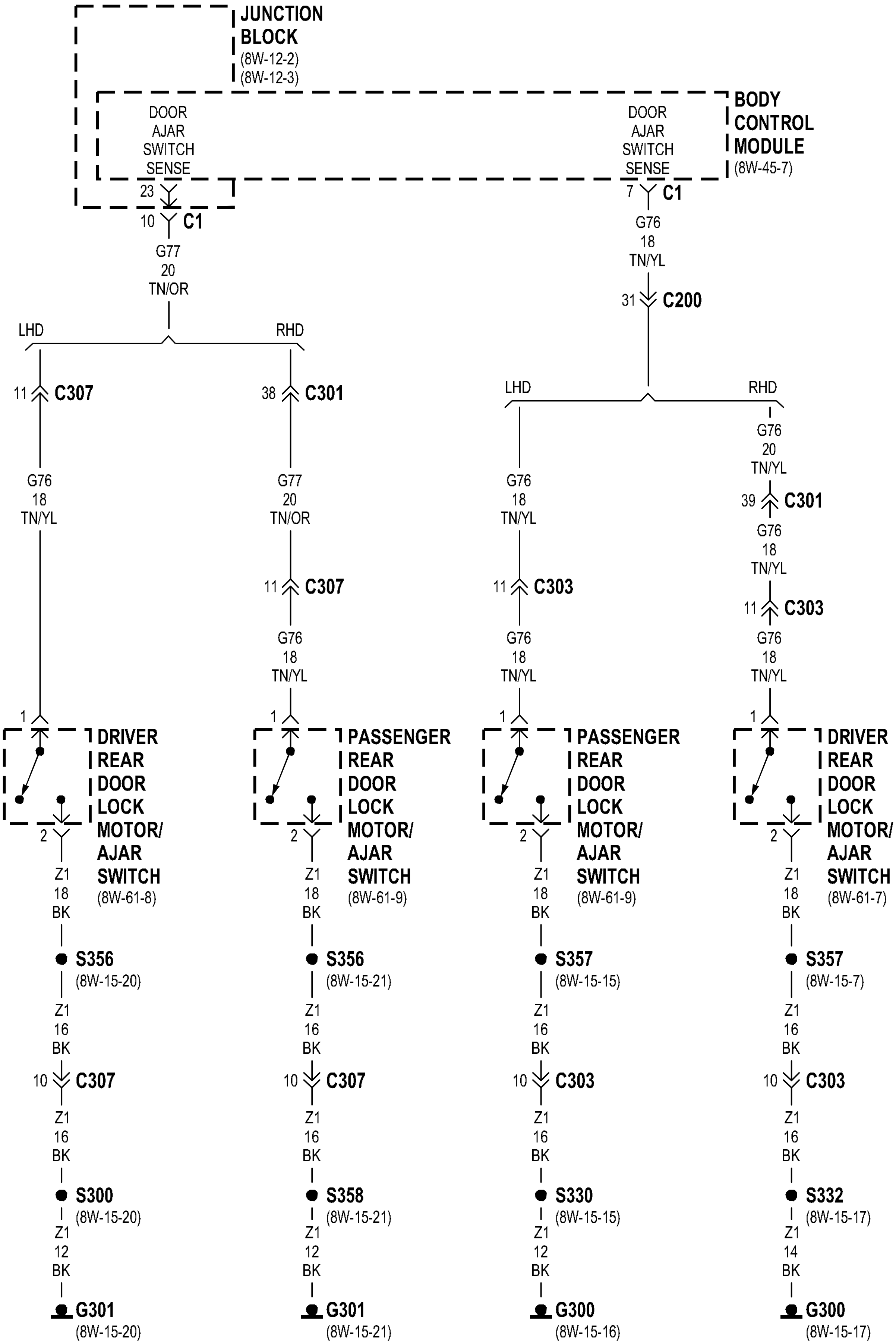

BATT A148
(8W-10-27)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
8
15A
(8W-12-16)
BODY CONTROL MODULE
(8W-45-5)
(8W-45-6)
COURTESY LAMP DRIVER
19
47
C1
26
C1
LHD
RHD
F70
18
PK
2
C301
RHD
LHD
M20
18
YL/BK
4
C301
M20
20
YL/BK
S304
(8W-12-16)
F70
20
PK
F70
18
PK
10
C309
2
S346
(8W-12-16)
1
LEFT VISOR/ VANITY LAMP
RIGHT VISOR/ VANITY LAMP
2
M20
20
YL/BK
S347
(8W-12-30)

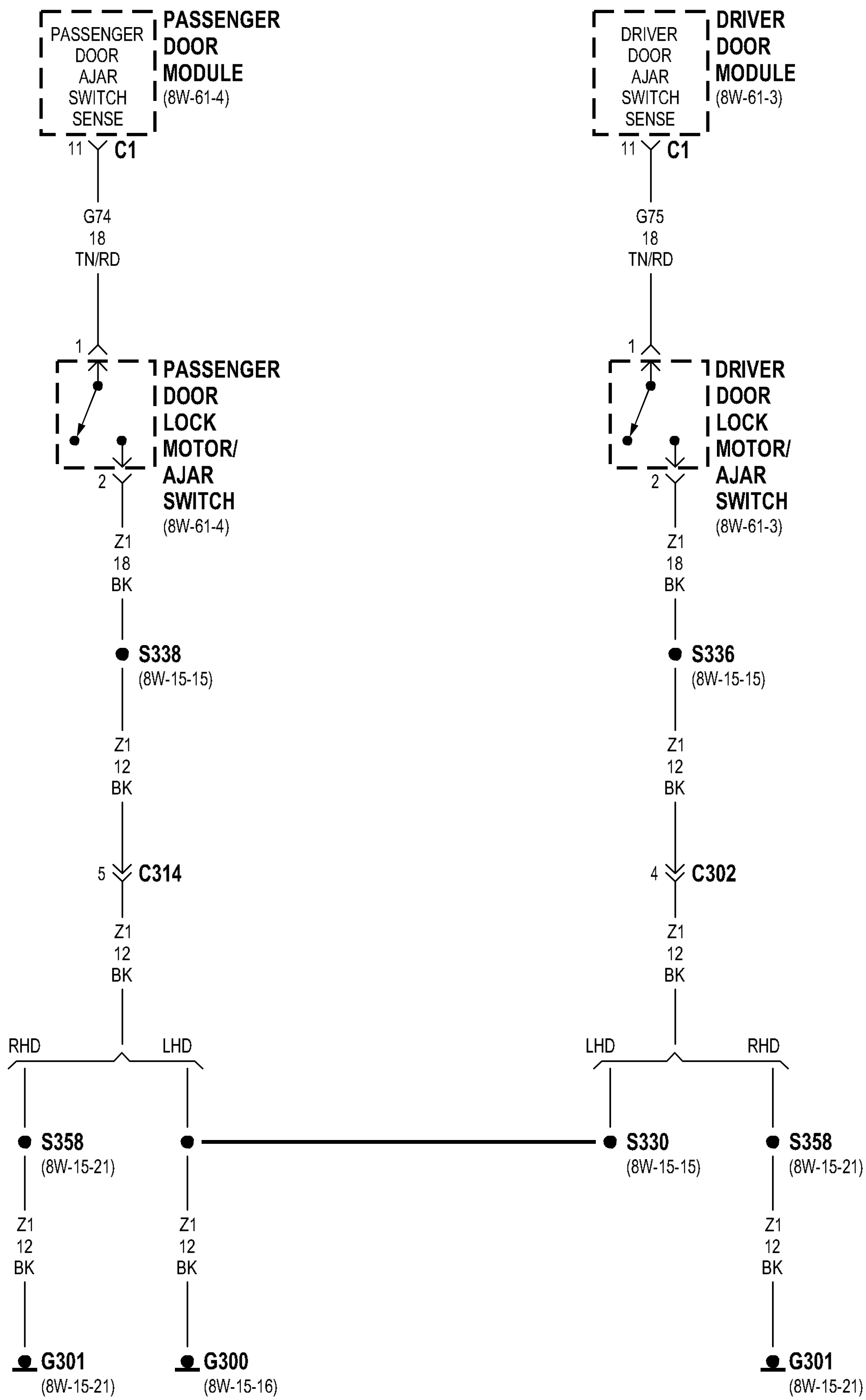

BATT A148
(8W-10-27)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
8
15A
(8W-12-16)
BODY CONTROL MODULE
(8W-45-5)
(8W-45-6)
COURTESY LAMP DRIVER
COURTESY LAMP DRIVER
16
19
47
C1
16
C1
26
C1
LHD
RHD
F70
18
PK
2
C301
S304
(8W-12-16)
F70
20
PK
S304
(8W-12-16)
F70
18
PK
M2
20
YL/DG
M2
18
YL
3
C301
M20
20
YL/BK
M20
18
YL/BK
4
C301
10
3
2
C309
F70
20
PK
S346
(8W-12-16)
1
WT
RIGHT HANDLE COURTESY LAMP
LEFT HANDLE COURTESY LAMP
OVERHEAD MAP/ COURTESY LAMP
PK
BK
3
2
M2
20
YL/DG
M20
20
YL/BK
S348
(8W-12-19)
S347
(8W-12-30)

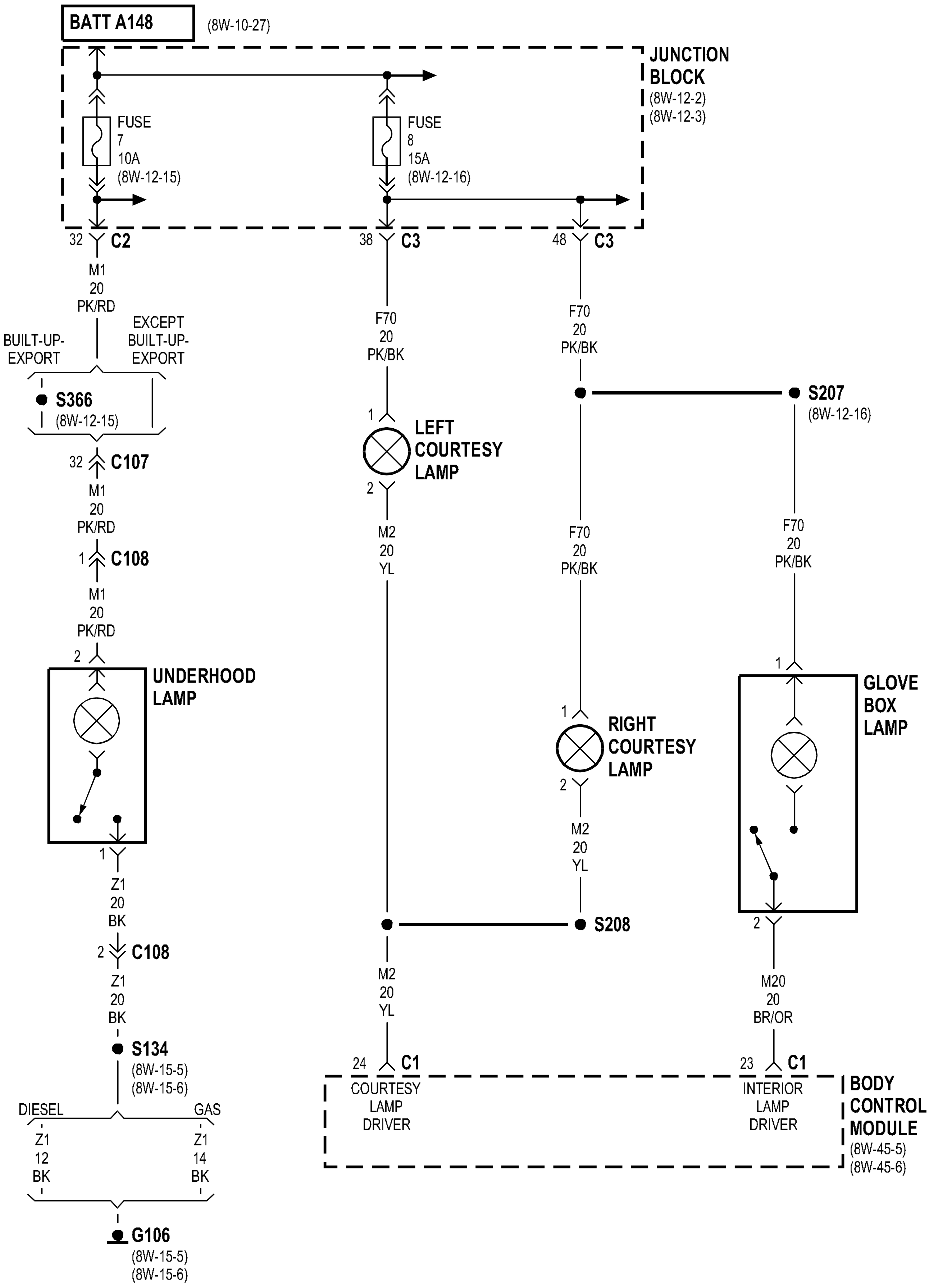

BATT A148
(8W-10-27)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
8
15A
(8W-12-16)
BODY CONTROL MODULE
(8W-45-5)
(8W-45-6)
LIFTGATE COURTESY DISABLE
COURTESY LAMP DRIVER
24
16
47 C1
9 C1
16 C1
LHD
RHD
F70
18
PK
2 C301
G73
20
LG/OR
44 C301
M2
20
YL/DG
M2
18
YL
3 C301
S304
(8W-12-16)
F70
20
PK
10
15
3 C309
S346
(8W-12-16)
1
CARGO LAMP
3
2
RIGHT HANDLE COURTESY LAMP
(8W-44-3)
LEFT HANDLE COURTESY LAMP
(8W-44-3)
S348
(8W-12-19)
OVERHEAD MAP/ COURTESY LAMP
(8W-44-3)



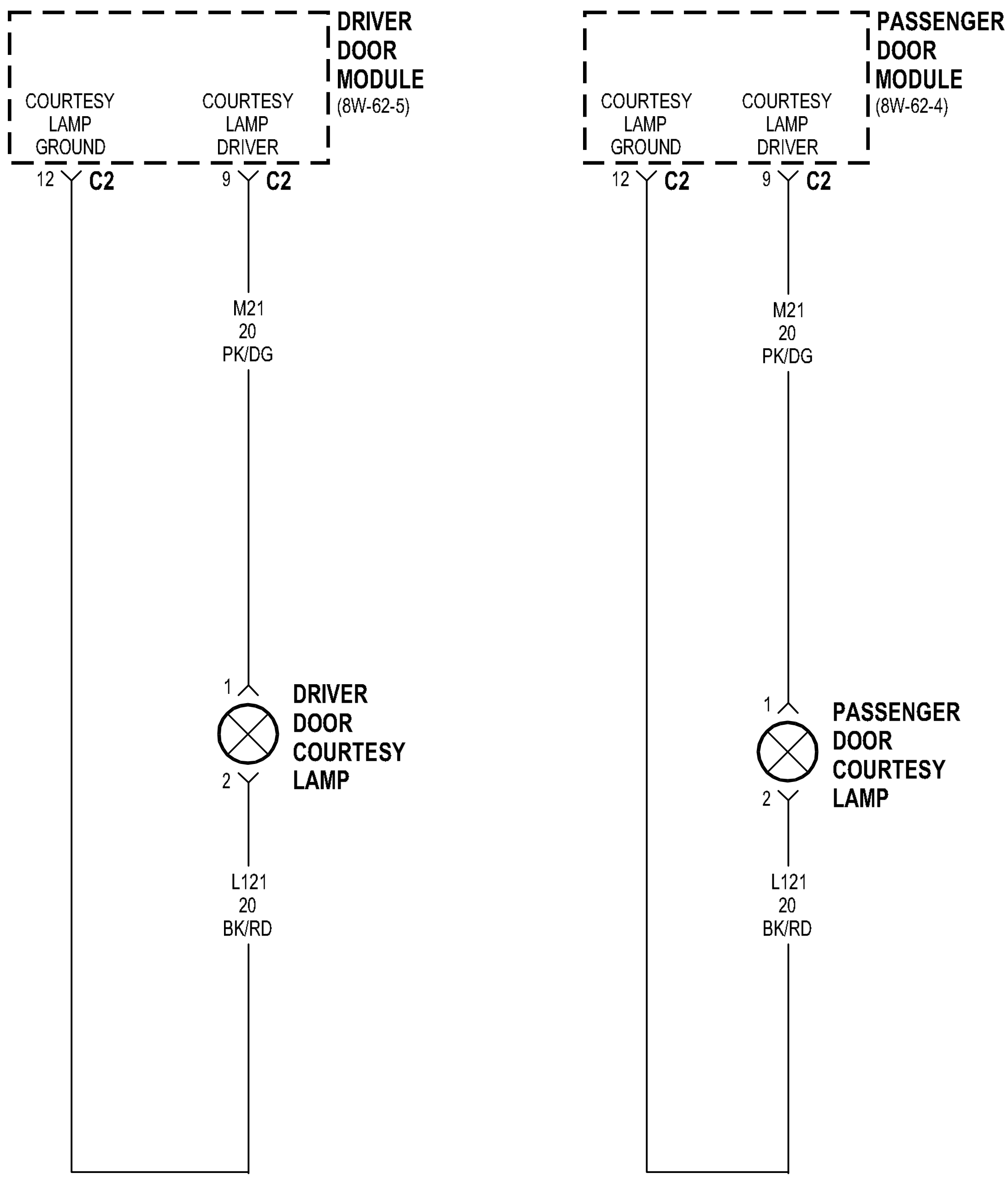
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
LIFTGATE AJAR SWITCH SENSE
BODY CONTROL MODULE
(8W-45-8)
21
25
C1
G78
20
TN/BK
LHD
RHD
34
C301
G78
20
TN/BK
1
C308
G78
20
TN/BK
S404
(8W-12-30)
G78
20
TN/BK
2
RIGHT LIFTGATE AJAR SWITCH
(8W-61-11)
LEFT LIFTGATE AJAR SWITCH
(8W-61-11)
LIFTGATE FLIP-UP AJAR SWITCH
(8W-61-11)
1
Z1
20
BK
S402
(8W-15-19)
Z1
12
BK
S401
(8W-15-19)
8
C308
G301
(8W-15-20)
(8W-15-21)

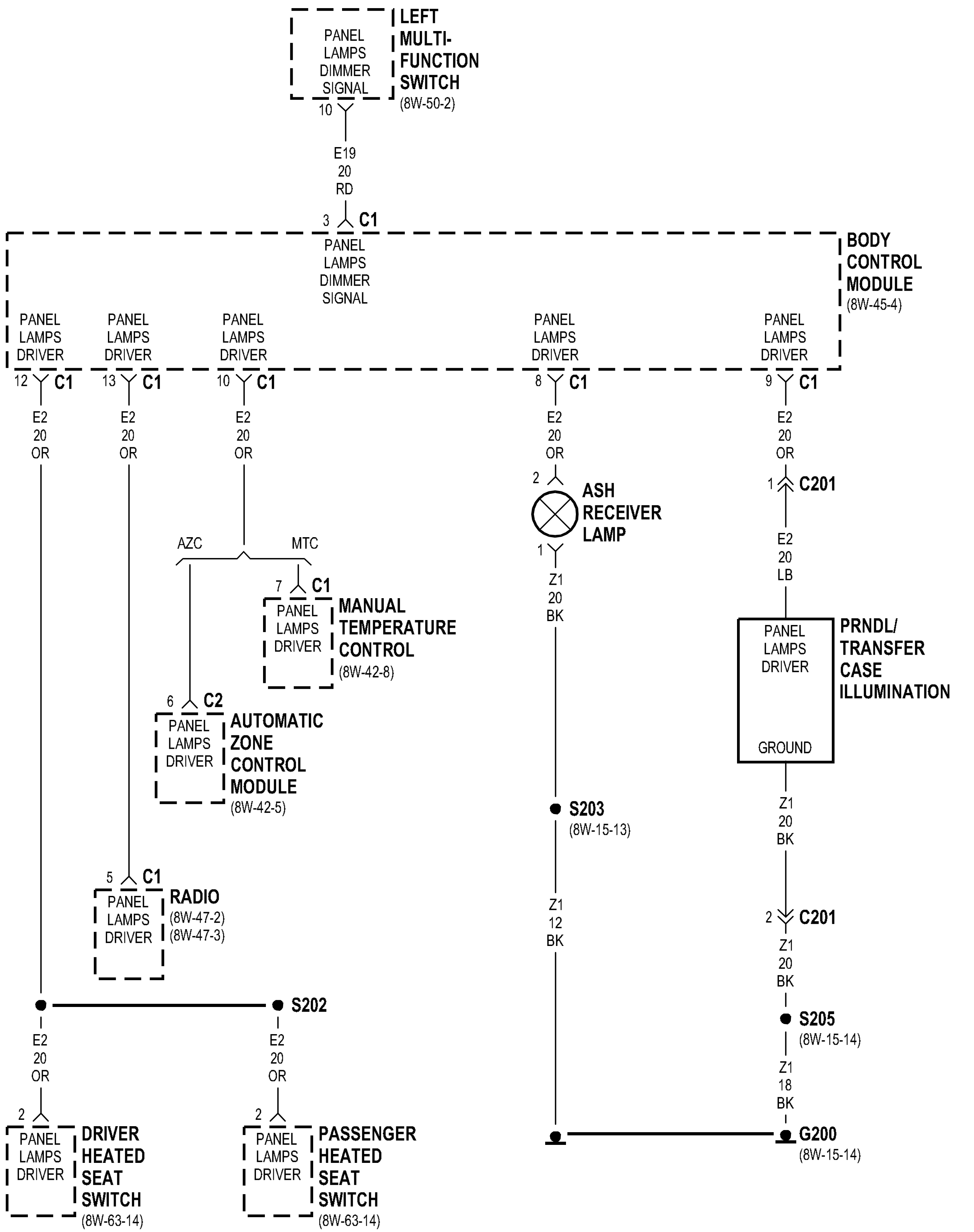

JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
BODY CONTROL MODULE
(8W-45-7)
DOOR AJAR SWITCH SENSE
23
10 C1
G77 20 TN/OR
DOOR AJAR SWITCH SENSE
7 C1
G76 18 TN/YL
31 C200
LHD
RHD
11 C307
G76 18 TN/YL
38 C301
G77 20 TN/OR
11 C307
G76 18 TN/YL
LHD
RHD
G76 18 TN/YL
11 C303
G76 18 TN/YL
G76 20 TN/YL
39 C301
G76 18 TN/YL
11 C303
G76 18 TN/YL
1
2
DRIVER REAR DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-8)
PASSENGER REAR DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-9)
PASSENGER REAR DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-9)
DRIVER REAR DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-7)
Z1 18 BK
S356
(8W-15-20)
S356
(8W-15-21)
S357
(8W-15-15)
S357
(8W-15-7)
Z1 16 BK
10 C307
10 C307
10 C303
10 C303
Z1 16 BK
S300
(8W-15-20)
S358
(8W-15-21)
S330
(8W-15-15)
S332
(8W-15-17)
Z1 12 BK
Z1 14 BK
G301
(8W-15-20)
G301
(8W-15-21)
G300
(8W-15-16)
G300
(8W-15-17)


PASSENGER DOOR AJAR SWITCH SENSE
PASSENGER DOOR MODULE
(8W-61-4)
11
C1
G74
18
TN/RD
1
PASSENGER DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-4)
2
Z1
18
BK
S338
(8W-15-15)
Z1
12
BK
5
C314
Z1
12
BK
RHD
LHD
S358
(8W-15-21)
Z1
12
BK
G301
(8W-15-21)
Z1
12
BK
G300
(8W-15-16)
DRIVER DOOR AJAR SWITCH SENSE
DRIVER DOOR MODULE
(8W-61-3)
11
C1
G75
18
TN/RD
1
DRIVER DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-3)
2
Z1
18
BK
S336
(8W-15-15)
Z1
12
BK
4
C302
Z1
12
BK
LHD
RHD
S330
(8W-15-15)
S358
(8W-15-21)
Z1
12
BK
G301
(8W-15-21)



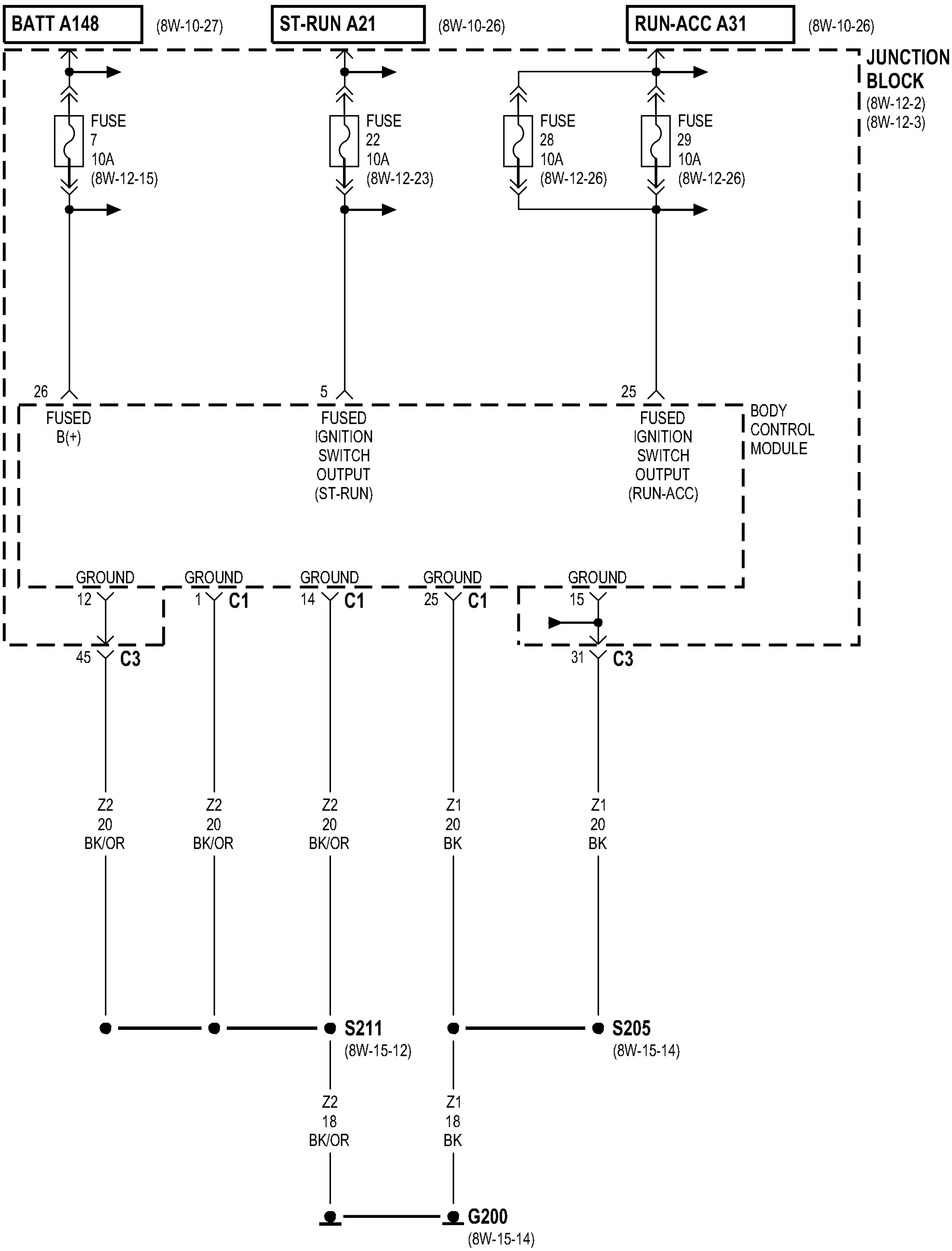
BATT A148
(8W-10-27)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 7 10A (8W-12-15)
FUSE 8 15A (8W-12-16)
32 C2
38 C3
48 C3
M1 20 PK/RD
BUILT-UP-EXPORT
EXCEPT BUILT-UP-EXPORT
S366
(8W-12-15)
32 C107
M1 20 PK/RD
1 C108
M1 20 PK/RD
2
UNDERHOOD LAMP
1
Z1 20 BK
2 C108
Z1 20 BK
S134
(8W-15-5)
(8W-15-6)
DIESEL
GAS
Z1 12 BK
Z1 14 BK
G106
(8W-15-5)
(8W-15-6)
F70 20 PK/BK
1
LEFT COURTESY LAMP
2
M2 20 YL
F70 20 PK/BK
S207
(8W-12-16)
F70 20 PK/BK
F70 20 PK/BK
1
RIGHT COURTESY LAMP
2
M2 20 YL
S208
1
GLOVE BOX LAMP
2
M2 20 YL
M20 20 BR/OR
24 C1
23 C1
COURTESY LAMP DRIVER
INTERIOR LAMP DRIVER
BODY CONTROL MODULE
(8W-45-5)
(8W-45-6)

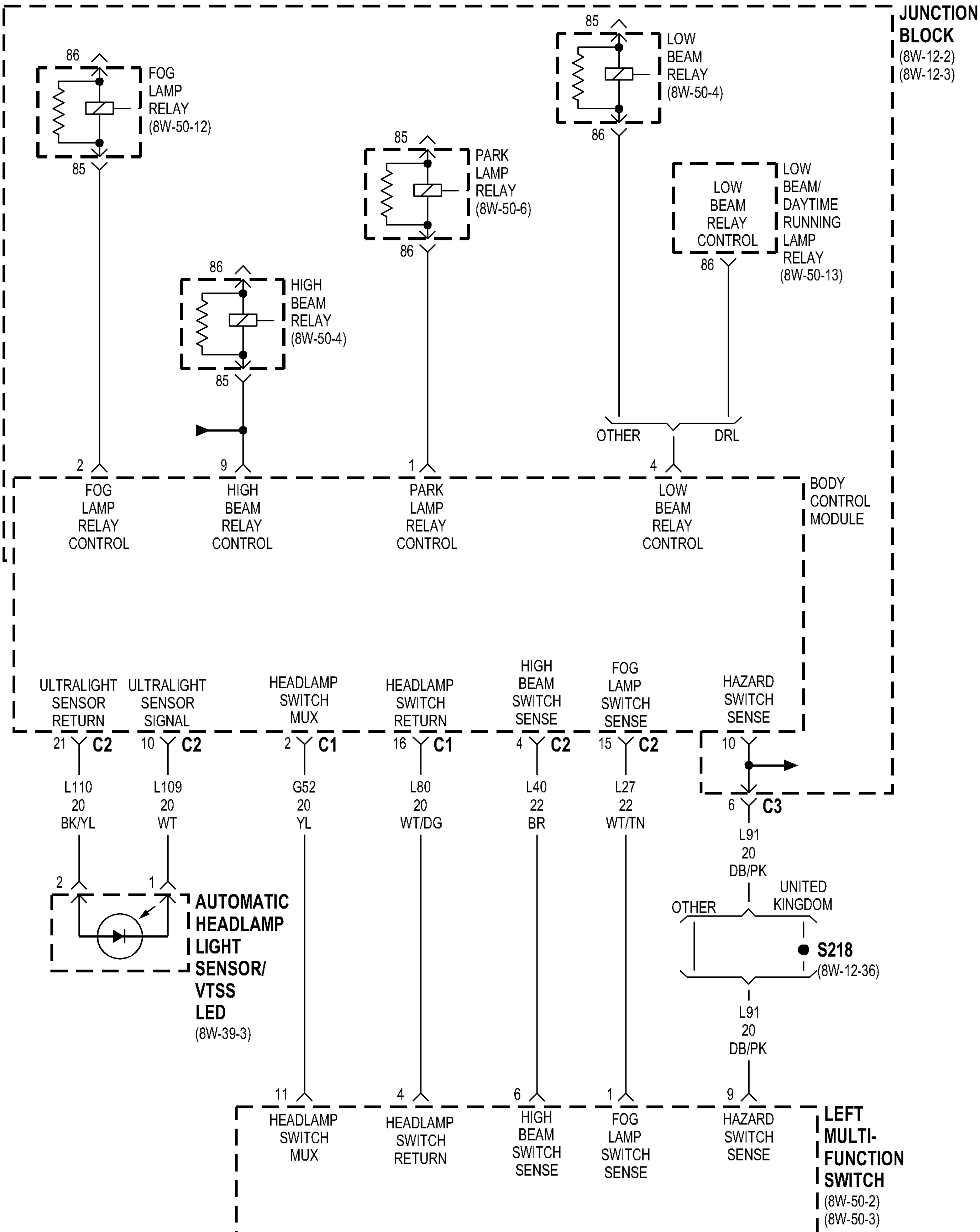

DRIVER
DOOR
MODULE
(8W-62-5)
COURTESY
LAMP
GROUND
COURTESY
LAMP
DRIVER
12
C2
9
C2
M21
20
PK/DG
1
DRIVER
DOOR
COURTESY
LAMP
2
L121
20
BK/RD
PASSENGER
DOOR
MODULE
(8W-62-4)
COURTESY
LAMP
GROUND
COURTESY
LAMP
DRIVER
12
C2
9
C2
M21
20
PK/DG
1
PASSENGER
DOOR
COURTESY
LAMP
2
L121
20
BK/RD



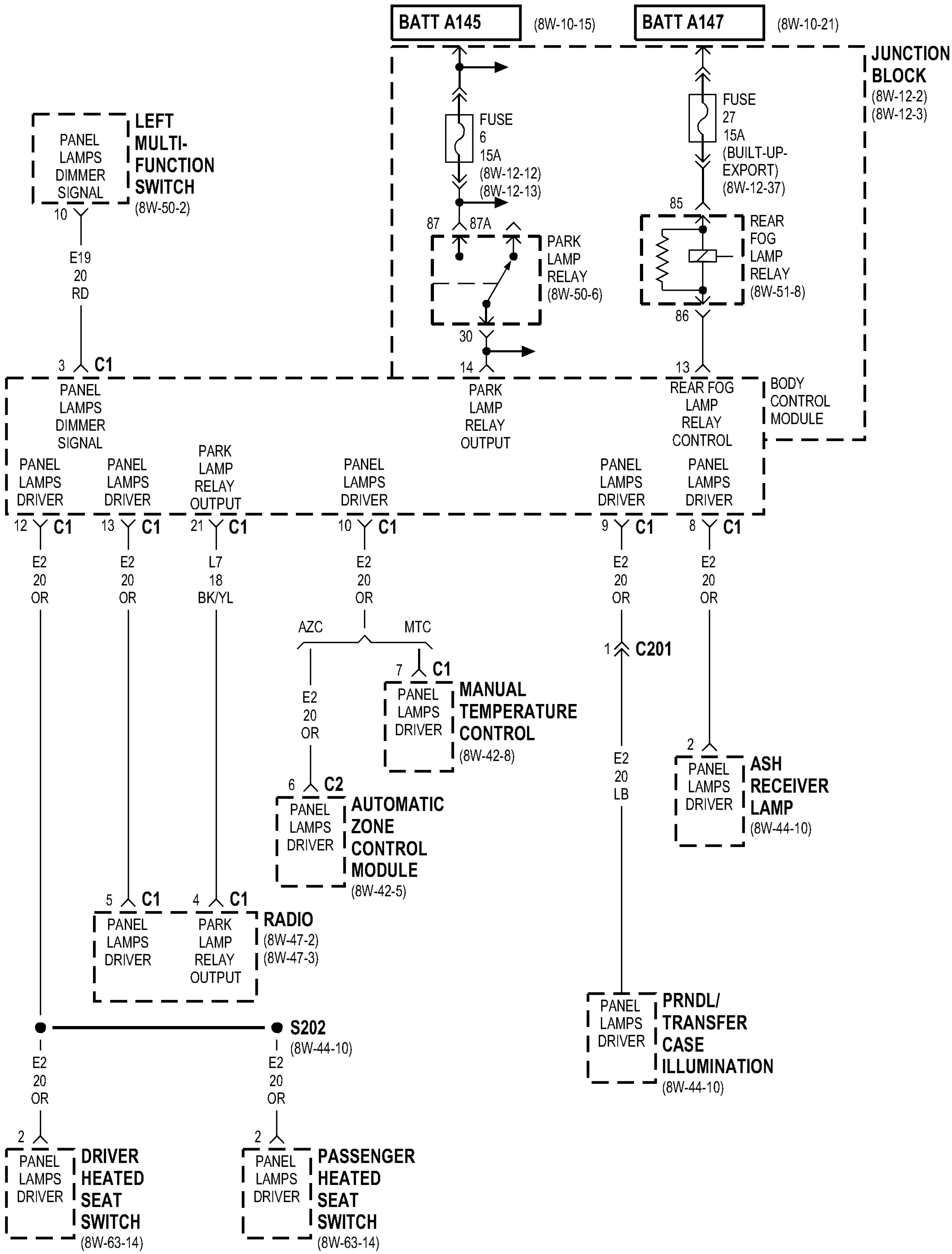
LEFT MULTI-FUNCTION SWITCH
(8W-50-2)
PANEL LAMPS DIMMER SIGNAL
10
E19
20
RD
3 C1
PANEL LAMPS DIMMER SIGNAL
BODY CONTROL MODULE
(8W-45-4)
PANEL LAMPS DRIVER
12 C1
13 C1
10 C1
8 C1
9 C1
E2
20
OR
AZC
MTC
7 C1
MANUAL TEMPERATURE CONTROL
(8W-42-8)
6 C2
AUTOMATIC ZONE CONTROL MODULE
(8W-42-5)
5 C1
RADIO
(8W-47-2)
(8W-47-3)
S202
2
DRIVER HEATED SEAT SWITCH
(8W-63-14)
PASSENGER HEATED SEAT SWITCH
(8W-63-14)
ASH RECEIVER LAMP
1
Z1
20
BK
S203
(8W-15-13)
Z1
12
BK
1 C201
E2
20
LB
PRNDL/ TRANSFER CASE ILLUMINATION
GROUND
2 C201
S205
(8W-15-14)
Z1
18
BK
G200
(8W-15-14)

8W-45 BODY CONTROL MODULE

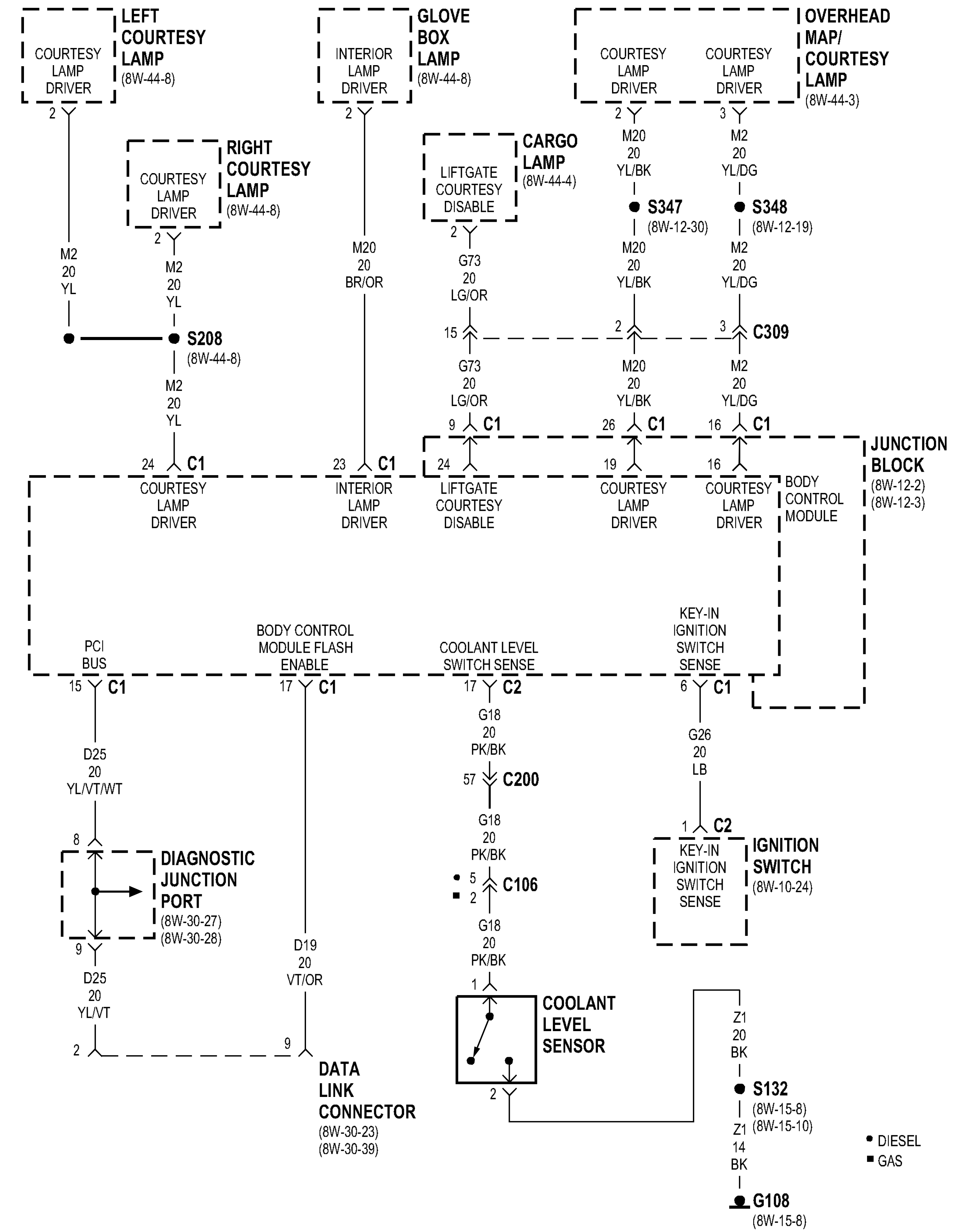

BATT A148
(8W-10-27)
ST-RUN A21
(8W-10-26)
RUN-ACC A31
(8W-10-26)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
7
10A
(8W-12-15)
FUSE
22
10A
(8W-12-23)
FUSE
28
10A
(8W-12-26)
FUSE
29
10A
(8W-12-26)
26
FUSED
B(+)
5
FUSED
IGNITION
SWITCH
OUTPUT
(ST-RUN)
25
FUSED
IGNITION
SWITCH
OUTPUT
(RUN-ACC)
BODY
CONTROL
MODULE
GROUND
12
45
C3
GROUND
1
C1
GROUND
14
C1
GROUND
25
C1
GROUND
15
31
C3
Z2
20
BK/OR
Z2
20
BK/OR
Z2
20
BK/OR
Z1
20
BK
Z1
20
BK
S211
(8W-15-12)
S205
(8W-15-14)
Z2
18
BK/OR
Z1
18
BK
G200
(8W-15-14)



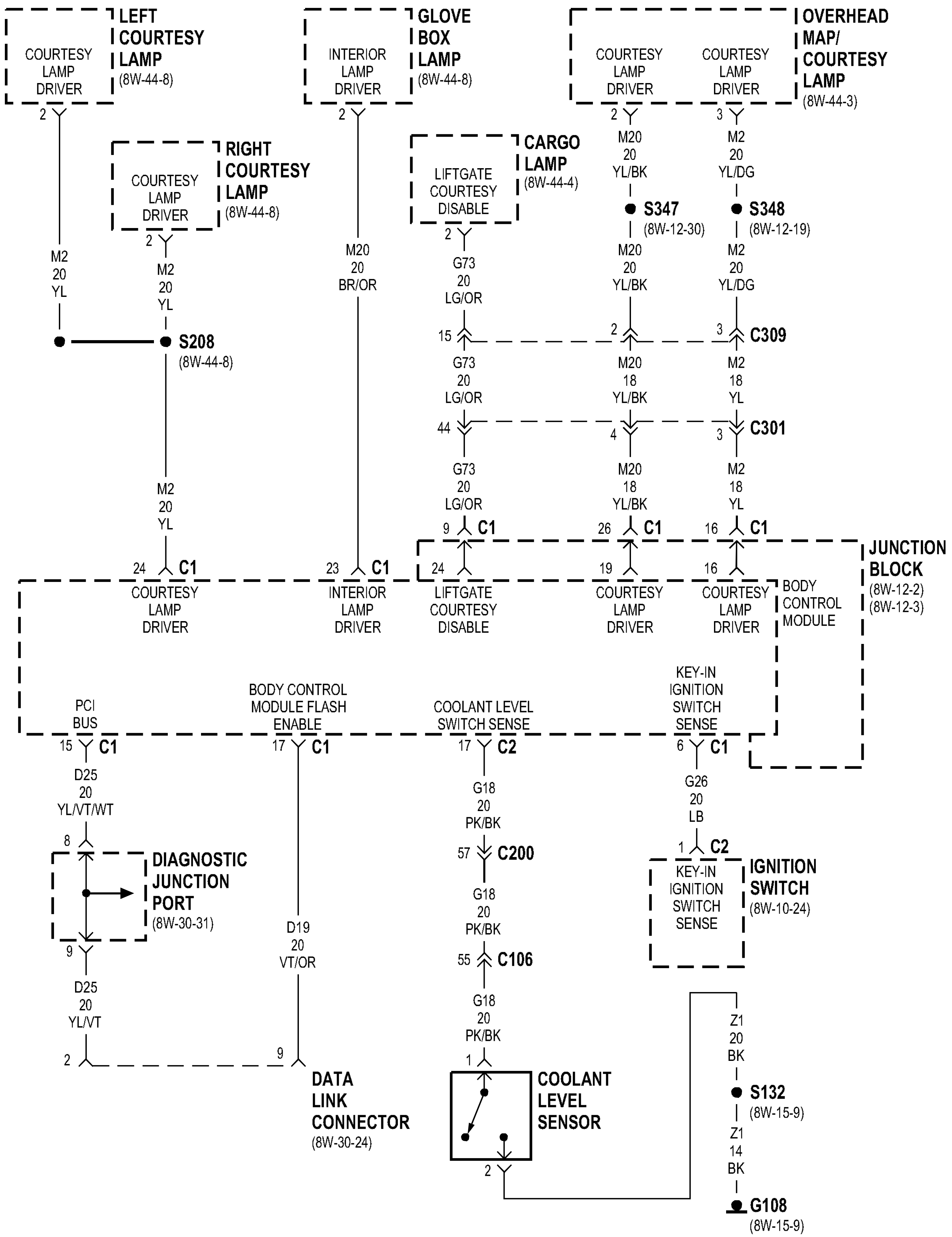
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
86
FOG LAMP RELAY
(8W-50-12)
85
86
HIGH BEAM RELAY
(8W-50-4)
85
85
PARK LAMP RELAY
(8W-50-6)
86
85
LOW BEAM RELAY
(8W-50-4)
86
LOW BEAM RELAY CONTROL
LOW BEAM/ DAYTIME RUNNING LAMP RELAY
(8W-50-13)
86
OTHER
DRL
2
FOG LAMP RELAY CONTROL
9
HIGH BEAM RELAY CONTROL
1
PARK LAMP RELAY CONTROL
4
LOW BEAM RELAY CONTROL
BODY CONTROL MODULE
ULTRALIGHT SENSOR RETURN
ULTRALIGHT SENSOR SIGNAL
HEADLAMP SWITCH MUX
HEADLAMP SWITCH RETURN
HIGH BEAM SWITCH SENSE
FOG LAMP SWITCH SENSE
HAZARD SWITCH SENSE
21 C2
10 C2
2 C1
16 C1
4 C2
15 C2
10
6 C3
L110 20 BK/YL
L109 20 WT
G52 20 YL
L80 20 WT/DG
L40 22 BR
L27 22 WT/TN
L91 20 DB/PK
2
1
AUTOMATIC HEADLAMP LIGHT SENSOR/ VTSS LED
(8W-39-3)
OTHER
UNITED KINGDOM
S218
(8W-12-36)
L91 20 DB/PK
11
4
6
1
9
HEADLAMP SWITCH MUX
HEADLAMP SWITCH RETURN
HIGH BEAM SWITCH SENSE
FOG LAMP SWITCH SENSE
HAZARD SWITCH SENSE
LEFT MULTI-FUNCTION SWITCH
(8W-50-2)
(8W-50-3)

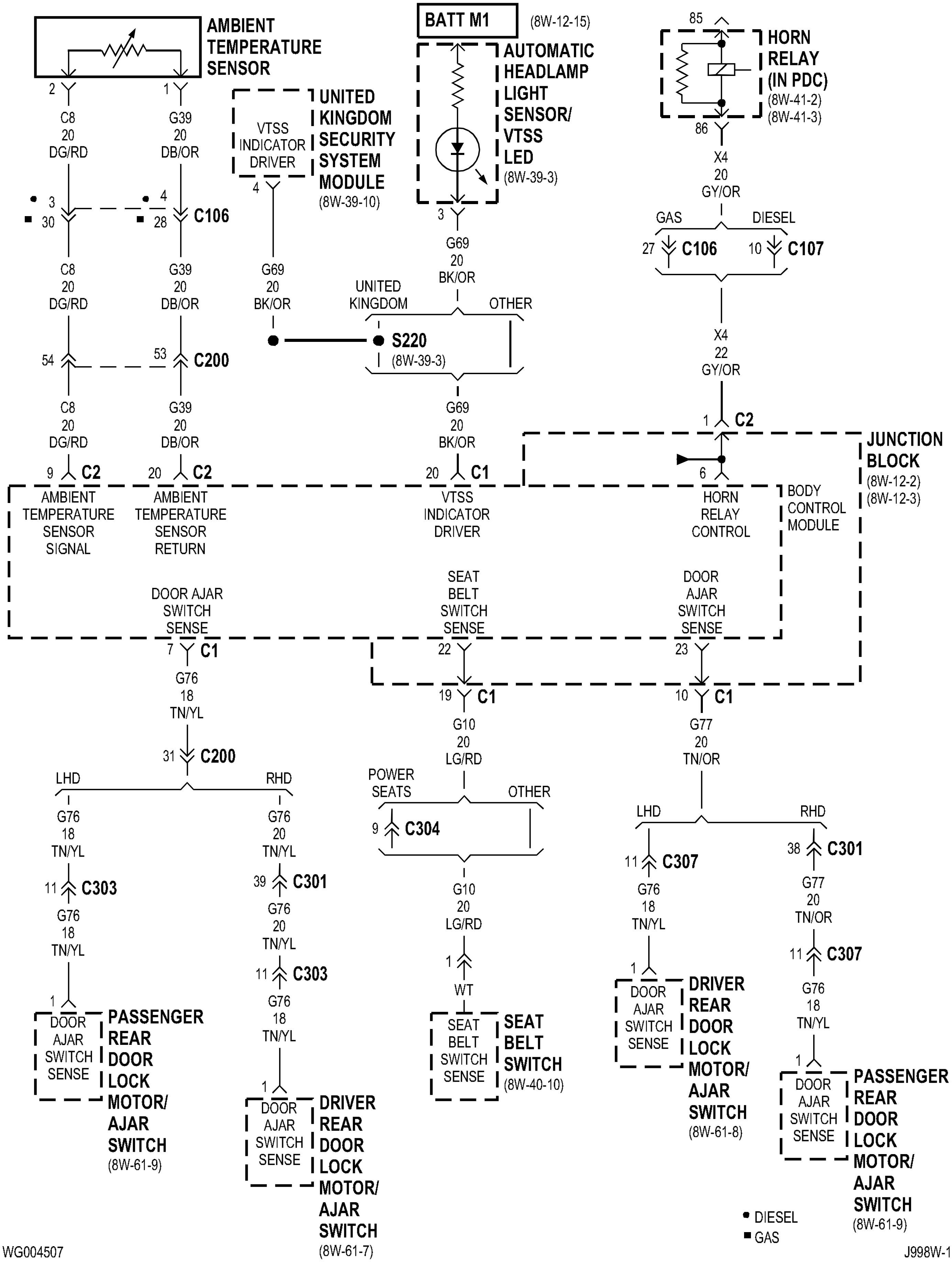

BATT A145
(8W-10-15)
BATT A147
(8W-10-21)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 6 15A
(8W-12-12)
(8W-12-13)
FUSE 27 15A (BUILT-UP-EXPORT)
(8W-12-37)
87
87A
PARK LAMP RELAY
(8W-50-6)
30
85
REAR FOG LAMP RELAY
(8W-51-8)
86
14
13
PANEL LAMPS DIMMER SIGNAL
LEFT MULTI-FUNCTION SWITCH
(8W-50-2)
10
E19 20 RD
3 C1
PANEL LAMPS DIMMER SIGNAL
PARK LAMP RELAY OUTPUT
REAR FOG LAMP RELAY CONTROL
BODY CONTROL MODULE
PANEL LAMPS DRIVER
PANEL LAMPS DRIVER
PARK LAMP RELAY OUTPUT
PANEL LAMPS DRIVER
PANEL LAMPS DRIVER
PANEL LAMPS DRIVER
12 C1
13 C1
21 C1
10 C1
9 C1
8 C1
E2 20 OR
E2 20 OR
L7 18 BK/YL
E2 20 OR
E2 20 OR
E2 20 OR
AZC
MTC
7 C1
PANEL LAMPS DRIVER
MANUAL TEMPERATURE CONTROL
(8W-42-8)
E2 20 OR
6 C2
PANEL LAMPS DRIVER
AUTOMATIC ZONE CONTROL MODULE
(8W-42-5)
1 C201
E2 20 LB
2
PANEL LAMPS DRIVER
ASH RECEIVER LAMP
(8W-44-10)
5 C1
4 C1
PANEL LAMPS DRIVER
PARK LAMP RELAY OUTPUT
RADIO
(8W-47-2)
(8W-47-3)
PANEL LAMPS DRIVER
PRNDL/ TRANSFER CASE ILLUMINATION
(8W-44-10)
S202
(8W-44-10)
E2 20 OR
E2 20 OR
2
PANEL LAMPS DRIVER
DRIVER HEATED SEAT SWITCH
(8W-63-14)
2
PANEL LAMPS DRIVER
PASSENGER HEATED SEAT SWITCH
(8W-63-14)

LHD


LEFT COURTESY LAMP (8W-44-8)
COURTESY LAMP DRIVER
GLOVE BOX LAMP (8W-44-8)
INTERIOR LAMP DRIVER
OVERHEAD MAP/ COURTESY LAMP (8W-44-3)
COURTESY LAMP DRIVER
COURTESY LAMP DRIVER
RIGHT COURTESY LAMP (8W-44-8)
COURTESY LAMP DRIVER
CARGO LAMP (8W-44-4)
LIFTGATE COURTESY DISABLE
M2 20 YL
M20 20 BR/OR
G73 20 LG/OR
M20 20 YL/BK
M2 20 YL/DG
S347 (8W-12-30)
S348 (8W-12-19)
S208 (8W-44-8)
C309
C1
C2
JUNCTION BLOCK (8W-12-2) (8W-12-3)
BODY CONTROL MODULE
COURTESY LAMP DRIVER
INTERIOR LAMP DRIVER
LIFTGATE COURTESY DISABLE
PCI BUS
BODY CONTROL MODULE FLASH ENABLE
COOLANT LEVEL SWITCH SENSE
KEY-IN IGNITION SWITCH SENSE
D25 20 YL/VT/WT
G18 20 PK/BK
G26 20 LB
C200
C106
DIAGNOSTIC JUNCTION PORT (8W-30-27) (8W-30-28)
IGNITION SWITCH (8W-10-24)
D25 20 YL/VT
D19 20 VT/OR
COOLANT LEVEL SENSOR
Z1 20 BK
S132 (8W-15-8) (8W-15-10)
Z1 14 BK
G108 (8W-15-8)
DATA LINK CONNECTOR (8W-30-23) (8W-30-39)
● DIESEL
■ GAS

RHD


LEFT COURTESY LAMP
(8W-44-8)
COURTESY LAMP DRIVER
GLOVE BOX LAMP
(8W-44-8)
INTERIOR LAMP DRIVER
OVERHEAD MAP/ COURTESY LAMP
(8W-44-3)
COURTESY LAMP DRIVER
RIGHT COURTESY LAMP
(8W-44-8)
CARGO LAMP
(8W-44-4)
LIFTGATE COURTESY DISABLE
M2 20 YL
M20 20 BR/OR
M20 20 YL/BK
M2 20 YL/DG
S347
(8W-12-30)
S348
(8W-12-19)
G73 20 LG/OR
S208
(8W-44-8)
C309
M20 18 YL/BK
M2 18 YL
C301
C1
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
BODY CONTROL MODULE
COURTESY LAMP DRIVER
INTERIOR LAMP DRIVER
LIFTGATE COURTESY DISABLE
PCI BUS
BODY CONTROL MODULE FLASH ENABLE
COOLANT LEVEL SWITCH SENSE
KEY-IN IGNITION SWITCH SENSE
C2
D25 20 YL/VT/WT
G18 20 PK/BK
G26 20 LB
C200
DIAGNOSTIC JUNCTION PORT
(8W-30-31)
IGNITION SWITCH
(8W-10-24)
D19 20 VT/OR
C106
D25 20 YL/VT
Z1 20 BK
DATA LINK CONNECTOR
(8W-30-24)
COOLANT LEVEL SENSOR
S132
(8W-15-9)
Z1 14 BK
G108
(8W-15-9)



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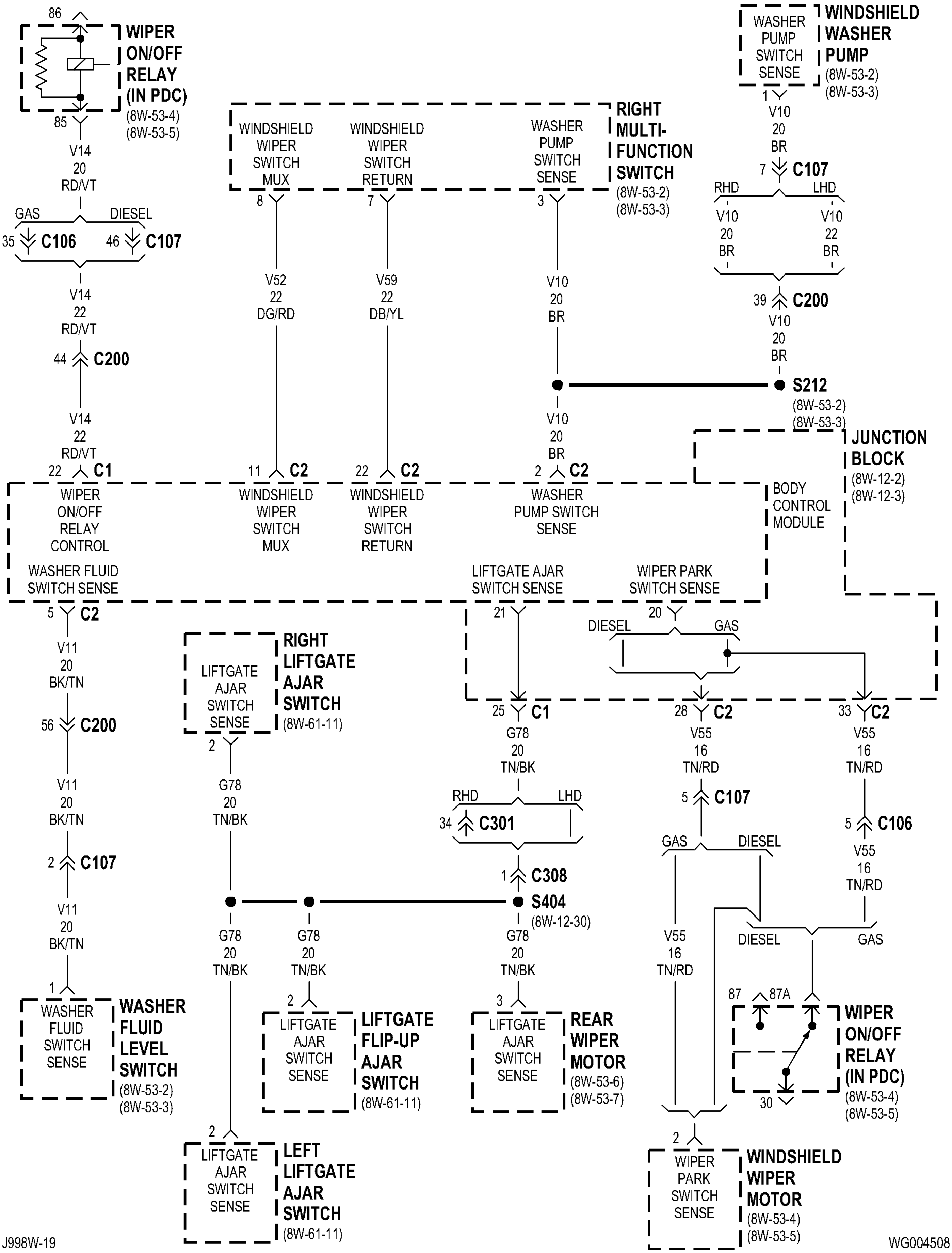
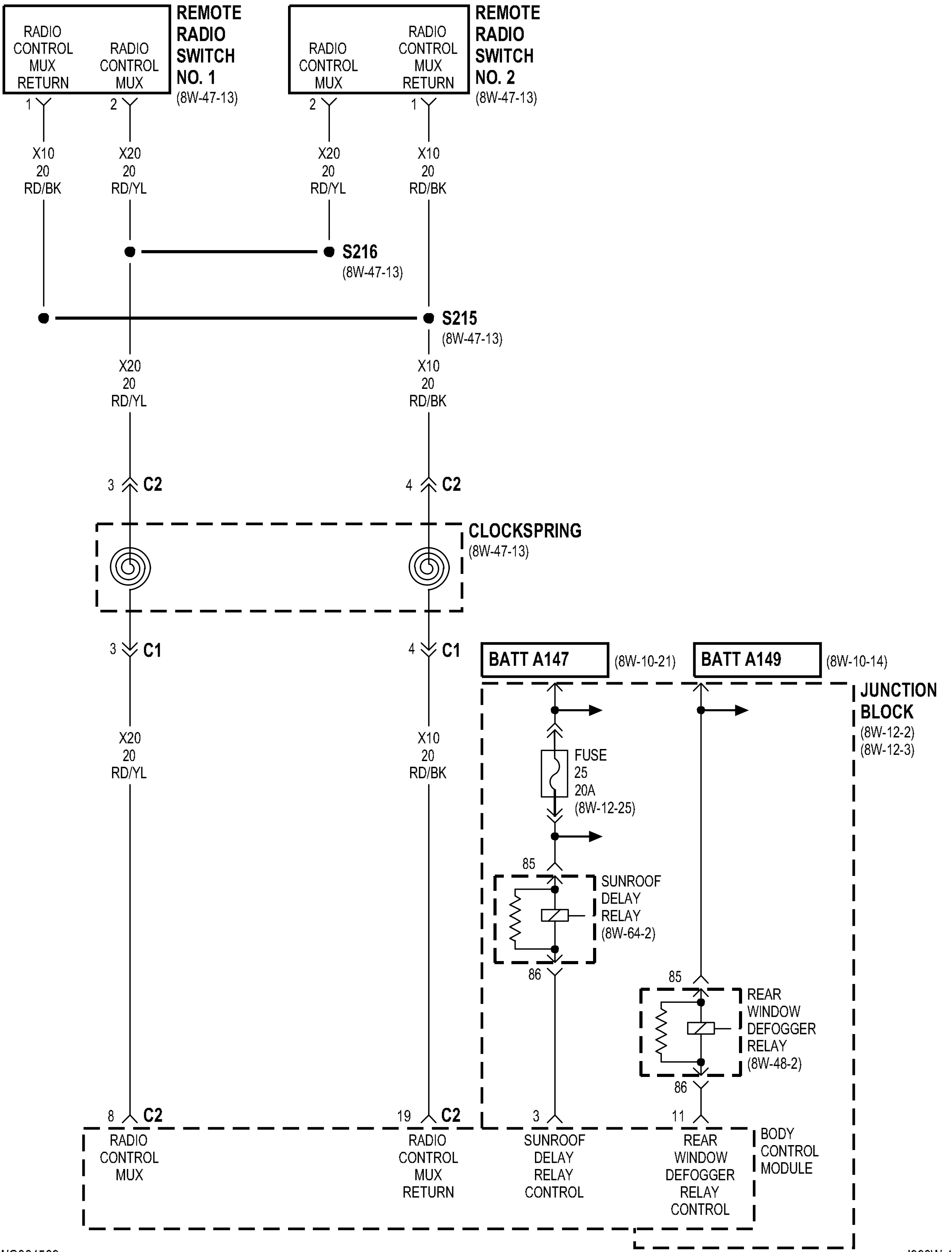
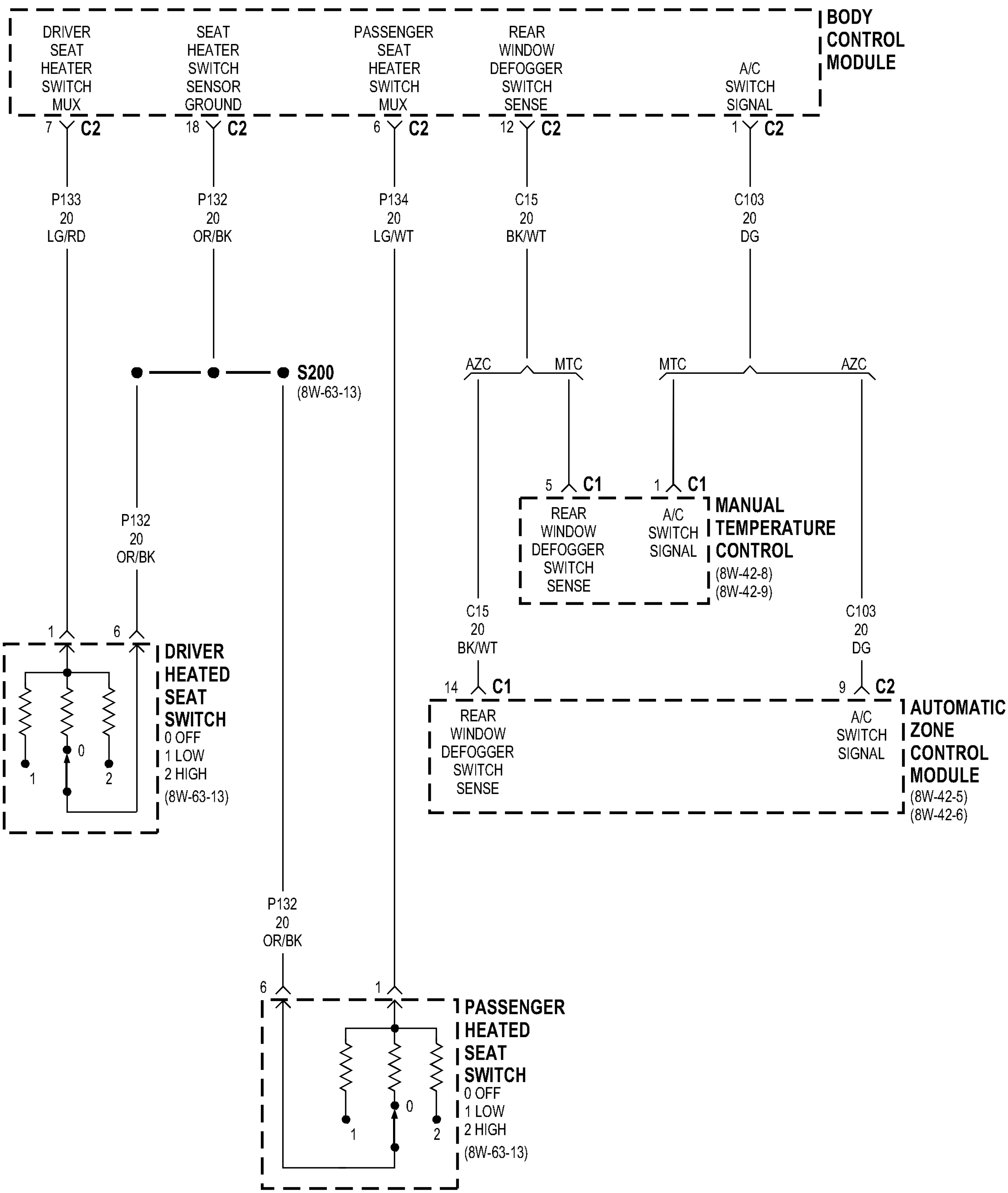
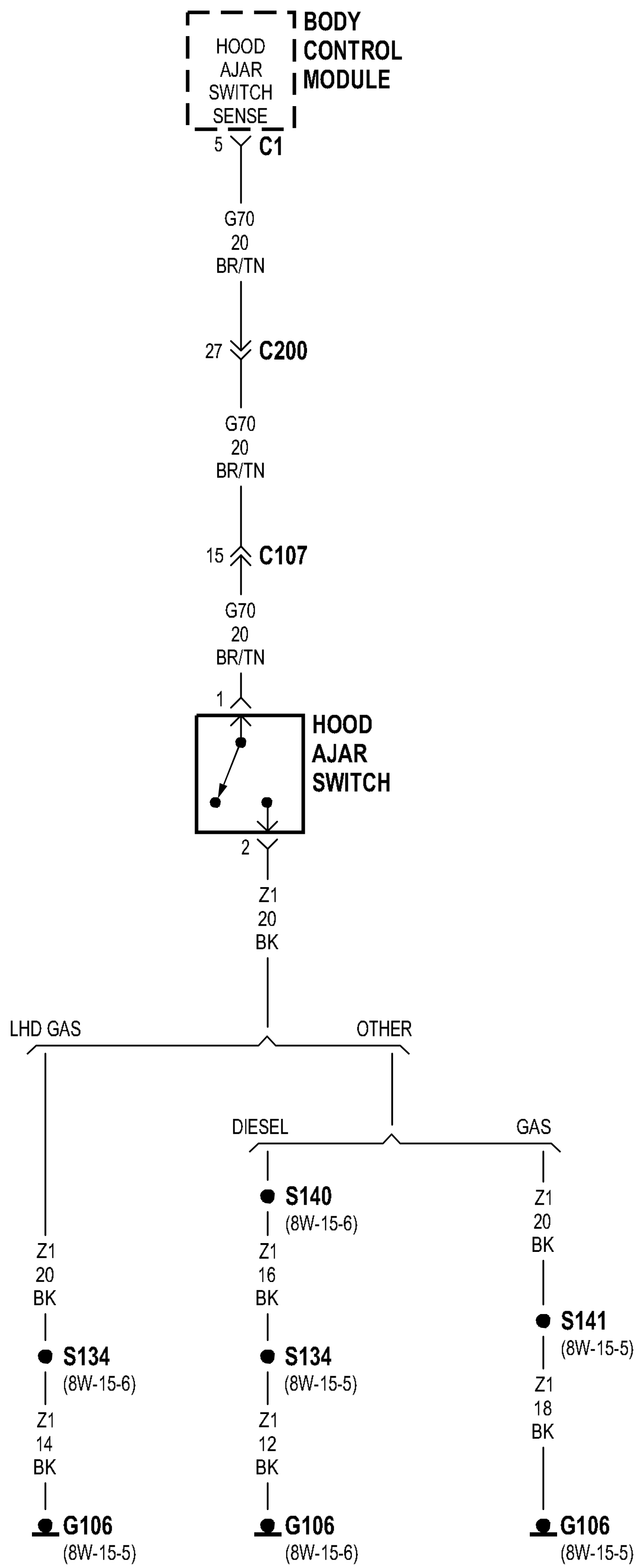

WIPER ON/OFF RELAY (IN PDC)
(8W-53-4)
(8W-53-5)
86
85
V14 20 RD/VT
GAS
DIESEL
35 C106
46 C107
V14 22 RD/VT
44 C200
V14 22 RD/VT
22 C1
WINDSHIELD WIPER SWITCH MUX
WINDSHIELD WIPER SWITCH RETURN
WASHER PUMP SWITCH SENSE
RIGHT MULTI-FUNCTION SWITCH
(8W-53-2)
(8W-53-3)
8
7
3
V52 22 DG/RD
V59 22 DB/YL
V10 20 BR
WASHER PUMP SWITCH SENSE
WINDSHIELD WASHER PUMP
(8W-53-2)
(8W-53-3)
1
V10 20 BR
7 C107
RHD
LHD
V10 20 BR
V10 22 BR
39 C200
V10 20 BR
S212
(8W-53-2)
(8W-53-3)
V10 20 BR
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
11 C2
22 C2
2 C2
WIPER ON/OFF RELAY CONTROL
WINDSHIELD WIPER SWITCH MUX
WINDSHIELD WIPER SWITCH RETURN
WASHER PUMP SWITCH SENSE
BODY CONTROL MODULE
WASHER FLUID SWITCH SENSE
LIFTGATE AJAR SWITCH SENSE
WIPER PARK SWITCH SENSE
5 C2
21
20
DIESEL
GAS
V11 20 BK/TN
56 C200
V11 20 BK/TN
2 C107
V11 20 BK/TN
1
WASHER FLUID SWITCH SENSE
WASHER FLUID LEVEL SWITCH
(8W-53-2)
(8W-53-3)
LIFTGATE AJAR SWITCH SENSE
RIGHT LIFTGATE AJAR SWITCH
(8W-61-11)
2
G78 20 TN/BK
25 C1
G78 20 TN/BK
RHD
LHD
34 C301
1 C308
S404
(8W-12-30)
G78 20 TN/BK
G78 20 TN/BK
G78 20 TN/BK
2
LIFTGATE AJAR SWITCH SENSE
LIFTGATE FLIP-UP AJAR SWITCH
(8W-61-11)
3
LIFTGATE AJAR SWITCH SENSE
REAR WIPER MOTOR
(8W-53-6)
(8W-53-7)
2
LIFTGATE AJAR SWITCH SENSE
LEFT LIFTGATE AJAR SWITCH
(8W-61-11)
28 C2
V55 16 TN/RD
5 C107
GAS
DIESEL
V55 16 TN/RD
33 C2
V55 16 TN/RD
5 C106
V55 16 TN/RD
DIESEL
GAS
87
87A
30
WIPER ON/OFF RELAY (IN PDC)
(8W-53-4)
(8W-53-5)
2
WIPER PARK SWITCH SENSE
WINDSHIELD WIPER MOTOR
(8W-53-4)
(8W-53-5)

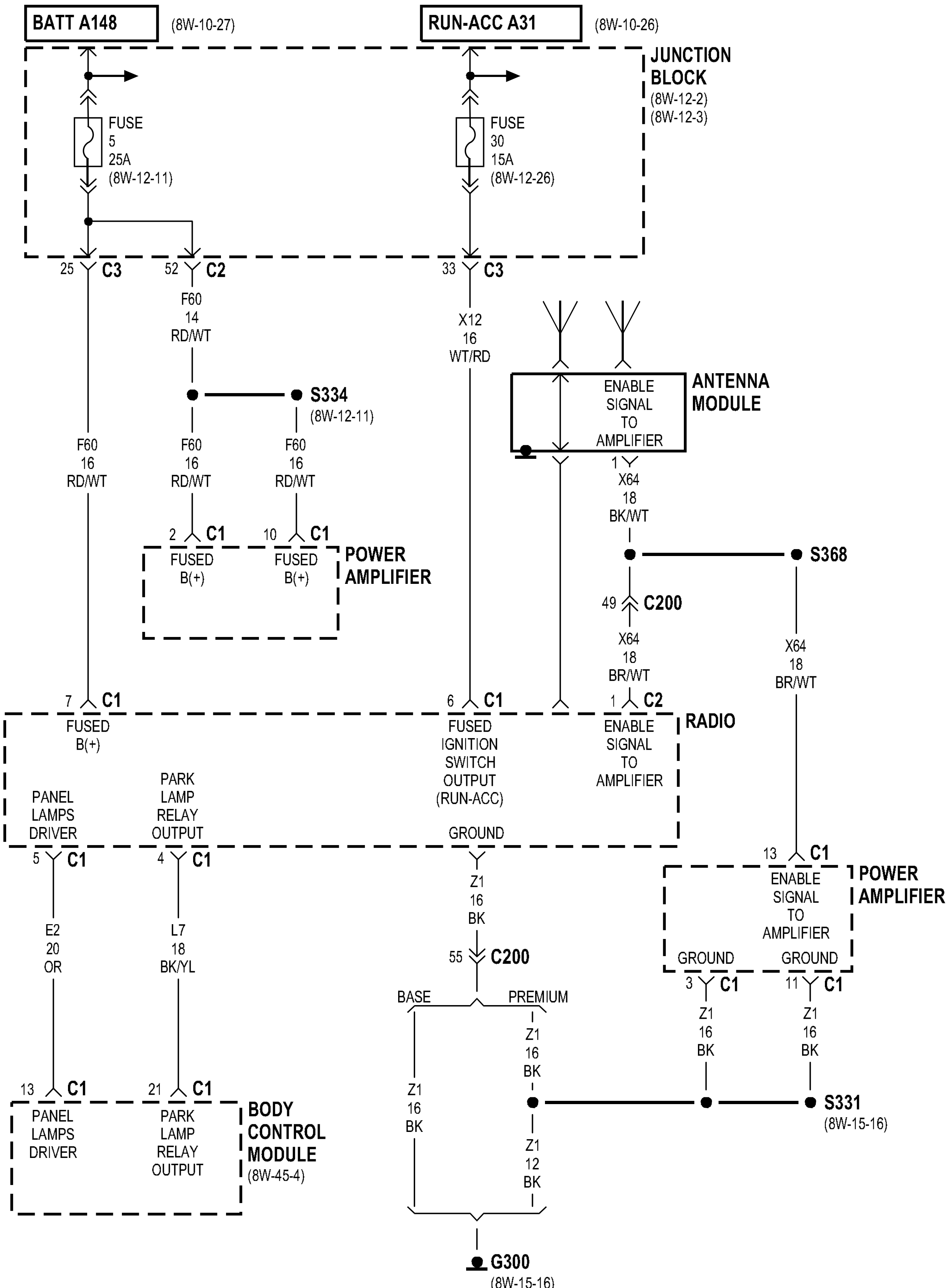


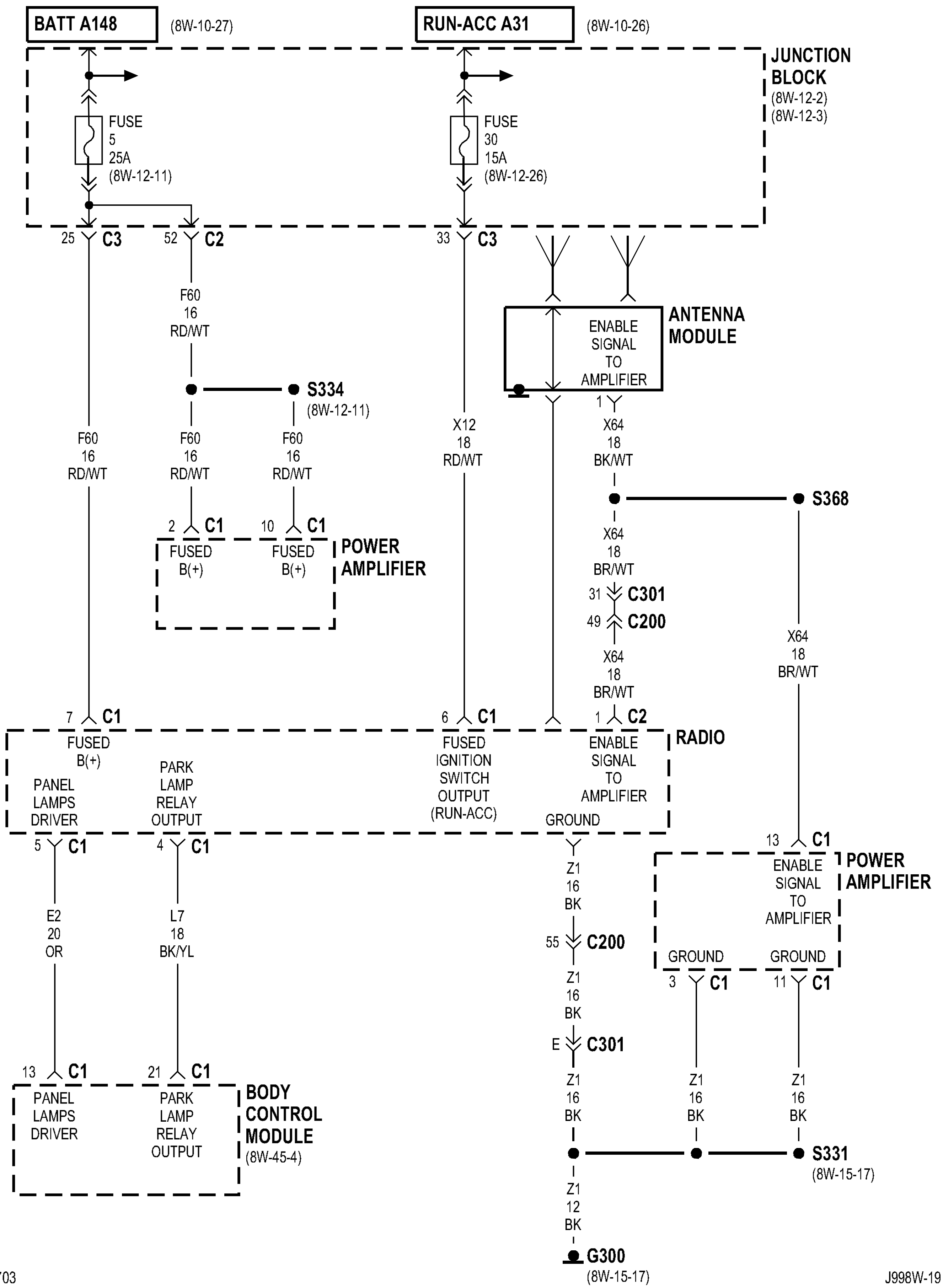
RADIO CONTROL MUX RETURN
RADIO CONTROL MUX
REMOTE RADIO SWITCH NO. 1
(8W-47-13)
RADIO CONTROL MUX
RADIO CONTROL MUX RETURN
REMOTE RADIO SWITCH NO. 2
(8W-47-13)
1
2
2
1
X10 20 RD/BK
X20 20 RD/YL
X20 20 RD/YL
X10 20 RD/BK
S216
(8W-47-13)
S215
(8W-47-13)
X20 20 RD/YL
X10 20 RD/BK
3 C2
4 C2
CLOCKSPRING
(8W-47-13)
3 C1
4 C1
X20 20 RD/YL
X10 20 RD/BK
BATT A147
(8W-10-21)
BATT A149
(8W-10-14)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 25 20A
(8W-12-25)
85
SUNROOF DELAY RELAY
(8W-64-2)
86
85
REAR WINDOW DEFOGGER RELAY
(8W-48-2)
86
8 C2
19 C2
3
11
RADIO CONTROL MUX
RADIO CONTROL MUX RETURN
SUNROOF DELAY RELAY CONTROL
REAR WINDOW DEFOGGER RELAY CONTROL
BODY CONTROL MODULE


BODY CONTROL MODULE
DRIVER SEAT HEATER SWITCH MUX
SEAT HEATER SWITCH SENSOR GROUND
PASSENGER SEAT HEATER SWITCH MUX
REAR WINDOW DEFOGGER SWITCH SENSE
A/C SWITCH SIGNAL
7 C2
18 C2
6 C2
12 C2
1 C2
P133 20 LG/RD
P132 20 OR/BK
P134 20 LG/WT
C15 20 BK/WT
C103 20 DG
S200
(8W-63-13)
AZC
MTC
MTC
AZC
5 C1
1 C1
MANUAL TEMPERATURE CONTROL
REAR WINDOW DEFOGGER SWITCH SENSE
A/C SWITCH SIGNAL
(8W-42-8)
(8W-42-9)
P132 20 OR/BK
C15 20 BK/WT
C103 20 DG
1
6
DRIVER HEATED SEAT SWITCH
0 OFF
1 LOW
2 HIGH
(8W-63-13)
0
1
2
14 C1
9 C2
AUTOMATIC ZONE CONTROL MODULE
REAR WINDOW DEFOGGER SWITCH SENSE
A/C SWITCH SIGNAL
(8W-42-5)
(8W-42-6)
P132 20 OR/BK
6
1
PASSENGER HEATED SEAT SWITCH
0 OFF
1 LOW
2 HIGH
(8W-63-13)
0
1
2

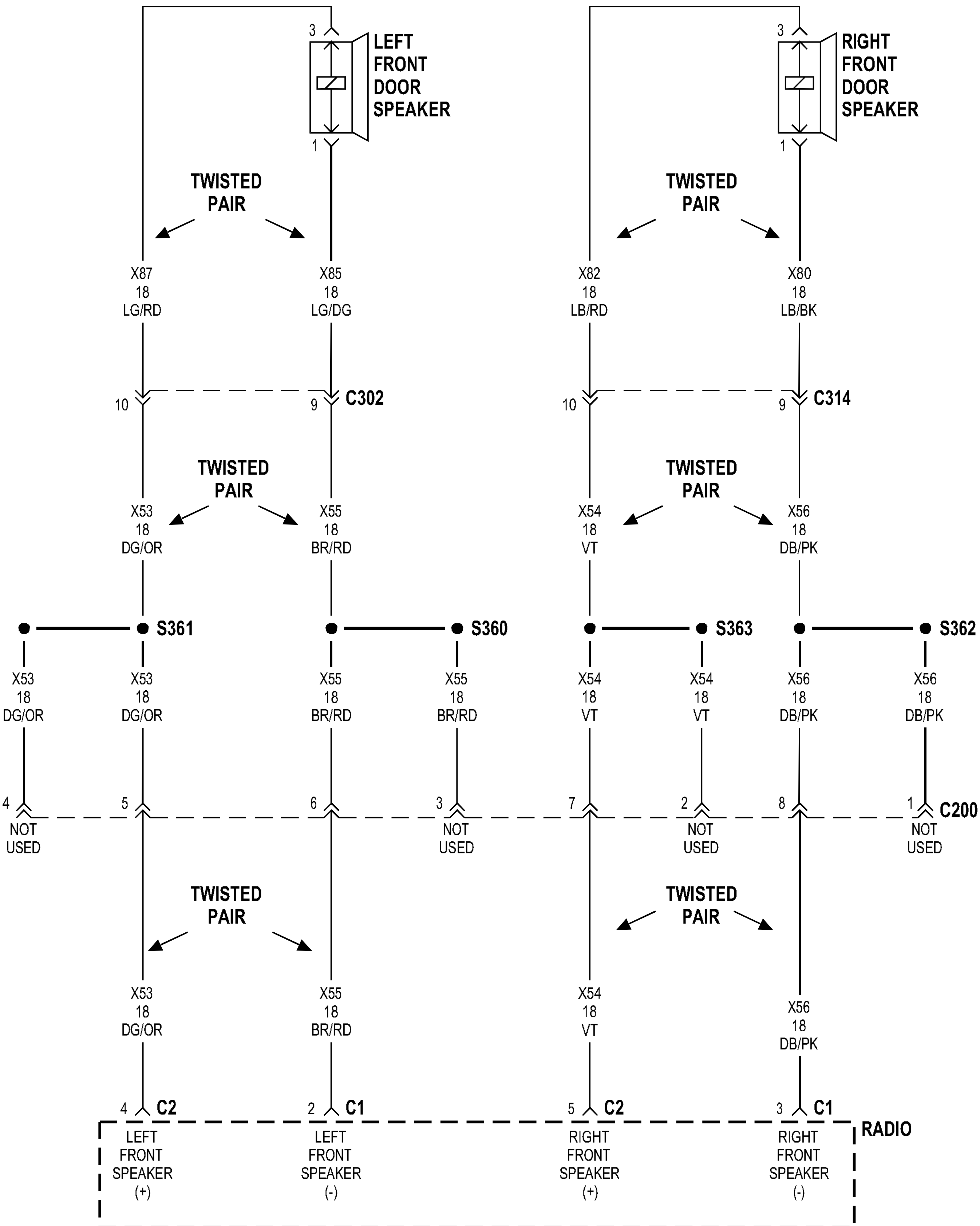

BODY
CONTROL
MODULE
HOOD
AJAR
SWITCH
SENSE
5
C1
G70
20
BR/TN
27
C200
G70
20
BR/TN
15
C107
G70
20
BR/TN
1
HOOD
AJAR
SWITCH
2
Z1
20
BK
LHD GAS
OTHER
DIESEL
GAS
S140
(8W-15-6)
Z1
20
BK
Z1
16
BK
S141
(8W-15-5)
S134
(8W-15-6)
S134
(8W-15-5)
Z1
14
BK
Z1
12
BK
Z1
18
BK
G106
(8W-15-5)
G106
(8W-15-6)
G106
(8W-15-5)

8W-47 AUDIO SYSTEM

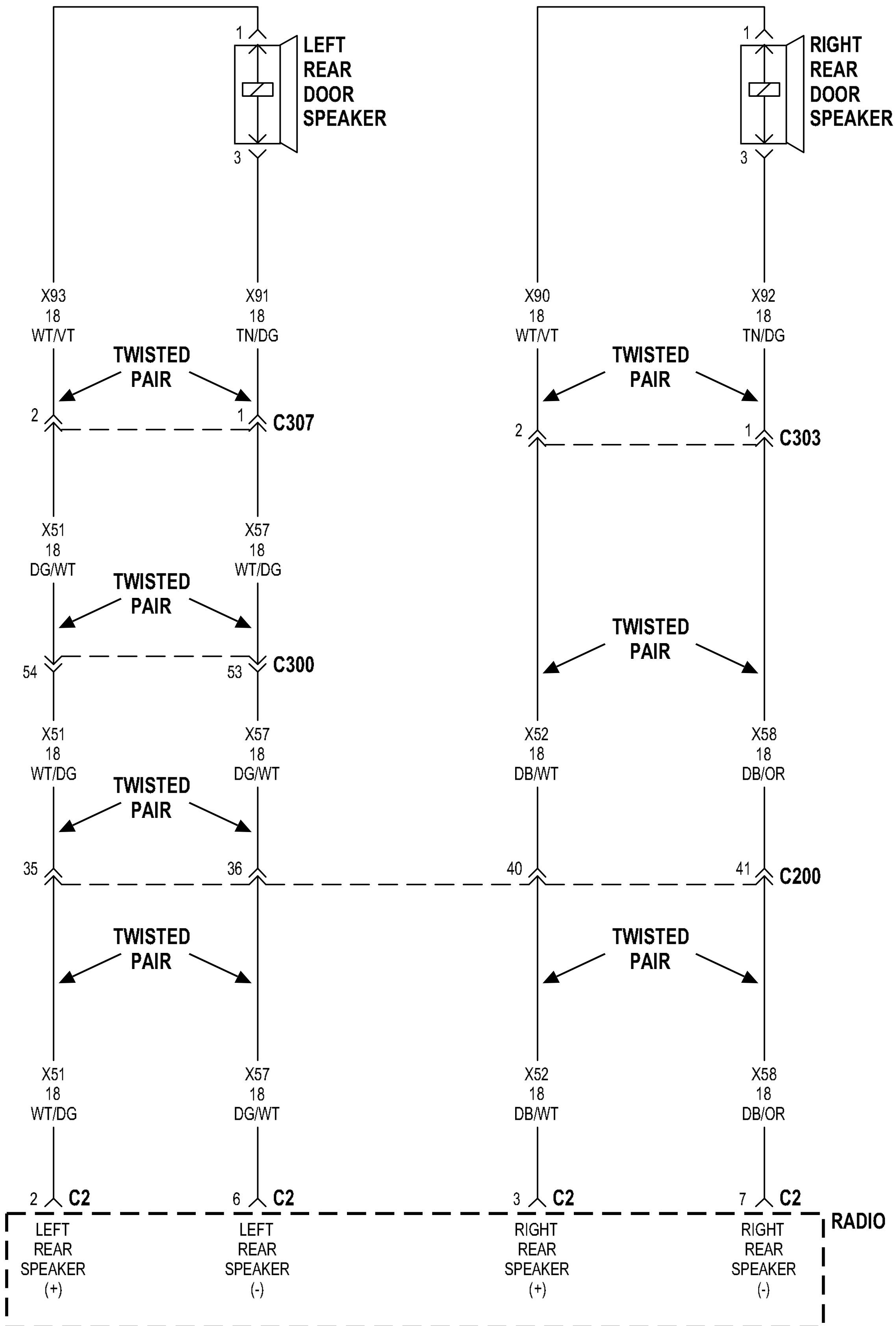

BATT A148
(8W-10-27)
RUN-ACC A31
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 5 25A (8W-12-11)
FUSE 30 15A (8W-12-26)
25 C3
52 C2
33 C3
F60 14 RD/WT
X12 16 WT/RD
S334
(8W-12-11)
F60 16 RD/WT
F60 16 RD/WT
F60 16 RD/WT
2 C1
10 C1
FUSED B(+)
FUSED B(+)
POWER AMPLIFIER
ENABLE SIGNAL TO AMPLIFIER
ANTENNA MODULE
1
X64 18 BK/WT
S368
49 C200
X64 18 BR/WT
X64 18 BR/WT
7 C1
6 C1
1 C2
RADIO
FUSED B(+)
FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
ENABLE SIGNAL TO AMPLIFIER
PANEL LAMPS DRIVER
PARK LAMP RELAY OUTPUT
GROUND
5 C1
4 C1
13 C1
POWER AMPLIFIER
ENABLE SIGNAL TO AMPLIFIER
GROUND
GROUND
3 C1
11 C1
Z1 16 BK
Z1 16 BK
Z1 16 BK
E2 20 OR
L7 18 BK/YL
Z1 16 BK
55 C200
BASE
PREMIUM
Z1 16 BK
Z1 16 BK
Z1 12 BK
S331
(8W-15-16)
13 C1
21 C1
PANEL LAMPS DRIVER
PARK LAMP RELAY OUTPUT
BODY CONTROL MODULE
(8W-45-4)
G300
(8W-15-16)

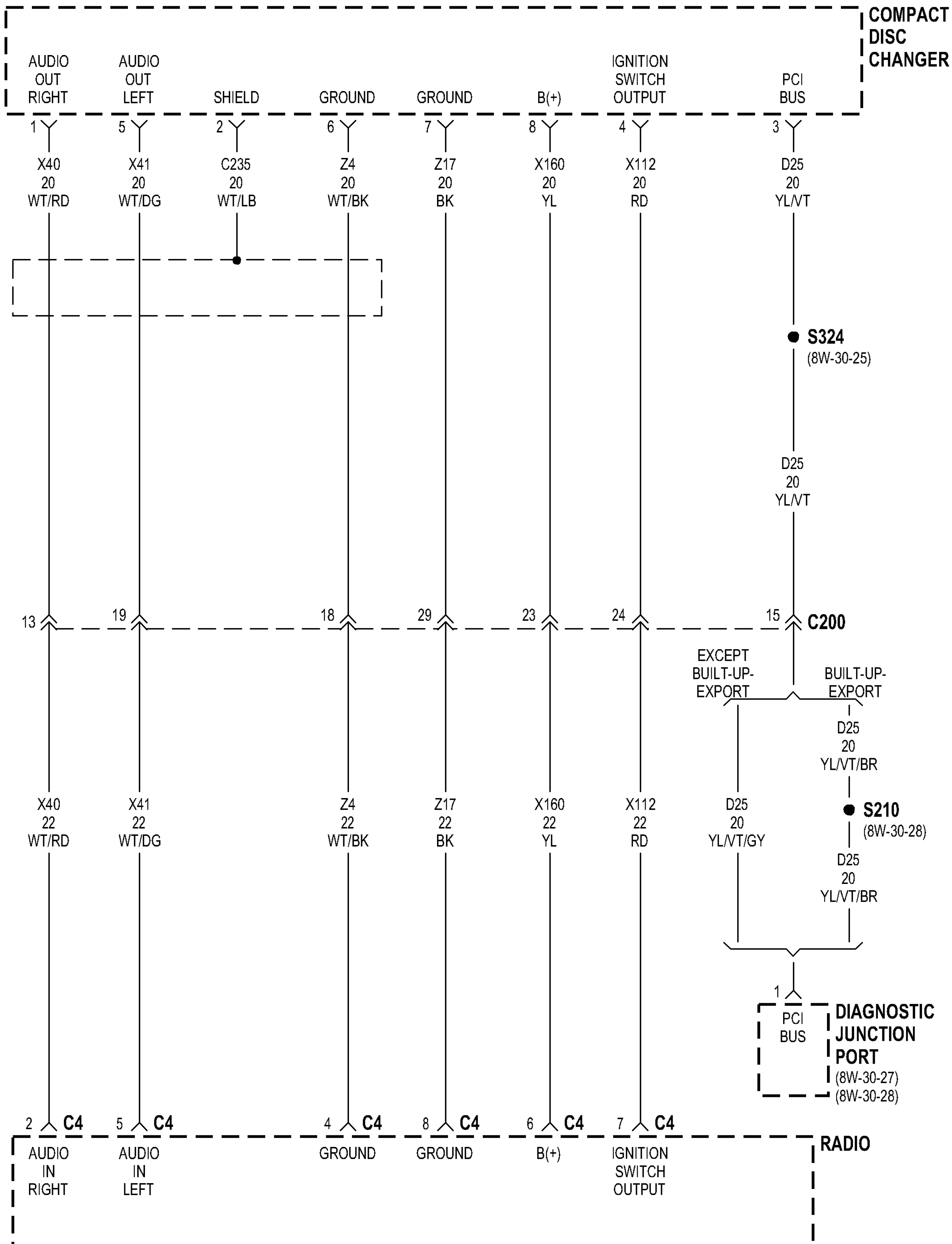


BATT A148
(8W-10-27)
RUN-ACC A31
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 5 25A (8W-12-11)
FUSE 30 15A (8W-12-26)
25 C3
52 C2
33 C3
F60 16 RD/WT
S334
(8W-12-11)
X12 18 RD/WT
ANTENNA MODULE
ENABLE SIGNAL TO AMPLIFIER
1
X64 18 BK/WT
S368
X64 18 BR/WT
31 C301
49 C200
2 C1
10 C1
FUSED B(+)
POWER AMPLIFIER
7 C1
6 C1
1 C2
RADIO
FUSED B(+)
PANEL LAMPS DRIVER
PARK LAMP RELAY OUTPUT
FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
ENABLE SIGNAL TO AMPLIFIER
GROUND
5 C1
4 C1
E2 20 OR
L7 18 BK/YL
Z1 16 BK
55 C200
E C301
13 C1
21 C1
BODY CONTROL MODULE
(8W-45-4)
13 C1
POWER AMPLIFIER
GROUND
3 C1
11 C1
S331
(8W-15-17)
Z1 12 BK
G300
(8W-15-17)

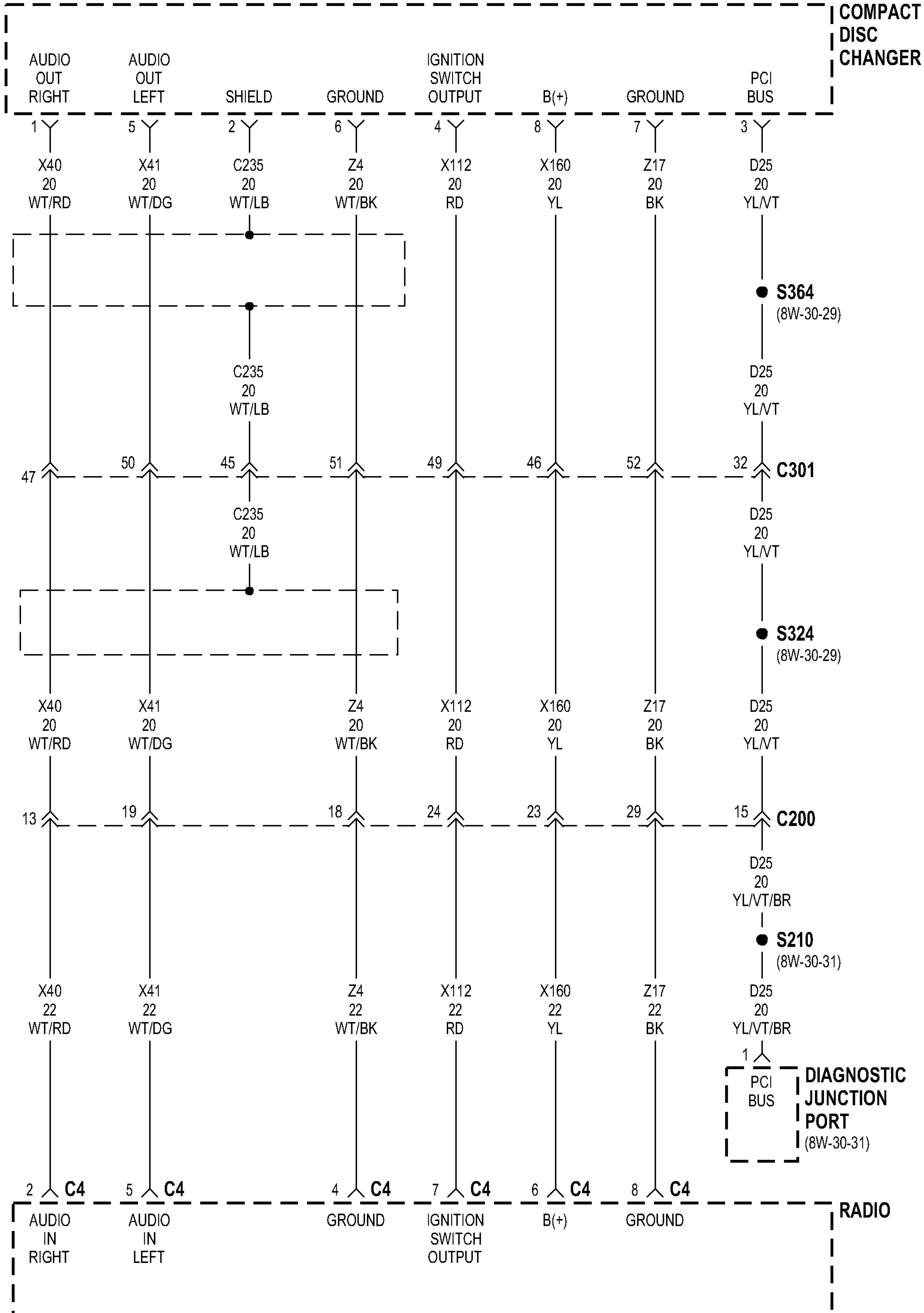


J998W-19 WG004704

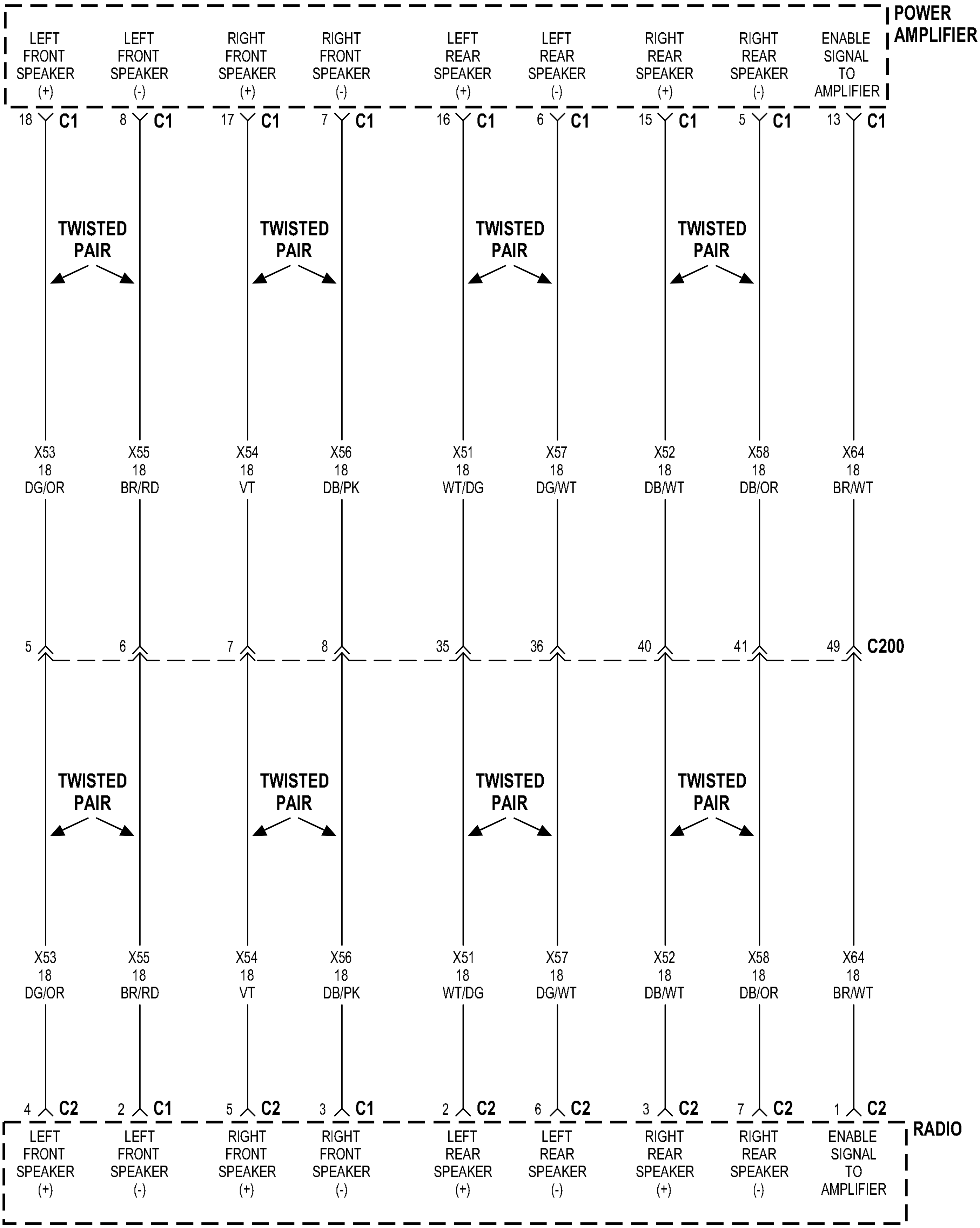

1
LEFT REAR DOOR SPEAKER
3
1
RIGHT REAR DOOR SPEAKER
3
X93 18 WT/VT
X91 18 TN/DG
X90 18 WT/VT
X92 18 TN/DG
TWISTED PAIR
TWISTED PAIR
2
1
C307
2
1
C303
X51 18 DG/WT
X57 18 WT/DG
TWISTED PAIR
TWISTED PAIR
54
53
C300
X51 18 WT/DG
X57 18 DG/WT
X52 18 DB/WT
X58 18 DB/OR
TWISTED PAIR
35
36
40
41
C200
TWISTED PAIR
TWISTED PAIR
X51 18 WT/DG
X57 18 DG/WT
X52 18 DB/WT
X58 18 DB/OR
2 C2
6 C2
3 C2
7 C2
RADIO
LEFT REAR SPEAKER (+)
LEFT REAR SPEAKER (-)
RIGHT REAR SPEAKER (+)
RIGHT REAR SPEAKER (-)


COMPACT DISC CHANGER
AUDIO OUT RIGHT
AUDIO OUT LEFT
SHIELD
GROUND
GROUND
B(+)
IGNITION SWITCH OUTPUT
PCI BUS
1
5
2
6
7
8
4
3
X40 20 WT/RD
X41 20 WT/DG
C235 20 WT/LB
Z4 20 WT/BK
Z17 20 BK
X160 20 YL
X112 20 RD
D25 20 YL/VT
S324
(8W-30-25)
D25 20 YL/VT
13
19
18
29
23
24
15
C200
EXCEPT BUILT-UP-EXPORT
BUILT-UP-EXPORT
D25 20 YL/VT/BR
S210
(8W-30-28)
D25 20 YL/VT/BR
X40 22 WT/RD
X41 22 WT/DG
Z4 22 WT/BK
Z17 22 BK
X160 22 YL
X112 22 RD
D25 20 YL/VT/GY
1
PCI BUS
DIAGNOSTIC JUNCTION PORT
(8W-30-27)
(8W-30-28)
2 C4
5 C4
4 C4
8 C4
6 C4
7 C4
RADIO
AUDIO IN RIGHT
AUDIO IN LEFT
GROUND
GROUND
B(+)
IGNITION SWITCH OUTPUT

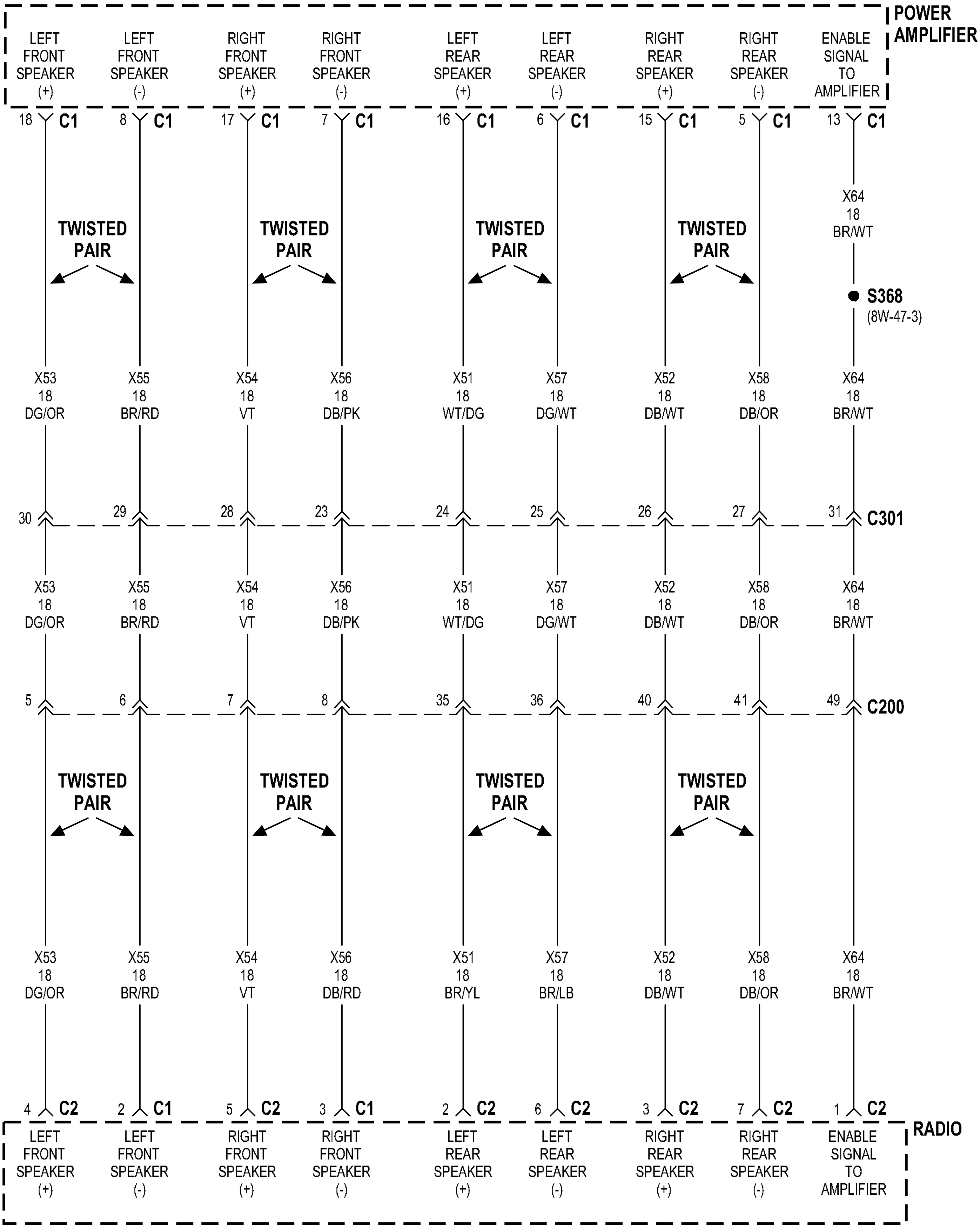
RHD PREMIUM

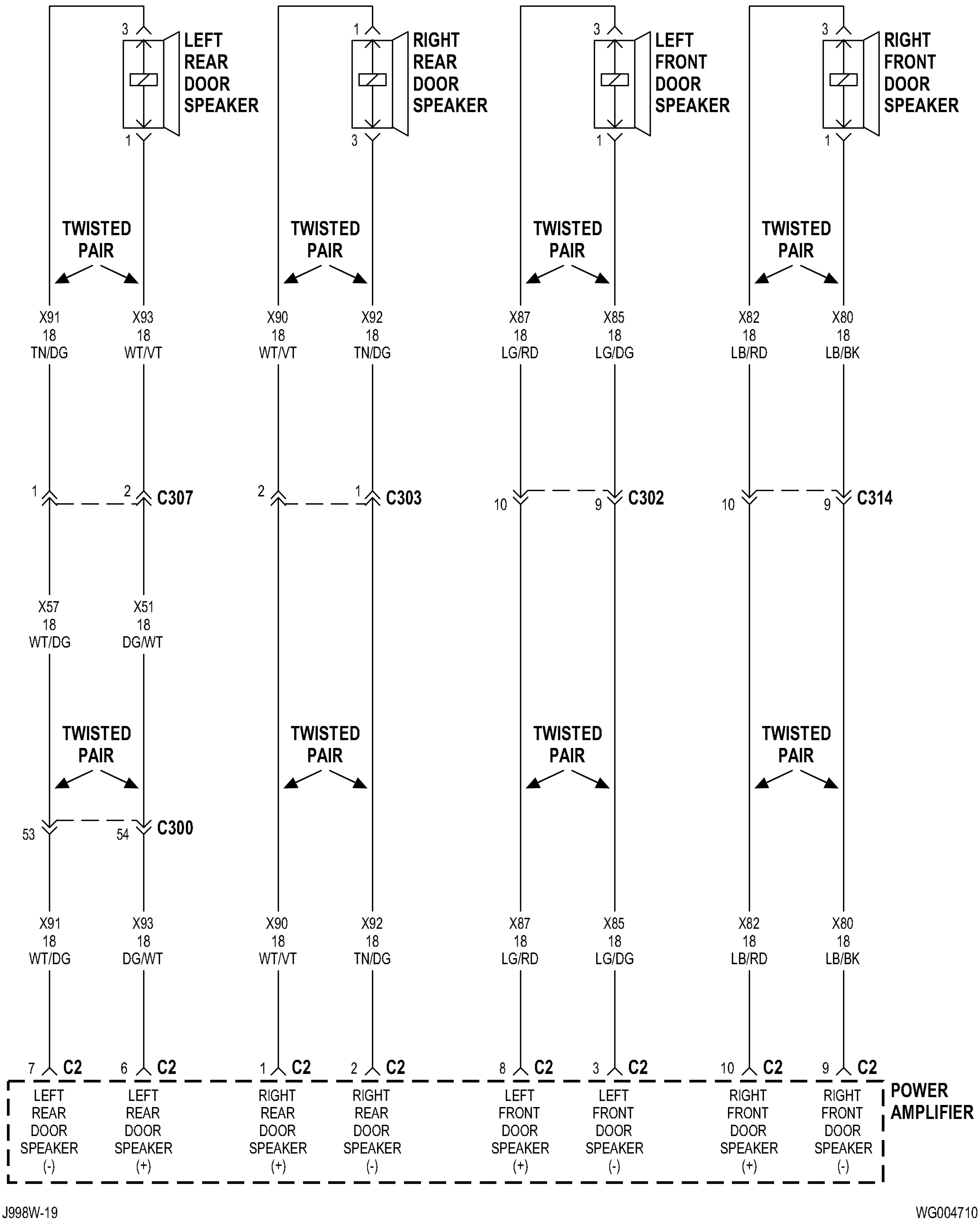


WG004707 J998W-19

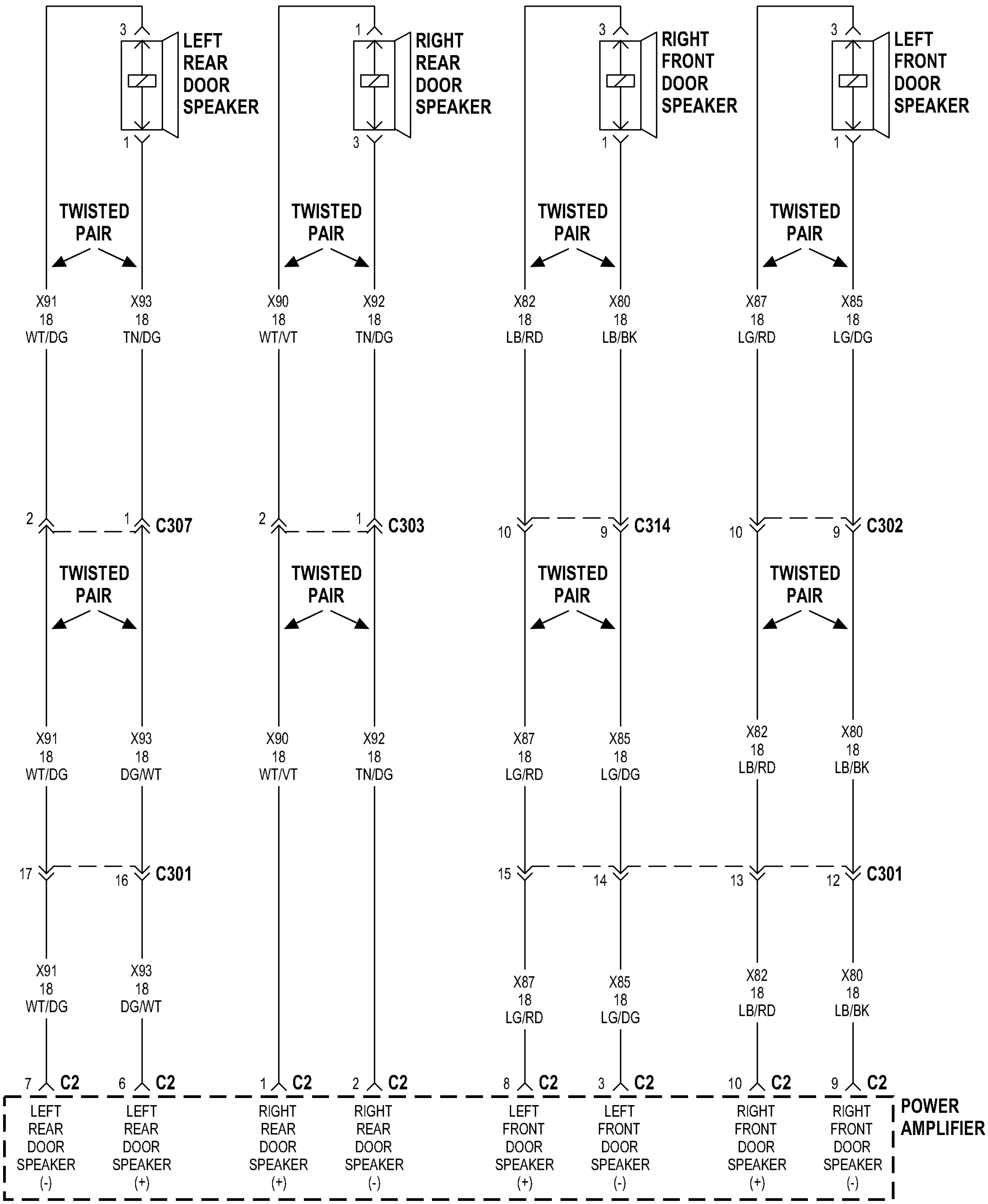


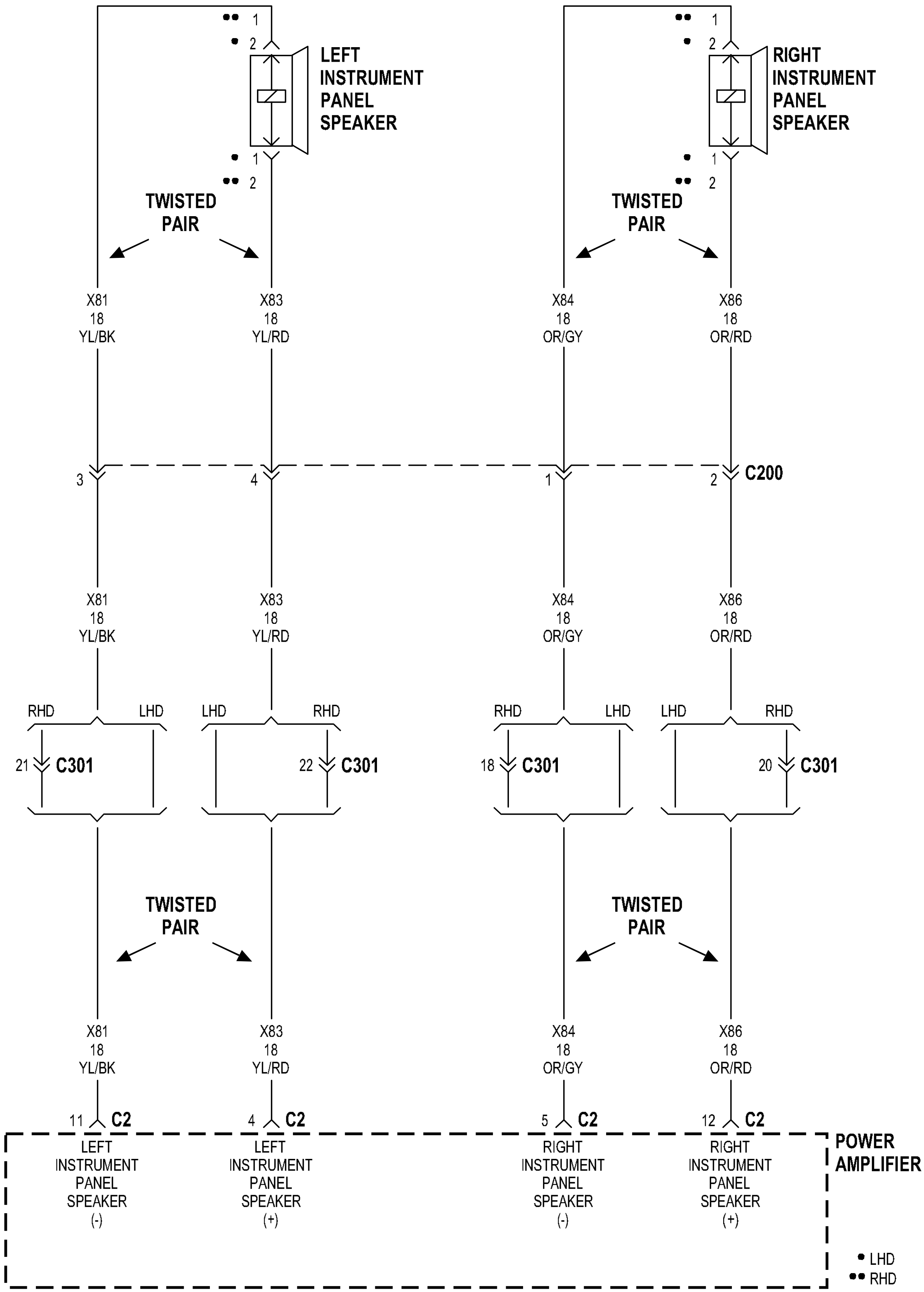
J998W-19 WG004708


POWER AMPLIFIER
LEFT FRONT SPEAKER (+)
LEFT FRONT SPEAKER (-)
RIGHT FRONT SPEAKER (+)
RIGHT FRONT SPEAKER (-)
LEFT REAR SPEAKER (+)
LEFT REAR SPEAKER (-)
RIGHT REAR SPEAKER (+)
RIGHT REAR SPEAKER (-)
ENABLE SIGNAL TO AMPLIFIER
18 C1
8 C1
17 C1
7 C1
16 C1
6 C1
15 C1
5 C1
13 C1
TWISTED PAIR
X64 18 BR/WT
S368 (8W-47-3)
X53 18 DG/OR
X55 18 BR/RD
X54 18 VT
X56 18 DB/PK
X51 18 WT/DG
X57 18 DG/WT
X52 18 DB/WT
X58 18 DB/OR
X64 18 BR/WT
30 29 28 23 24 25 26 27 31 C301
5 6 7 8 35 36 40 41 49 C200
X53 18 DG/OR
X55 18 BR/RD
X54 18 VT
X56 18 DB/RD
X51 18 BR/YL
X57 18 BR/LB
X52 18 DB/WT
X58 18 DB/OR
X64 18 BR/WT
4 C2
2 C1
5 C2
3 C1
2 C2
6 C2
3 C2
7 C2
1 C2
RADIO
LEFT FRONT SPEAKER (+)
LEFT FRONT SPEAKER (-)
RIGHT FRONT SPEAKER (+)
RIGHT FRONT SPEAKER (-)
LEFT REAR SPEAKER (+)
LEFT REAR SPEAKER (-)
RIGHT REAR SPEAKER (+)
RIGHT REAR SPEAKER (-)
ENABLE SIGNAL TO AMPLIFIER

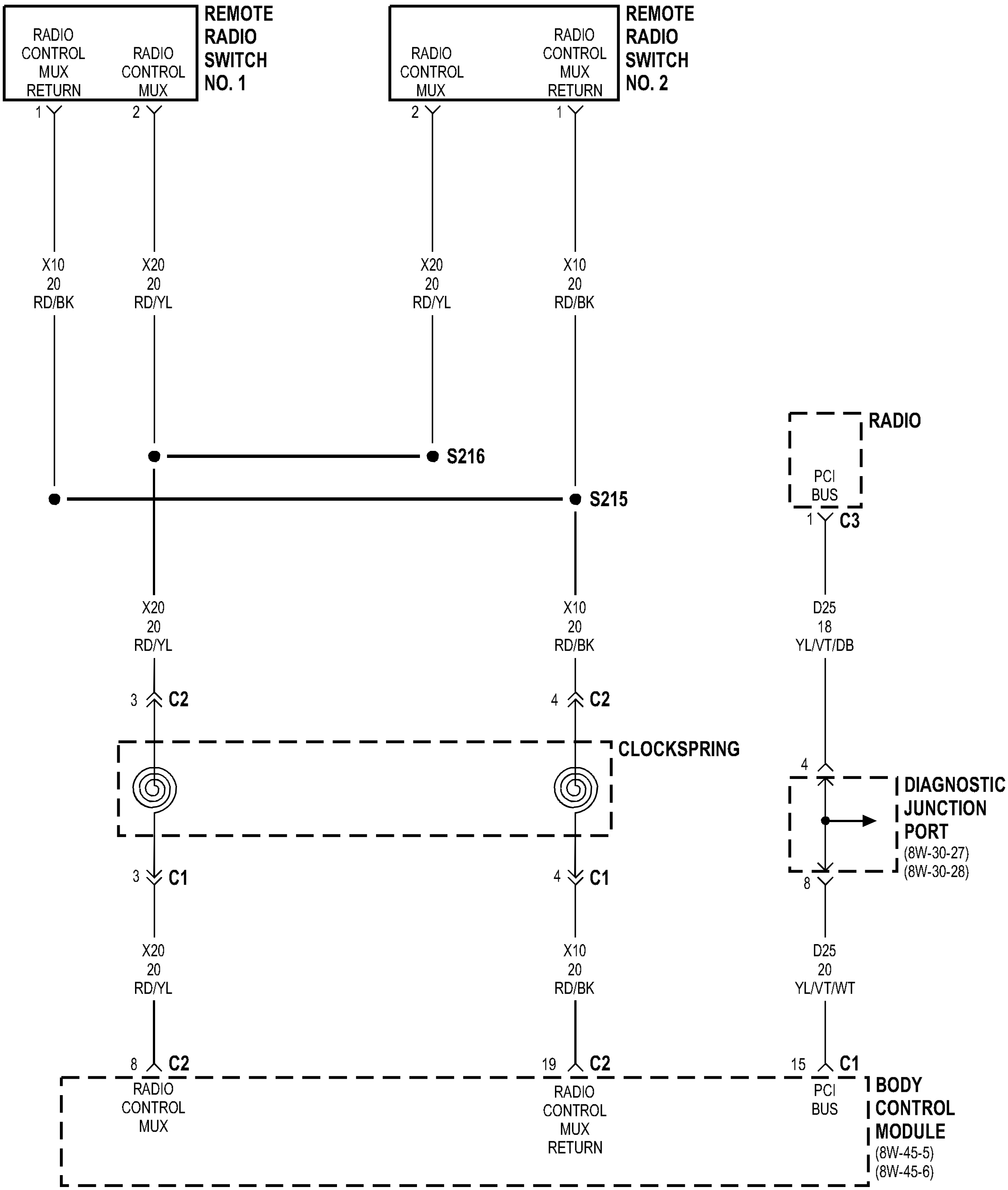


LEFT REAR DOOR SPEAKER
RIGHT REAR DOOR SPEAKER
LEFT FRONT DOOR SPEAKER
RIGHT FRONT DOOR SPEAKER
TWISTED PAIR
X91 18 TN/DG
X93 18 WT/VT
X90 18 WT/VT
X92 18 TN/DG
X87 18 LG/RD
X85 18 LG/DG
X82 18 LB/RD
X80 18 LB/BK
C307
C303
C302
C314
X57 18 WT/DG
X51 18 DG/WT
C300
X91 18 WT/DG
X93 18 DG/WT
X90 18 WT/VT
X92 18 TN/DG
X87 18 LG/RD
X85 18 LG/DG
X82 18 LB/RD
X80 18 LB/BK
C2
LEFT REAR DOOR SPEAKER (-)
LEFT REAR DOOR SPEAKER (+)
RIGHT REAR DOOR SPEAKER (+)
RIGHT REAR DOOR SPEAKER (-)
LEFT FRONT DOOR SPEAKER (+)
LEFT FRONT DOOR SPEAKER (-)
RIGHT FRONT DOOR SPEAKER (+)
RIGHT FRONT DOOR SPEAKER (-)
POWER AMPLIFIER
J998W-19
WG004710

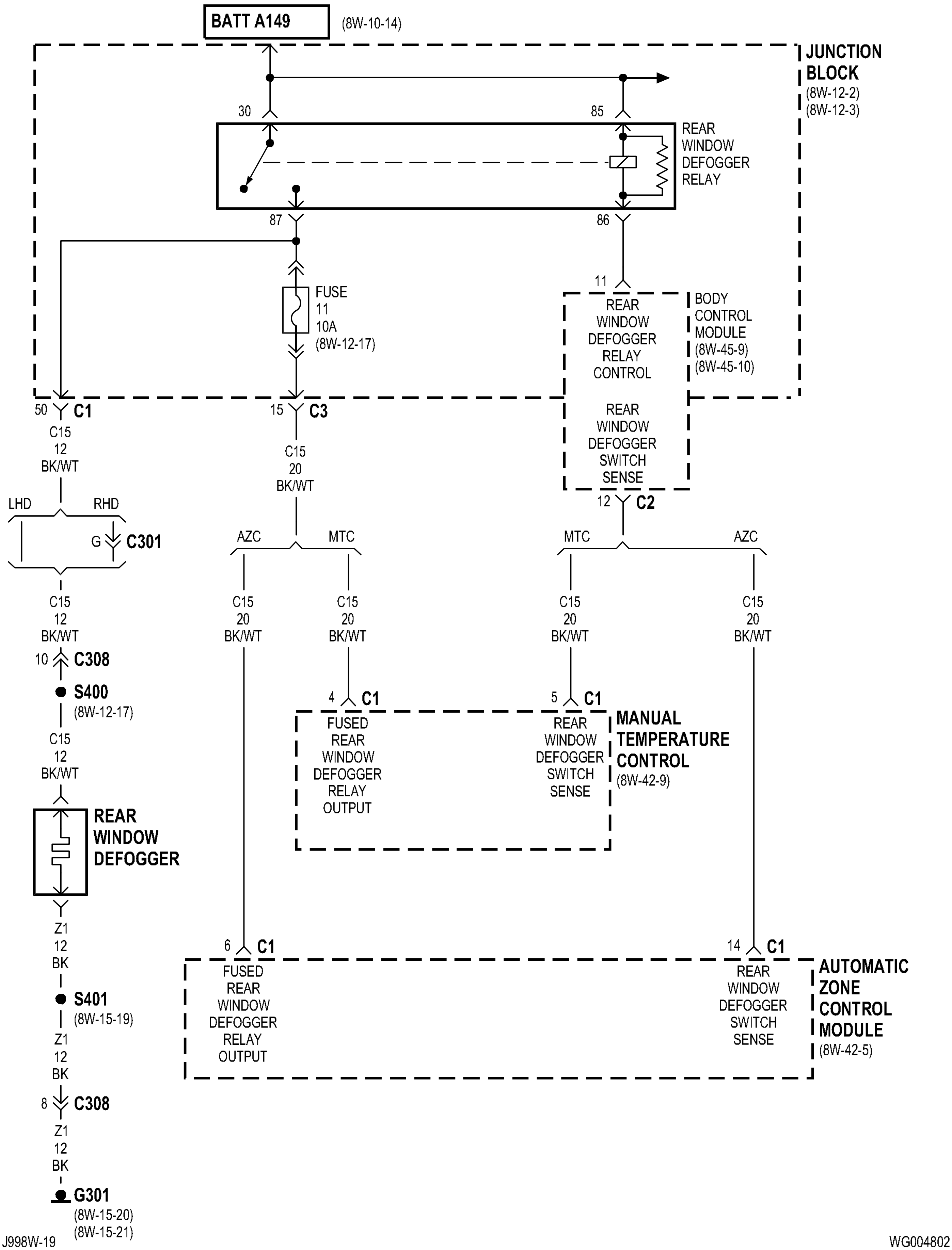

LEFT REAR DOOR SPEAKER
RIGHT REAR DOOR SPEAKER
RIGHT FRONT DOOR SPEAKER
LEFT FRONT DOOR SPEAKER
TWISTED PAIR
X91 18 WT/DG
X93 18 TN/DG
X90 18 WT/VT
X92 18 TN/DG
X82 18 LB/RD
X80 18 LB/BK
X87 18 LG/RD
X85 18 LG/DG
C307
C303
C314
C302
X93 18 DG/WT
C301
C2
POWER AMPLIFIER
LEFT REAR DOOR SPEAKER (-)
LEFT REAR DOOR SPEAKER (+)
RIGHT REAR DOOR SPEAKER (+)
RIGHT REAR DOOR SPEAKER (-)
LEFT FRONT DOOR SPEAKER (+)
LEFT FRONT DOOR SPEAKER (-)
RIGHT FRONT DOOR SPEAKER (+)
RIGHT FRONT DOOR SPEAKER (-)



LEFT INSTRUMENT PANEL SPEAKER
RIGHT INSTRUMENT PANEL SPEAKER
TWISTED PAIR
TWISTED PAIR
X81 18 YL/BK
X83 18 YL/RD
X84 18 OR/GY
X86 18 OR/RD
C200
RHD
LHD
C301
TWISTED PAIR
TWISTED PAIR
C2
LEFT INSTRUMENT PANEL SPEAKER (-)
LEFT INSTRUMENT PANEL SPEAKER (+)
RIGHT INSTRUMENT PANEL SPEAKER (-)
RIGHT INSTRUMENT PANEL SPEAKER (+)
POWER AMPLIFIER
• LHD
•• RHD


REMOTE RADIO SWITCH NO. 1
RADIO CONTROL MUX RETURN
RADIO CONTROL MUX
1
2
REMOTE RADIO SWITCH NO. 2
RADIO CONTROL MUX
RADIO CONTROL MUX RETURN
2
1
X10 20 RD/BK
X20 20 RD/YL
X20 20 RD/YL
X10 20 RD/BK
S216
S215
RADIO
PCI BUS
1 C3
X20 20 RD/YL
X10 20 RD/BK
D25 18 YL/VT/DB
3 C2
4 C2
CLOCKSPRING
4
DIAGNOSTIC JUNCTION PORT
(8W-30-27)
(8W-30-28)
3 C1
4 C1
8
X20 20 RD/YL
X10 20 RD/BK
D25 20 YL/VT/WT
8 C2
19 C2
15 C1
RADIO CONTROL MUX
RADIO CONTROL MUX RETURN
PCI BUS
BODY CONTROL MODULE
(8W-45-5)
(8W-45-6)

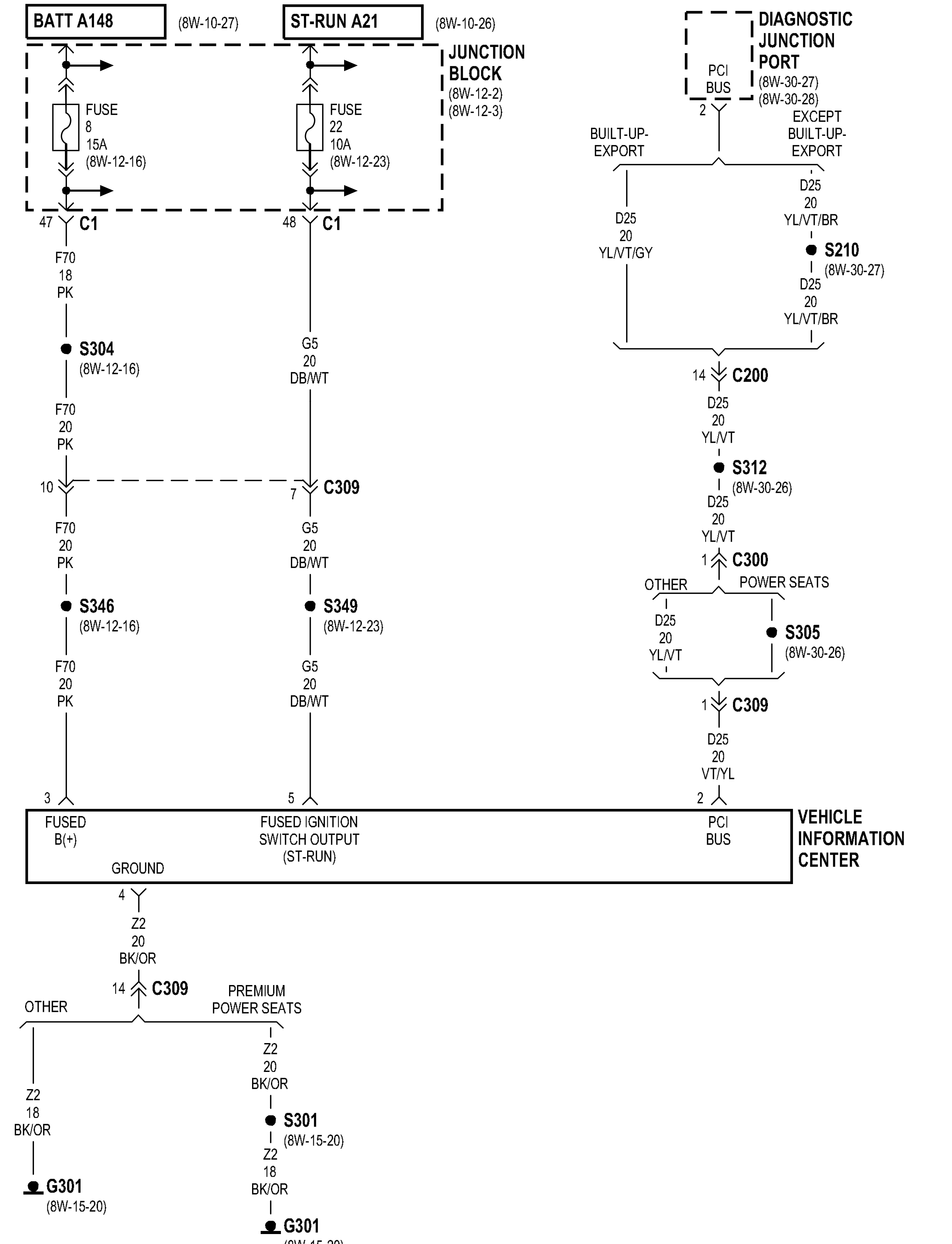
8W-48 REAR WINDOW DEFOGGER



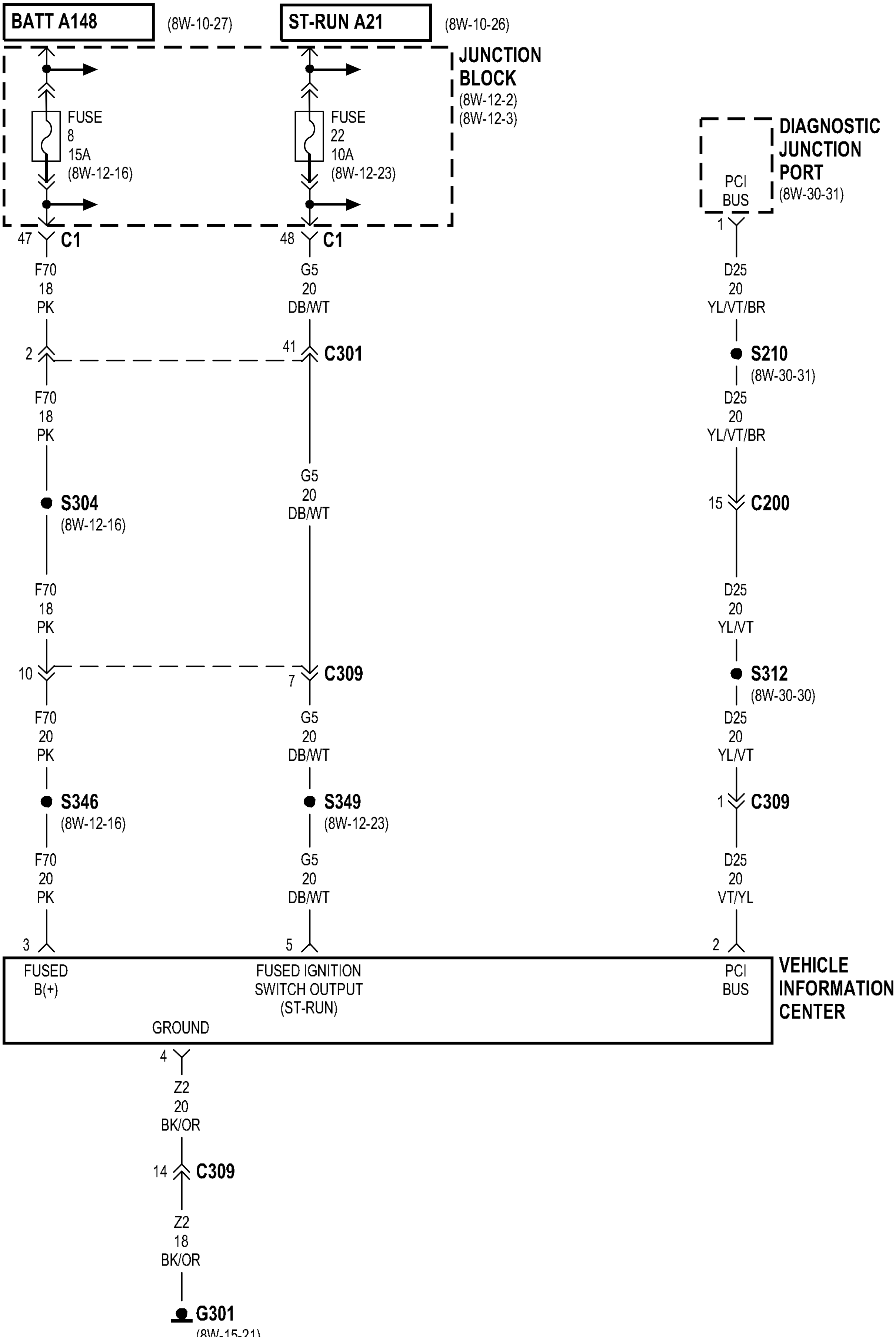
BATT A149
(8W-10-14)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
30
85
REAR WINDOW DEFOGGER RELAY
87
86
FUSE
11
10A
(8W-12-17)
11
REAR WINDOW DEFOGGER RELAY CONTROL
REAR WINDOW DEFOGGER SWITCH SENSE
BODY CONTROL MODULE
(8W-45-9)
(8W-45-10)
50 C1
15 C3
12 C2
C15 12 BK/WT
C15 20 BK/WT
LHD
RHD
G C301
AZC
MTC
MTC
AZC
C15 12 BK/WT
C15 20 BK/WT
C15 20 BK/WT
C15 20 BK/WT
C15 20 BK/WT
10 C308
S400
(8W-12-17)
C15 12 BK/WT
4 C1
5 C1
FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
REAR WINDOW DEFOGGER SWITCH SENSE
MANUAL TEMPERATURE CONTROL
(8W-42-9)
REAR WINDOW DEFOGGER
Z1 12 BK
6 C1
14 C1
FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
REAR WINDOW DEFOGGER SWITCH SENSE
AUTOMATIC ZONE CONTROL MODULE
(8W-42-5)
S401
(8W-15-19)
Z1 12 BK
8 C308
Z1 12 BK
G301
(8W-15-20)
(8W-15-21)

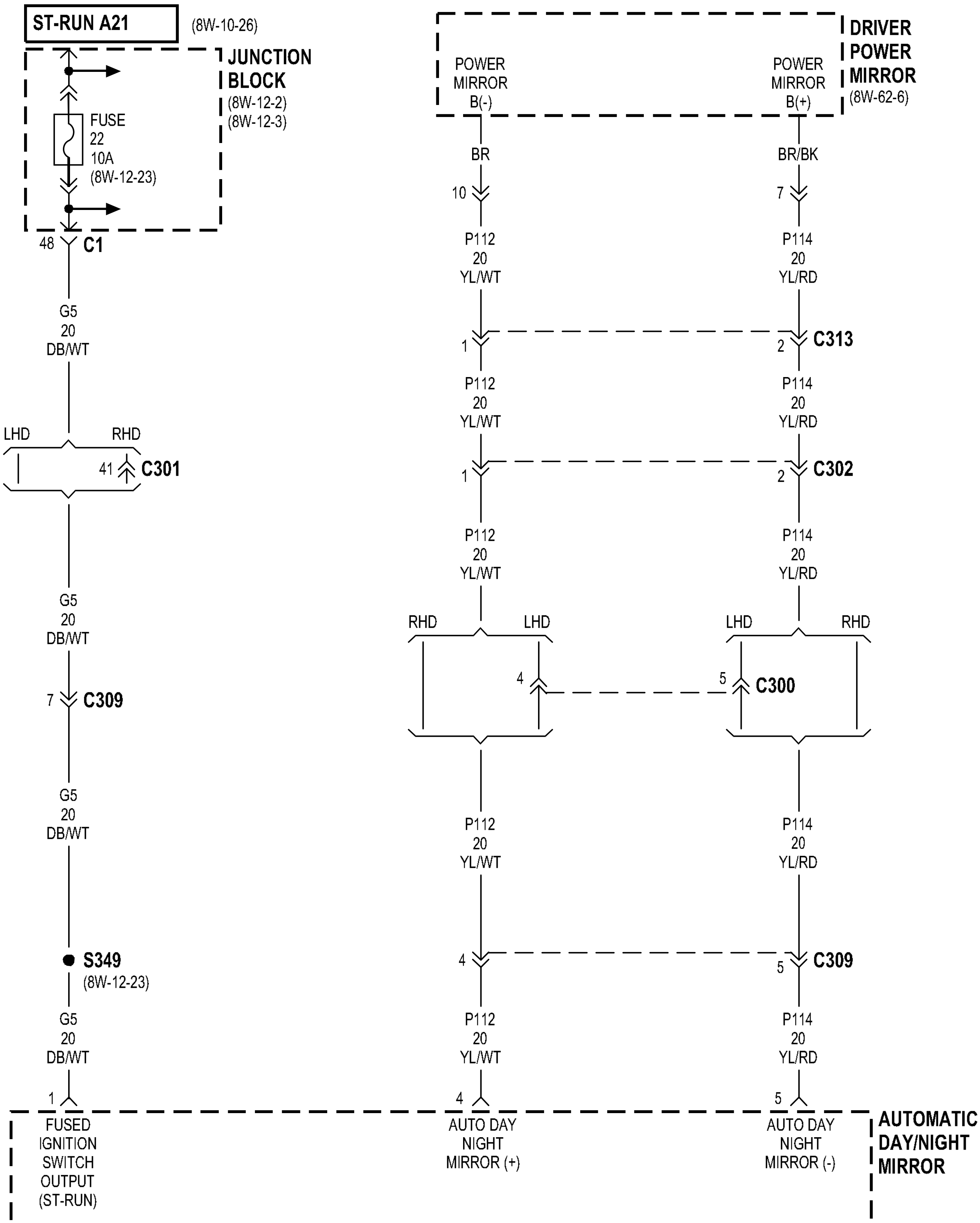
8W-49 OVERHEAD CONSOLE

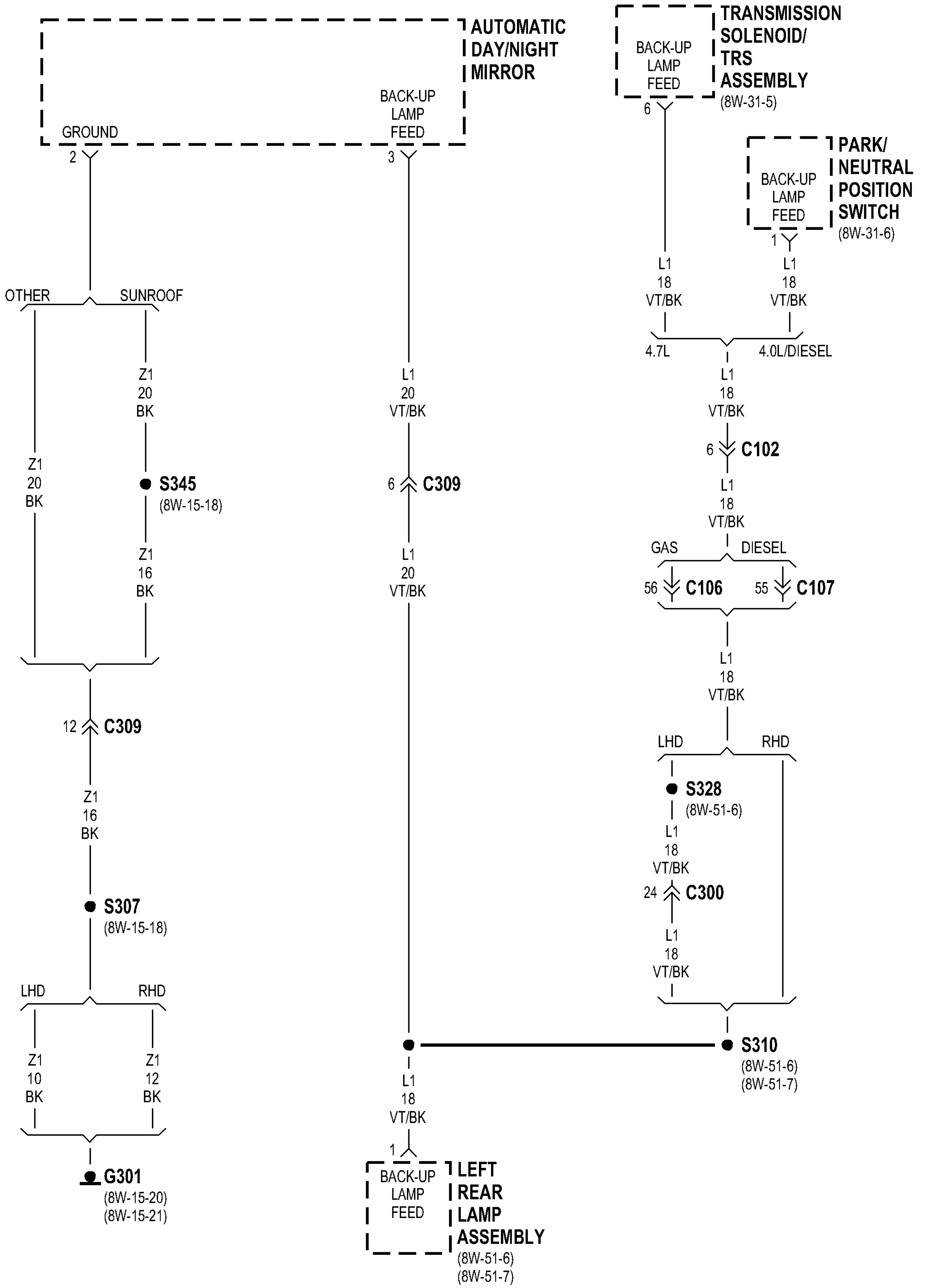
LHD


BATT A148
(8W-10-27)
ST-RUN A21
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
8
15A
(8W-12-16)
FUSE
22
10A
(8W-12-23)
47 C1
48 C1
F70
18
PK
S304
(8W-12-16)
F70
20
PK
G5
20
DB/WT
10
7 C309
F70
20
PK
G5
20
DB/WT
S346
(8W-12-16)
S349
(8W-12-23)
F70
20
PK
G5
20
DB/WT
DIAGNOSTIC JUNCTION PORT
PCI BUS
(8W-30-27)
(8W-30-28)
2
BUILT-UP-EXPORT
EXCEPT BUILT-UP-EXPORT
D25
20
YL/VT/GY
D25
20
YL/VT/BR
S210
(8W-30-27)
D25
20
YL/VT/BR
14 C200
D25
20
YL/VT
S312
(8W-30-26)
D25
20
YL/VT
1 C300
OTHER
POWER SEATS
D25
20
YL/VT
S305
(8W-30-26)
1 C309
D25
20
VT/YL
3
5
2
FUSED B(+)
FUSED IGNITION SWITCH OUTPUT (ST-RUN)
PCI BUS
GROUND
VEHICLE INFORMATION CENTER
4
Z2
20
BK/OR
14 C309
OTHER
PREMIUM POWER SEATS
Z2
20
BK/OR
S301
(8W-15-20)
Z2
18
BK/OR
Z2
18
BK/OR
G301
(8W-15-20)
G301
(8W-15-20)

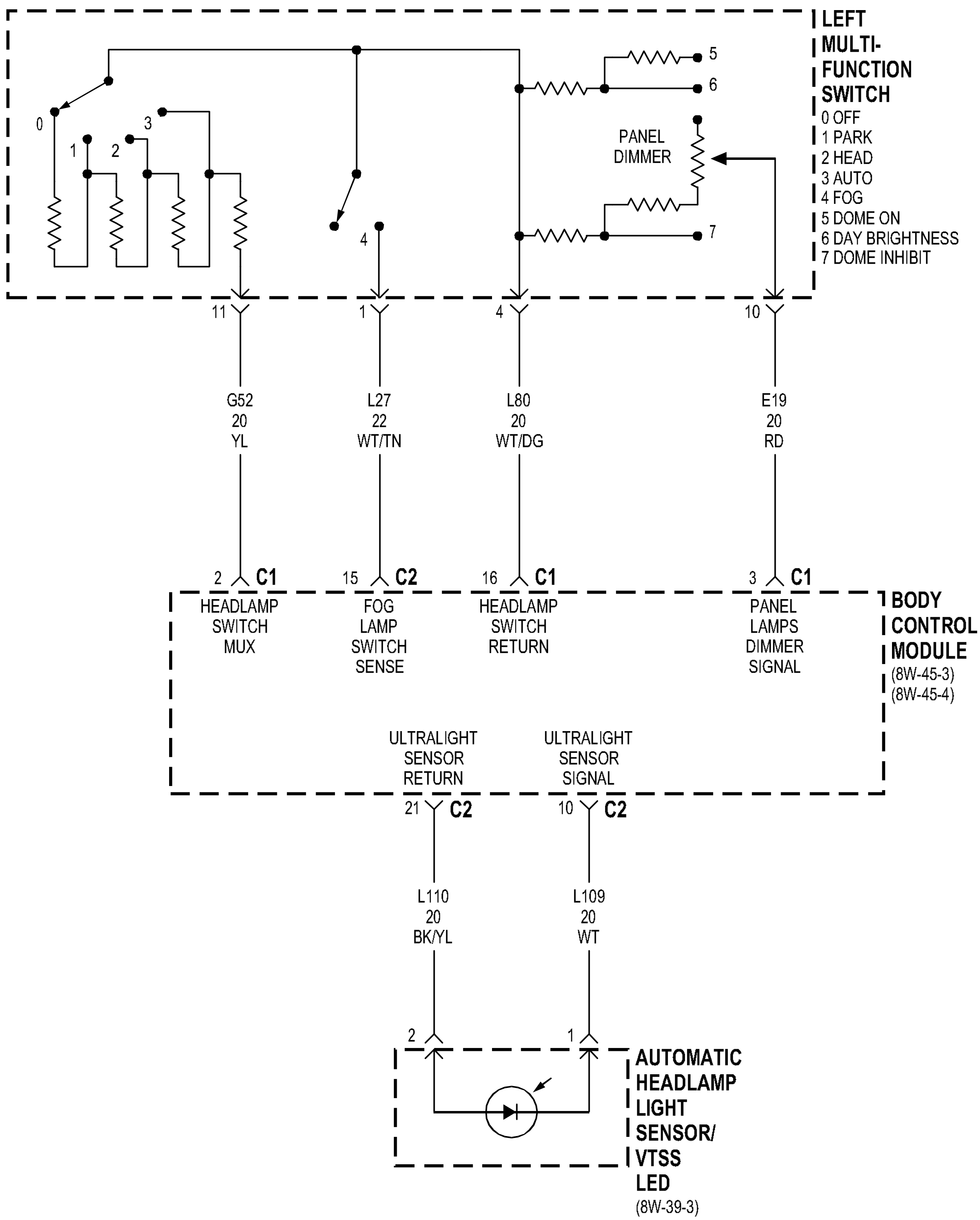
RHD


BATT A148
(8W-10-27)
ST-RUN A21
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 8 15A (8W-12-16)
FUSE 22 10A (8W-12-23)
DIAGNOSTIC JUNCTION PORT
(8W-30-31)
PCI BUS
47 C1
48 C1
1
F70 18 PK
G5 20 DB/WT
D25 20 YL/VT/BR
2
41 C301
S210
(8W-30-31)
F70 18 PK
D25 20 YL/VT/BR
S304
(8W-12-16)
G5 20 DB/WT
15 C200
F70 18 PK
D25 20 YL/VT
10
7 C309
S312
(8W-30-30)
F70 20 PK
G5 20 DB/WT
D25 20 YL/VT
S346
(8W-12-16)
S349
(8W-12-23)
1 C309
F70 20 PK
G5 20 DB/WT
D25 20 VT/YL
3
5
2
FUSED B(+)
FUSED IGNITION SWITCH OUTPUT (ST-RUN)
PCI BUS
GROUND
VEHICLE INFORMATION CENTER
4
Z2 20 BK/OR
14 C309
Z2 18 BK/OR
G301
(8W-15-21)

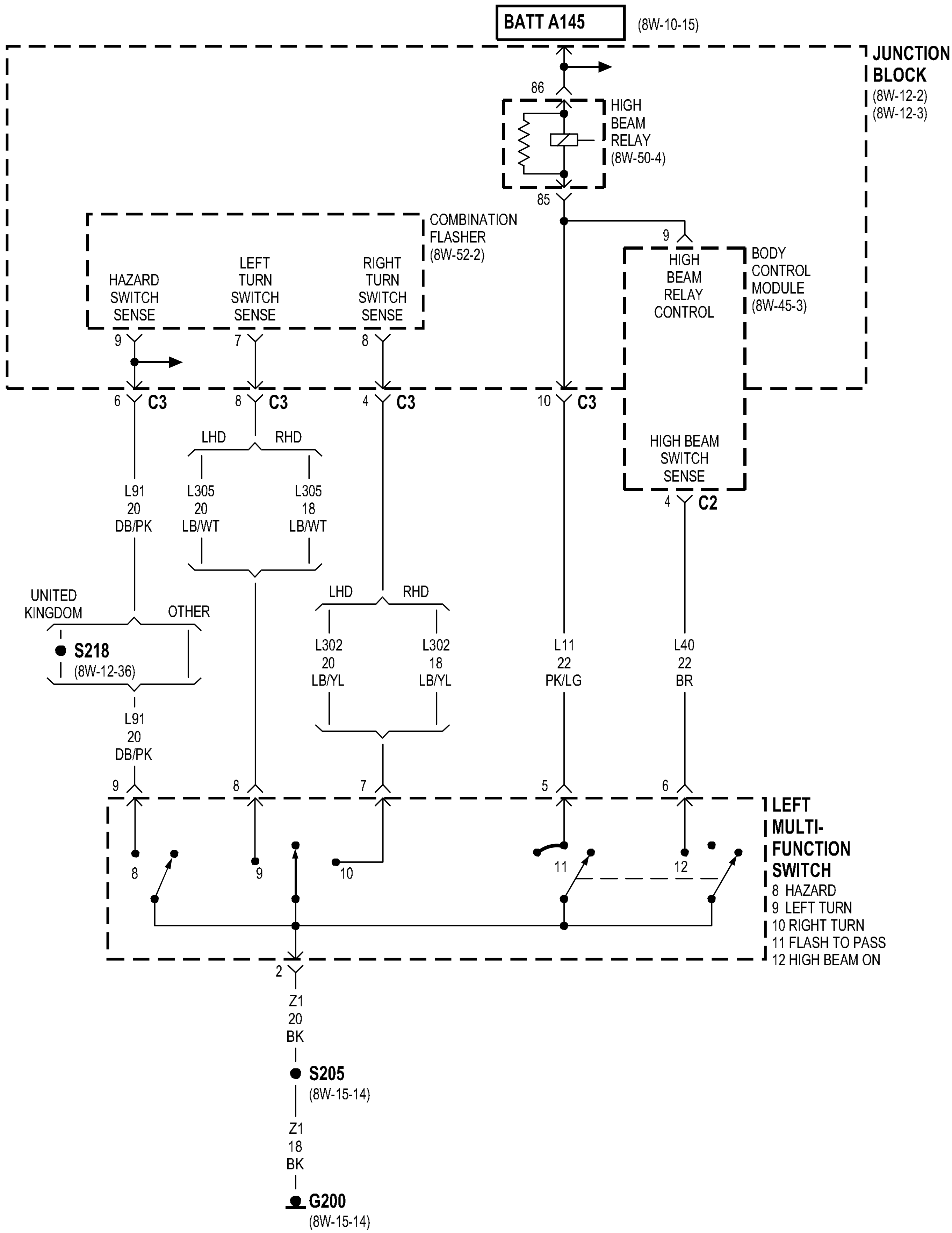

ST-RUN A21
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
22
10A
(8W-12-23)
48
C1
G5
20
DB/WT
LHD
RHD
41
C301
7
C309
S349
(8W-12-23)
POWER MIRROR B(-)
POWER MIRROR B(+)
DRIVER POWER MIRROR
(8W-62-6)
BR
BR/BK
10
7
P112
20
YL/WT
P114
20
YL/RD
C313
C302
C300
C309
1
FUSED IGNITION SWITCH OUTPUT (ST-RUN)
4
AUTO DAY NIGHT MIRROR (+)
5
AUTO DAY NIGHT MIRROR (-)
AUTOMATIC DAY/NIGHT MIRROR

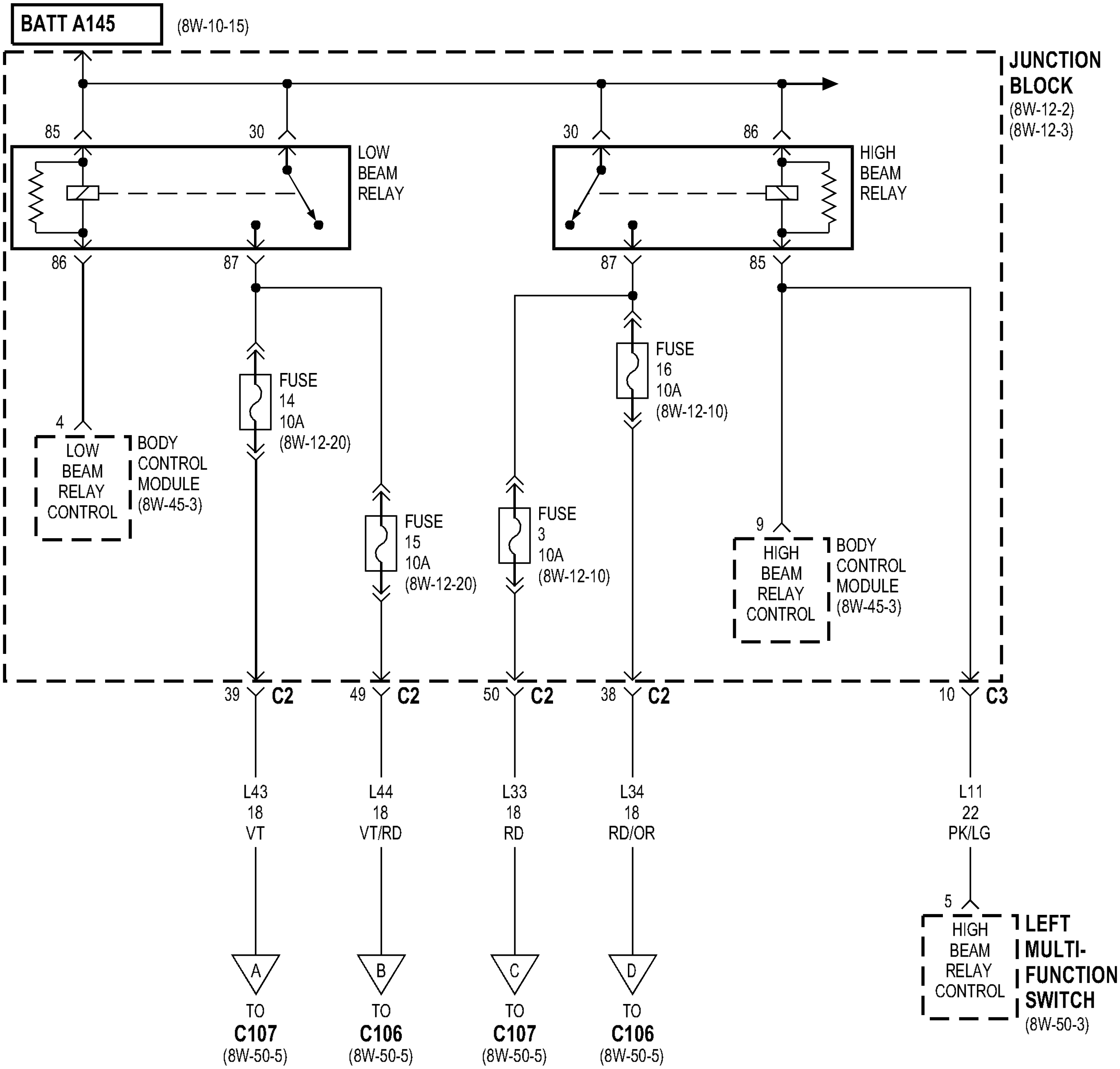

AUTOMATIC DAY/NIGHT MIRROR
GROUND
2
BACK-UP LAMP FEED
3
TRANSMISSION SOLENOID/ TRS ASSEMBLY
(8W-31-5)
BACK-UP LAMP FEED
6
PARK/ NEUTRAL POSITION SWITCH
(8W-31-6)
BACK-UP LAMP FEED
1
OTHER
SUNROOF
Z1 20 BK
Z1 20 BK
S345
(8W-15-18)
Z1 16 BK
12
C309
Z1 16 BK
S307
(8W-15-18)
LHD
RHD
Z1 10 BK
Z1 12 BK
G301
(8W-15-20)
(8W-15-21)
L1 20 VT/BK
6
C309
L1 20 VT/BK
L1 18 VT/BK
1
LEFT REAR LAMP ASSEMBLY
(8W-51-6)
(8W-51-7)
BACK-UP LAMP FEED
L1 18 VT/BK
L1 18 VT/BK
4.7L
4.0L/DIESEL
L1 18 VT/BK
6
C102
L1 18 VT/BK
GAS
DIESEL
56
C106
55
C107
L1 18 VT/BK
LHD
RHD
S328
(8W-51-6)
L1 18 VT/BK
24
C300
L1 18 VT/BK
S310
(8W-51-6)
(8W-51-7)

8W-50 FRONT LIGHTING

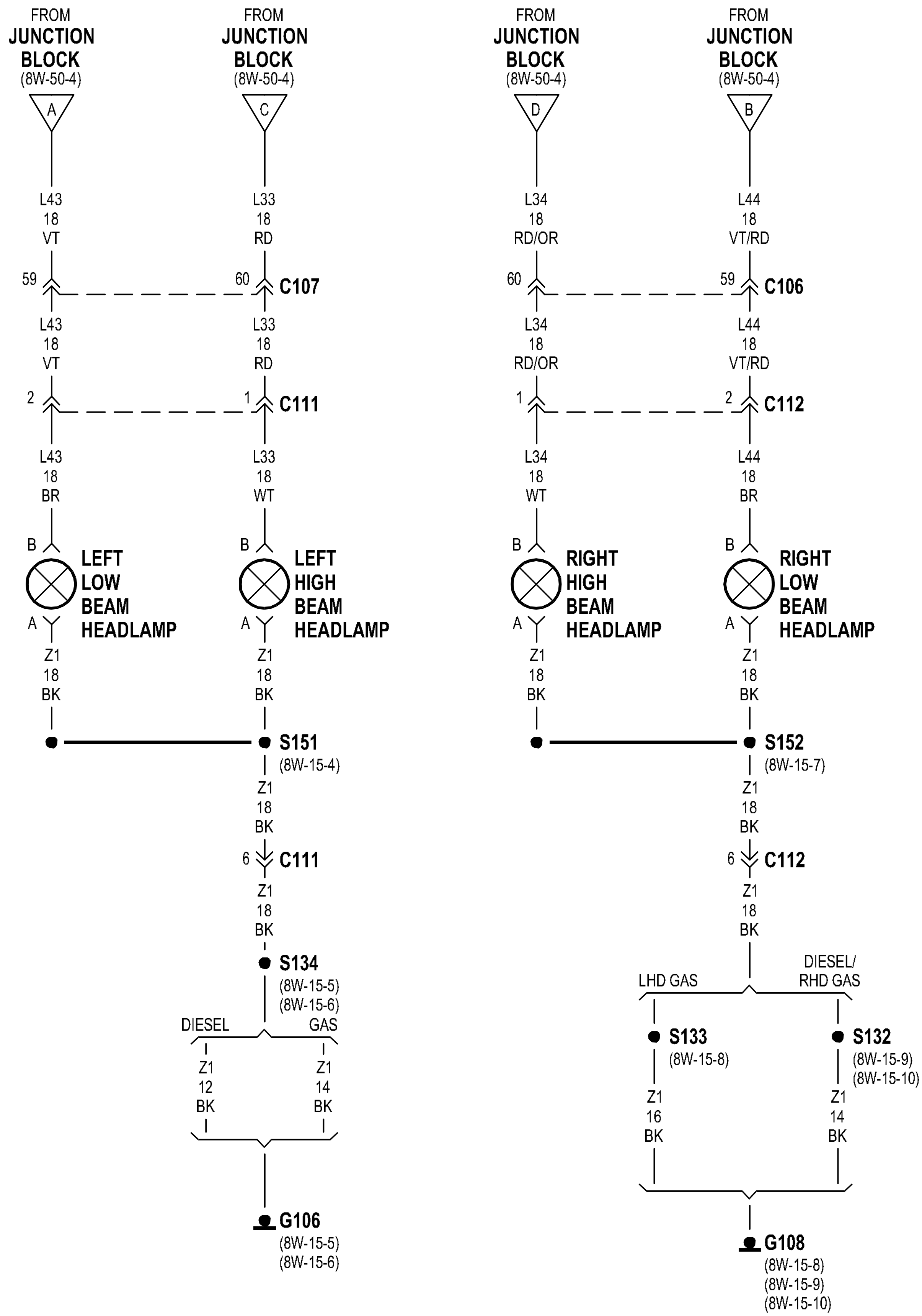


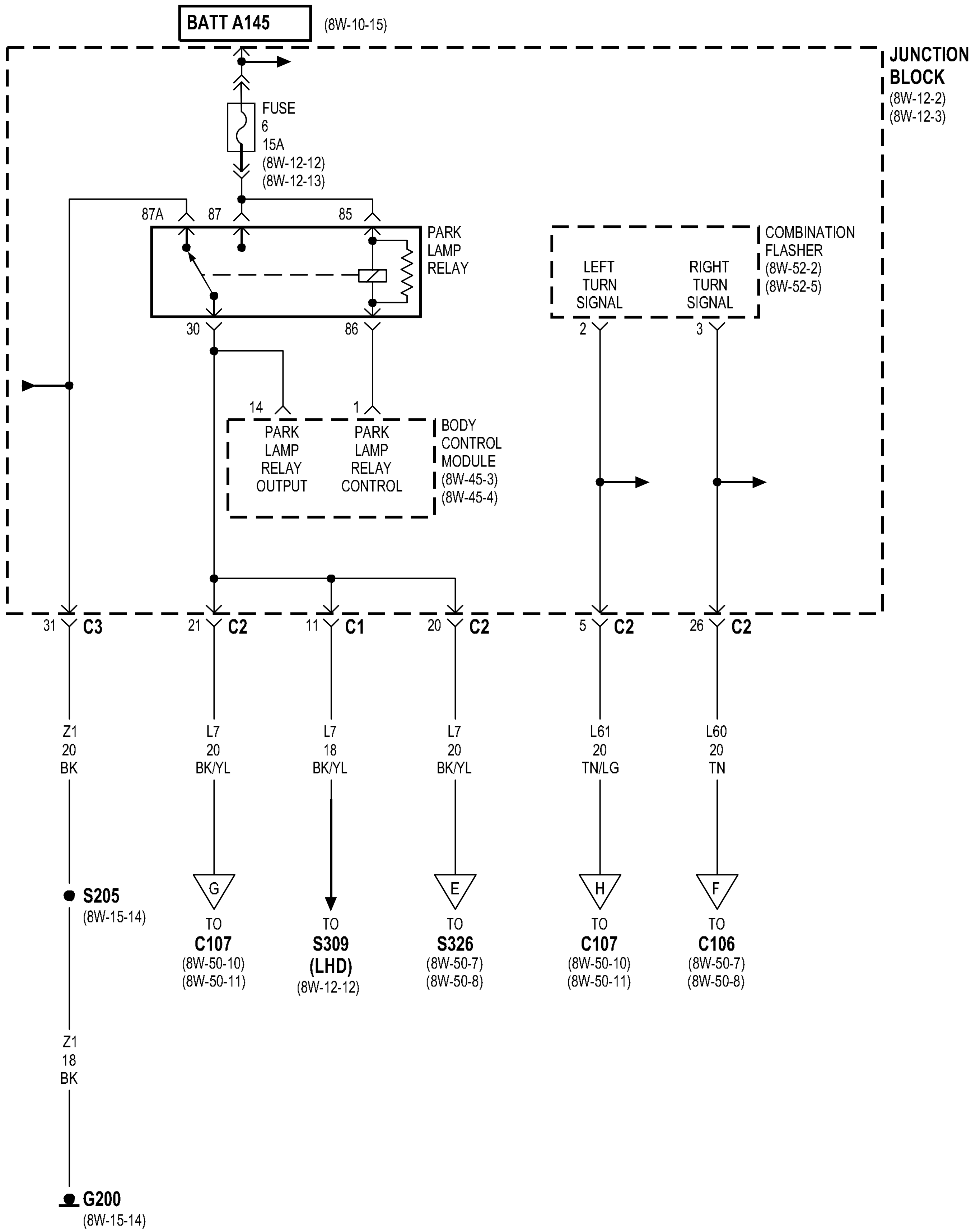
LEFT MULTI-FUNCTION SWITCH
0 OFF
1 PARK
2 HEAD
3 AUTO
4 FOG
5 DOME ON
6 DAY BRIGHTNESS
7 DOME INHIBIT
PANEL DIMMER
G52 20 YL
L27 22 WT/TN
L80 20 WT/DG
E19 20 RD
C1
C2
HEADLAMP SWITCH MUX
FOG LAMP SWITCH SENSE
HEADLAMP SWITCH RETURN
PANEL LAMPS DIMMER SIGNAL
BODY CONTROL MODULE
(8W-45-3)
(8W-45-4)
ULTRALIGHT SENSOR RETURN
ULTRALIGHT SENSOR SIGNAL
L110 20 BK/YL
L109 20 WT
AUTOMATIC HEADLAMP LIGHT SENSOR/ VTSS LED
(8W-39-3)


BATT A145
(8W-10-15)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
86
HIGH BEAM RELAY
(8W-50-4)
85
COMBINATION FLASHER
(8W-52-2)
HAZARD SWITCH SENSE
LEFT TURN SWITCH SENSE
RIGHT TURN SWITCH SENSE
9
HIGH BEAM RELAY CONTROL
BODY CONTROL MODULE
(8W-45-3)
9 7 8
6 C3
8 C3
4 C3
10 C3
LHD RHD
HIGH BEAM SWITCH SENSE
4 C2
L91 20 DB/PK
L305 20 LB/WT
L305 18 LB/WT
UNITED KINGDOM
OTHER
S218
(8W-12-36)
LHD RHD
L302 20 LB/YL
L302 18 LB/YL
L11 22 PK/LG
L40 22 BR
L91 20 DB/PK
9 8 7 5 6
LEFT MULTI-FUNCTION SWITCH
8 HAZARD
9 LEFT TURN
10 RIGHT TURN
11 FLASH TO PASS
12 HIGH BEAM ON
8 9 10 11 12
2
Z1 20 BK
S205
(8W-15-14)
Z1 18 BK
G200
(8W-15-14)

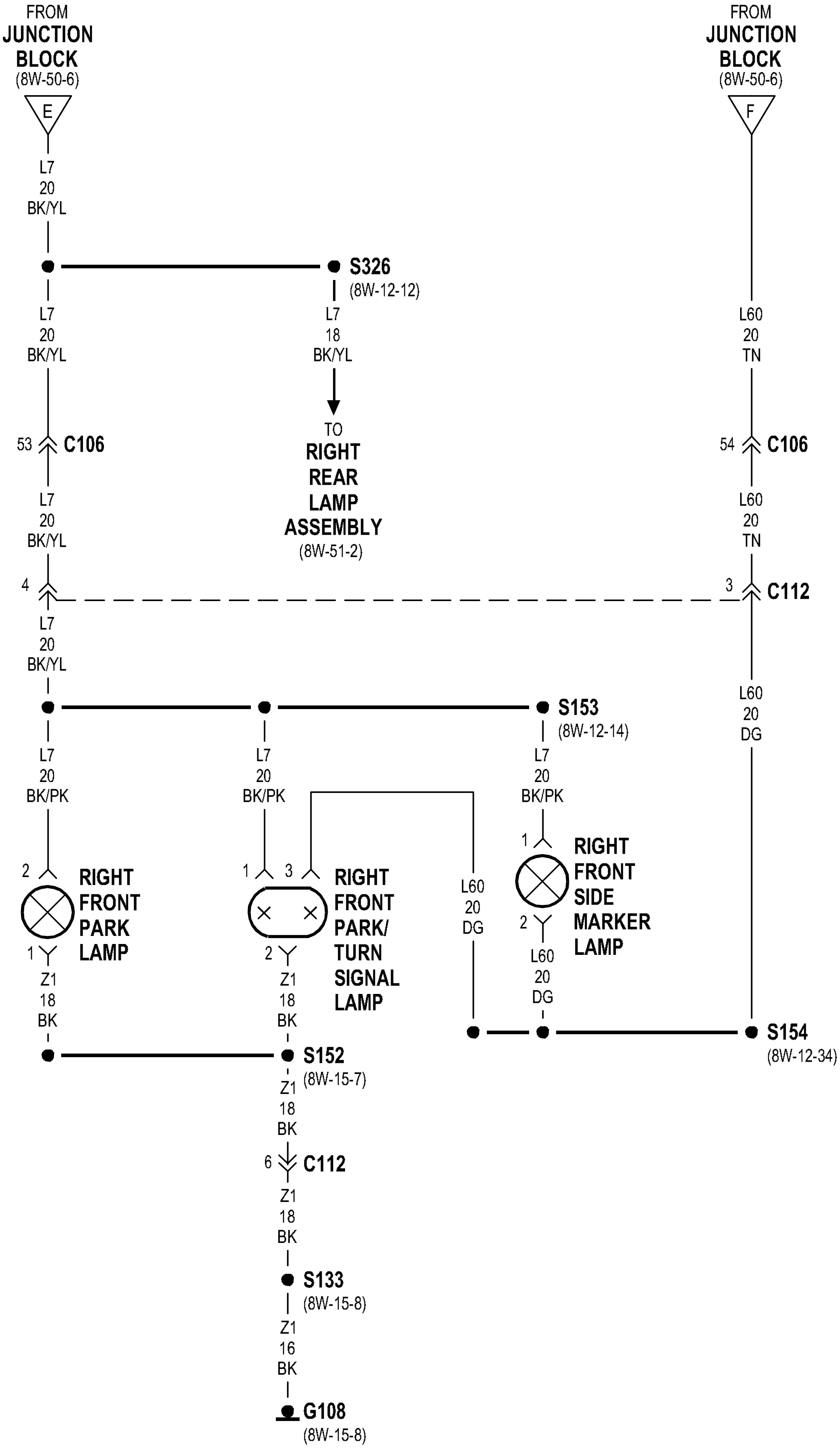


BATT A145
(8W-10-15)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
85
30
LOW BEAM RELAY
30
86
HIGH BEAM RELAY
86
87
87
85
FUSE 14 10A (8W-12-20)
FUSE 16 10A (8W-12-10)
FUSE 15 10A (8W-12-20)
FUSE 3 10A (8W-12-10)
4
LOW BEAM RELAY CONTROL
BODY CONTROL MODULE (8W-45-3)
9
HIGH BEAM RELAY CONTROL
BODY CONTROL MODULE (8W-45-3)
39 C2
49 C2
50 C2
38 C2
10 C3
L43 18 VT
L44 18 VT/RD
L33 18 RD
L34 18 RD/OR
L11 22 PK/LG
A
B
C
D
TO C107 (8W-50-5)
TO C106 (8W-50-5)
TO C107 (8W-50-5)
TO C106 (8W-50-5)
5
HIGH BEAM RELAY CONTROL
LEFT MULTI-FUNCTION SWITCH
(8W-50-3)

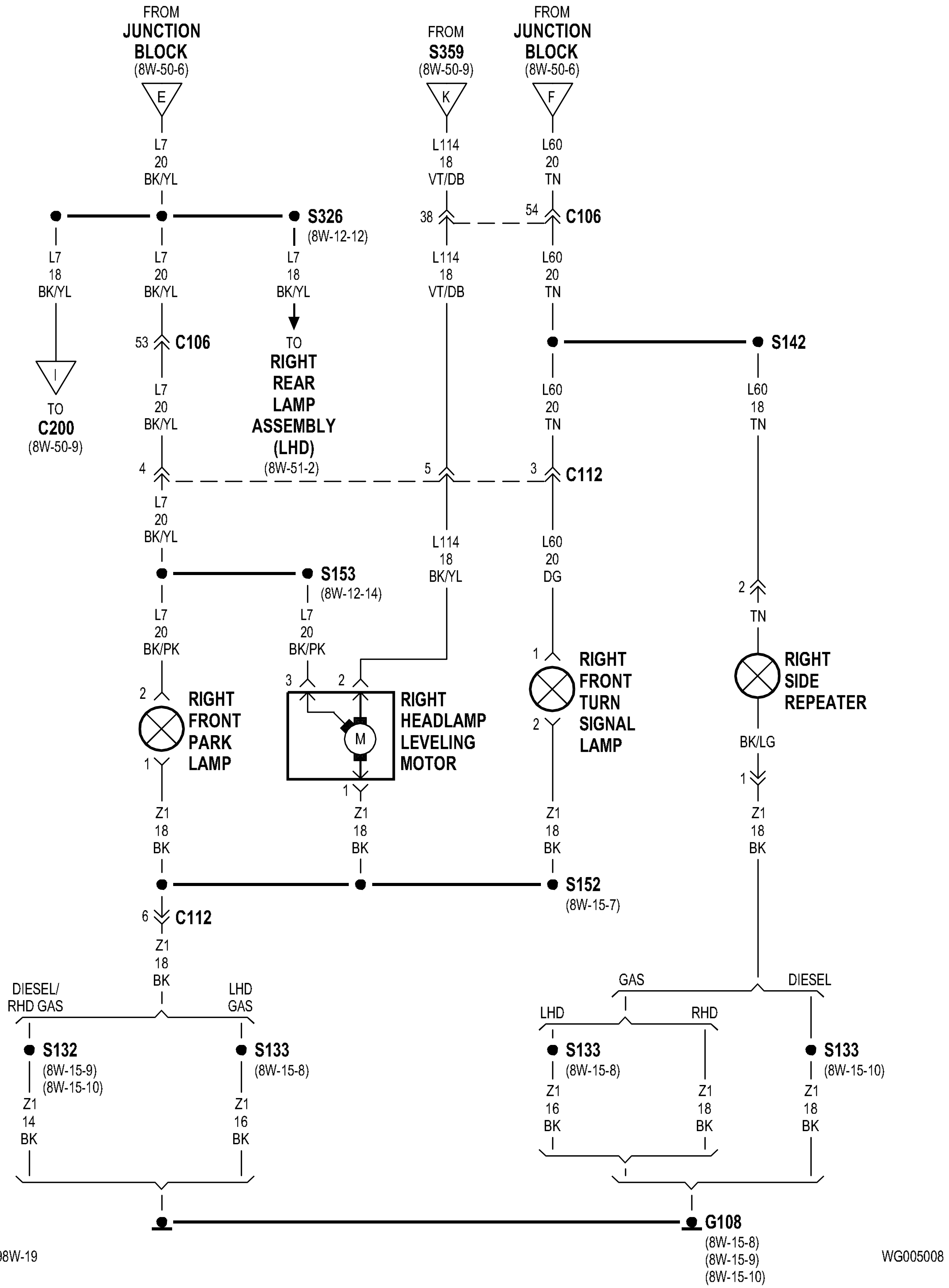

FROM
JUNCTION BLOCK
(8W-50-4)
A
C
D
B
L43
18
VT
L33
18
RD
L34
18
RD/OR
L44
18
VT/RD
59
60
C107
60
59
C106
L43
18
BR
L33
18
WT
L34
18
WT
L44
18
BR
2
1
C111
1
2
C112
LEFT LOW BEAM HEADLAMP
LEFT HIGH BEAM HEADLAMP
RIGHT HIGH BEAM HEADLAMP
RIGHT LOW BEAM HEADLAMP
B
A
Z1
18
BK
S151
(8W-15-4)
S152
(8W-15-7)
6
C111
6
C112
S134
(8W-15-5)
(8W-15-6)
DIESEL
GAS
Z1
12
BK
Z1
14
BK
G106
(8W-15-5)
(8W-15-6)
LHD GAS
DIESEL/
RHD GAS
S133
(8W-15-8)
S132
(8W-15-9)
(8W-15-10)
Z1
16
BK
Z1
14
BK
G108
(8W-15-8)
(8W-15-9)
(8W-15-10)

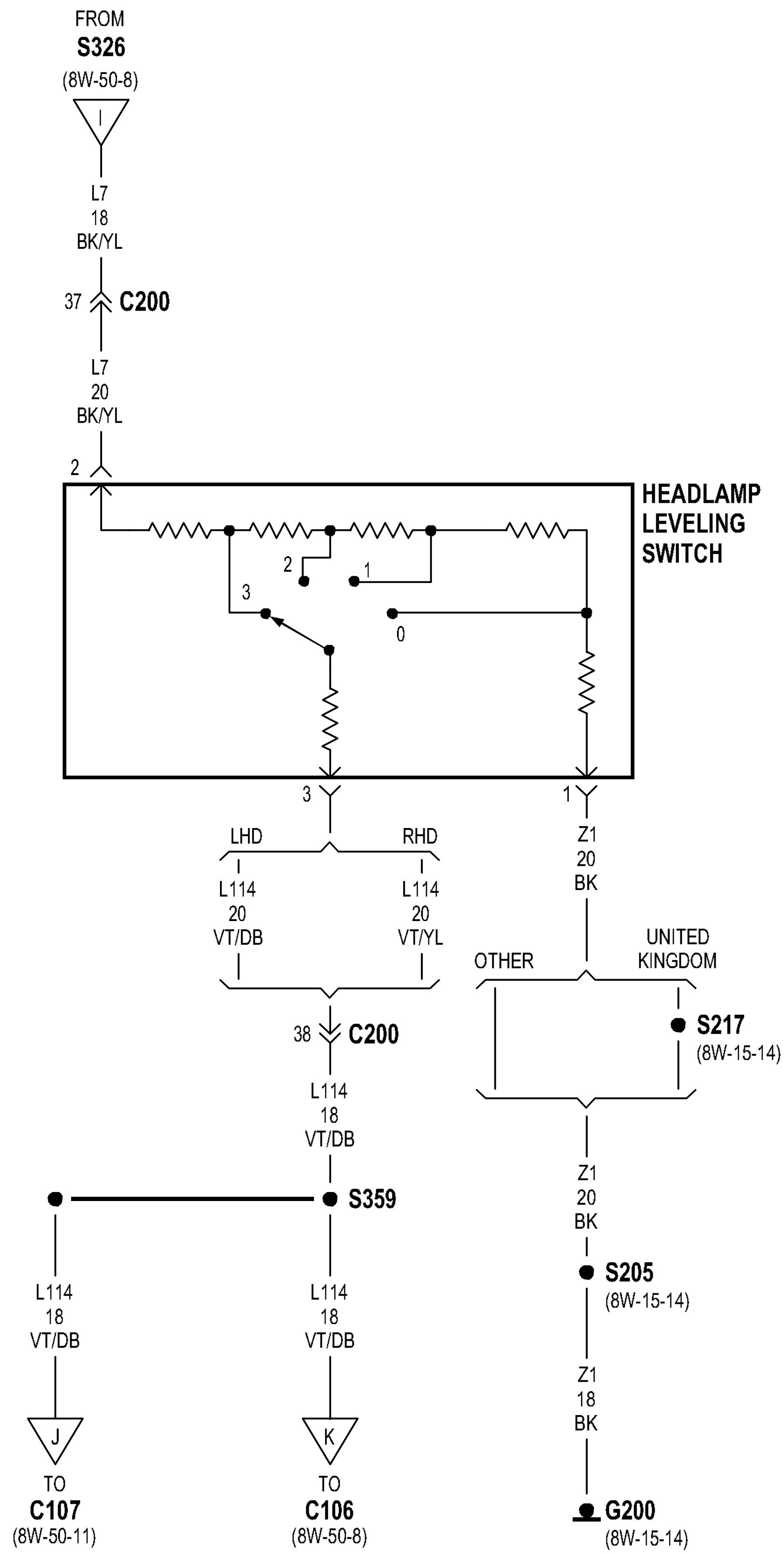


BATT A145
(8W-10-15)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
6
15A
(8W-12-12)
(8W-12-13)
87A
87
85
PARK LAMP RELAY
30
86
COMBINATION FLASHER
(8W-52-2)
(8W-52-5)
LEFT TURN SIGNAL
RIGHT TURN SIGNAL
2
3
14
1
PARK LAMP RELAY OUTPUT
PARK LAMP RELAY CONTROL
BODY CONTROL MODULE
(8W-45-3)
(8W-45-4)
31 C3
21 C2
11 C1
20 C2
5 C2
26 C2
Z1 20 BK
L7 20 BK/YL
L7 18 BK/YL
L7 20 BK/YL
L61 20 TN/LG
L60 20 TN
S205
(8W-15-14)
G
TO C107
(8W-50-10)
(8W-50-11)
TO S309 (LHD)
(8W-12-12)
E
TO S326
(8W-50-7)
(8W-50-8)
H
TO C107
(8W-50-10)
(8W-50-11)
F
TO C106
(8W-50-7)
(8W-50-8)
Z1 18 BK
G200
(8W-15-14)

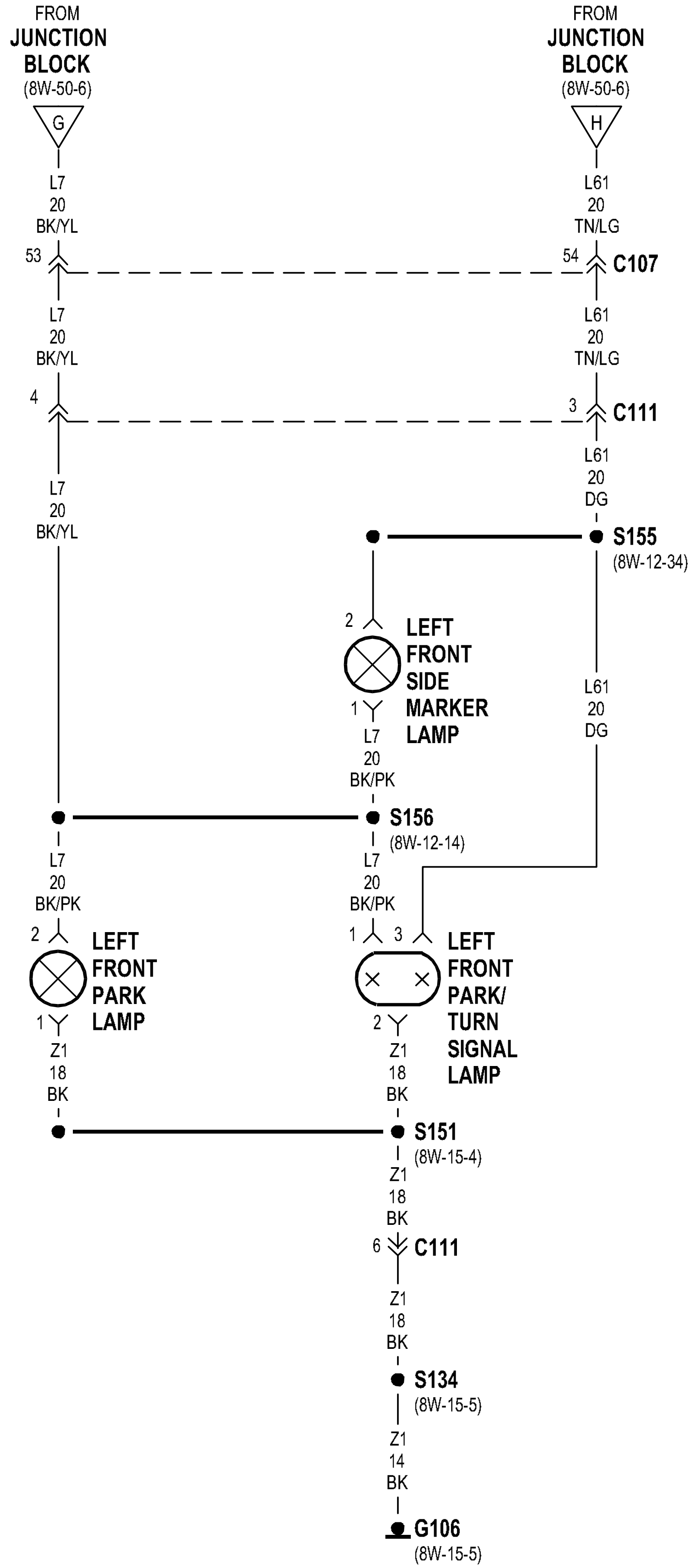

FROM
JUNCTION
BLOCK
(8W-50-6)
E
FROM
JUNCTION
BLOCK
(8W-50-6)
F
L7
20
BK/YL
S326
(8W-12-12)
L7
18
BK/YL
TO
RIGHT
REAR
LAMP
ASSEMBLY
(8W-51-2)
L60
20
TN
53
C106
54
C106
4
3
C112
L60
20
DG
S153
(8W-12-14)
L7
20
BK/PK
2
RIGHT
FRONT
PARK
LAMP
1
3
RIGHT
FRONT
PARK/
TURN
SIGNAL
LAMP
RIGHT
FRONT
SIDE
MARKER
LAMP
Z1
18
BK
S152
(8W-15-7)
S154
(8W-12-34)
6
C112
S133
(8W-15-8)
Z1
16
BK
G108
(8W-15-8)

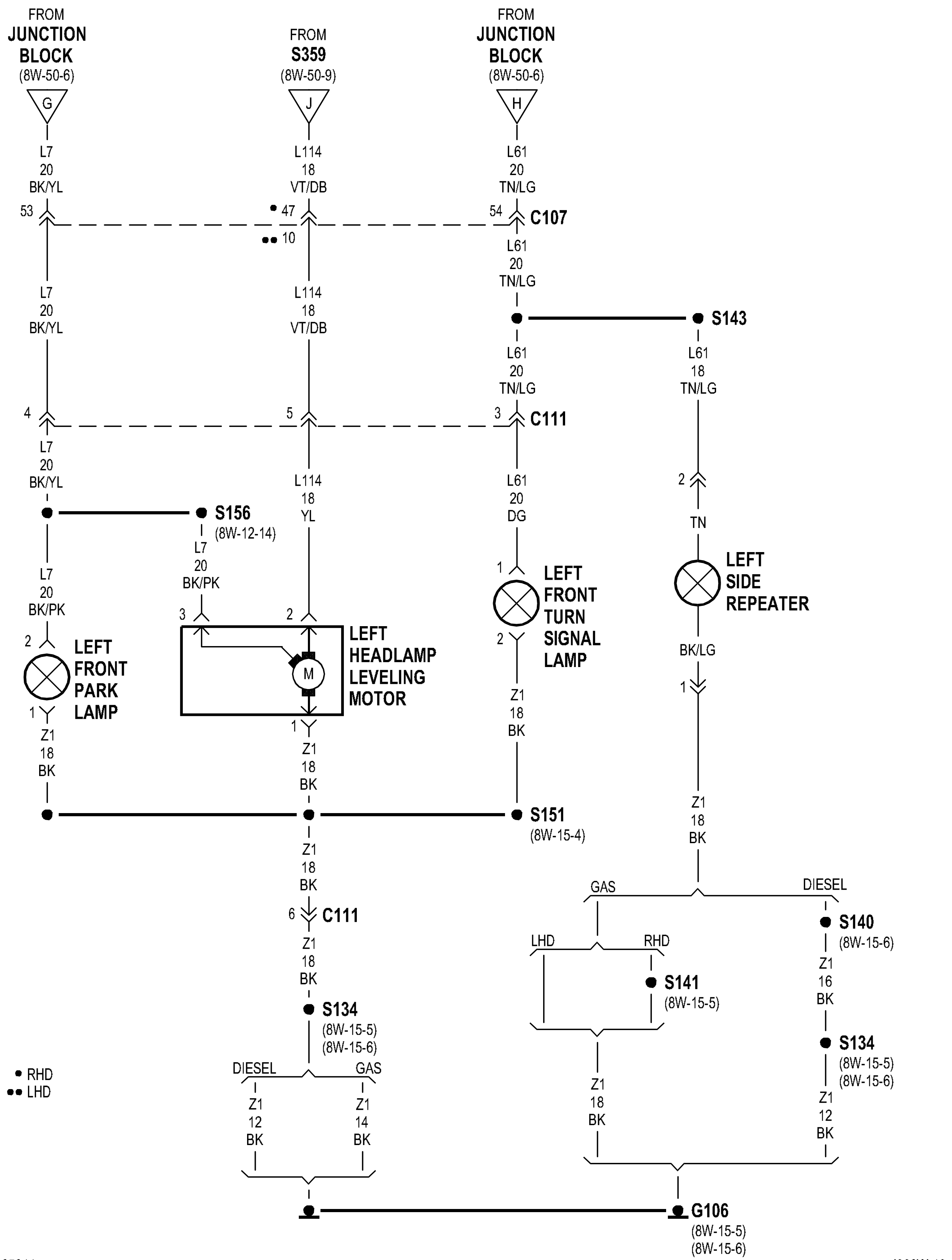
BUILT-UP-EXPORT



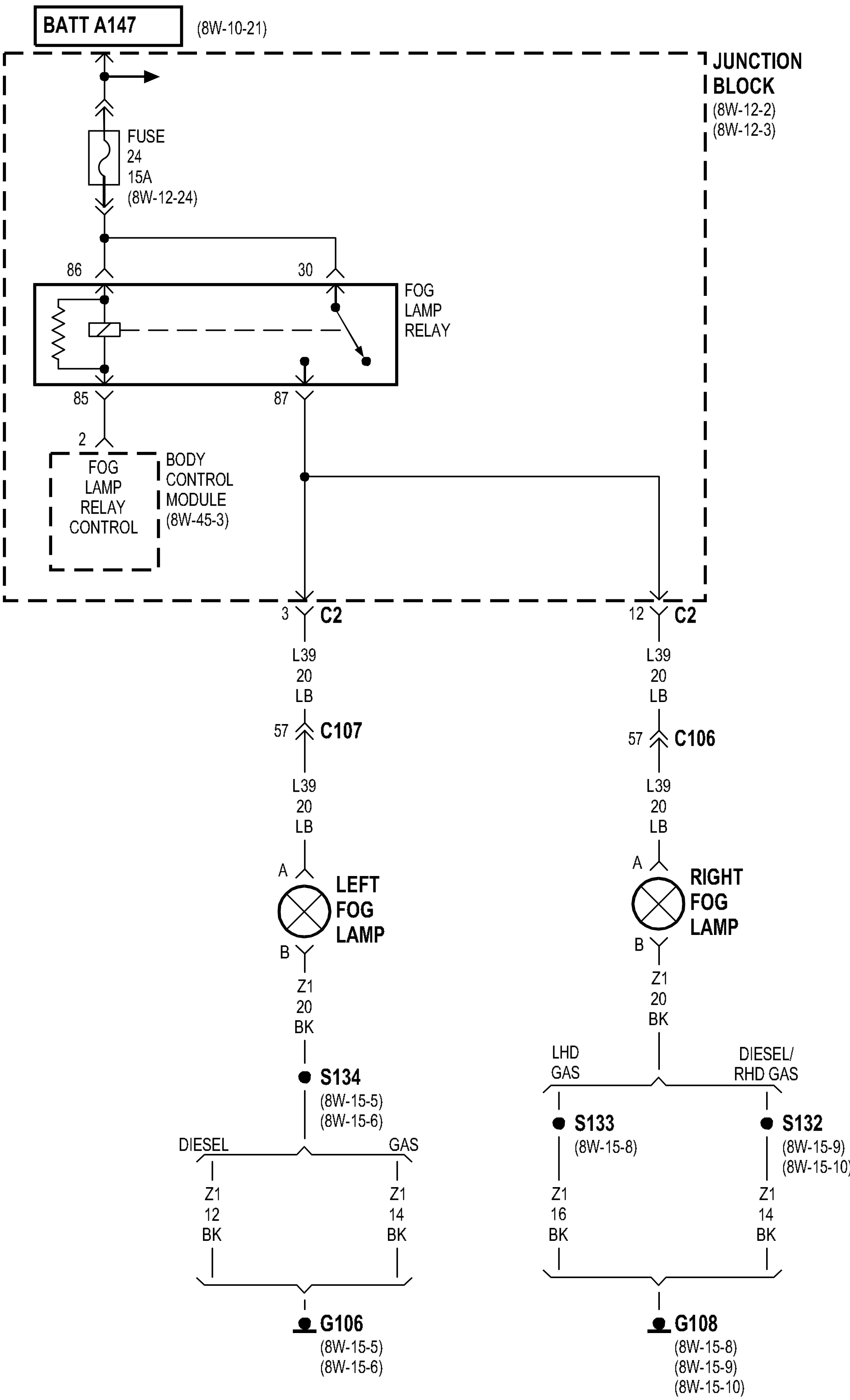

FROM
S326
(8W-50-8)
I
L7
18
BK/YL
37
C200
L7
20
BK/YL
2
HEADLAMP LEVELING SWITCH
2
1
3
0
3
1
LHD
RHD
L114
20
VT/DB
L114
20
VT/YL
Z1
20
BK
OTHER
UNITED KINGDOM
S217
(8W-15-14)
38
C200
L114
18
VT/DB
S359
Z1
20
BK
S205
(8W-15-14)
L114
18
VT/DB
L114
18
VT/DB
Z1
18
BK
J
K
TO
C107
(8W-50-11)
TO
C106
(8W-50-8)
G200
(8W-15-14)

EXCEPT BUILT-UP-EXPORT

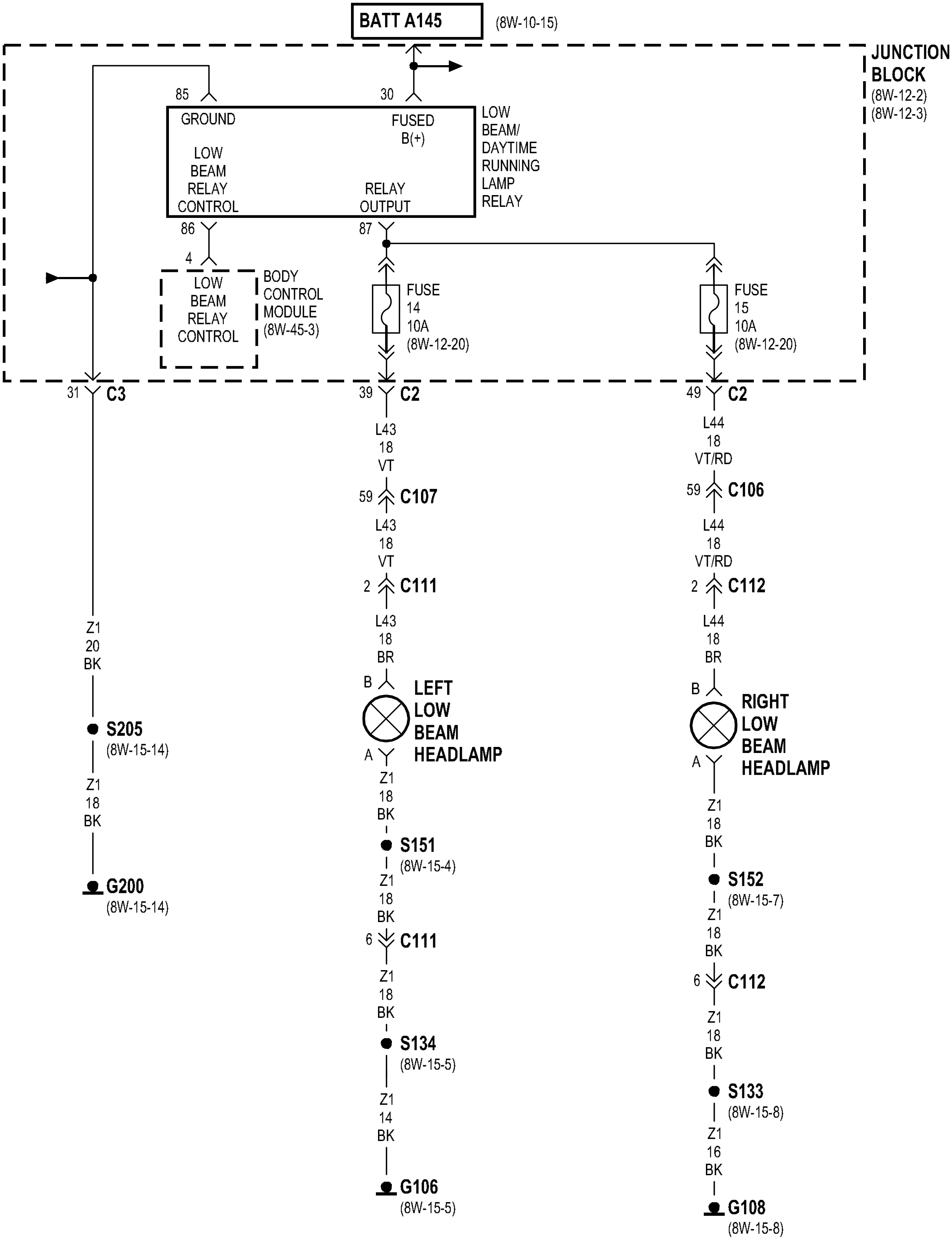



FROM
JUNCTION
BLOCK
(8W-50-6)
G
FROM
S359
(8W-50-9)
J
FROM
JUNCTION
BLOCK
(8W-50-6)
H
L7
20
BK/YL
L114
18
VT/DB
L61
20
TN/LG
53
47
54
C107
10
L61
20
TN/LG
L7
20
BK/YL
L114
18
VT/DB
S143
L61
20
TN/LG
L61
18
TN/LG
4
5
3
C111
L7
20
BK/YL
L114
18
YL
L61
20
DG
2
S156
(8W-12-14)
TN
L7
20
BK/PK
1
LEFT
FRONT
TURN
SIGNAL
LAMP
LEFT
SIDE
REPEATER
L7
20
BK/PK
3
2
LEFT
HEADLAMP
LEVELING
MOTOR
M
2
BK/LG
2
LEFT
FRONT
PARK
LAMP
1
1
Z1
18
BK
1
Z1
18
BK
Z1
18
BK
Z1
18
BK
S151
(8W-15-4)
Z1
18
BK
Z1
18
BK
GAS
DIESEL
6
C111
S140
(8W-15-6)
LHD
RHD
Z1
18
BK
S141
(8W-15-5)
Z1
16
BK
S134
(8W-15-5)
(8W-15-6)
S134
(8W-15-5)
(8W-15-6)
RHD
LHD
DIESEL
GAS
Z1
18
BK
Z1
12
BK
Z1
12
BK
Z1
14
BK
G106
(8W-15-5)
(8W-15-6)

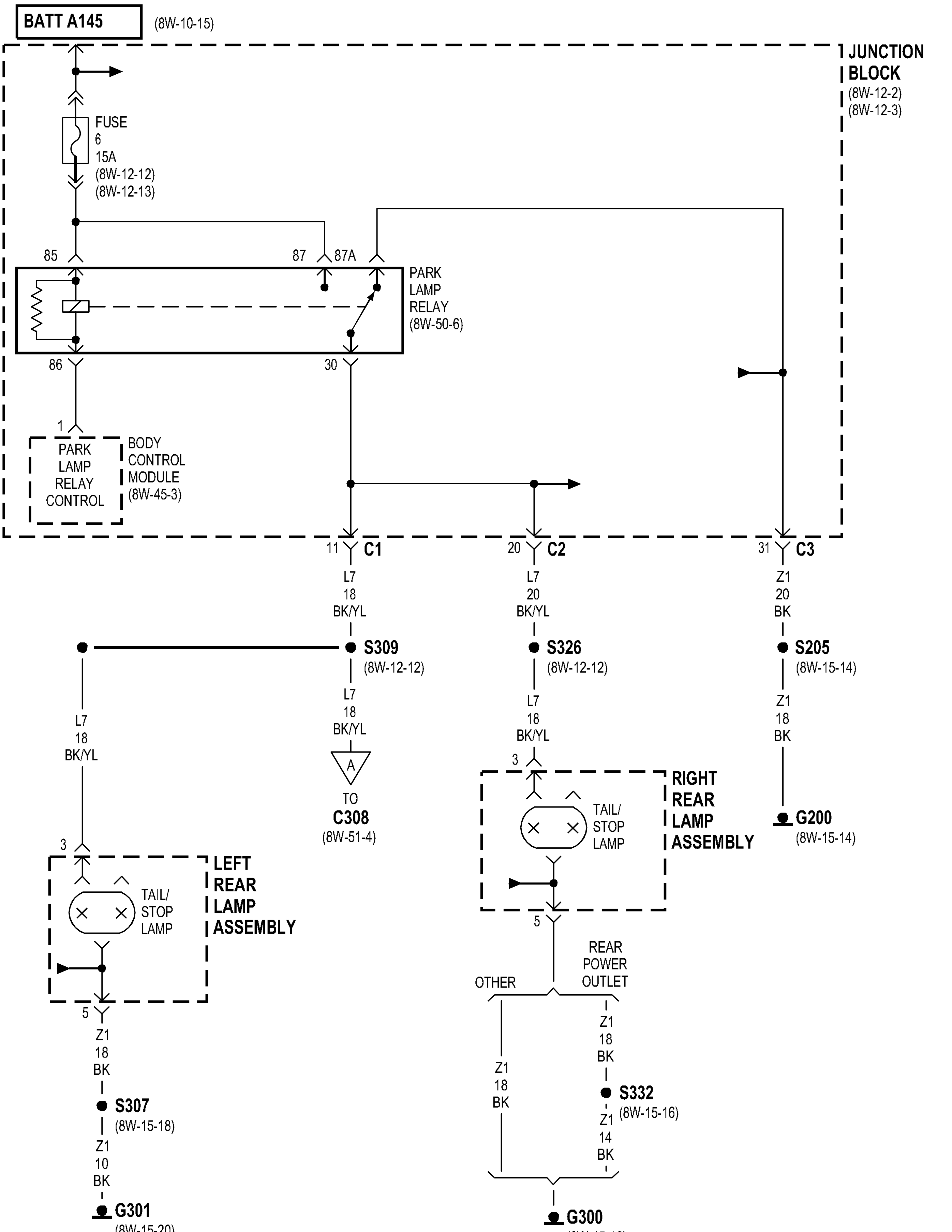
FOG LAMPS

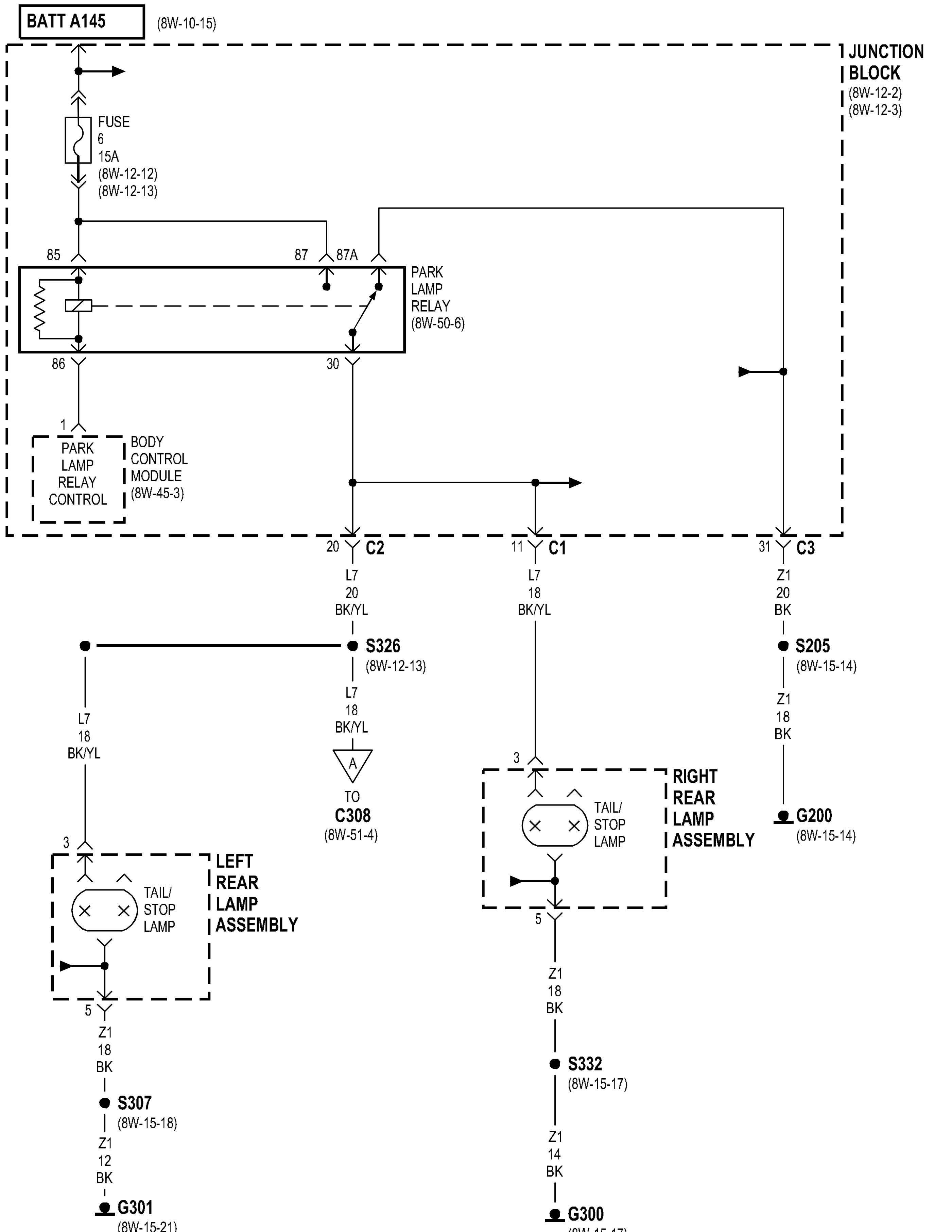

BATT A147
(8W-10-21)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
24
15A
(8W-12-24)
86
30
FOG
LAMP
RELAY
85
87
2
FOG
LAMP
RELAY
CONTROL
BODY
CONTROL
MODULE
(8W-45-3)
3
C2
12
C2
L39
20
LB
57
C107
57
C106
L39
20
LB
A
LEFT
FOG
LAMP
B
A
RIGHT
FOG
LAMP
B
Z1
20
BK
S134
(8W-15-5)
(8W-15-6)
DIESEL
GAS
Z1
12
BK
Z1
14
BK
G106
(8W-15-5)
(8W-15-6)
LHD
GAS
DIESEL/
RHD GAS
S133
(8W-15-8)
S132
(8W-15-9)
(8W-15-10)
Z1
16
BK
Z1
14
BK
G108
(8W-15-8)
(8W-15-9)
(8W-15-10)

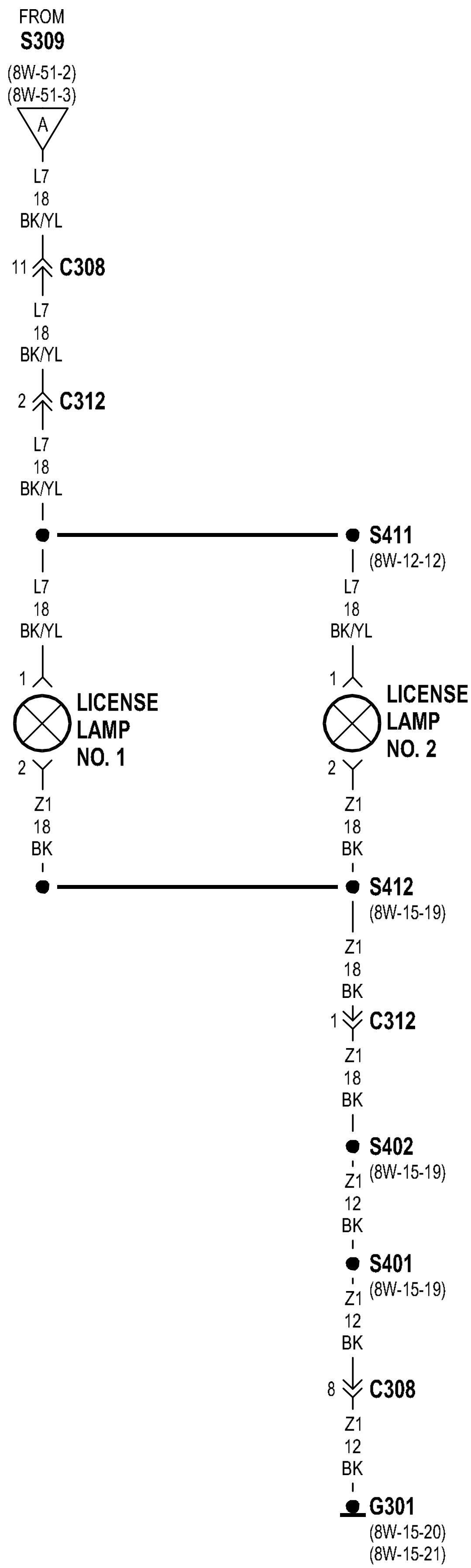
DRL

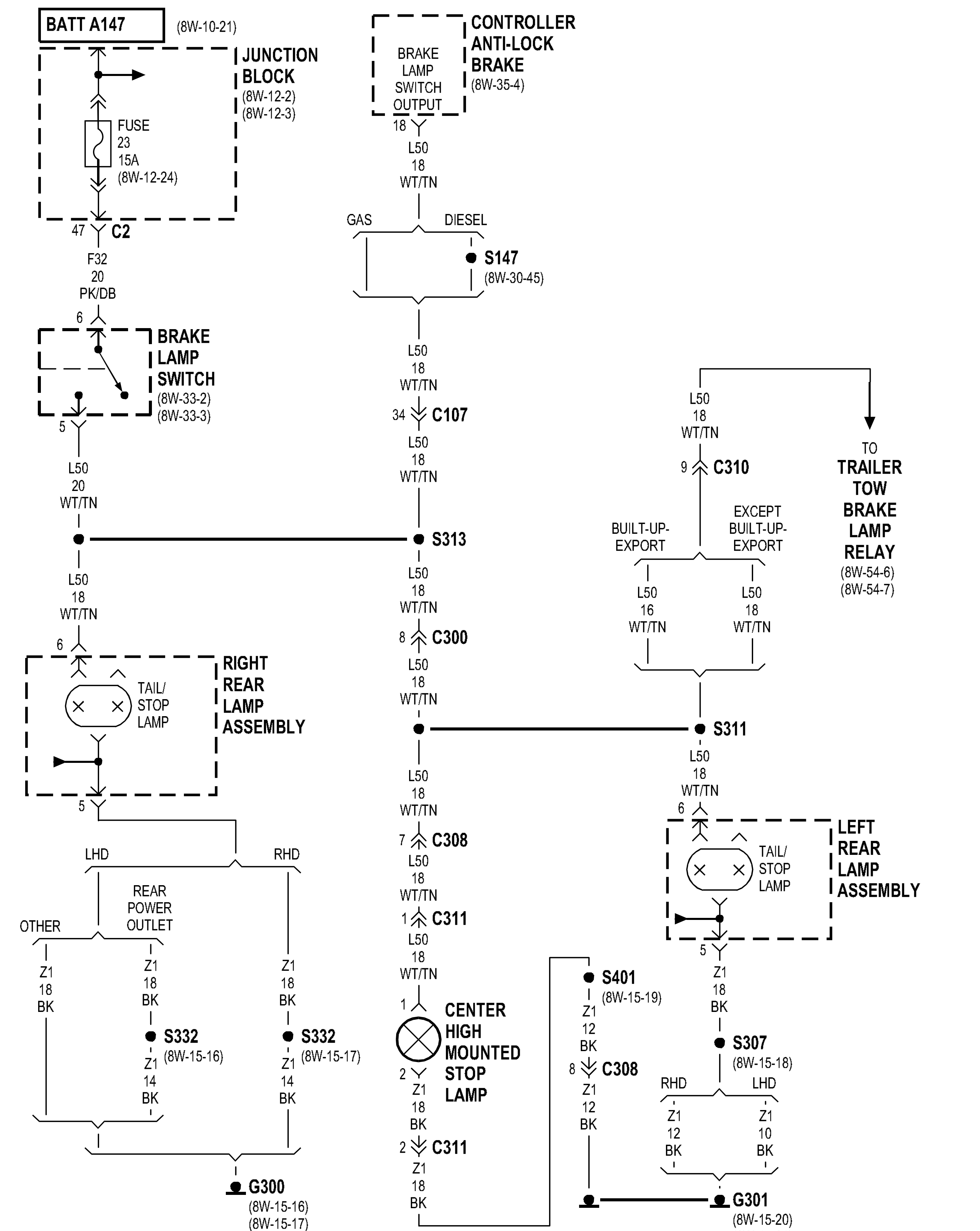

BATT A145
(8W-10-15)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
85
30
GROUND
FUSED B(+)
LOW BEAM RELAY CONTROL
RELAY OUTPUT
LOW BEAM/ DAYTIME RUNNING LAMP RELAY
86
87
4
LOW BEAM RELAY CONTROL
BODY CONTROL MODULE
(8W-45-3)
FUSE 14 10A
(8W-12-20)
FUSE 15 10A
(8W-12-20)
31 C3
39 C2
49 C2
L43 18 VT
L44 18 VT/RD
59 C107
59 C106
L43 18 VT
L44 18 VT/RD
2 C111
2 C112
L43 18 BR
L44 18 BR
Z1 20 BK
B
LEFT LOW BEAM HEADLAMP
A
B
RIGHT LOW BEAM HEADLAMP
A
S205
(8W-15-14)
Z1 18 BK
G200
(8W-15-14)
Z1 18 BK
S151
(8W-15-4)
Z1 18 BK
6 C111
Z1 18 BK
S134
(8W-15-5)
Z1 14 BK
G106
(8W-15-5)
Z1 18 BK
S152
(8W-15-7)
Z1 18 BK
6 C112
Z1 18 BK
S133
(8W-15-8)
Z1 16 BK
G108
(8W-15-8)

8W-51 REAR LIGHTING

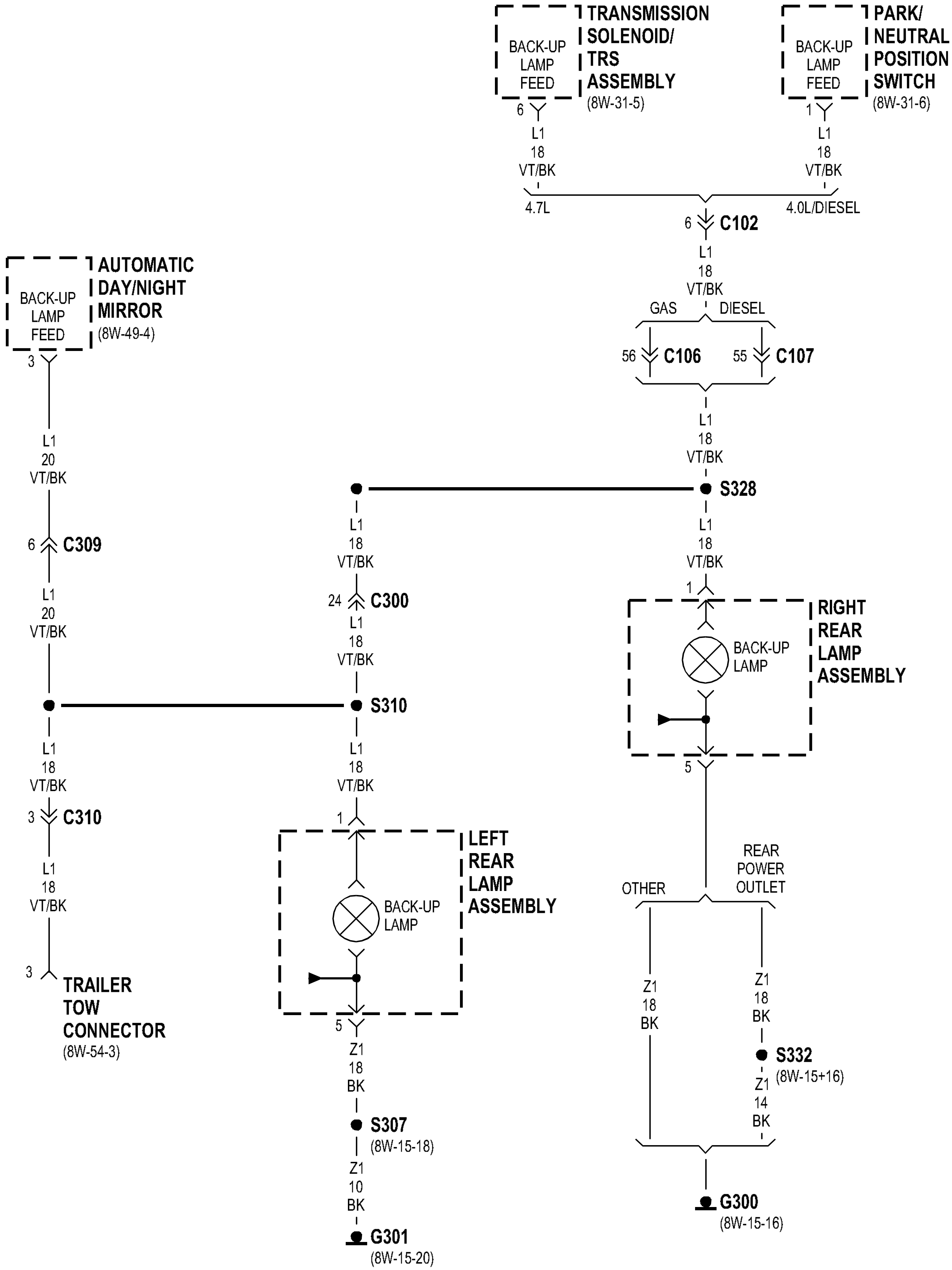

BATT A145
(8W-10-15)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
6
15A
(8W-12-12)
(8W-12-13)
85
87
87A
PARK LAMP RELAY
(8W-50-6)
86
30
1
PARK LAMP RELAY CONTROL
BODY CONTROL MODULE
(8W-45-3)
11
C1
20
C2
31
C3
L7
18
BK/YL
L7
20
BK/YL
Z1
20
BK
S309
(8W-12-12)
S326
(8W-12-12)
S205
(8W-15-14)
L7
18
BK/YL
L7
18
BK/YL
Z1
18
BK
L7
18
BK/YL
A
TO
C308
(8W-51-4)
3
RIGHT REAR LAMP ASSEMBLY
TAIL/ STOP LAMP
G200
(8W-15-14)
3
LEFT REAR LAMP ASSEMBLY
TAIL/ STOP LAMP
5
REAR POWER OUTLET
OTHER
5
Z1
18
BK
Z1
18
BK
Z1
18
BK
S307
(8W-15-18)
S332
(8W-15-16)
Z1
14
BK
Z1
10
BK
G301
(8W-15-20)
G300
(8W-15-16)


BATT A145
(8W-10-15)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
6
15A
(8W-12-12)
(8W-12-13)
85
87
87A
PARK LAMP RELAY
(8W-50-6)
86
30
1
PARK LAMP RELAY CONTROL
BODY CONTROL MODULE
(8W-45-3)
20
C2
11
C1
31
C3
L7
20
BK/YL
L7
18
BK/YL
Z1
20
BK
S326
(8W-12-13)
S205
(8W-15-14)
L7
18
BK/YL
L7
18
BK/YL
Z1
18
BK
A
TO
C308
(8W-51-4)
3
RIGHT REAR LAMP ASSEMBLY
TAIL/ STOP LAMP
G200
(8W-15-14)
3
LEFT REAR LAMP ASSEMBLY
TAIL/ STOP LAMP
5
5
Z1
18
BK
Z1
18
BK
S332
(8W-15-17)
S307
(8W-15-18)
Z1
14
BK
Z1
12
BK
G301
(8W-15-21)
G300
(8W-15-17)

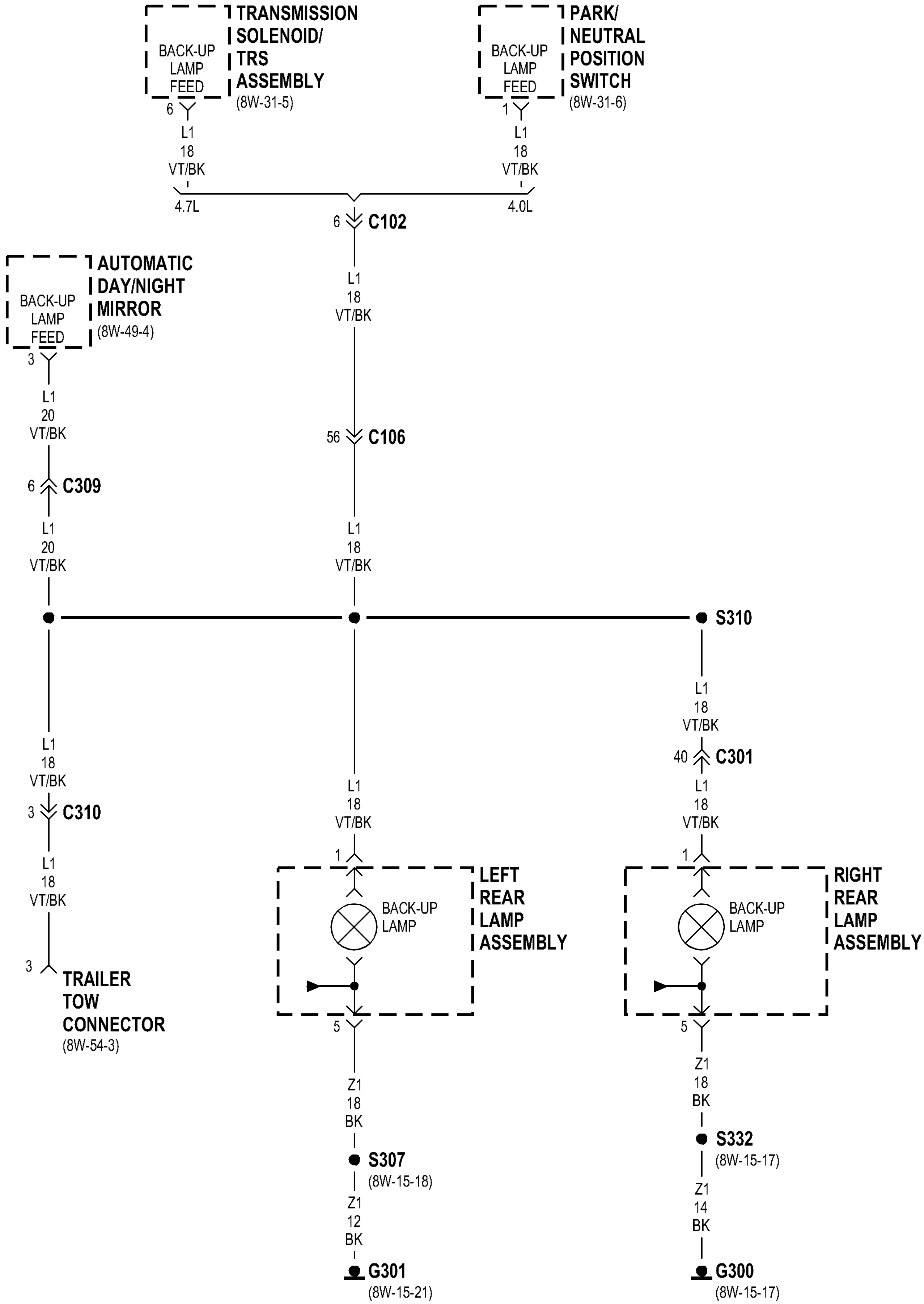

FROM
S309
(8W-51-2)
(8W-51-3)
A
L7
18
BK/YL
11
C308
L7
18
BK/YL
2
C312
L7
18
BK/YL
S411
(8W-12-12)
L7
18
BK/YL
L7
18
BK/YL
1
LICENSE
LAMP
NO. 1
2
1
LICENSE
LAMP
NO. 2
2
Z1
18
BK
Z1
18
BK
S412
(8W-15-19)
Z1
18
BK
1
C312
Z1
18
BK
S402
(8W-15-19)
Z1
12
BK
S401
(8W-15-19)
Z1
12
BK
8
C308
Z1
12
BK
G301
(8W-15-20)
(8W-15-21)



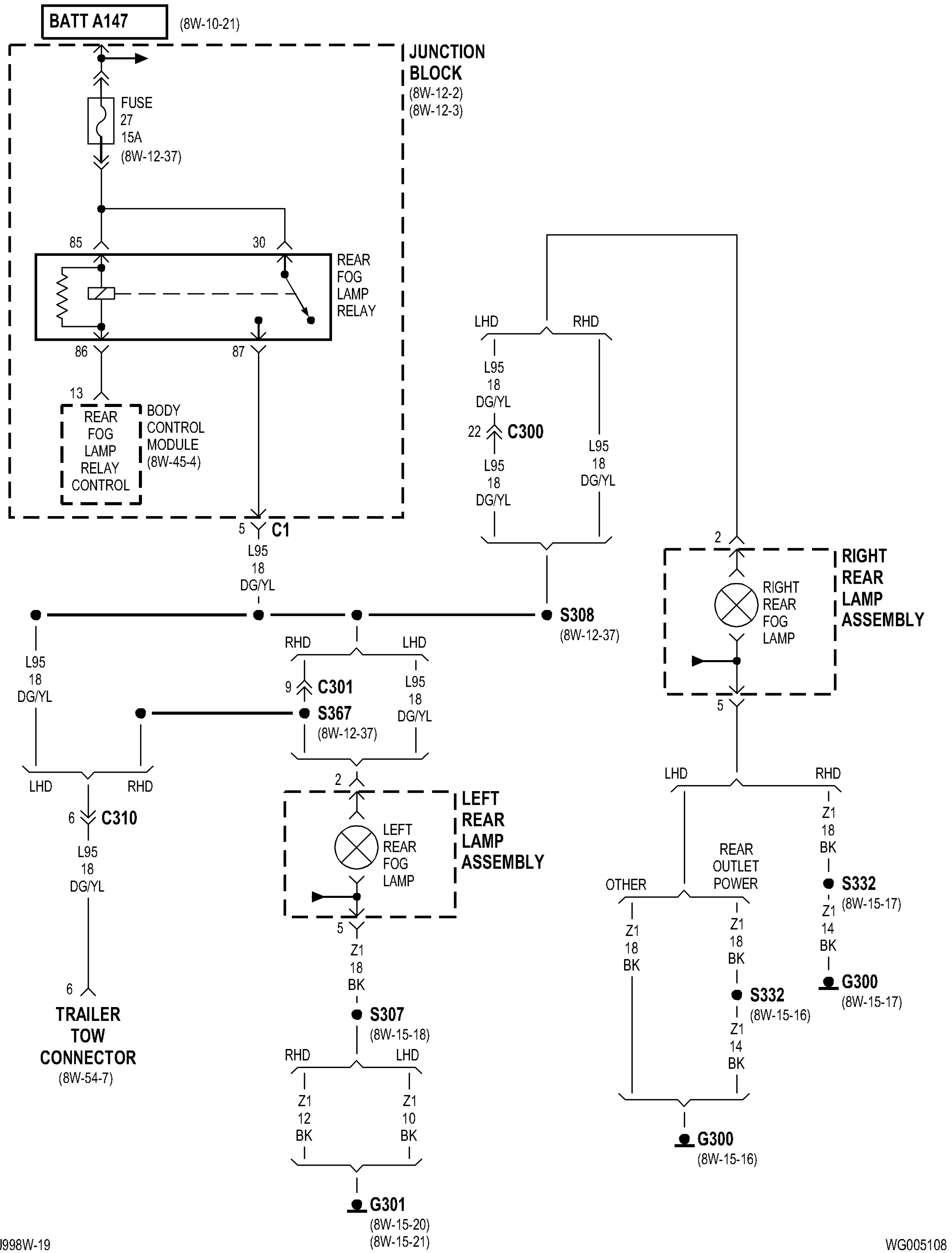
BATT A147
(8W-10-21)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
23
15A
(8W-12-24)
47
C2
F32
20
PK/DB
6
BRAKE LAMP SWITCH
(8W-33-2)
(8W-33-3)
5
L50
20
WT/TN
L50
18
WT/TN
6
RIGHT REAR LAMP ASSEMBLY
TAIL/ STOP LAMP
5
LHD
RHD
OTHER
REAR POWER OUTLET
Z1
18
BK
S332
(8W-15-16)
(8W-15-17)
Z1
14
BK
G300
(8W-15-16)
(8W-15-17)
CONTROLLER ANTI-LOCK BRAKE
(8W-35-4)
BRAKE LAMP SWITCH OUTPUT
18
L50
18
WT/TN
GAS
DIESEL
S147
(8W-30-45)
34
C107
S313
8
C300
S311
7
C308
1
C311
CENTER HIGH MOUNTED STOP LAMP
2
Z1
18
BK
C311
TO TRAILER TOW BRAKE LAMP RELAY
(8W-54-6)
(8W-54-7)
9
C310
BUILT-UP-EXPORT
EXCEPT BUILT-UP-EXPORT
L50
16
WT/TN
LEFT REAR LAMP ASSEMBLY
S401
(8W-15-19)
Z1
12
BK
8
C308
S307
(8W-15-18)
Z1
10
BK
G301
(8W-15-20)
(8W-15-21)


TRANSMISSION SOLENOID/ TRS ASSEMBLY
(8W-31-5)
BACK-UP LAMP FEED
PARK/ NEUTRAL POSITION SWITCH
(8W-31-6)
L1
18
VT/BK
4.7L
4.0L/DIESEL
C102
GAS
DIESEL
C106
C107
AUTOMATIC DAY/NIGHT MIRROR
(8W-49-4)
L1
20
VT/BK
C309
S328
C300
S310
C310
RIGHT REAR LAMP ASSEMBLY
BACK-UP LAMP
LEFT REAR LAMP ASSEMBLY
TRAILER TOW CONNECTOR
(8W-54-3)
OTHER
REAR POWER OUTLET
Z1
18
BK
S332
(8W-15+16)
Z1
14
BK
S307
(8W-15-18)
Z1
10
BK
G301
(8W-15-20)
G300
(8W-15-16)

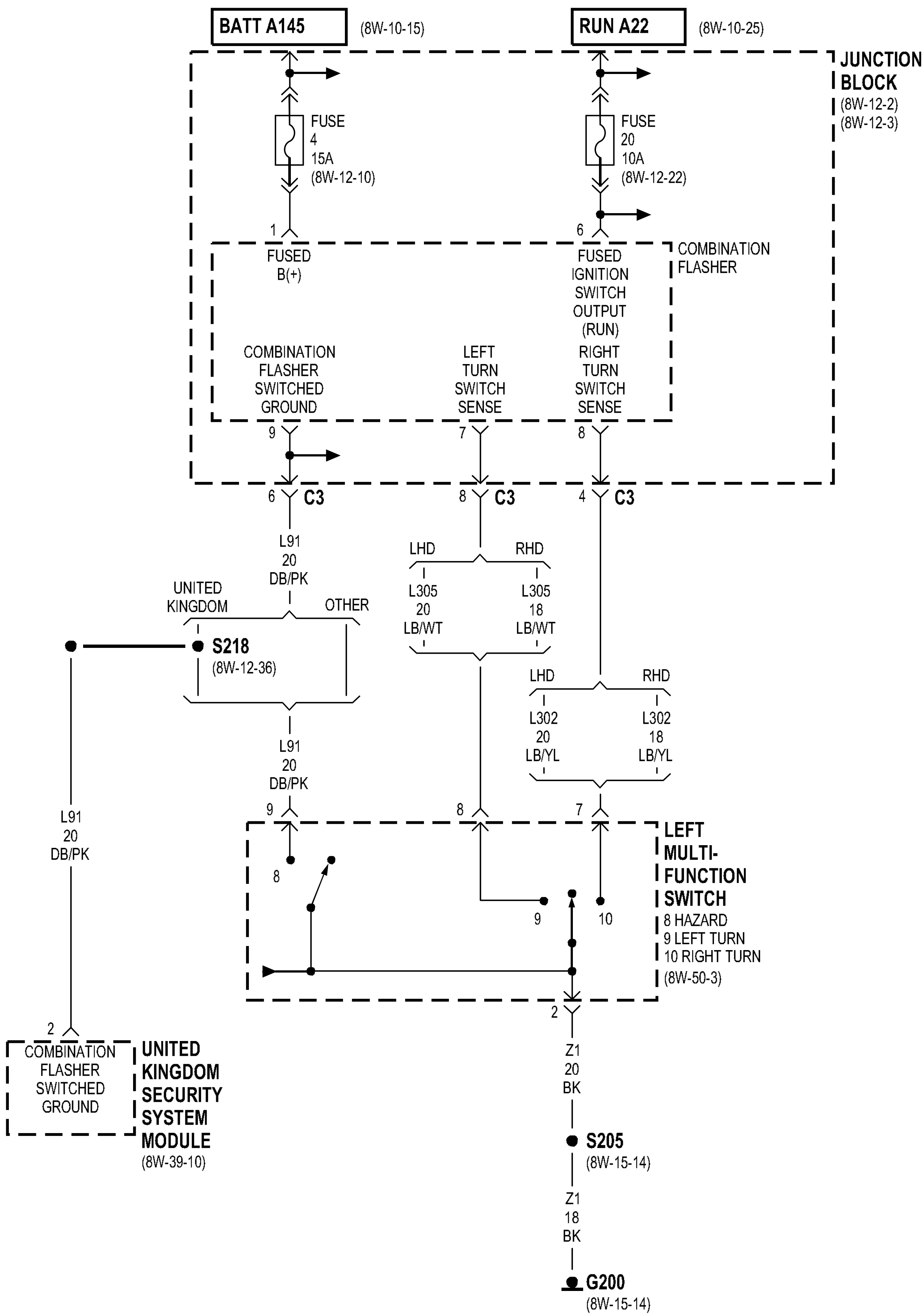
RHD



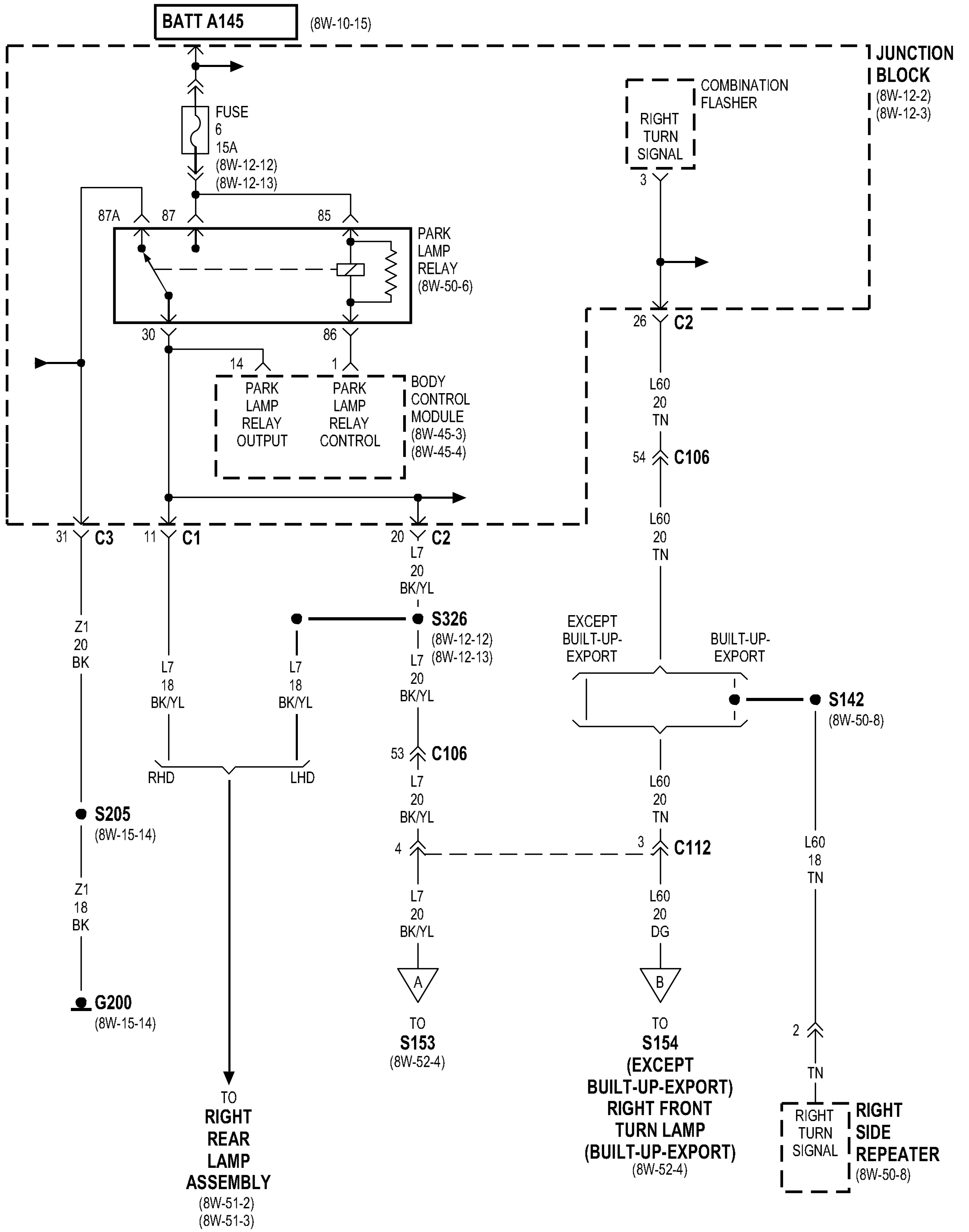
TRANSMISSION SOLENOID/ TRS ASSEMBLY
(8W-31-5)
BACK-UP LAMP FEED
6
L1
18
VT/BK
4.7L
PARK/ NEUTRAL POSITION SWITCH
(8W-31-6)
BACK-UP LAMP FEED
1
L1
18
VT/BK
4.0L
6
C102
L1
18
VT/BK
56
C106
L1
18
VT/BK
AUTOMATIC DAY/NIGHT MIRROR
(8W-49-4)
BACK-UP LAMP FEED
3
L1
20
VT/BK
6
C309
L1
20
VT/BK
S310
L1
18
VT/BK
40
C301
L1
18
VT/BK
L1
18
VT/BK
3
C310
L1
18
VT/BK
3
TRAILER TOW CONNECTOR
(8W-54-3)
L1
18
VT/BK
1
BACK-UP LAMP
LEFT REAR LAMP ASSEMBLY
5
Z1
18
BK
S307
(8W-15-18)
Z1
12
BK
G301
(8W-15-21)
1
BACK-UP LAMP
RIGHT REAR LAMP ASSEMBLY
5
Z1
18
BK
S332
(8W-15-17)
Z1
14
BK
G300
(8W-15-17)

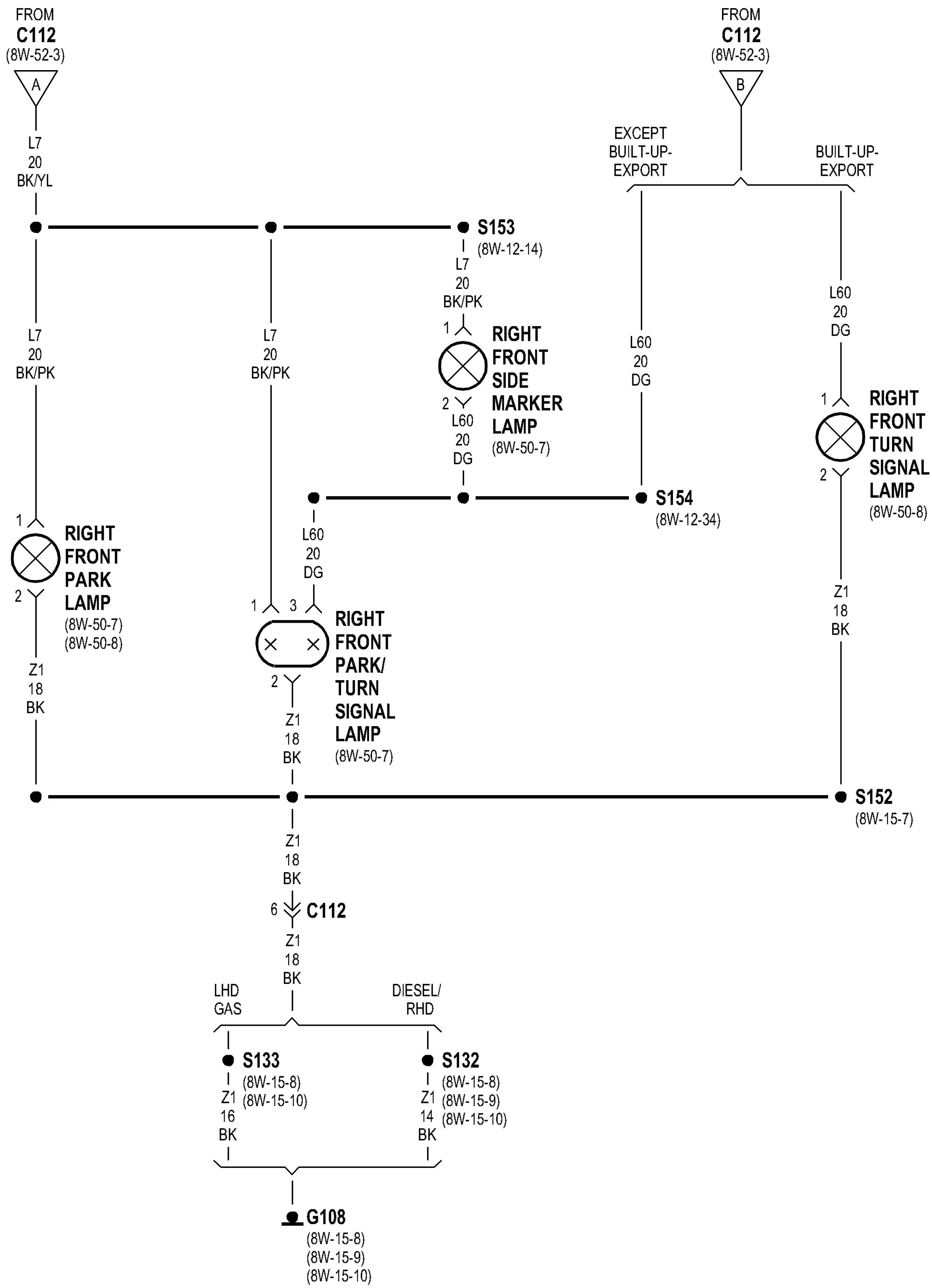

BATT A147
(8W-10-21)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
27
15A
(8W-12-37)
85
30
REAR FOG LAMP RELAY
86
87
13
REAR FOG LAMP RELAY CONTROL
BODY CONTROL MODULE
(8W-45-4)
5
C1
L95 18 DG/YL
LHD
RHD
L95 18 DG/YL
22
C300
L95 18 DG/YL
L95 18 DG/YL
S308
(8W-12-37)
L95 18 DG/YL
RHD
LHD
9
C301
S367
(8W-12-37)
L95 18 DG/YL
LHD
RHD
6
C310
L95 18 DG/YL
6
TRAILER TOW CONNECTOR
(8W-54-7)
2
LEFT REAR FOG LAMP
LEFT REAR LAMP ASSEMBLY
5
Z1 18 BK
S307
(8W-15-18)
RHD
LHD
Z1 12 BK
Z1 10 BK
G301
(8W-15-20)
(8W-15-21)
2
RIGHT REAR FOG LAMP
RIGHT REAR LAMP ASSEMBLY
5
LHD
RHD
Z1 18 BK
S332
(8W-15-17)
Z1 14 BK
G300
(8W-15-17)
OTHER
REAR OUTLET POWER
Z1 18 BK
Z1 18 BK
S332
(8W-15-16)
Z1 14 BK
G300
(8W-15-16)

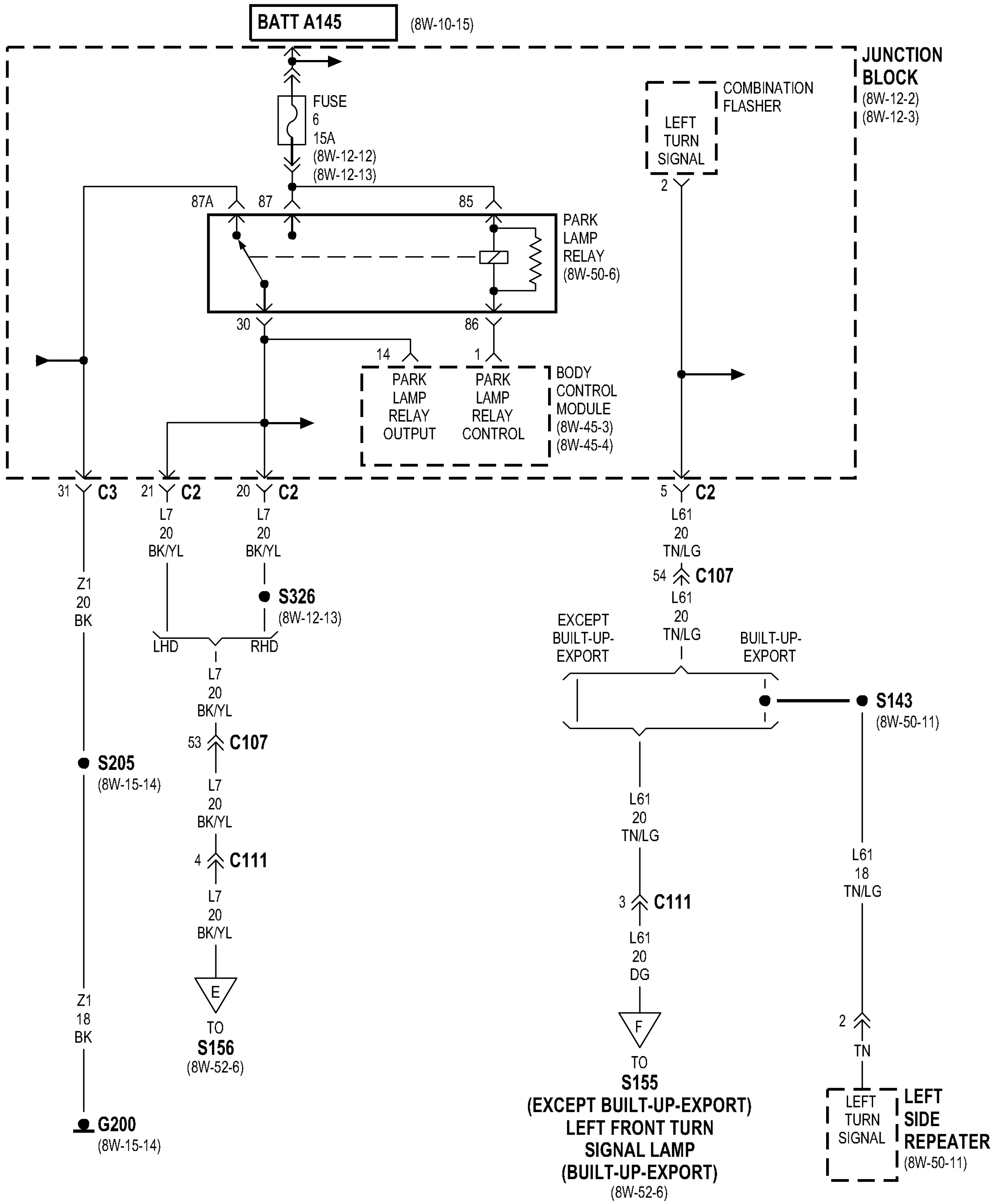
8W-52 TURN SIGNALS

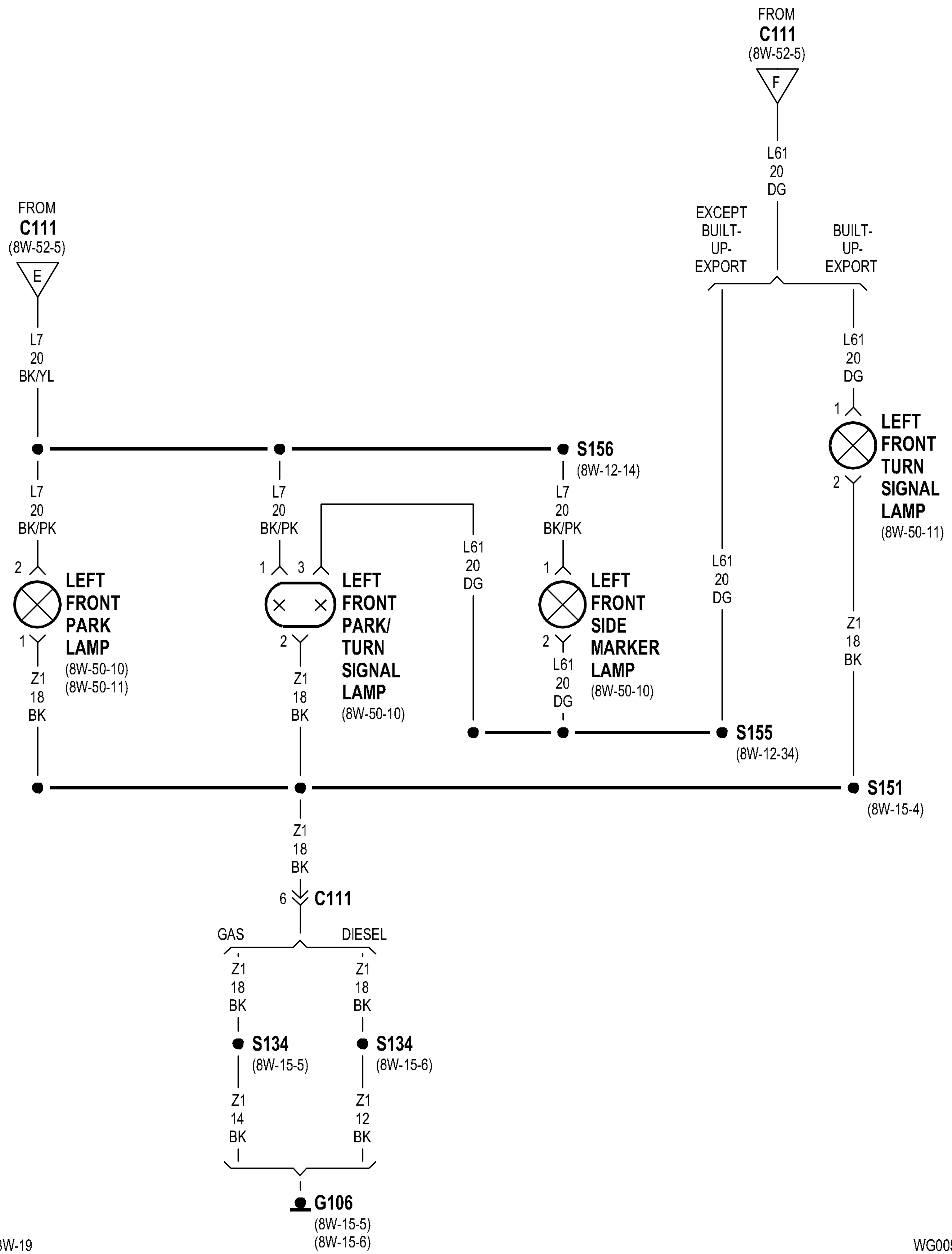


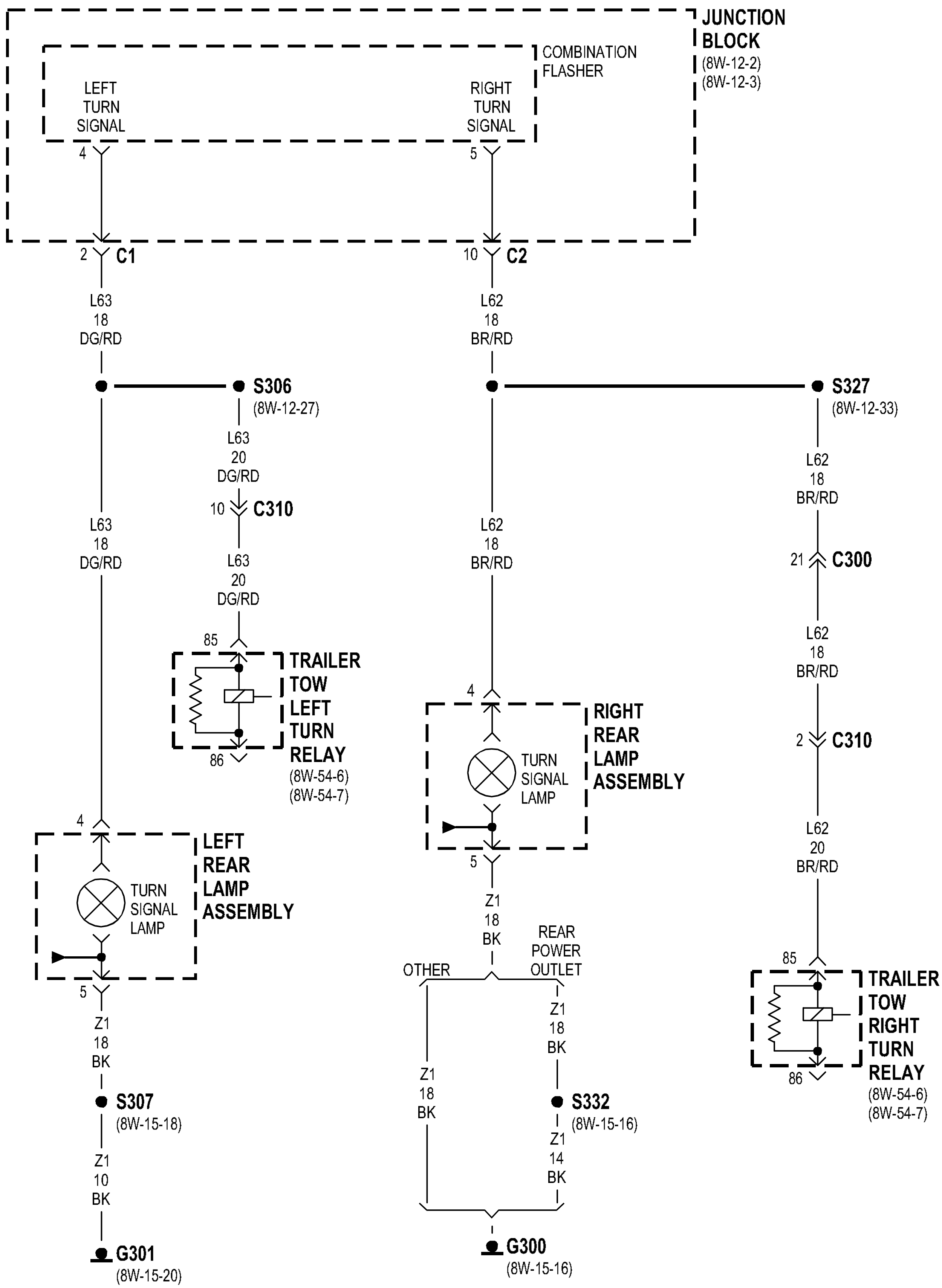
BATT A145
(8W-10-15)
RUN A22
(8W-10-25)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 4 15A (8W-12-10)
FUSE 20 10A (8W-12-22)
1
6
COMBINATION FLASHER
FUSED B(+)
FUSED IGNITION SWITCH OUTPUT (RUN)
COMBINATION FLASHER SWITCHED GROUND
LEFT TURN SWITCH SENSE
RIGHT TURN SWITCH SENSE
9
7
8
6 C3
8 C3
4 C3
L91 20 DB/PK
UNITED KINGDOM
OTHER
S218
(8W-12-36)
LHD
RHD
L305 20 LB/WT
L305 18 LB/WT
L302 20 LB/YL
L302 18 LB/YL
L91 20 DB/PK
L91 20 DB/PK
9
8
7
LEFT MULTI-FUNCTION SWITCH
8 HAZARD
9 LEFT TURN
10 RIGHT TURN
(8W-50-3)
8
9
10
2
2
COMBINATION FLASHER SWITCHED GROUND
UNITED KINGDOM SECURITY SYSTEM MODULE
(8W-39-10)
Z1 20 BK
S205
(8W-15-14)
Z1 18 BK
G200
(8W-15-14)

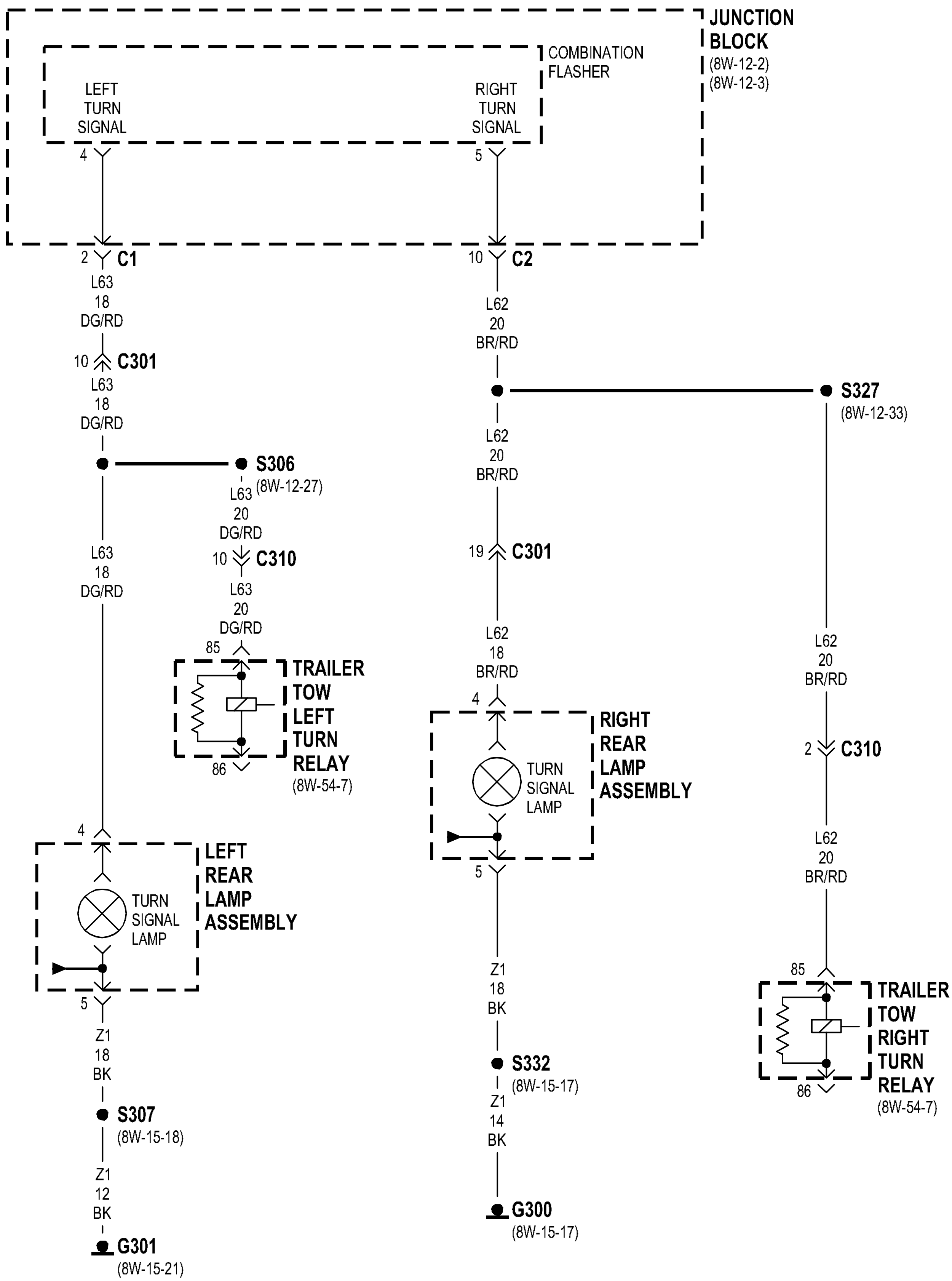

BATT A145
(8W-10-15)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
6
15A
(8W-12-12)
(8W-12-13)
COMBINATION FLASHER
RIGHT TURN SIGNAL
3
87A
87
85
PARK LAMP RELAY
(8W-50-6)
30
86
14
1
PARK LAMP RELAY OUTPUT
PARK LAMP RELAY CONTROL
BODY CONTROL MODULE
(8W-45-3)
(8W-45-4)
26
C2
L60
20
TN
54
C106
L60
20
TN
31
C3
11
C1
20
C2
L7
20
BK/YL
S326
(8W-12-12)
(8W-12-13)
Z1
20
BK
L7
18
BK/YL
L7
18
BK/YL
L7
20
BK/YL
EXCEPT BUILT-UP-EXPORT
BUILT-UP-EXPORT
S142
(8W-50-8)
RHD
LHD
53
C106
L7
20
BK/YL
L60
20
TN
S205
(8W-15-14)
4
3
C112
L60
18
TN
Z1
18
BK
L7
20
BK/YL
L60
20
DG
G200
(8W-15-14)
A
B
TO
S153
(8W-52-4)
TO
S154
(EXCEPT BUILT-UP-EXPORT)
RIGHT FRONT TURN LAMP
(BUILT-UP-EXPORT)
(8W-52-4)
2
TN
RIGHT TURN SIGNAL
RIGHT SIDE REPEATER
(8W-50-8)
TO
RIGHT REAR LAMP ASSEMBLY
(8W-51-2)
(8W-51-3)


FROM
C112
(8W-52-3)
A
L7
20
BK/YL
FROM
C112
(8W-52-3)
B
EXCEPT
BUILT-UP-
EXPORT
BUILT-UP-
EXPORT
S153
(8W-12-14)
L7
20
BK/PK
RIGHT
FRONT
SIDE
MARKER
LAMP
(8W-50-7)
L60
20
DG
S154
(8W-12-34)
RIGHT
FRONT
TURN
SIGNAL
LAMP
(8W-50-8)
Z1
18
BK
RIGHT
FRONT
PARK
LAMP
(8W-50-7)
(8W-50-8)
RIGHT
FRONT
PARK/
TURN
SIGNAL
LAMP
(8W-50-7)
S152
(8W-15-7)
C112
LHD
GAS
DIESEL/
RHD
S133
(8W-15-8)
(8W-15-10)
Z1
16
BK
S132
(8W-15-8)
(8W-15-9)
(8W-15-10)
Z1
14
BK
G108
(8W-15-8)
(8W-15-9)
(8W-15-10)


BATT A145
(8W-10-15)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
6
15A
(8W-12-12)
(8W-12-13)
COMBINATION FLASHER
LEFT TURN SIGNAL
87A
87
85
30
86
PARK LAMP RELAY
(8W-50-6)
14
1
PARK LAMP RELAY OUTPUT
PARK LAMP RELAY CONTROL
BODY CONTROL MODULE
(8W-45-3)
(8W-45-4)
31 C3
21 C2
20 C2
5 C2
Z1 20 BK
L7 20 BK/YL
L7 20 BK/YL
L61 20 TN/LG
54 C107
L61 20 TN/LG
S326
(8W-12-13)
LHD
RHD
L7 20 BK/YL
53 C107
L7 20 BK/YL
4 C111
L7 20 BK/YL
E
TO S156
(8W-52-6)
S205
(8W-15-14)
Z1 18 BK
G200
(8W-15-14)
EXCEPT BUILT-UP-EXPORT
BUILT-UP-EXPORT
S143
(8W-50-11)
L61 20 TN/LG
3 C111
L61 20 DG
F
TO S155
(EXCEPT BUILT-UP-EXPORT)
LEFT FRONT TURN SIGNAL LAMP
(BUILT-UP-EXPORT)
(8W-52-6)
L61 18 TN/LG
2
TN
LEFT TURN SIGNAL
LEFT SIDE REPEATER
(8W-50-11)

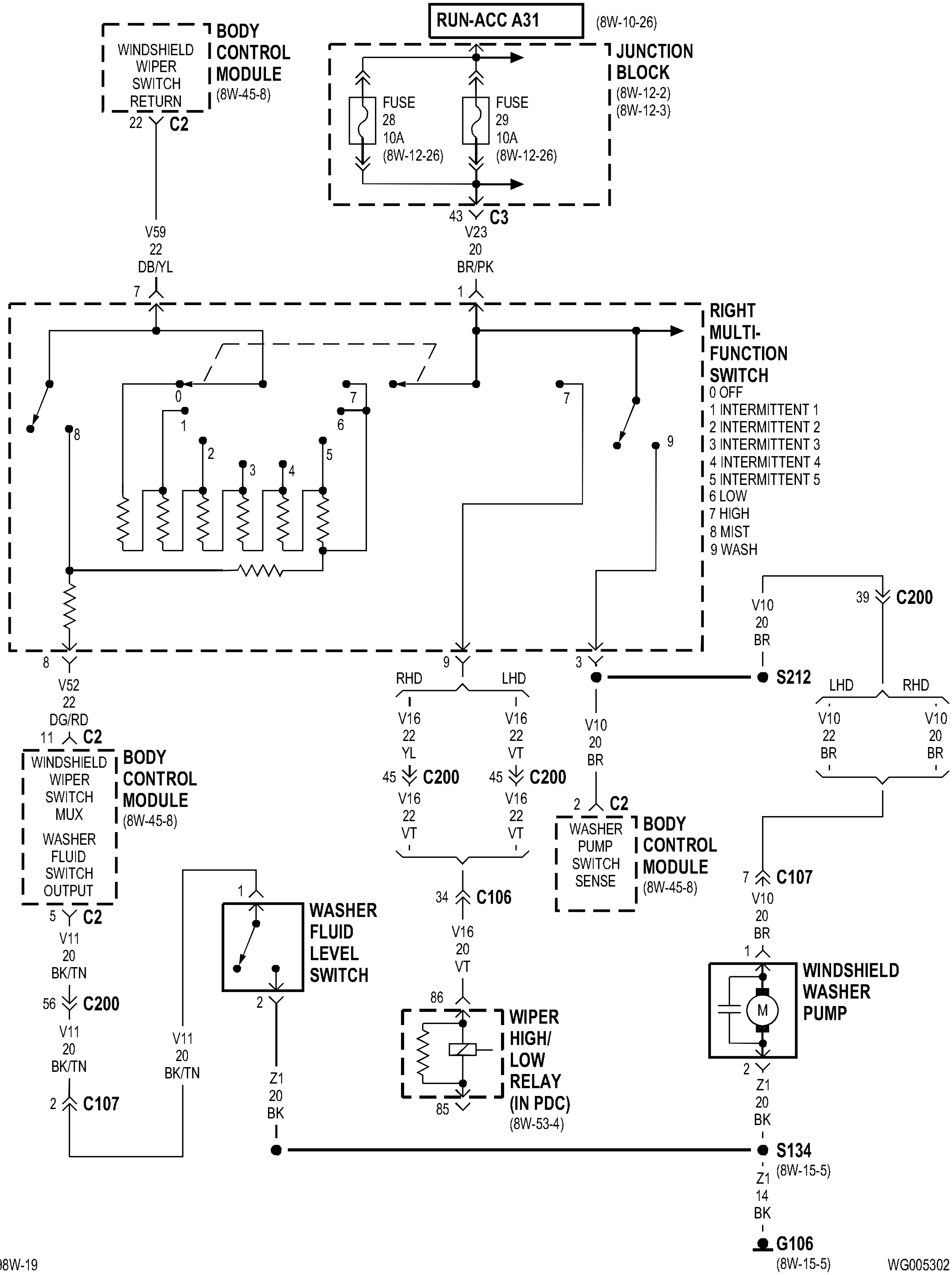

FROM
C111
(8W-52-5)
F
L61
20
DG
EXCEPT BUILT-UP-EXPORT
BUILT-UP-EXPORT
FROM
C111
(8W-52-5)
E
L7
20
BK/YL
S156
(8W-12-14)
L7
20
BK/PK
L7
20
BK/PK
L7
20
BK/PK
L61
20
DG
L61
20
DG
L61
20
DG
1
2
LEFT FRONT TURN SIGNAL LAMP
(8W-50-11)
2
1
LEFT FRONT PARK LAMP
(8W-50-10)
(8W-50-11)
1
3
2
LEFT FRONT PARK/ TURN SIGNAL LAMP
(8W-50-10)
1
2
LEFT FRONT SIDE MARKER LAMP
(8W-50-10)
L61
20
DG
Z1
18
BK
Z1
18
BK
Z1
18
BK
Z1
18
BK
S155
(8W-12-34)
S151
(8W-15-4)
Z1
18
BK
6
C111
GAS
DIESEL
Z1
18
BK
Z1
18
BK
S134
(8W-15-5)
S134
(8W-15-6)
Z1
14
BK
Z1
12
BK
G106
(8W-15-5)
(8W-15-6)


JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
COMBINATION FLASHER
LEFT TURN SIGNAL
RIGHT TURN SIGNAL
4
5
2
C1
10
C2
L63 18 DG/RD
L62 18 BR/RD
S306
(8W-12-27)
L63 20 DG/RD
10
C310
L63 20 DG/RD
L63 18 DG/RD
85
TRAILER TOW LEFT TURN RELAY
86
(8W-54-6)
(8W-54-7)
4
LEFT REAR LAMP ASSEMBLY
TURN SIGNAL LAMP
5
Z1 18 BK
S307
(8W-15-18)
Z1 10 BK
G301
(8W-15-20)
S327
(8W-12-33)
L62 18 BR/RD
L62 18 BR/RD
21
C300
L62 18 BR/RD
4
RIGHT REAR LAMP ASSEMBLY
TURN SIGNAL LAMP
5
Z1 18 BK
OTHER
REAR POWER OUTLET
Z1 18 BK
Z1 18 BK
S332
(8W-15-16)
Z1 14 BK
G300
(8W-15-16)
2
C310
L62 20 BR/RD
85
TRAILER TOW RIGHT TURN RELAY
86
(8W-54-6)
(8W-54-7)


JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
COMBINATION FLASHER
LEFT TURN SIGNAL
RIGHT TURN SIGNAL
4
5
2
C1
10
C2
L63
18
DG/RD
10
C301
L63
18
DG/RD
L62
20
BR/RD
S327
(8W-12-33)
S306
(8W-12-27)
L63
20
DG/RD
10
C310
L63
20
DG/RD
L63
18
DG/RD
L62
20
BR/RD
19
C301
L62
18
BR/RD
85
TRAILER TOW LEFT TURN RELAY
(8W-54-7)
86
4
RIGHT REAR LAMP ASSEMBLY
TURN SIGNAL LAMP
5
L62
20
BR/RD
2
C310
L62
20
BR/RD
4
LEFT REAR LAMP ASSEMBLY
TURN SIGNAL LAMP
5
Z1
18
BK
S307
(8W-15-18)
Z1
12
BK
G301
(8W-15-21)
Z1
18
BK
S332
(8W-15-17)
Z1
14
BK
G300
(8W-15-17)
85
TRAILER TOW RIGHT TURN RELAY
(8W-54-7)
86

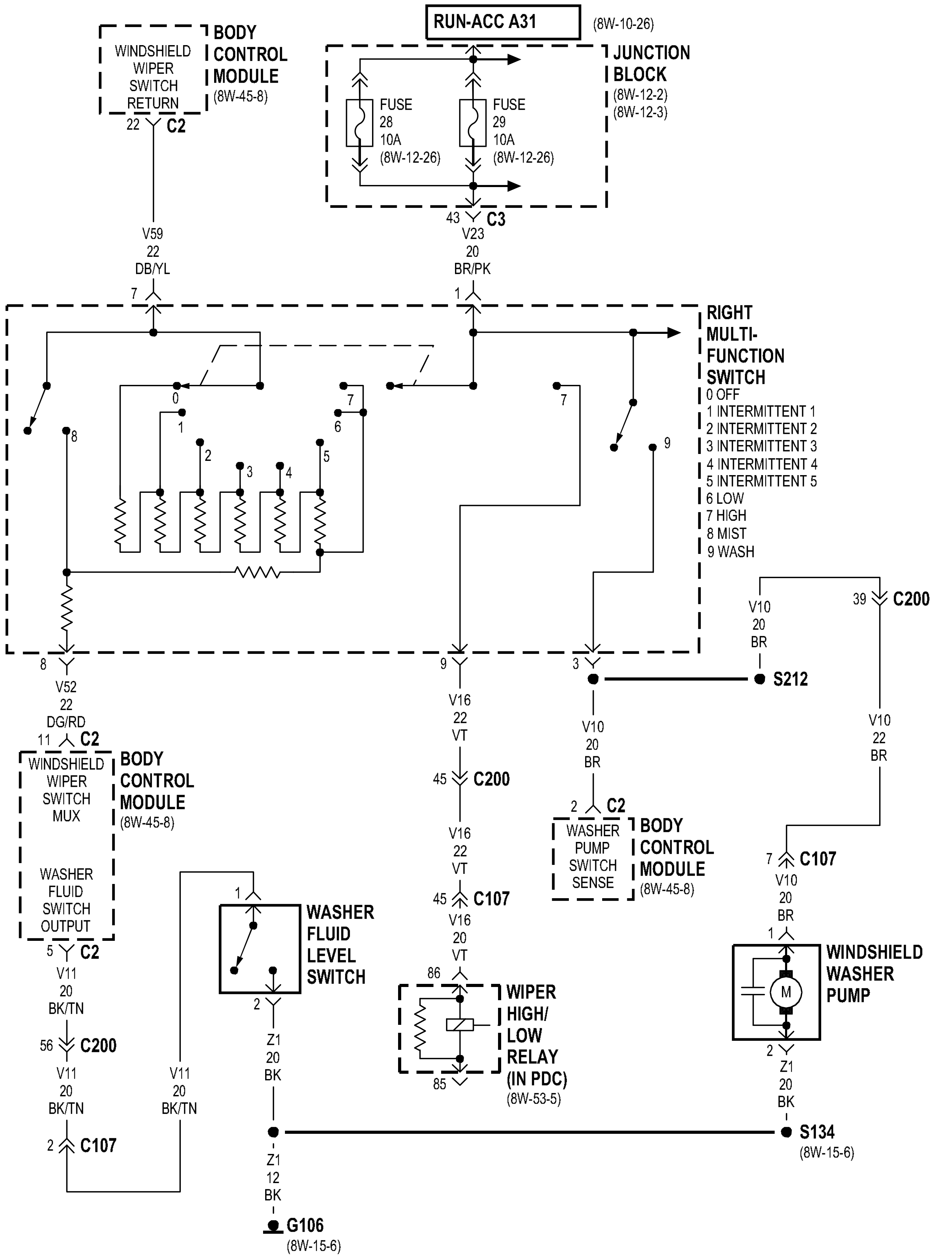
8W-53 WIPERS

GAS

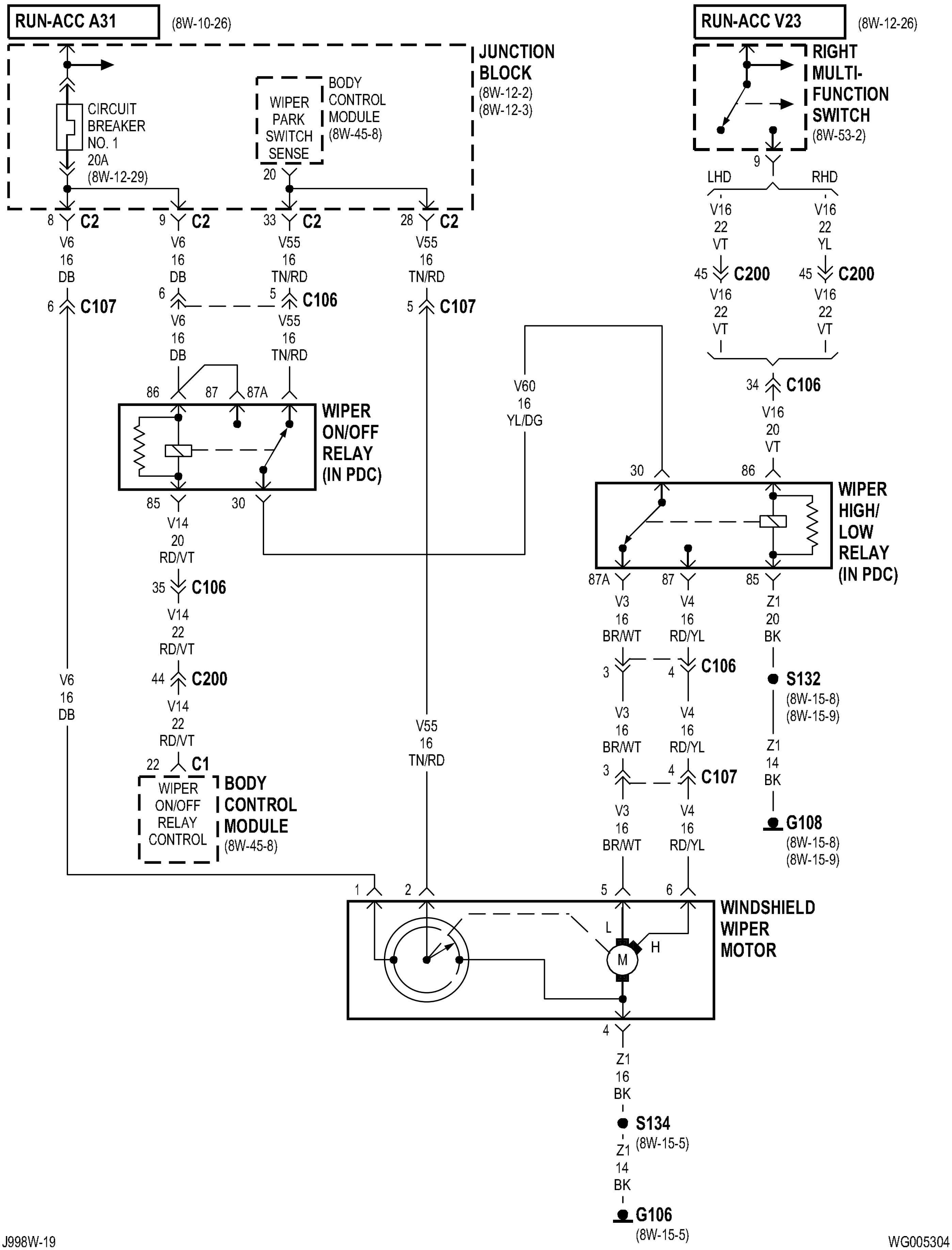


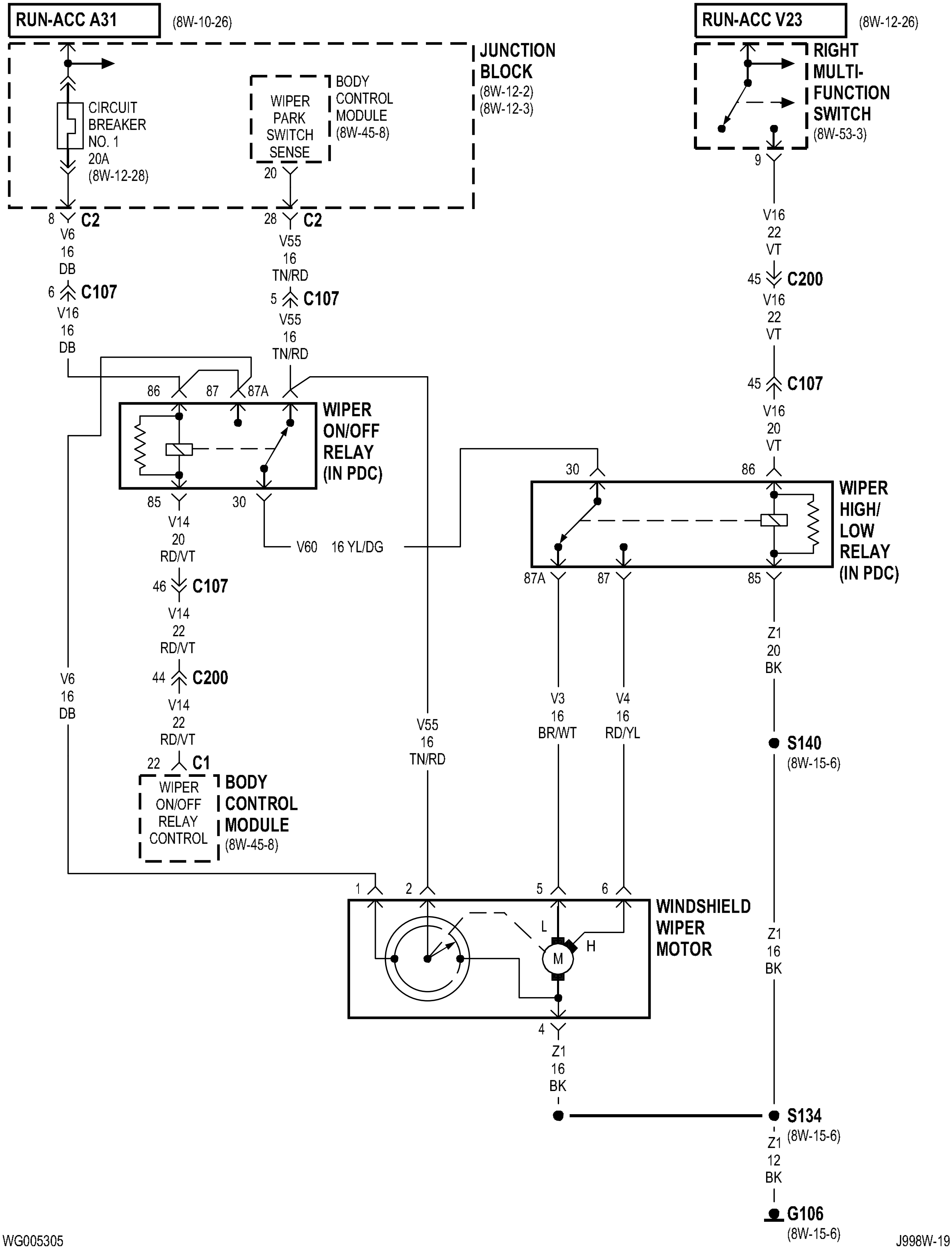
RUN-ACC A31
(8W-10-26)
BODY CONTROL MODULE
WINDSHIELD WIPER SWITCH RETURN
(8W-45-8)
22 C2
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 28 10A (8W-12-26)
FUSE 29 10A (8W-12-26)
43 C3
V59 22 DB/YL
V23 20 BR/PK
RIGHT MULTI-FUNCTION SWITCH
0 OFF
1 INTERMITTENT 1
2 INTERMITTENT 2
3 INTERMITTENT 3
4 INTERMITTENT 4
5 INTERMITTENT 5
6 LOW
7 HIGH
8 MIST
9 WASH
V52 22 DG/RD
11 C2
BODY CONTROL MODULE
WINDSHIELD WIPER SWITCH MUX
WASHER FLUID SWITCH OUTPUT
(8W-45-8)
5 C2
V11 20 BK/TN
56 C200
V11 20 BK/TN
2 C107
V11 20 BK/TN
WASHER FLUID LEVEL SWITCH
Z1 20 BK
RHD LHD
V16 22 YL
V16 22 VT
45 C200
45 C200
V16 22 VT
V16 22 VT
34 C106
V16 20 VT
WIPER HIGH/ LOW RELAY (IN PDC)
(8W-53-4)
86
85
V10 20 BR
2 C2
BODY CONTROL MODULE
WASHER PUMP SWITCH SENSE
(8W-45-8)
S212
V10 20 BR
39 C200
LHD RHD
V10 22 BR
V10 20 BR
7 C107
V10 20 BR
WINDSHIELD WASHER PUMP
M
Z1 20 BK
S134
(8W-15-5)
Z1 14 BK
G106
(8W-15-5)

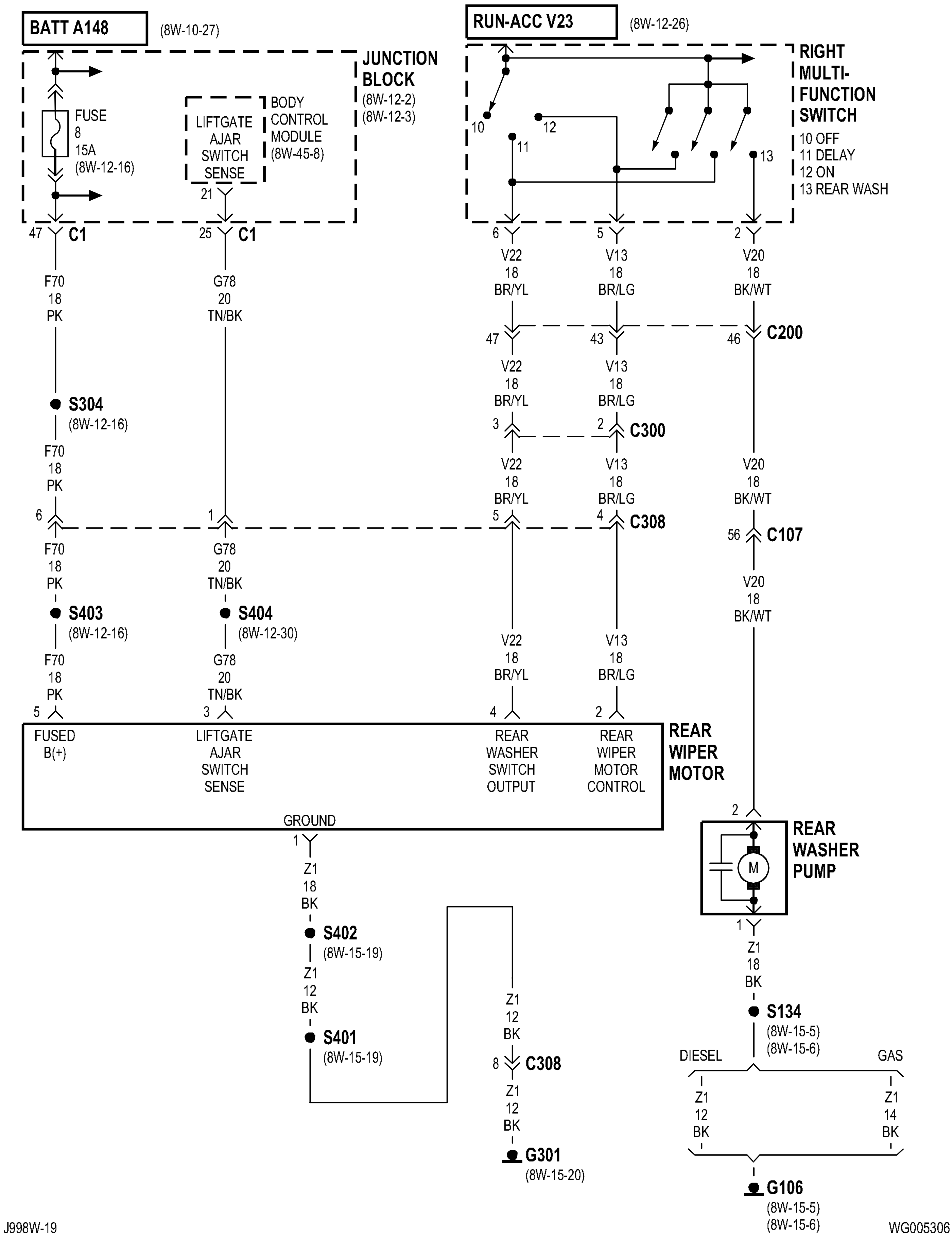
DIESEL

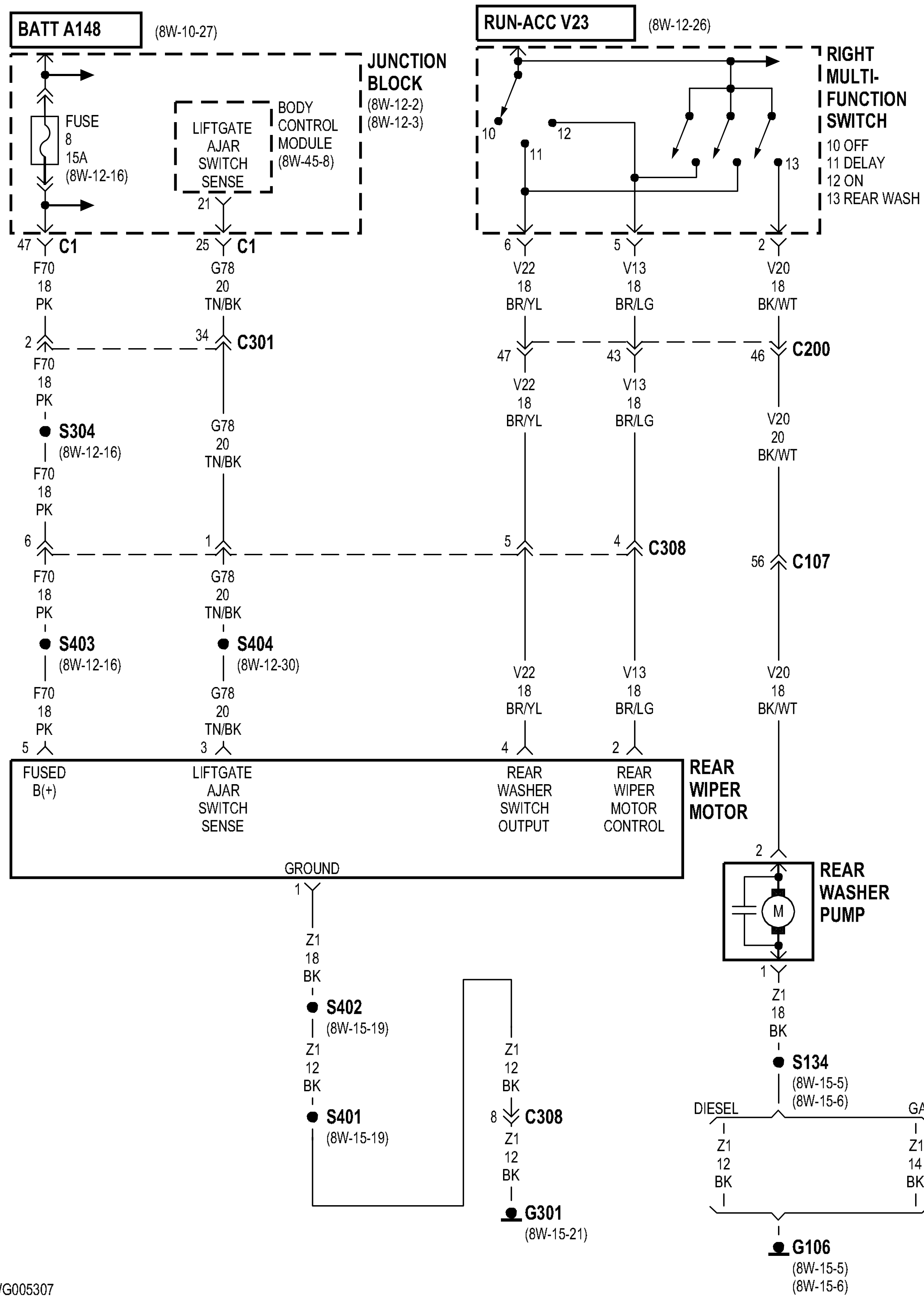


RUN-ACC A31
(8W-10-26)
WINDSHIELD WIPER SWITCH RETURN
BODY CONTROL MODULE
(8W-45-8)
22 C2
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE 28 10A (8W-12-26)
FUSE 29 10A (8W-12-26)
43 C3
V59 22 DB/YL
V23 20 BR/PK
RIGHT MULTI-FUNCTION SWITCH
0 OFF
1 INTERMITTENT 1
2 INTERMITTENT 2
3 INTERMITTENT 3
4 INTERMITTENT 4
5 INTERMITTENT 5
6 LOW
7 HIGH
8 MIST
9 WASH
V52 22 DG/RD
11 C2
WINDSHIELD WIPER SWITCH MUX
WASHER FLUID SWITCH OUTPUT
BODY CONTROL MODULE
(8W-45-8)
5 C2
V11 20 BK/TN
56 C200
V11 20 BK/TN
2 C107
V11 20 BK/TN
WASHER FLUID LEVEL SWITCH
Z1 20 BK
Z1 12 BK
G106
(8W-15-6)
V16 22 VT
45 C200
V16 22 VT
45 C107
V16 20 VT
WIPER HIGH/ LOW RELAY (IN PDC)
(8W-53-5)
86
85
S212
V10 20 BR
2 C2
WASHER PUMP SWITCH SENSE
BODY CONTROL MODULE
(8W-45-8)
V10 20 BR
39 C200
V10 22 BR
7 C107
V10 20 BR
WINDSHIELD WASHER PUMP
M
Z1 20 BK
S134
(8W-15-6)


RUN-ACC A31
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
CIRCUIT BREAKER NO. 1 20A
(8W-12-29)
WIPER PARK SWITCH SENSE
BODY CONTROL MODULE
(8W-45-8)
RUN-ACC V23
(8W-12-26)
RIGHT MULTI-FUNCTION SWITCH
(8W-53-2)
LHD
RHD
C2
C107
C106
C200
V6 16 DB
V55 16 TN/RD
V16 22 VT
V16 22 YL
V60 16 YL/DG
WIPER ON/OFF RELAY (IN PDC)
86
87
87A
85
30
V14 20 RD/VT
V14 22 RD/VT
C1
WIPER ON/OFF RELAY CONTROL
BODY CONTROL MODULE
(8W-45-8)
V16 20 VT
WIPER HIGH/ LOW RELAY (IN PDC)
V3 16 BR/WT
V4 16 RD/YL
Z1 20 BK
S132
(8W-15-8)
(8W-15-9)
Z1 14 BK
G108
(8W-15-8)
(8W-15-9)
WINDSHIELD WIPER MOTOR
L
H
M
Z1 16 BK
S134
(8W-15-5)
Z1 14 BK
G106
(8W-15-5)

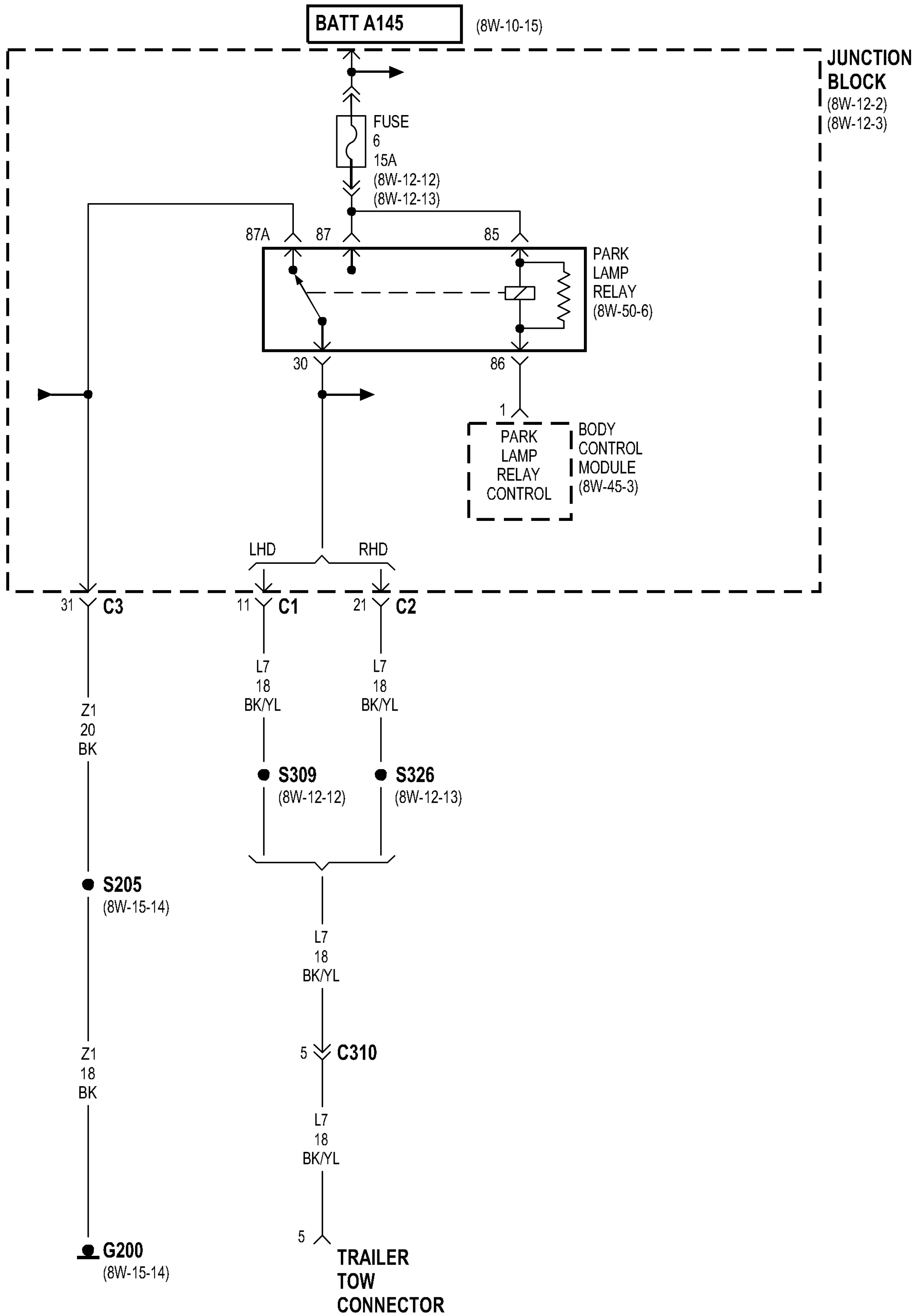

RUN-ACC A31
(8W-10-26)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
CIRCUIT BREAKER NO. 1 20A
(8W-12-28)
WIPER PARK SWITCH SENSE
BODY CONTROL MODULE
(8W-45-8)
20
8 C2
28 C2
V6 16 DB
6 C107
V16 16 DB
V55 16 TN/RD
5 C107
V55 16 TN/RD
86 87 87A
WIPER ON/OFF RELAY (IN PDC)
85 30
V14 20 RD/VT
46 C107
V14 22 RD/VT
44 C200
V14 22 RD/VT
22 C1
WIPER ON/OFF RELAY CONTROL
BODY CONTROL MODULE
(8W-45-8)
V6 16 DB
V60 16 YL/DG
V55 16 TN/RD
RUN-ACC V23
(8W-12-26)
RIGHT MULTI-FUNCTION SWITCH
(8W-53-3)
9
V16 22 VT
45 C200
V16 22 VT
45 C107
V16 20 VT
30 86
WIPER HIGH/ LOW RELAY (IN PDC)
87A 87 85
V3 16 BR/WT
V4 16 RD/YL
Z1 20 BK
S140
(8W-15-6)
1 2 5 6
WINDSHIELD WIPER MOTOR
L H M
4
Z1 16 BK
Z1 16 BK
S134
(8W-15-6)
Z1 12 BK
G106
(8W-15-6)

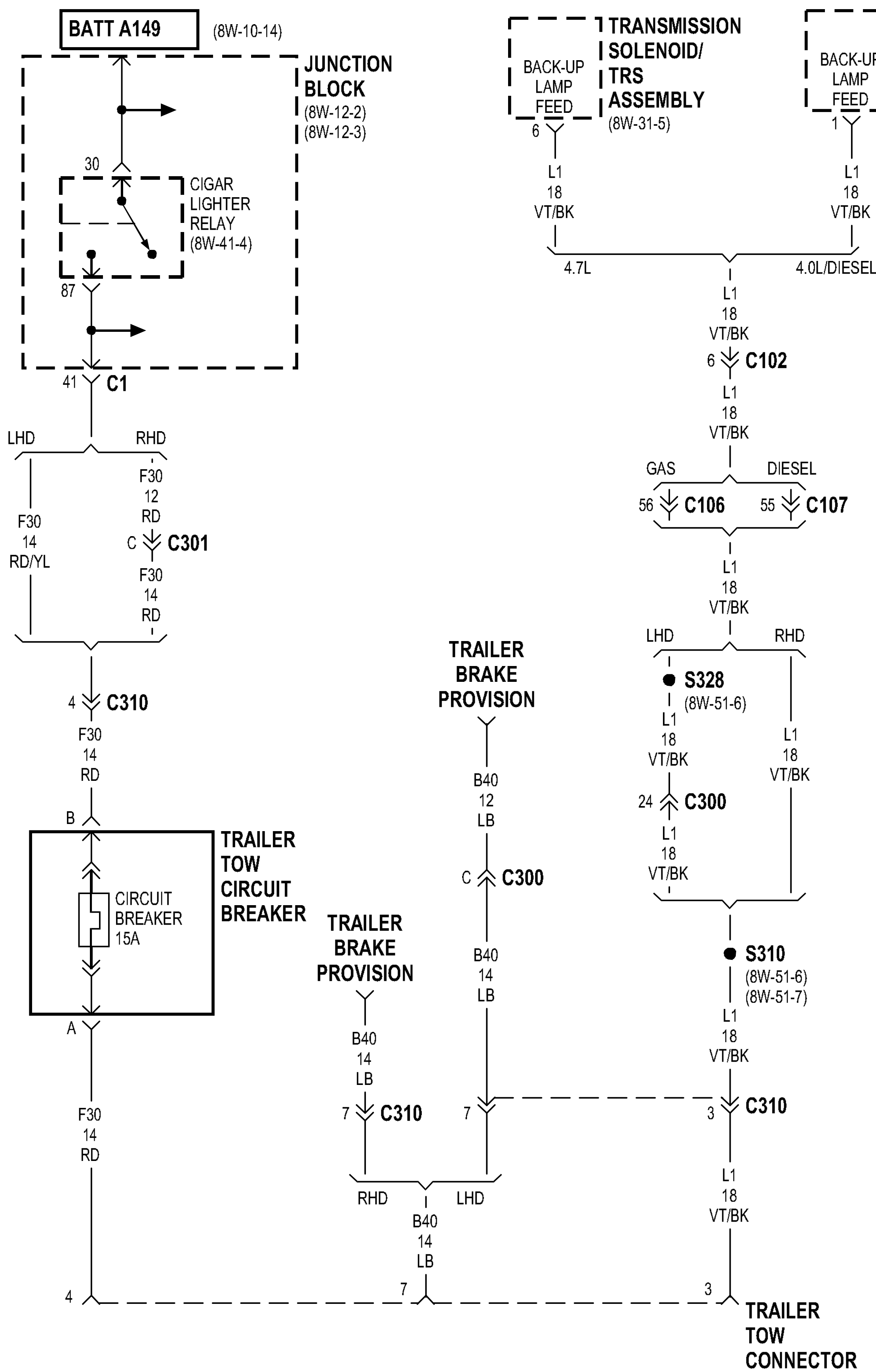

BATT A148
(8W-10-27)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
8
15A
(8W-12-16)
LIFTGATE AJAR SWITCH SENSE
BODY CONTROL MODULE
(8W-45-8)
21
47
C1
25
C1
F70
18
PK
G78
20
TN/BK
S304
(8W-12-16)
RUN-ACC V23
(8W-12-26)
RIGHT MULTI-FUNCTION SWITCH
10 OFF
11 DELAY
12 ON
13 REAR WASH
10
11
12
13
6
5
2
V22
18
BR/YL
V13
18
BR/LG
V20
18
BK/WT
47
43
46
C200
3
2
C300
6
1
5
4
C308
56
C107
S403
(8W-12-16)
S404
(8W-12-30)
5
3
4
2
FUSED B(+)
LIFTGATE AJAR SWITCH SENSE
REAR WASHER SWITCH OUTPUT
REAR WIPER MOTOR CONTROL
REAR WIPER MOTOR
GROUND
1
Z1
18
BK
S402
(8W-15-19)
Z1
12
BK
S401
(8W-15-19)
8
C308
G301
(8W-15-20)
2
REAR WASHER PUMP
M
1
S134
(8W-15-5)
(8W-15-6)
DIESEL
GAS
Z1
14
BK
G106
(8W-15-5)
(8W-15-6)



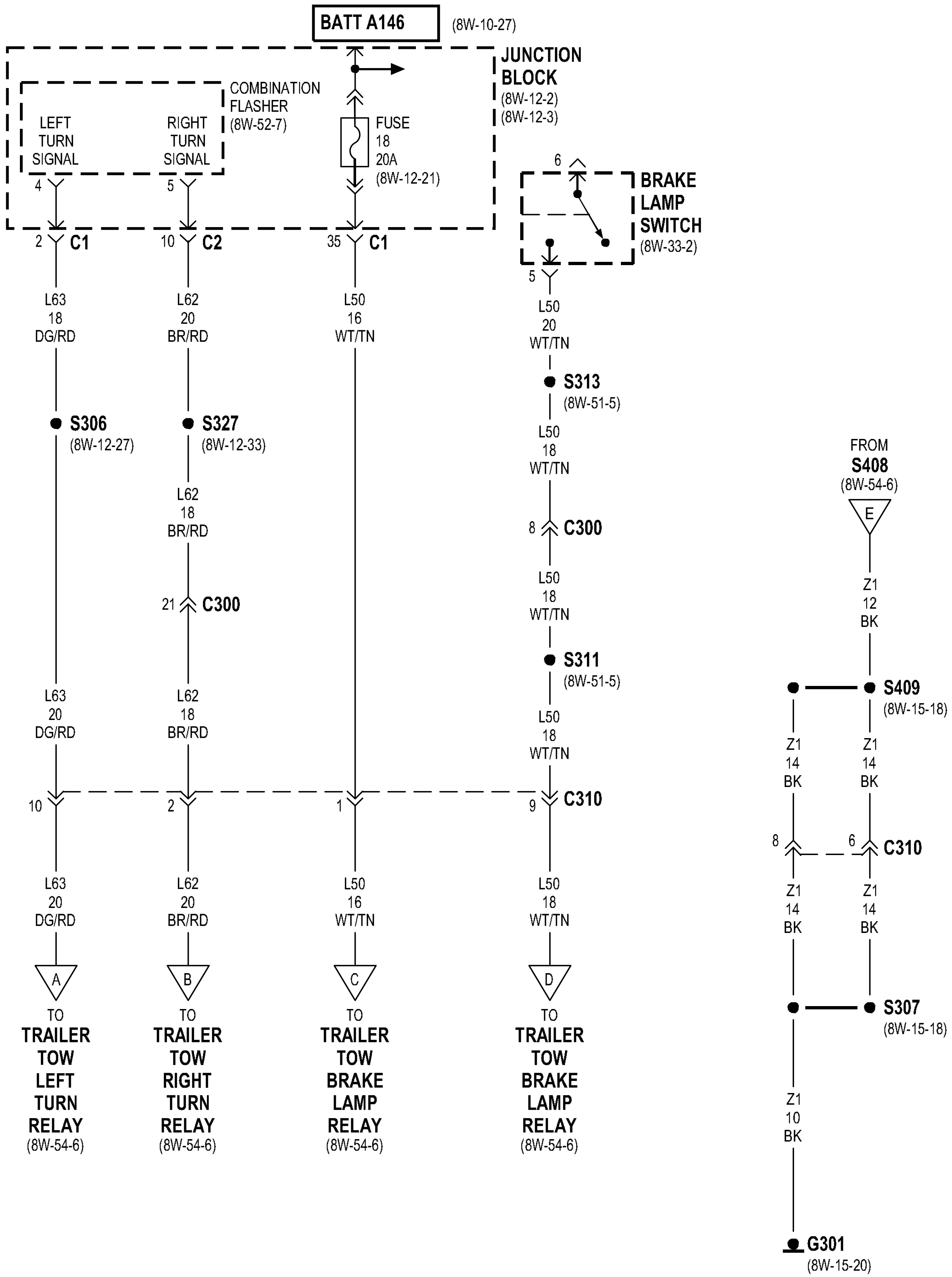
BATT A148
(8W-10-27)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
8
15A
(8W-12-16)
LIFTGATE AJAR SWITCH SENSE
BODY CONTROL MODULE
(8W-45-8)
21
47 C1
25 C1
RUN-ACC V23
(8W-12-26)
RIGHT MULTI-FUNCTION SWITCH
10 OFF
11 DELAY
12 ON
13 REAR WASH
10
11
12
13
6
5
2
F70 18 PK
G78 20 TN/BK
V22 18 BR/YL
V13 18 BR/LG
V20 18 BK/WT
2
34 C301
47
43
46 C200
V20 20 BK/WT
S304
(8W-12-16)
6
1
5
4 C308
56 C107
S403
(8W-12-16)
S404
(8W-12-30)
5
3
4
2
FUSED B(+)
LIFTGATE AJAR SWITCH SENSE
REAR WASHER SWITCH OUTPUT
REAR WIPER MOTOR CONTROL
REAR WIPER MOTOR
GROUND
1
Z1 18 BK
S402
(8W-15-19)
Z1 12 BK
S401
(8W-15-19)
8 C308
G301
(8W-15-21)
REAR WASHER PUMP
M
2
1
S134
(8W-15-5)
(8W-15-6)
DIESEL
GAS
Z1 14 BK
G106
(8W-15-5)
(8W-15-6)

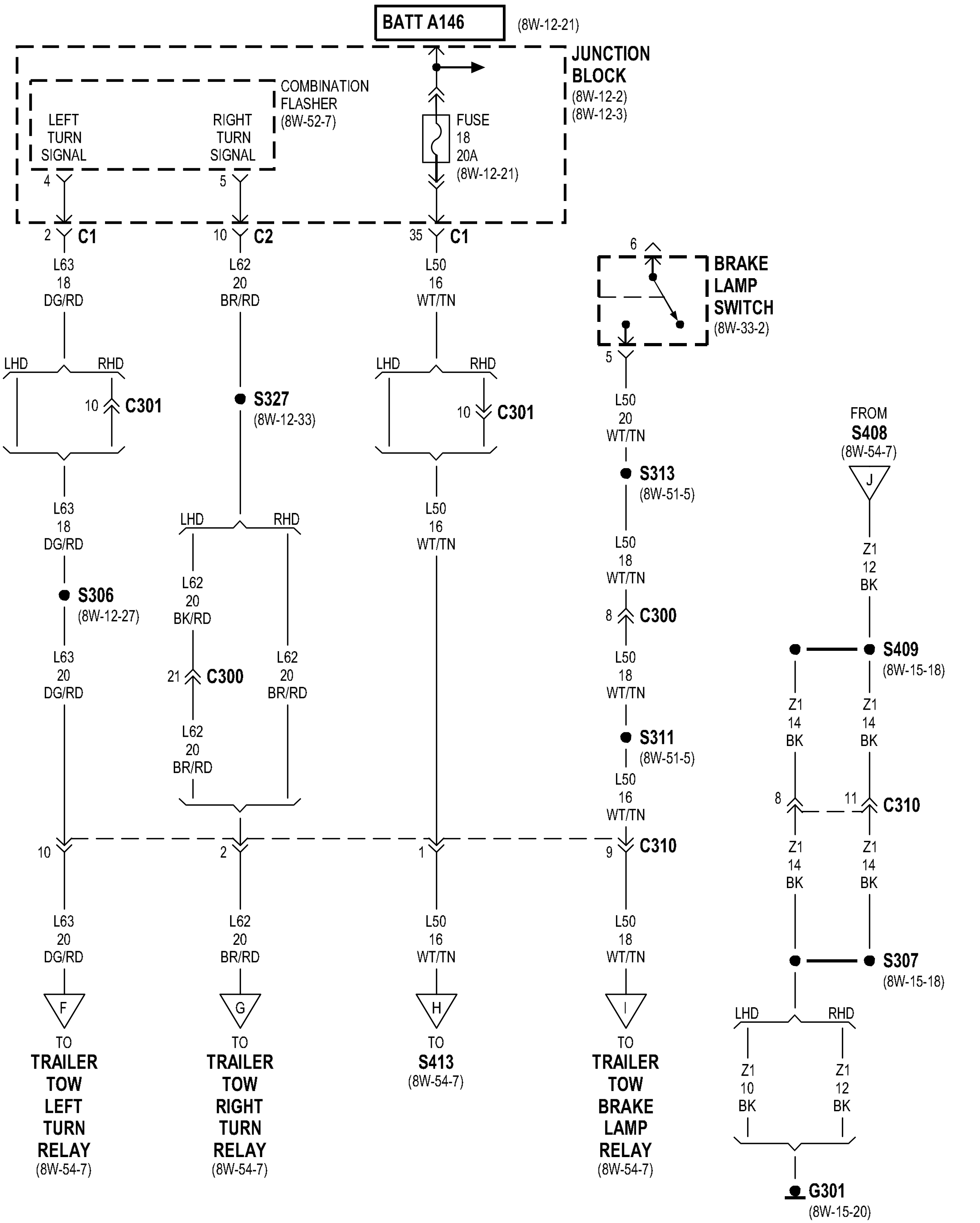
8W-54 TRAILER TOW

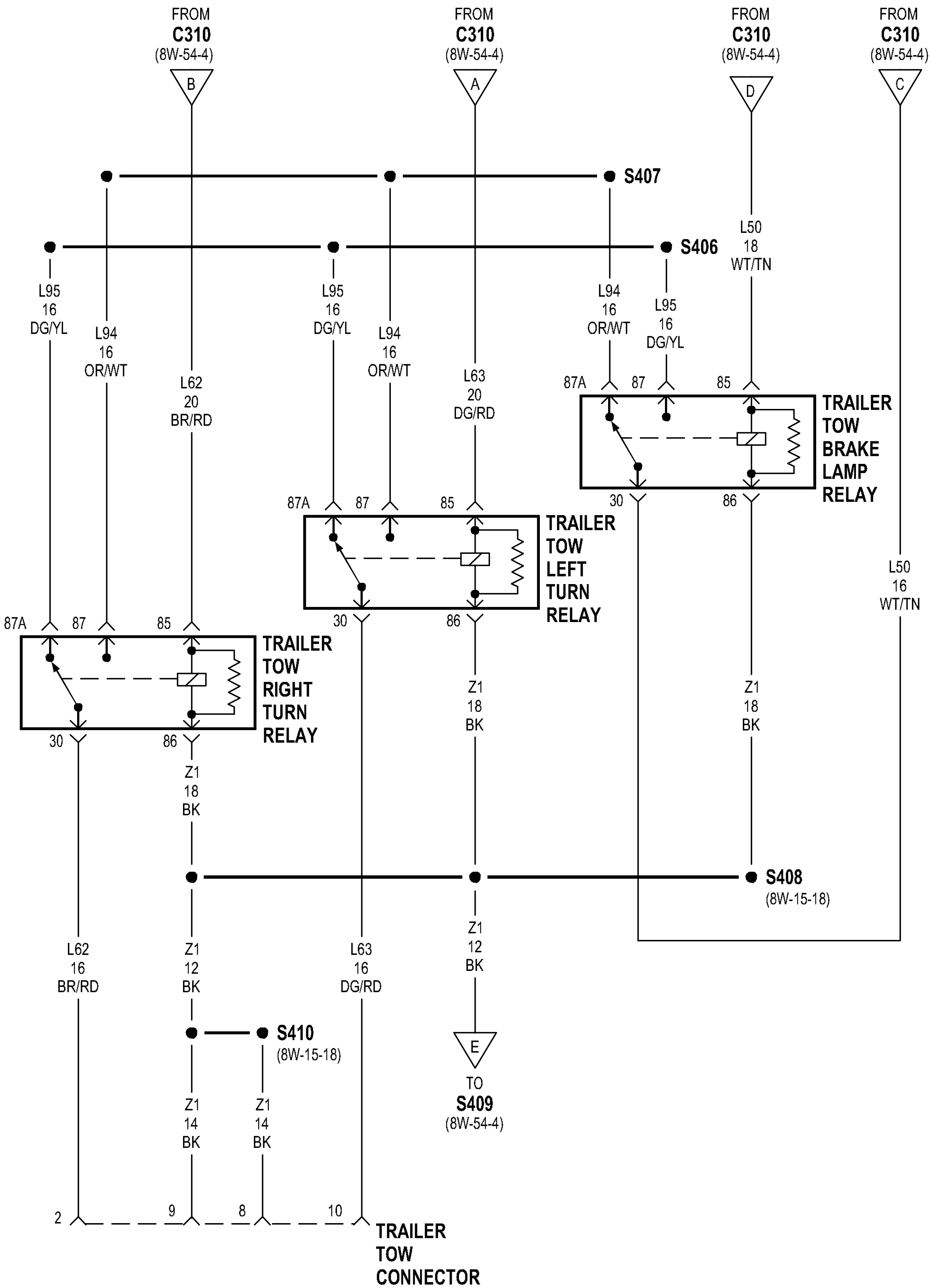

BATT A145
(8W-10-15)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
6
15A
(8W-12-12)
(8W-12-13)
87A
87
85
PARK LAMP RELAY
(8W-50-6)
30
86
1
PARK LAMP RELAY CONTROL
BODY CONTROL MODULE
(8W-45-3)
LHD
RHD
31
C3
11
C1
21
C2
Z1
20
BK
L7
18
BK/YL
L7
18
BK/YL
S309
(8W-12-12)
S326
(8W-12-13)
S205
(8W-15-14)
L7
18
BK/YL
5
C310
Z1
18
BK
L7
18
BK/YL
5
G200
(8W-15-14)
TRAILER TOW CONNECTOR


BATT A149
(8W-10-14)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
30
CIGAR
LIGHTER
RELAY
(8W-41-4)
87
41
C1
LHD
RHD
F30
12
RD
C
C301
F30
14
RD
F30
14
RD/YL
4
C310
F30
14
RD
B
TRAILER
TOW
CIRCUIT
BREAKER
CIRCUIT
BREAKER
15A
A
F30
14
RD
4
TRANSMISSION
SOLENOID/
TRS
ASSEMBLY
(8W-31-5)
BACK-UP
LAMP
FEED
6
L1
18
VT/BK
PARK/
NEUTRAL
POSITION
SWITCH
(8W-31-6)
BACK-UP
LAMP
FEED
1
L1
18
VT/BK
4.7L
4.0L/DIESEL
L1
18
VT/BK
6
C102
L1
18
VT/BK
GAS
DIESEL
56
C106
55
C107
L1
18
VT/BK
LHD
RHD
S328
(8W-51-6)
L1
18
VT/BK
24
C300
L1
18
VT/BK
L1
18
VT/BK
S310
(8W-51-6)
(8W-51-7)
L1
18
VT/BK
3
C310
L1
18
VT/BK
3
TRAILER
BRAKE
PROVISION
B40
12
LB
C
C300
B40
14
LB
7
TRAILER
BRAKE
PROVISION
B40
14
LB
7
C310
RHD
LHD
B40
14
LB
7
TRAILER
TOW
CONNECTOR

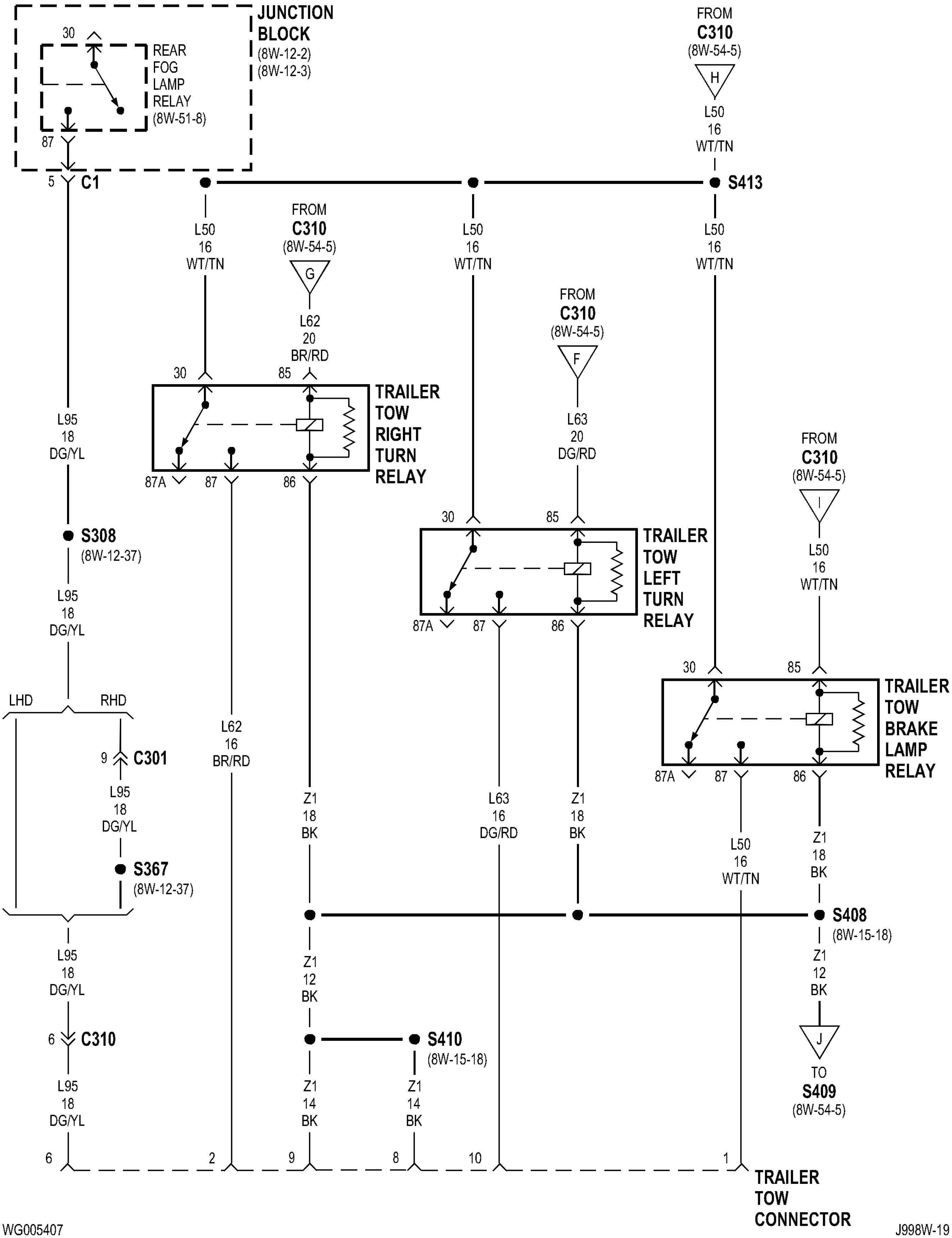
EXCEPT BUILT-UP-EXPORT




BATT A146
(8W-12-21)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
COMBINATION FLASHER
(8W-52-7)
LEFT TURN SIGNAL
RIGHT TURN SIGNAL
FUSE
18
20A
(8W-12-21)
4
5
2 C1
10 C2
35 C1
L63 18 DG/RD
L62 20 BR/RD
L50 16 WT/TN
BRAKE LAMP SWITCH
(8W-33-2)
6
5
LHD
RHD
10 C301
S327
(8W-12-33)
L50 20 WT/TN
S313
(8W-51-5)
FROM S408
(8W-54-7)
J
L63 18 DG/RD
L62 20 BK/RD
L62 20 BR/RD
L50 16 WT/TN
L50 18 WT/TN
Z1 12 BK
S306
(8W-12-27)
L63 20 DG/RD
8 C300
21 C300
S409
(8W-15-18)
Z1 14 BK
S311
(8W-51-5)
L50 16 WT/TN
8
11 C310
10
2
1
9 C310
L63 20 DG/RD
L62 20 BR/RD
L50 16 WT/TN
L50 18 WT/TN
S307
(8W-15-18)
F
G
H
I
TO TRAILER TOW LEFT TURN RELAY
(8W-54-7)
TO TRAILER TOW RIGHT TURN RELAY
(8W-54-7)
TO S413
(8W-54-7)
TO TRAILER TOW BRAKE LAMP RELAY
(8W-54-7)
Z1 10 BK
Z1 12 BK
G301
(8W-15-20)

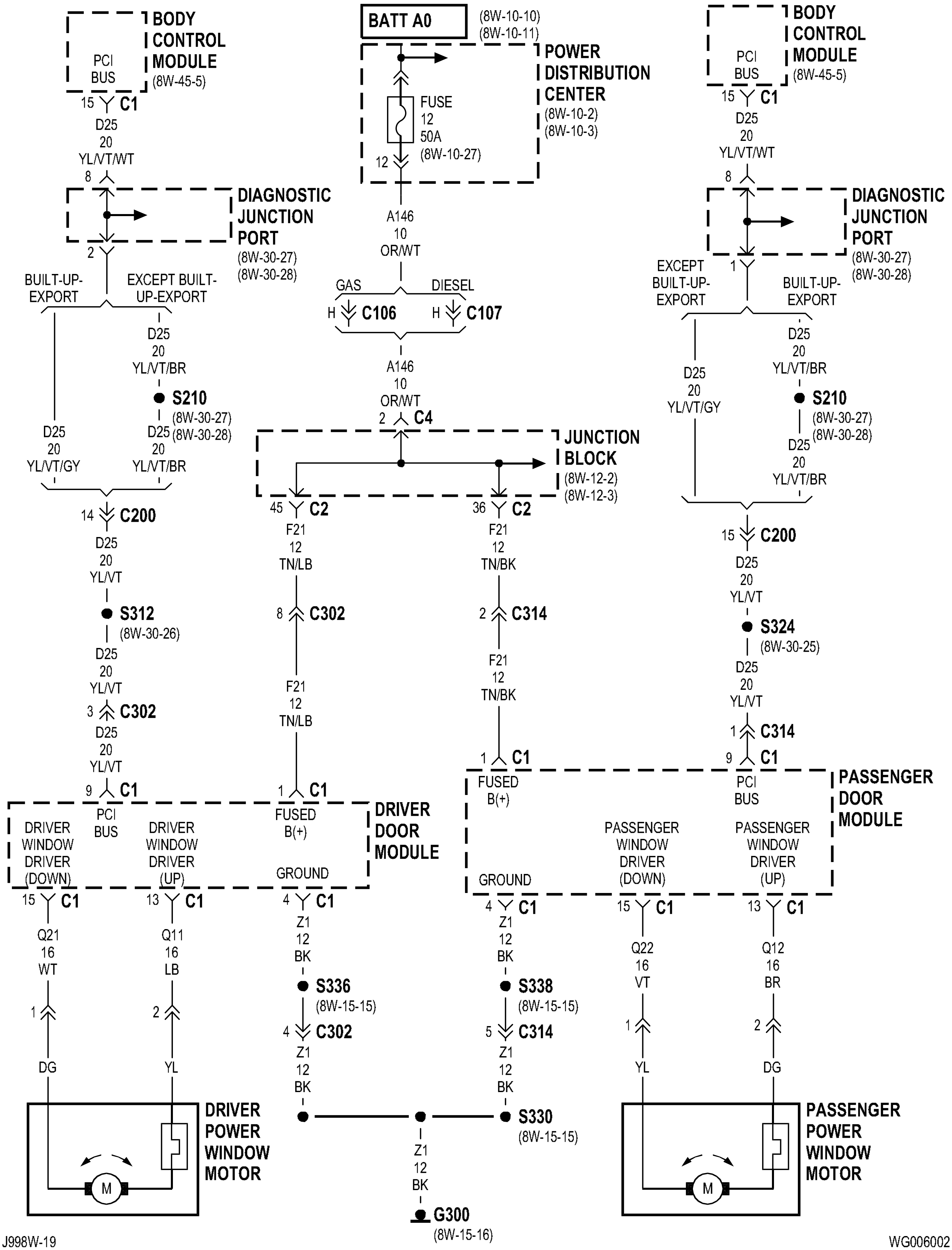

FROM C310 (8W-54-4) B
FROM C310 (8W-54-4) A
FROM C310 (8W-54-4) D
FROM C310 (8W-54-4) C
S407
S406
L95 16 DG/YL
L94 16 OR/WT
L62 20 BR/RD
L95 16 DG/YL
L94 16 OR/WT
L63 20 DG/RD
L94 16 OR/WT
L95 16 DG/YL
L50 18 WT/TN
87A 87 85
TRAILER TOW BRAKE LAMP RELAY
30 86
87A 87 85
TRAILER TOW LEFT TURN RELAY
30 86
L50 16 WT/TN
87A 87 85
TRAILER TOW RIGHT TURN RELAY
30 86
Z1 18 BK
Z1 18 BK
Z1 18 BK
S408 (8W-15-18)
L62 16 BR/RD
Z1 12 BK
L63 16 DG/RD
Z1 12 BK
S410 (8W-15-18)
E
TO S409 (8W-54-4)
Z1 14 BK
Z1 14 BK
2 9 8 10
TRAILER TOW CONNECTOR

BUILT-UP-EXPORT

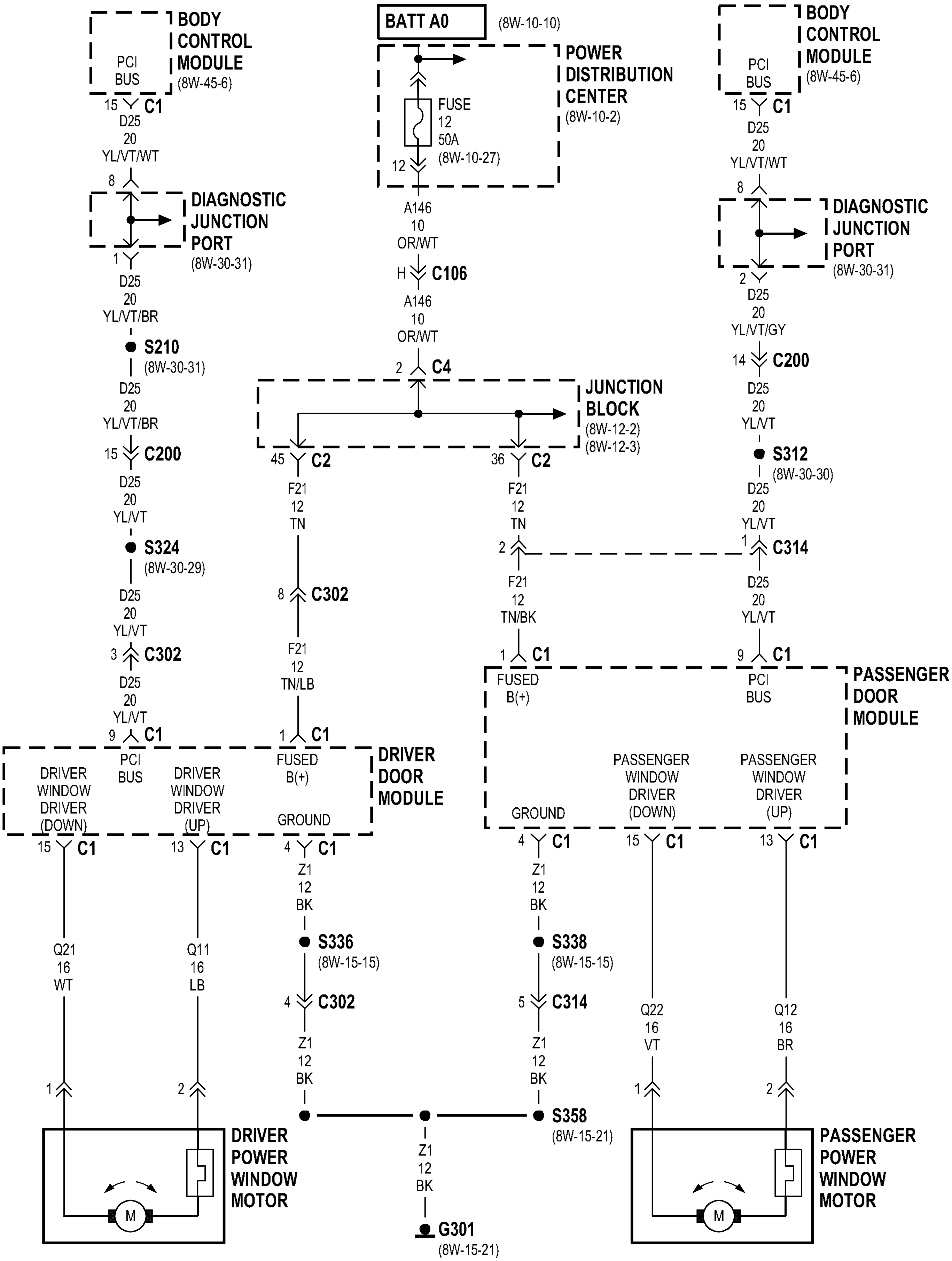


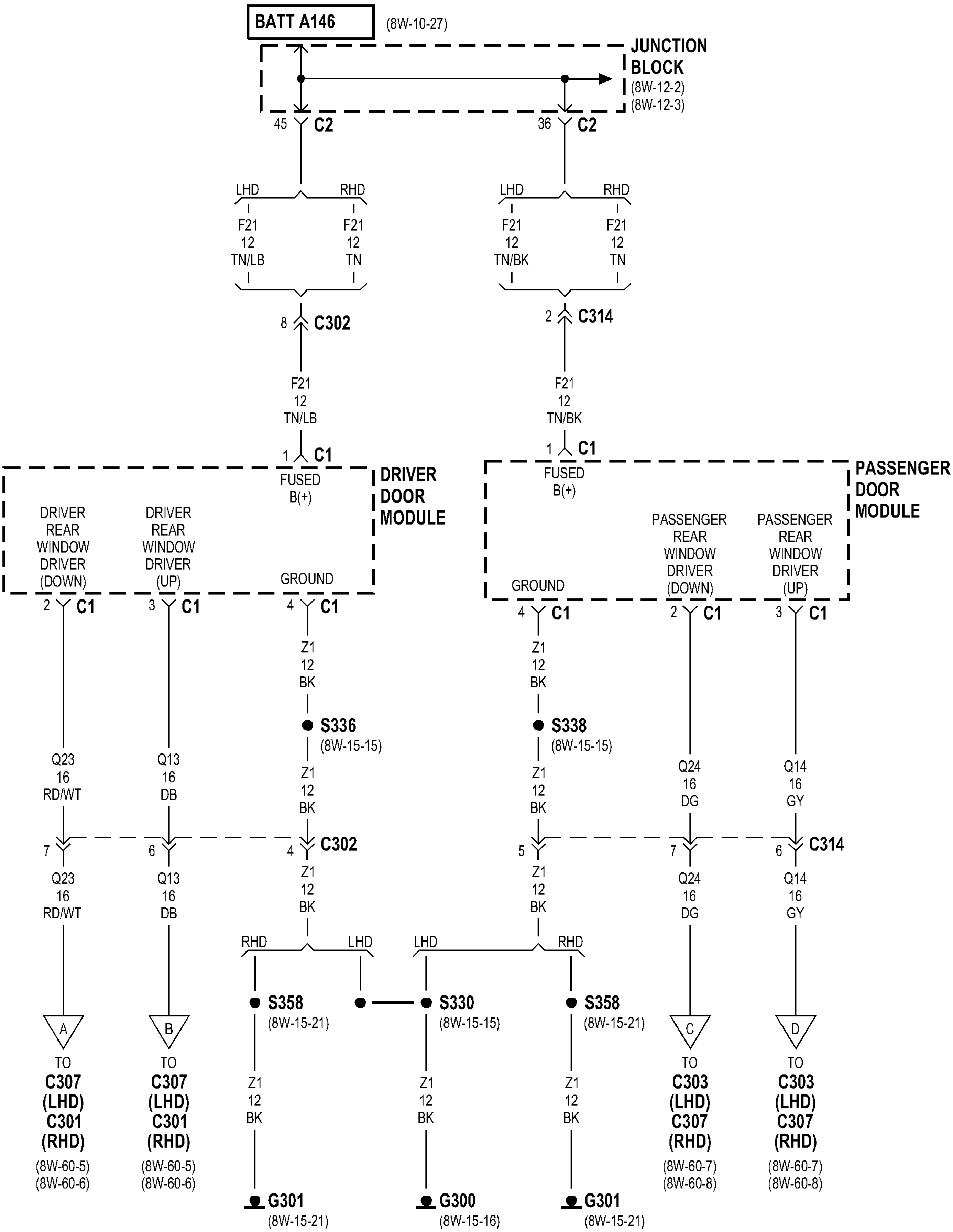
8W-60 POWER WINDOWS

LHD

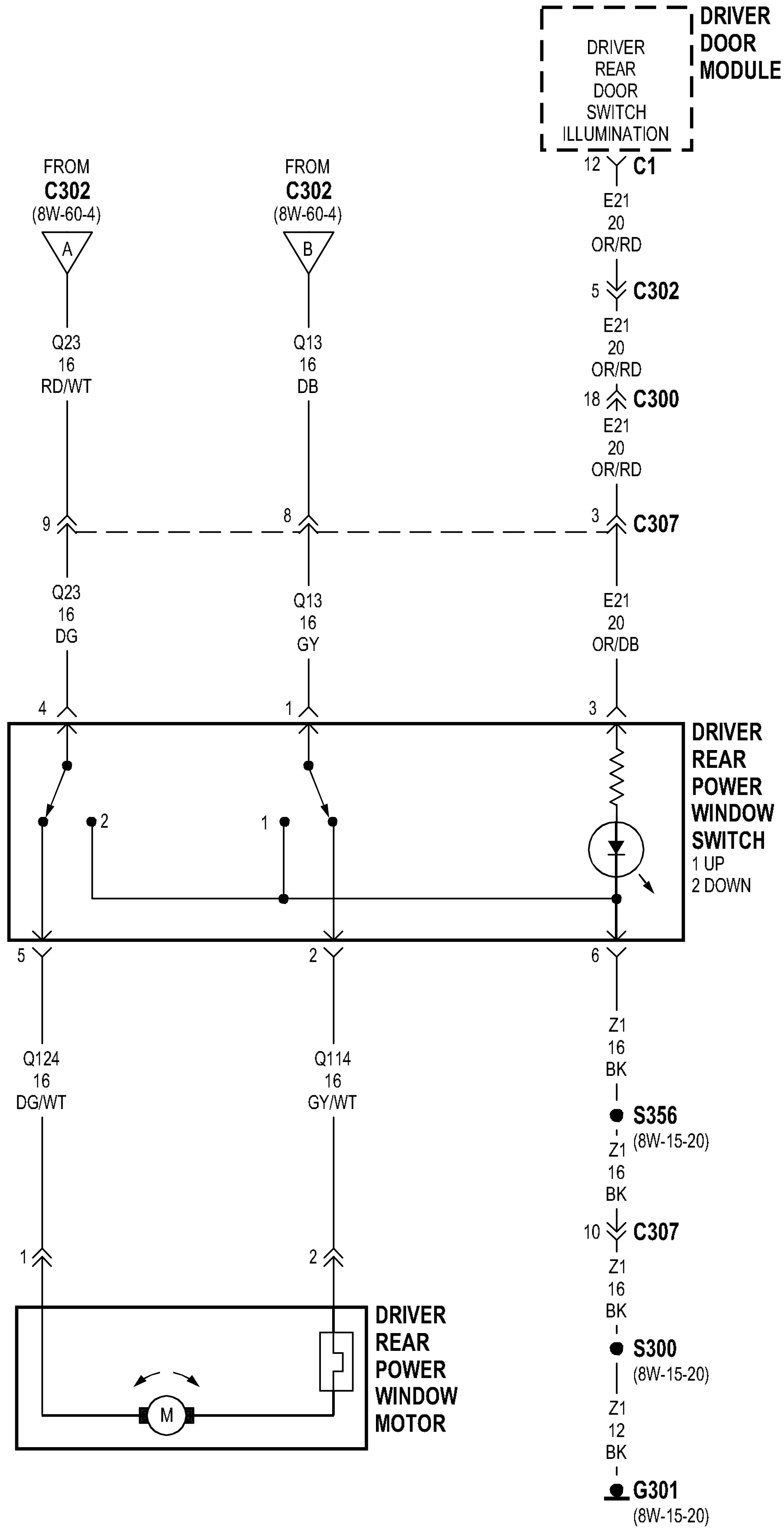

BODY CONTROL MODULE
PCI BUS
(8W-45-5)
15 C1
D25 20 YL/VT/WT
DIAGNOSTIC JUNCTION PORT
(8W-30-27)
(8W-30-28)
BUILT-UP-EXPORT
EXCEPT BUILT-UP-EXPORT
D25 20 YL/VT/BR
S210
D25 20 YL/VT/GY
14 C200
D25 20 YL/VT
S312
(8W-30-26)
3 C302
9 C1
BATT A0
(8W-10-10)
(8W-10-11)
POWER DISTRIBUTION CENTER
FUSE 12 50A (8W-10-27)
(8W-10-2)
(8W-10-3)
A146 10 OR/WT
GAS
DIESEL
C106
C107
2 C4
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
45 C2
36 C2
F21 12 TN/LB
F21 12 TN/BK
8 C302
2 C314
1 C1
DRIVER DOOR MODULE
DRIVER WINDOW DRIVER (DOWN)
DRIVER WINDOW DRIVER (UP)
FUSED B(+)
GROUND
15 C1
13 C1
4 C1
Q21 16 WT
Q11 16 LB
Z1 12 BK
S336
(8W-15-15)
4 C302
DG
YL
DRIVER POWER WINDOW MOTOR
M
S338
5 C314
S330
G300
(8W-15-16)
S324
(8W-30-25)
15 C200
1 C314
PASSENGER DOOR MODULE
PASSENGER WINDOW DRIVER (DOWN)
PASSENGER WINDOW DRIVER (UP)
Q22 16 VT
Q12 16 BR
PASSENGER POWER WINDOW MOTOR

RHD

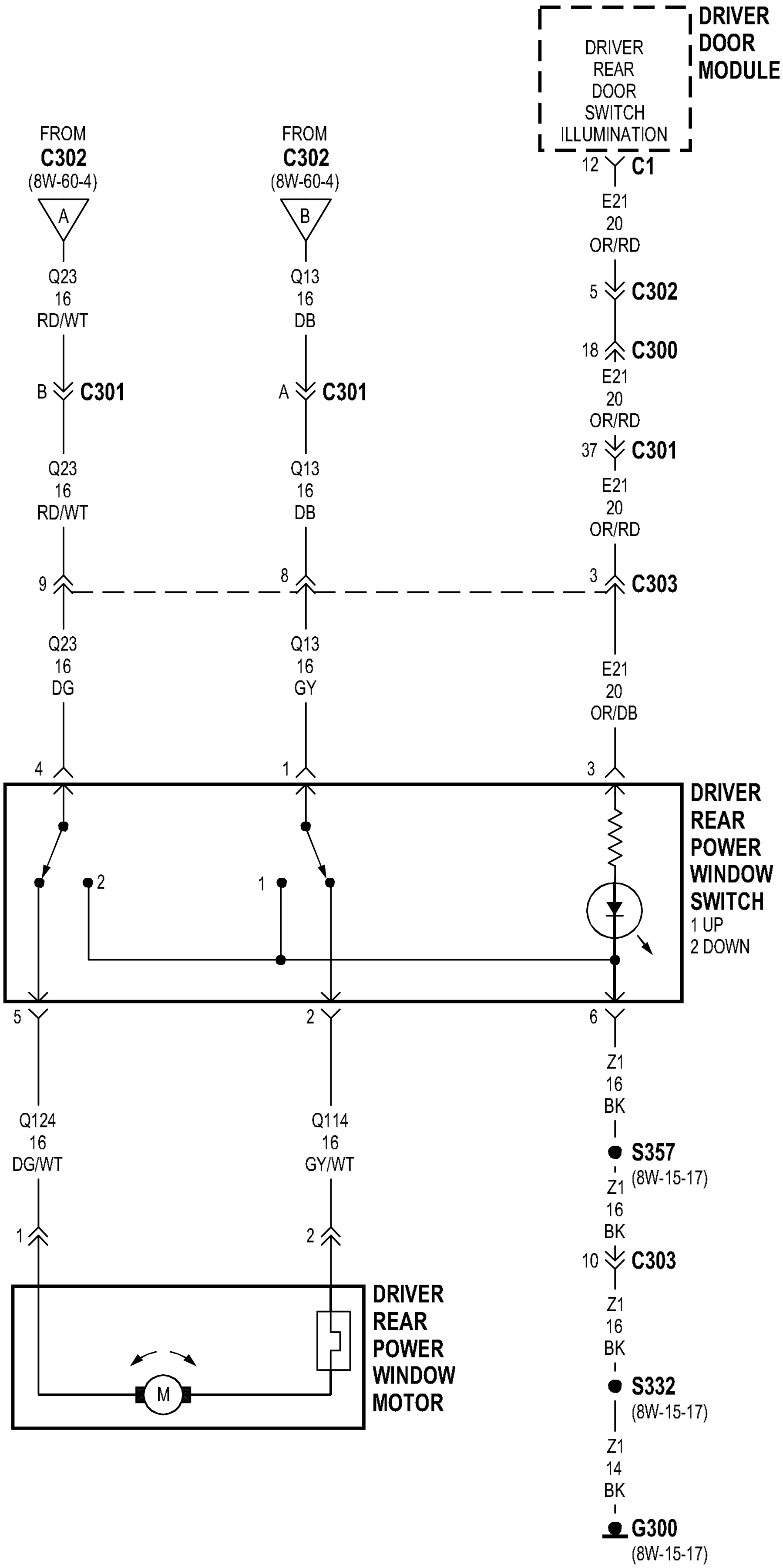

BATT A0
(8W-10-10)
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 12 50A
(8W-10-27)
BODY CONTROL MODULE
(8W-45-6)
PCI BUS
C1
D25 20 YL/VT/WT
DIAGNOSTIC JUNCTION PORT
(8W-30-31)
D25 20 YL/VT/BR
S210
(8W-30-31)
C200
D25 20 YL/VT
S324
(8W-30-29)
C302
A146 10 OR/WT
C106
C4
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
C2
F21 12 TN
F21 12 TN/LB
F21 12 TN/BK
D25 20 YL/VT/GY
S312
(8W-30-30)
C314
PASSENGER DOOR MODULE
FUSED B(+)
GROUND
PASSENGER WINDOW DRIVER (DOWN)
PASSENGER WINDOW DRIVER (UP)
DRIVER DOOR MODULE
DRIVER WINDOW DRIVER (DOWN)
DRIVER WINDOW DRIVER (UP)
Z1 12 BK
S336
(8W-15-15)
S338
(8W-15-15)
S358
(8W-15-21)
G301
(8W-15-21)
Q21 16 WT
Q11 16 LB
Q22 16 VT
Q12 16 BR
DRIVER POWER WINDOW MOTOR
PASSENGER POWER WINDOW MOTOR
M

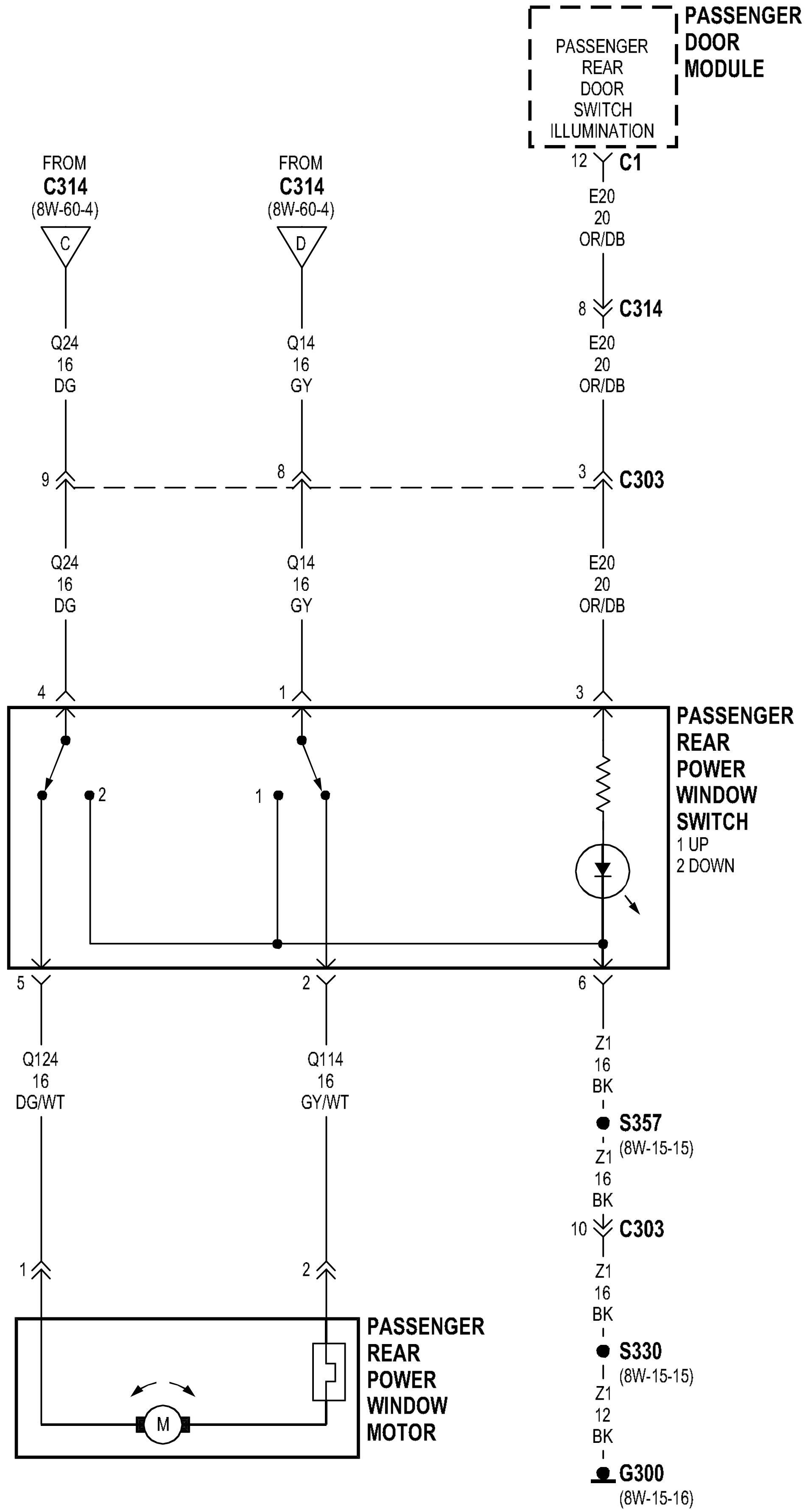


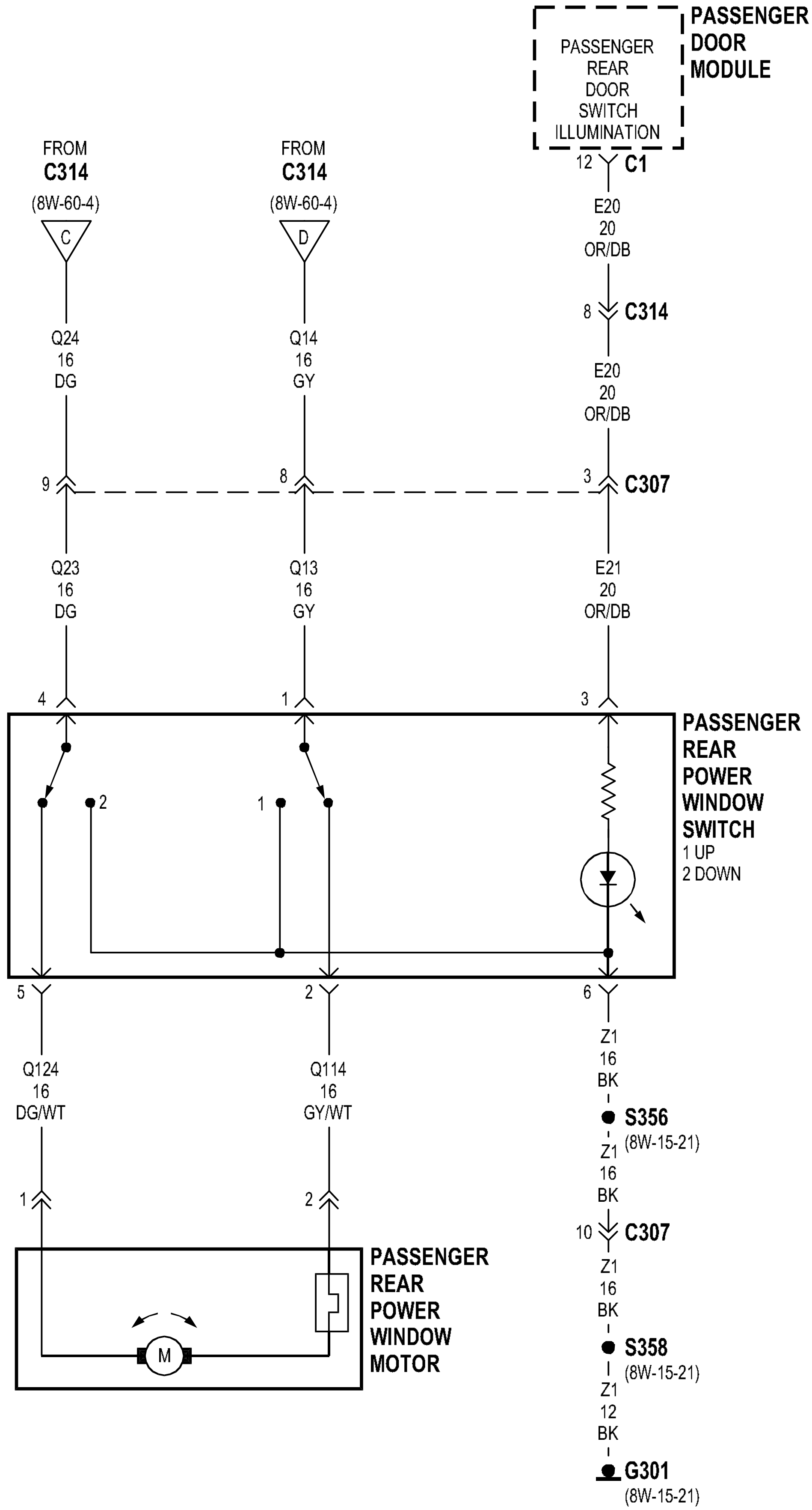
J998W-19 WG006004


DRIVER DOOR MODULE
DRIVER REAR DOOR SWITCH ILLUMINATION
12 C1
E21 20 OR/RD
5 C302
E21 20 OR/RD
18 C300
E21 20 OR/RD
3 C307
E21 20 OR/DB
FROM C302 (8W-60-4) A
Q23 16 RD/WT
9
Q23 16 DG
4
FROM C302 (8W-60-4) B
Q13 16 DB
8
Q13 16 GY
1
3
DRIVER REAR POWER WINDOW SWITCH
1 UP
2 DOWN
2
1
5
2
6
Q124 16 DG/WT
Q114 16 GY/WT
1
2
DRIVER REAR POWER WINDOW MOTOR
M
Z1 16 BK
S356 (8W-15-20)
Z1 16 BK
10 C307
Z1 16 BK
S300 (8W-15-20)
Z1 12 BK
G301 (8W-15-20)

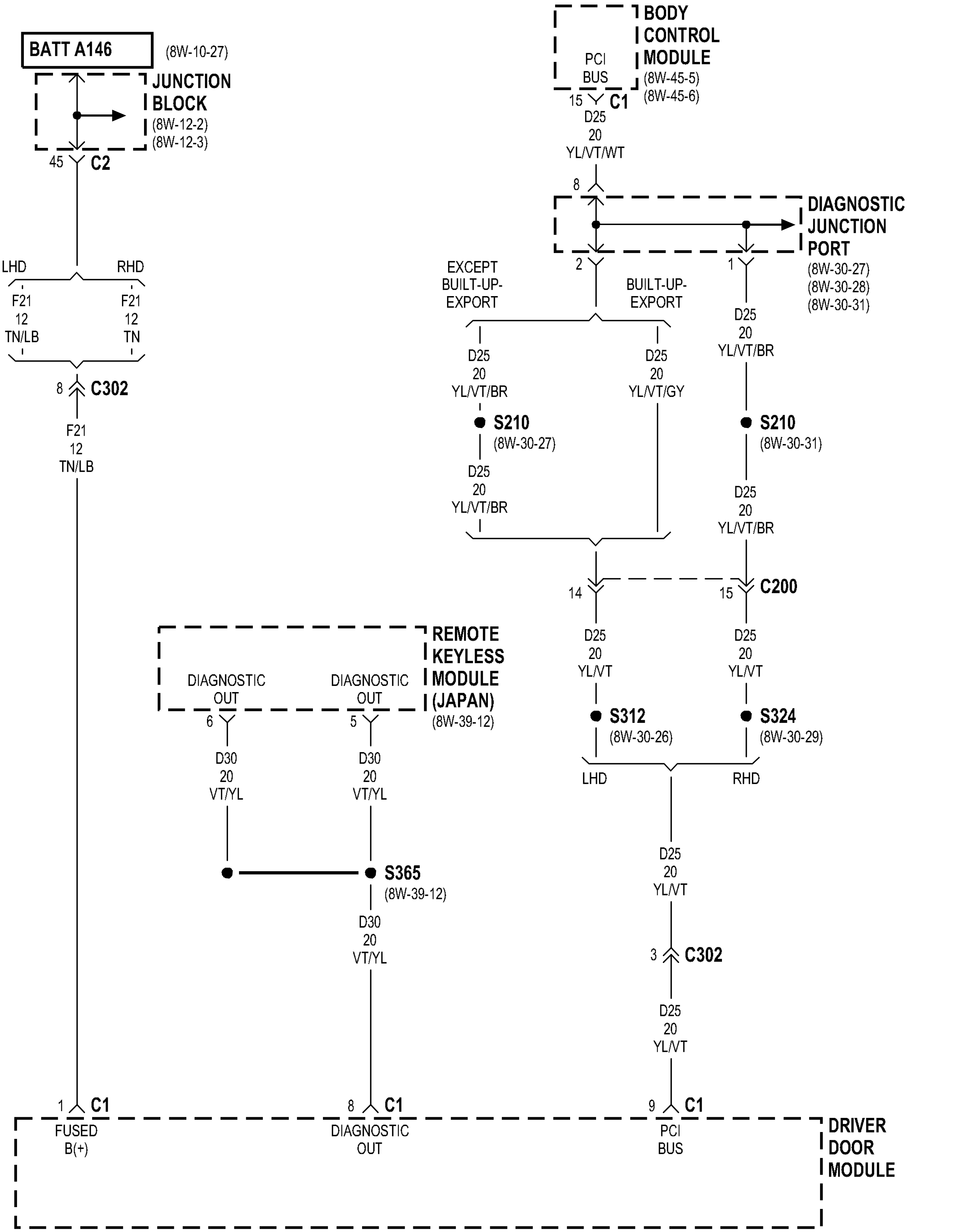
RHD

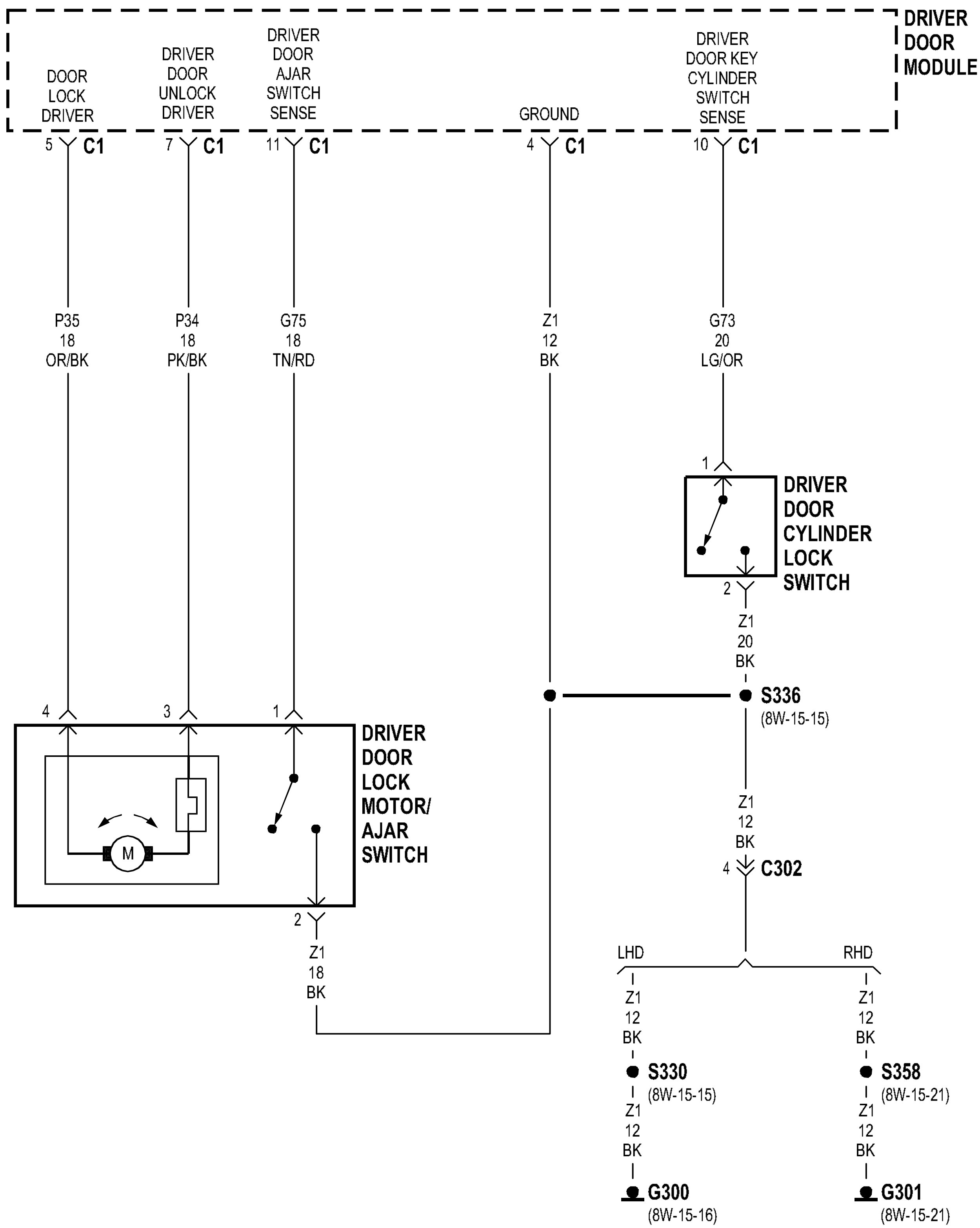

DRIVER DOOR MODULE
DRIVER REAR DOOR SWITCH ILLUMINATION
12 C1
E21 20 OR/RD
5 C302
18 C300
E21 20 OR/RD
37 C301
E21 20 OR/RD
3 C303
E21 20 OR/DB
FROM C302 (8W-60-4) A
Q23 16 RD/WT
B C301
Q23 16 RD/WT
9
Q23 16 DG
FROM C302 (8W-60-4) B
Q13 16 DB
A C301
Q13 16 DB
8
Q13 16 GY
4
1
3
2
1
DRIVER REAR POWER WINDOW SWITCH
1 UP
2 DOWN
5
2
6
Q124 16 DG/WT
Q114 16 GY/WT
1
2
Z1 16 BK
S357 (8W-15-17)
Z1 16 BK
10 C303
Z1 16 BK
S332 (8W-15-17)
Z1 14 BK
G300 (8W-15-17)
M
DRIVER REAR POWER WINDOW MOTOR

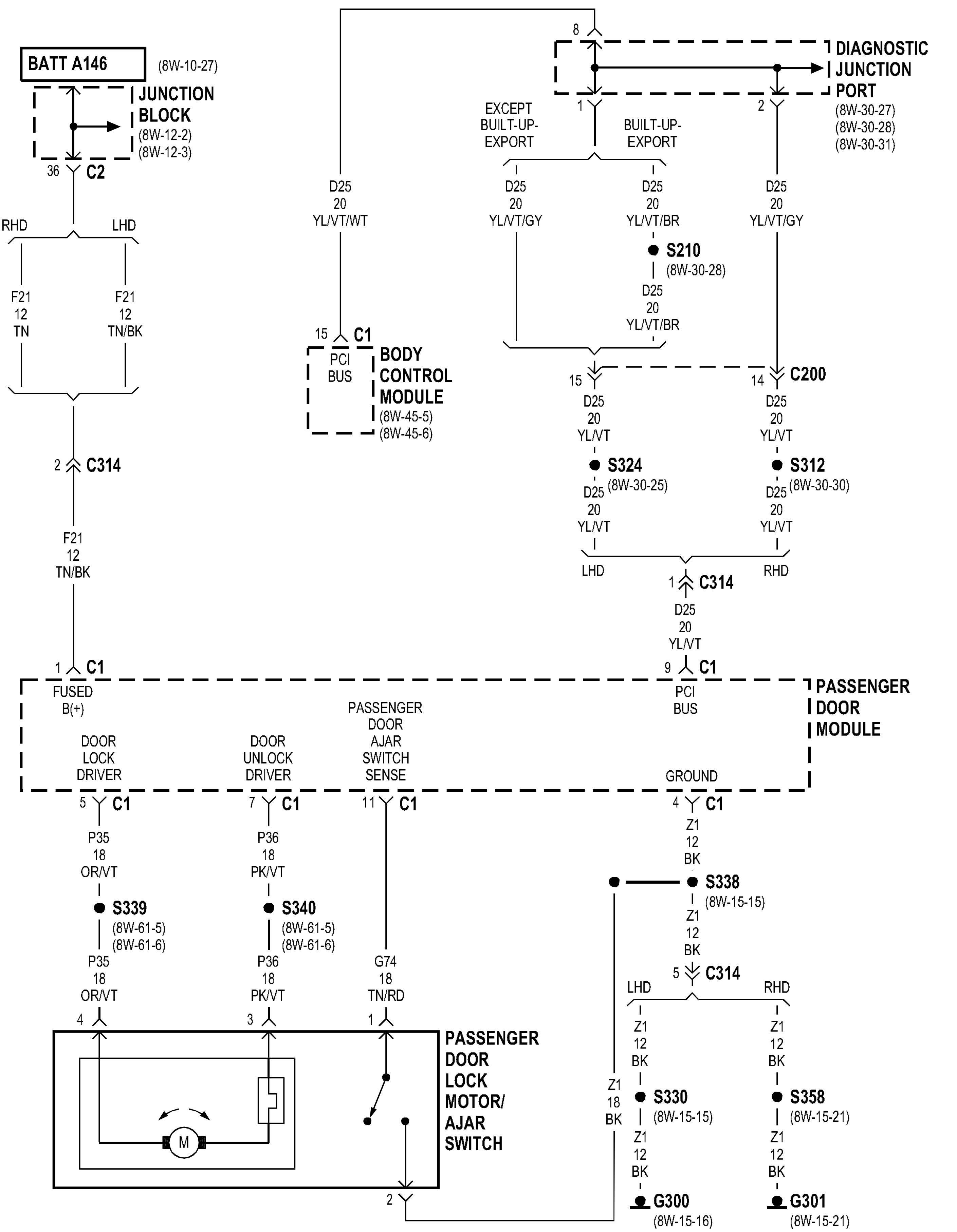

PASSENGER REAR DOOR SWITCH ILLUMINATION
PASSENGER DOOR MODULE
12 C1
E20 20 OR/DB
8 C314
E20 20 OR/DB
FROM C314 (8W-60-4) C
FROM C314 (8W-60-4) D
Q24 16 DG
Q14 16 GY
9
8
3 C303
Q24 16 DG
Q14 16 GY
E20 20 OR/DB
4
1
3
2
1
PASSENGER REAR POWER WINDOW SWITCH
1 UP
2 DOWN
5
2
6
Q124 16 DG/WT
Q114 16 GY/WT
Z1 16 BK
S357 (8W-15-15)
Z1 16 BK
10 C303
Z1 16 BK
S330 (8W-15-15)
Z1 12 BK
G300 (8W-15-16)
1
2
M
PASSENGER REAR POWER WINDOW MOTOR


PASSENGER DOOR MODULE
PASSENGER REAR DOOR SWITCH ILLUMINATION
12 C1
E20 20 OR/DB
8 C314
E20 20 OR/DB
3 C307
E21 20 OR/DB
FROM C314 (8W-60-4) C
Q24 16 DG
9
Q23 16 DG
FROM C314 (8W-60-4) D
Q14 16 GY
8
Q13 16 GY
4
1
3
PASSENGER REAR POWER WINDOW SWITCH
1 UP
2 DOWN
2
1
5
2
6
Q124 16 DG/WT
Q114 16 GY/WT
Z1 16 BK
S356 (8W-15-21)
Z1 16 BK
10 C307
Z1 16 BK
S358 (8W-15-21)
Z1 12 BK
G301 (8W-15-21)
1
2
PASSENGER REAR POWER WINDOW MOTOR
M

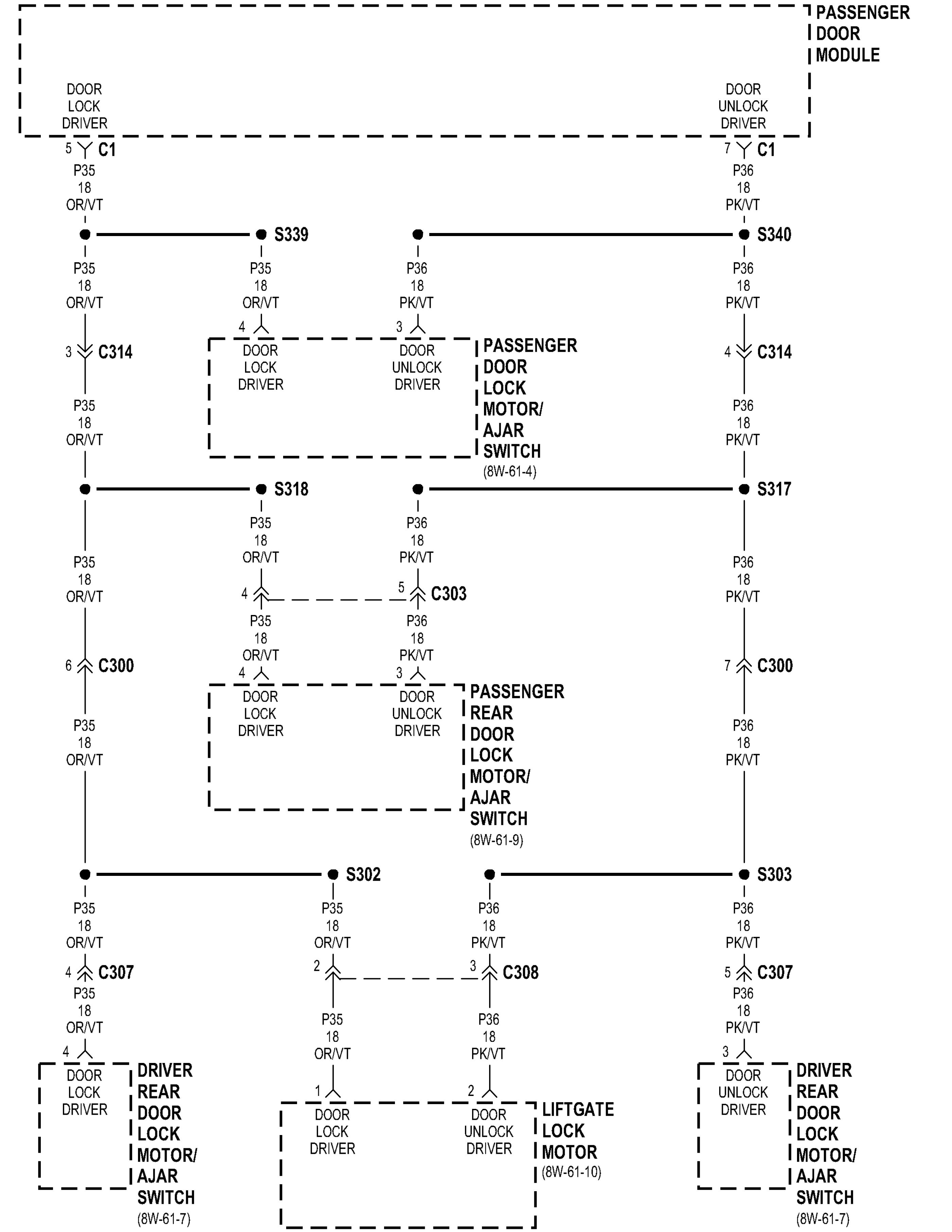
8W-61 POWER DOOR LOCKS


BATT A146
(8W-10-27)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
45 C2
LHD
RHD
F21
12
TN/LB
F21
12
TN
8 C302
F21
12
TN/LB
BODY CONTROL MODULE
PCI BUS
(8W-45-5)
(8W-45-6)
15 C1
D25
20
YL/VT/WT
8
DIAGNOSTIC JUNCTION PORT
(8W-30-27)
(8W-30-28)
(8W-30-31)
2
1
EXCEPT BUILT-UP-EXPORT
BUILT-UP-EXPORT
D25
20
YL/VT/BR
D25
20
YL/VT/GY
D25
20
YL/VT/BR
S210
(8W-30-27)
D25
20
YL/VT/BR
S210
(8W-30-31)
D25
20
YL/VT/BR
D25
20
YL/VT/BR
14
15
C200
D25
20
YL/VT
D25
20
YL/VT
S312
(8W-30-26)
S324
(8W-30-29)
LHD
RHD
D25
20
YL/VT
3 C302
D25
20
YL/VT
REMOTE KEYLESS MODULE (JAPAN)
(8W-39-12)
DIAGNOSTIC OUT
DIAGNOSTIC OUT
6
5
D30
20
VT/YL
D30
20
VT/YL
S365
(8W-39-12)
D30
20
VT/YL
1 C1
8 C1
9 C1
FUSED B(+)
DIAGNOSTIC OUT
PCI BUS
DRIVER DOOR MODULE

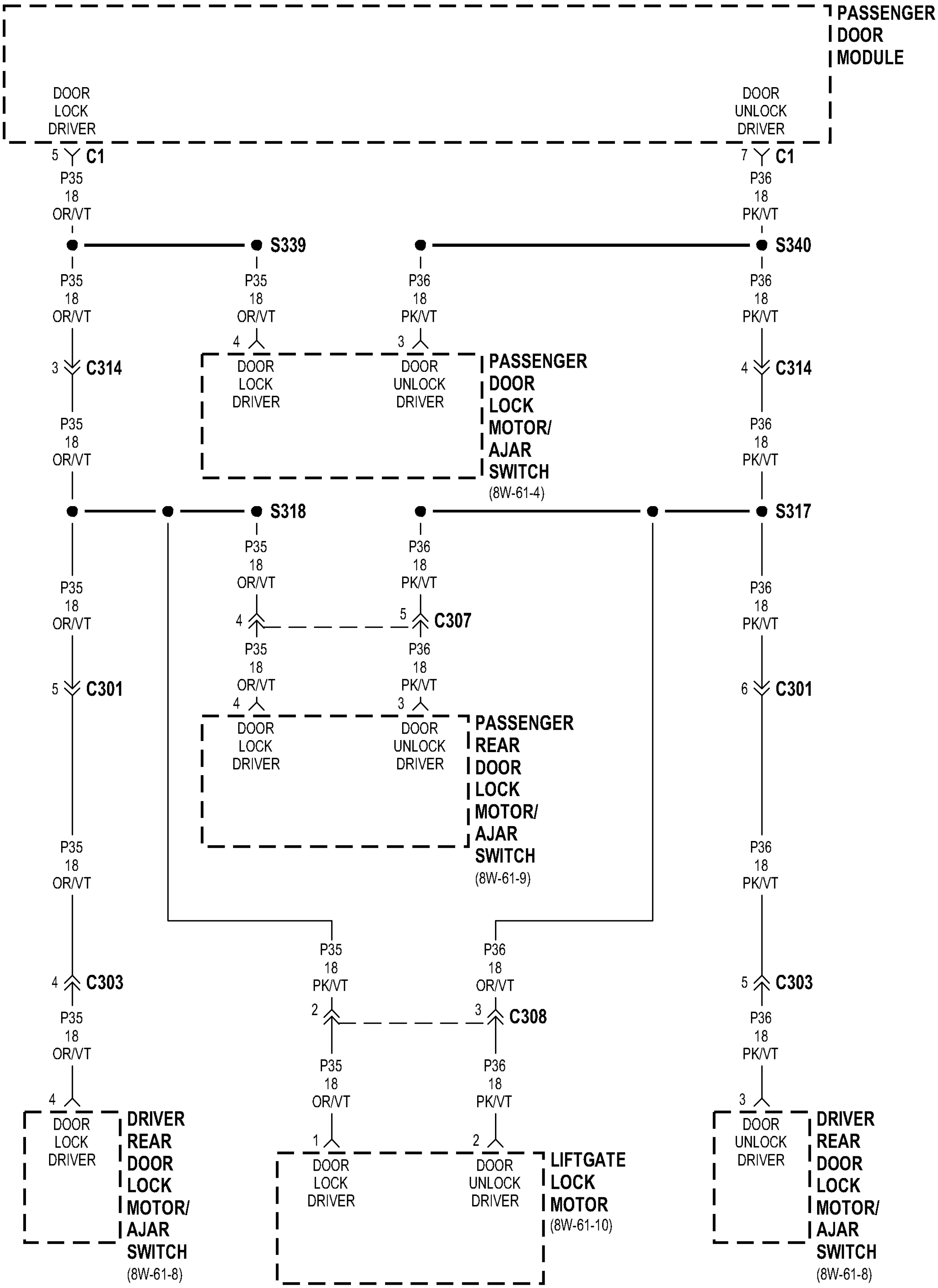

DRIVER DOOR MODULE
DOOR LOCK DRIVER
DRIVER DOOR UNLOCK DRIVER
DRIVER DOOR AJAR SWITCH SENSE
GROUND
DRIVER DOOR KEY CYLINDER SWITCH SENSE
5 C1
7 C1
11 C1
4 C1
10 C1
P35 18 OR/BK
P34 18 PK/BK
G75 18 TN/RD
Z1 12 BK
G73 20 LG/OR
1
2
DRIVER DOOR CYLINDER LOCK SWITCH
Z1 20 BK
S336 (8W-15-15)
Z1 12 BK
4 C302
LHD
RHD
Z1 12 BK
S330 (8W-15-15)
S358 (8W-15-21)
G300 (8W-15-16)
G301 (8W-15-21)
4
3
1
M
DRIVER DOOR LOCK MOTOR/ AJAR SWITCH
2
Z1 18 BK

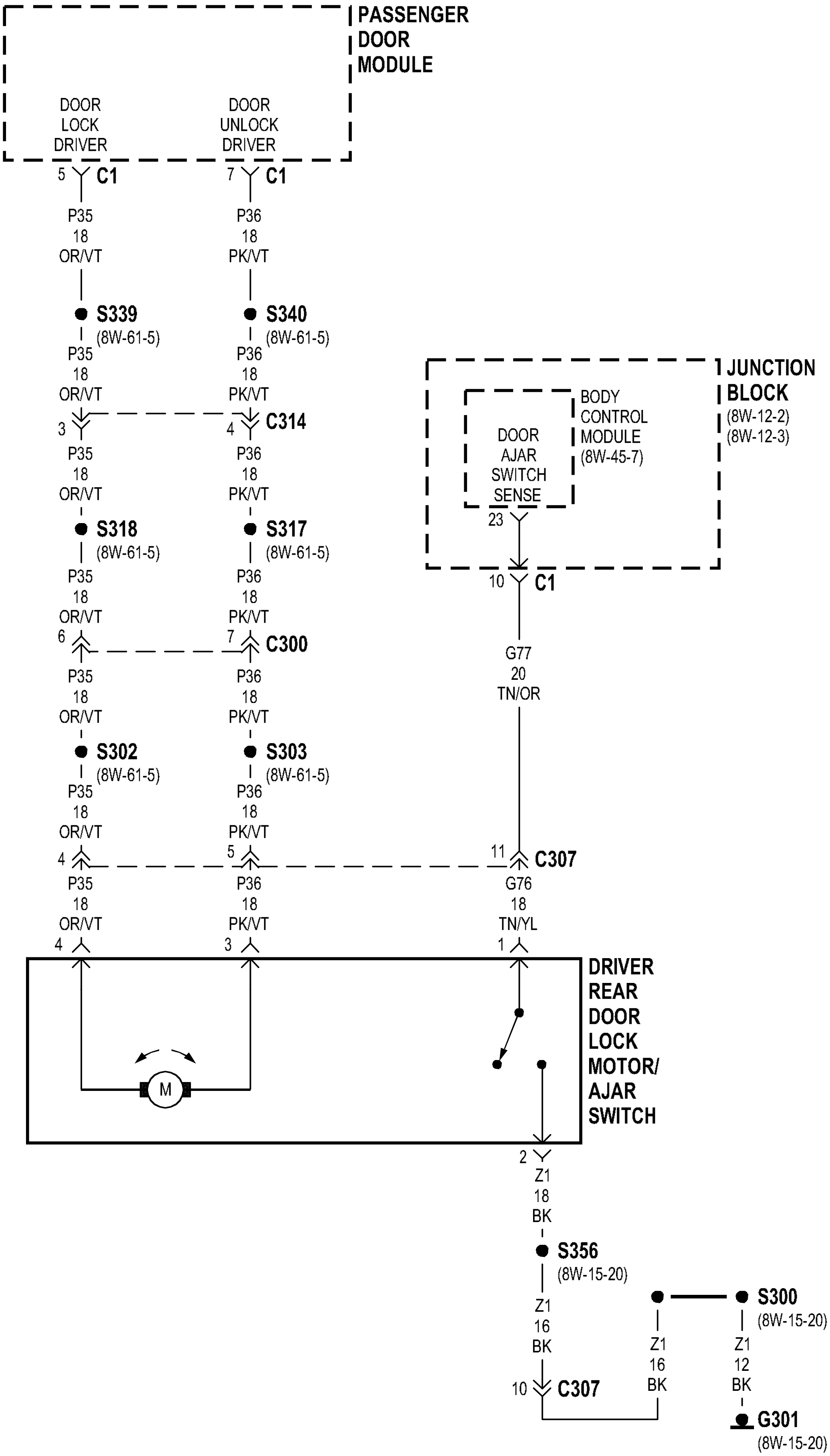


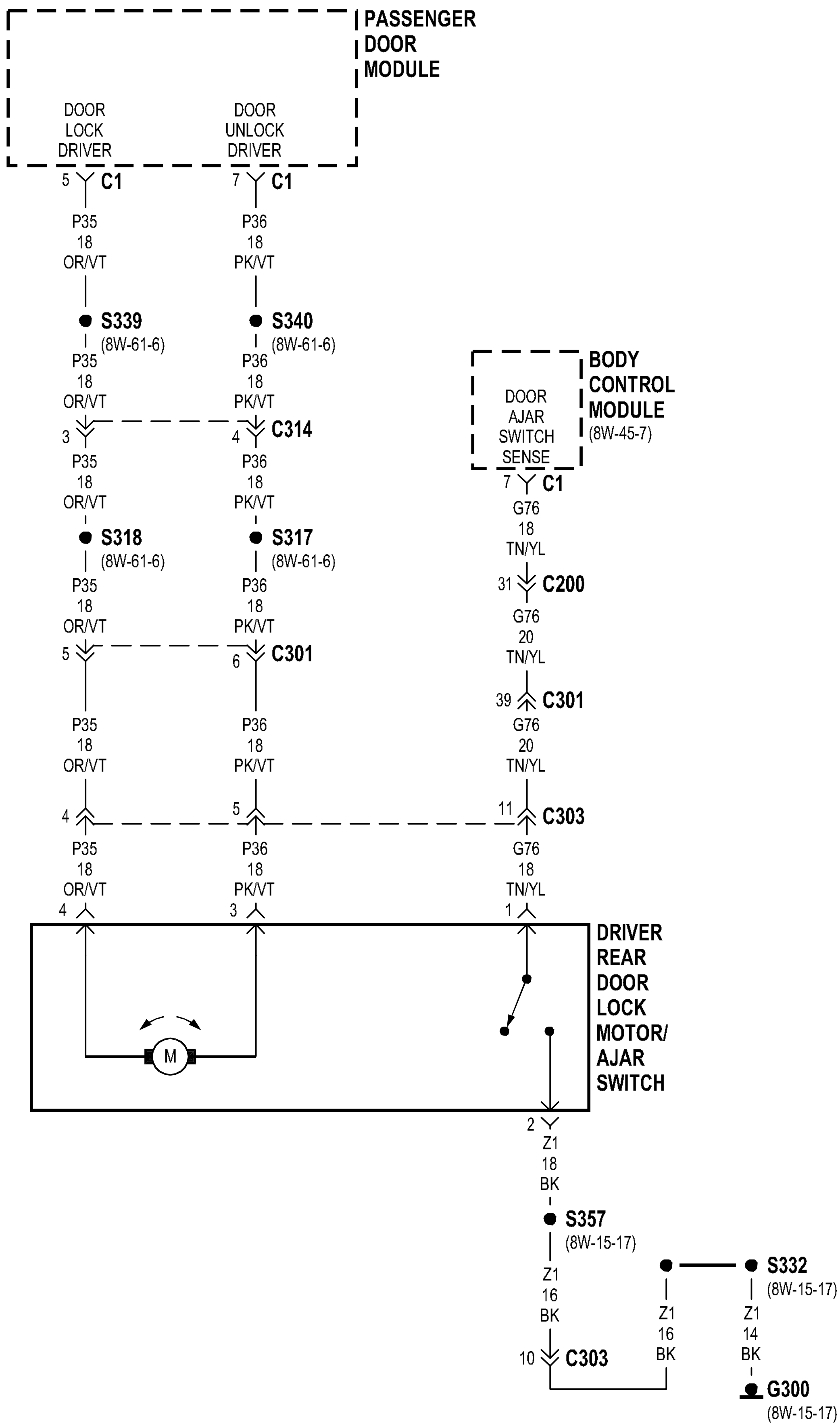
BATT A146
(8W-10-27)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
36 C2
RHD
LHD
F21 12 TN
F21 12 TN/BK
2 C314
F21 12 TN/BK
1 C1
8
DIAGNOSTIC JUNCTION PORT
(8W-30-27)
(8W-30-28)
(8W-30-31)
1
2
EXCEPT BUILT-UP-EXPORT
BUILT-UP-EXPORT
D25 20 YL/VT/WT
D25 20 YL/VT/GY
D25 20 YL/VT/BR
D25 20 YL/VT/GY
S210
(8W-30-28)
D25 20 YL/VT/BR
15 C1
PCI BUS
BODY CONTROL MODULE
(8W-45-5)
(8W-45-6)
15
14 C200
D25 20 YL/VT
D25 20 YL/VT
S324
(8W-30-25)
S312
(8W-30-30)
D25 20 YL/VT
D25 20 YL/VT
LHD
RHD
1 C314
D25 20 YL/VT
9 C1
FUSED B(+)
PCI BUS
PASSENGER DOOR MODULE
DOOR LOCK DRIVER
DOOR UNLOCK DRIVER
PASSENGER DOOR AJAR SWITCH SENSE
GROUND
5 C1
7 C1
11 C1
4 C1
P35 18 OR/VT
P36 18 PK/VT
Z1 12 BK
S339
(8W-61-5)
(8W-61-6)
S340
(8W-61-5)
(8W-61-6)
S338
(8W-15-15)
P35 18 OR/VT
P36 18 PK/VT
G74 18 TN/RD
Z1 12 BK
5 C314
LHD
RHD
4
3
1
M
PASSENGER DOOR LOCK MOTOR/ AJAR SWITCH
Z1 18 BK
Z1 12 BK
Z1 12 BK
S330
(8W-15-15)
S358
(8W-15-21)
Z1 12 BK
Z1 12 BK
2
G300
(8W-15-16)
G301
(8W-15-21)

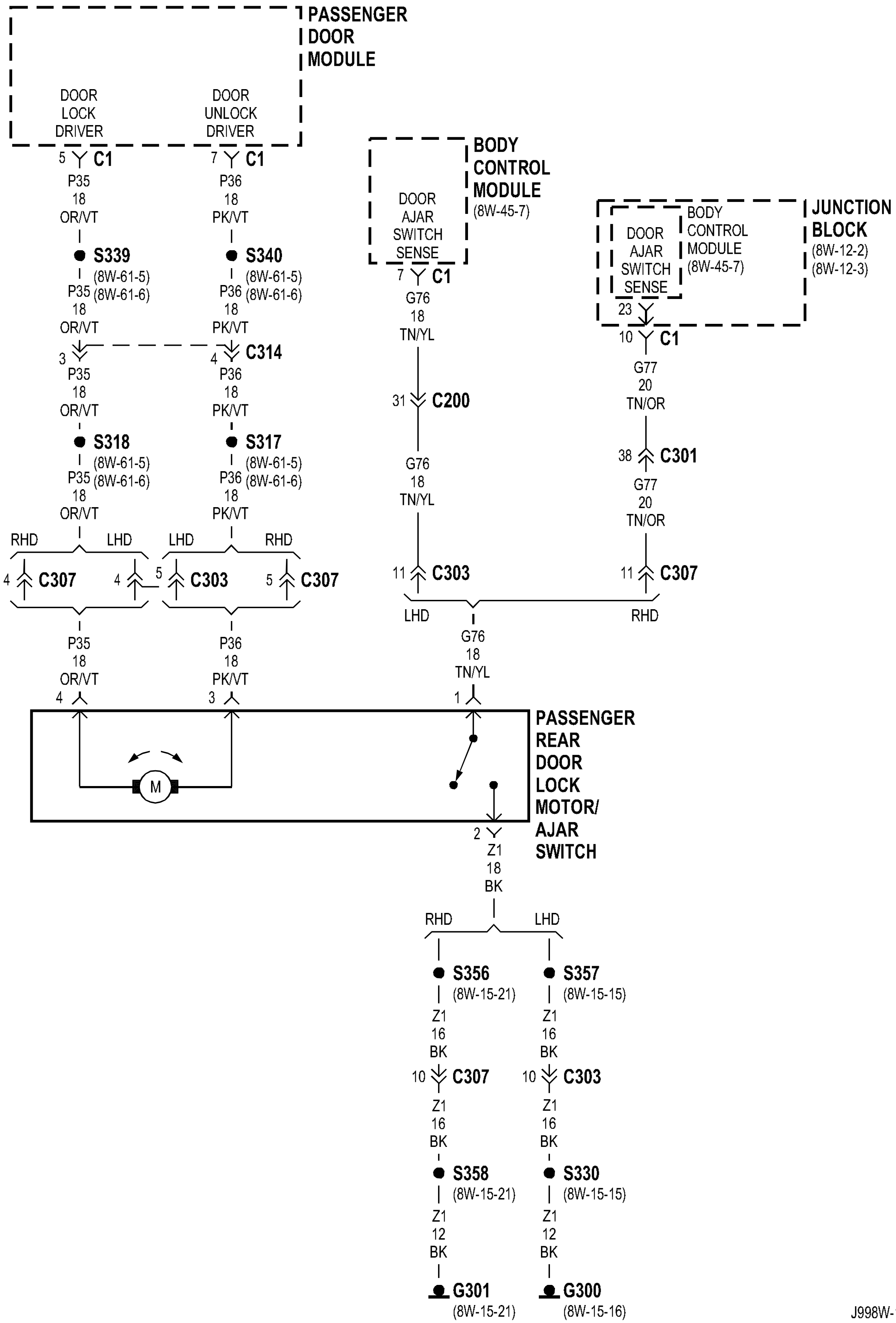

PASSENGER DOOR MODULE
DOOR LOCK DRIVER
DOOR UNLOCK DRIVER
5 C1
7 C1
P35 18 OR/VT
P36 18 PK/VT
S339
S340
4
3
PASSENGER DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-4)
3 C314
4 C314
S318
S317
4
5 C303
6 C300
7 C300
PASSENGER REAR DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-9)
S302
S303
4 C307
5 C307
2
3 C308
DRIVER REAR DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-7)
1
2
LIFTGATE LOCK MOTOR
(8W-61-10)

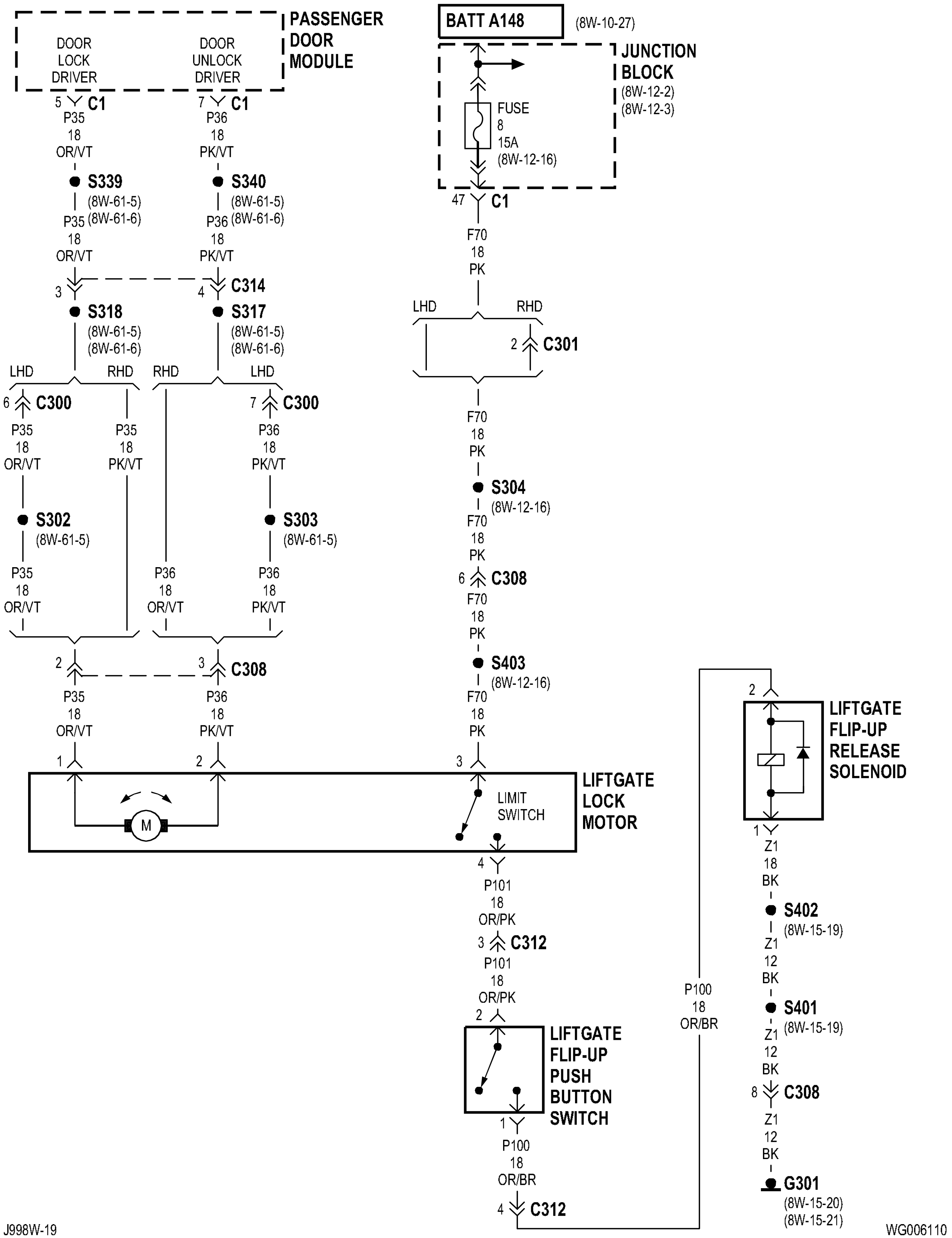
RHD

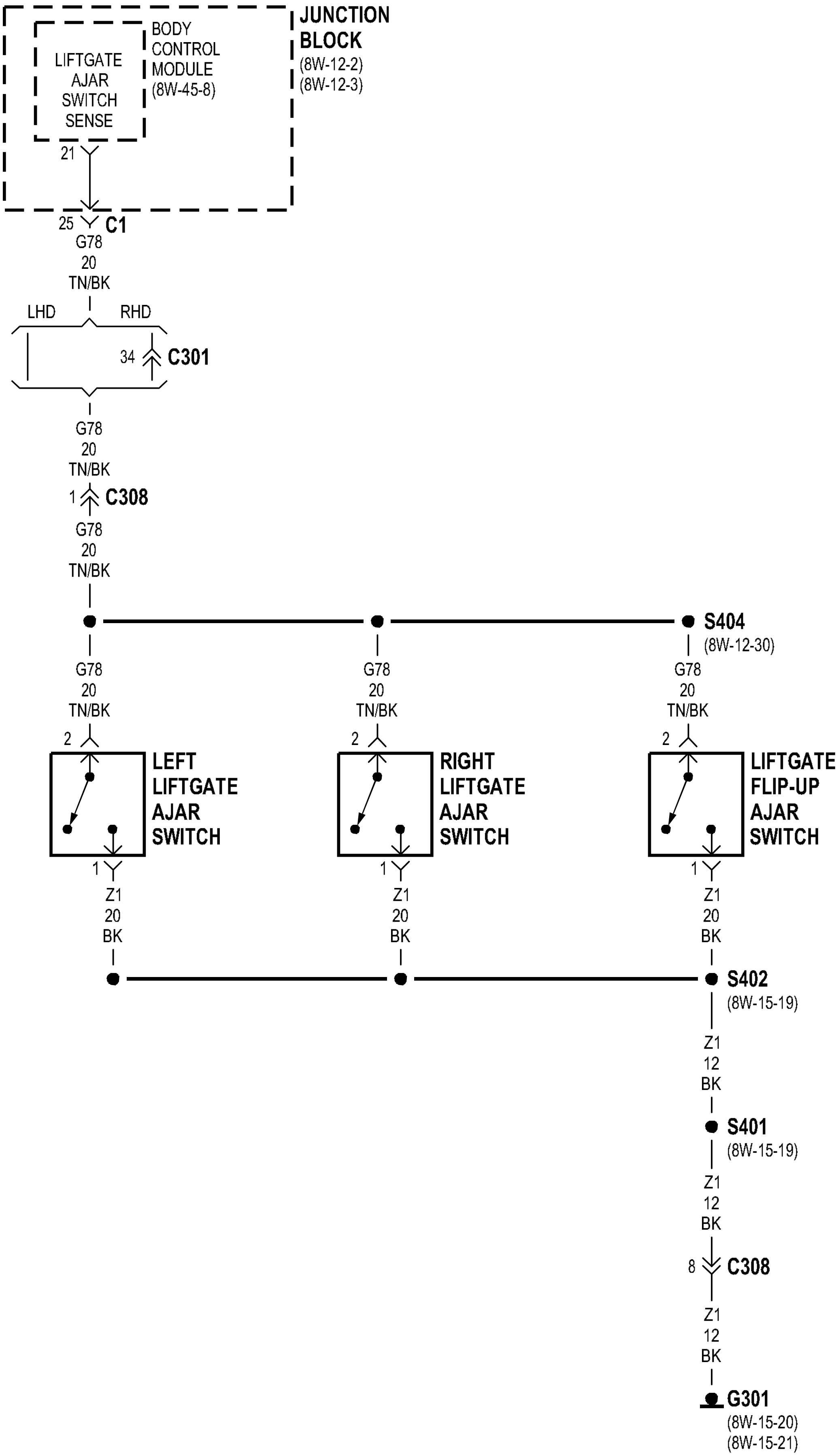

PASSENGER DOOR MODULE
DOOR LOCK DRIVER
DOOR UNLOCK DRIVER
5 C1
7 C1
P35 18 OR/VT
P36 18 PK/VT
S339
S340
4
3
PASSENGER DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-4)
3 C314
4 C314
S318
S317
4
5 C307
PASSENGER REAR DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-9)
5 C301
6 C301
4 C303
5 C303
P35 18 PK/VT
P36 18 OR/VT
2
3 C308
1
2
LIFTGATE LOCK MOTOR
(8W-61-10)
DRIVER REAR DOOR LOCK MOTOR/ AJAR SWITCH
(8W-61-8)


PASSENGER
DOOR
MODULE
DOOR
LOCK
DRIVER
DOOR
UNLOCK
DRIVER
5
C1
7
C1
P35
18
OR/VT
P36
18
PK/VT
S339
(8W-61-5)
S340
(8W-61-5)
3
4
C314
S318
(8W-61-5)
S317
(8W-61-5)
6
7
C300
S302
(8W-61-5)
S303
(8W-61-5)
4
5
11
C307
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
BODY
CONTROL
MODULE
(8W-45-7)
DOOR
AJAR
SWITCH
SENSE
23
10
C1
G77
20
TN/OR
G76
18
TN/YL
4
3
1
M
DRIVER
REAR
DOOR
LOCK
MOTOR/
AJAR
SWITCH
2
Z1
18
BK
S356
(8W-15-20)
Z1
16
BK
10
C307
Z1
16
BK
S300
(8W-15-20)
Z1
12
BK
G301
(8W-15-20)

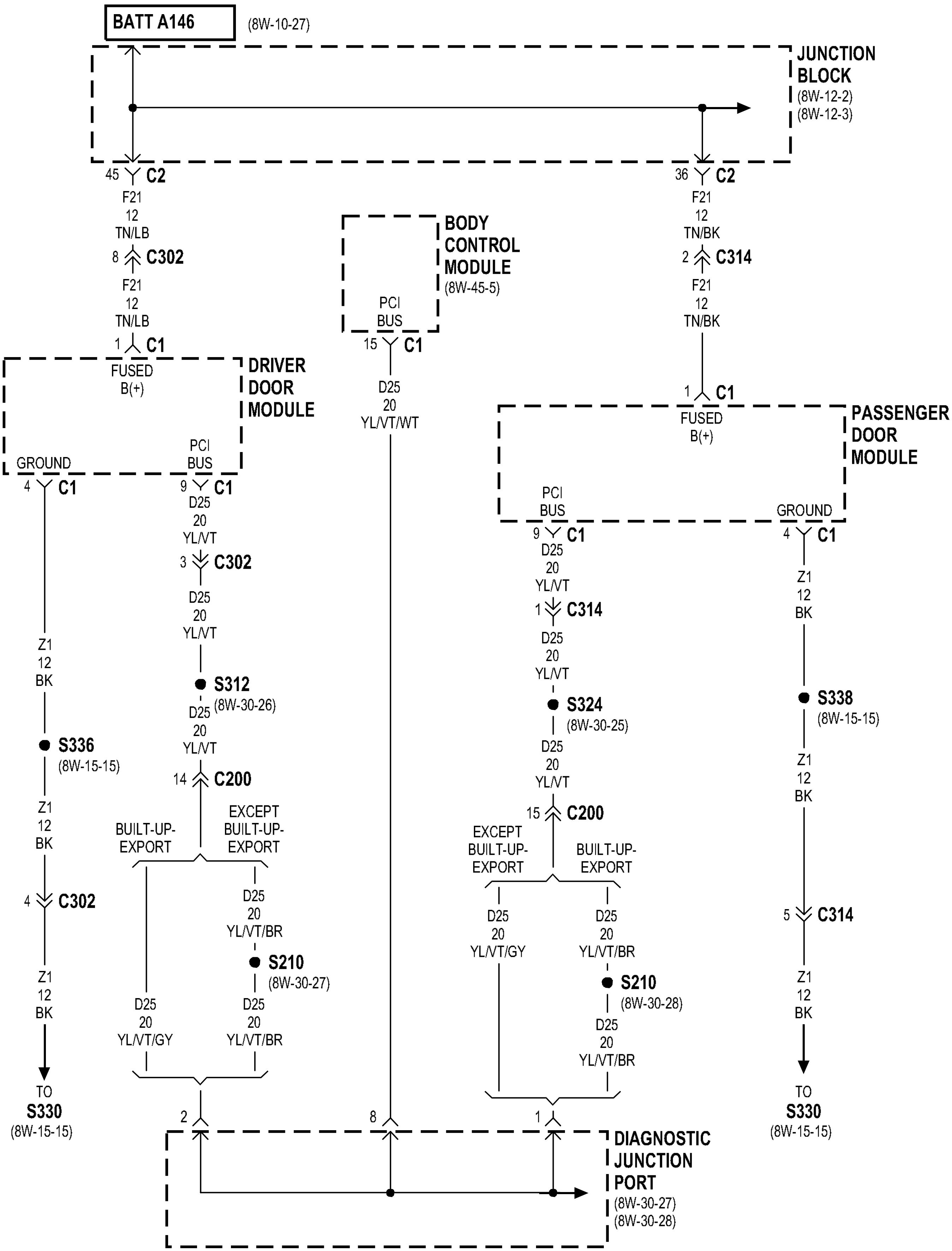

PASSENGER DOOR MODULE
DOOR LOCK DRIVER
DOOR UNLOCK DRIVER
5 C1
7 C1
P35 18 OR/VT
P36 18 PK/VT
S339 (8W-61-6)
S340 (8W-61-6)
3 4 C314
S318 (8W-61-6)
S317 (8W-61-6)
5 6 C301
4 5 11 C303
BODY CONTROL MODULE (8W-45-7)
DOOR AJAR SWITCH SENSE
7 C1
G76 18 TN/YL
31 C200
G76 20 TN/YL
39 C301
4 3 1
M
DRIVER REAR DOOR LOCK MOTOR/ AJAR SWITCH
2
Z1 18 BK
S357 (8W-15-17)
Z1 16 BK
10 C303
Z1 16 BK
S332 (8W-15-17)
Z1 14 BK
G300 (8W-15-17)


PASSENGER DOOR MODULE
DOOR LOCK DRIVER
DOOR UNLOCK DRIVER
5 C1
7 C1
P35 18 OR/VT
P36 18 PK/VT
S339 (8W-61-5) (8W-61-6)
S340 (8W-61-5) (8W-61-6)
3 4 C314
S318 (8W-61-5) (8W-61-6)
S317 (8W-61-5) (8W-61-6)
RHD LHD LHD RHD
4 C307 4 5 C303 5 C307
BODY CONTROL MODULE (8W-45-7)
DOOR AJAR SWITCH SENSE
7 C1
G76 18 TN/YL
31 C200
11 C303
JUNCTION BLOCK (8W-12-2) (8W-12-3)
BODY CONTROL MODULE (8W-45-7)
DOOR AJAR SWITCH SENSE
23
10 C1
G77 20 TN/OR
38 C301
11 C307
LHD RHD
4 3 1
PASSENGER REAR DOOR LOCK MOTOR/ AJAR SWITCH
M
2
Z1 18 BK
RHD LHD
S356 (8W-15-21)
S357 (8W-15-15)
Z1 16 BK
10 C307
10 C303
S358 (8W-15-21)
S330 (8W-15-15)
Z1 12 BK
G301 (8W-15-21)
G300 (8W-15-16)

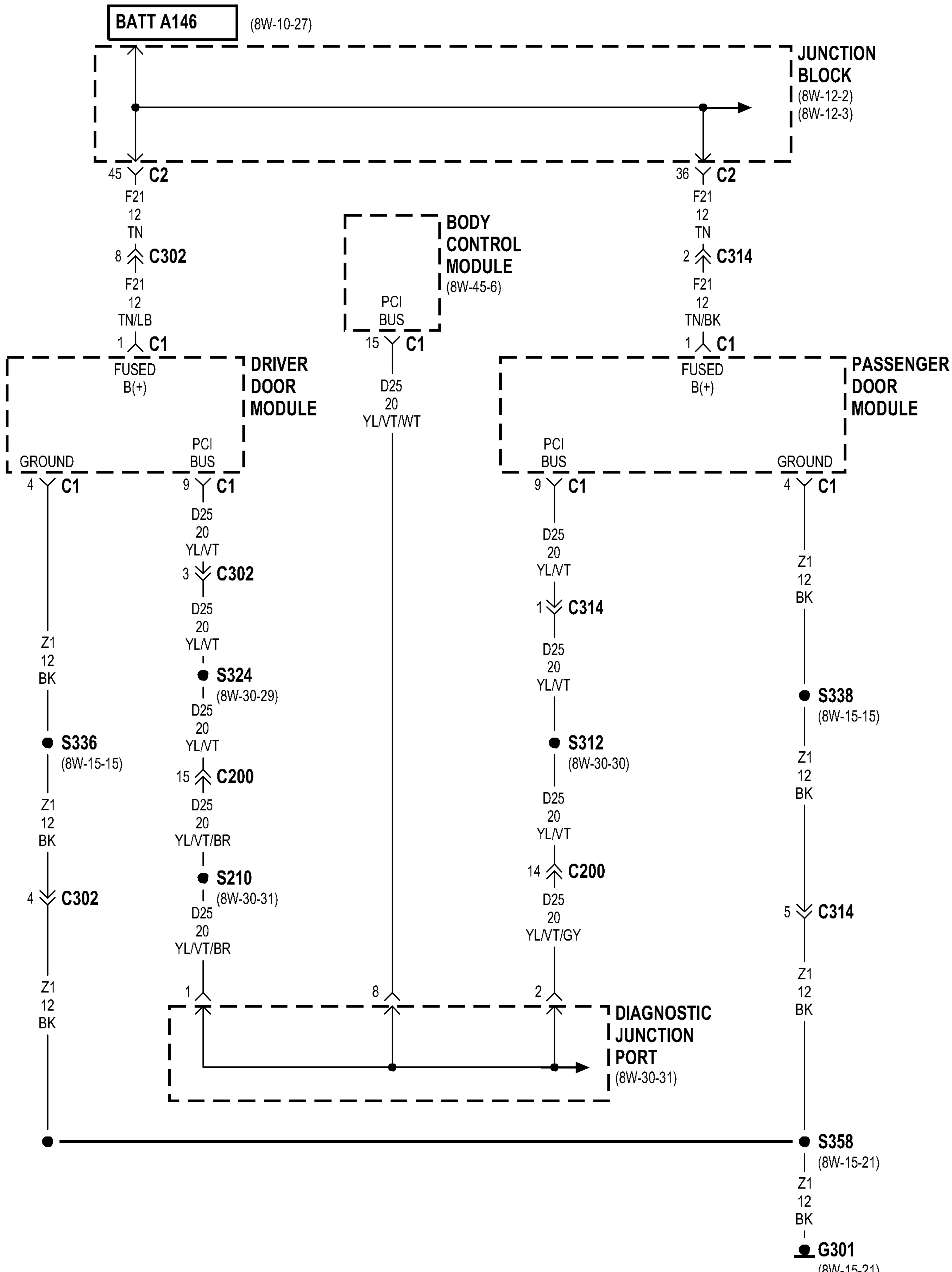

PASSENGER DOOR MODULE
DOOR LOCK DRIVER
DOOR UNLOCK DRIVER
5 C1
7 C1
P35 18 OR/VT
P36 18 PK/VT
S339 (8W-61-5) (8W-61-6)
S340 (8W-61-5) (8W-61-6)
P35 18 OR/VT
P36 18 PK/VT
3 4 C314
S318 (8W-61-5) (8W-61-6)
S317 (8W-61-5) (8W-61-6)
LHD RHD RHD LHD
6 C300
7 C300
P35 18 OR/VT
P35 18 PK/VT
P36 18 PK/VT
S302 (8W-61-5)
S303 (8W-61-5)
P35 18 OR/VT
P36 18 OR/VT
P36 18 PK/VT
2 3 C308
P35 18 OR/VT
P36 18 PK/VT
BATT A148 (8W-10-27)
JUNCTION BLOCK (8W-12-2) (8W-12-3)
FUSE 8 15A (8W-12-16)
47 C1
F70 18 PK
LHD RHD
2 C301
F70 18 PK
S304 (8W-12-16)
F70 18 PK
6 C308
F70 18 PK
S403 (8W-12-16)
F70 18 PK
1 2 3
M
LIMIT SWITCH
LIFTGATE LOCK MOTOR
4
P101 18 OR/PK
3 C312
P101 18 OR/PK
2
LIFTGATE FLIP-UP PUSH BUTTON SWITCH
1
P100 18 OR/BR
4 C312
P100 18 OR/BR
2
LIFTGATE FLIP-UP RELEASE SOLENOID
1
Z1 18 BK
S402 (8W-15-19)
Z1 12 BK
S401 (8W-15-19)
Z1 12 BK
8 C308
Z1 12 BK
G301 (8W-15-20) (8W-15-21)

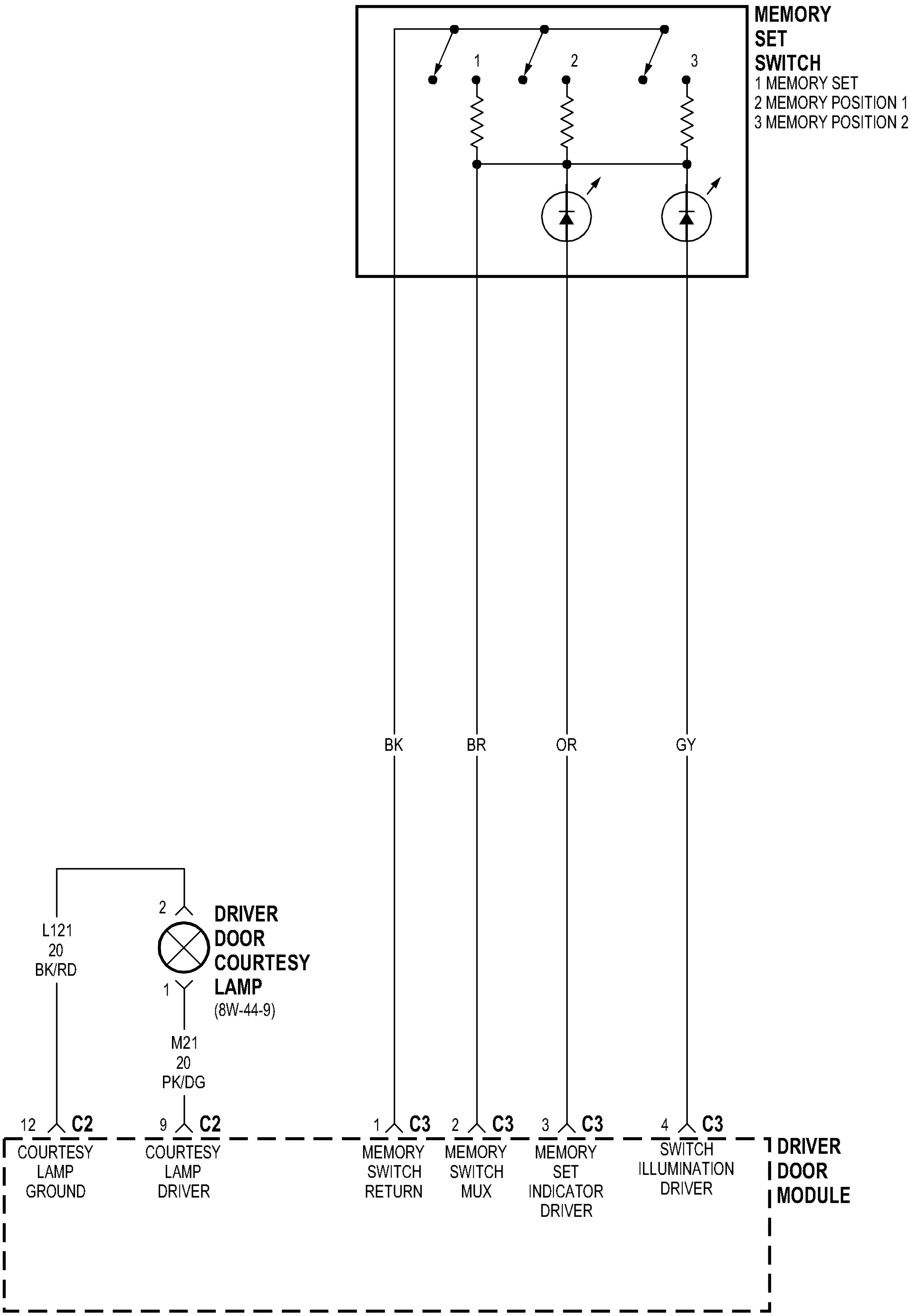

JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
BODY CONTROL MODULE
(8W-45-8)
LIFTGATE AJAR SWITCH SENSE
21
25
C1
G78
20
TN/BK
LHD
RHD
34
C301
G78
20
TN/BK
1
C308
G78
20
TN/BK
S404
(8W-12-30)
G78
20
TN/BK
2
LEFT LIFTGATE AJAR SWITCH
RIGHT LIFTGATE AJAR SWITCH
LIFTGATE FLIP-UP AJAR SWITCH
1
Z1
20
BK
S402
(8W-15-19)
Z1
12
BK
S401
(8W-15-19)
8
C308
G301
(8W-15-20)
(8W-15-21)

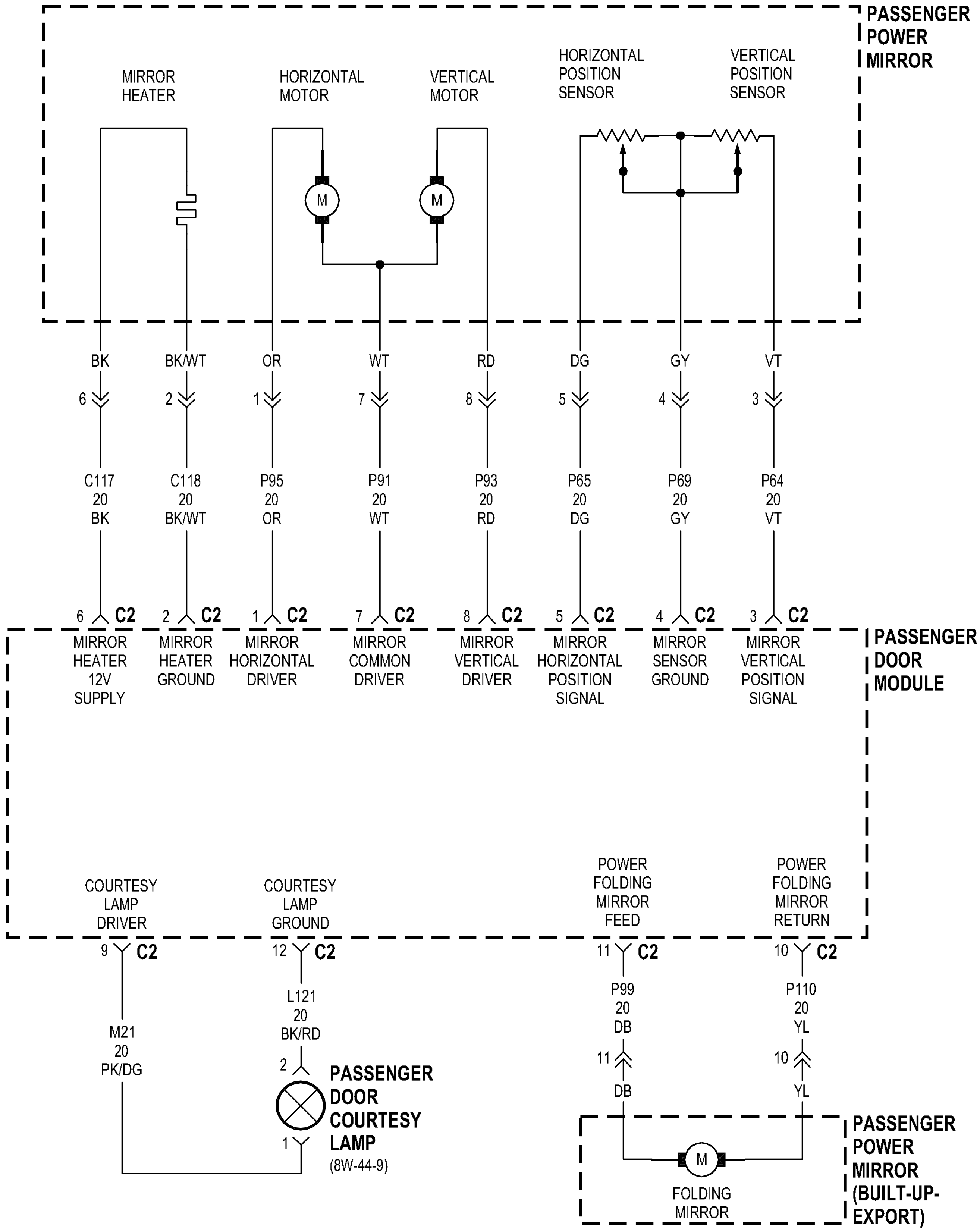
8W-62 POWER MIRRORS

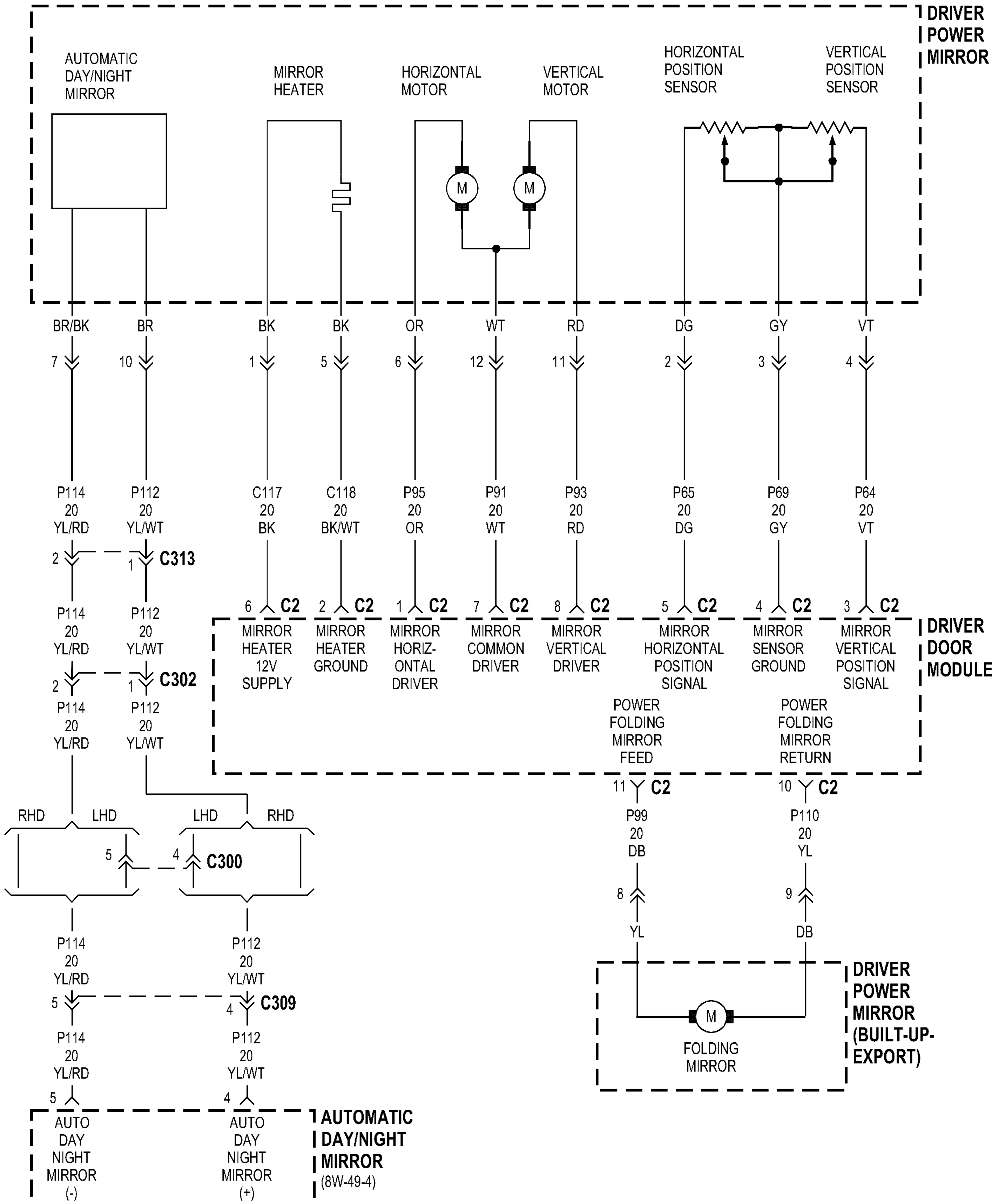


BATT A146
(8W-10-27)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
45 C2
F21 12 TN/LB
8 C302
F21 12 TN/LB
1 C1
DRIVER DOOR MODULE
FUSED B(+)
GROUND
PCI BUS
4 C1
9 C1
D25 20 YL/VT
3 C302
D25 20 YL/VT
S312
(8W-30-26)
D25 20 YL/VT
14 C200
BUILT-UP-EXPORT
EXCEPT BUILT-UP-EXPORT
D25 20 YL/VT/BR
S210
(8W-30-27)
D25 20 YL/VT/GY
D25 20 YL/VT/BR
Z1 12 BK
S336
(8W-15-15)
Z1 12 BK
4 C302
Z1 12 BK
TO S330
(8W-15-15)
BODY CONTROL MODULE
(8W-45-5)
PCI BUS
15 C1
D25 20 YL/VT/WT
36 C2
F21 12 TN/BK
2 C314
F21 12 TN/BK
1 C1
PASSENGER DOOR MODULE
FUSED B(+)
PCI BUS
GROUND
9 C1
4 C1
D25 20 YL/VT
1 C314
D25 20 YL/VT
S324
(8W-30-25)
D25 20 YL/VT
15 C200
EXCEPT BUILT-UP-EXPORT
BUILT-UP-EXPORT
D25 20 YL/VT/GY
D25 20 YL/VT/BR
S210
(8W-30-28)
D25 20 YL/VT/BR
Z1 12 BK
S338
(8W-15-15)
Z1 12 BK
5 C314
Z1 12 BK
TO S330
(8W-15-15)
2
8
1
DIAGNOSTIC JUNCTION PORT
(8W-30-27)
(8W-30-28)

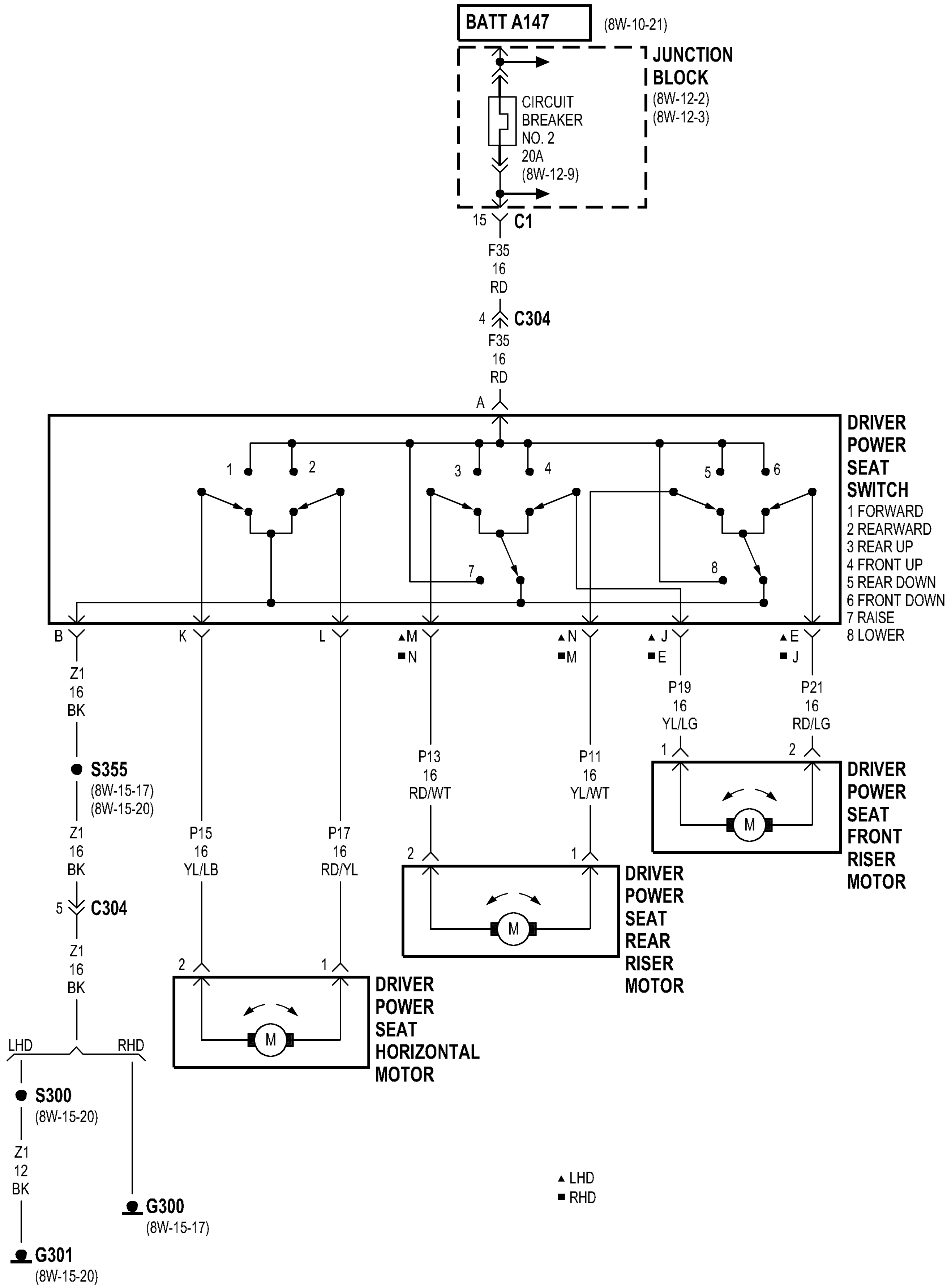

BATT A146
(8W-10-27)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
45 C2
F21
12
TN
8 C302
F21
12
TN/LB
1 C1
36 C2
F21
12
TN
2 C314
F21
12
TN/BK
1 C1
BODY CONTROL MODULE
(8W-45-6)
PCI BUS
15 C1
D25
20
YL/VT/WT
DRIVER DOOR MODULE
FUSED B(+)
GROUND
PCI BUS
4 C1
9 C1
PASSENGER DOOR MODULE
FUSED B(+)
PCI BUS
GROUND
9 C1
4 C1
D25
20
YL/VT
3 C302
D25
20
YL/VT
S324
(8W-30-29)
D25
20
YL/VT
15 C200
D25
20
YL/VT/BR
S210
(8W-30-31)
D25
20
YL/VT/BR
Z1
12
BK
S336
(8W-15-15)
Z1
12
BK
4 C302
Z1
12
BK
D25
20
YL/VT
1 C314
D25
20
YL/VT
S312
(8W-30-30)
D25
20
YL/VT
14 C200
D25
20
YL/VT/GY
Z1
12
BK
S338
(8W-15-15)
Z1
12
BK
5 C314
Z1
12
BK
1
8
2
DIAGNOSTIC JUNCTION PORT
(8W-30-31)
S358
(8W-15-21)
Z1
12
BK
G301
(8W-15-21)


MEMORY SET SWITCH
1 MEMORY SET
2 MEMORY POSITION 1
3 MEMORY POSITION 2
1
2
3
BK
BR
OR
GY
L121
20
BK/RD
2
1
DRIVER DOOR COURTESY LAMP
(8W-44-9)
M21
20
PK/DG
12 C2
9 C2
1 C3
2 C3
3 C3
4 C3
COURTESY LAMP GROUND
COURTESY LAMP DRIVER
MEMORY SWITCH RETURN
MEMORY SWITCH MUX
MEMORY SET INDICATOR DRIVER
SWITCH ILLUMINATION DRIVER
DRIVER DOOR MODULE

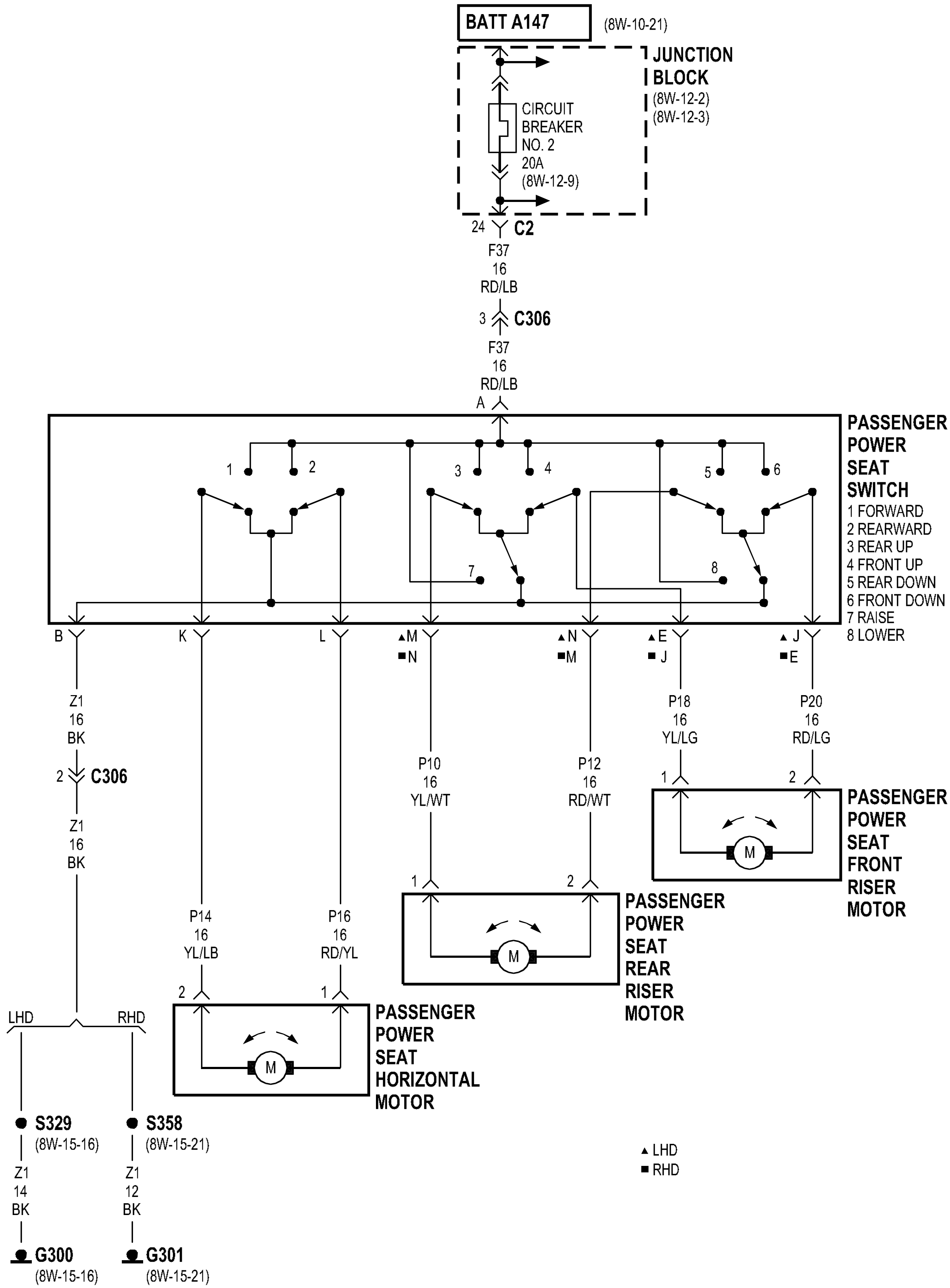

PASSENGER POWER MIRROR
MIRROR HEATER
HORIZONTAL MOTOR
VERTICAL MOTOR
HORIZONTAL POSITION SENSOR
VERTICAL POSITION SENSOR
M
M
BK
BK/WT
OR
WT
RD
DG
GY
VT
6
2
1
7
8
5
4
3
C117 20 BK
C118 20 BK/WT
P95 20 OR
P91 20 WT
P93 20 RD
P65 20 DG
P69 20 GY
P64 20 VT
6 C2
2 C2
1 C2
7 C2
8 C2
5 C2
4 C2
3 C2
PASSENGER DOOR MODULE
MIRROR HEATER 12V SUPPLY
MIRROR HEATER GROUND
MIRROR HORIZONTAL DRIVER
MIRROR COMMON DRIVER
MIRROR VERTICAL DRIVER
MIRROR HORIZONTAL POSITION SIGNAL
MIRROR SENSOR GROUND
MIRROR VERTICAL POSITION SIGNAL
COURTESY LAMP DRIVER
COURTESY LAMP GROUND
POWER FOLDING MIRROR FEED
POWER FOLDING MIRROR RETURN
9 C2
12 C2
11 C2
10 C2
M21 20 PK/DG
L121 20 BK/RD
P99 20 DB
P110 20 YL
2
1
PASSENGER DOOR COURTESY LAMP
(8W-44-9)
11
10
DB
YL
PASSENGER POWER MIRROR (BUILT-UP-EXPORT)
M
FOLDING MIRROR

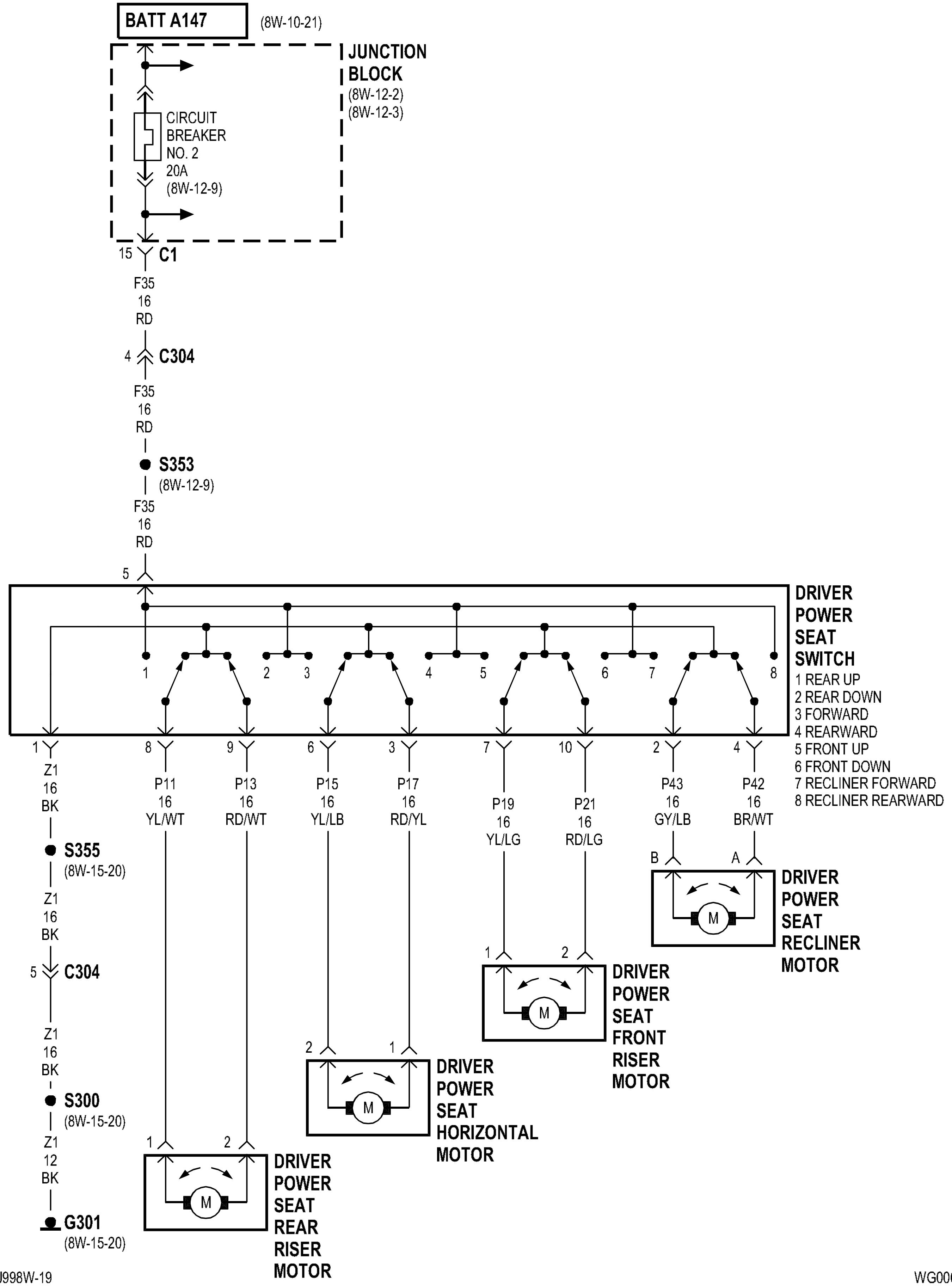

DRIVER POWER MIRROR
AUTOMATIC DAY/NIGHT MIRROR
MIRROR HEATER
HORIZONTAL MOTOR
VERTICAL MOTOR
HORIZONTAL POSITION SENSOR
VERTICAL POSITION SENSOR
M
M
BR/BK
BR
BK
BK
OR
WT
RD
DG
GY
VT
7
10
1
5
6
12
11
2
3
4
P114 20 YL/RD
P112 20 YL/WT
C117 20 BK
C118 20 BK/WT
P95 20 OR
P91 20 WT
P93 20 RD
P65 20 DG
P69 20 GY
P64 20 VT
C313
C302
6 C2
2 C2
1 C2
7 C2
8 C2
5 C2
4 C2
3 C2
DRIVER DOOR MODULE
MIRROR HEATER 12V SUPPLY
MIRROR HEATER GROUND
MIRROR HORIZ-ONTAL DRIVER
MIRROR COMMON DRIVER
MIRROR VERTICAL DRIVER
MIRROR HORIZONTAL POSITION SIGNAL
MIRROR SENSOR GROUND
MIRROR VERTICAL POSITION SIGNAL
POWER FOLDING MIRROR FEED
POWER FOLDING MIRROR RETURN
11 C2
10 C2
P99 20 DB
P110 20 YL
8
9
YL
DB
DRIVER POWER MIRROR (BUILT-UP-EXPORT)
FOLDING MIRROR
RHD
LHD
LHD
RHD
5
4
C300
C309
AUTOMATIC DAY/NIGHT MIRROR
(8W-49-4)
AUTO DAY NIGHT MIRROR (-)
AUTO DAY NIGHT MIRROR (+)

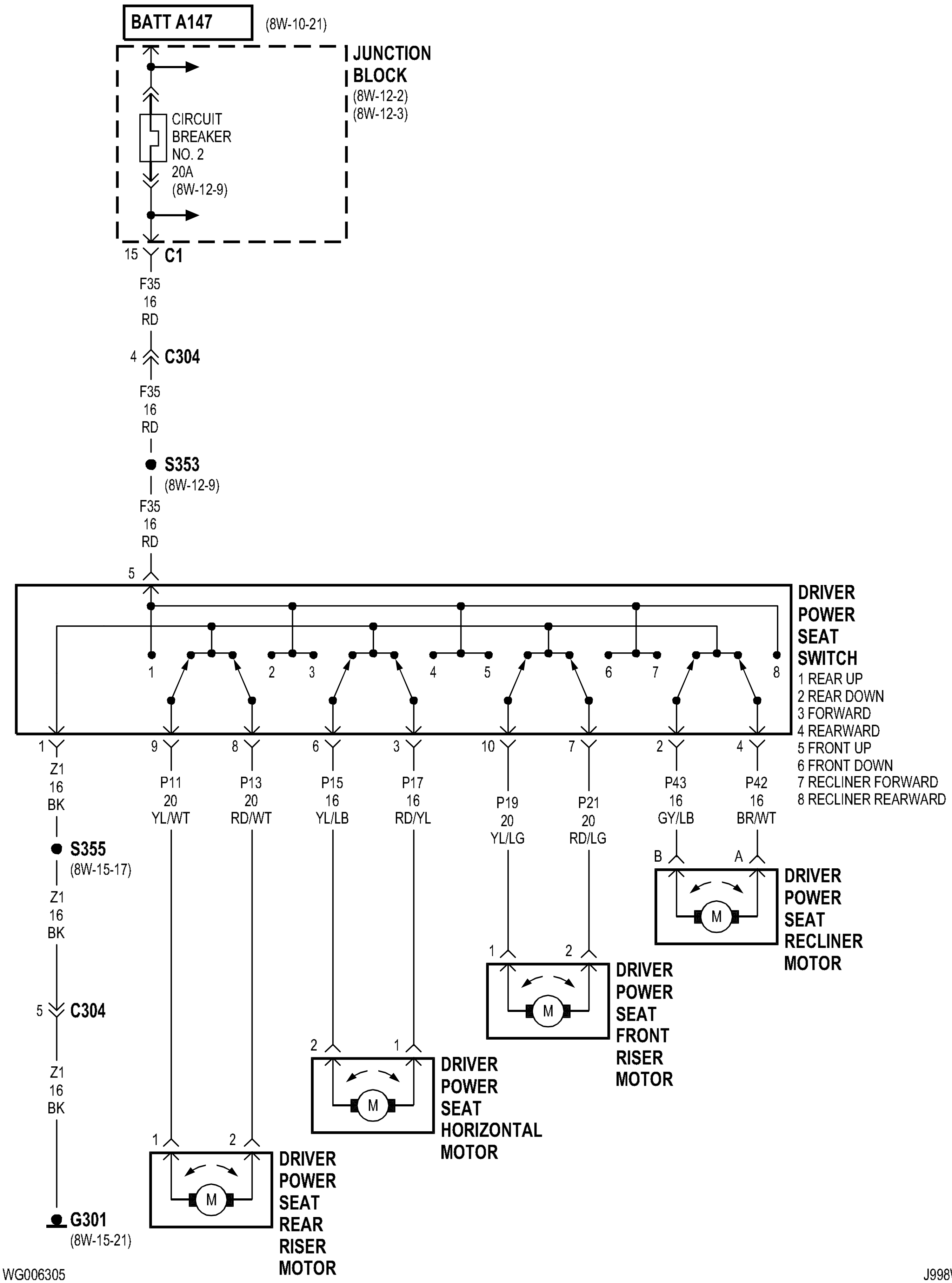
8W-63 POWER SEATS

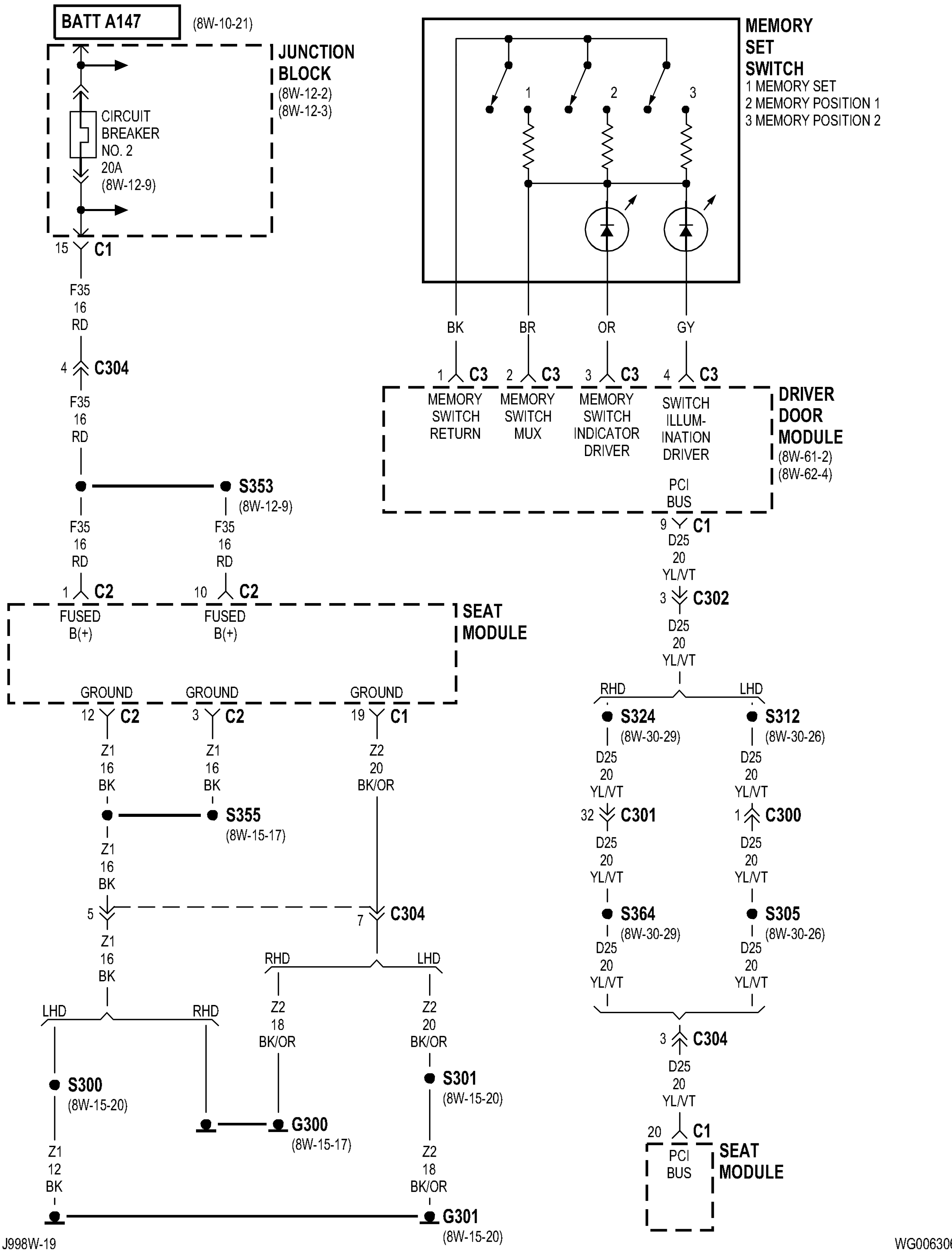

BATT A147
(8W-10-21)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
CIRCUIT BREAKER NO. 2
20A
(8W-12-9)
15 C1
F35 16 RD
4 C304
F35 16 RD
A
DRIVER POWER SEAT SWITCH
1 FORWARD
2 REARWARD
3 REAR UP
4 FRONT UP
5 REAR DOWN
6 FRONT DOWN
7 RAISE
8 LOWER
B K L ▲M ■N ▲N ■M ▲J ■E ▲E ■J
Z1 16 BK
S355
(8W-15-17)
(8W-15-20)
Z1 16 BK
5 C304
Z1 16 BK
P15 16 YL/LB
P17 16 RD/YL
P13 16 RD/WT
P11 16 YL/WT
P19 16 YL/LG
P21 16 RD/LG
DRIVER POWER SEAT FRONT RISER MOTOR
DRIVER POWER SEAT REAR RISER MOTOR
DRIVER POWER SEAT HORIZONTAL MOTOR
M
LHD RHD
S300
(8W-15-20)
Z1 12 BK
G300
(8W-15-17)
G301
(8W-15-20)
▲ LHD
■ RHD

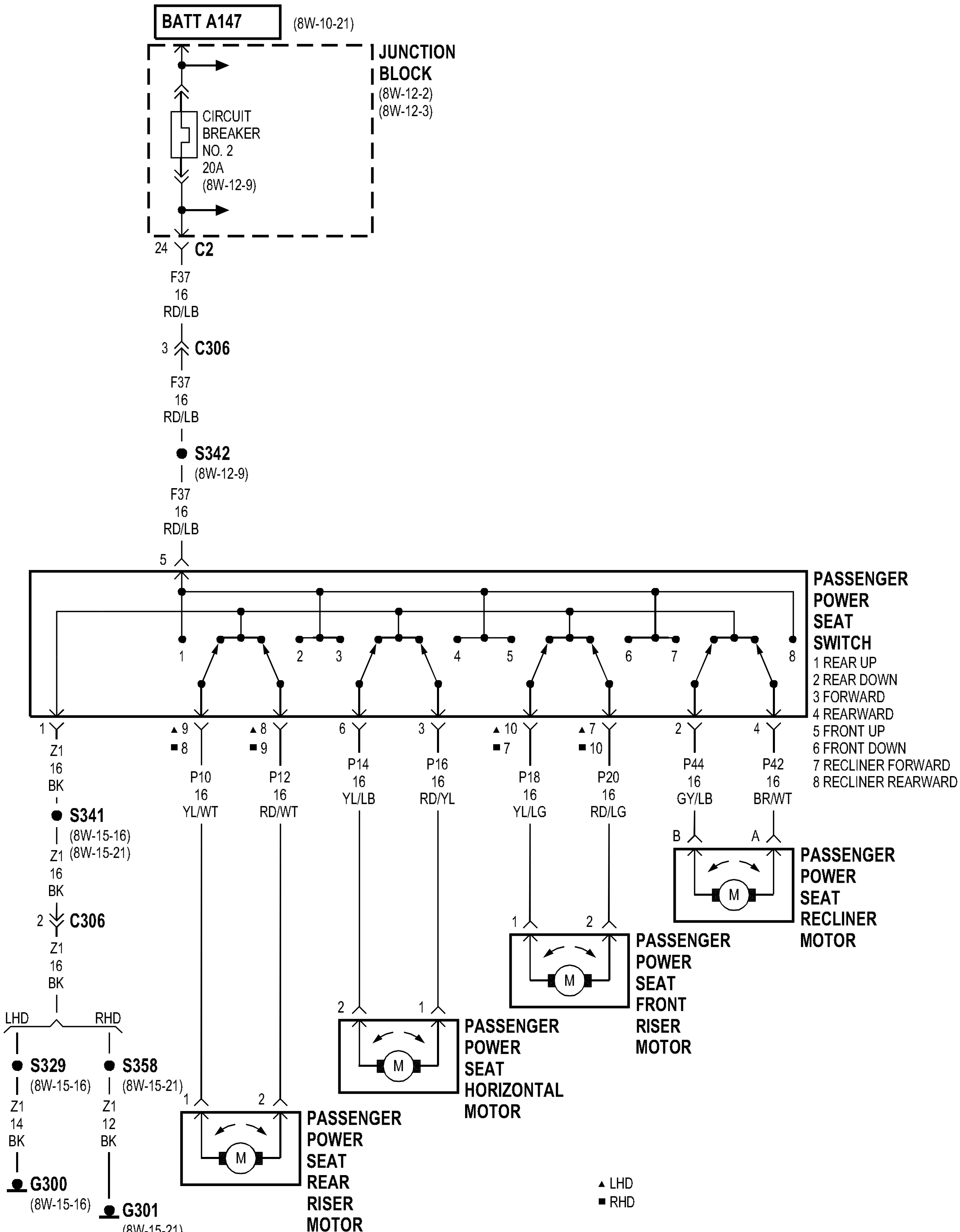
BASE

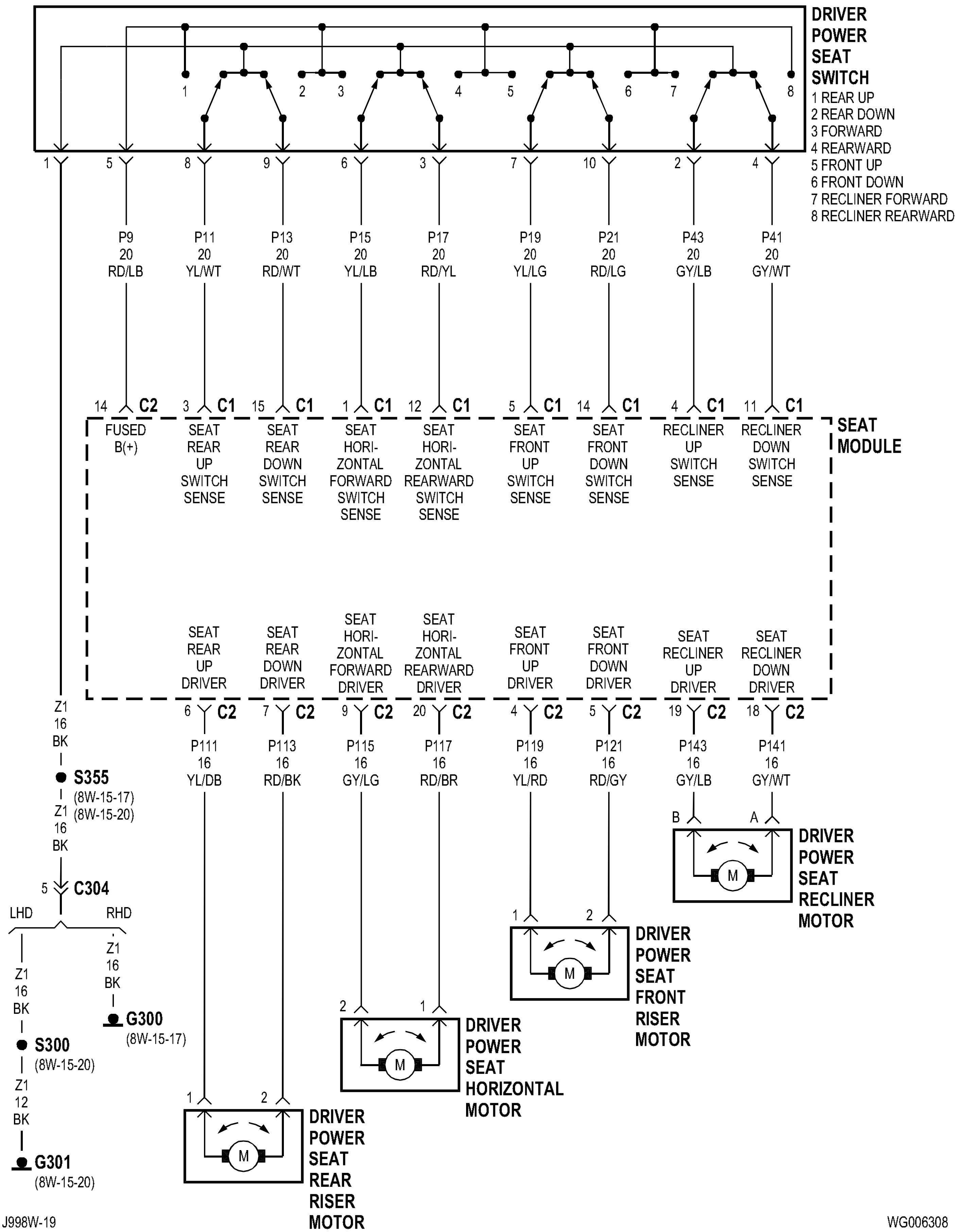

BATT A147
(8W-10-21)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
CIRCUIT BREAKER NO. 2 20A (8W-12-9)
24 C2
F37 16 RD/LB
3 C306
F37 16 RD/LB
A
PASSENGER POWER SEAT SWITCH
1 FORWARD
2 REARWARD
3 REAR UP
4 FRONT UP
5 REAR DOWN
6 FRONT DOWN
7 RAISE
8 LOWER
B K L ▲M ■N ▲N ■M ▲E ■J ▲J ■E
Z1 16 BK
2 C306
Z1 16 BK
P14 16 YL/LB
P16 16 RD/YL
P10 16 YL/WT
P12 16 RD/WT
P18 16 YL/LG
P20 16 RD/LG
PASSENGER POWER SEAT FRONT RISER MOTOR
PASSENGER POWER SEAT REAR RISER MOTOR
PASSENGER POWER SEAT HORIZONTAL MOTOR
M
LHD RHD
S329 (8W-15-16)
S358 (8W-15-21)
Z1 14 BK
Z1 12 BK
G300 (8W-15-16)
G301 (8W-15-21)
▲ LHD
■ RHD

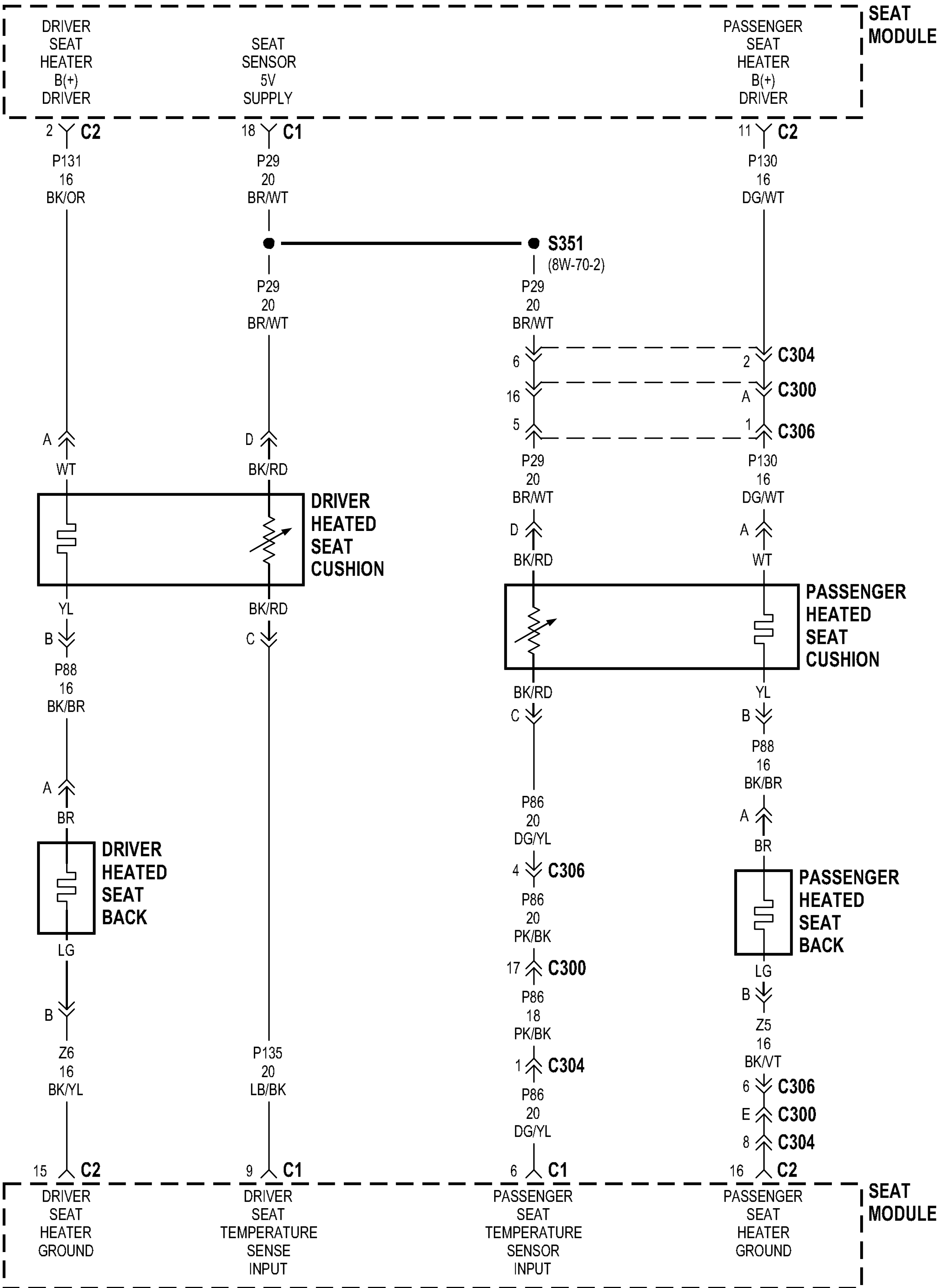

BATT A147
(8W-10-21)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
CIRCUIT BREAKER NO. 2 20A
(8W-12-9)
15 C1
F35 16 RD
4 C304
F35 16 RD
S353
(8W-12-9)
F35 16 RD
5
DRIVER POWER SEAT SWITCH
1 REAR UP
2 REAR DOWN
3 FORWARD
4 REARWARD
5 FRONT UP
6 FRONT DOWN
7 RECLINER FORWARD
8 RECLINER REARWARD
1 Z1 16 BK
8 P11 16 YL/WT
9 P13 16 RD/WT
6 P15 16 YL/LB
3 P17 16 RD/YL
7 P19 16 YL/LG
10 P21 16 RD/LG
2 P43 16 GY/LB
4 P42 16 BR/WT
S355
(8W-15-20)
Z1 16 BK
5 C304
Z1 16 BK
S300
(8W-15-20)
Z1 12 BK
G301
(8W-15-20)
DRIVER POWER SEAT RECLINER MOTOR
DRIVER POWER SEAT FRONT RISER MOTOR
DRIVER POWER SEAT HORIZONTAL MOTOR
DRIVER POWER SEAT REAR RISER MOTOR
M

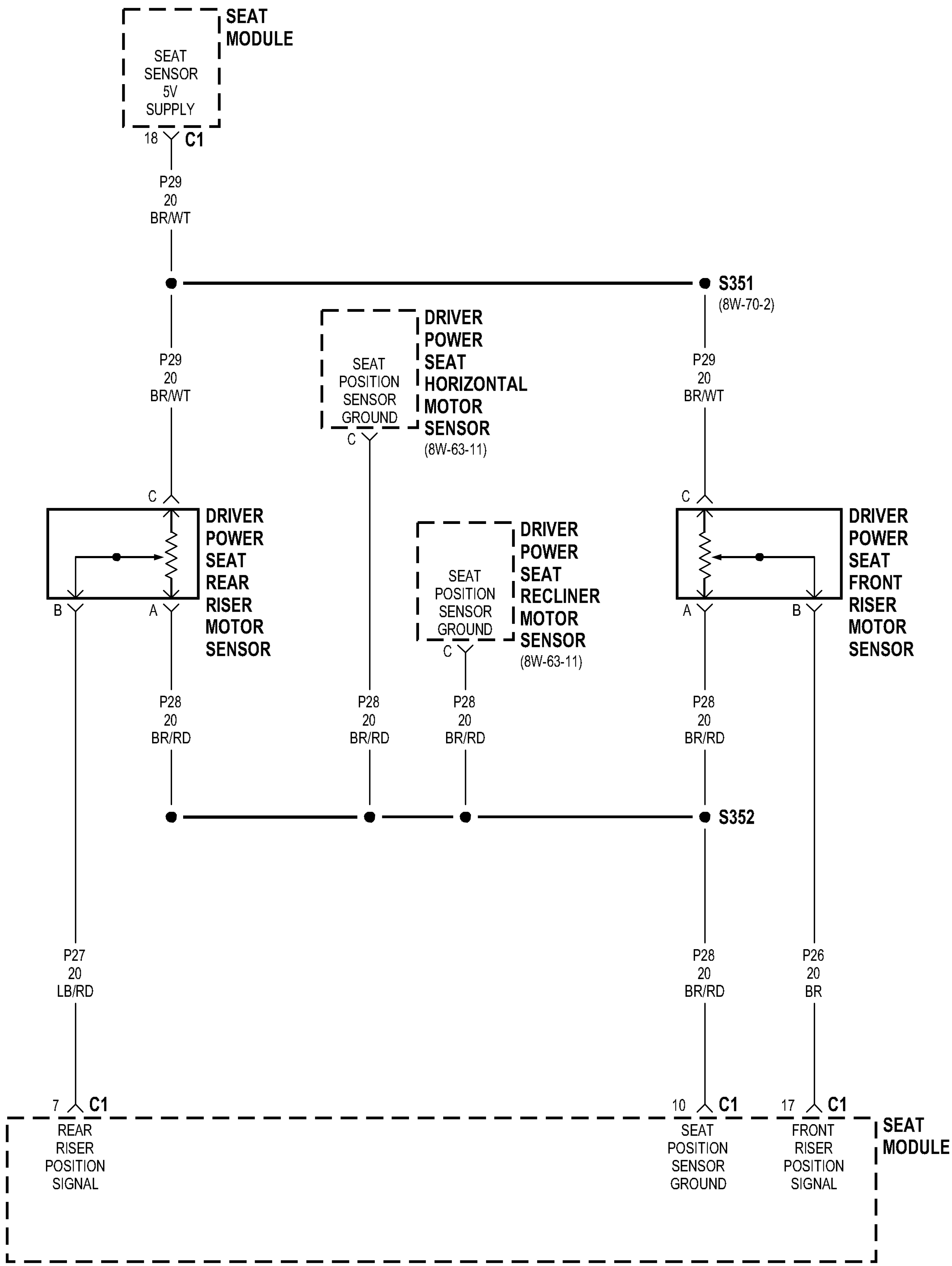

BATT A147
(8W-10-21)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
CIRCUIT BREAKER NO. 2 20A
(8W-12-9)
15 C1
F35 16 RD
4 C304
F35 16 RD
S353
(8W-12-9)
F35 16 RD
5
DRIVER POWER SEAT SWITCH
1 REAR UP
2 REAR DOWN
3 FORWARD
4 REARWARD
5 FRONT UP
6 FRONT DOWN
7 RECLINER FORWARD
8 RECLINER REARWARD
1 Z1 16 BK
9 P11 20 YL/WT
8 P13 20 RD/WT
6 P15 16 YL/LB
3 P17 16 RD/YL
10 P19 20 YL/LG
7 P21 20 RD/LG
2 P43 16 GY/LB
4 P42 16 BR/WT
S355
(8W-15-17)
Z1 16 BK
5 C304
Z1 16 BK
G301
(8W-15-21)
B A
DRIVER POWER SEAT RECLINER MOTOR
1 2
DRIVER POWER SEAT FRONT RISER MOTOR
2 1
DRIVER POWER SEAT HORIZONTAL MOTOR
1 2
DRIVER POWER SEAT REAR RISER MOTOR
M

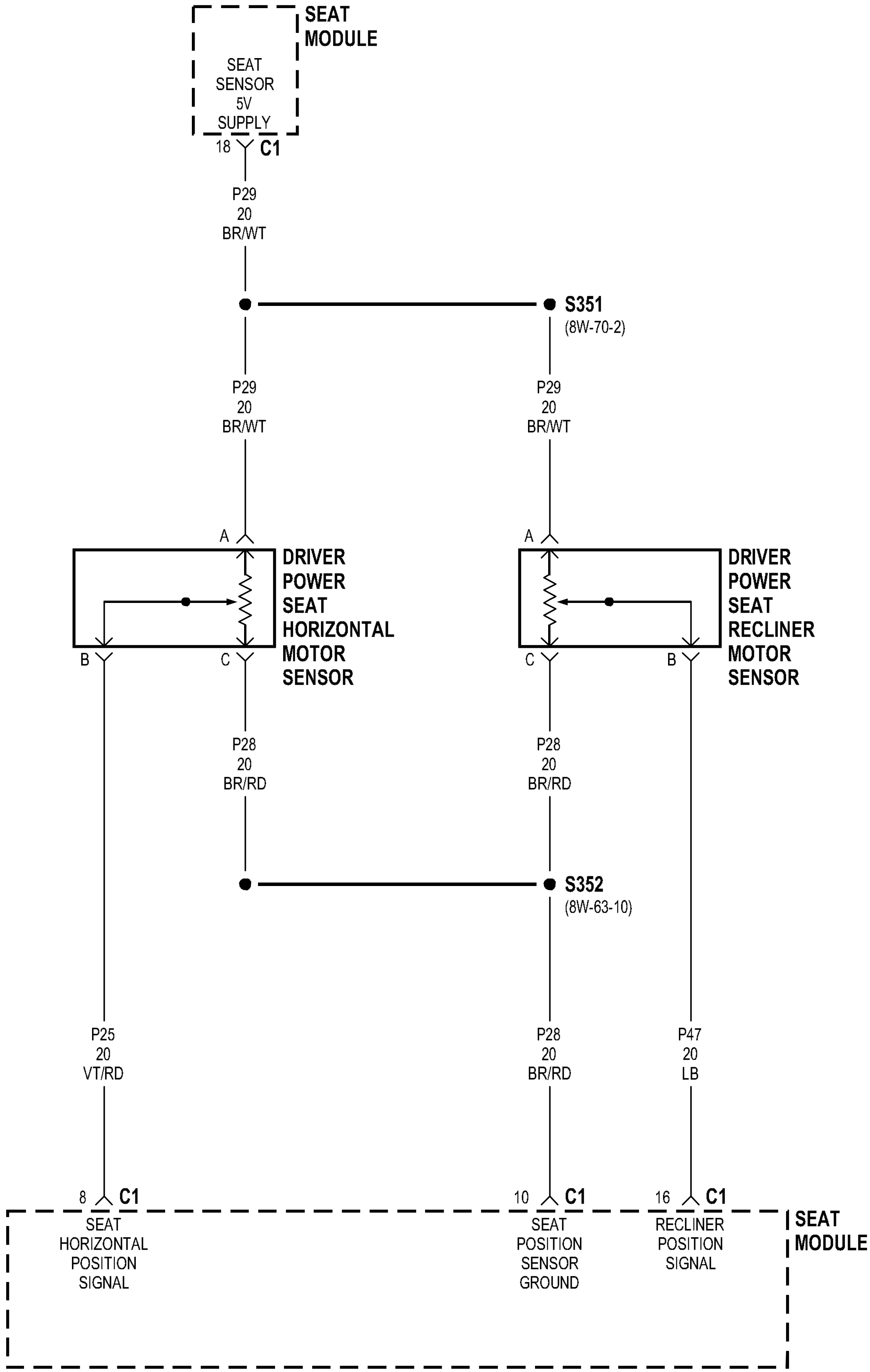

BATT A147
(8W-10-21)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
CIRCUIT BREAKER NO. 2 20A
(8W-12-9)
15 C1
F35 16 RD
4 C304
F35 16 RD
S353
(8W-12-9)
F35 16 RD
F35 16 RD
1 C2
10 C2
FUSED B(+)
FUSED B(+)
SEAT MODULE
GROUND
GROUND
GROUND
12 C2
3 C2
19 C1
Z1 16 BK
Z1 16 BK
Z2 20 BK/OR
S355
(8W-15-17)
Z1 16 BK
5
7 C304
Z1 16 BK
RHD
LHD
LHD
RHD
Z2 18 BK/OR
Z2 20 BK/OR
S300
(8W-15-20)
S301
(8W-15-20)
G300
(8W-15-17)
Z1 12 BK
Z2 18 BK/OR
G301
(8W-15-20)
MEMORY SET SWITCH
1 MEMORY SET
2 MEMORY POSITION 1
3 MEMORY POSITION 2
1
2
3
BK
BR
OR
GY
1 C3
2 C3
3 C3
4 C3
MEMORY SWITCH RETURN
MEMORY SWITCH MUX
MEMORY SWITCH INDICATOR DRIVER
SWITCH ILLUM-INATION DRIVER
PCI BUS
DRIVER DOOR MODULE
(8W-61-2)
(8W-62-4)
9 C1
D25 20 YL/VT
3 C302
D25 20 YL/VT
RHD
LHD
S324
(8W-30-29)
S312
(8W-30-26)
D25 20 YL/VT
D25 20 YL/VT
32 C301
1 C300
D25 20 YL/VT
D25 20 YL/VT
S364
(8W-30-29)
S305
(8W-30-26)
D25 20 YL/VT
D25 20 YL/VT
3 C304
D25 20 YL/VT
20 C1
PCI BUS
SEAT MODULE


BATT A147
(8W-10-21)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
CIRCUIT BREAKER NO. 2 20A (8W-12-9)
24 C2
F37 16 RD/LB
3 C306
F37 16 RD/LB
S342
(8W-12-9)
F37 16 RD/LB
5
PASSENGER POWER SEAT SWITCH
1 REAR UP
2 REAR DOWN
3 FORWARD
4 REARWARD
5 FRONT UP
6 FRONT DOWN
7 RECLINER FORWARD
8 RECLINER REARWARD
1 Z1 16 BK
S341
(8W-15-16)
(8W-15-21)
Z1 16 BK
2 C306
Z1 16 BK
LHD
RHD
S329
(8W-15-16)
Z1 14 BK
G300
(8W-15-16)
S358
(8W-15-21)
Z1 12 BK
G301
(8W-15-21)
▲9 ■8 P10 16 YL/WT
▲8 ■9 P12 16 RD/WT
6 P14 16 YL/LB
3 P16 16 RD/YL
▲10 ■7 P18 16 YL/LG
▲7 ■10 P20 16 RD/LG
2 P44 16 GY/LB
4 P42 16 BR/WT
PASSENGER POWER SEAT RECLINER MOTOR
PASSENGER POWER SEAT FRONT RISER MOTOR
PASSENGER POWER SEAT HORIZONTAL MOTOR
PASSENGER POWER SEAT REAR RISER MOTOR
M
▲ LHD
■ RHD

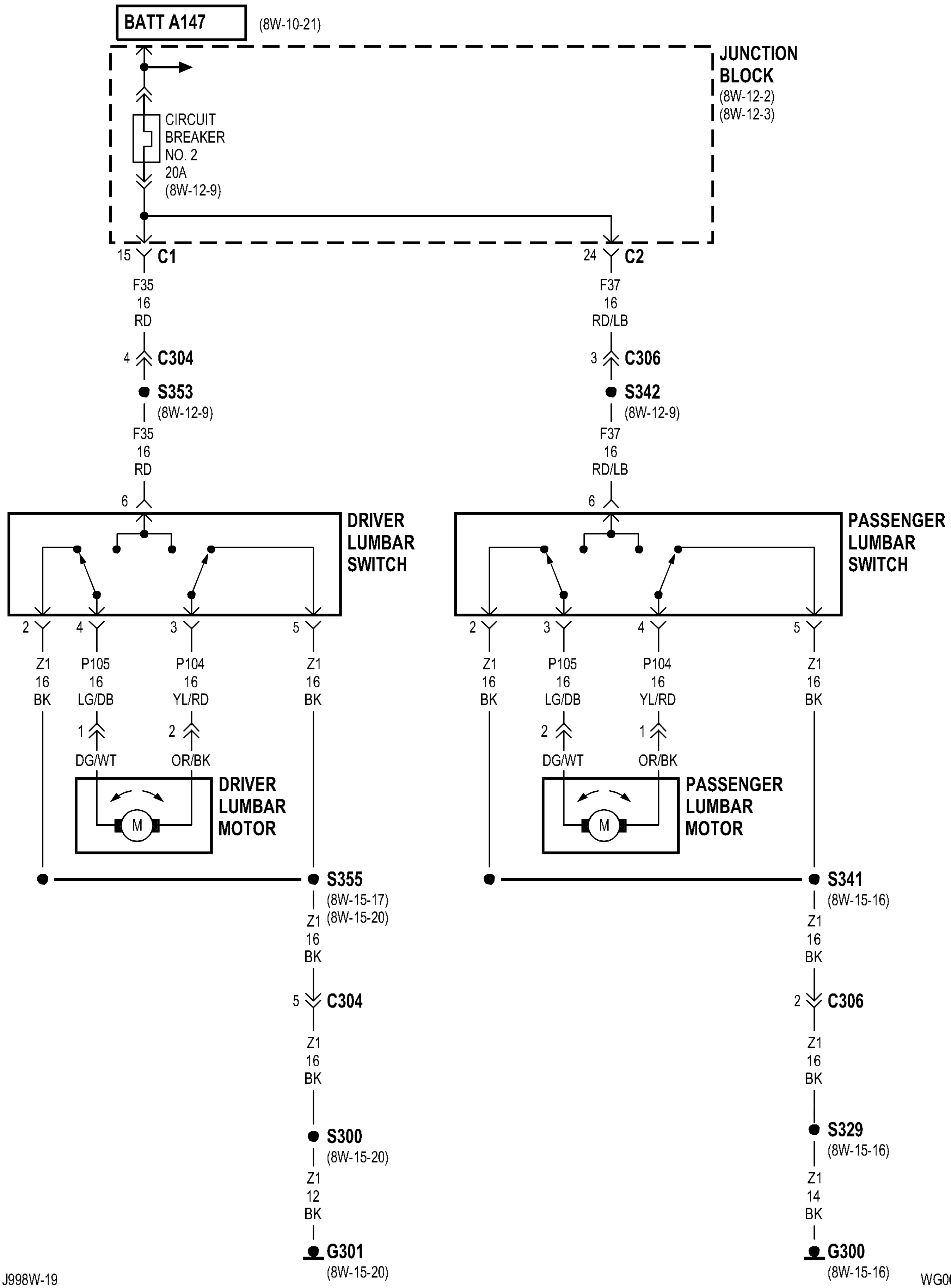

DRIVER POWER SEAT SWITCH
1 REAR UP
2 REAR DOWN
3 FORWARD
4 REARWARD
5 FRONT UP
6 FRONT DOWN
7 RECLINER FORWARD
8 RECLINER REARWARD
P9 20 RD/LB
P11 20 YL/WT
P13 20 RD/WT
P15 20 YL/LB
P17 20 RD/YL
P19 20 YL/LG
P21 20 RD/LG
P43 20 GY/LB
P41 20 GY/WT
14 C2
3 C1
15 C1
1 C1
12 C1
5 C1
14 C1
4 C1
11 C1
SEAT MODULE
FUSED B(+)
SEAT REAR UP SWITCH SENSE
SEAT REAR DOWN SWITCH SENSE
SEAT HORI-ZONTAL FORWARD SWITCH SENSE
SEAT HORI-ZONTAL REARWARD SWITCH SENSE
SEAT FRONT UP SWITCH SENSE
SEAT FRONT DOWN SWITCH SENSE
RECLINER UP SWITCH SENSE
RECLINER DOWN SWITCH SENSE
SEAT REAR UP DRIVER
SEAT REAR DOWN DRIVER
SEAT HORI-ZONTAL FORWARD DRIVER
SEAT HORI-ZONTAL REARWARD DRIVER
SEAT FRONT UP DRIVER
SEAT FRONT DOWN DRIVER
SEAT RECLINER UP DRIVER
SEAT RECLINER DOWN DRIVER
6 C2
7 C2
9 C2
20 C2
4 C2
5 C2
19 C2
18 C2
P111 16 YL/DB
P113 16 RD/BK
P115 16 GY/LG
P117 16 RD/BR
P119 16 YL/RD
P121 16 RD/GY
P143 16 GY/LB
P141 16 GY/WT
Z1 16 BK
S355
(8W-15-17)
(8W-15-20)
Z1 16 BK
5 C304
LHD
RHD
Z1 16 BK
Z1 16 BK
G300
(8W-15-17)
S300
(8W-15-20)
Z1 12 BK
G301
(8W-15-20)
DRIVER POWER SEAT RECLINER MOTOR
DRIVER POWER SEAT FRONT RISER MOTOR
DRIVER POWER SEAT HORIZONTAL MOTOR
DRIVER POWER SEAT REAR RISER MOTOR
M

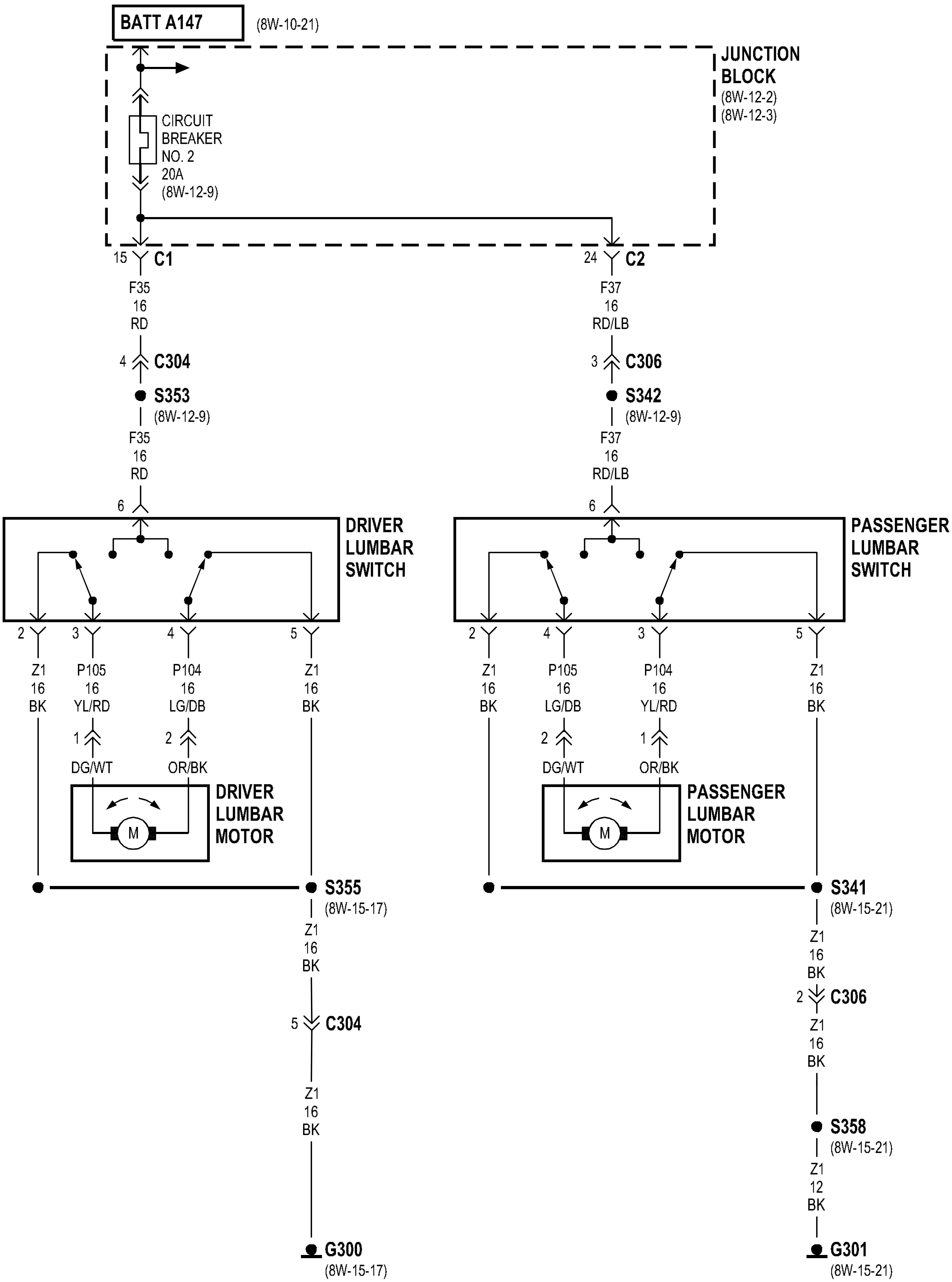

SEAT MODULE
DRIVER SEAT HEATER B(+) DRIVER
SEAT SENSOR 5V SUPPLY
PASSENGER SEAT HEATER B(+) DRIVER
2 C2
P131 16 BK/OR
18 C1
P29 20 BR/WT
11 C2
P130 16 DG/WT
S351
(8W-70-2)
P29 20 BR/WT
P29 20 BR/WT
6 2 C304
16 A C300
5 1 C306
A WT
D BK/RD
DRIVER HEATED SEAT CUSHION
P29 20 BR/WT
P130 16 DG/WT
D BK/RD
A WT
PASSENGER HEATED SEAT CUSHION
YL B
BK/RD C
P88 16 BK/BR
A BR
DRIVER HEATED SEAT BACK
LG B
BK/RD C
YL B
P88 16 BK/BR
A BR
PASSENGER HEATED SEAT BACK
P86 20 DG/YL
4 C306
P86 20 PK/BK
17 C300
P86 18 PK/BK
1 C304
P86 20 DG/YL
LG B
Z5 16 BK/VT
6 C306
E C300
8 C304
Z6 16 BK/YL
P135 20 LB/BK
15 C2
9 C1
6 C1
16 C2
SEAT MODULE
DRIVER SEAT HEATER GROUND
DRIVER SEAT TEMPERATURE SENSE INPUT
PASSENGER SEAT TEMPERATURE SENSOR INPUT
PASSENGER SEAT HEATER GROUND

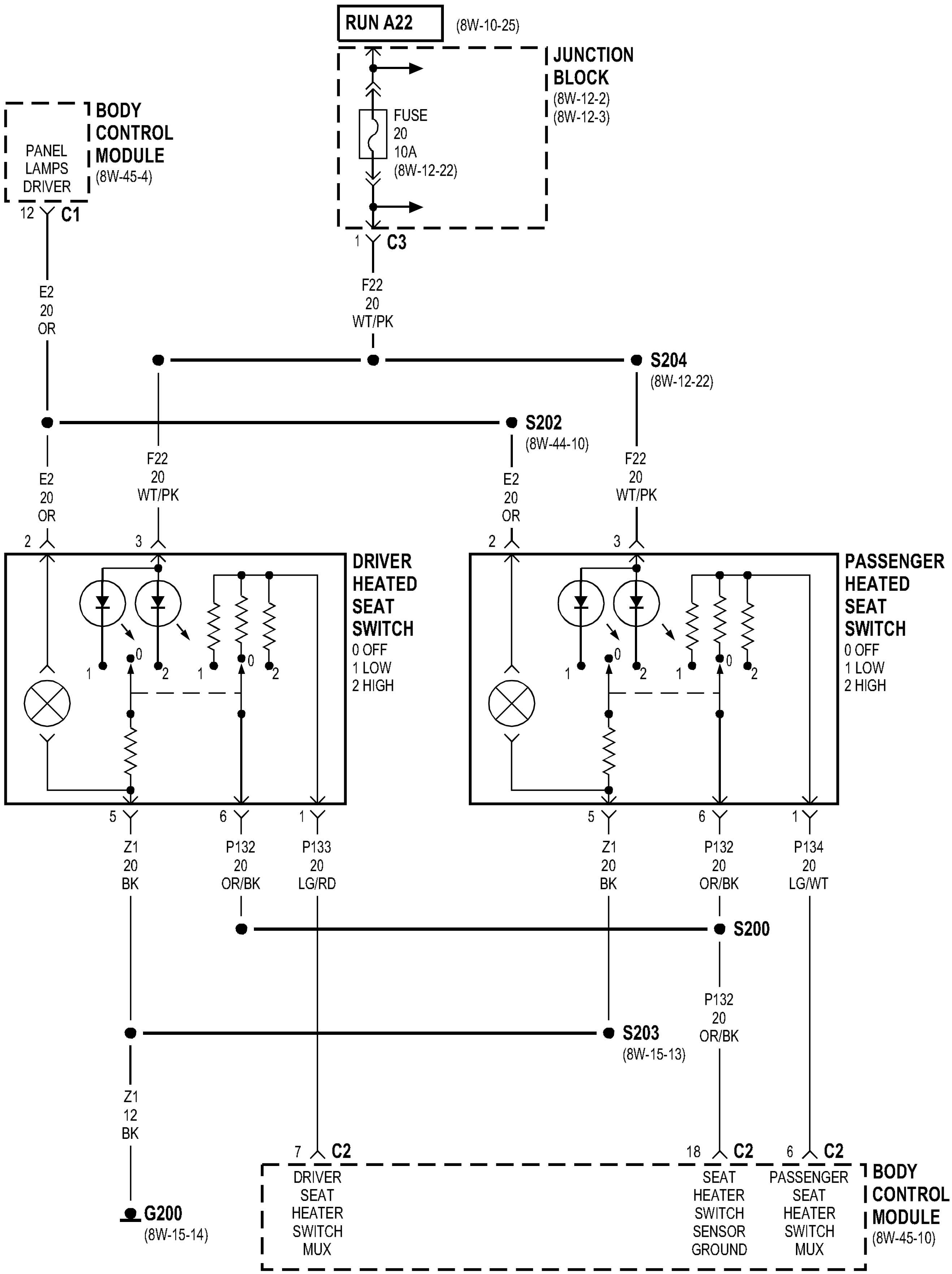

SEAT MODULE
SEAT SENSOR 5V SUPPLY
18 C1
P29 20 BR/WT
S351 (8W-70-2)
P29 20 BR/WT
P29 20 BR/WT
DRIVER POWER SEAT HORIZONTAL MOTOR SENSOR (8W-63-11)
SEAT POSITION SENSOR GROUND
C
DRIVER POWER SEAT REAR RISER MOTOR SENSOR
C
B
A
DRIVER POWER SEAT RECLINER MOTOR SENSOR (8W-63-11)
SEAT POSITION SENSOR GROUND
C
DRIVER POWER SEAT FRONT RISER MOTOR SENSOR
C
A
B
P28 20 BR/RD
P28 20 BR/RD
P28 20 BR/RD
P28 20 BR/RD
S352
P27 20 LB/RD
P28 20 BR/RD
P26 20 BR
7 C1
10 C1
17 C1
REAR RISER POSITION SIGNAL
SEAT POSITION SENSOR GROUND
FRONT RISER POSITION SIGNAL
SEAT MODULE


SEAT MODULE
SEAT SENSOR 5V SUPPLY
18 C1
P29 20 BR/WT
S351 (8W-70-2)
P29 20 BR/WT
P29 20 BR/WT
A
A
DRIVER POWER SEAT HORIZONTAL MOTOR SENSOR
DRIVER POWER SEAT RECLINER MOTOR SENSOR
B
C
C
B
P28 20 BR/RD
P28 20 BR/RD
S352 (8W-63-10)
P25 20 VT/RD
P28 20 BR/RD
P47 20 LB
8 C1
10 C1
16 C1
SEAT HORIZONTAL POSITION SIGNAL
SEAT POSITION SENSOR GROUND
RECLINER POSITION SIGNAL
SEAT MODULE

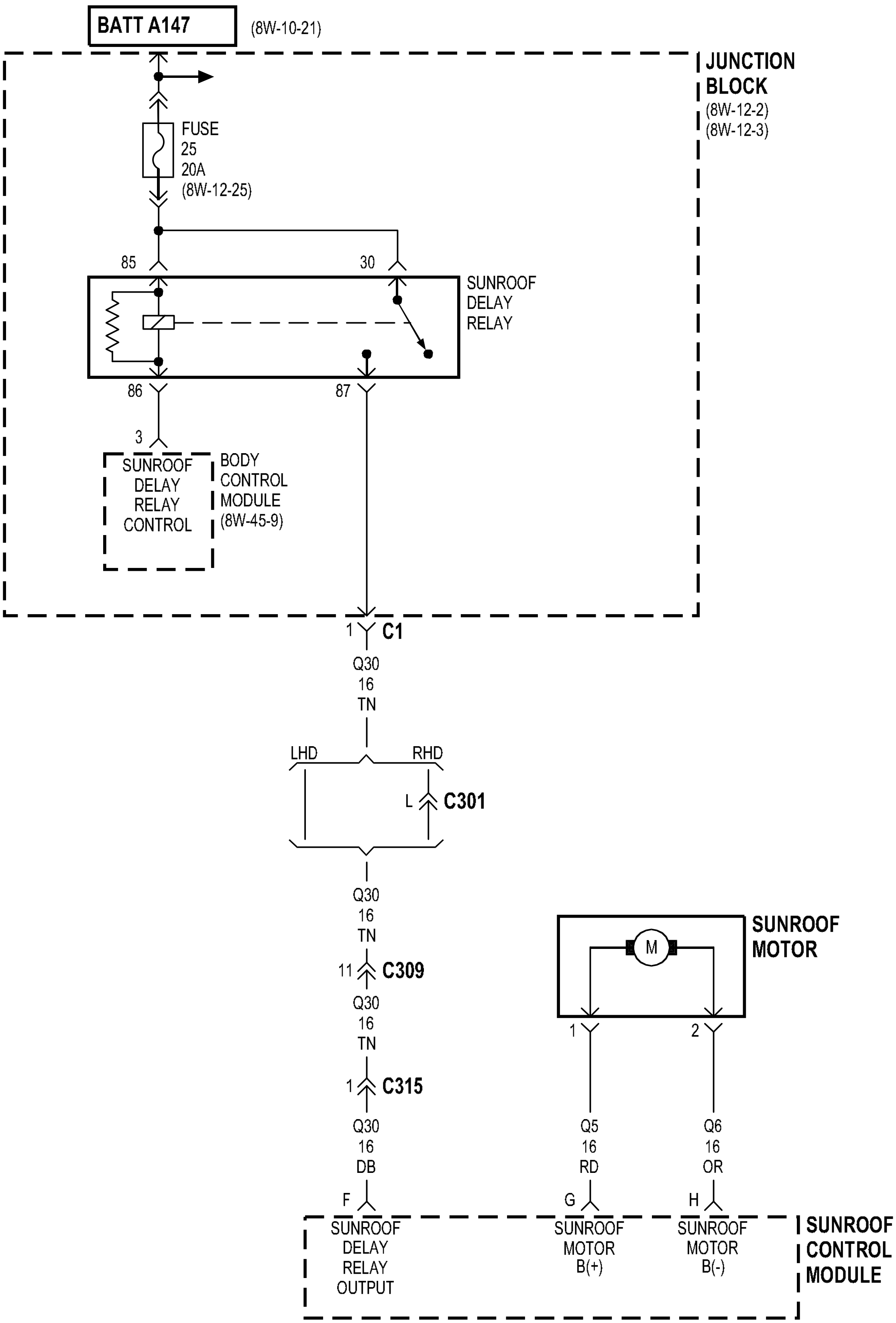
LHD MIDLINE/PREMIUM

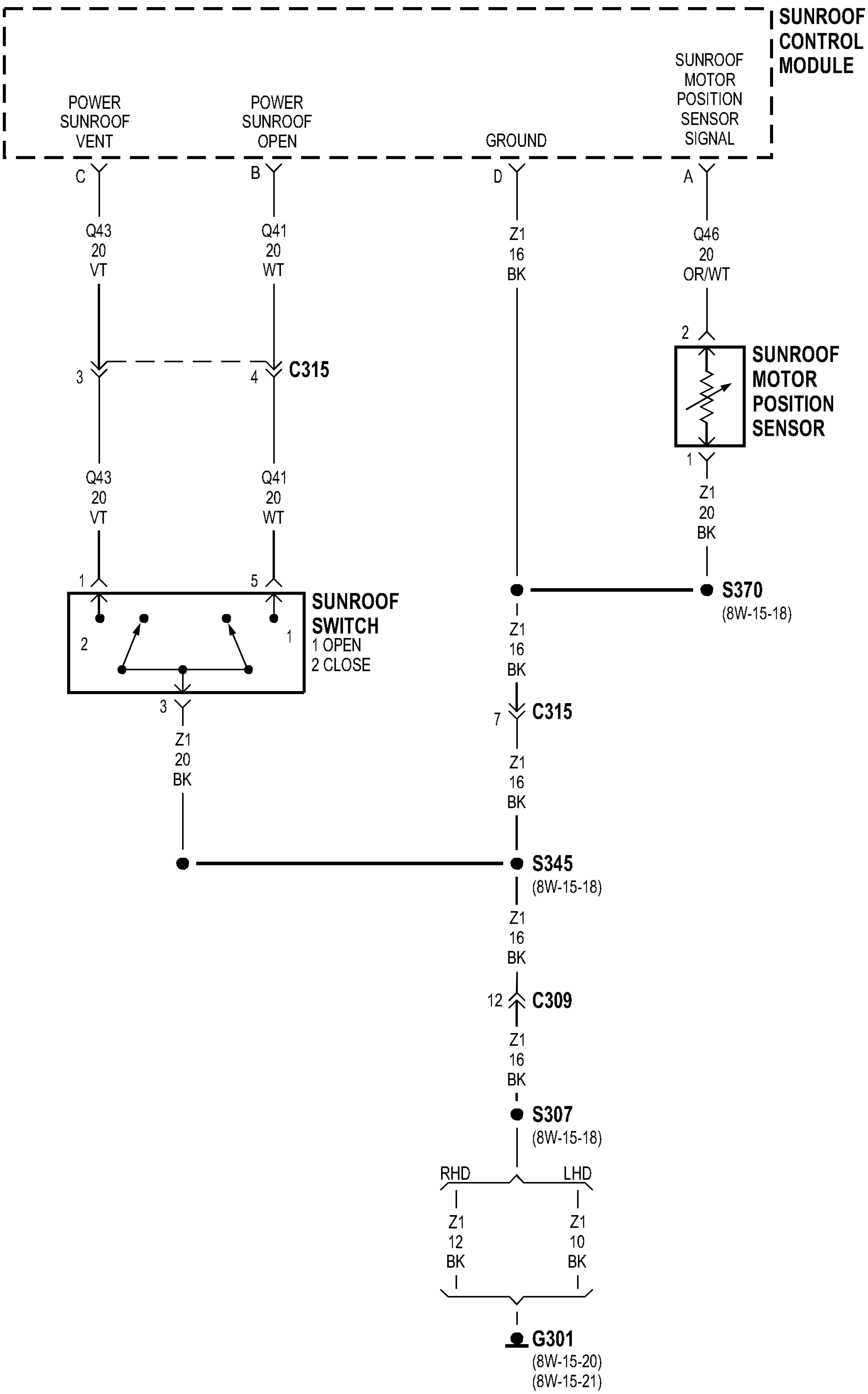



BATT A147
(8W-10-21)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
CIRCUIT BREAKER NO. 2 20A
(8W-12-9)
15 C1
24 C2
F35 16 RD
F37 16 RD/LB
4 C304
3 C306
S353
(8W-12-9)
S342
(8W-12-9)
F35 16 RD
F37 16 RD/LB
6
6
DRIVER LUMBAR SWITCH
PASSENGER LUMBAR SWITCH
2 3 4 5
2 4 3 5
Z1 16 BK
P105 16 YL/RD
P104 16 LG/DB
Z1 16 BK
Z1 16 BK
P105 16 LG/DB
P104 16 YL/RD
Z1 16 BK
1 2
2 1
DG/WT
OR/BK
DG/WT
OR/BK
M
M
DRIVER LUMBAR MOTOR
PASSENGER LUMBAR MOTOR
S355
(8W-15-17)
S341
(8W-15-21)
Z1 16 BK
Z1 16 BK
5 C304
2 C306
Z1 16 BK
Z1 16 BK
S358
(8W-15-21)
Z1 12 BK
G300
(8W-15-17)
G301
(8W-15-21)


RUN A22
(8W-10-25)
JUNCTION BLOCK
(8W-12-2)
(8W-12-3)
FUSE
20
10A
(8W-12-22)
1 C3
F22
20
WT/PK
BODY CONTROL MODULE
(8W-45-4)
PANEL LAMPS DRIVER
12 C1
E2
20
OR
S204
(8W-12-22)
S202
(8W-44-10)
E2 20 OR
F22 20 WT/PK
E2 20 OR
F22 20 WT/PK
DRIVER HEATED SEAT SWITCH
0 OFF
1 LOW
2 HIGH
PASSENGER HEATED SEAT SWITCH
0 OFF
1 LOW
2 HIGH
Z1 20 BK
P132 20 OR/BK
P133 20 LG/RD
Z1 20 BK
P132 20 OR/BK
P134 20 LG/WT
S200
S203
(8W-15-13)
P132 20 OR/BK
Z1 12 BK
G200
(8W-15-14)
7 C2
18 C2
6 C2
DRIVER SEAT HEATER SWITCH MUX
SEAT HEATER SWITCH SENSOR GROUND
PASSENGER SEAT HEATER SWITCH MUX
BODY CONTROL MODULE
(8W-45-10)

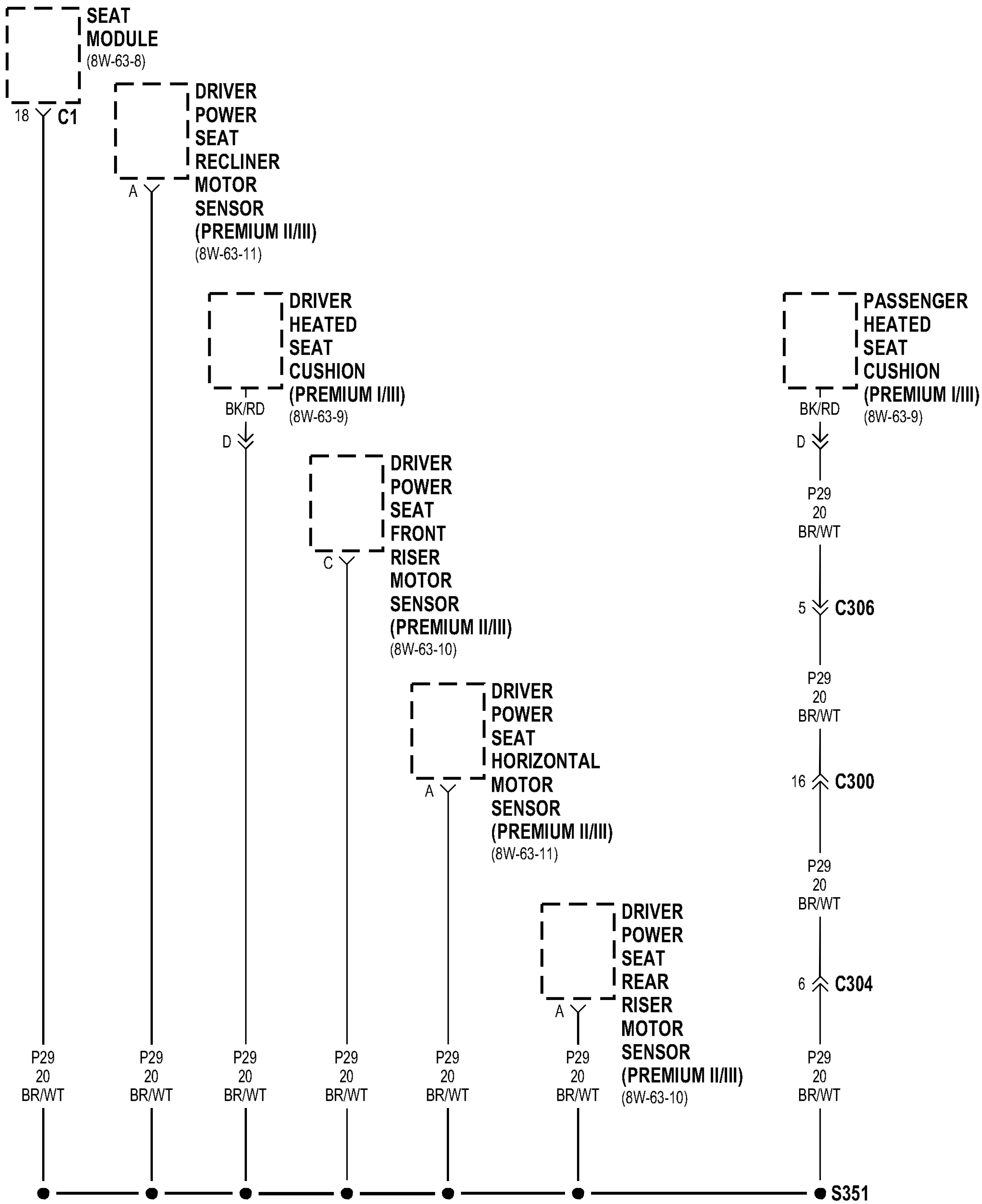
8W-64 POWER SUNROOF


BATT A147
(8W-10-21)
JUNCTION
BLOCK
(8W-12-2)
(8W-12-3)
FUSE
25
20A
(8W-12-25)
85
30
SUNROOF
DELAY
RELAY
86
87
3
SUNROOF
DELAY
RELAY
CONTROL
BODY
CONTROL
MODULE
(8W-45-9)
1
C1
Q30
16
TN
LHD
RHD
L
C301
Q30
16
TN
11
C309
Q30
16
TN
1
C315
Q30
16
DB
SUNROOF
MOTOR
M
1
2
Q5
16
RD
Q6
16
OR
F
G
H
SUNROOF
DELAY
RELAY
OUTPUT
SUNROOF
MOTOR
B(+)
SUNROOF
MOTOR
B(-)
SUNROOF
CONTROL
MODULE

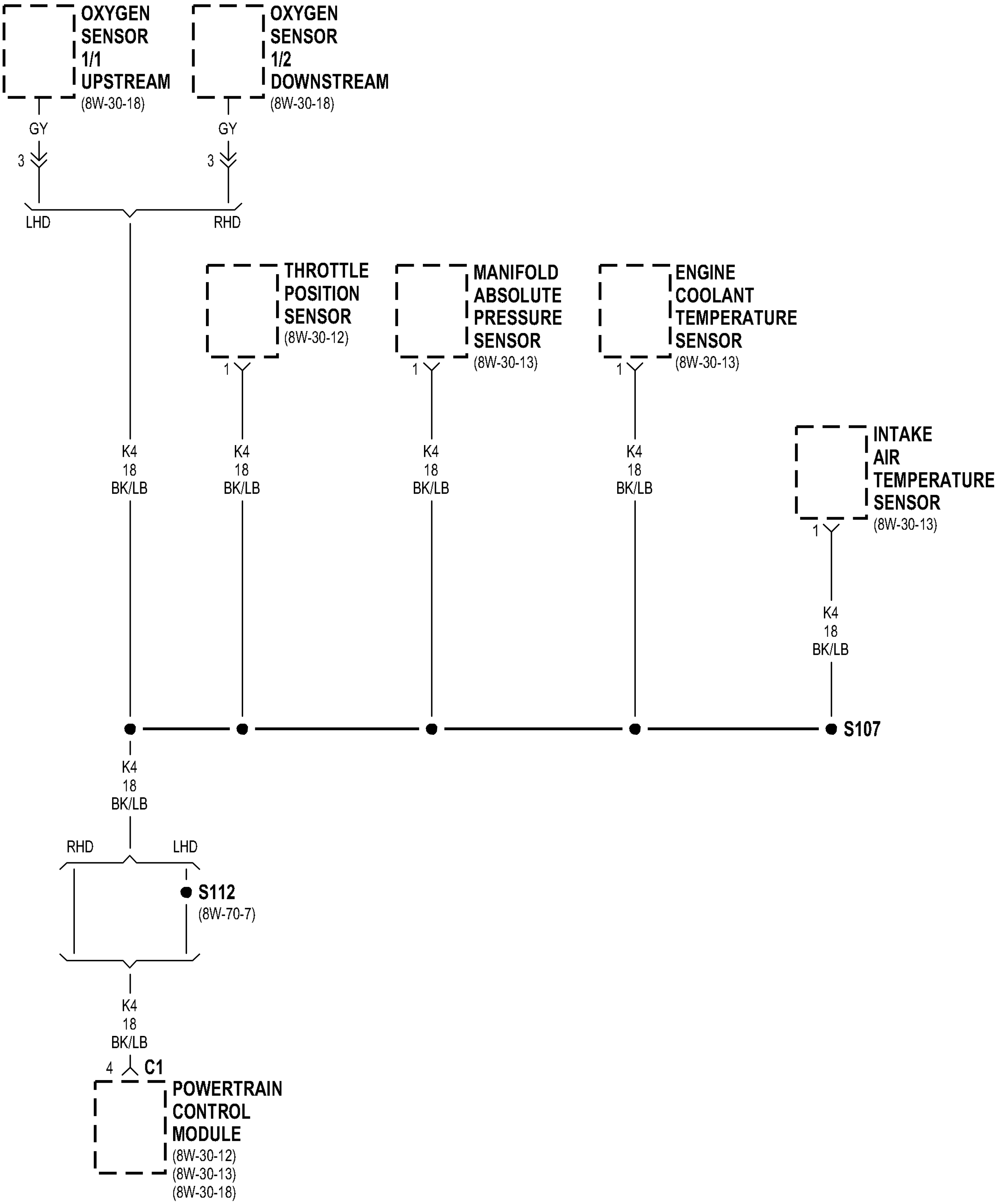

SUNROOF CONTROL MODULE
POWER SUNROOF VENT
POWER SUNROOF OPEN
GROUND
SUNROOF MOTOR POSITION SENSOR SIGNAL
C
B
D
A
Q43 20 VT
Q41 20 WT
Z1 16 BK
Q46 20 OR/WT
3
4
C315
2
SUNROOF MOTOR POSITION SENSOR
1
Z1 20 BK
Q43 20 VT
Q41 20 WT
1
5
SUNROOF SWITCH
1 OPEN
2 CLOSE
2
1
3
Z1 20 BK
S370
(8W-15-18)
Z1 16 BK
7
C315
Z1 16 BK
S345
(8W-15-18)
Z1 16 BK
12
C309
Z1 16 BK
S307
(8W-15-18)
RHD
LHD
Z1 12 BK
Z1 10 BK
G301
(8W-15-20)
(8W-15-21)

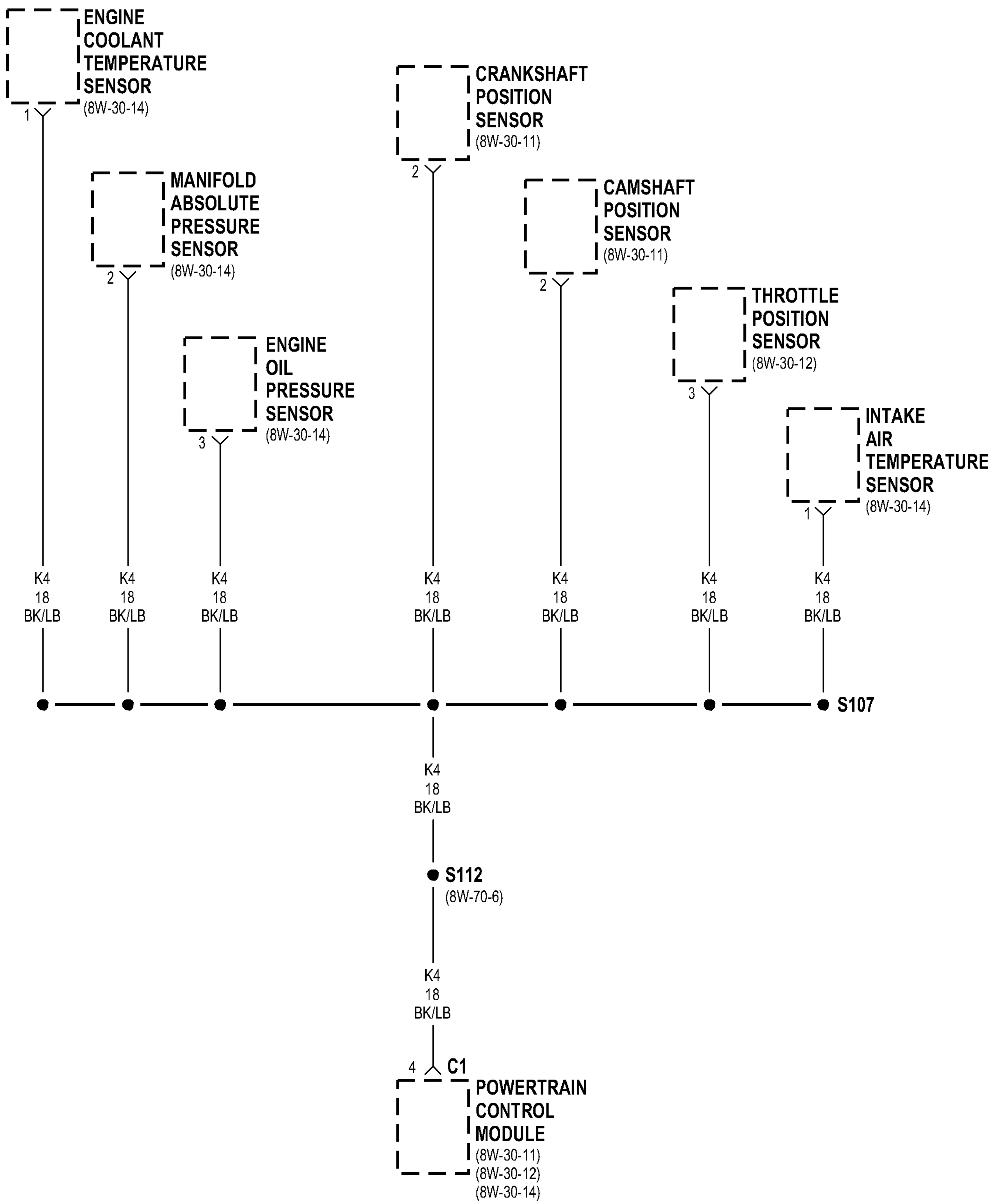
8W-70 SPLICE INFORMATION

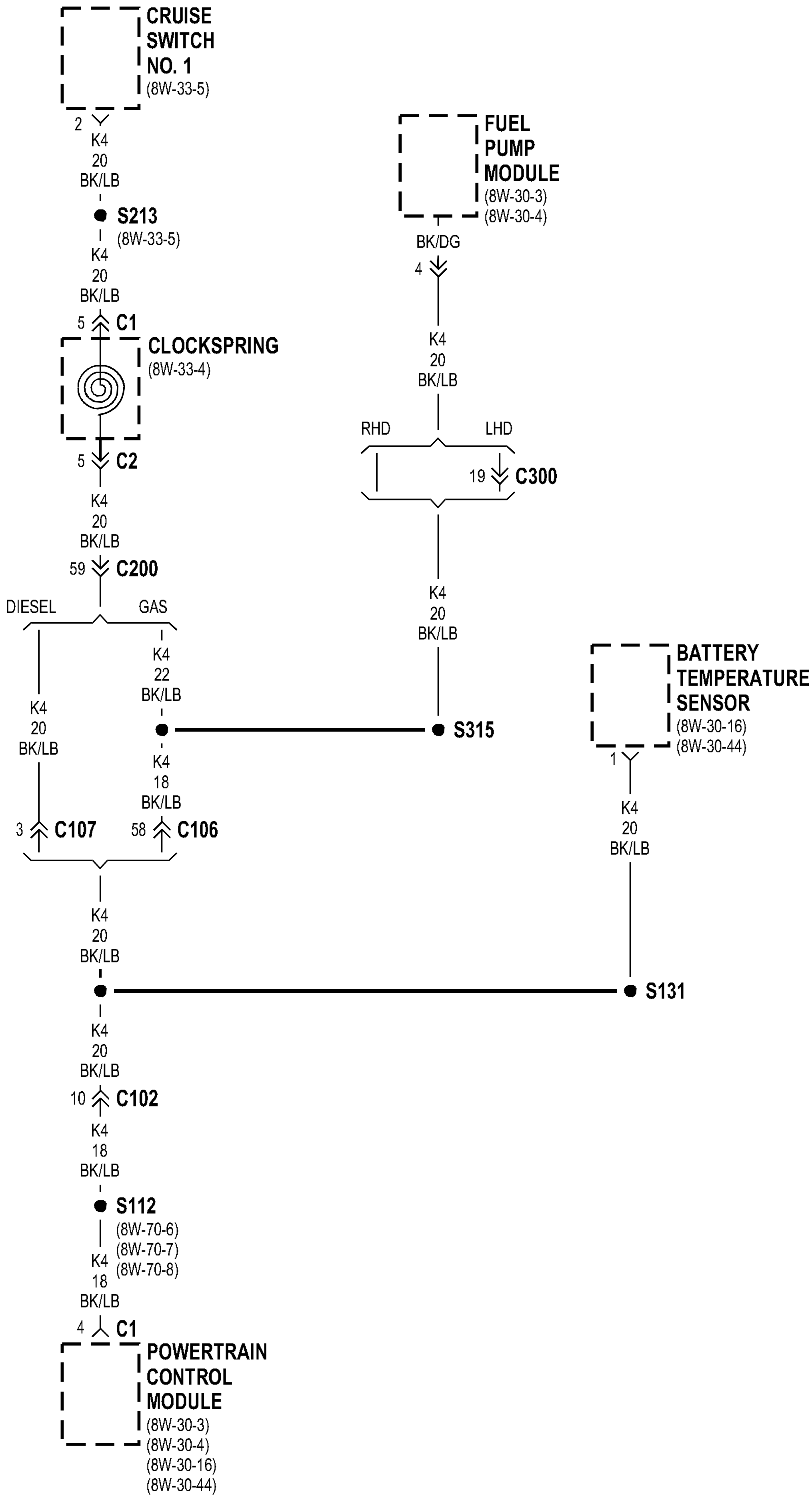
Component	Page
S100	8W-10-2, -3, -10, 11
S102	8W-30-13, 38
S103	8W-15-3
S104	8W-15-3
S105	8W-30-12
S106	8W-10-18
S107	8W-70-3, 4
S109	8W-30-6, -7, 19
S112	8W-70-6, -7, 8
S113	8W-31-14
S114	8W-15-2
S115	8W-10-16
S116	8W-12-18
S117	8W-12-31
S118	8W-10-20, 22
S119	8W-31-7
S120	8W-30-12
S121	8W-10-8, 19
S122	8W-31-5, 6
S124	8W-10-10, 20
S125	8W-30-23, 39
S126	8W-30-16
S127	8W-10-24
S128	8W-10-18, 22
S130	8W-30-25, 29
S131	8W-70-5
S132	8W-15-8, -9, 10
S133	8W-15-8, 10
S134	8W-15-5, 6
S135	8W-10-17
S136	8W-10-17
S137	8W-10-28
S138	8W-15-2
S139	8W-15-2
S140	8W-15-6
S141	8W-15-5
S142	8W-50-8
S143	8W-50-11
S144	8W-10-22
S145	8W-70-9
S146	8W-30-41
S147	8W-30-45
S148	8W-30-41
S150	8W-30-33
S151	8W-15-4
S152	8W-15-7
S153	8W-12-14
S154	8W-12-34
S155	8W-12-34
S156	8W-12-14
S200	8W-63-14
S201	8W-15-14
S202	8W-44-10
S203	8W-15-13
S204	8W-12-22
S205	8W-15-14
S206	8W-12-22
S207	8W-12-16
S208	8W-44-8
S209	8W-12-11
S210	8W-30-27, -28, 31
S211	8W-15-12
S212	8W-53-2, 3
S213	8W-33-5
S214	8W-33-5
S215	8W-47-13
S216	8W-47-13
S217	8W-15-14
S218	8W-12-36
S219	8W-12-23
S220	8W-39-3
S300	8W-15-20
S301	8W-15-20
S302	8W-61-5
S303	8W-61-5
S304	8W-12-16
S305	8W-30-26
S306	8W-12-27
S307	8W-15-18
S308	8W-12-37
S309	8W-12-12
S310	8W-51-6, 7
S311	8W-51-5
S312	8W-30-26, 30
S313	8W-51-5
S314	8W-30-20, 33
S315	8W-70-5
S316	8W-12-18
S317	8W-61-5, 6
S318	8W-61-5, 6
S324	8W-30-25, 29
S325	8W-12-31
S326	8W-12-12, 13
S327	8W-12-33
S328	8W-51-6
S329	8W-15-16
S330	8W-15-15
S331	8W-15-16, 17
S332	8W-15-16, 17
S333	8W-30-24
S334	8W-12-11
S336	8W-15-15
S338	8W-15-15
S339	8W-61-5, 6
S340	8W-61-5, 6
S341	8W-15-16, 21
S342	8W-12-9
S345	8W-15-18
S346	8W-12-16
S347	8W-12-30
S348	8W-12-19
S349	8W-12-23
S351	8W-70-2
S352	8W-63-10
S353	8W-12-9
S355	8W-15-17, 20
S356	8W-15-20, 21
S357	8W-15-15, 17
S358	8W-15-21
S359	8W-50-9
S360	8W-47-4
S361	8W-47-4
S362	8W-47-4
S363	8W-47-4
S364	8W-30-29
S365	8W-39-12
S366	8W-12-15
S367	8W-12-37
S368	8W-47-2, 3
S370	8W-15-18
S400	8W-12-17
S401	8W-15-19
S402	8W-15-19
S403	8W-12-16
S404	8W-12-30
S406	8W-54-6
S407	8W-54-6
S408	8W-15-18
S409	8W-15-18
S410	8W-15-18
S411	8W-12-12, 13
S412	8W-15-19
S413	8W-54-7


SEAT MODULE (8W-63-8)
18 C1
DRIVER POWER SEAT RECLINER MOTOR SENSOR (PREMIUM II/III) (8W-63-11)
A
DRIVER HEATED SEAT CUSHION (PREMIUM I/III) (8W-63-9)
BK/RD
D
DRIVER POWER SEAT FRONT RISER MOTOR SENSOR (PREMIUM II/III) (8W-63-10)
C
DRIVER POWER SEAT HORIZONTAL MOTOR SENSOR (PREMIUM II/III) (8W-63-11)
A
DRIVER POWER SEAT REAR RISER MOTOR SENSOR (PREMIUM II/III) (8W-63-10)
A
PASSENGER HEATED SEAT CUSHION (PREMIUM I/III) (8W-63-9)
BK/RD
D
P29 20 BR/WT
5 C306
16 C300
6 C304
S351

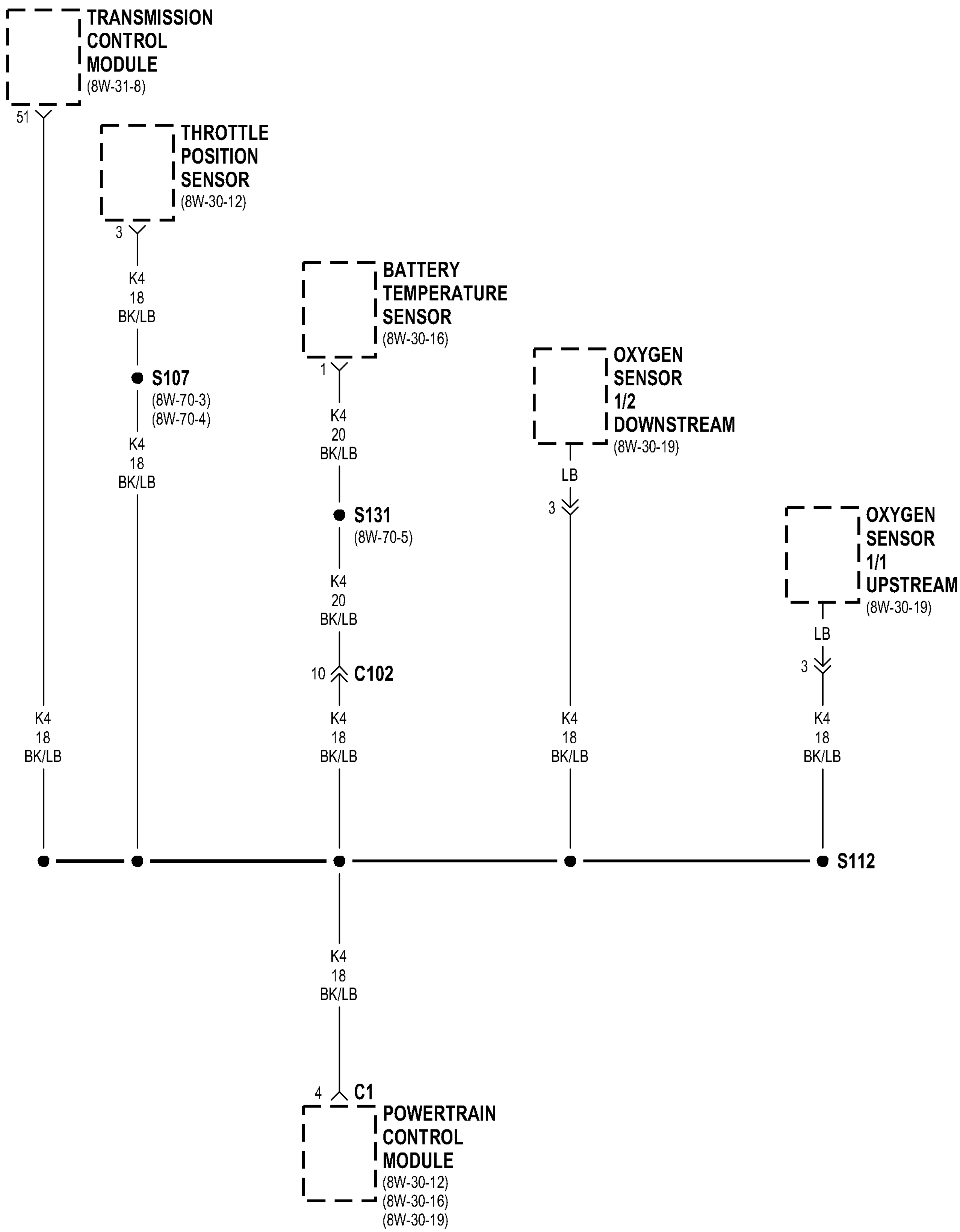
4.0L


OXYGEN SENSOR 1/1 UPSTREAM
(8W-30-18)
OXYGEN SENSOR 1/2 DOWNSTREAM
(8W-30-18)
GY
3
GY
3
LHD
RHD
THROTTLE POSITION SENSOR
(8W-30-12)
MANIFOLD ABSOLUTE PRESSURE SENSOR
(8W-30-13)
ENGINE COOLANT TEMPERATURE SENSOR
(8W-30-13)
INTAKE AIR TEMPERATURE SENSOR
(8W-30-13)
1
K4
18
BK/LB
S107
RHD
LHD
S112
(8W-70-7)
4
C1
POWERTRAIN CONTROL MODULE
(8W-30-12)
(8W-30-13)
(8W-30-18)

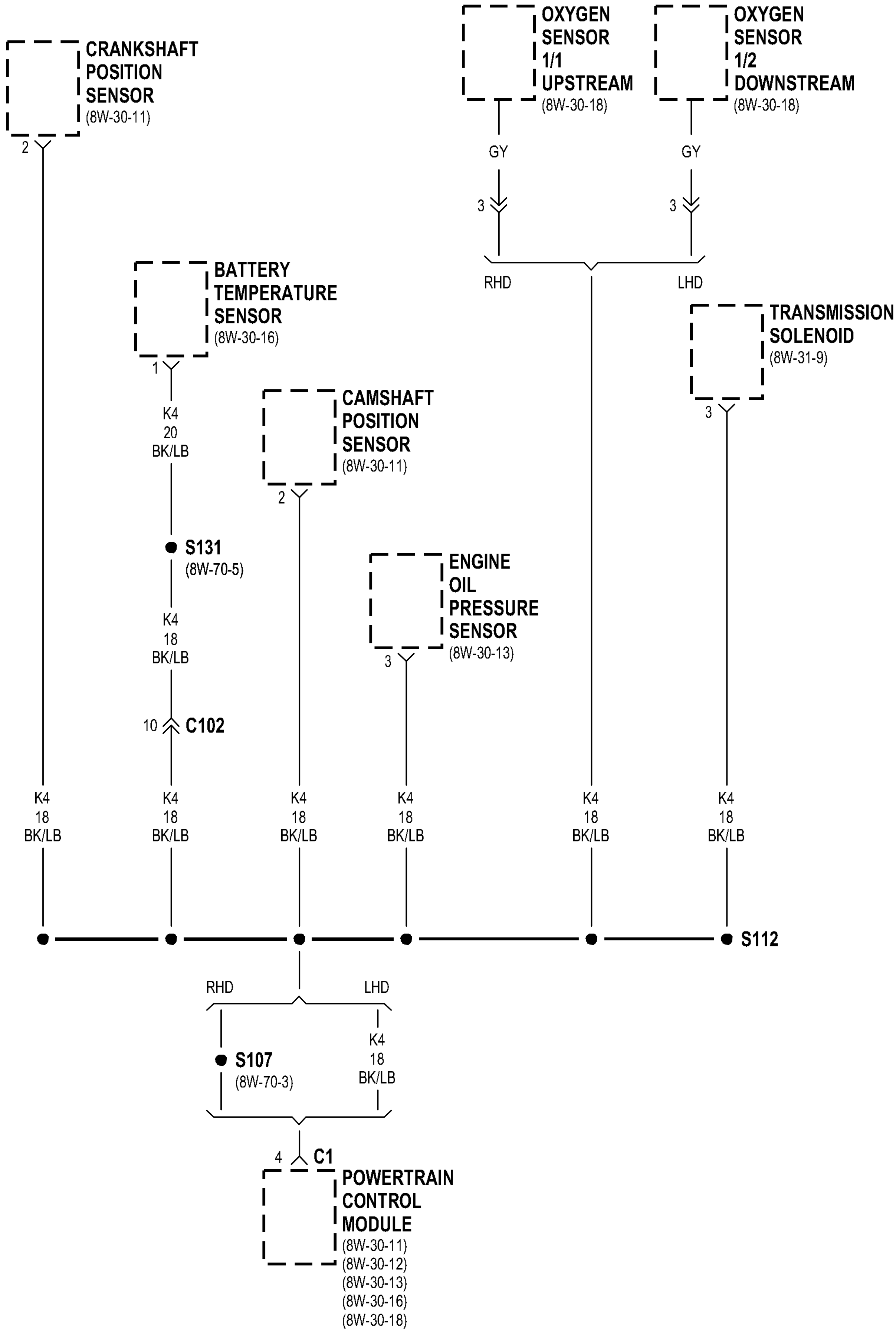

ENGINE COOLANT TEMPERATURE SENSOR
(8W-30-14)
1
CRANKSHAFT POSITION SENSOR
(8W-30-11)
2
MANIFOLD ABSOLUTE PRESSURE SENSOR
(8W-30-14)
2
CAMSHAFT POSITION SENSOR
(8W-30-11)
2
ENGINE OIL PRESSURE SENSOR
(8W-30-14)
3
THROTTLE POSITION SENSOR
(8W-30-12)
3
INTAKE AIR TEMPERATURE SENSOR
(8W-30-14)
1
K4 18 BK/LB
K4 18 BK/LB
K4 18 BK/LB
K4 18 BK/LB
K4 18 BK/LB
K4 18 BK/LB
K4 18 BK/LB
S107
K4 18 BK/LB
S112
(8W-70-6)
K4 18 BK/LB
4
C1
POWERTRAIN CONTROL MODULE
(8W-30-11)
(8W-30-12)
(8W-30-14)

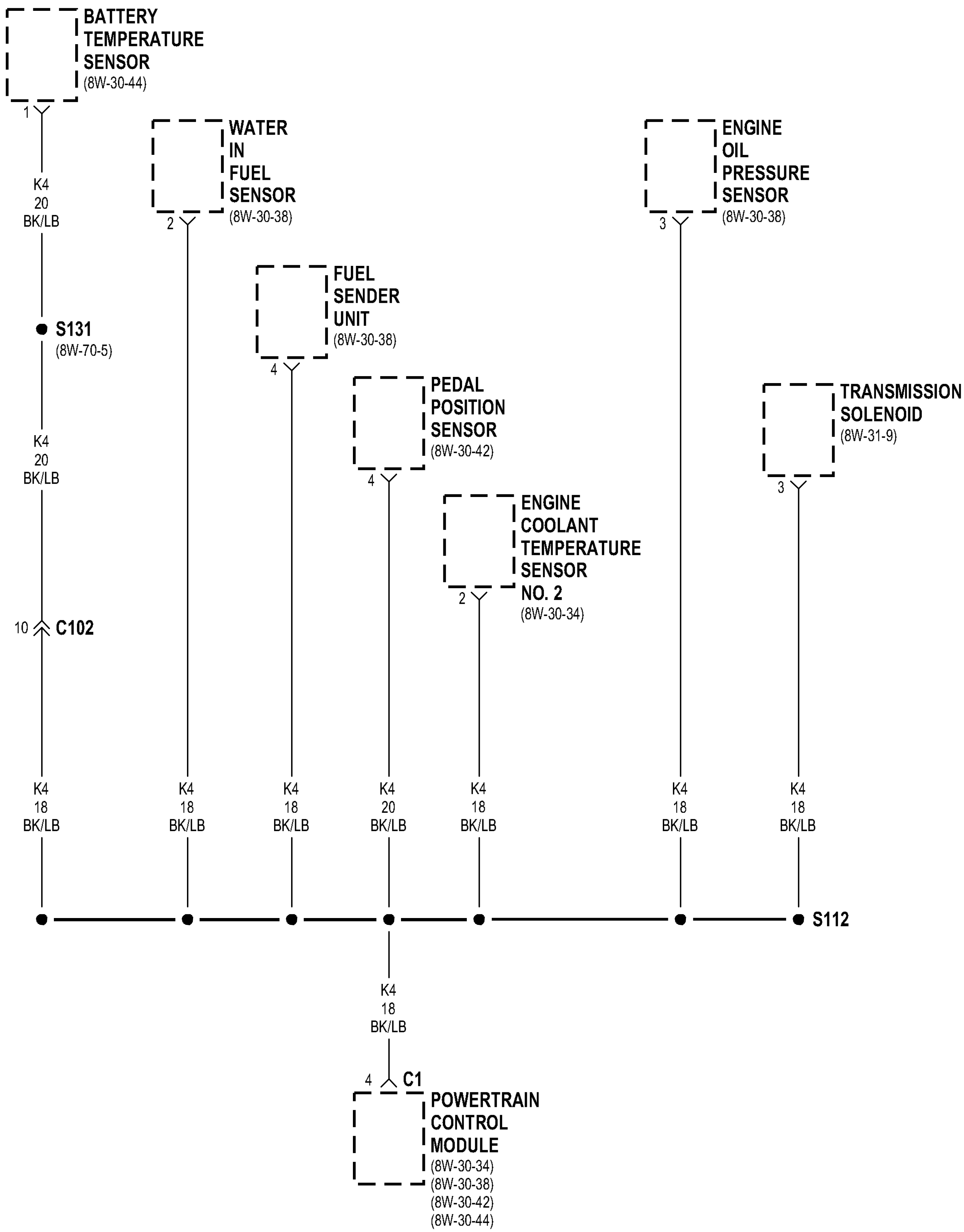

CRUISE
SWITCH
NO. 1
(8W-33-5)
2
K4
20
BK/LB
S213
(8W-33-5)
K4
20
BK/LB
5
C1
CLOCKSPRING
(8W-33-4)
5
C2
K4
20
BK/LB
59
C200
DIESEL
GAS
K4
22
BK/LB
K4
20
BK/LB
K4
18
BK/LB
3
C107
58
C106
K4
20
BK/LB
K4
20
BK/LB
10
C102
K4
18
BK/LB
S112
(8W-70-6)
(8W-70-7)
(8W-70-8)
K4
18
BK/LB
4
C1
POWERTRAIN
CONTROL
MODULE
(8W-30-3)
(8W-30-4)
(8W-30-16)
(8W-30-44)
FUEL
PUMP
MODULE
(8W-30-3)
(8W-30-4)
BK/DG
4
K4
20
BK/LB
RHD
LHD
19
C300
K4
20
BK/LB
S315
BATTERY
TEMPERATURE
SENSOR
(8W-30-16)
(8W-30-44)
1
K4
20
BK/LB
S131

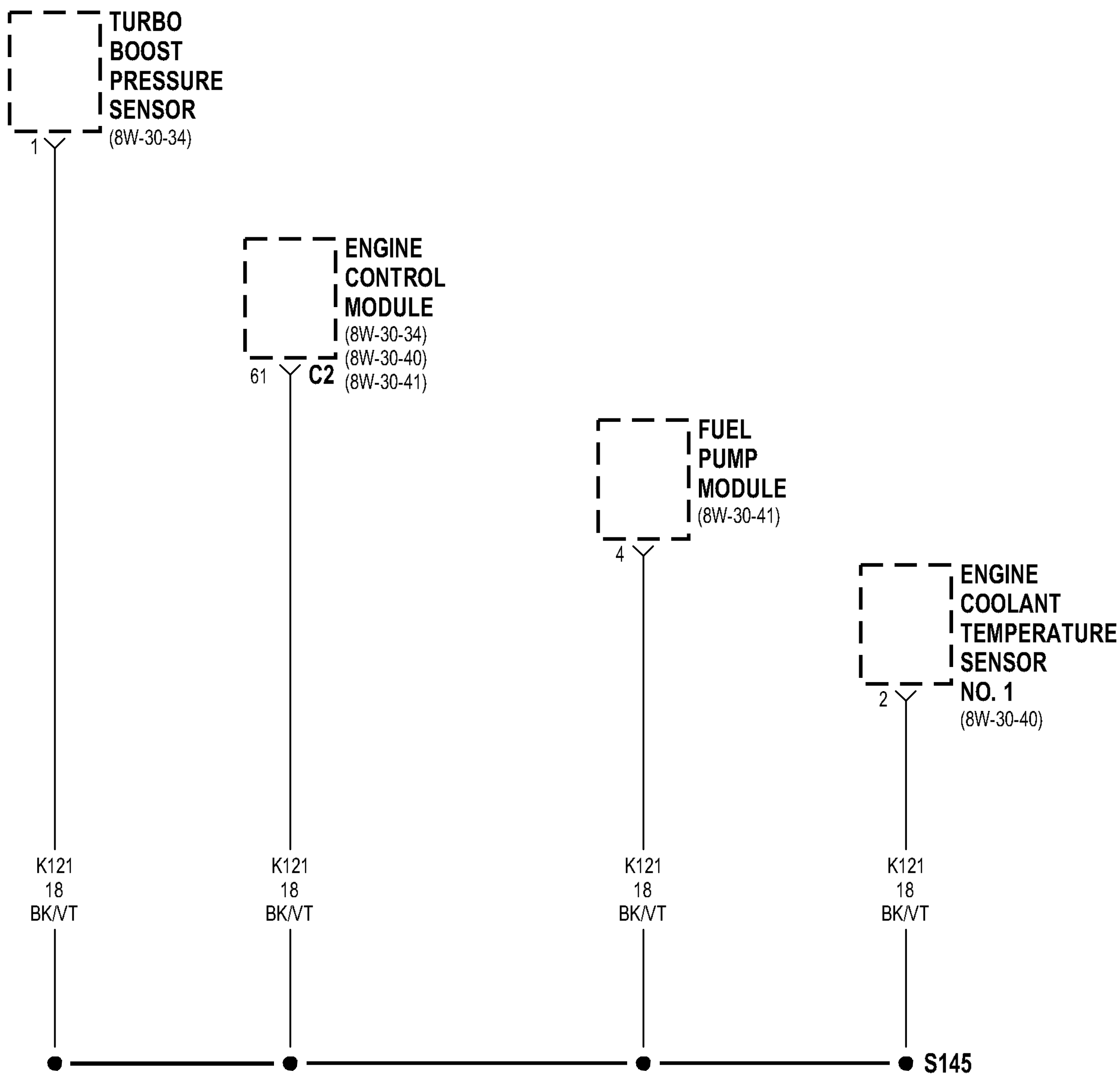
4.7L


TRANSMISSION
CONTROL
MODULE
(8W-31-8)
51
THROTTLE
POSITION
SENSOR
(8W-30-12)
3
K4
18
BK/LB
S107
(8W-70-3)
(8W-70-4)
K4
18
BK/LB
BATTERY
TEMPERATURE
SENSOR
(8W-30-16)
1
K4
20
BK/LB
S131
(8W-70-5)
K4
20
BK/LB
10
C102
OXYGEN
SENSOR
1/2
DOWNSTREAM
(8W-30-19)
LB
3
OXYGEN
SENSOR
1/1
UPSTREAM
(8W-30-19)
LB
3
K4
18
BK/LB
K4
18
BK/LB
K4
18
BK/LB
K4
18
BK/LB
S112
K4
18
BK/LB
4
C1
POWERTRAIN
CONTROL
MODULE
(8W-30-12)
(8W-30-16)
(8W-30-19)

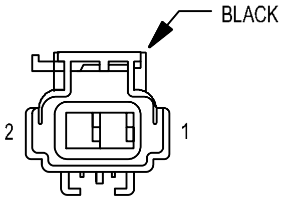
4.0L


CRANKSHAFT POSITION SENSOR
(8W-30-11)
OXYGEN SENSOR 1/1 UPSTREAM
(8W-30-18)
OXYGEN SENSOR 1/2 DOWNSTREAM
(8W-30-18)
GY
RHD
LHD
BATTERY TEMPERATURE SENSOR
(8W-30-16)
TRANSMISSION SOLENOID
(8W-31-9)
CAMSHAFT POSITION SENSOR
(8W-30-11)
K4 20 BK/LB
S131
(8W-70-5)
ENGINE OIL PRESSURE SENSOR
(8W-30-13)
K4 18 BK/LB
C102
S112
S107
(8W-70-3)
C1
POWERTRAIN CONTROL MODULE
(8W-30-11)
(8W-30-12)
(8W-30-13)
(8W-30-16)
(8W-30-18)


BATTERY TEMPERATURE SENSOR
(8W-30-44)
1
K4
20
BK/LB
S131
(8W-70-5)
K4
20
BK/LB
10
C102
WATER IN FUEL SENSOR
(8W-30-38)
2
FUEL SENDER UNIT
(8W-30-38)
4
PEDAL POSITION SENSOR
(8W-30-42)
4
ENGINE COOLANT TEMPERATURE SENSOR NO. 2
(8W-30-34)
2
ENGINE OIL PRESSURE SENSOR
(8W-30-38)
3
TRANSMISSION SOLENOID
(8W-31-9)
3
K4
18
BK/LB
K4
18
BK/LB
K4
18
BK/LB
K4
20
BK/LB
K4
18
BK/LB
K4
18
BK/LB
K4
18
BK/LB
S112
K4
18
BK/LB
4
C1
POWERTRAIN CONTROL MODULE
(8W-30-34)
(8W-30-38)
(8W-30-42)
(8W-30-44)

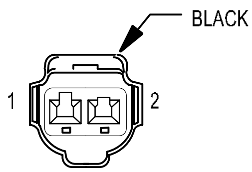

TURBO BOOST PRESSURE SENSOR
(8W-30-34)
1
ENGINE CONTROL MODULE
(8W-30-34)
(8W-30-40)
(8W-30-41)
61
C2
FUEL PUMP MODULE
(8W-30-41)
4
ENGINE COOLANT TEMPERATURE SENSOR NO. 1
(8W-30-40)
2
K121
18
BK/VT
K121
18
BK/VT
K121
18
BK/VT
K121
18
BK/VT
S145

8W-80 CONNECTOR PIN-OUTS



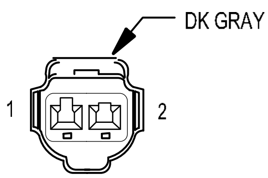
A/C
COMPRESSOR
CLUTCH

CAV	CIRCUIT	FUNCTION
1	C2 18DB/YL	A/C COMPRESSOR CLUTCH RELAY OUTPUT
2	Z1 18BK	GROUND



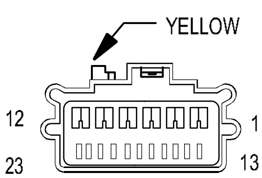
A/C HIGH
PRESSURE
CUTOUT
SWITCH

CAV	CIRCUIT	FUNCTION
1	C18 18DB	A/C PRESSURE SIGNAL
2	C21 20DB/YL	A/C SWITCH SENSE



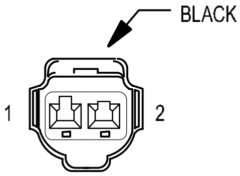
A/C LOW
PRESSURE CYCLE
CLUTCH SWITCH

CAV	CIRCUIT	FUNCTION
1	C21 20DB/YL	A/C SWITCH SENSE
2	Z1 20BK	GROUND



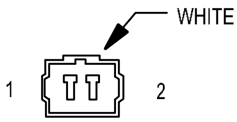
AIRBAG CONTROL
MODULE

CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	-	-
4	Z2 18BK/OR	GROUND
5	R43 18BK/LB	DRIVER AIRBAG LINE 2
6	R45 18DG/LB	DRIVER AIRBAG LINE 1
7	R44 18DG/YL	PASSENGER AIRBAG LINE 1
8	R42 18BK/YL	PASSENGER AIRBAG LINE 2
9	-	-
10	-	-
11	-	-
12	-	-
13	-	-
14	F14 18LG/YL	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
15	F23 18DB/YL	FUSED IGNITION SWITCH OUTPUT (RUN)
16	-	-
17	-	-
18	-	-
19	-	-
20	-	-
21	D25 18YL/VT/OR	PCI BUS
22	-	-
23	-	-



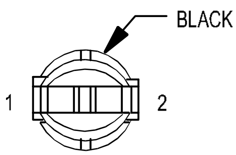
AMBIENT TEMPERATURE SENSOR

CAV	CIRCUIT	FUNCTION
1	G39 20DB/OR	AMBIENT TEMPERATURE SENSOR RETURN
2	C8 20DG/RD	AMBIENT TEMPERATURE SENSOR SIGNAL



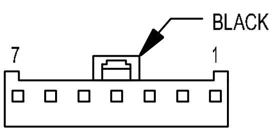
ANTENNA MODULE

CAV	CIRCUIT	FUNCTION
1	X64 18BK/WT	ENABLE SIGNAL TO AMPLIFIER
2	-	-



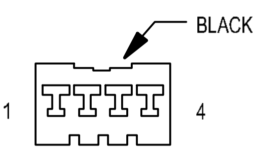
ASH RECEIVER LAMP

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	E2 20OR	PANEL LAMPS DRIVER



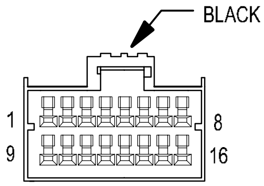
AUTOMATIC DAY/ NIGHT MIRROR

CAV	CIRCUIT	FUNCTION
1	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
2	Z1 20BK	GROUND
3	L1 20VT/BK	BACK-UP LAMP FEED
4	P112 20YL/WT	AUTO DAY NIGHT MIRROR (+)
5	P114 20YL/RD	AUTO DAY NIGHT MIRROR (-)
6	-	-
7	-	-



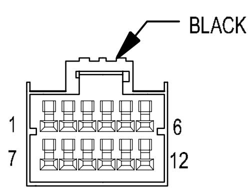
AUTOMATIC HEADLAMP LIGHT SENSOR/VTSS LED

CAV	CIRCUIT	FUNCTION
1	L109 20WT	ULTRALIGHT SENSOR SIGNAL
2	L110 20BK/YL	ULTRALIGHT SENSOR RETURN
3	G69 20BK/OR	VTSS INDICATOR DRIVER
4	M1 20PK	FUSED B(+)



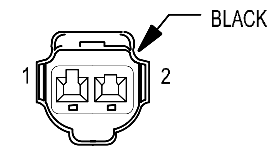
AUTOMATIC
ZONE CONTROL
MODULE - C1

CAV	CIRCUIT	FUNCTION
1	C102 20TN/BK	MODE DOOR DRIVER (B)
2	-	-
3	C32 20GY/DB	RECIRCULATION DOOR DRIVER (A)
4	C100 20YL/DB	RECIRCULATION DOOR DRIVER (B)
5	-	-
6	C15 20BK/WT	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
7	-	-
8	Z1 20BK	GROUND
9	C35 20DG/YL	MODE DOOR DRIVER (A)
10	C33 20DB/RD	DRIVER BLEND DOOR DRIVER (A)
11	-	-
12	-	-
13	-	-
14	C15 20BK/WT	REAR WINDOW DEFOGGER SWITCH SENSE
15	-	-
16	-	-



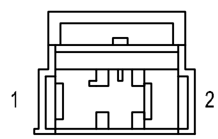
AUTOMATIC
ZONE CONTROL
MODULE - C2

CAV	CIRCUIT	FUNCTION
1	-	-
2	C94 20WT/DG	PASSENGER BLEND DOOR DRIVER (A)
3	C95 20WT/BK	DRIVER BLEND DOOR DRIVER (B)
4	C96 20WT/DB	PASSENGER BLEND DOOR DRIVER (B)
5	-	-
6	E2 20OR	PANEL LAMPS DRIVER
7	C56 20RD/LG	BLOWER MOTOR CONTROL
8	D25 20YL/VT/DG	PCI BUS
9	C103 20DG	A/C SWITCH SIGNAL
10	-	-
11	F22 20WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
12	M1 20PK	FUSED B(+)



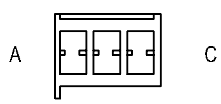
BATTERY TEMPERATURE SENSOR

CAV	CIRCUIT	FUNCTION
1	K4 20BK/LB	SENSOR GROUND
2	K25 18VT/LG	BATTERY TEMPERATURE SENSOR SIGNAL



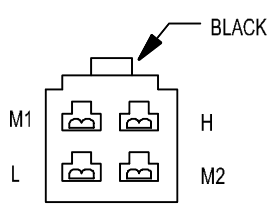
BLOWER MOTOR

CAV	CIRCUIT	FUNCTION
1	C1 12RD	BLOWER MOTOR SUPPLY
2	C7 12BK	HIGH BLOWER MOTOR DRIVER



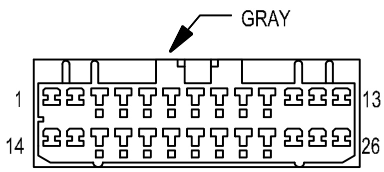
BLOWER MOTOR CONTROLLER (AZC)

CAV	CIRCUIT	FUNCTION
A	Z1 12BK	GROUND
B	C56 20BR/LG	BLOWER MOTOR CONTROL
C	C1 12RD	BLOWER MOTOR SUPPLY



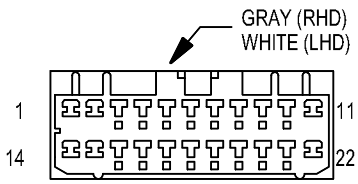
BLOWER MOTOR RESISTOR BLOCK (MTC)

CAV	CIRCUIT	FUNCTION
M2	C4 12TN	BLOWER MOTOR LOW DRIVER
H	C5 16LG	BLOWER MOTOR M1 DRIVER
L	C6 14LB	BLOWER MOTOR M2 DRIVER
M1	C7 16BK/TN	BLOWER MOTOR HIGH DRIVER



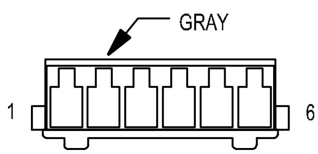
BODY CONTROL MODULE - C1

CAV	CIRCUIT	FUNCTION
1	Z2 20BK/OR	GROUND
2	G52 20YL	HEADLAMP SWITCH MUX
3	E19 20RD	PANEL LAMPS DIMMER SIGNAL
4	-	-
5	G70 20BR/TN	HOOD AJAR SWITCH SENSE
6	G26 20LB	KEY-IN IGNITION SWITCH SENSE
7	G76 18TN/YL	DOOR AJAR SWITCH SENSE
8	E2 20OR	PANEL LAMPS DRIVER
9	E2 20OR	PANEL LAMPS DRIVER
10	E2 20OR	PANEL LAMPS DRIVER
11	-	-
12	E2 20OR	PANEL LAMPS DRIVER
13	E2 20OR	PANEL LAMPS DRIVER
14	Z2 20BK/OR	GROUND
15	D25 20YL/VT/WT	PCI BUS
16	L80 20WT/DG	HEADLAMP SWITCH RETURN
17	D19 20VT/OR	BODY CONTROL MODULE FLASH ENABLE
18	-	-
19	-	-
20	G69 20BK/OR	VTSS INDICATOR DRIVER
21	L7 18BK/YL	PARK LAMP RELAY OUTPUT
22	V14 22RD/VT	WIPER ON/OFF RELAY CONTROL
23	M20 20BR/OR	INTERIOR LAMP DRIVER
24	M2 20YL	COURTESY LAMP DRIVER
25	Z1 20BK	GROUND
26	-	-



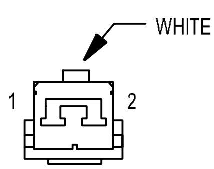
BODY CONTROL MODULE - C2

CAV	CIRCUIT	FUNCTION
1	C103 20DG	A/C SWITCH SIGNAL
2	V10 20BR	WASHER PUMP SWITCH SENSE
3	-	-
4	L40 22BR	HIGH BEAM SWITCH SENSE
5	V11 20BK/TN	WASHER FLUID SWITCH SENSE
6	P134 20LG/WT	PASSENGER SEAT HEATER SWITCH MUX
7	P133 20LG/RD	DRIVER SEAT HEATER SWITCH MUX
8	X20 20RD/YL	RADIO CONTROL MUX
9	C8 20DG/RD	AMBIENT TEMPERATURE SENSOR SIGNAL
10	L109 20WT	ULTRALIGHT SENSOR SIGNAL
11	V52 22DG/RD	WINDSHIELD WIPER SWITCH MUX
12	C15 20BK/WT	REAR WINDOW DEFOGGER SWITCH SENSE
13	-	-
14	-	-
15	L27 22WT/TN	FOG LAMP SWITCH SENSE
16	-	-
17	G18 20PK/BK	COOLANT LEVEL SWITCH SENSE
18	P132 20OR/BK	SEAT HEATER SWITCH SENSOR GROUND
19	X10 20RD/BK	RADIO CONTROL MUX RETURN
20	G39 20DB/OR	AMBIENT TEMPERATURE SENSOR RETURN
21	L110 20BK/YL	ULTRALIGHT SENSOR RETURN
22	V59 22DB/YL	WINDSHIELD WIPER SWITCH RETURN



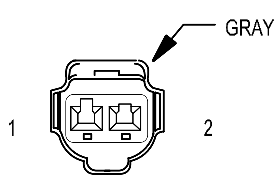
BRAKE LAMP SWITCH

CAV	CIRCUIT	FUNCTION
1	K29 18WT/PK	BRAKE SWITCH SENSE
2	Z1 18BK	GROUND
3	V32 22OR/DG	SPEED CONTROL POWER SUPPLY
4	V30 22DB/RD	SPEED CONTROL BRAKE SWITCH OUTPUT
5	L50 20WT/TN	BRAKE LAMP SWITCH OUTPUT
6	F32 20PK/DB	FUSED B(+)



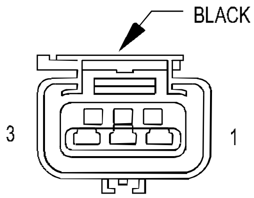
BRAKE SHIFT INTERLOCK SOLENOID

CAV	CIRCUIT	FUNCTION
1	K29 18WT/PK	BRAKE SWITCH SENSE
2	F99 20OR	FUSED IGNITION SWITCH OUTPUT (ST-RUN)



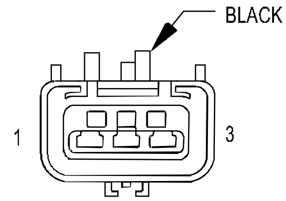
BRAKE WARNING INDICATOR SWITCH

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	G9 18GY/BK	RED BRAKE WARNING INDICATOR DRIVER



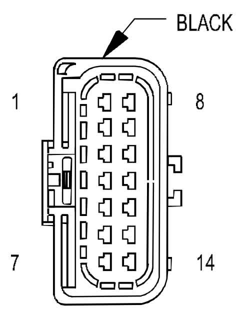
C100

CAV	CIRCUIT
1	T40 12LG
2	K21 18LB/RD
3	K20 18DG



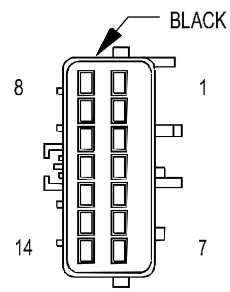
C100

CAV	CIRCUIT
1	T40 12LG
2	K21 18LB/RD
3	K20 18DG



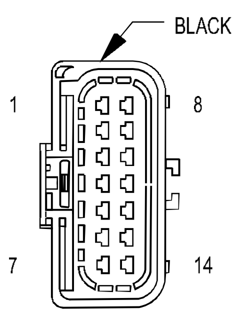
C102
(GAS)

CAV	CIRCUIT
1	A30 14RD/WT
2	F991 20OR/DB
3	C24 20DB/PK
4	F42 18DG/LG
5	A7 14RD/BK
6	L1 18VT/BK
7	Z21 20BK/LG
8	T24 20BR/YL
9	K210 18BK/YL
10	K4 20BK/LB
11	K21 18LB/RD
12	C2 18DB/YL
13	T107 20BK/RD ■ ●
14	A142 14DG/OR



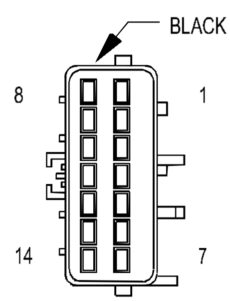
C102
(GAS)

CAV	CIRCUIT
1	A30 14RD/WT ▲
2	F991 18OR/DB
3	C24 18DB/PK
4	F42 18DG/LG
5	A7 14RD/BK
6	L1 18VT/BK
7	Z21 20BK/LG
8	T24 18BR/YL
9	Z1 18BK ▲
9	K210 18BK/YL ■
10	K4 18BK/LB
11	K210 18BK/YL ■
12	C2 18DB/YL
13	T107 18BK/RD ■ ●
14	A142 16DG/OR ■
14	A142 14DG/OR ▲



C102
(DIESEL)

CAV	CIRCUIT
1	F42 18DG/LG
2	F99 20OR
3	C24 20DB/PK
4	A142 14DG/OR
5	A14 16RD/WT
6	L1 18VT/BK
7	K30 20PK/YL
8	T24 20BR/YL
9	K152 20WT
10	K4 20BK/LB
11	L50 18WT/TN
12	C2 18DB/YL
13	K35 18GY/YL
14	-

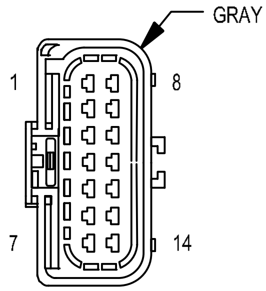


C102
(DIESEL)

CAV	CIRCUIT
1	F42 18DG/LG
2	F99 18OR
3	C24 18DB/PK
4	A142 14DG/OR
5	A14 16RD/WT
6	L1 18VT/BK
7	K30 18PK/YL
8	T24 18BR/YL
9	K152 18WT
10	K4 18BK/LB
11	L50 18WT/TN
12	C2 18DB/YL
13	K35 18GY/YL
14	-

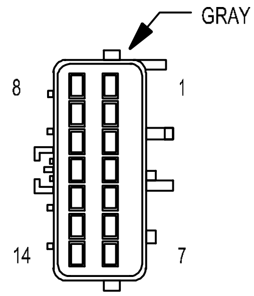
▲ 4.7L
■ 4.0L
● EXCEPT BUILT-UP-EXPORT

J998W-19 WG008010



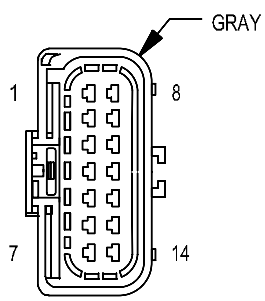
C103
(GAS)

CAV	CIRCUIT
1	F22 20WT/TN
2	T9 18OR/BK
3	D20 20LG
4	D21 20PK
5	G7 20WT/OR
6	K20 18DG
7	K30 20PK/YL
8	T99 18OR/YL
9	T16 14RD
10	D25 20YL/VT
11	Z2 20BK/OR
12	F45 20YL/RD
13	T60 18BR
14	F142 18OR/DG



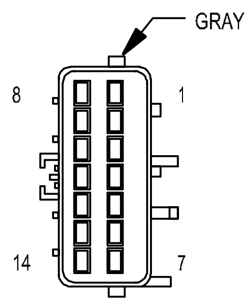
C103
(GAS)

CAV	CIRCUIT	
1	F22 18WT/TN	
2	T6 18VT/WT	▲
2	T9 18OR/BK	●
3	D20 20LG	▲
4	D21 20PK	▲
5	G7 18WT/OR	
6	K20 18DG	
7	K30 18PK/YL	
8	T9 18OR/BK	●
8	T10 18YL/DG	▲
9	T16 14RD	▲
10	D25 18YL/VT	▲
11	Z2 20BK/OR	
12	F45 18YL/RD	▲
13	T60 18BR	●
14	F142 18OR/DG	



C103
(DIESEL)

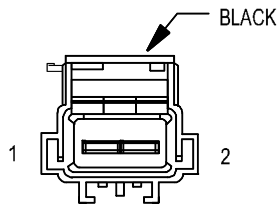
CAV	CIRCUIT
1	F22 20WT/TN
2	C13 18DB/OR
3	T40 12LG
4	D21 18PK
5	G7 18WT/OR
6	A93 16RD/BK
7	C18 20DB
8	G3 18BK/PK
9	T60 18BR
10	G55 18OR/LG
11	Z21 20BK/LG
12	Z2 20BK/OR
13	-
14	K125 18WT/DB



C103
(DIESEL)

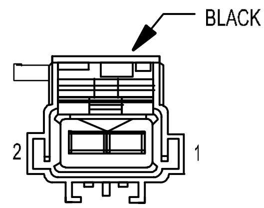
CAV	CIRCUIT
1	F22 18WT/TN
2	C13 18DB/OR
3	T40 12LG
4	D21 18PK
5	G7 18WT/OR
6	A93 16RD/BK
7	C18 18DB
8	G3 18BK/PK
9	T60 18BR
10	G55 18OR/BK
11	Z21 20BK/OR
12	Z2 20BK/OR
13	-
14	K125 18WT/DB

▲ 4.7L
● 4.0L



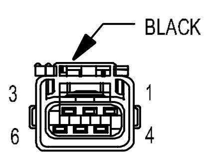
C104

CAV	CIRCUIT
1	K100 18VT/WT
2	K200 18VT/OR



C104

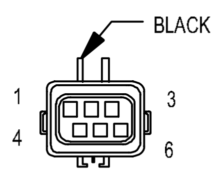
CAV	CIRCUIT
1	K100 18VT/WT
2	K200 18VT/OR



C105

(DIESEL)

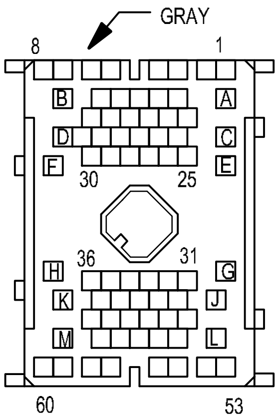
CAV	CIRCUIT
1	C90 18LG
2	K226 18LB/YL
3	K185 18OR/LB
4	K252 20LB/WT
5	K51 20 DB/YL
6	K29 18WT/PK



C105

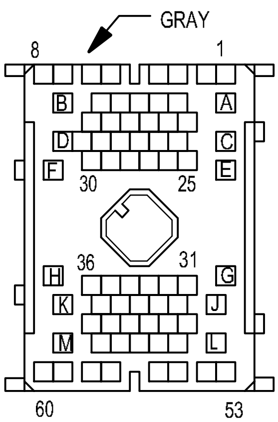
(DIESEL)

CAV	CIRCUIT
1	C90 18LG
2	K226 18LB/YL
3	K185 18OR/LB
4	K252 18LB/WT
5	K51 20 DB/YL
6	K29 18WT/PK



C106

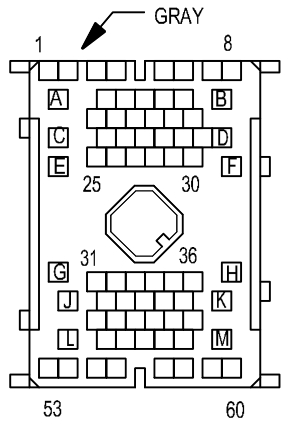
(LHD GAS)



C106

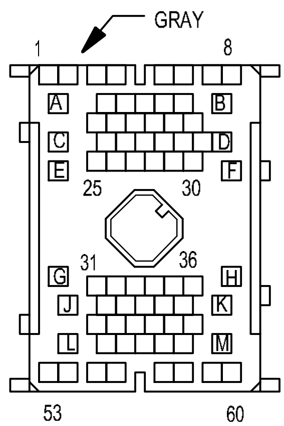
(RHD GAS)

CAV	CIRCUIT	
1	A141 16DG/BK	
2	F42 18 DG/LG	▲
2	G18 20PK/BK	●
3	V3 16BR/WT	
4	V4 16RD/YL	
5	V55 16TN/RD	
6	V6 16DB	
7	F22 20WT/PK	●
7	F22 18WT/TN	▲
8	F99 20OR	
9	K52 20PK/BK	●
10	Z1 18BK	▲
10	K29 18WT/PK	●
11	K226 20LB/YL	●
12	K107 20OR/PK	■■
13	K106 20WT/DG	■■
14	C13 20DB/OR	▲
15	V35 20LG/RD	▲
16	V36 20TN/RD	▲
17	G9 18GY/BK	▲
18	K25 18VT/LG	▲
19	K51 20DB/YL	▲
20	F142 18OR/DG	■■
21	K21 18LB/RD	▲
22	K31 20BR	▲
23	T99 18OR/YL	
24	-	
25	B7 18WT	
26	B6 18WT/DB	
27	X4 22GY/OR	
28	G39 20DB/OR	
29	-	
30	C8 20DG/RD	
31	-	
32	V32 22OR/DG	●
33	V30 22DB/RD	
34	V16 22VT	
35	V14 22RD/VT	
36	G7 20WT/OR	▲
36	G7 18WT/OR	●
37	F45 20YL/RD	



C106

(LHD GAS)



C106

(RHD GAS)

CAV	CIRCUIT	
1	A141 16DG/BK	
2	F42 18DG/LG	▲
2	G18 20PK/BK	●
3	V3 16BR/WT	
4	V4 16RD/YL	
5	V55 16TN/RD	
6	V6 16DB	
7	F22 20WT/TN	
8	F99 20OR	
9	K52 18PK/BK	●
10	Z1 18BK	▲
10	K29 18WT/PK	●
11	K226 18LB/YL	●
12	K107 18OR/PK	■■
13	K106 18WT/DG	■■
14	C13 20DB/OR	▲
15	V35 20LG/RD	▲
16	V36 20TN/RD	▲
17	G9 18GY/BK	▲
18	K25 18VT/LG	▲
19	K51 20DB/YL	▲
20	F142 18OR/DG	■■
21	K21 18LB/RD	▲
22	K31 20BR	▲
23	T99 18OR/YL	▲
24	-	
25	B7 18WT	
26	B6 18WT/DB	
27	X4 20GY/OR	
28	G39 20DB/OR	
29	-	
30	C8 20DG/RD	
31	-	
32	V32 18OR/DG	●
33	V30 20DB/RD	
34	V16 20VT	
35	V14 20RD/VT	
36	G7 20WT/OR	
37	F45 20YL/RD	

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● LHD
▲ RHD
■■ EXCEPT BUILT-UP-EXPORT

(CONTINUED)

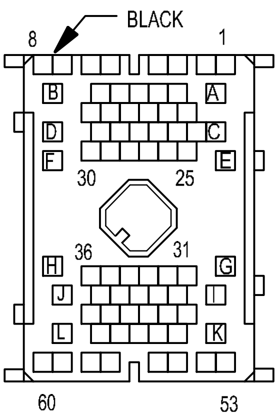
C106 (GAS)

38	L114 18VT/DB	■
39	T107 20BK/RD	
40	Z21 20BK/LG	
41	Z2 20BK/OR	
42	-	
43	-	
44	F991 20OR/DB	
45	-	
46	-	
47	-	
48	D25 18YL/VT	
49	D21 20PK	
50	D20 20LG	
51	D32 20LG/DG	●
52	T9 20OR/BK	▲
52	T9 18OR/BK	●
53	L7 20BK/YL	
54	L60 20TN	
55	V37 22RD/LG	●
55	G18 20PK/BK	▲
56	L1 18VT/BK	
57	L39 20LB	
58	K4 18BK/LB	
59	L44 18VT/RD	
60	L34 18RD/OR	
A	-	
B	-	
C	C1 12DG	
D	A149 12RD/TN	
E	A10 12RD/DG	
F	A1 12RD	
G	A145 10WT/RD	
H	A146 10OR/WT	
J	A147 10RD/GY	
K	A148 10PK/WT	
L	A2 12PK/BK	
M	A20 14RD/DB	

C106 (GAS)

38	L114 18VT/DB	■
39	T107 20BK/RD	■■
40	Z21 20BK/LG	
41	Z2 20BK/OR	
42	-	
43	-	
44	F991 20OR/DB	
45	-	
46	-	
47	-	
48	D25 20YL/VT	
49	D21 20PK	
50	D20 20LG	
51	D32 18LG/DG	●
52	T9 18OR/BK	
53	L7 20BK/YL	
54	L60 20TN	
55	V37 18RD/LG	●
55	G18 20PK/BK	▲
56	L1 18VT/BK	
57	L39 20LB	
58	K4 20BK/LB	
59	L44 18VT/RD	
60	L34 18RD/OR	
A	-	
B	-	
C	C1 12DG	
D	A149 12RD/TN	
E	A10 12RD/DG	
F	A1 12RD	
G	A145 10WT/RD	
H	A146 10OR/WT	
J	A147 10RD/GY	
K	A148 10PK/WT	
L	A2 12PK/BK	
M	A20 12RD/DB	

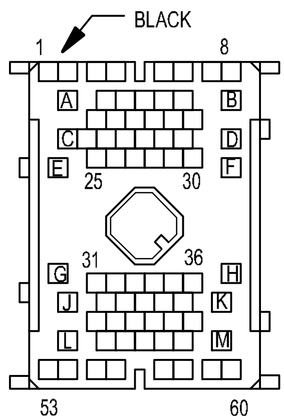
● LHD
▲ RHD
■ BUILT-UP-EXPORT
■■ EXCEPT BUILT-UP-EXPORT



C106

(DIESEL)

CAV	CIRCUIT
1	F15 20DB/WT
2	-
3	C8 20DG/RD
4	G39 20DB/OR
5	G18 20PK/BK
6	-
7	-
8	-
9	C21 20DB/OR
10	Z1 18BK
11	-
12	-
13	-
14	K480 18DB/OR
15	K35 18GY/YL
16	-
17	G9 18GY/BK
18	X2 18DG/RD
19	C18 18DB
20	-
21	-
22	-
23	-
24	-
25	B7 18WT
26	B6 18WT/DB
27	-
28	-
29	-
30	-
31	-
32	-
33	-
34	-
35	-
36	-
37	-



C106

(DIESEL)

CAV	CIRCUIT
1	F15 18DB/WT
2	-
3	C8 20DG/RD
4	G39 20DB/OR
5	G18 20PK/BK
6	-
7	-
8	-
9	-
10	-
11	-
12	-
13	-
14	-
15	K35 18GY/YL
16	-
17	-
18	X2 18DG/RD
19	C18 18DB
20	-
21	-
22	-
23	-
24	-
25	B7 18WT
26	B6 18WT/DB
27	-
28	-
29	-
30	-
31	-
32	-
33	-
34	-
35	-
36	-
37	-

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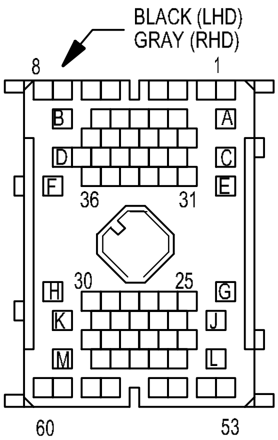
(CONTINUED)

C106 (DIESEL)

38	L114 18VT/DB
39	-
40	-
41	-
42	-
43	-
44	-
45	-
46	-
47	-
48	-
49	-
50	-
51	-
52	-
53	L7 20BK/YL
54	L60 20TN
55	-
56	-
57	L39 20LB
58	
59	L44 18VT/RD
60	L34 18RD/OR
A	-
B	-
C	-
D	-
E	-
F	-
G	-
H	-
J	-
K	-
L	-
M	-

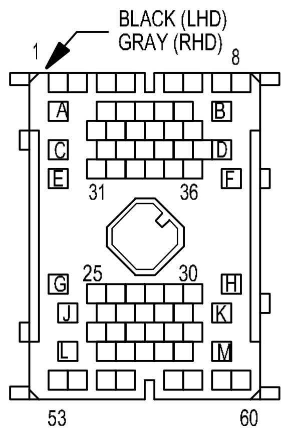
C106 (DIESEL)

38	L114 18VT/DB
39	-
40	-
41	-
42	-
43	-
44	-
45	-
46	-
47	-
48	-
49	-
50	-
51	-
52	-
53	L7 20BK/YL
54	L60 20TN
55	-
56	-
57	L39 20LB
58	
59	L44 18VT/RD
60	L34 18RD/OR
A	-
B	-
C	-
D	-
E	-
F	-
G	-
H	-
J	-
K	-
L	-
M	-



C107
(GAS)

CAV	CIRCUIT
1	V37 20RD/LG ▲
2	V11 20BK/TN
3	V3 16BR/WT
4	V4 16RD/YL
5	V55 16TN/RD
6	V6 16DB
7	V10 20BR ▲
7	V10 22BR
8	F99 20OR
9	K226 20LB/YL ▲
9	K52 20PK/BK ▲▲
10	L114 18VT/DB ●●
11	-
12	K107 20OR/PK ■
13	K106 20WT/DG ■
14	T99 18OR/YL ▲
15	G70 20BR/TN ●
16	G9 18GY/BK ▲
17	Z1 18BK ▲
18	-
19	D32 20LG/DG ▲
20	Y10 18VT/WT ▲
20	F142 18OR/DG ■
21	-
22	-
23	Y11 18VT/OR ▲
24	F42 18DG/LG ▲
25	B7 18WT
26	B6 18WT/DB
27	B4 18LG
28	B3 18LG/DB
29	B2 18YL
30	B1 18YL/DB
31	Y12 18VT/TN ▲
32	M1 20PK/RD
33	F20 18DB/PK
34	L50 18WT/TN
35	Y13 18VT/PK ▲
36	G7 18WT/OR
37	K51 20DB/YL ▲
38	K25 18VT/LG ▲
39	K31 20BR ▲
40	K29 18WT/PK ▲



C107
(GAS)

CAV	CIRCUIT
1	V37 18RD/LG ▲
2	V11 20BK/TN
3	V3 16BR/WT
4	V4 16RD/YL
5	V55 16TN/RD
6	V6 16DB
7	V10 20BR
8	F99 20OR
9	K226 18LB/YL ▲
9	K52 20PK/BK ▲▲
10	L114 18VT/DB ●●
11	-
12	K107 20OR/PK ■
13	K106 20WT/DG ■
14	T99 18OR/YL ▲
15	G70 20BR/TN ●
16	G9 18GY/BK ▲
17	Z1 18BK ▲
18	-
19	D32 18LG/DG ▲
20	Y10 18VT/WT ▲
20	F142 18OR/DG ■
21	-
22	-
23	Y11 18VT/OR ▲
24	F42 18LG/DG ▲
25	B7 18WT
26	B6 18WT/DB
27	B4 18LG
28	B3 18LG/DB
29	B2 18YL
30	B1 18YL/DB
31	Y12 18VT/TN ▲
32	M1 20PK/RD
33	F20 18DB/PK
34	L50 18WT/TN
35	Y13 18VT/PK ▲
36	G7 18WT/OR
37	K51 18DB/YL ▲
38	K25 18VT/LG ▲
39	K31 18BR ▲
40	K29 18WT/PK ▲

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▲ RHD
▲▲ LHD
● BUILT-UP-EXPORT
●● LHD BUILT-UP-EXPORT
■ EXCEPT BUILT-UP-EXPORT

(CONTINUED)

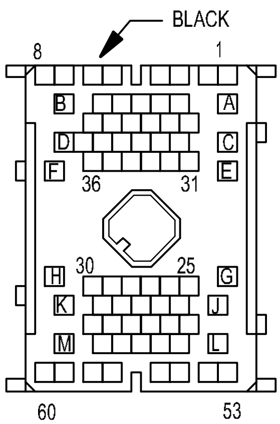
C107 (GAS)

41	K21 18LB/RD	▲
42	V32 22OR/DG	▲
43	-	
44	V35 20LG/RD	▲
45	V36 20TN/RD	▲
46	C13 20DB/OR	▲
47	L114 18VT/DB	▲
48	D25 18YL/VT	
49	D21 20PK	▲
50	B41 18YL/PK	
51	B42 18TN/WT	
52	B43 18PK/OR	
53	L7 20BK/YL	
54	L61 20TN/LG	
55	-	
56	V20 20BK/WT	▲
56	V20 18BK/WT	▲▲
57	L39 20LB	
58	-	
59	L43 18VT	
60	L33 18RD	
A	-	
B	-	
C	-	
D	-	
E	A10 12RD/DG	
F	-	
G	-	
H	-	
J	-	
K	-	
L	-	
M	A20 14RD/DB	

C107 (GAS)

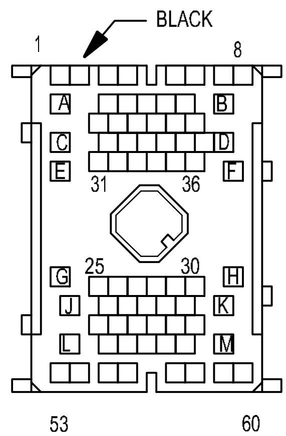
41	K21 18LB/RD	▲
42	V32 18OR/DG	▲
43	-	
44	V35 18LG/RD	▲
45	V36 18TN/RD	▲
46	C13 18DB/OR	▲
47	L114 18VT/DB	▲
48	D25 18YL/VT	
49	D21 18PK	▲
50	B41 18YL/PK	
51	B42 18TN/WT	
52	B43 18PK/OR	
53	L7 20BK/YL	
54	L61 20TN/LG	
55	-	
56	V20 18BK/WT	
57	L39 20LB	
58	-	
59	L43 18VT	
60	L33 18RD	
A	-	
B	-	
C	-	
D	-	
E	A10 12RD/DG	
F	-	
G	-	
H	-	
J	-	
K	-	
L	-	
M	A20 12RD/DB	

▲▲ LHD
▲ RHD



C107
(DIESEL)

CAV	CIRCUIT
1	X2 18DG/RD
2	V11 20BK/TN
3	K4 20BK/LB
4	V37 22RD/LG
5	V55 16TN/RD
6	V6 16DB
7	V10 22BR
8	F99 20OR
9	-
10	X4 22GY/OR
11	F15 20DB/WT
12	F45 20YL/RD
13	-
14	T9 18OR/BK
15	G70 20BR/TN
16	-
17	-
18	-
19	D32 20LG/DG
20	K35 18GY/YL
21	
22	-
23	-
24	K480 18DB/OR
25	B7 18WT
26	B6 18WT/DB
27	B4 18LG
28	B3 18LG/DB
29	B2 18YL
30	B1 18YL/DB
31	-
32	M1 20PK/RD
33	F20 18DB/PK
34	L50 18WT/TN
35	-
36	G7 20WT/OR
37	Z21 20BK/LG
38	Z2 20BK/OR
39	V10 22BR
40	K29 18WT/PK



C107
(DIESEL)

CAV	CIRCUIT
1	X2 18DG/RD
2	V11 20BK/TN
3	K4 20BK/LB
4	V37 18RD/LG
5	V55 16TN/RD
6	V6 16DB
7	V10 20BR
8	F99 20OR
9	-
10	X4 20GY/OR
11	F15 20DB/WT
12	F45 20YL/RD
13	-
14	T9 18OR/BK
15	G70 20BR/TN
16	-
17	-
18	-
19	D32 18LG/DG
20	K35 18GY/YL
21	
22	-
23	-
24	-
25	B7 18WT
26	B6 18WT/DB
27	B4 18LG
28	B3 18LG/DB
29	B2 18YL
30	B1 18YL/DB
31	-
32	M1 20PK/RD
33	F20 18DB/PK
34	L50 18WT/TN
35	-
36	G7 18WT/OR
37	Z21 20BK/LG
38	Z2 20BK/OR
39	V10 20BR
40	K29 18WT/PK

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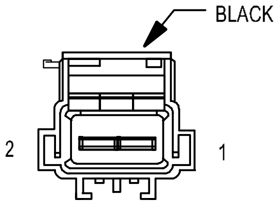
C107 (DIESEL)

41	C18 18DB
42	V32 22OR/DG
43	-
44	V30 22DB/RD
45	V16 22VT
46	V14 22RD/VT
47	L114 18VT/DB
48	D25 18YL/VT
49	D21 20PK
50	B41 18YL/PK
51	B42 18TN/WT
52	B43 18PK/OR
53	L7 20BK/YL
54	L61 20TN/LG
55	L1 18VT/BK
56	V20 18BK/WT
57	L39 20LB
58	F22 20WT/PK
59	L43 18VT
60	L33 18RD
A	-
B	-
C	C1 12DG
D	A149 12RD/TN
E	-
F	A1 12RD
G	A145 10WT/RD
H	A146 10OR/WT
J	A147 10RD/GY
K	A148 10PK/WT
L	A2 12PK/BK
M	-

(CONTINUED)

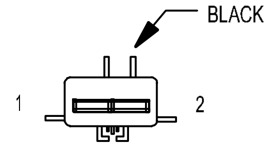
C107 (DIESEL)

41	C18 20DB
42	V32 18OR/DG
43	-
44	V30 20DB/RD
45	V16 20VT
46	V14 20RD/VT
47	L114 18VT/DB
48	D25 18YL/VT
49	D21 18PK
50	B41 18YL/PK
51	B42 18TN/WT
52	B43 18PK/OR
53	L7 20BK/YL
54	L61 20TN/LG
55	L1 18VT/BK
56	V20 18BK/WT
57	L39 20LB
58	F22 20WT/TN
59	L43 18VT
60	L33 18RD
A	-
B	-
C	C1 12DG
D	A149 12RD/TN
E	-
F	A1 12RD
G	A145 10WT/RD
H	A146 10OR/WT
J	A147 10RD/GY
K	A148 10PK/WT
L	A2 12PK/BK
M	-



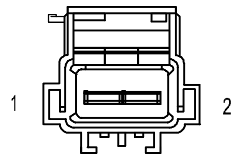
C108

CAV	CIRCUIT
1	M1 20PK/RD
2	Z1 20BK



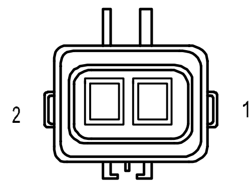
C108

CAV	CIRCUIT
1	M1 20PK/RD
2	Z1 20BK



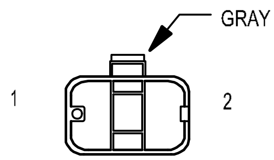
C109

CAV	CIRCUIT
1	Z1 18BK
2	T107 18BK/RD



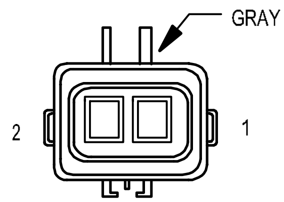
C109

CAV	CIRCUIT
1	Z1 18BK
2	T107 18BK/RD



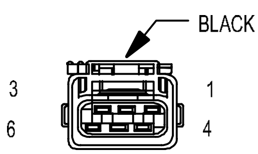
C110
(DIESEL)

CAV	CIRCUIT
1	K154 10GY
2	K254 10GY/YL



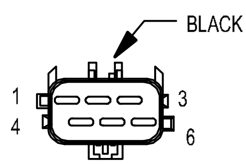
C110
(DIESEL)

CAV	CIRCUIT
1	K154 10GY
2	K254 10GY/YL



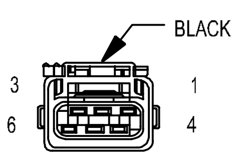
C111

CAV	CIRCUIT
1	L33 18RD
2	L43 18VT
3	L61 20TN/LG
4	L7 20BK/YL
5	L114 18VT/DB ■
6	Z1 18BK



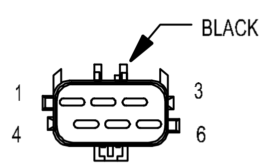
C111

CAV	CIRCUIT
1	L33 18WT
2	L43 18BR
3	L61 20DG
4	L7 20BK/YL
5	L114 18YL ■
6	Z1 18BK



C112

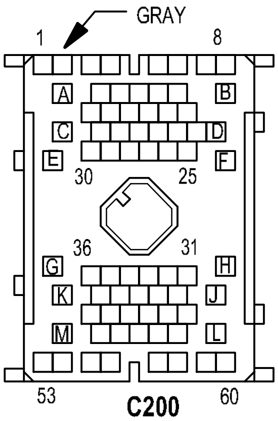
CAV	CIRCUIT
1	L34 18RD/OR
2	L44 18VT/RD
3	L60 20TN
4	L7 20BK/YL
5	L114 18VT/DB ■
6	Z1 18BK



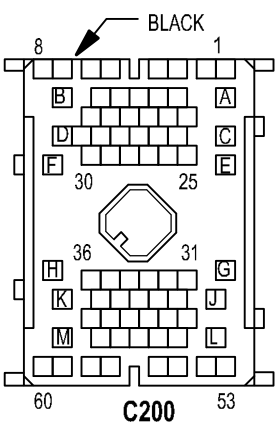
C112

CAV	CIRCUIT
1	L34 18WT
2	L44 18BR
3	L60 20DG
4	L7 20BK/YL
5	L114 18BK/YL ■
6	Z1 18BK

■ BUILT-UP-EXPORT



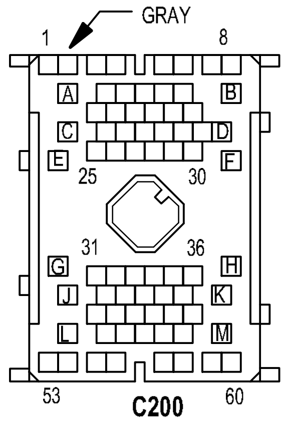
C200
(LHD)



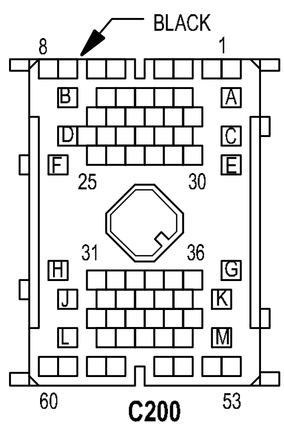
C200
(RHD)

▼▼ PREMIUM AUDIO
▲ RHD
● LHD BUILT-UP-EXPORT
■ BUILT-UP-EXPORT
●● LHD
▼ BASE
■■ GAS
▲▲ EXCEPT BUILT-UP-EXPORT

CAV	CIRCUIT
1	X84 18OR/GY ▼▼
1	X56 18DB/PK ▼
2	X86 18OR/RD ▼▼
2	X54 18VT ▼
3	X81 18YL/BK ▼▼
3	X55 18BR/RD ▼
4	X83 18YL/RD ▼▼
4	X53 18DG/OR ▼
5	X53 18DG/OR
6	X55 18BR/RD
7	X54 18VT
8	X56 18DB/PK
9	-
10	D20 20LG ■■
11	-
12	-
13	X40 20WT/RD ▼▼
14	D25 20YL/VT
15	D25 20YL/VT
16	D32 20LG/DG
17	T107 20BK/RD
18	Z4 20WT/BK ▼▼
19	X41 20WT/DG ▼▼
20	T9 18OR/BK ●●
20	T9 20OR/BK ▲
21	D21 20PK
22	K29 18WT/PK
23	X160 20YL ▼▼
24	X112 20RD ▼▼
25	-
26	-
27	G70 20BR/TN ■
28	-
29	Z17 20BK ▼▼
30	-
31	G76 18TN/YL ●●
31	G76 20TN/YL ▲
32	Y10 18VT/WT ▲
33	Y11 18VT/OR ▲
34	Y12 18VT/TN ▲
35	X51 18WT/DG
36	X57 18DG/WT
37	L7 18BK/YL ■
38	L114 18VT/DB ■
39	V10 22BR ●●
39	V10 20BR ▲



C200
(LHD)



C200
(RHD)

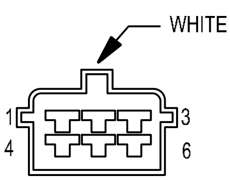
CAV	CIRCUIT
1	X84 18OR/GY ▼▼
2	X86 18OR/RD ▼▼
3	X81 18YL/BK ▼▼
4	X83 18YL/RD ▼▼
5	X53 18DG/OR
6	X55 18BR/RD
7	X54 18VT
8	X56 18DB/RD ▲
8	X56 18DB/PK ●●
9	-
10	D20 20LG
11	D33 20LG/DB
12	-
13	X40 22WT/RD
14	D25 20YL/VT/GY ■
14	D25 20YL/VT/BR ▲▲
15	D25 20YL/VT/BR ■
15	D25 20YL/VT/GY ▲▲
16	D32 20LG/DG
17	T107 20BK/RD
18	Z4 22WT/BK
19	X41 22WT/DG
20	T9 18OR/BK
21	D21 20PK
22	K29 18WT/PK
23	X160 22YL
24	X112 22RD
25	-
26	-
27	G70 20BR/TN ■
28	-
29	Z17 22BK
30	-
31	G76 18TN/YL
32	Y10 20VT/WT ▲
33	Y11 20VT/OR ▲
34	Y12 20VT/TN ▲
35	X51 18BR/YL ▲
35	X51 18WT/DG ●●
36	X57 18BR/LB ▲
36	X57 18DG/WT ●●
37	L7 20BK/YL ■
38	L390 20VT/YL ▲
38	L114 20VT/DB ●
39	V10 20BR

C200 (CONTINUED)

40	X52 18DB/WT	
41	X58 18DB/OR	
42	Y13 18VT/PK	▲
43	V13 18BR/LG	
44	V14 22RD/VT	
45	V16 22VT	
46	V20 20BK/WT	▲
46	V20 18BK/WT	●●
47	V22 18BR/YL	
48	-	
49	X64 18BR/WT	
50	Z2 20BK/OR	
51	Z21 20BK/LG	
52	-	
53	G39 20DB/OR	
54	C8 20DG/RD	
55	Z1 16BK	
56	V11 20BK/TN	
57	G18 20PK/BK	
58	V37 22RD/LG	●●
58	V37 20RD/LG	▲
59	K4 22BK/LB	■
59	K4 20BK/LB	●
60	-	
A	-	
B	-	
C	A1 12RD	
D	-	
E	-	
F	-	
G	A2 12PK/BK	
H	C1 12DG	
J	-	
K	-	
L	-	
M	-	

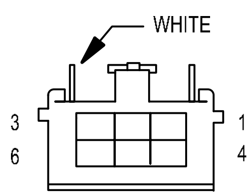
C200 (CONTINUED)

40	X52 18DB/WT	
41	X58 18DB/OR	
42	Y13 20VT/PK	▲
43	V13 18BR/LG	
44	V14 22RD/VT	
45	V16 22VT	●●
45	V16 22YL	▲
46	V20 18BK/WT	
47	V22 18BR/YL	
48	-	
49	X64 18BR/WT	
50	Z2 20BK/OR	
51	Z21 20BK/LG	
52	-	
53	G39 20DB/OR	
54	C8 20DG/RD	
55	Z1 16BK	
56	V11 20BK/TN	
57	G18 20PK/BK	
58	V37 20RD/LG	
59	K4 20BK/LB	
60	-	
A	-	
B	-	
C	A1 12RD	
D	-	
E	-	
F	-	
G	A2 12PK/BK	
H	C1 12DG	
J	-	
K	-	
L	-	
M	-	



C201

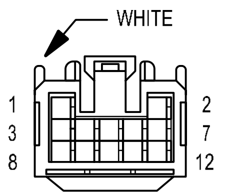
CAV	CIRCUIT
1	E2 20OR
2	Z1 20BK
3	T9 18OR/BK
4	Z1 18BK
5	-
6	-



C201

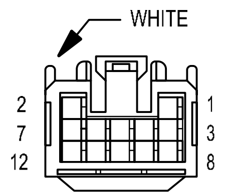
CAV	CIRCUIT
1	E2 20LB
2	Z1 20BK
3	T9 18OR/WT
4	Z1 18BK
5	-
6	-

■ GAS
● DIESEL
▲ RHD
●● LHD



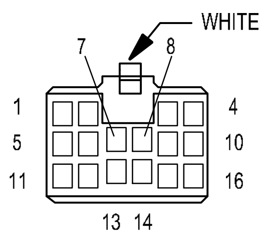
C202
(AZC)

CAV	CIRCUIT
1	C32 20GY/DB
2	C100 20YL/DB
3	C33 20DB/RD
4	C95 20WT/BK
5	C94 20WT/DG
6	C96 20WT/DB
7	C102 20TN/BK
8	C35 20DG/YL
9	C56 20RD/LG
10	-
11	-
12	-



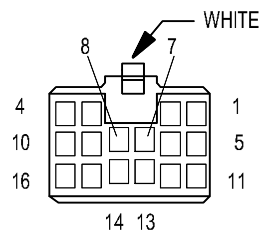
C202
(AZC)

CAV	CIRCUIT
1	C32 20VT/OR
2	C100 20LB/DG
3	C33 20PK/DG
4	C95 20VT/WT
5	C94 20DB/RD
6	C96 20DB/WT
7	C102 20YL
8	C35 20TN/BK
9	C56 20BR/LG
10	-
11	-
12	-



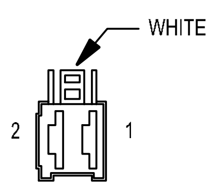
C202
(MTC)

CAV	CIRCUIT
1	-
2	-
3	-
4	-
5	C67 20RD/LB
6	-
7	-
8	-
9	-
10	C6 14LB
11	Z2 20BK/OR
12	F22 20WT/PK
13	C7 12BK/TN
14	C1 12DG
15	C4 16TN
16	C5 16LG



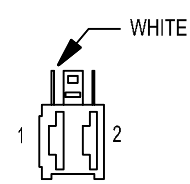
C202
(MTC)

CAV	CIRCUIT
1	-
2	-
3	-
4	-
5	C67 20DB/RD
6	WT/YL
7	-
8	-
9	-
10	C6 14LB
11	Z2 20VT/WT
12	F22 20PK/DG
13	C7 12BK/TN
14	C1 12RD
15	C4 16TN
16	C5 16LG



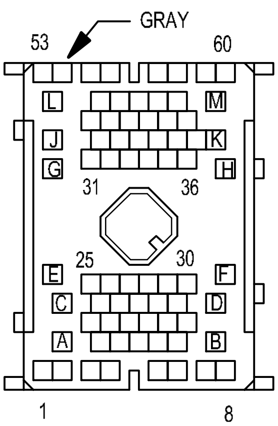
C203
(AZC)

CAV	CIRCUIT
1	C1 12DG
2	Z1 12BK



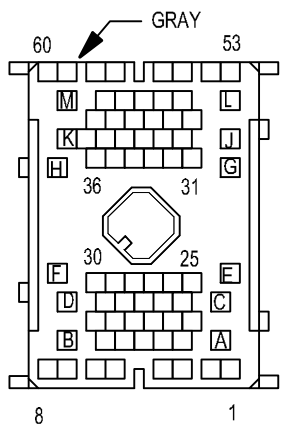
C203
(AZC)

CAV	CIRCUIT
1	C1 12RD
2	Z1 12BK



C300

CAV	CIRCUIT
1	D25 20YL/VT
2	V13 18BR/LG
3	V22 18BR/YL
4	P112 20YL/WT
5	P114 20YL/RD
6	P35 18OR/VT
7	P36 18PK/VT
8	L50 18WT/TN
9	B1 18YL/DB
10	B2 18YL
11	B3 18LG/DB
12	B4 18LG
13	B41 18YL/PK
14	B42 18TN/WT
15	B43 18PK/OR
16	P29 20BR/WT
17	P86 20PK/BK
18	E21 20OR/RD
19	K4 20BK/LB ▲
20	K226 20LB/YL ▲
21	L62 18BR/RD
22	L95 18DG/YL ●●
23	-
24	L1 18VT/BK
25	-
26	-
27	-
28	-
29	-
30	-
31	-
32	-
33	-
34	-
35	-
36	-
37	-
38	-
39	-
40	-
41	-
42	-
43	-
44	-
45	-
46	-
47	-
48	-
49	-
50	-
51	-
52	-
53	X57 18WT/DG ■■
53	X91 18WT/DG ▼



C300

▼ EXCEPT BASE
▲ GAS
■■ BASE
●● BUILT-UP-EXPORT

CAV	CIRCUIT
1	D25 20YL/VT
2	V13 18BR/LG
3	V22 18BR/YL
4	P112 20YL/WT
5	P114 20YL/RD
6	P35 18OR/VT
7	P36 18PK/VT
8	L50 18WT/TN
9	B1 18YL/DB
10	B2 18YL
11	B3 18LG/DB
12	B4 18LG
13	B41 18YL/PK
14	B42 18TN/WT
15	B43 18PK/OR
16	P29 20BR/WT ▼
17	P86 18PK/BK ▼
18	E21 20OR/RD
19	K4 20BK/LB ▲
20	K226 20LB/YL ▲
21	L62 18BR/RD
22	L95 18DG/YL ●●
23	-
24	L1 18VT/BK
25	-
26	-
27	-
28	-
29	-
30	-
31	-
32	-
33	-
34	-
35	-
36	-
37	-
38	-
39	-
40	-
41	-
42	-
43	-
44	-
45	-
46	-
47	-
48	-
49	-
50	-
51	-
52	-
53	X57 18WT/DG

WG008025

J998W-19

C300 (CONTINUED)

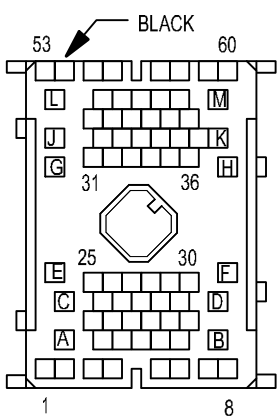
54	X51 18WT/DG ■■
54	X93 18DG/WT ▼
55	-
56	-
57	-
58	-
59	-
60	-
A	P130 16DG/WT ▼
B	Q13 16DB
C	B40 12LB
D	-
E	Z5 16BK/VT ▼
F	-
G	-
H	-
J	-
K	-
L	Q23 16RD/WT
M	A141 16DG/BK •

C300 (CONTINUED)

54	X51 18DG/WT
55	-
56	-
57	-
58	-
59	-
60	-
A	P130 16DG/WT
B	Q13 16DB
C	B40 14LB
D	-
E	Z5 16BK/VT
F	-
G	-
H	-
J	-
K	-
L	Q23 16RD/WT
M	A141 16DG/BK •

• GAS
▼ EXCEPT BASE
■■ BASE

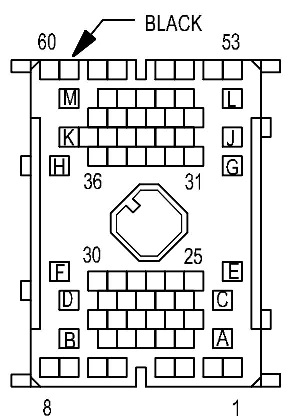
J998W-19 WG008026



C301
(RHD)

• PREMIUM AUDIO

CAV	CIRCUIT
1	L50 18WT/TN
2	F70 18PK
3	M2 18YL
4	M20 18YL/BK
5	P35 18OR/VT
6	P36 18PK/VT
7	-
8	-
9	L95 18DG/YL
10	L63 18DG/RD
11	-
12	X80 18LB/BK
13	X82 18LB/RD
14	X85 18LG/DG
15	X87 18LG/RD
16	X93 18DG/WT
17	X91 18WT/DG
18	X84 18OR/GY
19	L62 20BR/RD
20	X86 18OR/RD
21	X81 18YL/BK
22	X83 18YL/RD
23	X56 18DB/PK
24	X51 18WT/DG
25	X57 18DG/WT
26	X52 18DB/WT
27	X58 18DB/OR
28	X54 18VT
29	X55 18BR/RD
30	X53 18DG/OR
31	X64 18BR/WT
32	D25 20YL/VT
33	-
34	G78 20TN/BK
35	-
36	-
37	E21 20OR/RD
38	G77 20TN/OR
39	G76 20TN/YL
40	L1 18VT/BK
41	G5 20DB/WT
42	P86 20PK/BK
43	P29 20BR/WT
44	G73 20LG/OR
45	C235 20WT/LB •
46	X160 20YL •
47	X40 20WT/RD •
48	-
49	X112 20RD •
50	X41 20WT/DG •
51	Z4 20WT/BK •
52	Z17 20BK •
53	-



C301
(RHD)

CAV	CIRCUIT
1	L50 18WT/TN
2	F70 18PK
3	M2 18YL
4	M20 18YL/BK
5	P35 18OR/VT
6	P36 18PK/VT
7	-
8	-
9	L95 18DG/YL
10	L63 18DG/RD
11	-
12	X80 18LB/BK
13	X82 18LB/RD
14	X85 18LG/DG
15	X87 18LG/RD
16	X93 18DG/WT
17	X91 18WT/DG
18	X84 18OR/GY
19	L62 18BR/RD
20	X86 18OR/RD
21	X81 18YL/BK
22	X83 18YL/RD
23	X56 18DB/PK
24	X51 18WT/DG
25	X57 18DG/WT
26	X52 18DB/WT
27	X58 18DB/OR
28	X54 18VT
29	X55 18BR/RD
30	X53 18DG/OR
31	X64 18BR/WT
32	D25 20YL/VT
33	-
34	G78 20TN/BK
35	-
36	-
37	E21 20OR/RD
38	G77 20TN/OR
39	G76 20TN/YL
40	L1 18VT/BK
41	G5 20DB/WT
42	P86 20PK/BK
43	P29 20BR/WT
44	G73 20LG/OR
45	C235 20WT/LB
46	X160 20YL
47	X40 20WT/RD
48	-
49	X112 20RD
50	X41 20WT/DG
51	Z4 20WT/BK
52	Z17 20BK
53	-

C301 (CONTINUED)

54	-
55	-
56	-
57	-
58	-
59	-
60	-
A	Q13 16DB
B	Q23 16RD/WT
C	F30 14RD
D	F60 16RD/WT
E	Z1 16BK
F	Z5 16BK/VT
G	C15 12BK/WT
H	A148 16VT
J	L50 16WT/TN
K	-
L	Q30 16TN
M	P130 16DG/WT

C301 (CONTINUED)

54	-
55	-
56	-
57	-
58	-
59	-
60	-
A	Q13 16DB
B	Q23 16RD/WT
C	F30 12RD
D	F60 16RD/WT
E	Z1 16BK
F	Z5 16BK/VT
G	C15 12BK/WT
H	A148 16VT
J	L50 16WT/TN
K	-
L	Q30 16TN
M	P130 16DG/WT

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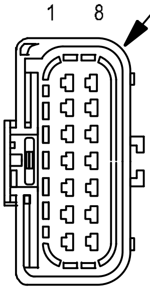


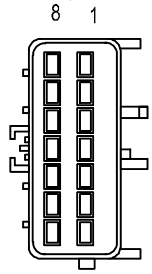
7 14

C302

CAV	CIRCUIT
1	P112 20YL/WT
2	P114 20YL/RD
3	D25 20YL/VT
4	Z1 12BK
5	E21 20OR/RD
6	Q13 16DB
7	Q23 16RD/WT
8	F21 12TN ■
8	F21 12TN/LB ■■
9	X85 18LG/DG ▲▲
9	X55 18BR/RD ▲
9	X80 18LB/BK ■
10	X87 18LG/RD ▲▲
10	X53 18DG/OR ▲
10	X82 18LB/RD ■
11	M1 18PK/RD ●
12	-
13	-
14	-

BLACK

8 1

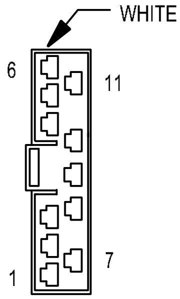


14 7

C302

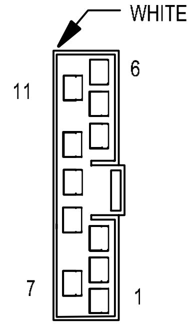
CAV	CIRCUIT
1	P112 20YL/WT
2	P114 20YL/RD
3	D25 20YL/VT
4	Z1 12BK
5	E21 20OR/RD
6	Q13 16DB
7	Q23 16RD/WT
8	F21 12TN/LB
9	X85 18LG/DG
10	X87 18LG/RD
11	M1 18PK ●
12	-
13	-
14	-

● JAPAN
■■ LHD
■ RHD
▲ BASE
▲▲ PREMIUM



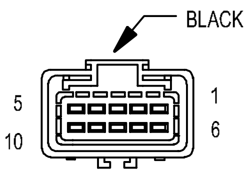
C303

CAV	CIRCUIT
1	X92 18TN/DG
2	X90 18WT/VT
3	E21 20OR/RD ▲
3	E20 20OR/DB ▲▲
4	P35 18OR/VT
5	P36 18PK/VT
6	-
7	-
8	Q14 16DB ▲
8	Q13 16GY ▲▲
9	Q24 16DG ▲▲
9	Q23 16RD/WT ▲
10	Z1 16BK
11	G76 20TN/YL



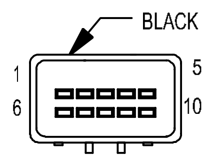
C303

CAV	CIRCUIT
1	X92 18TN/DG ■
1	X58 18DB/OR ●
2	X52 18DB/WT ●
2	X90 18WT/VT ■
3	E20 20OR/DB
4	P35 18OR/VT
5	P36 18PK/VT
6	-
7	-
8	Q14 16GY
9	Q24 16DG
10	Z1 16BK
11	G76 18TN/YL



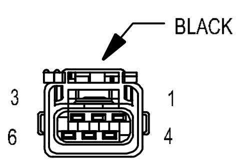
C304

CAV	CIRCUIT
1	P86 18PK/BK
2	P130 16DG/WT
3	D25 20YL/VT
4	F35 16RD
5	Z1 16BK
6	P29 20BR/WT
7	Z2 18BK/OR ▲
7	Z2 20BK/OR ▲▲
8	Z5 16BK/VT
9	G10 20LG/RD
10	-



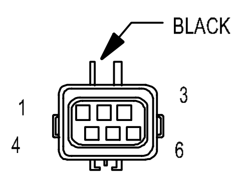
C304

CAV	CIRCUIT
1	P86 20DG/YL ■■
2	P130 16DG/WT ■■
3	D25 20VT/YL
4	F35 16RD
5	Z1 16BK
6	P29 20BR/WT ■■
7	Z2 20BK/OR ●●
8	Z5 16BK/VT
9	G10 20LG/RD ◇
10	-



C306

CAV	CIRCUIT
1	P130 16DG/WT
2	Z1 16BK
3	F37 16RD/LB
4	P86 20PK/BK
5	P29 20BR/WT
6	Z5 16BK/VT

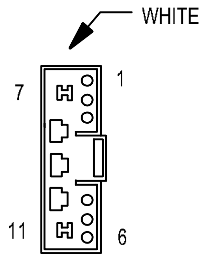


C306

CAV	CIRCUIT
1	P130 16DG/WT ■■
2	Z1 16BK
3	F37 16RD/LB
4	P86 20DG/YL ■■
5	P29 20BR/WT ■■
6	Z5 16BK/VT ■■

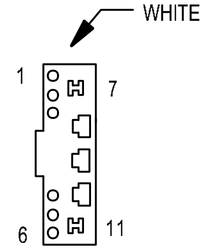
▲▲ LHD
▲ RHD
■ PREMIUM AUDIO
● BASE AUDIO
●● PREMIUM POWER SEATS

■■ HEATED SEATS
◇ POWER SEATS



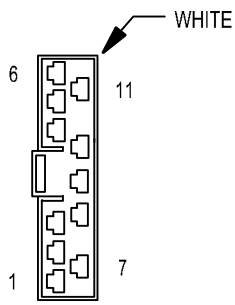
C307

CAV	CIRCUIT
1	X93 18TN/DG ▲
1	X91 18TN/DG ▼▼
2	X91 18WT/DG ▲
2	X93 18WT/VT ▼▼
3	E20 20OR/DB ▲
3	E21 20OR/RD ▼▼
4	P35 18OR/VT
5	P36 18PK/VT
6	-
7	-
8	Q13 16DB ▼▼
8	Q14 16GY ▲
9	Q23 16RD/WT ▼▼
9	Q24 16DG ▲
10	Z1 16BK
11	G77 20TN/OR



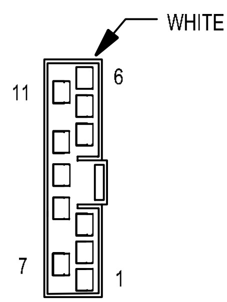
C307

CAV	CIRCUIT
1	X93 18DG/WT ▲
1	X57 18WT/DG ▼▼
2	X91 18WT/DG ▲
2	X51 18DG/WT ▼▼
3	E21 20OR/DB
4	P35 18OR/VT
5	P36 18PK/VT
6	-
7	-
8	Q13 16GY
9	Q23 16DG
10	Z1 16BK
11	G76 18TN/YL



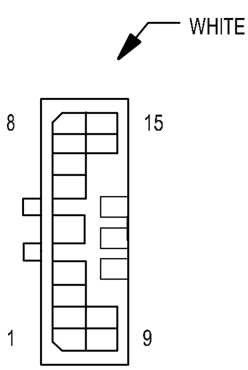
C308

CAV	CIRCUIT
1	G78 20TN/BK
2	P35 18PK/VT ▲
2	P35 18OR/VT ▼▼
3	P36 18OR/VT ▲
3	P36 18PK/VT ▼▼
4	V13 18BR/LG
5	V22 18BR/YL
6	F70 18PK
7	L50 18WT/TN
8	Z1 12BK
9	-
10	C15 12BK/WT
11	L7 18BK/YL



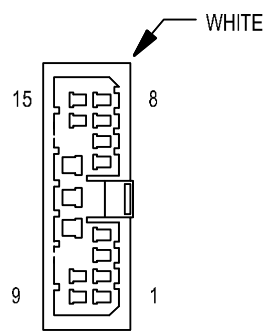
C308

CAV	CIRCUIT
1	G78 20TN/BK
2	P35 18OR/VT
3	P36 18PK/VT
4	V13 18BR/LG
5	V22 18BR/YL
6	F70 18PK
7	L50 18WT/TN
8	Z1 12BK
9	-
10	C15 12BK/WT
11	L7 18BK/YL



C309

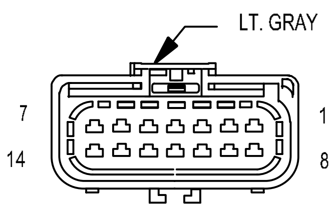
CAV	CIRCUIT
1	D25 20VT/YL
2	M20 20YL/BK
3	M2 20YL/DG
4	P112 20YL/WT
5	P114 20YL/RD
6	L1 20VT/BK
7	G5 20DB/WT
8	-
9	-
10	F70 20PK
11	Q30 16TN ▲▲
12	Z1 20BK ▼
12	Z1 16BK ▲▲
13	-
14	Z2 20BK/OR
15	G73 20LG/OR



C309

CAV	CIRCUIT
1	D25 20YL/VT
2	M20 20YL/BK ▼▼
2	M20 18YL/BK ▲
3	M2 20YL/DG ▼▼
3	M2 18YL ▲
4	P112 20YL/WT
5	P114 20YL/RD
6	L1 20VT/BK
7	G5 20DB/WT
8	-
9	-
10	F70 20PK ▼▼
10	F70 18PK ▲
11	Q30 16TN
12	Z1 16BK
13	-
14	Z2 20BK/OR ▼▼●
14	Z2 18BK/OR ▲●●
15	G73 20LG/OR

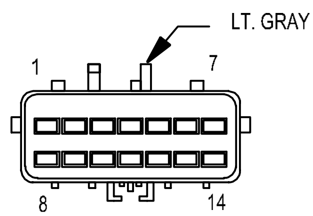
▲▲ SUNROOF
▼ WITHOUT SUNROOF
● PREMIUM POWER SEATS
●● EXCEPT PREMIUM POWER SEATS
▲ RHD
▼▼ LHD



C310

(BUILT-UP-EXPORT)

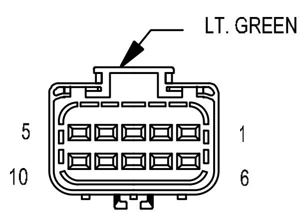
CAV	CIRCUIT
1	L50 16WT/TN
2	L62 20BR/RD
3	L1 18VT/BK
4	F30 14RD
5	L7 18BK/YL
6	L95 18DG/YL
7	B40 14LB
8	Z1 14BK
9	L50 18WT/TN
10	L63 20DG/RD
11	Z1 14BK
12	-
13	-
14	-



C310

(BUILT-UP-EXPORT)

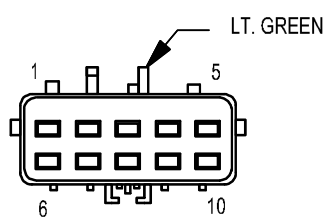
CAV	CIRCUIT
1	L50 16WT/TN
2	L62 18BR/RD ■■
2	L62 20BR/RD ■
3	L1 18VT/BK
4	F30 14RD ■
4	F30 14RD/YL ■■
5	L7 18BK/YL
6	L95 18DG/YL
7	B40 14LB
8	Z1 14BK
9	L50 16WT/TN
10	L63 20DG/RD
11	Z1 14BK
12	-
13	-
14	-



C310

(EXCEPT BUILT-UP-EXPORT)

CAV	CIRCUIT
1	L50 16WT/TN
2	L62 20BR/RD
3	L1 18VT/BK
4	F30 14RD
5	L7 18BK/YL
6	Z1 14BK
7	B40 14LB
8	Z1 14BK
9	L50 18WT/TN
10	L63 20DG/RD

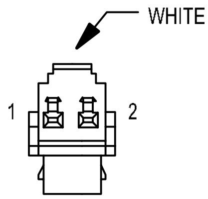


C310

(EXCEPT BUILT-UP-EXPORT)

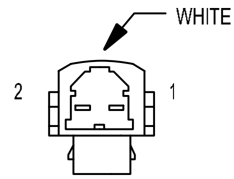
CAV	CIRCUIT
1	L50 16WT/TN
2	L62 18BR/RD
3	L1 18VT/BK
4	F30 14RD/YL
5	L7 18BK/YL
6	Z1 14BK
7	B40 14LB
8	Z1 14BK
9	L50 18WT/TN
10	L63 20DG/RD

■ RHD
■■ LHD



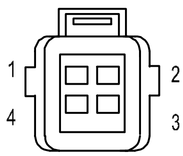
C311

CAV	CIRCUIT
1	L50 18WT/TN
2	Z1 18BK



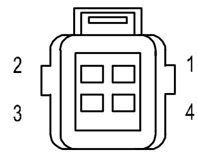
C311

CAV	CIRCUIT
1	L50 18WT/TN
2	Z1 18BK



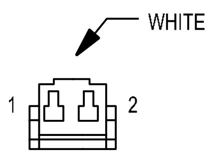
C312

CAV	CIRCUIT
1	Z1 18BK
2	L7 18BK/YL
3	P101 18OR/PK
4	P100 18OR/BR



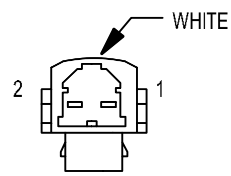
C312

CAV	CIRCUIT
1	Z1 18BK
2	L7 18BK/YL
3	P101 18OR/PK
4	P100 18OR/BR



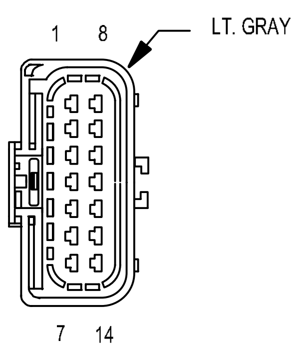
C313

CAV	CIRCUIT
1	P112 20YL/WT
2	P114 20YL/RD



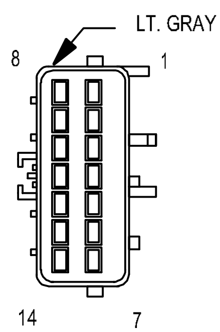
C313

CAV	CIRCUIT
1	P112 20YL/WT
2	P114 20YL/RD



C314

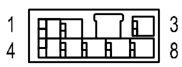
CAV	CIRCUIT
1	D25 20YL/VT
2	F21 12TN ■
2	F21 12TN/BK ■■
3	P35 18OR/VT
4	P36 18PK/VT
5	Z1 12BK
6	Q14 16GY
7	Q24 16DG
8	E20 20OR/DB
9	X80 18LB/BK ▲▲
9	X56 18DB/PK ▲
9	X85 18LG/DG ■
10	X82 18LB/RD ▲▲
10	X54 18VT ▲
10	X87 18LG/RD ■
11	-
12	-
13	-
14	-



C314

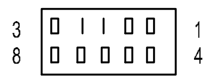
CAV	CIRCUIT
1	D25 20YL/VT
2	F21 12TN/BK
3	P35 18OR/VT
4	P36 18PK/VT
5	Z1 12BK
6	Q14 16GY
7	Q24 16DG
8	E20 20OR/DB
9	X80 18LB/BK
10	X82 18LB/RD
11	-
12	-
13	-
14	-

■■ LHD
■ RHD
▲▲ PREMIUM
▲ BASE



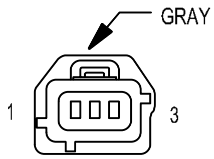
C315

CAV	CIRCUIT
1	Q30 16TN
2	-
3	Q43 20VT
4	Q41 20WT
5	-
6	-
7	Z1 16BK
8	-



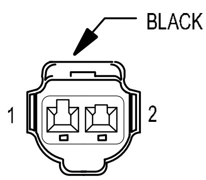
C315

CAV	CIRCUIT
1	Q30 16DB
2	-
3	Q43 20VT
4	Q41 20WT
5	-
6	-
7	Z1 16BK
8	-



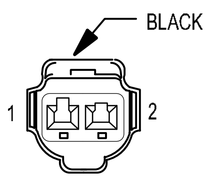
CAMSHAFT POSITION SENSOR

CAV	CIRCUIT	FUNCTION
1	K44 18TN/YL	CAMSHAFT POSITION SENSOR SIGNAL
2	K4 18BK/LB	SENSOR GROUND
3	K7 20OR	5V SUPPLY



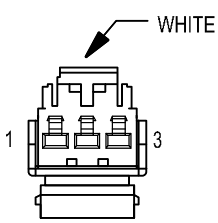
CAPACITOR NO. 1

CAV	CIRCUIT	FUNCTION
1	A142 14DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
2	-	-



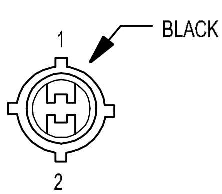
CAPACITOR NO. 2

CAV	CIRCUIT	FUNCTION
1	A142 14DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
2	-	-



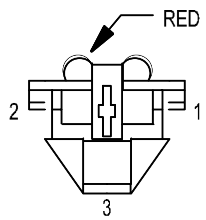
CARGO LAMP

CAV	CIRCUIT	FUNCTION
1	F70 20PK	FUSED B(+)
2	G73 20LG/OR	LIFTGATE COURTESY DISABLE
3	M2 20YL/DG	COURTESY LAMP DRIVER



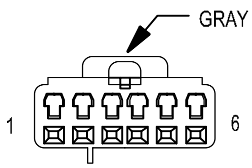
CENTER HIGH MOUNTED STOP LAMP

CAV	CIRCUIT	FUNCTION
1	L50 18WT/TN	BRAKE LAMP SWITCH OUTPUT
2	Z1 18BK	GROUND



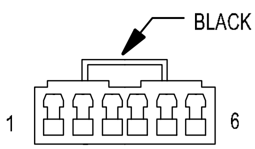
CIGAR LIGHTER

CAV	CIRCUIT	FUNCTION
1	F30 18RD	FUSED CIGAR LIGHTER RELAY OUTPUT
2	-	-
3	Z1 18BK	GROUND



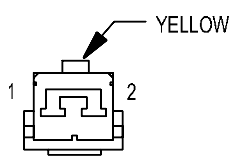
CLOCKSPRING - C1

CAV	CIRCUIT	FUNCTION
1	-	-
2	X4 22GY/OR ••	HORN RELAY CONTROL
2	X4 20GY/OR •	HORN RELAY CONTROL
3	X20 20RD/YL	RADIO CONTROL MUX
4	X10 20RD/BK	RADIO CONTROL MUX RETURN
5	K4 20BK/LB	SENSOR GROUND
6	V37 20RD/LG	SPEED CONTROL SWITCH SIGNAL



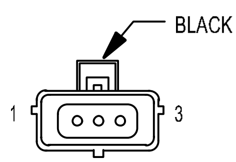
CLOCKSPRING - C2

CAV	CIRCUIT	FUNCTION
1	-	-
2	X4 20GY/OR	HORN RELAY CONTROL
3	X20 20RD/YL	RADIO CONTROL MUX
4	X10 20RD/BK	RADIO CONTROL MUX RETURN
5	K4 20BK/LB	SENSOR GROUND
6	V37 20RD/LG	SPEED CONTROL SWITCH SIGNAL



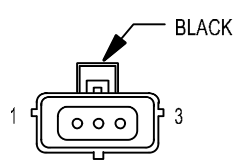
CLOCKSPRING - C3

CAV	CIRCUIT	FUNCTION
1	R43 18BK/LB	DRIVER AIRBAG LINE 2
2	R45 18DG/LB	DRIVER AIRBAG LINE 1



COIL ON PLUG NO. 1 (4.7L)

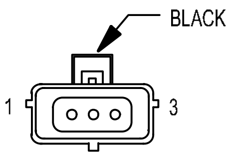
CAV	CIRCUIT	FUNCTION
1	K91 14TN/RD	COIL DRIVER NO. 1
2	A142 14DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
3	-	-



COIL ON PLUG NO. 2 (4.7L)

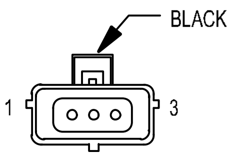
CAV	CIRCUIT	FUNCTION
1	K92 14TN/PK	COIL DRIVER NO. 2
2	A142 14DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
3	-	-

• RHD
•• LHD



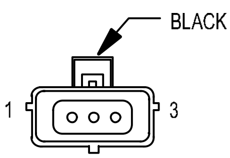
COIL ON PLUG NO. 3 (4.7L)

CAV	CIRCUIT	FUNCTION
1	K93 14TN/OR	COIL DRIVER NO. 3
2	A142 14DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
3	-	-



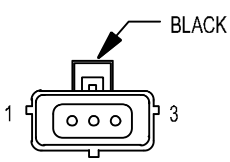
COIL ON PLUG NO. 4 (4.7L)

CAV	CIRCUIT	FUNCTION
1	K94 14TN/LG	COIL DRIVER NO. 4
2	A142 14DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
3	-	-



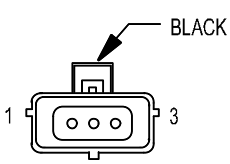
COIL ON PLUG NO. 5 (4.7L)

CAV	CIRCUIT	FUNCTION
1	K95 14TN/DG	COIL DRIVER NO. 5
2	A142 14DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
3	-	-



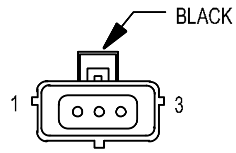
COIL ON PLUG NO. 6 (4.7L)

CAV	CIRCUIT	FUNCTION
1	K96 14TN/LB	COIL DRIVER NO. 6
2	A142 14DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
3	-	-



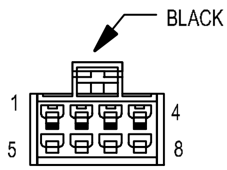
COIL ON PLUG NO. 7 (4.7L)

CAV	CIRCUIT	FUNCTION
1	K97 14BR	COIL DRIVER NO. 7
2	A142 14DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
3	-	-



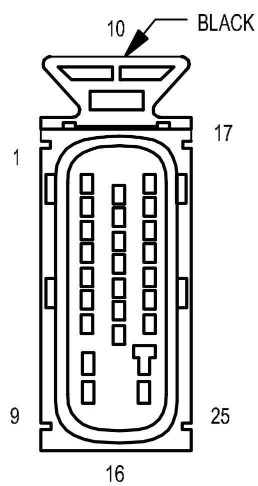
COIL ON PLUG NO. 8 (4.7L)

CAV	CIRCUIT	FUNCTION
1	K98 14LB/RD	COIL DRIVER NO. 8
2	A142 14DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
3	-	-



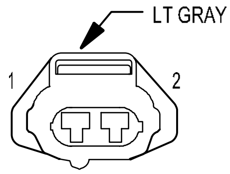
COMPACT DISC CHANGER

CAV	CIRCUIT	FUNCTION
1	X40 20WT/RD	AUDIO OUT RIGHT
2	C235 20WT/LB	SHIELD
3	D25 20YL/VT	PCI BUS
4	X112 20RD	IGNITION SWITCH OUTPUT
5	X41 20WT/DG	AUDIO OUT LEFT
6	Z4 20WT/BK	GROUND
7	Z17 20BK	GROUND
8	X160 20YL	B(+)



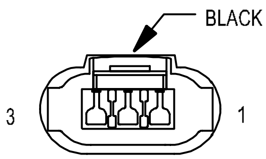
CONTROLLER ANTI-LOCK BRAKE

CAV	CIRCUIT	FUNCTION
1	B9 18RD	LEFT FRONT WHEEL SPEED SENSOR (+)
2	B8 18RD/DB	LEFT FRONT WHEEL SPEED SENSOR (-)
3	G7 18WT/OR	VEHICLE SPEED SENSOR SIGNAL
4	F20 18DB/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
5	B4 18LG	LEFT REAR WHEEL SPEED SENSOR (+)
6	B3 18LG/DB	LEFT REAR WHEEL SPEED SENSOR (-)
7	-	-
8	Z3 12BK/OR	GROUND
9	A20 12RD/DB	FUSED B(+)
10	D25 18YL/VT	PCI BUS
11	-	-
12	Z1 18BK	GROUND
13	B43 18PK/OR	G SWITCH TEST SIGNAL
14	B41 18YL/PK	G SWITCH NO. 1 SENSE
15	-	-
16	-	-
17	B42 18TN/WT	G SWITCH NO. 2 SENSE
18	L50 18WT/TN	BRAKE LAMP SWITCH OUTPUT
19	B7 18WT	RIGHT FRONT WHEEL SPEED SENSOR (+)
20	B6 18WT/DB	RIGHT FRONT WHEEL SPEED SENSOR (-)
21	G9 18GY/BK	RED BRAKE WARNING INDICATOR DRIVER
22	B1 18YL/DB	RIGHT REAR WHEEL SPEED SENSOR (-)
23	B2 18YL	RIGHT REAR WHEEL SPEED SENSOR (+)
24	Z3 12BK/OR	GROUND
25	A10 12RD/DG	FUSED B(+)



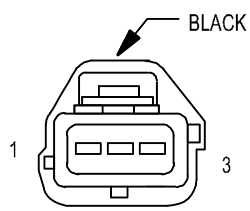
COOLANT LEVEL SENSOR

CAV	CIRCUIT	FUNCTION
1	G18 20PK/BK	COOLANT LEVEL SWITCH SENSE
2	Z1 20BK	GROUND



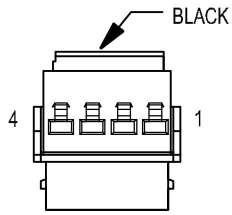
CRANKSHAFT POSITION SENSOR (DIESEL)

CAV	CIRCUIT	FUNCTION
1	Z3 18BK/OR	GROUND
2	-	-
3	K24 18GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL



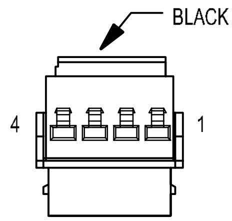
CRANKSHAFT POSITION SENSOR (GAS)

CAV	CIRCUIT	FUNCTION
1	K24 18GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL
2	K4 18BK/LB	SENSOR GROUND
3	K7 20OR	5V SUPPLY



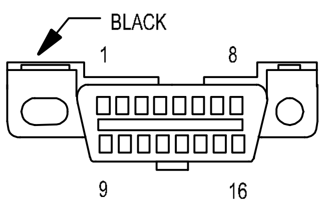
CRUISE SWITCH NO. 1

CAV	CIRCUIT	FUNCTION
1	-	-
2	K4 20BK/LB	SENSOR GROUND
3	V37 20RD/LG	SPEED CONTROL SWITCH SIGNAL
4	-	-



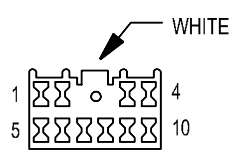
CRUISE SWITCH NO. 2

CAV	CIRCUIT	FUNCTION
1	-	-
2	K4 20BK/LB	SENSOR GROUND
3	V37 20RD/LG	SPEED CONTROL SWITCH SIGNAL
4	-	-



DATA LINK CONNECTOR

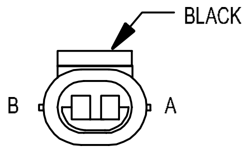
CAV	CIRCUIT	FUNCTION
1	-	-
2	D25 20YL/VT	PCI BUS
3	-	-
4	Z2 20BK/OR	GROUND
5	Z21 20BK/LG	GROUND
6	D32 20LG/DG	SCI RECEIVE
7	D21 20PK	SCI TRANSMIT
8	-	-
9	D19 20VT/OR	BODY CONTROL MODULE FLASH ENABLE
10	-	-
11	-	-
12	D33 20LG/DB	
13	-	-
14	D20 20LG	SCI RECEIVE
15	-	-
16	F33 20PK/RD	FUSED B(+)



DIAGNOSTIC JUNCTION PORT

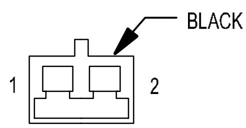
CAV	CIRCUIT	FUNCTION
1	D25 20YL/VT/BR ●●	PCI BUS
1	D25 20YL/VT/GY ●	PCI BUS
2	D25 20YL/VT/GY ●●	PCI BUS
2	D25 20YL/VT/BR ●	PCI BUS
3	D25 20YL/VT/DG ▲	PCI BUS
4	D25 18YL/VT/DB	PCI BUS
5	D25 18YL/VT/OR	PCI BUS
6	D25 20YL/VT/RD	PCI BUS
7	-	-
8	D25 20YL/VT/WT	PCI BUS
9	D25 20YL/VT	PCI BUS
10	-	-

▲ AZC
● EXCEPT BUILT-UP-EXPORT
●● BUILT-UP-EXPORT



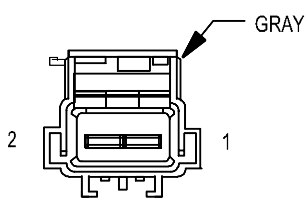
DRIVER BLEND DOOR MOTOR/ACTUATOR (AZC)

CAV	CIRCUIT	FUNCTION
A	C95 20VT/WT	DRIVER BLEND DOOR DRIVER (B)
B	C33 20PK/DG	DRIVER BLEND DOOR DRIVER (A)



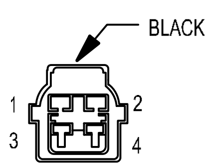
DRIVER DOOR COURTESY LAMP

CAV	CIRCUIT	FUNCTION
1	M21 20PK/DG	COURTESY LAMP DRIVER
2	L121 20BK/RD	COURTESY LAMP GROUND



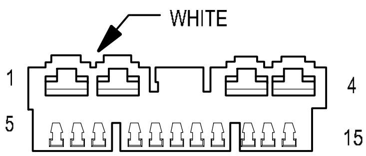
DRIVER DOOR CYLINDER LOCK SWITCH

CAV	CIRCUIT	FUNCTION
1	G73 20LG/OR	DRIVER DOOR KEY CYLINDER SWITCH SENSE
2	Z1 20BK	GROUND



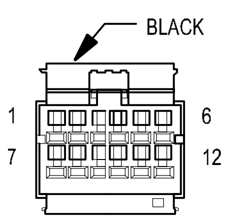
DRIVER DOOR LOCK MOTOR/ AJAR SWITCH

CAV	CIRCUIT	FUNCTION
1	G75 18TN/RD	DRIVER DOOR AJAR SWITCH SENSE
2	Z1 18BK	GROUND
3	P34 18PK/BK	DRIVER DOOR UNLOCK DRIVER
4	P35 18OR/BK	DOOR LOCK DRIVER



DRIVER DOOR MODULE-C1

CAV	CIRCUIT	FUNCTION
1	F21 12TN/LB	FUSED B(+)
2	Q23 16RD/WT	DRIVER REAR WINDOW DRIVER DOWN
3	Q13 16DB	DRIVER REAR WINDOW DRIVER UP
4	Z1 12BK	GROUND
5	P35 18OR/BK	DOOR LOCK DRIVER
6	-	-
7	P34 18PK/BK	DRIVER DOOR UNLOCK DRIVER
8	D30 20VT/YL	DIAGNOSTIC OUT
9	D25 20YL/VT	PCI BUS
10	G73 20LG/OR	DRIVER DOOR KEY CYLINDER SWITCH SENSE
11	G75 18TN/RD	DRIVER DOOR AJAR SWITCH SENSE
12	E21 20OR/RD	DRIVER REAR DOOR SWITCH ILLUMINATION
13	Q11 16LB	DRIVER WINDOW DRIVER (UP)
14	-	-
15	Q21 16WT	DRIVER WINDOW DRIVER (DOWN)

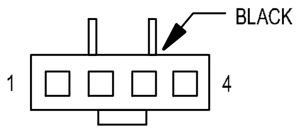


DRIVER DOOR MODULE-C2

CAV	CIRCUIT	FUNCTION
1	P95 20OR	MIRROR HORIZONTAL DRIVER
2	C118 20BK/WT	MIRROR HEATER GROUND
3	P64 20VT	MIRROR VERTICAL POSITION SIGNAL
4	P69 20GY	MIRROR SENSOR GROUND
5	P65 20DG	MIRROR HORIZONTAL POSITION SIGNAL
6	C117 20BK	MIRROR HEATER 12V SUPPLY
7	P91 20WT	MIRROR COMMON DRIVER
8	P93 20RD	MIRROR VERTICAL DRIVER
9	M21 20PK/DG	COURTESY LAMP DRIVER
10	P110 20YL •	POWER FOLDING MIRROR RETURN
11	P99 20DB •	POWER FOLDING MIRROR FEED
12	L121 20BK/RD	COURTESY LAMP GROUND

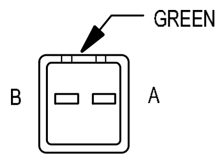
• BUILT-UP-EXPORT

J998W-19 WG008040



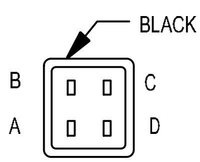
DRIVER DOOR MODULE-C3

CAV	CIRCUIT	FUNCTION
1	BK	MEMORY SWITCH RETURN
2	BR	MEMORY SWITCH MUX
3	OR	MEMORY SET INDICATOR DRIVER
4	GY	SWITCH ILLUMINATION DRIVER



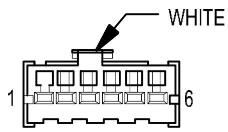
DRIVER HEATED SEAT BACK (PREMIUM I/III)

CAV	CIRCUIT	FUNCTION
A	P88 16BK/BR	HEATED SEAT DRIVER
B	Z6 16BK/YL	DRIVER SEAT HEATER GROUND



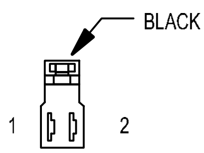
DRIVER HEATED SEAT CUSHION (PREMIUM I/III)

CAV	CIRCUIT	FUNCTION
A	P131 16BK/OR	DRIVER SEAT HEATER B(+) DRIVER
B	P88 16BK/BR	HEATED SEAT DRIVER
C	P135 20LB/BK	DRIVER SEAT TEMPERATURE SENSOR INPUT
D	P29 20BR/WT	SEAT SENSOR 5V SUPPLY



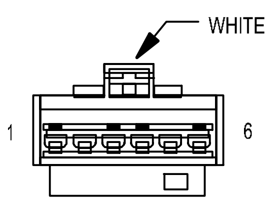
DRIVER HEATED SEAT SWITCH

CAV	CIRCUIT	FUNCTION
1	P133 20LG/RD	LEFT SEAT HEATER SWITCH MUX
2	E2 20OR	PANEL LAMPS DRIVER
3	F22 20WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
4	-	-
5	Z1 20BK	GROUND
6	P132 20OR/BK	SEAT HEATER SWITCH SENSOR GROUND



DRIVER LUMBAR MOTOR

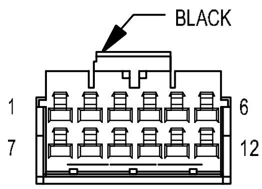
CAV	CIRCUIT	FUNCTION
1	P105 16LG/DB	LUMBAR FORWARD SWITCH SENSE
2	P104 16YL/RD	LUMBAR REARWARD SWITCH SENSE



DRIVER LUMBAR SWITCH (MIDLINE/PREMIUM)

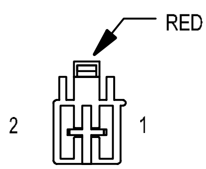
CAV	CIRCUIT	FUNCTION
1	-	-
2	Z1 16BK	GROUND
3	P104 16YL/RD ••	LUMBAR REARWARD SWITCH SENSE
3	P105 16YL/RD •	LUMBAR FORWARD SWITCH SENSE
4	P105 16LG/DB ••	LUMBAR FORWARD SWITCH SENSE
4	P104 16LG/DB •	LUMBAR REARWARD SWITCH SENSE
5	Z1 16BK	GROUND
6	F35 16RD	FUSED B(+)

• RHD
•• LHD



DRIVER POWER MIRROR

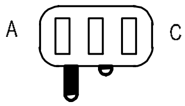
CAV	CIRCUIT	FUNCTION
1	C117 20BK	MIRROR HEATER 12V SUPPLY
2	P65 20DG	MIRROR HORIZONTAL POSITION SIGNAL
3	P69 20GY	MIRROR SENSOR GROUND
4	P64 20VT	MIRROR VERTICAL POSITION SIGNAL
5	C118 20BK/WT	MIRROR HEATER GROUND
6	P95 20OR	DRIVER POWER MIRROR HORIZONTAL
7	P114 20YL/RD	POWER MIRROR B(+)
8	P99 20DB	POWER FOLDING MIRROR FEED
9	P110 20YL	POWER FOLDING MIRROR RETURN
10	P112 20YL/WT	POWER MIRROR B(-)
11	P93 20RD	MIRROR VERTICAL DRIVER
12	P91 20WT	MIRROR COMMON DRIVER



DRIVER POWER SEAT FRONT RISER MOTOR

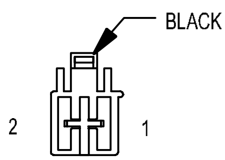
CAV	CIRCUIT	FUNCTION
1	P19 16YL/LG •	DRIVER SEAT FRONT UP DRIVER
1	P119 16YL/RD ••	SEAT FRONT UP DRIVER
2	P21 16RD/LG •	DRIVER SEAT FRONT DOWN DRIVER
2	P121 16RD/GY ••	SEAT FRONT DOWN DRIVER

• EXCEPT PREMIUM II/III
•• PREMIUM II/III



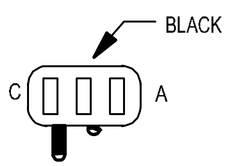
DRIVER POWER SEAT FRONT RISER MOTOR SENSOR (PREMIUM II/III)

CAV	CIRCUIT	FUNCTION
A	P28 20BR/RD	SEAT POSITION SENSOR GROUND
B	P26 20BR	FRONT RISER POSITION SIGNAL
C	P29 20BR/WT	SEAT SENSOR 5V SUPPLY



DRIVER POWER SEAT HORIZONTAL MOTOR

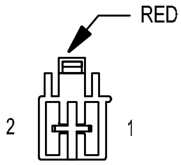
CAV	CIRCUIT	FUNCTION
1	P117 16RD/BR ●●	SEAT HORIZONTAL REARWARD DRIVER
1	P17 16RD/YL ●	DRIVER SEAT HORIZONTAL REARWARD DRIVER
2	P115 16GY/LG ●●	SEAT HORIZONTAL FORWARD DRIVER
2	P15 16YL/LB ●	DRIVER SEAT HORIZONTAL FORWARD DRIVER



DRIVER POWER SEAT HORIZONTAL MOTOR SENSOR (PREMIUM II/III)

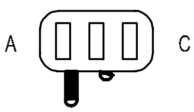
CAV	CIRCUIT	FUNCTION
A	P29 20BR/WT	SEAT SENSOR 5V SUPPLY
B	P25 20VT/RD	SEAT HORIZONTAL POSITION SIGNAL
C	P28 20BR/RD	SEAT POSITION SENSOR GROUND

● EXCEPT PREMIUM II/III
●● PREMIUM II/III



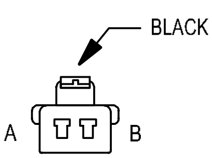
DRIVER POWER SEAT REAR RISER MOTOR

CAV	CIRCUIT	FUNCTION
1	P111 16YL/DB ●	SEAT REAR UP DRIVER
1	P11 16YL/WT ●●	DRIVER SEAT REAR UP DRIVER
2	P113 16RD/BK ●	SEAT REAR DOWN DRIVER
2	P13 16RD/WT ●●	DRIVER SEAT REAR DOWN DRIVER



DRIVER POWER SEAT REAR RISER MOTOR SENSOR (PREMIUM II/III)

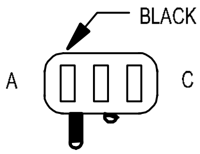
CAV	CIRCUIT	FUNCTION
A	P28 20BR/RD	SEAT POSITION SENSOR GROUND
B	P27 20LB/RD	REAR RISER POSITION SIGNAL
C	P29 20BR/WT	SEAT SENSOR 5V SUPPLY



DRIVER POWER SEAT RECLINER MOTOR

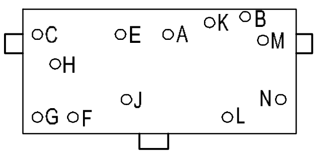
CAV	CIRCUIT	FUNCTION
A	P141 16GY/WT ●	SEAT RECLINER DOWN DRIVER
A	P42 16BR/WT ●●	DRIVER SEAT RECLINER DOWN DRIVER
B	P143 16GY/LB ●	SEAT RECLINER UP DRIVER
B	P43 16GY/LB ●●	DRIVER SEAT RECLINER UP DRIVER

●● EXCEPT PREMIUM II/III
● PREMIUM II/III



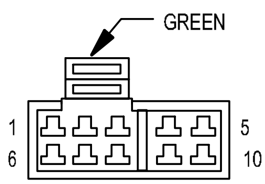
DRIVER POWER SEAT RECLINER MOTOR SENSOR (PREMIUM II/III)

CAV	CIRCUIT	FUNCTION
A	P29 20BR/WT	SEAT SENSOR 5V SUPPLY
B	P47 20LB	RECLINER POSITION SIGNAL
C	P28 20BR/RD	SEAT POSITION SENSOR GROUND



DRIVER POWER SEAT SWITCH (BASE)

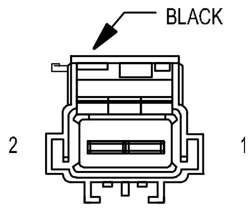
CAV	CIRCUIT	FUNCTION
A	F35 16RD	FUSED B(+)
B	Z1 16BK	GROUND
C	-	-
D	-	-
E	P19 16YL/LG ●	DRIVER SEAT FRONT DOWN DRIVER
E	P21 16RD/LG ●●	DRIVER SEAT FRONT DOWN DRIVER
F	-	-
G	-	-
H	-	-
I	-	-
J	P21 16RD/LG ●	DRIVER SEAT FRONT UP DRIVER
J	P19 16YL/LG ●●	DRIVER SEAT FRONT UP DRIVER
K	P15 16YL/LB	DRIVER SEAT HORIZONTAL FORWARD DRIVER
L	P17 16RD/YL	DRIVER SEAT HORIZONTAL REARWARD DRIVER
M	P11 16YL/WT ●	DRIVER SEAT REAR DOWN DRIVER
M	P13 16RD/WT ●●	DRIVER SEAT REAR DOWN DRIVER
N	P13 16RD/WT ●	DRIVER SEAT REAR UP DRIVER
N	P11 16YL/WT ●●	DRIVER SEAT REAR UP DRIVER



DRIVER POWER SEAT SWITCH (MIDLINE/ PREMIUM)

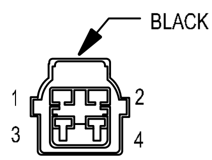
CAV	CIRCUIT	FUNCTION
1	Z1 16BK	GROUND
2	P43 16GY/LB ■	DRIVER SEAT RECLINER DRIVER UP
2	P43 20GY/LB ▲	RECLINER UP SWITCH SENSE
3	P17 16RD/YL ■	DRIVER SEAT HORIZONTAL REARWARD
3	P17 20RD/YL ▲	SEAT HORIZONTAL FORWARD SWITCH
4	P42 20BR/WT ▲	RECLINER DOWN SWITCH SENSE
4	P42 16BR/WT ■	DRIVER SEAT RECLINER DRIVER DOWN
5	F35 16RD ■	FUSED B(+)
5	P9 20RD/LB ▲	SEAT SWITCH B(+) SUPPLY
6	P15 20YL/LB ▲	DRIVER POWER SEAT HORIZONTAL FORWARD
6	P15 16YL/LB ■	DRIVER SEAT HORIZONTAL FORWARD DRIVER
7	P19 20YL/LG ▲	SEAT FRONT UP SWITCH SENSE
7	P19 16YL/LG ■	DRIVER SEAT FRONT UP DRIVER
7	P21 20RD/LG ●	DRIVER SEAT FRONT UP DRIVER
8	P11 20YL/WT ▲	SEAT REAR UP SWITCH SENSE
8	P11 16YL/WT ■	DRIVER SEAT REAR UP DRIVER
8	P13 20RD/WT ●	DRIVER SEAT REAR UP DRIVER
9	P13 20RD/WT ▲	SEAT REAR DOWN SWITCH SENSE
9	P13 16RD/WT ■	DRIVER SEAT REAR DOWN DRIVER
9	P11 20YL/WT ●	DRIVER SEAT REAR DOWN DRIVER
10	P21 20RD/LG ▲	SEAT FRONT DOWN SWITCH SENSE
10	P21 16RD/LG ■	DRIVER SEAT FRONT DOWN DRIVER
10	P19 20YL/LG ●	DRIVER SEAT FRONT DOWN DRIVER

●● LHD
● RHD
▲ PREMIUM II/III
■ MIDLINE/PREMIUM I



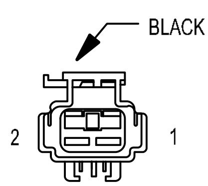
DRIVER POWER WINDOW MOTOR

CAV	CIRCUIT	FUNCTION
1	Q21 16WT	DRIVER WINDOW DRIVER (DOWN)
2	Q11 16LB	DRIVER WINDOW DRIVER (UP)



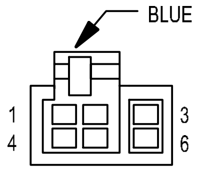
DRIVER REAR DOOR LOCK MOTOR/AJAR SWITCH

CAV	CIRCUIT	FUNCTION
1	G76 18TN/YL	DOOR AJAR SWITCH SENSE
2	Z1 18BK	GROUND
3	P36 18PK/VT	DOOR UNLOCK DRIVER
4	P35 18OR/VT	DOOR LOCK DRIVER



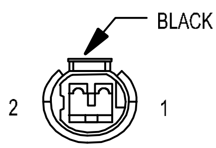
DRIVER REAR POWER WINDOW MOTOR

CAV	CIRCUIT	FUNCTION
1	Q124 16DG/WT	WINDOW DRIVER DOWN
2	Q114 16GY/WT	WINDOW DRIVER UP



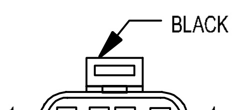
DRIVER REAR POWER WINDOW SWITCH

CAV	CIRCUIT	FUNCTION
1	Q13 16GY ▲▲	DRIVER REAR WINDOW DRIVER UP
1	Q14 16GY ▲	DRIVER REAR WINDOW DRIVER UP
2	Q114 16GY/WT	WINDOW DRIVER UP
3	E21 20OR/DB ▲▲	DOOR SWITCH ILLUMINATION
3	E20 20OR/DB ▲	DOOR SWITCH ILLUMINATION
4	Q23 16DG ▲▲	DRIVER REAR WINDOW DRIVER DOWN
4	Q24 16DG ▲	DRIVER REAR WINDOW DRIVER DOWN
5	Q124 16DG/WT	WINDOW DRIVER DOWN
6	Z1 16BK	GROUND



DUTY CYCLE EVAP/PURGE SOLENOID (GAS)

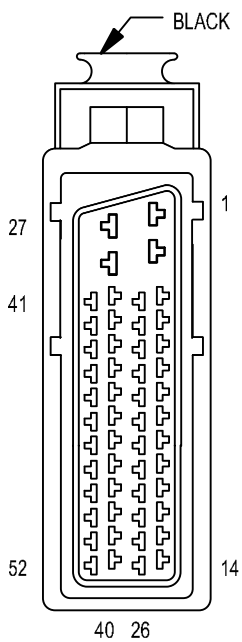
CAV	CIRCUIT	FUNCTION
1	F99 20OR	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
2	K52 20PK/BK ▲▲	DUTY CYCLE EVAP/PURGE SOLENOID CONTROL
2	K52 18PK/BK ▲	DUTY CYCLE EVAP/PURGE SOLENOID CONTROL



EGR SOLENOID (DIESEL)

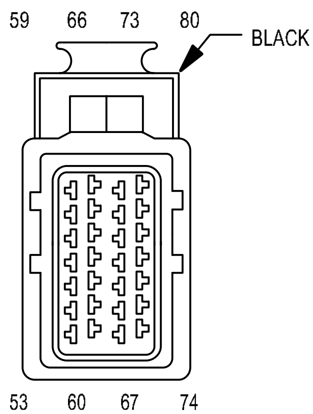
CAV	CIRCUIT	FUNCTION
1	F15 18DB/WT	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
2	K35 18GY/YL	EGR SOLENOID CONTROL
3	-	-
4	Z1 18BK	GROUND

▲▲ LHD
▲ RHD



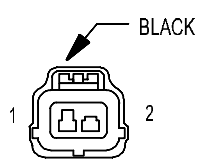
ENGINE CONTROL MODULE-C1 (DIESEL)

CAV	CIRCUIT	FUNCTION
1	Z12 14BK/TN	GROUND
2	A142 14DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
3	-	-
4	-	-
5	C13 18DB/OR	A/C COMPRESSOR CLUTCH RELAY CONTROL
6	K159 18GY	ENGINE SPEED SENSOR SIGNAL
7	-	-
8	C90 18LG	A/C SWITCH SENSE
9	K29 18WT/PK	BRAKE SWITCH SENSE
10	C18 18DB	A/C PRESSURE SIGNAL
11	K440 18VT/WT	5V SUPPLY
12	K151 18WT/RD	LOW IDLE POSITION SWITCH
13	K21 18BK/RD	INTAKE AIR TEMPERATURE SENSOR SIGNAL
14	-	-
15	-	-
16	-	-
17	-	-
18	G8 18LB/BK	FUEL MONITOR OUTPUT SIGNAL
19	-	-
20	L50 18WT/TN	BRAKE LAMP SWITCH OUTPUT
21	-	-
22	-	-
23	K255 18WT/DB	PEDAL POSITION SENSOR
24	K167 18BR	SENSOR GROUND
25	-	-
26	-	-
27	Z12 14BK/TN	GROUND
28	A142 14DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
29	K35 18GY/YL	EGR SOLENOID CONTROL
30	-	-
31	-	-
32	K185 18OR/LB	WAIT TO START INDICATOR
33	K51 18DB/YL	AUTOMATIC SHUT DOWN RELAY CONTROL
34	G3 18BK/PK	CHECK ENGINE INDICATOR DRIVER
35	-	-
36	-	-
37	-	-
38	G55 18OR/BK	ENGINE DISABLE SIGNAL
39	K70 18OR/WT	5V SUPPLY
40	K22 18OR/DB	BOOST PRESSURE SENSOR SIGNAL
41	-	-
42	K252 18LB/WT	GLOW PLUG RELAY NO. 2 CONTROL
43	K152 18WT	GLOW PLUG RELAY NO. 1 CONTROL
44	-	-
45	D21 18PK	SCI TRANSMIT
46	T24 18BR/YL	ENGINE STARTER MOTOR RELAY CONTROL
47	F99 18OR	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
48	-	-
49	-	-
50	-	-
51	G7 18WT/OR	VEHICLE SPEED SENSOR SIGNAL
52	-	-



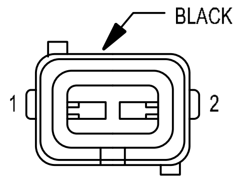
ENGINE CONTROL MODULE-C2 (DIESEL)

CAV	CIRCUIT	FUNCTION
53	K156 18GY	FUEL TEMPERATURE SENSOR SIGNAL
54	K2 18TN/BK	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
55	K68 18LG/YL	NEEDLE MOVEMENT SENSOR (-)
56	K134 18LB/BK	SLEEVE POSITION SENSOR (-)
57	K57 18LG/OR	CONTROL SLEEVE POSITION SENSOR
58	K135 18WT/BK	SLEEVE POSITION SENSOR (+)
59	K140 18TN/WT	FUEL QUANTITY ACTUATOR GROUND
60	-	-
61	K121 18BK/VT	SENSOR GROUND
62	K67 18BR/BK	NEEDLE MOVEMENT SENSOR (+)
63	-	-
64	-	-
65	-	-
66	K140 18TN/WT	FUEL QUANTITY ACTUATOR GROUND
67	K24 18GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL
68	-	-
69	Z3 18BK/OR	GROUND
70	-	-
71	-	-
72	-	-
73	-	-
74	-	-
75	-	-
76	-	-
77	K153 18OR	SHUT OFF FEED
78	-	-
79	K238 18VT	FUEL TIMING SHUT OFF SOLENOID
80	K140 18TN/WT	FUEL QUANTITY ACTUATOR GROUND



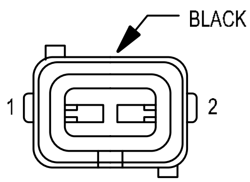
ENGINE COOLANT TEMPERATURE SENSOR (GAS)

CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K2 18TN/BK	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL



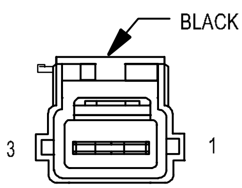
ENGINE COOLANT TEMPERATURE SENSOR NO. 1 (DIESEL)

CAV	CIRCUIT	FUNCTION
1	K2 18TN/BK	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
2	K121 18BK/VT	SENSOR GROUND



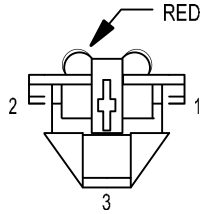
ENGINE COOLANT TEMPERATURE SENSOR NO. 2 (DIESEL)

CAV	CIRCUIT	FUNCTION
1	K222 18TN/RD	SECONDARY ENGINE COOLANT TEMPERATURE SENSOR
2	K4 18BK/LB	SENSOR GROUND



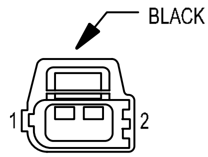
ENGINE OIL PRESSURE SENSOR

CAV	CIRCUIT	FUNCTION
1	K6 18VT/WT	5V SUPPLY
2	G60 18GY/YL	ENGINE OIL PRESSURE SENSOR SIGNAL
3	K4 18BK/LB	SENSOR GROUND



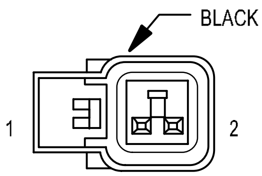
FRONT POWER OUTLET

CAV	CIRCUIT	FUNCTION
1	A148 16VT	FUSED B(+)
2	-	-
3	Z1 16BK	GROUND



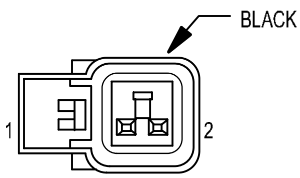
FUEL HEATER (DIESEL)

CAV	CIRCUIT	FUNCTION
1	Z1 16BK	GROUND
2	A93 16RD/BK	FUEL HEATER RELAY OUTPUT



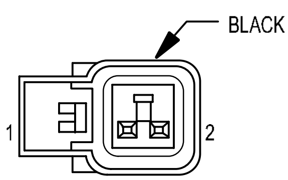
FUEL INJECTOR NO. 1

CAV	CIRCUIT	FUNCTION
1	K11 18WT/DB	FUEL INJECTOR NO. 1 DRIVER
2	F42 18DG/LG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT



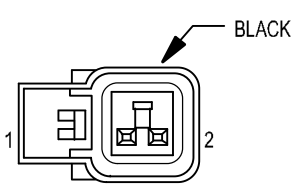
FUEL INJECTOR NO. 2

CAV	CIRCUIT	FUNCTION
1	K12 18TN	FUEL INJECTOR NO. 2 DRIVER
2	F42 18DG/LG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT



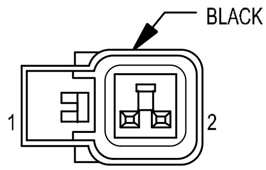
FUEL INJECTOR NO. 3

CAV	CIRCUIT	FUNCTION
1	K13 18YL/WT	FUEL INJECTOR NO. 3 DRIVER
2	F42 18DG/LG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT



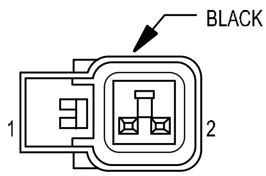
FUEL INJECTOR NO. 4

CAV	CIRCUIT	FUNCTION
1	K14 18LB/BR	FUEL INJECTOR NO. 4 DRIVER
2	F42 18DG/LG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT



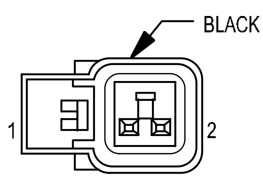
FUEL INJECTOR NO. 5

CAV	CIRCUIT	FUNCTION
1	K38 18GY	FUEL INJECTOR NO. 5 DRIVER
2	F42 18DG/LG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT



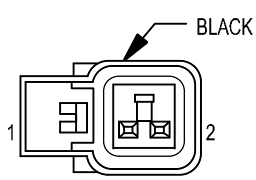
FUEL INJECTOR NO. 6

CAV	CIRCUIT	FUNCTION
1	K58 18BR/DB	FUEL INJECTOR NO. 6 DRIVER
2	F42 18DG/LG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT



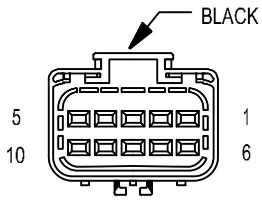
FUEL INJECTOR NO. 7 (4.7L)

CAV	CIRCUIT	FUNCTION
1	K17 18DB/TN	FUEL INJECTOR NO. 7 DRIVER
2	F42 18DG/LG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT



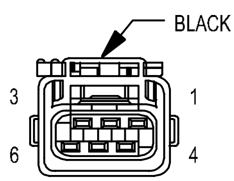
FUEL INJECTOR NO. 8 (4.7L)

CAV	CIRCUIT	FUNCTION
1	K18 18DB/GY	FUEL INJECTOR NO. 8 DRIVER
2	F42 18DG/LG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT



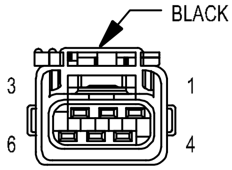
FUEL PUMP MODULE (DIESEL)

CAV	CIRCUIT	FUNCTION
1	K134 18LB/BK	SLEEVE POSITION SENSOR (-)
2	K57 18LG/OR	CONTROL SLEEVE POSITION SENSOR
3	K135 18WT/BK	SLEEVE POSITION SENSOR (+)
4	K121 18BK/VT	SENSOR GROUND
5	K238 16VT	FUEL TIMING SHUT OFF SOLENOID
6	K153 18OR	FUEL INJECTOR DRIVER
7	K156 18GY	FUEL TEMPERATURE SENSOR SIGNAL
8	K140 14TN/WT	FUEL QUANTITY ACTUATOR GROUND
9	F42 18DG/LG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
10	F42 18DG/LG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT



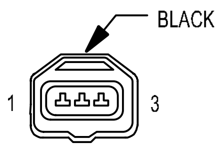
FUEL PUMP MODULE (GAS)

CAV	CIRCUIT	FUNCTION
1	A141 16DG/BK	FUEL PUMP RELAY OUTPUT
2	-	-
3	K226 20LB/YL	FUEL LEVEL SENSOR SIGNAL
4	K4 20BK/LB	SENSOR GROUND
5	-	-
6	Z1 16BK	GROUND



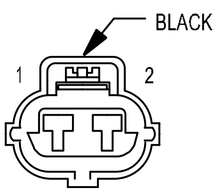
FUEL SENDER UNIT (DIESEL)

CAV	CIRCUIT	FUNCTION
1	-	-
2	-	-
3	K226 18LB/YL	FUEL LEVEL SENSOR SIGNAL
4	K4 18BK/LB	SENSOR GROUND
5	-	-
6	-	-



G-SWITCH

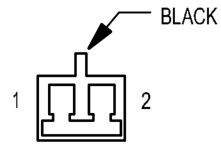
CAV	CIRCUIT	FUNCTION
1	B41 18YL/PK	G SWITCH NO. 1 SENSE
2	B43 18PK/OR	G SWITCH TEST SIGNAL
3	B42 18TN/WT	G SWITCH NO. 2 SENSE



GENERATOR

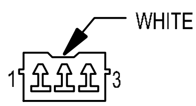
CAV	CIRCUIT	FUNCTION
1	K125 18WT/DB ●●	GENERATOR SOURCE
1	K21 18LB/RD ●	GENERATOR SOURCE
2	K20 18DG	GENERATOR FIELD DRIVER

● GAS
●● DIESEL



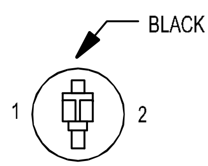
GLOVE BOX LAMP

CAV	CIRCUIT	FUNCTION
1	F70 20PK/BK	FUSED B(+)
2	M20 20BR/OR	INTERIOR LAMP DRIVER



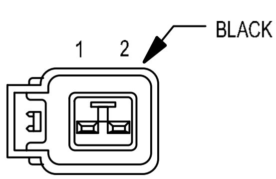
HEADLAMP LEVELING SWITCH (BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	L7 20BK/YL	PARK LAMP RELAY OUTPUT
3	L114 20VT/DB ■	HEADLAMP ADJUST SIGNAL
3	L114 20VT/YL ▲	HEADLAMP ADJUST SIGNAL



HOOD AJAR SWITCH

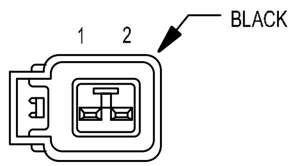
CAV	CIRCUIT	FUNCTION
1	G70 20BR/TN	HOOD AJAR SWITCH SENSE
2	Z1 20BK	GROUND



HORN NO. 1

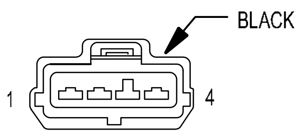
CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	X2 18DG/RD	HORN RELAY OUTPUT

▲ RHD
■ LHD



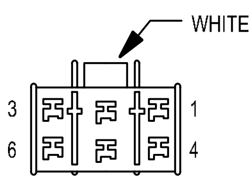
HORN NO. 2

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	X2 18DG/RD	HORN RELAY OUTPUT



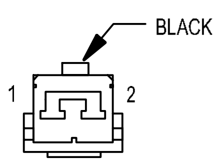
IDLE AIR CONTROL MOTOR

CAV	CIRCUIT	FUNCTION
1	K59 18VT/BK	IDLE AIR CONTROL NO. 4 DRIVER
2	K40 18BR/WT	IDLE AIR CONTROL NO. 3 DRIVER
3	K60 18YL/BK	IDLE AIR CONTROL NO. 2 DRIVER
4	K39 18GY/BK ••	IDLE AIR CONTROL NO. 1 DRIVER
4	K39 18GY/RD •	IDLE AIR CONTROL NO. 1 DRIVER



IGNITION SWITCH - C1

CAV	CIRCUIT	FUNCTION
1	A41 12YL	IGNITION SWITCH OUTPUT (START)
2	A2 12PK/BK	FUSED B(+)
3	A22 12BK/OR	IGNITION SWITCH OUTPUT (RUN)
4	A1 12RD	FUSED B(+)
5	A31 12RD/BK	IGNITION SWITCH OUTPUT (RUN-ACC)
6	A21 12DB	IGNITION SWITCH OUTPUT (ST-RUN)

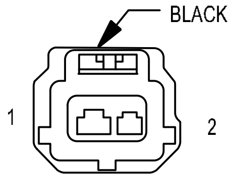


IGNITION SWITCH - C2

CAV	CIRCUIT	FUNCTION
1	G26 20LB	KEY-IN IGNITION SWITCH SENSE
2	Z1 20BK	GROUND

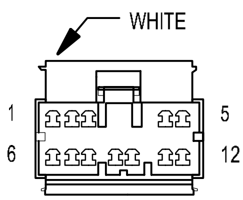
• 4.0L

•• 4.7L



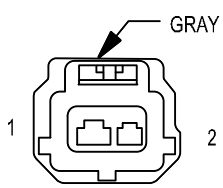
INPUT SPEED SENSOR (4.7L)

CAV	CIRCUIT	FUNCTION
1	T52 18RD/BK	INPUT SPEED SENSOR SIGNAL
2	T13 18DB/BK	SPEED SENSOR GROUND



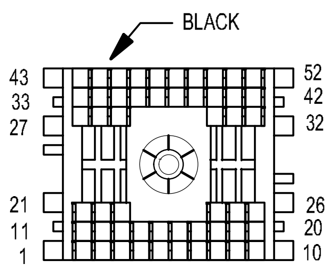
INSTRUMENT CLUSTER

CAV	CIRCUIT	FUNCTION
1	L61 20LG	LEFT TURN SIGNAL
2	L60 20TN	RIGHT TURN SIGNAL
3	-	-
4	G7 20WT/OR	VEHICLE SPEED SENSOR SIGNAL
5	G9 20GY/BK	RED BRAKE WARNING INDICATOR DRIVER
6	F33 20PK/RD	FUSED B(+)
7	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
8	-	-
9	Z1 20BK	GROUND
10	D25 20YL/VT/RD	PCI BUS
11	Z2 20BK/OR	GROUND
12	T107 20BK/RD	PART TIME 4 WHEEL DRIVE INDICATOR DRIVER



INTAKE AIR TEMPERATURE SENSOR

CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K21 18BK/RD	INTAKE AIR TEMPERATURE SENSOR SIGNAL



JUNCTION BLOCK - C1

CAV	CIRCUIT	FUNCTION
1	Q30 16TN	SUNROOF DELAY RELAY OUTPUT
2	L63 18DG/RD	LEFT TURN SIGNAL
3	-	-
4	-	-
5	L95 18DG/YL ■	REAR FOG LAMP RELAY OUTPUT
6	-	-
7	-	-
8	-	-
9	G73 20LG/OR	LIFTGATE COURTESY DISABLE
10	G77 20TN/OR	DOOR AJAR SWITCH SENSE
11	L7 18BK/YL	PARK LAMP RELAY OUTPUT
12	-	-
13	-	-
14	-	-
15	F35 16RD	FUSED B(+)
16	M2 20YL/DG ▲	COURTESY LAMP DRIVER
16	M2 18YL ●●	COURTESY LAMP DRIVER
17	-	-
18	-	-
19	G10 20LG/RD	SEAT BELT SWITCH SENSE
20	-	-
21	-	-
22	-	-
23	-	-
24	-	-
25	G78 20TN/BK	LIFTGATE AJAR SWITCH SENSE
26	M20 20YL/BK ▲	COURTESY LAMP DRIVER
26	M20 18YL/BK ●●	COURTESY LAMP DRIVER
27	-	-
28	-	-
29	-	-
30	-	-
31	-	-
32	-	-
33	-	-
34	-	-
35	L50 16WT/TN	FUSED B(+)
36	-	-
37	-	-
38	-	-
39	-	-
40	-	-
41	F30 14RD/YL ▲	CIGAR LIGHTER RELAY OUTPUT
41	F30 12RD ●●	CIGAR LIGHTER RELAY OUTPUT
42	-	-
43	-	-
44	-	-
45	-	-
46	-	-
47	F70 18PK	FUSED B(+)
48	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
49	-	-
50	C15 12BK/WT	REAR WINDOW DEFOGGER RELAY OUTPUT
51	-	-
52	-	-

▲ LHD
■ BUILT-UP-EXPORT
●● RHD

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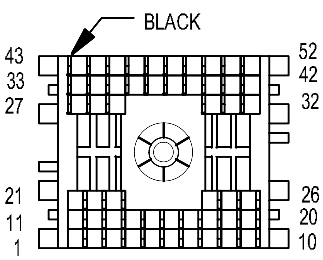
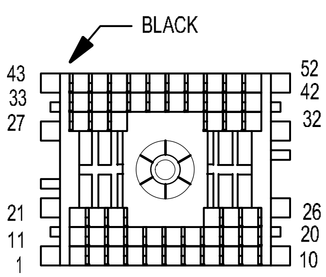


JUNCTION BLOCK - C2 (LHD)

CAV	CIRCUIT	FUNCTION
1	X4 22GY/OR	HORN RELAY CONTROL
2	G7 20WT/OR	VEHICLE SPEED SENSOR SIGNAL
3	L39 20LB	FOG LAMP RELAY OUTPUT
4	-	-
5	L61 20TN/LG	LEFT TURN SIGNAL
6	-	-
7	-	-
8	V6 16DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
9	V6 16DB •	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
10	L62 18BR/RD	RIGHT TURN SIGNAL
11	F991 20OR/DB •	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
12	L39 20LB	FOG LAMP RELAY OUTPUT
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	L7 20BK/YL	PARK LAMP RELAY OUTPUT
21	L7 20BK/YL	PARK LAMP RELAY OUTPUT
22	-	-
23	-	-
24	F37 16RD/LB	FUSED B(+)
25	F22 20WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
26	L60 20TN	RIGHT TURN SIGNAL
27	F45 20YL/RD	FUSED IGNITION SWITCH OUTPUT (ST)
28	V55 16TN/RD	WIPER PARK SWITCH SENSE
29	-	-
30	-	-
31	A148 16VT	FUSED B(+)
32	M1 20PK/RD	FUSED B(+)
33	V55 16TN/RD •	WIPER PARK SWITCH SENSE
34	-	-
35	-	-
36	F21 12TN/BK	FUSED B(+)
37	-	-
38	L34 18RD/OR	FUSED RIGHT HIGH BEAM OUTPUT
39	L43 18VT	FUSED LEFT LOW BEAM OUTPUT
40	-	-
41	-	-
42	F20 18DB/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
43	F99 20OR	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
44	-	-
45	F21 12TN/LB	FUSED B(+)
46	-	-
47	F32 20PK/DB	FUSED B(+)
48	-	-
49	L44 18VT/RD	FUSED RIGHT LOW BEAM OUTPUT
50	L33 18RD	FUSED LEFT HIGH BEAM OUTPUT
51	-	-
52	F60 14RD/WT	FUSED B(+)

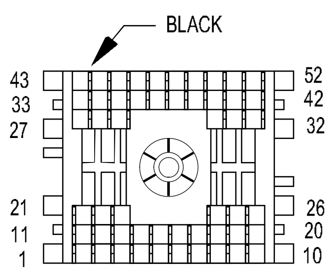
• GAS



JUNCTION BLOCK - C2 (RHD)

CAV	CIRCUIT	FUNCTION
1	X4 22GY/OR	HORN RELAY CONTROL
2	G7 20WT/OR	VEHICLE SPEED SENSOR SIGNAL
3	L39 20LB	FOG LAMP RELAY OUTPUT
4	-	-
5	L61 20TN/LG	LEFT TURN SIGNAL
6	-	-
7	-	-
8	V6 16DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
9	V6 16DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
10	L62 20BR/RD	RIGHT TURN SIGNAL
11	F991 20OR/DB	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
12	L39 20LB	FOG LAMP RELAY OUTPUT
13	-	-
14	-	-
15	-	-
16	-	-
17	-	-
18	-	-
19	-	-
20	L7 20BK/YL	PARK LAMP RELAY OUTPUT
21	L7 18BK/YL	PARK LAMP RELAY OUTPUT
22	-	-
23	-	-
24	F37 16RD/LB	FUSED B(+)
25	F22 18WT/TN	FUSED IGNITION SWITCH OUTPUT (RUN)
26	L60 20TN	RIGHT TURN SIGNAL
27	F45 20YL/RD	FUSED IGNITION SWITCH OUTPUT (ST)
28	V55 16TN/RD	WIPER PARK SWITCH SENSE
29	-	-
30	-	-
31	A148 16VT	FUSED B(+)
32	M1 20PK/RD	FUSED B(+)
33	V55 16TN/RD	WIPER PARK SWITCH SENSE
34	-	-
35	-	-
36	F21 12TN	FUSED B(+)
37	-	-
38	L34 18RD/OR	FUSED RIGHT HIGH BEAM OUTPUT
39	L43 18VT	FUSED LEFT LOW BEAM OUTPUT
40	-	-
41	-	-
42	F20 18DB/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
43	F99 20OR	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
44	-	-
45	F21 12TN	FUSED B(+)
46	-	-
47	F32 20PK/DB	FUSED B(+)
48	-	-
49	L44 18VT/RD	FUSED RIGHT LOW BEAM OUTPUT
50	L33 18RD	FUSED LEFT HIGH BEAM OUTPUT
51	-	-
52	F60 16RD/WT	FUSED B(+)

CAV	CIRCUIT	FUNCTION
1	F22 20WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
2	-	-
3	L60 20TN	RIGHT TURN SIGNAL
4	L302 20LB/YL ▲	RIGHT TURN SWITCH SENSE
4	L302 18LB/YL ▼	RIGHT TURN SWITCH SENSE
5	L61 20LG	LEFT TURN SIGNAL
6	L91 20DB/PK	HAZARD SWITCH SENSE
7	-	-
8	L305 20LB/WT ▲	LEFT TURN SWITCH SENSE
8	L305 18LB/WT ▼	LEFT TURN SWITCH SENSE
9	-	-
10	L11 22PK/LG	HIGH BEAM RELAY CONTROL
11	F23 18DB/YL	FUSED IGNITION SWITCH OUTPUT (RUN)
12	F22 20WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
13	-	-
14	A148 16VT	FUSED B(+)
15	C15 20BK/WT	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
16	-	-
17	-	-
18	-	-
19	-	-
20	G7 20WT/OR	VEHICLE SPEED SENSOR SIGNAL
21	-	-
22	-	-
23	-	-
24	A31 12RD/BK	IGNITION SWITCH OUTPUT (RUN-ACC)
25	F60 16RD/WT	FUSED B(+)
26	-	-
27	A41 12YL	IGNITION SWITCH OUTPUT (START)
28	F14 18LG/YL	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
29	A22 12BK/OR	IGNITION SWITCH OUTPUT (RUN)
30	-	-
31	Z1 20BK	GROUND
32	F33 20PK/RD	FUSED B(+)
33	X12 16WT/RD ▲	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
33	X12 18RD/WT ▼	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
34	M1 20PK	FUSED B(+)
35	M1 20PK ■	FUSED B(+)
36	A21 12DB	IGNITION SWITCH OUTPUT (ST-RUN)
37	-	-
38	F70 20PK/BK	FUSED B(+)
39	X4 20GY/OR ▼	HORN RELAY CONTROL
39	X4 22GY/OR ▲	HORN RELAY CONTROL
40	F30 18RD	FUSED CIGAR LIGHTER RELAY OUTPUT
41	F33 20PK/RD	FUSED B(+)
42	-	-
43	V23 20BR/PK	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
44	M1 20PK	FUSED B(+)
45	Z2 20BK/OR	GROUND
46	-	-
47	-	-
48	F70 20PK/BK	FUSED B(+)
49	-	-
50	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
51	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
52	F99 20OR	FUSED IGNITION SWITCH OUTPUT (ST-RUN)



JUNCTION BLOCK - C3

■ AZC
▲ LHD
▼ RHD

J998W-19

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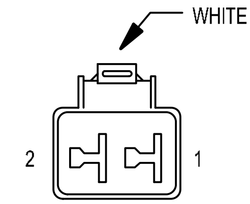
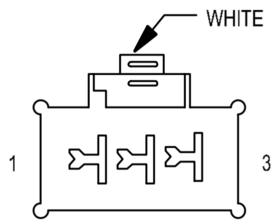


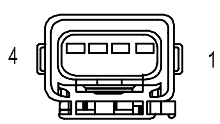
JUNCTION BLOCK - C4

CAV	CIRCUIT	FUNCTION
1	A148 10PK/WT	FUSED B(+)
2	A146 10OR/WT	FUSED B(+)



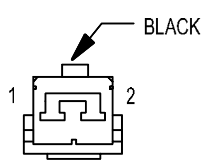
JUNCTION BLOCK - C5

CAV	CIRCUIT	FUNCTION
1	A145 10WT/RD	FUSED B(+)
2	A149 12RD/TN	FUSED B(+)
3	A147 10RD/GY	FUSED B(+)



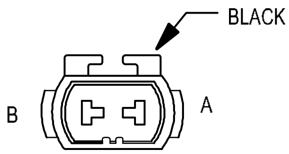
LEAK DETECTION PUMP (EXCEPT BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	-	-
2	F142 18OR/DG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
3	K106 20WT/DG	LEAK DETECTION PUMP SOLENOID CONTROL
4	K107 20OR/PK	LEAK DETECTION PUMP SWITCH SENSE



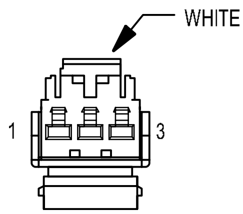
LEFT COURTESY LAMP

CAV	CIRCUIT	FUNCTION
1	F70 20PK/BK	FUSED B(+)
2	M2 20YL	COURTESY LAMP DRIVER



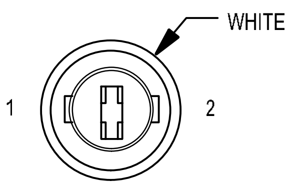
LEFT FOG LAMP

CAV	CIRCUIT	FUNCTION
A	L39 20LB	FOG LAMP RELAY OUTPUT
B	Z1 20BK	GROUND



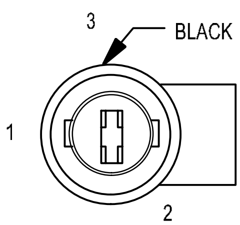
LEFT FRONT DOOR SPEAKER

CAV	CIRCUIT	FUNCTION
1	X85 18LG/DG	LEFT FRONT DOOR SPEAKER (-)
2	-	-
3	X87 18LG/RD	LEFT FRONT DOOR SPEAKER (+)



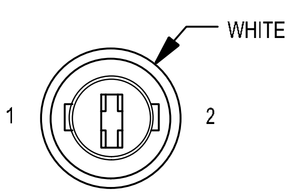
LEFT FRONT PARK LAMP

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	L7 20BK/PK	PARK LAMP RELAY OUTPUT



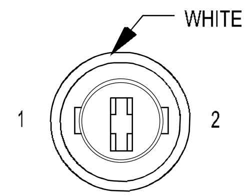
LEFT FRONT PARK/TURN SIGNAL LAMP (EXCEPT BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	L7 20BK/PK	PARK LAMP RELAY CONTROL
2	Z1 18BK	GROUND
3	L61 20DG	LEFT TURN SIGNAL



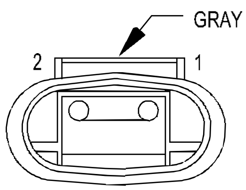
LEFT FRONT SIDE MARKER LAMP (EXCEPT BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	L7 20BK/PK	PARK LAMP RELAY OUTPUT
2	L61 20DG	LEFT TURN SIGNAL



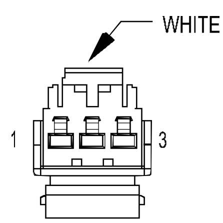
LEFT FRONT TURN SIGNAL LAMP (BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	L61 20DG	FUSED B(+)
2	Z1 18BK	GROUND



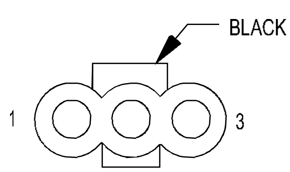
LEFT FRONT WHEEL SPEED SENSOR

CAV	CIRCUIT	FUNCTION
1	B8 18RD/DB	LEFT FRONT WHEEL SPEED SENSOR (-)
2	B9 18RD	LEFT FRONT WHEEL SPEED SENSOR (+)



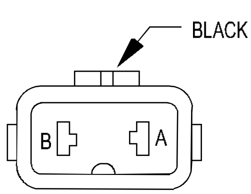
LEFT HANDLE COURTESY LAMP

CAV	CIRCUIT	FUNCTION
1	F70 20PK	FUSED B(+)
2	M20 20YL/BK	COURTESY LAMP DRIVER
3	M2 20YL/DG	COURTESY LAMP DRIVER



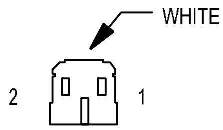
LEFT HEADLAMP LEVELING MOTOR

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	L114 18YL	HEADLAMP ADJUST SIGNAL
3	L7 20BK/PK	PARK LAMP RELAY OUTPUT



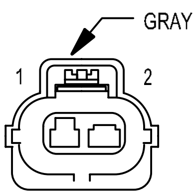
LEFT HIGH BEAM HEADLAMP

CAV	CIRCUIT	FUNCTION
A	Z1 18BK	GROUND
B	L33 18WT	FUSED LEFT HIGH BEAM OUTPUT



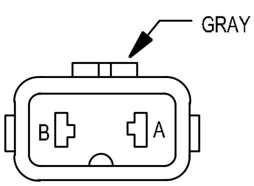
LEFT INSTRUMENT PANEL SPEAKER

CAV	CIRCUIT		FUNCTION
1	X83 18YL/RD	•	LEFT INSTRUMENT PANEL SPEAKER (+)
1	X81 18YL/BK	••	LEFT INSTRUMENT PANEL SPEAKER (+)
2	X81 18YL/BK	•	LEFT INSTRUMENT PANEL SPEAKER (-)
2	X83 18YL/RD	••	LEFT INSTRUMENT PANEL SPEAKER (-)



LEFT LIFTGATE AJAR SWITCH

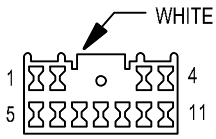
CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	G78 20TN/BK	LIFTGATE AJAR SWITCH SENSE



LEFT LOW BEAM HEADLAMP

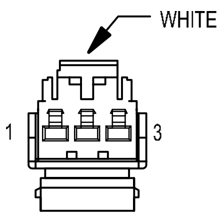
CAV	CIRCUIT	FUNCTION
A	Z1 18BK	GROUND
B	L43 18BR	FUSED LEFT LOW BEAM HEADLAMP

• LHD
•• RHD



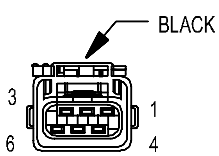
LEFT MULTI-FUNCTION SWITCH

CAV	CIRCUIT		FUNCTION
1	L27 22WT/TN		FOG LAMP SWITCH SENSE
2	Z1 20BK		GROUND
3	-		-
4	L80 20WT/DG		HEADLAMP SWITCH RETURN
5	L11 22PK/LG		HIGH BEAM RELAY CONTROL
6	L40 22BR		HIGH BEAM SWITCH SENSE
7	L302 18LB/YL	●	RIGHT TURN SWITCH SENSE
7	L302 20LB/YL	●●	RIGHT TURN SWITCH SENSE
8	L305 18LB/WT	●	LEFT TURN SWITCH SENSE
8	L305 20LB/WT	●●	LEFT TURN SWITCH SENSE
9	L91 20DB/PK		COMBINATION FLASHER SWITCHED GROUND
10	E19 20RD		PANEL LAMPS DIMMER SIGNAL
11	G52 20YL		HEADLAMP SWITCH MUX



LEFT REAR DOOR SPEAKER

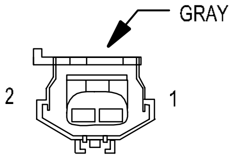
CAV	CIRCUIT	FUNCTION
1	X93 18WT/VT	LEFT REAR DOOR SPEAKER (-)
2	-	-
3	X91 18TN/DG	LEFT REAR DOOR SPEAKER (+)



LEFT REAR LAMP ASSEMBLY

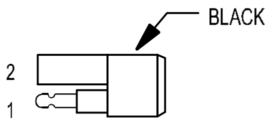
CAV	CIRCUIT		FUNCTION
1	L1 18VT/BK		BACK-UP LAMP FEED
2	L95 18DG/YL	■	REAR FOG LAMP RELAY OUTPUT
3	L7 18BK/YL		PARK LAMP RELAY OUTPUT
4	L63 18DG/RD		LEFT TURN SIGNAL
5	Z1 18BK		GROUND
6	L50 18WT/TN		BRAKE LAMP SWITCH OUTPUT

● RHD
●● LHD
■ BUILT-UP-EXPORT



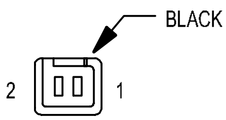
LEFT REAR WHEEL SPEED SENSOR

CAV	CIRCUIT	FUNCTION
1	B3 18LG/DB	LEFT REAR WHEEL SPEED SENSOR (-)
2	B4 18LG	LEFT REAR WHEEL SPEED SENSOR (+)



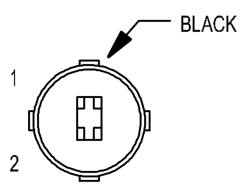
LEFT SIDE REPEATER

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	L61 18TN/LG	LEFT TURN SIGNAL



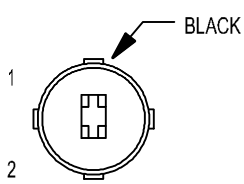
LEFT VISOR/ VANITY LAMP

CAV	CIRCUIT	FUNCTION
1	F70 20PK	FUSED B(+)
2	M20 20YL/BK	COURTESY LAMP DRIVER



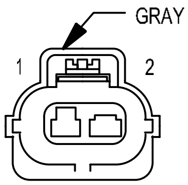
LICENSE LAMP NO. 1

CAV	CIRCUIT	FUNCTION
1	L7 18BK/YL	PARK LAMP RELAY OUTPUT
2	Z1 18BK	GROUND



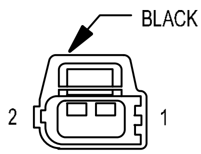
LICENSE LAMP NO. 2

CAV	CIRCUIT	FUNCTION
1	L7 18BK/YL	PARK LAMP RELAY OUTPUT
2	Z1 18BK	GROUND



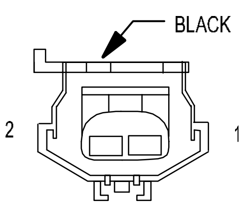
LIFTGATE
FLIP-UP
AJAR SWITCH

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	G78 20TN/BK	LIFTGATE AJAR SWITCH SENSE



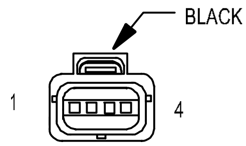
LIFTGATE
FLIP-UP
PUSH BUTTON
SWITCH

CAV	CIRCUIT	FUNCTION
1	P100 18OR/BR	LIFTGATE FLIP-UP SWITCH OUTPUT
2	P101 18OR/PK	LIFTGATE LOCK LIMIT SWITCH OUTPUT



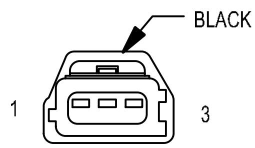
LIFTGATE
FLIP-UP
RELEASE
SOLENOID

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	P100 18OR/BR	LIFTGATE FLIP-UP



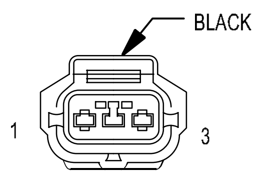
LIFTGATE LOCK MOTOR

CAV	CIRCUIT	FUNCTION
1	P35 18OR/VT	DOOR LOCK DRIVER
2	P36 18PK/VT	DOOR UNLOCK DRIVER
3	F70 18PK	FUSED B(+)
4	P101 18OR/PK	LIFTGATE GLASS LIMIT SWITCH OUTPUT



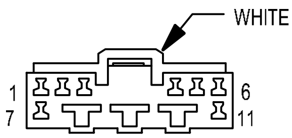
MANIFOLD ABSOLUTE PRESSURE SENSOR (4.0L)

CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K1 18DG/RD	MAP SENSOR SIGNAL
3	K7 20OR	5V SUPPLY



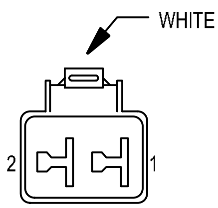
MANIFOLD ABSOLUTE PRESSURE SENSOR (4.7L)

CAV	CIRCUIT	FUNCTION
1	K7 20OR	5V SUPPLY
2	K4 18BK/LB	SENSOR SIGNAL
3	K1 18DG/RD	MAP SENSOR SIGNAL



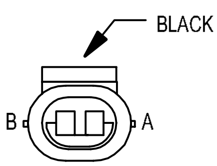
MANUAL TEMPERATURE CONTROL - C1

CAV	CIRCUIT	FUNCTION
1	C103 20DG	A/C SWITCH SIGNAL
2	Z2 20BK/OR	GROUND
3	C67 20RD/LB	BLEND AIR DOOR POSITION CONTROL
4	C15 20BK/WT	FUSED REAR WINDOW DEFOGGER RELAY OUTPUT
5	C15 20BK/WT	REAR WINDOW DEFOGGER SWITCH SENSE
6	F22 20WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
7	E2 20OR	PANEL LAMPS DRIVER
8	C4 16TN	BLOWER MOTOR LOW DRIVER
9	C5 16LG	BLOWER MOTOR M1 DRIVER
10	C6 14LB	BLOWER MOTOR M2 DRIVER
11	-	-



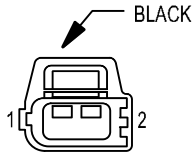
MANUAL TEMPERATURE CONTROL - C2

CAV	CIRCUIT	FUNCTION
1	C7 12BK/TN	BLOWER MOTOR HIGH DRIVER
2	Z1 12BK	GROUND



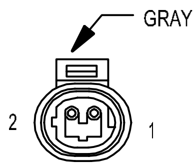
MODE DOOR MOTOR/ ACTUATOR (AZC)

CAV	CIRCUIT	FUNCTION
A	C35 20YL	MODE DOOR DRIVER (A)
B	C102 20TN/BK	MODE DOOR DRIVER (B)



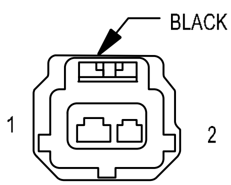
NEEDLE MOVEMENT SENSOR

CAV	CIRCUIT	FUNCTION
1	K67 18BR/BK	NEEDLE MOVEMENT SENSOR (+)
2	K68 18LG/YL	NEEDLE MOVEMENT SENSOR (-)



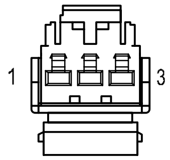
OUTPUT SPEED SENSOR (4.0L/DIESEL)

CAV	CIRCUIT	FUNCTION
1	T13 18DB/BK	SPEED SENSOR GROUND
2	T14 18LG/WT	OUTPUT SPEED SENSOR SIGNAL



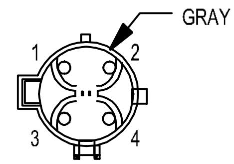
OUTPUT SPEED SENSOR (4.7L)

CAV	CIRCUIT	FUNCTION
1	T14 18LG/WT	OUTPUT SPEED SENSOR SIGNAL
2	T13 18DB/BK	SPEED SENSOR GROUND



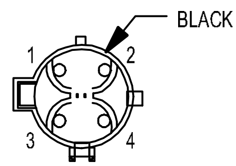
OVERHEAD MAP/ COURTESY LAMP

CAV	CIRCUIT	FUNCTION
1	F70 20PK	FUSED B(+)
2	M20 20YL/BK	COURTESY LAMP DRIVER
3	M2 20YL/DG	COURTESY LAMP DRIVER



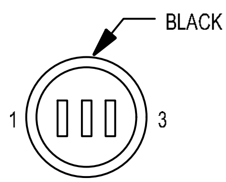
OXYGEN SENSOR 1/1 UPSTREAM

CAV	CIRCUIT	FUNCTION
1	F142 18OR/DG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
2	Z1 18BK	GROUND
3	K4 18BK/LB	SENSOR GROUND
4	K241 18LG/RD	OXYGEN SENSOR 1/1 SIGNAL



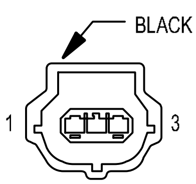
OXYGEN SENSOR 1/2 DOWNSTREAM

CAV	CIRCUIT	FUNCTION
1	F142 18OR/DG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
2	Z1 18BK	GROUND
3	K4 18BK/LB	SENSOR GROUND
4	K41 18BK/DG	OXYGEN SENSOR 1/2 SIGNAL



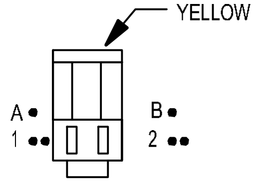
PARK/NEUTRAL POSITION SWITCH (4.0L GAS)

CAV	CIRCUIT	FUNCTION
1	L1 18VT/BK	BACK-UP LAMP FEED
2	T24 18BR/YL	ENGINE STARTER MOTOR RELAY CONTROL
3	F22 18WT/TN	FUSED IGNITION SWITCH OUTPUT (RUN)



PARK/NEUTRAL POSITION SWITCH (DIESEL)

CAV	CIRCUIT	FUNCTION
1	L1 18VT/BK	BACK-UP LAMP FEED
2	T24 18BR/YL	ENGINE STARTER MOTOR RELAY CONTROL
3	F22 18WT/TN	FUSED IGNITION SWITCH OUTPUT (RUN)

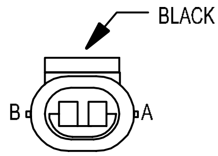


PASSENGER AIRBAG

CAV	CIRCUIT	FUNCTION
1	R42 18BK/YL ••	PASSENGER AIRBAG LINE 1
A	R44 18DG/YL •	PASSENGER AIRBAG LINE 1
2	R44 18DG/YL ••	PASSENGER AIRBAG LINE 2
B	R42 18BK/YL •	PASSENGER AIRBAG LINE 2

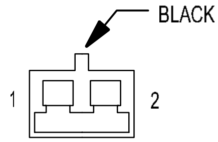
• BUILT-UP-EXPORT
•• EXCEPT BUILT-UP-EXPORT

WG008073 J998W-19



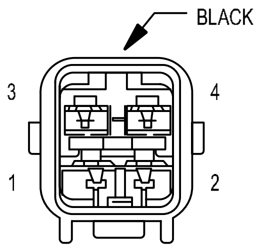
PASSENGER
BLEND DOOR MOTOR/
ACTUATOR
(AZC)

CAV	CIRCUIT	FUNCTION
A	C94 20VT/WT	PASSENGER BLEND DOOR DRIVER (A)
B	C96 20PK/DG	PASSENGER BLEND DOOR DRIVER (B)



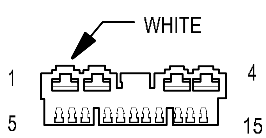
PASSENGER
DOOR
COURTESY
LAMP

CAV	CIRCUIT	FUNCTION
1	M21 20PK/DG	COURTESY LAMP DRIVER
2	L121 20BK/RD	COURTESY LAMP GROUND



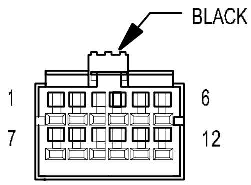
PASSENGER
DOOR LOCK
MOTOR/
AJAR SWITCH

CAV	CIRCUIT	FUNCTION
1	G74 18TN/RD	DOOR AJAR SWITCH SENSE
2	Z1 18BK	GROUND
3	P36 18PK/VT	DOOR UNLOCK DRIVER
4	P35 18OR/VT	DOOR LOCK DRIVER



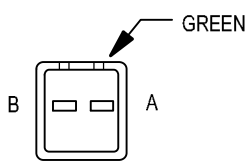
PASSENGER
DOOR
MODULE - C1

CAV	CIRCUIT	FUNCTION
1	F21 12TN/BK	FUSED B(+)
2	Q24 16DG	PASSENGER REAR WINDOW DRIVER DOWN
3	Q14 16GY	PASSENGER REAR WINDOW DRIVER UP
4	Z1 12BK	GROUND
5	P35 18OR/VT	DOOR LOCK DRIVER
6	-	-
7	P36 18PK/VT	DOOR UNLOCK DRIVER
8	-	-
9	D25 20YL/VT	PCI BUS
10	-	-
11	G74 18TN/RD	PASSENGER DOOR AJAR SWITCH SENSE
12	E20 20OR/DB	PASSENGER REAR DOOR SWITCH ILLUMINATION
13	Q12 16BR	PASSENGER WINDOW DRIVER (UP)
14	-	-
15	Q22 16VT	PASSENGER WINDOW DRIVER (DOWN)



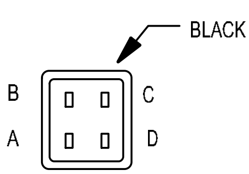
PASSENGER DOOR MODULE-C2

CAV	CIRCUIT	FUNCTION
1	P95 20OR	MIRROR HORIZONTAL DRIVER
2	C118 20BK/WT	MIRROR HEATER GROUND
3	P64 20VT	MIRROR VERTICAL POSITION SIGNAL
4	P69 20GY	MIRROR SENSOR GROUND
5	P65 20DG	MIRROR HORIZONTAL POSITION SIGNAL
6	C117 20BK	MIRROR HEATER 12V SUPPLY
7	P91 20WT	MIRROR COMMON DRIVER
8	P93 20RD	MIRROR VERTICAL DRIVER
9	M21 20PK/DG	COURTESY LAMP DRIVER
10	P110 20YL	POWER FOLDING MIRROR RETURN
11	P99 20DB	POWER FOLDING MIRROR FEED
12	L121 20BK/RD	COURTESY LAMP GROUND



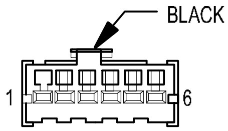
PASSENGER HEATED SEAT BACK (PREMIUM I/III)

CAV	CIRCUIT	FUNCTION
A	P88 16BK/BR	HEATED SEAT DRIVER
B	Z5 16BK/VT	GROUND



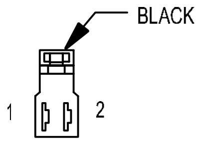
PASSENGER HEATED SEAT CUSHION (PREMIUM I/III)

CAV	CIRCUIT	FUNCTION
A	P130 16DG/WT	PASSENGER SEAT HEATER B(+) DRIVER
B	P88 16BK/BR	HEATED SEAT DRIVER
C	P86 20DG/YL	PASSENGER SEAT TEMPERATURE SENSOR INPUT
D	P29 20BR/WT	SEAT SENSOR 5V SUPPLY



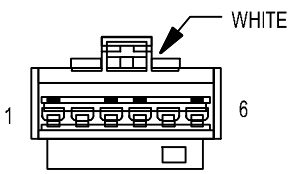
PASSENGER HEATED SEAT SWITCH

CAV	CIRCUIT	FUNCTION
1	P134 20LG/WT	PASSENGER SEAT HEATER SWITCH MUX
2	E2 20OR	PANEL LAMPS DRIVER
3	F22 20WT/PK	FUSED IGNITION SWITCH OUTPUT (RUN)
4	-	-
5	Z1 20BK	GROUND
6	P132 20OR/BK	SEAT HEATER SWITCH SENSOR GROUND



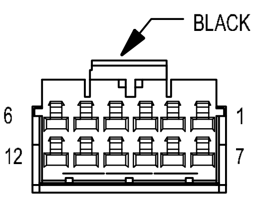
PASSENGER LUMBAR MOTOR (MIDLINE/PREMIUM)

CAV	CIRCUIT	FUNCTION
1	P104 16YL/RD	LUMBAR REARWARD SWITCH SENSE
2	P105 16LG/DB	LUMBAR FORWARD SWITCH SENSE



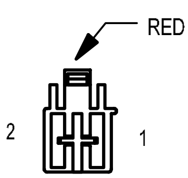
PASSENGER LUMBAR SWITCH (MIDLINE/PREMIUM)

CAV	CIRCUIT	FUNCTION
1	-	-
2	Z1 16BK	GROUND
3	P105 16LG/DB ••	LUMBAR FORWARD SWITCH SENSE
3	P104 16YL/RD •	LUMBAR REARWARD SWITCH SENSE
4	P104 16YL/RD ••	LUMBAR REARWARD SWITCH SENSE
4	P105 16LG/DB •	LUMBAR FORWARD SWITCH SENSE
5	Z1 16BK	GROUND
6	F37 16RD/LB	FUSED B(+)



PASSENGER POWER MIRROR

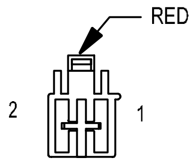
CAV	CIRCUIT	FUNCTION
1	P95 20OR	MIRROR HORIZONTAL DRIVER
2	C118 20BK/WT	MIRROR HEATER GROUND
3	P64 20VT	MIRROR VERTICAL POSITION SIGNAL
4	P69 20GY	MIRROR SENSOR GROUND
5	P65 20DG	MIRROR HORIZONTAL POSITION SIGNAL
6	C117 20BK	MIRROR HEATER 12V SUPPLY
7	P91 20WT	MIRROR COMMON DRIVER
8	P93 20RD	MIRROR VERTICAL DRIVER
9	-	-
10	P110 20YL ▲	POWER FOLDING MIRROR RETURN
11	P99 20DB ▲	POWER FOLDING MIRROR FEED
12	-	-



PASSENGER POWER SEAT FRONT RISER MOTOR

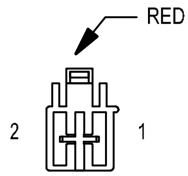
CAV	CIRCUIT	FUNCTION
1	P18 16YL/LG	PASSENGER SEAT FRONT UP DRIVER
2	P20 16RD/LG	PASSENGER SEAT FRONT DOWN DRIVER

•• LHD
• RHD
▲ BUILT-UP-EXPORT



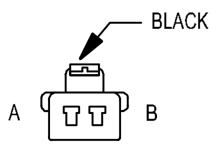
PASSENGER POWER SEAT HORIZONTAL MOTOR

CAV	CIRCUIT	FUNCTION
1	P16 16RD/YL	PASSENGER SEAT HORIZONTAL REARWARD DRIVER
2	P14 16YL/LB	PASSENGER SEAT HORIZONTAL FORWARD DRIVER



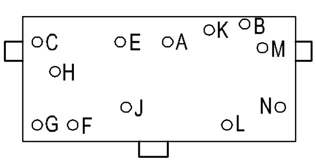
PASSENGER POWER SEAT REAR RISER MOTOR

CAV	CIRCUIT	FUNCTION
1	P10 16YL/WT	PASSENGER SEAT REAR UP DRIVER
2	P12 16RD/WT	PASSENGER SEAT REAR DOWN DRIVER



PASSENGER POWER SEAT RECLINER MOTOR (MIDLINE/PREMIUM)

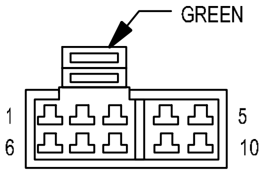
CAV	CIRCUIT	FUNCTION
A	P42 16BR/WT	PASSENGER SEAT RECLINER DRIVER DOWN
B	P44 16GY/LB	PASSENGER SEAT RECLINER DRIVER UP



PASSENGER POWER SEAT SWITCH (BASE)

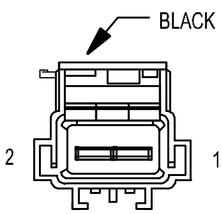
CAV	CIRCUIT	FUNCTION
A	F37 16RD/LB	FUSED B(+)
B	Z1 16BK	GROUND
C	-	-
D	-	-
E	P18 16YL/LG ••	PASSENGER SEAT FRONT UP DRIVER
E	P20 16RD/LG •	PASSENGER SEAT FRONT DOWN DRIVER
F	-	-
G	-	-
H	-	-
I	-	-
J	P20 16RD/LG ••	PASSENGER SEAT FRONT DOWN DRIVER
J	P18 16YL/LG •	PASSENGER SEAT FRONT UP DRIVER
K	P14 16YL/LB	PASSENGER SEAT HORIZONTAL FORWARD DRIVER
L	P16 16RD/YL	PASSENGER SEAT HORIZONTAL REARWARD DRIVER
M	P10 16YL/WT ••	PASSENGER SEAT REAR UP DRIVER
M	P12 16RD/WT •	PASSENGER SEAT REAR DOWN DRIVER
N	P12 16RD/WT ••	PASSENGER SEAT REAR DOWN DRIVER
N	P10 16YL/WT •	PASSENGER SEAT REAR UP DRIVER

•• LHD
• RHD



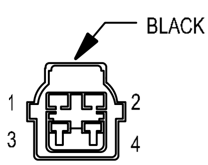
PASSENGER POWER SEAT SWITCH (MIDLINE/PREMIUM)

CAV	CIRCUIT	FUNCTION
1	Z1 16BK	GROUND
2	P44 16GY/LB	PASSENGER SEAT RECLINER DRIVER UP
3	P16 16RD/YL	PASSENGER SEAT HORIZONTAL REARWARD DRIVER
4	P42 16BR/WT	PASSENGER SEAT RECLINER DOWN DRIVER
5	F37 16RD/LB	FUSED B(+)
6	P14 16YL/LB	PASSENGER SEAT HORIZONTAL FORWARD DRIVER
7	P20 16RD/LG ••	PASSENGER SEAT FRONT DOWN DRIVER
7	P18 16YL/LG •	PASSENGER SEAT FRONT UP DRIVER
8	P12 16RD/WT ••	PASSENGER SEAT REAR DOWN DRIVER
8	P10 16YL/WT •	PASSENGER SEAT REAR UP DRIVER
9	P10 16YL/WT ••	PASSENGER SEAT REAR UP DRIVER
9	P12 16RD/WT •	PASSENGER SEAT REAR DOWN DRIVER
10	P18 16YL/LG ••	PASSENGER SEAT FRONT UP DRIVER
10	P20 16RD/LG •	PASSENGER SEAT FRONT DOWN DRIVER



PASSENGER POWER WINDOW MOTOR

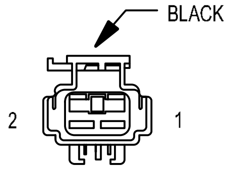
CAV	CIRCUIT	FUNCTION
1	Q22 16VT	PASSENGER WINDOW DRIVER DOWN
2	Q12 16BR	PASSENGER WINDOW DRIVER UP



PASSENGER REAR DOOR LOCK MOTOR/AJAR SWITCH

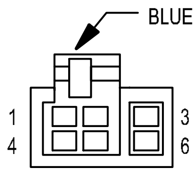
CAV	CIRCUIT	FUNCTION
1	G76 18TN/YL	DOOR AJAR SWITCH SENSE
2	Z1 18BK	GROUND
3	P36 18PK/VT	DOOR UNLOCK DRIVER
4	P35 18OR/VT	DOOR LOCK DRIVER

•• LHD
• RHD



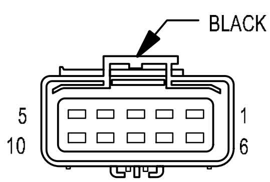
PASSENGER REAR POWER WINDOW MOTOR

CAV	CIRCUIT	FUNCTION
1	Q124 16DG/WT	WINDOW DRIVER DOWN
2	Q114 16GY/WT	WINDOW DRIVER UP



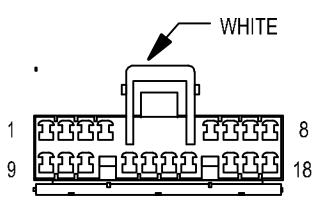
PASSENGER REAR POWER WINDOW SWITCH

CAV	CIRCUIT	FUNCTION
1	Q14 16GY •	PASSENGER REAR WINDOW DRIVER UP
1	Q13 16GY ••	PASSENGER REAR WINDOW DRIVER UP
2	Q114 16GY/WT	WINDOW DRIVER UP
3	E20 20OR/DB •	RIGHT REAR DOOR SWITCH ILLUMINATION
3	E21 20OR/DB ••	RIGHT REAR DOOR SWITCH ILLUMINATION
4	Q24 16DG •	PASSENGER REAR WINDOW DRIVER DOWN
4	Q23 16DG ••	PASSENGER REAR WINDOW DRIVER DOWN
5	Q124 16DG/WT	WINDOW DRIVER DOWN
6	Z1 16BK	GROUND



PEDAL POSITION SENSOR (DIESEL)

CAV	CIRCUIT	FUNCTION
1	-	-
2	K7 18OR	5V SUPPLY
3	K101 18WT	THROTTLE POSITION SENSOR SIGNAL
4	K4 20BK/LB	SENSOR GROUND
5	K151 18WT/RD	LOW IDLE POSITION SWITCH
6	-	-
7	K167 18BR	SENSOR RETURN
8	K255 18WT/DB	PEDAL POSITION SENSOR
9	-	-
10	K440 18VT/WT	5V SUPPLY



POWER AMPLIFIER - C1

CAV	CIRCUIT	FUNCTION
1	-	-
2	F60 16RD/WT	FUSED B(+)
3	Z1 16BK	GROUND
4	-	-
5	X58 18DB/OR	RIGHT REAR SPEAKER (-)
6	X57 18DG/WT	LEFT REAR SPEAKER (-)
7	X56 18DB/PK	RIGHT FRONT SPEAKER (-)
8	X55 18BR/RD	LEFT FRONT SPEAKER (-)
9	-	-
10	F60 16RD/WT	FUSED B(+)
11	Z1 16BK	GROUND
12	-	-
13	X64 18BR/WT	ENABLE SIGNAL TO AMPLIFIER
14	-	-
15	X52 18DB/WT	RIGHT REAR SPEAKER (+)
16	X51 18WT/DG	LEFT REAR SPEAKER (+)
17	X54 18VT	RIGHT FRONT SPEAKER (+)
18	X53 18DG/OR	LEFT FRONT SPEAKER (+)

• LHD
•• RHD

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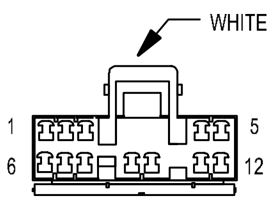
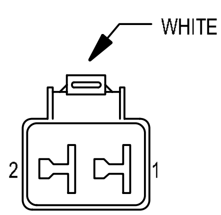


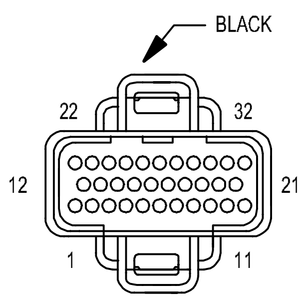
POWER AMPLIFIER - C2

CAV	CIRCUIT	FUNCTION
1	X90 18WT/VT	RIGHT REAR DOOR SPEAKER (+)
2	X92 18TN/DG	RIGHT REAR DOOR SPEAKER (-)
3	X85 18LG/DG	LEFT FRONT DOOR SPEAKER (-)
4	X83 18YL/RD	LEFT INSTRUMENT PANEL SPEAKER (+)
5	X84 18OR/GY	RIGHT INSTRUMENT PANEL SPEAKER (-)
6	X93 18DG/WT	LEFT REAR DOOR SPEAKER (+)
7	X91 18WT/DG	LEFT REAR DOOR SPEAKER (-)
8	X87 18LG/RD	LEFT FRONT DOOR SPEAKER (+)
9	X80 18LB/BK	RIGHT FRONT DOOR SPEAKER (-)
10	X82 18LB/RD	RIGHT FRONT DOOR SPEAKER (+)
11	X81 18YL/BK	LEFT INSTRUMENT PANEL SPEAKER (-)
12	X86 18OR/RD	RIGHT INSTRUMENT PANEL SPEAKER (+)



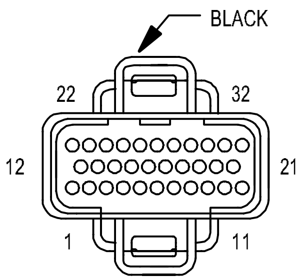
POWER CONNECTOR

CAV	CIRCUIT	FUNCTION
1	A148 16VT	FUSED B (+)
2	Z1 16BK	GROUND



POWERTRAIN CONTROL MODULE - C1 (DIESEL)

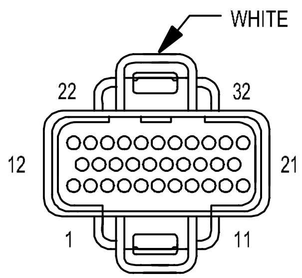
CAV	CIRCUIT	FUNCTION
1	-	-
2	A142 14DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
3	-	-
4	K4 18BK/LB	SENSOR GROUND
5	-	-
6	T24 18BR/YL	ENGINE STARTER MOTOR RELAY CONTROL
7	-	-
8	K159 18GY	ENGINE SPEED SENSOR SIGNAL
9	-	-
10	-	-
11	-	-
12	-	-
13	-	-
14	-	-
15	-	-
16	K222 18TN/RD	SECONDARY ENGINE COOLANT TEMPERATURE SENSOR
17	K7 18OR	5V SUPPLY
18	G8 18LB/BK	FUEL MONITOR OUTPUT SIGNAL
19	-	-
20	-	-
21	-	-
22	A14 16RD/WT	FUSED B(+)
23	K101 18WT	THROTTLE POSITION SENSOR OUTPUT
24	-	-
25	-	-
26	-	-
27	G123 18DG/WT	WATER IN FUEL SENSE
28	-	-
29	-	-
30	-	-
31	Z12 14BK/TN	GROUND
32	Z12 14BK/TN	GROUND



POWERTRAIN CONTROL MODULE - C1 (GAS)

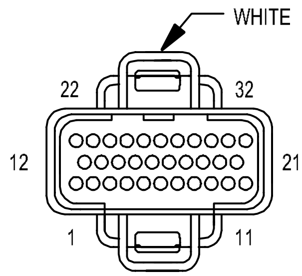
CAV	CIRCUIT		FUNCTION
1	K93 16TN/OR	•	COIL DRIVER NO. 3
1	K93 14TN/OR	••	COIL DRIVER NO. 3
2	F991 18OR/DB		FUSED IGNITION SWITCH OUTPUT (ST-RUN)
3	K94 14TN/LG	••	COIL DRIVER NO. 4
4	K4 18BK/LB		SENSOR GROUND
5	K96 14TN/LB	••	COIL DRIVER NO. 6
6	T24 18BR/YL		ENGINE STARTER MOTOR RELAY CONTROL
7	K91 16TN/RD	•	COIL DRIVER NO. 1
7	K91 14TN/RD	••	COIL DRIVER NO. 1
8	K24 18GY/BK		CRANKSHAFT POSITION SENSOR SIGNAL
9	K98 14LB/RD	••	COIL DRIVER NO. 8
10	K60 18YL/BK		IDLE AIR CONTROL NO. 2 DRIVER
11	K40 18BR/WT		IDLE AIR CONTROL NO. 3 DRIVER
12	-		-
13	-		-
14	-		-
15	K21 18BK/RD		INTAKE AIR TEMPERATURE SENSOR SIGNAL
16	K2 18TN/BK		ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
17	K7 18OR		5V SUPPLY
18	K44 18TN/YL		CAMSHAFT POSITION SENSOR SIGNAL
19	K39 18GY/RD	•	IDLE AIR CONTROL NO. 1 DRIVER
19	K39 18GY/BK	••	IDLE AIR CONTROL NO. 1 DRIVER
20	K59 18VT/BK		IDLE AIR CONTROL NO. 4 DRIVER
21	K95 14TN/DG	••	COIL DRIVER NO. 5
22	A7 14RD/BK		FUSED B(+)
23	K22 18OR/RD		THROTTLE POSITION SENSOR SIGNAL
24	K241 18LG/RD		OXYGEN SENSOR 1/1 SIGNAL
25	K41 18BK/DG		OXYGEN SENSOR 1/2 SIGNAL
26	-		-
27	K1 18DG/RD		MAP SENSOR SIGNAL
28	-		-
29	-		-
30	-		-
31	Z11 14BK/WT		GROUND
32	Z12 14BK/TN		GROUND

•• 4.7L
• 4.0L



POWERTRAIN CONTROL MODULE - C2 (DIESEL)

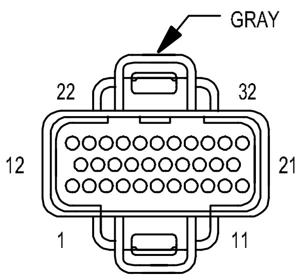
CAV	CIRCUIT	FUNCTION
1	T54 18VT	TRANSMISSION TEMPERATURE SENSOR SIGNAL
2	-	-
3	-	-
4	-	-
5	-	-
6	-	-
7	-	-
8	K88 18PK	GOVERNOR PRESSURE SOLENOID CONTROL
9	-	-
10	K20 18DG	GENERATOR FIELD DRIVER
11	T22 18DG/LB	TORQUE CONVERTER CLUTCH SOLENOID CONTROL
12	-	-
13	-	-
14	-	-
15	-	-
16	-	-
17	C24 18DB/PK	RADIATOR FAN RELAY CONTROL
18	-	-
19	-	-
20	-	-
21	T121 18BK/RD	3-4 SHIFT SOLENOID CONTROL
22	-	-
23	G60 18GY/YL	ENGINE OIL PRESSURE SENSOR SIGNAL
24	-	-
25	T14 18LG/WT	OUTPUT SPEED SENSOR SIGNAL
26	-	-
27	G7 18WT/OR	VEHICLE SPEED SENSOR SIGNAL
28	T13 18DB/BK	SPEED SENSOR GROUND
29	T25 18LG	GOVERNOR PRESSURE SENSOR SIGNAL
30	K30 18PK/YL	TRANSMISSION CONTROL RELAY CONTROL
31	K6 18VT/WT	5V SUPPLY
32	-	-



POWERTRAIN CONTROL MODULE - C2 (GAS)

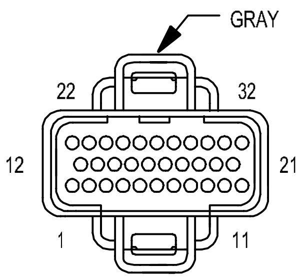
CAV	CIRCUIT		FUNCTION
1	T54 18VT	•	TRANSMISSION TEMPERATURE SENSOR SIGNAL
2	K17 18DB/TN	••	FUEL INJECTOR NO. 7 DRIVER
3	-		-
4	K11 18WT/DB		FUEL INJECTOR NO. 1 DRIVER
5	K13 18YL/WT		FUEL INJECTOR NO. 3 DRIVER
6	K38 18GY		FUEL INJECTOR NO. 5 DRIVER
7	K97 14BR	••	COIL DRIVER NO. 7
8	K88 18PK	•	GOVERNOR PRESSURE SOLENOID CONTROL
9	K92 16TN/PK	•	COIL DRIVER NO. 2
9	K92 14TN/PK	••	COIL DRIVER NO. 2
10	K20 18DG		GENERATOR FIELD DRIVER
11	T22 18DG/LB	•	TORQUE CONVERTER CLUTCH SOLENOID CONTROL
12	K58 18BR/DB		FUEL INJECTOR NO. 6 DRIVER
13	K18 18DB/GY	••	FUEL INJECTOR NO. 8 DRIVER
14	-		-
15	K12 18TN		FUEL INJECTOR NO. 2 DRIVER
16	K14 18LB/BR		FUEL INJECTOR NO. 4 DRIVER
17	C24 18DB/PK		RADIATOR FAN RELAY CONTROL
18	-		-
19	-		-
20	-		-
21	T121 18BR/WT	•	3-4 SHIFT SOLENOID CONTROL
22	-		-
23	G60 18GY/YL		ENGINE OIL PRESSURE SENSOR SIGNAL
24	-		-
25	T13 18DB/BK	•	SPEED SENSOR GROUND
26	-		-
27	G7 18WT/OR		VEHICLE SPEED SENSOR SIGNAL
28	T14 18LG/WT	•	OUTPUT SPEED SENSOR SIGNAL
29	T25 18LG/RD	•	GOVERNOR PRESSURE SENSOR SIGNAL
30	K30 18PK/YL	•	TRANSMISSION CONTROL RELAY CONTROL
31	K6 18VT/WT		5V SUPPLY
32	-		-

• 4.0L
•• 4.7L



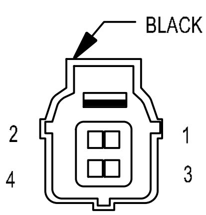
POWERTRAIN CONTROL MODULE - C3 (DIESEL)

CAV	CIRCUIT	FUNCTION
1	C90 18LG	A/C SWITCH SENSE
2	-	-
3	-	-
4	V36 18TN/RD	SPEED CONTROL VACUUM SOLENOID CONTROL
5	V35 18LG/RD	SPEED CONTROL VENT SOLENOID CONTROL
6	-	-
7	-	-
8	-	-
9	-	-
10	-	-
11	V32 18OR/DG	SPEED CONTROL POWER SUPPLY
12	A142 14DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
13	T9 18OR/BK	OVERDRIVE OFF SWITCH SENSE
14	-	-
15	K25 18VT/LG	BATTERY TEMPERATURE SENSOR SIGNAL
16	G55 18OR/LG	ENGINE DISABLE SIGNAL
17	-	-
18	-	-
19	-	-
20	-	-
21	-	-
22	G3 18BK/PK	CHECK ENGINE INDICATOR DRIVER
23	K185 18OR/LB	WAIT TO START INDICATOR
24	K29 18WT/PK	BRAKE SWITCH SENSE
25	K125 18WT/DB	GENERATOR SOURCE
26	K226 18LB/YL	FUEL LEVEL SENSOR SIGNAL
27	D21 18PK	SCI TRANSMIT
28	-	-
29	D32 18LG/DG	SCI RECEIVE
30	D25 18YL/VT	PCI BUS
31	-	-
32	V37 18RD/LG	SPEED CONTROL SWITCH SIGNAL



POWERTRAIN CONTROL MODULE - C3 (GAS)

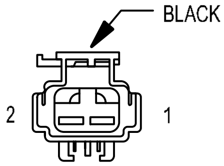
CAV	CIRCUIT	FUNCTION
1	C13 18DB/OR	A/C COMPRESSOR CLUTCH RELAY CONTROL
2	-	-
3	K51 18DB/YL	AUTOMATIC SHUT DOWN RELAY CONTROL
4	V36 18TN/RD	SPEED CONTROL VACUUM SOLENOID CONTROL
5	V35 18LG/RD	SPEED CONTROL VENT SOLENOID CONTROL
6	-	-
7	-	-
8	-	-
9	-	-
10	K106 18WT/DG ●	LEAK DETECTION PUMP SOLENOID CONTROL
11	V32 18OR/DG	SPEED CONTROL POWER SUPPLY
12	F42 18DG/LG	FUSED AUTOMATIC SHUT DOWN RELAY OUTPUT
13	T99 18OR/YL ■	TORQUE MANAGEMENT REQUEST SENSE
13	T99 18OR/YL ▲	OVERDRIVE OFF SWITCH SENSE
14	K107 18OR/PK ●	LEAK DETECTION PUMP SWITCH SENSE
15	K25 18VT/LG	BATTERY TEMPERATURE SENSOR SIGNAL
16	-	-
17	-	-
18	-	-
19	K31 18BR	FUEL PUMP RELAY CONTROL
20	K52 18PK/BK	DUTY CYCLE EVAP/PURGE SOLENOID CONTROL
21	-	-
22	C18 18DB	A/C PRESSURE SIGNAL
23	-	-
24	K29 18WT/PK	BRAKE SWITCH SENSE
25	K21 18LB/RD	GENERATOR SOURCE
26	K226 18LB/YL	FUEL LEVEL SENSOR SIGNAL
27	D21 18PK	SCI TRANSMIT
28	-	-
29	D32 18LG/DG	SCI RECEIVE
30	D25 18YL/VT	PCI BUS
31	-	-
32	V37 18RD/LG	SPEED CONTROL SWITCH SIGNAL



PRESSURE TRANSDUCER (4.7L)

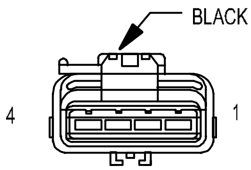
CAV	CIRCUIT	FUNCTION
1	Z13 14BK/RD	GROUND
2	T138 14GY/LB	5V SUPPLY
3	T130 14VT/TN	LINE PRESSURE SENSOR SIGNAL
4	-	-

▲ 4.0L
■ 4.7L
● EXCEPT BUILT-UP-EXPORT



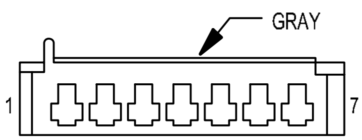
RADIATOR FAN MOTOR

CAV	CIRCUIT	FUNCTION
1	C23 12DG	RADIATOR FAN RELAY OUTPUT
2	Z4 12BK/PK	GROUND



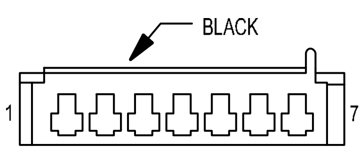
RADIATOR FAN RELAY

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	C24 20DB/PK	RADIATOR FAN RELAY CONTROL
3	C23 12DG	RADIATOR FAN RELAY OUTPUT
4	A16 12GY	FUSED B(+)



RADIO - C1

CAV	CIRCUIT	FUNCTION
1	-	-
2	X55 18BR/RD	LEFT FRONT SPEAKER (-)
3	X56 18DB/PK ▲▲	RIGHT FRONT SPEAKER (-)
3	X56 18DB/RD ▲	RIGHT FRONT SPEAKER (-)
4	L7 18BK/YL	PARK LAMP RELAY OUTPUT
5	E2 20OR	PANEL LAMPS DRIVER
6	X12 16WT/RD ▲▲	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
6	X12 18RD/WT ▲	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
7	F60 16RD/WT	FUSED B(+)



RADIO - C2

CAV	CIRCUIT	FUNCTION
1	X64 18BR/WT	ENABLE SIGNAL TO AMPLIFIER
2	X51 18WT/DG ▲▲	LEFT REAR SPEAKER (+)
2	X51 18BR/YL ▲	LEFT REAR SPEAKER (+)
3	X52 18DB/WT	RIGHT REAR SPEAKER (+)
4	X53 18DG/OR	LEFT FRONT SPEAKER (+)
5	X54 18VT	RIGHT FRONT SPEAKER (+)
6	X57 18DG/WT ▲▲	LEFT REAR SPEAKER (-)
6	X57 18BR/LB ▲	LEFT REAR SPEAKER (-)
7	X58 18DB/OR	RIGHT REAR SPEAKER (-)

▲ RHD
▲▲ LHD

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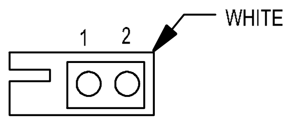
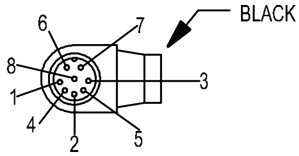


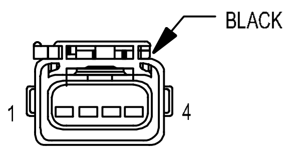
RADIO - C3

CAV	CIRCUIT	FUNCTION
1	D25 18YL/VT/DB	PCI BUS
2	-	-



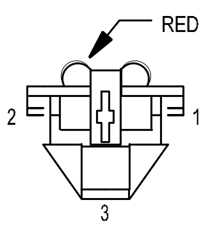
RADIO - C4
(PREMIUM)

CAV	CIRCUIT	FUNCTION
1	-	-
2	X40 22WT/RD	AUDIO IN RIGHT
3	-	-
4	Z4 22WT/BK	GROUND
5	X41 22WT/DG	AUDIO IN LEFT
6	X160 22YL	B(+)
7	X112 22RD	IGNITION SWITCH OUTPUT
8	Z17 22BK	GROUND



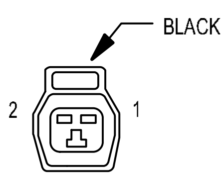
RAIL
COIL
(4.0L)

CAV	CIRCUIT	FUNCTION
1	K93 16TN/OR	COIL DRIVER NO. 3
2	K92 16TN/PK	COIL DRIVER NO. 2
3	A142 16DG/OR	AUTOMATIC SHUT DOWN RELAY OUTPUT
4	K91 16TN/RD	COIL DRIVER NO. 1



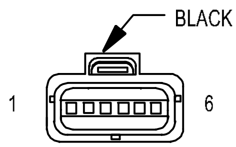
REAR
POWER
OUTLET

CAV	CIRCUIT	FUNCTION
1	A148 16VT	FUSED B(+)
2	-	-
3	Z1 16BK	GROUND



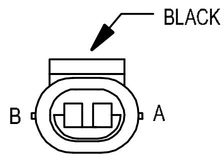
REAR
WASHER
PUMP

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	V20 18BK/WT	REAR WASHER MOTOR CONTROL



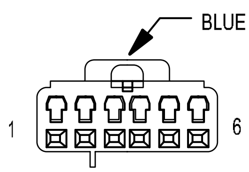
REAR WIPER MOTOR

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	V13 18BR/LG	REAR WIPER MOTOR CONTROL
3	G78 20TN/BK	LIFTGATE AJAR SWITCH SENSE
4	V22 18BR/YL	REAR WASHER SWITCH OUTPUT
5	F70 18PK	FUSED B(+)
6	-	-



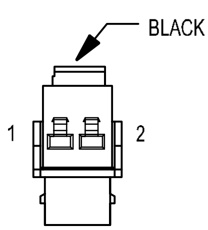
RECIRCULATION DOOR MOTOR/ ACTUATOR (AZC)

CAV	CIRCUIT	FUNCTION
A	C100 20VT/OR	RECIRCULATION DOOR DRIVER (B)
B	C32 20LB/DG	RECIRCULATION DOOR DRIVER (A)



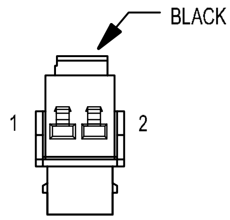
REMOTE KEYLESS MODULE (JAPAN)

CAV	CIRCUIT	FUNCTION
1	K25 20RD/GY	ANTENNA SIGNAL
2	K25 20RD/GY	ANTENNA SIGNAL
3	M1 18PK	FUSED B(+)
4	Z1 18BK	GROUND
5	D30 20VT/YL	DIAGNOSTIC OUT
6	D30 20VT/YL	DIAGNOSTIC OUT



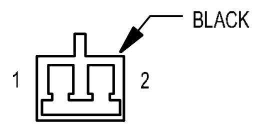
REMOTE RADIO SWITCH NO. 1

CAV	CIRCUIT	FUNCTION
1	X10 20RD/BK	RADIO CONTROL MUX RETURN
2	X20 20RD/YL	RADIO CONTROL MUX



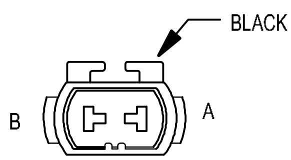
REMOTE RADIO SWITCH NO. 2

CAV	CIRCUIT	FUNCTION
1	X10 20RD/BK	RADIO CONTROL MUX RETURN
2	X20 20RD/YL	RADIO CONTROL MUX



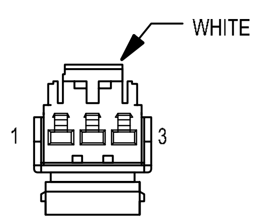
RIGHT COURTESY LAMP

CAV	CIRCUIT	FUNCTION
1	F70 20PK/BK	FUSED B (+)
2	M2 20YL	COURTESY LAMP DRIVER



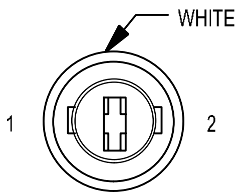
RIGHT FOG LAMP

CAV	CIRCUIT	FUNCTION
A	L39 20LB	FOG LAMP RELAY OUTPUT
B	Z1 20BK	GROUND



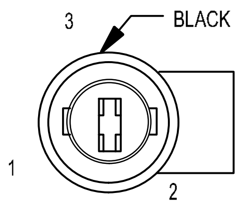
RIGHT FRONT DOOR SPEAKER

CAV	CIRCUIT	FUNCTION
1	X80 18LB/BK	RIGHT FRONT DOOR SPEAKER (-)
2	-	-
3	X82 18LB/RD	RIGHT FRONT DOOR SPEAKER (+)



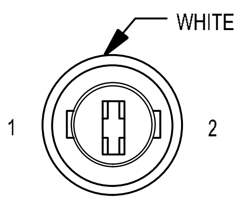
RIGHT
FRONT
PARK
LAMP

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	L7 20BK/PK	PARK LAMP RELAY OUTPUT



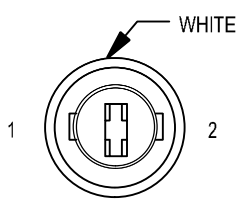
RIGHT
FRONT
PARK/TURN
SIGNAL LAMP
(EXCEPT BUILT-
UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	L7 20BK/PK	PARK LAMP RELAY CONTROL
2	Z1 18BK	GROUND
3	L60 20DG	RIGHT TURN SIGNAL



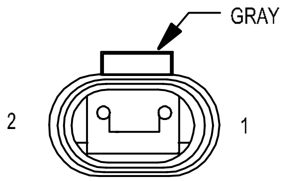
RIGHT
FRONT
SIDE
MARKER
LAMP
(EXCEPT BUILT-
UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	L7 20BK/PK	PARK LAMP RELAY OUTPUT
2	L60 20DG	RIGHT TURN SIGNAL



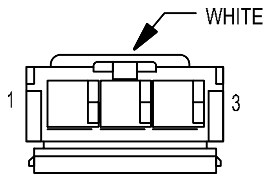
RIGHT
FRONT
TURN
SIGNAL LAMP
(BUILT-
UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	L60 20DG	FUSED B(+)
2	Z1 18BK	GROUND



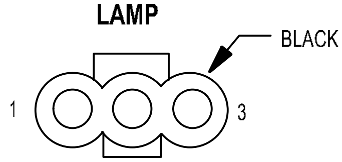
RIGHT FRONT WHEEL SPEED SENSOR

CAV	CIRCUIT	FUNCTION
1	B6 18WT/DB	RIGHT FRONT WHEEL SPEED SENSOR (-)
2	B7 18WT	RIGHT FRONT WHEEL SPEED SENSOR (+)



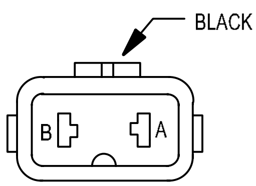
RIGHT HANDLE COURTESY LAMP

CAV	CIRCUIT	FUNCTION
1	F70 20PK	FUSED B(+)
2	M20 20YL/BK	COURTESY LAMP DRIVER
3	M2 20YL/DG	COURTESY LAMP DRIVER



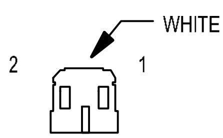
RIGHT HEADLAMP LEVELING MOTOR

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	L114 18YL	HEADLAMP ADJUST SIGNAL
3	L7 20BK/PK	PARK LAMP RELAY OUTPUT



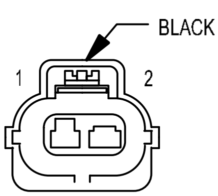
RIGHT HIGH BEAM HEADLAMP

CAV	CIRCUIT	FUNCTION
A	Z1 18BK	GROUND
B	L34 18WT	FUSED RIGHT HIGH BEAM OUTPUT



RIGHT INSTRUMENT PANEL SPEAKER

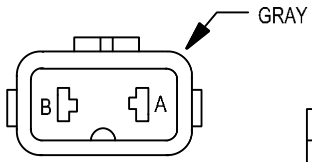
CAV	CIRCUIT	FUNCTION
1	X86 18OR/RD ▲▲	RIGHT INSTRUMENT PANEL SPEAKER (+)
1	X84 18OR/GY ▲	RIGHT INSTRUMENT PANEL SPEAKER (+)
2	X84 18OR/GY ▲▲	RIGHT INSTRUMENT PANEL SPEAKER (-)
2	X86 18OR/RD ▲	RIGHT INSTRUMENT PANEL SPEAKER (-)



RIGHT LIFTGATE AJAR SWITCH

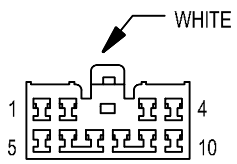
CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	G78 20TN/BK	LIFTGATE AJAR SWITCH SENSE

▲▲ LHD
▲ RHD
■ BUILT-UP-EXPORT



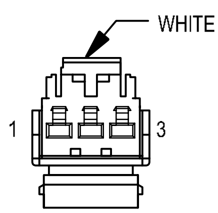
RIGHT LOW BEAM HEADLAMP

CAV	CIRCUIT	FUNCTION
A	Z1 18BK	GROUND
B	L44 18BR	FUSED RIGHT LOW BEAM HEADLAMP



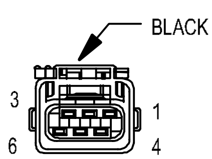
RIGHT MULTI-FUNCTION SWITCH

CAV	CIRCUIT	FUNCTION
1	V23 20BR/PK	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
2	V20 18BK/WT	REAR WASHER MOTOR CONTROL
3	V10 20BR	WASHER PUMP SWITCH SENSE
4	-	-
5	V13 18BR/LG	REAR WIPER MOTOR CONTROL
6	V22 18BR/YL	REAR WIPER MOTOR INTERMITTENT CONTROL
7	V59 22DB/YL	WINDSHIELD WIPER SWITCH RETURN
8	V52 22DG/RD	WINDSHIELD WIPER SWITCH MUX
9	V16 22VT ▲▲	WIPER HIGH/LOW RELAY CONTROL
9	V16 22YL ▲	WIPER HIGH/LOW RELAY CONTROL
10	-	-



RIGHT REAR DOOR SPEAKER

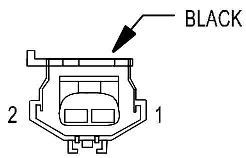
CAV	CIRCUIT	FUNCTION
1	X90 18WT/VT	RIGHT REAR DOOR SPEAKER (+)
2	-	-
3	X92 18TN/DG	RIGHT REAR DOOR SPEAKER (-)



RIGHT REAR LAMP ASSEMBLY

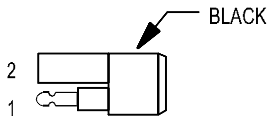
CAV	CIRCUIT	FUNCTION
1	L1 18VT/BK	BACK-UP LAMP FEED
2	L95 18DG/YL ■	REAR FOG LAMP RELAY CONTROL
3	L7 18BK/YL	PARK LAMP RELAY OUTPUT
4	L62 18BR/RD	RIGHT TURN SIGNAL
5	Z1 18BK	GROUND
6	L50 18WT/TN	BRAKE LAMP SWITCH OUTPUT

▲ RHD
▲▲ LHD
■ BUILT-UP-EXPORT



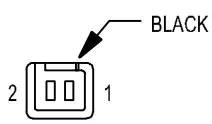
RIGHT REAR WHEEL SPEED SENSOR

CAV	CIRCUIT	FUNCTION
1	B1 18YL/DB	RIGHT REAR WHEEL SPEED SENSOR (-)
2	B2 18YL	RIGHT REAR WHEEL SPEED SENSOR (+)



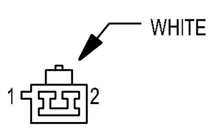
RIGHT SIDE REPEATER

CAV	CIRCUIT	FUNCTION
1	Z1 18BK	GROUND
2	L60 18TN	RIGHT TURN SIGNAL



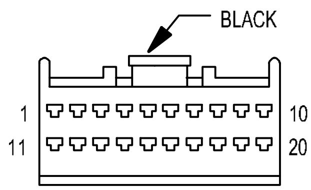
RIGHT VISOR/ VANITY LAMP

CAV	CIRCUIT	FUNCTION
1	F70 20PK	FUSED B(+)
2	M20 20YL/BK	COURTESY LAMP DRIVER



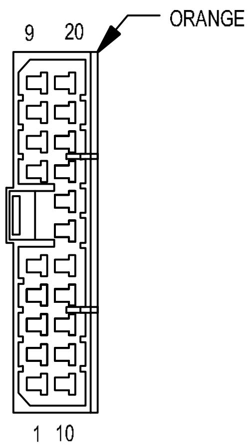
SEAT BELT SWITCH

CAV	CIRCUIT	FUNCTION
1	G10 20LG/RD	SEAT BELT SWITCH SENSE
2	Z1 20BK	GROUND



SEAT MODULE - C1 (PREMIUM)

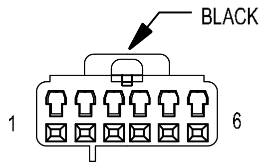
CAV	CIRCUIT	FUNCTION
1	P15 20YL/LB ●●	SEAT HORIZONTAL FORWARD SWITCH SENSE
2	-	-
3	P11 20YL/WT ●●	SEAT REAR UP SWITCH SENSE
4	P43 20GY/LB ●●	RECLINER UP SWITCH SENSE
5	P19 20YL/LG ●●	SEAT FRONT UP SWITCH SENSE
6	P86 20DG/YL ●	PASSENGER SEAT TEMPERATURE SENSOR INPUT
7	P27 20LB/RD ●●	REAR RISER POSITION SIGNAL
8	P25 20VT/RD ●●	SEAT HORIZONTAL POSITION SIGNAL
9	P135 20LB/BK ●	DRIVER SEAT TEMPERATURE SENSE INPUT
10	P28 20BR/RD ●●	SEAT POSITION SENSOR GROUND
11	P41 20GY/WT ●●	RECLINER DOWN SWITCH SENSE
12	P17 20RD/YL ●●	SEAT HORIZONTAL REARWARD SWITCH SENSE
13	-	-
14	P21 20RD/LG ●●	SEAT FRONT DOWN SWITCH SENSE
15	P13 20RD/WT ●●	SEAT REAR DOWN SWITCH SENSE
16	P47 20LB ●●	RECLINER POSITION SIGNAL
17	P26 20BR ●●	FRONT RISER POSITION SIGNAL
18	P29 20BR/WT	SEAT SENSOR 5V SUPPLY
19	Z2 20BK/OR	GROUND
20	D25 20YL/VT	PCI BUS



SEAT MODULE - C2 (PREMIUM)

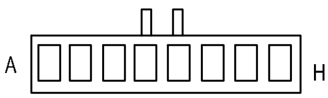
CAV	CIRCUIT	FUNCTION
1	F35 16RD	FUSED B(+)
2	P131 16BK/OR ●	DRIVER SEAT HEATER B(+) DRIVER
3	Z1 16BK	GROUND
4	P119 16YL/RD ●●	SEAT FRONT UP DRIVER
5	P121 16RD/GY ●●	SEAT FRONT DOWN DRIVER
6	P111 16YL/DB ●●	SEAT REAR UP DRIVER
7	P113 16RD/BK ●●	SEAT REAR DOWN DRIVER
8	-	-
9	P115 16GY/LG ●●	SEAT HORIZONTAL FORWARD DRIVER
10	F35 16RD	FUSED B(+)
11	P130 16DG/WT ●	PASSENGER SEAT HEATER B(+) DRIVER
12	Z1 16BK	GROUND
13	-	-
14	P9 20RD/LB ●●	FUSED B (+)
15	Z6 16BK/YL ●	DRIVER SEAT HEATER GROUND
16	Z5 16BK/VT ●	PASSENGER SEAT HEATER GROUND
17	-	-
18	P141 16GY/WT ●●	SEAT RECLINER DOWN DRIVER
19	P143 16GY/LB ●●	SEAT RECLINER UP DRIVER
20	P117 16RD/BR ●●	SEAT HORIZONTAL REARWARD DRIVER

● PREMIUM I/III
●● PREMIUM II/III



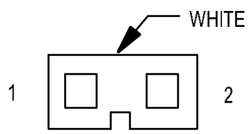
SENTRY KEY IMMOBILIZER MODULE

CAV	CIRCUIT	FUNCTION
1	M1 20PK	FUSED B (+)
2	Z2 20BK/OR	GROUND
3	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
4	-	-
5	D25 20YL/VT/BK	PCI BUS
6	-	-



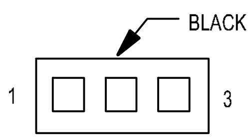
SUNROOF CONTROL MODULE

CAV	CIRCUIT	FUNCTION
A	Q46 20OR/WT	SUNROOF MOTOR POSITION SENSOR SIGNAL
B	Q41 20WT	POWER SUNROOF OPEN
C	Q43 20VT	POWER SUNROOF VENT
D	Z1 16BK	GROUND
E	-	-
F	Q30 16DB	SUNROOF DELAY RELAY OUTPUT
G	Q5 16RD	SUNROOF MOTOR B(+)
H	Q6 16OR	SUNROOF MOTOR B(-)



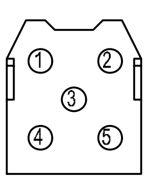
SUNROOF MOTOR

CAV	CIRCUIT	FUNCTION
1	Q5 16RD	SUNROOF MOTOR B(+)
2	Q6 16OR	SUNROOF MOTOR B(-)



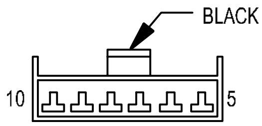
SUNROOF MOTOR POSITION SENSOR

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	Q46 20OR/WT	SUNROOF MOTOR POSITION SENSOR SIGNAL
3	-	-



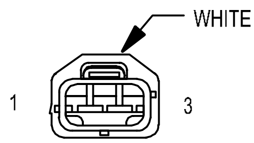
SUNROOF SWITCH

CAV	CIRCUIT	FUNCTION
1	Q43 20VT	POWER SUNROOF VENT
2	-	-
3	Z1 20BK	GROUND
4	-	-
5	Q41 20WT	POWER SUNROOF OPEN



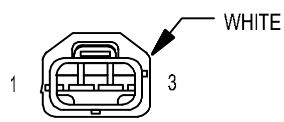
TEMPERATURE VALVE ACTUATOR (MTC)

CAV	CIRCUIT	FUNCTION
5	-	-
6	-	-
7	Z2 20VT/WT	GROUND
8	C67 20DB/RD	BLEND AIR DOOR POSITION CONTROL
9	WT/YL	NOT USED
10	F22 20PK/DG	FUSED IGNITION SWITCH OUTPUT (RUN)



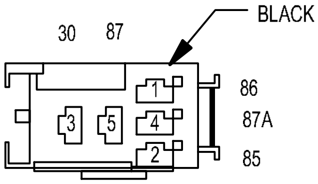
THROTTLE POSITION SENSOR (4.0L)

CAV	CIRCUIT	FUNCTION
1	K4 18BK/LB	SENSOR GROUND
2	K22 18OR/RD	THROTTLE POSITION SENSOR SIGNAL
3	K7 20OR	5V SUPPLY



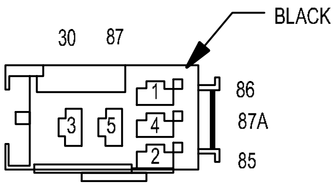
THROTTLE POSITION SENSOR (4.7L)

CAV	CIRCUIT	FUNCTION
1	K7 20OR	5V SUPPLY
2	K22 18OR/RD	THROTTLE POSITION SENSOR SIGNAL
3	K4 18BK/LB	SENSOR GROUND



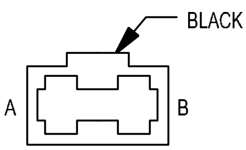
CAV	CIRCUIT	FUNCTION
30 (3)	L50 16WT/TN	FUSED B(+)
85 (2)	L50 16WT/TN	BRAKE LAMP SWITCH OUTPUT
86 (1)	Z1 18BK	GROUND
87 (5)	L50 16WT/TN	BRAKE LAMP SWITCH OUTPUT
87A (4)	-	-

TRAILER TOW BRAKE LAMP RELAY (BUILT-UP-EXPORT)



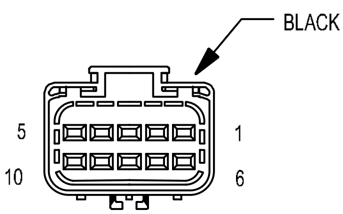
CAV	CIRCUIT	FUNCTION
30 (3)	L50 16WT/TN	BRAKE LAMP SWITCH OUTPUT
85 (2)	L50 18WT/TN	BRAKE LAMP SWITCH OUTPUT
86 (1)	Z1 18BK	GROUND
87 (5)	L95 16DG/YL	TRAILER TOW BRAKE LAMP RELAY OUTPUT
87A (4)	L94 16OR/WT	TRAILER TOW BRAKE LAMP RELAY OUTPUT

TRAILER TOW BRAKE LAMP RELAY (EXCEPT BUILT-UP-EXPORT)



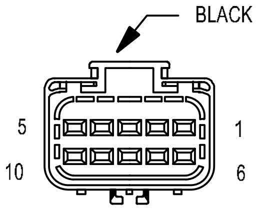
CAV	CIRCUIT	FUNCTION
A	F30 14RD	FUSED CIGAR LIGHTER RELAY OUTPUT
B	F30 14RD	CIGAR LIGHTER RELAY OUTPUT

TRAILER TOW CIRCUIT BREAKER



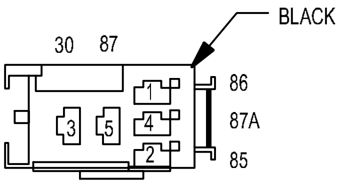
CAV	CIRCUIT	FUNCTION
1	L50 16WT/TN	BRAKE LAMP SWITCH OUTPUT
2	L62 16BR/RD	RIGHT TURN SIGNAL
3	L1 18VT/BK	BACK-UP LAMP FEED
4	F30 14RD	FUSED CIGAR LIGHTER RELAY OUTPUT
5	L7 18BK/YL	PARK LAMP RELAY OUTPUT
6	L95 18DG/YL	REAR FOG LAMP RELAY OUTPUT
7	B40 14LB	TRAILER TOW BRAKE B(+)
8	Z1 14BK	GROUND
9	Z1 14BK	GROUND
10	L63 16DG/RD	LEFT TURN SIGNAL

TRAILER TOW CONNECTOR (BUILT-UP-EXPORT)



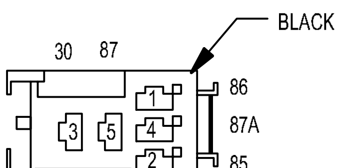
TRAILER TOW CONNECTOR (EXCEPT BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
1	-	-
2	L62 16BR/RD	RIGHT TURN SIGNAL
3	L1 18VT/BK	BACK-UP LAMP FEED
4	F30 14RD	FUSED CIGAR LIGHTER RELAY OUTPUT
5	L7 18BK/YL	PARK LAMP RELAY OUTPUT
6	-	-
7	B40 14LB	TRAILER TOW BRAKE B(+)
8	Z1 14BK	GROUND
9	Z1 14BK	BRAKE LAMP SWITCH OUTPUT
10	L63 16DG/RD	LEFT TURN SIGNAL



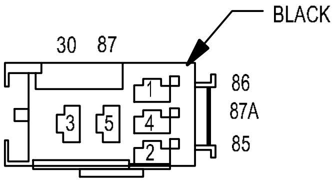
TRAILER TOW LEFT TURN RELAY (BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
30 (3)	L50 16WT/TN	BRAKE LAMP SWITCH OUTPUT
85 (2)	L63 20DG/RD	LEFT TURN SIGNAL
86 (1)	Z1 18BK	GROUND
87 (5)	L63 16DG/RD	LEFT TURN SIGNAL
87A (4)	-	-



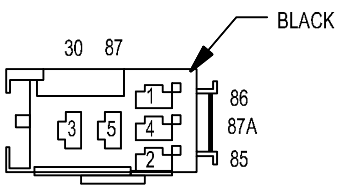
TRAILER TOW LEFT TURN RELAY (EXCEPT BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
30 (3)	L63 16DG/RD	LEFT TURN SIGNAL
85 (2)	L63 20DG/RD	LEFT TURN SIGNAL
86 (1)	Z1 18BK	GROUND
87 (5)	L94 16OR/WT	TRAILER TOW BRAKE LAMP RELAY OUTPUT
87A (4)	L95 16DG/YL	TRAILER TOW BRAKE LAMP RELAY OUTPUT



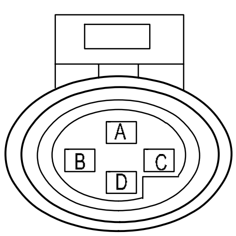
TRAILER TOW RIGHT TURN RELAY (BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
30 (3)	L50 16WT/TN	BRAKE LAMP SWITCH OUTPUT
85 (2)	L62 20BR/RD	RIGHT TURN SIGNAL
86 (1)	Z1 18BK	GROUND
87 (5)	L62 16BR/RD	RIGHT TURN SIGNAL
87A (4)	-	-



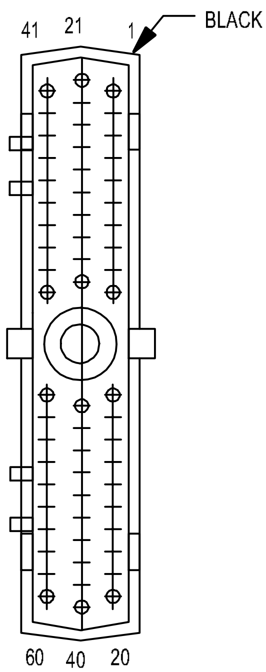
TRAILER TOW RIGHT TURN RELAY (EXCEPT BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
30 (3)	L62 16BR/RD	RIGHT TURN SIGNAL
85 (2)	L62 20BR/RD	RIGHT TURN SIGNAL
86 (1)	Z1 18BK	GROUND
87 (5)	L94 16OR/WT	TRAILER TOW BRAKE LAMP RELAY OUTPUT
87A (4)	L95 16DG/YL	TRAILER TOW BRAKE LAMP RELAY OUTPUT



TRANSFER CASE SWITCH (4.0L) (EXCEPT BUILT-UP-EXPORT)

CAV	CIRCUIT	FUNCTION
A	Z1 18BK	GROUND
B	T107 18BK/RD	PART TIME 4 WHEEL DRIVE INDICATOR DRIVER
C	-	-
D	-	-



TRANSMISSION CONTROL MODULE (4.7L)

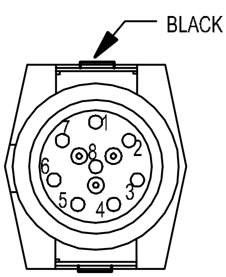
CAV	CIRCUIT	FUNCTION
1	T1 18LG/BK	TRS T1 SENSE
2	T2 18TN/BK	TRS T2 SENSE
3	T3 18VT	TRS T3 SENSE
4	-	-
5	-	-
6	K24 18GY/BK	CRANKSHAFT POSITION SENSOR SIGNAL
7	D21 20PK	SCI TRANSMIT
8	F45 18YL/RD	FUSED IGNITION SWITCH OUTPUT (ST)
9	T9 18OR/BK	OVERDRIVE PRESSURE SWITCH SENSE
10	T10 18YL/DG	TORQUE MANAGEMENT REQUEST SENSE
11	F991 18OR/DB	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
12	K22 18OR/RD	THROTTLE POSITION SENSOR SIGNAL
13	T13 18DB/BK	SPEED SENSOR GROUND
14	T14 18LG/WT	OUTPUT SPEED SENSOR SIGNAL
15	K30 18PK/YL	TRANSMISSION CONTROL RELAY CONTROL
16	T16 14RD	TRANSMISSION CONTROL RELAY OUTPUT
17	T16 14RD	TRANSMISSION CONTROL RELAY OUTPUT
18	T118 18YL/DB	PRESSURE CONTROL SOLENOID CONTROL
19	T119 18WT/DB	2C SOLENOID CONTROL
20	T120 18LG	LR/CC SOLENOID CONTROL
21	-	-
22	-	-
23	-	-
24	-	-
25	-	-
26	-	-
27	-	-
28	G7 18WT/OR	VEHICLE SPEED SENSOR SIGNAL
29	T29 18GY	UNDERDRIVE PRESSURE SWITCH SENSE
30	T130 14VT/TN	LINE PRESSURE SENSOR SIGNAL
31	-	-
32	-	-
33	-	-
34	-	-
35	-	-
36	T16 14RD	TRANSMISSION CONTROL RELAY OUTPUT
37	Z14 14BK/YL	GROUND
38	T138 14GY/LB	5V SUPPLY
39	Z14 14BK/YL	GROUND
40	T140 18VT/LG	MS SOLENOID CONTROL
41	T141 18WT	TRS T41 SENSE
42	T42 18VT/WT	TRS T42 SENSE
43	D25 18YL/VT	PCI BUS
44	-	-
45	-	-
46	D20 20LG	SCI RECEIVE
47	T147 18LB	2C PRESSURE SWITCH SENSE
48	T48 18DB	4C PRESSURE SWITCH SENSE
49	T6 18VT/WT	OVERDRIVE OFF SWITCH SENSE
50	T150 18BR/LB	LR PRESSURE SWITCH SENSE
51	K4 18BK/LB	SENSOR GROUND
52	T52 18RD/BK	INPUT SPEED SENSOR SIGNAL

(CONTINUED ON NEXT PAGE)

(CONTINUED)

TRANSMISSION CONTROL MODULE (4.7L) (CONTINUED)

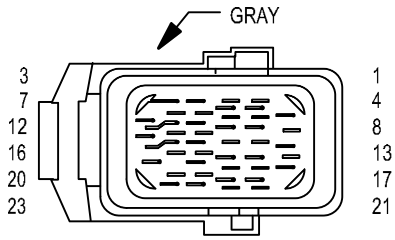
CAV	CIRCUIT	FUNCTION
53	Z13 14BK/RD	GROUND
54	T54 18VT	TRANSMISSION TEMPERATURE SENSOR SIGNAL
55	T59 18PK	UNDERDRIVE SOLENOID CONTROL
56	A30 14RD/WT	FUSED B(+)
57	Z14 14BK/YL	GROUND
58	-	-
59	T159 18DG/WT	4C SOLENIOD CONTROL
60	T60 18BR	OVERDRIVE SOLENOID CONTROL



TRANSMISSION SOLENOID (DIESEL/4.0L GAS)

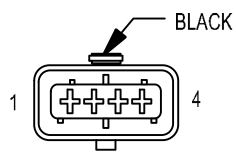
CAV	CIRCUIT	FUNCTION
1	T60 18BR ■	FUSED TRANSMISSION CONTROL RELAY OUTPUT
1	T60 18BR •	TRANSMISSION CONTROL RELAY OUTPUT
2	K6 18VT/WT	5V SUPPLY
3	K4 18BK/LB	SENSOR GROUND
4	T25 18LG •	GOVERNOR PRESSURE SENSOR SIGNAL
4	T25 18LG/RD ■	GOVERNOR PRESSURE SENSOR SIGNAL
5	K88 18PK	GOVERNOR PRESSURE SOLENOID CONTROL
6	T121 18BK/RD •	3-4 SHIFT SOLENOID CONTROL
6	T121 18BR/WT ■	3-4 SHIFT SOLENOID CONTROL
7	T22 18DG/LB	TORQUE CONVERTER CLUTCH SOLENOID CONTROL
8	T54 18VT	TRANSMISSION TEMPERATURE SENSOR SIGNAL

• DIESEL
■ 4.0L GAS



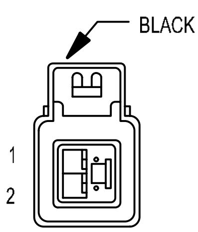
TRANSMISSION SOLENOID/ TRS ASSEMBLY (4.7L)

CAV	CIRCUIT	FUNCTION
1	F22 18WT/TN	FUSED IGNITION SWITCH OUTPUT (RUN)
2	T120 18LG	LR/CC SOLENOID CONTROL
3	T24 18BR/YL	ENGINE STARTER MOTOR RELAY CONTROL
4	T141 18WT	TRS T141 SENSE
5	T42 18VT/WT	TRS T42 SENSE
6	L1 18VT/BK	BACK-UP LAMP FEED
7	T60 18BR	OVERDRIVE SOLENOID CONTROL
8	T3 18VT	TRS T3 SENSE
9	T1 18LG/BK	TRS T1 SENSE
10	T16 14RD	TRANSMISSION CONTROL RELAY OUTPUT
11	T48 18DB	4C PRESSURE SWITCH SENSE
12	T118 18YL/DB	PRESSURE CONTROL SOLENOID CONTROL
13	T2 18TN/BK	TRS T2 SENSE
14	T150 18BR/LB	LR PRESSURE SWITCH SENSE
15	T147 18LB	2C PRESSURE SWITCH SENSE
16	T9 18OR/BK	OVERDRIVE PRESSURE SWITCH SENSE
17	T59 18PK	UNDERDRIVE SOLENOID CONTROL
18	T29 18GY	UNDERDRIVE PRESSURE SWITCH SENSE
19	T159 18DG/WT	4C SOLENOID CONTROL
20	T119 18WT/DB	2C SOLENOID CONTROL
21	T140 18VT/LG	MS SOLENOID CONTROL
22	T13 18DB/BK	SPEED SENSOR GROUND
23	T54 18VT	TRANSMISSION TEMPERATURE SENSOR SIGNAL



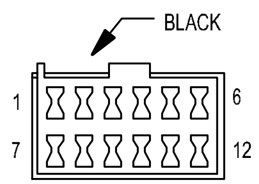
TURBO BOOST PRESSURE SENSOR (DIESEL)

CAV	CIRCUIT	FUNCTION
1	K121 18BK/VT	SENSOR GROUND
2	K21 18BK/RD	INTAKE AIR TEMPERATURE SENSOR SIGNAL
3	K70 18OR/WT	5V SUPPLY
4	K22 18OR/DB	BOOST PRESSURE SENSOR SIGNAL



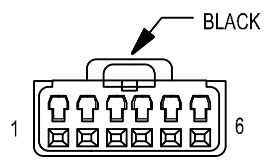
UNDERHOOD LAMP

CAV	CIRCUIT	FUNCTION
1	Z1 20BK	GROUND
2	M1 20PK/RD	FUSED B (+)



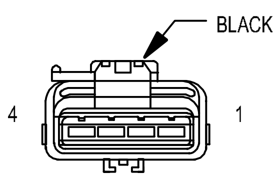
UNITED KINGDOM SECURITY SYSTEM MODULE (RHD)

CAV	CIRCUIT	FUNCTION
1	F70 18PK/BK	FUSED B(+)
2	L91 20DB/PK	HAZARD SWITCH SENSE
3	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
4	G69 20BK/OR	VTSS INDICATOR DRIVER
5	Y10 20VT/WT	-
6	Y11 20VT/OR	-
7	Y12 20VT/TN	-
8	Y13 20VT/PK	-
9	-	-
10	Z1 18BK	GROUND
11	-	-
12	D25 20YL/VT/TN	PCI BUS



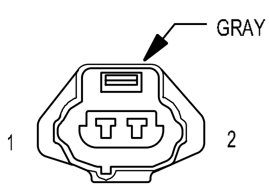
VEHICLE INFORMATION CENTER

CAV	CIRCUIT	FUNCTION
1	-	-
2	D25 20VT/YL	PCI BUS
3	F70 20PK	FUSED B(+)
4	Z2 20BK/OR	GROUND
5	G5 20DB/WT	FUSED IGNITION SWITCH OUTPUT (ST-RUN)
6	-	-



VEHICLE SPEED CONTROL SERVO

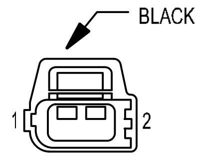
CAV	CIRCUIT	FUNCTION
1	V36 20TN/RD •	SPEED CONTROL VACUUM SOLENOID CONTROL
1	V36 18TN/RD ••	SPEED CONTROL VACUUM SOLENOID CONTROL
2	V35 20LG/RD •	SPEED CONTROL VENT SOLENOID CONTROL
2	V35 18LG/RD ••	SPEED CONTROL VENT SOLENOID CONTROL
3	V30 20DB/RD	SPEED CONTROL BRAKE SWITCH OUTPUT
4	Z1 20BK	GROUND



WASHER FLUID LEVEL SWITCH

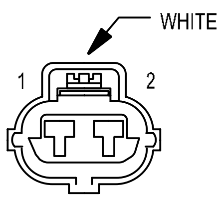
CAV	CIRCUIT	FUNCTION
1	V11 20BK/TN	WASHER FLUID SWITCH SENSE
2	Z1 20BK	GROUND

• RHD
•• LHD



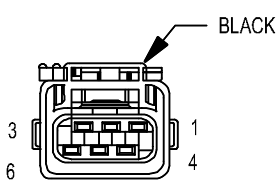
WATER IN FUEL SENSOR

CAV	CIRCUIT	FUNCTION
1	G123 18DG/WT	WATER IN FUEL SENSE
2	K4 18BK/LB	SENSOR GROUND



WINDSHIELD WASHER PUMP

CAV	CIRCUIT	FUNCTION
1	V10 20BR	WASHER PUMP SWITCH SENSE
2	Z1 20BK	GROUND



WINDSHIELD WIPER MOTOR

CAV	CIRCUIT	FUNCTION
1	V6 16DB	FUSED IGNITION SWITCH OUTPUT (RUN-ACC)
2	V55 16TN/RD	WIPER PARK SWITCH SENSE
3	-	-
4	Z1 16BK	GROUND
5	V3 16BR/WT	WIPER HIGH/LOW RELAY LOW SPEED OUTPUT
6	V4 16RD/YL	WIPER HIGH/LOW RELAY HIGH SPEED OUTPUT

8W-90 CONNECTOR LOCATIONS

DESCRIPTION AND OPERATION

INTRODUCTION

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/GROUND LOCATIONS (LHD)

For items that are not shown in this section N/S is placed in the Fig. column.

Connector Name/Number	Color	Location	Fig.
A/C Compressor Clutch	BK	At Compressor	4, 10
A/C High Pressure Cutout Switch	BK	Near Compressor	12
A/C Low Pressure Cycle Clutch Switch	DK GY	Right Rear of Engine Compartment	12
Airbag Control Module	YL	At Center Console	15, 17, 18
Ambient Air Temperature Sensor	BK	At Radiator Center Support	12
Antenna Module	WT	Above Rear Liftgate Glass	29
Ash Receiver Lamp	BK	Rear of Ash Receiver	18
Automatic Day/Night Mirror	BK	Overhead Console Near Driver Rearview Mirror	N/S
Automatic Headlamp Light Sensor/VTSS LED	BK	Top Left Side of Instrument Panel	18
Automatic Zone Control Module - C1	BK	Center of Instrument Panel	18
Automatic Zone Control Module - C2	BK	Center of Instrument Panel	18
Battery Temperature Sensor	BK	At Battery Tray	12
Blower Motor		Center of Instrument Panel	18

Connector Name/Number	Color	Location	Fig.
Blower Motor Controller (AZC)		On HVAC Housing	N/S
Blower Motor Resistor Block (MTC)	BK	On HVAC Housing Near Blower Motor	N/S
Body Control Module - C1	GY	Left Side of Instrument Panel Near Data Link Connector	17
Body Control Module - C2	WT	Left Side of Instrument Panel Near Data Link Connector	17
Brake Lamp Switch	GY	Top of Brake Pedal	20
Brake Shift Interlock Solenoid	WT	On Steering Column Near Ignition Switch	19
Brake Warning Indicator Switch	GY	Left Side of Engine Compartment Near Brake Fluid Reservoir	N/S
C100	BK	On Battery Harness Near Front of Battery	2, 13
C102 (Diesel)	BK	Near Starter	4
C102 (Gas)	BK	Rear of Engine Near Powertrain Control Module	5, 9, 12, 14
C103 (Diesel)	GY	Near Starter	4
C103 (Gas)	GY	Rear of Engine Near Powertrain Control Module	5, 9, 14

DESCRIPTION AND OPERATION (Continued)

Connector Name/Number	Color	Location	Fig.
C104	BK	Rear of Engine Near Powertrain Control Module	5, 9, 14
C105 (Diesel)	BK	Near Starter	4
C106	BK	Right Kick Panel Area	15
C107	BK	Near Junction Block	11, 20, 21
C108	BK	Near Junction Block	11
C109		Left Side of Transmission	N/S
C110 (Diesel)	GY	Top of Engine Near Glow Plugs	N/S
C111	BK	Left Front Fascia Behind Headlamp	1, 11
C112	BK	Right Front Fascia Behind Headlamp	1, 13
C200	GY	Right Side of Instrument Panel	15, 16, 17, 18
C201	WT	At Center Console	15, 17, 18
C202	WT	Near Right Kick Panel Area	16, 17
C203 (AZC)	WT	Near Right Kick Panel Area	16, 17
C300	GY	Near Junction Block	20, 23, 21
C302	BK	At Driver Door	20, 21, 25
C303	WT	On Right Side of B Pillar at Passenger Side Rear Door	24, 28
C304	BK	Under Driver Seat	23
C306	BK	Under Passenger Seat	24
C307	WT	At Driver Side Rear Door	23, 26
C308	WT	At Liftgate	32

Connector Name/Number	Color	Location	Fig.
C309	WT	Near Right Rear Window	N/S
C310 (Built-Up-Export)	LT GY	Left Side Near Interior Rear Wheelhouse	33
C310 (Except Built-Up-Export)	LT GN	Left Side Near Interior Rear Wheelhouse	33
C311	WT	Top of Liftgate	34
C312		Center of Liftgate	32
C313	WT	In Driver Door	25
C314	LT GY	At Passenger Door	20, 27
C315		Right Rear Headliner Near Liftgate	22
Camshaft Position Sensor	GY	Right Side of Engine	5, 9
Capacitor NO. 1	BK	Right Side of Engine	9
Capacitor NO. 2	BK	Left Side of Engine	10
Cargo Lamp	WT	Near Liftgate	N/S
Center High Mounted Stop Lamp	BK	Top of Liftgate	34
Cigar Lighter	RD	Center of Instrument Panel	18
Clockspring - C1	GY	At Steering Column	19
Clockspring - C2	BK	At Steering Column	N/S
Clockspring - C3	YL	At Steering Column	19
Coil On Plug NO. 1 (4.7L)	BK	Left Side of Engine Near Fuel Injector NO. 1	10
Coil On Plug NO. 2 (4.7L)	BK	Right Side of Engine Near Fuel Injector NO. 2	9
Coil On Plug NO. 3 (4.7L)	BK	Left Side of Engine Near Fuel Injector NO. 3	10

DESCRIPTION AND OPERATION (Continued)

Connector Name/Number	Color	Location	Fig.
Coil On Plug NO. 4 (4.7L)	BK	Right Side of Engine Near Fuel Injector NO. 4	9
Coil On Plug NO. 5 (4.7L)	BK	Left Side of Engine Near Fuel Injector NO. 5	10
Coil On Plug NO. 6 (4.7L)	BK	Right Side of Engine Near Fuel Injector NO. 6	9
Coil On Plug NO. 7 (4.7L)	BK	Left Side of Engine Near Fuel Injector NO. 7	10
Coil On Plug NO. 8 (4.7L)	BK	Right Side of Engine Near Fuel Injector NO. 8	9
Compact Disc Changer	BK	Right Rear Quarter Panel	31
Controller Anti-Lock Brake	BK	Left Front Engine Compartment	11
Coolant Level Sensor	LT GY	Right Rear of Engine Compartment	12
Crankshaft Position Sensor (Diesel)	BK	Right Rear of Engine	3
Crankshaft Position Sensor (Gas)	BK	Left Rear of Engine	5, 9
Cruise Switch NO. 1	BK	On Steering Wheel	N/S
Cruise Switch NO. 2	BK	On Steering Wheel	N/S
Data Link Connector	BK	Left Side of Instrument Panel	17, 18
Diagnostic Junction Port	WT	At Steering Column	19
Driver Blend Door Motor/ Actuator (AZC)	BK	On HVAC Housing	N/S
Driver Door Courtesy Lamp	BK	In Driver Door	N/S
Driver Door Cylinder Lock Switch	GY	In Driver Door	25
Driver Door Lock Motor/Ajar Switch	BK	In Driver Door	25
Driver Door Module - C1	WT	In Driver Door	25
Driver Door Module - C2	BK	In Driver Door	N/S
Driver Door Module - C3	BK	In Driver Door	N/S
Driver Heated Seat Back (Premium I/III)	GN	At Driver Seat	N/S
Driver Heated Seat Cushion (Premium I/III)	BK	At Driver Seat	N/S
Driver Heated Seat Switch	WT	Center of Instrument Panel	N/S
Driver Lumbar Motor	BK	At Driver Seat	N/S
Driver Lumbar Switch (Midline/ Premium)	WT	At Driver Seat	N/S
Driver Power Mirror	BK	At Driver Door	N/S
Driver Power Seat Front Riser Motor	RD	At Driver Seat	N/S
Driver Power Seat Front Riser Motor Sensor (Premium II/III)		At Driver Seat	N/S
Driver Power Seat Horizontal Motor	BK	At Driver Seat	N/S
Driver Power Seat Horizontal Motor Sensor (Premium II/III)	BK	At Driver Seat	N/S
Driver Power Seat Rear Riser Motor	RD	At Driver Seat	N/S

DESCRIPTION AND OPERATION (Continued)

Connector Name/Number	Color	Location	Fig.
Driver Power Seat Rear Riser Motor Sensor (Premium II/III)		At Driver Seat	N/S
Driver Power Seat Recliner Motor	BK	At Driver Seat	N/S
Driver Power Seat Recliner Motor Sensor (Premium II/III)	BK	At Driver Seat	N/S
Driver Power Seat Switch (Base)		At Driver Seat	N/S
Driver Power Seat Switch (Midline/ Premium)	GN	At Driver Seat	N/S
Driver Power Window Motor	BK	In Driver Door	25
Driver Rear Door Lock Motor/Ajar Switch	BK	In Rear Door Driver Side	26
Driver Rear Power Window Motor	BK	In Rear Door Driver Side	26
Driver Rear Power Window Switch	BL	In Rear Door Driver Side	26
Duty Cycle EVAP/Purge Solenoid (GAS)	BK	Left Side of Engine Compartment	11
EGR Solenoid (Diesel)	BK	Right Side of Engine Compartment	N/S
Engine Control Module - C1 (Diesel)	BK	Under Rear Seats	30
Engine Control Module - C2 (Diesel)	BK	Under Rear Seats	30
Engine Coolant Temperature Sensor (GAS)	BK	Front of Engine	8, 10
Engine Coolant Temperature Sensor NO.1 (Diesel)	BK	Top of Engine	4

Connector Name/Number	Color	Location	Fig.
Engine Coolant Temperature Sensor NO.2 (Diesel)	BK	Top of Engine	4
Engine Oil Pressure Sensor	BK	Rear of Engine Near Transmission	3, 5, 10
Front Power Outlet	RD	Center of Instrument Panel	18
Fuel Heater (Diesel)	BK	Rear of Engine Compartment Near Powertrain Control Module	N/S
Fuel Injector NO. 1	BK	At Injector	8, 10
Fuel Injector NO. 2	BK	At Injector	8, 9
Fuel Injector NO. 3	BK	At Injector	8, 10
Fuel Injector NO. 4	BK	At Injector	8, 9
Fuel Injector NO. 5	BK	At Injector	8, 10
Fuel Injector NO. 6	BK	At Injector	8, 9
Fuel Injector NO. 7 (4.7L)	BK	At Injector	10
Fuel Injector NO. 8 (4.7L)	BK	At Injector	9
Fuel Pump Module (Diesel)	BK	Left Side of Engine	4
Fuel Pump Module (Gas)	BK	Near Fuel Tank	23
Fuel Sender Unit (Diesel)	BK	Rear of Engine Compartment	N/S
G100 (4.0L)		Near Starter	N/S
G100 (4.7L)		Near Intake Plenum	N/S
G101		Near Front of Battery	2
G102		Right Side of Engine	9
G103		Right Side of Engine	5, 9

DESCRIPTION AND OPERATION (Continued)

Connector Name/Number	Color	Location	Fig.
G104 (4.0L)		Right Rear of Engine	5
G104 (4.7L)		Left Side of Engine	10
G105		Right Front of Engine	3
G106		Left Side of Engine Compartment	11
G107		Left Side of Engine Compartment	11
G108		Near Power Distribution Center	12
G200		Near Airbag Control Module	15, 17, 18
G201		Near Airbag Control Module	15, 17, 18
G300		Near Passenger Seat	24
G301		Near Driver Seat	23
G-Switch	BK	Under Rear Seat	23
Generator (Diesel)	BK	At Generator	4
Generator (Gas)	BK	At Generator	N/S
Glove Box Lamp	BK	Right Side of Instrument Panel	N/S
Headlamp Leveling Switch (Built-Up-Export)	WT	Left Side of Instrument Panel	18
Hood Ajar Switch	BK	Left Side of Engine Compartment	N/S
Horn NO. 1	BK	Right Front Fascia	12
Horn NO. 2	BK	Right Front Fascia	12
Idle Air Control Motor	BK	Left Side of Engine Near Throttle Body	8, 10
Ignition Switch - C1	WT	On Steering Column	19
Ignition Switch - C2	BK	On Steering Column	19
Input Speed Sensor (4.7L)	BK	Left Side of Transmission	7
Instrument Cluster	WT	At Instrument Cluster	18
Intake Air Temperature Sensor	GY	Left Side of Engine	8, 10
Junction Block - C1	BK	At Junction Block	20, 21, 23
Junction Block - C2	BK	At Junction Block	21
Junction Block - C3	BK	At Junction Block	16, 17
Junction Block - C4	WT	At Junction Block	20, 21
Junction Block - C5	WT	At Junction Block	21
Leak Detection Pump (Except Built-Up-Export)		Left Front Wheel Opening	11
Left Courtesy Lamp	BK	Left Side of Instrument Panel	18, 19
Left Fog Lamp	BK	Left Front Fascia	11
Left Front Door Speaker	WT	In Driver Door	25
Left Front Park Lamp	WT	At Lamp	N/S
Left Front Park/Turn Signal Lamp (Except Built-Up-Export)	BK	At Lamp	N/S
Left Front Side Marker Lamp (Except Built-Up-Export)	WT	At Lamp	N/S
Left Front Turn Signal Lamp (Built-Up-Export)	WT	At Lamp	N/S
Left Front Wheel Speed Sensor	GY	At Left Front Wheel Opening	N/S

DESCRIPTION AND OPERATION (Continued)

Connector Name/Number	Color	Location	Fig.
Left Handle Courtesy Lamp	WT	At Lamp	N/S
Left Headlamp Leveling Motor (Built-Up-Export)	BK	At Motor	N/S
Left High Beam Headlamp	BK	At Lamp	N/S
Left Instrument Panel Speaker	WT	At Speaker	18
Left Liftgate Ajar Switch	GY	In Liftgate	32
Left Low Beam Headlamp	GY	At Lamp	N/S
Left Multi-Function Switch	WT	On Steering Column	19
Left Rear Door Speaker	WT	In Left Rear Door	26
Left Rear Lamp Assembly	BK	At Lamp Assembly	N/S
Left Rear Wheel Speed Sensor	GY	Near Left Rear Wheel	23
Left Side Repeater (Built-Up-Export)	BK	On Left Front Fender	N/S
Left Visor/Vanity Lamp	BK	At Lamp	N/S
License Lamp NO. 1	BK	At Lamp	N/S
License Lamp NO. 2	BK	At Lamp	N/S
Liftgate Flip-Up Ajar Switch	GY	In Liftgate	32
Liftgate Flip-Up Push Button Switch	BK	In Liftgate	N/S
Liftgate Flip-Up Release Solenoid	BK	In Liftgate	32
Liftgate Lock Motor	BK	In Liftgate	32
Manifold Absolute Pressure Sensor (4.0L)	BK	At Throttle Body	8

Connector Name/Number	Color	Location	Fig.
Manifold Absolute Pressure Sensor (4.7L)	BK	Right Side of Engine	10
Manual Temperature Control - C1	WT	Center of Instrument Panel	18
Manual Temperature Control - C2	WT	Center of Instrument Panel	18
Mode Door Motor/Actuator (AZC)	BK	Right Center of Instrument Panel	N/S
Needle Movement sensor (Diesel)	BK	Left Rear of Engine	4
Output Speed Sensor (4.0L/Diesel)	GY	Left Side of Transmission	4, 6
Output Speed Sensor (4.7L)	BK	Left Side of Transmission	7
Overhead Map/Courtesy Lamp		At Overhead Console	N/S
Oxygen Sensor 1/1 Upstream (4.0L)	GY	Left Side of Engine at Exhaust	6
Oxygen Sensor 1/1 Upstream (4.7L)	GY	Left Side of Engine at Exhaust	N/S
Oxygen Sensor 1/2 Downstream (4.0L)	BK	Rear of Transmission	6
Oxygen Sensor 1/2 Downstream (4.7L)	BK	Rear of Transmission	N/S
Park/Neutral Position Switch (4.0L)	BK	Left Side of Transmission	6
Park/Neutral Position Switch (Diesel)	BK	Left Side of Transmission	4
Passenger Airbag	YL	Right Side of Instrument Panel	18
Passenger Blend Door Motor/Actuator (AZC)	BK	Right Side of Instrument Panel	N/S

DESCRIPTION AND OPERATION (Continued)

Connector Name/Number	Color	Location	Fig.
Passenger Door Courtesy Lamp	BK	In Passenger Door	N/S
Passenger Door Lock Motor/Ajar Switch	BK	In Passenger Door	27
Passenger Door Module - C1	WT	In Passenger Door	27
Passenger Door Module - C2	BK	In Passenger Door	N/S
Passenger Heated Seat Back (Premium I/III)	GN	At Passenger Seat	N/S
Passenger Heated Seat Cushion (Premium I/III)	BK	At Passenger Seat	N/S
Passenger Heated Seat Switch	BK	Center of Instrument Panel	N/S
Passenger Lumbar Motor (Midline/ Premium)	BK	At Passenger Seat	N/S
Passenger Lumbar Switch (Midline/ Premium)	WT	At Passenger Seat	N/S
Passenger Power Mirror	BK	At Passenger Door	N/S
Passenger Power Seat Front Riser Motor	RD	At Passenger Seat	N/S
Passenger Power Seat Horizontal Motor	RD	At Passenger Seat	N/S
Passenger Power Seat Rear Riser Motor	RD	At Passenger Seat	N/S
Passenger Power Seat Recliner Motor (Midline/ Premium)	BK	At Passenger Seat	N/S
Passenger Power Seat Switch (Base)		At Passenger Seat	N/S
Passenger Power Seat Switch (Midline/ Premium)	GN	At Passenger Seat	N/S
Passenger Power Window Motor	BK	In Passenger Door	27
Passenger Rear Door Lock Motor/Ajar Switch	BK	In Rear Door Passenger Side	28
Passenger Rear Power Window Motor	BK	In Rear Door Passenger Side	28
Passenger Rear Power Window Switch	BL	In Rear Door Passenger Side	28
Pedal Position Sensor (Diesel)	BK	Left Side of Engine	4
Power Amplifier - C1	WT	Under Rear Seat Right Side	24
Power Amplifier - C2	WT	Under Rear Seat Right Side	24
Power Connector	WT	Center of Instrument Panel	17
Powertrain Control Module - C1	BK	Right Rear of Engine Compartment	5, 9, 12, 14
Powertrain Control Module - C2	WT	Right Rear of Engine Compartment	5, 9, 12, 14
Powertrain Control Module - C3 (Diesel)	GY	Right Rear of Engine Compartment	N/S
Radiator Fan Motor	BK	At Radiator	12
Radiator Fan Relay	BK	Right Side of Engine Compartment	12
Radio - C1	GY	Center of Instrument Panel	18
Radio - C2	BK	Center of Instrument Panel	18

DESCRIPTION AND OPERATION (Continued)

Connector Name/Number	Color	Location	Fig.
Radio - C3	WT	Center of Instrument Panel	18
Radio - C4 (Premium)	BK	Center of Instrument Panel	18
Rail Coil (4.0L)	BK	Right Rear of Engine	5
Rear Power Outlet	RD	Right Rear Quarter Panel	31
Rear Washer Pump	BK	Left Front of Engine Compartment	11
Rear Wiper Motor	BK	In Liftgate	32
Recirculation Door Motor/ Actuator (AZC)	BK	Center of Instrument Panel	N/S
Remote Radio Switch NO. 1	BK	At Switch in Steering Wheel	N/S
Remote Radio Switch NO. 2	BK	At Switch in Steering Wheel	N/S
Right Courtesy Lamp	BK	At Lamp	17
Right Fog Lamp	BK	At Right Front Fascia	12
Right Front Door Speaker	WT	In Passenger Door	27
Right Front Park Lamp	WT	At Lamp	N/S
Right Front Park/Turn Signal Lamp (Except Built-Up-Export)	BK	At Lamp	N/S
Right Front Side Marker Lamp (Except Built-Up-Export)	WT	At Lamp	N/S
Right Front Turn Signal Lamp (Built-Up-Export)	WT	At Lamp	N/S
Right Front Wheel Speed Sensor	GY	In Right Front Wheel Opening	N/S
Right Handle Courtesy Lamp	WT	At Lamp	N/S

Connector Name/Number	Color	Location	Fig.
Right Headlamp Leveling Motor (Built-Up-Export)	BK	At Motor	N/S
Right High Beam Headlamp	BK	At Lamp	N/S
Right Instrument Panel Speaker	WT	At Speaker	18
Right Liftgate Ajar Switch	BK	In Liftgate	32
Right Low Beam Headlamp	GY	At Lamp	N/S
Right Multi-Function Switch	WT	On Steering Column	19
Right Rear Door Speaker	WT	In Right Rear Door	28
Right Rear Lamp Assembly	BK	At Lamp Assembly	31
Right Rear Wheel Speed Sensor	BK	Near Right Rear Wheel	23
Right Side Repeater (Built-Up-Export)	BK	On Right Front Fender	N/S
Right Visor/ Vanity Lamp	BK	At Lamp	N/S
Seat Belt Switch	WT	At Driver Seat	N/S
Seat Module - C1 (Premium)	BK	Under Driver Seat	N/S
Seat Module - C2 (Premium)	OR	Under Driver Seat	N/S
Sentry Key Immobilizer Module	BK	On Steering Column	19
Sunroof Control Module		At Sunroof	22
Sunroof Motor	WT	At Sunroof	N/S
Sunroof Motor Position Sensor	BK	At Sunroof	N/S
Sunroof Switch		At Switch	N/S
Temperature Valve Actuator (MTC)	BK	On HVAC Housing	N/S

DESCRIPTION AND OPERATION (Continued)

Connector Name/Number	Color	Location	Fig.
Throttle Position Sensor (4.0L)	WT	Left Side of Engine	8
Throttle Position Sensor (4.7L)	WT	Left Side of Engine	10
Trailer Tow Brake Lamp Relay	BK	Left Rear Quarter Panel	N/S
Trailer Tow Circuit Breaker	BK	Left Rear Quarter Panel	N/S
Trailer Tow Connector	BK	In Rear Bumper	33
Trailer Tow Left Turn Relay	BK	Left Rear Quarter Panel	N/S
Trailer Tow Right Turn Relay	BK	Left Rear Quarter Panel	N/S
Transfer Case Switch (4.0L) (Except Built-Up-Export)		On Transfer Case	N/S
Transmission Control Module (4.7L)	BK	Right Rear of Engine	9, 14
Transmission Solenoid (Diesel/4.0L Gas)	BK	Left Side of Transmission	4, 6

Connector Name/Number	Color	Location	Fig.
Transmission Solenoid/TRS Assembly (4.7L)	GY	Left Side of Transmission	7
Turbo Boost Pressure Sensor (Diesel)	BK	Top Front of Engine	3
Underhood Lamp	BK	At Lamp	13
Vehicle Information Center	BK	In Overhead Console	N/S
Vehicle Speed Control Servo	BK	Right Front of Engine Compartment	12
Washer Fluid Level Switch	GY	Left Front of Engine Compartment	11
Water In Fuel Sensor (Diesel)	BK	Right Rear of Engine Compartment	N/S
Windshield Washer Pump	WT	Left Front of Engine Compartment	11
Windshield Wiper Motor	BK	Left Side of Cowl	11

DESCRIPTION AND OPERATION (Continued)

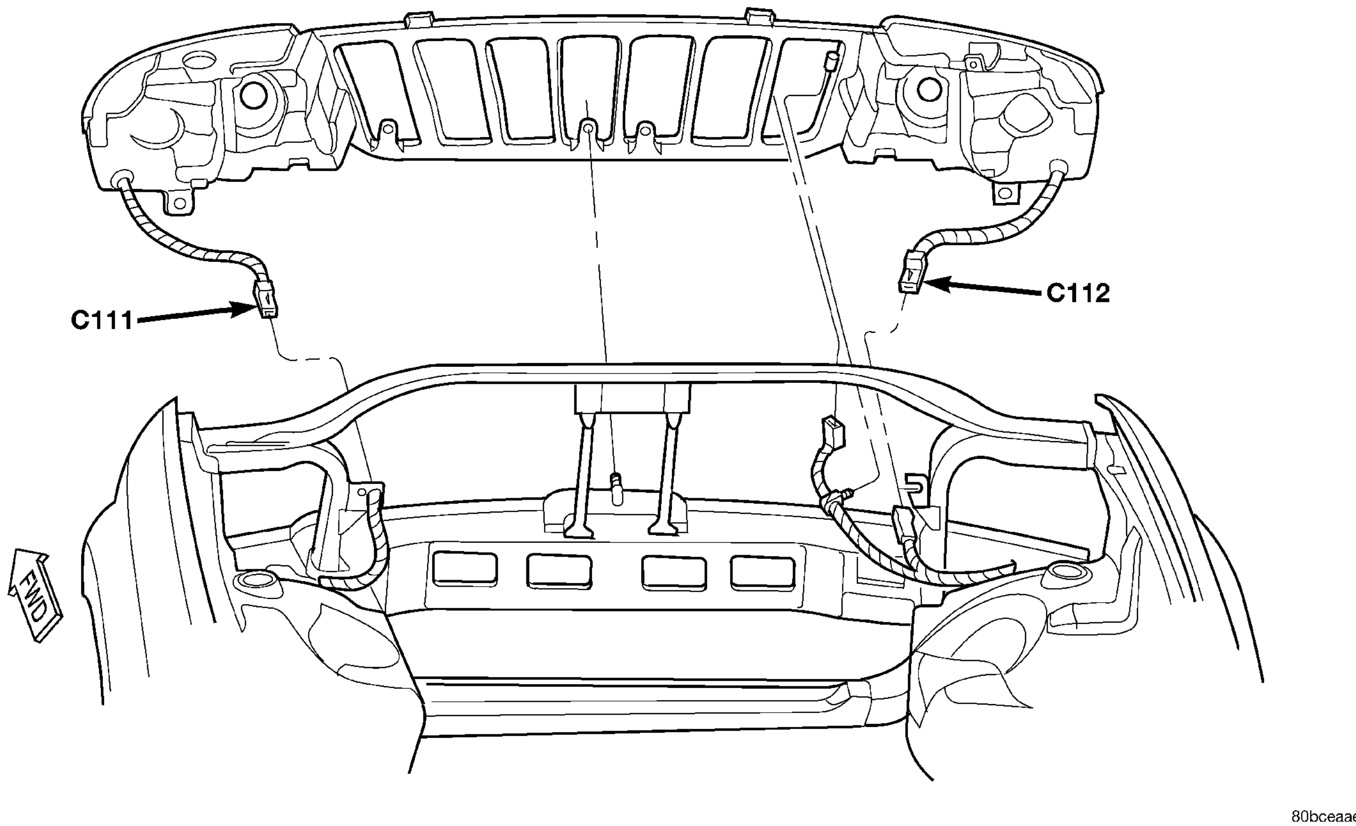


Fig. 1 Engine Compartment Connections (Front Clip) — LHD

DESCRIPTION AND OPERATION (Continued)

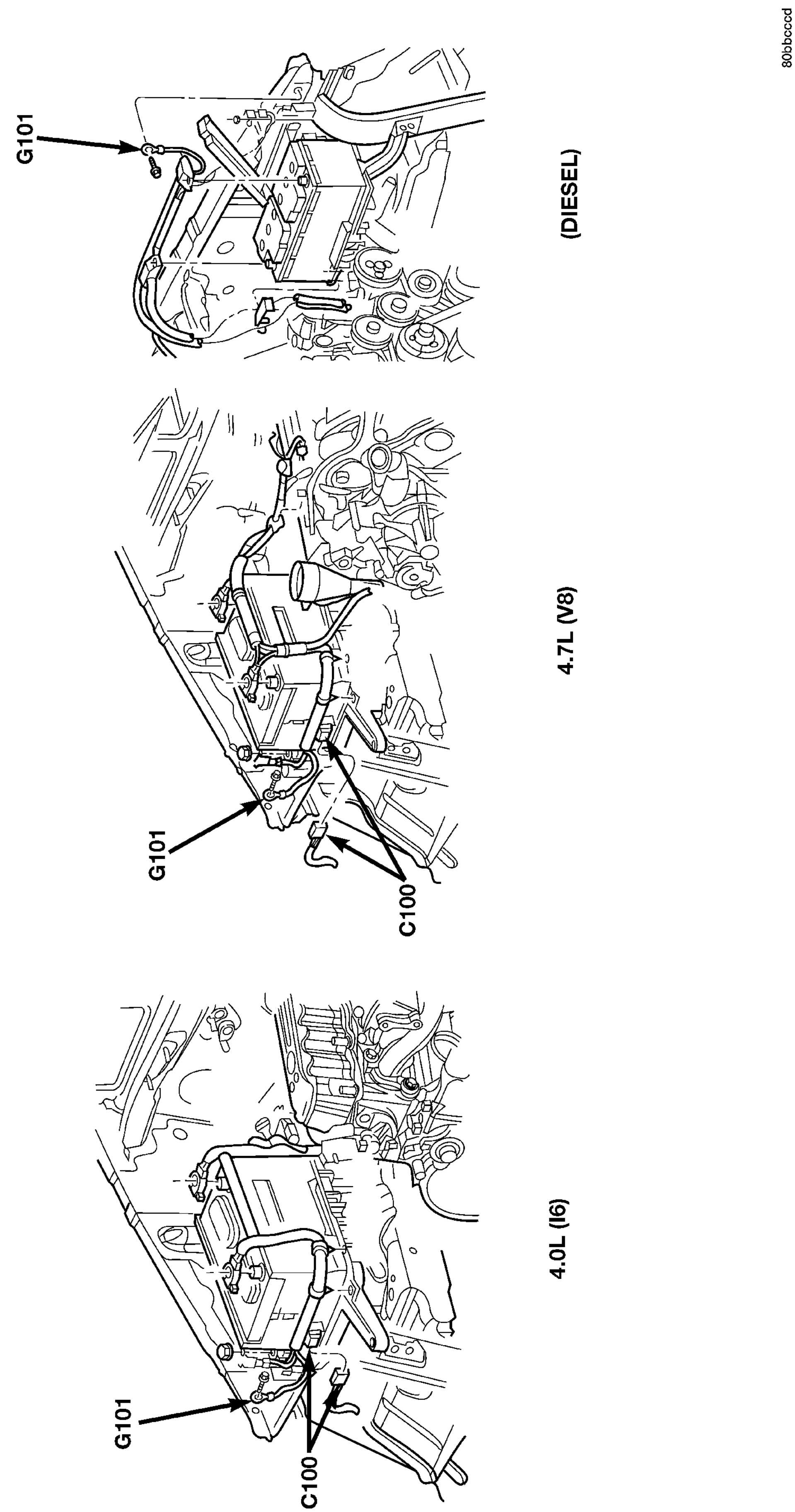


Fig. 2 Engine Compartment Connections (Battery) — LHD

DESCRIPTION AND OPERATION (Continued)

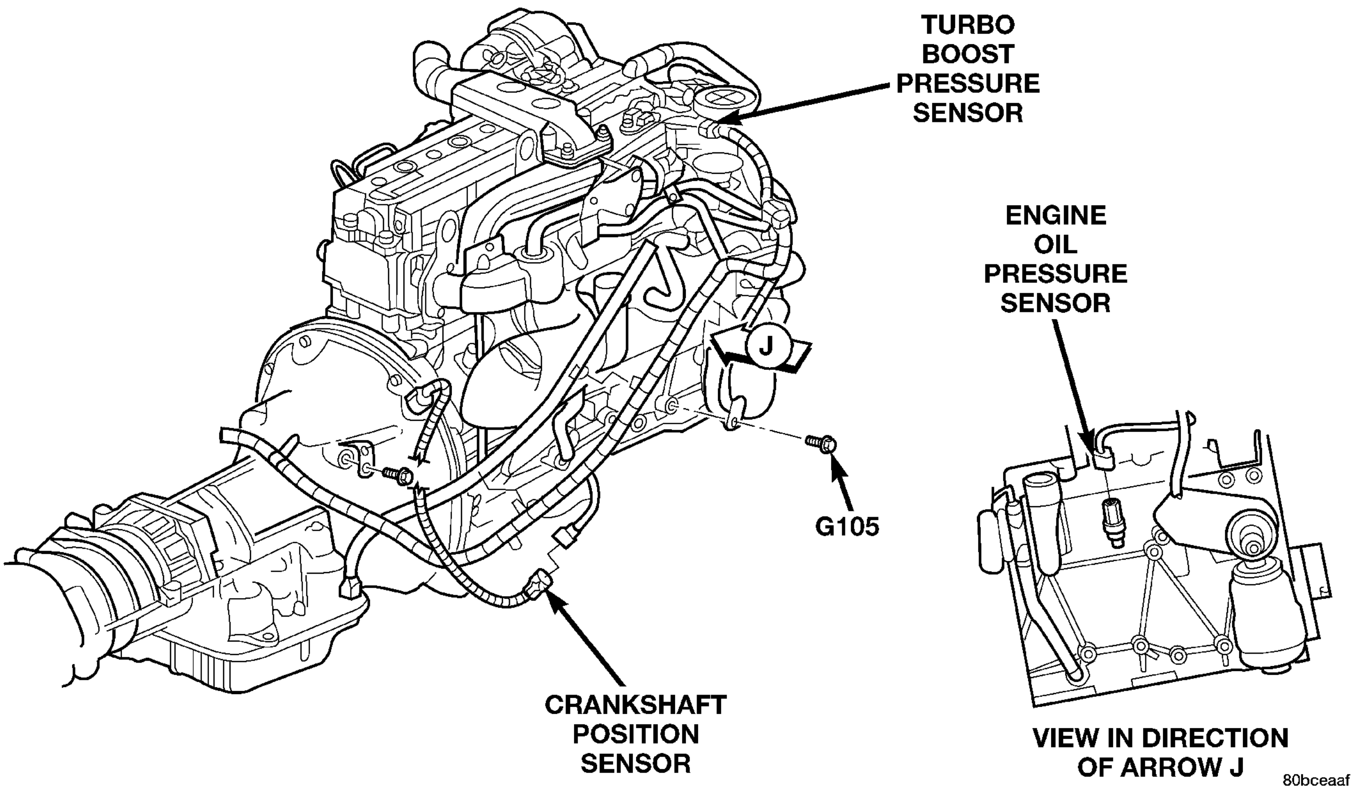


Fig. 3 Engine Connections (Diesel) — LHD

DESCRIPTION AND OPERATION (Continued)

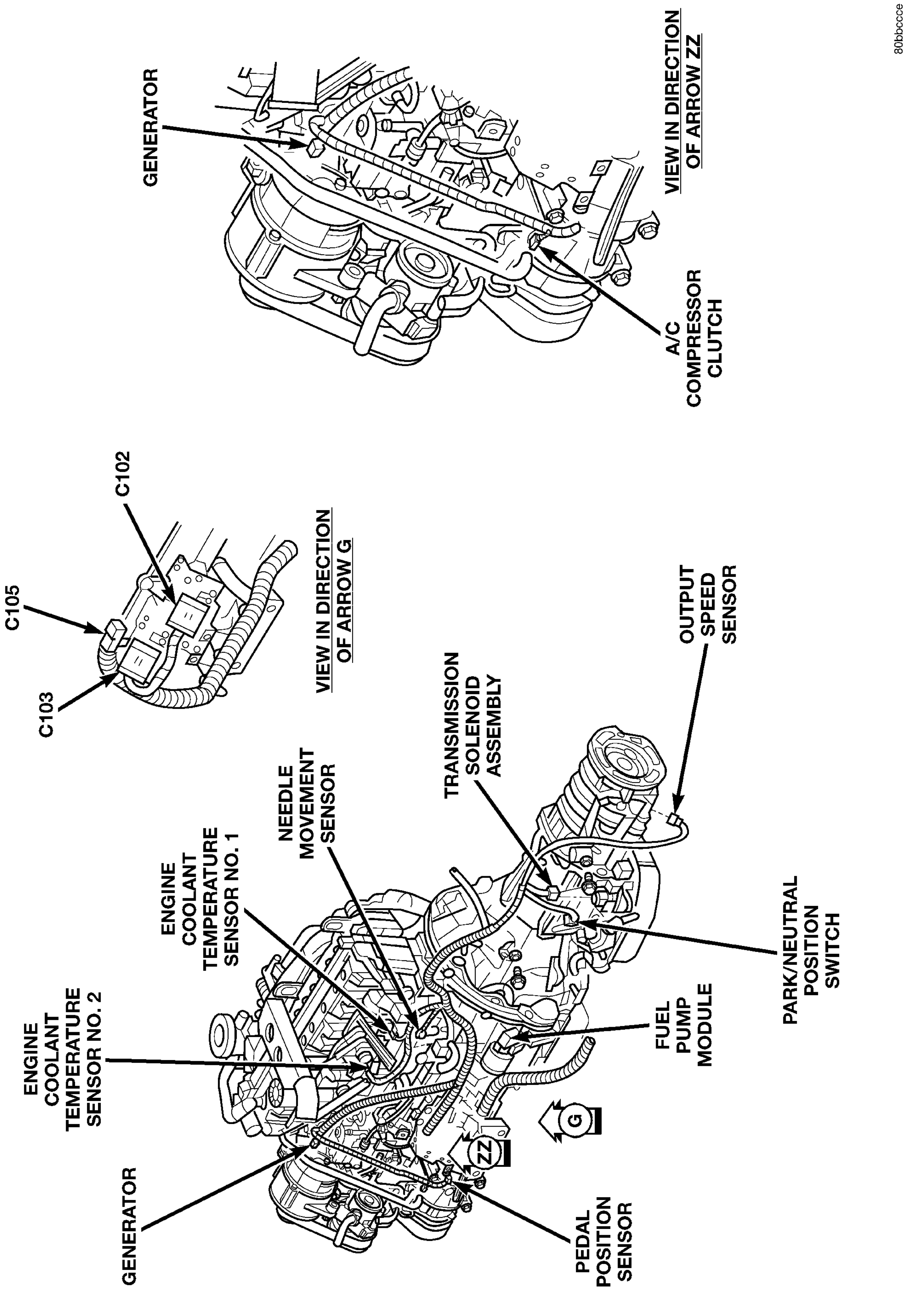


Fig. 4 Engine Connections (Diesel) — LHD

DESCRIPTION AND OPERATION (Continued)

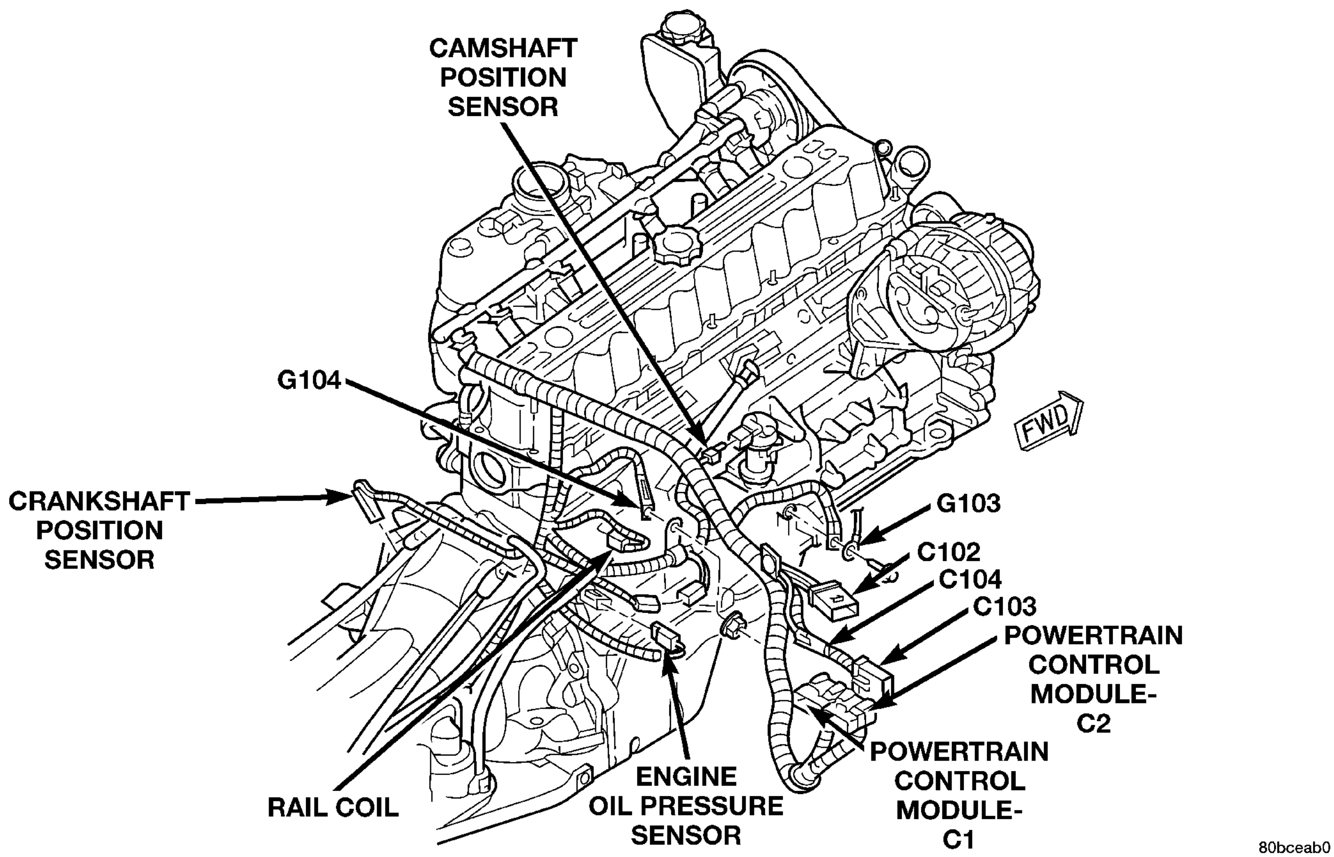


Fig. 5 Engine Connections (4.0L) — LHD

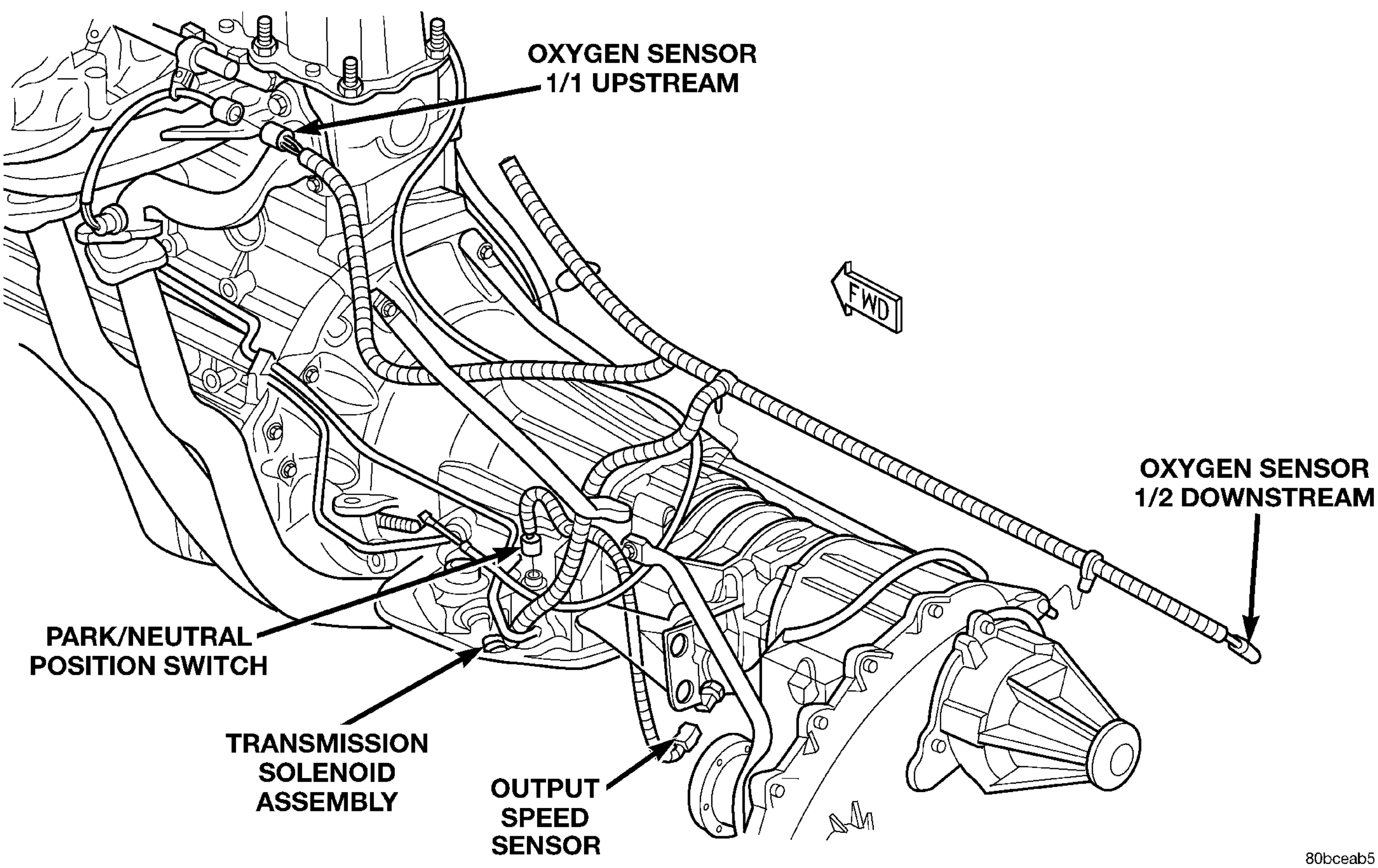


Fig. 6 Transmission Connections (4.0L) — LHD

DESCRIPTION AND OPERATION (Continued)

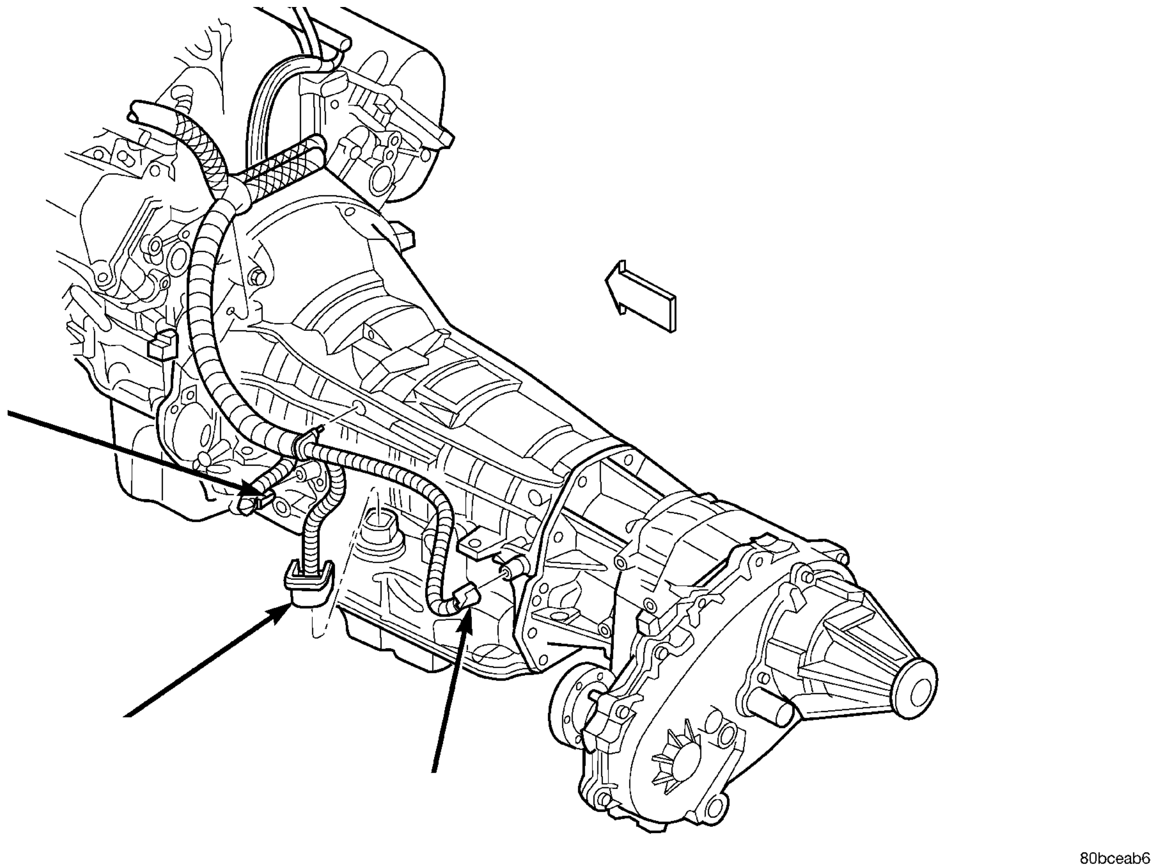


Fig. 7 Transmission Connections (4.7L) — LHD

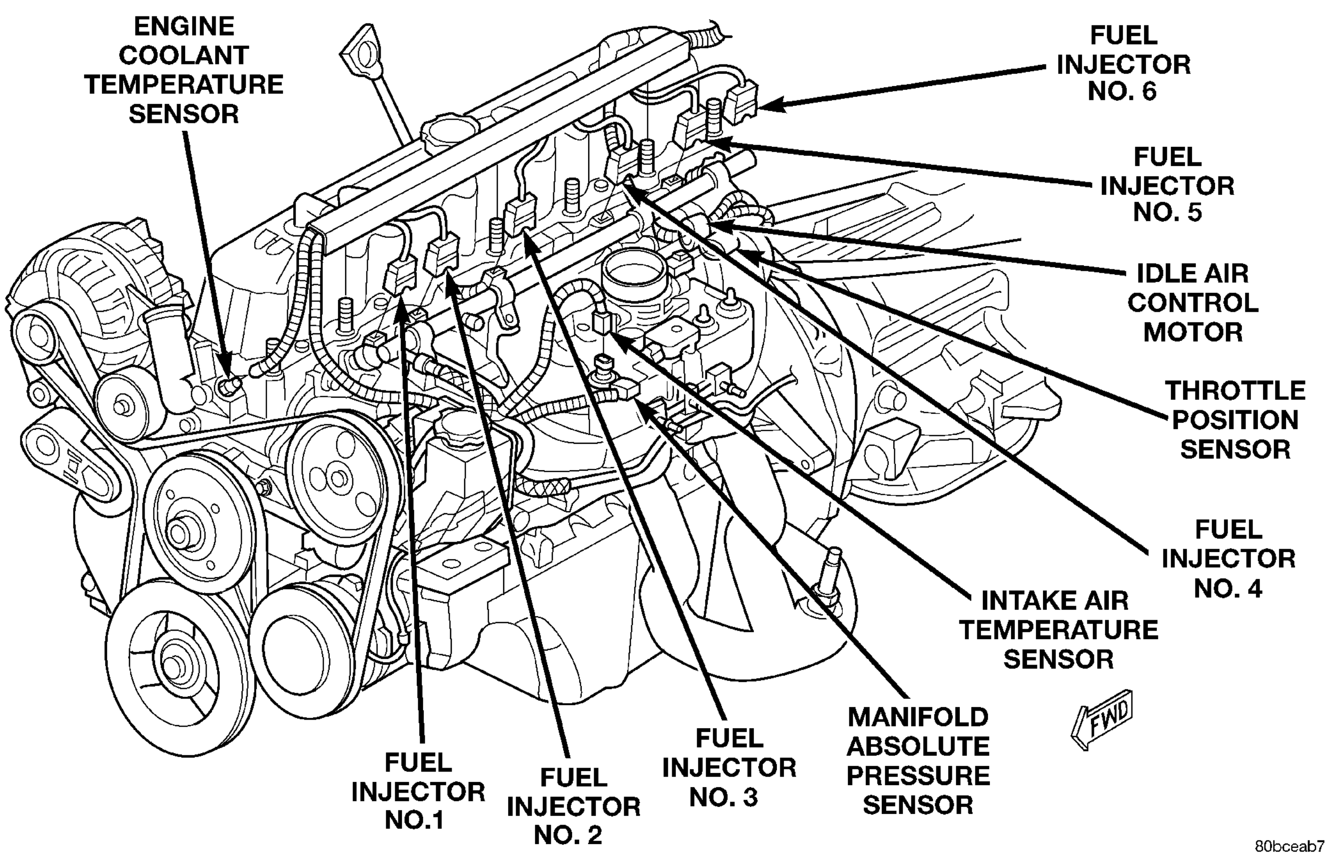


Fig. 8 Engine Connections (4.0L) — LHD

DESCRIPTION AND OPERATION (Continued)

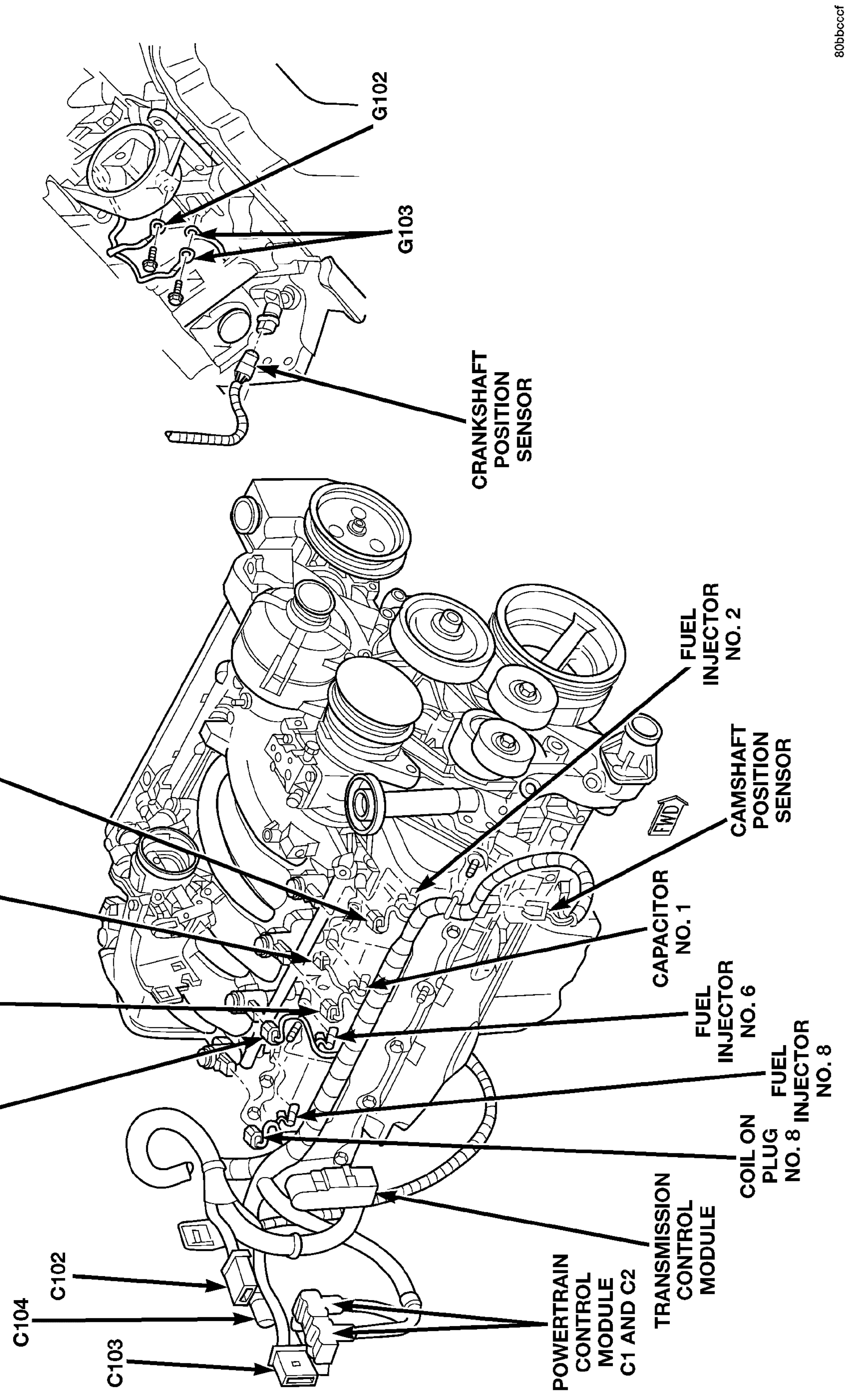


Fig. 9 Engine Connections (4.7L) — LHD

DESCRIPTION AND OPERATION (Continued)

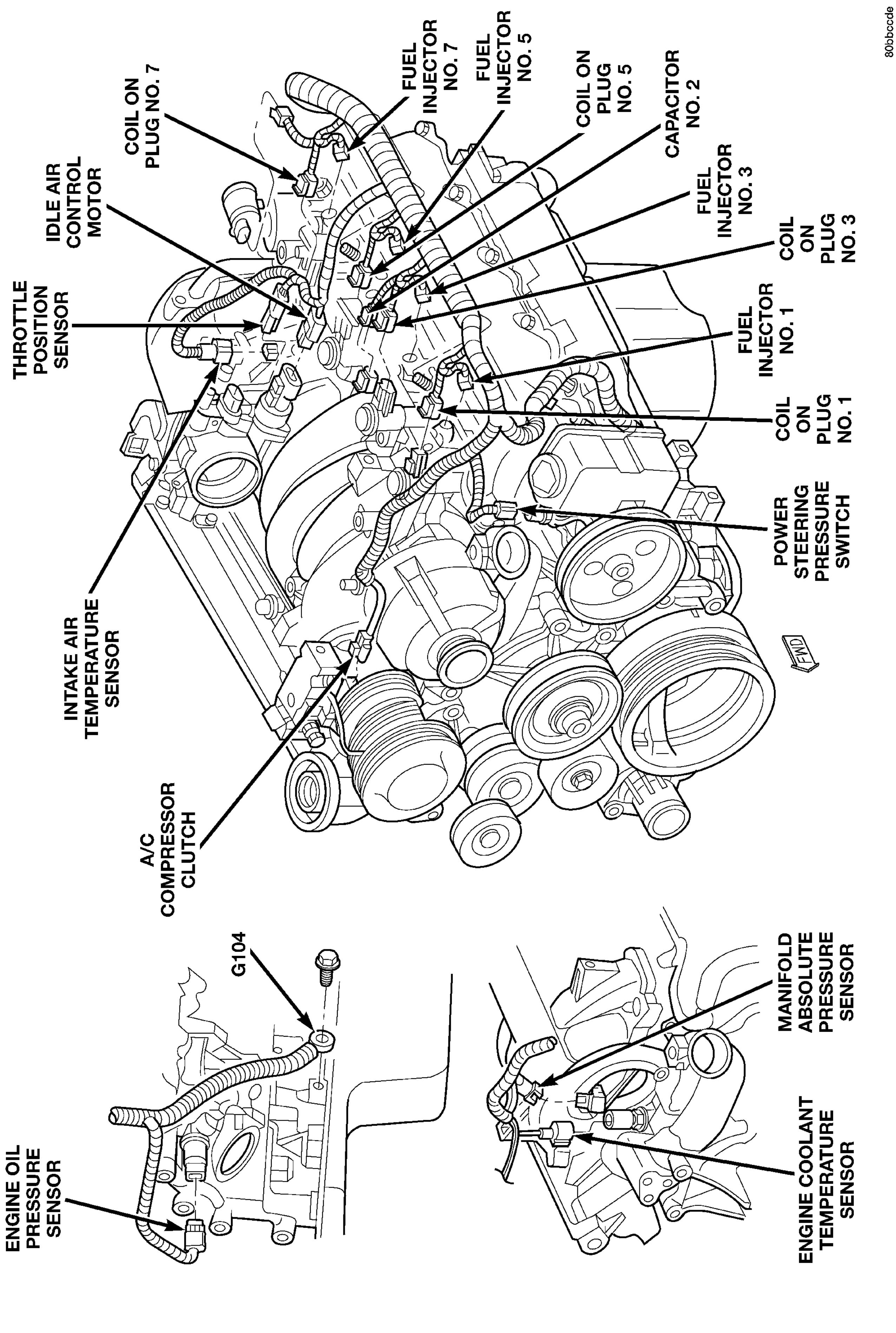


Fig. 10 Engine Connections (4.7L) — LHD

DESCRIPTION AND OPERATION (Continued)

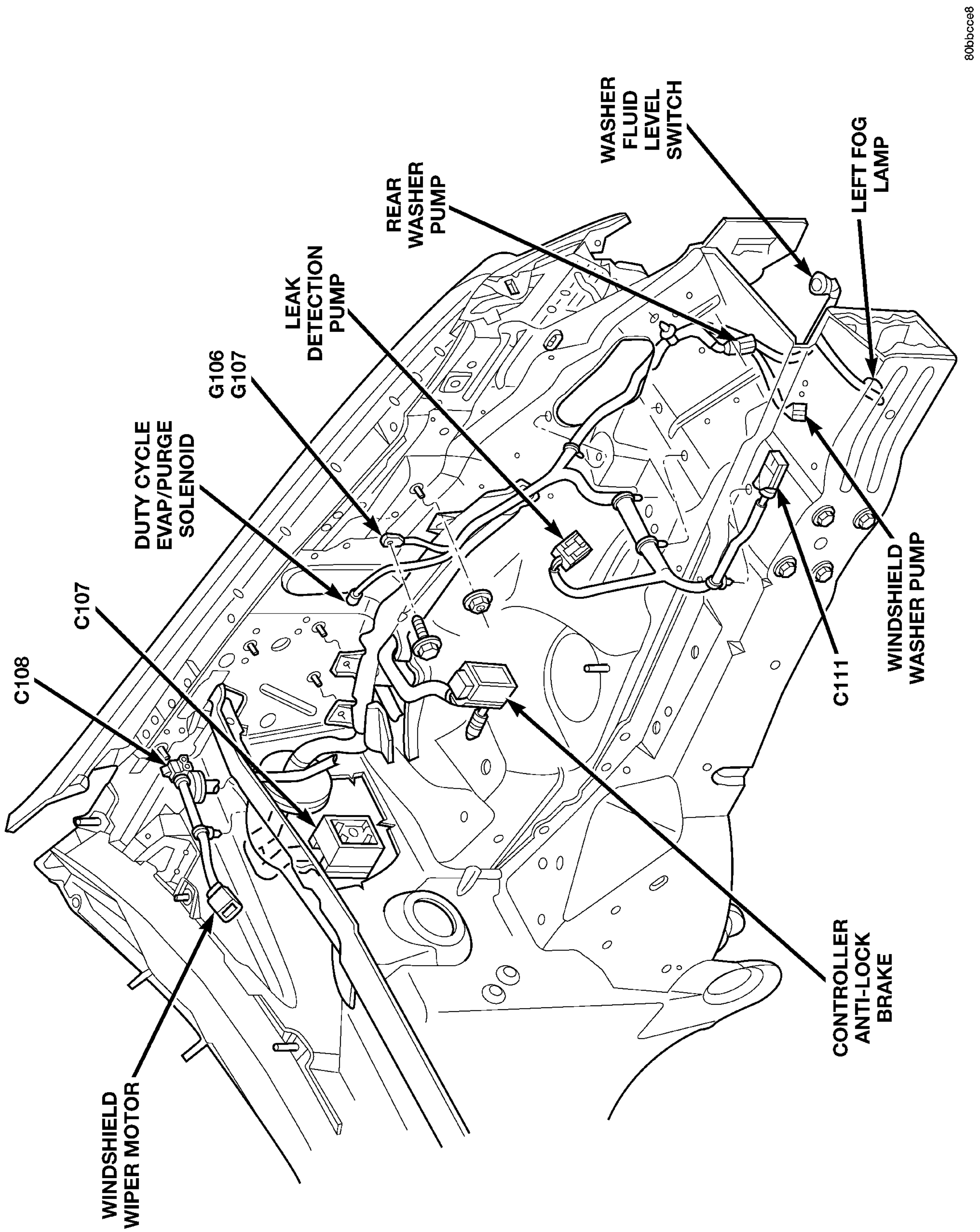


Fig. 11 Engine Compartment Connections (Left Side) — LHD

DESCRIPTION AND OPERATION (Continued)

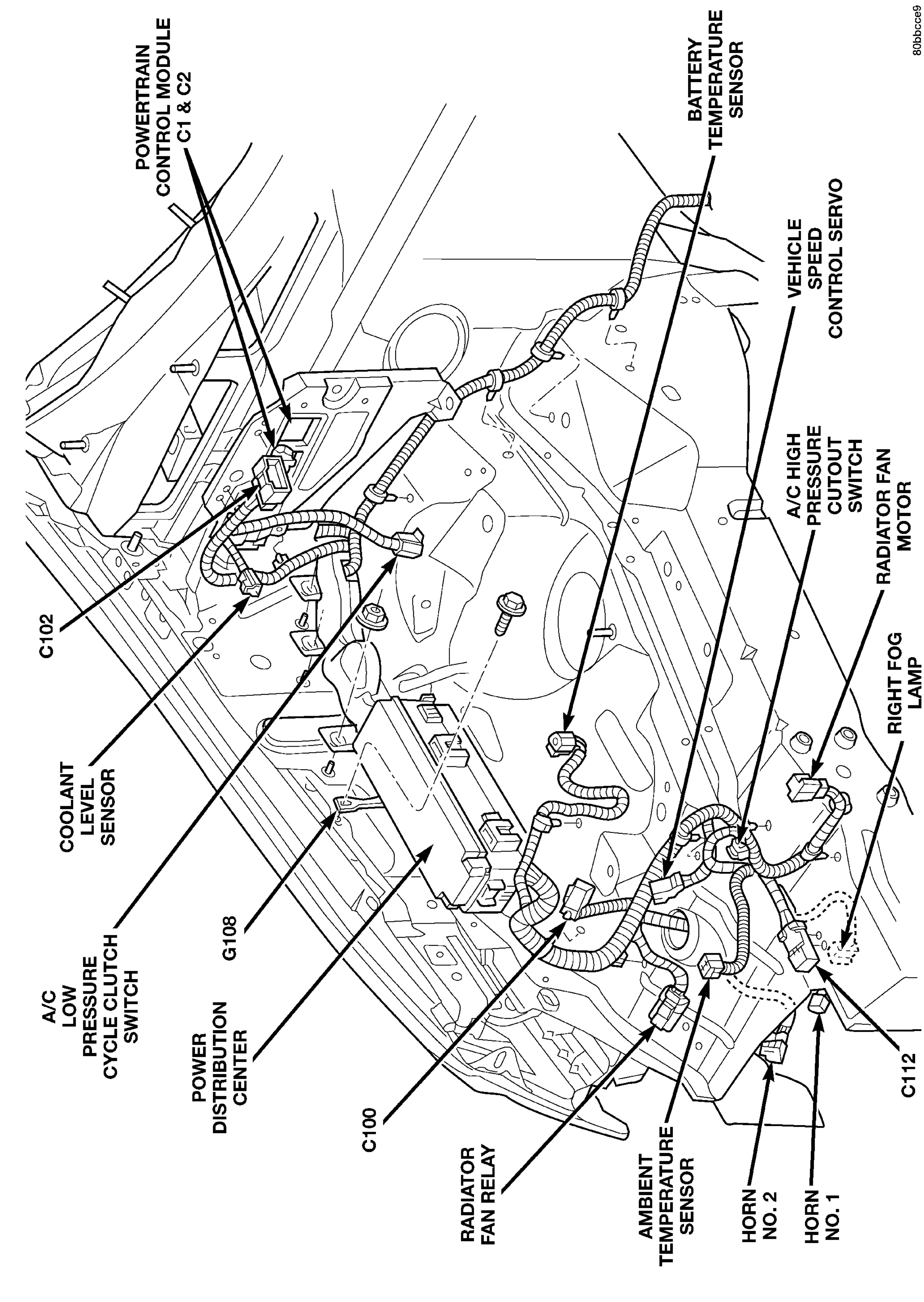


Fig. 12 Engine Compartment Connections (Right Side) — LHD

DESCRIPTION AND OPERATION (Continued)

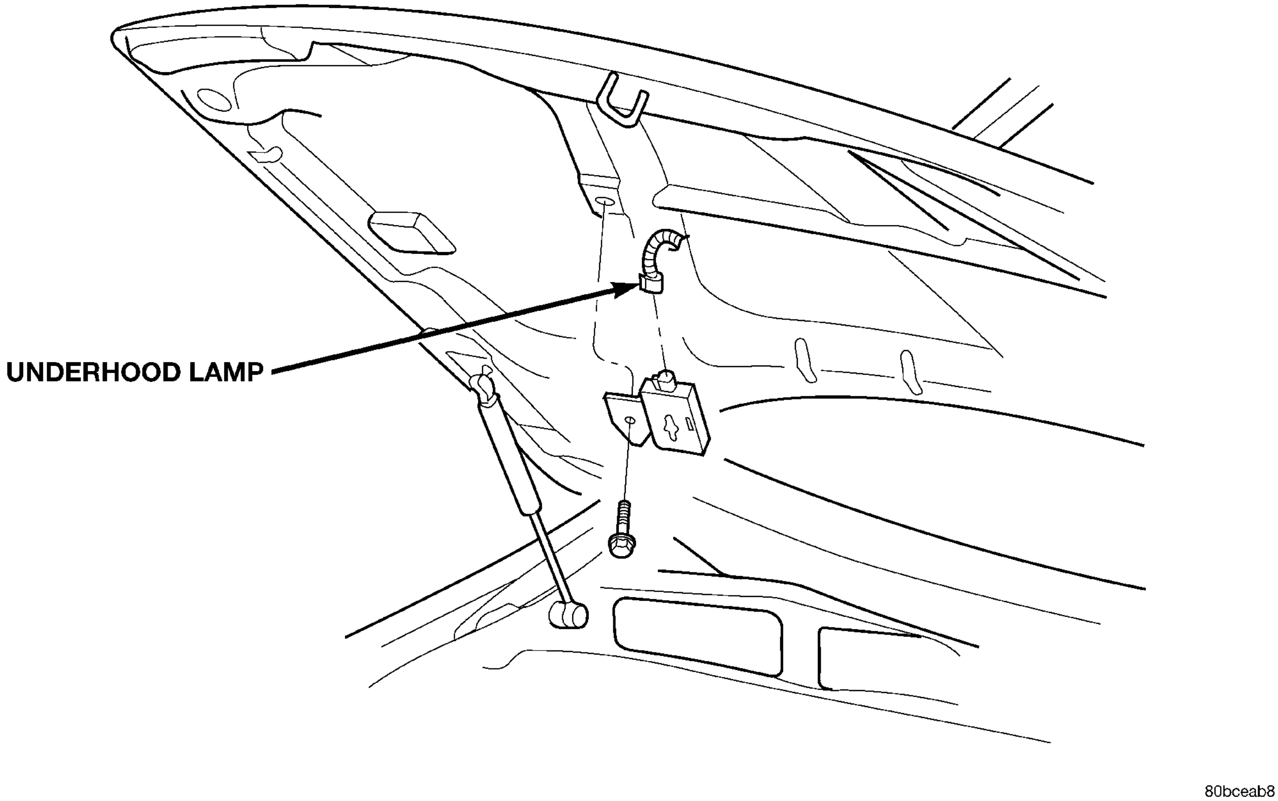


Fig. 13 Engine Compartment Connections — LHD

DESCRIPTION AND OPERATION (Continued)

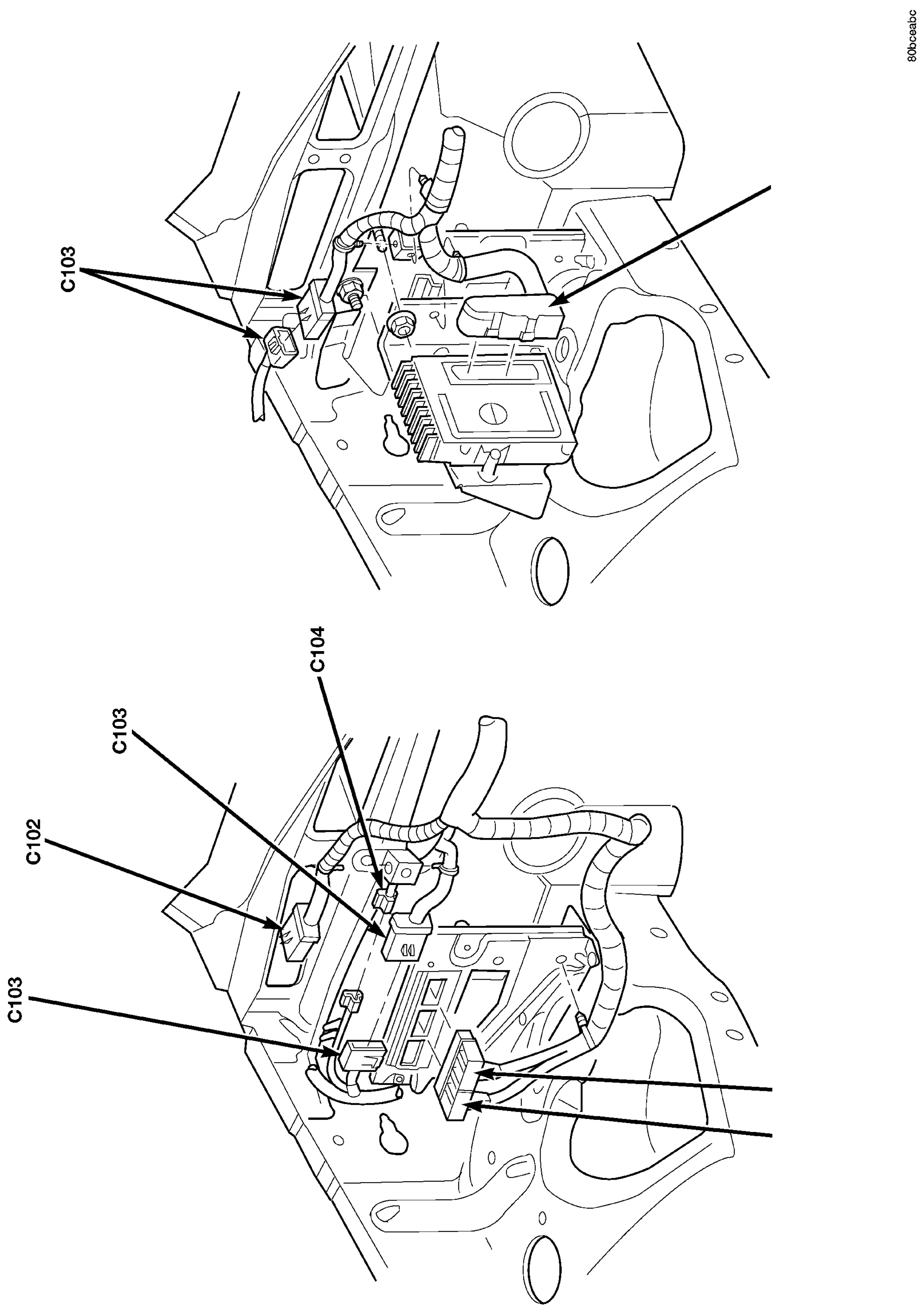


Fig. 14 Engine Compartment Connections — LHD

DESCRIPTION AND OPERATION (Continued)

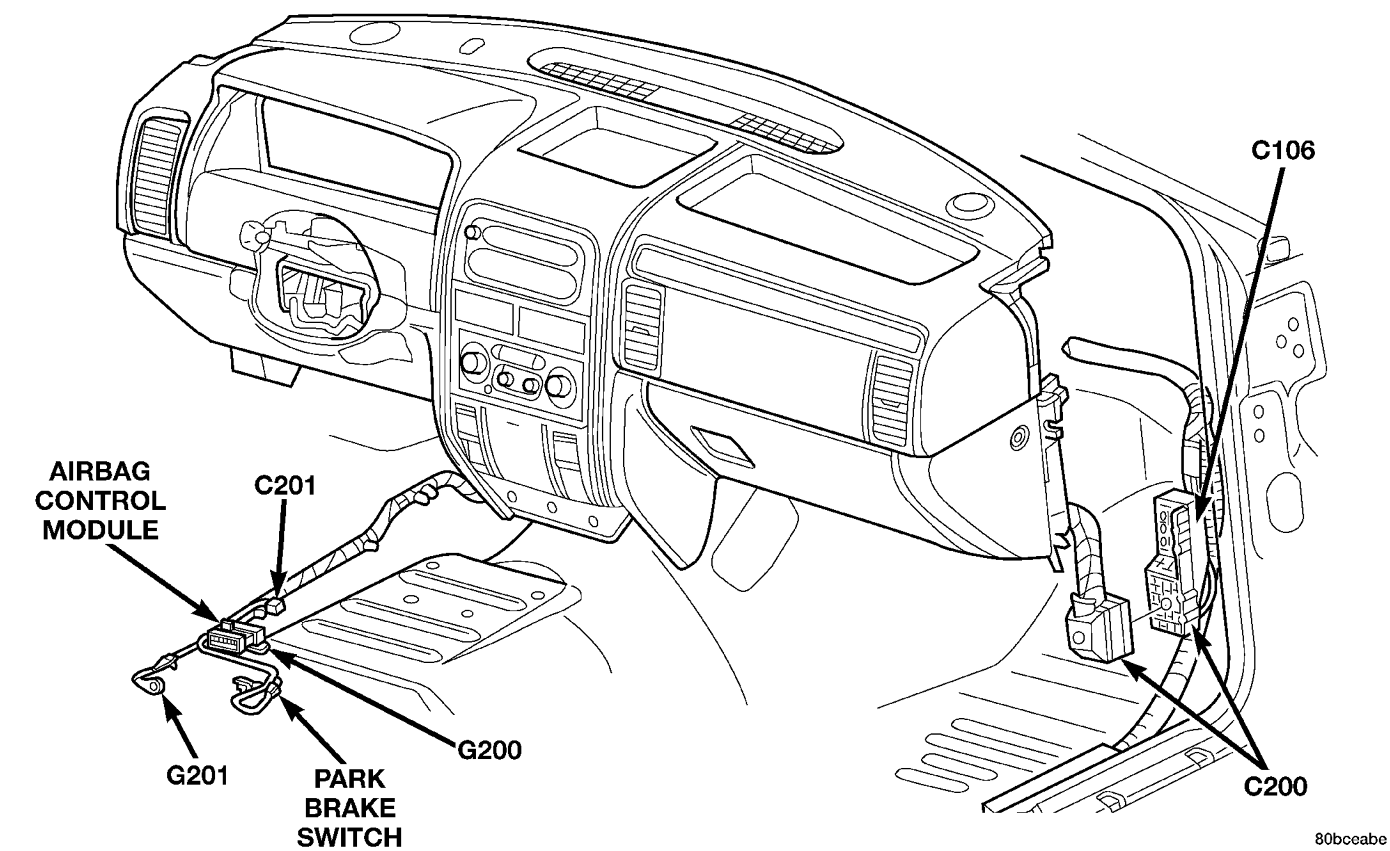


Fig. 15 Instrument Panel Connections — LHD

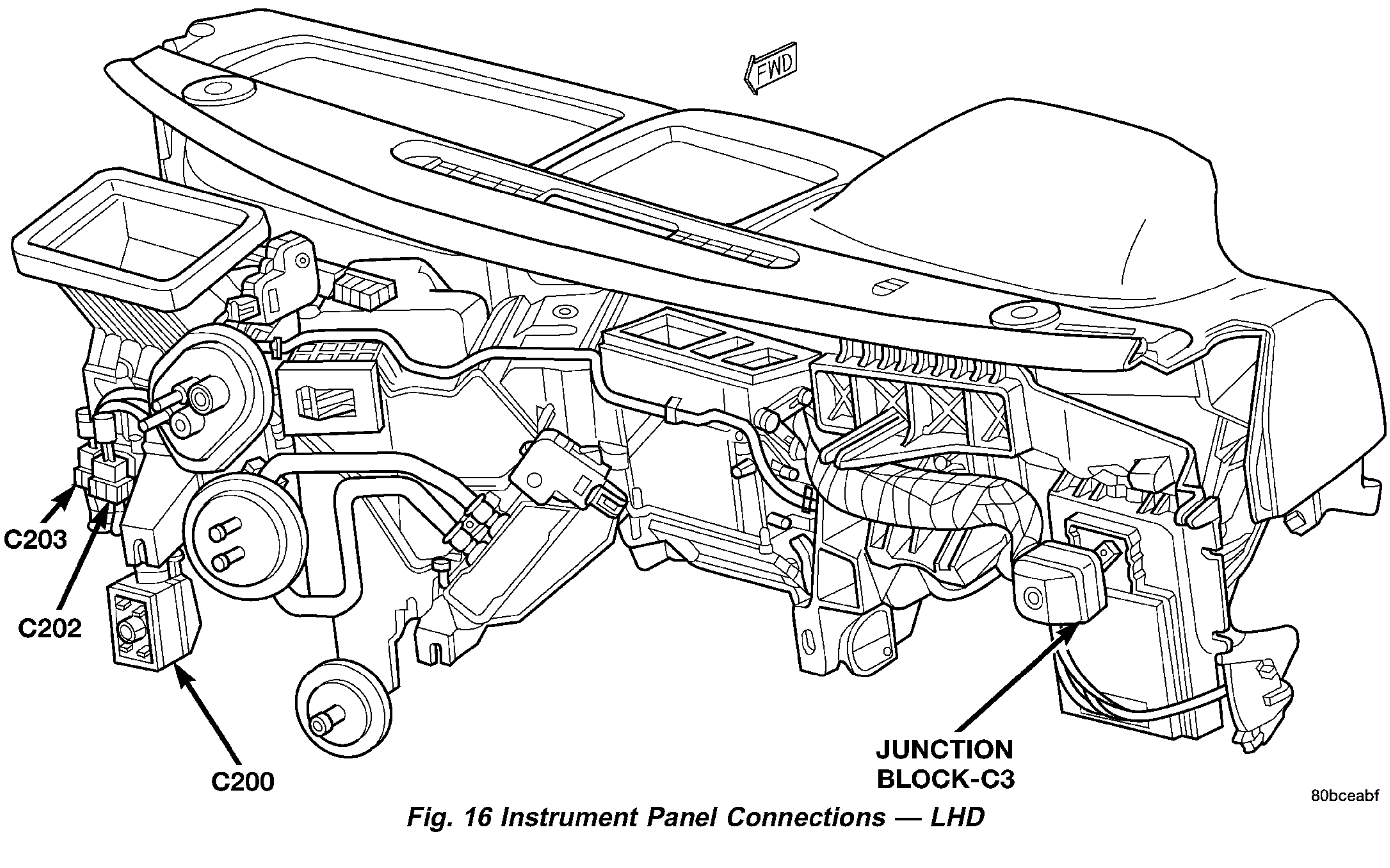


Fig. 16 Instrument Panel Connections — LHD

DESCRIPTION AND OPERATION (Continued)

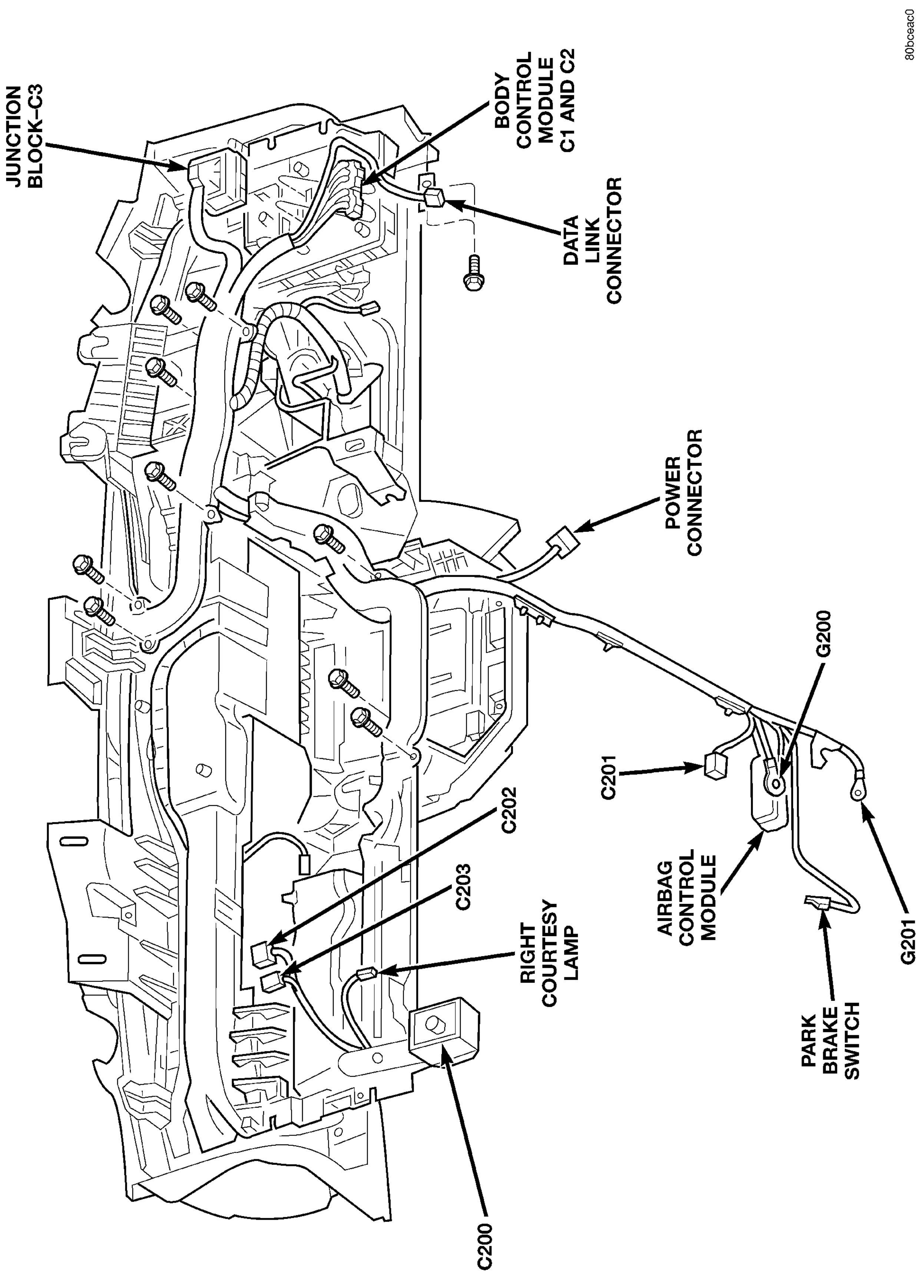


Fig. 17 Instrument Panel Connectors — LHD

DESCRIPTION AND OPERATION (Continued)

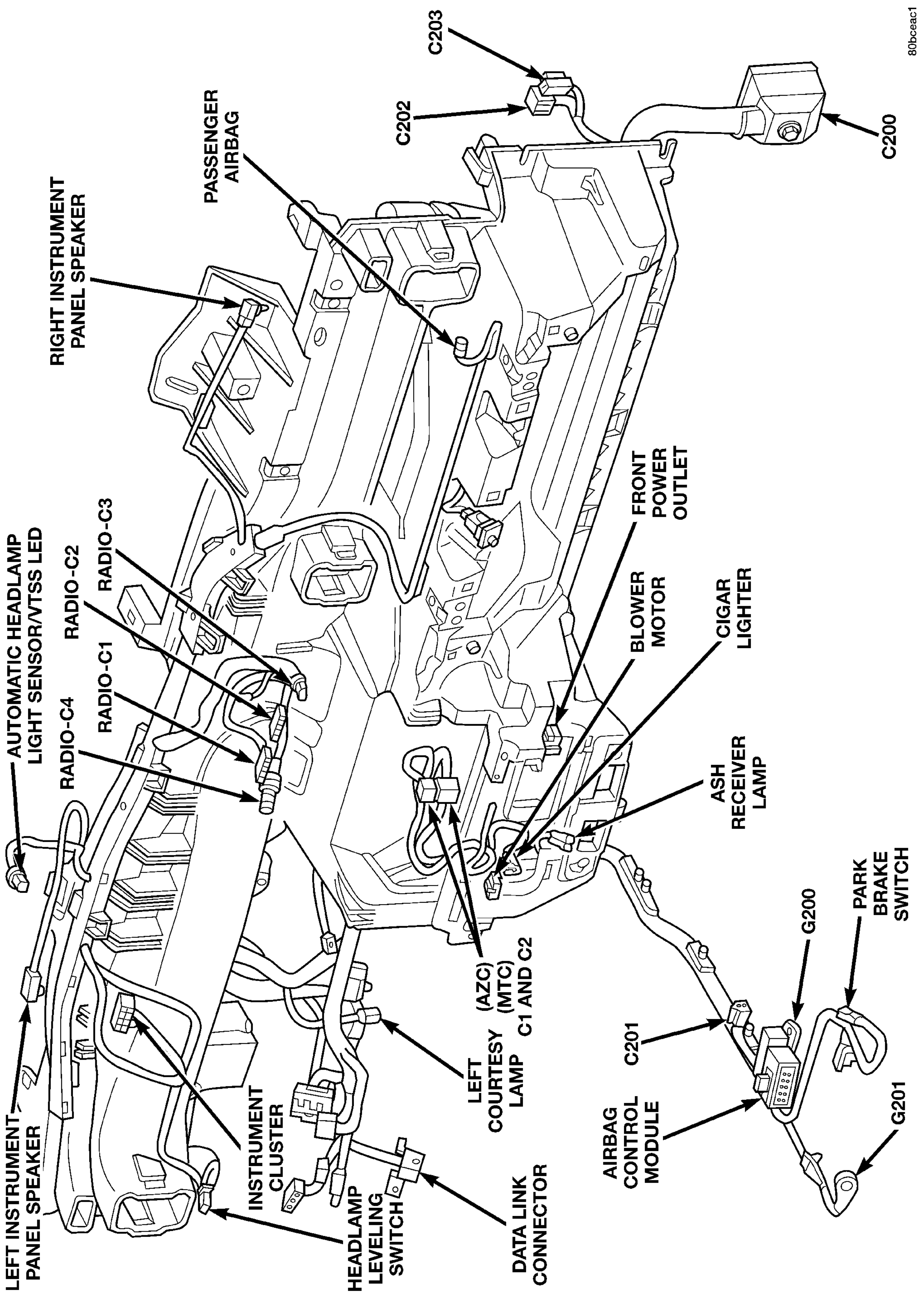


Fig. 18 Instrument Panel Connectors — LHD

DESCRIPTION AND OPERATION (Continued)

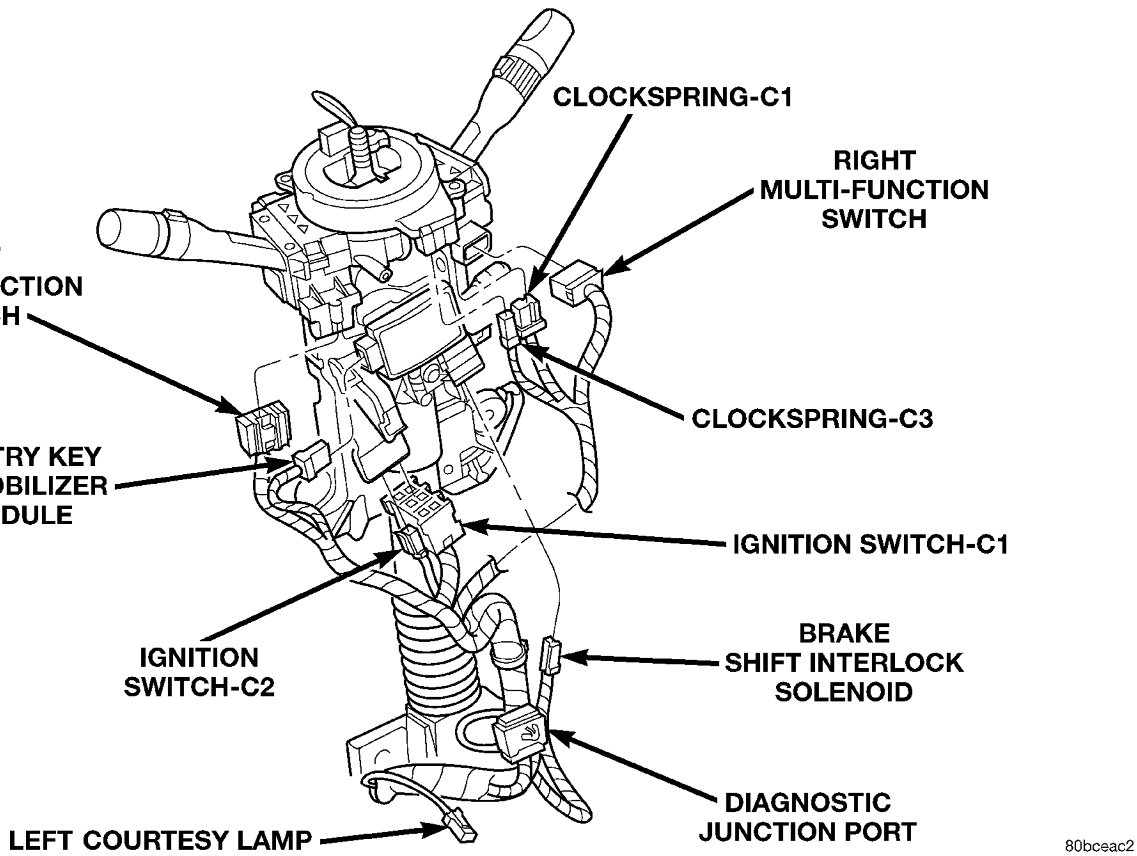


Fig. 19 Steering Column Connections — LHD

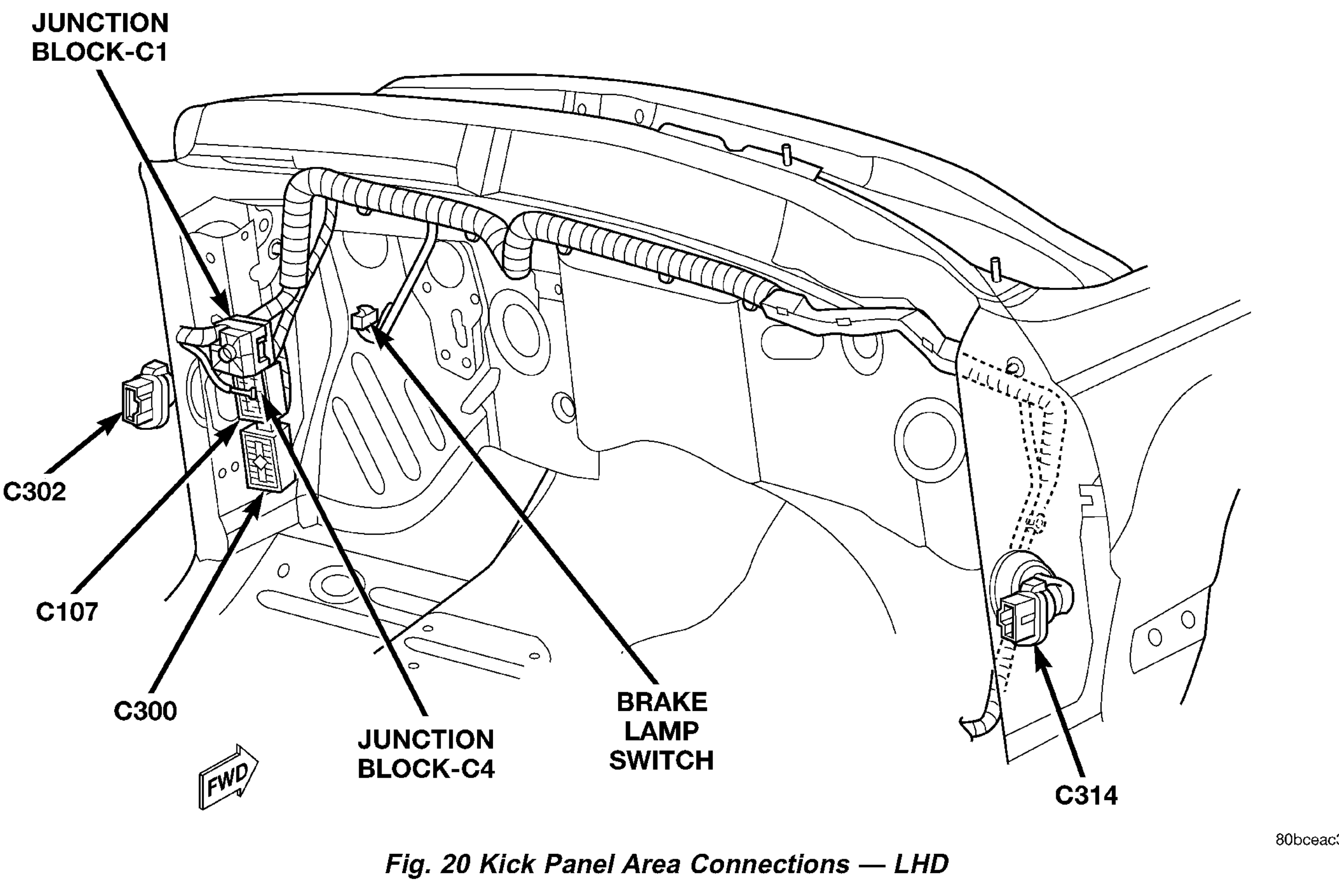


Fig. 20 Kick Panel Area Connections — LHD

DESCRIPTION AND OPERATION (Continued)

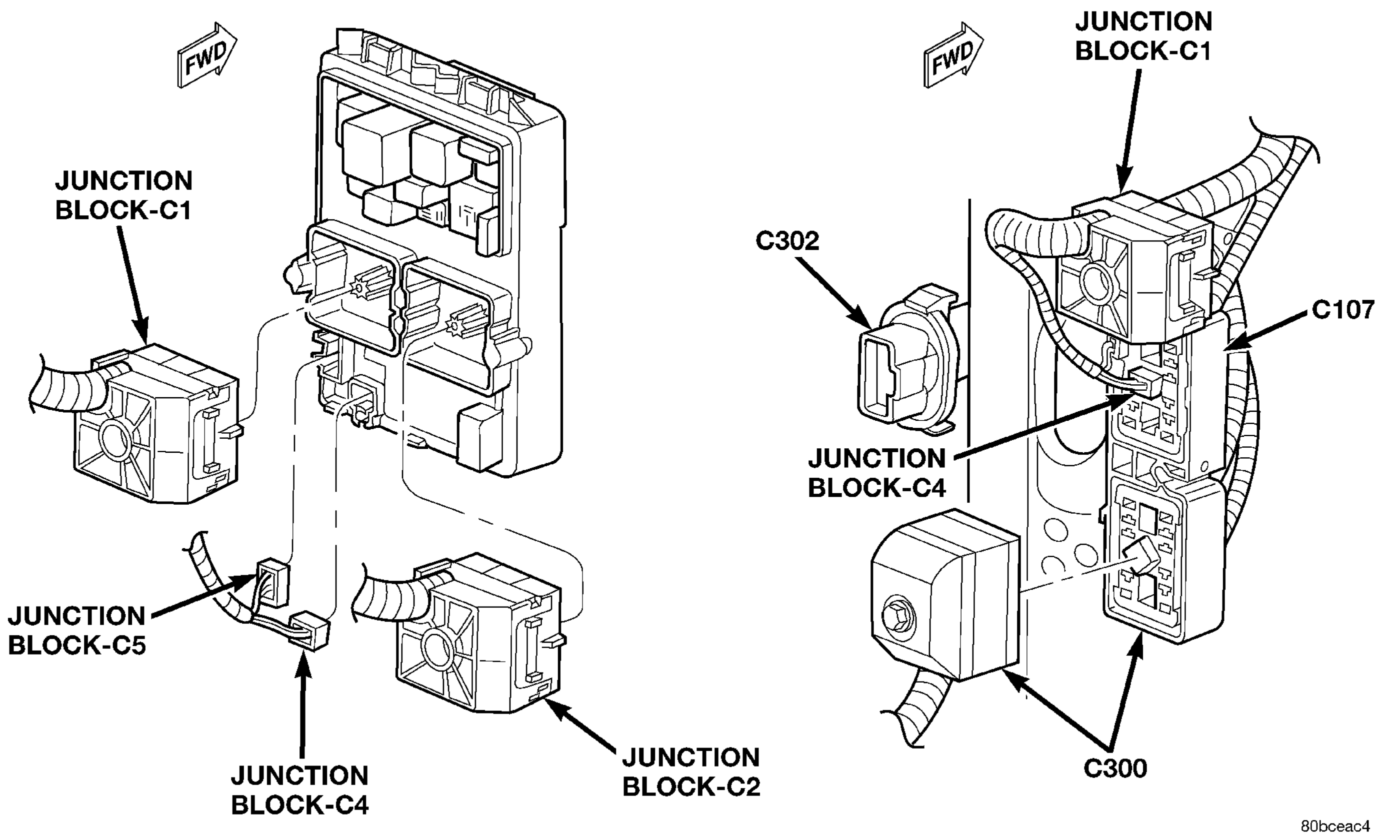


Fig. 21 Kick Panel Area Connections — LHD

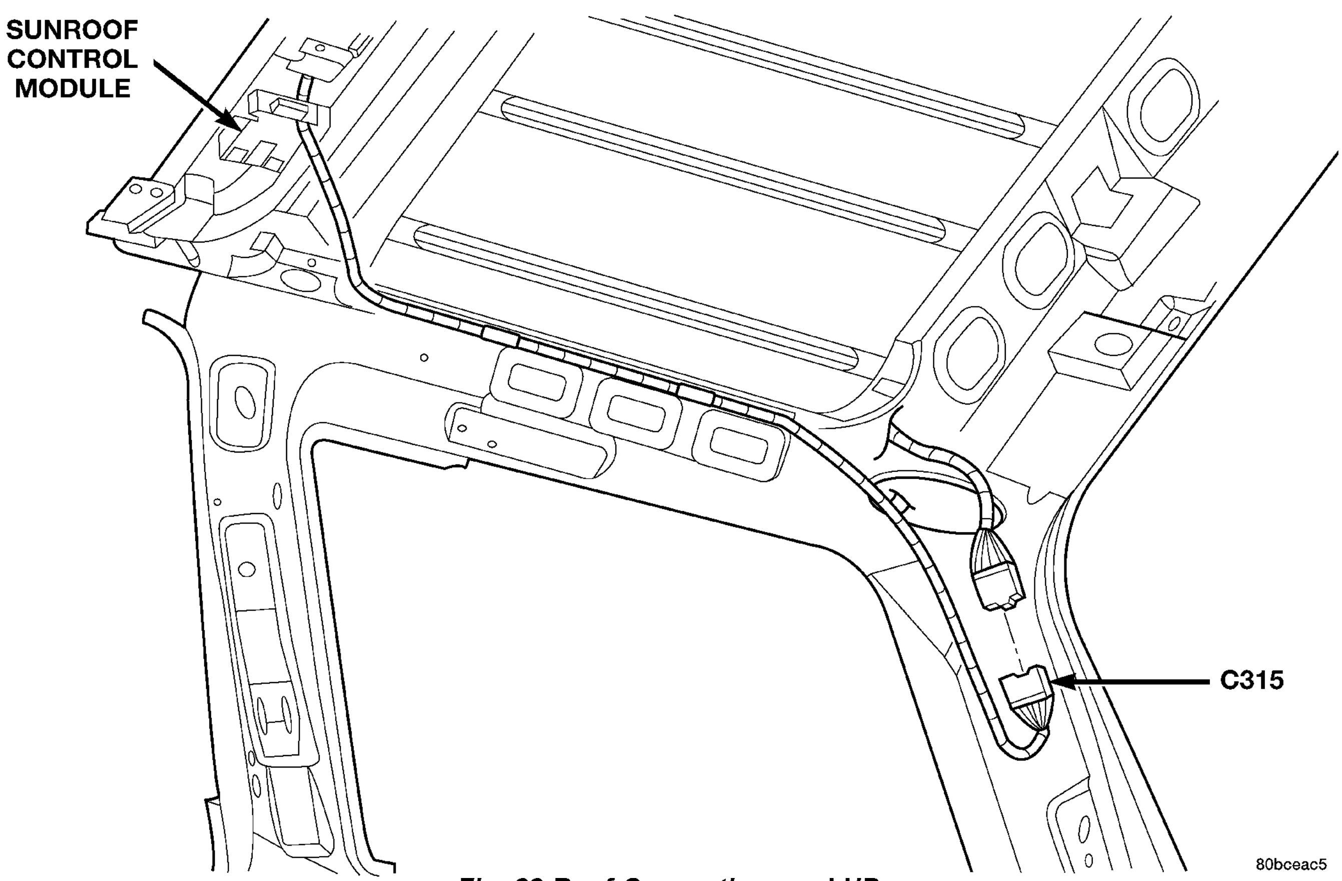


Fig. 22 Roof Connections — LHD

DESCRIPTION AND OPERATION (Continued)

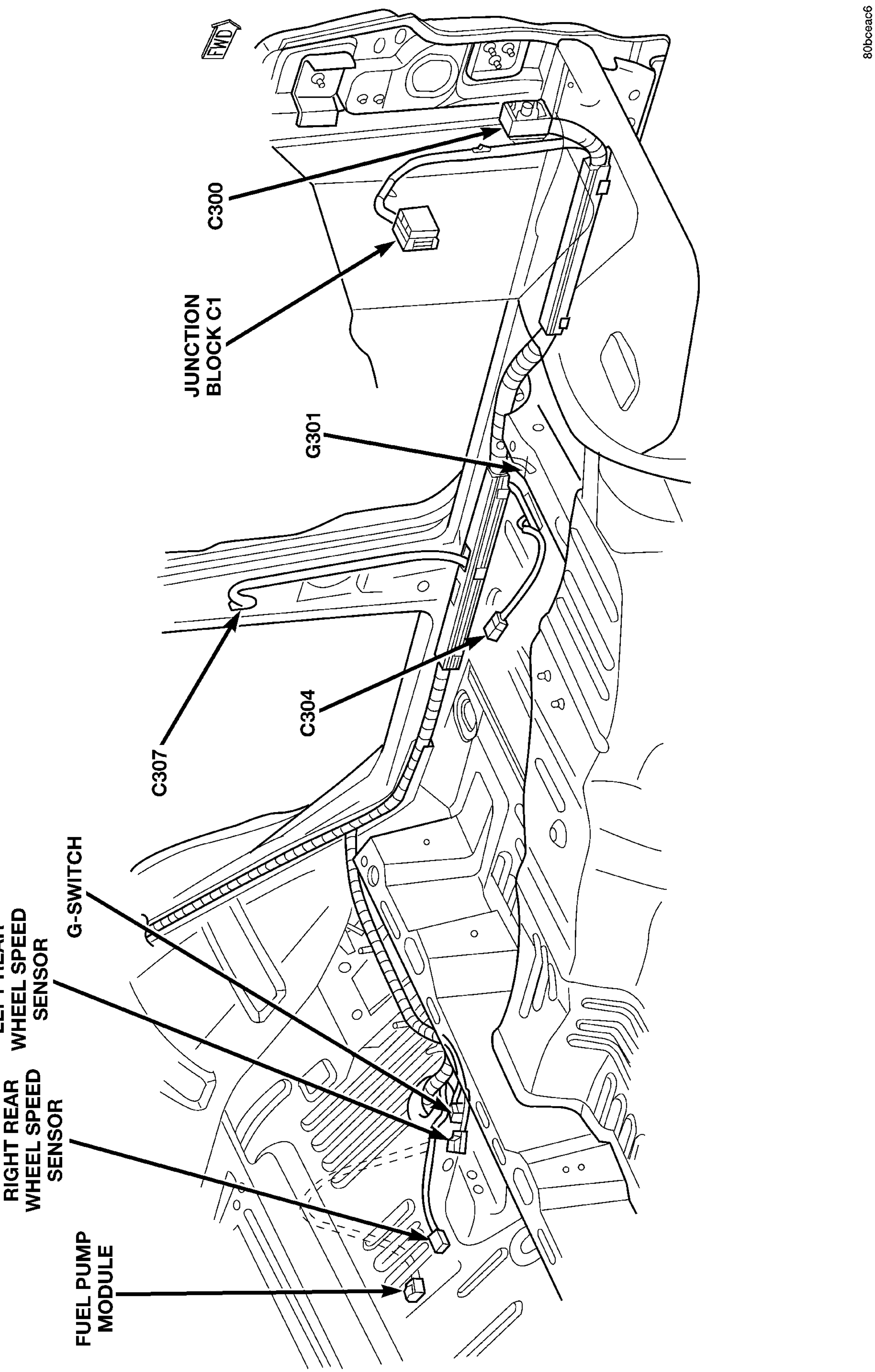


Fig. 23 Body Connections — LHD

DESCRIPTION AND OPERATION (Continued)

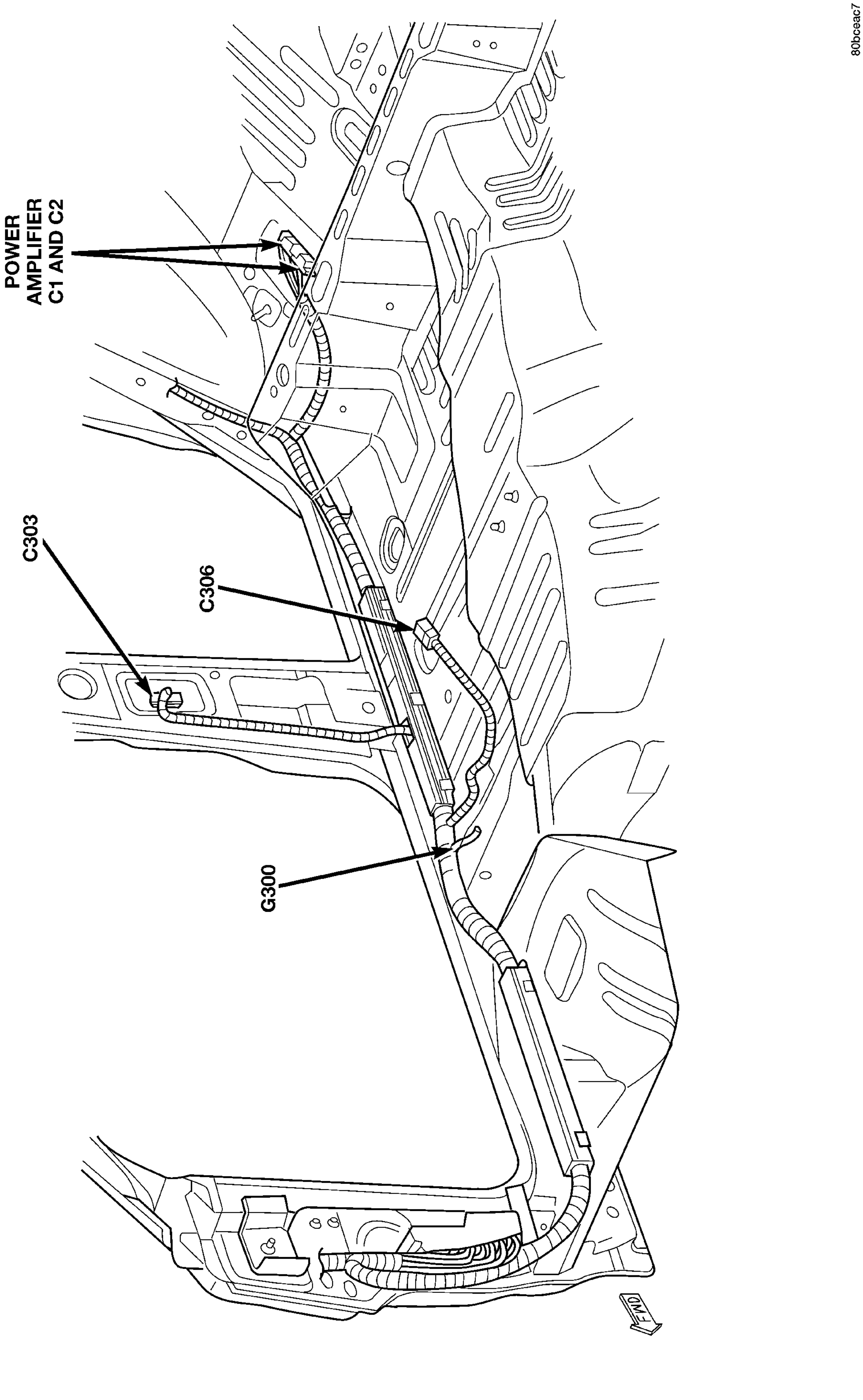


Fig. 24 Body Connections — LHD

DESCRIPTION AND OPERATION (Continued)

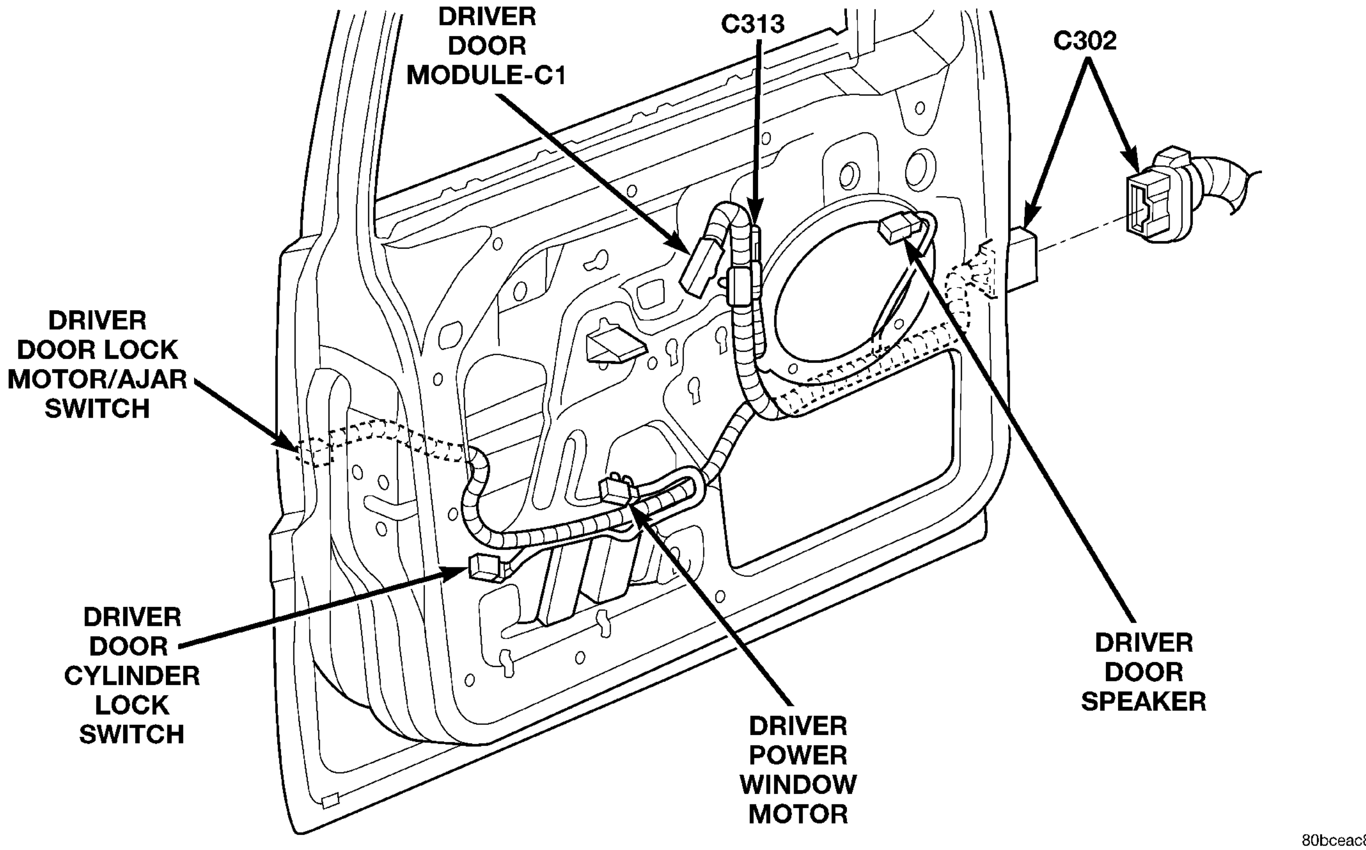


Fig. 25 Door Connections (Driver Door) — LHD

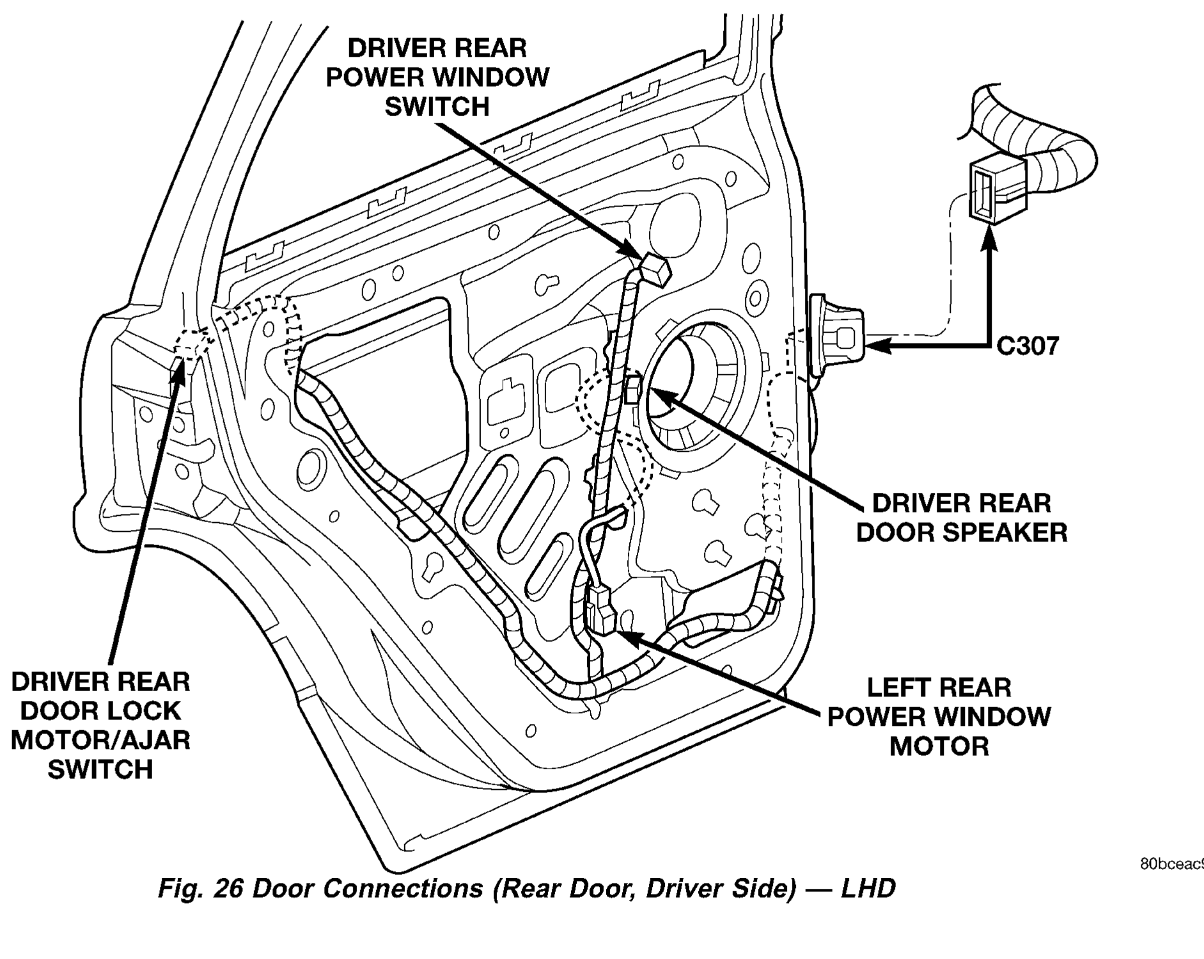


Fig. 26 Door Connections (Rear Door, Driver Side) — LHD

DESCRIPTION AND OPERATION (Continued)

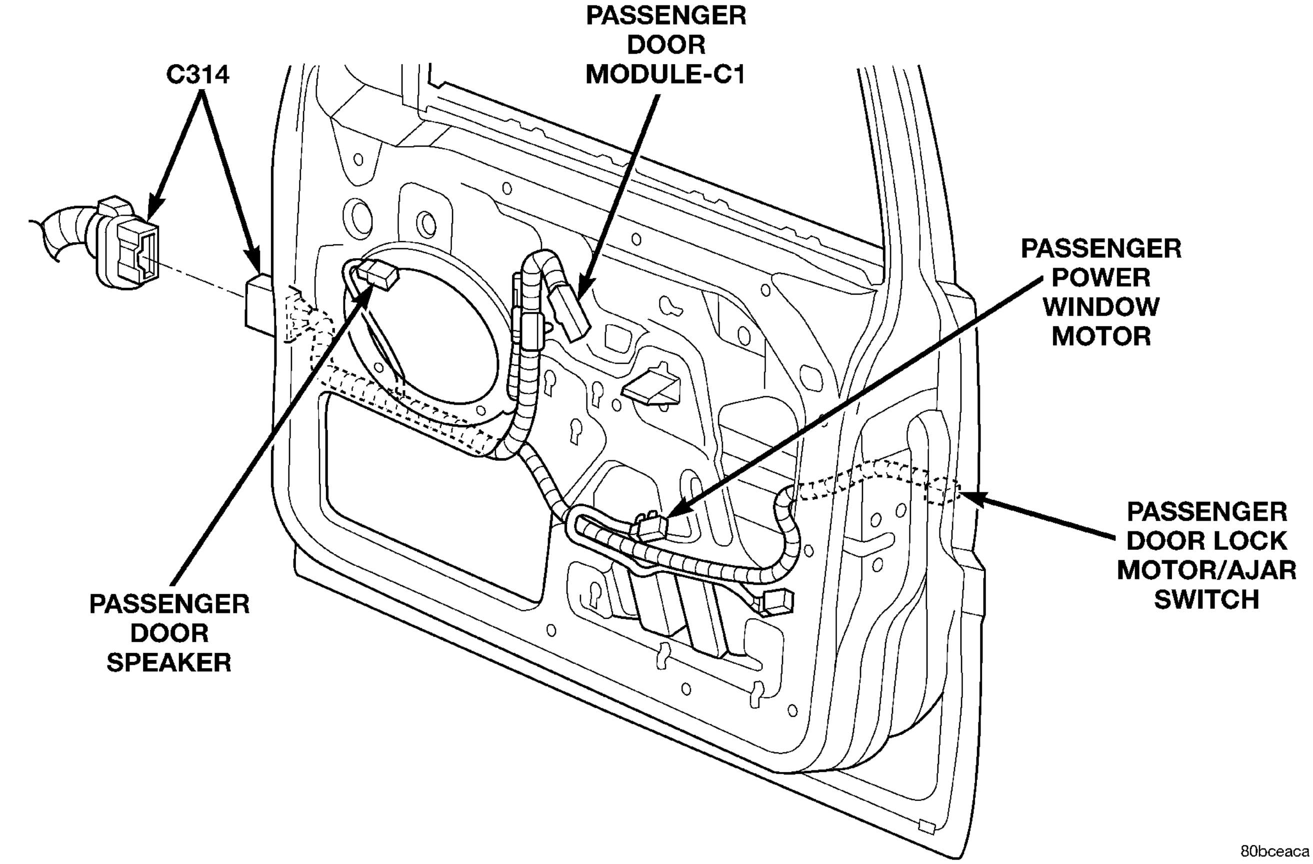


Fig. 27 Door Connections (Passenger Door) — LHD

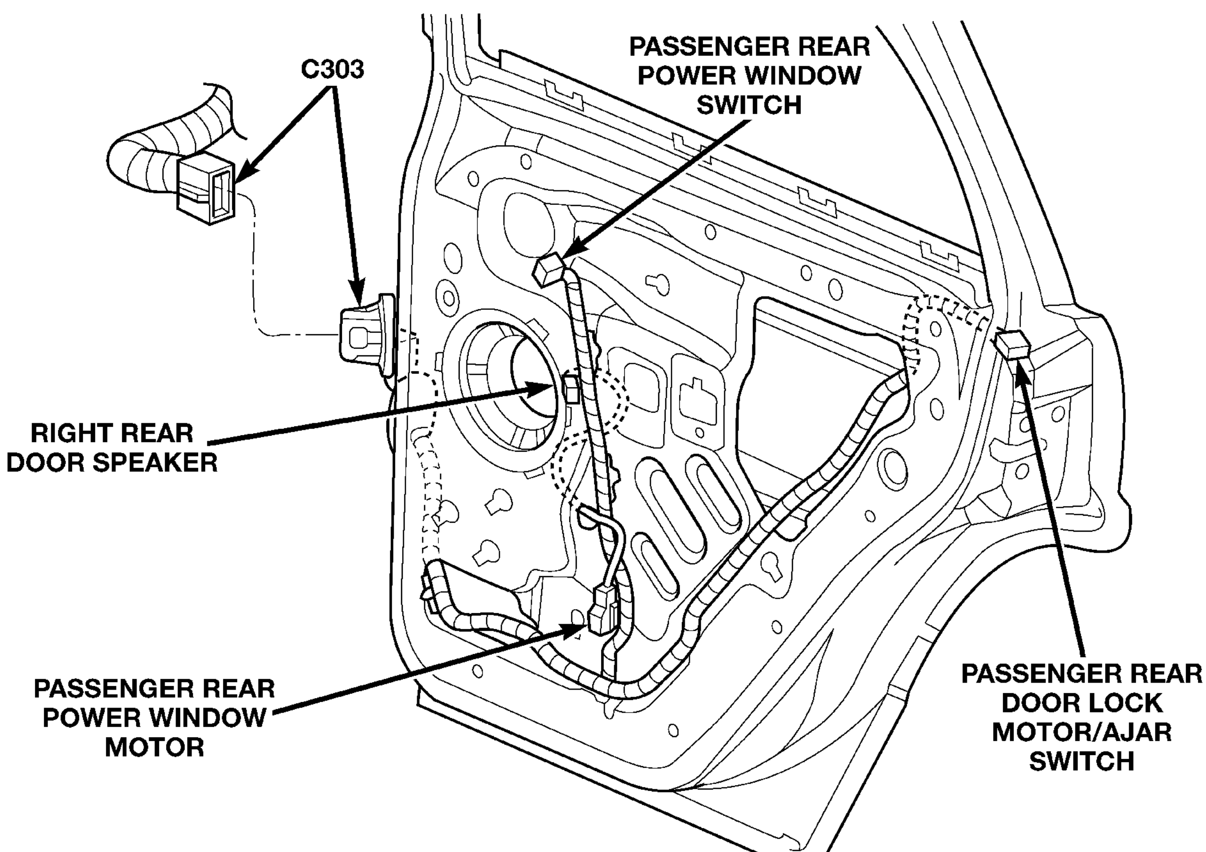


Fig. 28 Door Connections (Rear Door, Passenger Side) — LHD

DESCRIPTION AND OPERATION (Continued)

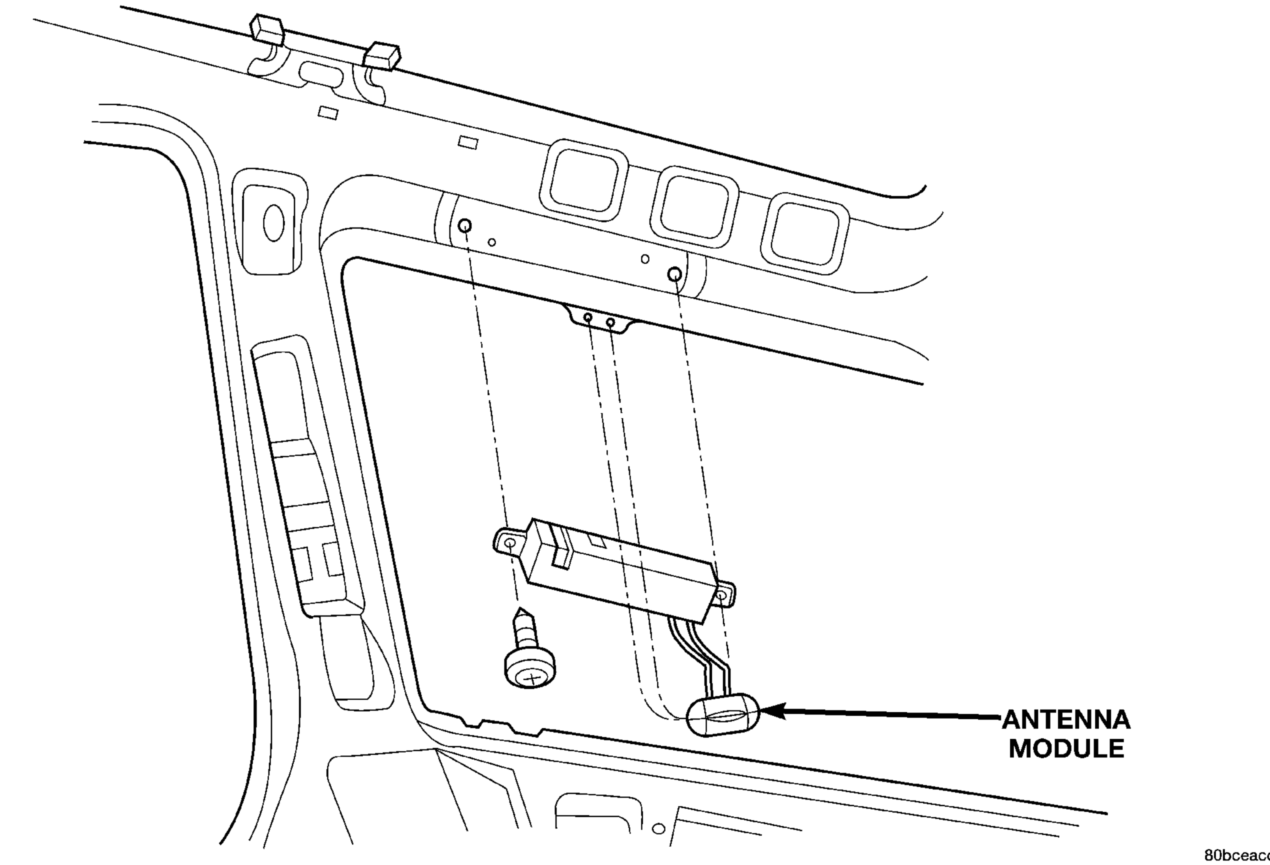


Fig. 29 Body Connections — LHD

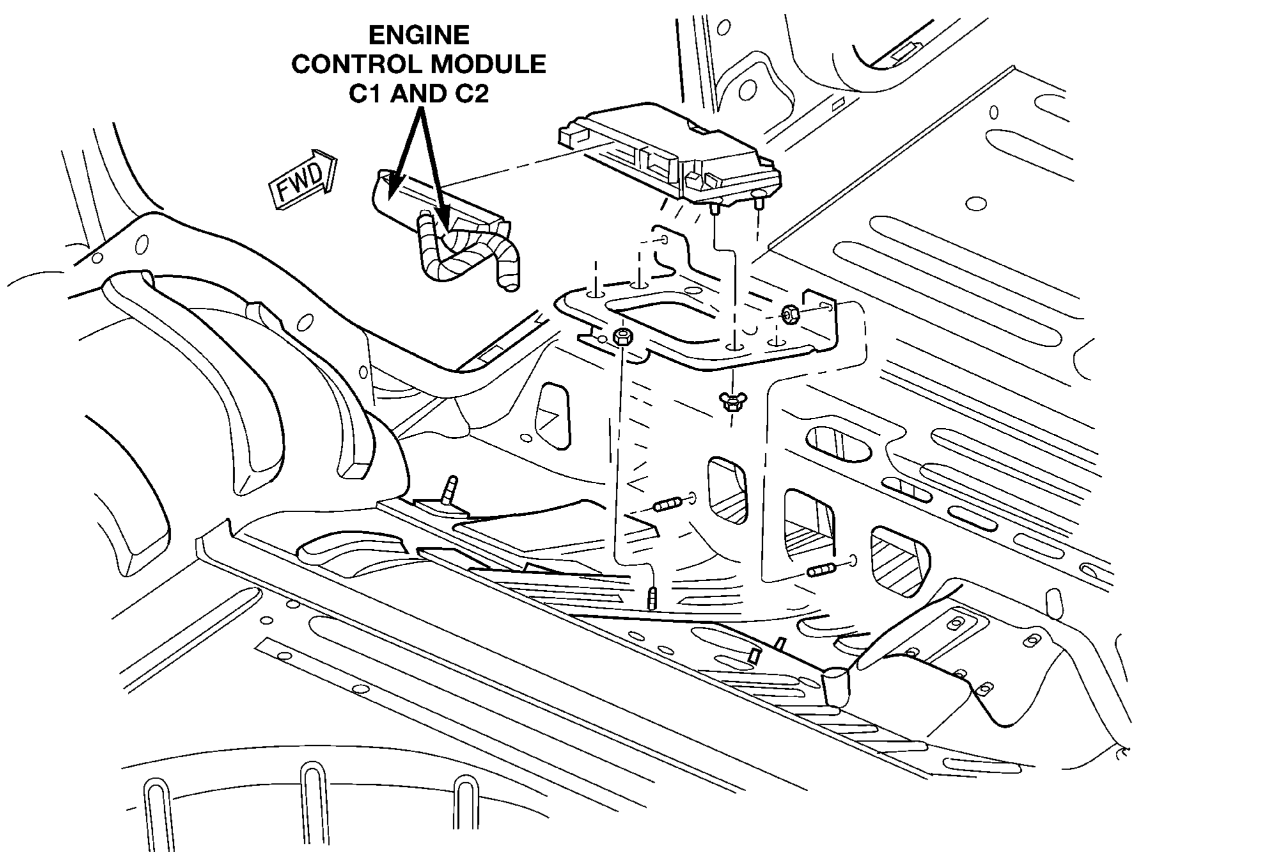


Fig. 30 Body Connections (Diesel) — LHD

DESCRIPTION AND OPERATION (Continued)

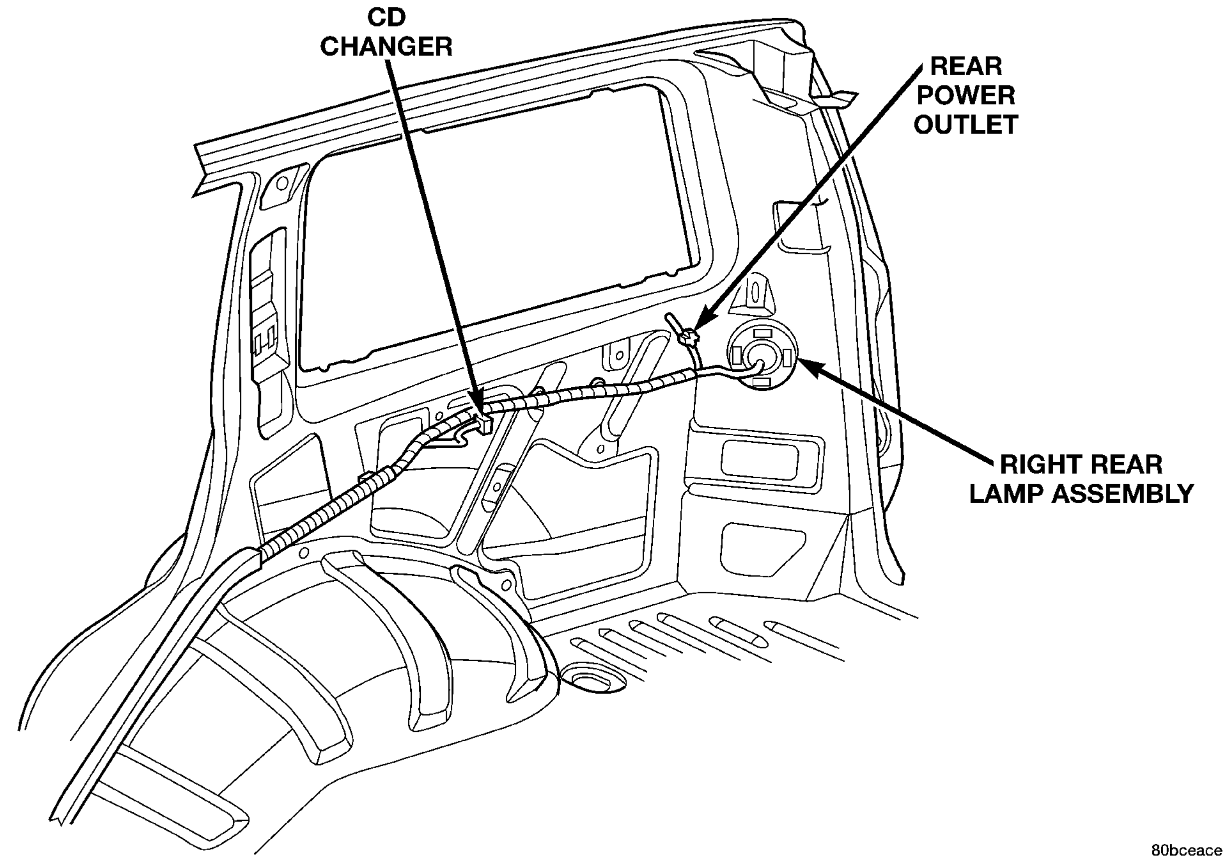


Fig. 31 Body Connections — LHD

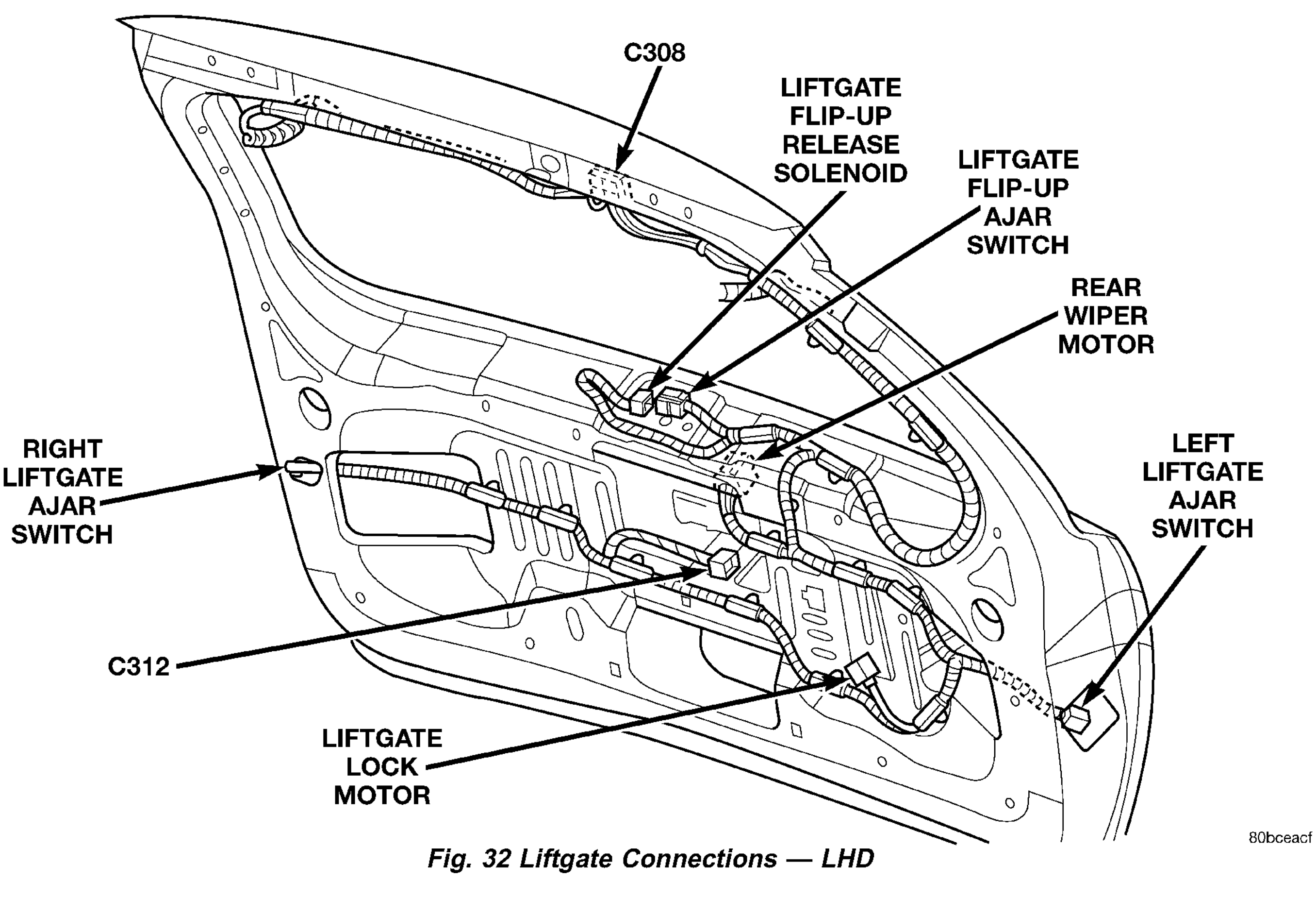


Fig. 32 Liftgate Connections — LHD

DESCRIPTION AND OPERATION (Continued)

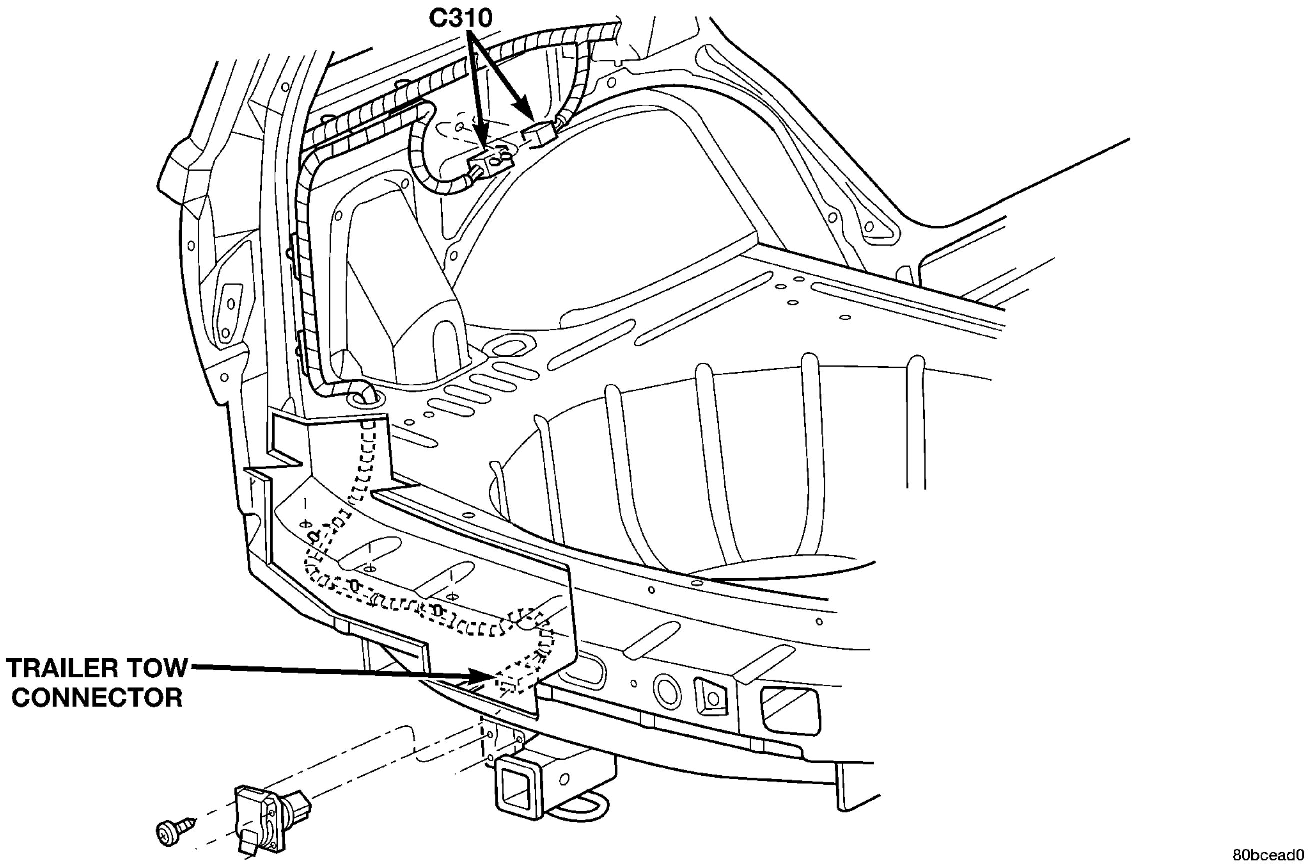


Fig. 33 Trailer Tow Connections — LHD

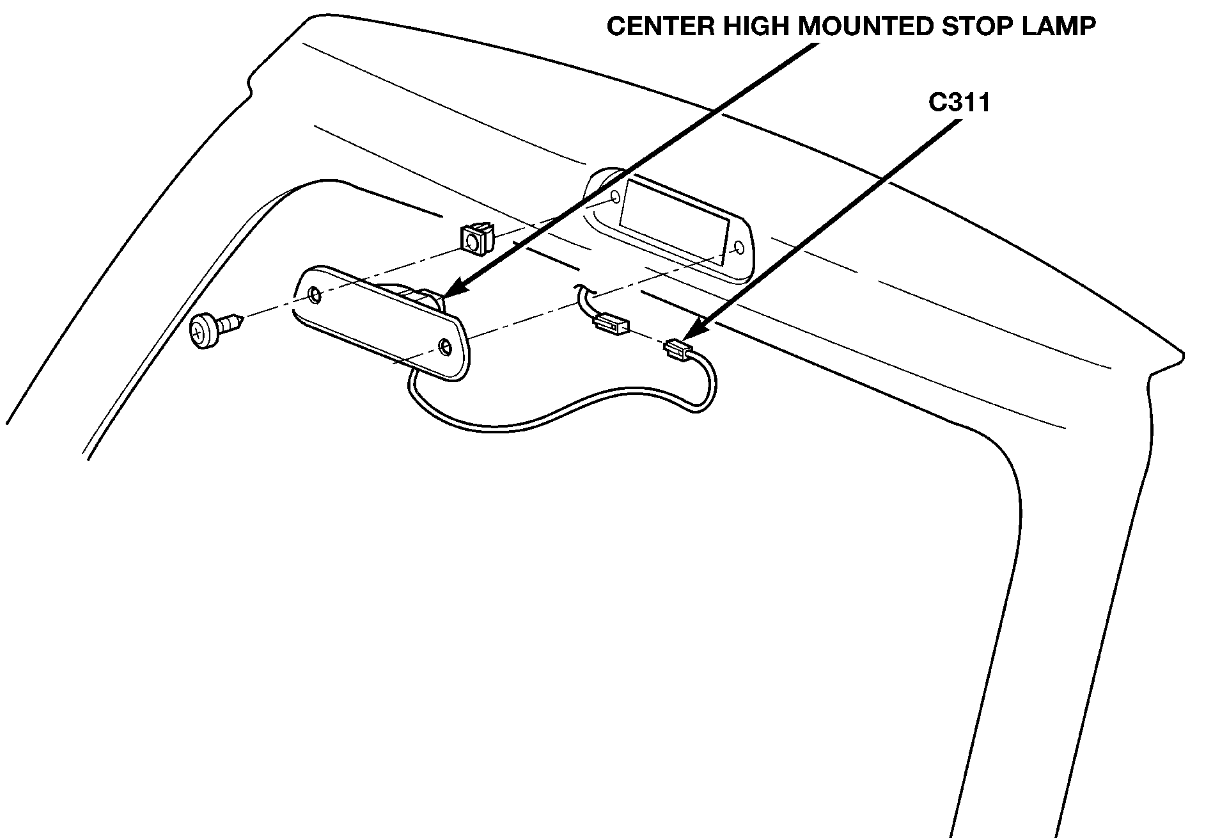


Fig. 34 Liftgate Connections — LHD

DESCRIPTION AND OPERATION (Continued)

CONNECTOR/GROUND LOCATIONS (RHD)

For items that are not shown in this section N/S is placed in the Fig. column.

Connector Name/Number	Color	Location	Fig.
A/C Compressor Clutch	BK	At Compressor	36
A/C High Pressure Cutout Switch	BK	Near Compressor	44
A/C Low Pressure Cycle Clutch Switch	DK GY	Left Rear of Engine Compartment	N/S
Airbag Control Module	YL	At Center Console	47, 48
Ambient Air Temperature Sensor	BK	At Radiator Center Support	43
Antenna Module	WT	Above Rear Liftgate Glass	58
Ash Receiver Lamp	BK	Rear of Ash Receiver	48
Automatic Day/Night Mirror	BK	Overhead Console Near Driver Rearview Mirror	N/S
Automatic Headlamp Light Sensor/VTSS LED	BK	Top Left Side of Instrument Panel	48
Automatic Zone Control Module - C1	BK	Center of Instrument Panel	48
Automatic Zone Control Module - C2	BK	Center of Instrument Panel	48
Battery Temperature Sensor	BK	At Battery Tray	43
Blower Motor		Center of Instrument Panel	N/S
Blower Motor Controller (AZC)		On HVAC Housing	N/S
Blower Motor Resistor Block (MTC)	BK	On HVAC Housing Near Blower Motor	N/S
Body Control Module - C1	GY	Right Side of Instrument Panel Near Data Link Connector	47

Connector Name/Number	Color	Location	Fig.
Body Control Module - C2	GY	Right Side of Instrument Panel Near Data Link Connector	47
Brake Lamp Switch	GY	Top of Brake Pedal	50
Brake Shift Interlock Solenoid	WT	On Steering Column Near Ignition Switch	49
Brake Warning Indicator Switch	GY	Left Side of Engine Compartment Near Brake Fluid Reservoir	N/S
C100	BK	On Battery Harness Near Front of Battery	42, 43
C102	BK	Right Rear of Engine Compartment Near Powertrain Control Module	37, 40, 43
C103	GY	Right Rear of Engine Compartment Near Powertrain Control Module	37, 40
C106	GY	Right Kick Panel Area	N/S
C107	GY	Left Side of Instrument Panel	44, 50, 52
C108	BK	Left Rear Cowl	44
C109		Left Side of Transmission	N/S
C111	BK	Left Front Fascia Behind Headlamp	35, 44
C112	BK	Right Front Fascia Behind Headlamp	35, 43
C200	BK	Left Side of Instrument Panel	47, 48, 52
C201	WT	At Center Console	47, 48
C202	WT	Near Left Kick Panel Area	47, 48
C203 (AZC)	WT	Near Left Kick Panel Area	47, 48

DESCRIPTION AND OPERATION (Continued)

Connector Name/Number	Color	Location	Fig.
C301	BK	Near Junction Block	50
C302	BK	At Driver Door	50, 54
C303	WT	On Right Side of B Pillar at Driver Side Rear Door	53, 55
C304	BK	Under Driver Seat	53
C306	BK	Under Passenger Seat	52
C307	WT	At Passenger Side Rear Door	52, 57
C308	WT	At Liftgate	60
C309	WT	Near Right Rear Window	N/S
C310	LT GY	Left Side Near Interior Rear Wheelhouse	61
C311	WT	Top of Liftgate	60, 62
C312		Center of Liftgate	60
C313	WT	At Driver Door	54
C314	LT GY	At Passenger Door	50, 56
C315		Right Rear Headliner Near Liftgate	51
Camshaft Position Sensor	GY	Right Side of Engine	37, 40
Capacitor NO. 1	BK	Right Side of Engine	37
Capacitor NO. 2	BK	Left Side of Engine	36
Cargo Lamp	WT	Near Liftgate	N/S
Center High Mounted Stop Lamp	BK	Top of Liftgate	62
Cigar Lighter	RD	Center of Instrument Panel	48
Clockspring - C1	GY	At Steering Column	49
Clockspring - C2	BK	At Steering Column	N/S
Clockspring - C3	YL	At Steering Column	49

Connector Name/Number	Color	Location	Fig.
Coil On Plug NO. 1 (4.7L)	BK	Left Side of Engine Near Fuel Injector NO. 1	36
Coil On Plug NO. 2 (4.7L)	BK	Right Side of Engine Near Fuel Injector NO. 2	37
Coil On Plug NO. 3 (4.7L)	BK	Left Side of Engine Near Fuel Injector NO. 3	36
Coil On Plug NO. 4 (4.7L)	BK	Right Side of Engine Near Fuel Injector NO. 4	37
Coil On Plug NO. 5 (4.7L)	BK	Left Side of Engine Near Fuel Injector NO. 5	36
Coil On Plug NO. 6 (4.7L)	BK	Right Side of Engine Near Fuel Injector NO. 6	37
Coil On Plug NO. 7 (4.7L)	BK	Left Side of Engine Near Fuel Injector NO. 7	36
Coil On Plug NO. 8 (4.7L)	BK	Right Side of Engine Near Fuel Injector NO. 8	37
Compact Disc Changer	BK	Right Rear Quarter Panel	59
Controller Anti-Lock Brake	BK	Left Front of Engine Compartment	44
Coolant Level Sensor	LT GY	Right Rear of Engine Compartment	43
Crankshaft Position Sensor (4.0L)	BK	Left Rear of Engine	40
Crankshaft Position Sensor (4.7L)	BK	Right Rear of Engine	37
Cruise Switch NO. 1	BK	On Steering Wheel	N/S
Cruise Switch NO. 2	BK	On Steering Wheel	N/S
Data Link Connector	BK	Right Side of Instrument Panel	47
Diagnostic Junction Port	WT	On Steering Column	49

DESCRIPTION AND OPERATION (Continued)

Connector Name/Number	Color	Location	Fig.
Driver Blend Door Motor/Actuator (AZC)	BK	On HVAC Housing	N/S
Driver Door Courtesy Lamp	BK	In Driver Door	N/S
Driver Door Cylinder Lock Switch	GY	In Driver Door	54
Driver Door Lock Motor/Ajar Switch	BK	In Driver Door	54
Driver Door Module - C1	WT	In Driver Door	54
Driver Door Module - C2	BK	In Driver Door	N/S
Driver Door Module - C3	BK	In Driver Door	N/S
Driver Heated Seat Back (Premium I/III)	GN	At Driver Seat	N/S
Driver Heated Seat Cushion (Premium I/III)	BK	At Driver Seat	N/S
Driver Heated Seat Switch	WT	Center of Instrument Panel	N/S
Driver Lumbar Motor	BK	At Driver Seat	N/S
Driver Lumbar Switch (Midline/ Premium)	WT	At Driver Seat	N/S
Driver Power Mirror	BK	At Driver Door	N/S
Driver Power Seat Front Riser Motor	RD	At Driver Seat	N/S
Driver Power Seat Front Riser Motor Sensor (Premium II/III)		At Driver Seat	N/S
Driver Power Seat Horizontal Motor	BK	At Driver Seat	N/S
Driver Power Seat Horizontal Motor Sensor (Premium II/III)	BK	At Driver Seat	N/S
Driver Power Seat Rear Riser Motor	RD	At Driver Seat	N/S

Connector Name/Number	Color	Location	Fig.
Driver Power Seat Rear Riser Motor Sensor (Premium II/III)		At Driver Seat	N/S
Driver Power Seat Recliner Motor	BK	At Driver Seat	N/S
Driver Power Seat Recliner Motor Sensor (Premium II/III)	BK	At Driver Seat	N/S
Driver Power Seat Switch (Base)		At Driver Seat	N/S
Driver Power Seat Switch (Midline/ Premium)	GN	At Driver Seat	N/S
Driver Power Window Motor	BK	In Driver Door	54
Driver Rear Door Lock Motor/Ajar Switch	BK	In Rear Door Driver Side	55
Driver Rear Power Window Motor	BK	In Rear Door Driver Side	55
Driver Rear Power Window Switch	BL	In Rear Door Driver Side	55
Duty Cycle EVAP/Purge Solenoid	BK	Left Side of Engine Compartment	44
Engine Coolant Temperature Sensor	BK	Front of Engine	36, 39
Engine Oil Pressure Sensor	BK	Rear of Engine Near Transmission	36, 40
Front Power Outlet	RD	Center of Instrument Panel	48
Fuel Injector NO. 1	BK	At Injector	36, 39
Fuel Injector NO. 2	BK	At Injector	37, 39
Fuel Injector NO. 3	BK	At Injector	36, 39
Fuel Injector NO. 4	BK	At Injector	37, 39
Fuel Injector NO. 5	BK	At Injector	36, 39
Fuel Injector NO. 6	BK	At Injector	37, 39

DESCRIPTION AND OPERATION (Continued)

Connector Name/Number	Color	Location	Fig.
Fuel Injector NO. 7 (4.7L)	BK	At Injector	36
Fuel Injector NO. 8 (4.7L)	BK	At Injector	37
Fuel Pump Module	BK	Near Fuel Tank	52
G100 (4.0L)		Near Starter	N/S
G100 (4.7L)		Near Intake Plenum	N/S
G101		Near Front of Battery	42
G102		Right Side of Engine	37
G103		Right Side of Engine	37, 40
G104 (4.0L)		Right Rear Side of Engine	40
G104 (4.7L)		Left Side of Engine	36
G105		Right Side of Engine	N/S
G106		Left Side of Engine Compartment	44
G107		Left Side of Engine Compartment	44
G108		Near Power Distribution Center	43
G200		Near Airbag Control Module	47, 48
G201		Near Airbag Control Module	47, 48
G300		Near Driver Seat	N/S
G301		Near Passenger Seat	52
G-Switch	BK	Under Rear Seat	52
Generator	BK	At Generator	N/S
Glove Box Lamp	BK	Left Side of Instrument Panel	48
Headlamp Leveling Switch	WT	Right Side of Instrument Panel	48
Hood Ajar Switch	BK	Left Side of Engine Compartment	N/S
Horn NO. 1	BK	Right Front Fascia	43

Connector Name/Number	Color	Location	Fig.
Horn NO. 2	BK	Right Front Fascia	43
Idle Air Control Motor	BK	Left Side of Engine Near Throttle Body	36, 39
Ignition Switch - C1	WT	On Steering Column	49
Ignition Switch - C2	BK	On Steering Column	49
Input Speed Sensor (4.7L)	BK	Left Side of Transmission	38
Instrument Cluster	WT	At Instrument Cluster	48
Intake Air Temperature Sensor	GY	Left Side of Engine	36, 39
Junction Block - C1	BK	At Junction Block	50
Junction Block - C2	BK	At Junction Block	50
Junction Block - C3	BK	At Junction Block	47
Junction Block - C4	WT	At Junction Block	50
Junction Block - C5	WT	At Junction Block	50
Left Courtesy Lamp	BK	Left Side of Instrument Panel	47
Left Fog Lamp	BK	Left Front Fascia	44
Left Front Door Speaker	WT	At Speaker	56
Left Front Park Lamp	WT	At Lamp	N/S
Left Front Turn Signal Lamp	WT	At Lamp	N/S
Left Front Wheel Speed Sensor	GY	At Left Front Wheel Opening	N/S
Left Handle Courtesy Lamp	WT	At Lamp	N/S
Left Headlamp Leveling Motor	BK	At Motor	N/S
Left High Beam Headlamp	BK	At Lamp	N/S
Left Instrument Panel Speaker	WT	At Speaker	48
Left Liftgate Ajar Switch	GY	At Liftgate	60

DESCRIPTION AND OPERATION (Continued)

Connector Name/Number	Color	Location	Fig.
Left Low Beam Headlamp	GY	At Lamp	N/S
Left Multi-Function Switch	WT	On Steering Column	49
Left Rear Door Speaker	WT	In Left Rear Door	57
Left Rear Lamp Assembly	BK	At Lamp Assembly	N/S
Left Rear Wheel Speed Sensor	GY	Near Left Rear Wheel	52
Left Side Repeater	BK	At Left Front Fender	N/S
Left Visor/Vanity Lamp	BK	At Lamp	N/S
License Lamp NO. 1	BK	At Lamp	N/S
License Lamp NO. 2	BK	At Lamp	N/S
Liftgate Flip-Up Ajar Switch	GY	In Liftgate	60
Liftgate Flip-Up Push Button Switch	BK	In Liftgate	N/S
Liftgate Flip-Up Release Solenoid	BK	In Liftgate	60
Liftgate Lock Motor	BK	In Liftgate	60
Manifold Absolute Pressure Sensor (4.0L)	BK	Front of Throttle Body	39
Manifold Absolute Pressure Sensor (4.7L)	BK	Right Front of Engine	36
Manual Temperature Control - C1	WT	Center of Instrument Panel	48
Manual Temperature Control - C2	WT	Center of Instrument Panel	48
Mode Door Motor/Actuator (AZC)	BK	Right Center of Instrument Panel	N/S
Output Speed Sensor (4.0L)	GY	Left Side of Transmission	41
Output Speed Sensor (4.7L)	BK	Left Side of Transmission	38

Connector Name/Number	Color	Location	Fig.
Overhead Map/Courtesy Lamp		At Overhead Console	N/S
Oxygen Sensor 1/1 Upstream (4.0L)	GY	Left Side of Engine at Exhaust	41
Oxygen Sensor 1/1 Upstream (4.7L)	GY	Left Side of Engine at Exhaust	N/S
Oxygen Sensor 1/2 Downstream (4.0L)	BK	Rear of Transmission	41
Oxygen Sensor 1/2 Downstream (4.7L)	BK	Rear of Transmission	N/S
Park/Neutral Position Switch	BK	Left Side of Transmission	41
Passenger Airbag	YL	Left Side of Instrument Panel	48
Passenger Blend Door Motor/ Actuator (AZC)	BK	Left Side of Instrument Panel	N/S
Passenger Door Courtesy Lamp	BK	In Passenger Door	N/S
Passenger Door Lock Motor/Ajar Switch	BK	In Passenger Door	56
Passenger Door Module - C1	WT	In Passenger Door	56
Passenger Door Module - C2	BK	In Passenger Door	N/S
Passenger Heated Seat Back (Premium I/III)	GN	At Passenger Seat	N/S
Passenger Heated Seat Cushion (Premium I/III)	BK	At Passenger Seat	N/S
Passenger Heated Seat Switch	BK	Center of Instrument Panel	N/S
Passenger Lumbar Motor (Midline/ Premium)	BK	At Passenger Seat	N/S
Passenger Lumbar Switch (Midline/ Premium)	WT	At Passenger Seat	N/S
Passenger Power Mirror	BK	At Passenger Door	N/S

DESCRIPTION AND OPERATION (Continued)

Connector Name/Number	Color	Location	Fig.
Passenger Power Seat Front Riser Motor	RD	At Passenger Seat	N/S
Passenger Power Seat Horizontal Motor	RD	At Passenger Seat	N/S
Passenger Power Seat Rear Riser Motor	RD	At Passenger Seat	N/S
Passenger Power Seat Recliner Motor (Midline/ Premium)	BK	At Passenger Seat	N/S
Passenger Power Seat Switch (Base)		At Passenger Seat	N/S
Passenger Power Seat Switch (Midline/Premium)	GN	At Passenger Seat	N/S
Passenger Power Window Motor	BK	In Passenger Door	56
Passenger Rear Door Lock Motor/Ajar Switch	BK	In Rear Door Passenger Side	57
Passenger Rear Power Window Motor	BK	In Rear Door Passenger Side	57
Passenger Rear Power Window Switch	BL	In Rear Door Passenger Side	57
Power Amplifier - C1	WT	Under Rear Seat Right Side	53
Power Amplifier - C2	WT	Under Rear Seat Right Side	53
Power Connector	WT	Center of Instrument Panel	47
Powertrain Control Module - C1	BK	Left Rear of Engine Compartment	37, 40, 46
Powertrain Control Module - C2	WT	Left Rear of Engine Compartment	37, 40, 46
Radiator Fan Motor	BK	At Radiator	43
Radiator Fan Relay	BK	Right Side of Engine Compartment	43

Connector Name/Number	Color	Location	Fig.
Radio - C1	GY	Center of Instrument Panel	48
Radio - C2	BK	Center of Instrument Panel	48
Radio - C3	WT	Center of Instrument Panel	48
Radio - C4 (Premium)	BK	Center of Instrument Panel	48
Rail Coil (4.0L)	BK	Right Rear of Engine	40
Rear Power Outlet	RD	Right Rear Quarter Panel	59
Rear Washer Pump	BK	Left Front of Engine Compartment	44
Rear Wiper Motor	BK	In Liftgate	60
Recirculation Door Motor/Actuator (AZC)	BK	Center of Instrument Panel	N/S
Remote Keyless Module (Japan)	BL	In Driver Door	N/S
Remote Radio Switch NO. 1	BK	At Switch in Steering Wheel	N/S
Remote Radio Switch NO. 2	BK	At Switch in Steering Wheel	N/S
Right Courtesy Lamp	BK	At Lamp	49
Right Fog Lamp	BK	Right Front Fascia	43
Right Front Door Speaker	WT	In Driver Door	54
Right Front Park Lamp	WT	At Lamp	N/S
Right Front Turn Signal Lamp	WT	At Lamp	N/S
Right Front Wheel Speed Sensor	GY	In Right Front Wheel Opening	N/S
Right Handle Courtesy Lamp	WT	At Lamp	N/S
Right Headlamp Leveling Motor	BK	At Motor	N/S
Right High Beam Headlamp	BK	At Lamp	N/S
Right Instrument Panel Speaker	WT	At Speaker	48
Right Liftgate Ajar Switch	BK	In Liftgate	60

DESCRIPTION AND OPERATION (Continued)

Connector Name/Number	Color	Location	Fig.
Right Low Beam Headlamp	GY	At Lamp	N/S
Right Multi-Function Switch	WT	On Steering Column	49
Right Rear Door Speaker	WT	In Right Rear Door	55
Right Rear Lamp Assembly	BK	At Lamp Assembly	59
Right Rear Wheel Speed Sensor	BK	Near Right Rear Wheel	52
Right Side Repeater	BK	On Right Front Fender	N/S
Right Visor/Vanity Lamp	BK	At Lamp	N/S
Seat Belt Switch	WT	At Driver Seat	N/S
Seat Module - C1 (Premium)	BK	Under Driver Seat	N/S
Seat Module - C2 (Premium)	OR	Under Driver Seat	N/S
Sentry Key Immobilizer Module	BK	On Steering Column	49
Sunroof Control Module		At Sunroof	51
Sunroof Motor	WT	At Sunroof	N/S
Sunroof Motor Position Sensor	BK	At Sunroof	N/S
Sunroof Switch		At Switch	N/S
Temperature Valve Actuator (MTC)	BK	On HVAC Housing	N/S
Throttle Position Sensor (4.0L)	WT	Left Side of Engine	39
Throttle Position Sensor (4.7L)	WT	Left Side of Engine	36
Trailer Tow Brake Lamp Relay	BK	Left Rear Quarter Panel	N/S

Connector Name/Number	Color	Location	Fig.
Trailer Tow Circuit Breaker	BK	Left Rear Quarter Panel	N/S
Trailer Tow Connector	BK	In Rear Bumper	61
Trailer Tow Left Turn Relay	BK	Left Rear Quarter Panel	N/S
Trailer Tow Right Turn Relay	BK	Left Rear Quarter Panel	N/S
Transmission Control Module (4.7L)	BK	Left Rear of Engine Compartment	37, 46
Transmission Solenoid (4.0L)	BK	Left Side of Transmission	41
Transmission Solenoid/TRS Assembly (4.7L)	GY	Left Side of Transmission	38
Underhood Lamp	BK	At Lamp	45
United Kingdom Security System Module	BK	Left Side of Instrument Panel	N/S
Vehicle Information Center	BK	In Overhead Console	N/S
Vehicle Speed Control Servo	BK	Right Front of Engine Compartment	43
Washer Fluid Level Switch	GY	Left Front of Engine Compartment	44
Windshield Washer Pump	WT	Left Front of Engine Compartment	44
Windshield Wiper Motor	BK	Left Side of Cowl	44

DESCRIPTION AND OPERATION (Continued)

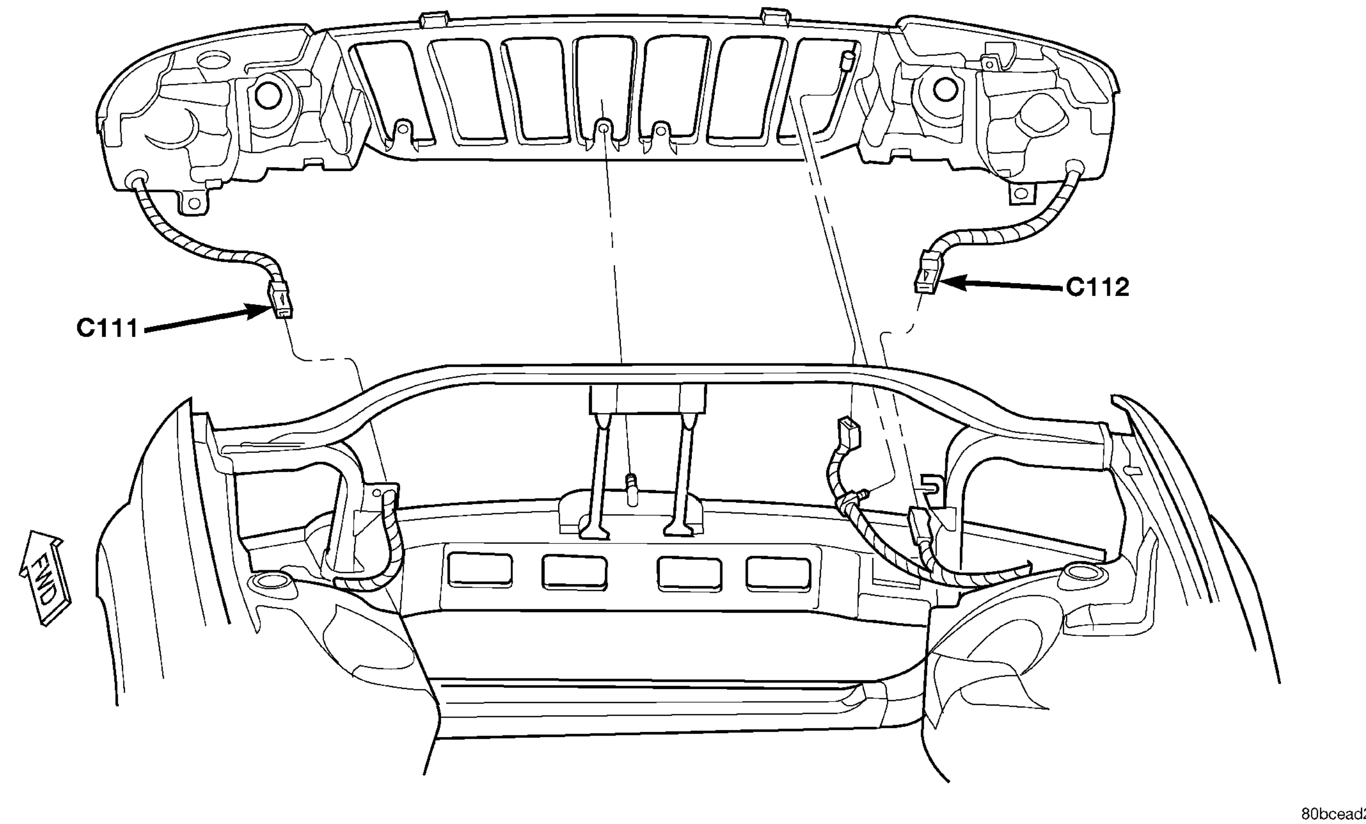


Fig. 35 Engine Compartment Connections (Front Clip) — RHD

DESCRIPTION AND OPERATION (Continued)

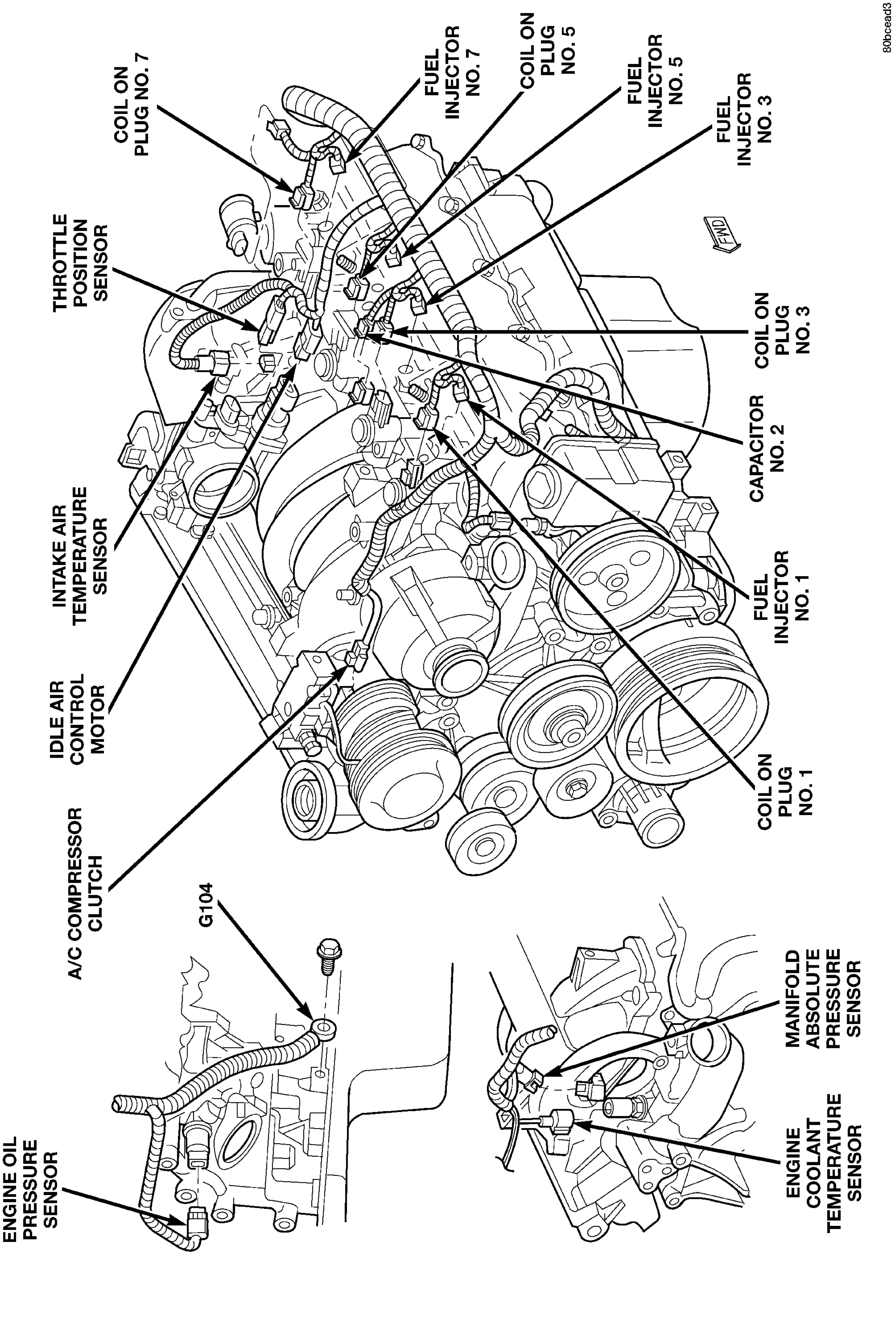


Fig. 36 Engine Connections (4.7L) — RHD

DESCRIPTION AND OPERATION (Continued)

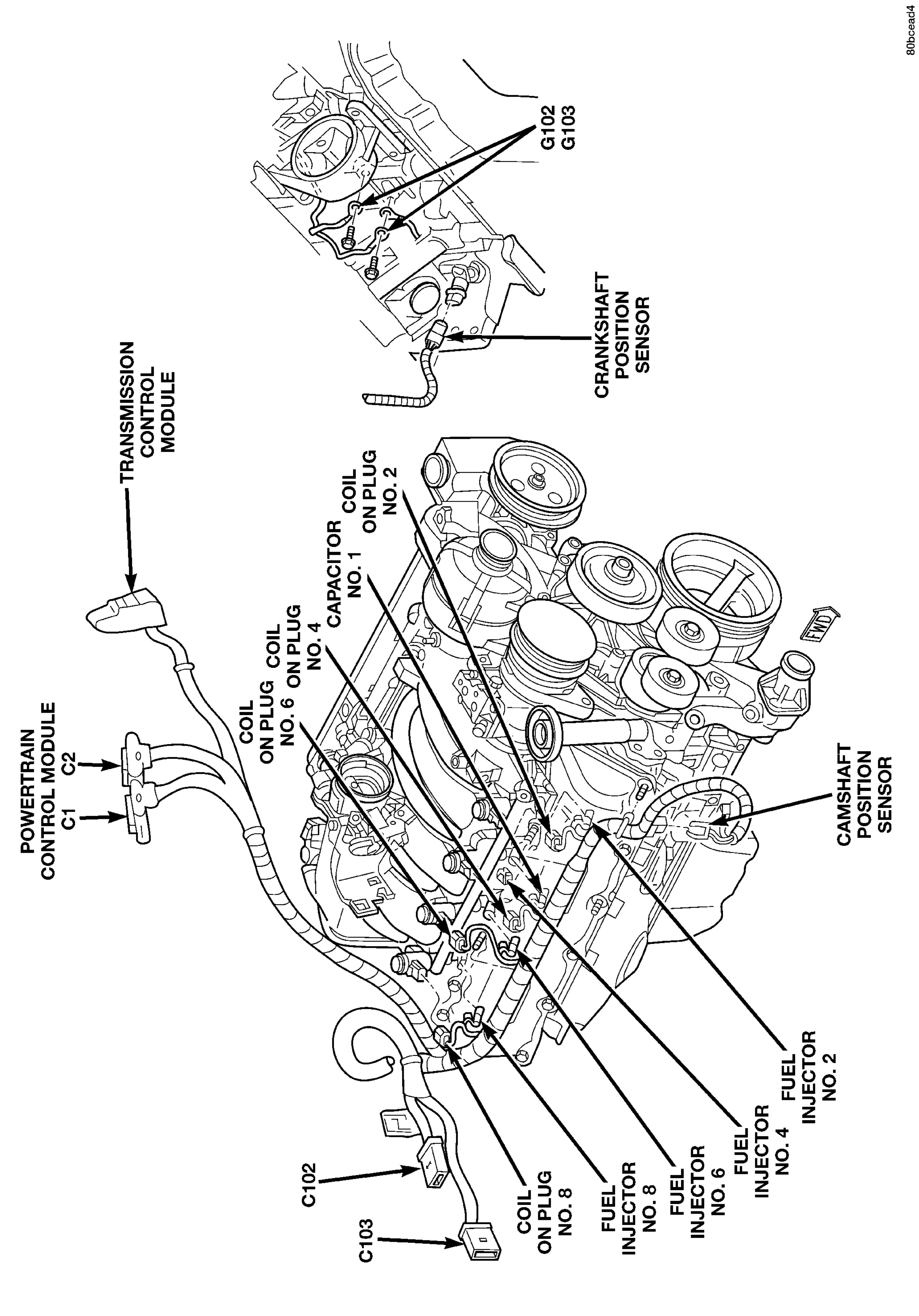


Fig. 37 Engine Connections (4.7L) — RHD

DESCRIPTION AND OPERATION (Continued)

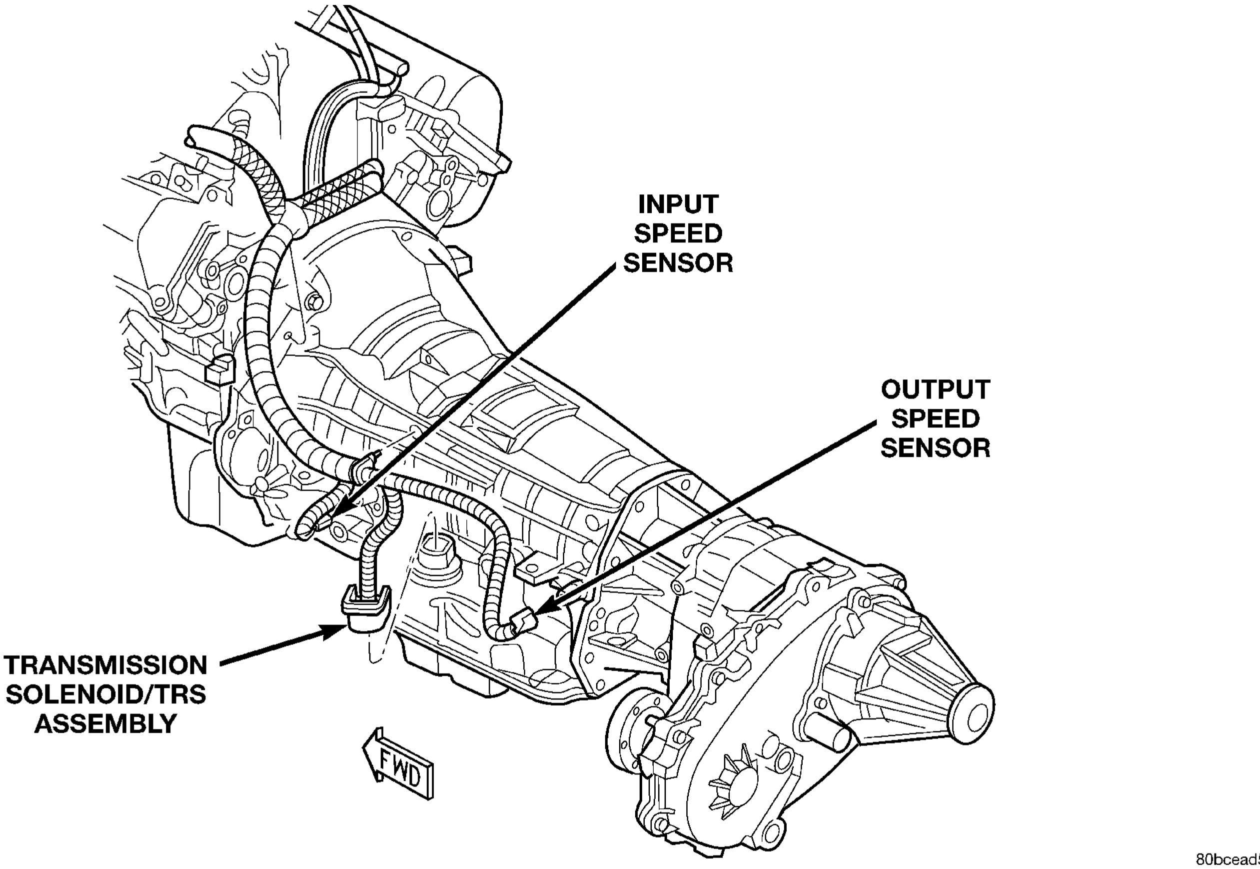


Fig. 38 Transmission Connections (4.7L) — RHD

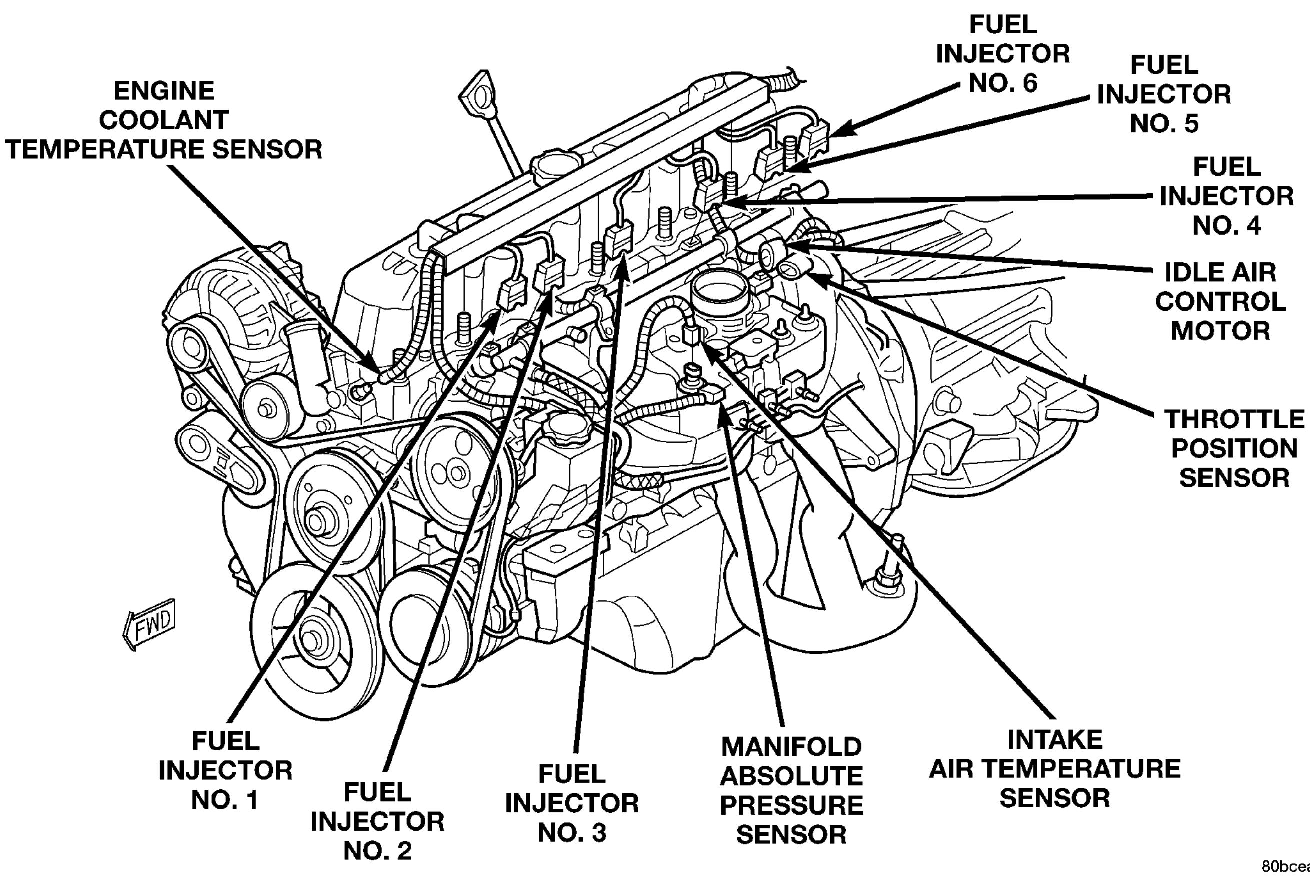


Fig. 39 Engine Connections (4.0L) — RHD

DESCRIPTION AND OPERATION (Continued)

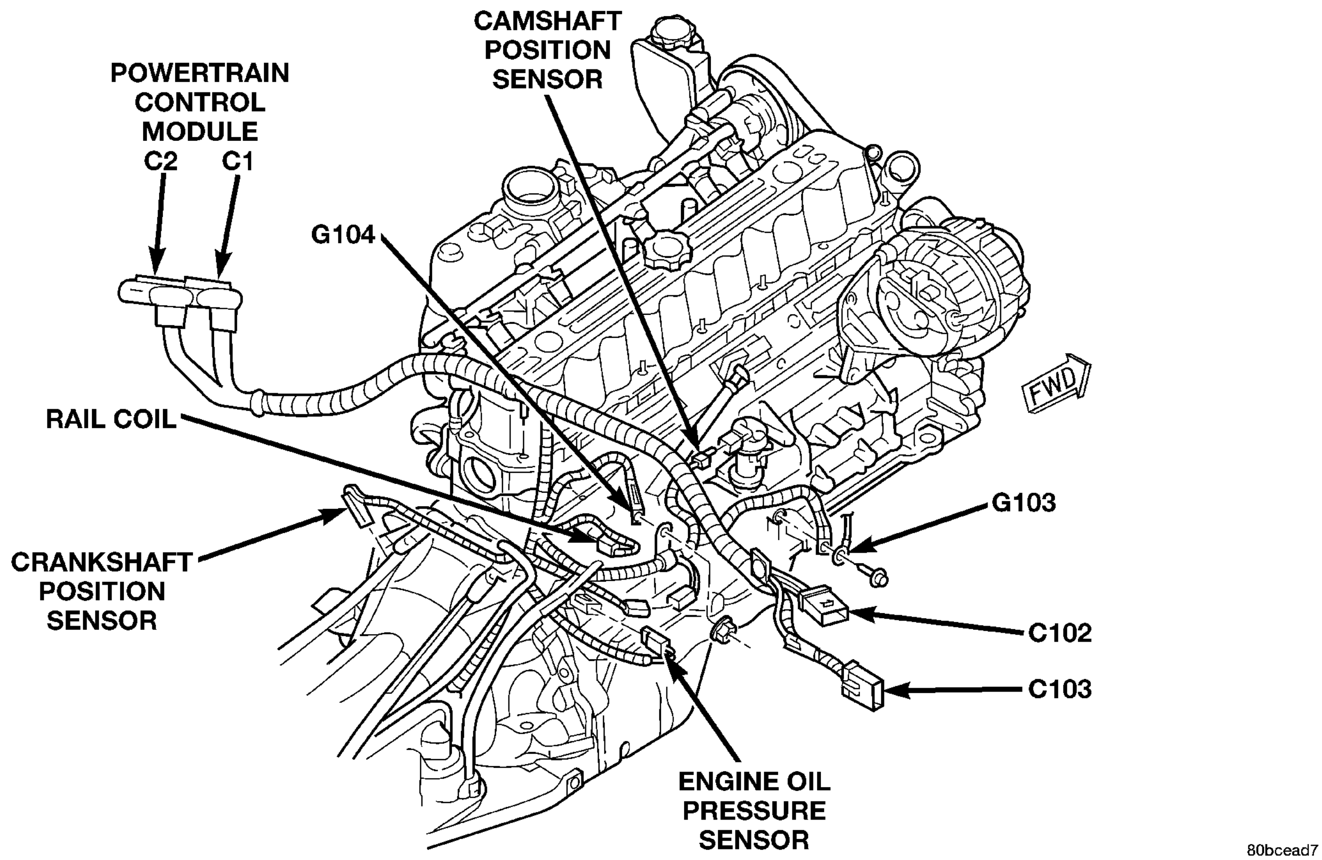


Fig. 40 Engine Connections (4.0L) — RHD

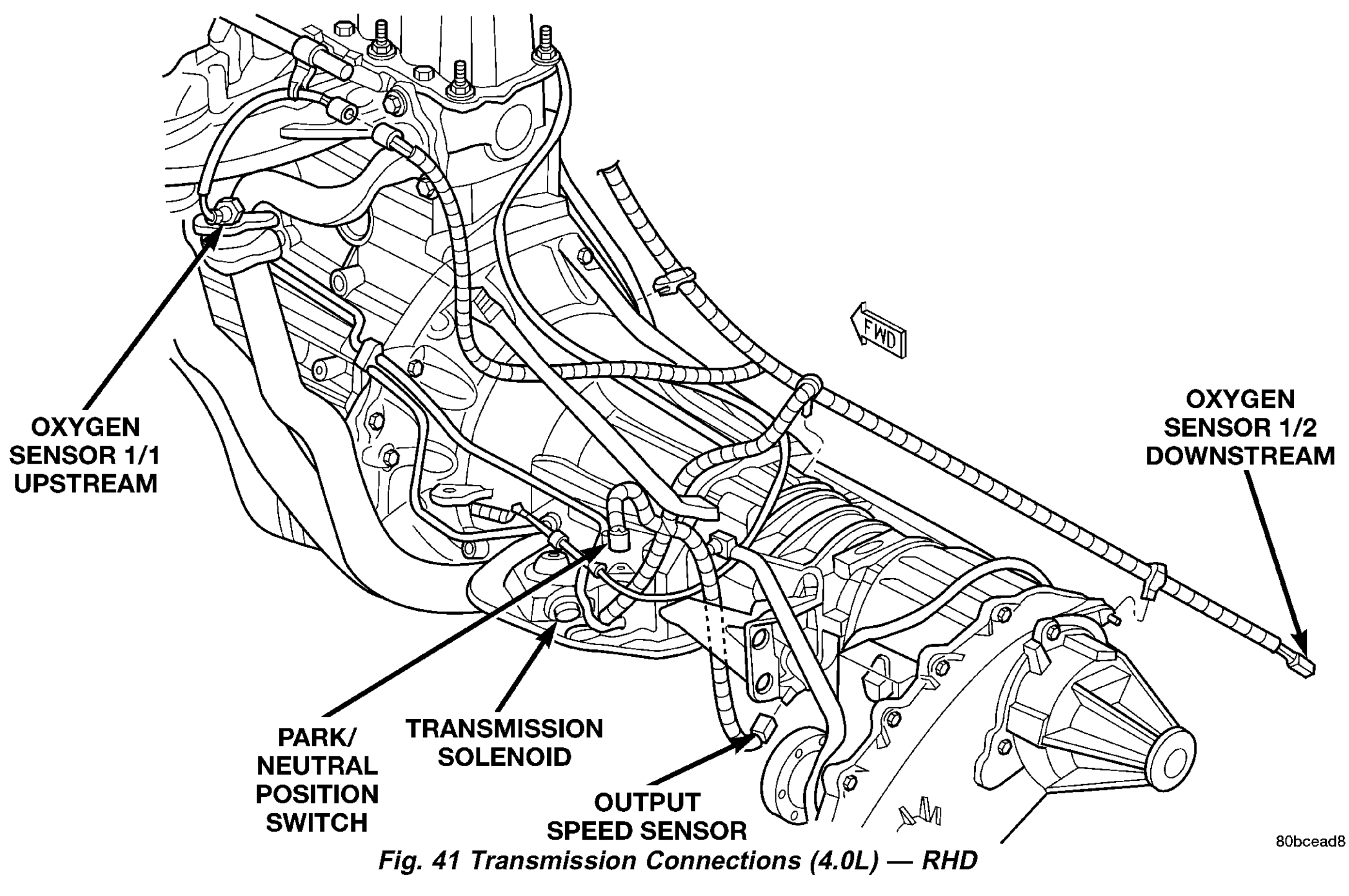


Fig. 41 Transmission Connections (4.0L) — RHD

DESCRIPTION AND OPERATION (Continued)

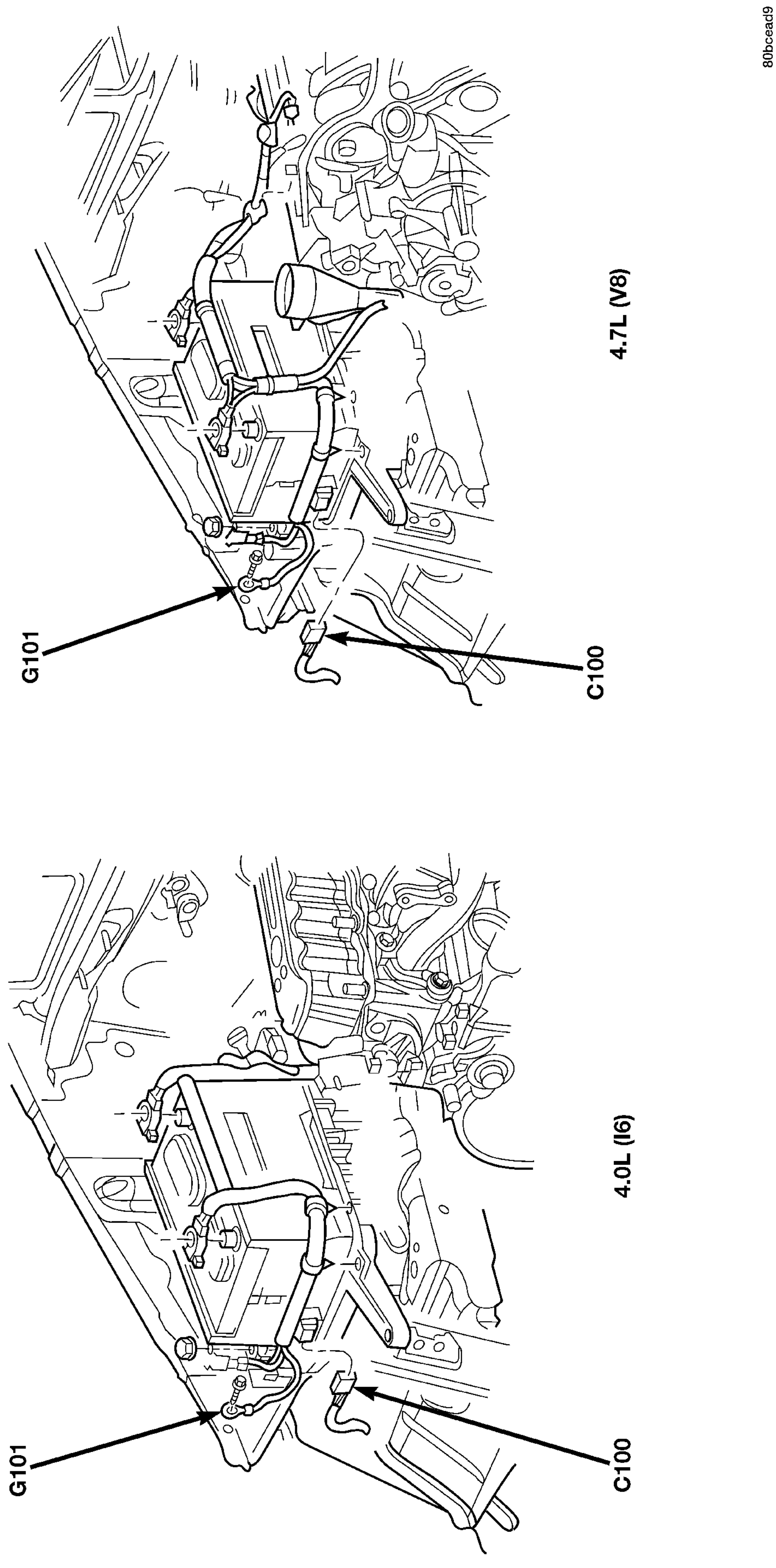


Fig. 42 Engine Compartment Connections (Battery) — RHD

DESCRIPTION AND OPERATION (Continued)

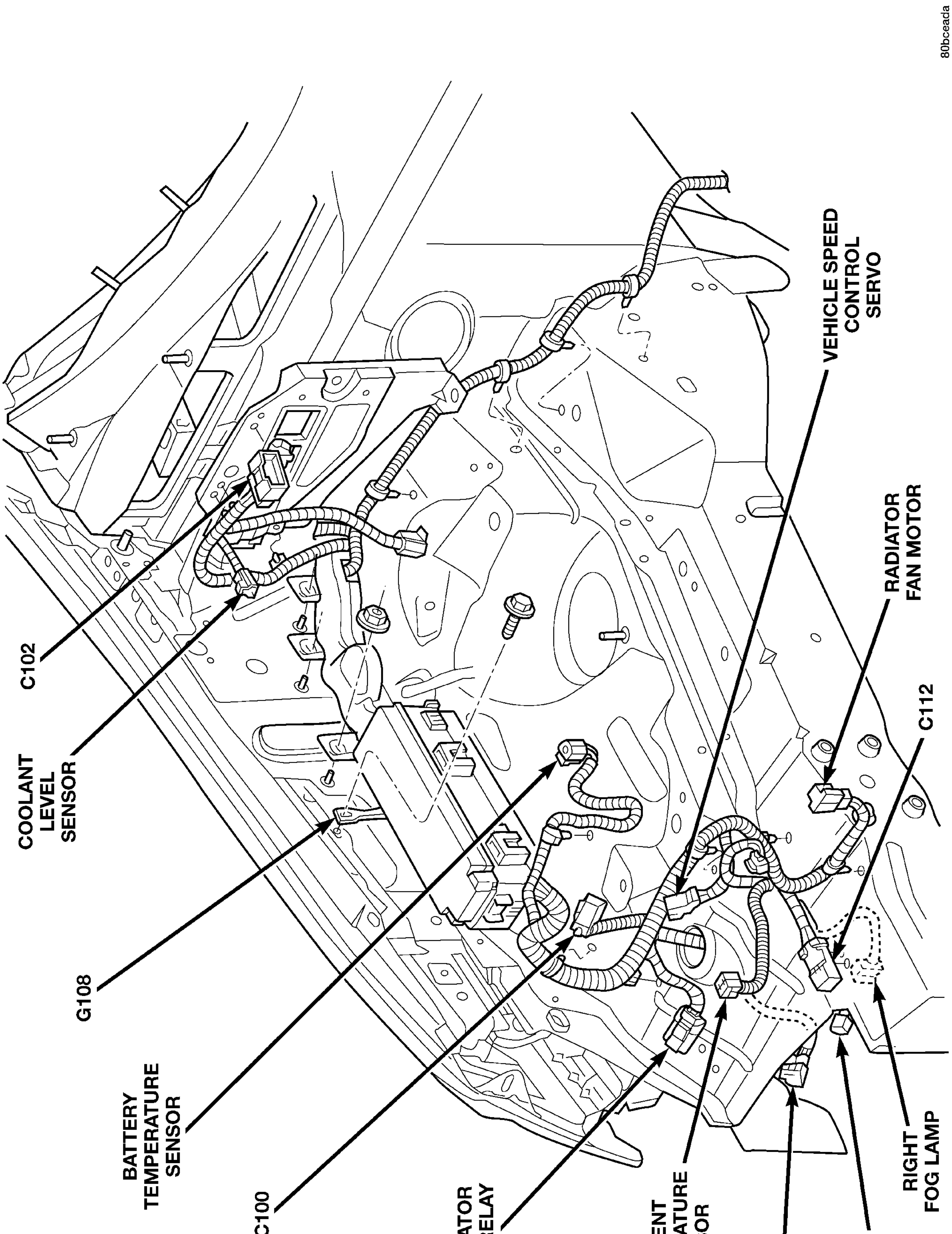


Fig. 43 Engine Compartment Connections (Right Side) — RHD

DESCRIPTION AND OPERATION (Continued)

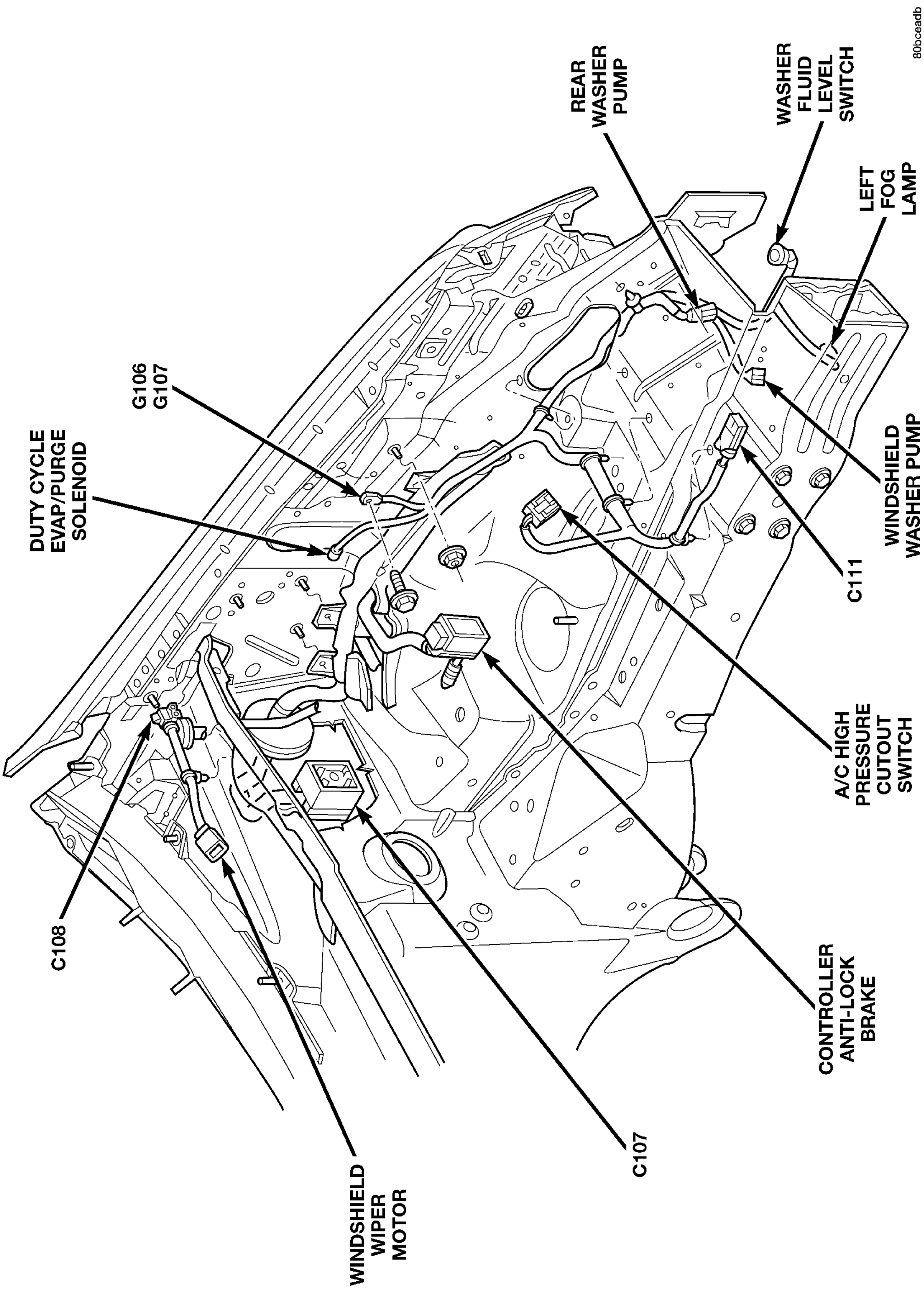


Fig. 44 Engine Compartment Connections (Left Side) — RHD

DESCRIPTION AND OPERATION (Continued)

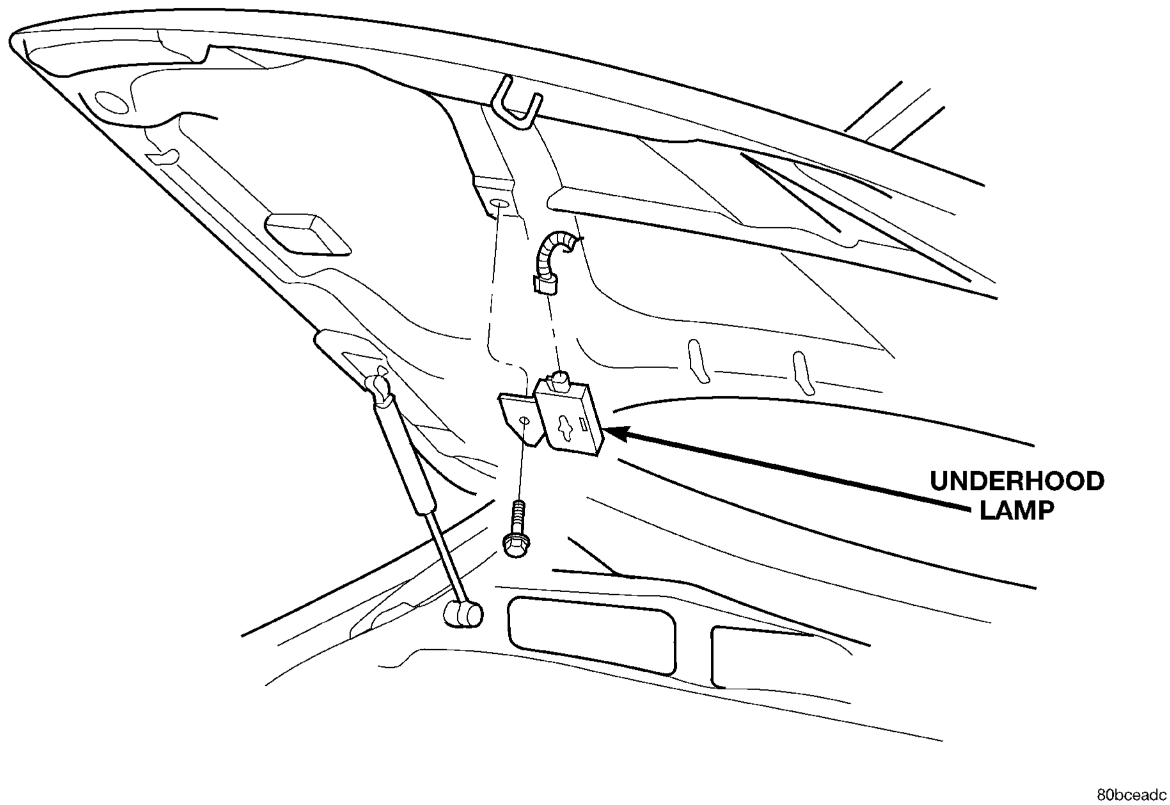


Fig. 45 Engine Compartment Connections — RHD

DESCRIPTION AND OPERATION (Continued)

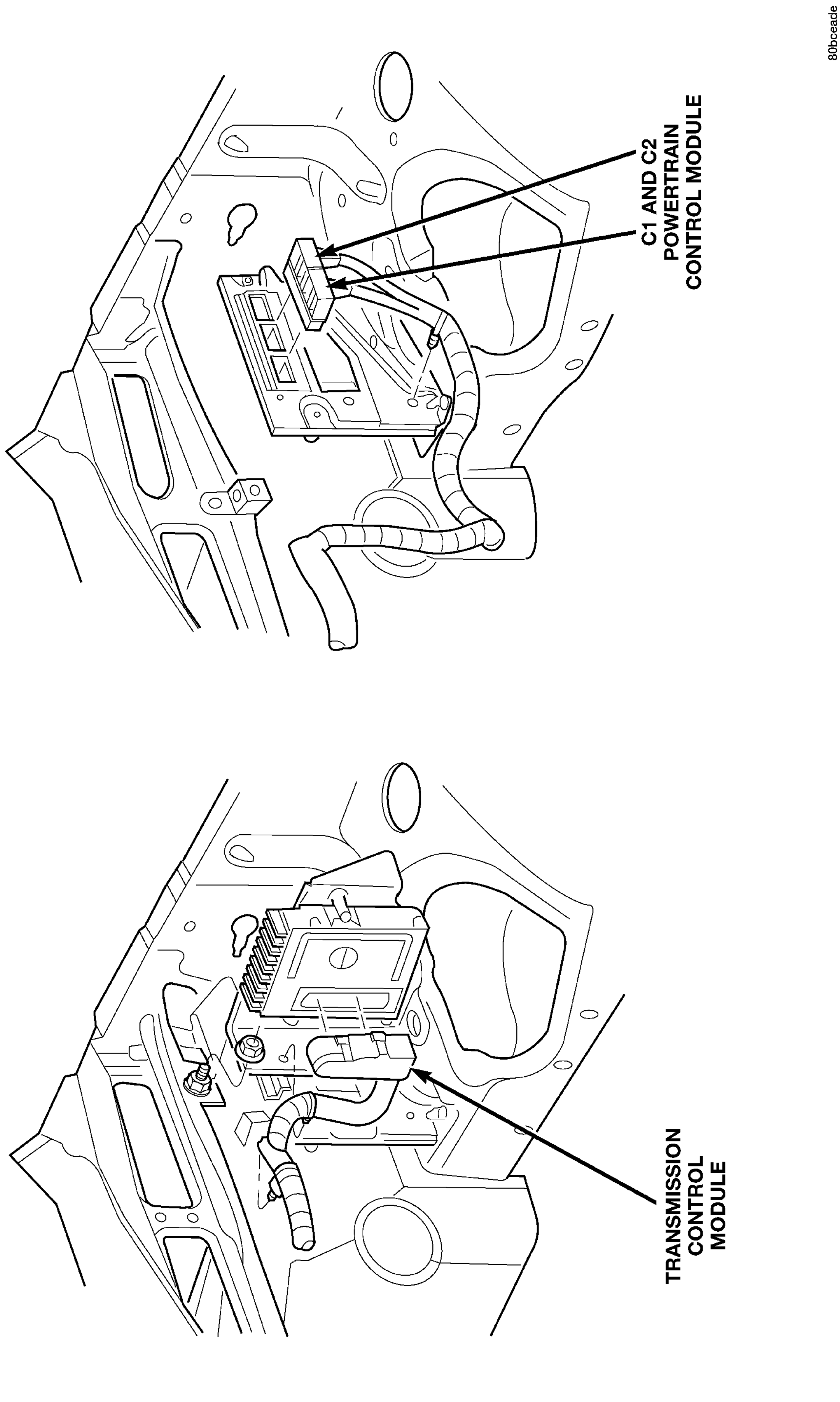


Fig. 46 Engine Compartment Connections — RHD

DESCRIPTION AND OPERATION (Continued)

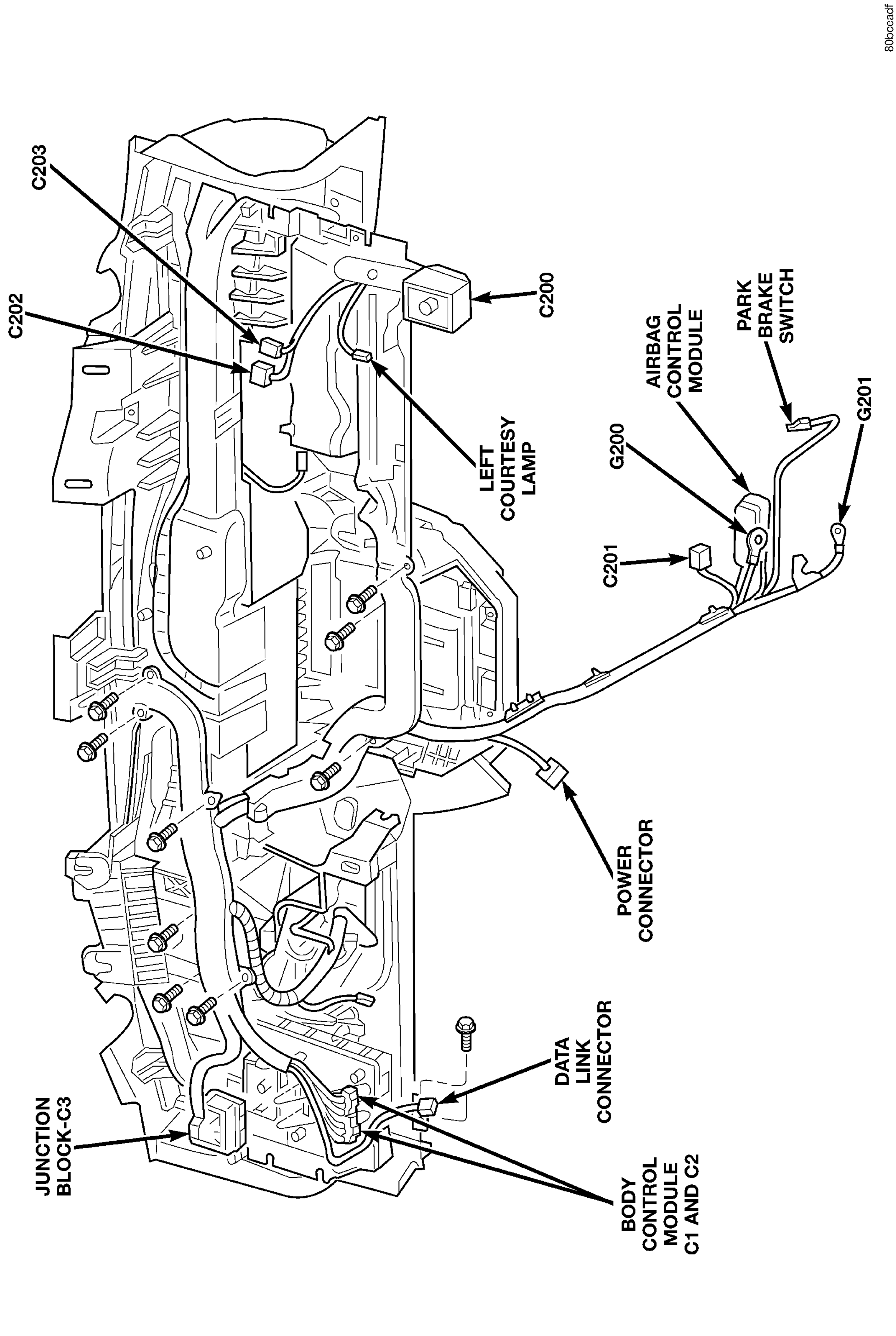


Fig. 47 Instrument Panel Connections — RHD

DESCRIPTION AND OPERATION (Continued)

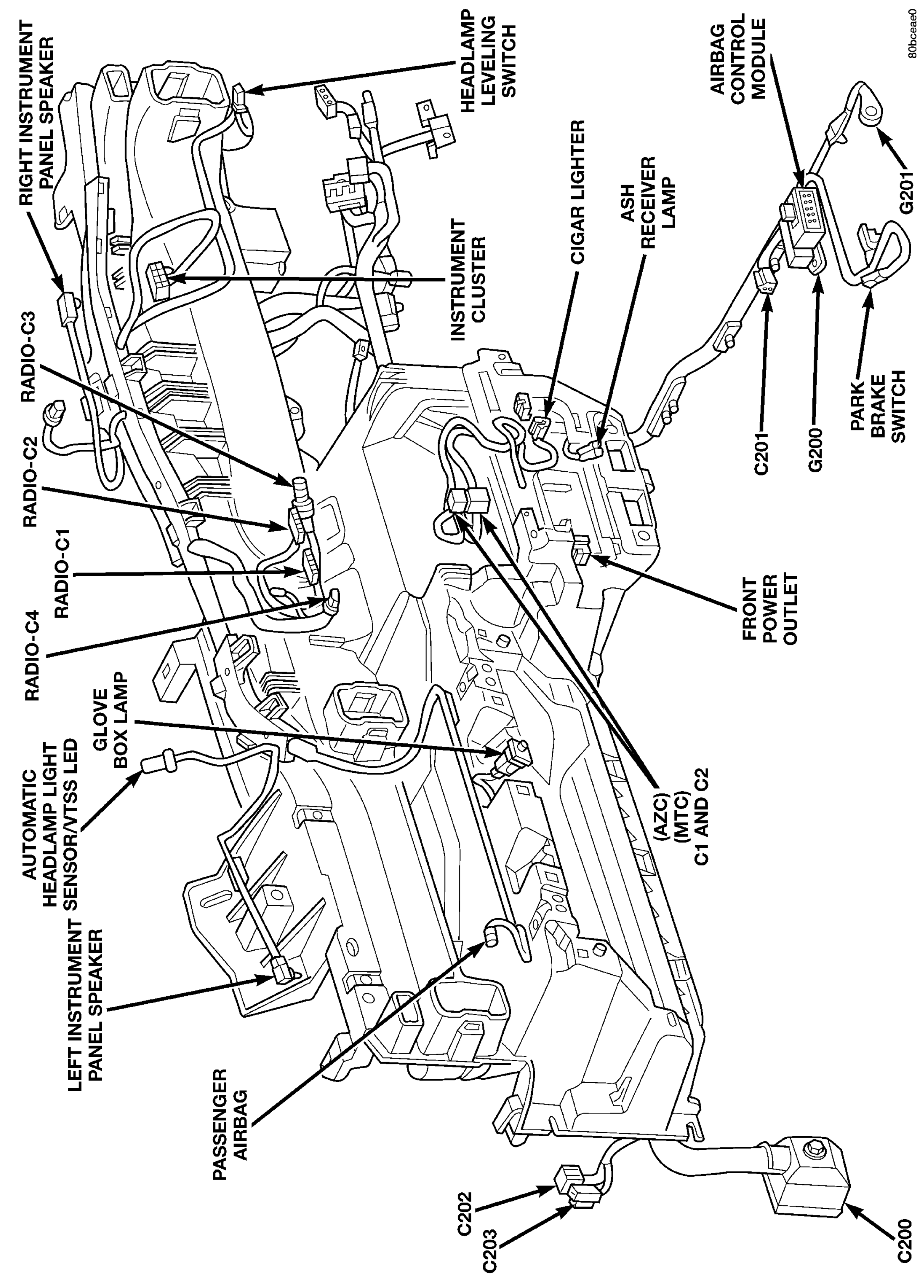


Fig. 48 Instrument Panel Connections — RHD

DESCRIPTION AND OPERATION (Continued)

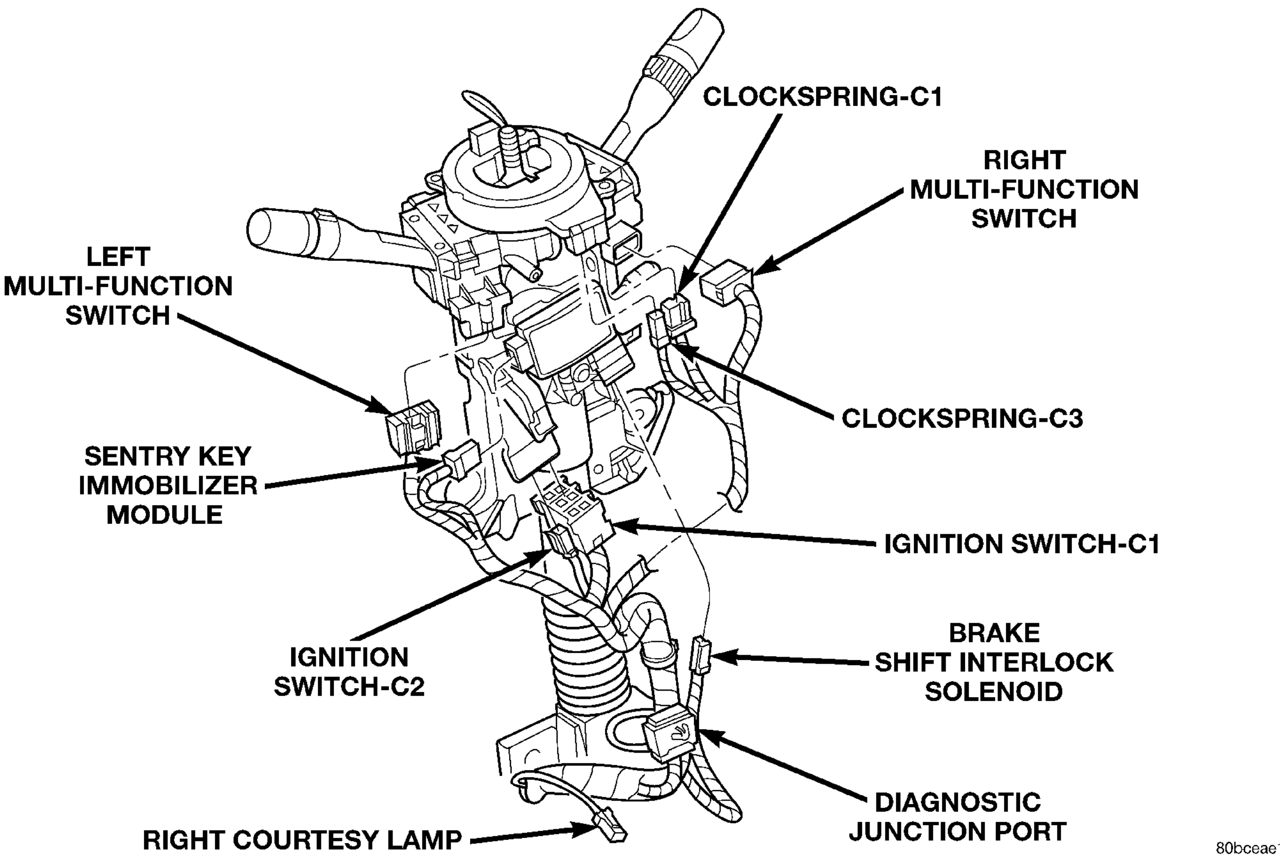


Fig. 49 Steering Column Connections — RHD

DESCRIPTION AND OPERATION (Continued)

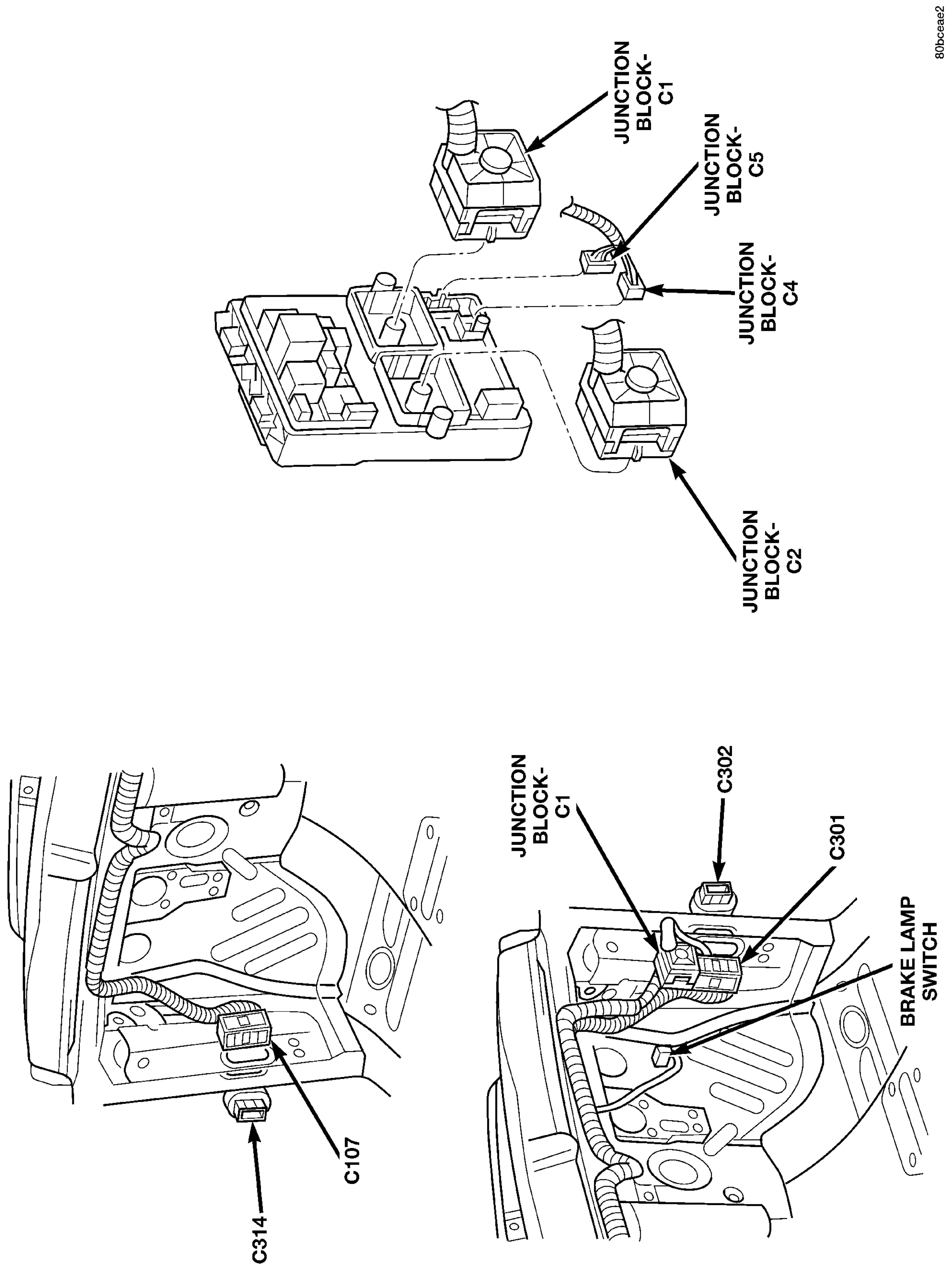


Fig. 50 Kick Panel Area Connections — RHD

DESCRIPTION AND OPERATION (Continued)

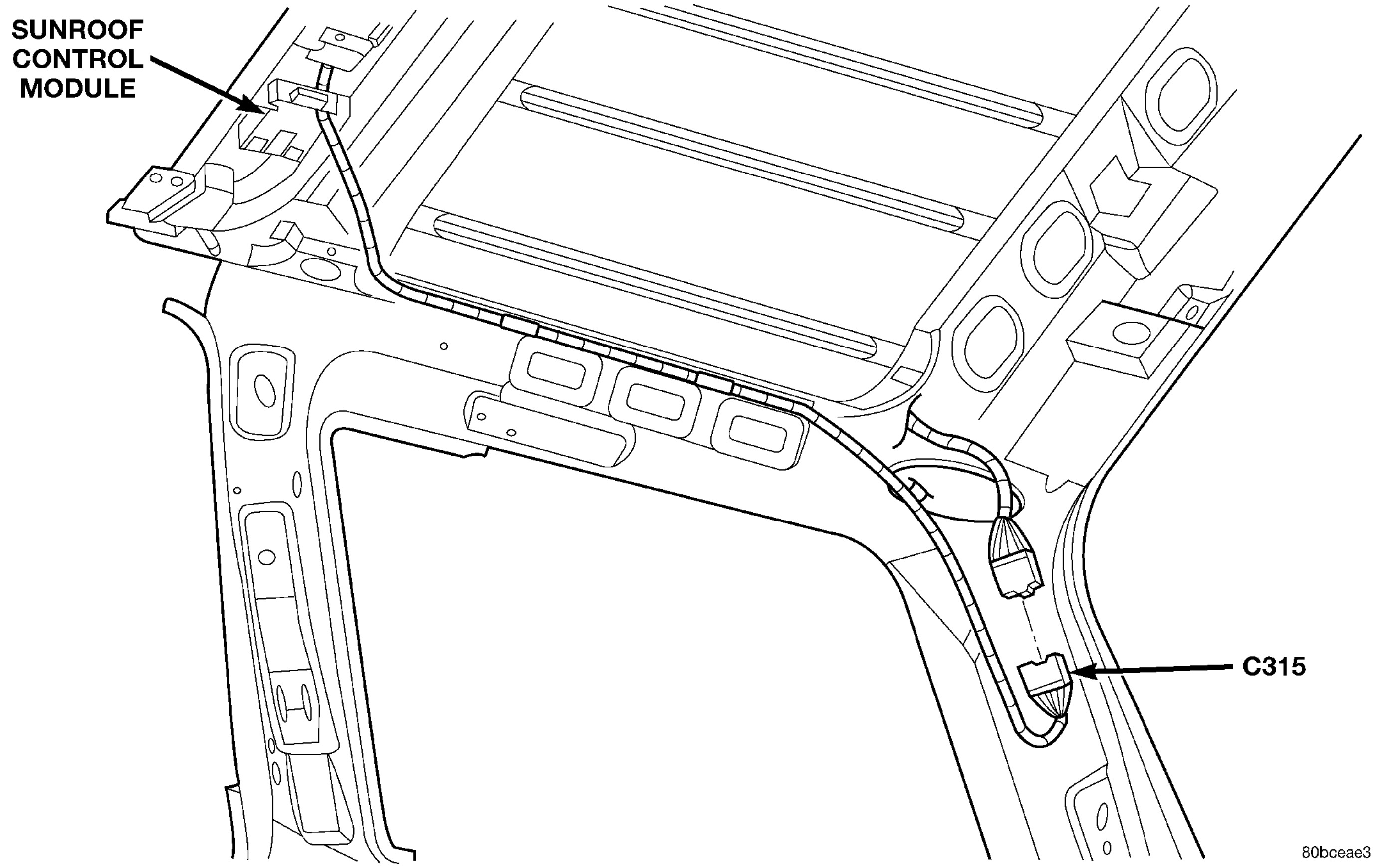


Fig. 51 Roof Connections — RHD

DESCRIPTION AND OPERATION (Continued)

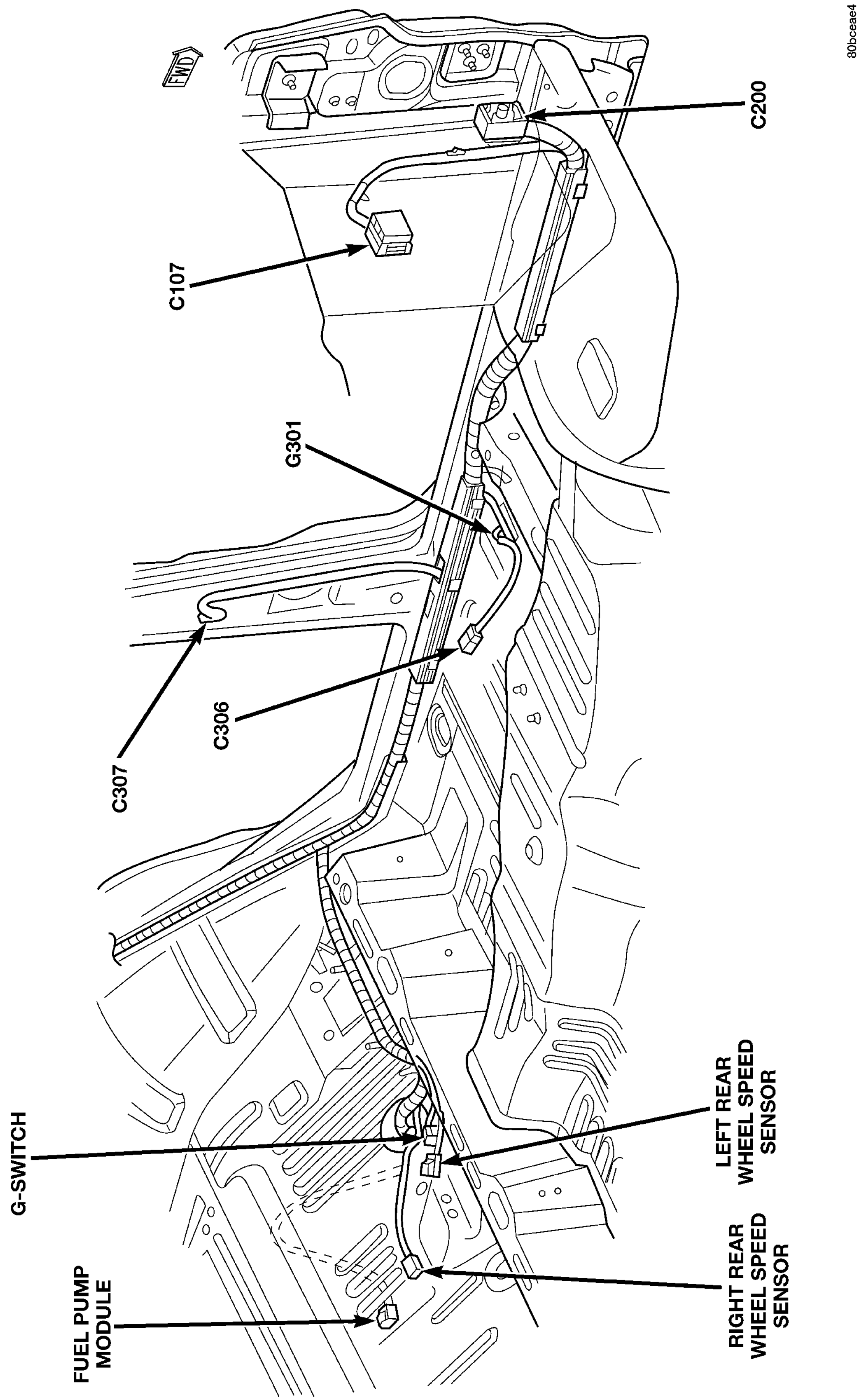


Fig. 52 Body Connections — RHD

DESCRIPTION AND OPERATION (Continued)

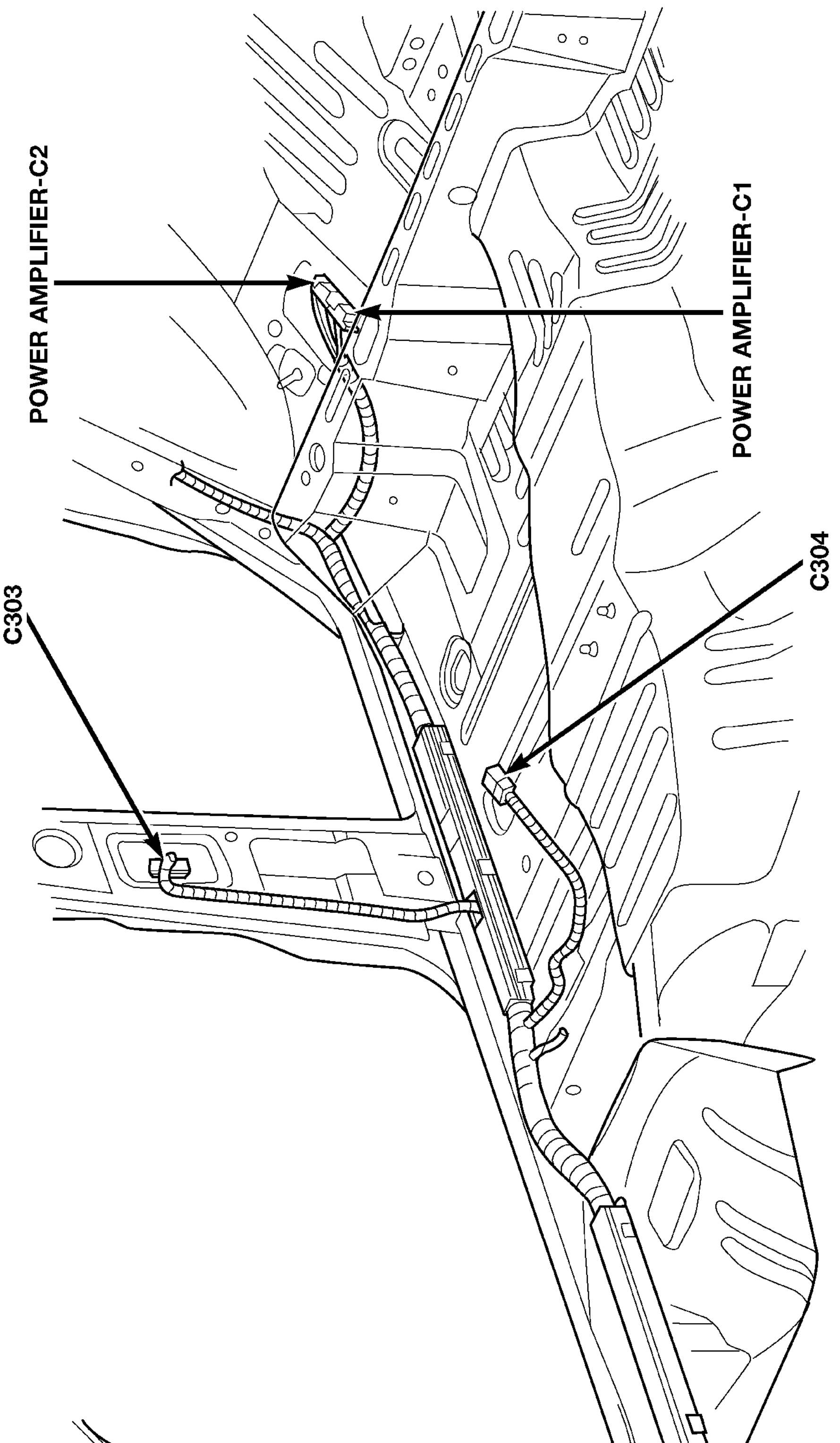


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Fig. 53 Body Connections — RHD

DESCRIPTION AND OPERATION (Continued)

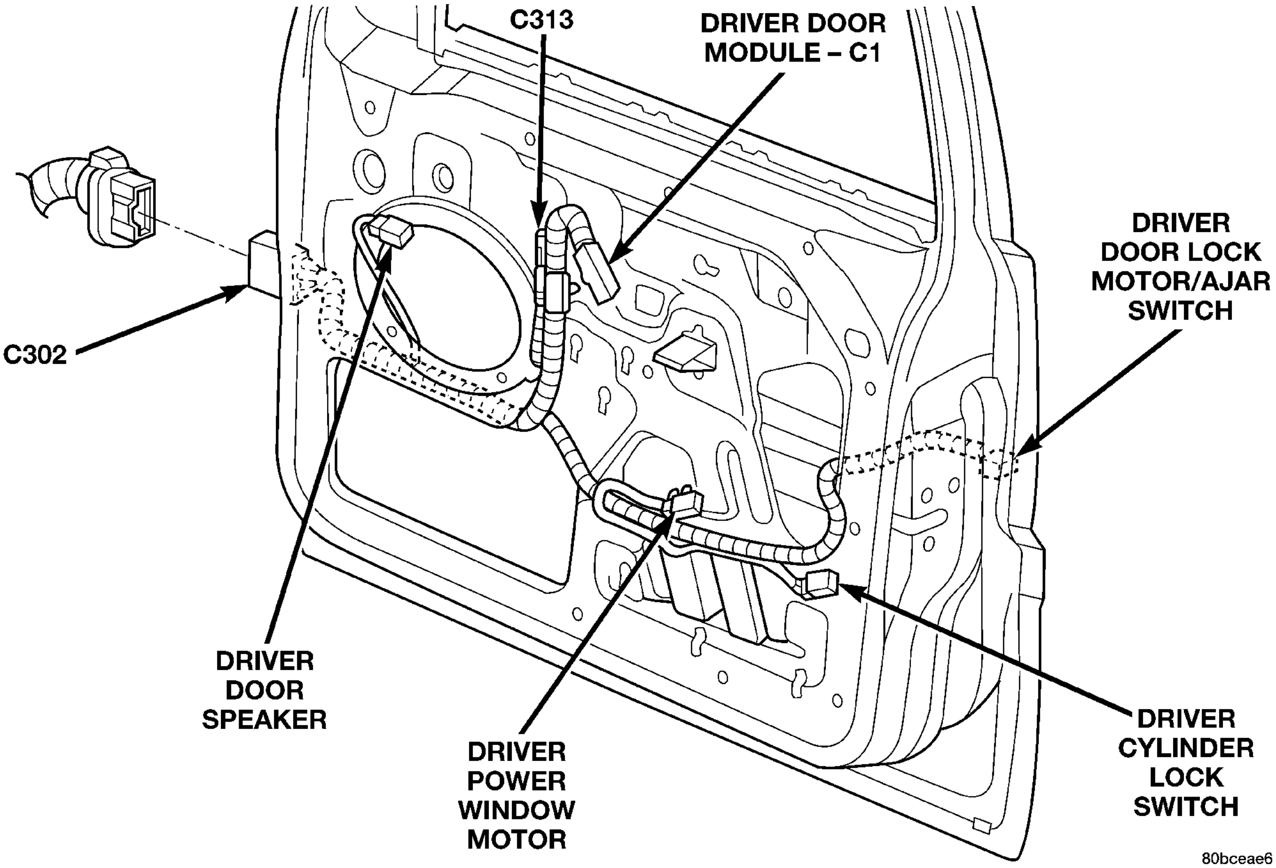


Fig. 54 Door Connections (Driver Door) — RHD

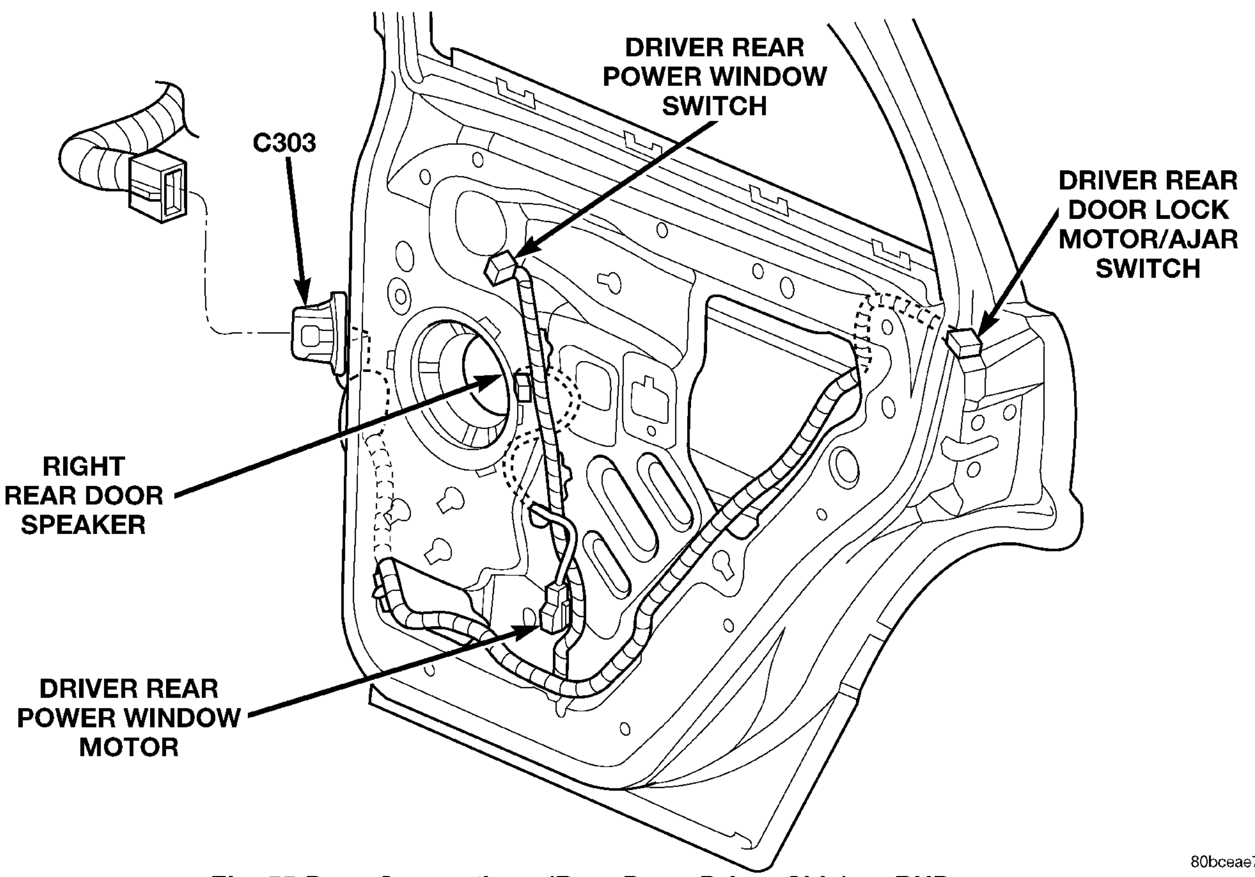


Fig. 55 Door Connections (Rear Door, Driver Side) — RHD

DESCRIPTION AND OPERATION (Continued)

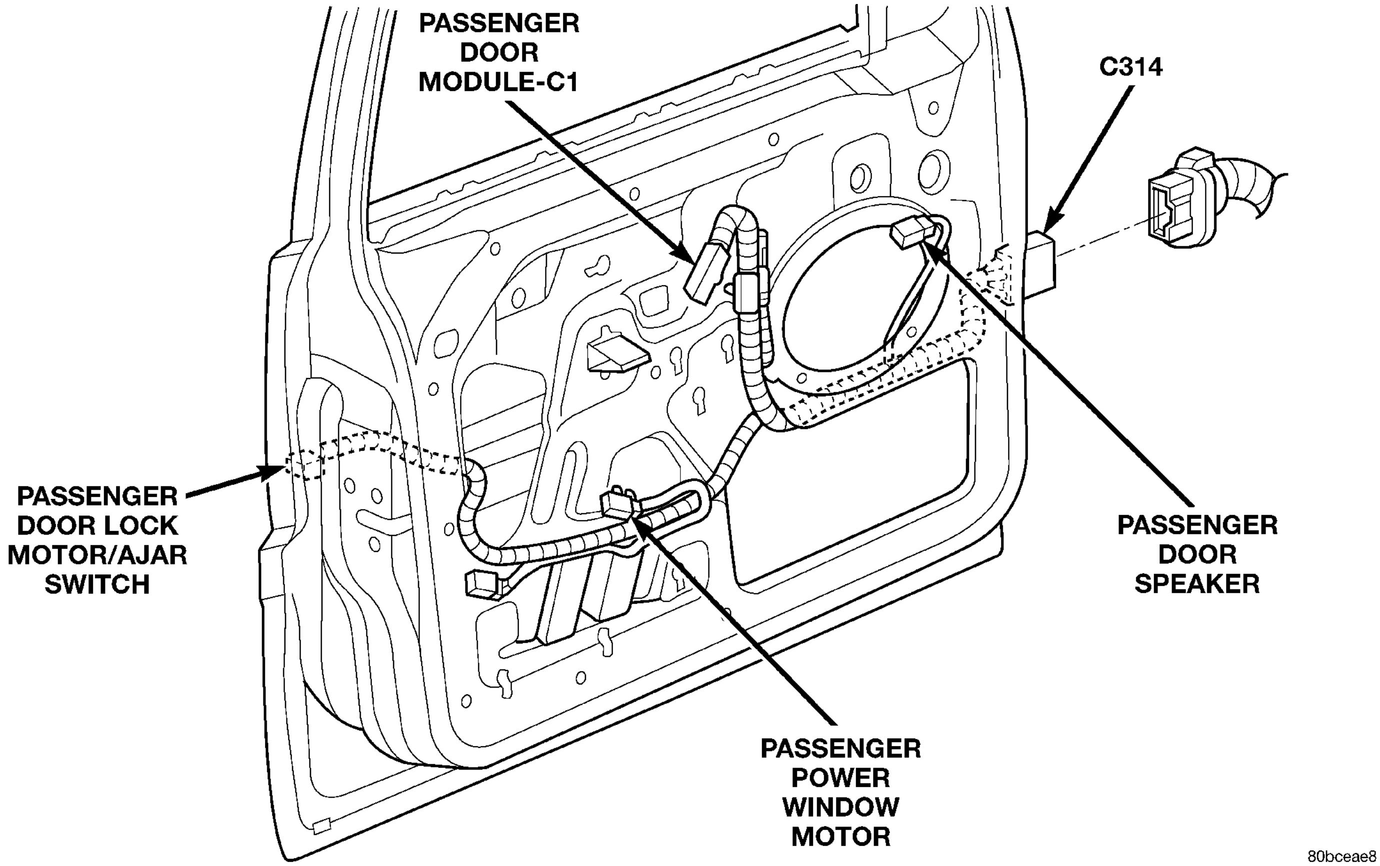


Fig. 56 Door Connections (Passenger Door) — RHD

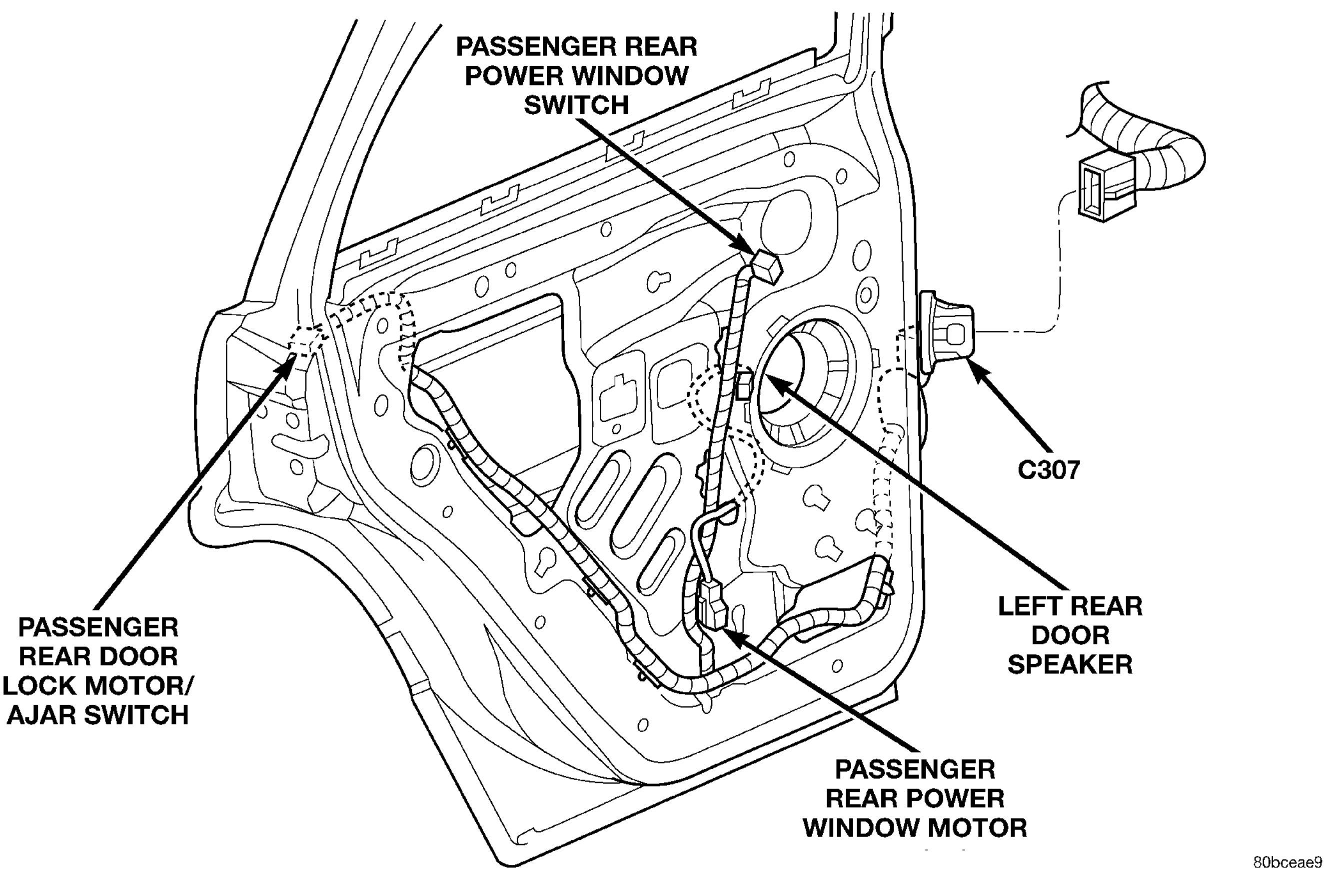


Fig. 57 Door Connections (Rear Door, Passenger Side) — RHD

DESCRIPTION AND OPERATION (Continued)

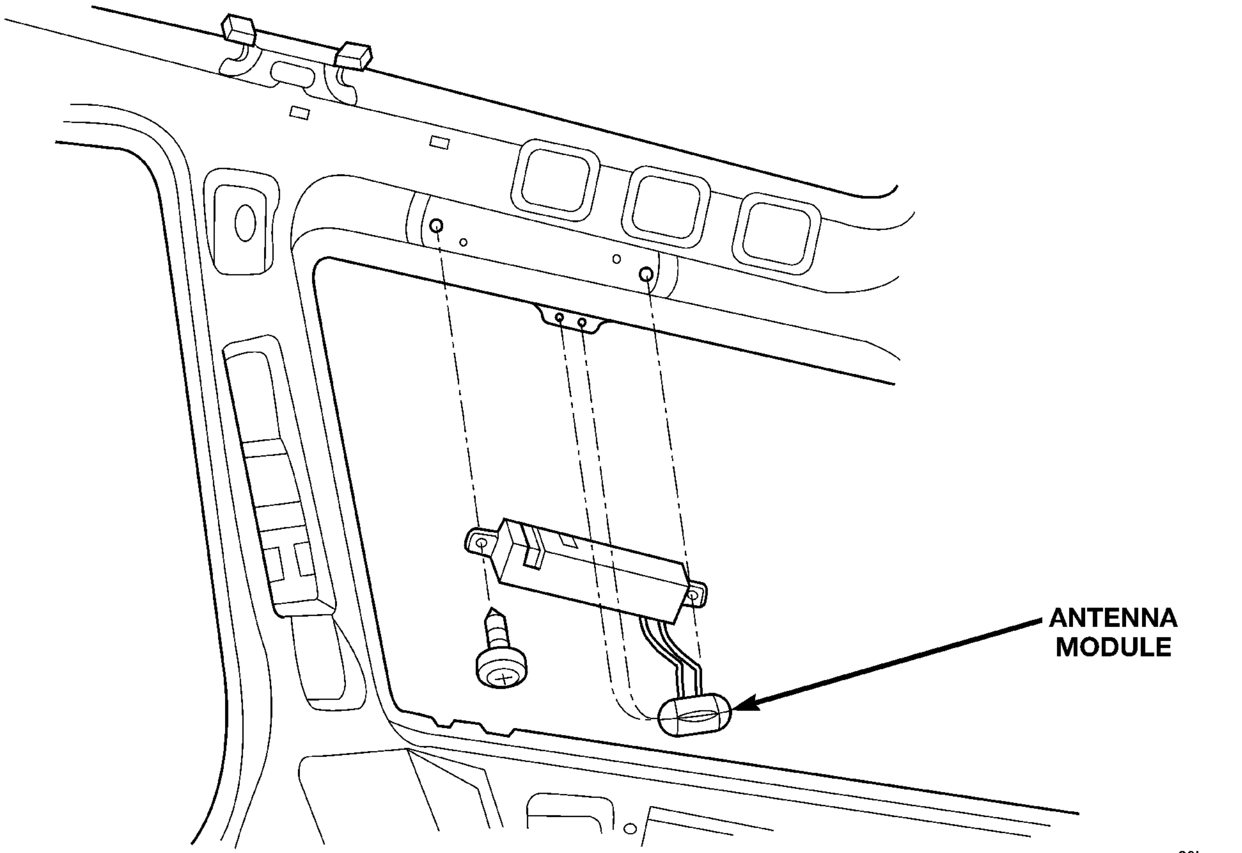


Fig. 58 Body Connections — RHD

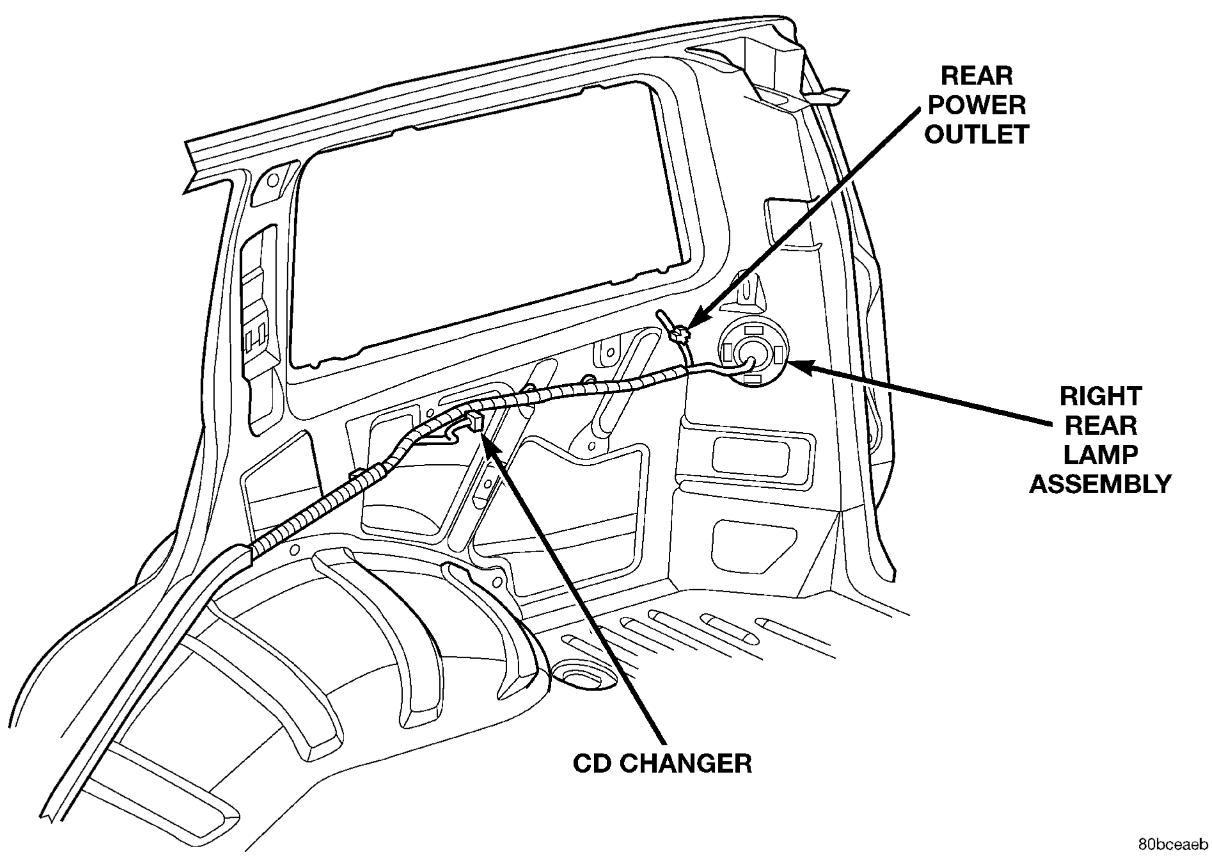


Fig. 59 Body Connections — RHD

DESCRIPTION AND OPERATION (Continued)

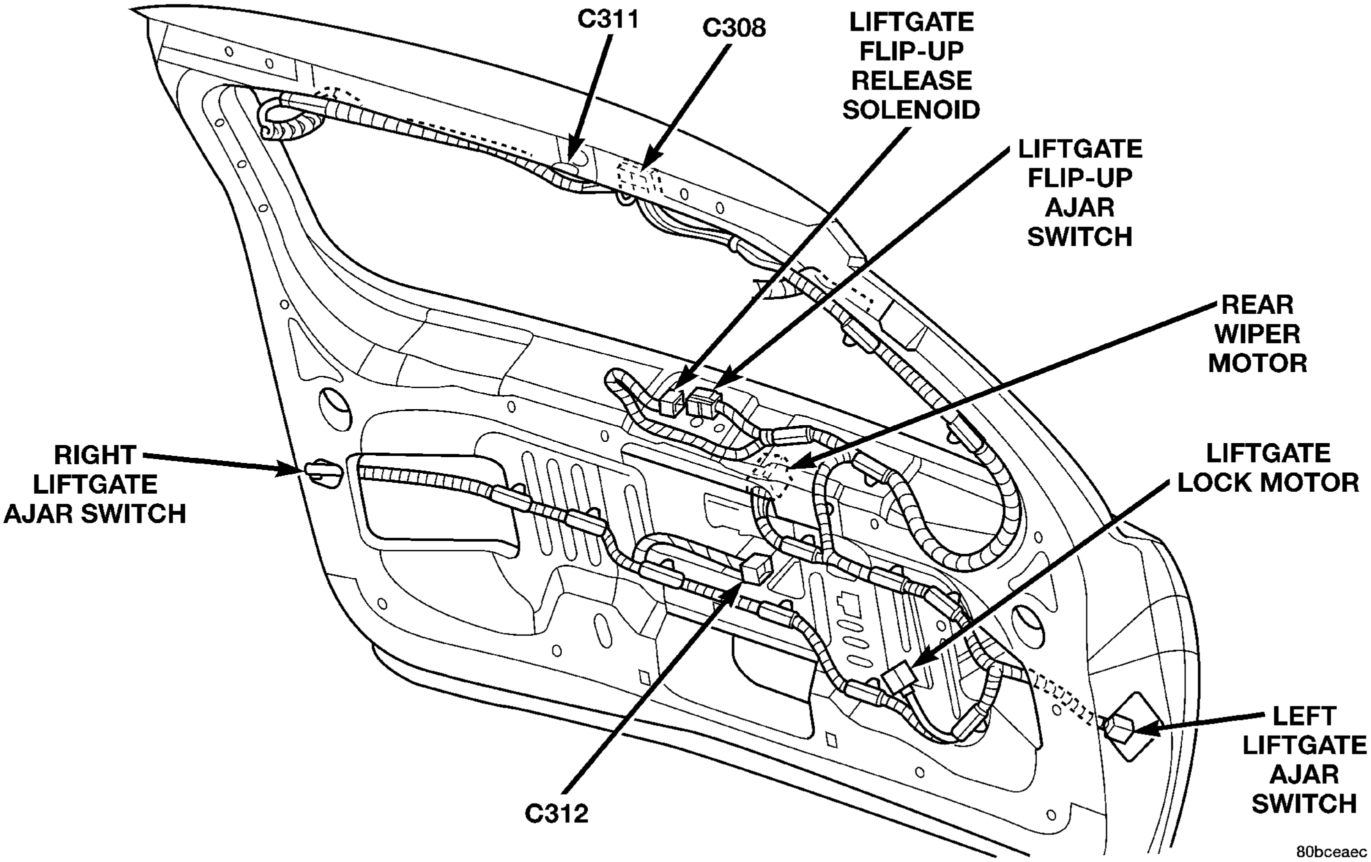


Fig. 60 Liftgate Connections — RHD

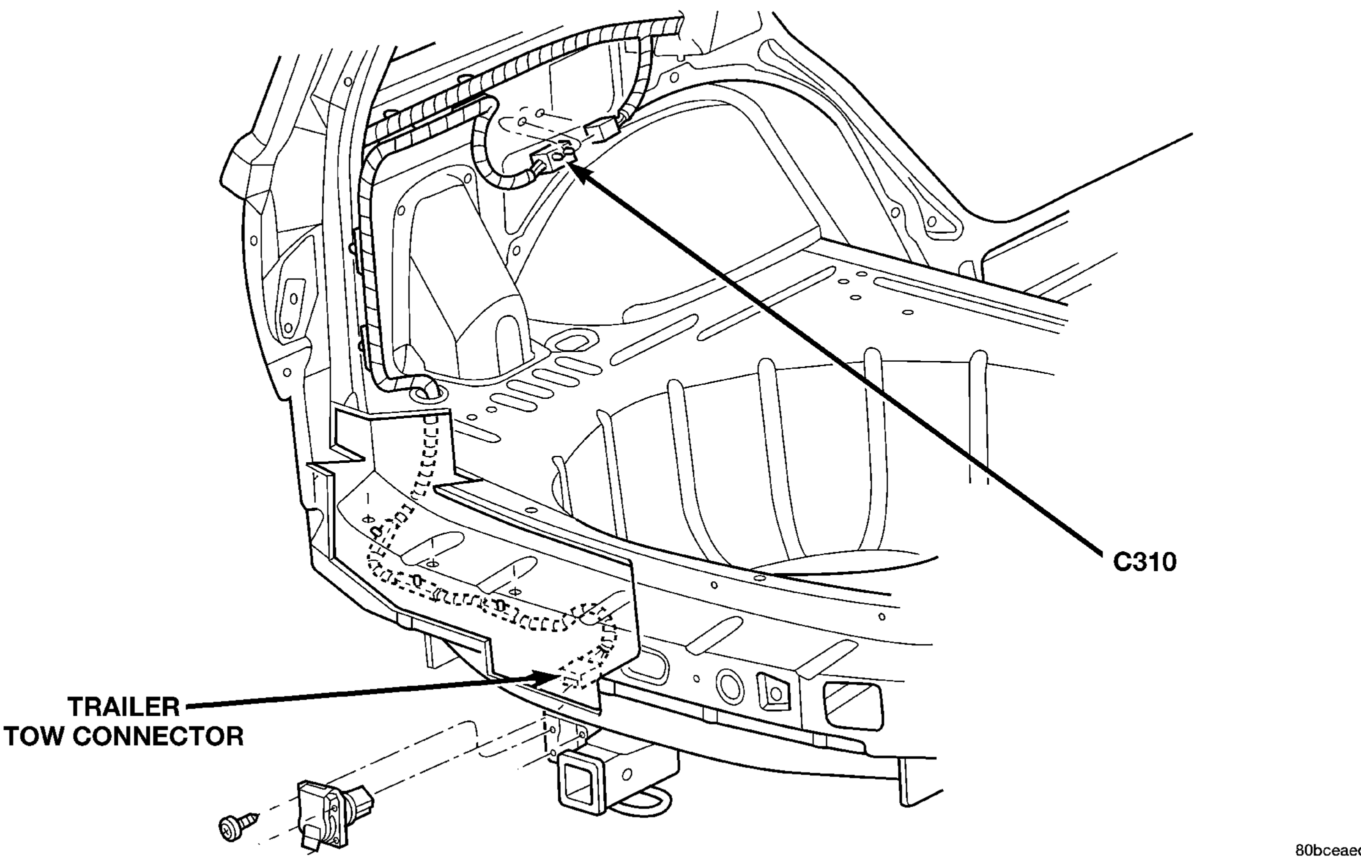


Fig. 61 Trailer Tow Connections — RHD

DESCRIPTION AND OPERATION (Continued)

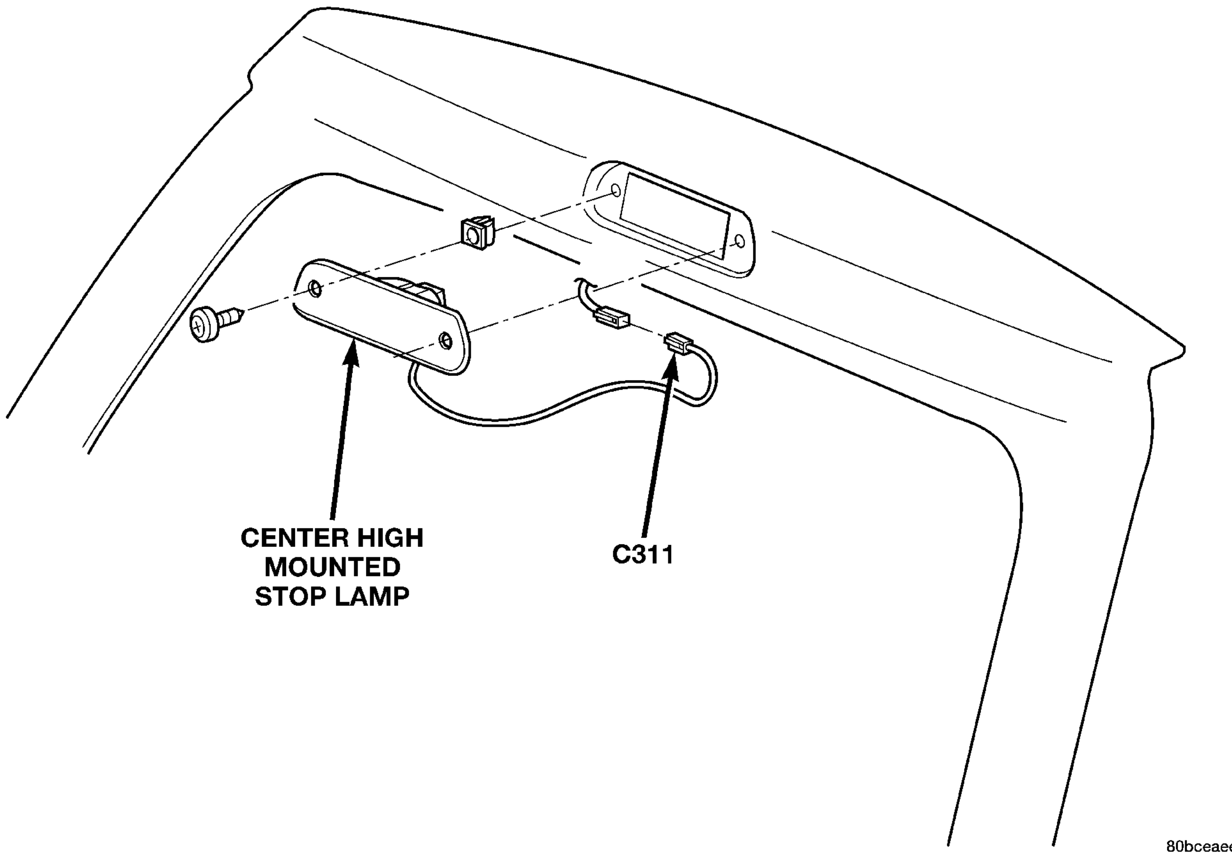


Fig. 62 Liftgate Connections — RHD

8W-95 SPLICE LOCATIONS

DESCRIPTION AND OPERATION

INTRODUCTION

This section provides illustrations identifying the general location of the splices in this vehicle. A splice index is provided. Use the wiring diagrams in each section for splice number identification. Refer to the index for proper splice number.

SPLICE LOCATIONS (LHD)

For splices that are not shown in the figures in this section a N/S is placed in the Fig. column.

Splice Number	Location	Fig.
S100	Near T/O for Power Distribution Center Eyelet	N/S
S102 (4.0L)	Near T/O for Rail Coil	5
S102 (Diesel)	Near T/O for Park/Neutral Position Switch	6
S103 (4.0L)	Near T/O for Oxygen Sensor 1/1 Upstream	5
S103 (4.7L)	Near T/O for Engine Oil Pressure Switch	N/S
S104 (4.0L)	In T/O for G104	5
S104 (4.7L)	Near T/O for Oxygen Sensors	3
S105 (4.0L)	Near T/O for Crankshaft Position Sensor	5
S105 (4.7L)	Near T/O for Fuel Injector NO. 7	1
S106 (4.0L)	In T/O for Oxygen Sensors	5
S106 (4.7L)	In T/O for Oxygen Sensors	N/S
S107 (4.0L)	Near T/O for Fuel Injector NO. 5	4
S107 (4.7L)	Near T/O for Fuel Injector NO. 7	1
S109 (4.0L)	Near T/O for Fuel Injector NO. 2	4
S109 (4.7L)	Near T/O for Fuel Injector NO. 6	2
S112 (4.0L)	Near T/O for C102, C103 and C104	5
S112 (4.7L)	Near T/O for Fuel Injector NO. 8	2
S112 (Diesel)	Near T/O for Pedal Position Sensor	6
S113 (4.7L)	Near T/O for Transmission Control Module	2
S114 (4.7L)	Near T/O for Transmission Control Module	2
S115 (4.7L)	Near T/O for Transmission Control Module	2
S116 (4.7L)	Near T/O for C102, C103 and C104	2
S117 (4.7L)	Near T/O for C102, C103 and C104	2
S117 (Diesel)	Near T/O for Fuel Sender Unit	7
S118 (4.7L)	Near T/O for Fuel Injector NO. 4	2
S118 (Diesel)	Near T/O for Fuel Sender Unit	7
S119 (4.7L)	In T/O for Crankshaft Position Sensor	N/S
S120 (4.7L)	Near T/O for Crankshaft Position Sensor	N/S
S121 (4.7L)	Near T/O for Idle Air Control Motor	1
S122 (4.0L)	Near T/O for Rail Coil	5
S122 (4.7L)	Near T/O for Oxygen Sensors	3
S122 (Diesel)	Near T/O for Generator	6
S124 (4.7L)	Near T/O for Idle Air Control Motor	1
S125 (Diesel)	In T/O for C103 and C105 Left Rear of Engine Compartment	N/S
S125 (Gas)	Near T/O for Powertrain Control Module - C3	8
S126 (4.0L)	In Trough Near T/O for Powertrain Control Module - C3	8
S127	In Trough Near T/O for Powertrain Control Module - C3	8
S127 (Diesel)	In Trough Near T/O for Powertrain Control Module - C3	N/S

DESCRIPTION AND OPERATION (Continued)

Splice Number	Location	Fig.
S128 (Diesel)	In T/O for C102 Left Rear of Engine Compartment	N/S
S128 (Gas)	In Trough Near T/O for Powertrain Control Module - C3	8
S130	In T/O for Powertrain Control Module - C3	N/S
S131	In Trough Near T/O for Power Distribution Center	8
S131 (Diesel)	In Trough Near T/O for Power Distribution Center	N/S
S132 (Diesel)	Near T/O for EGR Solenoid	N/S
S132 (Gas)	Between Troughs in Right Engine Compartment	8
S133 (Diesel)	In Trough Near T/O for EGR Solenoid	8
S133 (Gas)	Near T/O for Battery Temperature Sensor	8
S134 (Diesel)	In Trough Near T/O for G106	N/S
S134 (Gas)	In Trough Near T/O for Controller Anti-Lock Brake	9
S135 (Diesel)	In Glow Plug Harness	N/S
S136 (Diesel)	In Glow Plug Harness	N/S
S137 (Diesel)	In Trough Near T/O for Coolant Level Sensor	8
S138 (Diesel)	In T/O for C102, C103 and C105	N/S
S139 (Diesel)	Near T/O for Crankshaft Position Sensor	6
S140 (Diesel)	In Trough Near T/O for Power Distribution Center	N/S
S142 (Built-Up-Export)	In Trough Near T/O for Coolant Level Sensor	8
S143 (Diesel)	In Trough Near T/O for Hood Ajar Switch	N/S
S143 (Gas, Built-Up-Export)	In Trough Near T/O for Controller Anti-Lock Brake	9
S144 (Diesel)	In T/O for C102, C103 and C105	6

Splice Number	Location	Fig.
S145 (Diesel)	Near T/O for Fuel Sender Unit	7
S146 (Diesel)	In T/O for Engine Control Module - C2	7
S147 (Diesel)	In T/O for Controller Anti-Lock Brake	N/S
S148 (Diesel)	In T/O for Engine Control Module - C2	7
S149 (Diesel)	In T/O for C103 Left Rear of Engine Compartment	N/S
S150 (Diesel)	In T/O for C105 Left Rear of Engine Compartment	N/S
S151	In Headlamp Assembly	N/S
S152	In Headlamp Assembly	N/S
S153	In Headlamp Assembly	N/S
S154	In Headlamp Assembly	N/S
S155	In Headlamp Assembly	N/S
S156	In Headlamp Assembly	N/S
S200	Near T/O for Passenger Heated Seat Switch	16
S201	Near T/O for Front Power Outlet	16
S202	Near T/O for Passenger Heated Seat Switch	16
S203	Near T/O for Cigar Lighter	16
S204	In Trough Near T/O for Power Connector	16
S205	In Trough Near T/O for Power Connector	16
S206	In Trough Opposite End of Power Connector	16
S207	In Trough Near T/O for Radio Connectors	16
S208	In Trough Near T/O for Radio Connectors	16
S209	In Trough Near T/O for Left Courtesy Lamp	16
S210 (Built-Up-Export)	In Trough Near T/O for Left Courtesy Lamp	16
S211	In Trough Near T/O for Left Courtesy Lamp	16
S212	In Trough Near T/O for Left Courtesy Lamp	16
S213	Near T/O for Cruise Switch NO. 1	N/S
S214	Near T/O for Cruise Switch NO. 1	N/S

DESCRIPTION AND OPERATION (Continued)

Splice Number	Location	Fig.
S215	Near T/O for Horn Switch	N/S
S216	Near T/O for Remote Radio Switch NO. 2	N/S
S300	Near T/O for G301	11
S301	In T/O for C304	11
S302	In Sill Trough Near T/O for C307	11
S303	In Sill Trough Near T/O for C307	11
S304	In Sill Trough Near T/O for C307	11
S305	In Sill Trough Near T/O for C307	11
S306	Near T/O for C310	14
S307	Near T/O for C310	14
S308 (Built-Up-Export)	Between T/O's for C310 and Left Rear Lamp Assembly	14
S309	Between T/O's for C310 and Left Rear Lamp Assembly	14
S310	Between T/O's for C310 and Left Rear Lamp Assembly	14
S311	Near T/O for Left Rear Lamp Assembly	14
S312	Near T/O for Brake Lamp Switch	12
S313	Near T/O for Brake Lamp Switch	12
S314	Near T/O for Brake Lamp Switch	12
S315 (Gas)	In Center Spline Near T/O for Brake Lamp Switch	12
S316 (Gas)	In Center Spline Trough Side	12
S317	Between Troughs Near T/O for C314	12
S318	Between Troughs Near T/O for C314	12
S324	In T/O for C200	10
S325 (Gas)	Near T/O for Junction Block - C5	12
S326	Between T/O for C106 and Sill Trough	10
S327	Between T/O for C106 and Sill Trough	10
S328	Between T/O for C106 and Sill Trough	10
S329	In Sill Trough Near T/O for G300	10
S330	Near T/O for C306	10
S331	In Sill Trough Near T/O for C303	10
S332	In Sill Trough Near T/O for C303	10

Splice Number	Location	Fig.
S334	In T/O for Power Amplifier - C1	10
S336	Near T/O for Driver Power Window Motor	15
S338	Near T/O for Passenger Power Window Motor	N/S
S339	Near T/O for Passenger Power Window Motor	N/S
S340	In T/O for Passenger Door Module - C1	N/S
S341	Near T/O for C306	N/S
S342	Near T/O for C306	N/S
S345	Near T/O for Left Handle Courtesy Lamp	N/S
S346	Near T/O for Left Visor/Vanity Lamp	N/S
S347	Near T/O for Left Visor/Vanity Lamp	N/S
S348	Near T/O for Automatic Day/Night Mirror	N/S
S349	Near T/O for Automatic Day/Night Mirror	N/S
S351	Near T/O for Seat Belt Switch	N/S
S352	Near T/O for Seat Belt Switch	N/S
S353	Near T/O for Driver Lumbar Switch	N/S
S355	Near T/O for C304 and C306	N/S
S356	In T/O for Driver Rear Door Lock Motor/Ajar Switch	N/S
S357	In T/O for Passenger Rear Door Lock Motor/Ajar Switch	N/S
S359 (Built-Up-Export)	Near T/O for C106	10
S360	In T/O for C302	12
S361	In T/O for C302	12
S362	In T/O for C200	N/S
S363	In T/O for C200	N/S
S368	Near T/O for Power Amplifier - C1	10
S400	Near Rear Window Defogger Ground Connector	13
S401	Near Rear Window Defogger Ground Connector	13
S402	Near T/O for Liftgate Flip-Up Ajar Switch	13
S403	Near T/O for Rear Wiper Motor	13
S404	Near T/O for Liftgate Lock Motor	13

DESCRIPTION AND OPERATION (Continued)

Splice Number	Location	Fig.
S406 (Except Built-Up-Export)	In T/O for Trailer Tow Right Turn Relay	N/S
S407 (Except Built-Up-Export)	Near T/O for Trailer Tow Left Turn Relay	N/S
S408	Near T/O for Trailer Tow Circuit Breaker	14
S409	In T/O for C310	14
S410	In T/O for Trailer Tow Connector	14
S411	Near T/O for License Lamp NO. 1	N/S
S412	In T/O for C312	N/S
S413 (Built-Up-Export)	Near T/O for Trailer Tow Brake Lamp Relay	N/S

DESCRIPTION AND OPERATION (Continued)

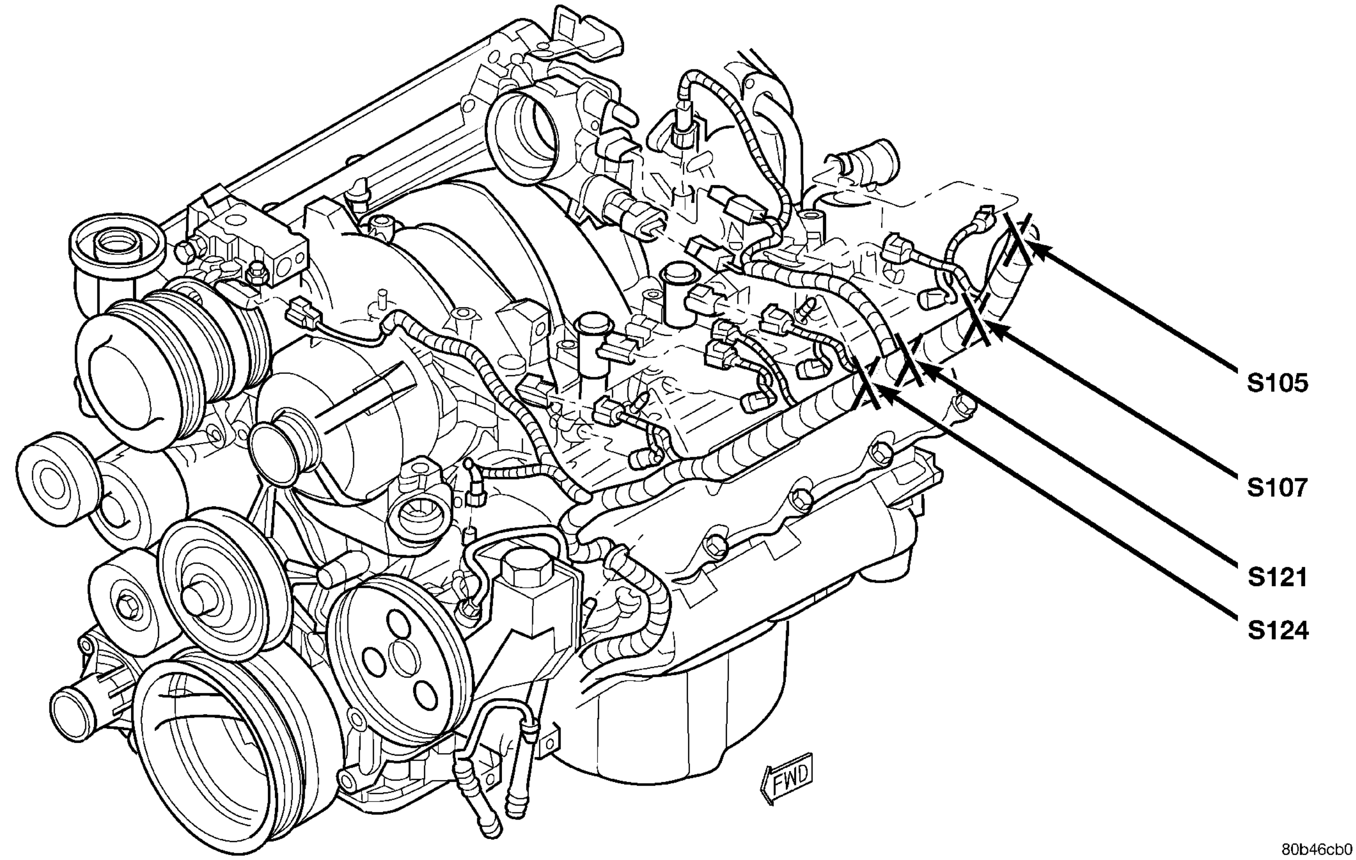


Fig. 1 Engine Splices (4.7L) — LHD

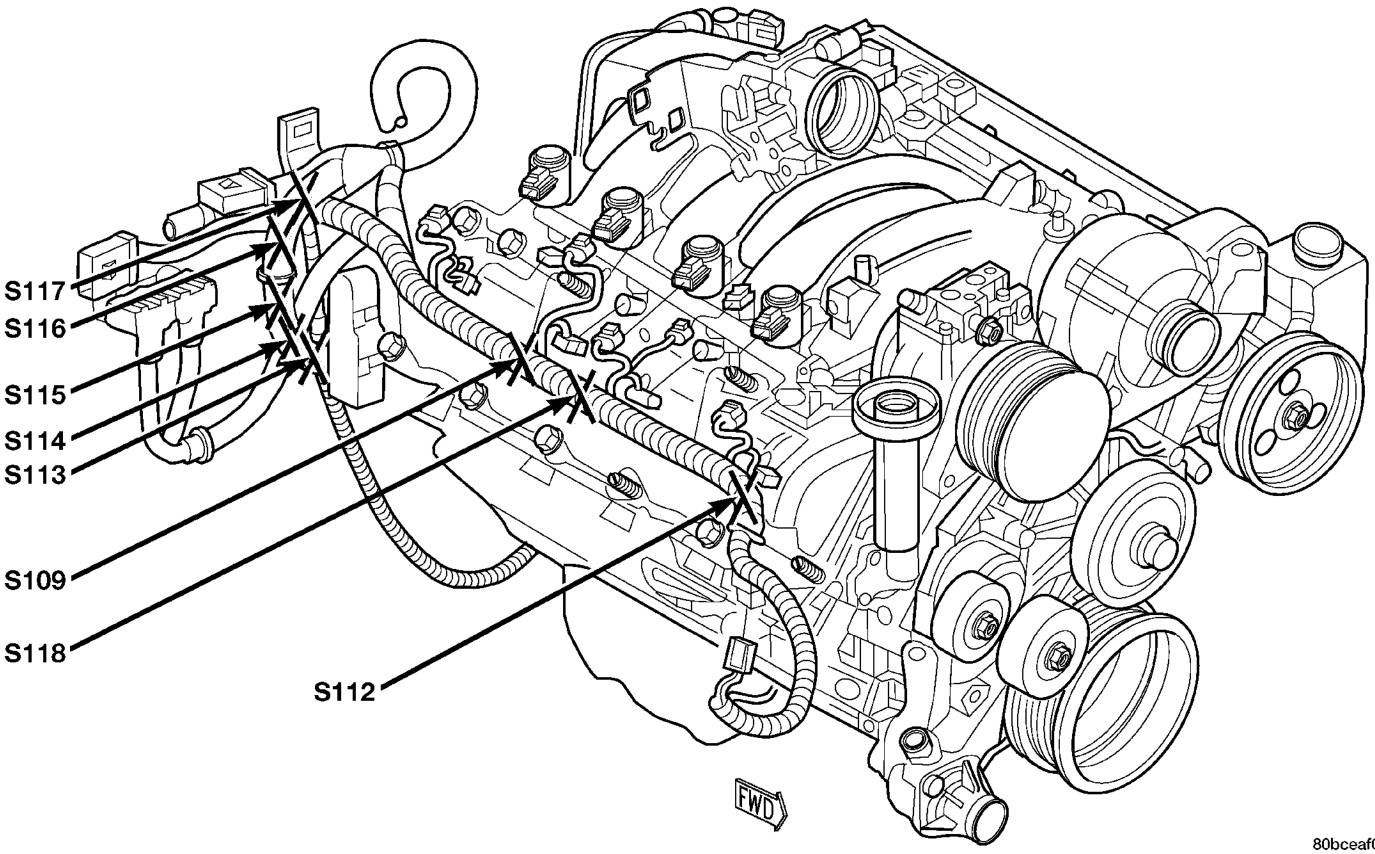


Fig. 2 Engine Splices (4.7L) — LHD

DESCRIPTION AND OPERATION (Continued)

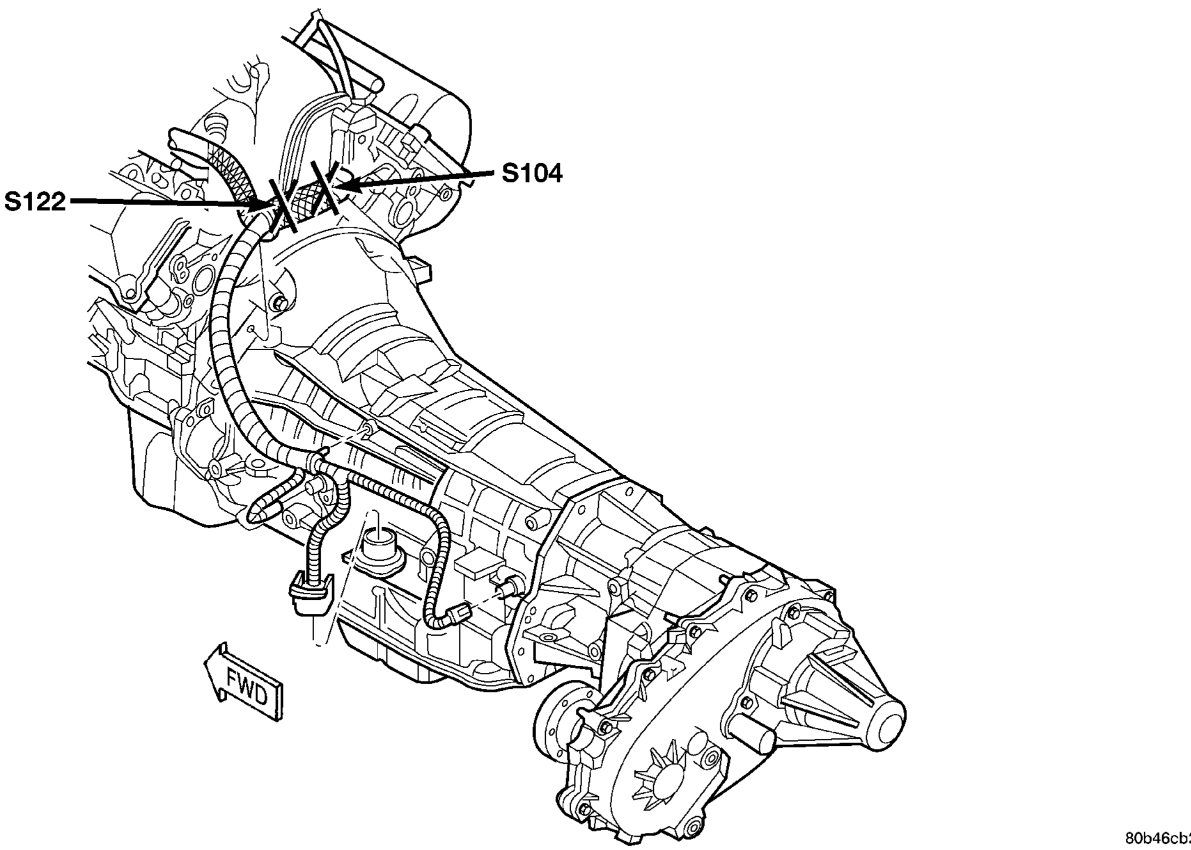


Fig. 3 Transmission Splices (4.7L) — LHD

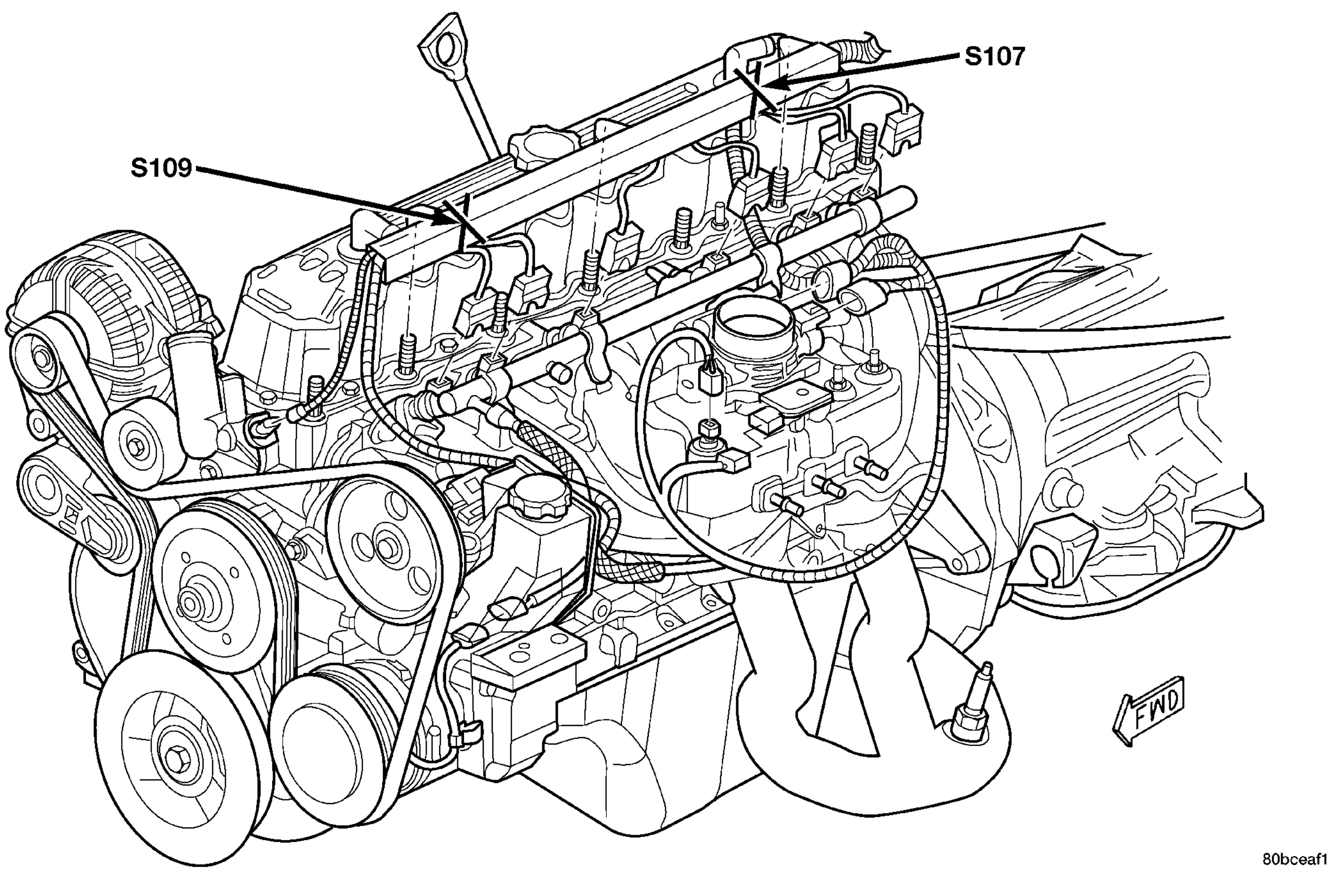


Fig. 4 Engine Splices (4.0L) — LHD

DESCRIPTION AND OPERATION (Continued)

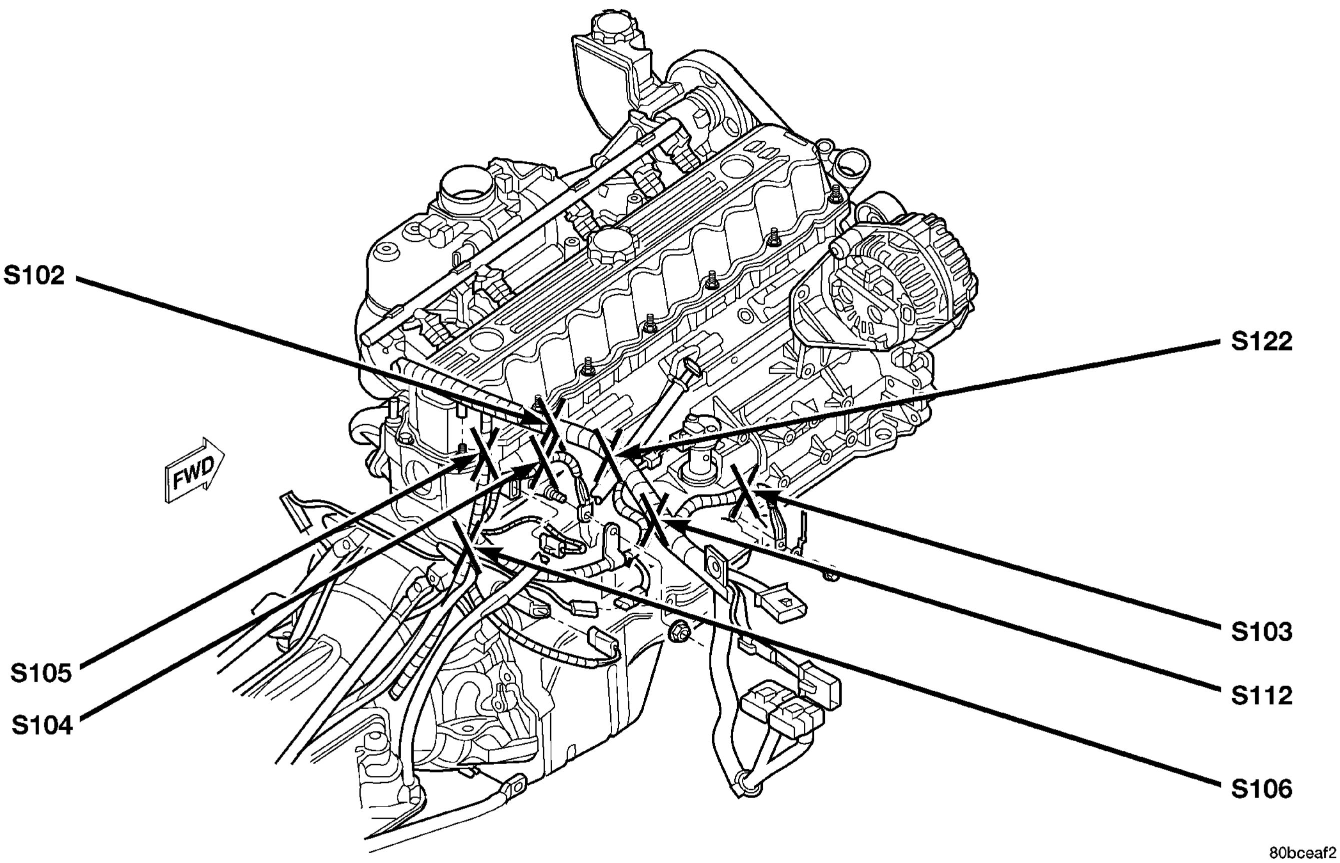


Fig. 5 Engine Splices (4.0L) — LHD

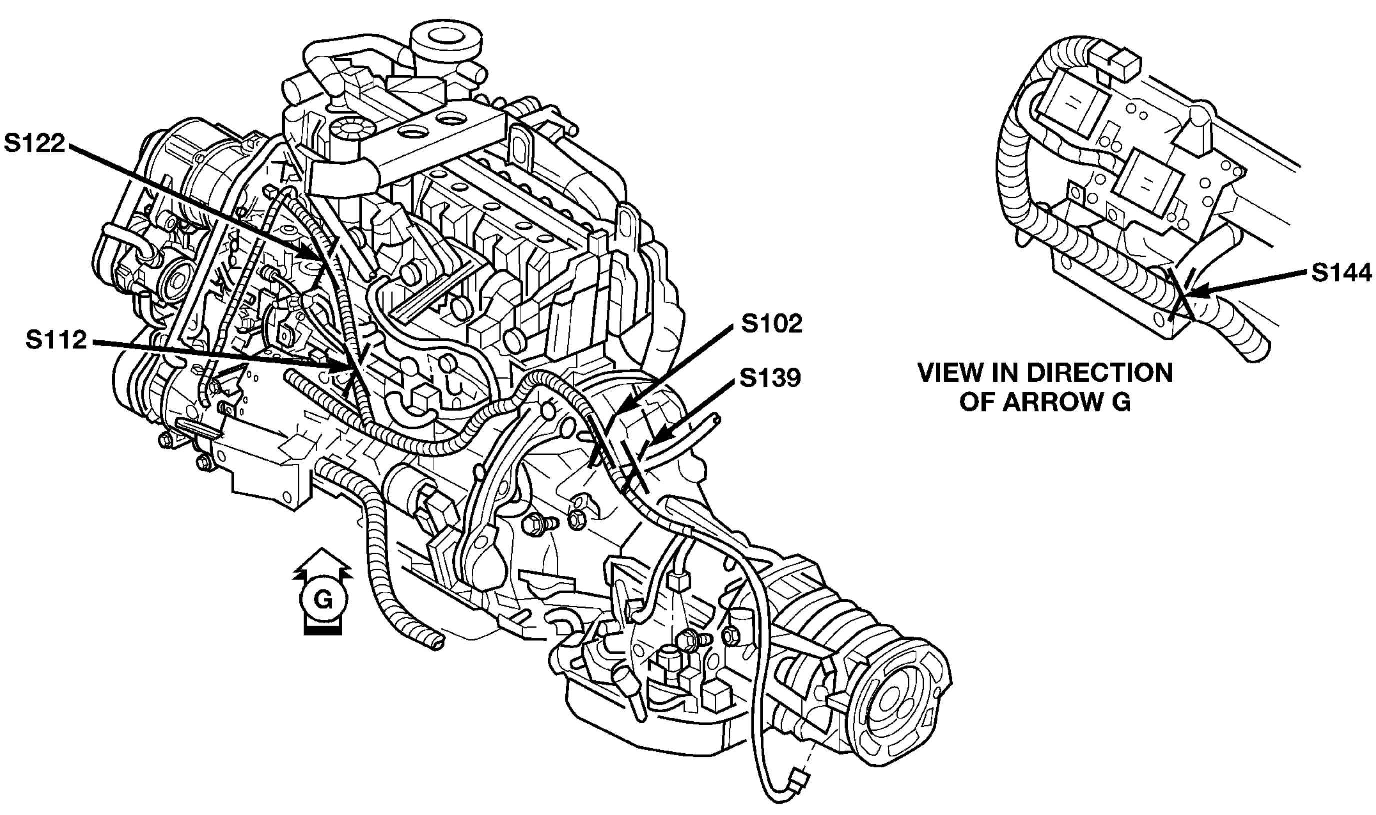


Fig. 6 Engine Splices (Diesel) — LHD

DESCRIPTION AND OPERATION (Continued)

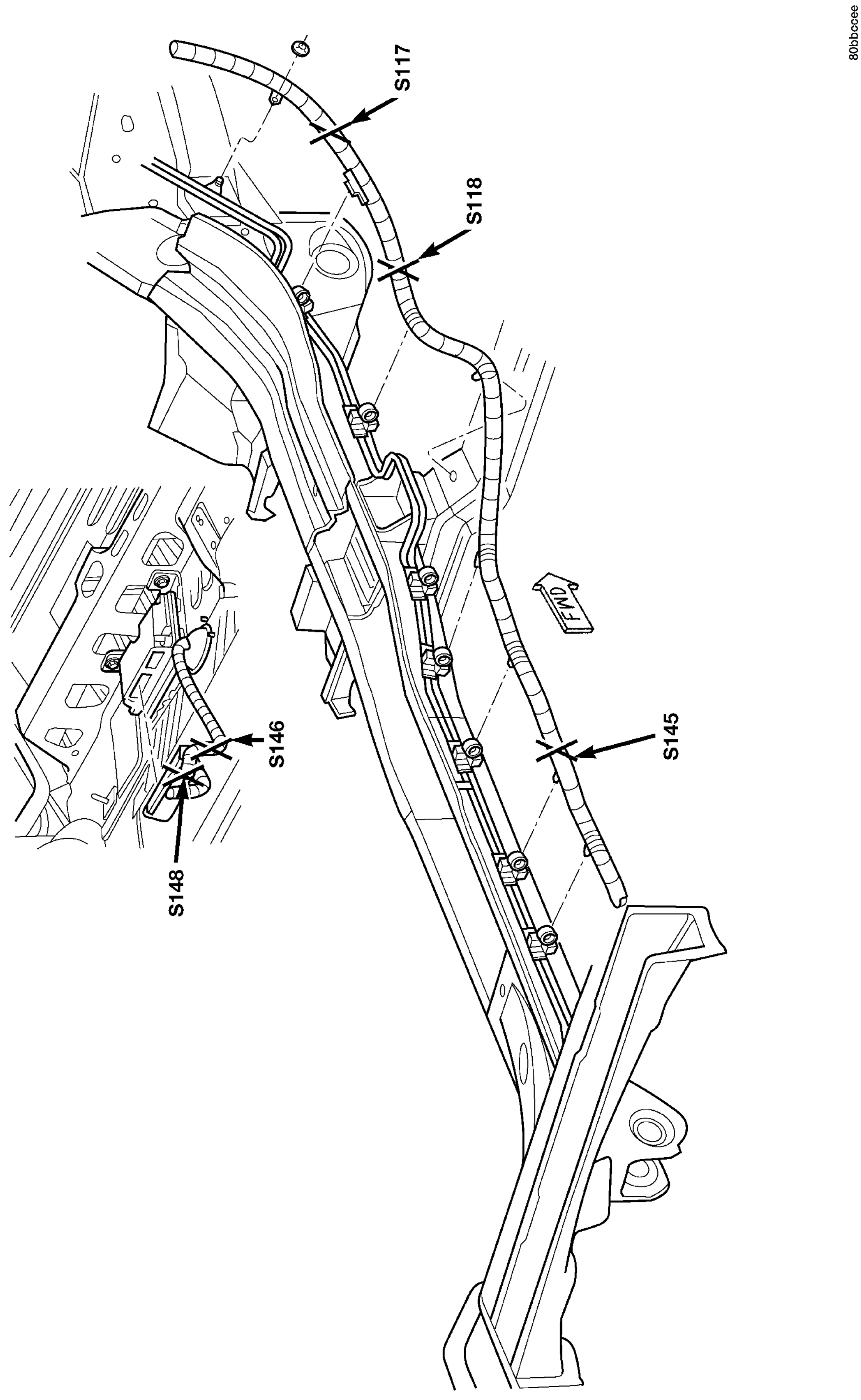


Fig. 7 Engine Splices (Diesel) — LHD

DESCRIPTION AND OPERATION (Continued)

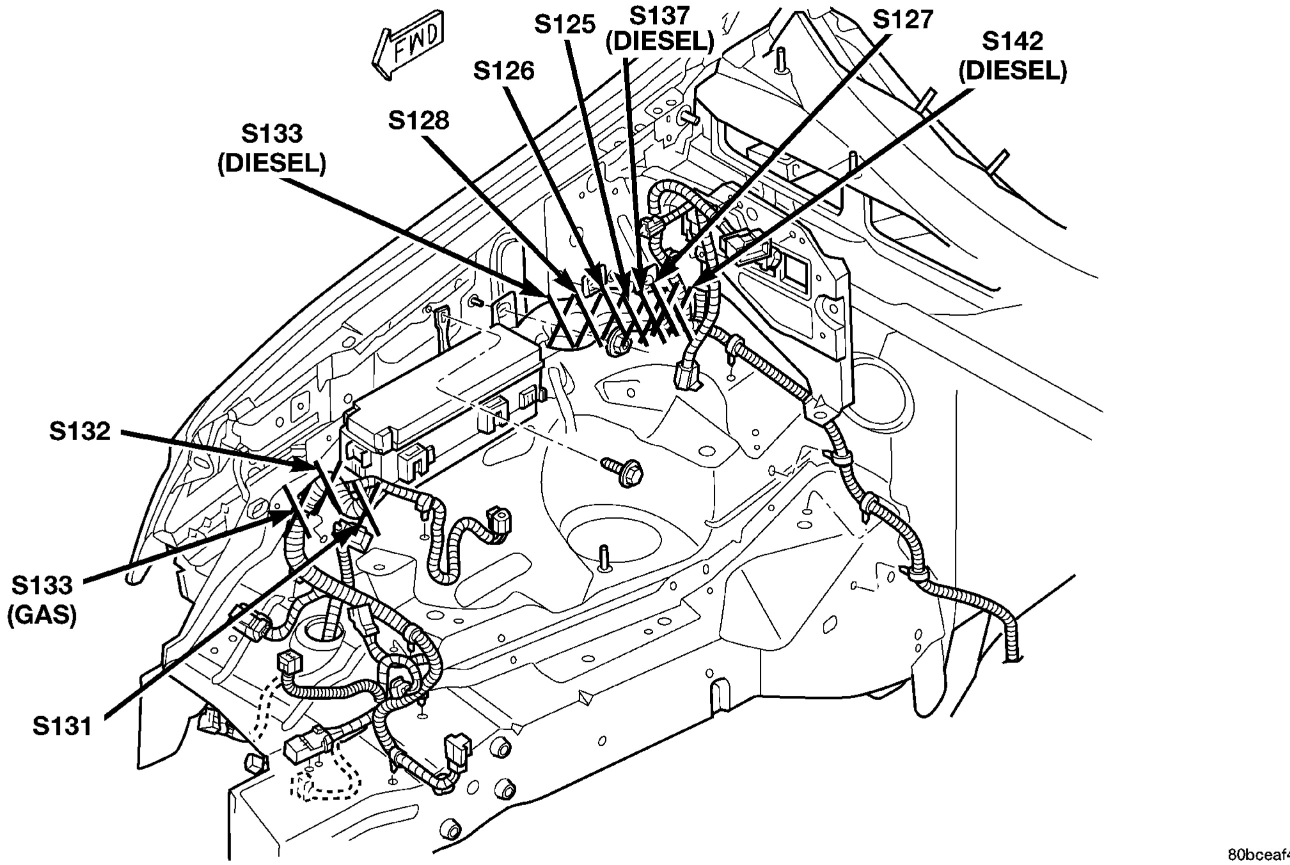


Fig. 8 Engine Compartment Splices (Right Side) — LHD

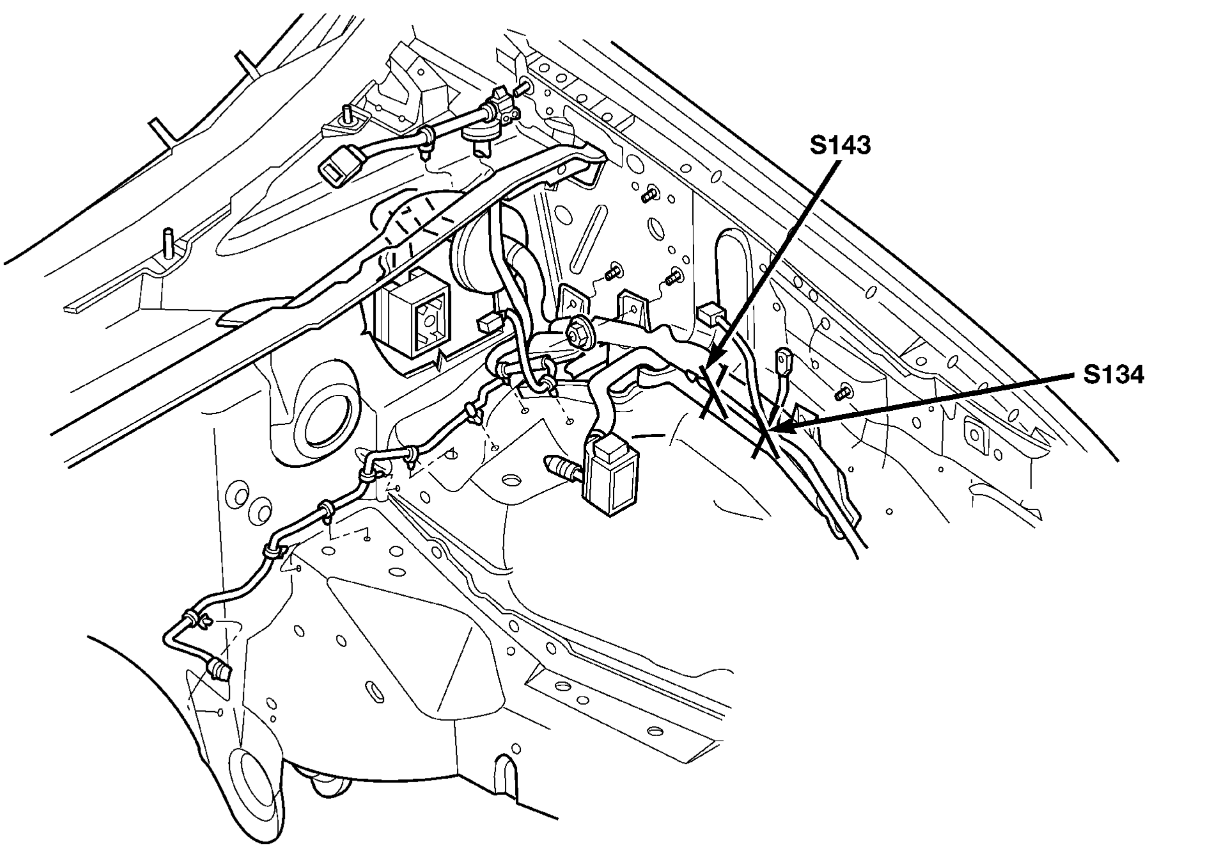


Fig. 9 Engine Compartment Splices (Left Side) — LHD

DESCRIPTION AND OPERATION (Continued)

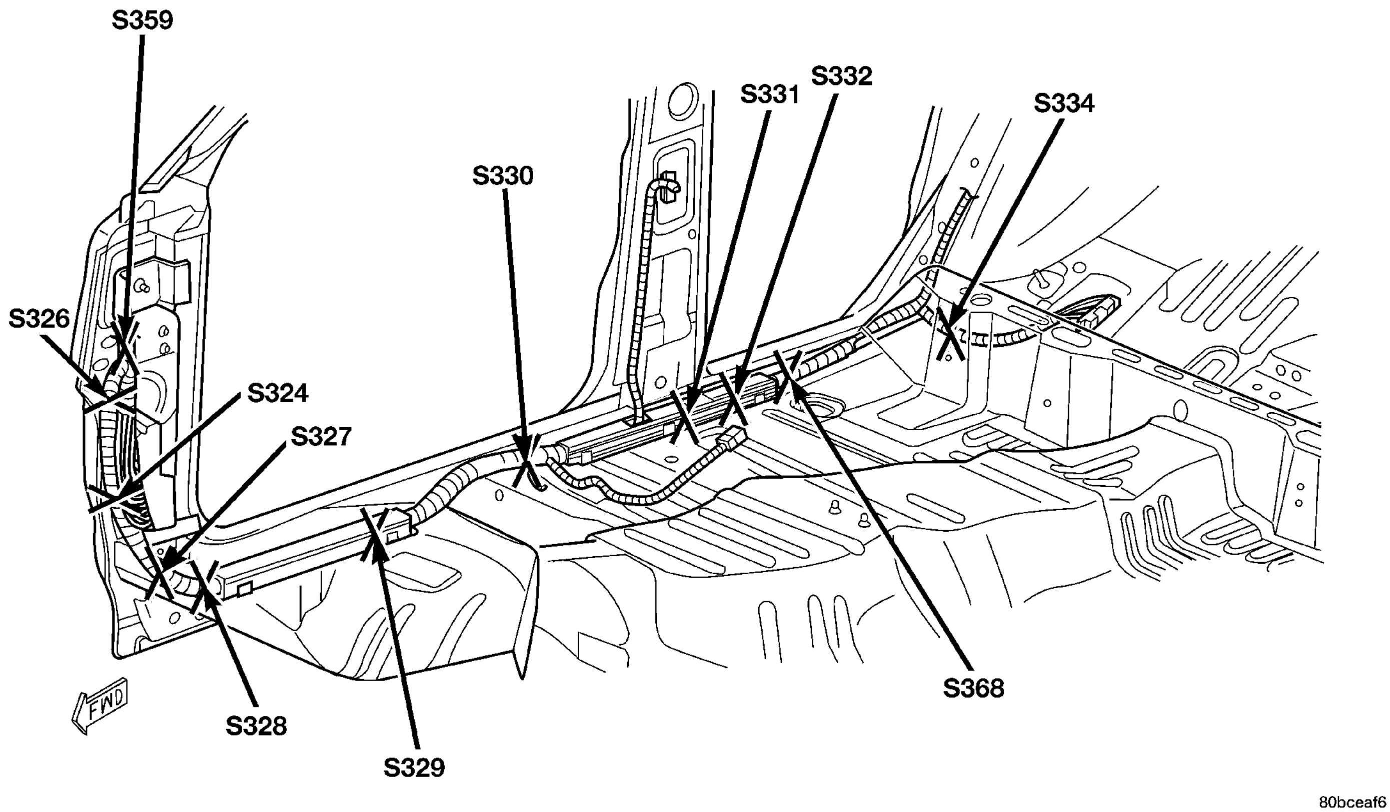


Fig. 10 Body Splices — LHD

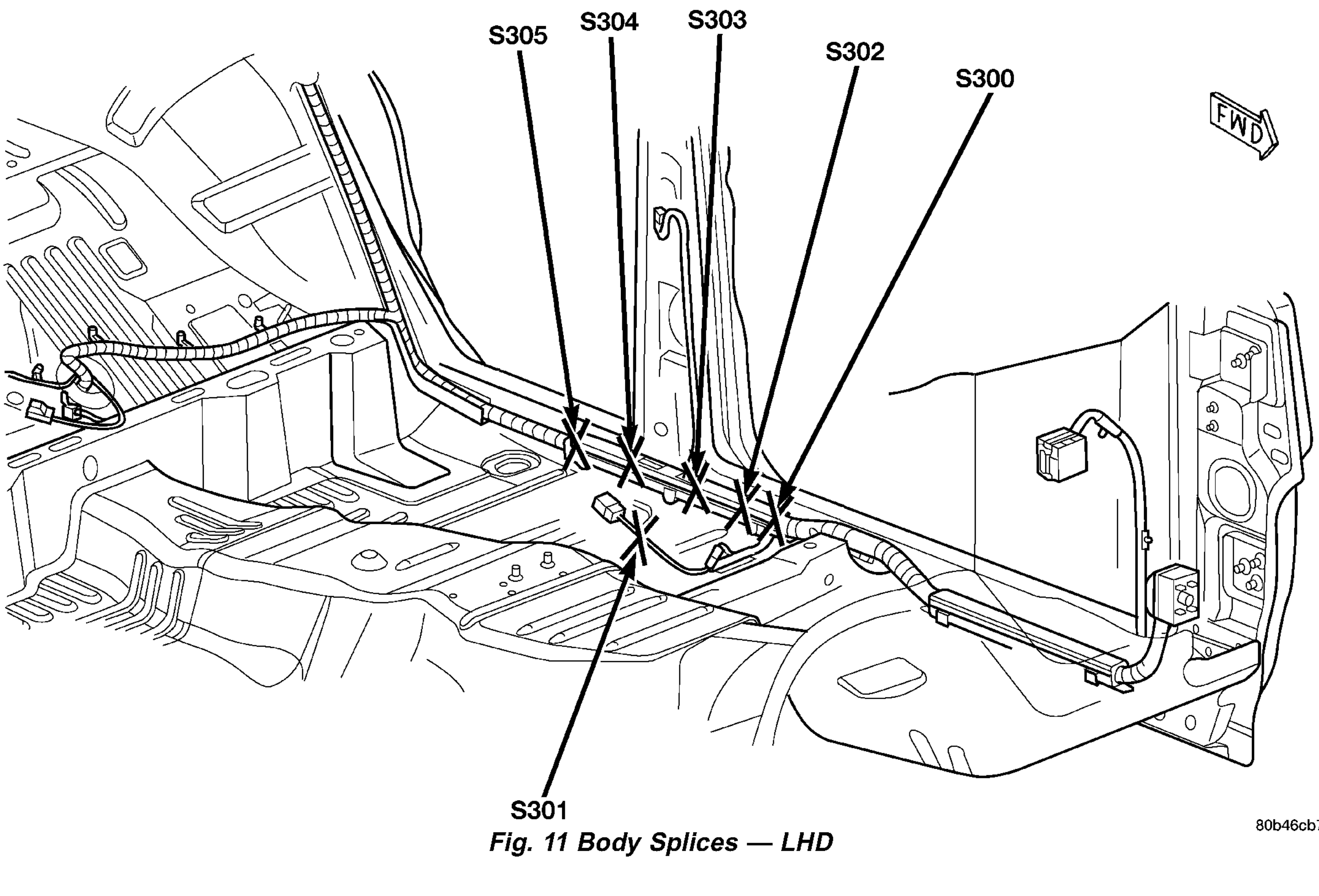


Fig. 11 Body Splices — LHD

DESCRIPTION AND OPERATION (Continued)

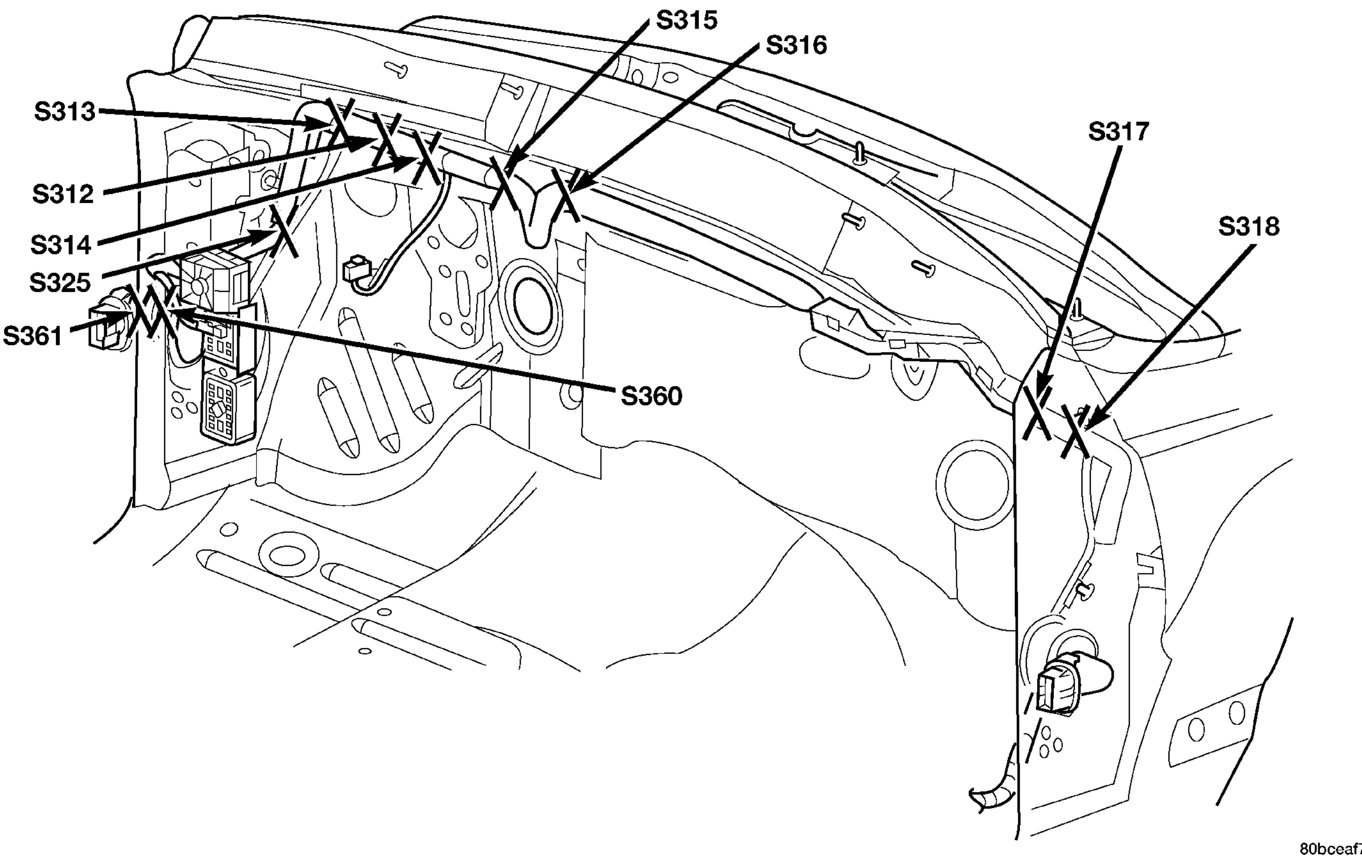


Fig. 12 Body Splices — LHD

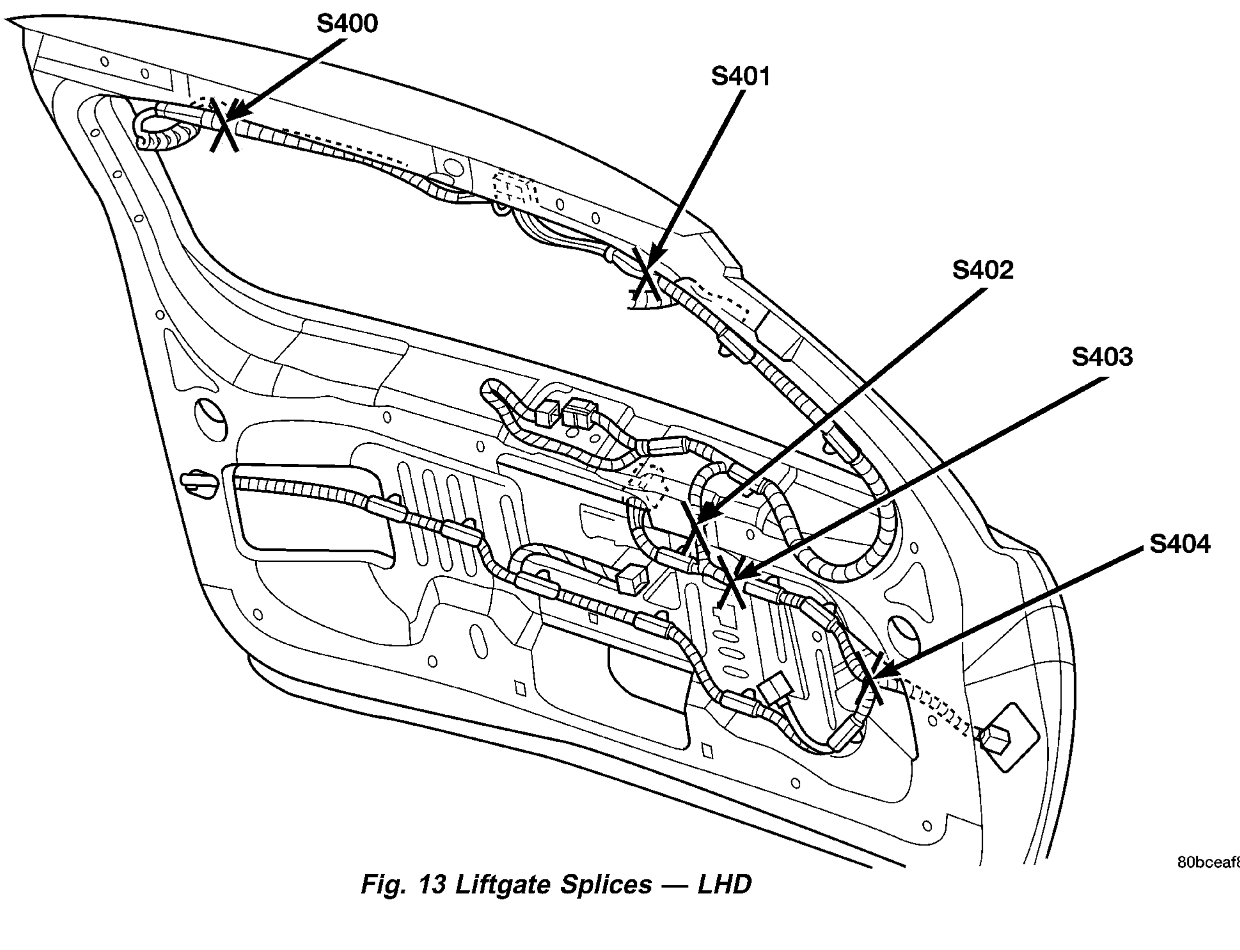


Fig. 13 Liftgate Splices — LHD

DESCRIPTION AND OPERATION (Continued)

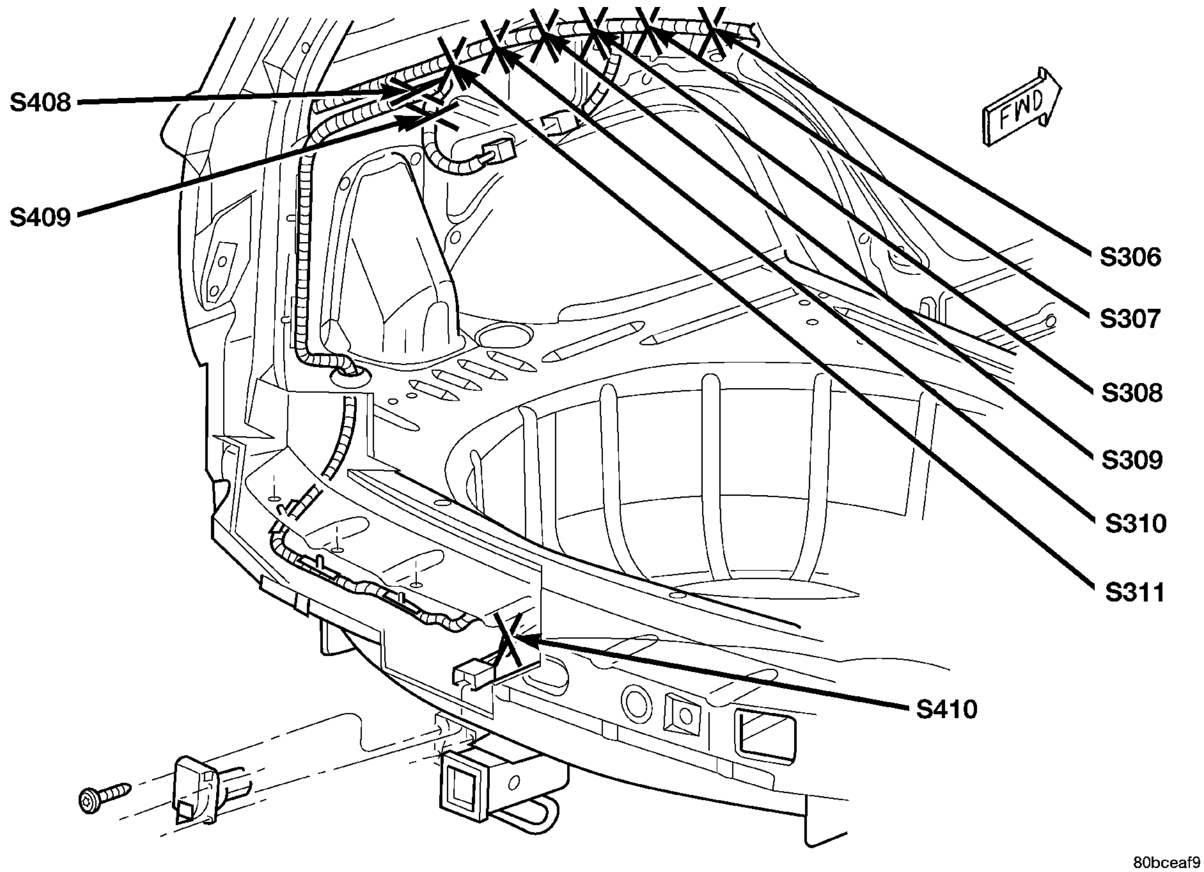


Fig. 14 Trailer Tow/Body Splices — LHD

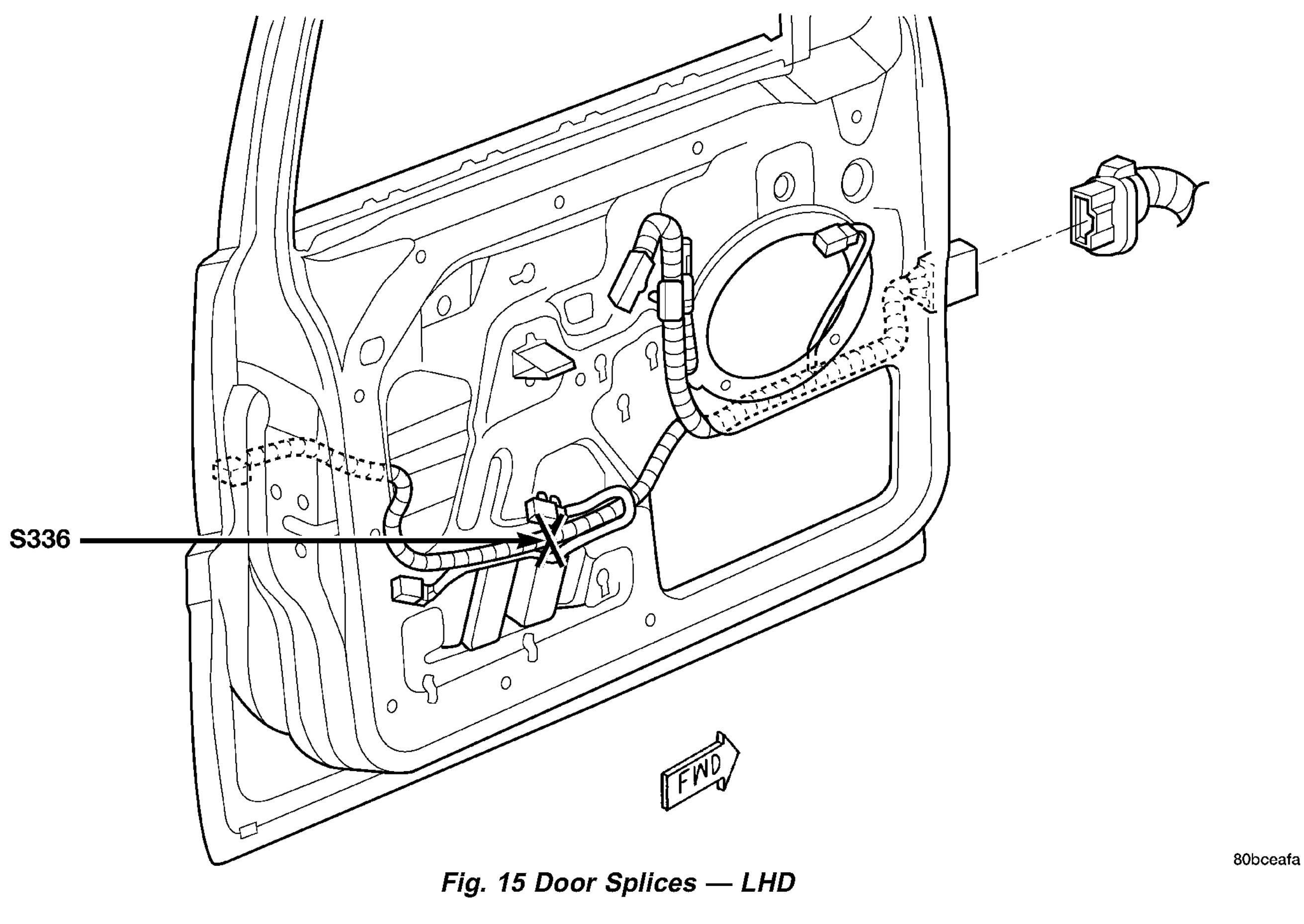


Fig. 15 Door Splices — LHD

DESCRIPTION AND OPERATION (Continued)

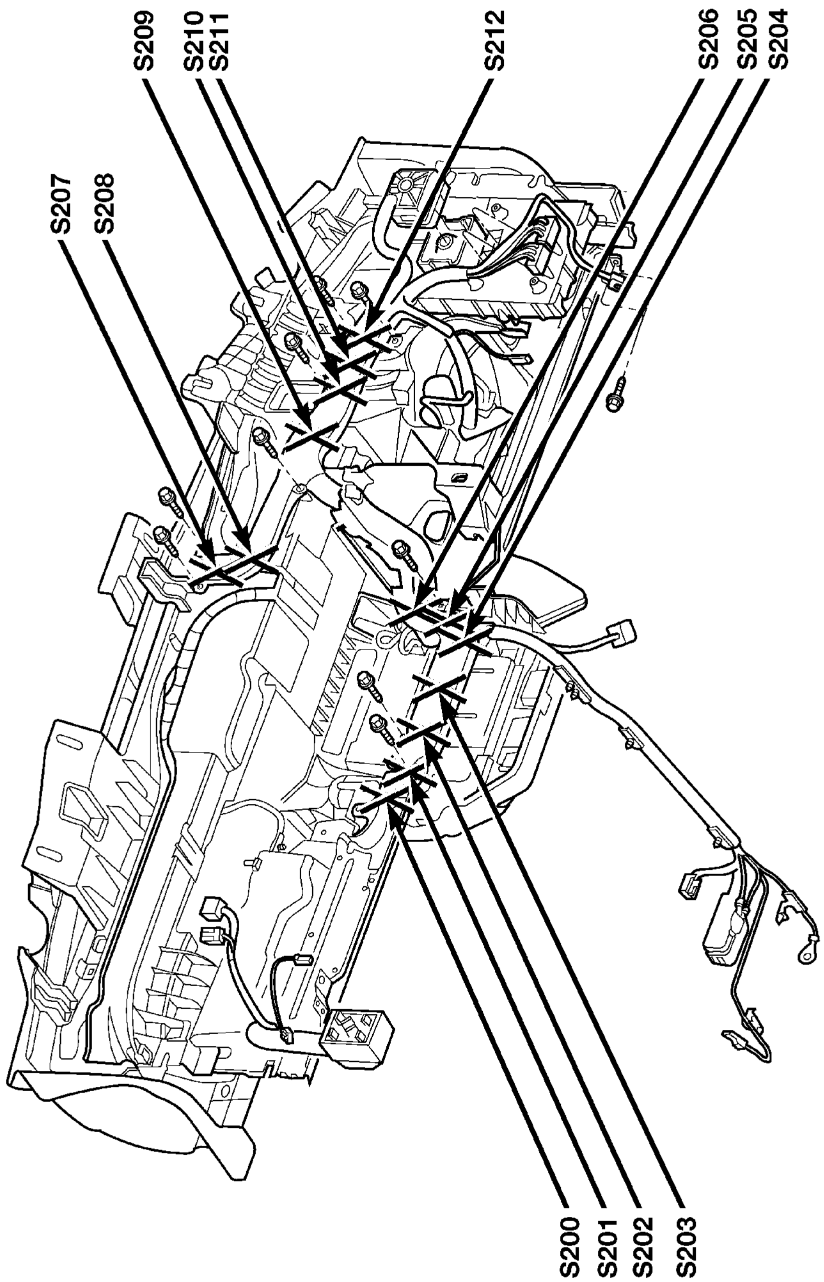


Fig. 16 Instrument Panel Splices — LHD

DESCRIPTION AND OPERATION (Continued)

SPLICE LOCATIONS (RHD)

For splices that are not shown in the figures in this section a N/S is placed in the Fig. column.

Splice Number	Location	Fig.
S100	Near Power Distribution Center Eyelet T/O	N/S
S102	Near T/O for Rail Coil	20
S103	Near T/O for Engine Oil Pressure Switch	17
S104 (4.0L)	Near T/O for G104	20
S104 (4.7L)	Near T/O for C102 and C103	18
S105 (4.0L)	Near T/O for Crankshaft Position Sensor	20
S105 (4.7L)	Near T/O for Fuel Injector NO. 7	17, 24
S106 (4.0L)	Near T/O for Oxygen Sensor 1/1 Upstream	21
S106 (4.7L)	Near T/O for Oxygen Sensor 1/1 Upstream	N/S
S107 (4.0L)	Near T/O for Fuel Injector NO. 5	19
S107 (4.7L)	Near T/O for Fuel Injector NO. 5	17
S109 (4.0L)	Near T/O for Fuel Injector NO. 4	19
S109 (4.7L)	Near T/O for Fuel Injector NO. 8	18
S112 (4.0L)	Near T/O for Camshaft Position Sensor	20
S112 (4.7L)	Near Oxygen Sensor T/O	N/S
S113	Near T/O for Transmission Control Module	18, 24
S114	Near T/O for Transmission Control Module	18, 24
S115	Near T/O for Transmission Control Module	18, 24
S116	Near T/O for Transmission Control Module	18, 24
S117	Near T/O for Transmission Control Module	18, 24
S118 (4.7L)	Near T/O for Fuel Injector NO. 6	18

Splice Number	Location	Fig.
S119	Near T/O for C102 and C103	18, 24
S120	Near T/O for C102 and C103	18, 24
S121	Near T/O for Idle Air Control Motor	17
S122 (4.0L)	Near T/O for C102 and C103	20
S122 (4.7L)	Near T/O for C102 and C103	18, 24
S124	Near T/O for Idle Air Control Motor	17
S126	Right Rear Engine Compartment in Trough	22
S127	Right Rear Engine Compartment in Trough	22
S128	Near T/O for Coolant Level Sensor	22
S130	Near T/O for Controller Anti-Lock Brake	23
S131	Right Rear Engine Compartment in Trough	22
S132	Near T/O for Battery Temperature Sensor	22
S134	Near T/O for G107	23
S141	Near T/O for Duty Cycle EVAP/ Purge Solenoid	23
S142	Right Rear Engine Compartment in Trough	22
S143	Near T/O for G107	23
S151	In Headlamp Assembly	N/S
S152	In Headlamp Assembly	N/S
S153	In Headlamp Assembly	N/S
S154	In Headlamp Assembly	N/S
S155	In Headlamp Assembly	N/S
S156	In Headlamp Assembly	N/S
S200	Upper Center Instrument Panel	25
S201	Near T/O for Power Connector	25
S202	Upper Center Instrument Panel	25
S203	Lower Center Instrument Panel	25
S204	Right Center Instrument Panel	25
S205	Lower Center Instrument Panel	25
S206	Lower Center Instrument Panel	25

DESCRIPTION AND OPERATION (Continued)

Splice Number	Location	Fig.
S207	Upper Center Instrument Panel	25
S208	Right Center Instrument Panel	25
S209	Lower Center Instrument Panel	25
S210	Lower Center Instrument Panel	25
S211	Right Side of Instrument Panel	25
S212	Right Center Instrument Panel	25
S213	Near Cruise Switch NO. 1 T/O	N/S
S214	Near Cruise Switch NO. 1 T/O	N/S
S215	Near Horn Switch T/O	N/S
S216	Near Remote Radio Switch NO. 2 T/O	N/S
S217	Lower Center Instrument Panel	25
S218	Lower Center Instrument Panel	25
S219	Upper Center Instrument Panel	25
S220	Upper Center Instrument Panel	25
S304	In Trough Near T/O for C307	28
S306	Near T/O for C310	28
S307	Near C310	35
S308	In Right Front Sill Trough	29
S310	In Left Front Sill Trough	28
S312	In Left Front Sill Trough	28
S313	Near Left B Pillar Sill Trough	28
S314	Near T/O for C314	26
S315	Behind Left Center of Instrument Panel	26
S316	In Center Spline Trough Side	N/S
S317	In Left B Pillar Sill Trough	28
S318	In Left B Pillar Sill Trough	28
S324	Near T/O for Brake Lamp Switch	26
S325	Near Junction Block - C5 T/O	N/S
S326	In Left Front Sill Trough	28
S327	In Left B Pillar Sill Trough	28
S331	In Right B Pillar Sill Trough	29
S332	In Right B Pillar Sill Trough	29
S333	Behind Left Center of Instrument Panel	26
S334	Near T/O for Power Amplifier	29
S336	In Driver Door	30
S338	In Passenger Door	32
S339	In Passenger Door	32
S340	In Passenger Door	32

Splice Number	Location	Fig.
S341	Near C306 T/O	N/S
S342	Near C306 T/O	N/S
S345	Near Left Handle Courtesy Lamp T/O	N/S
S346	Near Left Handle Courtesy Lamp T/O	N/S
S347	Near Left Visor/Vanity Lamp T/O	N/S
S348	Near Automatic Day/Night Mirror T/O	N/S
S351	Near Seatbelt Switch T/O	N/S
S352	Near Seatbelt Switch T/O	N/S
S353	Near Driver Lumbar Switch T/O	N/S
S355	Near T/O for C304 and C306	N/S
S356	In Passenger Rear Door	33
S357	In Driver Rear Door	31
S358	Near Left B Pillar Sill Trough	28
S359	Near T/O for Brake Lamp Switch	26
S364	Near B Pillar Sill Trough	29
S365	Near Remote Keyless Entry Module T/O	N/S
S366	Near T/O for Junction Block - C1	26
S367	Near C310	35
S368	Near T/O for Power Amplifier	29
S370	Near T/O for Sunroof Module	27
S400	Near Rear Window Defogger Ground Connector	34
S401	Near C308	34
S402	Near Rear Wiper Motor T/O	34
S403	Near Rear Wiper Motor T/O	34
S404	Near Left Liftgate Ajar Switch T/O	34
S406	Near Trailer Tow Right Turn Relay T/O	N/S
S407	Near Trailer Tow Left Turn Relay T/O	N/S
S408	Near Trailer Tow Circuit Breaker T/O	N/S
S409	In C310 T/O	N/S
S410	In Trailer Tow Connector T/O	N/S
S413	Near Trailer Tow Brake Lamp Relay T/O	N/S

DESCRIPTION AND OPERATION (Continued)

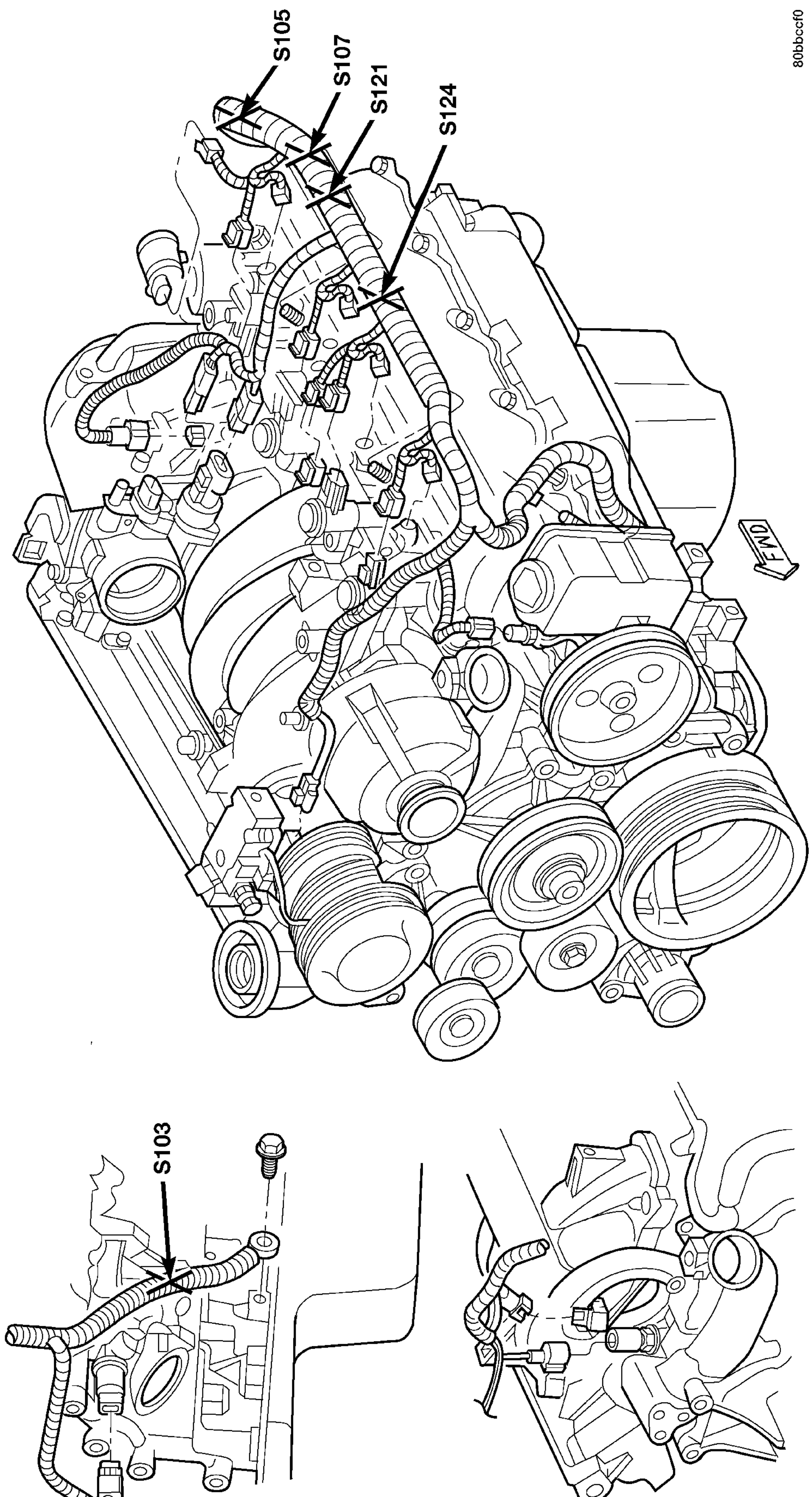


Fig. 17 Engine Splices (4.7L) — RHD

DESCRIPTION AND OPERATION (Continued)

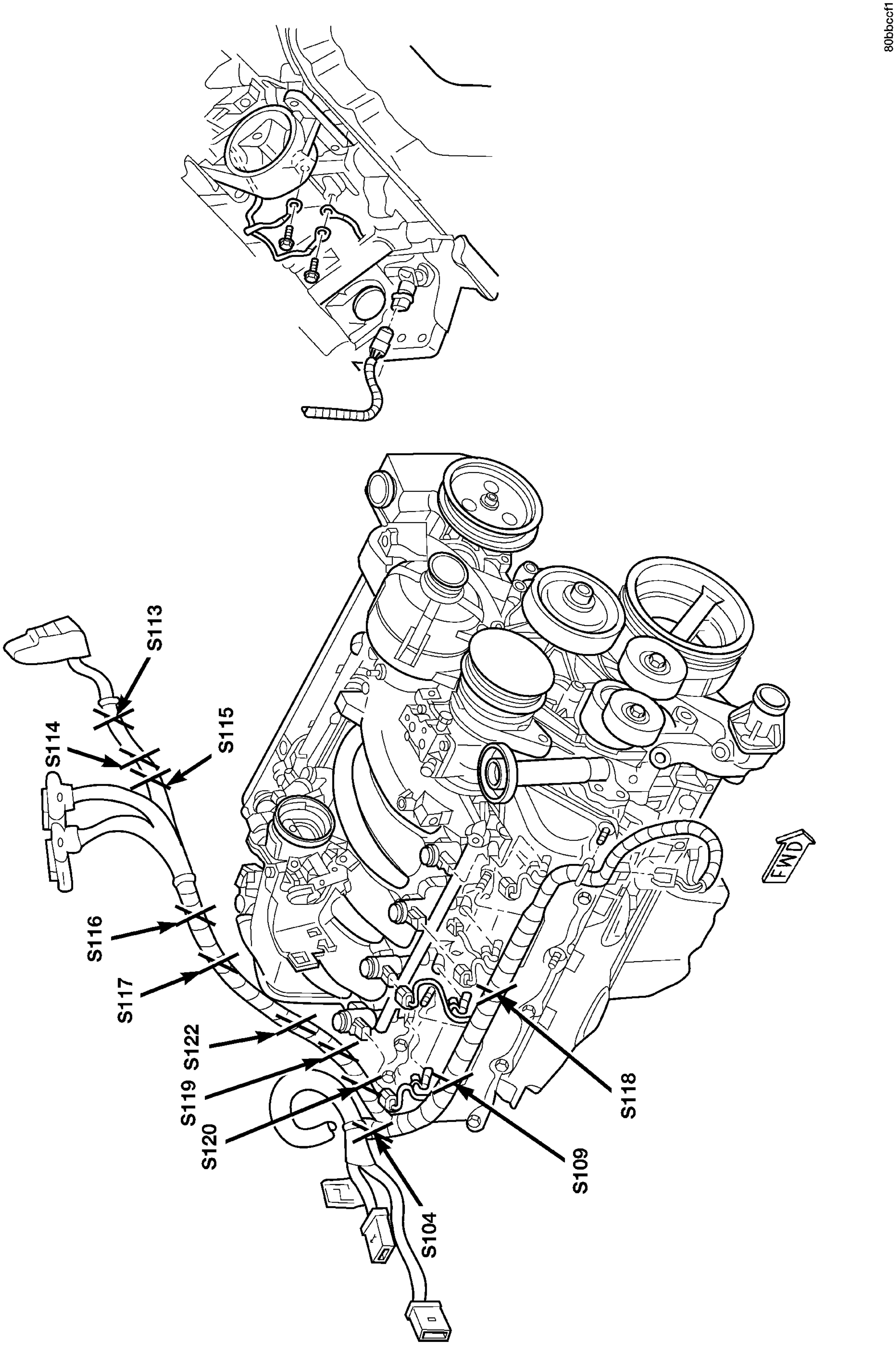


Fig. 18 Engine Splices (4.7L) — RHD

DESCRIPTION AND OPERATION (Continued)

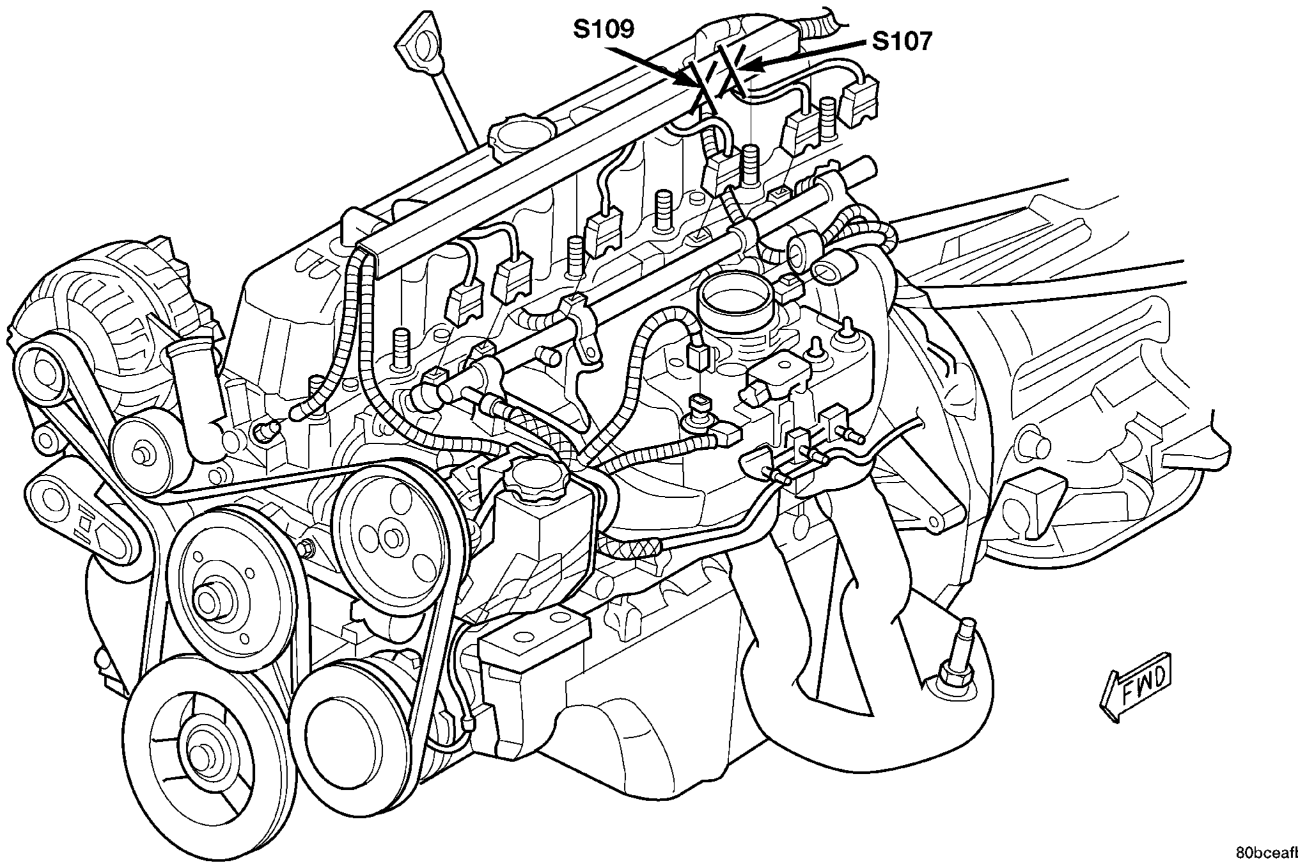


Fig. 19 Engine Splices (4.0L) — RHD

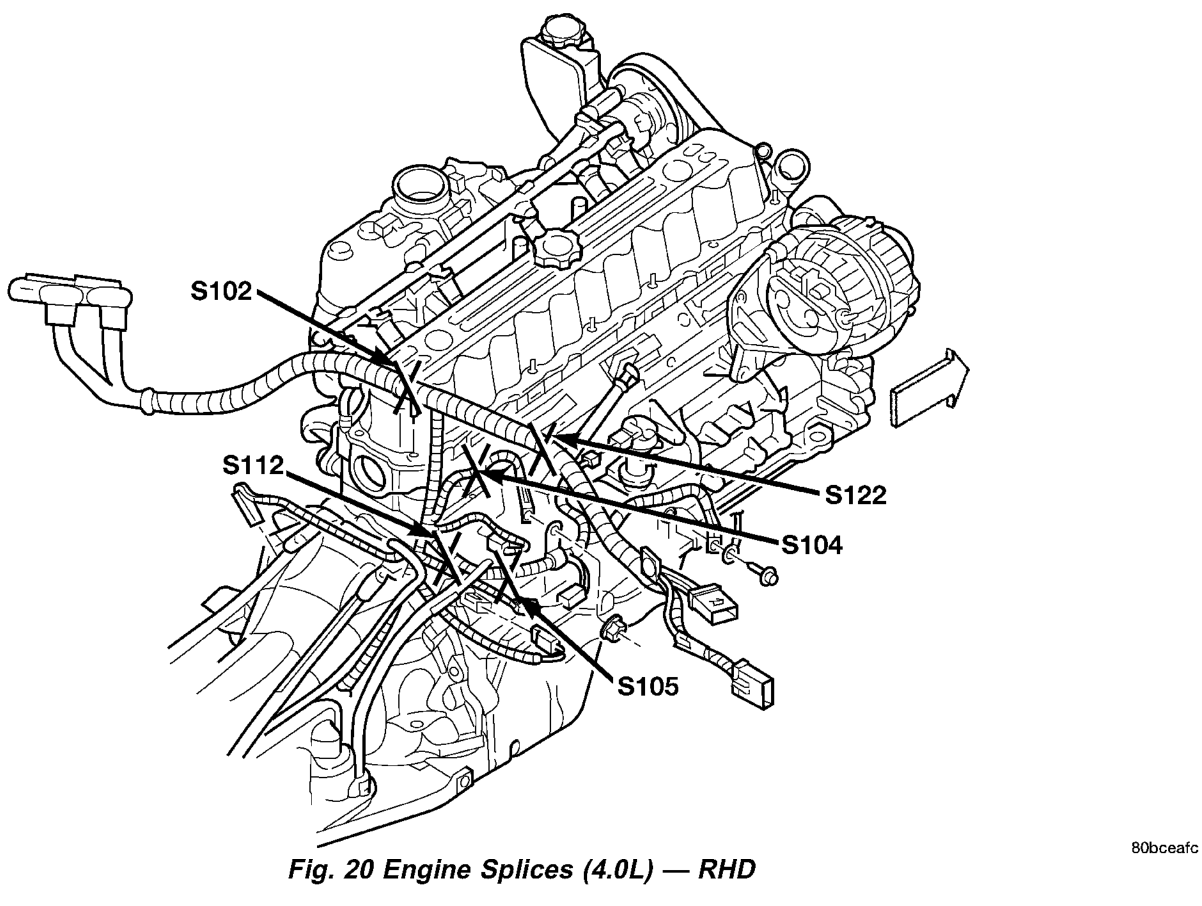


Fig. 20 Engine Splices (4.0L) — RHD

DESCRIPTION AND OPERATION (Continued)

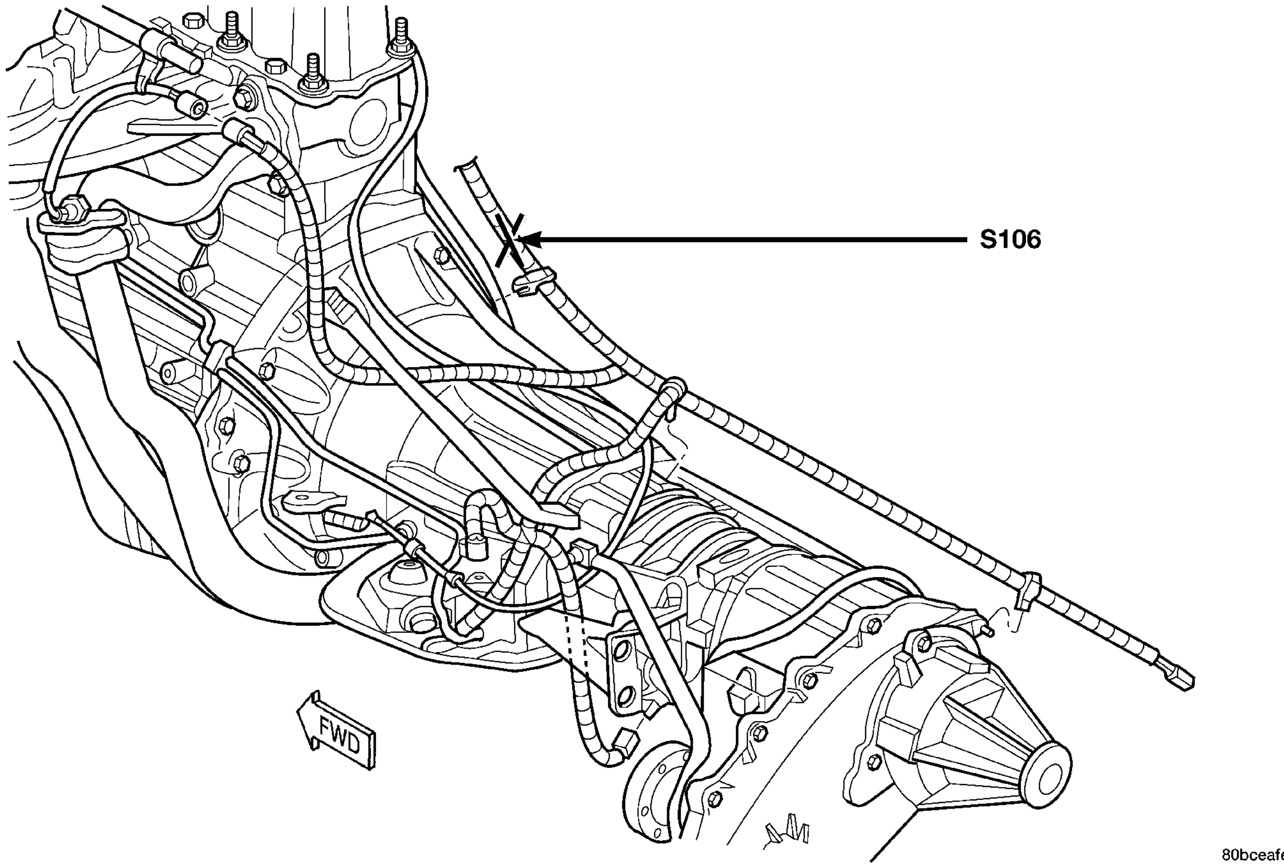


Fig. 21 Transmission Splices (4.0L) — RHD

DESCRIPTION AND OPERATION (Continued)

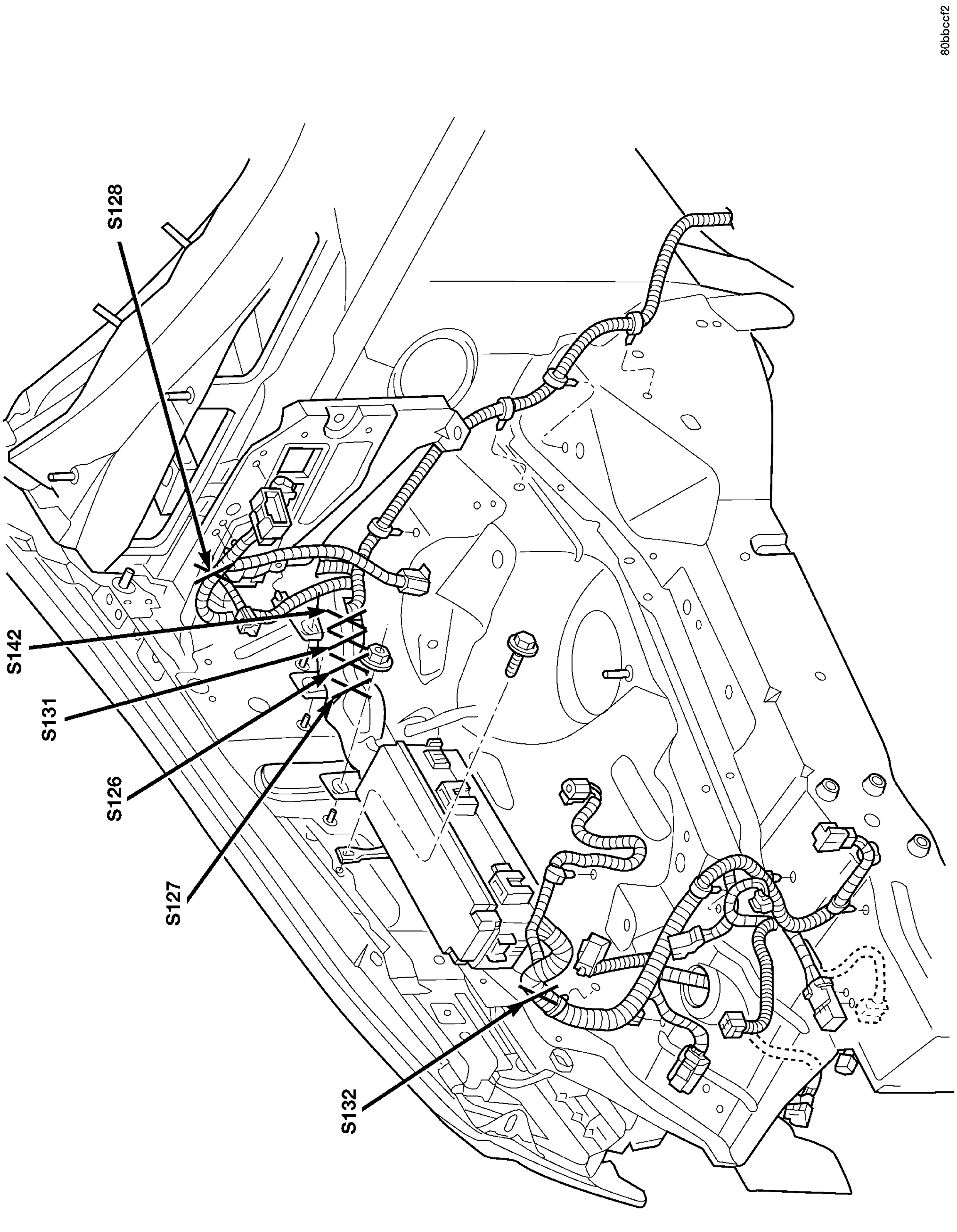


Fig. 22 Engine Compartment Splices (Right Side) — RHD

DESCRIPTION AND OPERATION (Continued)

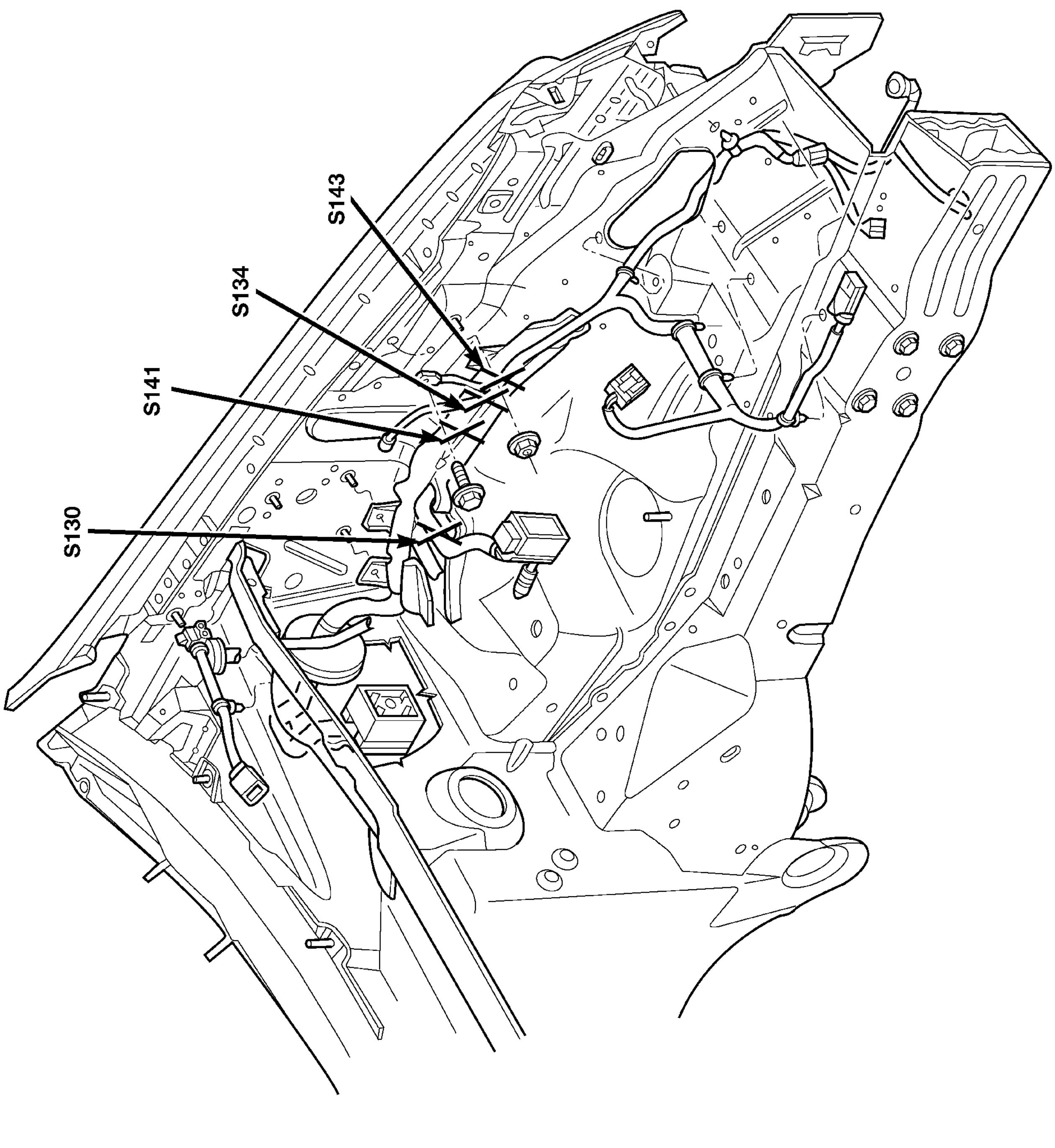


Fig. 23 Engine Compartment Splices (Left Side) — RHD

DESCRIPTION AND OPERATION (Continued)

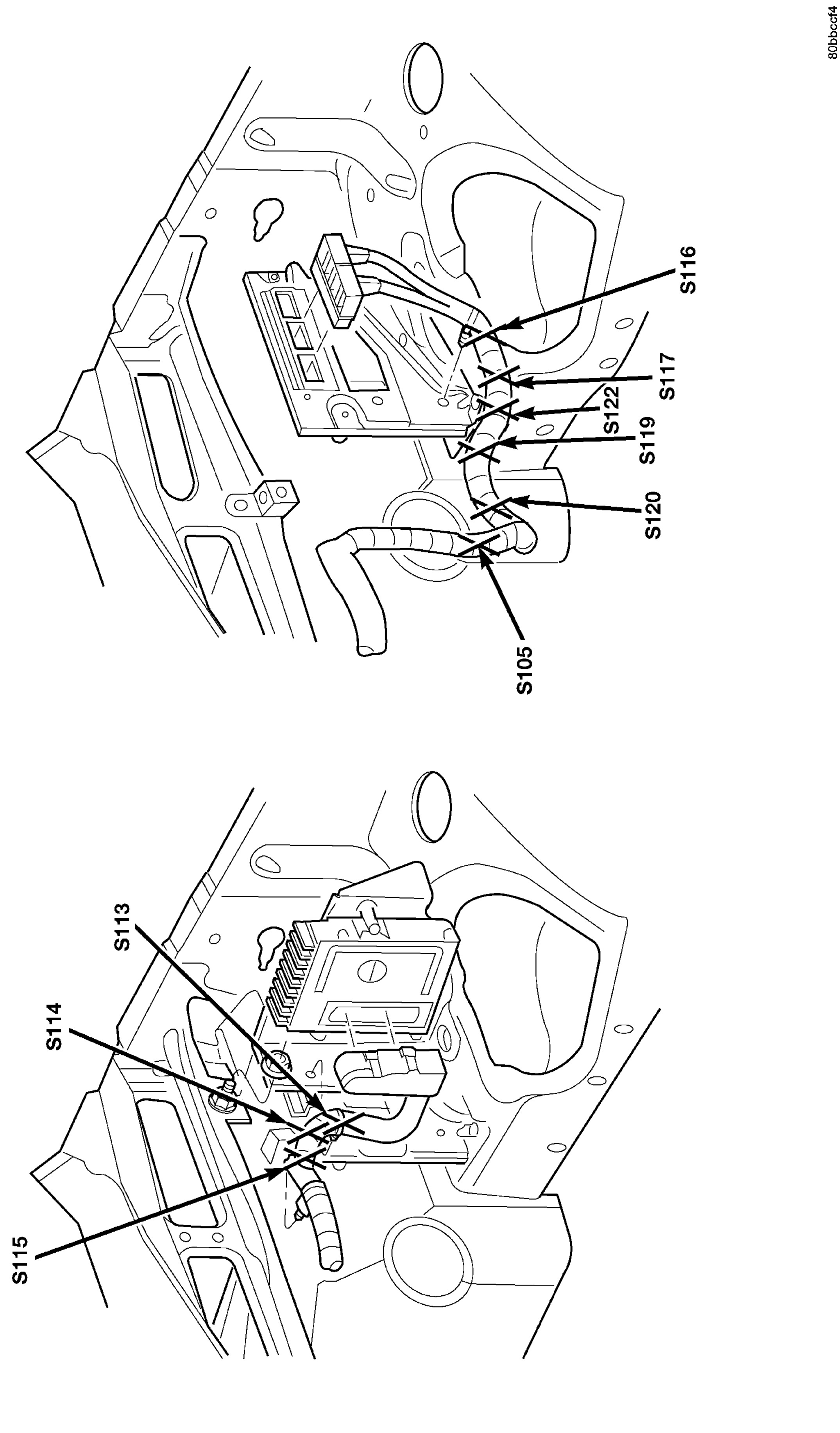


Fig. 24 Engine Compartment Splices — RHD

DESCRIPTION AND OPERATION (Continued)

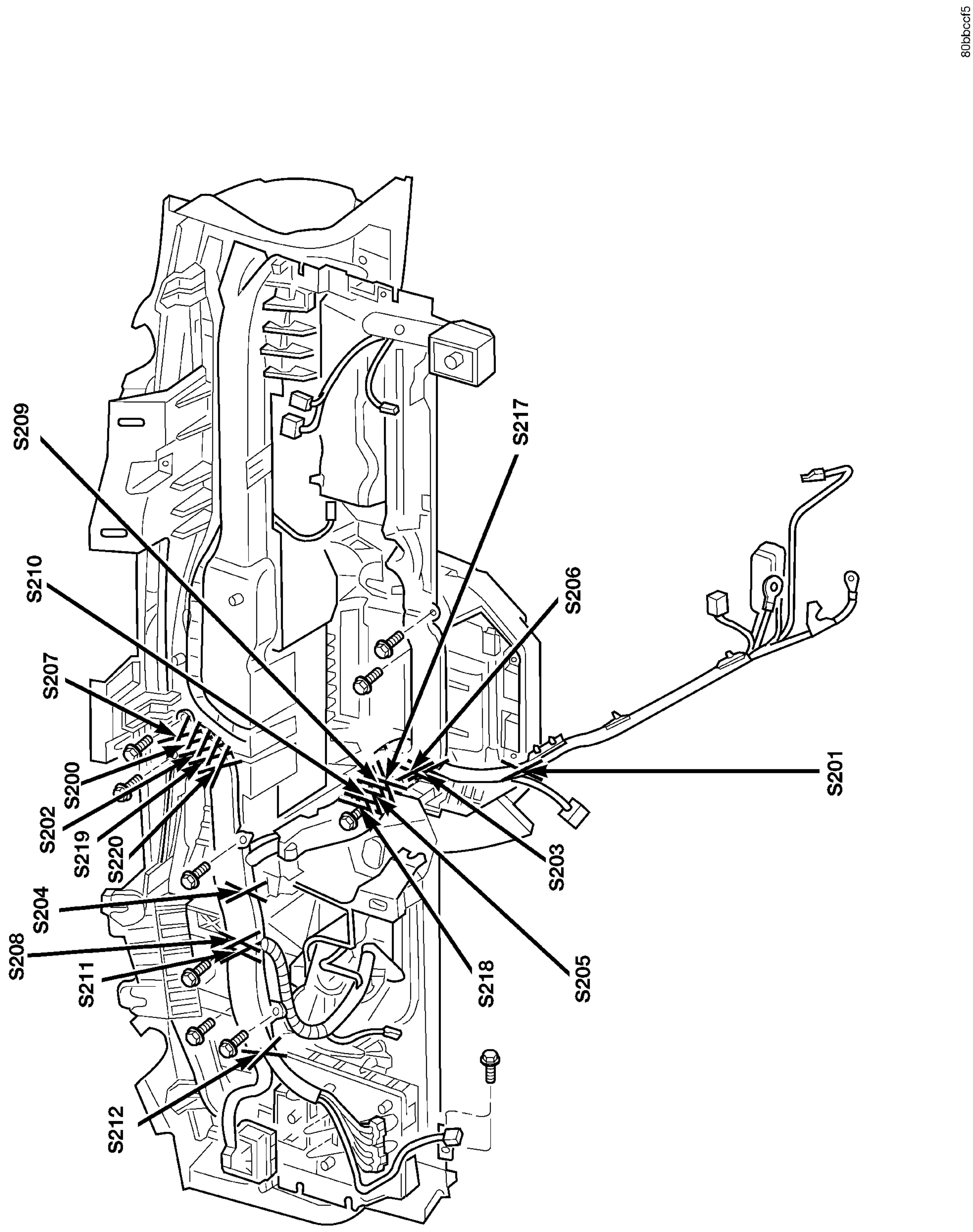


Fig. 25 Instrument Panel Splices — RHD

DESCRIPTION AND OPERATION (Continued)

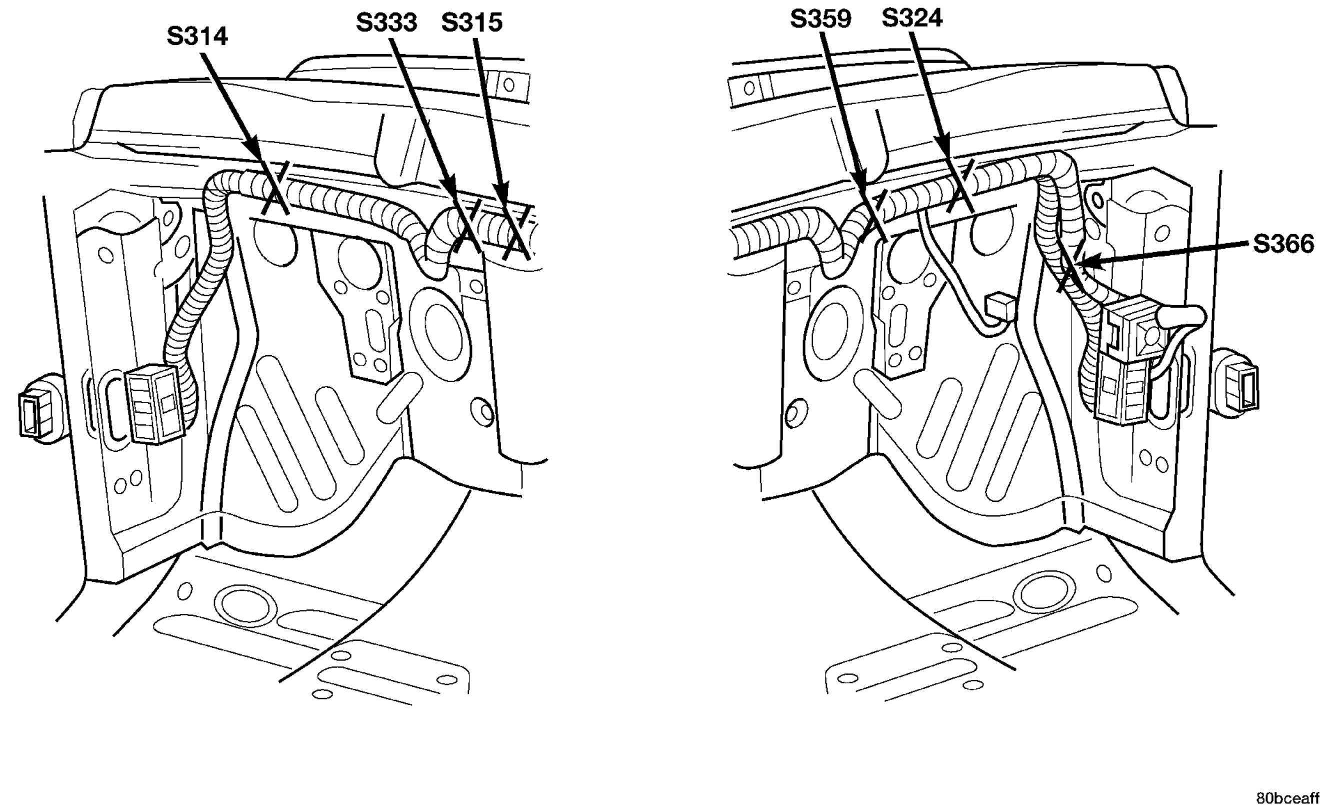


Fig. 26 Kick Panel Area Splices — RHD

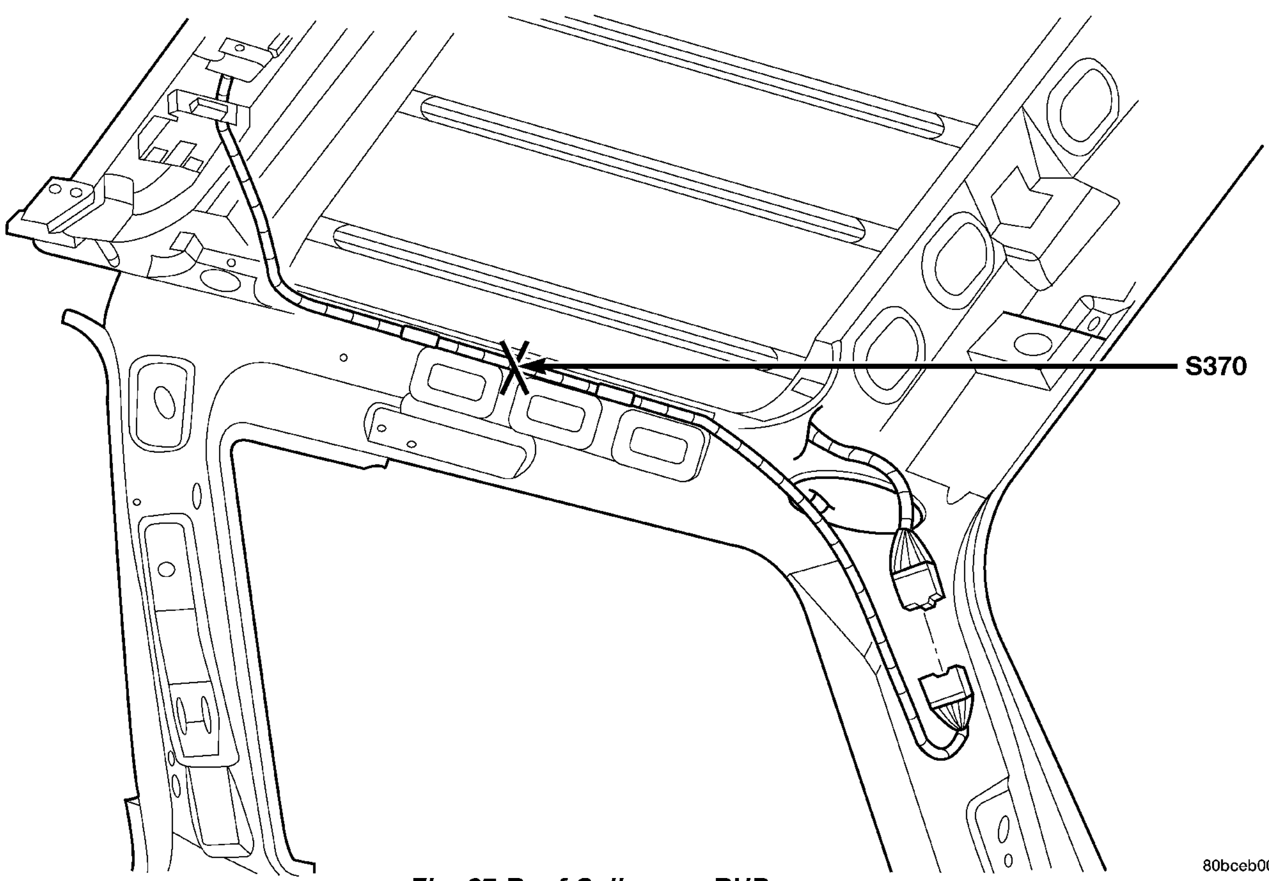


Fig. 27 Roof Splices — RHD

DESCRIPTION AND OPERATION (Continued)

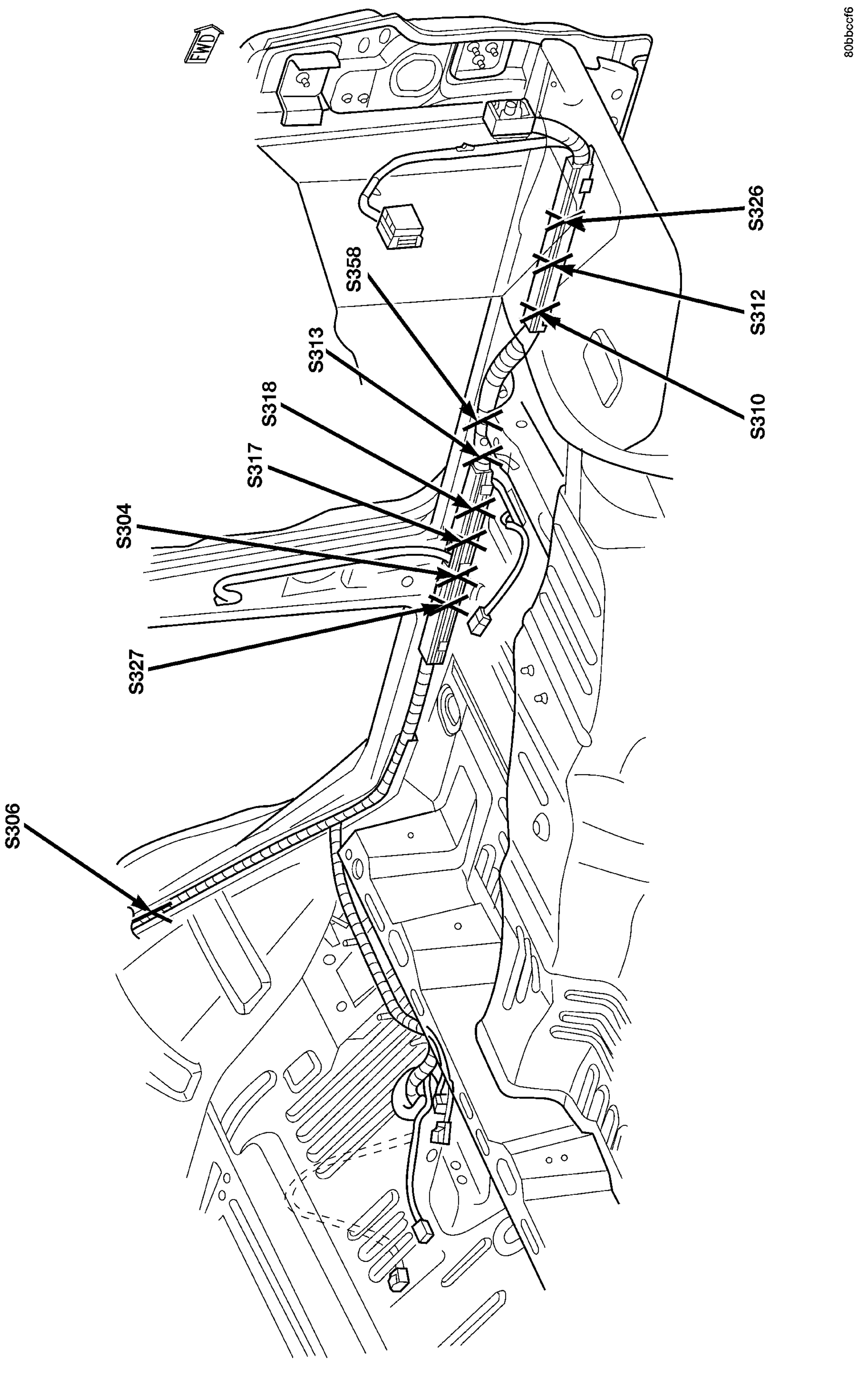


Fig. 28 Body Splices — RHD

DESCRIPTION AND OPERATION (Continued)

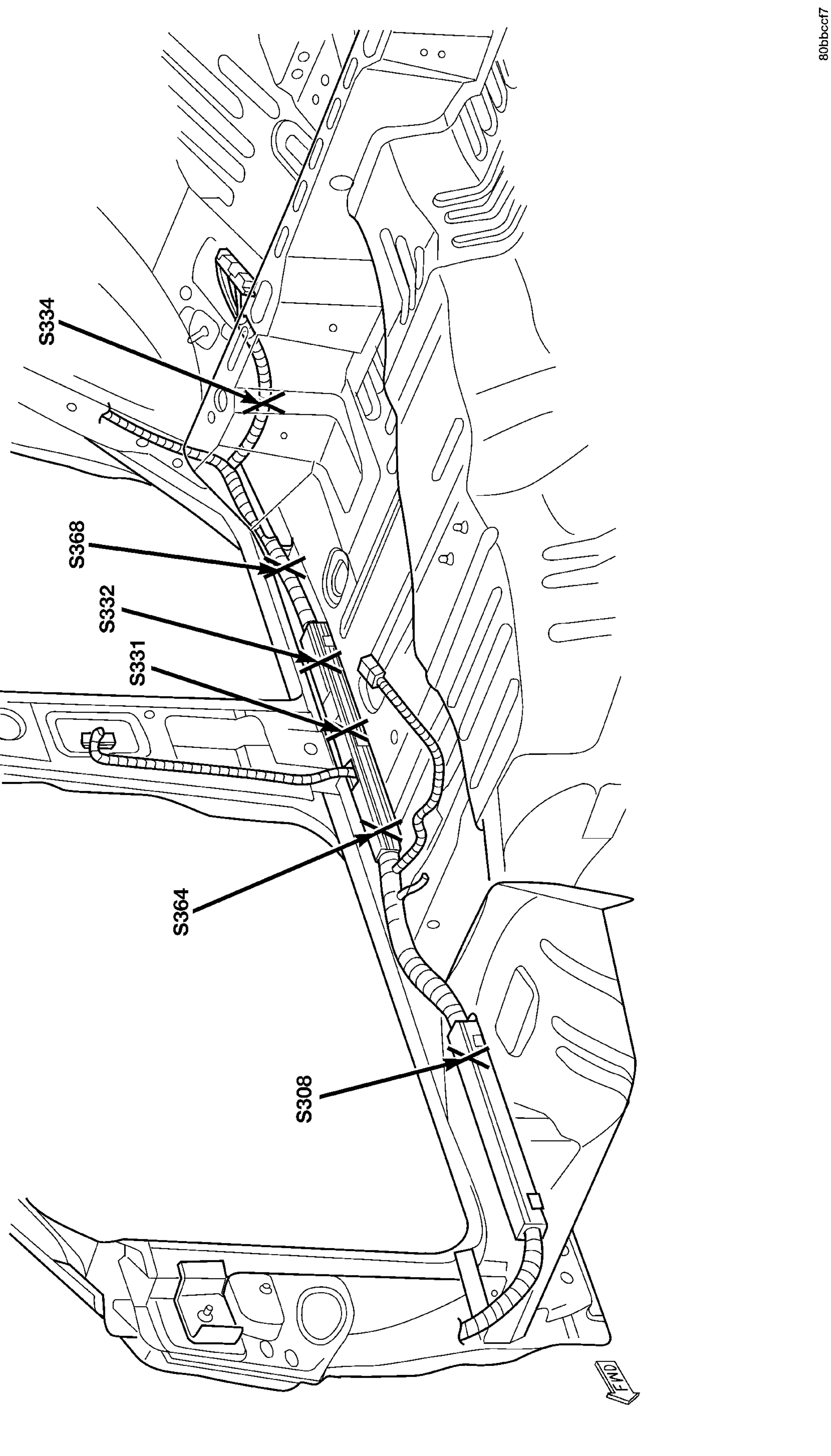


Fig. 29 Body Splices — RHD

DESCRIPTION AND OPERATION (Continued)

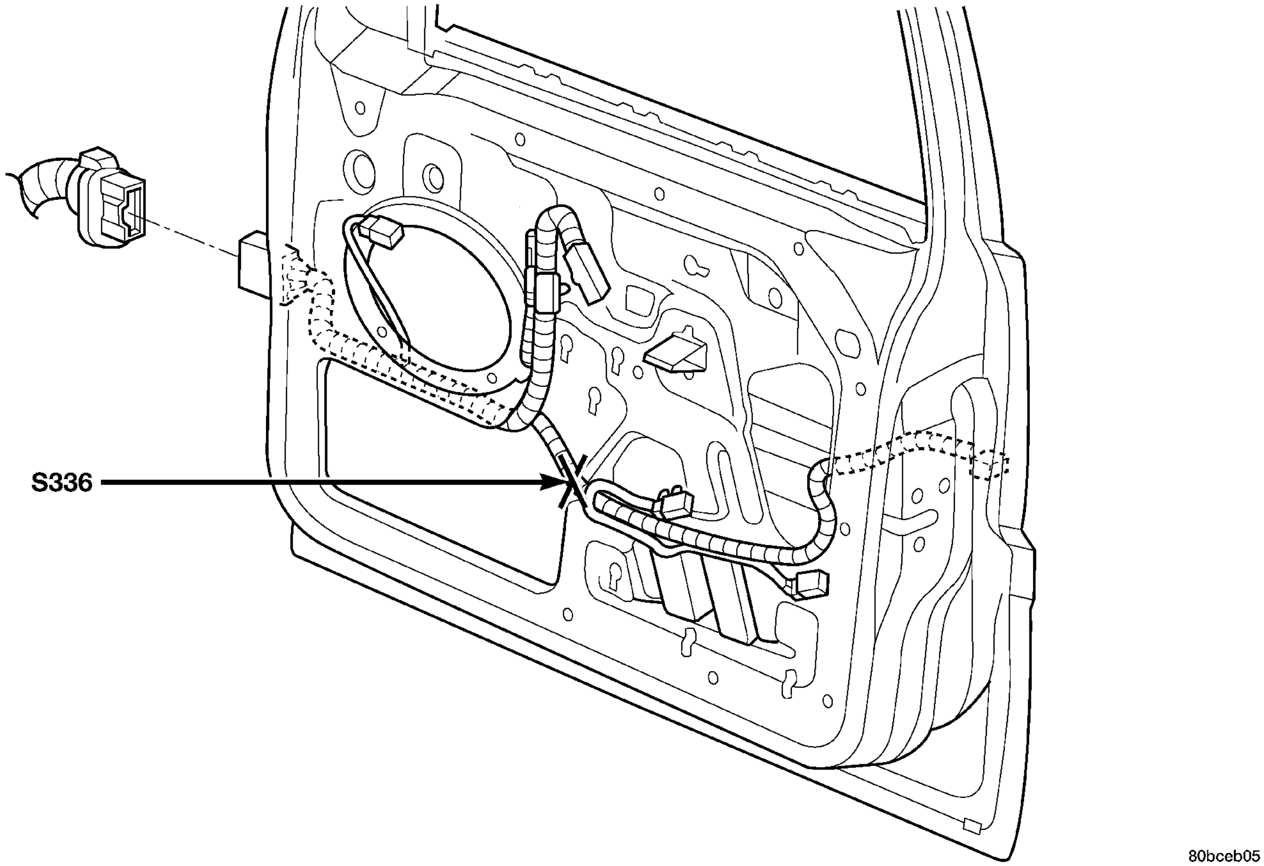


Fig. 30 Door Splices (Driver Door) — RHD

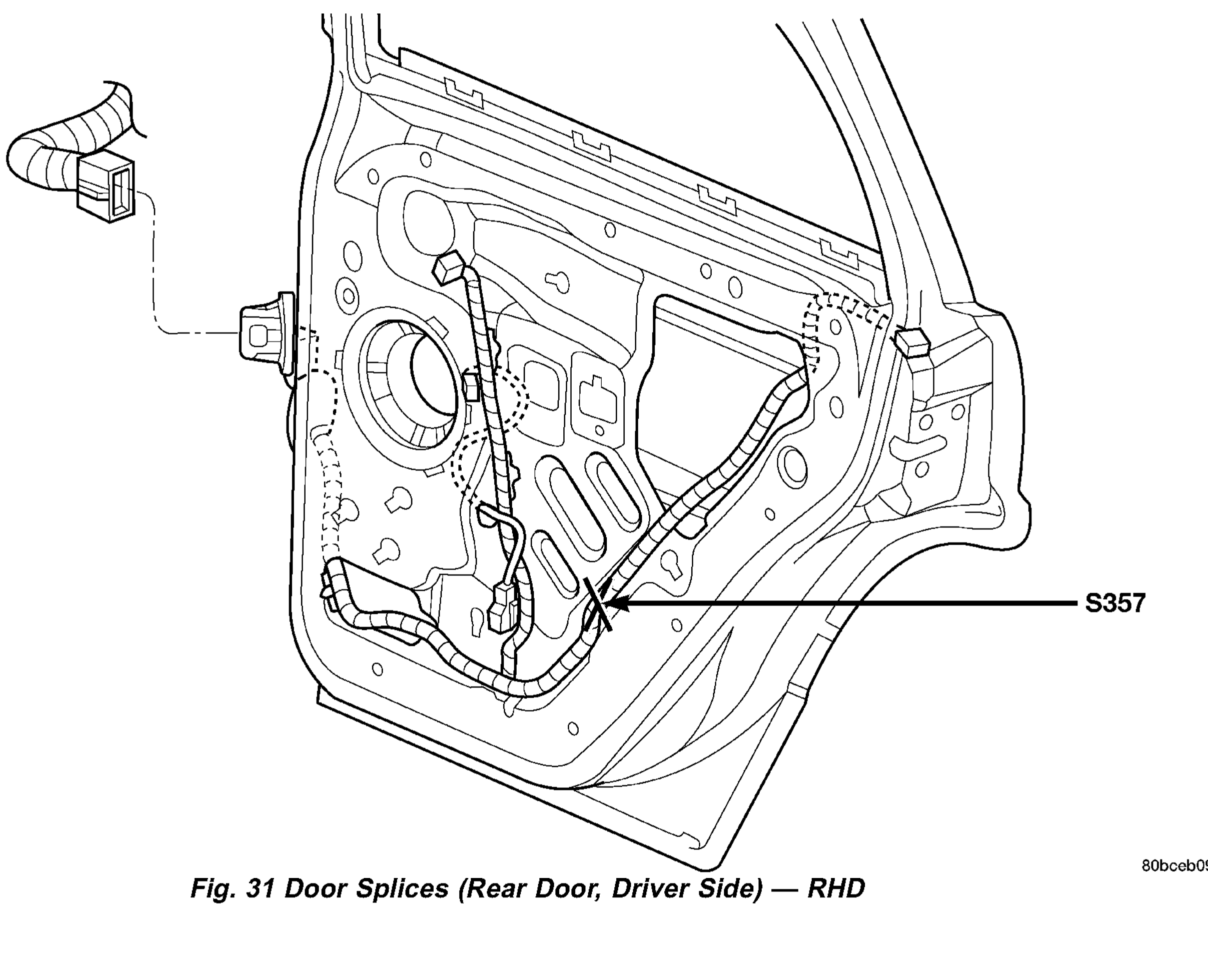


Fig. 31 Door Splices (Rear Door, Driver Side) — RHD

DESCRIPTION AND OPERATION (Continued)

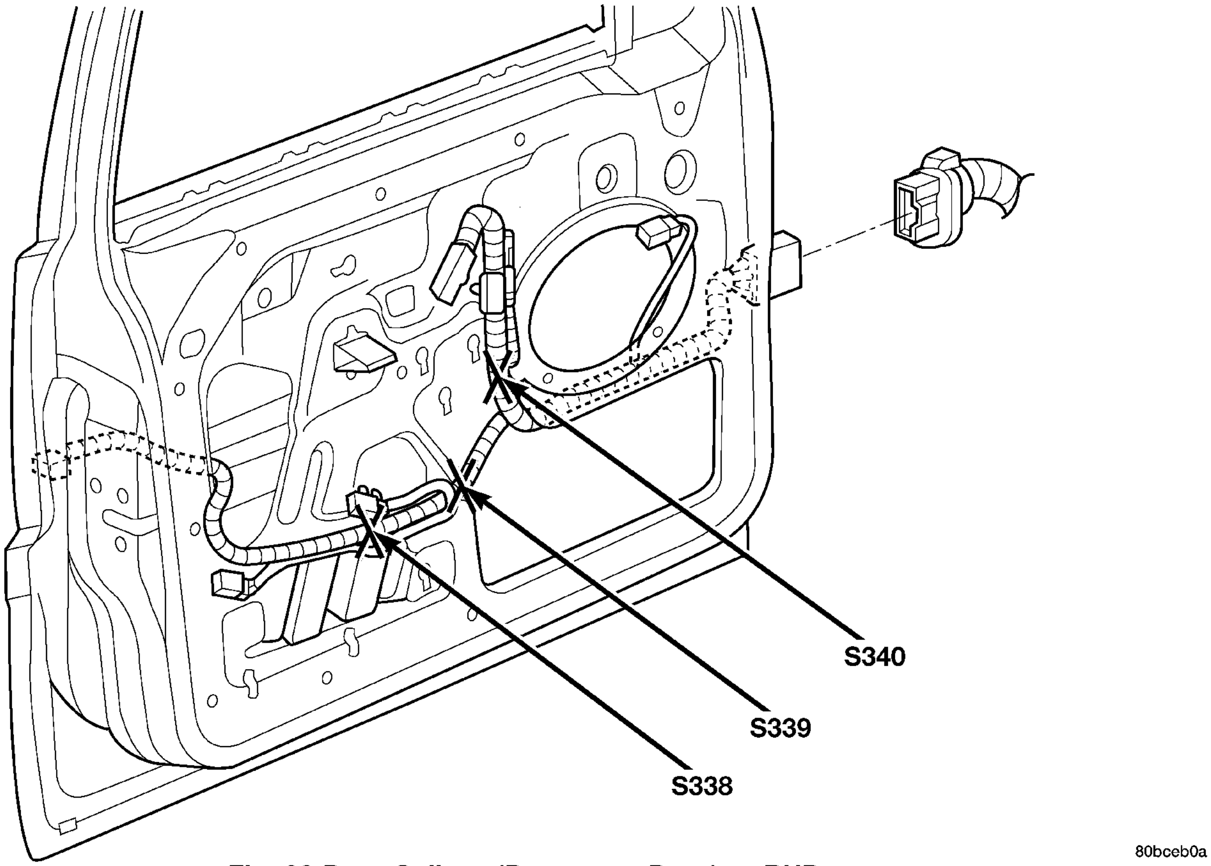


Fig. 32 Door Splices (Passenger Door) — RHD

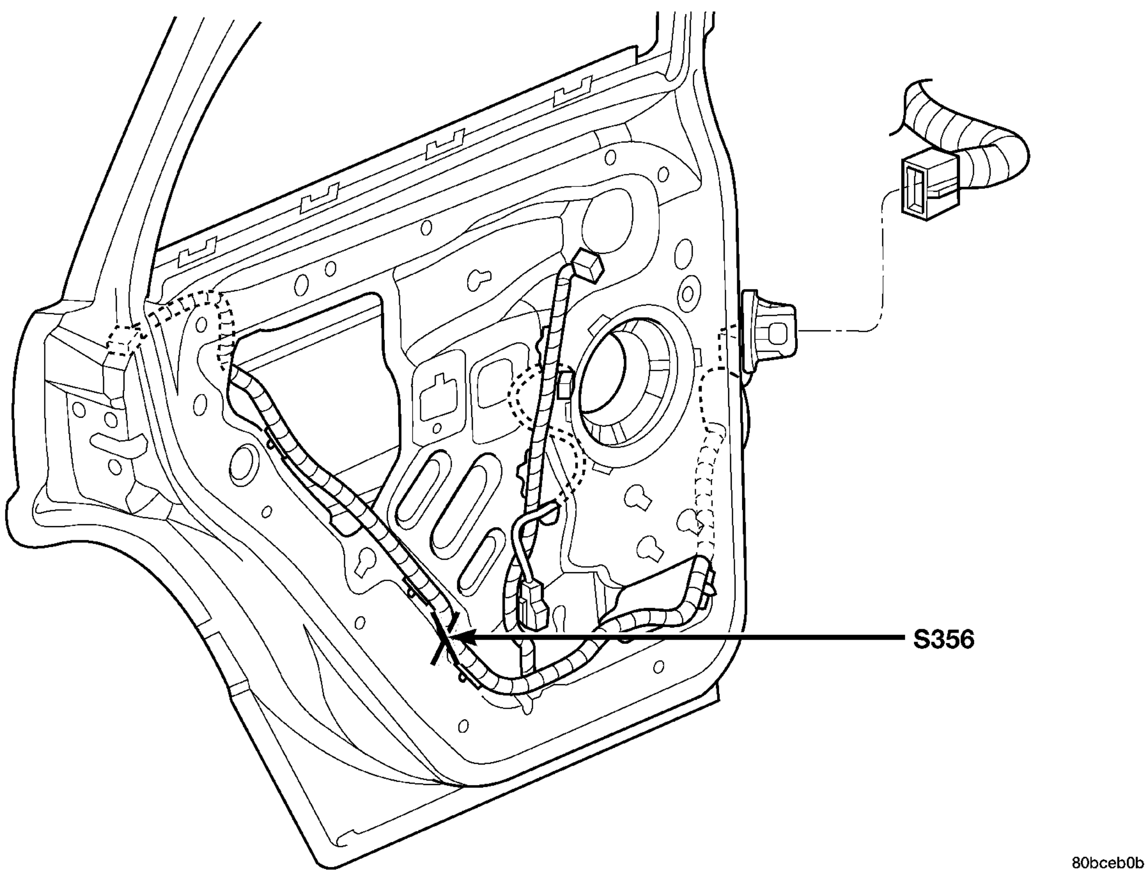


Fig. 33 Door Splices (Rear Door, Passenger Side) — RHD

DESCRIPTION AND OPERATION (Continued)

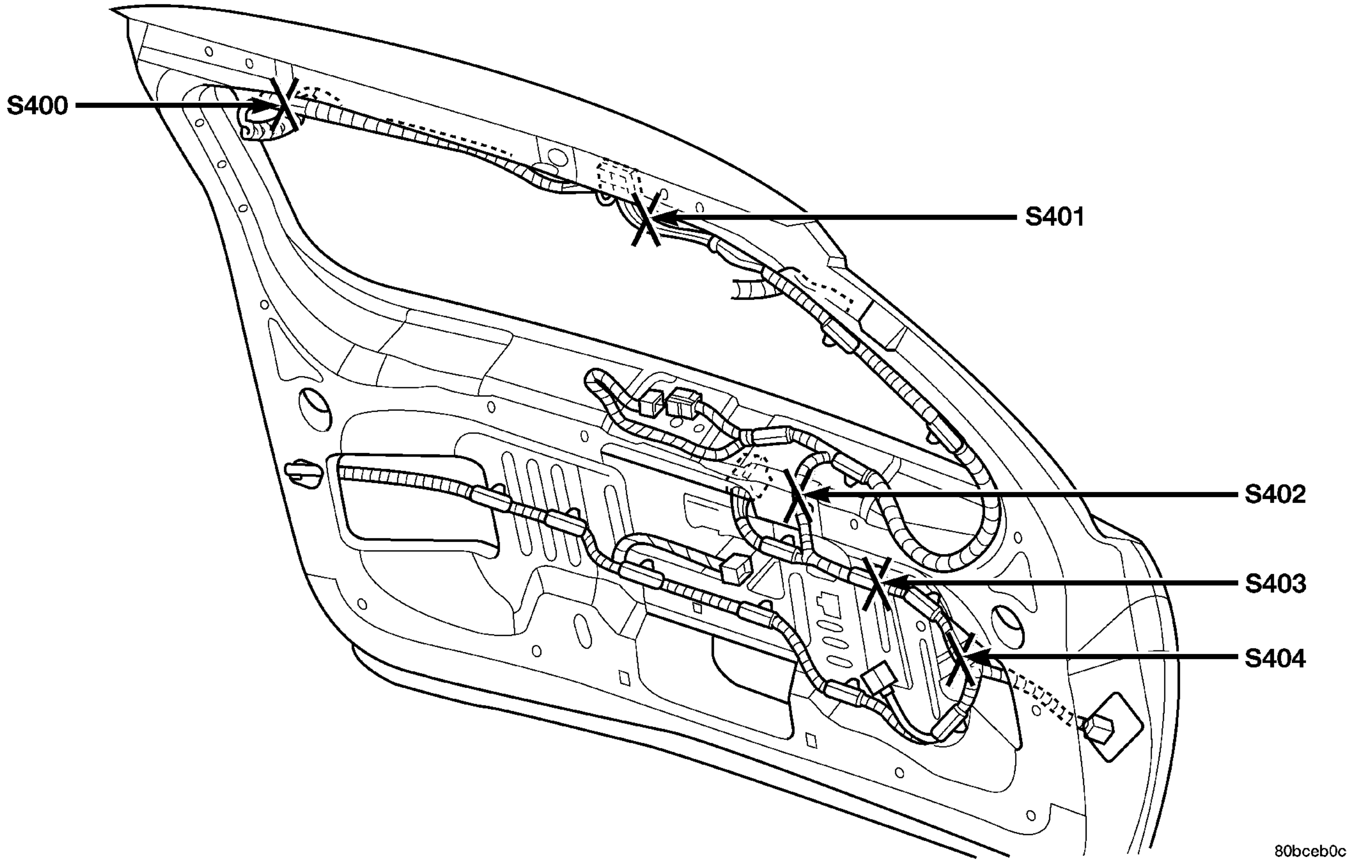


Fig. 34 Liftgate Splices — RHD

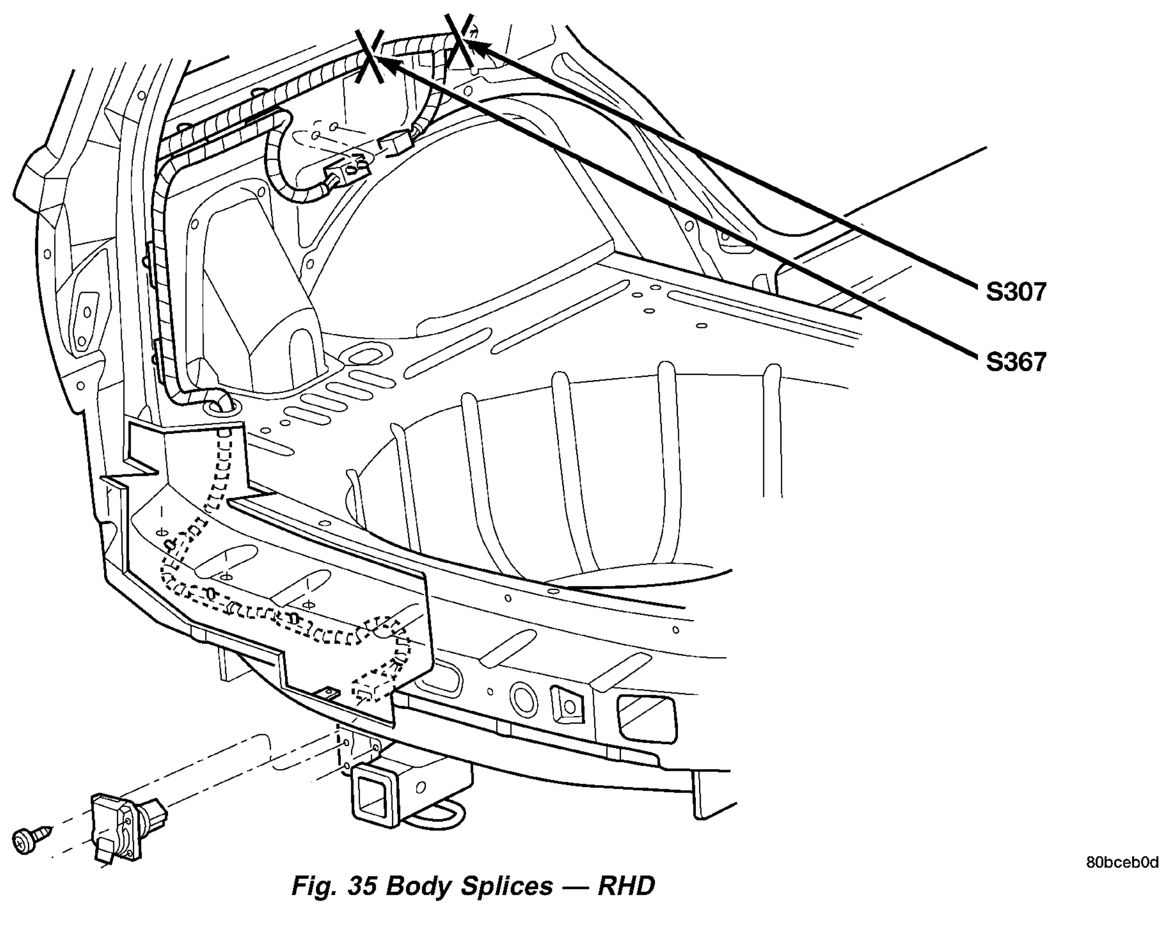


Fig. 35 Body Splices — RHD

ENGINE

CONTENTS

STANDARD SERVICE INFORMATION

INDEX

GENERAL INFORMATION

FORM-IN-PLACE GASKETS—GASOLINE ENGINES

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 has different properties and they cannot be used interchangeably.

MOPAR® SILICONE RUBBER ADHESIVE SEALANT

Mopar® Silicone Rubber Adhesive Sealant, normally black in color, is available in both three ounce tubes and four and one-half ounce power tubes. Moisture in the air causes the sealant material to cure. This material is normally used on flexible metal flanges. The regular tubes have a shelf life of one year and the power tubes a two year shelf life, 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 six-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 that gasket rails are flat. Flatten rails with a hammer on a flat plate, if required. Gasket surfaces must be free of oil and dirt. Be sure the old gasket material is removed from blind attaching holes.

GASKET APPLICATION

Assembling parts using a form-in-place gasket requires care.

GENERAL INFORMATION (Continued)

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 ten 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 be easily 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 GASKET SURFACE PREPARATION

To ensure engine gasket sealing, proper surface preparation must be performed, especially with the use of aluminum engine components and multi-layer steel cylinder head gaskets.

Never use the following to clean gasket surfaces:

- Never use a metal scraper.
- Never use an abrasive pad or paper to clean cylinder block and head.
- Never use a high speed power tool or wire brush on any gasket sealing surface (Fig. 1)

NOTE: Multi-Layer Steel (MLS) head gaskets require a scratch free sealing surface.

Only use the following for cleaning gasket surfaces:

- use Mopar® Brake and Parts Cleaner
- use only a plastic or wood scraper (Fig. 1)

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 for the proper procedure).

(3) Tighten the intake manifold bolts (refer to Group 11, Exhaust System and Intake Manifold for the proper specifications).

(4) Perform cylinder compression test:

CAUTION: DO NOT overspeed the engine.

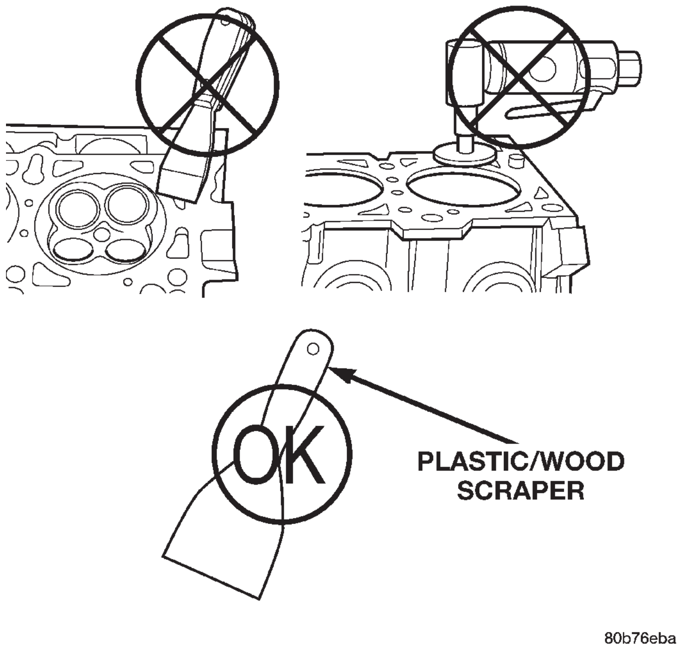


Fig. 1 Proper Tool Usage For Surface Preparation

(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.

(d) Disconnect electrical connectors from coil towers and then remove coil towers.

(e) 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.

(f) Be sure throttle blades are fully open during the compression check.

(g) Insert compression gauge 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 for all remaining cylinders.

(i) Record the findings and compare them with the compression standards listed under Engine Specifications.

(j) If cylinder(s) have abnormally low compression pressures, repeat procedure.

(k) If the same cylinder(s) repeat an abnormally low reading, it could indicate the existence of a problem in the cylinder.

GENERAL INFORMATION (Continued)

NOTE: 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) Perform a combustion analysis.

(7) Test fuel pump for pressure (refer to Group 14, Fuel System for the proper specifications).

(8) Inspect air filter element (refer to Group 0, Lubrication and Maintenance for the proper procedure).

(9) Inspect crankcase ventilation system (refer to Group 0, Lubrication and Maintenance for the proper procedure).

(10) For emission controls refer to Group 25, Emission Controls System for service procedures.

(11) Inspect and adjust accessory belt drives (refer to Group 7, Cooling System for the proper adjustments).

(12) 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. 2).

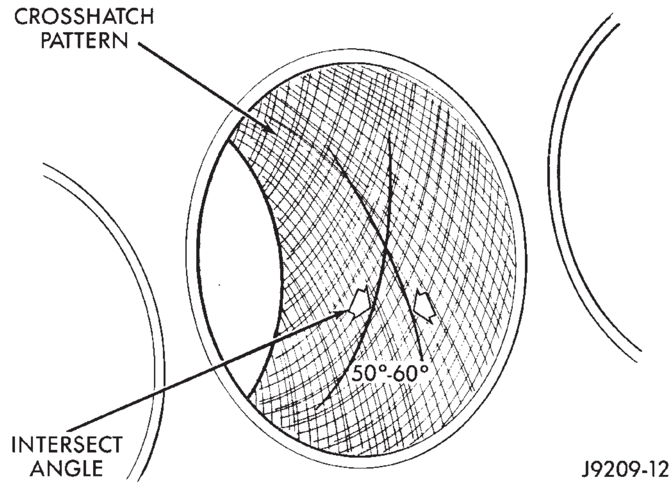


Fig. 2 Cylinder Bore Crosshatch Pattern

(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—4.0L

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.

- **ALL ENGINES** —When checking No.1 main bearing; shim No.2 main bearing.
- **ALL ENGINES** —When checking No.2 main bearing; shim No.1 and No.3 main bearing.

GENERAL INFORMATION (Continued)

• **ALL ENGINES** —When checking No.3 main bearing; shim No.2 and No.4 main bearing.

• **ALL ENGINES** —When checking No.4 main bearing; shim No.3 and No.5 main bearing.

• **ALL ENGINES** —When checking No.5 main bearing; shim No.4 main bearing.

NOTE: 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.

(1) Place a piece of Plastigage across the entire width of the bearing cap shell (Fig. 3). 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 the proper specification. **DO NOT rotate the crankshaft or the Plastigage may be smeared, giving inaccurate results.**

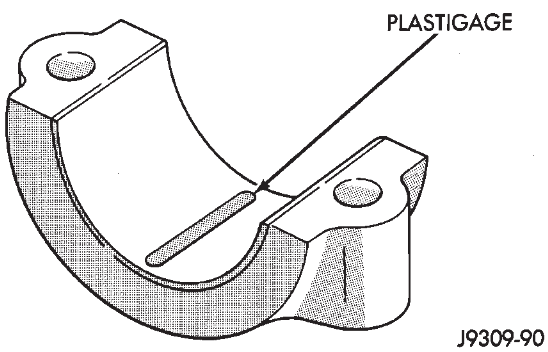


Fig. 3 Placement of Plastigage in Bearing Shell

(2) Remove the bearing cap and compare the width of the flattened Plastigage with the scale provided on the package (Fig. 4). 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).

(3) 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:

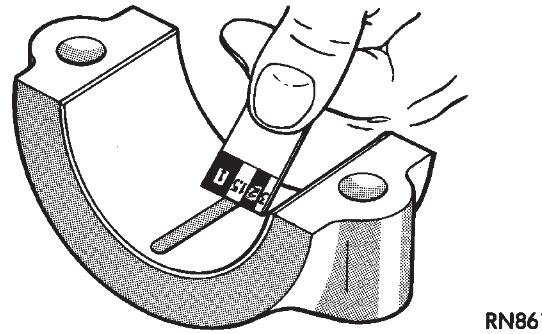


Fig. 4 Clearance Measurement

(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. 3). 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 rod cap nut to the specified 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. 4). 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 to bring 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.

GENERAL INFORMATION (Continued)

HYDROSTATIC LOCK

When an engine is suspected of hydrostatic lock (regardless of what caused the problem), follow the steps below.

(1) Perform the Fuel Pressure Release Procedure (refer to Group 14, Fuel System).

(2) Disconnect the battery negative cable.

(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 (i.e. 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 engine spark plugs to the specified torque.

(11) Drain engine oil. Remove and discard the oil filter.

(12) Install the drain plug. Tighten the plug to the recommended torque.

(13) Install a new oil filter.

(14) Fill engine crankcase with the specified amount and grade of oil.

(15) Connect the battery negative cable.

(16) Start the engine and check for any leaks.

ENGINE OIL

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

ENGINE OIL SPECIFICATION

CAUTION: Do not use non-detergent or straight mineral oil when adding or changing crankcase lubricant. Engine failure can result.

API SERVICE GRADE CERTIFIED

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

SAE VISCOSITY

An SAE viscosity grade is used to specify the viscosity of engine oil. Use only engine oils with multiple viscosities such as 5W-30 or 10W-30 in the 4.0L, and 4.7L engines. These are specified with a dual SAE viscosity grade which indicates the cold-to-hot temperature viscosity range. Select an engine oil that is best suited to your particular temperature range and variation (Fig. 5) (Fig. 6).

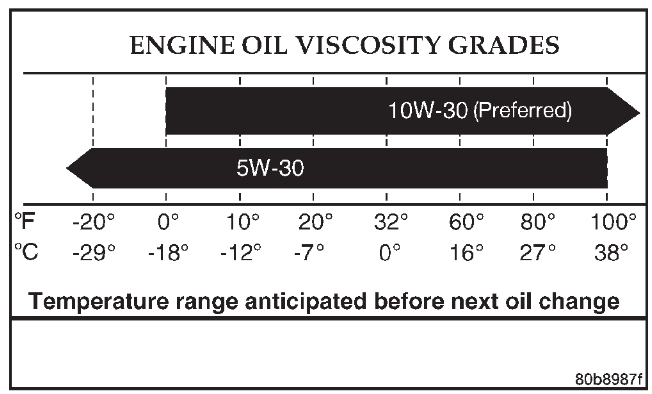


Fig. 5 Temperature/Engine Oil Viscosity—4.0L Engine

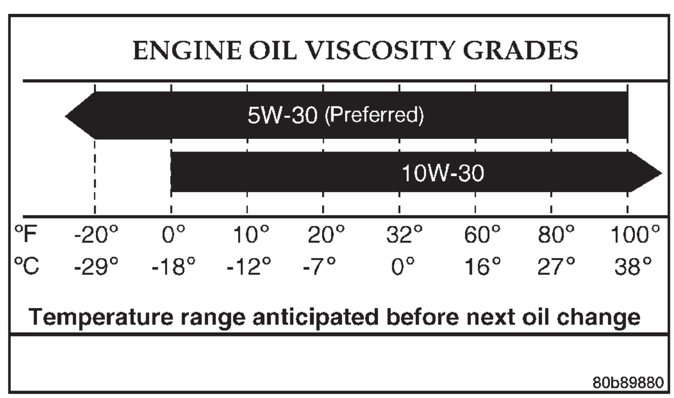


Fig. 6 Temperature/Engine Oil Viscosity—4.7L Engine

GENERAL INFORMATION (Continued)

ENERGY CONSERVING OIL

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

CONTAINER IDENTIFICATION

Standard engine oil identification notations have been adopted to aid in the proper selection of engine oil. The identifying notations are located on the label of engine oil plastic bottles and the top of engine oil cans (Fig. 7).

Fig. 7 Engine Oil Container Standard Notations

OIL LEVEL INDICATOR (DIPSTICK)

The engine oil level indicator is located at the right rear of the engine on the 4.0L, 4.7L engines. (Fig. 8) (Fig. 9).

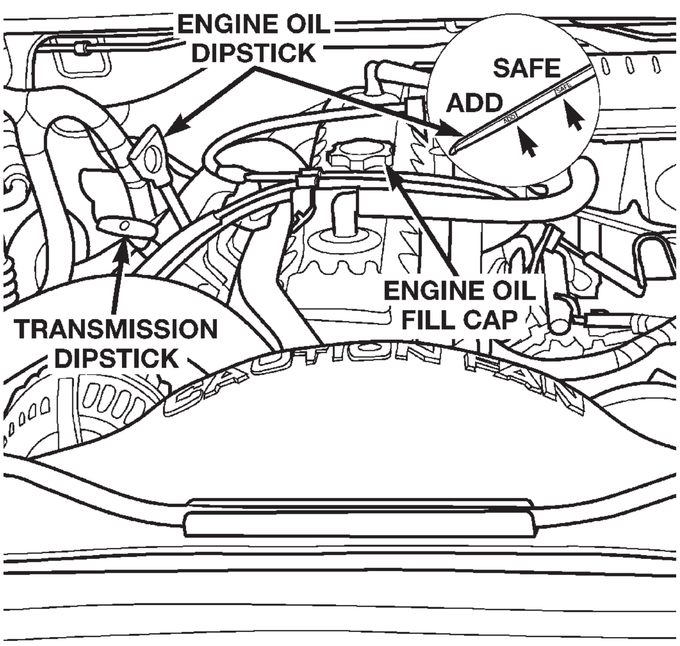


Fig. 8 Engine Oil Dipstick 4.0L Engine

CRANKCASE OIL LEVEL INSPECTION

CAUTION: Do not overfill crankcase with engine oil, pressure loss or oil foaming can result.

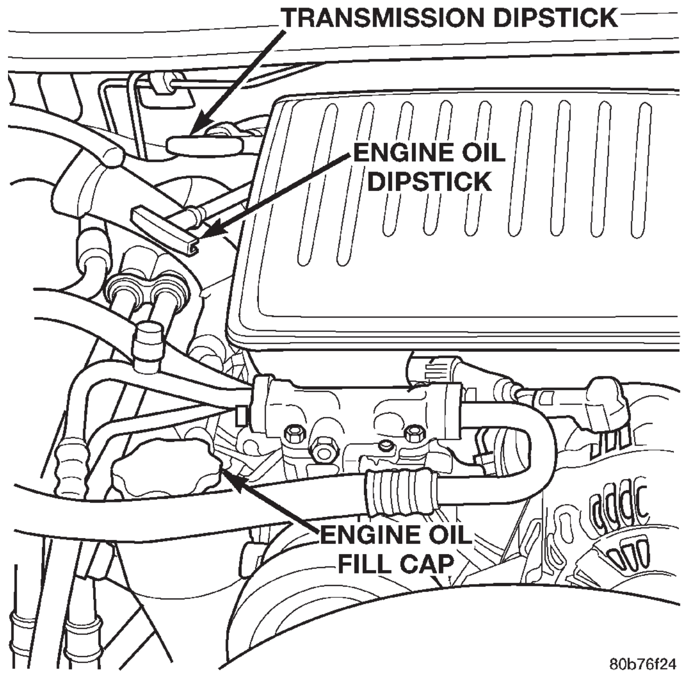


Fig. 9 Engine Oil Dipstick 4.7L Engine

Inspect engine oil level approximately every 800 kilometers (500 miles). Unless the engine has exhibited loss of oil pressure, run the engine for about five minutes before checking oil level. Checking engine oil level on a cold engine is not accurate.

To ensure proper lubrication of an engine, the engine oil must be maintained at an acceptable level. The acceptable levels are indicated between the ADD and SAFE marks on the engine oil dipstick.

(1) Position vehicle on level surface.

(2) With engine OFF, allow approximately ten minutes for oil to settle to bottom of crankcase, remove engine oil dipstick.

(3) Wipe dipstick clean.

(4) Install dipstick and verify it is seated in the tube.

(5) Remove dipstick, with handle held above the tip, take oil level reading.

(6) Add oil only if level is below the ADD mark on dipstick.

ENGINE OIL CHANGE

Change engine oil at mileage and time intervals described in Maintenance Schedules.

Run engine until achieving normal operating temperature.

(1) Position the vehicle on a level surface and turn engine off.

(2) Hoist and support vehicle on safety stands.

(3) Remove oil fill cap.

(4) Place a suitable drain pan under crankcase drain.

GENERAL INFORMATION (Continued)

(5) Remove drain plug from crankcase and allow oil to drain into pan. Inspect drain plug threads for stretching or other damage. Replace drain plug if damaged.

(6) Install drain plug in crankcase.

(7) Lower vehicle and fill crankcase with specified type and amount of engine oil described in this section.

(8) Install oil fill cap.

(9) Start engine and inspect for leaks.

(10) Stop engine and inspect oil level.

ENGINE OIL FILTER CHANGE

FILTER SPECIFICATION

All engines are equipped with a high quality full-flow, disposable type oil filter. Chrysler Corporation recommends a Mopar or equivalent oil filter be used.

OIL FILTER REMOVAL

(1) Position a drain pan under the oil filter.

(2) Using a suitable oil filter wrench loosen filter.

(3) Rotate the oil filter counterclockwise (Fig. 10) (Fig. 11) to remove it from the cylinder block oil filter boss.

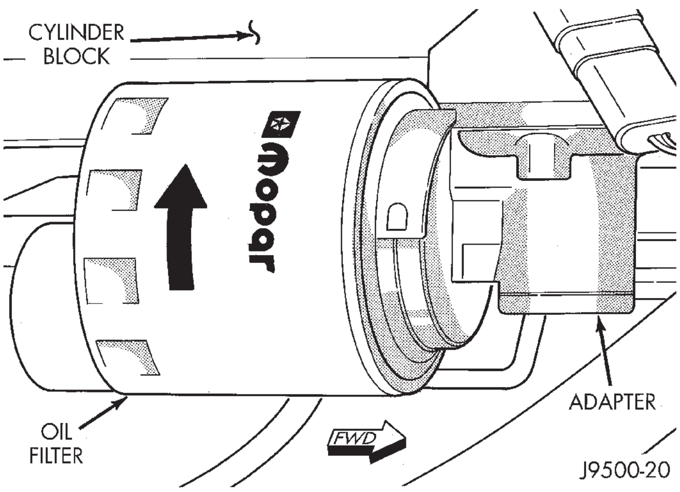


Fig. 10 Oil Filter—4.0L Engine

(4) When filter separates from adapter nipple, tip gasket end upward to minimize oil spill. Remove filter from vehicle.

(5) With a wiping cloth, clean the gasket sealing surface (Fig. 12) of oil and grime.

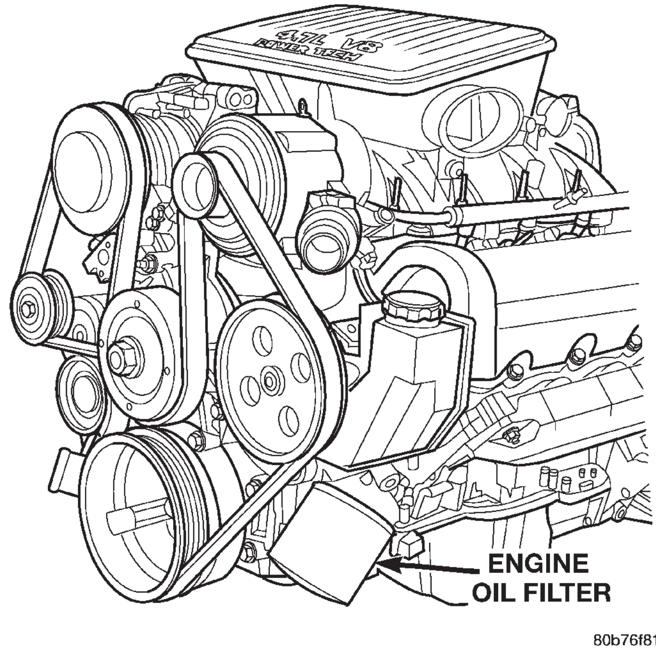


Fig. 11 Oil Filter—4.7L Engine

OIL FILTER INSTALLATION

(1) Lightly lubricate oil filter gasket with engine oil.

(2) Thread filter onto adapter nipple. When gasket makes contact with sealing surface, (Fig. 12) hand tighten filter one full turn, do not over tighten.

(3) Add oil, verify crankcase oil level and start engine. Inspect for oil leaks.

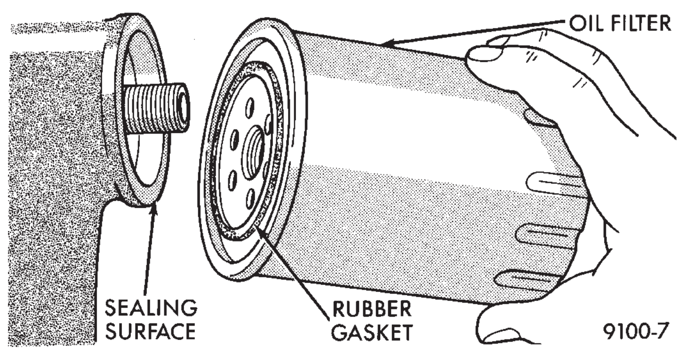


Fig. 12 Oil Filter Sealing Surface—Typical

USED ENGINE OIL DISPOSAL

Care should be exercised when disposing used engine oil after it has been drained from a vehicle engine. Refer to the WARNING at beginning of this section.

ENGINE DIAGNOSIS

INDEX

DIAGNOSIS AND TESTING

GENERAL INFORMATION

Engine diagnosis is helpful in determining the causes of malfunctions not detected and remedied by routine maintenance.

These malfunctions may be classified as either performance (e.g., engine idles rough and stalls) or mechanical (e.g., 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.

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 is observed 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) Disconnect the ignition coil tower electrical connectors and remove ignition coil towers.

(2) Remove the spark plugs.

(3) Clean the spark plug recesses with compressed air.

(4) Secure the throttle in the wide-open position.

(5) Disable the fuel system. (Refer to Group 14, Fuel System for the correct procedure)

(6) Insert a compression pressure gauge and rotate the engine with the engine starter motor for three revolutions.

(7) 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, and/or 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 and/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.

DIAGNOSIS AND TESTING (Continued)

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.

(1) Check the coolant level and fill as required. DO NOT install the radiator cap.

(2) Start and operate the engine until it attains normal operating temperature, then turn the engine OFF.

(3) Disconnect ignition coil tower electrical connectors.

(4) Remove ignition coil towers.

(5) Remove the spark plugs.

(6) Remove the oil filler cap.

(7) Remove the air cleaner.

(8) 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.

(9) 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.

CYLINDER COMBUSTION PRESSURE LEAKAGE DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
AIR ESCAPES THROUGH THROTTLE BODY	Intake valve bent, burnt, or not seated properly	Inspect valve and valve seat. Reface or replace, as necessary
AIR ESCAPES THROUGH TAILPIPE	Exhaust valve bent, burnt, or not seated properly	Inspect valve and valve seat. Reface or replace, as necessary
AIR ESCAPES THROUGH RADIATOR	Head gasket leaking or cracked cylinder head or block	Remove cylinder head and inspect. Replace defective part
MORE THAN 50% LEAKAGE FROM ADJACENT CYLINDERS	Head gasket leaking or crack in cylinder head or block between adjacent cylinders	Remove cylinder head and inspect. Replace gasket, head, or block as necessary
MORE THAN 25% LEAKAGE AND AIR ESCAPES THROUGH OIL FILLER CAP OPENING ONLY	Stuck or broken piston rings; cracked piston; worn rings and/or cylinder wall	Inspect for broken rings or piston. Measure ring gap and cylinder diameter, taper and out-of-round. Replace defective part as necessary

DIAGNOSIS AND TESTING (Continued)

ENGINE OIL LEAK INSPECTION

Begin with a thorough visual inspection of the engine, particularly at the area of the suspected leak. If an oil leak source is not readily identifiable, the following steps should be followed:

(1) Do not clean or degrease the engine at this time because some solvents may cause rubber to swell, temporarily stopping the leak.

(2) Add an oil soluble dye (use as recommended by manufacturer). Start the engine and let idle for approximately 15 minutes. Check the oil dipstick to 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 inspection.

(4) **If the oil leak source is not positively identified at this time** , proceed with the air leak detection test method.

Air Leak Detection Test Method

(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.

(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, camshaft position sensor (4.0L) seal, camshaft bore cup plugs oil galley pipe plugs, oil filter runoff, and main bearing cap to cylinder block mating surfaces.

(4) If no leaks are detected, pressurize 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.

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 two conditions could be responsible for noisy tappets.

DIAGNOSIS AND TESTING (Continued)

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 one 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.

NOTE: 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 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.

(4) 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. If more than one tappet seems to be noisy, it's probably not the tappets.

LASH ADJUSTER (TAPPET) NOISE DIAGNOSIS (4.7L ONLY)

A tappet-like noise may be produced from several items. Check the following items.

(1) Engine oil level too high or too low. This may cause aerated oil to enter the adjusters and cause them to be spongy.

(2) Insufficient running time after rebuilding cylinder head. Low speed running up to 1 hour may be required.

(3) During this time, turn engine off and let set for a few minutes before restarting. Repeat this several times after engine has reached normal operating temperature.

(4) Low oil pressure.

(5) The oil restrictor in cylinder head gasket or the oil passage to the cylinder head is plugged with debris.

(6) Air ingested into oil due to broken or cracked oil pump pick up.

(7) Worn valve guides.

(8) Rocker arm ears contacting valve spring retainer.

(9) Rocker arm loose, adjuster stuck or at maximum extension and still leaves lash in the system.

(10) Faulty lash adjuster.

a. Check lash adjusters for sponginess while installed in cylinder head. Depress part of rocker arm over adjuster. Normal adjusters should feel very firm. Spongy adjusters can be bottomed out easily.

b. Remove suspected lash adjusters, and replace.

c. Before installation, make sure adjusters are at least partially full of oil. This can be verified by little or no plunger travel when lash adjuster is depressed.

ENGINE OIL PRESSURE

(1) Disconnect connector and remove oil pressure sending unit.

(2) Install Oil Pressure Line and Gauge Tool C-3292 or equivalent. Start engine and record pressure. Refer to Oil Pressure in Engine Specifications for the correct pressures.

DIAGNOSIS AND TESTING (Continued)

ENGINE DIAGNOSIS—PERFORMANCE

CONDITION	POSSIBLE CAUSE	CORRECTION
ENGINE WILL NOT START	1. Weak battery.	1. Test battery. Charge or replace as necessary. Refer to Group 8A, Battery.
	2. Corroded or loose battery connections.	2. Clean and tighten battery connections. Apply a coat of light mineral grease to terminals.
	3. Faulty starter.	3. Test starting system. Refer to Group 8B, Starting.
	4. Faulty coil towers or coil rail.	4. Test and replace as needed. Refer to Group 8D, Ignition System.
	5. Incorrect spark plug gap.	5. Set gap. Refer to Group 8D, Ignition System.
	6. Contamination in fuel system.	6. Clean system and replace fuel filter.
	7. Faulty fuel pump.	7. Test fuel pump and replace as needed. Refer to Group 14, Fuel System.
	8. Incorrect engine timing.	8. Check for a worn timing chain(s) or a loose camshaft sprocket.
ENGINE STALLS OR IDLES ROUGH	1. Idle speed too low.	1. Test minimum air flow. Refer to Group 14, Fuel System.
	2. Incorrect fuel mixture.	2. Refer to Group 14, Fuel System.
	3. Intake manifold leakage.	3. Inspect intake manifold, manifold gasket, and vacuum hoses. Refer to Intake Manifold in this section.
	4. Faulty coil towers or coil rail.	4. Test and replace as necessary. Refer to Group 8D, Ignition System.
ENGINE LOSS OF POWER	1. Dirty or incorrectly gapped plugs.	1. Clean plugs and set gap. Refer to Group 8D, Ignition System.
	2. Contamination in fuel system.	2. Clean system and replace fuel filter.
	3. Faulty fuel pump.	3. Test and replace as necessary. Refer to Group 14, Fuel System.
	4. Incorrect valve timing.	4. Check for a worn timing chain(s) or a loose camshaft sprocket.
	5. Leaking cylinder head gasket.	5. Replace cylinder head gasket.
	6. Low compression.	6. Test compression of each cylinder.
	7. Burned, warped, or pitted valves.	7. Replace valves.
	8. Plugged or restricted exhaust system.	8. Install new parts, as necessary.
	9. Faulty coil towers or rail coil system.	9. Test and replace as necessary. Refer to Group 8D, Ignition System.
ENGINE MISSES ON ACCELERATION	1. Dirty or incorrectly gapped spark plugs.	1. Clean spark plugs and set gap. Refer to Group 8D, Ignition System.
	2. Contamination in Fuel System.	2. Clean fuel system and replace fuel filter.
	3. Burned, warped, or pitted valves.	3. Replace valves.
	4. Faulty coil towers or rail coil system.	4. Test and replace as necessary. Refer to Group 8D, Ignition System.
ENGINE MISSES AT HIGH SPEED	1. Dirty or incorrect spark plug gap.	1. Clean spark plugs and set gap. Refer to Group 8D, Ignition System.
	2. Faulty coil towers or rail coil system.	2. Test and replace as necessary. Refer to Group 8D, Ignition System.
	3. Dirty fuel injector(s).	Test and replace as necessary. Refer to Group 14, Fuel System.
	4. Contamination in fuel system.	4. Clean system and replace fuel filter.

DIAGNOSIS AND TESTING (Continued)

ENGINE—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.

J9509-62

DIAGNOSIS AND TESTING (Continued)

ENGINE—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. 2. Crankshaft Rear Seal (a) Misinstalled, inverted or torn lip (b) Torn, cut or shaved seal back bead. 3. Crankshaft Seal Flange. Scratched, nicked or grooved. 4. Cylinder block to Cap Mating Surface. (a) Inadequate Loctite sealant. (b) Oil hole burr. 5. Oil Pan to Rear Main Cap Sealant. (a) Inadequate or mislocated sealant. (b) Torn, cut or misinstalled oil pan. (c) Cracked or damaged oil pan flange. 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.	1. (a) Replace the part. (b) Tighten, repair or replace the part. 2. (a) Replace the seal. (b) Replace the seal. 3. Replace or polish if necessary. 4. (a) Apply sealant per sealant per service manual. (b) Carefully stone or chamfer hole. 5. (a) Apply sealant per service manual procedures. (b) Replace the gasket. (c) Replace the oil pan. 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. 2. Faulty oil pressure sending unit. 3. Low oil pressure. 4. Clogged oil filter. 5. Worn parts in oil pump. 6. Thin or diluted oil. 7. Excessive bearing clearance. 8. Oil pump relief valve stuck. 9. Oil pump suction tube loose; bent or cracked. 10. Oil pump cover warped or cracked.	1. Check engine oil level. 2. Install new sending unit. 3. Check sending unit and check main bearing oil clearance. 4. Install new oil filter. 5. Replace worn parts or pump. 6. Change oil to correct viscosity. 7. Measure bearings for correct clearance. 8. Remove valve and inspect, clean and install. 9. Remove oil pan and install new tube, if necessary. 10. Install new oil pump.
OIL PUMPING AT RINGS; SPARK PLUGS FOULING	1. Worn, scuffed or broken rings. 2. Carbon in oil ring slot. 3. Rings fitted too tightly in grooves. 4. Worn valve guides. 5. Leaking intake gasket. 6. Leaking valve guide seals. 7. Dislodged valve guide seals.	1. Hone cylinder bores and install new rings. 2. Install new rings. 3. Remove the rings. Check grooves. If grooves are not proper width, replace piston. 4. Ream guides and replace valves with oversize valves and seals. 5. Replace gasket and tighten intake manifold to proper torque. 6. Replace seals. 7. Seat valve guide seals or replace, as needed.

J9509-61

4.0L ENGINE

INDEX

DESCRIPTION AND OPERATION

ENGINE DESCRIPTION

The 4.0 Liter (242 CID) six-cylinder engine is an In-line, lightweight, overhead valve engine. 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 better fuel economy.

The cylinders are numbered 1 through 6 from front to rear. The firing order is 1-5-3-6-2-4 (Fig. 1).

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.

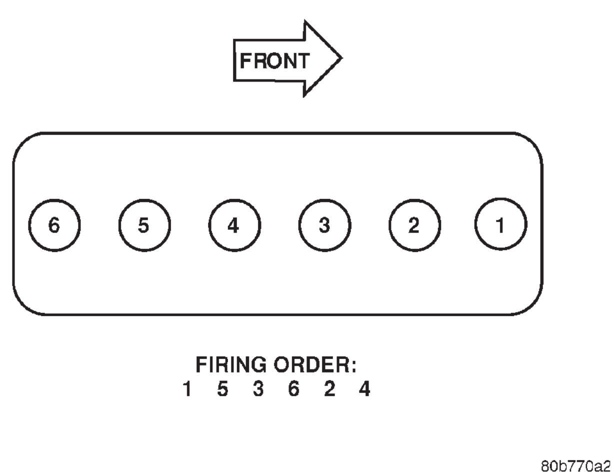


Fig. 1 Engine Firing Order

DESCRIPTION AND OPERATION (Continued)

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. 2).

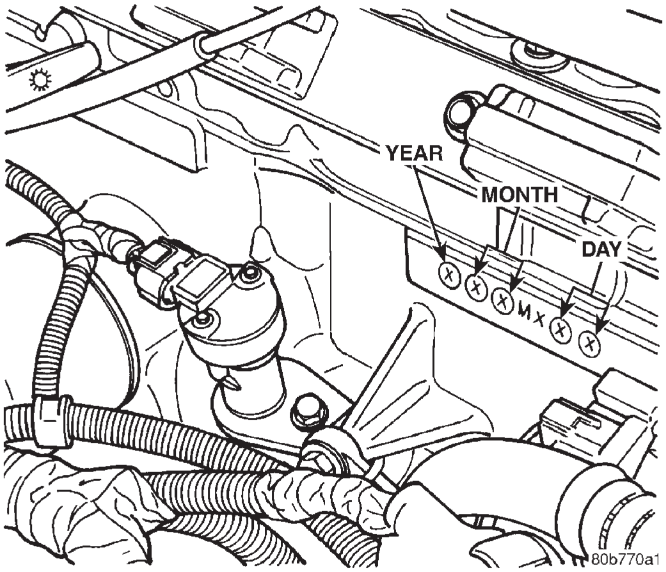


Fig. 2 Build Date Code Location

The digits of the code identify:

- 1st Digit—The year (8 = 1998).
- 2nd & 3rd Digits—The month (01 - 12).
- 4th & 5th Digits—The engine type/fuel system/ compression ratio (MX = A 4.0 Liter (242 CID) 8.7:1 compression ratio engine with a multi-point fuel injection system).
- 6th & 7th Digits—The day of engine build (01 - 31).

(1) **FOR EXAMPLE:** Code * 801MX12 * 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, 1998.

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, camshaft position sensor 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.

OIL PUMP PRESSURE

The MINIMUM oil pump pressure is 89.6 kPa (13 psi) at 600 rpm. The NORMAL oil pump pressure is 517 kPa (75 psi) at 1600 rpm or more.

ENGINE COMPONENTS

CYLINDER BLOCK

The cylinder block is a cast iron inline six cylinder design. The cylinder block is drilled forming galleries for both oil and coolant.

CYLINDER HEAD

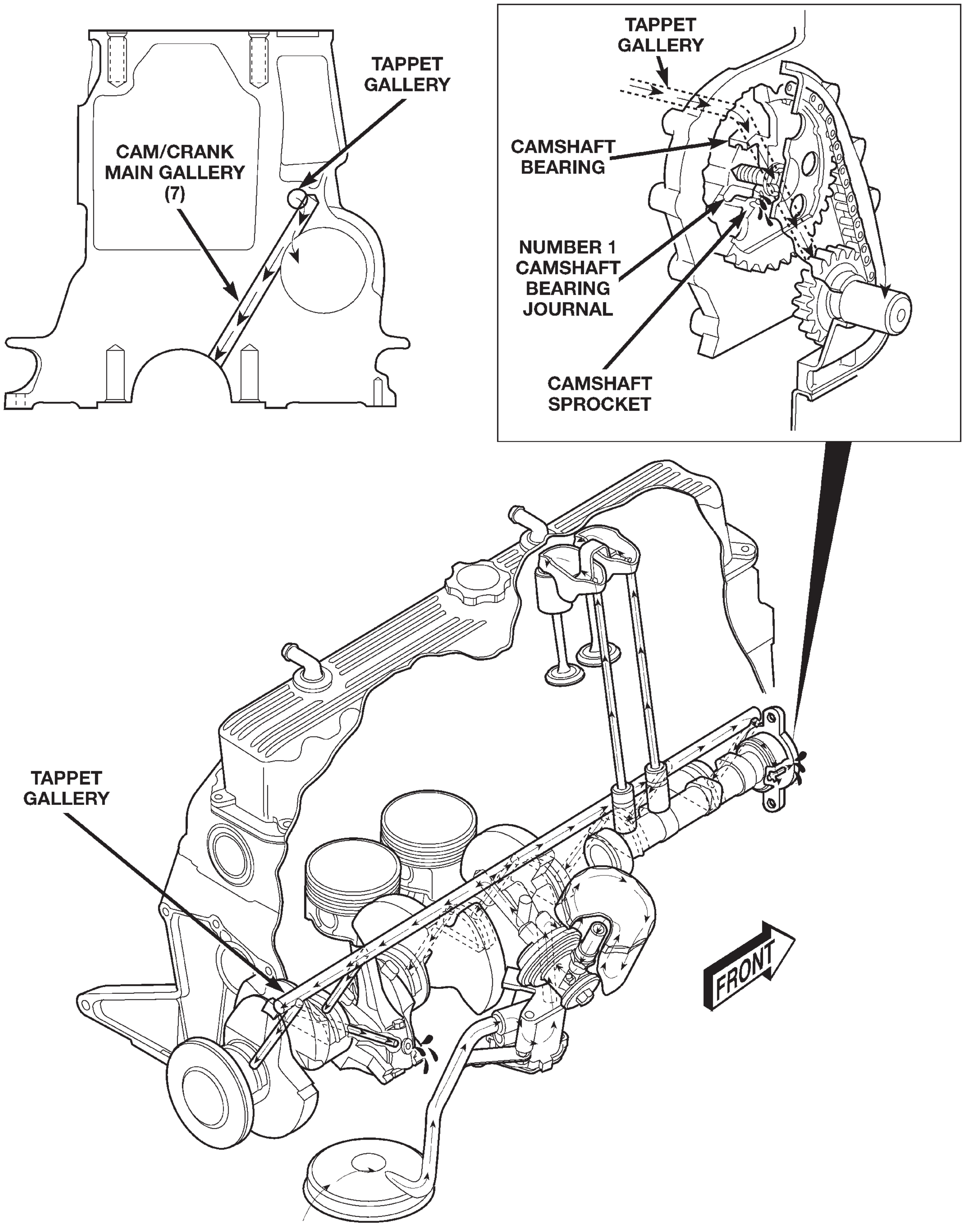
The cylinder head is made of cast iron containing twelve valves made of chrome plated heat resistant steel, valve stem seals, springs, retainers and keepers. The cylinder head, valve seats and guides can be resurfaced for service purposes.

The cylinder head uses dual quench-type design combustion chambers which cause turbulence in the cylinders allowing faster burning of the air/fuel mixture, resulting in better fuel economy.

CRANKSHAFT

The crankshaft is constructed of nodular cast iron. The crankshaft is a crosshaped four throw design with eight counterweights for balancing purposes. The crankshaft is supported by seven select main bearings with the number three serving as the thrust washer location. The main journals of the crankshaft are cross drilled to improve rod bearing lubrication. The select fit main bearing markings are located on the crankshaft counter weights. The crankshaft rear oil seal is a two piece design. The front oil seal is a one piece design retained in the timing chain cover.

DESCRIPTION AND OPERATION (Continued)



Oil Lubrication System—4.0L Engine

DESCRIPTION AND OPERATION (Continued)

PISTONS AND CONNECTING RODS

The pistons are made of a high strength aluminum alloy with an anodized top ring groove and crown. Piston skirts are coated with a solid lubricant (Molykote) to reduce friction and provide scuff resistance. The connecting rods are made of cast malleable iron. A pressed fit piston pin is used to attach the piston and connecting rod.

CAMSHAFT

The camshaft is made of cast iron with twelve machined lobes and four bearing journals. When the camshaft rotates the lobes actuate the push rods forcing upward on the rocker arms which applies downward force on the valves.

ROCKER ARMS

The rocker arms are made of stamped steel and have a operational ratio of 1.6:1. When the push rods are forced upward by the camshaft lobes the push rod presses upward on the rocker arms, the rocker arms pivot, forcing downward pressure on the valves forcing the valves to move downward and off from their seats.

VALVES

The valves are made of heat resistant steel and have chrome plated stems to prevent scuffing. All valves use a three bead lock keeper to retaining the valve spring and promote valve rotation.

VALVE SPRINGS

The valve springs are made of high strength chrome steel. The springs are common between intake and exhaust applications. The valve spring seat is integral with the valve stem seal.

CYLINDER HEAD COVER

The cylinder head cover is made of stamped steel and incorporates the Crankcase Ventilation (CCV) Hoses and the oil fill opening.

HYDRAULIC TAPPETS

Valve lash is controlled by hydraulic tappets located inside the cylinder block, in tappet bores above the camshaft. The tappets have a hole in the tappet body, oil from the cylinder block main bore enters and flows through the tappet exiting the top of the tappet. Oil that exits the tappet enters the hollow push rods, travels up the push rod and exits through a small hole in the rocker arm where it enters the cylinder head and returns to the oil pan.

VALVE GUIDES

The valve guides are integral to the cylinder head, They are not replaceable. However, they are serviceable.

OIL PAN

The oil pan is made of laminated steel and has a single plane sealing surface. The oil pan gasket is a one piece steel backbone silicone coated gasket.

VALVE STEM SEALS

The valve stem seals are made of rubber and incorporate a garter spring to maintain consistent lubrication control.

INTAKE MANIFOLD

The intake manifold is made of cast aluminum and uses eleven bolts to mount to the cylinder head. This mounting style improves sealing and reduces the chance of leaks.

EXHAUST MANIFOLDS

The two exhaust manifolds are log style and are made of high silicon molybdenum cast iron. The exhaust manifolds share a common gasket with the intake manifold. The exhaust manifolds also incorporate ball flange outlets for improved sealing and strain free connections.

SERVICE PROCEDURES

VALVE TIMING

Disconnect the coil rail and remove from engine.

Remove 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.

SERVICE PROCEDURES (Continued)

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.

PISTON FITTING

BORE GAGE METHOD

(1) To correctly select the proper size piston, a cylinder bore gauge, capable of reading in 0.003 mm (.0001 in.) INCREMENTS is required. If a bore gauge is not available, do not use an inside micrometer.

(2) Measure the inside diameter of the cylinder bore at a point 49.5 mm (1-15/16 inches) below top of bore. Start perpendicular (across or at 90 degrees) to the axis of the crankshaft at point A and then take an additional bore reading 90 degrees to that at point B (Fig. 4).

(3) 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 coated pistons.

(4) 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 (Fig. 3). 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 0.003 mm (.0001 in.) increments is required.

(5) Piston installation into the cylinder bore requires 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 SIZE CHART

CYLINDER BORE SIZE	PISTON LETTER SIZE
98.438 to 98.448 mm (3.8755 to 3.8759 in.)	A
98.448 to 98.458 mm (3.8759 to 3.8763 in.)	B
98.458 to 98.468 mm (3.8763 to 3.8767 in.)	C
98.468 to 98.478 mm (3.8767 to 3.8771 in.)	D
98.478 to 98.488 mm (3.8771 to 3.8775 in.)	E
98.488 to 98.498 mm (3.8775 to 3.8779 in.)	F

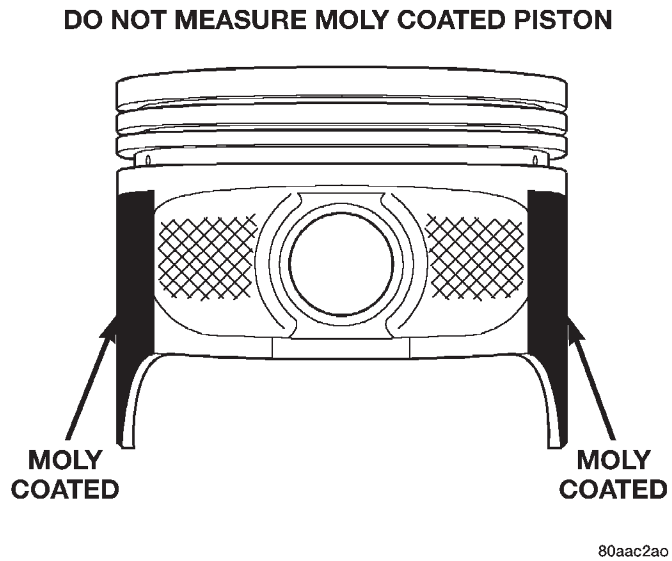


Fig. 3 Moly Coated Piston

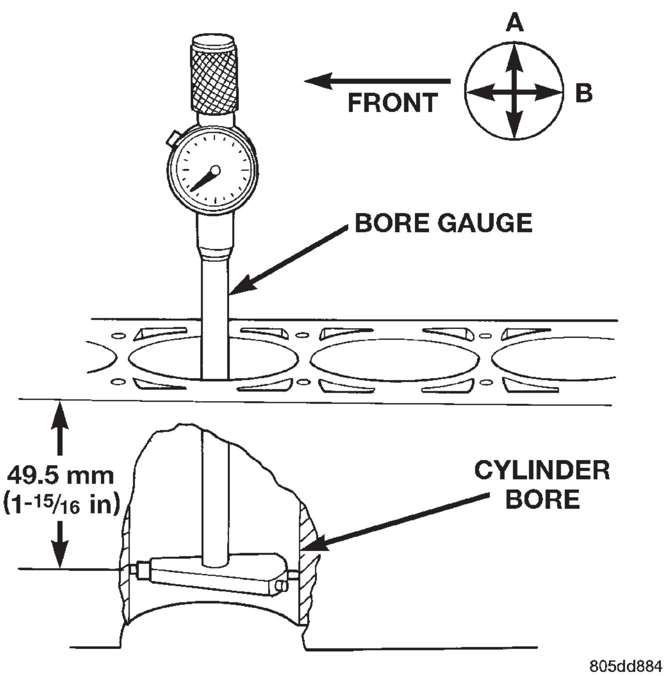


Fig. 4 Bore Gauge

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.

(3) Measure the ring side clearance with a feeler gauge fitted snugly between the ring land and ring (Fig. 5) (Fig. 6). Rotate the ring in the groove. It must move freely around circumference of the groove.

SERVICE PROCEDURES (Continued)

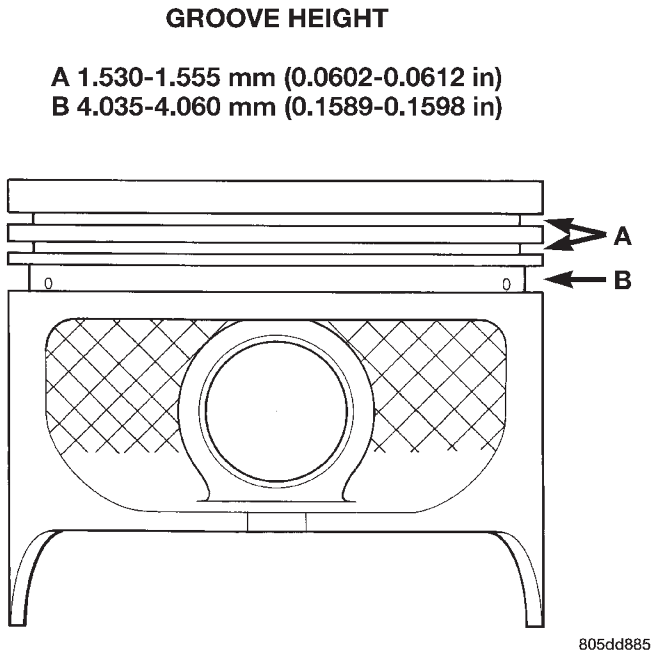


Fig. 5 Piston Dimensions

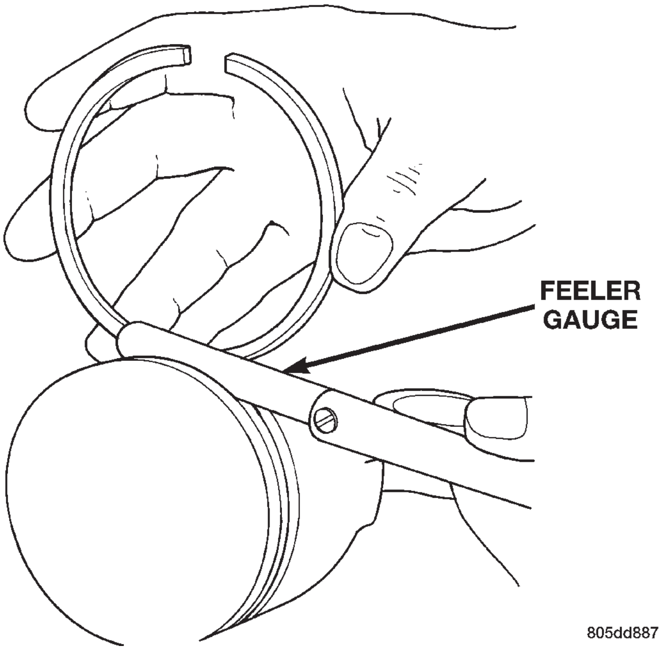


Fig. 6 Ring Side Clearance Measurement

Ring Side Clearance Measurement

Top Compression Ring . . . . 0.042 to 0.084 mm (0.0017 to 0.0033 in.)
Second Compression Ring . . . . . . 0.042 to 0.084 mm (0.0017 to 0.0033 in.)
Oil Control Ring . . . . 0.06 to 0.21 mm (0.0024 to 0.0083 in.)

(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. 7).

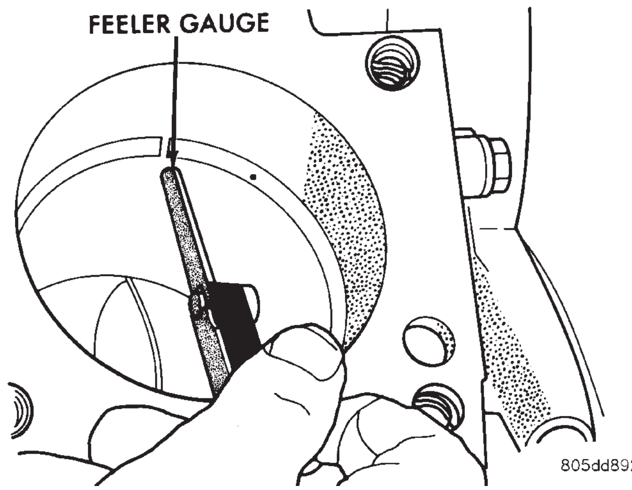


Fig. 7 Gap Measurement

Ring Gap Measurement

Top Compression Ring . . . . 0.229 to 0.610 mm (0.0090 to 0.0240 inch)
Second Compression Ring . . . . . . 0.483 to 0.965 mm (0.0190 to 0.0380 inch)
Oil Control Ring . . . . 0.254 to 1.500 mm (0.010 to 0.060 inch)

(5) The oil control rings are symmetrical, and can be installed with either side up. 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 compression ring can be identified by the shiny coating on the outer sealing surface and can be installed with either side up. (Fig. 8).

(7) The second compression ring has a slight chamfer on the bottom of the inside edge and a dot on the top for correct installation (Fig. 9).

(8) Using a ring installer, install the second compression ring with the dot facing up (Fig. 9) (Fig. 11).

(9) Using a ring installer, install the top compression ring (either side up).

Ring Gap Orientation

- Position the gaps on the piston as shown (Fig. 12).
- Oil spacer - Gap on center line of piston skirt.
- Oil rails - gap 180° apart on centerline of piston pin bore.
- No. 2 Compression ring - Gap 180° from top oil rail gap.
- No. 1 Compression ring - Gap 180° from No. 2 compression ring gap.

SERVICE PROCEDURES (Continued)

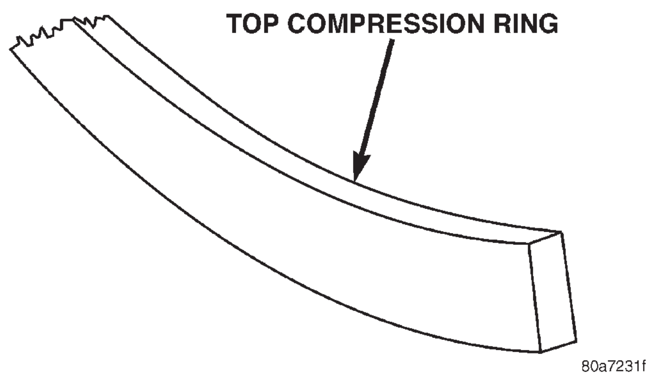


Fig. 8 Top Compression ring identification

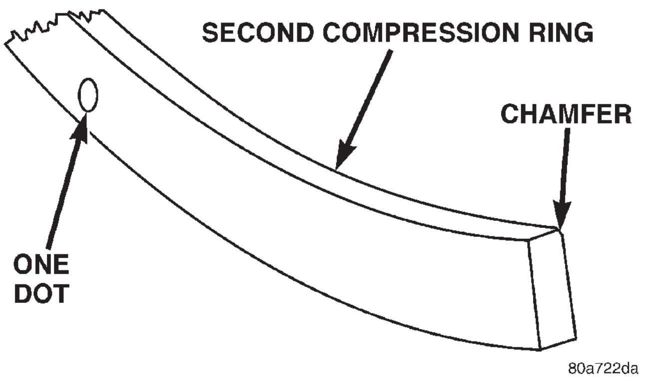


Fig. 9 Second Compression Ring Identification

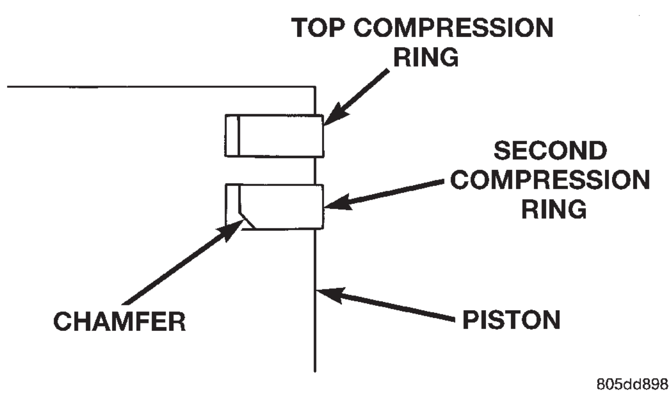


Fig. 10 Compression Ring Chamfer Location

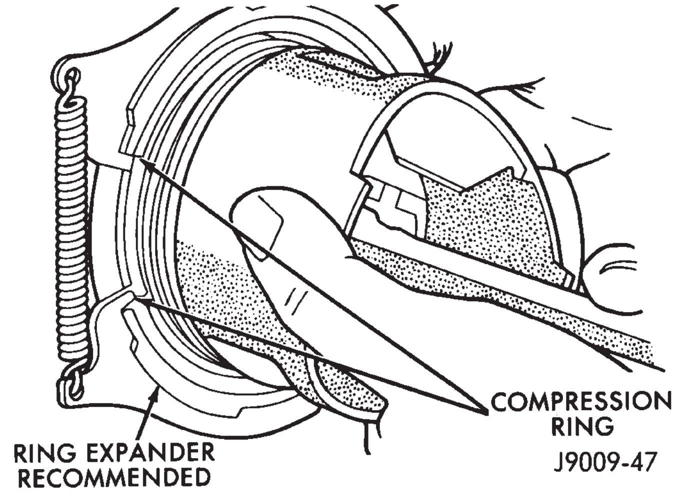


Fig. 11 Compression Ring Installation

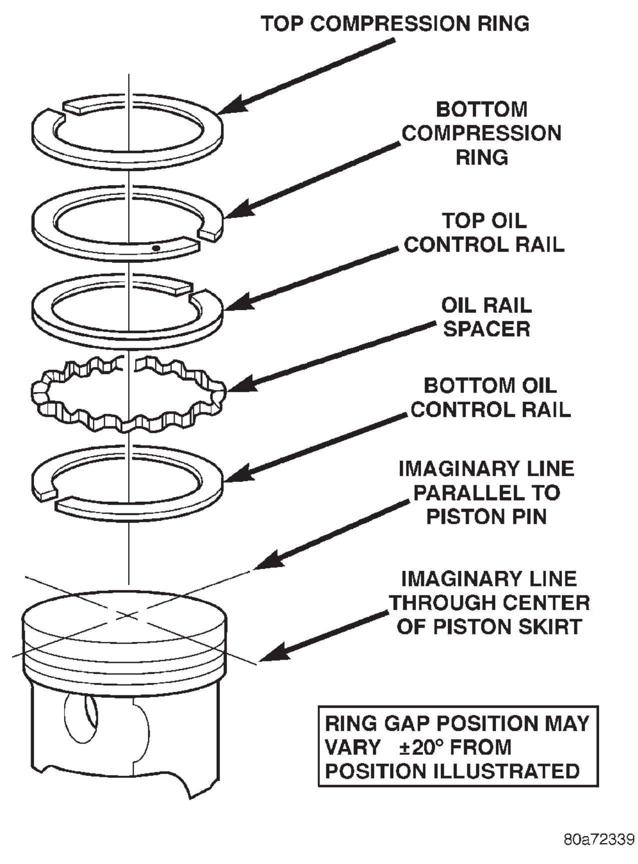


Fig. 12 Ring Gap Orientation

SERVICE PROCEDURES (Continued)

FITTING CONNECTING ROD BEARINGS

INSPECTION

BEARINGS

Inspect the connecting rod bearings for scoring and bent alignment tabs (Fig. 13) (Fig. 14). Check the bearings for normal wear patterns, scoring, grooving, fatigue and pitting (Fig. 15). Replace any bearing that shows abnormal wear.

Inspect the connecting rod journals for signs of scoring, nicks and burrs.

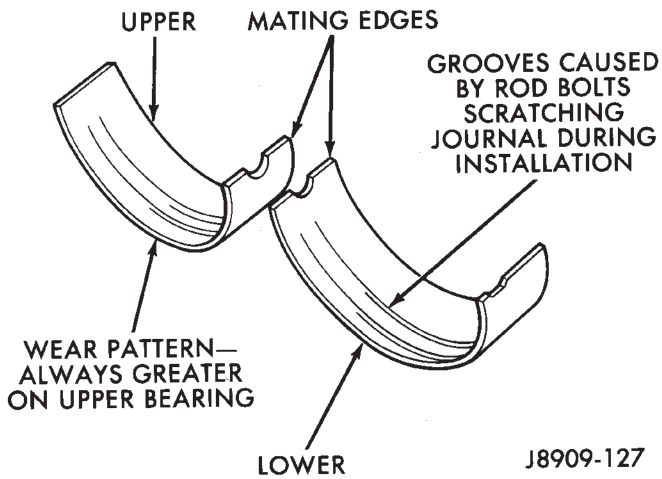


Fig. 13 Connecting Rod Bearing Inspection

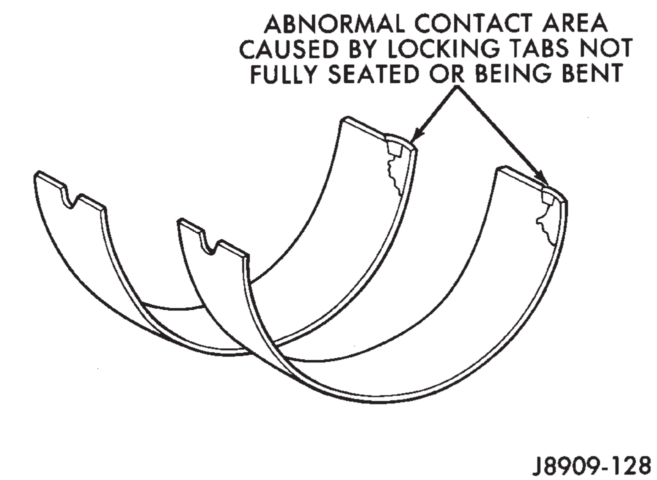


Fig. 14 Locking Tab Inspection

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.

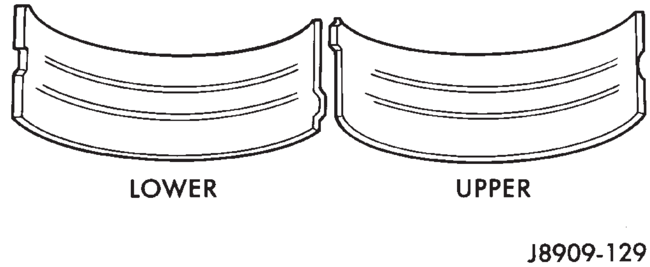


Fig. 15 Scoring Caused by Insufficient Lubrication or by Damaged Crankshaft Pin Journal

BEARING-TO-JOURNAL CLEARANCE

(1) Wipe the oil from the connecting rod journal.

(2) Use short rubber hose sections over rod bolts during installation.

(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. 16). 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.

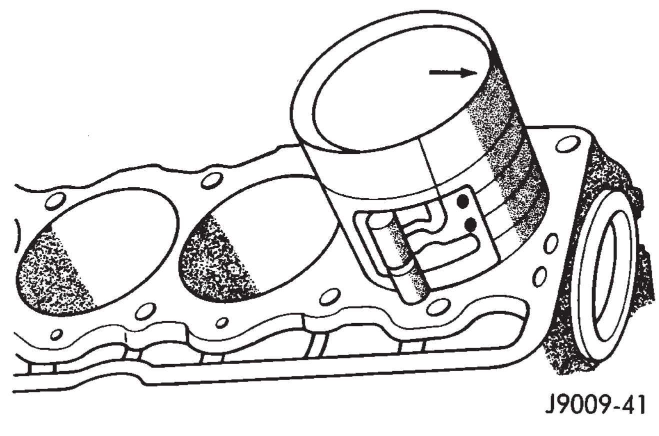


Fig. 16 Rod and Piston Assembly Installation

(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 center 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. 17). 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**

SERVICE PROCEDURES (Continued)

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).

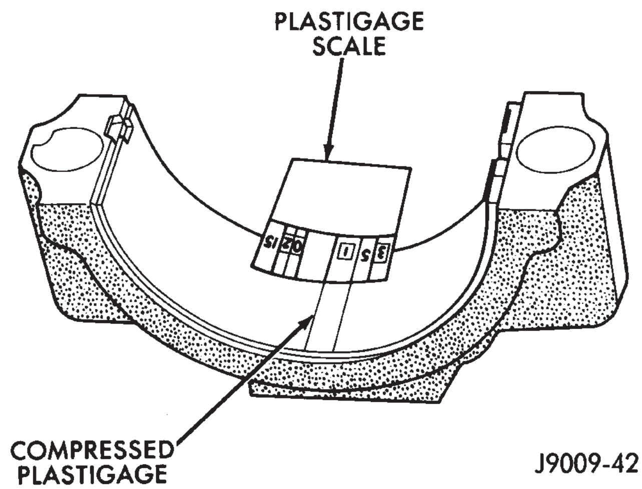


Fig. 17 Measuring Bearing Clearance with Plastigage

CONNECTING ROD BEARING FITTING CHART

CRANKSHAFT JOURNAL		CORRESPONDING 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.)

(11) **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).

(12) Repeat the Plastigage measurement to verify your bearing selection prior to final assembly.

(13) 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 (Fig. 18). Refer to Engine Specifications for the proper clearance. Replace the connecting rod if the side clearance is not within specification.

SERVICE PROCEDURES (Continued)

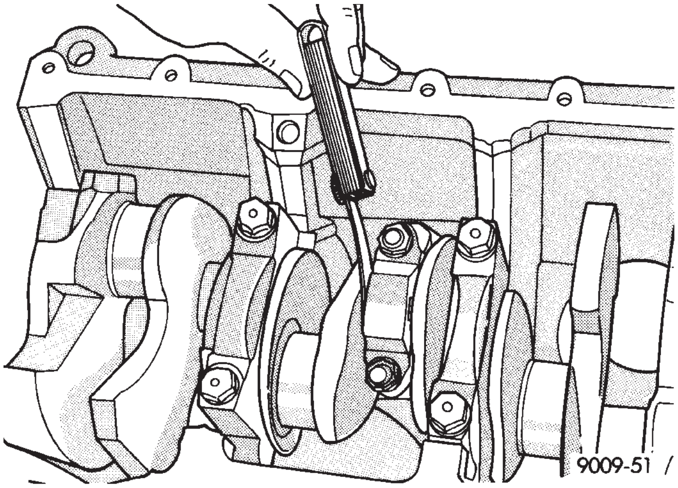


Fig. 18 Checking Connecting Rod Side Clearance—Typical

FITTING CRANKSHAFT MAIN BEARINGS

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. 19).

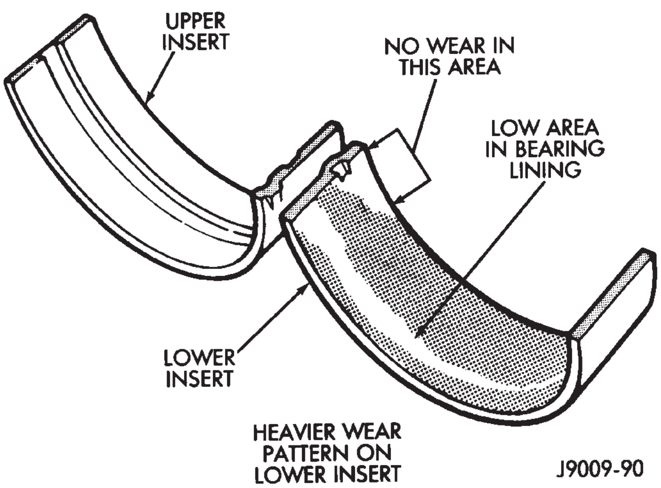


Fig. 19 Main Bearing Wear Patterns

NOTE: 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.

Replace all damaged or worn bearing inserts.

FITTING BEARINGS (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 (Fig. 20) on the adjacent cheek or counterweight towards the rear of the crankshaft (flange end). 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. 21).**

NOTE: 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.

NOTE: 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.

SERVICE PROCEDURES (Continued)

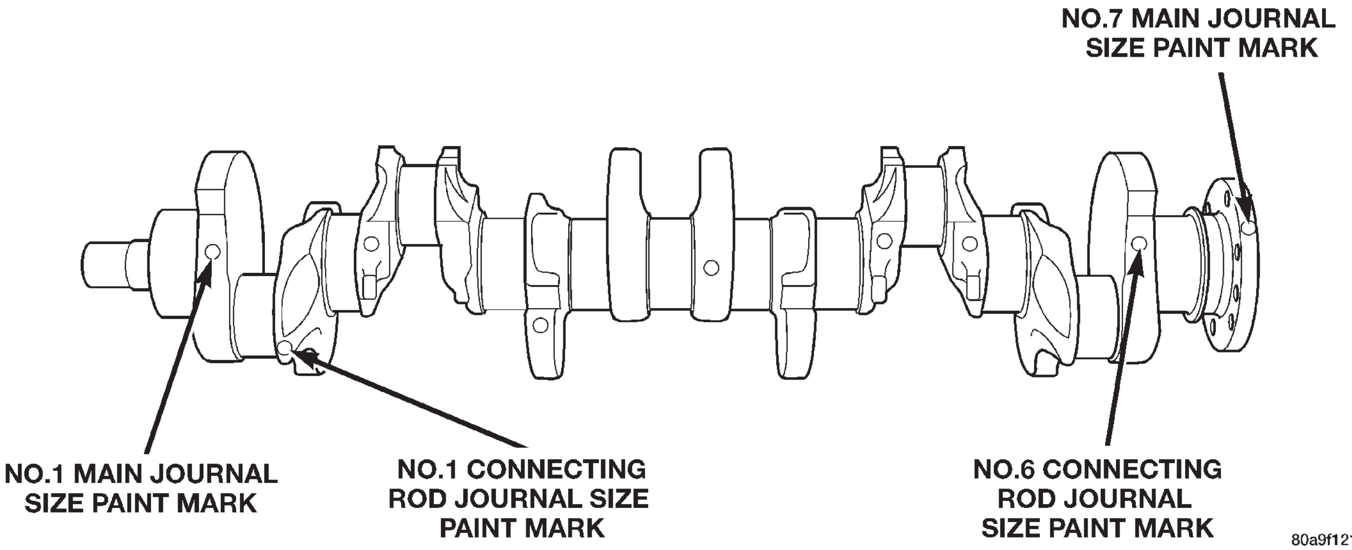


Fig. 20 Crankshaft Journal Size Paint I.D. Location

Insert	Correct	Incorrect
Upper	Standard	Standard
Lower	0.025 mm (0.001 in.) Undersize	0.051 mm (0.002 in.) Undersize

J9109-179

Fig. 21 Bearing Insert Pairs

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. 22). Refer to Engine Specifications for the proper clearance.

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 indicate 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

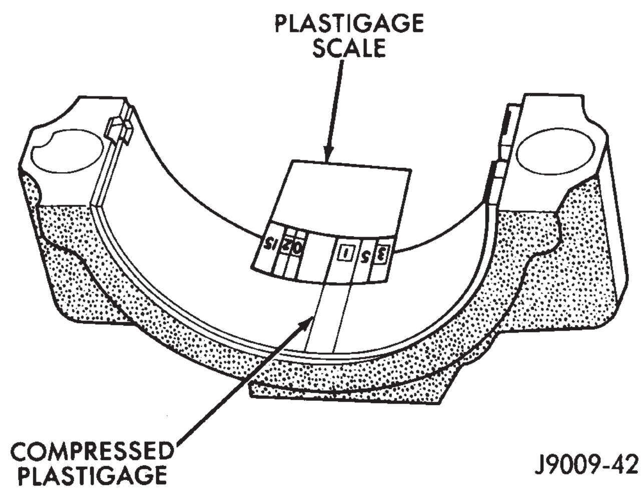


Fig. 22 Measuring Bearing Clearance with Plastigage

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).

SERVICE PROCEDURES (Continued)

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 (0.0015 in.) Undersize	Yellow - Standard	Blue - Undersize 0.025 mm (0.001 in.)
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 Journal #7 Only		Corresponding 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 (2.4996 - 2.4991 in.) 0.0127 mm (0.0005 in.) Undersize	Yellow - Standard	Blue - Undersize 0.025 mm (0.001 in.)
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.)

REMOVAL AND INSTALLATION

ENGINE MOUNTS—FRONT

The front mounts support the engine at each side. These insulators are made of resilient rubber.

REMOVAL

(1) Disconnect the negative cable from the battery.
(2) Raise the vehicle.
(3) Support the engine.
(4) Remove the insulator assembly-to-lower front sill bolts (Fig. 23) (Fig. 24).
(5) Raise the engine slightly.
(6) Remove the through bolt nut and through bolt. Remove the insulator (Fig. 23) (Fig. 24).
(7) If required, remove the engine bracket from the block.

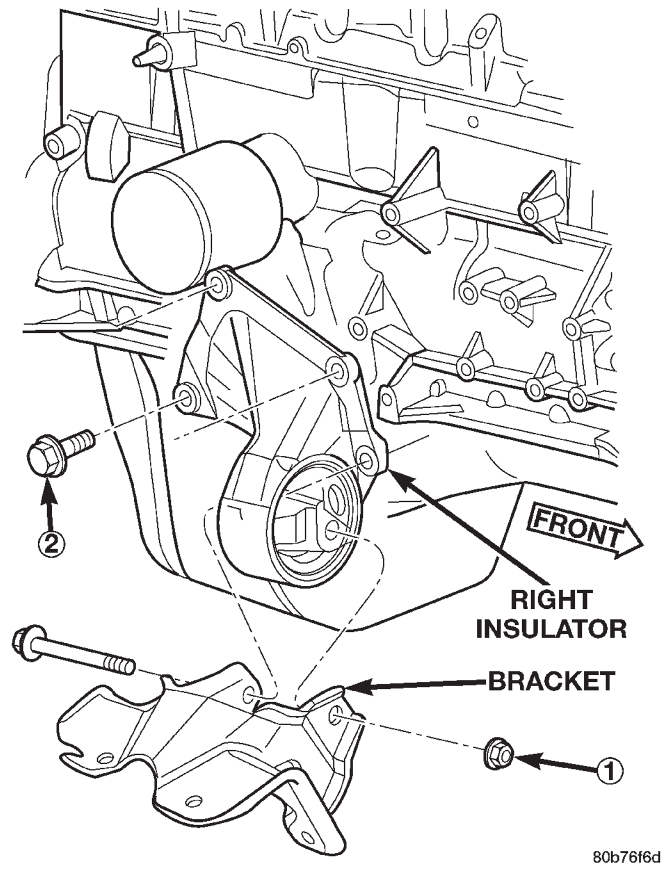


Fig. 23 Front Engine Mount—Right Side

INSTALLATION

(1) If removed, install the engine bracket to the block. 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 61 N·m (45 ft. lbs.) torque.
(3) With the engine insulator assembly and engine bracket in position, install the through bolt and nut .

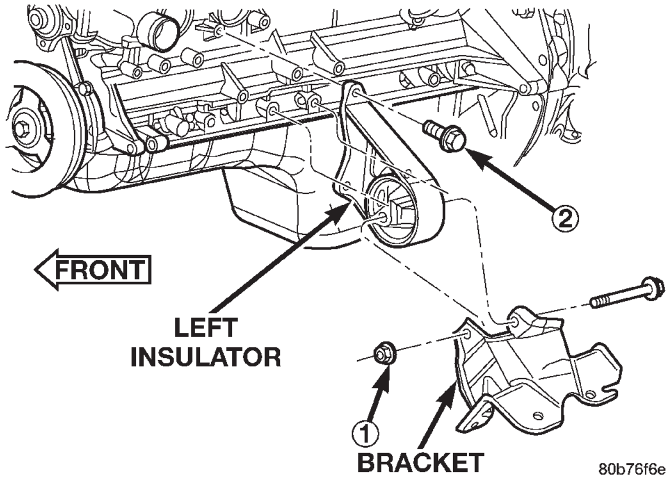


Fig. 24 Front Engine Mount—Left Side

ITEM	DESCRIPTION	TORQUE
1	NUT (Qty 1 Per side)	61 N·m (45 ft. lbs.)
2	Bolt (Qty 4 Per Side)	

Tighten the through bolt nut to 61 N·m (45 ft. lbs.) torque.
(4) Remove the engine support.
(5) Lower the vehicle.
(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.

REMOVAL

(1) Disconnect the negative cable from the battery.
(2) Raise the vehicle and support the transmission.
(3) Remove the bolts holding the isolator mount assembly to the transmission (Fig. 25) (Fig. 26).
(4) Raise the transmission SLIGHTLY.
(5) Remove the through bolt and nut. Remove the rear isolator mount assembly.
(6) If necessary, remove the bolts holding the rear mount bracket to the crossmember.

INSTALLATION

(1) Position the rear mount bracket assembly onto the crossmember and install the bolts. Tighten the bolts to 46 N·m (34 ft. lbs.)
(2) Position isolator mount into mount bracket and install through bolt and nut. DO NOT tighten the bolt at this time.
(3) Lower the transmission.
(4) Remove the transmission support.

REMOVAL AND INSTALLATION (Continued)

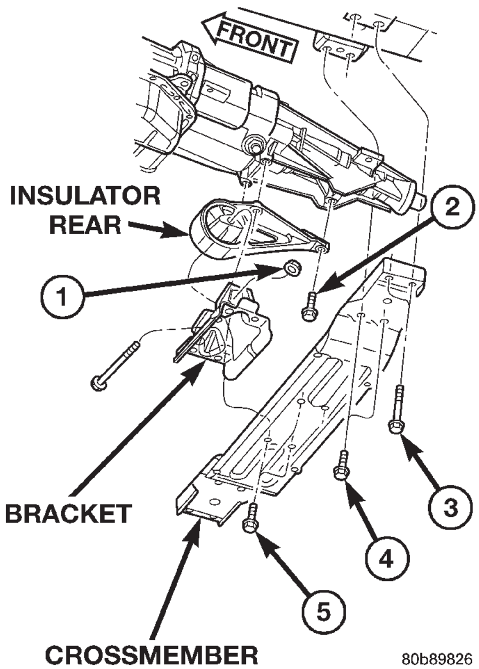


Fig. 25 Rear Engine Mount—(4X2)

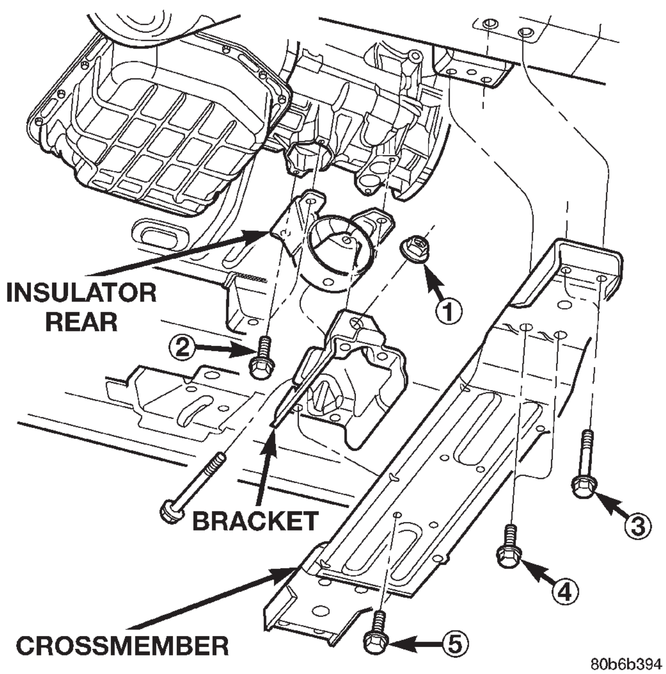


Fig. 26 Rear Engine Mount—(4X4)

(5) Install the mount fastening bolts and tighten to 54 N·m (40 ft. lbs.) torque.

(6) Tighten the through bolt nut to 50 N·m (37 ft. lbs.).

(7) Lower the vehicle.

(8) Connect the negative cable to the battery.

ITEM	DESCRIPTON	TORQUE
1	NUT (Qty 1)	45 N·m (33 ft. lbs.)
2	BOLT (Qty 4)	46 N·m (34 ft. lbs.)
3	BOLT (Qty 2 Per Side)	68 N·m (50 ft. lbs.)
4	BOLT (Qty 2 Per Side)	46 N·m (34 ft. lbs.)
5	BOLT (Qty 4)	46 N·m (34 ft. lbs.)

ENGINE BENDING BRACES

REMOVAL

The engine bending braces are used to add strength to the powertrain and to address some minor NVH concerns.

NOTE: Before the engine or the transmission can be removed the engine bending braces must be removed.

(1) Raise and support vehicle.

NOTE: Both left and right side bending braces are removed the sameway. Only the right side is shown.

NOTE: The exhaust does not require removal to preform this procedure.

(2) Remove the exhaust hanger bracket retaining bolt.

(3) Remove locknut and transmission bending brace bar.

(4) Remove engine-to-bending brace retaining bolt, bending brace bar and cross bar.

INSTALLATION

NOTE: DO NOT tighten the retaining hardware until all bending braces are in place.

(1) Position the cross brace into the engine-to-transmission brace, then position the engine-to-transmission brace and install retaining bolt.

(2) Position the transmission bending brace onto through brace and install new locknut.

(3) Position exhaust hanger and transmission brace, install retaining bolt (Fig. 28).

(4) Tighten engine-to-transmission brace retaining bolt (Fig. 27) to 40 N·m (30 ft. lbs.).

REMOVAL AND INSTALLATION (Continued)

(5) Tighten transmission brace retaining bolts (Fig. 28) to 40 N·m (30 ft. lbs.), then tighten transmission brace retaining lock nuts (Fig. 28) to 108 N·m (80 ft. lbs.).

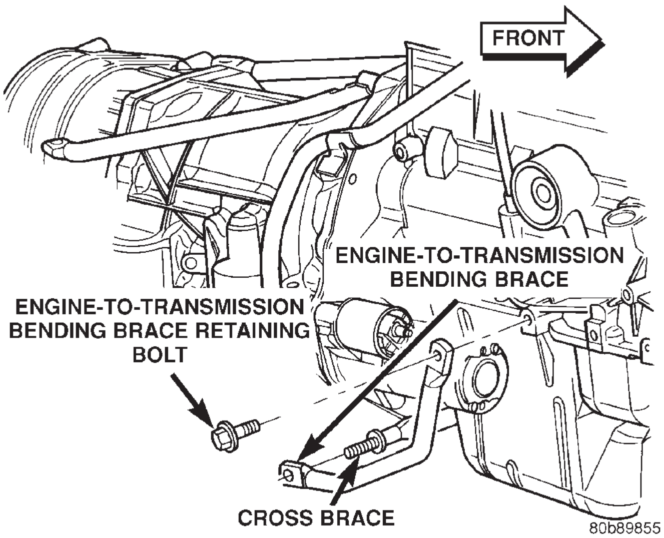


Fig. 27 Engine-to-Transmission Bending Braces

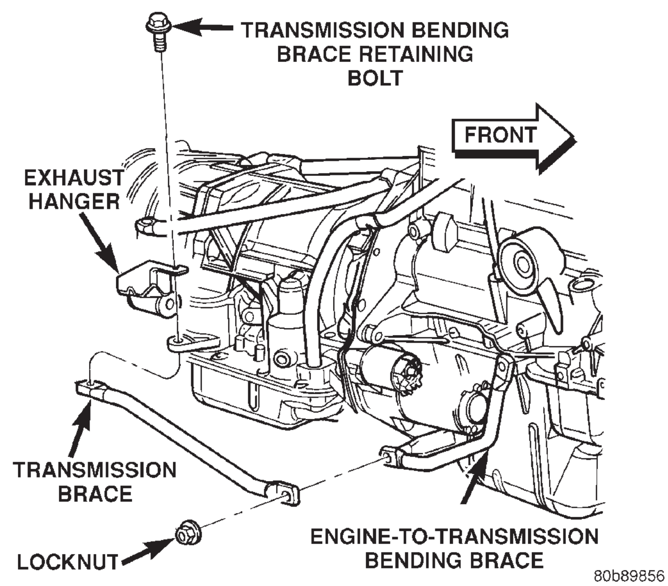


Fig. 28 Transmission Bending Braces and Exhaust Hanger

ENGINE ASSEMBLY

REMOVAL

(1) Disconnect the battery negative cable.

(2) Mark the hinge locations on the hood panel for alignment reference during installation. Remove the engine compartment lamp. Remove the hood.

(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. 29).

(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. 29).

(9) Disconnect the transmission fluid cooler lines (automatic transmission).

(10) Discharge the A/C system. (Refer to Group 24, Heating and Air Conditioning)

(11) Remove the service valves and cap the compressor ports.

(12) Remove the radiator or radiator/condenser (if equipped with A/C).

(13) Disconnect the heater hoses at the engine thermostat housing and water pump (Fig. 29).

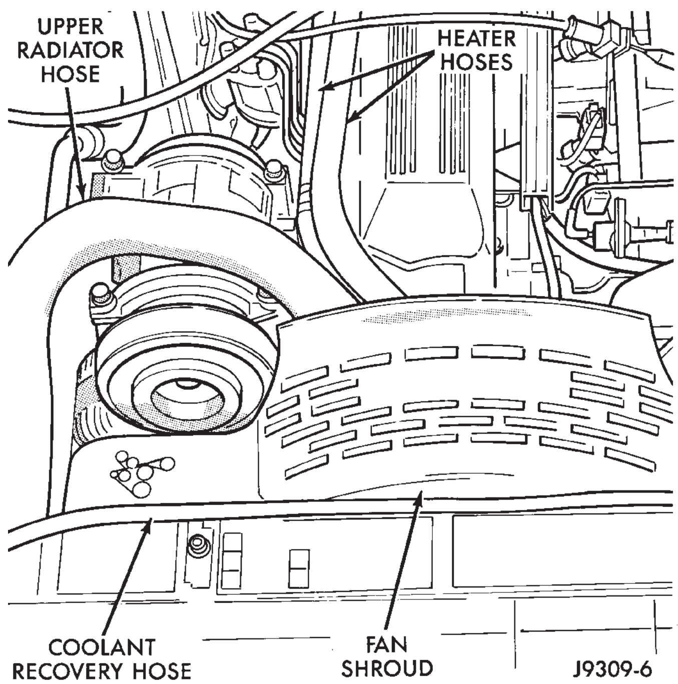


Fig. 29 Upper Radiator Hose, Coolant Recovery Hose, Fan Shroud & Heater hoses

(14) Disconnect the accelerator cable, transmission line pressure cable and speed control cable (if equipped) from the throttle body (Fig. 30).

(15) Remove cables from the bracket and secure out of the way.

(16) Disconnect the body ground at the engine.

(17) Disconnect the following connectors and secure their harness out of the way.

- Power steering pressure switch
- Coolant temperature sensor
- Six (6) fuel injector connectors

REMOVAL AND INSTALLATION (Continued)

- Intake air temperature sensor
- Throttle position sensor
- Map sensor
- Crankshaft position sensor
- Oxygen sensor
- Camshaft position sensor

(18) Disconnect the coil rail electrical connections and the oil pressure switch connector.

(19) Perform the fuel pressure release procedure. (Refer to Group 14, Fuel System for correct procedure)

(20) Disconnect the fuel supply line at the injector rail. (Refer to Group 14, Quick-Connect Fittings for the correct procedure)

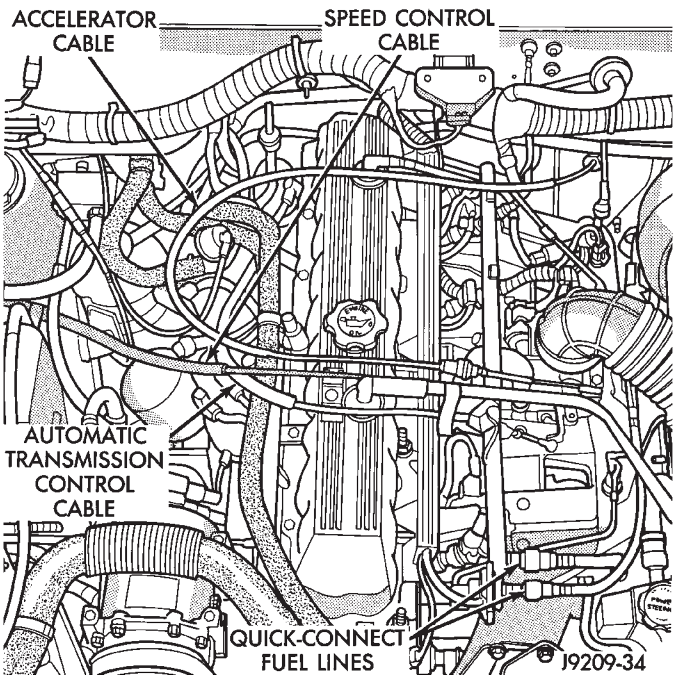


Fig. 30 Accelerator Cable, Vehicle Speed Control Cable, Automatic Transmission Control Cable & Quick-Connect Fuel Lines

(21) Remove the fuel line bracket from the intake manifold.

(22) Remove the air cleaner assembly (Fig. 31).

(23) Disconnect the hoses from the fittings at the steering gear.

(24) Drain the pump reservoir.

(25) Cap the fittings on the hoses and steering gear to prevent foreign objects from entering the system.

(26) Raise and support the vehicle.

(27) Disconnect the wires from the engine starter motor solenoid.

(28) Remove the engine starter motor.

(29) Disconnect the oxygen sensor from the exhaust pipe.

(30) Disconnect the exhaust pipe from the manifold.

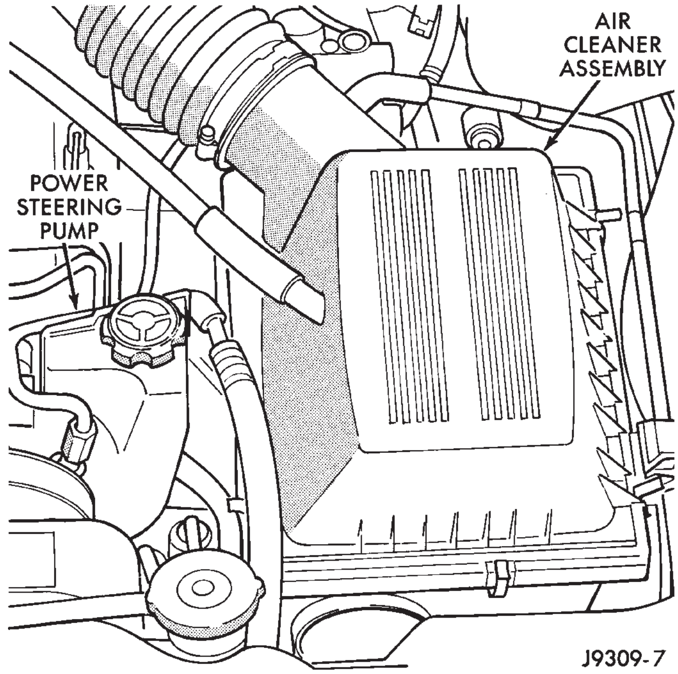


Fig. 31 Air Cleaner Assembly & Power Steering Pump

(31) Remove the exhaust pipe support.

(32) Remove the bending brace. Refer to Engine Bending Brace in this section for procedure.

(33) Remove the engine flywheel/converter housing access cover.

(34) Mark the converter and drive plate location.

(35) Remove the converter-to-drive plate bolts.

(36) Remove the upper engine flywheel/converter housing bolts and loosen the bottom bolts.

(37) Remove the engine mount cushion-to-engine compartment bracket bolts.

(38) Lower the vehicle.

(39) Attach a lifting device to the engine.

(40) Raise the engine off the front supports.

(41) Place a support or floor jack under the converter (or engine flywheel) housing.

(42) Remove the remaining converter (or engine flywheel) housing bolts.

(43) 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

REMOVAL AND INSTALLATION (Continued)

engine mount bracket as an aid in alignment of the engine to the transmission.

(2) Align the transmission torque converter housing with the engine.

(3) Loosely install the converter housing lower bolts and install the next higher bolt and nut on each side.

(4) Tighten all 4 bolts finger tight.

(5) Install the engine mount brackets (if removed).

(6) Lower the engine and engine mount brackets onto the engine compartment cushions. Install the bolts and finger tighten the nuts.

(7) Remove the engine lifting device.

(8) Raise and support the vehicle.

(9) Install the remaining engine flywheel/converter housing bolts. Tighten all bolts to 38 N·m (28 ft. lbs.) torque.

(10) Install the converter-to-drive plate bolts.

(11) Ensure the installation reference marks are aligned.

(12) Install the engine flywheel/converter housing access cover.

(13) Install the exhaust pipe support and tighten the screw.

(14) Install the engine bending brace.

(15) Tighten the engine mount-to-bracket bolts.

(16) Connect the vehicle speed sensor wire connections and tighten the screws.

(17) Connect the exhaust pipe to the manifold.

(18) Install the engine starter motor and connect the cable.

(19) Connect the wires to the engine starter motor solenoid.

(20) Lower the vehicle.

(21) Connect all the vacuum hoses and wire connectors identified during engine removal.

(22) Remove protective caps from the power steering hoses.

(23) Connect the hoses to the fittings at the steering gear. Tighten the nut to 52 N·m (38 ft. lbs.) torque.

(24) Fill the pump reservoir with fluid.

(25) Inspect the fuel supply line o-ring(s) and replace if necessary. Connect fuel supply line to injection rail and verify connection by pulling outward on the line.

(26) Install the fuel line bracket to the intake manifold.

(27) Connect the coil rail electrical connectors and oil pressure switch connector.

(28) Connect the following electrical connectors:

- Power steering pressure switch
- Coolant temperature sensor
- Six (6) fuel injector connectors
- Intake air temperature sensor
- Throttle position sensor
- Map sensor
- Crankshaft position sensor
- Oxygen sensor
- Camshaft position sensor

(29) Connect all previously removed vacuum hoses.

(30) Connect the body ground strap.

(31) Install the throttle, transmission line pressure, and speed control cables to their mounting bracket and connect them to the throttle body.

(32) Connect the heater hoses at the engine thermostat housing and water pump.

(33) Install the fan assembly to the water pump.

(34) Place the fan shroud in position over the fan.

(35) Install the radiator or radiator/condenser.

(36) Connect the service valves to the A/C compressor ports, if equipped with A/C.

(37) Charge the air conditioner system (refer to Group 24, Heating and Air Conditioning).

(38) Connect the radiator hoses and automatic transmission fluid cooler pipes, if equipped.

(39) Install the fan shroud to the radiator or radiator/condenser (if equipped with A/C).

(40) Install upper radiator support.

(41) Connect the upper radiator hose and tighten the clamp.

(42) Connect the lower radiator hose and tighten the clamp.

(43) Fill crankcase with engine oil. (Refer to Group 0, Lubrication and Maintenance for correct capacities.)

(44) Fill the cooling system with reusable coolant or new coolant (refer to Group 7, Cooling System).

(45) Align the hood to the scribe marks. Install the hood.

(46) Install the air cleaner assembly.

(47) 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.

(48) Start the engine, inspect for leaks and correct the fluid levels, as necessary.

INTAKE AND EXHAUST MANIFOLD

REMOVAL

NOTE: THE ENGINE INTAKE AND EXHAUST MANIFOLD MUST BE REMOVED AND INSTALLED TOGETHER. THE MANIFOLDS USE A COMMON GASKET AT THE CYLINDER HEAD.

REMOVAL AND INSTALLATION (Continued)

(1) Disconnect the battery negative cable.

(2) Remove air cleaner inlet hose from throttle body 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 the following electrical connections and secure their harness out of the way:

- Throttle Position Sensor
- Idle Air Control Motor
- Coolant Temperature Sensor (at thermostat housing)
- Intake Air Temperature Sensor
- Oxygen Sensor
- Crank Position Sensor
- Six (6) Fuel Injector Connectors

(6) Disconnect the Map Sensor, HVAC, and Brake Booster vacuum supply hoses at the intake manifold.

(7) Perform the fuel pressure release procedure. (Refer to Group 14, Fuel Systems for correct procedure)

(8) Disconnect and remove the fuel system supply line from the fuel rail assembly. (Refer to Group 14, Quick Connect Fittings for correct procedures)

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

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

(11) Raise the vehicle.

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

(13) Lower the vehicle.

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

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 Number 3 and finger tighten at this time (Fig. 32).

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

(4) Install washer and fastener Numbers 1, 2, 4, 5, 8, 9, 10 and 11 (Fig. 32).

(5) Install washer and fastener Numbers 6 and 7 (Fig. 32).

(6) Tighten the fasteners in sequence and to the specified torque (Fig. 32).

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

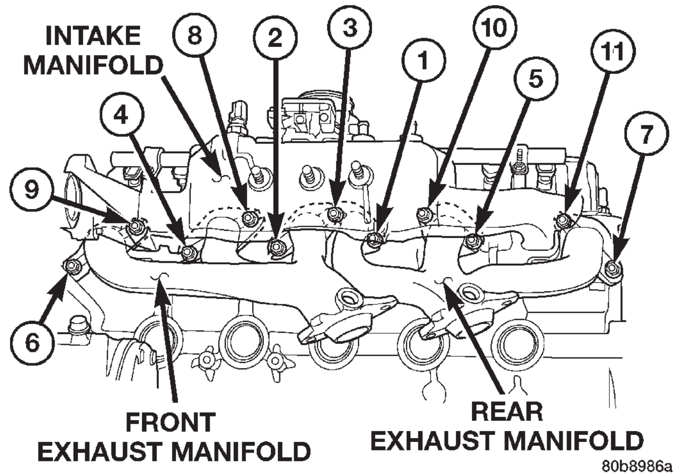


Fig. 32 Intake and Exhaust Manifolds—4.0L

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

(8) Install the fuel system supply line to the fuel rail assembly. **Before connecting the fuel supply line to the fuel rail inspect the O-rings and replace if necessary. Refer to Group 14, Fuel System for the correct procedure.**

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

(10) Connect the vacuum hoses previously removed.

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

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

(13) Install air cleaner assembly.

(14) Connect air inlet hose to the throttle body assembly.

(15) Raise the vehicle.

(16) Using a new exhaust manifold seal, connect the exhaust pipe to the engine exhaust manifold. Tighten the bolts to 31 N·m (23 ft. lbs.)

(17) Lower the vehicle.

(18) Connect the battery negative cable.

(19) Start the engine and check for leaks.

CYLINDER HEAD COVER

The cylinder head cover is isolated from the cylinder head via grommets and a reusable molded rubber gasket. The grommet and limiter are retained in the cylinder head cover.

REMOVAL AND INSTALLATION (Continued)

There are two cylinder head bolts that have a pin to locate the cylinder head cover gasket, they are located at position 8 and 9 (Fig. 34)

REMOVAL

(1) Disconnect negative cable from battery.

(2) Disconnect the Crankcase Ventilation (CCV) vacuum hose from engine cylinder head cover.

(3) Disconnect the fresh air inlet hose from the engine cylinder head cover.

(4) Disconnect the accelerator, transmission, and speed (if equipped) control cables from the throttle body (Fig. 33).

(5) Remove the three bolts that fasten the control cable bracket to the intake manifold.

(6) Remove control cables from cylinder head cover clip.

(7) Position control cables and bracket away from cylinder head cover secure with tie straps.

(8) Remove the engine cylinder head cover mounting bolts.

(9) Remove the engine cylinder head cover and gasket.

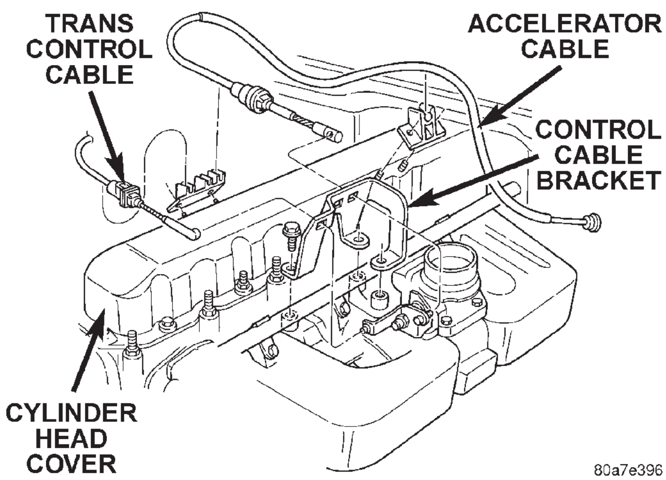


Fig. 33 Engine Cylinder Head Cover

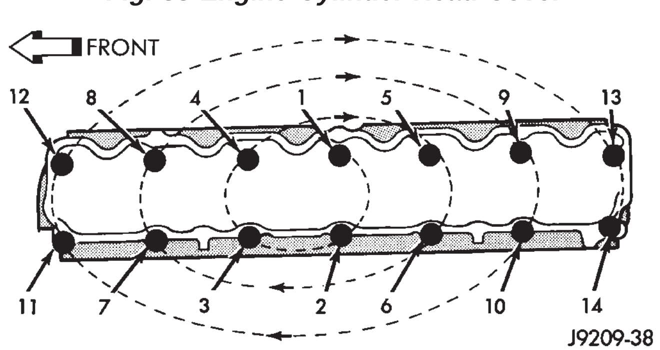


Fig. 34 Cylinder Head Cover Gasket Locator Pins at #8 & #9

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 cylinder head cover and gasket. Tighten the mounting bolts to 10 N·m (85 in. lbs.) torque.

(3) Connect the CCV hoses.

(4) Install control cables and bracket on intake manifold and tighten bolts to 8.7 N·m (77 in. lbs.) torque.

(5) Connect control cables to throttle body linkage.

(6) Snap control cables into cylinder head cover clip.

(7) Connect negative cable to battery.

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) Check for rocker arm bridges which are causing misalignment of the rocker arm to valve tip area.

(3) Remove the capscrews at each bridge and pivot assembly (Fig. 35). Alternately loosen the capscrews one turn at a time to avoid damaging the bridges.

(4) Remove the bridges, pivots and corresponding pairs of rocker arms (Fig. 35). 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.

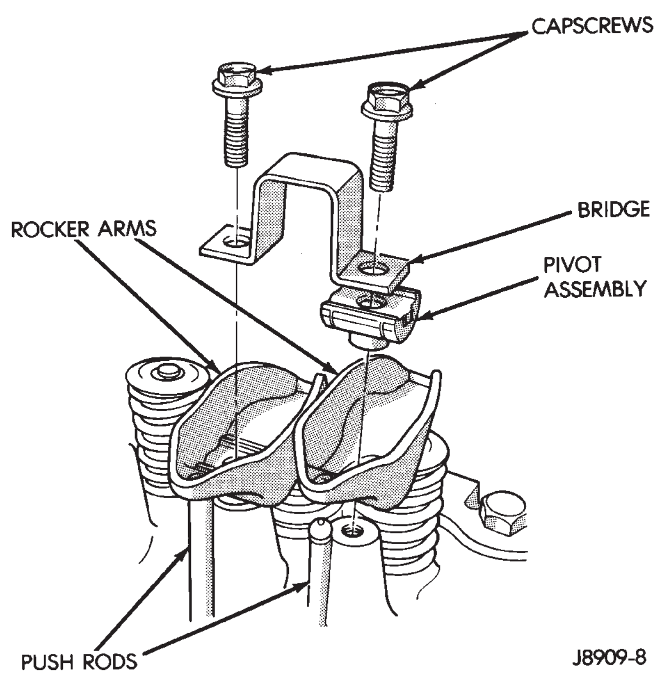


Fig. 35 Rocker Arm Assembly

REMOVAL AND INSTALLATION (Continued)

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 originally 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

This procedure can be done with the engine cylinder head installed on the block.

REMOVAL

Inspect the valve stems, especially the grooves for nicks, and high spots. If excessive nicks or high spots are found the valve or valves should be replaced.

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) 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.

(7) 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. 36).

(8) Remove valve spring and retainer (Fig. 36).

(9) Remove valve stem oil seals (Fig. 36). 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.

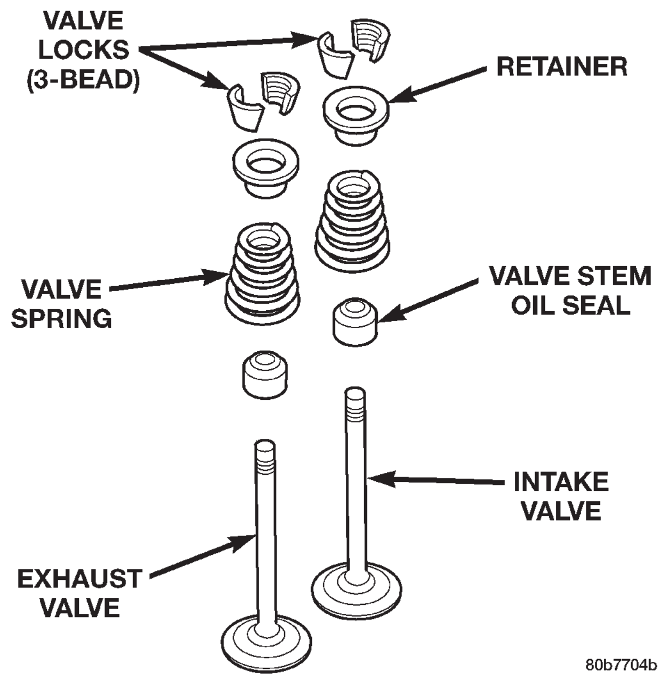


Fig. 36 Valve and Valve Components

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-998772A 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) Release air pressure and 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.

REMOVAL AND INSTALLATION (Continued)

CYLINDER HEAD

This procedure can be done with the engine in or out of the vehicle.

REMOVAL

(1) Disconnect the battery negative cable.

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 and the water pump inlet. 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.

(6) Remove the push rods. **Retain the push rods, bridges, pivots and rocker arms in the same order as removed.**

(7) Loosen the accessory drive belt at the power steering pump. (Refer to Group 7, Cooling System for the correct procedure). Slip the belt off of the power steering pulley.

(8) Remove the air conditioning compressor mounting bolts and secure the compressor to the side.

(9) Remove the power steering pump and bracket from the intake manifold and water pump. 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)

(11) Disconnect the fuel supply line at the fuel rail. (Refer to Group 14, Quick-Connect Fittings for the correct procedures)

(12) 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)

(13) Disconnect the coil rail electrical connectors and remove the coil rail.

(14) Remove spark plugs.

(15) Disconnect the temperature sending unit wire connector.

(16) Remove the engine cylinder head bolts. Bolt No.14 cannot be removed until the head is moved forward (Fig. 37). Pull bolt No.14 out as far as it will go and then suspend the bolt in this position (tape around the bolt).

(17) Remove the engine cylinder head and gasket (Fig. 37).

(18) 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.

(19) Stuff clean lint free shop towels into the cylinder bores.

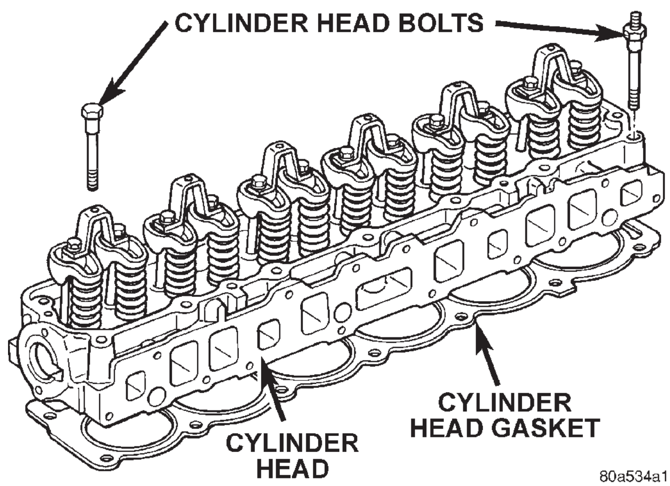


Fig. 37 Engine Cylinder Head Assembly

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) using the alignment dowels in the cylinder block, to position the gasket.

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 over the same dowels used to locate the gasket. Remove the tape from bolt No.14.

(4) Coat the threads of stud bolt No.11 with Loctite 592 sealant, or equivalent.

REMOVAL AND INSTALLATION (Continued)

(5) Tighten the engine cylinder head bolts in sequence according to the following procedure (Fig. 38).

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.

(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 13 N·m (100 ft. lbs.) torque.

• Bolts 12 through 14 to 149 N·m (110 ft. lbs.) torque.

CYLINDER HEAD BOLTS

POSITION	DESCRIPTION
1,4,5,12,13	1/2 in.-13 BOLT
8,9	1/2 in.-13 BOLT WITH DOWEL POINT
2,3,6,7,10,11,14	1/2 in.-13 WITH 7/16 in.-14 STUD END
All bolts are 12 point drives for rocker cover clearance	

(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.

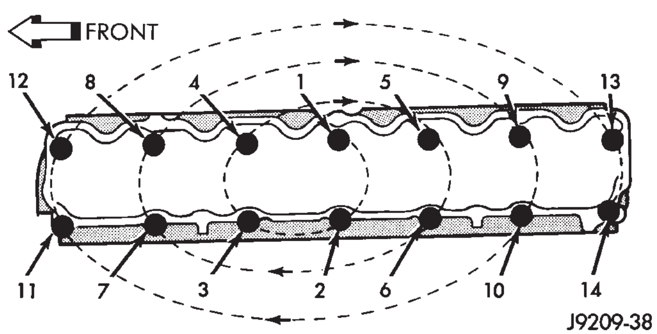


Fig. 38 Engine Cylinder Head Bolt Tightening Sequence

(6) Install the spark plugs and tighten to 37 N·m (27 ft. lbs.) torque.

(7) Connect the temperature sending unit wire connector.

(8) Install the ignition coil rail and coil rail electrical connectors.

(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 (refer to Rocker Arms and Push Rods in this section).

(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 line.

(23) If equipped with air conditioning, install air compressor and charge A/C system (refer to Group 24 Heating and Air Conditioning).

(24) Connect negative cable to battery.

(25) Connect the upper radiator hose and heater hose at the engine thermostat housing.

(26) 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.

REMOVAL AND INSTALLATION (Continued)

(27) 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 a 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.

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.

HYDRAULIC TAPPETS

Retain all the components in the same order as removed.

REMOVAL

(1) Remove the engine cylinder head (Refer to cylinder head r&i in this section).

(2) Remove the push rods.

(3) Remove the tappets through the push rod openings in the cylinder block with a Hydraulic Valve Tappet Removal/Installation Tool (Fig. 39).

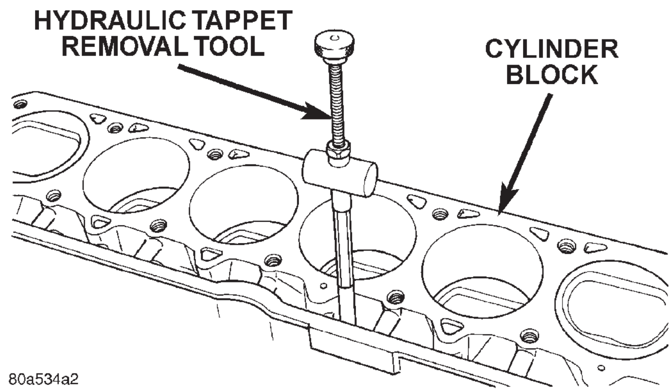


Fig. 39 Hydraulic Valve Tappet Removal—Installation Tool

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 to install each tappet in the same bore from where it was originally removed.

(3) Install the cylinder head assy (Refer to cylinder head r&i in this section).

(4) Install the push rods in their original locations.

(5) Install the rocker arms and bridge and pivot assemblies at their original locations. Loosely install the capscrews at each bridge.

(6) 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.

(7) 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.

(8) Install the engine cylinder head cover.

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 7697 to remove the damper from the crankshaft (Fig. 40).

REMOVAL AND INSTALLATION (Continued)

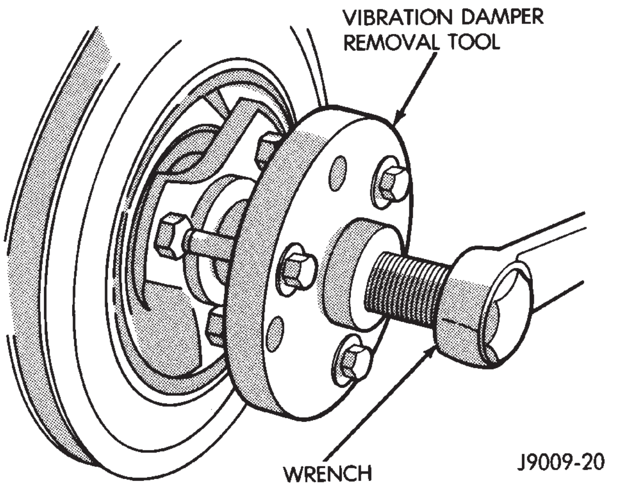


Fig. 40 Vibration Damper Removal Tool 7697

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 on 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.

(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.

(8) Pry the crankshaft oil seal from the front of the timing case cover (Fig. 41).

INSTALLATION

Clean the timing case cover, oil pan and cylinder block gasket surfaces.

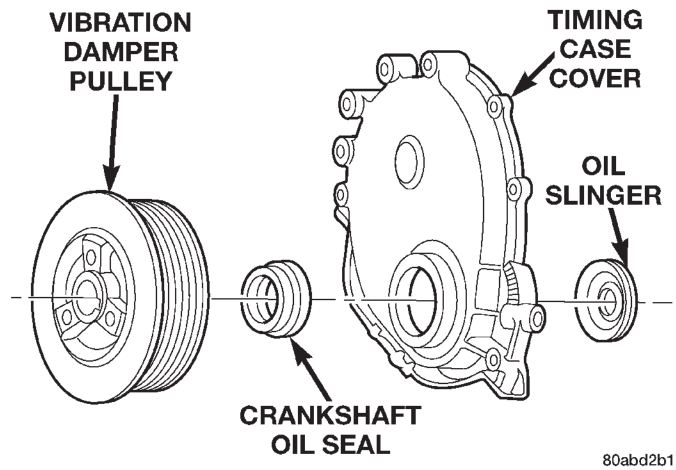


Fig. 41 Timing Case Cover Components

(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.

(4) Insert Timing Case Cover Alignment and Seal Installation Tool 6139 in the crankshaft opening in the cover (Fig. 42).

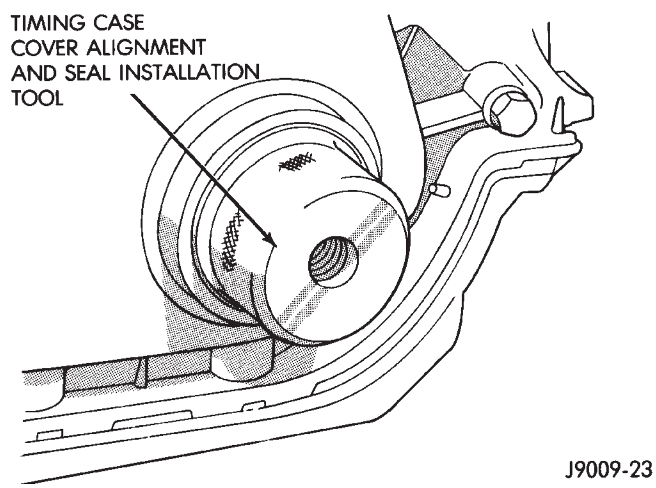


Fig. 42 Timing Case Cover Alignment and Seal Installation Tool 6139

(5) Install the timing case cover-to-cylinder block and the oil pan-to-timing case cover bolts.

(6) Tighten the 1/4 inch 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 9.5 N·m (84 in. lbs.) torque.

(7) Remove the cover alignment tool.

REMOVAL AND INSTALLATION (Continued)

(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 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. 43).

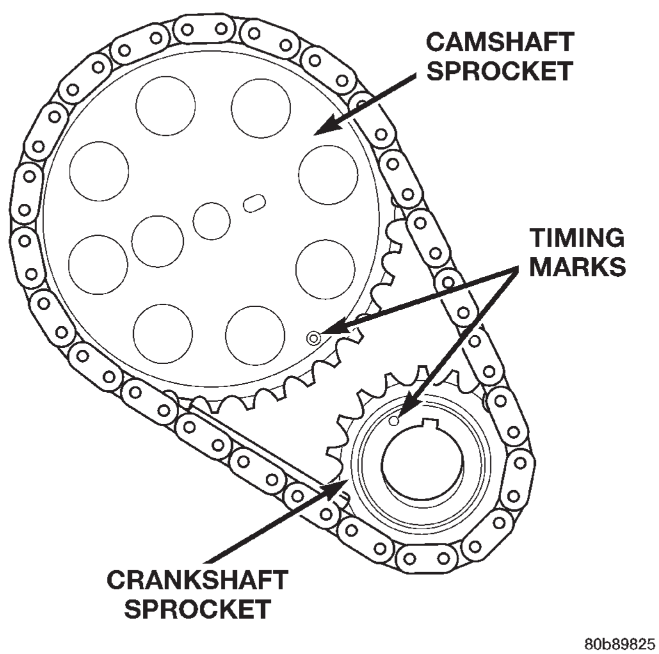


Fig. 43 Crankshaft—Camshaft Alignment

(7) Remove the oil slinger from the crankshaft.

(8) Remove the camshaft sprocket bolt and washer (Fig. 44).

(9) Remove the crankshaft sprocket, camshaft sprocket and timing chain as an assembly.

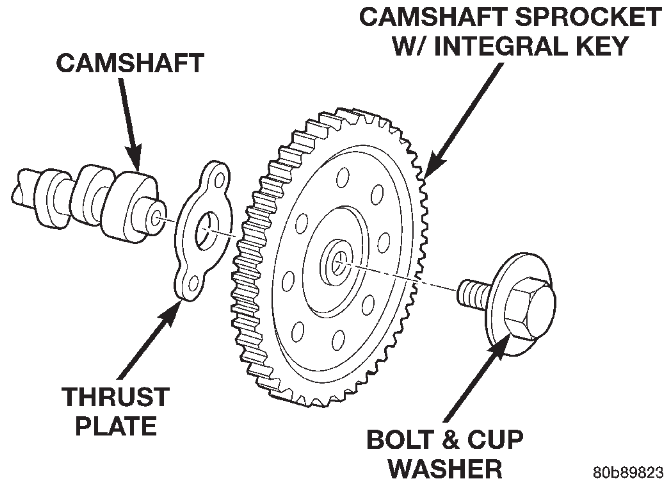


Fig. 44 Camshaft Sprocket and Thrust Plate

(10) 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.

INSTALLATION

Assemble the timing chain, crankshaft sprocket and camshaft sprocket with the timing marks aligned (Fig. 43).

(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 bolt and washer (Fig. 44). Tighten the bolt to 68 N·m (50 ft. lbs.) torque.

(3) To verify correct installation of the timing chain, rotate the crankshaft 2 revolutions. The camshaft and crankshaft sprocket timing mark should align (Fig. 43).

(4) Install the crankshaft oil slinger.

(5) Replace the oil seal in the timing case cover.

(6) Install the timing case cover and gasket.

(7) 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.

(8) Install the serpentine drive belt and tighten to the specified tension (refer to Group 7, Cooling System for the proper procedure).

(9) Install the fan and hub assembly. Install the shroud.

(10) Connect negative cable to battery.

REMOVAL AND INSTALLATION (Continued)

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 and condenser, if equipped with A/C (refer to Group 7, Cooling System for the proper procedure).

(4) Remove the distributor cap and mark the position of the rotor.

(5) Remove the front fascia and/or grille, as required.

(6) Disconnect camshaft position sensor electrical connector and remove camshaft position sensor.

(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 block.

(12) Remove the vibration damper.

(13) Remove the timing case cover.

(14) Remove the timing chain and sprockets.

(15) Remove the two thrust plate retaining screws and thrust plate.

(16) Remove the camshaft (Fig. 45).

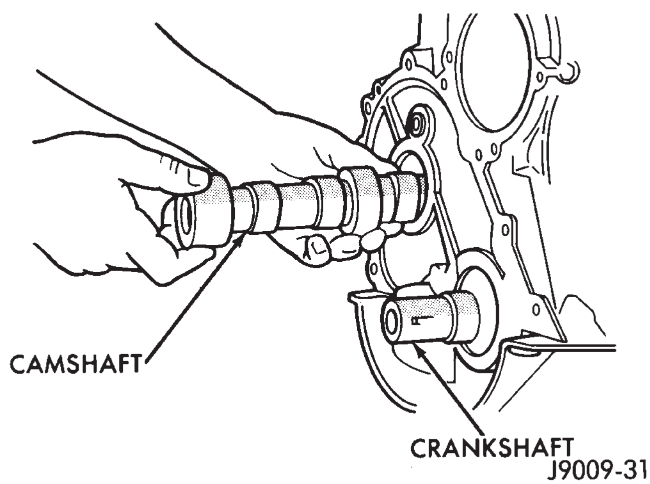


Fig. 45 Camshaft

INSTALLATION

(1) Inspect the cam lobes for wear.

(2) Inspect the bearing journals for uneven wear pattern or finish.

(3) Inspect the bearings for wear.

(4) Inspect the distributor drive gear for wear.

(5) If the camshaft thrust surface appears to have excessive wear, examine the oil pressure relief holes in the rear cam journal. The oil pressure relief holes must be free of debris.

(6) Lubricate the camshaft with Mopar Engine Oil Supplement, or equivalent.

(7) Carefully install the camshaft to prevent damage to the camshaft bearings (Fig. 45).

(8) Inspect thrust plate surfaces for excessive wear, position thrust plate and install retaining screws. Tighten screws to 24 N·m (18 ft. lbs.).

(9) Install the timing chain, crankshaft sprocket and camshaft sprocket with the timing marks aligned.

(10) Install the camshaft sprocket bolt / cup washer. Tighten the bolt to 68 N·m (50 ft. lbs.).

(11) Install the timing case cover with a replacement oil seal (Fig. 46). Refer to Timing Case Cover Installation.

(12) Install the vibration damper (Fig. 46).

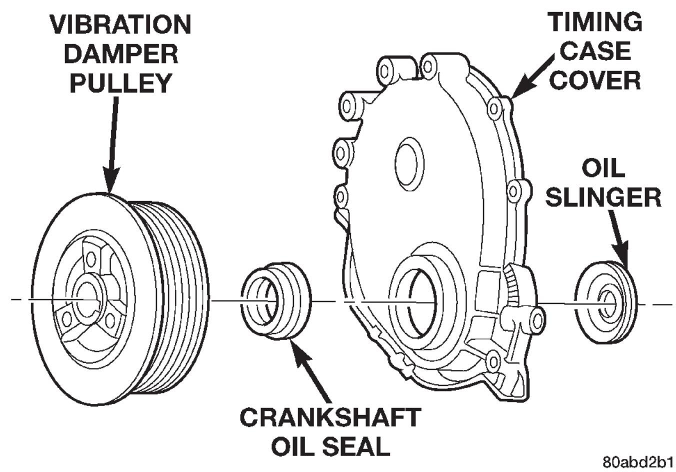


Fig. 46 Timing Case Cover Components

(13) Install the hydraulic valve tappets.

(14) Install the cylinder head gasket with the numbers facing up.

(15) Install the cylinder head and head bolts (Refer to cylinder head R&I in this section for torque values and tightening sequence).

(16) Install the push rods.

(17) 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 (Refer to Rocker Arms and Push Rods in this section).

(18) Install the engine cylinder head cover.

(19) Position the oil pump gear. Refer to Camshaft position sensor in the Component Removal/Installation section of Group 14, Fuel Systems.

(20) Install the Camshaft position sensor and ignition coil rail. Refer to Camshaft position sensor in

REMOVAL AND INSTALLATION (Continued)

the Component Removal/Installation section of Group 14, Fuel Systems.

(21) Install the serpentine drive belt and tighten to the specified tension (refer to Group 7, Cooling System for the proper procedure).

NOTE: 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 1609 km (1,000 miles). The oil supplement need not be drained until the next scheduled oil change.

(22) 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.

(23) 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).

(24) Install the grille and fascia, if removed.

(25) Connect negative cable to battery.

CAMSHAFT BEARINGS

REMOVAL

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. Camshaft end play is maintained by the thrust plate.

(1) Remove the camshaft. Refer to Camshaft in this section for procedure.

NOTE: It is not advisable to attempt to replace camshaft bearings unless special removal and installation tools are available.

(2) Using Special tool, remove the camshaft bearings.

INSTALLATION

(1) Inspect the camshaft bearing journals for uneven wear pattern or finish.

(2) Inspect the camshaft lobes and distributor gear for wear.

(3) Inspect the camshaft thrust plate for wear. If the plate shows excessive wear inspect the camshaft oil pressure relief holes in the rear cam jounral. The relief holes must be clean and free of debris.

CAUTION: Make sure outside diameter of number 1 bearing is clean. Make sure that the bearing is properly installed in the engine block, align the oil hole in the bearing with the oil gallery in the bearing bore. Failure to do so will cause inadequate oil supply for the sprockets and timing chain.

(4) Using special tool, install new camshaft bearings.

(5) Lubricate the camshaft with Mopar® engine oil supplement, or equivalent.

(6) Carefully install the camshaft to prevent damage to the camshaft bearings

(7) Position the thrust plate and install the two retaining screws. Tighten screws to 24 N·m (18 ft. lbs.).

(8) Install the camshaft sprocket, crankshaft sprocket and timing chain with the timing marks aligned. Install the sprocket bolt.

(9) Tighten the camshaft sprocket bolt and washer to 68 N·m (50 ft. lbs.).

(10) To verify correct installation of the timing chain, turn the crankshaft two full revolutions then position the camshaft sprocket timing mark as shown in (Fig. 47). Count the number of chain pins between the timing marks of both sprockets. There must be 21 pins.

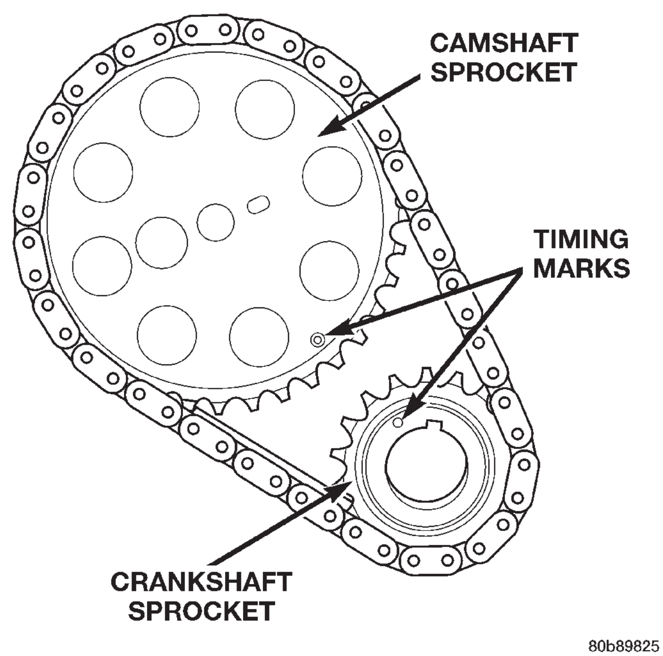


Fig. 47 Verify Crankshaft—Camshaft Installation—Typical

(11) Install the timing chain cover refer to the procedure in this section.

REMOVAL AND INSTALLATION (Continued)

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 main bearing cap brace (Fig. 48).

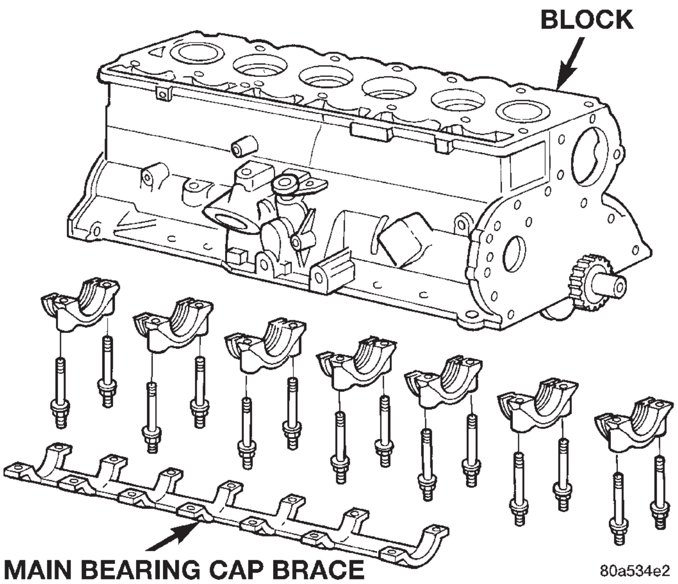


Fig. 48 Main Bearing Caps and Brace.

(6) Remove only one main bearing cap and lower insert at a time (Fig. 49).

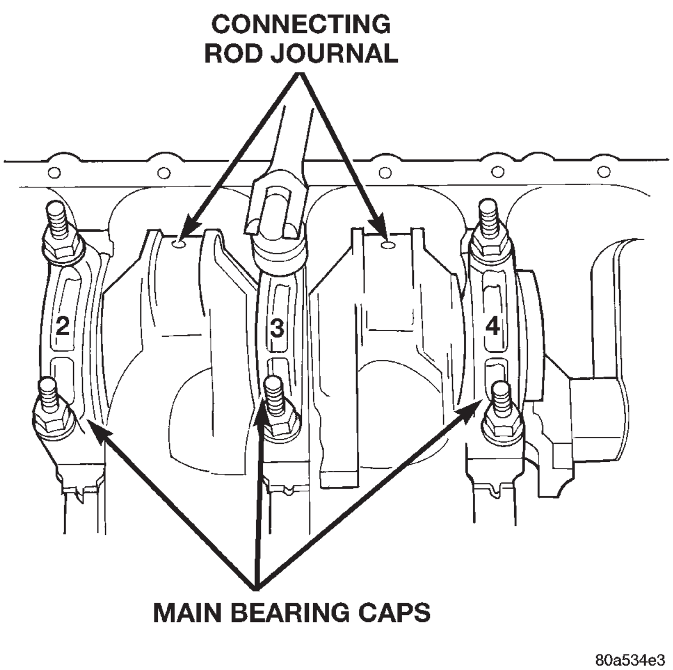


Fig. 49 Removing Main Bearing Caps and Lower Inserts

(7) Remove the lower insert from the bearing cap.

(8) 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. 50). 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. 50). After moving the insert approximately 25 mm (1 inch), it can be removed by applying pressure under the tab.

(9) Using the same procedure described above, remove the remaining bearing inserts one at a time for inspection.

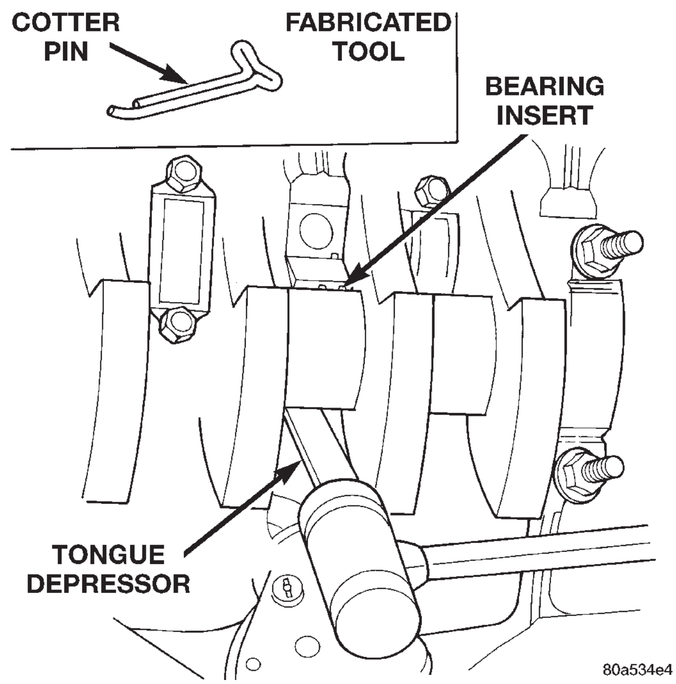


Fig. 50 Removing Upper Inserts

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

REMOVAL AND INSTALLATION (Continued)

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. 51). 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.

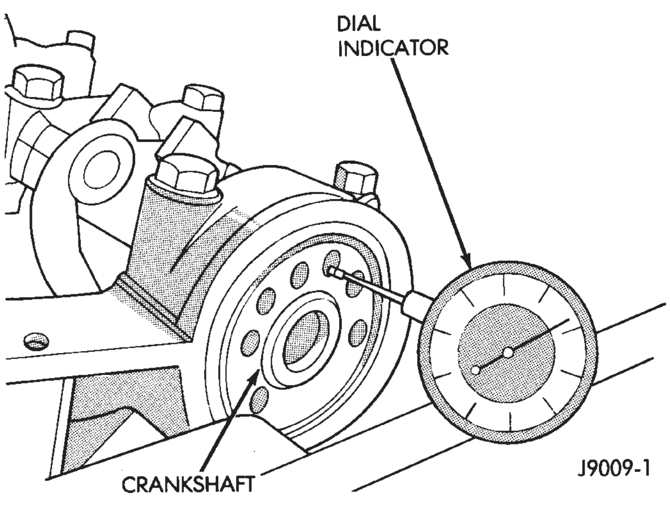


Fig. 51 Crankshaft End Play Measurement

(9) If the crankshaft was removed, install the crankshaft into the cylinder block (refer to Cylinder Block - Assemble).

(10) Install main bearing cap brace tighten nuts to 47 N·m (35 ft. lbs.) torque.

(11) Install oil pump assy. and tighten attaching bolts to 23 N·m (17 ft. lbs.)

(12) Install the oil pan.

(13) Install the drain plug. Tighten the plug to 34 N·m (25 ft. lbs.) torque.

(14) Lower the vehicle.

(15) Install the spark plugs. Tighten the plugs to 37 N·m (27 ft. lbs.) torque.

(16) Fill the oil pan with engine oil to the full mark on the dipstick level.

(17) 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 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 and 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 through bolts.

(12) Using the jack stand, raise the engine until adequate clearance is obtained to remove the oil pan.

(13) Remove transmission oil cooling lines (if equipped) and oxygen sensor wiring supports that are attached to the oil pan studs.

(14) Remove the oil pan bolts and studs. Carefully slide the oil pan and gasket to the rear. If equipped with an oil level sensor, take care not to damage the sensor.

INSTALLATION

(1) Clean the block and pan gasket surfaces.

(2) Fabricate 4 alignment dowels from 1 1/2 x 1/4 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. 52).

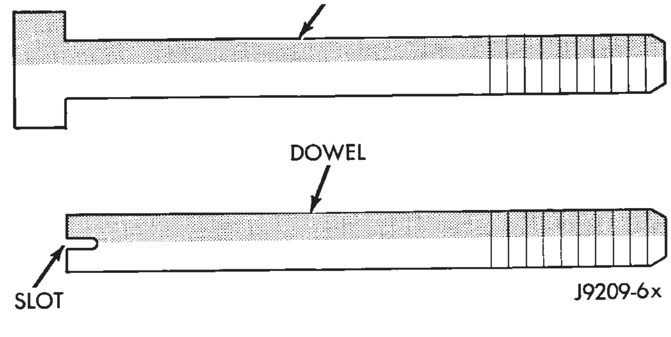


Fig. 52 Fabrication of Alignment Dowels

REMOVAL AND INSTALLATION (Continued)

(3) Install two dowels in the timing case cover. Install the other two dowels in the cylinder block (Fig. 53).

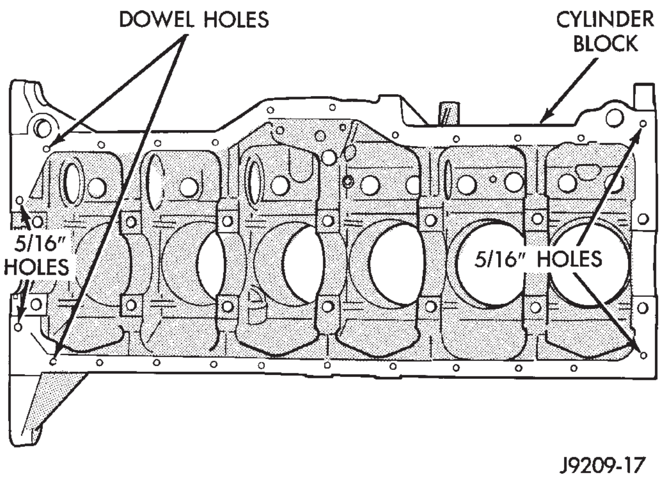


Fig. 53 Position of Dowels in Cylinder Block

(4) Apply Mopar® Silicone Rubber Adhesive Sealant on cylinder block to rear main bearing cap corners and cylinder block to front cover joints (four places) (Fig. 54).

(5) Slide the one-piece gasket over the dowels and onto the block and timing case cover.

(6) 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.

(7) Install the 1/4 inch oil pan bolts. Tighten these bolts to 9.5 N·m (84 in. lbs.) torque. Install the 5/16 inch oil pan bolts (Fig. 55). Tighten these bolts to 15 N·m (132 in. lbs.) torque.

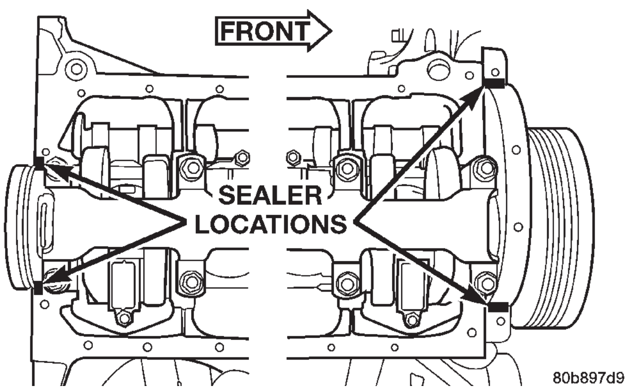


Fig. 54 Oil Pan Sealer Location

(8) Remove the dowels. Install the remaining 1/4 inch oil pan bolts. Tighten these bolts to 9.5 N·m (84 in. lbs.) torque.

(9) Lower the engine until it is properly located on the engine mounts.

(10) Install the through bolts and tighten the nuts.

(11) Lower the jack stand and remove the piece of wood.

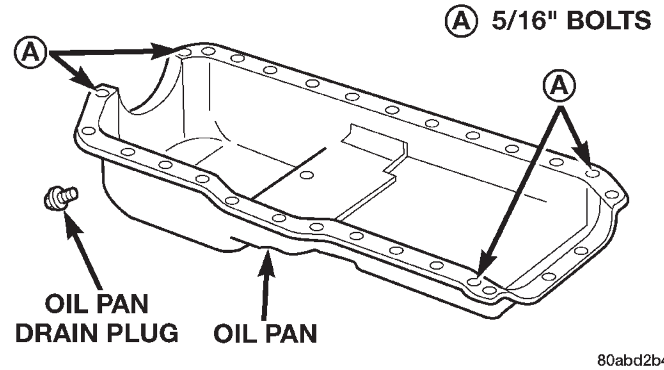


Fig. 55 Position of 5/16 inch Oil Pan Bolts

(12) Install the engine flywheel and transmission torque converter housing access cover.

(13) Install the engine starter motor.

(14) Connect the exhaust pipe to the hanger and to the engine exhaust manifold.

(15) Install transmission oil cooling lines (if equipped) and oxygen sensor wiring supports that attach to the oil pan studs.

(16) Install the oil pan drain plug (Fig. 55). Tighten the plug to 34 N·m (25 ft. lbs.) torque.

(17) Lower the vehicle.

(18) Connect negative cable to battery.

(19) 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.

(20) Start the engine and inspect for leaks.

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 main bearing cap brace (Fig. 56).

(10) 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. 57).

REMOVAL AND INSTALLATION (Continued)

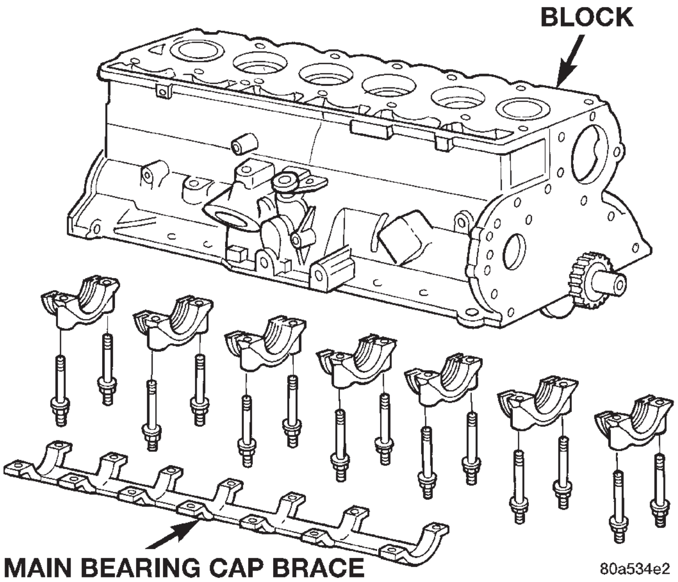


Fig. 56 Main Bearings Caps and Brace

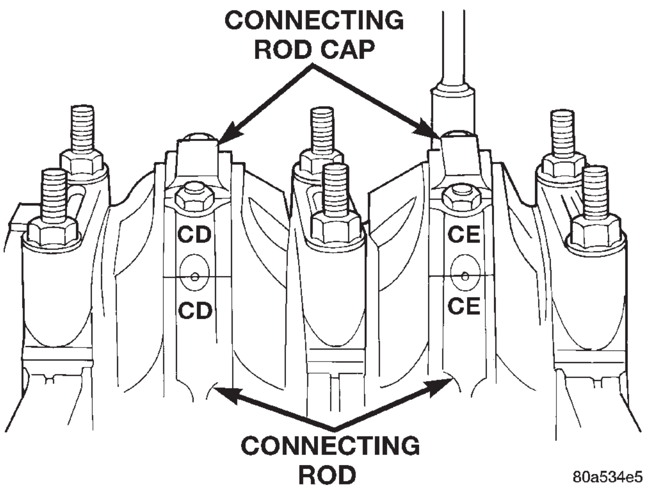


Fig. 57 Stamped Connecting Rods and Caps

(11) 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.

(12) Have an assistant push the piston and connecting rod assemblies up and through the top of the cylinder bores (Fig. 58).

INSTALLATION

(1) Clean the cylinder bores thoroughly. Apply a light film of clean engine oil to the bores with a clean lint-free cloth.

(2) Install the piston rings on the pistons if removed.

(3) Lubricate the piston and rings with clean engine oil.

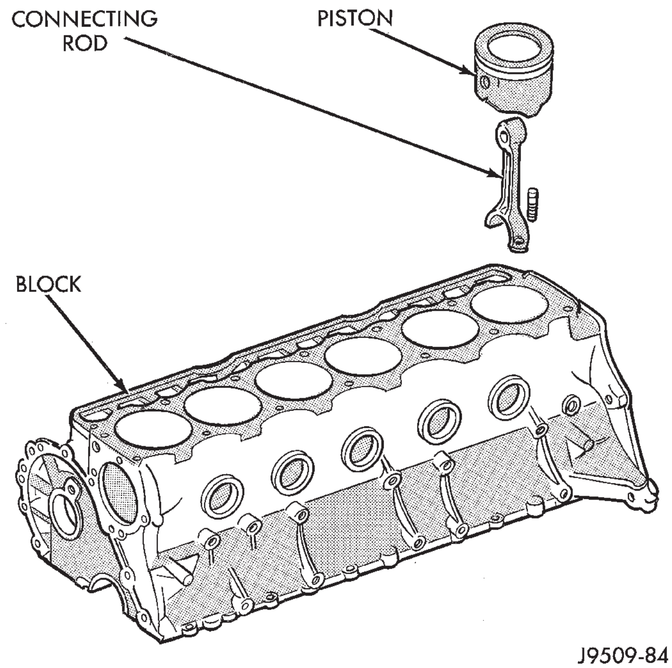


Fig. 58 Removal of Connecting Rod and Piston Assembly

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.

(4) Use a piston ring compressor to install the connecting rod and piston assemblies through the top of the cylinder bores (Fig. 59).

(5) Ensure the arrow on the piston top points to the front of the engine (Fig. 59).

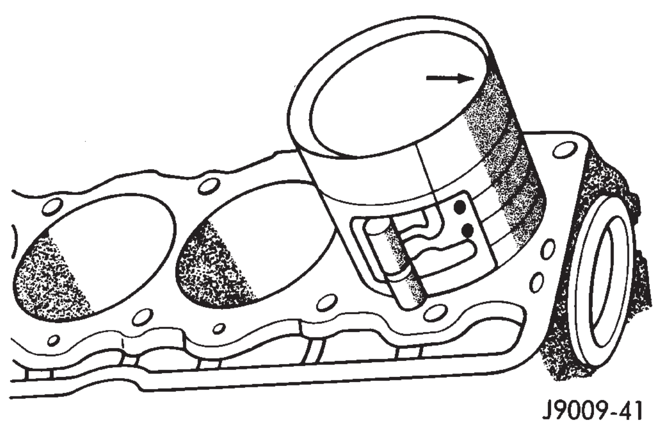


Fig. 59 Rod and Piston Assembly Installation

(6) Raise the vehicle.

(7) 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.

(8) 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.

(9) 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.

(10) 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.

(11) Install main bearing cap brace (Fig. 56). Tighten nuts to 47 N·m (35 ft. lbs.).

(12) Install the oil pan and gaskets as outlined in the installation procedure.

(13) Lower the vehicle.

(14) Install the engine cylinder head, push rods, rocker arms, bridges, pivots and engine cylinder head cover.

(15) Fill the crankcase with engine oil.

CRANKSHAFT OIL SEALS—REAR

The crankshaft rear main bearing oil seal consists of two half pieces of viton with a single lip that effectively seals the rear of the crankshaft. Replace the upper and lower seal halves as a unit to ensure leak-free operation.

REMOVAL

(1) Remove transmission inspection cover.

(2) Remove oil pan. Refer to procedure in this section

(3) Remove main bearing cap brace.

(4) Remove rear main bearing cap (No.7).

(5) Push upper seal out of the groove. Ensure that the crankshaft and seal groove are not damaged.

(6) Remove 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 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) Apply Mopar® Gasket Maker sealer on both sides of cylinder block as shown in (Fig. 60). The dab of sealer should be 3 mm (0.125 in.) in diameter.

(6) Apply Mopar® Gasket Maker on the rear bearing cap (Fig. 60). The bead should be 2.3 mm (0.09 in.) in diameter. DO NOT apply sealer to the lip of the seal.

(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) Coat the outer curved surface of the lower seal with soap and the lip of the seal with engine oil.

(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 main bearing cap brace. Tighten nuts to 47 N·m (35 ft. lbs.).

(12) Install the oil pan gasket and oil pan. Tighten 1/4 – 20 screws to 14 N·m (120 in. lbs.). Tighten 5/16 – 18 screws to 18 N·m (156 in. lbs.)

(13) Apply Mopar® Silicone Rubber Adhesive Sealant on cylinder block to rear main bearing cap corners and cylinder block to front cover joints (four places) (Fig. 61)

(14) Install transmission inspection cover.

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.

REMOVAL

(1) Drain the engine oil.

(2) Remove the oil pan.

REMOVAL AND INSTALLATION (Continued)

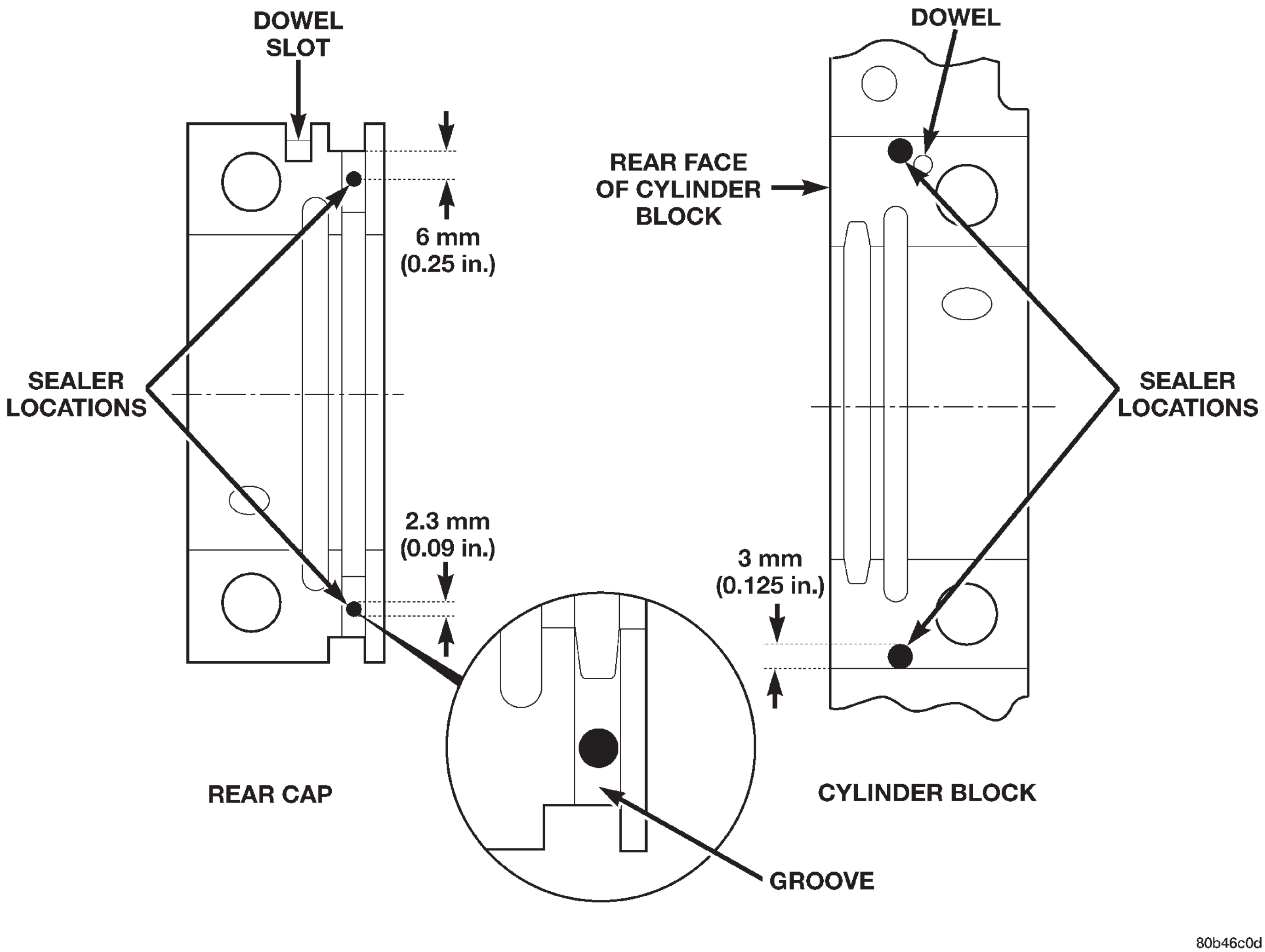


Fig. 60 Location of Sealer

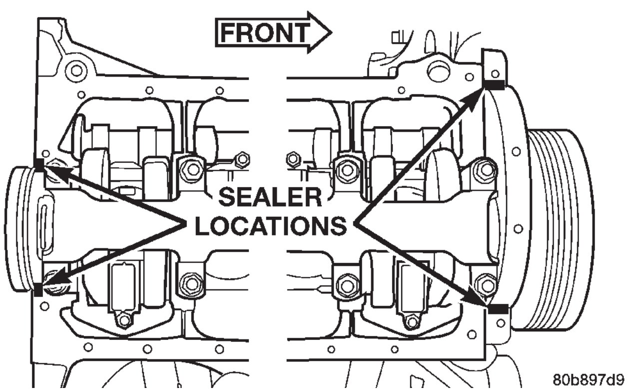


Fig. 61 Oil Pan Sealer Location

(3) Remove the pump-to-cylinder block attaching bolts. Remove the pump assembly with gasket (Fig. 62).

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.

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.

REMOVAL AND INSTALLATION (Continued)

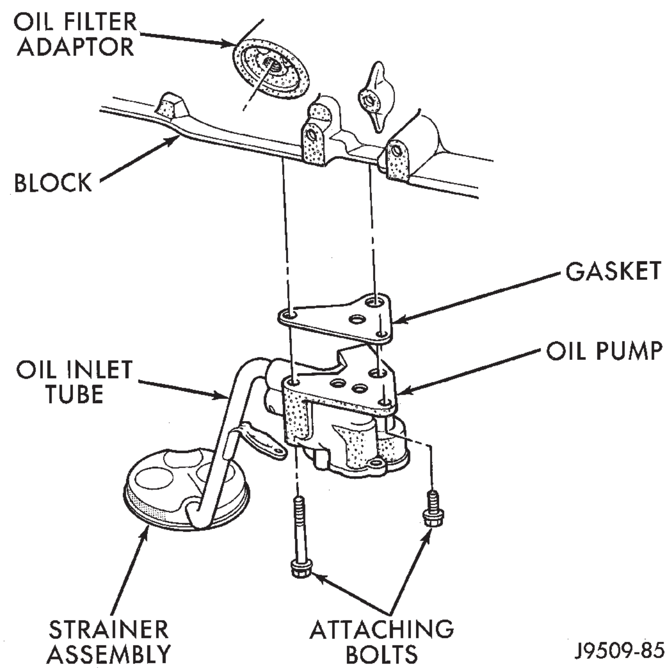


Fig. 62 Oil Pump Assembly

TIMING CASE COVER OIL SEAL

This procedure is done with the timing case cover installed.

REMOVAL

(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.

INSTALLATION

(1) 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.

(2) Position the tool and seal over the end of the crankshaft and insert a draw screw tool into Seal Installation Tool 6139 (Fig. 63). Tighten the nut against the tool until it contacts the cover.

(3) Remove the tools. Apply a light film of engine oil on the vibration damper hub contact surface of the seal.

(4) 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.

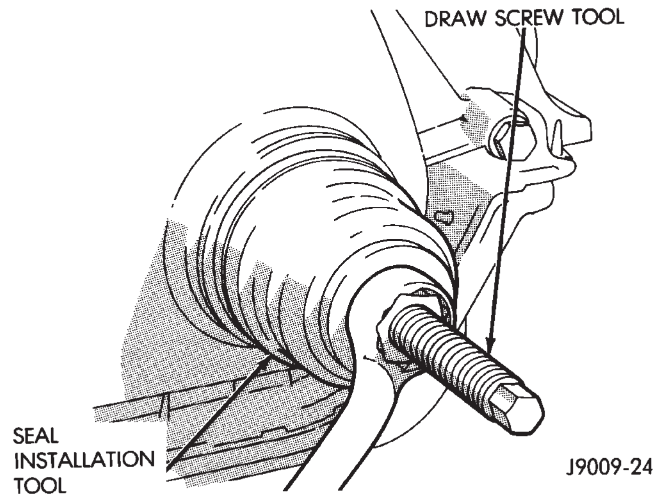


Fig. 63 Timing Case Cover Oil Seal Installation

(5) Install the serpentine belt and tighten to the specified tension (refer to Group 7, Cooling Systems for the proper specifications and procedures).
(6) Install the radiator shroud.
(7) Connect negative cable to battery.

DISASSEMBLY AND ASSEMBLY

VALVE SERVICE

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.

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. 64). If the margin is less than 0.787 mm (0.031 inch), the valve must be replaced.

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.

DISASSEMBLY AND ASSEMBLY (Continued)

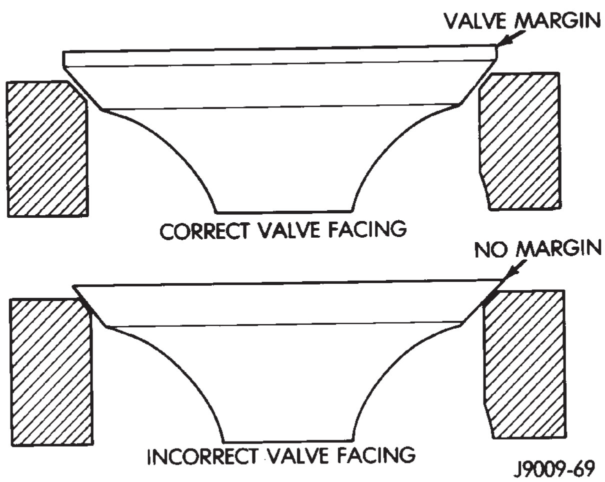


Fig. 64 Valve Facing Margin

(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. 65).

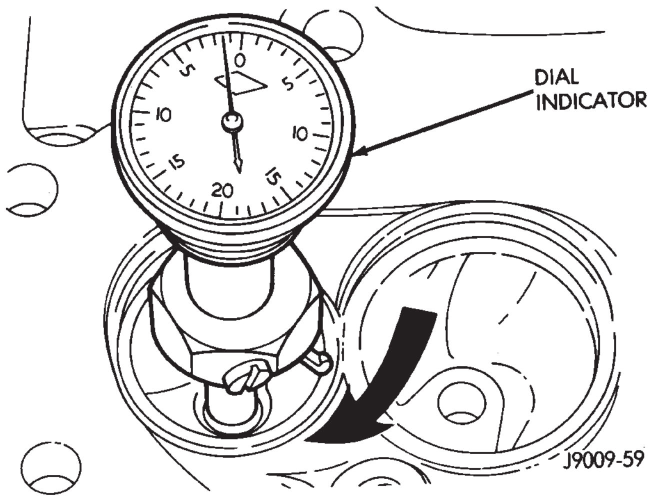


Fig. 65 Measurement of Valve Seat Runout

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.

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.

NOTE: 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. 66).

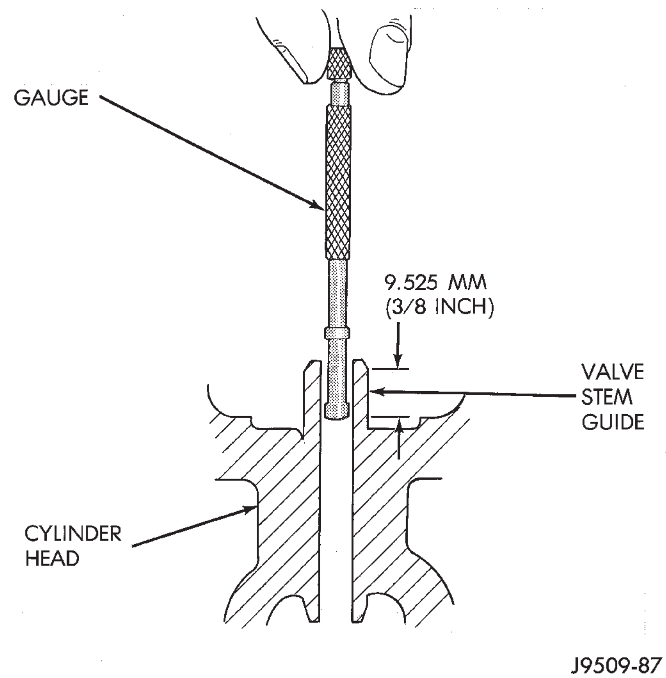


Fig. 66 Measurement of Valve Guide Bore Diameter

(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

DISASSEMBLY AND ASSEMBLY (Continued)

by more than 0.076 mm (0.003 inch), ream the guide bore to accommodate an oversize valve stem.

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. 67).

(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.

NOTE: Valve seats must be ground after reaming the valve guides to ensure that the valve seat is concentric to the valve guide.

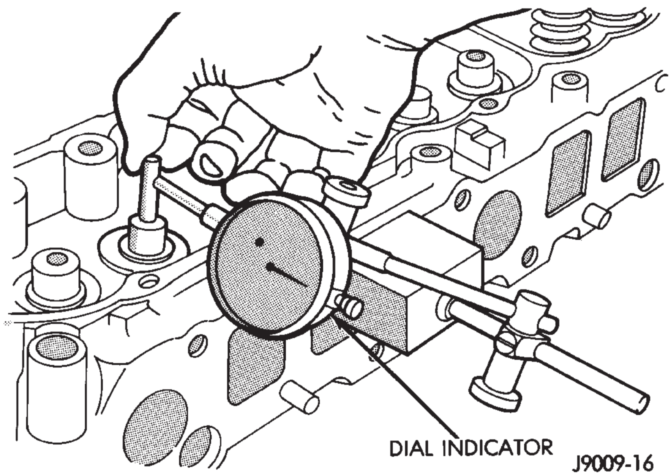


Fig. 67 Measurement of Lateral Movement of Valve Stem

VALVE SPRING TENSION TEST

Use a universal Valve Spring Tester and a torque wrench to test each valve spring for the specified tension value (Fig. 68).

Replace valve springs that are not within specifications.

CYLINDER BLOCK

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.

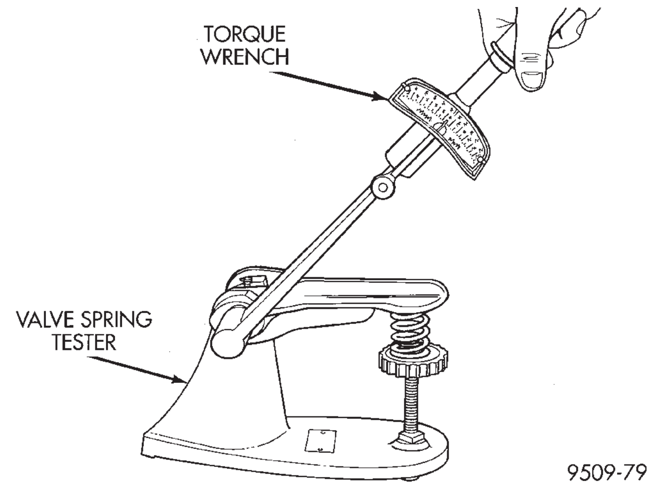


Fig. 68 Valve Spring Tester

(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.

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 (23 ft. lbs.) torque.

(12) Lubricate the oil filter seal with clean engine oil. Tighten oil filter to 18 N·m (156 in. 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.

CLEANING AND INSPECTION

INTAKE AND EXHAUST MANIFOLD

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

CYLINDER HEAD

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.

INSPECTION

Use a straightedge and feeler gauge to check the flatness of the engine cylinder head and block mating surfaces.

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.

ROCKER ARMS AND PUSH RODS

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.

HYDRAULIC TAPPETS

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. 69).

Swing the weighted arm of the hydraulic valve tappet tester away from the ram of the Leak-Down Tester.

(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.

CLEANING AND INSPECTION (Continued)

(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.

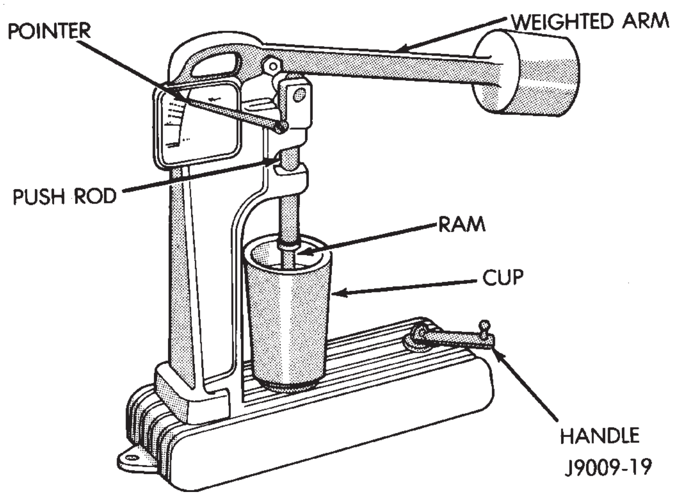


Fig. 69 Leak-Down Tester

CYLINDER BLOCK

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 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 34 N·m (25 ft. lbs.) torque.

INSPECTION—CYLINDER BORE

(1) It is mandatory to use a dial bore gauge to measure each cylinder bore diameter (Fig. 70). To correctly select the proper size piston, a cylinder bore gauge, capable of reading in 0.003 mm (.0001 in.) INCREMENTS is required. If a bore gauge is not available, do not use an inside micrometer.

(2) Measure the inside diameter of the cylinder bore at three levels below top of bore. Start perpendicular (across or at 90 degrees) to the axis of the crankshaft and then take two additional reading.

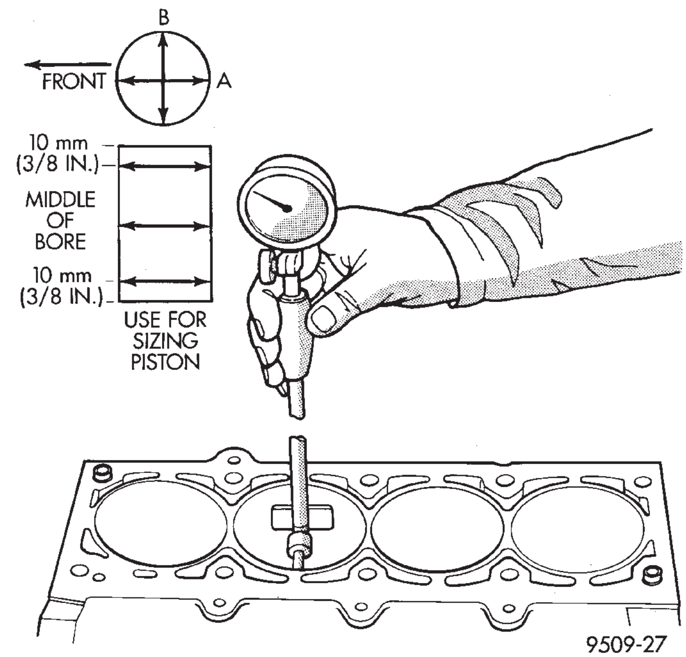


Fig. 70 Cylinder Bore Measurement

(3) Measure the cylinder bore diameter crosswise to the cylinder block near the top of the bore. Repeat the measurement near the middle of the bore, then repeat the measurement near the bottom of the bore.

(4) Determine taper by subtracting the smaller diameter from the larger diameter.

(5) Rotate measuring device 90° and repeat steps above.

(6) Determine out-of-roundness by comparing the difference between each measurement.

(7) 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.

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.

SPECIFICATIONS

4.0L ENGINE SPECIFICATIONS

Engine Description

Engine Type . . . . In-line 6 Cylinder
Bore and Stroke . . . . 98.4 x 86.69 mm (3.88 x 3.413 in.)
Displacement . . . . 4.0L (242 cu. in.)
Compression Ratio 8.8:1
Firing Order 1–5–3–6–2–4
Lubrication . . . . Pressure Feed–Full Flow Filtration
Cooling System . . Liquid Cooled–Forced Circulation
Cylinder Block . . . . Cast Iron
Crankshaft . . . . Cast Nodular Iron
Cylinder Head . . . . Cast Iron
Camshaft . . . . Cast Iron
Pistons . . . . Aluminum Alloy
Combustion Chamber . . . . Dual-Quench
Connecting Rods . . . . Cast Malleable Iron

Engine Specifications

Camshaft

Hydraulic Tappet Clearance . . . . Zero Lash
Bearing Clearance . . . . 0.025 to 0.076 mm (0.001 to 0.003 in.)

Bearing Journal Diameter

No. 1 . . . . . 51.54 to 51.56 mm (2.029 to 2.030 in.)
No. 2 . . . . . 51.28 to 51.31 mm (2.019 to 2.020 in.)
No. 3 . . . . . 51.03 to 51.05 mm (2.009 to 2.010 in.)
No. 4 . . . . . 50.78 to 50.80 mm (1.999 to 2.000 in.)
Base Circle Runout . . . . 0.03 mm - max. (0.001 in. - max.)
Valve Lift . . . . 10.29 mm (0.405 in.)

Intake Valve Timing

Opens . . . . 12.4° BTDC
Closes . . . . 60.9° ABDC

Exhaust Valve Timing

Opens . . . . 49.8 BBDC
Closes . . . . 29.2° ATDC
Valve Overlap . . . . 41.6°
Intake Duration . . . . 253.3°
Exhaust Duration . . . . 259.°

Crankshaft

End Play . . . . 0.038 to 0.165 mm (0.0015 to 0.0065 in.)
Main Bearing Journal Diameter No. 1-6 . . . . 63.489 to 63.502 mm (2.4996 to 2.5001 in.)
Main Bearing Journal Diameter No. 7 . . . . 63.449 to 63.487 mm (2.4980 to 2.4995 in.)

Camshaft

Main Bearing Journal Width No. 1 . . . . 27.58 to 27.89 mm (1.086 to 1.098 in.)
Main Bearing Journal Width No. 3 . . . . 32.28 to 32.33 mm (1.271 to 1.273 in.)
Main Bearing Journal Width No. 2-4-5-6-7 . . . . 30.02 to 30.18 mm (1.182 to 1.188 in.)
Main Bearing Clearance . . . . 0.03 to 0.06 mm (0.001 to 0.0025 in.)
Main Bearing Clearance (Preferred) . . . 0.051 mm (0.002 in.)
Connecting Rod Journal Diameter . . . . 53.17 to 53.23 mm (2.0934 to 2.0955 in.)
Connecting Rod Journal Width . . . . 27.18 to 27.33 mm (1.070 to 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 to 240.18 mm (9.450 to 9.456 in.)
Deck Clearance (Below Block) . . . . 0.546 mm (0.0215 in.)
Cylinder Bore Diameter— Standard . . . . 98.45 to 98.48 mm (3.8759 to 3.8775 in.)
Cylinder Bore Diameter— Taper (Max.) . . . . 0.025 mm (0.001 in.)
Cylinder Bore Diameter— Out-of-Round . . . . 0.025 mm (0.001 in.)
Tappet Bore Diameter . . . . . 23.000 to 23.025 mm (0.9055 to 0.9065 in.)
Flatness . . . . 0.03 mm per 25 mm (0.001 in. per 1 in.)
Flatness . . . . 0.05 mm per 152 mm (0.002 in. per 6 in.)
Flatness Max. . . . . 0.20 mm max. for total length (0.008 in. max. for total length)
Main Bearing Bore Diameter . . . . 68.3514 to 68.3768 mm (2.691 to 2.692 in.)

Connecting Rods

Total Weight (Less Bearing) . . . 657 to 665 grams (23.17 to 23.45 oz.)
Length (Center-to-Center) . . 155.52 to 155.62 mm (6.123 to 6.127 in.)

SPECIFICATIONS (Continued)

Camshaft

Piston Pin Bore Diameter . . . . 23.59 to 23.62 mm (0.9288 to 0.9298 in.)
Bore (Less Bearings) . . . . 56.08 to 56.09 mm (2.2080 to 2.2085 in.)
Bearing Clearance . . . . 0.025 to 0.076 mm (0.001 to 0.003 in.)
Bearing Clearance (Preferred) . . . . 0.044 to 0.050 mm (0.0015 to 0.0020 in.)
Side Clearance . . . . 0.25 to 0.48 mm (0.010 to 0.019 in.)
Twist (Max.) . . . . 0.001 mm per mm (0.001 in. per inch)
Bend (Max.) . . . . 0.001 mm per mm (0.001 in. per inch.)

Cylinder Compression Pressure

Ratio 8.8:1
Pressure Range . . . . 827 to 1,034 kPa (120 to 150 psi)
Max. Variation Between Cylinders . . . . . 206 kPa (30 psi)

Cylinder Head

Combustion Chamber . . . . 52.22 to 58.22 cc (3.37 to 3.55 cu. in.)
Valve Guide I.D. (Integral) . . . . . 7.95 to 7.97 mm (0.313 to 0.314 in.)
Valve Stem-to-Guide Clearance . . . . 0.025 to 0.076 mm (0.001 to 0.003 in.)
Intake Valve Seat Angle . . . . 44.5°
Exhaust Valve Seat Angle . . . . 44.5°
Valve Seat Width . . . . 1.02 to 1.52 mm (0.040 to 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.)
Flatness . . . . 0.05 mm per 152 mm (0.002 in. per 6 in.)
Flatness Max. . . . 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 to 245.364 mm (9.640 to 9.660 in.)
Push Rod Diameter . . . . 7.92 to 8.00 mm (0.312 to 0.315 in.)
Hydraulic Tappet Diameter . . 22.962 to 22.974 mm (0.904 to 0.9045 in.)
Tappet-to-Bore Clearance . . . . 0.025 to 0.063 mm (0.001 to 0.0025 in.)

Valves

Length (Tip-to-Gauge Dimension Line)
Intake . . . . 122.479 to 122.860 mm (4.822 to 4.837 in.)

Camshaft

Length (Tip-to-Gauge Dimension Line)
Exhaust . . . . 122.860 to 123.241 mm (4.837 to 4.852 in.)
Valve Stem Diameter . . . . 7.899 to 7.925 mm (0.311 to 0.312 in.)
Stem-to-Guide Clearance . . . . . 0.025 to 0.076 mm (0.001 to 0.003 in.)
Valve Head Diameter—ntake . . . . 48.387 to 48.641 mm (1.905 to 1.915 in.)
Valve Head Diameter—Exhaust . . . . 37.973 to 38.227 mm (1.495 to 1.505 in.)
Valve Face Angle—Intake . . . . 45°
Valve Face Angle—Exhaust . . . . 45°
Tip Refinishing (Max. Allowable) . . . . . . 0.25 mm (0.010 in.)

Valve Springs

Free Length (Approx.) . . . . . 47.65 mm (1.876 in.)
Spring Tension—Valve Closed . . . . 316 to 351 N @ 41.656 mm (71 to 79 lbf. @ 1.64 in.)
Spring Tension—Valve Open . . . . 898.6 to 969.7 N 30.89 mm (202 to 218 lbf @ 1.216 in.)
Inside Diameter . . . . 21.0 mm to 21.51 mm (0.827 to 0.847 in.)

Pistons

Weight (Less Pin) . . . . 417 to 429 grams (14.7 to 15.1 oz.)
Piston Pin Bore (Centerline to Piston Top) . . . . 40.61 to 40.72 mm (1.599 to 1.603 in.)
Piston-to-Bore Clearance . . . . . 0.018 to 0.038 mm (0.0008 to 0.0015 in.)
Ring Gap Clearance—op Compression Ring . . . . 0.229 to 0.610 mm (0.0090 to 0.0240 in.)
Ring Gap Clearance—2nd Compression Ring . . . . . . 0.483 to 0.965 mm (0.0190 to 0.0380 in.)
Ring Gap Clearance—Oil Control Steel Rails . . . . . . 0.254 to 1.500 mm (0.010 to 0.060 in.)
Ring Side Clearance—Compression Rings . . . . 0.042 to 0.084 mm (0.0017 to 0.0033 in.)
Ring Side Clearance—Oil Control Rings . . . . 0.06 to 0.21 mm (0.0024 to 0.0083 in.)
Piston Ring Groove Height—Compression Rings . . . . 1.530 to 1.555 mm (0.0602 to 0.0612 in.)

SPECIFICATIONS (Continued)

Camshaft

Piston Ring Groove Height—
Oil Control Ring . . . . 4.035 to 4.060 mm (0.1589 to 0.1598 in.)

Piston Ring Groove Diameter—
No.1 Compression Ring . . . . . . 88.39 to 88.65 mm (3.48 to 3.49 in.)

Piston Ring Groove Diameter—
No.2 Compression Ring . . . . . . 87.63 to 87.88 mm (3.45 to 3.46 in.)

Piston Ring Groove Diameter—
Oil Control Ring . . . . 89.66 to 89.92 mm (3.53 to 3.54 in.)

Piston Pin Bore Diameter . . 23.650 to 23.658 mm (0.9312 to 0.9315 in.)

Piston Pin Diameter . . . . . . 23.637 to 23.640 mm (0.9306 to 0.9307 in.)

Piston-to-Pin Clearance . . . . 0.0102 to 0.0208 mm (0.0005 to 0.0009 in.)

Piston-to-Pin Connecting Rod
(Press Fit) . . . . 8.9 kN (2000 lbf.)

Oil Pump

Gear-to-Body Clearance
(Radial) . . . . 0.051 to 0.102 mm (0.002 to 0.004 in.)

Gear-to-Body Clearance
(Radial) (Preferred) . . . . 0.051 mm (0.002 in.)

Gear End Clearance—
Plastigage . . . . 0.051 to 0.152 mm (0.002 to 0.006 in.)

Gear End Clearance—
Plastigage (Preferred) . . . . . 0.051 mm (0.002 in.)

Gear End Clearance—
Feeler Gauge . . . . 0.1016 to 0.2032 mm (0.004 to 0.008 in.)

Gear End Clearance—
Feeler Gauge (Preferred) . . 0.1778 mm (0.007 in.)

Oil Pressure

At Idle Speed (600 rpm) . . . . 89.6 kPa (13 psi)

At 1600 rpm & Higher . . . . 255 to 517 kPa (37 to 75 psi)

Oil Pressure Relief . . . . 517 kPa (75 psi)

4.0L TORQUE SPECIFICATIONS

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 . . . . 2 N·m (16 in. lbs.)

TORQUE SPECIFICATIONS

Camshaft Sprocket

Bolt . . . . 68 N·m (50 ft. lbs.)

Camshaft Thrust Plate to Cylinder Block

Screws . . . . 24 N·m (18 ft. lbs.)

Clutch Cover to Flywheel

Bolts . . . . 54 N·m (40 ft. lbs.)

Coil Bracket to Block

Bolts . . . . 22 N·m (192 in. lbs.)

Connecting Rod

Nuts . . . . 45 N·m (33 ft. lbs.)

Cylinder Block

Drain Plugs . . . . 34 N·m (25 ft. lbs.)

Cylinder Head

Bolts . . . . 135 N·m (100 ft. lbs.)

Cylinder Head Cover

Bolts . . . . 10 N·m (85 in. lbs.)

Distributor Clamp

Bolt . . . . 23 N·m (204 in. lbs.)

Engine Mounts—Front

Support Bracket Bolts . . . . 61 N·m (45 ft. lbs.)

Support Cushion Bolts/Nuts . . 41 N·m (30 ft. lbs.)

Support Cushion Bracket Bolts . . . . 54 N·m (40 ft. lbs.)

Support Cushion Bracket Stud Nuts . . . . . . 41 N·m (30 ft. lbs.)

Support Cushion Thru-Bolt . . . 65 N·m (48 ft. lbs.)

Engine Mounts—Rear

Crossmember-to-Sill Bolts (Automatic) . . . 41 N·m (30 ft. lbs.)

Insulator Stud Assembly Nut . 41 N·m (30 ft. lbs.)

Support Cushion/Crossmember Nuts . . . . 22 N·m (192 in. lbs.)

Support Cushion/Bracket Nuts (Manual) . 75 N·m (55 ft. lbs.)

Transmission Support Bracket Bolt
(Manual) . . . . 46 N·m (34 ft. lbs.)

Transmission Support Bracket/Cushion Bolt
(4WD Auto) . . . . 75 N·m (55 ft. lbs.)

Transmission Support Adaptor Bracket Bolts
(2WD Auto) . . . . 75 N·m (55 ft. lbs.)

Exhaust Manifold/Pipe

Nuts . . . . 27 N·m (20 ft. lbs.)

Flywheel to Converter Housing

Bolts . . . . 38 N·m (28 ft. lbs.)

Flywheel to Crankshaft

Bolts . . . . 143 N·m (105 ft. lbs.)

Front Cover-to-Block

Bolts 1/4–20 . . . . 7 N·m (60 in. lbs.)

Bolts 5/16–18 . . . . 22 N·m (192 in. lbs.)

Fuel Rail

Bolts/Stud . . . . 12 N·m (108 in. lbs.)

Generator

Fixed Bolt . . . . 24 N·m (18 ft. lbs.)

Thru Bolt/Nut . . . . 38 N·m (28 ft. lbs.)

SPECIFICATIONS (Continued)

TORQUE SPECIFICATIONS

Main Bearing Cap
Bolts . . . . 108 N·m (80 ft. lbs.)

Main Bearing Brace
Nuts . . . . 47 N·m (35 ft. lbs.)

Oil Filter
Filter . . . . 18 N·m (156 in. lbs.)
Connector (to adaptor) . . . . . . 47 N·m (35 ft. lbs.)
Connector (to block) . . . . 68 N·m (50 ft. lbs.)
Adaptor Bolts . . . . 102 N·m (50 ft. lbs.)

Oil Galley
Plug . . . . 41 N·m (30 ft. lbs.)

Oil Pan
1/4–20 Bolts . . . . 9.5 N·m (84 in. lbs.)
5/16–18 Bolts . . . . 15 N·m (132 in. lbs.)
Drain Plug . . . . 34 N·m (25 ft. lbs.)

Oil Pump
Short Attaching Bolts . . . . . . 23 N·m (204 in. lbs.)
Long Attaching Bolts . . . . . . 23 N·m (204 in. lbs.)
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 . . . . 30 N·m (21ft. lbs.)

Spark Plugs
Plugs . . . . 37 N·m (27 ft. lbs.)

Starter Motor
Mounting Bolts . . . . 45 N·m (33 ft. lbs.)

Thermostat Housing
Bolts . . . . 18 N·m (156 in. lbs.)

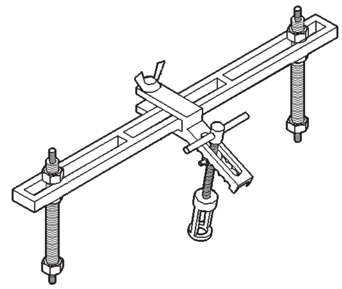
Throttle Body
Bolts . . . . 10 N·m (90 in.lbs.)

Vibration Damper
Bolts . . . . 108 N·m (80 ft. lbs.)

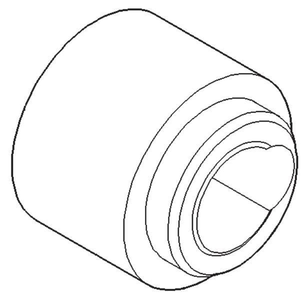
Water Pump/Block
Bolts . . . . 23 N·m (17 ft. lbs.)

SPECIAL TOOLS

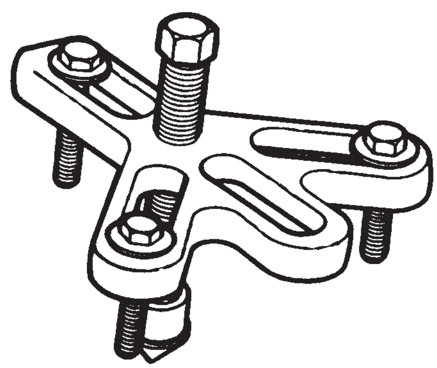
4.0L ENGINE



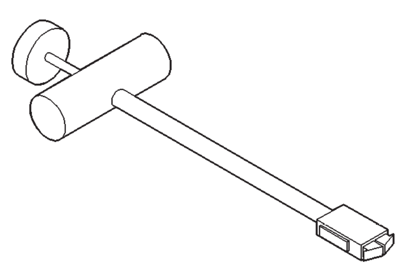
Valve Spring Compressor Tool MD-998772A



Timing Case Cover Alignment and Seal installation Tool 6139



Vibration Damper Removal Tool 7697



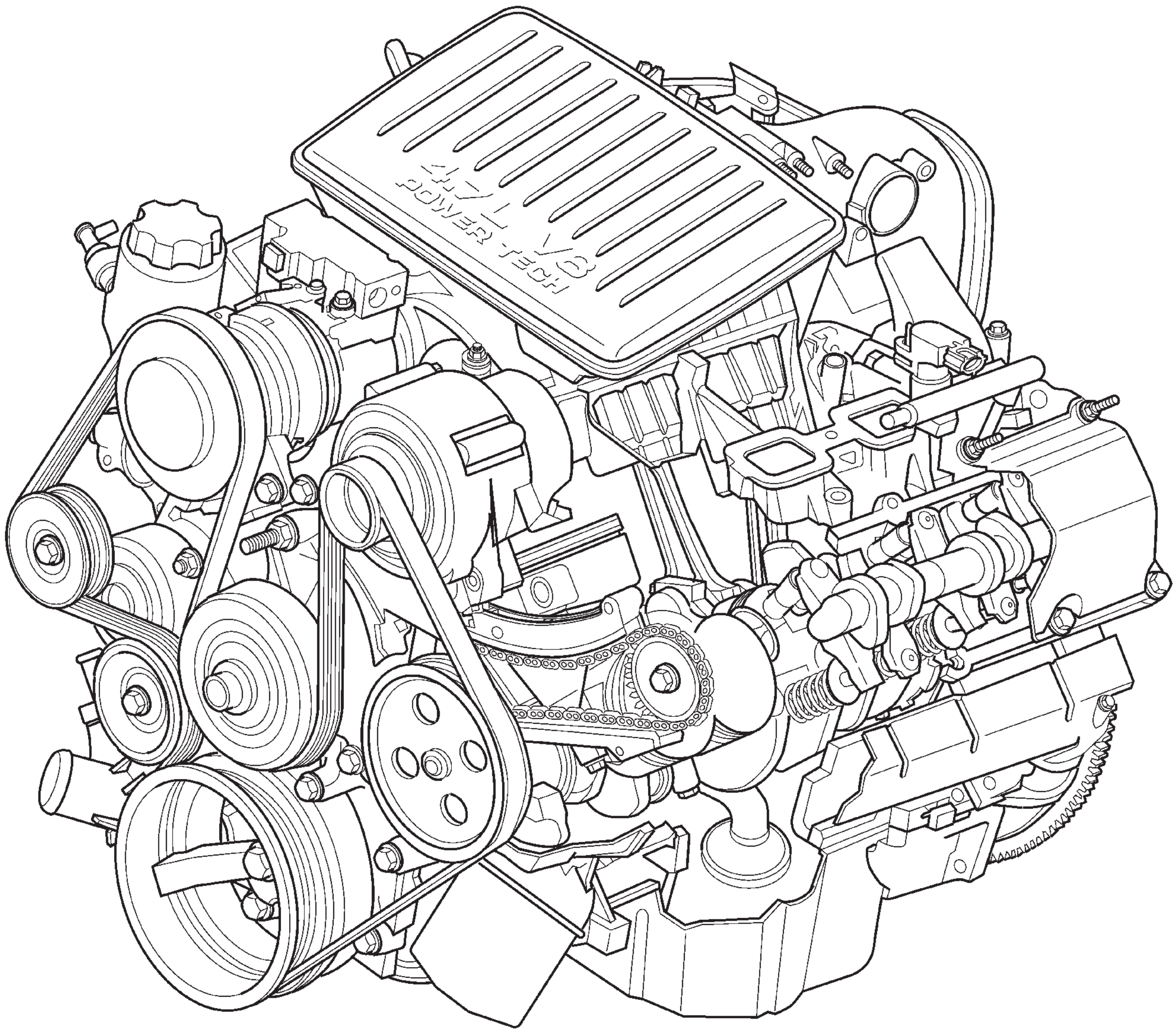
Hydraulic Valve Tappet Removal/Installation Tool C-4129–A

4.7L ENGINE

INDEX

DESCRIPTION AND OPERATION

4.7L ENGINE



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4.7L GENERAL SPECIFICATIONS

Type	90° SOHC V-8
Displacement	4.7 Liters 4701cc (287 Cubic Inches)
Bore	93.0 mm (3.66 in.)
Stroke	86.5 mm (3.40 in.)
Compression Ratio	9.0:1
Horsepower	230 BHP @ 4600 RPM
Torque	300 LB-FT @ 3200 RPM
Lead Cylinder	#1 Left Bank
Firing Order	1-8-4-3-6-5-7-2
Cylinder Block	Cast Iron
Cylinder Head	Aluminum
Connecting Rod	Powdered Metal With Cracked Cap
Piston	Aluminum (Press-Fit Wrist Pin)
Lubrication	Pressure Feed-Full Flow Filtration (Direct Crankshaft Driven Pump)
Cooling System	Liquid Cooled-forced Circulation

DESCRIPTION AND OPERATION (Continued)

ENGINE IDENTIFICATION

The engine is stamped with the vehicles identification number. This area is located at the right front side of the engine block. The engine build date code is included in the yellow bar code sticker on the oil fill housing. (Fig. 1).

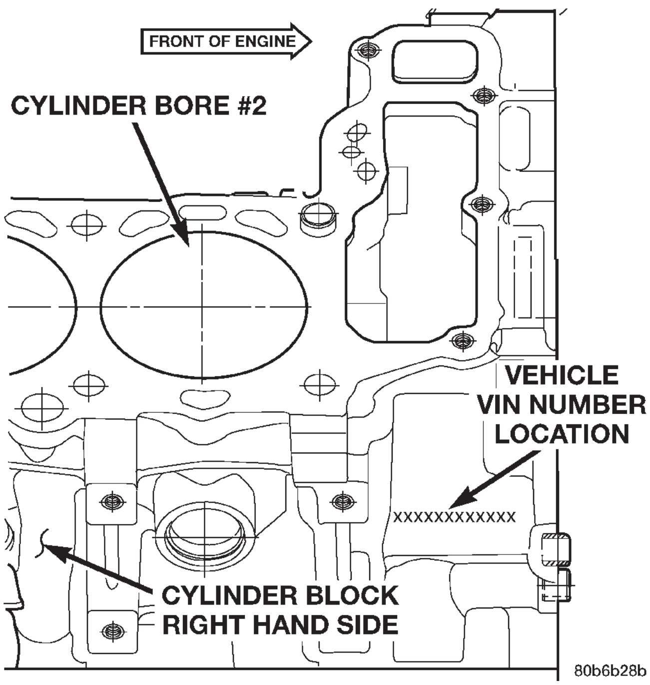


Fig. 1 4.7L Engine Identification

LUBRICATION SYSTEM

The lubrication system (Fig. 2) is a full flow filtration pressure feed type. Oil from the oil pan is pumped by a geroter type oil pump directly mounted to the crankshaft nose. Oil pressure is controlled by a relief valve mounted inside the oil pump housing. For lubrication flow refer to the chart below.

The camshaft exhaust valve lobes and rocker arms are lubed through a small hole in the rocker arm, oil flows through the lash adjuster then through the rocker arm and onto the camshaft lobe. Due to the design of the rocker arm configuration the camshaft intake lobes are not lubed in the same manner as the exhaust lobes, So the intake lobes are lubed through internal passages in the camshaft. Oil flows through a bore in the number 3 camshaft bearing bore, as the camshaft turns, a hole in the camshaft aligns with the hole in the camshaft bore allowing engine oil to enter the camshaft tube. The oil then exits through 1.6mm (0.063 in.) holes drilled into the intake lobes, lubing the lobes and the rocker arms.

ENGINE LUBRICATION FLOW CHART—BLOCK: TABLE 1

FROM	TO
Oil Pickup Tube	Oil Pump
Oil Pump	Oil Filter
Oil Filter	Block Main Oil Gallery
Block Main Oil Gallery	1. Crankshaft Main Journal 2. Left Cylinder Head* 3. Right Cylinder Head*
Crankshaft Main Journals	Crankshaft Rod Journals
Crankshaft Number One Main Journal	1. Front Timing Chain Idler Shaft 2. Both Secondary Chain Tensioners
Left Cylinder Head	See Table 2
Right Cylinder Head	See Table 2
* The cylinder head gaskets have an oil restricter to control oil flow to the cylinder heads.	

4.7L ENGINE COMPONENTS

ENGINE LUBRICATION FLOW CHART—CYLINDER HEADS: TABLE 2

Cylinder Head Oil Port (in bolt hole)	Diagonal Cross Drilling to Main Oil Gallery
Main Oil Gallery (drilled through head from rear to front)	1. Base of Camshaft Towers 2. Lash Adjuster Towers
Base of Camshaft Towers	Vertical Drilling Through Tower to Camshaft Bearings**
Lash Adjuster Towers	Diagonal Drillings to Hydraulic Lash Adjuster Pockets
** The number three camshaft bearing journal feeds oil into the hollow camshaft tubes. Oil is routed to the intake lobes, which have oil passages drilled into them to lubricate the rocker arms.	

DESCRIPTION AND OPERATION (Continued)

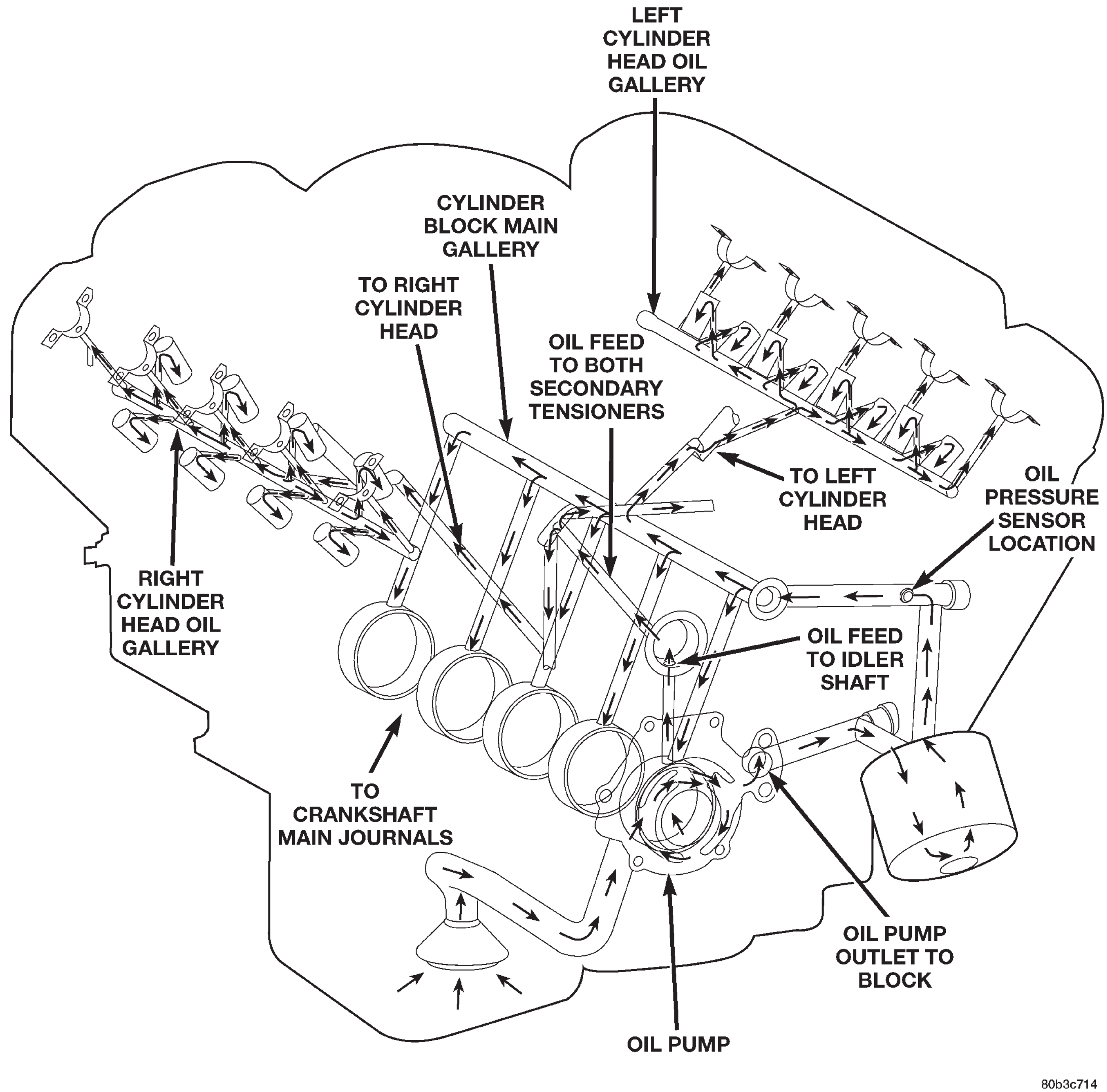


Fig. 2 Engine Oil Lubrication System

CYLINDER BLOCK

The cylinder block is made of cast iron. The block is a closed deck design with the left bank forward. To provide high rigidity and improved NVH an enhanced compacted graphite bedplate is bolted to the block. The block design allows coolant flow between the cylinders bores, and an internal coolant by pass to a dual poppet inlet thermostat is included in the cast aluminum front cover.

CRANKSHAFT

The crankshaft is constructed of nodular cast iron. The crankshaft is a crosshaped four throw design with eight counterweights for balancing purposes. The crankshaft is supported by five select main bearings with the number three serving as the thrust washer location. The main journals of the crankshaft are cross drilled to improve rod bearing lubrication. The number eight counterweight has provisions for crankshaft position sensor target wheel mounting.

DESCRIPTION AND OPERATION (Continued)

The select fit main bearing markings are located on the rear side of the target wheel. The crankshaft oil seals are one piece design. The front oil seal is retained in the timing chain cover, and the rear seal is pressed in to a bore formed by the cylinder block and the bedplate assembly.

PISTONS AND CONNECTING RODS

The pistons are made of a high strength aluminum alloy with an anodized top ring groove and crown. Piston skirts are coated with a solid lubricant (Molykote) to reduce friction and provide scuff resistance. The connecting rods are made of powdered metal, with a “fractured cap” design. A pressed fit piston pin is used to attach the piston and connecting rod.

NOTE: Do not use a metal stamp to mark connecting rods as damage may result, instead use ink or a scratch awl.

CYLINDER HEADS

The cylinder heads are made of an aluminum alloy. The cylinder head features two valves per cylinder with pressed in powdered metal valve guides. The cylinder heads also provide enclosures for the timing chain drain, necessitating unique left and right cylinder heads.

TIMING DRIVE SYSTEM

The timing drive system has been designed to provide quiet performance and reliability to support a **non-free wheeling** engine. Specifically the intake valves are non free wheeling and can be easily damaged with forceful engine rotation if camshaft-to-crankshaft timing is incorrect. The timing drive system consist of a primary chain and two secondary timing chain drives.

The primary timing chain is a single inverted tooth type. The primary chain drives the large fifty tooth idler sprocket directly from a 25 tooth crankshaft sprocket. Primary chain motion is controlled by a pivoting leaf spring tensioner arm and a fixed guide. The arm and the guide both use nylon plastic wear faces for low friction and long wear. The primary chain receives oil splash lubrication from the secondary chain drive and oil pump leakage. The idler sprocket assembly connects the primary and secondary chain drives. The idler sprocket assembly consists of two integral thirty tooth sprockets and a fifty tooth sprocket that is splined to the assembly. The spline joint is a press fit anti rattle type. A spiral ring is installed on the outboard side of the fifty tooth sprocket to prevent spline disengagement. The idler sprocket assembly spins on a stationary idler shaft. The idler shaft is press fit into the cylinder block. A large washer on the idler shaft bolt and the rear flange of the idler shaft are used to control sprocket thrust movement. Pressurized oil is routed through the center of the idler shaft to provide lubrication for the two bushings used in the idler sprocket assembly.

There are two secondary drive chains, both are inverted tooth type, one to drive the camshaft in each SOHC cylinder head. There are no shaft speed changes in the secondary chain drive system. Each secondary chain drives a thirty tooth cam sprocket directly from the a thirty tooth sprocket on the idler sprocket assembly. A fixed chain guide and a hydraulic oil damped tensioner are used to maintain tightness in each secondary chain system. The hydraulic tensioners for the secondary chain systems are fed pressurized oil from oil reservoir pockets in the block. Each tensioner also has a mechanical ratchet system that limits chain slack if the tensioner piston bleeds down after engine shut down. The tensioner arms and guides also utilize nylon wear faces for low friction and long wear. The secondary timing chains receive lubrication from a small orifice in the tensioners. This orifice is protected from clogging by a fine mesh screen which is located on the back of the hydraulic tensioners.

CAMSHAFTS

The camshafts consist of powdered metal steel lobes which are sinter-bonded to a steel tube. A steel post or nose piece is friction welded to the camshaft steel tube. Five bearing journals are machined into the camshaft, four on the steel tube and one on the steel nose piece. Camshaft end play is controlled by two thrust walls that border the nose piece journal. Engine oil enters the hollow camshafts at the third journal and lubricates every intake lobe rocker through a drilled passage in the intake lobe.

ROCKER ARMS

The rocker arms are steel stampings with an integral roller bearing. The rocker arms incorporate a 2.8 mm (0.11 inch) oil hole in the lash adjuster socket for roller and camshaft lubrication.

VALVES

The valves are made of heat resistant steel and have chrome plated stems to prevent scuffing. Each valve is actuated by a roller rocker arm which pivots on a stationary lash adjuster. All valves use three bead lock keepers to retain the springs and promote valve rotation.

VALVE SPRINGS

The valve springs are made from high strength chrome silicon steel. The springs are common for

DESCRIPTION AND OPERATION (Continued)

intake and exhaust applications. The valve spring seat is integral with the valve stem seal, which is a positive type seal to control lubrication.

CYLINDER HEAD COVERS

The cylinder head covers are made of die cast magnesium, and are not interchangeable from side-to-side. It is imperative that nothing rest on the cylinder head covers. Prolonged contact with other items may wear a hole in the cylinder head cover.

HYDRAULIC LASH ADJUSTERS

Valve lash is controlled by hydraulic lash adjusters that are stationary mounted in the cylinder heads. The lash adjusters have a hole in the ball plunger that feeds oil through the rocker arm squirt holes for rocker arm roller and camshaft lobe lubrication.

VALVE GUIDES

The valve guides are made of powered metal and are pressed into the cylinder head. The guides are not replaceable or serviceable, valve guide reaming is not recommended. If the guides are worn beyond acceptable limits, replace the cylinder heads.

OIL PAN

The engine oil pan is made of laminated steel and has a single plane sealing surface. The sandwich style oil pan gasket has an integrated windage tray and steel carrier. The sealing area of the gasket is molded with rubber and is designed to be reused as long as the gasket is not cut, torn or ripped.

STRUCTURAL DUST COVER

The structural dust cover is made of die cast aluminum and joins the lower half of the transmission bell housing to the engine bedplate. The structural cover provides additional powertrain stiffness and reduces noise and vibration.

VALVE STEM SEALS

The valve stem seals are made of rubber and incorporate an integral steel valve spring seat. The integral garter spring maintains consistent lubrication control to the valve stems.

INTAKE MANIFOLD

The intake manifold is made of a composite material and features long runners which maximizes low end torque. The intake manifold uses single plane sealing which consist of eight individual press in place port gaskets to prevent leaks. Eight studs and two bolts are used to fasten the intake to the head.

EXHAUST MANIFOLD

The exhaust manifolds are log style with a patented flow enhancing design to maximize performance. The exhaust manifolds are made of high silicon molybdenum cast iron. A perforated core graphite exhaust manifold gasket is used to improve sealing to the cylinder head. The exhaust manifolds are covered by a three layer laminated heat shield for thermal protection and noise reduction. The heat shields are fastened with a torque prevailing nut that is backed off slightly to allow for the thermal expansion of the exhaust manifold.

DIAGNOSIS AND TESTING

CHECKING ENGINE OIL PRESSURE

(1) Remove oil pressure sending unit (Fig. 3) and install gauge assembly C-3292.

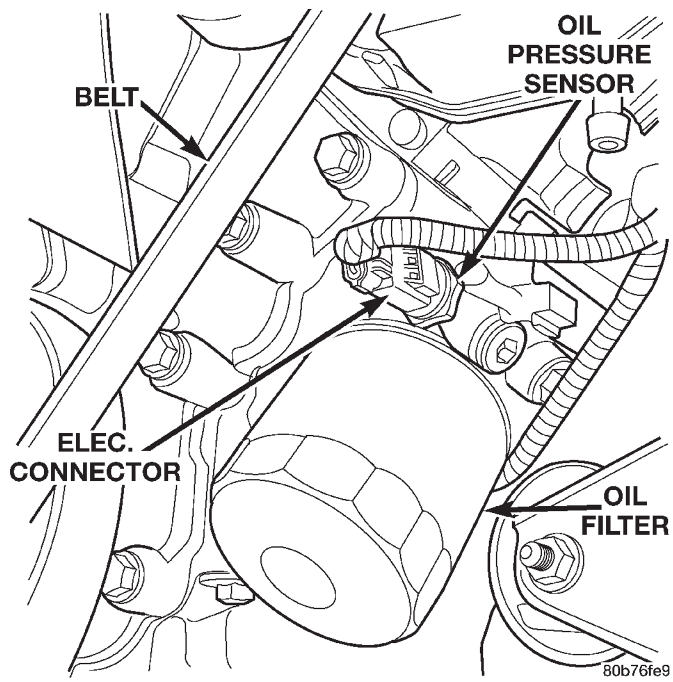


Fig. 3 Oil Pressure Sending Unit

(2) Run engine until thermostat opens.

(3) Oil Pressure:

- Curb Idle—25 Kpa (4 psi) minimum
- 3000 rpm—170 - 550 KPa (25 - 80 psi)

(4) If oil pressure is 0 at idle, shut off engine. Check for a clogged oil pick-up screen or a pressure relief valve stuck open.

SERVICE PROCEDURES

ENGINE TIMING—VERIFICATION

CAUTION: The 4.7L is a non free-wheeling design engine. Therefore, correct engine timing is critical.

NOTE: Components referred to as left hand or right hand are as viewed from the drivers position inside the vehicle.

NOTE: The blue link plates on the chains and the dots on the camshaft drive sprockets may not line up during the timing verification procedure. The blue link plates are lined up with the sprocket dots only when re-timing the complete timing drive. Once the timing drive is rotated blue link-to-dot alignment is no longer valid.

Engine base timing can be verified by the following procedure:

(1) Remove the cylinder head covers. Refer to the procedure in this section.

(2) Using a mirror, locate the TDC arrow on the front cover (Fig. 4). Rotate the crankshaft until the mark on the crankshaft damper is aligned with the TDC arrow on the front cover. The engine is now at TDC.

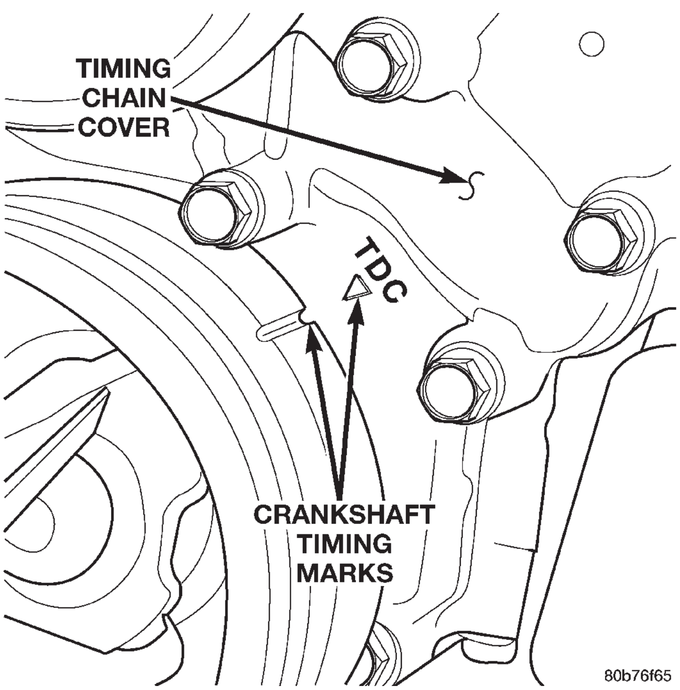


Fig. 4 Engine Top Dead Center (TDC) Indicator Mark

(3) Note the location of the V8 mark stamped into the camshaft drive gears (Fig. 5). If the V8 mark on each camshaft drive gear is at the twelve o'clock position, the engine is at TDC on the exhaust stroke. If the V8 mark on each gear is at the six o'clock position, the engine is at TDC on the compression stroke.

(4) If both of the camshaft drive gears are off in the same or opposite directions, the primary chain or both secondary chains are at fault. Refer to Timing Chain and Sprockets procedure in this section.

(5) If only one of the camshaft drive gears is off and the other is correct, the problem is confined to one secondary chain. Refer to Single camshaft timing, in this procedure.

(6) If both camshaft drive gear V8 marks are at the twelve o'clock or the six o' clock position the engine base timing is correct. Reinstall the cylinder head covers.

SINGLE CAMSHAFT TIMING

NOTE: to adjust the timing on one camshaft, preform the following procedure.

(1) Using Chain Tensioner Wedge, special tool 8350, stablize the secondary chain drive. For reference purposes, mark the chain-to-sprocket position.

(2) Remove the camshaft drive gear retaining bolt.

(3) Carefully remove the camshaft drive gear from the camshaft.

(4) Re-index the camshaft drive gear in the chain until the V8 mark is at the same position as the V8 mark on the opposite camshaft drive gear.

NOTE: When gripping the camshaft, place the pliers on the tube portion of the camshaft only. Do not grip the lobes or the sprocket areas.

(5) Using a suitable pair of adjustable pliers, rotate the camshaft until the alignment dowel on the camshaft is aligned with the slot in the camshaft drive gear (Fig. 6).

(6) Position the camshaft drive gear onto the camshaft, and install the retaining bolt. Using Special Tools, Spanner Wrench 6958 with Adapter Pins 8346 and a suitable torque wrench, Tighten retaining bolt to 122N·m (90 ft. Lbs.) (Fig. 7) (Fig. 8).

(7) Remove special tool 8350.

(8) Rotate the crankshaft two full revolutions, then reverify that the camshaft drive gear V8 marks are in fact aligned.

(9) Install the cylinder head covers. Refer to Cylinder Head Cover in this section.

MEASURING TIMING CHAIN WEAR

NOTE: This procedure must be performed with the timing chain cover removed.

SERVICE PROCEDURES (Continued)

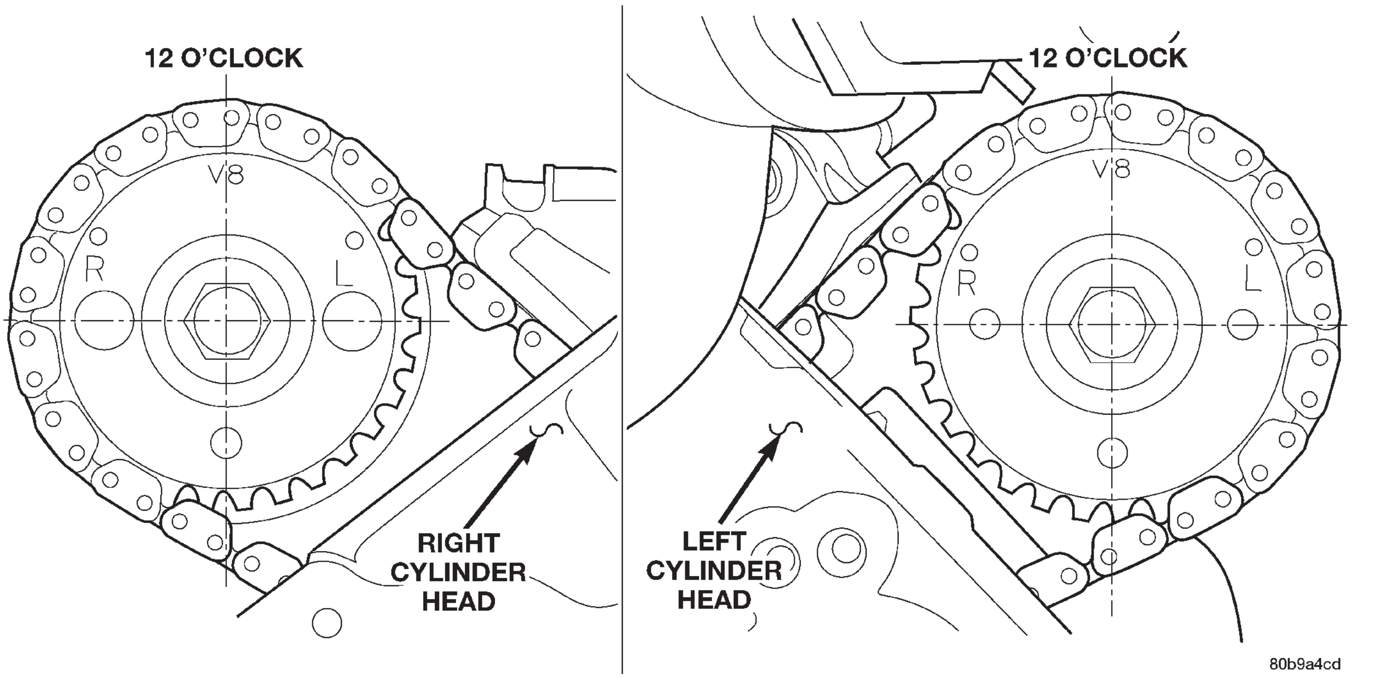


Fig. 5 Camshaft Sprocket V8 Marks

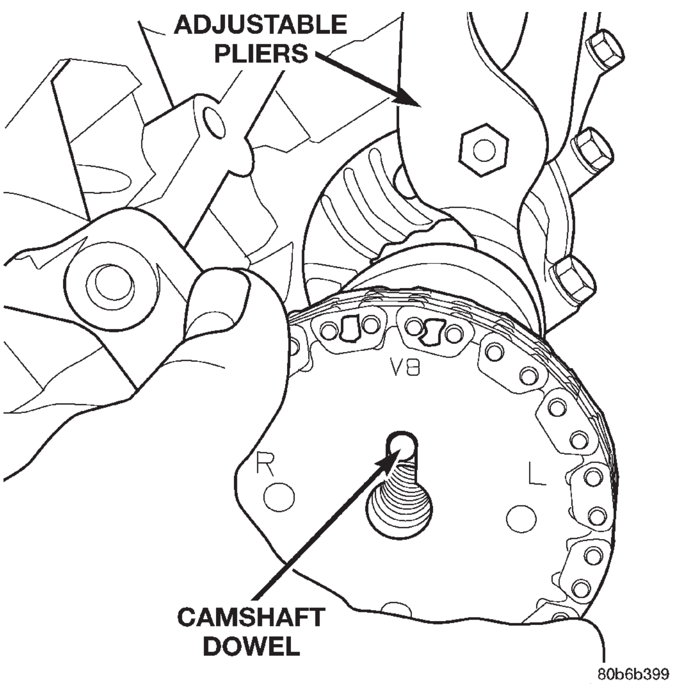


Fig. 6 Camshaft Dowel To Sprocket Alignment

(1) Remove the timing chain cover. Refer to Timing Chain Cover in this section for procedure.

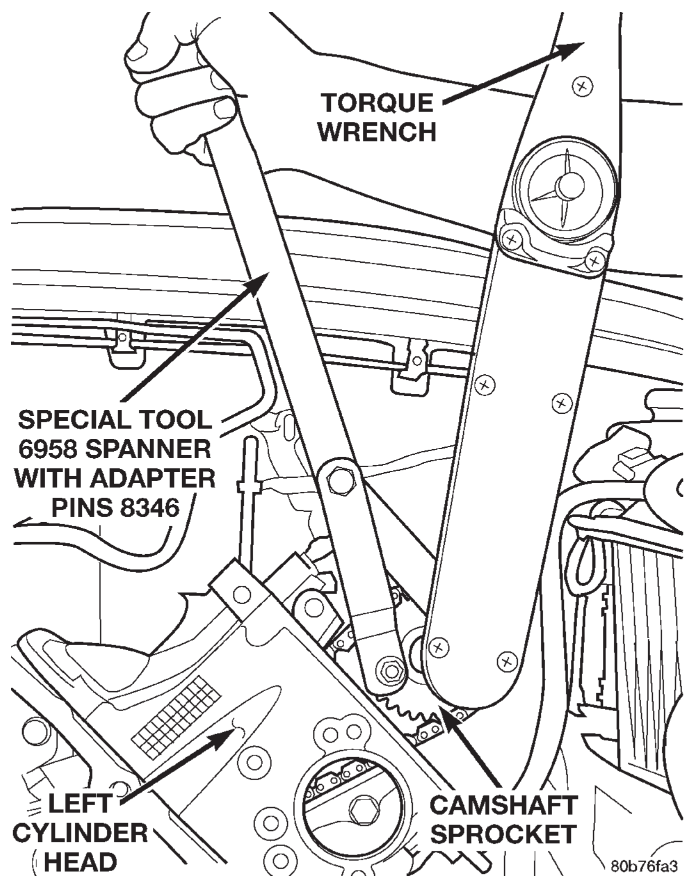


Fig. 7 Camshaft Sprocket Installation—Left Cylinder Head

SERVICE PROCEDURES (Continued)

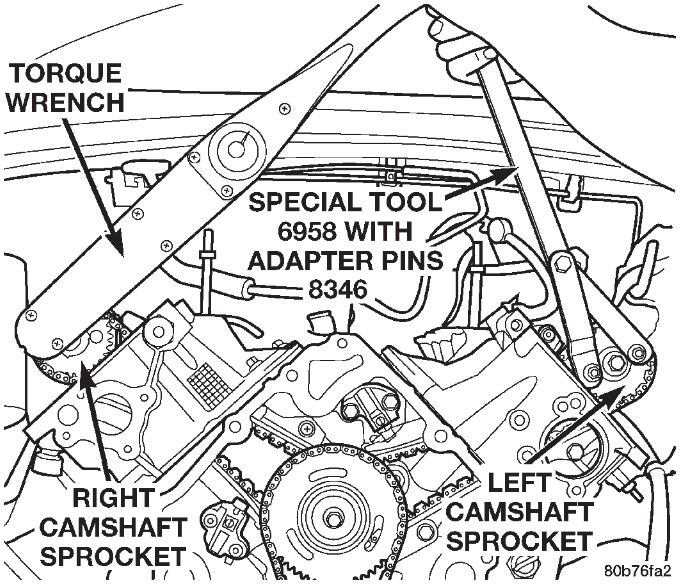


Fig. 8 Camshaft Sprocket Installation—Right Cylinder Head

(2) To determine if the secondary timing chains are worn, rotate the engine clockwise until maximum tensioner piston extension is obtained. Measure the distance between the secondary timing chain tensioner housing and the step ledge on the piston (Fig. 9). The measurement at point (A) must be less than 15mm (.5906 inches).

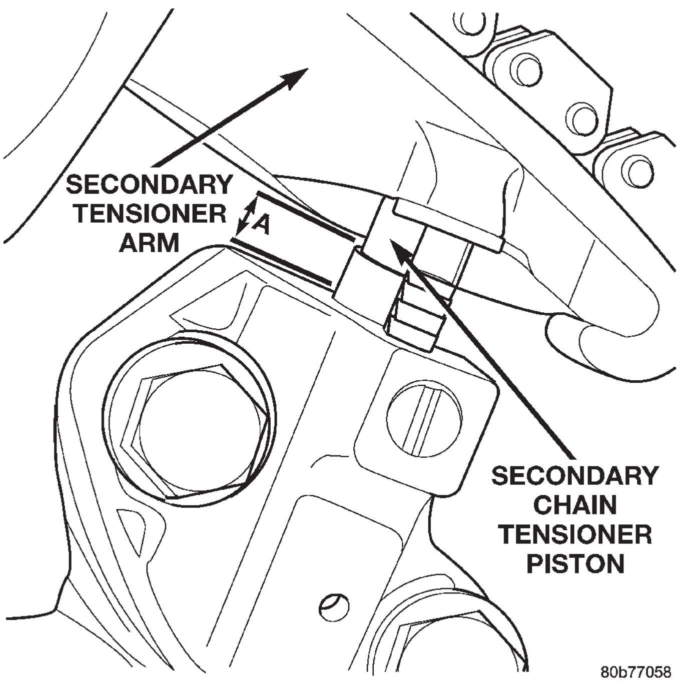


Fig. 9 Measuring Secondary Timing Chains For Stretch

(3) If the measurement exceeds the specification the secondary timing chains are worn and require replacement. Refer to Timing Chain and Sprockets in this section for procedure.

FITTING PISTONS

BORE GAGE METHOD

(1) To correctly select the proper size piston, a cylinder bore gauge, capable of reading in 0.003 mm (.0001 in.) INCREMENTS is required. If a bore gauge is not available, do not use an inside micrometer.

(2) Measure the inside diameter of the cylinder bore at a point 49.5 mm (1-15/16 inches) below top of bore. Start perpendicular (across or at 90 degrees) to the axis of the crankshaft at point A and then take an additional bore reading 90 degrees to that at point B (Fig. 11).

(3) The coated pistons will be serviced with the piston pin and connecting rod pre-assembled. Tin coated pistons should not be used as replacements for coated pistons.

(4) 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 (Fig. 10). 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 0.003 mm (.0001 in.) increments is required.

(5) Piston installation into the cylinder bore requires 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.

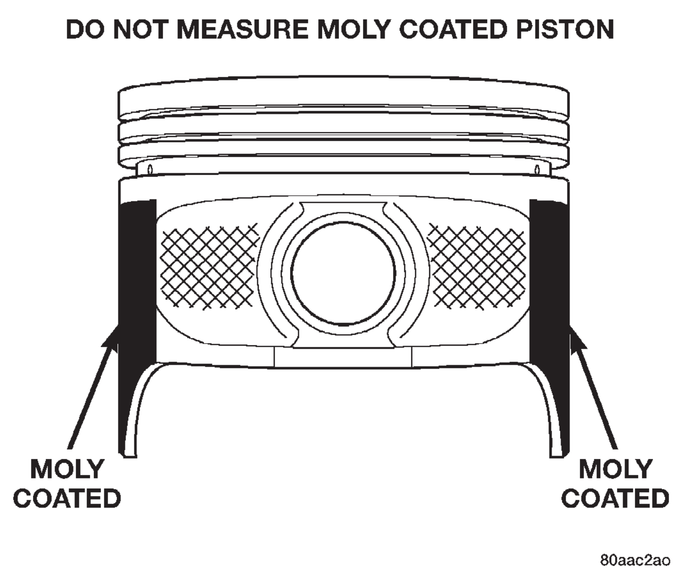


Fig. 10 Moly Coated Piston

SERVICE PROCEDURES (Continued)

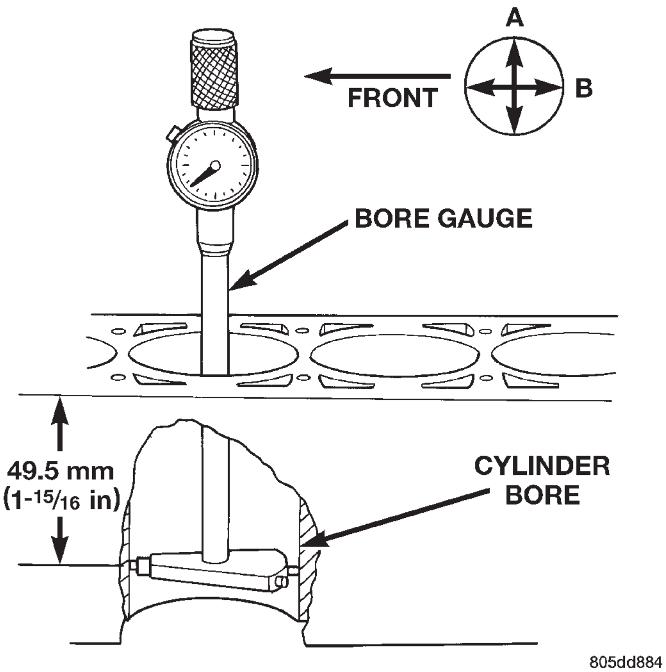


Fig. 11 Bore Gauge—Typical

FITTING PISTON RINGS

MEASUREMENT

RING END GAP

Before reinstalling used rings or installing new rings, the ring clearances must be checked.

(1) Wipe the cylinder bore clean.

(2) Insert the ring in the cylinder bore.

NOTE: The ring gap measurement must be made with the ring positioned at least 12mm (0.50 inch.) from bottom of cylinder bore.

(3) Using a piston, to ensure that the ring is squared in the cylinder bore, slide the ring downward into the cylinder.

(4) Using a feeler gauge check the ring end gap (Fig. 12). Replace any rings not within specification.

MEASURING PISTON RING SIDE CLEARANCE

NOTE: Make sure the piston ring grooves are clean and free of nicks and burrs.

(1) Measure the ring side clearance as shown (Fig. 13) make sure the feeler gauge fits snugly between the ring land and the ring. Replace any ring not within specification.

(2) Rotate the ring around the piston, the ring must rotate in the groove with out binding.

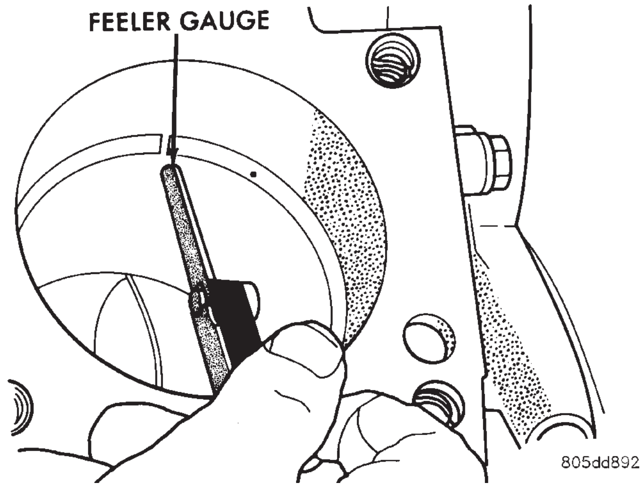


Fig. 12 Ring End Gap Measurement—Typical

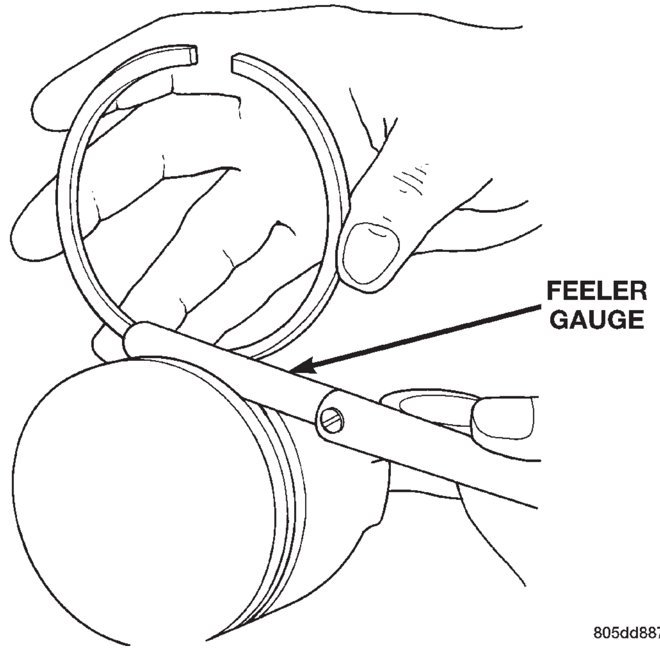


Fig. 13 Measuring Piston Ring Side Clearance

PISTON RINGS—INSTALLATION

(1) The No. 1 and No. 2 piston rings have a different cross section. Ensure No. 2 ring is installed with manufacturers I.D. mark (Dot) facing up, towards top of the piston.

NOTE: Piston rings are installed in the following order:

- **Oil ring expander.**
- **Upper oil ring side rail.**
- **Lower oil ring side rail.**
- **No. 2 Intermediate piston ring.**
- **No. 1 Upper piston ring.**

(2) Install the oil ring expander.

SERVICE PROCEDURES (Continued)

PISTON RING SPECIFICATION CHART

Ring Position	Groove Clearance	Maximum Clearance
Upper Ring	.051-.094mm (0.0020- .0037 in.	0.11mm (0.004 in.)
Intermediate Ring	0.04-0.08mm (0.0016-0.0031 in.)	0.10mm (0.004 in.)
Oil Control Ring (Steel Rails)	.019-.229mm (.0007-.0090 in.)	.25mm (0.010 in.)
Ring Position	**Ring Gap**	**Wear Limit**
Upper Ring:	0.20-0.36mm (0.008-0.014 in.)	0.10mm (0.004 in.)
Intermediate Ring:	0.37-0.63mm (0.014-0.025 in.)	0.10mm (0.004 in.)
Oil Control Ring (Steel Rail):	0.025-0.76mm (0.010- 0.030 in.)	0.23mm (0.0091 in.)

(3) Install upper side rail (Fig. 14) by placing one end between the piston ring groove and the expander ring. Hold end firmly and press down the portion to be installed until side rail is in position. Repeat this step for the lower side rail.

(4) Install No. 2 intermediate piston ring using a piston ring installer (Fig. 15).

(5) Install No. 1 upper piston ring using a piston ring installer (Fig. 15).

(6) Position piston ring end gaps as shown in (Fig. 16). It is important that expander ring gap is at least 45° from the side rail gaps, but not on the piston pin center or on the thrust direction.

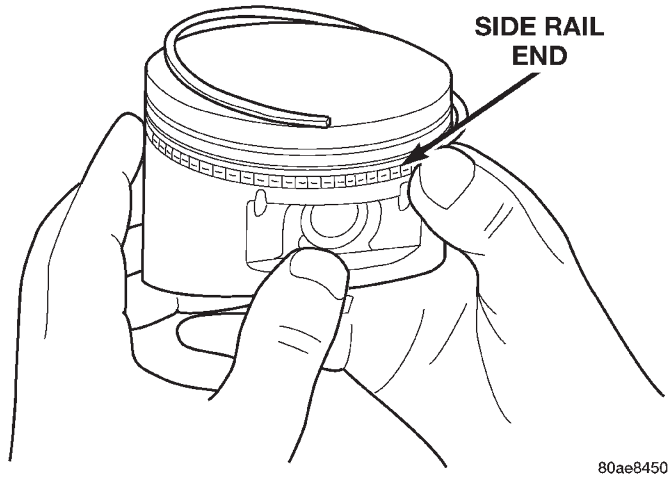


Fig. 14 Side Rail—Installation

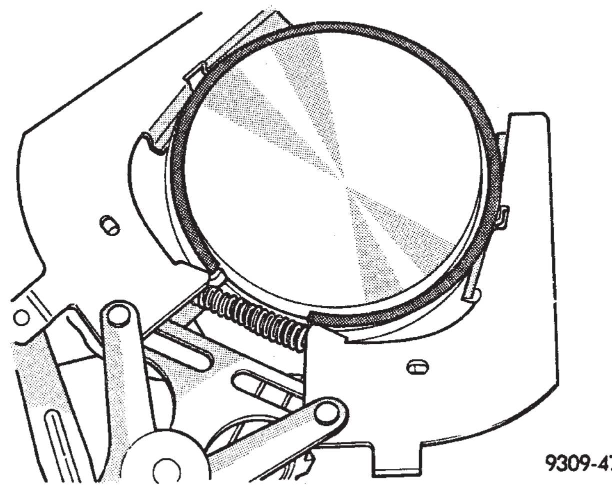


Fig. 15 Upper and Intermediate Rings—Installation

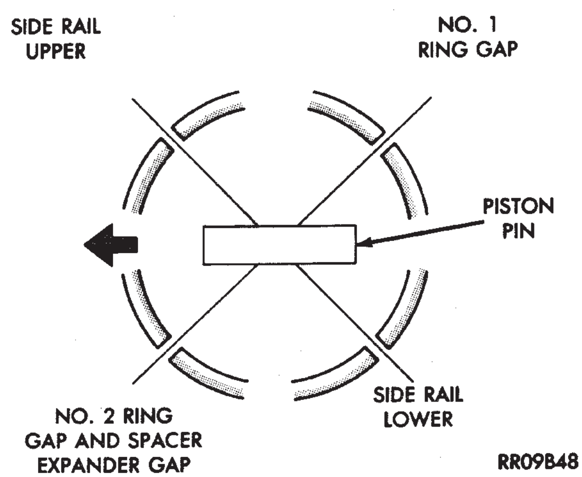


Fig. 16 Piston Ring End Gap Position

FITTING CONNECTING ROD BEARINGS

INSPECTION

BEARINGS

Inspect the connecting rod bearings for scoring and bent alignment tabs (Fig. 17) (Fig. 18). Check the bearings for normal wear patterns, scoring, grooving, fatigue and pitting (Fig. 19). Replace any bearing that shows abnormal wear.

Inspect the connecting rod journals for signs of scoring, nicks and burrs.

CONNECTING RODS

Misaligned or bent connecting rods can cause abnormal wear on pistons, piston rings, cylinder walls, connecting rod bearings and crankshaft con-

SERVICE PROCEDURES (Continued)

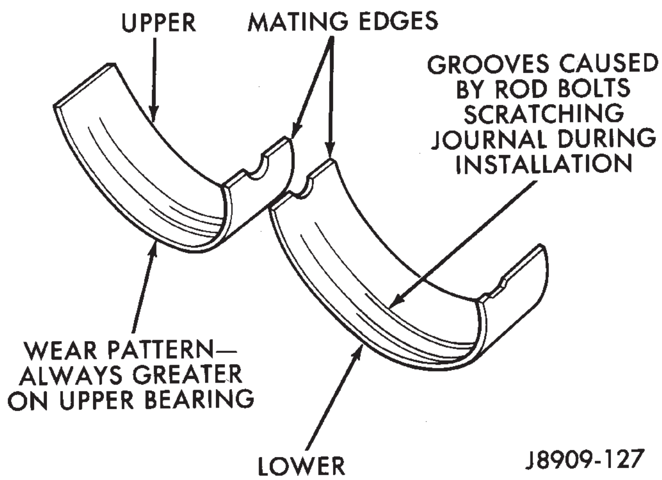


Fig. 17 Connecting Rod Bearing Inspection

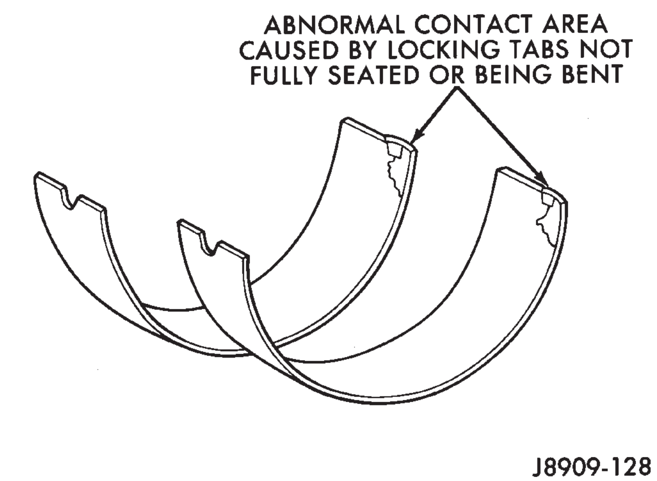


Fig. 18 Locking Tab Inspection

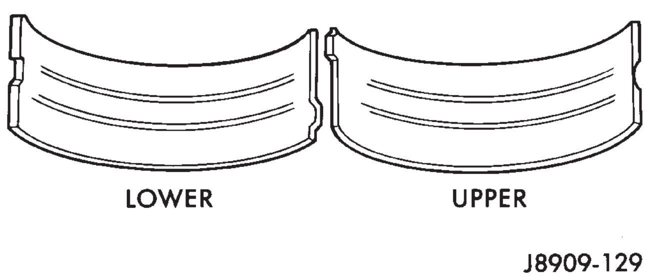


Fig. 19 Scoring Caused by Insufficient Lubrication or by Damaged Crankshaft Pin Journal

necting 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) Lubricate the upper bearing insert and install in connecting rod.

(3) Use piston ring compressor and Guide Pins Special Tool 8507 (Fig. 20) to install the rod and piston assemblies. The oil slinger slots in the rods must face front of the engine. The “F”’s near the piston wrist pin bore should point to the front of the engine.

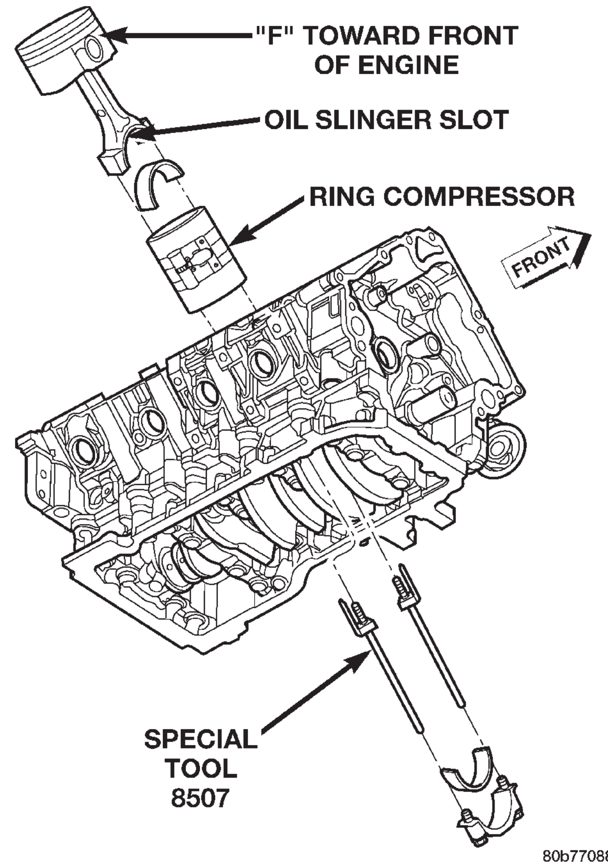


Fig. 20 Piston and Connecting Rod—Installation

(4) 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 center of bearing cap. Plastigage must not crumble in use. If brittle, obtain fresh stock.

(5) Install bearing cap and connecting rod on the journal and tighten bolts to 45 N·m (33 ft. lbs.) torque. DO NOT rotate crankshaft. Plastigage will smear, resulting in inaccurate indication.

(6) Remove the bearing cap and determine amount of bearing-to-journal clearance by measuring the width of compressed Plastigage (Fig. 21). 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.**

(7) If the correct clearance is indicated, replacement of the bearing inserts is not necessary. Remove

SERVICE PROCEDURES (Continued)

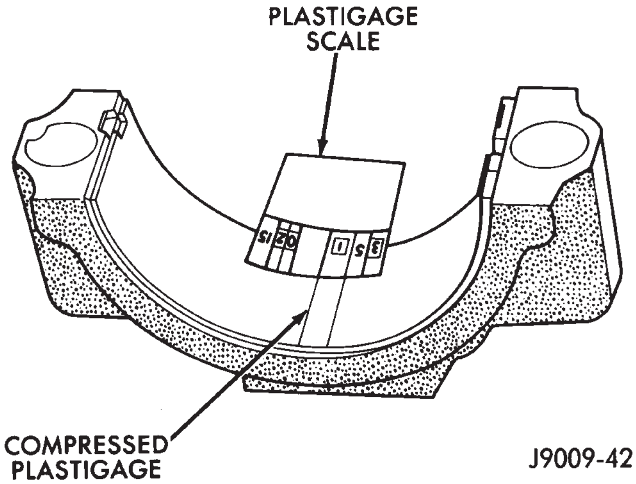


Fig. 21 Measuring Bearing Clearance with Plastigage

the Plastigage from crankshaft journal and bearing insert. Proceed with installation.

(8) If bearing-to-journal clearance exceeds the specification, determin which services bearing set to use the bearing sizes are as follows:

Bearing Mark	SIZE	USED WITH JOURNAL SIZE
.025 US	.025 mm (.001 in.) U/S	50.983-50.967 mm (2.0073-2.0066 in.)
Std.	STANDARD	50.992-51.008 mm (2.0076-2.0082 in.)
.250 US	.250 mm (.010 in.) U/S	50.758-50.742 mm (1.9984-1.9978 in.)

(9) Repeat the Plastigage measurement to verify your bearing selection prior to final assembly.

(10) 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 (Fig. 22). Refer to Engine Specifications for the proper clearance. Replace the connecting rod if the side clearance is not within specification.

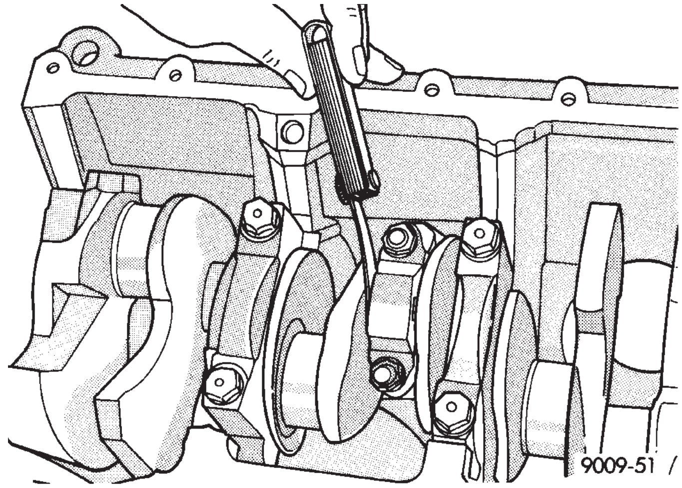


Fig. 22 Checking Connecting Rod Side Clearance—Typical

CRANKSHAFT MAIN BEARINGS

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. 23).

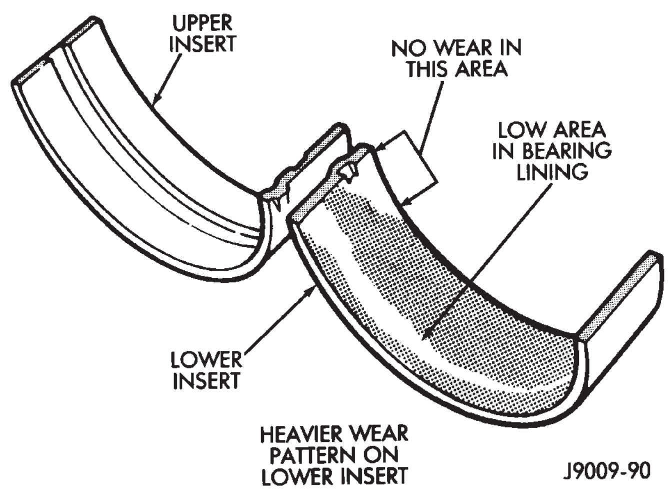


Fig. 23 Main Bearing Wear Patterns

NOTE: 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.

Replace all damaged or worn bearing inserts.

MAIN BEARING JOURNAL DIAMETER (CRANKSHAFT REMOVED)

Remove the crankshaft from the cylinder block. Refer to Crankshaft in this section for procedure.

Clean the oil off the main bearing journal.

SERVICE PROCEDURES (Continued)

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 is 0.008mm (0.0004 inch.) and maximum out of round is 0.005mm (0.002 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 Crankshaft in this section for procedure.

CRANKSHAFT MAIN BEARING SELECTION

(1) Service main bearings are available in three grades. The chart below identifies the three service grades available.

GRADE MARKING	SIZE mm (in.)	FOR USE WITH JOURNAL SIZE
A	.008 mm (.0004 in.) U/S	63.488-63.496 mm (2.4996-2.4999 in.)
B	STANDARD	63.496-63.504 mm (2.4999-2.5002 in.)
C	.008 mm (.0004 in.) O/S	63.504-63.512 mm (2.5002-2.5005 in.)

REMOVAL AND INSTALLATION

ENGINE MOUNTS—LEFT AND RIGHT

REMOVAL

(1) Disconnect the negative cable from the battery.

CAUTION: Remove the fan blade, fan clutch and fan shroud before raising engine. Failure to do so may cause damage to the fan blade, fan clutch and fan shroud.

(2) Remove the fan blade, fan clutch and fan shroud. Refer to Group 7. for procedure.

(3) Remove the engine oil filter.

(4) Support the engine with a suitable jack and a block of wood across the full width of the engine oil pan.

(5) Remove the four cylinder block-to-insulator mount bolts and the nut form the engine insulator mount through bolt (Fig. 24) (Fig. 25)

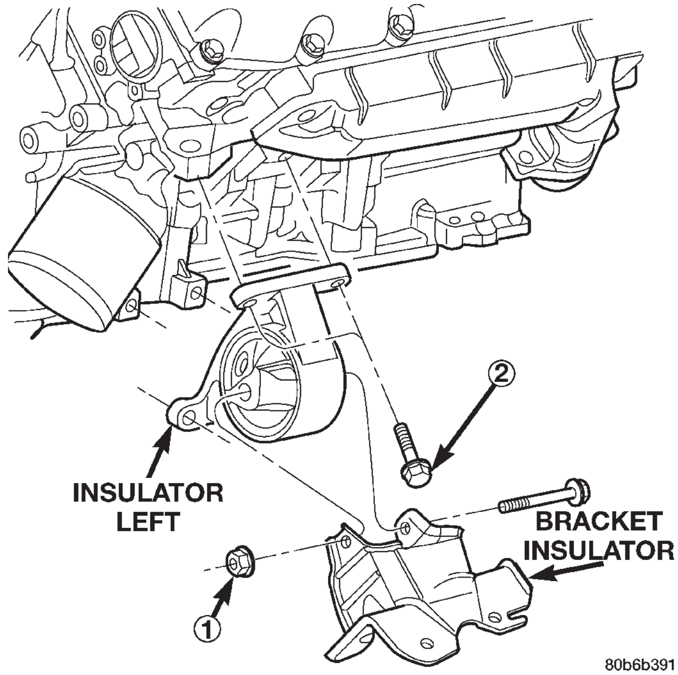


Fig. 24 Engine Insulator Mount—Left

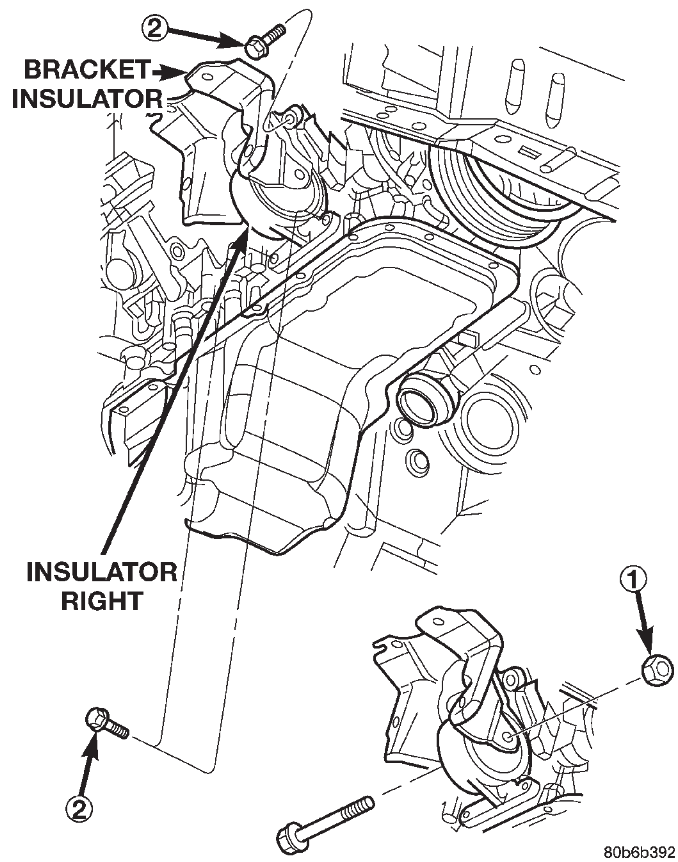


Fig. 25 Engine Insulator Mount—Right

(6) Using the jack, raise the engine high enough to remove the engine insulator mount through bolt and the insulator mount.

REMOVAL AND INSTALLATION (Continued)

ITEM	DESCRIPTION	TORQUE
1	NUT (Qty 1 Per Side)	61N·m (45 ft. lbs)
2	BOLT (Qty 4 Per Side)	61N·m (45 ft. lbs.)

INSTALLATION

(1) Position the insulator mount and install the insulator mount through bolt.

(2) Lower the engine until the four cylinder block-to-insulator mount bolts can be installed.

(3) Remove the jack and block of wood.

(4) Torque the cylinder block-to-insulator mount bolts to 61 N·m (45 ft. lbs.).

(5) Install and torque the through bolt retaining nut to 61 N·m (45 ft. lbs.).

(6) Install the fan blade, fan clutch and fan shroud.

ENGINE MOUNT—REAR

REMOVAL

(1) Raise vehicle on hoist.

(2) Using a suitable jack, support transmission.

(3) Remove the lock nut from the insulator mount through bolt and the four insulator-to-transmission mounting bolts.

(4) Raise the transmission enough to remove the through bolt and insulator mount (Fig. 26) (Fig. 27).

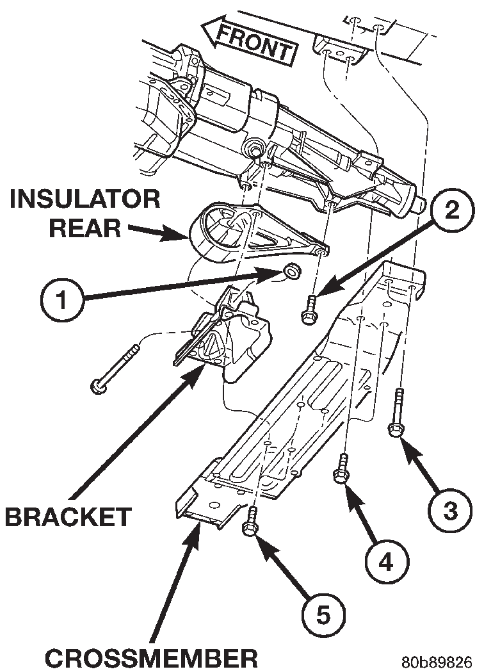


Fig. 26 Engine Rear Mount—4X2

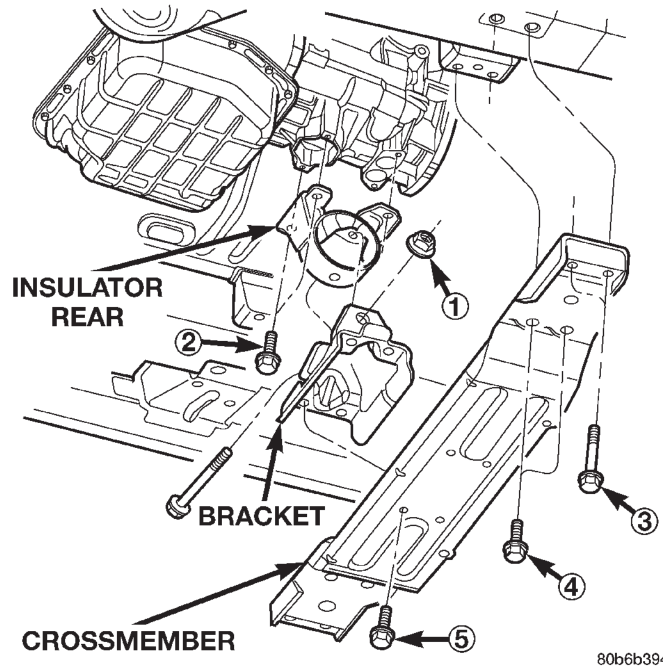


Fig. 27 Engine Rear Mount—4X4

ITEM	DESCRIPTION	TORQUE
1	NUT (Qty 1)	45 N·m (33 ft. lbs)
2	BOLT (Qty 4)	46 N·m (34 ft. lbs.)
3	BOLT (Qty 2 Per Side)	68 N·m (50 ft. lbs.)
4	BOLT (Qty 2 Per Side)	46 N·m (34 ft. lbs.)
5	BOLT (Qty 4)	46 N·m (34 ft. lbs.)

INSTALLATION

(1) Position the insulator mount and install the through bolt.

(2) Lower the transmission enough to install the four insulator-to-transmission mounting bolts. Torque the bolts to 46 N·m (34 ft. lbs.).

(3) Install the through bolt lock nut. Torque nut to 68 N·m (50 ft. lbs.).

(4) Remove jack, lower vehicle.

STRUCTURAL COVER

REMOVAL

(1) Raise vehicle on hoist.

(2) Remove the left hand exhaust pipe from exhaust manifold. Refer to Group 11, Exhaust System.

REMOVAL AND INSTALLATION (Continued)

(3) Loosen the right hand exhaust manifold-to-exhaust pipe retaining bolts.

(4) Remove the eight bolts retaining structural cover (Fig. 28).

(5) Pivot the exhaust pipe downward and remove the structural cover.

INSTALLATION

CAUTION: The structural cover must be installed as described in the following steps. Failure to do so will cause severe damage to the cover.

(1) Position the structural cover in the vehicle.

(2) Install all four bolts retaining the cover-to-engine. DO NOT tighten the bolts at this time.

(3) Install the four cover-to-transmission bolts. Do NOT tighten at this time.

CAUTION: The structural cover must be held tightly against both the engine and the transmission bell housing during tightening sequence. Failure to do so may cause damage to the cover.

(4) Starting with the two rear cover-to-engine bolts, tighten bolts (1) (Fig. 28) to 54 N·m (40 ft. lbs.), then tighten bolts (2) (Fig. 28) and (3) to 54 N·m (40 ft. lbs.) in the sequence shown.

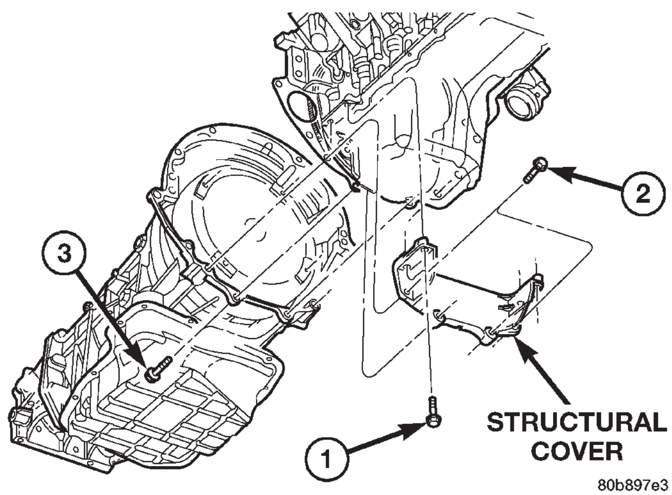


Fig. 28 Structural Cover

SEQUENCE	ITEM	TORQUE
1	BOLT (Qty 4)	54 N·m (40 ft. lbs.)
2	BOLT (Qty 2)	54 N·m (40 ft. lbs.)
3	BOLT (Qty 2)	54 N·m (40 ft. lbs.)

(5) Install the exhaust pipe on left hand exhaust manifold.

(6) Tighten exhaust manifold-to-exhaust pipe retaining bolts to 20–26 N·m (15–20 ft. lbs.).

ENGINE ASSEMBLY

REMOVAL

(1) Disconnect the battery negative cable.

(2) Remove front fascia. Refer to Group 13, Frames and Bumpers for procedure.

(3) Remove the head lamp mounting module (HMM). Refer to Group 23, Body for procedure.

(4) Raise vehicle on hoist.

(5) Disconnect the O2 sensor.

(6) Remove engine oil filter.

(7) Remove exhaust crossover pipe from the vehicle. Refer to Group 11, Exhaust System.

(8) Remove structural cover. Refer to Structural Cover in this section for procedure.

(9) Remove rubber splash shield.

(10) Drain cooling system. Refer to Group 7, Cooling System.

(11) Remove starter. Refer to Group 8B, Starting System.

(12) Disconnect crankshaft position sensor. (Fig. 29)

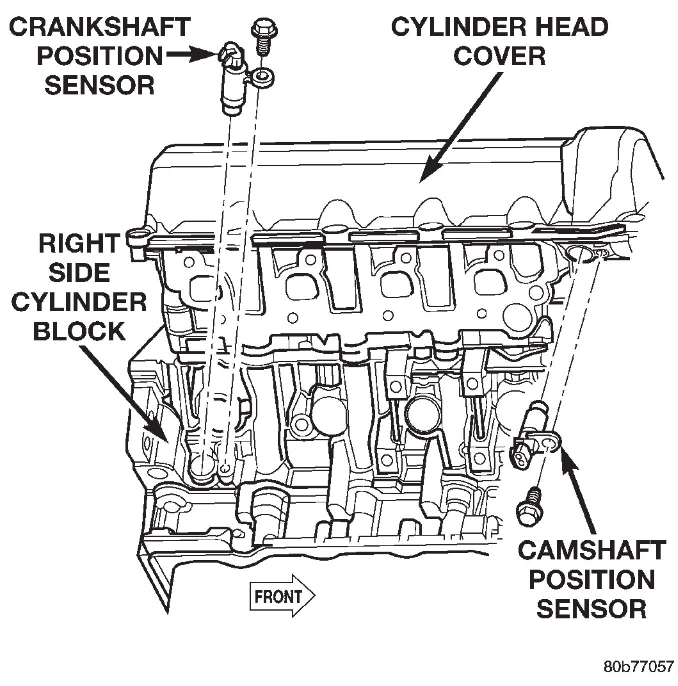


Fig. 29 Crankshaft Position Sensor

(13) Remove torque converter bolts. Refer to Group 21, Transmission.

Remove transmission to engine mounting bolts, all except the two lower bolts.

(14) Disconnect two ground straps from the lower right hand side of the engine.

(15) Lower vehicle.

REMOVAL AND INSTALLATION (Continued)

(16) Remove throttle body resonator assembly and inlet hose (Fig. 30).

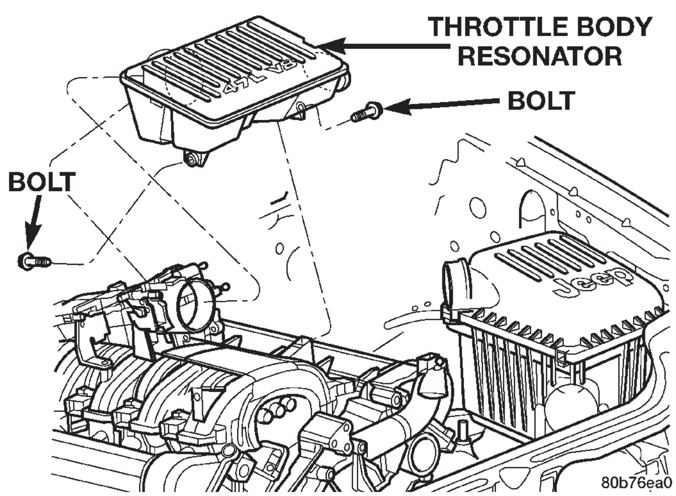


Fig. 30 Throttle Body Resonator

(17) Disconnect throttle and speed control cables.

(18) Disconnect tube from both the left and right side crankcase breathers (Fig. 31).

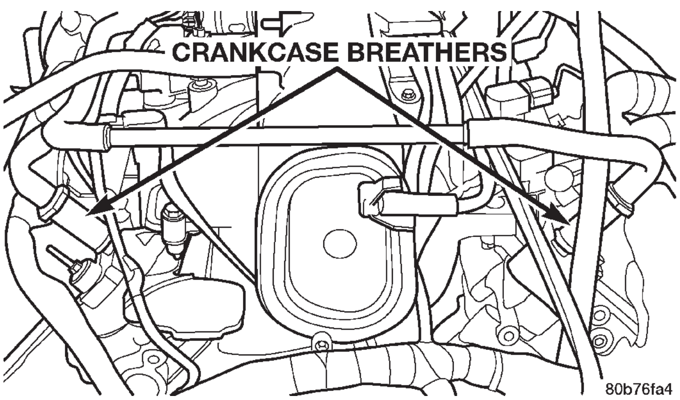


Fig. 31 Crankcase Breather Connection Points

(19) Discharge A/C system. Refer to Group 24, Heating and Air Conditioning.

(20) Remove A/C compressor.

(21) Remove shroud, fan assemblies and accessory drive belt. Refer to Group 7, Cooling System.

(22) Remove oil fill tube.

(23) Disconnect transmission oil cooler lines at the radiator.

(24) Disconnect radiator lower hose at the thermostat housing. Refer to Group 7.

(25) Remove radiator. Refer to Group 7, Cooling System.

(26) Remove A/C condenser. Refer to Group 24, Heating and Air Conditioning.

(27) Remove generator mounting bolts, set the generator aside.

(28) Disconnect the two heater hoses from the timing chain cover.

(29) Disconnect engine harness at the following points:

- Intake air temperature (IAT) sensor (Fig. 32)
- Fuel Injectors
- Throttle Position (TPS) Switch
- Idle Air Control (IAC) Motor
- Engine Oil Pressure Switch
- Engine Coolant Temperature (ECT) Sensor
- Manifold absolute pressure (MAP) Sensor
- Camshaft Position (CMP) Sensor
- Coil Over Plugs

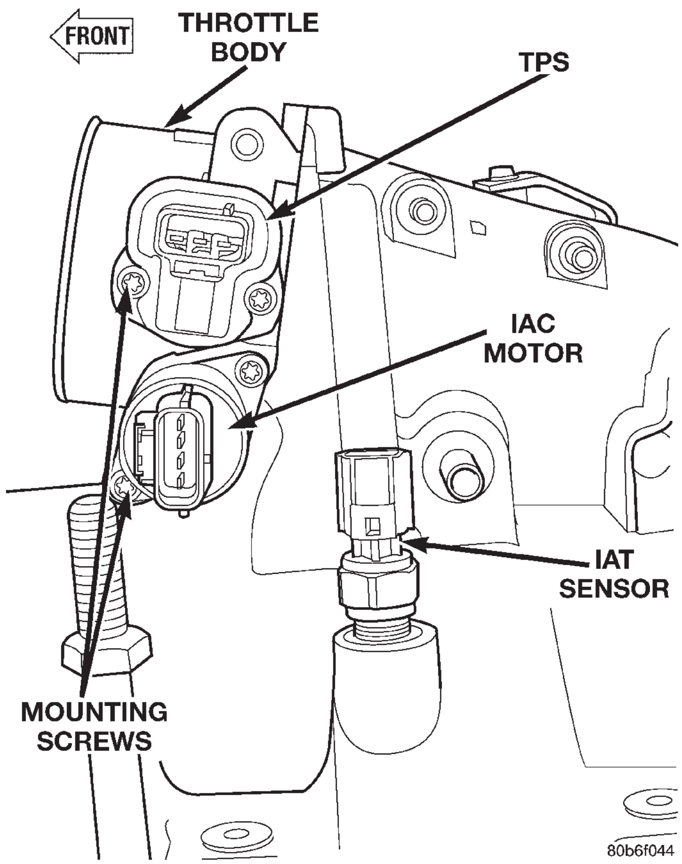


Fig. 32 Throttle Body Connection Points

(30) Release fuel rail pressure then disconnect the fuel supply quick connect fitting at the fuel rail. Refer to Group 14 Fuel System for procedure.

(31) Remove power steering pump and position out of the way.

(32) Disconnect ground straps from the left side of the engine.

(33) Remove oil dipstick tube upper mounting bolt. Then remove the generator wiring from behind the dipstick tube.

(34) Install Engine Lifting Fixture Special Tool 8347 (Fig. 33) following these steps.

- Holding the lifting fixture at a slight angle, slide the large bore in the front plate over the hex portion of the lifting stud.

REMOVAL AND INSTALLATION (Continued)

• Position the two remaining fixture arms onto the two lifting studs in the cylinder heads.
• Pull foward and upward on the lifting fixture so that the lifting stud rest in the slotted area below the large bore.
• Secure the lifting fixture to the three studs using three 7/16 – 14 N/C locknuts.
• Make sure the lifting loop in the lifting fixture is in the last hole (closest to the throttle body) to minimize the angle of engine during removal.

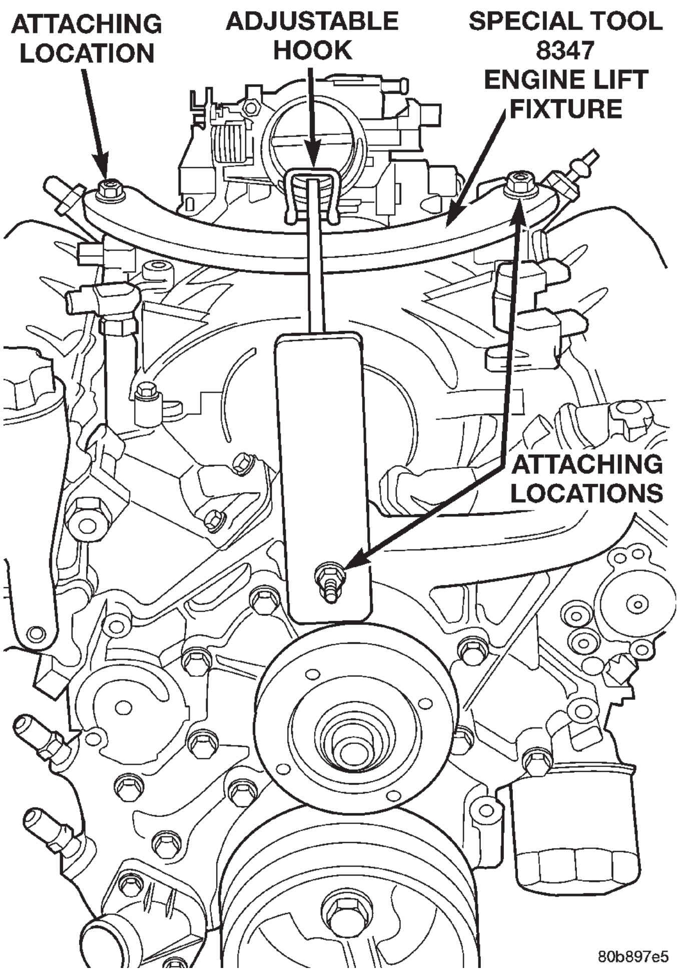


Fig. 33 Engine Lifting Fixture Attachment Locations

(35) Disconnect body ground strap at the right side cowl.

NOTE: In order to remove the engine from the vehicle the engine mount insulators must be removed from the engine.

(36) Remove both left and right side engine mount insulator to engine bolts.

NOTE: It will be necessary to support the transmission in order to remove the engine.

(37) Position a suitable jack under the transmission.

(38) Remove two lower transmission to engine mounting bolts.

(39) Remove the through bolt retaining nut from both the left and right side engine mounts.

(40) Raise engine enough to remove the engine mount through bolts and the engine mount insulators.

(41) Remove engine from the vehicle.

INSTALLATION

(1) Position engine in the vehicle.

Position both the left and right side engine mount insulators and install the through bolts.

(2) Install two lower transmission to engine mounting bolts.

(3) Remove jack from under the transmission.

(4) Install both the left and right side engine mount insulators onto the engine.

(5) Remove engine lifting fixture special tool 8347 (Fig. 33).

(6) Position generator wiring behind the oil dipstick tube, then install the oil dipstick tube upper mounting bolt.

(7) Connect ground straps on the left side of the engine.

(8) Install power steering pump.

(9) Connect fuel supply line quick connect fitting.

(10) Connect engine harness at the following points (Fig. 32):

• Intake Air Temperature (IAT) Sensor
• Idle Air Control (IAC) Motor
• Fuel Injectors
• Throttle Position (TPS) Switch
• Engine Oil Pressure Switch
• Engine Coolant Temperature (ECT) Sensor
• Manifold Absolute Pressure (MAP) Sensor
• Camshaft Position (CMP) Sensor
• Coil Over Plugs

(11) Install generator.

(12) Install A/C condenser.

(13) Install radiator.

(14) Connect radiator lower hose at the thermostat housing.

(15) Connect the transmission oil cooler lines to the radiator.

(16) Install oil fill tube.

(17) Install accessory drive belt, fan assembly and shroud.

(18) Install A/C compressor. Tighten the A/C compressor and generator M10 mounting bolts 40–68N·M (30–50 ft. lbs.) and the M8 bolts 22–34 N·m (200–300 in. lbs.).

(19) Connect tube to both crankcase breathers (Fig. 31).

REMOVAL AND INSTALLATION (Continued)

(20) Connect throttle and speed control cables.
(21) Install throttle body resonator assembly and inlet hose (Fig. 30).
(22) Raise vehicle.
(23) Connect two ground straps on the lower right hand side of the engine.
(24) Install transmission to engine mounting bolts. Tighten the bolts to 41 N·m (30 ft. lbs.).
(25) Install torque converter bolts.
(26) Connect crankshaft position sensor (Fig. 29).
(27) Install starter.
(28) Install rubber splash shield.

CAUTION: The structural cover requires a specific torque sequence. Failure to follow this sequence may cause severe damage to the cover.

(29) Install structural cover. Refer to Structural Cover in this section.
(30) Install exhaust crossover pipe.
(31) Install engine oil filter.
(32) Connect O2 sensor.
(33) Lower vehicle.
(34) Check and fill engine oil.
(35) Recharge the A/C system.
(36) Refill the engine cooling system. Refer to Group 7, Cooling System.
(37) Connect the battery negative cable.
(38) Start the engine and check for leaks.

INTAKE MANIFOLD

REMOVAL

(1) Disconnect negative cable from battery.
(2) Remove air cleaner housing and throttle body resonator (Fig. 34).

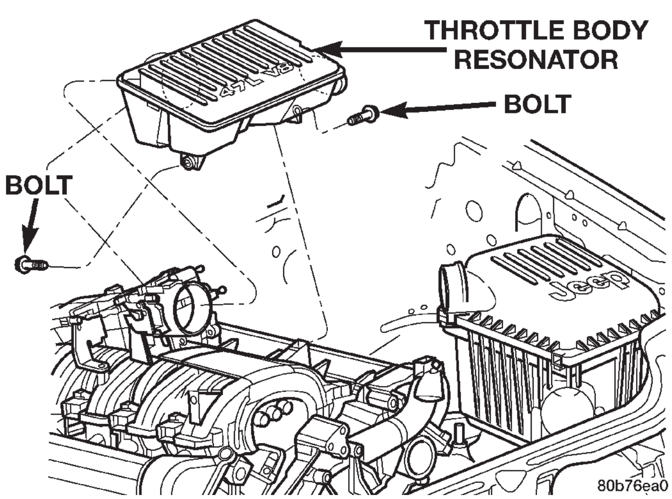


Fig. 34 Throttle Body Resonator

(3) Disconnect throttle and speed control cables.
(4) Disconnect electrical connectors for the following components: (Refer to Group 14, Fuel System for component locations)

- Manifold Absolute Pressure (MAP) Sensor
- Intake Air Temperature (IAT) Sensor
- Throttle Position (TPS) Sensor
- Coolant Temperature (CTS) Sensor
- Idle Air Control (IAC) Motor

(5) Disconnect vapor purge hose, brake booster hose, speed control servo hose, positive ventilation crankcase (PCV) hose.
(6) Remove accessory drive belt. Refer to Group 7, Cooling System for procedure.
(7) Disconnect generator electrical connections.
(8) Unbolt the generator and move it away from the intake manifold for clearance.
(9) Disconnect air conditioning compressor electrical connections.
(10) Unbolt the air conditioning compressor and move it away from the intake manifold for clearance.
(11) Disconnect left and right radio suppressor straps.
(12) Disconnect and remove ignition coil towers.
(13) Remove top oil dipstick tube retaining bolt and ground strap.
(14) Bleed fuel system. Refer to Group 14, Fuel System for bleeding procedures.
(15) Remove fuel rail.
(16) Remove throttle body assembly and mounting bracket.
(17) Drain cooling system below coolant temperature level. Refer to Group 7, Cooling System for procedure.
(18) Remove coolant temperature sensor. Refer to Group 14, Fuel System for component location.
(19) Remove cowl to hood seal. Refer to Group 23, Body for component location and procedure.
(20) Remove right side engine lifting stud.
(21) Remove intake manifold retaining fasteners, in reverse order of tightening sequence (Fig. 35).

NOTE: Intake must be lifted upward and level in the front and rear to clear the cowl. Interference with the cowl will occur during removal.

(22) Remove intake manifold.

INSTALLATION

(1) Install intake manifold gaskets.
(2) Install intake manifold.
(3) Install intake manifold retaining bolts and tighten in sequence shown in (Fig. 35) to 12 N·m (105 in. lbs.).
(4) Install left and right radio suppressor straps.
(5) Install throttle body assembly.
(6) Install throttle cable bracket.

REMOVAL AND INSTALLATION (Continued)

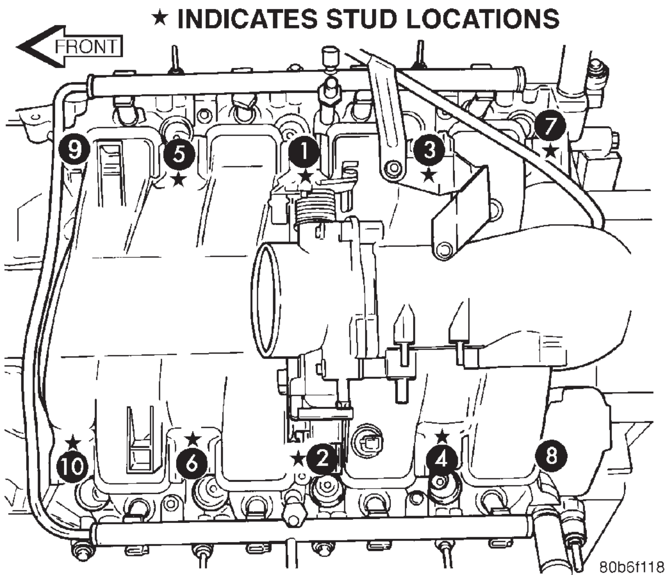


Fig. 35 Intake Manifold Tightening Sequence

(7) Connect throttle cable and speed control cable to throttle body.

(8) Install fuel rail.

(9) Install ignition coil towers.

(10) Install coolant temperature sensor.

(11) Connect electrical connectors for the following components:

- Manifold Absolute Pressure (MAP) Sensor
- Intake Air Temperature (IAT) Sensor
- Throttle Position (TPS) Sensor
- Coolant Temperature (CTS) Sensor
- Idle Air Control (IAC) Motor
- Ignition coil towers
- Fuel injectors

(12) Install top oil dipstick tube retaining bolt and ground strap.

(13) Install right side engine lifting stud.

(14) Install generator including electrical connections.

(15) Connect Vapor purge hose, Brake booster hose, Speed control servo hose, Positive ventilation crankcase (PCV) hose.

(16) Install air conditioning compressor including electrical connections.

(17) Fill cooling system. Refer to Group 7, Cooling System for procedure.

(18) Install accessory drive belt.

(19) Install cowl to hood seal. Refer to Group 23, Body for procedure.

(20) Install air cleaner housing and throttle body resonator.

(21) Connect negative cable to battery.

EXHAUST MANIFOLDS

RIGHT EXHAUST MANIFOLD

REMOVAL

(1) Disconnect negative cable for battery.

(2) Remove battery from vehicle.

(3) Remove Power Distribution Center (PDC) fasteners and set aside.

(4) Remove battery tray assembly.

(5) Remove washer bottle assembly

(6) Remove accessory drive belt. Refer to Group 7, Cooling System for procedures.

(7) Remove A/C compressor from mounting and set aside.

(8) Remove A/C accumulator support bracket fastener.

(9) Drain coolant below heater hose level. Refer to Group 7, Cooling System for procedures.

(10) Remove heater hoses at engine.

(11) Remove fasteners attaching exhaust manifold heat shield.

(12) Remove heat shield.

(13) Remove upper exhaust manifold attaching fasteners.

(14) Raise vehicle on hoist.

(15) Disconnect exhaust pipe from manifold.

(16) Remove fasteners attaching starter. Move starter aside.

(17) Remove lower exhaust manifold attaching fasteners.

(18) Remove exhaust manifold and gasket. Manifold is removed from below the engine compartment.

INSTALLATION

(1) Install exhaust manifold and gasket from below engine compartment.

(2) Install lower exhaust manifold fasteners. DO NOT tighten until all fasteners are in place.

(3) Lower vehicle and install upper exhaust manifold fasteners. Tighten all manifold bolts starting at center and working outward to 25 N·m (18 ft. lbs.).

CAUTION: Over tightening heat shield fasteners, may cause shield to distort and/or crack.

(4) Install exhaust manifold heat shield. Tighten fasteners to 8 N·m (72 in. lbs.), then loosen 45 degrees.

(5) Install starter and fasteners.

(6) Connect exhaust pipe to manifold.

(7) Connect heater hoses at engine.

(8) Install fastener attaching A/C accumulator.

(9) Install A/C compressor and fasteners.

(10) Install accessory drive belt.

(11) Install washer bottle and battery tray assembly.

REMOVAL AND INSTALLATION (Continued)

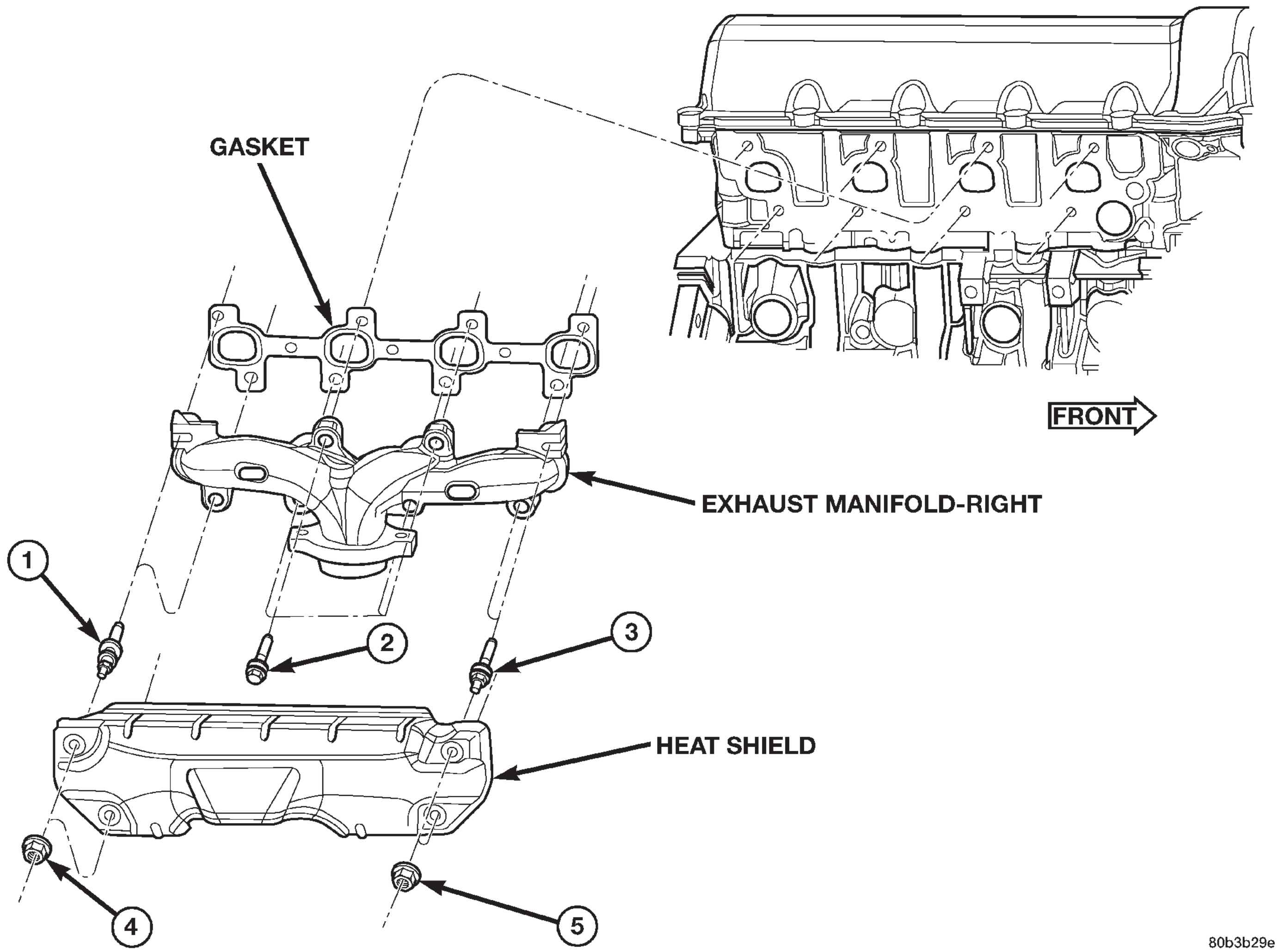


Fig. 36 Exhaust Manifold—Right

ITEM	DESCRIPTION	TORQUE	ITEM	DESCRIPTION	TORQUE
1	Stud (Qty 2)	25 N·m (18 ft. lbs.)	4	Nut (Qty 2)	8 N·m (72 in. lbs.), then loosen 45 degrees
2	Bolt (Qty 4)		5	Nut (Qty 2)	
3	Stud (Qty 2)				

(12) Install PDC.

(13) Install battery and connect cables.

(14) Fill cooling system. Refer to Group 7, Cooling System for procedure.

LEFT EXHAUST MANIFOLD

REMOVAL

(1) Disconnect negative cable for battery.

(2) Hoist vehicle.

(3) Disconnect exhaust pipe at manifold.

(4) Lower vehicle.

(5) Remove air cleaner housing and tube.

(6) Remove the front two exhaust heat shield retaining fasteners. Raise vehicle and remove the fasteners at rear of heat shield.

(7) Remove heat shield (Fig. 37).

(8) Lower vehicle and remove the upper exhaust manifold retaining bolts (Fig. 37).

(9) Raise vehicle and remove the lower exhaust manifold retaining bolts (Fig. 37).

(10) Remove exhaust manifold and gasket (Fig. 37). Manifold is removed from below the engine compartment.

REMOVAL AND INSTALLATION (Continued)

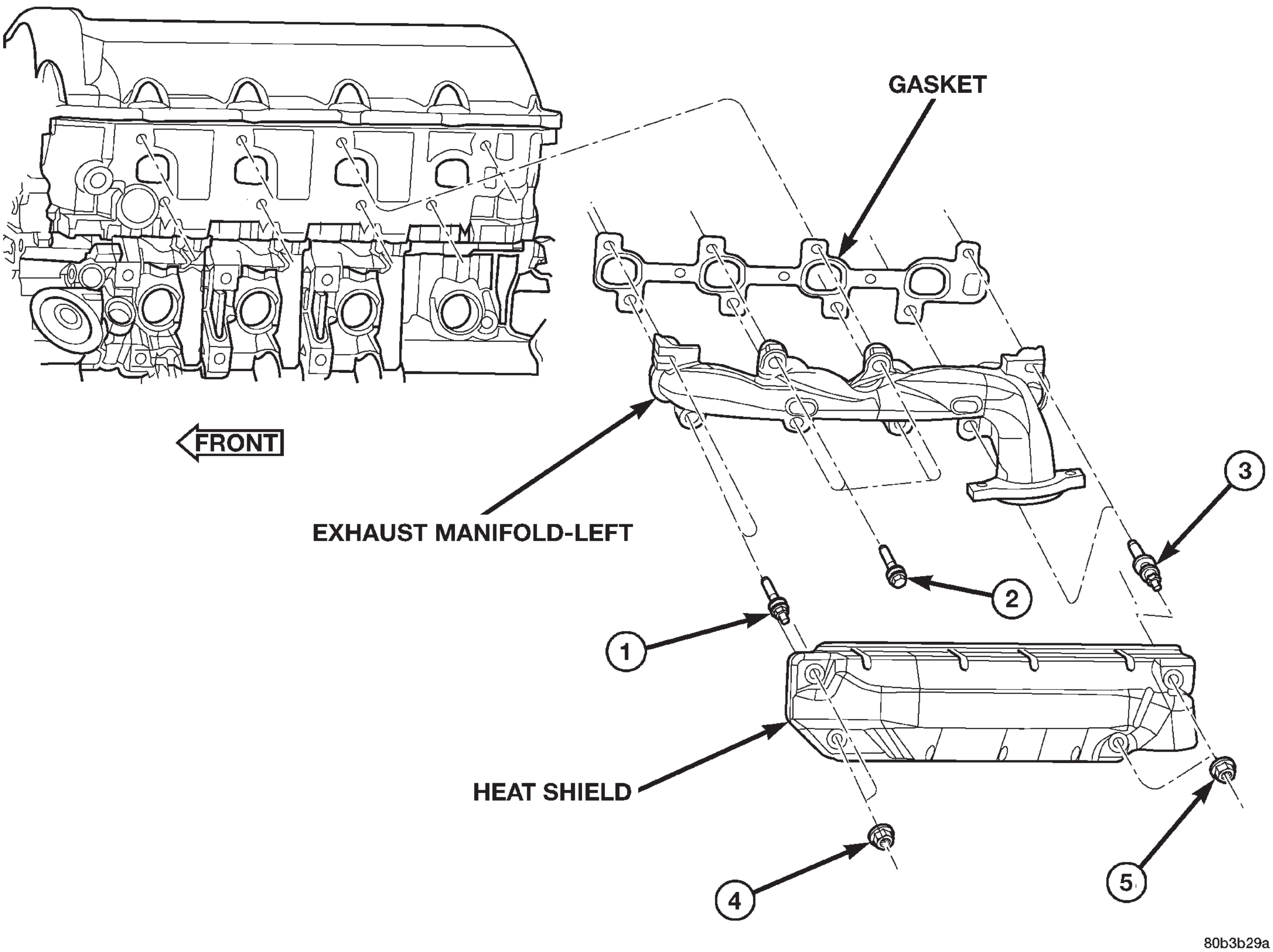


Fig. 37 Exhaust Manifold—Left

ITEM	DESCRIPTION	TORQUE	ITEM	DESCRIPTION	TORQUE
1	Stud (Qty 2)	25 N·m (18 ft. lbs.)	4	Nut (Qty 2)	8 N·m (72 in. lbs.), then loosen 45 degrees
2	Bolt (Qty 4)		5	Nut (Qty 2)	
3	Stud (Qty 2)				

INSTALLATION

(1) Install exhaust manifold and gasket from below engine compartment.

(2) Install lower exhaust manifold fasteners (Fig. 37). DO NOT tighten until all fasteners are in place.

(3) Lower vehicle and install upper exhaust manifold fasteners (Fig. 37). Tighten all manifold bolts starting at center and working outward to 25 N·m (18 ft. lbs.).

CAUTION: Over tightening heat shield fasteners, may cause shield to distort and/or crack.

(4) Install exhaust manifold heat shield (Fig. 37). Tighten fasteners to 8 N·m (72 in. lbs.), then loosen 45 degrees.

(5) Install air cleaner housing and tube.

(6) Connect exhaust pipe to manifold.

(7) Connect negative cable to battery.

CYLINDER HEAD COVERS

CYLINDER HEAD COVER LEFT

REMOVAL

(1) Disconnect negative cable from battery.

REMOVAL AND INSTALLATION (Continued)

(2) Remove air cleaner housing and throttle body resonator (Fig. 38).

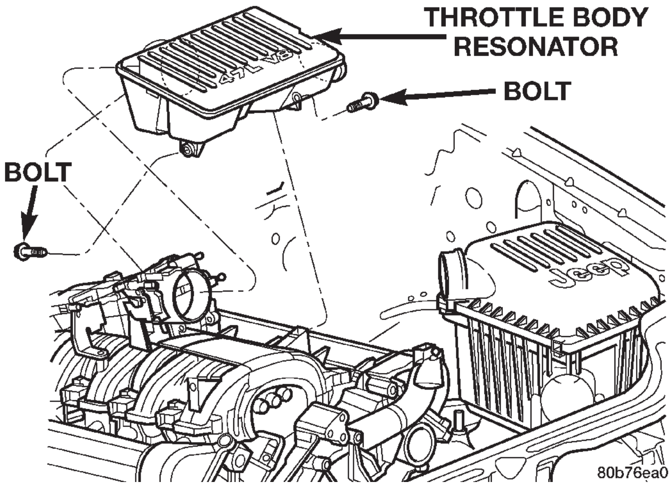


Fig. 38 Throttle Body Resonator

(3) Disconnect injector connectors and un-clip the injector harness.

(4) Route injector harness in front of cylinder head cover.

(5) Remove the cylinder head cover mounting bolts.

(6) Remove cylinder head cover and gasket.

NOTE: The gasket may be used again, provided no cuts, tears, or deformation has occurred.

INSTALLATION

CAUTION: Do not use harsh cleaners to clean the cylinder head covers. Severe damage to covers may occur.

(1) Clean cylinder head cover and both sealing surfaces. Inspect and replace gasket as necessary.

(2) Install cylinder head cover and hand start all fasteners. Verify that all studs are in the correct location shown in (Fig. 39).

(3) Tighten cylinder head cover bolts and double ended studs to 12 N·m (105 in. lbs.).

(4) Connect injector electrical connectors and injector harness retaining clips.

(5) Install air cleaner assembly and throttle body resonator.

(6) Connect negative cable to battery.

CAUTION: DO NOT allow other components including the wire harness to rest on or against the cylinder head cover. Prolonged contact with other objects may wear a hole in the engine cylinder head cover.

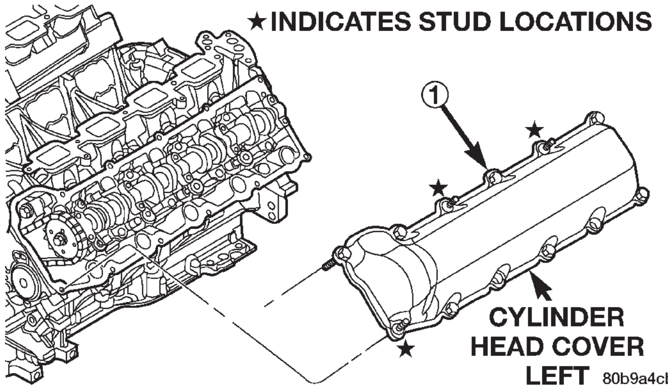


Fig. 39 Cylinder Head Cover—Left

ITEM	DESCRIPTION	TORQUE
1	Cover Fasteners	12 N·m (105 in. lbs.)

CYLINDER HEAD COVER RIGHT

REMOVAL

(1) Disconnect and remove battery from engine compartment.

(2) Remove air cleaner housing and throttle body resonator (Fig. 38).

(3) Disconnect battery lugs from Power Distribution Center (PDC).

(4) Un-clip PDC and move to the left side of the fender well.

(5) Drain cooling system, below the level of the heater hoses. Refer to Group 7, Cooling System.

(6) Remove accessory drive belt.

(7) Remove air conditioning compressor retaining bolts and move compressor to the left.

(8) Remove battery tray and disconnect battery temperature sensor.

(9) Remove heater hoses from front of engine.

(10) Loosen air conditioning accumulator bracket.

(11) Disconnect injector and ignition coil connectors.

(12) Disconnect and remove positive crankcase ventilation (PCV) hose.

(13) Remove oil fill tube.

(14) Un-clip injector and ignition coil harness and move away from cylinder head cover.

(15) Remove right rear breather tube and filter assembly.

(16) Remove cylinder head cover retaining bolts.

(17) Remove cylinder head cover.

NOTE: The gasket may be used again, provided no cuts, tears, or deformation has occurred.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

CAUTION: Do not use harsh cleaners to clean the cylinder head covers. Severe damage to covers may occur.

(1) Clean cylinder head cover and both sealing surfaces. Inspect and replace gasket as necessary.

(2) Install cylinder head cover and hand start all fasteners. Verify that all double ended studs are in the correct location shown in (Fig. 40).

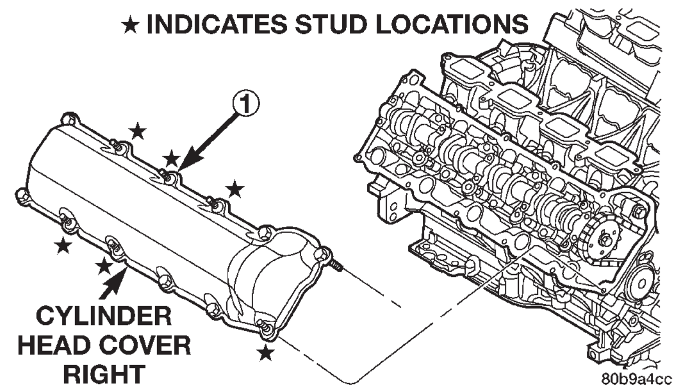


Fig. 40 Cylinder Head Cover—Right

ITEM	DESCRIPTION	TORQUE
1	Cover Fasteners	12 N·m (105 in. lbs.)

(3) Tighten cylinder head cover bolts and double ended studs to 12 N·m (105 in. lbs).

(4) Install right rear breather tube and filter assembly.

(5) Connect injector, ignition coil electrical connectors and harness retaining clips.

(6) Install the oil fill tube.

(7) Install PCV hose.

(8) Tighten air conditioning accumulator bracket.

(9) Install heater hoses.

(10) Connect battery temperature sensor and install battery tray.

(11) Install air conditioning compressor retaining bolts.

(12) Install accessory drive belt. Refer to Group 7, Cooling System.

(13) Fill Cooling system. Refer to Group 7, Cooling System.

(14) Connect PDC and install battery lugs.

(15) Install throttle body resonator and air cleaner housing.

(16) Install battery and connect battery cables.

CAUTION: DO NOT allow other components including the wire harness to rest on or against the engine cylinder head cover. Prolonged contact with other objects may wear a hole in the cylinder head cover.

ROCKER ARMS

REMOVAL

NOTE: Disconnect the battery negative cable to prevent accidental starter engagement.

(1) Remove the cylinder head cover. Refer to Cylinder Head Cover in this section.

(2) For rocker arm removal on cylinders 3 and 5 Rotate the crankshaft until cylinder #1 is at TDC exhaust stroke.

(3) For rocker arm removal on cylinders 2 and 8 Rotate the crankshaft until cylinder #1 is at TDC compression stroke.

(4) For rocker arm removal on cylinders 4 and 6 Rotate the crankshaft until cylinder #3 is at TDC compression stroke.

(5) For rocker arm removal on cylinders 1 and 7 Rotate the crankshaft until cylinder #2 is at TDC compression stroke.

(6) Using special tool 8516 press downward on the valve spring, remove rocker arm (Fig. 41).

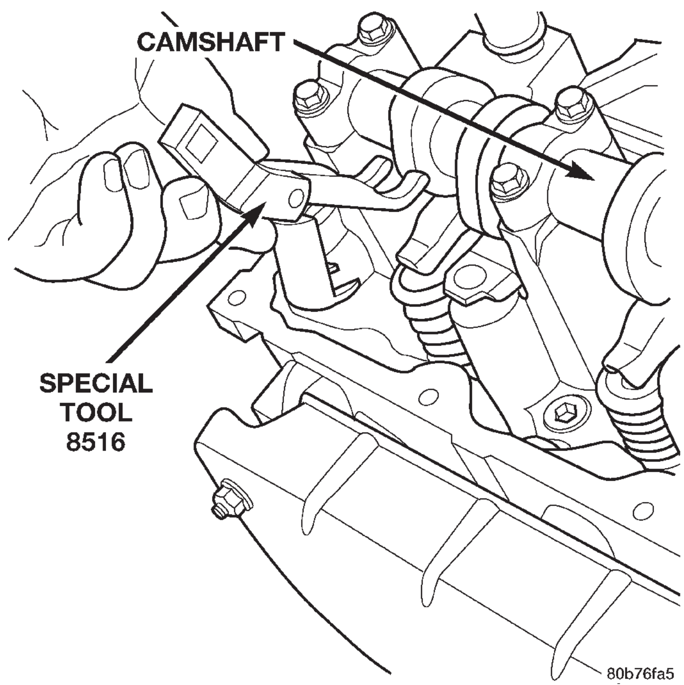


Fig. 41 Rocker Arm—Removal

INSTALLATION

CAUTION: Make sure the rocker arms are installed with the concave pocket over the lash adjusters. Failure to do so may cause severe damage to the rocker arms and/or lash adjusters.

REMOVAL AND INSTALLATION (Continued)

NOTE: Coat the rocker arms with clean engine oil prior to installation.

(1) For rocker arm installation on cylinders 3 and 5 Rotate the crankshaft until cylinder #1 is at TDC exhaust stroke.

(2) For rocker arm installation on cylinders 2 and 8 Rotate the crankshaft until cylinder #1 is at TDC compression stroke.

(3) For rocker arm installation on cylinders 4 and 6 Rotate the crankshaft until cylinder #3 is at TDC compression stroke.

(4) For rocker arm installation on cylinders 1 and 7 Rotate the crankshaft until cylinder #2 is at TDC compression stroke.

(5) Using special tool 8516 press downward on the valve spring, install rocker arm (Fig. 41).

(6) Install the cylinder head cover.

VALVE STEM SEALS AND SPRINGS

To service valve stem seals or springs refer to cylinder head removal procedures outlined in this section.

CYLINDER HEADS

CYLINDER HEAD—LEFT

REMOVAL

(1) Disconnect the negative cable from the battery.

(2) Raise the vehicle on a hoist.

(3) Disconnect the exhaust pipe at the left side exhaust manifold.

(4) Drain the engine coolant. Refer to Group 7, Cooling system for procedure.

(5) Lower the vehicle.

(6) Remove the intake manifold. Refer to procedure in this section.

(7) Remove the cylinder head cover. Refer to procedure in this section.

(8) Remove the fan shroud. Refer to Group 7, Cooling System for procedure.

(9) Remove the power steering pump.

(10) Rotate the crankshaft until the damper timing mark is aligned with TDC indicator mark (Fig. 42).

(11) Verify the V8 mark on the camshaft sprocket is at the 12 o'clock position (Fig. 44). Rotate the crankshaft one turn if necessary.

(12) Remove the crankshaft damper. Refer to Crankshaft Damper in this section.

(13) Remove the timing chain cover. Refer to procedure in this section.

(14) Lock the secondary timing chains to the idler sprocket using Special Tool 8515 (Fig. 43).

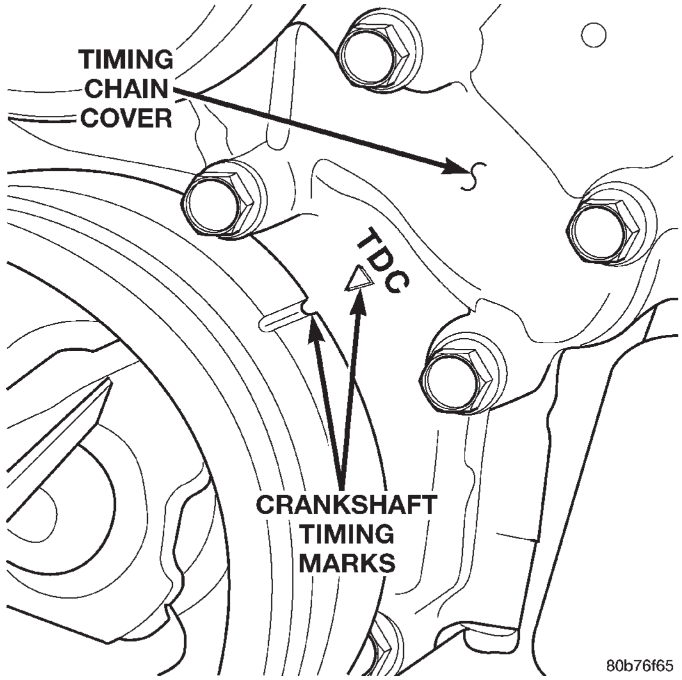


Fig. 42 Engine Top Dead Center (TDC) Indicator Mark

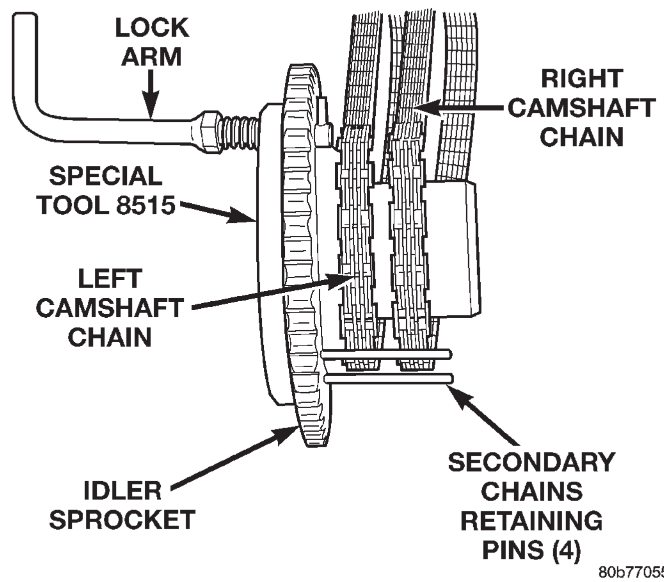


Fig. 43 Using Special Tool 8515 to Hold Chains to Idler Sprocket.

NOTE: Mark the secondary timing chain prior to removal to aid in installation.

(15) Mark the secondary timing chain, one link on each side of the V8 mark on the camshaft drive gear (Fig. 44).

(16) Remove the left side secondary chain tensioner. Refer to Timing Chain and Sprockets in this section.

(17) Remove the cylinder head access plug (Fig. 45).

REMOVAL AND INSTALLATION (Continued)

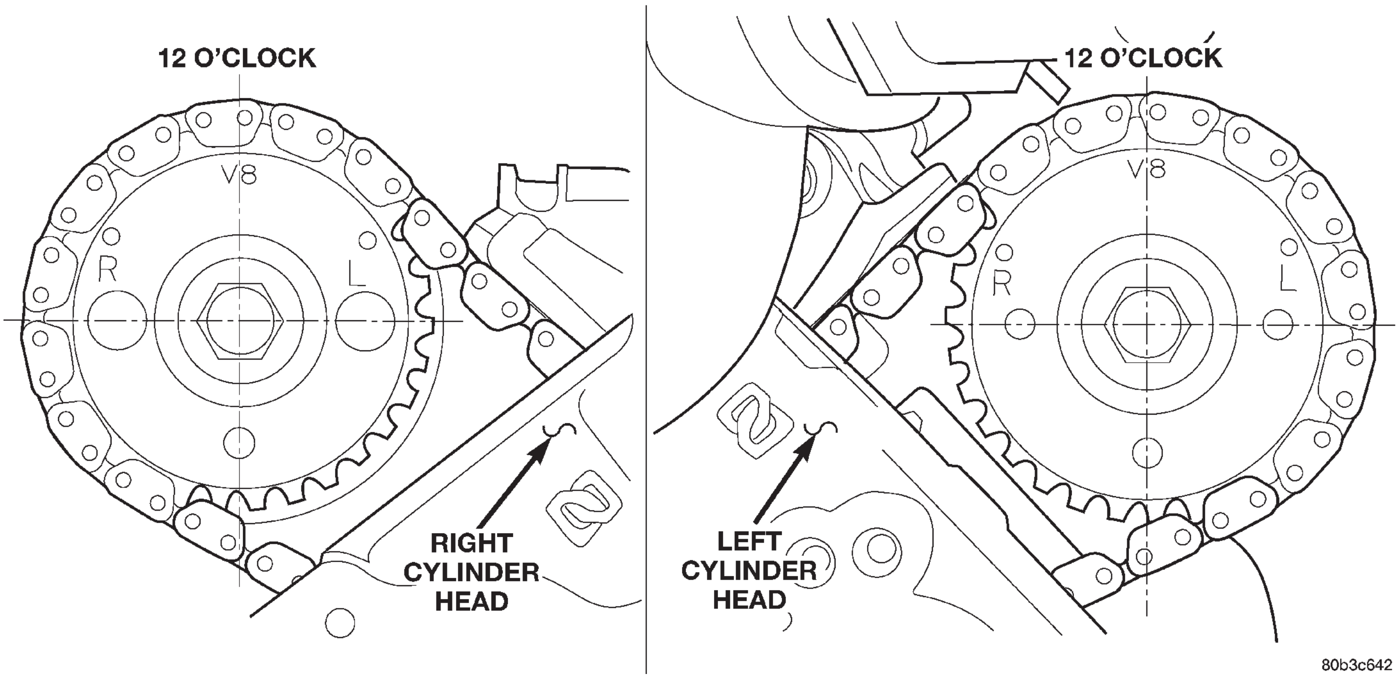


Fig. 44 Camshaft Sprocket V8 Marks

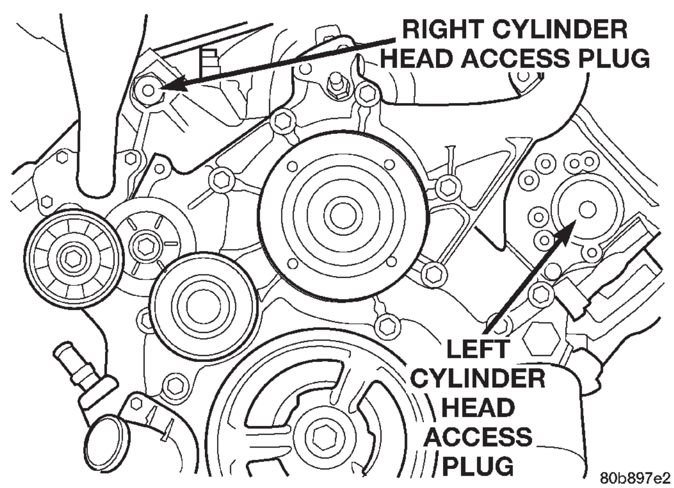


Fig. 45 Cylinder Head Access Plugs

(18) Remove the left side secondary chain guide. Refer to Timing Chain and Sprockets in this section.

(19) Remove the retaining bolt and the camshaft drive gear.

CAUTION: Do not allow the engine to rotate. Severe damage to the valve train can occur.

CAUTION: Do not overlook the four smaller bolts at the front of the cylinder head. Do not attempt to remove the cylinder head without removing these four bolts.

NOTE: The cylinder head is attached to the cylinder block with fourteen bolts.

(20) Remove the cylinder head retaining bolts.

(21) Remove the cylinder head and gasket. Discard the gasket.

CAUTION: Do not lay the cylinder head on it's gasket sealing surface, due to the design of the cylinder head gasket any distortion to the cylinder head sealing surface may prevent the gasket from properly sealing resulting in leaks.

INSTALLATION

NOTE: The cylinder head bolts are tightened using a torque plus angle procedure. The bolts must be examined BEFORE reuse. If the threads are necked down the bolts should be replaced.

Necking can be checked by holding a straight edge against the threads. If all the threads do not contact the scale, the bolt should be replaced (Fig. 46).

CAUTION: When cleaning cylinder head and cylinder block surfaces, DO NOT use a metal scraper because the surfaces could be cut or ground. Use only a wooden or plastic scraper.

(1) Clean the cylinder head and cylinder block mating surfaces (Fig. 47).

(2) Position the new cylinder head gasket on the locating dowels.

REMOVAL AND INSTALLATION (Continued)

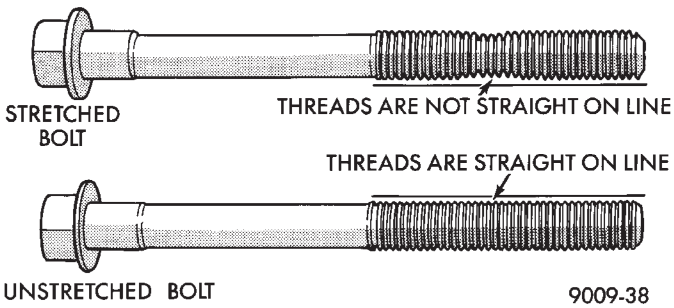


Fig. 46 Checking Cylinder Head Bolts for Stretching (Necking)

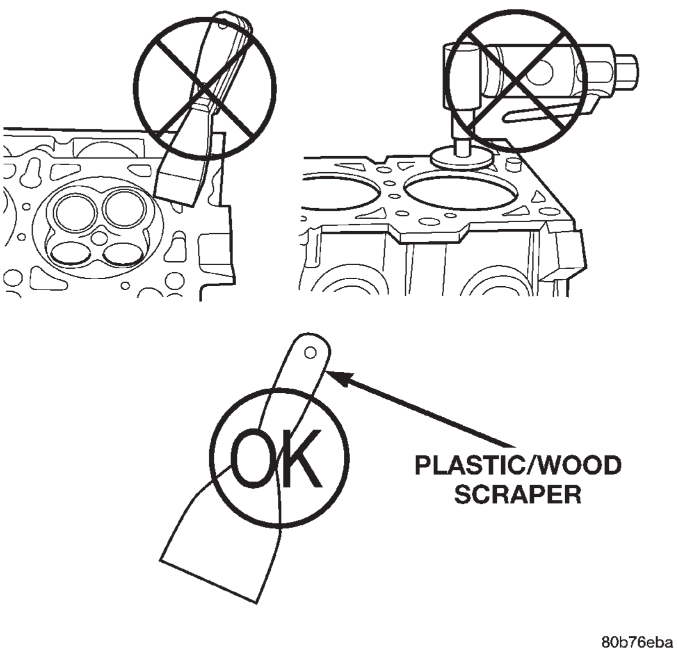


Fig. 47 Proper Tool Usage for Surface Preparation

CAUTION: When installing cylinder head, use care not damage the tensioner arm or the guide arm.

(3) Position the cylinder head onto the cylinder block. Make sure the cylinder head seats fully over the locating dowels.

NOTE: The four smaller cylinder head mounting bolts require sealant to be added to them before installing. Failure to do so may cause leaks.

(4) Lubricate the cylinder head bolt threads with clean engine oil and install the ten M11 bolts.

(5) Coat the four M8 cylinder head bolts with **Mopar® Lock and Seal Adhesive** then install the bolts.

NOTE: The cylinder head bolts are tightened using an angle torque procedure, however, the bolts are not a torque-to-yield design.

(6) Tighten the bolts in sequence (Fig. 48) using the following steps and torque values:

- Step 1: Tighten bolts 1–10, 20 N·m (15 ft. lbs.).
- Step 2: Tighten bolts 1–10, 47 N·m (35 ft. lbs.). Tighten bolts 11–14, 25 N·m (18 ft. lbs.).
- Step 3: Tighten bolts 1–10, 90 degrees. Tighten bolts 11–14, 30 N·m (22 ft. lbs.).

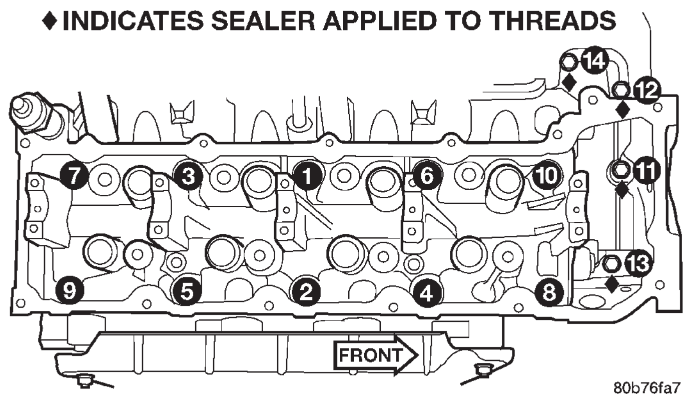


Fig. 48 Cylinder Head Tightening Sequence

(7) Position the secondary chain onto the camshaft drive gear, making sure one marked chain link is on either side of the V8 mark on the gear and position the gear onto the camshaft.

(8) Install the camshaft drive gear retaining bolt.

(9) Re-set and install the left side secondary chain guide.

(10) Install the cylinder head access plug.

(11) Install the left side secondary chain tensioner.

(12) Remove Special Tool 8515.

(13) Install the timing chain cover.

(14) Install the crankshaft damper.

(15) Install the power steering pump.

(16) Install the fan shroud. Refer to Group 7, Cooling System.

(17) Install the cylinder head cover.

(18) Install the intake manifold.

(19) Refill the cooling system. Refer to Group 7, Cooling System.

(20) Raise the vehicle.

(21) Install the exhaust pipe onto the left exhaust manifold.

(22) Lower the vehicle.

(23) Connect the negative cable to the battery.

(24) Start the engine and check for leaks.

CYLINDER HEAD—RIGHT

REMOVAL

(1) Remove the battery and battery tray.

(2) Raise the vehicle on a hoist.

(3) Disconnect the exhaust pipe at the right side exhaust manifold.

REMOVAL AND INSTALLATION (Continued)

(4) Drain the engine coolant. Refer to group 7 Cooling system for procedure.

(5) Lower the vehicle.

(6) Remove the intake manifold. Refer to procedure in this section.

(7) Remove the cylinder head cover. Refer to Cylinder Head Cover in this section.

(8) Remove the fan shroud. Refer to Group 7, Cooling System for procedure.

(9) Rotate the crankshaft until the damper timing mark is aligned with TDC indicator mark (Fig. 42).

(10) Verify the V8 mark on the camshaft sprocket is at the 12 o'clock position (Fig. 44). Rotate the crankshaft one turn if necessary.

(11) Remove the crankshaft damper. Refer to Crankshaft Damper in this section.

(12) Remove the timing chain cover. Refer to Timing Chain Cover in this section.

(13) Lock the secondary timing chains to the idler sprocket using Special Tool 8515 (Fig. 43).

NOTE: Mark the secondary timing chain prior to removal to aid in installation.

(14) Mark the secondary timing chain, one link on each side of the V8 mark on the camshaft drive gear (Fig. 44).

(15) Remove the right side secondary chain tensioner. Refer to Timing Chain and Sprockets in this section.

(16) Remove the cylinder head access plug (Fig. 49).

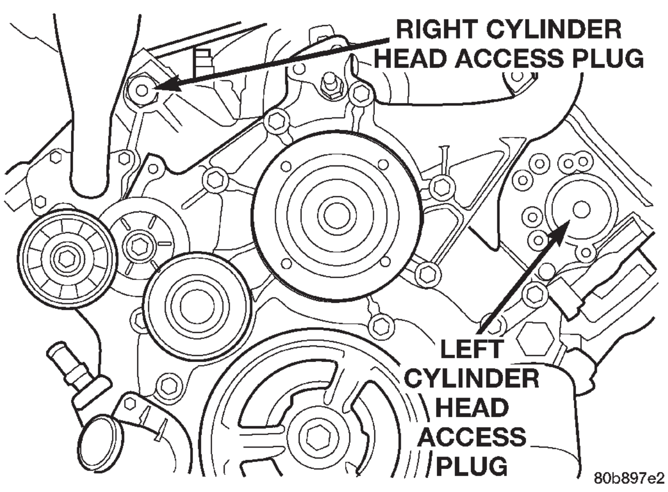


Fig. 49 Cylinder Head Access Plugs

(17) Remove the right side secondary chain guide. Refer to Timing Chain and Sprockets in this section.

(18) Remove the retaining bolt and the camshaft drive gear.

CAUTION: Do not allow the engine to rotate. severe damage to the valve train can occur.

CAUTION: Do not overlook the four smaller bolts at the front of the cylinder head. Do not attempt to remove the cylinder head without removing these four bolts.

CAUTION: Do not hold or pry on the camshaft target wheel for any reason. A damaged target wheel can result in a vehicle no start condition.

NOTE: The cylinder head is attached to the cylinder block with fourteen bolts.

(19) Remove the cylinder head retaining bolts.

(20) Remove the cylinder head and gasket. Discard the gasket.

CAUTION: Do not lay the cylinder head on it's gasket sealing surface, do to the design of the cylinder head gasket any distortion to the cylinder head sealing surface may prevent the gasket from properly sealing resulting in leaks.

INSTALLATION

NOTE: The cylinder head bolts are tightened using a torque plus angle procedure. The bolts must be examined BEFORE reuse. If the threads are necked down the bolts should be replaced.

Necking can be checked by holding a straight edge against the threads. If all the threads do not contact the scale, the bolt should be replaced (Fig. 46).

CAUTION: When cleaning cylinder head and cylinder block surfaces, DO NOT use a metal scraper because the surfaces could be cut or ground. Use only a wooden or plastic scraper.

(1) Clean the cylinder head and cylinder block mating surfaces (Fig. 50).

(2) Position the new cylinder head gasket on the locating dowels.

CAUTION: When installing cylinder head, use care not damage the tensioner arm or the guide arm.

(3) Position the cylinder head onto the cylinder block. Make sure the cylinder head seats fully over the locating dowels.

NOTE: The four smaller cylinder head mounting bolts require sealant to be added to them before installing. Failure to do so may cause leaks.

(4) Lubricate the cylinder head bolt threads with clean engine oil and install the ten M10 bolts.

REMOVAL AND INSTALLATION (Continued)

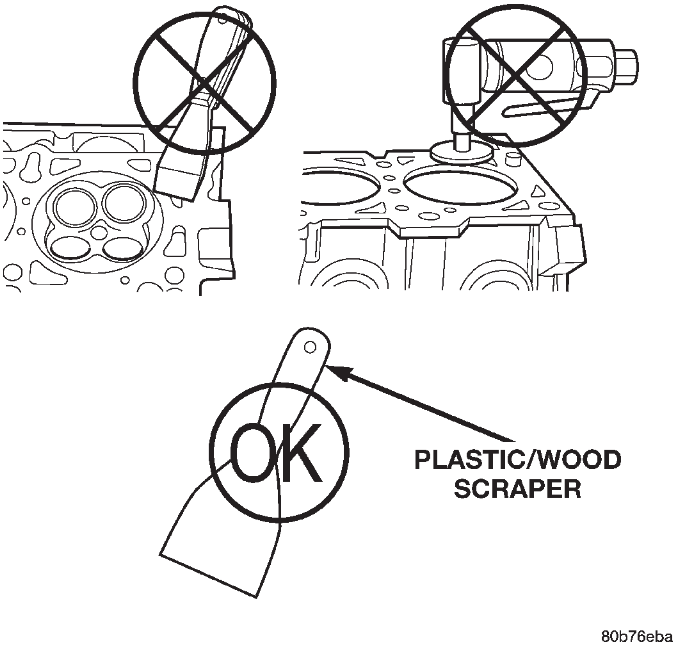


Fig. 50 Proper Tool Usage For Surface Preparation

(5) Coat the four M8 cylinder head bolts with **Mopar Lock and Seal Adhesive** then install the bolts.

NOTE: The cylinder head bolts are tightened using an angle torque procedure, however, the bolts are not a torque-to-yield design.

(6) Tighten the bolts in sequence (Fig. 51) using the following steps and torque values:

- Step 1: Tighten bolts 1–10, 20 N·m (15 ft. lbs.).
- Step 2: Tighten bolts 1–10, 47 N·m (35 ft. lbs.). Tighten bolts 11–14, 25 N·m (18 ft. lbs.).
- Step 3: Tighten bolts 1–10, 90 degrees. Tighten bolts 11–14, 30 N·m (22 ft. lbs.).

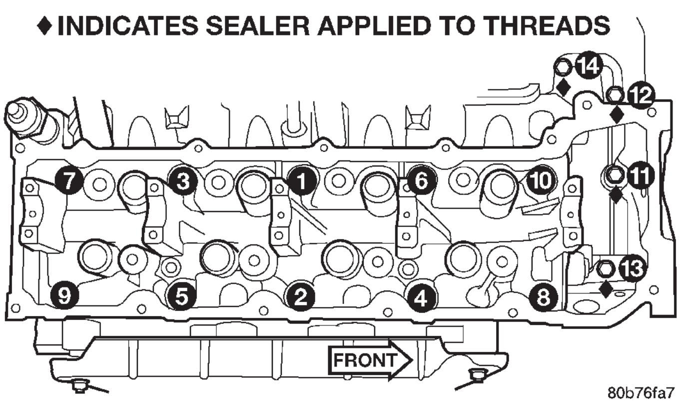


Fig. 51 Cylinder Head Tightening Sequence

(7) Position the secondary chain onto the camshaft drive gear, making sure one plated marked chain link is on either side of the V8 mark on the gear and position the gear onto the camshaft.

(8) Install the camshaft drive gear retaining bolt.

(9) Install the right side secondary chain tensioner arm.

(10) Install the cylinder head access plug.

(11) Re-set and install the right side secondary chain tensioner.

(12) Remove Special Tool 8515.

(13) Install the timing chain cover.

(14) Install the crankshaft damper.

(15) Install the fan shroud. Refer to Group 7, Cooling System.

(16) Install the cylinder head cover.

(17) Install the intake manifold.

(18) Refill the cooling system. Refer to Group 7, Cooling System.

(19) Raise the vehicle.

(20) Install the exhaust pipe onto the right exhaust manifold.

(21) Lower the vehicle.

(22) Install the battery tray and battery.

(23) Start the engine and check for leaks.

VALVES AND VALVE SPRINGS

REMOVAL

NOTE: The cylinder heads must be removed in order to preform this procedure.

(1) Using Special Tool 8516 Valve Spring Compressor, remove the rocker arms and the hydraulic lash adjusters (Fig. 52).

(2) Remove the camshaft bearing caps and the camshaft.

NOTE: All eight valve springs and valve are removed in the same manner; this procedure only covers one valve and valve spring.

(3) Using Special Tool C-3422–B or C-3422–C Valve Spring Compressor and Special tool 8519 Adapter, compress the valve spring.

NOTE: It may be necessary to tap the top of the valve spring to loosen the spring retainers locks enough to be removed.

(4) Remove the two spring retainer lock halves.

NOTE: the valve spring is under tension use care when releasing the valve spring compressor.

(5) Remove the valve spring compressor.

(6) Remove the spring retainer, and the spring.

REMOVAL AND INSTALLATION (Continued)

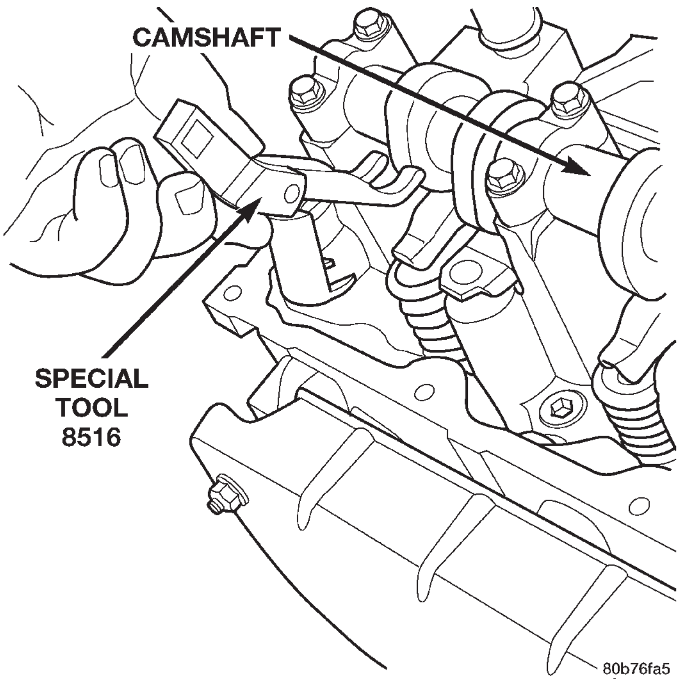


Fig. 52 Rocker Arm—Removal

NOTE: Check for sharp edges on the keeper grooves. Remove any burrs from the valve stem before removing the valve from the cylinder head.

(7) Remove the valve from the cylinder head.

NOTE: The valve stem seals are common between intake and exhaust.

(8) Remove the valve stem seal. Mark the valve for proper installation.

TESTING VALVE SPRINGS

NOTE: Whenever the valves are removed from the cylinder head it is recommended that the valve springs be inspected and tested for reuse.

Inspect the valve springs for physical signs of wear or damage. Turn table of tool C-647 until surface is in line with the 40.69 mm (1.602 in.) mark on the threaded stud and the zero mark on the front. Place spring over the 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 two. This will give the spring load at test length. Fractional measurements are indicated on the table for finer adjustments. Refer to Specifications Section to obtain specified height and allowable tensions. Replace any springs that do not meet specifications. (Fig. 53)

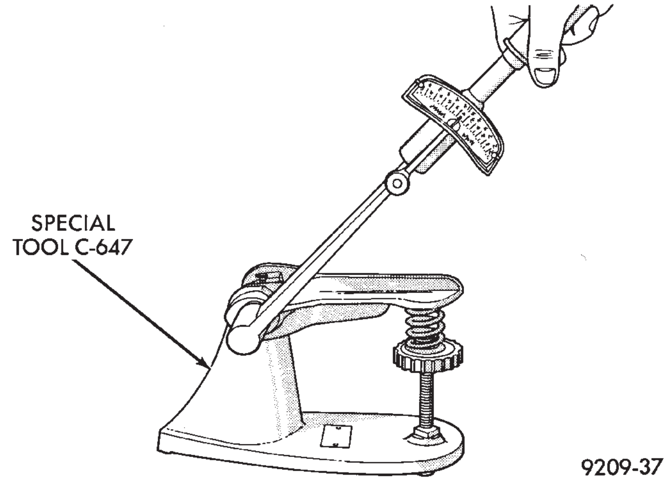


Fig. 53 Testing Valve Springs

INSTALLATION

(1) coat the valve stem with clean engine oil and insert it into the cylinder head.

(2) Install the valve stem seal. make sure the seal is fully seated and that the garter spring at the top of the seal is intact.

(3) Install the spring and the spring retainer.

(4) Using the valve spring compressor, compress the spring and install the two valve spring retainer halves.

(5) Release the valve spring compressor and make sure the two spring retainer halves and the spring retainer are fully seated.

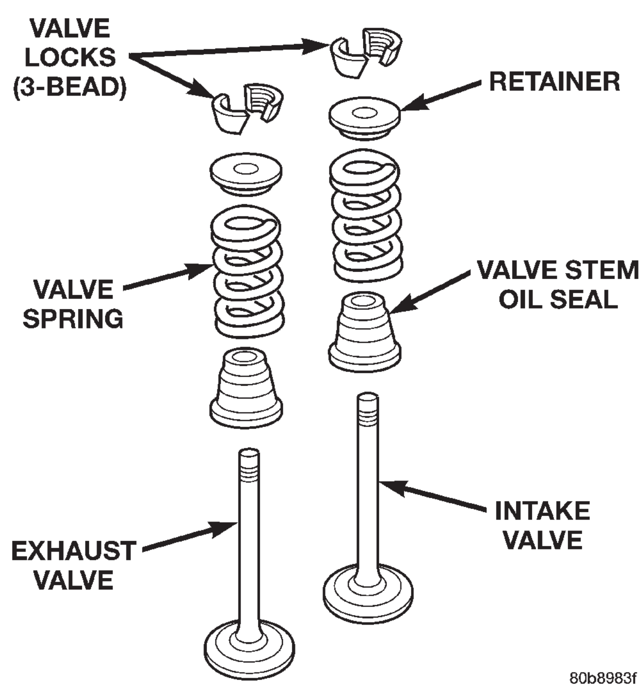


Fig. 54 Valve Assembly Configuration

(6) lubricate the camshaft journal with clean engine oil then Position the camshaft (with the

sprocket dowel on the left camshaft at 11 o'clock and the right camshaft at 12 o'clock), then position the camshaft bearing caps.

(7) Install the camshaft bearing cap retaining bolts. Tighten the bolts 9–13 N·m (100 in. lbs.) in ½ turn increments in the sequence shown (Fig. 55).

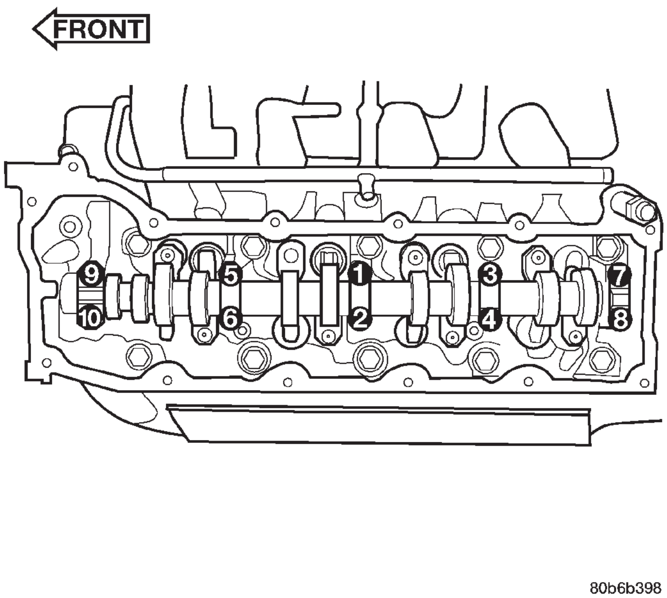


Fig. 55 Camshaft Bearing Caps Tightening Sequence

(8) Position the hydraulic lash adjusters and rocker arms (Fig. 52).

HYDRAULIC LASH ADJUSTER

REMOVAL

(1) Remove cylinder head cover(s). Refer to procedure in this section.

(2) Remove rocker arm(s). Refer to procedure in this section.

CAUTION: If lash adjusters and rocker arms are to be reused, always mark position for reassembly in their original positions.

(3) Remove lash adjuster(s).

INSTALLATION

(1) Install hydraulic lash adjuster making sure adjusters are at least partially full of oil. This can be verified by little or no plunger travel when lash adjuster is depressed.

(2) Install rocker arm(s). Refer to procedure in this section.

(3) Install cylinder head cover(s). Refer to procedure in this section.

CRANKSHAFT DAMPER

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove accessory drive belt. Refer to Group 7, Cooling System for procedure.

(3) Remove A/C compressor mounting bolts and set aside.

(4) Drain cooling system. Refer to Group 7, Cooling System for procedure.

(5) Remove upper radiator hose.

(6) Using Special Tools 6958 spanner with adapter pins 8346, loosen fan and viscous assembly from water pump (Fig. 56).

(7) Remove fan and viscous assembly.

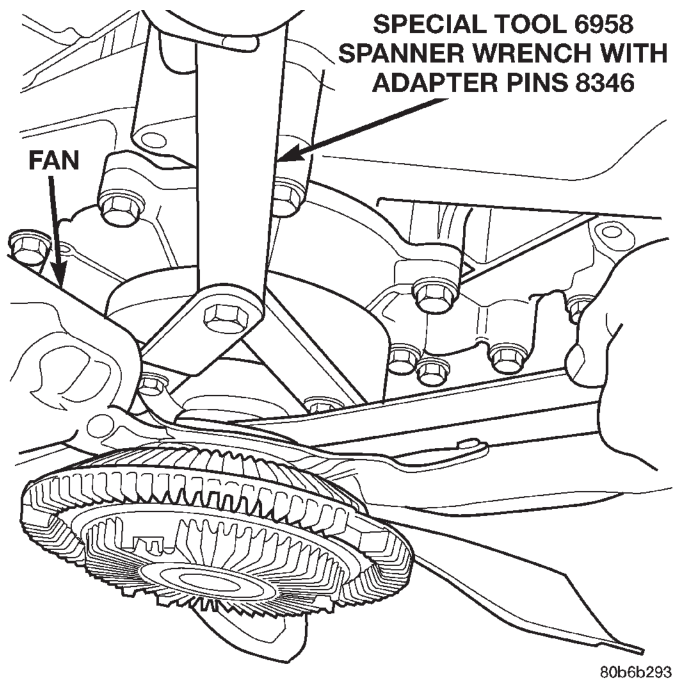


Fig. 56 Fan Assembly—Removal

(8) Disconnect electrical connector for fan mounted inside radiator shroud.

(9) Remove radiator shroud attaching fasteners.

NOTE: Transmission cooler line snaps into shroud lower right hand corner.

(10) Remove radiator shroud.

(11) Remove crankshaft damper bolt.

(12) Remove damper using Special Tools 8513 Insert and 1026 Three Jaw Puller (Fig. 57).

INSTALLATION

(1) Align crankshaft damper slot with key in crankshaft. Slide damper onto crankshaft slightly.

(2) Using Special Tool 8512, press damper onto crankshaft (Fig. 58).

REMOVAL AND INSTALLATION (Continued)

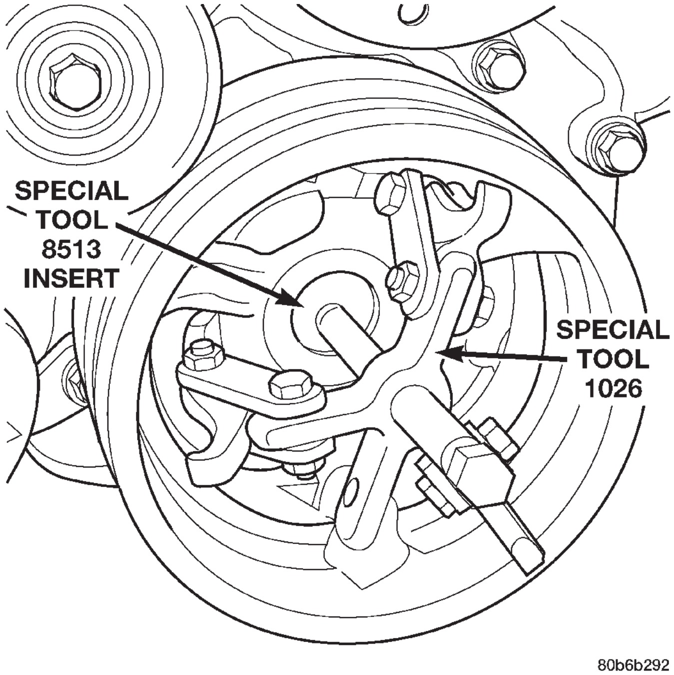


Fig. 57 Crankshaft Damper—Removal

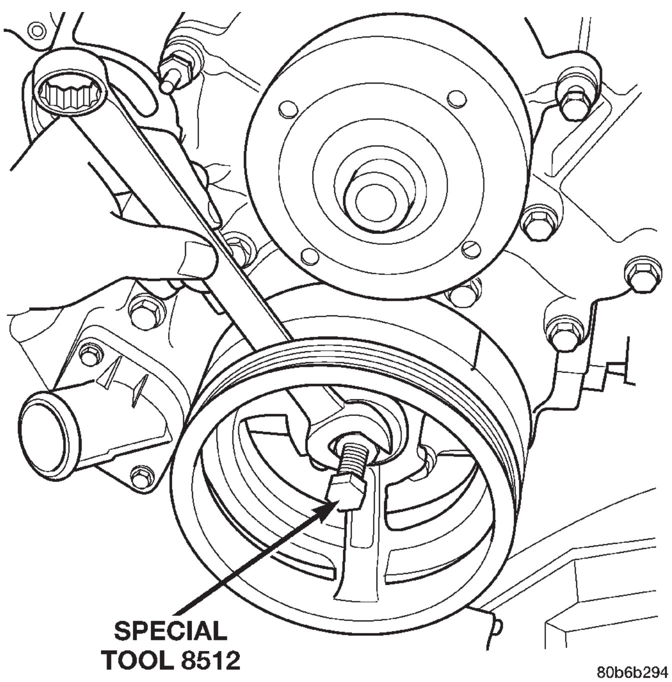


Fig. 58 Crankshaft Damper—Installation

(3) Tighten crankshaft damper bolt to 175 N·m (130 ft. lbs.).

(4) Install radiator shroud and tighten fasteners to 11 N·m (95 in. lbs.).

(5) Connect electrical connector for shroud fan.

(6) Install fan and viscous assembly.

(7) Using Special Tools 6958 spanner with adapter pins 8346, tighten fan and viscous assembly to water pump (Fig. 56).

(8) Install upper radiator hose.

(9) Install A/C compressor and tighten fasteners to 54 N·m (40 ft. lbs.).

(10) Install accessory drive belt. Refer to Group 7, Cooling System for procedure.

(11) Refill cooling system. Refer to Group 7, Cooling System for procedure.

(12) Connect negative cable to battery.

TIMING CHAIN COVER

REMOVAL

(1) Drain cooling system and remove viscous fan drive assembly. Refer to Group 7, Cooling System for procedures.

(2) Remove radiator shroud. Refer to Group 7, Cooling System for procedure.

(3) Disconnect both heater hoses at timing cover.

(4) Disconnect lower radiator hoses at engine.

(5) Remove crankshaft damper. Refer to procedure in this section.

(6) Remove accessory drive belt tensioner assembly (Fig. 59).

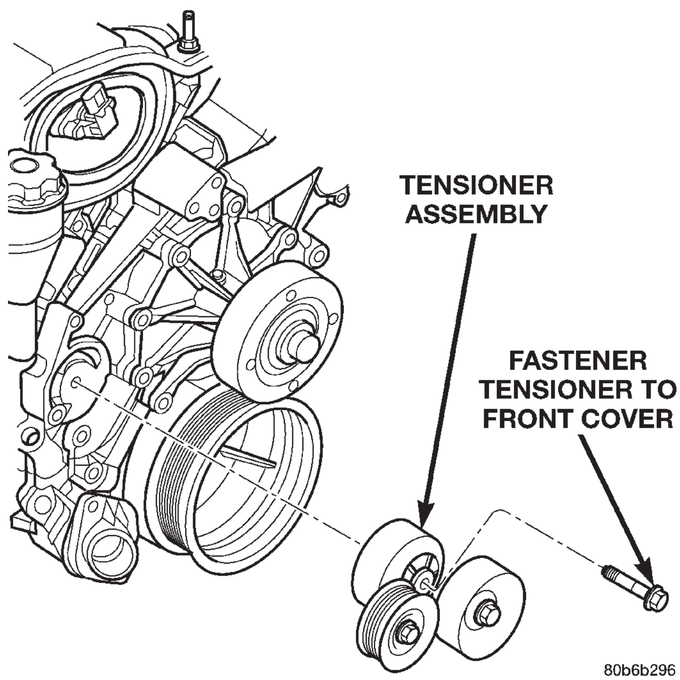


Fig. 59 Accessory Drive Belt Tensioner

(7) Remove cover and gasket (Fig. 60).

INSTALLATION

(1) Clean timing chain cover and block surface. Inspect cover gasket and replace as necessary.

(2) Install cover and gasket. Tighten fasteners in sequence as shown in (Fig. 60) to 54 N·m (40 ft. lbs.).

(3) Install crankshaft damper. Refer to procedure in this section.

(4) Install accessory drive belt tensioner assembly. Tighten fastener to 54 N·m (40 ft. lbs.).

REMOVAL AND INSTALLATION (Continued)

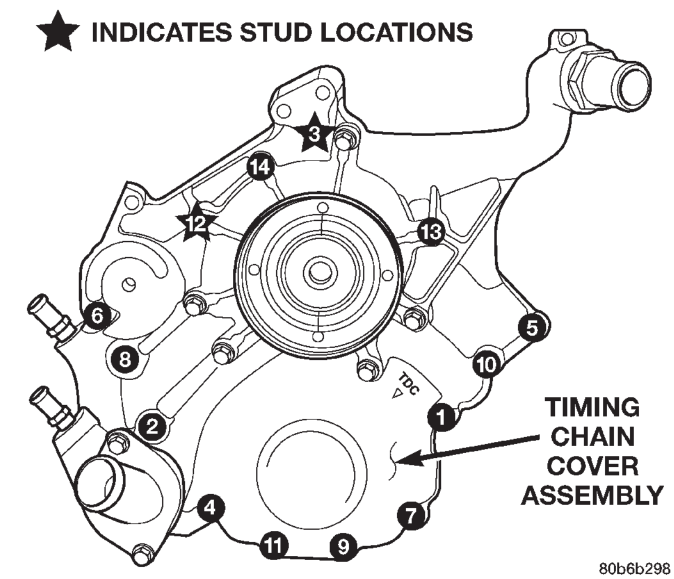


Fig. 60 Timing Chain Cover Fasteners

(5) Install lower radiator hose.

(6) Install both heater hoses.

(7) Install radiator shroud and viscous fan drive assembly. Refer to Group 7, Cooling System for procedure.

(8) Fill cooling system. Refer to Group 7, Cooling System for procedures.

TIMING CHAIN AND SPROCKETS

REMOVAL

(1) Disconnect negative cable from battery.

(2) Drain cooling system. Refer to Group 7, Cooling System for procedures.

(3) Remove right and left cylinder head covers. Refer to procedure in this section.

(4) Remove radiator fan shroud. Refer to Group 7, Cooling System for procedure.

(5) Rotate engine until timing mark on crankshaft damper aligns with TDC mark on timing chain cover (Fig. 61) (#1 cylinder exhaust stroke) and the camshaft sprocket "V8" marks are at the 12 o'clock position (Fig. 62).

(6) Remove power steering pump. Refer to Group 19, Steering for procedures.

(7) Remove access plugs (2) from left and right cylinder heads for access to chain guide fasteners (Fig. 63).

(8) Remove the oil fill housing to gain access to the right side tensioner arm fastener.

(9) Remove crankshaft damper and timing chain cover. Refer to procedures in this section.

(10) Collapse and pin primary chain tensioner (Fig. 64).

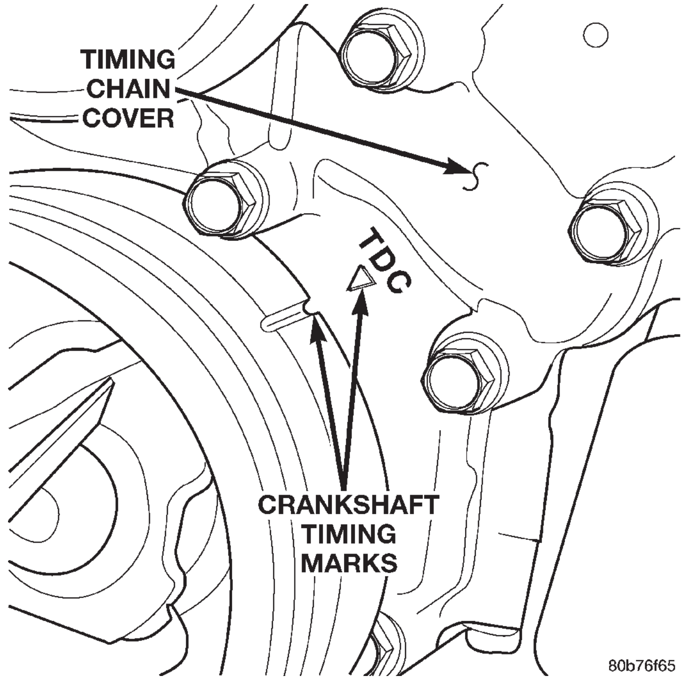


Fig. 61 Engine Top Dead Center (TDC) Indicator Mark

CAUTION: Plate behind left secondary chain tensioner could fall into oil pan. Therefore, cover pan opening.

(11) Remove secondary chain tensioners.

(12) Remove camshaft position sensor from right cylinder head (Fig. 65).

CAUTION: Care should be taken not to damage camshaft target wheel. Do not hold target wheel while loosening or tightening camshaft sprocket. Do not place the target wheel near a magnetic source of any kind. A damaged or magnetized target wheel could cause a vehicle no start condition.

CAUTION: Do not forcefully rotate the camshafts or crankshaft independently of each other. Damaging intake valve to piston contact will occur. Ensure negative battery cable is disconnected to guard against accidental engagement.

(13) Remove left and right camshaft sprocket bolts.

(14) While holding the left camshaft steel tube with adjustable pliers, (Fig. 66) remove the left camshaft sprocket. Slowly rotate the camshaft approximately 15 degrees clockwise to a neutral position.

(15) While holding the right camshaft steel tube with adjustable pliers, (Fig. 67) remove the right camshaft sprocket. Slowly rotate the camshaft approximately 45 degrees counterclockwise to a neutral position.

(16) Remove idler sprocket assembly bolt.

REMOVAL AND INSTALLATION (Continued)

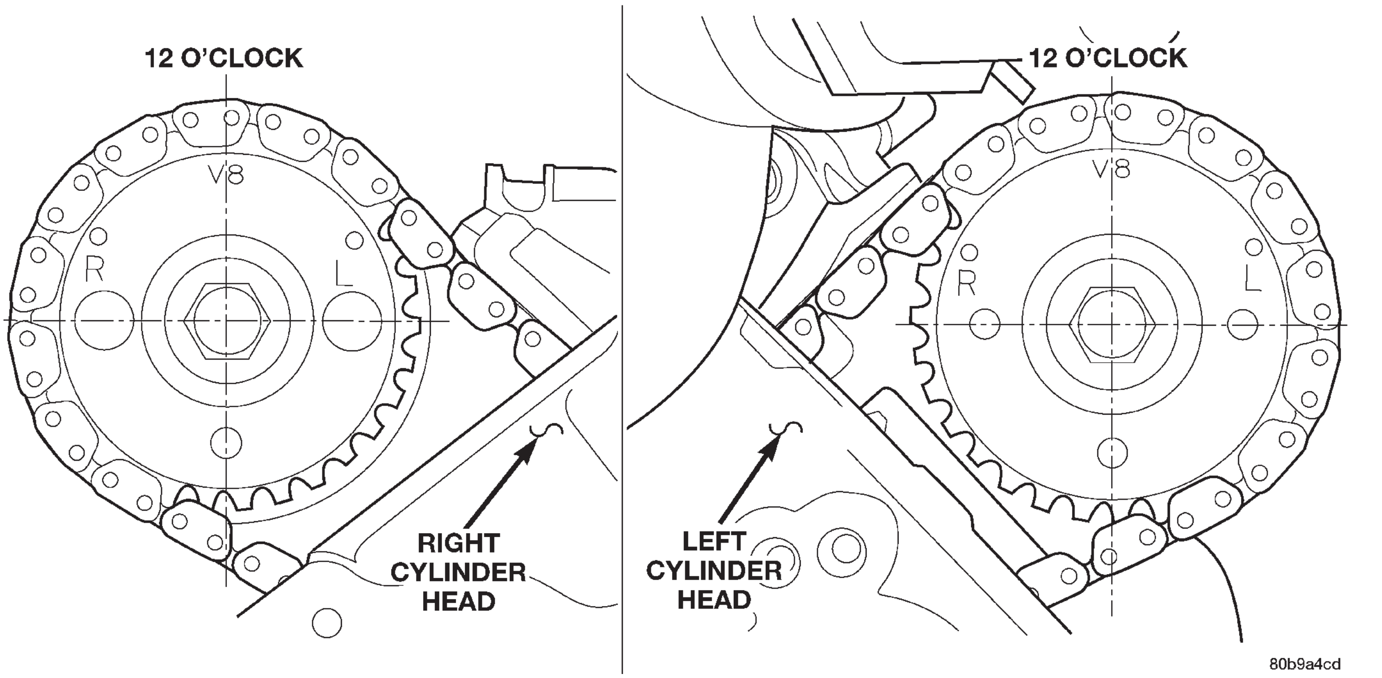


Fig. 62 Camshaft Sprocket V8 Marks

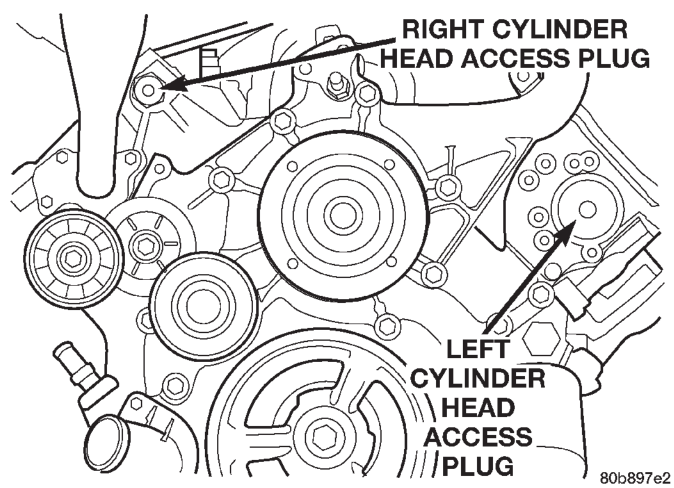


Fig. 63 Cylinder Head Access Plug Location

(17) Slide the idler sprocket assembly and crank sprocket forward simultaneously to remove the primary and secondary chains.

(18) Remove both pivoting tensioner arms and chain guides.

(19) Remove chain tensioner.

INSPECTION OF COMPONENTS

Inspect the following components:

• Sprockets for excessive tooth wear. Some tooth markings are normal and not a cause for sprocket replacement.

• Idler sprocket assembly bushing and shaft for excessive wear.

• Idler sprocket assembly spline joint. The joint should be tight with no backlash or axial movement.

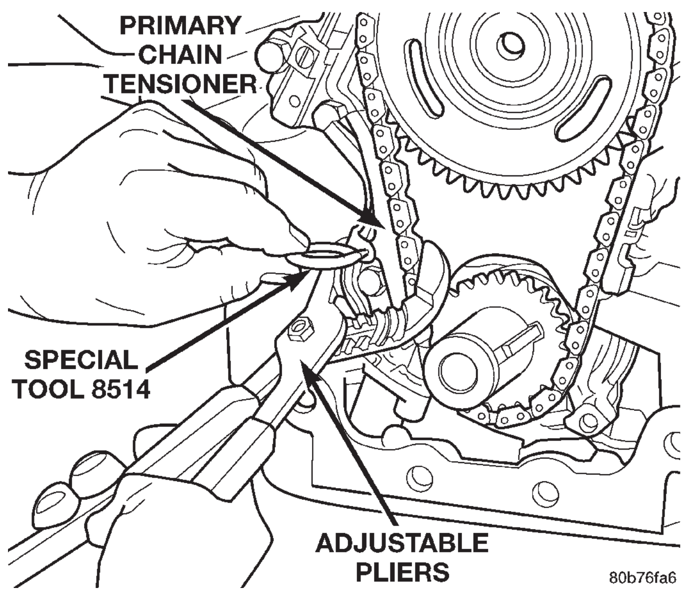


Fig. 64 Collapsing And Pinning Primary Chain Tensioner

• Chain guides and tensioner arms. Replace these parts if grooving in plastic face is more than 1 mm (0.039 in.) deep. If plastic face is severely grooved or melted, the tensioner lube jet may be clogged. The tensioner should be replaced.

• secondary chain tensioner piston and ratcheting device. Inspect for evidence of heavy contact between piston and tensioner arm. If this condition exist the tensioner should be replaced.

• Primary chain tensioner plastic faces. Replace as required.

REMOVAL AND INSTALLATION (Continued)

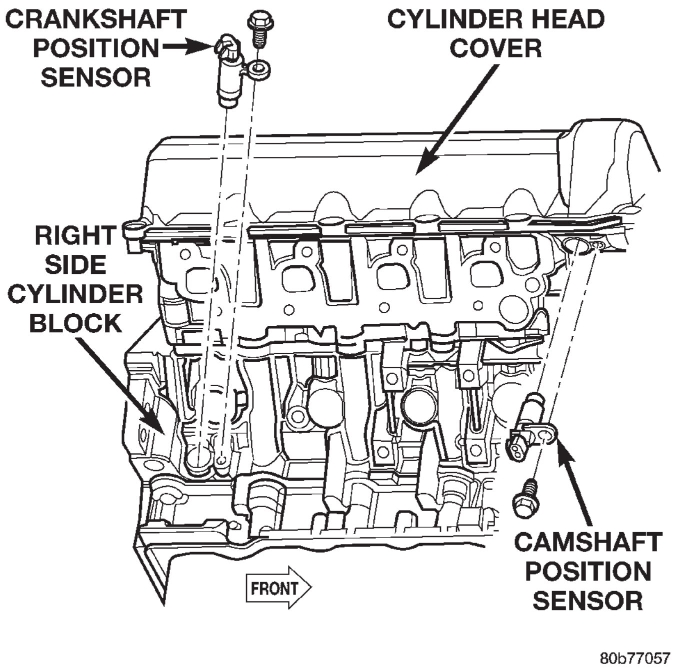


Fig. 65 Camshaft Position Sensor—Removal

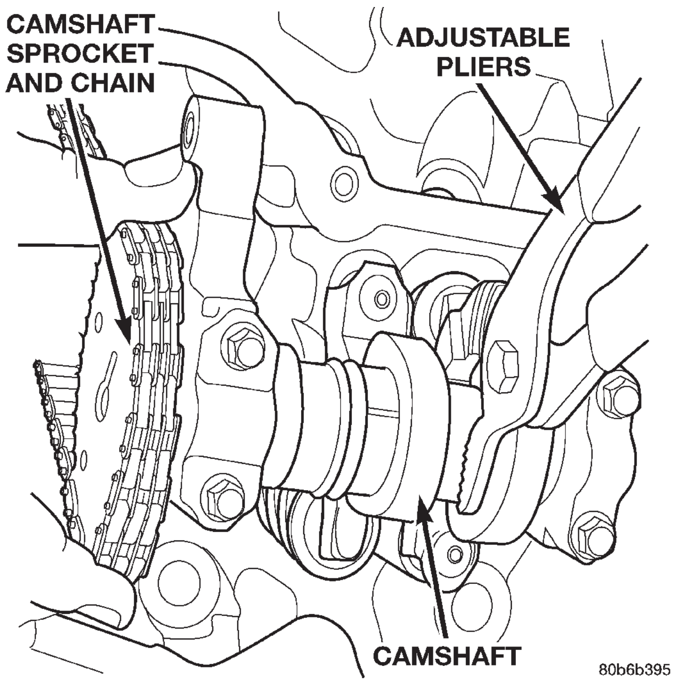


Fig. 66 Camshaft Rotation—Left Side

INSTALLATION

(1) Using a vise, lightly compress the secondary chain tensioner piston until the piston step is flush with the tensioner body. Using a pin or suitable tool, release ratchet pawl by pulling pawl back against spring force through access hole on side of tensioner. While continuing to hold pawl back, Push ratchet device to approximately 2 mm from the tensioner body. Install Special Tool 8514 lock pin into hole on

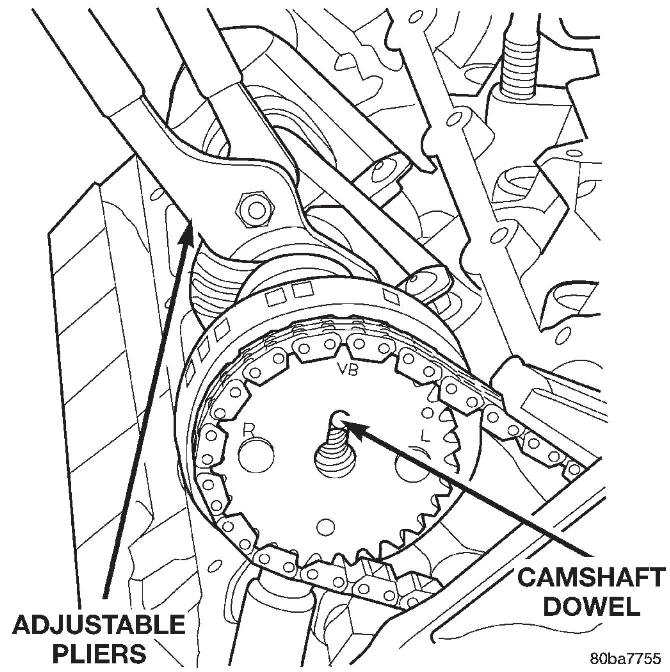


Fig. 67 Camshaft Rotation—Right Side

front of tensioner. Slowly open vise to transfer piston spring force to lock pin (Fig. 69).

(2) Position primary chain tensioner over oil pump and insert bolts into lower two holes on tensioner bracket. Tighten bolts to 28 N·m (250 in. lbs.).

(3) Install right side chain tensioner arm. Apply Mopar® lock and seal and tighten bolt to 17 N·m (150 in. lbs.).

NOTE: The silver bolts retain the guides to the cylinder heads and the black bolts retain the guides to the engine block.

(4) Install the left side chain guide. Tighten the bolts to 28 N·m (250 in. lbs.).

(5) Install left side chain tensioner arm. Apply Mopar® lock and seal and tighten bolt to 17 N·m (150 in. lbs.).

(6) Install the right side chain guide. Tighten the bolts to 28 N·m (250 in. lbs.).

(7) Install both secondary chain tensioners. Tighten bolts to 28 N·m (250 in. lbs.).

NOTE: Left and right secondary chain tensioners are not common.

(8) Install both secondary chains onto the idler sprocket. Align two plated links on the secondary chains to be visible through the two lower openings on the idler sprocket (4 o'clock and 8 o'clock). Once the secondary timing chains are installed, position special tool 8515 to hold chains in place for installation (Fig. 70).

REMOVAL AND INSTALLATION (Continued)

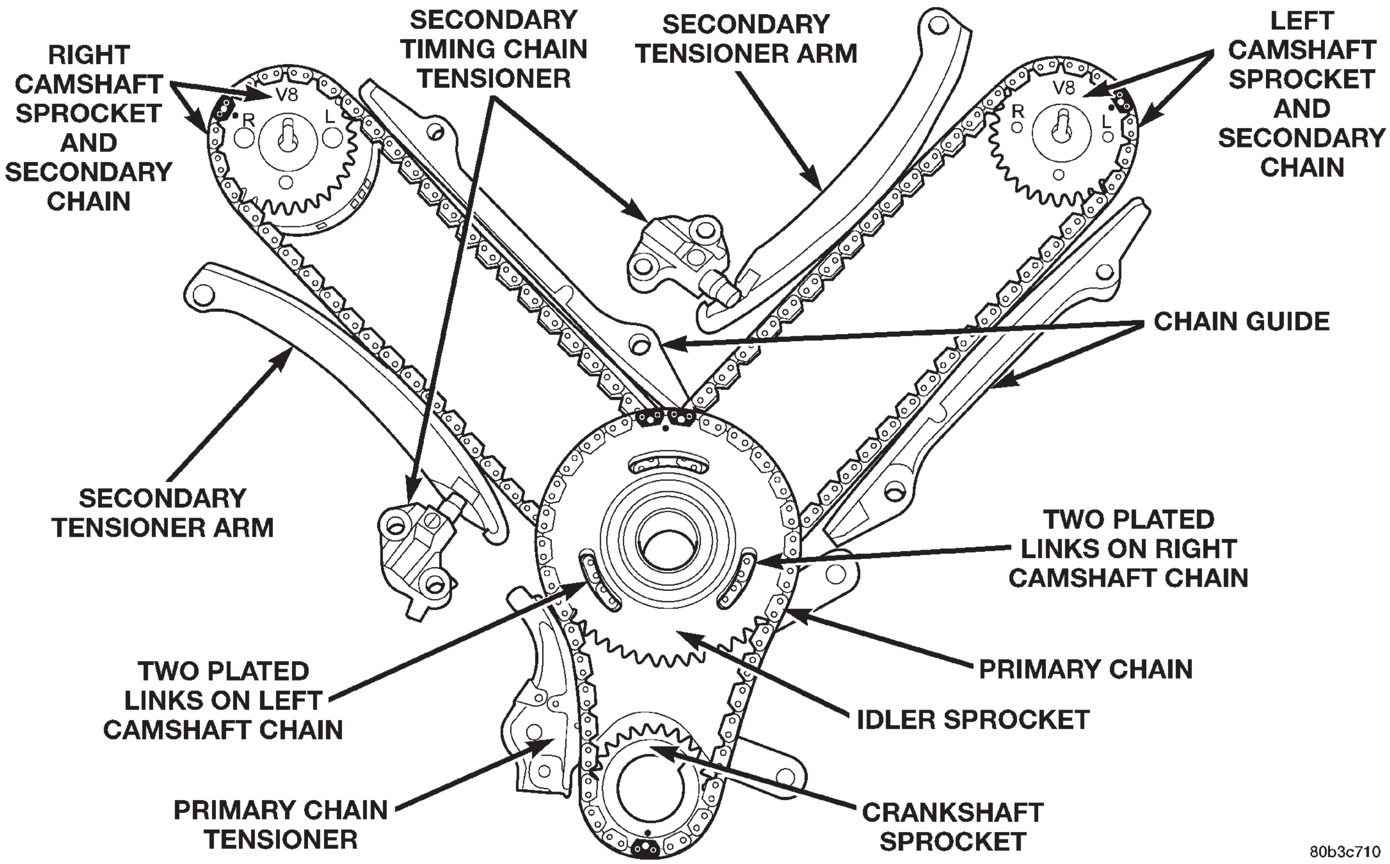


Fig. 68 Timing Chain System

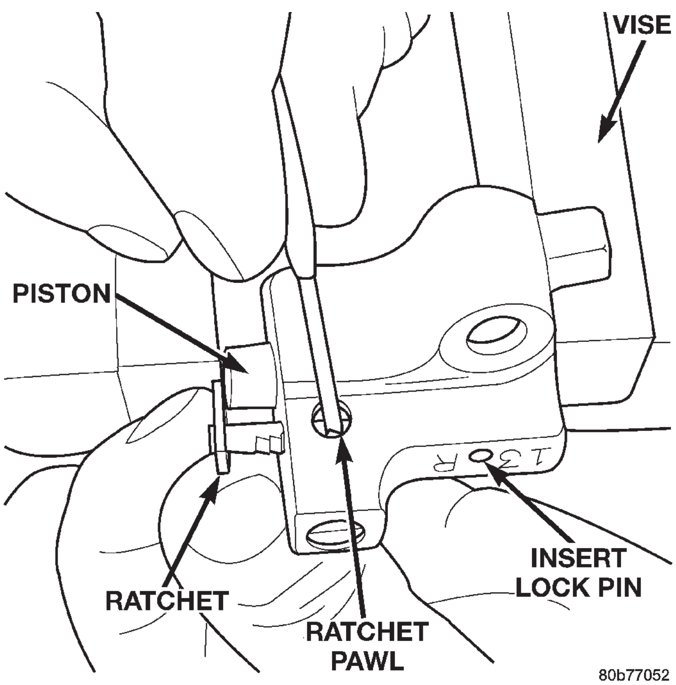


Fig. 69 Resetting Secondary Chain Tensioners

(9) Align primary chain double plated links with the timing mark at 12 o'clock on the idler sprocket. Align the primary chain single plated link with the timing mark at 6 o'clock on the crankshaft sprocket (Fig. 68).

CAUTION: Ensure the plate between the left secondary chain tensioner and block is correctly installed.

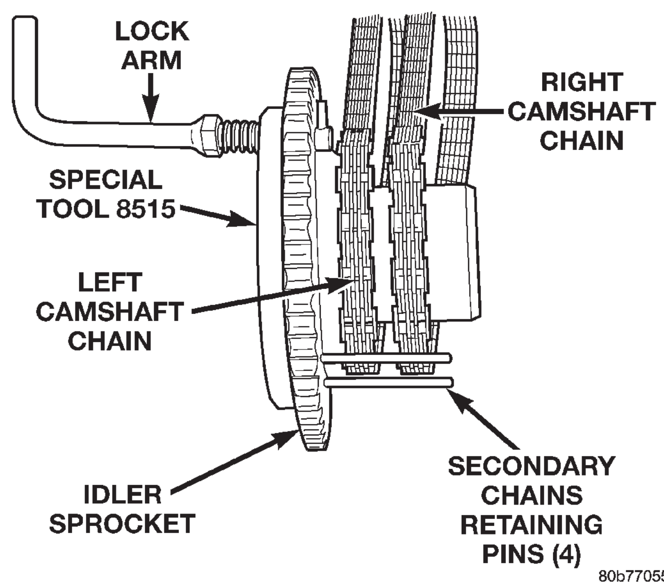


Fig. 70 Installing Secondary Timing Chains on Idler Sprocket

REMOVAL AND INSTALLATION (Continued)

(10) Lubricate idler shaft and bushings with clean engine oil.

(11) Install all chains, crankshaft sprocket, and idler sprocket as an assembly (Fig. 71). After guiding both secondary chains through the block and cylinder head openings, affix chains with a elastic strap or the equivalent, This will maintain tension on chains to aid in installation.

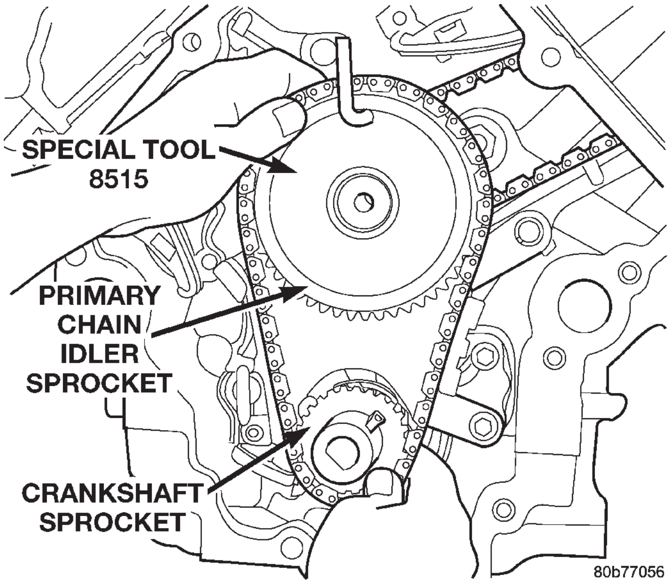


Fig. 71 Installing Idler Gear, Primary and Secondary Timing Chains

NOTE: It will be necessary to slightly rotate camshafts for sprocket installation.

(12) Align left camshaft sprocket “L” dot to plated link on chain.

(13) Align right camshaft sprocket “R” dot to plated link on chain.

(14) Remove Special Tool 8515, then attach both sprockets to camshafts. Install sprocket bolts, but do not tighten at this time.

(15) Verify that all plated links are aligned with the marks on all sprockets and the “V8” marks on camshaft sprockets are at the 12 o’clock position (Fig. 68).

(16) Before installing idler sprocket bolt, lubricate washer with oil, and tighten idler sprocket assembly retaining bolt to 34 N·m (25 ft. lbs.).

(17) Remove all locking pins (3) from tensioners.

CAUTION: After pulling locking pins out of each tensioner, DO NOT manually extend the tensioner(s) ratchet. Doing so will over tension the chains, resulting in noise and/or high timing chain loads.

(18) Using Special Tool 6958, Spanner with Adaptor Pins 8346, tighten left (Fig. 72) and right (Fig. 73). camshaft sprocket bolts to 122 N·m (90 ft. lbs.).

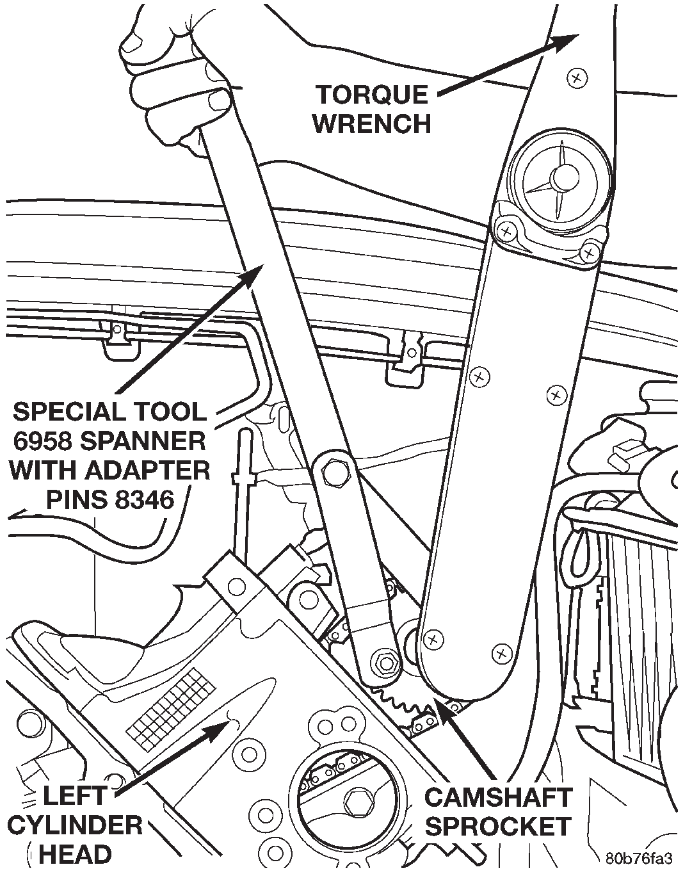


Fig. 72 Tightening Left Side Camshaft Sprocket Bolt

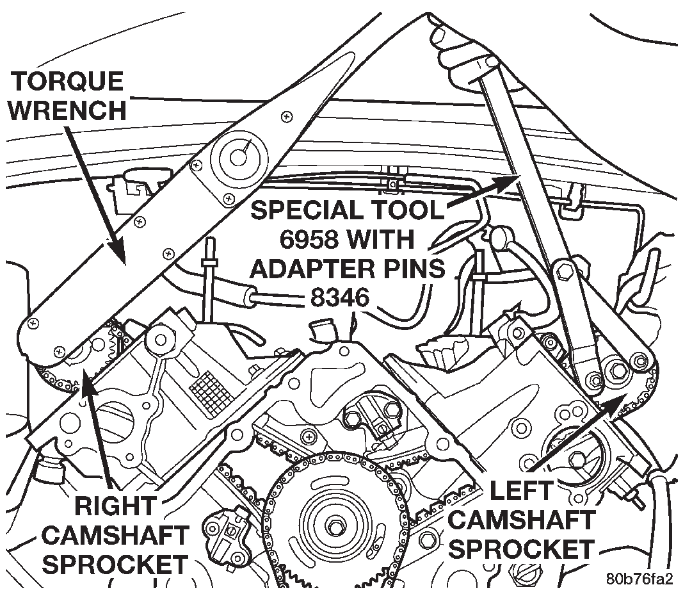


Fig. 73 Tightening Right Side Camshaft Sprocket Bolt

(19) Rotate engine two full revolutions. Verify timing marks are at the follow locations:

• primary chain idler sprocket dot is at 12 o’clock (Fig. 68)

• primary chain crankshaft sprocket dot is at 6 o’clock (Fig. 68)

REMOVAL AND INSTALLATION (Continued)

• secondary chain camshaft sprockets "V8" marks are at 12 o'clock (Fig. 68)

(20) Lubricate all three chains with engine oil.

(21) After installing all chains, it is recommended that the idler gear end play be checked (Fig. 74). The end play must be within 0.10–0.25 mm (0.004–0.010 in.). If not within specification, the idler gear must be replaced.

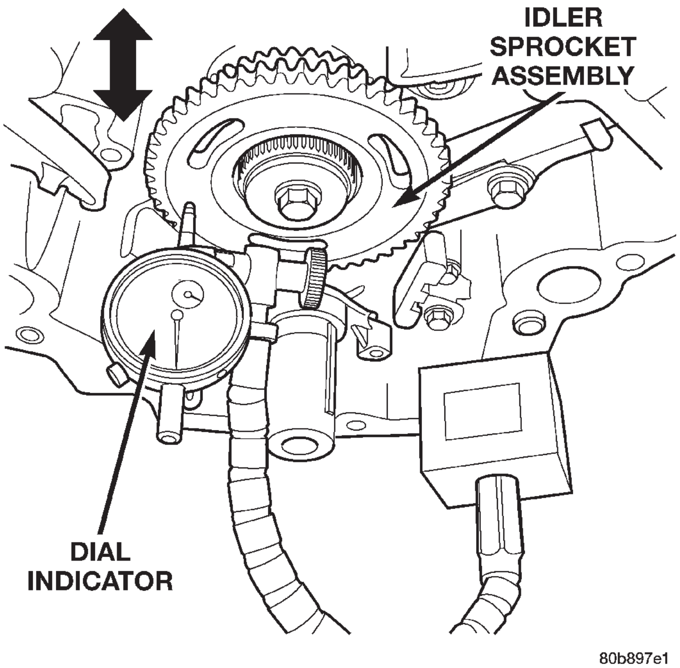


Fig. 74 Measuring Idler Gear End Play

(22) Install timing chain cover and crankshaft damper. Refer to procedures in this section.

(23) Install cylinder head covers. Refer to procedures in this section.

NOTE: Before installing threaded plug in right cylinder head, the plug must be coated with sealant to prevent leaks.

(24) Coat the large threaded access plug with **Mopar® Thread Sealant with Teflon** , then install into the right cylinder head and tighten to 81 N·m (60 ft. lbs.) (Fig. 63).

(25) Install the oil fill housing.

(26) Install access plug in left cylinder head (Fig. 63).

(27) Install power steering pump. Refer to Group 19, Steering for procedure.

(28) Install radiator fan shroud. Refer to Group 7, Cooling System for procedure.

(29) Fill cooling system. Refer to Group 7, Cooling System for coolant fill procedure.

(30) Connect negative cable to battery.

IDLER SHAFT—TIMING DRIVE

REMOVAL

(1) Remove the timing chain and sprockets. Refer to procedure in this section.

NOTE: To remove the idler shaft, it is necessary to tap threads into the shaft to install the removal tool.

(2) Using a 12 mm X 1.75 tap, cut threads in the idler shaft center bore (Fig. 75).

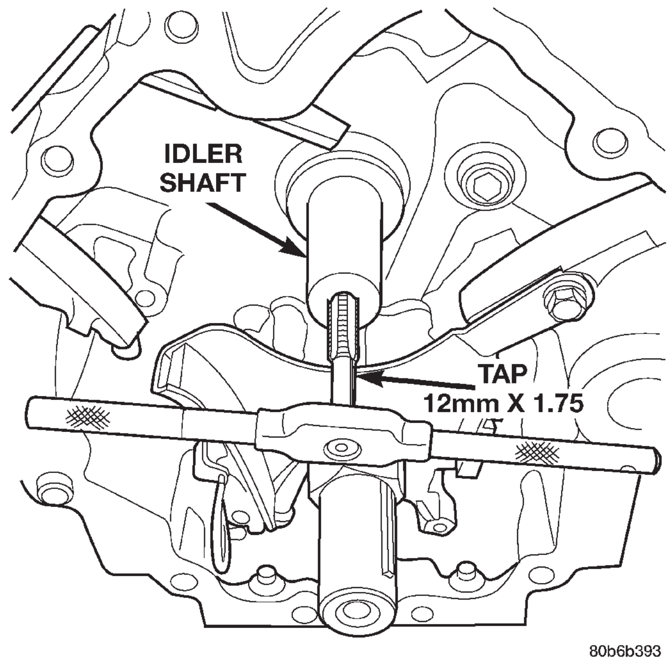


Fig. 75 Tapping Idler Shaft For Special Tool 8517

(3) Cover the radiator core with a suitable cover.

CAUTION: Use care when removing idler shaft, DO NOT strike the radiator cooling fins with the slide hammer.

(4) Using Special Tool 8517 Slide Hammer, remove the idler shaft (Fig. 76).

INSTALLATION

(1) Thoroughly clean the idler shaft bore.

(2) Position the idler shaft in the bore.

NOTE: The two lubrication holes in the idler shaft do not require any special alignment.

NOTE: Before using the retaining bolt to install the idler shaft, coat the threads and the pilot on the idler shaft with clean engine oil.

(3) Using the primary idler sprocket retaining bolt and washer, carefully draw the idler shaft into the bore until fully seated.

REMOVAL AND INSTALLATION (Continued)

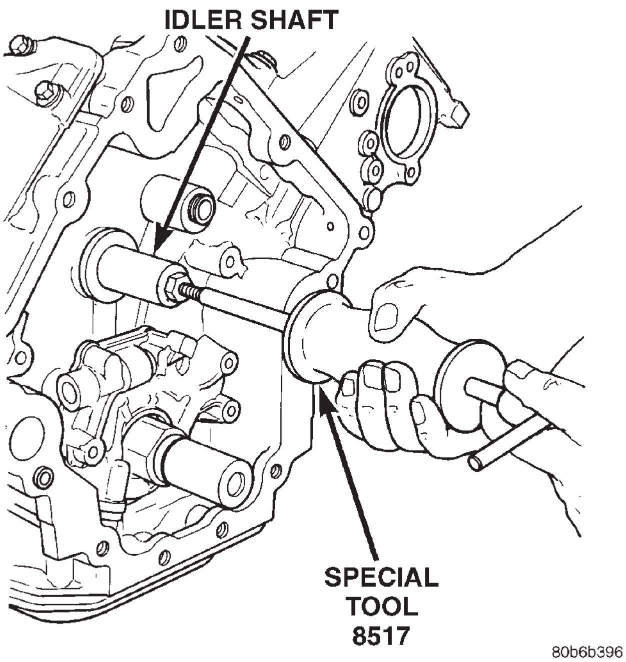


Fig. 76 Removing Idler Shaft

(4) Coat the idler shaft with clean engine oil and install the timing chains and sprockets. Refer to procedure in this section.

CAMSHAFTS—IN VEHICLE

LEFT CAMSHAFT

REMOVAL

CAUTION: When the timing chain is removed and the cylinder heads are still installed, DO NOT forcefully rotate the camshafts or crankshaft independently of each other. Severe valve and/or piston damage can occur.

CAUTION: When removing the cam sprocket, timing chains or camshaft, Failure to use Special Tool 8350 will result in hydraulic tensioner ratchet over extension, requiring timing chain cover removal to reset the tensioner ratchet.

(1) Remove cylinder head cover. Refer to Cylinder Head Cover in this section.

(2) Set engine to TDC cylinder #1, camshaft sprocket V8 marks at the 12 o'clock position.

(3) Mark one link on the secondary timing chain on both sides of the V8 mark on the camshaft sprocket to aid in installation.

CAUTION: Do not hold or pry on the camshaft target wheel (Located on the right side camshaft sprocket) for any reason, Severe damage will occur to the target wheel resulting in a vehicle no start condition.

(4) Loosen but **DO NOT** remove the camshaft sprocket retaining bolt. Leave the bolt snug against the sprocket.

NOTE: The timing chain tensioners must be secured prior to removing the camshaft sprockets. Failure to secure tensioners will allow the tensioners to extend, requiring timing chain cover removal in order to reset tensioners.

CAUTION: Do not force wedge past the narrowest point between the chain strands. Damage to the tensioners may occur.

(5) Position Special Tool 8350 timing chain wedge between the timing chain strands, tap the tool to securely wedge the timing chain against the tensioner arm and guide (Fig. 77).

(6) Hold the camshaft with adjustable pliers while removing the camshaft sprocket bolt and sprocket (Fig. 78).

(7) Using the pliers, gently allow the camshaft to rotate 15° until the camshaft is in the neutral position (no valve load).

(8) Starting at the outside working inward, loosen the camshaft bearing cap retaining bolts 1/2 turn at a time. Repeat until all load is off the bearing caps.

CAUTION: DO NOT STAMP OR STRIKE THE CAMSHAFT BEARING CAPS. SEVERE DAMAGE WILL OCCUR TO THE BEARING CAPS.

NOTE: When the camshaft is removed the rocker arms may slide downward, mark the rocker arms before removing camshaft.

(9) Remove the camshaft bearing caps and the camshaft.

INSTALLATION

(1) Lubricate camshaft journals with clean engine oil.

NOTE: Position the left side camshaft so that the camshaft sprocket dowel is near the 1 o'clock position, This will place the camshaft at the neutral position easing the installation of the camshaft bearing caps.

(2) Position the camshaft into the cylinder head.

(3) Install the camshaft bearing caps, hand tighten the retaining bolts.

REMOVAL AND INSTALLATION (Continued)

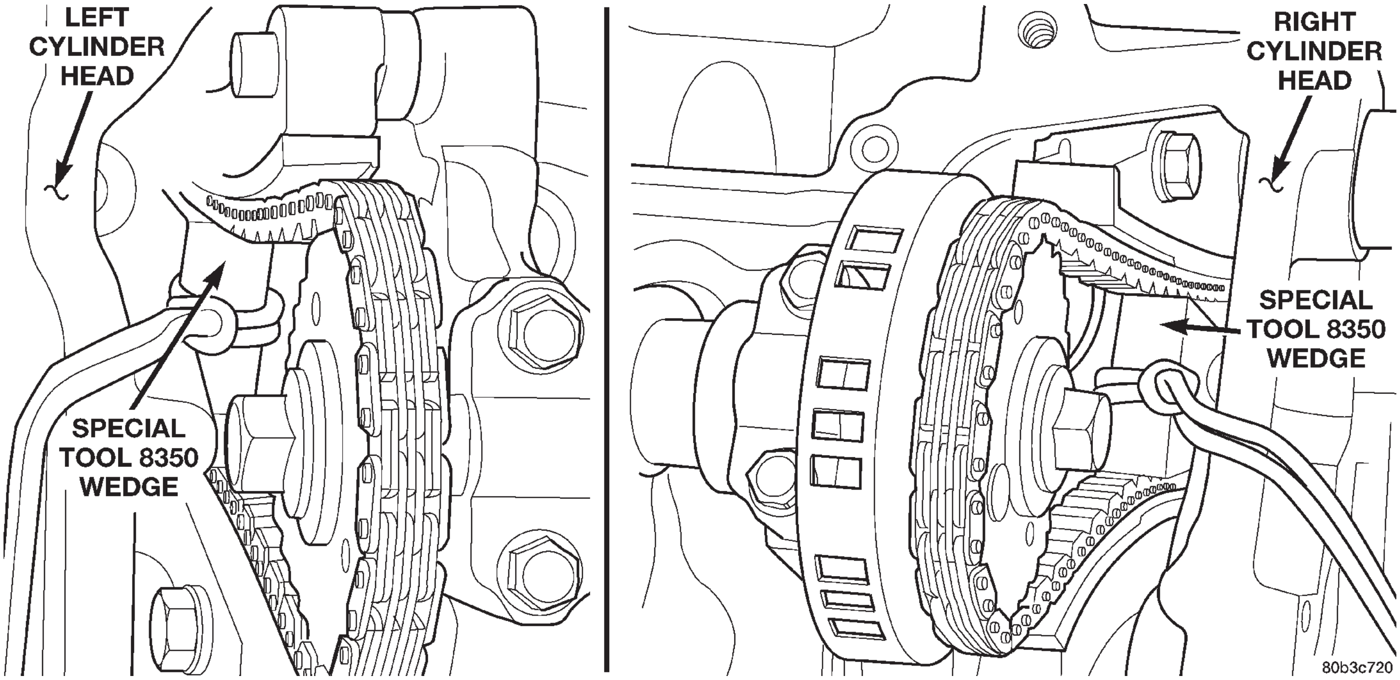


Fig. 77 Securing Timing Chain Tensioners Using Timing Chain Wedge

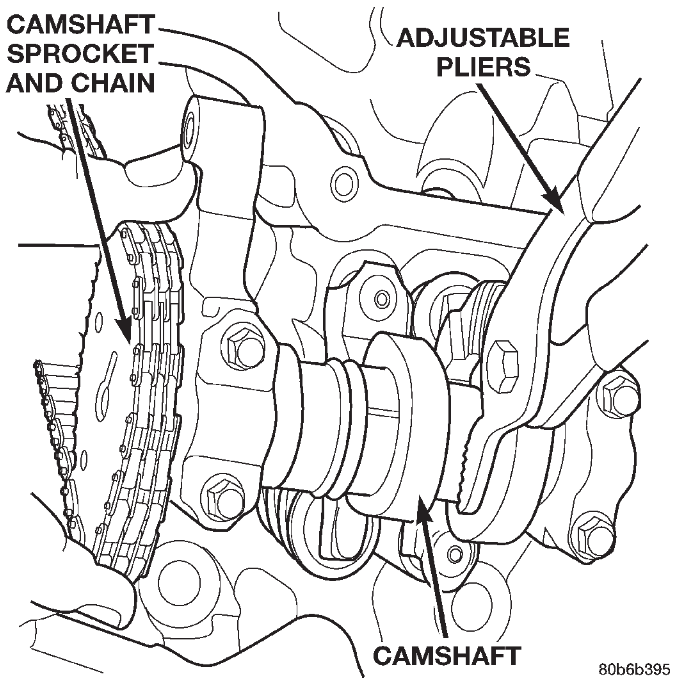


Fig. 78 Camshaft Sprocket and Chain

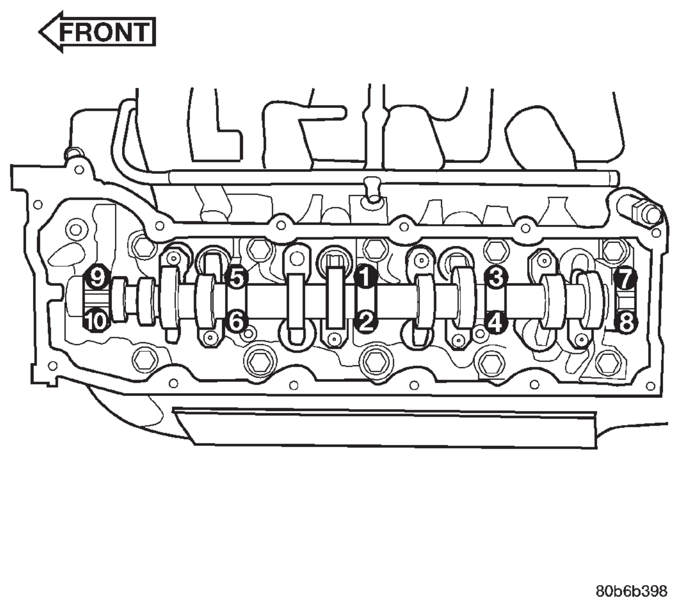


Fig. 79 Camshaft Bearing Caps Tightening Sequence

(4) Working in ½ turn increments, tighten the bearing cap retaining bolts starting with the middle cap working outward (Fig. 79).

(5) Torque the camshaft bearing cap retaining bolts to 11 N·m (100 in. lbs.).

(6) Position the camshaft drive gear into the timing chain aligning the V8 mark between the two marked chain links (Two links marked during removal) (Fig. 80).

(7) Using the adjustable pliers, rotate the camshaft until the camshaft sprocket dowel is aligned with the slot in the camshaft sprocket. Install the sprocket onto the camshaft (Fig. 81).

(8) Install the camshaft sprocket retaining bolt and hand tighten.

(9) Remove Special Tool 8350 timing chain wedge (Fig. 77).

REMOVAL AND INSTALLATION (Continued)

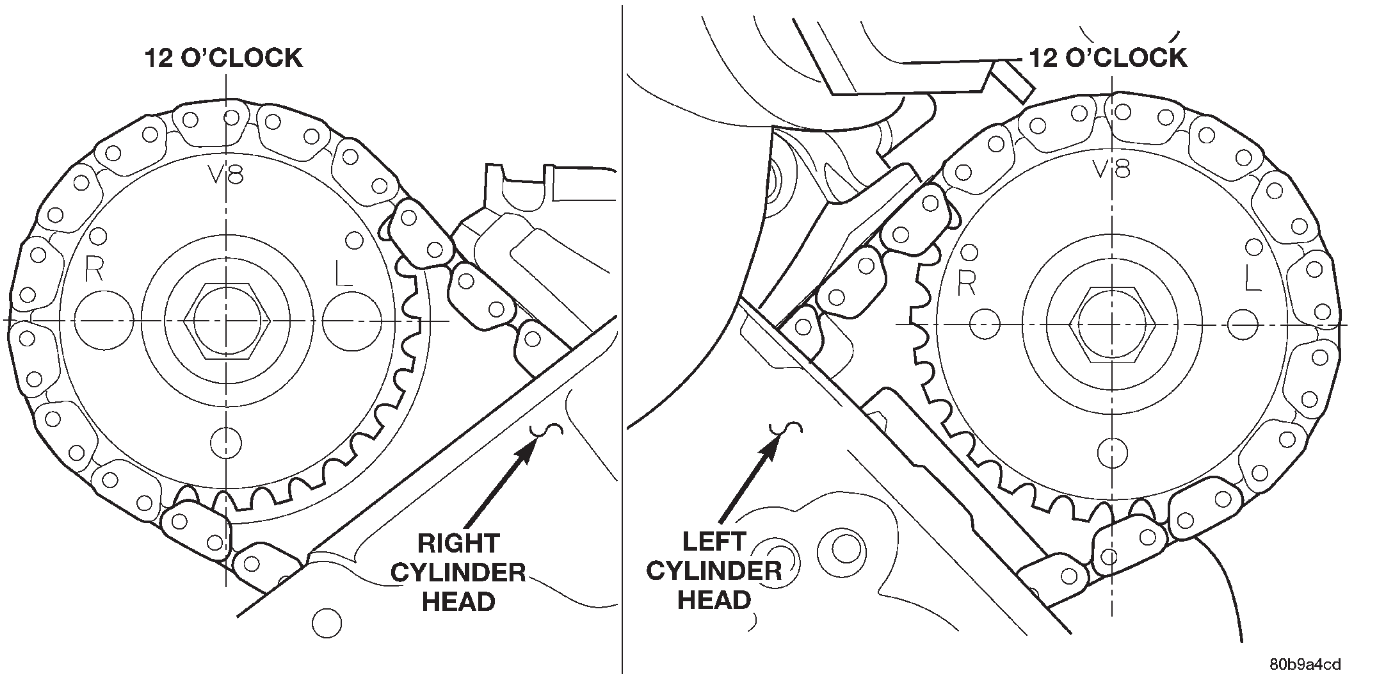


Fig. 80 Timing Chain to Sprocket Alignment

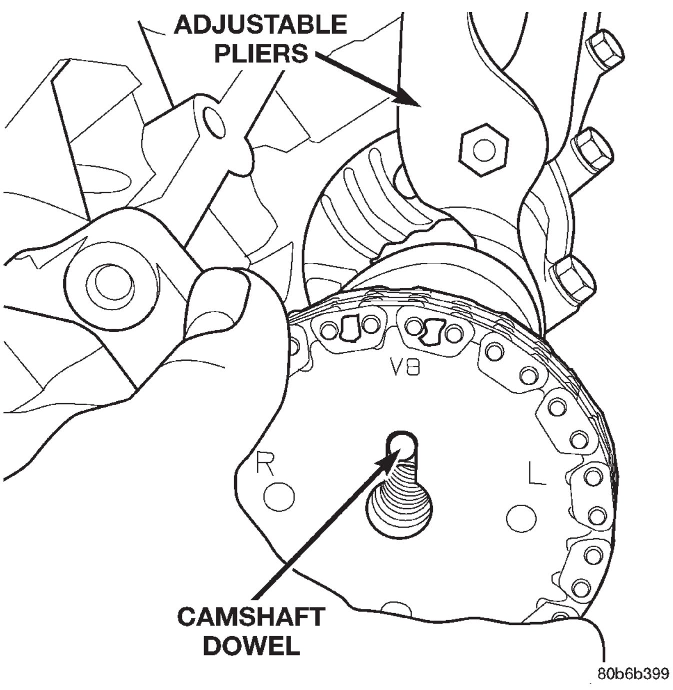


Fig. 81 Camshaft Sprocket Installation

(10) Using Special Tool 6958 spanner wrench with adapter pins 8346 (Fig. 82), torque the camshaft sprocket retaining bolt to 122 N·m (90 ft. lbs.).

(11) Install the cylinder head cover.

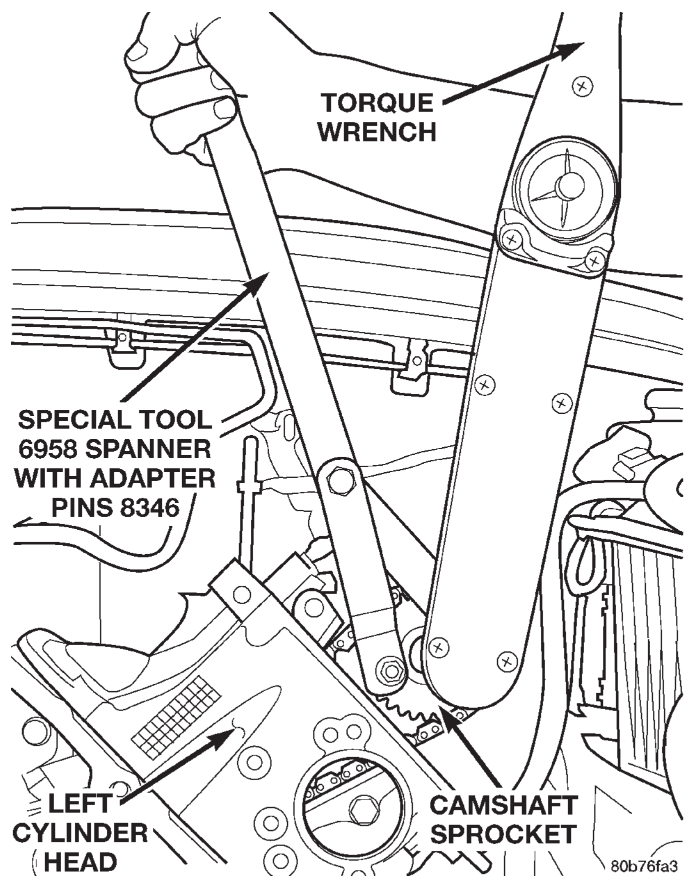


Fig. 82 Tightening Left Side Cam Sprocket Retaining Bolt

REMOVAL AND INSTALLATION (Continued)

RIGHT CAMSHAFT

REMOVAL

CAUTION: When the timing chain is removed and the cylinder heads are still installed, DO NOT forcefully rotate the camshafts or crankshaft independently of each other. Severe valve and/or piston damage can occur.

CAUTION: When removing the cam sprocket, timing chains or camshaft, Failure to use special tool 8350 will result in hydraulic tensioner ratchet over extension, Requiring timing chain cover removal to re-set the tensioner ratchet.

(1) Remove the cylinder head covers. Refer to Cylinder Head Cover in this section.

(2) Set engine to TDC cylinder #1, camshaft sprocket V8 marks at the 12 o'clock position.

(3) Mark one link on the secondary timing chain on both sides of the V8 mark on the camshaft sprocket to aid in installation.

CAUTION: Do not hold or pry on the camshaft target wheel for any reason, Severe damage will occur to the target wheel. A damaged target wheel could cause a vehicle no start condition.

(4) Loosen but **DO NOT** remove the camshaft sprocket retaining bolt. Leave bolt snug against sprocket.

NOTE: The timing chain tensioners must be secured prior to removing the camshaft sprockets. Failure to secure tensioners will allow the tensioners to extend, requiring timing chain cover removal in order to reset tensioners.

CAUTION: Do not force wedge past the narrowest point between the chain strands. Damage to the tensioners may occur.

(5) Position Special Tool 8350 timing chain wedge between the timing chain strands. Tap the tool to securely wedge the timing chain against the tensioner arm and guide (Fig. 83).

(6) Remove the camshaft position sensor (Fig. 84).

(7) Hold the camshaft with adjustable pliers while removing the camshaft sprocket bolt and sprocket (Fig. 85).

(8) Using the pliers, gently allow the camshaft to rotate 45° until the camshaft is in the neutral position (no valve load).

(9) Starting at the outside working inward, loosen the camshaft bearing cap retaining bolts 1/2 turn at a time. Repeat until all load is off the bearing caps.

CAUTION: DO NOT STAMP OR STRIKE THE CAMSHAFT BEARING CAPS. SEVERE DAMAGE WILL OCCUR TO THE BEARING CAPS.

NOTE: When the camshaft is removed the rocker arms may slide downward, mark the rocker arms before removing camshaft.

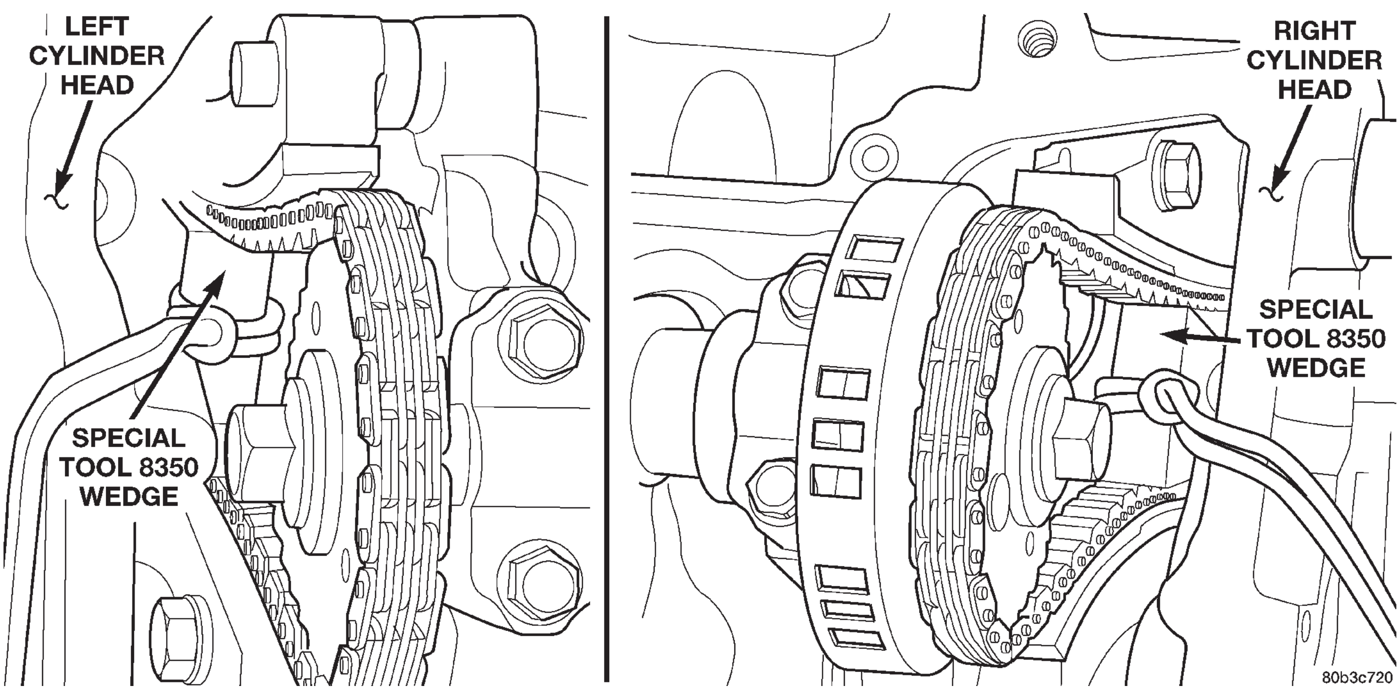


Fig. 83 Securing Timing Chain Tensioners Using Timing Chain Wedge

REMOVAL AND INSTALLATION (Continued)

(10) Remove the camshaft bearing caps and the camshaft.

INSTALLATION

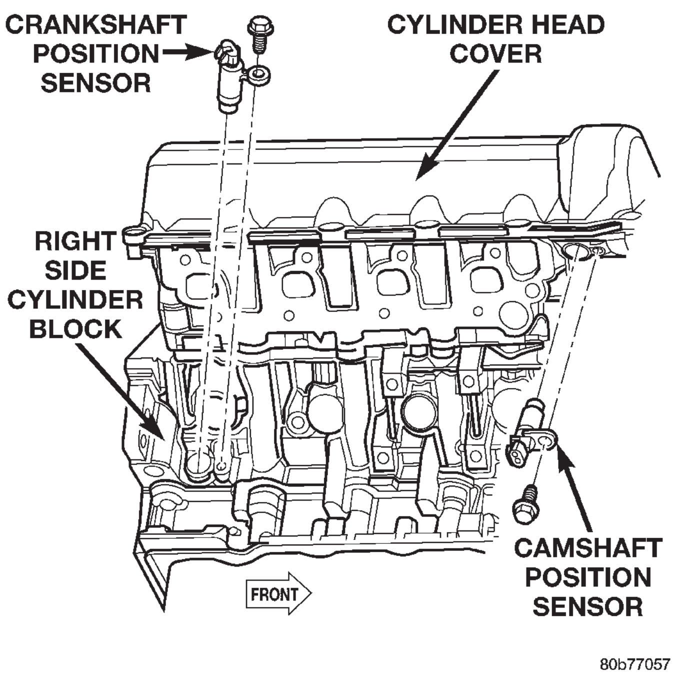


Fig. 84 Camshaft Position Sensor

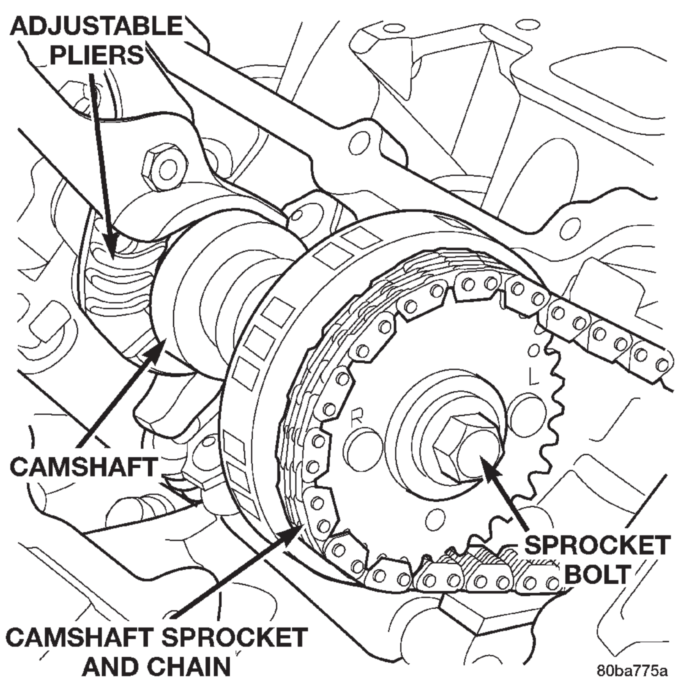


Fig. 85 Camshaft Sprocket and Chain

(1) Lubricate camshaft journals with clean engine oil.

NOTE: Position the right side camshaft so that the camshaft sprocket dowel is near the 10 o'clock position, This will place the camshaft at the neutral position easing the installation of the camshaft bearing caps.

(2) Position the camshaft into the cylinder head.

(3) Install the camshaft bearing caps, hand tighten the retaining bolts.

(4) Working in 1/2 turn increments, tighten the bearing cap retaining bolts starting with the middle cap working outward (Fig. 86).

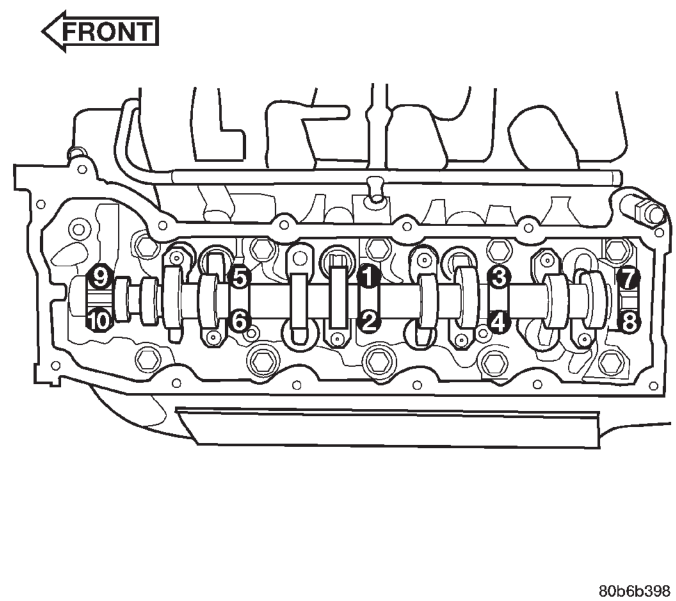


Fig. 86 Camshaft Bearing Caps Tightening Sequence

(5) Torque the camshaft bearing cap retaining bolts to 11 N·m (100 in. lbs.).

(6) Position the camshaft drive gear into the timing chain aligning the V8 mark between the two marked chain links (Two links marked during removal) (Fig. 87).

(7) Using the adjustable pliers, rotate the camshaft until the camshaft sprocket dowel is aligned with the slot in the camshaft sprocket. Install the sprocket onto the camshaft (Fig. 88).

(8) Install the camshaft sprocket retaining bolt and hand tighten.

(9) Remove timing chain wedge special tool 8350 (Fig. 83).

(10) Using Special Tool 6958 spanner wrench with adapter pins 8346 (Fig. 89), torque the camshaft sprocket retaining bolt to 122 N·m (90 ft. lbs.).

(11) Install the camshaft position sensor (Fig. 84).

(12) Install the cylinder head cover.

REMOVAL AND INSTALLATION (Continued)

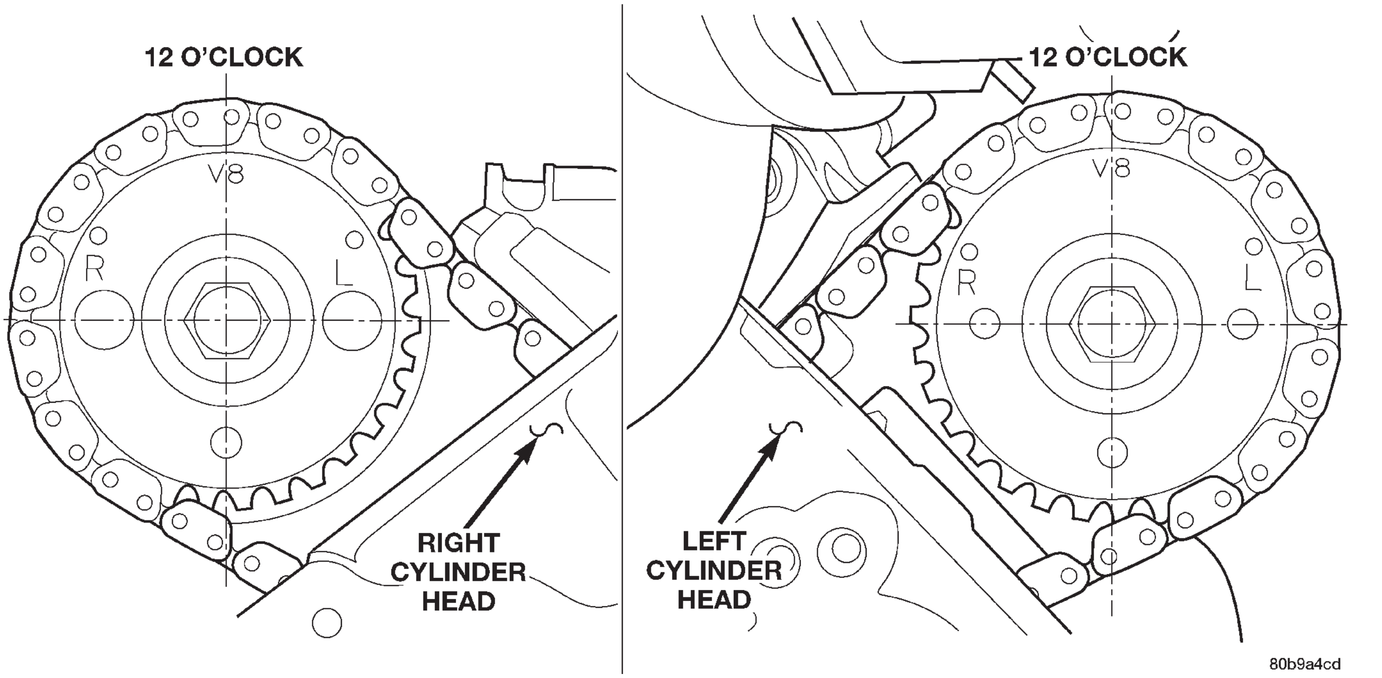


Fig. 87 Timing Chain to Sprocket Alignment

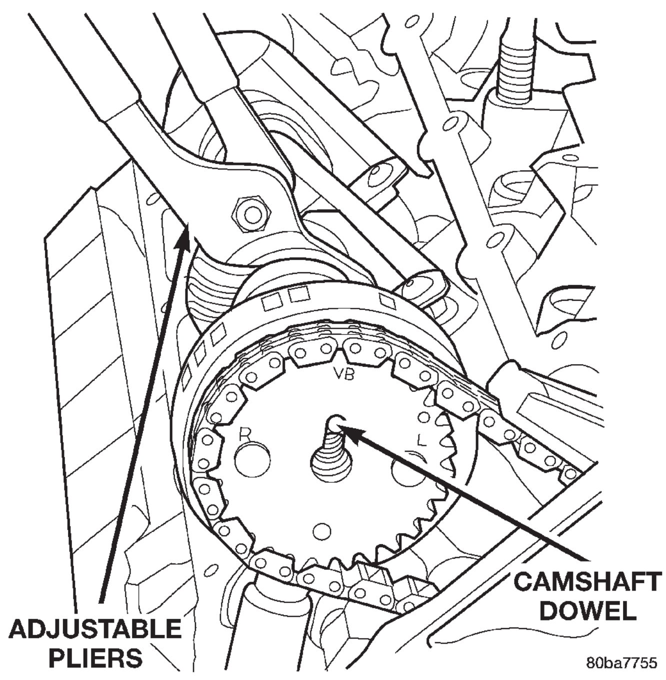


Fig. 88 Camshaft Sprocket Installation

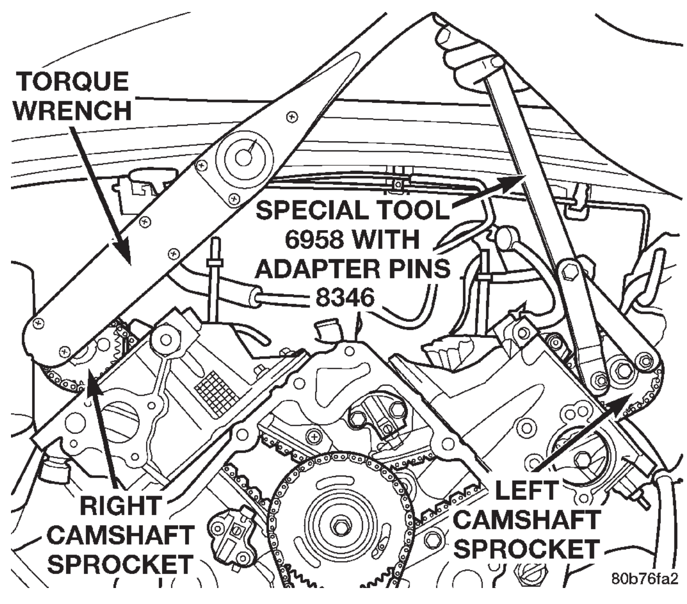


Fig. 89 Tightening Right Side Cam Sprocket Retaining Bolt

CRANKSHAFT MAIN BEARINGS

CRANKSHAFT MAIN BEARING SELECTION

The main bearings are “select fit” to achieve proper oil clearances. For main bearing selection, the crankshaft position sensor target wheel has grade identification marks stamped into it (Fig. 90). These marks are read from left to right, corresponding with journal number 1, 2, 3, 4 and 5. The crankshaft position sensor target wheel is mounted to the number 8 counter weight on the crankshaft.

NOTE: Service main bearings color coded. These color codes identify what size (grade) the bearing is.

CHECKING CRANKSHAFT END PLAY

(1) Mount a dial indicator to a stationary point at front of engine. Locate the probe perpendicular against nose of crankshaft (Fig. 91).

REMOVAL AND INSTALLATION (Continued)

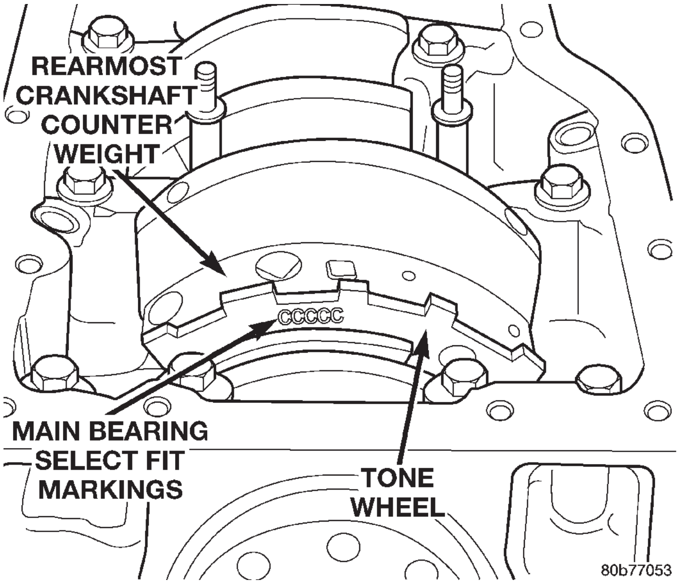


Fig. 90 Main Bearing Markings on Target Wheel

MAIN BEARING SELECTION CHART—4.7L

GRADE MARKING	SIZE mm (in.)	FOR USE WITH JOURNAL SIZE
A	0.008 mm (0.0004 in.) U/S	63.488–63.496 mm (2.4996–2.4999 in.)
B	NOMINAL	63.496–63.504 mm (2.4999–2.5002 in.)
C	0.008 mm (0.0004 in.) O/S	63.504–63.512 mm (2.5002–2.5005 in.)

(2) Move the crankshaft all the way to the rear of it's travel.

(3) Zero the dial indicator.

(4) Move the crankshaft all the way to the front of it's travel and read the dial indicator. Refer to Crankshaft End Play Specification Chart.

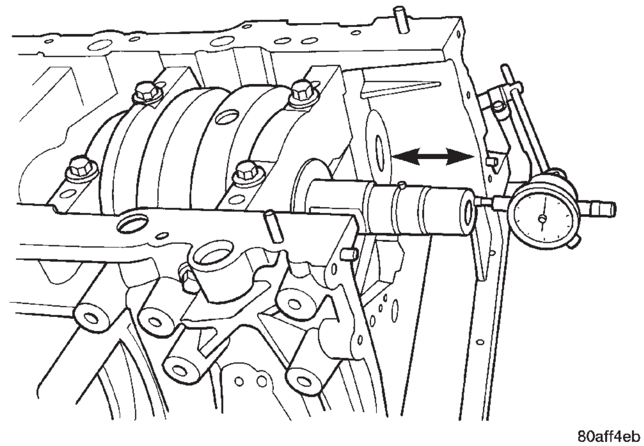


Fig. 91 Checking Crankshaft end Play—Typical

CRANKSHAFT END PLAY SPECIFICATION CHART

New Part:	0.052 - 0.282mm (0.002 - 0.011 in.)
Wear Limit:	0.43mm (0.017 in.)

OIL PAN

REMOVAL

(1) Disconnect negative cable from battery.

(2) Raise vehicle on hoist.

(3) Remove structural cover. Refer to Structural Cover in this section for procedure.

(4) Remove exhaust system Y-pipe.

(5) Remove starter. Refer to Group 8B, Starting.

(6) Drain engine oil.

(7) Un-clip transmission lines from support on oil pan stud. Move lines for oil pan clearance.

CAUTION: DO NOT pry on the oil pan gasket when removing the oil pan, The oil pan gasket is mounted to the cylinder block in three locations and will remain attached to block when lowering oil pan. Gasket can not be removed with oil pan.

(8) Remove oil pan bolts and oil pan.

(9) Remove oil pump pickup tube.

(10) Remove oil pan gasket.

INSTALLATION

(1) Clean oil pan and all sealing surfaces. Inspect oil pan gasket and replace as necessary.

(2) Install oil pan gasket.

NOTE: When installing oil pan gasket/windage tray, start four pan bolts at each corner before tightening oil pickup tube. This will keep pan gasket in alignment.

(3) Install oil pump pick-up tube using a new O-ring. First tighten bolt at O-ring end of tube to 28 N·m (20 ft. lbs.). Tighten remain tube support fasteners to 28 N·m (20 ft. lbs.).

(4) Install oil pan and tighten fasteners to 15 N·m (11 ft. lbs.) (Fig. 92).

(5) Reconnect transmission oil cooler lines to oil pan stud bolt.

(6) Install starter.

(7) Install exhaust system Y-pipe.

REMOVAL AND INSTALLATION (Continued)

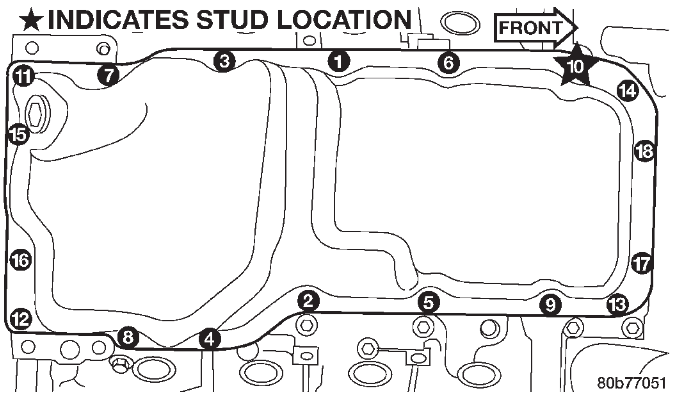


Fig. 92 Oil Pan Tightening Sequence

(8) Install structural cover. Refer to Structural Cover in this section for procedure.
(9) Lower vehicle.
(10) Fill engine with proper amount of oil.
(11) Connect negative cable to battery.

PISTON AND CONNECTING ROD ASSEMBLY

REMOVAL

(1) Disconnect negative cable from battery.
(2) Remove the following components: (Refer to procedures in this section)

- Oil pan and gasket/windage tray.
- Cylinder head covers.
- Timing chain cover.
- Cylinder head(s).

(3) If necessary, 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.** Pistons and connecting rods must be removed from top of cylinder block. When removing piston and connecting rod assemblies from the engine, rotate crankshaft so the each connecting rod is centered in cylinder bore.

CAUTION: DO NOT use a number stamp or a punch to mark connecting rods or caps, as damage to connecting rods could occur

NOTE: Connecting rods and bearing caps are not interchangeable and should be marked before removing to ensure correct reassembly.

(4) Mark connecting rod and bearing cap positions using a permanent ink marker or scribe tool (Fig. 93).

CAUTION: Care must be taken not to damage the fractured rod and cap joint face surfaces, as engine damage may occur.

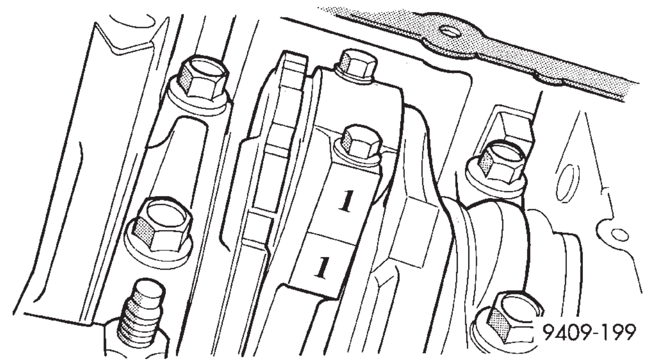


Fig. 93 Identify Connecting Rod to Cylinder Position—Typical

(5) Remove connecting rod cap. Install Special Tool 8507 Connecting Rod Guides into the connecting rod being removed. Remove piston from cylinder bore. Repeat this procedure for each piston being removed.

CAUTION: Care must be taken not to nick crankshaft journals, as engine damage may occur

(6) Immediately after piston and connecting rod removal, install bearing cap on the mating connecting rod to prevent damage to the fractured cap and rod surfaces.
(7) Carefully remove piston rings from piston(s), starting from the top ring down.

PISTON RINGS—INSTALLATION

(1) The No. 1 and No. 2 piston rings have a different cross section. Ensure No. 2 ring is installed with manufacturers I.D. mark (Dot) facing up, towards top of the piston.

NOTE: Piston rings are installed in the following order:

- **Oil ring expander.**
- **Upper oil ring side rail.**
- **Lower oil ring side rail.**
- **No. 2 Intermediate piston ring.**
- **No. 1 Upper piston ring.**

(2) Install the oil ring expander.
(3) Install upper side rail (Fig. 94) by placing one end between the piston ring groove and the expander ring. Hold end firmly and press down the portion to be installed until side rail is in position. Repeat this step for the lower side rail.
(4) Install No. 2 intermediate piston ring using a piston ring installer (Fig. 95).
(5) Install No. 1 upper piston ring using a piston ring installer (Fig. 95).
(6) Position piston ring end gaps as shown in (Fig. 96). It is important that expander ring gap is at least 45° from the side rail gaps, but not on the piston pin center or on the thrust direction.

REMOVAL AND INSTALLATION (Continued)

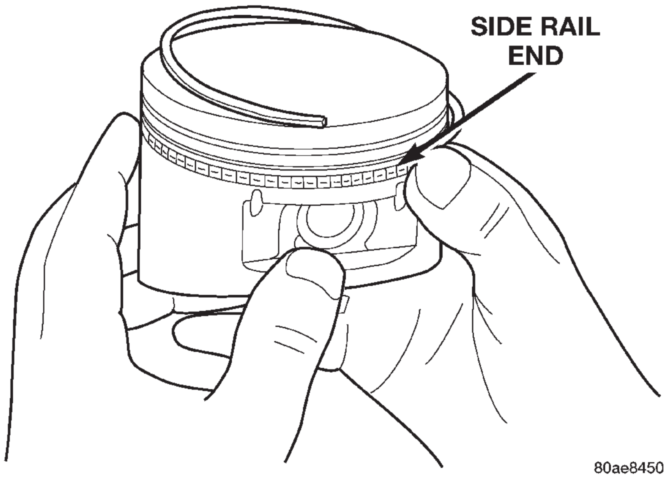


Fig. 94 Side Rail—Installation

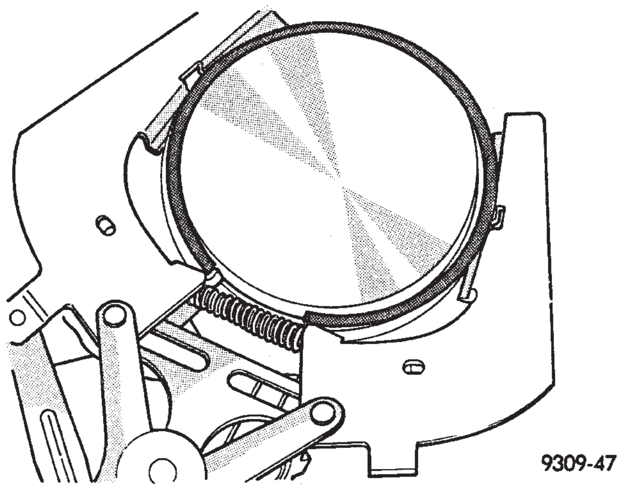


Fig. 95 Upper and Intermediate Rings—Installation

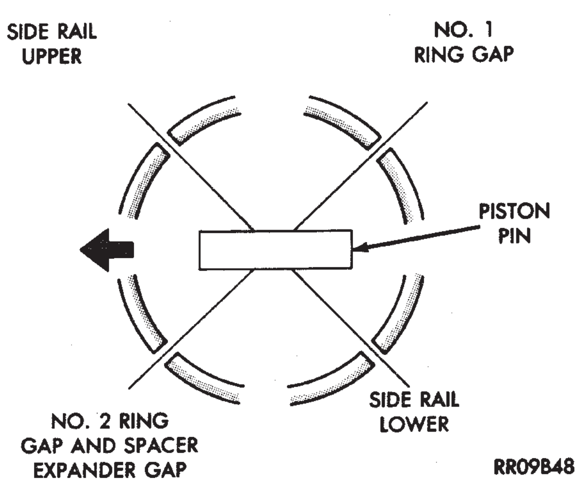


Fig. 96 Piston Ring End Gap Position

INSTALLATION

(1) Before installing piston and connecting rod assemblies in to the bore, ensure all rings are in position shown in (Fig. 96).

(2) Immerse the piston head and rings in clean engine oil. Position a ring compressor over the piston and rings. Tighten ring compressor. **Ensure position of rings do not change during this operation.**

(3) Position bearing onto connecting rod. Ensure that hole in bearing shell aligns with hole in connecting rod. Lubricate bearing surface with clean engine oil.

(4) Install Special Tool 8507 Connecting Rod Guides into connecting rod bolt threads (Fig. 97).

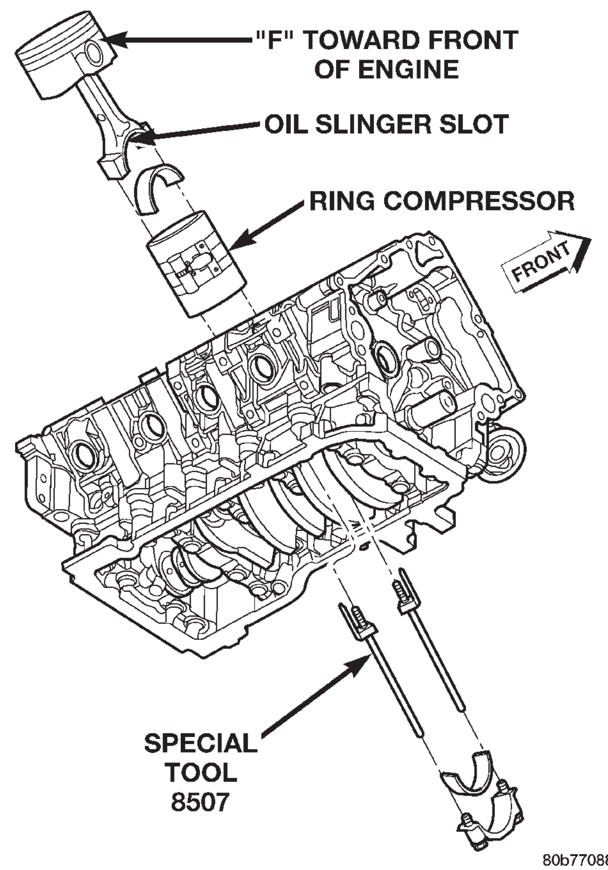


Fig. 97 Piston and Connecting Rod—Installation

(5) The pistons are marked on the piston pin bore surface with an raised “F” indicating installation position. This mark must be pointing toward the front of engine on both cylinder banks. The connecting rod oil slinger slot faces the front of the engine (Fig. 98).

(6) Wipe cylinder bore clean and lubricate with engine oil.

(7) Rotate crankshaft until connecting rod journal is on the center of cylinder bore. Insert rod and piston into cylinder bore and carefully position connecting rod guides over crankshaft journal.

(8) Tap piston down in cylinder bore using a hammer handle. While at the same time, guide connecting rod into position on rod journal.

REMOVAL AND INSTALLATION (Continued)

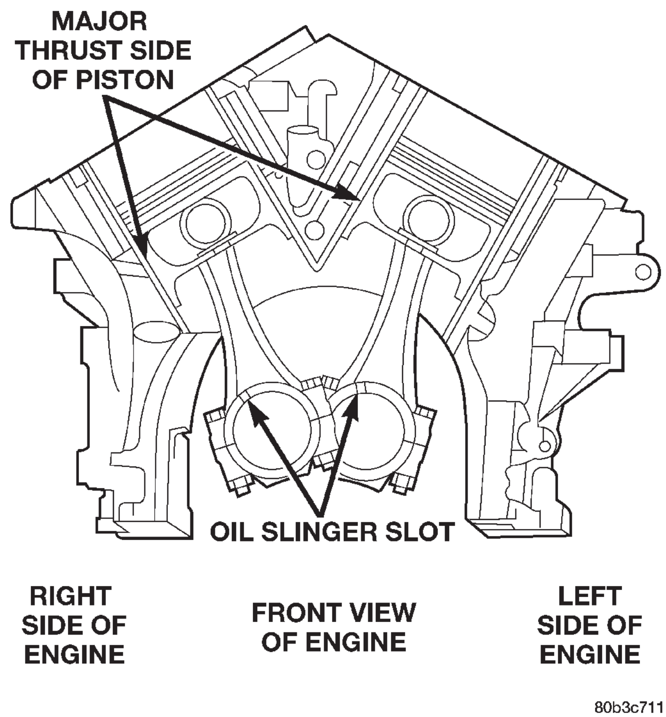


Fig. 98 Piston and Connecting Rod Positioning

CAUTION: Connecting Rod Bolts are Torque to Yield Bolts and Must Not Be Reused. Always replace the Rod Bolts whenever they are loosened or removed.

(9) Lubricate rod bolts and bearing surfaces with engine oil. Install connecting rod cap and bearing. Tighten bolts to 20 N·m (15 ft. lbs.) plus 110 degrees.

(10) Install the following components: (Refer to procedures in this section)

- Cylinder head(s).
- Timing chain and cover.
- Cylinder head covers.
- Oil pan and gasket/windage tray.

(11) Fill crankcase with proper engine oil to correct level.

(12) Connect negative cable to battery.

CRANKSHAFT

REMOVAL

NOTE: To remove the crankshaft from the engine, the engine must be removed from the vehicle.

(1) Remove the engine. Refer to Engine Assembly in this section for procedure.

(2) Remove the engine oil pump. Refer to Oil Pump in this section for procedure.

CAUTION: DO NOT pry on the oil pan gasket when removing the oil pan, The oil pan gasket is mounted to the cylinder block in three locations and will remain attached to block when removing oil pan. Gasket can not be removed with oil pan.

(3) Remove oil pan bolts and oil pan.

(4) Remove the oil pump pickup tube and oil pan gasket /windage tray.

(5) Remove the bedplate mounting bolts. Note the location of the three stud bolts for installation.

(6) Remove the connecting rods from the crankshaft.

CAUTION: The bedplate to cylinder block mating surface is a critical sealing surface. Do not pry on or damage this surface in anyway.

NOTE: The bedplate contains the lower main bearing halves. Use care when handling bedplate as not to drop or damage bearing halves. Installing main bearing halves in the wrong position will cause sever damage to the crankshaft.

(7) Remove the bedplate.

CAUTION: When removing the crankshaft, use care not to damage bearing surfaces on the crankshaft.

(8) Remove the crankshaft.

(9) Remove the crankshaft tone wheel.

INSPECTION

NOTE: Thoroughly inspect the connecting rod bearing bores and main bearing bores for scoring, blueing or severe scratches. Further disassembly may be required.

If connecting rod bearing bores show damage, the cylinder heads must be removed to service the piston and rod assemblies. If the bedplate or the cylinder block main bearing bores show damage the engine must be replaced.

(1) If required, remove the main bearing halves from the cylinder block and bedplate.

(2) Thoroughly clean the bedplate to cylinder block sealing surfaces and main bearing bores. Remove all oil and sealant residue.

(3) Inspect the bedplate main bearing bores for cracks, scoring or severe blueing. If either condition exists the engine must be replaced.

(4) Inspect the crankshaft thrust washer for scoring, scratches or blueing. If either condition exist replace the thrust washer.

REMOVAL AND INSTALLATION (Continued)

(5) Inspect the oil pan gasket/windage tray for splits, tears or cracks in the gasket sealing surfaces. Replace gasket as necessary.

INSTALLATION

CAUTION: Main bearings are select fit. Refer to Crankshaft Main Bearings in this section for proper bearing selections.

(1) Lubricate upper main bearing halves with clean engine oil.

CAUTION: When installing crankshaft, use care not to damage bearing surfaces on the crankshaft.

NOTE: Apply sealant to the tone wheel retaining screws prior to installation.

(2) Install the crankshaft tone wheel. torque the mounting screws to 22 N·m (21 ft. lbs.).

(3) Install the thrust washer (Fig. 99).

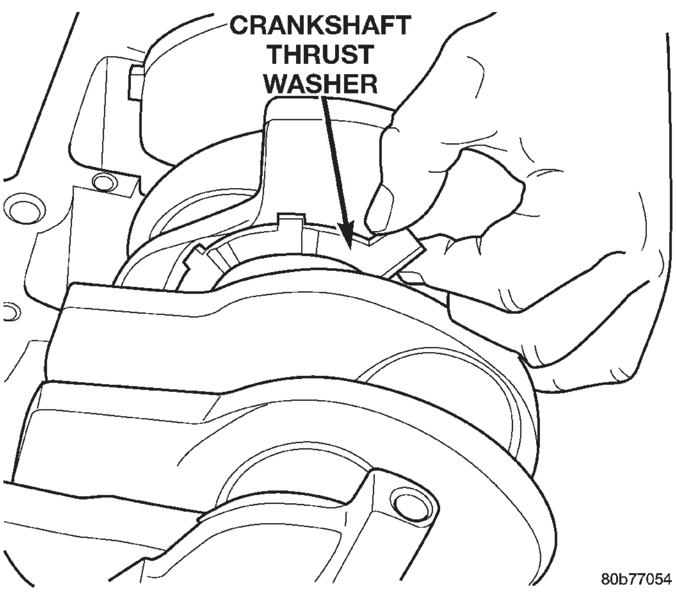


Fig. 99 Crankshaft Thrust Washer Installation

(4) Position crankshaft in cylinder block.

CAUTION: The bedplate to cylinder block mateing surface must be coated with sealant prior to installation. Failure to do so will cause severe oil leaks.

NOTE: The installation time to install the bedplate after the sealant has been applied is critical.

NOTE: Make sure that the bedplate and cylinder block sealing surfaces are clean and free of oil or other contaminants. Contaminants on the sealing surfaces may cause main bearing distortion and/or oil leaks.

(5) Apply a 2.5mm (0.100 inch) (Fig. 100) bead of Mopar® Silicone Rubber Adhesive sealant to the cylinder block-to-bedplate mating surface as shown (Fig. 101).

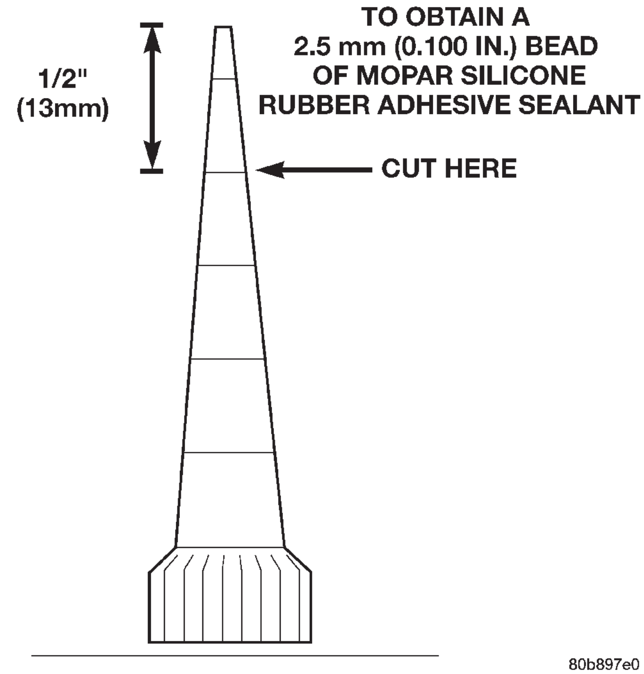


Fig. 100 Cutting Aplicator to Achieve 2.5mm (0.100 in.) Bead

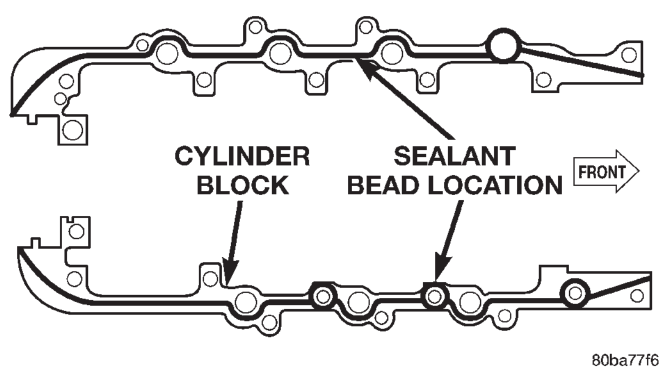


Fig. 101 Cylinder Block-to-Bedplate Sealent Bead Location

(6) Coat the crankshaft main bearing journals with clean engine oil and position the bedplate onto the cylinder block.

NOTE: Lubricate the bedplate retaining bolts with clean engine oil prior to installation.

(7) Install the bedplate retaining bolts, making sure to place the stud bolts in the correct location, Torque the bolts in the sequence shown (Fig. 102).

REMOVAL AND INSTALLATION (Continued)

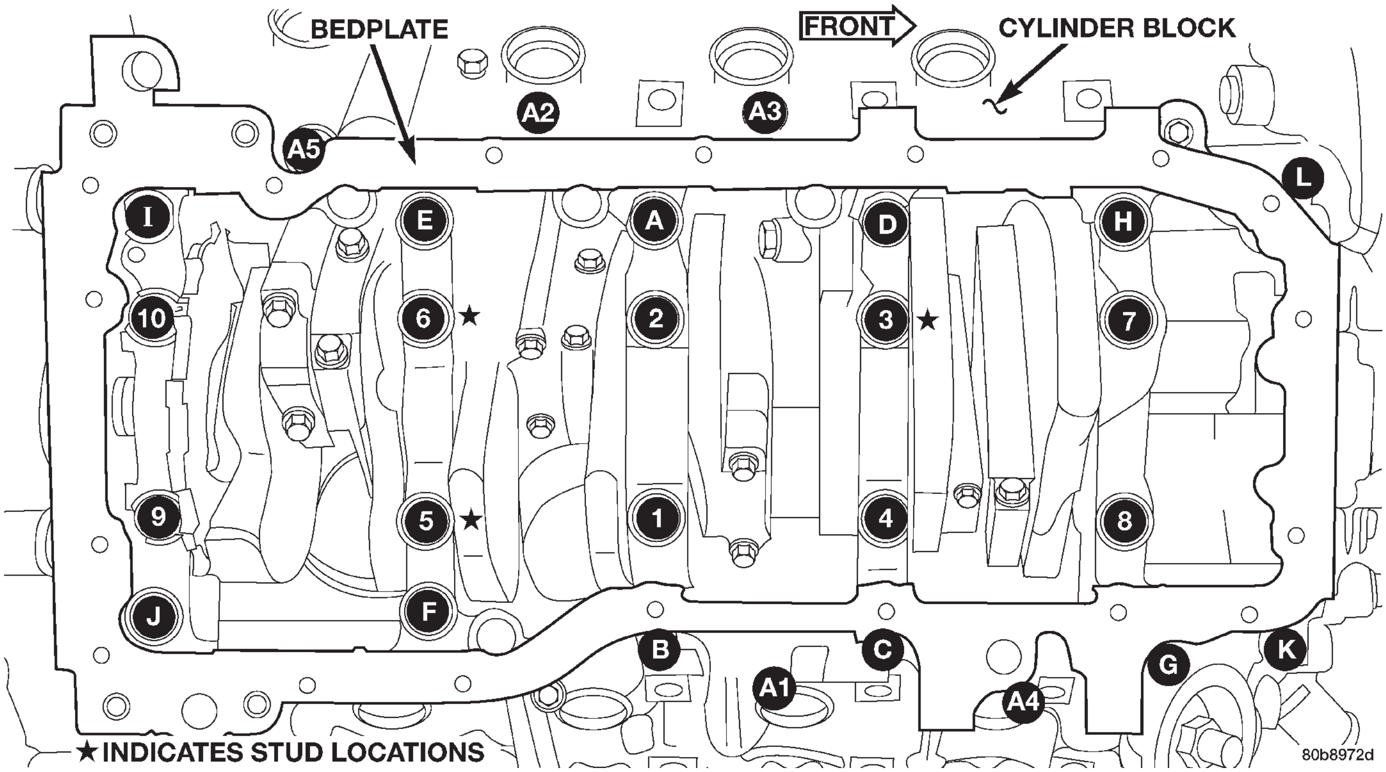


Fig. 102 Bedplate Tightening Sequence

- Tighten bolts **1–10** to 2.8 N·m (25 in. lbs.)
- Turn bolts **1–10** an additional 90°.
- Tighten bolts **A – K** to 54 N·m (40 ft. lbs.)
- Tighten bolts **A1– A5** to 27 N·m (20 ft. lbs.)

(8) Measure crankshaft end play. Refer to Crankshaft Main Bearings in this section for procedure.

(9) Install the connecting rods and measure side clearance. Refer to Connecting Rod Bearings in this section for procedure.

(10) Position the oil pan gasket/windage tray, using a new o-ring, install the oil pickup tube. Torque the bolt to 28N·n (20 ft. lbs.) torque the nuts to 28N·m (20 ft. lbs.).

(11) Install the oil pan. Torque the retaining bolts to 15 N·m (11 ft. lbs.) in the sequence shown (Fig. 103).

(12) Install the engine.

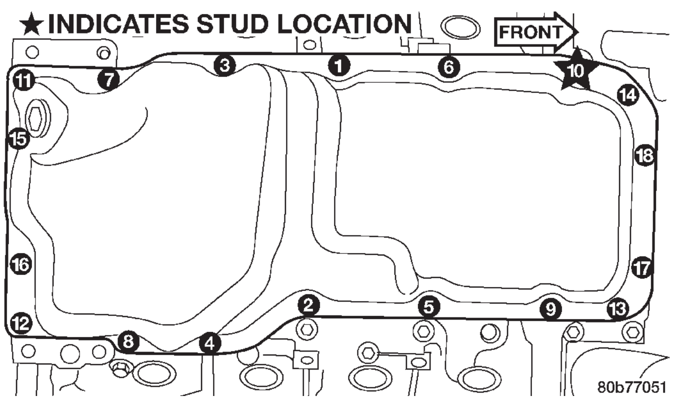


Fig. 103 Oil Pan Tightening Sequence

(3) Install the transmission.

FLEXPLATE

REMOVAL

(1) Remove the transmission. Refer to Group 21, Transmission and Transfer Case for procedure.

(2) Remove the bolts and flexplate.

INSTALLATION

(1) Position the flexplate onto the crankshaft and install the bolts hand tight.

(2) Tighten the flexplate retaining bolts to 60 N·m (45 ft. lbs.) in the sequence shown (Fig. 104).

OIL PUMP

REMOVAL

(1) Remove the timing chain cover. Refer to the procedure in this section.

(2) Remove the timing chains and tensioners. Refer to Timing Chain and Sprockets in this section.

(3) Remove the four bolts, primary timing chain tensioner and the oil pump.

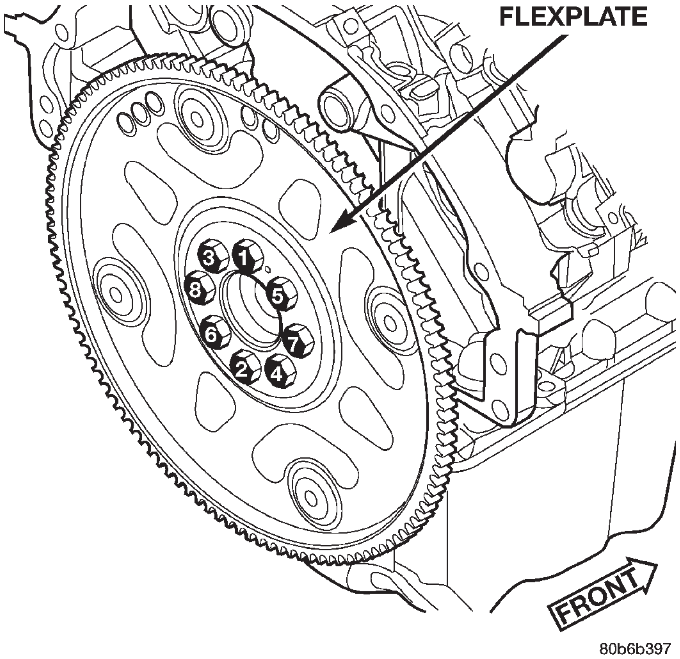


Fig. 104 Flexplate Tightening Sequence

INSTALLATION

(1) Position the oil pump onto the crankshaft and install two oil pump retaining bolts.

(2) Position the primary timing chain tensioner and install the two retaining bolts.

(3) Tighten the oil pump and primary timing chain tensioner retaining bolts to 28 N·m (250 in. lbs.) in the sequence shown (Fig. 105).

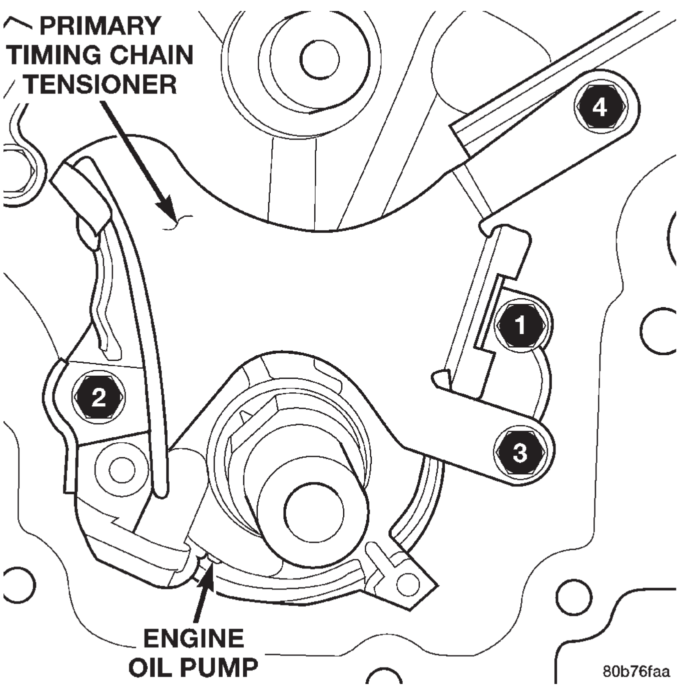


Fig. 105 Oil Pump and Primary Timing Chain Tightening Sequence

(4) Install the secondary timing chain tensioners and timing chains.

(5) Install the timing chain cover.

ENGINE OIL PRESSURE SENDING UNIT

REMOVAL

(1) Disconnect the negative cable from the battery.

(2) Raise vehicle on hoist.

(3) Remove front splash shield.

(4) Disconnect oil pressure sender wire (Fig. 106).

(5) Remove the pressure sender (Fig. 106).

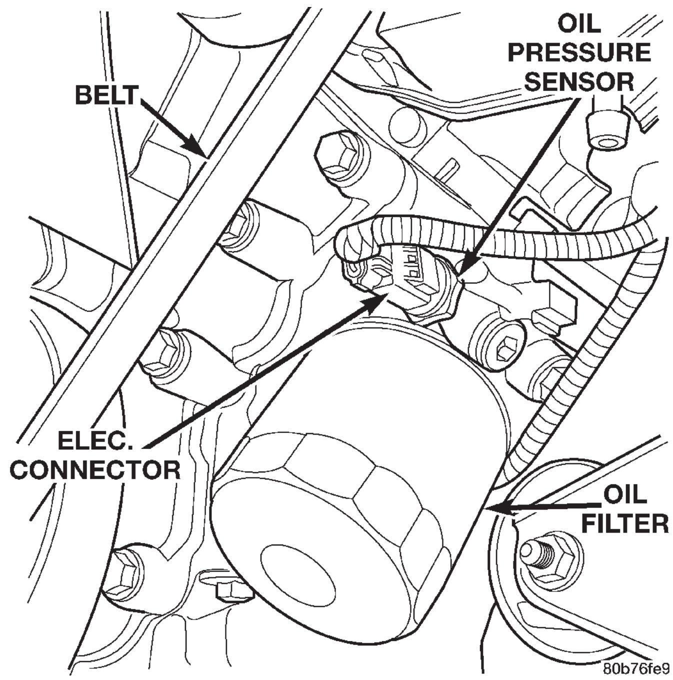


Fig. 106 Oil Pressure Sending Unit

INSTALLATION

(1) Install oil pressure sender.

(2) Connect oil pressure sender wire.

(3) Install front splash shield.

(4) Lower vehicle.

(5) Connect the negative battery cable.

CRANKSHAFT OIL SEAL—FRONT

REMOVAL

(1) Disconnect negative cable from battery.

(2) Remove accessory drive belt refer to Group 7, Cooling System for procedure.

(3) Remove A/C compressor mounting bolts and set aside.

(4) Drain cooling system. Refer to Group 7, Cooling System for procedure.

(5) Remove upper radiator hose.

REMOVAL AND INSTALLATION (Continued)

(6) Using Special Tools 6958 spanner with adapter pins 8346 loosen fan and viscous assembly from water pump (Fig. 107).

(7) Remove fan and viscous assembly

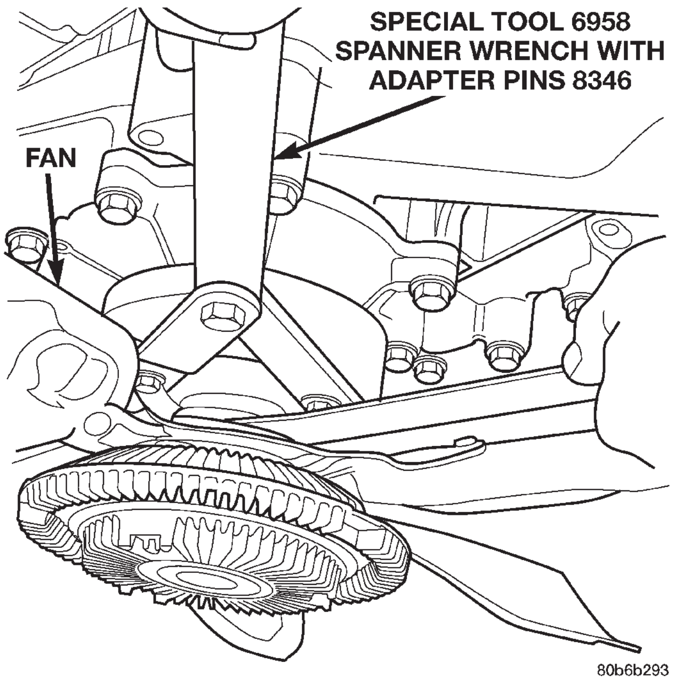


Fig. 107 Fan Assembly—Removal

(8) Disconnect electrical connector for fan mounted inside radiator shroud.

(9) Remove radiator shroud attaching fasteners.

NOTE: Transmission cooler line snaps into shroud lower right hand corner.

(10) Remove radiator shroud.

(11) Remove crankshaft damper bolt.

(12) Remove damper using Special Tools 8513 insert and 1026 three jaw puller (Fig. 108).

(13) Using Special Tool 8511, remove crankshaft front seal (Fig. 109).

INSTALLATION

(1) Using Special Tool 8348 install crankshaft front seal (Fig. 110).

(2) Align crankshaft damper slot with key in crankshaft. Slide damper onto crankshaft slightly.

(3) Using Special Tool 8512 press damper onto crankshaft (Fig. 111).

(4) Tighten crankshaft damper bolt to 175 N·m (130 ft. lbs.).

(5) Install radiator shroud and tighten fasteners to 11 N·m (95 in. lbs.).

(6) Connect electrical connector for shroud fan.

(7) Install fan and viscous assembly.

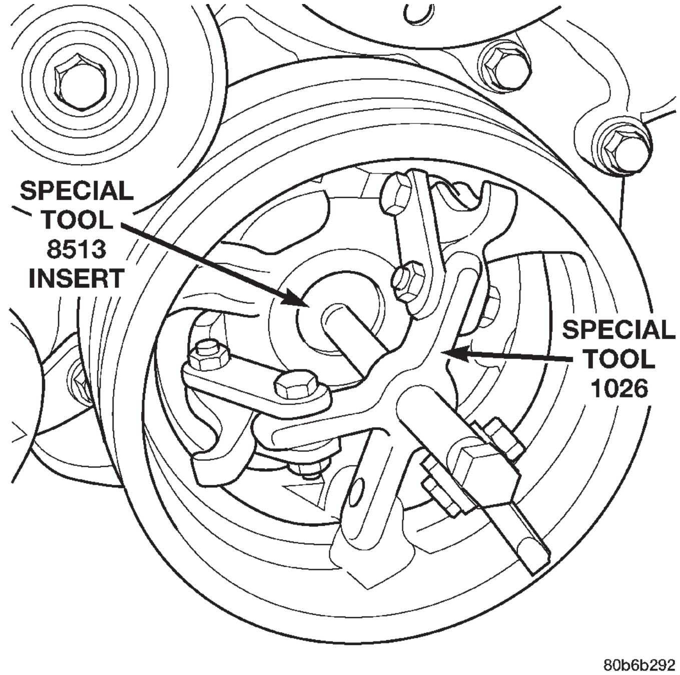


Fig. 108 Crankshaft Damper—Removal

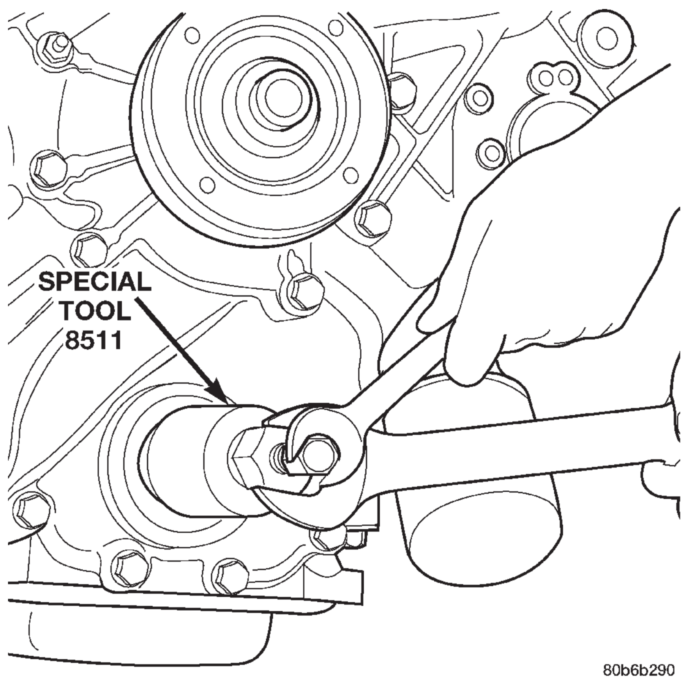


Fig. 109 Crankshaft Front Seal—Removal

(8) Using Special Tools 6958 spanner with adapter pins 8346 tighten fan and viscous assembly to water pump (Fig. 107).

(9) Install upper radiator hose.

(10) Install A/C compressor and tighten fasteners to 54 N·m (40 ft. lbs.).

(11) Install accessory drive belt refer to Group 7, Cooling System for procedure.

(12) Refill cooling system. Refer to Group 7, Cooling System for procedure.

REMOVAL AND INSTALLATION (Continued)

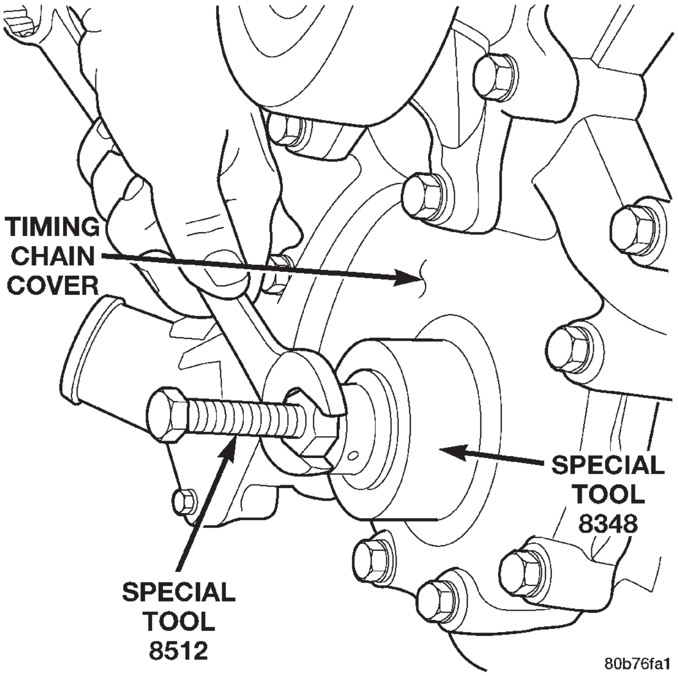


Fig. 110 Crankshaft Front Seal—Installation

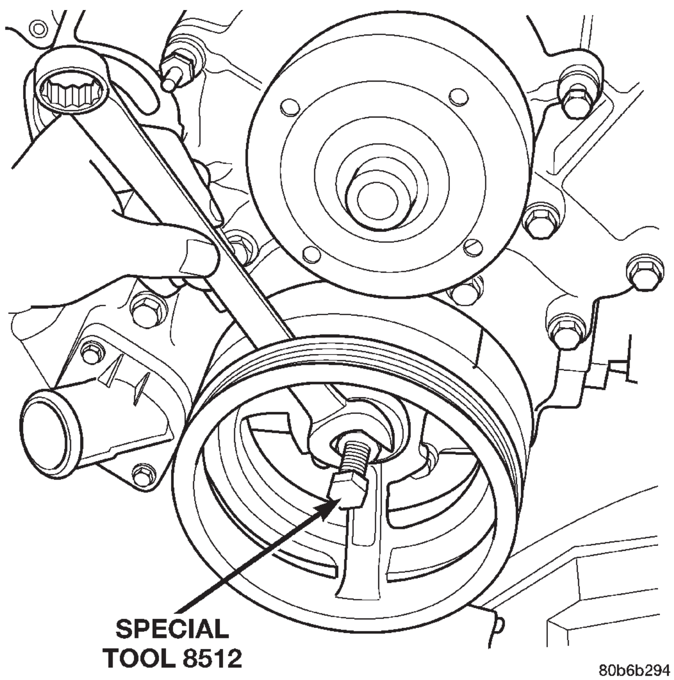


Fig. 111 Crankshaft Damper—Installation

(13) Connect negative cable to battery.

CRANKSHAFT OIL SEAL—REAR

REMOVAL

NOTE: This procedure can be preformed in vehicle.

(1) If being preformed in vehicle, remove the transmission. Refer to Group 21, Transmission and Transfer Case.

(2) Remove the flexplate. Refer to procedure in this section.

NOTE: The crankshaft oil seal CAN NOT be reused after removal.

NOTE: The crankshaft rear oil seal remover Special Tool 8506 must be installed deeply into the seal. Continue to tighten the removal tool into the seal until the tool can not be turned farther. Failure to install tool correctly the first time will cause tool to pull free of seal without removing seal from engine.

(3) Using Special Tool 8506 (Fig. 112), remove the crankshaft rear oil seal.

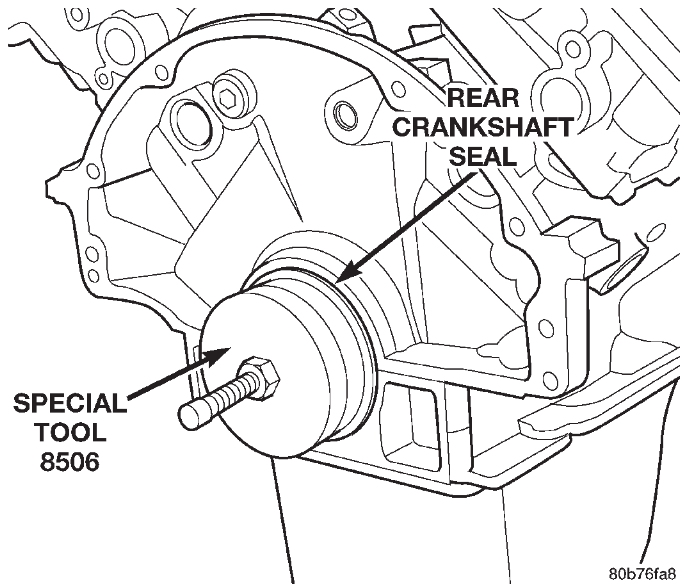


Fig. 112 Crankshaft Rear Oil Seal Removal

INSTALLATION

(1) Position the magnetic seal guide Special Tool 8349–2 (Fig. 113) onto the crankshaft rear face. Then position the crankshaft rear oil seal onto the guide.

(2) Using Special Tools 8349 Crankshaft Rear Oil Seal Installer and C-4171 Driver Handle (Fig. 114), with a hammer, tap the seal into place. Continue to tap on the driver handle until the seal installer seats against the cylinder block crankshaft bore.

(3) Install the flexplate.

(4) If removed, install the transmission.

ENGINE CORE PLUGS

REMOVAL

(1) Drain the cooling system. Refer to Group 7, Cooling System for procedure.

(2) Using a blunt tool such as a drift or a screw driver and a hammer, strike the bottom edge of the cup plug (Fig. 115)

REMOVAL AND INSTALLATION (Continued)

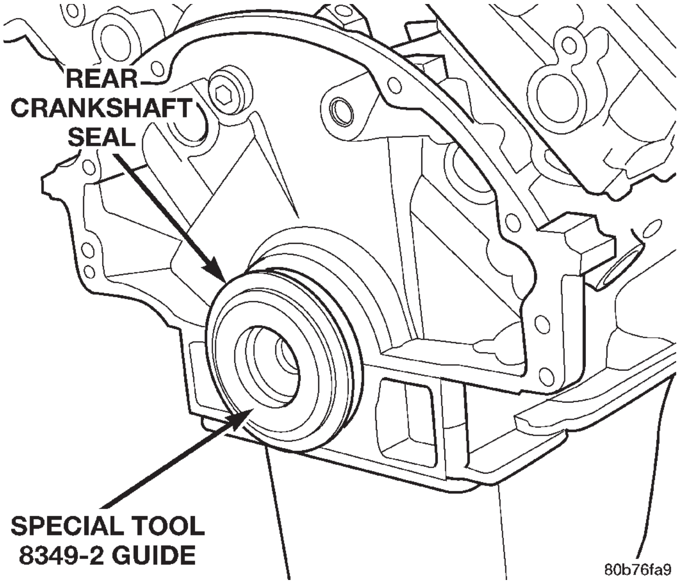


Fig. 113 Crankshaft Rear Oil Seal Guide Special Tool 8349–2 and Oil Seal

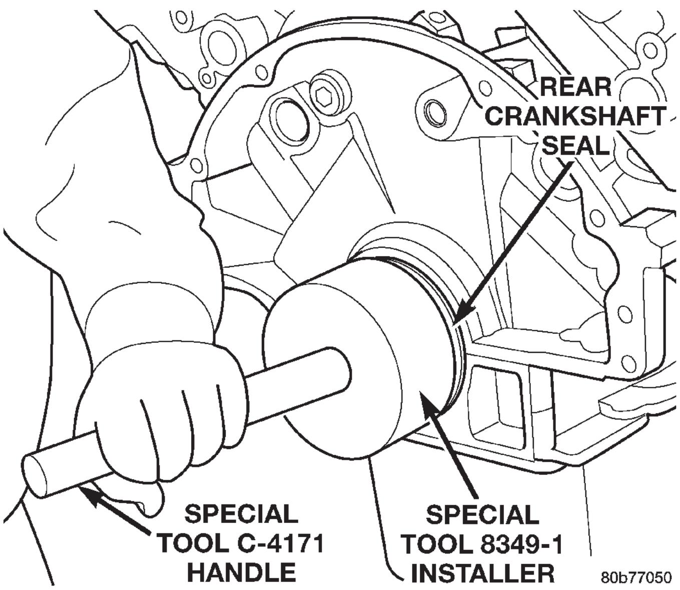


Fig. 114 Crankshaft Rear Oil Seal Installation

(3) Using a suitable pair of pliers, grasp the core plug and remove.

INSTALLATION

NOTE: Thoroughly clean core plug bore, remove all of the old sealer.

(1) Coat the edges of the engine core plug and the core plug bore with Mopar Gasket Maker, or equivalent.

NOTE: It is not necessary to wait for the sealant to cure on the core plugs. The cooling system can be filled and the vehicle returned to service immediately.

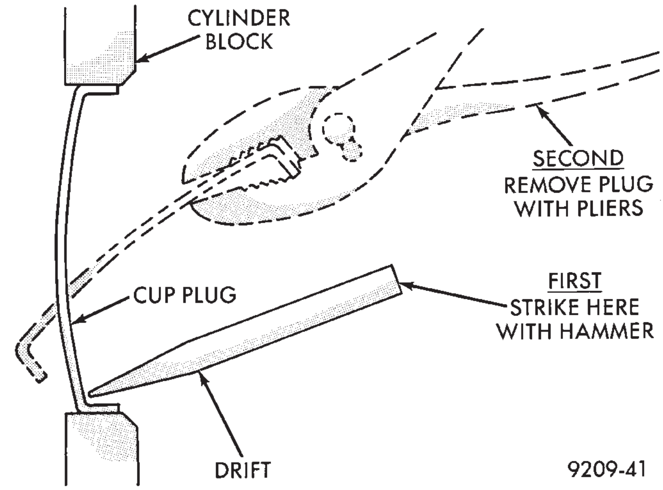


Fig. 115 Engine Core Plug Removal

(2) Using proper plug driver, drive core plug into the core plug bore. The sharp edge of the core plug should be at least 0.50 mm (0.020 in.) inside the lead in chamfer.

(3) Refill the cooling system.

DISASSEMBLY AND ASSEMBLY

VALVE SERVICE

REFACING

NOTE: Valve seats that are worn or burned can be reworked, provided that correct angle and seat width are maintained. Otherwise the cylinder head must be replaced.

NOTE: When refacing valves and 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.

(1) Using a suitable dial indicator measure the center of the valve seat Total run out must not exceed 0.051 mm (0.002 in).

(2) Apply a small amount of Prussian blue to the valve seat, insert the valve into the cylinder head, while applying light pressure on the valve rotate the valve. Remove the valve and examine the valve face. If the blue is transferred to the top edge of the valve face, lower the valve seat using a 15 degree stone. If the blue is transferred to the bottom edge of the valve face, raise the valve seat using a 65 degree stone.

DISASSEMBLY AND ASSEMBLY (Continued)

(3) When the seat is properly positioned the width of the intake seat must be 1.75 – 2.36 mm (0.0689 – 0.0928 in.) and the exhaust seat must be 1.71 – 2.32 mm (0.0673 – 0.0911 in.).

(4) Check the valve spring installed height after refacing the valve and seat. The installed height for both intake and exhaust valve springs must not exceed 40.69 mm (1.6020 in.).

(5) The valve seat and valve face must maintain a face angle of 44.5 – 45 degrees angle.

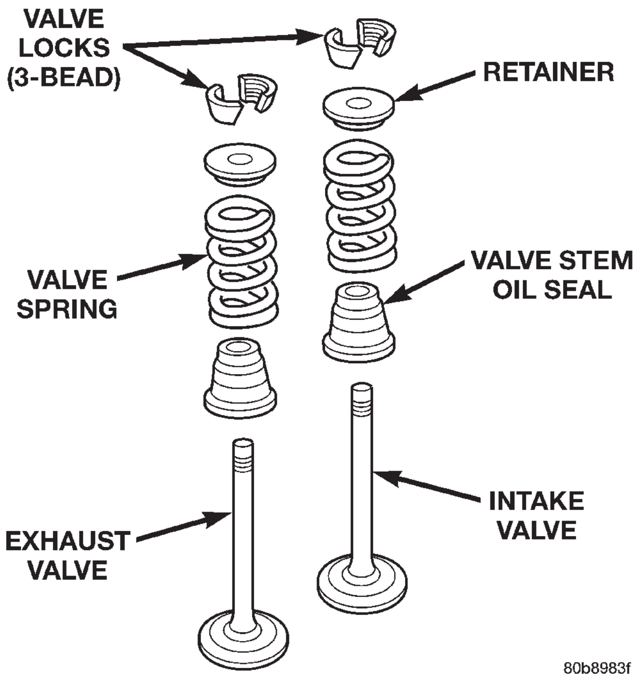


Fig. 116 Valve Assembly Configuration

OIL PUMP

DISASSEMBLE

(1) Remove oil pump cover screws and lift off cover plate.

(2) Remove pump inner and outer rotors.

NOTE: Once the oil pressure relief valve, cup plug, and pin are removed, the pump assembly must be replaced.

(3) If it is necessary to remove the pressure relief valve, drive the roll pin from pump housing and remove cup plug, spring and valve.

ASSEMBLE

(1) Wash all parts in a suitable solvent and inspect carefully for damage or wear.

(2) Install inner and outer rotors

(3) Install oil pump cover plate and install cover bolts and tighten them to 12 N·m (105 in. lbs.).

(4) Prime oil pump before installation by filling rotor cavity with engine oil.

(5) If oil pressure is low and pump is within specifications, inspect for worn engine bearings or other causes for oil pressure loss.

CLEANING AND INSPECTION

INTAKE MANIFOLD

CLEANING

NOTE: There is NO approved repair procedure for the intake manifold. If severe damage is found during inspection, the intake manifold must be replaced.

Before installing the intake manifold thoroughly clean the mating surfaces. Use a suitable cleaning solvent, then air dry.

INSPECTION

(1) Inspect the intake sealing surface for cracks, nicks and distortion.

(2) Inspect the intake manifold vacuum hose fittings for looseness or blockage.

(3) Inspect the manifold to throttle body mating surface for cracks, nicks and distortion.

EXHAUST MANIFOLD

CLEANING

(1) Clean the exhaust manifold using a suitable cleaning solvent, then allow to air dry.

(2) Clean all gasket residue from the manifold mating surface.

INSPECTION

(1) Inspect the exhaust manifold for cracks in the mating surface and at every mounting bolt hole.

(2) Using a straight edge and a feeler gauge, check the mating surface for warp and twist.

(3) Inspect the manifold to exhaust pipe mating surface for cracks, gouges, or other damage that would prevent sealing.

CYLINDER HEADS

CLEANING

CYLINDER HEAD GASKET SURFACE PREPARATION

To ensure engine gasket sealing, proper surface preparation must be performed, especially with the use of aluminum engine components.

Never use the following to clean gasket surfaces:

- never use a metal scraper
- never use an abrasive pad or paper to clean the cylinder block.

CLEANING AND INSPECTION (Continued)

- never use a high speed power tool or wire brush on any gasket sealing surface (Fig. 117)

Only use the following for cleaning gasket surfaces:

- use Mopar® Brake and Parts Cleaner
- use only a plastic or wood scraper (Fig. 117)

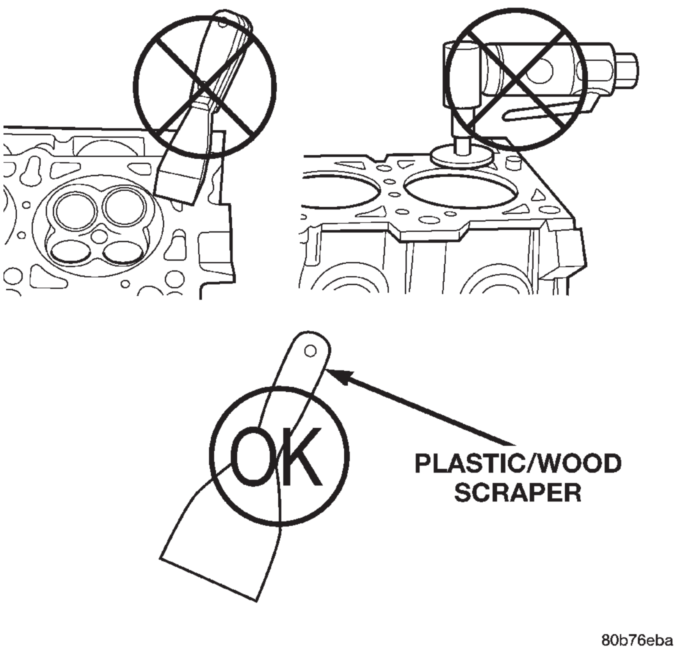


Fig. 117 Proper Tool Usage For Surface Preparation

INSPECTION

(1) Inspect the cylinder head for out-of-flatness, using a straightedge and a feeler gauge. If tolerances exceed 0.0508 mm (0.002 in.) replace the cylinder head.

(2) Inspect the valve seats for damage. Service the valve seats as necessary.

(3) Inspect the valve guides for wear, cracks or looseness. If either condition exist, replace the cylinder head.

PISTON AND CONNECTING ROD ASSEMBLY

CLEANING

CAUTION: DO NOT use a wire wheel or other abrasive cleaning devise to clean the pistons or connecting rods. The pistons have a Moly coating, this coating must not be damaged.

(1) Using a suitable cleaning solvent clean the pistons in warm water and towel dry.

(2) Use a wood or plastic scraper to clean the ring land grooves.

CAUTION: DO NOT remove the piston pin from the piston and connecting rod assembly.

INSPECTION

Check the crankshaft connecting rod journal for excessive wear, taper and scoring.

Check the pistons for taper and elliptical shape before they are fitted into the cylinder bore .

PISTON SPECIFICATION CHART

PISTON DIAMETER	PISTON PIN BORE DIAMETER
92.975mm (3.665 in.)	24.026 - 24.032mm (0.946 - 0.9462 in.)
RING GROOVE WIDTH	**RING GROOVE DIAMETER**
Upper Ring 1.541 - 1.566mm (0.0607 - 0.0617 in.)	Upper Ring 83.73 - 83.97mm (3.2965 - 3.3059 in.)
Middle Ring 1.53 - 1.55 mm (0.0603 - 0.0611 in.)	Middle Ring 82.833 - 83.033 mm (3.2612 - 3.2691 in.)
Oil Rails 3.031 - 3.055 mm (0.1194 - 0.1203 in.)	Oil Rails 83.88 - 84.08 mm (3.3024 - 3.3103 in.)
PISTON OVER ALL HEIGHT	
53.49 - 54.09mm (2.106 - 2.1296 in.)	

Replace any piston and connecting rod not meeting the specifications above.

CRANKSHAFT 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.

OIL PAN

CLEANING

(1) Clean oil pan in solvent and wipe dry with a clean cloth.

(2) Clean the oil pan gasket surface. **DO NOT** use a grinder wheel or other abrasive tool to clean sealing surface.

CLEANING AND INSPECTION (Continued)

(3) Clean oil screen and tube thoroughly in clean solvent.

INSPECTION

(1) Inspect oil drain plug and plug hole for stripped or damaged threads. Repair as necessary.

(2) Inspect the oil pan mounting flange for bends or distortion. Straighten flange, if necessary.

OIL PUMP

INSPECTION

CAUTION: Oil pump pressure relief valve and spring should not be removed from the oil pump. If the these components are disassembled andør removed from the pump the entire oil pump assembly must be replaced.

(1) Clean all parts thoroughly. Mating surface of the oil pump housing should be smooth. If the pump cover is scratched or grooved the oil pump assembly should be replaced.

(2) Lay a straight edge across the pump cover surface (Fig. 118). If a 0.025 mm (0.001 in.) feeler gauge can be inserted between the cover and the straight edge the oil pump assembly should be replaced.

(3) Measure the thickness of the outer rotor (Fig. 119). If the outer rotor thickness measures at 12.005 mm (0.400 in.) or less the oil pump assembly must be replaced.

(4) Measure the diameter of the outer rotor. If the outer rotor diameter measures at 85.925 mm (0.400 in.) or less the oil pump assembly must be replaced.

(5) Measure the thickness of the inner rotor (Fig. 120). If the inner rotor thickness measures at 12.005 mm (0.400 in.) or less then the oil pump assembly must be replaced.

(6) Slide outer rotor into the body of the oil pump. Press the outer rotor to one side of the oil pump body and measure clearance between the outer rotor and the body (Fig. 121). If the measurement is 0.47mm (0.0186 in.) or more the oil pump assembly must be replaced.

(7) Install the inner rotor in the into the oil pump body. Measure the clearance between the inner and outer rotors (Fig. 122). If the clearance between the rotors is .150 mm (0.006 in.) or more the oil pump assembly must be replaced.

(8) Place a straight edge across the body of the oil pump (between the bolt holes), if a feeler gauge of .095 mm (0.0038 in.) or greater can be inserted between the straightedge and the rotors, the pump must be replaced (Fig. 123).

NOTE: 4.7 Oil pump is released as an assembly. There are no Chrysler part numbers for Sub-Assembly components. In the event the oil pump is not functioning or out of specification it must be replaced as an assembly.

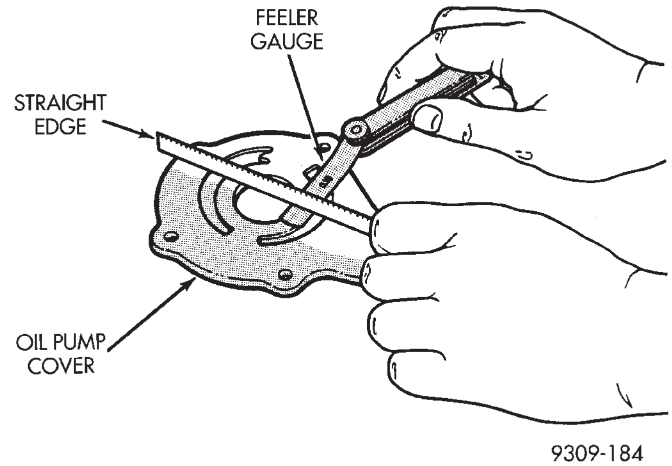


Fig. 118 Checking Oil Pump Cover Flatness

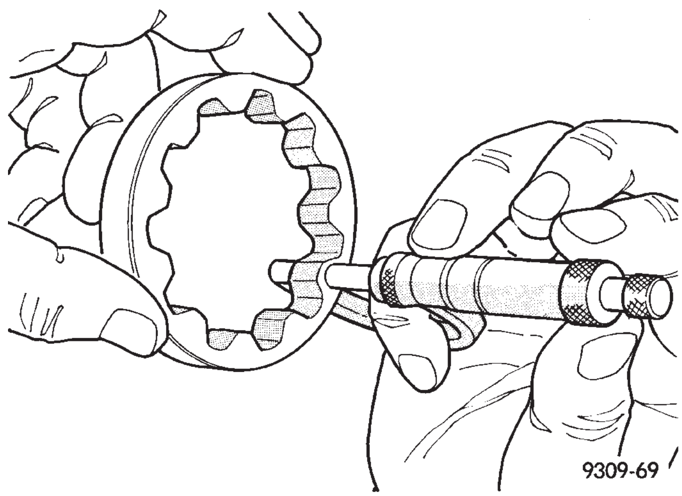


Fig. 119 Measuring Outer Rotor Thickness

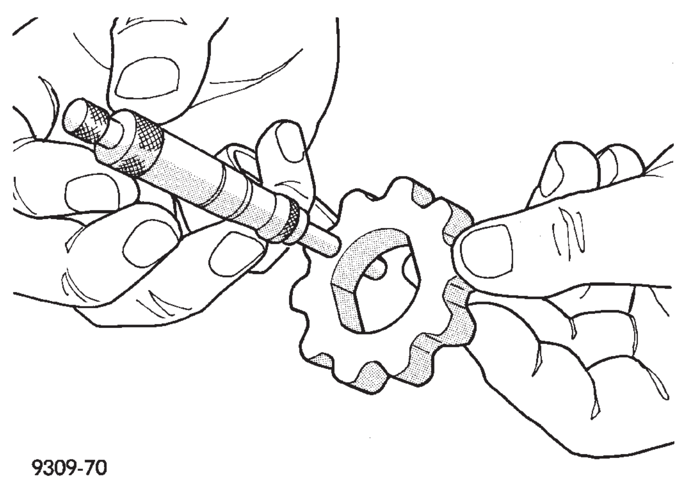


Fig. 120 Measuring Inner Rotor Thickness

CLEANING AND INSPECTION (Continued)

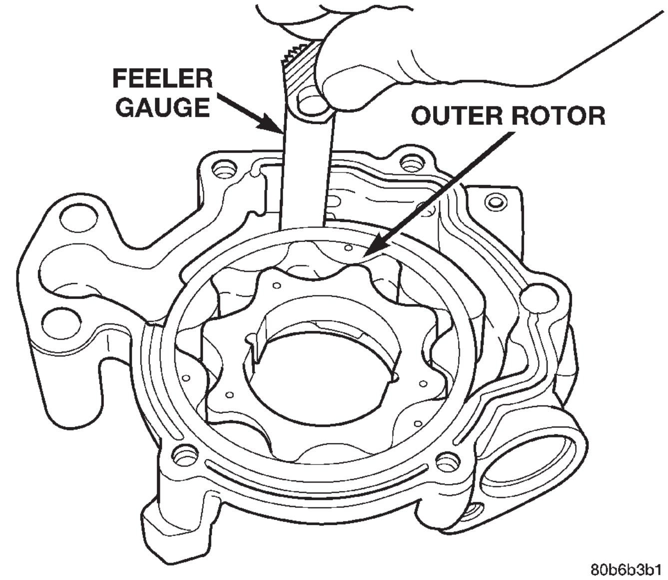


Fig. 121 Measuring Outer Rotor Clearance in Housing

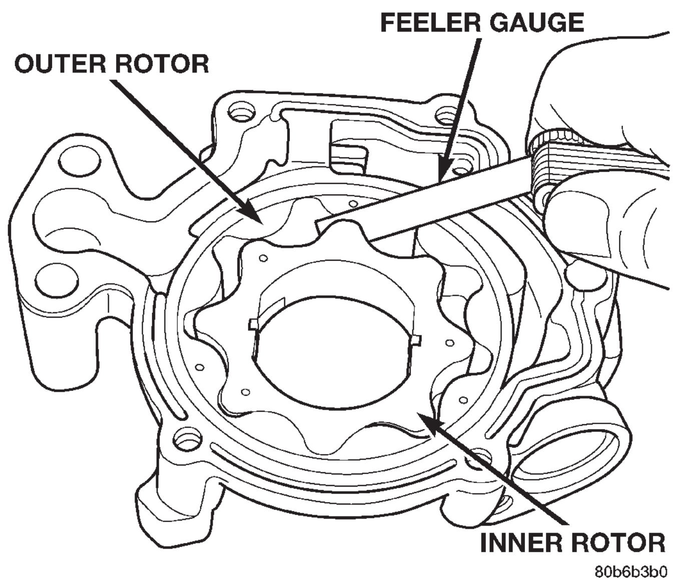


Fig. 122 Measuring Clearance Between Rotors

OIL PUMP ASSEMBLY

(1) Wash all parts in a suitable solvent and inspect carefully for damage or wear.

(2) Install inner and outer rotors

(3) Install oil pump cover plate and install cover bolts and tighten them to 12 N·m (105 in. lbs.).

(4) Prime oil pump before installation by filling rotor cavity with engine oil.

(5) If oil pressure is low and pump is within specifications, inspect for worn engine bearings or other causes for oil pressure loss.

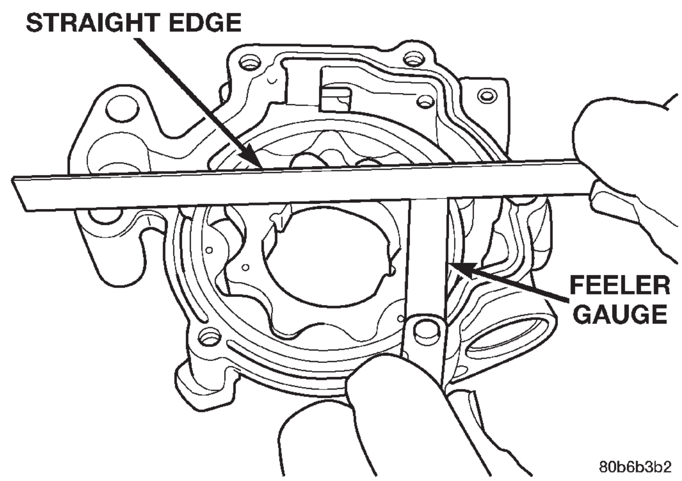


Fig. 123 Measuring Clearance Over Rotors

CYLINDER BLOCK

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 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 34 N·m (25 ft. lbs.) torque.

INSPECTION—CYLINDER BORE

(1) It is mandatory to use a dial bore gauge to measure each cylinder bore diameter. To correctly select the proper size piston, a cylinder bore gauge, capable of reading in 0.003 mm (.0001 in.) INCREMENTS is required. If a bore gauge is not available, do not use an inside micrometer (Fig. 124).

(2) Measure the inside diameter of the cylinder bore at three levels below top of bore. Start perpendicular (across or at 90 degrees) to the axis of the crankshaft and then take two additional reading.

(3) Measure the cylinder bore diameter crosswise to the cylinder block near the top of the bore. Repeat the measurement near the middle of the bore, then repeat the measurement near the bottom of the bore.

(4) Determine taper by subtracting the smaller diameter from the larger diameter.

(5) Rotate measuring device 90° and repeat steps above.

(6) Determine out-of-roundness by comparing the difference between each measurement.

(7) 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

CLEANING AND INSPECTION (Continued)

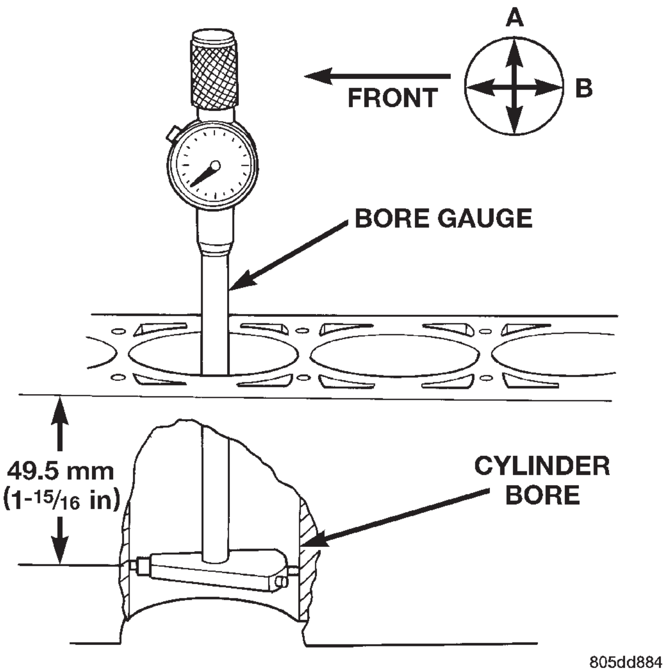


Fig. 124 Bore Gauge—Typical

condition exceeds these maximum limits, the cylinder block must be replaced. A slight amount of taper always exists in the cylinder bore after the engine has been in use for a period of time.

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.

SPECIFICATIONS

4.7L ENGINE

DESCRIPTION	SPECIFICATION
General Specification	
Type	90° SOHC V-8 16-Valve
Displacement	4.7 Liters 4701 cc (287 Cubic Inches)
Bore & Stroke	93.0 mm x 86.5 mm (3.66 in. x 3.40 in.)
Compression Ratio	9.0:1
Lead Cylinder	#1 Left Bank
Firing Order	1,8,4,3,6,5,7,2
Cylinder Block	Cast Iron
Cylinder Head	Aluminum
Cylinder Block	
Cylinder Bore Diameter	93.010 ± .0075 mm (3.6619 ± 0.0003 in.)
Out of Round (Max)	0.076 mm (0.003 in.)
Taper (Max)	0.051 mm (0.002 in.)
Pistons	
Type Material	Aluminum alloy
Piston diameter	92.975 mm (3.6605 in.)
Clearance at Size Location	0.0198 – 0.0501 mm (0.0008 – 0.0020 in.)
Piston Weight	367.5 grams (12.96 oz.)
Piston Ring Groove Diameter	
No. 1	83.73 – 83.97 mm (3.296 – 3.269 in.)
No. 2	82.833 – 83.033 mm (3.261 – 3.310 in.)
No. 3	83.88 – 84.08 mm (3.302 – 3.310 in.)
Piston Pins	
Type	Pressed Fit
Clearance In Piston	0.018 – 0.019 mm (0.0008 in.)
Diameter	24.008 – 24.013 mm (0.9452 – 0.9454 in.)
Piston Rings	
Ring Gap Top Compression Ring	0.37 – 0.63 mm (0.0146 – 0.0249 in.)
Ring Gap 2nd Compression Ring	0.37 – 0.63 mm (0.0146 – 0.0249 in.)
Ring Gap Oil Control (Steel Rails)	0.25 – 1.27 mm (0.0099 – 0.05 in.)
Ring Side Clearance	
Top Compression Ring	.051 – .104 mm (0.0020 – 0.0041 in.)
Second Compression Ring	0.040 – 0.080 mm (0.0016 – 0.0032 in.)
Oil Ring (Steel Rails)	.019 – .229 mm (.0007 – .0091 in.)
Ring Width	
Top Compression Ring	1.472 – 1.490 mm (0.057 – 0.058in.)
2nd Compression Ring	1.472 – 1.490 mm (0.057 – 0.058in.)
Oil Ring (Steel Rails)	0.445 – 0.470 mm (0.017 – 0.018 in.)
Connecting Rods	
Bearing Clearance	0.010 – 0.048 mm (0.0004 – 0.0019 in.)
Side Clearance	0.10 – 0.35 mm (0.004 – 0.0138 in.)
Piston Pin Bore Diameter	Interference fit .022 – .045 mm (0.0009 – 0.0018 in.)
Bearing Bore Out of Round (Max. Allowable)	0.004 mm (in.)
Total Weight (Less Bearing)	578 grams (20.388 ounces)

SPECIFICATIONS (Continued)

DESCRIPTION	SPECIFICATION
Crankshaft Main Bearing Journals	
Diameter	63.488 – 63.512 mm (2.4996 – 2.5005 in.)
Bearing Clearance	0.004 – 0.032 mm (0.0002 – 0.0013 in.)
Out of Round (Max.)	0.005 mm (0.0002 in.)
Taper (Max.)	0.008 mm (0.0004 in.)
End Play	0.052 – 0.282 mm (0.0021 – 0.0112 in.)
End Play (Max. Allowable)	0.282 mm (0.0112 in.)
Connecting Rod Journals	
Diameter	50.992 – 51.008 mm (2.0076 – 2.0082 in.)
Bearing Clearance	0.010 – 0.048 mm (0.0004 – 0.0019 in.)
Out Of Round (Max.)	0.005 mm (0.0002 in.)
Taper (Max.)	0.008 mm (0.0004 in.)
Camshaft	
Bore Diameter	26.02 – 26.04 mm (1.0245 – 1.0252 in.)
Bearing Journal Diameter	25.975 – 25.995 mm (1.0227 – 1.0235 in.)
Bearing Clearance	0.025 – 0.065 mm (0.001 – 0.0026 in.)
Bearing Clearance (Max. Allowable)	0.065 mm (0.0026 in.)
End Play	mm (in.)
Valve Timing Intake Valve	
Opens (ATDC)	3.5°
Closes (ATDC)	247°
Duration	243.5°
Valve Timing Exhaust Valve	
Opens (BBDC)	232.5°
Closes (ATDC)	21.25°
Duration	253.75°
Valve Overlap	17.75°
Cylinder Head	
Gasket Thickness (Compressed)	.7 mm (0.0276 in.)
Valve Seat Angle	44.5° – 45.0°
Valve Seat Runout (Max)	0.051 mm (0.002 in.)
Intake Valve Seat Width	1..75 – 2.36 mm (0.0698 – 0.0928 in.)
Exhaust Valve Seat Width	1.71 – 2.32 mm (0.0673 – 0.0911 in.)
Guide Bore Diameter (Std.)	6.975 – 7.00 mm (0.2747 – 0.2756 in.)
Cylinder Head Warpage (Flatness)	0.0508 mm (0.002 in.)
Valves	
Face Angle	45.0° – 45.5°
Head Diameter Intake	47.87 – 48.13 mm (1.8846 – 1.8949 in.)
Head Diameter Exhaust	36.87 – 37.13 mm (1.4516 – 1.4618 in.)
Length—Intake (Overall)	113.13 – 113.89 mm (4.4539 – 4.4839 in.)
Length—Exhaust (Overall)	114.92 – 115.68 mm (4.5244 – 4.5543 in.)
Stem Diameter—Intake	6.931 – 6.957 mm (0.2729 – 0.2739 in.)
Stem Diameter—Exhaust	6.902 – 6.928 mm (0.2717 – 0.2728 in.)
Stem-to-Guide Clearance Intake (New)	.026 – .043 mm (0.0011 – 0.0017 in.)
Stem-to-Guide Clearance—Exhaust (New)	.072 – .073 mm (0.0029 in.)
Max. Allowable (Rocking Method)—Intake	0.069 mm (0.0028 in.)
Max. Allowable (Rocking Method)—Exhaust	0.098 mm (0.0039 in.)
Valve Lift (Zero Lash)—Intake	11.25 mm (0.443 in.)
Valve Lift (Zero Lash)—Exhaust	10.90 mm (0.4292 in.)
Valve Spring	
Free Length (Approx.) Intake & Exhaust	47.5 mm (1.870 in)
Spring Force (Valve Closed) Intake & Exhaust	285.2–320.8 N @ 40.69 mm (64.0–72.0 lbs. @ 1.6020 in.)
Spring Force (Valve Open) Intake	775.3–846.7 N @ 29.29 mm (176.2–192.4 lbs. @ 1.1532 in.)
Spring Force (Valve Open) Exhaust	775.3–846.7 N @ 29.29 mm (176.2–192.4 lbs. @ 1.1532 in.)
Number of Coils—Intake & Exhaust	6.6
Wire Diameter Intake & Exhaust	4.2799 – 4.3561 mm (0.1685 – 0.1715 in.)
Installed Height—Intake (Spring Seat to Bottom of Retainer)	40.97 mm (1.613 in.)
Installed Height—Exhaust (Spring Seat to Bottom of Retainer)	40.81 mm (1.606 in.)
Oil Pump	
Clearance Over Rotors (Max.)	.035 – .095 mm (0.0014 – 0.0038 in.)
Cover Out-of-Flat (Max.)	.025 mm (0.001 in.)
Inner and Outer Rotor Thickness	12.08 mm (0.4756 in.)
Outer Rotor Clearance (Max.)	85.96 mm (3.3843 in.)
Outer Rotor Diameter (Min.)	85.925 mm (0.400 in.)

1999 Grand Cherokee
Publication No. 81-370-9147
TSB 26-11-99 November, 1999

SPECIFICATIONS (Continued)

DESCRIPTION	SPECIFICATION
Tip Clearance Between Rotors (Max.)	.150 mm (0.006 in.)
Oil Pressure	
At Curb Idle Speed *	25 kPa (4 psi) minimum
At 3000 rpm	170 – 550 kPa (25 – 80 psi)

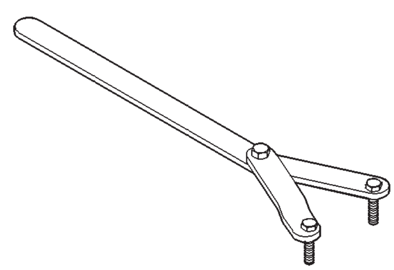
*CAUTION: If pressure is zero at curb idle, DO NOT run engine at 3000 rpm.

TORQUE—4.7L ENGINE

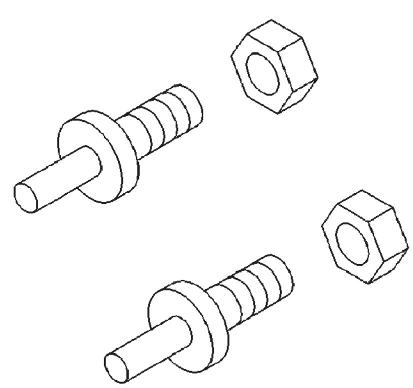
DESCRIPTION	TORQUE
Camshaft Sprocket	
Bolt	122 N·m (90 ft. lbs.)
Camshaft Bearing Caps	
Bolt	11 N·m (100 in. lbs.)
Timing Chain Cover	
Bolt	54 N·m (40 ft. lbs.)
Connecting Rod Cap	
Bolt	20 N·m (15 ft. lbs.), Plus 110°
Crankshaft Main Bearing Cap/Bedplate	
Bolt	Refer to Procedure
Crankshaft Damper	
Bolt	175 N·m (130 ft. lbs.)
Cylinder Head Bolts	
M11 Bolt	81 N·m (60 ft. lbs.)
M8 Bolt	28 N·m (250 in. lbs.)
Cylinder Head Cover	
Bolt	12 N·m (105 in. lbs.)
Exhaust Manifold	
Bolt	25 N·m (18 ft. lbs.)
Exhaust Manifold Heat Shield	
Nut	8 N·m (72 in. lbs.), then loosen 45°
Flexplate	
Bolts	60 N·m (45 ft. lbs.)
Engine Mount Bracket to Block—Front	
Bolts	61 N·m (45 ft. lbs.)
Engine Mount—Rear-to-Transmission	
Bolts	46 N·m (34 ft. lbs.)
Generator Mounting	
M10 Bolts	54 N·m (40 ft. lbs.)
M8 Bolts	28 N·m (250 in. lbs.)
Intake Manifold	
Bolts	12 N·m (105 in. lbs.)—Refer to procedure for tightening sequence.
Oil Pan	
Bolts	15 N·m (130 in. lbs.)
Oil Pan Drain Plug	
Plug	34 N·m (25 ft. lbs.)
Oil Pump	
Bolts	28 N·m (250 in. lbs.)
Oil Pump Cover	
Bolts	12 N·m (105 in. lbs.)
Oil Pickup Tube	
Bolts	28 N·m (250 in. lbs.)
Oil Dipstick Tube	
Bolt	28 N·m (250 in. lbs.)
Oil Fill Tube	
Bolts	12 N·m (105 in. lbs.)
Spark Plugs	
Plugs	27 N·m (20 ft. lbs.)
Starter Mounting	
Bolts	45 N·m (33 ft. lbs.)
Timing Chain Guide	
Bolts	28 N·m (250 in. lbs.)
Timing Chain Tensioner Arm	
Special Pin Bolt	17 N·m (150 in. lbs.)
Secondary Timing Chain Hydraulic Tensioner	
Bolts	28 N·m (250 in. lbs.)
Timing Chain Primary Tensioner	
Bolts	28 N·m (250 in. lbs.)
Timing Drive Idler Sprocket	
Bolt	34 N·m (25 ft. lbs.)
Thermostat Housing	
Bolts	12 N·m (105 in. lbs.)
Torque Converter to Flexplate	
Bolts	38 N·m (28 ft. lbs.)
Water Pump	
Bolts	54 N·m (40 ft. lbs.)

SPECIAL TOOLS

4.7L ENGINE

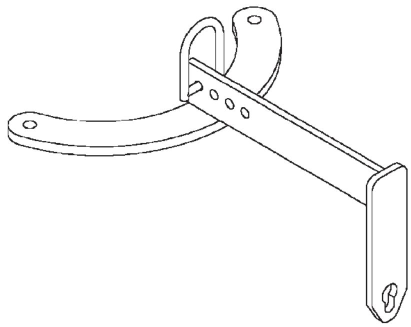


Spanner Wrench 6958

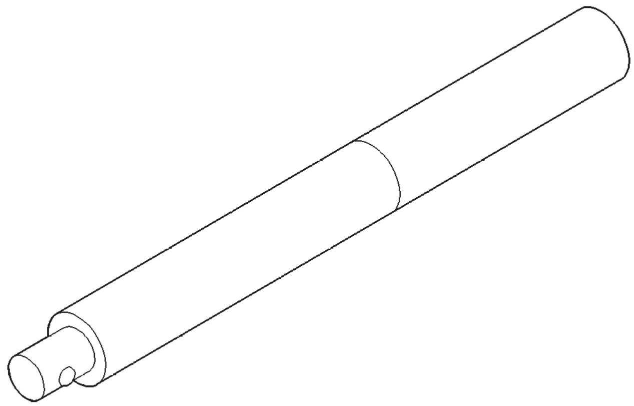


Adapter Pins 8346

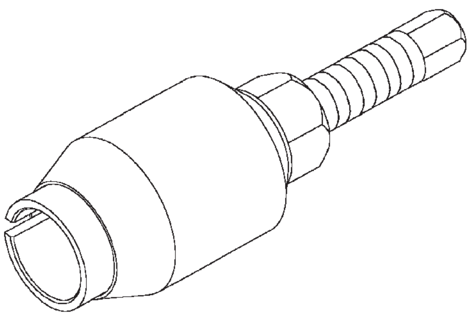
SPECIAL TOOLS (Continued)



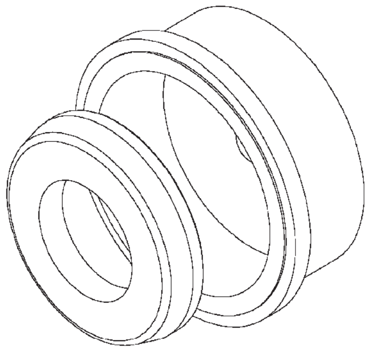
Engine Lift Fixture 8347



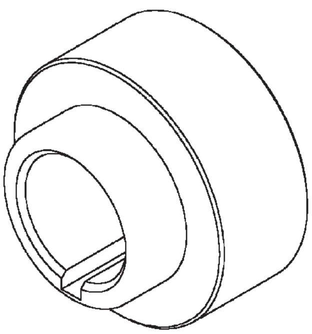
Handle C-4171



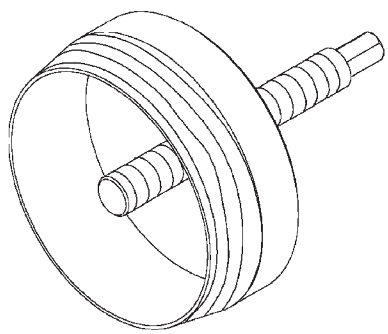
Front Crankshaft Seal Remover 8511



Rear Crankshaft Seal Installer 8349

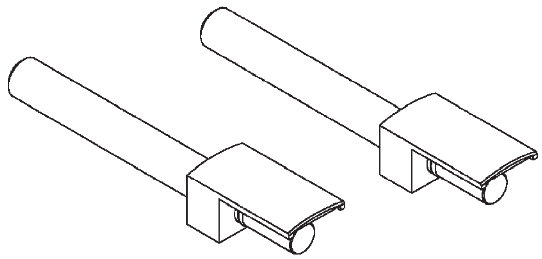


Front Crankshaft Seal Installer 8348

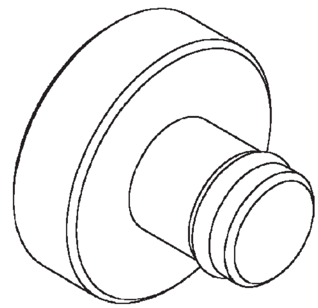


Rear Crankshaft Seal Remover 8506

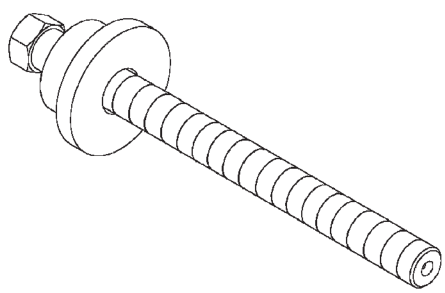
SPECIAL TOOLS (Continued)



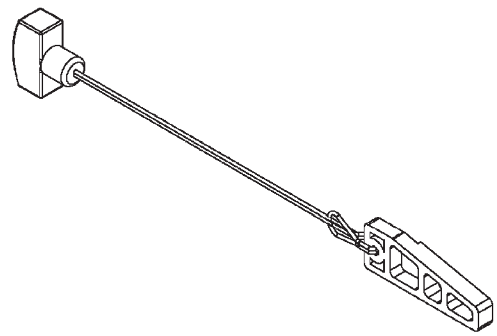
Connecting Rod Guides 8507



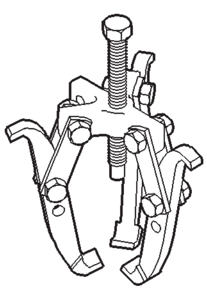
Crankshaft Damper Removal Insert 8513



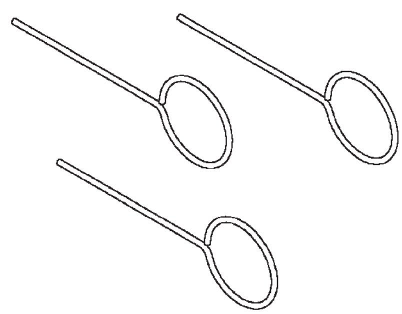
Crankshaft Damper Installer 8512



Chain Tensioner Wedge 8350

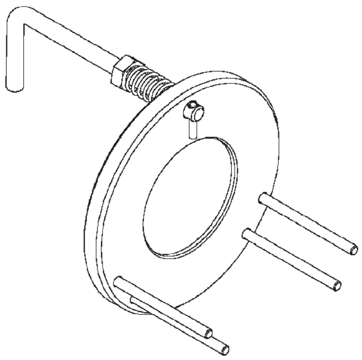


Puller 1026

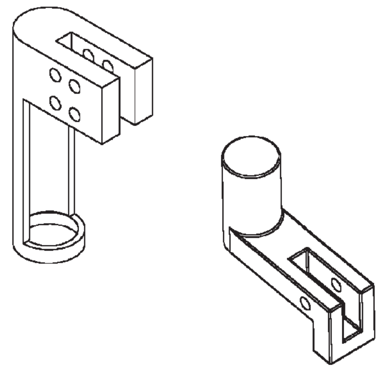


Chain Tensioner Pins 8514

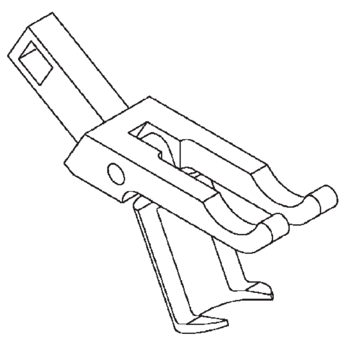
SPECIAL TOOLS (Continued)



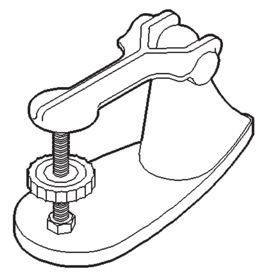
Secondary Chain Holder 8515



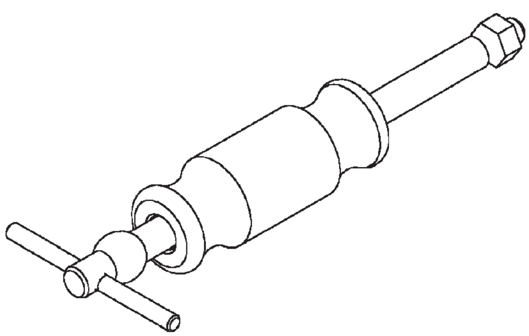
Valve Spring Compressor Adapters 8519



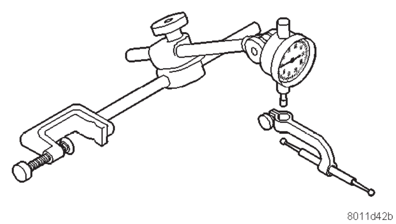
Rocker Arm Removal 8516



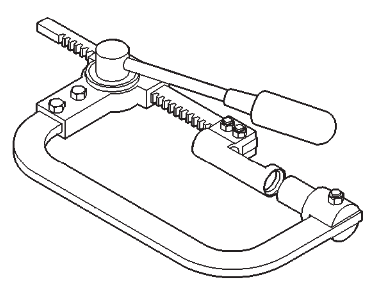
Valve Spring Tester C-647



Idler Shaft Remover 8517

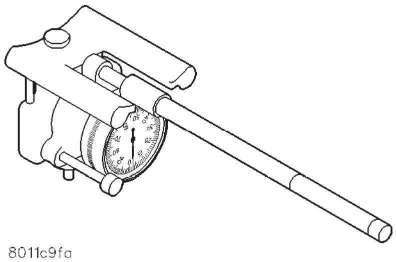


Dial Indicator C-3339

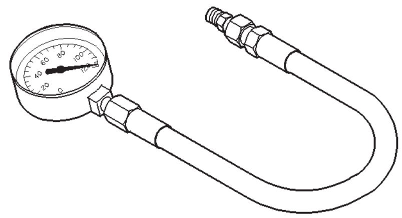


Valve Spring Compressor C-3422-B

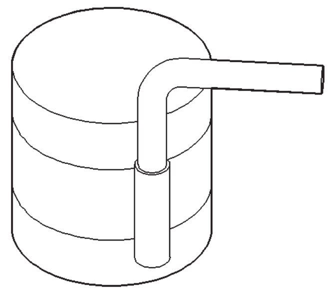
SPECIAL TOOLS (Continued)



Bore Size Indicator C-119



Oil Pressure Gauge C-3292



Piston Ring Compressor C-385

ENGINE

CONTENTS

GENERAL INFORMATION

ENGINE IDENTIFICATION

The engine model code and serial number are stamped on the left side of the engine block, just below the oil dipstick tube (Fig. 1). The model code for the 3.1L is 73B followed by a four digit serial number.

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 4 bars (50 psi) at 3000 RPM.

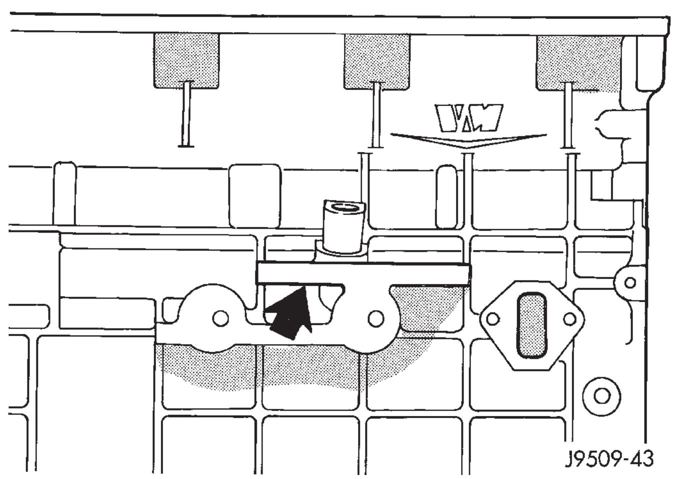


Fig. 1 Engine Code Location

GENERAL INFORMATION (Continued)

Displacement	3.1L (3125cc)
Bore	92.00 mm
Stroke	94.00 mm
Compression Ratio	20.95:1
Vacuum at idle	600 mm/Hg (23.6 In/Hg)
Belt Tension	47 ± 3 DaN
Thermostat Opening	80°C ± 2°C
Generator Rating	Denso 130A
Cooling System Capacity	9.5 Liter
P/S Capacity	0.75 Liter
Engine Oil Capacity	7.5 Liter w/filter change
Timing System	Pushrod operated overhead valves, with gear-driven camshaft in crankcase.
Air Intake	Dry filter.
Fuel feed	Vane pump incorporated in injection pump.
Fuel System	Indirect fuel injection (precombustion chamber).
Combustion Cycle	4 stroke.
Cooling System	Water cooling.
Injection Pump	Rotary pump with electronic management.
Lubrication	Pressure lubrication by rotary pump, full-flow filtration.
Engine Rotation	Clockwise viewed from front cover.

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Engine Description

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.

OIL LEVEL 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.

DIAGNOSIS AND TESTING

SERVICE DIAGNOSIS—DIESEL—PERFORMANCE

CONDITION	POSSIBLE CAUSES	CORRECTION
ENGINE WILL NOT CRANK OR CRANKS SLOWLY	1. Starting motor operating, but not cranking the engine.	1. Remove the starter motor. Check for broken flywheel teeth or a broken starting motor spring.
	2. Crankshaft rotation restricted.	2. Rotate the engine to check for rotational resistance.
	3. Starting circuit connections loose or corroded.	3. Clean and tighten connections.
	4. Neutral safety switch or starter relay inoperative.	4. Check starter relay supply voltage and proper operation of neutral safety switch (if equipped). Replace defective parts.
	5. Battery charge low.	5. Check battery voltage. Replace battery if a charge cannot be held.
	6. No voltage to starter solenoid.	6. Check voltage to solenoid. If necessary, replace the solenoid.
	7. Solenoid or starter motor inoperative.	7. Replace starter motor.
ENGINE CRANKS, BUT WILL NOT START NO SMOKE	1. No fuel in supply tank.	1. Fill fuel supply.
	2. Electrical fuel shutdown solenoid not operating.	2. Check for loose wires and verify that the fuel shutdown solenoid and fuel shutdown solenoid relay is functioning.
	3. Exhaust plugged.	3. Remove the obstruction.
	4. Fuel filter plugged.	4. Drain fuel/water separator and replace fuel filter.
	5. Excessive fuel inlet restriction.	5. Check fuel inlet restriction. Correct cause.
	6. Injection pump not getting fuel or fuel is aerated.	6. Check fuel flow/bleed fuel system.
	7. Worn or inoperative injection pump.	7. Visually check delivery with externally connected injector to one of the pump outlets. Repair or replace the pump if fuel is not being delivered.
ENGINE HARD TO START, OR WILL NOT START SMOKE FROM EXHAUST	1. Incorrect starting procedure.	1. The fuel shutoff solenoid control must be in the run position. Ensure proper procedure is being used.
	2. Cranking speed too slow.	2. (A) Verify that the transmission is not engaged. (B) Check the battery, starting motor and look for loose or corroded wiring connections.
	3. Cylinder heads heater plugs relay defective.	3. Verify system is working. Repair/replace inoperative parts.
	4. One or more cylinder head heater plugs defective.	4. Verify system is working. Repair/replace inoperative parts.
	5. Insufficient intake air.	5. Inspect or replace filter and check for obstruction to the air supply tube.

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DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
ENGINE HARD TO START, OR WILL NOT START SMOKE FROM EXHAUST (CONT.)	6. Air in fuel system or the fuel supply is inadequate. 7. Contaminated fuel. 8. Fuel screen plugged. 9. One or more injectors worn or not operating properly. 10. Worn or inoperative injection pump. 11. Injection pump out of time. 12. Engine compression low. 13. Camshaft out of time.	6. Check the flow through the filter and bleed the system. Locate and eliminate the air source. 7. Verify by operating the engine with clean fuel from a temporary tank. Check for presence of gasoline. Drain and flush fuel supply tank. Replace fuel/water separator filter. 8. Check fuel screen. 9. Check/replace improperly operating injectors. 10. Visually check fuel delivery with an externally connected injector to one of the pump outlets. Repair or replace the pump if fuel is not being delivered. 11. Check/Time the pump (refer to Group 14, Fuel System). 12. Check compression to identify the problem. 13. Check camshaft timing.
ENGINE STARTS, BUT WILL NOT KEEP RUNNING	1. Cylinder heads heater plugs relay defective. 2. One or more cylinder head heater plugs defective. 3. Intake air or exhaust system restricted. 4. Air in the fuel system or the fuel supply is inadequate. 5. Fuel waxing due to extremely cold weather. 6. Contaminated fuel.	1. Verify system is working. Repair/ replace inoperative parts. 2. Verify system is working. Repair/ replace inoperative parts. 3. Visually check for exhaust restriction and inspect the air intake. Repair/replace restricting parts. 4. Check flow through the filter and bleed the system. Locate and eliminate the air source. 5. Verify by inspecting the fuel filter. Clean the system and use climatized fuel. Replace fuel/water separator filter. Check fuel heater for proper operation. 6. Verify by operating the engine with clean fuel from a temporary supply tank. Check for presence of gasoline. Replace fuel/water separator filter.
SURGING (SPEED CHANGE)	1. If the condition occurs at idle, the idle speed is set too low for the accessories. 2. High pressure fuel leak. 3. One or more injectors worn or not operating properly. 4. Improperly operating injection pump.	1. Adjust the idle speed. 2. Inspect/correct leaks in the high pressure lines. Fitting and delivery valve sealing washers. 3. Check/replace the inoperative injectors. 4. Replace the injector pump.

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DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
ROUGH IDLE (IRREGULARLY FIRING OR ENGINE SHAKING)	1. If engine is cold, glow plug relay on glow plug(s) defective. 2. Engine mounts damaged or lose. 3. High pressure fuel leaks. 4. Air in the fuel system. 5. Sticking needle valve in an injector.	1. Refer to troubleshooting for cylinder head heater plugs (see Group 14, Fuel System). 2. Repair or replace mounts. 3. Correct leaks in the high pressure lines, fittings or delivery valves. 4. Bleed the fuel system and eliminate the source of the air. 5. Check and replace the injector with the sticking needle valve.
ENGINE RUNS ROUGH	1. Fuel injection lines leaking. 2. Air in the fuel or the fuel supply is inadequate. 3. Contaminated fuel. 4. Incorrect valve operation. 5. Injection pump timing incorrect. 6. Improperly operating injectors. 7. Defective injection pump (delivery valve). 8. Camshaft out of time. 9. Damaged camshaft or tappets. 10. Automatic timing advance not operating.	1. Correct leaks in the high pressure lines, fittings, injectors sealing washers or delivery valves. 2. Check the flow through the filter and bleed the system. Locate and eliminate the air source. 3. Verify by operating the engine with clean fuel from a temporary supply tank. Check for presence of gasoline. Replace fuel/water separator filter. 4. Check for a bent push rod and adjust valves. Replace push rod, if necessary. 5. Check/time pump (refer to Group 14, Fuel System). 6. Replace inoperative injectors. 7. Repair or replace injection pump. 8. Check/correct gear train timing alignment. 9. Inspect camshaft valve lift. Replace camshaft and tappets. 10. Check injection pump. Check fuel injector sensor at number 1 cylinder injector.
ENGINE RPM WILL NOT REACH RATED SPEED	1. Engine overload. 2. Improperly operating tachometer. 3. Inadequate fuel supply. 4. Air/fuel controls leak.	1. Verify high idle speed without load. Investigate operation to be sure correct gear is being used. 2. Verify engine speed with hand tachometer, correct as required. 3. Check the fuel flow through the system to locate the reason for inadequate fuel supply, correct as required. 4. Check and repair leak. Check AFC tubing for obstruction.

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DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
ENGINE RPM WILL NOT REACH RATED SPEED (CONT.)	6. Improperly operating injection pump.	6. Repair or replace injection pump.
LOW POWER	1. Fuel control lever not moving to full throttle.	1. Check/correct for stop-to-stop travel.
	2. High oil level.	2. Check/correct oil level.
	3. Engine overloaded.	3. Check for added loading from accessories or driven units, brakes dragging and other changes in vehicle loading. Repair/replace as needed.
	4. Slow throttle response caused by leaking or obstructed air control tube or improperly operating control in the pump.	4. Check for leaks and obstructions. Tighten the fittings. Repair or replace the pump if the controls are not functioning.
	5. Inadequate intake air flow.	5. Inspect/replace air cleaner element. Look for other restrictions.
	6. Inadequate fuel supply. Air in the fuel.	6. Check the flow through the filter to locate the source of the restriction. Check fuel pressure and inlet restriction.
	7. Excessive exhaust restriction.	7. Check/correct the restriction in the exhaust system.
	8. High fuel temperature.	8. Verify that fuel heater is off when engine is warm. Check for restricted fuel drain tubes. Repair/replace as needed.
	9. Poor quality fuel or fuel contaminated with gasoline.	9. Verify by operating from a temporary tank with good fuel. Check for presence of gasoline. Replace fuel/water separator filter.
	10. Air leak between the turbocharger and the intake manifold.	10. Check/correct leaks in hoses, gaskets, charge air cooler and around mounting capscrews or through holes in the manifold cover.
	11. Exhaust leak at the manifold or turbocharger.	11. Check/correct leaks in the manifold or turbocharger gaskets. If manifold is cracked, replace manifold.
	12. Improperly operating turbocharger.	12. Inspect/replace turbocharger.
	13. Wastegate operation.	13. Check wastegate operation.
	14. Valve not operating.	14. Check for bent push rod, replace if necessary.
	15. Worn or improperly operating injectors.	15. Check/replace injectors.
	16. Incorrect injection pump timing.	16. Verify injection pump timing (see Group 14, Fuel System).
	17. Improperly operating injection pump.	17. Repair or replace injection pump.

J9509-131

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
EXCESSIVE EXHAUST SMOKE	1. Engine running too cold (white smoke).	1. Refer to troubleshooting for coolant temperature below normal (refer to Group 7, Cooling System). Inspect cylinder head heater plugs for proper operation.
	2. Improper starting procedure (white smoke).	2. Use proper starting procedures.
	3. Fuel supply inadequate.	3. Check fuel supply pressure and inlet restriction.
	4. Injection pump timing.	4. Check and time pump (refer to Group 14, Fuel System).
	5. Inadequate intake air.	5. Inspect/change air filter. Look for other restriction. Check charge air cooler for obstructions.
	6. Air leak between turbocharger and intake manifold.	6. Check/correct leaks in the air crossover tube, hoses, gaskets, mounting capscrews or through holes in the manifold cover.
	7. Exhaust leak at the manifold or turbocharger.	7. Check/correct leaks in the manifold or turbocharger gaskets. If cracked replace manifold.
	8. Improperly operating turbocharger.	8. Inspect/replace turbocharger.
	9. Improperly operating injectors.	9. Check and replace inoperative injectors.
	10. Improperly operating or overfueled injector pump.	10. Repair or replace injection pump.
	11. Piston rings not sealing (blue smoke).	11. Perform blow-by check. Correct as required.
ENGINE WILL NOT SHUT-OFF	1. Fuel shutoff solenoid inoperative.	1. Check/replace fuel shutoff solenoid.
	2. Engine running on fumes drawn into the air intake.	2. Check the air intake ducts for the source of fumes. **WARNING: In case of engine runaway due to flammable fumes from gasoline spills or turbocharger oil leaks being sucked into the engine, shut off engine ignition switch first then use a CO2 fire extinguisher and direct the spray under the front bumper to remove oxygen supply. The engine air intake is on the passenger side behind the bumper. The fire extinguisher must be directed at this location for emergency shutdown conditions.**
	3. Fuel injection pump malfunction.	3. Repair or replace fuel injection pump.

J9509-132

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
COOLANT TEMPERATURE ABOVE NORMAL	1. Low coolant level.	1. Check coolant level. Add coolant, if necessary. Locate and correct the source of the coolant loss, (refer to Group 7, Cooling).
	2. Incorrect/improperly operating pressure cap.	2. Replace cap with the correct rating for the system.
	3. Loose drive belt on water pump/fan.	3. Check/replace belt or belt tensioner.
	4. Inadequate air flow to the radiator.	4. Check/repair radiator core, fan shroud and viscous fan drive as required.
	5. Radiator fins plugged.	5. Blow debris from fins.
	6. Collapsed radiator hose.	6. Replace the hose. Check coolant tank cap operation, (refer to Group 7, Cooling Tanks).
	7. Improperly operating temperature sensor/gauge.	7. Verify that the gauge and temperature sensor are accurate. Replace gauge/sensor, if bad.
	8. Improperly operating, incorrect or no thermostat.	8. Check and replace the thermostat.
	9. Air in the cooling system.	9. (A) make sure the fill rate is not being exceeded and the correct vented thermostat is installed. (B) Check for loose hose clamps. Tighten if loose. (C) If aeration continued, check for a compression leak through the head gasket.
	10. Inoperative water pump.	10. Check and replace the water pump.
	11. Incorrect injection pump timing.	11. Verify pump timing marks are aligned. Check/time the injector pump(refer to Group 14, Fuel System).
	12. Overfueled injection pump.	12. Repair or replace the injection pump.
	13. Plugged cooling passages in radiator, head, head gasket or block.	13. Flush the system and fill with clean coolant.
	14. Engine overloaded.	14. Verify that the engine load rating is not being exceeded.
COOLANT TEMPERATURE BELOW NORMAL	1. Too much air flow across the radiator.	1. Check/repair viscous fan drive as required.
	2. Incorrect thermostat or contamination in thermostat.	2. Check and replace thermostat.
	3. Temperature sensor or gauge inoperative.	3. Verify that the gauge and sensor are accurate. If not, replace gauge/sensor.
	4. Coolant not flowing by temperature sensor.	4. Check and clean coolant passages.

J9509-133

DIAGNOSIS AND TESTING (Continued)

SERVICE DIAGNOSIS—DIESEL—MECHANICAL.

CONDITION	POSSIBLE CAUSES	CORRECTION
LUBRICATING OIL PRESSURE LOW	1. Low oil level.	1. (A) Check and fill with clean engine oil. (B) Check for a severe external oil leak that could reduce the pressure.
	2. Oil viscosity thin, diluted or wrong specification.	2. Verify the correct oil is being used. Check for oil dilution.
	3. Improperly operating pressure switch/gauge.	3. Verify the pressure switch is functioning correctly. If not, replace switch/gauge.
	4. Relief valve stuck open.	4. Check/replace valve.
	5. If cooler was replaced, shipping plugs left in cooler.	5. Check/remove shipping plugs.
	6. Worn oil pump.	6. Check and replace oil pump.
	7. Suction tube loose or seal leaking.	7. Check and replace seal.
	8. Loose main bearing cap.	8. Check and install new bearing and tighten cap to proper torque.
	9. Worn bearings or wrong bearings installed.	9. Inspect and replace connecting rod or main bearings. Check and replace piston cooling nozzles.
	10. Oil jet under piston bad fit into cylinder block.	10. Check oil jet position.
LUBRICATING OIL PRESSURE TOO HIGH	1. Pressure switch/gauge not operating properly.	1. Verify the pressure switch is functioning correctly. If not, replace switch/gauge.
	2. Engine running too cold.	2. Refer to Coolant Temperature Below Normal (Engine Diagnosis Performance).
	3. Oil viscosity too thick.	3. Make sure the correct oil being used, (Refer to Group 0, Lubrication and Maintenance).
	4. Oil pressure relief valve stuck closed or binding.	4. Check and replace valve.
LUBRICATING OIL LOSS	1. External leaks.	1. Visually inspect for oil leaks. Repair as required.
	2. Crankcase being overfilled.	2. Verify that the correct dipstick is being used.
	3. Incorrect oil specification or viscosity.	3. (A) Make sure the correct oil is being used. (B) Look for reduced viscosity from dilution with fuel. (C) Review/reduce the oil change intervals.
	4. Oil cooler leak.	4. Check and replace the oil cooler.
	5. High blow-by forcing oil out the breather.	5. Check the breather tube area for signs of oil loss. Perform the required repairs.

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DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
LUBRICATING OIL LOSS (CONT.)	6. Turbocharger leaking oil to the air intake. 7. Piston rings not sealing (oil being consumed by the engine).	6. Inspect the air ducts for evidence of oil transfer. Repair as required. 7. Perform blow-by check. Repair as required.
COMPRESSION KNOCKS	1. Poor quality fuel or water/gasoline contaminated fuel. 2. Incorrect injection pump timing. 3. Improperly operating injectors. 4. Wrong injection pump timing.	1. Verify by operating from a temporary tank with good fuel. Clean and flush the fuel supply tanks. Replace fuel/ water separator. 2. Check and time injection pump (refer to Group 14, Fuel System). 3. Check and replace inoperative injectors. 4. Check injection pump timing.
EXCESSIVE VIBRATION	1. Loose or broken engine mounts. 2. Damaged fan or improperly operating accessories. 3. Improperly operating vibration damper. 4. Improperly operating viscous fan drive. 5. Worn or damaged generator bearing. 6. Flywheel housing misaligned. 7. Loose or broken power component. 8. Worn or unbalanced driveline components.	1. Replace engine mounts. 2. Check and replace the vibrating components. 3. Inspect/replace the vibration damper. 4. Inspect/replace the fan drive. 5. Check/replace the generator. 6. Check/correct flywheel alignment. 7. Inspect the crankshaft and rods for damage that causes an unbalance. Repair/replace as required. 8. Check/repair driveline components.
EXCESSIVE ENGINE NOISES	1. Drive belt squeal, insufficient tension or abnormally high loading. 2. Intake air or exhaust leaks. 3. Turbocharger noise. 4. Gear train noise. 5. Power function knock.	1. Check the automatic tensioner and inspect the drive belt. Make sure water pump, tensioner pulley, fan hub and generator turn freely. 2. Refer to Excessive Exhaust smoke (Engine Diagnosis Performance). 3. Check turbocharger impeller and turbine wheel for housing contact. Repair/replace as required. 4. Visually inspect and measure gear backlash. Replace gears as required. 5. Check/replace rod and main bearings.

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DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
GENERATOR NOT CHARGING OR INSUFFICIENT CHARGING	1. Loose or corroded battery.	1. Clean/tighten battery connection.
	2. Generator belt slipping.	2. Check/replace automatic belt tensioner. Check/replace and adjust belt.
	3. Generator pulley loose on shaft.	3. Tighten pulley.
	4. Improperly operating generator.	4. Check/replace generator.

J9509-136

DIAGNOSIS AND TESTING (Continued)

TAPPET NOISE

(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.

NOTE: 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.

SERVICE PROCEDURES

VALVE SERVICE

This procedure is done with the engine cylinder head removed from the block.

DISASSEMBLY

(1) Remove the engine cylinder head from the cylinder block. Refer to cylinder head removal and installation in this section.

(2) Use Valve Spring Compressor Tool and compress each valve spring.

(3) Remove the valve locks, retainers, and springs.

(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

(1) Clean all carbon deposits from the combustion chambers, valve ports, valve stems, valve stem guides and head.

(2) Clean all grime and gasket material from the engine cylinder head machined gasket surface.

INSPECTION

(1) Inspect for cracks in the combustion chambers and valve ports.

(2) Inspect for cracks on the exhaust seat.

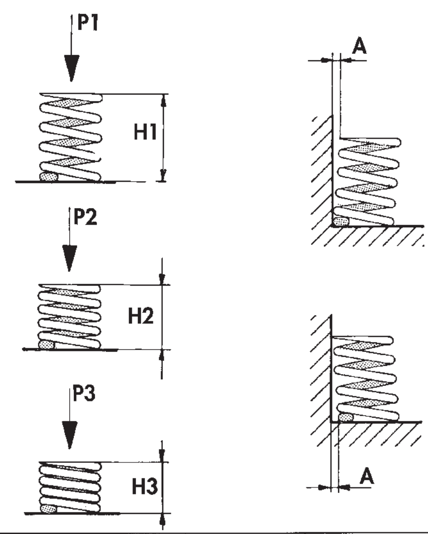
(3) Inspect for cracks in the gasket surface at each coolant passage.

(4) Inspect valves for burned, cracked or warped heads.

(5) Inspect for scuffed or bent valve stems.

(6) Replace valves displaying any damage.

(7) Check valve spring height (Fig. 2).



LOAD Kg		HEIGHT mm		STATE
P1	0.00	H1	44.65	FREE LENGTH
P2	33-35	H2	38.60	VALVE CLOSED
P3	90-95	H3	28.20	VALVE OPEN

J9509-38

Fig. 2 Valve Spring Chart

VALVE REFACING

(1) Use a valve refacing machine to reface the intake and exhaust valves to the specified angle.

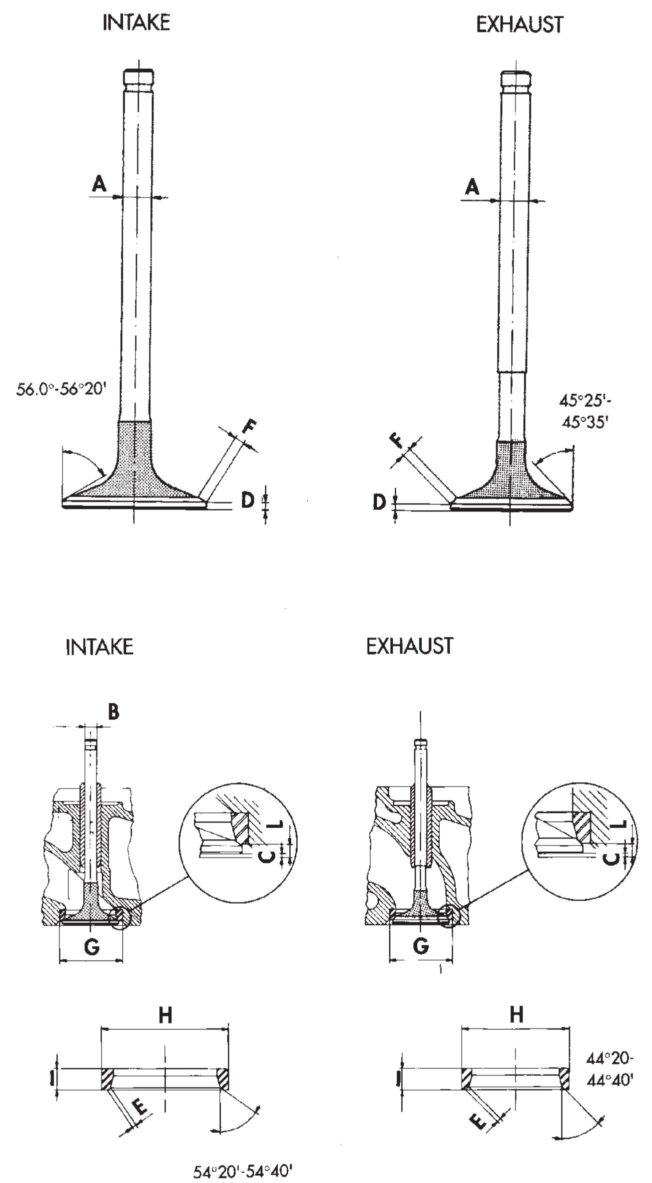
(2) After refacing, a margin of at least 4.52-4.49 mm (.178-.177 inch) must remain (Fig. 3). If the margin is less than 4.49 mm (.177 inch), the valve must be replaced.

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.

SERVICE PROCEDURES (Continued)



MEASUREMENT	INTAKE	EXHAUST
A	7.940-7.960	7.922-7.940
B	8.00-8.015	8.000-8.015
C	0.880-1.140	0.990-1.250
D	2.2±0.08	$2.09^{+0.07}_{-0.09}$
E	1.80-2.20	1.65-2.05
F	2.73-3.44	2.45-3.02
G	41.962-41.985	35.964-35.987
H	42.070-42.086	36.050-36.066
I	7.14-7.19	7.00-7.05
L	3.11-3.26	3.10-3.25

J9509-40

Fig. 3 Valve Specification

VALVE STAND DOWN

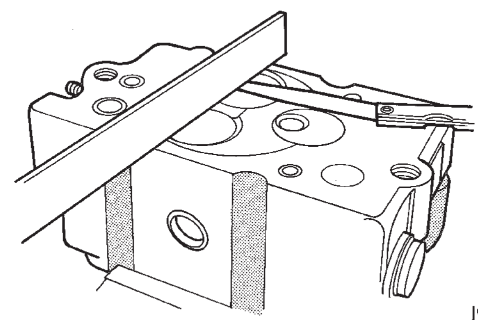
Valve stand down is to maintain the adequate compression ratio.

(1) Invert cylinder head.

(2) Fit each valve to its respective valve guide.

(3) Using a straight edge and feeler gauge (Fig. 4), check valve head stand down: Inlet valve head stand down .80 to 1.2 mm (.031 to .047 in.) and exhaust valve stand down .79 to 1.19 mm (.031 to .047 in).

(4) If valve head stand down is not in accordance with above, discard original valves, check stand down with new valves and recut valve seat inserts to obtain correct stand down.



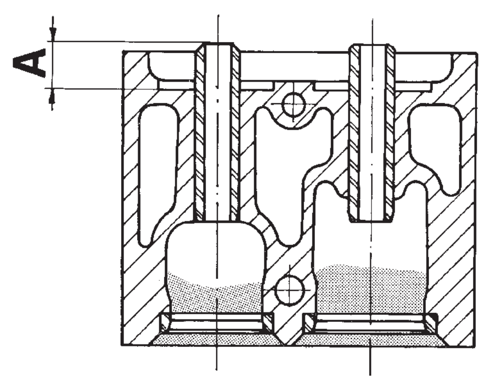
J9509-166

Fig. 4 Checking Valve Stand Down

VALVE GUIDES

(1) Valve Guides height requirement.

(2) Measurement A (Fig. 5): 13.50 - 14.00 mm.



J9509-36

Fig. 5 Valve Guide Height

VALVE STEM-TO-GUIDE CLEARANCE MEASUREMENT

(1) Measure and record internal diameter of valve guides. Valve guide internal diameter is 8.0 to 8.015 mm (.3149 to .3155 ins.).

(2) Measure valve stems and record diameters. Intake valve stem diameter 7.94 to 7.96 mm (.3125 to .3133 in). Exhaust valve stem diameter 7.92 to 7.94 mm (.3118 to .31215 in).

SERVICE PROCEDURES (Continued)

(3) Subtract diameter of valve stem from internal diameter of its respective valve guide to obtain valve stem clearance in valve guide. Clearance of inlet valve stem in valve guide is .040 to .075 mm (.0015 to .0029 in). Clearance of exhaust valve stem in valve guide is .060 to .095 mm (.0023 to .0037 in).

(4) If valve stem clearance in valve guide exceeds tolerances, new valve guides must be installed.

REMOVAL AND INSTALLATION

3.1L TURBO DIESEL ENGINE

REMOVAL

(1) Disconnect and isolate the negative battery cable.

(2) Mark the hinge locations on the hood for alignment reference during installation.

(3) Disconnect the engine compartment lamp.

(4) With assistance from another person, remove the hood.

(5) Cover both fenders to prevent paint damage.

WARNING: DO NOT LOOSEN THE RADIATOR VENT OR DRAINCOCK WITH THE SYSTEM HOT AND PRESSURIZED. SERIOUS BURNS FROM COOLANT CAN OCCUR

(6) Open the cooling system vent. Located on top of the radiator.

(7) Raise the vehicle on the hoist

(8) Remove both of the front splash shields (Fig. 6).

(9) Drain the cooling system. Refer to Group 7, Cooling System for the procedure.

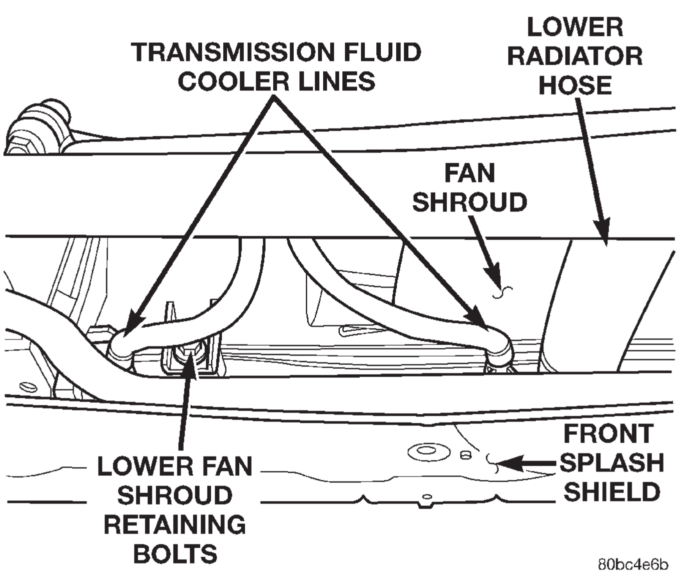


Fig. 6 Transmission Fluid Cooler Lines

(10) Remove the transmission fluid cooler lines from the radiator (Fig. 6).

(11) Remove the lower radiator hose from the radiator (Fig. 6).

(12) Remove the lower fan shroud retaining bolts (Fig. 6).

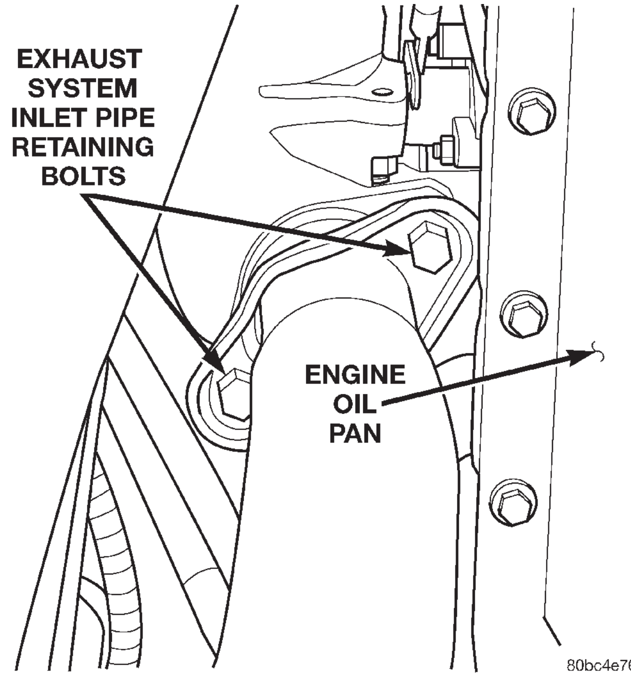


Fig. 7 Exhaust System Inlet Pipe

(13) Remove the exhaust system inlet pipe retaining bolts from the turbocharger (Fig. 7).

(14) Remove the nut retaining the wire harnesses on the left engine mount.

(15) Lower the vehicle on the hoist.

(16) Remove the right and left headlamp assemblies from the vehicle. Refer to Group 8L, Lamps for the procedure.

(17) Remove the front fascia. Refer to Group 13, Frame and Bumpers for the procedure.

(18) Disconnect the ambient temperature sensor and unclip the wire harness from the headlamp module mounting assembly.

(19) Disconnect the right and left headlamp module wire harnesses at the 10-way connectors. Located just above the front bumper to the right and left of the A/C condenser.

(20) Remove the headlamp module mounting (HMM) assembly. Refer to Group 23, Body for the procedure.

NOTE: Mark the position of the hood latch in relation to its mounting bracket. This will aid in aligning the hood latch during reassembly.

(21) Remove the hood latch retaining fasteners and position it out of the way.

REMOVAL AND INSTALLATION (Continued)

(22) Remove the hood latch support brackets from the vehicle.

(23) Remove the upper fan shroud retaining bolts.

(24) Remove the radiator crossmember from the vehicle.

(25) Remove the manual cooling fan and let set inside of the fan shroud.

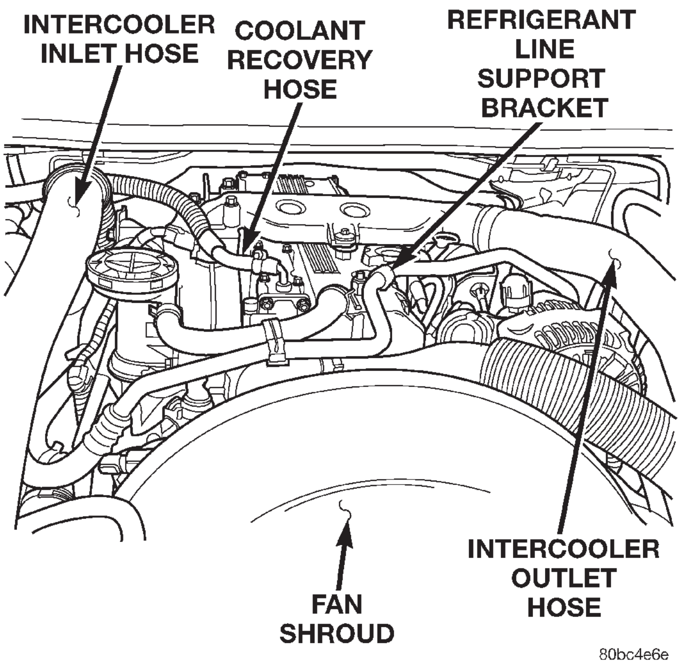


Fig. 8 Intercooler Hoses

(26) Remove the intercooler inlet and outlet hoses from the vehicle (Fig. 8).

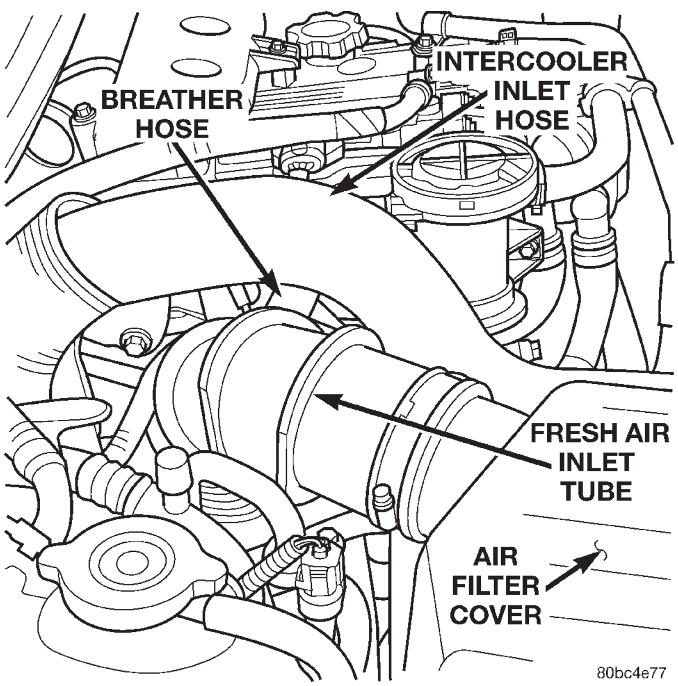


Fig. 9 Air Intake Hoses

(27) Disconnect the breather hose and remove the fresh air inlet tube from the vehicle (Fig. 9).

(28) Remove the radiator overflow hose from the radiator

(29) Remove the upper radiator hose from the vehicle.

(30) Disconnect the electric radiator cooling fan electrical connector.

(31) If equipped, recover the refrigerant. Refer to Group 24, Heating and Air Conditioning for the procedure.

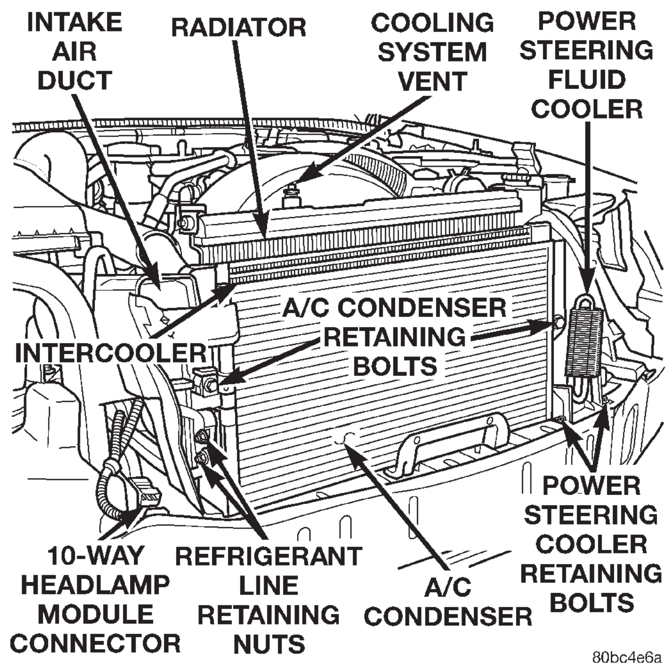


Fig. 10 Cooling Module Assembly

(32) Remove the intake air duct from the vehicle (Fig. 10).

(33) Remove the power steering cooler retaining bolts (Fig. 10) and position the cooler aside.

(34) Remove the suction and discharge lines from the condenser assembly (Fig. 10).

(35) Remove the fan shroud and both cooling fans as an assembly from the vehicle.

NOTE: The cooling module assembly includes the radiator, intercooler and A/C condenser.

(36) Remove the cooling module assembly retaining bolts and remove the cooling module from the vehicle.

(37) Remove the coolant reservoir supply hose from the engine .

(38) Remove the coolant recovery hose from the water manifold.

(39) Remove the EGR valve vacuum supply line from the valve (Fig. 11).

REMOVAL AND INSTALLATION (Continued)

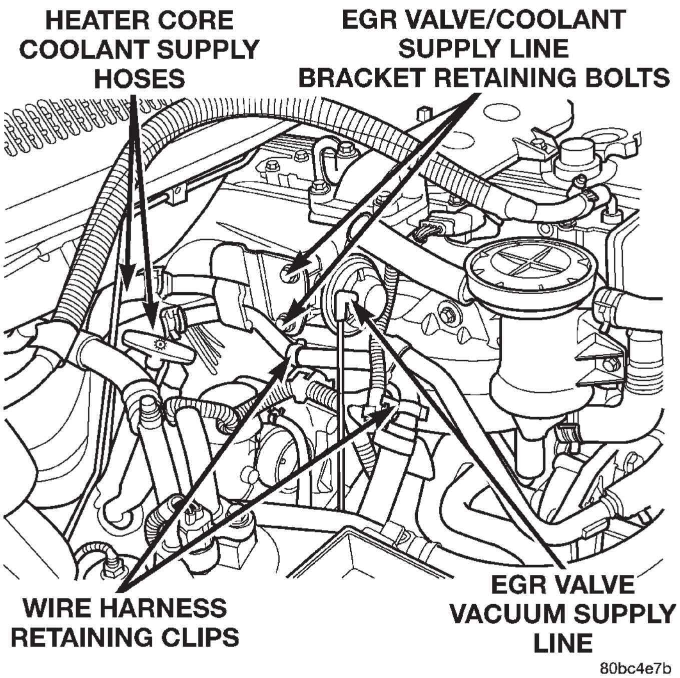


Fig. 11 Engine Compartment View - Rightside

(40) Remove the heater core coolant supply lines from the engine assembly (Fig. 11).

(41) Remove the refrigerant line from the A/C accumulator assembly.

(42) Disconnect the oil pressure and boost pressure sensor electrical connectors and unclip wire harness from the coolant supply lines.

(43) Disconnect the engine ground. Located just behind the oil filter.

(44) Remove the refrigerant line retaining nut from the bulkhead and remove the refrigerant liquid line from the vehicle.

(45) Cut the tiestraps retaining the wire harness to the refrigerant line. Located above the compressor assembly.

(46) Remove the refrigerant line support bracket bolt from the cylinder head cover.

(47) Remove both of the refrigerant line retaining bolts from the compressor and remove the lines from the vehicle.

(48) Remove the power steering fluid supply hose from the pump (Fig. 12).

(49) Remove the power steering fluid pressure line from the pump (Fig. 12).

(50) Remove the vacuum supply hose from the engine mounted steel vacuum source line.

(51) Disconnect the generator field wire connector from the rear of the generator.

(52) Unclip the battery feed wire cover and remove the wire from the top of the generator.

(53) Disconnect the speed control servo vacuum supply hose from the engine mounted steel vacuum source line.

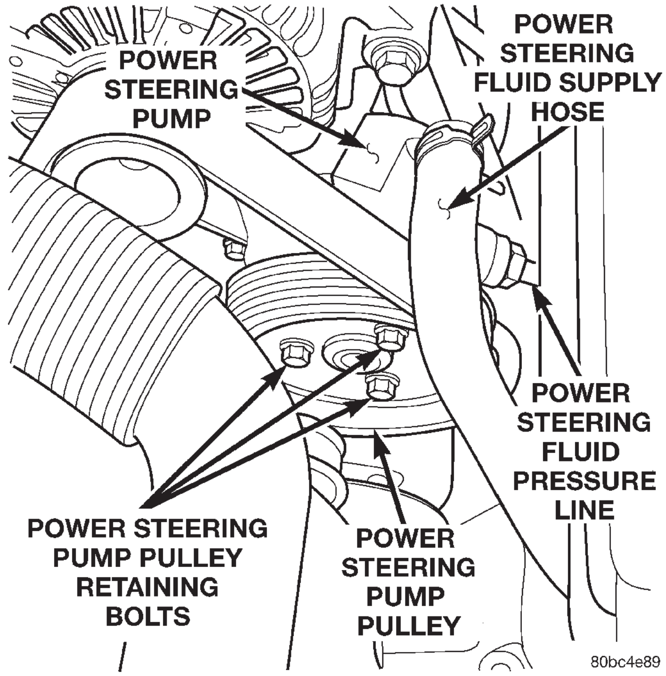


Fig. 12 Power Steering Fluid Lines At Pump

(54) Disconnect the fuel supply and return hoses from the engine assembly.

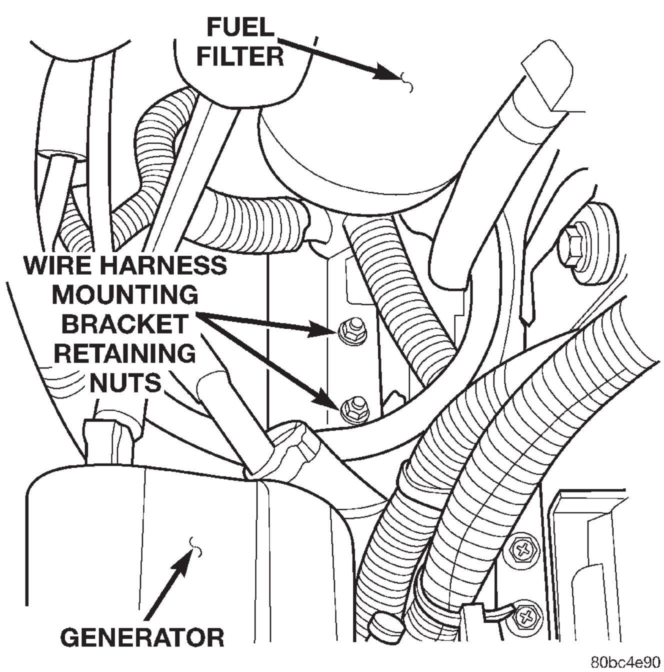


Fig. 13 Wire Harness Mounting Bracket

(55) Remove the wire harness mounting bracket retaining nuts from the left engine mount (Fig. 13).

(56) Disconnect the black and gray 10–way electrical connectors from the engine wire harness.

(57) Disconnect the A/C compressor clutch and glow plug harness electrical connectors.

REMOVAL AND INSTALLATION (Continued)

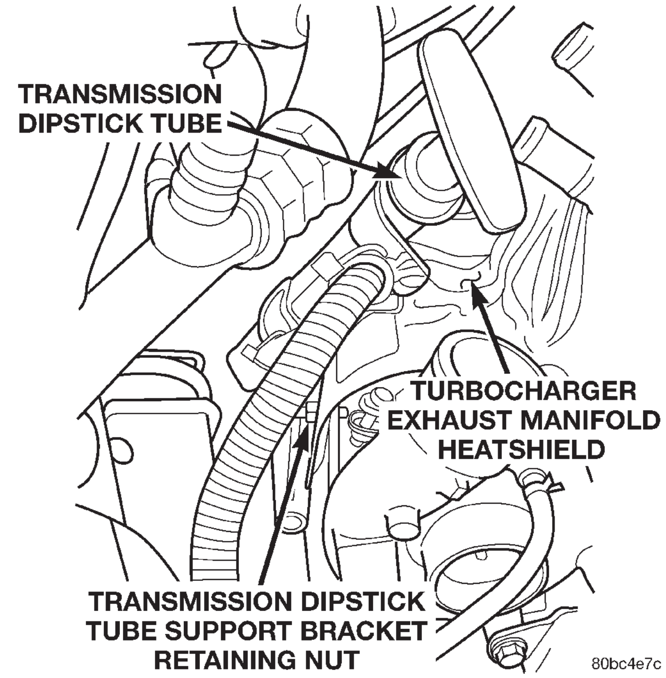


Fig. 14 Transmission Dipstick Tube Support Bracket

(58) Remove the transmission dipstick tube support bracket retaining nut from the turbocharger heatshield (Fig. 14).

(59) Raise the vehicle on the hoist.

(60) Disconnect the starter motor electrical.

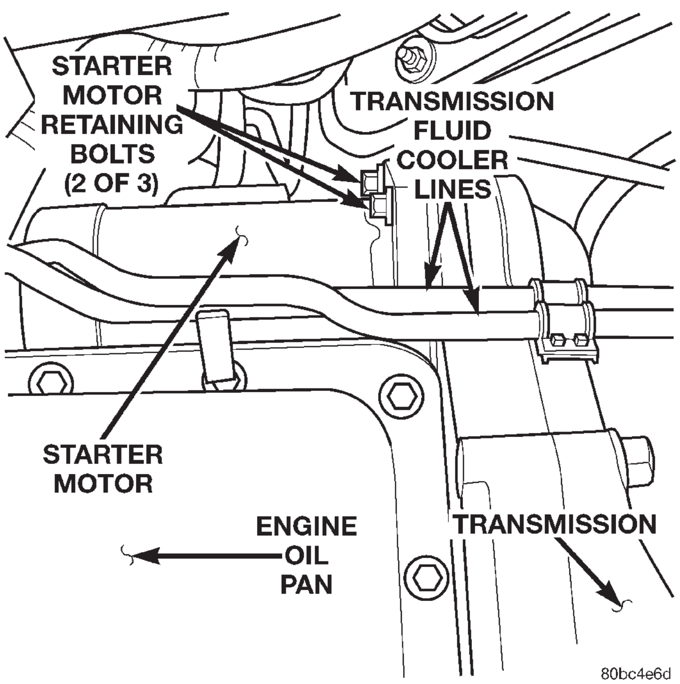


Fig. 15 Starter Motor Position & Orientation

(61) Remove the starter motor retaining bolts and remove the starter from the vehicle (Fig. 15).

NOTE: Mark the position of the torque convertor in relation to the driveplate through the starter motor access hole. This reference mark will be used to line up the two components for reassemble.

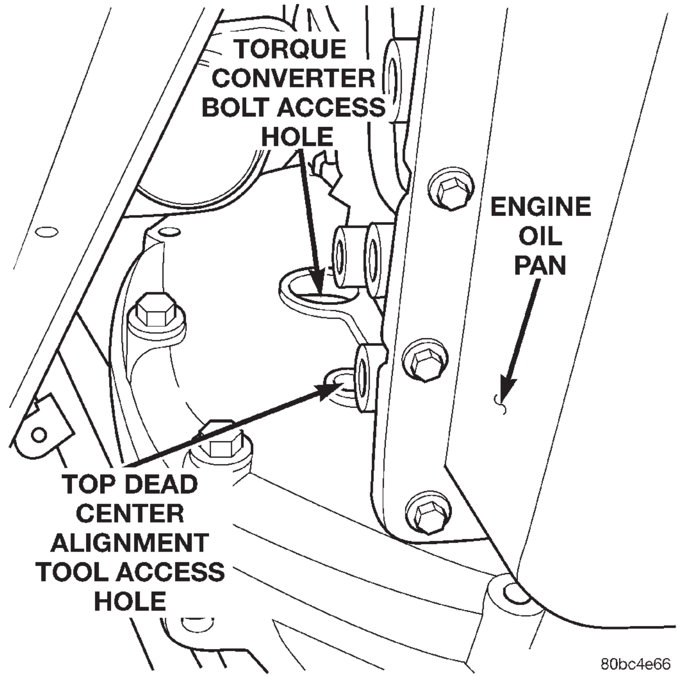


Fig. 16 Torque Convertor Bolt Access Hole

(62) Working through the torque convertor bolt access hole (Fig. 16), Rotate the engine to access and remove the (4) torque convertor to driveplate retaining bolts.

(63) Disconnect the engine ground. Located to the rear of the left engine mount.

(64) Remove the left engine mount throughbolt nut. Do not remove the bolt at this time.

(65) Support the rear of the transmission assembly with a jack.

(66) Remove the (8) transmission support crossmember retaining bolts (Fig. 17).

(67) Lower the transmission and transfer case assembly enough to gain access to the upper six transmission bellhousing bolts.

(68) Remove the upper six bellhousing bolts.

(69) Raise the transmission assembly back into position and temporarily install four of the eight transmission crossmember retaining bolts. Install two bolts on each side.

(70) Remove the remaining four bellhousing bolts.

(71) Partially lower the vehicle.

(72) Remove the engine mount sill plate retaining bolts in the left wheel well (Fig. 18).

(73) Remove the engine mount sill plate retaining bolts in the right wheel well (Fig. 19).

(74) lower the vehicle to the ground.

(75) Support the front of the transmission with a jack.

REMOVAL AND INSTALLATION (Continued)

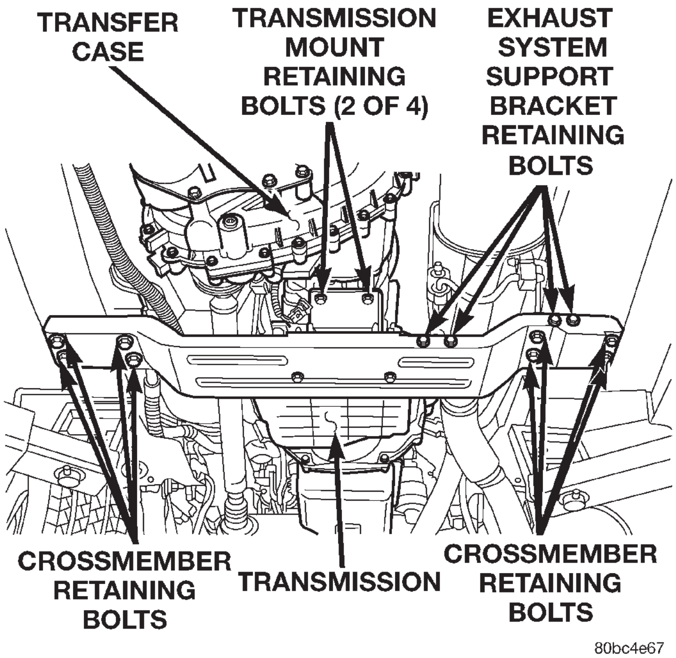


Fig. 17 Transmission Support Crossmember

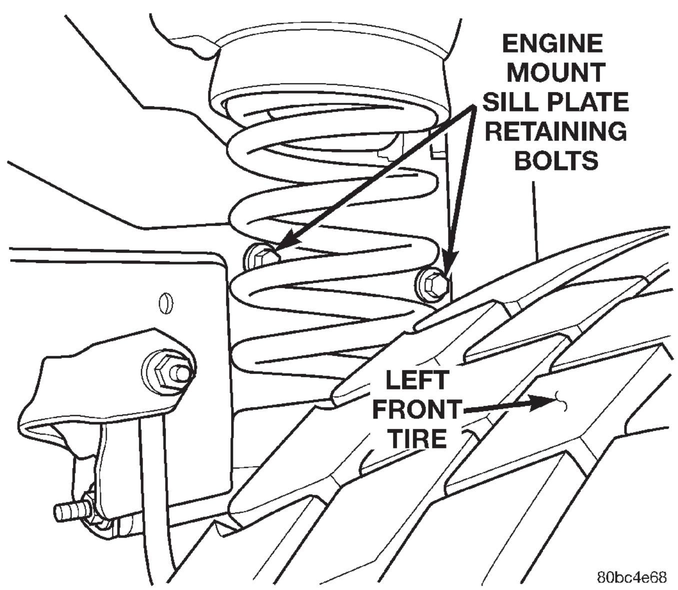


Fig. 18 Engine Mount Sill Plate Retaining Bolts - Left Wheel Well

(76) Remove the left engine mount sill plate retaining bolts (Fig. 20).

(77) Remove the right engine mount sill plate retaining bolts (Fig. 21).

(78) Set up an engine lifting device and support the weight of the engine assembly.

CAUTION: Before proceeding be certain the front of the transmission is properly supported with a jack.

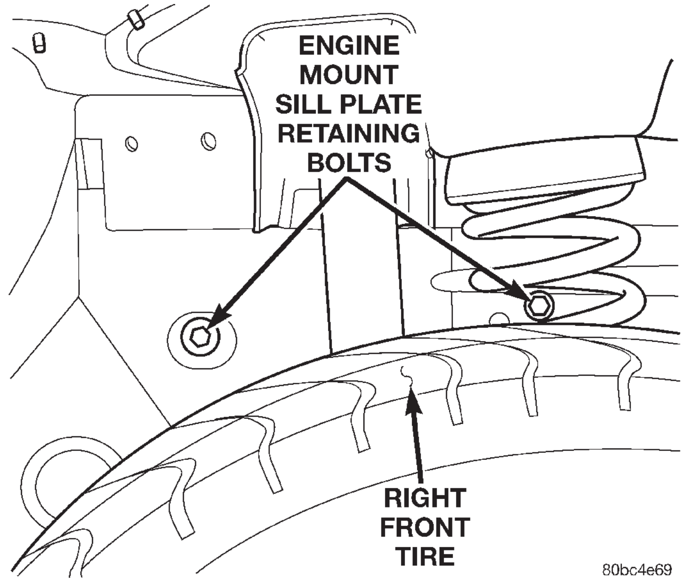


Fig. 19 Engine Mount Sill Plate Retaining Bolts - Right Wheel Well

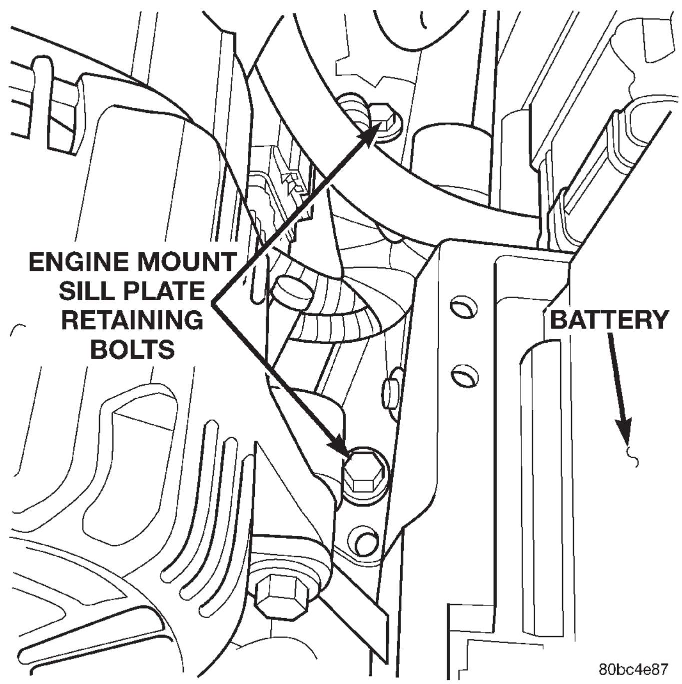


Fig. 20 Engine Mount Sill Plate Bolts - Leftside

CAUTION: This engine is equipped with a misfire sensor. Located in the top of the bellhousing. Care must be taken not to damage the sensor or corresponding wires during engine removal and installation.

(79) Using the engine lifting device, pull the engine assembly away from the transmission approximately three inches and **stop**.

(80) Working between the bulkhead and the right rear of the engine assembly, disconnect the engine misfire sensor electrical connector.

REMOVAL AND INSTALLATION (Continued)

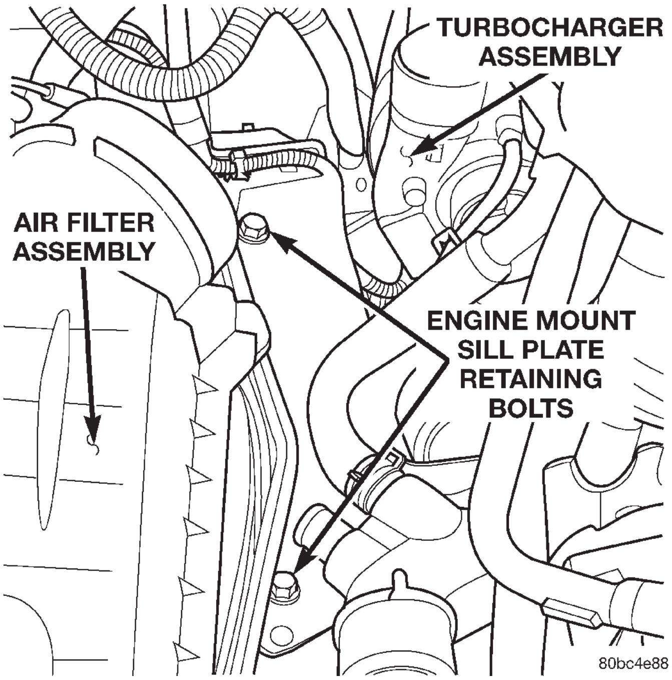


Fig. 21 Engine Mount Sill Plate Bolts - Rightside

(81) Remove the left engine mount throughbolt.

(82) Using the engine lifting device, position the engine assembly so the left engine mount sill plate can be removed from the left engine mount.

(83) With assistance from another person, carefully remove the engine assembly from the vehicle. One person operating the engine lifting device and the other facilitating the engine removal.

INSTALLATION

CAUTION: This engine is equipped with a misfire sensor. Located in the top of the bellhousing. Care must be taken not to damage the sensor or corresponding wires during engine removal and installation.

CAUTION: Be certain the torque convertor is properly installed in the transmission. If the torque convertor is not installed all the way in the transmission the engine will not rotate upon installation.

(1) With assistance from another person, carefully install the engine assembly in the vehicle. One person operating the engine lifting device and the other facilitating the engine installation.

(2) Using the engine lifting device, position the engine assembly so the left engine mount sill plate can be installed around the left engine mount.

(3) Install the left engine mount throughbolt and nut. Leave loose at this time.

(4) Working between the bulkhead and the right rear of the engine assembly, connect the engine misfire sensor electrical connector.

(5) Using the engine lifting device and/or the jack under the transmission, position the engine/transmission assembly so the engine block mounted dowel pins are perfectly aligned with the corresponding holes in the transmission bellhousing.

CAUTION: The engine block and transmission must be in perfect alignment before attempting to install the bellhousing bolts. Misalignment will cause the aluminum bellhousing to be damaged.

(6) Install two engine to transmission bellhousing retaining bolts. One on each side of the bellhousing.

(7) Make certain the engine mount sill plate bolt holes are aligned with there corresponding weld nuts in the frame rails.

(8) Remove the engine lifting device.

(9) Remove the jack from the transmission.

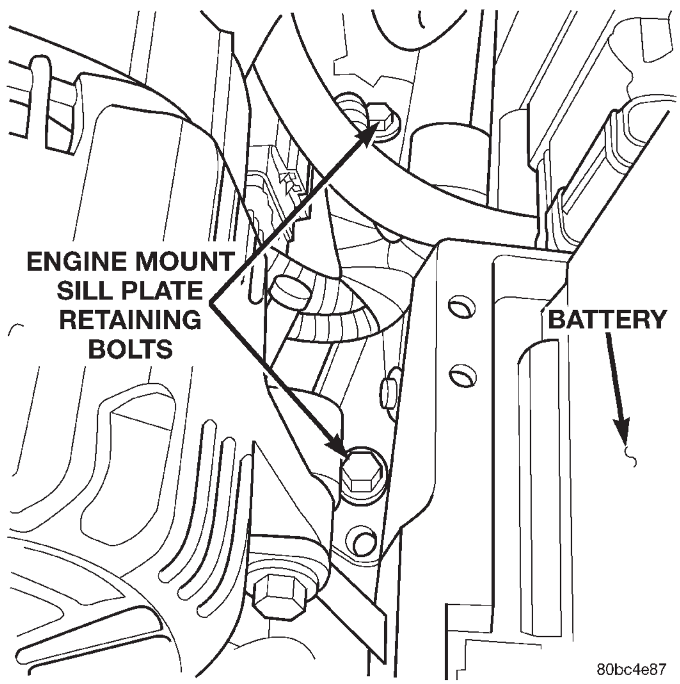


Fig. 22 Engine Mount Sill Plate Bolts - Leftside

(10) Install the leftside engine mount sill plate retaining bolts (Fig. 22). Leave loose at this time.

(11) Install the rightside engine mount sill plate retaining bolts (Fig. 23). Leave loose at this time.

(12) Partially raise the vehicle on the hoist.

(13) Install the engine mount sill plate retaining bolts in the right wheel well (Fig. 24). Leave loose at this time.

(14) Install the engine mount sill plate retaining bolts in the left wheel well (Fig. 25). Torque the bolts to 61 N·m (45 ft. lbs.).

REMOVAL AND INSTALLATION (Continued)

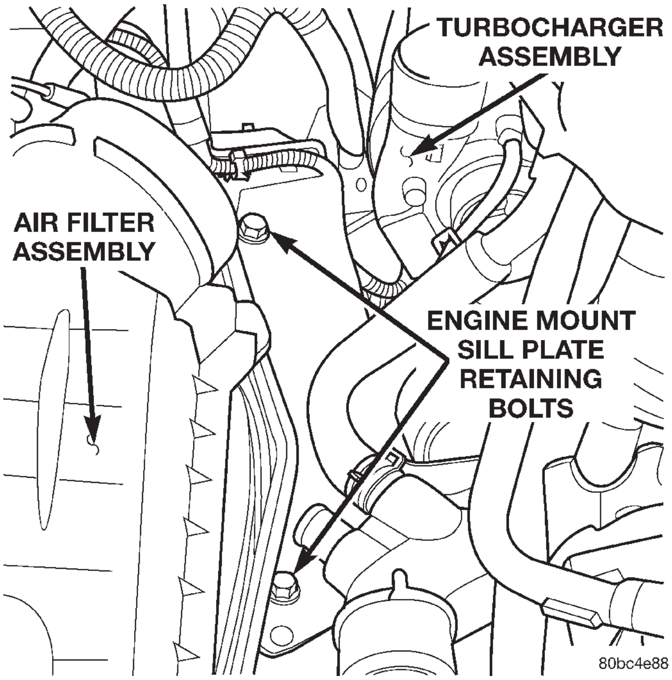


Fig. 23 Engine Mount Sill Plate Bolts - Rightside

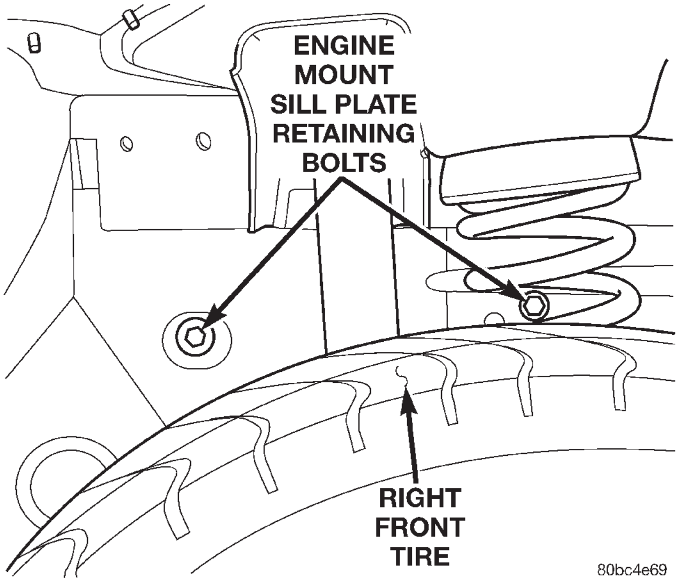


Fig. 24 Engine Mount Sill Plate Bolts - Right Wheel Well

(15) Torque all engine mount sill plate bolts to 61 N·m (45 ft. lbs.).

(16) Torque the left engine mount throughbolt to 61 N·m (45 ft. lbs.).

(17) Raise the vehicle on the hoist.

(18) Install the remaining lower bellhousing bolts. Torque all the bolts to 102 N·m (75 ft. lbs.).

(19) Support the rear of the transmission with a jack.

(20) Remove the (4) temporarily installed transmission crossmember bolts.

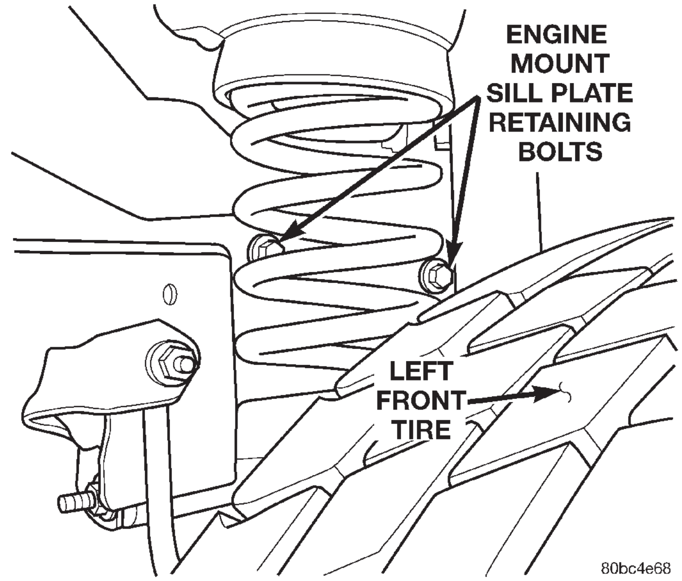


Fig. 25 Engine Mount Sill Plate Bolts - Left Wheel Well

(21) Lower the transmission and transfer case assembly enough to gain access to the upper six bellhousing bolts.

NOTE: Be certain all brackets that were originally installed on the bellhousing bolts are reinstalled. Cable misrouting could result.

(22) Install the upper six bellhousing bolts. Torque the bolts to 102 N·m (75 ft. lbs.).

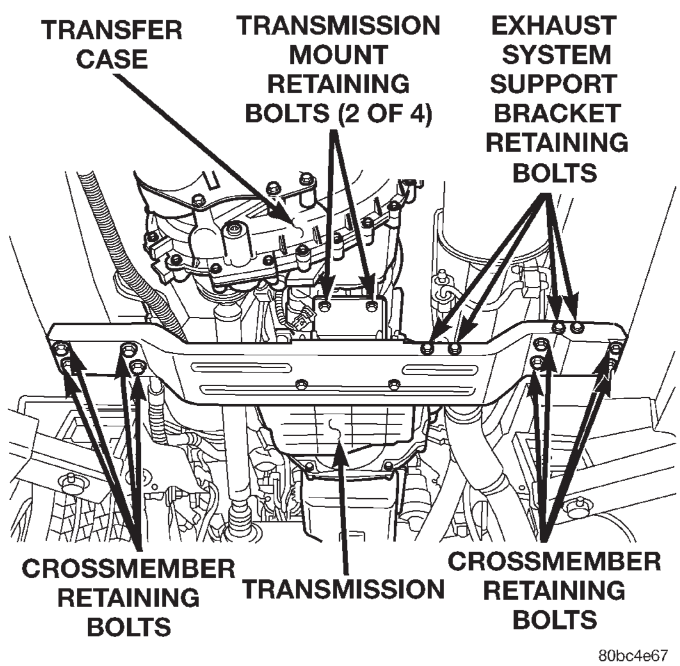


Fig. 26 Transmission Support Crossmember

REMOVAL AND INSTALLATION (Continued)

(23) Raise the transmission assembly back into position and install the eight transmission crossmember retaining bolts (Fig. 26). Torque the bolts to 41 N·m (30 ft. lbs.).

NOTE: Be certain the torque convertor is properly aligned with the driveplate before attempting to installing the retaining bolts.

NOTE: When installing the torque convertor to driveplate retaining bolts, the torque convertor can be rotated into position with a flat-bladed screwdriver through the starter motor access hole. Then working through the torque convertor bolt access hole, thread a longer than original bolt into the convertor and pull the convertor up against the driveplate by hand. Remove the longer bolt and install the original bolts one by one until all bolts are installed. Then go back and torque all bolts to specification.

(24) Rotate the engine assembly to access and install the (4) torque convertor to driveplate retaining bolts. Torque the bolts to 75 N·m (55 ft. lbs.).

(25) Install the wire harness support bracket on the left engine mount.

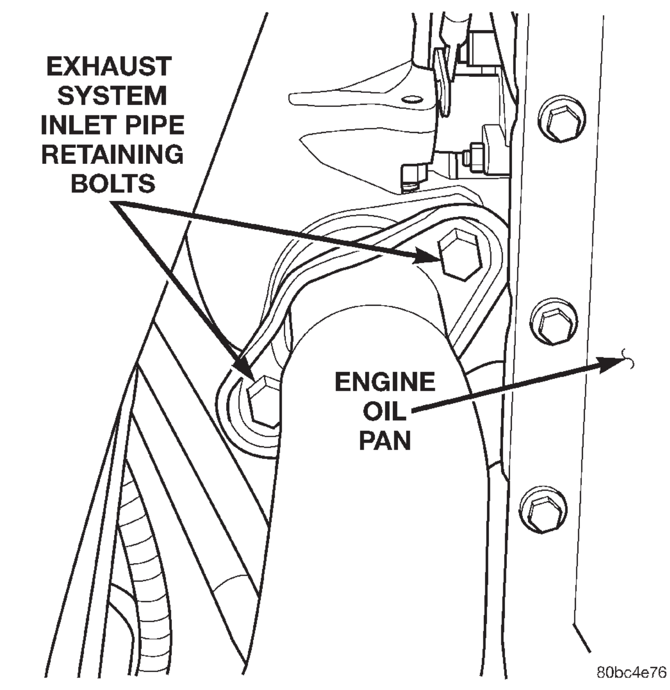


Fig. 27 Exhaust System Inlet Pipe

(26) Install the exhaust system inlet pipe on the turbocharger (Fig. 27). Torque the bolts to 41 N·m (30 ft. lbs.).

(27) Lower the vehicle on the hoist.

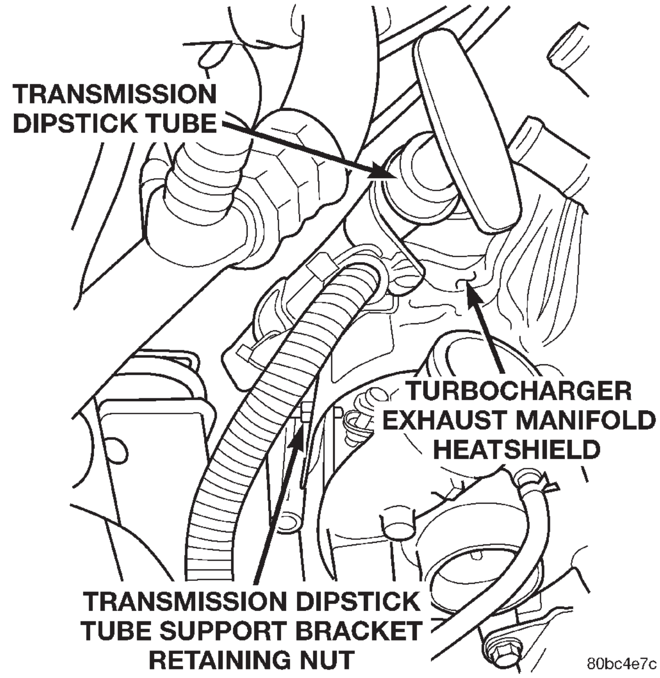


Fig. 28 Transmission Dipstick Tube Support Bracket

(28) Install the transmission dipstick tube support bracket retaining nut on the turbocharger heatshield (Fig. 28). Torque the nut to 25 N·m (221 in. lbs.).

(29) Connect the A/C compressor clutch and glow plug harness electrical connectors.

(30) Connect the black and gray 10–way electrical connectors and clip connectors on the wire harness mounting bracket.

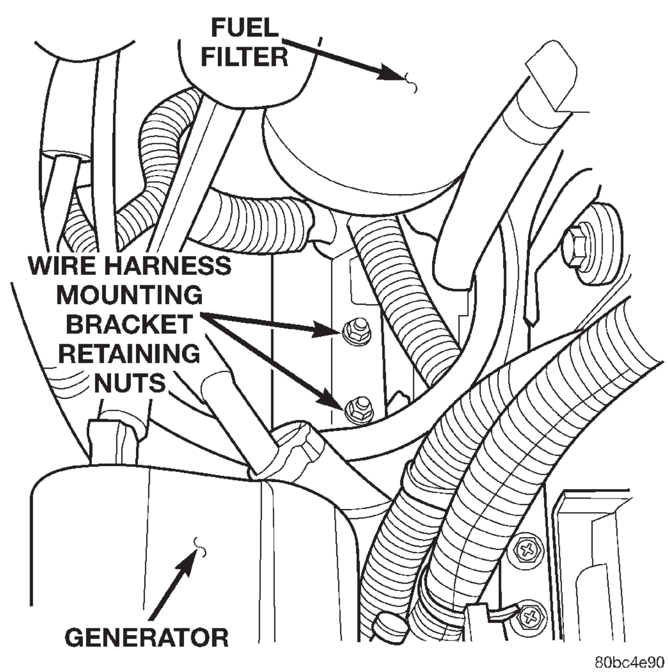


Fig. 29 Wire Harness Mounting Bracket

REMOVAL AND INSTALLATION (Continued)

(31) Install the wire harness mounting bracket and retaining nuts on the left engine mount. Torque the nuts to 25 N·m (221 in. lbs.).

(32) Connect the fuel supply and return hoses on the engine assembly.

(33) Connect the speed control servo vacuum supply hose on the engine mounted steel vacuum source line.

(34) Install the battery feed wire on the top of the generator and install the cover.

(35) Connect the generator field wire connector on the rear of the generator.

(36) Install the vacuum supply hose on the engine mounted steel vacuum source line.

NOTE: When lubricating sealing o-rings or gaskets. Use only the same lubricate that is present in that system.

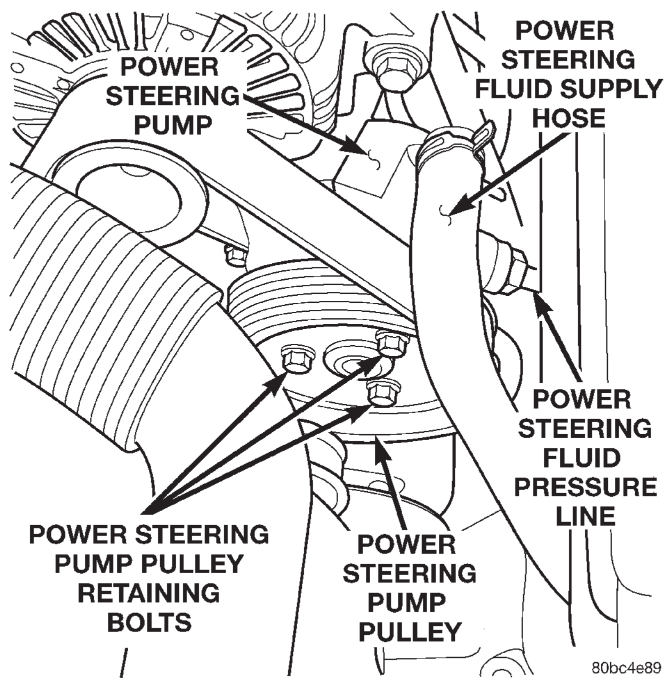


Fig. 30 Power Steering Fluid Lines At Pump

(37) Install the power steering fluid pressure line on the pump (Fig. 30). Be certain the sealing 0-ring is well lubricated and free of tears.

(38) Install the power steering fluid supply hose on the pump (Fig. 30).

(39) Install both of the refrigerant lines on the A/C compressor. Torque the retaining bolts to 28 N·m (21 ft. lbs.). Be certain the sealing gaskets are well lubricated and free of tears.

(40) Install the refrigerant line support bracket and bolt on the cylinder head cover.

(41) Install the tiestraps retaining the wire harness on the low side refrigerant line.

(42) Install the refrigerant liquid line. Torque the retaining nut on the bulkhead to 28 N·m (21 ft. lbs.). Be certain the sealing gasket is well lubricated and free of tears.

(43) Connect the engine ground. Located just behind the oil filter.

(44) Connect the oil pressure and boost pressure sensor electrical connectors and clip the wire harness on the coolant supply tubes.

(45) Install the low side refrigerant line on the A/C accumulator assembly. Torque the nut to 28 N·m (21 ft. lbs.). Be certain the sealing gasket is well lubricated and free of tears.

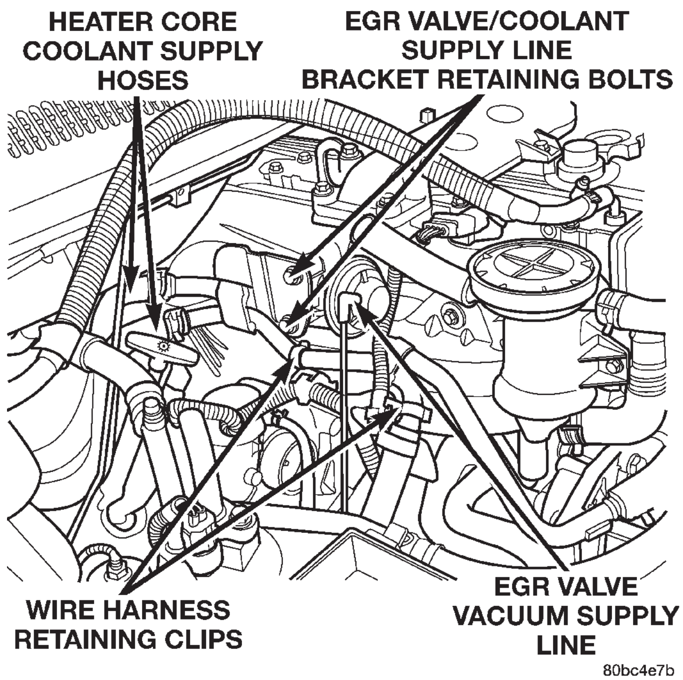


Fig. 31 Engine Compartment View - Rightside

(46) Install the heater core coolant supply hoses on the engine (Fig. 31).

(47) Install the EGR valve vacuum supply line on the valve (Fig. 31).

(48) Install the coolant recovery hose on the water manifold.

(49) Install the coolant reservoir supply hose on the engine.

(50) Install the cooling module assembly and retaining bolts (Fig. 32). Torque the bolts to 41 N·m (30 ft. lbs.).

(51) Install the fan shroud and both cooling fans as an assembly on the vehicle.

(52) Install the suction and discharge refrigerant lines on the condenser assembly (Fig. 32). Torque the retaining nuts to 28 N·m (21 ft. lbs.). Be certain the sealing gaskets are well lubricated and free of tears.

(53) Position the power steering cooler and install the retaining bolts (Fig. 32).

(54) Charge the refrigerant system. Refer to Group 24, Heating and Air Conditioning for the procedure.

REMOVAL AND INSTALLATION (Continued)

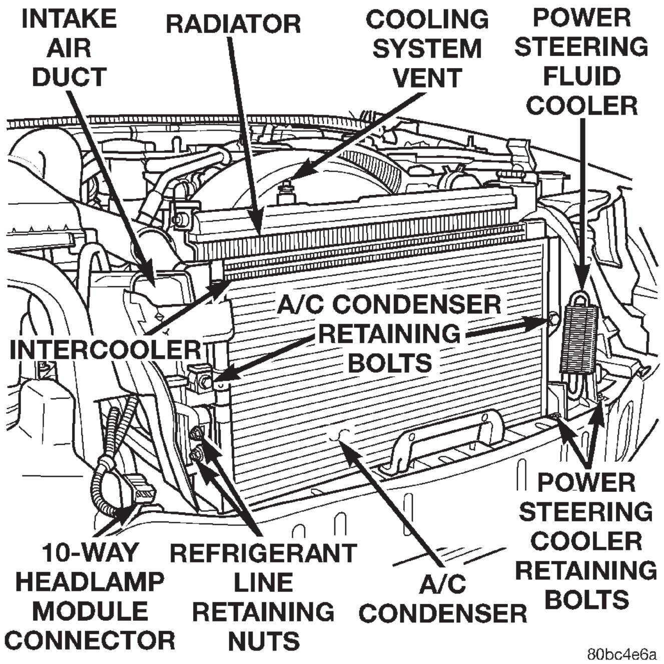


Fig. 32 Cooling Module Assembly

(55) Connect the electric radiator cooling fan electrical connector.

(56) Install the intake air duct on the vehicle (Fig. 32).

(57) Install the upper radiator hose on the vehicle.

(58) Install the radiator overflow hose on the radiator

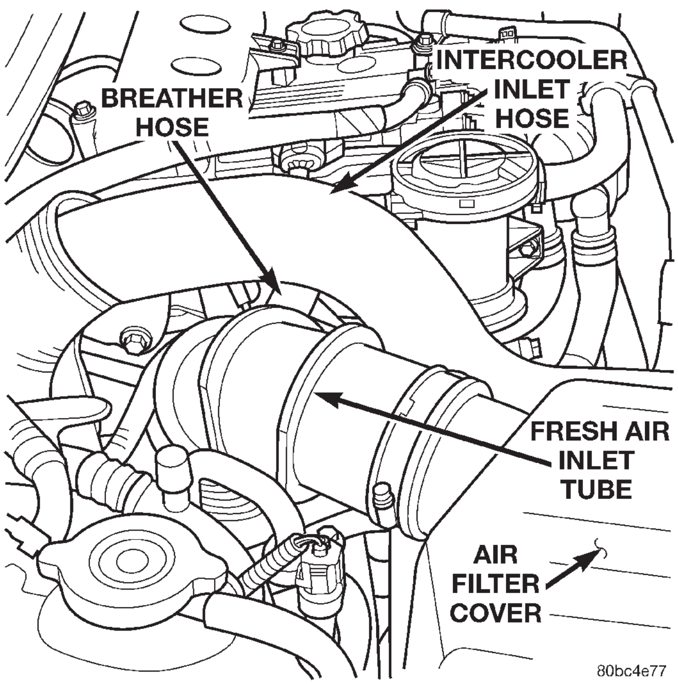


Fig. 33 Air Intake Hoses

(59) Connect the breather hose and install the fresh air inlet tube on the engine.

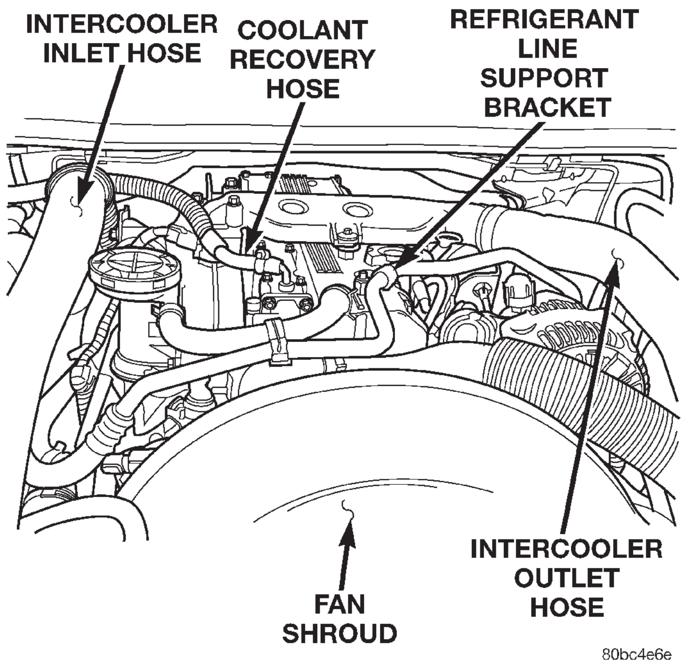


Fig. 34 Intercooler Hoses

(60) Install the intercooler inlet and outlet hoses on the engine (Fig. 34).

(61) Install the manual cooling fan on the engine.

(62) Install the radiator crossmember on the vehicle. Refer to Group 23, Body for the procedure.

(63) Install the upper fan shroud retaining bolts. Torque the bolts to 15 N·m (132 in. lbs.).

(64) Install the hood latch support brackets and the hood latch on the vehicle.

(65) Install the headlamp module mounting (HMM) assembly. Refer to Group 23, Body for the procedure.

(66) Connect the right and left headlamp module wire harnesses at the 10-way connectors. Located just above the front bumper to the right and left of the a/c condenser.

(67) Connect the ambient temperature sensor and clip the wire harness on the headlamp module mounting assembly.

(68) Install the front fascia. Refer to Group 13, Frame and Bumpers for the procedure.

(69) Install the right and left headlamp assemblies on the vehicle. Refer to Group 8L, Lamps for the procedure.

(70) Raise the vehicle on the hoist.

(71) Connect the engine ground. Located to the rear of the left engine mount.

(72) Install the starter motor. Torque the retaining bolts to 24 N·m (212 in. lbs.).

(73) Connect the starter motor electrical. Torque the B+ nut to 15 N·m (132 in. lbs.).

(74) Install the lower fan shroud retaining bolts (Fig. 35). Torque the bolts to 15 N·m (132 in. lbs.).

REMOVAL AND INSTALLATION (Continued)

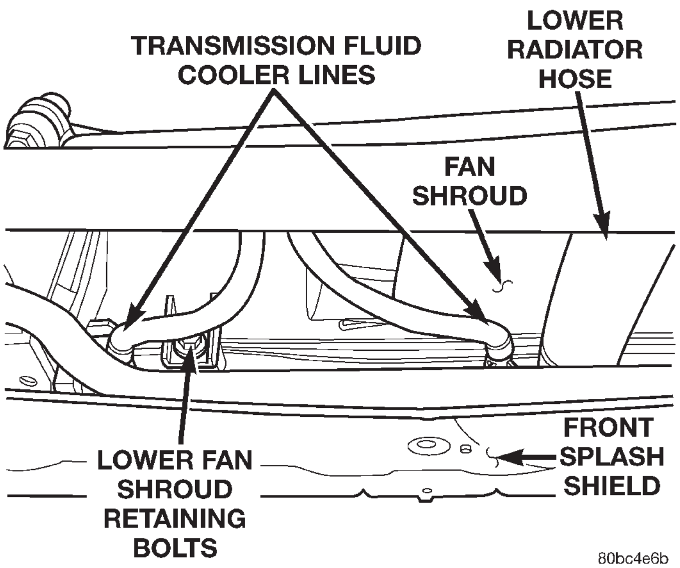


Fig. 35 Transmission Fluid Cooler Lines

(75) Install the lower radiator hose on the radiator (Fig. 35).

(76) Install the transmission fluid cooler lines on the radiator (Fig. 35).

(77) Install both of the front splash shields (Fig. 35).

(78) Lower the vehicle on the hoist.

(79) Fill the cooling system and close the system vent. Refer to Group 7, Cooling System for the procedure.

(80) With assistance from another person, install the hood.

NOTE: Use the previously marked hinge locations for alignment reference.

(81) Install the hood retaining bolts. Torque the bolts to 40 N·m (30 ft. lbs.).

(82) Fill the power steering system fluid. Refer to Group 19, Steering – Power Steering Pump-Initial operation for the procedure.

(83) Fill the transmission fluid. Refer to Group 21, Transmission and Transfer Case for the procedure.

(84) Remove both fender covers.

(85) Connect the engine compartment lamp.

(86) Connect the negative battery cable.

(87) Check the engine oil level before engine start up.

EXHAUST / INTAKE MANIFOLD

REMOVAL

NOTE: The 3.1L Turbo Diesel Engine Exhaust Manifold must be removed first in order to remove the intake manifold. Because these manifolds utilize a single sealing gasket at the cylinder head if either manifold requires service both manifolds must be removed.

(1) Disconnect the negative battery cable.

(2) Raise the vehicle on a hoist.

WARNING: DO NOT LOOSEN THE RADIATOR VENT OR DRAINCOCK WITH THE SYSTEM HOT AND PRESSURIZED. SERIOUS BURNS FROM COOLANT CAN OCCUR

(3) Drain the cooling system. Refer to Group 7, Cooling System for procedure.

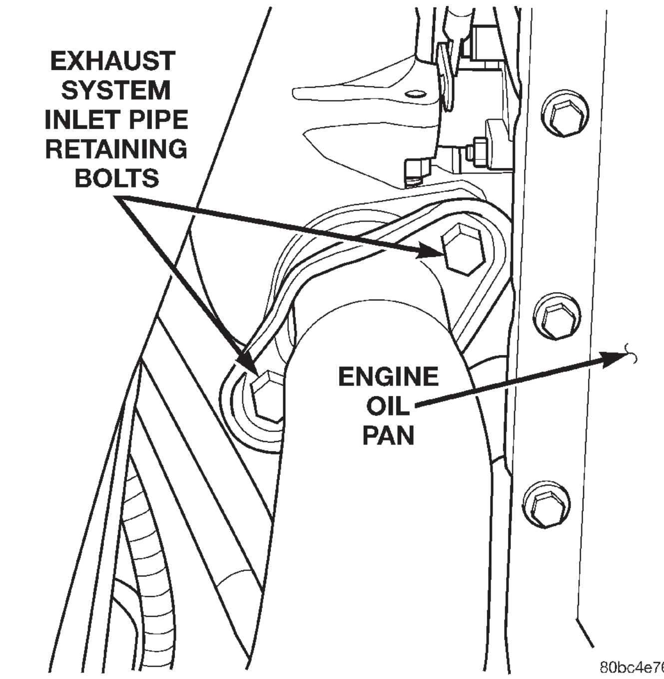


Fig. 36 Exhaust System Inlet Pipe Retaining Bolts

(4) Remove the exhaust system inlet pipe retaining bolts (Fig. 36).

(5) Disconnect the turbocharger oil return hose from the turbocharger.

(6) Lower the vehicle on the hoist.

(7) Remove the intercooler inlet hose from the vehicle (Fig. 37).

(8) Disconnect the breather hose from the fresh air inlet tube (Fig. 37).

(9) Unclip the air filter cover and remove the fresh air inlet tube from the turbocharger (Fig. 37). Remove the assembly from the vehicle.

(10) Remove the EGR vacuum supply hose from the EGR valve (Fig. 38).

(11) Disconnect the heater core coolant supply lines from the engine assembly (Fig. 38).

(12) Unclip the wire harness from the coolant supply lines (Fig. 38).

(13) Remove the (2) EGR valve / coolant supply line retaining bolts (Fig. 38).

(14) Remove the coolant supply line support bracket bolt from the water pump housing.

REMOVAL AND INSTALLATION (Continued)

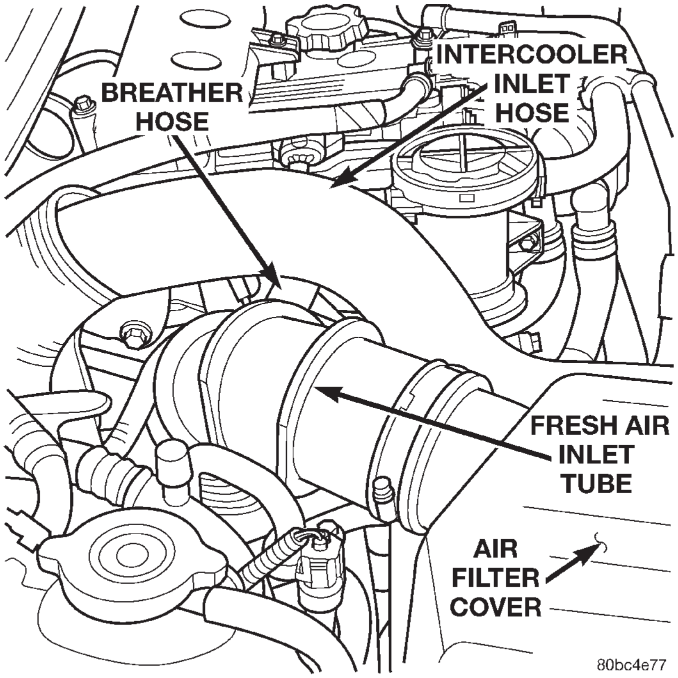


Fig. 37 Air Intake Hoses

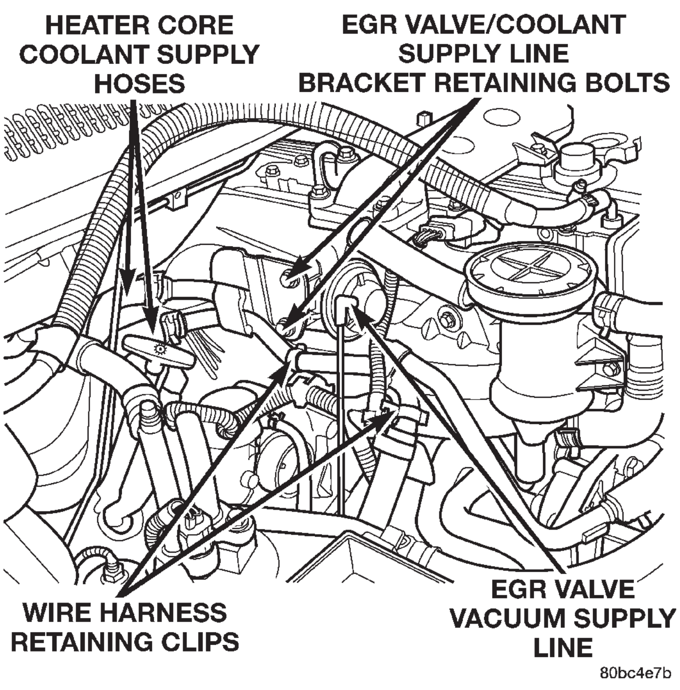


Fig. 38 3.1 L Diesel Engine

(15) Disconnect the two remaining hoses and remove the coolant lines from the vehicle.

(16) Remove the oil separator retaining bolts.

(17) Disconnect the crankcase vapor supply and return hoses and remove the oil separator from the vehicle.

(18) Remove the transmission dipstick tube support bracket nut from the turbocharger heatshield (Fig. 39).

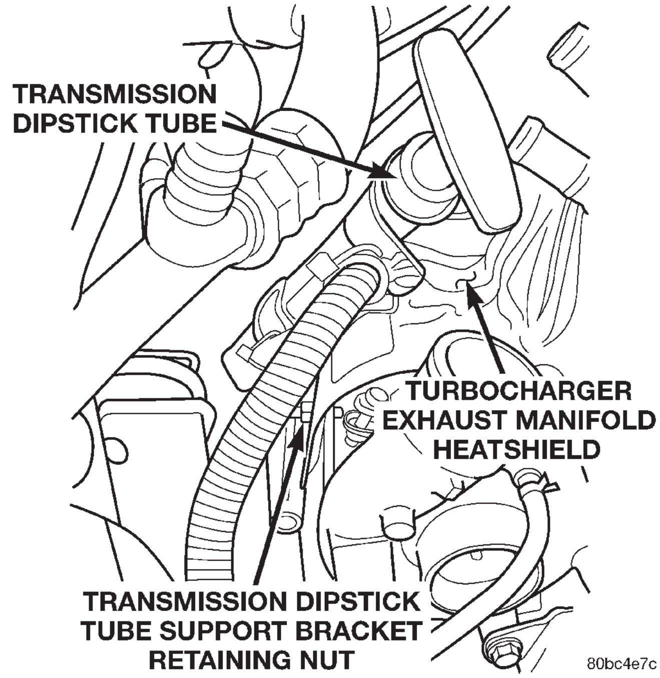


Fig. 39 Transmission Dipstick Tube Support Bracket

WARNING: Heatshield is very sharp. Wear gloves to prevent injury.

(19) Remove the exhaust manifold / turbocharger heatshield retaining bolts and remove the heatshield from the vehicle.

(20) Pull back the EGR tube heatshield to access and remove the EGR tube nut from the exhaust manifold. Remove the EGR valve and tube assembly from the vehicle.

(21) Remove the oil pressure supply line bango bolt from the turbocharger.

(22) Position a drain pan under the transmission.

(23) Remove the transmission dipstick tube from the transmission oil pan by pulling straight up. Position the tube assembly out of the way to allow for manifold / turbocharger removal.

(24) Remove the (10) exhaust manifold retaining nuts and remove the manifold and turbocharger assembly from the vehicle.

NOTE: If only servicing the intake manifold the following two steps are not required.

(25) Place the assembly in a vice.

(26) Remove the (4) turbocharger to exhaust manifold retaining nuts and separate.

(27) Remove the (4) intake air duct retaining bolts from the intake manifold.

(28) Remove the remaining bolts from the intake air duct and position the duct and hose assembly out of the way.

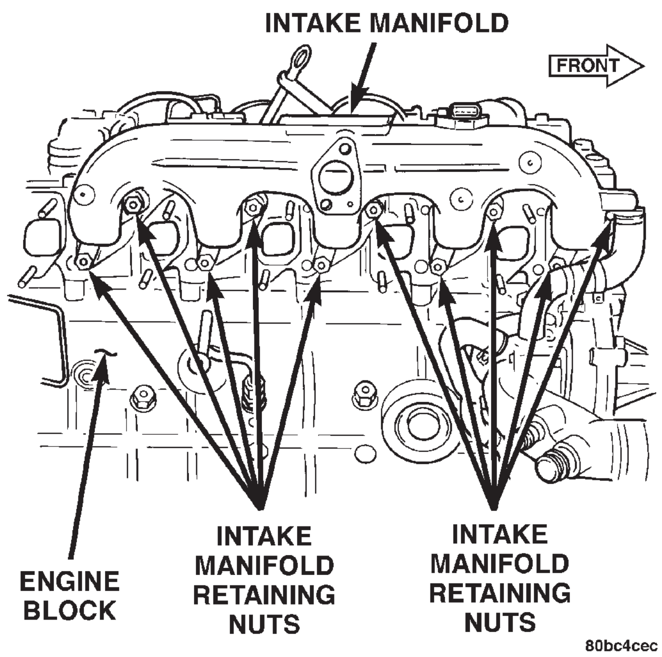


Fig. 40 Intake Manifold Retaining Nuts

(29) Remove the (10) intake manifold retaining bolts and remove the intake manifold from the vehicle (Fig. 40).

(30) Remove the intake/exhaust manifold gasket from the manifolds mounting studs.

CLEANING

All old gaskets should be inspected for any tears or signs of prior leakage. If any gaskets show such indications, they should be replaced with new gaskets. All gasket mating surfaces must be cleaned of old gasket material to produce a smooth and dirt/oil free sealing surface for the new gasket.

INSTALLATION

(1) Position the new intake/exhaust manifold gasket on the manifolds mounting studs.

(2) Install the intake manifold and install the (10) retaining nuts (Fig. 40). Torque the nuts to 32 N·m (23 ft. lbs.).

(3) Position the new intake air duct gasket.

(4) Install the intake air duct on the engine. Torque the bolts to 32 N·m (23 ft. lbs.).

NOTE: If only servicing the intake manifold the following two steps are not required.

(5) Position the gasket and install the turbo on the exhaust manifold. Torque the nuts to 32 N·m (23 ft. lbs.) (Fig. 41).

(6) Remove the assembly from the vice and position on the exhaust manifold mounting studs.

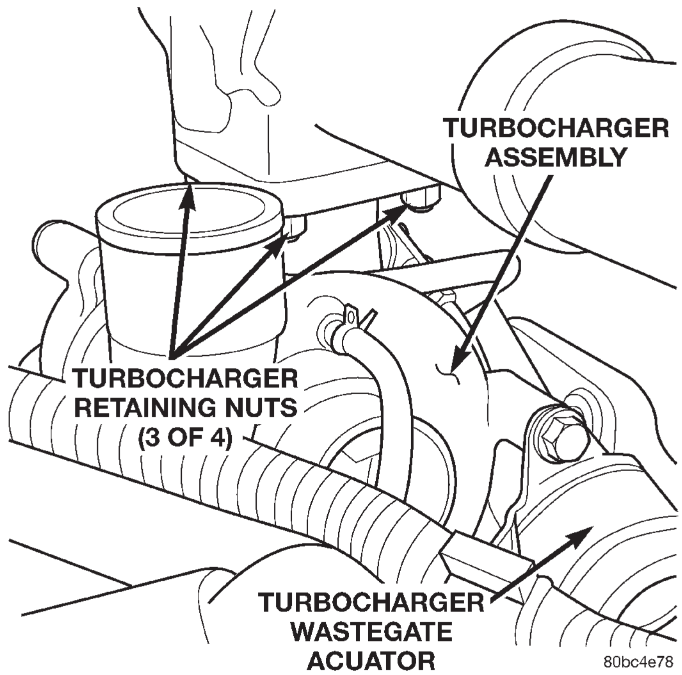


Fig. 41 Turbocharger Retaining Nuts

(7) Install the exhaust manifold retaining nuts and torque to 32 N·m (23 ft. lbs.).

(8) Install the transmission dipstick tube in the transmission case.

(9) Remove the drain pan.

(10) Install the oil pressure supply line on turbocharger. Torque bango bolt fitting to 27 N·m (20 ft. lbs.). Be certain the copper sealing washers are installed. One on the top and bottom of the supply line.

(11) Install the EGR tube nut on the exhaust manifold and temporarily install one of the EGR valve retaining bolts. Be certain the EGR valve gasket is in place.

(12) Torque the EGR tube retaining nut to 34 N·m (25 ft.lbs.). Remove the temporarily installed EGR valve bolt

WARNING: Heatshield is very sharp. Wear gloves to prevent injury.

(13) Install the exhaust manifold heatshield. Torque bolts to 11 N·m (97 in. lbs.).

(14) Install the transmission dipstick tube support bracket retaining nut on the turbocharger heatshield (Fig. 42). Torque the nut to 20 N·m (177 in. lbs.).

(15) Install the front (front of engine) heater core coolant supply hoses on the coolant line assembly and install the line assembly on the engine. Torque the (3) retaining bolts to 27 N·m (20 ft. lbs.) (Fig. 43).

(16) Connect the crankcase vapor supply and return hoses on the oil separator.

(17) Install the oil separator retaining bolts.

REMOVAL AND INSTALLATION (Continued)

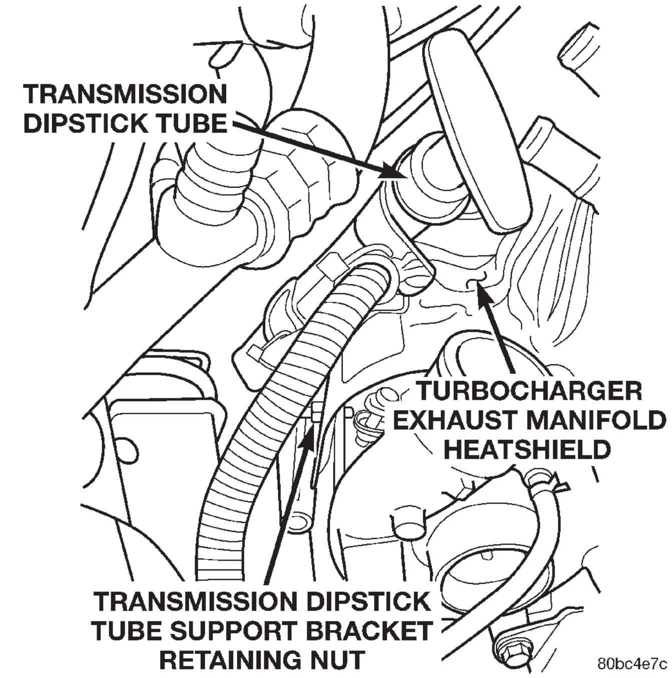


Fig. 42 Transmission Dipstick Tube Support Bracket

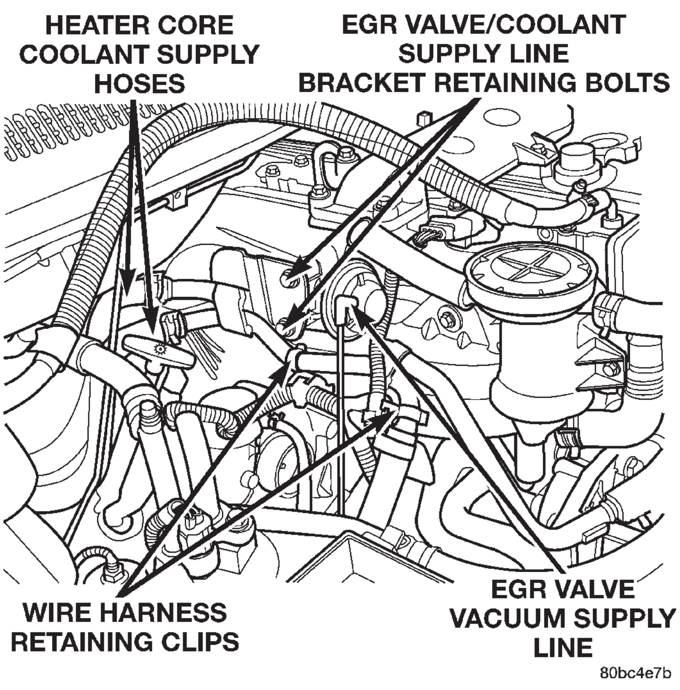


Fig. 43 3.1L Diesel Engine

(18) Install the heater core coolant supply hoses on the coolant line assembly (Fig. 43).

(19) Clip the wire harness on the coolant supply lines (Fig. 43).

(20) Install the EGR vacuum supply hose on the EGR valve.

(21) Install the fresh air inlet tube assembly on the turbocharger. Clip the air filter cover in position and connect the breather hose (Fig. 44).

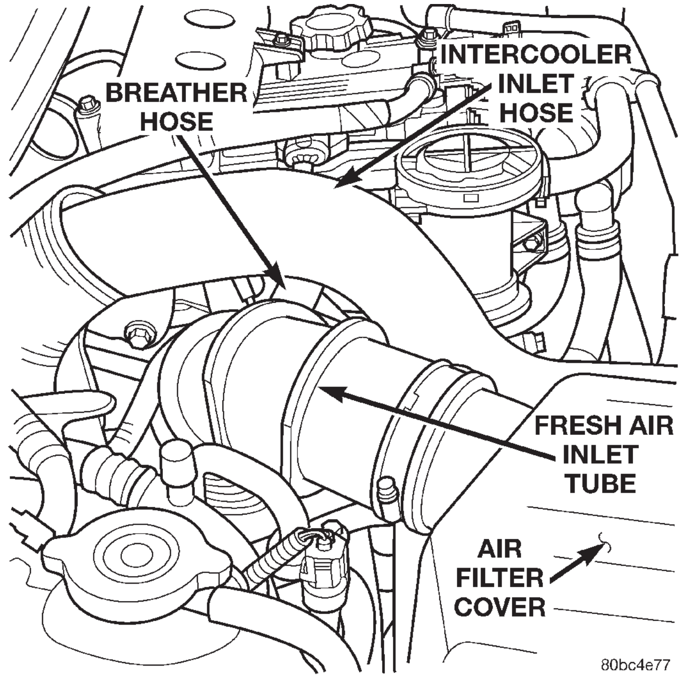


Fig. 44 Air Intake Hoses

(22) Install the intercooler inlet hose on the vehicle (Fig. 44).

(23) Raise the vehicle on the hoist.

(24) Install the turbocharger oil return hose on the turbocharger.

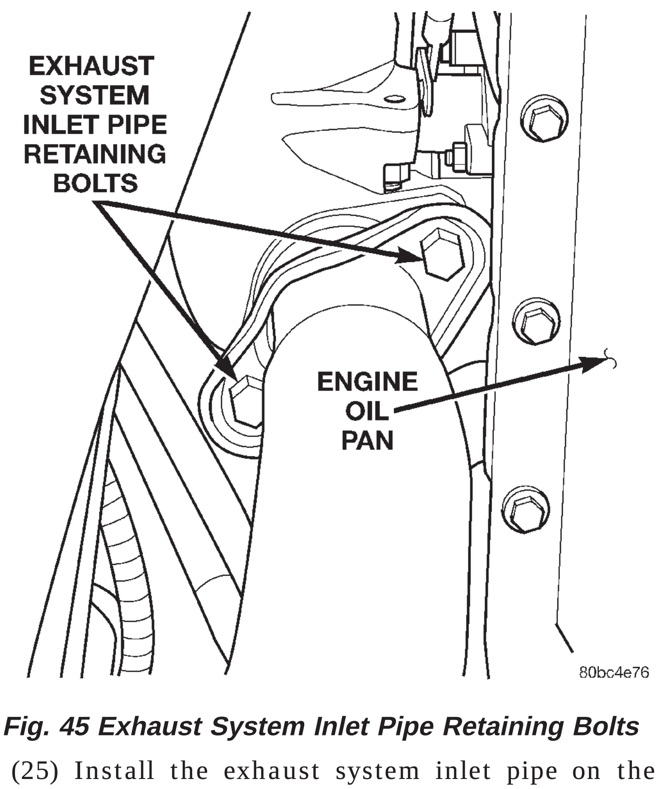


Fig. 45 Exhaust System Inlet Pipe Retaining Bolts

(25) Install the exhaust system inlet pipe on the turbocharger (Fig. 45). Torque the bolts to 22 N·m (194 in. lbs.).

(26) Lower the vehicle on the hoist.

REMOVAL AND INSTALLATION (Continued)

(27) Fill the cooling system. Refer to Group 7, Cooling System for procedure.

(28) Check the transmission fluid level and top off if necessary.

(29) Connect the negative battery cable.

(30) Start the engine and check for leaks.

CYLINDER HEAD COVER

REMOVAL

(1) Disconnect the negative battery cable.

(2) Recover the refrigerant system. Refer to Group 24, Heating and Air Conditioning for the procedure.

(3) Raise the vehicle on the hoist.

(4) Remove the front splash shield.

(5) Remove the low pressure refrigerant line retaining bolt and remove the line from the compressor. Cover both openings.

(6) Remove the left engine mount throughbolt nut. Do not remove the bolt at this time.

(7) Lower the vehicle on the hoist.

(8) Remove the intake manifold elbow inlet hose (Fig. 46).

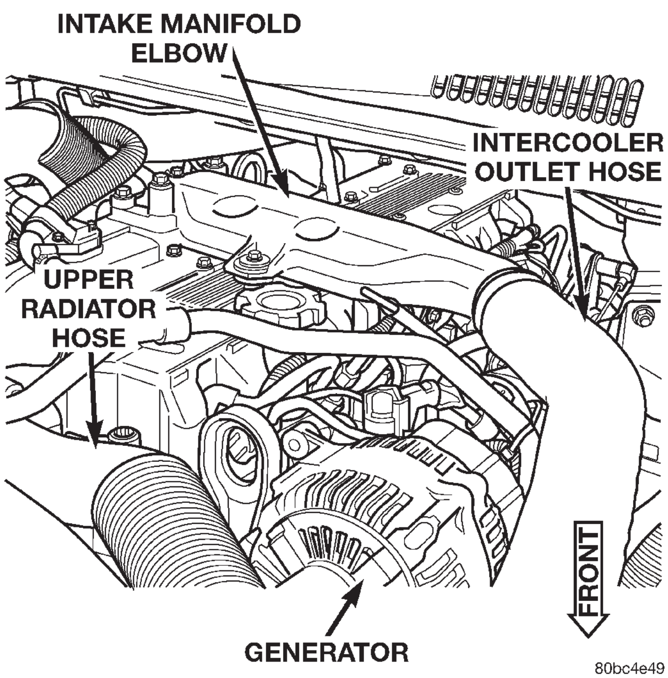


Fig. 46 Intake Manifold Elbow

(9) Remove the intake manifold elbow (Fig. 46).

(10) Remove the refrigerant line support bracket retaining bolt from the cylinder head cover and position the refrigerant line out of the way.

(11) Disconnect the (5) glow plug electrical connectors and position the wire harness out of the way.

(12) Remove the Crankcase breather hose from the front of the cylinder head cover.

(13) Remove the cylinder head cover retaining bolts (Fig. 47).

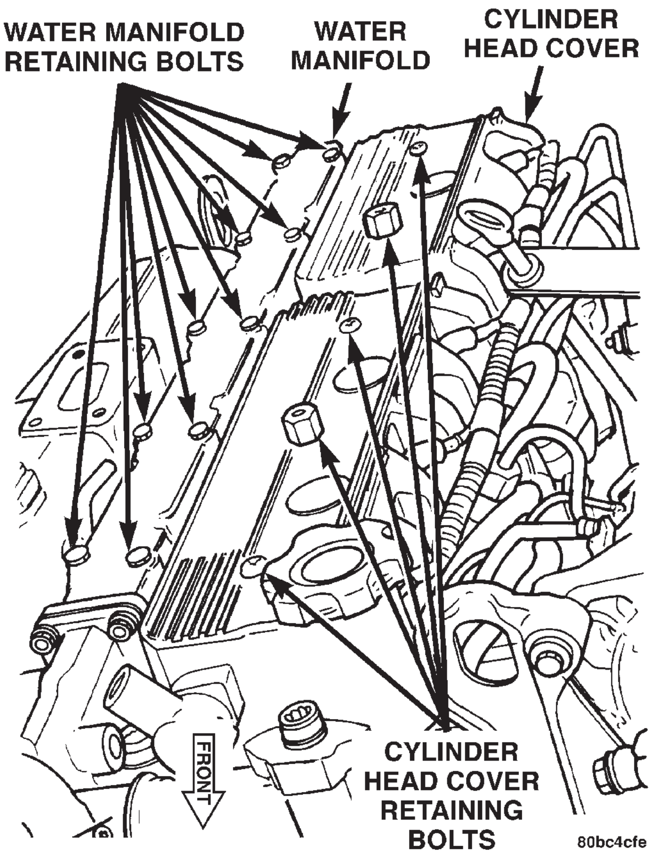


Fig. 47 Cylinder Head Cover

(14) Remove the fuel filter / water separator retaining nuts and position the filter assembly out of the way.

(15) Position a jack under the oil pan. Make sure to place a piece of wood between the jack and the oil pan.

(16) **Slightly,** raise the weight off of the left engine mount until the left engine mount throughbolt can be removed.

(17) Using the jack, lower the engine assembly until the cylinder head cover can be removed from the vehicle.

INSTALLATION

(1) Install the cylinder head cover and gasket. Torque the bolts to 15 N·m (133 in. lbs.) (Fig. 48).

(2) Using the jack, raise the engine assembly until the left engine mount throughbolt can be installed.

(3) Remove the jack and install the fuel filter / water separator.

(4) Connect the crankcase breather hose to front of cylinder head cover.

(5) Connect the (5) glow plug electrical connectors (Fig. 48).

(6) Position the refrigerant line and install the retaining bolt.

(7) Install the intake manifold elbow (Fig. 49).

REMOVAL AND INSTALLATION (Continued)

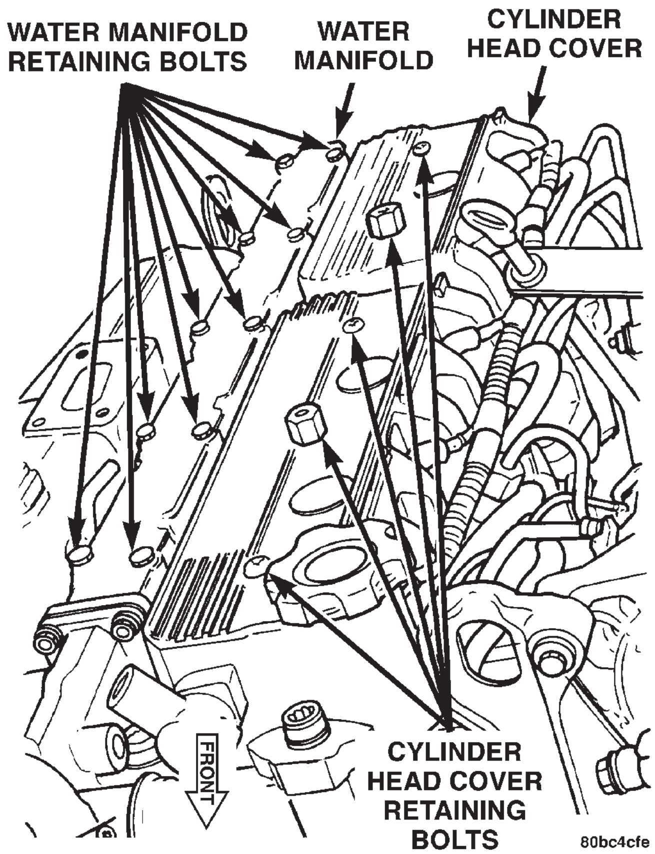


Fig. 48 Cylinder Head Cover

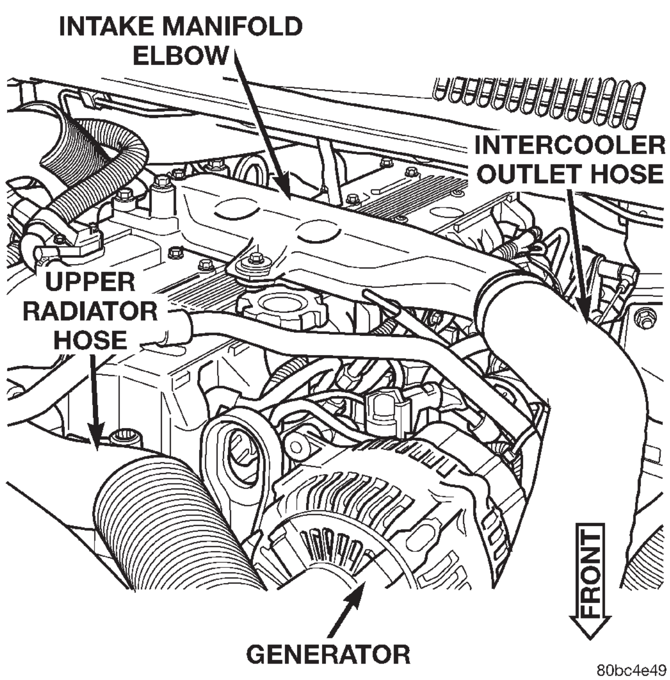


Fig. 49 Intake Manifold Elbow

(8) Install the intake manifold elbow inlet hose (Fig. 49).

(9) Raise the vehicle on the hoist.

(10) Install the left engine mount throughbolt nut. Torque the nut to 61 N·m (45 ft. lbs.).

(11) Install the low pressure refrigerant line and retaining bolt. Torque the bolt to 28 N·m (21 ft. lbs.). Be certain the sealing o-ring is well lubricated and free of tears.

(12) Install the front splash shield.

(13) Lower the vehicle on the hoist.

(14) Connect the negative battery cable.

(15) Evacuate and charge the refrigerant system. Refer to Group 24, Heater and Air Conditioning for the procedure.

(16) Start the engine and 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.

HYDRAULIC TAPPETS

REMOVAL

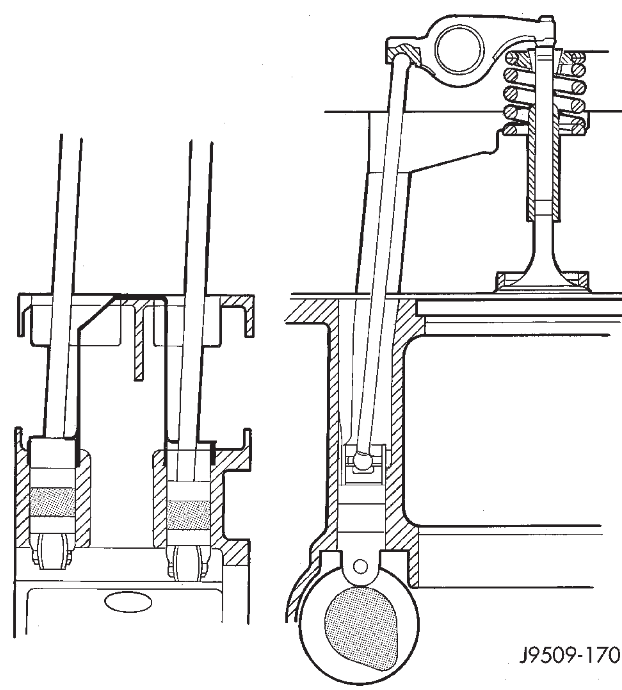


Fig. 50 Tappet And Rocker Arm Assembly

(1) Disconnect the negative battery cable.

(2) Discharge the air conditioning system. Refer to Group 24, Heating and Air Conditioning for procedure.

(3) Remove the A/C lines at the compressor and cap.

(4) Remove the A/C line bracket attached to the cylinder head cover and move the lines away from the cylinder head.

REMOVAL AND INSTALLATION (Continued)

(5) Remove cylinder head cover. Refer to cylinder head cover removal and installation procedure in this section.

(6) Remove the rocker assemblies and push rods. Refer to rocker arms and push rod removal and installation procedure in this section. Identify push rods to ensure installation in original location.

(7) Remove cylinder head, intake manifold, and exhaust manifold. Refer to cylinder head removal and installation in this section.

(8) Remove the tappet retainers (Fig. 51).

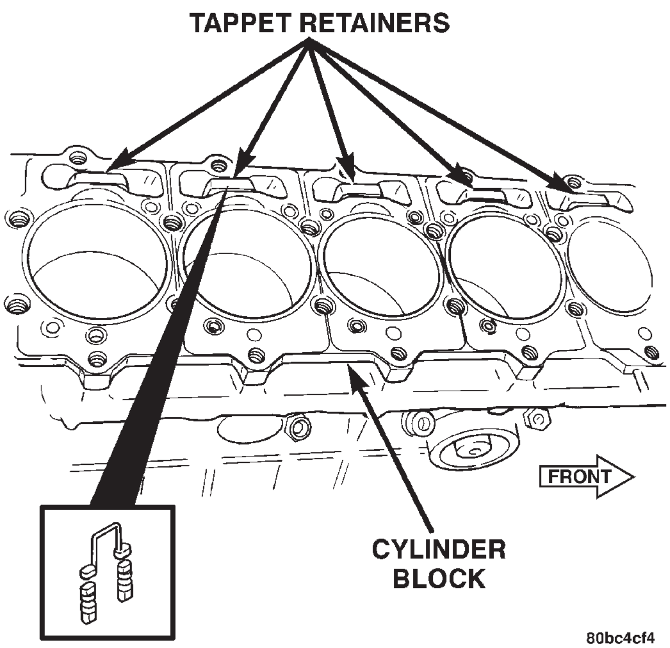


Fig. 51 Tappet And Retainer

(9) Slide Hydraulic Tappet Remover/Installer Tool through opening in block and seat tool firmly in the head of tappet.

(10) Pull the tappet out of the bore with a twisting motion. If all tappets are to be removed, identify tappets to ensure installation in original location.

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.

INSTALLATION

(1) Lubricate the tappets.

(2) Install the tappets and retainers 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 the cylinder head, intake manifold, and exhaust manifold. Refer to cylinder head removal and installation in this section.

(4) Install the push rods.

(5) Install the rocker arms. Refer to rocker arms and push rod removal and installation in this section.

(6) Install the cylinder head cover. Refer to cylinder head cover removal and installation in this section.

(7) Connect the negative battery cable.

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.

(8) Start and operate engine. Warm up to normal operating temperature.

ROCKER ARMS AND PUSH RODS

REMOVAL

(1) Disconnect the negative battery cable.

(2) Discharge the air conditioning system. Refer to Group 24, Heating and Air Conditioning for procedure.

(3) Remove the service valves and cap the compressor ports. Refer to Group 24, Heating and Air Conditioning.

(4) Remove the cylinder head cover. Refer to cylinder head cover removal and installation in this section.

(5) Remove the rocker arm retaining nut (Fig. 52) (Fig. 53).

(6) Remove the rocker assembly. Place them on a bench in the same order as removed.

(7) Remove the push rods and place them on a bench in the same order as removed.

INSTALLATION

(1) Rotate the crankshaft until the mark lines up with the TDC mark on the timing cover.

(2) Install the push rods in the same order as removed.

WARNING: During the installation of the rocker arm assemblies it is possible to cause valve interference between the piston and valve if the piston is near Top Dead Center (TDC). This is due to the slow bleed down rate of the tappets when adjusting the rocker arm assemblies. Follow the procedure below to ensure that engine damage does not occur.

- Install the rocker arm assemblies in the same order as removed.
- Bring piston # 1 to Top Dead Center.

REMOVAL AND INSTALLATION (Continued)

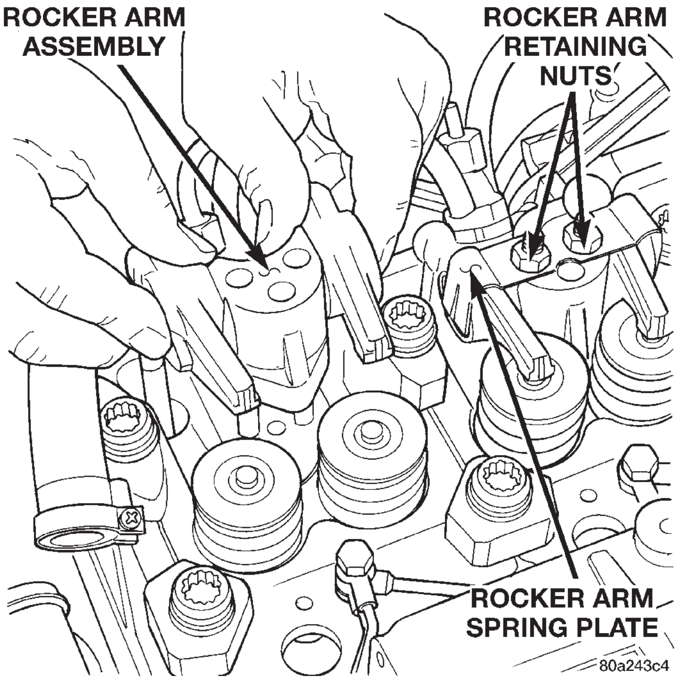


Fig. 52 Rocker Arm Retaining Nut

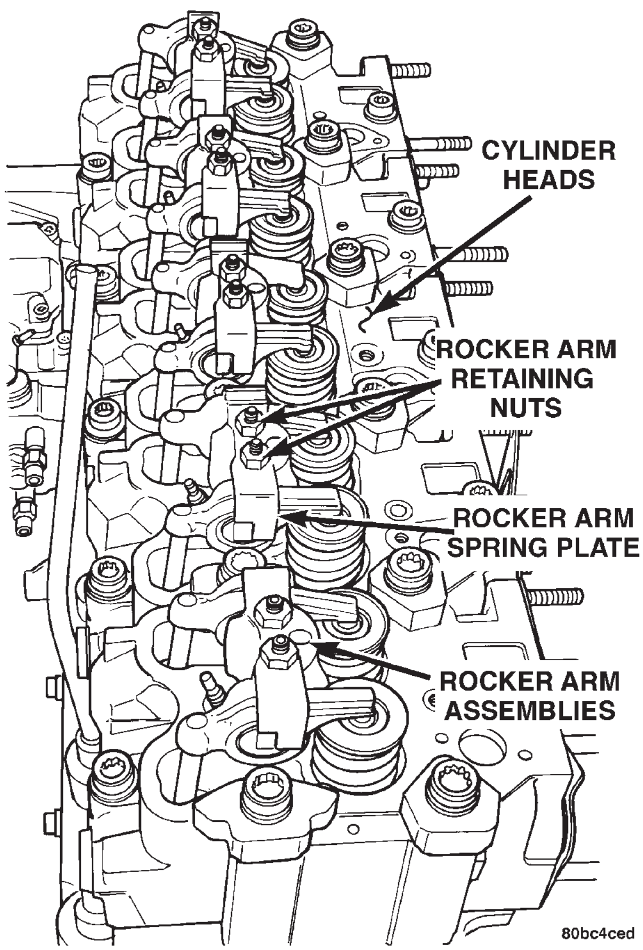


Fig. 53 Rocker Arm Assemblies

- At this point tighten the rocker arm nuts for cylinder # 2–3–4–5. Torque nuts to 27 N·m (20 ft. lbs.).
- Slowly rotate the crankshaft 90° clockwise or counterclockwise, then tighten the rocker arm nuts for cylinder # 1. Torque nuts to 27 N·m (20 ft. lbs.).

(4) Install the cylinder head cover. Refer to cylinder head cover removal and installation in this group.

(5) Evacuate and charge the air conditioning system. Refer to Group 24, Heater and Air Conditioning.

(6) Connect the negative battery cable.

VALVE SPRINGS

This procedure can be done with the engine cylinder head installed on the block. 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.

REMOVAL

(1) Disconnect the negative battery cable.

(2) Remove the cylinder head cover. Refer to cylinder head cover removal and installation in this section.

(3) Remove the rocker arms assemblies and push rods. Refer to rocker arm and push rod removal and installation in this section. Retain the push rods, and rocker arms assemblies in the same order and position as removed.

(4) Inspect the springs and retainer for cracks and possible signs of weakening.

(5) Install an air hose adaptor in the fuel injector hole.

(6) 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.

(7) Tap the retainer or tip with a rawhide hammer to loosen the lock from the retainer. Use Valve Spring Compressor Tool to compress the spring and remove the locks.

(8) Remove the valve spring and retainer.

(9) Inspect the valve stems, especially the grooves. An Arkansas smooth stone should be used to remove nicks and high spots.

INSTALLATION

(1) Install the valve spring and retainer.

(2) Compress the valve spring with Valve Spring Compressor Tool 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.

(3) Disconnect the air hose. Remove the adaptor from the fuel injector hole and install the fuel injector.

REMOVAL AND INSTALLATION (Continued)

(4) Repeat the procedures for each remaining valve spring to be removed.

(5) Install the push rods. Ensure the bottom end of each rod is centered in the plunger cap seat of the hydraulic valve tappet.

WARNING: During the installation of the rocker arm assemblies it is possible to cause valve interference between the piston and valve if the piston is near Top Dead Center (TDC). This is due to the slow bleed down rate of the tappets when adjusting the rocker arm assemblies. Follow the procedure below to ensure that engine damage does not occur.

- Install the rocker arm assemblies in the same order as removed.
- Bring piston # 1 to Top Dead Center.
- At this point tighten the rocker arm nuts for cylinder # 2–3–4–5. Torque nuts to 27 N·m (20 ft. lbs.).
- Slowly rotate the crankshaft 90° clockwise or counterclockwise, then tighten the rocker arm nuts for cylinder # 1. Torque nuts to 27 N·m (20 ft. lbs.).

(7) Install the cylinder head cover. Refer to cylinder head cover removal and installation in this section.

(8) Connect the negative battery cable.

ENGINE CYLINDER HEAD

REMOVAL

(1) Disconnect the negative battery cable.

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 cooling system. Refer to Group 7, Cooling System for procedure.

(3) Discharge the air conditioning system. Refer to Group 24, Heating and Air Conditioning for procedure.

(4) Remove the A/C lines at the compressor and cap. Refer to Group 24, Heating and Air Conditioning.

(5) Remove A/C line bracket attached to cylinder head cover, and move A/C lines away from cylinder head.

(6) Remove the intake manifold elbow air inlet hose (Fig. 54).

(7) Remove the intake manifold elbow (Fig. 54).

(8) Remove the air cleaner hose from turbocharger and breather hose.

(9) Remove the upper radiator hose and coolant recovery hose.

(10) Remove the water manifold (Fig. 55).

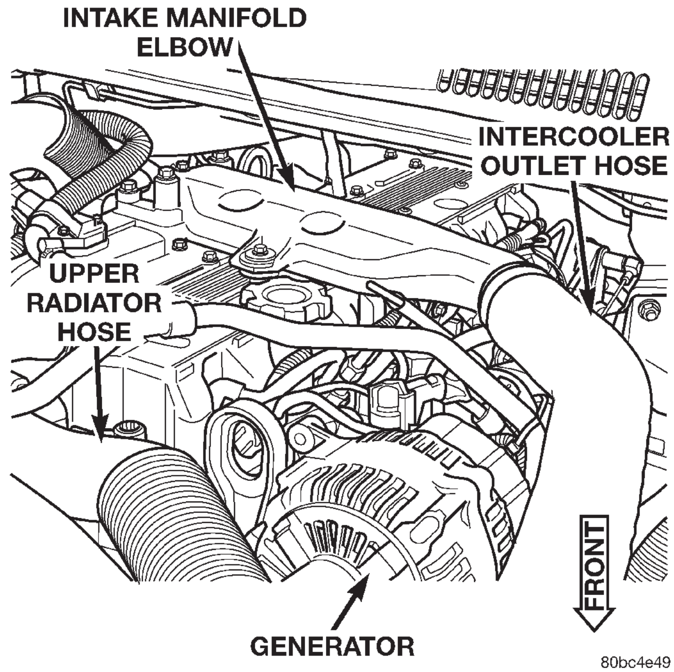


Fig. 54 Intake Manifold Elbow

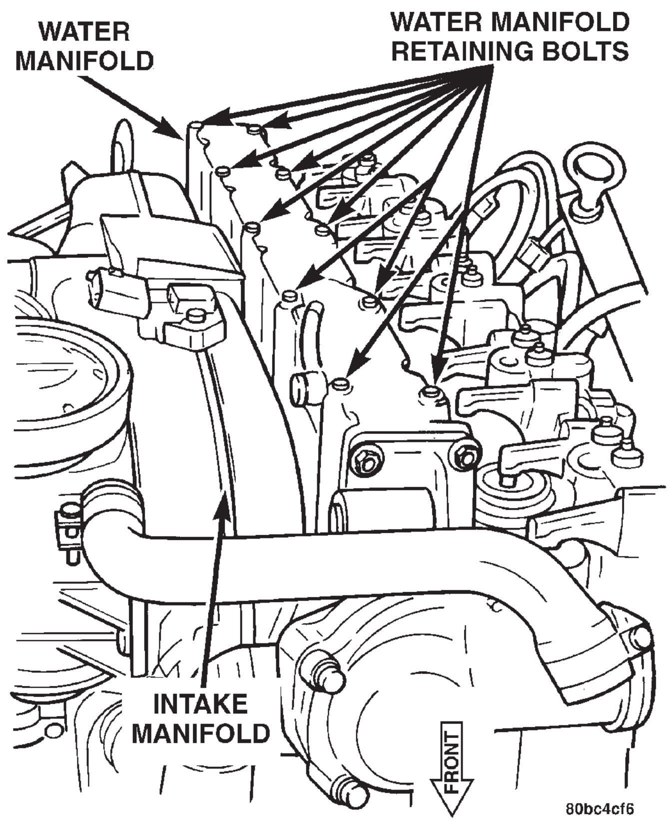


Fig. 55 Water Manifold

(11) Disconnect the heater hoses (Fig. 56).

(12) Remove the EGR valve/heater core supply line retaining bolts

(13) Remove the heater core supply lines

REMOVAL AND INSTALLATION (Continued)

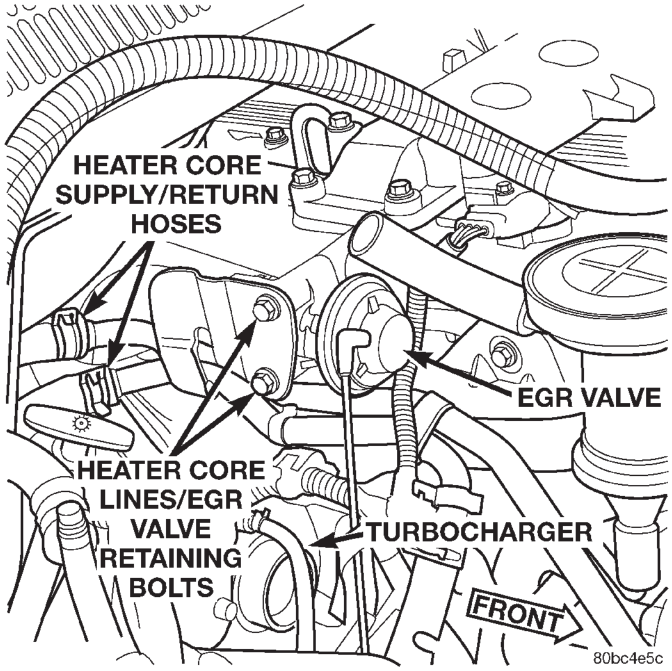


Fig. 56 Heater Hoses

(14) Remove the exhaust manifold/turbocharger heat shield (Fig. 57).

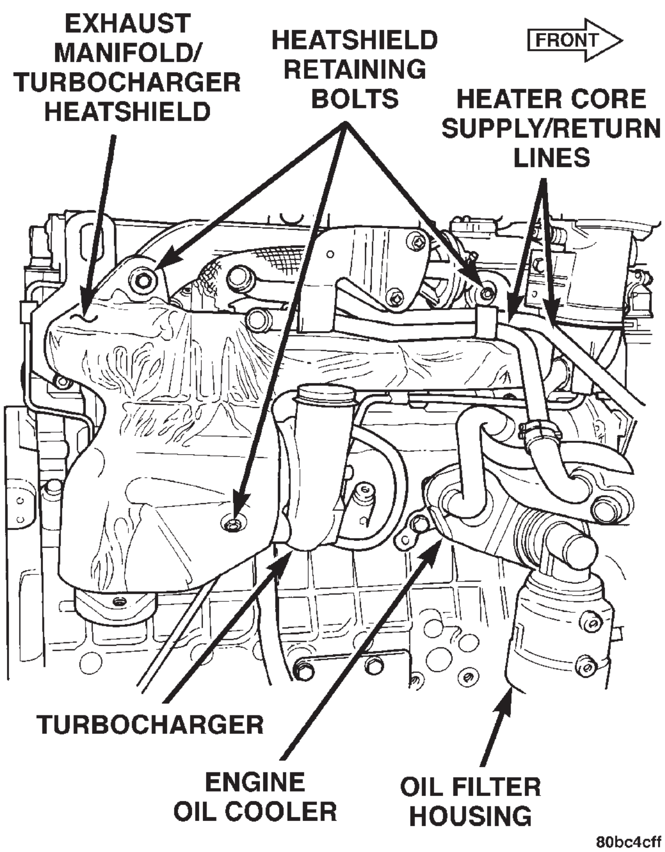


Fig. 57 Exhaust Manifold/Turbocharger Heat Shield

(15) Disconnect the oil feed line from turbocharger.

(16) Disconnect the oil return line from turbocharger (Fig. 58).

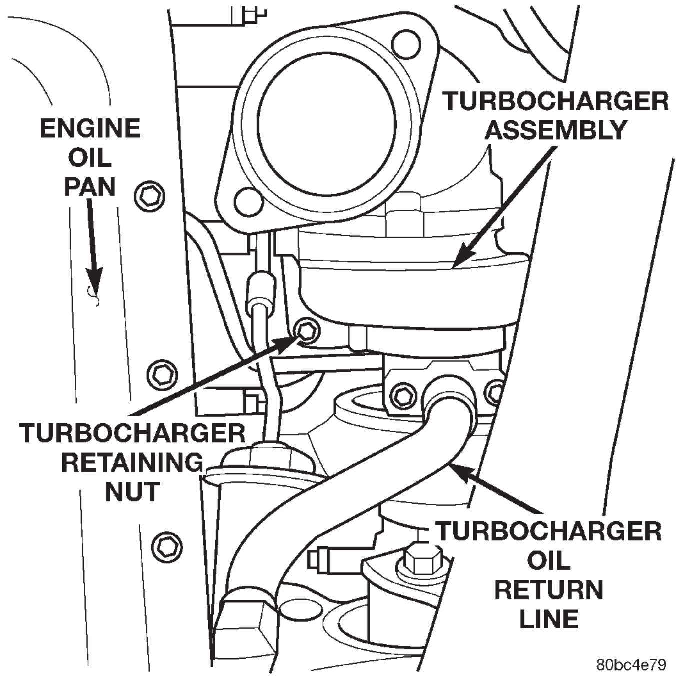


Fig. 58 Oil Return Line

(17) Raise vehicle on hoist.

(18) Disconnect the exhaust pipe at the turbocharger.

(19) Remove the Exhaust manifold and turbocharger. Refer to Group 11, Exhaust System and Turbocharger.

(20) Disconnect the boost pressure sensor electrical connector.

(21) Remove the Intake manifold. Refer to intake manifold removal and installation procedure in this section.

(22) Remove the oil feed line support bracket at rear of the cylinder head (Fig. 59).

(23) Remove the oil feed line for rocker arm assemblies (Fig. 60).

(24) Remove the Crankcase breather hose from front of the valve cover

(25) Remove the injector sensor wire and the glow plug hot lead .

(26) Remove the fuel injector supply lines from injectors.

(27) Remove the fuel injectors with tool VM.1012 (Fig. 61). Refer to Group 14, Fuel System for procedure.

(28) Remove the cylinder head cover. Refer to cylinder head cover removal and installation procedure in this section.

REMOVAL AND INSTALLATION (Continued)

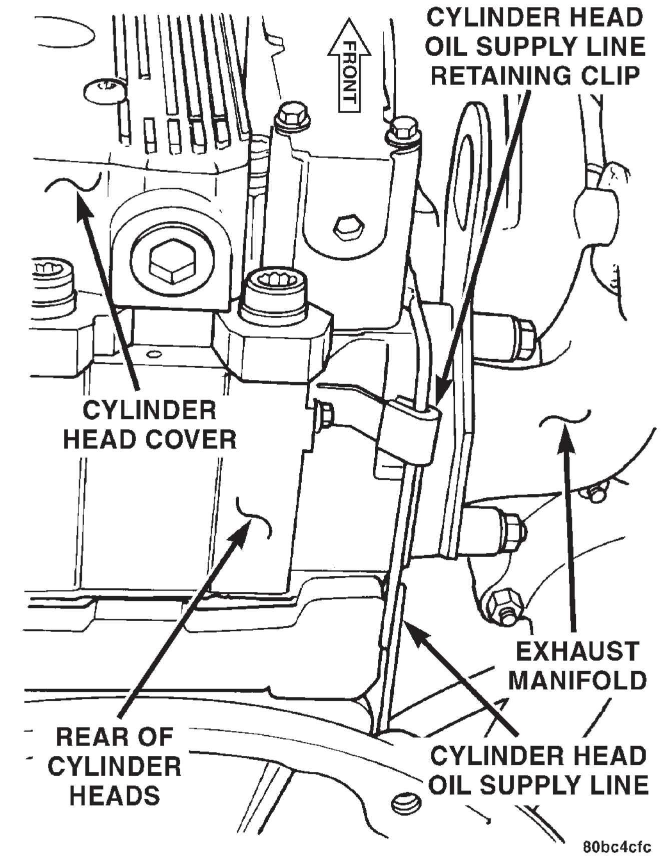


Fig. 59 Cylinder Head Oil Supply Line Retaining Clip

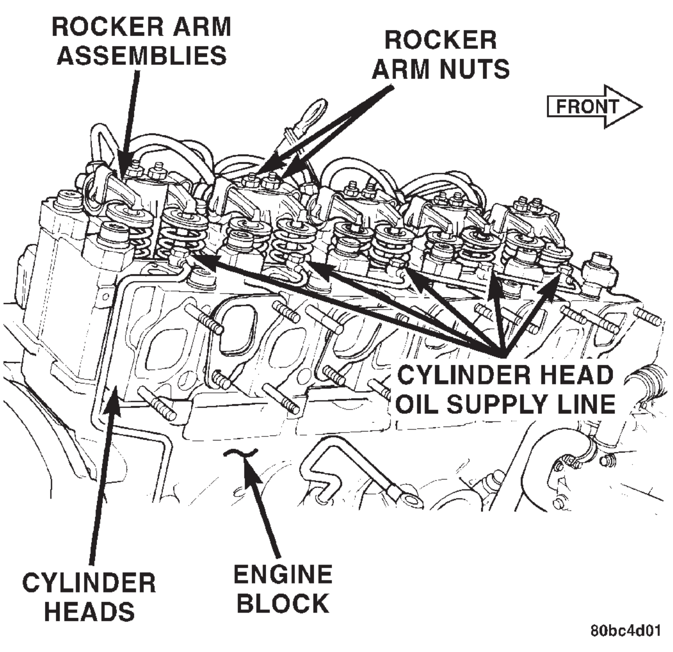


Fig. 60 Rocker Arm Oil Feed Lines

(29) Remove the rocker retaining nuts (Fig. 63) (Fig. 64).

(30) Remove the rocker arm assemblies. Place them on a bench in the same order as removed.

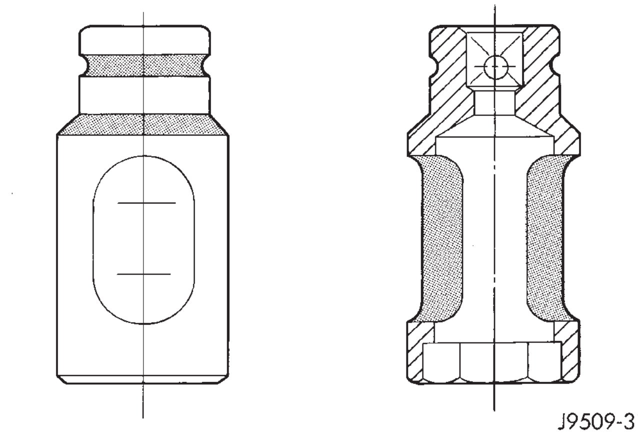


Fig. 61 Fuel Injector Tool VM.1012

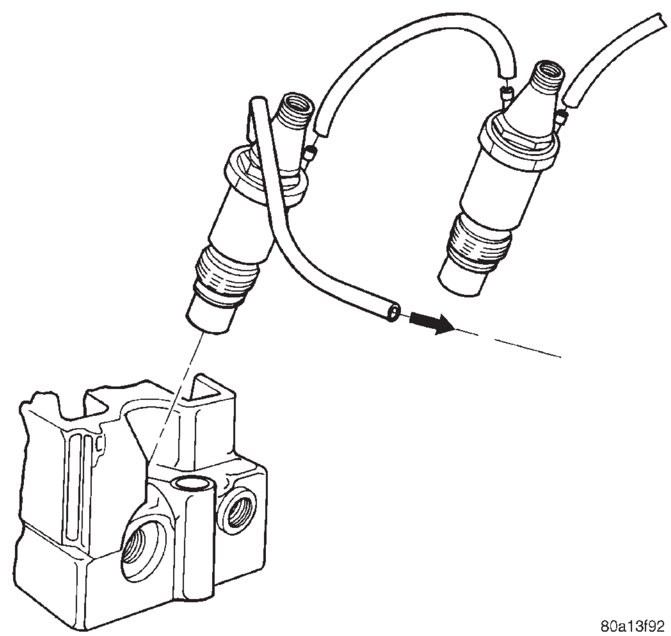


Fig. 62 Fuel Injector

(31) Remove the push rods and place them on a bench in the same order as removed.

(32) Mark the cylinder head positions.

(33) Remove the engine cylinder head bolts with special tool VM.1018 and VM.1019.

(34) Remove the engine cylinder head and gasket .

(35) Stuff clean lint free shop towels into the cylinder bores.

CYLINDER HEAD GASKETS

A one piece steel cylinder head gasket is used for all five cylinder heads.

Cylinder head gaskets are available in three thicknesses. Identification holes or notches in the right front corner of the gasket indicate the thickness of the gasket (Fig. 65).

REMOVAL AND INSTALLATION (Continued)

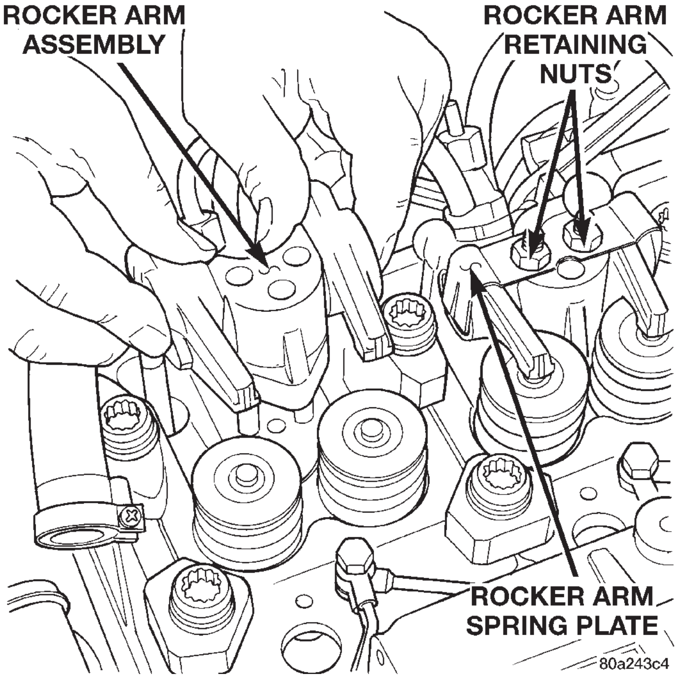


Fig. 63 Rocker Arm Retaining Nuts

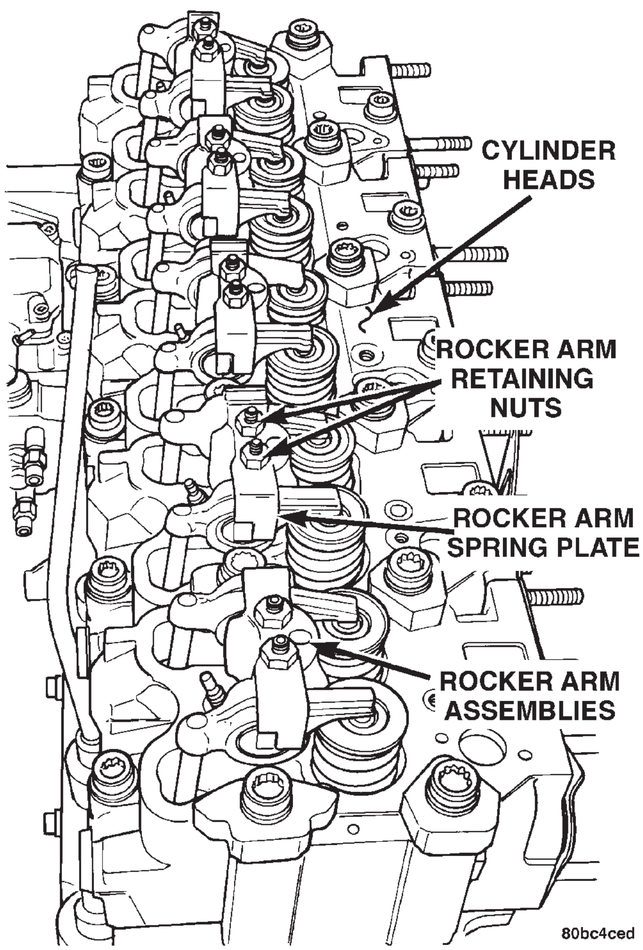
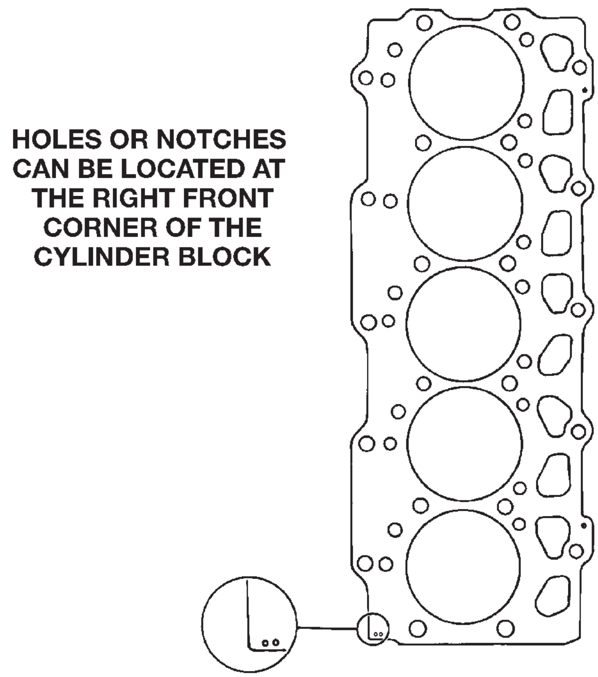


Fig. 64 Rocker Arm Assemblies



HOW TO IDENTIFY GASKET THICKNESS	
NO HOLES OR NOTCHES	1.41 mm
2 HOLES OR NOTCHES	1.51 mm
1 HOLE OR NOTCHES	1.61 mm

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Fig. 65 Steel Type Cylinder Head Gasket—identification

CAUTION: Piston protrusion must be measured, to determine cylinder head gasket thickness, if one or more cylinder wall liners have been replaced.

NOTE: If cylinder wall liners have not been removed; the same thickness head gasket removed, may be used.

MEASURING PISTON PROTRUSION

(1) Use special tool VM.1010 with dial indicator special tool VM.1013 (Fig. 66).

(2) Bring the piston of cylinder no. 1 exactly to top dead center.

(3) Zero the dial indicator on the cylinder block mating surface.

(4) Setup the dial indicator on the piston crown (above the center of the piston pin) 5mm (1/8 in.) from the edge of the piston and note the measurement (Fig. 67).

(5) Repeat the procedure with the rest of the cylinders.

(6) Establish the thickness of the steel gasket for all four cylinder heads on the basis of the greatest piston protrusion (Fig. 65).

REMOVAL AND INSTALLATION (Continued)

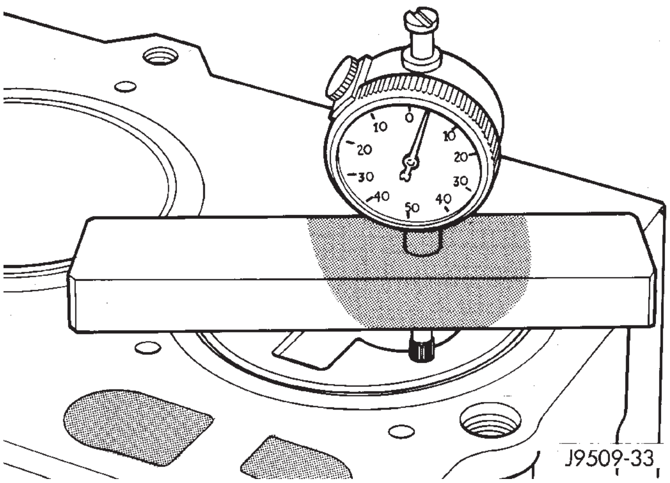

Fig. 66 Measuring Piston Protrusion

Measured dimension (mm)	0.53 - 0.62
Cyl. head gasket thickness (mm)	1.41
Piston clearance (mm)	0.80 - 0.89
Measured dimension (mm)	0.63 - 0.72
Cyl. head gasket thickness (mm)	1.51
Piston clearance (mm)	0.80 - 0.89
Measured dimension (mm)	0.73 - 0.82
Cyl. head gasket thickness (mm)	1.61
Piston clearance (mm)	0.80 - 0.89

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Fig. 67 Piston Protrusion Chart

CAUTION: The cylinder head gasket is to be installed DRY. DO NOT use a gasket sealing compound on the gasket.

INSTALLATION

(1) Remove the shop towels from the cylinder bores. Coat the bores with clean engine oil.

(2) Install cylinder head alignment studs VM.1009.

(3) After determining the correct head gasket thickness, clean the block and head mating surfaces, place the engine cylinder head gasket over the alignment studs.

(4) Place the engine cylinder head over the alignment studs.

CAUTION: New cylinder head bolts must be used.

(5) Tighten the engine cylinder head bolts in sequence according to the following procedure (Fig. 68) :

a. The threads and underside heads of the bolts should be lubricated. Use the cylinder head alignment studs tool number VM-1009. Position the heads on the block and secure with the twelve large center bolts and spacers (clamps), finger tight only.

b. Ensure that the various clamps are installed correctly and the head gasket remains in it's proper position, completely covered. Then, lubricate and install the ten small bolts, also finger tight.

(6) Install the intake and exhaust manifolds with a new gasket, partially tightening the nuts to a maximum of 5 N·m (44 in. lbs.). This will align the heads. Refer to Group 11, Exhaust System and Turbocharger for the proper procedure.

(7) Then, tighten the 14mm bolts with special tool VM.1019 in the following manner:

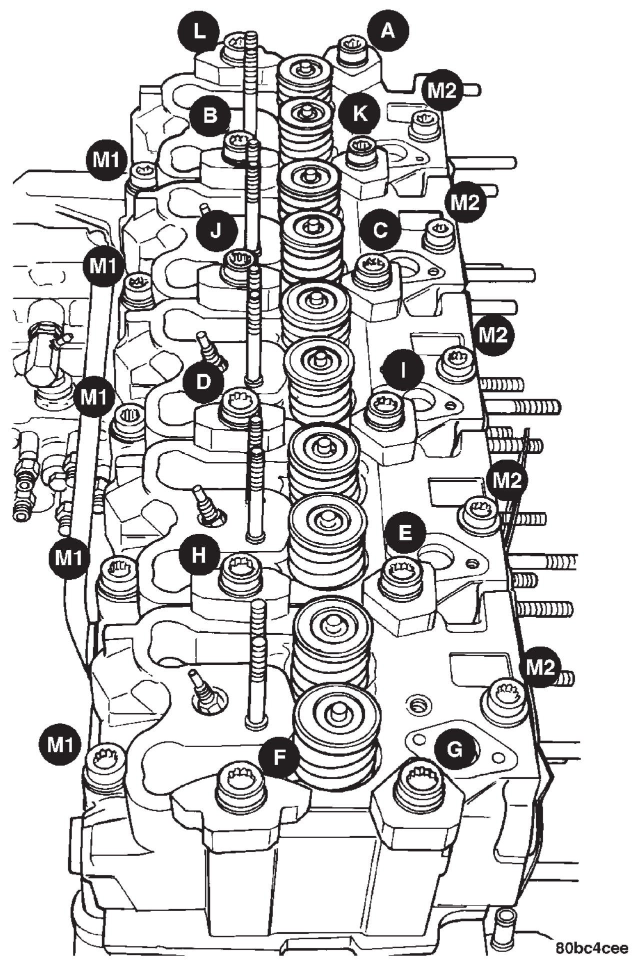

Fig. 68 Engine Cylinder Head Bolt Tightening Sequence

(8) **1st Phase:** Tightening Head Bolts (Fig. 68). Central bolts (A-L): Tighten all bolts, starting with bolt I then J-K-L-A-B-C-D-E-F-G-H, to 30 N·m. Tighten all bolts an additional 70°, starting with bolt A and continuing in alphabetical order. Finally, tighten all bolts an additional 70°, starting again with bolt A and continuing in alphabetical order.

(9) Tighten the 12mm bolts in the following manner:

REMOVAL AND INSTALLATION (Continued)

(10) Side bolts (M1-M2): Tighten M1 bolts to 30 N·m, then rotate them 85° (±5). Tighten M2 bolts to 30 N·m, then rotate them 85° (±5).

NOTE: If vehicle is equipped with A/C do not install A/C lines to compressor and charge A/C till Phase 2 is complete.

(11) **2nd Phase:** After 20 minutes of engine operation at operating temperature, allow engine to cool down completely. Then retorque the head bolts as follows:

(12) Central bolts A-L: Completely back off bolts one-by-one and then retighten to 30 N·m plus 130° (±5°). Then proceed in the same way, bolt by bolt, following alphabetical order, as indicated.

(13) Side bolts M1-M2: **Without slackening** , torque bolts M1 then bolts M2 to 90 N·m (66 ft. lbs.).

(14) Torque intake nuts to 28 N·m (20 ft. lbs.) and exhaust manifolds nuts to 32 N·m (24 ft. lbs.) after completing the cylinder head torquing procedure.

(15) Install the oil feed lines for the rocker arm assemblies. Torque oil feed lines to 13 N·m (115 in. lbs.) (Fig. 69).

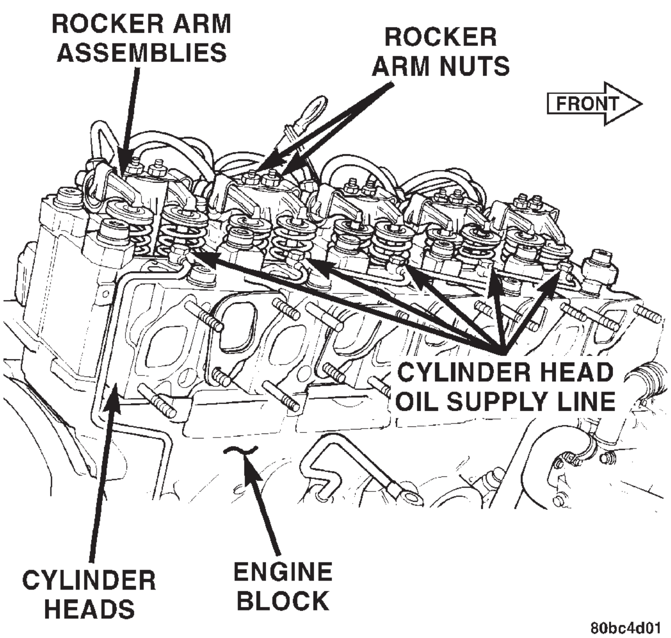

Fig. 69 Oil Feed Lines

(16) Install the oil feed line support bracket at rear of the cylinder head (Fig. 70). Torque bolt to 5.5 N·m (4 ft. lbs.).

(17) Install the push rods. (Fig. 71).

WARNING: During the installation of the rocker arm assemblies it is possible to cause valve interference between the piston and valve if the piston is near Top Dead Center (TDC). This is due to the slow bleed down rate of the tappets when adjusting the rocker arm assemblies. Follow the procedure below to ensure that engine damage does not occur.

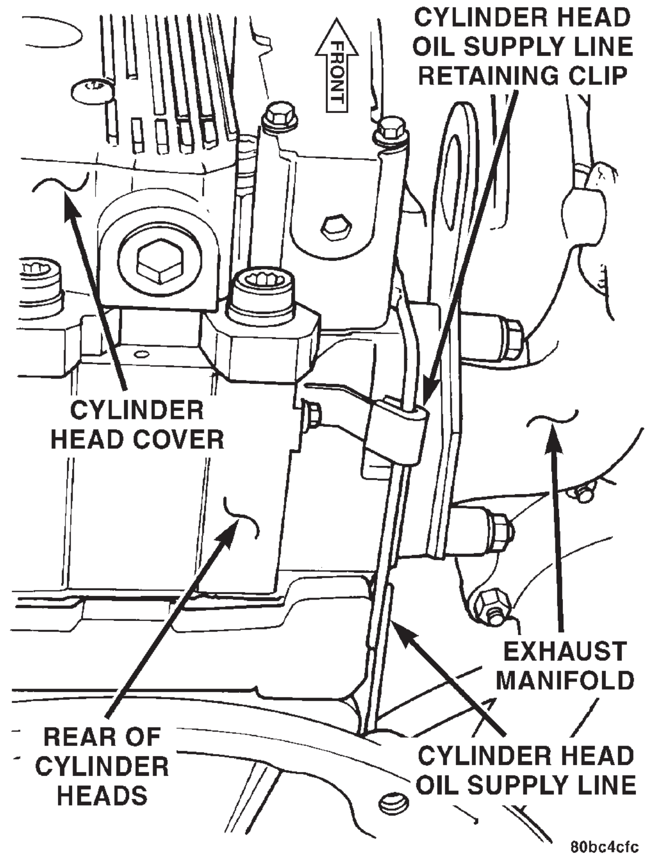

Fig. 70 Cylinder Head Oil Supply Line Retaining Clip

• Install the rocker arm assemblies in the same order as removed (Fig. 71).
• Bring piston # 1 to Top Dead Center.
• At this point tighten the rocker arm nuts for cylinder # 2–3–4–5. Torque nuts to 27 N·m (20 ft. lbs.).
• Slowly rotate the crankshaft 90° clockwise or counterclockwise, then tighten the rocker arm nuts for cylinder # 1. Torque nuts to 27 N·m (20 ft. lbs.).

(19) Install the cylinder head cover. Torque bolts to 15 N·m (133 in. lbs.) (Fig. 72).

(20) Connect the crankcase breather hose to front of cylinder head cover.

(21) Connect the injector sensor wire and the glow plug hot lead.

(22) Install the turbocharger oil feed line. Torque banjo bolts to 27 N·m (20 ft. lbs).

(23) Install the turbocharger oil return line. Torque bolts to 11 N·m (97 in. lbs.) .

(24) Install the water manifold. Torque bolts to 12 N·m (106 in. lbs.).

(25) Raise the vehicle on hoist.

(26) Install the exhaust pipe to turbocharger. Torque bolts to 32 N·m (23 ft. lbs.).

REMOVAL AND INSTALLATION (Continued)

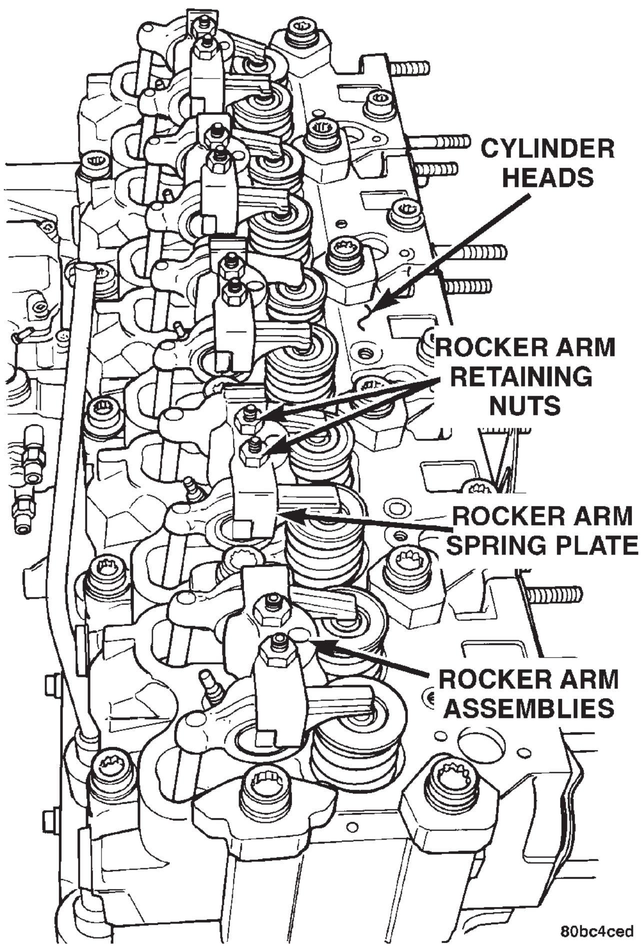

Fig. 71 Rocker Arm Assemblies

(27) Lower vehicle form hoist.

(28) Install the exhaust manifold/turbocharger heat shield. Torque bolts to 11 N·m (8 ft. lbs.).

(29) Install the heater core supply lines.

(30) Install the EGR valve/heater core supply line retaining bolts. Torque bolts to 28 N·m (20 ft. lbs.).

(31) Install the intercooler hose to turbocharger.

(32) Install the air cleaner hose to turbocharger.

(33) Install the oil breather hose to air cleaner hose.

(34) Connect the recover hose to water manifold.

(35) Install the fuel injectors using special tool VM.1012. Refer to Group 14, Fuel System for procedures.

(36) Install the fuel supply lines to injectors. Torque nuts to 19 N·m (14 ft. lbs.).

(37) Connect the A/C lines to compressor and install bracket on cylinder head cover.

(38) Connect the upper radiator hose.

(39) Install the intake manifold elbow and intercooler hose.

(40) Connect the negative cable battery.

(41) Evacuate and charge the air conditioning system. Refer to Group 24, Heater and Air Conditioning.

(42) Fill the cooling system. Check for leaks.

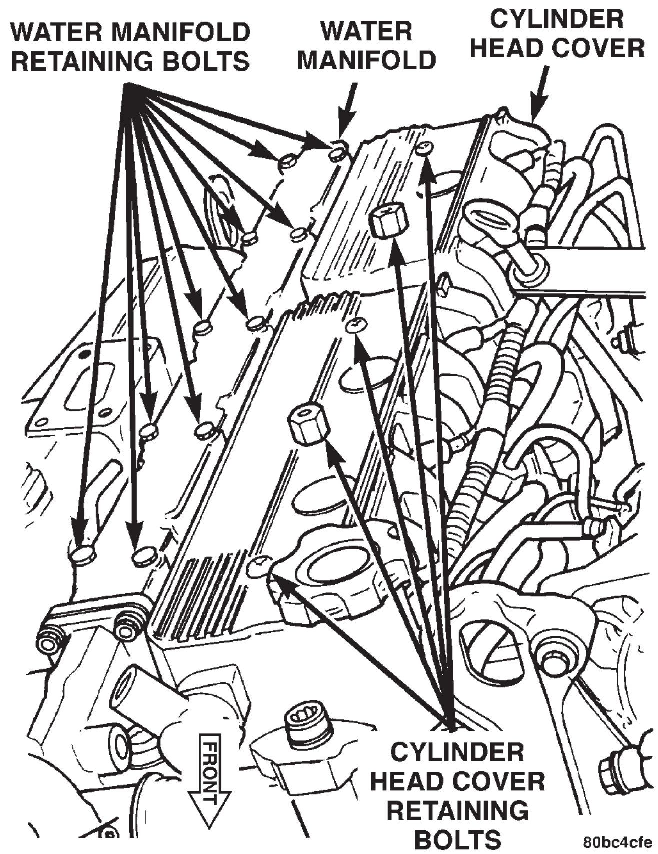

Fig. 72 Cylinder Head Cover

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.

(43) Operate the engine with the radiator cap off. Inspect for leaks and continue operating the engine until the thermostat opens. Add coolant, if required.

NOTE: The one piece steel type head gasket does not require retorqueing.

VIBRATION DAMPER

REMOVAL

(1) Disconnect the negative battery cable.

(2) Remove the fan and set fan inside fan shroud then remove fan shroud and fan as an assembly.

(3) Remove the accessary drive belt. Refer to Group 7, Cooling System for procedure.

(4) Remove the vibration damper nut.

(5) Install special tool VM.1000-A to remove vibration damper (Fig. 73).

REMOVAL AND INSTALLATION (Continued)

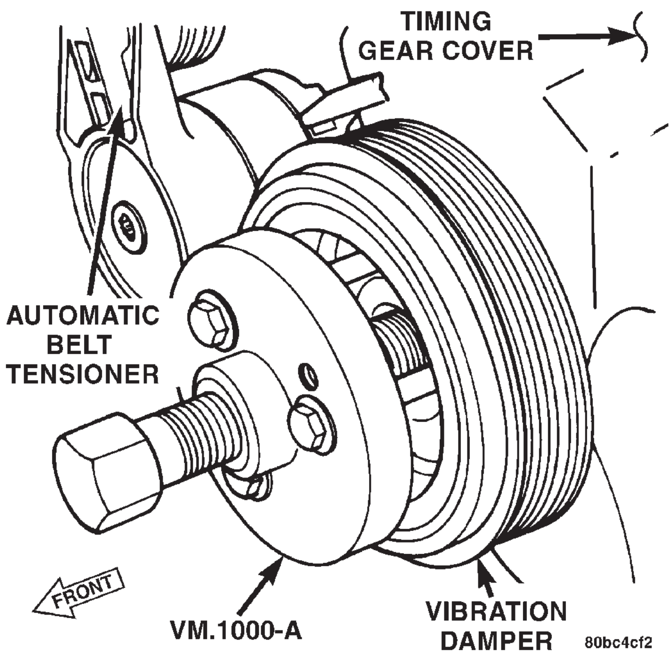

Fig. 73 VM.1000–A

INSTALLATION

(1) Install the vibration damper and align with key way.

(2) Install the vibration damper nut. Torque nut to 196 N·m (147 ft. lbs.).

(3) Install the accessary drive belt. Refer to Group 7, Cooling System for procedure.

(4) Connect the negateive battery cable.

TIMING GEAR COVER OIL SEAL

REMOVAL

(1) Disconnect the negative battery cable.

(2) Remove the vibration damper. Refer to vibration damper removal and installation procedure in this section.

CAUTION: Use care when removing the old seal. Be sure not to damage the timing gear cover .

(3) Pry out the old seal.

INSTALLATION

The seating diameter must be 68.000 - 68.030 mm.

(1) Install the new seal using special tool VM.1015A (Fig. 75).

(2) Install the vibration damper. Refer to vibration damper removal and installation procedure in this section.

(3) Connect the negative battery cable.

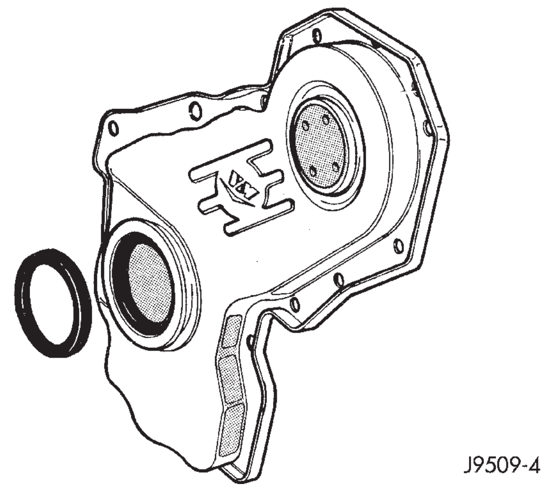

Fig. 74 Timing Gear Cover Oil Seal

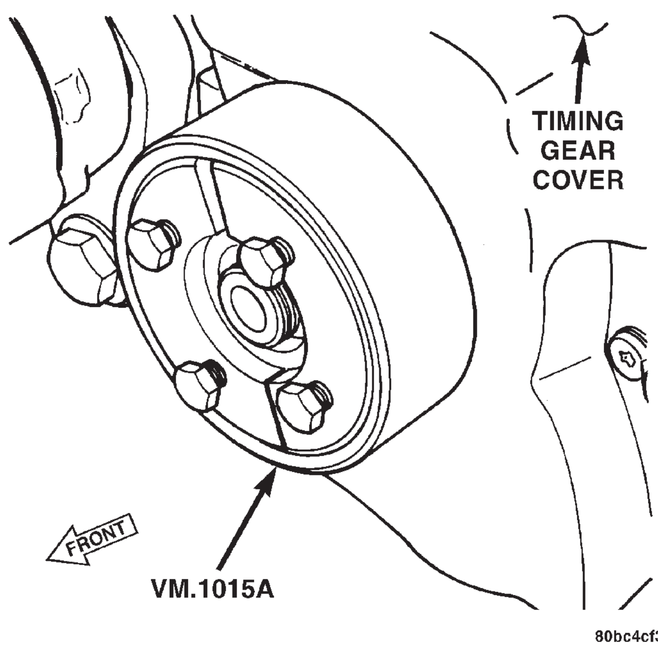

Fig. 75 VM.1015–A

TIMING GEAR COVER

REMOVAL

(1) Disconnect the negative battery cable.

(2) Remove the fan and set fan inside fan shroud then remove fan shroud and fan as an assembly.

(3) Remove the accessary drive belt. Refer to Group 7, Cooling System for procedure.

(4) Remove the vibration damper nut.

(5) Install special tool VM.1000-A to remove the vibration damper (Fig. 76).

(6) Remove the fan pulley (Fig. 77).

NOTE: The idler pulleys have left hand threaded bolts.

REMOVAL AND INSTALLATION (Continued)

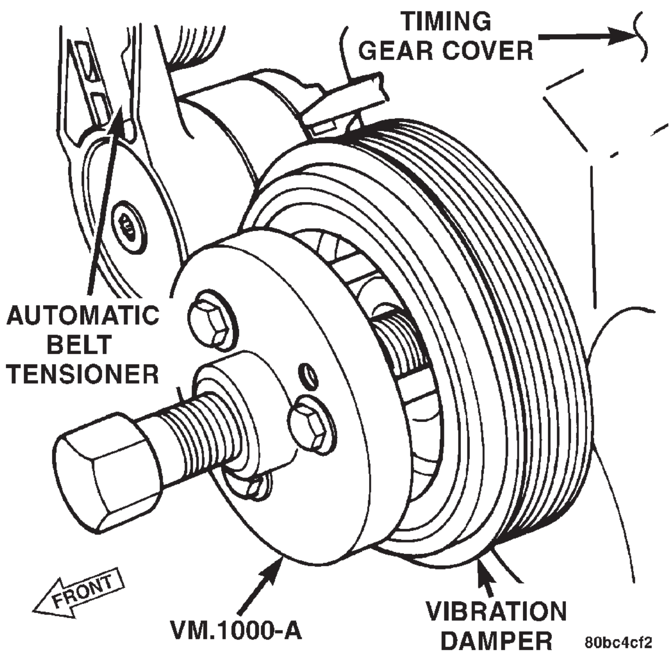

Fig. 76 VM.1000–A

(7) Remove the idler pulley and bracket (Fig. 77).

(8) Remove the automatic belt tensioner (Fig. 77).

(9) Remove the Power steering pump pulley (Fig. 77).

(10) Remove the timing gear cover.

INSTALLATION

(1) Be sure the mating surfaces of the gear case cover and the cylinder block are clean and free from burrs.

(2) Apply a continuous 3 mm bead of Silicone Sealer (Fig. 78) to timing cover, install within 10 minutes, tighten 6mm bolts to 11 N·m (8 ft. lbs.) and tighten 8mm bolts to 26.2 N·m (19 ft. lbs.).

(3) Install Power steering pump pulley. Torque bolts to 25 N·m (18 ft. lbs.).

(4) Install the automatic belt tensioner.

(5) Install the idler pulley bracket. Torque bolts to 47 N·m (34 ft. lbs.).

NOTE: The idler pulley has left hand thread.

(6) Install the idler pulleys. Torque nut to 47 N·m (34 ft. lbs.).

(7) Install the fan pulley. Torque bolts to 28 N·m (21 ft. lbs.).

(8) Install the vibration damper. Torque nut to 196 N·m (147 ft. lbs.).

(9) Install the accessary drive belt. Refer to Group 7, Cooling System for procedure.

(10) Install the fan and fan shroud.

(11) Connect the negative battery cable.

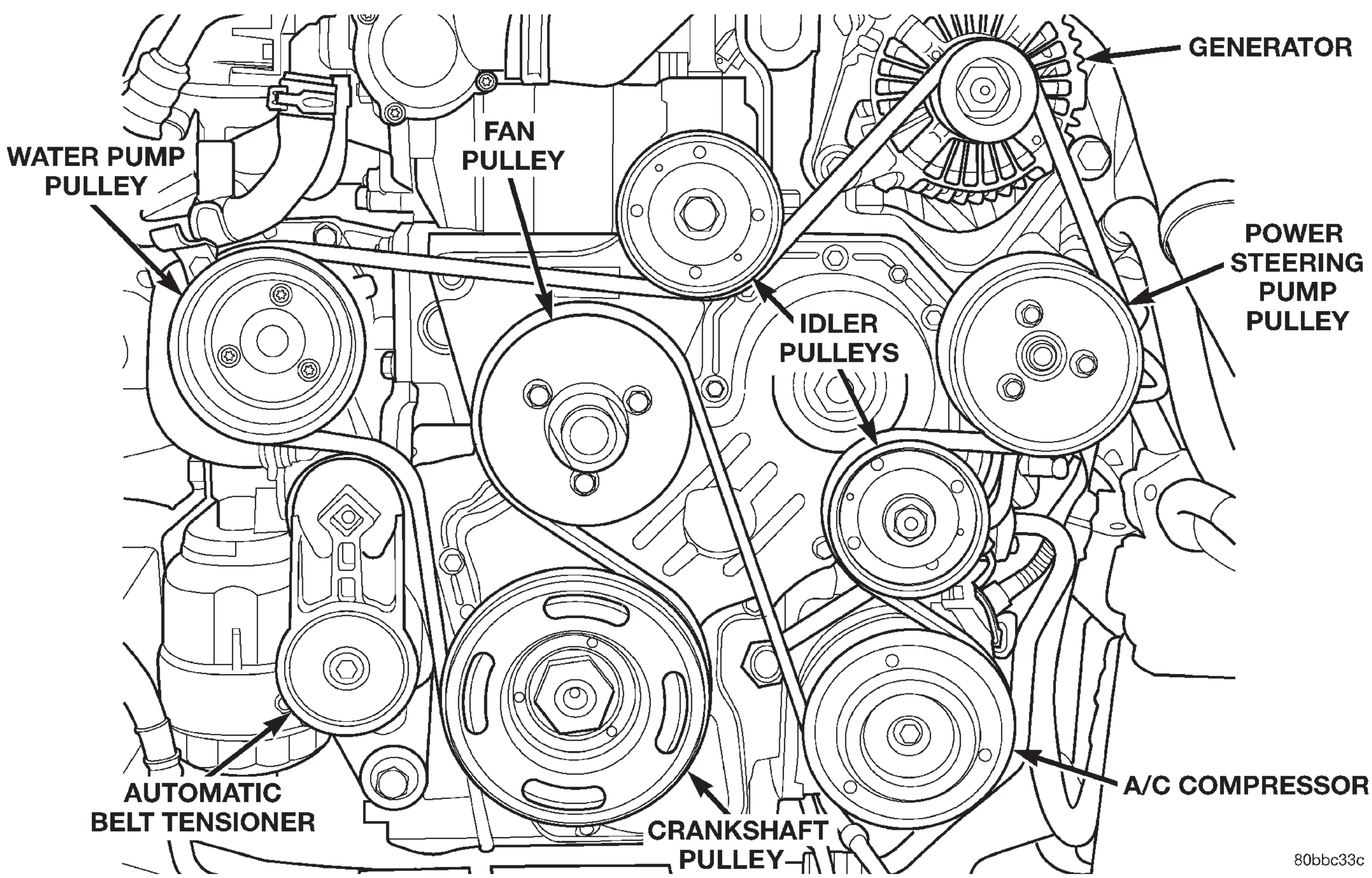

Fig. 77 Idler Pulley And Tensioner Location

REMOVAL AND INSTALLATION (Continued)

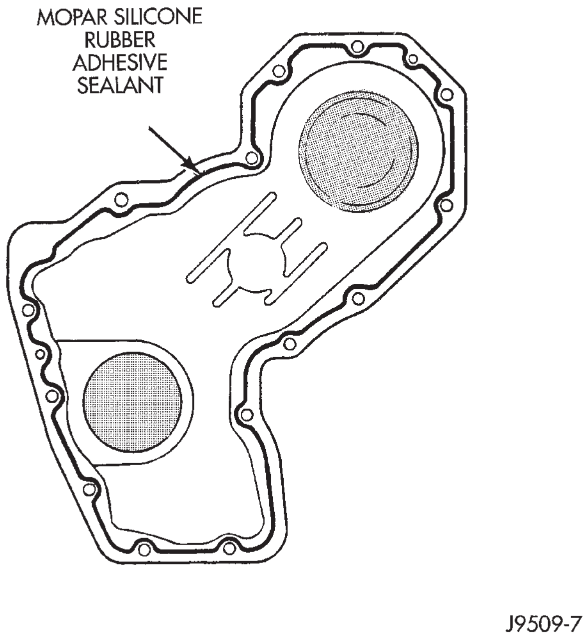

Fig. 78 Front Cover Sealer Location

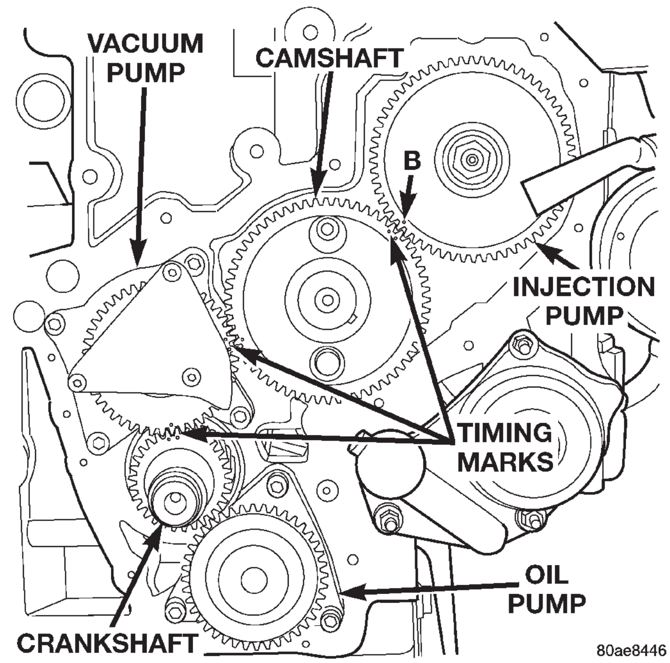

Fig. 79 Timing Marks

CAMSHAFT

REMOVAL

(1) Disconnect the negative battery cable.

(2) Remove the cylinder head cover. Refer to cylinder head cover removal and installation in this section.

(3) Remove the cylinder heads. Refer to cylinder head removal and installation in this section.

(4) Remove the rocker arm assemblies, push rods, and hydraulic tappets. Refer to the respective groups in this section.

(5) Remove the fan and set fan inside fan shroud then remove fan shroud and fan as an assembly.

(6) Remove the accessary drive belt. Refer to Group 7, Cooling System for procedure.

(7) Remove the radiator, A/C condensor, and intercooler as an assembly. Refer to Group 7, Cooling System for procedure.

(8) Remove the vibration damper. Refer to vibration damper removal and installation in this section.

(9) Remove the power steering pump pulley.

(10) Remove timing gear cover. Refer to timing gear cover removal and installation in this section.

(11) Rotate the engine to align the timing marks as shown (Fig. 79).

NOTE: The oil dipstick tube must be removed for camshaft removal.

(12) Unscrew the flange bolts and remove camshaft (Fig. 80).

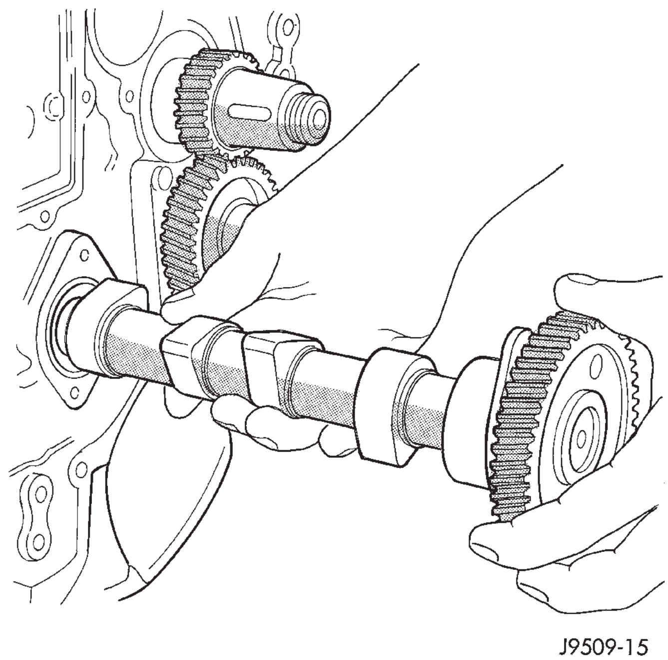

Fig. 80 Camshaft Removal

THRUST PLATE INSPECTION

Check the thickness (Fig. 81) of the plate at points a-b-c-d. If the measurement is not between 3.950 - 4.050 it must be changed.

INSTALLATION

(1) Coat the camshaft journals with clean engine oil and carefully install the camshaft complete with thrust plate and gear. Tighten retaining bolts to 18 N·m (13 ft. lbs.). Be sure to align the timing marks as shown (Fig. 82).

REMOVAL AND INSTALLATION (Continued)

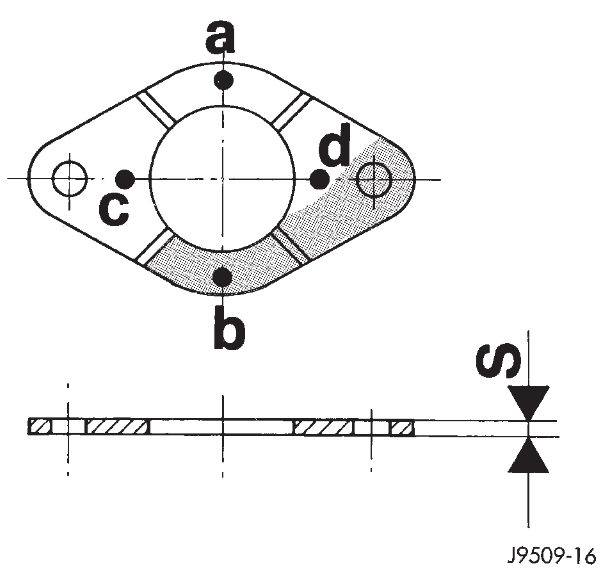

Fig. 81 Camshaft Thrust Plate

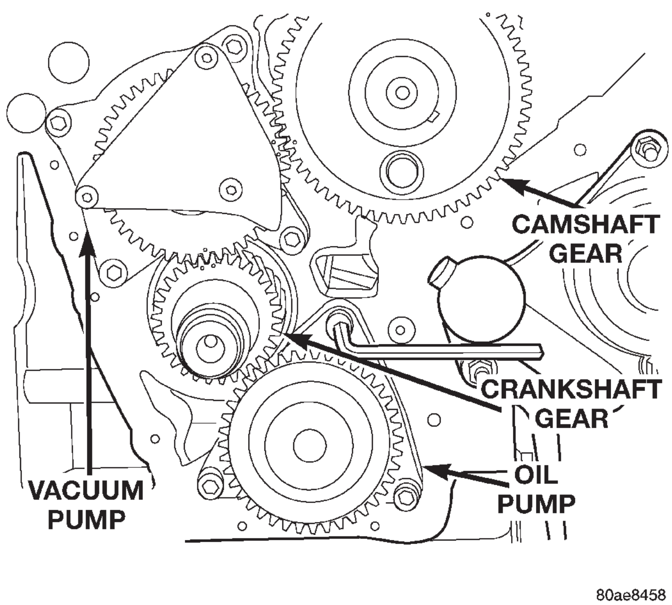

Fig. 82 Timing Marks

(2) Install the hydraulic tappets and retainers. Refer to hydraulic tappet removal and installation in this section.

(3) Install the cylinder heads. Refer to cylinder head removal and installation in this section.

(4) Install the push rods and rocker arm assemblies. Refer to the respective sections.

(5) Install the cylinder head cover. Refer to cylinder head cover removal and installation in this section.

(6) Install the timing gear cover. Refer to timing gear cover removal and installation in this section.

(7) Install the vibration damper. Refer to the vibration damper removal and installation in this section.

(8) Install the radiator, A/C condensor, and intercooler. Refer to Group 7, Cooling System for procedure.

(9) Install the fan and fan shroud,. Torque fan to 56 N·m (41 ft. lbs.).

(10) Evacuate and charge the air conditioning system. Refer to Group 24, Heater and Air Conditioning for procedure.

(11) Connect the negative battery cable.

(12) 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.

(13) Operate the engine with the radiator cap off. Inspect for leaks and continue operating the engine until the thermostat opens. Add coolant, if required.

CAMSHAFT BEARINGS

This procedure requires that the engine is removed from the vehicle.

REMOVAL

(1) With the engine completely disassembled, install the Camshaft Bearing Remover/Installer Tool VM.1040 (Fig. 83).

(2) Pull the camshaft bearings out of the cylinder block.

INSTALLATION

CAUTION: Be sure the oil holes in the center bearings are lined up with oil gallery holes in the cylinder block.

(1) Install the front and rear camshaft bearings with Camshaft Bearing Remover/Installer Tool VM.1040.

(2) Push the new bearings into place.

(3) Install the remaining bearings in the same manner. The 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.

REMOVAL AND INSTALLATION (Continued)

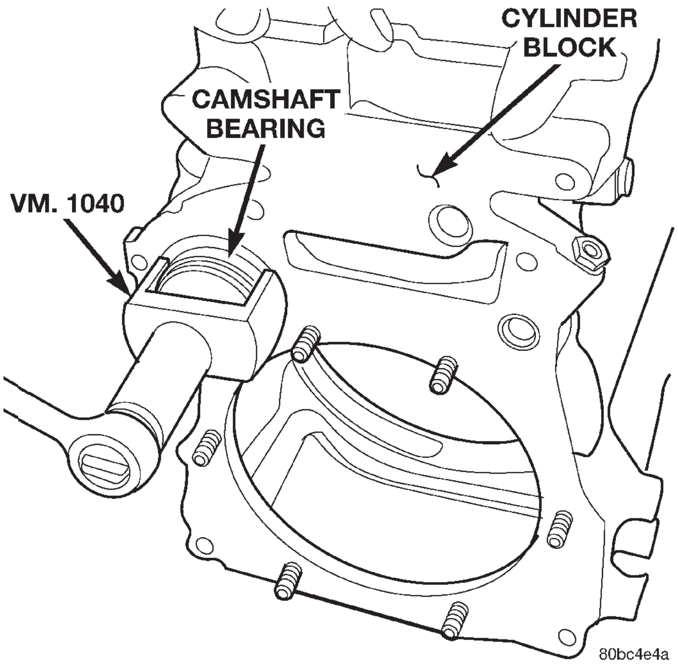

Fig. 83 VM.1040

OIL PAN

REMOVAL

(1) Disconnect the negative battery cable.
(2) Raise the vehicle on hoist.
(3) Drain the oil.
(4) Remove the oil pan lower cover.
(5) Remove the bolts from oil pan. Remove the 6 bolts that are on the inside of the oil pan.
(6) Remove the oil pan.

INSTALLATION

(1) Remove all gasket material from cylinder block. Be careful not gouge or scratch aluminum pan sealing surface.
(2) Apply a continuous 3 mm bead of Silicone Sealer to oil pan, install within 10 minutes. Install the oil pan.
(3) Install the oil pan bolts. Torque bolts to 13 N·m (9 ft. lbs.).
(4) Install the oil pan lower cover. Torque bolts to 13 N·m (9 ft. lbs.).
(5) Install the oil drain plug. Torque to 79 N·m (58 ft. lbs).
(6) Lower the vehicle from hoist.
(7) Fill engine with proper amount of oil.
(8) Connect the negative battery cable.

OIL PUMP

REMOVAL

(1) Disconnect the negative battery cable.
(2) Remove the timing gear cover. Refer to timing gear cover removal and installation in this section.
(3) Remove the oil pump (Fig. 84).

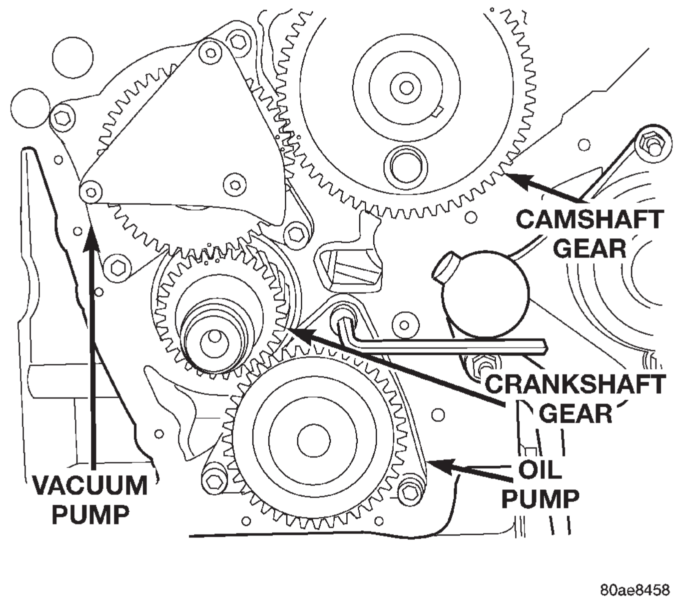

Fig. 84 Oil Pump Removal

INSTALLATION

(1) Install new O-ring and lubricate with clean engine oil.
(2) Install the oil pump. Torque screws to 28 N·m (20 ft. lbs.). Check for normal backlash between pump and crankshaft gears.
(3) Install the timing gear cover. Refer to timing gear cover removal and installation in this section.

INTERNAL VACUUM PUMP

REMOVAL

(1) Disconnect the negative battery cable.
(2) Remove the timing gear cover. Refer to timing gear cover removal and installation in this section.
(3) Align all the timing marks before removing the vacuum pump (Fig. 85).
(4) Remove the vacuum pump retaining bolts..
(5) Remove the internal vacuum pump.

INSTALLATION

(1) To install the vacuum pump, align the outer part of the gear with the inner part using a screwdriver or similar tool, align with timing marks on gear set and install (Fig. 85). Torque bolts to 28 N·m (20 ft. lbs.).
(2) Install the timing gear cover. Refer to timing gear cover removal and installation in this section.
(3) Connect the negative battery cable.

REMOVAL AND INSTALLATION (Continued)

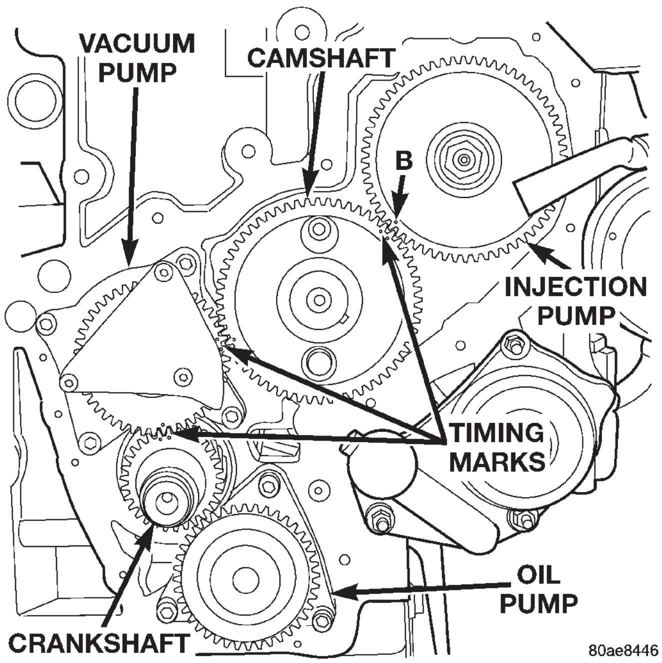

Fig. 85 Timing Marks

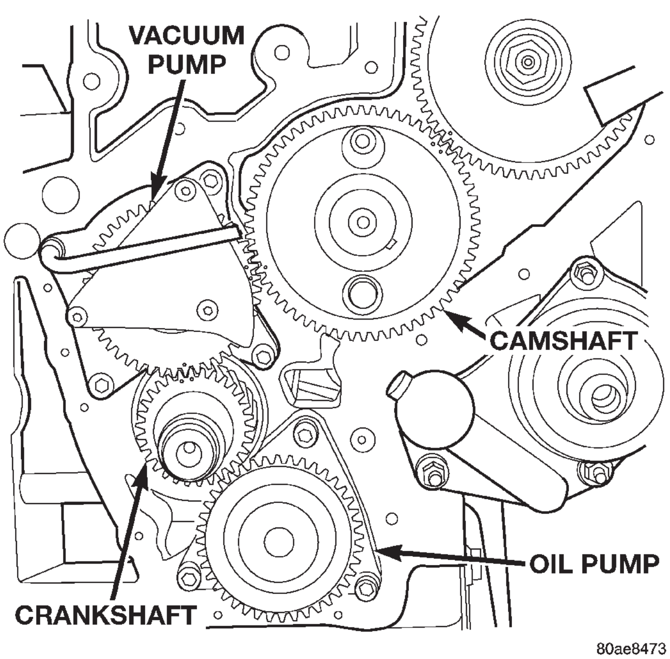

Fig. 86 Vacuum Pump

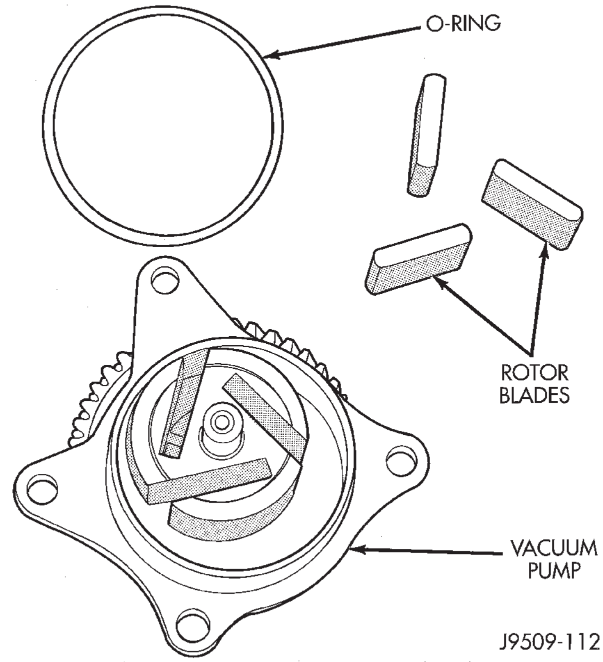

Fig. 87 Vacuum Pump Parts

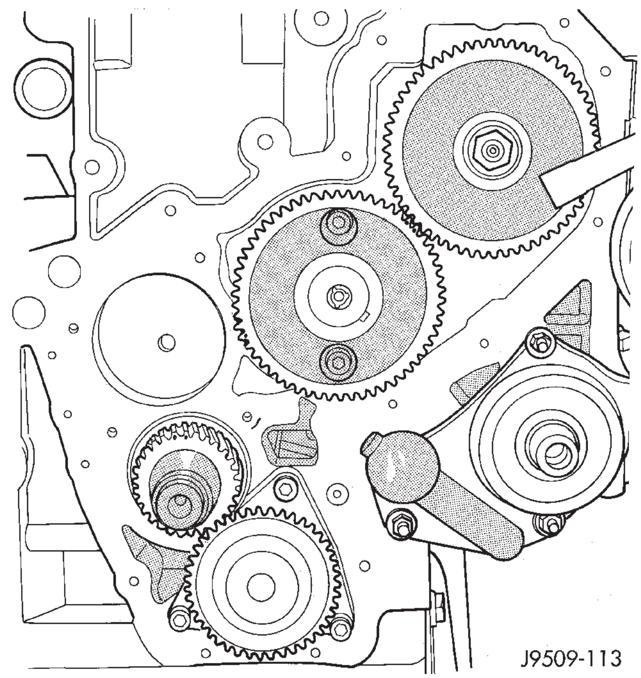

Fig. 88 Vacuum Pump Mounting Hole

OIL PUMP PRESSURE RELIEF VALVE

REMOVAL

(1) Disconnect the negative battery cable

(2) Remove the oil pan. Refer to oil pan removal and installation procedure in this section.

(3) Remove the relief valve snap ring.

(4) Remove the relief valve cap, spring, and plunger (Fig. 89).

(5) Check the relief valve spring length. Relief valve spring free length is 57.5mm (2.263 in.). If spring length is less or spring is distorted it must be replaced.

(6) Check the plunger for scoring, replace if necessary.

INSTALLATION

(1) Thoroughly clean all components and relief valve pocket in cylinder block.

REMOVAL AND INSTALLATION (Continued)

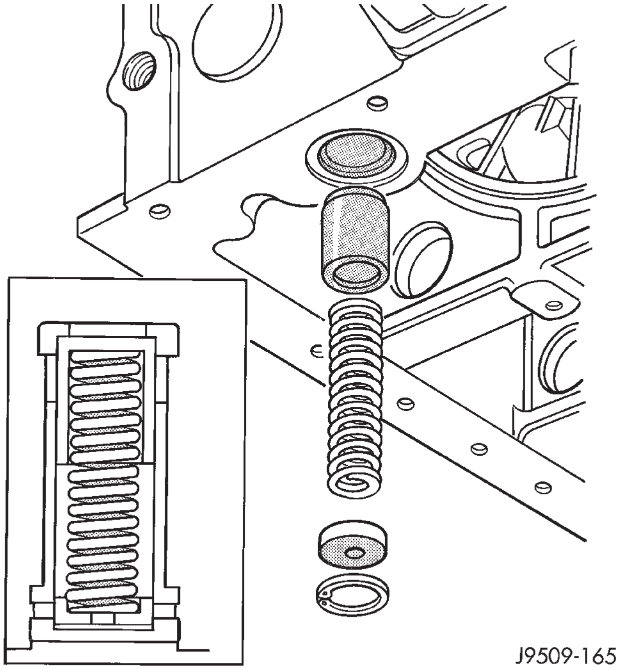

Fig. 89 Oil Pressure Relief Valve

(2) Fit plunger, spring and cap into block.

(3) Compress spring and install the snap ring. Ensure the snap ring is completely seated in groove.

(4) Install the oil pan. Refer to oil pan removal and installation procedure in this section.

(5) Connect the negative battery cable.

OIL FILTER ADAPTER AND OIL COOLER

REMOVAL

(1) Disconnect the negative battery cable.

(2) Remove the oil cooler coolant hoses.

(3) Remove the oil filter housing/oil cooler retaining bolt (Fig. 90).

(4) Remove the oil filter housing and oil cooler (Fig. 91).

INSTALLATION

(1) Install the oil cooler and oil filter housing with a new gasket. Torque bolt to 46.6 N·m (34 ft. lbs.).

(2) Install the oil cooler coolant hoses.

(3) Connect the negative battery cable.

ENGINE OIL FILTER

REMOVAL

(1) Raise the vehicle on a hoist.

(2) Position a drainpan under the oil filter housing (Fig. 93).

(3) Remove the oil filter housing drain plug. Located in the center of the housing cap. Drain the engine oil from the oil filter housing.

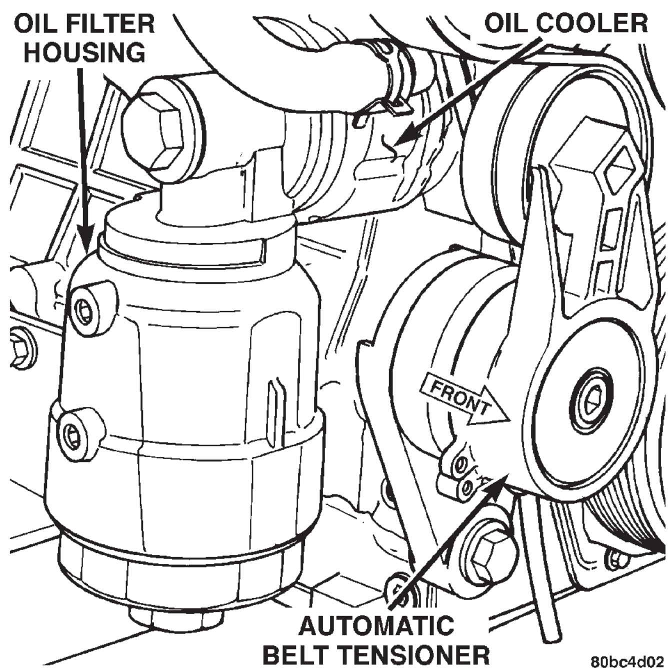

Fig. 90 Oil Filter Housing

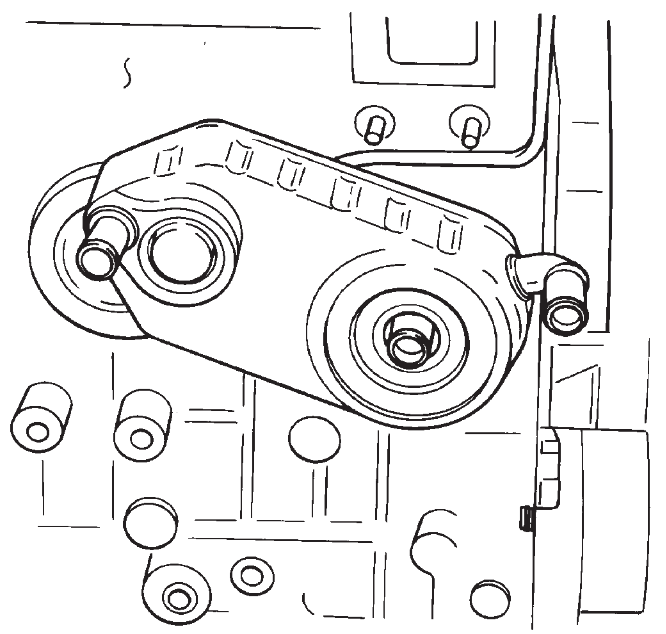

Fig. 91 Oil Cooler

(4) Remove the oil filter housing cap by rotating counter-clockwise.

(5) If the element remains in the housing remove the oil filter element by pulling it straight down and out of the oil filter housing.

(6) Remove the oil filter housing sealing o-ring from the housing cap and discard. A new o-ring is supplied with the oil filter element.

(7) Clean the oil filter housing and housing cap with shop solvent

REMOVAL AND INSTALLATION (Continued)

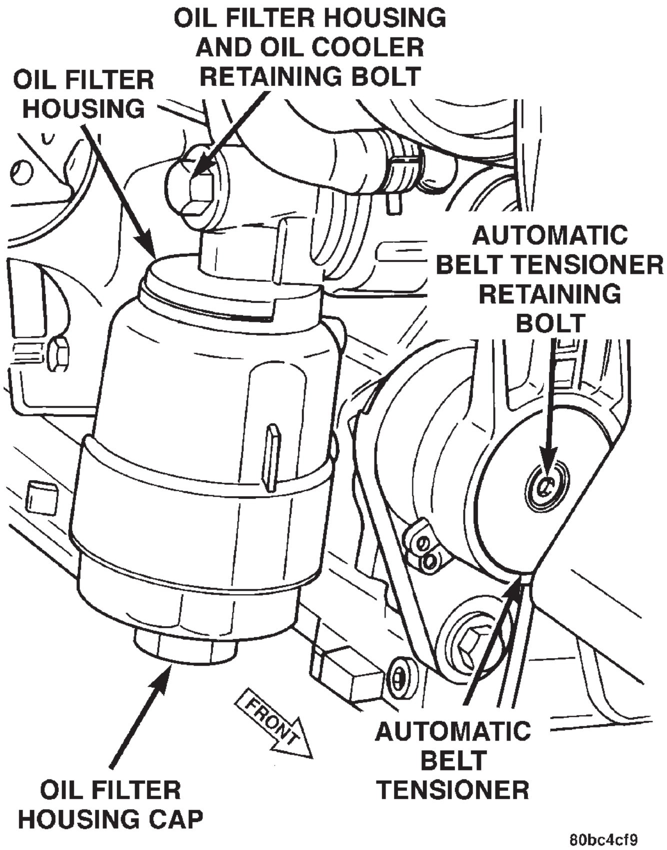

Fig. 92 Oil Filter Position & Orientation

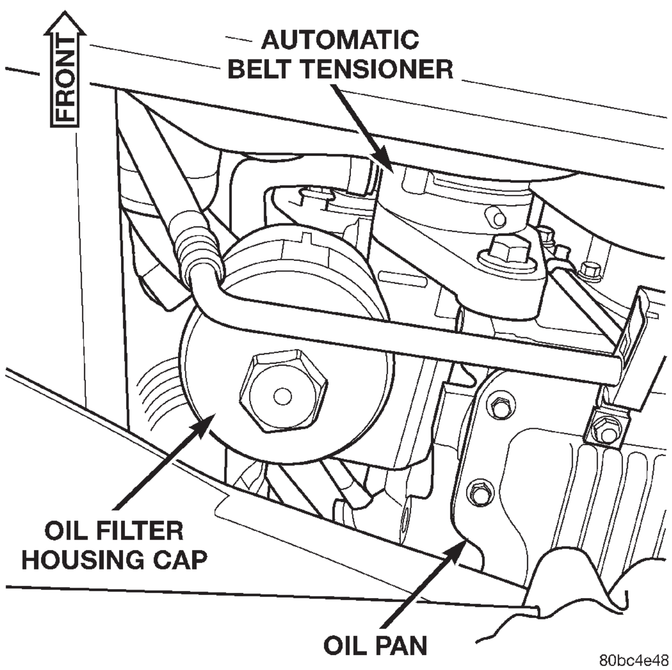

Fig. 93 Oil Filter Housing Cap

INSTALLATION

(1) Install a new sealing o-ring in the housing cap and lubricate with fresh engine oil.

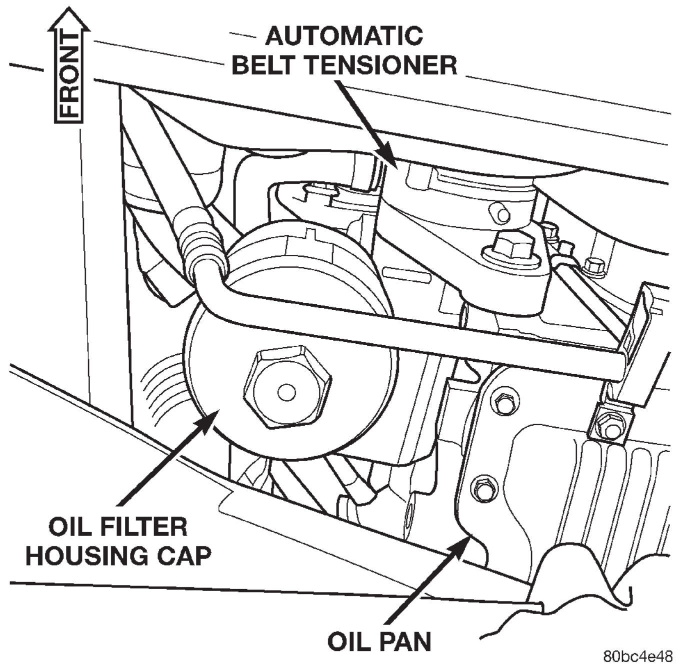

Fig. 94 Oil Filter Housing Cap

(2) Install the new filter element in the housing and install cap. Torque to 22.5 N·m (194in. lbs.) (Fig. 94).

(3) Install the oil filter housing drain plug. Torque to 12 N·m (106in. lbs.).

(4) Lower the vehicle on hoist.

(5) Fill the engine oil level to specification.

(6) Start the engine and check for leaks.

PISTONS AND CONNECTING ROD ASSEMBLY

REMOVAL

(1) Disconnect the battery cable.

(2) Remove cylinder heads, refer to cylinder head removal and installation in this section.

(3) Raise vehicle on host.

(4) Remove oil pan, refer to oil pan removal and installtion in this section.

(5) Remove top ridge of cylinder bores with a ridge reamer before removing pistons from cylinder block. **Be sure to keep tops of pistons covered during this operation** . Mark piston with matching cylinder number.

(6) Pistons and connecting rods must be removed from top of cylinder block. Rotate crankshaft so that each connecting rod is centered in cylinder bore.

(7) Remove connecting rod cap bolts and cap. Push each piston and rod assembly out of cylinder bore.

NOTE: Be careful not to nick crankshaft journals.

(8) After removal, install bearing cap on the mating rod.

REMOVAL AND INSTALLATION (Continued)

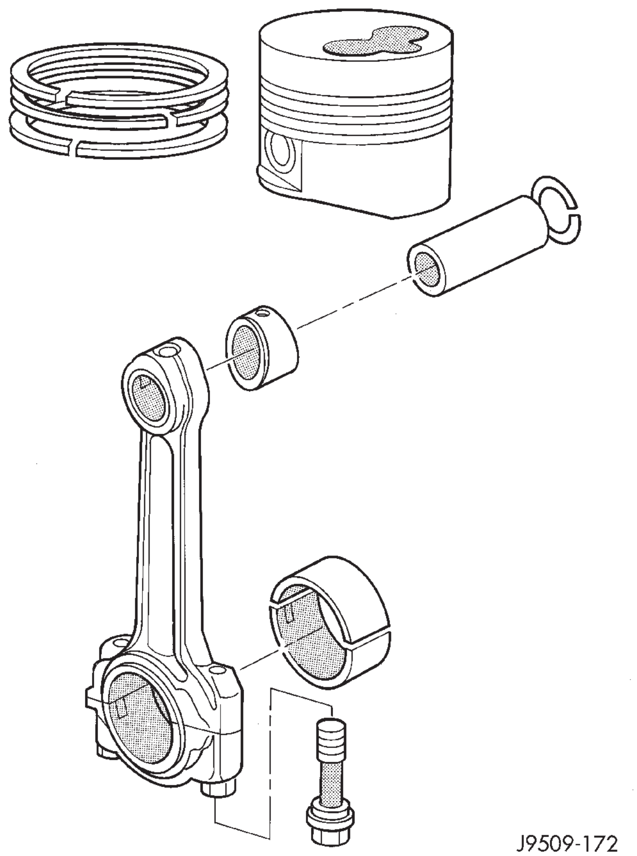

Fig. 95 Piston Assembly

PISTON PIN—REMOVAL

(1) Secure connecting rod in a soft jawed vice.

(2) Remove 2 clips securing piston pin.

(3) Push piston pin out of piston and connecting rod.

PISTON RING—REMOVAL

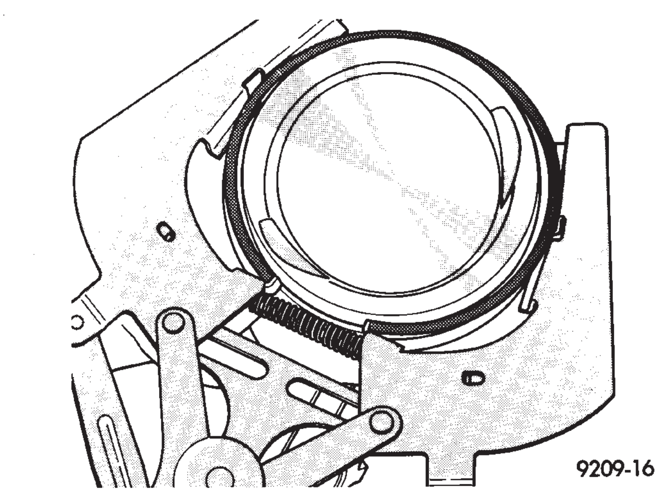

Fig. 96 Piston Rings—Removing and Installing

(1) ID mark on face of upper and intermediate piston rings must point toward piston crown.

(2) Using a suitable ring expander, remove upper and intermediate piston rings (Fig. 96).

(3) Remove the upper oil ring side rail, lower oil ring side rail and then oil ring expander from piston.

(4) Carefully clean carbon from piston crowns, skirts and ring grooves ensuring the 4 oil holes in the oil control ring groove are clear.

PISTON RING FITTING

(1) Wipe cylinder bore clean. Insert ring and push down with piston to ensure it is square in bore. The ring gap measurement must be made with the ring positioning at least 12 mm (0.50 in.) from bottom of cylinder bore. Check gap with feeler gauge. Top compression ring gap .25 to .50mm (.0098 to .0196 in.). Second compression ring gap .25 to .35mm (.0098 to .0137 in.). Oil control ring gap .25 to .58mm (.0098 to .0228 in.).

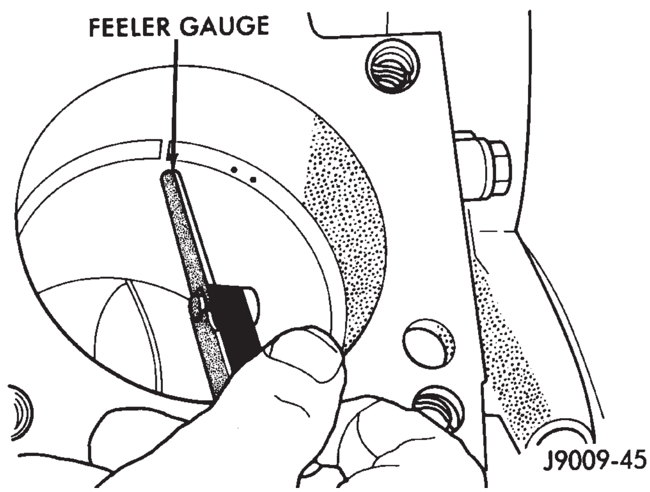

Fig. 97 Ring Gap Measurement

(2) If ring gaps exceed dimension given, new rings or cylinder liners must be fitted. Keep piston rings in piston sets.

(3) Check piston ring to groove clearance (Fig. 98). Top compression ring gap .08 to .130mm (.0031 to .0051 in.). Second compression ring gap .070 to .102mm (.0027 to .0040 in.). Oil control ring gap .040 to .072mm (.0015 to .0028 in.).

PISTON RINGS—INSTALLATION

(1) Install rings on the pistons using a suitable ring expander (Fig. 99).

(2) Top compression ring is tapered and chromium plated. The second ring is of the scraper type and must be installed with scraping edge facing bottom of the piston. The third is an oil control ring. Ring gaps must be positioned, before inserting piston into the liners, as follows (Fig. 101).

(3) Top ring gap must be positioned at 30 degrees to the right of the combustion chamber recess (looking at the piston crown from above).

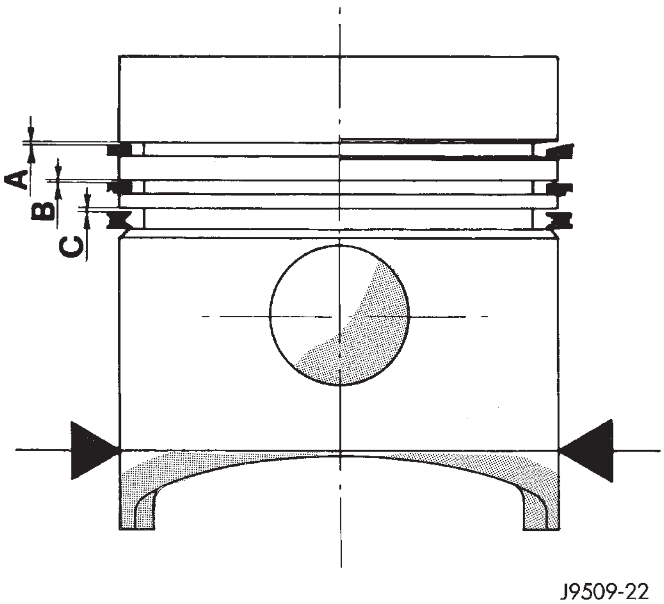

Fig. 98 Piston Ring to Groove Clearance

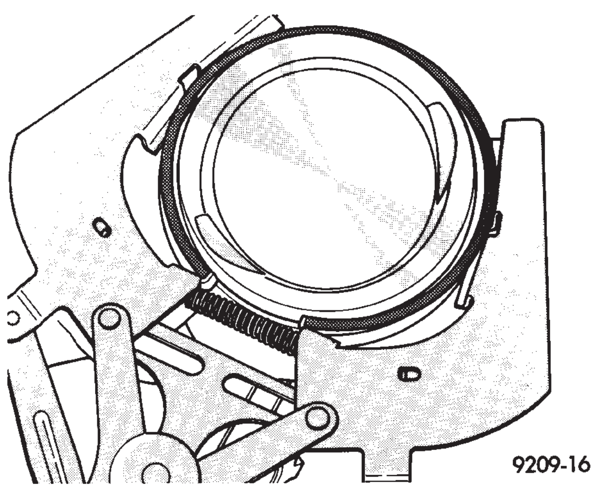

Fig. 99 Piston Rings—Removing and Installing

(4) Second piston ring gap should be positioned on the opposite side of the combustion chamber recess.

(5) Oil control ring gap to be located 30 degrees to the left of combustion chamber recess.

(6) When assembling pistons check that components are installed in the same position as before disassembly, determined by the numbers stamped on the crown of individual pistons. Engine cylinders are numbered starting from gear train end of the engine. **Face chamber recess side of piston towards camshaft** . Therefore, the numbers stamped on con rod big end should also face in the same direction. To insert piston into cylinder use a ring compressor as shown in (Fig. 102).

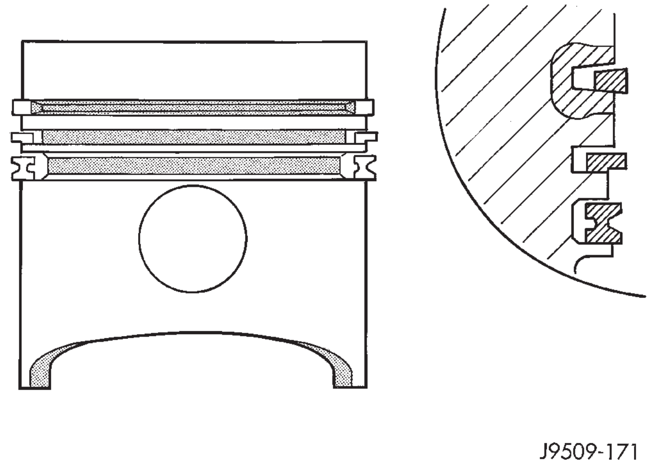

Fig. 100 Piston Ring Identification

PISTON PIN INSTALLATION

(1) Secure connecting rod in soft jawed vice.

(2) Lubricate piston pin and piston with clean oil.

(3) Position piston on connecting rod.

CAUTION: Ensure combustion recess in piston crown and the bearing cap numbers on the connecting rod are on the same side.

(4) Install piston pin.

(5) Install clips in piston to retain piston pin.

(6) Remove connecting rod from vice.

INSTALLATION

(1) Before installing pistons, and connecting rod assemblies into the bore, be sure that compression ring gaps are staggered so that neither is in line with oil ring rail gap (Fig. 101).

- The top piston ring gap must be positioned at 30 degrees to the right of the combustion chamber recess (looking at the piston crown from above).
- The second piston ring gap should be positioned on the opposite side of the combustion chamber recess.
- The piston oil control ring gap is to be located 30 degrees too the left of the combustion chamber recess.

(2) Before installing the ring compressor, make sure the oil ring expander ends are butted and the rail gaps located as shown in (Fig. 101).

(3) Immerse the piston head and rings in clean engine oil, slide the ring compressor, over the piston and tighten with the special wrench (Fig. 102). **Ensure position of rings does not change during this operation** .

(4) Face chamber recess side of piston towards camshaft.

(5) Rotate crankshaft so that the connecting rod journal is on the center of the cylinder bore. Insert

REMOVAL AND INSTALLATION (Continued)

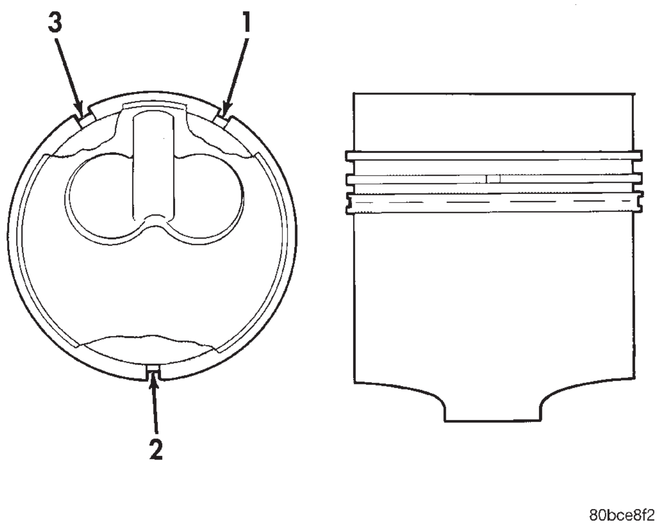

Fig. 101 Piston Ring Gap Location

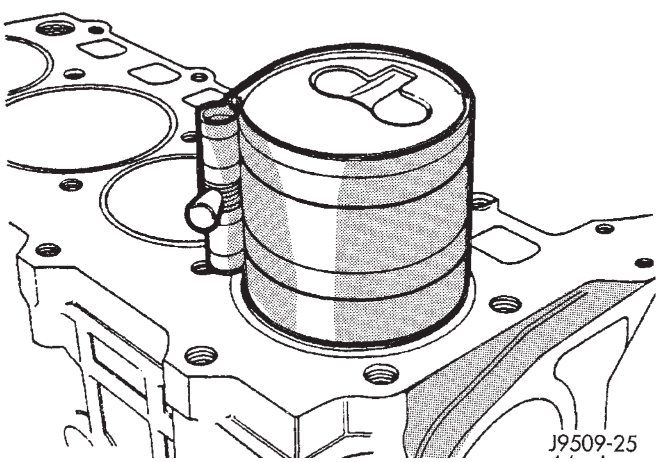

Fig. 102 Installing Piston

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 connecting rod journal.

(7) Install rod caps. Install cleaned and oiled rod bolts. Torque bolts to 29.5 N·m (22 ft. lb.) plus 60°.

CYLINDER WALL LINER ASSEMBLY

REMOVAL

(1) Disconnect the negative battery cable

(2) Remove the engine from vehicle.

(3) With the engine completely disassembled, install the Cylinder Liner Puller Tool VM-1001 to remove liners (Fig. 103) (Fig. 104).

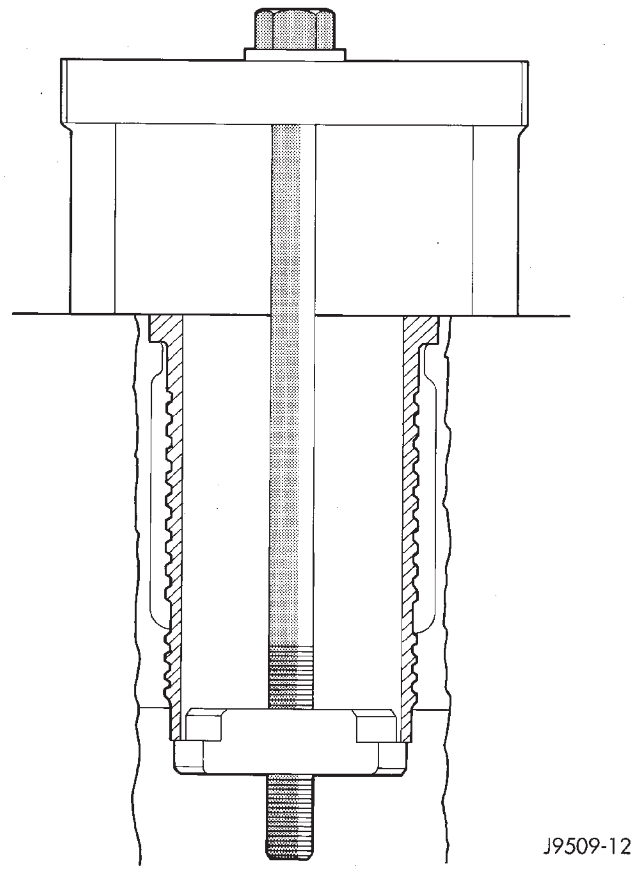

Fig. 103 Liner Removal Tool

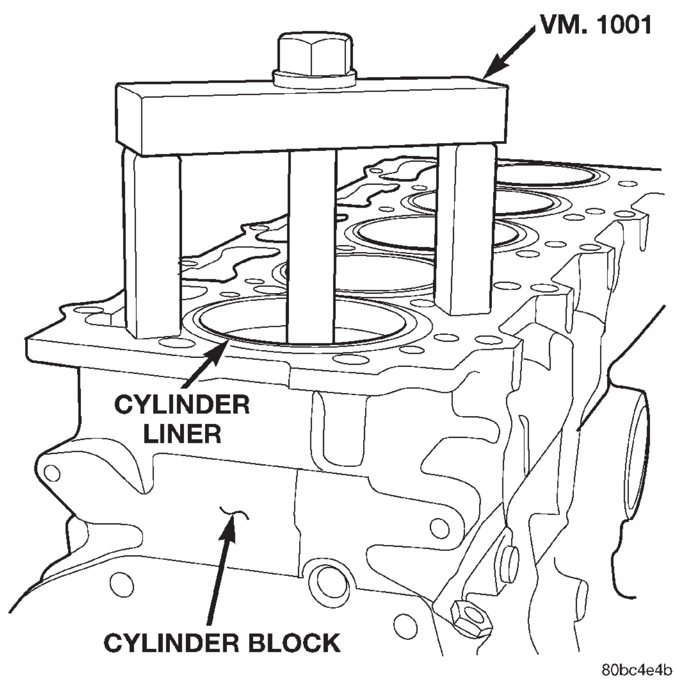

Fig. 104 VM.1001

REMOVAL AND INSTALLATION (Continued)

(4) Remove shims from cylinder liner or cylinder block recess. Keep shims with each cylinder liner.

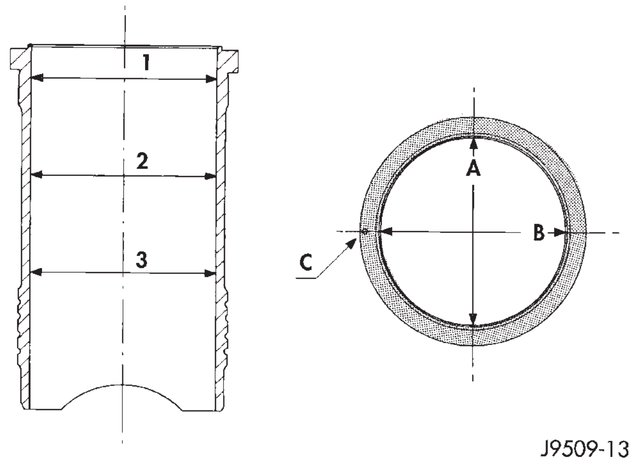

Fig. 105 Liner Inspection

INSTALLATION

(1) Carefully clean residual LOCTITE from liner and crankcase, and degrease the crankcase where it comes into contact with the liners. Install the liners in the crankcase as shown (A), rotating them back and forth by 45° in order to guarantee correct positioning (Fig. 106).

(2) Measure the liner recess relative to block deck with a dial indicator mounted on a special tool VM-1010 A. **All the measurements must be taken on camshaft side** . Zero dial gauge on block deck.

(3) Move dial gauge to cylinder liner record reading on dial gauge.

(4) Remove liner and special tool.

(5) Then select the correct shim thickness to give proper protrusion (0.01 - 0.06 mm).

(6) Fit the shim and the O-rings onto the liner.

(7) Lubricate the lower liner location in the block. Apply LOCTITE AVX to the corner of the liner seat. Apply LOCTITE AVX uniformly to the upper part of the liner at area.

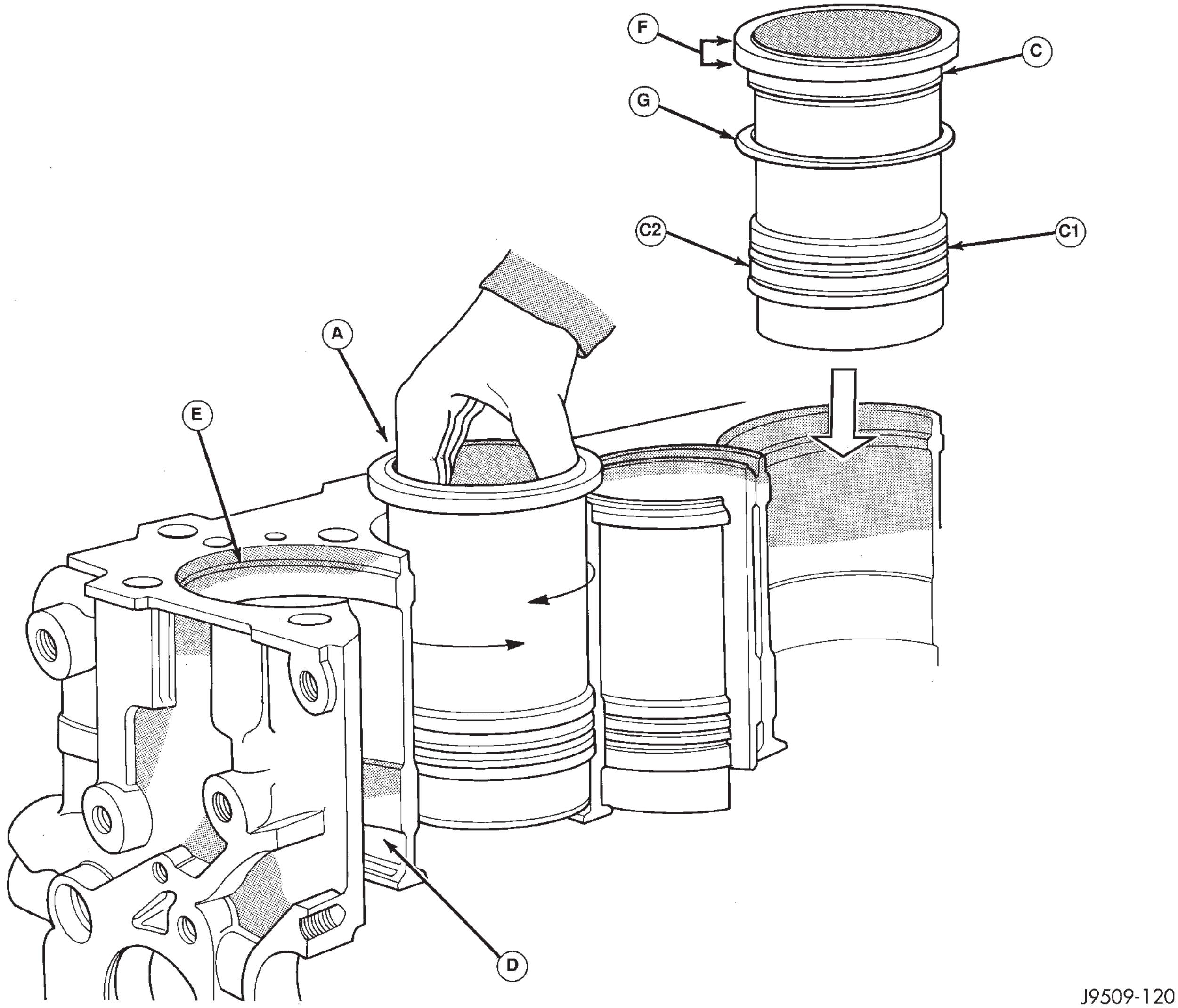

Fig. 106 Liner Installation

REMOVAL AND INSTALLATION (Continued)

(8) Fit the liners in the crankcase making sure that the shim is positioned correctly in the seat. Lock the liners in position using special tool (VM-1016) and bolts (Fig. 107). Clean the residual LOCTITE on the upper surface of the block deck.

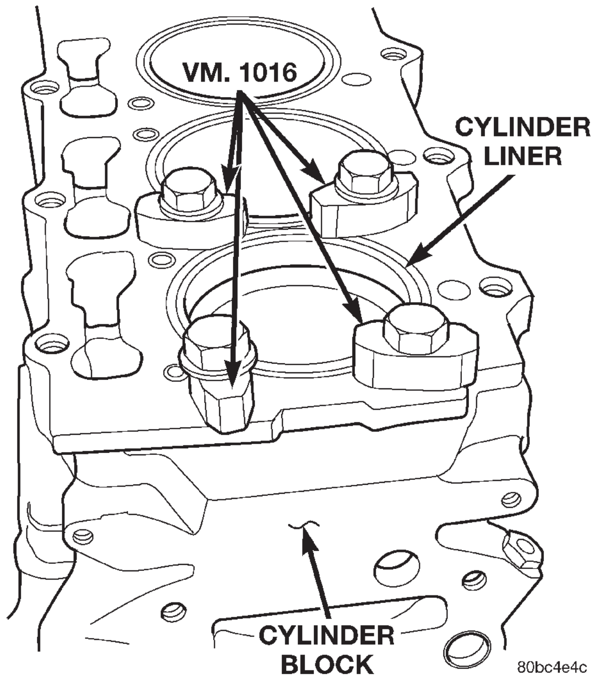

Fig. 107 Liner Clamp Location

(9) Recheck the liner protrusion. It should be 0.01 - 0.06 mm.

NOTE: A period of six hours must elapse between the liners being installed and engine start-up. If engine assembly is not continued after liner installation, the liners need to be clamped for twelve hours minimum.

CRANKSHAFT AND MAIN BEARINGS

REMOVAL

(1) Disconnect the negative battery cable.

(2) Remove the engine from vehicle. Refer to engine removal and installation in this section.

(3) Install the engine on an engine stand.

(4) Remove the accessary drive system.

(5) Remove the cylinder head cover. Refer to cylinder head cover removal and installation in this section.

(6) Remove the rocker arm assemblies and push rods. Refer to rocker arm and push rod removal and installation in this section.

(7) Remove the intake manifold, exhaust manifold and turbocharger. Refer to Group 11, Exhaust System and Turbocharger.

(8) Remove the water manifold.

(9) Remove the oil feed lines to rocker arms.

(10) Remove the cylinder heads. Refer to cylinder head removal and installation in this section.

(11) Remove the oil pan and oil pick-up.

(12) Remove the pistons and connecting rods.

(13) Remove the vibration damper. Refer to vibration damper removal and installation in this section.

(14) Remove the timing gear cover. Refer to timing gear cover removal and installation in this section.

(15) Remove the oil pump and vacuum pump from block.

(16) Install special tool VM.1004 onto crankshaft over gear (Fig. 108).

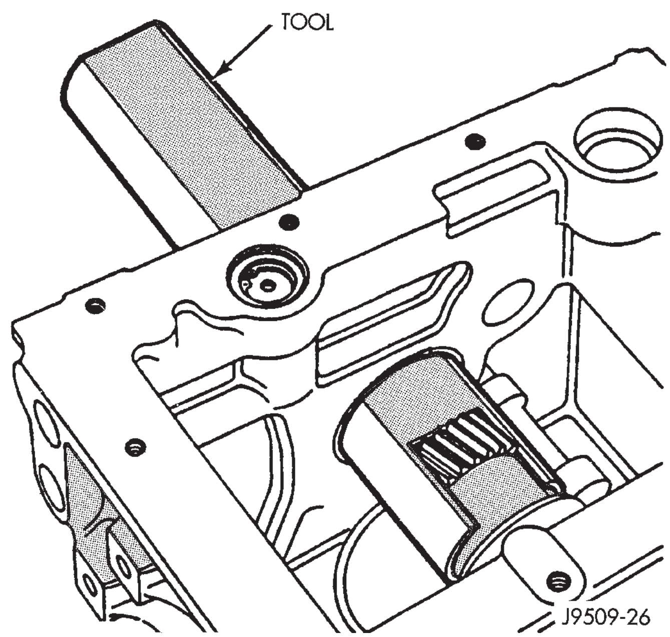

Fig. 108 Crankshaft Special Tool VM.1004

(17) Remove the main bearing oil feed and crankshaft support locators from block.

(18) Remove the flywheel and adaptor plate from engine block.

(19) Remove the thrust bearings from rear main bearing carrier.

(20) Slide the crankshaft and bearing carriers rearward to rear of cylinder block. Remove crankshaft from the rear of the cylinder block.

(21) Mark the carriers for assembly and remove the bolts, two for each carrier. Separate the two halves of each carrier, remove from the crankshaft and temporarily re-assemble the carriers (Fig. 109).

(22) Install the Crankshaft Bearing Remover/Installer VM.1002 on the front main bearing (Fig. 110).

(23) Using the VM.1002 pull the front main bearing out of the cylinder block (Fig. 110).

REMOVAL AND INSTALLATION (Continued)

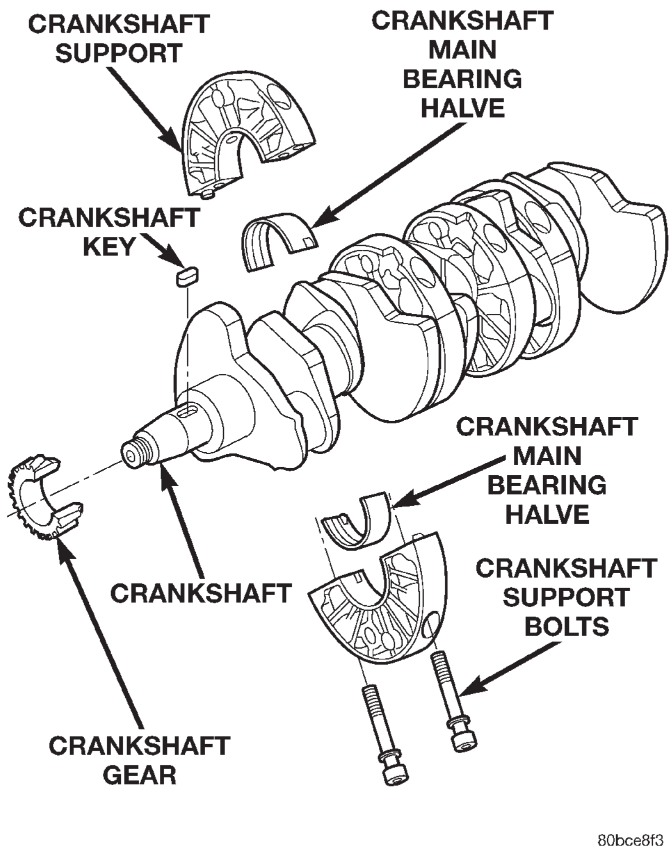

Fig. 109 Crankshaft and Carrier Bearing Assembly

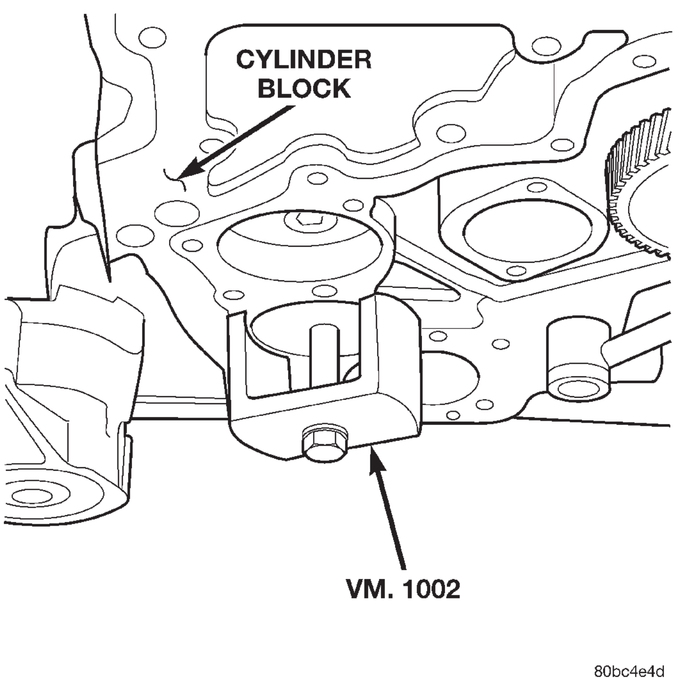

Fig. 110 Crankshaft Front Main Bearing Removal

INSTALLATION

NOTE: Be sure that the oil hole in the main bearing lines up with the oil gallery hole in the cylinder block.

(1) Using the VM.1002 push the front main bearing into the cylinder block (Fig. 111).

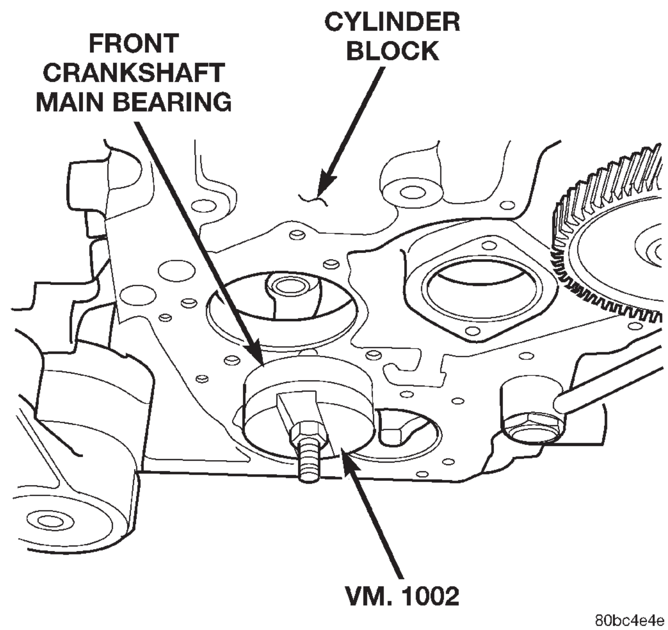

Fig. 111 Crankshaft Front Main Bearing Installation

(2) Fit the main bearing supports together. Torque to 44 N·m (32 ft. lbs.)

(3) Check internal diameter of bearings.

(4) If internal diameter of original bearing is being checked and figures are not within specifications, new bearings must be used.

(5) Check the crankshaft main bearing journals to bearing clearances. Clearances of main bearings is .03 to .088mm (.0011 to .0035 in.).

NOTE: Assemble engine according to sequence described, thus saving time and preventing damages to engine components. Clean parts with a suitable solvent and dry them with compressed air before assembly. Use new gaskets where applicable and torque wrenches for correct tightening of components.

(6) Thoroughly clean crankcase and oil passages, and blow dry with compressed air.

(7) Install new main bearing shells in each of the carrier halves. Assemble the carriers to the crankshaft journals, ensuring that the carriers are installed in their original locations. Secure each carrier with the two bolts tightening evenly to 44 N·m (32 ft. lbs.).

REMOVAL AND INSTALLATION (Continued)

(8) Slide special tool VM.1004 over the crankshaft gear and, insert the crankshaft and support assembly into the crankcase in the same manner used for removal.

(9) Align the holes in the lower supports, with the center of the crankcase webs (Fig. 112).

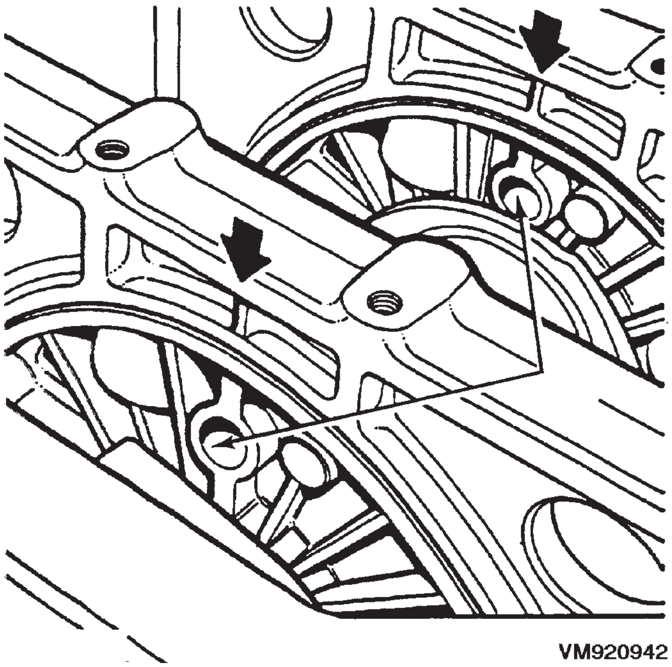

Fig. 112 Main Bearing Support Alignment

(10) Secure each support assembly to the crankcase with the main bearing oil feed and support locators. Torque to 54 N·m (40 ft. lbs).

(11) Install the rear main bearing support onto crankshaft ensuring arrow on bearing support aligns with vertical web in center of crankcase.

(12) Install the rear oil seal.

(13) Install the new O-rings in adaptor plate.

(14) Install the adaptor plate to block. Torque nuts to 28 N·m (20 ft. lbs.).

(15) Install the Allen bolts through adaptor plate to rear main bearing support. Torque to 11 N·m (97 in. lbs.).

(16) Position the flexplate adapter hub and O-ring on crankshaft and align bolt holes.

NOTE: For purposes of checking crankshaft end play, used adapter hub bolts may be used. Final assembly requires new adapter hub bolts.

(17) Install 2 adapter hub bolts, 180° apart, and tighten bolts to 20 N·m plus 60° (15 ft. lbs.) plus 60°.

(18) Attach dial indicator to engine block.

(19) Move crankshaft toward front of engine and zero indicator.

(20) Move crankshaft toward the rear of engine and record measurement.

(21) Subtract specified crankshaft end play from figure obtained. Crankshaft end play 0.08 to 0.28 mm (.0060 to .0119 in.).

(22) Select thrust washers which will give correct end play.

(23) Remove tools and adapter hub.

(24) Lubricate thrust washer halves and fit them into the rear main bearing carrier.

(25) Ensure that crankshaft end and adapter hub mating surfaces are clean and dry. Install ''O'' ring in adapter hub groove.

(26) To verify correct end play, install 2 adapter hub bolts 180° apart, and tighten bolts to 20 N·m plus 60° (15 ft. lbs. plus 60°).

(27) Measure crankshaft end play with a dial gauge. Crankshaft end play should not exceed 0.08 to 0.28 mm (.0060 to .0119 in.) (Fig. 113).

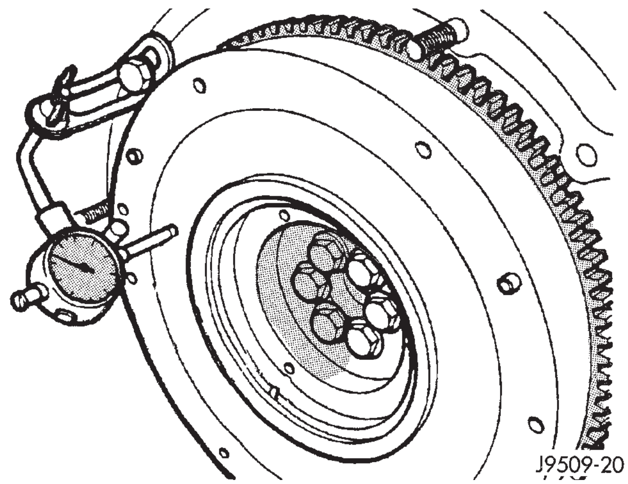

Fig. 113 Measuring Crankshaft End Play

CAUTION: Use NEW adapter hub bolts for the following procedure.

(28) Install a new O-ring on adapter hub. Install adapter hub on crankshaft. The 6 adapter hub bolts must be tightened as follows:

a. Lubricate and install the 6 new adapter hub bolts.

b. Torque the 6 adapter hub bolts to 50 N·m (36 ft. lbs.) starting one bolt and following with the opposite one (cross tightening) until completion, in a clockwise direction..

c. Loosen one bolt at a time and tighten to 20 N·m (14 ft. lbs.) plus 75° using the cross tightening method.

(29) Install the pistons and connecting rod assemblies. Refer to piston and connecting rods removal and installation in this section.

(30) Install the oil pick up tube. Torque bolts to 25 N·m (18 ft. lbs.).

REMOVAL AND INSTALLATION (Continued)

(31) Install the oil pan. Refer to oil pan removal and installation in this section.

(32) Install the vacuum pump, being careful to align the gear timing marks with those on the crankshaft gear. Torque screws to 20 N·m (15 ft. lbs.).

(33) Before installing the oil pump check pump bore depth in block (A) and pump body height (B) (Fig. 114). Difference between A and B should be 0.020-0.082 mm (.0007 to 0032 in.).

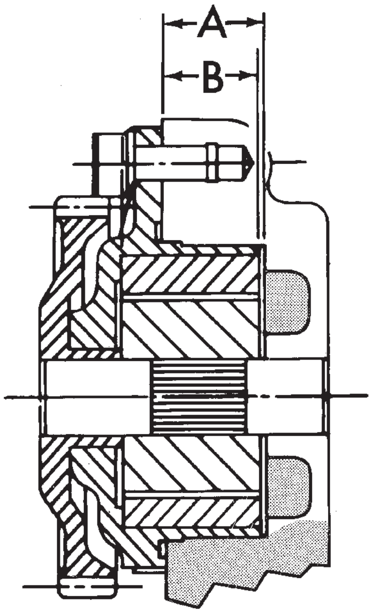

Fig. 114 Oil Pump Bore Depth

(34) Install the oil pump. Torque screws to 27 N·M (20 ft.lbs.). Check for normal backlash between pump and crankshaft gears.

(35) Install the timing gear cover. Refer to timing gear cover removal and installation in this section.

(36) Install the vibration damper. Refer to vibration damper removal and installation in this section.

(37) Install the cylinder heads. Refer to cylinder head removal and installation in this section.

(38) Install the rocker arms and push rods. Refer to rocker arm and push rod removal and installation in this section.

(39) Install the cylinder head cover. Refer to cylinder head cover removal and installation in this section.

(40) Install the accessary drive system.

(41) Install the engine in vehicle. Refer to engine removal and installation in this section.

(42) Fill engine with the correct amount of fluids specified.

(43) Connect the negativre battery cable.

DISASSEMBLY AND ASSEMBLY

HYDRAULIC TAPPETS

DISASSEMBLE

(1) Pry out plunger retainer spring clip.

(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. 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.

CLEANING AND INSPECTION

CYLINDER HEAD

CLEANING

Thoroughly clean the engine cylinder head and cylinder block mating surfaces. Clean the intake and 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.

INSPECTION

Use a straightedge and feeler gauge to check the flatness of the engine cylinder head and block mating surfaces (Fig. 115).

Minimum cylinder head thickness 89.95mm (3.541 in.)

CAUTION: If only one cylinder head is found to be distorted and requires machining, it will also be necessary to machine the remaining cylinders heads and end plates by a corresponding amount to maintain correct cylinder alignment.

CLEANING AND INSPECTION (Continued)

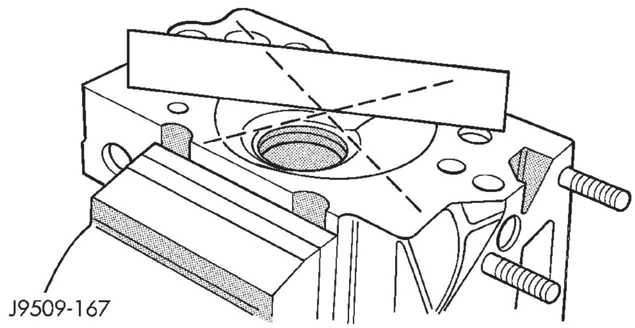

Fig. 115 Checking Cylinder Head Flatness

ROCKER ARMS AND PUSH RODS

CLEANING

Clean all the components (Fig. 116) with cleaning solvent.

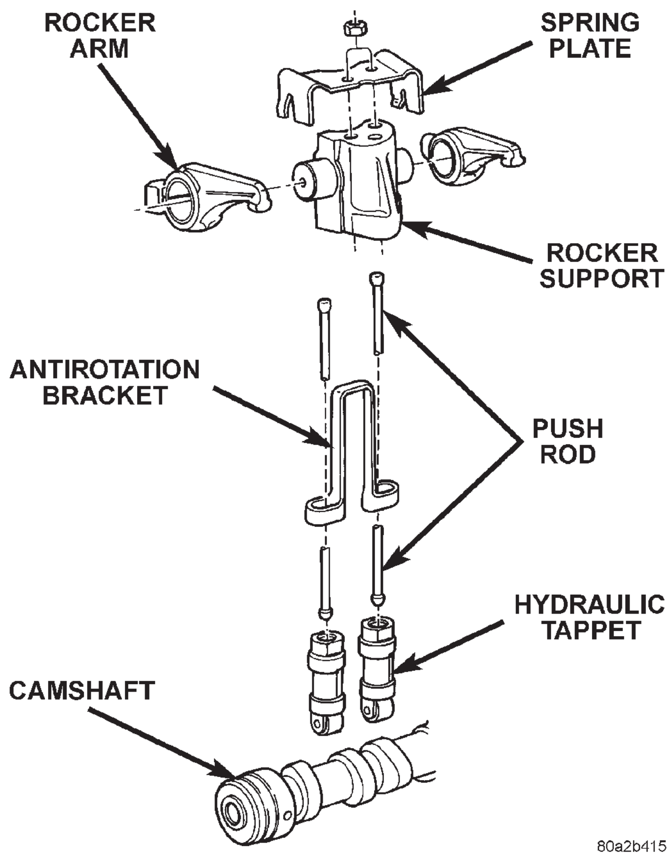

Fig. 116 Rocker Arm Components

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.

PISTONS AND CONNECTING ROD ASSEMBLY

INSPECTION—PISTONS

(1) Piston Diameter: Size: 91.93-91.94mm (3.6191-3.6196 in.) Maximum wear limit .05mm (.0019 in.).

(2) Check piston pin bores in piston for roundness. Make 3 checks at 120° intervals. Maximum out of roundness .05mm (.0019in.).

(3) The piston diameter should be measured approximately 15 mm (.590 in.) up from the base.

(4) Skirt wear should not exceed 0.1 mm (.00039 in.).

(5) The clearance between the cylinder liner and piston should not exceed 0.25 mm (.0009 in.).

(6) Make sure the weight of the pistons does not differ by more than 5 g.

INSPECTION—CONNECTING ROD

(1) Assemble bearing shells and bearing caps to their respective connecting rods ensuring that the serrations on the cap and reference marks are aligned.

(2) Tighten bearing cap bolts to 29N·m (21 ft. lbs.) plus 60°.

(3) Check and record internal diameter of crank end of connecting rod.

NOTE: When changing connecting rods, all four must have the same weight and be stamped with the same number. Replacement connecting rods will only be supplied in sets of four.

Connecting rods are supplied in sets of four since they all must be of the same weight category. Max allowable weight difference is 18 gr.

CLEANING AND INSPECTION (Continued)

NOTE: On one side of the big end of the con-rod there is a two-digit number which refers to the weight category. On the other side of the big end there is a four digit number on both the rod and the cap. These numbers must both face the camshaft as well as the recess on the piston crown (Fig. 118). Lightly heat the piston in oven. Insert piston pin in position and secure it with provided snap rings.

The Four digit numbers marked on con rod big end and rod cap must be on the same side as the camshaft (Fig. 118). After having coated threads with Molyguard, tighten con rod bolts to 29 N·m (21 ft. lbs.) plus 60°.

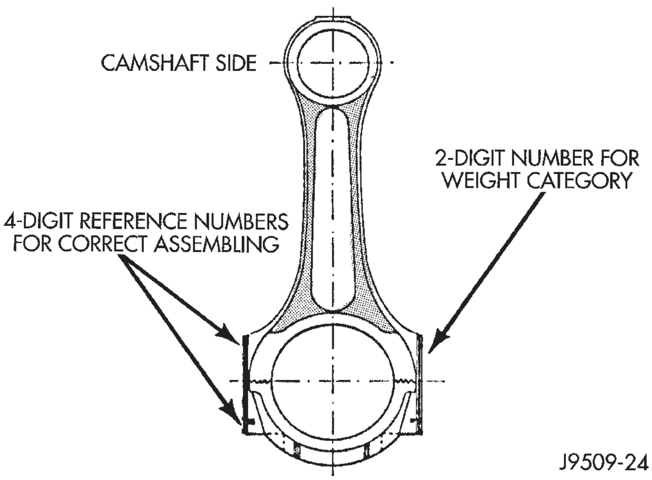

Fig. 117 Connecting Rod Identification

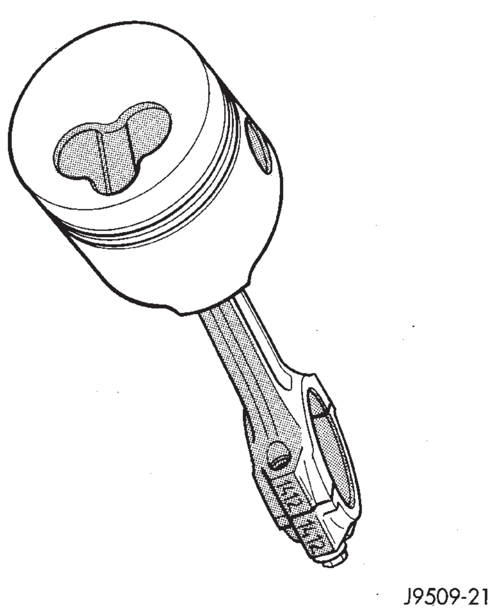

Fig. 118 Piston and Connecting Rod Assembly

INSPECTION—PISTON PIN

(1) Measure the diameter of piston pin in the center and both ends.

(2) Piston pin diameter is 29.990 to 29.996mm (1.1807 to 1.1809 in.).

INSPECTION—CRANKSHAFT JOURNALS

(1) Using a micrometer, measure and record crankshaft connecting rod journals, take reading of each journal 120° apart. Crankshaft journal diameter is 53.84 to 53.955mm (2.1196 to 2.1242 in.).

(2) Crankshaft journals worn beyond limits or show signs of out of roundness must be reground or replaced. Minimum reground diameter is 53.69mm (2.1137 in.).

BEARING-TO-JOURNAL CLEARANCE

Compare internal diameters of connecting rod with crankshaft journal diameter. Maximum clearance between connecting rod and crankshaft journals .022 to .076mm (.0008 to .0029 in.).

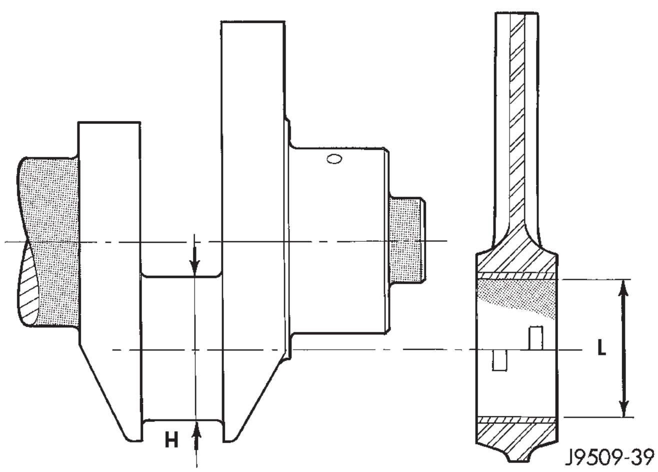

Fig. 119 Bearing Clearance

CYLINDER WALL LINER ASSEMBLY

INSPECTION

The cylinder walls should be checked for out-of-round and taper with dail bore gauge. The cylinder bore out-of-round is 0.100 mm (.0039 inch) maximum and cylinder bore taper is 0.100 mm (0.0039 inch) maximum. If the cylinder walls are badly scuffed or scored, new liners should be installed and honed, and new pistons and rings fitted.

Measure the cylinder bore at three levels in directions A and B (Fig. 120). Top measurement should be 10 mm (3/8 inch) down and bottom measurement should be 10 mm (3/8 inch.) up from bottom of bore.

CLEANING AND INSPECTION (Continued)

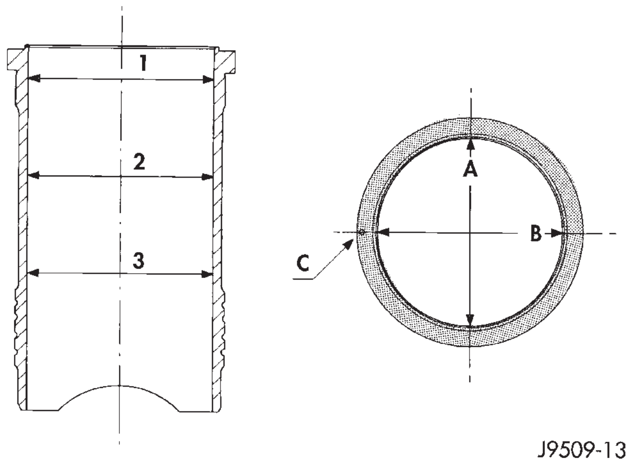

Fig. 120 Liner Inspection

OIL PUMP

CLEANING

Wash all parts in a suitable solvent and inspect carefully for damage or wear.

INSPECTION

(1) Before installing oil pump check pump bore depth in block (A) and pump body height (B) (Fig. 121). Difference between A and B should be 0.020-0.082 mm.

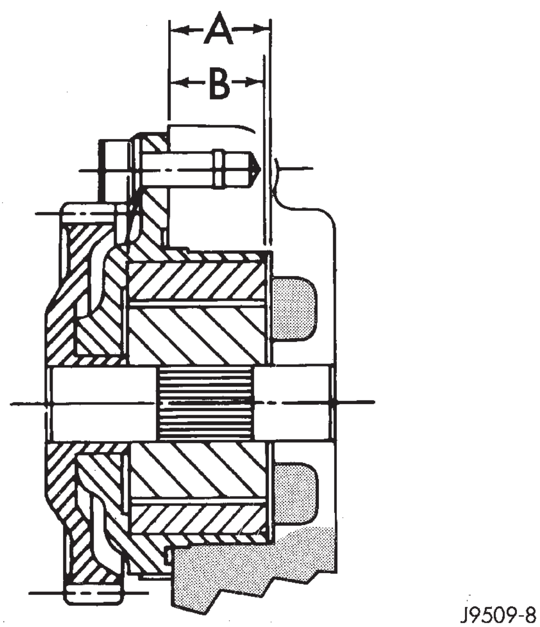

Fig. 121 Oil Pump Bore Depth

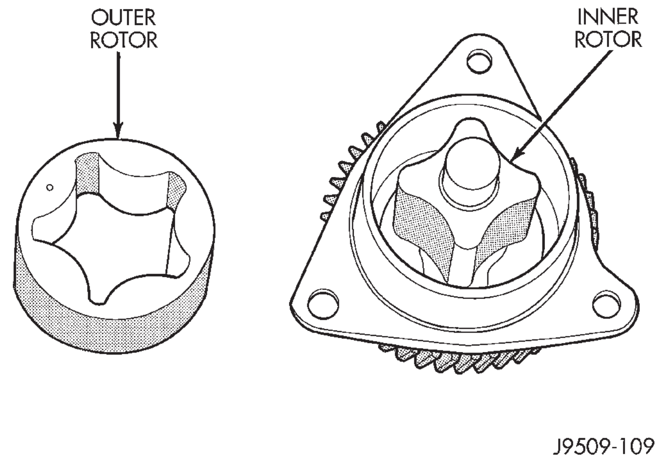

Fig. 122 Oil Pump Inner and Outer Rotors

(2) Check clearance between rotors (Fig. 123).

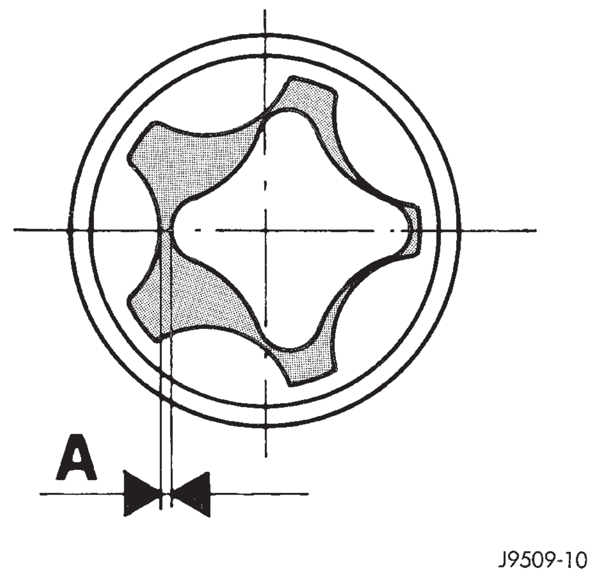

Fig. 123 Checking Rotor Clearance

SPECIFICATIONS

ENGINE SPECIFICATIONS

Description	Specifications
Type	531CIEW
Number of cylinders	5
Bore	92 mm
Stroke	94 mm
Capacity	3125cc
Injection order	1-2-4-5-3
Compression ratio	21 : 1 (+/- 0.5)
Gasket	Asbestos free
Crankshaft	
Front journal diameter	
Nominal	62.985-63.005 mm
-0.25	62.735-62.755 mm
-0.125	62.860-62.880 mm
Front bearing diameter	
Nominal	63.043-63.088 mm
-0.25	62.793-62.838 mm
-0.125	62.918-62.963 mm
Clearance between journal and bearing: 0.038-0.103 mm	
Center journal diameter	
Nominal	63.005-63.020 mm
-0.25	62.755-62.770 mm
-0.125	62.880-62.895 mm
Center bearing diameter	
Nominal	63.050-63.093 mm
-0.25	62.800-62.843 mm
-0.125	62.925-62.968 mm
Clearance between journal and bearing: 0.030-0.088	
Rear journal diameter	
Nominal	79.980-80.000 mm
-0.25	79.730-79.750 mm
-0.125	79.855-79.875 mm
Rear bearing diameter	
Nominal	80.045-80.070 mm
-0.25	79.795-79.820 mm
-0.125	79.920-79.945 mm
Clearance between journal and bearing: 0.045-0.090	
Wear limit: 0.200 mm.	
Connecting rod journal	
Nominal	53.940-53.955 mm
-0.25	53.690-53.705 mm
-0.125	53.815-53.830 mm
Connecting rod bearing	
Nominal	53.977-54.016 mm
-0.25	53.727-53.766 mm
-0.125	53.852-53.891 mm
Clearance between journal and bearing: 0.022-0.076	
Wear limit: 0.200 mm	

Description	Specifications
Crankshaft end play	
End play	0.080-0.280 mm
Adjustment.	Thrust washers
Thrust washers available:	2.31-2.36 mm
	2.41-2.46 mm
	2.51-2.56 mm
Main bearing carriers	
Internal diameter	
Front	67.025-67.050 mm
Center	66.670-66.687 mm
Rear	85.985-86.005 mm
Liners	
Internal diameter	91.997-92.015 mm
Protrusion	0.01-0.06 mm
Adjustment	Shims
Available shims:	0.15 mm
	0.17 mm
	0.20 mm
	0.23 mm
	0.25 mm
Cylinder head	
Minimum thickness	89.95-90.05 mm
Gaskets thickness:	1.41 mm +/- 0.08, 0 notches
	1.61 mm +/- 0.08, 1 notches
	1.51 mm +/- 0.08, 2 notches
End plates:	
Height	89.92-90.00 mm
Connecting rods	
Weight (without the crank bearing): 966 grams	
Small end bearing	
Internal diameter	
Minimum	30.035 mm
Maximum	30.050 mm
Crankshaft bearings	
Standard Internal diameter	53.977-54.016 mm
Pistons	
Skirt diameter (measured at approximately 10 mm above the bottom of the skirt).	91.918-91.932 mm
Piston clearance:	0.065-0.083 mm
Top of piston to cylinder head	0.80-0.89 mm
Piston protrusion	0.53 - 0.62 Fit gasket Number (1.41),0 notches
	0.73 - 0.82 Fit gasket Number (1.61),1 notches
	0.63 - 0.72 Fit gasket Number (1.51),2 notches

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SPECIFICATIONS (Continued)

Description	Specifications
Piston pins	
Type	Fully floating
Pin diameter	29.992-29.996 mm
Clearance	0.004-0.012 mm
Piston rings	
Clearance in groove:	
Top	0.080-0.130 mm
Second.	0.070-0.110 mm
Oil control	0.040-0.080 mm
Fitted gap:	
Top	0.30-0.45 mm
Second.	0.30-0.45 mm
Oil control	0.25-0.50 mm
Camshaft	
Journal diameter, front	53.495-53.51 mm
Bearing clearance	0.030-0.095 mm
Center	53.45-53.47 mm
Bearing clearance	0.07-0.14 mm
Rear	53.48-53.50 mm
Bearing clearance	0.04-0.11 mm
Tappets	
Outside diameter	22.195-22.212 mm
Rocker gear	
Shaft diameter	21.979-22.00 mm
Bush internal diameter	22.020-22.041 mm
Assembly clearance	0.020-0.062 mm
Valves	
Intake valve:	
Opens	26° B.T.D.C.
Closes	58° A.B.D.C.
Exhaust valve:	
Opens.	66° B.B.D.C.
Closes	36° A.T.D.C.

Description	Specifications
Face angle:	
Intake	55°30` - 55°40`
Exhaust.	45° 25` - 45° 35`
Head diameter:	
Intake	40.05-40.25 mm
Exhaust.	33.8-34.0 mm
Head stand down:	
Intake	1.08-1.34 mm
Exhaust.	0.99-1.25 mm
Stem diameter:	
Intake	7.940-7.960 mm
Exhaust.	7.922-7.940 mm
Clearance in guide:	
Intake	0.040-0.075 mm
Exhaust.	0.060-0.093 mm
Valve guide	
Inside diameter	8.0-8.015 mm
Fitted height	13.5-14 mm
Valve springs	
Free length	44.65 mm
Fitted length	38.6 mm
Load at fitted length	34 +/- 6% Kg
Load at top of lift.	92.5 +/- 4% Kg
Number of coils	5.33 Valve timing
Lubrication	
System pressure at 4000 rev/min	3.5 to 5.0 bar (oil at 90-100°C)
Pressure relief valve opens	6.84 bar
Pressure relief valve spring - free length	57.5 mm
Oil pump:	
Outer rotor end float	0.030-0.107 mm
Inner rotor end float	0.030-0.107 mm
Outer rotor to body diam. clearance	0.130-0.230 mm
Rotor body to drive gear clearance (pump not fitted)	0.30 - 0.50 mm

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SPECIFICATIONS (Continued)

TORQUE SPECIFICATIONS

DESCRIPTION	TORQUE
Adaptor Plate to Block	
Nuts (6)	27 N·m
Automatic Belt Tensioner to Block	
Bolts (2)	120 N·m
Automatic Belt Tensioner to Mounting Bracket	
Bolt (1)	75 N·m
Generator belt	
Tensioner	79 N·m
Generator bracket	
Mounting bolts (10 mm)	47 N·m
Mounting bolts (12 mm)	83 N·m
Generator	
Mounting bolt	47 N·m
Camshaft thrust plate	
Bolts	27 N·m
Connecting rod	
Mounting bolt	29.5 N·m +60°
Crankshaft bearing	
Carrier screw	44 N·m
Crankshaft pulley	
Locknut	196 N·m
Crossmember	
Bolts	42 N·m
Diesel delivery	
Union nut	19 N·m
EGR valve	
To intake manifold	27 N·m
EGR tube	
To EGR valve	26 N·m
Engine mounts	
Engine support bracket	61 N·m
Support Cushion	47 N·m
Support cushion bracket bolts	54 N·m
Support cushion bracket stud nuts	41 N·m
Support Cushion through bolt	65 N·m
Exhaust down pipe	
To turbocharger	32 N·m
Exhaust heat shield	
Screws	11 N·m
Exhaust manifold collar	
Mounting nut	24.5 to 29.5 N·m
Exhaust manifold	
Mounting nut	32 N·m
Fan drive	
To fan hub	56 N·m
Flexplate adapter hub to crankshaft	
Bolts	1st 50 N·m2nd 20 N·m + 75°
Flexplate to adapter hub	
Bolts	44 N·m
Front timing cover	
Bolts	11 N·m

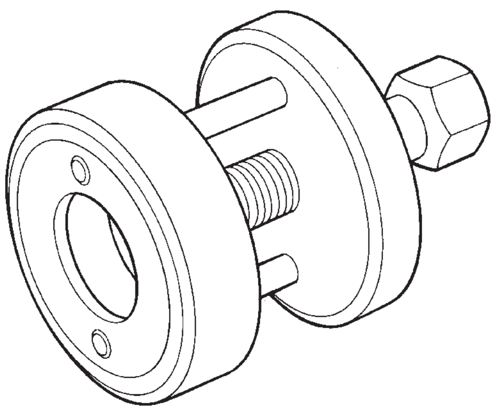
DESCRIPTION	TORQUE
Fuel filter	
Nuts	28 N·m
Glow plug	
Torque	14 N·m
Idler pulley bracket	
Bolts	40 N·m
Idler pulley	
Bolt (left hand thread)	47 N·m
Injection pump fuel lines	
Nut	23 N·m
Injection pump gear	
Lock nut	86 N·m
Injection pump	
Mounting nut	27.5 N·m
Injector	
Torque	68.5 N·m
Intake manifold	
Mounting nut	32.5 N·m
Main bearing oil delivery	
Union	54 N·m
Water hose to cylinder head	
Nut	8 to 10 N·m
Oil cooler adaptor	
Bolt	60 N·m
Oil feed line	
For rocker arms	12 N·m
To block	27 N·m
To vacuum pump	15 N·m
Oil filter	
Torque	18 N·m
Oil filter adapter	
Torque	46.6 N·m
Oil filter base	
Torque	46.6 N·m
Oil pan	
Mounting bolts	13 N·m
Oil pickup tube	
Torque	25 N·m
Oil pump	
Mounting screw	27 N·m
Oil sump drain plug	
Torque	54 N·m
Power steering pressure hose	
Nut	28 N·m
Power steering pulley	
Nut	130 N·m
Rear crankshaft bearing carrier Allen Bolts	
Torque	11 N·m
Rocker cover	
Bolts	19 N·m
Rocker mounting	
Lock Nut	35 N·m
Steering pump	

SPECIFICATIONS (Continued)

DESCRIPTION	TORQUE
Bolts	28 N·m
Turbocharger	
Mounting nuts	32.5 N·m
Turbocharger	
Oil delivery fitting	27.5 N·m
Turbocharger oil drain	
Plug	10.8 N·m
Vacuum pump	
Torque	27 N·m
Water manifold	
Bolts	12 N·m
Water pump pulley	
Nut	27 N·m

SPECIAL TOOLS

SPECIAL TOOLS



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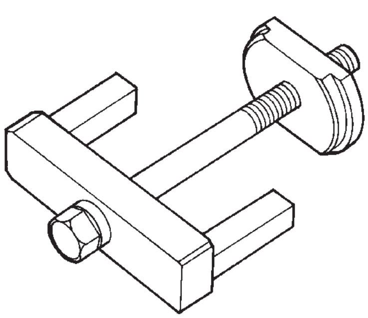
Crankshaft Pulley and Gear Remover VM. 1000A



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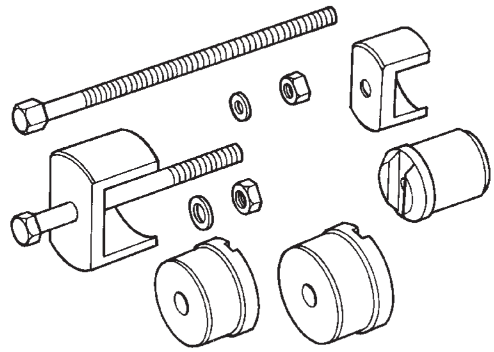
Cylinder Liner Puller VM, 1001



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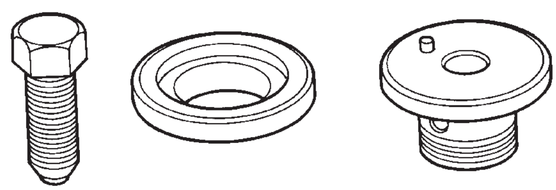
Crankshaft Bearing Remover/Replacer VM. 1002



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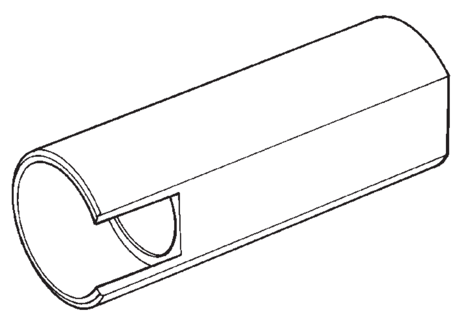
Injection Pump Puller and Gear retainer VM. 1003



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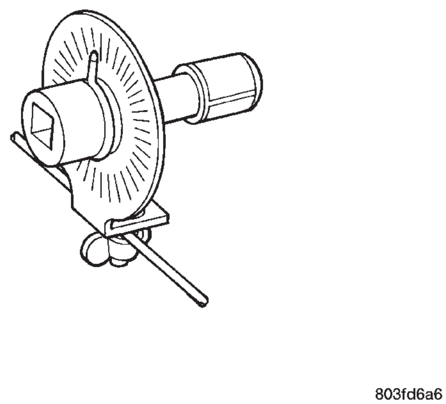
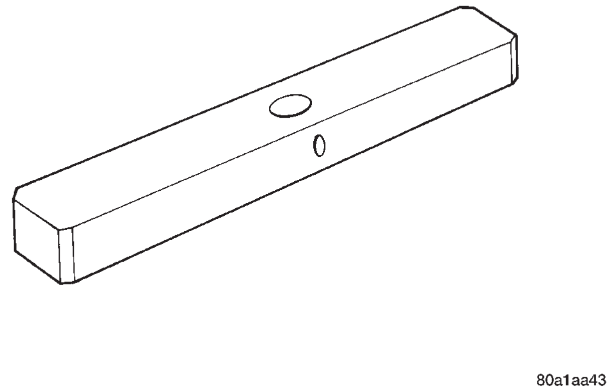
Crankshaft Remover/Installer Sleeve VM. 1004

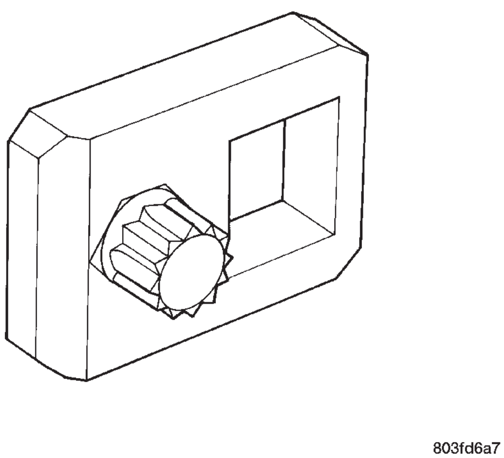
SPECIAL TOOLS (Continued)



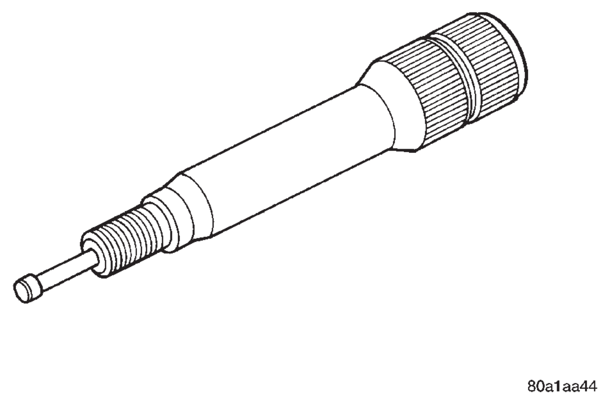
Torque Angle Gauge VM. 1005



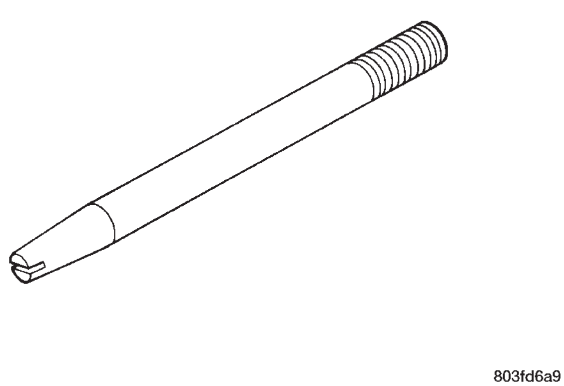
Cylinder Liner Protrusion Tool VM. 1010



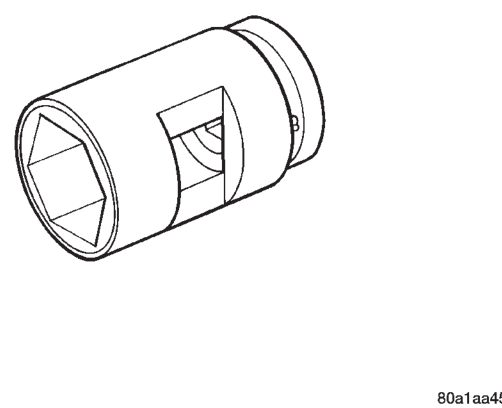
Cylinder Head Bolt Wrench VM. 1006A



Bosch Pump Timing Adapter VM. 1011

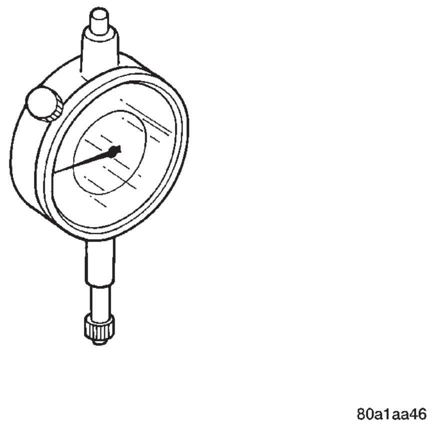


Cylinder Head Guide Studs VM. 1009

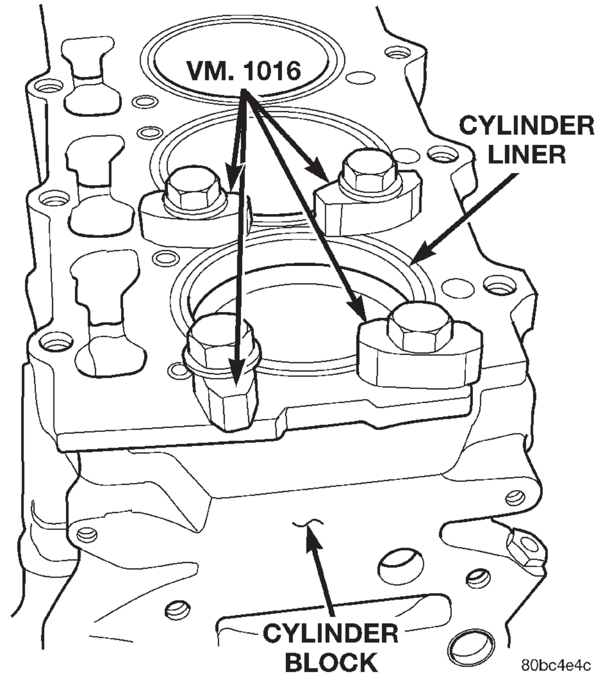


Injector Remover/Installer Socket VM. 1012

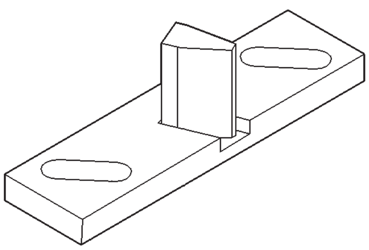
SPECIAL TOOLS (Continued)



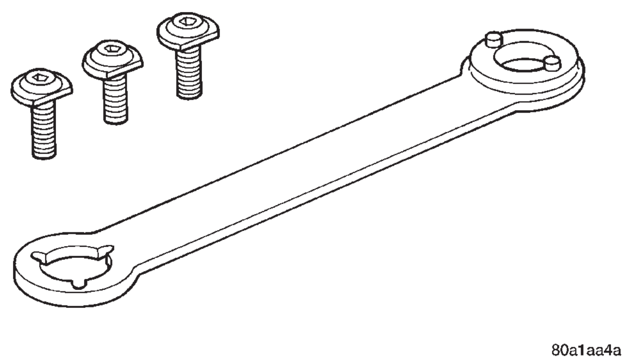
Dial Indicator Gauge VM. 1013



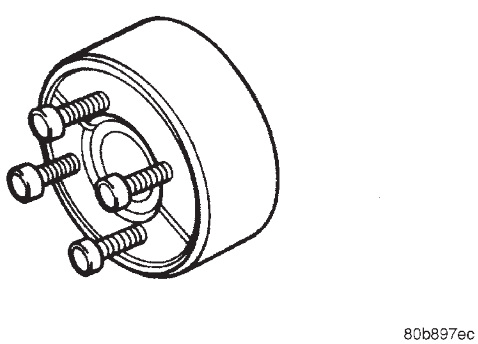
Cylinder Retainer VM. 1016



Flywheel Locking Tool VM. 1014

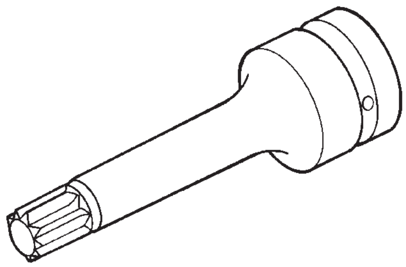


Crankshaft and Water Pump Pulley Holder VM. 1017



Timing Cover Oil Seal Installer VM. 1015A

SPECIAL TOOLS (Continued)



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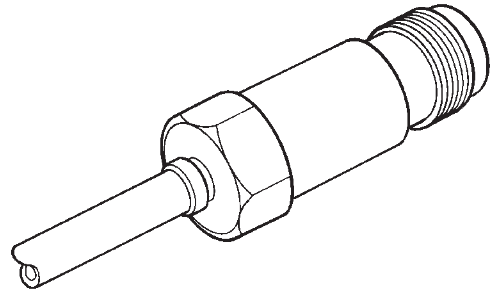
Cylinder Head Bolt Wrench M12 VM. 1018



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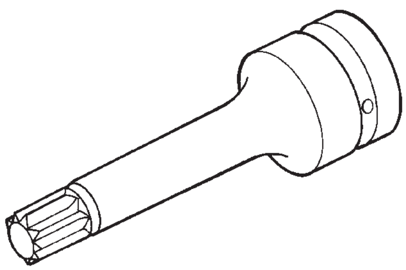
Cylinder Leakage Tester Adapter VM. 1021



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Cylinder Head Bolt Wrench M14 VM. 1019

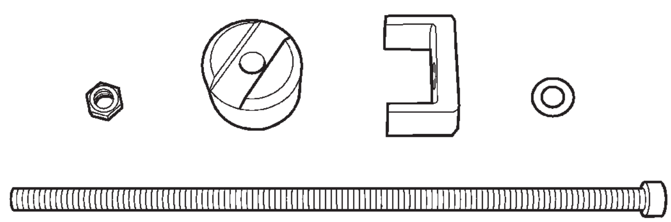

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Fig. 124 Camshaft Bearing Remover/Installer VM. 1040

EXHAUST SYSTEM

CONTENTS

DESCRIPTION AND OPERATION

EXHAUST SYSTEM COMPONENTS

CATALYTIC CONVERTERS

California emissions vehicles incorporate two mini catalytic converters into the exhaust system. These catalytic converters are made of stainless steel designed to operate at extremely high temperatures.

OXYGEN SENSORS

The exhaust system uses oxygen sensors to detect exhaust gasses. These gasses are sampled to determine whether the system is rich (to much fuel) or lean (not enough fuel) then the Powertrain Control Module (PCM) makes the appropriate adjustment to the fuel system.

MUFFLER

Both the 4.0L and 4.7L engines use a galvanized steel muffler to control exhaust noise levels and exhaust back pressure.

TAILPIPE

The tail pipe is also made of galvanized steel and channels the exhaust out of the muffler and out from under the vehicle to control noise and prevent exhaust gas fumes from entering the passenger compartment.

EXHAUST SYSTEM

WARNING: THE NORMAL OPERATING TEMPERATURE OF THE EXHAUST SYSTEM IS VERY HIGH. THEREFORE, NEVER WORK AROUND OR ATTEMPT TO SERVICE ANY PART OF THE EXHAUST SYSTEM UNTIL IT IS COOLED. SPECIAL CARE SHOULD BE TAKEN WHEN WORKING NEAR THE CATALYTIC CONVERTER. THE TEMPERATURE OF THE CONVERTER RISES TO A HIGH LEVEL AFTER A SHORT PERIOD OF ENGINE OPERATION TIME.

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

The exhaust system uses a single muffler with a welded tail pipe.

The 4.0L and 4.7L Federal Emissions vheicles use a single catalytic converter, while the California models use two additional mini catalytic converters inline with the exhaust pipe below the exhaust manifolds.

The 4.0L and 4.7L 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.

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.

DESCRIPTION AND OPERATION (Continued)

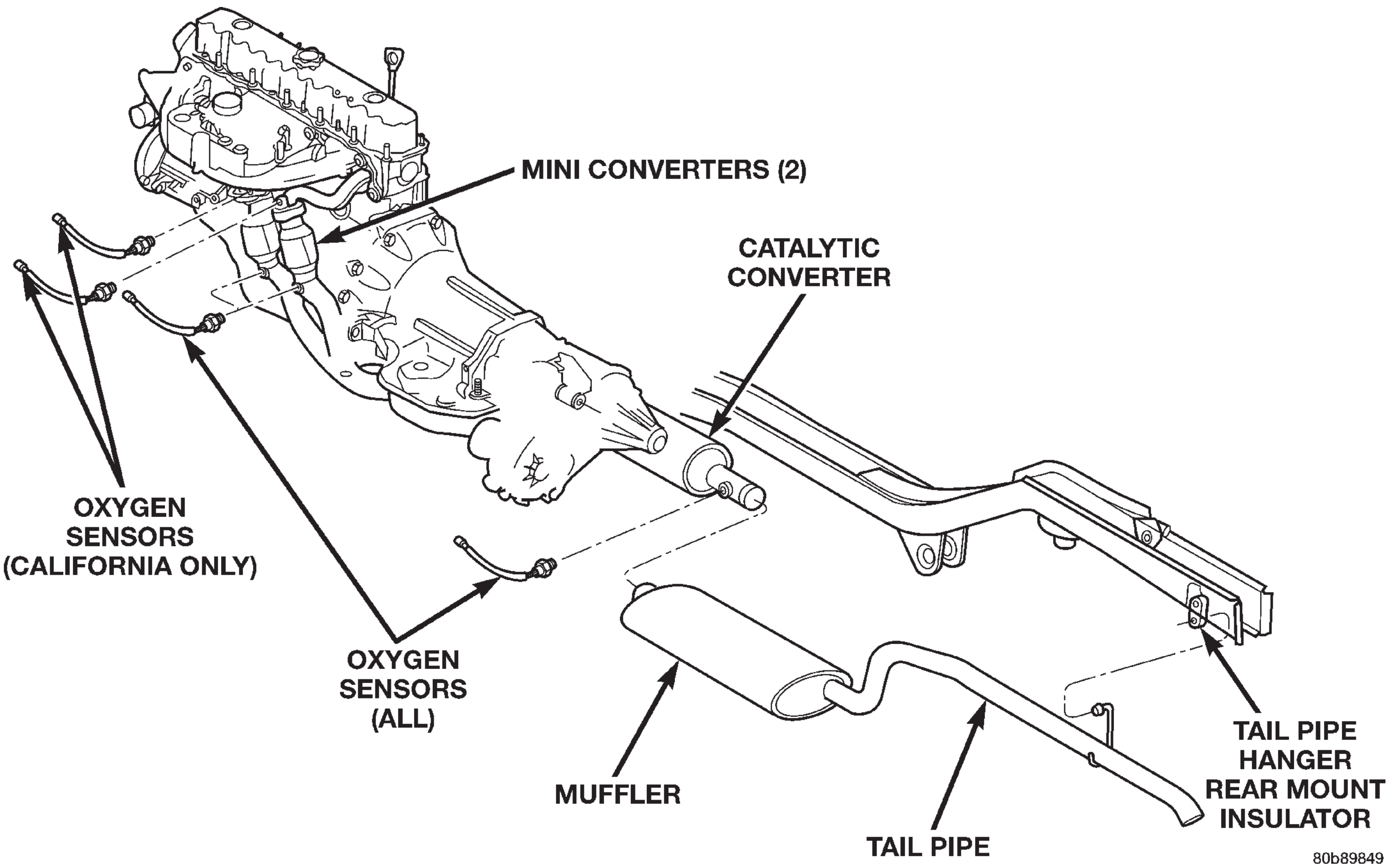


Fig. 1 Exhaust System—4.0L

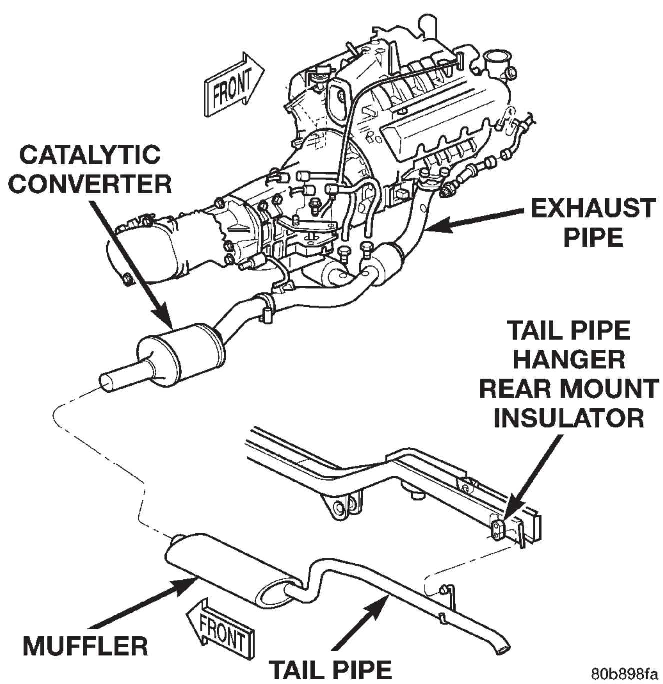


Fig. 2 Exhaust System—4.7L

CATALYTIC CONVERTER

WARNING: THE NORMAL OPERATING TEMPERATURE OF THE EXHAUST SYSTEM IS VERY HIGH. THEREFORE, NEVER WORK AROUND OR ATTEMPT TO SERVICE ANY PART OF THE EXHAUST SYSTEM UNTIL IT IS COOLED. SPECIAL CARE SHOULD BE TAKEN WHEN WORKING NEAR THE CATALYTIC CONVERTER. THE TEMPERATURE OF THE CONVERTER RISES TO A HIGH LEVEL AFTER A SHORT PERIOD OF ENGINE OPERATION TIME.

CAUTION: 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.

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.

DESCRIPTION AND OPERATION (Continued)

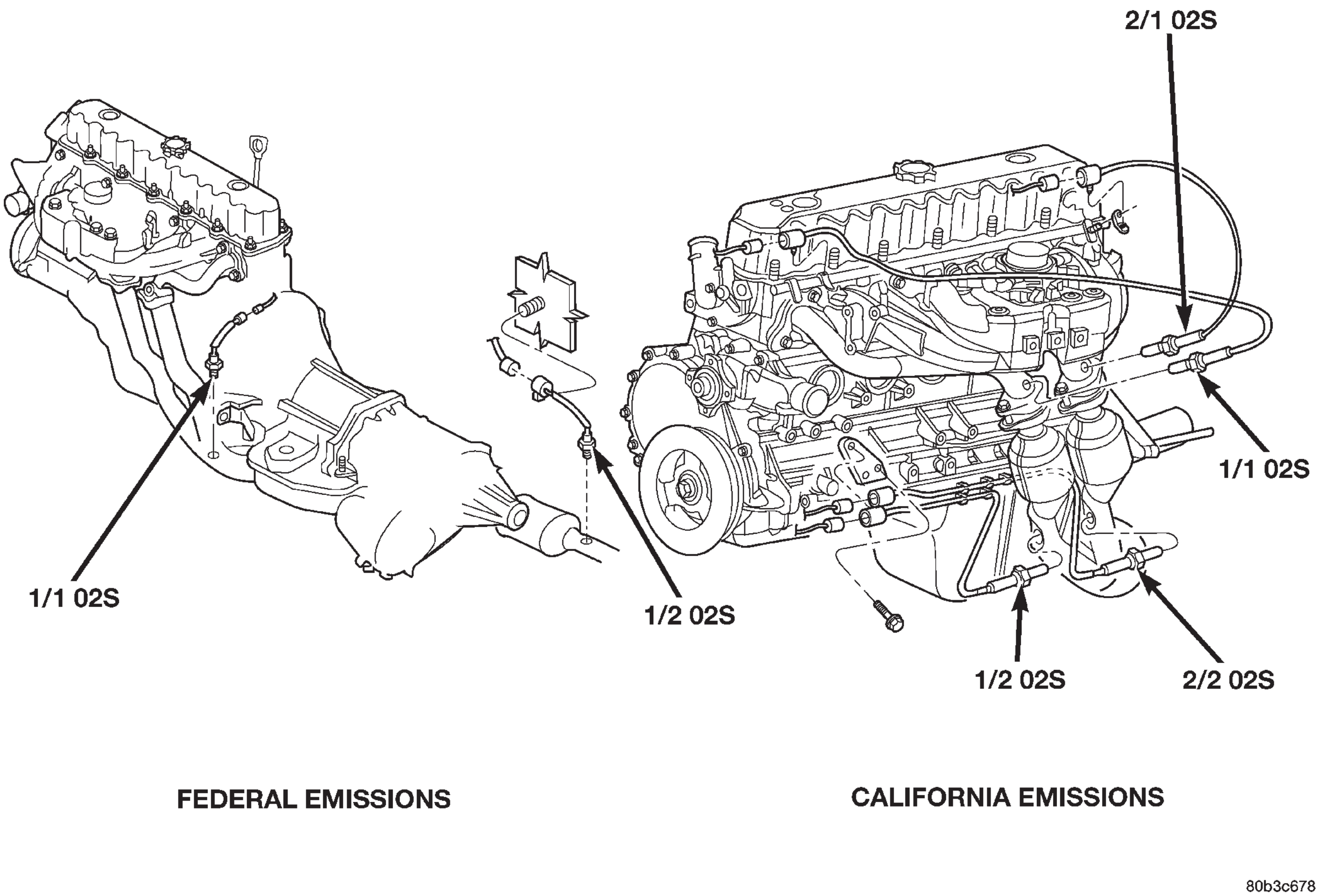


Fig. 3 4.0L Catalytic Converter and O2 Sensor Configuration—California and Federal Emissions

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

Federal emission vehicles use only one catalytic converter, However, California emission vehicles incorporate two mini catalytic converters located after the exhaust manifolds and before the inline catalytic converter (Fig. 3) (Fig. 4).

DESCRIPTION AND OPERATION (Continued)

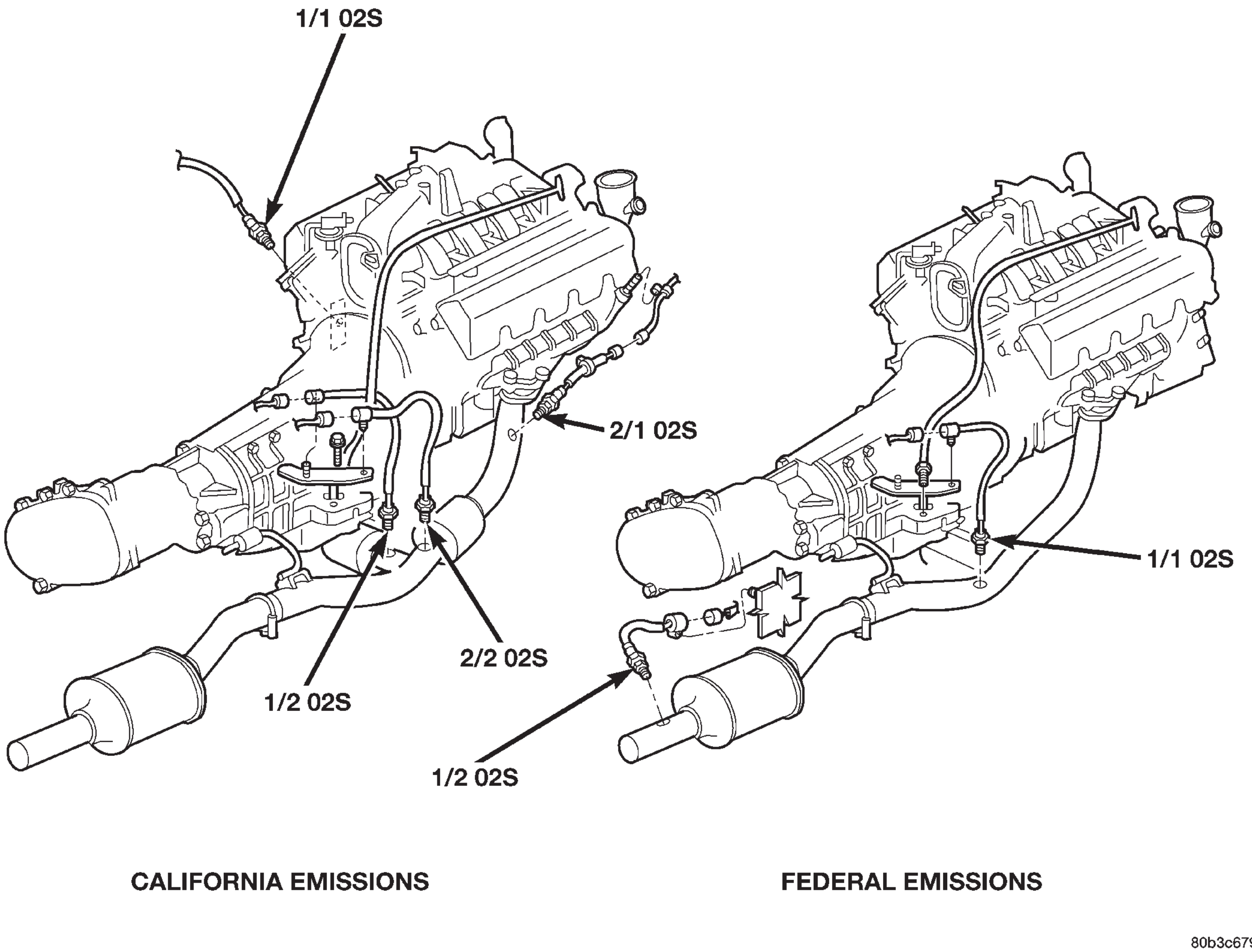


Fig. 4 4.7L Catalytic Converter and O2 Sensor Configuration—California and Federal Emissions

DESCRIPTION AND OPERATION (Continued)

HEAT SHIELDS

Heat shields are needed to protect both the vehicle and the environment from the high temperatures developed by the catalytic converter. 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. 5).

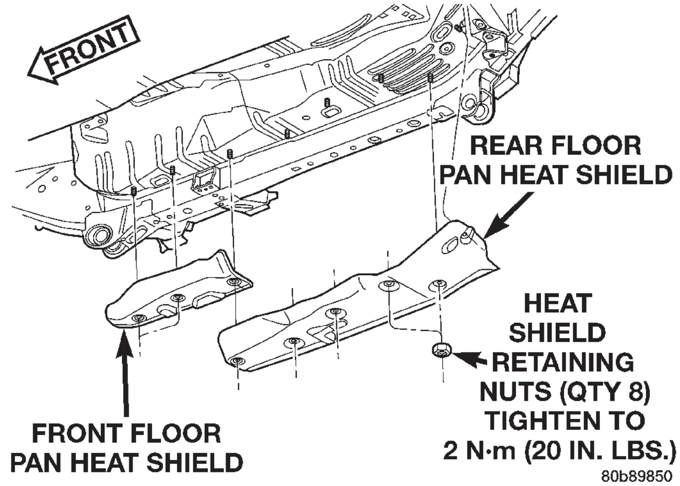


Fig. 5 Front and Rear Floor Pan Heat Shields

DIAGNOSIS AND TESTING

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 tailpipe.	7. Remove restriction, if possible. Replace muffler or tailpipe, as necessary.
	8. Exhaust system contacting body or chassis.	8. Re-align exhaust system to clear surrounding components.
LEAKING EXHAUST GASES	1. Leaks at pipe joints.	1. Tighten/replace clamps at leaking joints.
	2. Damaged or improperly installed gaskets.	2. Replace gaskets as necessary

REMOVAL AND INSTALLATION

EXHAUST PIPE

REMOVAL

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

WARNING: THE NORMAL OPERATING TEMPERATURE OF THE EXHAUST SYSTEM IS VERY HIGH. THEREFORE, NEVER WORK AROUND OR ATTEMPT TO SERVICE ANY PART OF THE EXHAUST SYSTEM UNTIL IT IS COOLED. SPECIAL CARE SHOULD BE TAKEN WHEN WORKING NEAR THE CATALYTIC CONVERTER. THE TEMPERATURE OF THE CONVERTER RISES TO A HIGH LEVEL AFTER A SHORT PERIOD OF ENGINE OPERATION TIME.

(1) Raise 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. 6) (Fig. 7).

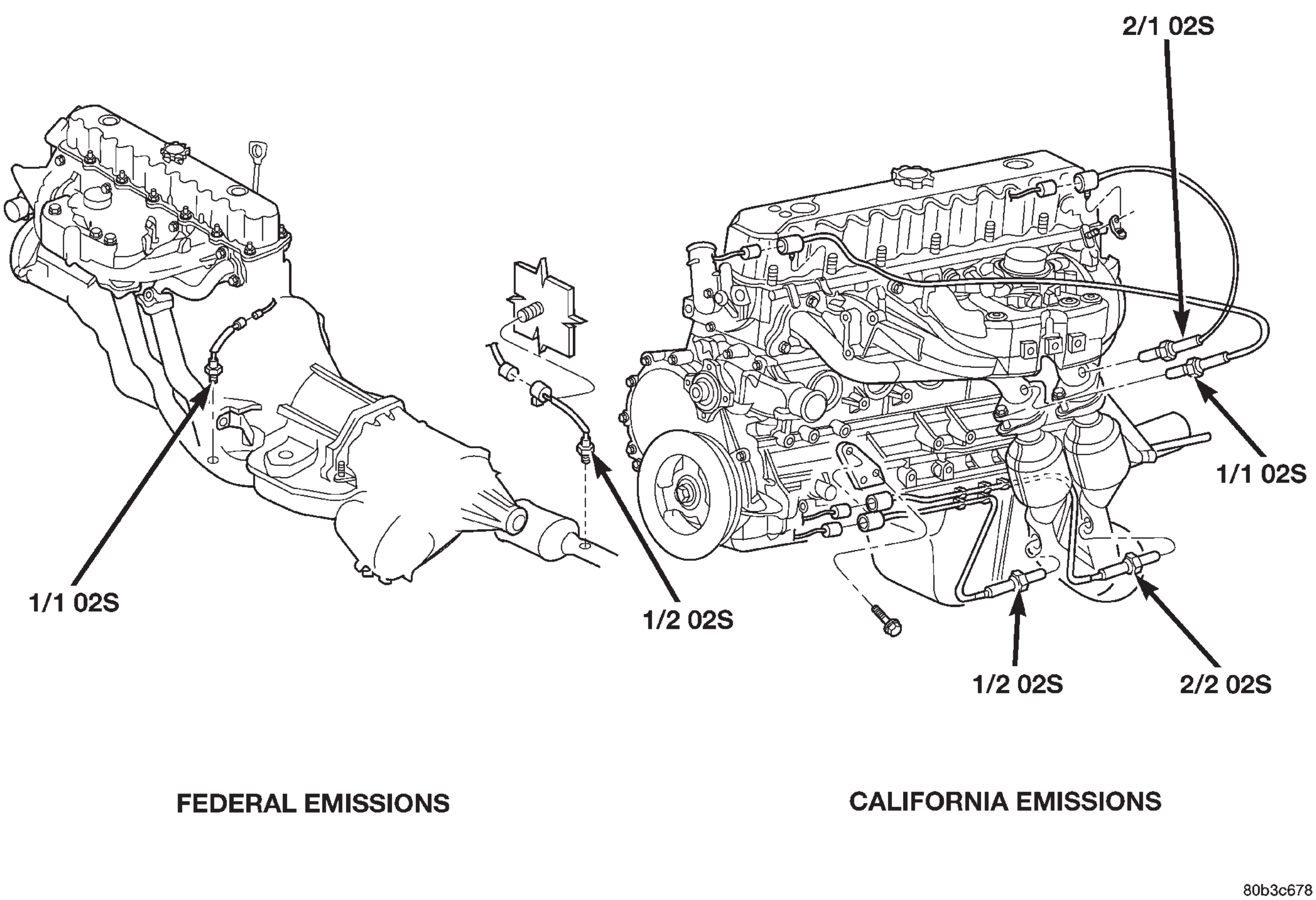


Fig. 6 O2 Sensor Location 4.0L

REMOVAL AND INSTALLATION (Continued)

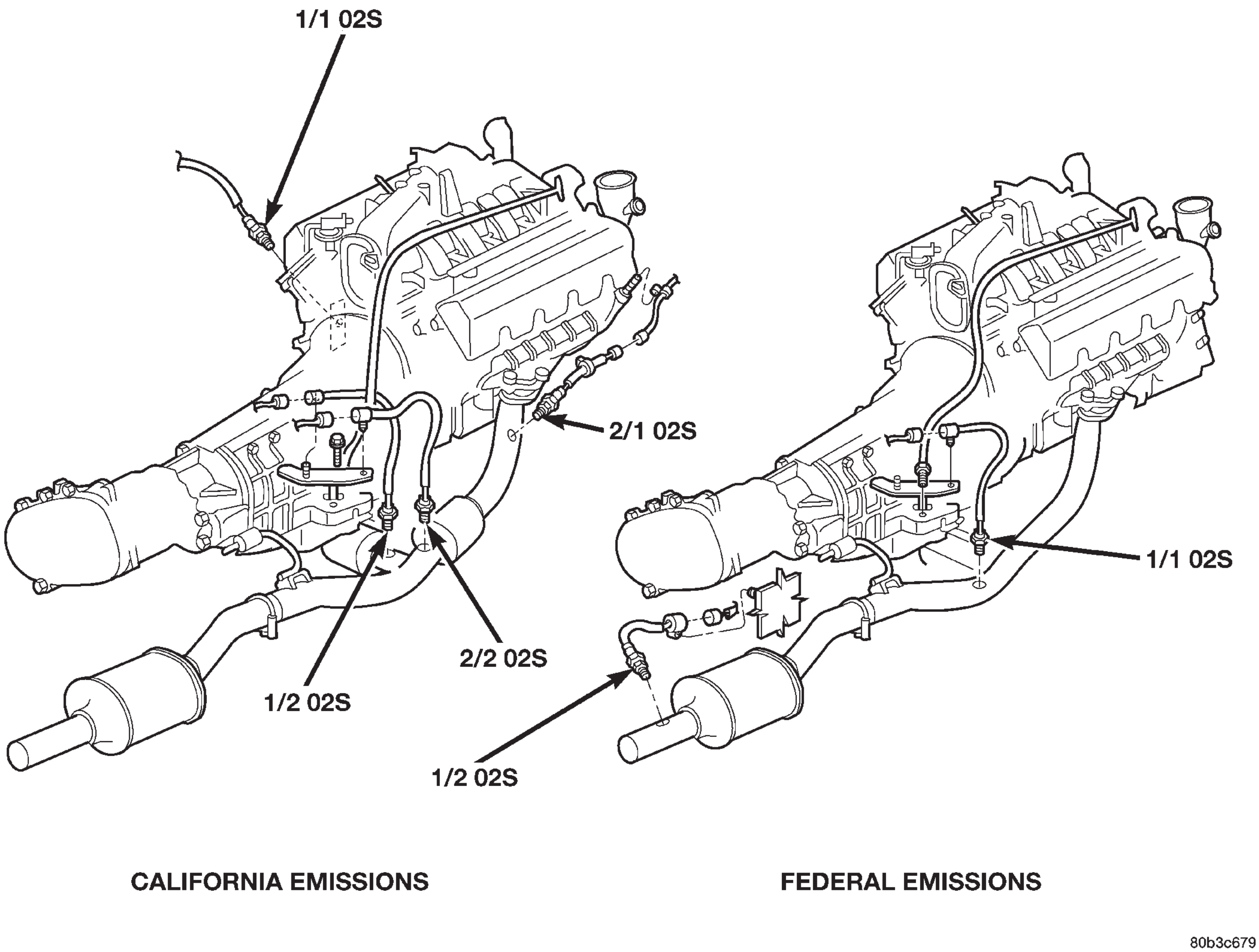


Fig. 7 O2 Sensor Location 4.7L

(4) Heat the exhaust pipe and catalytic converter connection with an torch until the metal becomes cherry red. While the metal is still cherry red, twist the catalytic converter back and forth to separate it from the exhaust pipe (Fig. 10).

(5) Disconnect the exhaust pipe from the exhaust manifold (Fig. 8) (Fig. 9).

(6) Remove the exhaust clamp from the muffler and catalytic converter connection. Disconnect the muffler from the catalytic converter. If needed:

REMOVAL AND INSTALLATION (Continued)

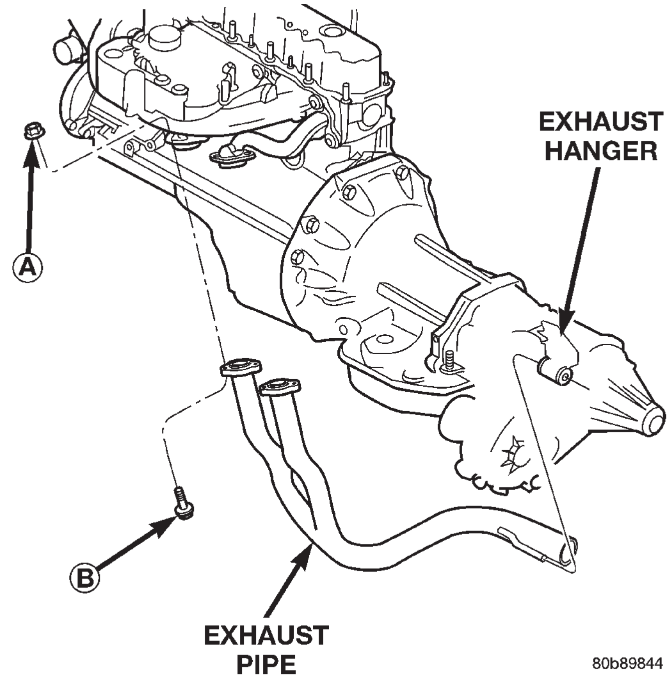


Fig. 8 Exhaust Pipe 4.0L

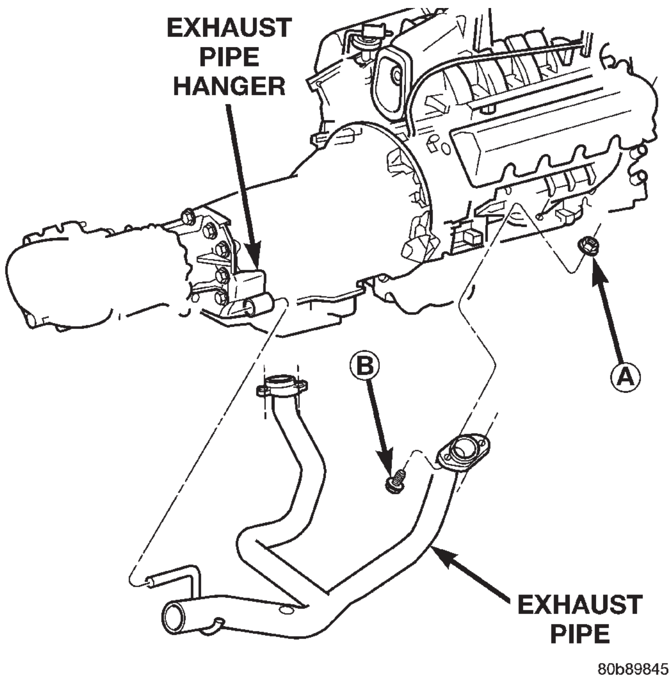


Fig. 9 Exhaust Pipe 4.7L

ITEM	DESCRIPTION
A	NUT Qty.4 Torque to 31 N·m (23 ft. lbs.)
B	BOLT Qty.4

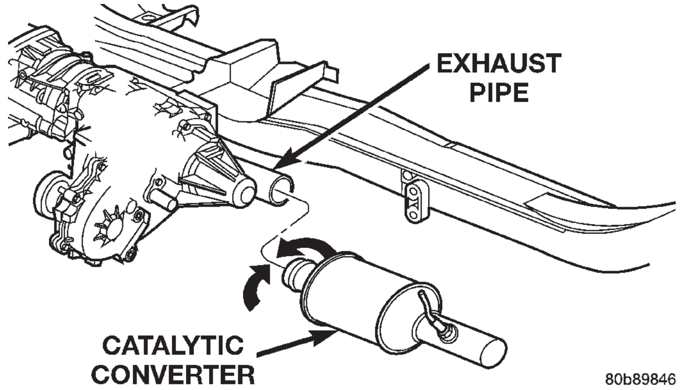


Fig. 10 Catalytic Converter—Removal

(7) Disconnect the tail pipe from the hanger (Fig. 11).

(8) Remove the muffler and tail pipe.

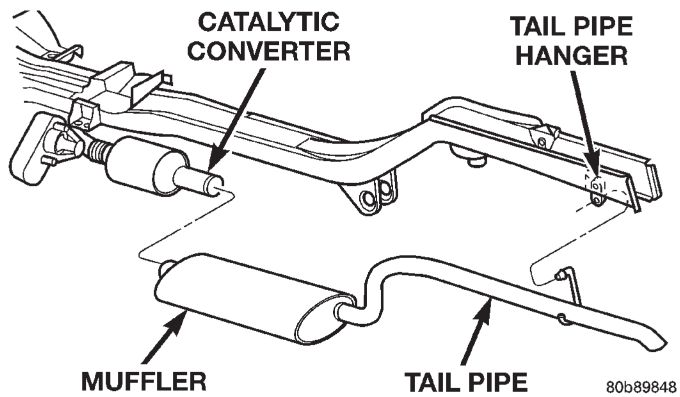


Fig. 11 Muffler and Tail Pipe

INSTALLATION

NOTE: When servicing the exhaust system, replace the factory installed uni-clamp with standard u-bolt clamps.

(1) If the catalytic converter was removed, Install the catalytic converter onto the exhaust pipe (Fig. 10).

(2) Position the muffler and tail pipe onto the catalytic converter.

(3) Connect the tail pipe hanger to the rear mount bracket insulator (Fig. 11).

(4) Connect the exhaust pipe to the engine exhaust manifold. Tighten the nuts to 31 N·m (23 ft. lbs.) (Fig. 8) (Fig. 9).

NOTE: When servicing the exhaust system, replace the factory installed uni-clamp with standard u-bolt clamps.

REMOVAL AND INSTALLATION (Continued)

(5) Position the exhaust clamp over the exhaust pipe/catalytic converter connection. Tighten clamp retaining nuts to (Fig. 12)

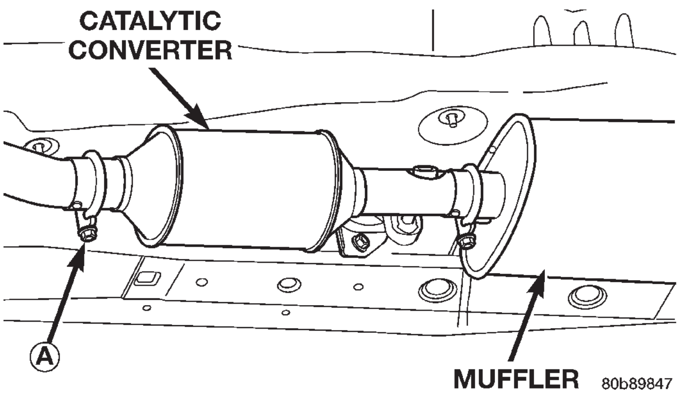


Fig. 12 Installing Exhaust Clamps

ITEM	DESCRIPTION
A	NUT. Torque to 61 N·m (45 ft. lbs.)

(6) Coat the oxygen sensor with anti-seize compound. Install the sensor and tighten the nut to 48 N·m (35 ft. lbs.) torque (Fig. 7) (Fig. 6).

(7) Lower the vehicle.

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

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

CATALYTIC CONVERTER

REMOVAL

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

(1) Raise and support the vehicle.

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

(3) Remove exhaust clamp from the catalytic converter and exhaust pipe connection (Fig. 13).

(4) Remove exhaust clamp from the catalytic converter and muffler connection (Fig. 13).

(5) Disconnect oxygen sensor wiring (Fig. 13).

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

(7) 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. 14).

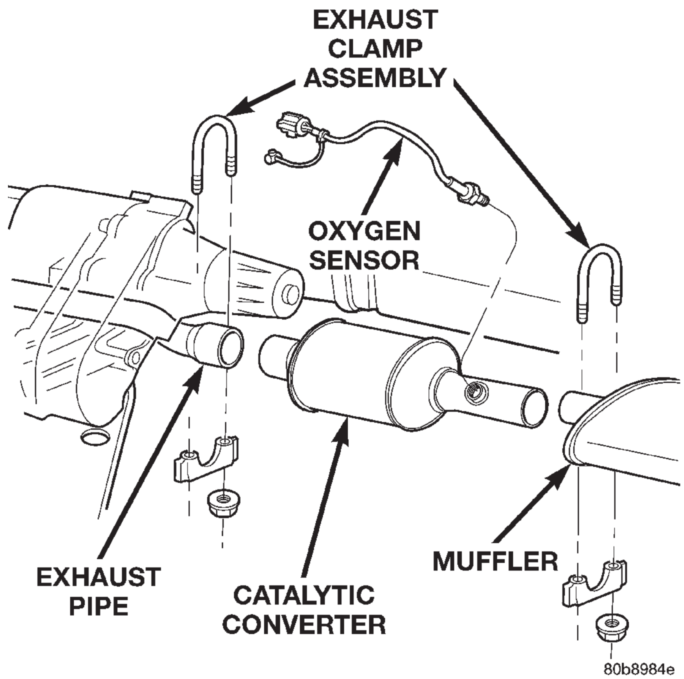


Fig. 13 Exhaust Pipe-to-Catalytic Converter-to-Muffler Connection

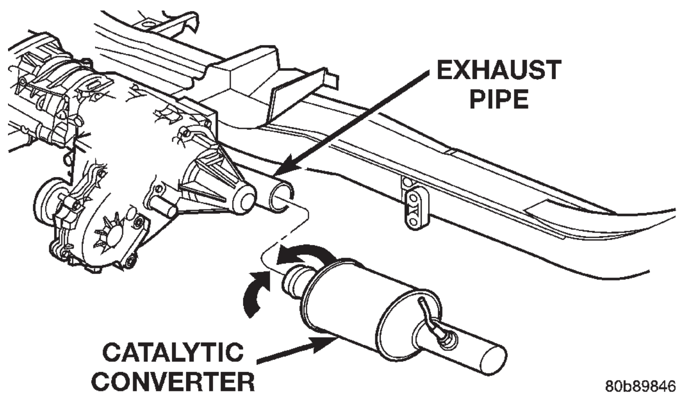


Fig. 14 Catalytic Converter—Removal

INSTALLATION

(1) Position the exhaust clamp over the exhaust pipe/catalytic converter connection (Fig. 13). Tighten the nuts to 61 N·m (45 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 at the muffler and catalytic converter connection (Fig. 13). Tighten the clamp nuts to 61 N·m (45 ft. lbs.) torque.

(4) Connect oxygen sensor wiring (Fig. 13).

(5) Lower the vehicle.

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

REMOVAL AND INSTALLATION (Continued)

MUFFLER AND TAILPIPE

REMOVAL

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.

(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 from the catalytic converter and muffler connection (Fig. 15).

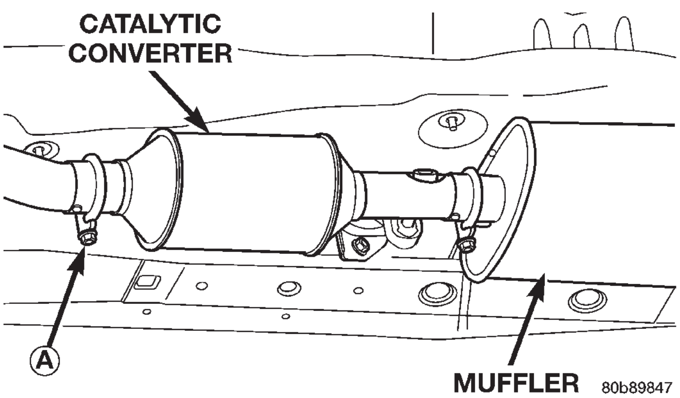


Fig. 15 Exhaust Pipe-to-Muffler Clamp

ITEM	DESCRIPTION
A	NUT Torque to 61 N·m (45 ft. lbs.)

(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. 16).

(7) Remove the tailpipe/muffler assembly (Fig. 16).

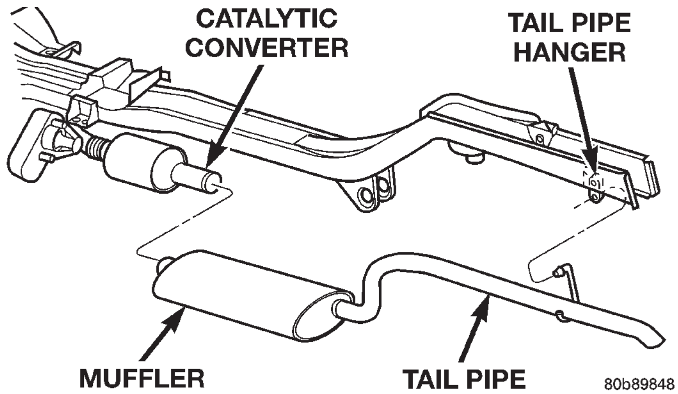


Fig. 16 Muffler and TailPipe Assembly

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. 16).

(3) Install the muffler onto the catalytic converter. Make sure that the tailpipe has sufficient clearance from the floor pan. Install exhaust clamp and tighten the nuts to 61 N·m (45 ft. lbs.) torque (Fig. 15).

(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.

SPECIFICATIONS

TORQUE

DESCRIPTION . . . . **TORQUE**

Catalytic Converter-to-Exhaust Pipe

U-bolt rod clamp . . . . 61 N·m (45 ft. lbs.)

Exhaust Pipe-to-Manifold

Nuts . . . . 31 N·m (23 ft. lbs.)

Floor Pan Heat Shield

Bolts/Nuts . . . . 2.5 N·m (20 in. lbs.)

Muffler-to-Catalytic Converter

U-bolt rod clamp . . . . 61 N·m (45 ft. lbs.)

Oxygen Sensor

Sensor . . . . 27 N·m (20 ft. lbs.)

Rear Tailpipe Hanger

Bolts . . . . 22 N·m (192 in. lbs.)

EXHAUST SYSTEM AND TURBOCHARGER

CONTENTS

GENERAL INFORMATION

EXHAUST SYSTEM

The basic exhaust system consists of an engine exhaust manifold, exhaust pipe, exhaust heat shield(s), muffler and exhaust tailpipe

The exhaust system uses a single muffler.

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.

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 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 exhaust heat shields. Light overspray near the edges is permitted. Application of coating will result in excessive floor pan temperatures and objectionable fumes.

REMOVAL AND INSTALLATION

EXHAUST MANIFOLD

REMOVAL

(1) Disconnect the negative battery cable

(2) Raise the vehicle on a hoist.

WARNING: DO NOT LOOSEN THE RADIATOR VENT OR DRAINCOCK WITH THE SYSTEM HOT AND PRESSURIZED. SERIOUS BURNS FROM COOLANT CAN OCCUR.

(3) Drain the cooling system. Refer to Group 7, Cooling System for procedure.

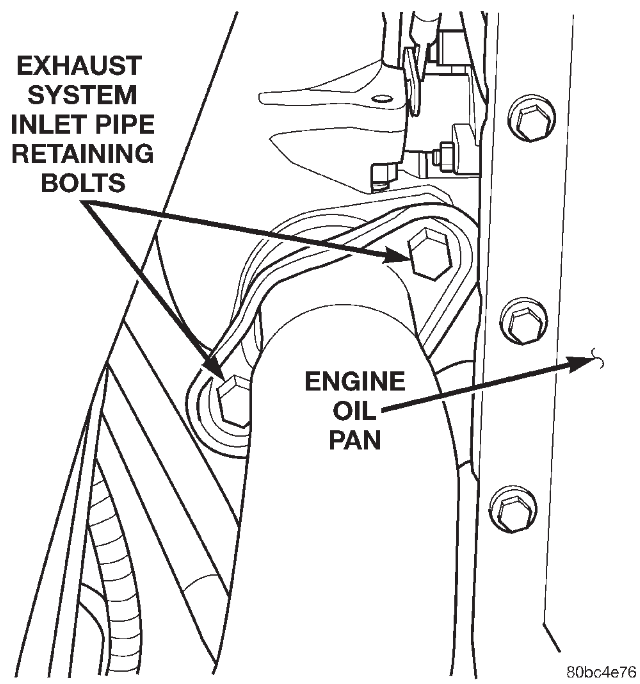


Fig. 1 Exhaust System Inlet Pipe Retaining Bolts

(4) Remove the exhaust system inlet pipe retaining bolts (Fig. 1).

(5) Disconnect the turbocharger oil return hose from the turbocharger.

(6) Lower the vehicle on the hoist.

(7) Remove the intercooler inlet hose from the vehicle (Fig. 2).

(8) Disconnect the breather hose from the fresh air inlet tube (Fig. 2).

(9) Unclip the air filter cover and remove the fresh air inlet tube from the turbocharger (Fig. 2). Remove the assembly from the vehicle.

(10) Remove the EGR vacuum supply hose from the EGR valve (Fig. 3).

(11) Disconnect the heater core coolant supply lines from the engine assembly (Fig. 3).

REMOVAL AND INSTALLATION (Continued)

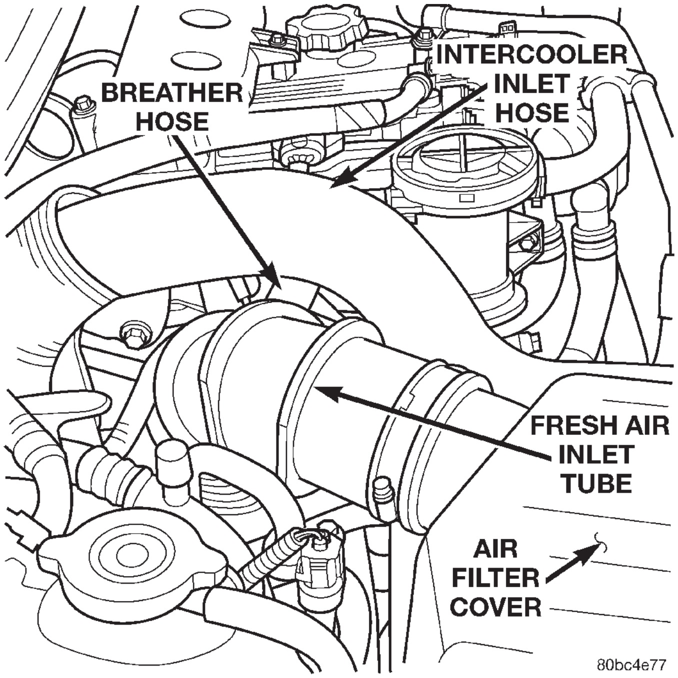


Fig. 2 Air Intake Hoses

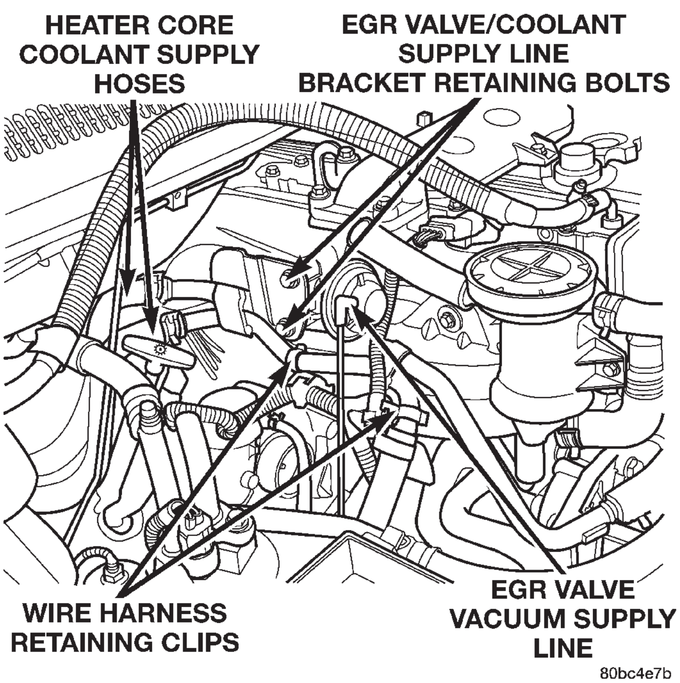


Fig. 3 3.1 L Diesel Engine

(12) Unclip the wire harness from the coolant supply lines (Fig. 3).

(13) Remove the (2) EGR valve / coolant supply line retaining bolts (Fig. 3).

(14) Remove the coolant supply line support bracket bolt from the water pump housing.

(15) Disconnect the two remaining hoses and remove the coolant lines from the vehicle.

(16) Remove the oil separator retaining bolts.

(17) Disconnect the crankcase vapor supply and return hoses and remove the oil separator from the vehicle.

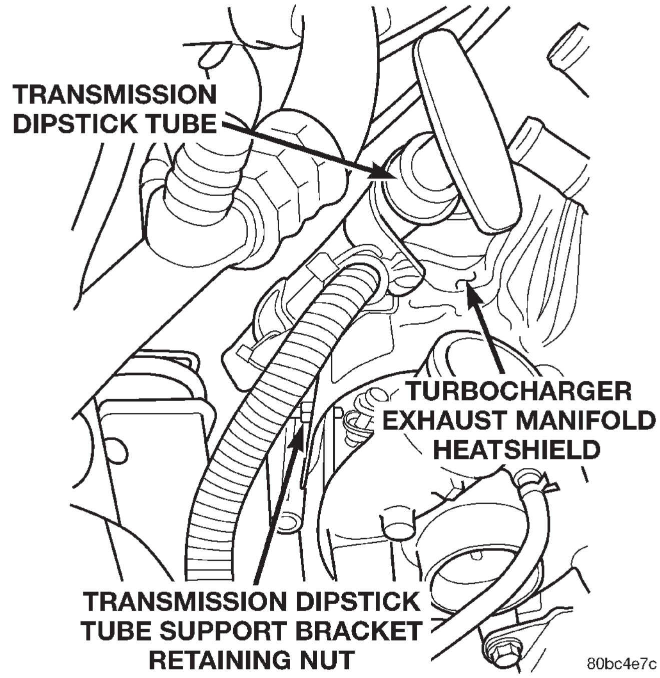


Fig. 4 Transmission Dipstick Tube Support Bracket

(18) Remove the transmission dipstick tube support bracket nut from the turbocharger heatshield (Fig. 4).

WARNING: Heatshield is very sharp. Wear gloves to prevent injury.

(19) Remove the exhaust manifold / turbocharger heatshield retaining bolts and remove the heatshield from the vehicle.

(20) Pull back the EGR tube heatshield to access and remove the EGR tube nut from the exhaust manifold. Remove the EGR valve and tube assembly from the vehicle.

(21) Remove the oil pressure supply line bango bolt from the turbocharger.

(22) Position a drain pan under the transmission.

(23) Remove the transmission dipstick tube from the transmission oil pan by pulling straight up. Position the tube assembly out of the way to allow for manifold / turbocharger removal.

(24) Remove the (10) exhaust manifold retaining nuts and remove the manifold and turbocharger assembly from the vehicle.

(25) Place the assembly in a vice.

(26) Remove the (4) turbocharger to exhaust manifold retaining nuts and separate.

REMOVAL AND INSTALLATION (Continued)

CLEANING

All old gaskets should be inspected for any tears or signs of prior leakage. If any gaskets show such indications, they should be replaced with new gaskets. All gasket mating surfaces must be cleaned of old gasket material to produce a smooth and dirt free sealing surface for the new gasket.

INSTALLATION

(1) Position the gasket and install the turbo on the exhaust manifold. Torque the nuts to 32 N·m (23 ft. lbs.) (Fig. 5).

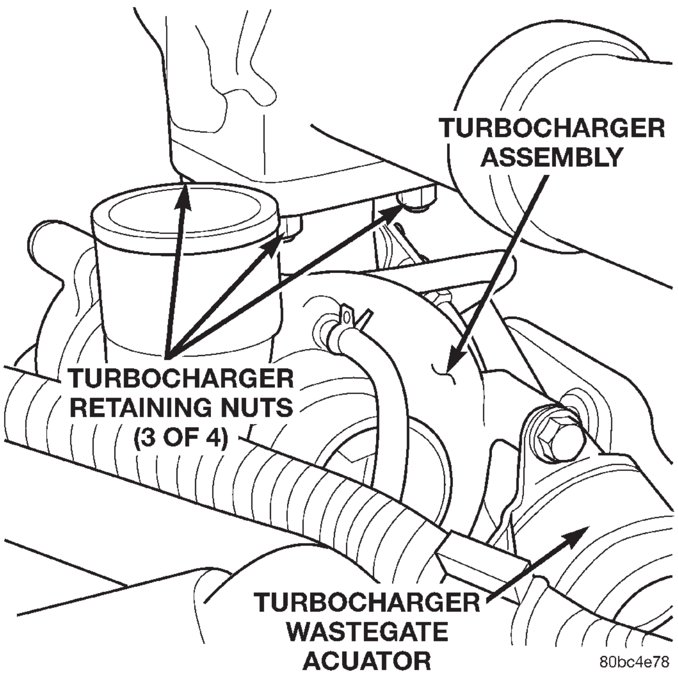


Fig. 5 Turbocharger Retaining Nuts

(2) Remove the assembly from the vice and position on the exhaust manifold mounting studs. Install the retaining nuts and torque to 32 N·m (23 ft. lbs.).

(3) Install the transmission dipstick tube in the transmission oil pan.

(4) Remove the drain pan.

(5) Install the oil pressure supply line on turbocharger. Torque banjo bolt fitting to 27 N·m (20 ft. lbs.). Be certain the copper sealing washers are installed. One on the top and bottom of the supply line.

(6) Install the EGR tube nut on the exhaust manifold and temporarily install one of the EGR valve retaining bolts. Be certain the EGR valve gasket is in place.

(7) Torque the EGR tube retaining nut to 34 N·m (25 ft.lbs.). Remove the temporarily installed EGR valve bolt.

WARNING: Heatshield is very sharp. Wear gloves to prevent injury.

(8) Install the exhaust manifold heatshield. Torque bolts to 11 N·m (97 in. lbs.).

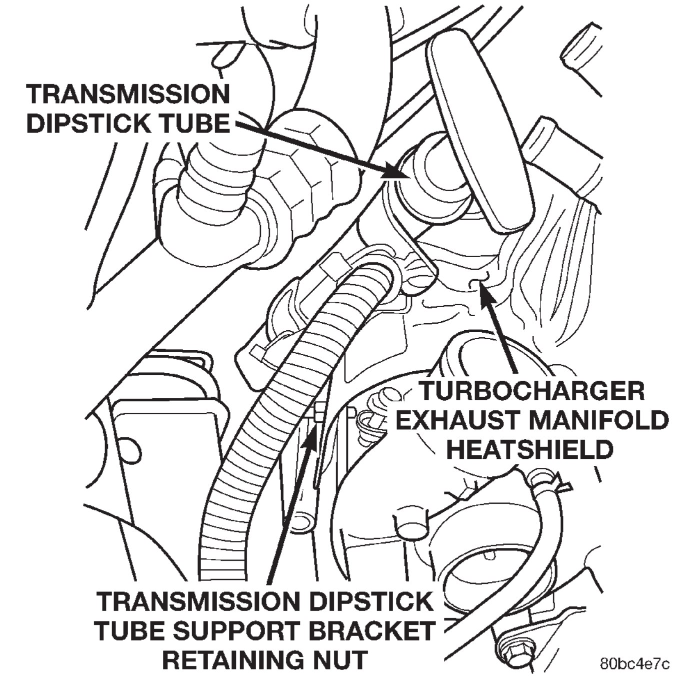


Fig. 6 Transmission Dipstick Tube Support Bracket

(9) Install the transmission dipstick tube support bracket retaining nut on the turbocharger heatshield (Fig. 6). Torque the nut to 20 N·m (177 in. lbs.).

(10) Install the front (front of engine) heater core coolant supply hoses on the coolant line assembly and install the line assembly on the engine. Torque the (3) retaining bolts to 27 N·m (20 ft. lbs.) (Fig. 7).

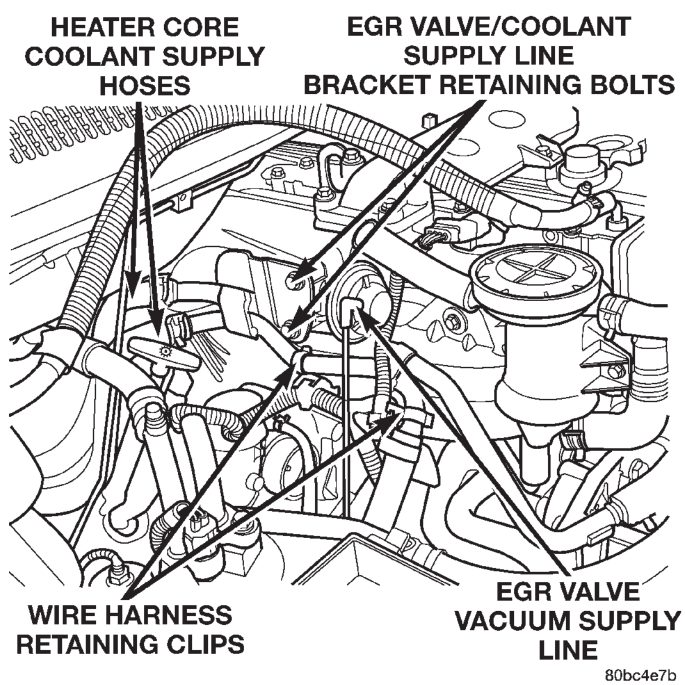


Fig. 7 3.1L Diesel Engine

REMOVAL AND INSTALLATION (Continued)

(11) Connect the crankcase vapor supply and return hoses on the oil separator.

(12) Install the oil separator retaining bolts.

(13) Install the heater core coolant supply hoses on the coolant line assembly (Fig. 7).

(14) Clip the wire harness on the coolant supply lines (Fig. 7).

(15) Install the EGR vacuum supply hose on the EGR valve.

(16) Install the fresh air inlet tube assembly on the turbocharger. Clip the air filter cover in position and connect the breather hose (Fig. 8).

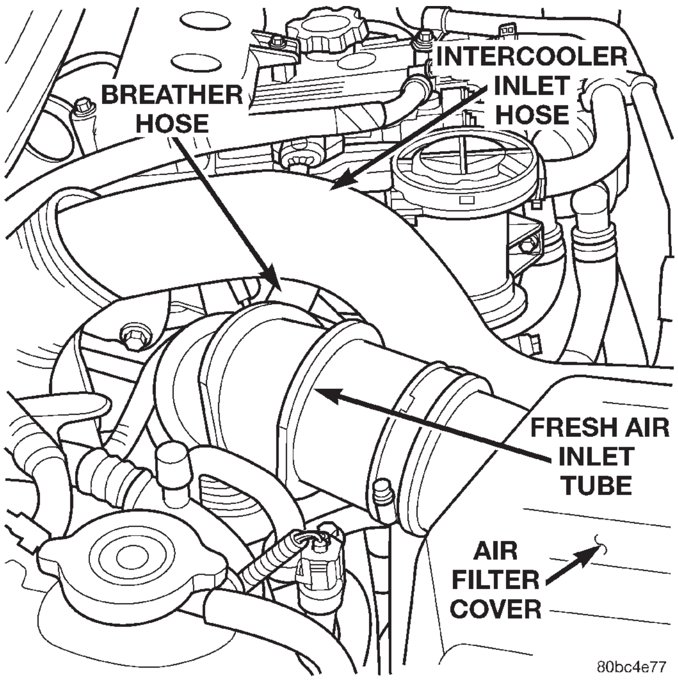


Fig. 8 Air Intake Hoses

(17) Install the intercooler inlet hose on the vehicle (Fig. 8).

(18) Raise the vehicle on the hoist.

(19) Install the turbocharger oil return hose on the turbocharger.

(20) Install the exhaust system inlet pipe on the turbocharger (Fig. 9). Torque the bolts to 22 N·m (194 in. lbs.).

(21) Lower the vehicle on the hoist.

(22) Fill the cooling system. Refer to Group 7, Cooling System for procedure.

(23) Check the transmission fluid level and top off if necessary.

(24) Connect the negative battery cable.

(25) Start the engine and check for leaks.

TURBOCHARGER

REMOVAL

(1) Disconnect the negative battery cable.

(2) Raise the vehicle on a hoist.

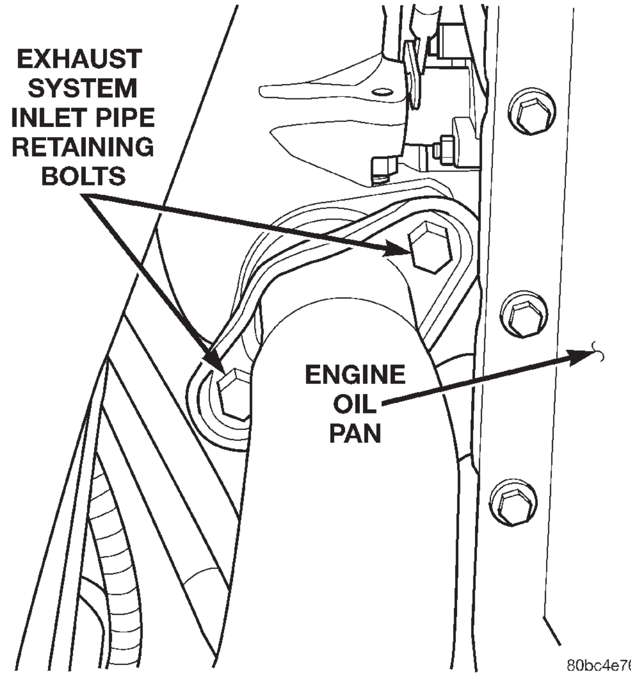


Fig. 9 Exhaust System Inlet Pipe Retaining Bolts

WARNING: DO NOT LOOSEN THE RADIATOR VENT OR DRAINCOCK WITH THE SYSTEM HOT AND PRESSURIZED. SERIOUS BURNS FROM COOLANT CAN OCCUR

(3) Drain the cooling system. Refer to Group 7, Cooling System for procedure.

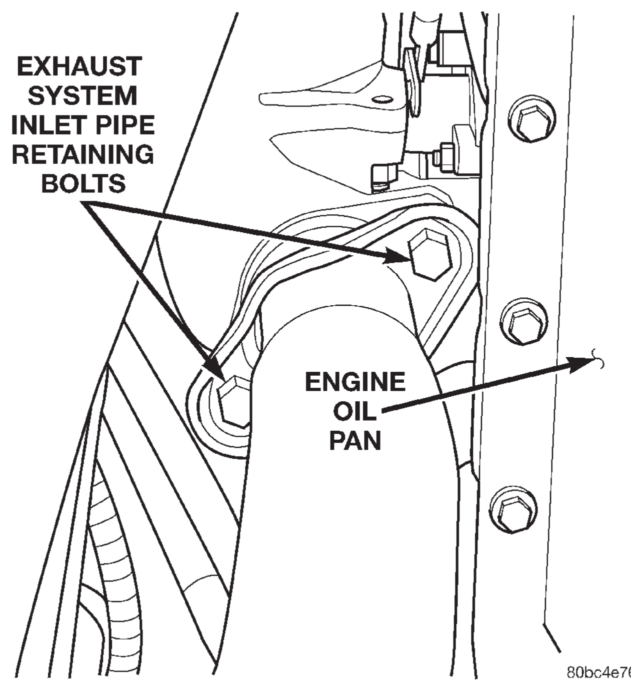


Fig. 10 Exhaust System Inlet Pipe Retaining Bolts

(4) Remove the exhaust system inlet pipe retaining bolts (Fig. 10).

REMOVAL AND INSTALLATION (Continued)

(5) Disconnect the turbocharger oil return hose from the turbocharger (Fig. 11).

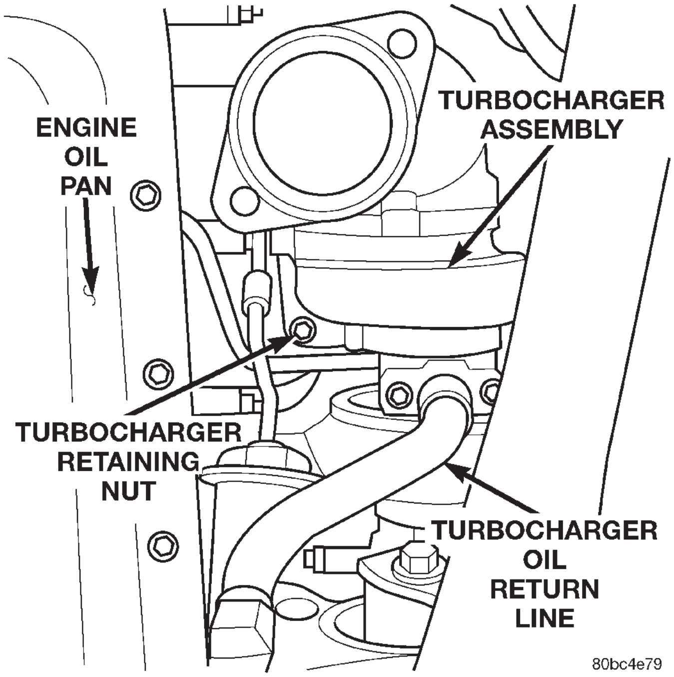


Fig. 11 Turbocharger Oil Return Line & Retaining Nut

(6) Remove the turbocharger retaining nut (Fig. 11).

(7) Lower the vehicle on the hoist.

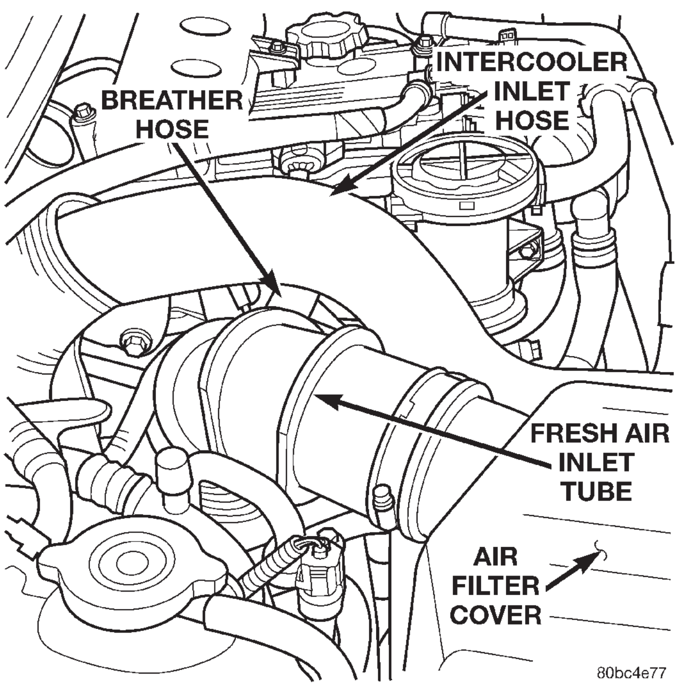


Fig. 12 Air Intake Hoses

(8) Remove the intercooler inlet hose from the vehicle (Fig. 12).

(9) Disconnect the breather hose from the fresh air inlet tube (Fig. 12).

(10) Unclip the air filter cover and remove the fresh air inlet tube from the turbocharger (Fig. 12). Remove the assembly from the vehicle.

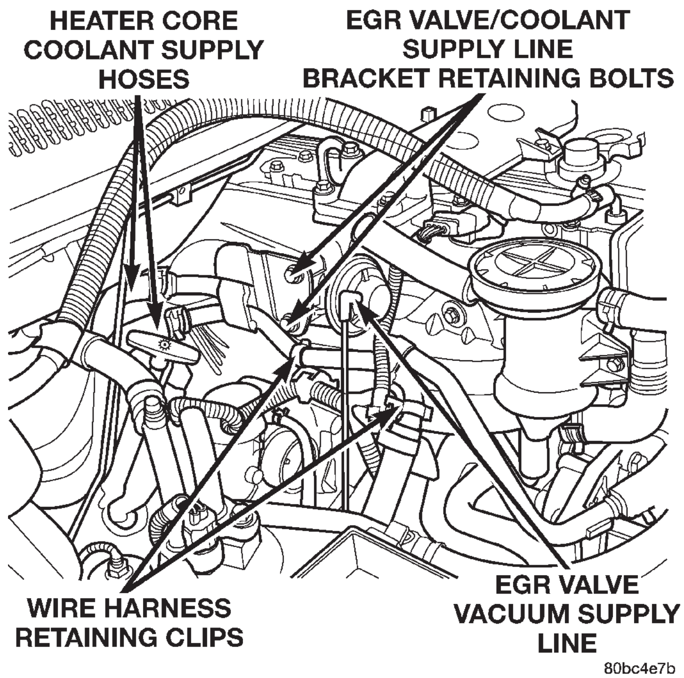


Fig. 13 3.1 L Diesel Engine

(11) Remove the EGR vacuum supply hose from the EGR valve (Fig. 13).

(12) Disconnect the heater core coolant supply lines from the engine assembly (Fig. 13).

(13) Unclip the wire harness from the coolant supply lines (Fig. 13).

(14) Remove the (2) EGR valve / coolant supply line retaining bolts (Fig. 13).

(15) Remove the coolant supply line support bracket bolt from the water pump housing.

(16) Disconnect the two remaining hoses and remove the coolant lines from the vehicle.

(17) Remove the transmission dipstick tube support bracket nut from the turbocharger heatshield (Fig. 14).

WARNING: Heatshield is very sharp. Wear gloves to prevent injury.

(18) Remove the exhaust manifold / turbocharger heatshield retaining bolts and remove the heatshield from the vehicle.

(19) Remove the oil pressure supply line banjo bolt from the turbocharger.

(20) Position a drainpan under the transmission.

REMOVAL AND INSTALLATION (Continued)

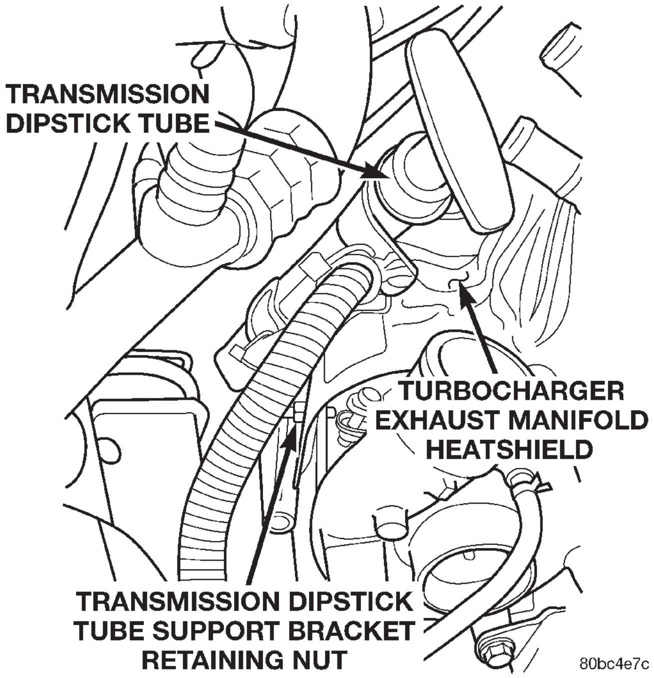


Fig. 14 Transmission Dipstick Tube Support Bracket

(21) Remove the transmission dipstick tube from the transmission oil pan by pulling straight up. Position the tube assembly out of the way to allow for turbocharger removal.

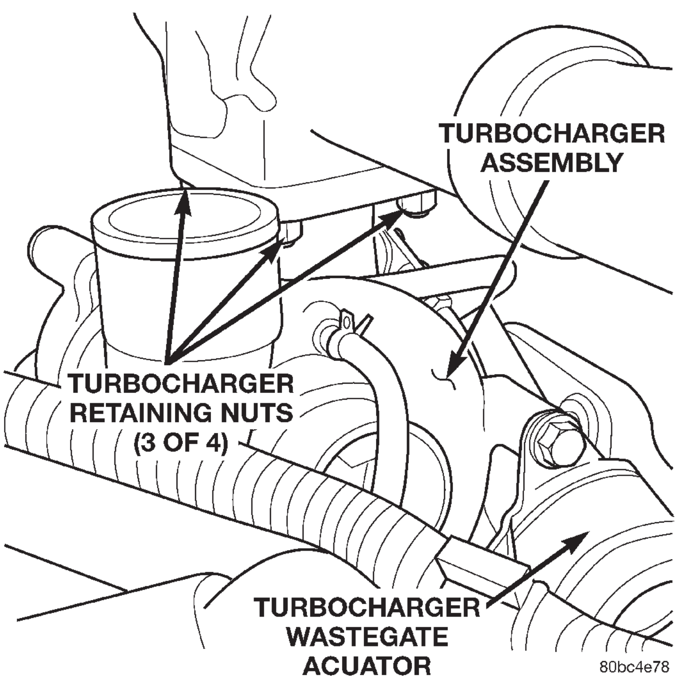


Fig. 15 Turbocharger Retaining Nuts

(22) Remove the remaining turbocharger retaining nuts (Fig. 16) (Fig. 15) and remove the turbocharger from the vehicle.

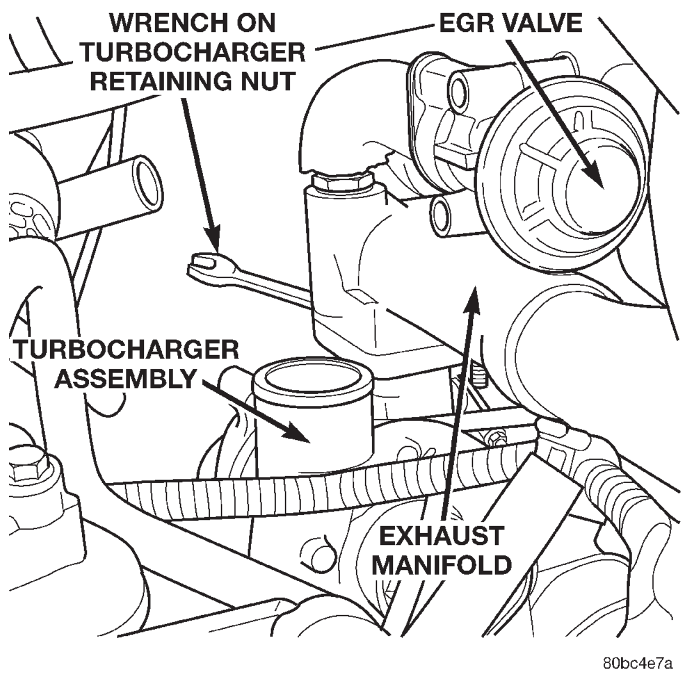


Fig. 16 Rear Turbocharger Retaining Nut

CLEANING

All old gaskets should be inspected for any tears or signs of prior leakage. If any gaskets show such indications, they should be replaced with new gaskets. All gasket mating surfaces must be cleaned of old gasket material to produce a smooth and dirt free sealing surface for the new gasket.

INSTALLATION

(1) Position the gasket and install the turbo on the exhaust manifold. Torque the nuts to 32 N·m (23 ft. lbs.) (Fig. 17).

(2) Install the oil pressure supply line on turbocharger. Torque banjo bolt fitting to 27 N·m (20 ft. lbs.). Be certain the copper sealing washers are installed. One on the top and bottom of the supply line.

(3) Install the transmission dipstick tube in the transmission oil pan.

(4) Remove the drain pan.

WARNING: Heatshield is very sharp. Wear gloves to prevent injury.

(5) Install the exhaust manifold heatshield. Torque bolts to 11 N·m (97 in. lbs.).

(6) Install the transmission dipstick tube support bracket retaining nut on the turbocharger heatshield (Fig. 18). Torque the nut to 20 N·m (177 in. lbs.).

(7) Install the front (front of engine) heater core coolant supply hoses on the coolant line assembly and install the line assembly on the engine. Torque the (3) retaining bolts to 27 N·m (20 ft. lbs.) (Fig. 19).

REMOVAL AND INSTALLATION (Continued)

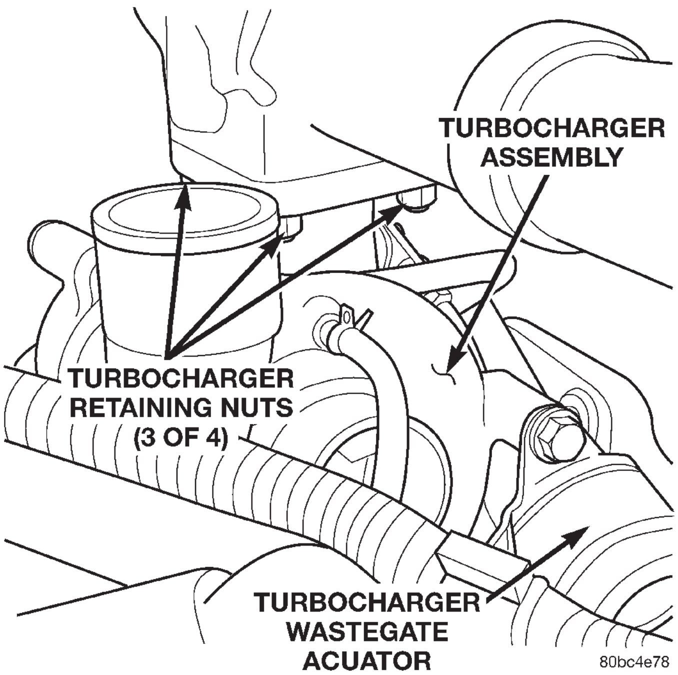


Fig. 17 Turbocharger Retaining Nuts

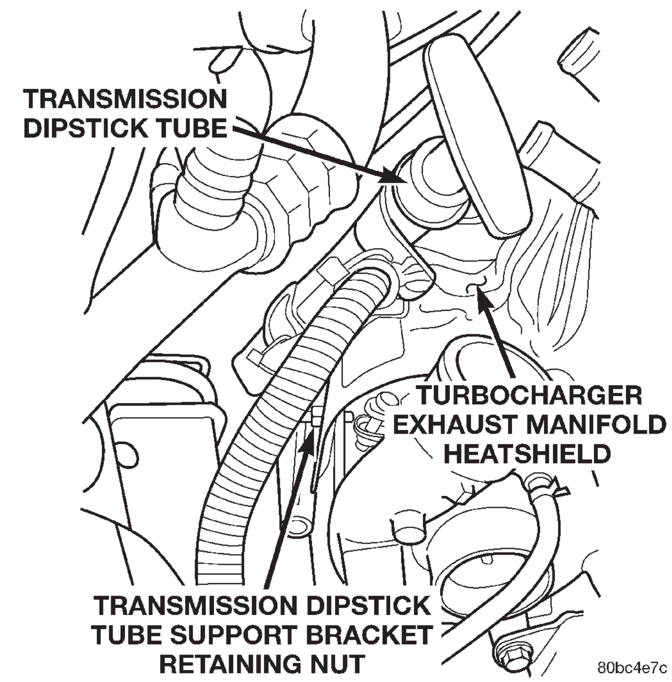


Fig. 18 Transmission Dipstick Tube Support Bracket

(8) Install the heater core coolant supply hoses on the coolant line assembly (Fig. 19).

(9) Clip the wire harness on the coolant supply lines (Fig. 19).

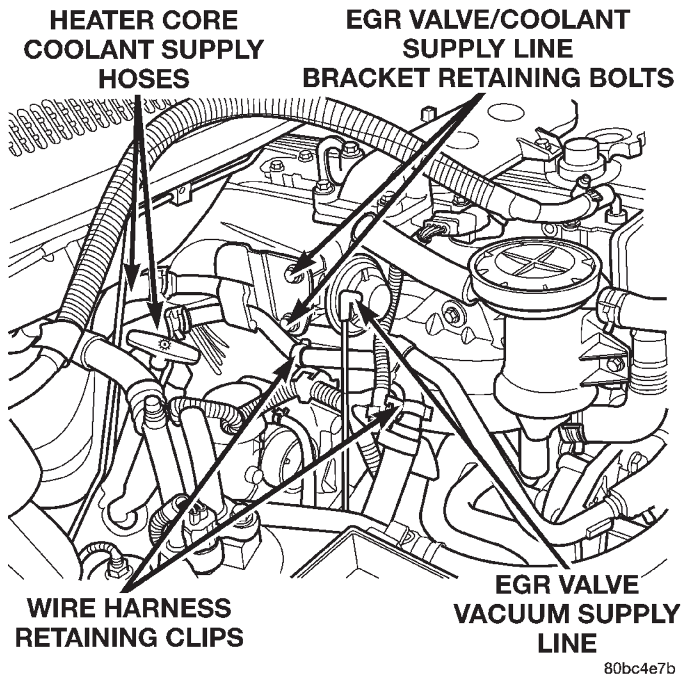


Fig. 19 3.1L Diesel Engine

(10) Install the EGR vacuum supply hose on the EGR valve.

(11) Install the fresh air inlet tube assembly on the turbocharger. Clip the air filter cover in position and connect the breather hose (Fig. 20).

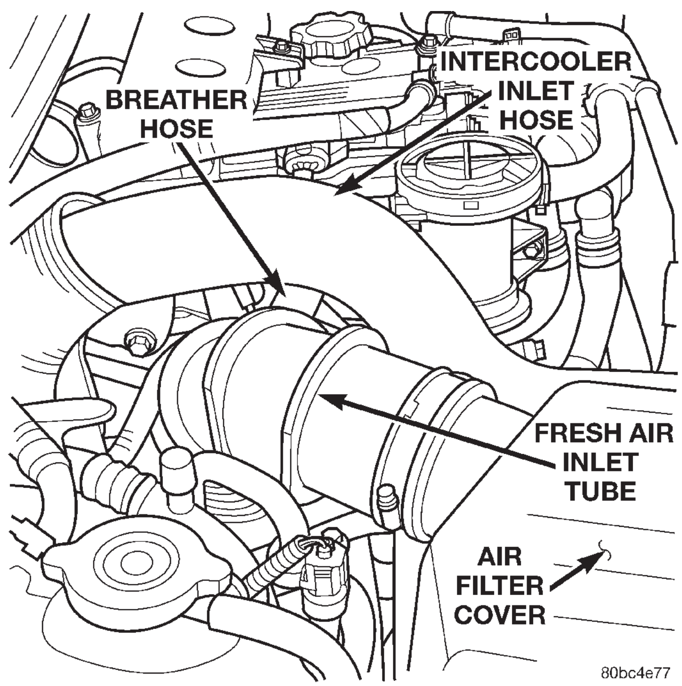


Fig. 20 Air Intake Hoses

(12) Install the intercooler inlet hose on the vehicle (Fig. 20).

(13) Raise the vehicle on the hoist.

REMOVAL AND INSTALLATION (Continued)

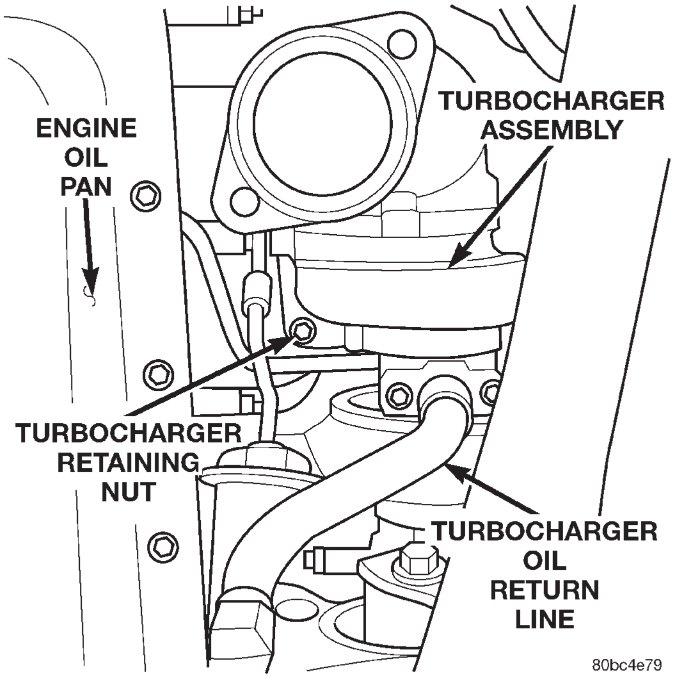


Fig. 21 Turbocharger Oil Return Line & Retaining Nut

(14) Install the remaining turbocharger retaining nut (Fig. 21). Torque the nut to 32 N·m (23 ft. lbs.).

(15) Install the turbocharger oil return hose on the turbocharger (Fig. 21).

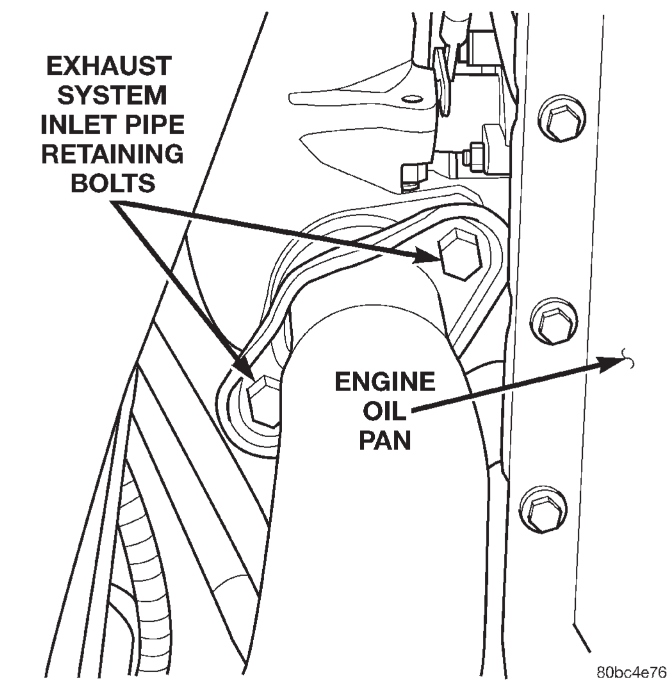


Fig. 22 Exhaust System Inlet Pipe Retaining Bolts

(16) Install the exhaust system inlet pipe on the turbocharger (Fig. 22). Torque the bolts to 22 N·m (194 in. lbs.).

(17) Lower the vehicle on the hoist.

(18) Fill the cooling system. Refer to Group 7, Cooling System for procedure.

(19) Check the transmission fluid level and top off if necessary.

(20) Connect the negative battery cable.

(21) Start the engine and check for leaks.

CHARGE AIR COOLER (INTERCOOLER)

The cooling module assembly includes the radiator, charge air cooler (intercooler) and the A/C condenser. To replace any one of these components, the entire assembly must be removed from the vehicle and then disassembled. Refer to Group 7, Cooling System - Cooling Module removal and installation procedure for replacement of the intercooler.

SPECIFICATIONS

TORQUE SPECIFICATIONS

Description	Torque
EGR	
Attaching Bolts	27N·m
EGR	
Tube Nut	34 N·m
EGR	
Tube Flange Bolts	27 N·m
Exhaust Manifold	
Nuts	32 N·m
Exhaust Manifold	
Heat Shield Bolts	11 N·m
Exhaust Pipe	
Support Clamp Bolts	22.5 N·m
Exhaust Pipe	
Support Clamp Screw	22.5 N·m
Intake Manifold	
Nuts	32 N·m
Muffler-to-Exhaust Pipe	
Clamp Nuts	43 N·m
Tail Pipe Clamp	
Hanger bolt	22.5 N·m
Turbocharger-to-Exhaust manifold	
Nuts	32 N·m
Turbocharger	
Oil Feed Line	27.4 N·m
Turbocharger Down Pipe-to-Exhaust Pipe	
Bolts/Nuts	22.5 N·m
Turbocharger Down Pipe-to-Turbocharger	
Bolts	27 N·m

FRAME AND BUMPERS

CONTENTS

BUMPERS

INDEX

REMOVAL AND INSTALLATION

FRONT FASCIA

REMOVAL

(1) Raise and support vehicle.
(2) Turn front wheels to access rivets and remove plastic rivets attaching fascia to wheel liner.
(3) Remove bolts attaching fascia to fender (Fig. 1).
(4) Remove plastic push pin fasteners attaching front fascia to lower radiator crossmember splash shield (Fig. 2).
(5) Disengage fog lamp connectors, if equipped.
(6) Remove screws attaching fascia/grille to upper radiator crossmember (Fig. 3).
(7) Slide fascia forward to separate from vehicle.

INSTALLATION

(1) Slide fascia onto vehicle engaging fascia with tabs on bottom of front fenders.
(2) Install screws attaching fascia/grille to upper radiator crossmember.
(3) Install bolts attaching fascia to fender.
(4) Engage fog lamp connectors, if equipped.
(5) Install plastic rivets attaching fascia to wheel liner.
(6) Install plastic push pin fasteners attaching front fascia to lower radiator crossmember splash shield.
(7) Remove supports and lower vehicle.

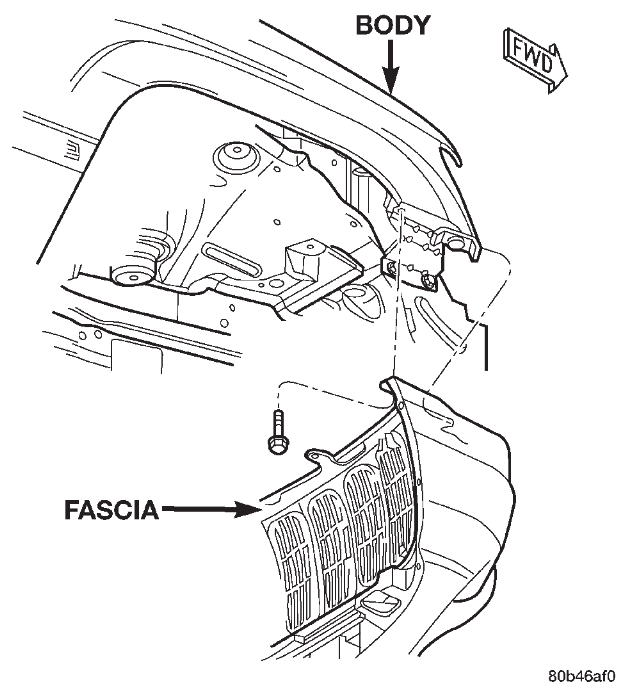


Fig. 1 Front Fascia

FRONT ABSORBER

REMOVAL

(1) Remove front fascia.
(2) Remove the retainer attaching the absorber to the fascia.
(3) Separate the absorber from the fascia.

REMOVAL AND INSTALLATION (Continued)

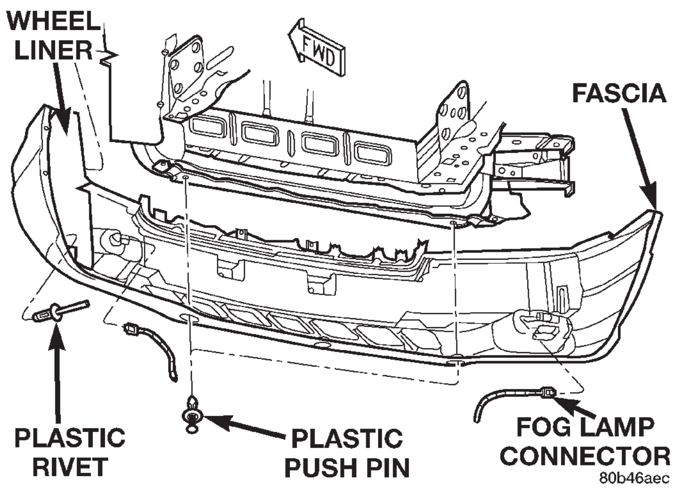


Fig. 2 Front Fascia

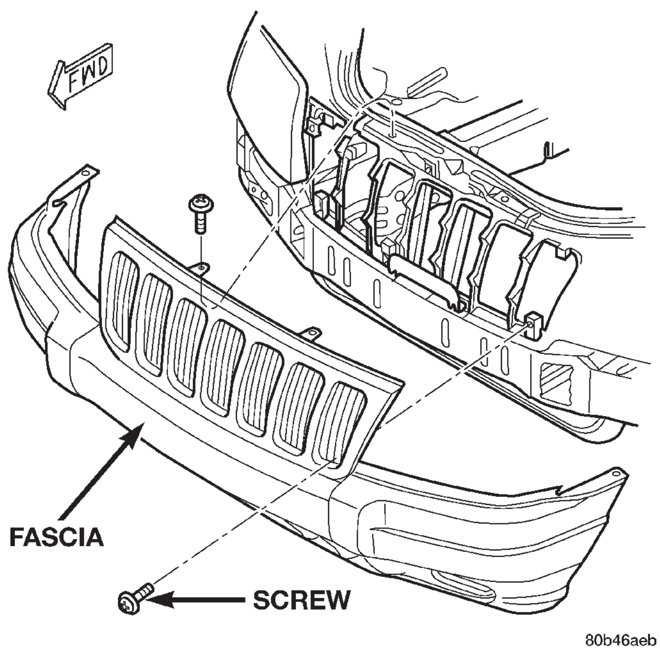


Fig. 3 Front Fascia

INSTALLATION

(1) Position the absorber on the fascia.

(2) Install the retainer attaching the absorber to the fascia.

(3) Install front fascia.

REAR FASCIA

REMOVAL

(1) Raise and support vehicle.

(2) Remove tires.

(3) Remove plastic push pins attaching fascia to fuel tank skid plate.

(4) Remove plastic rivets attaching fascia to wheel liner.

(5) Remove nuts attaching upper edge of fascia to quarter panel and wheel liner (Fig. 4).

(6) Remove plastic push pins attaching fascia to liftgate opening (Fig. 5).

(7) Remove screws attaching fascia to liftgate opening.

(8) Remove D pillar trim and scuff plate outboard screws.

(9) Remove the rearward tie down screws and the aperture trim panel.

(10) Carefully peel back the rubber body sealer patch to access the retainer clips.

(11) Release the forward and rearward retainer clips on both sides of the fascia.

(12) Grasp forward edges of fascia and pull outward to disengage retainers attaching fascia to quarter panel (Fig. 6).

(13) Separate fascia from vehicle.

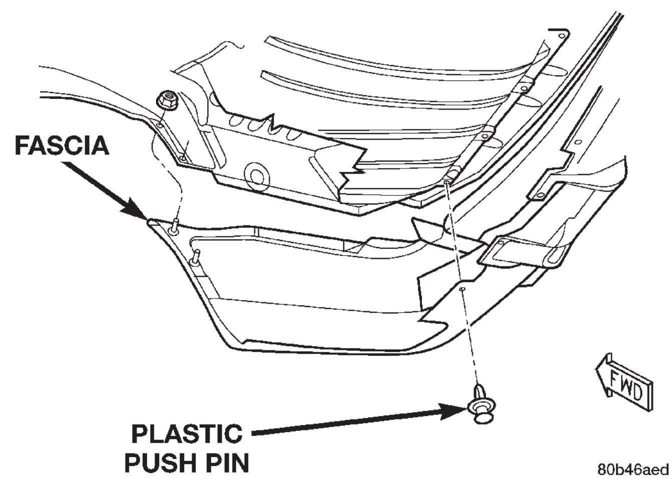


Fig. 4 Rear Fascia Attachment

INSTALLATION

(1) Position fascia on vehicle aligning retainers with slots in quarter panel (Fig. 7).

(2) Press forward edges of fascia inward to engage retainers.

(3) Install screws attaching fascia to liftgate opening.

(4) Install plastic push pins attaching fascia to liftgate opening.

(5) Install nuts attaching upper edge of fascia to quarter panel and wheel liner.

(6) Install plastic rivets attaching fascia to wheel liner.

(7) Install support lower vehicle.

(8) Install plastic push pins attaching fascia to fuel tank skid plate.

(9) Install the interior trim panels removed to access fascia retainers.

(10) Install tie down loop screws.

(11) Install tires.

REMOVAL AND INSTALLATION (Continued)

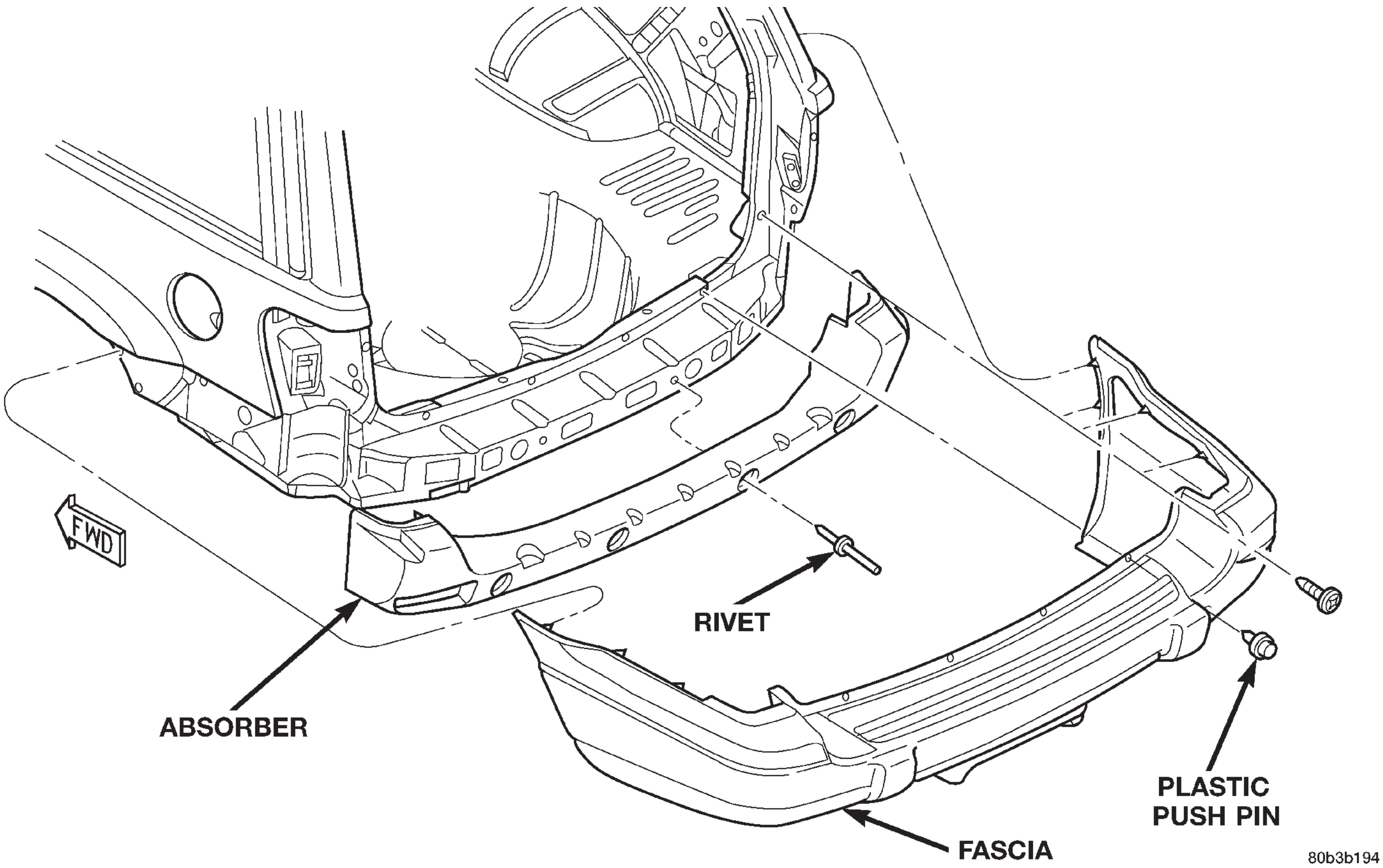


Fig. 5 Rear Fascia

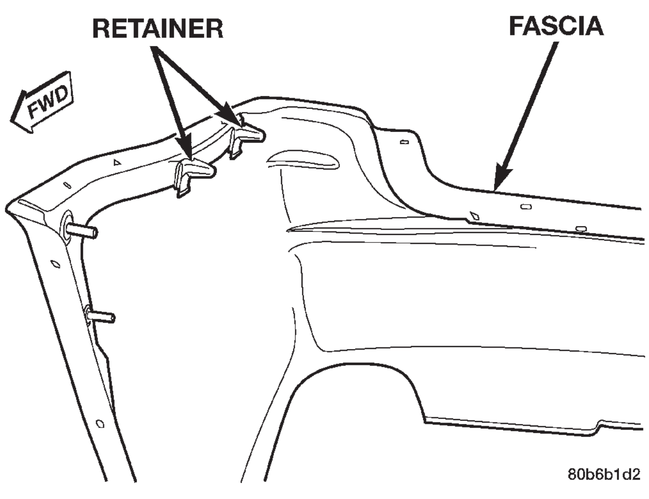


Fig. 6 Rear Fascia Retainers

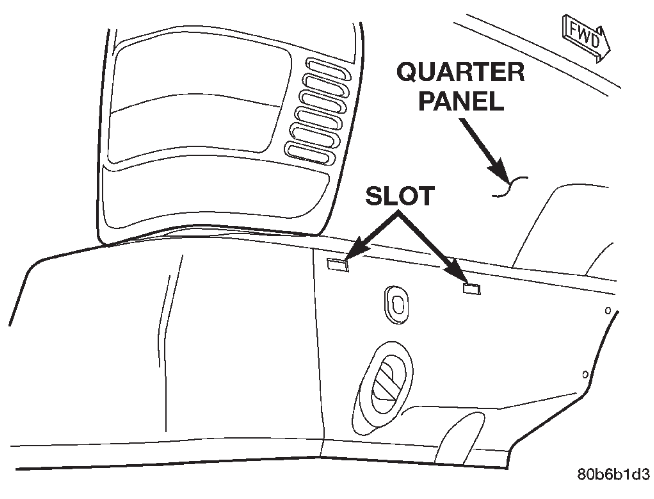


Fig. 7 Fascia Attachment

REAR ABSORBER

REMOVAL

(1) Remove rear fascia.

(2) Remove rivets attaching absorber to rear cross-member (Fig. 5).

(3) Separate absorber from vehicle.

INSTALLATION

(1) Position absorber on vehicle.

(2) Install rivets attaching absorber to rear cross-member.

(3) Install rear fascia.

FRAME

INDEX

DESCRIPTION AND OPERATION

FRAME CONSTRUCTION

DESCRIPTION

Jeep Grand Cherokee vehicles do not have a conventional frame. 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.

REMOVAL AND INSTALLATION

FRONT TOW HOOK

REMOVAL

(1) Remove bolts that attach tow hook bracket to the lower crossmember (Fig. 1).

(2) Separate tow hook bracket from lower crossmember.

INSTALLATION

(1) Position tow hook bracket at the lower crossmember.

(2) Install bolts attaching tow hook bracket to crossmember. Tighten bolts to 54 N·m (40 ft. lbs.) torque.

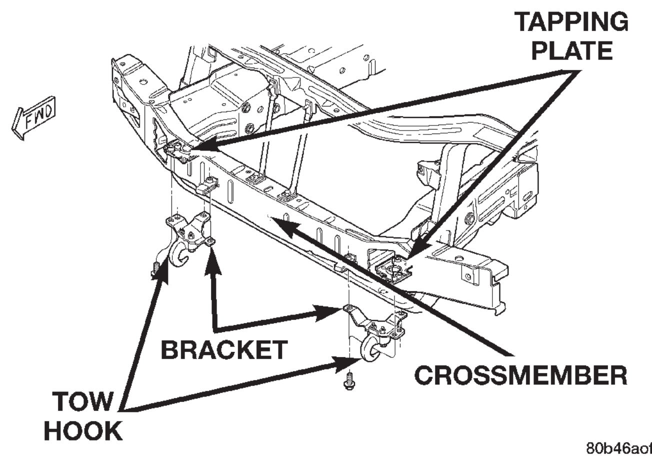


Fig. 1 Front Tow Hook

FRONT SKID PLATE

REMOVAL

(1) Position a support under skid plate.

(2) Remove bolts attaching skid plate to frame (Fig. 2).

(3) Separate skid plate from frame.

INSTALLATION

(1) Position skid plate on a support.

(2) Raise it into position

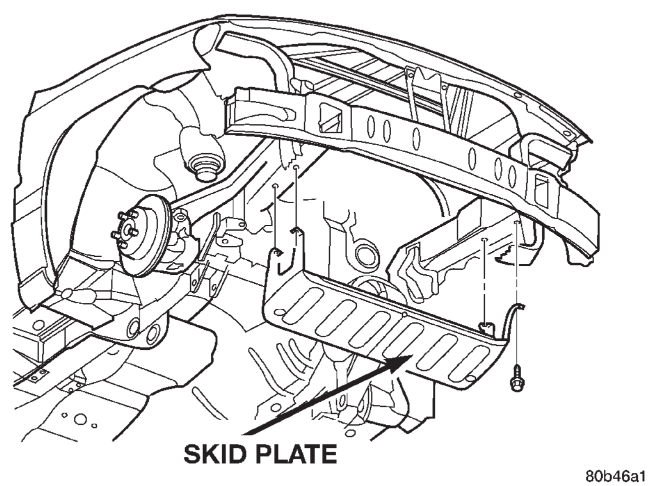


Fig. 2 Front Skid Plate

(3) Install bolts attaching skid plate to frame. Tighten bolts to 54 N·m (40 ft. lbs.) torque.

REMOVAL AND INSTALLATION (Continued)

TRANSFER CASE SKID PLATE

REMOVAL

(1) Support skid plate.

(2) Remove bolts that attach skid plate to transmission support crossmember and frame sill (Fig. 3).

(3) Remove support and skid plate from vehicle.

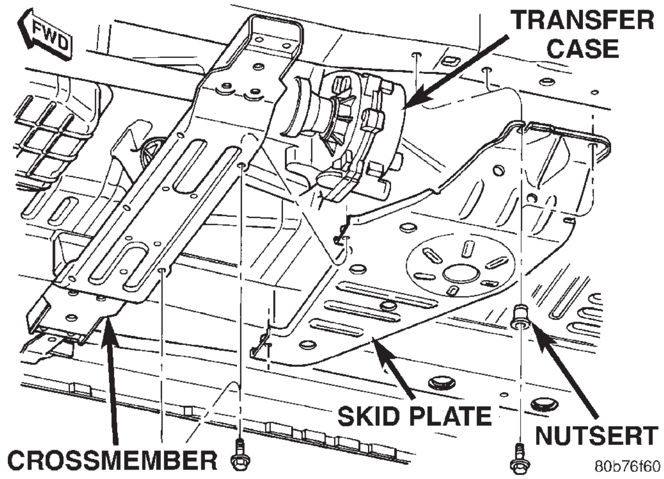


Fig. 3 Transfer Case Skid Plate

INSTALLATION

(1) Install nutserts, if removed.

(2) Position and support skid plate at the frame sill and transmission support crossmember.

(3) Attach skid plate to frame sill and crossmember with the bolts. Tighten bolts to 34 N·m (25 ft. lbs) torque.

FUEL TANK SKID PLATE

The fuel tank skid plate is integrated with the fuel tank. Refer to Fuel Tank for service procedures

REAR TOW HOOK

REMOVAL

(1) Remove rear tow hook to frame brace.

(2) Remove bolts attaching the tow hook bracket to frame (Fig. 4).

(3) Separate tow hook bracket from frame.

INSTALLATION

(1) position tow hook bracket on frame.

(2) Install bolts attaching tow hook bracket to frame. Tighten bolts to 68 N·m (50 ft. lbs.) torque.

(3) Install rear tow hook to frame brace.

TRAILER HITCH

REMOVAL

(1) Raise and support vehicle.

(2) Remove rear fascia.

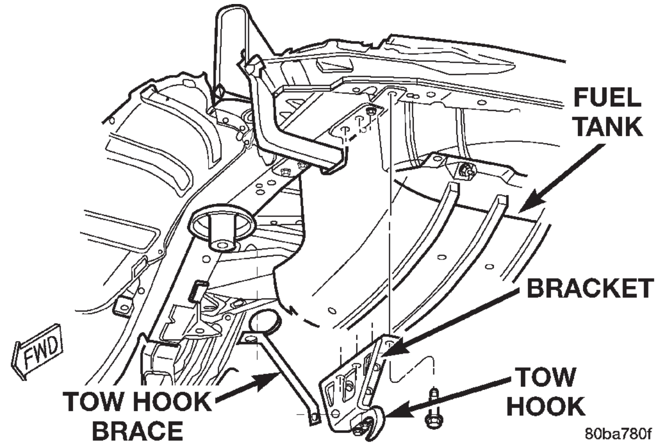


Fig. 4 Rear Tow Hook

(3) Remove screws attaching trailer harness plug to trailer hitch.

(4) Disconnect harness connector from harness plug.

(5) Position support stands under trailer hitch.

(6) Remove bolts attaching trailer hitch to frame rails (Fig. 5).

(7) Separate trailer hitch from vehicle.

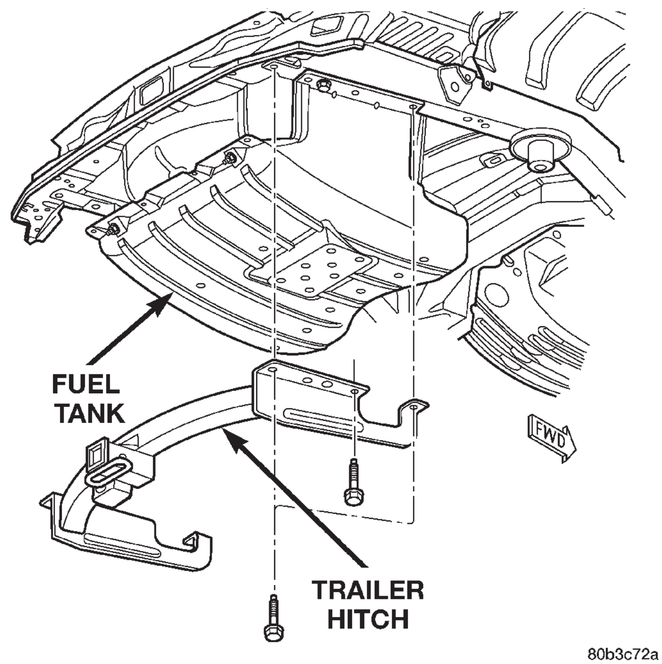


Fig. 5 Trailer Hitch

INSTALLATION

(1) Position trailer hitch on support stands.

(2) Position trailer hitch on vehicle.

(3) Install bolts attaching trailer hitch to frame rails. Tighten bolts to 68 N·m (50 lbs.) torque.

(4) Connect harness connector to harness plug.

(5) Position harness plug in trailer hitch and install screws.

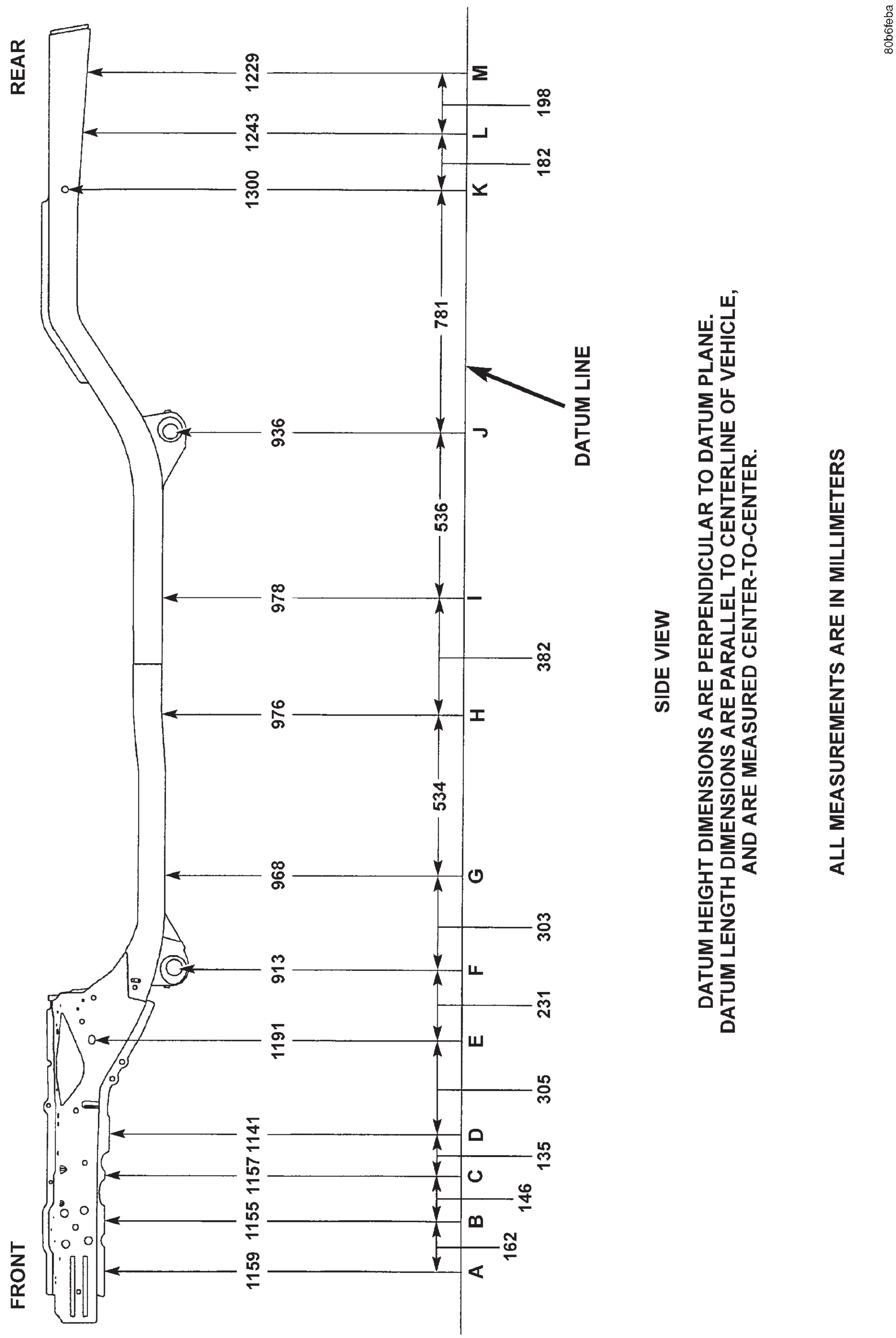
(6) Install rear fascia.

(7) Remove supports and lower vehicle.

SPECIFICATIONS

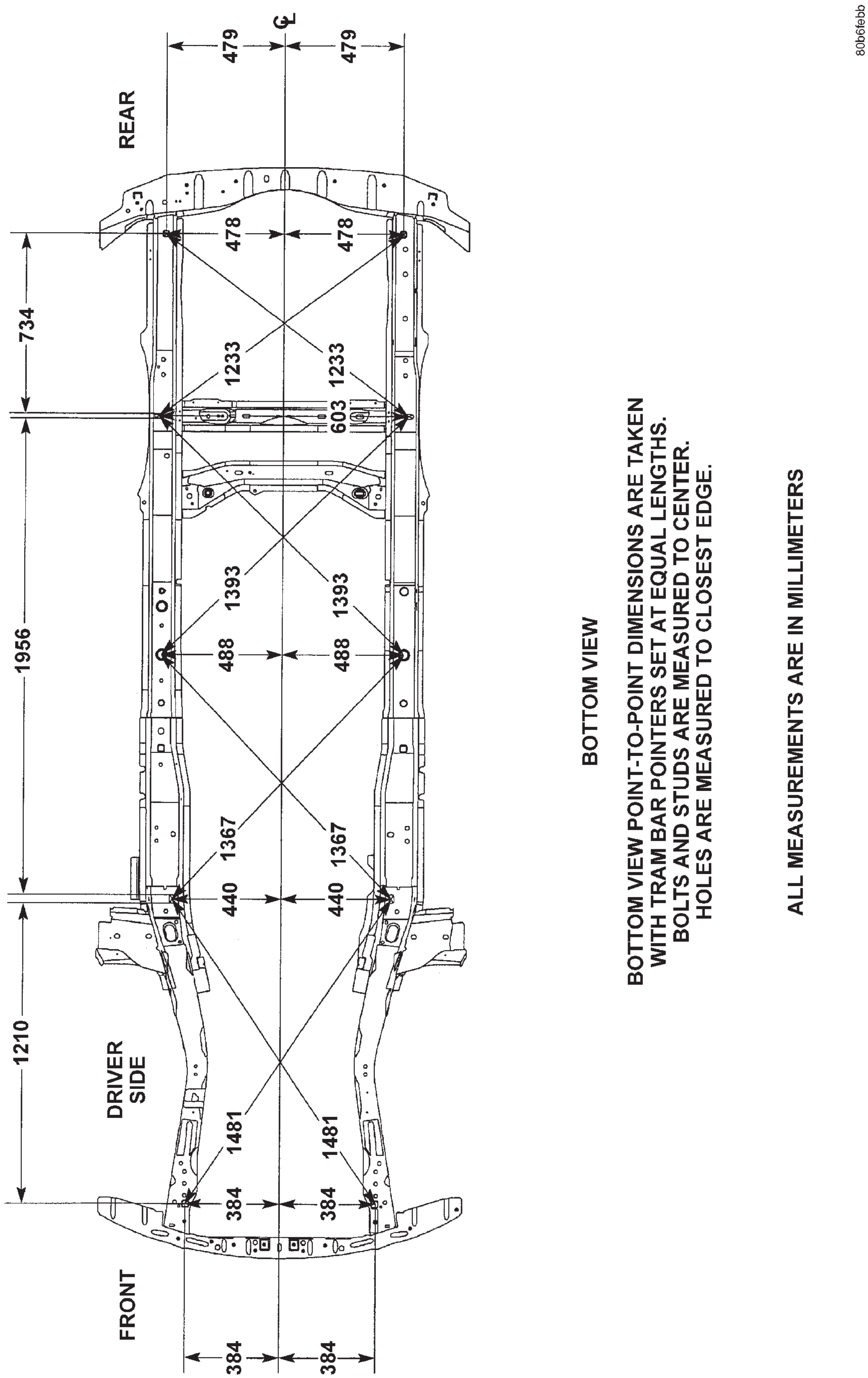
FRAME DIMENSIONS

SIDE VIEW



SPECIFICATIONS (Continued)

BOTTOM VIEW



SPECIFICATIONS (Continued)

TORQUE SPECIFICATIONS

DESCRIPTION	TORQUE
Front Tow Hook Bolt	54 N·m (40 ft. lbs.)
Front Skid Plate Bolt	54 N·m (40 ft. lbs.)
Rear Tow Hook Bolt	68 N·m (50 ft. lbs.)
Trailer Hitch Bolts	68 N·m (50 ft. lbs.)
Transfer Case Skid Plate Bolts	34 N·m (25ft. lbs.)

FRAME AND BUMPERS

CONTENTS

FRAME

INDEX

GENERAL INFORMATION

EMERGENCY TOW EYES

If your vehicle is equipped with emergency tow eyes, one is mounted in the front and one in the rear.

The front tow eye has two holes, the front hole is for towing use only and the rear angled hole is for shipping use only.

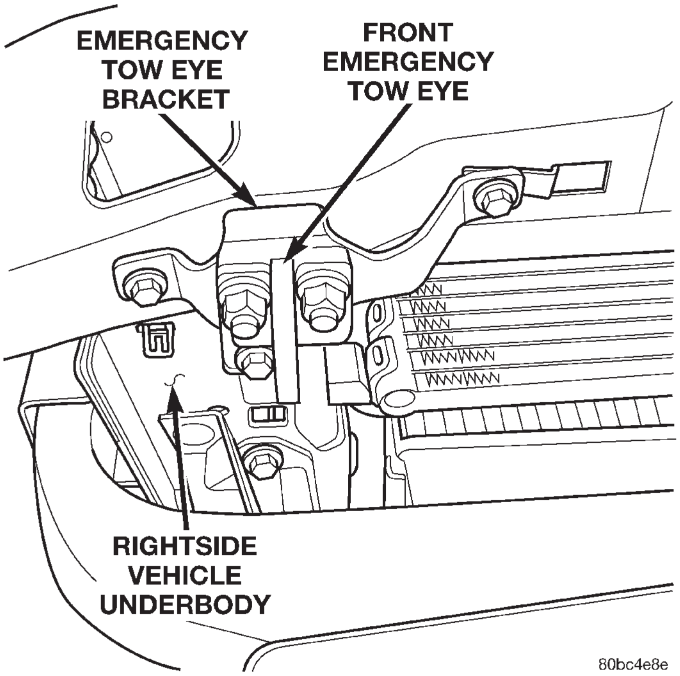


Fig. 1 Front Emergency Tow Eye

CAUTION: Do not use the angled hole for towing. You could damage your vehicle.

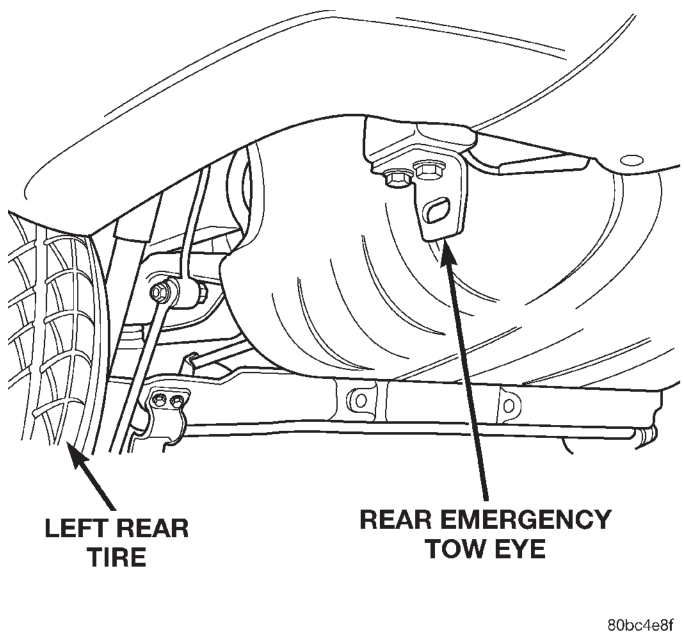


Fig. 2 Rear Emergency Tow Eye

WARNING: Stand clear of vehicles when pulling with tow eyes. Tow straps and chains may break, causing serious injury.

CAUTION: Tow eyes are for emergency use only, to rescue a vehicle stranded off road. Do not use tow eyes for tow truck hookup or highway towing. You could damage your vehicle.

FUEL SYSTEM

CONTENTS

FUEL DELIVERY SYSTEM

INDEX

DESCRIPTION AND OPERATION

PCM REPLACEMENT

USE THE DRB SCAN TOOL TO REPROGRAM THE NEW POWERTRAIN CONTROL MODULE (PCM) WITH THE VEHICLES ORIGINAL IDENTIFICATION NUMBER (VIN) AND THE VEHICLES ORIGINAL MILEAGE. IF THIS STEP IS NOT DONE, A DIAGNOSTIC TROUBLE CODE (DTC) MAY BE SET.

FUEL REQUIREMENTS

Your engine is designed to meet all emissions regulations and provide excellent fuel economy and performance when using high quality unleaded gasoline having an octane rating of 87. The use of premium gasoline is not recommended. The use of premium gasoline will provide no benefit over high quality regular gasoline, and in some circumstances may result in poorer performance.

Light spark knock at low engine speeds is not harmful to your engine. However, continued heavy spark knock at high speeds can cause damage and

DESCRIPTION AND OPERATION (Continued)

immediate service is required. Engine damage resulting from operation with a heavy spark knock may not be covered by the new vehicle warranty.

Poor quality gasoline can cause problems such as hard starting, stalling and hesitations. If you experience these symptoms, try another brand of gasoline before considering service for the vehicle.

The American Automobile Manufacturers Association, AAMA, has issued gasoline specifications to define the minimum fuel properties necessary to deliver enhanced performance and durability for your vehicle. Chrysler recommends the use of gasoline that meet the AAMA specifications if they are available.

REFORMULATED GASOLINE

Many areas of the country require the use of cleaner burning gasoline referred to as "reformulated" gasoline. Reformulated gasoline contain oxygenates, and are specifically blended to reduce vehicle emissions and improve air quality.

Chrysler strongly supports the use of reformulated gasoline. Properly blended reformulated gasoline will provide excellent performance and durability for the engine and fuel system components.

GASOLINE/OXYGENATE BLENDS

Some fuel suppliers blend unleaded gasoline with oxygenates such as 10% ethanol, MTBE, and ETBE. Oxygenates are required in some areas of the country during the winter months to reduce carbon monoxide emissions. Fuels blended with these oxygenates may be used in your vehicle.

CAUTION: DO NOT use gasoline containing METHANOL. Gasoline containing methanol may damage critical fuel system components.

MMT

MMT is a manganese-containing metallic additive that is blended into some gasoline to increase octane. Gasoline blended with MMT provide no performance advantage beyond gasoline of the same octane number without MMT. Gasoline blended with MMT reduce spark plug life and reduce emission system performance in some vehicles. Chrysler recommends that gasoline without MMT be used in your vehicle. The MMT content of gasoline may not be indicated on the gasoline pump; therefore, you should ask your gasoline retailer whether or not his/her gasoline contains MMT.

It is even more important to look for gasoline without MMT in Canada because MMT can be used at levels higher than allowed in the United States. MMT is prohibited in Federal and California reformulated gasoline.

SULFUR IN GASOLINE

If you live in the northeast United States, your vehicle may have been designed to meet California low emission standards with clean-burning, low-sulfur, California gasoline. Gasoline sold outside of California is permitted to have higher sulfur levels which may affect the performance of the vehicle's catalytic converter. This may cause the Check Engine or Service Engine Soon light to illuminate.

Illumination of either light while operating on high sulfur gasoline does not necessarily mean your emission control system is malfunctioning. Chrysler recommends that you try a different brand of unleaded gasoline having lower sulfur to determine if the problem is fuel related prior to returning your vehicle to an authorized dealer for service.

CAUTION: If the Check Engine or Service Engine Soon light is flashing, immediate service is required; see on-board diagnostics system section.

MATERIALS ADDED TO FUEL

All gasoline sold in the United States and Canada are required to contain effective detergent additives. Use of additional detergents or other additives is not needed under normal conditions.

FUEL SYSTEM CAUTIONS

CAUTION: Follow these guidelines to maintain your vehicle's performance:

- The use of leaded gas is prohibited by Federal law. Using leaded gasoline can impair engine performance, damage the emission control system, and could result in loss of warranty coverage.
- An out-of-tune engine, or certain fuel or ignition malfunctions, can cause the catalytic converter to overheat. If you notice a pungent burning odor or some light smoke, your engine may be out of tune or malfunctioning and may require immediate service. Contact your dealer for service assistance.
- When pulling a heavy load or driving a fully loaded vehicle when the humidity is low and the temperature is high, use a premium unleaded fuel to help prevent spark knock. If spark knock persists, lighten the load, or engine piston damage may result.
- The use of fuel additives which are now being sold as octane enhancers is not recommended. Most of these products contain high concentrations of methanol. Fuel system damage or vehicle performance problems resulting from the use of such fuels or additives is not the responsibility of Chrysler Corporation and may not be covered under the new vehicle warranty.

DESCRIPTION AND OPERATION (Continued)

NOTE: Intentional tampering with emissions control systems can result in civil penalties being assessed against you.

FUEL DELIVERY SYSTEM

DESCRIPTION

The fuel delivery system consists of:

- the fuel pump module containing the electric fuel pump, fuel gauge sending unit (fuel level sensor) and a separate fuel filter located at bottom of pump module
- a separate combination fuel filter/fuel pressure regulator
- fuel tubes/lines/hoses
- quick-connect fittings
- fuel injector rail
- fuel injectors
- fuel tank
- fuel tank filler/vent tube assembly
- fuel tank filler tube cap
- accelerator pedal
- throttle cable

The fuel tank assembly consists of: the fuel tank, fuel tank shield, fuel tank straps, fuel pump module assembly, fuel pump module locknut/gasket, and roll-over valve (refer to Emission Control System for roll-over valve information).

A fuel filler/vent tube assembly using a pressure/vacuum fuel filler cap is used. The fuel filler tube contains a spring-loaded flap (door) located below the fuel fill cap. The flap is used as a secondary way of sealing the fuel tank if the fuel fill cap has not been properly tightened. The flap is used as part of the EVAP monitor system when the vehicle is equipped with a Leak Detection Pump (LDP). The flap will be installed to all fuel filler tubes (equipped/not equipped with LDP and EVAP monitor system).

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 Emission Control Systems.

Both fuel filters (at bottom of fuel pump module and within fuel pressure regulator) are designed for extended service. They do not require normal scheduled maintenance. Filters should only be replaced if a diagnostic procedure indicates to do so.

FUEL PUMP MODULE

DESCRIPTION

The fuel pump module is installed in the top of the fuel tank (Fig. 1). The fuel pump module (Fig. 2) contains the following components:

- A separate fuel pick-up filter (strainer)
- An electric fuel pump
- A threaded locknut to retain module to tank
- A gasket between tank flange and module
- Fuel gauge sending unit (fuel level sensor)
- Fuel supply tube (line) connection
- Fuel return tube (line) connection

The fuel gauge sending unit and pick-up filter may be serviced separately. If the electrical fuel pump requires service, the entire fuel pump module must be replaced.

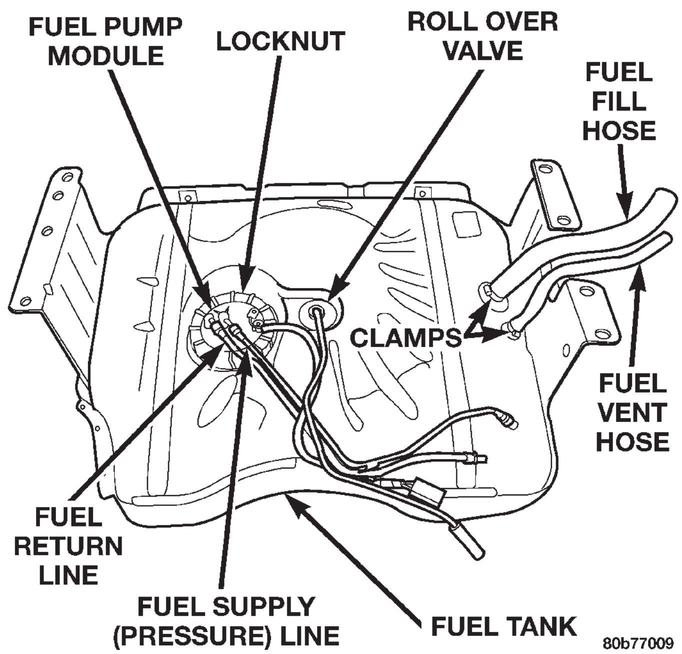


Fig. 1 Fuel Tank/Fuel Pump Module Location (Top View)

FUEL PUMP

DESCRIPTION

The electric fuel pump is located inside of the fuel pump module.

OPERATION

The fuel pump used in this system has a permanent magnet electric motor. Fuel is drawn in through a filter at the bottom of the module and pushed through the electric motor gearset to the pump outlet.

DESCRIPTION AND OPERATION (Continued)

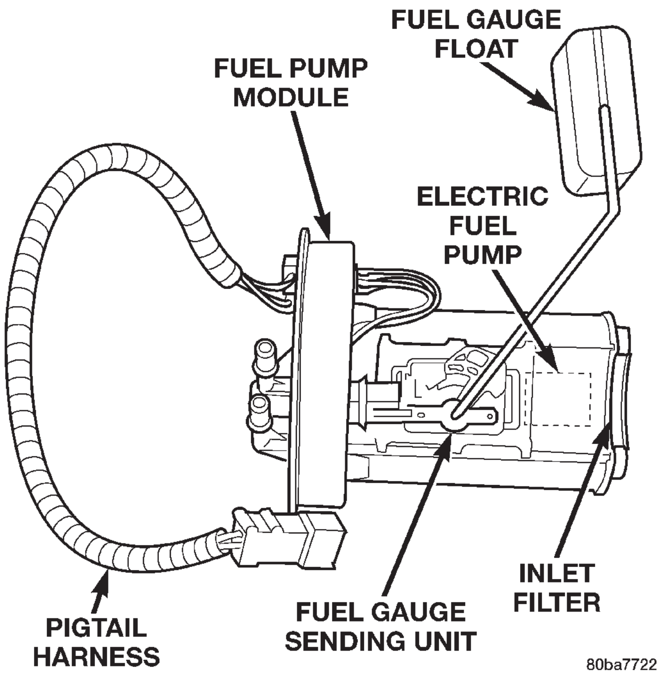


Fig. 2 Fuel Pump Module Components

Check Valve Operation: The pump outlet contains a one-way check valve to prevent fuel flow back into the tank and to maintain fuel supply line pressure (engine warm) when pump is not operational. It is also used to keep the fuel supply line full of gasoline when pump is not operational. After the vehicle has cooled down, fuel pressure may drop to 0 psi (cold fluid contracts), but liquid gasoline will remain in fuel supply line between the check valve and fuel injectors. **Fuel pressure that has dropped to 0 psi on a cooled down vehicle (engine off) is a normal condition.** Refer to the Fuel Pressure Leak Down Test for more information.

Voltage to operate the electric pump is supplied through the fuel pump relay.

FUEL GAUGE SENDING UNIT

DESCRIPTION

The fuel gauge sending unit (fuel level sensor) is attached to the side of the fuel pump module. The sending unit consists of a float, an arm, and a variable resistor (track).

OPERATION

The resistor track is used to send electrical signals to the Powertrain Control Module (PCM) for fuel gauge operation and for OBD II emission requirements.

For fuel gauge operation: As fuel level increases, the float and arm move up. This decreases the sending unit resistance, causing the fuel gauge to read full. As fuel level decreases, the float and arm move down. This increases the sending unit resistance causing the fuel gauge to read empty.

After this fuel level signal is sent to the PCM, the PCM will transmit the data across the J1850 Programmable Communications Interface (PCI) bus circuits to the instrument panel. Here it is translated into the appropriate fuel gauge level reading.

For OBD II emission monitor requirements: A voltage signal is sent from the resistor track on the sending unit to the PCM to indicate fuel level. The purpose of this feature is to prevent the OBD II system from recording/setting false misfire and fuel system monitor trouble codes. The feature is activated if the fuel level in the tank is less than approximately 15 percent of its rated capacity. If equipped with a Leak Detection Pump (EVAP system monitor), this feature will also be activated if the fuel level in the tank is more than approximately 85 percent of its rated capacity.

FUEL FILTER/FUEL PRESSURE REGULATOR

DESCRIPTION

A combination fuel filter and fuel pressure regulator is used on all engines. It is remotely mounted to the body near the front of the fuel tank (Fig. 3). A separate frame mounted fuel filter is not used with any engine.

The filter/regulator is equipped with three different fuel line connections (Fig. 3). They are used for: fuel pressure (from the fuel pump module to the filter/regulator), fuel return (from the filter/regulator back to the fuel pump module) and fuel supply (to the fuel rail and fuel injectors).

OPERATION

Fuel Pressure Regulator Operation: The pressure regulator is a mechanical device that is not controlled by engine vacuum or the Powertrain Control Module (PCM).

The regulator is calibrated to maintain fuel system operating pressure of approximately 339 kPa ± 34 kPa (49.2 psi ± 5 psi) at the fuel injectors. It contains a diaphragm, calibrated springs and a fuel return valve. The internal fuel filter is also part of the assembly.

Fuel is supplied to the filter/regulator by the electric fuel pump. The regulator acts as a check valve to maintain some fuel pressure when the engine is not operating. This will help to start the engine. A second check valve is located at the outlet end of the electric fuel pump.

If fuel pressure at the pressure regulator exceeds approximately 49 psi, an internal diaphragm closes. Excess fuel is then routed into a separate fuel return

DESCRIPTION AND OPERATION (Continued)

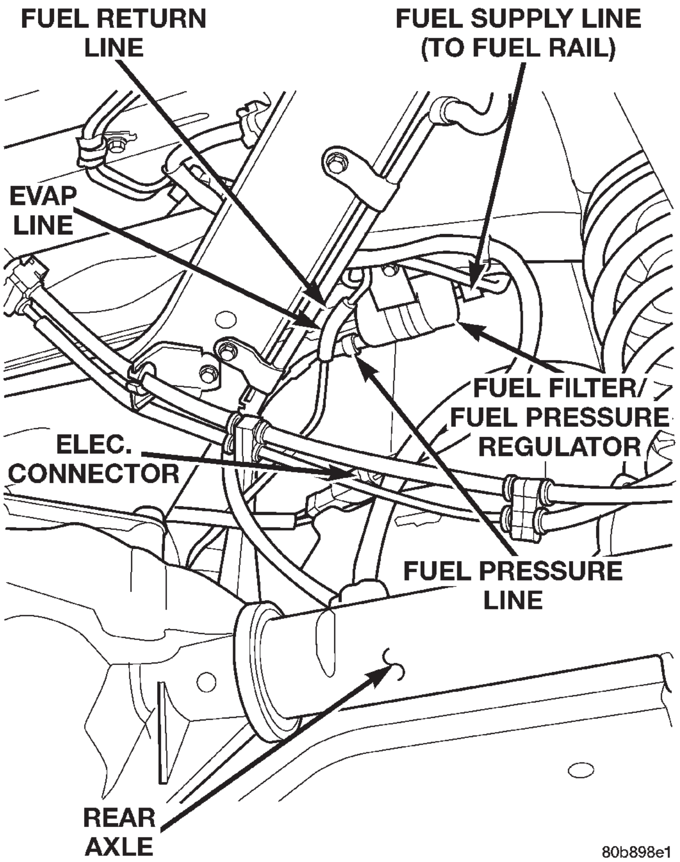


Fig. 3 Fuel Filter/Fuel Pressure Regulator Location

line and returned to the fuel tank through the top of the fuel pump module.

Both fuel filters (at bottom of fuel pump module and within fuel pressure regulator) are designed for extended service. They do not require normal scheduled maintenance. Filters should only be replaced if a diagnostic procedure indicates to do so.

FUEL TANK

DESCRIPTION

The fuel tank is constructed of a plastic material. Its main functions are for fuel storage and for placement of the fuel pump module.

OPERATION

All models pass a full 360 degree rollover test without fuel leakage. To accomplish this, fuel and vapor flow controls are required for all fuel tank connections.

A rollover valve(s) is mounted into the top of the fuel tank (or pump module). Refer to Emission Control System for rollover valve information.

An evaporation control system is connected to the rollover valve(s) to reduce emissions of fuel vapors into the atmosphere. When fuel evaporates from the fuel tank, vapors pass through vent hoses or tubes to a charcoal canister where they are temporarily held. When the engine is running, the vapors are drawn into the intake manifold. Certain models are also equipped with a self-diagnosing system using a Leak Detection Pump (LDP). Refer to Emission Control System for additional information.

FUEL INJECTORS

DESCRIPTION

A separate fuel injector (Fig. 4) is used for each individual cylinder.

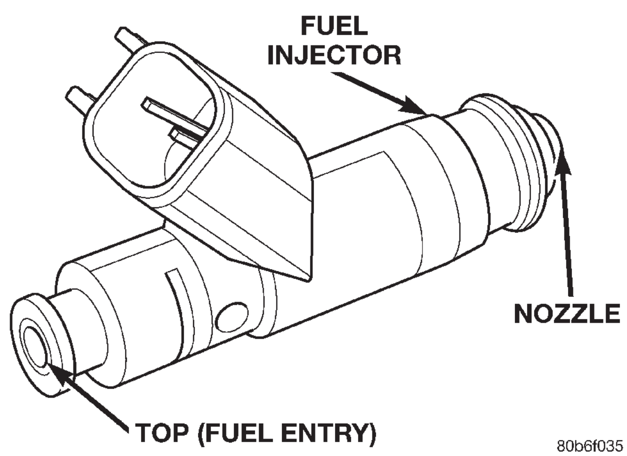


Fig. 4 Fuel Injector—4.0L/4.7L Engines

OPERATION

The fuel injectors are electrical solenoids. The injector contains a pintle that closes off an orifice at the nozzle end. When electric current is supplied to the injector, the armature and needle move a short distance against a spring, allowing fuel to flow out the orifice. Because the fuel is under high pressure, a fine spray is developed in the shape of a pencil stream. The spraying action atomizes the fuel, adding it to the air entering the combustion chamber.

The top (fuel entry) end of the injector (Fig. 4) is attached into an opening on the fuel rail.

The nozzle (outlet) 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 electrically energized, individually and 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.

DESCRIPTION AND OPERATION (Continued)

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.

FUEL INJECTOR RAIL—4.0L ENGINE

DESCRIPTION

The metal fuel injector rail is used to mount the fuel injectors to the engine. It is mounted to the intake manifold (Fig. 5).

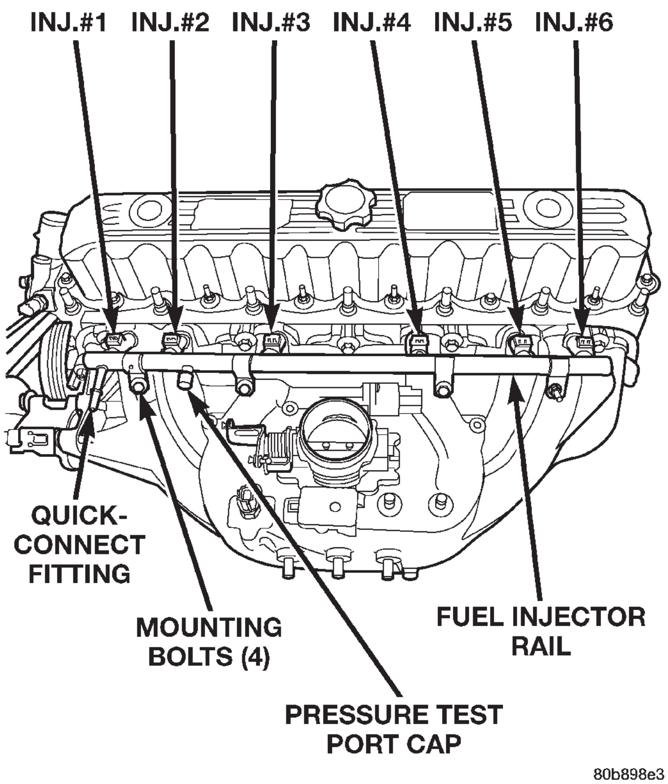


Fig. 5 Fuel Injector Rail—4.0L Engine

OPERATION

High pressure fuel from the fuel pump is routed to the fuel rail. The fuel rail then supplies the necessary fuel to each individual fuel injector.

A fuel pressure test port is located on the fuel rail (Fig. 5). A quick-connect fitting with a safety latch is used to attach the fuel line to the fuel rail.

The fuel rail is not repairable.

FUEL INJECTOR RAIL—4.7L ENGINE

DESCRIPTION

The metal fuel injector rail is used to mount the fuel injectors to the engine. It is mounted to the intake manifold (Fig. 6).

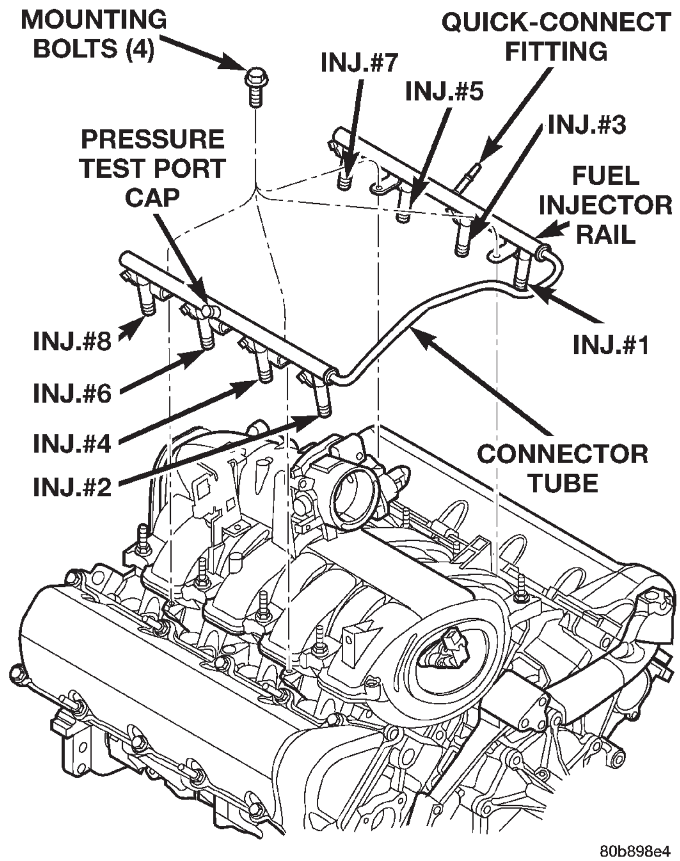


Fig. 6 Fuel Injector Rail—4.7L V-8 Engine

OPERATION

High pressure fuel from the fuel pump is routed to the fuel rail. The fuel rail then supplies the necessary fuel to each individual fuel injector.

A fuel pressure test port is located on the fuel rail (Fig. 6). A quick-connect fitting with a safety latch is used to attach the fuel line to the fuel rail.

The fuel rail is not repairable.

CAUTION: 4.7L Engine Only: The left and right sections of the fuel rail are joined with a connector tube (Fig. 6). Do not attempt to separate the rail halves at this tube. Due to the design of this connecting tube, it does not use any clamps. Never attempt to install a clamping device of any kind to the tube. When removing the fuel rail assembly for any reason, be careful not to bend or kink the connector tube.

DESCRIPTION AND OPERATION (Continued)

FUEL TANK FILLER TUBE CAP

DESCRIPTION

The plastic fuel fill cap is threaded onto the end of the fuel fill tube.

OPERATION

The loss of any fuel or vapor out of fuel filler tube is prevented by the use of a pressure-vacuum fuel fill cap. Relief valves inside the cap will release fuel tank pressure at predetermined pressures. Fuel tank vacuum will also be released at predetermined values. This cap must be replaced by a similar unit if replacement is necessary. This is in order for the system to remain effective.

CAUTION: Remove fill cap before servicing any fuel system component. This is done to help relieve tank pressure. If equipped with a California emissions package and a Leak Detection Pump (LDP), the secondary seal below the fill cap must be pressed (opened) to relieve fuel tank pressure.

QUICK-CONNECT FITTINGS

DESCRIPTION

Different types of quick-connect fittings are used to attach various fuel system components, lines and tubes. These are: a single-tab type, a two-tab type or a plastic retainer ring type. Some are equipped with safety latch clips. Some may require the use of a special tool for disconnection and removal. Refer to Quick-Connect Fittings Removal/Installation for more information.

CAUTION: The interior components (o-rings, clips) of quick-connect fittings are not serviced separately, but new plastic spacers are available for some types. If service parts are not available, do not attempt to repair the damaged fitting or fuel line (tube). If repair is necessary, replace the complete fuel line (tube) assembly.

DIAGNOSIS AND TESTING

FUEL PUMP PRESSURE TEST

Use this test in conjunction with other fuel system tests. Refer to the Fuel Pump Capacity Test, Fuel Pressure Leak Down Test and Fuel Pump Amperage Test.

Check Valve Operation: The electric fuel pump outlet contains a one-way check valve to prevent fuel flow back into the tank and to maintain fuel supply line pressure (engine warm) when pump is not operational. It is also used to keep the fuel supply line full of gasoline when pump is not operational. After the vehicle has cooled down, fuel pressure may drop to 0 psi (cold fluid contracts), but liquid gasoline will remain in fuel supply line between the check valve and fuel injectors. **Fuel pressure that has dropped to 0 psi on a cooled down vehicle (engine off) is a normal condition.** When the electric fuel pump is activated, fuel pressure should **immediately** (1–2 seconds) rise to specification.

The fuel system is equipped with a combination fuel filter/fuel pressure regulator. The fuel pressure regulator is not controlled by engine vacuum.

WARNING: THE FUEL SYSTEM IS UNDER CONSTANT FUEL PRESSURE EVEN WITH THE ENGINE OFF. BEFORE DISCONNECTING FUEL LINE AT FUEL RAIL, THIS PRESSURE MUST BE RELEASED. REFER TO THE FUEL SYSTEM PRESSURE RELEASE PROCEDURE.

(1) Remove pressure test port cap at fuel rail test port (Fig. 7) or (Fig. 8). Connect 0–414 kPa (0-60 psi) fuel pressure gauge (from gauge set 5069) to test port pressure fitting on fuel rail (Fig. 9).

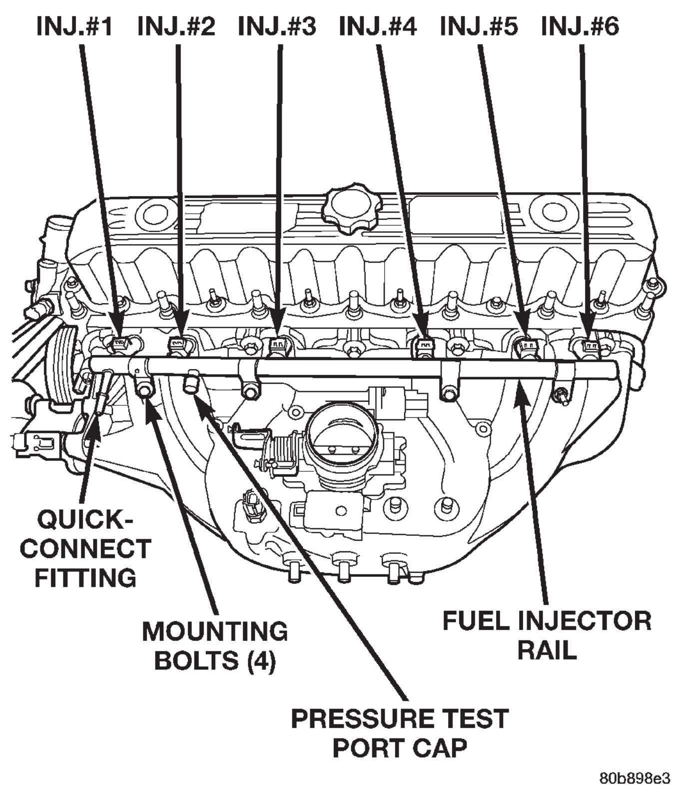


Fig. 7 Test Port Cap Location—4.0L Engine

(2) Start and warm engine and note pressure gauge reading. The DRB scan tool may also be used

DIAGNOSIS AND TESTING (Continued)

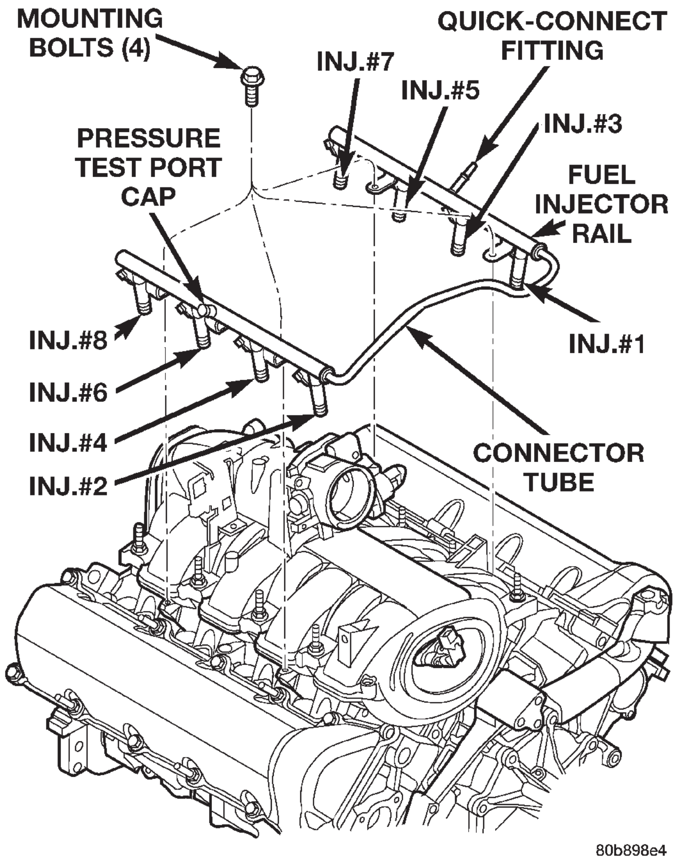


Fig. 8 Test Port Cap Location—4.7L V-8 Engine

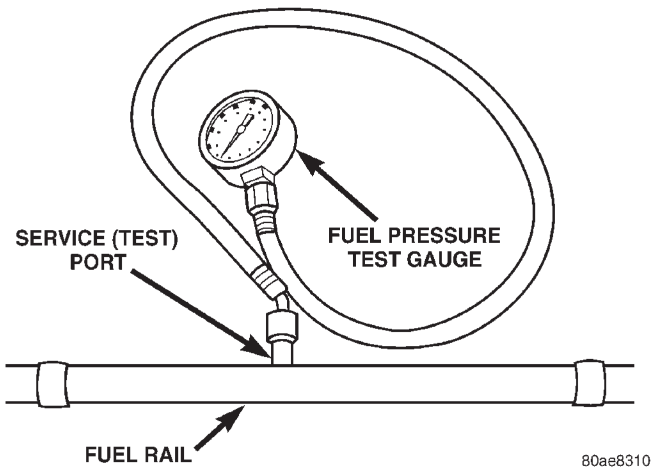


Fig. 9 Fuel Pressure Test Gauge (Typical Gauge Installation at Test Port)

to power fuel pump. Fuel pressure should be 339 kPa ± 34 kPa (49.2 psi ± 5 psi) at idle.

(3) If engine runs, but pressure is below 44.2 psi, determine if fuel pump or filter/regulator is defective. Proceed to next step:

(a) Check for a kinked fuel supply line somewhere between fuel rail and fuel pump module.

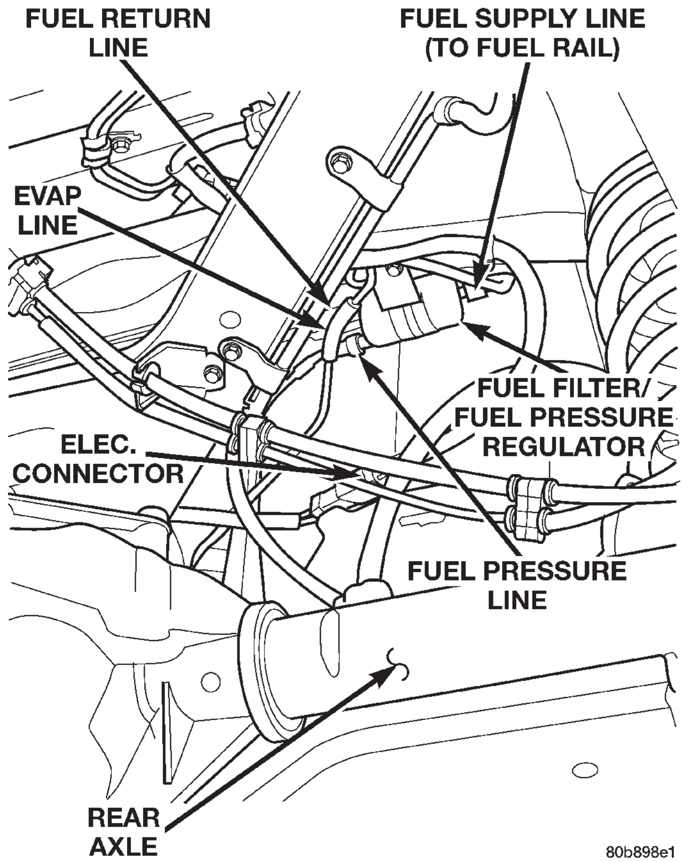


Fig. 10 Fuel Filter/Fuel Pressure Regulator Location

(b) If line is not kinked and pressure is low, raise vehicle and disconnect fuel pressure line at fuel filter/fuel pressure regulator (Fig. 10).

(c) Install Special 5/16” Fuel Line Adapter Tool # 6539 between disconnected fuel line and filter/regulator fitting

(d) Attach 0–60 psi fuel pressure test gauge to “T” fitting on tool 6539.

(e) Use DRB scan tool to power fuel pump. If pressure is now within specifications, replace fuel filter/fuel pressure regulator.

(f) If pressure is still low, replace fuel pump module.

(4) If operating pressure is above 54.2 psi, electric fuel pump is OK, but fuel pressure regulator is defective. Replace fuel filter/fuel pressure regulator.

(5) Install test port cap to fuel rail test port.

FUEL PUMP CAPACITY TEST

Before performing this test, verify fuel pump pressure. Refer to Fuel Pump Pressure Test. Use this test in conjunction with the Fuel Pressure Leak Down Test.

(1) Release fuel system pressure. Refer to Fuel Pressure Release Procedure.

DIAGNOSIS AND TESTING (Continued)

(2) Disconnect fuel supply line at fuel rail. Refer to Quick-Connect Fittings. Some engines may require air cleaner housing removal before line disconnection.

(3) Obtain correct Fuel Line Pressure Test Adapter Tool Hose. Tool number 6539 is used for 5/16” fuel lines and tool number 6631 is used for 3/8” fuel lines.

(4) Connect correct Fuel Line Pressure Test Adapter Tool Hose into disconnected fuel supply line. Insert other end of Adaptor Tool Hose into a graduated container.

(5) Remove fuel fill cap.

(6) To activate fuel pump and pressurize system, obtain DRB scan tool and actuate ASD Fuel System Test.

(7) A good fuel pump will deliver at least 1/4 liter of fuel in 7 seconds. Do not operate fuel pump for longer than 7 seconds with fuel line disconnected as fuel pump module reservoir may run empty.

(a) If capacity is lower than specification, but fuel pump can be heard operating through fuel fill cap opening, check for a kinked/damaged fuel supply line somewhere between fuel rail and fuel pump module.

(b) If line is not kinked/damaged, and fuel pressure is OK, but capacity is low, replace fuel filter/fuel pressure regulator. The filter/regulator may be serviced separately on certain applications. Refer to Fuel Filter/Fuel Pressure Regulator Removal/Installation for additional information.

(c) If both fuel pressure and capacity are low, replace fuel pump module assembly. Refer to Fuel Pump Module Removal/Installation.

FUEL PRESSURE LEAK DOWN TEST

Use this test in conjunction with the Fuel Pump Pressure Test and Fuel Pump Capacity Test.

Check Valve Operation: The electric fuel pump outlet contains a one-way check valve to prevent fuel flow back into the tank and to maintain fuel supply line pressure (engine warm) when pump is not operational. It is also used to keep the fuel supply line full of gasoline when pump is not operational. After the vehicle has cooled down, fuel pressure may drop to 0 psi (cold fluid contracts), but liquid gasoline will remain in fuel supply line between the check valve and fuel injectors. **Fuel pressure that has dropped to 0 psi on a cooled down vehicle (engine off) is a normal condition.** When the electric fuel pump is activated, fuel pressure should **immediately** (1–2 seconds) rise to specification.

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. On some engines, air cleaner housing removal may be necessary before fuel line disconnection.

(2) Obtain correct Fuel Line Pressure Test Adapter Tool Hose. Tool number 6539 is used for 5/16” fuel lines and tool number 6631 is used for 3/8” fuel lines.

(3) Connect correct Fuel Line Pressure Test Adapter Tool Hose between disconnected fuel line and fuel rail (Fig. 11).

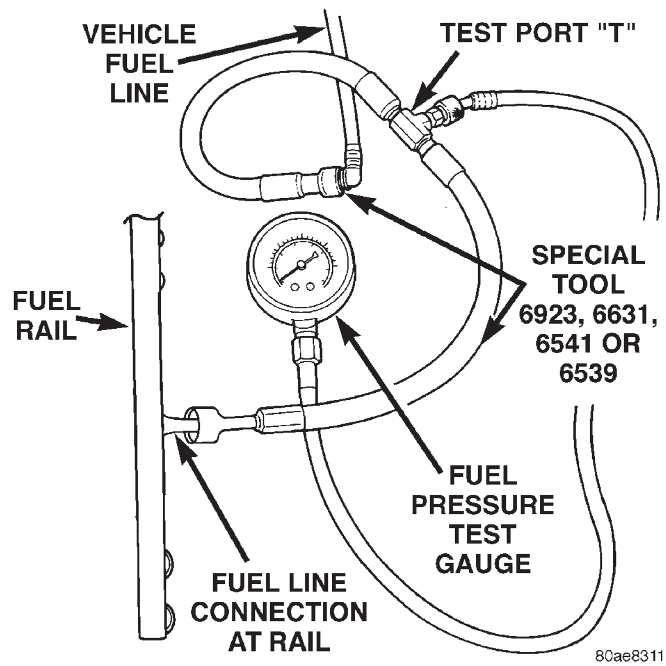


Fig. 11 Connecting Adapter Tool—Typical

(4) Connect the 0-414 kPa (0-60 psi) fuel pressure test gauge (from Gauge Set 5069) to the test port on the appropriate Adaptor Tool. **The fittings on both tools must be in good condition and free from any small leaks before performing the proceeding test.**

(5) Start engine and bring to normal operating temperature.

(6) Observe test gauge. Normal operating pressure should be 339 kPa ± 34 kPa (49.2 psi ± 5 psi).

(7) Shut engine off.

(8) Pressure should not fall below **30 psi for five minutes.**

(9) If pressure falls below 30 psi, it must be determined if a fuel injector, the check valve within the fuel pump module, or a fuel tube/line is leaking.

(10) Again, start engine and bring to normal operating temperature.

(11) Shut engine off.

(12) **Testing for fuel injector or fuel rail leakage:** Clamp off the rubber hose portion of Adaptor Tool between the fuel rail and the test port “T” on

DIAGNOSIS AND TESTING (Continued)

Adapter Tool. If pressure now holds at or above 30 psi, a fuel injector or the fuel rail is leaking.

(13) **Testing for fuel pump check valve, filter/regulator check valve or fuel tube/line leakage:** Clamp off the rubber hose portion of Adaptor Tool between the vehicle fuel line and test port "T" on Adapter Tool. If pressure now holds at or above 30 psi, a leak may be found at a fuel tube/line. If no leaks are found at fuel tubes or lines, one of the check valves in either the electric fuel pump or filter/regulator may be leaking.

Note: A quick loss of pressure usually indicates a defective check valve in the filter/regulator. A slow loss of pressure usually indicates a defective check valve in the electric fuel pump.

The electric fuel pump is not serviced separately. Replace the fuel pump module assembly. The filter/regulator may be replaced separately on certain applications. Refer to Fuel Filter/Fuel Pressure Regulator Removal/Installation for additional information.

FUEL PUMP AMPERAGE TEST

This amperage (current draw) test is to be done in conjunction with the Fuel Pump Pressure Test, Fuel Pump Capacity Test and Fuel Pressure Leak Down Test. Before performing the amperage test, be sure the temperature of the fuel tank is above 50° F (10° C).

The DRB Scan Tool along with the DRB Low Current Shunt (LCS) adapter (Fig. 12) and its test leads will be used to check fuel pump amperage specifications.

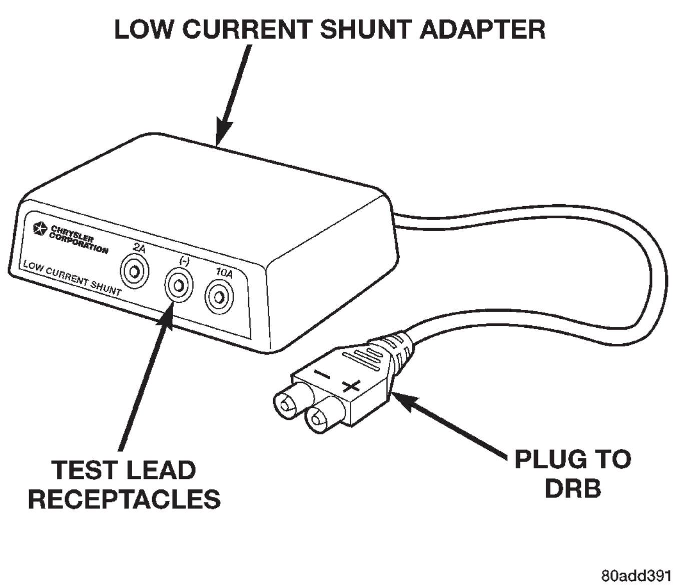


Fig. 12 Low Current Shunt Adapter

(1) Be sure fuel tank contains fuel before starting test. If tank is empty or near empty, amperage readings will be incorrect.

(2) Obtain LCS adapter.

(3) Plug cable from LCS adapter into DRB scan tool at SET 1 receptacle.

(4) Plug DRB into vehicle 16–way connector (data link connector).

(5) Connect (-) and (+) test cable leads into LCS adapter receptacles. Use **10 amp (10A +)** receptacle and common (-) receptacles.

(6) Gain access to MAIN MENU on DRB screen.

(7) Press DVOM button on DRB.

(8) Using left/right arrow keys, highlight CHANNEL 1 function on DRB screen.

(9) Press ENTER three times.

(10) Using up/down arrow keys, highlight RANGE on DRB screen (screen will default to 2 amp scale).

(11) Press ENTER to change 2 amp scale to 10 amp scale. **This step must be done to prevent damage to DRB scan tool or LCS adapter (blown fuse).**

(12) Remove cover from Power Distribution Center (PDC).

(13) Remove fuel pump relay from PDC. Refer to label on PDC cover for relay location.

WARNING: BEFORE PROCEEDING TO NEXT STEP, NOTE THE FUEL PUMP WILL BE ACTIVATED AND SYSTEM PRESSURE WILL BE PRESENT. THIS WILL OCCUR AFTER CONNECTING TEST LEADS FROM LCS ADAPTER INTO FUEL PUMP RELAY CAVITIES. THE FUEL PUMP WILL OPERATE EVEN WITH IGNITION KEY IN OFF POSITION. BEFORE ATTACHING TEST LEADS, BE SURE ALL FUEL LINES AND FUEL SYSTEM COMPONENTS ARE CONNECTED.

CAUTION: TO PREVENT POSSIBLE DAMAGE TO THE VEHICLE ELECTRICAL SYSTEM AND LCS ADAPTER, THE TEST LEADS MUST BE CONNECTED INTO RELAY CAVITIES EXACTLY AS SHOWN IN FOLLOWING STEPS.

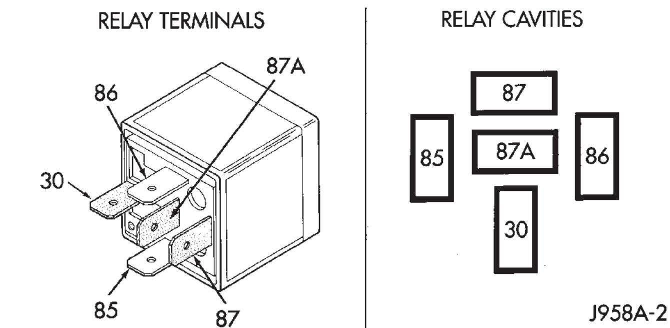
Depending upon vehicle model, year or engine configuration, three different types of relays may be used: Type-1, type-2 and type–3.

(14) If equipped with **type–1 relay** (Fig. 13), attach test leads from LCS adapter into PDC relay cavities number 30 and 87. For location of these cavities, refer to numbers stamped to bottom of relay (Fig. 13).

(15) If equipped with **type–2 relay** (Fig. 14), attach test leads from LCS adapter into PDC relay cavities number 30 and 87. For location of these cavities, refer to numbers stamped to bottom of relay (Fig. 14).

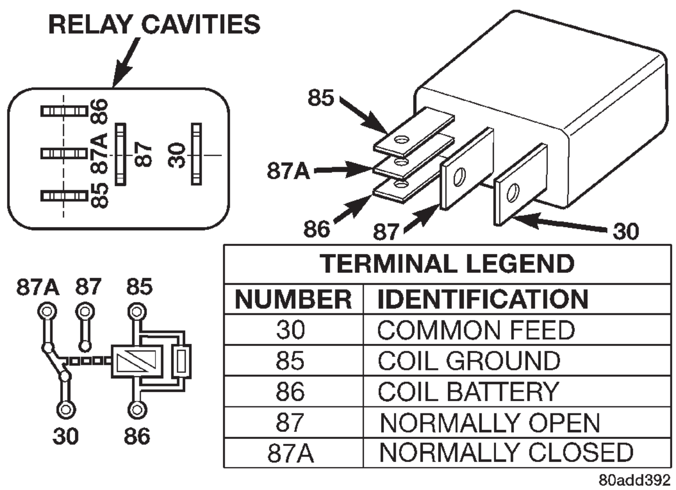
(16) If equipped with **type–3 relay** (Fig. 15), attach test leads from LCS adapter into PDC relay cavities number 3 and 5. For location of these cavities, refer to numbers stamped to bottom of relay (Fig. 15).

DIAGNOSIS AND TESTING (Continued)



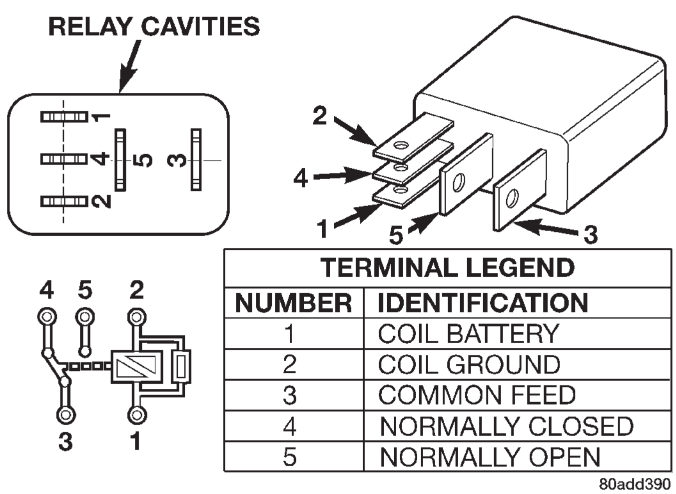
TERMINAL LEGEND	
NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

Fig. 13 Type–1 Relay



TERMINAL LEGEND	
NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

Fig. 14 Type–2 Relay



TERMINAL LEGEND	
NUMBER	IDENTIFICATION
1	COIL BATTERY
2	COIL GROUND
3	COMMON FEED
4	NORMALLY CLOSED
5	NORMALLY OPEN

Fig. 15 Type–3 Relay

(17) When LCS adapter test leads are attached into relay cavities, fuel pump **will be activated.** Determine fuel pump amperage on DRB screen. Amperage should be below 10.0 amps. If amperage is below 10.0 amps, and specifications for the Fuel Pump Pressure, Fuel Pump Capacity and Fuel Pressure Leak Down tests were met, the fuel pump module is OK.

(18) If amperage is more than 10.0 amps, replace fuel pump module assembly. The electric fuel pump is not serviced separately.

(19) Disconnect test leads from relay cavities immediately after testing.

FUEL GAUGE SENDING UNIT

The fuel gauge sending unit contains a variable resistor (track). As the float moves up or down, electrical resistance will change. Refer to Instrument Panel and Gauges for Fuel Gauge testing. To test the gauge sending unit only, it must be removed from vehicle. The unit is part of the fuel pump module. Refer to Fuel Pump Module Removal/Installation for procedures. Measure the resistance across the sending unit terminals. With float in up position, resistance should be 20 ohms (+/- 5%). With float in down position, resistance should be 270 ohms (+/- 5%).

FUEL INJECTOR TEST

To perform a complete test of the fuel injectors and their circuitry, use the DRB scan tool and refer to the appropriate Powertrain Diagnostics Procedures manual. To test the injector only, refer to the following:

Disconnect the fuel injector wire harness connector from the injector. The injector is equipped with 2 electrical terminals (pins). Place an ohmmeter across the terminals. Resistance reading should be approximately 12 ohms ±1.2 ohms at 20°C (68°F).

SERVICE PROCEDURES

FUEL SYSTEM PRESSURE RELEASE PROCEDURE

Use following procedure if fuel rail is or is not equipped with fuel pressure test port.

(1) Remove fuel fill cap.

(2) The fuel filler tube contains a spring-loaded flap (door) located below fuel fill cap. The flap is used as a secondary way of sealing fuel tank if fuel fill cap has not been properly tightened. It is part of EVAP monitor system when vehicle is equipped with a Leak Detection Pump (LDP). **The vehicle may be equipped with flap installed into fuel filler tube even though vehicle is not equipped with LDP and EVAP monitor system.** Place a nonmetallic object into fuel fill tube and press on flap to relieve any tank pressure.

(3) Remove Fuel Pump relay from Power Distribution Center (PDC). For location of relay, refer to label on underside of PDC cover.

SERVICE PROCEDURES (Continued)

(4) Start and run engine until it stalls.

(5) Attempt restarting engine until it will no longer run.

(6) Turn ignition key to OFF position.

CAUTION: Steps 1, 2, 3 and 4 must be performed to relieve high pressure fuel from within fuel rail. Do not attempt to use following steps to relieve this pressure as excessive fuel will be forced into a cylinder chamber.

(7) Unplug connector from any fuel injector.

(8) Attach one end of a jumper wire with alligator clips (18 gauge or smaller) to either injector terminal.

(9) Connect other end of jumper wire to positive side of battery.

(10) Connect one end of a second jumper wire to remaining injector terminal.

CAUTION: Powering an injector for more than a few seconds will permanently damage the injector.

(11) Momentarily touch other end of jumper wire to negative terminal of battery for no more than a few seconds.

(12) Place a rag or towel below fuel line quick-connect fitting at fuel rail.

(13) Disconnect quick-connect fitting at fuel rail. Refer to Quick-Connect Fittings.

(14) Return fuel pump relay to PDC.

(15) One or more Diagnostic Trouble Codes (DTC's) may have been stored in PCM memory due to fuel pump relay removal. The DRB scan tool must be used to erase a DTC.

FUEL TUBES/LINES/HOSES AND CLAMPS

OPERATION

Also refer to Quick-Connect Fittings.

WARNING: THE FUEL SYSTEM IS UNDER A CONSTANT PRESSURE (EVEN WITH THE ENGINE OFF). BEFORE SERVICING ANY FUEL SYSTEM HOSES, FITTINGS OR LINES, THE FUEL SYSTEM PRESSURE MUST BE RELEASED. REFER TO THE FUEL SYSTEM PRESSURE RELEASE PROCEDURE IN THIS GROUP.

Inspect all hose connections such as clamps, couplings and fittings to make sure they are secure and leaks are not present. The component should be replaced immediately if there is any evidence of degradation that could result in failure.

Never attempt to repair a plastic fuel line/tube. Replace as necessary.

Avoid contact of any fuel tubes/hoses with other vehicle components that could cause abrasions or scuffing. Be sure that the plastic fuel lines/tubes are properly routed to prevent pinching and to avoid heat sources.

The lines/tubes/hoses used on fuel injected vehicles are of a special construction. This is due to the higher fuel pressures and the possibility of contaminated fuel in this system. If it is necessary to replace these lines/tubes/hoses, only those marked EFM/EFI may be used.

If equipped: The hose clamps used to secure rubber hoses on fuel injected vehicles are of a special rolled edge construction. This construction is used to prevent the edge of the clamp from cutting into the hose. Only these rolled edge type clamps may be used in this system. All other types of clamps may cut into the hoses and cause high-pressure fuel leaks.

Use new original equipment type hose clamps. Tighten hose clamps to 3 N·m (25 in. lbs.) torque.

QUICK-CONNECT FITTINGS

Also refer to Fuel Tubes/Lines/Hoses and Clamps.

Different types of quick-connect fittings are used to attach various fuel system components, lines and tubes. These are: a single-tab type, a two-tab type or a plastic retainer ring type. Safety latch clips are used on certain components/lines. Certain fittings may require use of a special tool for disconnection.

DISCONNECTING

WARNING: THE FUEL SYSTEM IS UNDER A CONSTANT PRESSURE (EVEN WITH ENGINE OFF). BEFORE SERVICING ANY FUEL SYSTEM HOSE, FITTING OR LINE, FUEL SYSTEM PRESSURE MUST BE RELEASED. REFER TO FUEL SYSTEM PRESSURE RELEASE PROCEDURE.

CAUTION: The interior components (o-rings, spacers) of some types of quick-connect fitting are not serviced separately. If service parts are not available, do not attempt to repair a damaged fitting or fuel line. If repair is necessary, replace complete fuel line assembly.

(1) Perform fuel pressure release procedure. Refer to Fuel Pressure Release Procedure in this group.

(2) Disconnect negative battery cable from battery.

(3) Clean fitting of any foreign material before disassembly.

(4) **Single-Tab Type Fitting:** This type of fitting is equipped with a single pull tab (Fig. 16). The tab is removable. After tab is removed, quick-connect fitting can be separated from fuel system component.

(a) Press release tab on side of fitting to release pull tab (Fig. 17). **If release tab is not pressed**

SERVICE PROCEDURES (Continued)

prior to releasing pull tab, pull tab will be damaged.

(b) While pressing release tab on side of fitting, use screwdriver to pry up pull tab (Fig. 17).

(c) Raise pull tab until it separates from quick-connect fitting (Fig. 18).

(5) **Two-Tab Type Fitting:** This type of fitting is equipped with tabs located on both sides of fitting (Fig. 19). The tabs are supplied for disconnecting quick-connect fitting from component being serviced.

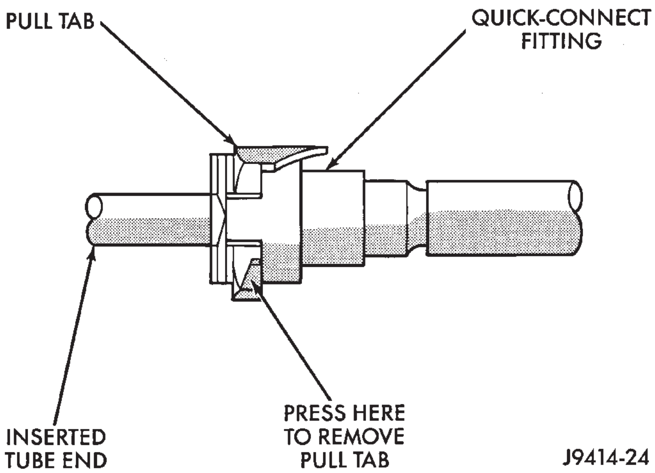


Fig. 16 Single-Tab Type Fitting

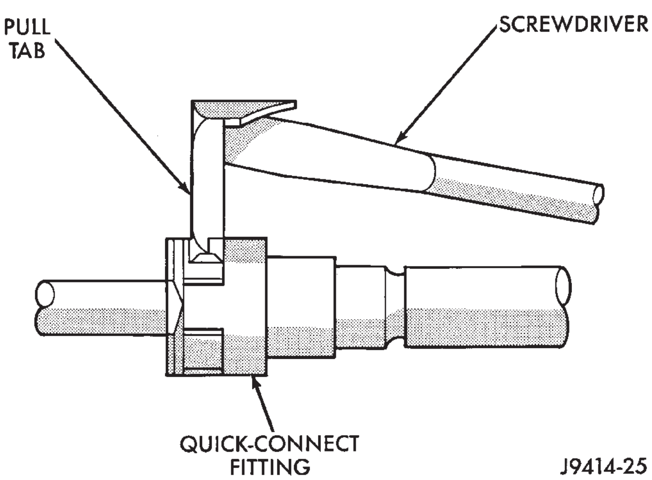


Fig. 17 Disconnecting Single-Tab Type Fitting

(a) To disconnect quick-connect fitting, squeeze plastic retainer tabs (Fig. 19) against sides of quick-connect fitting with your fingers. Tool use is not required for removal and may damage plastic retainer.

(b) Pull fitting from fuel system component being serviced.

(c) The plastic retainer will remain on component being serviced after fitting is disconnected. The o-rings and spacer will remain in quick-connect fitting connector body.

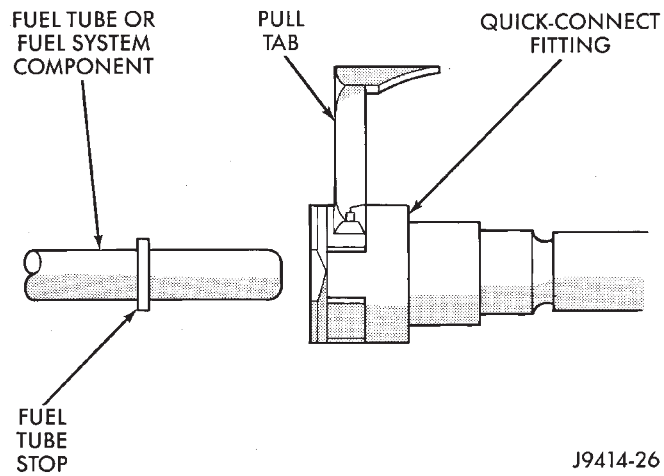


Fig. 18 Removing Pull Tab

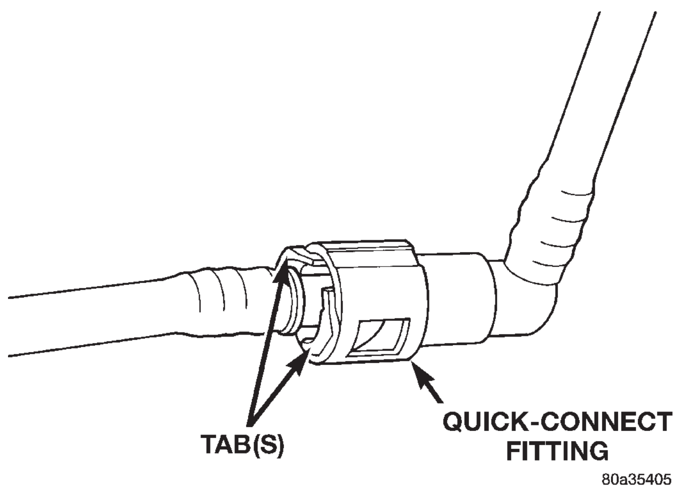


Fig. 19 Typical Two-Tab Type Quick-Connect Fitting

(6) **Plastic Retainer Ring Type Fitting:** This type of fitting can be identified by the use of a full-round plastic retainer ring (Fig. 20) usually black in color.

(a) To release fuel system component from quick-connect fitting, firmly push fitting towards component being serviced while firmly pushing plastic retainer ring into fitting (Fig. 20). With plastic ring depressed, pull fitting from component. **The plastic retainer ring must be pressed squarely into fitting body. If this retainer is cocked during removal, it may be difficult to disconnect fitting. Use an open-end wrench on shoulder of plastic retainer ring to aid in disconnection.**

(b) After disconnection, plastic retainer ring will remain with quick-connect fitting connector body.

(c) Inspect fitting connector body, plastic retainer ring and fuel system component for damage. Replace as necessary.

(7) **Latch Clips:** Depending on vehicle model and engine, 2 different types of safety latch clips are used

SERVICE PROCEDURES (Continued)

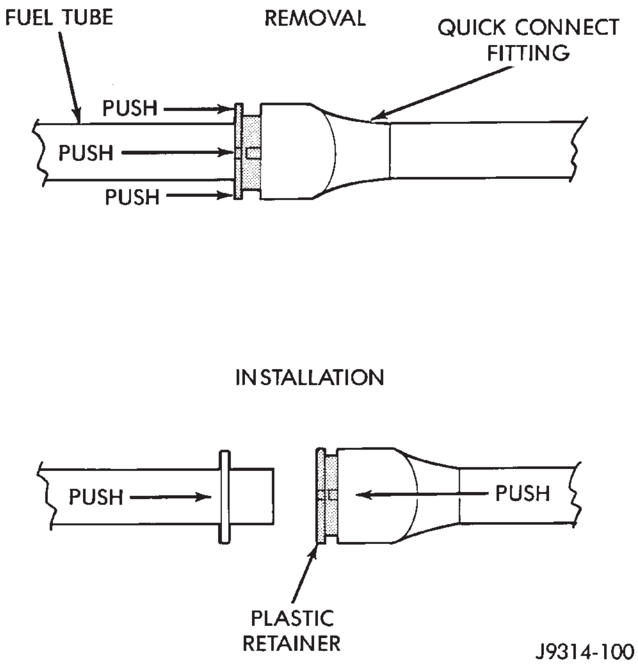


Fig. 20 Plastic Retainer Ring Type Fitting

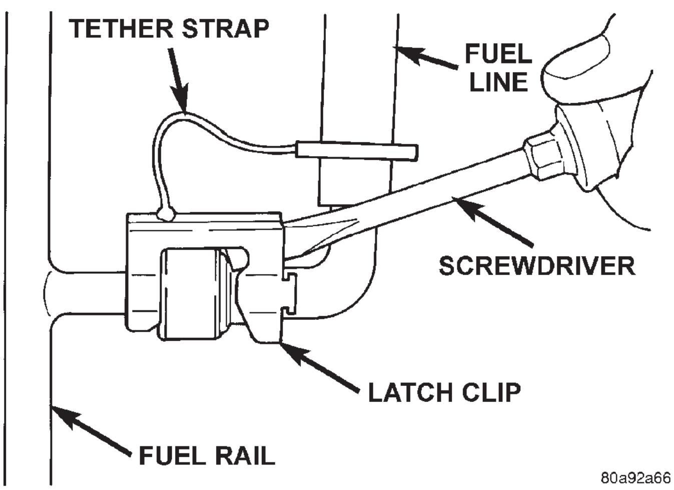


Fig. 21 Latch Clip—Type 1

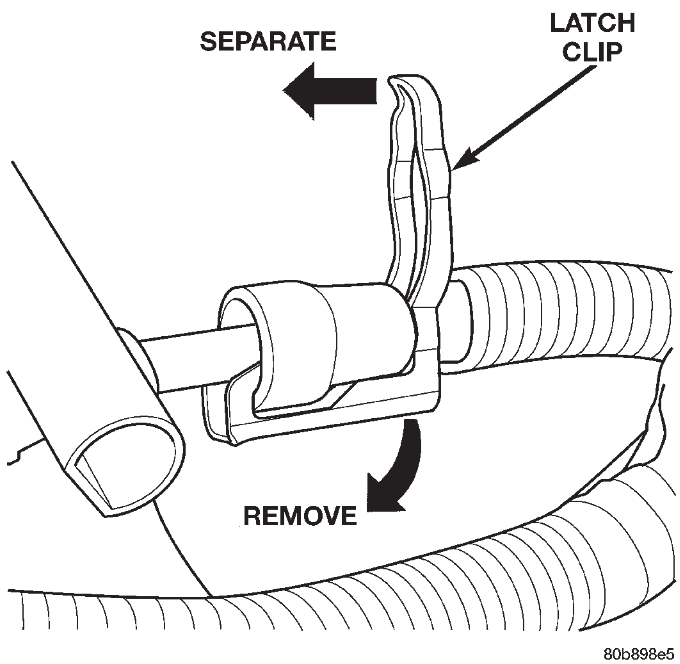


Fig. 22 Latch Clip—Type 2

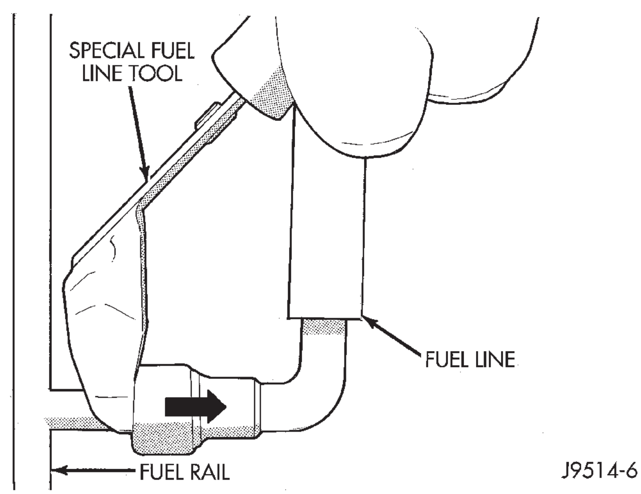


Fig. 23 Fuel Line Disconnection Using Special Tool

(Fig. 21) or (Fig. 22). Type-1 is tethered to fuel line and type-2 is not. A special tool will be necessary to disconnect fuel line after latch clip is removed. The latch clip may be used on certain fuel line/fuel rail connection, or to join fuel lines together.

(a) Type 1: Pry up on latch clip with a screwdriver (Fig. 21).

(b) Type 2: Separate and unlatch 2 small arms on end of clip (Fig. 22) and swing away from fuel line.

(c) Slide latch clip toward fuel rail while lifting with screwdriver.

(d) Insert special fuel line removal tool (Snap-On number FIH 9055-1 or equivalent) into fuel line (Fig. 23). Use tool to release locking fingers in end of line.

(e) With special tool still inserted, pull fuel line from fuel rail.

(f) After disconnection, locking fingers will remain within quick-connect fitting at end of fuel line.

(8) Disconnect quick-connect fitting from fuel system component being serviced.

CONNECTING

(1) Inspect quick-connect fitting body and fuel system component for damage. Replace as necessary.

(2) Prior to connecting quick-connect fitting to component being serviced, check condition of fitting and component. Clean parts with a lint-free cloth. Lubricate with clean engine oil.

SERVICE PROCEDURES (Continued)

(3) Insert quick-connect fitting into fuel tube or fuel system component until built-on stop on fuel tube or component rests against back of fitting.

(4) Continue pushing until a click is felt.

(5) Single-tab type fitting: Push new tab down until it locks into place in quick-connect fitting.

(6) Verify a locked condition by firmly pulling on fuel tube and fitting (15-30 lbs.).

(7) Latch Clip Equipped: Install latch clip (snaps into position). **If latch clip will not fit, this indicates fuel line is not properly installed to fuel rail (or other fuel line). Recheck fuel line connection.**

(8) Connect negative cable to battery.

(9) Start engine and check for leaks.

REMOVAL AND INSTALLATION

FUEL FILTER/FUEL PRESSURE REGULATOR

The combination Fuel Filter/Fuel Pressure Regulator is remotely mounted to the vehicle body near the front of the fuel tank (Fig. 24).

REMOVAL

(1) Perform Fuel System Pressure Release Procedure.

(2) Disconnect negative battery cable at battery.

(3) Raise vehicle.

(4) Clean area around 3 filter/regulator fittings.

(5) Disconnect fuel supply, fuel return and fuel pressure lines at filter/regulator (Fig. 24). Refer to Quick-Connect Fittings.

(6) Remove 2 mounting bolts (Fig. 25) and remove filter/regulator.

INSTALLATION

(1) Before installing filter/regulator, be sure all fittings are cleaned of all dirt and contaminants.

(2) Be sure o-ring is positioned into fuel return fitting in filter/regulator.

(3) Apply a small amount of clean engine oil to o-rings.

(4) Position filter/regulator to body and install 2 bolts. Tighten bolts to 3 N·m (30 in. lbs.) torque.

(5) Connect 3 fittings. Refer to Quick-Connect Fittings.

(6) Connect negative battery cable to battery.

(7) Start engine and check for leaks.

FUEL PUMP MODULE

Fuel tank removal will be necessary for fuel pump module removal.

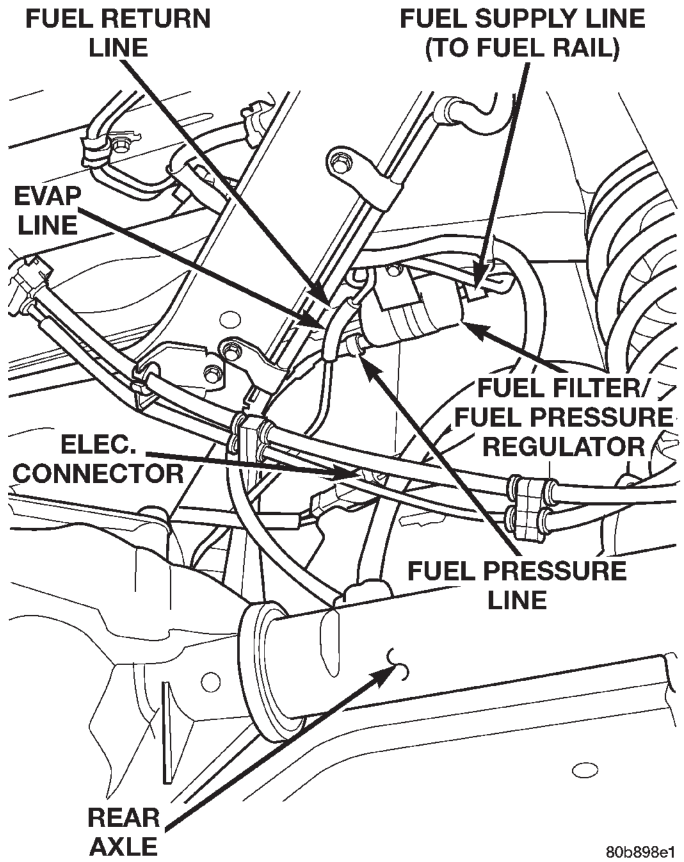


Fig. 24 Fuel Filter/Fuel Pressure Regulator Location

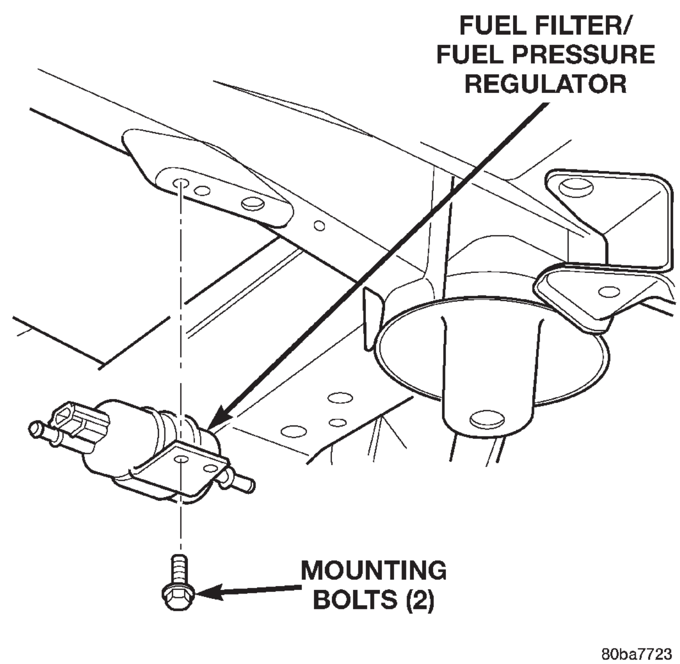


Fig. 25 Fuel Filter/Fuel Pressure Regulator Removal/Installation

REMOVAL AND INSTALLATION (Continued)

REMOVAL

WARNING: THE FUEL SYSTEM IS UNDER A CONSTANT PRESSURE (EVEN WITH THE ENGINE OFF). BEFORE SERVICING FUEL PUMP MODULE, FUEL SYSTEM PRESSURE MUST BE RELEASED.

(1) Perform Fuel System Pressure Release Procedure.

(2) Drain fuel tank and remove tank. Refer to Fuel Tank Removal/Installation.

(3) Thoroughly wash and clean area around pump module to prevent contaminants from entering tank.

(4) Disconnect fuel return and pressure lines from fuel pump module fittings (Fig. 26). Refer to Quick-Connect Fittings for procedures.

(5) The plastic fuel pump module locknut is threaded onto fuel tank (Fig. 26). Install Special Tool 6856 to fuel pump module locknut and remove locknut (Fig. 27). The fuel pump module will spring up slightly after locknut is removed.

(6) Remove module from fuel tank.

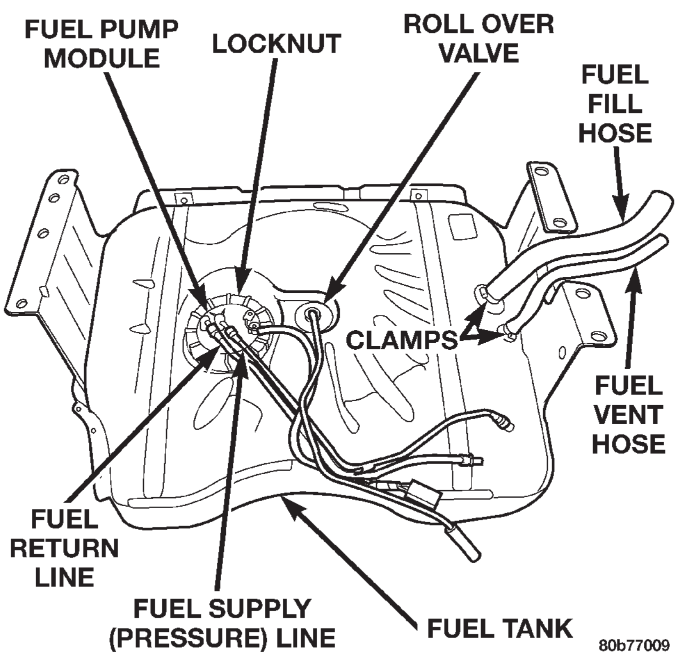


Fig. 26 Top View of Fuel Tank and Fuel Pump Module

INSTALLATION

CAUTION: Whenever fuel pump module is serviced, module gasket must be replaced.

(1) Thoroughly clean locknut threads and mating fuel tank threads. Use a soap/water solution. Do not use carburetor cleaner to clean threads.

(2) Using new gasket, position fuel pump module into opening in fuel tank.

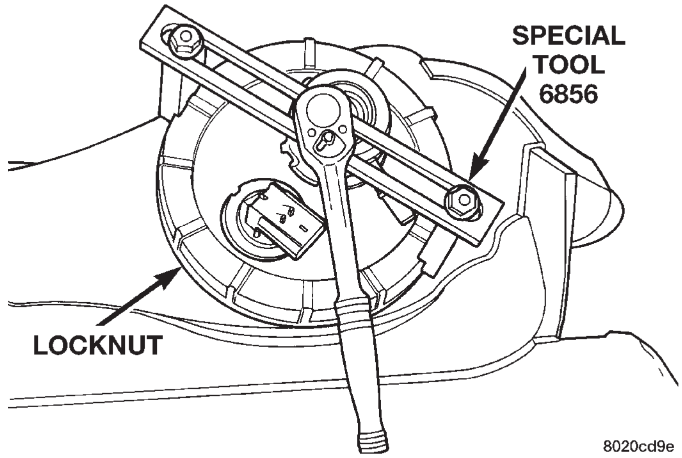


Fig. 27 Locknut Removal/Installation—TYPICAL

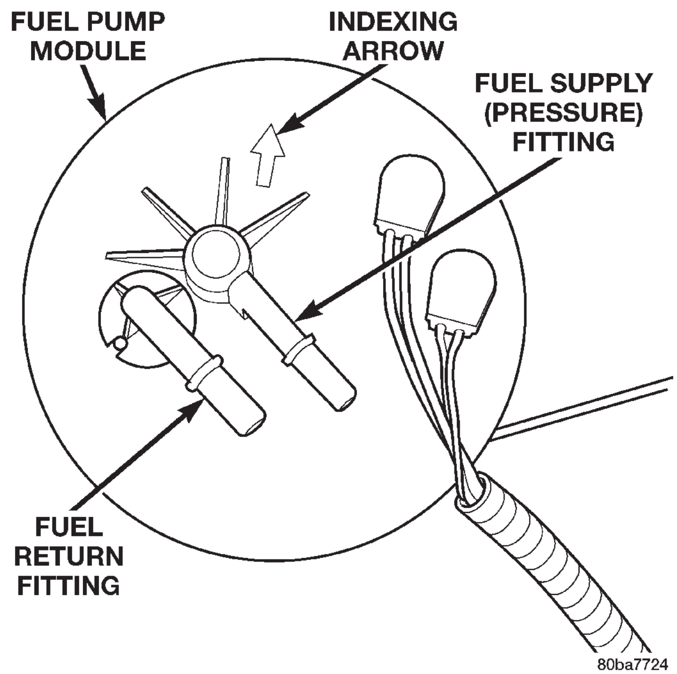


Fig. 28 Fuel Pump Module Indexing Arrow

(3) Apply clean water to locknut threads.

(4) Position locknut over top of fuel pump module.

(5) Rotate module until indexing arrow at top of module (Fig. 28) is pointed toward rear of vehicle. Align arrow to tick mark on top of fuel tank. **This step must be done to prevent float/float rod assembly from contacting sides of fuel tank.**

(6) Install Special Tool 6856 to locknut.

(7) Tighten locknut to 74 N·m (55 ft. lbs.) torque.

(8) Connect fuel return and pressure lines to fuel pump module fittings (Fig. 26). Refer to Quick-Connect Fittings.

(9) Install fuel tank. Refer to Fuel Tank Installation.

REMOVAL AND INSTALLATION (Continued)

FUEL PUMP INLET FILTER

The fuel pump inlet filter (strainer) is located on the bottom of fuel pump module (Fig. 29). The fuel pump module is located on top of fuel tank.

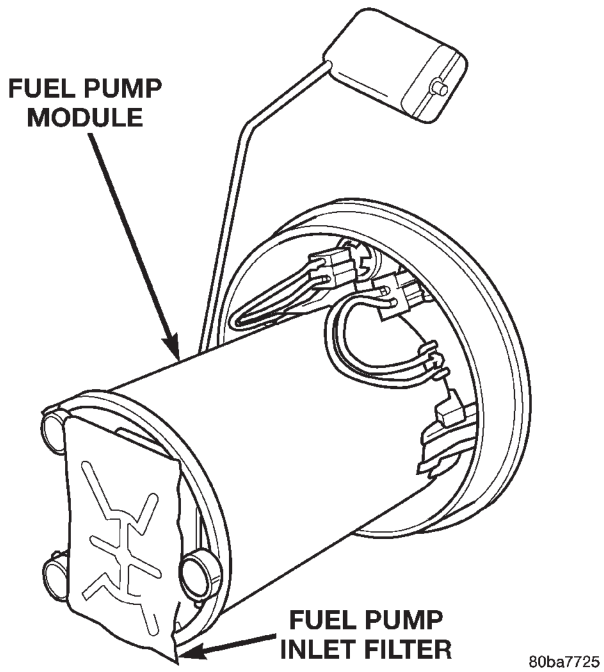


Fig. 29 Fuel Pump Inlet Filter

REMOVAL

(1) Remove fuel tank. Refer to Fuel Tank Removal/Installation.

(2) Remove fuel pump module. Refer to Fuel Pump Module Removal/Installation.

(3) Remove filter by prying from bottom of module with 2 screwdrivers. Filter is snapped to module.

(4) Clean bottom of pump module.

INSTALLATION

(1) Snap new filter to bottom of module.

(2) Install fuel pump module. Refer to Fuel Pump Module Removal/Installation.

(3) Install fuel tank. Refer to Fuel Tank Removal/Installation.

FUEL GAUGE SENDING UNIT

The fuel gauge sending unit (fuel level sensor) and float assembly is located on the side of fuel pump module (Fig. 30). The fuel pump module is located within the fuel tank.

REMOVAL

(1) Remove fuel tank. Refer to Fuel Tank Removal/Installation.

(2) Remove fuel pump module. Refer to Fuel Pump Module Removal/Installation.

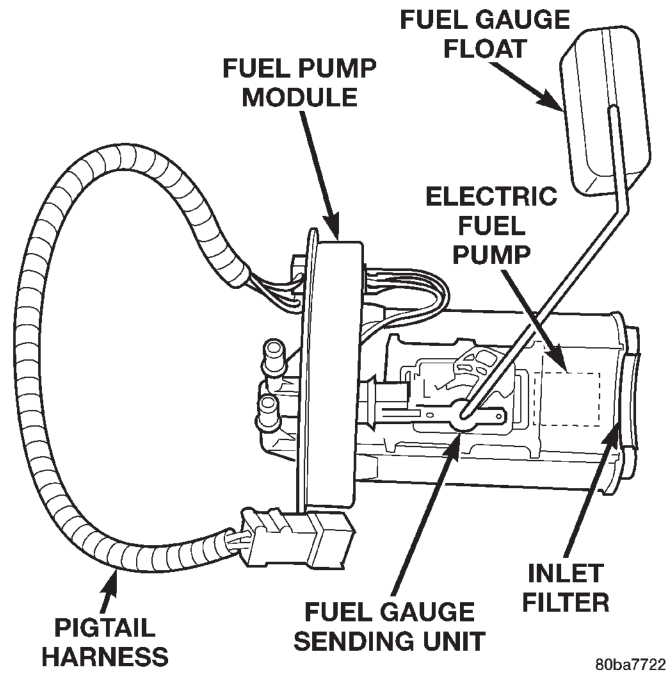


Fig. 30 Fuel Gauge Sending Unit Location

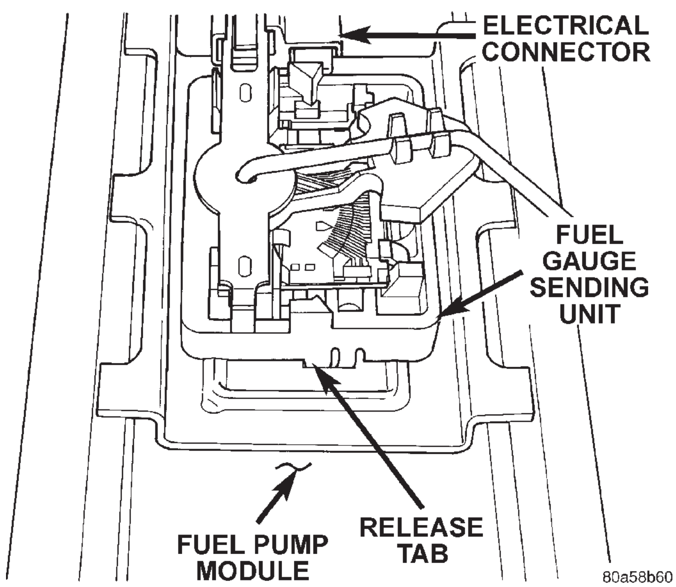


Fig. 31 Fuel Gauge Sending Unit Release Tab

(3) Remove electrical wire connector at sending unit terminals.

(4) Press upward on release tab (Fig. 31) to remove sending unit from pump module.

INSTALLATION

(1) Position sending unit to pump module and snap into place.

(2) Connect electrical connector to terminals.

(3) Install fuel pump module. Refer to Fuel Pump Module Removal/Installation.

(4) Install fuel tank. Refer to Fuel Tank Removal/Installation.

REMOVAL AND INSTALLATION (Continued)

FUEL INJECTOR RAIL—4.0L ENGINE

REMOVAL

WARNING: THE FUEL SYSTEM IS UNDER CONSTANT FUEL PRESSURE EVEN WITH ENGINE OFF. THIS PRESSURE MUST BE RELEASED BEFORE SERVICING FUEL RAIL.

(1) Remove fuel tank filler tube cap.

(2) Perform Fuel System Pressure Release Procedure.

(3) Disconnect negative battery cable from battery.

(4) Remove air tube at top of throttle body. Note: Some engine/vehicles may require removal of air cleaner ducts at throttle body.

(5) Disconnect electrical connectors at all 6 fuel injectors. To remove connector refer to (Fig. 33). Push red colored slider away from injector (1). While pushing slider, depress tab (2) and remove connector (3) from injector. The factory fuel injection wiring harness is numerically tagged (INJ 1, INJ 2, etc.) for injector position identification. If harness is not tagged, note wiring location before removal.

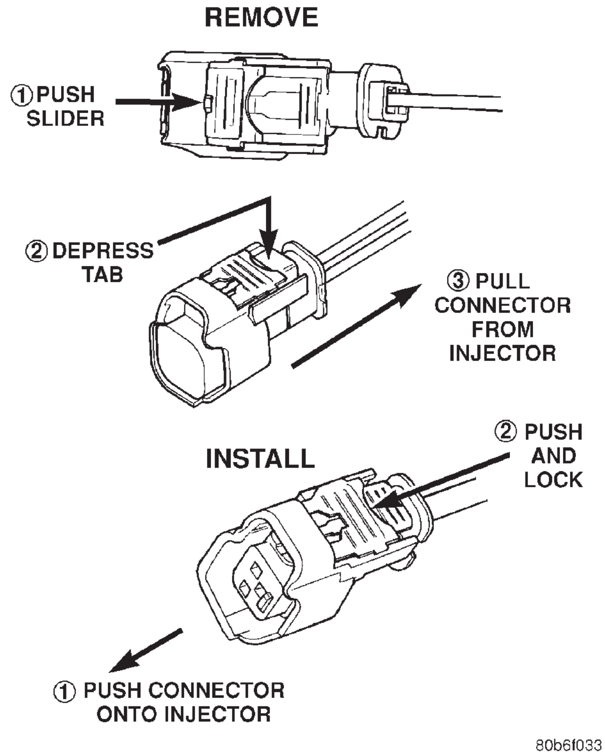


Fig. 33 Remove/Install Injector Connector—4.0L Engine

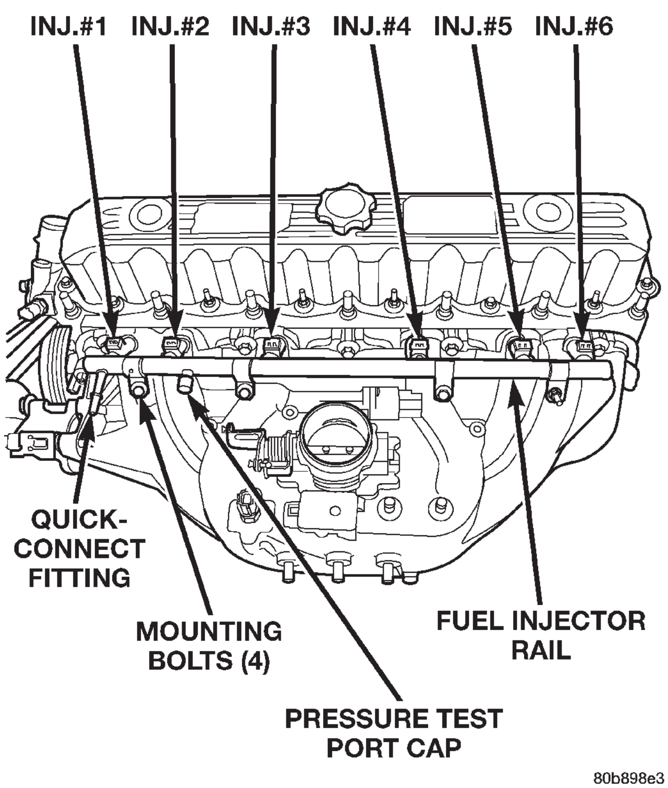


Fig. 32 Fuel Rail Mounting—4.0L Engine

(6) Remove oxygen sensor wiring clip nuts at fuel rail mounting studs (certain emissions packages only).

(7) Disconnect fuel supply line latch clip and fuel line at fuel rail. Refer to Quick-Connect Fittings.

(8) Disconnect throttle cable at throttle body. Refer to Throttle Cable Removal/Installation.

(9) Disconnect speed control cable at throttle body (if equipped). Refer to Speed Control Cable.

(10) Disconnect automatic transmission cable at throttle body (if equipped).

(11) Remove cable routing bracket at intake manifold.

(12) Clean dirt/debris from each fuel injector at intake manifold.

(13) Remove fuel rail mounting nuts/bolts (Fig. 32).

(14) Remove fuel rail by gently rocking until all fuel injectors have cleared machined holes at intake manifold.

(15) If fuel injectors are to be removed, refer to Fuel Injector Removal/Installation.

INSTALLATION

(1) If fuel injectors are to be installed, refer to Fuel Injector Removal/Installation.

(2) Clean each injector bore at intake manifold.

(3) Apply a small amount of clean engine oil to each injector o-ring. This will aid in installation.

REMOVAL AND INSTALLATION (Continued)

(4) Position tips of all fuel injectors into the corresponding injector bore in intake manifold. Seat injectors into manifold.

(5) Install and tighten fuel rail mounting bolts to 11 ±3 N·m (100 ±25 in. lbs.) torque.

(6) Connect electrical connectors at all fuel injectors. To install connector, refer to (Fig. 33). Push connector onto injector (1) and then push and lock red colored slider (2). Verify connector is locked to injector by lightly tugging on connector.

(7) Connect fuel line and fuel line latch clip to fuel rail. Refer Quick-Connect Fittings.

(8) Install protective cap to pressure test port fitting (if equipped).

(9) Install cable routing bracket to intake manifold.

(10) Connect throttle cable at throttle body.

(11) Connect speed control cable at throttle body (if equipped).

(12) Connect automatic transmission cable at throttle body (if equipped).

(13) Install oxygen sensor wiring clip nuts to fuel rail mounting studs (certain emissions packages only).

(14) Install air tube (or duct) at top of throttle body.

(15) Install fuel tank cap.

(16) Connect negative battery cable to battery.

(17) Start engine and check for fuel leaks.

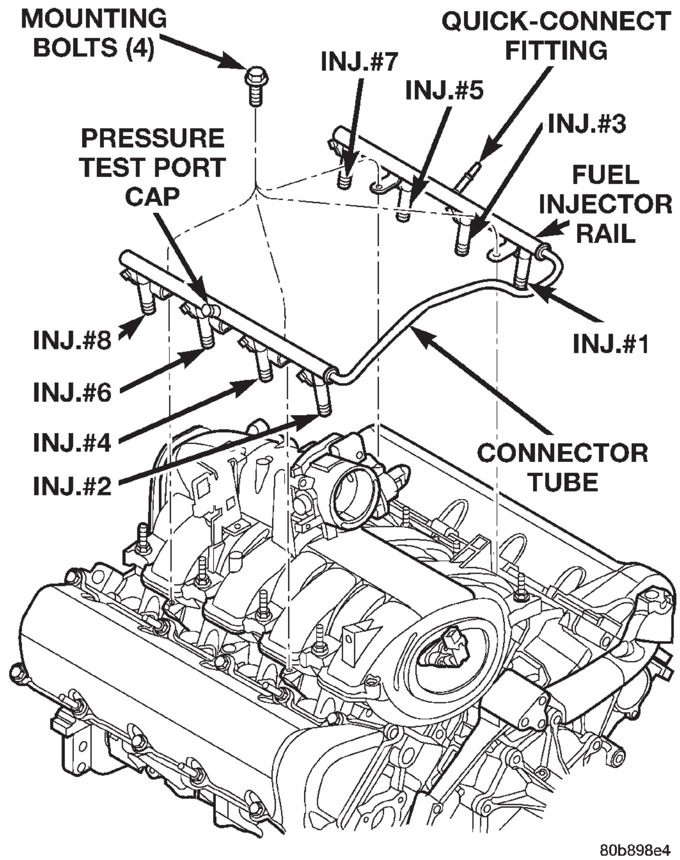


Fig. 34 Fuel Rail Mounting—4.7L V-8 Engine

FUEL INJECTOR RAIL—4.7L V–8 ENGINE

WARNING: THE FUEL SYSTEM IS UNDER CONSTANT PRESSURE EVEN WITH ENGINE OFF. BEFORE SERVICING FUEL RAIL, FUEL SYSTEM PRESSURE MUST BE RELEASED.

CAUTION: The left and right fuel rails are replaced as an assembly. Do not attempt to separate rail halves at connector tube (Fig. 34). Due to design of tube, it does not use any clamps. Never attempt to install a clamping device of any kind to tube. When removing fuel rail assembly for any reason, be careful not to bend or kink tube.

REMOVAL

(1) Remove fuel tank filler tube cap.

(2) Perform Fuel System Pressure Release Procedure.

(3) Remove negative battery cable at battery.

(4) Remove air duct at throttle body air box.

(5) Remove air box at throttle body.

(6) Remove wiring at rear of generator.

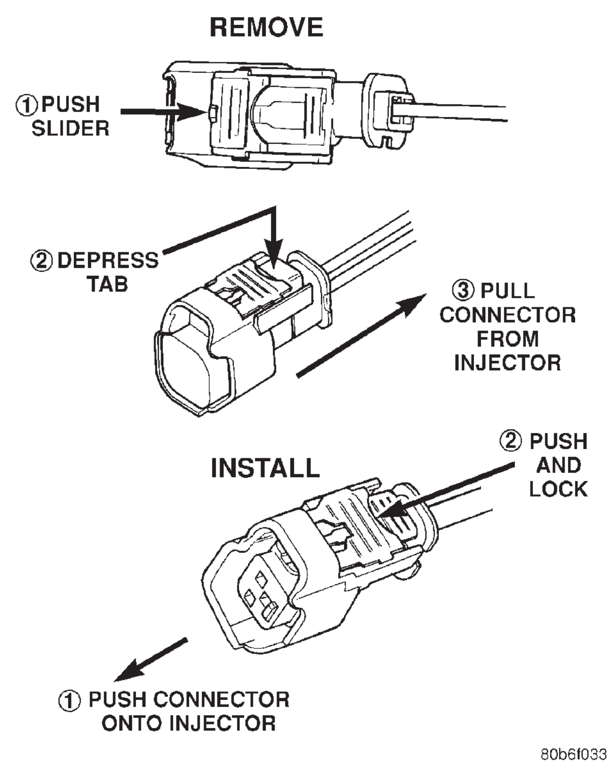


Fig. 35 Remove/Install Injector Connector—4.7L V-8 Engine

REMOVAL AND INSTALLATION (Continued)

(7) Disconnect fuel line latch clip and fuel line at fuel rail. A special tool will be necessary for fuel line disconnection. Refer to Quick-Connect Fittings.

(8) Remove vacuum lines at throttle body.

(9) Disconnect electrical connectors at all 8 fuel injectors. To remove connector refer to (Fig. 35). Push red colored slider away from injector (1). While pushing slider, depress tab (2) and remove connector (3) from injector. The factory fuel injection wiring harness is numerically tagged (INJ 1, INJ 2, etc.) for injector position identification. If harness is not tagged, note wiring location before removal.

(10) Disconnect electrical connectors at throttle body.

(11) Disconnect electrical connectors at MAP and IAT sensors.

(12) Remove first three ignition coils on each bank (cylinders #1, 3, 5, 2, 4 and 6). Refer to Ignition Coil Removal/Installation.

(13) Remove 4 fuel rail mounting bolts (Fig. 34).

(14) Gently rock and pull **left** side of fuel rail until fuel injectors just start to clear machined holes in cylinder head. Gently rock and pull **right** side of rail until injectors just start to clear cylinder head holes. Repeat this procedure (left/right) until all injectors have cleared cylinder head holes.

(15) Remove fuel rail (with injectors attached) from engine.

(16) If fuel injectors are to be removed, refer to Fuel Injector Removal/Installation.

INSTALLATION

(1) If fuel injectors are to be installed, refer to Fuel Injector Removal/Installation.

(2) Apply a small amount of engine oil to each fuel injector o-ring. This will help in fuel rail installation.

(3) Position fuel rail/fuel injector assembly to machined injector openings in cylinder head.

(4) Guide each injector into cylinder head. Be careful not to tear injector o-rings.

(5) Push **right** side of fuel rail down until fuel injectors have bottomed on cylinder head shoulder. Push **left** fuel rail down until injectors have bottomed on cylinder head shoulder.

(6) Install 4 fuel rail mounting bolts and tighten to 27 N·m (20 ft. lbs.).

(7) Install ignition coils. Refer to Ignition Coil Removal/Installation.

(8) Connect electrical connectors to throttle body.

(9) Connect electrical connectors to MAP and IAT sensors.

(10) Connect electrical connectors at all fuel injectors. To install connector, refer to (Fig. 35). Push connector onto injector (1) and then push and lock red colored slider (2). Verify connector is locked to injector by lightly tugging on connector.

(11) Connect vacuum lines to throttle body.

(12) Connect fuel line latch clip and fuel line to fuel rail. Refer to Quick-Connect Fittings.

(13) Connect wiring to rear of generator.

(14) Install air box to throttle body.

(15) Install air duct to air box.

(16) Connect battery cable to battery.

(17) Start engine and check for leaks.

FUEL INJECTORS

WARNING: THE FUEL SYSTEM IS UNDER CONSTANT PRESSURE EVEN WITH ENGINE OFF. BEFORE SERVICING FUEL INJECTOR(S), FUEL SYSTEM PRESSURE MUST BE RELEASED.

To remove one or more fuel injectors, the fuel rail assembly must be removed from engine.

REMOVAL

(1) Perform Fuel System Pressure Release Procedure.

(2) Remove fuel injector rail. Refer to Fuel Injector Rail Removal/Installation.

(3) Remove clip(s) retaining injector(s) to fuel rail (Fig. 36).

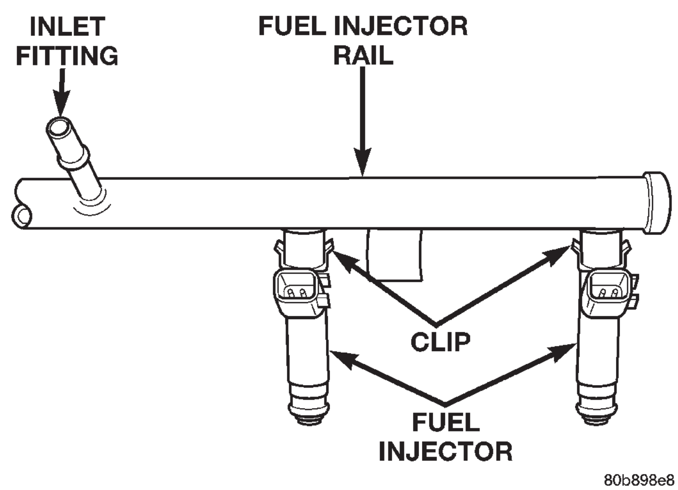


Fig. 36 Fuel Injector Mounting—Typical (4.7L V-8 Engine Shown)

(4) Remove injector(s) from fuel rail.

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.

(3) Install fuel rail assembly. Refer to Fuel Injector Rail Removal/Installation.

(4) Start engine and check for leaks.

REMOVAL AND INSTALLATION (Continued)

FUEL TANK

WARNING: THE FUEL SYSTEM IS UNDER CONSTANT FUEL PRESSURE EVEN WITH ENGINE OFF. PRESSURE MUST BE RELEASED BEFORE SERVICING FUEL TANK.

Two different procedures may be used to drain fuel tank (through tank vent fitting or using DRB scan tool). The quickest is draining through tank vent fitting.

As an alternative procedure, the electric fuel pump may be activated allowing tank to be drained at fuel rail connection. Refer to DRB scan tool for fuel pump activation procedures. Before disconnecting fuel line at fuel rail, release fuel pressure. Refer to the Fuel System Pressure Release Procedure for procedures. Attach end of Special Adapter Hose Tool number 6539 at fuel rail disconnection. Position opposite end of 6539 to an approved gasoline draining station. Activate fuel pump with DRB and drain tank until empty.

If electric fuel pump is not operating, tank **MUST** be drained through vent fitting.

REMOVAL

(1) Release fuel system pressure. Refer to Fuel System Pressure Release Procedure.

(2) Disconnect negative battery cable at battery.

(3) Raise and support vehicle.

(4) Working from front of fuel tank, loosen clamp at fuel **vent** hose at fuel tank end of hose (Fig. 37). Remove hose at tank fitting.

(5) Obtain a length of 3/8” O.D. thinwall, clear tubing.

(6) Position 3/8” O.D. tubing into tank vent fitting. Attach 3/8” tubing to an approved gasoline draining station. Drain tank until empty.

(7) Remove rear tow hooks (if equipped).

(8) Remove optional trailer hitch (if equipped).

(9) Remove fuel tank-to-rear bumper fascia clips (Fig. 38).

(10) Remove fuel tank heat shield mounting bolts (Fig. 39).

CAUTION: To protect fuel tank from exhaust heat, shield must re-installed after tank installation.

WARNING: PLACE SHOP TOWEL AROUND FUEL LINES TO CATCH ANY EXCESS FUEL.

(11) Disconnect fuel return line at fuel filter/fuel pressure regulator (Fig. 40). Refer to Quick-Connect Fittings for procedures.

(12) Disconnect fuel pressure line at fuel filter/fuel pressure regulator (Fig. 40). Refer to Quick-Connect Fittings for procedures.

(13) Disconnect EVAP canister vent line near front of tank (Fig. 40).

(14) Disconnect fuel pump module electrical connector (pigtail harness) near front of tank (Fig. 40). Harness connector is clipped to body.

(15) Cut and discard tie strap supporting rear axle vent hose to tank vent hose (Fig. 41).

(16) Remove clamp on axle vent hose at rear axle.

(17) Remove vent hose from fitting at rear axle.

(18) Loosen fill and vent hose clamps at body (Fig. 41). Disconnect fill and vent hoses at filler tube assembly.

(19) Place hydraulic jack to bottom of fuel tank.

(20) Remove tank-to-frame mounting bolts (Fig. 42).

(21) Carefully lower tank until clear of vehicle. Place tank on floor.

(22) If necessary, remove two fuel tank strap nuts (Fig. 42).

(23) If fuel pump module removal is necessary, refer to Fuel Pump Module Removal/Installation.

(24) If hoses are to be removed at fuel tank end, note painted alignment (indexing) markings on hoses, and molded indexing tangs on tank before removal. Remove hoses.

(25) If necessary, remove fuel filler tube assembly mounting bolts (Fig. 43) and remove fuel filler tube.

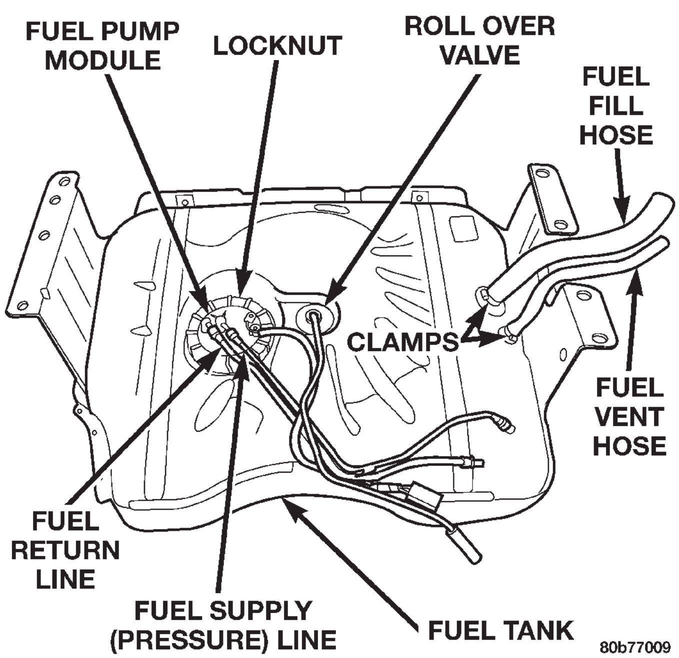


Fig. 37 Fuel Tank Assembly (Top View)

REMOVAL AND INSTALLATION (Continued)

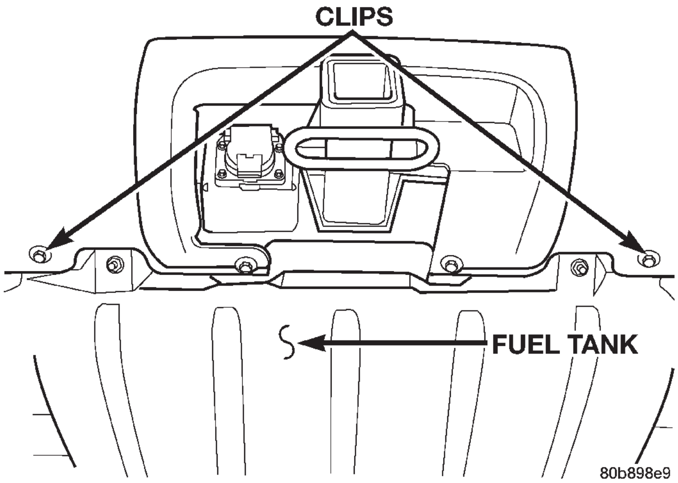


Fig. 38 Fuel Tank-to-Rear Bumper Fascia Clips

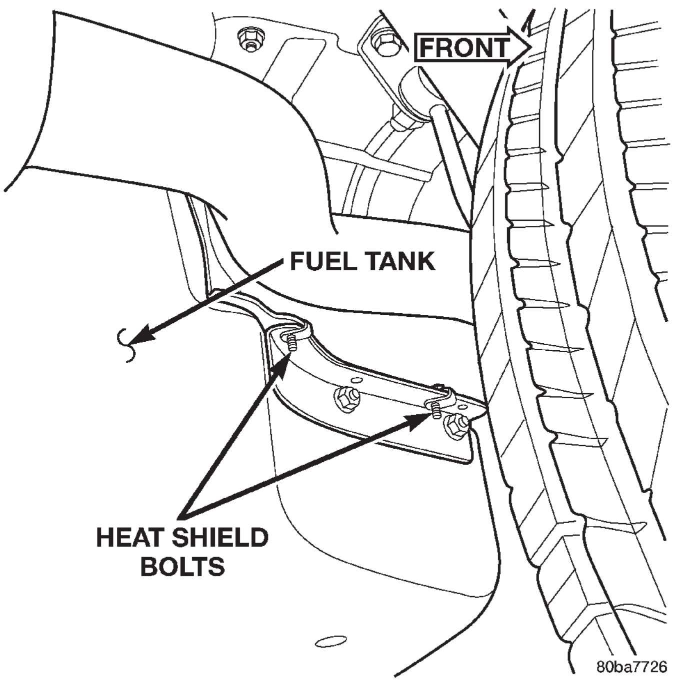


Fig. 39 Fuel Tank Heat Shield Bolts

INSTALLATION

(1) If fuel pump module is being installed, refer to Fuel Pump Module Removal/Installation.

(2) If necessary, position fuel filler tube assembly to body. Install bolts and tighten to 3 N·m (25 in. lbs.) torque.

(3) Install fuel fill/vent hoses to tank fittings. To prevent hoses from kinking, rotate each hose until painted indexing mark on hose is aligned to molded indexing tang on tank.

(4) Install hose clamps to hoses. Tighten clamp screws to 3 N·m (25 in. lbs.) torque.

(5) Position fuel tank to hydraulic jack.

(6) Raise tank into position.

(7) Install fuel tank mounting bolts. Tighten bolts to 81 N·m (60 ft. lbs.) torque.

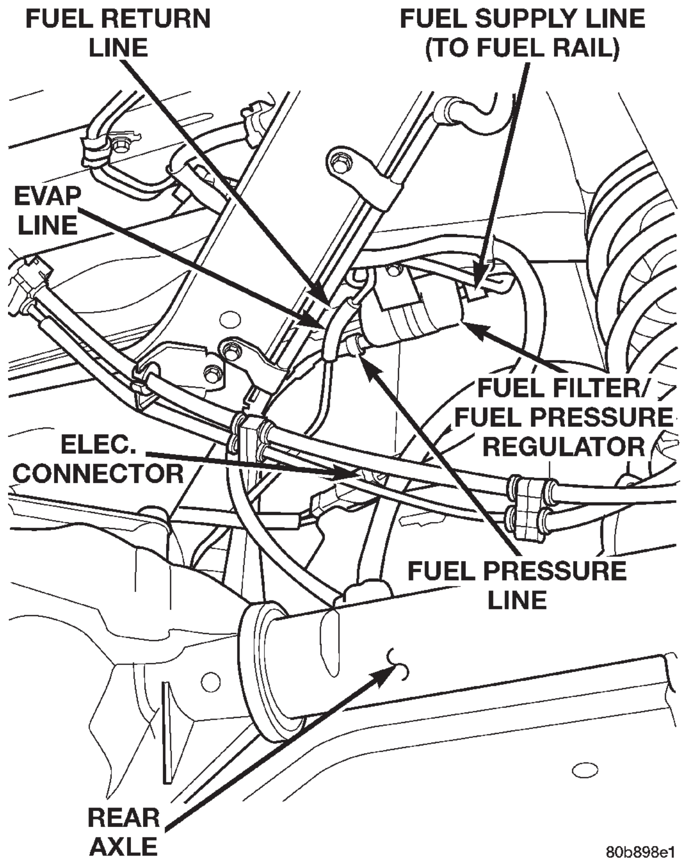


Fig. 40 Fuel Filter/Fuel Pressure Regulator

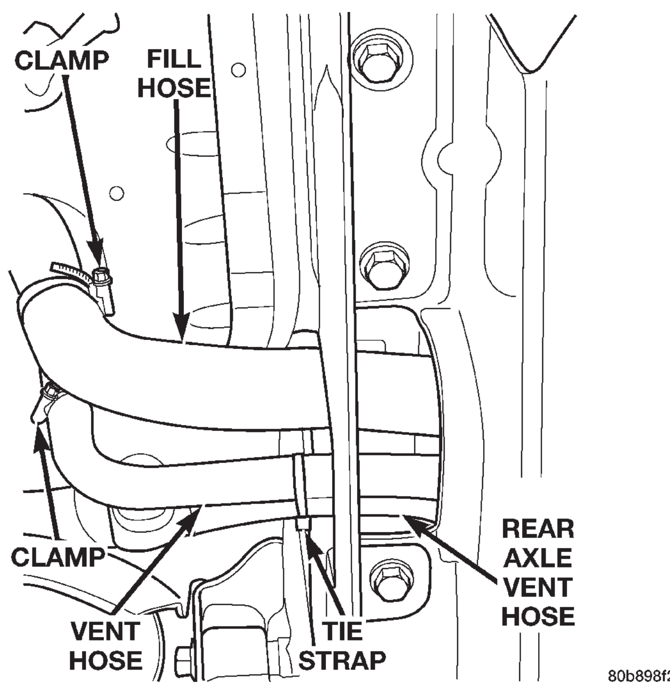


Fig. 41 Fill and Vent Hoses

REMOVAL AND INSTALLATION (Continued)

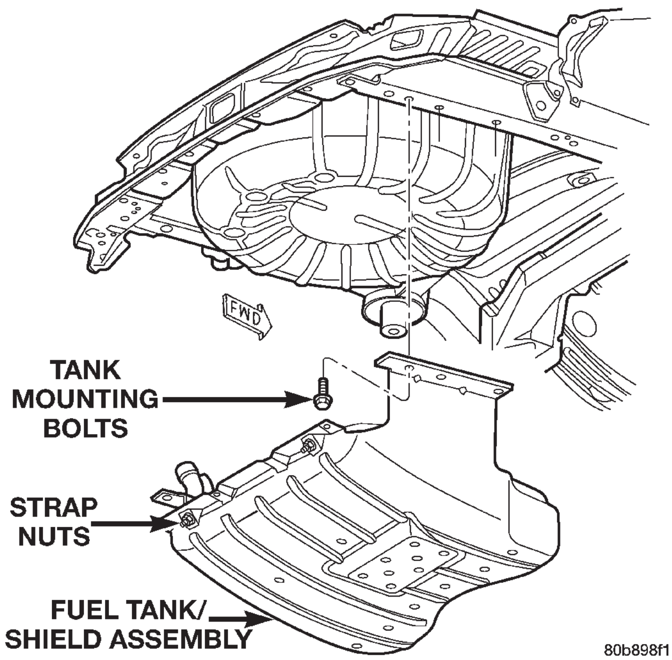


Fig. 42 Fuel Tank Mounting

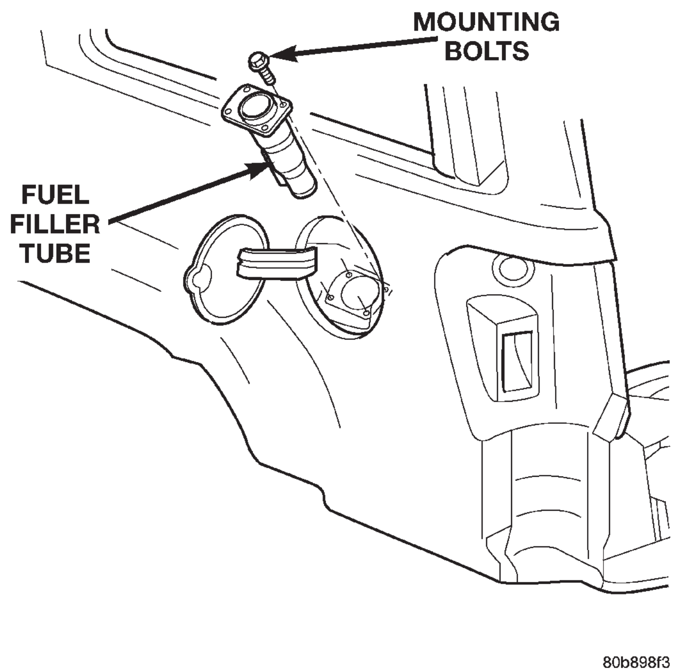


Fig. 43 Fuel Filler Tube

(8) Install fuel fill and vent hoses to fuel fill tube at body. Install clamps and tighten clamp screws to 3 N·m (25 in. lbs.) torque.

(9) Connect fuel pump module pigtail harness electrical connector near front of tank.

(10) Connect both fuel lines to fuel filter/fuel pressure regulator. Refer to Quick-Connect Fittings for procedures.

(11) Connect EVAP hose near front of tank.

(12) Position rear axle vent hose and install new tie strap.

(13) Install new clamp to rear axle vent hose.

(14) Install vent hose to fitting at rear axle and tighten clamp.

(15) Install heat shield bolts.

(16) Install trailer hitch (if equipped).

(17) Install rear tow hooks (if equipped).

(18) Install fuel tank-to-rear bumper fascia clips.

(19) Lower vehicle and connect negative battery cable to battery.

(20) Check for leaks.

FUEL TANK FILLER TUBE CAP

If replacement of the fuel tank filler tube cap is necessary, it must be replaced with an identical cap to be sure of correct system operation.

CAUTION: Remove the fuel tank filler tube cap to relieve fuel tank pressure. The cap must be removed prior to disconnecting any fuel system component or before draining the fuel tank.

ACCELERATOR PEDAL

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. It is connected to the accelerator pedal arm by a plastic retainer (clip) (Fig. 44). This retainer (clip) snaps into the top of the accelerator pedal arm. A retainer clip (Fig. 44) is also used to fasten cable to dash panel.

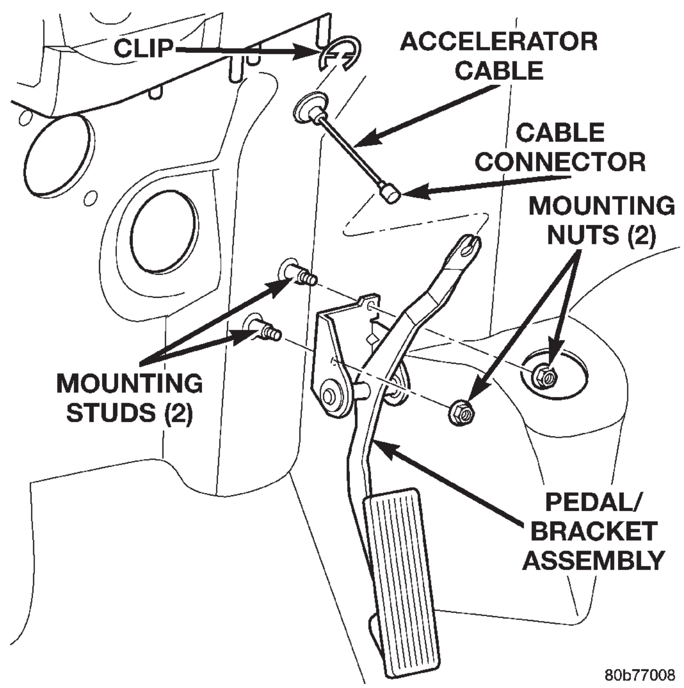


Fig. 44 Accelerator Pedal Mounting

REMOVAL AND INSTALLATION (Continued)

REMOVAL

CAUTION: Be careful not to damage or kink the cable core wire (within the cable sheathing) while servicing accelerator pedal or throttle cable.

(1) From inside vehicle, hold up accelerator pedal. Remove plastic cable retainer (clip) and throttle cable core wire from upper end of pedal arm. Plastic cable retainer (clip) snaps into pedal arm.

(2) Remove accelerator pedal bracket nuts. Remove accelerator pedal assembly.

INSTALLATION

(1) Place accelerator pedal assembly over studs protruding from floor pan. Tighten mounting nuts to 8.5 N·m (75 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—4.0L ENGINE

REMOVAL

CAUTION: Be careful not to damage or kink the cable core wire (within the cable sheathing) while servicing accelerator pedal or throttle cable.

(1) From inside vehicle, hold up accelerator pedal. Remove plastic cable retainer (clip) and throttle cable core wire from upper end of pedal arm (Fig. 44). Plastic cable retainer (clip) snaps into pedal arm.

(2) Remove cable core wire at pedal arm.

(3) From inside vehicle, remove clip holding cable to dashpanel (Fig. 44).

(4) Remove cable housing from dash panel and pull into engine compartment.

(5) Remove (unsnap) cable from routing clips on engine valve cover.

(6) Remove cable connector at throttle body bellcrank ball by unsnapping rearward (Fig. 45).

(7) Remove throttle cable from bracket by compressing release tabs (Fig. 45) and pushing cable through hole in bracket.

(8) Remove throttle cable from vehicle.

INSTALLATION

(1) Slide throttle cable through hole in bracket until release tabs lock into bracket.

(2) Connect cable ball end to throttle body bellcrank ball (snaps on).

(3) Snap cable into routing clips on engine valve cover.

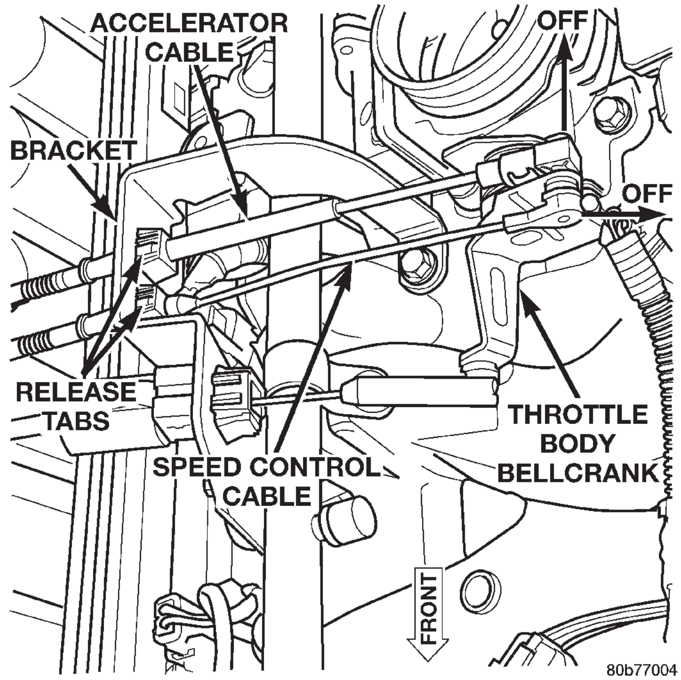


Fig. 45 Throttle (Accelerator) Cable at Throttle Body—4.0L Engine

(4) Slide rubber grommet away from plastic cable housing.

(5) Install rubber grommet into dash panel until seated.

(6) Push cable housing into rubber grommet and through opening in dash panel.

(7) From inside vehicle, install clip holding cable to dashpanel (Fig. 44).

(8) From inside vehicle, slide throttle cable core wire into opening in top of pedal arm.

(9) Push cable retainer (clip) into pedal arm opening until it snaps in place.

(10) Before starting engine, operate accelerator pedal to check for any binding.

THROTTLE CABLE—4.7L V-8 ENGINE

REMOVAL

CAUTION: Be careful not to damage or kink the cable core wire (within the cable sheathing) while servicing accelerator pedal or throttle cable.

(1) From inside vehicle, hold up accelerator pedal. Remove plastic cable retainer (clip) and throttle cable core wire from upper end of pedal arm (Fig. 44). Plastic cable retainer (clip) snaps into pedal arm.

(2) Remove cable core wire at pedal arm.

(3) From inside vehicle, remove clip holding cable to dashpanel (Fig. 44).

(4) Remove air box at throttle body.

(5) Unsnap cable from dashpanel routing clip.

REMOVAL AND INSTALLATION (Continued)

(6) Remove cable housing from dash panel and pull into engine compartment.

(7) Using finger pressure only, disconnect accelerator cable connector at throttle body bellcrank pin by pushing connector off bellcrank pin towards front of vehicle (Fig. 46). **DO NOT try to pull connector off perpendicular to the bellcrank pin. Connector will be broken.**

(8) Lift accelerator cable from top of cable cam (Fig. 46).

(9) Press tab (Fig. 47) to release plastic cable mount from bracket. **Press on tab only enough to release cable from bracket. If tab is pressed too much, it will be broken.** Slide plastic mount (Fig. 47) towards passenger side of vehicle to remove cable from bracket.

(10) Remove throttle cable from vehicle.

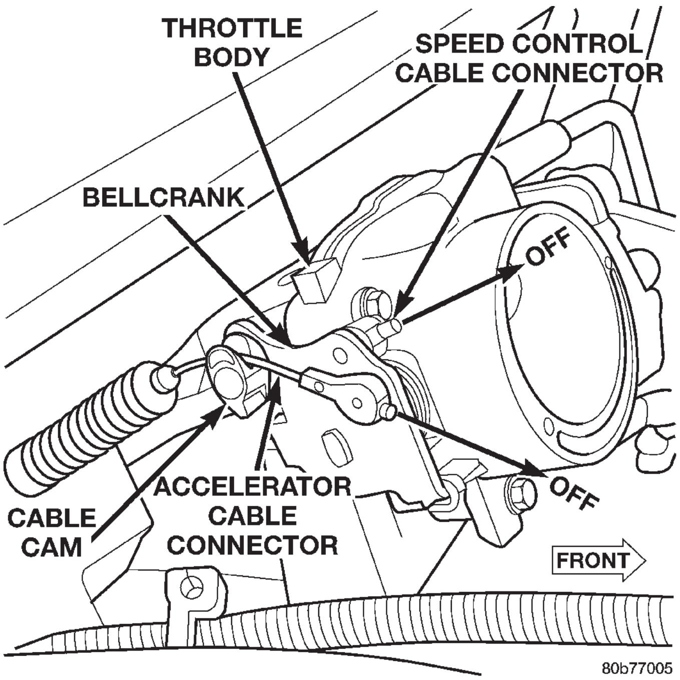


Fig. 46 Accelerator Cable at Bell Crank—4.7L V-8 Engine

INSTALLATION

(1) Slide accelerator cable plastic mount into bracket. Continue sliding until tab (Fig. 47) is aligned to hole in mounting bracket.

(2) Route accelerator cable over top of cable cam.

(3) Connect cable end to throttle body bellcrank pin (snaps on rearward).

(4) Slide rubber grommet away from plastic cable housing.

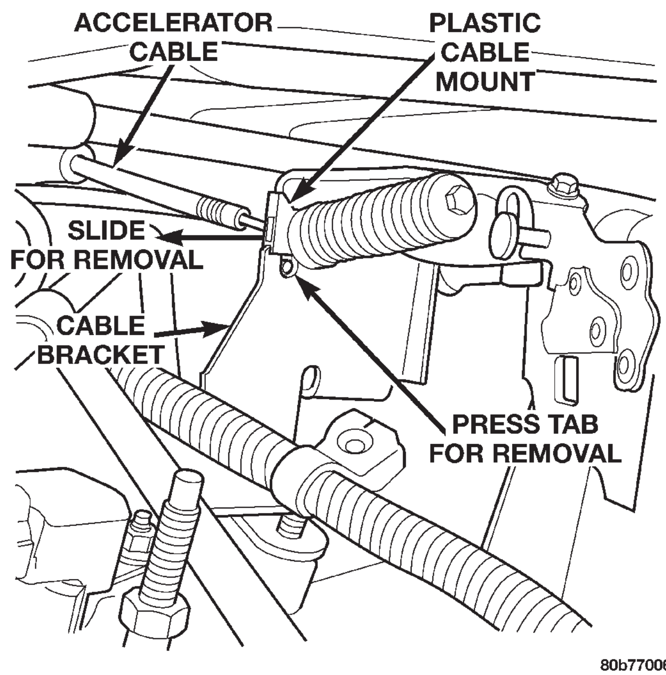


Fig. 47 Accelerator Cable Release Tab—4.7L V-8 Engine

(5) Install rubber grommet into dash panel until seated.

(6) Push cable housing into rubber grommet and through opening in dash panel.

(7) From inside vehicle, install clip holding cable to dashpanel (Fig. 44).

(8) From inside vehicle, slide throttle cable core wire into opening in top of pedal arm.

(9) Push cable retainer (clip) into pedal arm opening until it snaps in place.

(10) Snap cable into dashpanel routing clip.

(11) Install air box to throttle body.

(12) Before starting engine, operate accelerator pedal to check for any binding.

SPECIFICATIONS

FUEL TANK CAPACITY

Models	Liters	U.S. Gallons
All	78	20.5
Nominal refill capacities are shown. A variation may be observed from vehicle to vehicle due to manufacturing tolerance and refill procedure.		

FUEL SYSTEM PRESSURE

339 kPa ± 34 kPa (49.2 psi ± 5 psi).

SPECIFICATIONS (Continued)

TORQUE CHART

DESCRIPTION	TORQUE
Accelerator Pedal Bracket Mounting Nuts	8.5 N·m (75 in. lbs.)
Fuel Filter/Fuel Press. Reg. Bolts	3 N·m (30 in. lbs.)
Fuel Hose Clamps	3 N·m (25 in. lbs.)
Fuel Injector Rail Mounting Bolts—4.0L Engine	11 N·m (100 in. lbs.)
Fuel Injector Rail Mounting Bolts—4.7L V–8 Engine	11 N·m (100 in. lbs.)
Fuel Pump Module Locknut	74 N·m (55 ft. lbs.)
Fuel Tank Mounting Bolts	81 N·m (60 ft. lbs.)

FUEL INJECTION SYSTEM

INDEX

DESCRIPTION AND OPERATION

POWERTRAIN CONTROL MODULE (PCM)

DESCRIPTION

The Powertrain Control Module (PCM) is located in the engine compartment (Fig. 1).

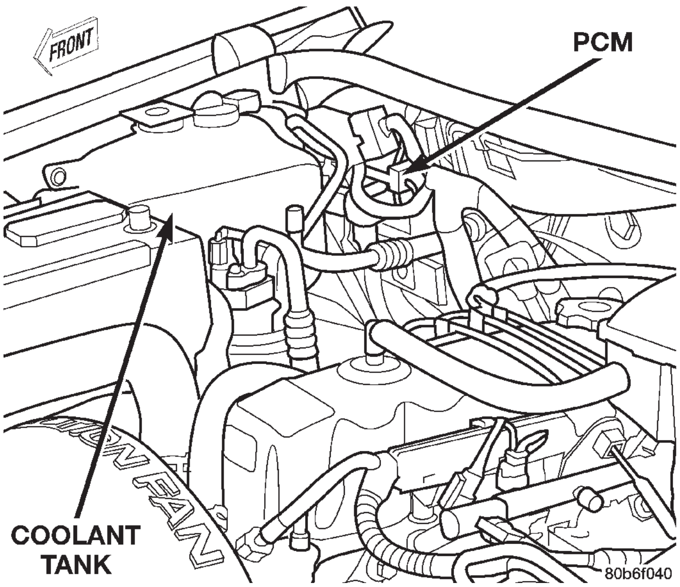


Fig. 1 PCM Location

OPERATION

(1) Also refer to Modes of Operation.

The PCM operates the fuel system. The PCM was formerly referred to as the SBEC or engine controller. The PCM is a pre-programmed, triple microprocessor digital computer. It regulates ignition timing, air-fuel ratio, emission control devices, charging system, certain transmission features, 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.

NOTE: PCM Inputs:

- A/C request
- Auto shutdown (ASD) sense
- Battery temperature
- Battery voltage
- Brake switch
- J1850 bus circuits
- Camshaft position sensor signal
- Crankshaft position sensor
- Data link connections for DRB scan tool
- Engine coolant temperature sensor
- Five volts (primary)
- Five volts (secondary)
- Fuel level
- Generator (battery voltage) output
- Ignition circuit sense (ignition switch in on/off/crank/run position)
- Intake manifold air temperature sensor
- Leak detection pump (switch) sense (if equipped)
- Manifold absolute pressure (MAP) sensor
- Oil pressure
- Overdrive/override switch
- Oxygen sensors
- Park/neutral switch (auto. trans. only)
- Power ground
- Sensor return
- Signal ground
- Speed control multiplexed single wire input
- Throttle position sensor
- Transmission governor pressure sensor
- Transmission temperature sensor
- Vehicle speed (from ABS module)

NOTE: PCM Outputs:

- A/C clutch relay
- Auto shutdown (ASD) relay
- J1850 (+/-) circuits for: speedometer, voltmeter, fuel gauge, oil pressure gauge/lamp, engine temp. gauge and speed control warn. lamp
- Data link connection for DRB scan tool
- EGR valve control solenoid (if equipped)
- EVAP canister purge solenoid
- Fuel injectors
- Fuel pump relay
- Generator field driver (-)
- Generator field driver (+)
- Generator lamp (if equipped)
- Idle air control (IAC) motor

DESCRIPTION AND OPERATION (Continued)

- Ignition coil
- Leak detection pump
- Malfunction indicator lamp (Check engine lamp). Driven through J1850 circuits.
- Overdrive indicator lamp (if equipped). Driven through J1850 circuits.
- Oxygen sensor heater relays (if equipped).
- Radiator cooling fan relay (pulse width modulated)
- Speed control source
- Speed control vacuum solenoid
- Speed control vent solenoid
- Tachometer (if equipped). Driven through J1850 circuits.
- Transmission convertor clutch circuit
- Transmission 3–4 shift solenoid
- Transmission relay
- Transmission temperature lamp (if equipped)
- Transmission variable force solenoid

MODES OF OPERATION

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).

The PCM will operate in two different modes: **Open Loop and Closed Loop** .

During Open Loop modes, the PCM receives input signals and responds only according to preset PCM programming. Input from the oxygen (O2S) sensors is not monitored during Open Loop modes.

During Closed Loop modes, the PCM will monitor the oxygen (O2S) sensors 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 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 via the O2S relays. The O2S sensor input is not used by the PCM to calibrate air-fuel ratio during this mode of operation.

ENGINE START-UP MODE

This is an Open Loop mode. The following actions occur when the starter motor is engaged.

The 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 approximately 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 ASD relay via 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.

DESCRIPTION AND OPERATION (Continued)

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 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
- 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 ASD relay via 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 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.
- When 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 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
- Battery voltage
- Park/neutral switch (gear indicator signal—auto. trans. only)
- Oxygen sensors

Based on these inputs, the following occurs:

- Voltage is applied to the fuel injectors with the ASD relay via the 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 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
- Park/neutral switch (gear indicator signal—auto. trans. only)
- Oxygen (O2S) sensors

Based on these inputs, the following occurs:

- Voltage is applied to the fuel injectors with the ASD relay via 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 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 PCM receives the following inputs.

- Air conditioning select signal (if equipped)

DESCRIPTION AND OPERATION (Continued)

- 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
- Park/neutral switch (gear indicator signal—auto. trans. only)
- Vehicle speed

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 a ground 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.

WIDE OPEN THROTTLE MODE

This is an Open Loop mode. During wide open throttle operation, the 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

During wide open throttle conditions, the following occurs:

- Voltage is applied to the fuel injectors with the ASD relay via 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 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.

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.

AIR CONDITIONING (A/C) CONTROLS—PCM INPUT

OPERATION

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, 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 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 PCM receives the A/C request signal from the clutch cycling pressure switch. The input indicates that the evaporator pressure 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 or high-pressure switch opens (indicating a low or high refrigerant pressure), the PCM will not receive an A/C request signal. The PCM will then remove the ground from the A/C relay. This will deactivate the A/C compressor clutch.

If the switch opens, (indicating that evaporator is not in proper pressure 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) RELAY SENSE—PCM INPUT

DESCRIPTION

The ASD relay is located in the Power Distribution Center (PDC). The PDC is located in the engine compartment. Refer to label on PDC cover for relay location.

OPERATION

A 12 volt signal at this input indicates to the PCM that the ASD has been activated. The relay is used to connect the oxygen sensor heater element, ignition coil 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).

DESCRIPTION AND OPERATION (Continued)

BATTERY TEMPERATURE SENSOR—PCM INPUT

OPERATION

Provides a signal to the PCM corresponding to the battery temperature.

BATTERY VOLTAGE—PCM INPUT

OPERATION

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 injector caused by the lowered voltage.

BRAKE SWITCH—PCM INPUT

OPERATION

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 disable vent and vacuum solenoid output signals to the speed control servo.

FIVE VOLT SENSOR SUPPLY—PRIMARY

OPERATION

Supplies the required 5 volt power source to the crankshaft position sensor, camshaft position sensor, MAP sensor and throttle position sensor.

FIVE VOLT SENSOR SUPPLY—SECONDARY

OPERATION

Supplies the required 5 volt source to certain sensors.

ENGINE COOLANT TEMPERATURE SENSOR—PCM INPUT

DESCRIPTION

The engine coolant temperature (ECT) sensor is used to sense engine coolant temperature. The sensor protrudes into an engine water jacket.

OPERATION

The ECT 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 resistance will change. This 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.

GENERATOR OUTPUT—PCM INPUT

OPERATION

Provides a charging system voltage input to the Powertrain Control Module (PCM). It is sensed at the battery input to the PCM.

OXYGEN SENSOR—PCM INPUT

DESCRIPTION

The oxygen sensors (O2S) are attached to, and protrude in to, the vehicle exhaust system.

OPERATION

The sensors produce voltages from 0 to 1 volt, depending upon the oxygen content of the exhaust gas. When a large amount of oxygen is present (caused by a lean air/fuel mixture), the sensors 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 sensors act as a rich-lean switches.

In Closed Loop operation, the PCM monitors certain O2 sensor input(s) along with other inputs, and adjusts the injector pulse width accordingly. During Open Loop operation, the PCM ignores the O2 sensor input. The PCM adjusts injector pulse width based on preprogrammed (fixed) values and inputs from other sensors.

The oxygen sensors are equipped with a heating element that keeps the sensors 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. Also, it allows the system to remain in closed loop operation during periods of extended idle. Certain emissions packages use the Automatic Shutdown (ASD) relay to supply battery voltage to the heating elements. Other emissions packages use separate oxygen sensor relays to supply battery voltage to the heating elements.

DESCRIPTION AND OPERATION (Continued)

IGNITION CIRCUIT SENSE—PCM INPUT

OPERATION

The ignition circuit sense input tells the Powertrain Control Module (PCM) the ignition switch has energized the ignition circuit.

INTAKE MANIFOLD AIR TEMPERATURE SENSOR—PCM INPUT

DESCRIPTION

The Intake Manifold Air temperature (IAT) sensor is installed in the intake manifold with the sensor element extending into the air stream.

OPERATION

The IAT 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.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—PCM INPUT

DESCRIPTION

The MAP sensor is mounted to the engine throttle body.

OPERATION

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.

OIL PRESSURE SENSOR—PCM INPUT

DESCRIPTION

The engine oil pressure sensor (sending unit) is located in an engine oil pressure gallery.

OPERATION

A signal is sent from the oil pressure sensor to the Powertrain Control Module (PCM) relating to engine oil pressure.

POWER GROUND

OPERATION

The power ground is used to control ground circuits for the following Powertrain Control Module (PCM) loads:

- Generator field winding
- Fuel injectors
- Ignition coil(s)
- Certain relays/solenoids

SENSOR RETURN—PCM INPUT

OPERATION

Sensor Return provides a low noise ground reference for all engine control system sensors.

THROTTLE POSITION SENSOR (TPS)—PCM INPUT

DESCRIPTION

The throttle position sensor (TPS) is mounted on the throttle body

OPERATION

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 .26 volts at minimum throttle opening (idle), to 4.49 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 AND DISTANCE—PCM INPUT

OPERATION

Vehicle speed and distance covered are measured by the Rear Wheel Speed Sensor. The sensor is mounted to the rear axle. A signal is sent from this sensor to the Controller Antilock Brake (CAB) computer. A signal is then sent from the CAB to the Pow-

DESCRIPTION AND OPERATION (Continued)

ertrain Control Module (PCM) to determine vehicle speed and distance covered. The PCM will then determine strategies for fuel system and speed control system operation.

Refer to Odometer and Trip Odometer in Group 8E, Instrument Panel for additional information.

AIR CONDITIONING (A/C) CLUTCH RELAY—PCM OUTPUT

DESCRIPTION

The A/C relay is located in the Power Distribution Center (PDC). The PDC is located in the engine compartment. Refer to label on PDC cover for relay location.

OPERATION

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.

When the PCM receives a request for A/C from 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 adjusts 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 abnormally low idle speeds it will de-energize the relay. This prevents A/C clutch engagement. The relay will remain de-energized until the idle speed increases. The PCM will also de-energize the relay if coolant temperature exceeds 125°C (257°F) or low or high system pressure exists.

AUTO SHUTDOWN (ASD) RELAY—PCM OUTPUT

DESCRIPTION

The ASD relay is located in the Power Distribution Center (PDC).

OPERATION

The ASD supplies battery voltage to the fuel injectors and ignition coil(s). With certain emissions packages it also supplys voltage to the oxygen sensor heating elements. 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.

J1850—PCM INPUTS/OUTPUTS

OPERATION

The Powertrain Control Module (PCM) sends certain output signals through the J1850 bus circuits. These signals are used to control certain instrument panel located items and to determine certain identification numbers.

Refer to Instrument Panel and Gauges for additional information.

DATA LINK CONNECTOR—PCM INPUT AND OUTPUT

DESCRIPTION

The data link connector is located at the lower edge of the instrument panel near the steering column.

OPERATION

The 16–way data link connector (diagnostic scan tool connector) links the Diagnostic Readout Box (DRB) scan tool or the Mopar Diagnostic System (MDS) with the Powertrain Control Module (PCM).

FUEL PUMP RELAY-PCM OUTPUT

DESCRIPTION

The fuel pump relay is located in the Power Distribution Center (PDC).

OPERATION

The PCM energizes the electric fuel pump through the fuel pump relay. Battery voltage is applied to the fuel pump relay when the ignition key is ON. The relay is energized when a ground signal is provided by the PCM.

The fuel pump will operate for approximately three seconds unless the engine is operating or the starter motor is engaged.

GENERATOR FIELD SOURCE (+)—PCM OUTPUT

OPERATION

This output from the Powertrain Control Module (PCM) regulates charging system voltage to the generator field source (+) circuit. The voltage range is 12.9 to 15.0 volts. Models of previous years had used the ASD relay (directly) to apply the 12 volt + power supply to the generator field source (+) circuit.

DESCRIPTION AND OPERATION (Continued)

GENERATOR FIELD DRIVER (-)—PCM OUTPUT

OPRATION

This output from the Powertrain Control Module (PCM) regulates charging system ground control to the generator field driver (-) circuit.

IDLE AIR CONTROL (IAC) MOTOR—PCM OUTPUT

DESCRIPTION

The IAC motor is mounted to the throttle body.

OPERATION

The motor 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 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.

OXYGEN SENSOR HEATER RELAYS—PCM OUTPUT

DESCRIPTION

The 2 oxygen (O2) sensor heater relays (upstream and downstream) are located in the Powertrain Distribution Center (PDC).

OPERATION

Engines equipped with the California (NAE) Emissions Package use **four O2 sensors.**

Two of the four sensor heater elements (upstream sensors 1/1 and 2/1) are controlled by the upstream heater relay through output signals from the Powertrain Control Module (PCM).

The other two heater elements (downstream sensors 1/2 and 2/2) are controlled by the downstream heater relay through output signals from the PCM.

To avoid a large simultaneous current surge, power is delayed to the 2 downstream heater elements by the PCM for approximately 2 seconds.

RADIATOR COOLING FAN RELAY—PCM OUTPUT

DESCRIPTION

The pulse width modulated (PWM) radiator cooling fan relay is located behind the front bumper fascia below the right headlamp.

OPERATION

The PWM relay is used to control the speed of the electric radiator cooling fan. It allows for multiple fan speeds. This allows for improved fan noise and A/C performance, better engine cooling, and additional vehicle power.

PWM relay operation is controlled by the Powertrain Control Module (PCM). To operate the PWM relay, the PCM looks at inputs from:

- Engine coolant temperature
- Ambient temperature from the body controller
- Vehicle speed
- Transmission oil temperature
- A/C switch position (A/C request)

THROTTLE BODY

DESCRIPTION

The throttle body is located on the intake manifold.

OPERATION

Filtered air from the air cleaner enters the intake manifold through the throttle body. Fuel does not enter the intake manifold through the throttle body. Fuel is sprayed into the manifold by the fuel injectors. The throttle body 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.

Certain sensors are attached to the throttle body. The accelerator pedal cable, speed control cable and transmission control cable (when equipped) are connected to the throttle body linkage 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.

DIAGNOSIS AND TESTING

VISUAL INSPECTION

A visual inspection for loose, disconnected or incorrectly routed wires, vacuum lines and hoses should be made. This should be done before attempting to diagnose or service the fuel injection system. A visual

DIAGNOSIS AND TESTING (Continued)

check will help spot these faults and save unnecessary test and diagnostic time. A thorough visual inspection will include the following checks:

(1) Verify three 32–way electrical connectors are fully inserted into connector of Powertrain Control Module (PCM) (Fig. 2).

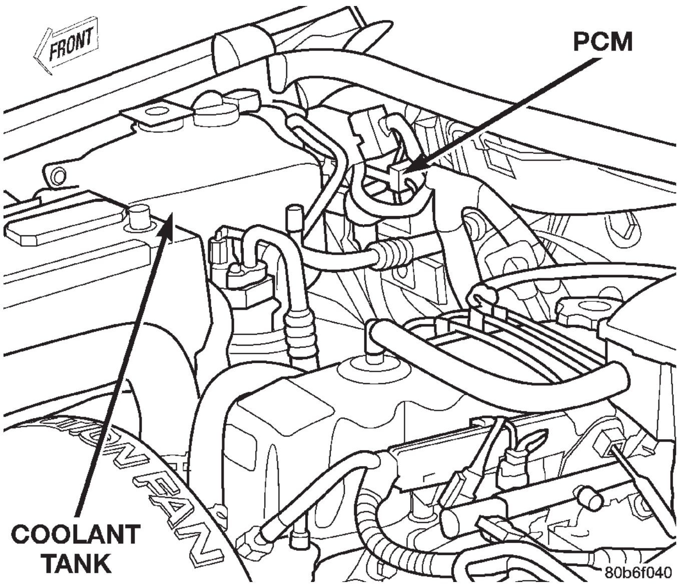


Fig. 2 Powertrain Control Module (PCM) Location

(2) Inspect battery cable connections. Be sure they are clean and tight.

(3) Inspect fuel pump relay and air conditioning compressor clutch relay (if equipped). Inspect ASD and oxygen sensor heater 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. 3). Refer to label on PDC cover for relay location.

(4) Inspect ignition coil connections (Fig. 4) or (Fig. 5).

(5) Verify camshaft position sensor wire connector is firmly connected (Fig. 6) or (Fig. 7).

(6) Verify crankshaft position sensor wire connector is firmly connected (Fig. 8) or (Fig. 9).

(7) Verify generator output wire (B+ wire) and generator field connector are firmly connected to generator.

(8) Inspect system body grounds for loose or dirty connections. Refer to Group 8, Wiring for ground locations.

(9) Verify crankcase ventilation (CCV) operation. Refer to Emission Control System for additional information.

(10) Inspect all fuel line quick-connect fittings for damage or leaks.

(11) Verify hose connections to all ports of vacuum fittings on intake manifold, and for emission system are tight and not leaking.

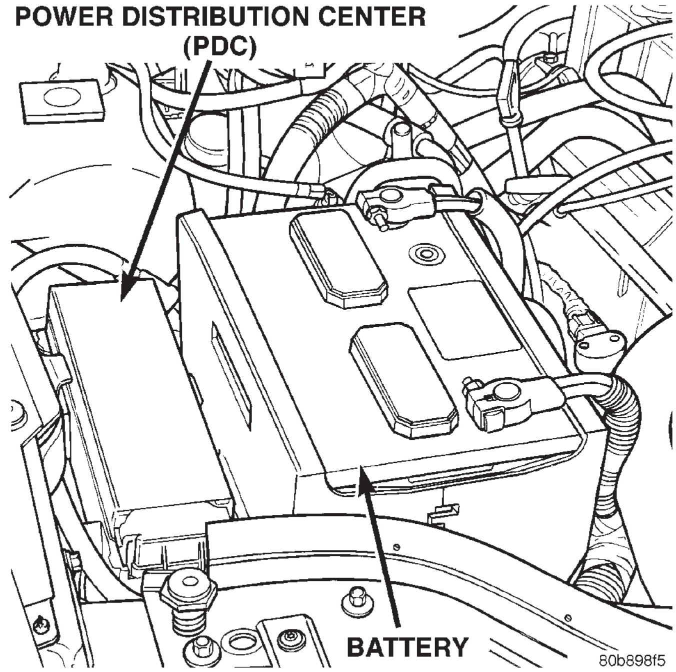


Fig. 3 Power Distribution Center (PDC) Location

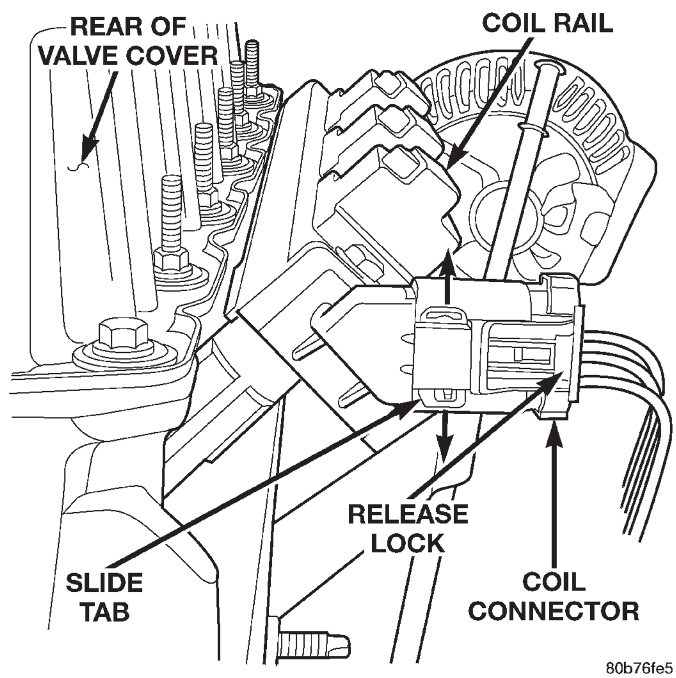


Fig. 4 Ignition Coil Connector—4.0L Engine

(12) Inspect accelerator cable, transmission throttle cable (if equipped) and speed control cable connections (if equipped). Check their connections to throttle body linkage for any binding or restrictions.

(13) Verify vacuum booster hose is firmly connected to fitting on intake manifold. Also check connection to brake vacuum booster.

(14) Inspect air cleaner inlet and air cleaner element for dirt or restrictions.

DIAGNOSIS AND TESTING (Continued)

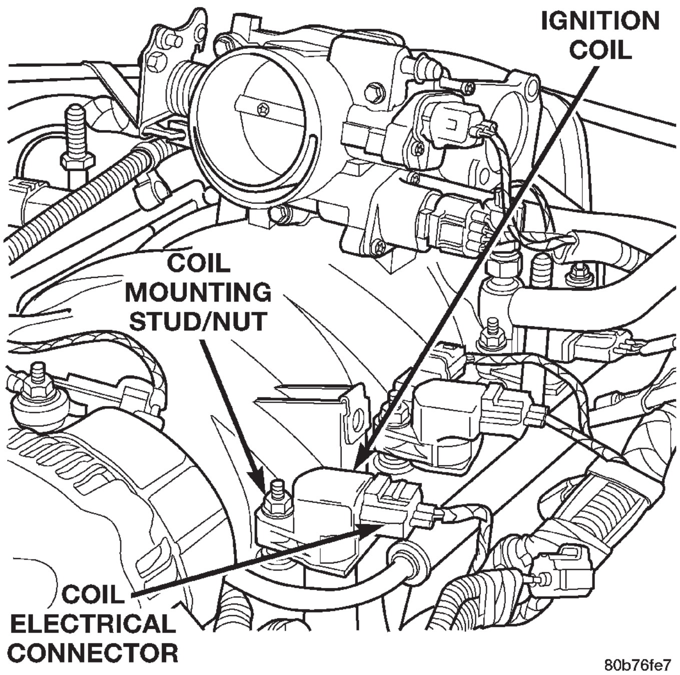


Fig. 5 Ignition Coil Connector—4.7L V-8 Engine

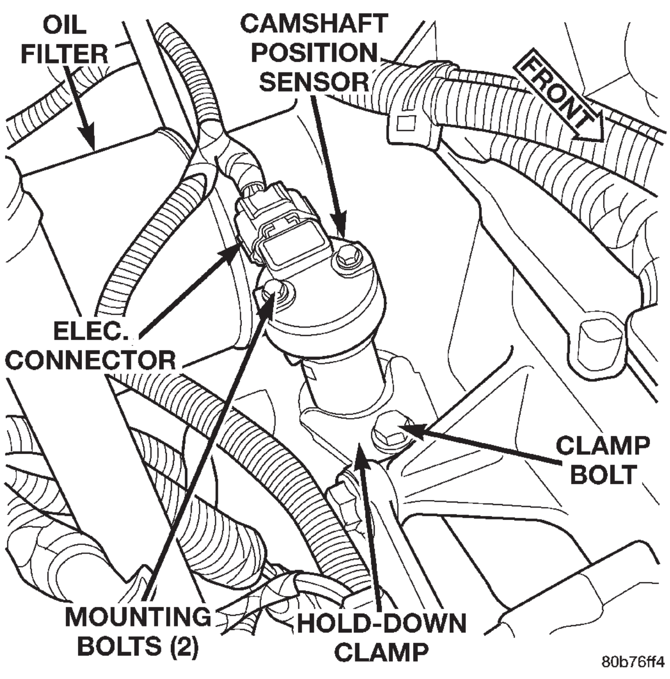


Fig. 6 Camshaft Position Sensor—4.0L Engine

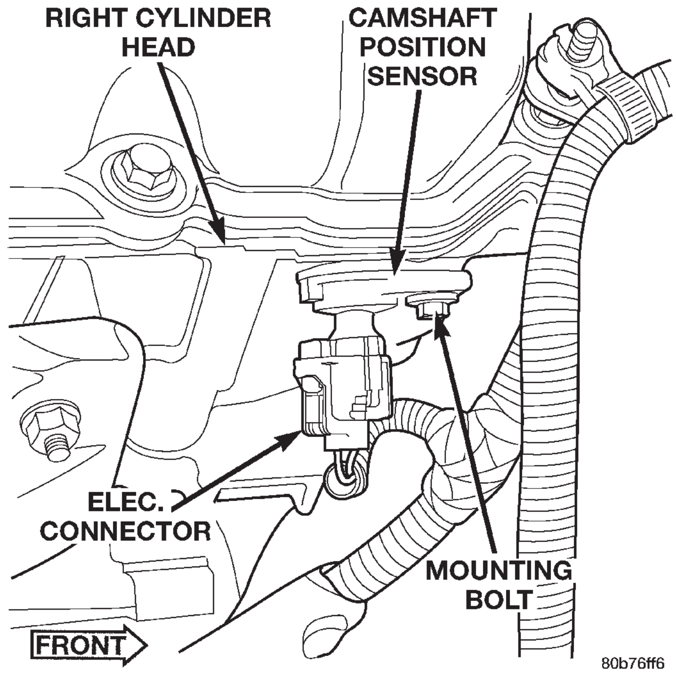


Fig. 7 Camshaft Position Sensor—4.7L V-8 Engine

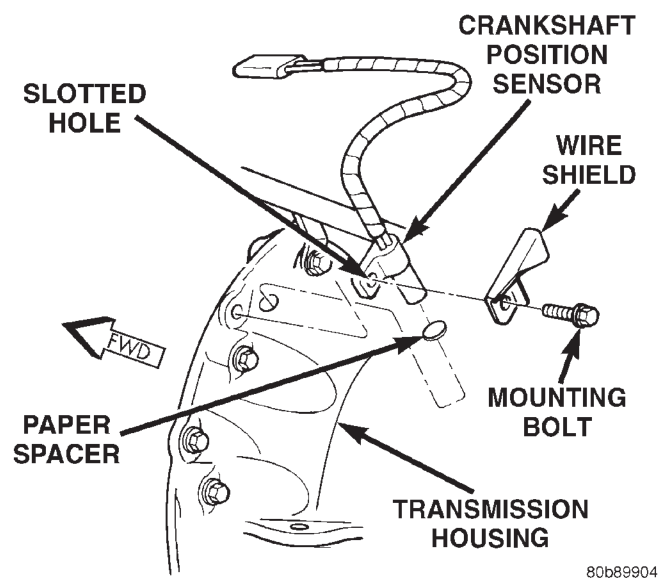


Fig. 8 Crankshaft Position Sensor—4.0L Engine

DIAGNOSIS AND TESTING (Continued)

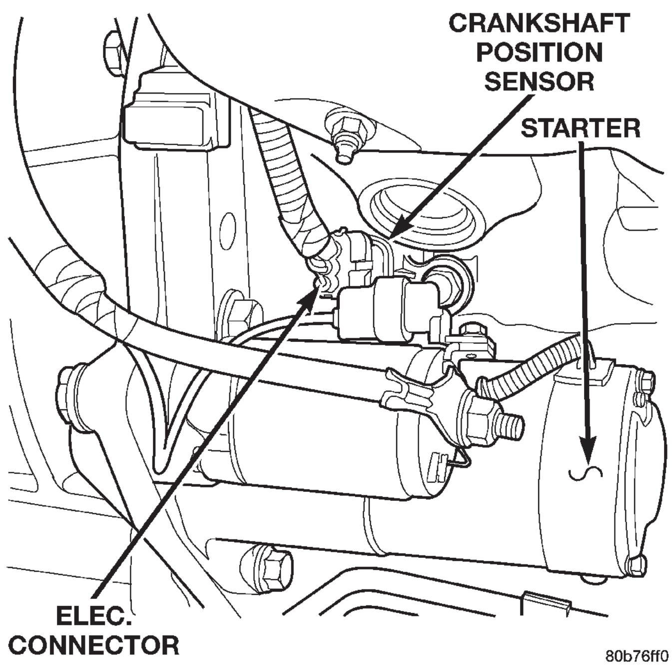


Fig. 9 Crankshaft Position Sensor—4.7L V-8 Engine

(15) Inspect radiator grille area, radiator fins and air conditioning condenser for restrictions.

(16) 4.0L Engine: Verify MAP, Intake Manifold Air Temperature (IAT) sensor, TPS and Idle Air Control (IAC) motor connectors are firmly connected (Fig. 10). Be sure throttle body mounting bolts (Fig. 10) are tight.

(17) 4.7L Engine: Verify Intake Manifold Air Temperature (IAT) sensor, TPS and Idle Air Control (IAC) motor connectors are firmly connected (Fig. 11). Be sure throttle body mounting bolts (Fig. 11) are tight.

(18) 4.0L Engine: Verify wire harness connector is firmly connected to Engine Coolant Temperature (ECT) sensor (Fig. 12).

(19) 4.7L Engine: Verify MAP and Engine Coolant Temperature (ECT) sensor electrical connectors are firmly connected to sensors (Fig. 13).

(20) Verify fuel injector wire harness connectors are firmly connected to injectors in correct order. Each harness connector is numerically tagged with injector number (INJ 1, INJ 2 etc.) of its corresponding fuel injector and cylinder number.

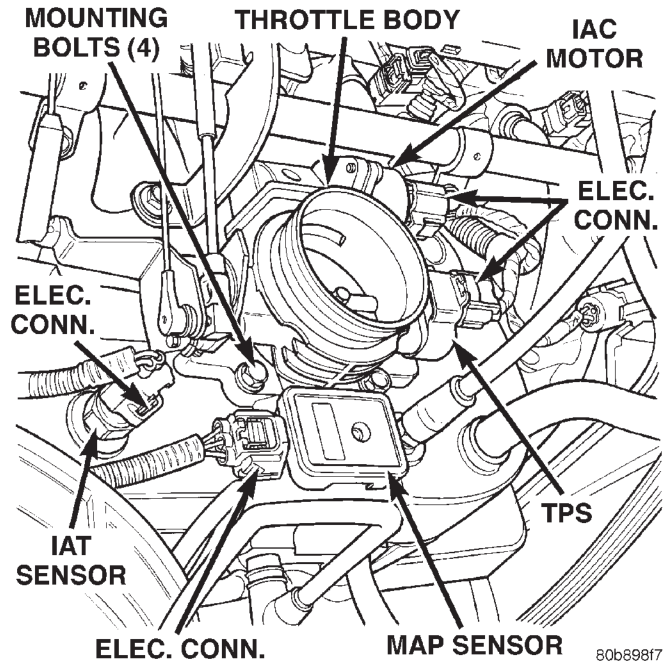


Fig. 10 IAT, MAP, IAC, TPS Sensor Locations—4.0L Engine

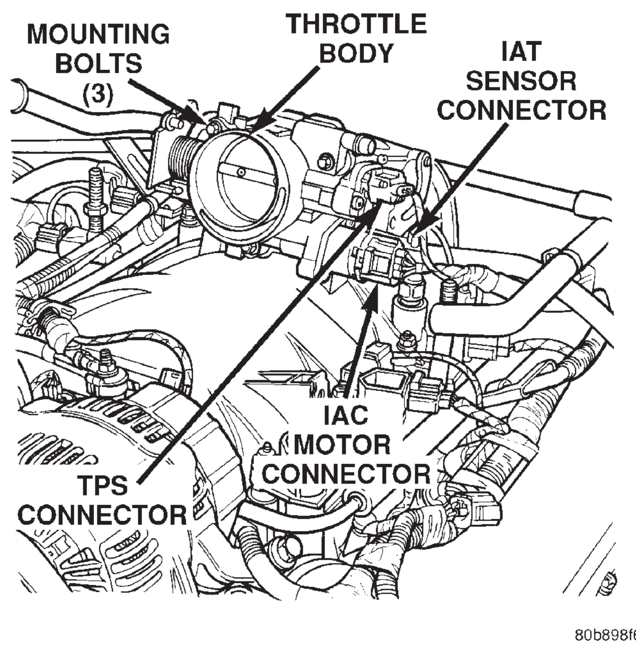


Fig. 11 IAT, IAC, TPS Sensor Locations—4.7L V-8 Engine

DIAGNOSIS AND TESTING (Continued)

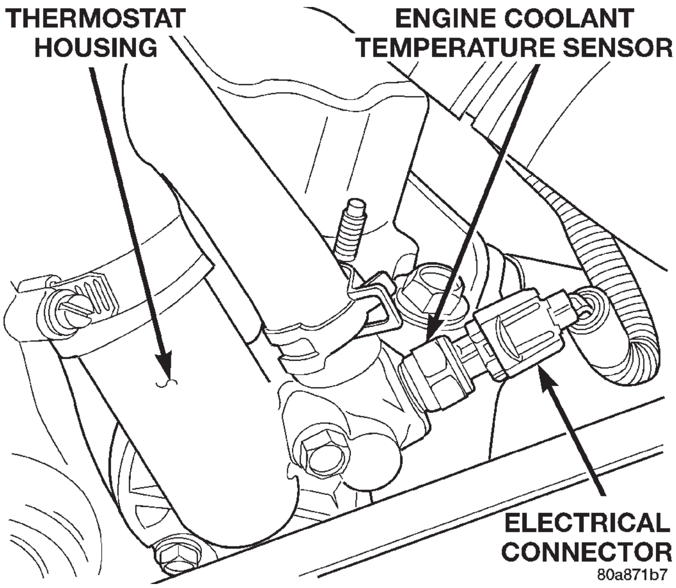


Fig. 12 ECT Sensor Location—4.0L Engine

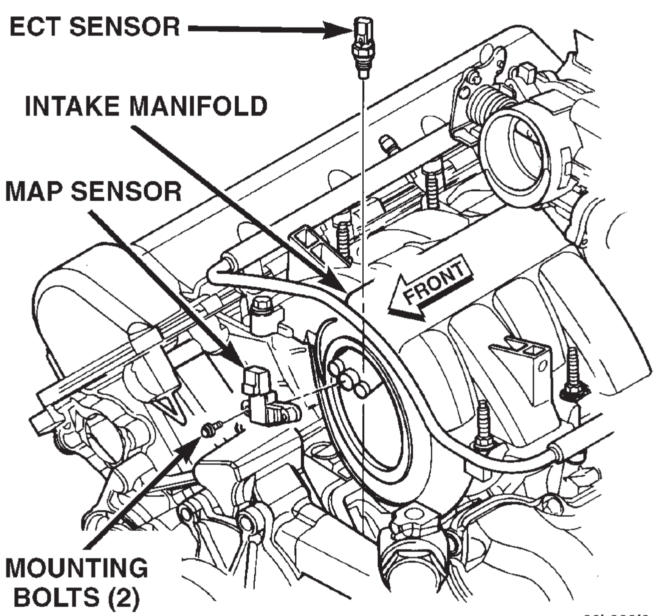


Fig. 13 MAP and ECT Sensor Locations—4.7L V-8 Engine

(21) Raise and support vehicle.

(22) Verify all oxygen sensor wire connectors are firmly connected to sensors. Inspect sensors and connectors for damage (Fig. 14) or (Fig. 15).

(23) Inspect for pinched or leaking fuel tubes/lines. Inspect for pinched, cracked or leaking fuel hoses.

(24) Inspect for exhaust system restrictions such as pinched exhaust pipes, collapsed muffler or plugged catalytic convertor.

(25) If equipped with automatic transmission, verify electrical harness is firmly connected to park/neutral switch and to transmission components.

(26) Verify fuel pump module pigtail harness electrical connector (Fig. 16) is firmly connected to body harness connector.

(27) Inspect fuel line harness (from fuel pump module) at fuel filter/fuel pressure regulator (Fig. 16) for chaffing, cracks or leaks.

(28) Verify battery cable and solenoid feed wire connections to starter solenoid are tight and clean.

(29) Inspect for chaffed wires or wires rubbing up against other components.

(30) Inspect for chaffed vacuum lines or lines rubbing up against other components.

RELAY TESTING

To perform a complete test of the fuel pump, ASD or oxygen sensor heater relay, or its circuitry, refer to the DRB scan tool and the appropriate Powertrain Diagnostic Manual. To test the relay only, refer to the following: . The terminals on bottom of each relay are numbered (Fig. 17) or (Fig. 18).

OPERATION

- Terminal number 30 is connected to battery voltage. For both the ASD and fuel pump relays, terminal 30 is connected to battery voltage at all times.
- The PCM grounds coil side of relay through terminal number 85.
- Terminal number 86 supplies voltage to coil side of relay.
- When the PCM de-energizes the relay, terminal number 87A connects to terminal 30. This is the OFF position. In the OFF position, voltage is not supplied to rest of circuit. Terminal 87A is the center terminal on relay.
- When the PCM energizes the ASD and fuel pump relays, terminal 87 connects to terminal 30. This is the ON position. Terminal 87 supplies voltage to rest of circuit.

TESTING

The following procedure applies only to ASD, oxygen sensor heater and fuel pump relays.

(1) Remove relay from PDC connector before testing.

(2) With relay removed from vehicle, use an ohmmeter to check resistance between terminals 85 and 86. The resistance should be between 75 ±5 ohms.

(3) Connect ohmmeter between terminals 30 and 87A. Ohmmeter should show continuity between terminals 30 and 87A.

(4) Connect ohmmeter between terminals 87 and 30. Ohmmeter should not show continuity at this time.

DIAGNOSIS AND TESTING (Continued)

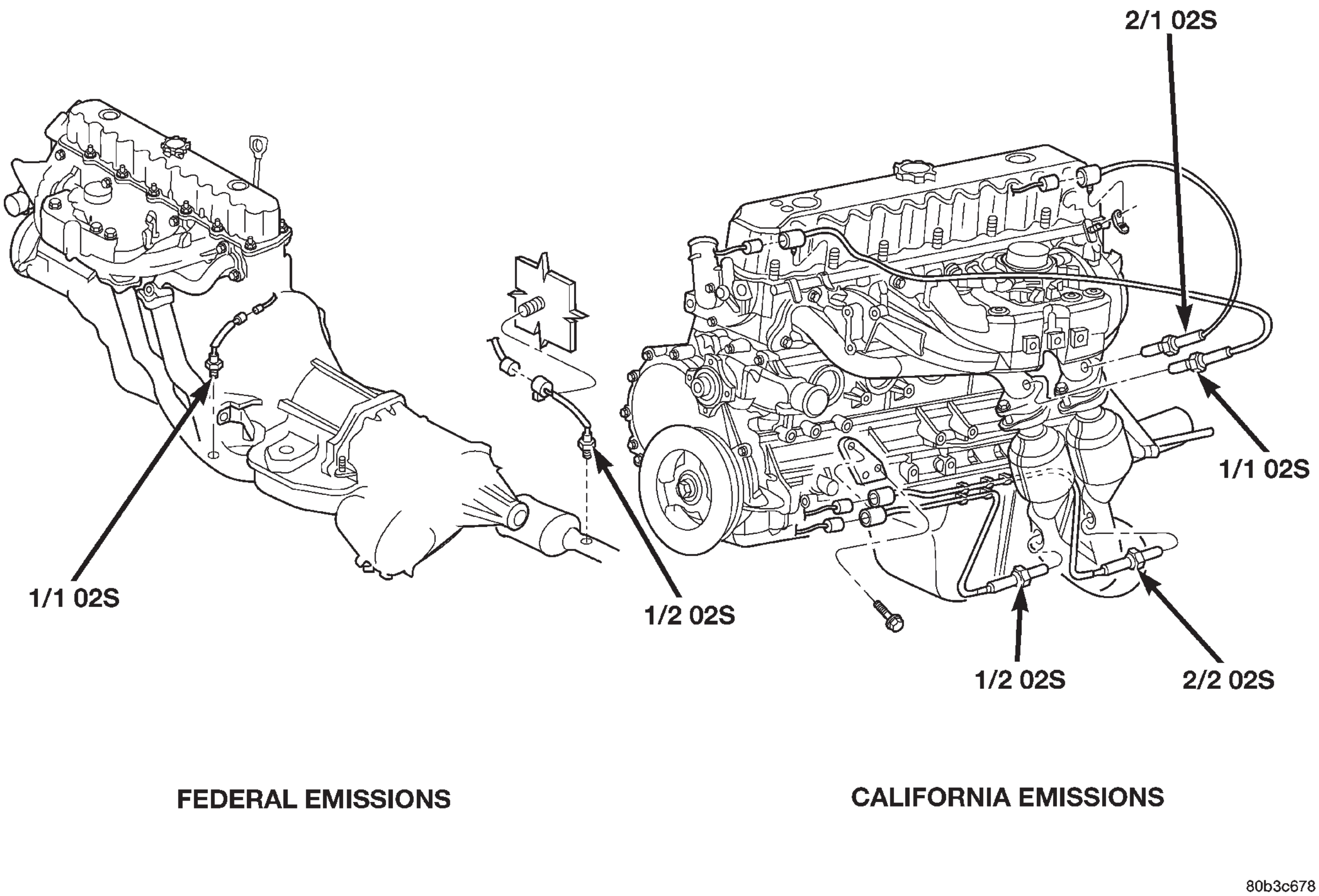


Fig. 14 Oxygen Sensor Locations—4.0L Engine

(5) Connect one end of a jumper wire (16 gauge or smaller) to relay terminal 85. Connect other end of jumper wire to ground side of a 12 volt power source.

(6) Connect one end of another jumper wire (16 gauge or smaller) to power side of 12 volt power source. **Do not attach other end of jumper wire to relay at this time.**

WARNING: DO NOT ALLOW OHMMETER TO CONTACT TERMINALS 85 OR 86 DURING THIS TEST.

(7) Attach other end of jumper wire to relay terminal 86. This activates relay. The ohmmeter should now show continuity between relay terminals 87 and 30. Ohmmeter should not show continuity between relay terminals 87A and 30.

(8) Disconnect jumper wires.

(9) Replace relay if it did not pass continuity and resistance tests. If relay passed tests, it operates properly. Check remainder of relay circuits using DRB scan tool. Also refer to Wiring Diagrams.

THROTTLE BODY MINIMUM AIR FLOW CHECK PROCEDURE

4.0L 6–Cylinder Engine

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. 19) must be used for the following test.

(1) Start engine and bring to operating temperature. Be sure all accessories are off before performing this test.

(2) Shut off engine and remove air duct and air resonator box from top of throttle body.

DIAGNOSIS AND TESTING (Continued)

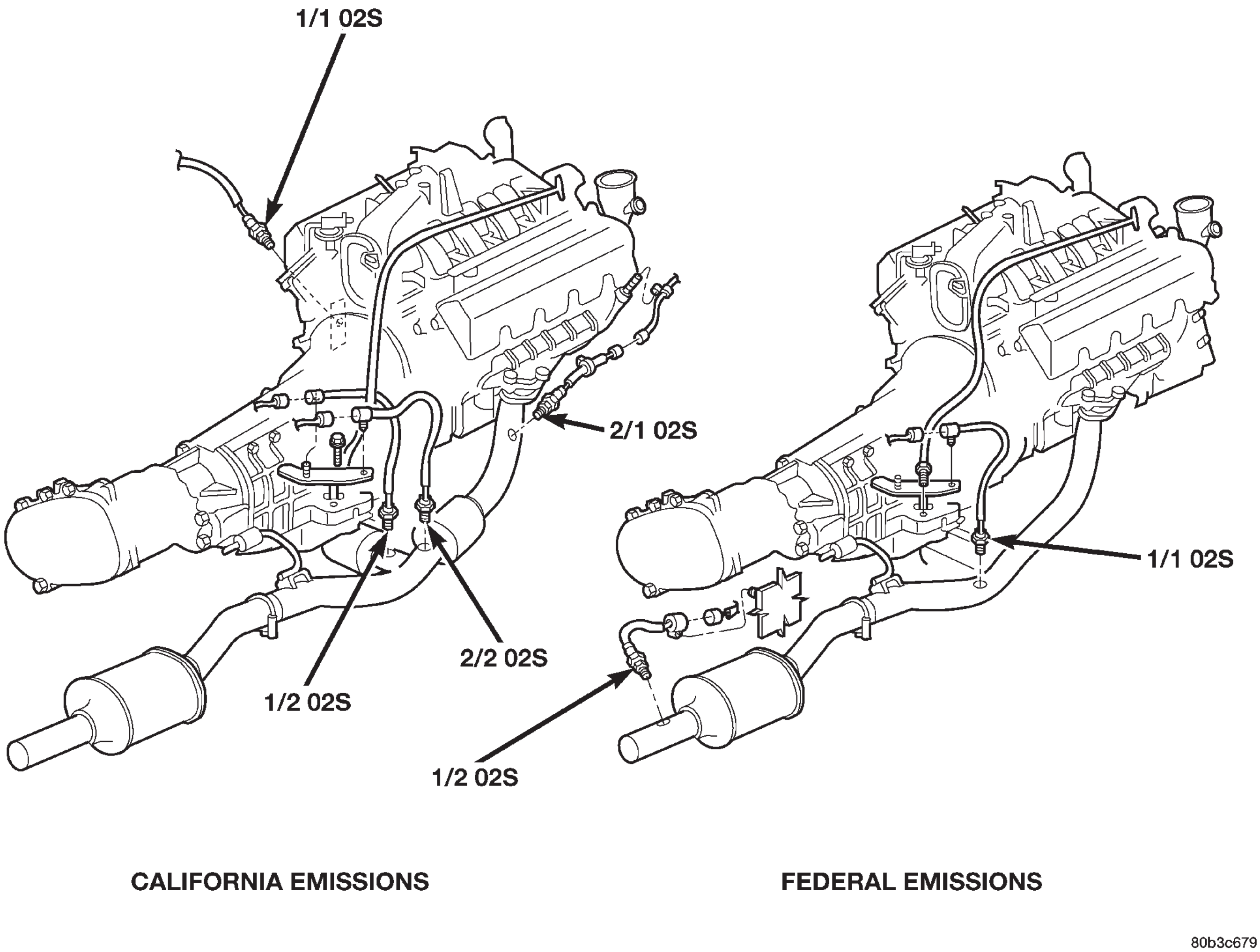


Fig. 15 Oxygen Sensor Locations—4.7L V-8 Engine

(3) Disconnect rear CCV breather tube (Fig. 20) at intake manifold fitting. Let CCV tube hang disconnected at side of engine.

(4) Attach a short piece of rubber hose to special tool 6714 (insert rubber hose to either end of tool). Install this hose/tool assembly to intake manifold fitting.

(5) Connect DRB scan tool to 16–way data link connector. This connector is located at lower edge of instrument panel near steering column.

(6) Start the engine and allow to warm up.

(7) Using the DRB scan tool, scroll through the menus as follows: select—Stand Alone DRB III, select 1999 Diagnostics, select—Engine, select—System Test, select—Minimum Air Flow.

(8) 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.

(9) Disconnect the DRB scan tool from vehicle.

(10) Remove orifice tool and connect CCV tube to engine.

(11) Install air duct and air box to throttle body.

DIAGNOSIS AND TESTING (Continued)

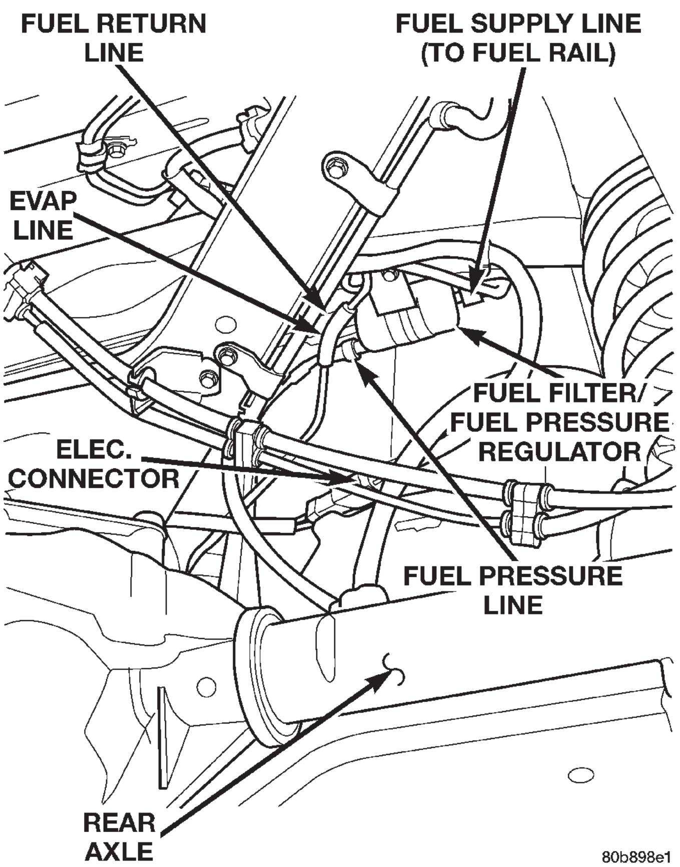
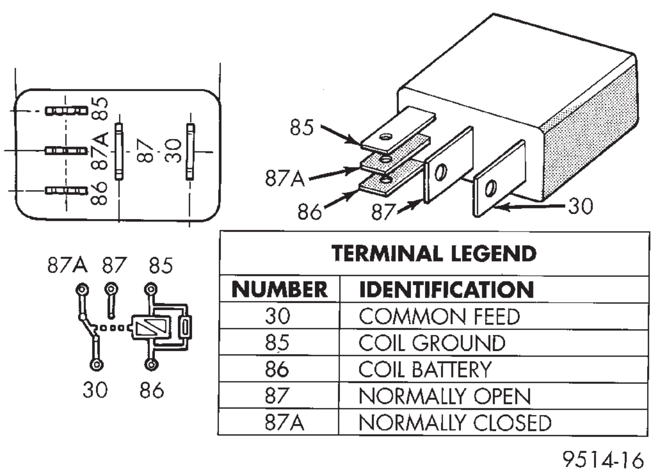
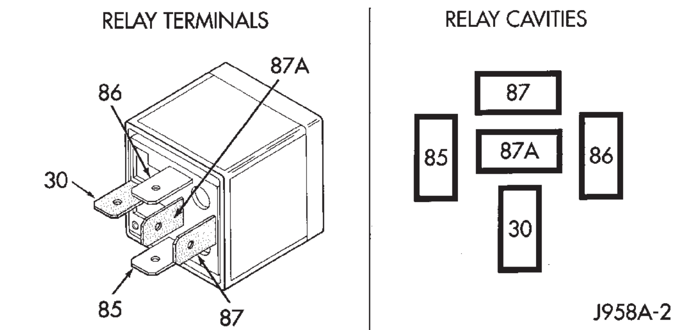


Fig. 16 Fuel Filter/Fuel Pressure Regulator Location



TERMINAL LEGEND	
NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

Fig. 17 Relay Terminals



TERMINAL LEGEND	
NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

Fig. 18 Relay Terminals

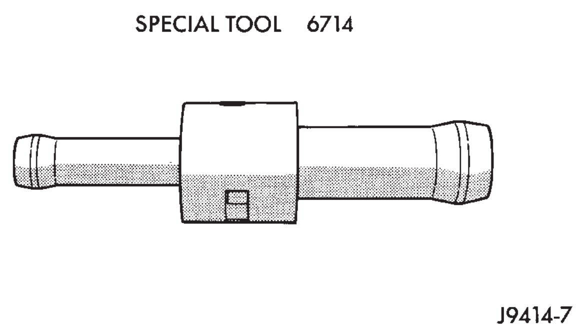


Fig. 19 Fixed Orifice Tool 6714

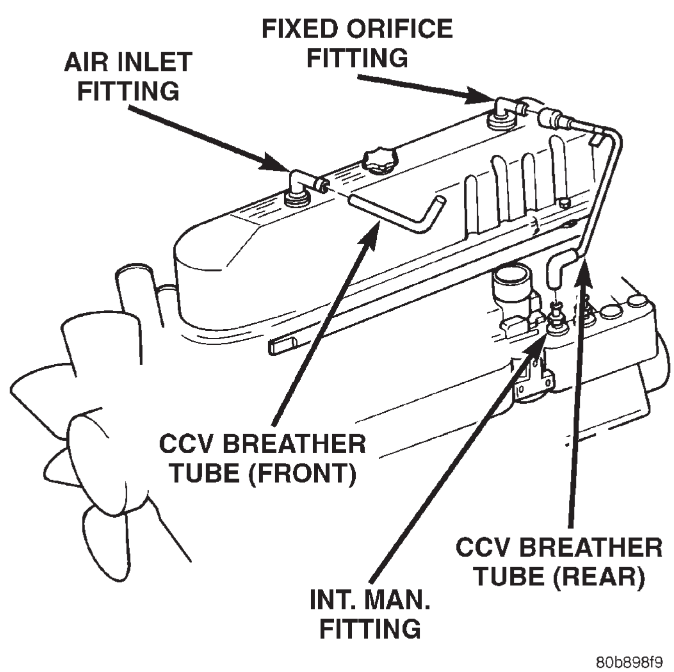


Fig. 20 Fixed Orifice Fitting and CCV Breather Tubes

REMOVAL AND INSTALLATION

AUTOMATIC SHUTDOWN (ASD) RELAY

The ASD relay is located in the Power Distribution Center (PDC) (Fig. 21). Refer to label on PDC cover for relay location.

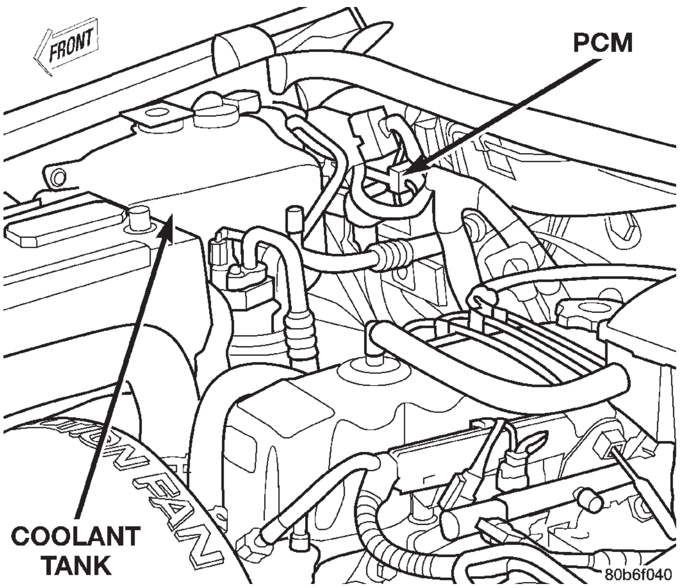


Fig. 21 Power Distribution Center (PDC) Location

REMOVAL

(1) Remove PDC cover.
(2) Remove relay from PDC.
(3) Check condition of relay terminals and PDC connector terminals for damage or corrosion. Repair if necessary before installing relay.
(4) Check for pin height (pin height should be the same for all terminals within the PDC connector). Repair if necessary before installing relay.

INSTALLATION

(1) Install relay to PDC.
(2) Install cover to PDC.

FUEL PUMP RELAY

The fuel pump relay is located in the Power Distribution Center (PDC) (Fig. 21). Refer to label on PDC cover for relay location.

REMOVAL

(1) Remove PDC cover.
(2) Remove relay from PDC.
(3) Check condition of relay terminals and PDC connector terminals for damage or corrosion. Repair if necessary before installing relay.
(4) Check for pin height (pin height should be the same for all terminals within the PDC connector). Repair if necessary before installing relay.

INSTALLATION

(1) Install relay to PDC.
(2) Install cover to PDC.

OXYGEN SENSOR HEATER RELAYS

The oxygen sensor heater relays are located in the Power Distribution Center (PDC) (Fig. 21). Refer to label on PDC cover for relay location.

REMOVAL

(1) Remove PDC cover.
(2) Remove relay from PDC.
(3) Check condition of relay terminals and PDC connector terminals for damage or corrosion. Repair if necessary before installing relay.
(4) Check for pin height (pin height should be the same for all terminals within the PDC connector). Repair if necessary before installing relay.

INSTALLATION

(1) Install relay to PDC.
(2) Install cover to PDC.

THROTTLE BODY—4.0L ENGINE

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).

REMOVAL

(1) Remove air cleaner duct and air resonator box at throttle body.
(2) Disconnect throttle body electrical connectors at MAP sensor, IAC motor and TPS (Fig. 22).
(3) Remove all control cables from throttle body (lever) arm. Refer to Accelerator Pedal and Throttle Cable.
(4) Remove four throttle body mounting bolts.
(5) Remove throttle body from intake manifold.
(6) 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 11 N·m (100 in. lbs.) torque.
(5) Install control cables.
(6) Install electrical connectors.
(7) Install air duct and air box at throttle body.

REMOVAL AND INSTALLATION (Continued)

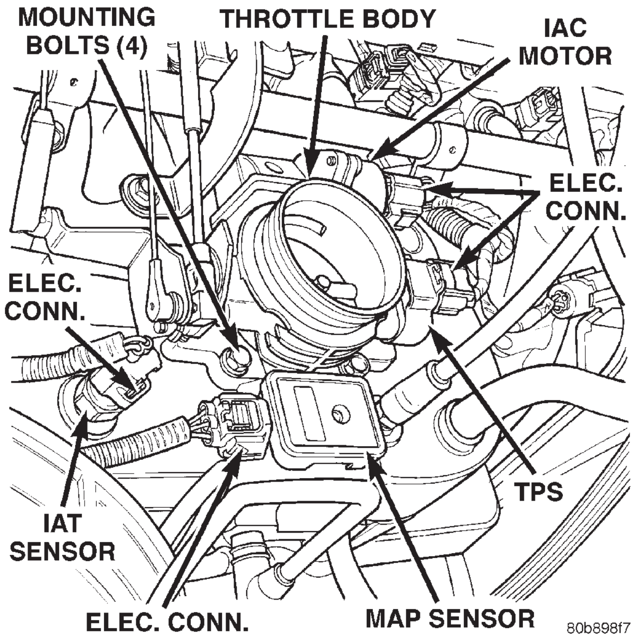


Fig. 22 Throttle Body and Sensor Locations—4.0L Engine

THROTTLE BODY—4.7L V-8 ENGINE

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).

REMOVAL

(1) Remove the air duct and air resonator box at throttle body.

(2) Disconnect throttle body electrical connectors at IAC motor and TPS (Fig. 23).

(3) Remove vacuum line at throttle body.

(4) Remove all control cables from throttle body (lever) arm. Refer to Accelerator Pedal and Throttle Cable.

(5) Remove three throttle body mounting bolts (Fig. 23).

(6) Remove throttle body from intake manifold.

INSTALLATION

(1) Clean throttle body-to-intake manifold o-ring.

(2) Clean mating surfaces of throttle body and intake manifold.

(3) Install throttle body to intake manifold by positioning throttle body to manifold alignment pins.

(4) Install three mounting bolts. Tighten bolts to 12 N·m (105 in. lbs.) torque.

(5) Install control cables.

(6) Install vacuum line to throttle body.

(7) Install electrical connectors.

(8) Install air duct/air box at throttle body.

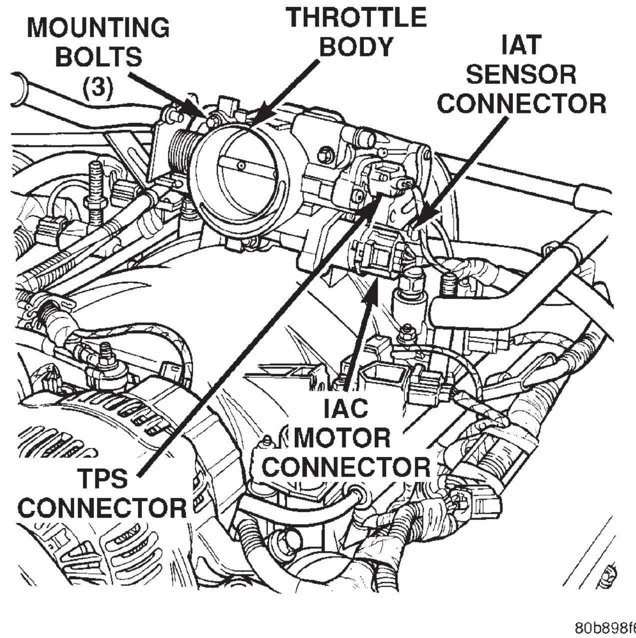


Fig. 23 Throttle Body, Sensors and Electrical Connectors—4.7L V-8 Engine

THROTTLE POSITION SENSOR (TPS)—4.0L ENGINE

The TPS is mounted to the throttle body.

REMOVAL

(1) Disconnect TPS electrical connector (Fig. 24).

(2) Remove TPS mounting screws (Fig. 25).

(3) Remove TPS.

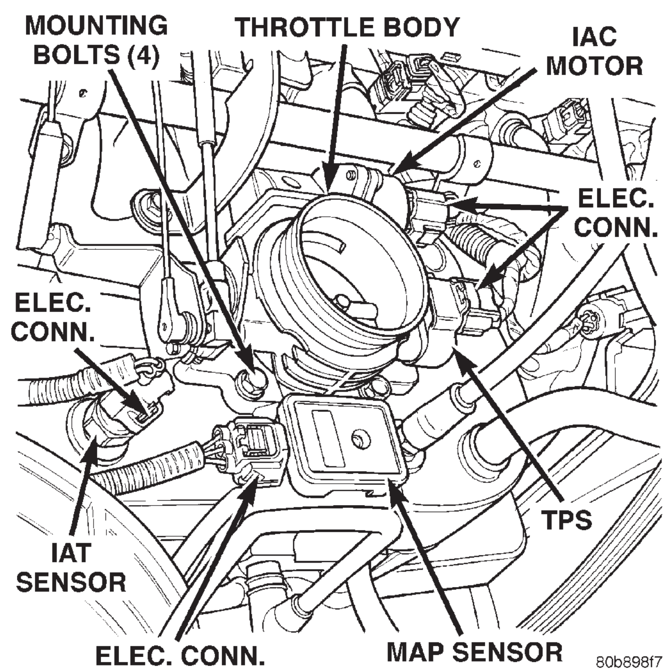


Fig. 24 TPS Electrical Connector—4.0L Engine

REMOVAL AND INSTALLATION (Continued)

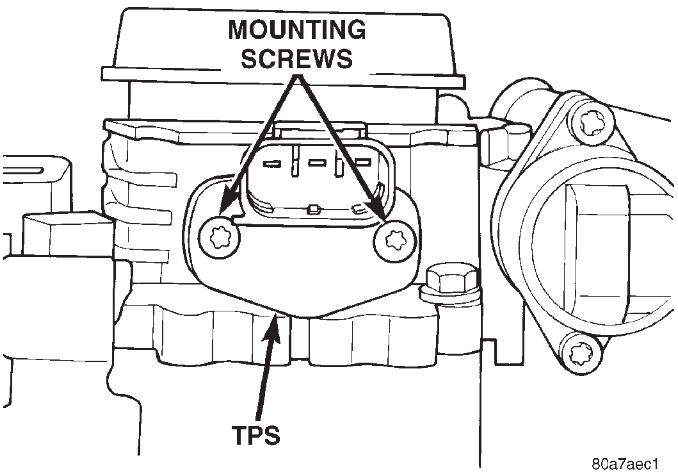


Fig. 25 TPS Mounting Screws—4.0L Engine

INSTALLATION

The throttle shaft end of throttle body slides into a socket in the TPS (Fig. 26). The TPS must be installed so that it can be rotated a few degrees. (If sensor will not rotate, install sensor with throttle shaft on other side of socket tangs). The TPS will be under slight tension when rotated.

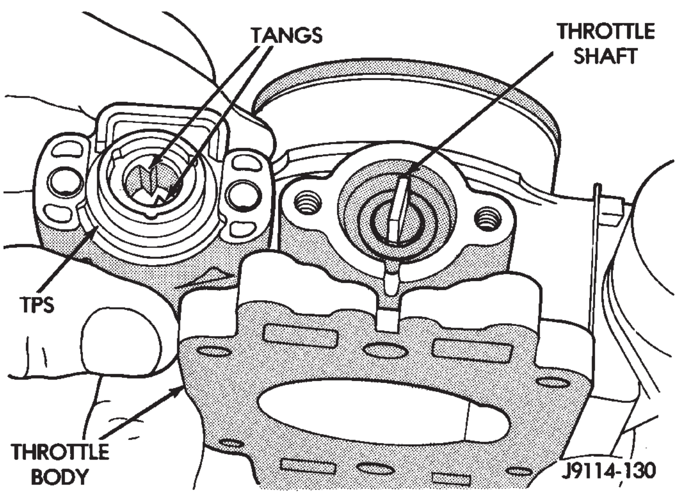


Fig. 26 Throttle Position Sensor Installation—4.0L Engine

(1) Install TPS and retaining screws.

(2) Tighten screws to 7 N·m (60 in. lbs.) torque.

(3) Connect TPS electrical connector to TPS.

(4) Manually operate throttle (by hand) to check for any TPS binding before starting engine.

THROTTLE POSITION SENSOR (TPS)—4.7L V-8 ENGINE

REMOVAL

The TPS is located on the throttle body.

(1) Remove air duct and air resonator box at throttle body.

(2) Disconnect TPS electrical connector (Fig. 23).

(3) Remove two TPS mounting bolts (screws) (Fig. 27).

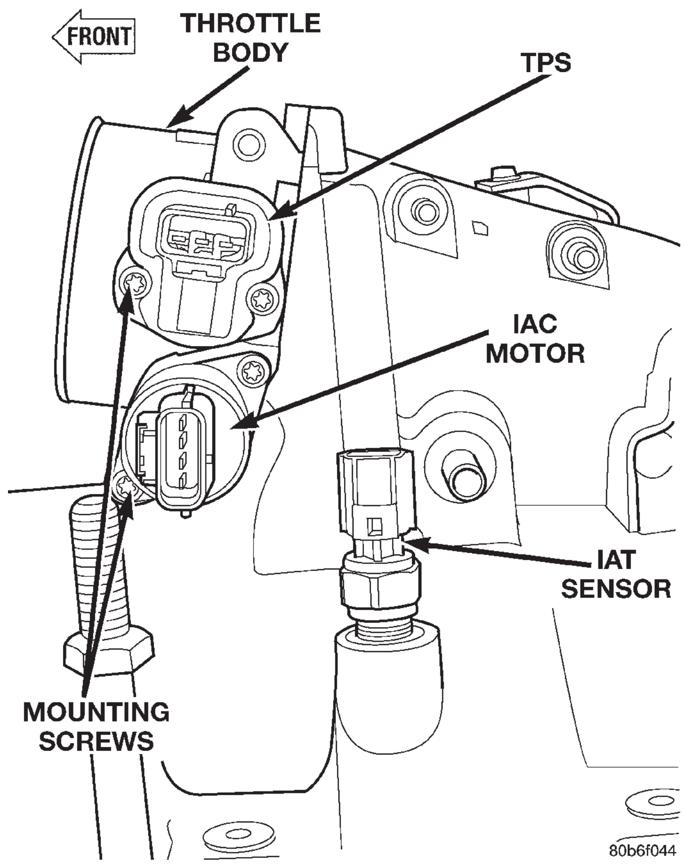


Fig. 27 TPS Mounting Bolts—4.7L V–8 Engine

(4) Remove TPS from throttle body.

INSTALLATION

The throttle shaft end of throttle body slides into a socket in TPS (Fig. 28). The TPS must be installed so that it can be rotated a few degrees. If sensor will not rotate, install sensor with throttle shaft on other side of socket tangs. The TPS will be under slight tension when rotated.

(1) Install TPS and two retaining bolts.

(2) Tighten bolts to 7 N·m (60 in. lbs.) torque.

(3) Manually operate throttle control lever by hand to check for any binding of TPS.

(4) Connect TPS electrical connector to TPS.

(5) Install air duct/air box to throttle body.

IDLE AIR CONTROL (IAC) MOTOR—4.0L ENGINE

The IAC motor is located on the throttle body.

REMOVAL

(1) Remove air duct and air resonator box at throttle body.

(2) Disconnect electrical connector from IAC motor (Fig. 24).

(3) Remove two mounting bolts (screws) (Fig. 29).

REMOVAL AND INSTALLATION (Continued)

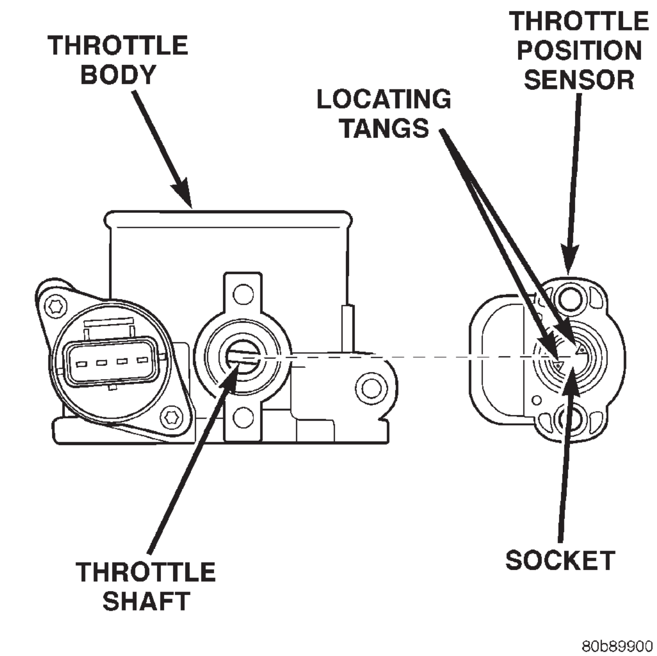


Fig. 28 TPS Installation—4.7L V–8 Engine

(4) Remove IAC motor from throttle body.

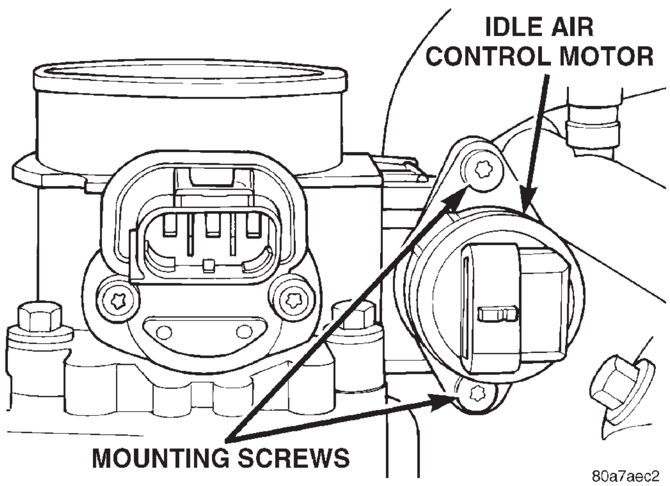


Fig. 29 Mounting Bolts (Screws)—IAC Motor—4.0L Engine

INSTALLATION

(1) Install IAC motor to throttle body.

(2) Install and tighten two mounting bolts (screws) to 7 N·m (60 in. lbs.) torque.

(3) Install electrical connector.

(4) Install air cleaner duct/air box to throttle body.

IDLE AIR CONTROL (IAC) MOTOR—4.7L V–8 ENGINE

The IAC motor is located on the throttle body.

REMOVAL

(1) Remove air duct and air resonator box at throttle body.

(2) Disconnect electrical connector from IAC motor (Fig. 23).

(3) Remove two mounting bolts (screws) (Fig. 27).

(4) Remove IAC motor from throttle body.

INSTALLATION

(1) Install IAC motor to throttle body.

(2) Install and tighten two mounting bolts (screws) to 7 N·m (60 in. lbs.) torque.

(3) Install electrical connector.

(4) Install air duct/air box to throttle body.

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—4.0L ENGINE

The MAP sensor is mounted to the side of the throttle body (Fig. 24). An L-shaped rubber fitting is used to connect the MAP sensor to throttle body (Fig. 30).

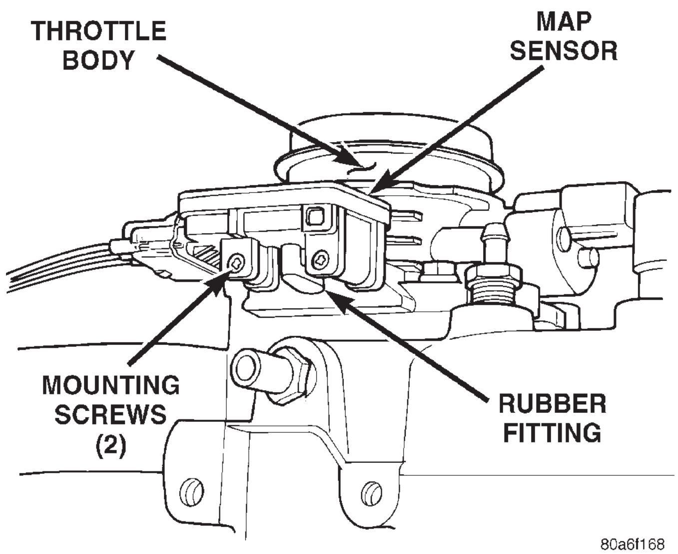


Fig. 30 Rubber L-Shaped Fitting—MAP Sensor-to-Throttle Body—4.0L Engine

REMOVAL

(1) Remove air cleaner duct and air resonator box at throttle body.

(2) Remove two MAP sensor mounting bolts (screws) (Fig. 30).

(3) While removing MAP sensor, slide the rubber L-shaped fitting (Fig. 30) from the throttle body.

(4) 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 (screws). Tighten screws to 3 N·m (25 in. lbs.) torque.

(4) Install air cleanerduct/air box.

REMOVAL AND INSTALLATION (Continued)

MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR—4.7L V–8 ENGINE

The MAP sensor is located on the front of the intake manifold (Fig. 31). An o-ring seals the sensor to the intake manifold.

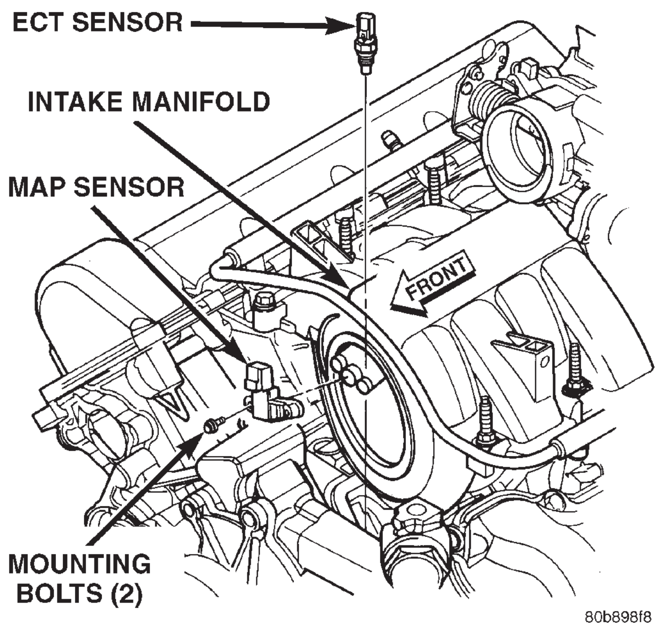


Fig. 31 MAP and ECT Sensor Locations—4.7L V–8 Engine

REMOVAL

(1) Disconnect electrical connector at sensor.

(2) Clean area around MAP sensor.

(3) Remove 2 sensor mounting bolts (Fig. 31).

(4) Remove MAP sensor from intake manifold.

INSTALLATION

(1) Clean MAP sensor mounting hole at intake manifold.

(2) Check MAP sensor o-ring seal for cuts or tears.

(3) Position sensor into manifold.

(4) Install MAP sensor mounting bolts (screws). Tighten screws to 3 N·m (25 in. lbs.) torque.

(5) Connect electrical connector.

POWERTRAIN CONTROL MODULE (PCM)

The PCM is located on the cowl panel in right/rear side of engine compartment (Fig. 32).

REMOVAL

To avoid possible voltage spike damage to PCM, ignition key must be off, and negative battery cable must be disconnected before unplugging PCM connectors.

(1) Disconnect negative battery cable at battery.

(2) If equipped, remove Transmission Control Module (TCM).

(3) Remove coolant reserve/overflow tank.

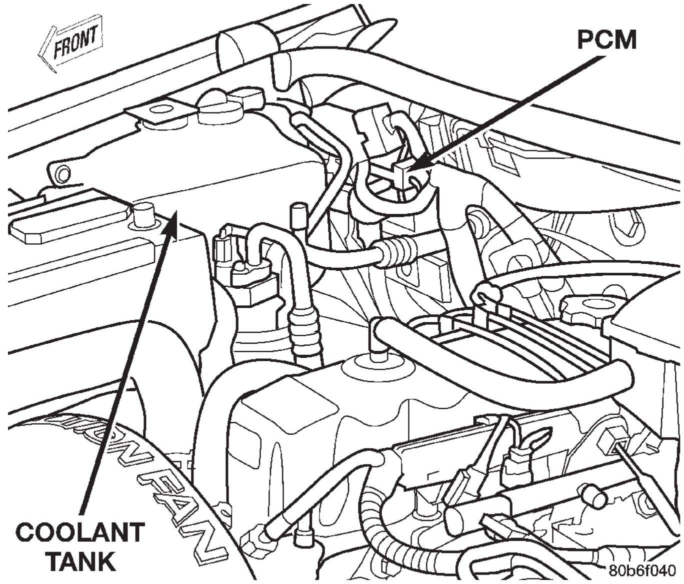


Fig. 32 Powertrain Control Module (PCM) Location

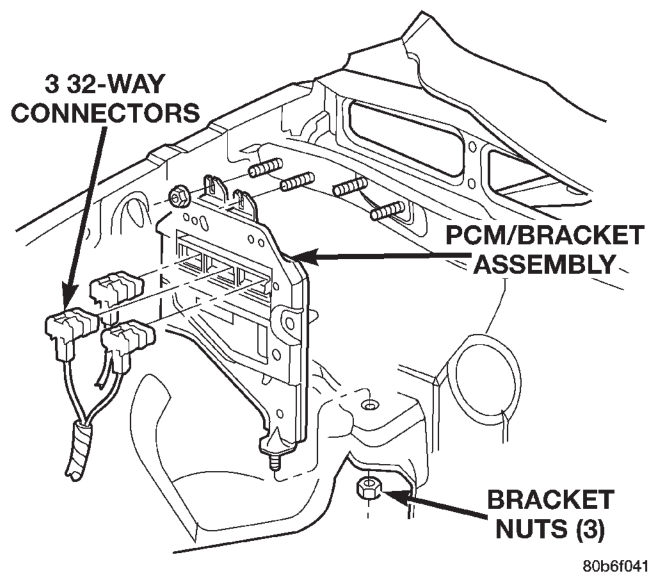


Fig. 33 Powertrain Control Module (PCM) 32–Way Connectors

(4) Remove cover over electrical connectors. Cover snaps onto PCM.

(5) Carefully unplug three 32–way connectors at PCM.

(6) Remove three PCM bracket-to-body mounting nuts (Fig. 33).

(7) Remove PCM/PCM bracket assembly from vehicle.

(8) Remove 3 PCM-to-PCM bracket bolts (screws) (Fig. 34).

INSTALLATION

(1) Check pins in three 32–way electrical connectors for damage. Repair as necessary.

(2) Install PCM to its mounting bracket. Tighten three mounting bolts to 3 N·m (25 in. lbs.) torque.

REMOVAL AND INSTALLATION (Continued)

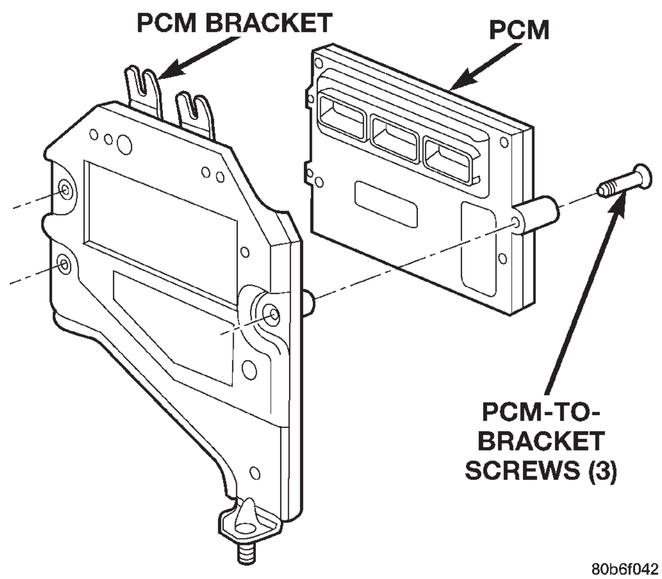


Fig. 34 Powertrain Control Module (PCM) Mounting Bracket

(3) Install PCM/PCM bracket to body. Install 3 nuts and tighten 9 N·m (80 in. lbs.) torque.

(4) Install three 32–way connectors.

(5) Install cover over electrical connectors. Cover snaps onto PCM.

(6) Install coolant reserve/overflow tank.

(7) If equipped, install Transmission Control Module (TCM).

(8) Connect negative cable to battery.

(9) Use the DRB scan tool to reprogram new PCM with vehicles original Identification Number (VIN) and original vehicle mileage.

OXYGEN SENSOR

REMOVAL

Oxygen sensor (O2S) locations are shown in (Fig. 35) and (Fig. 36).

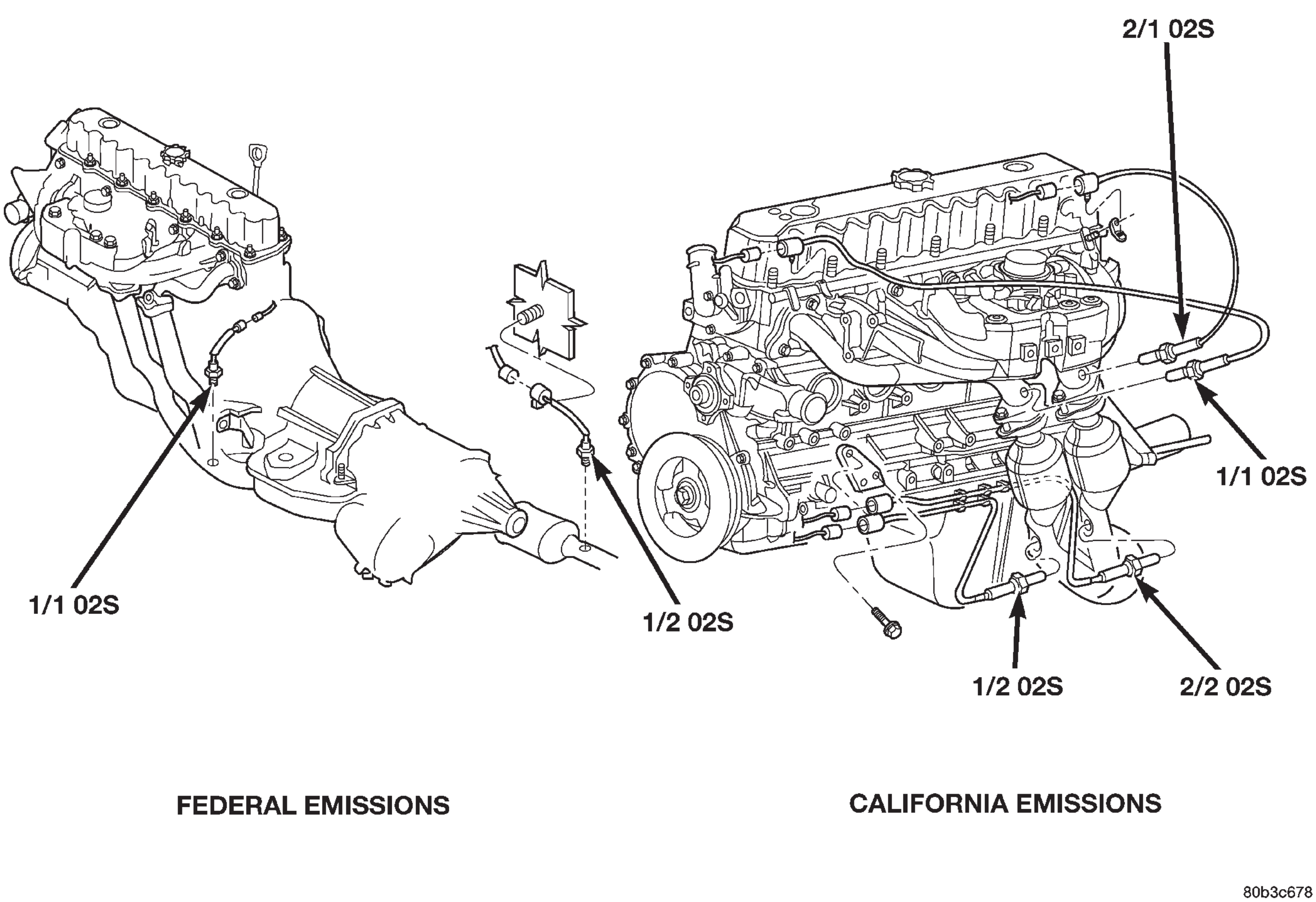


Fig. 35 Oxygen Sensor Locations—4.0L Engine

REMOVAL AND INSTALLATION (Continued)

WARNING: THE EXHAUST MANIFOLD, EXHAUST PIPES AND CATALYTIC CONVERTER(S) BECOME VERY HOT DURING ENGINE OPERATION. ALLOW ENGINE TO COOL BEFORE REMOVING OXYGEN SENSOR.

(1) Raise and support vehicle.

(2) Disconnect O2S pigtail harness from main wiring harness.

(3) If equipped, disconnect sensor wire harness mounting clips from engine or body.

CAUTION: When disconnecting sensor electrical connector, do not pull directly on wire going into sensor.

(4) Remove O2S sensor. 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 threads of a new oxygen sensor.**

(1) Install O2S sensor. Tighten to 30 N·m (22 ft. lbs.) torque.

(2) Connect O2S sensor wire connector to main wiring harness.

(3) If equipped, connect sensor wire harness mounting clips to engine or body. **When Equipped: The O2S pigtail harness must be clipped and/or bolted back to their original positions on engine or body to prevent mechanical damage to wiring.** .

(4) Lower vehicle.

RADIATOR FAN COOLING RELAY

REMOVAL

The Pulse Width Modulated (PWM) cooling fan relay is located below the right headlamp behind the bumper fascia (Fig. 37).

(1) Remove front bumper and grill assembly.

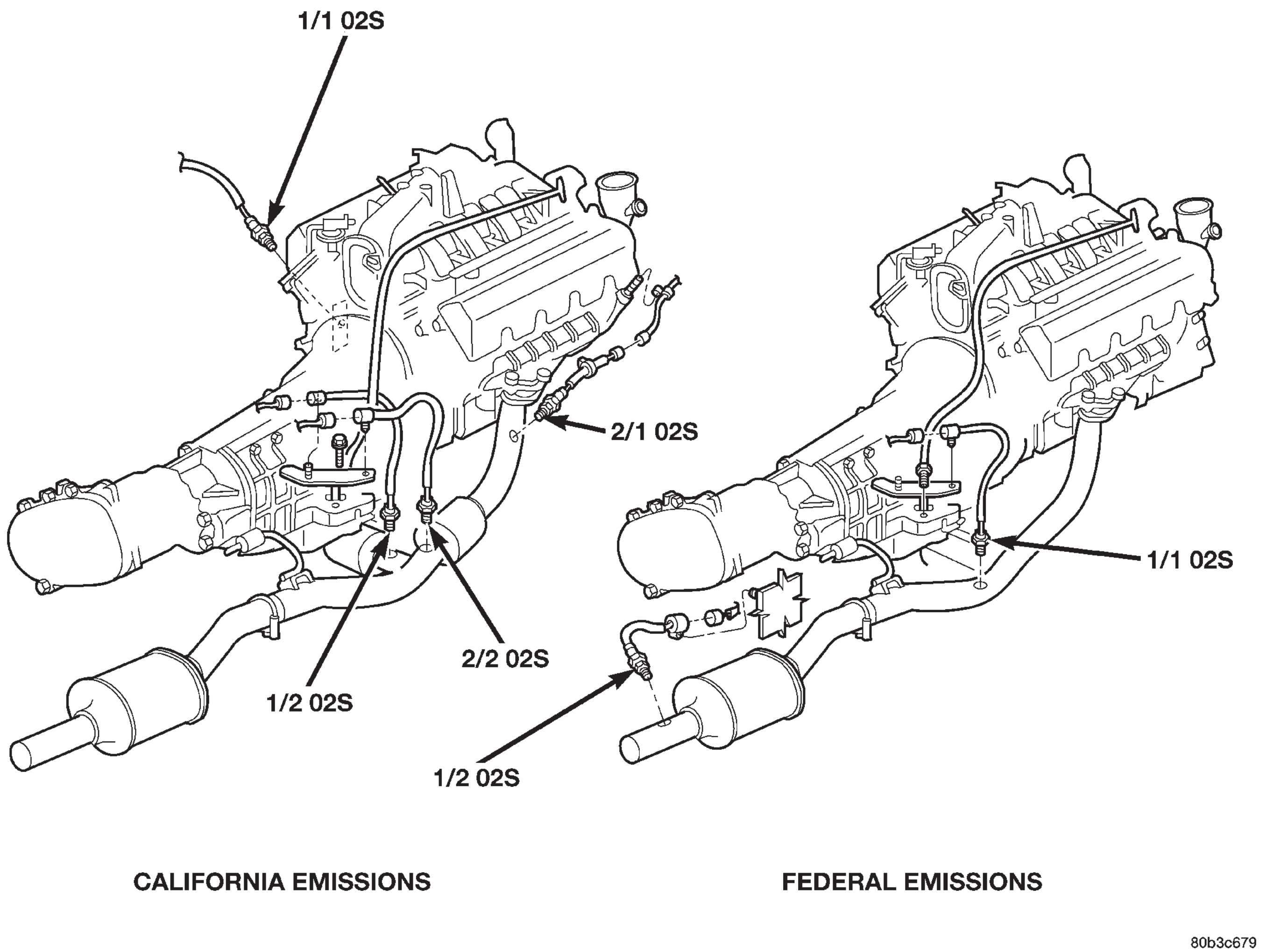


Fig. 36 Oxygen Sensor Locations—4.7L V-8 Engine

REMOVAL AND INSTALLATION (Continued)

(2) Remove 1 support bolt near front of reservoir (Fig. 37).

(3) Remove 2 reservoir mounting bolts.

(4) Remove reservoir from vehicle to gain access to vacuum hose (Fig. 38). Disconnect vacuum hose from reservoir fitting at rear of reservoir.

(5) Disconnect electrical connector at relay (Fig. 39).

(6) Remove 2 relay mounting bolts (Fig. 39) and remove relay.

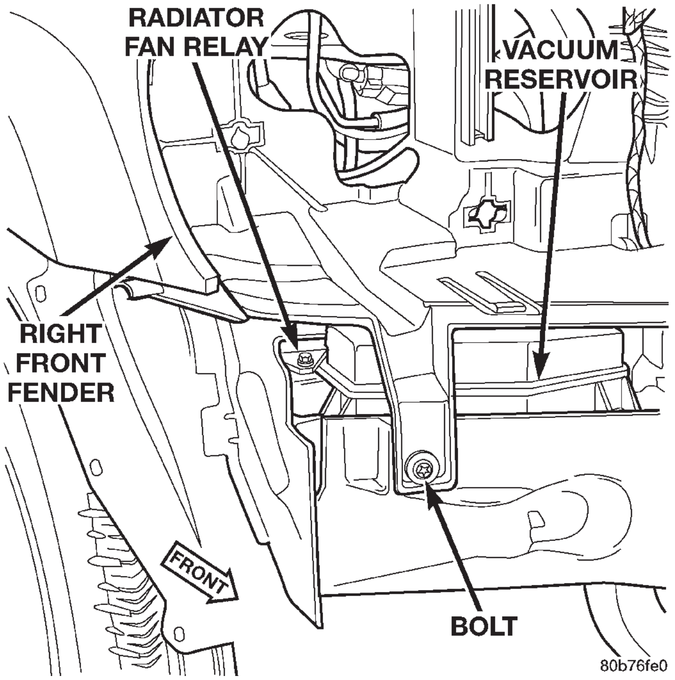


Fig. 37 Radiator Cooling Fan Relay Location

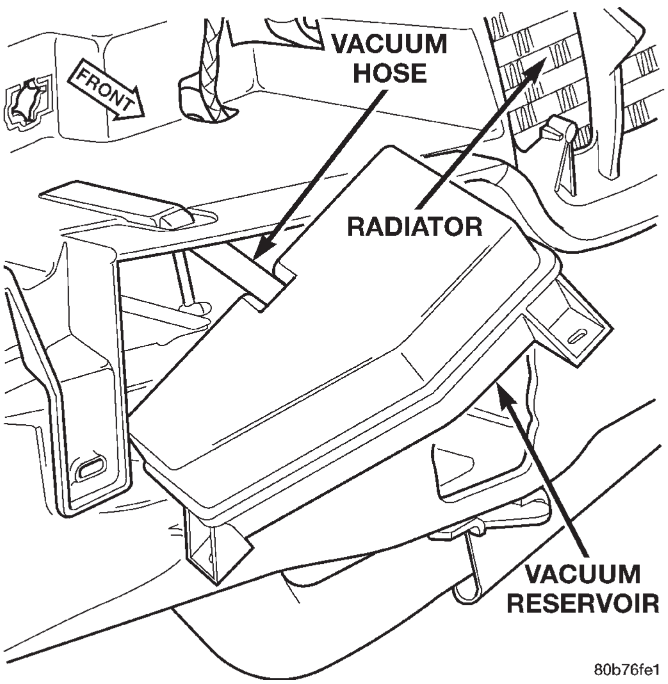


Fig. 38 Vacuum Reservoir Removal/Installation

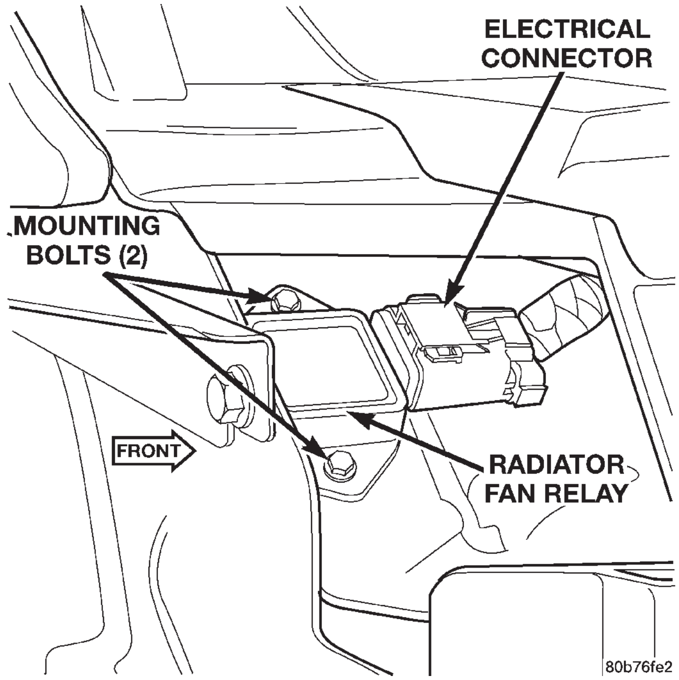


Fig. 39 Radiator Cooling Fan Relay Removal/ Installation

INSTALLATION

(1) Position relay to body and install 2 bolts. Tighten bolts to 3 N·m (25 in. lbs.) torque.

(2) Connect electrical connector to relay.

(3) Connect vacuum hose to reservoir.

(4) Install reservoir and tighten 2 bolts to 3 N·m (25 in. lbs.) torque.

(5) Install front bumper and grill assembly.

AIR CLEANER ELEMENT (FILTER)

REMOVAL

(1) Unlatch four clips retaining air cleaner cover to air cleaner housing (Fig. 40) or (Fig. 41).

(2) Lift cover up and position to the side.

(3) Remove air cleaner element.

INSTALLATION

(1) Clean inside of air cleaner housing before installing new element.

(2) Install air cleaner element into housing.

(3) Latch clips and clamp cover down to secure. Be sure air cleaner cover is properly seated to air cleaner housing.

AIR CLEANER HOUSING/RESONATOR/DUCTS

REMOVAL

(1) Disconnect air cleaner cover-to-air duct clamp (Fig. 40) or (Fig. 41).

(2) Disconnect air duct at housing.

REMOVAL AND INSTALLATION (Continued)

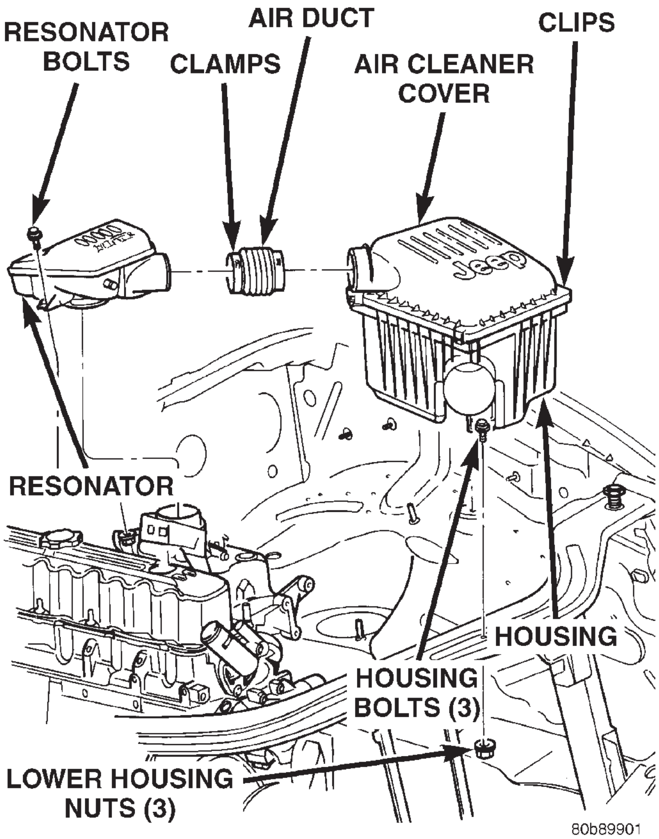


Fig. 40 Air Cleaner Assembly —4.0L Engine

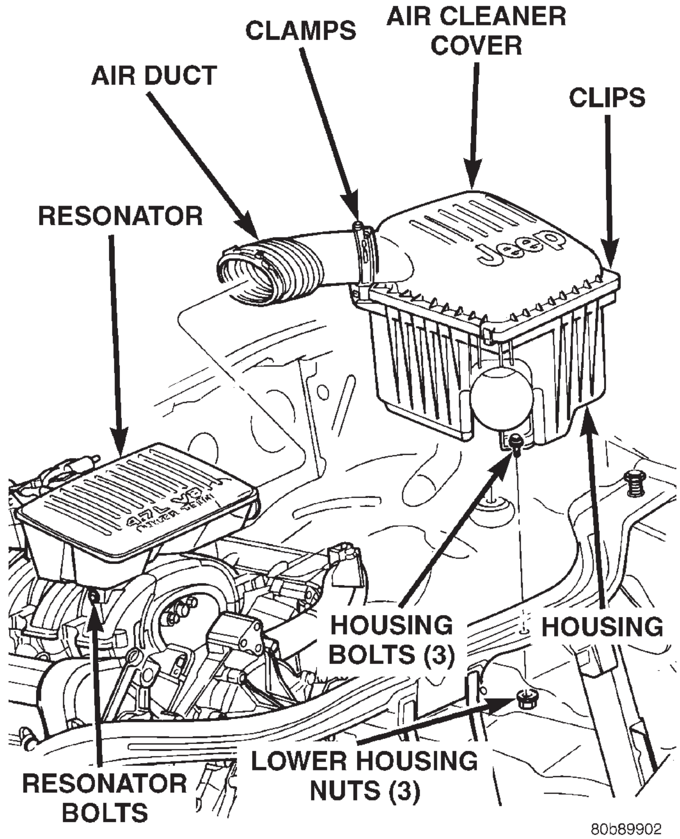


Fig. 41 Air Cleaner Assembly —4.7L V-8 Engine

(3) **Each of the 3 air cleaner housing mounting bolts is attached with 2 nuts (an upper nut and lower nut). DO NOT REMOVE BOLTS. To prevent stripping bolts, only remove lower nuts. The lower housing nuts are located under left front inner fender (Fig. 40) or (Fig. 41).**

(a) To gain access to lower nuts, raise vehicle.

(b) Remove clips retaining rubber inner fender shield.

(c) Pry back shield enough to gain access to lower nuts.

(d) Remove 3 nuts.

(e) Remove air cleaner assembly from vehicle.

(4) 4.0L Engine: If resonator is to be removed, disconnect breather tube at resonator, disconnect air duct clamp at resonator (Fig. 40) and remove 1 resonator mounting bolt. Remove resonator from throttle body by loosening clamp (Fig. 42).

(5) 4.7L V-8 Engine: If resonator is to be removed, disconnect breather tube at resonator, disconnect air duct clamp at resonator (Fig. 41) and remove 2 resonator mounting bolts (at sides of resonator). Remove resonator from throttle body by loosening clamp at throttle body.

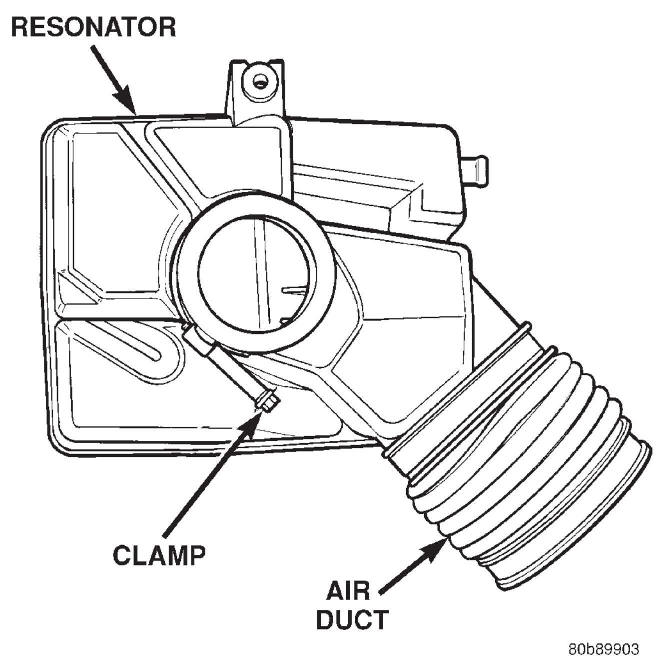


Fig. 42 Air Cleaner Resonator Clamp (Bottom View)—4.0L Engine

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Position air cleaner assembly to body and install 3 nuts. Tighten nuts to 10 N·m (93 in. lbs.) torque. **To prevent excessive vibration transmitted through housing, the nuts must be properly torqued. Do not overtighten nuts.**

(2) If resonator was removed: Install resonator and bolts. Tighten bolts to 4 N·m (35 in. lbs.) torque. Tighten clamp at throttle body to 4 N·m (35 in. lbs.) torque.

(3) Position fender liner and install clips.

(4) Connect air duct at housing (Fig. 40) or (Fig. 41).

(5) Tighten air duct clamp.

ENGINE COOLANT TEMPERATURE SENSOR—4.0L ENGINE

REMOVAL

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING. COOLING SYSTEM MUST BE PARTIALLY DRAINED BEFORE REMOVING THE ENGINE COOLANT TEMPERATURE (ECT) SENSOR. REFER TO GROUP 7, COOLING.

(1) Partially drain cooling system. Refer to Group 7, Cooling.

(2) Disconnect electrical connector from ECT sensor (Fig. 43).

(3) Remove sensor from thermostat housing.

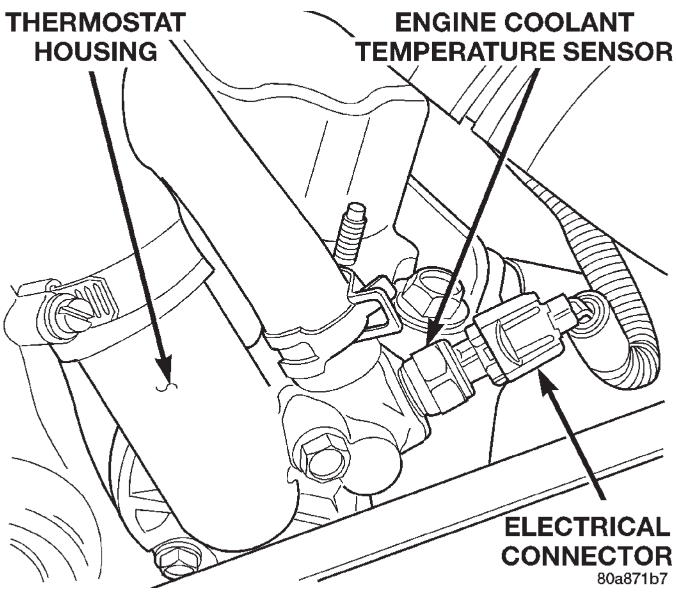


Fig. 43 Engine Coolant Temperature Sensor—4.0L Engine

INSTALLATION

(1) Install sensor.

(2) Tighten to 11 N·m (8 ft. lbs.) torque.

(3) Connect electrical connector to sensor.

(4) Replace any lost engine coolant. Refer to Group 7, Cooling System.

ENGINE COOLANT TEMPERATURE SENSOR—4.7L V-8 ENGINE

REMOVAL

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING. COOLING SYSTEM MUST BE PARTIALLY DRAINED BEFORE REMOVING THE ENGINE COOLANT TEMPERATURE (ECT) SENSOR. REFER TO GROUP 7, COOLING.

The ECT sensor is located near the front of the intake manifold (Fig. 44).

(1) Partially drain cooling system. Refer to Group 7, Cooling.

(2) Disconnect electrical connector from ECT sensor.

(3) Remove sensor from intake manifold.

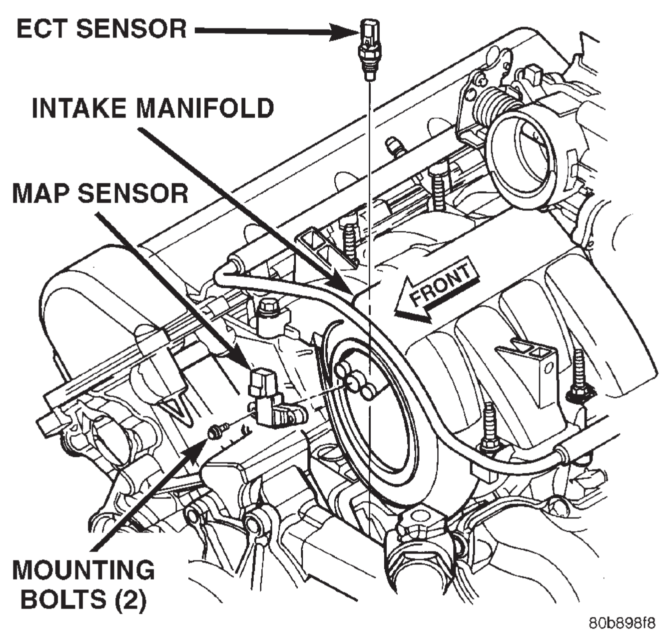


Fig. 44 Engine Coolant Temperature Sensor—4.7L V–8 Engine

INSTALLATION

(1) Install sensor.

(2) Tighten to 11 N·m (8 ft. lbs.) torque.

(3) Connect electrical connector to sensor.

(4) Replace any lost engine coolant. Refer to Group 7, Cooling System.

REMOVAL AND INSTALLATION (Continued)

INTAKE MANIFOLD AIR TEMPERATURE SENSOR—4.0L ENGINE

The Intake Manifold Air Temperature (IAT) sensor is installed into the intake manifold plenum near the front of the throttle body (Fig. 45).

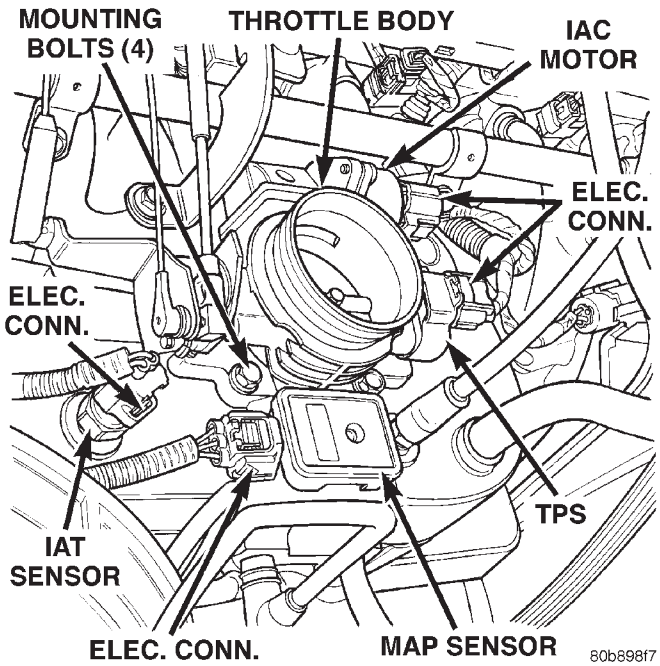


Fig. 45 Intake Manifold Air Sensor Location—4.0L Engine

REMOVAL

(1) Disconnect electrical connector from sensor.
(2) Remove sensor from intake manifold.

INSTALLATION

(1) Install sensor into intake manifold. Tighten sensor to 28 N·m (20 ft. lbs.) torque.
(2) Connect electrical connector to sensor.

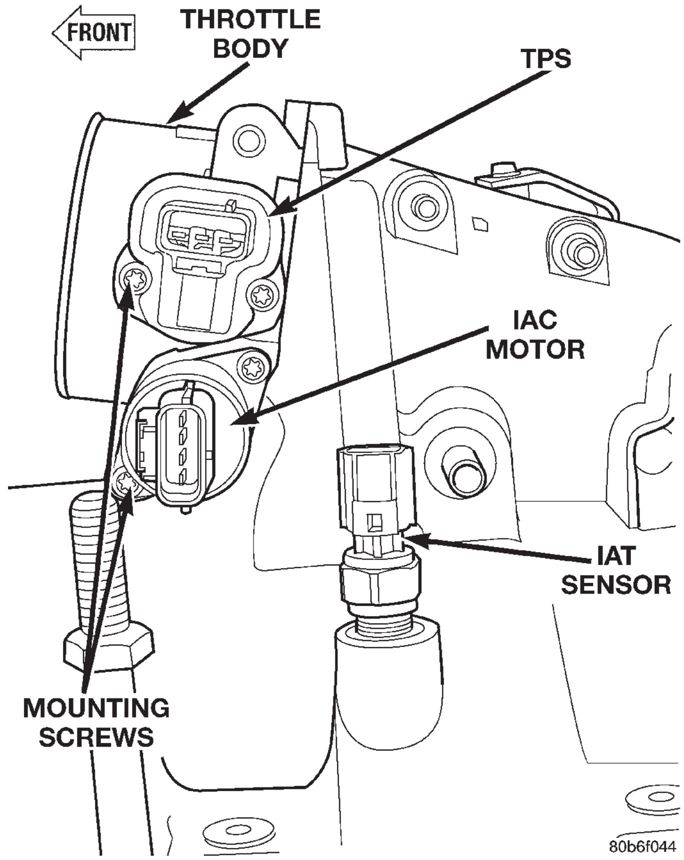


Fig. 46 Intake Manifold Air Sensor Location—4.7L V-8 Engine

INTAKE MANIFOLD AIR TEMPERATURE SENSOR—4.7L V-8 ENGINE

The Intake Manifold Air Temperature (IAT) sensor is installed into the intake manifold plenum near the left side of the throttle body (Fig. 46).

REMOVAL

(1) Disconnect electrical connector from sensor.
(2) Remove sensor from intake manifold.

INSTALLATION

(1) Install sensor into intake manifold. Tighten sensor to 28 N·m (20 ft. lbs.) torque.
(2) Connect electrical connector to sensor.

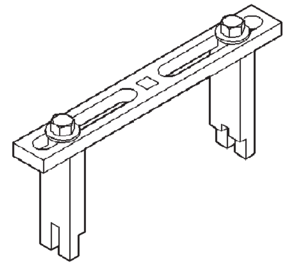
SPECIFICATIONS

TORQUE CHART

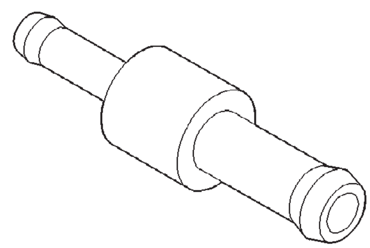
DESCRIPTION	TORQUE
Air Cleaner Housing Mount. Nuts	10 N·m (93 in. lbs.)
Air Cleaner Air Duct Clamps	4 N·m (35 in. lbs.)
Air Cleaner Resonator Bolts	4 N·m (35 in. lbs.)
Engine Coolant Temperature Sensor—4.0L Engine	11 N·m (96 in. lbs.)
Engine Coolant Temperature Sensor—4.7L Engine	11 N·m (96 in. lbs.)
Fuel Hose Clamps	1 N·m (10 in. lbs.)
IAC Motor-To-Throttle Body Bolts—4.0L Engine	7 N·m (60 in. lbs.)
IAC Motor-To-Throttle Body Bolts—4.7L Engine	7 N·m (60 in. lbs.)
Intake Manifold Air Temp. Sensor—4.0L Engine	28 N·m (20 ft. lbs.)
Intake Manifold Air Temp. Sensor—4.7L Engine	28 N·m (20 ft. lbs.)
MAP Sensor Mounting Screws—4.0L Engine	3 N·m (25 in. lbs.)
MAP Sensor Mounting Screws—4.7L Engine	3 N·m (25 in. lbs.)
Oxygen Sensor—All Engines	30 N·m (22 ft. lbs.)
PCM-to-Mounting Bracket Screws	3 N·m (25 in. lbs.)
PCM-to-Mounting Bracket Screws	9 N·m (80 in. lbs.)
Radiator Cooling Fan Relay Bolts	3 N·m (25 in. lbs.)
Throttle Body Mounting Bolts—4.0L Engine	11 N·m (100 in. lbs.)
Throttle Body Mounting Bolts—4.7L Engine	12 N·m (105 in. lbs.)
TPS Mounting Screws—4.0L Engine	7 N·m (60 in. lbs.)
TPS Mounting Screws—4.7L Engine	7 N·m (60 in. lbs.)

SPECIAL TOOLS

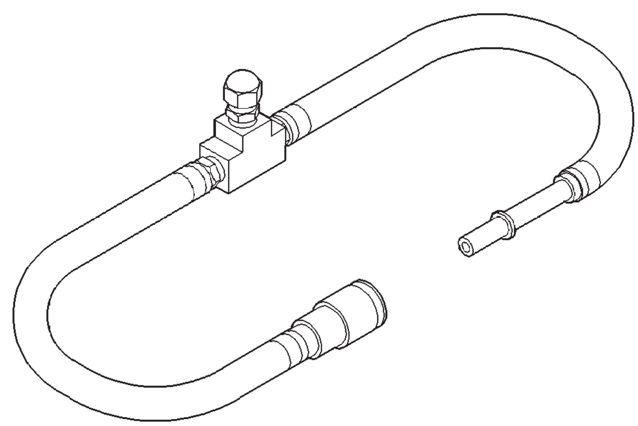
FUEL SYSTEM



Spanner Wrench—6856



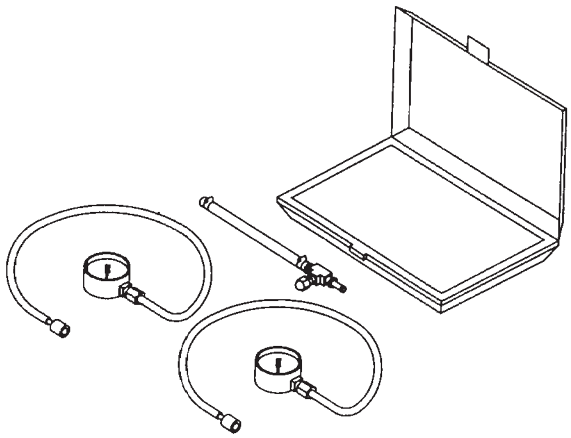
Fitting, Air Metering—6714



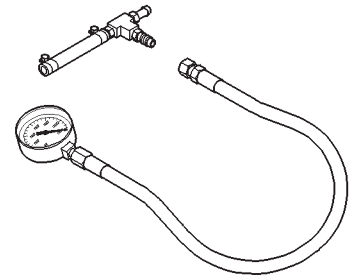
Adapters, Fuel Pressure Test—6539 and/or 6631

O2S (Oxygen Sensor) Remover/Installer—C-4907

SPECIAL TOOLS (Continued)



Test Kit, Fuel Pressure—5069



Test Kit, Fuel Pressure—C-4799-B

Fuel Line Removal Tool—6782

FUEL SYSTEM—3.1L DIESEL ENGINE

CONTENTS

GENERAL INFORMATION

INDEX

GENERAL INFORMATION

FUEL SHUTDOWN SOLENOID

The fuel shutdown solenoid is controlled and operated by the ECM.

The fuel shutdown (shut-off) solenoid is used to electrically shut off the diesel fuel supply to the high-pressure fuel injection pump. The solenoid is mounted to the rear of the injection pump.

The solenoid controls starting and stopping of the engine regardless of the position of the accelerator pedal. When the ignition (key) switch is OFF, the solenoid is shut off and fuel flow is not allowed to the fuel injection pump. When the key is placed in the ON or START positions, fuel supply is allowed at the injection pump.

FUEL REQUIREMENTS—3.1L DIESEL

Premium quality diesel fuel with a minimum Cetane rating of 50 or higher is required.

FUEL DELIVERY SYSTEM—3.1L DIESEL ENGINE

INDEX

DESCRIPTION AND OPERATION

INTRODUCTION

This Fuel Delivery section will cover components not controlled by the PCM. For components controlled by the PCM, refer to the Fuel Injection System—3.1L Diesel Engine section of this group.

The fuel heater relay, fuel heater and fuel gauge are not operated by the PCM. These components are controlled by the ignition (key) switch. All other fuel system electrical components necessary to operate the engine are controlled or regulated by the PCM.

FUEL SYSTEM PRESSURE WARNING

WARNING: HIGH–PRESSURE FUEL LINES DELIVER DIESEL FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE FUEL INJECTORS. THIS MAY BE AS HIGH AS 45,000 KPA (6526 PSI). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH–PRESSURE FUEL LEAKS. INSPECT FOR HIGH–PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD (Fig. 1). HIGH FUEL INJECTION PRESSURE CAN CAUSE PERSONAL INJURY IF CONTACT IS MADE WITH THE SKIN.

FUEL TANK

The fuel tank and tank mounting used with the diesel powered engine is the same as used with gasoline powered models, although the fuel tank module is different.

The fuel tank contains the fuel tank module and one rollover valve. Two fuel lines are routed to the fuel tank module. One line is used for fuel supply to the fuel filter/water separator. The other is used to return excess fuel back to the fuel tank.

The fuel tank module contains the fuel gauge electrical sending unit. **An electrical fuel pump is not used with the diesel engine.**

FUEL TANK MODULE

An electric fuel pump is not attached to the fuel tank module for diesel powered engines. Fuel is siphoned by the fuel injection pump.

DESCRIPTION AND OPERATION (Continued)

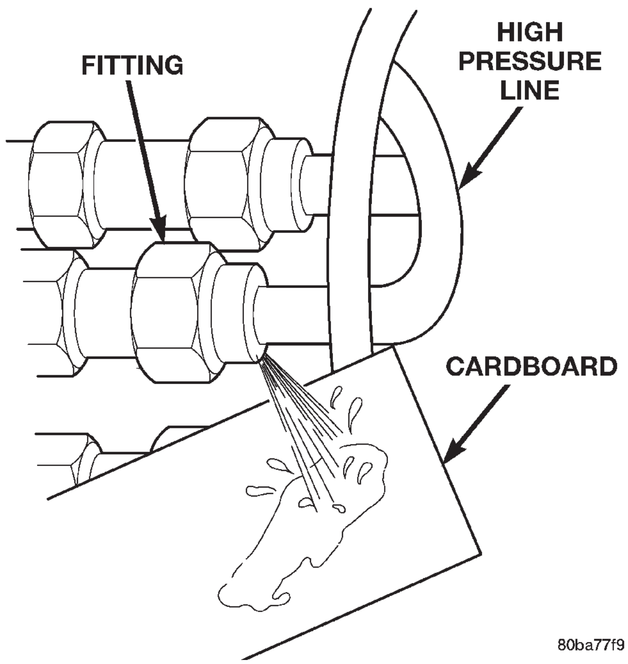


Fig. 1 Typical Fuel Pressure Test at Injection Pump

The fuel tank module is installed in the top of the fuel tank. The fuel tank module contains the following components:

- Fuel reservoir
- Electric fuel gauge sending unit
- Fuel supply line connection
- Fuel return line connection
- Wire harness

FUEL GAUGE SENDING UNIT

The fuel gauge sending unit is attached to the side of the fuel pump module. The sending unit consists of a float, an arm, and a variable resistor (track). The track is used to send an electrical signal used for fuel gauge operation.

As the fuel level increases, the float and arm move up. This decreases the sending unit resistance, causing the PCM to send a signal to the fuel gauge on the instrument panel to read full. As the fuel level decreases, the float and arm move down. This increases the sending unit resistance, causing the PCM to send a signal to the fuel gauge on the instrument panel to read empty.

FUEL FILTER/WATER SEPARATOR

The fuel filter/water separator is located in the engine compartment on the left side behind the generator (Fig. 2).

The combination fuel filter/water separator protects the fuel injection pump by helping to remove water and contaminants from the fuel. Moisture collects at the bottom of the filter/separator in a plastic bowl.

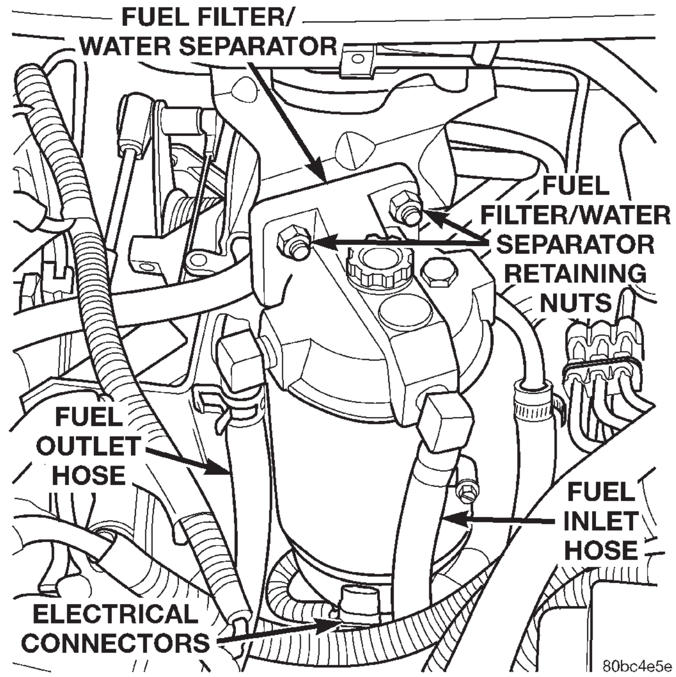


Fig. 2 Fuel Filter/Water Separator Location

The fuel filter/water separator assembly contains the fuel filter, fuel heater element, and fuel drain valve.

For information on the fuel heater, refer to Fuel Heater in this group.

Refer to the maintenance schedules in Group 0 in this manual for the recommended fuel filter replacement intervals.

For periodic draining of water from the bowl, refer to Fuel Filter/Water Separator Removal/Installation in this group.

FUEL SHUTDOWN SOLENOID

The fuel shutdown solenoid is controlled and operated by the ECM.

The fuel shutdown (shut-off) solenoid is used to electrically shut off the diesel fuel supply to the high-pressure fuel injection pump. The solenoid is mounted to the rear of the injection pump.

The solenoid controls starting and stopping of the engine regardless of the position of the accelerator pedal. When the ignition (key) switch is OFF, the solenoid is shut off and fuel flow is not allowed to the fuel injection pump. When the key is placed in the ON or START positions, fuel supply is allowed at the injection pump.

FUEL INJECTION PUMP

The fuel injection pump is a mechanical distributor–type, Bosch VP36 series (Fig. 3). A gear on the end of the injection pump shaft meshes with the drive gear at the front of engine. The pump is mechanically timed to the engine. The ECM can make adjustments to the timing of the injection pump.

DESCRIPTION AND OPERATION (Continued)

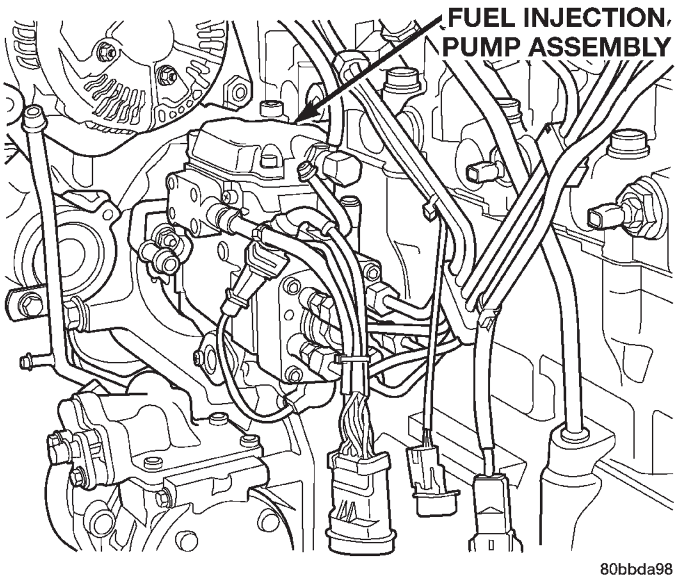


Fig. 3 Fuel Injection Pump

The injection pump contains the fuel shutdown solenoid, fuel temperature sensor, control sleeve sensor, fuel quantity actuator and the fuel timing solenoid (Fig. 3).

In the electronically controlled injection pump, the pump plunger works the same as the pump plunger in a mechanically controlled injection pump, but the amount of fuel and the time the fuel is injected is controlled by the vehicle's ECM, instead of by a mechanical governor assembly. A solenoid controlled by the ECM is used in place of the mechanical governor assembly, and it moves a control sleeve inside the pump that regulates the amount of fuel being injected. There is no mechanical connection between the accelerator pedal and the electronically controlled injection pump. Instead, a sensor connected to the accelerator pedal sends a signal to the ECM that represents the actual position of the accelerator pedal. The ECM uses this input, along with input from other sensors to move the control sleeve to deliver the appropriate amount of fuel. This system is known as "Drive-By-Wire"

The actual time that the fuel is delivered is very important to the diesel combustion process. The ECM monitors outputs from the engine speed sensor (flywheel position in degrees), and the fuel injector sensor (mechanical movement within the #1 cylinder fuel injector). Outputs from the Accelerator Pedal Position sensor , engine speed sensor (engine rpm) and engine coolant temperature sensor are also used. The ECM will then compare its set values to these outputs to electrically adjust the amount of fuel timing (amount of advance) within the injection pump. This is referred to as "Closed Loop" operation. The ECM monitors fuel timing by comparing its set value to when the injector #1 opens. If the value is greater than a preset value a fault will be set.

Actual electric fuel timing (amount of advance) is accomplished by the fuel timing solenoid mounted to the bottom of the injection pump (Fig. 3). Fuel timing will be adjusted by the ECM, which controls the fuel timing solenoid.

An overflow valve is attached into the fuel return line at the rear of the fuel injection pump (Fig. 3). This valve serves two purposes. One is to ensure that a certain amount of residual pressure is maintained within the pump when the engine is switched off. This will prevent the fuel timing mechanism within the injection pump from returning to its zero position. The other purpose is to allow excess fuel to be returned to the fuel tank through the fuel return line. The pressure values within this valve are preset and can not be adjusted.

The fuel injection pump supplies high–pressure fuel of approximately 45,000 kPa (6526 psi) to each injector in precise metered amounts at the correct time.

For mechanical injection pump timing, refer to Fuel Injection Pump Timing in the Service Procedures section of this group.

FUEL INJECTORS

Fuel drain tubes (Fig. 4) are used to route excess fuel back to the overflow valve at the rear of the injection pump. This excess fuel is then returned to the fuel tank through the fuel return line.

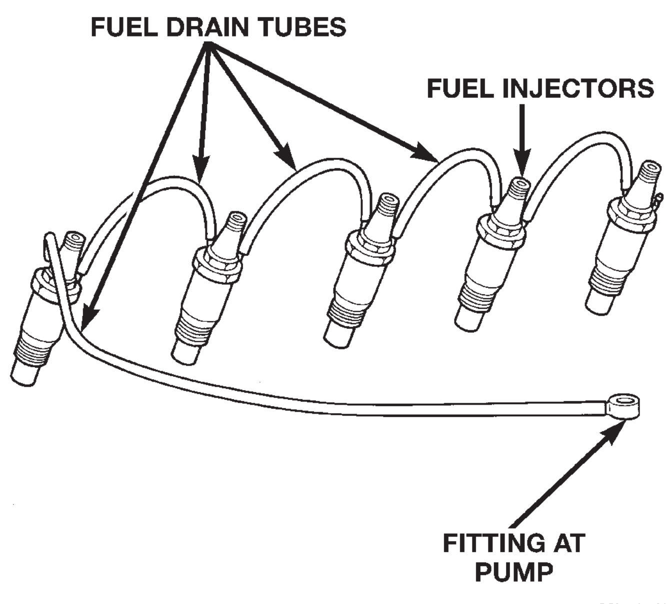


Fig. 4 Fuel Injectors and Drain Tubes

The injectors are connected to the fuel injection pump by the high– pressure fuel lines. A separate injector is used for each of the five cylinders. An injector containing a sensor (Fig. 5) is used on the

DESCRIPTION AND OPERATION (Continued)

cylinder number one injector. This injector is called instrumented injector #1 or needle movement sensor. It is used to tell the ECM when the #1 injector's internal spring-loaded valve seat has been forced open by pressurized fuel being delivered to the cylinder, which is at the end of its compression stroke. When the instrumented injector's valve seat is force open, it sends a small voltage spike pulse to the ECM. This tells the ECM that cylinder #1 is firing. It is not used with the other four injectors.

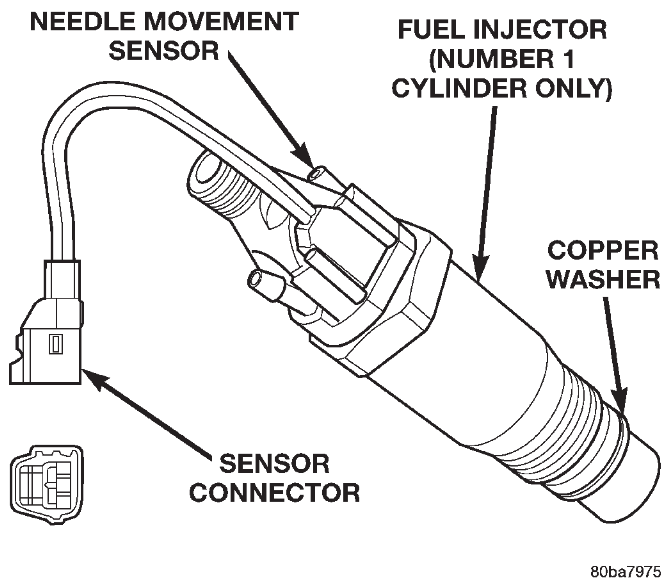


Fig. 5 Fuel Injector Sensor

Fuel enters the injector at the fuel inlet (top of injector) and is routed to the needle valve bore. When fuel pressure rises to approximately 15,000–15,800 kPa (2175–2291 psi), the needle valve spring tension is overcome. The needle valve rises and fuel flows through the spray holes in the nozzle tip into the combustion chamber. The pressure required to lift the needle valve is the injector opening pressure setting. This is referred to as the "pop-off" pressure setting.

Fuel pressure in the injector circuit decreases after injection. The injector needle valve is immediately closed by the needle valve spring and fuel flow into the combustion chamber is stopped. Exhaust gases are prevented from entering the injector nozzle by the needle valve.

A copper washer (gasket) is used at the base of each injector (Fig. 5) to prevent combustion gases from escaping.

Fuel injector firing sequence is 1–2–4–5–3.

FUEL TUBES/LINES/HOSES AND CLAMPS—LOW-PRESSURE TYPE

Also refer to the proceeding section on Quick–Connect Fittings.

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 or a quick–connect fitting. Replace complete line/tube as necessary.

Avoid contact of any fuel tubes/hoses with other vehicle components that could cause abrasions or scuffing. Be sure that the fuel lines/tubes are properly routed to prevent pinching and to avoid heat sources.

The lines/tubes/hoses are of a special construction. If it is necessary to replace these lines/tubes/hoses, use only original equipment type.

The hose clamps used to secure the rubber hoses 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 fuel leaks.

Where a rubber hose is joined to a metal tube (staked), do not attempt to repair. Replace entire line/tube assembly.

Use new original equipment type hose clamps. Tighten hose clamps to 2 N·m (20 in. lbs.) torque.

QUICK-CONNECT FITTINGS—LOW PRESSURE TYPE

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 (Fig. 6). Refer to Quick-Connect Fittings in the Removal/Installation section for more information.

CAUTION: The interior components (o-rings, spacers) of quick-connect fitting are not serviced separately, but new pull tabs are available for some types. Do not attempt to repair damaged fittings or fuel lines/tubes. If repair is necessary, replace the complete fuel tube assembly.

HIGH-PRESSURE FUEL LINES

CAUTION: The high–pressure fuel lines must be held securely in place in their holders. The lines cannot contact each other or other components. Do not attempt to weld high–pressure fuel lines or to repair lines that are damaged. Only use the recommended lines when replacement of high–pressure fuel line is necessary.

DESCRIPTION AND OPERATION (Continued)

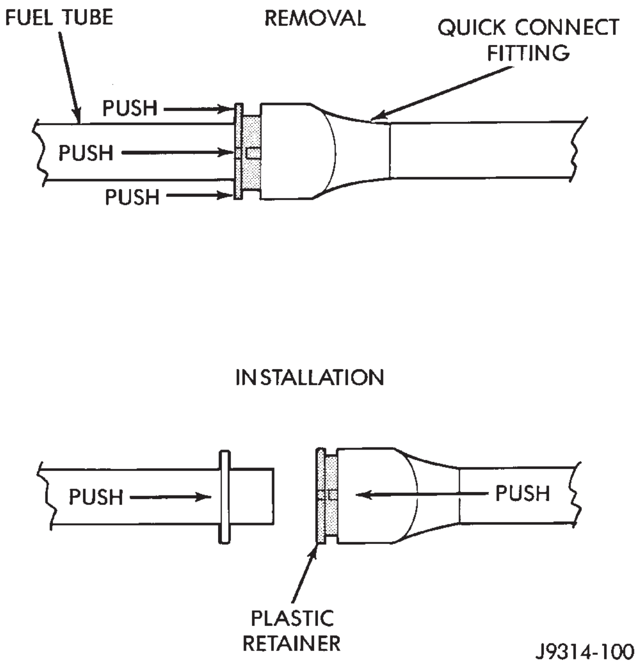


Fig. 6 Plastic Retainer Ring-Type Fitting

High–pressure fuel lines deliver fuel under pressure of up to approximately 45,000 kPa (6526 PSI) from the injection pump to the fuel injectors. The lines expand and contract from the high–pressure fuel pulses generated during the injection process. All high–pressure fuel lines are of the same length and inside diameter. Correct high–pressure fuel line usage and installation is critical to smooth engine operation.

WARNING: USE EXTREME CAUTION WHEN INSPECTING FOR HIGH–PRESSURE FUEL LEAKS. INSPECT FOR HIGH–PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. HIGH FUEL INJECTION PRESSURE CAN CAUSE PERSONAL INJURY IF CONTACT IS MADE WITH THE SKIN.

FUEL DRAIN TUBES

These rubber tubes are low–pressure type.

Some excess fuel is continually vented from the fuel injection pump. During injection, a small amount of fuel flows past the injector nozzle and is not injected into the combustion chamber. This fuel drains into the fuel drain tubes (Fig. 7) and back to the tee banjo fitting, which is connected to the same line as the overflow valve, which allows a variable quantity to return to the fuel tank. The overflow valve is calibrated to open at a preset pressure. Excess fuel not required by the pump to maintain the minimum pump cavity pressure is then returned through the overflow valve and on to the fuel tank through the fuel return line.

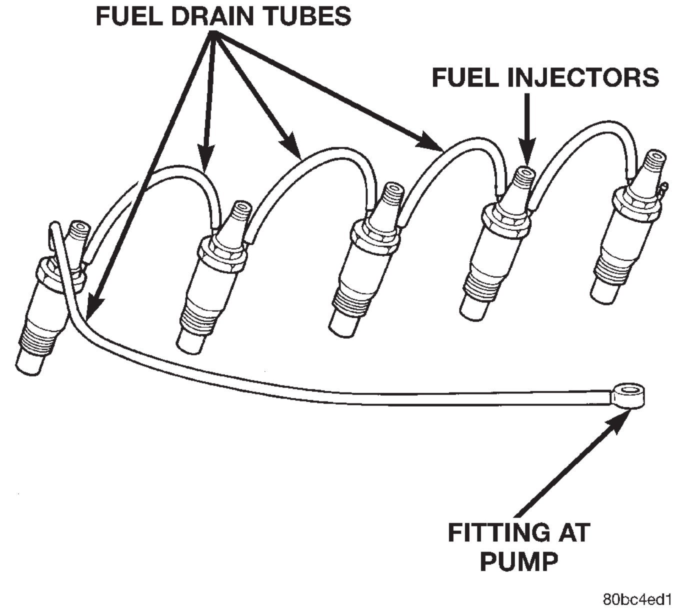


Fig. 7 Fuel Drain Tubes

FUEL HEATER

The fuel heater is used to prevent diesel fuel from waxing during cold weather operation. The fuel heater is located in the bottom plastic bowl of the fuel filter/water separator (Fig. 8).

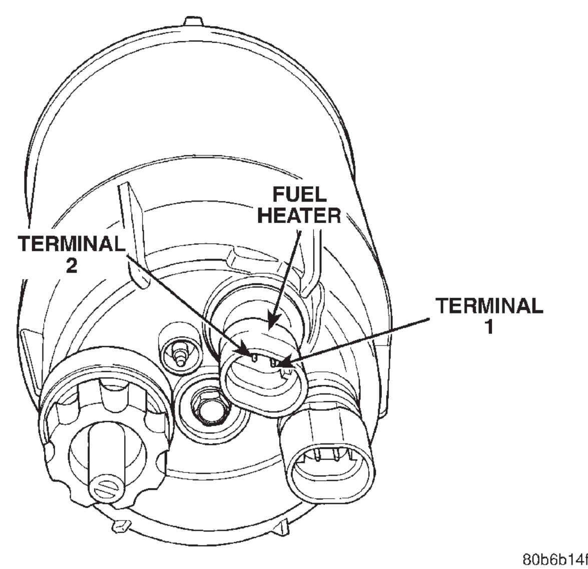


Fig. 8 Fuel Heater Temperature Sensor and Element Location

The element inside the heater assembly is made of a Positive Temperature Coefficient (PTC) material, and has power applied to it by the fuel heater relay anytime the ignition key is in the “on” position. PTC material has a high resistance to current flow when its temperature is high, which means that it will not

DESCRIPTION AND OPERATION (Continued)

generate heat when the temperature is above a certain value. When the temperature is below 7°C (45° F), the resistance of the PTC element is lowered, and allows current to flow through the fuel heater element warming the fuel. When the temperature is above 29°C (85° F), the PTC element's resistance rises, and current flow through the heater element stops.

Voltage to operate the fuel heater is supplied from the ignition (key) switch and through the fuel heater relay. Refer to the following Fuel Heater Relay for additional information. **The fuel heater and fuel heater relay are not controlled by the Powertrain Control Module (PCM).**

Current draw for the heater element is 150 watts at 14 volts (DC).

FUEL HEATER RELAY

Voltage to operate the fuel heater is supplied from the ignition (key) switch through the fuel heater relay. **The PCM or ECM is not used to control this relay.**

The fuel heater relay is located in the PDC. The PDC is located next to the battery in the engine compartment. For the location of the relay within the PDC, refer to label on PDC cover.

DIAGNOSIS AND TESTING

GENERAL INFORMATION

This section of the group will cover a general diagnosis of diesel engine fuel system components.

Diagnostic Trouble Codes: Refer to On-Board Diagnostics in Group 25, Emission Control System for a list of Diagnostic Trouble Codes (DTC's) for certain fuel system components.

VISUAL INSPECTION

A visual inspection for loose, disconnected, or incorrectly routed wires and hoses should be made before attempting to diagnose or service the diesel fuel injection system. A visual check will help find these conditions. It also saves unnecessary test and diagnostic time. A thorough visual inspection of the fuel injection system includes the following checks:

(1) Be sure that the battery connections are tight and not corroded.

(2) Be sure that the 60 way connector is fully engaged with the PCM.

(3) Be sure that the 68 way connector is fully engaged with the ECM.

(4) Verify that the electrical connections for the ASD relay are clean and free of corrosion. This relay is located in the PDC. For the location of the relay within the PDC, refer to label on PDC cover.

(5) Verify that the electrical connections for the fuel heater relay are clean and free of corrosion. This relay is located in the PDC. For the location of the relay within the PDC, refer to label on PDC cover.

(6) Be sure the electrical connectors at the ends of the glow plugs (Fig. 9) are tight and free of corrosion.

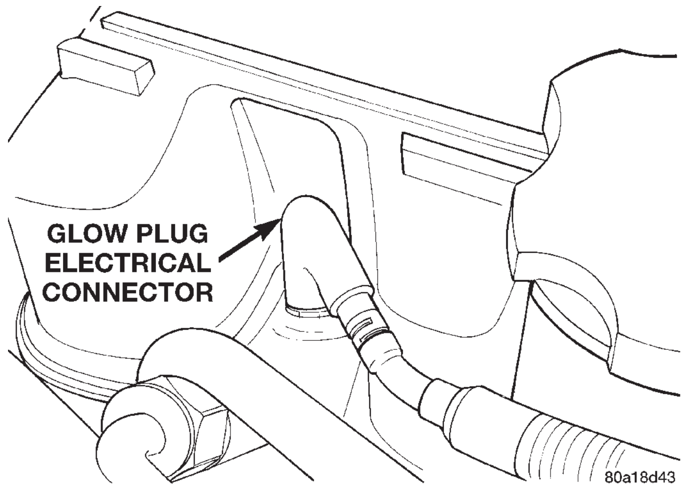


Fig. 9 Glow Plug Connector

(7) Be sure that the electrical connections at the glow plug relay are tight and not corroded. The glow plug relay is located in the engine compartment on the left–inner fender (Fig. 10) (Fig. 11).

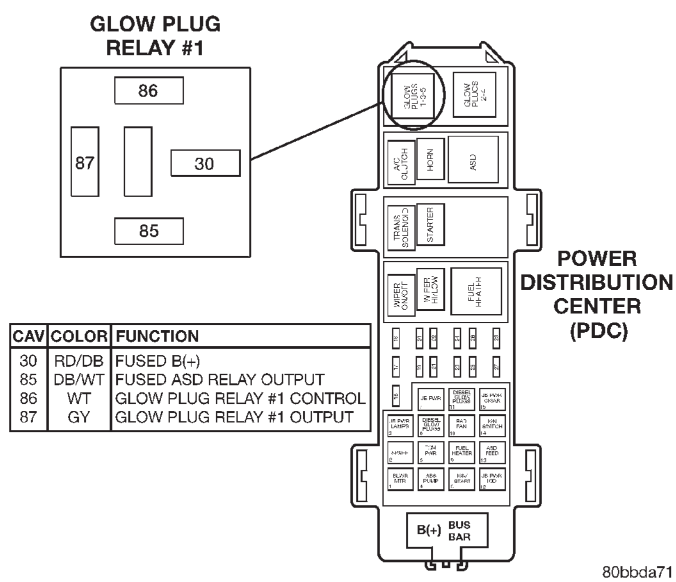


Fig. 10 Glow Plug Relay #1 Location

(8) Inspect the starter motor and starter solenoid connections for tightness and corrosion.

(9) Verify that the Fuel Injection Pump electrical connector is firmly connected. Inspect the connector for corrosion or damaged wires.

(10) Verify that the fuel heater electrical connector is firmly attached to the filter bowl at the bottom of

DIAGNOSIS AND TESTING (Continued)

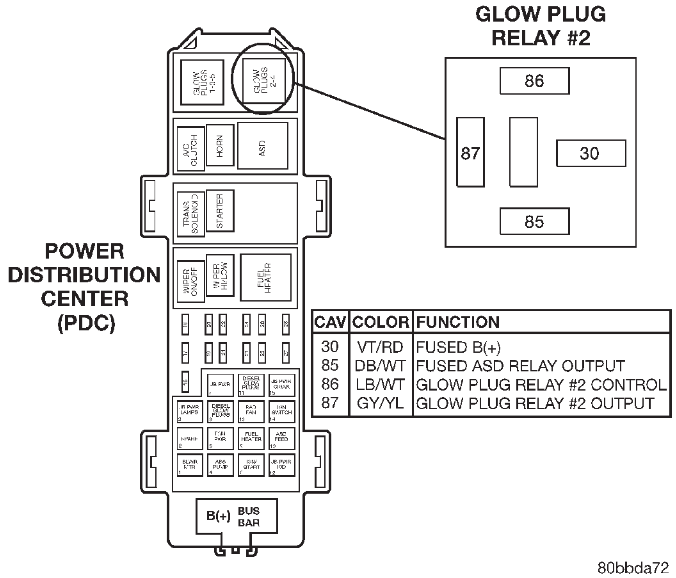


Fig. 11 Glow Plug Relay #2 Location

the fuel filter/water separator. Inspect the connector for corrosion or damaged wires.

(11) Verify that the electrical pigtail connector (sensor connector) (Fig. 12) for the fuel injector sensor is firmly connected to the engine wiring harness. Inspect the connector for corrosion or damaged wires. This sensor is used on the #1 cylinder injector only.

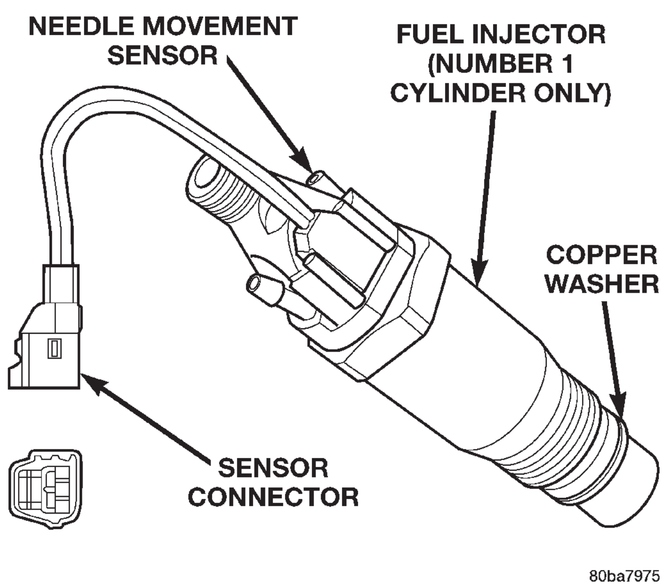


Fig. 12 Fuel Injector Sensor

(12) Inspect for exhaust system restrictions such as pinched exhaust pipes or a collapsed or plugged muffler.

(13) Verify turbocharger wastegate operation. Refer to Group 11, Exhaust System and Turbocharger Group for information.

(14) Verify that the harness connector is firmly connected to the engine coolant temperature sensors. The (PCM) E.C.T. sensor is located on the side of cylinder head near the rear of fuel injection pump (Fig. 13). The (ECM) E.C.T. sensor is located on the side of the cylinder head just to the rear of the PCM sensor (Fig. 13).

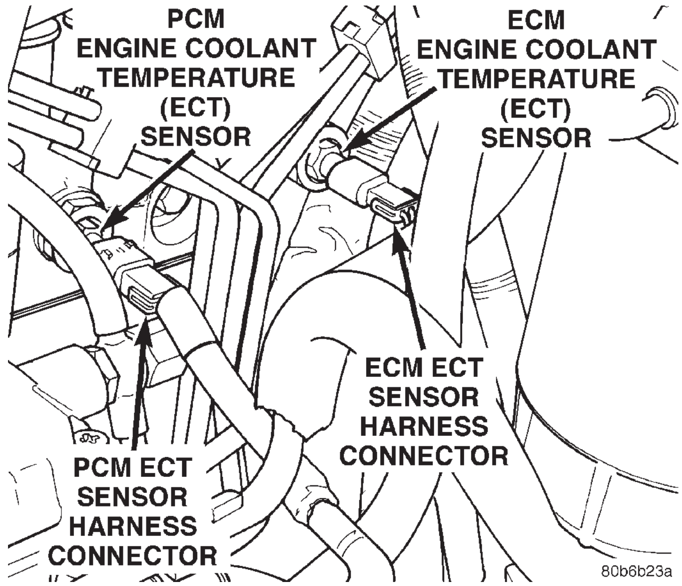


Fig. 13 Engine Coolant Temperature Sensor Locations

(15) Check for air in the fuel system. Refer to the Air Bleed Procedure.

(16) Inspect all fuel supply and return lines for signs of leakage.

(17) Be sure that the ground connections are tight and free of corrosion. Refer to Group 8, Wiring for locations of ground connections.

(18) Inspect the air cleaner element (filter) for restrictions.

(19) Be sure that the turbocharger output hose is properly connected to the charge air cooler (intercooler) inlet tube. Verify that the charge air cooler output hose is properly connected to the cooler and the intake manifold. Refer to Group 11, Exhaust System and Turbocharger for information.

(20) Be sure that the vacuum hoses to the vacuum pump are connected and not leaking. The vacuum pump is located in the front of engine (internal) and is driven from the crankshaft gear (Fig. 14). Disconnect the hose and check for minimum vacuum from the pump. Refer to Group 5, Brake System for specifications and procedures.

(21) Be sure that the accessory drive belt is not damaged or slipping.

(22) Verify there is a good connection at the engine speed sensor. Refer to the Fuel Injection System in this section for location of the engine speed sensor location.

DIAGNOSIS AND TESTING (Continued)

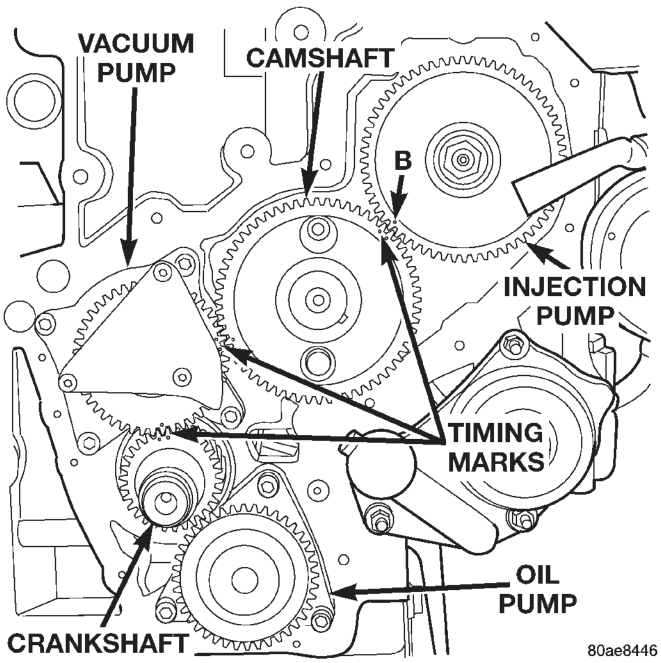


Fig. 14 Vacuum Pump at Front of Engine

(23) Verify there is a good connection at the Boost Pressure Sensor, which is a part of the air intake assembly.

AIR IN FUEL SYSTEM

Air will enter the fuel system whenever the fuel supply lines, fuel filter/water separator, fuel filter bowl, injection pump, high–pressure lines or injectors are removed or disconnected. Air will also enter the fuel system whenever the fuel tank has been run empty.

Air trapped in the fuel system can result in hard starting, a rough running engine, engine misfire, low power, excessive smoke and fuel knock. After service is performed, air must be bled from the system before starting the engine.

Inspect the fuel system from the fuel tank to the injectors for loose connections. Leaking fuel is an indicator of loose connections or defective seals. Air can also enter the fuel system between the fuel tank and the injection pump. Inspect the fuel tank and fuel lines for damage that might allow air into the system.

For air bleeding, refer to Air Bleed Procedure in the Service Procedures section of this group.

FUEL HEATER RELAY TEST

The fuel heater relay is located in the Power Distribution Center (PDC). Refer to Relays—Operation/Testing in Fuel Ingection System section of this group for test procedures.

FUEL INJECTOR TEST

The fuel injection nozzels, located on the engine cylinder head, spray fuel under high pressure into the individual combustion chambers. Pressurized fuel, delivered by the fuel injection pump, unseats a spring-loaded needle valve inside the injector, and the fuel is atomized as it escapes through the injector opening into the engine's combustion chamber. If the fuel injector does not operate properly, the engine may misfire, or cause other driveability problems.

A leak in the injection pump–to–injector high–pressure fuel line can cause many of the same symptoms as a malfunctioning injector. Inspect for a leak in the high–pressure lines before checking for a malfunctioning fuel injector.

WARNING: THE INJECTION PUMP SUPPLIES HIGH–PRESSURE FUEL OF UP TO APPROXIMATELY 45,000 KPA (6526 PSI) TO EACH INDIVIDUAL INJECTOR THROUGH THE HIGH–PRESSURE LINES. FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE THE SKIN AND CAUSE PERSONAL INJURY. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING. AVOID CONTACT WITH FUEL SPRAY WHEN BLEEDING HIGH–PRESSURE FUEL LINES.

WARNING: DO NOT BLEED AIR FROM THE FUEL SYSTEM OF A HOT ENGINE. DO NOT ALLOW FUEL TO SPRAY ONTO THE EXHAUST MANIFOLD WHEN BLEEDING AIR FROM THE FUEL SYSTEM.

To determine which fuel injector is malfunctioning, run the engine and loosen the high–pressure fuel line nut at the injector (Fig. 15). Listen for a change in engine speed. If engine speed drops, the injector was operating normally. If engine speed remains the same, the injector may be malfunctioning. After testing, tighten the line nut to 30 N·m (22 ft. lbs.) torque. Test all injectors in the same manner one at a time.

Once an injector has been found to be malfunctioning, remove it from the engine and test it. Refer to the Removal/Installation section of this group for procedures.

After the injector has been removed, install it to a bench–mount injector tester. Refer to operating instructions supplied with tester for procedures.

The opening pressure or "pop" pressure should be 15,000–15,800 kPa (2175–2291 psi). If the fuel injector needle valve is opening ("popping") to early or to late, replace the injector.

DIAGNOSIS AND TESTING (Continued)

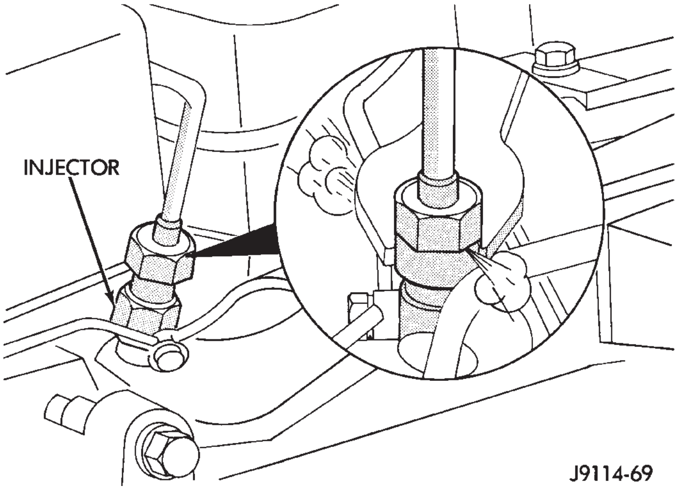


Fig. 15 Typical Inspection of Fuel Injector

FUEL INJECTOR / NEEDLE MOVEMENT SENSOR TEST

The needle movement sensor is used only on the number–1 cylinder fuel injector (Fig. 16). It is not used on the injectors for cylinders number 2, 3, 4 or 5.

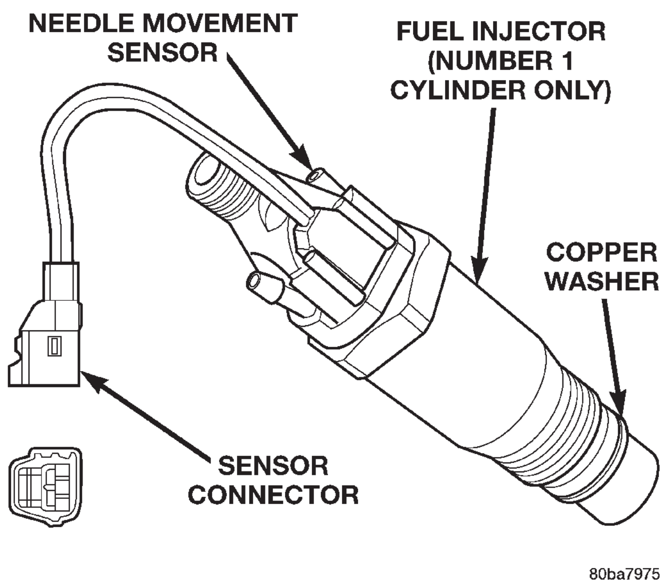


Fig. 16 Needle Movement Sensor Location

Testing the needle movement sensor requires the use of a DRB Scan tool. Refer to the Powertrain Diagnostic Procedures manual for additional information.

FUEL INJECTION PUMP TEST

The injection pump is not to be serviced or the warranty may be voided. If the injection pump requires service, the complete assembly must be replaced.

Incorrect injection pump timing (mechanical or electrical) can cause poor performance, excessive smoke and emissions and poor fuel economy.

A defective fuel injection pump, defective fuel timing solenoid or misadjusted mechanical pump timing can cause starting problems or prevent the engine from revving up. It can also cause:

- Engine surge at idle
- Rough idle (warm engine)
- Low power
- Excessive fuel consumption
- Poor performance
- Low power
- Black smoke from the exhaust
- Blue or white fog like exhaust
- Incorrect idle or maximum speed

The electronically controlled fuel pump has no mechanical governor like older mechanically controlled fuel pumps. Do not remove the top cover of the fuel pump, or the screws fastening the wiring pigtail to the side of the pump. **The warranty of the injection pump and the engine may be void if those seals have been removed or tampered with.**

FUEL SUPPLY RESTRICTIONS

LOW–PRESSURE LINES

Restricted or Plugged supply lines or fuel filter can cause a timing fault that will cause the ECM to operate the engine in a “Limp Home” mode. See the introduction of the Fuel Injection System in this group for more information on the Limp Home mode. Fuel supply line restrictions can cause starting problems and prevent the engine from revving up. The starting problems include; low power and blue or white fog like exhaust. Test all fuel supply lines for restrictions or blockage. Flush or replace as necessary. Bleed the fuel system of air once a fuel supply line has been replaced. Refer to the Air Bleed Procedure section of this group for procedures.

HIGH–PRESSURE LINES

Restricted (kinked or bent) high–pressure lines can cause starting problems, poor engine performance and black smoke from exhaust.

Examine all high–pressure lines for any damage. Each radius on each high–pressure line must be smooth and free of any bends or kinks.

Replace damaged, restricted or leaking high–pressure fuel lines with the correct replacement line.

CAUTION: The high–pressure fuel lines must be clamped securely in place in the holders. The lines cannot contact each other or other components. Do not attempt to weld high–pressure fuel lines or to repair lines that are damaged. Only use the recommended lines when replacement of high–pressure fuel line is necessary.

DIAGNOSIS AND TESTING (Continued)

FUEL SHUTDOWN SOLENOID TEST

Refer to the 3.1L Diesel Powertrain Diagnostic Manual for the Fuel Shutdown Solenoid test.

HIGH-PRESSURE FUEL LINE LEAK TEST

High–pressure fuel line leaks can cause starting problems and poor engine performance.

WARNING: DUE TO EXTREME FUEL PRESSURES OF UP TO 45,000 KPA (6526 PSI), USE EXTREME CAUTION WHEN INSPECTING FOR HIGH–PRESSURE FUEL LEAKS. DO NOT GET YOUR HAND, OR ANY PART OF YOUR BODY NEAR A SUSPECTED LEAK. INSPECT FOR HIGH–PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. HIGH FUEL INJECTION PRESSURE CAN CAUSE PERSONAL INJURY IF CONTACT IS MADE WITH THE SKIN.

Start the engine. Move the cardboard over the high–pressure fuel lines and check for fuel spray onto the cardboard (Fig. 17). If a high–pressure line connection is leaking, bleed the system and tighten the connection. Refer to the Air Bleed Procedure in this group for procedures. Replace damaged, restricted or leaking high–pressure fuel lines with the correct replacement line.

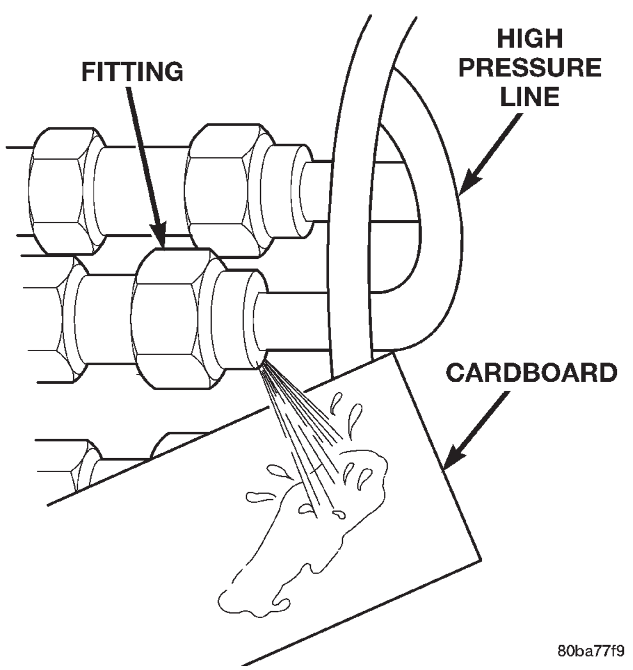


Fig. 17 Typical Fuel Pressure Test at Injection Pump

CAUTION: The high–pressure fuel lines must be clamped securely in the holders. The lines cannot contact each other or other components. Do not attempt to weld high–pressure fuel lines or to repair lines that are damaged. Only use the recommended lines when replacement of high–pressure fuel line is necessary.

SERVICE PROCEDURES

AIR BLEED PROCEDURES

AIR BLEEDING AT FUEL FILTER

A certain amount of air may become trapped in the fuel system when fuel system components are serviced or replaced. Bleed the system as needed after fuel system service according to the following procedures.

WARNING: DO NOT BLEED AIR FROM THE FUEL SYSTEM OF A HOT ENGINE. DO NOT ALLOW FUEL TO SPRAY ONTO THE EXHAUST MANIFOLD WHEN BLEEDING AIR FROM THE FUEL SYSTEM.

Some air enters the fuel system when the fuel filter or injection pump supply line is changed. This small amount of air is vented automatically from the injection pump through the fuel drain manifold tubes if the filter was changed according to instructions. Ensure the bowl of the fuel filter/water separator is full of fuel

It may be necessary to manually bleed the system if:

- The bowl of the fuel filter/water separator is not partially filled before installation of a new filter
- The injection pump is replaced
- High–pressure fuel line connections are loosened or lines replaced
- Initial engine start–up or start–up after an extended period of no engine operation
- Running fuel tank empty

FUEL INJECTION PUMP BLEEDING

(1) If the fuel injection pump has been replaced, air should be bled at the overflow valve before attempting to start engine.

(a) Loosen the overflow valve (Fig. 18) at the rear of the injection pump.

(b) Place a towel below the valve.

WARNING: WHEN CRANKING THE ENGINE TO BLEED AIR FROM THE INJECTION PUMP, THE ENGINE MAY START. PLACE THE TRANSMISSION IN NEUTRAL OR PARK AND SET PARKING BRAKE BEFORE ENGAGING THE STARTER MOTOR.

CAUTION: Do not engage the starter motor for more than 30 seconds at a time. Allow 2 minutes between cranking intervals.

SERVICE PROCEDURES (Continued)

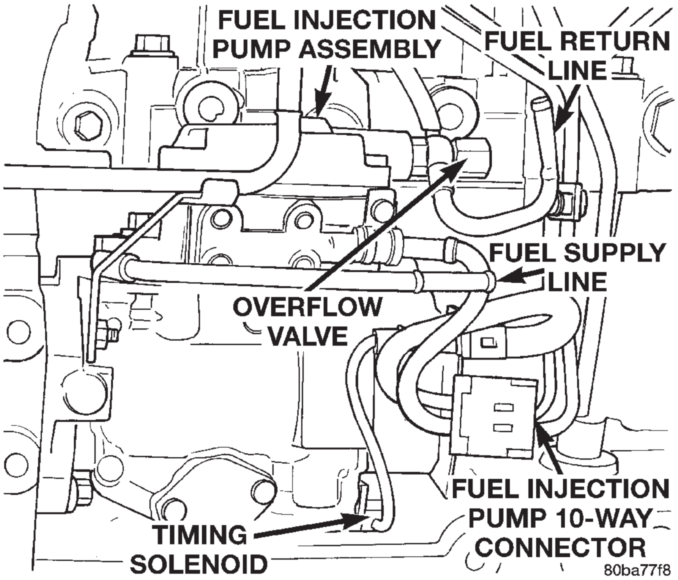


Fig. 18 Overflow Valve

(2) Crank the engine for 30 seconds at a time to allow air trapped in the injection pump to vent out the fuel injector drain tubes. Continue this procedure until the engine starts. Observe the previous WARNING and CAUTION.

(3) Tighten overflow valve.

HIGH–PRESSURE FUEL LINE BLEEDING

WARNING: THE INJECTION PUMP SUPPLIES HIGH–PRESSURE FUEL OF APPROXIMATELY 59,000 KPA (8,557 PSI) TO EACH INDIVIDUAL INJECTOR THROUGH THE HIGH–PRESSURE LINES. FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE THE SKIN AND CAUSE PERSONAL INJURY. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING AND AVOID CONTACT WITH FUEL SPRAY WHEN BLEEDING HIGH–PRESSURE FUEL LINES.

WARNING: DO NOT BLEED AIR FROM THE FUEL SYSTEM OF A HOT ENGINE. DO NOT ALLOW FUEL TO SPRAY ONTO THE EXHAUST MANIFOLD WHEN BLEEDING AIR FROM THE FUEL SYSTEM.

Bleed air from one injector at time.

(1) Loosen the high–pressure fuel line fitting at the injector (Fig. 19).

(2) Crank the engine until all air has been bled from the line. **Do not operate the starter motor for longer than 30 seconds. Wait 2 minutes between cranking intervals.**

(3) Start the engine and bleed one injector at a time until the engine runs smoothly.

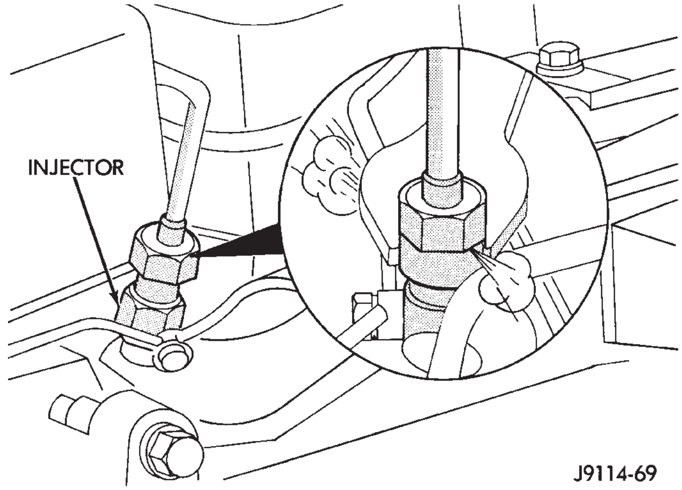


Fig. 19 Bleeding High–Pressure Fuel Line—Typical

FUEL INJECTION PUMP TIMING

Refer to the Fuel Injection Pump Removal and Installation procedure in Service Procedures later in this Group.

REMOVAL AND INSTALLATION

AIR CLEANER ELEMENT

REMOVAL

(1) Loosen 4 clamps holding air cleaner housing halves together.

(2) Remove top of air cleaner housing.

(3) Remove element from air cleaner housing.

INSTALLATION

(1) Install a new element in housing.

(2) Position housing halves together.

(3) Snap clamps into place.

FUEL DRAIN TUBES

The fuel drain tubes (Fig. 20) are low–pressure type.

Pull each tube from the injector for removal. Push on for installation. Clamps are not required for these tubes.

FUEL FILTER/WATER SEPARATOR

The fuel filter/water separator is located in the engine compartment on the left side behind the generator (Fig. 21).

The fuel filter/water separator assembly contains the fuel filter, fuel heater element, and fuel drain valve.

DRAINING WATER FROM FILTER BOWL

Moisture (water) collects at the bottom of the filter/separator in a plastic bowl. Water entering the fuel

REMOVAL AND INSTALLATION (Continued)

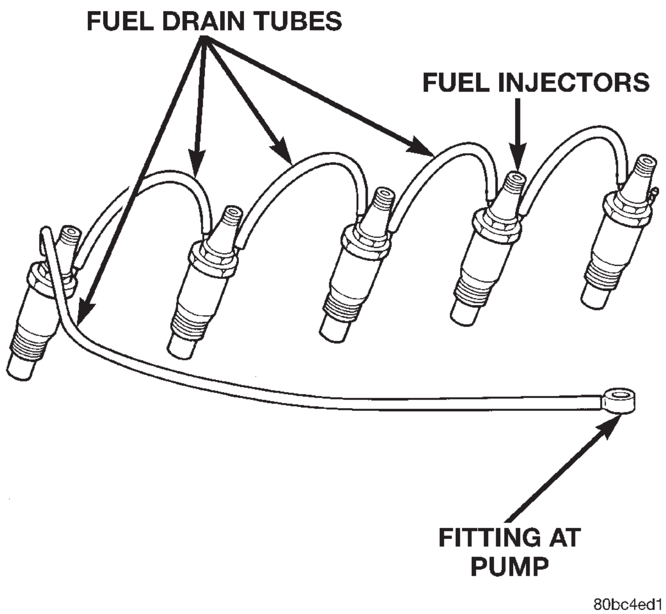


Fig. 20 Fuel Injectors and Drain Tubes

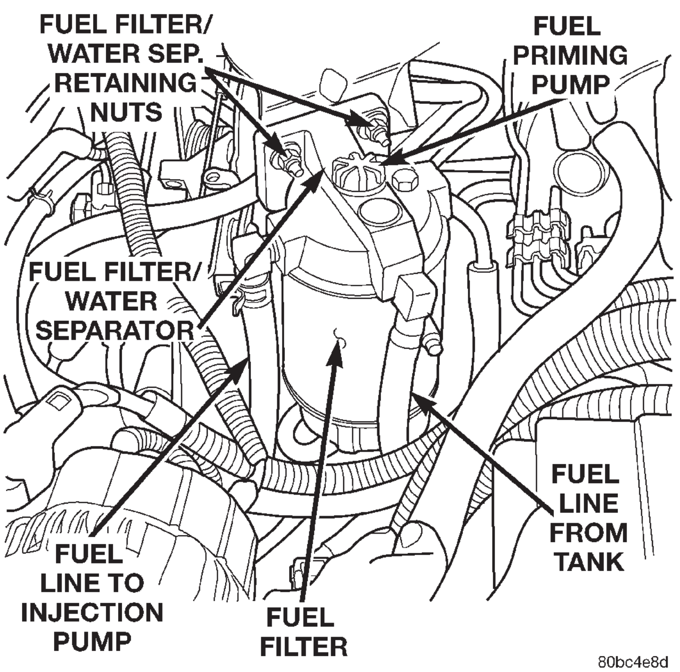


Fig. 21 Fuel Filter / Water Separator Position & Orientation

injection pump can cause serious damage to the pump. **Note that the bulb will be illuminated for approximately 2 seconds each time the key is initially placed in the ON position. This is done for a bulb check.**

WARNING: DO NOT ATTEMPT TO DRAIN WATER FROM THE FILTER/SEPARATOR WITH THE ENGINE HOT.

(1) The bottom of the filter/separator bowl is equipped with a drain valve. The drain valve is equipped with a fitting. Attach a piece of rubber hose to this fitting. This hose is to be used as a drain hose.

(2) Place a drain pan under the drain hose.

(3) With the engine not running, open the drain valve (unscrew—drain valve has right hand threads) from the filter/separator bowl. To gain access to this fitting, the two filter–to–mounting bracket nuts may have to be loosened a few turns.

(4) Hold the drain open until clean fuel exits the drain.

(5) After draining, close drain valve.

(6) Remove rubber drain hose.

(7) Dispose of mixture in drain pan according to applicable local or federal regulations.

FUEL FILTER REMOVAL

(1) Drain all fuel and/or water from fuel filter/water separator assembly. Refer to the previous Draining Water From Filter Bowl.

(2) Unplug the electrical connectors at bottom of plastic bowl.

(3) Remove plastic bowl from bottom of fuel filter (unscrews).

(4) Remove fuel filter from bottom of filter base (unscrews).

FUEL FILTER INSTALLATION

(1) Clean bottom of fuel filter base.

(2) Apply clean diesel fuel to new fuel filter gasket.

(3) Install and tighten filter to filter base. The beveled part of the rubber gasket should be facing up towards the filter base.

(4) Clean the inside of bowl with a soap and water mixture before installation. Carefully clean any residue between the two metal probes at the top of the water–in–fuel sensor. Do not use chemical cleaners as damage to the plastic bowl may result.

(5) Pour diesel fuel into the plastic bowl before installing bowl to bottom of fuel filter. Do this to help prevent air from entering fuel injection pump while attempting to starting engine.

(6) Install filter bowl to bottom of filter.

(7) Install the electrical connectors at bottom of bowl.

(8) Tighten the filter–to–mounting bracket nuts (Fig. 21) to 28 N·m (250 in. lbs.) torque.

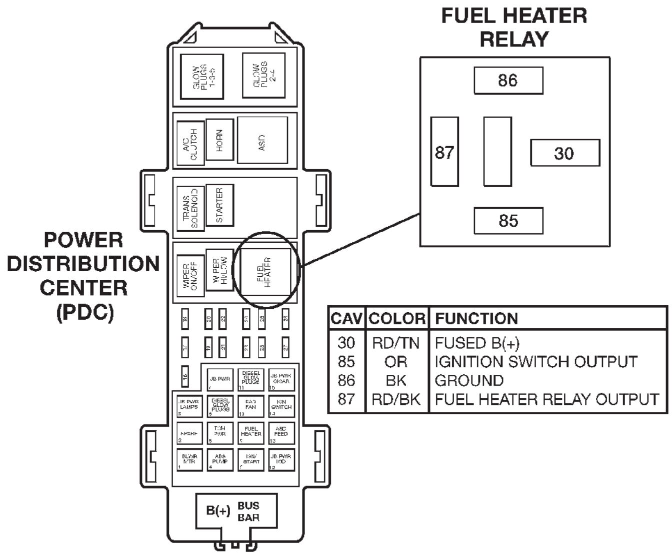
FUEL HEATER

If the fuel heater element needs replacement, the plastic filter bowl assembly must be replaced. Refer to Fuel Filter/Water Separator for information.

REMOVAL AND INSTALLATION (Continued)

FUEL HEATER RELAY

The fuel heater relay is located in the PDC. For the location of the relay within the PDC (Fig. 22), refer to label on PDC cover.



CAV	COLOR	FUNCTION
30	RD/TN	FUSED B(+)
85	OR	IGNITION SWITCH OUTPUT
86	BK	GROUND
87	RD/BK	FUEL HEATER RELAY OUTPUT

Fig. 22 Power Distribution Center (PDC)

FUEL LEVEL SENSOR

The fuel level sensor is located on the side of the fuel pump module.

REMOVAL

(1) Remove fuel tank. Refer to Fuel Tank Removal/Installation.

(2) Remove fuel pump module. Refer to Fuel Pump Module Removal/Installation

(3) Remove electrical wire connector at sending unit terminals.

(4) Press on release tab (Fig. 23) to remove level sensor from the pump module.

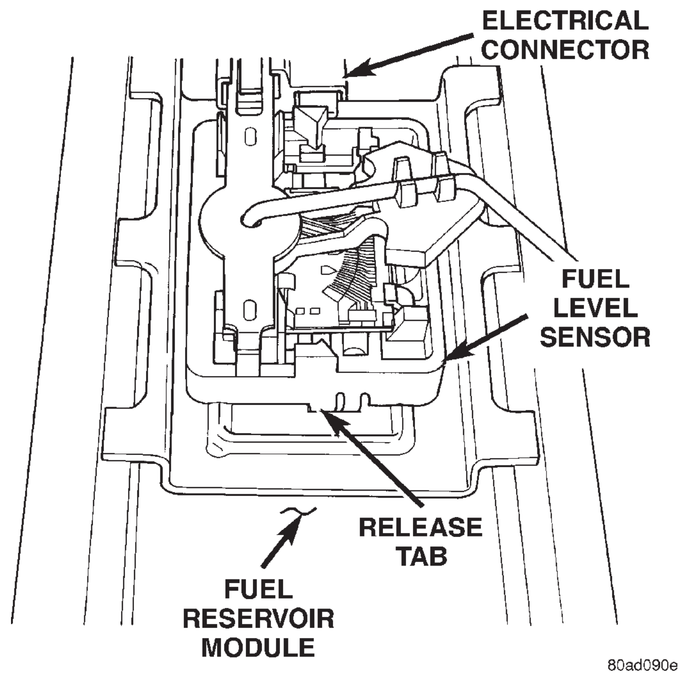


Fig. 23 Fuel Level Sensor Release Tab

FUEL INJECTION PUMP

REMOVAL

(1) Disconnect the negative battery cable.

(2) Remove the intake air duct retaining bolts from the top of the intake manifold.

(3) Disconnect the intercooler outlet hose from the intercooler.

(4) Remove the engine intake air duct and hose assembly from the vehicle.

(5) Remove the engine accessory drive belt. Refer to Group 7, Cooling System for the procedure.

(6) Remove the generator assembly. Refer to Group 8C, Charging System for the procedure.

(7) Thoroughly the clean the area around the injection pump and fuel lines of all dirt, grease and other contaminants. **Due to the close internal tolerances of the injection pump, this step must be performed before removing pump.**

(8) Remove the rubber fuel return and supply hoses from the metal lines at the pump (Fig. 24).

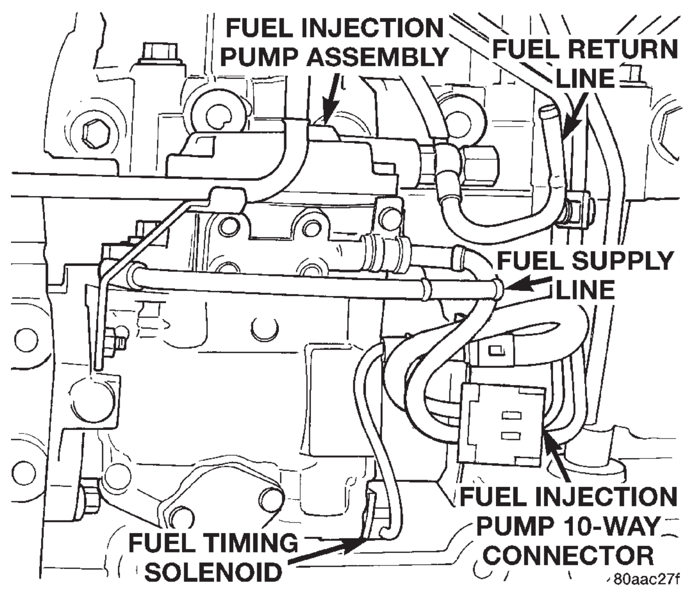


Fig. 24 Fuel Injection Pump

(9) Disconnect the engine coolant temperature sensor electrical connector (Fig. 25). Located closest to the injection pump.

(10) Disconnect the Fuel Injection Pump electrical connector at the pump. (Fig. 24).

(11) Disconnect the main engine wiring harness from the glow plugs.

REMOVAL AND INSTALLATION (Continued)

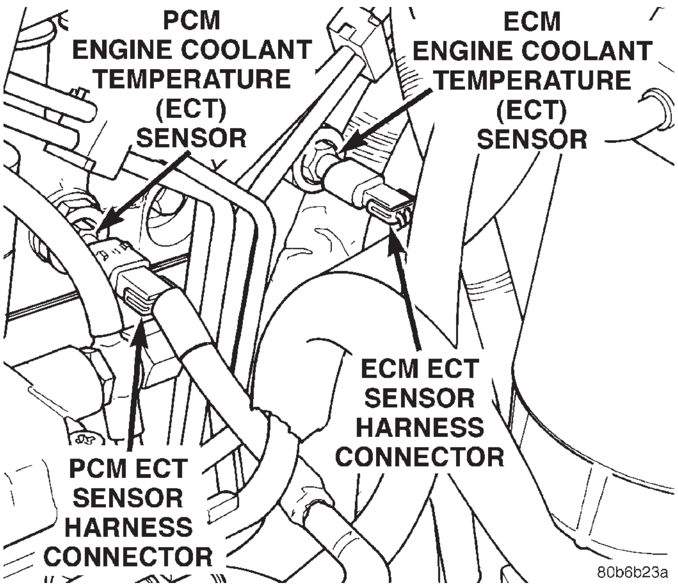


Fig. 25 Engine Coolant Temperature Sensors

(12) Disconnect the five high–pressure fuel lines from the fuel injection pump. Also disconnect fuel lines at the fuel injectors. For procedures, refer to High–Pressure Fuel Lines in this group. Place a rag beneath the fittings to catch excess fuel.

(13) Remove the plug from timing gear cover.

(14) The "Top Dead Center" (T.D.C.) compression firing position for the #1 cylinder can be determined as follows:

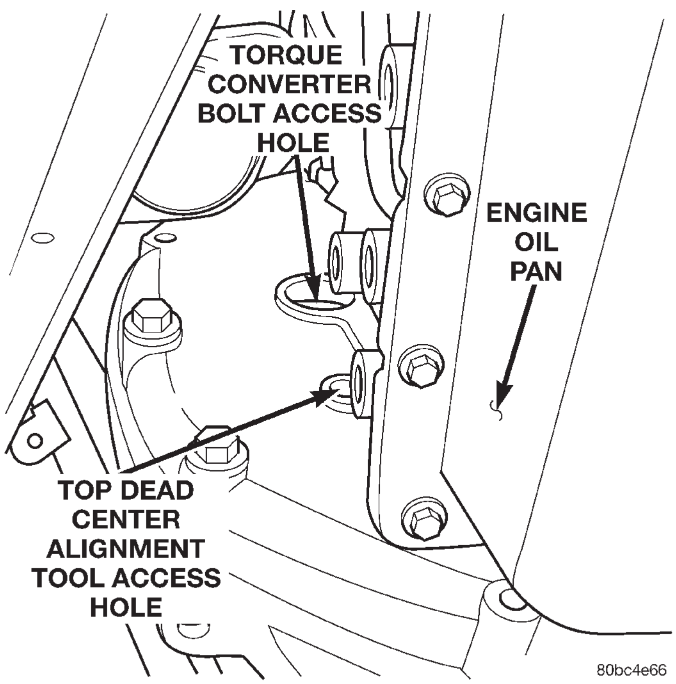


Fig. 26 Top Dead Center Alignment Tool Access Hole

(a) Using a socket attached to the front of the crankshaft, rotate the engine clockwise until special alignment tool VM# 8374 can be inserted through the T.D.C. tool access hole in the right side of the transmission adapter plate (Fig. 26), stopping the flywheel rotation. This position is T.D.C. or 360° (crankshaft deg.) away from T.D.C. **Engine must be positioned at T.D.C. on #1 cylinder compression firing stroke.**

(b) To verify that you are at T.D.C. Remove the oil fill cap from the cylinder head cover and the alignment tool from the transmission adapter plate.

(c) Rotate the crankshaft one-quarter turn counter-clockwise and clockwise while observing the cylinder #2 intake rocker arm through the oil fill cap hole. (The intake valve rocker arm should stop moving). If the rocker arm does not move you have identified T.D.C.

(d) If T.D.C. was found continue the procedure, if not rotate the crankshaft one revolution (360°) until the alignment tool can be re-installed in the flexplate (Fig. 26). T.D.C. is now identified for the #1 cylinder compression firing stroke. Mark the damper and timing cover for quick reference to T.D.C. Remove the alignment tool from the transmission adapter plate.

(15) Remove access plug and plug washer at rear of pump (Fig. 27). Thread special dial indicator and adapter tool VM# 1011 (Fig. 28) into this opening. Hand tighten only.

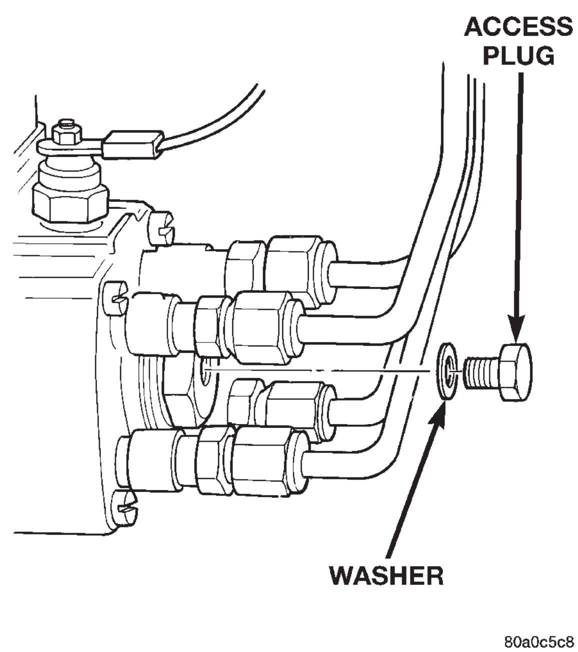


Fig. 27 Access Plug at Rear of Pump

(16) Slowly rotate the engine in a counter-clockwise direction until the dial gauge indicator stops moving (20°-25° before T.D.C.).

REMOVAL AND INSTALLATION (Continued)

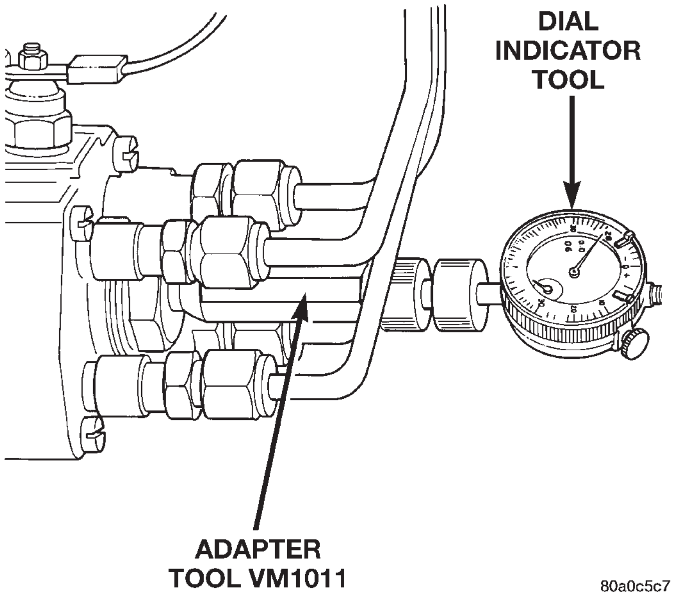


Fig. 28 Installing Dial Indicator and Special Adapter Tools

(17) Remove the injection pump drive gear nut (Fig. 29).

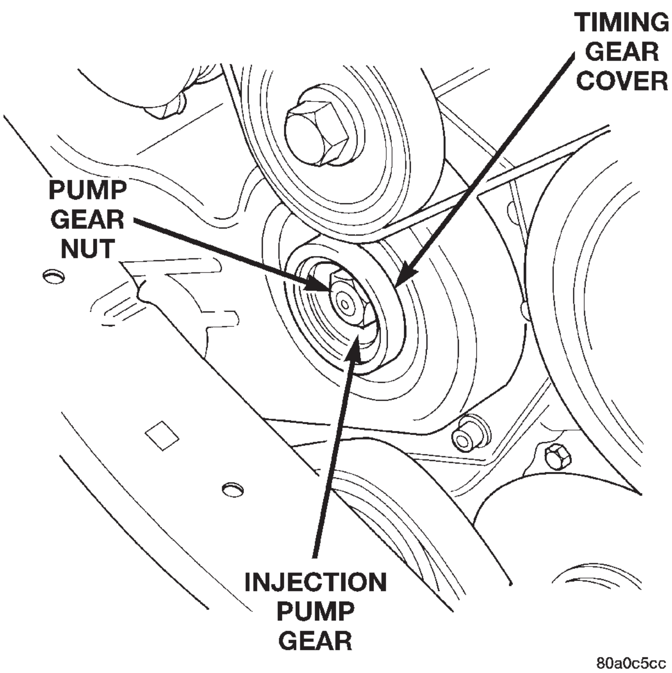


Fig. 29 Removing Pump Drive Gear Nut

(18) A special 3–piece gear removal tool set VM# 1003 (Fig. 30) must be used to remove the injection pump drive gear from the pump shaft.

(a) Thread the adapter (Fig. 31) into the timing cover.

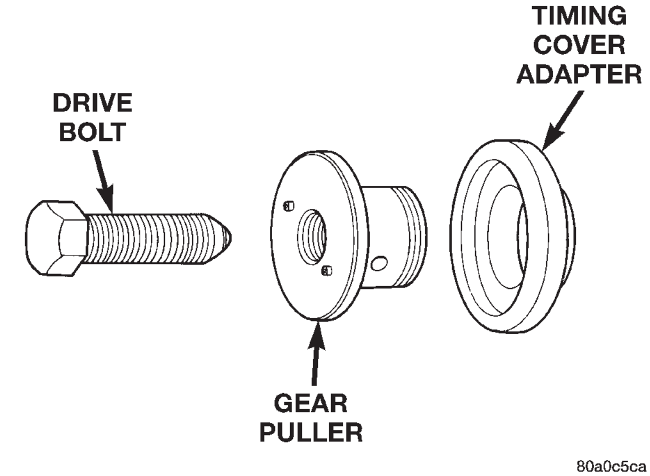


Fig. 30 Pump Gear Tools

(b) Thread the gear puller into the injection pump drive gear (Fig. 31). This tool is also used to hold the gear in synchronization during pump removal.

(c) Remove the three injection pump–to–gear cover mounting nuts (Fig. 32). **CAUTION: This step must be done to prevent injection pump damage.**

(d) Install the drive bolt into the gear puller (Fig. 31). Tighten the drive bolt to press (remove) the drive gear from injection pump shaft while driving injection pump rearward from timing gear cover mounting studs.

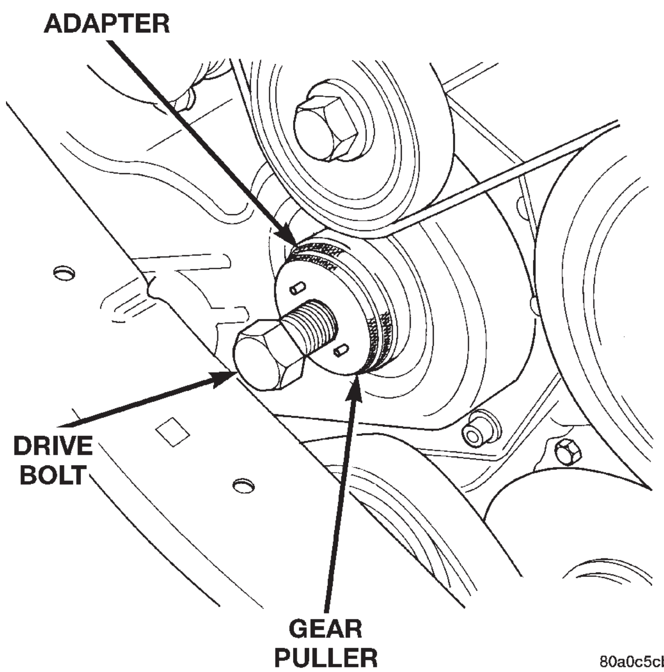


Fig. 31 Installing Pump Drive Gear Removal Tools

REMOVAL AND INSTALLATION (Continued)

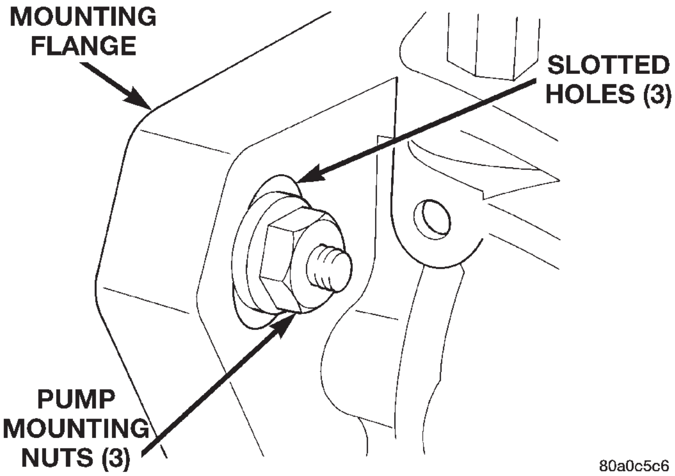


Fig. 32 Injection Pump Mounting Nuts

(19) Remove pump from engine. **Do not rotate engine while gear puller is installed. Engine damage will occur.**

INSTALLATION / ADJUSTING INJECTION PUMP TIMING

NOTE: Engine should be positioned at 20°- 25° degrees before T.D.C.

(1) Clean the mating surfaces of injection pump and timing gear cover.

(2) Install a new injection pump–to–timing gear cover gasket.

(3) Remove the gear removing bolt (drive bolt) from gear puller. **CAUTION: Do not remove the special gear puller or timing cover adapter tools from timing cover at this time. Gear misalignment will result.**

(4) Place the key way on the pump shaft to the 11 o'clock position as viewed from the front of pump. Install the pump into the rear of timing gear cover while aligning the key way on pump shaft into pump gear.

(5) Install and snug the 3 injection pump mounting nuts. This is not the final tightening sequence.

(6) Remove the special gear puller and adapter tools from timing gear cover.

(7) Install the injection pump drive gear nut. Torque the nut to 88 N·m (65 ft. lbs.) torque.

(8) Remove the access plug and plug washer at rear of pump (Fig. 33). Thread special dial indicator adapter tool VM# 1011 (Fig. 34) into this opening. Hand tighten only.

(9) Attach special dial indicator tool VM# 1013 into the adapter tool (Fig. 34)

(10) Using a socket attached to the front of the crankshaft, rotate the engine in a counter-clockwise direction until the dial gauge indicator stops moving (20°-25° before T.D.C.).

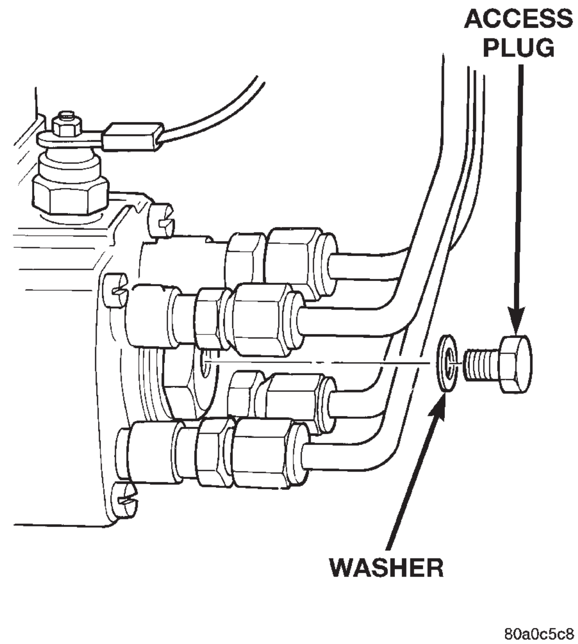


Fig. 33 Access Plug at Rear of Pump

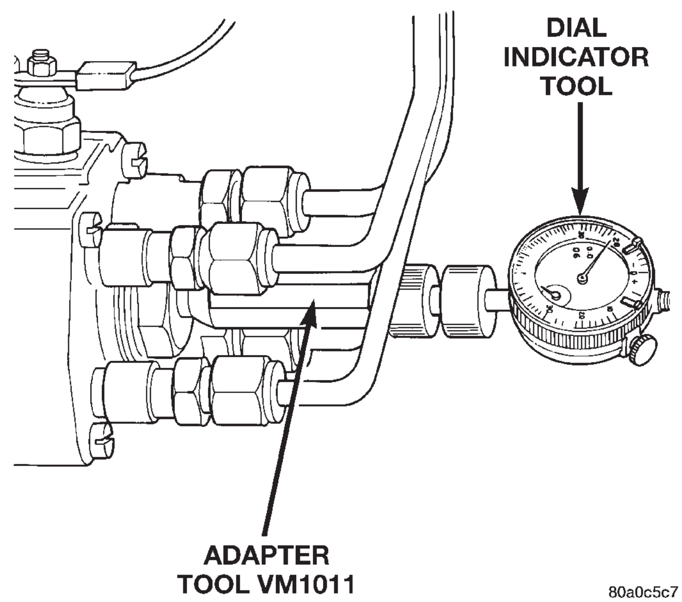


Fig. 34 Installing Dial Indicator and Special Adapter Tools

(11) Set the dial indicator to 0 mm. Be sure the tip of the dial indicator is touching the tip inside the adapter tool.

(12) Rotate the crankshaft clockwise until the alignment tool can be reinstalled in the flexplate (Fig. 35).

REMOVAL AND INSTALLATION (Continued)

NOTE: Engine must be positioned at T.D.C. #1 cylinder compression stroke.

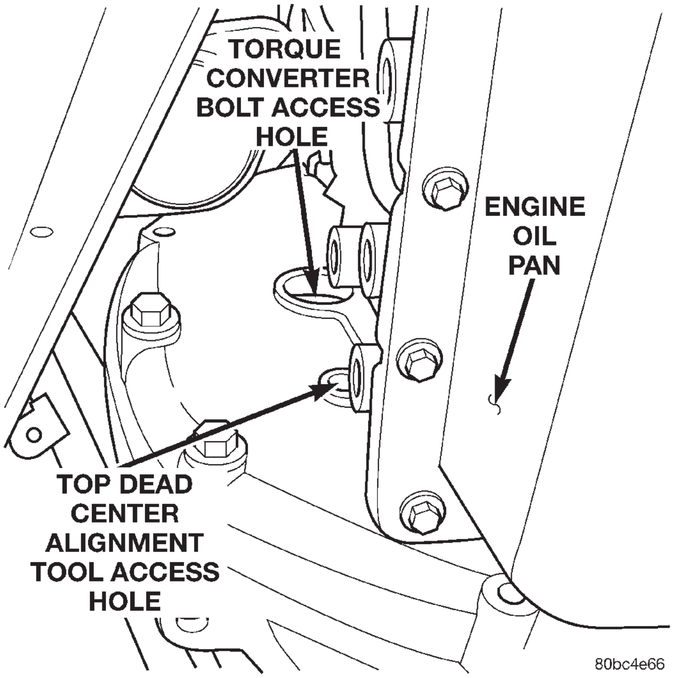


Fig. 35 Top Dead Center Alignment Tool Access Hole

(13) The gauge reading should be at 0.45 mm. If not, the pump must be rotated for adjustment:

NOTE: If the engine is fitted with all new gears, the specification is 0.49 - 0.50 mm.

(a) Loosen the three injection pump mounting nuts at the mounting flanges. These flanges are equipped with slotted holes. The slotted holes are used to rotate and position the injection pump for fuel timing. Loosen the three nuts just enough to rotate the pump.

(b) Rotate the pump until 0.45 mm is indicated on the dial indicator gauge. If while rotating the pump the 0.45 mm specification is passed do not attempt to rotate the pump in the opposite direction. You must rotate the pump back to 0.15 mm and start the procedure over from the start of the T.D.C. procedure. This will prevent a false reading due to gear backlash.

(c) Tighten the three pump mounting nuts to 30 N·m (22 ft. lbs.) torque.

(d) Recheck the dial indicator after tightening the pump mounting nuts. Gauge should still be reading 0.45 mm at T.D.C.

(14) Remove the dial indicator and adapter tools.

(15) Install access plug and washer to rear of injection pump.

(16) Install plug at timing gear cover.

(17) Install and connect the five high–pressure fuel lines to the fuel injection pump. Also connect fuel lines at the fuel injectors. For procedures, refer to High–Pressure Fuel Lines in this group.

(18) Install electrical connector at engine coolant temperature sensor.

(19) Connect electrical connector at fuel shutdown solenoid.

(20) Connect the main engine wiring harness to the glow plugs.

(21) Connect the fuel timing solenoid pigtail harness to the engine wiring harness.

(22) Connect the overflow valve/banjo fitting (fuel return line assembly). Replace copper gaskets before installing.

(23) Connect the rubber fuel return and supply hoses to metal lines at pump. Tighten hose clamps to 2 N·m (20 in. lbs.) torque.

(24) Install the generator assembly. Refer to Group 8C, Charging System for the procedure.

(25) Install the engine accessory drive belt. Refer to Group 7, Cooling System for the procedure.

(26) Position the gasket and Install the intake air duct on the intake manifold. Torque the bolts to 27 N·m (20 ft. lbs.).

(27) Install the intercooler outlet hose on the intercooler.

(28) Connect the negative battery cable.

(29) Start the engine and bring to normal operating temperature.

(30) Check for fuel leaks.

FUEL INJECTORS

Four fuel injectors are used on each engine. Of these four, two different types are used. The fuel injector used on cylinder number one is equipped with a fuel injector sensor (Fig. 36). The other three fuel injectors are identical. **Do not place the fuel injector equipped with the fuel injector sensor into any other location except the cylinder number one position.**

REMOVAL

(1) Disconnect negative battery cable at battery.

(2) Thoroughly clean the area around the injector with compressed air.

(3) Remove the fuel drain hoses (tubes) at each injector (Fig. 37) being serviced. Each of these hoses is slip–fit to the fitting on injector.

(4) Remove the high–pressure fuel line at injector being removed. Refer to High–Pressure Fuel Lines in this group for procedures.

(5) Remove the injector using special socket tool number VM.1012A. When removing cylinder number one injector, thread the wiring harness through the access hole on the special socket (Fig. 38).

REMOVAL AND INSTALLATION (Continued)

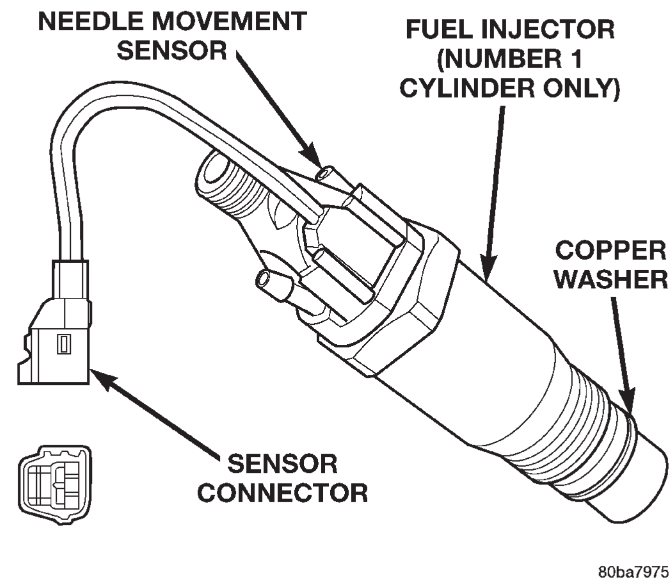


Fig. 36 Fuel Injector Sensor — #1 Cylinder

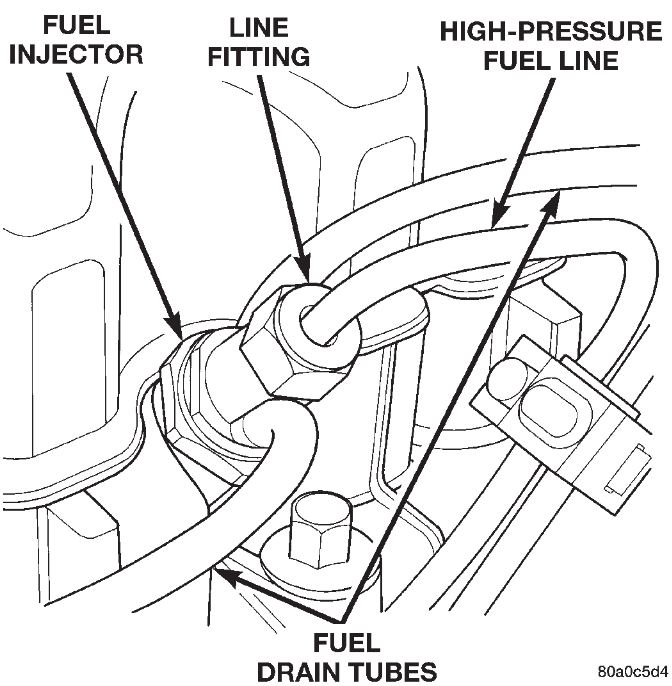


Fig. 37 Fuel Injector—Typical

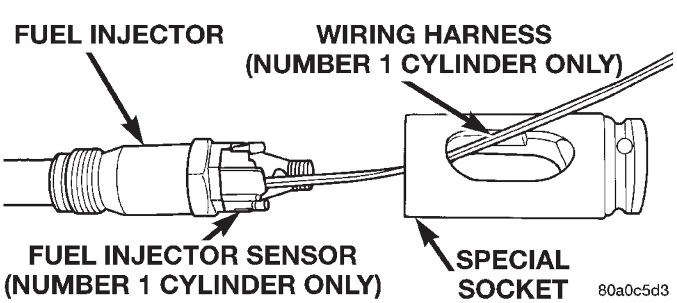


Fig. 38 Wiring Harness Through Socket

(6) Remove and discard the copper washer (seal) at bottom of injector (Fig. 36).

INSTALLATION

(1) Clean the injector threads in cylinder head.

(2) Install new copper washer (seal) to injector.

(3) Install injector to engine. Tighten to 70 N·m (52 ft. lbs.) torque.

(4) Install high–pressure fuel lines. Refer to High–Pressure Fuel Lines in this group for procedures.

(5) Install fuel drain hoses (tubes) to each injector. Do not use clamps at fuel drain hoses.

(6) Connect negative battery cable to battery.

(7) Bleed the air from the high–pressure lines. Refer to the Air Bleed Procedure section of this group.

HIGH-PRESSURE LINES

All high–pressure fuel lines are of the same length and inside diameter. Correct high–pressure fuel line usage and installation is critical to smooth engine operation.

CAUTION: The high–pressure fuel lines must be clamped securely in place in the holders. The lines cannot contact each other or other components. Do not attempt to weld high–pressure fuel lines or to repair lines that are damaged. Only use the recommended lines when replacement of high–pressure fuel line is necessary.

REMOVAL

(1) Disconnect negative battery cable from battery.

(2) Remove the necessary clamps holding the lines to the engine.

(3) Clean the area around each fuel line connection. Disconnect each line at the top of each fuel injector (Fig. 39).

(4) Disconnect each high–pressure line fitting at each fuel injection pump delivery valve.

(5) Very carefully remove each line from the engine. Note the position (firing order) of each line while removing. **Do not bend the line while removing.**

CAUTION: Be sure that the high–pressure fuel lines are installed in the same order that they were removed. Prevent the injection pump delivery valve holders from turning when removing or installing high–pressure lines from injection pump.

REMOVAL AND INSTALLATION (Continued)

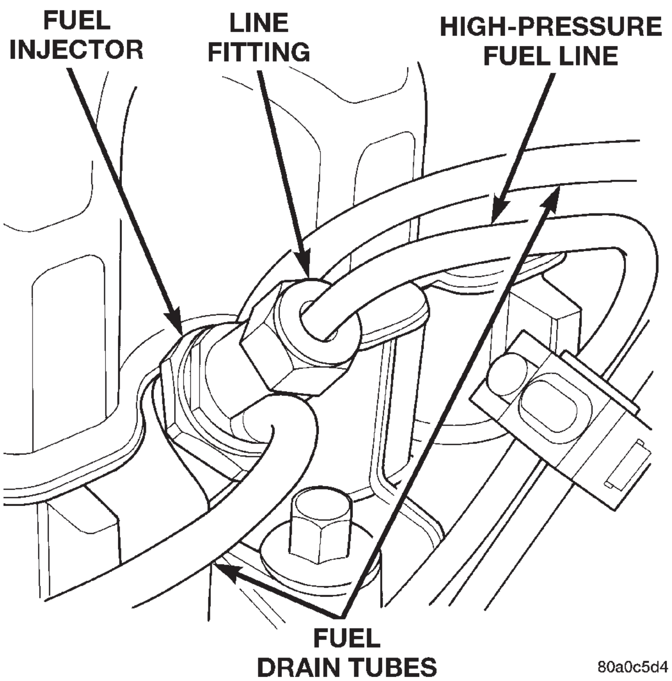


Fig. 39 Fuel Lines at Fuel Injectors

INSTALLATION

(1) Carefully position each high–pressure fuel line to the fuel injector and fuel injection pump delivery valve holder in the correct firing order. Also position each line in the correct line holder.

(2) Loosely install the line clamp/holder bolts.

(3) Tighten each line at the delivery valve to 19 N·m (168 in. lbs.) torque.

(4) Tighten each line at the fuel injector to 19 N·m (168 in. lbs.) torque.

Be sure the lines are not contacting each other or any other component.

(5) Bleed air from the fuel system. Refer to the Air Bleed Procedure section of this group.

SPECIFICATIONS

FUEL TANK CAPACITY

78 Liters (20.5 Gals.)

Nominal refill capacities are shown. A variation may be observed from vehicle to vehicle due to manufacturing tolerances, ambient temperatures and refill procedures.

IDLE SPEED

750 RPM ±25 RPM with engine at normal operating temperature.

FUEL INJECTOR FIRING SEQUENCE

1–2–4–5–3

FUEL SYSTEM PRESSURE

Peak Injection Pressure/Fuel Injection Pump Operating Pressure: 40,000–45,000 kPa (5801–6526 psi).

Opening Pressure of Fuel Injector: 16,500–17,300 kPa (2393–2509 psi).

FUEL INJECTION SYSTEM—3.1L DIESEL ENGINE

INDEX

GENERAL INFORMATION

INTRODUCTION

This section will cover components either regulated or controlled by the ECM controller and the Powertrain Control Module (PCM). The fuel heater relay and fuel heater are not operated by the ECM controller or the PCM. These components are controlled by the ignition (key) switch. All other fuel system electrical components necessary to operate the engine are controlled or regulated by the ECM controller, which interfaces with the PCM. Refer to the following description for more information.

Certain fuel system component failures may cause a no start, or prevent the engine from running. It is important to know that the ECM has a feature where, if possible, it will ignore the failed sensor, set a code related to the sensor, and operate the engine in a “Limp Home” mode. When the ECM is operating in a “Limp Home” mode, the Check Engine Lamp on the instrument panel may be constantly illuminated, and the engine will most likely have a noticeable loss of performance. An example of this would be an Accelerator Pedal Position Sensor failure, and in that situation, the engine would run at a constant 1100 RPM, regardless of the actual position of the pedal. This is the most extreme of the three “Limp Home” modes.

When the Check Engine Lamp is illuminated constantly with the key on and the engine running,, it usually indicates a problem has been detected somewhere within the fuel system. The DRBIII scan tool is the best method for communicating with the ECM and PCM to diagnose faults within the system.

DESCRIPTION AND OPERATION

POWERTRAIN CONTROL MODULE (PCM) AND ENGINE CONTROL MODULE (ECM)

The Engine Control Module (ECM) is mounted underneath the left rear seat. The Powertrain Control Module (PCM) is mounted in the engine compartment.

The ECM Controller is a pre–programmed, digital computer. It will either directly operate or partially regulate the:

- Speed Control
- Speed Control lamp
- Fuel Timing Solenoid
- Check Engine Light
- Glow Plug Relay
- Glow Plugs
- Glow Plug Lamp
- ASD Relay
- Air Conditioning
- Tachometer
- Electric Vacuum Modulator (EVM)

The ECM can adapt its programming to meet changing operating conditions.

The ECM receives input signals from various switches and sensors. Based on these inputs, the ECM regulates various engine and vehicle operations through different system components. These components are referred to as **ECM Outputs.** The sensors and switches that provide inputs to the ECM are considered **ECM Inputs.**

ECM Inputs are:

- Air Conditioning Selection
- Theft Alarm
- ASD Relay
- Control Sleeve Position Sensor
- Fuel Temperature Sensor
- Mass Air Flow Sensor
- Accelerator Pedal Position Sensor
- Engine Coolant Temperature Sensor
- Low Idle Position Switch
- 5 Volt Supply
- Vehicle Speed Sensor
- Engine Speed/Crank Position Sensor (rpm)
- Needle Movement Sensor
- Starter Signal
- Brake Switch
- Speed Control Switch
- Power Ground
- Ignition (key) Switch Sense

ECM Outputs:

After inputs are received by the ECM and PCM, certain sensors, switches and components are controlled or regulated by the ECM and PCM. These are considered **ECM Outputs.** These outputs are for:

- A/C Clutch Relay (for A/C clutch operation)
- Speed Control Lamp
- ASD Relay
- 5 Volts Supply
- Fuel Quantity Actuator
- Fuel Timing Solenoid
- Fuel Shutdown Solenoid
- Glow Plug Lamp
- Check Engine Lamp (“On/Off” signal)
- Electric Vacuum Modulator (EVM)
- Glow Plug Relay
- Tachometer

The PCM sends and receives signals to and from the ECM controller. **PCM inputs are:**

- Power Ground
- 5 Volts Supply
- Vehicle Speed Sensor
- Water-In-Fuel Sensor
- Coolant Temperature Sensor
- Low Coolant Sensor
- Sensor Return
- Fuel Level Sensor
- Oil Pressure Sensor
- Tachometer Signal
- Glow Plug Lamp
- Check Engine Lamp (“On/Off” signal)
- Brake On/Off Switch
- Battery Voltage
- ASD Relay

PCM Outputs:

- A/C On Signal
- Vehicle Theft Alarm “Ok to Run” signal
- Body Control Module CCD Bus (+)
- Body Control Module CCD Bus (–)
- Scan Tool Data Link Receive
- Scan Tool Data Link Transmit
- Low Coolant Lamp
- Generator Control

BOOST / PRESSURE SENSOR

The Boost Pressure Sensor is mounted to the top of the intake manifold (Fig. 1). It is a sensor that measures both manifold vacuum and turbo boost, and it also contains an integrated intake air temperature sensor. The Boost Pressure Sensor takes the place of the Mass Air Flow (MAF). In the Intake Air Temperature Sensor component, there is a ceramic element that changes its resistance based on temperature. The ceramic element is part of an electronic circuit connected to the PCM, and has a voltage applied to it. The ceramic element is exposed to the air inside the intake. This air has a cooling effect on the ceramic element, and its resistance changes. This causes the voltage flowing through the intake air temperature circuit to vary. The voltage signal produced by the Intake Air Temperature Sensor changes

DESCRIPTION AND OPERATION (Continued)

inversely to the temperature, and is measured by the PCM. As a general rule, when the temperature of the air in the intake is high, the voltage signal produced by the Intake Air Temperature Sensor is low. The component of the Boost Pressure Sensor that measures manifold vacuum and turbo boost produces a voltage signal that is proportional to the pressure in the intake manifold. When the intake manifold pressure is low, the voltage is low, and when the pressure is high, the voltage is high. The PCM uses the voltage signals from the Boost Pressure Sensor, and the Intake Air Temperature Sensor to determine the amount of air flowing through the intake manifold.

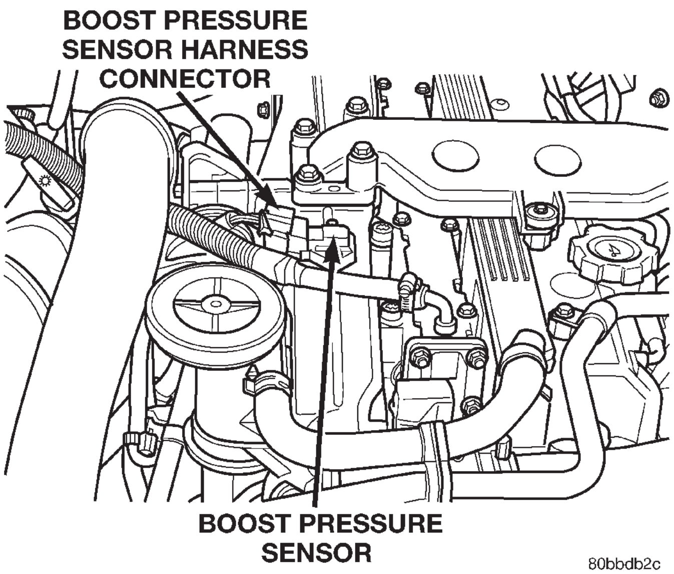


Fig. 1 Boost Pressure Sensor Location

VEHICLE THEFT ALARM

The PCM can learn if the vehicle has a Vehicle Theft Alarm (VTA) system. Once it detects the vehicle having VTA, **the controller can ONLY BE USED ON VEHICLES WITH VTA.**

If the PCM is put it on a vehicle without VTA the Glow Plug Lamp will start to blink and the vehicle will not start.

The PCM cannot be flashed to remove the VTA.

BATTERY VOLTAGE—PCM INPUT

The battery voltage input provides power to the PCM. It also informs the PCM what voltage level is being supplied by the generator once the vehicle is running.

The battery input also provides the voltage that is needed to keep the PCM memory alive. The memory stores Diagnostic Trouble Code (DTC) messages. Trouble codes will still be stored even if the battary voltage is lost.

SENSOR RETURN—ECM/PCM INPUT (ANALOG GROUND)

Sensor Return provides a low noise Analog ground reference for all system sensors.

IGNITION CIRCUIT SENSE—PCM/ECM INPUT

The ignition circuit sense input signals the PCM and ECM that the ignition (key) switch has been turned to the ON position. This signal initiates the glow plug control routine to begin the "pre–heat" cycle.

POWER GROUND

Provides a common ground for power devices (solenoid and relay devices).

NEEDLE MOVEMENT OR INTRUMENTED FIRST INJECTOR—ECM INPUT

This input from the ECM supplies a constant 30 mA electrical current source for the first injector sensor. It will vary the voltage to this sensor when it senses a mechanical movement within the injector needle (pintle) of the number–1 cylinder fuel injector. When this voltage has been determined by the ECM, it will then control an output to the fuel timing solenoid (the fuel timing solenoid is located on the fuel injection pump). Also refer to Fuel Injection Pump for additional information.

The first injector sensor is a magnetic (inductive) type.

The first injector sensor is used only on the fuel injector for the number–1 cylinder (Fig. 2).

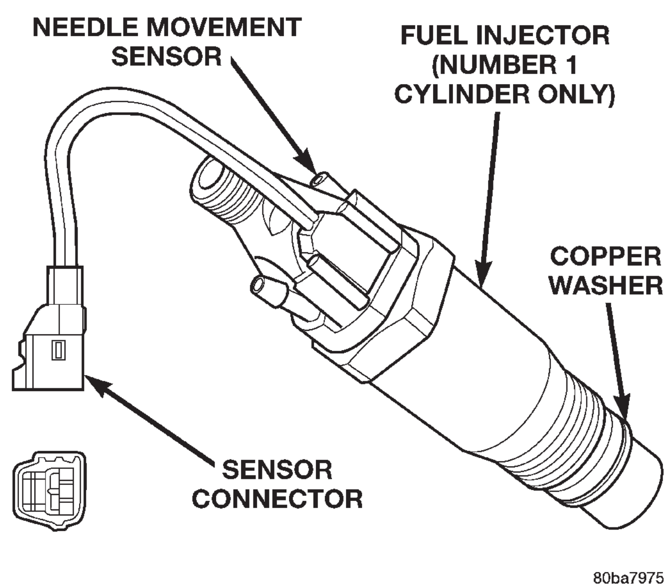


Fig. 2 Fuel Injector Sensor

DESCRIPTION AND OPERATION (Continued)

FUEL INJECTOR SENSOR—GROUND

Provides a low noise ground for the fuel injector sensor only.

ENGINE COOLANT TEMPERATURE SENSOR—ECM/PCM INPUT

The 0–5 volt input from this sensor tells the ECM and PCM the temperature of the engine coolant. Based on the voltage received at the ECM, it will then determine operation of the fuel timing solenoid, glow plug relay, electrical vacuum modulator (emission component) and generator (charging system).

The sensor is located on the side of the #3 cylinder head near the rear of fuel injection pump (Fig. 3).

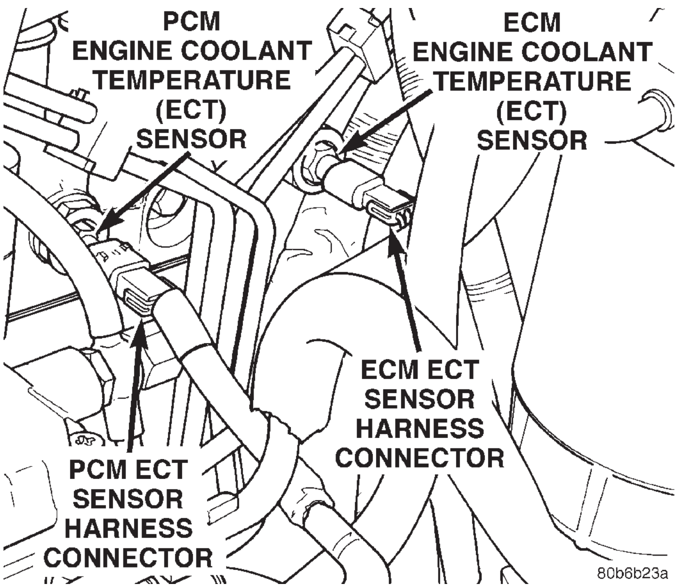


Fig. 3 Engine Coolant Temperature Sensor Location

ENGINE SPEED/CRANK POSITION SENSOR—ECM INPUT

The engine speed sensor is mounted to the transmission bellhousing at the right/rear side of the engine block (Fig. 4).

The engine speed sensor produces its own output signal. If this signal is not received, the ECM will not allow the engine to start.

The engine speed sensor input is used in conjunction with the first injector sensor to establish fuel injection pump timing.

The flywheel has five notches at its outer edge. Each notch is spaced equally every 72°. The notches cause a pulse to be generated when they pass under the speed sensor. These pulses are the input to the ECM. The input from this sensor determines crankshaft position (in degrees) by monitoring the notches.

The sensor also generates an rpm signal to the ECM. This signal is used as an input for the control of the generator field, vehicle speed control, and instrument panel mounted tachometer.

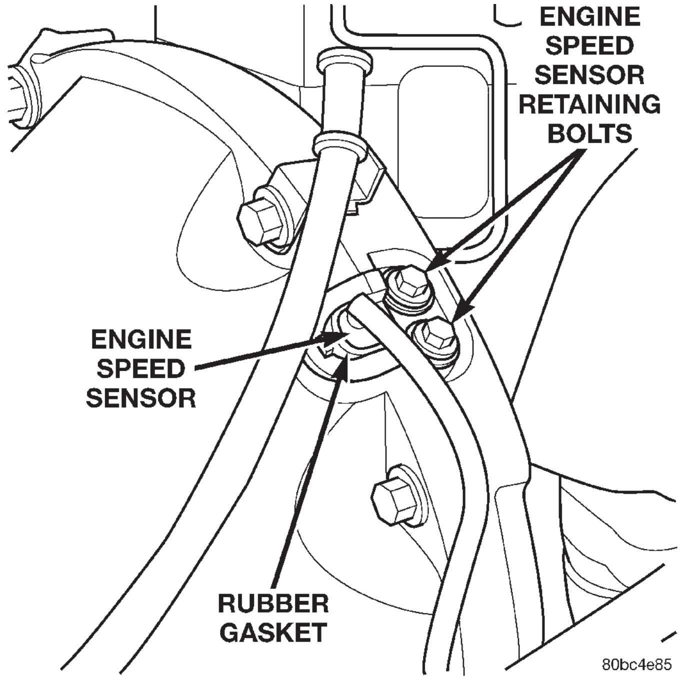


Fig. 4 Engine Speed Sensor Location

If the engine speed sensor should fail, the system is unable to compensate for the problem and the car will stop.

AIR CONDITIONING (A/C) CONTROLS—ECM INPUTS

The A/C control system information applies to factory installed air conditioning units.

A/C REQUEST SIGNAL: When either the A/C or Defrost mode has been selected and the A/C low and high–pressure switches are closed, an input signal is sent to the ECM. The ECM uses this input to cycle the A/C compressor through the A/C relay.

If the A/C low or high–pressure switch opens, the ECM will not receive an A/C request signal. The PCM will then remove the ground from the A/C relay. This will deactivate the A/C compressor clutch. Also, if the engine coolant reaches a temperature outside normal of its normal range, or it overheats, the ECM will deactivate the A/C clutch.

BRAKE SWITCH—ECM INPUT

When the brake light switch is activated, the ECM receives an input indicating that the brakes are being applied. After receiving this input, the ECM is used to control the speed control system. There is a Primary and a Secondary brake switch. The Secondary brake switch is closed until the brake pedal is pressed.

DESCRIPTION AND OPERATION (Continued)

DATA LINK CONNECTOR—PCM AND ECM INPUT AND OUTPUT

The 16–way data link connector (diagnostic scan tool connector) links the Diagnostic Readout Box (DRB) scan tool with the PCM and ECM. The data link connector is located under the instrument panel near the left body side cowl panel on left hand drive vehicles (Fig. 5). And near the right body side cowl panel on right hand drive vehicles.

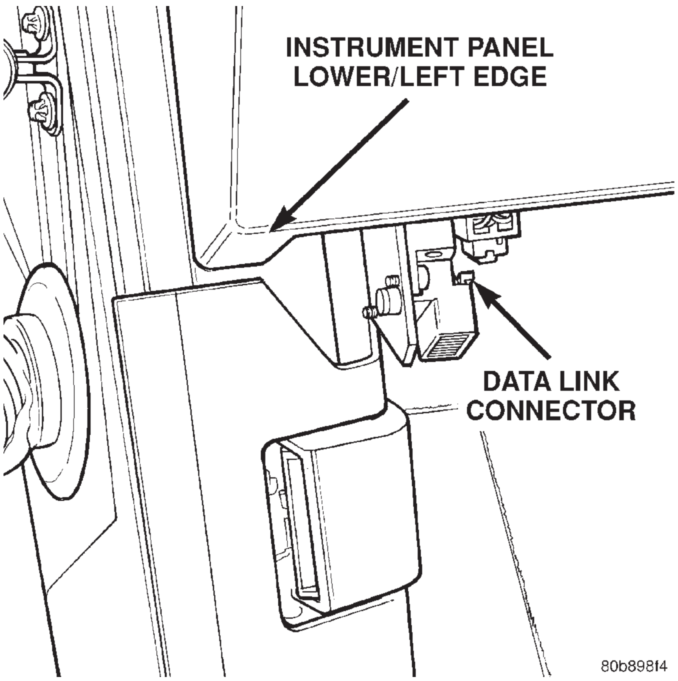


Fig. 5 Data Link Connector Location – L.H.D.

SPEED CONTROL—ECM INPUT

The speed control system provides five separate inputs to the ECM: On/Off, Set, Resume/Accel, Cancel, and Decel.. The On/Off input informs the ECM that the speed control system has been activated. The Set input informs the ECM that a fixed vehicle speed has been selected. The Resume input indicates to the ECM that the previous fixed speed is requested.

Speed control operation will start at 50 km/h–142 km/h (35–85 mph). The upper range of operation is not restricted by vehicle speed. Inputs that effect speed control operation are vehicle speed sensor and accelerator pedal position sensor.

Refer to Group 8H for further speed control information.

ASD RELAY—ECM INPUT

A 12 volt signal at this input indicates to the ECM that the ASD relay has been activated. The ASD relay is located in the PDC. The PDC is located next to the battery in the engine compartment. For the location of the relay within the PDC, refer to label on PDC cover.

This input is used only to sense that the ASD relay is energized. If the ECM does not see 12 volts (+) at this input when the ASD relay should be activated, it will set a Diagnostic Trouble Code (DTC).

FIVE VOLT POWER—ECM/PCM OUTPUT

This circuit supplies approximately 5 volts to power the Accelerator Pedal Position Sensor, and the Boost / Pressure Sensor.

ENGINE COOLANT GAUGE—PCM OUTPUT

Refer to the Instrument Panel and Gauges group for additional information.

ENGINE OIL PRESSURE GAUGE—PCM OUTPUT

Refer to the Instrument Panel and Gauges group for additional information.

GLOW PLUG LAMP—PCM OUTPUT

The Glow Plug lamp (malfunction indicator lamp) illuminates on the message center each time the ignition (key) switch is turned on. It will stay on for about two seconds as a bulb test.

Fig. 6 Glow Plug Lamp Symbol

SPEED CONTROL—PCM OUTPUTS

These two circuits control the fuel quantity actuator to regulate vehicle speed. Refer to Group 8H for Speed Control information.

AIR CONDITIONING RELAY—ECM OUTPUT

This circuit controls a ground signal for operation of the A/C clutch relay. Also refer to Air Conditioning (A/C) Controls—ECM Input for additional information.

The A/C relay is located in the Power Distribution Center (PDC). The PDC is located next to the battery in the engine compartment. For the location of the relay within the PDC, refer to label on PDC cover.

TIMING SOLENOID—ECM OUTPUT

The timing solenoid is located on the bottom of the fuel injection pump (Fig. 7).

This 12(+) volt, pulse width modulated (duty–cycle) output controls the amount of fuel timing (advance) in the fuel injection pump. The higher the duty–cycle, the lower the advance. The lower the duty–cycle, the more advanced the fuel timing.

The duty–cycle is determined by the ECM from inputs it receives from the fuel injector sensor and engine speed sensor.

DESCRIPTION AND OPERATION (Continued)

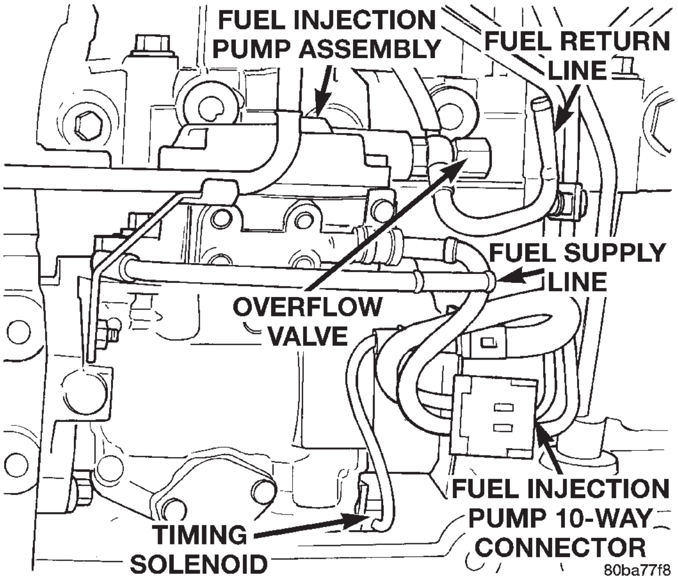


Fig. 7 Timing Solenoid

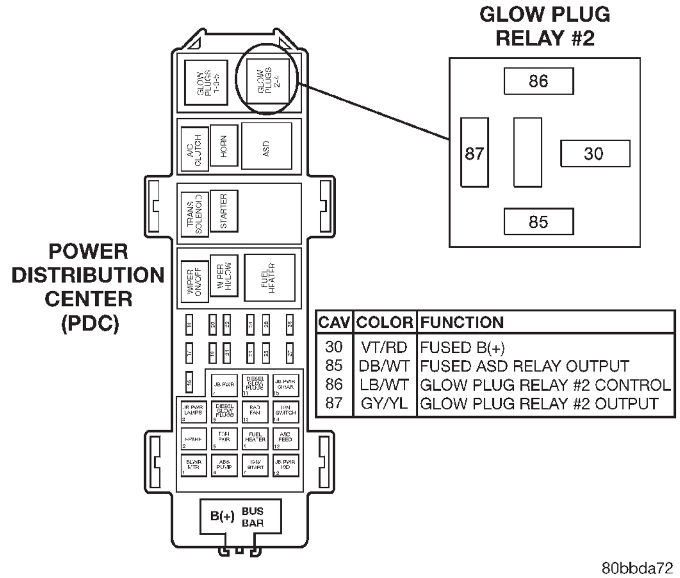


Fig. 9 Glow Plug Relay #2 Location

TACHOMETER—PCM OUTPUT

The PCM recieves engine rpm values from the ECM controller, and then supplies engine rpm values to the Body Controller that then supplies the instrument cluster mounted tachometer (if equipped). Refer to Group 8E for tachometer information.

GLOW PLUG RELAY—ECM OUTPUT

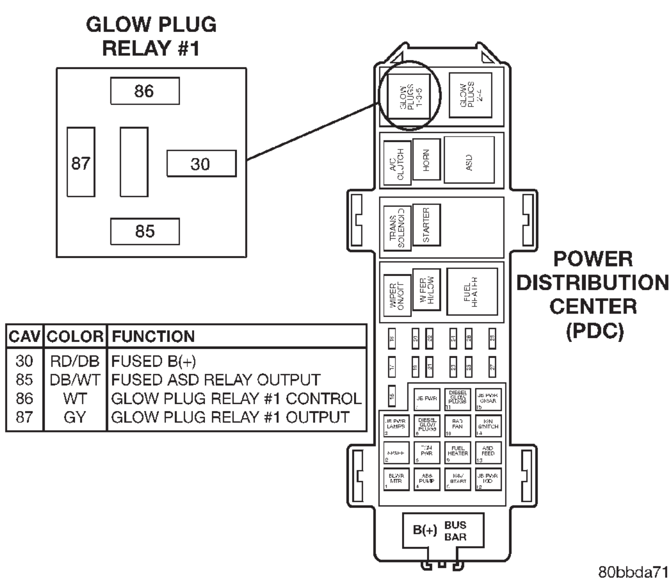


Fig. 8 Glow Plug Relay #1 Location

When the ignition (key) switch is placed in the ON position, a signal is sent to the ECM relating current engine coolant temperature. This signal is sent from the engine coolant temperature sensor.

After receiving this signal, the ECM will determine if, when and for how long a period the glow plug relay should be activated. This is done before, during and after the engine is started. Whenever the glow plug relay is activated, it will control the 12V+ 100 amp circuit for the operation of the four glow plugs.

With a cold engine, the glow plug relay and glow plugs may be activated for a maximum time of 200 seconds. Refer to the following Glow Plug Control chart for a temperature/time comparison of glow plug relay operation.

In this chart, Pre–Heat and Post–Heat times are mentioned. Pre–heat is the amount of time the glow plug relay circuit is activated when the ignition (key) switch is ON, but the engine has yet to be started. Post–heat is the amount of time the glow plug relay circuit is activated after the engine is operating. The Glow Plug lamp will not be illuminated during the post–heat cycle.

GLOW PLUG CONTROL

ENGINE COOLANT TEMPERATURE KEY ON	WAIT-TO-START LAMP ON (SECONDS)	PRE-HEAT CYCLE (GLOW PLUGS ON) (SECONDS)	POST-HEAT CYCLE (SECONDS)
-30 C	15 SEC.	45 SEC.	200 SEC.
-10 C	8 SEC.	35 SEC.	180 SEC.
+10 C	6 SEC.	25 SEC.	118 SEC.
+30 C	5 SEC.	20 SEC.	70 SEC.
+40 C	4 SEC.	16 SEC.	60 SEC.
+70 C	3 SEC.	16 SEC.	20 SEC.

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DESCRIPTION AND OPERATION (Continued)

GLOW PLUGS

Glow plugs are used to help start a cold or cool engine. The plug will heat up and glow to heat the combustion chamber of each cylinder. An individual plug is used for each cylinder. Each plug is threaded into the cylinder head above the fuel injector (Fig. 10).

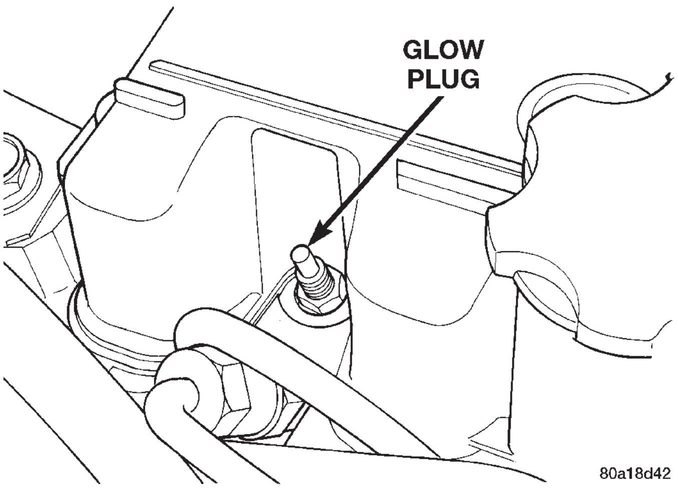

Fig. 10 Glow Plug

Each plug will momentarily draw approximately 25 amps of electrical current during the initial key–on cycle. This is on a cold or cool engine. After heating, the current draw will drop to approximately 9–12 amps per plug.

Total momentary current draw for all four plugs is approximately 100 amps on a cold engine dropping to a total of approximately 40 amps after the plugs are heated.

Electrical operation of the glow plugs are controlled by the glow plug relay. Refer to the previous Glow Plug Relay—ECM Output for additional information.

ELECTRIC VACUUM MODULATOR (EVM)—ECM OUTPUT

This circuit controls operation of the Electric Vacuum Modulator (EVM). The EVM controls operation of the EGR valve.

Refer to Group 25, Emission Control System for information. See Electric Vacuum Modulator.

DIAGNOSIS AND TESTING

DIESEL DIAGNOSTICS

The ECM controllers perform engine off diagnostic tests, which may be heard for about 60 seconds after turning the key off.

ASD RELAY TEST

To perform a test of the relay and its related circuitry, refer to the DRB scan tool. To test the relay only, refer to Relays—Operation/Testing in this section of the group.

Diagnostic Trouble Codes: Refer to On-Board Diagnostics in Group 25, Emission Control System for a list of Diagnostic Trouble Codes (DTC's) for certain fuel system components.

ENGINE SPEED SENSOR TEST

To perform a test of the engine speed sensor and its related circuitry, refer to the 3.1L Powertrain Diagnostic Procedures Manual.

Diagnostic Trouble Codes: Refer to On-Board Diagnostics in Group 25, Emission Control System for a list of Diagnostic Trouble Codes (DTC's) for certain fuel system components.

ENGINE COOLANT TEMPERATURE SENSOR TEST

The sensor is located on the side of cylinder head near the rear of fuel injection pump (Fig. 11).

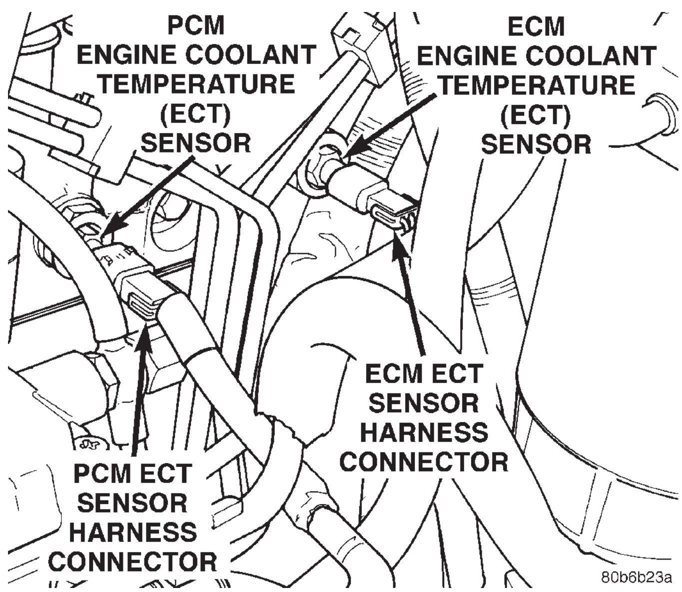

Fig. 11 Engine Coolant Temperature Sensor Location

For a list of Diagnostic Trouble Codes (DTC's) for certain fuel system components, refer to On-Board Diagnostics in Group 25, Emission Control System. To test the sensor only, refer to the following:

(1) Disconnect wire harness connector from coolant temperature sensor.

(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 following Sensor Resistance

DIAGNOSIS AND TESTING (Continued)

(OHMS) chart. Replace the sensor if it is not within the range of resistance specified in the chart.

SENSOR RESISTANCE (OHMS)

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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(3) Test continuity of the wire harness. Do this between the ECM wire harness connector and the sensor connector terminal. Also test continuity of wire harness to the sensor connector terminal. Refer to Group 8W for wiring connector and circuitry information. Repair the wire harness if an open circuit is indicated.

(4) After tests are completed, connect electrical connector to sensor.

GLOW PLUG TEST

Hard starting or a rough idle after starting may be caused by one or more defective glow plugs. Before testing the glow plugs, a test of the glow plug relays should be performed. This will ensure that 12V+ is available at the plugs when starting the engine. Refer to the Glow Plug Relay Test for information.

For accurate test results, the glow plugs should be removed from the engine. The plugs must be checked when cold. **Do not check the plugs if the engine has recently been operated. If plugs are checked when warm, incorrect amp gauge readings will result.**

Use Churchill Glow Plug Tester DX.900 or an equivalent (Fig. 12) for the following tests. This tester is equipped with 4 timer lamps.

(1) Remove the glow plugs from the engine. Refer to Glow Plug Removal/Installation.

(2) Attach the red lead of the tester to the 12V+ (positive) side of the battery.

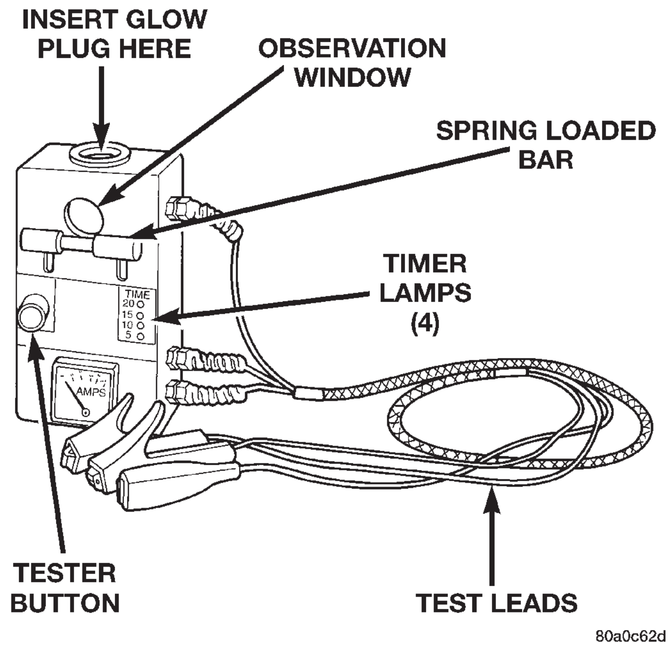


Fig. 12 Typical Glow Plug Tester

(3) Attach the black lead of the tester to the 12V– (negative) side of the battery.

(4) Fit the glow plug into the top of the tester and secure it with the spring loaded bar (Fig. 12).

(5) Attach the third lead wire of the tester to the electrical terminal at the end of the glow plug.

(6) When performing the test, the tester button (Fig. 12) should be held continuously without release for 20 seconds as indicated by the 4 timer lamps. Each illuminated lamp represents a 5 second time lapse.

(a) Press and hold the tester button (Fig. 12) and note the amp gauge reading. The gauge reading should indicate a momentary, initial current draw (surge) of approximately 25 amps. After the initial surge, the amp gauge reading should begin to fall off. The glow plug tip should start to glow an orange color after 5 seconds. If the tip did not glow after 5 seconds, replace the glow plug. Before discarding the glow plug, check the position of the circuit breaker on the bottom of the plug tester. It may have to be reset. Reset if necessary.

(b) Continue to hold the tester button while observing the amp gauge and the 4 timer lamps. When all 4 lamps are illuminated, indicating a 20 second time lapse, the amp gauge reading should indicate a 9–12 amp current draw. If not, replace the glow plug. Refer to Glow Plug Removal/Installation.

(7) Check each glow plug in this manner using one 20 second cycle. If the glow plug is to be retested, it must first be allowed to cool to room temperature.

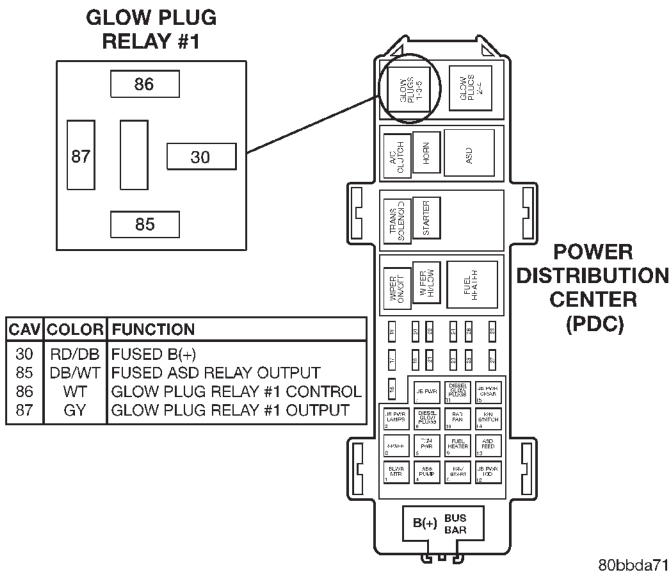
DIAGNOSIS AND TESTING (Continued)

WARNING: THE GLOW PLUG WILL BECOME EXTREMELY HOT (GLOWING) DURING THESE TESTS. BURNS COULD RESULT IF IMPROPERLY HANDLED. ALLOW THE GLOW PLUG TO COOL BEFORE REMOVING FROM TESTER.

(8) Remove the glow plug from the tester.

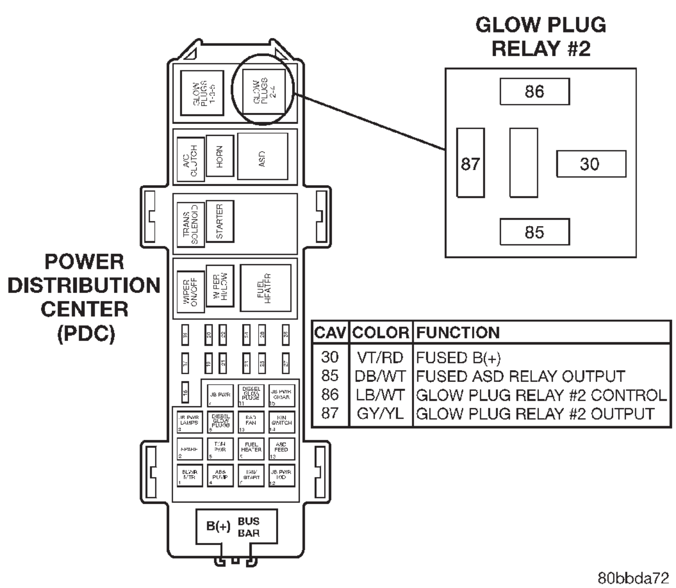
GLOW PLUG RELAY TEST

The glow plug relay is located in the Power Distribution Center (PDC) (Fig. 13) (Fig. 14).



CAV	COLOR	FUNCTION
30	RD/DB	FUSED B(+)
85	DB/WT	FUSED ASD RELAY OUTPUT
86	WT	GLOW PLUG RELAY #1 CONTROL
87	GY	GLOW PLUG RELAY #1 OUTPUT

Fig. 13 Glow Plug Relay #1 Location



CAV	COLOR	FUNCTION
30	VT/RD	FUSED B(+)
85	DB/WT	FUSED ASD RELAY OUTPUT
86	LB/WT	GLOW PLUG RELAY #2 CONTROL
87	GY/YL	GLOW PLUG RELAY #2 OUTPUT

Fig. 14 Glow Plug Relay #2 Location

When the ignition (key) switch is placed in the ON position, a signal is sent to the ECM relating current engine coolant temperature. This signal is sent from the engine coolant temperature sensor.

After receiving this signal, the ECM will determine if, when and for how long a period the glow plug relay should be activated. This is done before, during and after the engine is started. Whenever the glow plug relay is activated, it will control the 12V+ 100 amp circuit for the operation of the four glow plugs.

The Glow Plug lamp is tied to this circuit. Lamp operation is also controlled by the ECM.

With a cold engine, the glow plug relay and glow plugs may be activated for a maximum time of 200 seconds. Refer to the Glow Plug Control chart for a temperature/time comparison of glow plug relay operation.

In this chart, Pre–Heat and Post–Heat times are mentioned. Pre–heat is the amount of time the glow plug relay circuit is activated when the ignition (key) switch is ON, but the engine has yet to be started. Post–heat is the amount of time the glow plug relay circuit is activated after the engine is operating. The Glow Plug lamp will not be illuminated during the post–heat cycle.

TESTING:

Disconnect and isolate the electrical connectors (Fig. 15) at all four glow plugs. With the engine cool or cold, and the key in the ON position, check for 10–12 volts + at each electrical connector. 10–12 volts + should be at each connector whenever the ECM is operating in the pre–heat or post–heat cycles (refer to the following Glow Plug Control chart). **Be very careful not to allow any of the four disconnected glow plug electrical connectors to contact a metal surface. When the key is turned to the ON position, approximately 100 amps at 12 volts is supplied to these connectors.** If 10–12 volts + is not available at each connector, check continuity of wiring harness directly to the relay. If continuity is good directly to the relay, the fault is either with the relay or the relay input from the ECM. To test the relay only, refer to Relays—Operation/Testing in this section of the group. If the relay test is good, refer to the DRB scan tool.

Diagnostic Trouble Codes: Refer to On-Board Diagnostics in Group 25, Emission Control System for a list of Diagnostic Trouble Codes (DTC's) for certain fuel system components.

RELAYS—OPERATION/TESTING

The following description of operation and tests apply only to the ASD and other relays . The terminals on the bottom of each relay are numbered.

OPERATION

• Terminal number 30 is connected to battery voltage. For both the ASD and other relays, terminal 30 is connected to battery voltage at all times.

DIAGNOSIS AND TESTING (Continued)

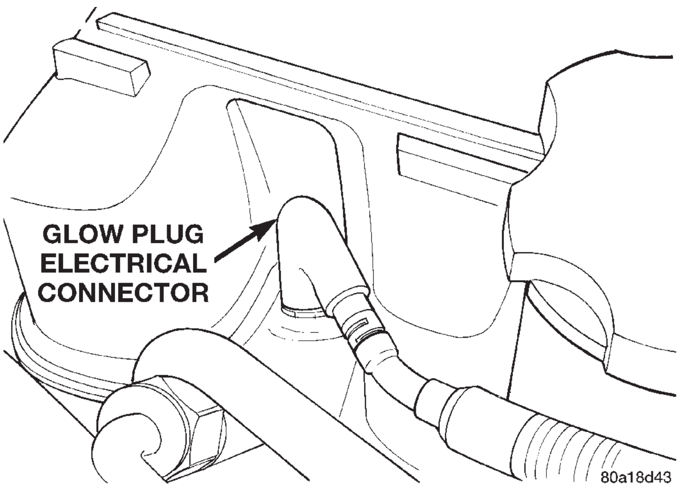


Fig. 15 Wiring Connection at Glow Plug

GLOW PLUG CONTROL

ENGINE COOLANT TEMPERATURE KEY ON	WAIT-TO-START LAMP ON (SECONDS)	PRE-HEAT CYCLE (GLOW PLUGS ON) (SECONDS)	POST-HEAT CYCLE (SECONDS)
-30 C	15 SEC.	45 SEC.	200 SEC.
-10 C	8 SEC.	35 SEC.	180 SEC.
+10 C	6 SEC.	25 SEC.	118 SEC.
+30 C	5 SEC.	20 SEC.	70 SEC.
+40 C	4 SEC.	16 SEC.	60 SEC.
+70 C	3 SEC.	16 SEC.	20 SEC.

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- The ECM grounds the coil side of the relay through terminal number 85.
- Terminal number 86 supplies voltage to the coil side of the relay.
- When the PCM de-energizes the ASD and other relays, terminal number 87A connects to terminal 30. This is the Off position. In the off position, voltage is not supplied to the rest of the circuit. Terminal 87A is the center terminal on the relay.
- When the ECM energizes the ASD and other relays, terminal 87 connects to terminal 30. This is the On position. Terminal 87 supplies voltage to the rest of the circuit.

TESTING

The following procedure applies to the ASD and other relays.

(1) Remove relay from connector before testing.

(2) With the relay removed from the vehicle, use an ohmmeter to check the resistance between terminals 85 and 86. The resistance should be between 75 ±5 ohms.

(3) Connect the ohmmeter between terminals 30 and 87A. The ohmmeter should show continuity between terminals 30 and 87A.

(4) Connect the ohmmeter between terminals 87 and 30. The ohmmeter should not show continuity at this time.

(5) Connect one end of a jumper wire (16 gauge or smaller) to relay terminal 85. Connect the other end of the jumper wire to the ground side of a 12 volt power source.

(6) Connect one end of another jumper wire (16 gauge or smaller) to the power side of the 12 volt power source. **Do not attach the other end of the jumper wire to the relay at this time.**

WARNING: DO NOT ALLOW OHMMETER TO CONTACT TERMINALS 85 OR 86 DURING THIS TEST.

(7) Attach the other end of the jumper wire to relay terminal 86. This activates the relay. The ohmmeter should now show continuity between relay terminals 87 and 30. The ohmmeter should not show continuity between relay terminals 87A and 30.

(8) Disconnect jumper wires.

(9) Replace the relay if it did not pass the continuity and resistance tests. If the relay passed the tests, it operates properly. Check the remainder of the ASD and other relay circuits. Refer to group 8W, Wiring Diagrams.

BOOST / PRESSURE SENSOR

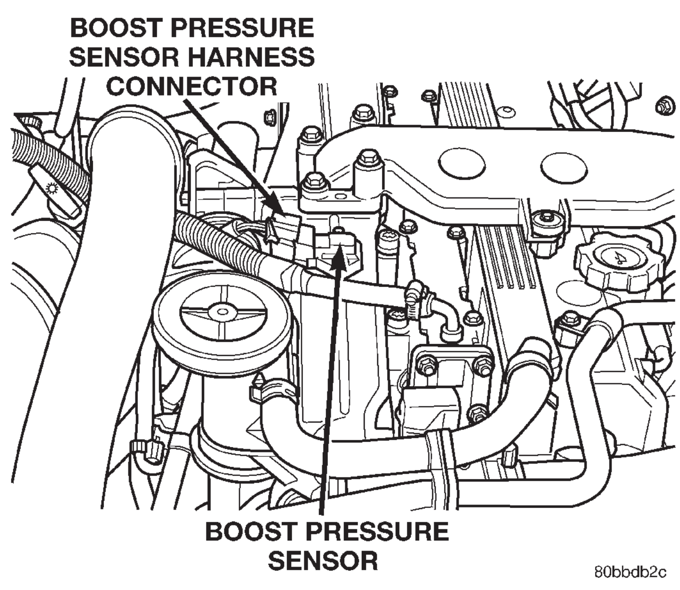

Fig. 16 Boost Pressure Sensor Location

DIAGNOSIS AND TESTING (Continued)

If the boost pressure sensor fails, the PCM records a DTC into memory and continues to operate the engine in one of the three “limp-in” modes. When the PCM is operating in this mode, a loss of power will be present, as if the turbocharger was not operating. The best method for diagnosing faults with the boost pressure sensor is with the DRB III scan tool. **Diagnostic Trouble Codes:** Refer to On-Board Diagnostics in Group 25, Emission Control System for a list of Diagnostic Trouble Codes (DTC’s) for certain fuel system components.

VEHICLE SPEED SENSOR TEST

To perform a test of the sensor and its related circuitry, refer to DRB scan tool.

Diagnostic Trouble Codes: Refer to On-Board Diagnostics in Group 25, Emission Control System for a list of Diagnostic Trouble Codes (DTC’s) for certain fuel system components.

DIAGNOSTIC TROUBLE CODES

For a list of Diagnostic Trouble Codes (DTC’s), refer to Group 25, Emission Control System for information. See On-Board Diagnostics.

REMOVAL AND INSTALLATION

ASD RELAY

The ASD relay is located in the PDC. For the location of the relay within the PDC, refer to label on PDC cover.

A/C CLUTCH RELAY

The A/C clutch relay is located in the PDC. For the location of the relay within the PDC, refer to label on PDC cover.

ENGINE SPEED SENSOR

The engine speed sensor is mounted to the top of the transmission adapter plate near the rear of the engine block (Fig. 17).

REMOVAL

(1) Remove the intercooler inlet hose from the turbocharger (Fig. 18).

(2) Disconnect the breather hose from the fresh air inlet tube (Fig. 18).

(3) Unclip the air filter cover and remove the fresh air inlet tube from the turbocharger (Fig. 18). Remove the assembly from the vehicle.

(4) Remove the EGR vacuum supply hose from the EGR valve (Fig. 19).

(5) Unclip the wire harness from the coolant supply lines (Fig. 19).

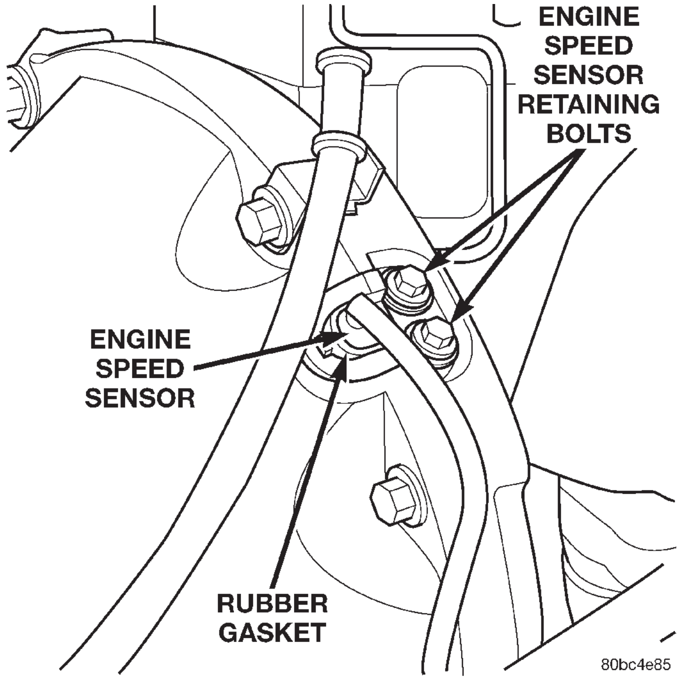

Fig. 17 Engine Speed Sensor Position & Orientation

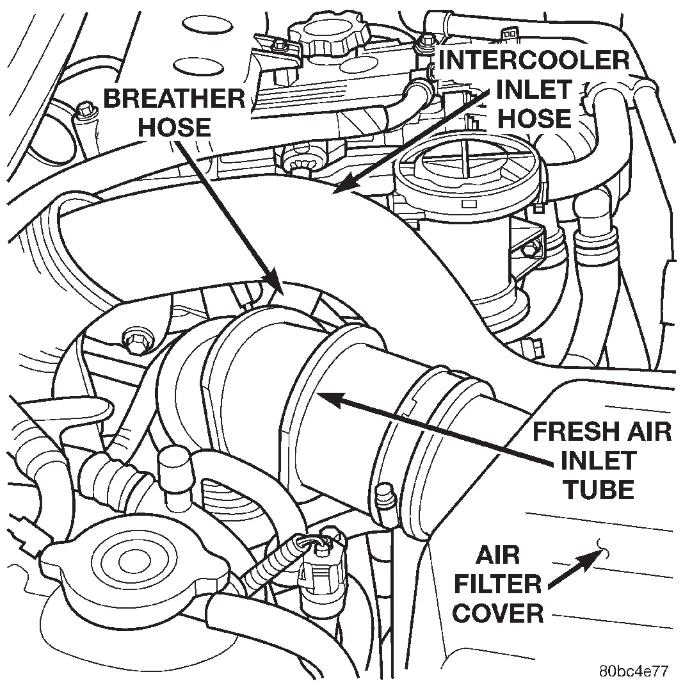

Fig. 18 Air Intake Hoses

(6) Remove the (2) EGR valve / coolant supply line retaining bolts (Fig. 19).

(7) Remove the coolant supply line support bracket bolt from the water pump housing.

(8) Remove the oil separator retaining bolts.

(9) Disconnect the crankcase vapor supply and return hoses and remove the oil separator from the vehicle.

REMOVAL AND INSTALLATION (Continued)

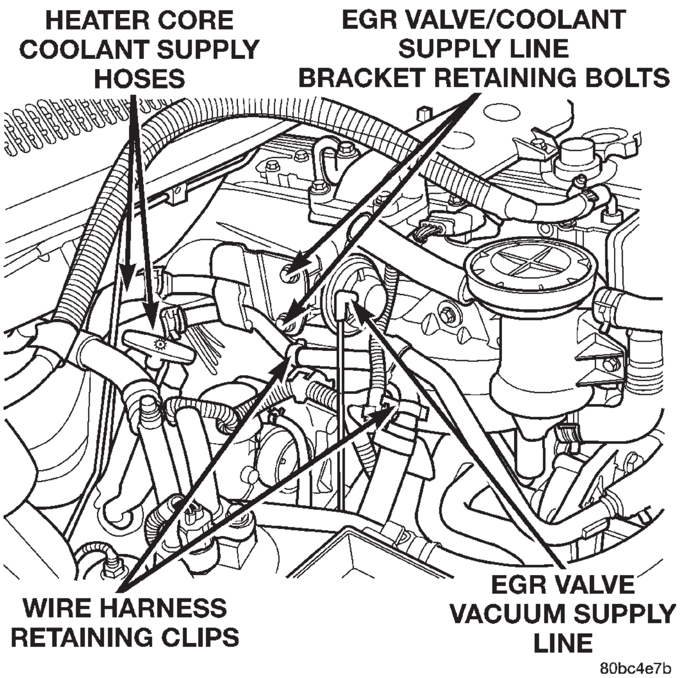

Fig. 19 3.1 L Diesel Engine

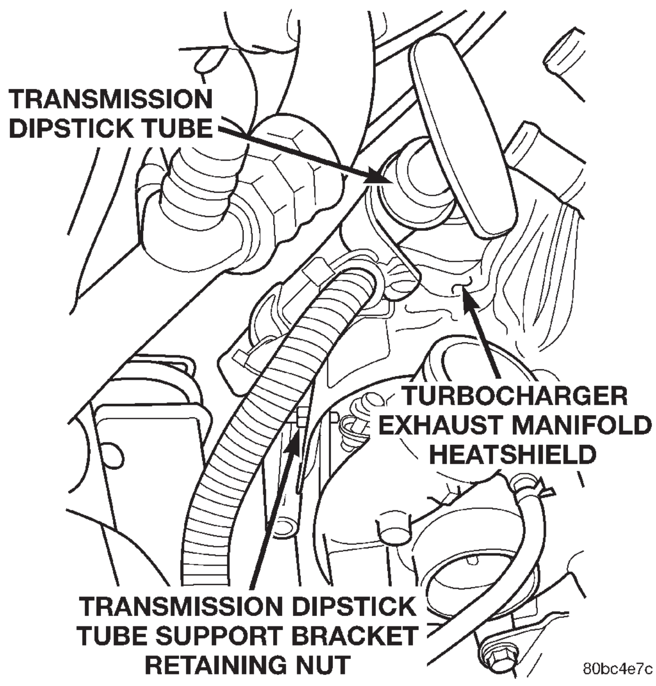

Fig. 20 Transmission Dipstick Tube Support Bracket

(10) Remove the transmission dipstick tube support bracket nut from the turbocharger heatshield (Fig. 20).

WARNING: Heatshield is very sharp. Wear gloves to prevent injury.

(11) Remove the exhaust manifold / turbocharger heatshield retaining bolts.

(12) Position the coolant line assembly out of the way and remove the heatshield from the vehicle.

(13) Working behind the exhaust manifold, disconnect the engine speed sensor electrical connector (Fig. 21).

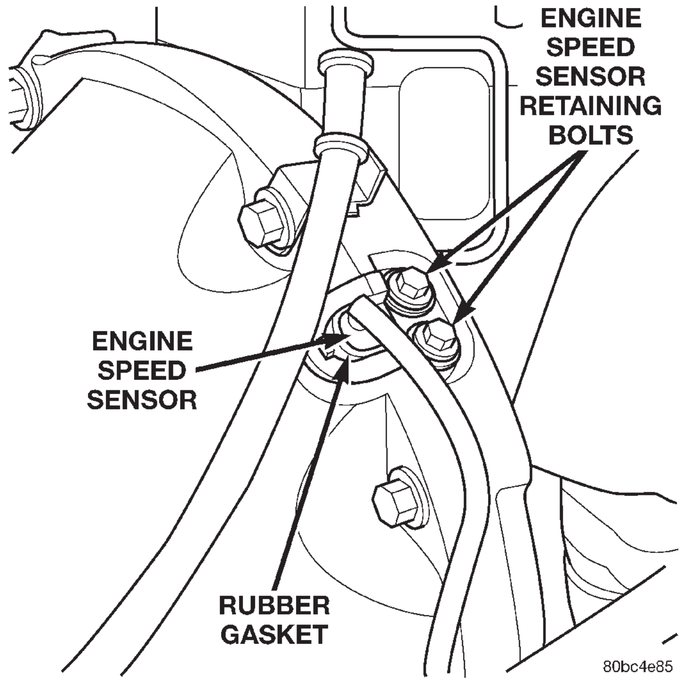

Fig. 21 Engine Speed Sensor

(14) Remove the (2) engine speed sensor retaining bolts (Fig. 21).

(15) Remove the engine speed sensor from the vehicle.

INSTALLATION

(1) Install the engine speed sensor in the transmission adapter plate.

(2) Install the (2) engine speed sensor retaining bolts (Fig. 22). Torque the bolts to 11 N·m (97 in. lbs.).

(3) Connect the engine speed sensor electrical connector (Fig. 22).

WARNING: Heatshield is very sharp. Wear gloves to prevent injury.

(4) Install the exhaust manifold heatshield. Torque bolts to 11 N·m (97 in. lbs.).

(5) Install the transmission dipstick tube support bracket retaining nut on the turbocharger heatshield (Fig. 23). Torque the nut to 11 N·m (97 in. lbs.).

(6) Install the coolant line assembly on the engine. Torque the (3) retaining bolts to 27 N·m (20 ft. lbs.) (Fig. 24).

(7) Connect the crankcase vapor supply and return hoses on the oil separator.

(8) Install the oil separator retaining bolts.

REMOVAL AND INSTALLATION (Continued)

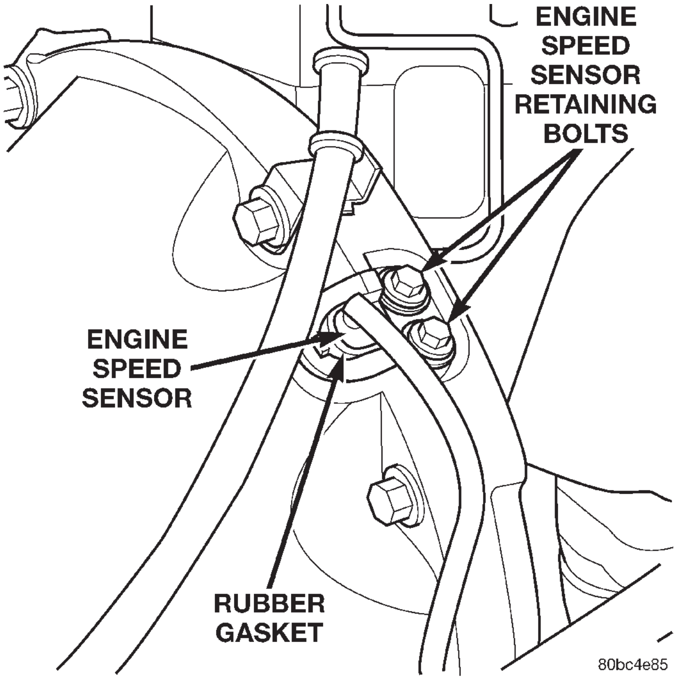

Fig. 22 Engine Speed Sensor

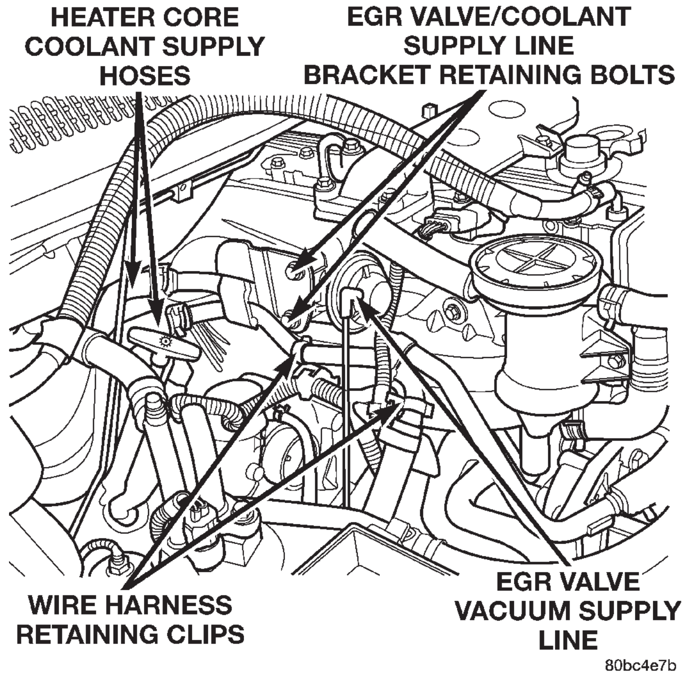

Fig. 24 3.1L Diesel Engine

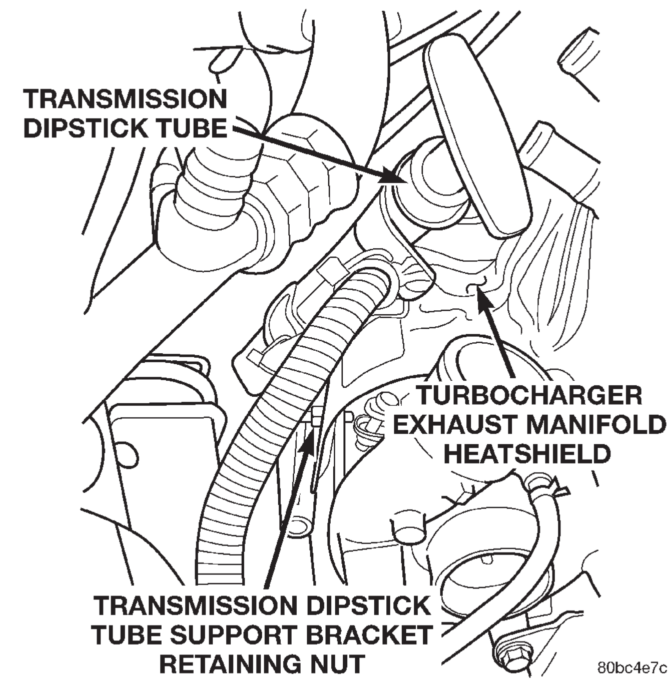

Fig. 23 Transmission Dipstick Tube Support Bracket

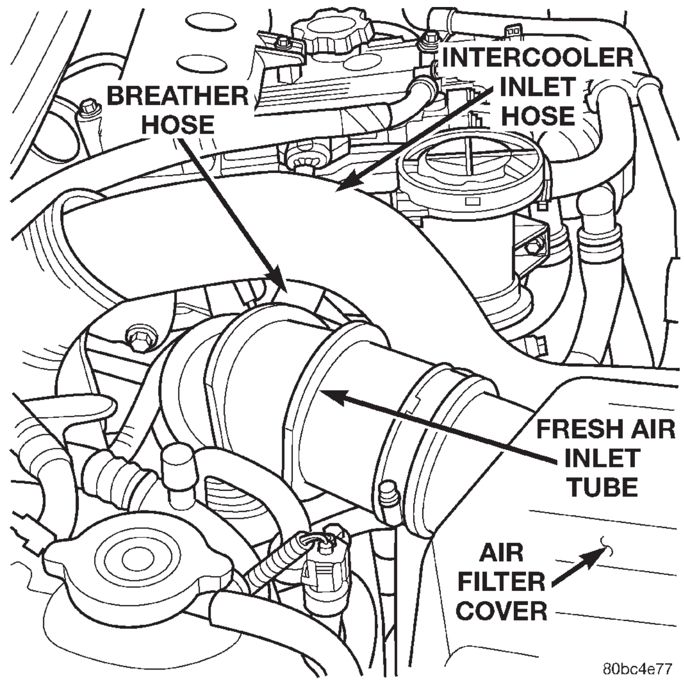

Fig. 25 Air Intake Hoses

(9) Clip the wire harness on the coolant supply lines (Fig. 24).

(10) Install the EGR vacuum supply hose on the EGR valve.

(11) Install the fresh air inlet tube assembly on the turbocharger. Clip the air filter cover in position and connect the breather hose (Fig. 25).

(12) Install the intercooler inlet hose on the turbocharger (Fig. 25).

(13) Check the transmission fluid level and top off if necessary.

(14) Connect the negative battery cable.

(15) Start the engine and check for leaks.

ENGINE COOLANT TEMPERATURE SENSOR

The sensors are located on the side of cylinder head near the rear of fuel injection pump.

REMOVAL AND INSTALLATION (Continued)

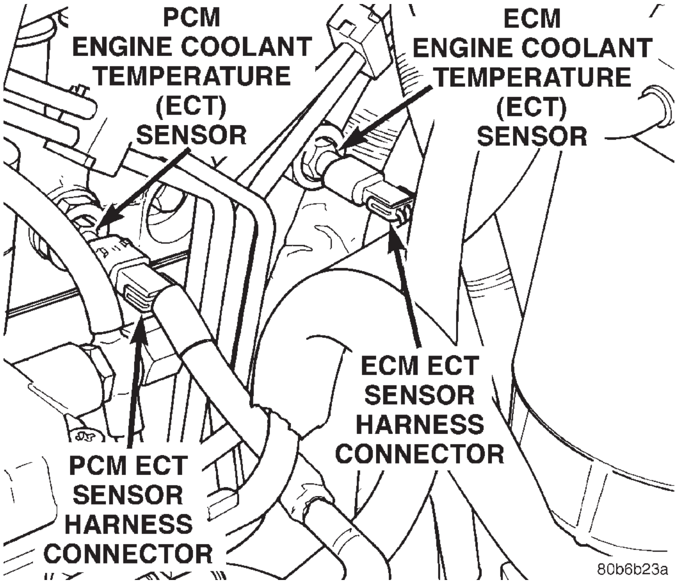

Fig. 26 Engine Coolant Temperature Sensors

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 the cooling system. Refer to Group 7, Cooling System for the procedure.
(2) Disconnect electrical connector from sensor.
(3) Remove sensor from cylinder head.

INSTALLATION

(1) Install a new copper gasket on sensor, if equipped.
(2) Install sensor in cylinder head.
(3) Torque the sensor to 8 N·m (70 in. lbs.).
(4) Install electrical connector on sensor.
(5) Replace any lost engine coolant. Refer to Group 7, Cooling System for the procedure.

GLOW PLUGS

The glow plugs are located above each fuel injector (Fig. 27). Four individual plugs are used.

REMOVAL

(1) Disconnect the negative battery cable at the battery.

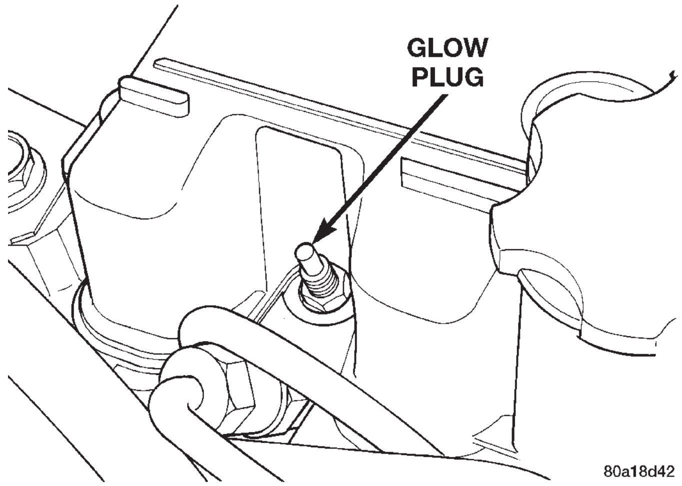

Fig. 27 Glow Plug

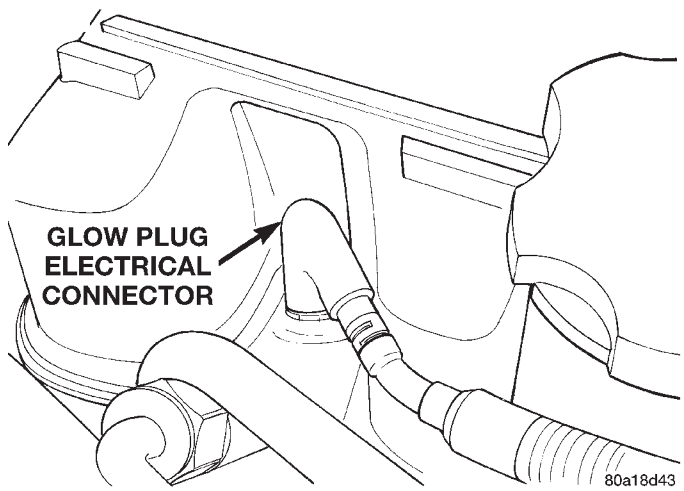

Fig. 28 Glow Plug Electrical Connector

(2) Clean the area around the glow plug with compressed air before removal.
(3) Disconnect electrical connector (Fig. 28) at glow plug.
(4) Remove the glow plug (Fig. 27) from cylinder head.

INSTALLATION

(1) Apply high–temperature anti–seize compound to glow plug threads before installation
(2) Install the glow plug into the cylinder head. Tighten to 14 N·m (123 in. lbs.) torque.
(3) Connect battery cable to battery.

SPECIFICATIONS

GLOW PLUG CURRENT DRAW

Initial Current Draw: Approximately 22–25 amps per plug.

After 20 seconds of operation: Approximately 9–12 amps per plug.

TORQUE CHART—3.1L DIESEL

DESCRIPTION	TORQUE
Accelerator Pedal Bracket Mounting Nuts	5 N•m (46 in. lbs.)
Banjo-Type Fittings	19 N•m (14 ft. lbs.)
Engine Coolant Temperature Sensor	8 N•m (70 in. lbs.)
Engine Speed Sensor Bolts	11N•m (97 in. lbs.)
Fuel Hose (Tube) Clamps For Rubber Hose	2 N•m (20 in. lbs.)
Fuel Injector	70 N•m (52 ft. lbs.)
Fuel Injector Line At Injector	19 N•m (168 in. lbs.)
Fuel Injector Line At Injector Pump	19 N•m (168 in. lbs.)
Fuel Injection Pump Mounting Nuts	27N•m (241 in. lbs.)
Fuel Injection Pump Drive Gear Nut	86 N•m (64 ft. lbs.)
Fuel Line Clamp Bracket Bolts	24 N•m (18 ft. lbs.)
Fuel Tank Nuts	11 N•m (100 in. lbs.)
Glow Plugs	14 N•m (123 in. lbs.)
Powertrain Control Module Mounting Bolts	1 N•m (9 in. lbs.)
Throttle Position Sensor Mounting Bolts	7 N•m (60 in. lbs.)
Vehicle Speed Sensor Mounting Bolt	3 N•m (26 in. lbs.)

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Torque Specifications

STEERING

CONTENTS

POWER STEERING

INDEX

DESCRIPTION AND OPERATION

POWER STEERING SYSTEM

The power steering pump (Fig. 1) is a constant flow rate and displacement vane type pump. The pump reservoir is attached to the pump body. The pump is connected to the steering by the pressure and return hoses.

The steering gear (Fig. 1) used is a recirculating ball type gear. The rack piston balls act 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 the rack piston moves. The rack piston teeth mesh with the pitman shaft. Turning the worm shaft turns the pitman shaft, which moves the steering linkage.

The power steering system consists of:
- Hydraulic pump
- Recirculating ball steering gear
- Steering column
- Steering linkage
- Cooler (optional)

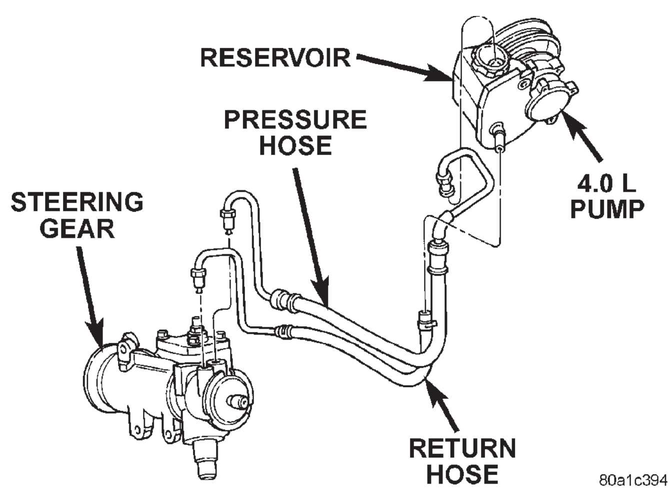


Fig. 1 Typical - Power Steering Gear & Pump

DIAGNOSIS AND TESTING

POWER STEERING SYSTEM DIAGNOSIS CHARTS

STEERING NOISE

There is some noise in all power steering systems. One of the most common is a hissing sound evident at a standstill parking. Or when the steering wheel is at the end of it's travel. Hiss is a high frequency noise similar to that of a water tap being closed slowly. The noise is present in all valves that have a high velocity fluid passing through an orifice. There is no relationship between this noise and steering performance.

CONDITION	POSSIBLE CAUSES	CORRECTION
OBJECTIONAL HISS OR WHISTLE	1. Steering intermediate shaft to dash panel seal. 2. Noisy valve in power steering gear.	1. Check and repair seal at dash panel. 2. Replace steering gear.
RATTLE OR CLUNK	1. Gear mounting bolts loose. 2. Loose or damaged suspension components/track bar. 3. Loose or damaged steering linkage. 4. Internal gear noise. 5. Pressure hose in contact with other components.	1. Tighten bolts to specification. 2. Inspect and repair suspension. 3. Inspect and repair steering linkage. 4. Replace gear. 5. Reposition hose.
CHIRP OR SQUEAL	1. Loose belt.	1. Adjust or replace.
WHINE OR GROWL	1. Low fluid level. 2. Pressure hose in contact with other components. 3. Internal pump noise. 4. Air in the system.	1. Fill to proper level. 2. Reposition hose. 3. Replace pump. 4. Perform pump initial operation.
SUCKING AIR SOUND	1. Loose return line clamp. 2. O-ring missing or damaged on hose fitting. 3. Low fluid level. 4. Air leak between pump and reservoir.	1. Replace clamp. 2. Replace o-ring. 3. Fill to proper level. 4. Repair as necessary.
SCRUBBING OR KNOCKING	1. Wrong tire size. 2. Wrong gear.	1. Verify tire size. 2. Verify gear.

DIAGNOSIS AND TESTING (Continued)

BINDING AND STICKING

CONDITION	POSSIBLE CAUSE	CORRECTION
DIFFICULT TO TURN WHEEL STICKS OR BINDS	1. Low fluid level.	1. Fill to proper level.
	2. Tire pressure.	2. Adjust tire pressure.
	3. Steering component.	3. Inspect and lube.
	4. Loose belt.	4. Adjust or replace.
	5. Low pump pressure.	5. Pressure test and replace if necessary.
	6. Column shaft coupler binding.	6. Replace coupler.
	7. Steering gear worn or out of adjustment.	7. Repair or replace gear.
	8. Ball joints binding.	8. Inspect and repair as necessary.

INSUFFICIENT ASST. OR POOR RETURN TO CENTER

CONDITION	POSSIBLE CAUSE	CORRECTION
HARD TURNING OR MOMENTARY INCREASE IN TURNING EFFORT	1. Tire pressure.	1. Adjust tire pressure.
	2. Low fluid level.	2. Fill to proper level.
	3. Loose belt.	3. Adjust or replace.
	4. Lack of lubrication.	4. Inspect and lubricate steering and suspension compnents.
	5. Low pump pressure.	5. Pressure test and repair as necessary.
	6. Internal gear leak.	6. Pressure and flow test, and repair as necessary.
STEERING WHEEL DOES NOT WANT TO RETURN TO CENTER POSITION	1. Tire pressure.	1. Adjust tire pressure.
	2. Wheel alignment.	2. Align front end.
	3. Lack of lubrication.	3. Inspect and lubricate steering and suspension compnents.
	4. High friction in steering gear.	4. Test and adjust as necessary.
	5. Ball joints binding.	5. Inspect and repair as necessary.

DIAGNOSIS AND TESTING (Continued)

LOOSE STEERING AND VEHICLE LEAD

CONDITION	POSSIBLE CAUSE	CORRECTION
EXCESSIVE PLAY IN STEERING WHEEL	1. Worn or loose suspension or steering components.	1. Repair as necessary.
	2. Worn or loose wheel bearings.	2. Repair as necessary.
	3. Steering gear mounting.	3. Tighten gear mounting bolts to specification.
	4. Gear out of adjustment.	4. Adjust gear to specification.
	5. Worn or loose steering coupler.	5. Repair as necessary.
VEHICLE PULLS OR LEADS TO ONE SIDE	1. Tire Pressure.	1. Adjust tire pressure.
	2. Radial tire lead.	2. Cross front tires.
	3. Brakes dragging.	3. Repair as necessary.
	4. Wheel alignment.	4. Align vehicle.
	5. Weak or broken spring.	5. Replace spring.
	6. Loose or worn steering or suspension components.	6. Repair as necessary.

STEERING FLOW AND PRESSURE

The following procedure is used to test the operation of the power steering system on the vehicle. This test will provide the gallons per minute (GPM) or flow rate of the power steering pump along with the maximum relief pressure. Perform test any time a power steering system problem is present. This test will determine if the power steering pump or power steering gear is not functioning properly. The following pressure and flow test is performed using Power Steering Analyzer Tool kit 6815 (Fig. 2) and Adapter Kit 6893.

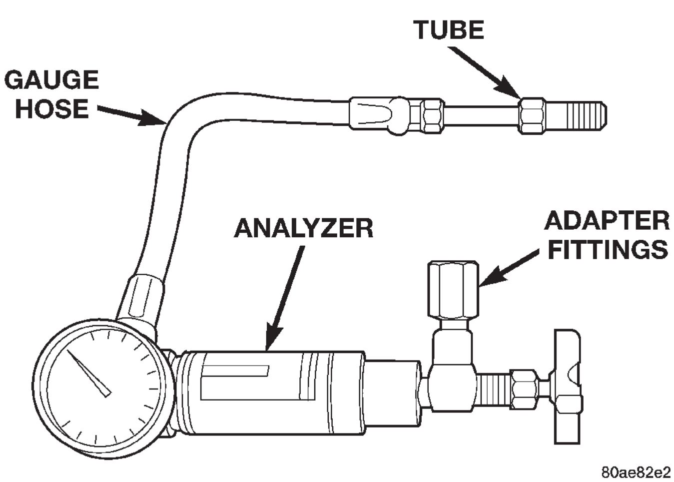


Fig. 2 Power Steering Analyzer

FLOW AND PRESSURE TEST

(1) Check the power steering belt to ensure it is in good condition and adjusted properly.

(2) Connect pressure gauge hose from the Power Steering Analyzer to Tube 6865.

(3) Connect Adapter 6826 to Power Steering Analyzer test valve end.

(4) Disconnect the high pressure hose from the power steering pump.

(5) Connect Tube 6865 to the pump hose fitting.

(6) Connect the power steering hose from the steering gear to Adapter 6826.

(7) Open the test valve completely.

(8) Start engine and let idle long enough to circulate power steering fluid through flow/pressure test gauge.

(9) Shut off the engine and check the fluid level, add fluid as necessary. Start engine again and let idle.

(10) The initial pressure reading should be 345-552 kPa (50-80 psi). If pressure is higher inspect the hoses for restrictions and repair as necessary.

(11) Increase the engine speed to 1500 RPM and read the flow meter. The reading should be 2.4 - 2.8 GPM, if the reading is below this specification the pump should be replaced.

CAUTION: This next step involves testing maximum pump pressure output and flow control valve operation. Do not leave valve closed for more than three seconds as the pump could be damaged.

(12) Close valve fully three times for three seconds and record highest pressure indicated each time. **All three readings must be at pump relief pressure**

DIAGNOSIS AND TESTING (Continued)

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.

(13) Open the test valve and turn the steering wheel to the extreme left and right positions against the stops. Record the highest pressure reading at each position. Compare readings to the pump specifications chart. If pressures readings are not within 50 psi. of each other, the gear is leaking internally and must be repaired.

CAUTION: Do not force the pump to operate against the stops for more than 2 to 4 seconds at a time because, pump damage will result.

PUMP SPECIFICATIONS

ENGINE	RELIEF PRESSURE ± 50	FLOW RATE (GPM)
4.0L	9653 kPa (1400 psi)	1500 RPM 2.4 - 2.8 GPM
4.7L	9653 kPa (1400 psi)	

POWER STEERING PUMP

INDEX

DESCRIPTION AND OPERATION

POWER STEERING PUMP

Hydraulic pressure for the power steering system is provided by a belt driven power steering pump (Fig. 1). The pump shaft has a pressed-on drive pulley that is belt driven by the crankshaft pulley. The power steering pump is a constant flow rate and displacement, vane-type pump. The pump internal parts operate submerged in fluid. The flow control orifice is part of the high pressure line fitting. The pressure relief valve inside the flow control valve limits the pump pressure. The reservoir is attached to the pump body with spring clips. The power steering pump is connected to the steering gear by the pressure and return hoses.

NOTE: Power steering pumps have different pressure rates and are not interchangeable with other pumps.

POWER STEERING PRESSURE LINE

Power steering pressure line, is used to transfer high pressure power steering fluid, from the power steering pump to the power steering gear.The hose consists of two metal ends and rubber center section that contains a tuning cable.

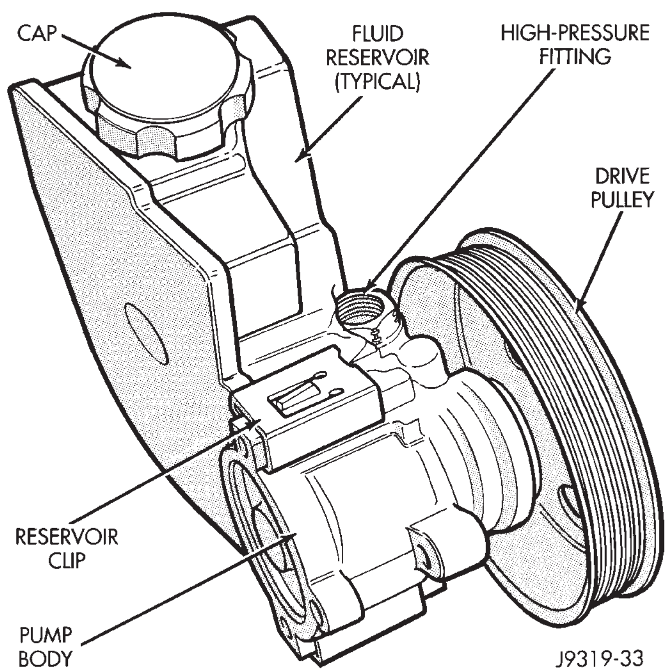


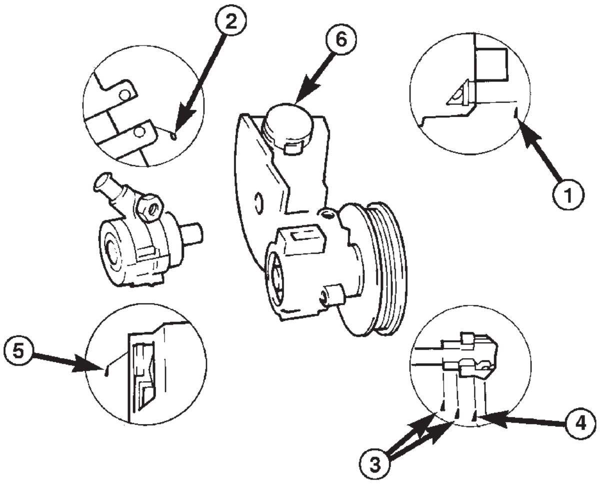
Fig. 1 Pump With Integral Reservoir

POWER STEERING RETURN LINE

Power steering return line, is used to transfer low pressure power steering fluid, from the power steering gear to the power steering pump.The hose is clamped at the pump and the gear.

DIAGNOSIS AND TESTING

PUMP LEAKAGE DIAGNOSIS



1. BUSHING (BEARING) WORN, SEAL WORN. REPLACE PUMP.
2. REPLACE RESERVOIR O-RING SEAL.
3. TORQUE HOSE FITTING NUT TO SPECIFICATIONS. IF LEAKAGE PERSISTS, REPLACE O-RING SEAL.
4. TORQUE FITTING TO SPECIFICATIONS. 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.

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SERVICE PROCEDURES

POWER STEERING PUMP – INITIAL OPERATION

WARNING: THE FLUID LEVEL SHOULD BE CHECKED WITH ENGINE OFF TO PREVENT INJURY FROM MOVING COMPONENTS.

CAUTION: Use MOPAR Power Steering Fluid or equivalent. Do not use automatic transmission fluid and do not overfill.

Wipe filler cap clean, then check the fluid level. The dipstick should indicate **COLD** when the fluid is at normal ambient temperature.

(1) Fill the pump fluid reservoir to the proper level and let the fluid settle for at least two minutes.

(2) Start the engine and let run for a few seconds then turn 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) Slowly turn the steering wheel right and left, lightly contacting the wheel stops at least 20 times.

(6) Check the fluid level add if necessary.

(7) Lower the vehicle, start the engine and turn the steering wheel slowly from lock to lock.

(8) Stop the engine and check the fluid level and refill as required.

(9) If the fluid is extremely foamy or milky looking, allow the vehicle to stand a few minutes and repeat the procedure.

CAUTION: Do not run a vehicle with foamy fluid for an extended period. This may cause pump damage.

REMOVAL AND INSTALLATION

POWER STEERING PUMP - 4.0L

REMOVAL

(1) Remove serpentine drive belt, refer to Group 7 Cooling.

(2) Remove pressure and return hoses from pump and drain pump.

(3) Remove 3 pump mounting bolts through pulley access holes.

(4) Tilt pump downward and remove from engine.

(5) Remove pulley from pump.

INSTALLATION

(1) Install pulley on pump.

(2) Install pump on engine.

(3) Install 3 pump mounting bolts and tighten to 28 N·m (21 ft. lbs.).

(4) Install the pressure and return hoses to pump.

(5) Install drive belt, refer to Group 7 Cooling.

(6) Add power steering fluid. Refer to Power Steering Pump Initial Operation.

REMOVAL AND INSTALLATION (Continued)

POWER STEERING PUMP - 4.7L

REMOVAL

(1) Remove the serpentine drive belt. Refer to Group 7 Cooling.

(2) Remove the pressure and return hoses from pump and drain pump.

(3) Remove 3 pump mounting bolts through pulley access holes (Fig. 2).

(4) Remove the pump from the vehicle.

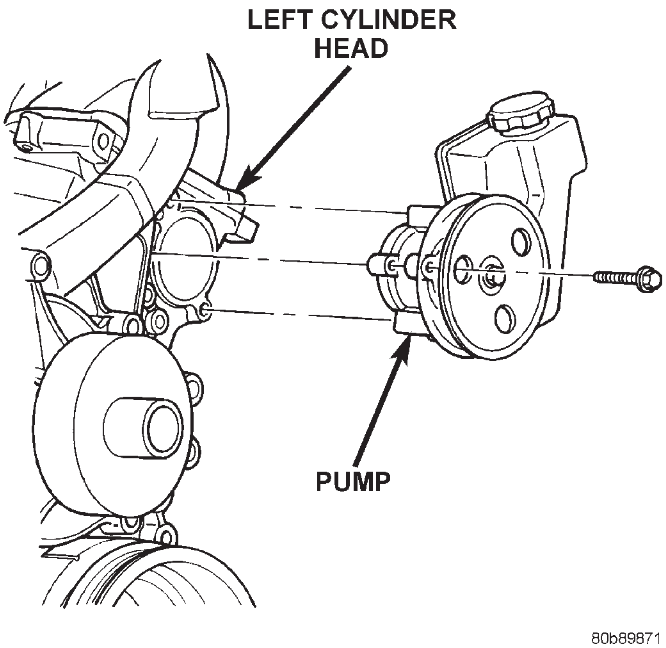


Fig. 2 Pump Mounting

INSTALLATION

(1) Position the pump on the left cylinder head and install bolts through pulley access holes. Tighten bolts to 40 N·m (30 ft. lbs.).

(2) Install the pressure and return hoses to pump.

(3) Install serpentine drive belt, refer to Group 7 Cooling.

(4) Add power steering fluid. Refer to Power Steering Pump Initial Operation in this section.

DISASSEMBLY AND ASSEMBLY

PUMP PULLEY

DISASSEMBLY

(1) Remove pump assembly.

(2) Remove pulley from pump with Puller C-4333 (Fig. 3).

ASSEMBLY

(1) Replace pulley if bent, cracked, or loose.

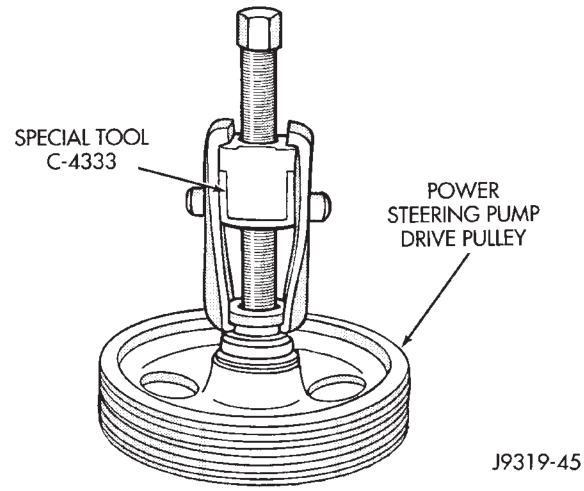


Fig. 3 Pulley Removal

(2) Install pulley on pump with Installer C-4063-B (Fig. 4) flush with the end of the shaft. Ensure the tool and pulley remain aligned with the pump shaft.

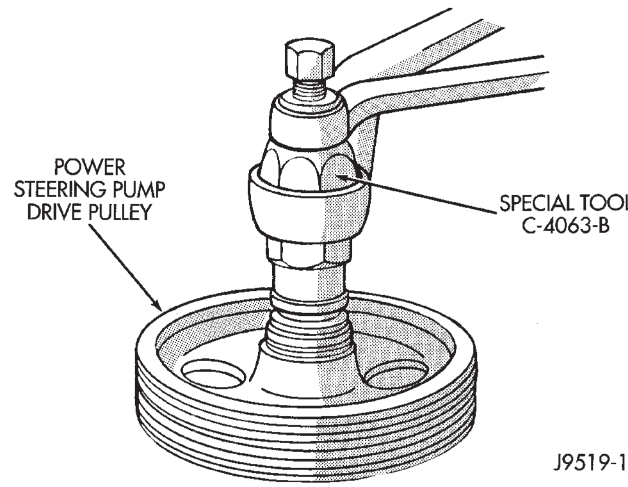


Fig. 4 Pulley Installation

(3) Install pump assembly.

(4) With Serpentine Belt, run engine until warm (5 min.) and note any belt chirp. If chirp exists, move pulley outward approximately 0.5 mm (0.020 in.). If noise increases, press on 1.0 mm (0.040 in.). **Be careful that pulley does not contact mounting bolts.**

PUMP RESERVOIR

DISASSEMBLY

(1) Remove power steering pump.

(2) Clean exterior of pump.

(3) Clamp the pump body in a soft jaw vice.

(4) Pry up tab and slide the retaining clips off (Fig. 5).

NOTE: Use new retaining clips for installtion.

DISASSEMBLY AND ASSEMBLY (Continued)

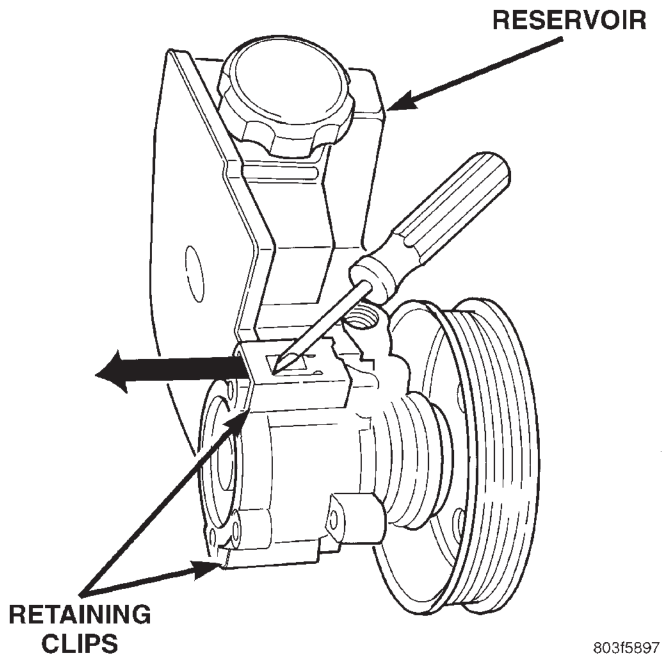


Fig. 5 Pump Reservoir Clips

(5) Remove fluid reservoir from pump body. Remove and discard O-ring seal.

ASSEMBLY

(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 **new** reservoir retainer clips until tab locks to housing.
(5) Install power steering pump.
(6) Add power steering fluid, refer to Pump Initial Operation.

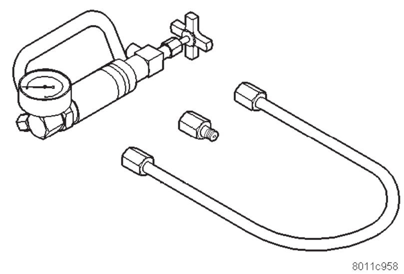
SPECIFICATIONS

TORQUE CHART

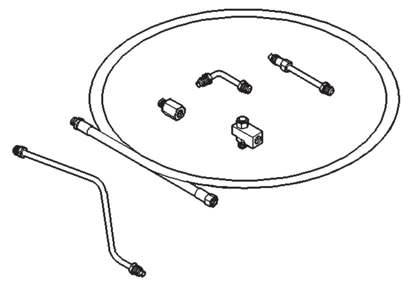
DESCRIPTION	TORQUE
Power Steering Pump	
Bracket Bolt-4.0L	57 N·m (42 ft. lbs.)
Pump Bolts-4.0L	28 N·m (21 ft. lbs.)
Pump Bolts-4.7L	40 N·m (30 ft. lbs.)
Flow Control Valve	75 N·m (55 ft. lbs.)
Pressure Line	20-38 N·m (14-28 ft. lbs.)
Return Line	20-38 N·m (14-28 ft. lbs.)

SPECIAL TOOLS

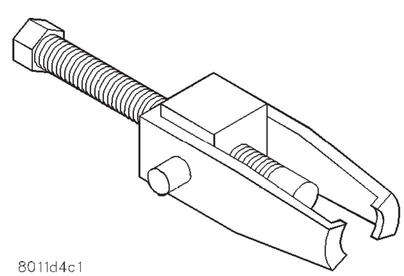
POWER STEERING PUMP



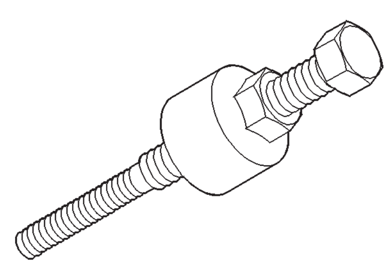
Analyzer Set, Power Steering Flow/Pressure 6815



Adapters, Power Steering Flow/Pressure Tester 6893



Puller C-4333



Installer, Power Steering Pulley C-4063–B

POWER STEERING GEAR

INDEX

DESCRIPTION AND OPERATION

POWER STEERING GEAR

The power steering gear is a recirculating ball type gear (Fig. 1). The gear 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 the rack piston moves. The rack piston teeth mesh with the pitman shaft. Turning the worm shaft turns the pitman shaft, which turns the steering linkage.

The following gear components can be serviced:

- Pitman Shaft and Cover
- Pitman Shaft Bearings
- Pitman Shaft Oil Seal/Dust Seal
- Stud Shaft Housing with Seal
- O-Rings and Teflon Rings

NOTE: If rack piston assembly is damaged the gear must be replaced.

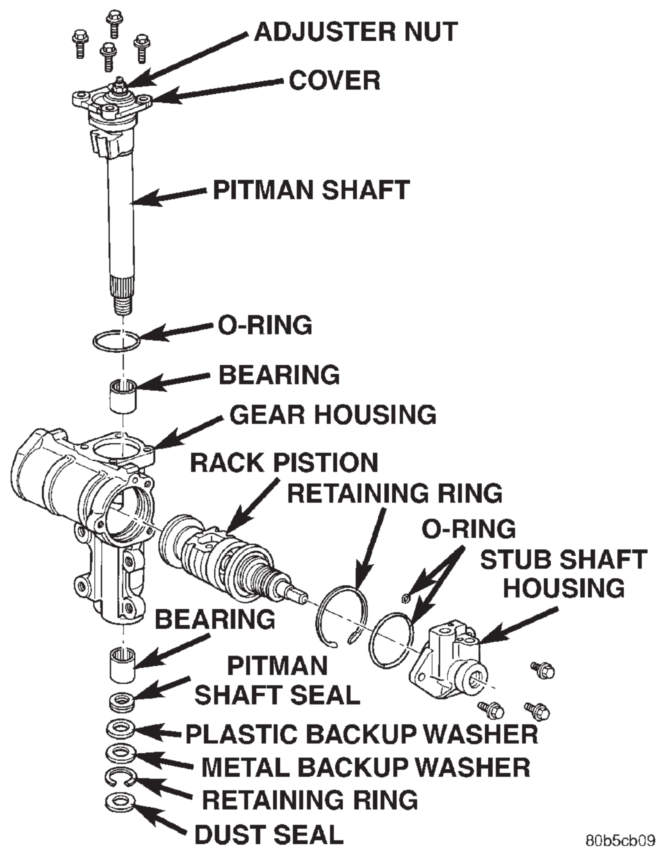
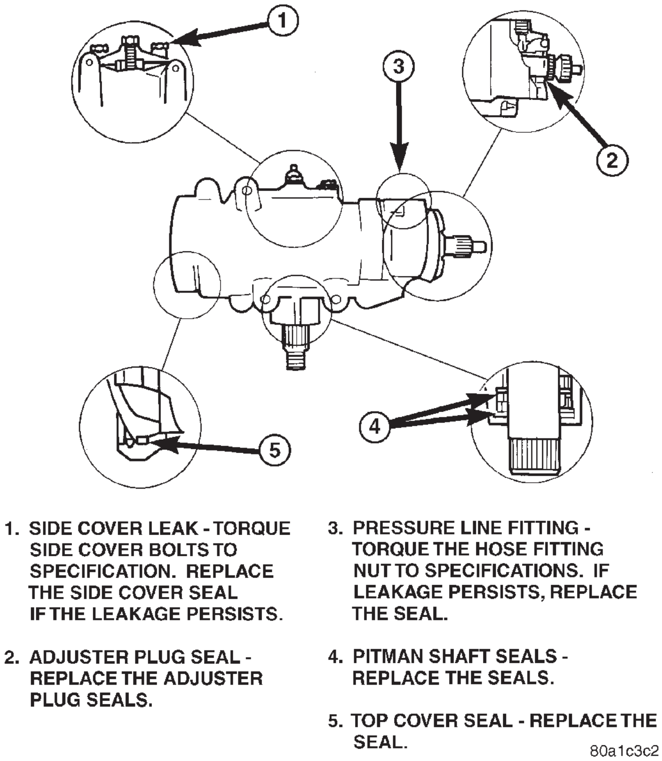


Fig. 1 Recirculating Ball Type Gear

DIAGNOSIS AND TESTING

POWER STEERING GEAR LEAKAGE DIAGNOSIS



REMOVAL AND INSTALLATION

STEERING GEAR

REMOVAL

(1) Place the front wheels in the straight ahead position with the steering wheel centered.

(2) Remove the air cleaner housing, refer to Group 14 Fuel System.

(3) Remove and cap the pressure and return lines (Fig. 2) from the steering gear.

(4) Remove the column coupler shaft bolt (Fig. 2) and remove the shaft from the gear.

(5) Remove left front wheel and tire assembly.

(6) Remove pitman arm from gear with Puller C-4150A.

(7) Remove windshield washer reservoir refer to Group 8 Electrical.

(8) Remove the steering gear mounting bolts. Remove the steering gear out of the engine compartment (Fig. 3).

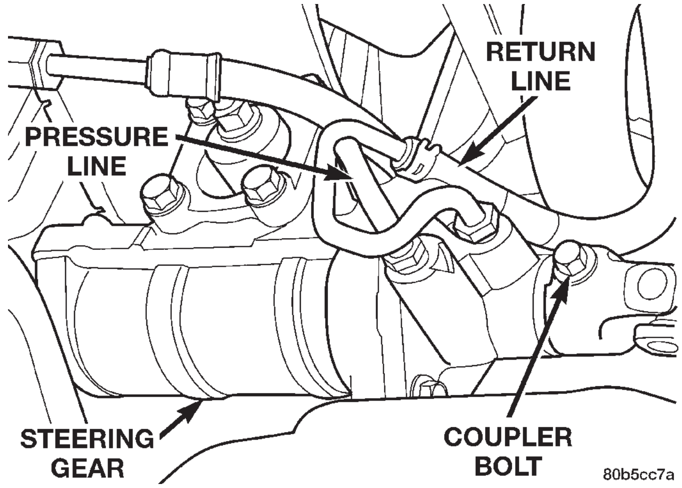


Fig. 2 Pressure And Return Lines

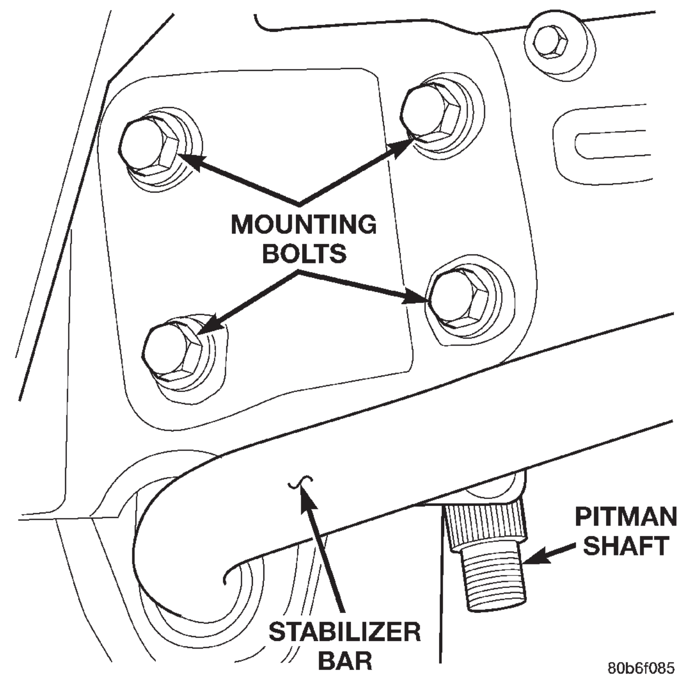


Fig. 3 Steering Gear Mounting

INSTALLATION

(1) Position the steering gear on the frame rail and install the bolts. Tighten the bolts to 108 N·m (80 ft. lbs.) torque.

(2) Install the pitman arm and tighten nut to 251 N·m (185 ft. lbs.).

(3) Install windshield washer reservoir refer to Group 8 Electrical.

(4) Install the wheel and tire assembly.

(5) Install the pressure and return hoses to the steering gear and tighten to 20-38 N·m (14-28 ft. lbs.).

(6) Install the column coupler shaft.

(7) Install the air cleaner housing refer to Group 14 Fuel System.

(8) Fill the power steering pump.

DISASSEMBLY AND ASSEMBLY

STUB SHAFT HOUSING

NOTE: If stub shaft housing, seal or bearing is damaged the housing must be replaced.

DISASSEMBLY

(1) Remove stub shaft housing bolts (Fig. 4).
(2) Remove housing from the steering gear (Fig. 5).
(3) Remove stub shaft housing o-rings (Fig. 6).

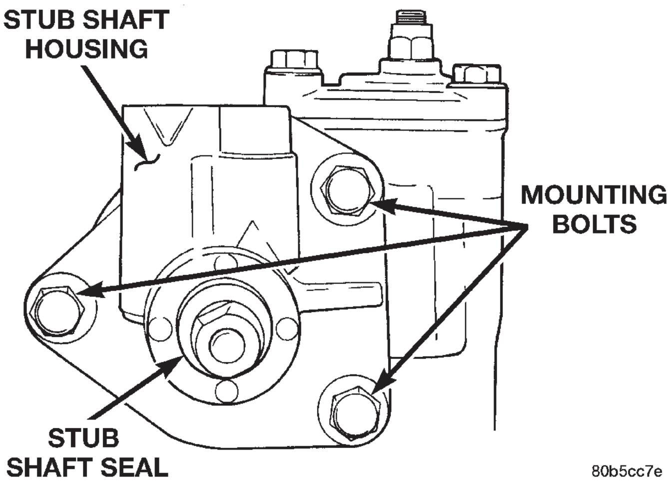


Fig. 4 Stub Shaft Housing

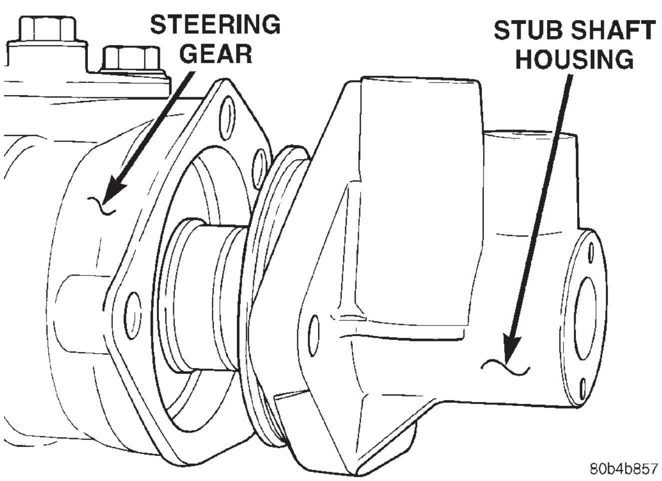


Fig. 5 Housing Removal

ASSEMBLY

(1) Grease stub shaft seal with **special grease** supplied with new stub shaft housing.
(2) Install new stub shaft housing o-rings.
(3) Install housing on the steering gear.
(4) Install the housing bolts and tighten to 62 N·m (46 ft. lbs.).

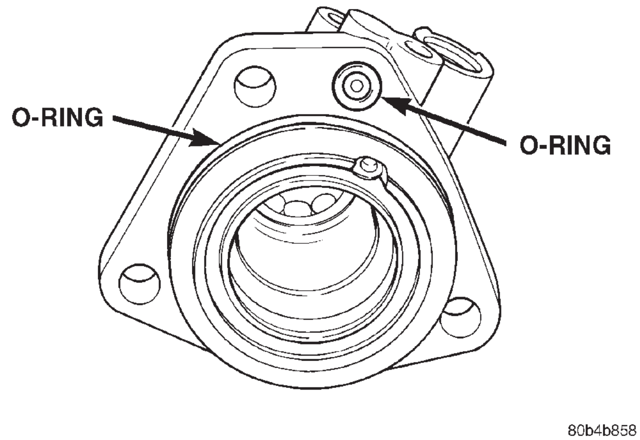


Fig. 6 O-Rings

PITMAN SHAFT/SEALS/BEARINGS

DISASSEMBLY

(1) Clean exposed end of pitman shaft and housing with a wire brush.
(2) Rotate the stub shaft with a wrench (Fig. 7) from stop to stop and count the number of turns.
(3) Center the stub shaft by rotating it from the stop 1/2 of the total amount of turns.

NOTE: The pitman shaft will not clear the housing if it is not centered.

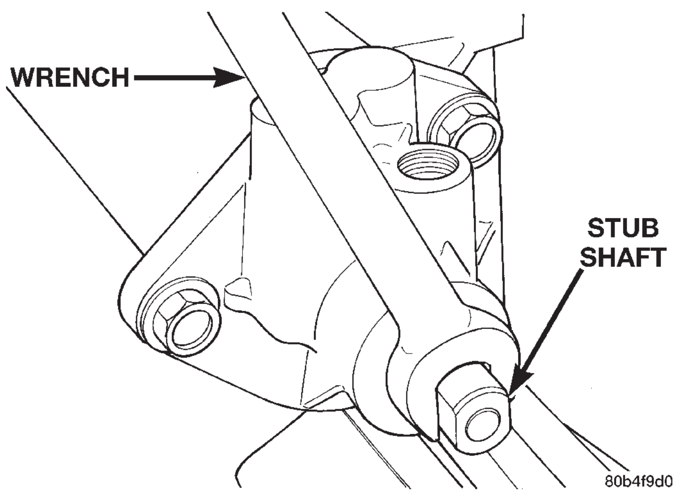


Fig. 7 Center Stub Shaft

(4) Remove pitman shaft cover bolts and remove the shaft assembly (Fig. 8).
(5) Remove pitman shaft cover o-ring.
(6) Remove pitman shaft dust seal from the housing with a Puller 7794-A and Slide Hammer C-637 (Fig. 9).
(7) Remove the pitman shaft oil seal retaining ring with snap ring pliers (Fig. 10).

DISASSEMBLY AND ASSEMBLY (Continued)

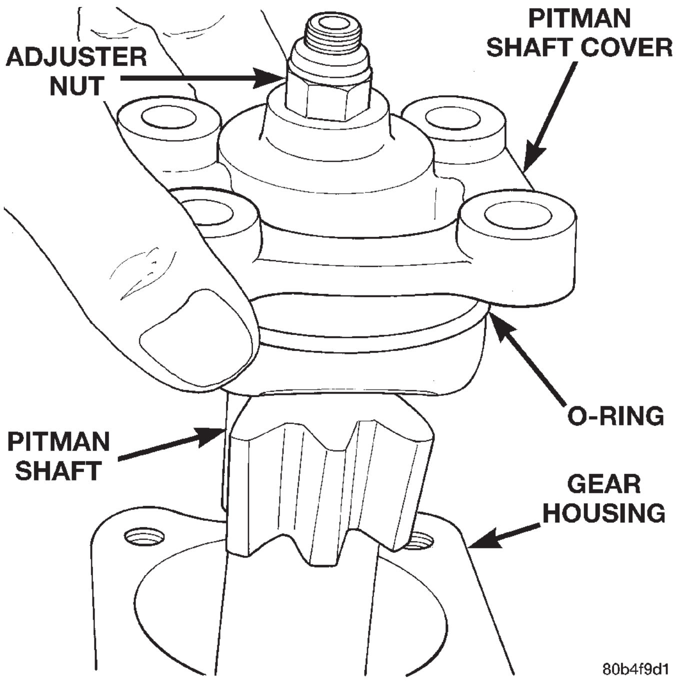


Fig. 8 Cover and Pitman Shaft

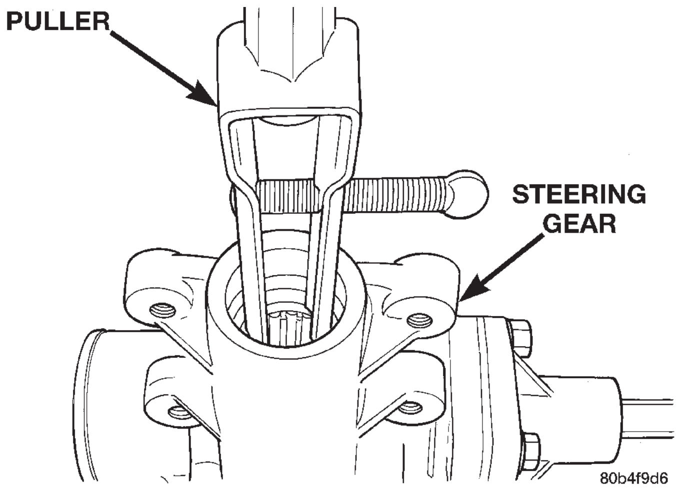


Fig. 9 Dust Seal Removal

(8) Remove oil seal metal backup washer then plastic backup washer from the housing (Fig. 11).

(9) Remove pitman shaft oil seal from the housing with a Puller 7794-A and Slide Hammer C-637 (Fig. 12).

(10) Drop Driver 8277 through the top bearing and align the driver up with the lower bearing. (Fig. 13). Install Handle C-4171 into the driver and remove the lower bearing.

(11) Turn the gear over and remover the upper bearing with Driver 8277 and Handle C-4171.

ASSEMBLY

(1) Install upper pitman shaft bearing, with Driver 8294 and Handle C-4171 (Fig. 14). Drive bearing into housing until the driver bottoms out.

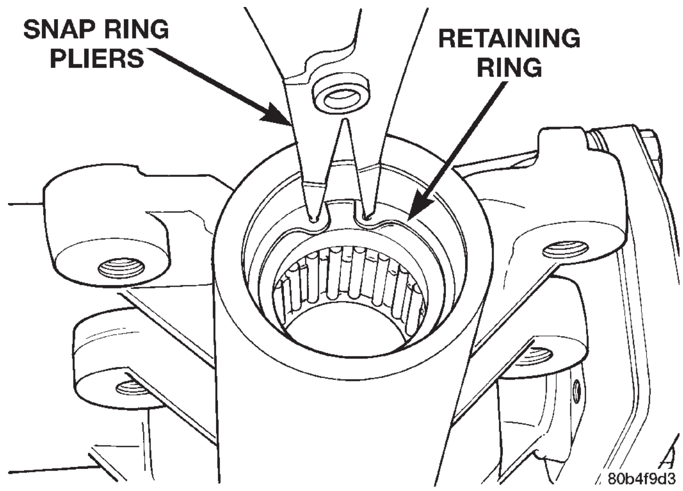


Fig. 10 Oil Seal Retaining Ring

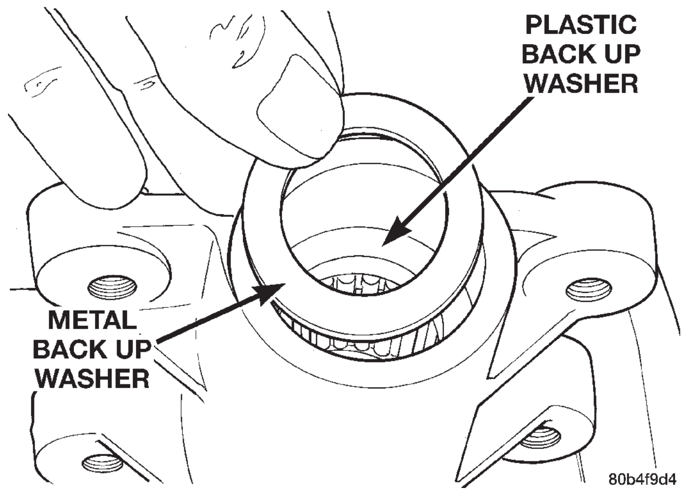


Fig. 11 Backup Washers

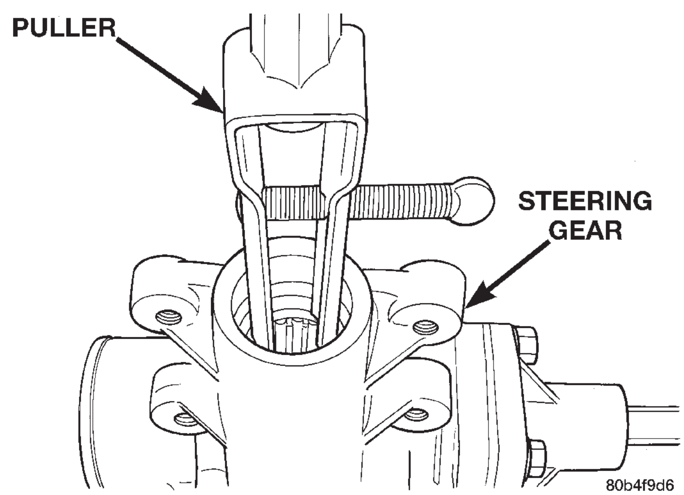


Fig. 12 Oil Seal Removal

NOTE: Install upper pitman shaft bearing with the part number/letters facing the driver.

DISASSEMBLY AND ASSEMBLY (Continued)

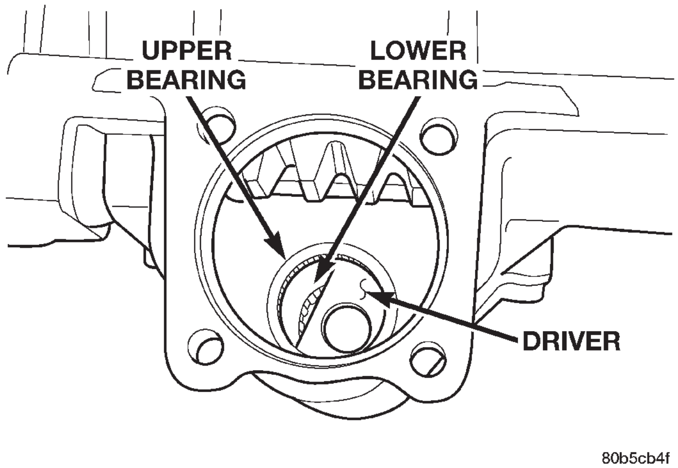


Fig. 13 Bearing Driver

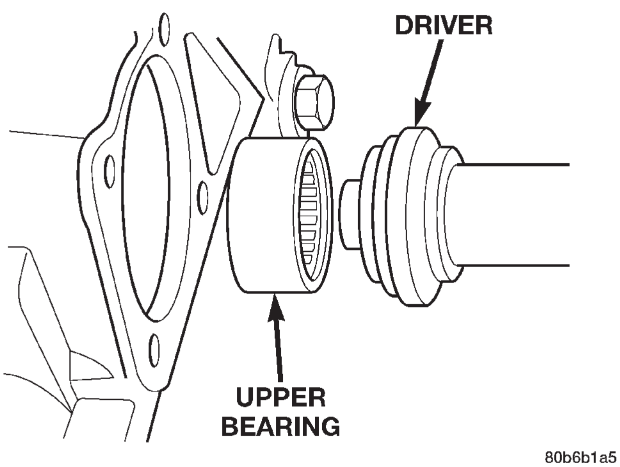


Fig. 14 Upper Pitman Shaft Bearing

(2) Install lower pitman shaft bearing with the other side Driver 8294 and Handle C-4171 (Fig. 15). Drive bearing into housing until the bearing shoulder is seated against the housing.

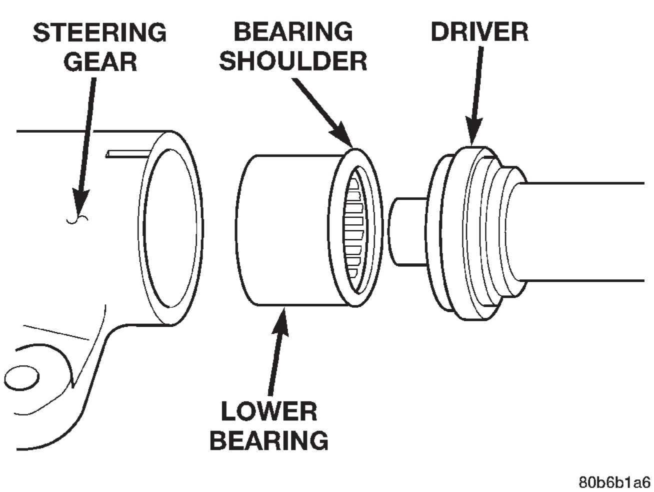


Fig. 15 Lower Pitman Shaft Bearing

(3) Coat the oil seal and backup washers with **special grease** supplied with the new seal.

(4) Install the oil seal with Driver 8294 and Handle C-4171.

(5) Install plastic backup washer.

NOTE: The plastic backup washer has a lip on the inside diameter that faces down towards the oil seal.

(6) Install metal backup washer.

(7) Install the retainer ring with snap ring pliers.

(8) Coat the dust seal with **special grease** supplied with the new seal.

(9) Install dust seal with Driver 8294 and Handle C-4171.

(10) Install new pitman shaft cover o-ring.

(11) Install pitman shaft assembly into the housing.

(12) Install cover bolts and tighten to 62 N·m (46 ft. lbs.).

(13) Perform over-center rotation torque adjustment.

RACK PISTON/VALVE ASSEMBLY

DISASSEMBLY

(1) Clean exposed end of pitman shaft and housing with a wire brush.

(2) Rotate the stub shaft with a wrench (Fig. 16) from stop to stop and count the number of turns.

(3) Center the stub shaft by rotating it from the stop 1/2 of the total amount of turns.

NOTE: The pitman shaft will not clear the housing if it is not centered.

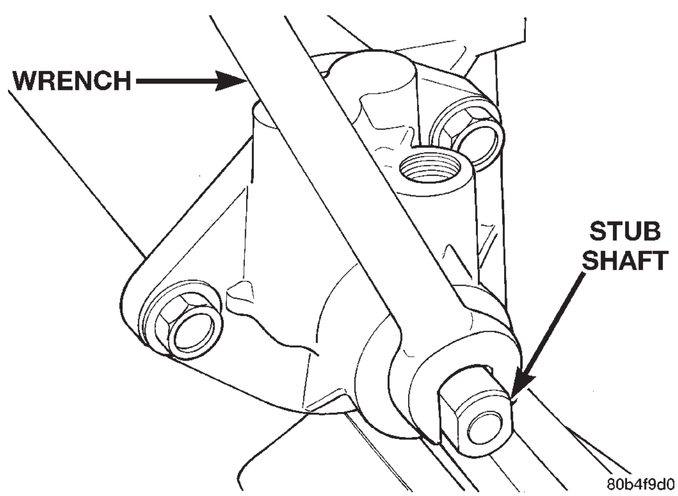


Fig. 16 Center Stub Shaft

(4) Remove pitman shaft cover bolts and remove the shaft assembly (Fig. 17).

(5) Remove the pitman shaft cover o-ring.

DISASSEMBLY AND ASSEMBLY (Continued)

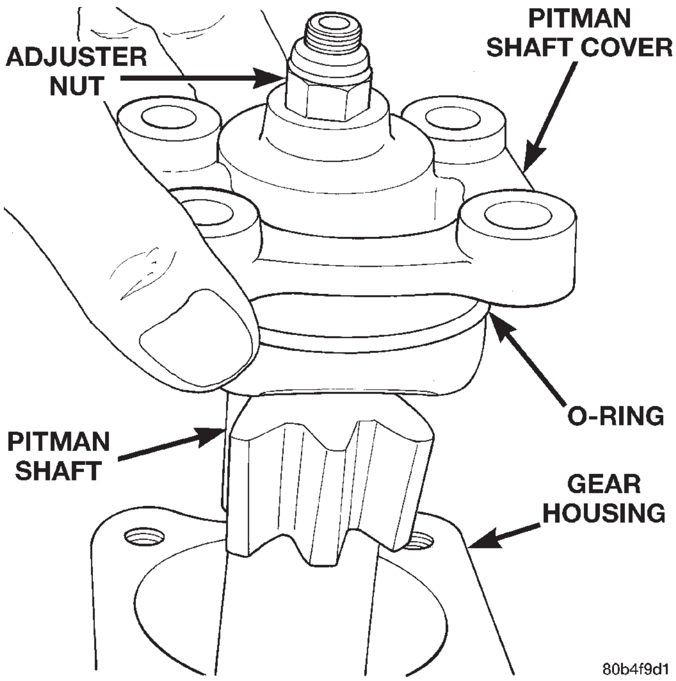


Fig. 17 Cover and Pitman Shaft

(6) Remove stub shaft housing bolts (Fig. 18).

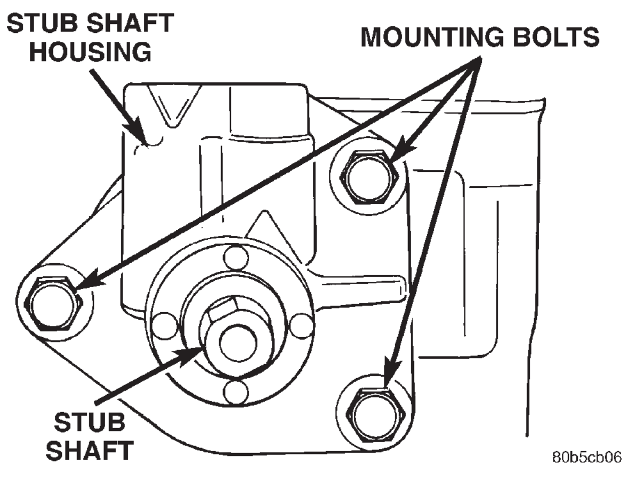


Fig. 18 Stub Shaft Housing

(7) Remove the housing from the stub shaft (Fig. 19).

(8) Remove stub shaft housing o-rings (Fig. 20).

(9) Remove the rack piston/valve assembly retaining ring with snap ring pliers (Fig. 21).

(10) Pull the rack piston/valve assembly out of the gear housing (Fig. 22).

NOTE: If the rack piston is damage the gear assembly must be replaced.

(11) Remove teflon rings and o-ring (Fig. 23) from the rack piston/valve assembly.

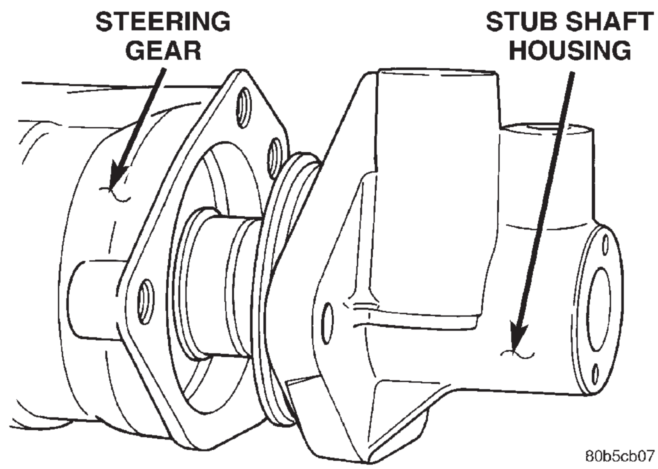


Fig. 19 Housing Removal

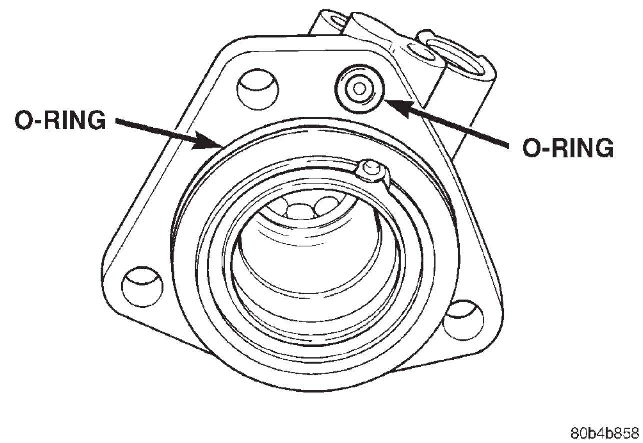


Fig. 20 O-Rings

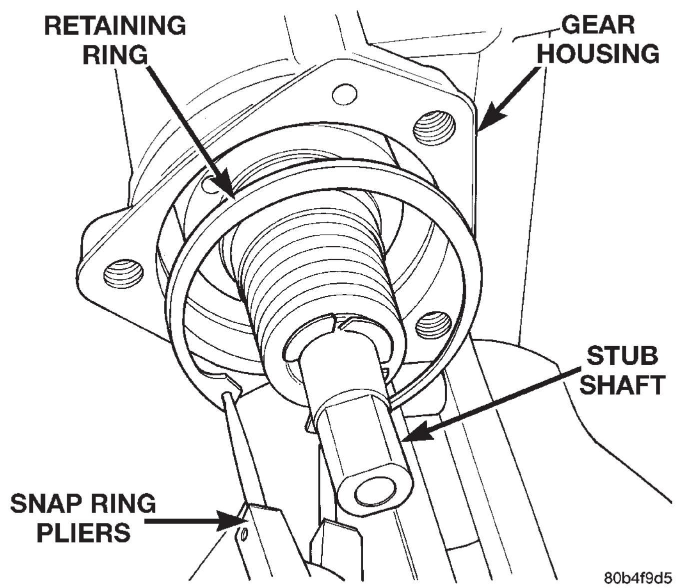


Fig. 21 Retaining Ring

DISASSEMBLY AND ASSEMBLY (Continued)

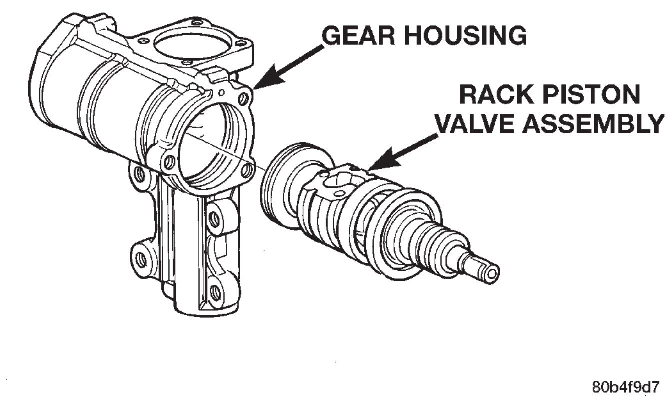


Fig. 22 Rack Piston/Valve Assembly

CAUTION: The rack piston teflon ring and o-ring must be replaced whenever the assembly is removed from the housing.

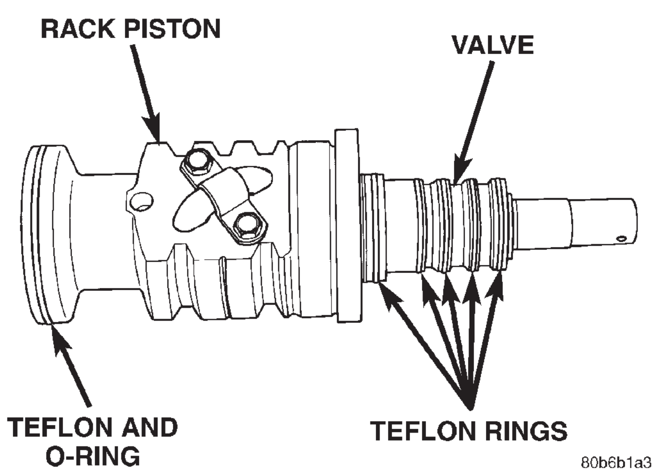


Fig. 23 Teflon Rings And O-Ring

(12) Remove pitman shaft dust seal from the housing with Puller 7794-A and Slide Hammer C-637 (Fig. 24).

(13) Remove pitman shaft oil seal retaining ring from the housing with snap ring pliers (Fig. 25).

(14) Remove metal backup washer then plastic backup washer from the housing (Fig. 26).

(15) Remove oil seal from the housing with a Puller 7794-A and Slide Hammer C-637 (Fig. 27).

ASSEMBLY

(1) Coat the oil seal and backup washers with **special grease** supplied with the new seal.

(2) Install the oil seal with Driver 8294 and Handle C-4171.

(3) Install plastic backup washer.

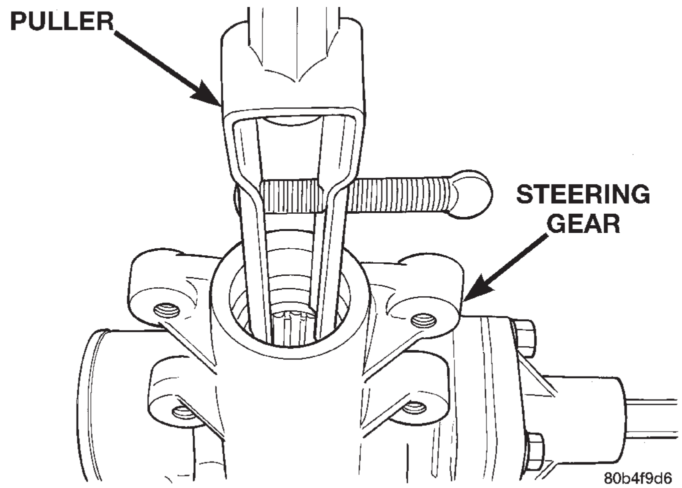


Fig. 24 Dust Seal

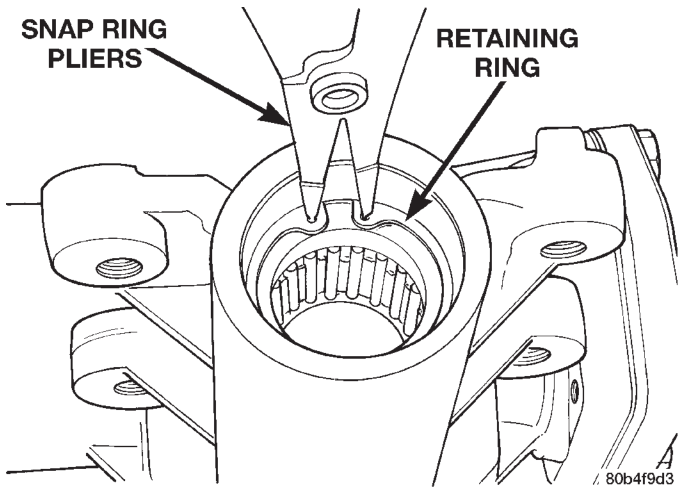


Fig. 25 Oil Seal Retaining Ring

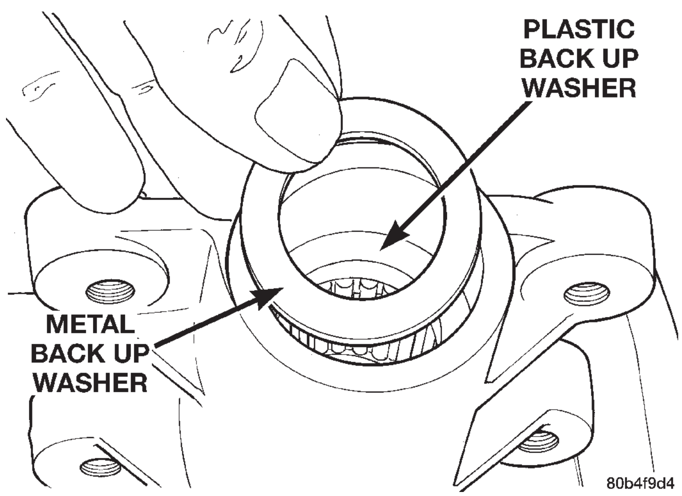


Fig. 26 Oil Seal Backup Washers

NOTE: The plastic backup washer has a lip on the inside diameter that faces down towards the oil seal.

DISASSEMBLY AND ASSEMBLY (Continued)

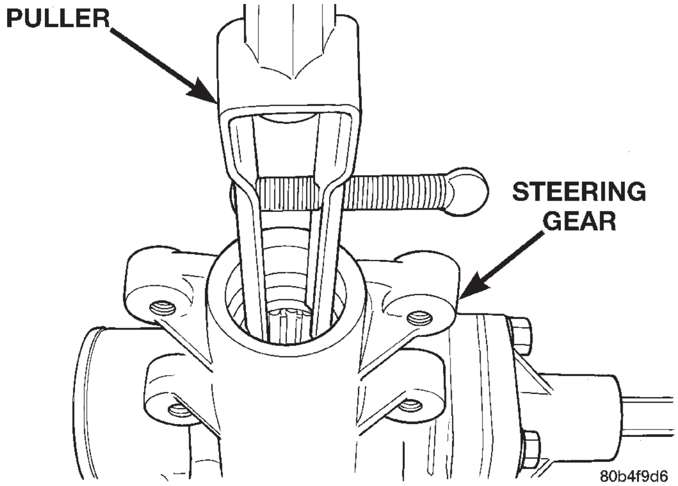


Fig. 27 Oil Seal Removal

(4) Install metal backup washer.

(5) Install the retainer ring with snap ring pliers.

(6) Coat the dust seal with **special grease** supplied with the new seal.

(7) Install dust seal with Driver 8294 and Handle C-4171.

(8) Lubricate new o-ring and teflon rings with power steering fluid and install on the rack piston/valve assembly.

(9) Lubricate the rack piston/valve assembly with power steering fluid.

(10) Slide the assembly into the gear housing.

(11) Install new stub shaft housing o-rings and install the housing. Tighten the housing bolts to 62 N·m (46 ft. lbs.).

(12) Install new o-ring on the pitman shaft cover.

(13) Install the pitman shaft into the gear housing.

(14) Install the pitman shaft cover bolts and tighten to 62 N·m (46 ft. lbs.).

(15) Perform over-center rotation torque adjustment.

ADJUSTMENTS

STEERING GEAR

NOTE: Adjusting the steering gear in the vehicle is not recommended. Remove gear from the vehicle and drain the fluid. Then mount gear in a vise to perform adjustments.

OVER-CENTER

(1) Rotate the stub shaft with Socket 8343 from stop to stop and count the number of turns.

(2) Center the stub shaft by rotating it from the stop 1/2 of the total amount of turns.

(3) Place torque wrench and Socket 8343 in a vertical position on the stub shaft. Rotate the wrench 45 degrees each side of the center and record the highest rotational torque in this range (Fig. 28). This is the Over-Center Rotating Torque.

NOTE: The stub shaft must rotate smoothly without sticking or binding.

(4) Rotate the stub shaft between 90° and 180° to the left of center and record the left off-center preload. Repeat this to the right of center and record the right off-center preload. The average of these two recorded readings is the Preload Rotating Torque.

(5) The Over-Center Rotating Torque should be 0.45-0.80 N·m (4-7 in. lbs.) **higher** than the Preload Rotating Torque.

(6) If an adjustment to the Over-Center Rotating Torque is necessary, first loosen the adjuster lock nut. Then turn the pitman shaft adjuster screw back (COUNTERCLOCKWISE) until fully extended, then turn back in (CLOCKWISE) one full turn.

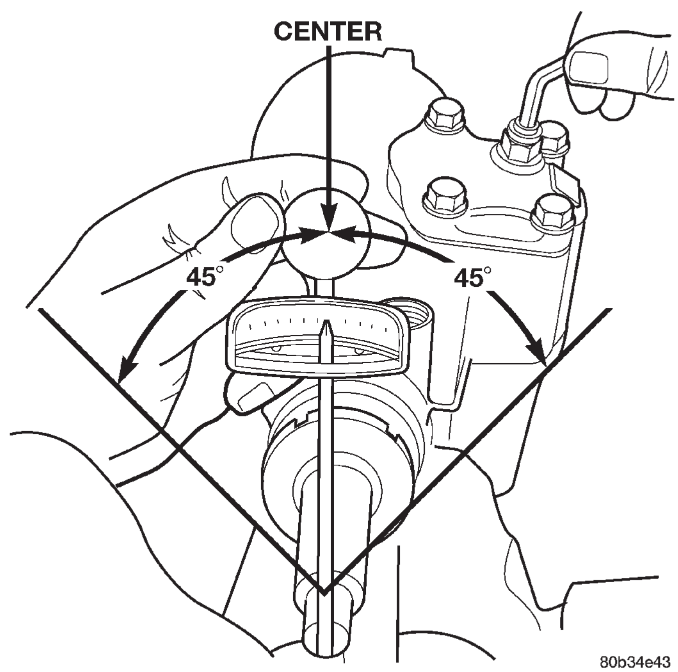


Fig. 28 Checking Over-center Rotation Torque

(7) Remeasure Over-Center Rotating Torque. If necessary turn the adjuster screw and repeat measurement until correct Over-Center Rotating Torque is reached.

NOTE: To increase the Over-Center Rotating Torque turn the screw CLOCKWISE.

(8) Prevent the adjuster screw from turning while tightening adjuster lock nut. Tighten the adjuster lock nut to 37-52 N·m (27-38 ft. lbs.).

SPECIFICATIONS

POWER STEERING GEAR

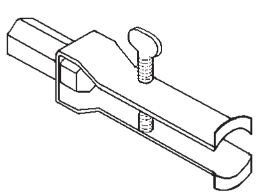
Steering Gear
Type . . . . Recirculating Ball
Overall Ratio 12.7:1
Pitman Shaft Overcenter Drag
New Gear (under 400 miles) . . . . . . 0.45-0.80 N·m (4-7 in. lbs.) + Worm Shaft Preload
Used Gear (over 400 miles) . . . . 0.5-0.6 N·m (4-5 in. lbs.) + Worm Shaft Preload

TORQUE CHART

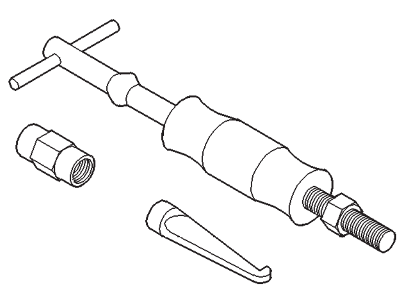
DESCRIPTION	TORQUE
Power Steering Gear	
Adjustment Screw Locknut	37-52 N·m (27-38 ft. lbs.)
Gear to Frame Bolts	108 N·m (80 ft. lbs.)
Pitman Shaft Nut	251 N·m (185 ft. lbs.)
Pitman Shaft Cover Bolts	62 N·m (46 ft. lbs.)
Stub Shaft Housing Bolts	62 N·m (46 ft. lbs.)
Pressure Line	20-38 N·m (14-28 ft. lbs.)
Return Line	20-38 N·m (14-28 ft. lbs.)

SPECIAL TOOLS

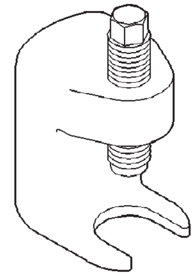
POWER STEERING GEAR



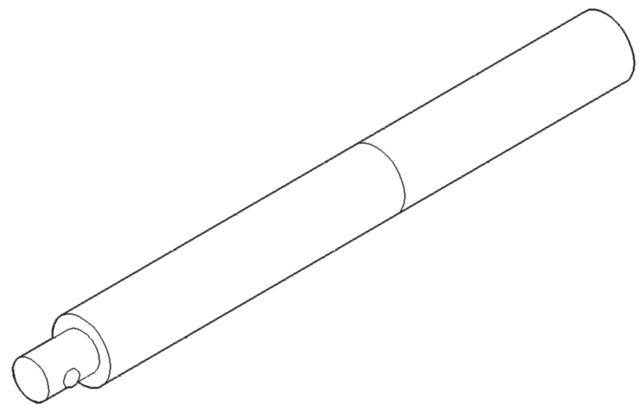
Puller Seal 7794-A



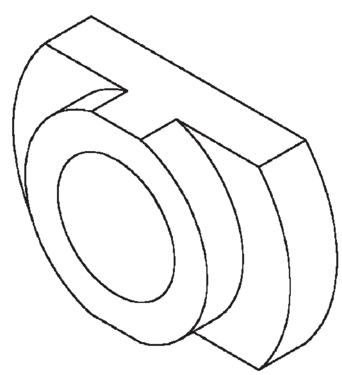
Slide Hammer C-637



Remover, Pitman Arm C-4150A

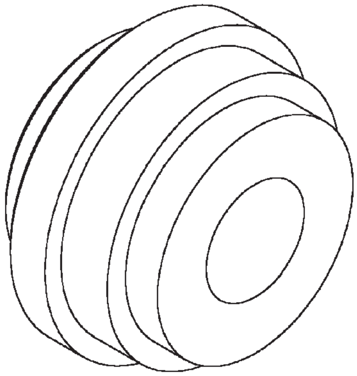


Handle C-4171

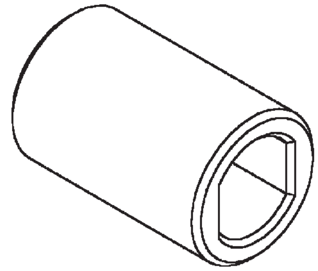


Driver 8277

SPECIAL TOOLS (Continued)



Driver 8294



Scoket 8343

STEERING LINKAGE

INDEX

DESCRIPTION AND OPERATION

STEERING LINKAGE

The steering linkage consists of a pitman arm, drag link, tie rod, and steering dampener (Fig. 1). An adjustment sleeve on the tie rod is used to set wheel toe position. The sleeve on the drag link is used for steering wheel centering.

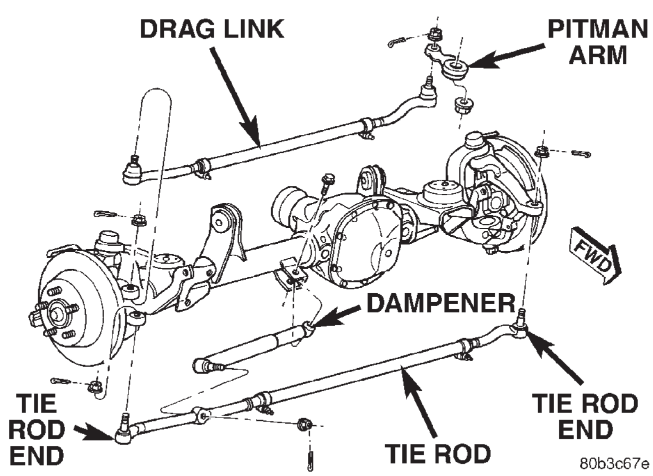


Fig. 1 Steering Linkage

CAUTION: If any steering components are replaced or serviced an alignment must be performed, to ensure the vehicle meets all alignment specifications.

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

TIE ROD ENDS

The tie rod ends connect the drag link to the wheel assembly. The ends are forged, with a lubed for life ball socket. The tie rod provides toe alignment and transfers steering input from the drag link to the wheels.

PITMAN ARM

The pitman arm is attached at one end of the steering gear's sector shaft. The other end is connected to the drag link. the pitman arm transfers rotary motion into side to side motion. The arm is splined to the steering gear shaft.

DRAG LINK AND ENDS

The drag link and ends are comprised of two forged ends connected by a steel adjusting tube. The drag link connects the steering gear pitman arm to the steering knuckle. The larger offset end is attached to the pitman arm. The sleeve is used for steering wheel centering.

STEERING DAMPER

The steering damper provides steering system dampening. The damper is mounted to the axle housing and the tie rod end. The damper consists of steel tube shock absorber with a permanent bushed end.

REMOVAL AND INSTALLATION

TIE ROD

REMOVAL

(1) Raise and support the vehicle.

(2) Remove wheel and tire assemblies.

(3) Remove the damper cotter pin and nut from the tie rod (Fig. 2).

REMOVAL AND INSTALLATION (Continued)

(4) Remove the damper from the tie rod with Puller C-3894-A.

(5) Remove the cotter pins and nuts from the tie rod ends at the steering knuckles (Fig. 2).

(6) Remove the tie rod ends from the steering knuckles with Puller C-3894-A.

(7) Loosen the adjustment sleeve clamp bolts and unscrew the tie rod ends from the sleeve.

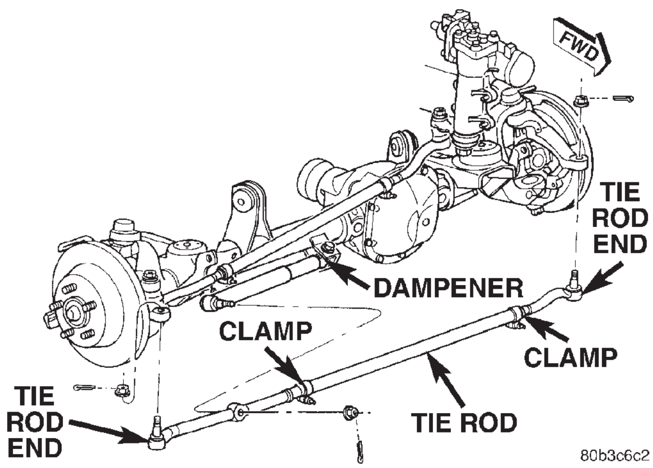


Fig. 2 Tie Rod Assembly

INSTALLATION

(1) Screw the tie rod ends into the adjustment sleeve.

(2) Install the tie rod on the steering knuckles and install the nuts.

(3) Tighten the nuts to 47 N·m (35 ft. lbs.). Install new cotter pins and bend end 60°.

(4) Position the adjustment sleeve clamp bolts to their original location and tighten to 68 N·m (50 ft. lbs.).

(5) Install the damper on the tie rod and install the nut.

(6) Tighten the nut to 68 N·m (50 ft. lbs.). Install new cotter pins and bend end 60°.

(7) Install wheel and tire assemblies.

(8) Remove support and lower the vehicle.

(9) Perform toe position adjustment.

PITMAN ARM

REMOVAL

(1) Remove the cotter pin and nut from the drag link at the pitman arm (Fig. 3).

(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 C-4150A (Fig. 4).

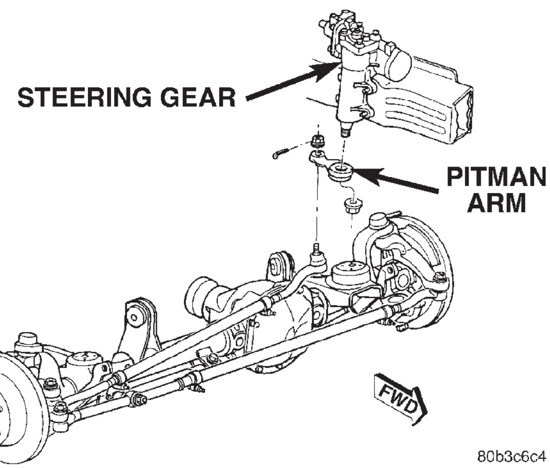


Fig. 3 Pitman Arm

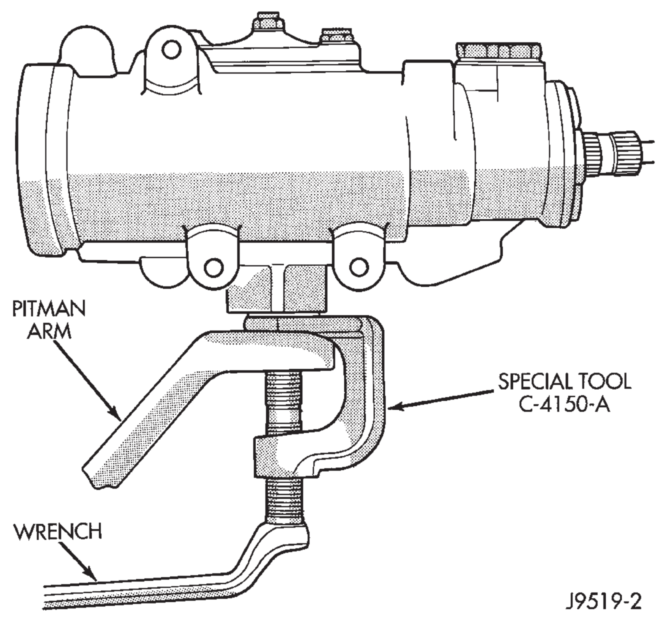


Fig. 4 Pitman Arm Removal

INSTALLATION

(1) Align and install the pitman arm on steering gear shaft.

(2) Install the washer and nut on the shaft and tighten the nut to 251 N·m (185 ft. lbs.).

(3) Install drag link ball stud to pitman arm. Install nut and tighten to 88 N·m (65 ft. lbs.). Install a new cotter pin.

DRAG LINK

REMOVAL

(1) Raise and support the vehicle.

(2) Remove right wheel and tire assembly.

(3) Remove the cotter pins and nuts at the right steering knuckle and pitman arm (Fig. 5).

REMOVAL AND INSTALLATION (Continued)

(4) Remove the drag link from the steering knuckle and pitman arm Puller C-3894-A.

(5) Loosen adjustment sleeve clamp bolts and unscrew the tie rod ends from the adjustment sleeve.

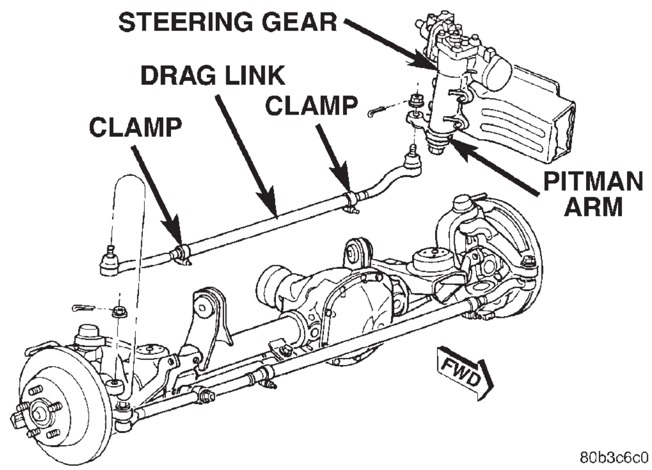


Fig. 5 Drag Link Assembly

INSTALLATION

(1) Screw the tie rod ends into the adjustment sleeve.

(2) Install the drag link onto the right steering knuckle and pitman arm.

(3) Tighten the nut at the steering knuckle to 47 N·m (35 ft. lbs.). Tighten the pitman nut to 88 N·m (65 ft. lbs.). Install new cotter pins.

(4) Position clamp bolts to their original position and tighten to 68 N·m (50 ft. lbs.).

(5) Install right wheel and tire assembly.

(6) Remove support and lower the vehicle.

(7) Center the steering wheel.

STEERING DAMPER

REMOVAL

(1) Remove the cotter pin and nut from the ball stud at the tie rod.

(2) Remove the steering damper from the tie rod with Puller C-3894-A (Fig. 6).

(3) Remove the steering damper nut and bolt from the axle bracket (Fig. 7).

INSTALLATION

(1) Install the steering damper to the axle bracket and tie rod.

(2) Install the steering damper bolt in the axle bracket and tighten bolt to 88 N·m (65 ft. lbs.).

(3) Install the nut at the tie rod and tighten to 68 N·m (50 ft. lbs.). Install a new cotter pin.

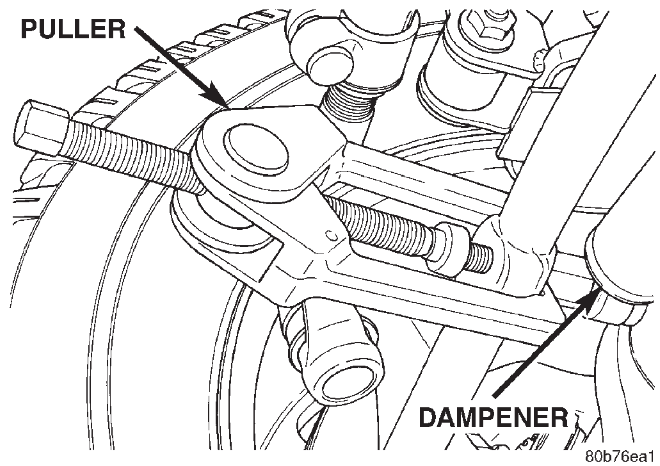


Fig. 6 Steering Damper Puller

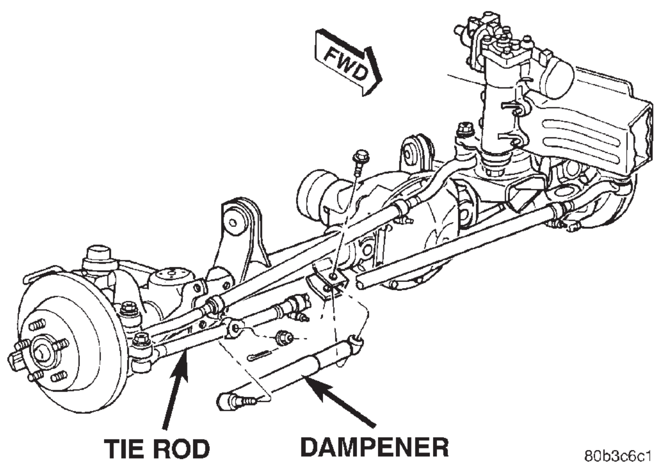


Fig. 7 Steering Damper

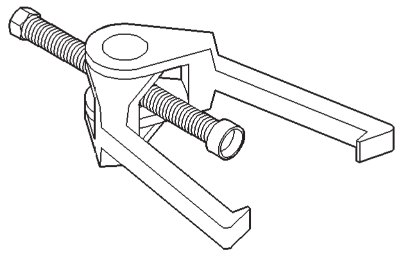
SPECIFICATIONS

TORQUE CHART

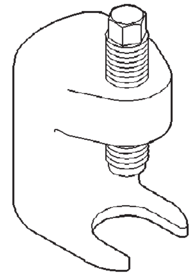
DESCRIPTION	TORQUE
Pitman Arm	
Shaft Nut	251 N·m (185 ft. lbs.)
Drag Link	
Pitman Arm Nut	88 N·m (65 ft. lbs.)
Knuckle Nut	47 N·m (35 ft. lbs.)
Clamp Nuts	68 N·m (50 ft. lbs.)
Tie Rod	
Knuckle Nut	47 N·m (35 ft. lbs.)
Clamp Nuts	68 N·m (50 ft. lbs.)
Steering Damper	
Axle Bolt	88 N·m (65 ft. lbs.)
Tie Rod Nut	68 N·m (50 ft. lbs.)

SPECIAL TOOLS

STEERING LINKAGE



Puller C-3894–A



Remover Pitman C-4150A

STEERING COLUMN

INDEX

DESCRIPTION AND OPERATION

STEERING COLUMN

The tilt column (Fig. 1) has been designed to be serviced as an assembly, less the wiring, switches, shrouds, steering wheel, etc. Most steering column components can be serviced without removing the steering column from the vehicle.

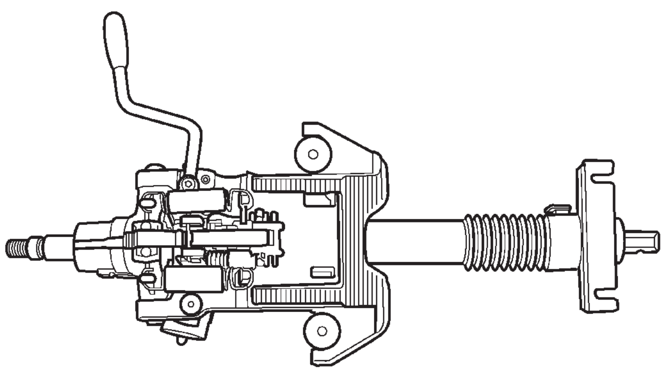


Fig. 1 Steering Column

SERVICE WARNINGS AND CAUTIONS

To service the steering wheel, switches or airbag, refer to Group 8M and follow all WARNINGS and CAUTIONS.

WARNING: THE AIRBAG 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 TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE. FAILURE TO DO SO COULD RESULT IN ACCIDENTAL DEPLOYMENT OF THE AIRBAG AND POSSIBLE PERSONAL INJURY. 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 FASTENERS LISTED IN THE PARTS BOOKS.

CAUTION: Safety goggles should be worn at all times when working on steering columns.

REMOVAL AND INSTALLATION

STEERING COLUMN

WARNING: BEFORE SERVICING THE STEERING COLUMN THE AIRBAG SYSTEM MUST BE DISARMED. FAILURE TO DO SO MAY RESULT IN ACCIDENTAL DEPLOYMENT OF THE AIRBAG AND POSSIBLE PERSONAL INJURY. REFER TO GROUP 8M RESTRAINT SYSTEMS FOR SERVICE PROCEDURES.

REMOVAL

(1) Position front wheels straight ahead.
(2) Disconnect and isolate the negative (ground) cable from the battery.
(3) Remove the airbag, refer to Group 8M Restraint Systems for service procedures.
(4) Remove the steering wheel nut and remove wheel with Puller C-3894-A (Fig. 2).

NOTE: Ensure the puller jaws are seated in the pockets (Fig. 3) of the steering wheel armature.

(5) Remove the cluster bezel by pulling it from the instrument panel (Fig. 4).
(6) Remove the knee blocker cover (Fig. 5), refer to Group 8E Instrument Panel Systems.
(7) Remove the lower steering column shroud mounting screw (Fig. 6).

REMOVAL AND INSTALLATION (Continued)

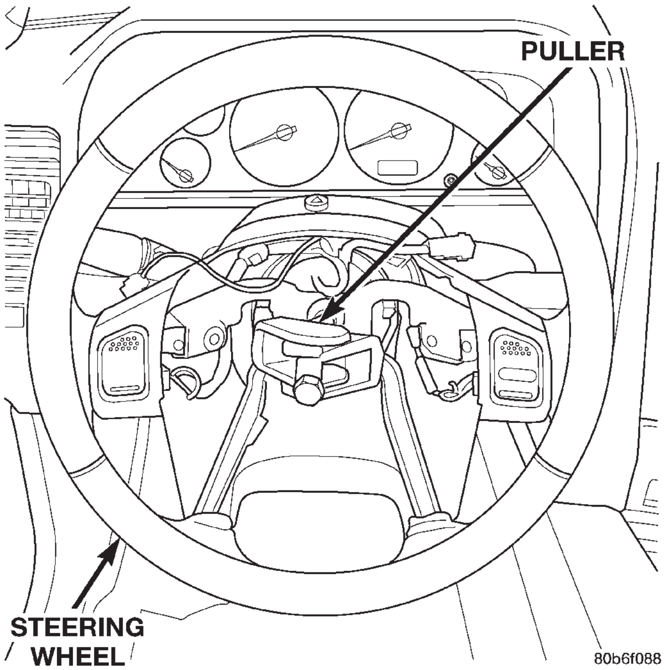


Fig. 2 Steering Wheel Puller

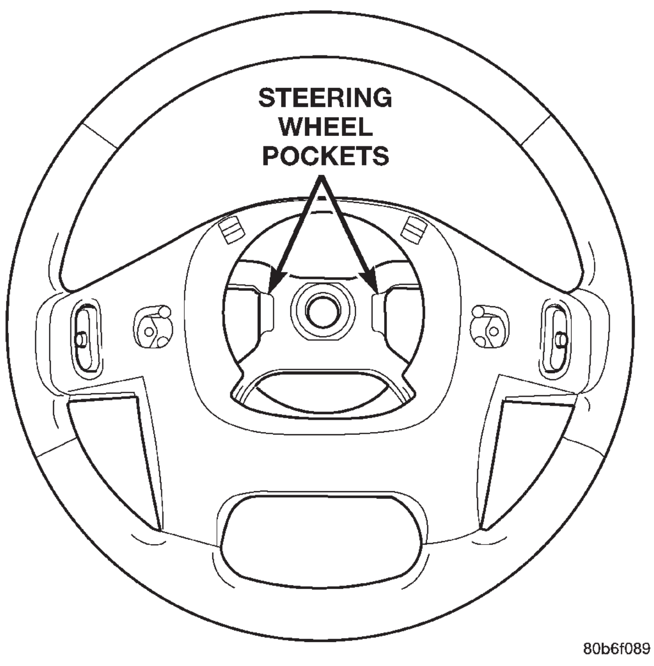


Fig. 3 Steering Wheel Pockets

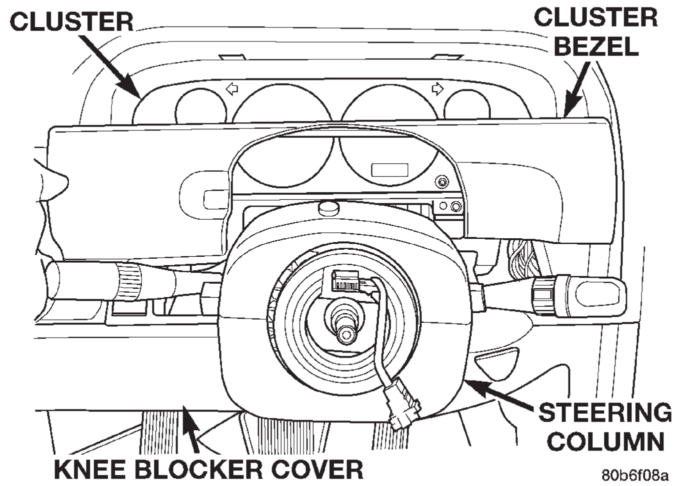


Fig. 4 Cluster Bezel

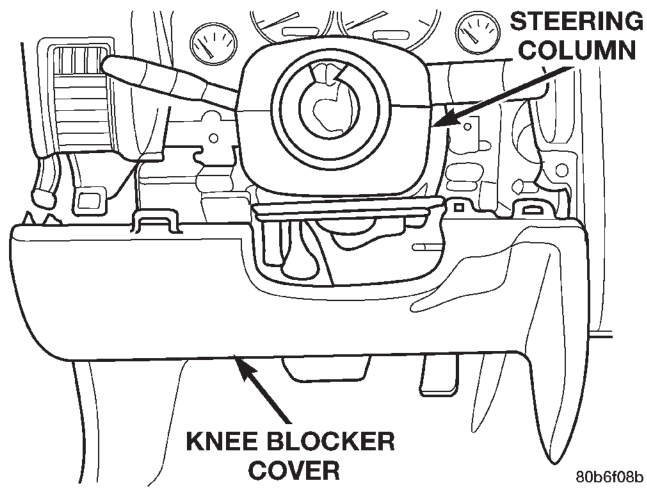


Fig. 5 Knee Blocker Cover

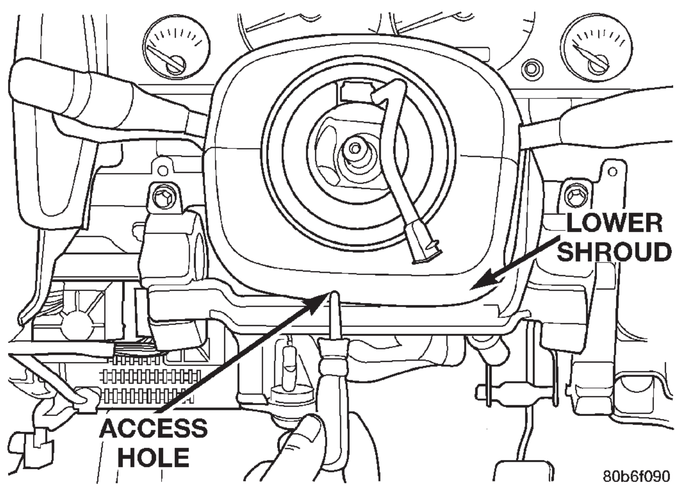


Fig. 6 Column Shroud Mounting Screw

REMOVAL AND INSTALLATION (Continued)

(8) Unsnap the two halves of the column shrouds by pressing on the sides of the upper shroud and tilting the rear of the upper shroud up. Remove the shrouds from the steering column (Fig. 7).

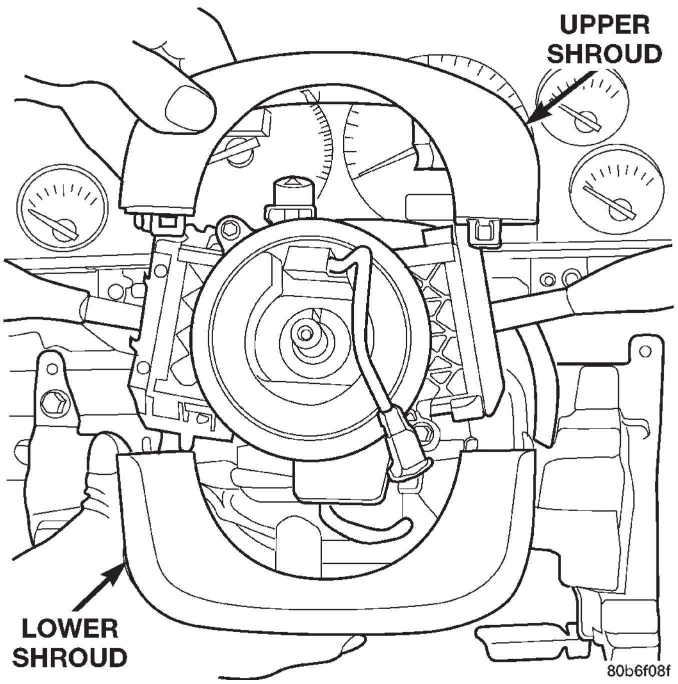


Fig. 7 Column Shrouds

(9) Remove the upper fixed shroud mounting screws and remove the shroud (Fig. 8).

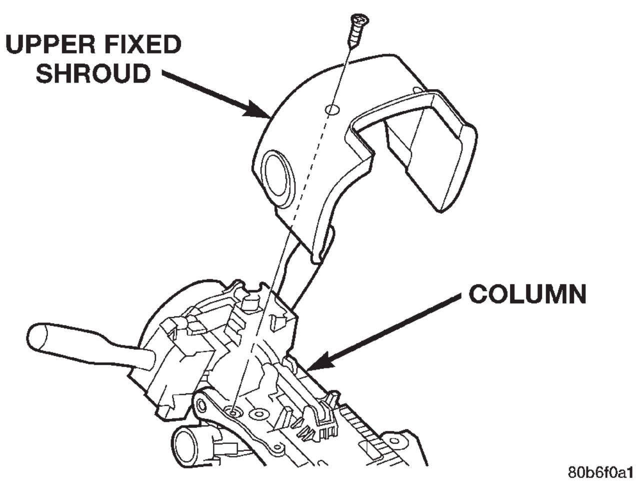


Fig. 8 Upper Fixed Shroud

(10) Disconnect the multifuction switch (Fig. 9) and ignition switch harness.

(11) Remove the multifuction switch screw from underneath the switch (Fig. 10). Slide the multifuction switch and clock spring off the column as an assembly (Fig. 11).

(12) Turn the ignition key to the on position then release and remove the shifter interlock cable (Fig. 12) from the ignition lock cylinder housing.

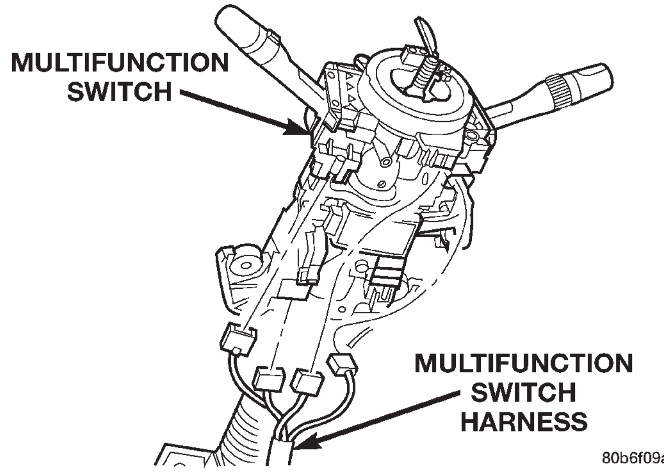


Fig. 9 Multifuction Switch Harness

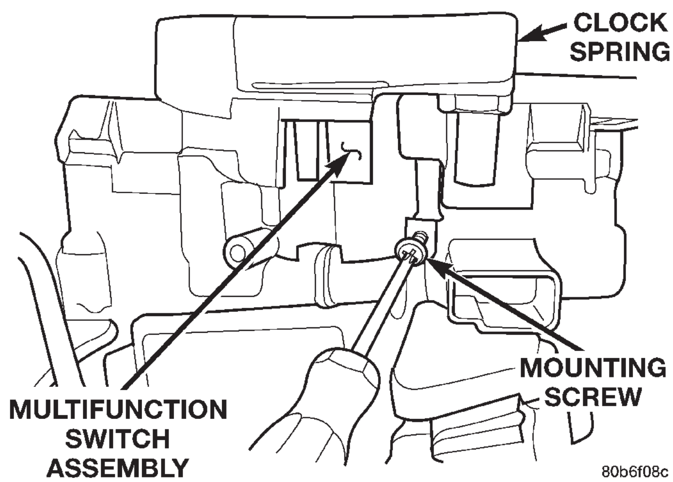


Fig. 10 Multifuction Switch Screw

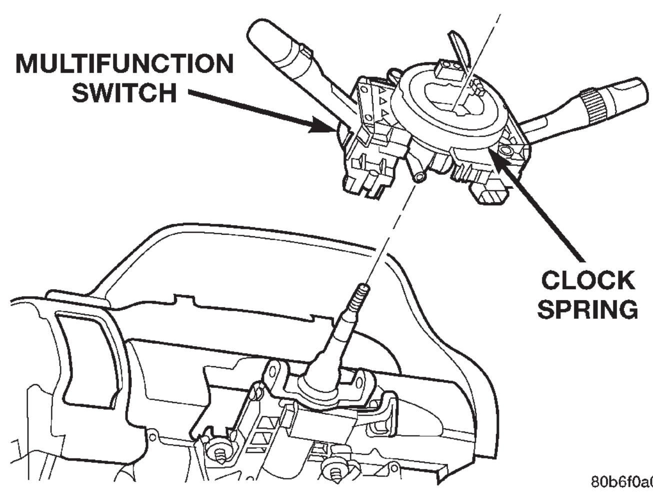


Fig. 11 Multifuction Switch And Clock Spring

REMOVAL AND INSTALLATION (Continued)

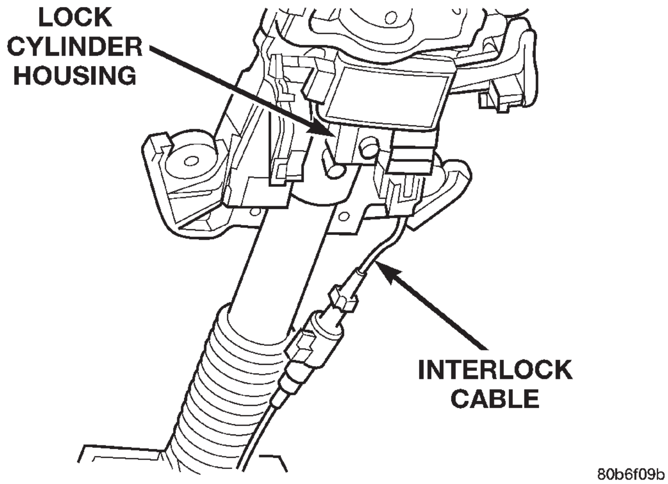


Fig. 12 Shifter Interlock Cable

(13) Remove the column coupler bolt (Fig. 13) and slide the coupler off the column shaft.

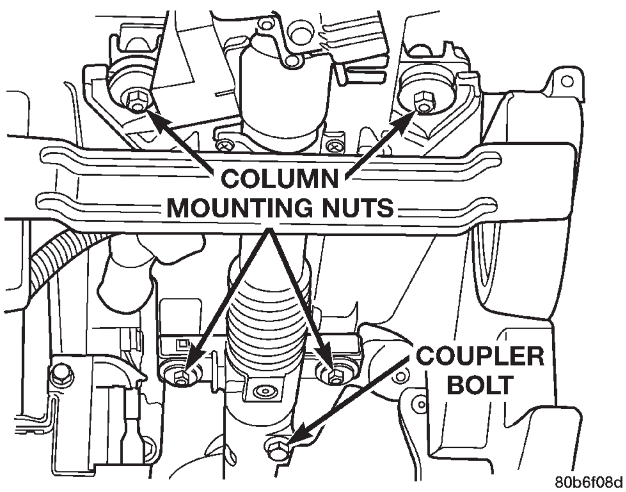


Fig. 13 Column Coupler Bolt And Mounting Nuts

(14) Remove the column mounting nuts (Fig. 13) and lower column off mounting studs. Remove the column from the vehicle.

(15) Remove the ignition switch, cylinder and SKIM (Fig. 14), refer to Group 8D Ignition System.

INSTALLATION

(1) Install the ignition switch, cylinder and SKIM, refer to Group 8D Ignition System.

(2) Install the column into the vehicle and lift the column up onto the mounting studs. Install the mounting nuts and tighten to 12 N·m (105 in. lbs.).

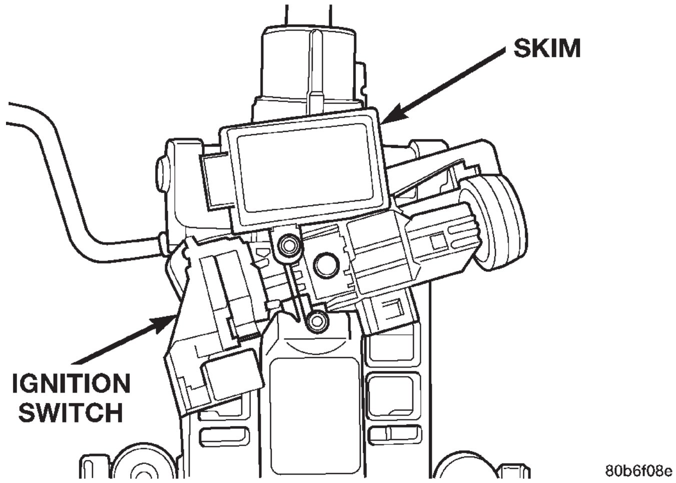


Fig. 14 Ignition Switch And SKIM

(3) Slid the coupler onto the column shaft and install the coupler bolt. Tighten the coupler bolt to 49 N·m (36 ft. lbs.).

(4) Turn the ignition key to the on position then release and install the shifter interlock cable (Fig. 12) into ignition lock cylinder housing.

(5) Slide the multifuction switch and clock spring onto the column as an assembly (Fig. 11).

(6) Install the multifuction switch mounting screw (Fig. 10).

(7) Connect the multifuction switch (Fig. 9) and ignition switch harness.

(8) Install the upper fixed shroud and mounting screws (Fig. 8).

(9) Install the lower steering column shroud to the steering column. Install and tighten the mounting screw.

(10) Install the upper column shroud. Align the upper shroud to the lower shroud and snap the two shroud halves together.

(11) Install the knee blocker cover (Fig. 5), refer to Group 8E Instrument Panel Systems.

(12) Install the cluster bezel by pulling it from the instrument panel (Fig. 4).

(13) Align the steering wheel with the column index spline and install the wheel on the column shaft. Pull the clockspring wire harness through the steering wheel armature spokes.

(14) Install and tighten the steering wheel mounting nut to 61 N·m (45 ft. lbs.).

(15) Connect the steering wheel wire harness connector to the clock spring connector.

(16) Install the airbag, refer to Group 8M Restraint Systems for service procedures.

(17) Connect the negative (ground) cable to the battery.

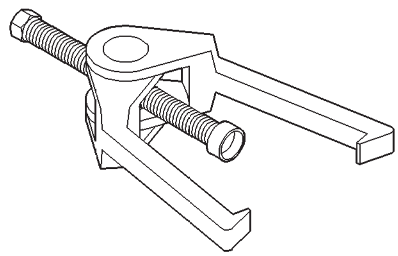
SPECIFICATIONS

TORQUE CHART

DESCRIPTION	TORQUE
Steering Column	
Steering Wheel Nut	61 N·m (45 ft. lbs.)
Column Bracket Nuts	12 N·m (105 in. lbs.)
Shaft Coupler Bolts	49 N·m (36 ft. lbs.)

SPECIAL TOOLS

STEERING COLUMN



Puller C-3894-A

STEERING

CONTENTS

POWER STEERING—3.1L VM DIESEL

INDEX

GENERAL INFORMATION

POWER STEERING PUMP

The power steering pump used with the 3.1L VM Diesel engine operates the same way as the power steering pump used with the 4.0/4.7L gasoline engines. Refer to the Description and Operation section for the 4.0/4.7L gasoline engine power steering pump for more information.

POWER STEERING PUMP—3.1L VM DIESEL

INDEX

SERVICE PROCEDURES

POWER STEERING PUMP – INITIAL OPERATION

WARNING: THE FLUID LEVEL SHOULD BE CHECKED WITH ENGINE OFF TO PREVENT INJURY FROM MOVING COMPONENTS.

CAUTION: Use MOPAR Power Steering Fluid or equivalent. Do not use automatic transmission fluid and do not overfill.

Wipe filler cap clean, then check the fluid level. The dipstick should indicate **COLD** when the fluid is at normal ambient temperature.

(1) Fill the pump fluid reservoir to the proper level and let the fluid settle for at least two minutes.

(2) Start the engine and let run for a few seconds then turn 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) Slowly turn the steering wheel right and left, lightly contacting the wheel stops at least 20 times.

(6) Check the fluid level add if necessary.

(7) Lower the vehicle, start the engine and turn the steering wheel slowly from lock to lock.

(8) Stop the engine and check the fluid level and refill as required.

(9) If the fluid is extremely foamy or milky looking, allow the vehicle to stand a few minutes and repeat the procedure.

CAUTION: Do not run a vehicle with foamy fluid for an extended period. This may cause pump damage.

REMOVAL AND INSTALLATION

POWER STEERING PUMP - 3.1L DIESEL

REMOVAL

(1) Open the hood and disconnect the negative battery cable.

(2) Remove the intercooler outlet hose from the vehicle (Fig. 1).

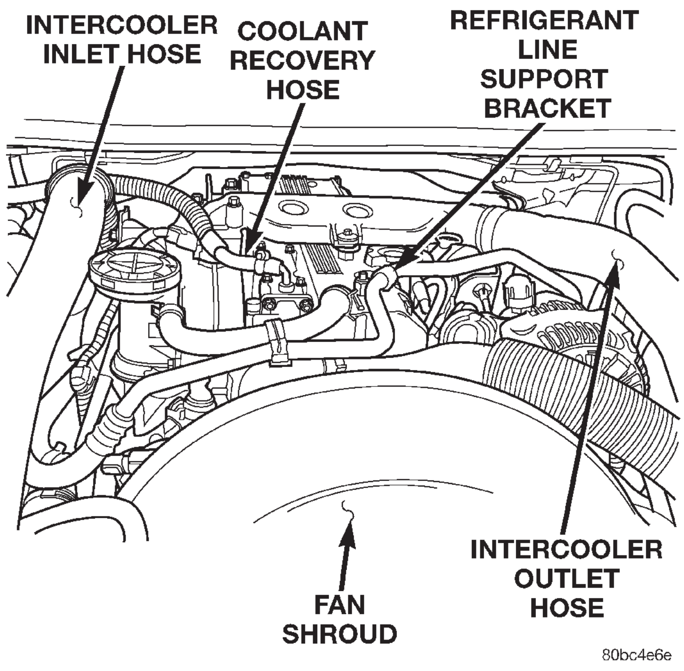


Fig. 1 Diesel Engine Compartment

REMOVAL AND INSTALLATION (Continued)

(3) Remove the accessory drive belt from the power steering pump pulley (Fig. 2). Refer to Group 7, Cooling System for the procedure.

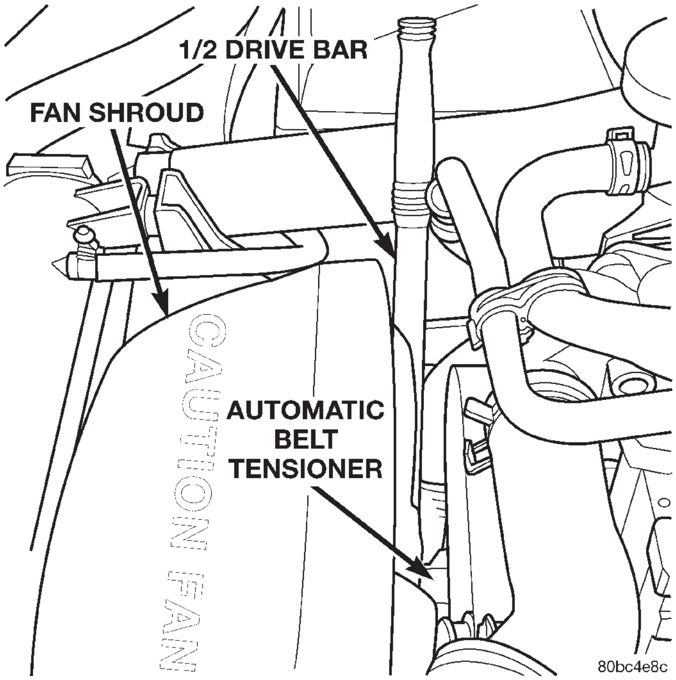


Fig. 2 Removing Accessory Drive Belt

(4) Install a allen wrench in the power steering pump center shaft to hold the pump in position. Remove the (3) power steering pump pulley retaining bolts (Fig. 3).

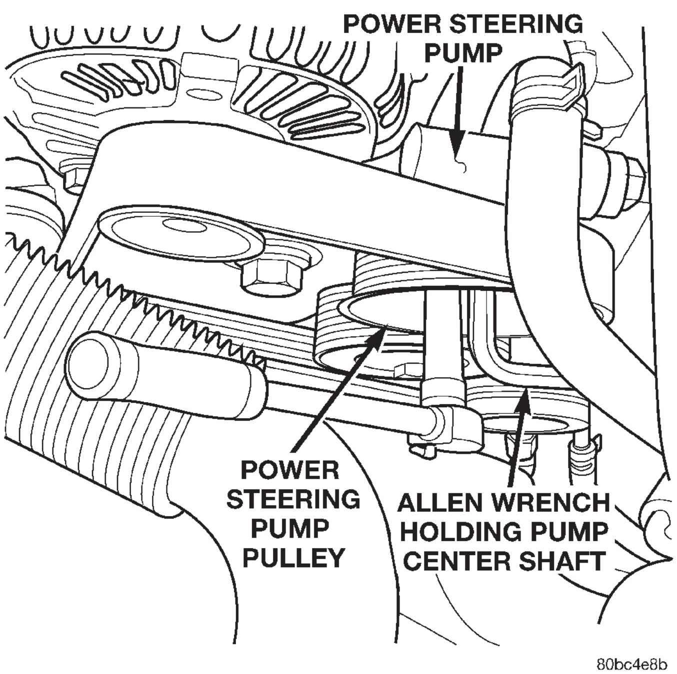


Fig. 3 Removing Power Steering Pump Pulley Retaining Bolts

(5) Remove the power steering pump pulley from the pump.

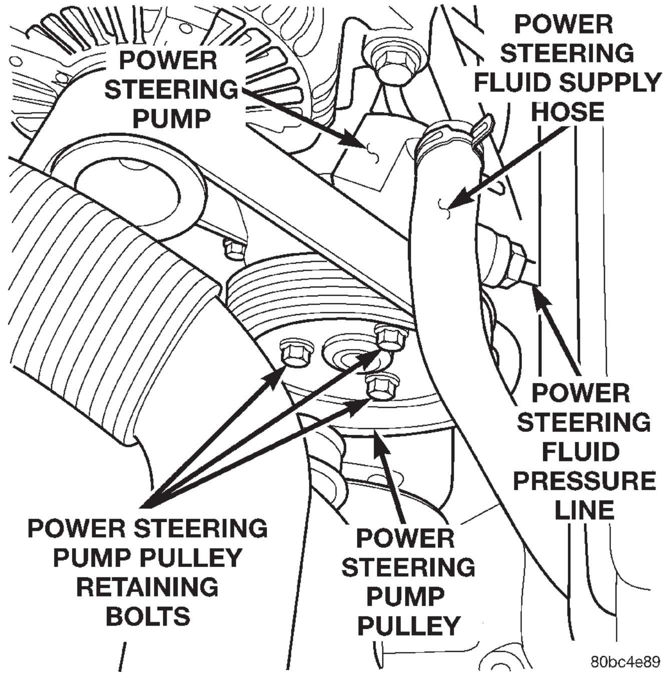


Fig. 4 Power Steering Pump Position & Orientation

(6) Remove the power steering fluid supply hose from the pump (Fig. 4).

(7) Remove the power steering fluid pressure line from the pump (Fig. 4).

(8) Remove the steel vacuum supply line from the rear of the power steering pump.

(9) Remove the power steering pump to mounting bracket retaining bolts and remove the pump from the vehicle.

INSTALLATION

WARNING: Power steering system fluid may be contaminated with metal shavings, overheated or improper fluid. All fluid should be drained from the system. After any component replacement, system should be flushed and filled with Mopar Power Steering fluid, or equivalent.

(1) Position the pump in the pump mounting bracket and install the retaining bolts. Torque the bolts to 27 N·m (20 ft. lbs.).

(2) Install the steel vacuum supply line on the rear of the power steering pump.

(3) Install the power steering fluid pressure line on the pump (Fig. 5). Torque the nut to 24 N·m (18 ft. lbs.). Be certain the sealing o-ring is lubricated and free of tears.

(4) Install the power steering fluid supply hose on the pump (Fig. 5).

REMOVAL AND INSTALLATION (Continued)

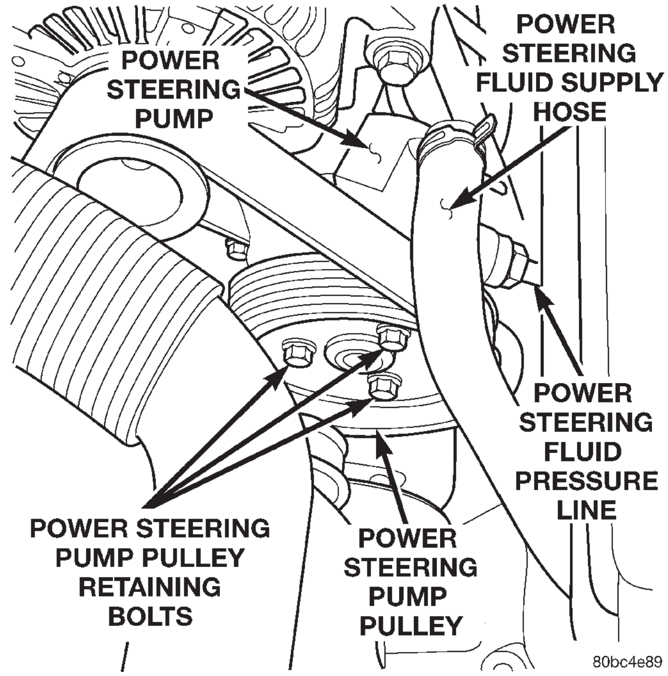


Fig. 5 Power Steering Pump Position & Orientation

(5) Install the power steering pump pulley on the pump. Torque the retaining bolts to 27 N·m (20 ft. lbs.). Use the allen wrench to hold the pump from rotating (Fig. 6).

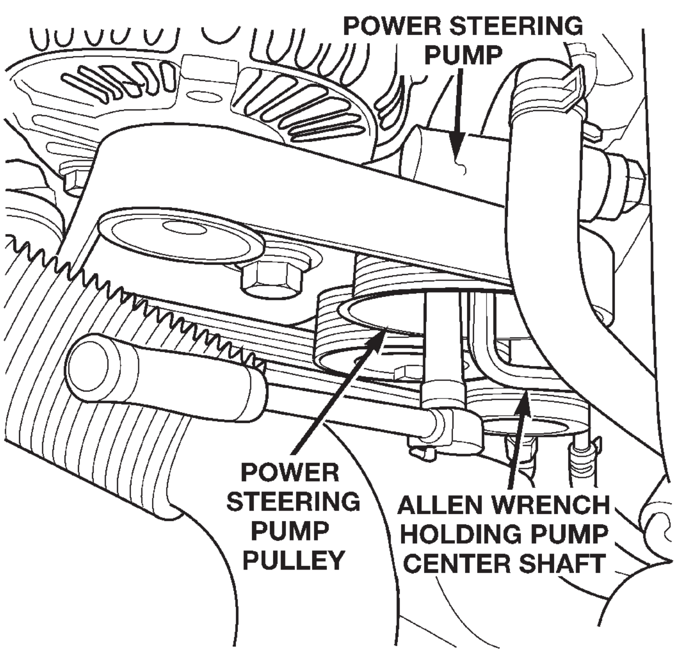


Fig. 6 Installing Power Steering Pump Pulley

(6) Install the accessory drive belt on the power steering pump pulley (Fig. 7). Refer to Group 7, Cooling System for the procedure.

(7) Install the intercooler outlet hose on the vehicle (Fig. 8).

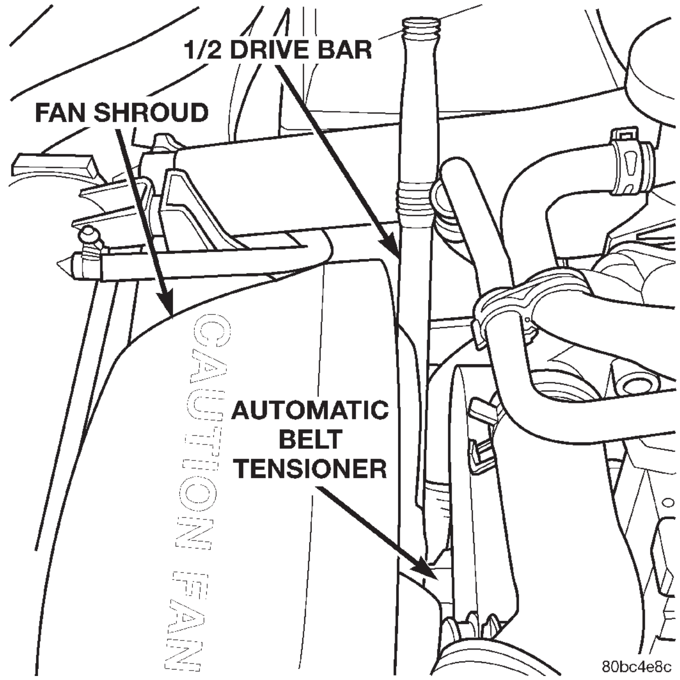


Fig. 7 Installing Accessory Drive Belt

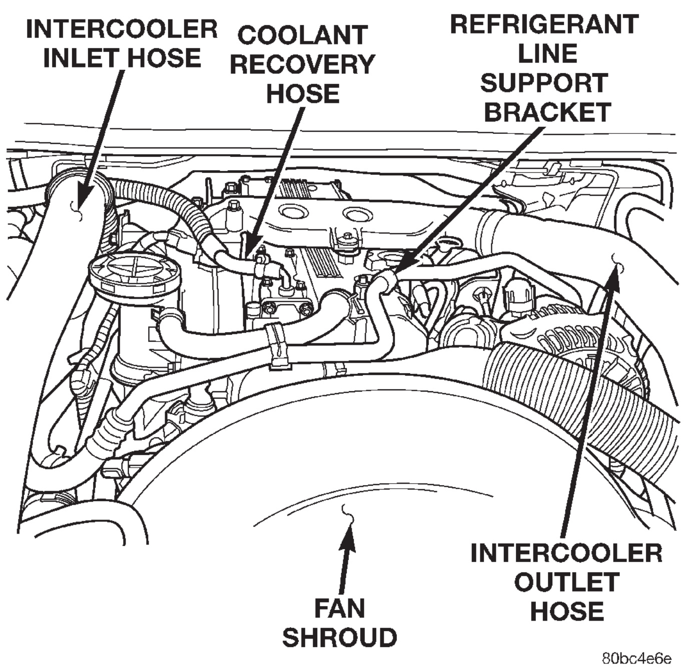


Fig. 8 Diesel Engine Compartment

(8) Connect the negative battery cable.

(9) Fill the power steering fluid. Refer to - Power Steering Pump Initial Operation - in this group for the procedure.

SPECIFICATIONS

TORQUE CHART

DESCRIPTION	TORQUE
Power steering pump mounting bolts	27 N·m (20 ft. lbs.)
Pump pressure line	24 N·m (18 ft. lbs.)
Pump pulley bolts	27 N·m (20 ft. lbs.)

TRANSMISSION AND TRANSFER CASE

CONTENTS

42RE AUTOMATIC TRANSMISSION

INDEX

GENERAL INFORMATION

42RE TRANSMISSION

The 42RE is a four speed fully automatic transmission (Fig. 1) with an electronic governor. First through third gear ranges are provided by the clutches, bands, overrunning clutch, and planetary gear sets in the transmission. Fourth gear range is provided by the overdrive unit that 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 is equipped with a lock-up clutch in the torque converter. The torque converter clutch is controlled by the Powertrain Control Module (PCM). The torque converter clutch is hydraulically applied and is released when fluid is vented from the hydraulic circuit by the torque converter control (TCC) solenoid on the valve body. The torque converter clutch engages in fourth gear, and in third gear when the O/D switch is OFF. Engagement occurs when the vehicle is cruising on a level plane after the vehicle has warmed up. The torque converter clutch disengages when the accelerator is applied. The torque converter clutch feature increases fuel economy and reduces the transmission fluid temperature. The 42RE transmission is cooled by an integral fluid cooler inside the radiator.

GENERAL INFORMATION (Continued)

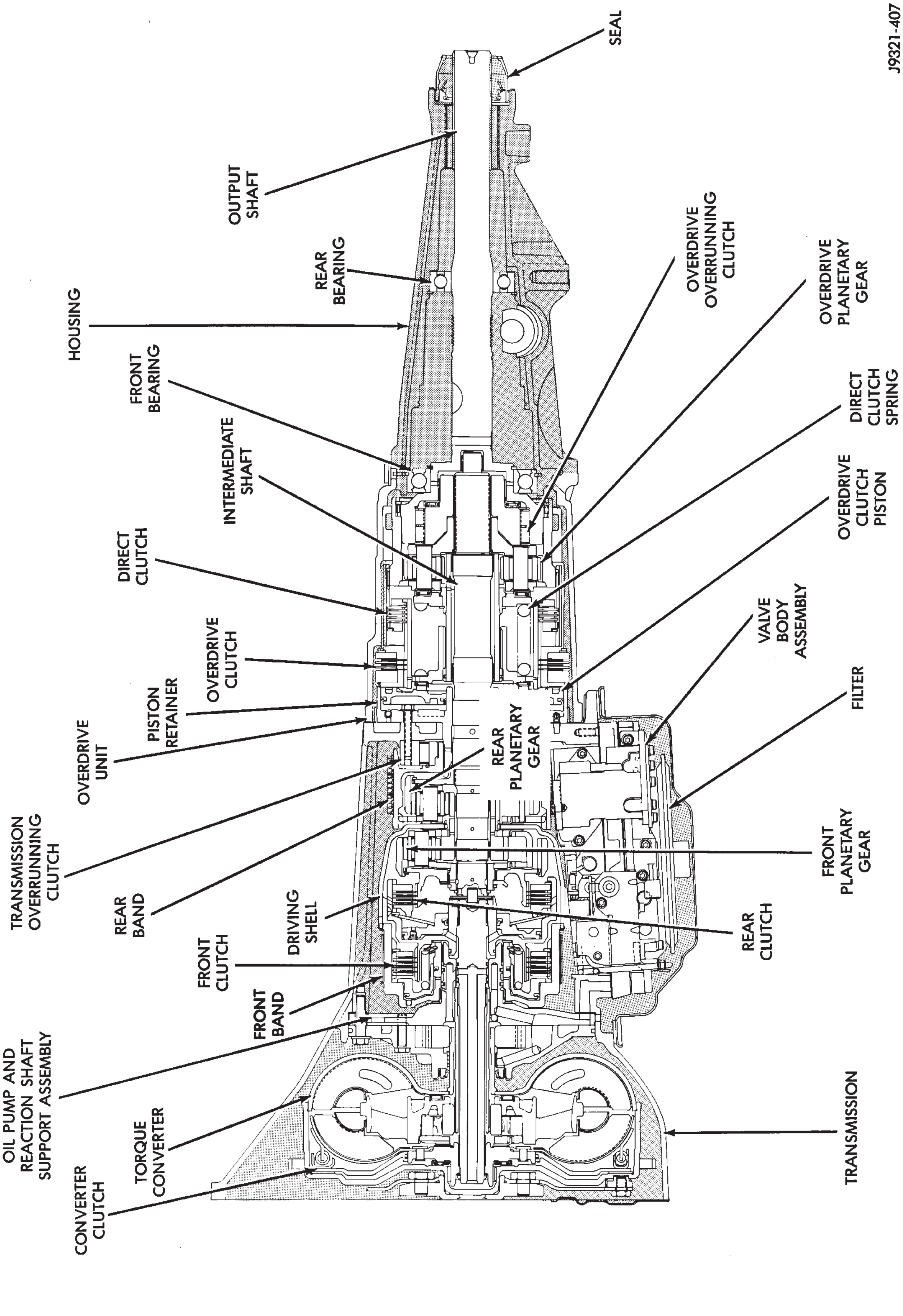


Fig. 1 42RE Transmission

GENERAL INFORMATION (Continued)

TRANSMISSION IDENTIFICATION

Transmission identification numbers are stamped on the left side of the case just above the oil pan gasket surface (Fig. 2). Refer to this information when ordering replacement parts.

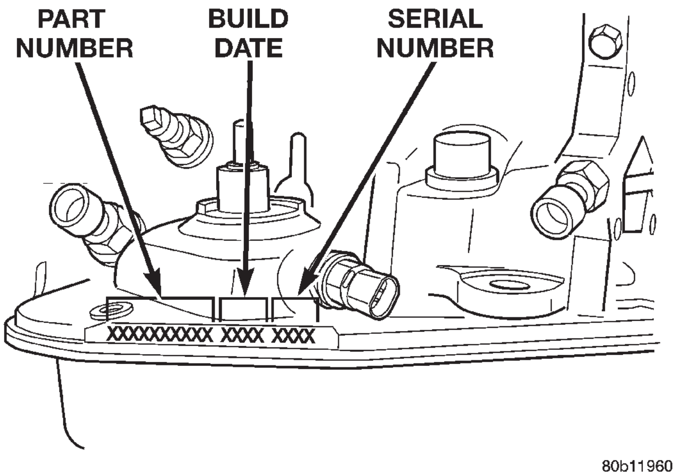


Fig. 2 Transmission Part And Serial Number Location

RECOMMENDED FLUID

NOTE: Refer to the Service Procedures section of this Group for fluid level checking procedures.

FLUID TYPE

Mopar® ATF Plus 3, Type 7176 automatic transmission fluid is the recommended fluid for Chrysler automatic transmissions.

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

FLUID ADDITIVES

Fluid additives other than Mopar® approved fluorescent leak detection dyes are not to be used in this transmission.

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. This aerates the fluid and causing the same conditions occurring 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 BURNT FLUID

Burnt, discolored fluid is a result of overheating which has two primary causes.

(1) 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 or kinked lines.

(2) 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

Transmission fluid contamination is generally a result of:

- adding incorrect fluid
- failure to clean dipstick and fill tube when checking level
- engine coolant entering the 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 after 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 recontamination. Flushing applies to auxiliary cool-

GENERAL INFORMATION (Continued)

ers as well. The torque converter should also be replaced whenever a failure generates sludge and debris. This is necessary because normal converter flushing procedures will not remove all contaminants.

ELECTRONIC LOCK-UP TORQUE CONVERTER

The torque converter is a hydraulic device that couples the engine crankshaft to the transmission. The torque converter consists of an outer shell with an internal turbine, a stator, an overrunning clutch, an impeller, and an electronically applied converter clutch. Torque multiplication is created when the stator directs the hydraulic flow from the turbine to rotate the impeller in the direction the engine crankshaft is turning. The turbine transfers power to the planetary gear sets in the transmission. The transfer of power into the impeller assists torque multiplication. At low vehicle-speed, the overrunning clutch holds the stator stationary (during torque multiplication) and allows the stator to freewheel at high vehicle speed. The converter clutch engagement reduces engine speed. Clutch engagement also provides reduced transmission fluid temperatures. The torque converter hub drives the transmission oil (fluid) pump.

The torque converter is a sealed, welded unit that is not repairable and is serviced as an assembly.

CAUTION: The torque converter must be replaced if a transmission failure results in large amounts of metal or fiber contamination in the fluid.

TRANSMISSION GEAR RATIOS

Gear ratios are:
- **1st** 2.74:1
- **2nd** 1.54:1
- **3rd** 1.00:1
- **4th** 0.69:1
- **Rev.** 2.21

GEARSHIFT MECHANISM

The shift mechanism is cable operated and provides six shift positions. The shift positions 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 mechanism is required to complete the 3-4 shift.

DESCRIPTION AND OPERATION

ELECTRONIC GOVERNOR

Governor pressure is controlled electronically. Components used for governor pressure control include:
- Governor body
- Valve body transfer plate
- Governor pressure solenoid valve
- Governor pressure sensor
- Fluid temperature thermistor
- Throttle position sensor (TPS)
- Transmission speed sensor
- Powertrain control module (PCM)

GOVERNOR PRESSURE SOLENOID VALVE

The solenoid valve is a duty-cycle solenoid which regulates the governor pressure needed for upshifts and downshifts. It is an electro-hydraulic device 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 powertrain control module (PCM) turns on the trans control relay which supplies electrical power to the solenoid valve. Operating voltage is 12 volts (DC). The PCM controls the ground side of the solenoid using the governor pressure solenoid control circuit.

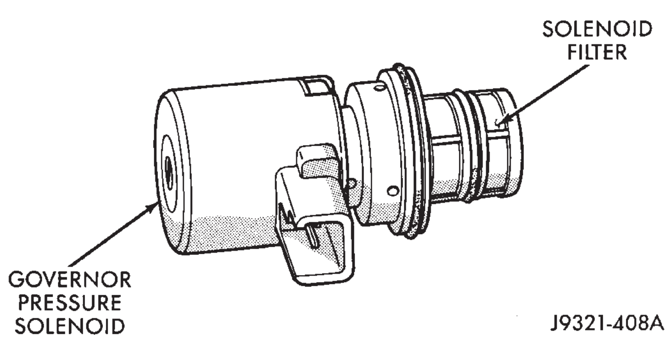


Fig. 3 Governor Pressure Solenoid Valve

DESCRIPTION AND OPERATION (Continued)

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 PCM. This feedback is needed to adequately control governor pressure.

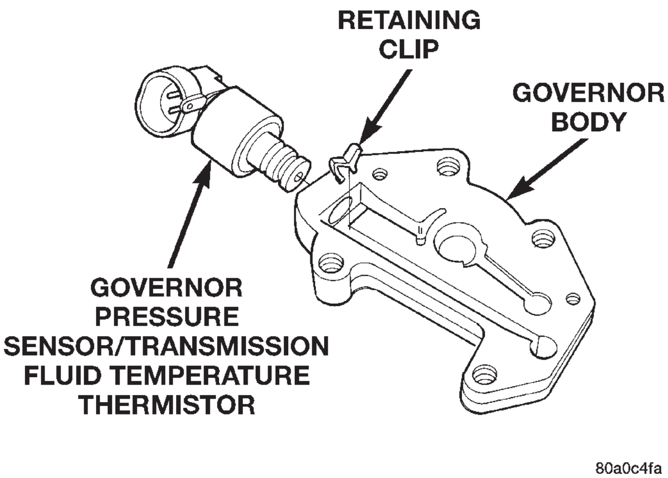


Fig. 4 Governor Pressure Sensor

GOVERNOR BODY AND TRANSFER PLATE

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. 4). 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 the necessary governor pressure.

TRANSMISSION FLUID TEMPERATURE THERMISTOR

Transmission fluid temperature readings are supplied to the transmission control module by the thermistor. 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 thermistor at room temperature is approximately 1000 ohms.

The PCM prevents engagement of the converter clutch and overdrive clutch, when fluid temperature is below approximately 10°C (50°F).

If fluid temperature exceeds 126°C (260°F), the PCM causes 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 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 part of the governor pressure sensor assembly and is immersed in transmission fluid at all times.

TRANSMISSION SPEED SENSOR

The speed sensor (Fig. 5) is located in the overdrive gear case. The sensor is positioned over the park gear and monitors transmission output shaft rotating speed. 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 a backup for the transmission speed sensor. Signals from this sensor are shared with the powertrain control module.

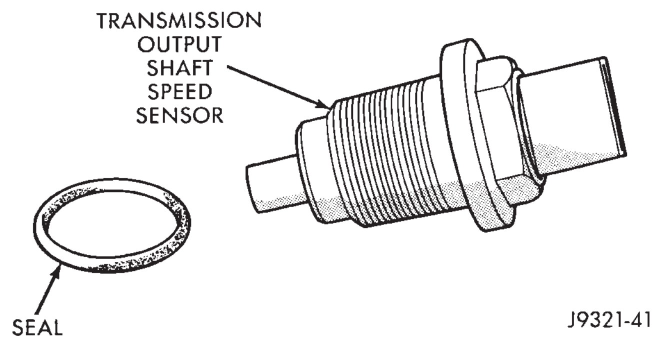


Fig. 5 Transmission Output Speed Sensor

THROTTLE POSITION SENSOR (TPS)

The TPS provides throttle position input signals to the PCM. This input signal is used to determine overdrive and converter clutch shift schedule and to select the proper governor curve.

POWERTRAIN CONTROL MODULE (PCM)

The PCM 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, throttle position sensor, and battery temperature sensor.

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, 1°C (30°F). A second curve is used when fluid

DESCRIPTION AND OPERATION (Continued)

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.

SHIFT VALVE OPERATION

The shift valves are moved by a combination of throttle and governor pressure. The governor pressure is generated by electrical components.

The conditions under which a shift to fourth will not occur are:

- Overdrive switch is Off
- Transmission fluid temperature is below 10° C (50° F) or above 121° C (250° F)
- Shift to third not yet completed
- Vehicle speed too low for 3-4 shift to occur
- Battery temperature below –5° F.

HYDRAULIC CONTROL SYSTEM

The 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, quick fill, and timing valves plus the 3-4 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 valves. The check ball either diverts line pressure away from or directly to the 3-4 valves.

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. The 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 valve.

The 3-4 accumulator is mounted on the overdrive housing and performs the same function as the 2-3 accumulator; it is used to smooth engagement during a 3-4 shift.

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.

OVERDRIVE OFF SWITCH

The overdrive OFF (control) switch is located in the shifter handle. The switch is a momentary contact device that signals the PCM 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 overdrive OFF mode defaults to ON after the ignition switch is cycled OFF and ON. 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 3-4 upshift. The control switch indicator light illuminates only when the overdrive switch is turned to the OFF position, or when illuminated by the transmission control module.

3-4 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

DESCRIPTION AND OPERATION (Continued)

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 control switch must be in the ON position to transmit overdrive status to the PCM. A 3-4 upshift occurs only when the overdrive solenoid is energized by the PCM. The PCM energizes the overdrive solenoid during the 3-4 upshift. This causes the solenoid check ball to close the vent port allowing line pressure from the 2-3 shift valve to act directly on the 3-4 upshift valve. Line pressure on the 3-4 shift valve overcomes valve spring pressure 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 direct clutch is disengaged before the overdrive clutch is engaged. The boost valve provides increased fluid apply pressure to the overdrive clutch during 3-4 upshifts, and when accelerating in fourth gear. The 3-4 accumulator cushions overdrive clutch engagement to smooth 3-4 upshifts. The accumulator is charged at the same time as apply pressure acts against the overdrive piston.

CONVERTER CLUTCH ENGAGEMENT

Converter clutch engagement in third or fourth gear range is controlled by sensor inputs to the powertrain control module. Inputs that determine clutch engagement are: coolant temperature, engine rpm, vehicle speed, throttle position, and manifold vacuum. 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.

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. All valves have an arrow (or similar mark) to indicate direction of flow through the valve.

BRAKE TRANSMISSION SHIFT INTERLOCK MECHANISM

The Brake Transmission Shifter/Ignition Interlock (BTSI), is a cable and solenoid operated system. It interconnects the automatic transmission floor mounted shifter to the steering column ignition switch (Fig. 6). 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. An additional electrically activated feature will prevent shifting out of the PARK position unless the brake pedal is depressed at least one-half an inch. A magnetic holding device in line with the park lock cable is energized when the ignition is in the RUN position. When the key is in the RUN position and the brake pedal is depressed, the shifter is unlocked and will move into any position. The interlock system also prevents the ignition switch from being turned to the LOCK or ACCESSORY position, unless the shifter is fully locked into the PARK position.

DIAGNOSIS AND TESTING

AUTOMATIC TRANSMISSION DIAGNOSIS

Automatic transmission problems can be a result of poor engine performance, incorrect fluid level, incorrect linkage or cable adjustment, band or hydraulic control pressure adjustments, hydraulic system malfunctions or electrical/mechanical component malfunctions. Begin diagnosis by checking the easily accessible items such as: fluid level and condition, linkage adjustments and electrical connections. A road test will determine if further diagnosis is necessary.

PRELIMINARY DIAGNOSIS

Two basic procedures are required. One procedure for vehicles that are drivable and an alternate procedure for disabled vehicles (will not back up or move forward).

DIAGNOSIS AND TESTING (Continued)

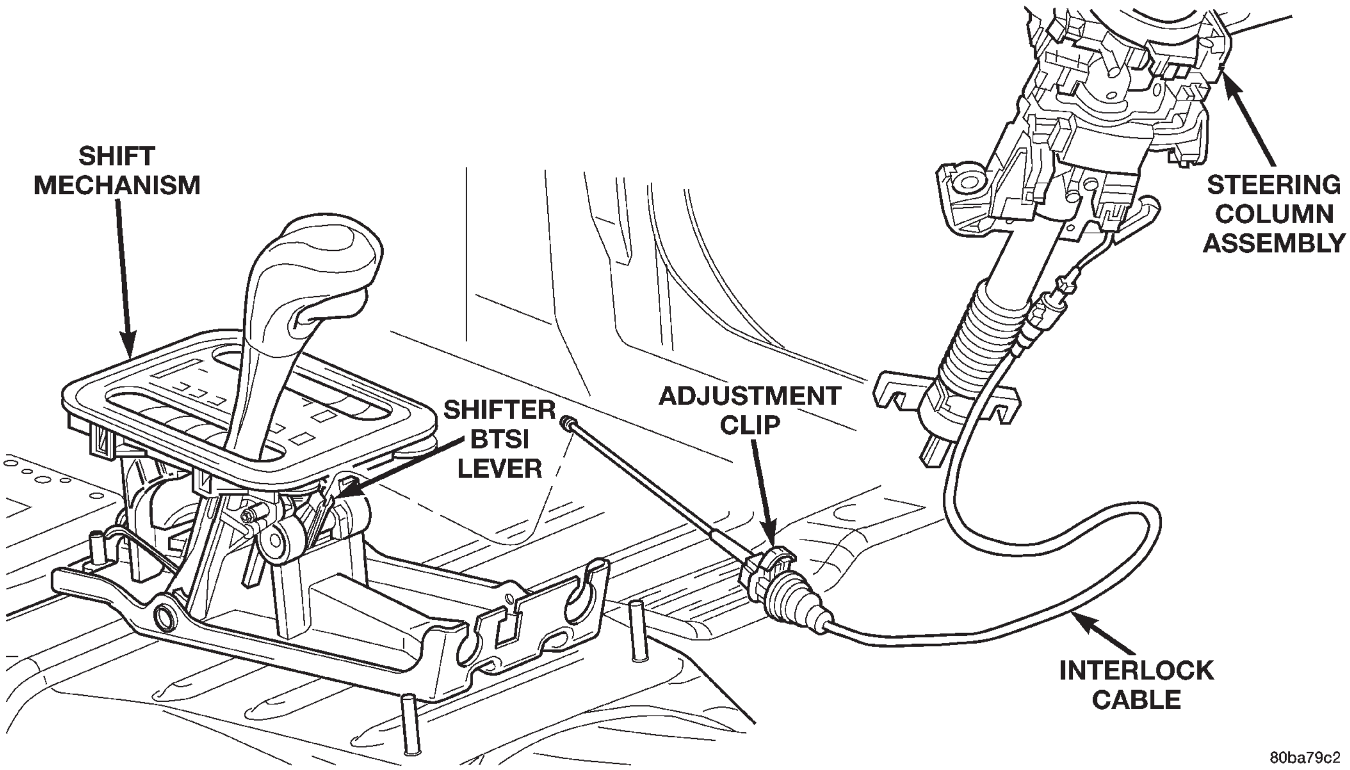


Fig. 6 Ignition Interlock Cable

VEHICLE IS DRIVEABLE

(1) Check for transmission fault codes using DRB scan tool.

(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 or disconnected gearshift or throttle linkage.

(3) Check for cracked, leaking cooler lines, or loose or missing pressure-port plugs.

(4) Raise and support vehicle on safety stands, 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 shaft 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, or input shaft.

(c) If propeller shaft does not turn and transmission is not noisy, perform hydraulic-pressure test to determine if problem is hydraulic or mechanical.

PARK/NEUTRAL POSITION SWITCH

The center terminal of the park/neutral position 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

To test the switch, remove the wiring connector. Test for continuity between the center terminal and the transmission case. Continuity should exist only when the transmission is in PARK or NEUTRAL.

Shift the transmission into REVERSE and test continuity at the switch outer terminals. Continuity should exist only when the transmission is in REVERSE. Continuity should not exist between the outer terminals and the case.

Check gearshift linkage adjustment before replacing a switch that tests faulty.

DIAGNOSIS AND TESTING (Continued)

OVERDRIVE ELECTRICAL CONTROLS

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. Refer to Group 8W, Wiring Diagrams, for component locations and circuit information.

Switch and solenoid continuity should be checked whenever the transmission fails to shift into fourth gear range.

BRAKE TRANSMISSION SHIFT INTERLOCK

(1) Verify that the key can only be removed in the PARK position.

(2) When the shift lever is in PARK and the shift handle pushbutton is in the "OUT" position, the ignition key cylinder should rotate freely from OFF to LOCK. When the shifter is in any other gear or neutral position, the ignition key cylinder should not rotate to the LOCK position.

(3) Shifting out of PARK should be possible when the ignition key cylinder is in the OFF position.

(4) Shifting out of PARK should not be possible while applying 25 lb. maximum handle pushbutton force and ignition key cylinder is in the RUN or START positions unless the foot brake pedal is depressed approximately 1/2 inch (12mm).

(5) Shifting out of PARK should not be possible when the ignition key cylinder is in the ACCESSORY or LOCK positions.

(6) Shifting between any gears, NEUTRAL or into PARK may be done without depressing foot brake pedal with ignition switch in RUN or START positions and vehicle stationary or in motion.

GEARSHIFT CABLE

(1) The floor shifter lever and gate positions should be in alignment with all transmission PARK, NEUTRAL, and gear detent positions.

(2) Engine starts must be possible with floor shift lever in PARK or NEUTRAL gate positions only. Engine starts must not be possible in any other gear position.

(3) With floor shift lever handle push-button not depressed and lever in:

- (a) PARK position—Apply forward force on center of handle and remove pressure. Engine starts must be possible.
- (b) PARK position—Apply rearward force on center of handle and remove pressure. Engine starts must be possible.
- (c) NEUTRAL position—Normal position. Engine starts must be possible.
- (d) NEUTRAL position—Engine running and brakes applied, apply forward force on center of shift handle. Transmission shall not be able to shift from neutral to reverse.

THROTTLE VALVE CABLE

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 loose, early shifts and slippage between shifts may occur. If the setting is too tight, shifts may be delayed and part throttle downshifts may be very sensitive. Refer to the Adjustments section for the proper adjustment procedure.

ROAD TESTING

Before road testing, be sure the fluid level and control cable adjustments have been checked and adjusted if necessary. Verify that diagnostic trouble codes have been resolved.

Observe engine performance during the road test. A poorly tuned engine will not allow 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 will 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 provides a basis for analyzing road test results.

ANALYZING ROAD TEST

Refer to the Clutch and Band Application chart 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.

DIAGNOSIS AND TESTING (Continued)

Clutch And Band Application Chart

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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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 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 determine the probable 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 pressure test gauges are required. Test Gauge C-3292 has a 100 psi range and is used at the accumulator, governor, and front servo ports. Test Gauge C-3293-SP has a 300 psi range and is used at the rear servo and overdrive ports where pressures exceed 100 psi.

Pressure Test Port Locations

Test ports are located at both sides of the transmission case (Fig. 7).

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.

Test One - Transmission In Manual Low

NOTE: This test checks pump output, pressure regulation, and condition of the rear clutch and servo circuit. Both test gauges are required for this test.

(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.

DIAGNOSIS AND TESTING (Continued)

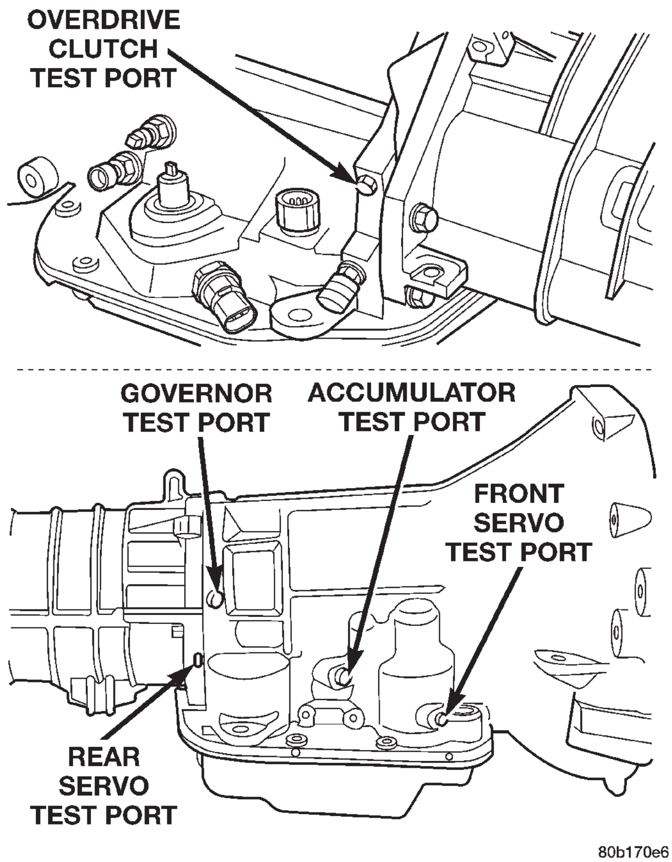


Fig. 7 Pressure Test Port Locations

(2) Connect 100 psi Gauge C-3292 to accumulator port. Then connect 300 psi Gauge C-3293-SP to rear servo port.

(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:

- 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.
- Rear servo pressure should be same as line pressure within 3 psi (20.68 kPa).

Test Two—Transmission In 2 Range

NOTE: 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

NOTE: This test checks pressure regulation and condition of the clutch circuits. Both test gauges are required for this test.

(1) Turn OD switch off.

(2) Leave vehicle on hoist and 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:

- 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.
- 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

NOTE: 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.

DIAGNOSIS AND TESTING (Continued)

Test Five—Governor Pressure

NOTE: 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 the road or on a hoist that will allow the rear wheels to rotate freely.

(1) Move 100 psi Test Gauge C-3292 to governor pressure port.

(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:

- Governor pressure should be no more than 20.6 kPa (3 psi) at curb idle speed and wheels not rotating.
- 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 (do not exceed 30 mph on speedometer). Governor pressure should increase in proportion to vehicle speed. Or approximately 6.89 kPa (1 psi) for every 1 mph.

(6) Governor 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.

Test Six—Transmission In Overdrive Fourth Gear

NOTE: 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 is not needed 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.

PRESSURE TEST ANALYSIS CHART

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 (seal rings, clutch seals)
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
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, low oil level
Governor pressure too high at idle speed	Governor pressure solenoid valve system fault. Refer to diagnostic book.
Governor pressure low at all mph figures	Faulty governor pressure solenoid, transmission control module, or governor pressure sensor
Lubrication pressure low at all throttle positions	Clogged fluid cooler or lines, seal rings leaking, worn pump bushings, pump, clutch retainer, or clogged filter.
Line pressure high	Output shaft plugged, sticky regulator valve
Line pressure low	Sticky regulator valve, clogged filter, worn pump

AIR TESTING TRANSMISSION CLUTCH AND BAND OPERATION

Air-pressure testing can be used to check transmission front/rear clutch and band operation. The test can be conducted 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 (Fig. 8).

DIAGNOSIS AND TESTING (Continued)

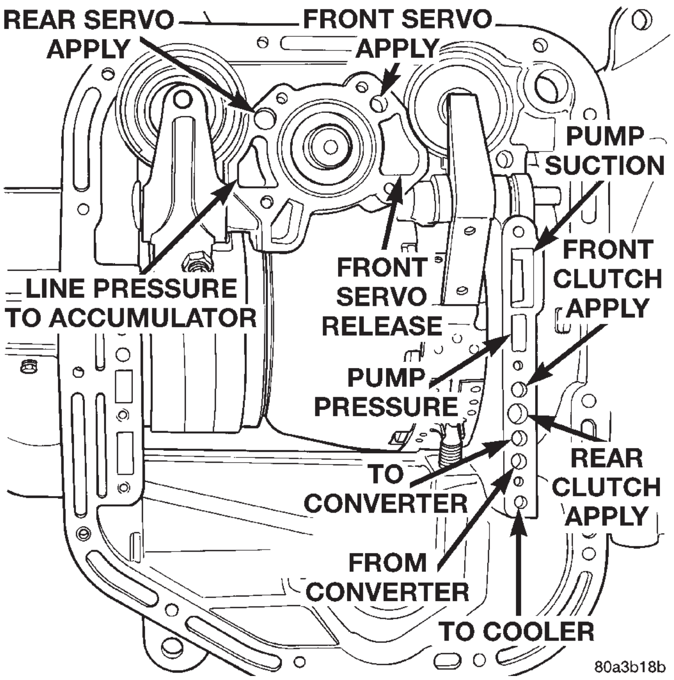


Fig. 8 Air Pressure Test Passages

Front Clutch Air Test

Place one or two fingers on the clutch housing and apply air pressure through front clutch apply passage. Piston movement can be felt and a soft thump 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 thump heard as the clutch applies.

Front Servo Apply 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 pressure 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 pressure 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.

(1) Verify that a leak condition actually exists.

(2) Determined the true source of the leak.

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 fill 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. 9). Pump vent or pump attaching bolt leaks are generally deposited on the inside of the converter housing and not on the converter itself (Fig. 9). 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.

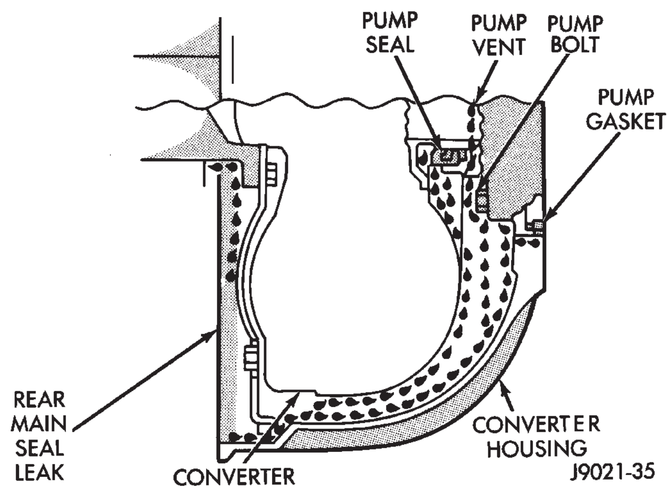


Fig. 9 Converter Housing Leak Paths

TORQUE CONVERTER LEAK POINTS

Possible sources of converter leaks are:

(1) Leaks at the weld joint around the outside diameter weld (Fig. 10).

(2) Leaks at the converter hub weld (Fig. 10).

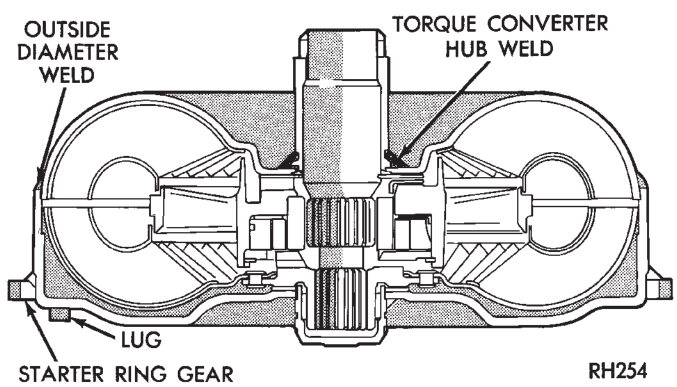


Fig. 10 Converter Leak Points—Typical

DIAGNOSIS AND TESTING (Continued)

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.

(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.

(5) Install new pump seal, O-ring, and gasket. Replace oil pump if cracked, porous or damaged in any way. Be sure to loosen the front band before installing the oil pump, damage to the oil pump seal may occur if the band is still tightened to the front clutch retainer.

(6) Loosen kickdown lever pin access plug three turns. Apply Loctite 592, or Permatex No. 2 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 TABLES AND CHARTS—RE TRANSMISSION

The diagnosis charts provide additional reference when diagnosing a transmission fault. The charts provide general information on a variety of transmission, overdrive unit and converter clutch fault conditions.

The hydraulic flow charts in the Schematics and Diagrams section of this group, outline fluid flow and hydraulic circuitry. Circuit operation is provided for neutral, third, fourth and reverse gear ranges. Normal working pressures are also supplied for each of the gear ranges.

DIAGNOSIS CHARTS

CONDITION	POSSIBLE CAUSES	CORRECTION
HARSH ENGAGEMENT (FROM NEUTRAL TO DRIVE OR REVERSE)	1. Fluid Level Low	1. Add Fluid
	2. Throttle Linkage Misadjusted	2. Adjust linkage - setting may be too long.
	3. Mount and Driveline Bolts Loose	3. Check engine mount, transmission mount, propeller shaft, rear spring to body bolts, rear control arms, crossmember and axle bolt torque. Tighten loose bolts and replace missing bolts.
	4. U-Joint Worn/Broken	4. Remove propeller shaft and replace U-Joint.
	5. Axle Backlash Incorrect	5. Check per Service Manual. Correct as needed.
	6. Hydraulic Pressure Incorrect	6. Check pressure. Remove, overhaul or adjust valve body as needed.
	7. Band Misadjusted.	7. Adjust rear band.
	8. Valve Body Check Balls Missing.	8. Inspect valve body for proper check ball installation.
	9. Axle Pinion Flange Loose.	9. Replace nut and check pinion threads before installing new nut. Replace pinion gear if threads are damaged.
	10. Clutch, band or planetary component damaged.	10. Remove, disassemble and repair transmission as necessary.
	11. Converter Clutch Faulty.	11. Replace converter and flush cooler and line before installing new converter.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
DELAYED ENGAGEMENT (FROM NEUTRAL TO DRIVE OR REVERSE)	1. Fluid Level Low.	1. Correct level and check for leaks.
	2. Filter Clogged.	2. Change filter.
	3. Gearshift Linkage Misadjusted.	3. Adjust linkage and repair linkage if worn or damaged.
	4. Torque Converter Drain Back (Oil drains from torque converter into transmission sump)	4. If vehicle moves normally after 5 seconds after shifting into gear, no repair is necessary. If longer, inspect pump bushing for wear. Replace pump house.
	5. Rear Band Misadjusted.	5. Adjust band.
	6. Valve Body Filter Plugged.	6. Replace fluid and filter. If oil pan and old fluid were full of clutch disc material and/or metal particles, overhaul will be necessary.
	7. Oil Pump Gears Worn/Damaged.	7. Remove transmission and replace oil pump.
	8. Governor Circuit and Solenoid Valve Electrical Fault.	8. Test with DRB scan tool and repair as required.
	9. Hydraulic Pressure Incorrect.	9. Perform pressure test, remove transmission and repair as needed.
	10. Reaction Shaft Seal Rings Worn/Broken.	10. Remove transmission, remove oil pump and replace seal rings.
	11. Rear Clutch/Input Shaft, Rear Clutch Seal Rings Damaged.	11. Remove and disassemble transmission and repair as necessary.
	12. Regulator Valve Stuck.	12. Clean.
	13. Cooler Plugged.	13. Transfer case failure can plug cooler.
NO DRIVE RANGE (REVERSE OK)	1. Fluid Level Low.	1. Add fluid and check for leaks if drive is restored.
	2. Gearshift Linkage/Cable Loose/Misadjusted.	2. Repair or replace linkage components.
	3. Rear Clutch Burnt.	3. Remove and disassemble transmission and rear clutch and seals. Repair/replace worn or damaged parts as needed.
	4. Valve Body Malfunction.	4. Remove and disassemble valve body. Replace assembly if any valves or bores are damaged.
	5. Transmission Overrunning Clutch Broken.	5. Remove and disassemble transmission. Replace overrunning clutch.
	6. Input Shaft Seal Rings Worn/ Damaged.	6. Remove and disassemble transmission. Replace seal rings and any other worn or damaged parts.
	7. Front Planetary Failed Broken.	7. Remove and repair.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NO DRIVE OR REVERSE (VEHICLE WILL NOT MOVE)	1. Fluid Level Low.	1. Add fluid and check for leaks if drive is restored.
	2. Gearshift Linkage/Cable Loose/Misadjusted.	2. Inspect, adjust and reassemble linkage as needed. Replace worn/damaged parts.
	3. U-Joint/Axle/Transfer Case Broken.	3. Perform preliminary inspection procedure for vehicle that will not move. Refer to procedure in diagnosis section.
	4. Filter Plugged.	4. Remove and disassemble transmission. Repair or replace failed components as needed. Replace filter. If filter and fluid contained clutch material or metal particles, an overhaul may be necessary. Perform lube flow test. Flush oil. Replace cooler as necessary.
	5. Oil Pump Damaged.	5. Perform pressure test to confirm low pressure. Replace pump body assembly if necessary.
	6. Valve Body Malfunctioned.	6. Check 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.
	7. Transmission Internal Component Damaged.	7. Remove and disassemble transmission. Repair or replace failed components as needed.
	8. Park Sprag not Releasing - Check Stall Speed, Worn/Damaged/Stuck.	8. Remove, disassemble, repair.
	9. Torque Converter Damage.	9. Inspect and replace as required.
SHIFTS DELAYED OR ERRATIC (SHIFTS ALSO HARSH AT TIMES)	1. Fluid Level Low/High.	1. Correct fluid level and check for leaks if low.
	2. Fluid Filter Clogged.	2. Replace filter. If filter and fluid contained clutch material or metal particles, an overhaul may be necessary. Perform lube flow test.
	3. Throttle Linkage Misadjusted.	3. Adjust linkage as described in service section.
	4. Throttle Linkage Binding.	4. Check cable for binding. Check for return to closed throttle at transmission.
	5. Gearshift Linkage/Cable Misadjusted.	5. Adjust linkage/cable as described in service section.
	6. Clutch or Servo Failure.	6. Remove valve body and air test clutch, and band servo operation. Disassemble and repair transmission as needed.
	7. Governor Circuit Electrical Fault.	7. Test using DRB scan tool and repair as required.
	8. Front Band Misadjusted.	8. Adjust band.
	9. Pump Suction Passage Leak.	9. Check for excessive foam on dipstick after normal driving. Check for loose pump bolts, defective gasket. Replace pump assembly if needed.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NO REVERSE (D RANGES OK)	1. Gearshift Linkage/Cable Misadjusted/Damaged.	1. Repair or replace linkage parts as needed.
	2. Park Sprag Sticking.	2. Replace overdrive annulus gear.
	3. Rear Band Misadjusted/Worn.	3. Adjust band; replace.
	4. Valve Body Malfunction.	4. Remove and service valve body. Replace valve body if any valves or valve bores are worn or damaged.
	5. Rear Servo Malfunction.	5. Remove and disassemble transmission. Replace worn/damaged servo parts as necessary.
	6. Direct Clutch in Overdrive Worn	6. Disassemble overdrive. Replace worn or damaged parts.
	7. Front Clutch Burnt.	7. Remove and disassemble transmission. Replace worn, damaged clutch parts as required.
HAS FIRST/REVERSE ONLY (NO 1-2 OR 2-3 UPSHIFT)	1. Governor Circuit Electrical Fault.	1. Test using DRB scan tool and repair as required.
	2. Valve Body Malfunction.	2. Repair stuck 1-2 shift valve or governor plug.
	3. Front Servo/Kickdown Band Damaged/Burned.	3. Repair/replace.
MOVES IN 2ND OR 3RD GEAR, ABRUPTLY DOWNSHIFTS TO LOW	1. Valve Body Malfunction.	1. Remove, clean and inspect. Look for stuck 1-2 valve or governor plug.
	2. Governor Components Sticking.	2. Remove, clean and inspect. Replace faulty parts.
NO LOW GEAR (MOVES IN 2ND OR 3RD GEAR ONLY)	1. Governor Components Sticking.	1. Remove clean, inspect and repair as required.
	2. Governor Circuit Electrical Fault.	2. Test with DRB scan tool and repair as required.
	3. Valve Body Malfunction.	3. Remove, clean and inspect. Look for sticking 1-2 shift valve, 2-3 shift valve, governor plug or broken springs.
	4. Front Servo Piston Cocked in Bore.	4. Inspect servo and repair as required.
	5. Front Band Linkage Malfunction	5. Inspect linkage and look for bind in linkage.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NO KICKDOWN OR NORMAL DOWNSHIFT	1. Throttle Linkage Misadjusted.	1. Adjust linkage.
	2. Accelerator Pedal Travel Restricted.	2. Verify floor mat is not under pedal, repair worn accelerator cable or bent brackets.
	3. Valve Body Hydraulic Pressures Too High or Too Low Due to Valve Body Malfunction or Incorrect Hydraulic Control Pressure Adjustments.	3. Perform hydraulic pressure tests to determine cause and repair as required. Correct valve body pressure adjustments as required.
	4. Governor Circuit Electrical Fault.	4. Test with DRB scan tool and repair as required.
	5. Valve Body Malfunction.	5. Perform hydraulic pressure tests to determine cause and repair as required. Correct valve body pressure adjustments as required.
	6. TPS Malfunction.	6. Replace sensor, check with DRB scan tool.
	7. PCM Malfunction.	7. Check with DRB scan tool and replace if required.
	8. Valve Body Malfunction.	8. Repair sticking 1-2, 2-3 shift valves, governor plugs, 3-4 solenoid, 3-4 shift valve, 3-4 timing valve.
STUCK IN LOW GEAR (WILL NOT UPSHIFT)	1. Throttle Linkage Misadjusted/ Stuck.	1. Adjust linkage and repair linkage if worn or damaged. Check for binding cable or missing return spring.
	2. Gearshift Linkage Misadjusted.	2. Adjust linkage and repair linkage if worn or damaged.
	3. Governor Component Electrical Fault.	3. Check operating pressures and test with DRB scan tool, repair faulty component.
	4. Front Band Out of Adjustment .	4. Adjust Band.
	5. Clutch or Servo Malfunction.	5. Air pressure check operation of clutches and bands. Repair faulty component.
CREEPS IN NEUTRAL	1. Gearshift Linkage Misadjusted.	1. Adjust linkage.
	2. Rear Clutch Dragging/Warped.	2. Disassemble and repair.
	3. Valve Body Malfunction.	3. Perform hydraulic pressure test to determine cause and repair as required.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
BUZZING NOISE	1. Fluid Level Low	1. Add fluid and check for leaks.
	2. Shift Cable Misassembled.	2. Route cable away from engine and bell housing.
	3. Valve Body Misassembled.	3. Remove, disassemble, inspect valve body. Reassemble correctly if necessary. Replace assembly if valves or springs are damaged. Check for loose bolts or screws.
	4. Pump Passages Leaking	4. Check pump for porous casting, scores on mating surfaces and excess rotor clearance. Repair as required. Loose pump bolts.
	5. Cooling System Cooler Plugged.	5. Flow check cooler circuit. Repair as needed.
	6. Overrunning Clutch Damaged.	6. Replace clutch.
SLIPS IN REVERSE ONLY	1. Fluid Level Low.	1. Add fluid and check for leaks.
	2. Gearshift Linkage Misadjusted.	2. Adjust linkage.
	3. Rear Band Misadjusted.	3. Adjust band.
	4. Rear Band Worn.	4. Replace as required.
	5. Overdrive Direct Clutch Worn.	5. Disassemble overdrive. Repair as needed.
	6. Hydraulic Pressure Too Low.	6. Perform hydraulic pressure tests to determine cause.
	7. Rear Servo Leaking.	7. Air pressure check clutch-servo operation and repair as required.
	8. Band Linkage Binding.	8. Inspect and repair as required.
SLIPS IN FORWARD DRIVE RANGES	1. Fluid Level Low.	1. Add fluid and check for leaks.
	2. Fluid Foaming.	2. Check for high oil level, bad pump gasket or seals, dirt between pump halves and loose pump bolts. Replace pump if necessary.
	3. Throttle Linkage Misadjusted.	3. Adjust linkage.
	4. Gearshift Linkage Misadjusted.	4. Adjust linkage.
	5. Rear Clutch Worn.	5. Inspect and replace as needed.
	6. Low Hydraulic Pressure Due to Worn Pump, Incorrect Control Pressure Adjustments, Valve Body Warpage or Malfunction, Sticking, Leaking Seal Rings, Clutch Seals Leaking, Servo Leaks, Clogged Filter or Cooler Lines	6. Perform hydraulic and air pressure tests to determine cause.
	7. Rear Clutch Malfunction, Leaking Seals or Worn Plates.	7. Air pressure check clutch-servo operation and repair as required.
	8. Overrunning Clutch Worn, Not Holding (Slips in 1 Only).	8. Replace Clutch.
SLIPS IN LOW GEAR ″D″ ONLY, BUT NO IN 1 POSITION	Overrunning Clutch Faulty.	Replace overrunning clutch.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
GROWLING, GRATING OR SCRAPING NOISES	1. Drive Plate Broken.	1. Replace.
	2. Torque Converter Bolts Hitting Dust Shield.	2. Dust shield bent. Replace or repair.
	3. Planetary Gear Set Broken/ Seized.	3. Check for debris in oil pan and repair as required.
	4. Overrunning Clutch Worn/Broken.	4. Inspect and check for debris in oil pan. Repair as required.
	5. Oil Pump Components Scored/ Binding.	5. Remove, inspect and repair as required.
	6. Output Shaft Bearing or Bushing Damaged.	6. Remove, inspect and repair as required.
	7. Clutch Operation Faulty.	7. Perform air pressure check and repair as required.
	8. Front and Rear Bands Misadjusted.	8. Adjust bands.
DRAGS OR LOCKS UP	1. Fluid Level Low.	1. Check and adjust level.
	2. Clutch Dragging/Failed	2. Air pressure check clutch operation and repair as required.
	3. Front or Rear Band Misadjusted.	3. Adjust bands.
	4. Case Leaks Internally.	4. Check for leakage between passages in case.
	5. Servo Band or Linkage Malfunction.	5. Air pressure check servo operation and repair as required.
	6. Overrunning Clutch Worn.	6. Remove and inspect clutch. Repair as required.
	7. Planetary Gears Broken.	7. Remove, inspect and repair as required (look for debris in oil pan).
NO 4-3 DOWNSHIFT	1. Circuit Wiring and/or Connectors Shorted.	1. Test wiring and connectors with test lamp and volt/ohmmeter. Repair wiring as necessary. Replace connectors and/or harnesses as required.
	2. PCM Malfunction.	2. Check PCM operation with DRB scan tool. Replace PCM only if faulty.
	3. TPS Malfunction	3. Check TPS with DRB scan tool at PCM.
	4. Lockup Solenoid Not Venting.	4. Remove valve body and replace solenoid assembly if plugged or shorted.
	5. Overdrive Solenoid Not Venting.	5. Remove valve body and replace solenoid if plugged or shorted.
	6. Valve Body Valve Sticking.	6. Repair stuck 3-4 shift valve or lockup timing valve.
NO 4-3 DOWNSHIFT WHEN CONTROL SWITCH IS TURNED OFF	1. Control Switch Open/Shorted.	1. Test and replace switch if faulty.
	2. Overdrive Solenoid Connector Shorted.	2. Test solenoids and replace if seized or shorted.
	3. PCM Malfunction.	3. Test with DRB scan tool. Replace PCM if faulty.
	4. Valve Body Stuck Valves.	4. Repair stuck 3-4, lockup or lockup timing valve.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
CLUNK NOISE FROM DRIVELINE ON CLOSED THROTTLE 4-3 DOWNSHIFT	1. Transmission Fluid Low.	1. Add Fluid.
	2. Throttle Cable Misadjusted.	2. Adjust cable.
	3. Overdrive Clutch Select Spacer Wrong Spacer.	3. Replace overdrive piston thrust plate spacer.
3-4 UPSHIFT OCCURS IMMEDIATELY AFTER 2-3 SHIFT	1. Overdrive Solenoid Connector or Wiring Shorted.	1. Test connector and wiring for loose connections, shorts or ground and repair as needed.
	2. TPS Malfunction.	2. Test TPS and replace as necessary. Check with DRB scan tool.
	3. PCM Malfunction.	3. Test PCM with DRB scan tool and replace controller if faulty.
	4. Overdrive Solenoid Malfunction.	4. Replace solenoid.
	5. Valve Body Malfunction.	5. 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.
WHINE/NOISE RELATED TO ENGINE SPEED	1. Fluid Level Low.	1. Add fluid and check for leaks.
	2. Shift Cable Incorrect Routing.	2. Check shift cable for correct routing. Should not touch engine or bell housing.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NO 3-4 UPSHIFT	1. O/D Switch 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 or grounds in circuit).
	3. O/D Switch Wire Shorted/Open Cut.	3. Check wires/connections with 12V test lamp and voltmeter. Repair damaged or loose wire/connection as necessary.
	4. Distance or Coolant Sensor Malfunction.	4. Test both sensors with test lamp or volt/ohmmeter and replace faulty sensor.
	5. TPS Malfunction.	5. Check with DRB scan tool and replace if necessary.
	6. Neutral Switch to PCM Wire Shorted/Cut.	6. Test switch as described in service section and replace if necessary. Engine no start.
	7. PCM Malfunction.	7. Check with DRB scan tool and replace if necessary.
	8. Overdrive Solenoid Shorted/Open.	8. Replace solenoid if shorted or open and repair loose or damaged wires (DRB scan tool).
	9. Solenoid Feed Orifice in Valve Body Blocked.	9. Remove, disassemble, and clean valve body thoroughly. Check feed orifice.
	10. Overdrive Clutch Failed.	10. Disassemble overdrive and repair as needed.
	11. Hydraulic Pressure Low.	11. Pressure test transmission to determine cause.
	12. Valve Body Valve Stuck.	12. Repair stuck 3-4 shift valve, 3-4 timing valve.
	13. O/D Piston Incorrect Spacer.	13. Remove unit, check end play and install correct spacer.
	14. Overdrive Piston Seal Failure.	14. Replace both seals.
	15. O/D Check Valve/Orifice Failed.	15. Check for free movement and secure assembly (in piston retainer). Check ball bleed orifice.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
SLIPS IN OVERDRIVE FOURTH GEAR	1. Fluid Level Low.	1. Add fluid and check for leaks.
	2. Overdrive Clutch Pack Worn.	2. Remove overdrive unit and rebuild clutch pack.
	3. Overdrive Piston Retainer Bleed Orifice Blown Out.	3. Disassemble transmission, remove retainer and replace orifice.
	4. Overdrive Piston or Seal Malfunction.	4. Remove overdrive unit. Replace seals if worn. Replace piston if damaged. If piston retainer is damaged, remove and disassemble the transmission.
	5. 3-4 Shift Valve, Timing Valve or Accumulator Malfunction.	5. 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.
	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. 3 thrust bearing is between overrunning clutch hub and output shaft).
	7. O/D Check Valve/Bleed Orifice Failure.	7. Check for function/secure orifice insert in O/D piston retainer.
DELAYED 3-4 UPSHIFT (SLOW TO ENGAGE)	1. Fluid Level Low.	1. Add fluid and check for leaks.
	2. Throttle Valve Cable Misadjusted.	2. Adjust throttle valve cable.
	3. Overdrive Clutch Pack Worn/ Burnt.	3. Remove unit and rebuild clutch pack.
	4. TPS Faulty.	4. Test with DRB scan tool and replace TPS.
	5. Overdrive Clutch Bleed Orifice Plugged.	5. Disassemble transmission and replace orifice.
	6. Overdrive Solenoid or Wiring Shorted/Open.	6. Test solenoid and check wiring for loose/corroded connections or shorts/ grounds. Replace solenoid if faulty and repair wiring if necessary.
	7. Overdrive Excess Clearance	7. Remove unit. Measure end play and select proper spacer.
	8. O/D Check Valve Missing or Stuck.	8. Check for presence of check valve. Repair or replace as required.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
TORQUE CONVERTER LOCKS UP IN SECOND AND/OR THIRD GEAR	Lockup Solenoid, Relay or Wiring Shorted/Open.	Test solenoid, relay and wiring for continuity, shorts or grounds. Replace solenoid and relay if faulty. Repair wiring and connectors as necessary.
HARSH 1-2, 2-3, 3-4 OR 3-2 SHIFTS	Lockup Solenoid Malfunction.	Remove valve body and replace solenoid assembly.
NO START IN PARK OR NEUTRAL	1. Gearshift Linkage/Cable Misadjusted.	1. Adjust linkage/cable.
	2. Neutral Switch Wire Open/Cut.	2. Check continuity with test lamp. Repair as required.
	3. Neutral Switch Faulty.	3. Refer to service section for test and replacement procedure.
	4. Neutral Switch Connect Faulty.	4. Connectors spread open. Repair.
	5. Valve Body Manual Lever Assembly Bent/Worn/Broken.	5. Inspect lever assembly and replace if damaged.
NO REVERSE (OR SLIPS IN REVERSE)	1. Direct Clutch Pack (front clutch) Worn.	1. Disassemble unit and rebuild clutch pack.
	2. Rear Band Misadjusted.	2. Adjust band.
	3. Front Clutch Malfunctioned/ Burned.	3. Air-pressure test clutch operation. Remove and rebuild if necessary.
	4. Overdrive Thrust Bearing Failure.	4. Disassemble geartrain and replace bearings.
	5. Direct Clutch Spring Collapsed/ Broken.	5. Remove and disassemble unit. Check clutch position and replace spring.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
OIL LEAKS.	1. Fluid Lines and Fittings Loose/ Leaks/Damaged.	1. Tighten fittings. If leaks persist, replace fittings and lines if necessary.
	2. Fill Tube (where tube enters case) Leaks/Damaged.	2. Replace O-ring seal. Inspect tube for cracks in fill tube.
	3. Pressure Port Plug Loose Loose/Damaged.	3. Tighten to correct torque. Replace plug or reseal if leak persists.
	4. Pan Gasket Leaks.	4. Tighten pan screws (150 in. lbs.). If leaks persist, replace gasket.
	5. Valve Body Manual Lever Shaft Seal Leaks/Worn.	5. Replace shaft seal.
	6. Rear Bearing Access Plate Leaks.	6. Replace gasket. Tighten screws.
	7. Gasket Damaged or Bolts are Loose.	7. Replace bolts or gasket or tighten both.
	8. Adapter/Extension Gasket Damaged Leaks/Damaged.	8. Replace gasket.
	9. Neutral Switch Leaks/Damaged.	9. Replace switch and gasket.
	10. Converter Housing Area Leaks.	10. 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.
	11. Pump Seal Leaks/Worn/ Damaged.	11. Replace seal.
	12. Torque Converter Weld Leak/Cracked Hub.	12. Replace converter.
	13. Case Porosity Leaks.	13. Replace case.
NOISY OPERATION IN FOURTH GEAR ONLY	1. Overdrive Clutch Discs, Plates or Snap Rings Damaged.	1. Remove unit and rebuild clutch pack.
	2. Overdrive Piston or Planetary Thrust Bearing Damaged.	2. Remove and disassemble unit. Replace either thrust bearing if damaged.
	3. Output Shaft Bearings Scored/ Damaged.	3. Remove and disassemble unit. Replace either bearing if damaged.
	4. Planetary Gears Worn/Chipped.	4. Remove and overhaul overdrive unit.
	5. Overdrive Unit Overrunning Clutch Rollers Worn/Scored.	5. Remove and overhaul overdrive unit.

SERVICE PROCEDURES

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 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.

(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 (Fig. 11) and check fluid level as follows:

(a) Correct acceptable level is in crosshatch area.

(b) Correct maximum level is to MAX arrow mark.

(c) Incorrect level is at or below MIN line.

(d) If fluid is low, add only enough Mopar® ATF Plus 3 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.

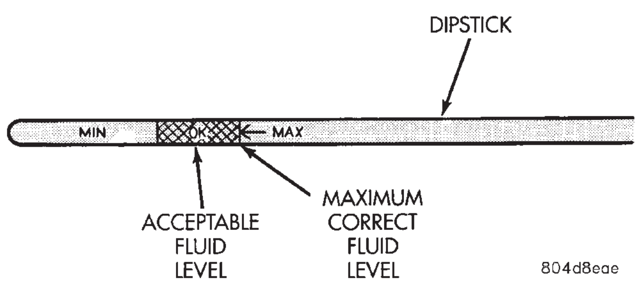


Fig. 11 Dipstick Fluid Level Marks—Typical

FLUID AND FILTER REPLACEMENT

Refer to the Maintenance Schedules in Group 0, Lubrication and Maintenance, for proper service intervals. The service fluid fill after a filter change is approximately 3.8 liters (4.0 quarts).

REMOVAL

(1) Hoist and support vehicle on safety stands.

(2) Place a large diameter shallow drain pan beneath the transmission pan.

(3) Remove bolts holding front and sides of pan to transmission (Fig. 12).

(4) Loosen bolts holding rear of pan to transmission.

(5) Slowly separate front of pan away from transmission allowing the fluid to drain into drain pan.

(6) Hold up pan and remove remaining bolt holding pan to transmission.

(7) While holding pan level, lower pan away from transmission.

(8) Pour remaining fluid in pan into drain pan.

(9) Remove screws holding filter to valve body (Fig. 13).

(10) Separate filter from valve body and pour fluid in filter into drain pan.

(11) Dispose of used trans fluid and filter properly.

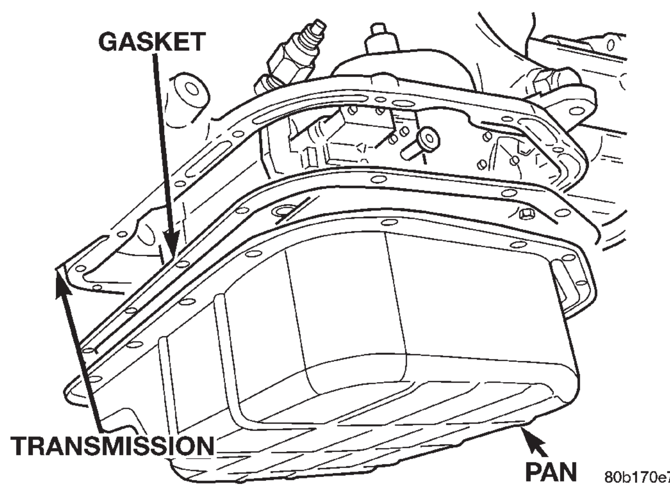


Fig. 12 Transmission Pan—Typical

INSPECTION

Inspect bottom of pan and magnet for excessive amounts of metal. A light coating of clutch or band material on the bottom of the pan does not indicate a problem unless accompanied by slipping condition or shift lag. If fluid and pan are contaminated with excessive amounts or debris, refer to the diagnosis section of this group.

Check the adjustment of the front and rear bands, adjust if necessary.

SERVICE PROCEDURES (Continued)

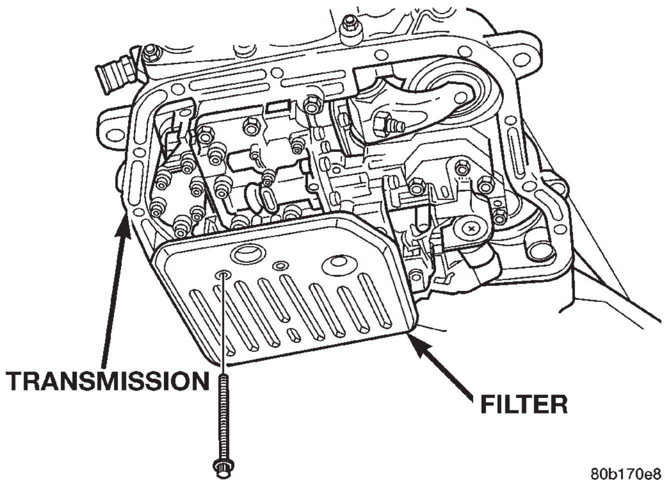


Fig. 13 Transmission Filter—Typical

CLEANING

(1) Using a suitable solvent, clean pan and magnet.

(2) Using a suitable gasket scraper, clean gasket material from gasket surface of transmission case and the gasket flange around the pan.

INSTALLATION

(1) Place replacement filter in position on valve body.

(2) Install screws to hold filter to valve body (Fig. 13). Tighten screws to 4 N·m (35 in. lbs.) torque.

(3) Place new gasket in position on pan and install pan on transmission.

(4) Place pan in position on transmission.

(5) Install screws to hold pan to transmission (Fig. 12). Tighten bolts to 17 N·m (150 in. lbs.) torque.

(6) Lower vehicle and fill transmission with Mopar® ATF Plus 3, type 7176 fluid.

TRANSMISSION FILL PROCEDURE

To avoid overfilling transmission after a fluid change or overhaul, perform the following procedure:

(1) Remove dipstick and insert clean funnel in transmission fill tube.

(2) Add following initial quantity of Mopar® ATF Plus 3 to transmission:

(a) If only fluid and filter were changed, add **3 pints (1-1/2 quarts)** of ATF Plus 3 to transmission.

(b) If transmission was completely overhauled, torque converter was replaced or drained, and cooler was flushed, add **12 pints (6 quarts)** of ATF Plus 3 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, set parking brake, and leave engine running at curb idle speed.

(6) Remove funnel, insert dipstick and check fluid level. If level is low, **add fluid to bring level to MIN mark on dipstick.** Check to see if the oil level is equal on both sides of the dipstick. If one side is noticably higher than the other, the dipstick has picked up some oil from the dipstick tube. Allow the oil to drain down the dipstick tube and re-check.

(7) Drive vehicle until transmission fluid is at normal operating temperature.

(8) With the engine running at curb idle speed, the gear selector in NEUTRAL, and the parking brake applied, check the transmission fluid level.

CAUTION: Do not overfill transmission, fluid foaming and shifting problems can result.

(9) Add fluid to bring level up to MAX arrow mark.

When fluid level is correct, shut engine off, release park brake, remove funnel, and install dipstick in fill tube.

CONVERTER DRAINBACK CHECK VALVE SERVICE

The converter drainback check valve is located in the cooler outlet (pressure) line near the radiator 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 significant amounts of 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 overheating condition and possible transmission failure.

CAUTION: The drainback valve is a one-way flow device. It must be properly oriented in terms of flow direction for the cooler to function properly. The valve must be installed in the pressure line. Otherwise flow will be blocked and would cause an overheating condition and eventual transmission failure.

OIL PUMP VOLUME CHECK

After the new or repaired transmission has been installed, fill to the proper level with Mopar® ATF

SERVICE PROCEDURES (Continued)

PLUS 3 (Type 7176) automatic transmission fluid. The volume should be checked using the following procedure:

(1) Disconnect the **From cooler** line at the transmission and place a collecting container under the disconnected line.

CAUTION: With the fluid set at the proper level, fluid collection should not exceed (1) quart or internal damage to the transmission may occur.

(2) Run the engine **at curb idle speed**, with the shift selector in neutral.

(3) If fluid flow is intermittent or it takes more than 20 seconds to collect one quart of ATF PLUS 3, disconnect the **To Cooler** line at the transaxle.

(4) Refill the transaxle to proper level and recheck pump volume.

(5) If flow is found to be within acceptable limits, replace the cooler. Then fill transmission to the proper level, using Mopar® ATF PLUS 3 (Type 7176) automatic transmission fluid.

(6) If fluid flow is still found to be inadequate, check the line pressure using the Transaxle Hydraulic Pressure Test procedure.

FLUSHING COOLERS AND TUBES

When a transmission failure has contaminated the fluid, the oil cooler(s) must be flushed. The torque converter must also be replaced. This will insure that metal particles or sludged oil are not later transferred back into the reconditioned (or replaced) transmission.

The only recommended procedure for flushing coolers and lines is to use Tool 6906 Cooler Flusher.

WARNING: WEAR PROTECTIVE EYEWEAR THAT MEETS THE REQUIREMENTS OF OSHA AND ANSI Z87.1–1968. WEAR STANDARD INDUSTRIAL RUBBER GLOVES.

KEEP LIGHTED CIGARETTES, SPARKS, FLAMES, AND OTHER IGNITION SOURCES AWAY FROM THE AREA TO PREVENT THE IGNITION OF COMBUSTIBLE LIQUIDS AND GASES. KEEP A CLASS (B) FIRE EXTINGUISHER IN THE AREA WHERE THE FLUSHER WILL BE USED.

KEEP THE AREA WELL VENTILATED.

DO NOT LET FLUSHING SOLVENT COME IN CONTACT WITH YOUR EYES OR SKIN: IF EYE CONTAMINATION OCCURS, FLUSH EYES WITH WATER FOR 15 TO 20 SECONDS. REMOVE CONTAMINATED CLOTHING AND WASH AFFECTED SKIN WITH SOAP AND WATER. SEEK MEDICAL ATTENTION.

COOLER FLUSH USING TOOL 6906

(1) Remove cover plate filler plug on Tool 6906. Fill reservoir 1/2 to 3/4 full of fresh flushing solution. Flushing solvents are petroleum based solutions generally used to clean automatic transmission components. **DO NOT** use solvents containing acids, water, gasoline, or any other corrosive liquids.

(2) Reinstall filler plug on Tool 6906.

(3) Verify pump power switch is turned OFF. Connect red alligator clip to positive (+) battery post. Connect black (-) alligator clip to a good ground.

(4) Disconnect the cooler lines at the transmission.

NOTE: When flushing transmission cooler and lines, ALWAYS reverse flush.

NOTE: The converter drainback valve must be removed and an appropriate replacement hose installed to bridge the space between the transmission cooler line and the cooler fitting. Failure to remove the drainback valve will prevent reverse flushing the system.

(5) Connect the BLUE pressure line to the OUTLET (From) cooler line.

(6) Connect the CLEAR return line to the INLET (To) cooler line

(7) Turn pump ON for two to three minutes to flush cooler(s) and lines. Monitor pressure readings and clear return lines. Pressure readings should stabilize below 20 psi. for vehicles equipped with a single cooler and 30 psi. for vehicles equipped with dual coolers. If flow is intermittent or exceeds these pressures, replace cooler.

(8) Turn pump OFF.

(9) Disconnect CLEAR suction line from reservoir at cover plate. Disconnect CLEAR return line at cover plate, and place it in a drain pan.

(10) Turn pump ON for 30 seconds to purge flushing solution from cooler and lines. Turn pump OFF.

(11) Place CLEAR suction line into a one quart container of Mopar® ATF Plus 3, type 7176 automatic transmission fluid.

(12) Turn pump ON until all transmission fluid is removed from the one quart container and lines. This purges any residual cleaning solvent from the transmission cooler and lines. Turn pump OFF.

(13) Disconnect alligator clips from battery. Reconnect flusher lines to cover plate, and remove flushing adapters from cooler lines.

SERVICE PROCEDURES (Continued)

ALUMINUM THREAD REPAIR

Damaged or worn threads in the aluminum transmission case and valve body can be repaired by the use of Heli-Coils, or equivalent. This repair consists of drilling out the worn-out damaged threads. Then tap the hole with a special Heli-Coil tap, or equivalent, and installing a Heli-Coil insert, or equivalent, into the hole. This brings the hole back to its original thread size.

Heli-Coil, or equivalent, tools and inserts are readily available from most automotive parts suppliers.

REMOVAL AND INSTALLATION

TRANSMISSION

The overdrive unit can be removed and serviced separately. It is not necessary to remove the entire transmission assembly to perform overdrive unit repairs.

If only the overdrive unit requires service, refer to the overdrive unit removal and installation procedures.

CAUTION: The transmission and torque converter must be removed as an assembly to avoid component damage. The converter driveplate, pump bushing, or oil seal can be damaged if the converter is left attached to the driveplate during removal. Be sure to remove the transmission and converter as an assembly.

REMOVAL

(1) Disconnect battery negative cable.

(2) Disconnect and lower or remove necessary exhaust components.

(3) Disconnect fluid cooler lines at transmission.

(4) Remove starter motor.

(5) Disconnect and remove crankshaft position sensor. Retain sensor attaching bolts.

CAUTION: The crankshaft position sensor will be damaged if the transmission is removed, or installed, while the sensor is still bolted to the engine block, or transmission (4.0L only). To avoid damage, be sure to remove the sensor before removing the transmission.

(6) Remove the bolts holding the bell housing brace to the transmission.

(7) Remove nut holding the bell housing brace to the engine to transmission bending brace.

(8) Remove the bell housing brace from the transmission (Fig. 14).

(9) Remove the bolt holding the torque converter cover to the transmission.

(10) Remove the torque converter cover from the transmission.

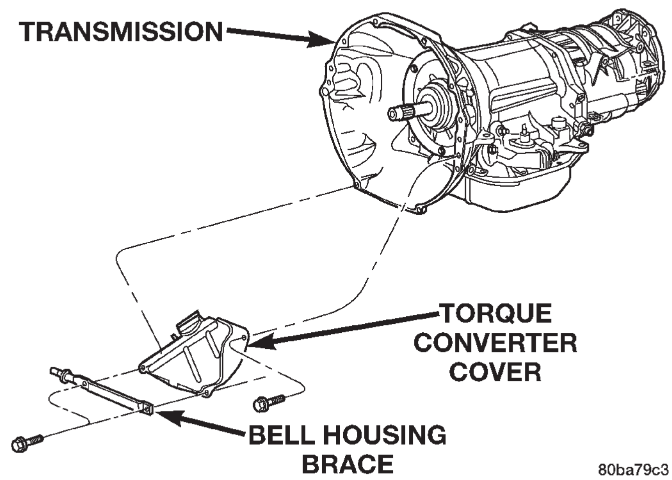


Fig. 14 Bell Housing Brace and Converter Cover

(11) If transmission is being removed for overhaul, remove transmission oil pan, drain fluid and reinstall pan.

(12) Remove fill tube bracket bolts and pull tube out of transmission. Retain fill tube seal. On 4 x 4 models, it will also be necessary to remove bolt attaching transfer case vent tube to converter housing.

(13) Mark torque converter and drive plate for assembly alignment.

(14) Rotate crankshaft in clockwise direction until converter bolts are accessible. Then remove bolts one at a time. Rotate crankshaft with socket wrench on dampener bolt.

(15) Mark propeller shaft and axle yokes for assembly alignment. Then disconnect and remove propeller shaft. On 4 x 4 models, remove both propeller shafts.

(16) Disconnect wires from park/neutral position switch and transmission solenoid.

(17) Disconnect gearshift cable from transmission manual valve lever (Fig. 15).

(18) Disconnect throttle valve cable from transmission bracket and throttle valve lever (Fig. 16).

(19) Disconnect transfer case shift cable from the transfer case shift lever (Fig. 17).

(20) Remove the clip securing the transfer case shift cable into the cable support bracket.

(21) Disconnect transmission fluid cooler lines at transmission fittings and clips.

(22) Support rear of engine with safety stand or jack.

(23) Raise transmission slightly with service jack to relieve load on crossmember and supports.

REMOVAL AND INSTALLATION (Continued)

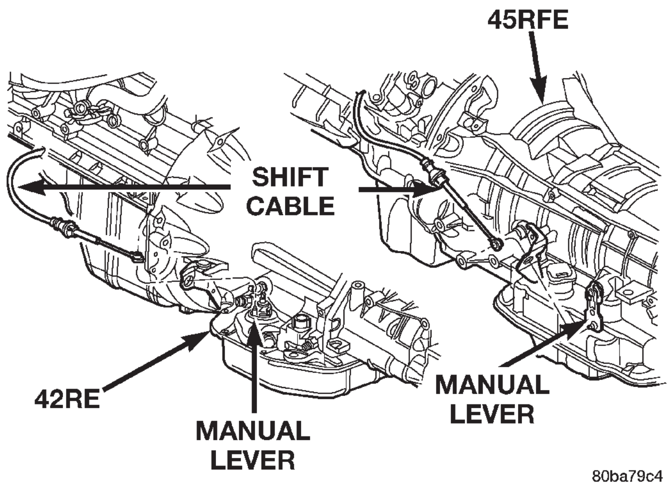


Fig. 15 Transmission Shift Cable

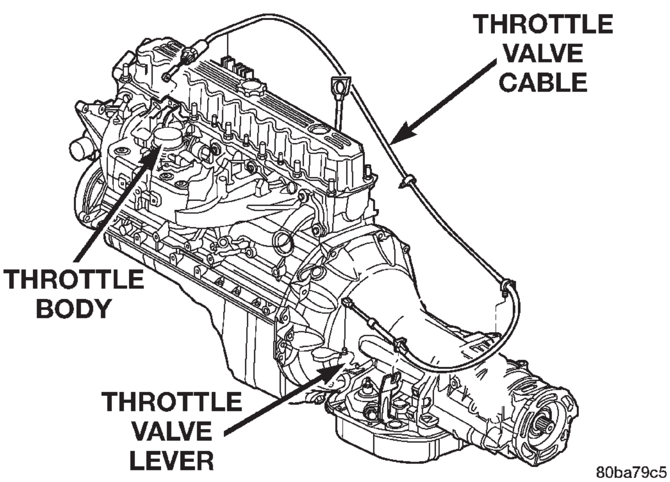


Fig. 16 Throttle Valve Cable

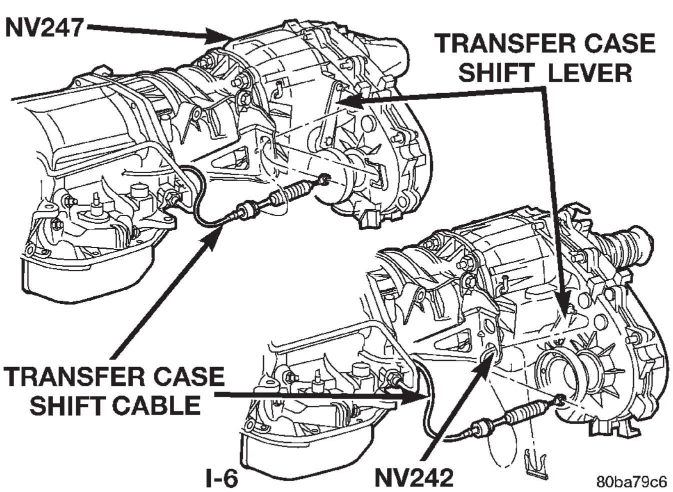


Fig. 17 Transfer Case Shift Cable

(24) Remove bolts securing rear support and cushion to transmission and crossmember (Fig. 18).

(25) Remove bolts attaching crossmember to frame and remove crossmember.

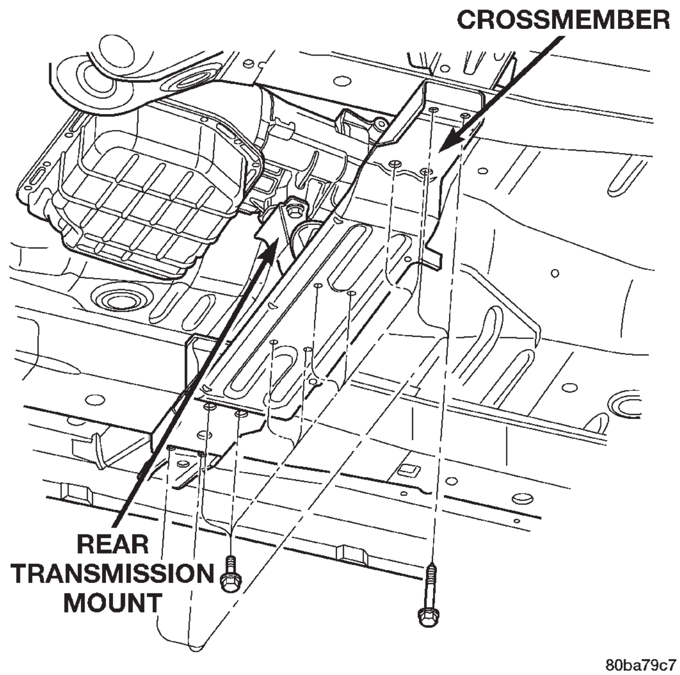


Fig. 18 Rear Transmission Crossmember

(26) Remove transfer case (Fig. 19) and (Fig. 20).

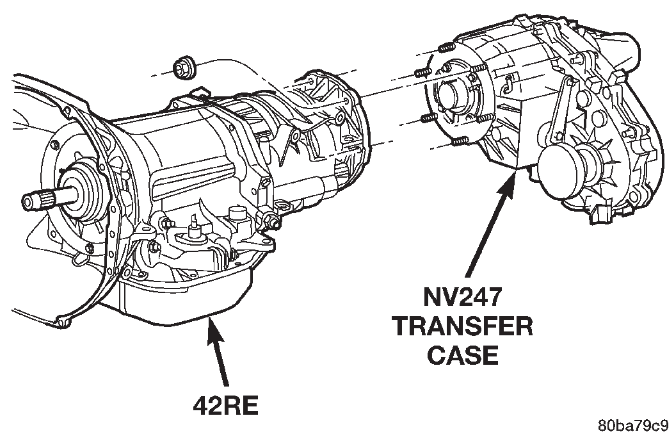


Fig. 19 Remove NV247 Transfer Case

(27) Remove bolts holding the upper transmission bending braces to the torque converter housing and the overdrive unit (Fig. 21).

(28) Remove all remaining converter housing bolts.

(29) Carefully work transmission and torque converter assembly rearward off engine block dowels.

(30) Hold torque converter in place during transmission removal.

(31) Lower transmission and remove assembly from under the vehicle.

(32) To remove torque converter, carefully slide torque converter out of the transmission.

REMOVAL AND INSTALLATION (Continued)

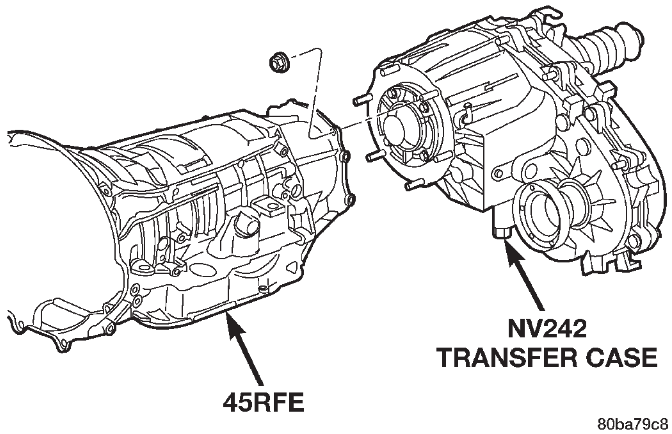


Fig. 20 Remove NV242 Transfer Case

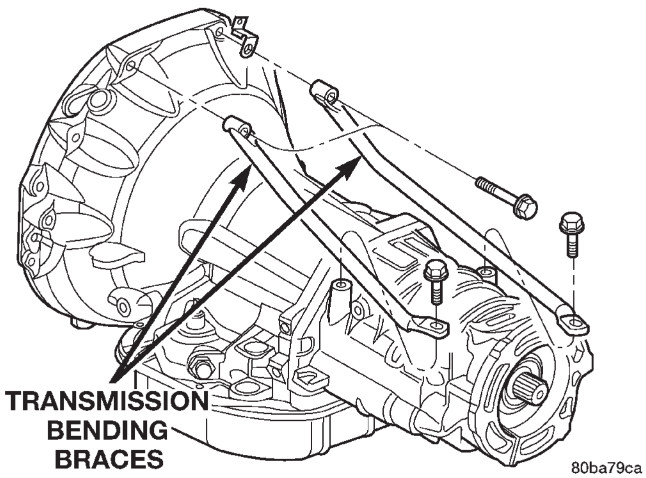


Fig. 21 Remove Upper Transmission Bending Braces

INSTALLATION

(1) Check torque converter hub and hub drive notches for sharp edges burrs, scratches, or nicks. Polish the hub and notches with 320/400 grit paper and crocus cloth if necessary. The hub must be smooth to avoid damaging pump seal at installation.

(2) Lubricate converter drive hub and oil pump seal lip with transmission fluid.

(3) Lubricate converter pilot hub with transmission fluid.

(4) Align converter and oil pump.

(5) Carefully insert converter in oil pump. Then rotate converter back and forth until fully seated in pump gears.

(6) Check converter seating with steel scale and straightedge (Fig. 22). Surface of converter lugs should be 1/2 in. to rear of straightedge when converter is fully seated.

(7) Temporarily secure converter with C-clamp.

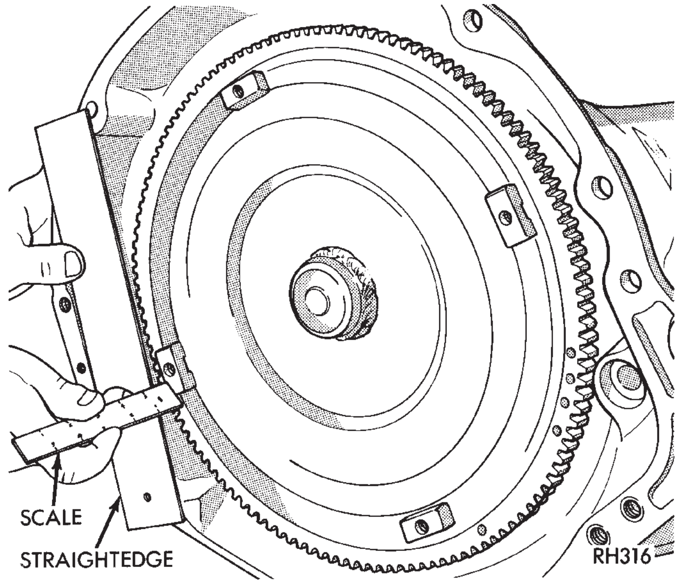


Fig. 22 Typical Method Of Checking Converter Seating

(8) Position transmission on jack and secure it with chains.

(9) Check condition of converter driveplate. Replace the plate if cracked, distorted or damaged. **Also be sure transmission dowel pins are seated in engine block and protrude far enough to hold transmission in alignment.**

(10) Raise transmission and align converter with drive plate and converter housing with engine block.

(11) Move transmission forward. Then raise, lower or tilt transmission to align converter housing with engine block dowels.

(12) Rotate converter so alignment marks scribed on converter are aligned with mark on driveplate.

(13) Carefully work transmission forward and over engine block dowels until converter hub is seated in crankshaft.

(14) Install two bolts to attach converter housing to engine.

(15) Install the upper transmission bending braces to the torque converter housing and the overdrive unit. Tighten the bolts to 41 N·m (30 ft. lbs.).

(16) Install remaining torque converter housing to engine bolts. Tighten to 68 N·m (50 ft. lbs.).

(17) Install rear transmission crossmember. Tighten crossmember to frame bolts to 68 N·m (50 ft. lbs.).

(18) Install rear support to transmission. Tighten bolts to 47 N·m (35 ft. lbs.).

(19) Lower transmission onto crossmember and install bolts attaching transmission mount to crossmember. Tighten clevis bracket to crossmember bolts to 47 N·m (35 ft. lbs.). Tighten the clevis bracket to rear support bolt to 68 N·m (50 ft. lbs.).

(20) Remove engine support fixture.

REMOVAL AND INSTALLATION (Continued)

(21) Install crankshaft position sensor.

(22) Install new plastic retainer grommet on any shift cable that was disconnected. Grommets should not be reused. Use pry tool to remove rod from grommet and cut away old grommet. Use pliers to snap new grommet into cable and to snap grommet onto lever.

(23) Connect gearshift and throttle valve cable to transmission.

(24) Connect wires to park/neutral position switch and transmission solenoid connector. Be sure transmission harnesses are properly routed.

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 clutch surface inside the converter.

(25) Install torque converter-to-driveplate bolts. Tighten bolts to 31 N·m (270 in. lbs.).

(26) Install converter housing access cover. Tighten bolt to 23 N·m (200 in. lbs.).

(27) Install the bell housing brace to the torque converter cover and the engine to transmission bending brace. Tighten the bolts and nut to 41 N·m (30 ft. lbs.).

(28) Install starter motor and cooler line bracket.

(29) Connect cooler lines to transmission.

(30) Install transmission fill tube. Install new seal on tube before installation.

(31) Install exhaust components.

(32) Install transfer case. Tighten transfer case nuts to 35 N·m (26 ft. lbs.).

(33) Install the transfer case shift cable to the cable support bracket and the transfer case shift lever.

(34) Align and connect propeller shaft(s).

(35) Adjust gearshift linkage and throttle valve cable if necessary.

(36) Lower vehicle.

(37) Fill transmission with Mopar® ATF Plus 3, Type 7176 fluid.

TORQUE CONVERTER

REMOVAL

(1) Remove transmission and torque converter from vehicle.

(2) Place a suitable drain pan under the converter housing end of the transmission.

CAUTION: Verify that transmission is secure on the lifting device or work surface, the center of gravity of the transmission will shift when the torque converter is removed creating an unstable condition.

The torque converter is a heavy unit. Use caution when separating the torque converter from the transmission.

(3) Pull the torque converter forward until the center hub clears the oil pump seal.

(4) Separate the torque converter from the transmission.

INSTALLATION

Check converter hub and drive notches for sharp edges, burrs, scratches, or nicks. Polish the hub and notches with 320/400 grit paper or crocus cloth if necessary. The hub must be smooth to avoid damaging the pump seal at installation. Check that the torque converter hub o-ring on the 45RFE torque converter hub is not damaged. Replace if necessary.

(1) Lubricate converter hub and oil pump seal lip with transmission fluid.

(2) Place torque converter in position on transmission.

CAUTION: Do not damage oil pump seal or bushing while inserting torque converter into the front of the transmission.

(3) Align torque converter to oil pump seal opening.

(4) Insert torque converter hub into oil pump.

(5) While pushing torque converter inward, rotate converter until converter is fully seated in the oil pump gears.

(6) Check converter seating with a scale and straightedge (Fig. 23). Surface of converter lugs should be 1/2 in. to rear of straightedge when converter is fully seated.

(7) If necessary, temporarily secure converter with C-clamp attached to the converter housing.

(8) Install the transmission in the vehicle.

(9) Fill the transmission with the recommended fluid.

PARK/NEUTRAL POSITION SWITCH

REMOVAL

(1) Raise vehicle and position drain pan under switch.

(2) Disconnect switch wires.

(3) Remove switch from case.

INSTALLATION

(1) Move shift lever to Park and Neutral positions. Verify that switch operating lever fingers are centered in switch opening in case (Fig. 24).

REMOVAL AND INSTALLATION (Continued)

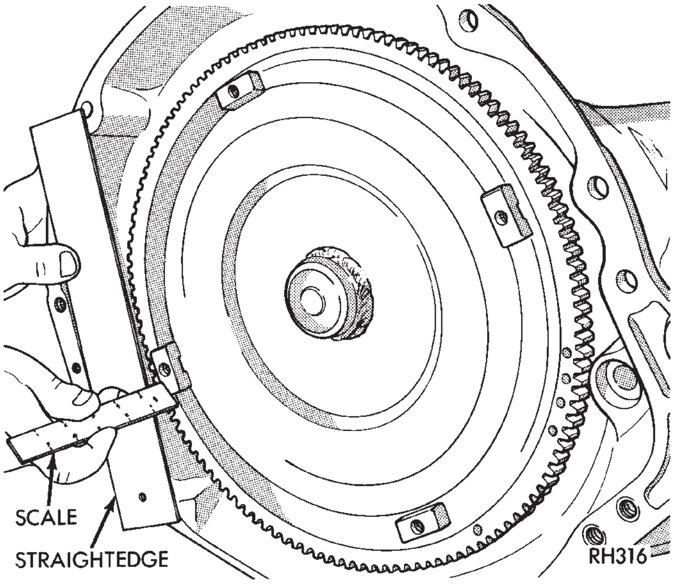


Fig. 23 Checking Torque Converter Seating–Typical

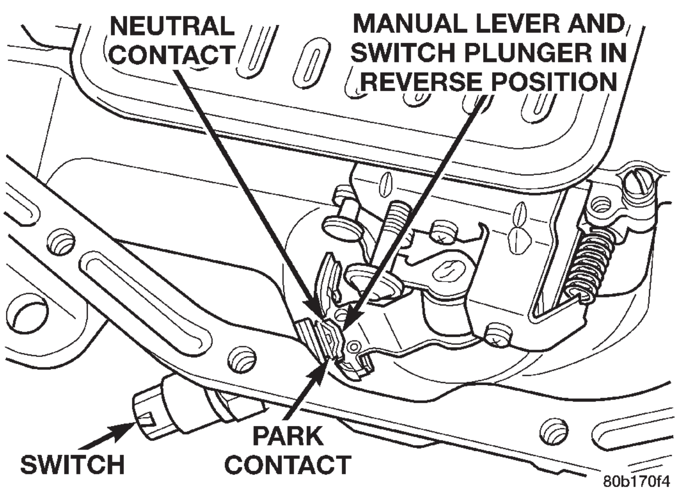


Fig. 24 Park/Neutral Position Switch

(2) Install new seal on switch and install switch in case. Tighten switch to 34 N·m (25 ft. lbs.) torque.

(3) Test continuity of new switch with 12V test lamp.

(4) Connect switch wires and lower vehicle.

(5) Top off transmission fluid level.

GEARSHIFT CABLE

REMOVAL

(1) Shift transmission into Park.

(2) Raise vehicle.

(3) Remove the shift cable eyelet from the transmission manual shift lever (Fig. 25).

(4) Remove shift cable from the cable support bracket.

(5) Lower vehicle.

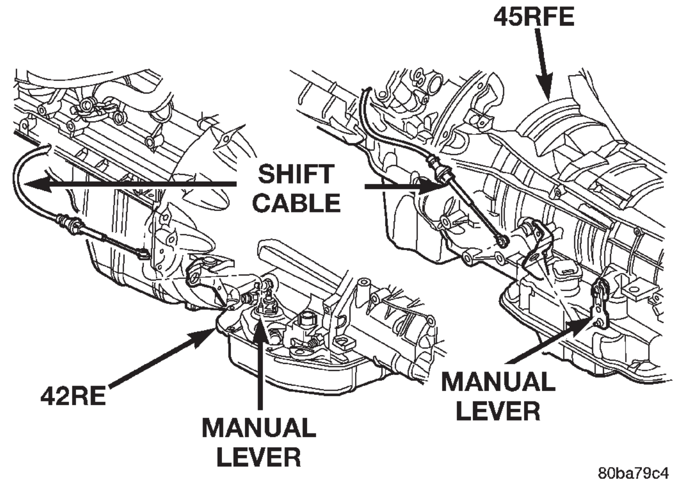


Fig. 25 Remove Shift Cable From Transmission

(6) Remove shift lever bezel and necessary console parts for access to shift lever assembly and shift cable.

(7) Disconnect cable at shift lever and shifter assembly bracket (Fig. 26).

(8) Remove the nuts holding the shift cable seal plate to the floor pan (Fig. 27).

(9) Pull cable through floor panel opening.

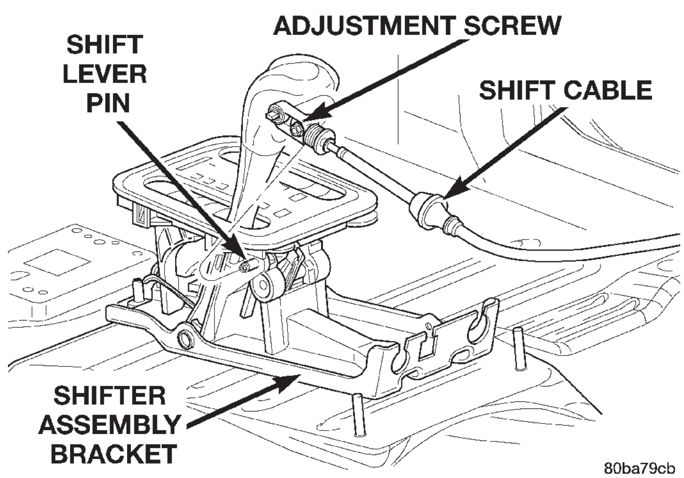


Fig. 26 Transmission Shift Cable at Shifter

(10) Remove shift cable from vehicle.

INSTALLATION

(1) Route cable through hole in floor pan.

(2) Install seal plate to studs in floor pan.

(3) Install nuts to hold seal plate to floor pan. Tighten nuts to 7 N·m (65 in. lbs.).

(4) Install the shift cable to the shifter assembly bracket. Push cable into the bracket until secure.

(5) Place the floor shifter lever in park position.

(6) Loosen the adjustment screw on the shift cable.

(7) Snap the shift cable onto the shift lever pin.

(8) Raise the vehicle.

REMOVAL AND INSTALLATION (Continued)

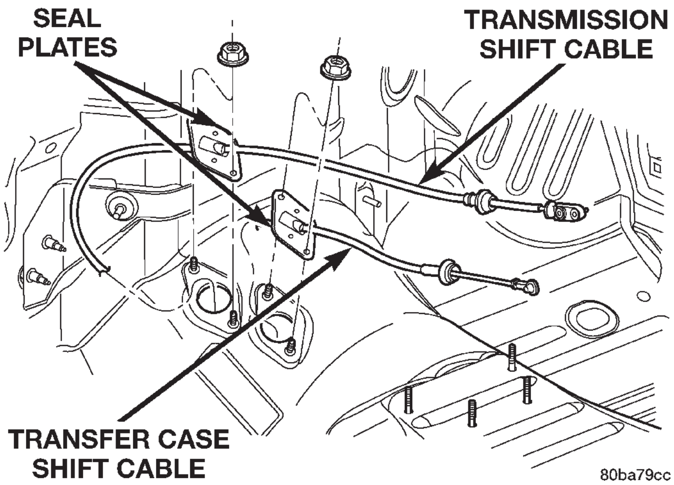


Fig. 27 Shift Cables at Floor Pan

(9) Install the shift cable to the shift cable support bracket.

(10) Shift the transmission into PARK. PARK is the rearmost detent position on the transmission manual shift lever.

(11) Snap the shift cable onto the transmission manual shift lever.

(12) Lower vehicle.

(13) Verify that the shift lever is in the PARK position.

(14) Tighten the adjustment screw to 7 N·m (65 in. lbs.).

(15) Verify correct shifter operation.

(16) Install shift lever bezel and any console parts removed for access to shift lever assembly and shift cable.

SHIFTER

REMOVAL

(1) Shift transmission into Park.

(2) Remove shift lever bezel and any necessary console parts for access to shift lever assembly and shifter cables.

(3) Disconnect the transmission shift cable at shift lever and shifter assembly bracket (Fig. 28).

(4) Disconnect the brake transmission interlock cable from the shifter BTSI lever and the shifter assembly bracket.

(5) Disconnect the transfer case shift cable from the transfer case shift lever pin (Fig. 30).

(6) Remove the clip holding the transfer case shift cable to the shifter assembly bracket.

(7) Remove the transfer case shift cable from the shifter assembly bracket.

(8) Disengage all wiring connectors from the shifter assembly.

(9) Remove all nuts holding the shifter assembly to the floor pan (Fig. 31).

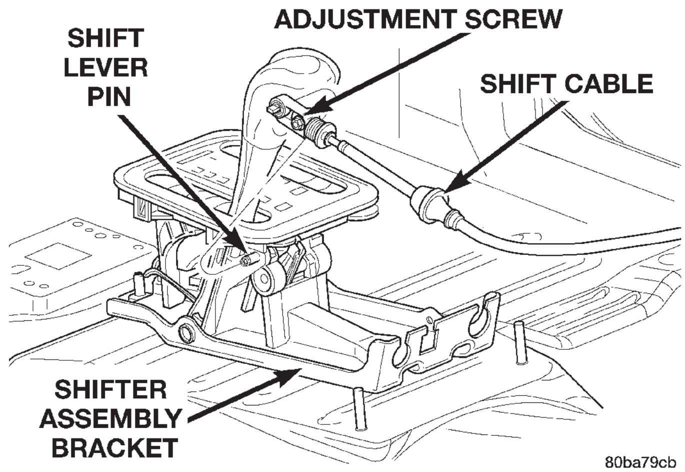


Fig. 28 Transmission Shift Cable at Shifter

(10) Remove the shifter assembly from the vehicle.

INSTALLATION

(1) Install shifter assembly onto the shifter assembly studs on the floor pan.

(2) Install the nuts to hold the shifter assembly onto the floor pan. Tighten nuts to 28 N·m (250 in. lbs.).

(3) Install wiring harness to the shifter assembly bracket. Engage any wire connectors removed from the shifter assembly.

(4) Install the transfer case shift cable to the shifter assembly bracket. Install clip to hold cable to the bracket.

(5) Snap the transfer case shift cable onto the transfer case shift lever pin.

(6) Install the brake transmission interlock cable into the shifter assembly bracket and into the shifter BTSI lever.

(7) Install the shift cable to the shifter assembly bracket. Push cable into the bracket until secure.

(8) Place the floor shifter lever in park position.

(9) Loosen the adjustment screw on the shift cable.

(10) Snap the shift cable onto the shift lever pin.

(11) Verify that the shift lever is in the PARK position.

(12) Tighten the adjustment screw to 7 N·m (65 in. lbs.).

(13) Verify correct shifter operation.

(14) Install shift lever bezel and any console parts removed for access to shift lever assembly and shift cables.

BRAKE TRANSMISSION SHIFT INTERLOCK

REMOVAL

(1) Lower the steering column.

(2) Remove the transmission shift interlock cable from steering column (Fig. 32).

REMOVAL AND INSTALLATION (Continued)

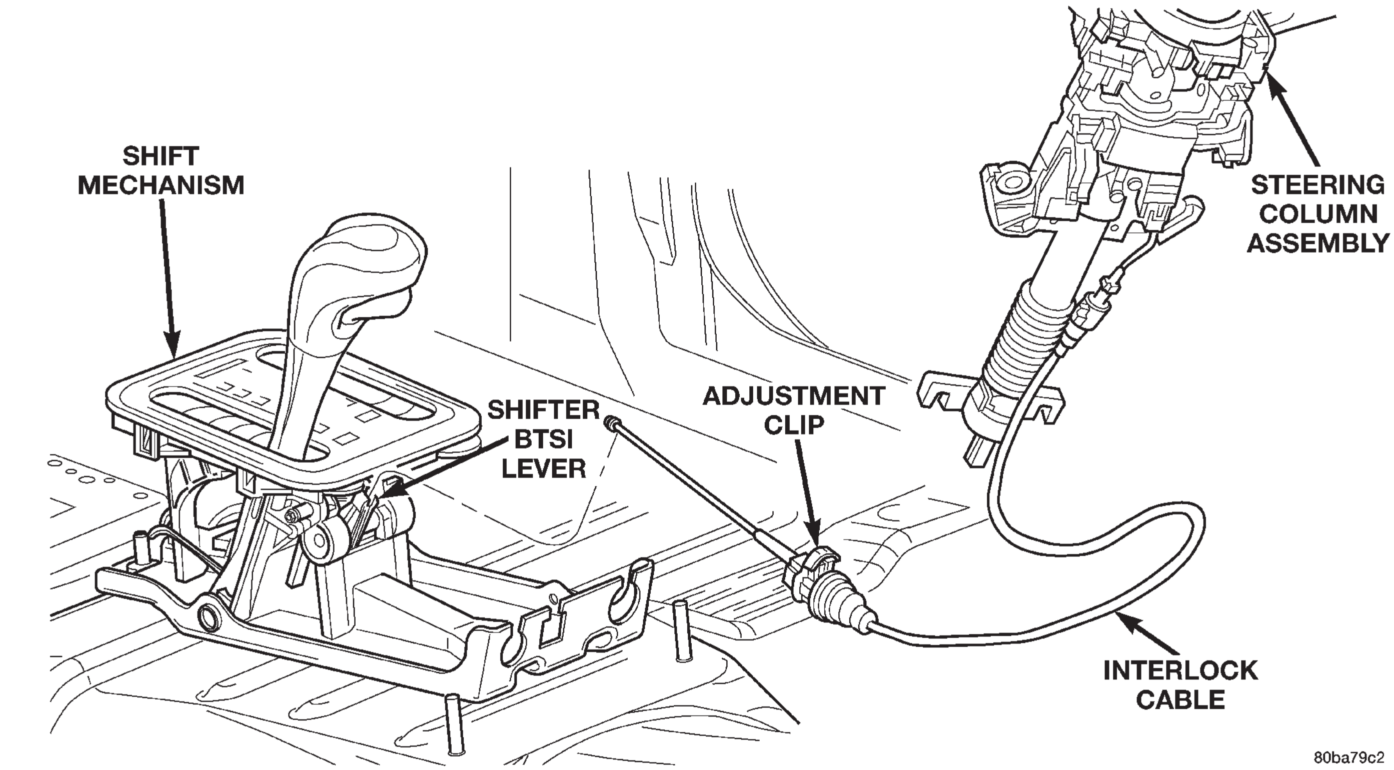


Fig. 29 Brake Transmission Interlock Cable

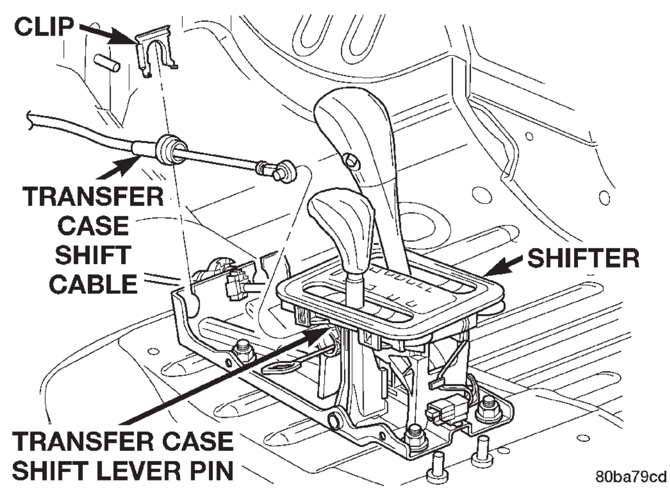


Fig. 30 Transfer Case Shift Cable

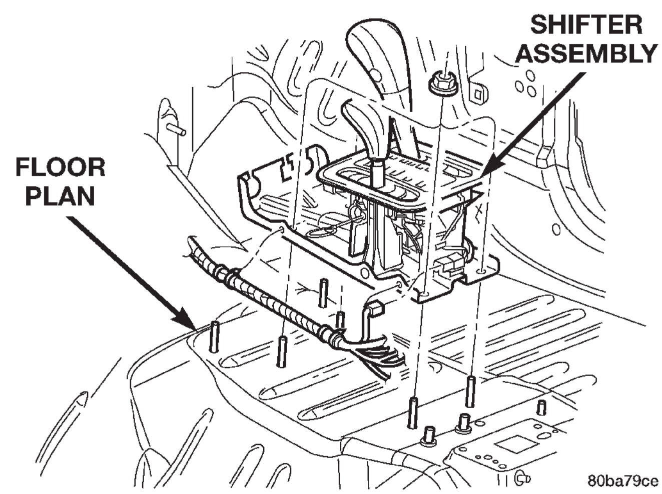


Fig. 31 Shifter Assembly

(3) Remove the center console and related trim. Refer to Group 23, Body, for proper procedures.

(4) Disconnect the BTSI cable from the shift BTSI lever and remove the cable from the shifter assembly bracket.

(5) Disengage the wire connector at the solenoid on the cable

(6) Release the BTSI cable from any remaining clips.

(7) Remove BTSI cable from the vehicle.

INSTALLATION

NOTE: The gearshift cable must be secured into position and properly adjusted before the installation of the Brake Transmission Interlock Cable (BTSI).

(1) Snap the BTSI cable assembly into the steering column.

(2) Snap BTSI cable solenoid tie strap into hole in steering column tube.

(3) Engage the wiring connector from brake light switch into BTSI cable solenoid housing.

REMOVAL AND INSTALLATION (Continued)

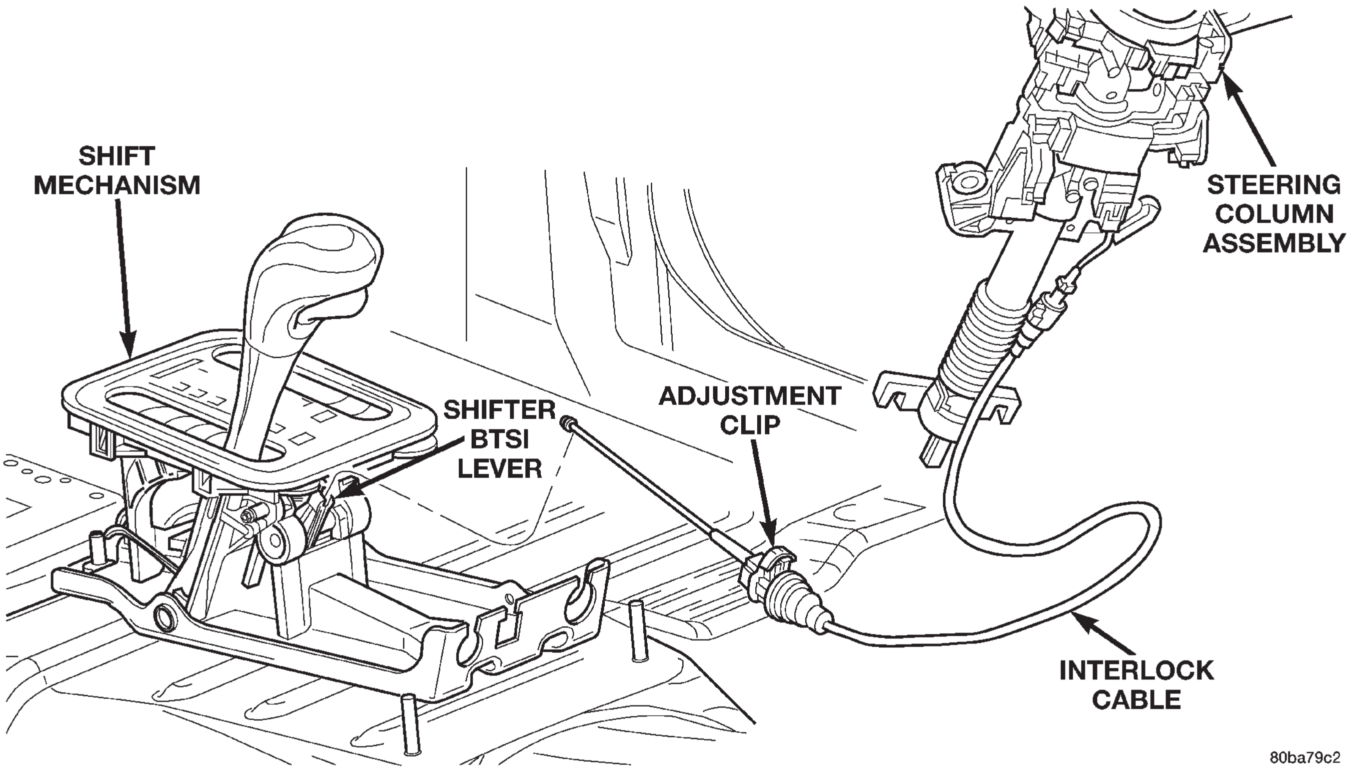


Fig. 32 Brake Transmission Shift Interlock

(4) Route BTSI cable to the shifter mechanism.

(5) Install the BTSI cable end fitting into shifter BTSI lever.

(6) Pull rearward on the BTSI cable housing and install the cable housing into the shifter assembly bracket.

(7) Place the ignition key cylinder in the LOCK position.

(8) Snap BTSI cable adjuster ears into floor shifter bracket and

(9) Push the cable adjuster lock clamp downward to lock it.

(10) Install the center console and related trim. Refer to Group 23, Body, for proper procedures.

(11) Test the BTSI cable operation.

GOVERNOR SOLENOID AND PRESSURE SENSOR

REMOVAL

(1) Hoist and support vehicle on safety stands.

(2) Remove transmission fluid pan and filter.

(3) Disengage wire connectors from pressure sensor and solenoid (Fig. 33).

(4) Remove screws holding pressure solenoid retainer to governor body.

(5) Separate solenoid retainer from governor (Fig. 34).

(6) Pull solenoid from governor body (Fig. 35).

(7) Remove bolts holding governor body to valve body.

(8) Separate governor body from valve body (Fig. 36).

(9) Remove governor body gasket.

(10) Remove retainer holding pressure sensor to governor body.

(11) Pull pressure sensor from governor body (Fig. 37).

INSTALLATION

Before installing the pressure sensor and solenoid in the governor body, replace O-ring seals, clean the gasket surfaces and replace gasket.

(1) Lubricate O-ring on pressure sensor with transmission fluid.

(2) Align pressure sensor to bore in governor body (Fig. 37).

(3) Push pressure sensor into governor body.

(4) Install retainer to hold pressure sensor to governor body.

(5) Place gasket in position on back of governor body (Fig. 36).

(6) Place governor body in position on valve body.

(7) Install bolts to hold governor body to valve body.

(8) Lubricate O-ring, on pressure solenoid, with transmission fluid.

(9) Align pressure solenoid to bore in governor body (Fig. 35).

REMOVAL AND INSTALLATION (Continued)

(10) Push solenoid into governor body.

(11) Place solenoid retainer in position on governor (Fig. 34).

(12) Install screws to hold pressure solenoid retainer to governor body.

(13) Engage wire connectors into pressure sensor and solenoid (Fig. 33).

(14) Install transmission fluid pan and (new) filter.

(15) Lower vehicle and road test to verify repair.

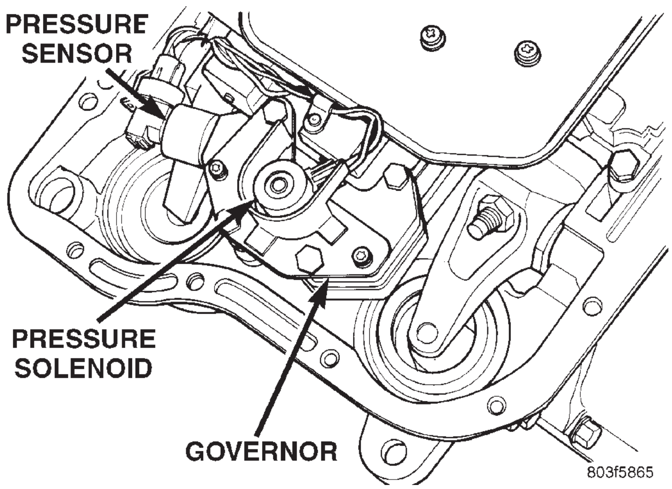


Fig. 33 Governor Solenoid And Pressure Sensor

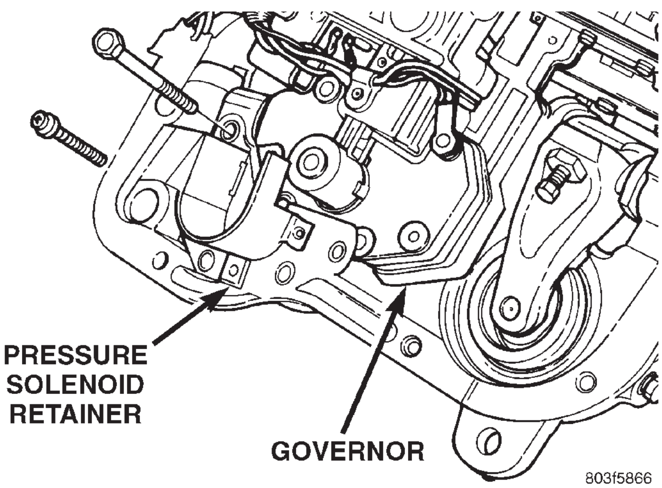


Fig. 34 Pressure Solenoid Retainer

VALVE BODY

The valve body can be removed for service without having to remove the transmission assembly.

The valve body can be disassembled for cleaning and inspection of the individual components. Refer to Disassembly and Assembly section for proper procedures.

The only replaceable valve body components are:

- Manual lever.
- Manual lever washer, seal, E-clip, and shaft seal.
- Manual lever detent ball.

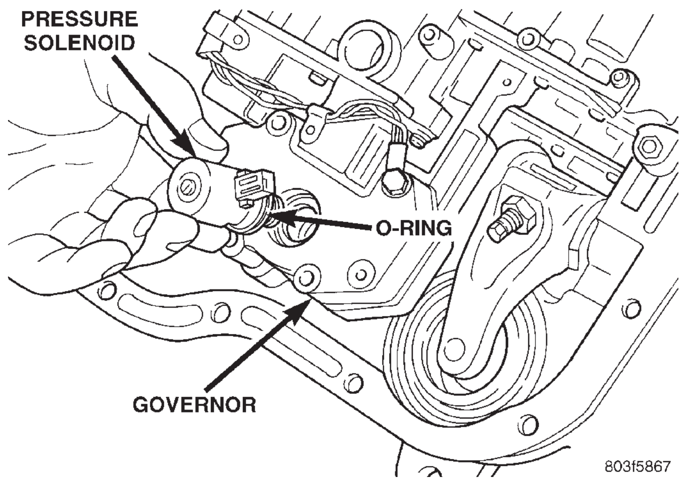


Fig. 35 Pressure Solenoid and O-ring

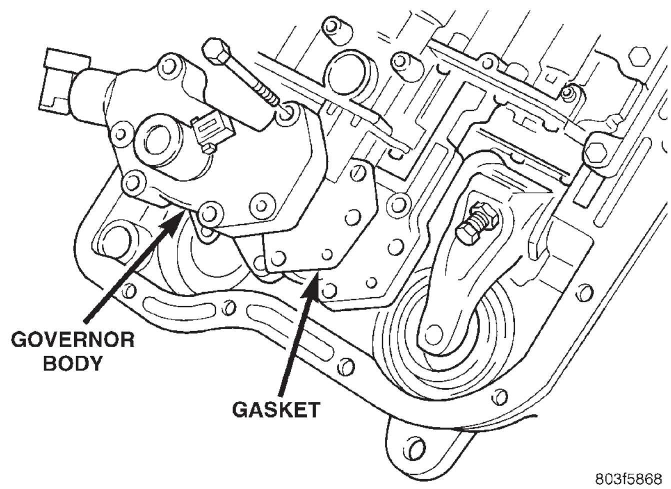


Fig. 36 Governor Body and Gasket

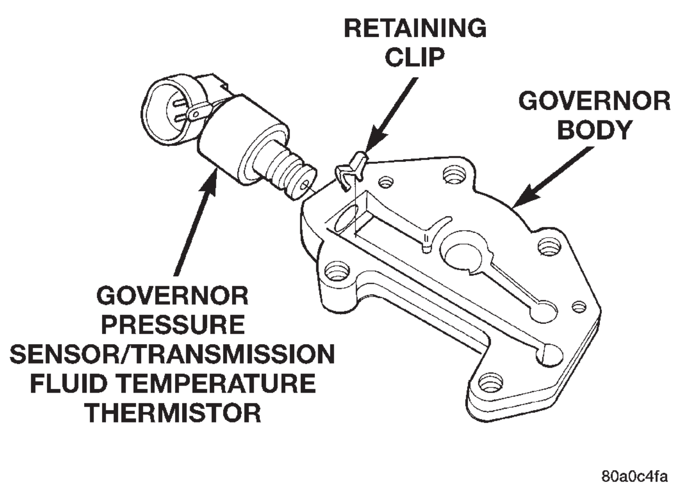


Fig. 37 Pressure Sensor and Retainer

- Throttle lever.
- Fluid filter.
- Pressure adjusting screw bracket.
- Governor pressure solenoid.

REMOVAL AND INSTALLATION (Continued)

- Governor pressure sensor.
- Converter clutch/overdrive solenoid assembly and harness (includes sump temperature thermistor).
- Governor housing gasket.
- Solenoid case connector O-rings.

The remaining valve body components are serviced only as part of a complete valve body assembly.

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 solenoid case connector (Fig. 38).
(5) Position drain pan under transmission oil pan.
(6) Remove transmission oil pan and gasket.
(7) Remove fluid filter from valve body.
(8) Remove bolts attaching valve body to transmission case.
(9) Lower valve body enough to remove accumulator piston and springs.
(10) Work manual lever shaft and electrical connector out of transmission case.
(11) Lower valve body, rotate valve body away from case, pull park rod out of sprag, and remove valve body (Fig. 39).

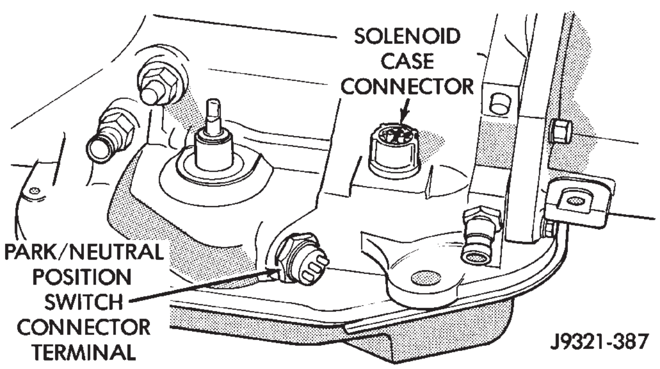


Fig. 38 Transmission Case Connector

INSTALLATION

(1) Check condition of O-ring seals on valve body harness connector (Fig. 40). Replace seals on connector body if cut or worn.
(2) 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. 41).
(3) Check condition of seals on accumulator piston (Fig. 42). Install new piston seals, if necessary.
(4) Place valve body manual lever in low (1 position) so ball on park lock rod will be easier to install in sprag.
(5) Lubricate shaft of manual lever with petroleum jelly. This will ease inserting shaft through seal in case.

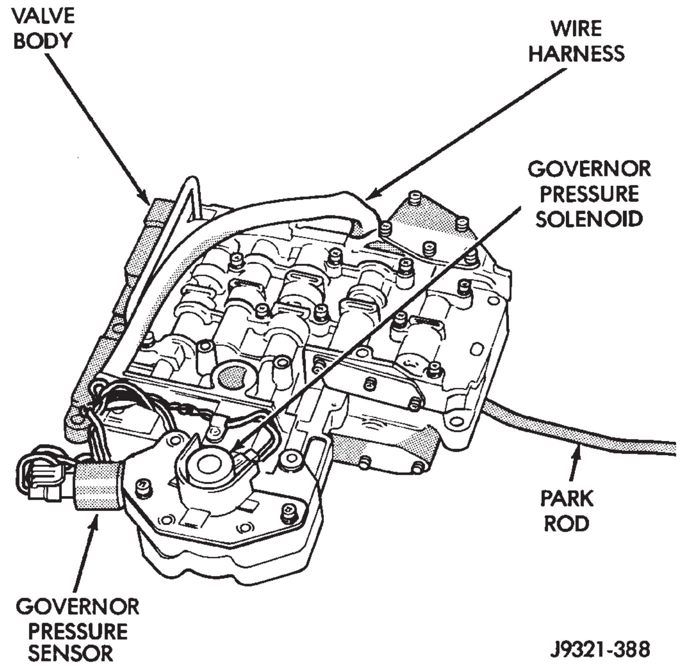


Fig. 39 Valve Body

(6) Lubricate seal rings on valve body harness connector with petroleum jelly.
(7) Position valve body in 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. The rod will click 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.

(8) Install accumulator springs and piston into case. Then swing valve body over piston and outer spring to hold it in place.
(9) Align accumulator piston and outer spring, manual lever shaft and electrical connector in case.
(10) Then seat valve body in 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 throttle and gearshift levers on valve body manual lever shaft.
(14) Check and adjust front and rear bands if necessary.
(15) Connect solenoid case connector wires.
(16) Install oil pan and new gasket. Tighten pan bolts to 17 N·m (13 ft. lbs.) torque.
(17) Lower vehicle and fill transmission with Mopar® ATF Plus 3, type 7176 fluid.

REMOVAL AND INSTALLATION (Continued)

(18) Check and adjust gearshift and throttle valve cables, if necessary.

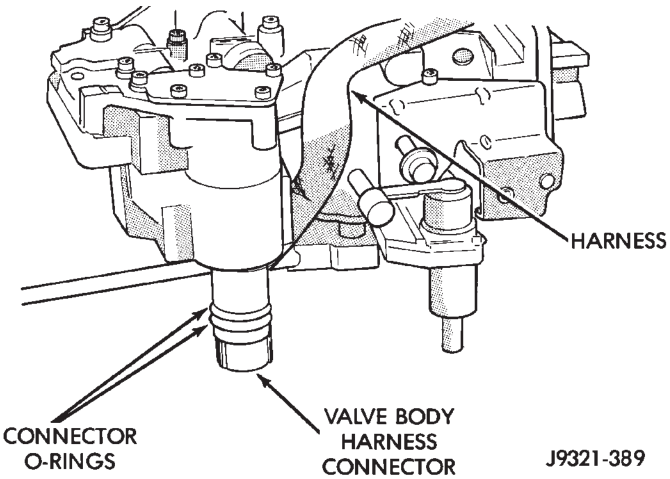


Fig. 40 Valve Body Harness Connector O-Ring Seal

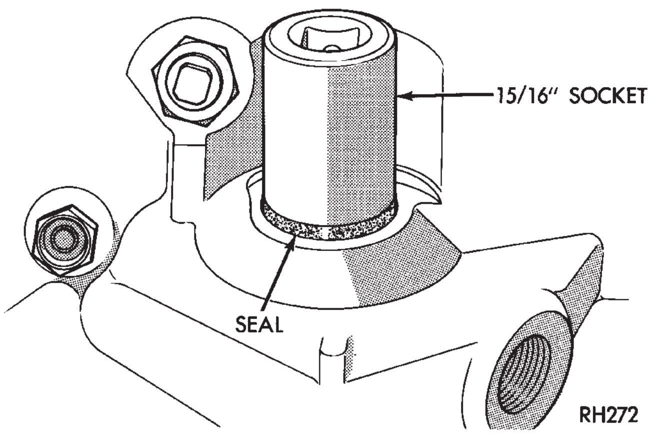


Fig. 41 Manual Lever Shaft Seal

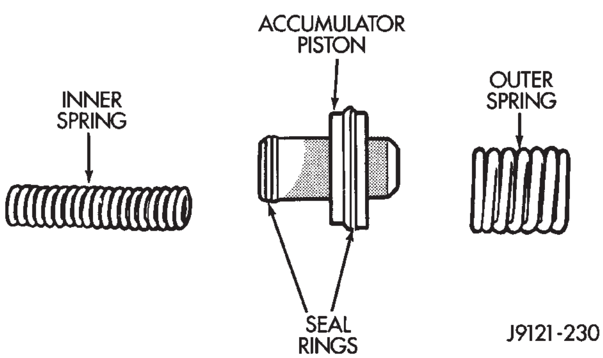


Fig. 42 Accumulator Piston Components

OVERDRIVE UNIT

REMOVAL

(1) Shift transmission into Park.

(2) Raise vehicle.

(3) Remove the transfer case.

(4) Disengage the wiring connector from the output shaft speed sensor.

(5) Remove transmission oil pan, remove gasket, drain oil and reinstall pan.

(6) If overdrive unit had malfunctioned, or if fluid is contaminated, remove entire transmission. If diagnosis indicated overdrive problems only, remove just the overdrive unit.

(7) Support transmission with transmission jack.

(8) Remove bolts holding the overdrive unit to the transmission rear support.

(9) Remove bolts attaching overdrive unit to transmission (Fig. 43).

CAUTION: Support the overdrive unit with a jack before moving it rearward. This is necessary to prevent damaging the intermediate shaft. Do not allow the shaft to support the entire weight of the overdrive unit.

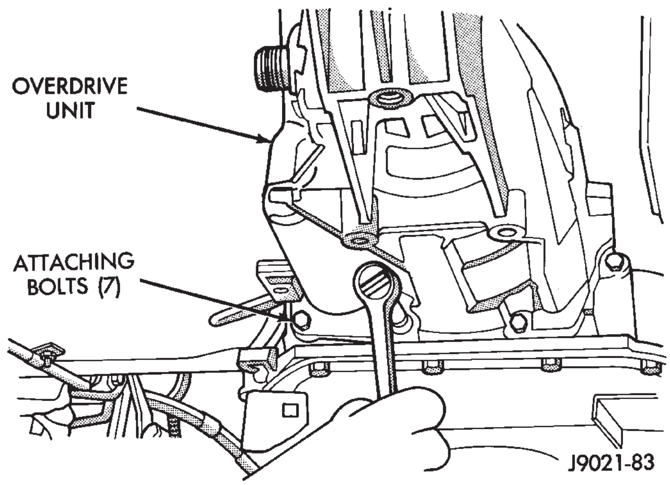


Fig. 43 Overdrive Unit Bolts—Typical

(10) Carefully work overdrive unit off intermediate shaft. Do not tilt unit during removal. Keep it as level as possible.

(11) If overdrive unit does not require service, immediately insert Alignment Tool 6227-2 in splines of planetary gear and overrunning clutch to prevent splines from rotating out of alignment. If misalignment occurs, overdrive unit will have to be disassembled in order to realign splines.

(12) Remove and retain overdrive piston thrust bearing. Bearing may remain on piston or in clutch hub during removal.

(13) Position drain pan on workbench.

(14) Place overdrive unit over drain pan. Tilt unit to drain residual fluid from case.

(15) Examine fluid for clutch material or metal fragments. If fluid contains these items, overhaul will be necessary.

(16) If overdrive unit does not require any service, leave alignment tool in position. Tool will prevent accidental misalignment of planetary gear and overrunning clutch splines.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Be sure overdrive unit Alignment Tool 6227-2 is fully seated before moving unit. If tool is not seated and gear splines rotate out of alignment, overdrive unit will have to be disassembled in order to realign splines.

(2) If overdrive piston retainer was not removed during service and original case gasket is no longer reusable, prepare new gasket by trimming it.

(3) Cut out old case gasket around piston retainer with razor knife (Fig. 44).

(4) Use old gasket as template and trim new gasket to fit.

(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.

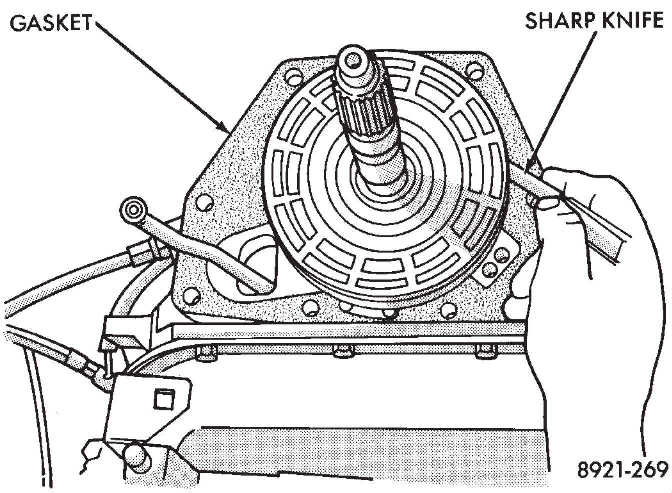


Fig. 44 Trimming Overdrive Case Gasket

(6) Install selective spacer on intermediate shaft, if removed. Spacer goes in groove just rearward of shaft rear splines (Fig. 45).

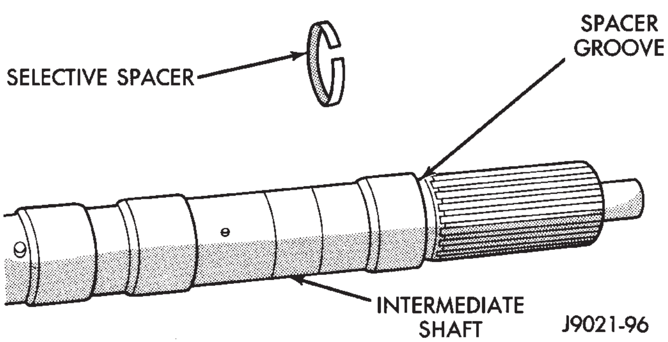


Fig. 45 Intermediate Shaft Selective Spacer Location

(7) Install thrust bearing in overdrive unit sliding hub. Use petroleum jelly to hold bearing in position.

CAUTION: Be sure the shoulder on the inside diameter of the bearing is facing forward.

(8) Verify that splines in overdrive planetary gear and overrunning clutch hub are aligned with Alignment Tool 6227-2. Overdrive unit cannot be installed if splines are not aligned. If splines have rotated out of alignment, unit will have to be disassembled to realign splines.

(9) Carefully slide Alignment Tool 6227-2 out of overdrive planetary gear and overrunning clutch splines.

(10) Raise overdrive unit and carefully slide it straight onto intermediate shaft. Insert park rod into park lock reaction plug at same time. Avoid tilting overdrive during installation as this could cause planetary gear and overrunning clutch splines to rotate out of alignment. If this occurs, it will be necessary to remove and disassemble overdrive unit to realign splines.

(11) Work overdrive unit forward on intermediate shaft until seated against transmission case.

(12) Install bolts attaching overdrive unit to transmission unit. Tighten bolts in diagonal pattern to 34 N·m (25 ft. lbs).

(13) Install the bolts to hold the transmission rear support to the overdrive unit.

(14) Engage the wiring connector to the output speed sensor.

(15) Install the transfer case.

OUTPUT SHAFT REAR BEARING

REMOVAL

(1) Remove overdrive unit from the vehicle.

(2) Remove overdrive geartrain from housing.

(3) Remove snap ring holding output shaft rear bearing into overdrive housing (Fig. 46).

(4) Using a suitable driver inserted through the rear end of housing, drive bearing from housing.

INSTALLATION

(1) Place replacement bearing in position in housing.

(2) Using a suitable driver, drive bearing into housing until the snap ring groove is visible.

(3) Install snap ring to hold bearing into housing (Fig. 46).

(4) Install overdrive geartrain into housing.

(5) Install overdrive unit in vehicle.

OUTPUT SHAFT FRONT BEARING

REMOVAL

(1) Remove overdrive unit from the vehicle.

(2) Remove overdrive geartrain from housing.

(3) Remove snap ring holding output shaft front bearing to overdrive geartrain. (Fig. 47).

(4) Pull bearing from output shaft.

REMOVAL AND INSTALLATION (Continued)

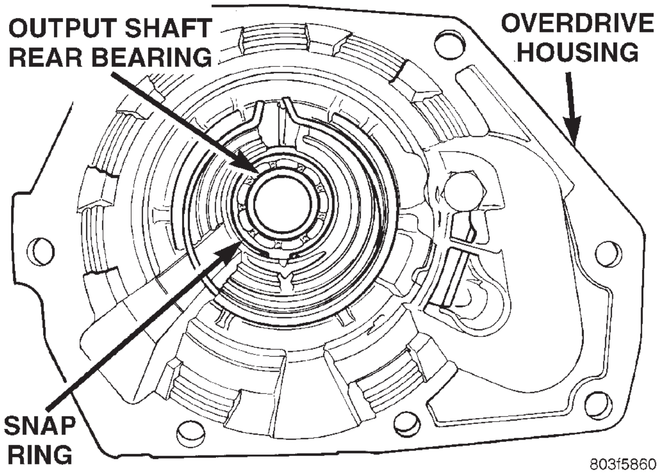


Fig. 46 Output Shaft Rear Bearing

INSTALLATION

(1) Place replacement bearing in position on geartrain with locating retainer groove toward the rear.

(2) Push bearing onto shaft until the snap ring groove is visible.

(3) Install snap ring to hold bearing onto output shaft (Fig. 47).

(4) Install overdrive geartrain into housing.

(5) Install overdrive unit in vehicle.

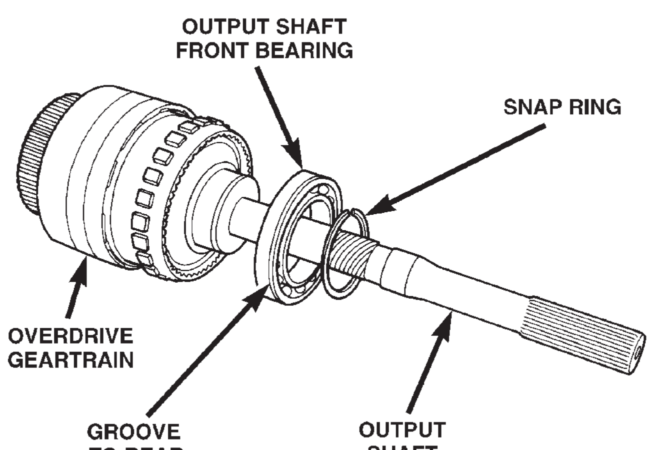


Fig. 47 Output Shaft Front Bearing

DISASSEMBLY AND ASSEMBLY

VALVE BODY

Remove the valve body from the transmission, refer to Removal and Installation procedures section in this group.

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) Remove fluid filter.

(2) Disconnect wires from governor pressure sensor and solenoid.

(3) Remove screws attaching governor body and retainer plate to transfer plate.

(4) Remove retainer plate, governor body and gasket from transfer plate.

(5) Disconnect wires from governor pressure sensor, if not done previously.

(6) Remove governor pressure sensor from governor body. Sensor is retained in body with M-shaped spring clip. Remove clip with small pointed tool and slide sensor out of body.

(7) Remove governor pressure solenoid by pulling it straight out of bore in governor body. Remove and discard solenoid O-rings if worn, cut, or torn.

(8) Remove small shoulder bolt that secures solenoid harness case connector to 3-4 accumulator housing (Fig. 48). **Retain shoulder bolt. Either tape it to harness or thread it back into accumulator housing after connector removal.**

(9) Unhook overdrive/converter solenoid harness from 3-4 accumulator cover plate (Fig. 49).

(10) Turn valve body over and remove screws that attach overdrive/converter solenoid assembly to valve body (Fig. 50).

(11) Remove solenoid and harness assembly from valve body (Fig. 51).

(12) Remove boost valve cover (Fig. 52).

(13) Remove boost valve retainer, valve spring and boost valve (Fig. 53).

DISASSEMBLY AND ASSEMBLY (Continued)

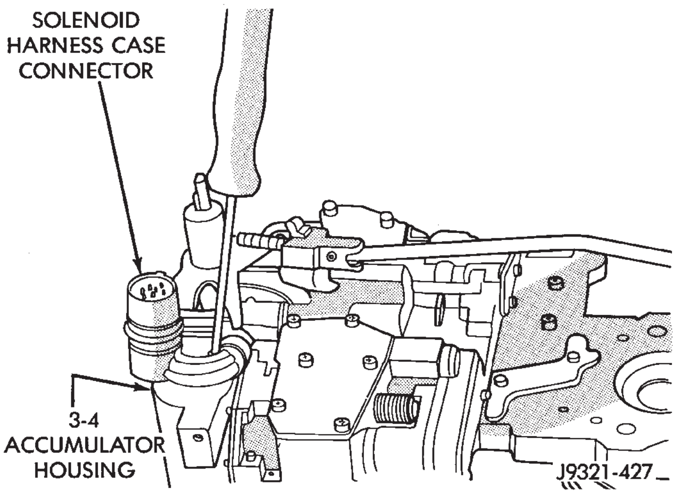


Fig. 48 Solenoid Harness Case Connector Shoulder Bolt

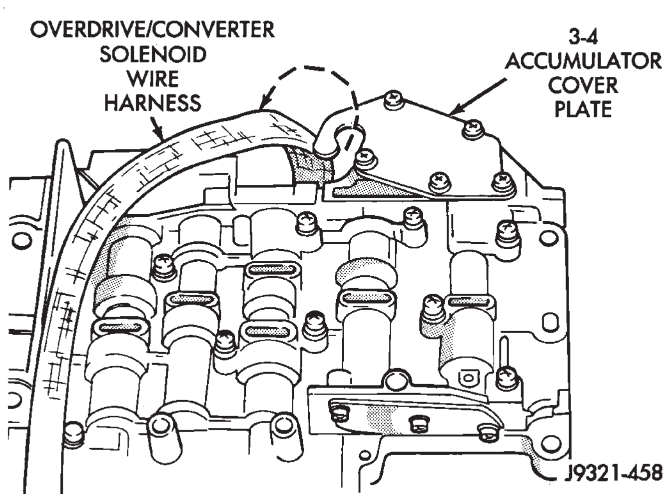


Fig. 49 Unhooking Solenoid Harness From Accumulator Cover Plate

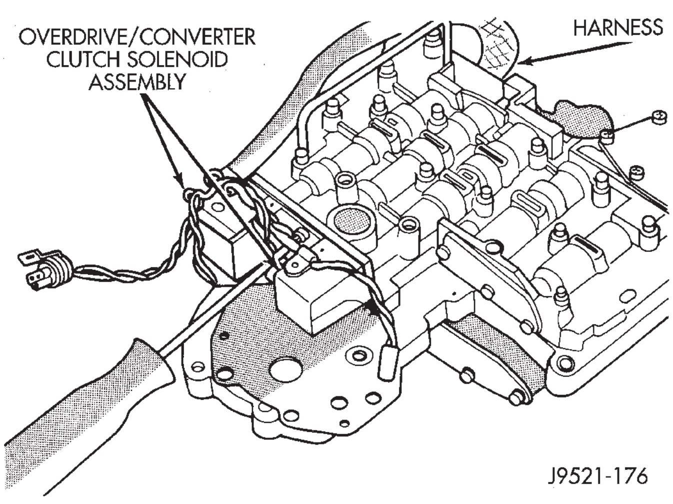


Fig. 50 Solenoid Assembly Screws

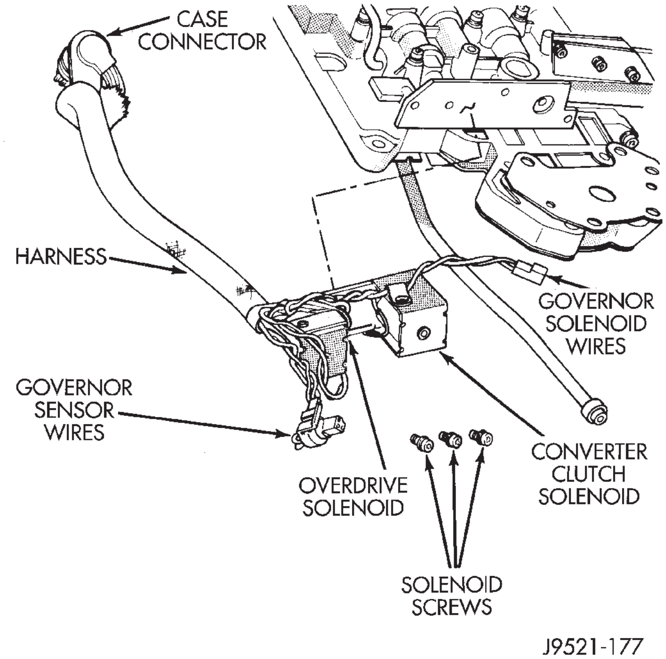


Fig. 51 Solenoid Assembly

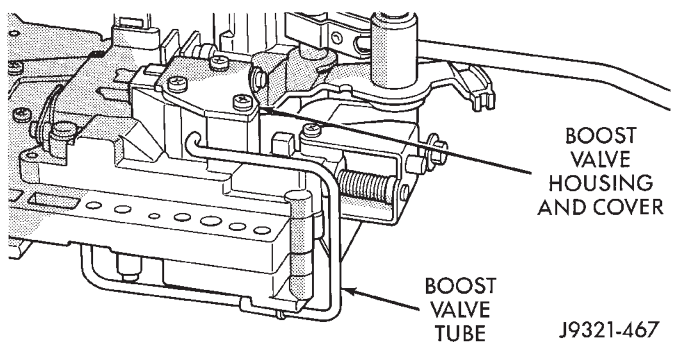


Fig. 52 Boost Valve Cover Location

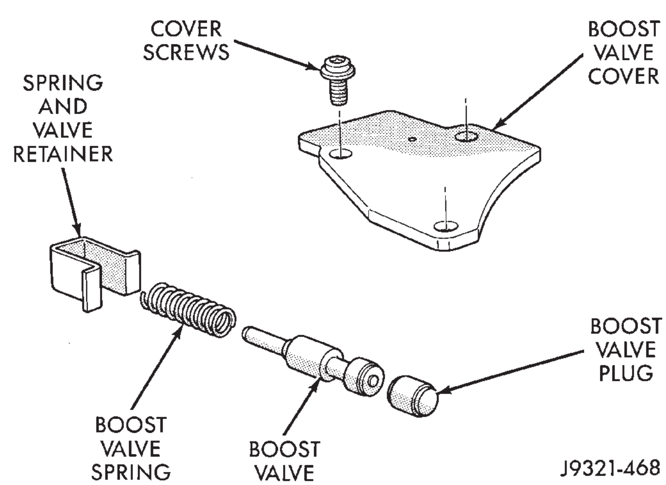


Fig. 53 Boost Valve Components

DISASSEMBLY AND ASSEMBLY (Continued)

(14) Secure detent ball and spring with Retainer Tool 6583 (Fig. 54).

(15) Remove park rod E-clip and separate rod from manual lever (Fig. 55).

(16) Remove E-clip and washer that retains throttle lever shaft in manual lever (Fig. 56).

(17) Remove manual lever and throttle lever (Fig. 57). Rotate and lift manual lever off valve body and throttle lever shaft. Then slide throttle lever out of valve body.

(18) 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. 58).

(19) Remove screws attaching pressure adjusting screw bracket to valve body and transfer plate (Fig. 59). Hold bracket firmly against spring tension while removing last screw.

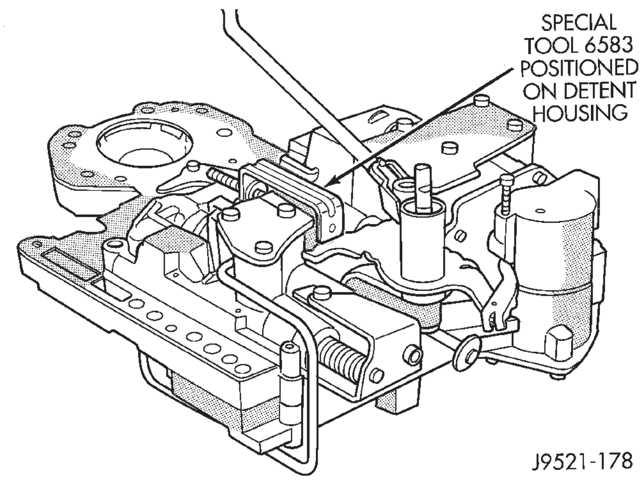


Fig. 54 Detent Ball And Spring

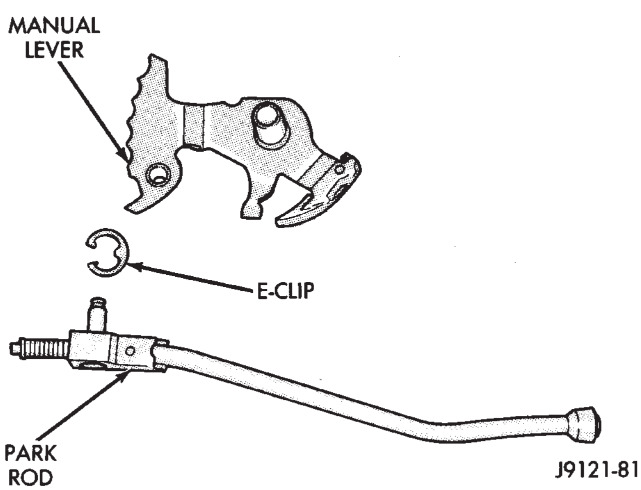


Fig. 55 Park Rod

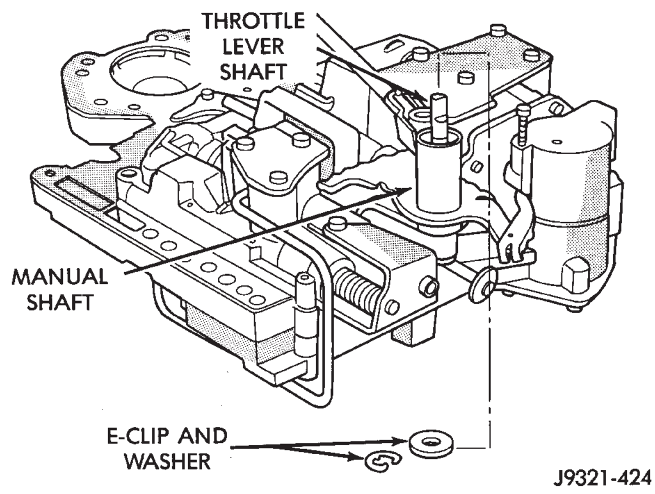


Fig. 56 Throttle Lever E-Clip And Washer

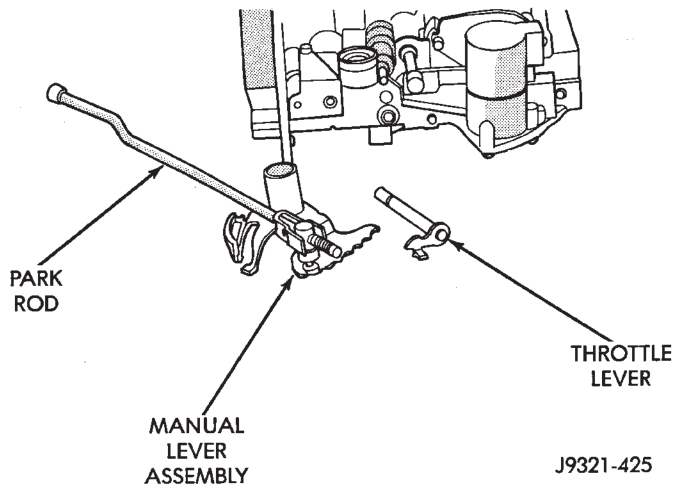


Fig. 57 Manual And Throttle Lever

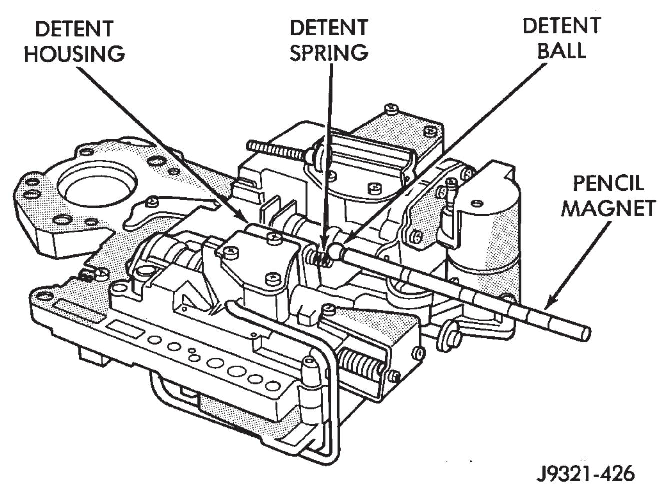


Fig. 58 Detent Ball And Spring

DISASSEMBLY AND ASSEMBLY (Continued)

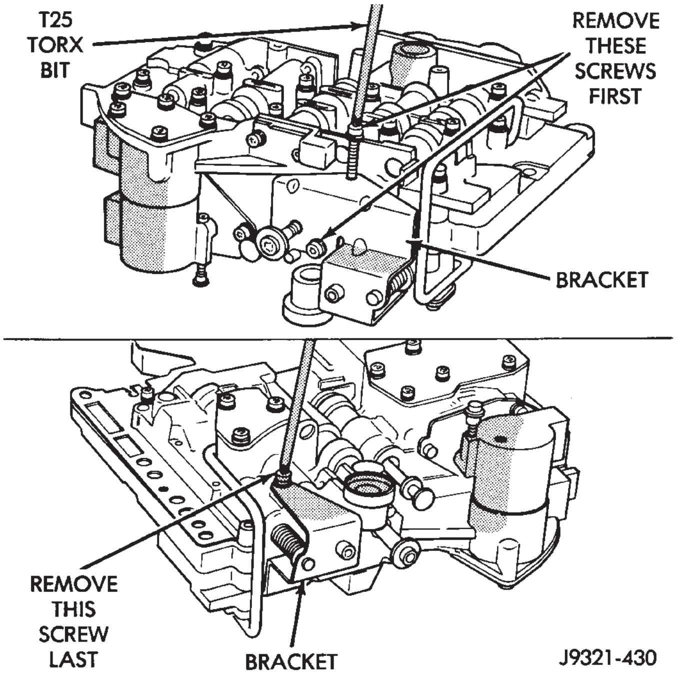


Fig. 59 Adjusting Screw Bracket Fastener

(20) Remove adjusting screw bracket, line pressure adjusting screw, pressure regulator valve spring and switch valve spring (Fig. 60). **Do not remove throttle pressure adjusting screw from bracket and do not disturb setting of either adjusting screw during removal.**

(21) Turn upper housing over and remove switch valve, regulator valve and spring, and manual valve (Fig. 61).

(22) Remove kickdown detent, kickdown valve, and throttle valve and spring (Fig. 61).

(23) Loosen left-side 3-4 accumulator housing attaching screw about 2-3 threads. Then remove center and right-side housing attaching screws (Fig. 62).

(24) Carefully rotate 3-4 accumulator housing upward and remove 3-4 shift valve spring and converter clutch valve plug and spring (Fig. 63).

(25) Remove left-side screw and remove 3-4 accumulator housing from valve body (Fig. 64).

(26) Bend back tabs on boost valve tube brace (Fig. 65).

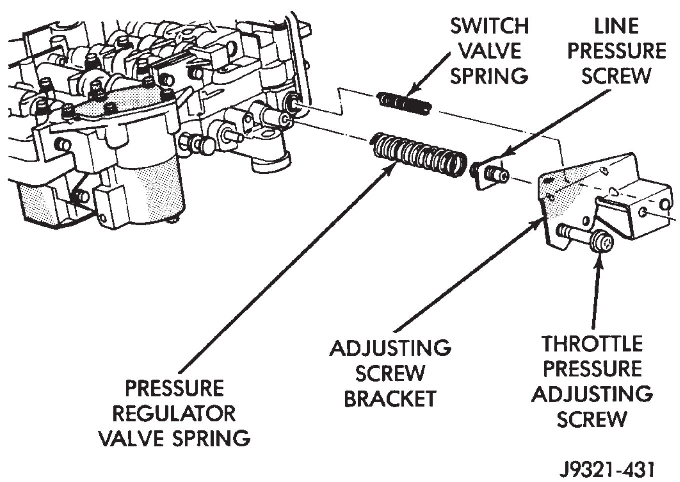


Fig. 60 Adjusting Screw Bracket And Spring

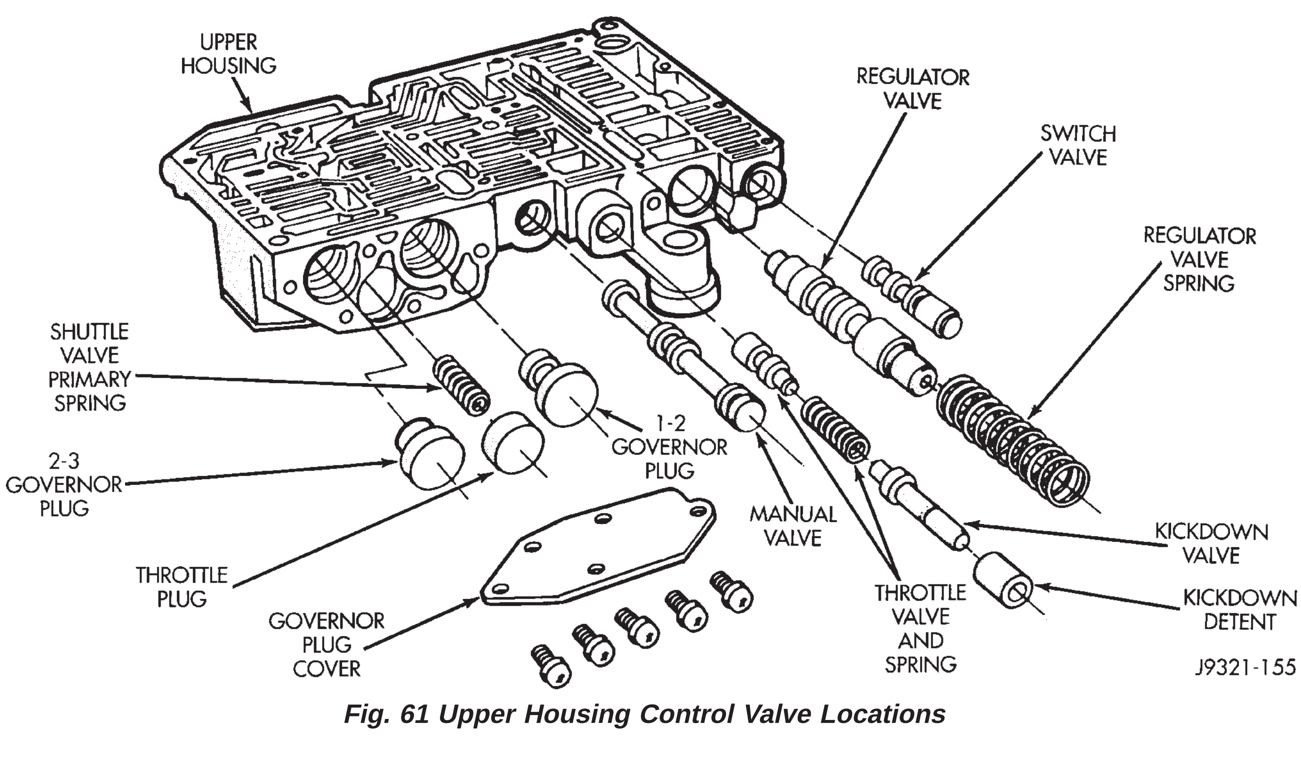


Fig. 61 Upper Housing Control Valve Locations

DISASSEMBLY AND ASSEMBLY (Continued)

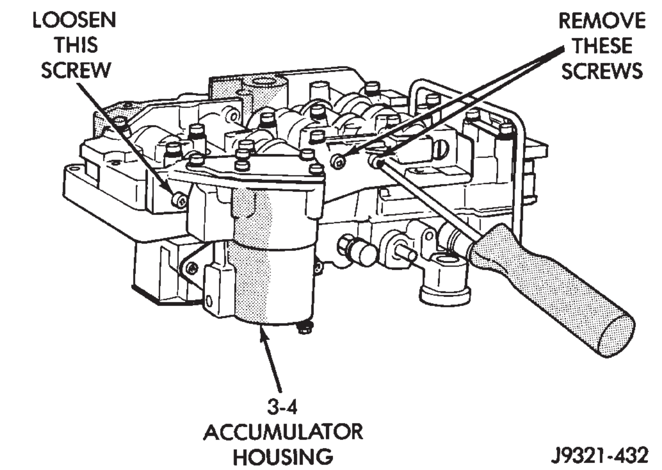


Fig. 62 Accumulator Housing Screw Locations

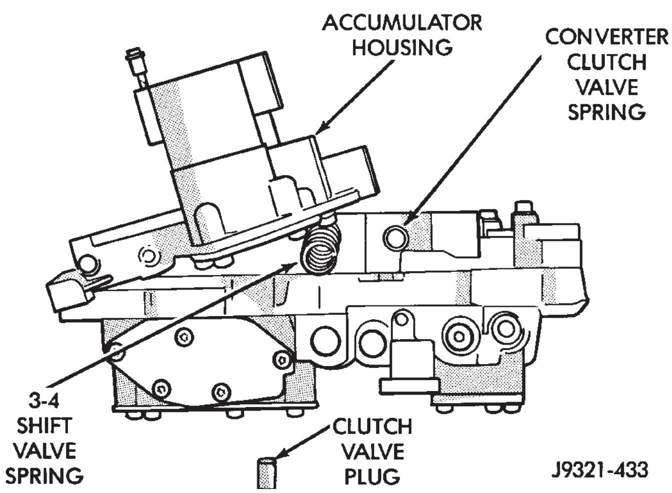


Fig. 63 3-4 Shift And Converter Clutch Valve Springs And Plug

(27) Remove boost valve connecting tube (Fig. 66). 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.

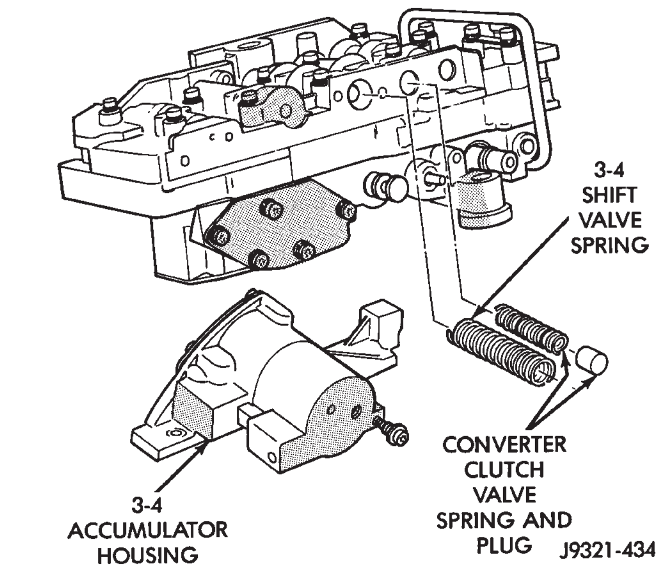


Fig. 64 Accumulator Housing, Valve Springs And Plug

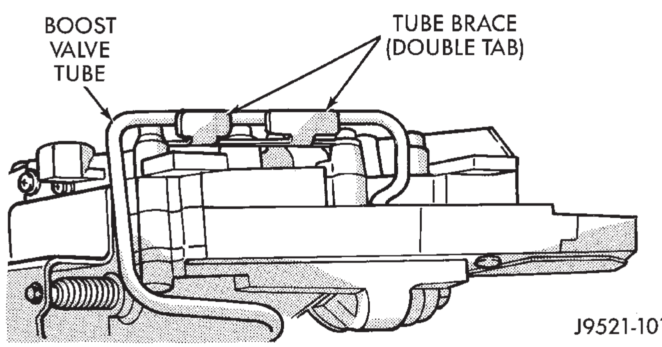


Fig. 65 Boost Valve Tube Brace

(28) Turn valve body over so lower housing is facing upward (Fig. 67). 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.

DISASSEMBLY AND ASSEMBLY (Continued)

(29) Remove screws attaching valve body lower housing to upper housing and transfer plate (Fig. 67). **Note position of boost valve tube brace for assembly reference.**

(30) Remove lower housing and overdrive separator plate from transfer plate (Fig. 67).

(31) Remove the ECE check ball from the transfer plate (Fig. 68). The ECE check ball is approximately 4.8 mm (3/16 in.) in diameter.

(32) Remove transfer plate from upper housing (Fig. 69).

(33) Turn transfer plate over so upper housing separator plate is facing upward.

(34) Remove upper housing separator plate from transfer plate (Fig. 70). Note position of filter in separator plate for assembly reference.

(35) Remove rear clutch and rear servo check balls from transfer plate. Note check ball location for assembly reference (Fig. 71).

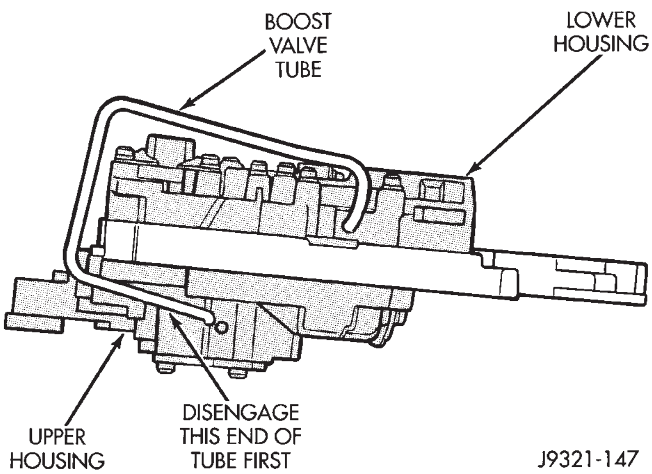


Fig. 66 Boost Valve Tube

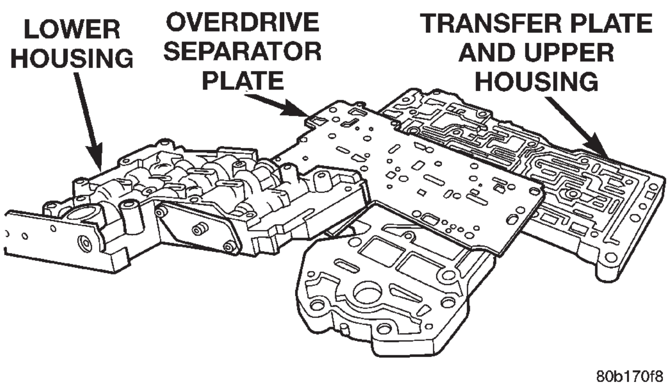


Fig. 67 Lower Housing

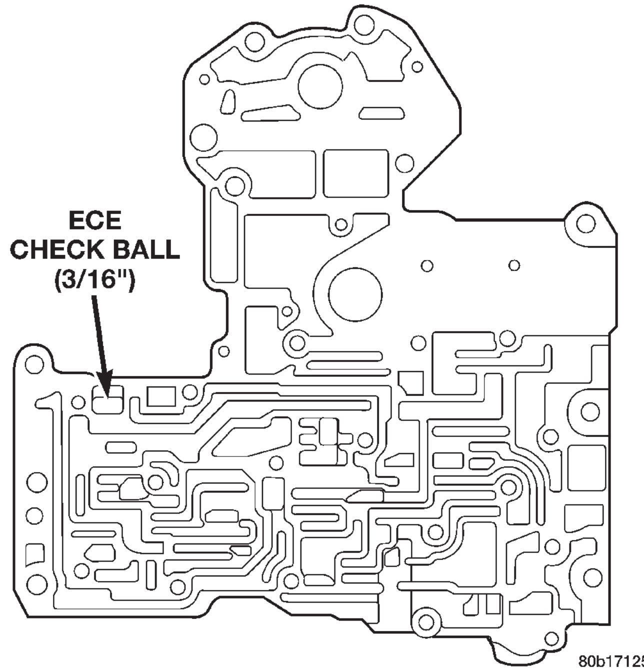


Fig. 68 ECE Check Ball

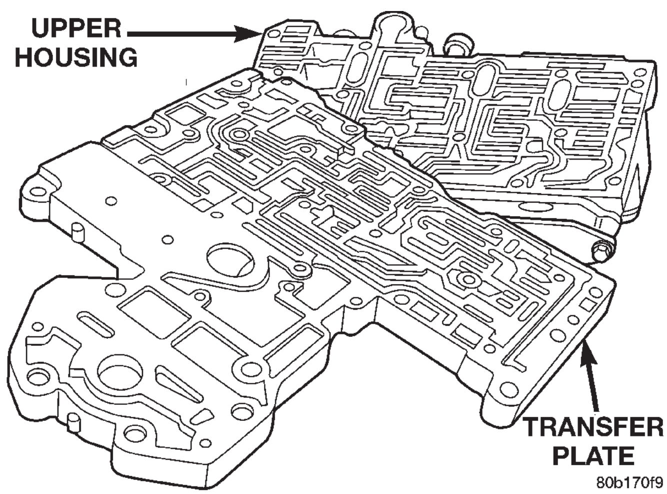


Fig. 69 Transfer Plate

DISASSEMBLY AND ASSEMBLY (Continued)

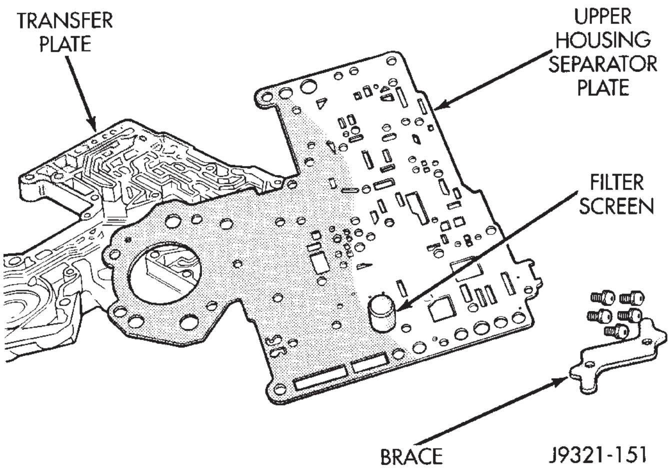


Fig. 70 Upper Housing Separator Plate

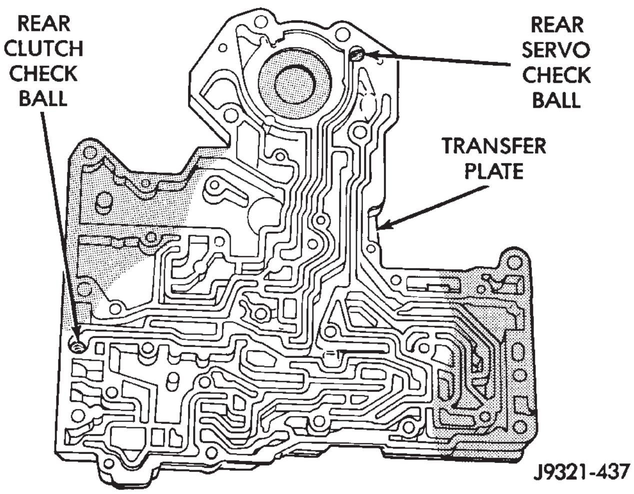


Fig. 71 Rear Clutch And Rear Servo Check Ball Locations

VALVE BODY UPPER HOUSING

(1) Note location of check balls in valve body upper housing (Fig. 72). Then remove the one large diameter and the six smaller diameter check balls.

(2) Remove governor plug and shuttle valve covers (Fig. 74).

(3) Remove E-clip that secures shuttle valve secondary spring on valve stem (Fig. 73).

(4) Remove throttle plug, primary spring, shuttle valve, secondary spring, and spring guides (Fig. 74).

(5) Remove boost valve retainer, spring and valve if not previously removed.

(6) Remove throttle plug and 1-2 and 2-3 governor plugs (Fig. 61).

(7) Turn upper housing around and remove limit valve and shift valve covers (Fig. 75).

(8) Remove limit valve housing. Then remove retainer, spring, limit valve, and 2-3 throttle plug from limit valve housing (Fig. 75).

(9) Remove 1-2 shift control valve and spring (Fig. 75).

(10) Remove 1-2 shift valve and spring (Fig. 75).

(11) Remove 2-3 shift valve and spring from valve body (Fig. 75).

(12) Remove pressure plug cover (Fig. 75).

(13) Remove line pressure plug, sleeve, throttle pressure plug and spring (Fig. 75).

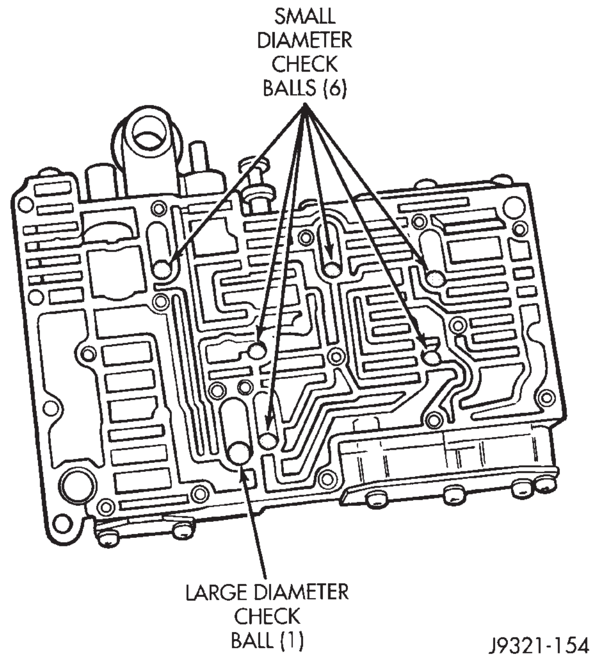


Fig. 72 Check Ball Locations In Upper Housing

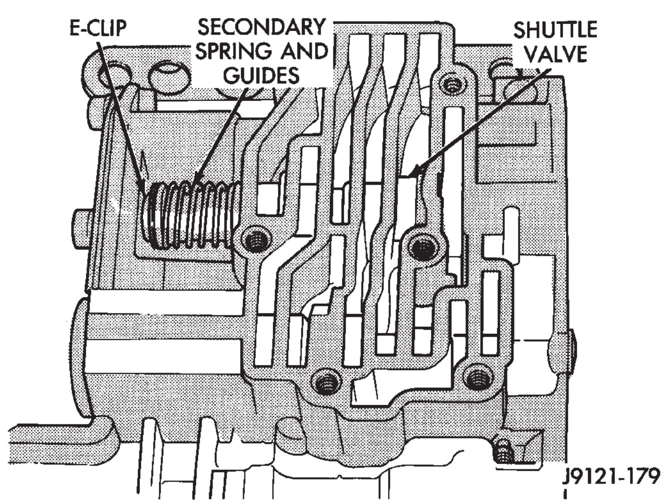


Fig. 73 Shuttle Valve E-Clip And Secondary Spring Location

DISASSEMBLY AND ASSEMBLY (Continued)

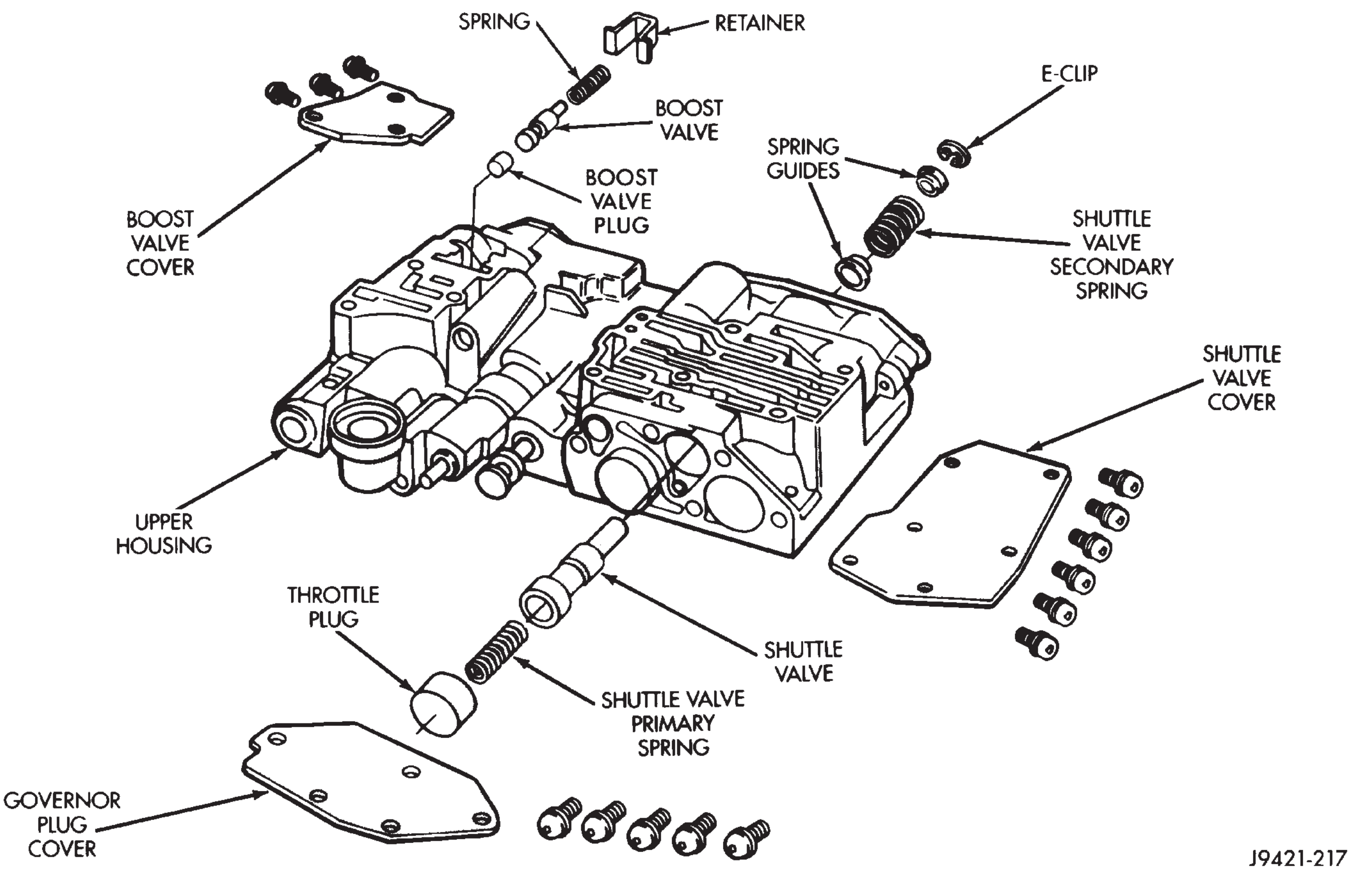


Fig. 74 Shuttle And Boost Valve Components

VALVE BODY LOWER HOUSING

(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 (Fig. 76).

(6) Remove converter clutch timing valve, retainer and valve spring.

3-4 ACCUMULATOR HOUSING

(1) Remove end plate from housing.

(2) Remove piston spring.

(3) Remove piston. Remove and discard piston seals (Fig. 77).

ASSEMBLY

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.

DISASSEMBLY AND ASSEMBLY (Continued)

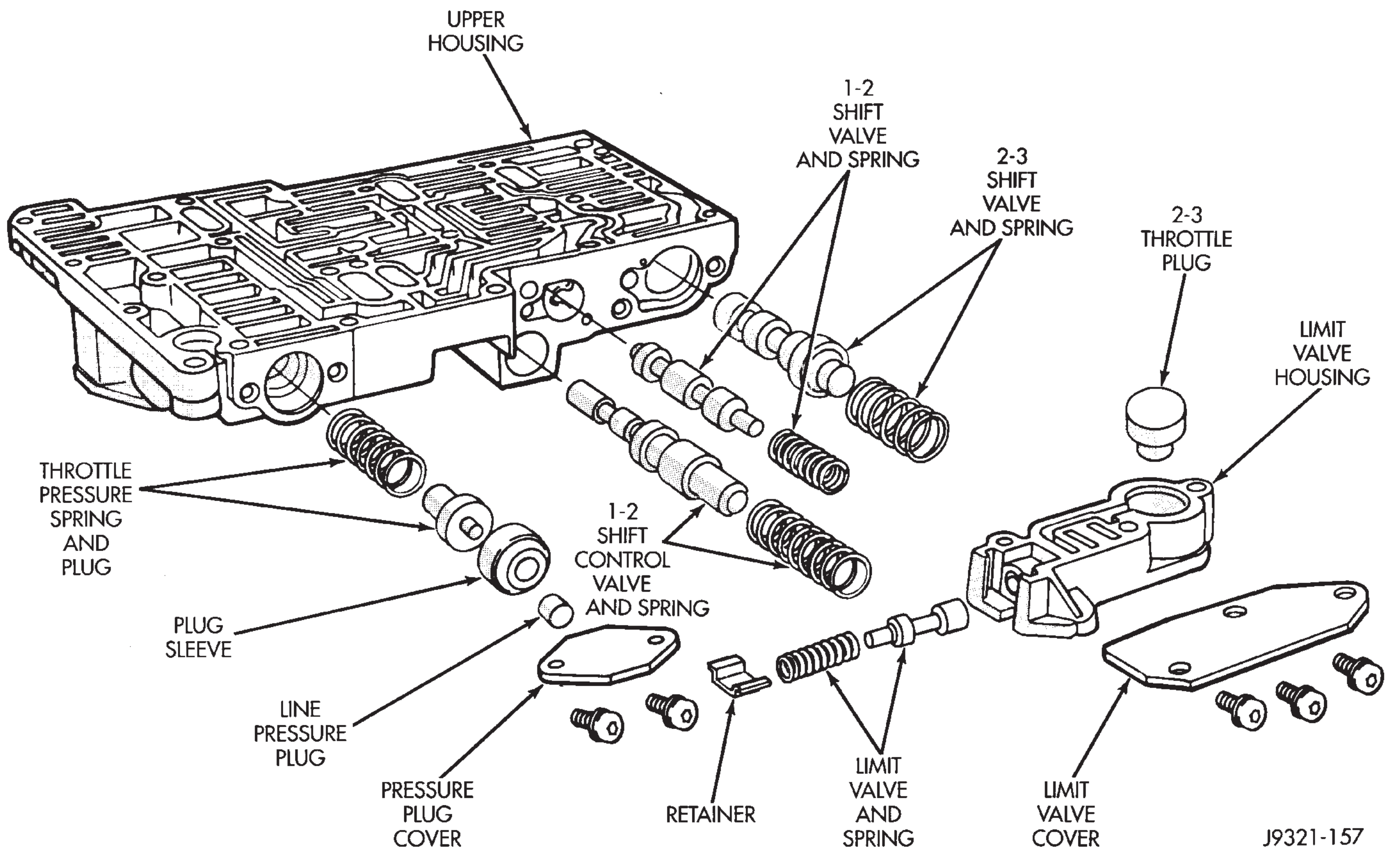


Fig. 75 Upper Housing Shift Valve And Pressure Plug Locations

LOWER HOUSING

(1) Lubricate valves, springs, and the housing valve and plug bores with clean transmission fluid (Fig. 76).

(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.

3-4 ACCUMULATOR

(1) Lubricate accumulator piston, seals and housing piston bore with clean transmission fluid (Fig. 77).

(2) Install new seal rings on accumulator piston.

(3) Install piston and spring in housing.

(4) Install end plate on housing.

TRANSFER PLATE

(1) Install rear clutch and rear servo check balls in transfer plate (Fig. 78).

(2) Install filter screen in upper housing separator plate (Fig. 79).

(3) Align and position upper housing separator plate on transfer plate (Fig. 80).

(4) Install brace plate (Fig. 80). 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.

DISASSEMBLY AND ASSEMBLY (Continued)

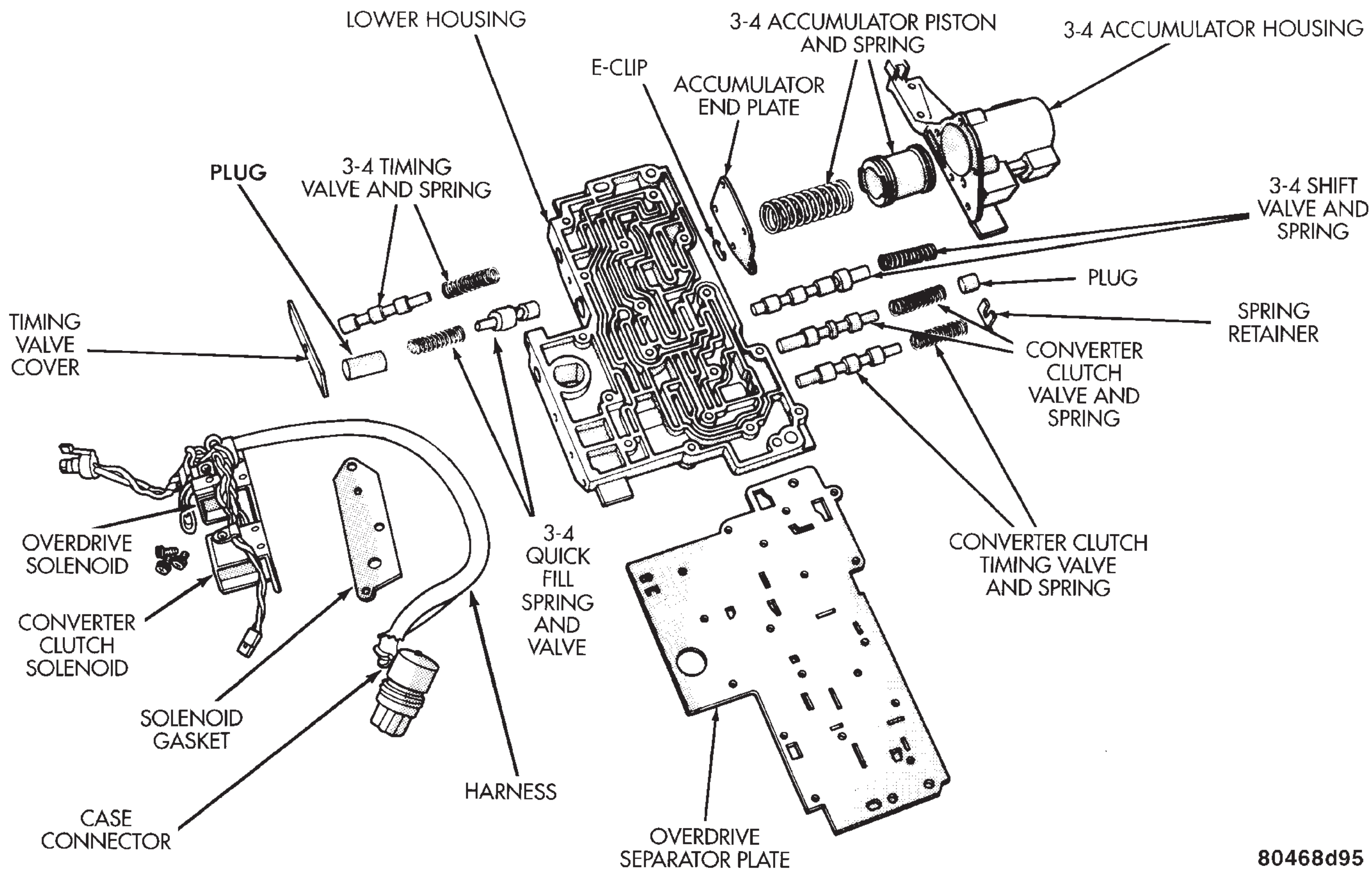


Fig. 76 Lower Housing Shift Valves And Springs

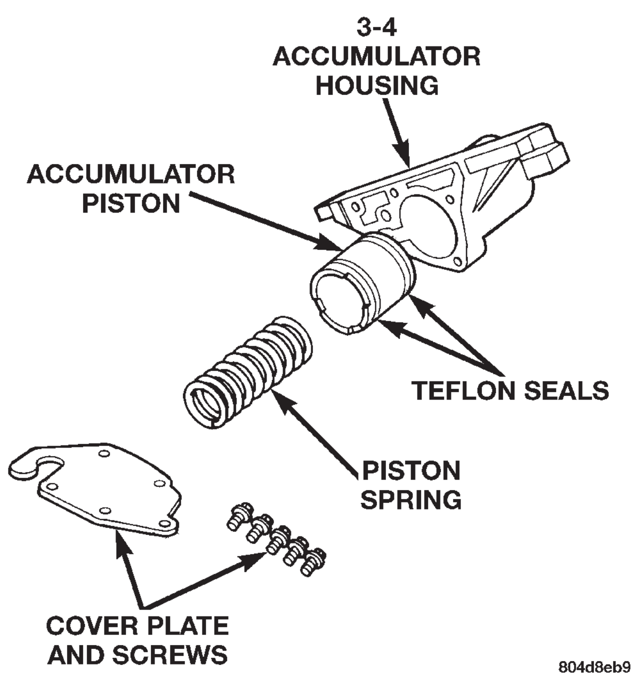


Fig. 77 Accumulator Housing Components

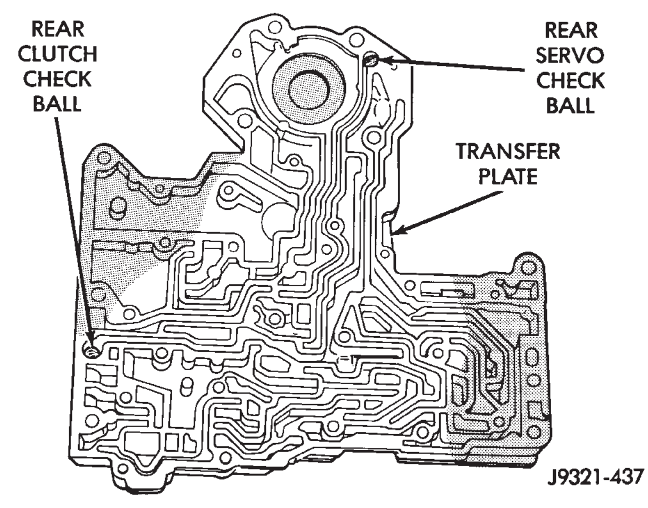


Fig. 78 Rear Clutch And Rear Servo Check Ball Locations

DISASSEMBLY AND ASSEMBLY (Continued)

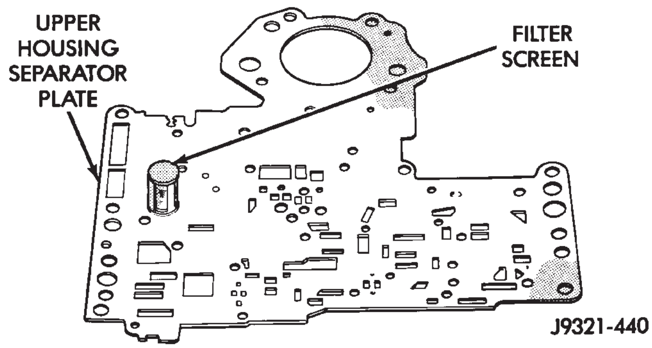


Fig. 79 Separator Plate Filter Screen Installation

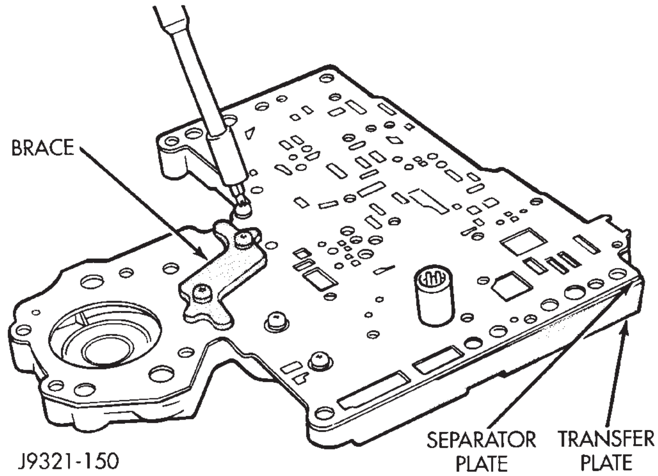


Fig. 80 Brace Plate

UPPER AND LOWER HOUSING

(1) Position upper housing so internal passages and check ball seats are facing upward. Then install check balls in housing (Fig. 81). Seven check balls are used. The single large check ball is approximately 8.7 mm (11/32 in.) diameter. The single small check ball is approximately 4.8 mm (3/16 in.) in diameter. The remaining 6 check balls are approximately 6.3 mm (1/4 in.) in diameter.

(2) Position assembled transfer plate and upper housing separator plate on upper housing (Fig. 82). Be sure filter screen is seated in proper housing recess.

(3) Install the ECE check ball into the transfer plate (Fig. 68). The ECE check ball is approximately 4.8 mm (3/16 in.) in diameter.

(4) Position lower housing separator plate on transfer plate (Fig. 83).

(5) Install lower housing on assembled transfer plate and upper housing (Fig. 84).

(6) Install and start all valve body screws by hand except for the screws to hold the boost valve tube brace. Save those screws for later installation. Then tighten screws evenly to 4 N·m (35 in. lbs.) torque. Start at center and work out to sides when tightening screws (Fig. 84).

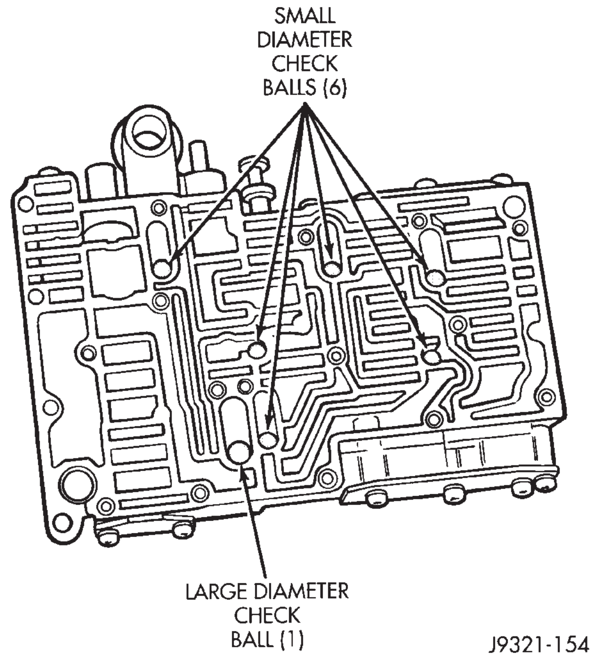


Fig. 81 Check Ball Locations In Upper Housing

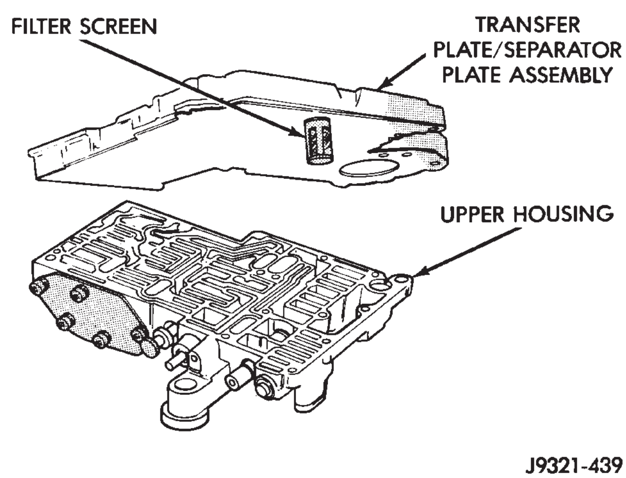


Fig. 82 Installing Transfer Plate On Upper Housing

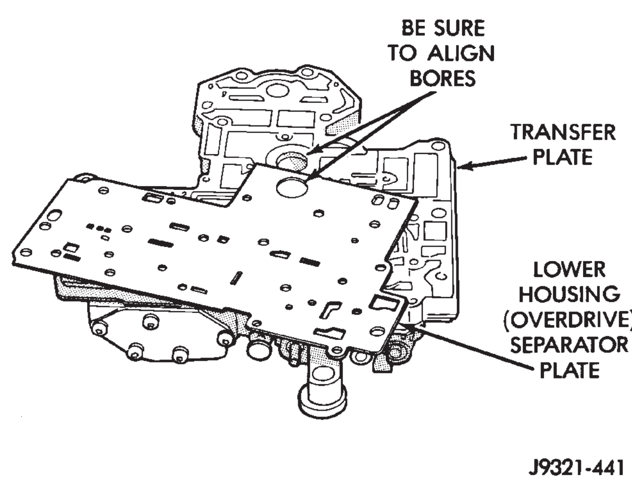


Fig. 83 Lower Housing Separator Plate

DISASSEMBLY AND ASSEMBLY (Continued)

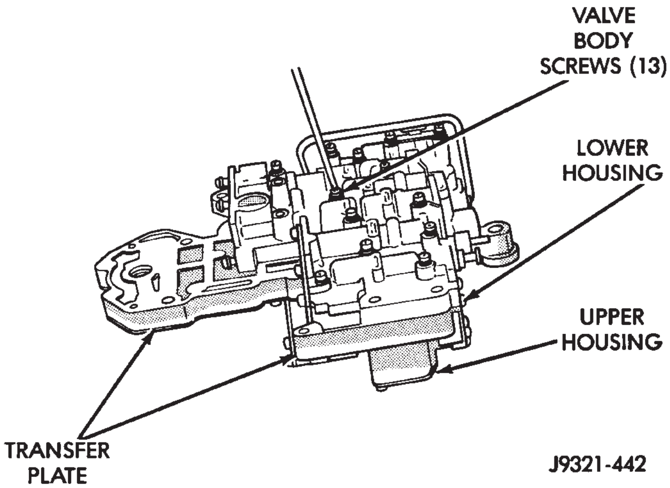


Fig. 84 Installing Lower Housing On Transfer Plate And Upper Housing

UPPER HOUSING VALVE AND PLUG

Refer to (Fig. 85), (Fig. 86) and (Fig. 87) to perform the following steps.

(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.

(5) Install retainer, spring, limit valve, and 2-3 throttle plug from limit valve housing.

(6) Install limit valve housing and cover plate. Tighten screws to 4 N·m (35 in. lbs.).

(7) Install shuttle valve as follows:

(a) Insert plastic guides in shuttle valve secondary spring and install spring on end of valve.

(b) Install shuttle valve into housing.

(c) Hold shuttle valve in place.

(d) Compress secondary spring and install E-clip in groove at end of shuttle valve.

(e) Verify that spring and E-clip are properly seated before proceeding.

(8) Install shuttle valve cover plate. Tighten cover plate screws to 4 N·m (35 in. lbs.) torque.

(9) Install 1-2 and 2-3 valve governor plugs in valve body.

(10) Install shuttle valve primary spring and throttle plug.

(11) Align and install governor plug cover. Tighten cover screws to 4 N·m (35 in. lbs.) torque.

BOOST VALVE TUBE AND BRACE

(1) Position valve body assembly so lower housing is facing upward (Fig. 88).

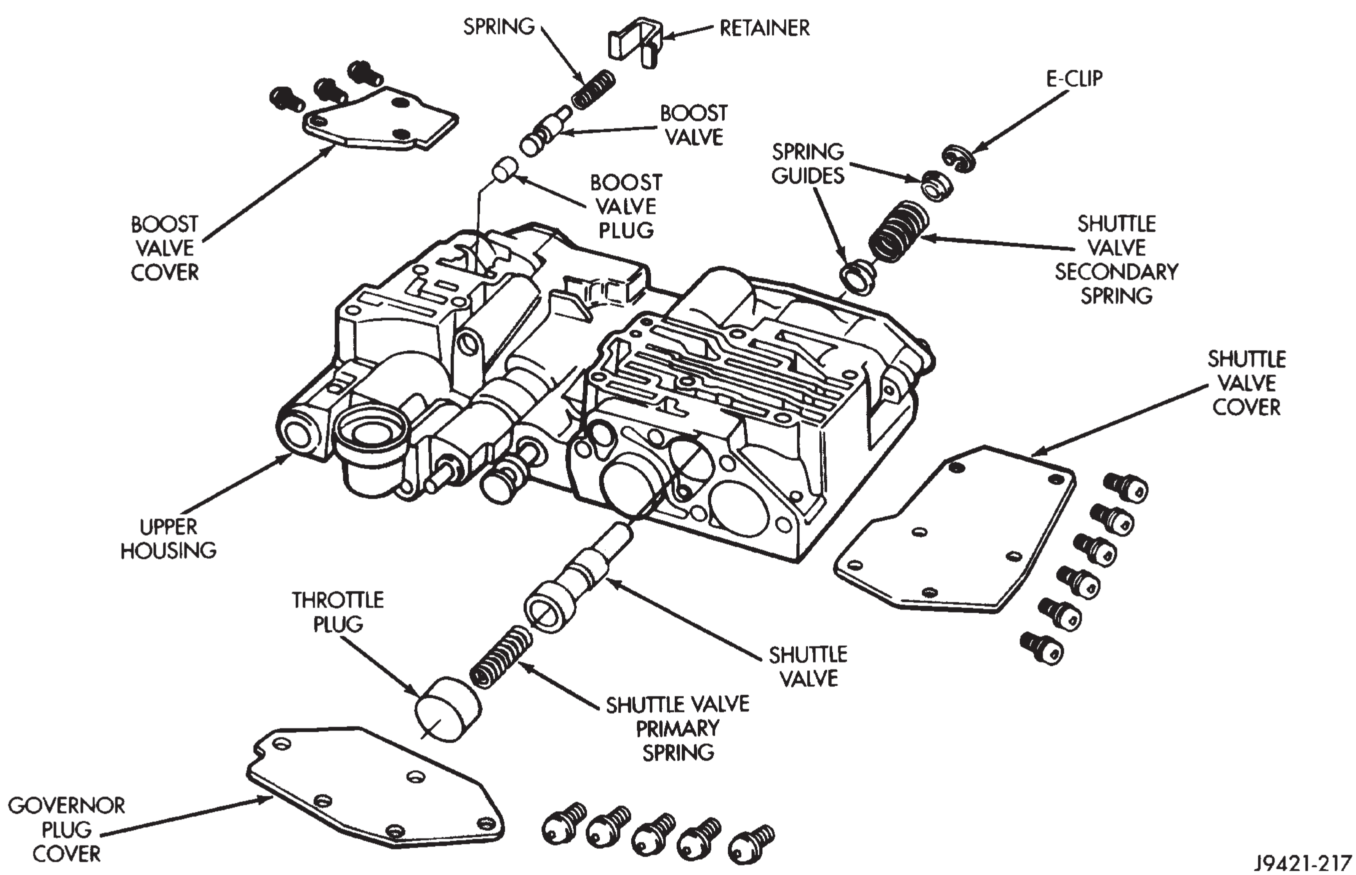


Fig. 85 Shuttle And Boost Valve Components

DISASSEMBLY AND ASSEMBLY (Continued)

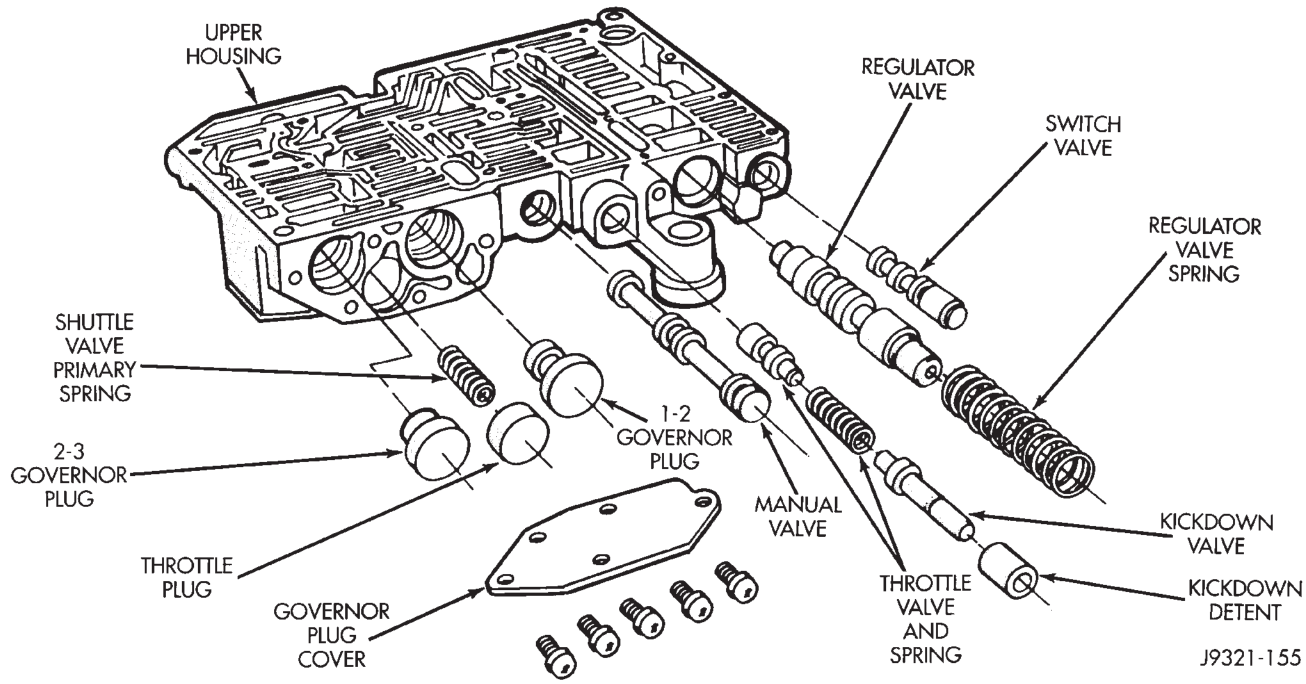


Fig. 86 Upper Housing Control Valve Locations

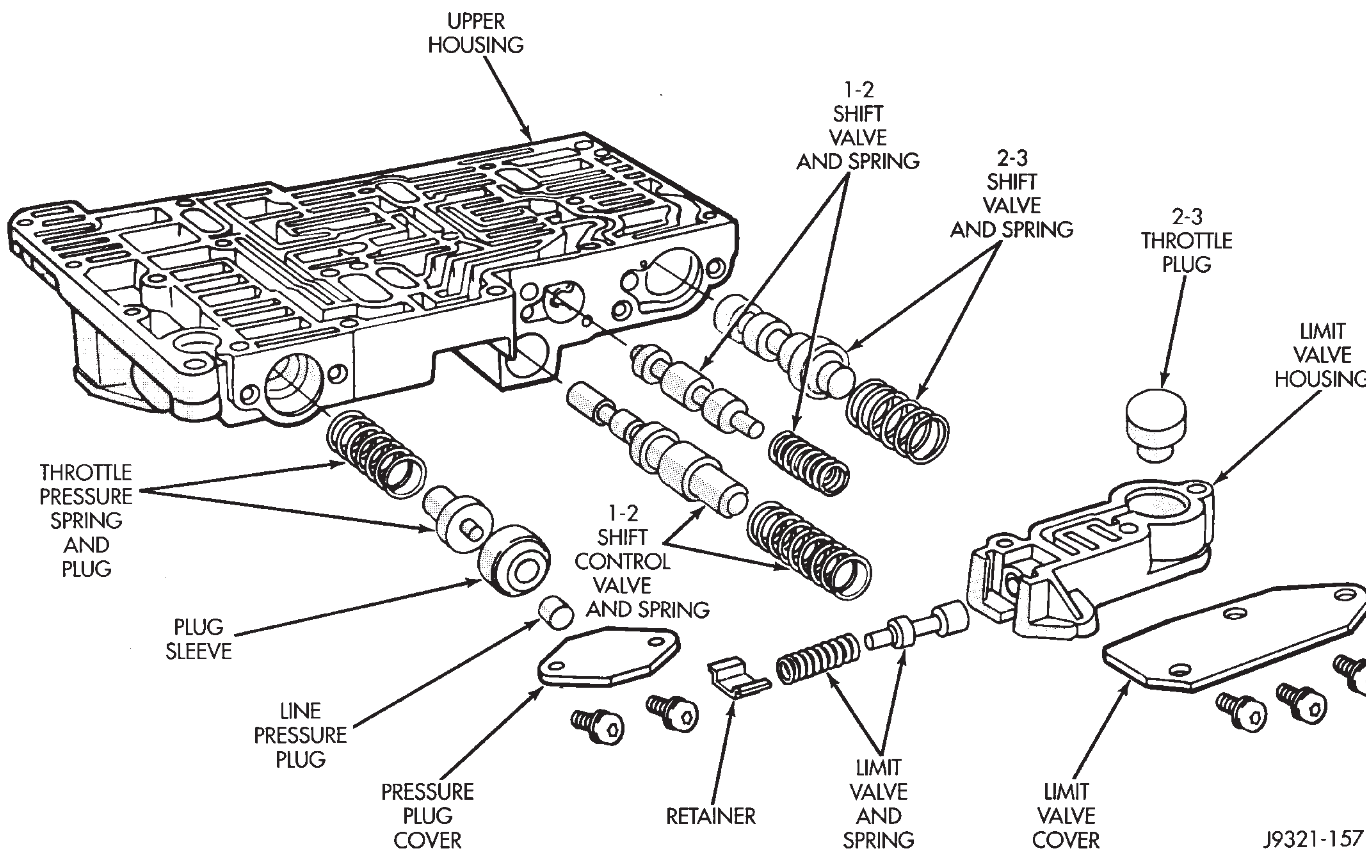


Fig. 87 Upper Housing Shift Valve And Pressure Plug Locations

DISASSEMBLY AND ASSEMBLY (Continued)

(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. 88).

(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. 89).

(6) Install and finger tighten three screws that secure tube brace to valve body housings (Fig. 89).

(7) Bend tube brace tabs up and against tube to hold it in position (Fig. 90).

(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.

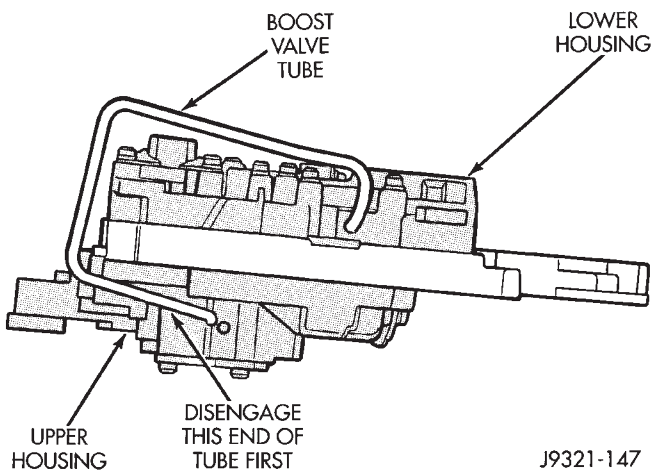


Fig. 88 Boost Valve Tube

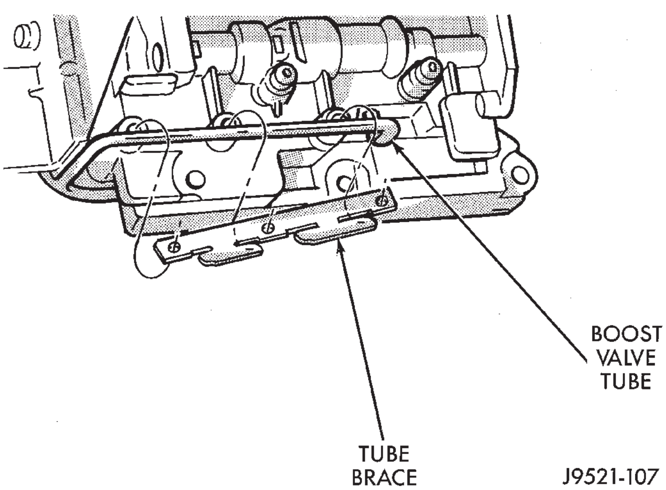


Fig. 89 Boost Valve Tube And Brace

3-4 ACCUMULATOR

(1) Position converter clutch valve and 3-4 shift valve springs in housing (Fig. 91).

(2) Loosely attach accumulator housing with right-side screw (Fig. 91). Install only one screw at this time as accumulator must be free to pivot upward for ease of installation.

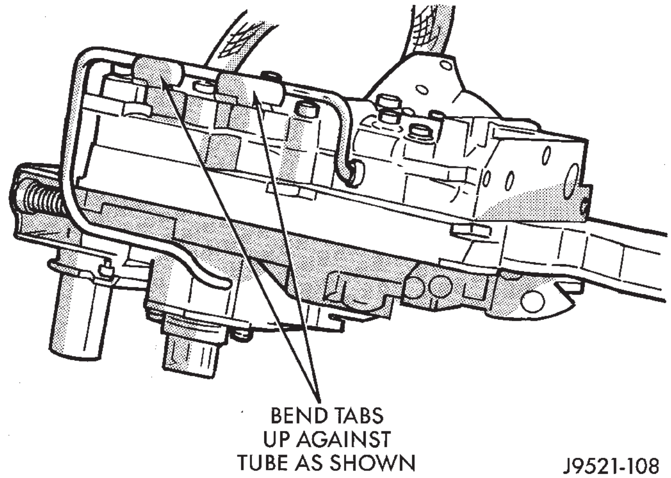


Fig. 90 Securing Boost Valve Tube With Brace Tabs

(3) Install 3-4 shift valve and spring.

(4) Install converter clutch timing valve and spring.

(5) Position plug on end of converter clutch valve spring. Then compress and hold springs and plug in place with fingers of one hand.

(6) Swing accumulator housing upward over valve springs and plug.

(7) Hold accumulator housing firmly in place and install remaining two attaching screws. Be sure springs and clutch valve plug are properly seated (Fig. 92). Tighten screws to 4 N·m (35 in. lbs.).

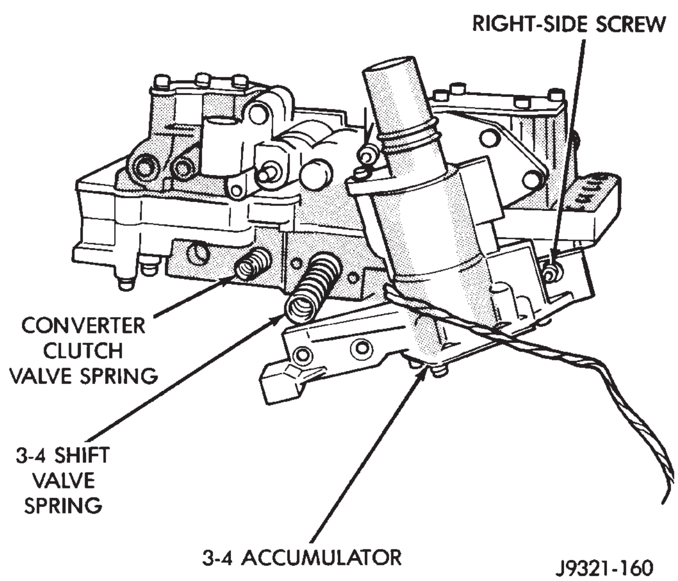


Fig. 91 Converter Clutch And 3-4 Shift Valve Springs

DISASSEMBLY AND ASSEMBLY (Continued)

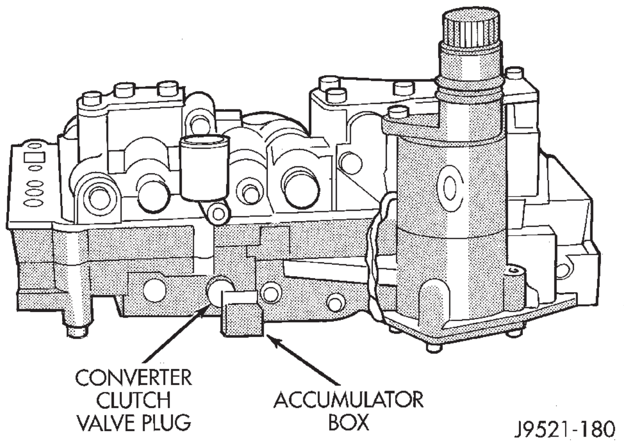


Fig. 92 Seating 3-4 Accumulator On Lower Housing

VALVE BODY FINAL

(1) Install boost valve, valve spring, retainer and cover plate. Tighten cover plate screws to 4 N·m (35 in. lbs.) torque.

(2) Insert manual lever detent spring in upper housing.

(3) Position detent ball on end of spring. Then hold detent ball and spring in detent housing with Retainer Tool 6583 (Fig. 93).

(4) Install throttle lever in upper housing. Then install manual lever over throttle lever and start manual lever into housing.

(5) 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.

(6) Then install manual lever seal, washer and E-clip.

(7) Verify that throttle lever is aligned with end of kickdown valve stem and that manual lever arm is engaged in manual valve (Fig. 94).

(8) Position line pressure adjusting screw in adjusting screw bracket.

(9) Install spring on end of line pressure regulator valve.

(10) Install switch valve spring on tang at end of adjusting screw bracket.

(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.

(16) 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.

(17) Lubricate solenoid case connector O-rings and shaft of manual lever with light coat of petroleum jelly.

(18) Obtain new fluid filter for valve body but do not install filter at this time.

(19) 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.

(20) 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.

(21) Install solenoid assembly and gasket. Tighten solenoid attaching screws to 8 N·m (72 in. lbs.) torque.

(22) Verify that solenoid wire harness is properly routed (Fig. 96). **Solenoid harness must be clear of manual lever and park rod and not be pinched between accumulator housing and cover.**

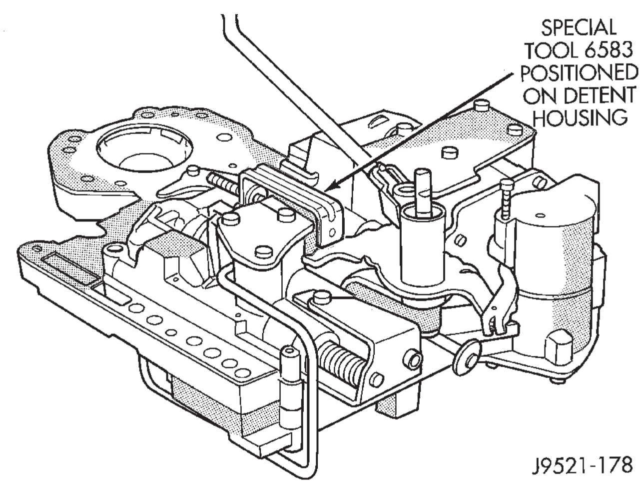


Fig. 93 Detent Ball Spring

GOVERNOR BODY, SENSOR AND SOLENOID

(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.

(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.

(5) Install governor pressure solenoid in governor body. Push solenoid in until it snaps into place in body.

(6) Position governor body gasket on transfer plate.

DISASSEMBLY AND ASSEMBLY (Continued)

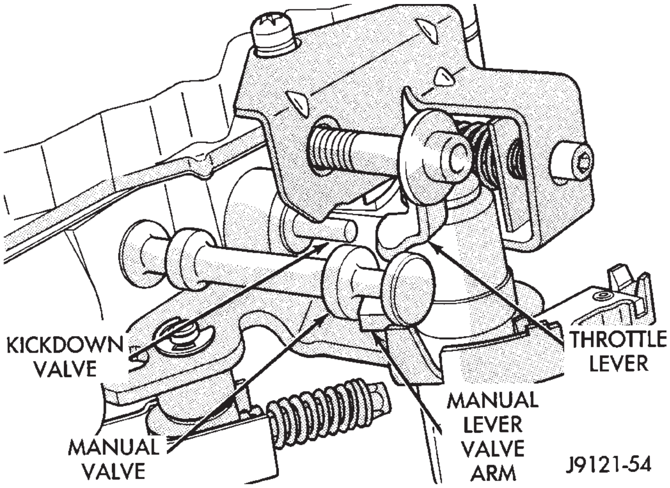


Fig. 94 Manual And Throttle Lever Alignment

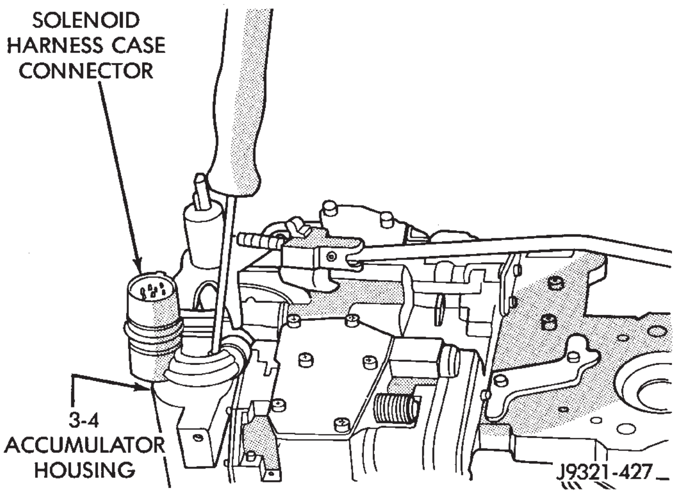


Fig. 95 Solenoid Harness Case Connector Shoulder Bolt

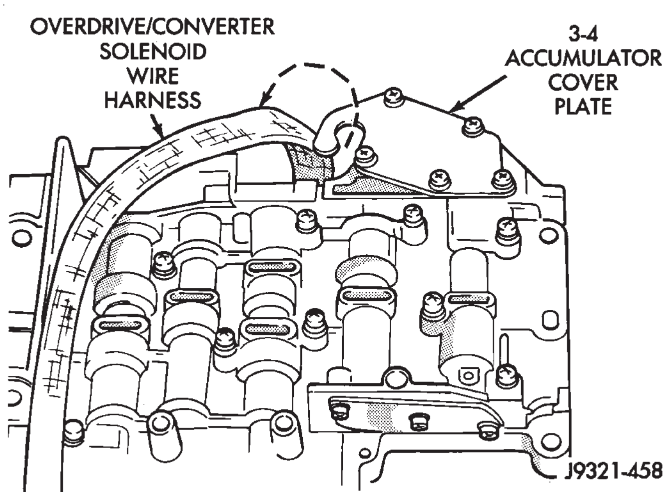


Fig. 96 Solenoid Harness Routing

(7) Install retainer plate on governor body and around solenoid. 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.

(10) Perform Line Pressure and Throttle Pressure adjustments. Refer to adjustment section of this group for proper procedures.

(11) Install fluid filter and pan.

(12) Lower vehicle.

(13) Fill transmission with recommended fluid and road test vehicle to verify repair.

TRANSMISSION

DISASSEMBLY

(1) Clean transmission exterior with steam gun or with solvent. Wear eye protection during cleaning operations.

(2) Place transmission in a vertical position.

(3) Measure and record input shaft end play readings.

(4) Remove shift and throttle levers from valve body manual lever shaft.

(5) Place transmission in horizontal position.

(6) Remove transmission oil pan and gasket.

(7) Remove filter from valve body (Fig. 97). Keep filter screws separate from other valve body screws. Filter screws are longer and should be kept with filter.

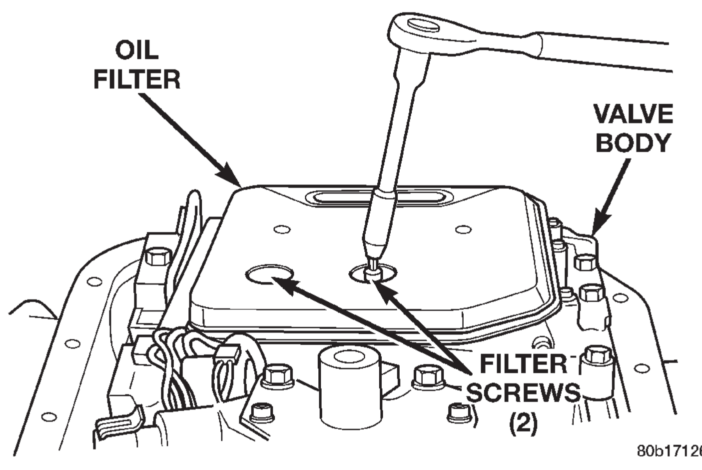


Fig. 97 Oil Filter Removal

(8) Remove park/neutral position switch.

(9) Remove hex head bolts attaching valve body to transmission case (Fig. 98). A total of 10 bolts are used. Note different bolt lengths for assembly reference.

DISASSEMBLY AND ASSEMBLY (Continued)

(10) Remove valve body assembly. Push valve body harness connector out of case. Then work park rod and valve body out of case (Fig. 99).

(11) Remove accumulator piston and inner and outer springs (Fig. 100).

(12) Remove pump oil seal with suitable pry tool or slide-hammer mounted screw.

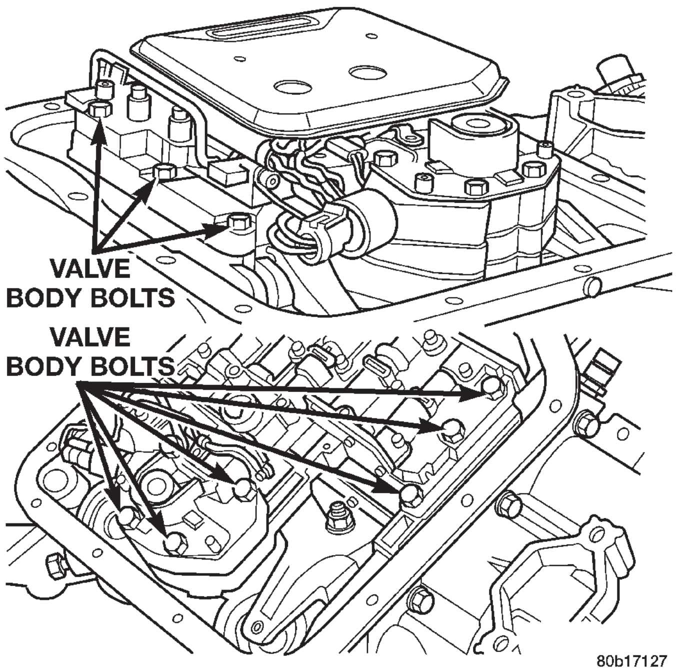


Fig. 98 Valve Body Bolt Locations

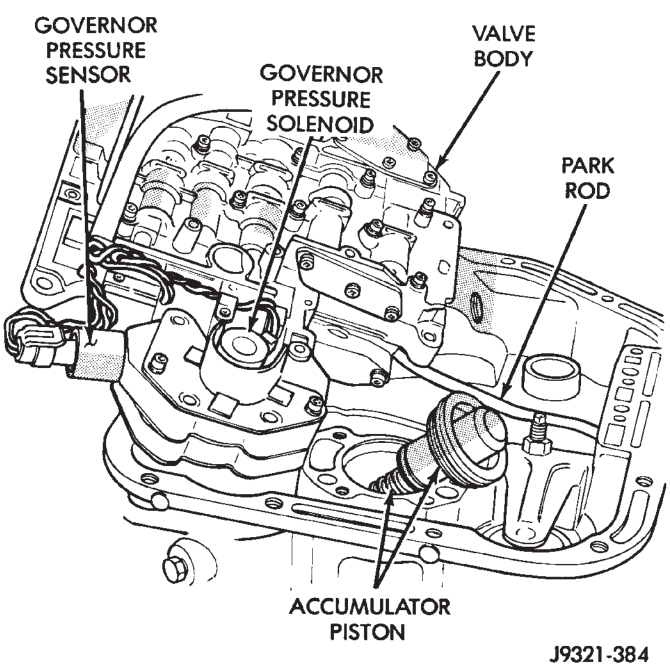


Fig. 99 Valve Body Removal

(13) Loosen front band adjusting screw locknut 4-5 turns. Then tighten band adjusting screw until band

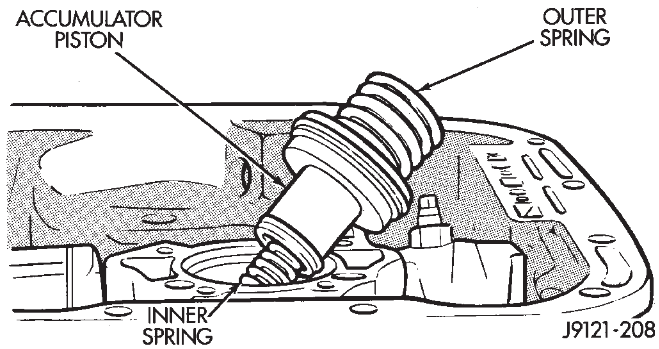


Fig. 100 Accumulator Piston And Springs

is tight around front clutch retainer. This prevents front/rear clutches from coming out with pump and possibly damaging clutch or pump components.

(14) Remove oil pump bolts.

(15) Thread bolts of Slide Hammer Tools C-3752 into threaded holes in pump body flange (Fig. 101).

(16) Bump slide hammer weights outward to remove pump and reaction shaft support assembly from case (Fig. 101).

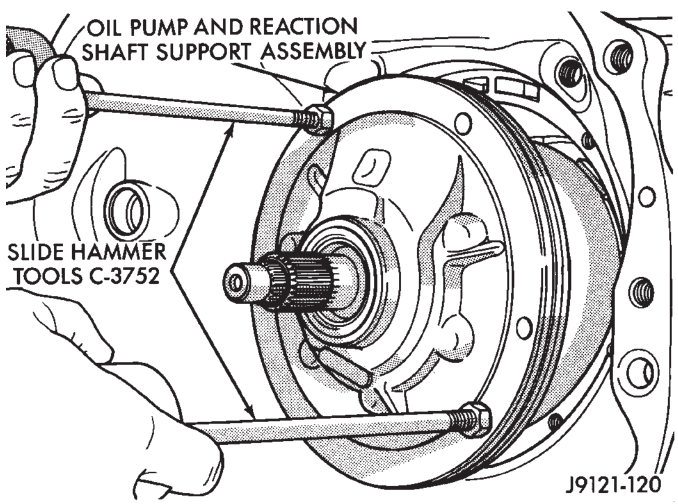


Fig. 101 Removing Oil Pump And Reaction Shaft Support Assembly

(17) Loosen front band adjusting screw until band is completely loose.

(18) Squeeze front band together and remove band strut (Fig. 102).

(19) Remove front band lever (Fig. 103).

(20) Remove front band lever shaft plug, if necessary, from converter housing.

(21) Remove front band lever shaft.

(22) Remove front and rear clutch units as assembly. Grasp input shaft, hold clutch units together and remove them from case (Fig. 104).

(23) Lift front clutch off rear clutch (Fig. 105). Set clutch units aside for overhaul.

DISASSEMBLY AND ASSEMBLY (Continued)

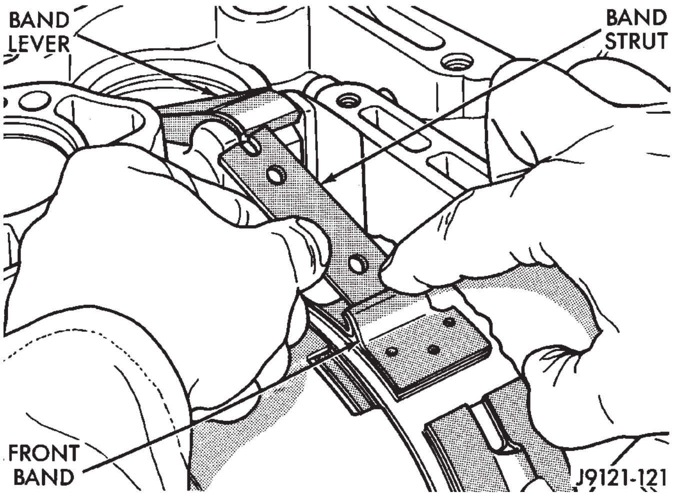


Fig. 102 Removing/Installing Front Band Strut

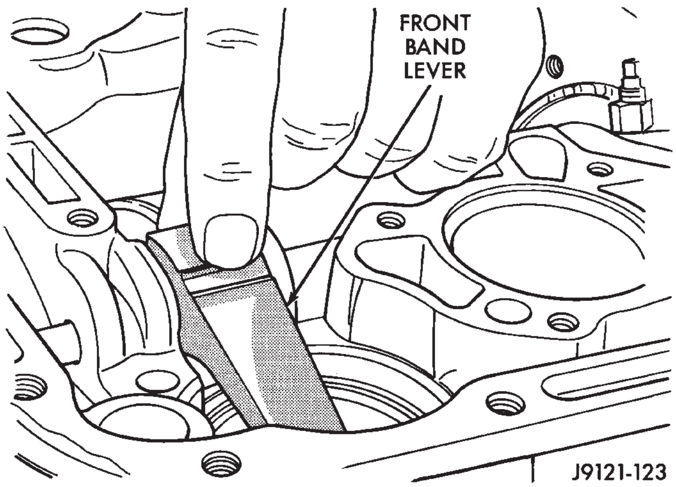


Fig. 103 Removing/Installing Front Band Lever

(24) Remove intermediate shaft thrust washer from front end of shaft or from rear clutch hub (Fig. 106).

(25) Remove output shaft thrust plate from intermediate shaft hub (Fig. 107).

(26) Slide front band off driving shell (Fig. 108) and remove band from case.

(27) Remove planetary geartrain as assembly (Fig. 109). Support geartrain with both hands during

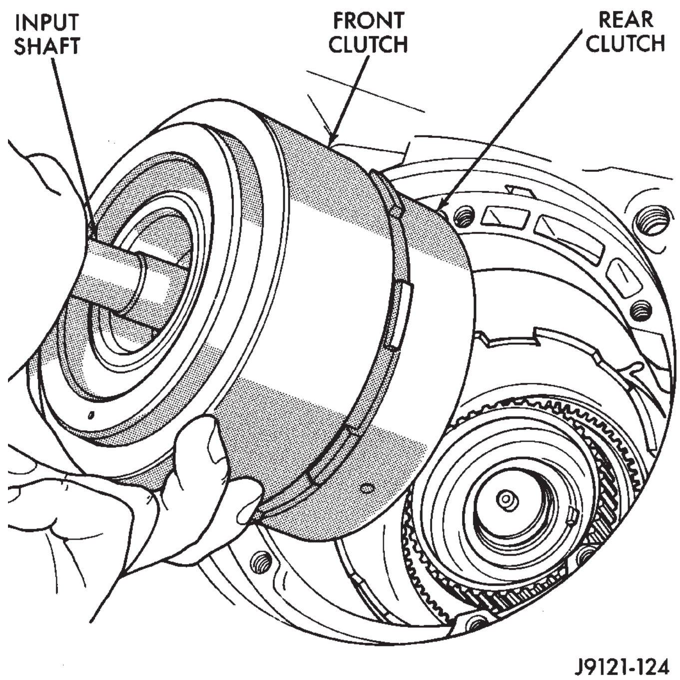


Fig. 104 Removing Front/Rear Clutch Assemblies

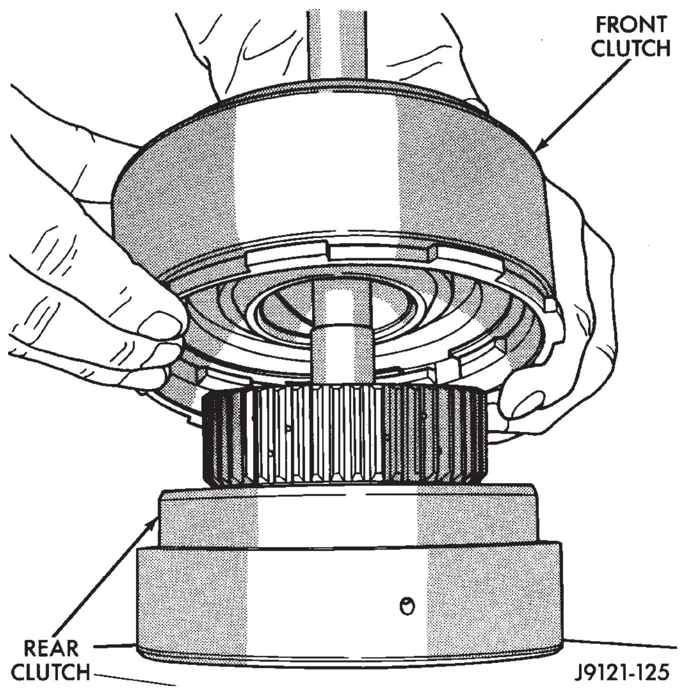


Fig. 105 Separating Front/Rear Clutch Assemblies

DISASSEMBLY AND ASSEMBLY (Continued)

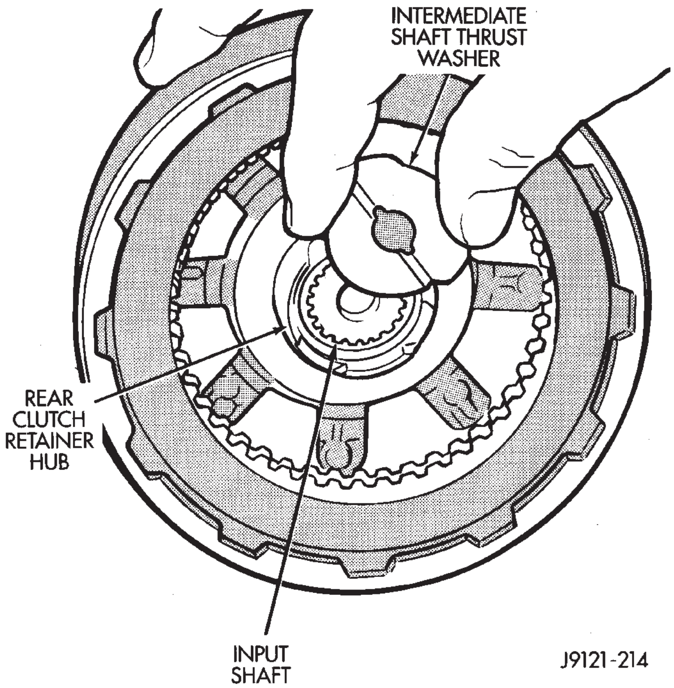


Fig. 106 Removing Intermediate Shaft Thrust Washer

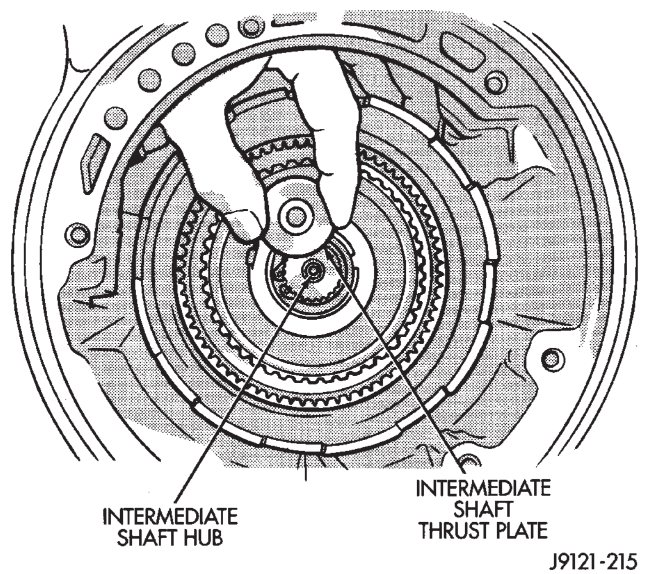


Fig. 107 Removing Intermediate Shaft Thrust Plate

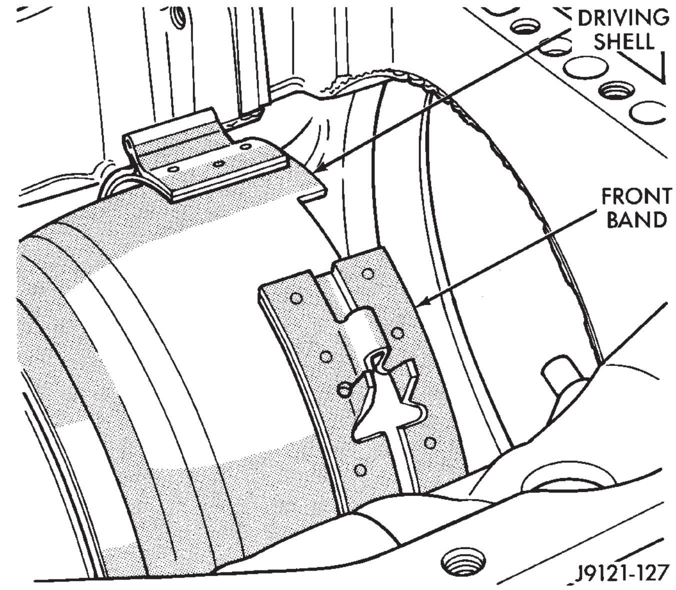


Fig. 108 Front Band Removal/Installation

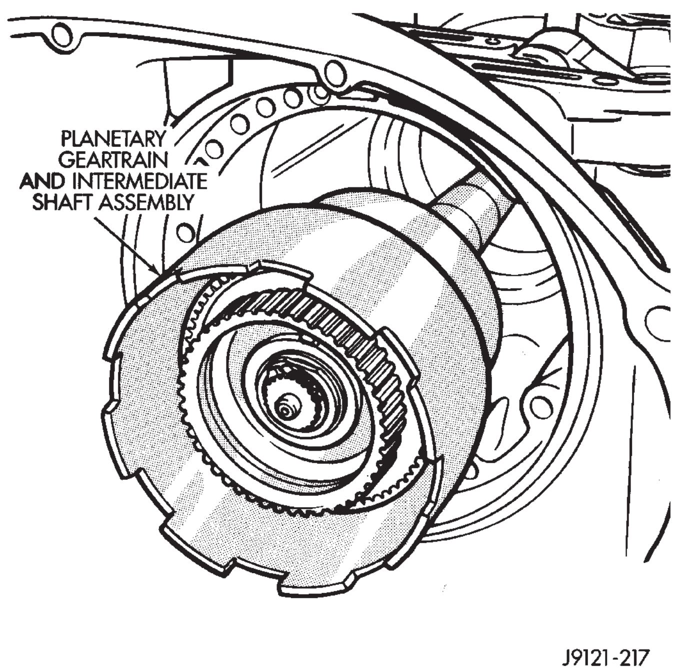


Fig. 109 Removing Planetary Geartrain And Intermediate Shaft Assembly

removal. Do not allow machined surfaces on intermediate shaft or overdrive piston retainer to become nicked or scratched.

(28) If overdrive unit is not to be serviced, install Alignment Shaft 6227-2 into the overdrive unit to prevent misalignment of the overdrive clutches during service of main transmission components.

(29) Loosen rear band adjusting screw 4-5 turns.

(30) Remove low-reverse drum snap ring (Fig. 110).

(31) Remove low-reverse drum and reverse band.

(32) Remove overrunning clutch roller and spring assembly as a unit (Fig. 111).

(33) Compress front servo rod guide about 1/8 inch with Valve Spring Compressor C-3422-B (Fig. 112).

(34) 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.**

(35) Remove compressor tools and remove front servo rod guide, spring and servo piston.

DISASSEMBLY AND ASSEMBLY (Continued)

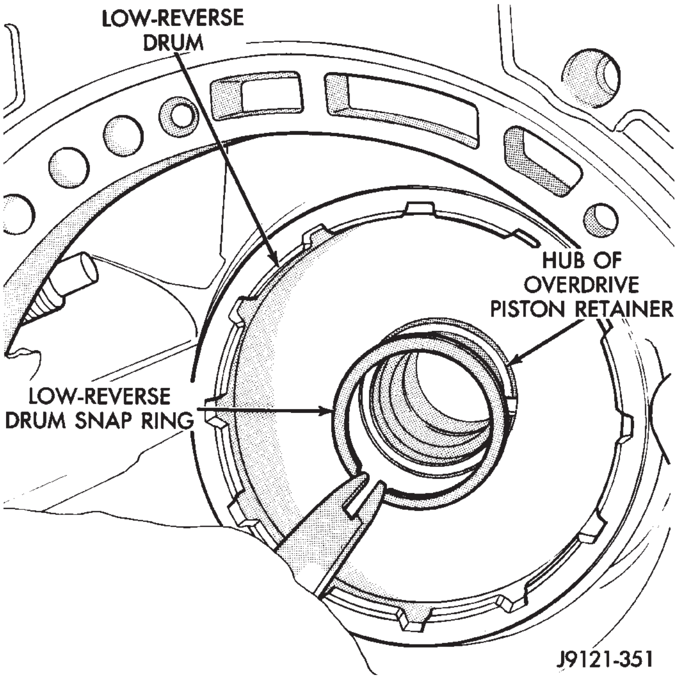


Fig. 110 Removing Low-Reverse Drum Snap Ring

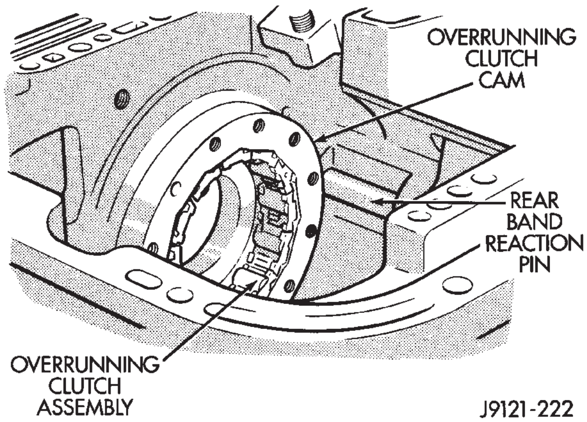


Fig. 111 Overrunning Clutch Assembly Removal

(36) Compress rear servo spring retainer about 1/16 inch with Valve Spring Compressor C-3422-B (Fig. 113).

(37) Remove rear servo spring retainer snap ring. Then remove compressor tools and remove rear servo spring and piston.

(38) Inspect transmission components.

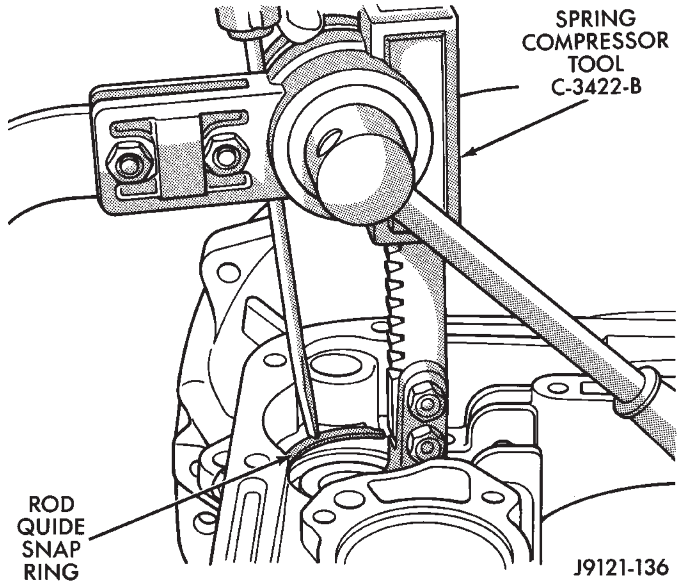


Fig. 112 Compressing Front Servo Rod Guide

NOTE: TO SERVICE THE OVERRUNNING CLUTCH CAM OR OVERDRIVE PISTON RETAINER, REFER TO OVERRUNNING CLUTCH CAM SERVICE IN THIS SECTION.

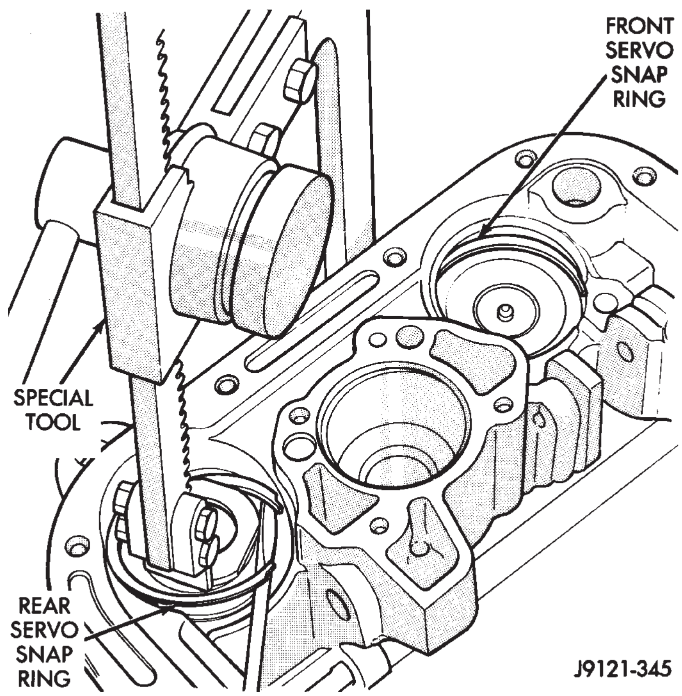


Fig. 113 Compressing Rear Servo Spring

DISASSEMBLY AND ASSEMBLY (Continued)

ASSEMBLY

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 subassemblies 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 mis-positioned.

The planetary geartrain, front/rear clutch assemblies and oil pump are all much easier to install when the transmission case is upright.

(1) Install rear servo piston, spring and retainer (Fig. 114). Install spring on top of servo piston and install retainer on top of spring.

(2) Install front servo piston assembly, servo spring and rod guide (Fig. 115).

(3) Compress front/rear servo springs with Valve Spring Compressor C-3422-B and install each servo snap ring (Fig. 116).

(4) Lubricate clutch cam rollers with transmission fluid.

(5) Install rear band in case (Fig. 117). Be sure twin lugs on band are seated against reaction pin.

(6) Install low-reverse drum and check overrunning clutch operation as follows:

(a) Lubricate overrunning clutch race (on drum hub) with transmission fluid.

(b) Guide drum through rear band.

(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. 118).

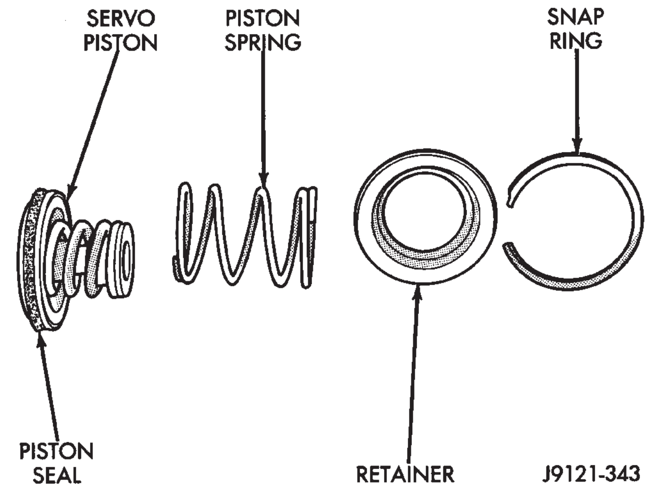


Fig. 114 Rear Servo Components

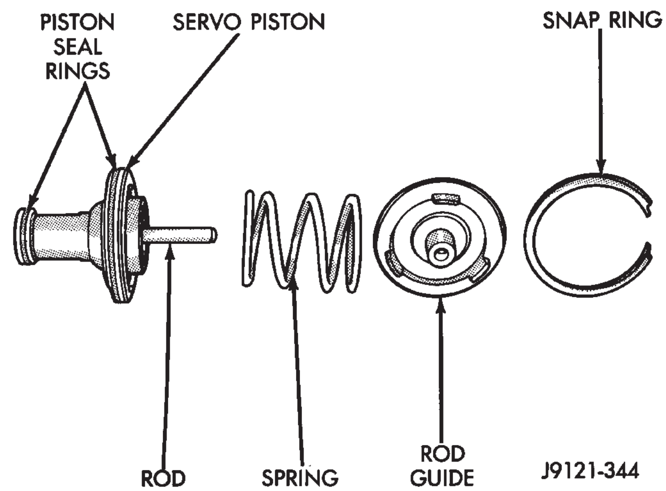


Fig. 115 Front Servo Components

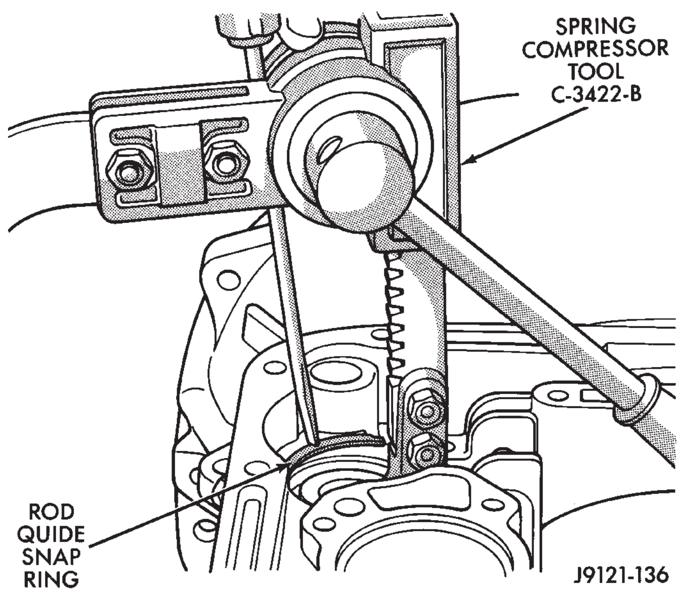


Fig. 116 Compressing Front/Rear Servo Springs

DISASSEMBLY AND ASSEMBLY (Continued)

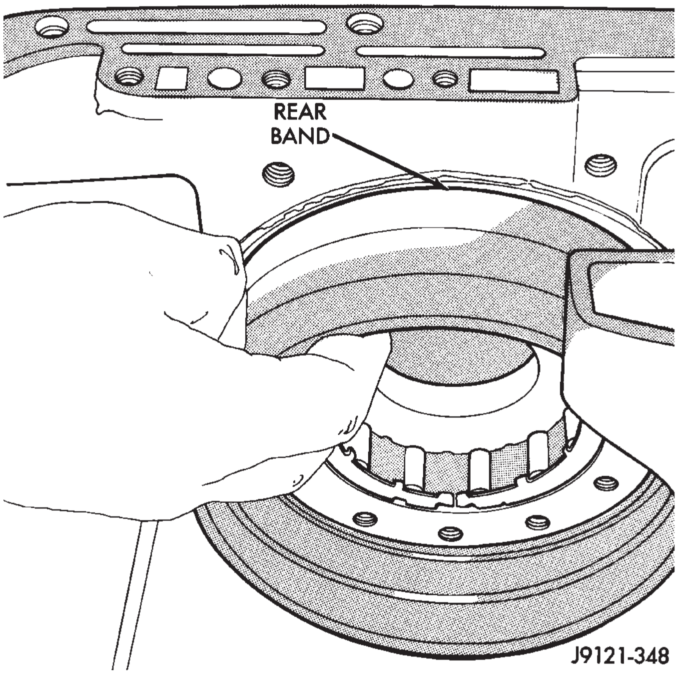


Fig. 117 Rear Band Installation

(e) Turn drum back and forth. **Drum should rotate freely in clockwise direction and lock in counterclockwise direction (as viewed from front of case).**

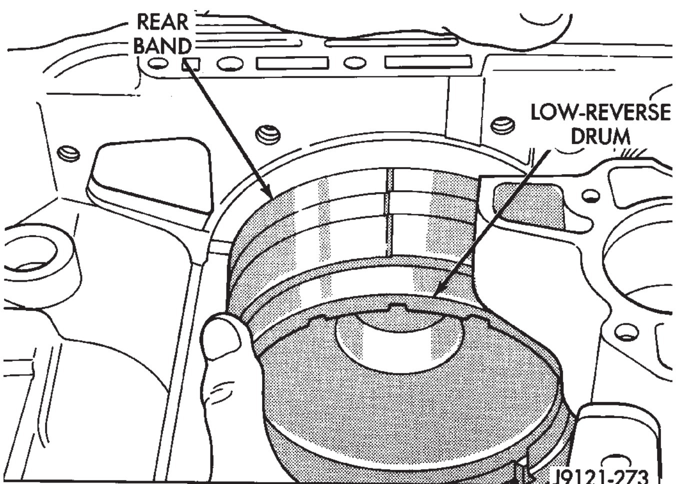


Fig. 118 Installing Low-Reverse Drum

(7) Install snap ring that secures low-reverse drum to hub of overdrive piston retainer (Fig. 119).

(8) Install rear band lever and pivot pin (Fig. 120). Align lever with pin bores in case and push pivot pin into place.

(9) Install planetary geartrain assembly (Fig. 121).

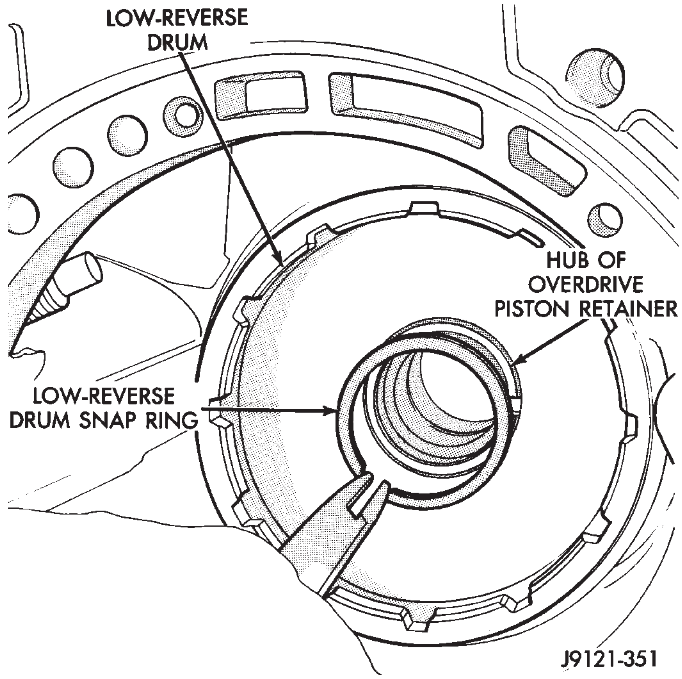


Fig. 119 Installing Low-Reverse Drum Retaining Snap Ring

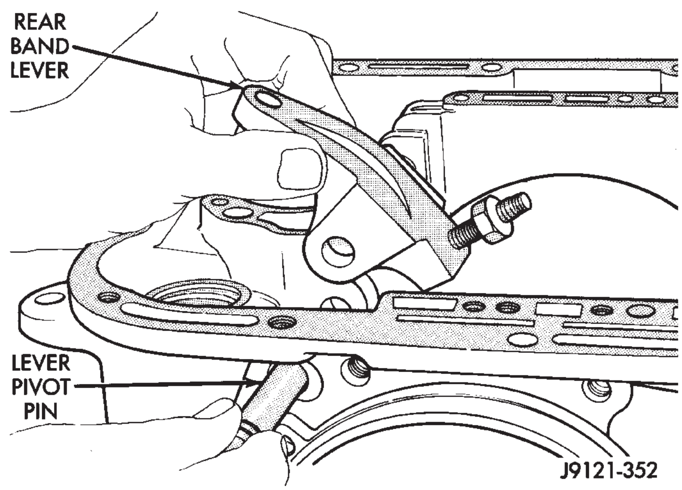


Fig. 120 Rear Band Lever And Pivot Pin Installation

(10) Install thrust plate on intermediate shaft hub (Fig. 122). Use petroleum jelly to hold thrust plate in place.

(11) Check seal ring on rear clutch retainer hub and seal rings on input shaft (Fig. 123). Also verify that shaft seal rings are installed in sequence shown.

(12) Install rear clutch thrust washer (Fig. 124). Use additional petroleum jelly to hold washer in place if necessary.

DISASSEMBLY AND ASSEMBLY (Continued)

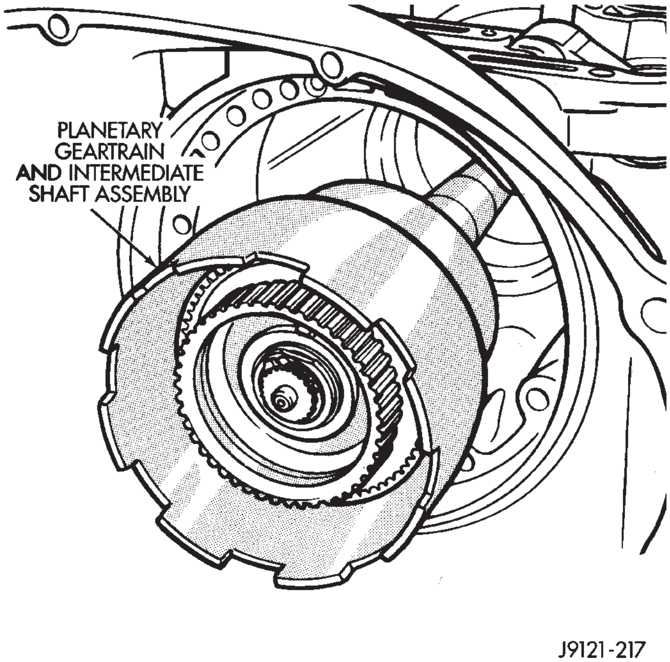


Fig. 121 Installing Planetary Geartrain

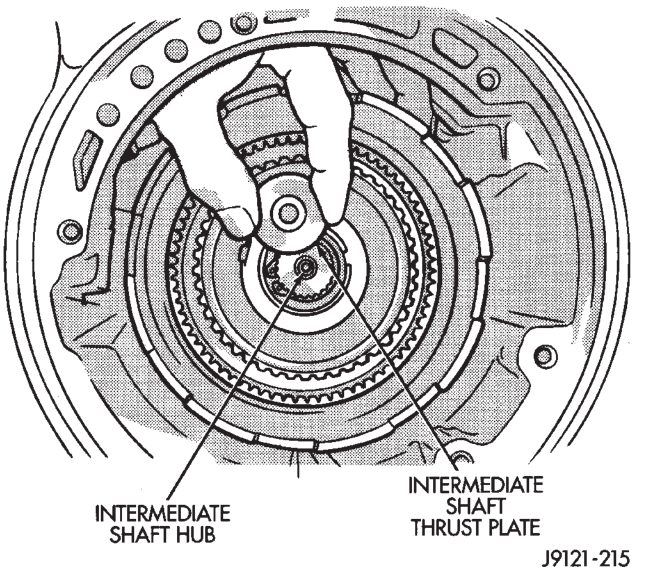


Fig. 122 Installing Intermediate Shaft Thrust Plate

(13) Align clutch discs in front clutch and install front clutch on rear clutch (Fig. 125). Rotate front clutch retainer back and forth until completely seated on rear clutch retainer.

(14) Coat intermediate shaft thrust washer with petroleum jelly. Then install washer in rear clutch hub (Fig. 126). 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.

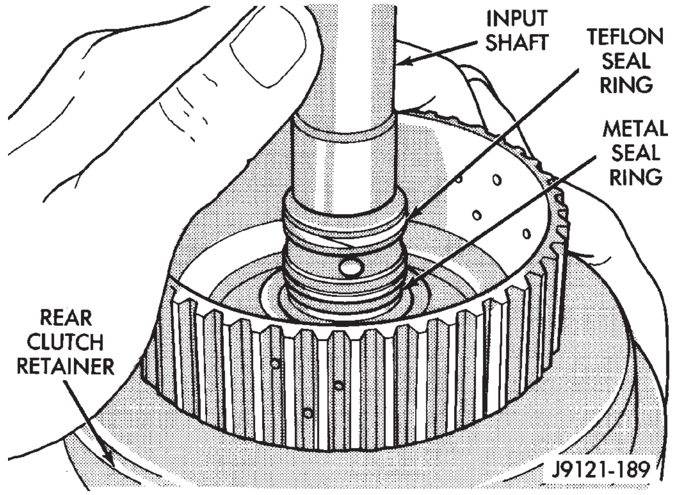


Fig. 123 Input Shaft Seal Ring Location

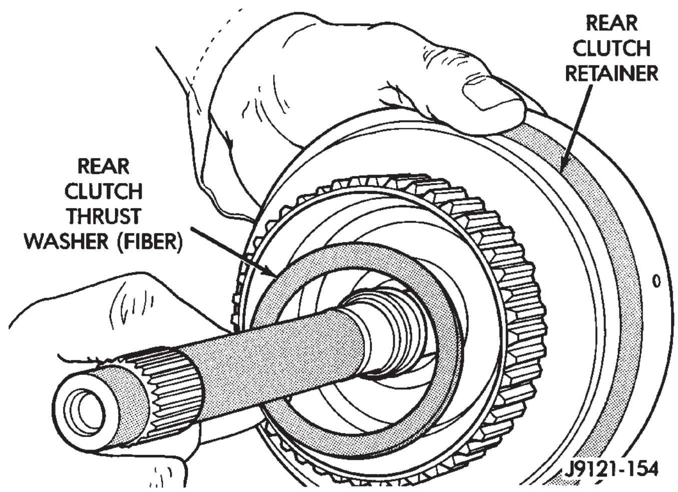


Fig. 124 Installing Rear Clutch Thrust Washer

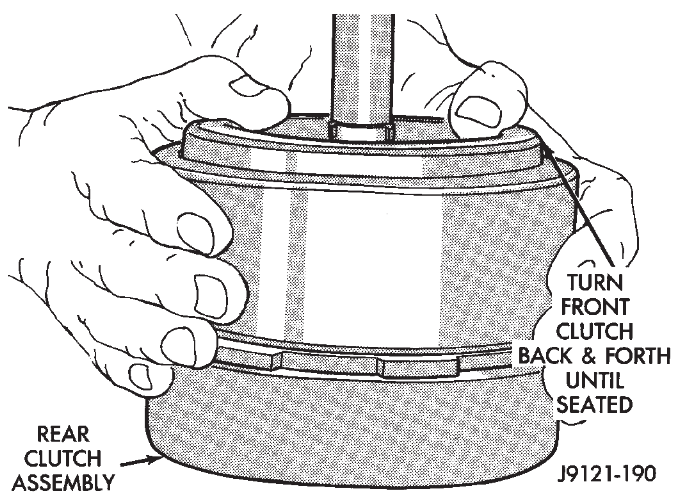


Fig. 125 Assembling Front And Rear Clutch Units

(15) Align drive teeth on rear clutch discs with small screwdriver (Fig. 127). This makes installation on front planetary easier.

DISASSEMBLY AND ASSEMBLY (Continued)

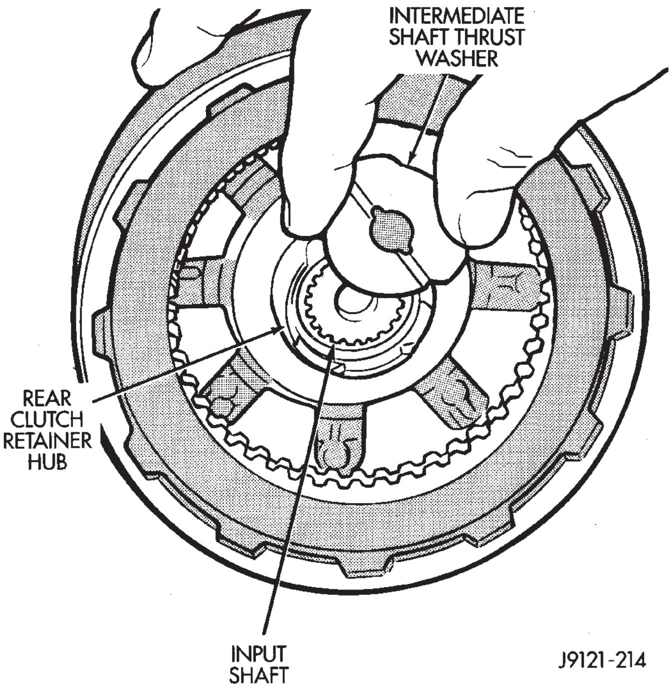


Fig. 126 Installing Intermediate Shaft Thrust Plate

(16) 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.

(17) Slide front band into case.

(18) Install front and rear clutch units as assembly (Fig. 128). 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.**

(19) 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.

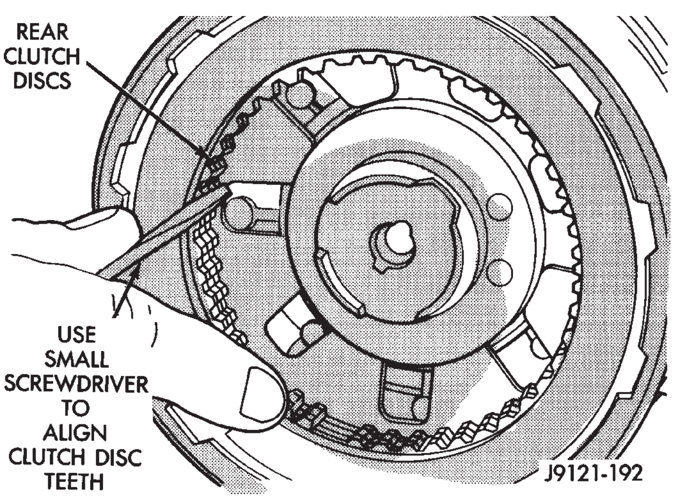


Fig. 127 Aligning Rear Clutch Disc Lugs

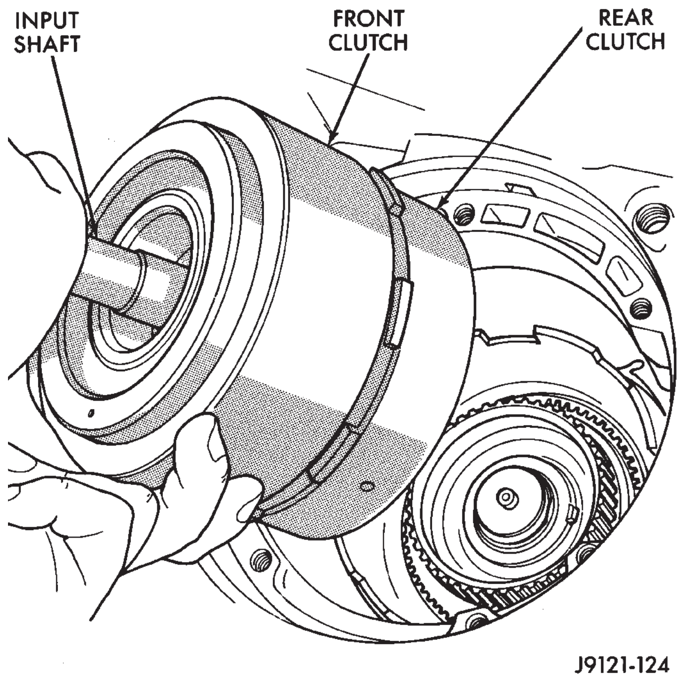


Fig. 128 Installing Front/Rear Clutch Assemblies

(20) Assemble front band strut.

(21) Install front band adjuster, strut and adjusting screw (Fig. 129).

(22) Tighten band adjusting screw until band just grips clutch retainer. Verify that front/rear clutches are still seated before continuing.

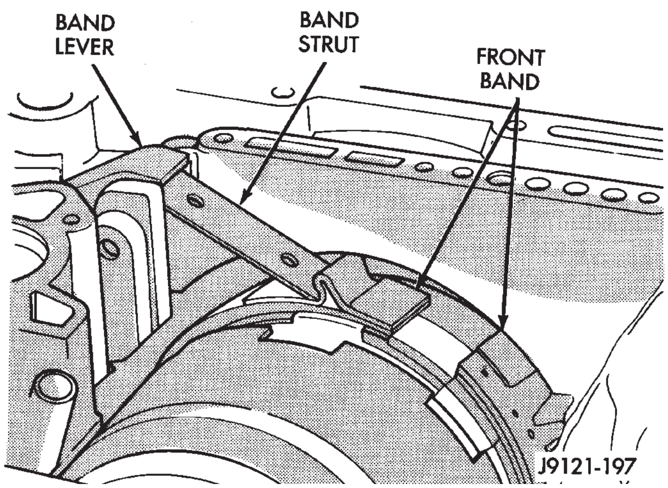


Fig. 129 Front Band Linkage Installation

(23) 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. 130). Use petroleum jelly to hold thrust washer in place if necessary.

(24) Lubricate oil pump body seal with petroleum jelly. Lubricate pump shaft seal lip with petroleum jelly.

DISASSEMBLY AND ASSEMBLY (Continued)

(25) Thread two Pilot Stud Tools C-3288-B into bolt holes in oil pump bore flange (Fig. 131).

(26) Align and install oil pump gasket (Fig. 131).

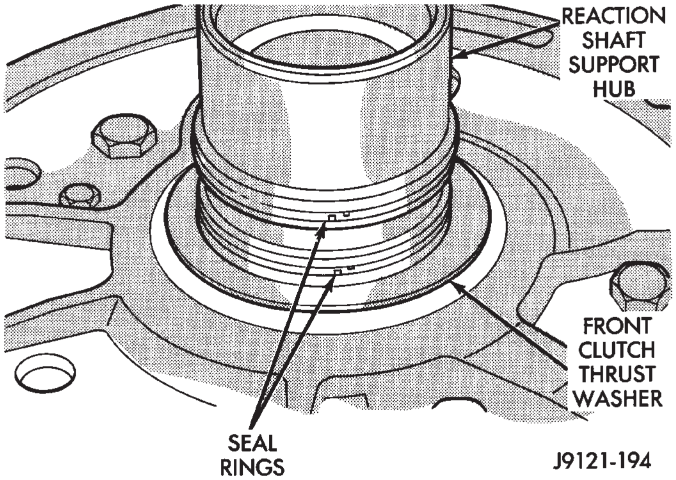


Fig. 130 Reaction Shaft Support Seal Rings And Front Clutch Thrust Washer

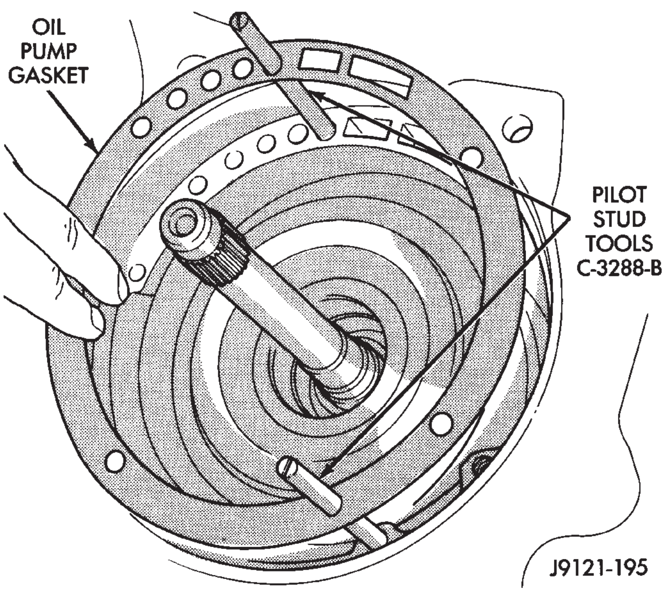


Fig. 131 Installing Pilot Studs And Oil Pump Gasket

(27) Install oil pump (Fig. 132). 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.

(28) Remove pilot stud tools and install remaining oil pump bolts. Tighten bolts alternately in diagonal pattern to 20 N·m (15 ft. lbs.).

(29) Measure and if necessary, correct input shaft end play as follows (Fig. 133):

(a) Attach dial indicator to converter housing.

(b) Position indicator plunger against input shaft and zero indicator.

(c) 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 next step if end play is not within specified limits.

(d) 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.

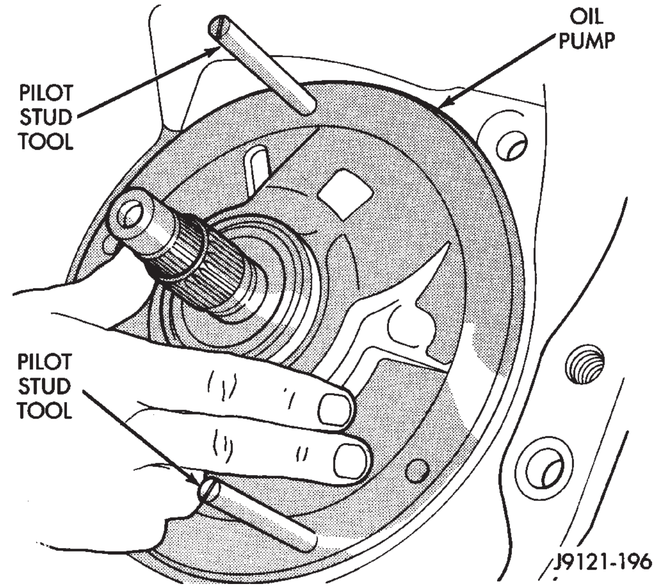


Fig. 132 Installing Oil Pump Assembly In Case

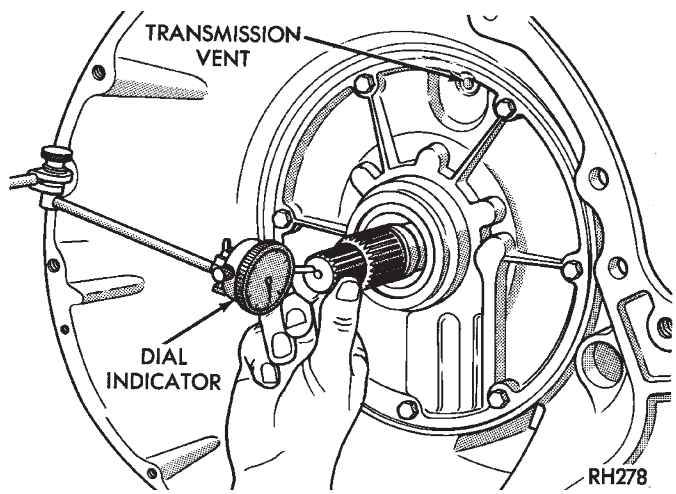


Fig. 133 Measuring Input Shaft End Play

(30) Install accumulator piston and inner and outer springs (Fig. 134).

(31) Verify that valve body solenoid harness is secured in 3-4 accumulator housing cover plate.

(32) 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.

(b) Align and seat valve body on case. Be sure manual lever shaft and overdrive connector are

DISASSEMBLY AND ASSEMBLY (Continued)

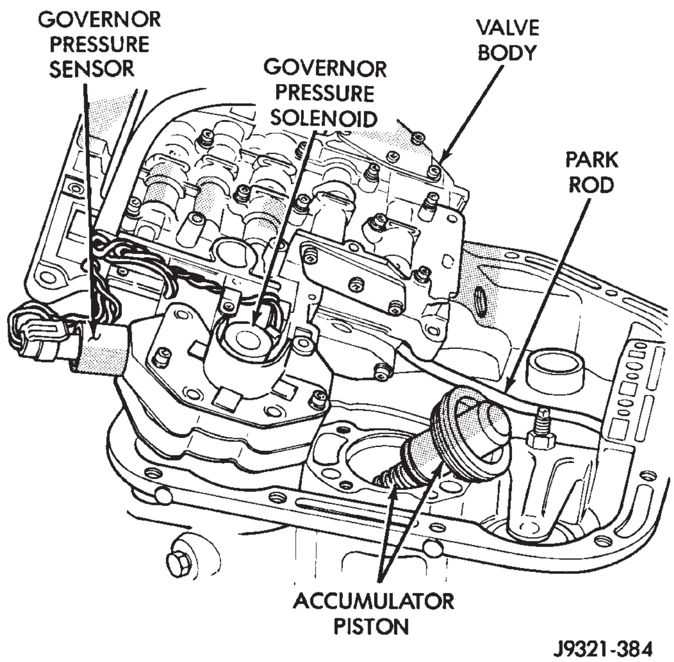


Fig. 134 Accumulator Piston And Springs

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.**

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.

(33) Install new filter on valve body. Tighten filter screws to 4 N·m (35 in. lbs.).

(34) Adjust front and rear bands.

(35) Install seal on park/neutral position switch (Fig. 135). Then install and tighten switch to 34 N·m (25 ft. lbs.).

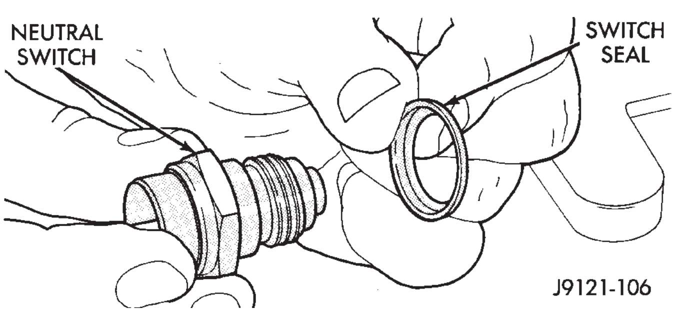


Fig. 135 Park/Neutral Position Switch Seal Position

(36) Install magnet in oil pan. Magnet goes on small protrusion at corner of pan.

(37) Position new oil pan gasket on case and install oil pan. Tighten pan bolts to 17 N·m (13 ft. lbs.).

(38) Install new valve body manual shaft seal in case (Fig. 136). 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.

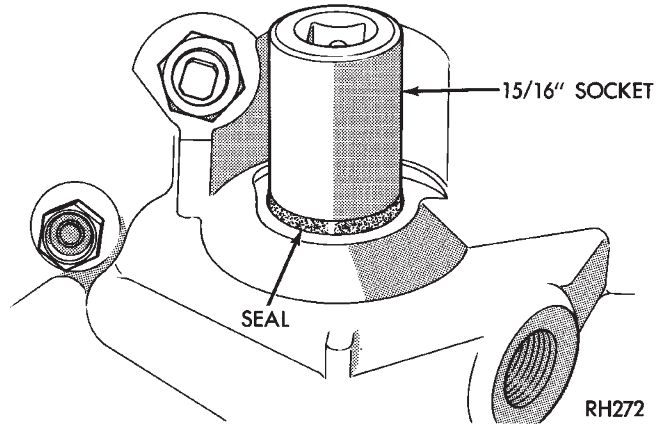


Fig. 136 Installing Manual Lever Shaft Seal

(39) Install throttle valve and shift selector levers on valve body manual lever shaft.

OVERRUNNING CLUTCH CAM/OVERDRIVE PISTON RETAINER

DISASSEMBLY

NOTE: TO SERVICE THE OVERRUNNING CLUTCH CAM AND THE OVERDRIVE PISTON RETAINER, THE TRANSMISSION GEARTRAIN AND OVERDRIVE UNIT MUST BE REMOVED FROM THE TRANSMISSION.

(1) Remove the overdrive piston (Fig. 137).

(2) Remove the overdrive piston retainer bolts.

(3) Remove overdrive piston retainer.

(4) Remove case gasket.

(5) Mark the position of the overrunning clutch cam in the case (Fig. 138).

(6) Remove the overrunning clutch cam bolts.

(7) Remove the overrunning clutch cam.

ASSEMBLY

(1) Examine bolt holes in overrunning clutch cam. Note that one hole is **not threaded** (Fig. 139). This hole must align with blank area in clutch cam bolt circle (Fig. 140). Mark hole location on clutch cam and blank area in case with grease pencil, paint stripe, or scribe mark for assembly reference.

(2) Mark location of non-threaded hole in clutch cam and blank area in bolt circle with grease pencil.

DISASSEMBLY AND ASSEMBLY (Continued)

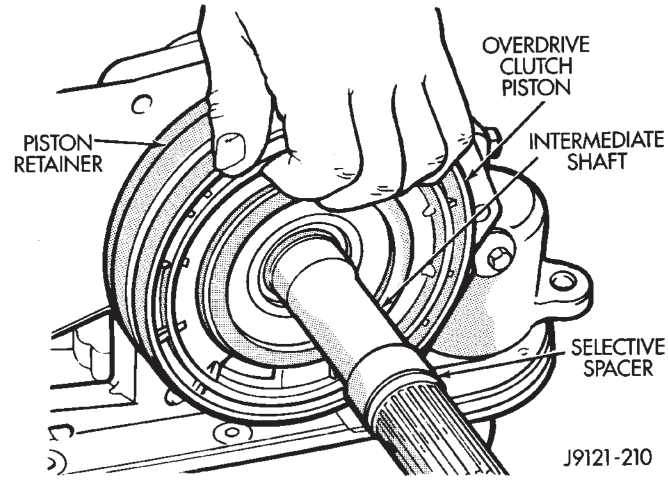


Fig. 137 Overdrive Piston Removal

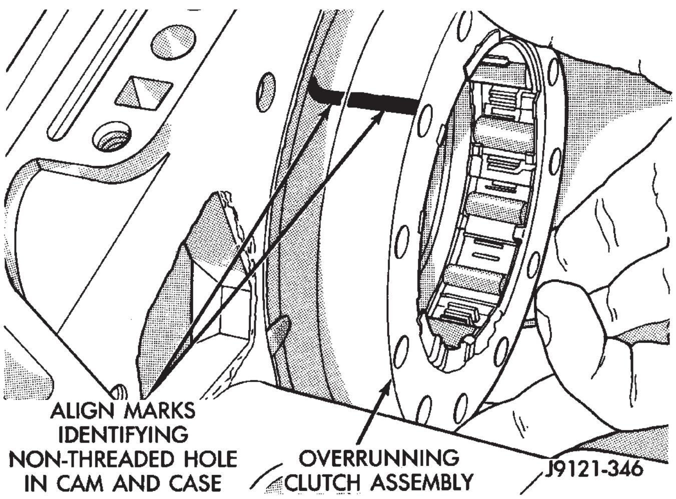


Fig. 138 Overrunning Clutch Cam Removal

(3) Align and install overrunning clutch and cam in case (Fig. 141). **Be sure cam is correctly installed. Bolt holes in cam are slightly counter-sunk on one side. Be sure this side of cam faces rearward (toward piston retainer).**

(4) 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.

(5) 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.

(6) 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. 142). Also install gasket before overdrive piston retainer. Center hole in gasket is smaller than retainer and cannot be installed over retainer.

(7) Position overdrive piston retainer on transmission case and align bolt holes in retainer, gasket and case (Fig. 143). Then install and tighten retainer bolts to 17 N·m (13 ft. lbs.) torque.

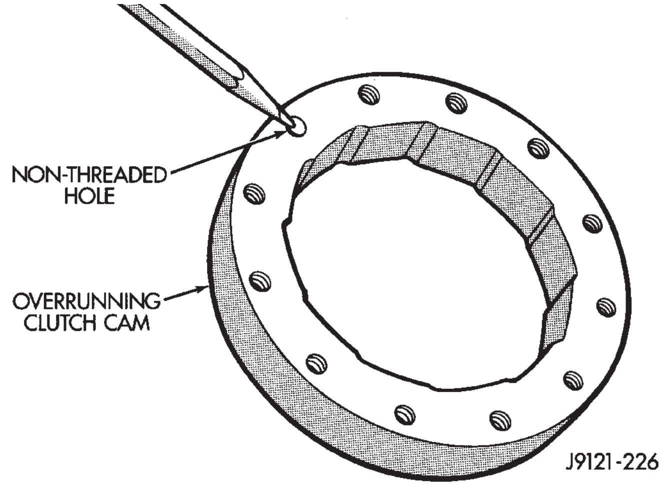


Fig. 139 Location Of Non-Threaded Hole In Clutch Cam

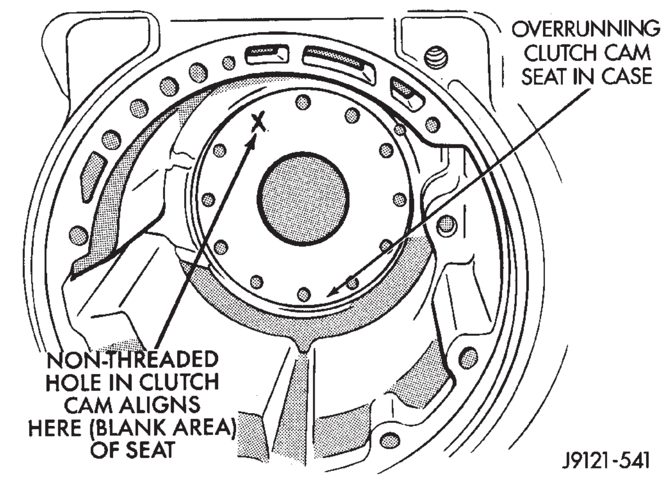


Fig. 140 Location Of Blank Area In Clutch Cam Bolt Circle

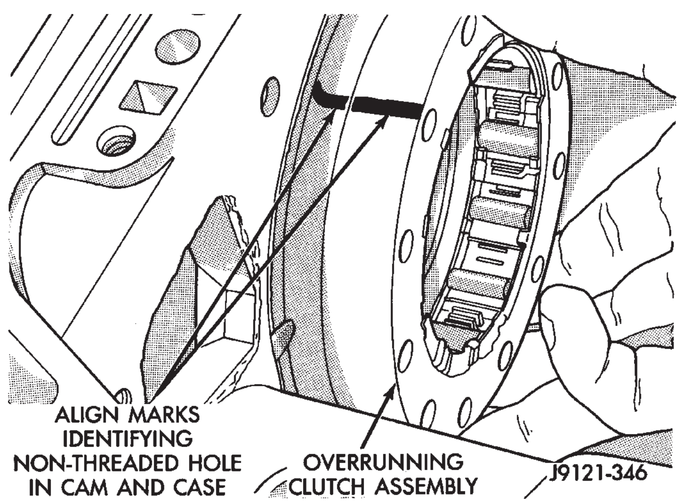


Fig. 141 Overrunning Clutch Installation

DISASSEMBLY AND ASSEMBLY (Continued)

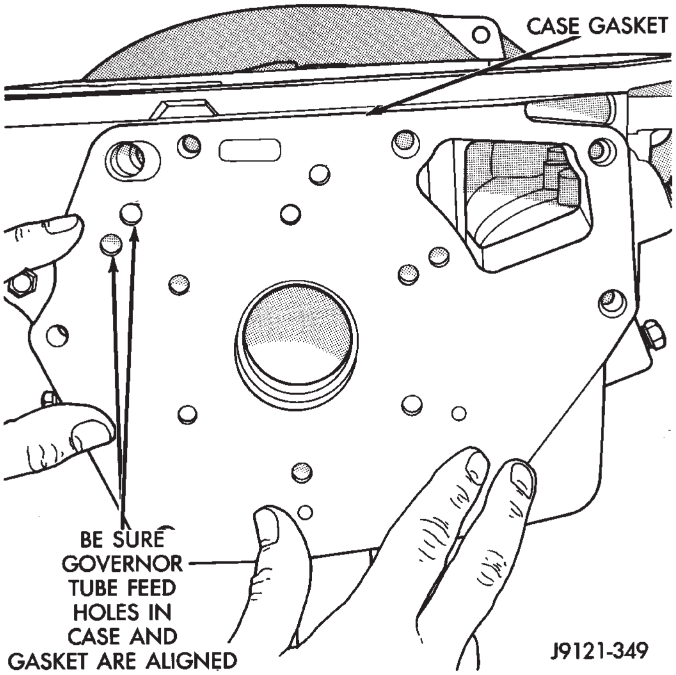


Fig. 142 Installing/Aligning Case Gasket

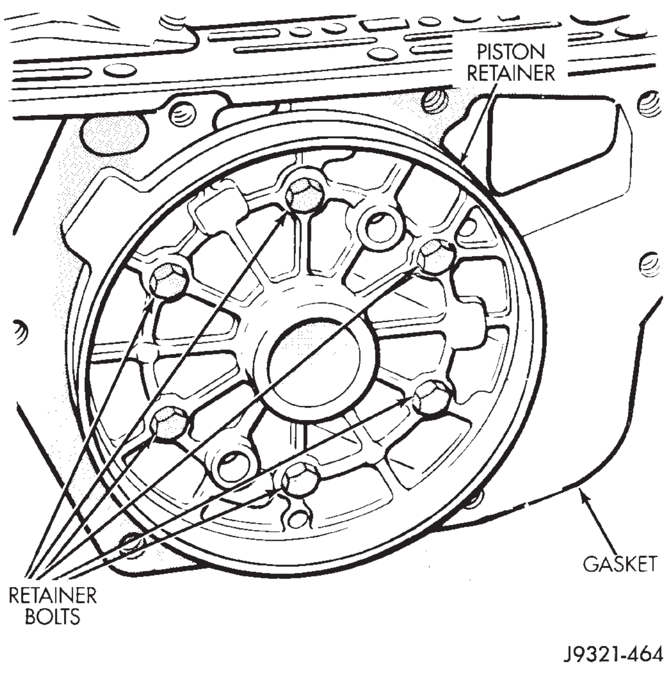


Fig. 143 Aligning Overdrive Piston Retainer

(8) Install new seals on over drive piston.

(9) Stand transmission case upright on bellhousing.

(10) Position Guide Ring 8114-1 on outer edge of overdrive piston retainer.

(11) Position Seal Guide 8114-2 on inner edge of overdrive piston retainer.

(12) Install overdrive piston in overdrive piston retainer by: aligning locating lugs on overdrive piston to the two mating holes in retainer.

(a) Aligning locating lugs on overdrive piston to the two mating holes in retainer.

(b) Lubricate overdrive piston seals with Mopar® Door Ease, or equivalent.

(c) Install piston over Seal Guide 8114–2 and inside Guide Ring 8114–1.

(d) Push overdrive piston into position in retainer.

(e) Verify that the locating lugs entered the lug bores in the retainer.

NOTE: INSTALL THE REMAINING TRANSMISSION COMPONENTS AND OVERDRIVE UNIT.

FRONT SERVO PISTON

DISASSEMBLY

(1) Remove seal ring from rod guide (Fig. 144).

(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.

ASSEMBLY

Clean and inspect front servo components.

(1) Lubricate new O-ring and seal rings with petroleum jelly and install them on piston, guide and rod.

(2) Install rod in piston. Install spring and washer on rod. Compress spring and install snap ring (Fig. 144).

(3) Set servo components aside for installation during transmission reassembly.

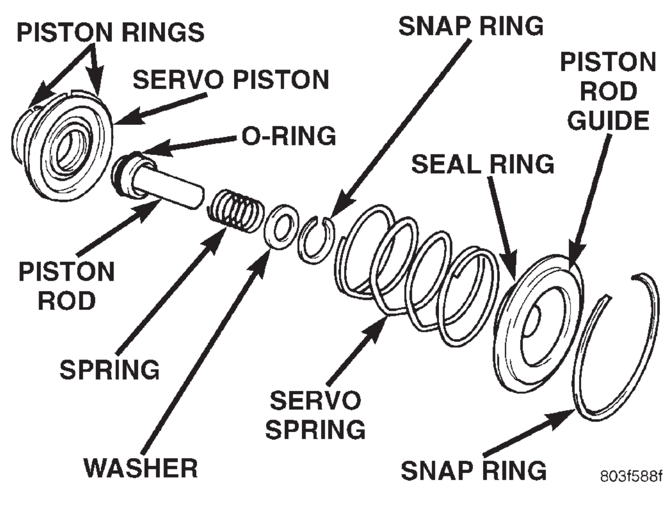


Fig. 144 Front Servo

DISASSEMBLY AND ASSEMBLY (Continued)

REAR SERVO PISTON

DISASSEMBLY

(1) Remove small snap ring and remove plug and spring from servo piston (Fig. 145).

(2) Remove and discard servo piston seal ring.

ASSEMBLY

(1) Lubricate piston and guide seals with petroleum jelly. Lubricate other servo parts with Mopar® ATF Plus 3, Type 7176, transmission fluid.

(2) Install new seal ring on servo piston.

(3) Assemble piston, plug, spring and new snap ring.

(4) Lubricate piston seal lip with petroleum jelly.

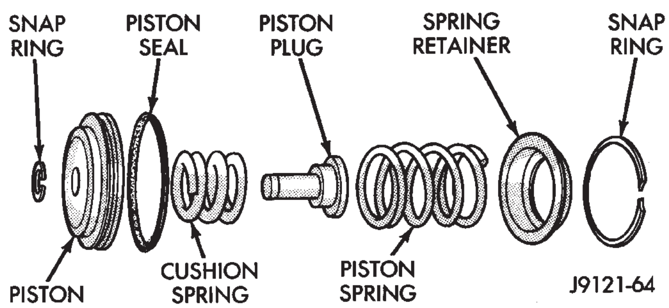


Fig. 145 Rear Servo Components

OIL PUMP AND REACTION SHAFT SUPPORT

DISASSEMBLY

(1) Remove seal ring from housing and reaction shaft support (Fig. 146).

(2) Mark pump housing and support assembly for alignment reference.

(3) Remove bolts attaching pump body to support (Fig. 147).

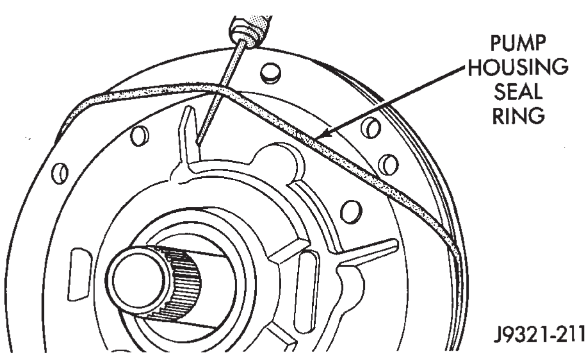


Fig. 146 Removing Pump Seal Ring

(4) Separate support from pump housing (Fig. 148).

(5) Remove inner and outer gears from reaction shaft support (Fig. 149).

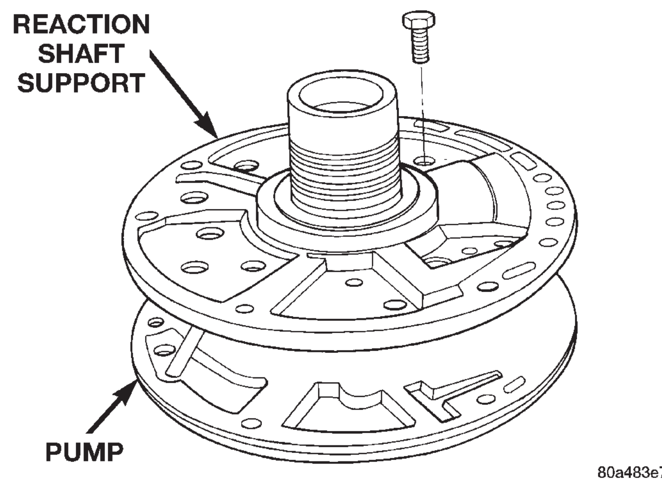


Fig. 147 Pump Support Bolts

(6) If pump seal was not removed during transmission disassembly, remove seal with punch and hammer.

(7) Remove front clutch thrust washer from support hub (Fig. 150).

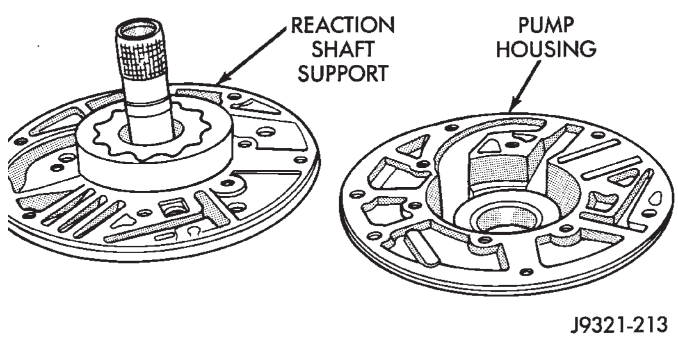


Fig. 148 Separating Pump Housing From Reaction Shaft Support

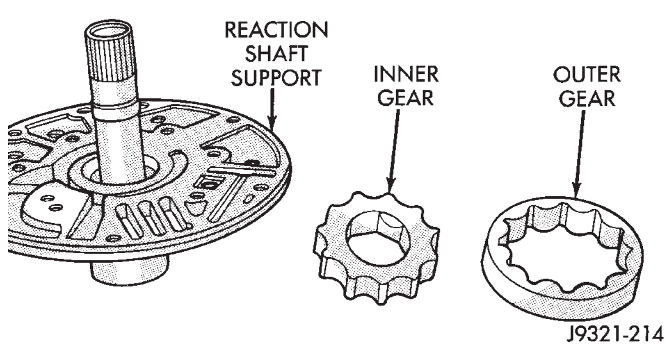


Fig. 149 Pump Gear Removal

OIL PUMP BUSHING REPLACEMENT

(1) Remove pump bushing with Tool Handle C-4171 and Bushing Remover SP-3551 from Tool Set C-3887-J (Fig. 151).

(2) Install new pump bushing with Tool Handle C-4171 and Bushing Installer SP-5117 (Fig. 151). Bushing should be flush with pump housing bore.

DISASSEMBLY AND ASSEMBLY (Continued)

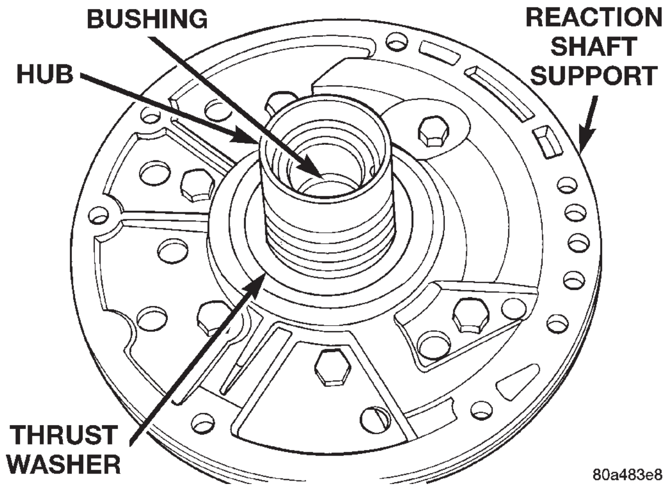


Fig. 150 Support Hub Thrust Washer

(3) Stake new pump bushing in two places with blunt punch (Fig. 152). Remove burrs from stake points with knife blade afterward.

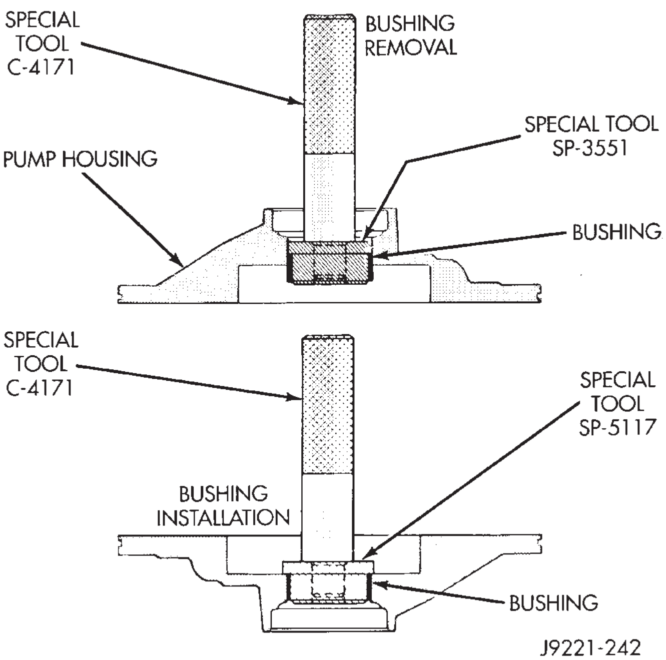


Fig. 151 Removing Oil Pump Bushing

REACTION SHAFT SUPPORT BUSHING REMOVAL

(1) Assemble Bushing Remover Tools SP-1191, 3633 and 5324 (Fig. 153). **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.

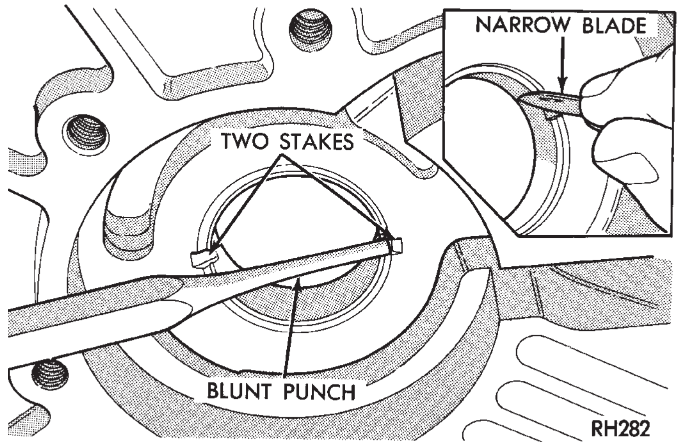


Fig. 152 Staking Oil Pump Bushing

(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. 153).

(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.

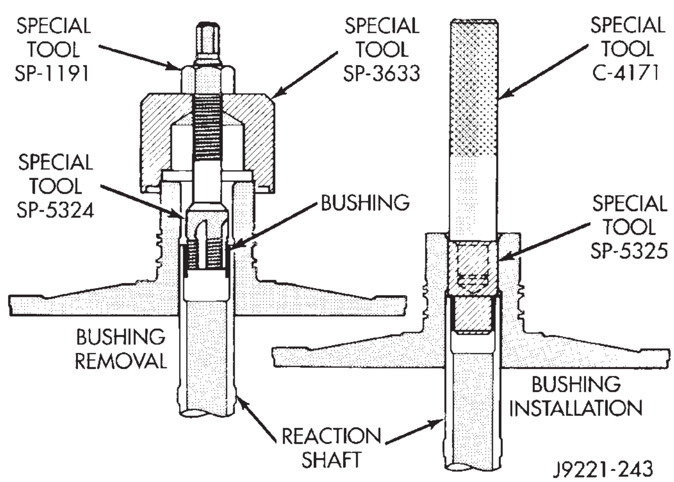


Fig. 153 Replacing Reaction Shaft Support Bushing

ASSEMBLY

(1) Lubricate gear bore in pump housing with transmission fluid.

(2) Lubricate pump gears with transmission fluid.

(3) Support pump housing on wood blocks (Fig. 154).

(4) Install outer gear in pump housing (Fig. 154). Gear can be installed either way (it is not a one-way fit).

(5) Install pump inner gear (Fig. 155).

DISASSEMBLY AND ASSEMBLY (Continued)

CAUTION: The pump inner gear is a one way fit. The bore on one side of the gear inside diameter (I.D.) is chamfered. Be sure the chamfered side faces forward (to front of pump).

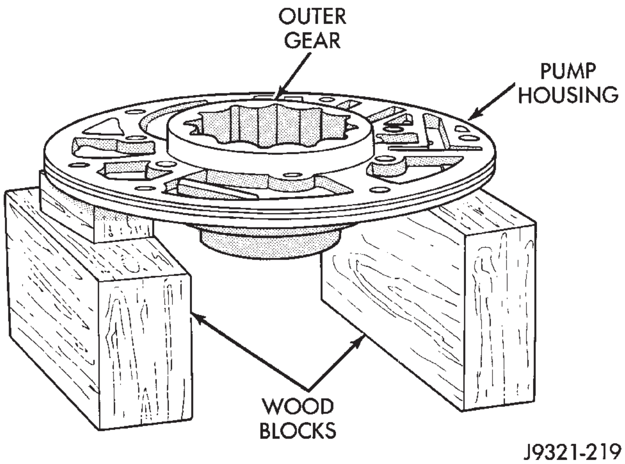


Fig. 154 Supporting Pump And Installing Outer Gear

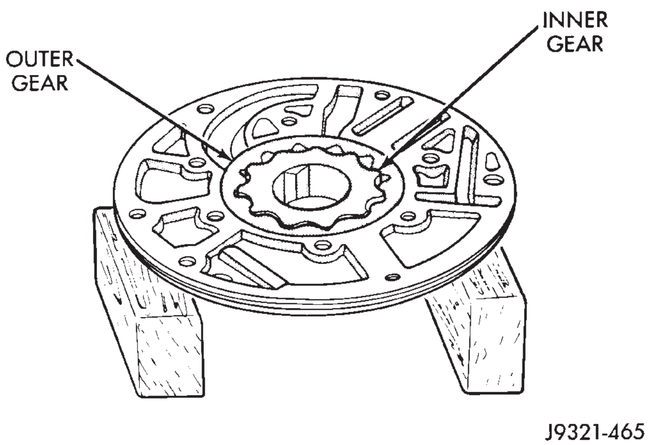


Fig. 155 Pump Inner Gear Installation

(6) Install new thrust washer on hub of reaction shaft support. Lubricate washer with transmission fluid or petroleum jelly.

(7) If reaction shaft seal rings are being replaced, install new seal rings on support hub (Fig. 156). 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.

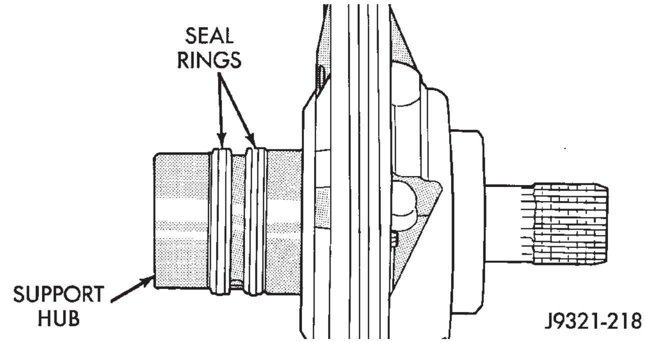


Fig. 156 Hub Seal Ring Position

(8) Install reaction shaft support on pump housing (Fig. 157).

(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).

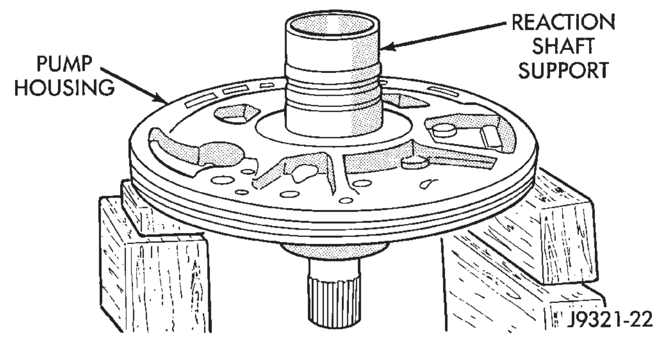


Fig. 157 Assembling Reaction Shaft Support And Pump Housing

(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.

(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. 158). 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 and O-ring seal with transmission fluid.

DISASSEMBLY AND ASSEMBLY (Continued)

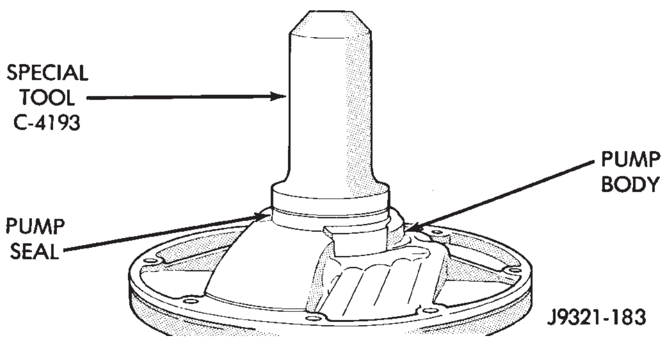


Fig. 158 Pump Oil Seal Installation

FRONT CLUTCH

NOTE: The 42RE transmission uses four plates and discs for the front clutch.

DISASSEMBLY

(1) Remove waved snap ring and remove pressure plate, clutch plates and clutch discs (Fig. 159).

(2) Compress clutch piston spring with Compressor Tool C-3575-A (Fig. 160). 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.

(6) Remove seals from clutch piston and clutch retainer hub. Discard both seals as they are not reusable.

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.

(3) Lubricate lips of piston and retainer seals with liberal quantity of Mopar® Door Ease. Then lubricate retainer hub, bore and piston with light coat of transmission fluid.

(4) Install clutch piston in retainer (Fig. 161). Use twisting motion to seat piston in bottom of retainer.

CAUTION: Never push the clutch piston straight in. This will fold the seals over causing leakage and clutch slip.

(5) Position spring in clutch piston (Fig. 162).

(6) Position spring retainer on top of piston spring (Fig. 163). **Make sure retainer is properly**

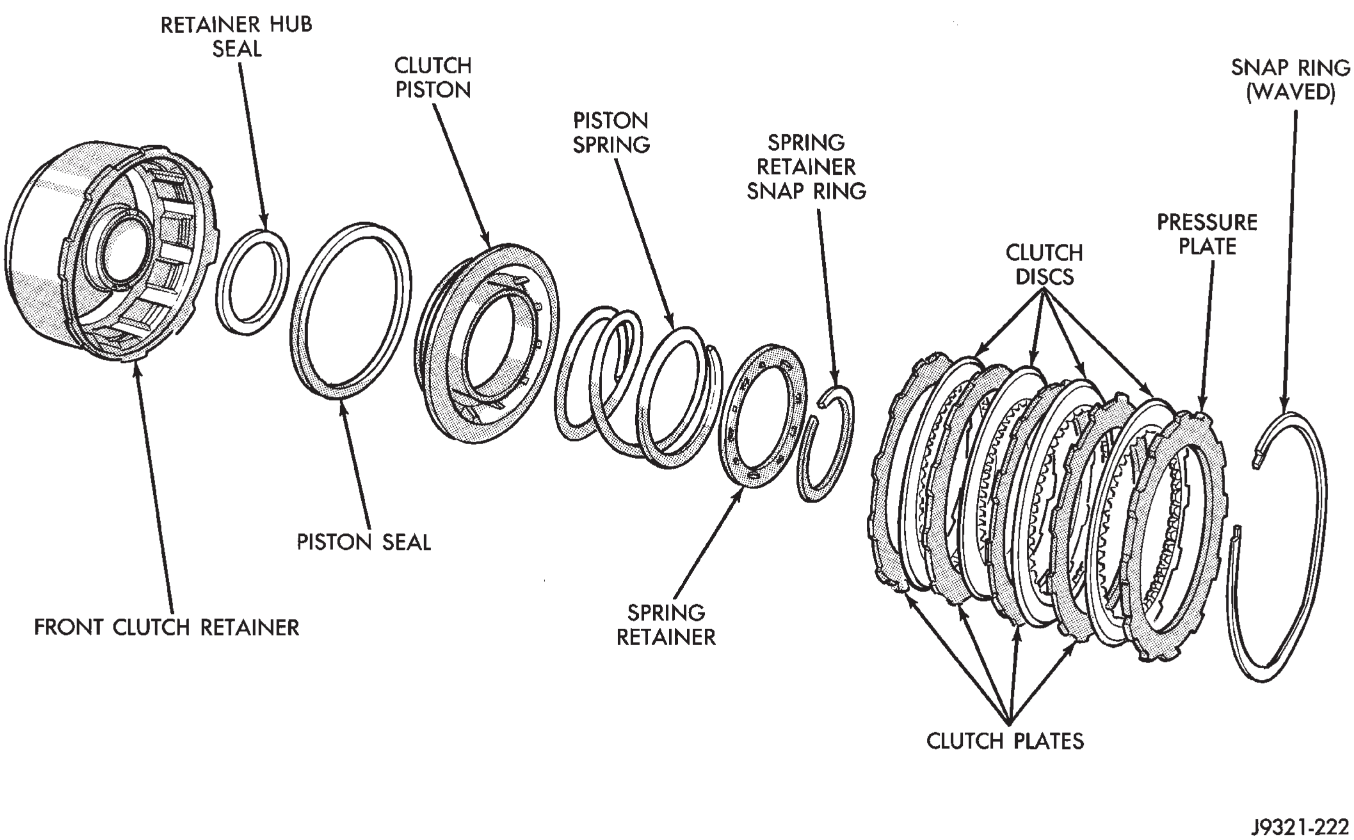


Fig. 159 42RE Front Clutch Components

DISASSEMBLY AND ASSEMBLY (Continued)

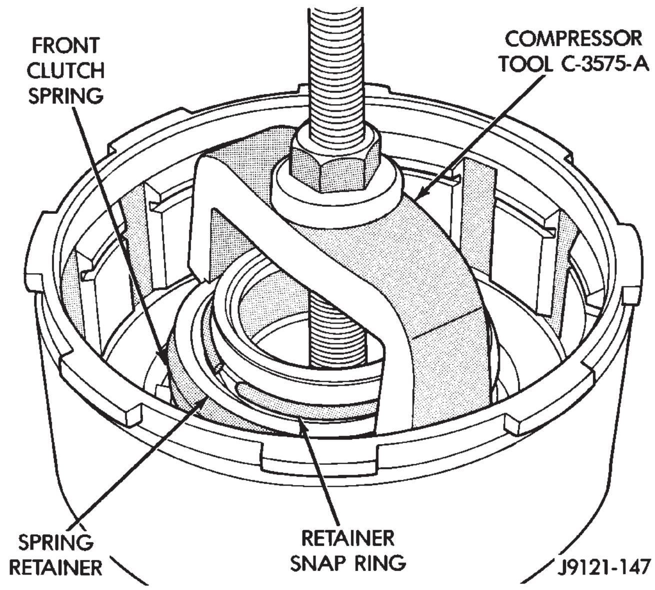


Fig. 160 Compressing Front Clutch Piston Spring

installed. Small raised tabs should be facing upward. Semicircular lugs on underside of retainer are for positioning retainer in spring.

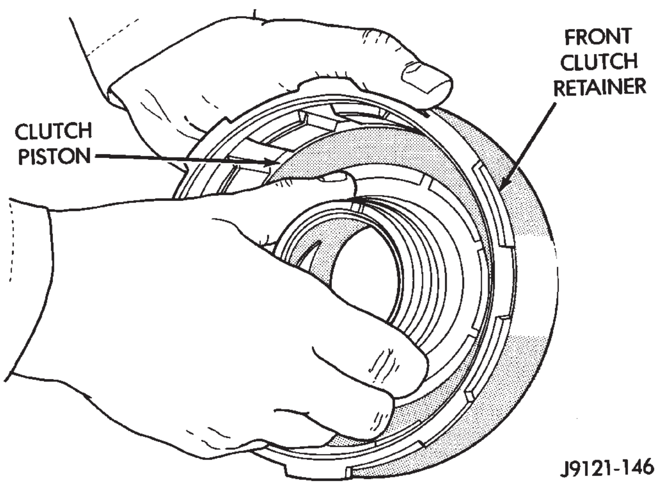


Fig. 161 Front Clutch Piston Installation

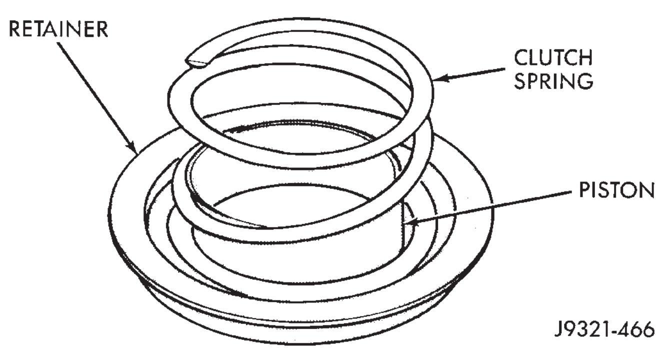


Fig. 162 Clutch Piston Spring Installation

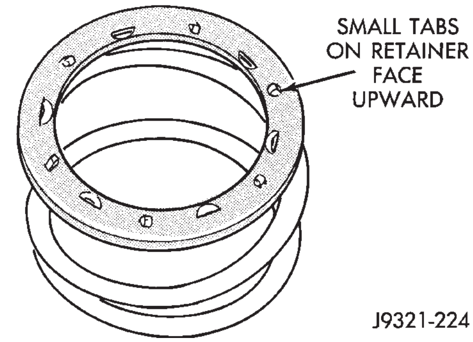


Fig. 163 Correct Spring Retainer Installed Position

(7) Compress piston spring and retainer with Compressor Tool C-3575-A (Fig. 160). Then install new snap ring to secure spring retainer and spring.

(8) Install clutch plates and discs (Fig. 159). Install steel plate then disc until all plates and discs are installed. The front clutch uses 4 clutch discs and plates in a 42RE transmission.

(9) Install pressure plate and waved snap ring (Fig. 159).

Clearance should be 1.70 to 3.40 mm (0.067 to 0.134 in.). If clearance is incorrect, clutch discs, plates, pressure plates and snap ring may have to be changed.

REAR CLUTCH

DISASSEMBLY

(1) Remove fiber thrust washer from forward side of clutch retainer.

(2) Remove input shaft front/rear seal rings.

(3) Remove selective clutch pack snap ring (Fig. 164).

(4) Remove top pressure plate, clutch discs, steel plates, bottom pressure plate and wave snap ring and wave spring (Fig. 164).

(5) Remove clutch piston with rotating motion.

(6) Remove and discard piston seals.

(7) Remove input shaft snap-ring (Fig. 165). It may be necessary to press the input shaft in slightly to relieve tension on the snap-ring

(8) Press input shaft out of retainer with shop press and suitable size press tool. Use a suitably sized press tool to support the retainer as close to the input shaft as possible.

ASSEMBLY

(1) Soak clutch discs in transmission fluid while assembling other clutch parts.

(2) Install new seal rings on clutch retainer hub and input shaft if necessary (Fig. 166).

(a) Be sure clutch hub seal ring is fully seated in groove and is not twisted.

DISASSEMBLY AND ASSEMBLY (Continued)

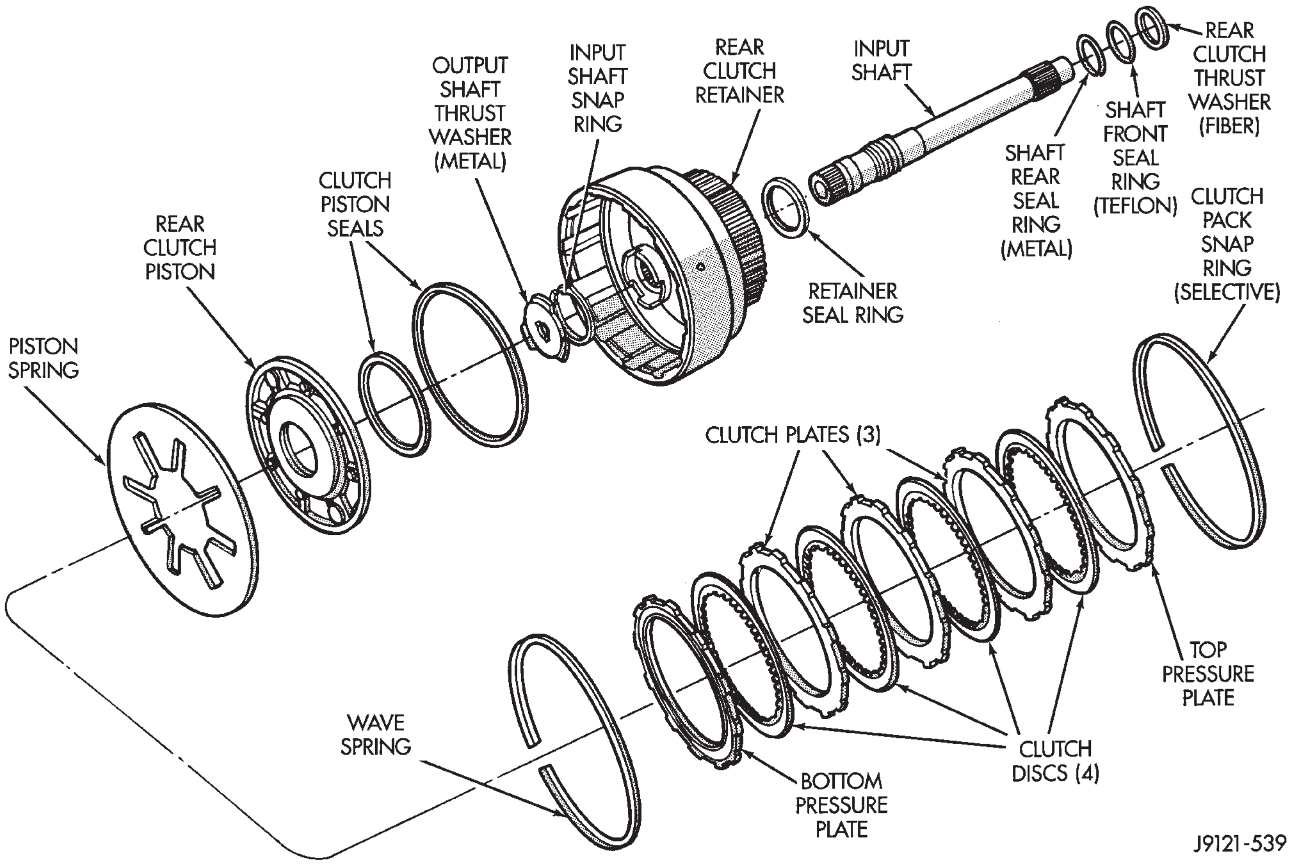


Fig. 164 Rear Clutch Components

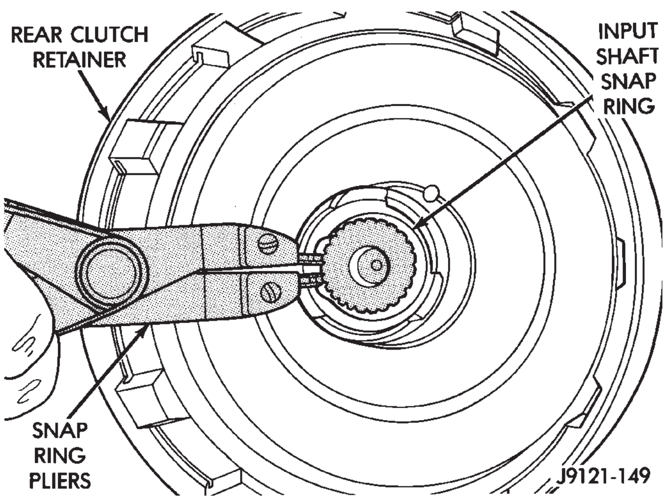


Fig. 165 Removing/Installing Input Shaft Snap-Ring

(3) Lubricate splined end of input shaft and clutch retainer with transmission fluid. Then press input shaft into retainer. Use a suitably sized press tool to support retainer as close to input shaft as possible.

(4) Install input shaft snap-ring (Fig. 165).

(5) Invert retainer and press input shaft in opposite direction until snap-ring is seated.

(6) Install new seals on clutch piston. Be sure lip of each seal faces interior of clutch retainer.

(7) Lubricate lip of piston seals with generous quantity of Mopar® Door Ease. Then lubricate retainer hub and bore with light coat of transmission fluid.

(8) 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.

(9) Install piston spring in retainer and on top of piston (Fig. 169). Concave side of spring faces downward (toward piston).

(10) Install wave spring in retainer (Fig. 169). Be sure spring is completely seated in retainer groove.

(11) Install bottom pressure plate (Fig. 164). Ridged side of plate faces downward (toward piston) and flat side toward clutch pack.

(12) 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 (4 discs and 3 plates are required) (Fig. 164).

DISASSEMBLY AND ASSEMBLY (Continued)

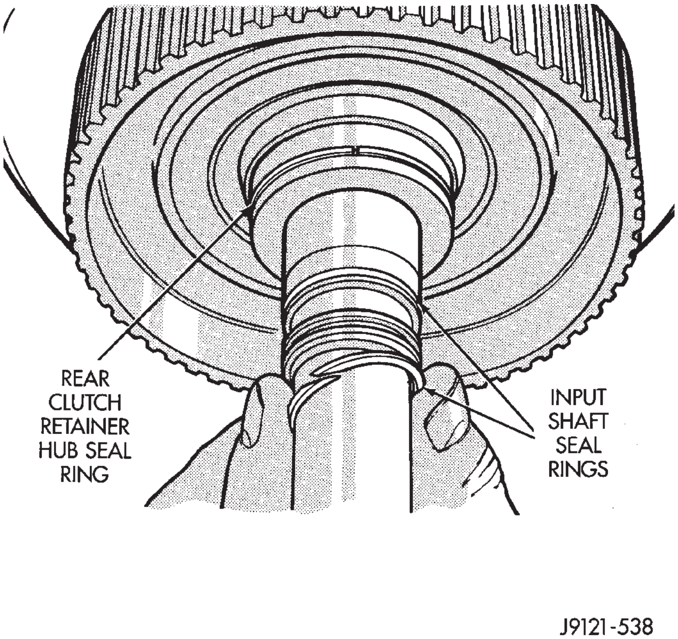


Fig. 166 Rear Clutch Retainer And Input Shaft Seal Ring Installation

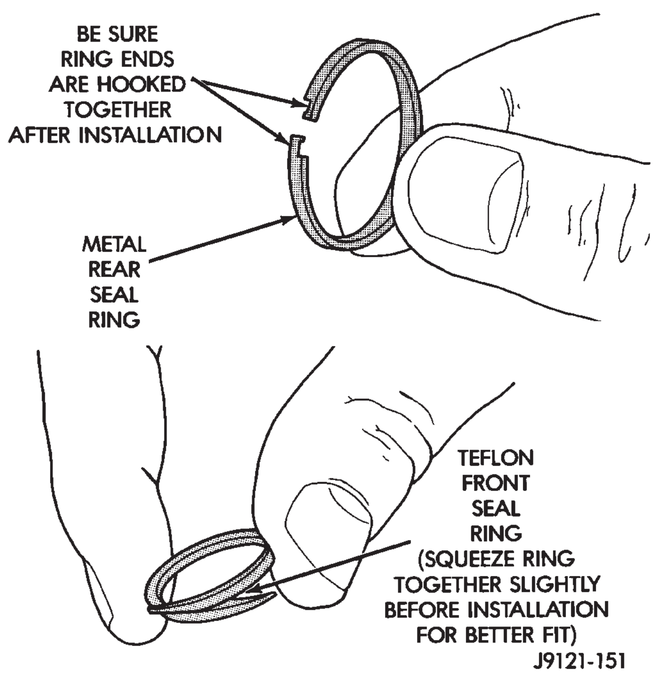


Fig. 167 Input Shaft Seal Ring Identification

(13) Install top pressure plate.

(14) Install selective snap ring. Be sure snap ring is fully seated in retainer groove.

(15) Using a suitable gauge bar and dial indicator, measure clutch pack clearance (Fig. 170).

(a) Position gauge bar across the clutch drum with the dial indicator pointer on the pressure plate (Fig. 170).

(b) Using two small screw drivers, lift the pressure plate and release it.

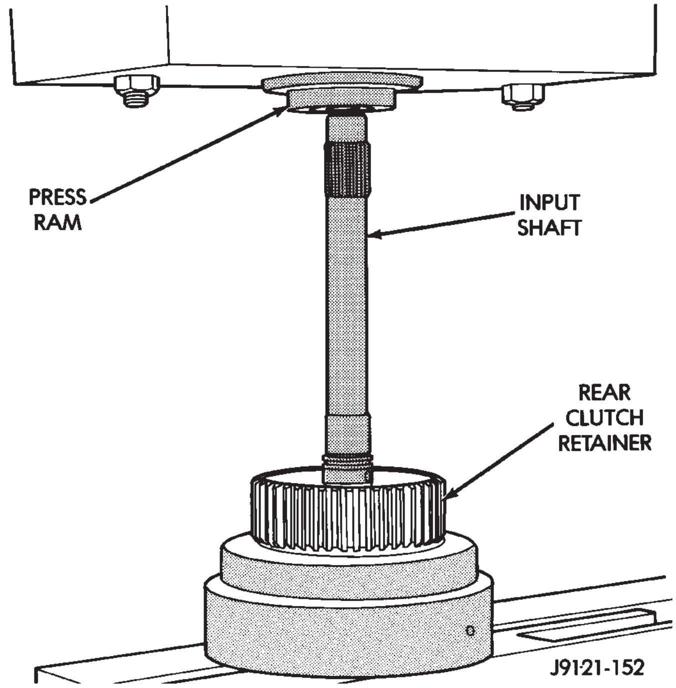


Fig. 168 Pressing Input Shaft Into Rear Clutch Retainer

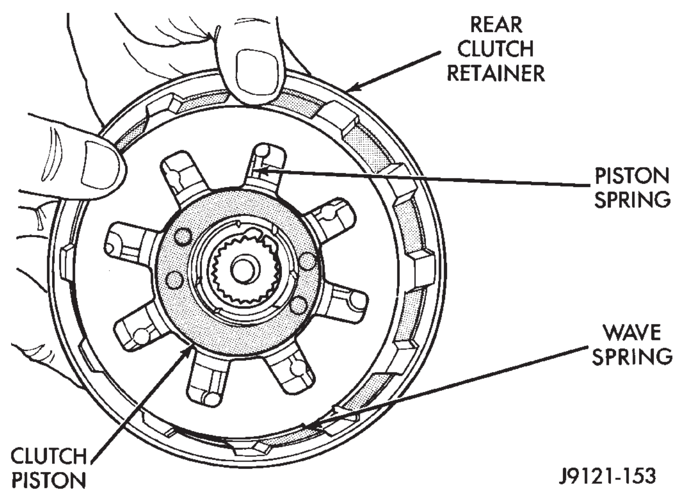


Fig. 169 Piston Spring/Wave Spring Position

(c) Zero the dial indicator.

(d) Lift the pressure plate until it contacts the snap-ring and record the dial indicator reading.

Clearance should be 0.64 - 1.14 mm (0.025 - 0.045 in.). If clearance is incorrect, steel plates, discs, selective snap ring and pressure plates may have to be changed.

The selective snap ring thicknesses are:

- .107–.109 in.
- .098–.100 in.
- .095–.097 in.
- .083–.085 in.
- .076–.078 in.
- .071–.073 in.
- .060–.062 in.

DISASSEMBLY AND ASSEMBLY (Continued)

(16) Coat rear clutch thrust washer with petroleum jelly and install washer over input shaft and into clutch retainer (Fig. 171). Use enough petroleum jelly to hold washer in place.

(17) Set rear clutch aside for installation during final assembly.

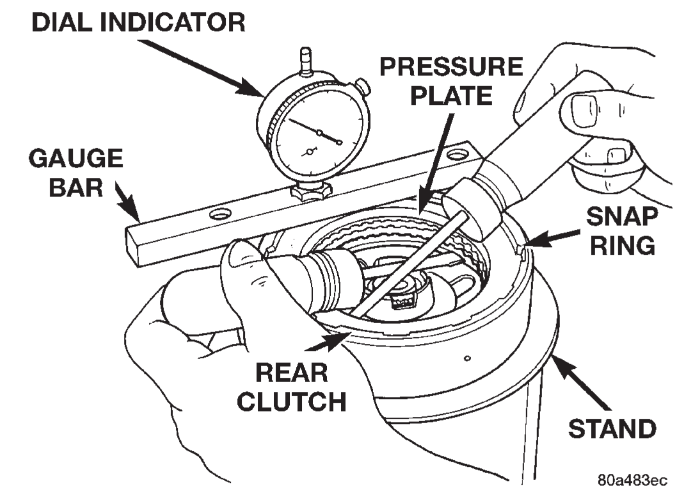


Fig. 170 Checking Rear Clutch Pack Clearance

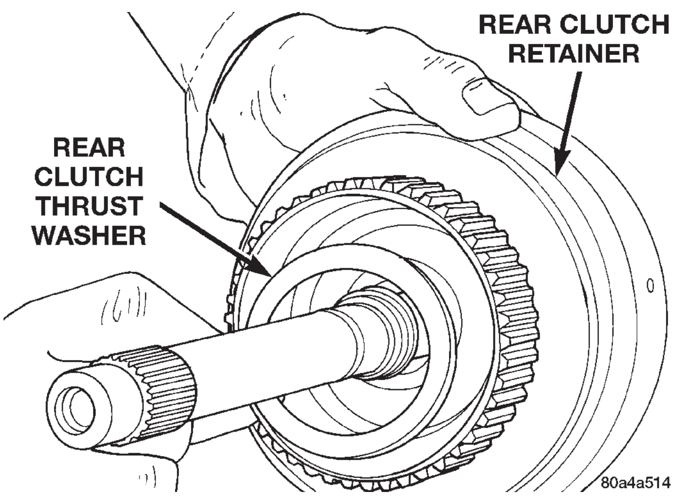


Fig. 171 Installing Rear Clutch Thrust Washer

PLANETARY GEARTRAIN/OUTPUT SHAFT

DISASSEMBLY

(1) Remove planetary snap ring (Fig. 172).

(2) Remove front annulus and planetary assembly from driving shell (Fig. 172).

(3) Remove snap ring that retains front planetary gear in annulus gear (Fig. 173).

(4) Remove tabbed thrust washer and tabbed thrust plate from hub of front annulus (Fig. 174).

(5) Separate front annulus and planetary gears (Fig. 174).

(6) Remove front planetary gear front thrust washer from annulus gear hub.

(7) Separate and remove driving shell, rear planetary and rear annulus from output shaft (Fig. 175).

(8) Remove front planetary rear thrust washer from driving shell.

(9) Remove tabbed thrust washers from rear planetary gear.

(10) Remove lock ring that retains sun gear in driving shell. Then remove sun gear, spacer and thrust plates.

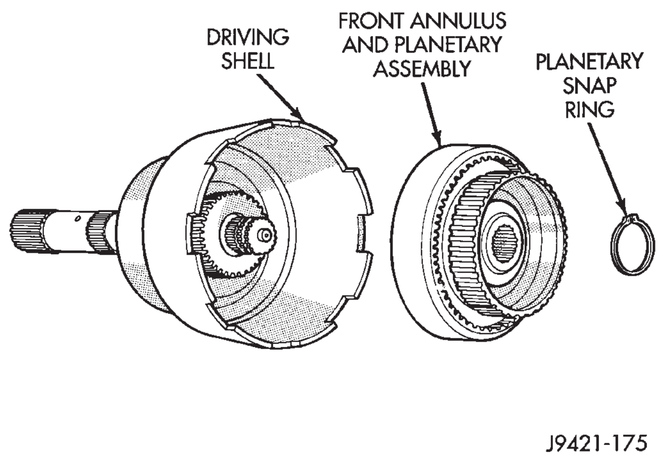


Fig. 172 Front Annulus And Planetary Assembly Removal

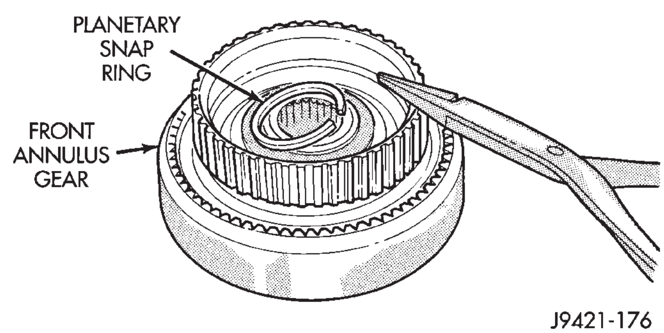


Fig. 173 Front Planetary Snap Ring Removal

ASSEMBLY

(1) Lubricate output 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 (Fig. 176).

(3) Install rear thrust washer on rear planetary gear. Use enough petroleum jelly to hold washer in place. Also be sure all four washer tabs are properly engaged in gear slots.

(4) Install rear annulus over and onto rear planetary gear (Fig. 176).

DISASSEMBLY AND ASSEMBLY (Continued)

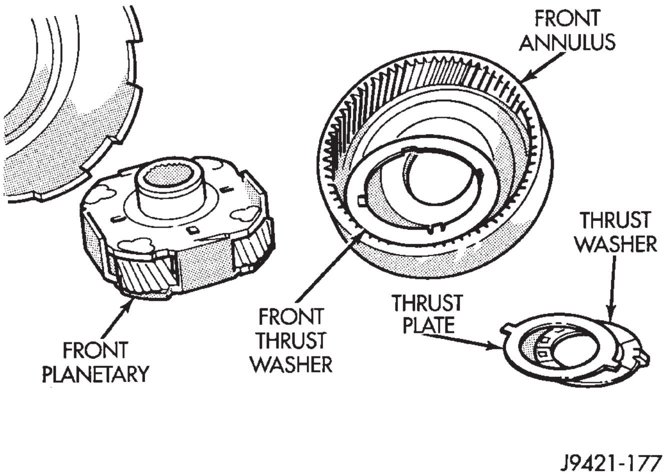


Fig. 174 Front Planetary And Annulus Gear Disassembly

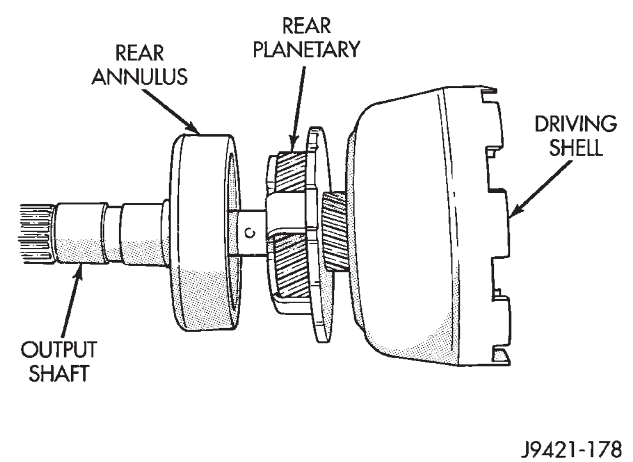


Fig. 175 Removing Driving Shell, Rear Planetary And Rear Annulus

(5) Install assembled rear planetary and annulus gear on output shaft (Fig. 177). Verify that assembly is fully seated on shaft.

(6) Install front thrust washer on rear planetary gear (Fig. 178). Use enough petroleum jelly to hold washer on gear. Be sure all four washer tabs are seated in slots.

(7) Install spacer on sun gear (Fig. 179).

(8) Install thrust plate on sun gear (Fig. 180). Note that driving shell thrust plates are interchangeable. Use either plate on sun gear and at front/rear of shell.

(9) Hold sun gear in place and install thrust plate over sun gear at rear of driving shell (Fig. 181).

(10) Position wood block on bench and support sun gear on block (Fig. 182). 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.

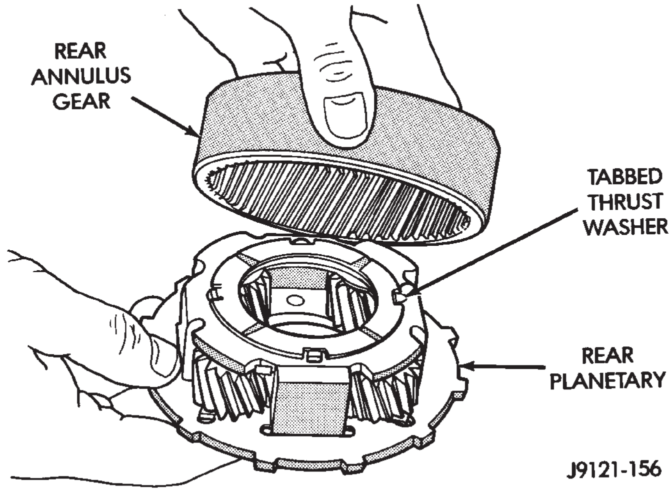


Fig. 176 Assembling Rear Annulus And Planetary Gear

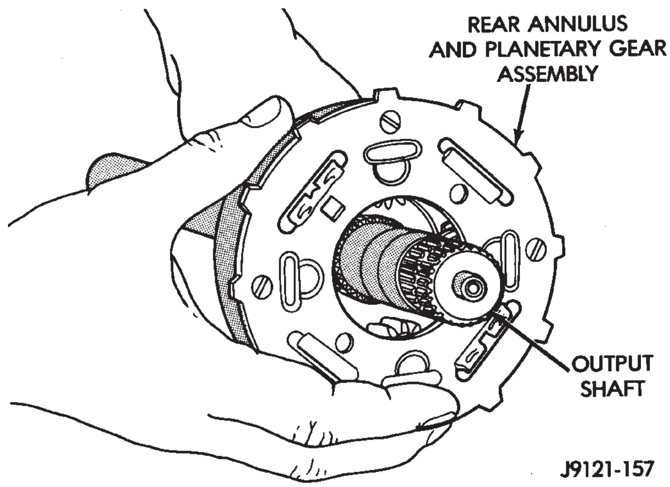


Fig. 177 Installing Rear Annulus And Planetary On Output Shaft

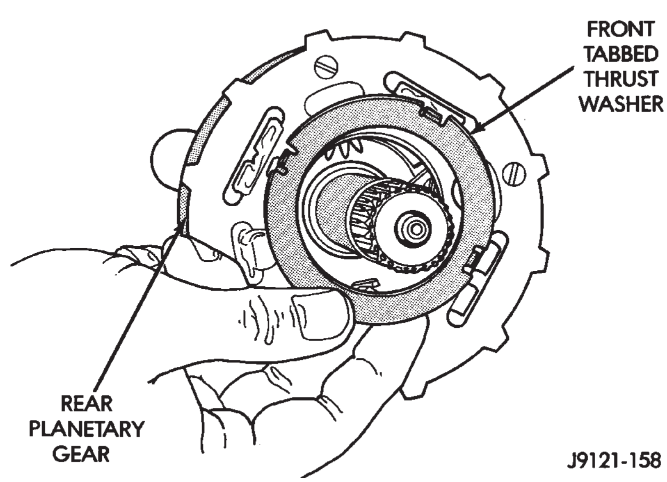


Fig. 178 Installing Rear Planetary Front Thrust Washer

DISASSEMBLY AND ASSEMBLY (Continued)

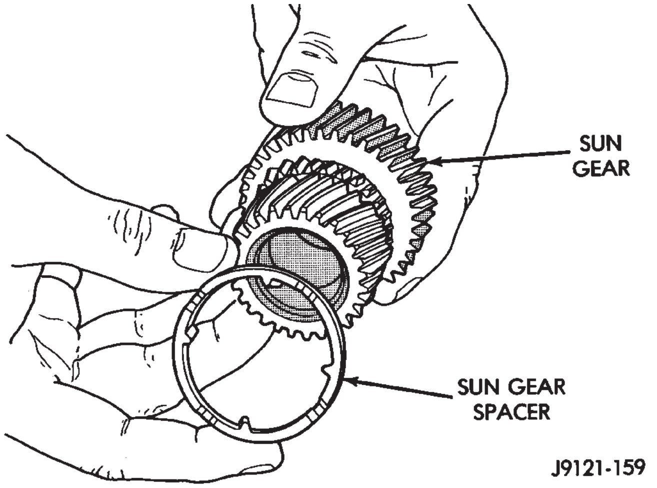


Fig. 179 Installing Spacer On Sun Gear

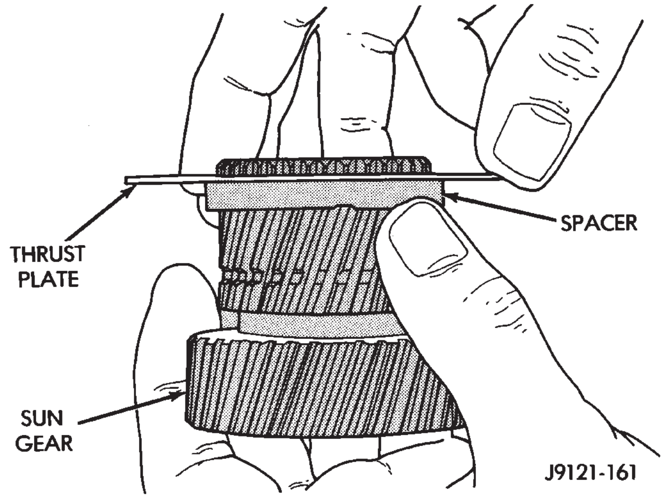


Fig. 180 Installing Driving Shell Front Thrust Plate On Sun Gear

(11) 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. 183).

(12) Install assembled driving shell and sun gear on output shaft (Fig. 184).

(13) Install rear thrust washer on front planetary gear (Fig. 185). Use enough petroleum jelly to hold washer in place and be sure all four washer tabs are seated.

(14) Install front planetary gear on output shaft and in driving shell (Fig. 186).

(15) Install front thrust washer on front planetary gear. Use enough petroleum jelly to hold washer in place and be sure all four washer tabs are seated.

(16) Assemble front annulus gear and support, if necessary. Be sure support snap ring is seated.

(17) Install front annulus on front planetary (Fig. 186).

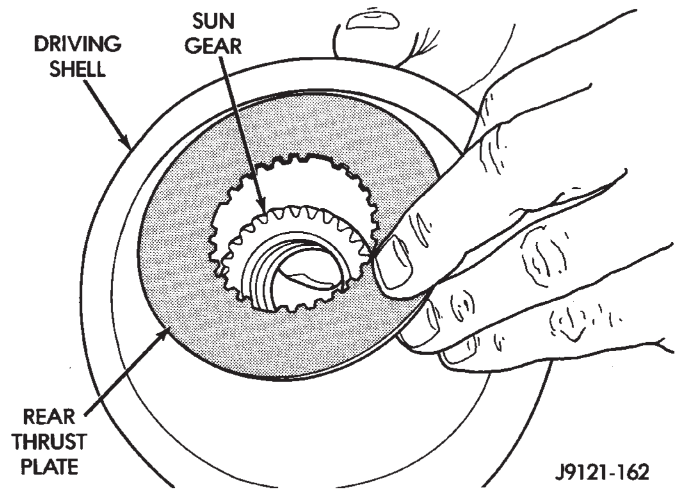


Fig. 181 Installing Driving Shell Rear Thrust Plate

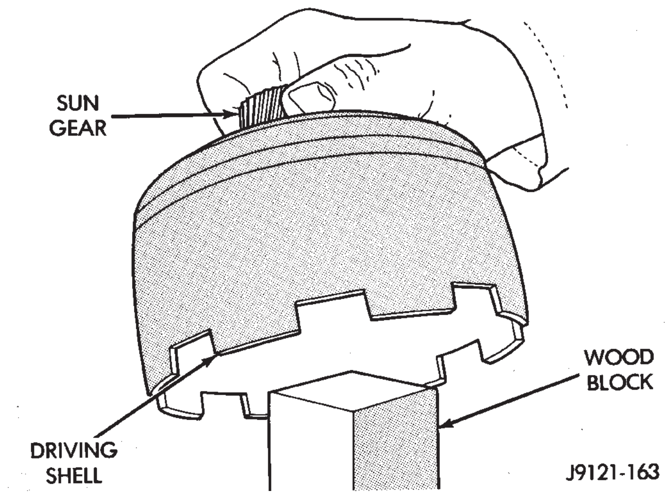


Fig. 182 Supporting Sun Gear On Wood Block

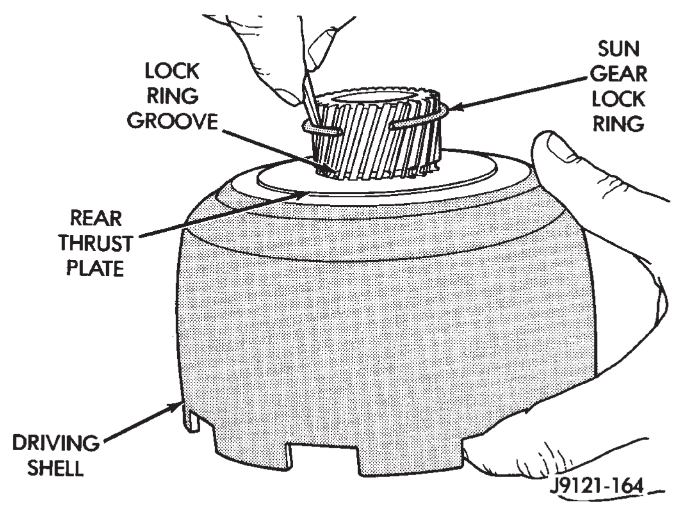


Fig. 183 Installing Sun Gear Lock Ring

(18) Position thrust plate on front annulus gear support (Fig. 187). **Note that plate has two tabs on it. These tabs fit in notches of annulus hub.**

DISASSEMBLY AND ASSEMBLY (Continued)

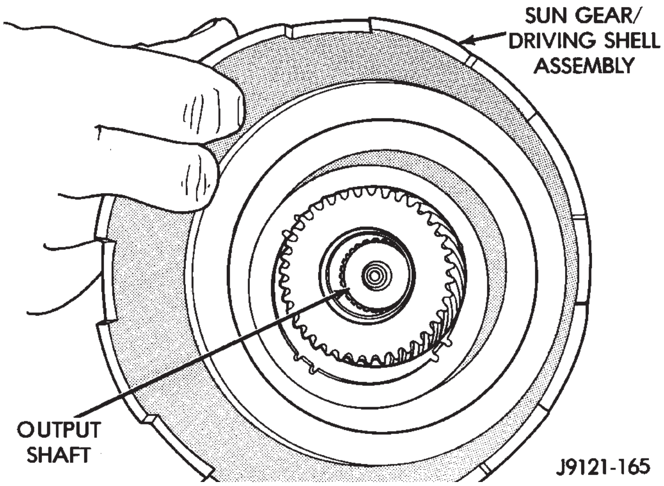


Fig. 184 Installing Assembled Sun Gear And Driving Shell On Output Shaft

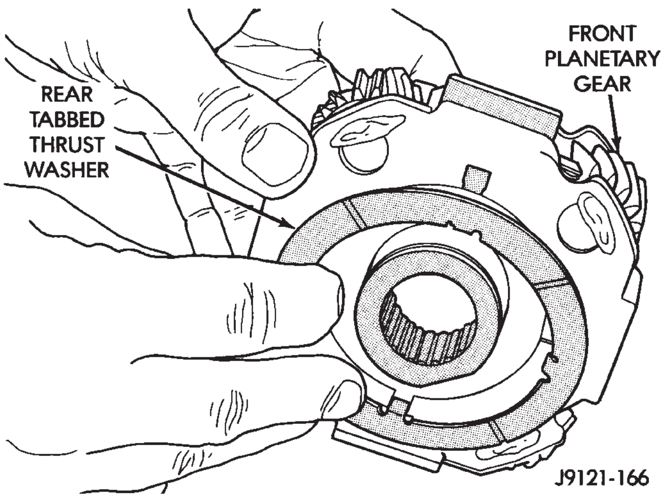


Fig. 185 Installing Rear Thrust Washer On Front Planetary Gear

(19) Install thrust washer in front annulus (Fig. 188). **Align flat on washer with flat on planetary hub. Also be sure washer tab is facing up.**

(20) Install front annulus snap ring (Fig. 189). Use snap ring pliers to avoid distorting ring during installation. Also be sure ring is fully seated.

(21) Install planetary selective snap ring with snap ring pliers (Fig. 190). Be sure ring is fully seated.

(22) 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 allows geartrain components to move forward for accurate end play check.

(23) Check planetary geartrain end play with feeler gauge (Fig. 191). Gauge goes between shoulder on output shaft and end of rear annulus support.

(24) 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.

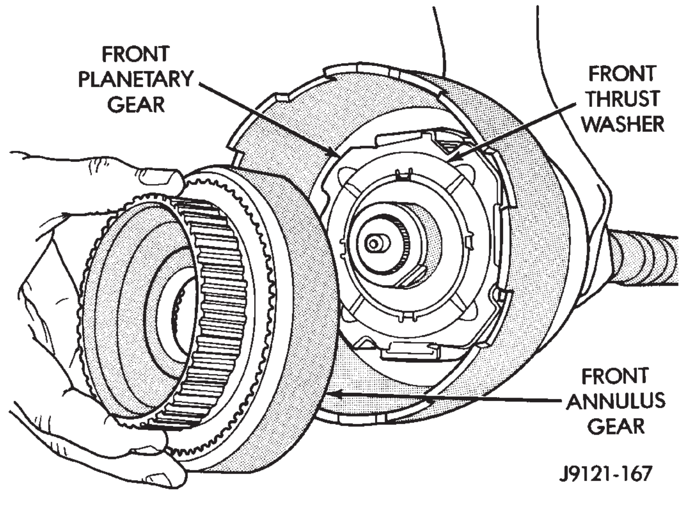


Fig. 186 Installing Front Planetary And Annulus Gears

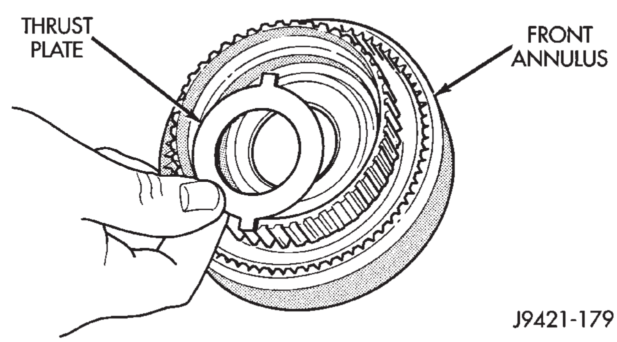


Fig. 187 Positioning Thrust Plate On Front Annulus Support

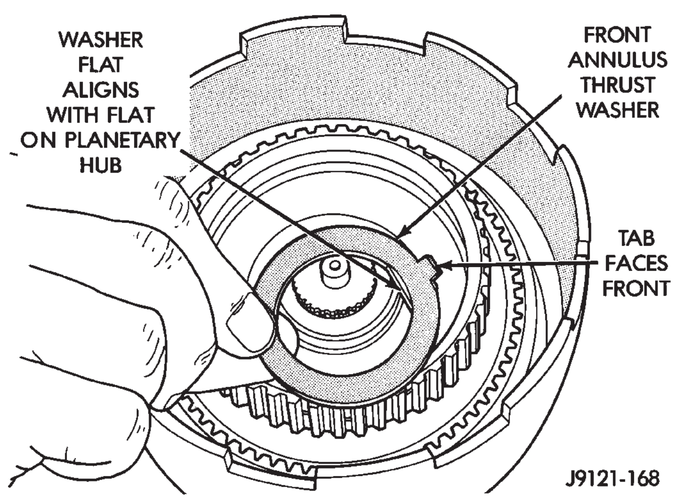


Fig. 188 Installing Front Annulus Thrust Washer

DISASSEMBLY AND ASSEMBLY (Continued)

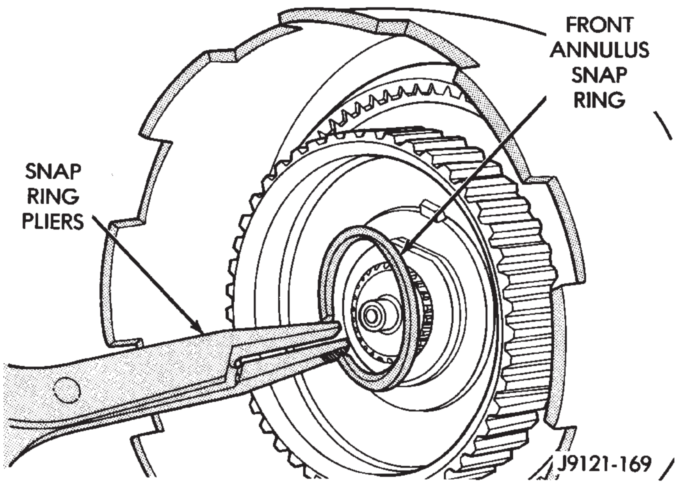


Fig. 189 Installing Front Annulus Snap Ring

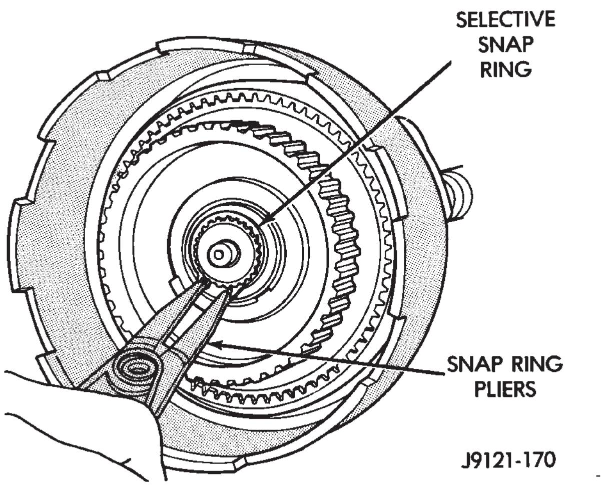


Fig. 190 Installing Planetary Selective Snap Ring

OVERDRIVE UNIT

DISASSEMBLY

(1) Remove transmission speed sensor and O-ring seal from overdrive case (Fig. 192).

(2) Remove overdrive piston thrust bearing (Fig. 193).

OVERDRIVE PISTON DISASSEMBLY

(1) Remove overdrive piston thrust plate (Fig. 194). Retain thrust plate. It is a select fit part and may possibly be reused.

(2) Remove intermediate shaft spacer (Fig. 195). Retain spacer. It is a select fit part and may possibly be reused.

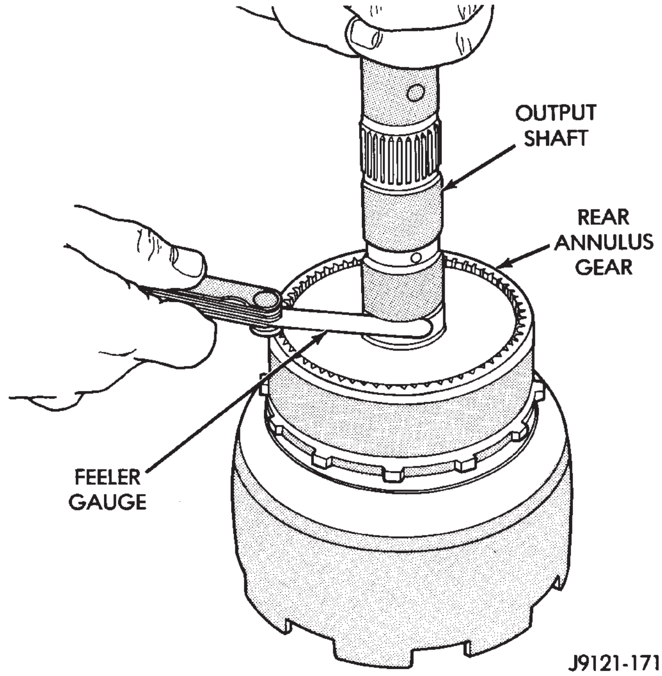


Fig. 191 Checking Planetary Geartrain End Play

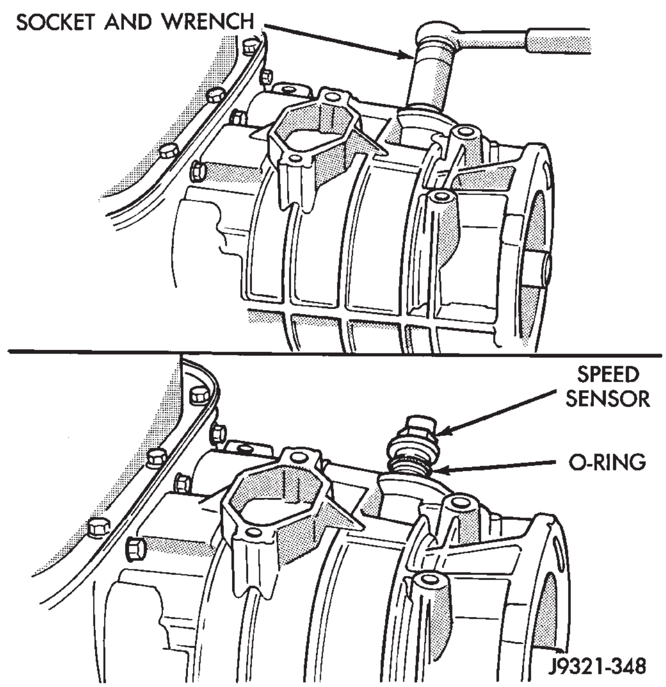


Fig. 192 Transmission Speed Sensor Removal/ Installation

DISASSEMBLY AND ASSEMBLY (Continued)

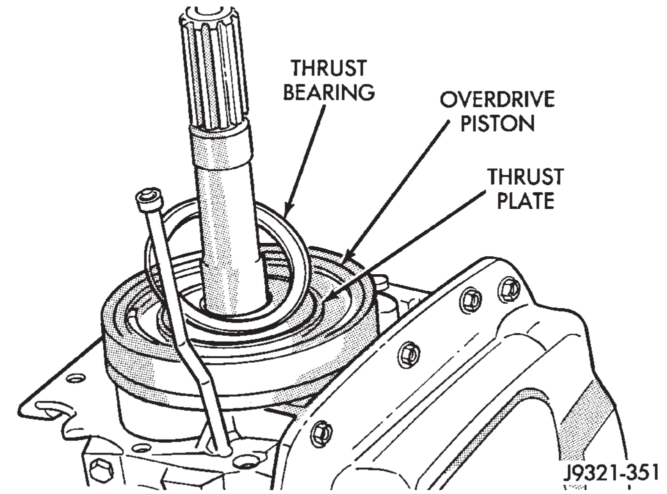


Fig. 193 Overdrive Piston Thrust Bearing Removal/ Installation

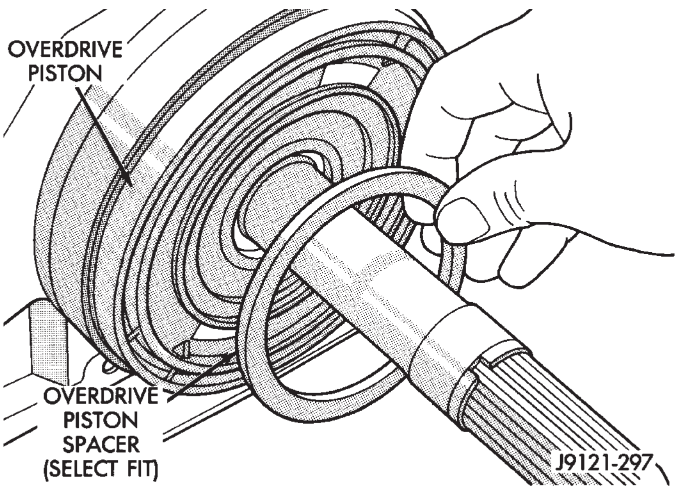


Fig. 194 Overdrive Piston Thrust Plate Removal/ Installation

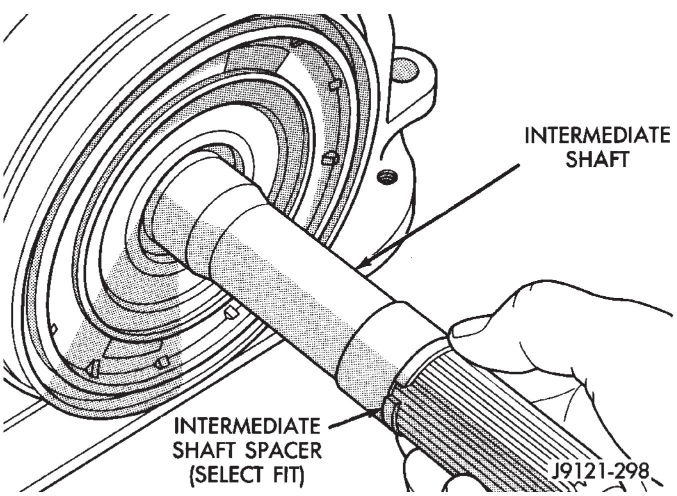


Fig. 195 Intermediate Shaft Spacer Location

(3) Remove overdrive piston from retainer (Fig. 196).

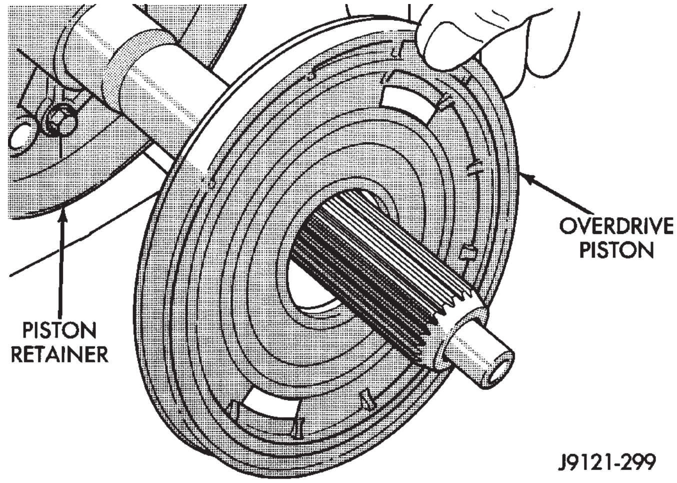


Fig. 196 Overdrive Piston Removal

OVERDRIVE CLUTCH PACK DISASSEMBLY

(1) Remove overdrive clutch pack wire retaining ring (Fig. 197).

(2) Remove overdrive clutch pack (Fig. 198).

NOTE: The 42RE transmission has three clutch discs and two clutch plates.

(3) Note position of clutch pack components for assembly reference (Fig. 199).

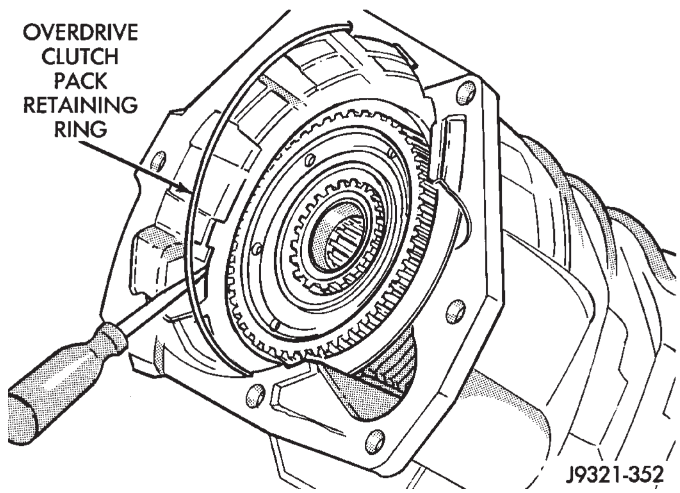


Fig. 197 Removing Overdrive Clutch Pack Retaining Ring

OVERDRIVE GEARTRAIN DISASSEMBLY

(1) Remove overdrive clutch wave spring (Fig. 200).

(2) Remove overdrive clutch reaction snap ring (Fig. 201). Note that snap ring is located in same groove as wave spring.

(3) Remove Torx head screws that attach access cover and gasket to overdrive case (Fig. 202).

(4) Remove access cover and gasket (Fig. 203).

DISASSEMBLY AND ASSEMBLY (Continued)

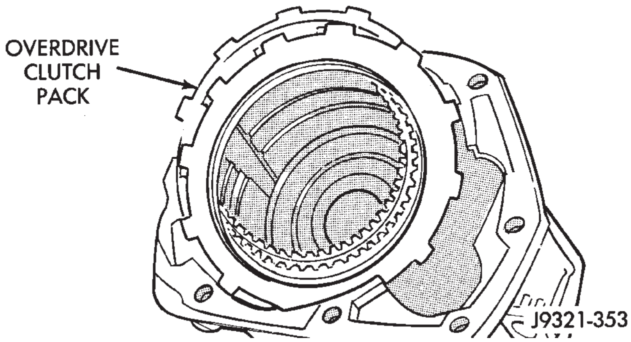


Fig. 198 Overdrive Clutch Pack Removal

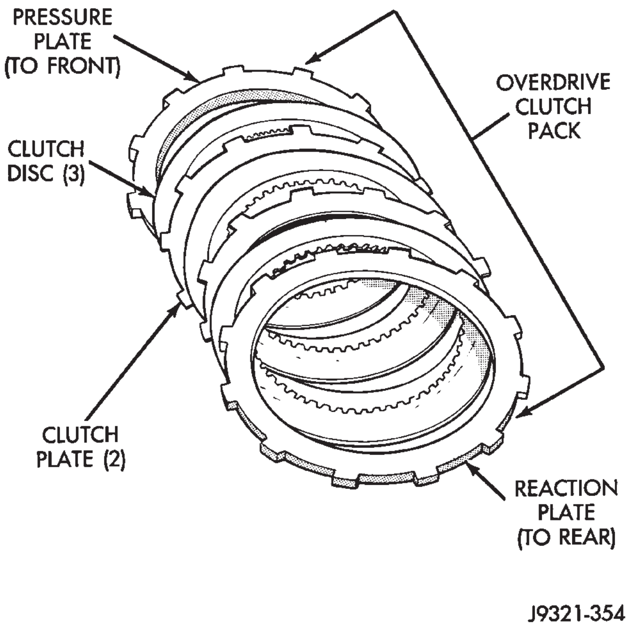


Fig. 199 42RE Overdrive Clutch Component Position

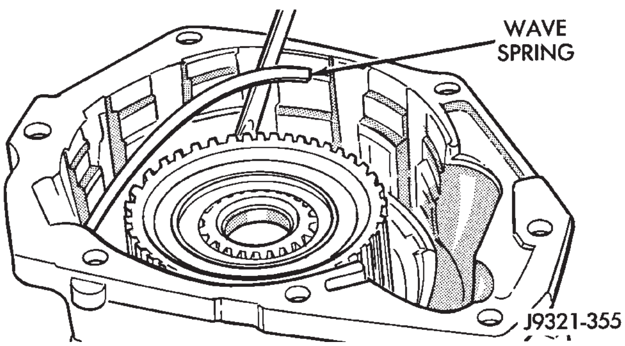


Fig. 200 Overdrive Clutch Wave Spring Removal/ Installation

(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. 204).

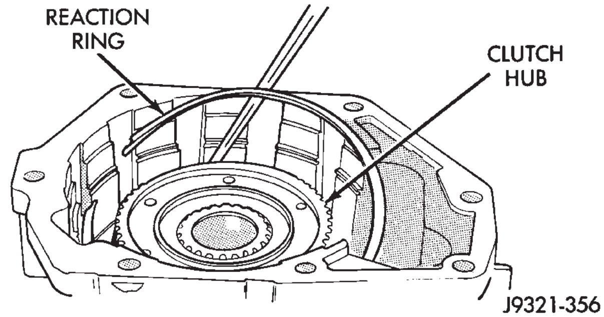


Fig. 201 Overdrive Clutch Reaction Snap Ring Removal/Installation

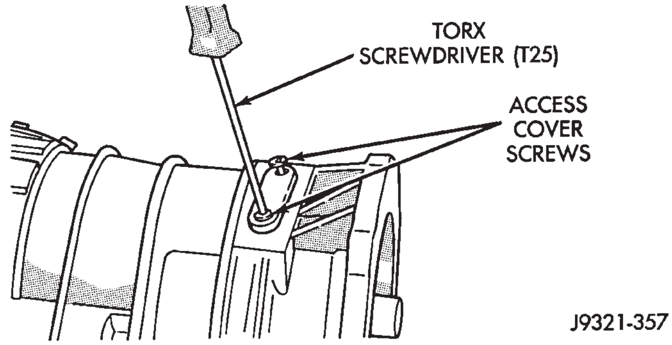


Fig. 202 Access Cover Screw Removal/Installation

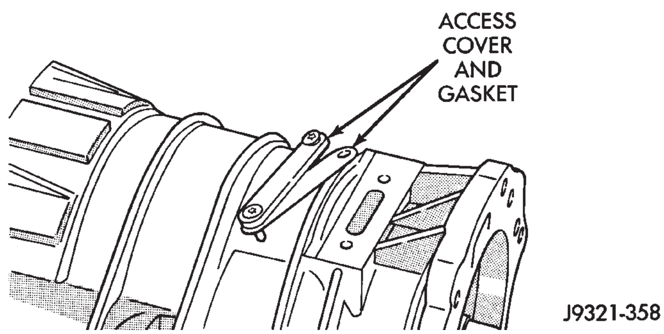


Fig. 203 Access Cover And Gasket Removal/ Installation

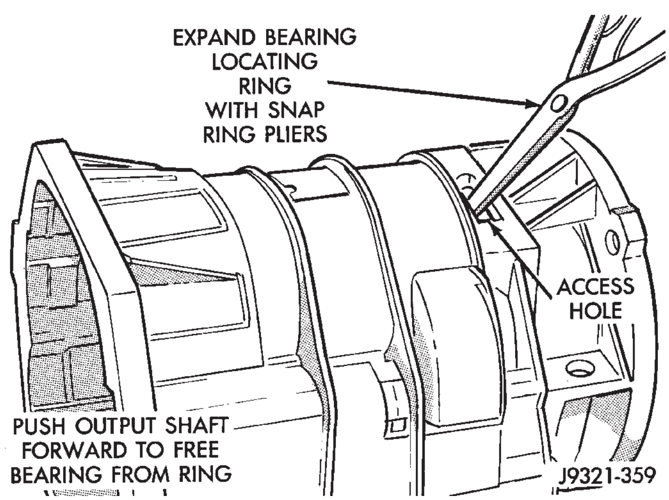


Fig. 204 Releasing Bearing From Locating Ring

DISASSEMBLY AND ASSEMBLY (Continued)

(6) Lift gear case up and off geartrain assembly (Fig. 205).

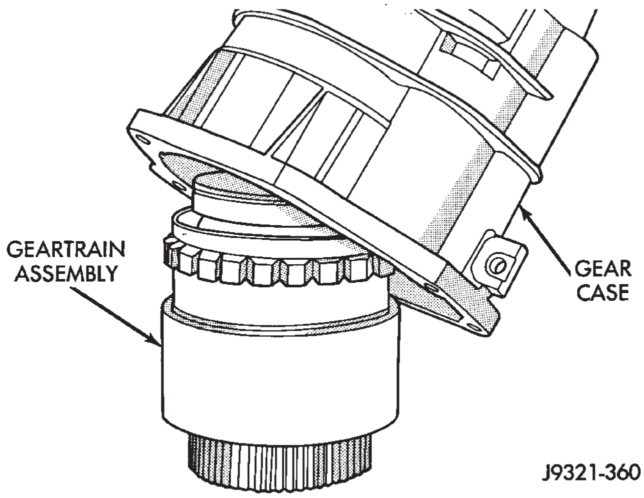


Fig. 205 Removing Gear Case From Geartrain Assembly

(7) Remove snap ring that retains rear bearing on output shaft.

(8) Remove rear bearing from output shaft (Fig. 206).

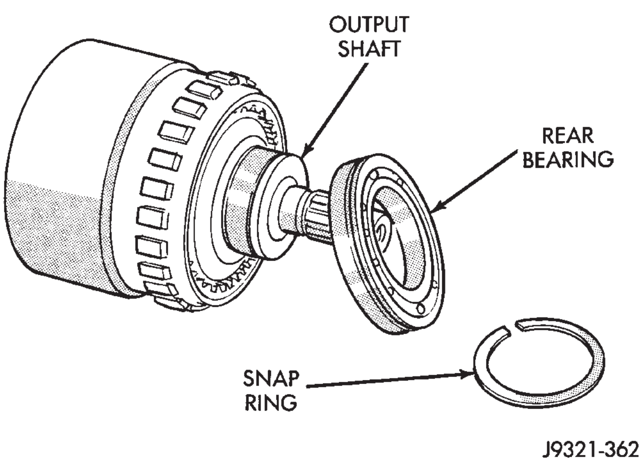


Fig. 206 Rear Bearing Removal

DIRECT CLUTCH, HUB AND SPRING DISASSEMBLY

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.

(1) Mount geartrain assembly in shop press (Fig. 207).

(2) Position Compressor Tool 6227-1 on clutch hub (Fig. 207). Support output shaft flange with steel press plates as shown and center assembly under press ram.

(3) 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. 207).

(4) Remove direct clutch pack snap ring (Fig. 208).

(5) Remove direct clutch hub retaining ring (Fig. 209).

(6) Release press load slowly and completely (Fig. 210).

(7) Remove Special Tool 6227-1. Then remove clutch pack from hub (Fig. 210).

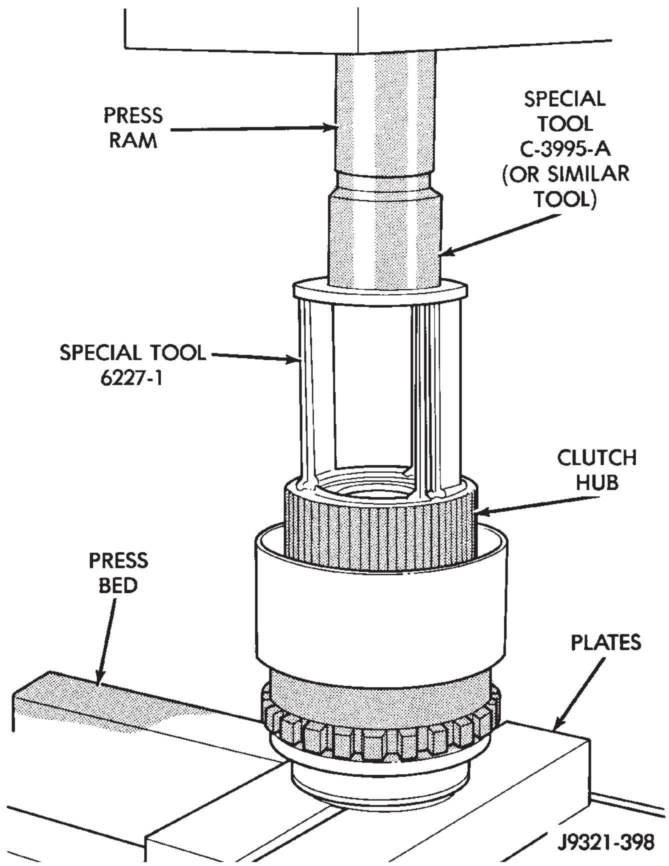


Fig. 207 Geartrain Mounted In Shop Press

Geartrain Disassembly

(1) Remove direct clutch hub and spring (Fig. 211).

(2) Remove sun gear and spring plate. Then remove planetary thrust bearing and planetary gear (Fig. 212).

(3) Remove overrunning clutch assembly with expanding type snap ring pliers (Fig. 213). Insert pliers into clutch hub. Expand pliers to grip hub splines and remove clutch with counterclockwise, twisting motion.

DISASSEMBLY AND ASSEMBLY (Continued)

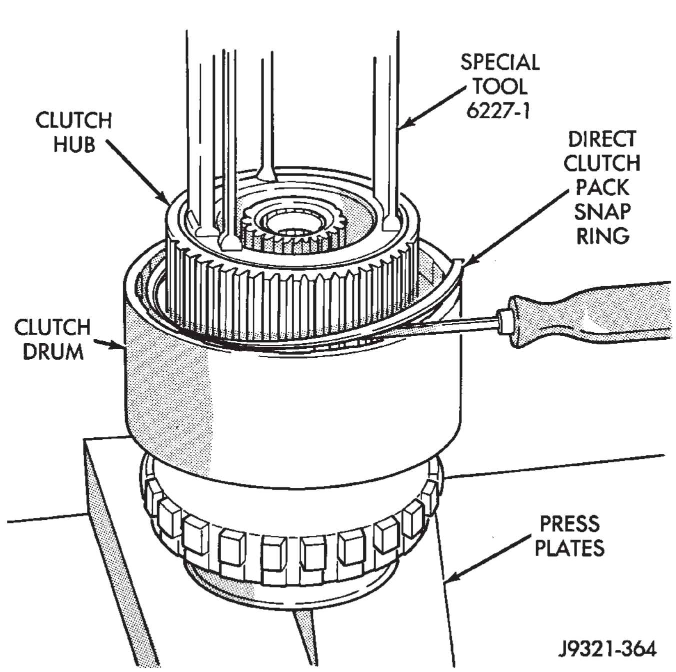


Fig. 208 Direct Clutch Pack Snap Ring Removal

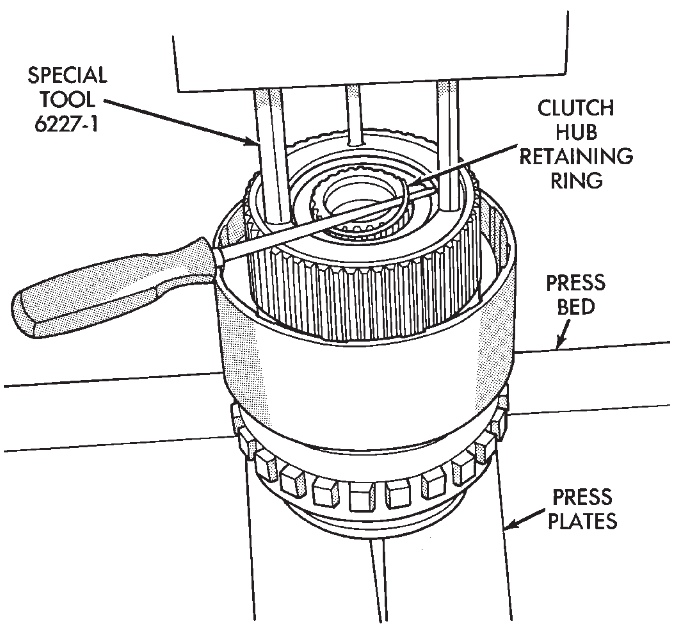


Fig. 209 Direct Clutch Hub Retaining Ring Removal

(4) Remove thrust bearing from overrunning clutch hub.

(5) Remove overrunning clutch from hub.

(6) Mark position of annulus gear and direct clutch drum for assembly alignment reference (Fig. 214). Use small center punch or scriber to make alignment marks.

(7) Remove direct clutch drum rear retaining ring (Fig. 215).

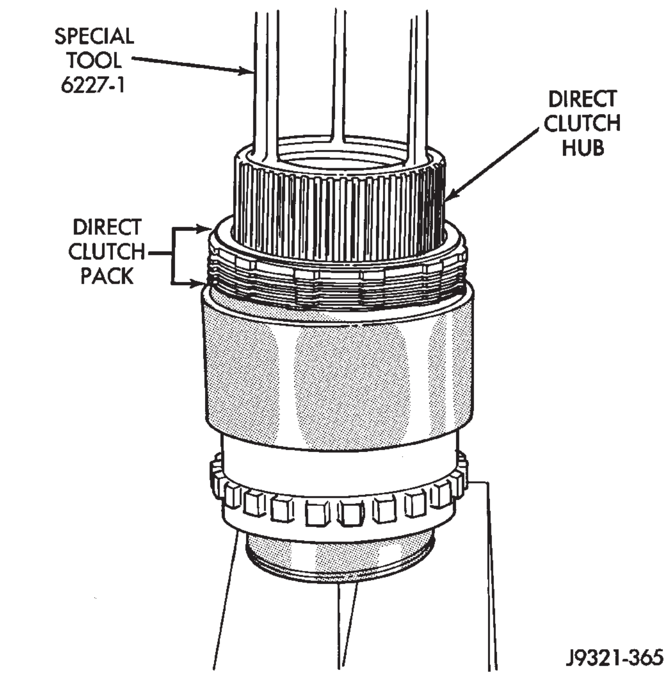


Fig. 210 Direct Clutch Pack Removal

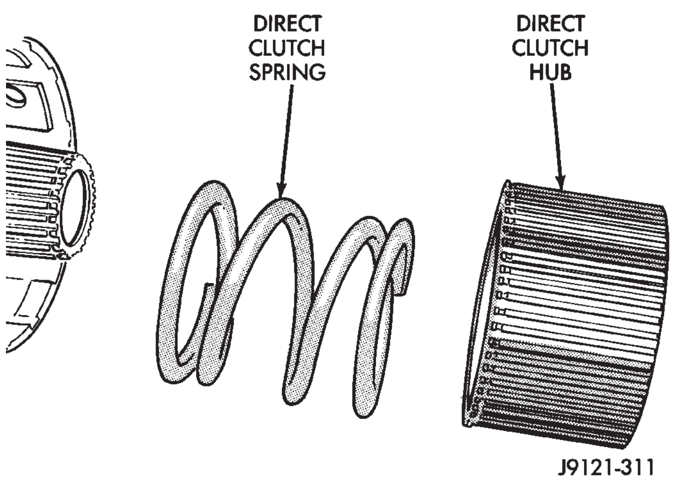


Fig. 211 Direct Clutch Hub And Spring Removal

(8) Remove direct clutch drum outer retaining ring (Fig. 216).

(9) Mark annulus gear and output shaft for assembly alignment reference (Fig. 217). Use punch or scriber to mark gear and shaft.

(10) Remove snap ring that secures annulus gear on output shaft (Fig. 218). Use two screwdrivers to unseat and work snap ring out of groove as shown.

(11) Remove annulus gear from output shaft (Fig. 219). 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.

DISASSEMBLY AND ASSEMBLY (Continued)

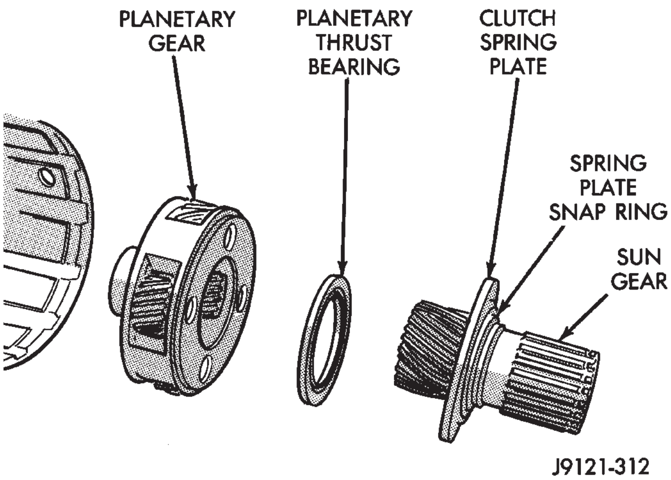


Fig. 212 Removing Sun Gear, Thrust Bearing And Planetary Gear

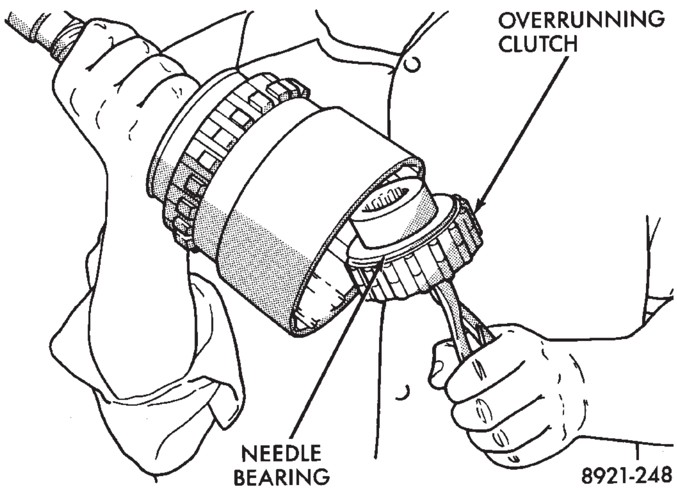


Fig. 213 Overrunning Clutch Assembly Removal/ Installation

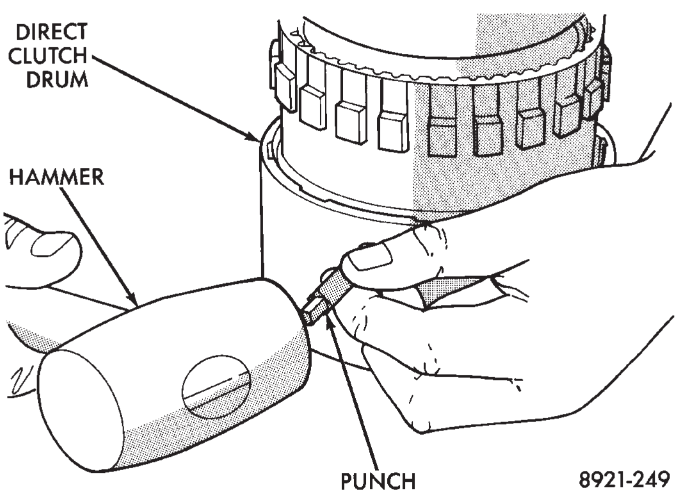


Fig. 214 Marking Direct Clutch Drum And Annulus Gear For Assembly Alignment

(3) Remove reaction plug snap ring and remove reaction plug.

(4) Remove output shaft seal.

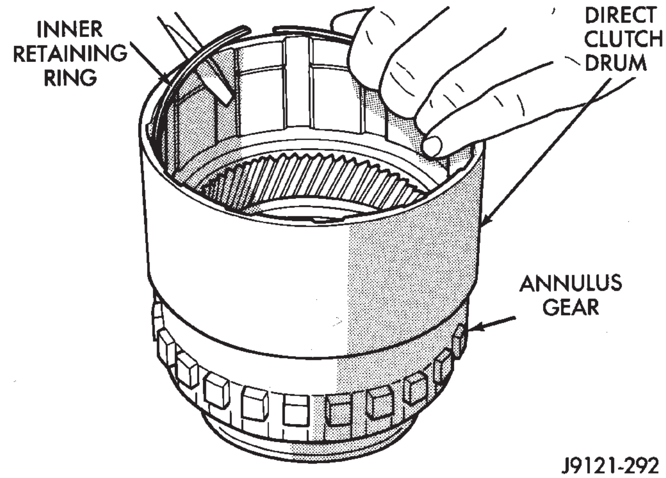


Fig. 215 Clutch Drum Inner Retaining Ring Removal

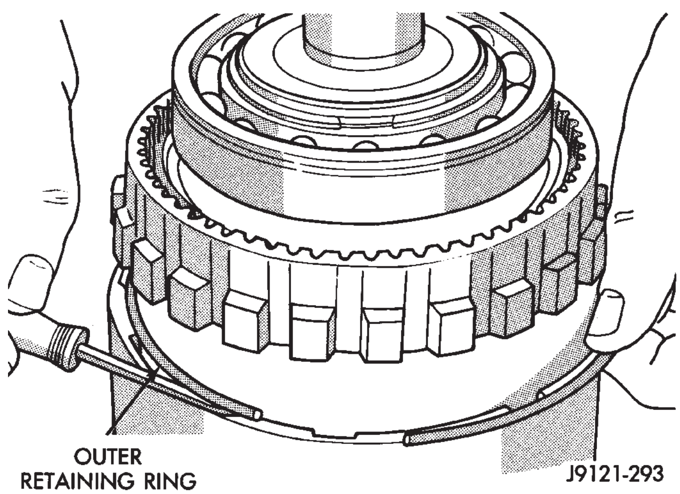


Fig. 216 Clutch Drum Outer Retaining Ring Removal

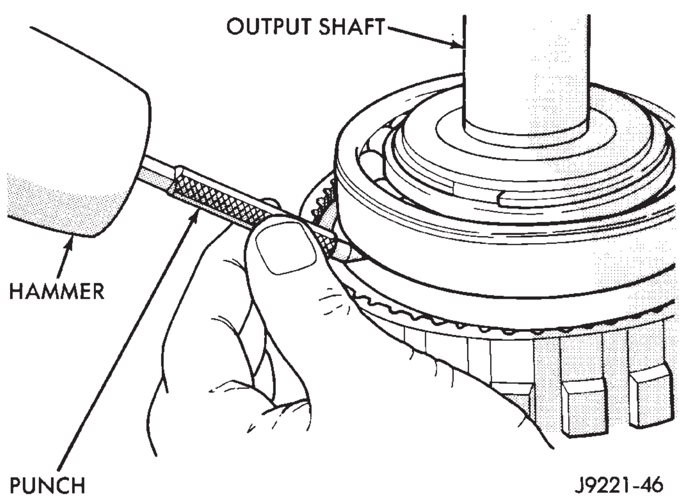


Fig. 217 Marking Annulus Gear And Output Shaft For Assembly Alignment

DISASSEMBLY AND ASSEMBLY (Continued)

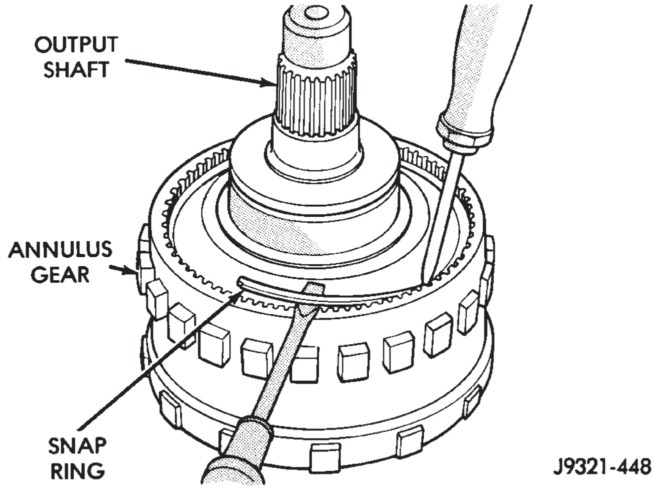


Fig. 218 Annulus Gear Snap Ring Removal

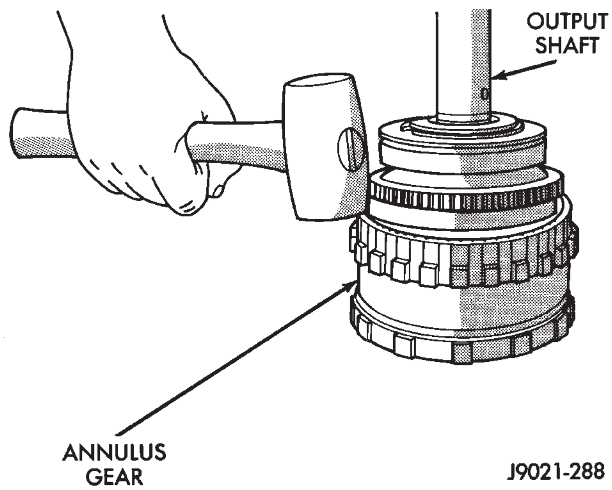


Fig. 219 Annulus Gear Removal

ASSEMBLY

GEARTRAIN AND DIRECT CLUTCH ASSEMBLY

(1) Soak direct clutch and overdrive clutch discs in Mopar® ATF Plus 3, type 7176, 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. 220). Lubricate bushings with petroleum jelly, or transmission fluid.

(3) Install annulus gear on output shaft, if removed. Then install annulus gear retaining snap ring (Fig. 221).

(4) Align and install clutch drum on annulus gear (Fig. 222). Be sure drum is engaged in annulus gear lugs.

(5) Install clutch drum outer retaining ring (Fig. 222).

(6) Slide clutch drum forward and install inner retaining ring (Fig. 223).

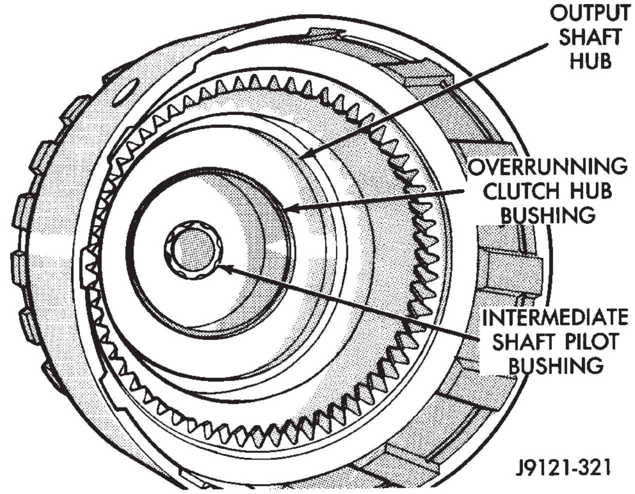


Fig. 220 Output Shaft Pilot Bushing

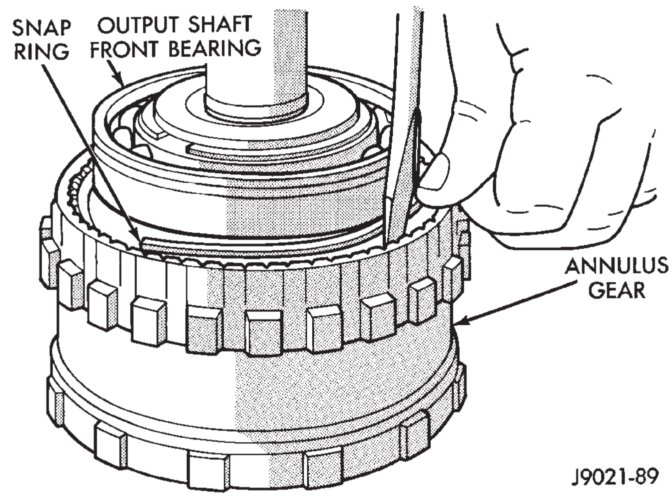


Fig. 221 Annulus Gear Installation

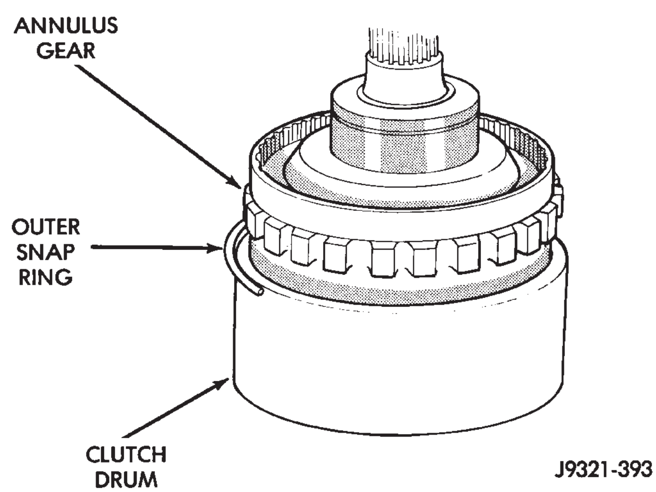


Fig. 222 Clutch Drum And Outer Retaining Ring Installation

DISASSEMBLY AND ASSEMBLY (Continued)

(7) Install rear bearing and snap ring on output shaft (Fig. 224). Be sure locating ring groove in bearing is toward rear.

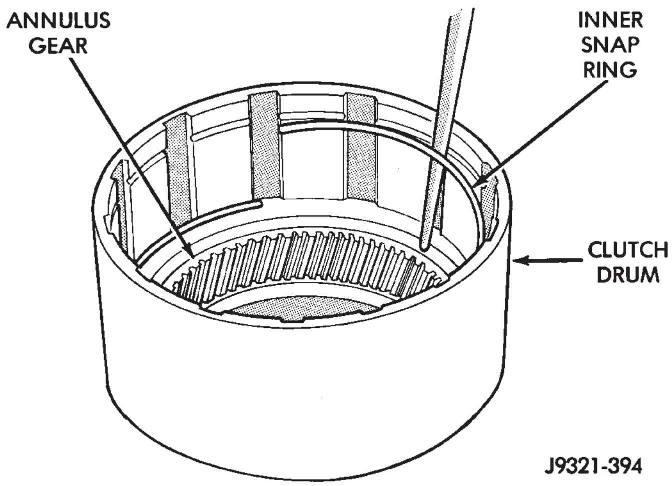


Fig. 223 Clutch Drum Inner Retaining Ring Installation

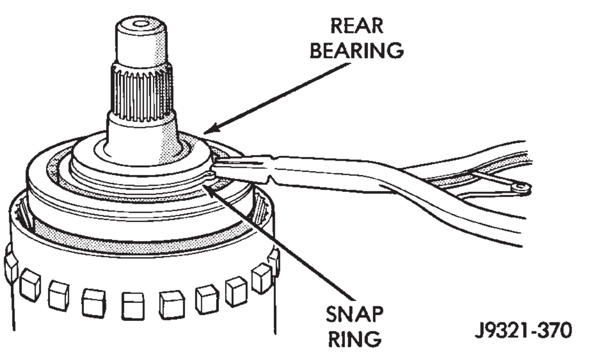


Fig. 224 Rear Bearing And Snap Ring Installation

(8) Install overrunning clutch on hub (Fig. 225). **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. 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.**

(10) Install overrunning clutch in output shaft (Fig. 226). 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. 227). **Be sure planetary pinions are fully seated in annulus gear before proceeding.**

(12) 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.

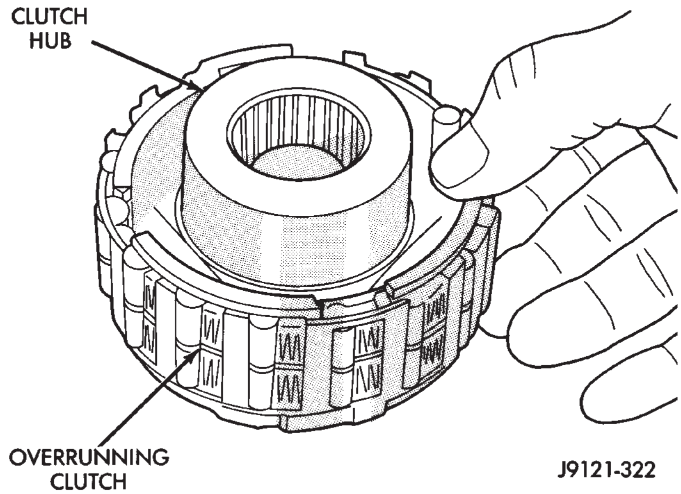


Fig. 225 Assembling Overrunning Clutch And Hub

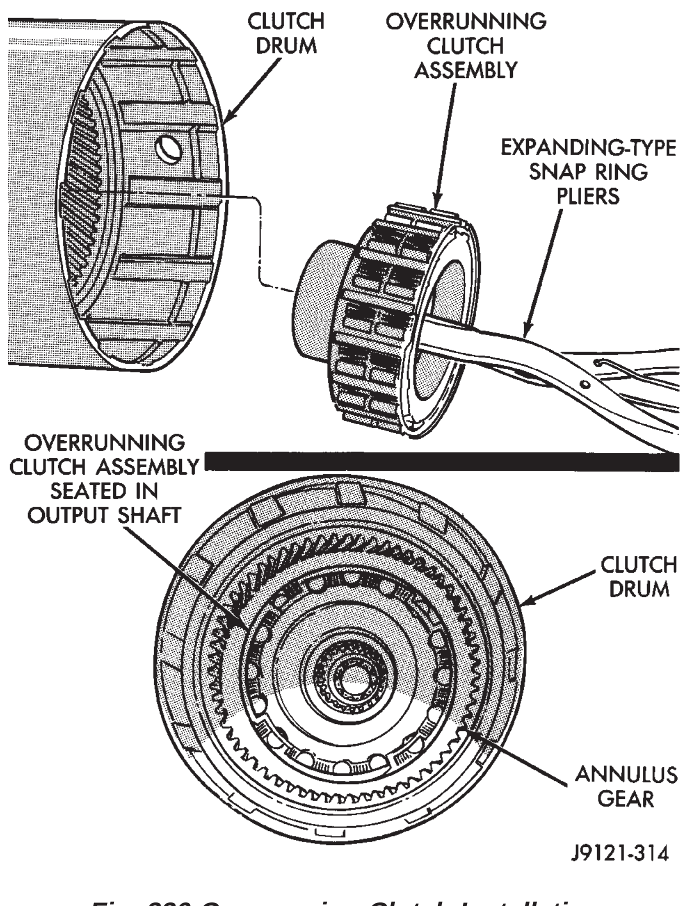


Fig. 226 Overrunning Clutch Installation

(13) Install planetary thrust bearing on sun gear (Fig. 228). 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.**

(14) Install assembled sun gear, spring plate and thrust bearing (Fig. 229). Be sure sun gear and thrust bearing are fully seated before proceeding.

DISASSEMBLY AND ASSEMBLY (Continued)

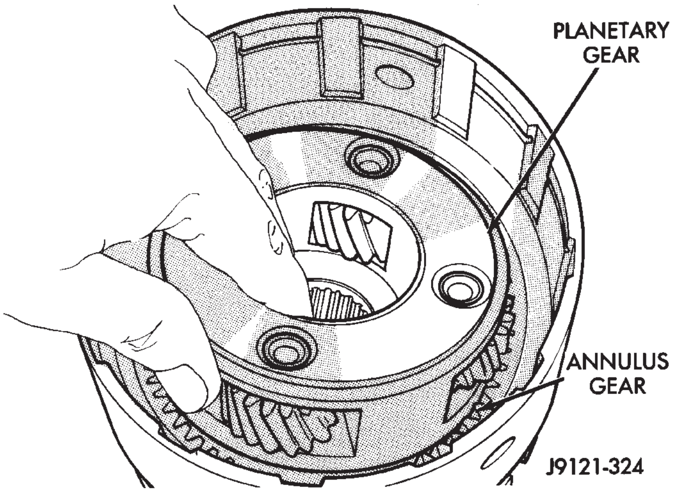


Fig. 227 Planetary Gear Installation

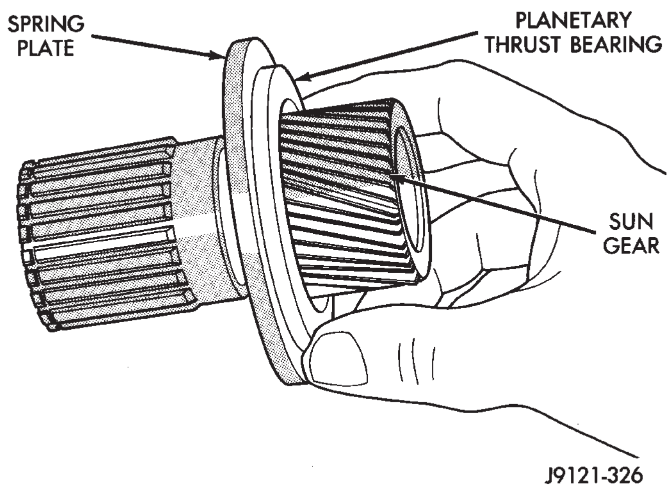


Fig. 228 Planetary Thrust Bearing Installation

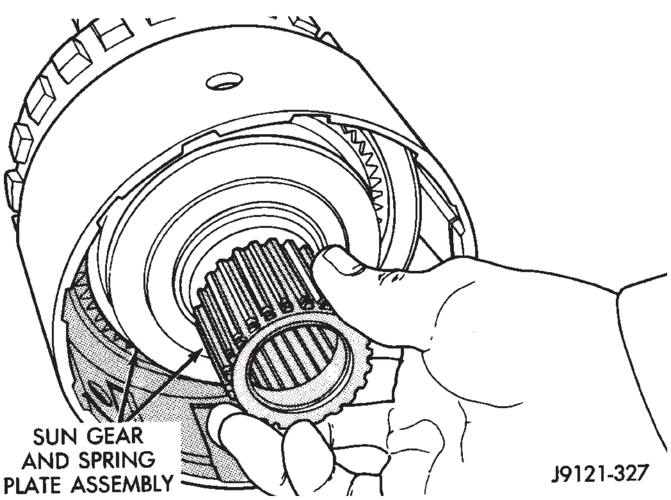


Fig. 229 Sun Gear Installation

(15) 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.

(16) Align splines in hubs of planetary gear and overrunning clutch with Alignment tool 6227-2 (Fig. 230). Insert tool through sun gear and into splines of both hubs. Be sure alignment tool is fully seated before proceeding.

(17) Install direct clutch spring (Fig. 231). Be sure spring is properly seated on spring plate.

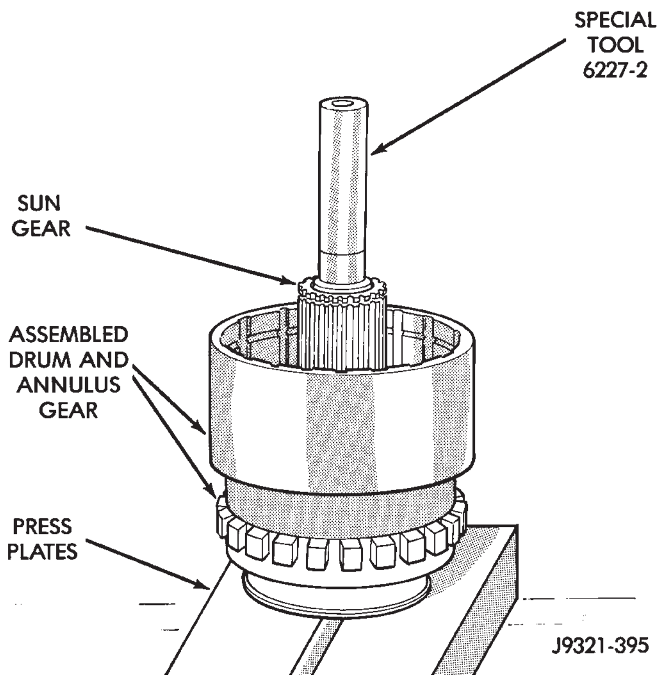


Fig. 230 Alignment Tool Installation

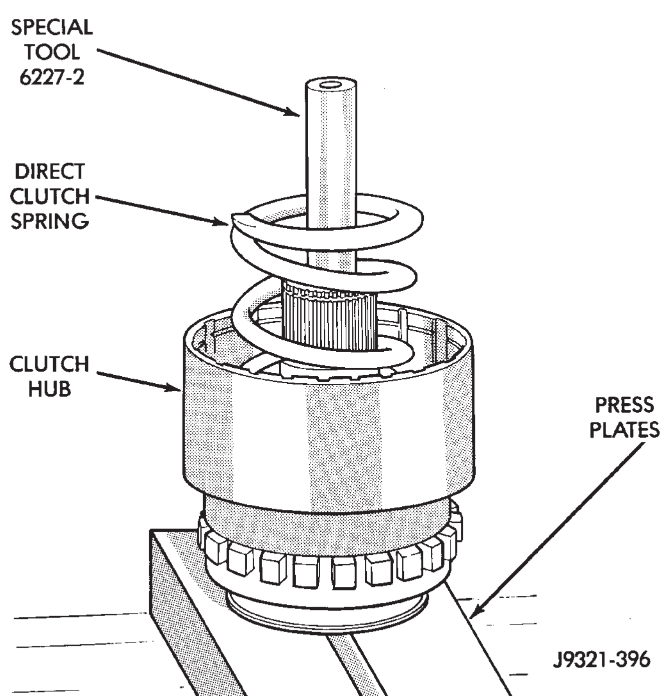


Fig. 231 Direct Clutch Spring Installation

NOTE: The 42RE transmission has 6 direct clutch discs and 5 clutch plates.

DISASSEMBLY AND ASSEMBLY (Continued)

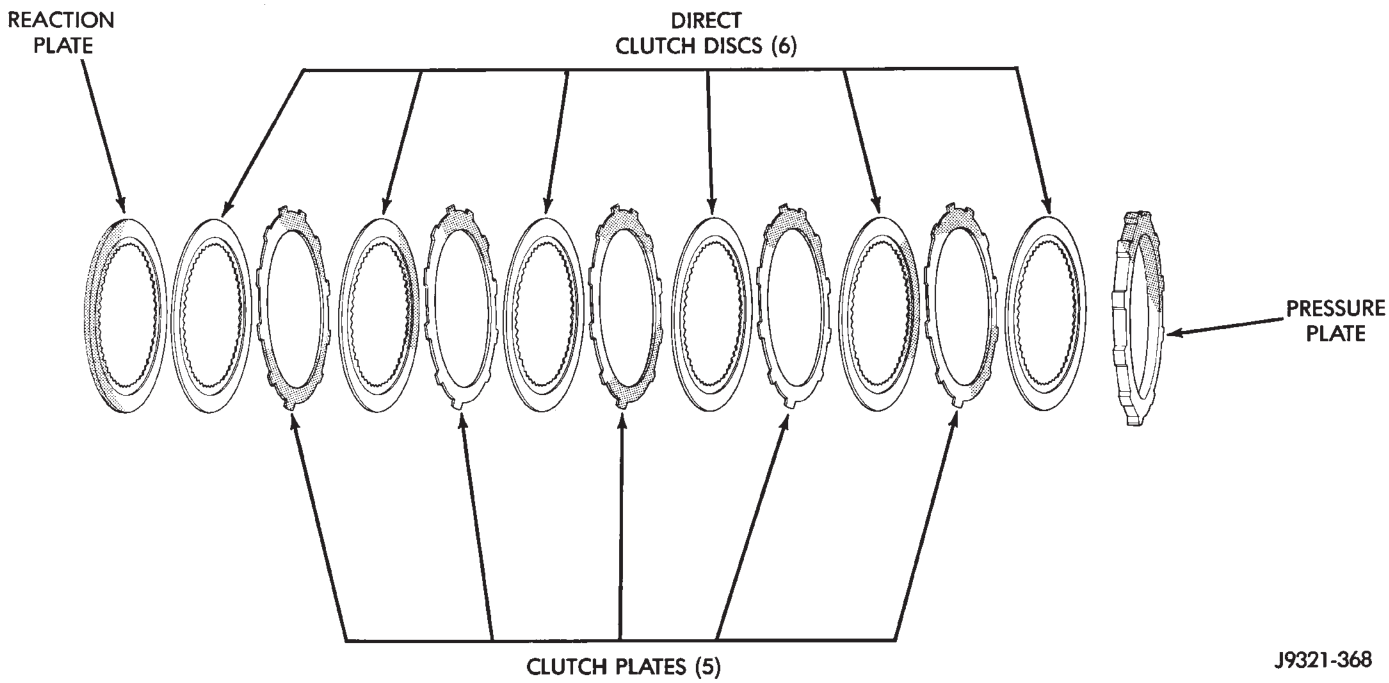


Fig. 232 42RE Direct Clutch Pack Components

(18) Assemble and install direct clutch pack on hub as follows:

(a) Assemble clutch pack components (Fig. 232).

(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. 233).**

(c) Install first clutch disc followed by a steel plate until all discs and 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. 234).**

(19) Install clutch hub and clutch pack on direct clutch spring (Fig. 235). **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.

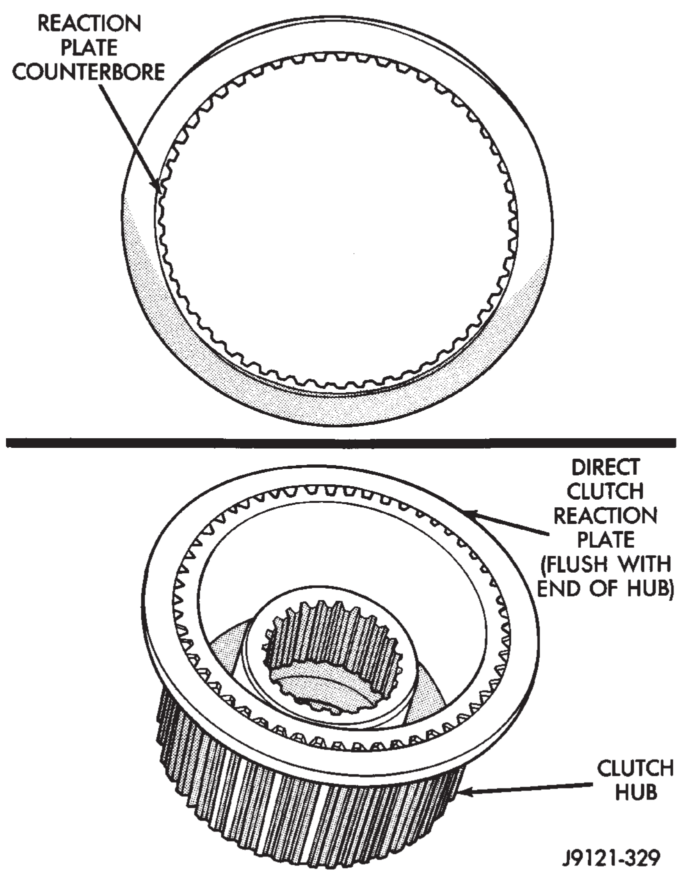


Fig. 233 Correct Position Of Direct Clutch Reaction Plate

(20) Position Compressor Tool 6227-1 on clutch hub.

DISASSEMBLY AND ASSEMBLY (Continued)

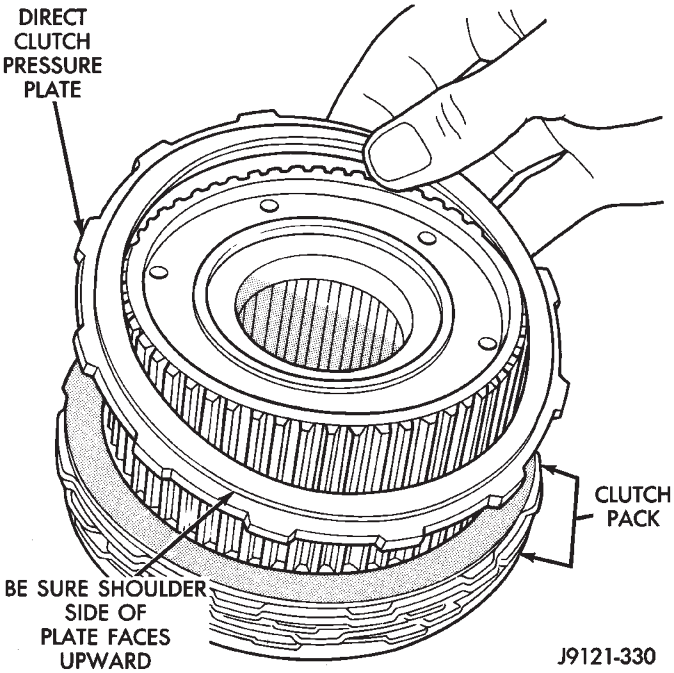


Fig. 234 Correct Position Of Direct Clutch Pressure Plate

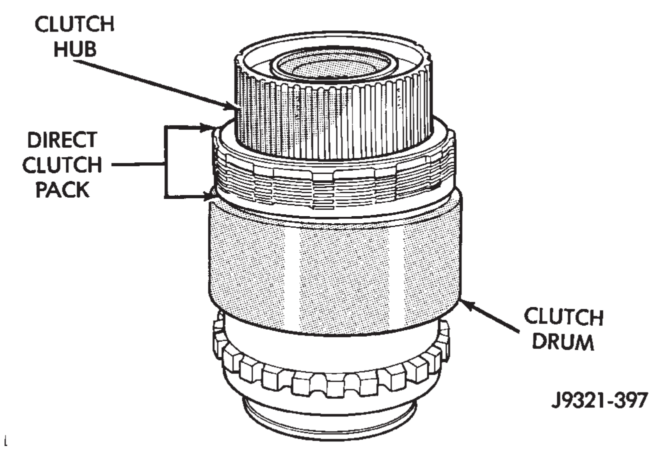


Fig. 235 Direct Clutch Pack And Clutch Hub Installation

(21) Compress clutch hub and spring just enough to place tension on hub and hold it in place.

(22) Slowly compress clutch hub and spring. Compress spring and hub only enough to expose ring grooves for clutch pack snap ring and clutch hub retaining ring.

(23) Realign clutch pack on hub and seat clutch discs and plates in clutch drum.

(24) Install direct clutch pack snap ring (Fig. 236). **Be very sure snap ring is fully seated in clutch drum ring groove.**

(25) Install clutch hub retaining ring (Fig. 237). **Be very sure retaining ring is fully seated in sun gear ring groove.**

(26) Slowly release press ram, remove compressor tools and remove geartrain assembly.

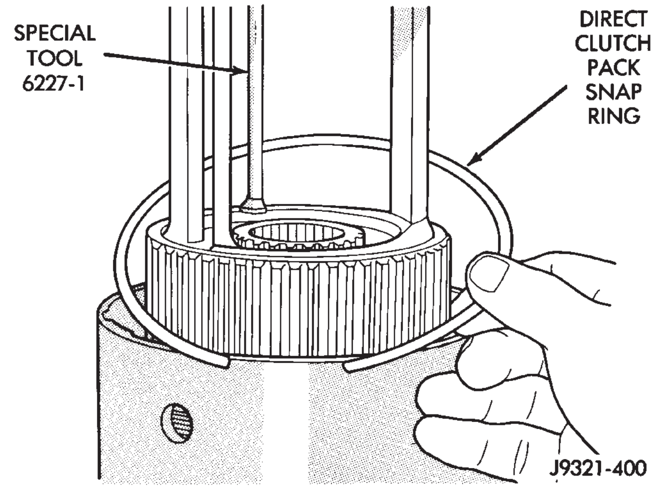


Fig. 236 Direct Clutch Pack Snap Ring Installation

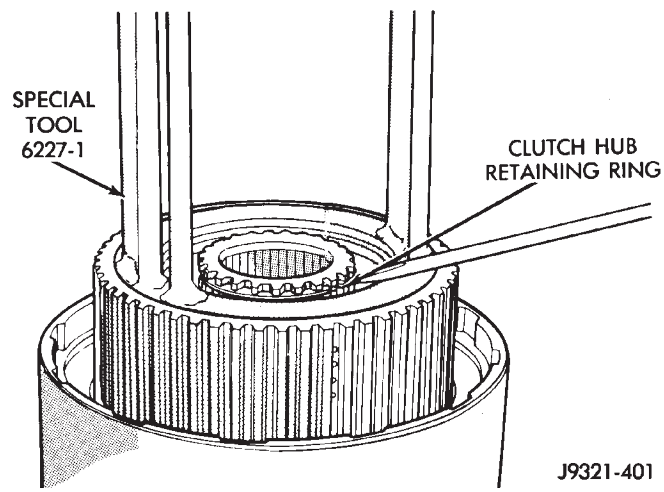


Fig. 237 Clutch Hub Retaining Ring Installation

GEAR CASE ASSEMBLY

(1) Position park pawl and spring in case and install park pawl shaft. Verify that end of spring with 90° bend is hooked to pawl and straight end of spring is seated against case.

(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. 238). Be sure pin is seated in hole in case before installing snap ring.**

(4) Install reaction plug snap-ring (Fig. 239). **Compress snap ring only enough for installation; do not distort it.**

(5) Install new seal in gear case. On 4x4 gear case, use Tool Handle C-4171 and Installer C-3860-A to

DISASSEMBLY AND ASSEMBLY (Continued)

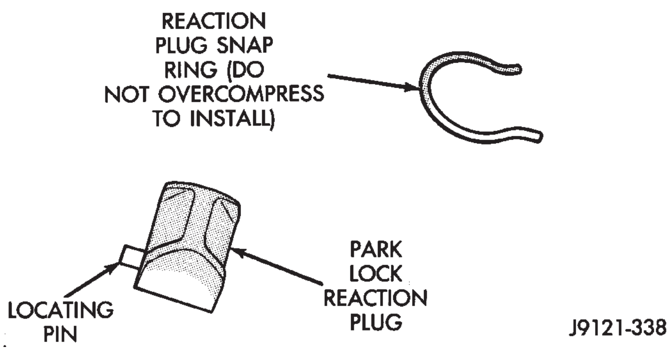


Fig. 238 Reaction Plug Locating Pin And Snap-Ring

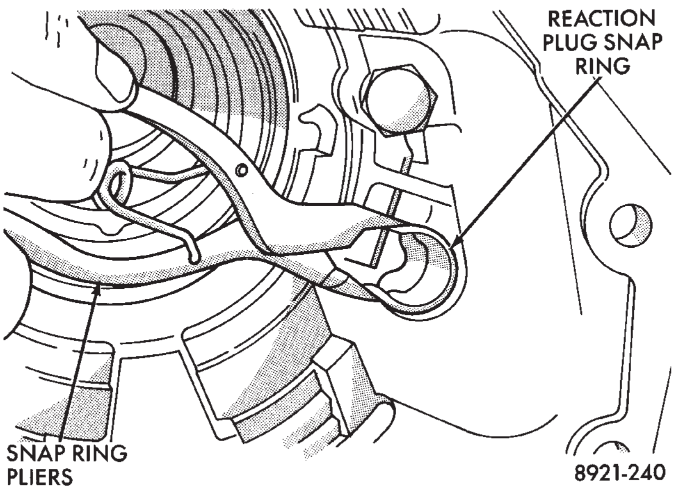


Fig. 239 Reaction Plug And Snap-Ring Installation

seat seal in case. On 4 x 2 gear case, use same Handle C-4171 and Installer C-3995-A to seat seal in case.

(6) Verify that tab ends of rear bearing locating ring extend into access hole in gear case (Fig. 240).

(7) Support geartrain on Tool 6227-1 (Fig. 241). Be sure tool is securely seated in clutch hub.

(8) Install overdrive gear case on geartrain (Fig. 241).

(9) Expand front bearing locating ring with snap ring pliers (Fig. 242). 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. 243).

OVERDRIVE CLUTCH ASSEMBLY

(1) Install overdrive clutch reaction ring first. Reaction ring is flat with notched ends (Fig. 244).

(2) Install wave spring on top of reaction ring (Fig. 245). **Reaction ring and wave ring both fit in same ring groove.** Use screwdriver to seat each ring securely in groove. Also ensure that the ends of the two rings are offset from each other.

NOTE: The 42RE transmission has 3 overdrive clutch discs and 2 plates.

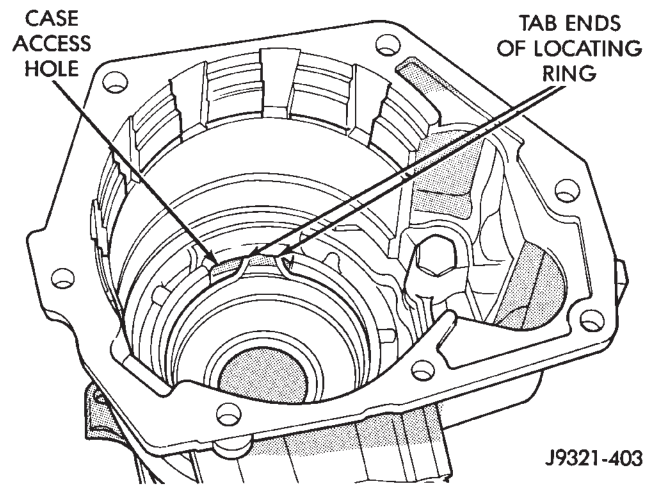


Fig. 240 Correct Rear Bearing Locating Ring Position

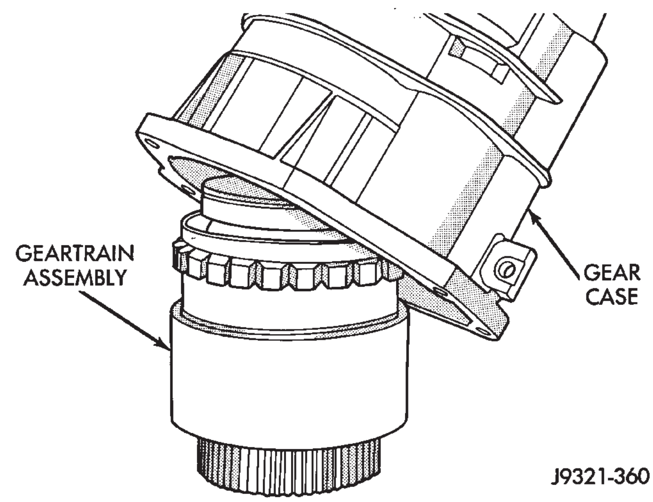


Fig. 241 Overdrive Gear Case Installation

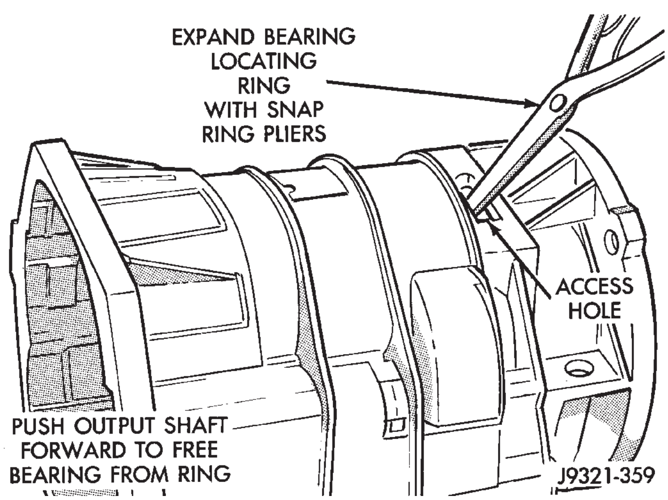


Fig. 242 Seating Locating Ring In Rear Bearing

(3) Assemble overdrive clutch pack (Fig. 246).

(4) Install overdrive clutch reaction plate first.

DISASSEMBLY AND ASSEMBLY (Continued)

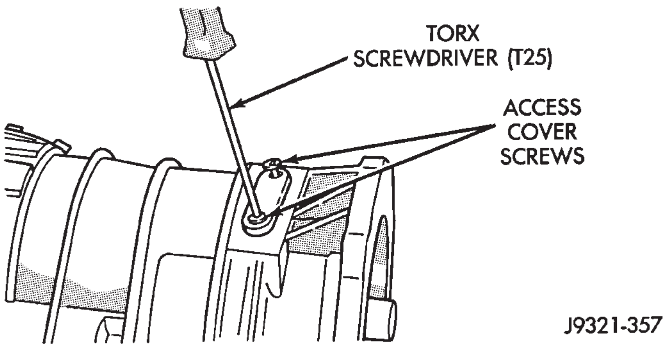


Fig. 243 Locating Ring Access Cover And Gasket Installation

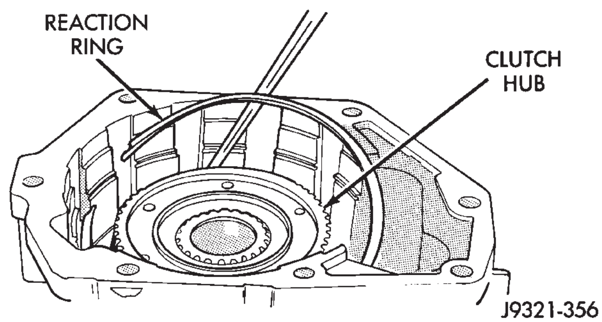


Fig. 244 Overdrive Clutch Reaction Ring Installation

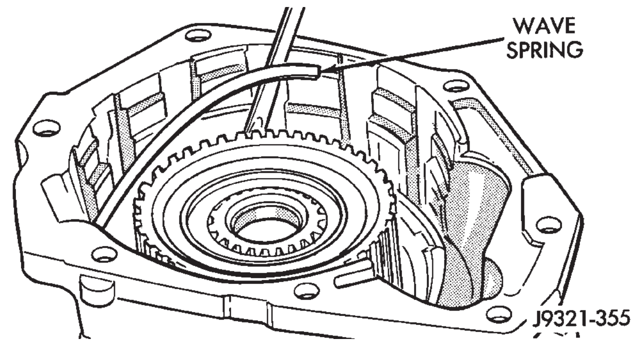


Fig. 245 Overdrive Clutch Wave Spring Installation

(5) Install first clutch disc followed by first clutch plate. Then install remaining clutch discs and plates in same order.

(6) Install clutch pack pressure plate.

(7) Install clutch pack wire-type retaining ring (Fig. 247).

INTERMEDIATE SHAFT SPACER SELECTION

(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.

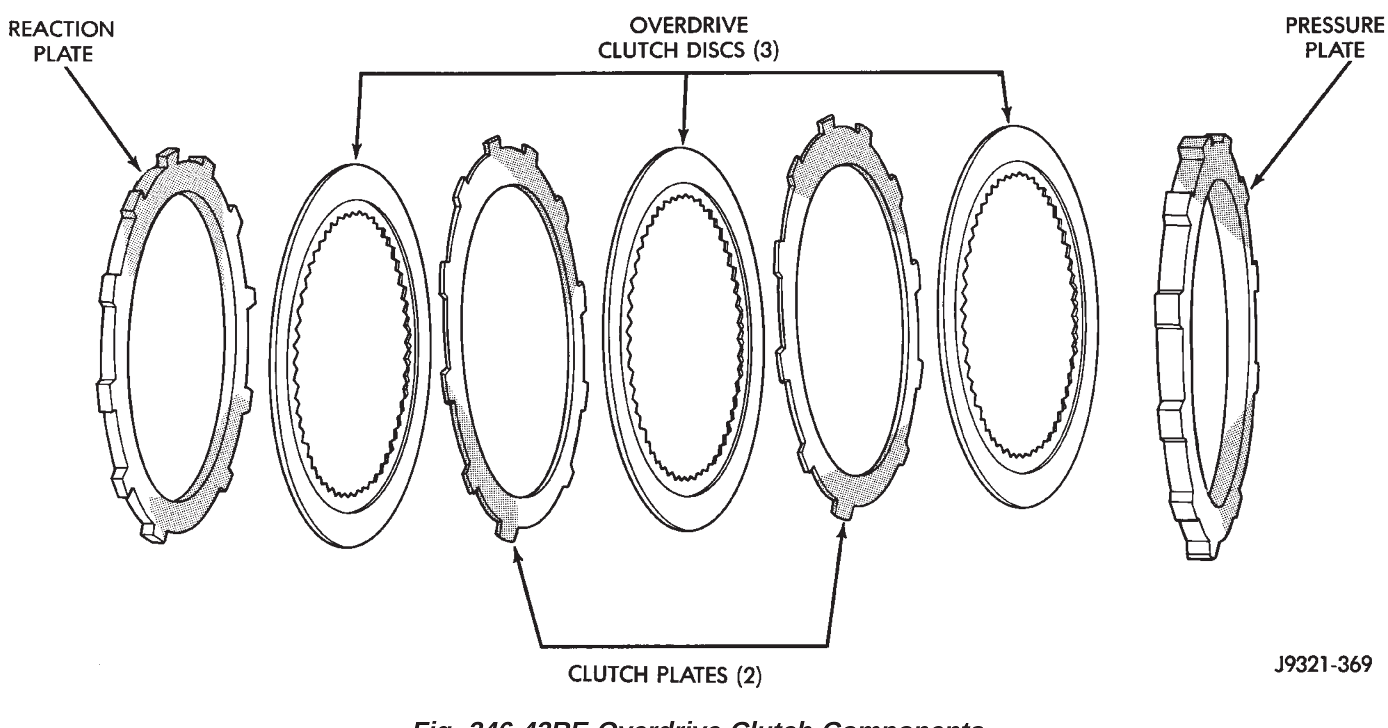


Fig. 246 42RE Overdrive Clutch Components

DISASSEMBLY AND ASSEMBLY (Continued)

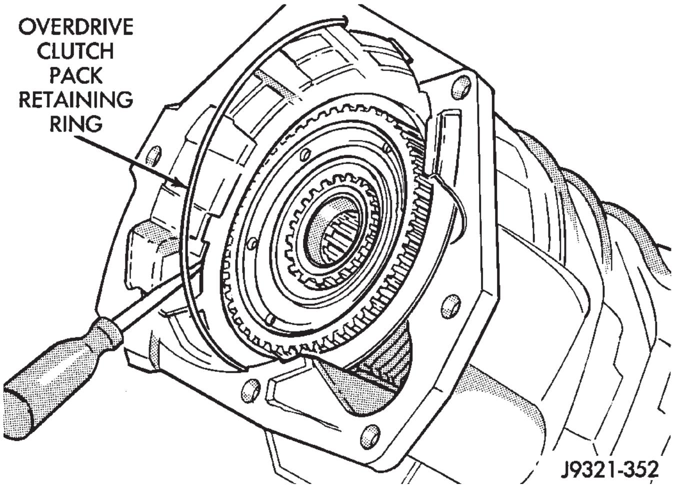


Fig. 247 Overdrive Clutch Pack Retaining Ring Installation

(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.

(b) Position Gauge Tool 6311 across face of overdrive case (Fig. 248). 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. 248).

(d) Select proper thickness end play spacer from spacer chart based on distance measured (Fig. 249).

(e) Remove Gauge Alignment Tool 6312.

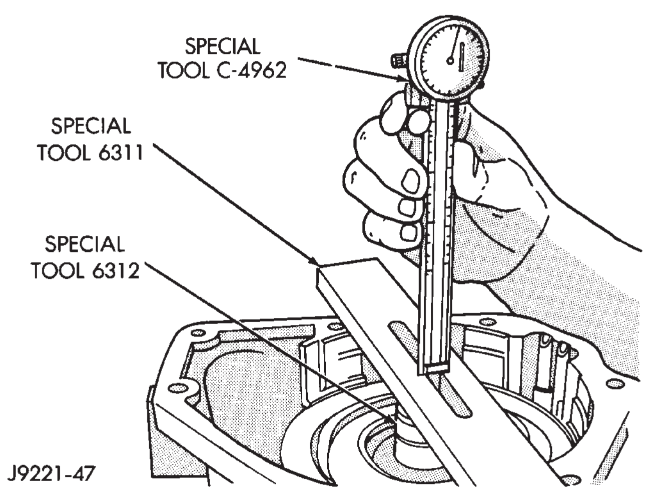


Fig. 248 Shaft End Play Measurement

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. 249 Intermediate Shaft End Play Spacer Selection

OD THRUST PLATE SELECTION

(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 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. 250).

(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. 251).

(3) 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.

(4) 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.

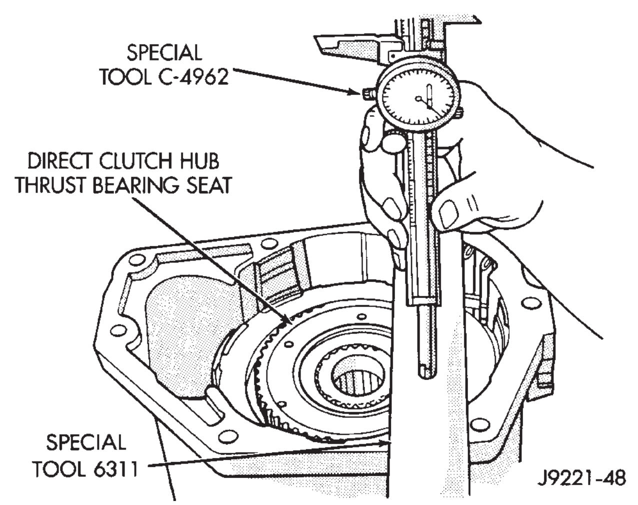


Fig. 250 Overdrive Piston Thrust Plate Measurement

DISASSEMBLY AND ASSEMBLY (Continued)

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

J9121-342

Fig. 251 Overdrive Piston Thrust Plate Selection

OVERDRIVE PISTON ASSEMBLY

(1) Install new seals on over drive piston.

(2) Stand transmission case upright on bellhousing.

(3) Position Guide Ring 8114-1 on outer edge of overdrive piston retainer.

(4) Position Seal Guide 8114-2 on inner edge of overdrive piston retainer.

(5) Install overdrive piston in overdrive piston retainer by: aligning locating lugs on overdrive piston to the two mating holes in retainer.

(a) Aligning locating lugs on overdrive piston to the two mating holes in retainer.

(b) Lubricate overdrive piston seals with Mopar® Door Ease, or equivalent.

(c) Install piston over Seal Guide 8114–2 and inside Guide Ring 8114–1.

(d) Push overdrive piston into position in retainer.

(e) Verify that the locating lugs entered the lug bores in the retainer.

(6) Install intermediate shaft spacer on intermediate shaft.

(7) Install overdrive piston thrust plate on overdrive piston.

(8) Install overdrive piston thrust bearing on overdrive piston.

(9) Install transmission speed sensor and O-ring seal in overdrive case (Fig. 192).

CLEANING AND INSPECTION

VALVE BODY

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 all except the electrical 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 can stick to valve body parts, interfere with valve operation, and 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. Be sure the vent ports in the solenoid valve are open and not blocked by dirt or debris. Replace the valve and/or sensor only when DRB 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.

Inspect the throttle and manual valve levers and shafts. 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 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.

CLEANING AND INSPECTION (Continued)

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

TRANSMISSION

GENERAL 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.

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-B.

Pre-sized service bushings are available for replacement purposes. Only the sun gear bushings are not serviced. Low cost of the sun gear assembly makes it easier to simply replace the gear and bushings as an assembly.

Heli-Coil inserts can be used to repair damaged, stripped or worn threads in aluminum parts. These inserts are available from most automotive parts suppliers. 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 3, Type 7176, transmission fluid during overhaul and assembly. Use petroleum jelly, Mopar® Door Ease, or Ru-Glyde to prelubricate seals, O-rings, and thrust washers. Petroleum jelly can also be used 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.

NOTE: 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.

CLEANING AND INSPECTION (Continued)

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/OVERDRIVE PISTON RETAINER

Clean the overrunning clutch assembly, clutch cam, low-reverse drum, and overdrive piston retainer in solvent. Dry them with compressed air after cleaning.

Inspect condition of each clutch part after cleaning. Replace the overrunning clutch roller and spring assembly if any rollers or springs are worn or damaged, or if the roller cage is distorted, or damaged. Replace the cam if worn, cracked or damaged.

Replace the low-reverse drum if the clutch race, roller surface or inside diameter is scored, worn or damaged. **Do not remove the clutch race from the low-reverse drum under any circumstances. Replace the drum and race as an assembly if either component is 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 drum. Replace the retainer if worn or damaged.

ACCUMULATOR

Inspect the accumulator piston and seal rings (Fig. 252). 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. 252). Replace the springs if the coils are cracked, distorted or collapsed.

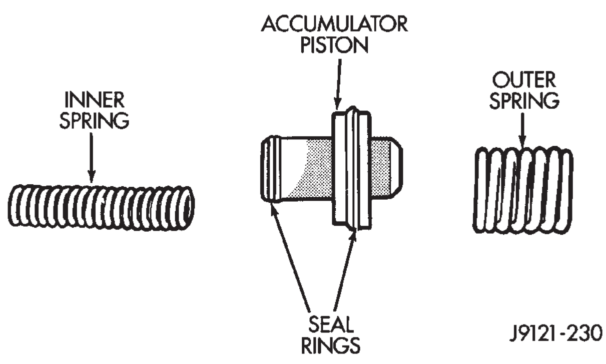


Fig. 252 Accumulator Components

FRONT SERVO

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.

REAR SERVO

Remove and discard the servo piston seal ring (Fig. 253). 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.

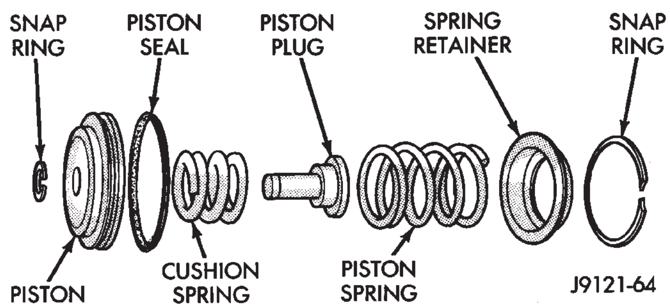


Fig. 253 Rear Servo Components

OIL PUMP AND REACTION SHAFT SUPPORT

(1) Clean pump and support components with solvent and dry them with compressed air.

(2) 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, broken, or severely worn.

(3) 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.

(4) Inspect the pump bushing. 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.

(5) Install the gears in the pump body and measure pump component clearances as follows:

(A) Clearance between outer gear and reaction shaft housing should be 0.010 to 0.063 mm (0.0004 to 0.0025 in.). Clearance between inner gear and reaction shaft housing should be 0.010 to 0.063 mm (0.0004 to 0.0025 in.). Both clearances can be measured at the same time by:

(I) Installing the pump gears in the pump housing.

(II) Position an appropriate piece of Plastigage™ across both gears.

CLEANING AND INSPECTION (Continued)

(III) Align the plastigage to a flat area on the reaction shaft housing.

(IV) Install the reaction shaft to the pump housing.

(V) Separate the reaction shaft housing from the pump housing and measure the Plastigage™ following the instructions supplied with it.

(B) Clearance between inner gear tooth and outer gear should be 0.08 to 0.19 mm (0.0035 to 0.0075 in.). Measure clearance with an appropriate feeler gauge.

(C) Clearance between outer gear and pump housing should also be 0.010 to 0.19 mm (0.0035 to 0.0075 in.). Measure clearance with an appropriate feeler gauge.

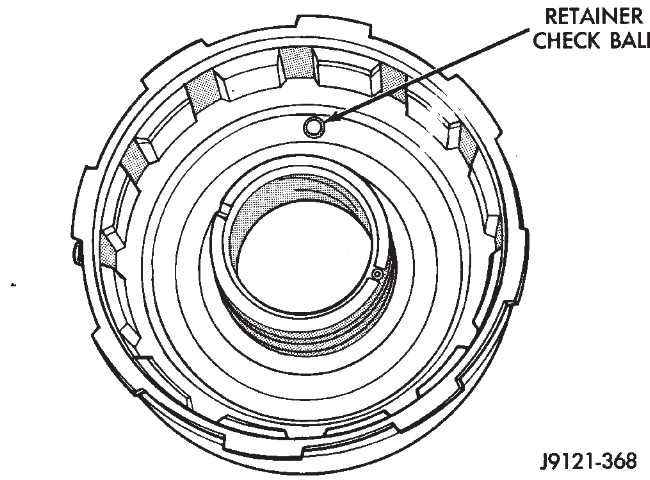


Fig. 254 Front Clutch Piston Retainer Check Ball Location

FRONT CLUTCH

Clean and inspect the front clutch components. 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. 254). The ball must move freely and not stick.

NOTE: Inspect the clutch retainer bushings carefully (Fig. 255). 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.

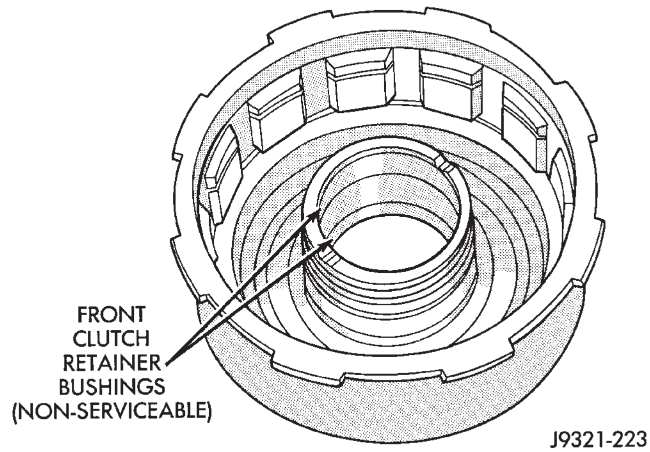


Fig. 255 Retainer Bushing Location/Inspection

REAR CLUTCH

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.

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 balls in the retainer and piston. Each check ball must move freely and not stick.

Replace the retainer bushing if worn, scored, or doubt exists 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 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 worn, distorted, or 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.

CLEANING AND INSPECTION (Continued)

PLANETARY GEARTRAIN

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 of these parts that are worn, distorted or damaged. Do not attempt to reuse these parts.

The planetary gear thrust washers are different sizes. The large diameter washers go on the front planetary and the smaller washers go on the rear planetary. All the washers have four locating tabs on them. These tabs fit in the holes or slots provided in each planetary gear.

Inspect the output shaft carefully. Pay particular attention to the machined bushing/bearing surfaces on the shaft and the governor valve shaft bore at the shaft rear.

Replace the output shaft if the 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 (especially at the governor valve shaft bore).

The annulus gears can be removed from their supports if necessary. Just remove the snap rings and separate the two parts when replacement is necessary. In addition, the annulus gear bushings can be replaced if severely worn, or scored. However it is not necessary to replace the bushings if they only exhibit normal wear. Check bushing fit on the output shaft to be sure.

OVERDRIVE UNIT

Clean the geartrain and case components 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 case.

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. 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. 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. 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. 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. 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 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 . 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.

ADJUSTMENTS

BRAKE TRANSMISSION SHIFT INTERLOCK

The park interlock cable is part of the brake/shift lever interlock system. Correct cable adjustment is important to proper interlock operation. The gear shift and park lock cables must both be correctly adjusted in order to shift out of Park.

Park Interlock Cable Adjustment Procedure

(1) Shift the transmission into the PARK position.

(2) Turn ignition switch to LOCK position. **Be sure ignition key cylinder is in the LOCK position. Cable will not adjust correctly in any other position.**

(3) Remove shift lever bezel and floor console as necessary for access to the brake transmission shift interlock cable.

(4) Pull cable lock button up to release cable (Fig. 256).

(5) Pull cable rearward. Then release cable and press lock button down until it snaps in place.

BTSI FUNCTION CHECK

(1) Verify removal of ignition key allowed in park position only.

(2) When the shift lever is in park, and the shift handle push-button is in the out position, the ignition key cylinder should rotate freely from off to lock. When the shifter is in any other position, the ignition key should not rotate from off to lock.

(3) Shifting out of park should be possible when the ignition key cylinder is in the off position.

(4) Shifting out of park should not be possible while applying 25 lb. max. handle push-button force, and ignition key cylinder is in the run or start positions, unless the foot brake pedal is depressed approximately 1/2 inch (12mm).

(5) Shifting out of park should not be possible when the ignition key cylinder is in the accessory or lock position.

(6) Shifting between any gears neutral or park may be done without depressing foot brake with ignition switch in run or start positions and vehicle stationary or in motion.

(7) The floor shifter lever and gate positions should be in alignment with all transmission detent positions.

(8) Engine starts must be possible with shifter lever in park or neutral gate positions only. Engine starts must not be possible in any other gate positions other than park or neutral.

(9) With shifter lever handle push-button not depressed and lever detent in:

- PARK POSITION- apply forward force on center of handle and remove pressure. Engine start must be possible.
- PARK POSITION- apply rearward force on center of handle and remove pressure. Engine start must be possible.
- NEUTRAL POSITION- engine start must be possible.

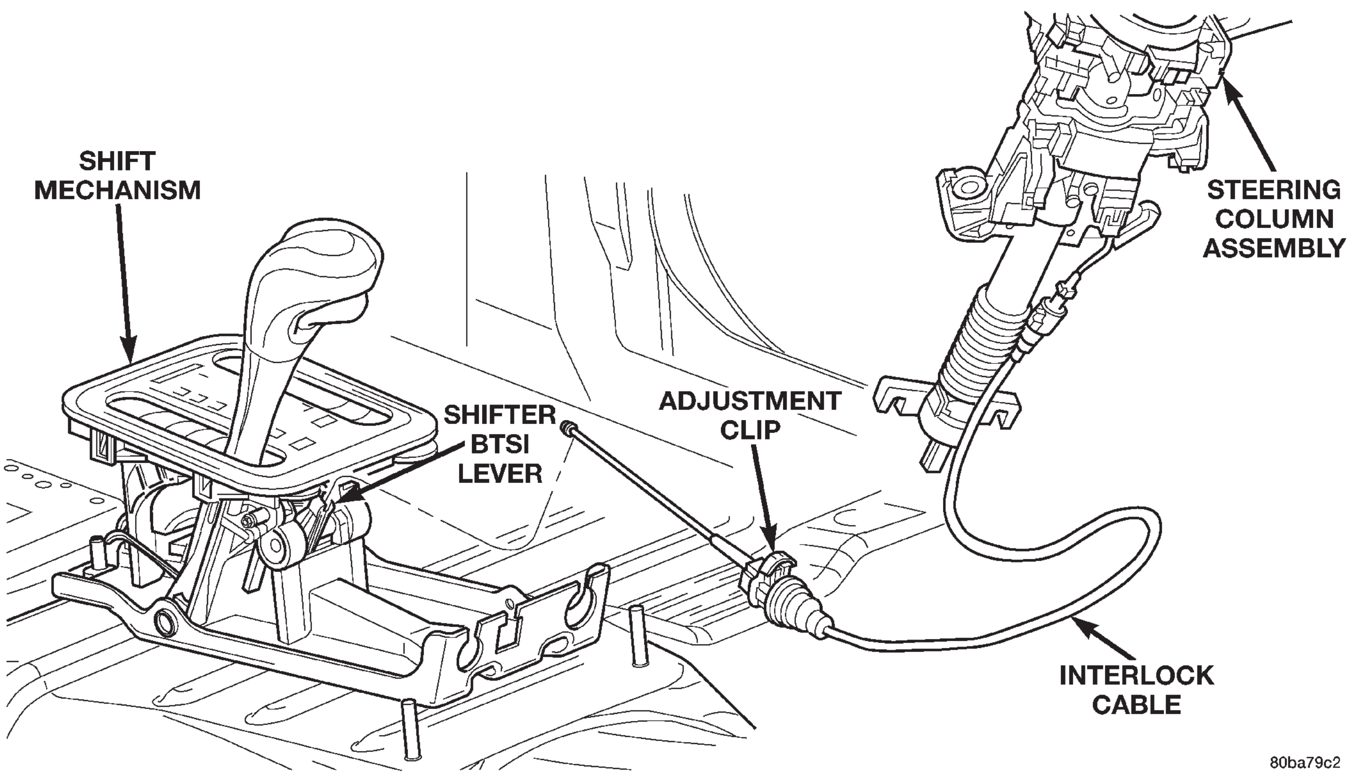


Fig. 256 Brake Transmission Shift Interlock Cable

ADJUSTMENTS (Continued)

• NEUTRAL POSITION, ENGINE RUNNING AND BRAKES APPLIED- Apply forward force on center of shift handle. Transmission should not be able to shift into reverse detent.

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. 257). The cable is attached to an arm mounted on the throttle lever shaft. A retaining clip at the engine-end of the cable is removed to provide for cable adjustment. The retaining clip is then installed back onto the throttle valve cable to lock in the 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.

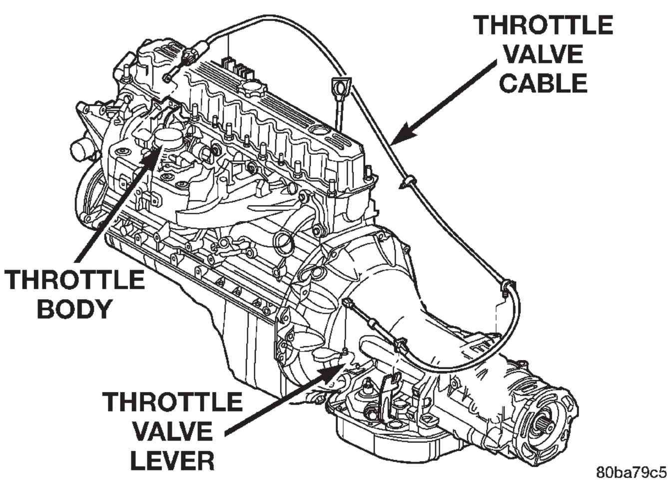


Fig. 257 Throttle Valve Cable

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. 257) is also at idle (fully forward) position.

(4) Slide cable off attachment stud on throttle body lever.

(5) Compare position of cable end to attachment stud on throttle body lever:

• Cable end and attachment stud should be aligned (or centered on one another) to within 1 mm (0.039 in.) in either direction.

• 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.

• If both levers move simultaneously from idle to half-throttle and back to idle position, adjustment is correct.

• 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) Insert a small screwdriver under edge of retaining clip and remove retaining clip.

(6) Center cable end on attachment stud to within 1 mm (0.039 in.).

NOTE: Be sure that as the cable is pulled forward and centered on the throttle lever stud, the cable housing moves smoothly with the cable. Due to the angle at which the cable housing enters the spring housing, the cable housing may bind slightly and create an incorrect adjustment.

(7) Install retaining clip onto cable housing.

(8) Check cable adjustment. Verify transmission throttle lever and lever on throttle body move simultaneously.

GEARSHIFT CABLE

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 or TRS may be faulty.

Gearshift Adjustment Procedure

(1) Shift transmission into Park.

(2) Remove shift lever bezel and floor console as necessary for access to the shift cable adjustment.

(3) Loosen the shift cable adjustment screw (Fig. 258).

(4) Raise vehicle.

ADJUSTMENTS (Continued)

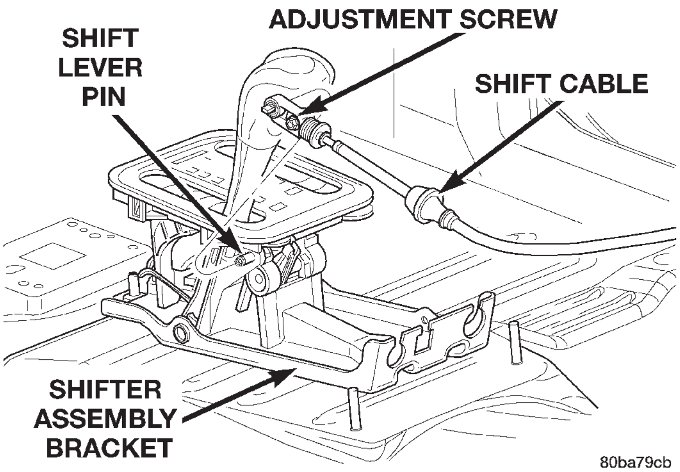


Fig. 258 Shift Cable at the Shifter

(5) Unsnap cable eyelet from transmission shift lever (Fig. 259).

(6) Verify transmission shift lever is in Park detent by moving lever fully rearward. Last rearward detent is Park position.

(7) Verify positive engagement of transmission park lock by attempting to rotate propeller shaft. Shaft will not rotate when park lock is engaged.

(8) Snap cable eyelet onto transmission shift lever.

(9) Lower vehicle

(10) Tighten the shift cable adjustment screw to 7 N·m (65 in. lbs.).

(11) Verify correct operation.

(12) Install the shifter bezel and any floor console components removed for access.

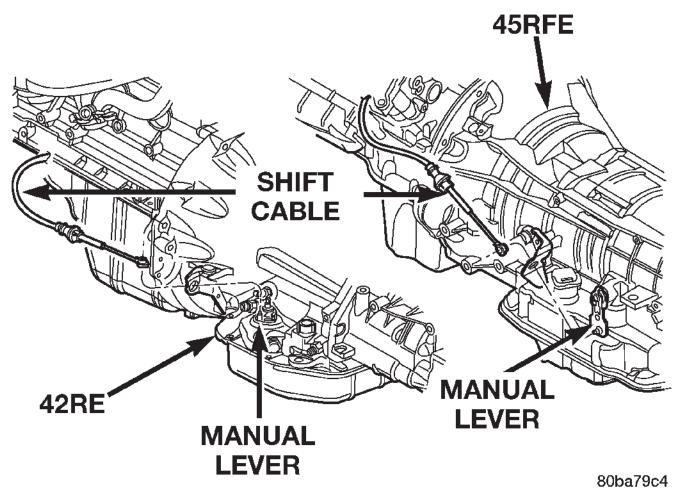


Fig. 259 Shift Cable Attachment At Transmission

BAND ADJUSTMENTS

FRONT BAND ADJUSTMENT

The front (kickdown) band adjusting screw is located on the left side of the transmission case above the manual valve and throttle valve levers.

(1) Raise vehicle.

(2) Loosen band adjusting screw locknut (Fig. 260). Then back locknut off 3-5 turns. Be sure adjusting screw turns freely in case. Apply lubricant to 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.

CAUTION: If Adapter C-3705 is needed to reach the adjusting screw (Fig. 261), tighten the screw to only 5 N·m (47-50 in. lbs.) torque.

(4) Back off front 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.

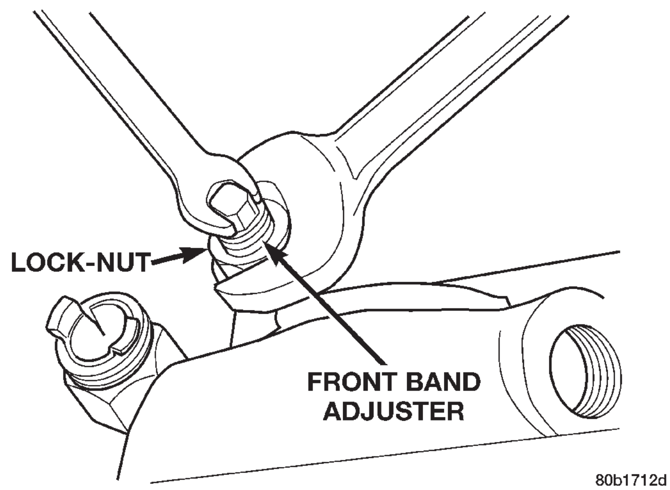


Fig. 260 Front Band Adjustment Screw Location

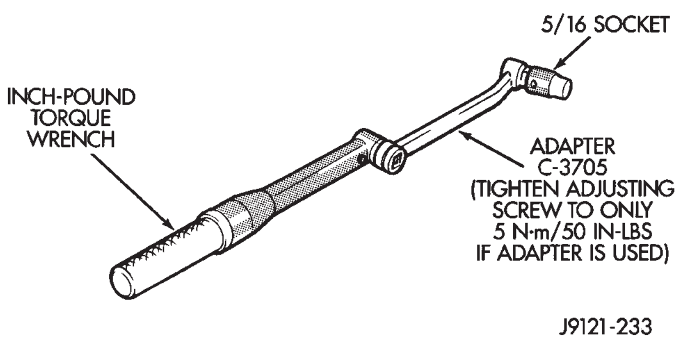


Fig. 261 Band Adjustment Adapter Tool

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 (Fig. 262). Be sure adjusting screw turns freely in lever.

(4) Tighten adjusting screw to 8 N·m (72 in. lbs.) torque.

ADJUSTMENTS (Continued)

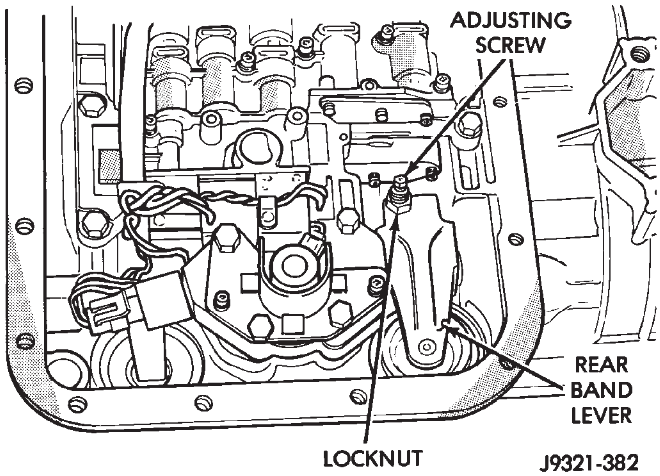


Fig. 262 Rear Band Adjusting Screw Location

(5) Back off adjusting screw 4 turns.

(6) Hold adjusting screw in place and tighten locknut to 34 N·m (25 ft. lbs.) torque.

(7) Position new gasket on oil pan and install pan on transmission. Tighten pan bolts to 17 N·m (13 ft. lbs.) torque.

(8) Lower vehicle and refill transmission with Mopar® ATF Plus 3, Type 7176 fluid.

VALVE BODY

CONTROL PRESSURE ADJUSTMENTS

There are two control pressure adjustments on the valve body;

- Line Pressure
- 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.

LINE PRESSURE ADJUSTMENT

Measure distance from the valve body to the inner edge of the adjusting screw with an accurate steel scale (Fig. 263).

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.

NOTE: 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.

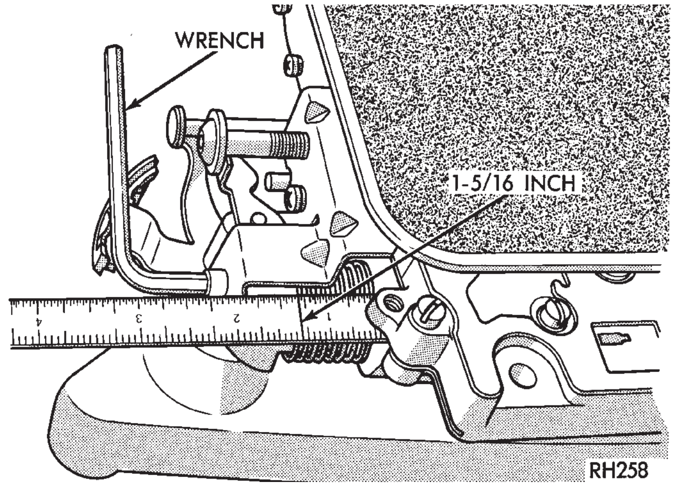


Fig. 263 Line Pressure Adjustment

THROTTLE PRESSURE ADJUSTMENT

Insert Gauge Tool C-3763 between the throttle lever cam and the kickdown valve stem (Fig. 264).

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.

NOTE: The kickdown valve spring must be fully compressed and the kickdown valve completely bottomed to obtain correct adjustment.

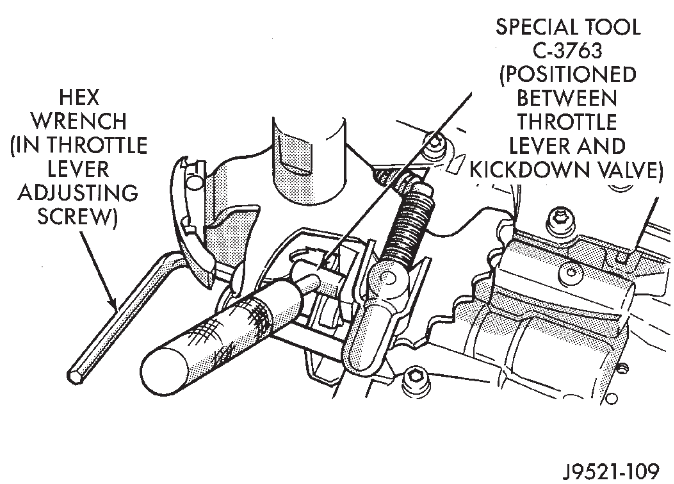
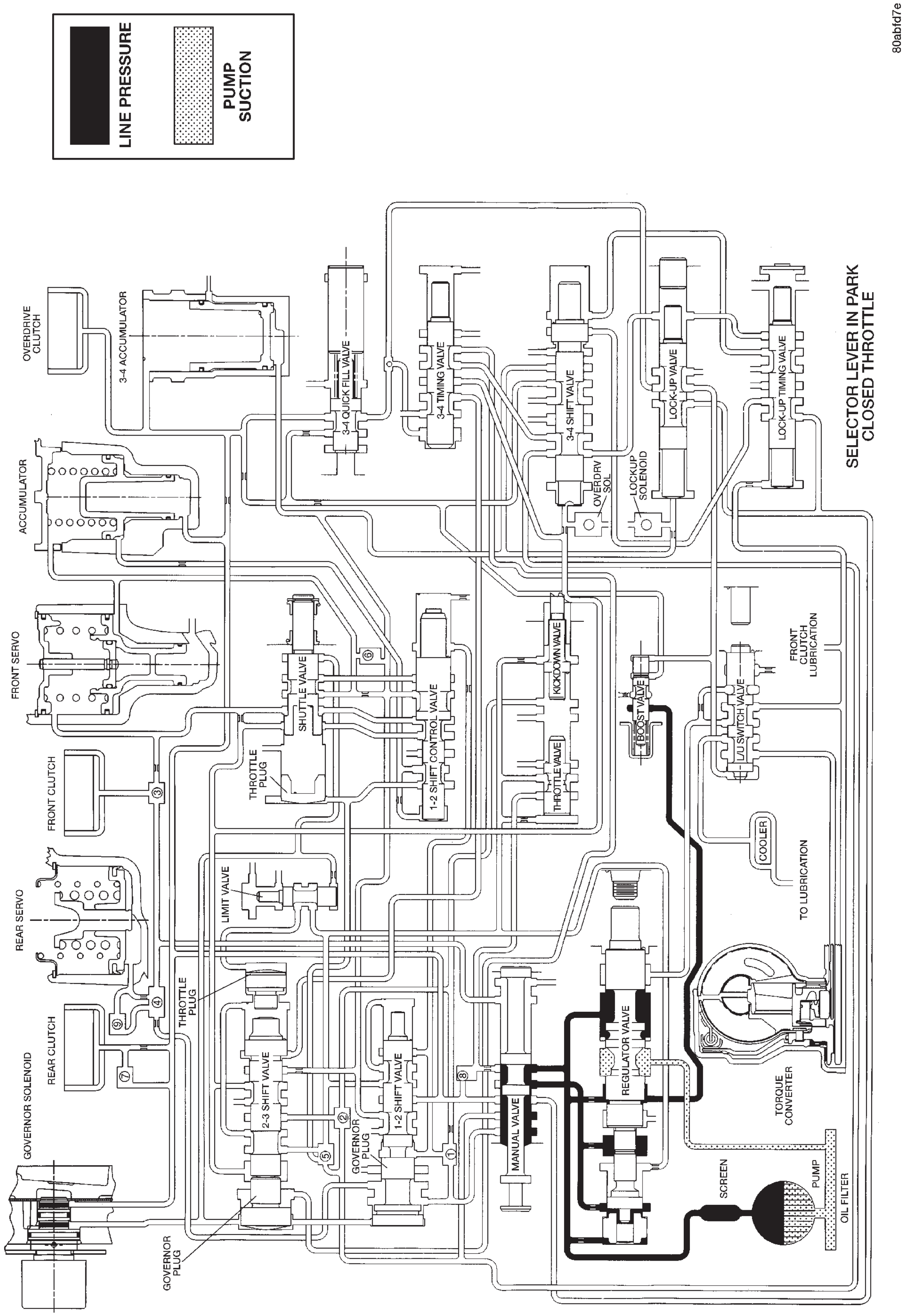


Fig. 264 Throttle Pressure Adjustment

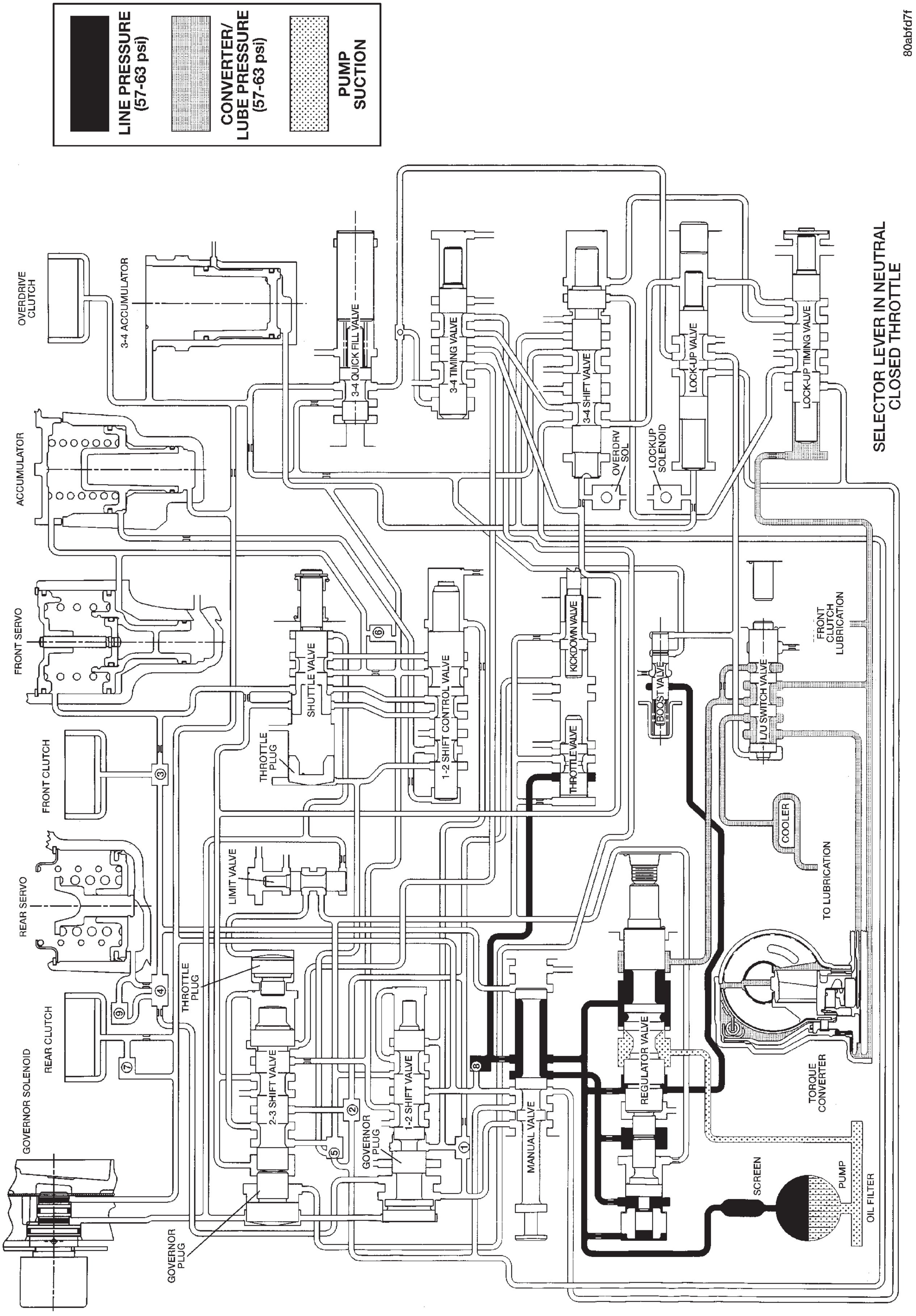
SCHEMATICS AND DIAGRAMS

HYDRAULIC SCHEMATICS



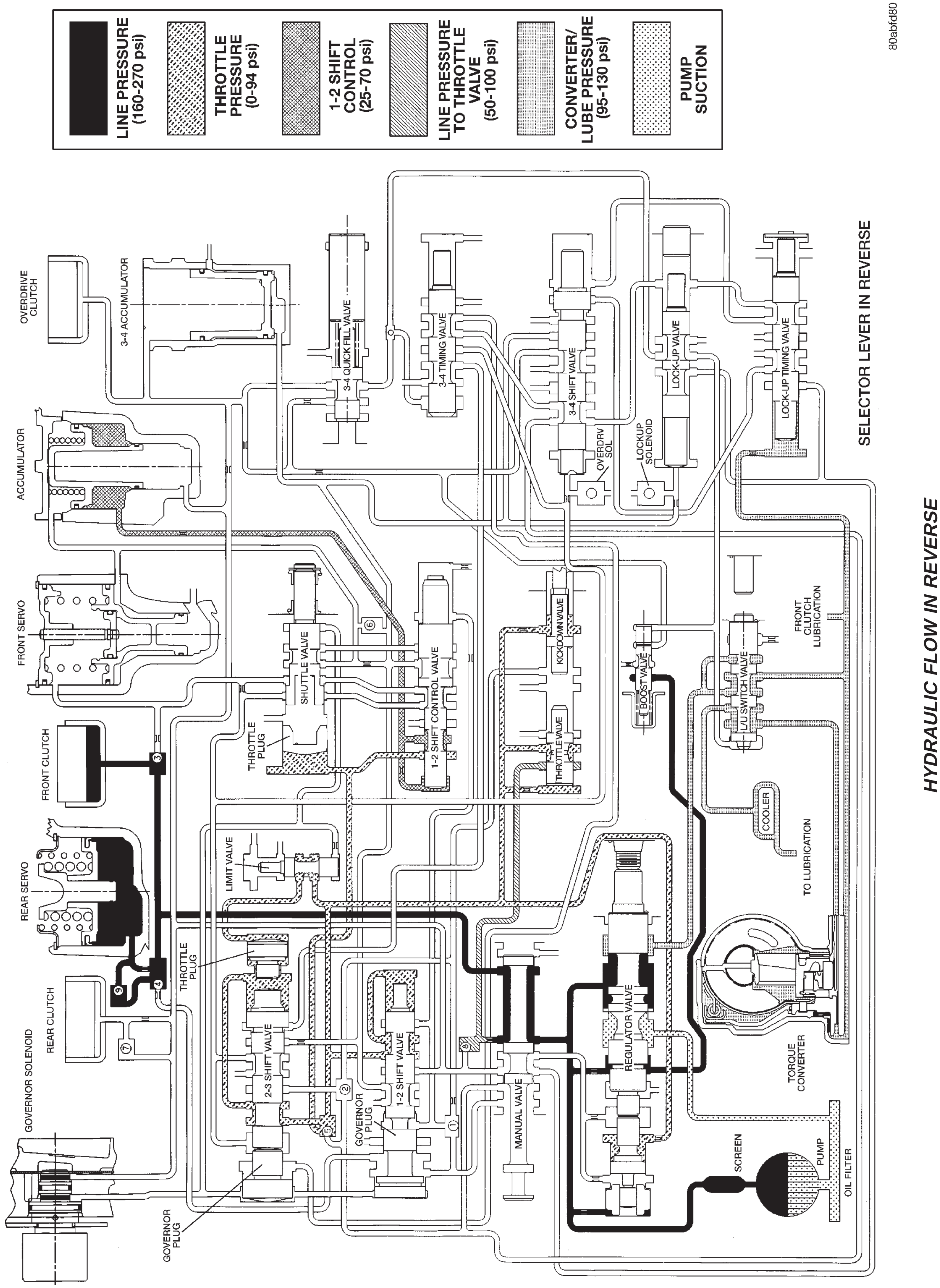
HYDRAULIC FLOW IN PARK

SCHEMATICS AND DIAGRAMS (Continued)

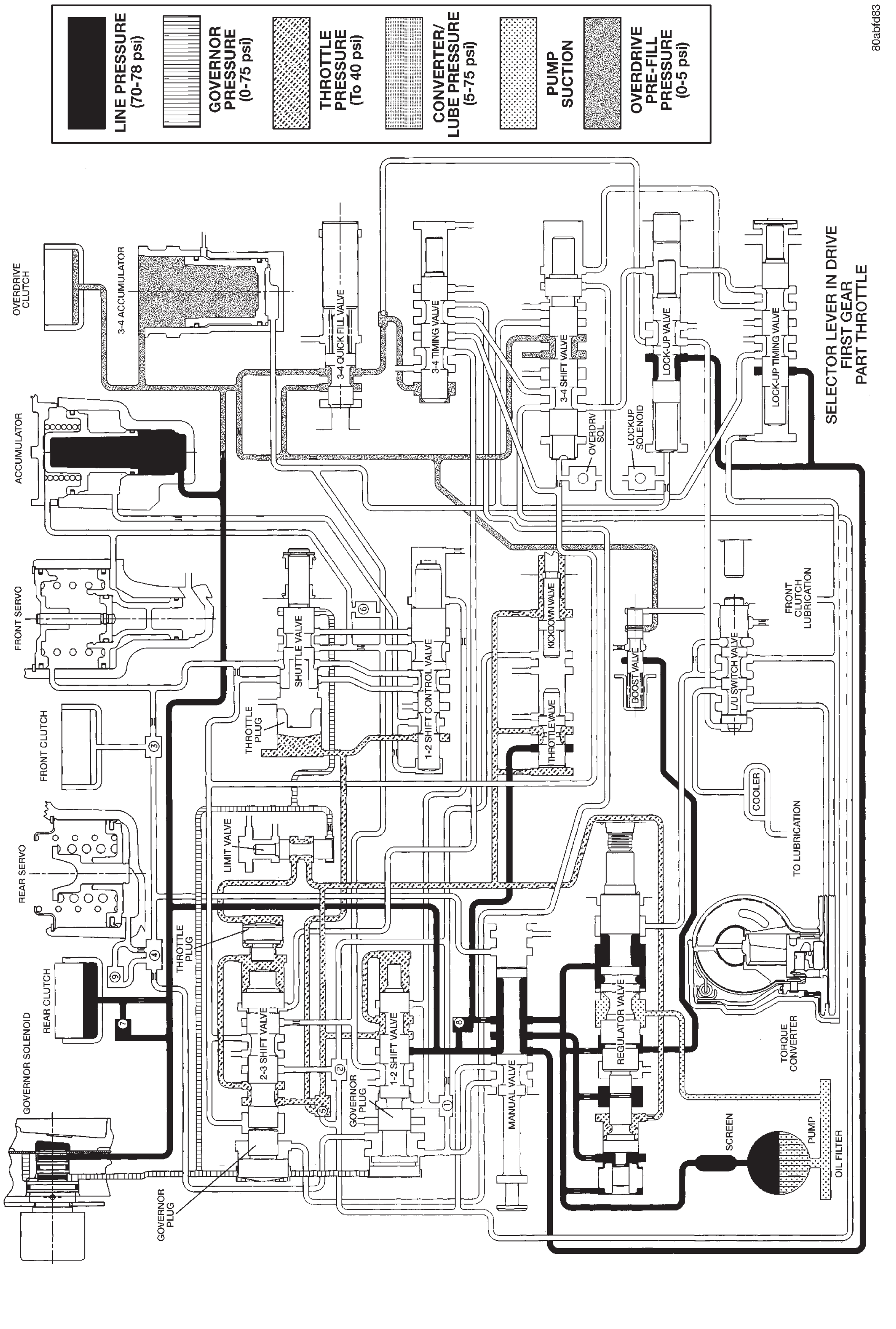


HYDRAULIC FLOW IN NEUTRAL

SCHEMATICS AND DIAGRAMS (Continued)

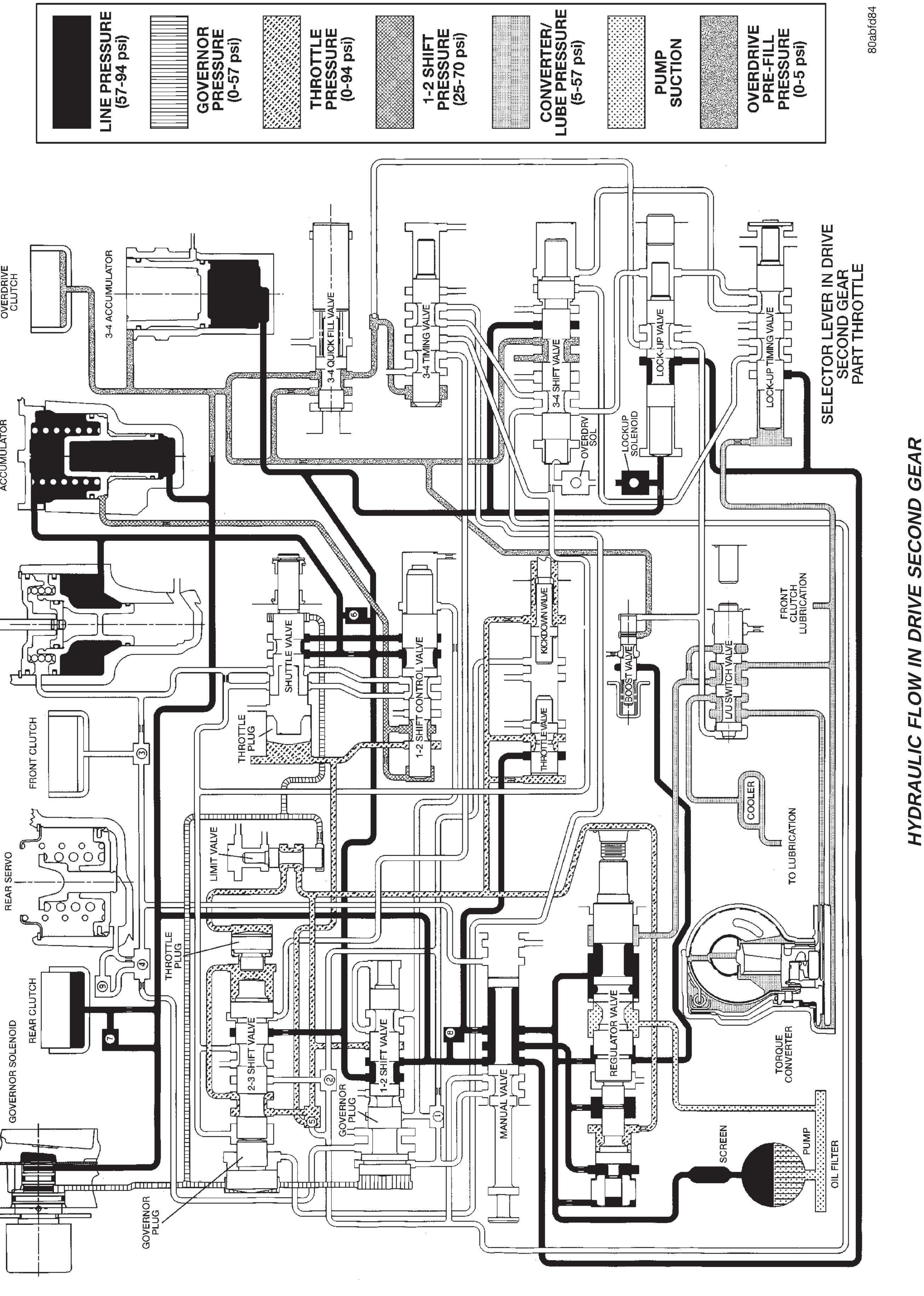


SCHEMATICS AND DIAGRAMS (Continued)

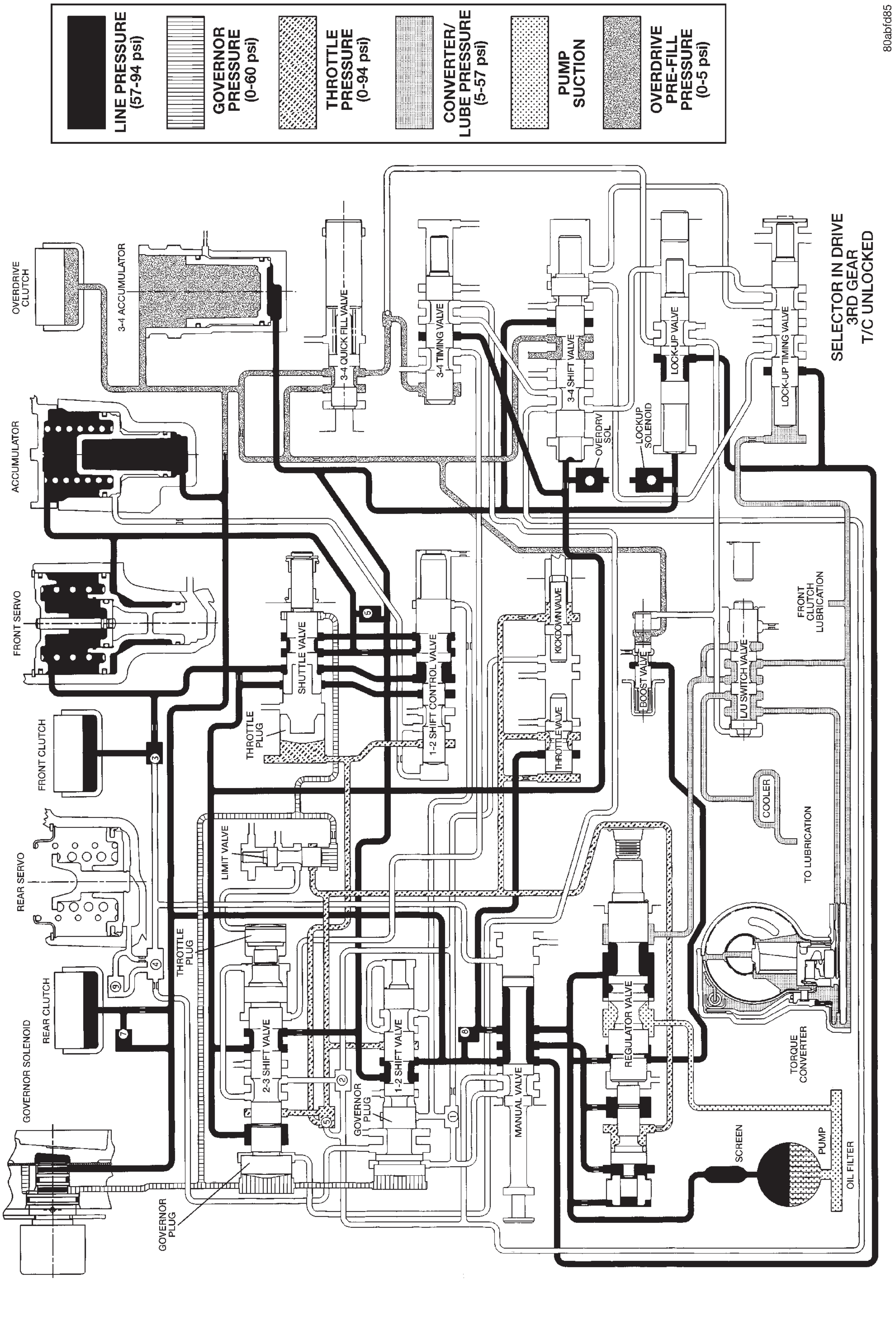


HYDRAULIC FLOW IN DRIVE FIRST GEAR

SCHEMATICS AND DIAGRAMS (Continued)

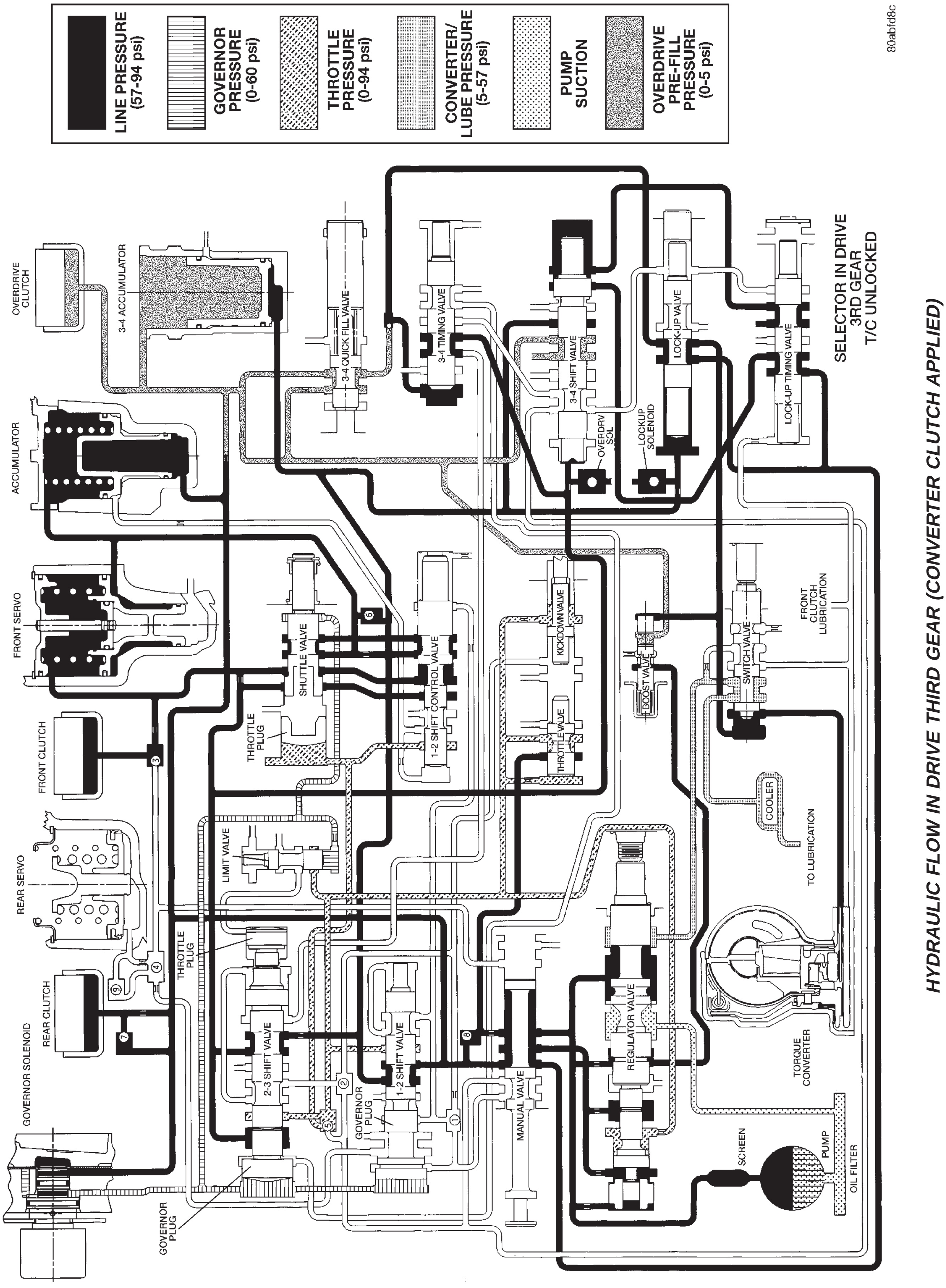


SCHEMATICS AND DIAGRAMS (Continued)

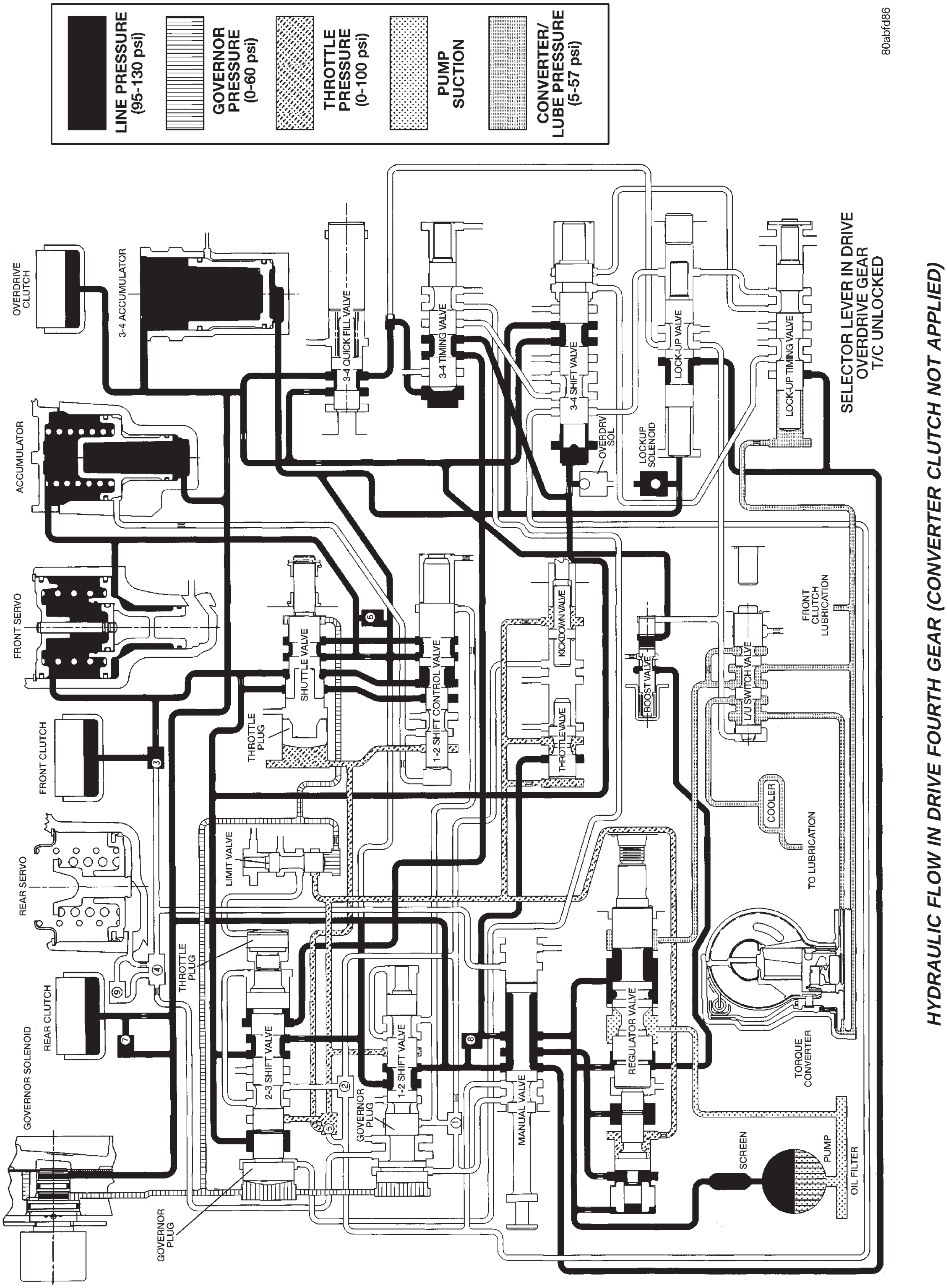


HYDRAULIC FLOW IN DRIVE THIRD GEAR (CONVERTER CLUTCH NOT APPLIED)

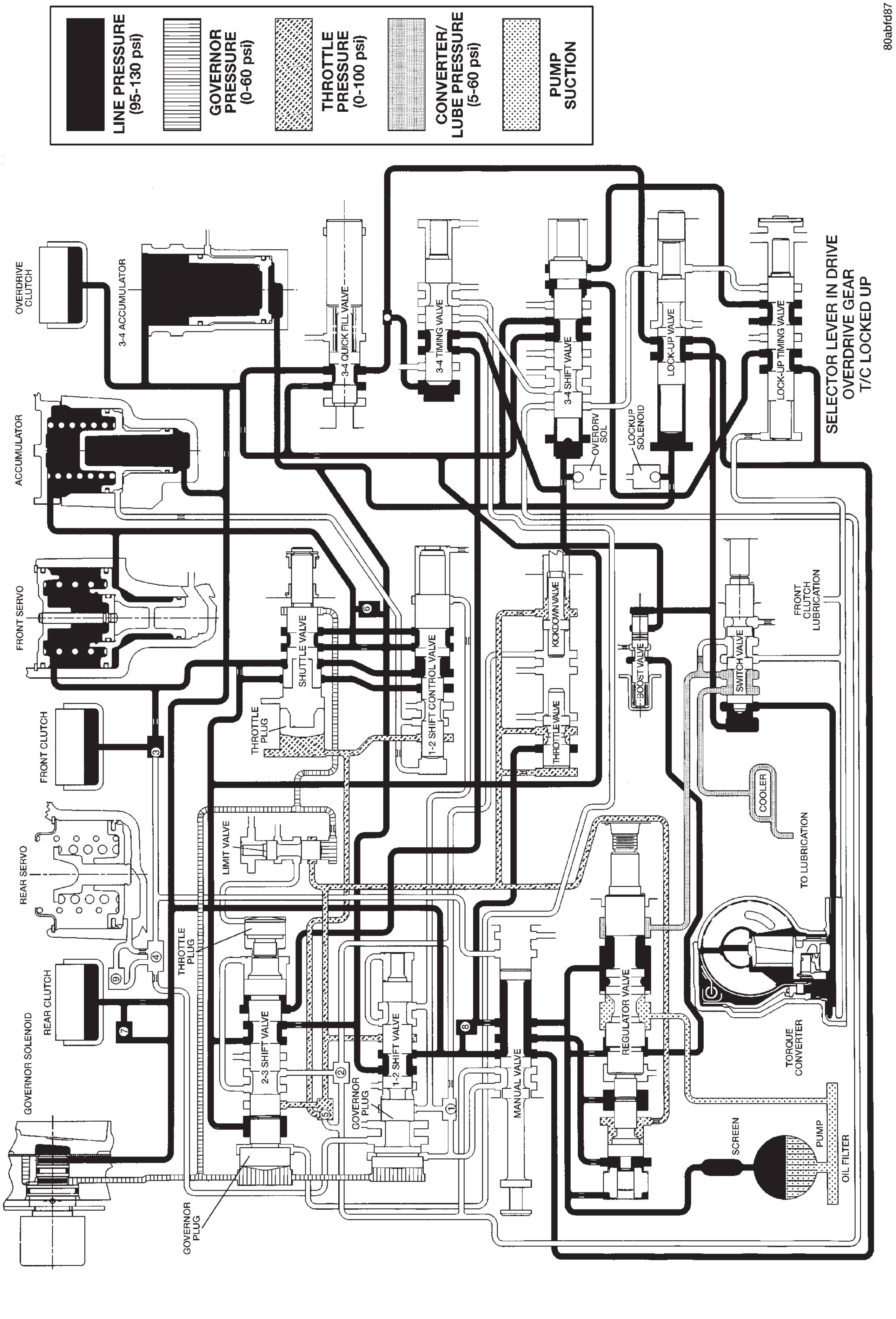
SCHEMATICS AND DIAGRAMS (Continued)



SCHEMATICS AND DIAGRAMS (Continued)

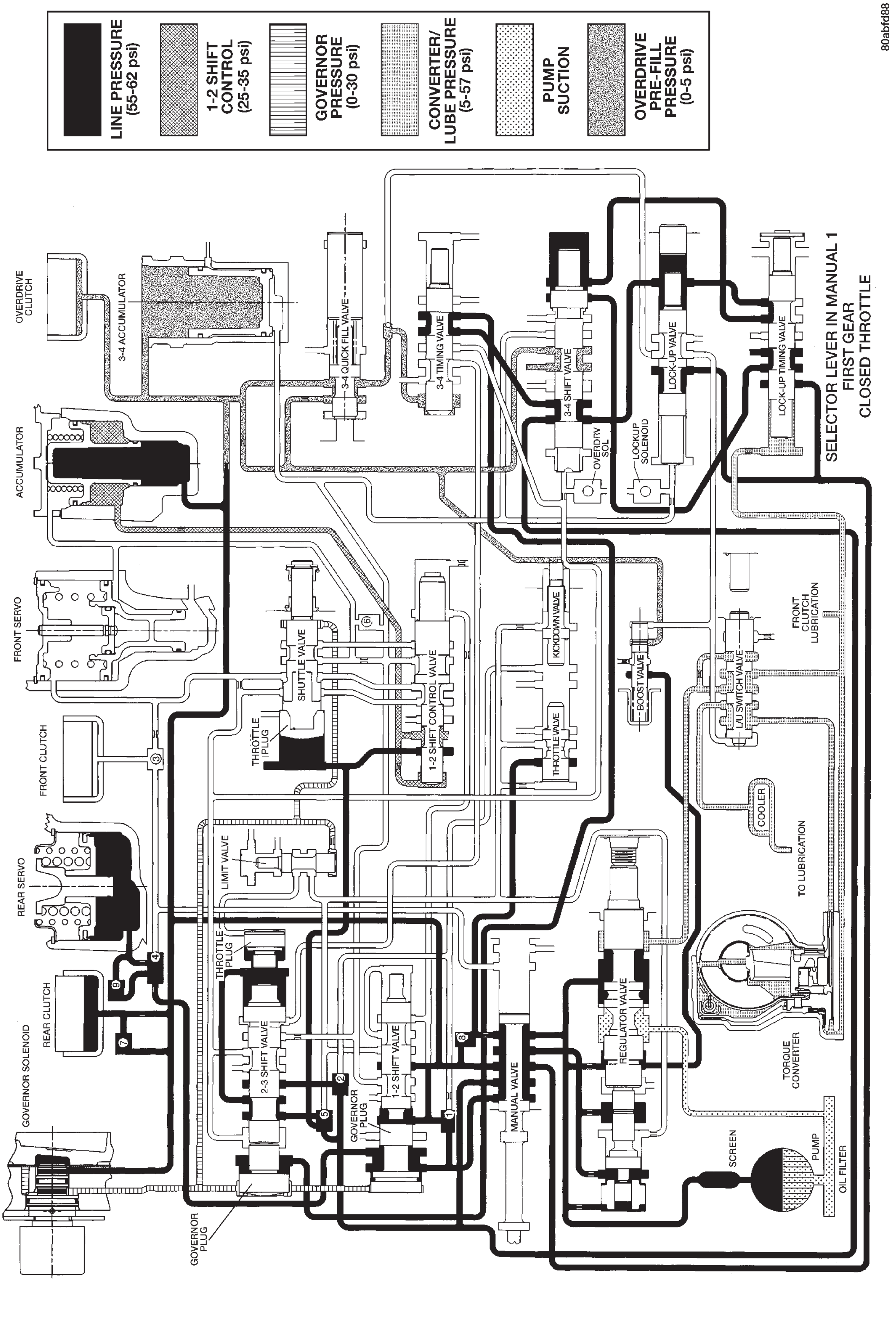


SCHEMATICS AND DIAGRAMS (Continued)



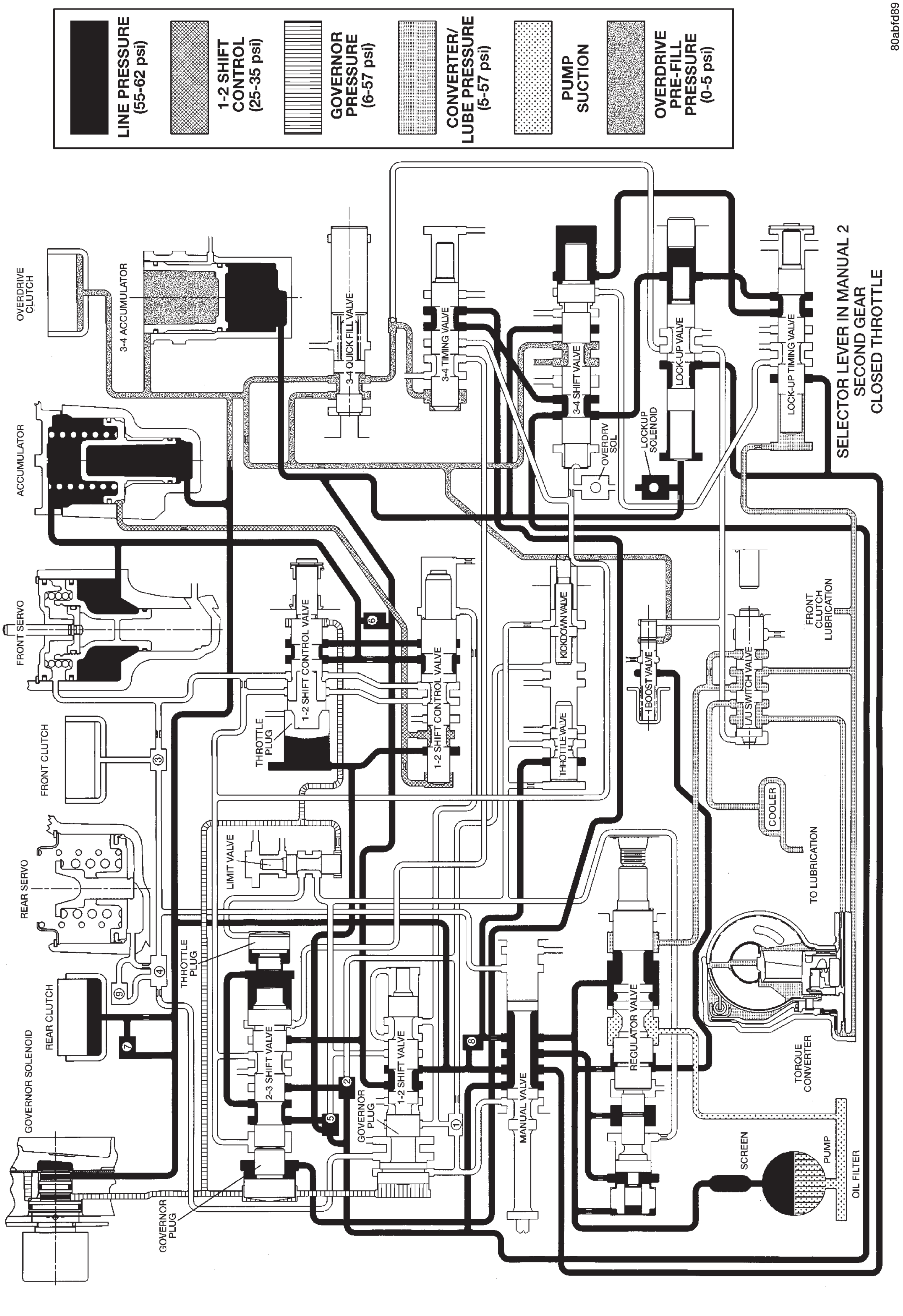
HYDRAULIC FLOW IN DRIVE FOURTH GEAR (CONVERTER CLUTCH APPLIED)

SCHEMATICS AND DIAGRAMS (Continued)



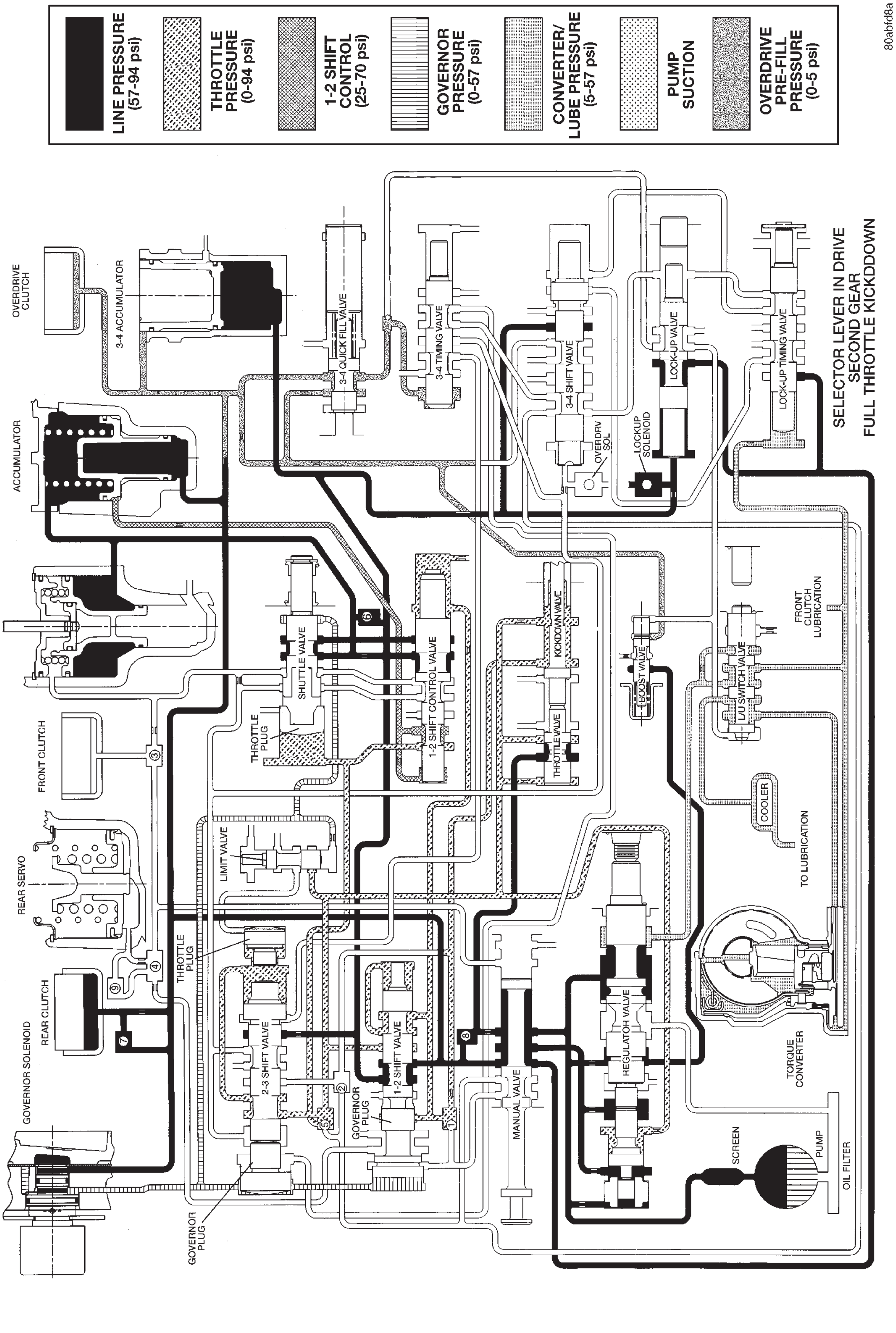
HYDRAULIC FLOW IN MANUAL LOW (1)

SCHEMATICS AND DIAGRAMS (Continued)



HYDRAULIC FLOW IN MANUAL SECOND (2)

SCHEMATICS AND DIAGRAMS (Continued)



HYDRAULIC FLOW DURING FULL THROTTLE 3–2 DOWNSHIFT (PASSING GEAR)

SPECIFICATIONS

RE TRANSMISSION

GENERAL

Component	Metric	Inch
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.	1.70-3.40mm	0.067-0.134 in.
Clutch pack clearance/ Rear.	0.81-1.40 mm	0.022-0.037 in.
Front clutch	4 discs	
Rear clutch	4 discs	
Overdrive clutch	3 discs	
Direct clutch	6 discs	
42RE Band adjustment from 72 in. lbs. Front band Rear band	 Back off 3-5/8 turns Back off 4 turns	
Recommended fluid	Mopar® ATF Plus 3,type 7176	

GEAR RATIOS

- 1ST GEAR-2.74
- 2ND GEAR-1.54
- 3RD GEAR-1.00
- 4TH GEAR-0.69
- REV. GEAR-2.21

TORQUE

DESCRIPTION	TORQUE
Fitting, cooler line at trans	18 N·m (13 ft. lbs.)
Bolt, torque convertor	31 N·m (23 ft. lbs.)
Bolt/nut, crossmember	68 N·m (50 ft. lbs.)
Bolt, driveplate to crankshaft	75 N·m (55 ft. lbs.)
Plug, front band reaction	17 N·m (13 ft. lbs.)
Locknut, front band adj.	34 N·m (25 ft. lbs.)
Switch, park/neutral	34 N·m (25 ft. lbs.)
Bolt, fluid pan	17 N·m (13 ft. lbs.)
Screws, fluid filter	4 N·m (35 in. lbs.)
Bolt, oil pump	20 N·m (15 ft. lbs.)
Bolt, overrunning clutch cam	17 N·m (13 ft. lbs.)
Bolt, O/D to trans.	34 N·m (25 ft. lbs.)
Bolt, O/D piston retainer	17 N·m (13 ft. lbs.)
Plug, pressure test port	14 N·m (10 ft. lbs.)
Bolt, reaction shaft support	20 N·m (15 ft. lbs.)
Locknut, rear band	41 N·m (30 ft. lbs.)
Bolt. speedometer adapter	11 N·m (8 ft. lbs.)
Bolt, valve body to case	12 N·m (100 in. lbs.)
Sensor, trans speed	27 N·m (20 ft. lbs.)
Screw, solenoid wiring connector	4 N·m (35 in. lbs.)
Screw, solenoid to transfer plate	4 N·m (35 in. lbs.)
Bolt, upper bending brace	41 N·m (30 ft. lbs.)
Bolt, trans to engine	68 N·m (50 ft. lbs.)

SPECIFICATIONS (Continued)

THRUST WASHER/SPACER/SNAP RING DIMENSIONS

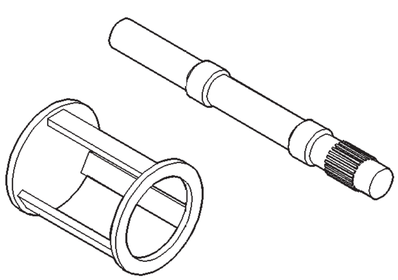
Component	Metric	Inch
Front clutch thrust washer (reaction shaft support hub)	1.55 mm	0.061 in.
Rear clutch thrust washer (clutch retainer)	1.55 mm	0.061 in.
Intermediate shaft thrust plate (shaft hub pilot)	1.5-1.6 mm	0.060-0.063 in.
Output shaft thrust washer (rear clutch hub)	Select fit to set end play	
Rear clutch pack snap ring	1.5 mm 1.95 mm 2.45 mm	0.060 in. 0.076 in. 0.098 in.
Planetary geartrain snap ring (at front of output shaft)	Select fit (three thicknesses avalible)	
Overdrive piston thrust plate Intermediate shaft spacer	Thrust plate and spacer are select fit. Refer to size charts and selection procedures in Overdrive Unit D&A procedures	

PRESSURE TEST

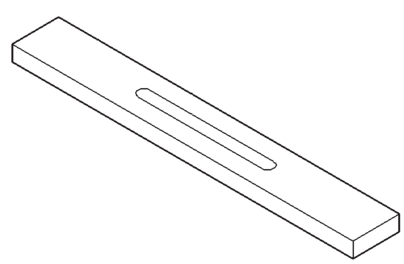
Overdrive clutch	Fourth gear only	Pressure should be 469-496 kPa (68-72 psi) with closed throttle and increase to 620-896 kPa (90-130 psi) at 1/2 to 3/4 throttle.
Line pressure (at accumulator)	Closed throttle	372-414 kPa (54-60 psi).
Front servo	Third gear only	No more than 21 kPa (3 psi) lower than 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 (0-1.5 psi) when stopped with transmission in D, 1, 2. Pressure above 7 kPa (1.5 psi) at stand still will prevent transmission from downshifting.

SPECIAL TOOLS

RE TRANSMISSION

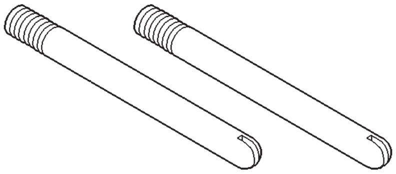


Spring Compressor and Alignment Shaft—6227

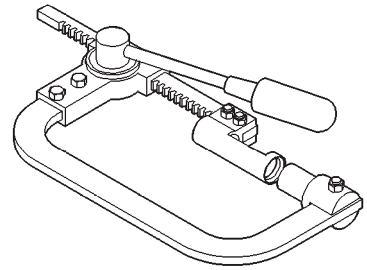


Gauge Bar—6311

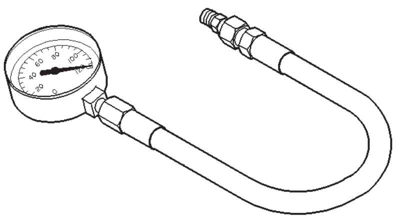
SPECIAL TOOLS (Continued)



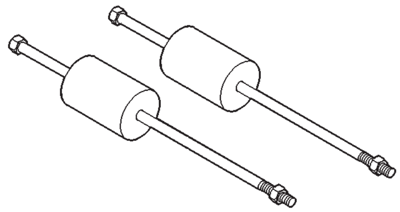
Extension Housing Pilot—C-3288-B



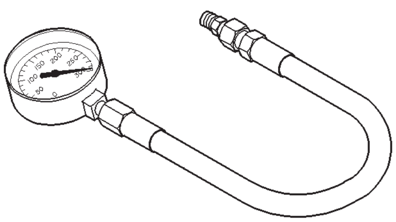
Spring Compressor—C-3422-B



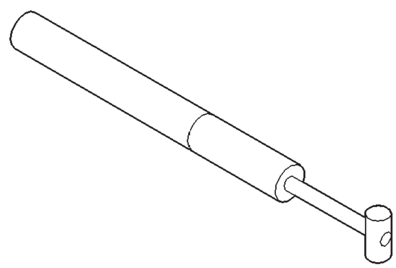
Pressure Gauge—C-3292



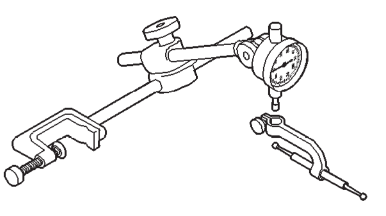
Puller, Slide Hammer—C-3752



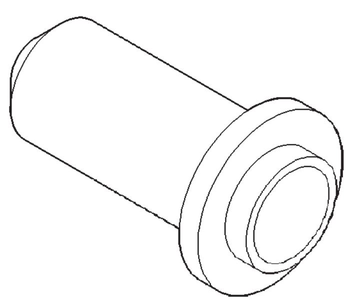
Pressure Gauge—C-3293SP



Gauge, Throttle Setting—C-3763

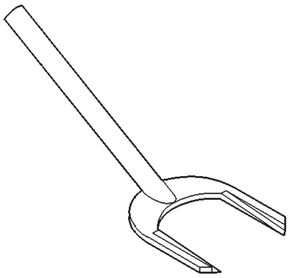


Dial Indicator—C-3339

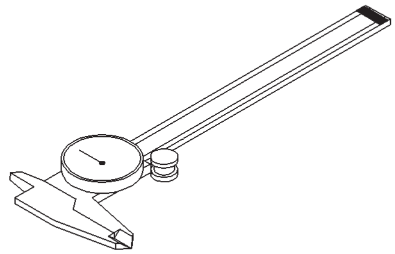


Seal Installer—C-3860–A

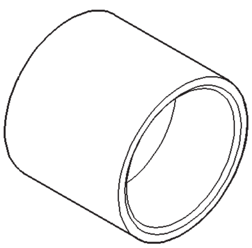
SPECIAL TOOLS (Continued)



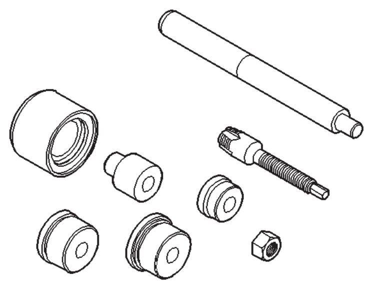
Seal Remover—C-3985-B



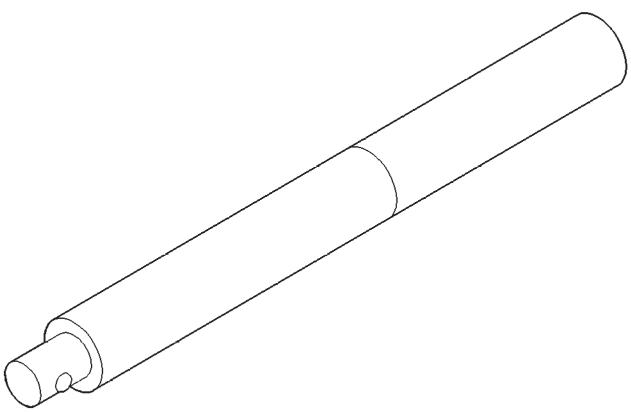
Dial Caliper—C-4962



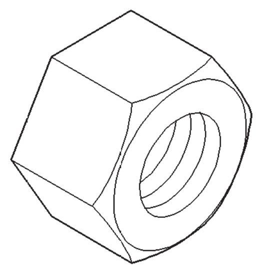
Installer—C-3995-A



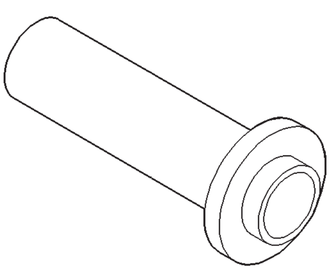
Bushing Remover/Installer Set—C-3887-J



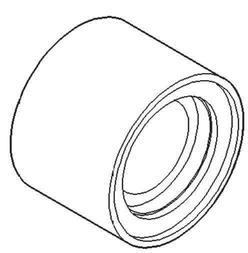
Universal Handle—C-4171



Nut, Bushing Remover—SP-1191, From kit C-3887-J

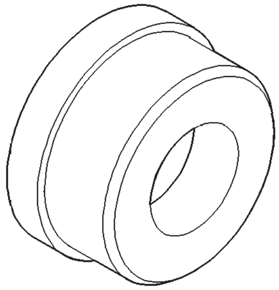


Seal Installer—C-4193-A

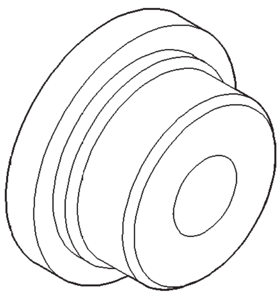


Cup, Bushing Remover—SP-3633, From kit C-3887-J

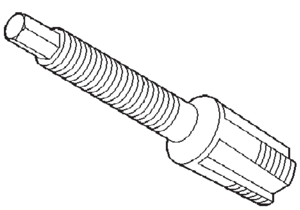
SPECIAL TOOLS (Continued)



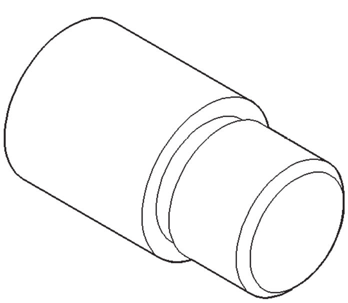
Remover, Bushing—SP-3551



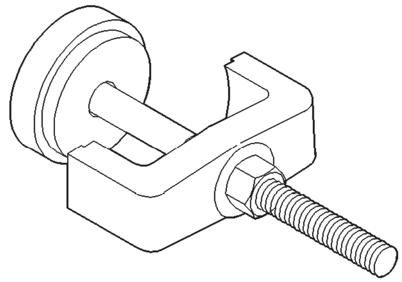
Installer, Bushing—SP-5117



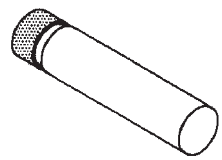
Remover, Bushing—SP-5324



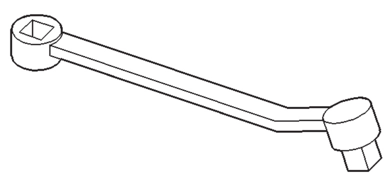
Installer, Bushing—SP-5325



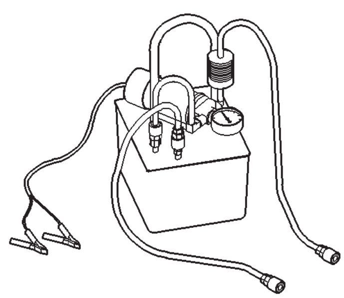
Compressor, Spring—C-3575-A



Gauge—6312

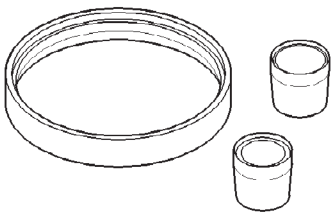


Adapter—C-3705

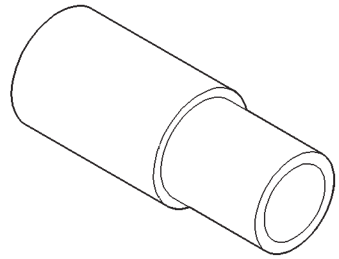


Flusher—6906

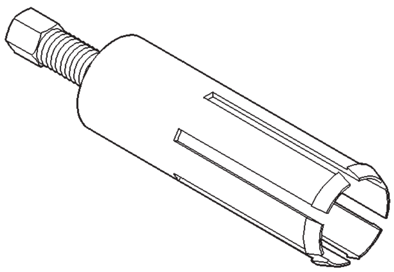
SPECIAL TOOLS (Continued)



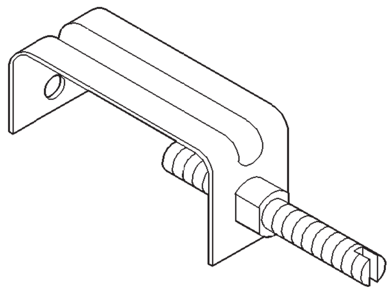
Installer—8114



Installer—6951



Remover—6957



Retainer—6583

45RFE AUTOMATIC TRANSMISSION

INDEX

GENERAL INFORMATION

45RFE AUTOMATIC TRANSMISSION

The 45RFE automatic transmission is a sophisticated, multi-range, electronically controlled transmission which combines optimized gear ratios for responsive performance, state of the art efficiency features and low NVH. Other features include driver adaptive shifting and three planetary gear sets to provide wide ratio capability with precise ratio steps for optimum driveability. The three planetary gear

GENERAL INFORMATION (Continued)

sets also make available a unique alternate second gear ratio. The primary 2nd gear ratio fits between 1st and 3rd gears for normal through-gear accelerations. The alternate second gear ratio (2prime) allows smoother 4–2 kickdowns at high speeds to provide 2nd gear passing performance over a wider highway cruising range.

The 45RFE offers full electronic control of all automatic up and downshifts, and features real-time adaptive closed-loop shift and pressure control. Electronic shift and torque converter clutch controls help protect the transmission from damage due to high temperatures, which can occur under severe operating conditions. By altering shift schedules, line pressure, and converter clutch control, these controls reduce heat generation and increase transmission cooling.

To help reduce efficiency-robbing parasitic losses, the transmission includes a dual-stage transmission fluid pump with electronic output pressure control. Under most driving conditions, pump output pressure greatly exceeds that which is needed to keep the clutches applied. The 45RFE pump-pressure control system monitors input torque and adjusts the pump pressure accordingly. The primary stage of the pump works continuously; the second stage is bypassed when demand is low. The control system also monitors input and output speed and, if incipient clutch slip is observed, the pressure control solenoid duty cycle is varied, increasing pressure in proportion to demand.

A high-travel torque converter damper assembly allow earlier torque converter clutch engagement to reduce slippage. Needle-type thrust bearings reduce internal friction. The 45RFE is packaged in a one-piece die-cast aluminum case. To reduce NVH, the case has high lateral, vertical and torsional stiffness. It is also designed to maximize the benefit of the structural dust cover that connects the bottom of the bell housing to the engine bedplate, enhancing overall power train stiffness. Dual filters protect the pump and other components. A pump return filter is added to the customary main sump filter. Independent lubrication and cooler circuits assure ample pressure for normal transmission operation even if the cooler is obstructed or the fluid cannot flow due to extremely low temperatures.

HYDRAULICS

The hydraulic portion of the transmission consists of the transmission fluid, fluid passages, hydraulic valves, and various line pressure control components.

The hydraulic control system design (without electronic assist) provides the transmission with PARK, REVERSE, NEUTRAL, SECOND, and THIRD gears, based solely on driver shift lever selection. This design allows the vehicle to be driven (in “limp-in” mode) in the event of a failure of the electronic control system, or a situation that the Transmission Control Module (TCM) recognizes as potentially damaging to the transmission.

MECHANICAL

The primary mechanical components of the transmission consist of the following:

- Three multiple disc input clutches
- Three multiple disc holding clutches
- Five hydraulic accumulators
- Three planetary gear sets
- Dual Stage Hydraulic oil pump
- Valve body
- Solenoid pack

ELECTRONICS

The TCM is the “heart” or “brain” of the electronic control system and relies on information from various direct and indirect inputs (sensors, switches, etc.) to determine driver demand and vehicle operating conditions. With this information, the TCM can calculate and perform timely and quality shifts through various output or control devices (solenoid pack, transmission control relay, etc.).

The TCM also performs certain self-diagnostic functions and provides comprehensive information (sensor data, DTC’s, etc.) which is helpful in proper diagnosis and repair. This information can be viewed with the DRB scan tool.

TRANSMISSION IDENTIFICATION

Transmission identification numbers are stamped on the left side of the case just above the oil pan gasket surface (Fig. 1). Refer to this information when ordering replacement parts. A label is attached to the transmission case above the stamped numbers. The label gives additional information which may also be necessary for identification purposes.

RECOMMENDED FLUID

NOTE: Refer to the Service Procedures section of this Group for fluid level checking procedures.

FLUID TYPE

Mopar® ATF Plus 3, Type 7176 automatic transmission fluid is the recommended fluid for Chrysler automatic transmissions.

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

GENERAL INFORMATION (Continued)

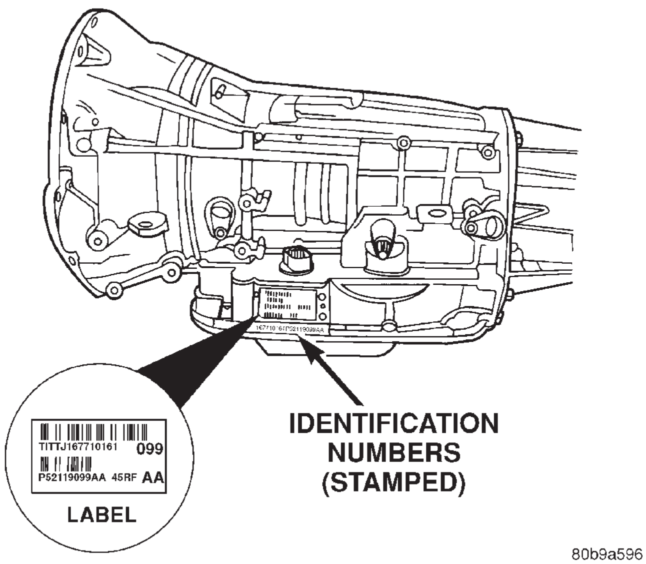


Fig. 1 Transmission Part And Serial Number Location

FLUID ADDITIVES

Fluid additives other than Mopar® approved fluorescent leak detection dyes are not to be used in this transmission.

TRANSMISSION GEAR RATIOS

Gear ratios are:

1st	3.00:1
2nd	1.67:1
2nd Prime	1.50:1
3rd	1.00:1
4th	0.75:1
Reverse	3.00:1

DESCRIPTION AND OPERATION

ELECTRONIC LOCK-UP TORQUE CONVERTER

The torque converter is a hydraulic device that couples the engine crankshaft to the transmission. The torque converter consists of an outer shell with an internal turbine, a stator, an overrunning clutch, an impeller, and an electronically applied converter clutch. Torque multiplication is created when the stator directs the hydraulic flow from the turbine to rotate the impeller in the direction the engine crankshaft is turning. The turbine transfers power to the planetary gear sets in the transmission. The transfer of power into the impeller assists torque multiplication. At low vehicle-speed, the overrunning clutch holds the stator stationary (during torque multiplication) and allows the stator to freewheel at high vehicle speed. The converter clutch engagement reduces engine speed. Clutch engagement also provides reduced transmission fluid temperatures. The torque converter hub drives the transmission oil (fluid) pump.

The torque converter is a sealed, welded unit that is not repairable and is serviced as an assembly.

CAUTION: The torque converter must be replaced if a transmission failure results in large amounts of metal or fiber contamination in the fluid.

GEARSHIFT MECHANISM

The shift mechanism is cable operated and provides six shift positions. The shift positions 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 mechanism is required to complete the 3-4 shift.

OVERDRIVE OFF SWITCH

The overdrive OFF (control) switch is located in the shifter handle. The switch is a momentary contact device that signals the PCM 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 overdrive OFF mode defaults to ON after the ignition switch is cycled OFF and ON. 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 3-4 upshift. The control switch indicator light illuminates only when the overdrive switch is turned to the OFF position, or when illuminated by the transmission control module.

ELECTRONICALLY MODULATED CONVERTER CLUTCH ENGAGEMENT

In order to reduce heat build-up in the transmission and buffer the powertrain against torsional vibrations, the TCM can duty cycle the L/R-CC Solenoid to achieve a smooth application of the torque converter clutch. This function, referred to as Electronically Modulated Converter Clutch (EMCC) can occur at various times depending on the following variables:

DESCRIPTION AND OPERATION (Continued)

- Shift lever position
- Current gear range
- Transmission fluid temperature
- Engine coolant temperature
- Input speed
- Throttle angle
- Engine speed

The TCM controls the torque converter by way of internal logic software. The programming of the software provides the TCM with control over the L/R-CC Solenoid. There are four output logic states that can be applied as follows:

- No EMCC
- Partial EMCC
- Full EMCC
- Gradual-to-no EMCC

NO EMCC

Under No EMCC conditions, the L/R Solenoid is OFF. There are several conditions that can result in NO EMCC operations. No EMCC can be initiated due to a fault in the transmission or because the TCM does not see the need for EMCC under current driving conditions.

PARTIAL EMCC

Partial EMCC operation modulates the L/R Solenoid (duty cycle) to obtain partial torque converter clutch application. Partial EMCC operation is maintained until Full EMCC is called for and actuated. During Partial EMCC some slip does occur. Partial EMCC will usually occur at low speeds, low load and light throttle situations.

FULL EMCC

During Full EMCC operation, the TCM increases the L/R Solenoid duty cycle to full ON after Partial EMCC control brings the engine speed within the desired slip range of transmission input speed relative to engine rpm.

GRADUAL-TO-NO EMCC

This operation is to soften the change from Full or Partial EMCC to No EMCC. This is done at mid-throttle by decreasing the L/R Solenoid duty cycle.

BRAKE TRANSMISSION SHIFT INTERLOCK MECHANISM

The Brake Transmission Shifter/Ignition Interlock (BTSI), is a cable and solenoid operated system. It interconnects the automatic transmission floor mounted shifter to the steering column ignition switch (Fig. 2). 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. An additional electrically activated feature will prevent shifting out of the PARK position unless the brake pedal is depressed at least one-half an inch. A magnetic holding device in line with the park lock cable is energized when the ignition is in the RUN position.When the key is in the RUN position and the brake pedal is depressed, the shifter is unlocked and will move into any position. The interlock system also prevents the ignition switch from being turned to the LOCK or ACCESSORY position, unless the shifter is fully locked into the PARK position.

TRANSMISSION CONTROL MODULE

DESCRIPTION

The Transmission Control Module (TCM) is located in the engine compartment on the right (passenger) side and is mounted to the inner fender (Fig. 3).

OPERATION

The TCM is the controlling unit for all electronic operations of the transmission. The TCM receives information regarding vehicle operation from both direct and indirect inputs, and selects the operational mode of the transmission. Direct inputs are hardwired to, and used specifically by the TCM. Indirect inputs originate from other components/modules, and are shared with the TCM via the vehicle communication bus.

Some examples of **direct inputs** to the TCM are:

- Battery (B+) voltage
- Ignition “ON” voltage
- Transmission Control Relay (Switched B+)
- Throttle Position Sensor
- Crankshaft Position Sensor
- Transmission Range Sensor
- Pressure Switches
- Transmission Temperature Sensor
- Input Shaft Speed Sensor
- Output Shaft Speed Sensor
- Line Pressure Sensor

Some examples of **indirect inputs** to the TCM are:

- Engine/Body Identification
- Manifold Pressure
- Target Idle
- Torque Reduction Confirmation
- Engine Coolant Temperature
- Ambient/Battery Temperature
- DRB Scan Tool Communication

Based on the information received from these various inputs, the TCM determines the appropriate shift schedule and shift points, depending on the present operating conditions and driver demand. This is possible through the control of various direct and indirect outputs.

DESCRIPTION AND OPERATION (Continued)

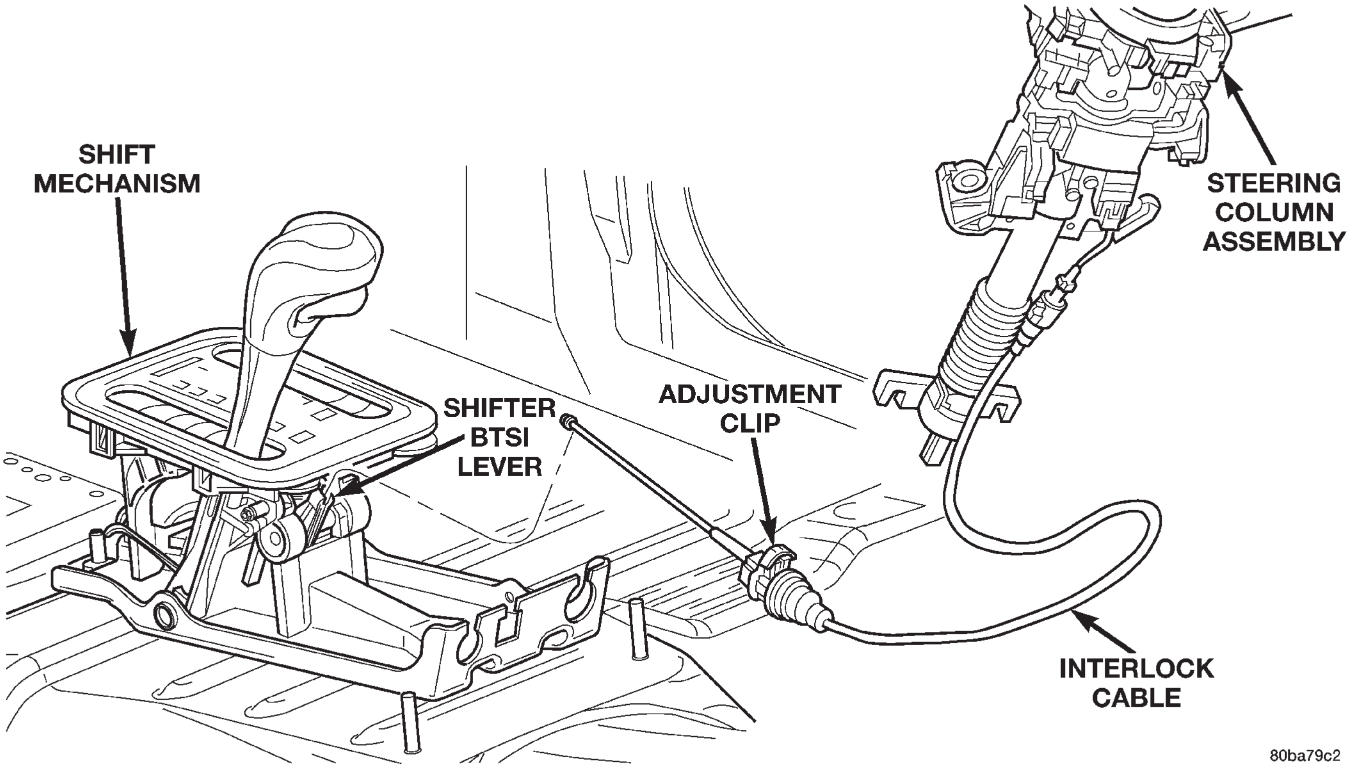


Fig. 2 Ignition Interlock Cable

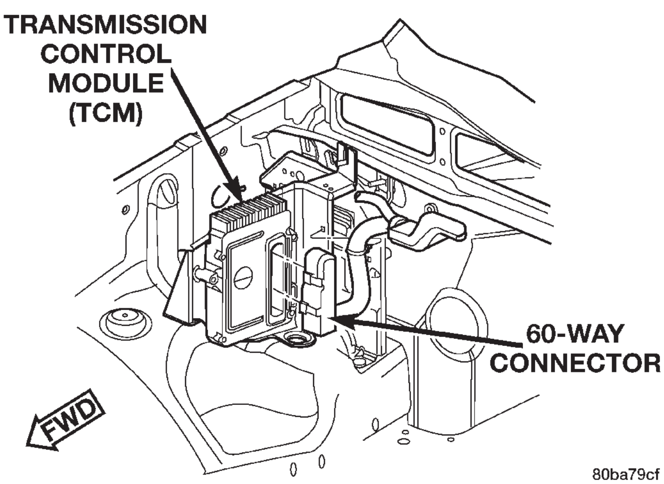


Fig. 3 Transmission Control Module Location

Some examples of TCM **direct outputs** are:
- Transmission Control Relay
- Solenoids
- Torque Reduction Request

Some examples of TCM **indirect outputs** are:
- Transmission Temperature (to PCM)
- PRNDL Position (to BCM)

In addition to monitoring inputs and controlling outputs, the TCM has other important responsibilities and functions:
- Storing and maintaining Clutch Volume Indexes (CVI)
- Storing and selecting appropriate Shift Schedules
- System self-diagnostics
- Diagnostic capabilities (with DRB scan tool)

NOTE: If the TCM has been replaced, the "Quick Learn Procedure" must be performed. Refer to "Quick Learn Procedure" in Service Procedures of this group.

CLUTCH VOLUME INDEXES

An important function of the TCM is to monitor Clutch Volume Indexes (CVI). CVIs represent the volume of fluid needed to compress a clutch pack.

The TCM monitors gear ratio changes by monitoring the Input and Output Speed Sensors. The Input, or Turbine Speed Sensor sends an electrical signal to the TCM that represents input shaft rpm. The Output Speed Sensor provides the TCM with output shaft speed information.

By comparing the two inputs, the TCM can determine transmission gear position. This is important to the CVI calculation because the TCM determines CVIs by monitoring how long it takes for a gear change to occur (Fig. 4).

Gear ratios can be determined by using the DRB Scan Tool and reading the Input/Output Speed Sensor values in the "Monitors" display. Gear ratio can be obtained by dividing the Input Speed Sensor value by the Output Speed Sensor value.

For example, if the input shaft is rotating at 1000 rpm and the output shaft is rotating at 500 rpm,

DESCRIPTION AND OPERATION (Continued)

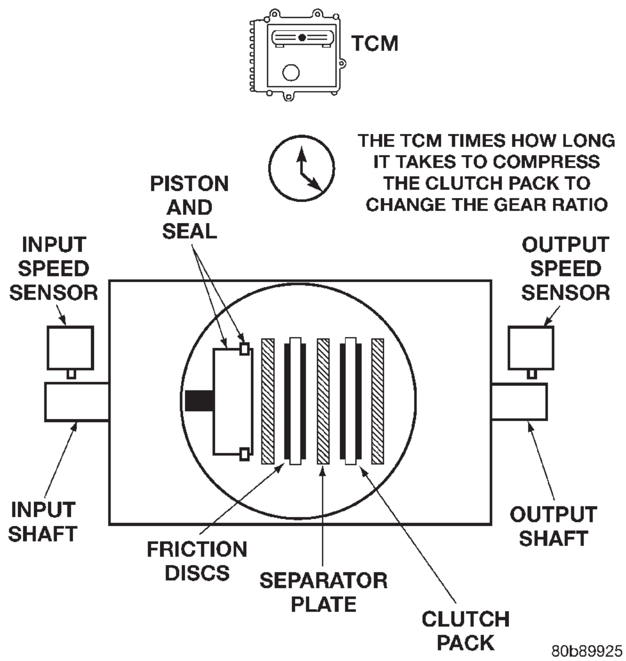


Fig. 4 Example of CVI Calculation

then the TCM can determine that the gear ratio is 2:1. In direct drive (3rd gear), the gear ratio changes to 1:1. The gear ratio changes as clutches are applied and released. By monitoring the length of time it takes for the gear ratio to change following a shift request, the TCM can determine the volume of fluid used to apply or release a friction element.

The volume of transmission fluid needed to apply the friction elements are continuously updated for adaptive controls. As friction material wears, the volume of fluid need to apply the element increases.

Certain mechanical problems within the input clutch assembly (broken return springs, out of position snap rings, excessive clutch pack clearance, improper assembly, etc.) can cause inadequate or out-of-range element volumes. Also, defective Input/Output Speed Sensors and wiring can cause these conditions. The following chart identifies the appropriate clutch volumes and when they are monitored/updated:

CLUTCH VOLUMES		
Clutch	**When Updated**	**Proper Clutch Volume**
L/R	2-1 or 3-1 downshift	82 to 134
2C	3-2 kickdown shift	25 to 64
OD	2-3 upshift	30 to 64
4C	3-4 upshift	30 to 64
UD	4-3 kickdown shift	44 to 92

SHIFT SCHEDULES

As mentioned earlier, the TCM has programming that allows it to select a variety of shift schedules. Shift schedule selection is dependent on the following:

- Shift lever position
- Throttle position
- Engine load
- Fluid temperature
- Software level

As driving conditions change, the TCM appropriately adjusts the shift schedule. Refer to the following chart to determine the appropriate operation expected, depending on driving conditions.

Schedule	Condition	Expected Operation
Extreme Cold	Oil temperature below -16° F	– Park, Reverse, Neutral and 1st and 3rd gear only in D position, 2nd gear only in Manual 2 or L – No EMCC
Super Cold	Oil temperature between -12° F and 10° F	– Delayed 2-3 upshift – Delayed 3-4 upshift – Early 4-3 coastdown shift – High speed 4-2, 3-2, 2-1 kickdown shifts are prevented – Shifts at high throttle openings willl be early. – No EMCC

DESCRIPTION AND OPERATION (Continued)

Schedule	Condition	Expected Operation
Cold	Oil temperature between 10° F and 36° F	– Shift schedule is the same as Super Cold except that the 2-3 upshifts are not delayed.
Warm	Oil temperature 40° F and 80° F	– Normal operation (upshift, kickdowns, and coastdowns) – No EMCC
Hot	Oil temperature above 80° F and 240° F	– Normal operation (upshift, kickdowns, and coastdowns) – Normal EMCC operation
Overheat	Oil temperature above 240° F or engine coolant temperature above 244° F	– Delayed 2-3 upshift – Delayed 3-4 upshift – 3rd gear FEMCC from 30-48 mph – 3rd gear PEMCC above 35 mph – Above 25 mph the torque converter will not unlock unless the throttle is closed or if a wide open throttle 2nd PEMCC to 1 kickdown is made

SOLENOID AND PRESSURE SWITCH ASSEMBLY

DESCRIPTION

The solenoid and pressure switch assembly is internal to the transmission and mounted on the valve body assembly (Fig. 5). The assembly consists of six solenoids that control hydraulic pressure to the six friction elements (transmission clutches), and the torque converter clutch. The pressure control solenoid is located on the side of the solenoid and pressure switch assembly. The solenoid assembly also contains five pressure switches that feed information to the TCM.

OPERATION

The solenoids within the assembly are supplied voltage by the Transmission Control Relay. The solenoids are energized when the TCM grounds the return wire for the solenoid that is needed. The pressure switches simply tell the TCM whether or not pressure exists within a clutch circuit.

BATTERY FEED (TCM)

A fused, direct battery feed to the TCM is used for continuous power. This battery voltage is necessary to retain adaptive learn values in the TCM's RAM (Random Access Memory). When the battery (B+) is disconnected, this memory is lost. When the battery (B+) is restored, this memory loss is detected by the TCM and a Diagnostic Trouble Code (DTC) is set.

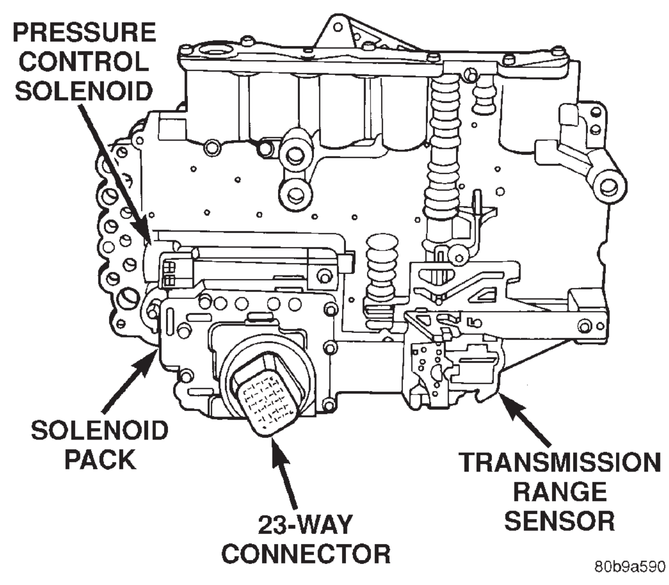


Fig. 5 SOLENOID AND PRESSURE SWITCH ASSEMBLY

TRANSMISSION CONTROL RELAY

The relay is supplied fused B+ voltage, energized by the TCM, and is used to supply power to the solenoid pack when the transmission is in normal operating mode. When the relay is "off", no power is supplied to the solenoid pack and the transmission is in "limp-in" mode. After a controller reset, the TCM energizes the relay. Prior to this, the TCM verifies that the contacts are open by checking for no voltage at the switched battery terminals. After this is verified, the voltage at the solenoid pack pressure

DESCRIPTION AND OPERATION (Continued)

switches is checked. After the relay is energized, the TCM monitors the terminals to verify that the voltage is greater than 3 volts.

PRESSURE SWITCHES

The pressure switches are located inside the solenoid and pressure switch assembly and are only serviced by replacing the assembly.

The TCM relies on five pressure switches to monitor fluid pressure in the L/R, 2C, 4C, UD, and OD hydraulic circuits. The primary purpose of these switches is to help the TCM detect when clutch circuit hydraulic failures occur. The switches close at 23 psi and open at 11 psi, and simply indicate whether or not pressure exists. The switches are continuously monitored by the TCM for the correct states (open or closed) in each gear as shown in the following chart:

GEAR	L/R	2C	4C	UD	OD
R	OP	OP	OP	OP	OP
P/N	CL	OP	OP	OP	OP
1ST	CL*	OP	OP	CL	OP
2ND	OP	CL	OP	CL	OP
2ND PRIME	OP	OP	CL	CL	OP
D	OP	OP	OP	CL	CL
OD	OP	OP	CL	OP	CL

*L/R is closed if output speed is below 100 rpm in Drive and Manual 2. L/R is open in Manual 1.

A Diagnostic Trouble Code (DTC) will set if the TCM senses any switch open or closed at the wrong time in a given gear.

INPUT AND OUTPUT SPEED SENSORS

DESCRIPTION

The Input and Output Speed Sensors are two-wire magnetic pickup devices that generate AC signals as rotation occurs. They are mounted in the left side of the transmission case and are considered primary inputs to the Transmission Control Module (TCM).

OPERATION

The Input Speed Sensor provides information on how fast the input shaft is rotating. As the teeth of the input clutch hub pass by the sensor coil, an AC voltage is generated and sent to the TCM. The TCM interprets this information as input shaft rpm.

The Output Speed Sensor generates an AC signal in a similar fashion, though its coil is excited by rotation of the rear planetary carrier lugs. The TCM interprets this information as output shaft rpm.

The TCM compares the input and output speed signals to determine the following:

- Transmission gear ratio
- Speed ratio error detection
- CVI calculation

The TCM also compares the input speed signal and the engine speed signal to determine the following:

- Torque converter clutch slippage
- Torque converter element speed ratio

LINE PRESSURE CONTROL

DESCRIPTION

The TCM utilizes a closed-loop system to control transmission line pressure. The system contains a variable force style solenoid, the Pressure Control Solenoid, mounted on the side of the solenoid and pressure switch assembly. The solenoid is duty cycle controlled by the TCM to vent the unnecessary line pressure supplied by the oil pump back to the sump. The system also contains a variable pressure style sensor, the Line Pressure Sensor, which is a direct input to the TCM. The line pressure solenoid monitors the transmission line pressure and completes the feedback loop to the TCM. The TCM uses this information to adjust its control of the pressure control solenoid to achieve the desired line pressure.

OPERATION

The TCM calculates the desired line pressure based upon inputs from the transmission and engine. The TCM calculates the torque input to the transmission and uses that information as the primary input to the calculation. The line pressure is set to a predetermined value during shifts and when the transmission is in the PARK and NEUTRAL positions. This is done to ensure consistent shift quality. During all other operation, the actual line pressure is compared to the desired line pressure and adjustments are made to the pressure control solenoid duty cycle.

THROTTLE POSITION SENSOR

The Transmission Control Module (TCM) receives the throttle position signal and its ground from the Throttle Position Sensor (TPS). The TPS has a 5 volt pull up supplied by the engine controller. The throttle signal is checked by the TCM for out-of-range as well as intermittence (excessive signal changes).

TRANSMISSION RANGE SENSOR

DESCRIPTION

The Transmission Range Sensor (TRS) is mounted to the top of the valve body inside the transmission.

DESCRIPTION AND OPERATION (Continued)

The Transmission Range Sensor (TRS) has six switch contacts that:

- Determine shift lever position
- Supply ground to the Starter Relay in Park and Neutral only.
- Supply ground to the Backup Lamp Relay in Reverse only.

The TRS also has an integrated temperature sensor (thermistor) that communicates transmission temperature to the TCM and PCM.

OPERATION

The Transmission Range Sensor (TRS) communicates shift lever position to the TCM as a combination of open and closed switches. Each shift lever position has an assigned combination of switch states (open/closed) that the TCM receives from four sense circuits. The TCM interprets this information and determines the appropriate transmission gear position and shift schedule.

There are many possible combinations of open and closed switches (codes). Seven of these possible codes are related to gear position and five are recognized as “between gear” codes. This results in many codes which should **never occur**. These are called “invalid” codes. An invalid code will result in a DTC, and the TCM will then determine the shift lever position based on pressure switch data. This allows reasonably normal transmission operation with a TRS failure.

GEAR	C5	C4	C3	C2	C1
Park	CL	OP	OP	CL	CL
Temp 1	CL	OP	OP	CL	OP
Reverse	OP	OP	OP	CL	OP
Temp 2	OP	OP	CL	CL	OP
Neutral 1	OP	OP	CL	CL	CL
Neutral 2	OP	CL	CL	CL	CL
Temp 3	OP	CL	CL	CL	OP
Drive	OP	CL	CL	OP	OP
Temp 4	OP	CL	OP	OP	OP
Manual 2	CL	CL	OP	OP	OP
Temp 5	CL	OP	OP	OP	OP
Manual 1	CL	OP	CL	OP	OP

TRANSMISSION TEMPERATURE SENSOR

DESCRIPTION

The transmission temperature sensor is a thermistor that is integral to the Transmission Range Sensor (TRS).

OPERATION

The transmission temperature sensor is used by the TCM to sense the temperature of the fluid in the sump. Since fluid temperature can affect transmission shift quality and convertor lock up, the TCM requires this information to determine which shift schedule to operate in.

Calculated Temperature

A failure in the temperature sensor or circuit will result in calculated temperature being substituted for actual temperature. Calculated temperature is a predicted fluid temperature which is calculated from a combination of inputs:

- Battery (ambient) temperature
- Engine coolant temperature
- In-gear run time since start-up

SOLENOIDS

DESCRIPTION

Solenoids are used to control the L/R, 2C, 4C, OD, and UD friction elements. The reverse clutch is controlled by line pressure and the position of the manual valve in the valve body. All the solenoids are contained within the Solenoid and Pressure Switch Assembly. The solenoid and pressure switch assembly contains one additional solenoid, Multi-Select (MS), which serves primarily to provide 2nd and 3rd gear limp-in operation.

OPERATION

The solenoids receive electrical power from the Transmission Control Relay through a single wire. The TCM energizes or operates the solenoids individually by grounding the return wire of the solenoid as necessary. When a solenoid is energized, the solenoid valve shifts, and a fluid passage is opened or closed (vented or applied), depending on its default operating state. The result is an apply or release of a frictional element.

The MS and UD solenoids are normally applied to allow transmission limp-in in the event of an electrical failure.

The continuity of the solenoids and circuits are periodically tested. Each solenoid is turned on or off depending on its current state. An inductive spike should be detected by the TCM during this test. If no spike is detected, the circuit is tested again to verify the failure. In addition to the periodic testing, the solenoid circuits are tested if a speed ratio or pressure switch error occurs.

DESCRIPTION AND OPERATION (Continued)

SOLENOID SWITCH VALVE

DESCRIPTION

The Solenoid Switch Valve (SSV) is located in the valve body controls the direction of the transmission fluid when the L/R-TCC solenoid is energized.

OPERATION

The Solenoid Switch Valve controls line pressure from the LR-TCC solenoid. In 1st gear, the SSV will be in the downshifted position, thus directing fluid to the L/R clutch circuit. In 2nd, 3rd, and 4th, it will be in the upshifted position and directs the fluid into the torque converter clutch (TCC) circuit.

When shifting into 1st gear, a special hydraulic sequence is performed to ensure SSV movement into the downshifted position. The L/R pressure switch is monitored to confirm SSV movement. If the movement is not confirmed (the L/R pressure switch does not close), 2nd gear is substituted for 1st. A DTC will be set after three unsuccessful attempts are made to get into 1st gear in one given key start.

DIAGNOSIS AND TESTING

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. This aerates the fluid and causing the same conditions occurring 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 BURNT FLUID

Burnt, discolored fluid is a result of overheating which has two primary causes.

(1) A result of restricted fluid flow through the main and/or auxiliary cooler. This condition is usually the result of a faulty or damaged main/auxiliary cooler, or severe restrictions in the coolers and lines caused by debris or kinked lines.

(2) 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

Transmission fluid contamination is generally a result of:

- adding incorrect fluid
- failure to clean dipstick and fill tube when checking level
- engine coolant entering the 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 after 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 recontamination. Flushing applies to auxiliary coolers as well. The torque converter should also be replaced whenever a failure generates sludge and debris. This is necessary because normal converter flushing procedures will not remove all contaminants.

45RFE AUTOMATIC TRANSMISSION GENERAL DIAGNOSIS

CAUTION: Before attempting any repair on a 45RFE automatic transmission, check for Diagnostic Trouble Codes with the DRB scan tool.

Transmission malfunctions may be caused by these general conditions:

- Poor engine performance
- Improper adjustments
- Hydraulic malfunctions

DIAGNOSIS AND TESTING (Continued)

- Mechanical malfunctions
- Electronic malfunctions

Diagnosis of these problems should always begin by checking the easily accessible variables: fluid level and condition, gearshift cable adjustment. Then perform a road test to determine if the problem has been corrected or if more diagnosis is necessary. If the problem persists after the preliminary tests and corrections are completed, hydraulic pressure checks should be performed.

PRELIMINARY DIAGNOSIS

Two basic procedures are required. One procedure for vehicles that are drivable and an alternate procedure for disabled vehicles (will not back up or move forward).

VEHICLE IS DRIVABLE

(1) Check for transmission fault codes using DRB scan tool.

(2) Check fluid level and condition.

(3) Adjust gearshift cable 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 operation.

VEHICLE IS DISABLED

(1) Check fluid level and condition.

(2) Check for broken or disconnected gearshift cable.

(3) Check for cracked, leaking cooler lines, or loose or missing pressure-port plugs.

(4) Raise and support vehicle on safety stands, 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 shaft 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 driveplate, converter, oil pump, or input shaft.

(c) If propeller shaft does not turn and transmission is not noisy, perform hydraulic-pressure test to determine if problem is hydraulic or mechanical.

BRAKE TRANSMISSION SHIFT INTERLOCK

(1) Verify that the key can only be removed in the PARK position.

(2) When the shift lever is in PARK And the shift handle pushbutton is in the “OUT” position, the ignition key cylinder should rotate freely from OFF to LOCK. When the shifter is in any other gear or neutral position, the ignition key cylinder should not rotate to the LOCK position.

(3) Shifting out of PARK should be possible when the ignition key cylinder is in the OFF position.

(4) Shifting out of PARK should not be possible while applying 25 lb. maximum handle pushbutton force and ignition key cylinder is in the RUN or START positions unless the foot brake pedal is depressed approximately 1/2 inch (12 mm).

(5) Shifting out of PARK should not be possible when the ignition key cylinder is in the ACCESSORY or LOCK positions.

(6) Shifting between any gears, NEUTRAL or into PARK may be done without depressing foot brake pedal with ignition switch in RUN or START positions and vehicle stationary or in motion.

GEARSHIFT CABLE

(1) The floor shifter lever and gate positions should be in alignment with all transmission PARK, NEUTRAL, and gear detent positions.

(2) Engine starts must be possible with floor shift lever in PARK or NEUTRAL gate positions only. Engine starts must not be possible in any other gear position.

(3) With floor shift lever handle push-button not depressed and lever in:

(a) PARK position—Apply forward force on center of handle and remove pressure. Engine starts must be possible.

(b) PARK position—Apply rearward force on center of handle and remove pressure. Engine starts must be possible.

(c) NEUTRAL position—Normal position. Engine starts must be possible.

(d) NEUTRAL position—Engine running and brakes applied, apply forward force on center of shift handle. Transmission shall not be able to shift from neutral to reverse.

ROAD TESTING

Before road testing, be sure the fluid level and control cable adjustments have been checked and adjusted if necessary. Verify that all diagnostic trouble codes have been resolved.

Observe engine performance during the road test. A poorly tuned engine will not allow accurate analysis of transmission operation.

DIAGNOSIS AND TESTING (Continued)

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 or overrunning clutch problems.

A slipping clutch can often be determined by comparing which internal units are applied in the various gear ranges. The Clutch Application chart provides a basis for analyzing road test results.

CLUTCH APPLICATION CHART

SLP	UD	OD	R	2C	4C	L/R	OVERRUNNING
P–PARK						ON	
R–REVERSE			ON			ON	
N-NEUTRAL						ON	
D–OVERDRIVE FIRST	ON					ON*	ON
SECOND	ON			ON			
SECOND PRIME	ON				ON		
THIRD	ON	ON					
FOURTH		ON			ON		
LIMP-IN	ON	ON					
2–FIRST	ON					ON*	ON
SECOND	ON			ON			
LIMP-IN	ON			ON			
1–LOW	ON					ON	ON

*L/R clutch is on only with the output shaft speed below 150 rpm.

HYDRAULIC PRESSURE TEST

An accurate tachometer and pressure test gauges are required. Test Gauge C-3293-SP has a 300 psi range and is used at all locations where pressures exceed 100 psi.

Pressure Test Port Locations

Only two pressure ports are supplied on the transmission case. The torque converter ON and torque converter OFF ports are located on the right side of the transmission case (Fig. 6).

To determine the line pressure, there are two available methods. The DRB scan tool can be used to read line pressure from the line pressure sensor. The second method is to install Line Pressure Adapter 8259 into the transmission case and then install the pressure gauge and the original sensor into the adapter. This will allow a comparison of the DRB readings and the gauge reading to make a determination regarding the accuracy of the feedback controls.

In order to access any other pressure tap locations, the transmission oil pan must be removed, the pressure port plugs removed and Valve Body Pressure Tap Adapter 8258 installed. The extensions supplied

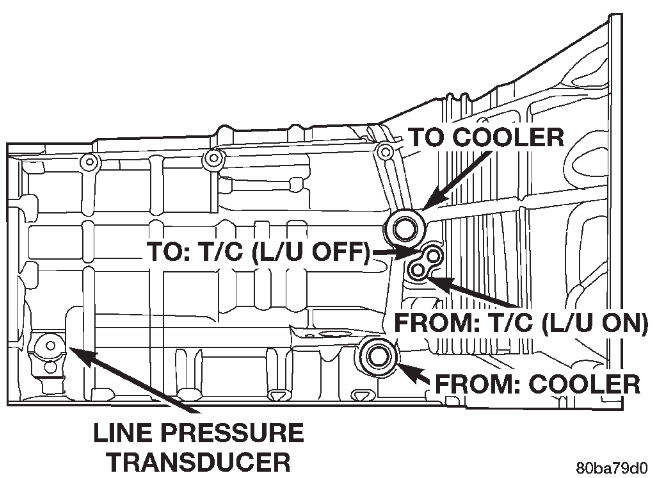


Fig. 6 Torque Converter Pressure Locations

with Adapter 8258 will allow the installation of pressure gauges to the valve body. Refer to (Fig. 7) for correct pressure tap location identification.

TEST PROCEDURE

All pressure readings should be taken with the transmission fluid level full, transmission oil at the

DIAGNOSIS AND TESTING (Continued)

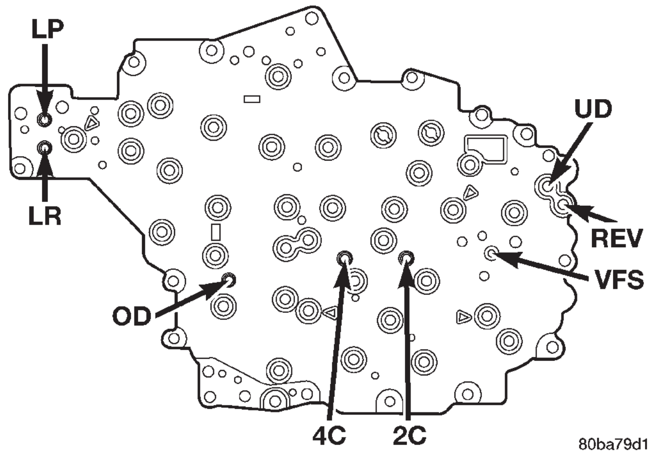


Fig. 7 Pressure Tap Locations

normal operating temperature, and the engine at 1500 rpm. Check the transmission for proper operation in each gear position that is in question or if a specific element is in question, check the pressure readings in at least two gear positions that employs that element. Refer to the Hydraulic Schematics at the rear of this section to determine the correct pressures for each element in a given gear position.

NOTE: The 45RFE utilizes closed loop control of pump line pressure. The pressure readings may therefore vary greatly but should always follow line pressure.

Some common pressures that can be measured to evaluate pump and clutch performance are the upshift/downshift pressures and the garage shift pressures. The upshift/downshift pressure for all shifts except the 3–4, 4–3, and 4–2prime shifts is 120 psi. The upshift/downshift pressure for the 3–4, 4–3, and the 4–2prime shifts is 100 psi. The garage shift pressure when performing a N–R shift is 220 psi. The garage shift pressure for the R–N and N–1 shifts is 120 psi.

AIR TESTING TRANSMISSION CLUTCH OPERATION

Air-pressure testing can be used to check transmission clutch operation. The test can be conducted with the transmission either in the vehicle or on the work bench, as a final check.

Air-pressure testing requires that the oil pan and valve body be removed from the transmission. The clutch apply passages are shown (Fig. 8).

NOTE: The air supply which is used must be free of moisture and dirt. Use a pressure of 30 psi to test clutch operation.

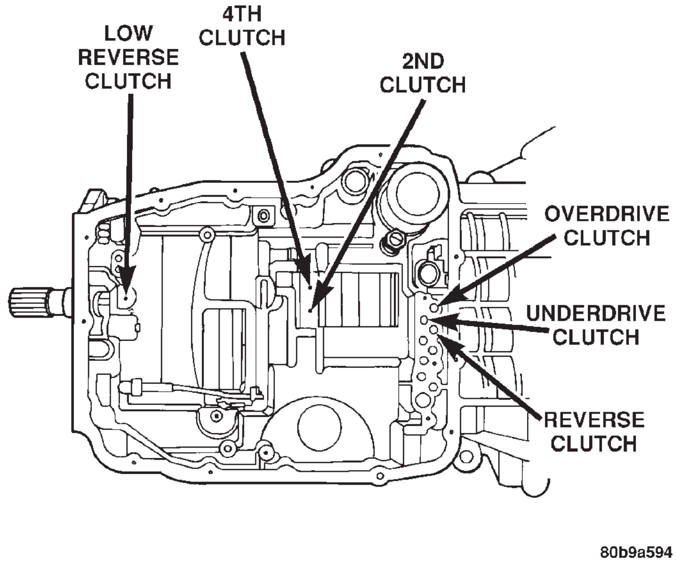


Fig. 8 Air Pressure Test Passages

Apply air pressure at each port. If the clutch is functioning, a soft thump will be heard as the clutch is applied. The clutch application can also be felt by touching the appropriate element while applying air pressure. As the air pressure is released, the clutch should also release.

CONVERTER HOUSING FLUID LEAK DIAGNOSIS

When diagnosing converter housing fluid leaks, two items must be established before repair.

(1) Verify that a leak condition actually exists.

(2) Determined the true source of the leak.

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 fill 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 cover O-ring leaks follow the same path as a seal leak.

TORQUE CONVERTER LEAK POINTS

Possible sources of converter leaks are:

(1) Leaks at the weld joint around the outside diameter weld (Fig. 9).

(2) Leaks at the converter hub weld (Fig. 9).

DIAGNOSIS AND TESTING (Continued)

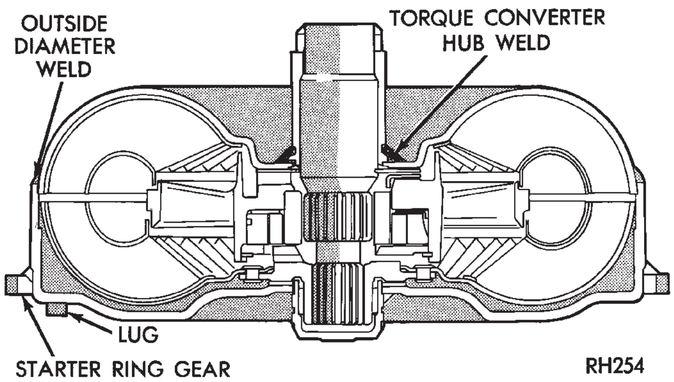


Fig. 9 Converter Leak Points—Typical

SERVICE PROCEDURES

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 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.

(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 (Fig. 10) and check fluid level as follows:

(a) Correct acceptable level is in crosshatch area.

(b) Correct maximum level is to MAX arrow mark.

(c) Incorrect level is at or below MIN line.

(d) If fluid is low, add only enough Mopar® ATF Plus 3 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.

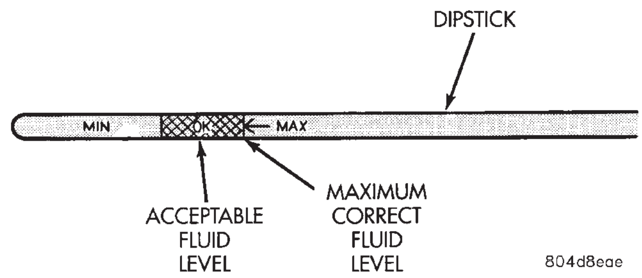


Fig. 10 Dipstick Fluid Level Marks—Typical

FLUID AND FILTER REPLACEMENT

Refer to the Maintenance Schedules in Group 0, Lubrication and Maintenance, for proper service intervals. The fluid capacity of the 45RFE is approximately 13.25 liters (14.0 quarts).

REMOVAL

(1) Hoist and support vehicle on safety stands.

(2) Place a large diameter shallow drain pan beneath the transmission pan.

(3) Remove bolts holding front and sides of pan to transmission.

(4) Loosen bolts holding rear of pan to transmission.

(5) Slowly separate front of pan away from transmission allowing the fluid to drain into drain pan.

(6) Hold up pan and remove remaining bolt holding pan to transmission.

(7) While holding pan level, lower pan away from transmission.

(8) Pour remaining fluid in pan into drain pan.

(9) Remove screws holding filter to valve body (Fig. 11).

(10) Separate filter from valve body and oil pump and pour fluid in filter into drain pan.

(11) Using Oil Filter Wrench 8321, remove the cooler return filter from the transmission.

(12) Dispose of used trans fluid and filter properly.

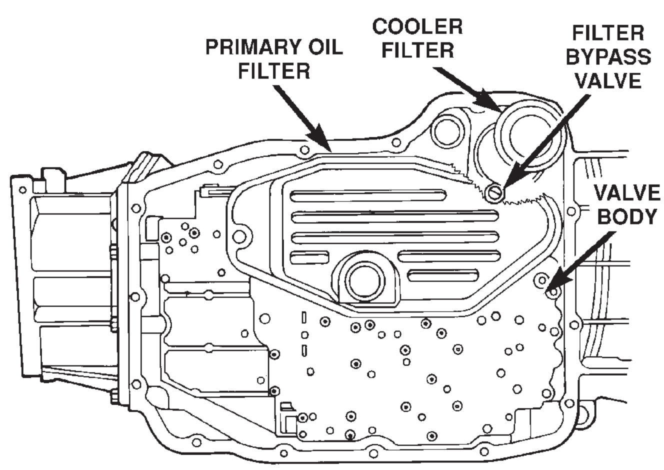


Fig. 11 Transmission Filters

SERVICE PROCEDURES (Continued)

INSPECTION

Inspect bottom of pan and magnet for excessive amounts of metal. A light coating of clutch material on the bottom of the pan does not indicate a problem unless accompanied by a slipping condition or shift lag. If fluid and pan are contaminated with excessive amounts or debris, refer to the diagnosis section of this group.

CLEANING

(1) Using a suitable solvent, clean pan and magnet.

(2) Using a suitable gasket scraper, clean original sealing material from surface of transmission case and the transmission pan.

INSTALLATION

(1) Place replacement filter in position on valve body.

(2) Install screws to hold filter to valve body (Fig. 11). Tighten screws to 4.5 N·m (40 in. lbs.) torque.

(3) Install new cooler return filter onto the transmission. Torque the filter to 14.12 N·m (125 in. lbs.).

(4) Place bead of Mopar® RTV sealant onto the transmission case sealing surface.

(5) Place pan in position on transmission.

(6) Install screws to hold pan to transmission. Tighten bolts to 11.8 N·m (105 in. lbs.) torque.

(7) Lower vehicle and fill transmission with Mopar® ATF Plus 3, type 7176 fluid.

TRANSMISSION FILL PROCEDURE

To avoid overfilling transmission after a fluid change or overhaul, perform the following procedure:

(1) Remove dipstick and insert clean funnel in transmission fill tube.

(2) Add following initial quantity of Mopar® ATF Plus 3 to transmission:

(a) If only fluid and filter were changed, add **3 pints (1-1/2 quarts)** of ATF Plus 3 to transmission.

(b) If transmission was completely overhauled, torque converter was replaced or drained, and cooler was flushed, add **12 pints (6 quarts)** of ATF Plus 3 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, set parking brake, and leave engine running at curb idle speed.

(6) Remove funnel, insert dipstick and check fluid level. If level is low, **add fluid to bring level to MIN mark on dipstick.** Check to see if the oil level is equal on both sides of the dipstick. If one side is noticably higher than the other, the dipstick has picked up some oil from the dipstick tube. Allow the oil to drain down the dipstick tube and re-check.

(7) Drive vehicle until transmission fluid is at normal operating temperature.

(8) With the engine running at curb idle speed, the gear selector in NEUTRAL, and the parking brake applied, check the transmission fluid level.

CAUTION: Do not overfill transmission, fluid foaming and shifting problems can result.

(9) Add fluid to bring level up to MAX arrow mark.

When fluid level is correct, shut engine off, release park brake, remove funnel, and install dipstick in fill tube.

OIL PUMP VOLUME CHECK

After the new or repaired transmission has been installed, fill to the proper level with Mopar® ATF PLUS 3 (Type 7176) automatic transmission fluid. The volume should be checked using the following procedure:

(1) Disconnect the **From cooler** line at the transmission and place a collecting container under the disconnected line.

CAUTION: With the fluid set at the proper level, fluid collection should not exceed (1) quart or internal damage to the transmission may occur.

(2) Run the engine **at curb idle speed** , with the shift selector in neutral.

(3) If fluid flow is intermittent or it takes more than 20 seconds to collect one quart of ATF PLUS 3, disconnect the **To Cooler** line at the transmission.

(4) Refill the transmission to proper level and recheck pump volume.

(5) If flow is found to be within acceptable limits, replace the cooler. Then fill transmission to the proper level, using Mopar® ATF PLUS 3 (Type 7176) automatic transmission fluid.

(6) If fluid flow is still found to be inadequate, check the line pressure using the Transmission Hydraulic Pressure Test procedure.

TRANSMISSION QUICK LEARN PROCEDURE

The quick learn procedure requires the use of the DRB scan tool.

This program allows the electronic transmission system to recalibrate itself. This will provide the best possible transmission operation. The quick learn procedure should be performed if any of the following procedures are performed:

- Transmission Assembly Replacement
- Transmission Control Module Replacement

SERVICE PROCEDURES (Continued)

- Solenoid Pack Replacement
- Clutch Plate and/or Seal Replacement
- Valve Body Replacement or Recondition

To perform the Quick Learn Procedure, the following conditions must be met:

- The brakes must be applied
- The engine speed must be above 500 rpm
- The throttle angle (TPS) must be less than 3 degrees
- The shift lever position must stay until prompted to shift to overdrive
- The shift lever position must stay in overdrive after the Shift to Overdrive prompt until the DRB indicates the procedure is complete
- The calculated oil temperature must be above 60° and below 200°

FLUSHING COOLERS AND TUBES

When a transmission failure has contaminated the fluid, the oil cooler(s) must be flushed. The torque converter must also be replaced. This will ensure that metal particles or sludged oil are not later transferred back into the reconditioned (or replaced) transmission.

The only recommended procedure for flushing coolers and lines is to use Tool 6906 Cooler Flusher.

WARNING: WEAR PROTECTIVE EYEWEAR THAT MEETS THE REQUIREMENTS OF OSHA AND ANSI Z87.1–1968. WEAR STANDARD INDUSTRIAL RUBBER GLOVES.

KEEP LIT CIGARETTES, SPARKS, FLAMES, AND OTHER IGNITION SOURCES AWAY FROM THE AREA TO PREVENT THE IGNITION OF COMBUSTIBLE LIQUIDS AND GASES. KEEP A CLASS (B) FIRE EXTINGUISHER IN THE AREA WHERE THE FLUSHER WILL BE USED.

KEEP THE AREA WELL VENTILATED.

DO NOT LET FLUSHING SOLVENT COME IN CONTACT WITH YOUR EYES OR SKIN: IF EYE CONTAMINATION OCCURS, FLUSH EYES WITH WATER FOR 15 TO 20 SECONDS. REMOVE CONTAMINATED CLOTHING AND WASH AFFECTED SKIN WITH SOAP AND WATER. SEEK MEDICAL ATTENTION.

COOLER FLUSH USING TOOL 6906

(1) Remove cover plate filler plug on Tool 6906. Fill reservoir 1/2 to 3/4 full of fresh flushing solution. Flushing solvents are petroleum based solutions generally used to clean automatic transmission components. **DO NOT** use solvents containing acids, water, gasoline, or any other corrosive liquids.

(2) Reinstall filler plug on Tool 6906.

(3) Verify pump power switch is turned OFF. Connect red alligator clip to positive (+) battery post. Connect black (-) alligator clip to a good ground.

(4) Disconnect the cooler lines at the transmission.

NOTE: When flushing transmission cooler and lines, ALWAYS reverse flush.

(5) Connect the BLUE pressure line to the OUTLET (From) cooler line (Fig. 12).

(6) Connect the CLEAR return line to the INLET (To) cooler line

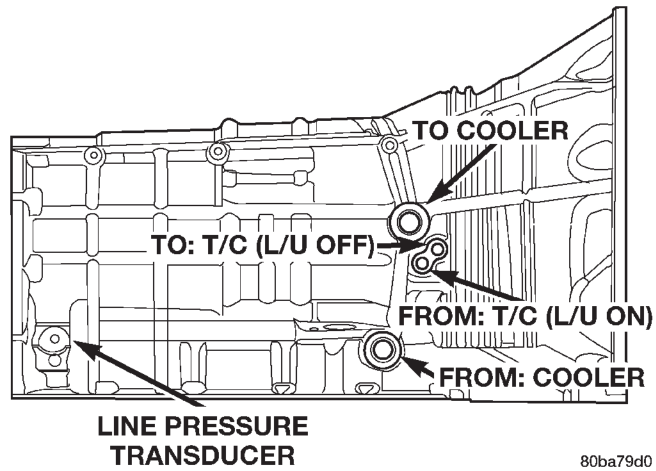


Fig. 12 Cooler Line Identification

(7) Turn pump ON for two to three minutes to flush cooler(s) and lines. Monitor pressure readings and clear return lines. Pressure readings should stabilize below 20 psi. for vehicles equipped with a single cooler and 30 psi. for vehicles equipped with dual coolers. If flow is intermittent or exceeds these pressures, replace cooler.

(8) Turn pump OFF.

(9) Disconnect CLEAR suction line from reservoir at cover plate. Disconnect CLEAR return line at cover plate, and place it in a drain pan.

(10) Turn pump ON for 30 seconds to purge flushing solution from cooler and lines. Turn pump OFF.

(11) Place CLEAR suction line into a one quart container of Mopar® ATF Plus 3, type 7176 automatic transmission fluid.

(12) Turn pump ON until all transmission fluid is removed from the one quart container and lines. This purges any residual cleaning solvent from the transmission cooler and lines. Turn pump OFF.

(13) Disconnect alligator clips from battery. Reconnect flusher lines to cover plate, and remove flushing adapters from cooler lines.

ALUMINUM THREAD REPAIR

Damaged or worn threads in the aluminum transmission case and valve body can be repaired by the use of Heli-Coils, or equivalent. This repair consists of drilling out the worn-out damaged threads. Then tap the hole with a special Heli-Coil tap, or equiva-

SERVICE PROCEDURES (Continued)

lent, and installing a Heli-Coil insert, or equivalent, into the hole. This brings the hole back to its original thread size.

Heli-Coil, or equivalent, tools and inserts are readily available from most automotive parts suppliers.

REMOVAL AND INSTALLATION

INPUT SPEED SENSOR

REMOVAL

(1) Raise vehicle.

(2) Place a suitable fluid catch pan under the transmission.

(3) Remove the wiring connector from the input speed sensor (Fig. 13).

(4) Remove the bolt holding the input speed sensor to the transmission case.

(5) Remove the input speed sensor from the transmission case.

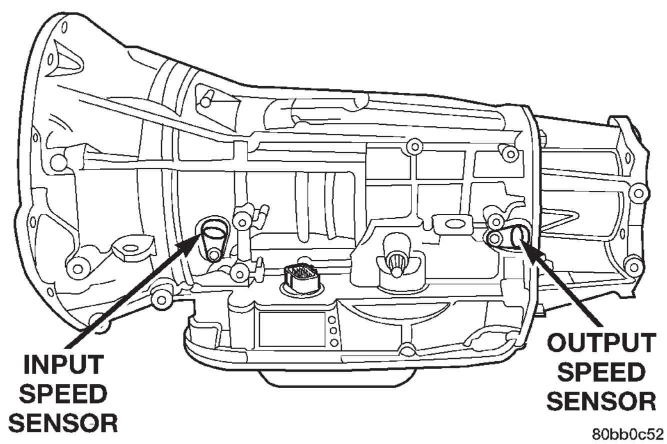


Fig. 13 Input Speed Sensor

INSTALLATION

(1) Install the input speed sensor into the transmission case.

(2) Install the bolt to hold the input speed sensor into the transmission case. Tighten the bolt to 11.9 N·m (105 in. lbs.).

(3) Install the wiring connector onto the input speed sensor

(4) Verify the transmission fluid level. Add fluid as necessary.

(5) Lower vehicle.

OUTPUT SPEED SENSOR

REMOVAL

(1) Raise vehicle.

(2) Place a suitable fluid catch pan under the transmission.

(3) Remove the wiring connector from the output speed sensor (Fig. 14).

(4) Remove the bolt holding the output speed sensor to the transmission case.

(5) Remove the output speed sensor from the transmission case.

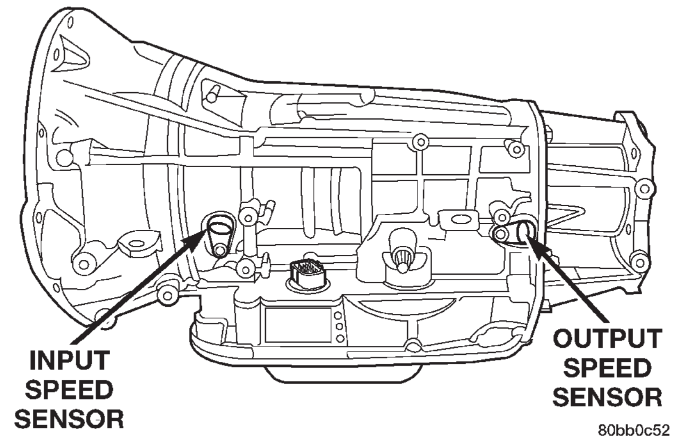


Fig. 14 Output Speed Sensor

INSTALLATION

(1) Install the output speed sensor into the transmission case.

(2) Install the bolt to hold the output speed sensor into the transmission case. Tighten the bolt to 11.9 N·m (105 in. lbs.).

(3) Install the wiring connector onto the output speed sensor

(4) Verify the transmission fluid level. Add fluid as necessary.

(5) Lower vehicle.

LINE PRESSURE SENSOR

REMOVAL

(1) Raise vehicle.

(2) Place a suitable fluid catch pan under the transmission.

(3) Remove the wiring connector from the line pressure sensor (Fig. 15).

(4) Remove the bolt holding the line pressure sensor to the transmission case.

(5) Remove the line pressure sensor from the transmission case.

INSTALLATION

(1) Install the line pressure sensor into the transmission case.

(2) Install the bolt to hold the line pressure sensor into the transmission case. Tighten the bolt to 11.9 N·m (105 in. lbs.).

REMOVAL AND INSTALLATION (Continued)

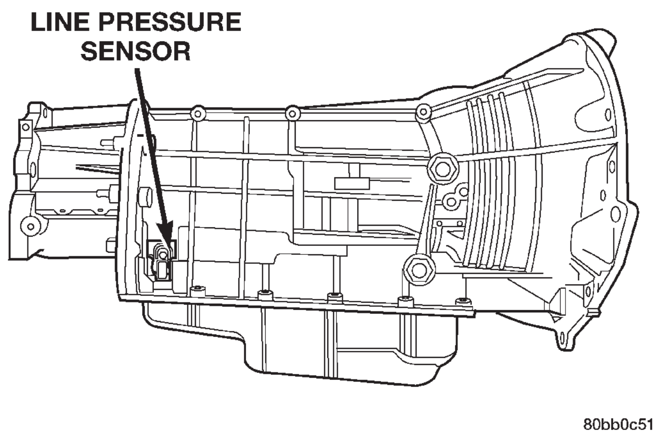


Fig. 15 Line Pressure Sensor

(3) Install the wiring connector onto the line pressure sensor

(4) Verify the transmission fluid level. Add fluid as necessary.

(5) Lower vehicle.

VALVE BODY

The valve body can be removed for service without having to remove the transmission assembly.

The valve body can be disassembled for cleaning and inspection of the individual components. Refer to Disassembly and Assembly section for proper procedures.

REMOVAL

(1) Shift transmission into PARK.

(2) Raise vehicle.

(3) Disconnect wires at the solenoid and pressure switch assembly connector.

(4) Position drain pan under transmission oil pan.

(5) Remove transmission oil pan.

(6) Remove the primary oil filter from valve body.

(7) Remove bolts attaching valve body to transmission case.

(8) Lower the valve body and work the electrical connector out of transmission case.

(9) Separate the valve body from the transmission.

INSTALLATION

(1) Check condition of seals on valve body and the solenoid and pressure switch assembly. Replace seals if cut or worn.

(2) Place TRS selector plate in the PARK position.

(3) Place the transmission in the PARK position.

(4) Lubricate seal on the solenoid and pressure switch assembly connector with petroleum jelly.

(5) Position valve body in transmission and align the manual lever on the valve body to the pin on the transmission manual shift lever.

(6) Seat valve body in case and install one or two bolts to hold valve body in place.

(7) Tighten valve body bolts alternately and evenly to 12 N·m (105 in. lbs.) torque.

(8) Install new fluid filter on valve body. Tighten filter screws to 4.5 N·m (40 in. lbs.) torque.

(9) Connect the solenoid and pressure switch assembly connector.

(10) Install oil pan. Tighten pan bolts to 12 N·m (105 in. lbs.) torque.

(11) Lower vehicle and fill transmission with Mopar® ATF Plus 3, type 7176 fluid.

(12) Check and adjust gearshift cable, if necessary.

TRANSMISSION

CAUTION: The transmission and torque converter must be removed as an assembly to avoid component damage. The converter driveplate, pump bushing, or oil seal can be damaged if the converter is left attached to the driveplate during removal. Be sure to remove the transmission and converter as an assembly.

REMOVAL

(1) Disconnect the negative battery cable.

(2) Raise and support the vehicle

(3) Mark propeller shaft and axle yokes for assembly alignment.

(4) Remove the rear propeller shaft

(5) Remove the front propeller shaft.

(6) Remove the engine to transmission collar (Fig. 16).

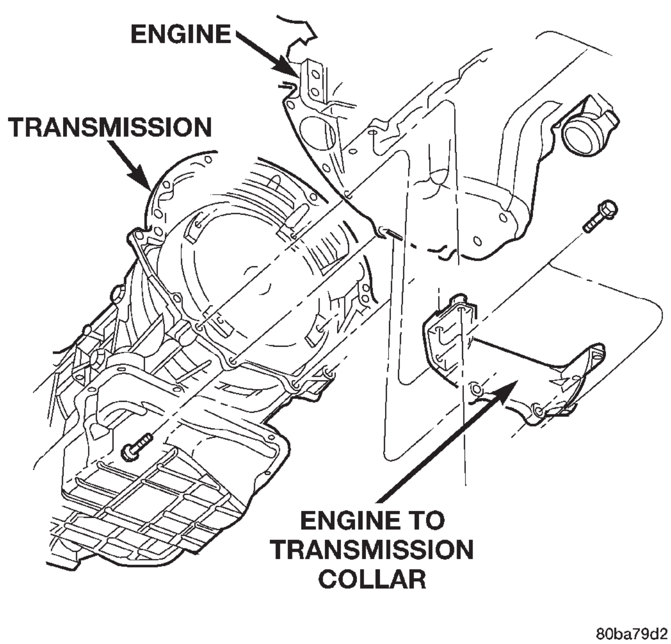


Fig. 16 Transmission Collar

REMOVAL AND INSTALLATION (Continued)

(7) Remove the exhaust support bracket from the rear of the transmission.

(8) Disconnect and lower or remove any necessary exhaust components.

(9) Remove the starter motor.

(10) Rotate crankshaft in clockwise direction until converter bolts are accessible. Then remove bolts one at a time. Rotate crankshaft with socket wrench on dampener bolt.

(11) Disconnect wires from solenoid and pressure switch assembly, input and output speed sensors, and line pressure sensor.

(12) Disconnect gearshift cable from transmission manual valve lever (Fig. 17).

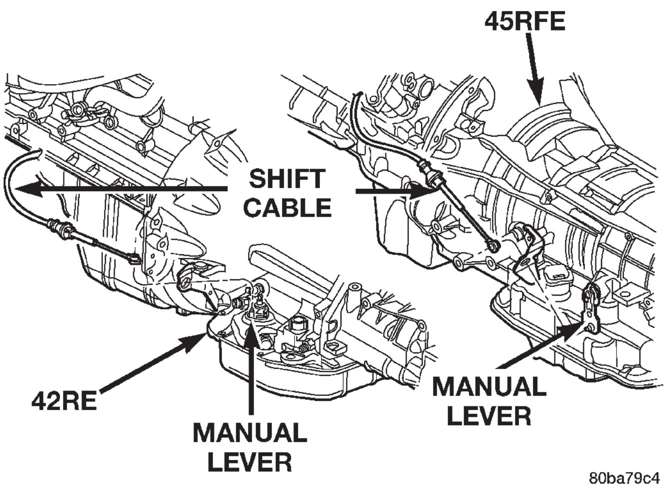


Fig. 17 Transmission Shift Cable

(13) Disconnect transfer case shift cable from the transfer case shift lever (Fig. 18).

(14) Remove the clip securing the transfer case shift cable into the cable support bracket.

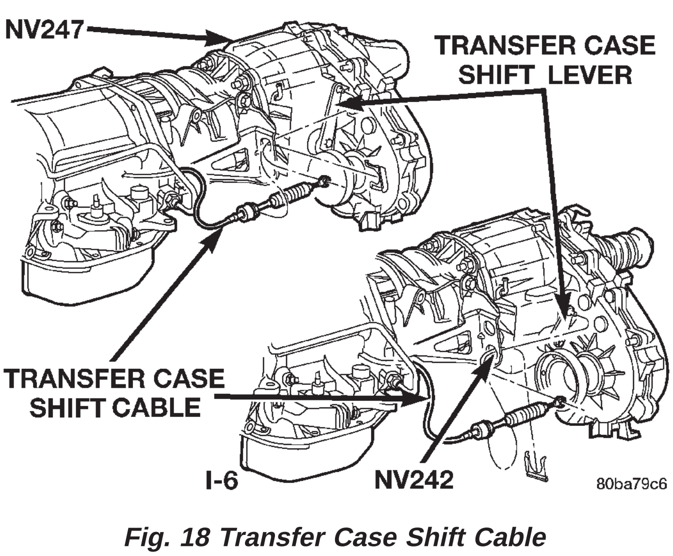


Fig. 18 Transfer Case Shift Cable

(15) Disconnect transmission fluid cooler lines at transmission fittings and clips.

(16) Disconnect the transmission vent hose from the transmission.

(17) Support rear of engine with safety stand or jack.

(18) Raise transmission slightly with service jack to relieve load on crossmember and supports.

(19) Remove bolts securing rear support and cushion to transmission and crossmember (Fig. 19).

(20) Remove bolts attaching crossmember to frame and remove crossmember.

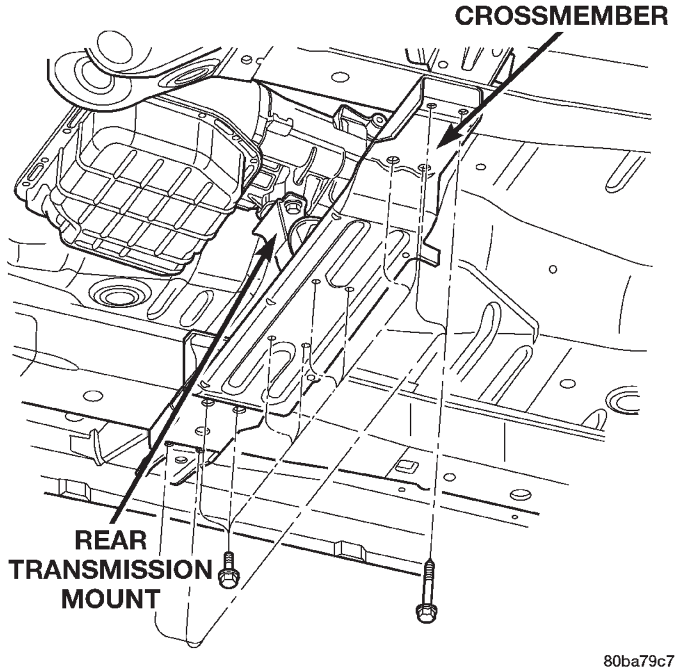


Fig. 19 Rear Transmission Crossmember

(21) Remove transfer case (Fig. 20) and (Fig. 21).

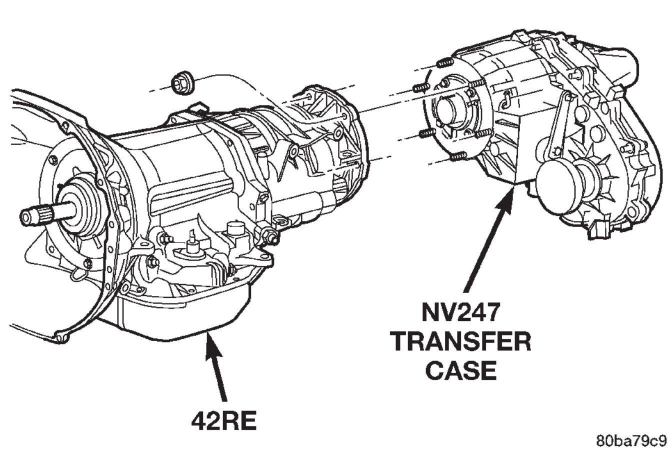


Fig. 20 Remove NV247 Transfer Case

(22) Remove all remaining converter housing bolts.

(23) Carefully work transmission and torque converter assembly rearward off engine block dowels.

REMOVAL AND INSTALLATION (Continued)

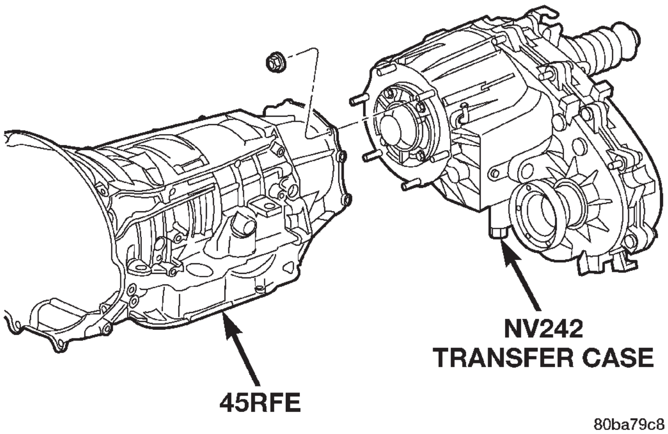


Fig. 21 Remove NV242 Transfer Case

(24) Hold torque converter in place during transmission removal.

(25) Lower transmission and remove assembly from under the vehicle.

(26) To remove torque converter, carefully slide torque converter out of the transmission.

INSTALLATION

(1) Check torque converter hub and hub drive notches for sharp edges burrs, scratches, or nicks. Polish the hub and notches with 320/400 grit paper and crocus cloth if necessary. The hub must be smooth to avoid damaging pump seal at installation.

(2) If a replacement transmission is being installed, transfer any components necessary, such as the manual shift lever and shift cable bracket, from the original transmission onto the replacement transmission.

(3) Lubricate converter drive hub and oil pump seal lip with transmission fluid.

(4) Lubricate converter pilot hub with transmission fluid.

(5) Align converter and oil pump.

(6) Carefully insert converter in oil pump. Then rotate converter back and forth until fully seated in pump gears.

(7) Check converter seating with steel scale and straightedge (Fig. 22). Surface of converter lugs should be 1/2 in. to rear of straightedge when converter is fully seated.

(8) Temporarily secure converter with C-clamp.

(9) Position transmission on jack and secure it with chains.

(10) Check condition of converter driveplate. Replace the plate if cracked, distorted or damaged. **Also be sure transmission dowel pins are seated in engine block and protrude far enough to hold transmission in alignment.**

(11) Raise transmission and align converter with drive plate and converter housing with engine block.

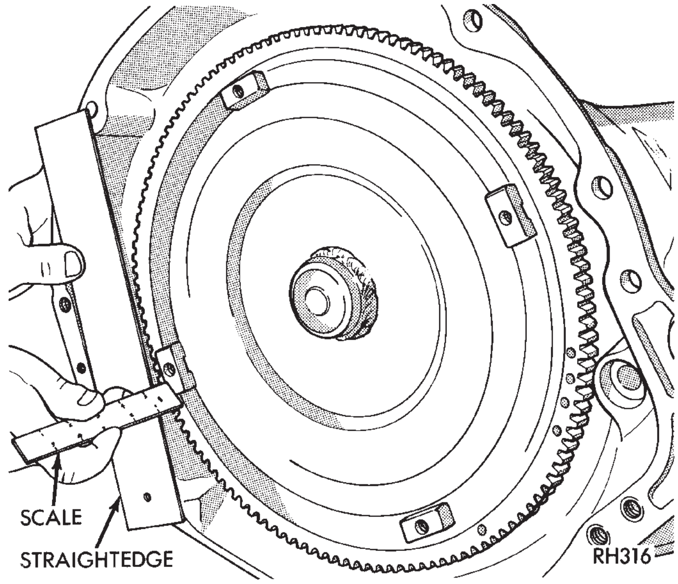


Fig. 22 Typical Method Of Checking Converter Seating

(12) Move transmission forward. Then raise, lower or tilt transmission to align converter housing with engine block dowels.

(13) Rotate converter so alignment marks scribed on converter are aligned with mark on driveplate.

(14) Carefully work transmission forward and over engine block dowels until converter hub is seated in crankshaft.

(15) Install two bolts to attach converter housing to engine.

(16) Install remaining torque converter housing to engine bolts. Tighten to 68 N·m (50 ft. lbs.).

(17) Install rear transmission crossmember. Tighten crossmember to frame bolts to 68 N·m (50 ft. lbs.).

(18) Install rear support to transmission. Tighten bolts to 47 N·m (35 ft. lbs.).

(19) Lower transmission onto crossmember and install bolts attaching transmission mount to crossmember. Tighten clevis bracket to crossmember bolts to 47 N·m (35 ft. lbs.). Tighten the clevis bracket to rear support bolt to 68 N·m (50 ft. lbs.).

(20) Remove engine support fixture.

(21) Install new plastic retainer grommet on any shift cable that was disconnected. Grommets should not be reused. Use pry tool to remove rod from grommet and cut away old grommet. Use pliers to snap new grommet into cable and to snap grommet onto lever.

(22) Connect gearshift cable to transmission.

(23) Connect wires to solenoid and pressure switch assembly connector, input and output speed sensors, and line pressure sensor. Be sure transmission harnesses are properly routed.

REMOVAL AND INSTALLATION (Continued)

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 clutch surface inside the converter.

(24) Install torque converter-to-driveplate bolts. Tighten bolts to 31 N·m (270 in. lbs.).

(25) Install starter motor and cooler line bracket.

(26) Connect cooler lines to transmission.

(27) Install transmission fill tube.

(28) Install exhaust components.

(29) Install transfer case. Tighten transfer case nuts to 35 N·m (26 ft. lbs.).

(30) Install the transfer case shift cable to the cable support bracket and the transfer case shift lever.

(31) Install the transmission collar onto the transmission and the engine. Tighten the bolts to 54 N·m (40 ft. lbs.).

(32) Align and connect propeller shaft(s).

(33) Adjust gearshift cable if necessary.

(34) Lower vehicle.

(35) Fill transmission with Mopar® ATF Plus 3, Type 7176 fluid.

TORQUE CONVERTER

REMOVAL

(1) Remove transmission and torque converter from vehicle.

(2) Place a suitable drain pan under the converter housing end of the transmission.

CAUTION: Verify that transmission is secure on the lifting device or work surface, the center of gravity of the transmission will shift when the torque converter is removed creating an unstable condition.

The torque converter is a heavy unit. Use caution when separating the torque converter from the transmission.

(3) Pull the torque converter forward until the center hub clears the oil pump seal.

(4) Separate the torque converter from the transmission.

INSTALLATION

Check converter hub and drive notches for sharp edges, burrs, scratches, or nicks. Polish the hub and notches with 320/400 grit paper or crocus cloth if necessary. The hub must be smooth to avoid damaging the pump seal at installation. Check that the torque converter hub o-ring on the 45RFE torque converter hub is not damaged. Replace if necessary.

(1) Lubricate converter hub and oil pump seal lip with transmission fluid.

(2) Place torque converter in position on transmission.

CAUTION: Do not damage oil pump seal or bushing while inserting torque converter into the front of the transmission.

(3) Align torque converter to oil pump seal opening.

(4) Insert torque converter hub into oil pump.

(5) While pushing torque converter inward, rotate converter until converter is fully seated in the oil pump gears.

(6) Check converter seating with a scale and straightedge (Fig. 23). Surface of converter lugs should be 1/2 in. to rear of straightedge when converter is fully seated.

(7) If necessary, temporarily secure converter with C-clamp attached to the converter housing.

(8) Install the transmission in the vehicle.

(9) Fill the transmission with the recommended fluid.

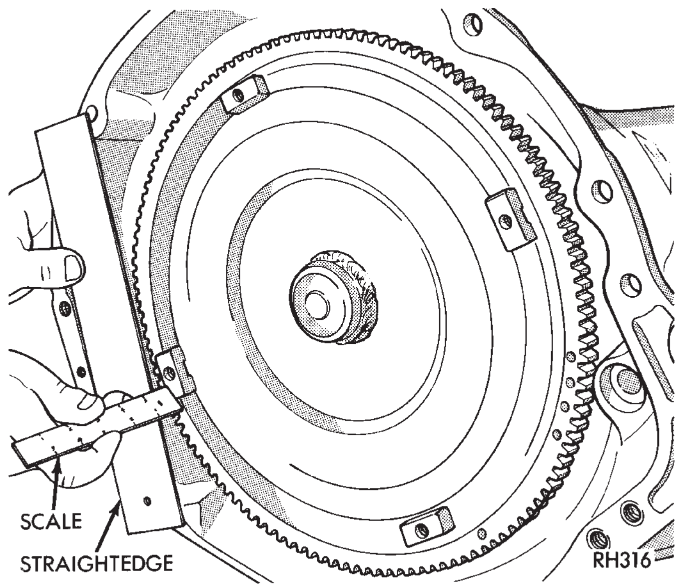


Fig. 23 Checking Torque Converter Seating–Typical

GEARSHIFT CABLE

REMOVAL

(1) Shift transmission into Park.

(2) Raise vehicle.

(3) Remove the shift cable eyelet from the transmission manual shift lever (Fig. 24).

(4) Remove shift cable from the cable support bracket.

(5) Lower vehicle.

(6) Remove shift lever bezel and necessary console parts for access to shift lever assembly and shift cable.

REMOVAL AND INSTALLATION (Continued)

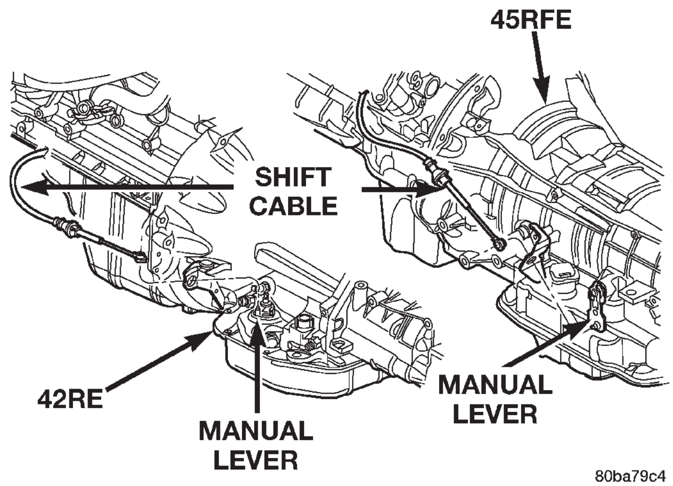


Fig. 24 Remove Shift Cable From Transmission

(7) Disconnect cable at shift lever and shifter assembly bracket (Fig. 25).

(8) Remove the nuts holding the shift cable seal plate to the floor pan (Fig. 26).

(9) Pull cable through floor panel opening.

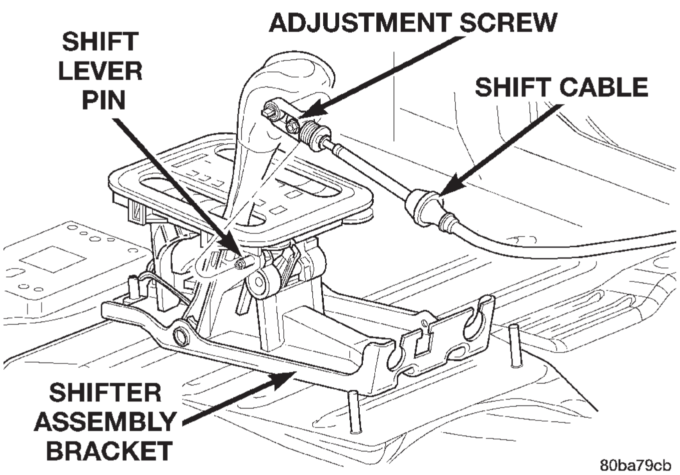


Fig. 25 Transmission Shift Cable at Shifter

(10) Remove shift cable from vehicle.

INSTALLATION

(1) Route cable through hole in floor pan.

(2) Install seal plate to studs in floor pan.

(3) Install nuts to hold seal plate to floor pan. Tighten nuts to 7 N·m (65 in. lbs.).

(4) Install the shift cable to the shifter assembly bracket. Push cable into the bracket until secure.

(5) Place the floor shifter lever in park position.

(6) Loosen the adjustment screw on the shift cable.

(7) Snap the shift cable onto the shift lever pin.

(8) Raise the vehicle.

(9) Install the shift cable to the shift cable support bracket.

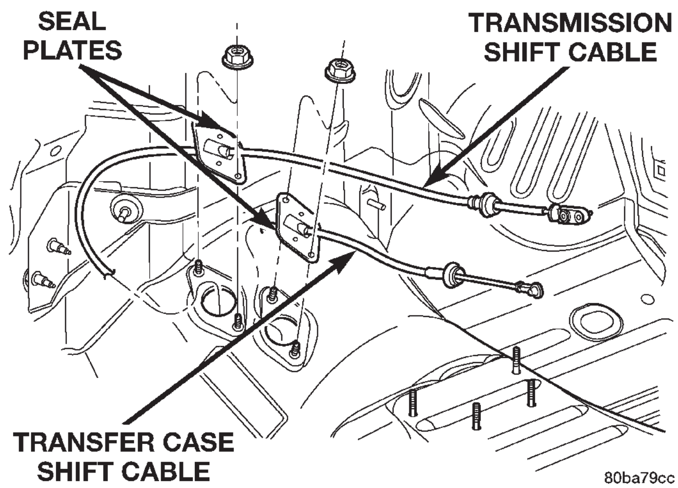


Fig. 26 Shift Cables at Floor Pan

(10) Shift the transmission into PARK. PARK is the rearmost detent position on the transmission manual shift lever.

(11) Snap the shift cable onto the transmission manual shift lever.

(12) Lower vehicle.

(13) Verify that the shift lever is in the PARK position.

(14) Tighten the adjustment screw to 7 N·m (65 in. lbs.).

(15) Verify correct shifter operation.

(16) Install shift lever bezel and any console parts removed for access to shift lever assembly and shift cable.

SHIFTER

REMOVAL

(1) Shift transmission into Park.

(2) Remove shift lever bezel and any necessary console parts for access to shift lever assembly and shifter cables.

(3) Disconnect the transmission shift cable at shift lever and shifter assembly bracket (Fig. 27).

(4) Disconnect the brake transmission interlock cable from the shifter BTSI lever and the shifter assembly bracket.

(5) Disconnect the transfer case shift cable from the transfer case shift lever pin (Fig. 29).

(6) Remove the clip holding the transfer case shift cable to the shifter assembly bracket.

(7) Remove the transfer case shift cable from the shifter assembly bracket.

(8) Disengage all wiring connectors from the shifter assembly.

(9) Remove all nuts holding the shifter assembly to the floor pan (Fig. 30).

(10) Remove the shifter assembly from the vehicle.

REMOVAL AND INSTALLATION (Continued)

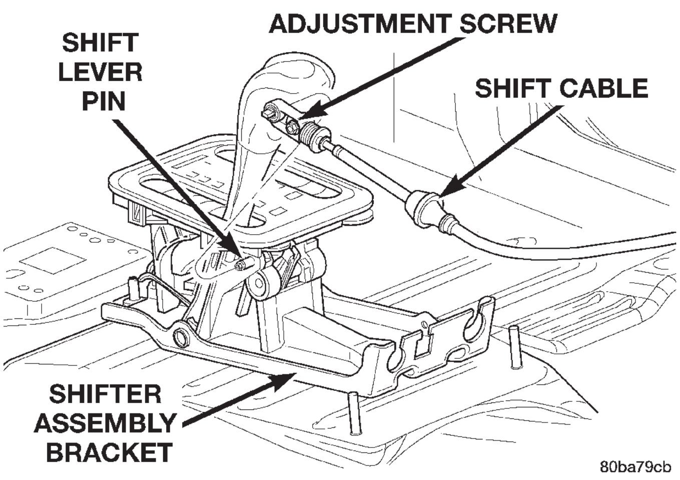


Fig. 27 Transmission Shift Cable at Shifter

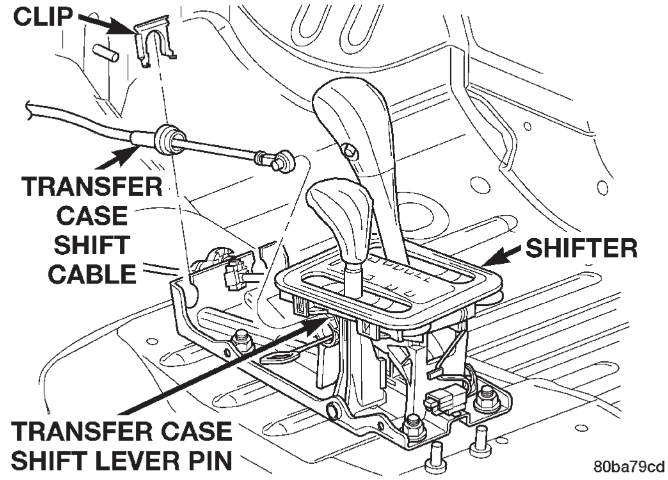


Fig. 29 Transfer Case Shift Cable

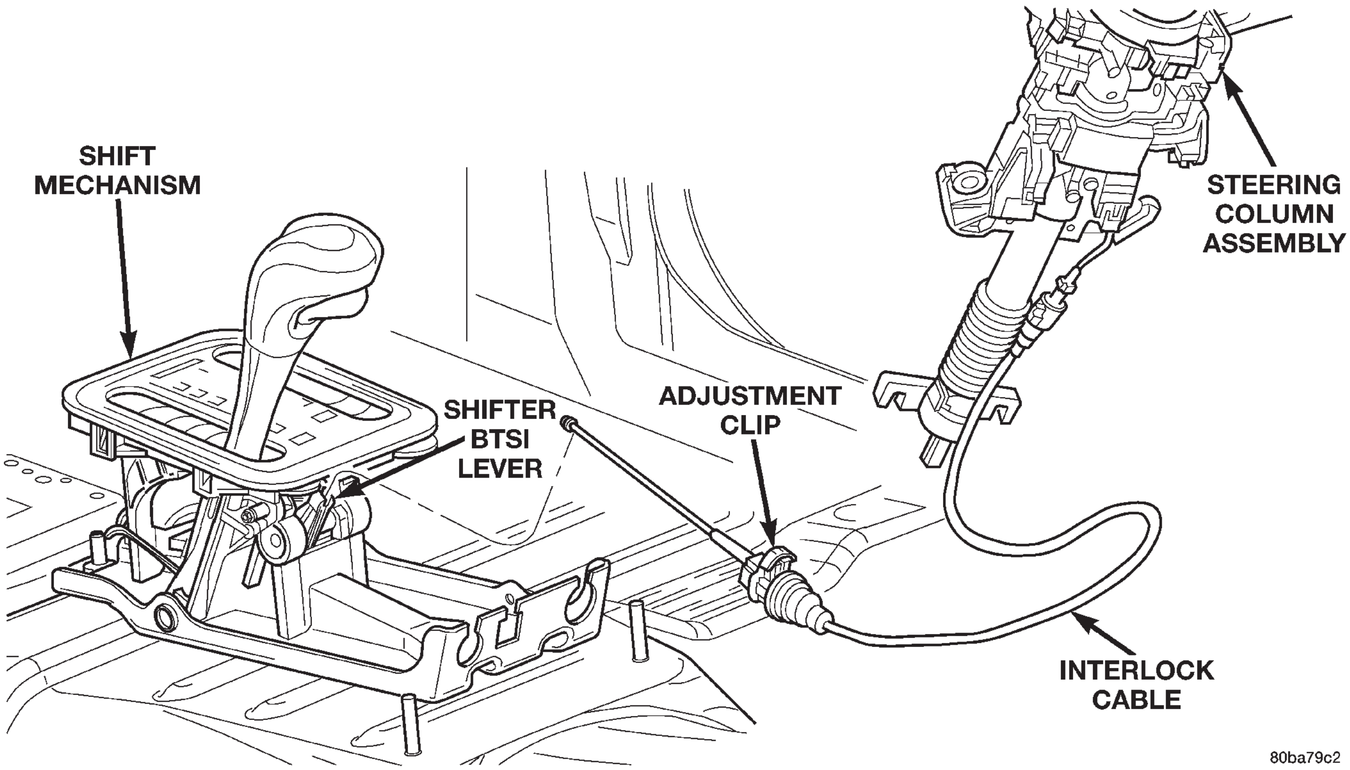


Fig. 28 Brake Transmission Interlock Cable

INSTALLATION

(1) Install shifter assembly onto the shifter assembly studs on the floor pan.

(2) Install the nuts to hold the shifter assembly onto the floor pan. Tighten nuts to 28 N·m (250 in. lbs.).

(3) Install wiring harness to the shifter assembly bracket. Engage any wire connectors removed from the shifter assembly.

(4) Install the transfer case shift cable to the shifter assembly bracket. Install clip to hold cable to the bracket.

(5) Snap the transfer case shift cable onto the transfer case shift lever pin.

(6) Install the brake transmission interlock cable into the shifter assembly bracket and into the shifter BTSI lever.

(7) Install the shift cable to the shifter assembly bracket. Push cable into the bracket until secure.

(8) Place the floor shifter lever in park position.

(9) Loosen the adjustment screw on the shift cable.

(10) Snap the shift cable onto the shift lever pin.

(11) Verify that the shift lever is in the PARK position.

REMOVAL AND INSTALLATION (Continued)

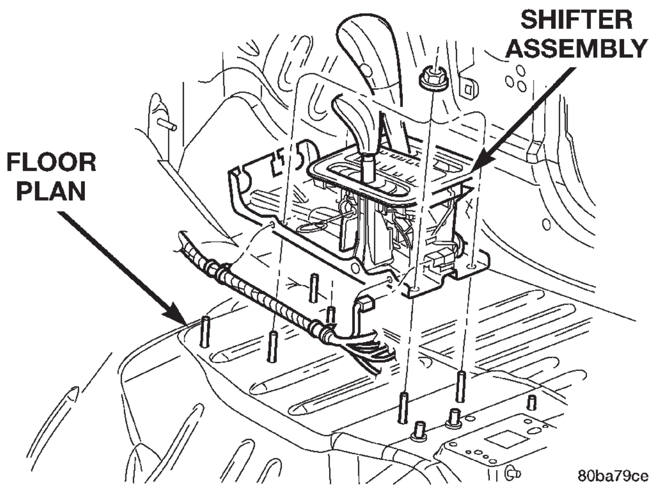


Fig. 30 Shifter Assembly

(12) Tighten the adjustment screw to 7 N·m (65 in. lbs.).

(13) Verify correct shifter operation.

(14) Install shift lever bezel and any console parts removed for access to shift lever assembly and shift cables.

BRAKE TRANSMISSION SHIFT INTERLOCK

REMOVAL

(1) Lower the steering column.

(2) Remove the transmission shift interlock cable from steering column (Fig. 31).

(3) Remove the center console and related trim. Refer to Group 23, Body, for proper procedures.

(4) Disconnect the BTSI cable from the shift BTSI lever and remove the cable from the shifter assembly bracket.

(5) Disengage the wire connector at the solenoid on the cable.

(6) Release the BTSI cable from any remaining clips.

(7) Remove BTSI cable from the vehicle.

INSTALLATION

NOTE: The gearshift cable must be secured into position and properly adjusted before the installation of the Brake Transmission Interlock Cable (BTSI).

(1) Snap the BTSI cable assembly into the steering column.

(2) Snap BTSI cable solenoid tie strap into hole in steering column tube.

(3) Engage the wiring connector from brake light switch into BTSI cable solenoid housing.

(4) Route BTSI cable to the shifter mechanism.

(5) Install the BTSI cable end fitting into shifter BTSI lever.

(6) Pull rearward on the BTSI cable housing and install the cable housing into the shifter assembly bracket.

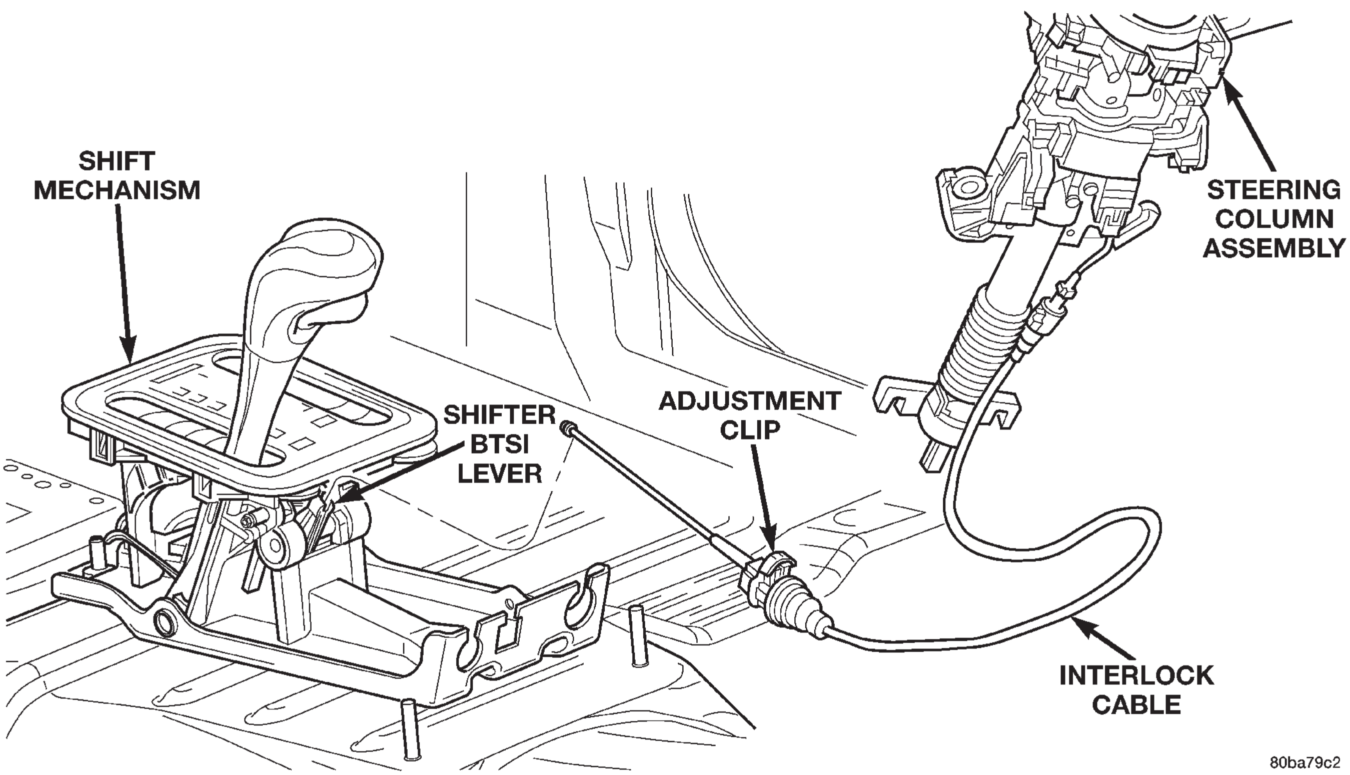


Fig. 31 Brake Transmission Shift Interlock

REMOVAL AND INSTALLATION (Continued)

(7) Place the ignition key cylinder in the LOCK position.

(8) Snap BTSI cable adjuster ears into floor shifter bracket and

(9) Push the cable adjuster lock clamp downward to lock it.

(10) Install the center console and related trim. Refer to Group 23, Body, for proper procedures.

(11) Test the BTSI cable operation.

DISASSEMBLY AND ASSEMBLY

TRANSMISSION

DISASSEMBLY

(1) Drain fluid from transmission.

(2) Clean exterior of transmission with suitable solvent or pressure washer.

(3) Remove the torque converter from the transmission.

(4) Remove the manual shift lever from the transmission.

(5) Remove the input, output, and line pressure sensors from the transmission case.

(6) Inspect the ends of the sensors for debris, which may indicate the nature of the transmission failure.

(7) Install Support Stand 8257 onto the transmission case.

(8) Using End-Play Tool Set 8266 and Dial Indicator C-3339, measure and record the input shaft end-play.

NOTE: When measuring the input shaft end-play, two ″stops″ will be felt. When the input shaft is pushed inward and the dial indicator zeroed, the first ″stop″ felt when the input shaft is pulled outward is the movement of the input shaft in the input clutch housing hub. This value should not be included in the end-play measured value and therefore must be recorded and subtracted from the dial indicator reading.

(9) Remove the bolts holding the transmission extension/adapter housing to the transmission case.

(10) Remove the extension/adapter housing from the transmission case.

(11) Using Alignment Plate 8261, End-Play Tool Set 8266 and Dial Indicator C-3339, measure and record the output shaft end-play.

(12) Remove the bolts holding the transmission oil pan to the transmission case.

(13) Remove the transmission oil pan from the transmission case.

(14) Remove the primary oil filter and the oil cooler filter (Fig. 32).

(15) Remove the cooler bypass valve.

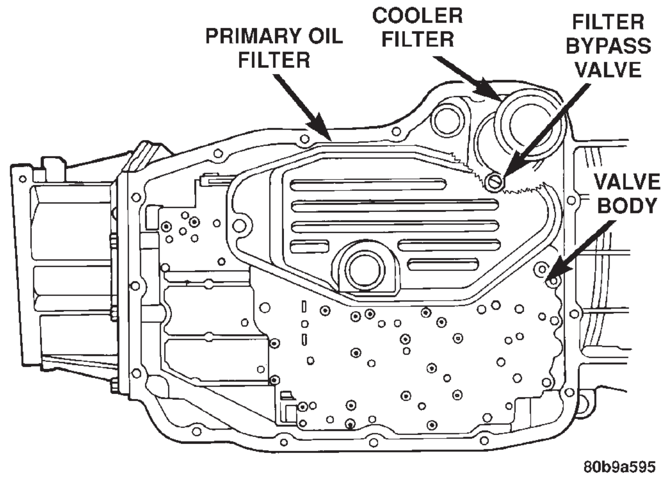


Fig. 32 Primary Oil and Cooler Filters

(16) Remove the bolts holding the valve body to the transmission case.

(17) Remove the valve body from the transmission case.

(18) Remove the outer snap-ring securing the transmission front cover into the transmission case.

(19) Remove the inner snap-ring securing the transmission front cover to the oil pump.

(20) Reaching through a case opening in the valve body area with a long blunted tool, remove the transmission front cover from the transmission case.

(21) Remove the bolts holding the oil pump into the transmission case.

(22) Remove the oil pump. Hold inward on the input shaft to prevent pulling the input clutch assembly with the oil pump (Fig. 33).

(23) Remove the number 1 bearing from the input clutch assembly.

(24) Remove the input clutch assembly from the transmission case.

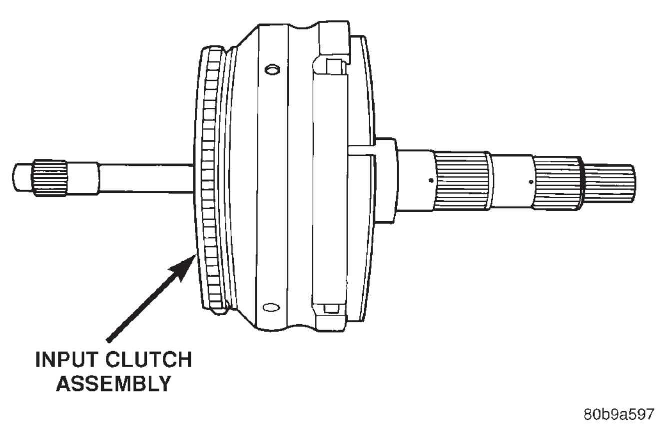


Fig. 33 Input Clutch Assembly

DISASSEMBLY AND ASSEMBLY (Continued)

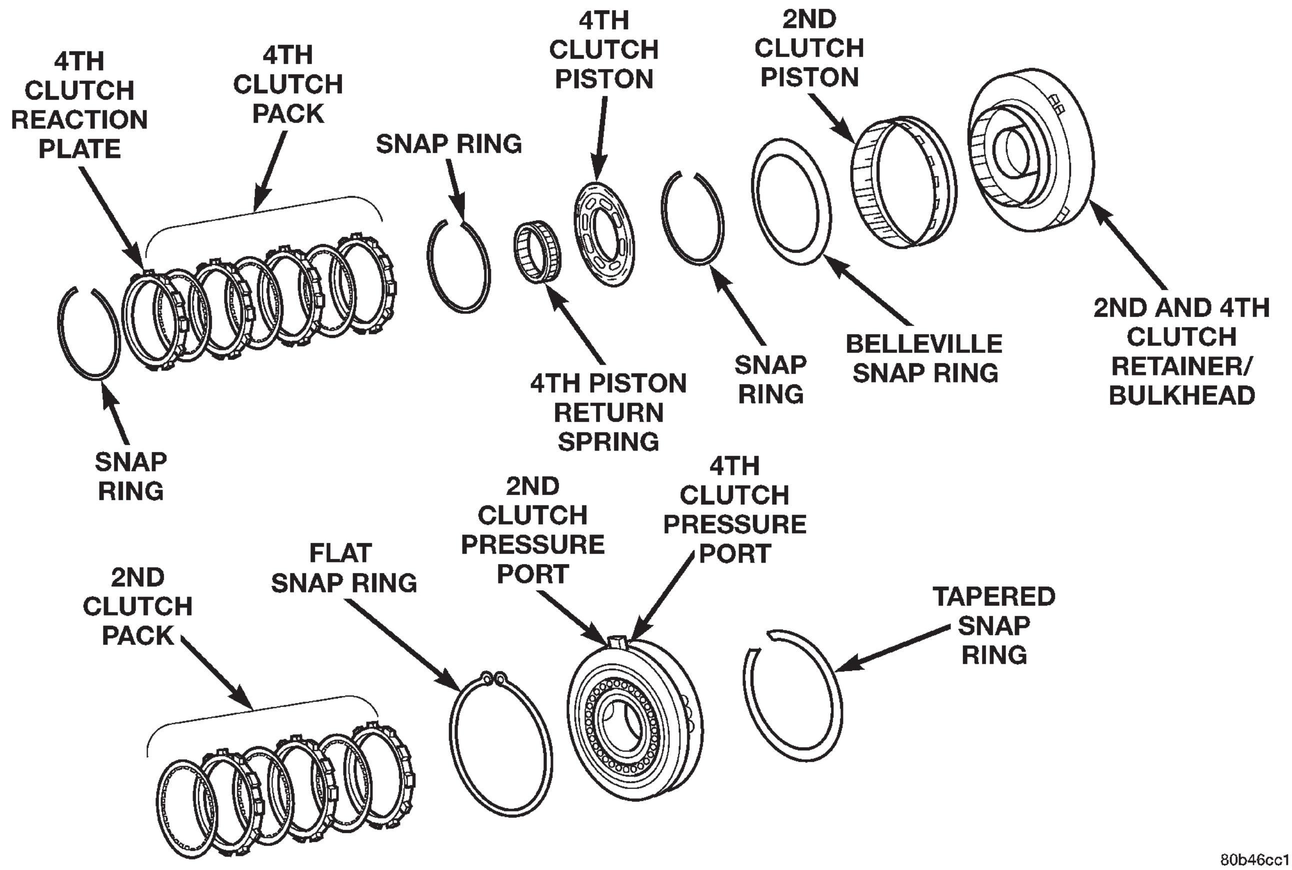


Fig. 34 4C Clutch Retainer/Bulkhead

(25) Remove the number 5 bearing and selective plate from the input clutch assembly or the 4C clutch retainer/bulkhead.

(26) Remove the 4C clutch retainer/bulkhead tapered snap-ring from the transmission case (Fig. 34).

(27) Remove the 4C clutch retainer/bulkhead from the transmission case.

(28) Remove the front 2C clutch pack snap-ring from the transmission case.

(29) Remove the 2C clutch pack from the transmission case.

(30) Remove the rear selective plate and number 6 bearing from the reaction annulus (Fig. 35).

(31) Remove the reaction annulus from the reaction planetary gear set.

(32) Remove the number 7 bearing from the reaction planetary gear set.

(33) Remove the reaction planetary gear set and sun gear from the transmission. Note that this planetary gear set has three pinion gears.

(34) Remove the number 8 bearing from the rear planetary gear set.

(35) Remove the snap-ring holding the park sprag gear onto the output shaft.

(36) Remove the park sprag gear from the output shaft.

(37) Remove the number 12 bearing from the rear of the rear planetary gear set.

(38) Remove the rear planetary gear sets.

(39) Remove the snap-ring holding the low/reverse clutch retainer into the transmission case.

(40) Remove the low/reverse clutch retainer from the transmission case (Fig. 36).

(41) Remove the park pawl rod and e-clip.

(42) Remove the park pawl rod guide snap-ring.

(43) Remove the park pawl rod guide.

(44) Remove the park pawl pivot pin, park pawl, and spring.

(45) Remove the manual selector shaft.

(46) Remove the manual selector shaft seal.

(47) Remove the dipstick tube seal.

ASSEMBLY

(1) Clean and inspect all components. Replace any components which show evidence of excessive wear or scoring.

(2) Install the cooler filter bypass valve.

(3) Torque the bypass valve to specification. The valve uses a tapered pipe thread and excessive torque can damage the transmission case. Tighten the cooler filter bypass valve to 11.3 N·m (100 in. lbs.).

DISASSEMBLY AND ASSEMBLY (Continued)

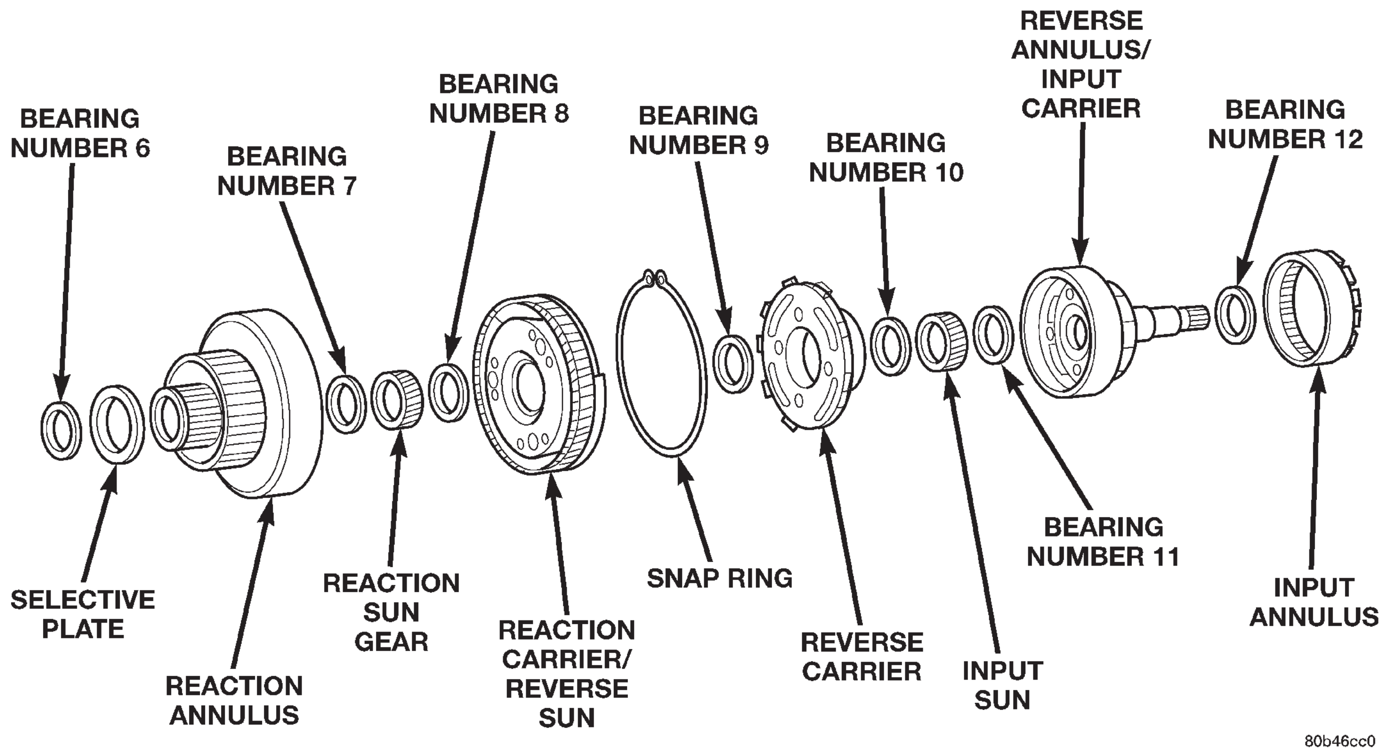


Fig. 35 Planetary Gear Set

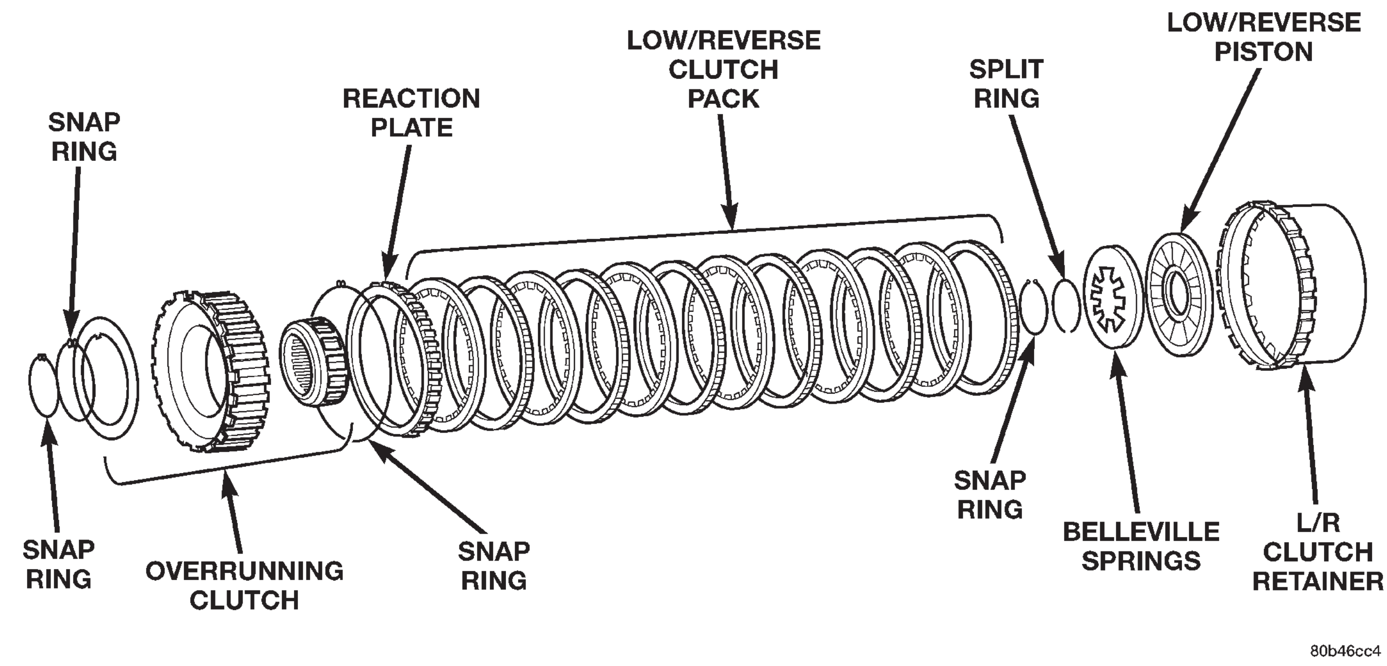


Fig. 36 Low/Reverse Clutch Assembly

(4) Install a new selector shaft seal using Seal Installer 8253.

(5) Install the manual selector shaft and retaining screw. Tighten the manual selector shaft retaining screw to 28 N·m (250 in. lbs.).

(6) Install the park pawl, spring, and pin.

(7) Install the park rod and e-clip.

(8) Install the park rod guide and snap-ring.

(9) Install a new dipstick tube seal using Seal Installer 8254.

(10) Install the 2C reaction plate into the transmission case. The reaction plate is selective and directional. The plate must be installed with the flat side toward the front.

DISASSEMBLY AND ASSEMBLY (Continued)

(11) Install the 2C clutch pack into the transmission case.

(12) Install the flat 2C clutch snap-ring into the transmission case.

(13) Install the 4C retainer/bulkhead into the transmission case. Make sure that the oil feed holes are pointing toward the valve body area.

(14) Install the 4C retainer/bulkhead tapered snap-ring into the transmission case. Make sure that the open ends of the snap-ring are located in the case opening toward the valve body area.

(15) Using a feeler gauge through the opening in the rear of the transmission case, measure the 2C clutch pack clearance between the 2C reaction plate and the transmission case at four different points. The average of these measurements is the 2C clutch pack clearance. Adjust the clearance as necessary. The correct clutch clearance is 0.533–1.27 mm (0.021–0.050 in.). The reaction plate is selective. Install the chosen reaction plate and re-measure the clutch clearance to verify the selection.

(16) Remove the 4C retainer/bulkhead and all of the 2C clutch components from the transmission case.

(17) Install the low/reverse clutch assembly. Make sure that the oil feed hole points toward the valve body area and that the bleed orifice is aligned with the notch in the rear of the transmission case.

(18) Install the snap-ring to hold the low/reverse clutch retainer into the transmission case. The snap-ring is tapered and must be installed with the tapered side forward. Once installed, verify that the snap-ring is fully seated in the snap-ring groove.

(19) Air check the low/reverse clutch and verify correct overrunning clutch operation.

(20) Install the rear planetary gear set through the low/reverse clutch assembly.

(21) Install the number 12 bearing over the output shaft of the rear planetary gear set and onto the low/reverse clutch assembly. The flat side of the bearing goes toward the clutch assembly.

(22) Install the park sprag onto the output shaft.

(23) Install the snap-ring to hold the park sprag onto the output shaft.

(24) Install the 2C reaction plate into the transmission case. The reaction plate is selective and directional. The plate must be installed with the flat side toward the front.

(25) Install the 2C clutch pack into the transmission case.

(26) Install the number 8 bearing inside the reaction planetary gear set with the round side against the planetary carrier.

(27) Install the reaction planetary gear set into the transmission case.

(28) Install the flat 2C clutch snap-ring into the transmission case.

(29) Install the reaction sun gear into the reaction planetary gear set with the small shoulder facing the front of the transmission.

(30) Install the number 7 bearing onto the reaction sun gear with the flat side against the sun gear.

(31) Install the output shaft selective spacer onto the reaction annulus with the oil grooves facing the annulus gear and the tabs and notches aligned.

(32) Install the number 6 bearing against the output shaft selective spacer with the flat side against the spacer.

(33) Install the reaction annulus into the reaction planetary gear set.

(34) Install the 4C retainer/bulkhead into the transmission case. Make sure that the oil feed holes are pointing toward the valve body area. Rotate the reaction annulus during the installation of the 4C retainer/bulkhead to ease installation.

(35) Install the 4C retainer/bulkhead tapered snap-ring into the transmission case. Make sure that the open ends of the snap-ring are located in the case opening toward the valve body area.

(36) Air check the 2C and 4C clutch operation.

(37) Using Alignment Plate 8261, End-Play Tool Set 8266 and Dial Indicator C-3339, measure and record the output shaft end-play. The correct output shaft end-play is 0.53–0.78 mm (0.021–0.031 in.). Adjust as necessary. Install the chosen output shaft selective spacer and re-measure end-play to verify selection.

(38) Apply a bead of RTV silicone and install the extension/adapter housing onto the transmission case.

(39) Install and torque the bolts to hold the extension/adapter housing onto the transmission case. The correct torque is 54 N·m (40 ft. lbs.).

(40) Install the number 5 bearing and spacer onto the 4C retainer/bulkhead.

(41) Install the input clutch assembly into the transmission case. Make sure that the input clutch assembly is fully installed by performing a visual inspection through the input speed sensor hole. If the tone wheel on the input clutch assembly is visible, the assembly is fully installed.

(42) Install the number 1 bearing with the flat side down in the pocket of the input clutch assembly.

(43) Install the oil pump into the transmission case.

(44) Install the bolts to hold the oil pump into the transmission case. Tighten the oil pump bolts to 28 N·m (250 in. lbs.).

(45) Using End-Play Tool Set 8266 and Dial Indicator C-3339, measure and record the input shaft end-play. The correct end-play is 0.79–1.07 mm

DISASSEMBLY AND ASSEMBLY (Continued)

(0.031–0.042 in.). Adjust as necessary. Install the chosen spacer on the number 5 bearing and re-measure end-play to verify selection.

NOTE: When measuring the input shaft end-play, two ″stops″ will be felt. When the input shaft is pushed inward and the dial indicator zeroed, the first ″stop″ felt when the input shaft is pulled outward is the movement of the input shaft in the input clutch housing hub. This value should not be included in the end-play measured value and therefore must be recorded and subtracted from the dial indicator reading.

(46) Install the transmission front cover into the transmission case.

(47) Install the outer snap-ring to hold the transmission front cover into the transmission case.

(48) Partially install the inner transmission front cover snap-ring onto the oil pump.

(49) Using Installer 8255, install the inner transmission front cover snap-ring the remainder of the way onto the oil pump.

(50) Install the valve body. Tighten the valve body to transmission case bolts to 12 N·m (105 in. lbs.).

(51) Install the primary oil filter and the oil cooler filter. Tighten the screws to hold the primary oil filter to the valve body to 4.5 N·m (40 in. lbs.). Using Oil Filter Wrench 8321, tighten the cooler return oil filter to the transmission case to 14 N·m (125 in. lbs.).

(52) Apply RTV silicone to the oil pan and install the transmission oil pan. Tighten the bolts to 12 N·m (105 in. lbs.).

(53) Install the input, output, and line pressure sensors. Tighten the bolts to 12 N·m (105 in. lbs.).

(54) Install the manual shift lever from the transmission. Torque the retaining cross-bolt to 16 N·m (140 in. lbs.).

VALVE BODY

DISASSEMBLY

(1) Remove the screws holding the solenoid and pressure switch assembly to the valve body transfer plate (Fig. 37). Do not remove the screws on the top of the solenoid and pressure switch assembly.

(2) Separate the solenoid and pressure switch assembly from the valve body transfer plate.

(3) Remove the screw holding the detent spring onto the valve body.

(4) Remove the detent spring from the valve body.

(5) Remove the TRS selector plate from the valve body and the manual valve.

(6) Remove the clutch passage seals from the valve body, if necessary.

(7) Remove the screws holding the accumulator cover onto the valve body (Fig. 38).

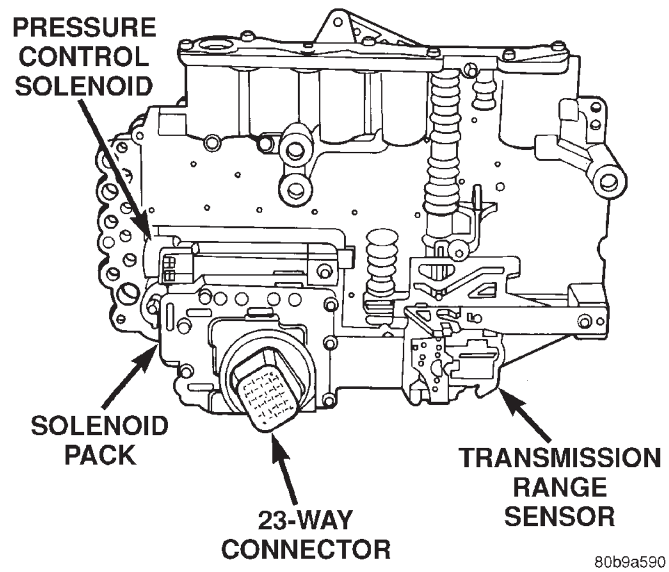


Fig. 37 Solenoid and Pressure Switch Assembly

(8) Remove the accumulator springs and pistons from the valve body. Note which accumulator piston and spring belong in each location.

(9) Place the valve body on the bench with the transfer plate upward.

NOTE: The valve body contains seven check balls. The transfer plate must be placed upward to prevent losing the check balls when the transfer plate is removed from the valve body.

(10) Remove the screws holding the valve body to the valve body transfer plate.

(11) Remove the transfer plate from the valve body. Note the location of all check balls.

(12) Remove the check balls from the valve body.

(13) Remove the retainers securing the solenoid switch valve, manual valve, and the low/reverse switch valve into the valve body and remove the associated valve and spring. Tag each valve and spring combination with location information to aid in assembly.

ASSEMBLY

(1) Lubricate valves, springs, and the housing valve bores with clean transmission fluid.

(2) Install solenoid switch valve, manual valve, and the low/reverse switch valve into the valve body.

(3) Install the retainers to hold each valve into the valve body.

(4) Install the valve body check balls into their proper locations.

(5) Position the transfer plate onto the valve body.

(6) Install the screws to hold the transfer plate to the valve body. Tighten the screws to 4.5 N·m (40 in. lbs.).

DISASSEMBLY AND ASSEMBLY (Continued)

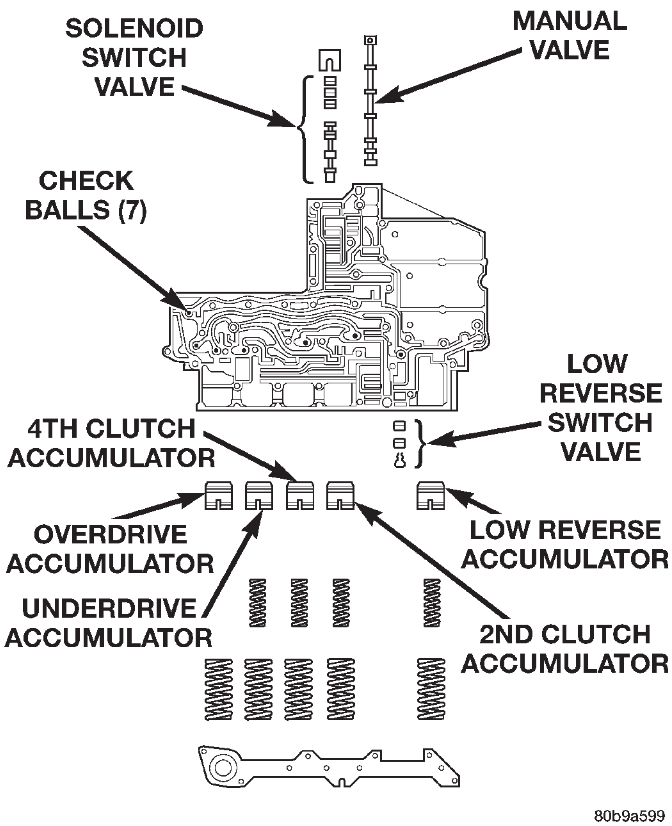


Fig. 38 Valve Body Components

(7) Install the accumulator pistons and springs into the valve body in the location from which they were removed. Note that all accumulators except the overdrive have two springs. The overdrive accumulator piston has only one spring.

(8) Position the accumulator cover onto the valve body.

(9) Install the screws to hold the accumulator cover onto the valve body. Tighten the screws to 4.5 N·m (40 in. lbs.).

(10) Install the TRS selector plate onto the valve body and the manual valve.

(11) Install the solenoid and pressure switch assembly onto the transfer plate.

(12) Install the screws to hold the solenoid and pressure switch assembly onto the transfer plate. Tighten the screws to 5.7 N·m (50 in. lbs.). Tighten the screws nearest the TRS selector plate first and then work toward the other end.

(13) Position the detent spring onto the valve body.

(14) Install the screw to hold the detent spring onto the valve body. Tighten the screw to 4.5 N·m (40 in. lbs.).

(15) Install new clutch passage seals onto the valve body, if necessary

OIL PUMP

DISASSEMBLY

(1) Remove the bolts holding the reaction shaft support to the oil pump.

(2) Remove the reaction shaft support from the oil pump.

(3) Remove all bolts holding the oil pump halves together.

(4) Using suitable prying tools, separate the oil pump sections by inserting the tools in the supplied areas and prying the halves apart.

NOTE: The oil pump halves are aligned to each other through the use of two dowels. Be sure to pry upward evenly to prevent damage to the oil pump components.

(5) Remove the screws holding the separator plate onto the oil pump body.

(6) Remove the separator plate from the oil pump body.

(7) Mark all gears for location. The gears are select fit and if the oil pump is to be reused, the gears must be returned to their original locations.

(8) Remove the oil pump gears from the oil pump case (Fig. 39).

(9) Remove the oil pump valve retainers and associated valve and spring one at a time (Fig. 40). Mark the combination of components as a group and tag them as to the location from which they were removed.

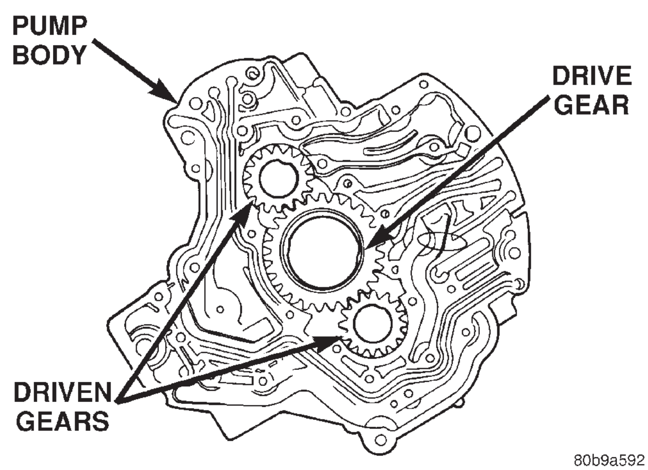


Fig. 39 Oil Pump Gears

ASSEMBLY

(1) Clean and inspect all components. Make sure that all passages are thoroughly cleaned and are free from dirt or debris. Make sure that all valves move freely in their proper bore. Make sure that all gear pockets and bushings are free from excessive wear and scoring. Replace the oil pump if any excessive wear or scoring is found.

DISASSEMBLY AND ASSEMBLY (Continued)

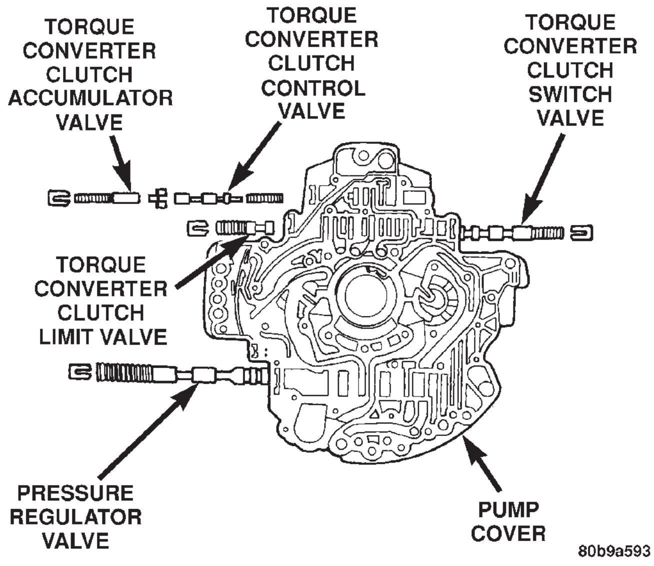


Fig. 40 Oil Pump Cover Components

(2) Coat the gears with Mopar® ATF+3, type 7176 and install into their original locations.

(3) Lubricate the oil pump valves with Mopar® ATF+3, type 7176 and install the valve, spring and retainer into the appropriate oil pump cover bore.

(4) Place the separator plate onto the oil pump body.

(5) Install the screws to hold the separator plate onto the oil pump body. Tighten the screws to 4.5 N·m (40 in. lbs.).

(6) Position the oil pump cover onto the locating dowels.

(7) Seat the two oil pump halves together and install all bolts finger tight.

(8) Torque all bolts down slowly starting in the center and working outward. The correct torque is 4.5 N·m (40 in. lbs.).

(9) Verify that the oil pump gears rotate freely and smoothly.

(10) Position the reaction shaft support into the oil pump.

(11) Install and torque the bolts to hold the reaction shaft support to the oil pump. The correct torque is 12 N·m (105 in. lbs.).

INPUT CLUTCH ASSEMBLY

DISASSEMBLY

(1) Remove the reverse reaction plate selective snap-ring from the input clutch retainer (Fig. 41).

(2) Remove the reverse reaction plate from the input clutch retainer.

(3) Remove the reverse hub (Fig. 42) and reverse clutch pack from the input clutch retainer.

(4) Remove the number 4 bearing from the overdrive hub.

(5) Remove the overdrive hub from the input clutch retainer.

(6) Remove the number 3 bearing from the underdrive hub.

(7) Remove the OD/reverse reaction plate snap-ring from the input clutch retainer.

(8) Remove the underdrive hub, overdrive clutch, and overdrive reaction plate from the input clutch retainer.

NOTE: The overdrive friction discs and steel discs are thicker than the matching components in the underdrive and reverse clutches.

(9) Remove the number 2 bearing from the input clutch hub.

(10) Remove the overdrive clutch wave snap-ring from the input clutch retainer.

(11) Remove the UD/OD reaction plate tapered snap-ring from the input clutch retainer.

(12) Remove the UD/OD reaction plate from the input clutch retainer.

(13) Remove the UD/OD reaction plate flat snap-ring from the input clutch retainer.

(14) Remove the underdrive clutch pack from the input clutch retainer.

(15) Using Spring Compressor 8251, compress the UD/OD balance piston and remove the snap-ring from the input clutch hub (Fig. 43).

(16) Remove the UD/OD balance piston and piston return spring from the input clutch retainer.

(17) Remove the underdrive piston from the input clutch retainer.

NOTE: Both the UD/OD balance piston and the underdrive piston have seals molded onto them. If the seal is damaged, do not attempt to install a new seal onto the piston. The piston/seal must be replaced as an assembly.

(18) Remove the input clutch retainer tapered snap-ring.

(19) Separate input clutch retainer from input clutch hub.

(20) Separate OD/reverse piston from input clutch hub retainer.

(21) Remove all seals and o-rings from the input shaft and input hub. The o-rings on the input hub are color coded. Be sure to make note of which o-ring belongs in which location.

ASSEMBLY

(1) Install all new seals and o-rings onto the input shaft and input hub. The o-rings on the input hub are color coded. Be sure to install the correct o-ring in the correct location.

DISASSEMBLY AND ASSEMBLY (Continued)

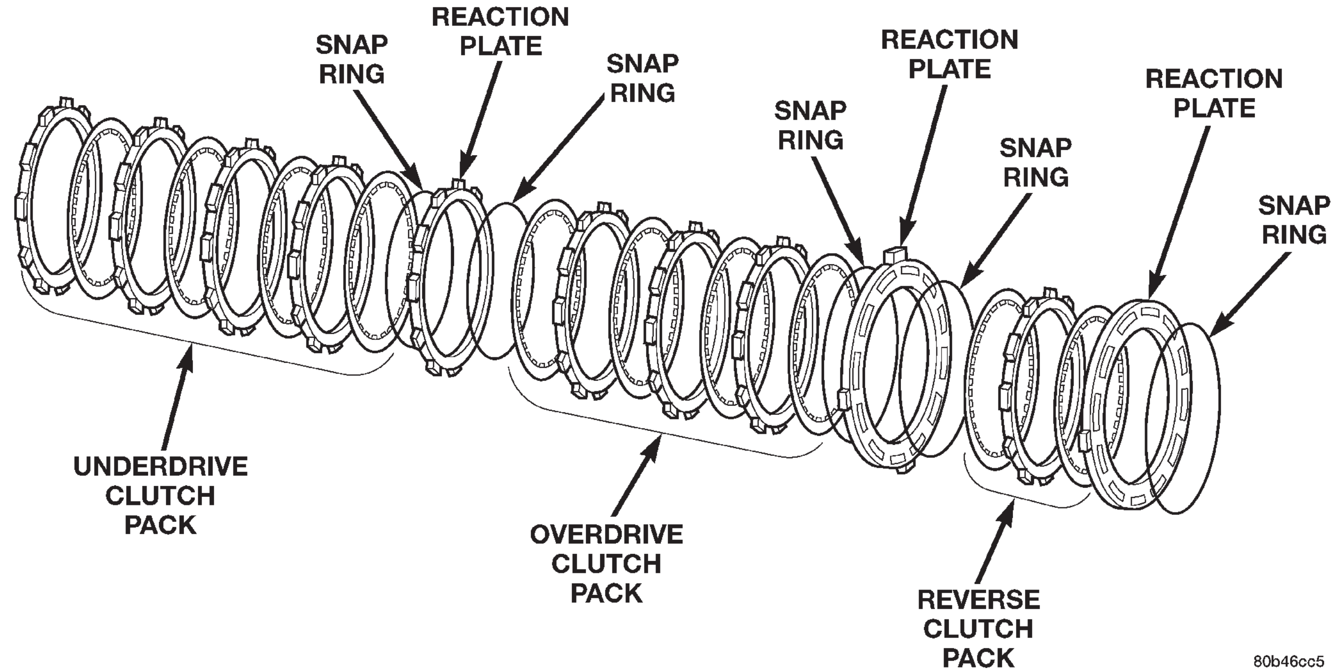


Fig. 41 Input Clutch Assembly Clutch Packs

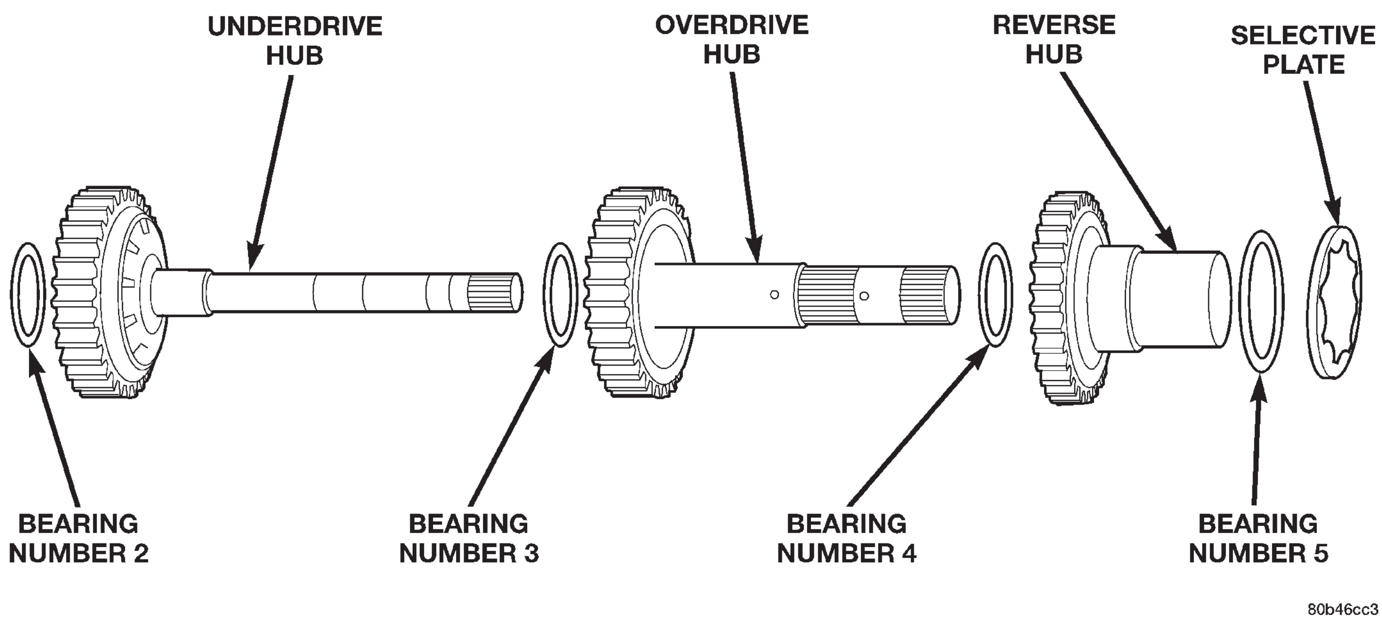


Fig. 42 Input Clutch Assembly Hubs

(2) Lubricate all seals with Mopar® ATF+3, type 7176 prior to installation.

(3) Assemble the OD/reverse piston onto the input clutch hub.

(4) Assemble the input clutch retainer onto the input clutch hub.

(5) Install the input clutch retainer tapered snap-ring with tapered side up onto the input clutch hub.

(6) Install Piston Guides 8504 into the input clutch retainer and onto the input clutch hub to guide the inner and outer underdrive piston seals into position.

(7) Install the underdrive piston into the input clutch retainer and over the input clutch hub.

(8) Install the UD/OD balance piston return spring pack into the input clutch retainer.

(9) Install Piston Guide 8252 into the input clutch retainer to guide the UD/OD balance piston seal into position inside the underdrive piston.

(10) Install the UD/OD balance piston into the input clutch retainer and the underdrive piston.

DISASSEMBLY AND ASSEMBLY (Continued)

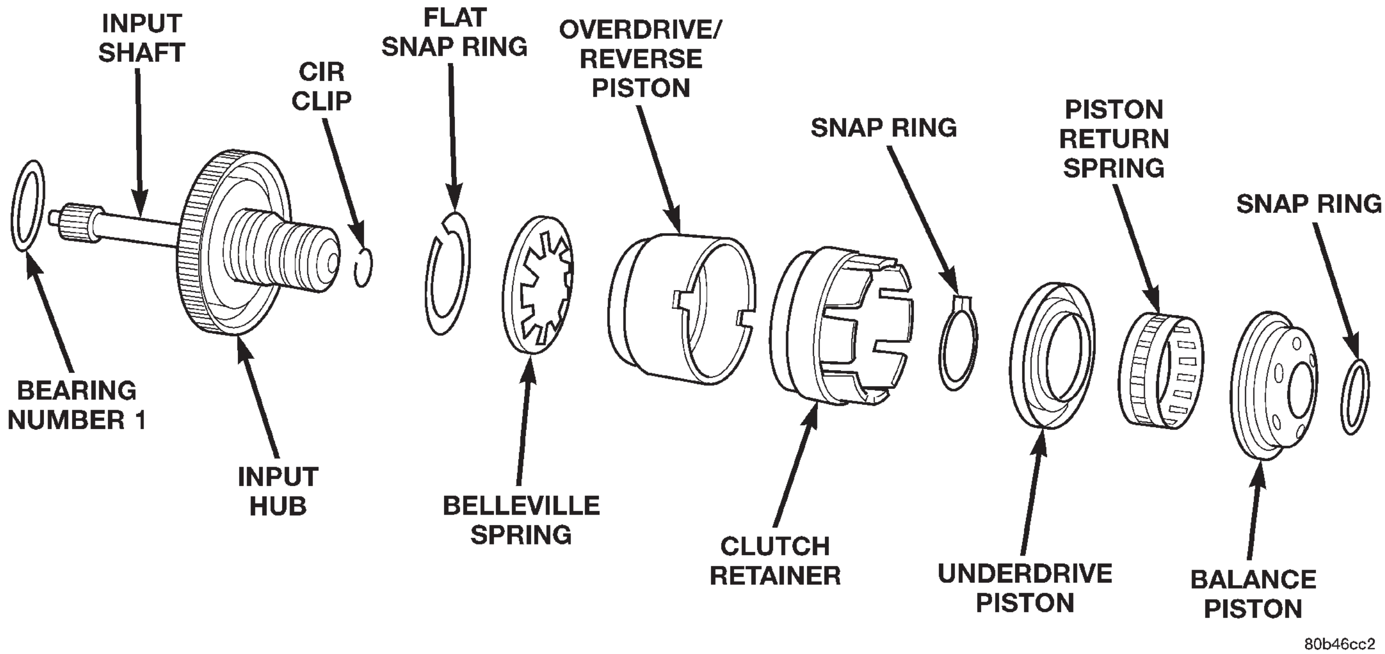


Fig. 43 Input Clutch Assembly Pistons

(11) Using Spring Compressor 8251, compress the UD/OD return spring pack and secure the piston in place with the snap-ring.

(12) Install the underdrive clutch pack into the input clutch retainer.

(13) Install the UD/OD reaction plate lower flat snap-ring. The correct snap-ring can be identified by the two tabbed ears.

(14) Install the UD/OD reaction plate into the input clutch retainer. The reaction plate is to be installed with the big step down. The reaction plate is also selectable and should be changed to achieve the correct clutch clearances.

(15) Install the UD/OD reaction plate upper tapered snap-ring with tapered side up.

(16) Install the input clutch assembly into Input Clutch Pressure Fixture 8260. Mount a dial indicator to the assembly and zero the indicator against the underdrive clutch discs. Apply 20 psi of air pressure to the underdrive clutch and record the dial indicator reading. The correct clutch clearance is 0.76–1.16 mm (0.030–0.063 in.). Adjust as necessary. Install the chosen reaction plate and re-measure to verify selection.

(17) Install the overdrive clutch pack into the input clutch retainer. The overdrive steel separator plates can be identified by the lack of the half-moon cuts in the locating tabs.

(18) Install the overdrive clutch wavy snap-ring with the two tabbed ears into the input clutch retainer.

(19) Install the OD/reverse reaction plate into the input clutch retainer. The reaction plate is non-directional.

(20) Install the OD/reverse reaction plate flat snap-ring into the input clutch retainer.

(21) Mount a dial indicator to the assembly and zero the indicator against the OD/reverse reaction plate. Apply 20 psi of air pressure to the overdrive clutch and record the dial indicator reading. Verify that the clutch clearance is 1.016–1.65 mm (0.040–0.065 in.).

(22) Install the reverse clutch pack into the input clutch retainer.

(23) Install the reverse reaction plate into the input clutch retainer.

(24) Install the reverse reaction plate selective snap-ring into the input clutch retainer.

(25) Mount a dial indicator to the assembly and zero the indicator against the reverse reaction plate. Apply 20 psi of air pressure to the reverse clutch and record the dial indicator reading. The correct clutch clearance is 0.81–1.24 mm (0.032–0.049 in.). Adjust as necessary. Install the chosen snap-ring and re-measure to verify selection.

(26) Remove the reverse clutch pack from the input clutch retainer.

(27) Install the number 2 bearing onto the underdrive hub with flat side up/forward with petroleum jelly.

(28) Install the underdrive hub into the input clutch retainer.

(29) Install the number 3 bearing into the overdrive hub with the flat side up/forward with petroleum jelly.

(30) Install the overdrive hub into the input clutch retainer.

DISASSEMBLY AND ASSEMBLY (Continued)

(31) Install the number 4 bearing into the reverse hub with flat side up/forward with petroleum jelly.

(32) Install the reverse hub into the input clutch retainer.

(33) Install the complete reverse clutch pack.

(34) Install the reverse reaction plate and snap-ring.

(35) Push up on reaction plate to allow reverse clutch to move freely.

4C RETAINER/BULKHEAD

DISASSEMBLY

(1) Remove the 2C piston belleville spring snap-ring from the 4C retainer /bulkhead (Fig. 44).

(2) Remove the 2C piston Belleville spring from the retainer/bulkhead.

(3) Remove the 2C piston from the retainer/bulk-head. Use 20 psi of air pressure to remove the piston if necessary.

(4) Remove the 4C clutch snap-ring from the retainer/bulkhead.

(5) Remove the 4C clutch pack from the retainer/ bulkhead.

(6) Using Spring Compressor 8250 and a suitable shop press, compress the 4C piston return spring and remove the snap-ring.

(7) Remove the 4C piston return spring and piston from the retainer/bulkhead. Use 20 psi of air pressure to remove the piston if necessary.

ASSEMBLY

(1) Clean and inspect all components. Replace any components which show evidence of excessive wear or scoring.

(2) Install new seals on the 2C and 4C pistons.

(3) Lubricate all seals with Mopar® ATF+3, type 7176 prior to installation.

(4) Install the 4C piston into the 4C retainer/bulk-head.

(5) Position the 4C piston return spring onto the 4C piston.

(6) Using Spring Compressor 8250 and a suitable shop press, compress the 4C piston return spring and install the snap-ring.

(7) Assemble and install the 4C clutch pack into the retainer/bulkhead.

(8) Install the 4C reaction plate and snap-ring into the retainer/bulkhead. The 4C reaction plate is non-directional.

(9) Measure the 4C clutch clearance. The correct clutch clearance is 0.81–1.35 mm (0.032–0.053 in.). The snap-ring is selectable. Install the chosen snap-ring and re-measure to verify the selection.

(10) Install the 2C piston into the retainer/bulk-head.

(11) Position the 2C Belleville spring onto the 2C piston.

(12) Position the 2C Belleville spring snap-ring onto the 2C Belleville spring.

(13) Using Spring Compressor 8249 and a suitable shop press, compress the belleville spring until the snap-ring is engaged with the snap-ring groove in the retainer/bulkhead.

PLANETARY GEAR SET

DISASSEMBLY

(1) Remove the snap-ring holding the input annulus into the input carrier.

(2) Remove the input annulus from the input carrier (Fig. 45).

(3) Remove the number 9 bearing from the reverse planetary carrier. Note that this planetary carrier has four pinion gears.

(4) Remove the reverse planetary gear carrier.

(5) Remove the number 10 bearing from the input sun gear.

(6) Remove the input sun gear from the input carrier.

(7) Remove the number 11 bearing from the input carrier.

ASSEMBLY

(1) Clean and inspect all components. Replace any components which show evidence of excessive wear or scoring.

(2) Install the number 11 bearing into the input planetary carrier with the flat side up and facing forward.

(3) Install the input sun gear into the input carrier.

(4) Install the number 10 bearing onto the rear of the reverse planetary carrier with the flat side toward the carrier.

(5) Install the number 9 bearing onto the front of the reverse planetary carrier with the rounded side toward the carrier and the flat side facing upward.

(6) Install the reverse planetary gear carrier into the input carrier.

(7) Install the input annulus gear into the input carrier.

(8) Install the snap-ring to hold the input annulus gear into the input carrier.

LOW/REVERSE CLUTCH

DISASSEMBLY

(1) Remove the inner overrunning clutch snap-ring from the low/reverse clutch retainer (Fig. 46).

(2) Remove the outer low/reverse reaction plate flat snap-ring.

DISASSEMBLY AND ASSEMBLY (Continued)

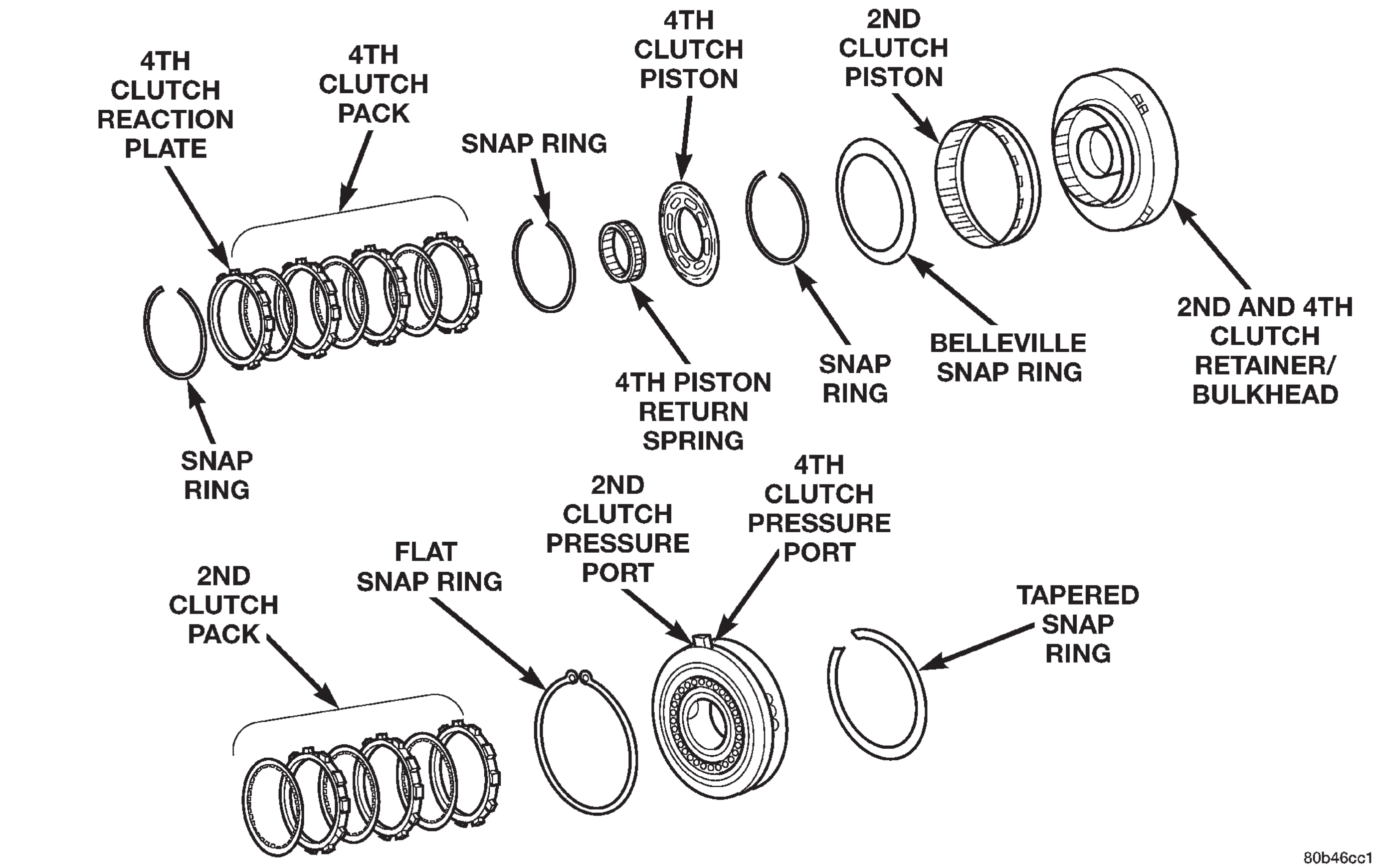


Fig. 44 4C Retainer/Bulkhead Components

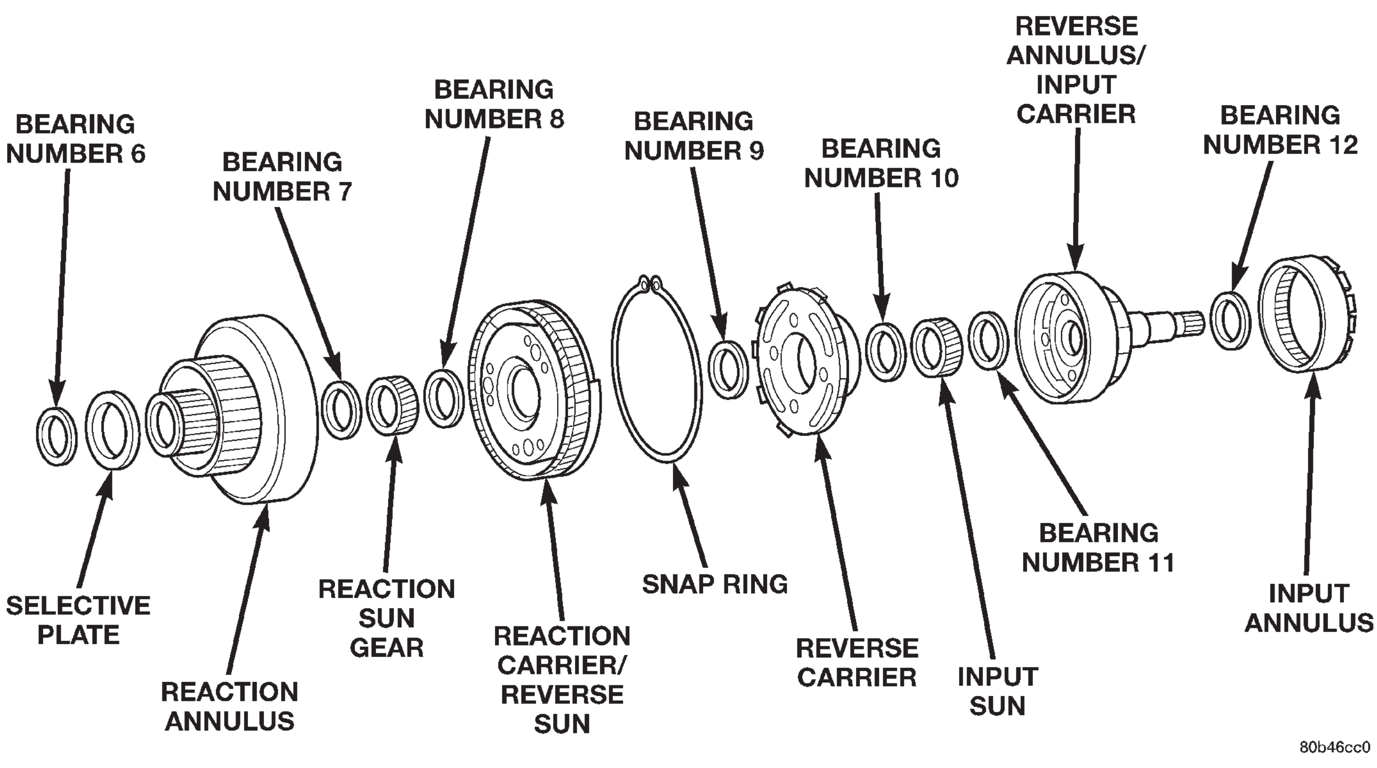


Fig. 45 Planetary Gear Set Components

DISASSEMBLY AND ASSEMBLY (Continued)

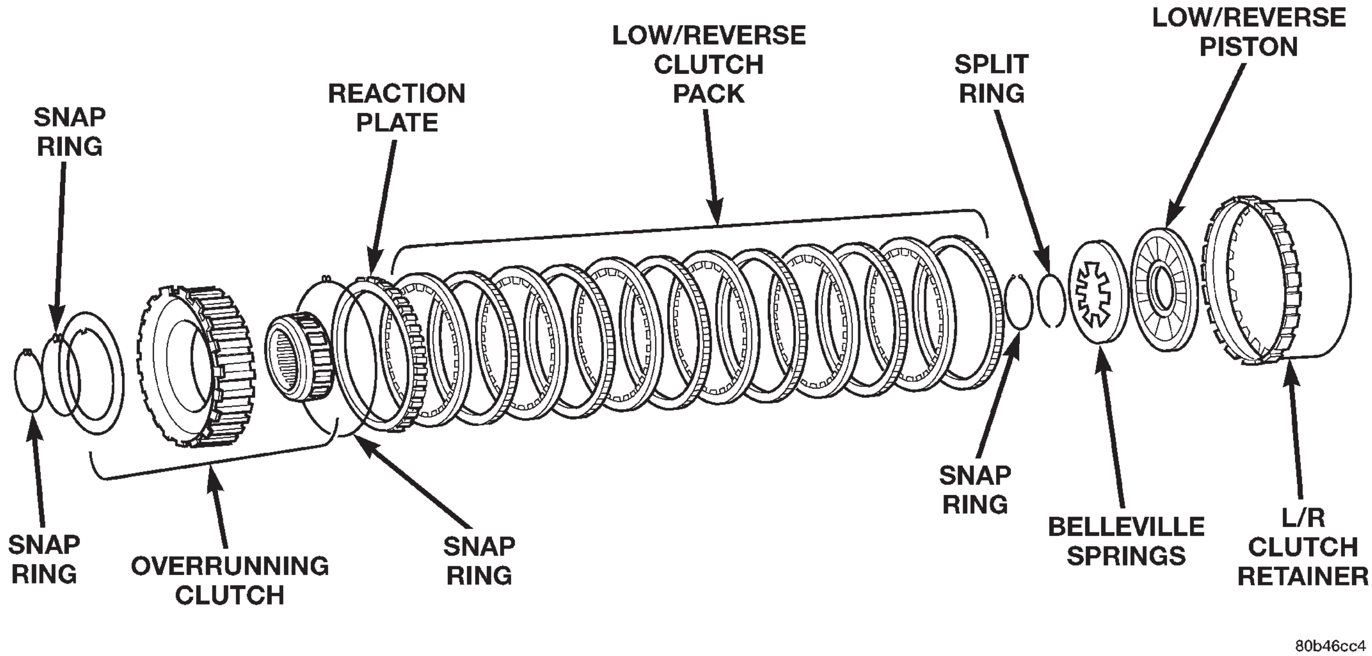


Fig. 46 Low/Reverse Clutch Components

(3) Remove the low/reverse clutch and the overrunning clutch from the low/reverse clutch retainer as an assembly.

(4) Separate the low/reverse clutch from the overrunning clutch.

(5) Remove the overrunning clutch snap-ring (Fig. 47).

(6) Remove the spacer from the overrunning clutch.

(7) Separate the inner and outer races of the overrunning clutch.

(8) Remove the overrunning clutch lower snap-ring.

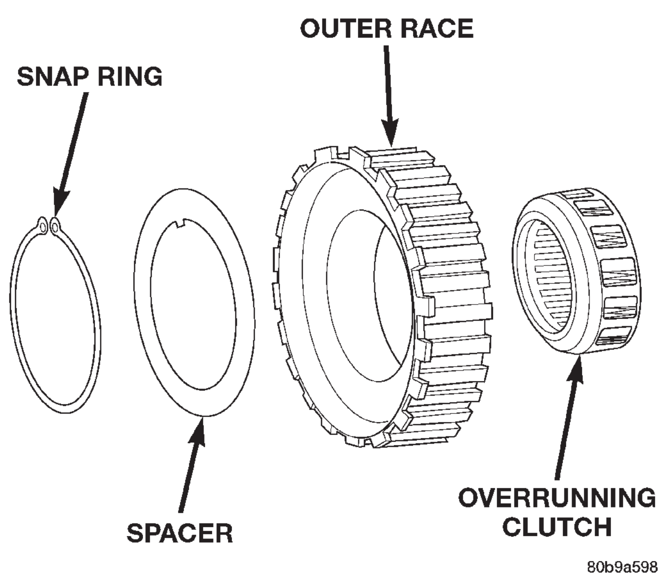


Fig. 47 Overrunning Clutch

(9) Using Spring Compressor 8285 and a suitable shop press, compress the low/reverse piston Belleville spring and remove the split retaining ring holding the Belleville spring into the low/reverse clutch retainer.

(10) Remove the low/reverse clutch Belleville spring and piston from the low/reverse clutch retainer. Use 20 psi of air pressure to remove the piston if necessary.

ASSEMBLY

(1) Clean and inspect all components. Replace any components which show evidence of excessive wear or scoring.

(2) Check the bleed orifice to ensure that it is not plugged or restricted.

(3) Install a new seal on the low/reverse piston. Lubricate the seal with Mopar® ATF+3, type 7176 prior to installation.

(4) Install the low/reverse piston into the low/reverse clutch retainer.

(5) Position the low/reverse piston Belleville spring on the low/reverse piston.

(6) Using Spring Compressor 8285 and a suitable shop press, compress the low/reverse piston Belleville spring and install the split retaining ring to hold the Belleville spring into the low/reverse clutch retainer.

(7) Install the lower overrunning clutch snap-ring.

(8) Assemble the inner and outer races of the overrunning clutch.

(9) Position the overrunning clutch spacer on the overrunning clutch.

DISASSEMBLY AND ASSEMBLY (Continued)

(10) Install the upper overrunning clutch snap-ring.

(11) Assemble and install the low/reverse clutch pack into the low/reverse clutch retainer.

(12) Install the low/reverse reaction plate into the low/reverse clutch retainer. The reaction plate is directional and must be installed with the flat side down.

(13) Install the low/reverse clutch pack snap-ring. The snap-ring is selectable and should be chosen based to give the correct clutch pack clearance.

(14) Measure the low/reverse clutch pack clearance and adjust as necessary. The correct clutch clearance is 1.14–1.91 mm (0.045–0.05 in.).

(15) Install the overrunning clutch into the low/reverse clutch retainer making sure that the index splines are aligned with the retainer.

(16) Install the overrunning clutch inner snap-ring.

CLEANING AND INSPECTION

VALVE BODY

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 electrical components by wiping them off with dry shop towels only.

Dry all except the electrical 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 can stick to valve body parts, interfere with valve operation, and clog filters and fluid passages.**

Inspect all of the valve body mating surfaces for scratches, nicks, burrs, or distortion. Use a straight-edge 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.

Inspect the valves and plugs (Fig. 48) 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.

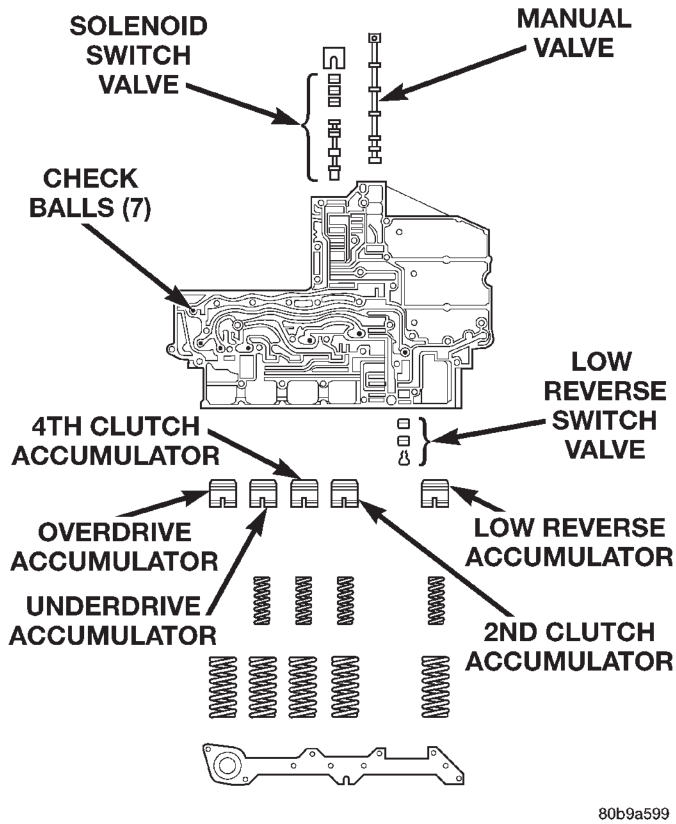


Fig. 48 Valve Body Components

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.

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.

Inspect all the accumulator 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 accumulator springs. The springs must be free of distortion, warpage or broken coils.

Inspect all the fluid seals on the valve body (Fig. 49). Replace any seals that are cracked, distorted, or damaged in any way. These seals pass fluid pressure directly to the clutches. Any pressure leak at these points, may cause transmission performance problems.

CLEANING AND INSPECTION (Continued)

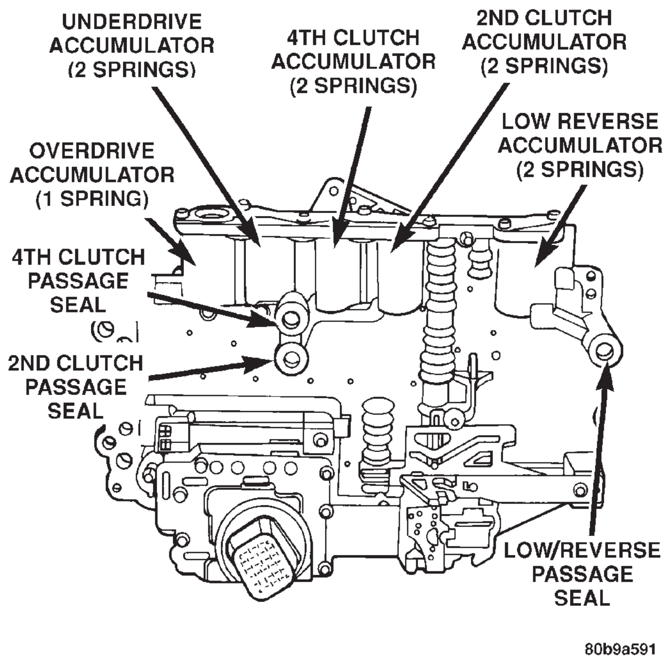


Fig. 49 Valve Body Seals

TRANSMISSION

GENERAL INFORMATION

Heli-Coil inserts can be used to repair damaged, stripped or worn threads in aluminum parts. These inserts are available from most automotive parts suppliers. 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 3, Type 7176, transmission fluid during overhaul and assembly. Use petroleum jelly, Mopar® Door Ease, or Ru-Glyde to prelubricate seals, O-rings, and thrust washers. Petroleum jelly can also be used 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.

NOTE: 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.

LOW/REVERSE CLUTCH ASSEMBLY

Clean the overrunning clutch assembly, clutch cam, and low-reverse clutch retainer. Dry them with compressed air after cleaning.

Inspect condition of each clutch part after cleaning. Replace the overrunning clutch roller and spring assembly if any rollers or springs are worn or damaged, or if the roller cage is distorted, or damaged. Replace the cam if worn, cracked or damaged.

Replace the low-reverse clutch retainer if the clutch race, roller surface or inside diameter is scored, worn or damaged.

ACCUMULATOR

Inspect the accumulator piston and seal rings. Replace the seal rings if worn or cut. Replace the piston if chipped or cracked.

Check condition of the accumulator inner and outer springs. Replace the springs if the coils are cracked, distorted or collapsed.

OIL PUMP AND REACTION SHAFT 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, broken, or severely worn.

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.

Inspect the pump bushing. 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.

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**

CLEANING AND INSPECTION (Continued)

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 oil pump cover. Use a penlight to view the bore interiors. Replace the oil pump if any bores are distorted or scored. Inspect all of the valve springs. The springs must be free of distortion, warpage or broken coils.

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.

PLANETARY GEARTRAIN

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.

Replace the output shaft if the 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.

ADJUSTMENTS

BRAKE TRANSMISSION SHIFT INTERLOCK

The park interlock cable is part of the brake/shift lever interlock system. Correct cable adjustment is important to proper interlock operation. The gear shift and park lock cables must both be correctly adjusted in order to shift out of Park.

Park Interlock Cable Adjustment Procedure

(1) Shift the transmission into the PARK position.

(2) Turn ignition switch to LOCK position. **Be sure ignition key cylinder is in the LOCK position. Cable will not adjust correctly in any other position.**

(3) Remove shift lever bezel and floor console as necessary for access to the brake transmission shift interlock cable.

(4) Pull cable lock button up to release cable (Fig. 50).

(5) Pull cable rearward. Then release cable and press lock button down until it snaps in place.

BTSI FUNCTION CHECK

(1) Verify removal of ignition key allowed in park position only.

(2) When the shift lever is in park, and the shift handle push-button is in the out position, the ignition key cylinder should rotate freely from off to lock. When the shifter is in any other position, the ignition key should not rotate from off to lock.

(3) Shifting out of park should be possible when the ignition key cylinder is in the off position.

(4) Shifting out of park should not be possible while applying 25 lb. max. handle push-button force, and ignition key cylinder is in the run or start positions, unless the foot brake pedal is depressed approximately 1/2 inch (12mm).

(5) Shifting out of park should not be possible when the ignition key cylinder is in the accessory or lock position.

(6) Shifting between any gears neutral or park may be done without depressing foot brake with ignition switch in run or start positions and vehicle stationary or in motion.

(7) The floor shifter lever and gate positions should be in alignment with all transmission detent positions.

(8) Engine starts must be possible with shifter lever in park or neutral gate positions only. Engine starts must not be possible in any other gate positions other than park or neutral.

(9) With shifter lever handle push-button not depressed and lever detent in:

- PARK POSITION- apply forward force on center of handle and remove pressure. Engine start must be possible.
- PARK POSITION- apply rearward force on center of handle and remove pressure. Engine start must be possible.
- NEUTRAL POSITION- engine start must be possible.
- NEUTRAL POSITION, ENGINE RUNNING AND BRAKES APPLIED- Apply forward force on center of shift handle. Transmission should not be able to shift into reverse detent.

GEARSHIFT CABLE

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 or TRS may be faulty.

Gearshift Adjustment Procedure

(1) Shift transmission into Park.

ADJUSTMENTS (Continued)

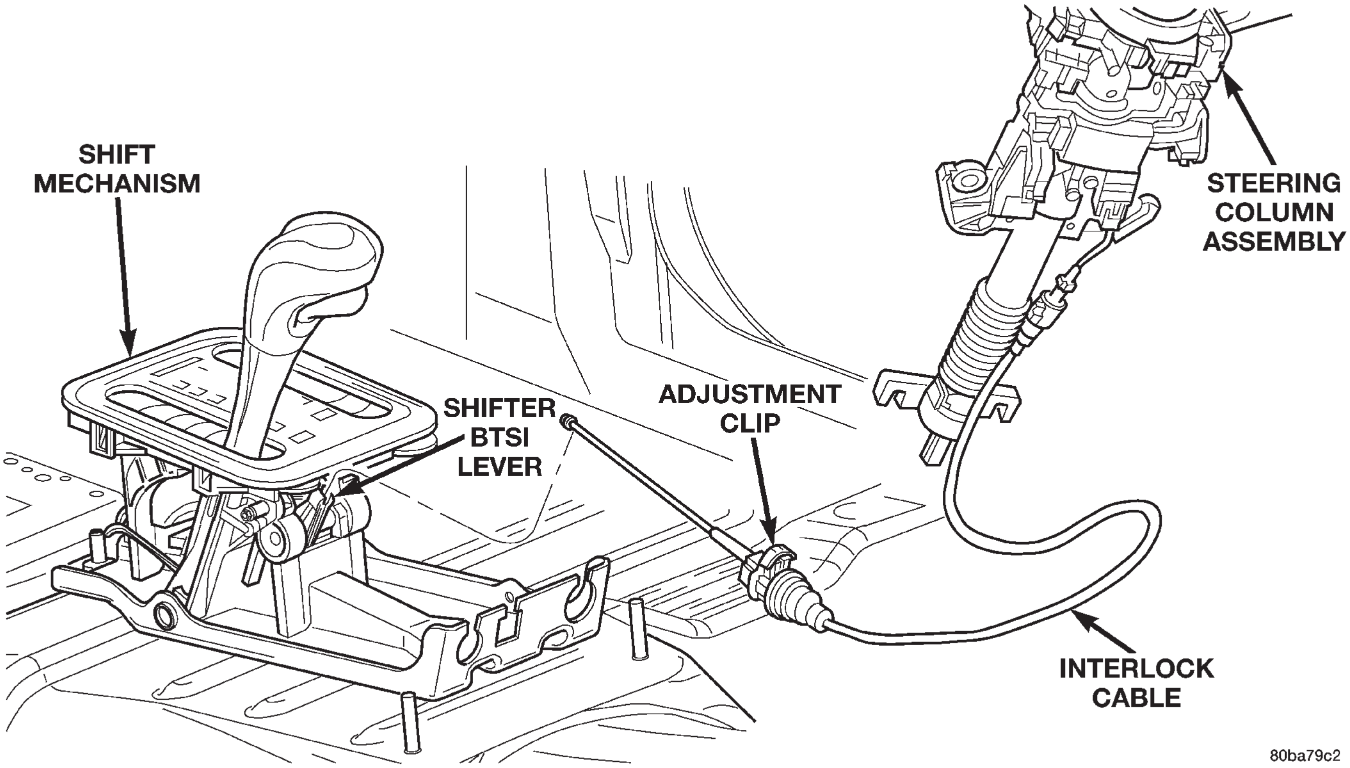


Fig. 50 Brake Transmission Shift Interlock Cable

(2) Remove shift lever bezel and floor console as necessary for access to the shift cable adjustment.

(3) Loosen the shift cable adjustment screw (Fig. 51).

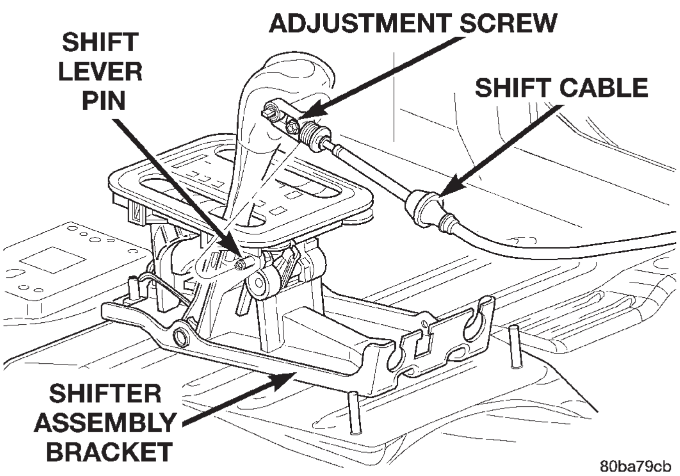


Fig. 51 Shift Cable at the Shifter

(4) Raise vehicle.

(5) Unsnap cable eyelet from transmission shift lever (Fig. 52).

(6) Verify transmission shift lever is in Park detent by moving lever fully rearward. Last rearward detent is Park position.

(7) Verify positive engagement of transmission park lock by attempting to rotate propeller shaft. Shaft will not rotate when park lock is engaged.

(8) Snap cable eyelet onto transmission shift lever.

(9) Lower vehicle

(10) Tighten the shift cable adjustment screw to 7 N·m (65 in. lbs.).

(11) Verify correct operation.

(12) Install the shifter bezel and any floor console components removed for access.

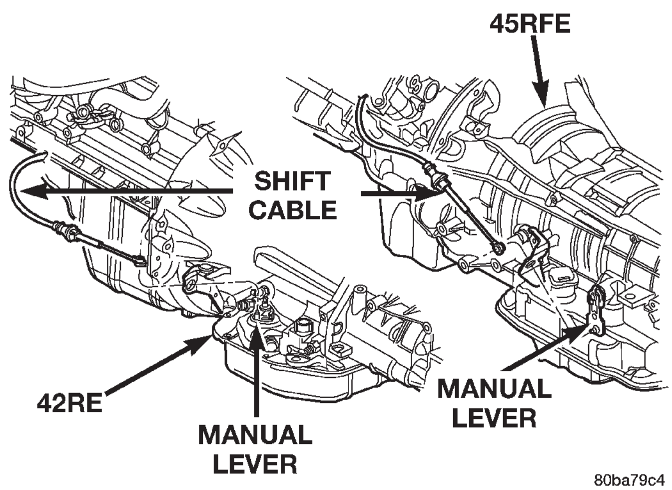
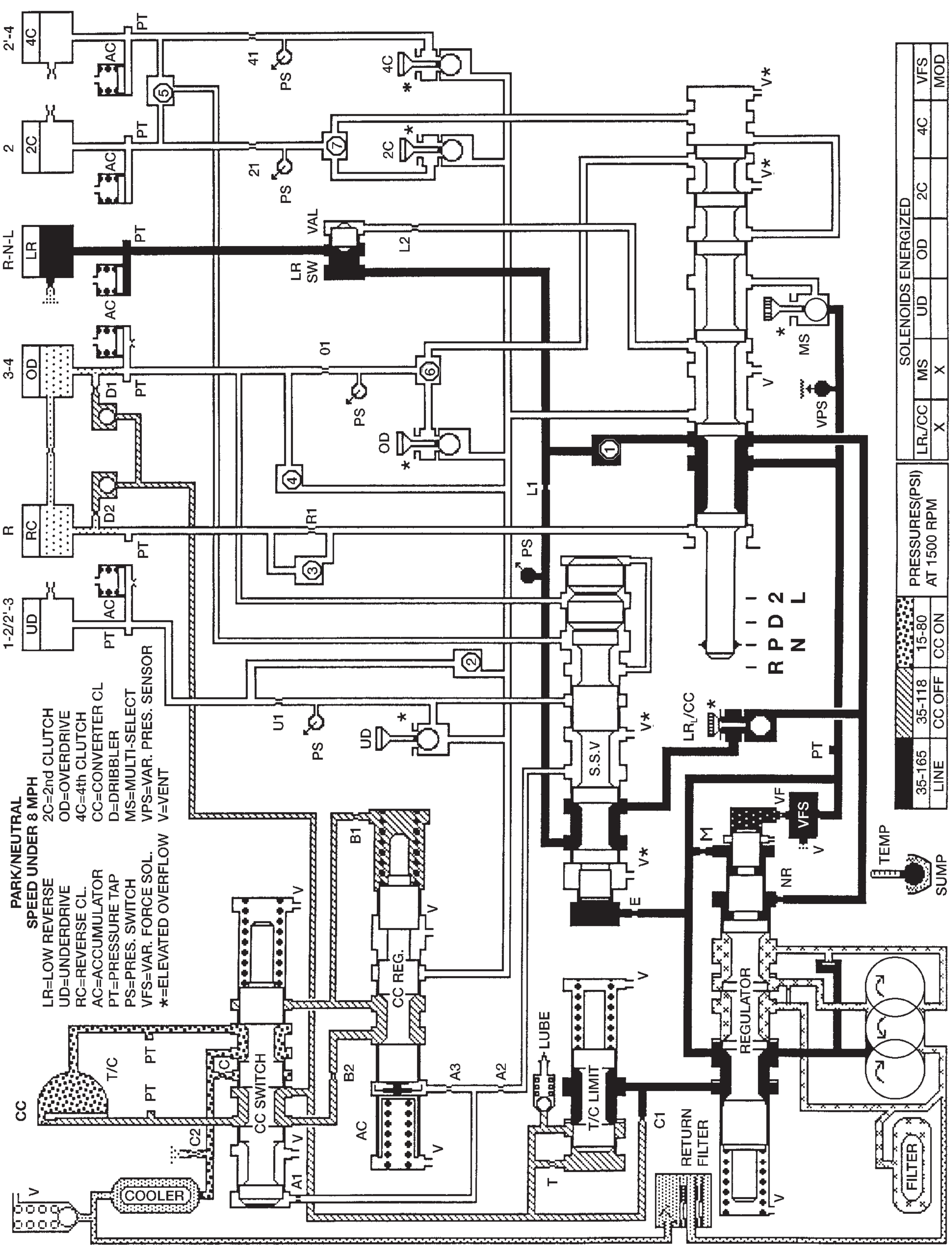


Fig. 52 Shift Cable Attachment At Transmission

SCHEMATICS AND DIAGRAMS

HYDRAULIC SCHEMATICS



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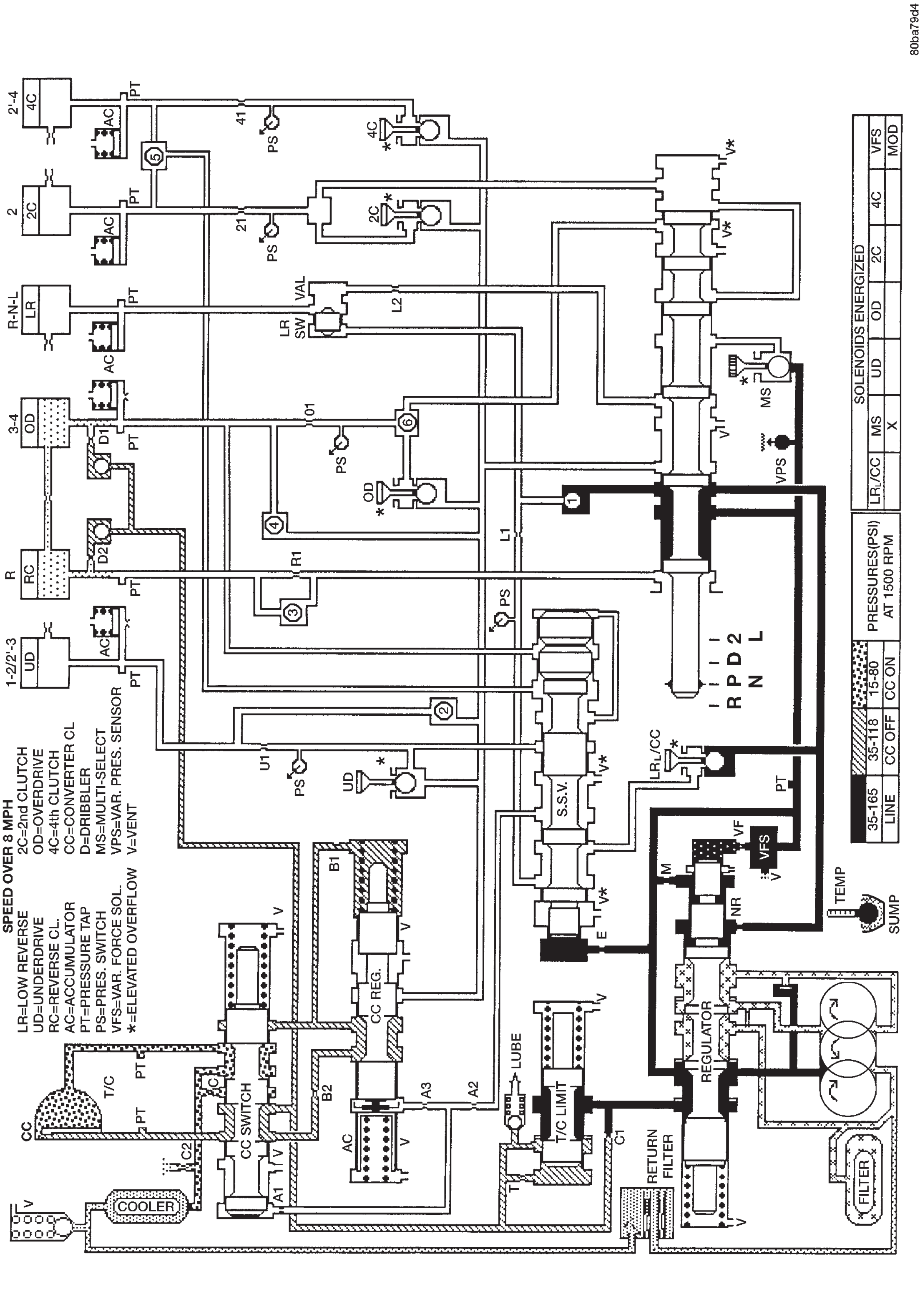
45RFE HYDRAULIC SCHEMATIC

SCHEMATICS AND DIAGRAMS (Continued)



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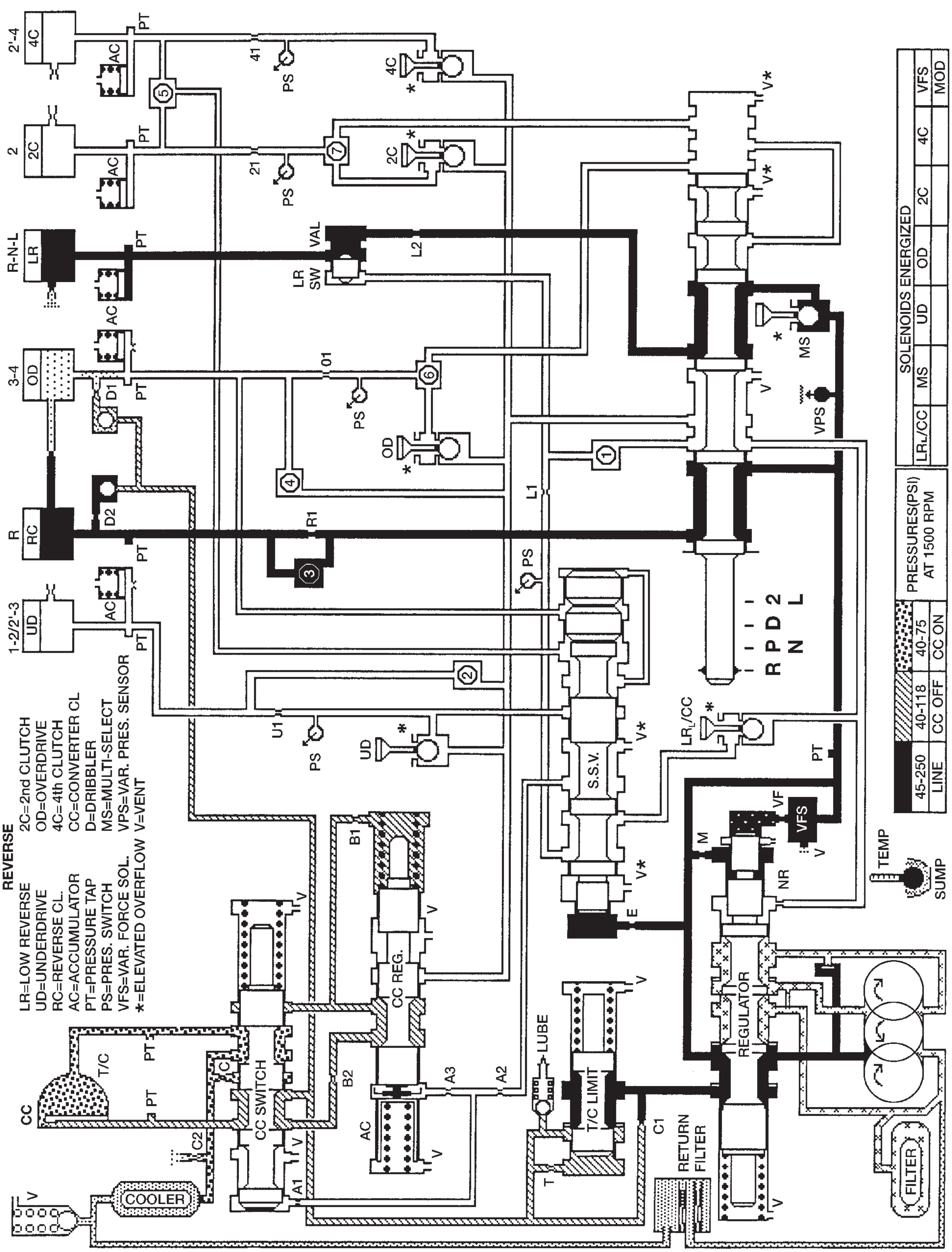
SCHEMATICS AND DIAGRAMS (Continued)



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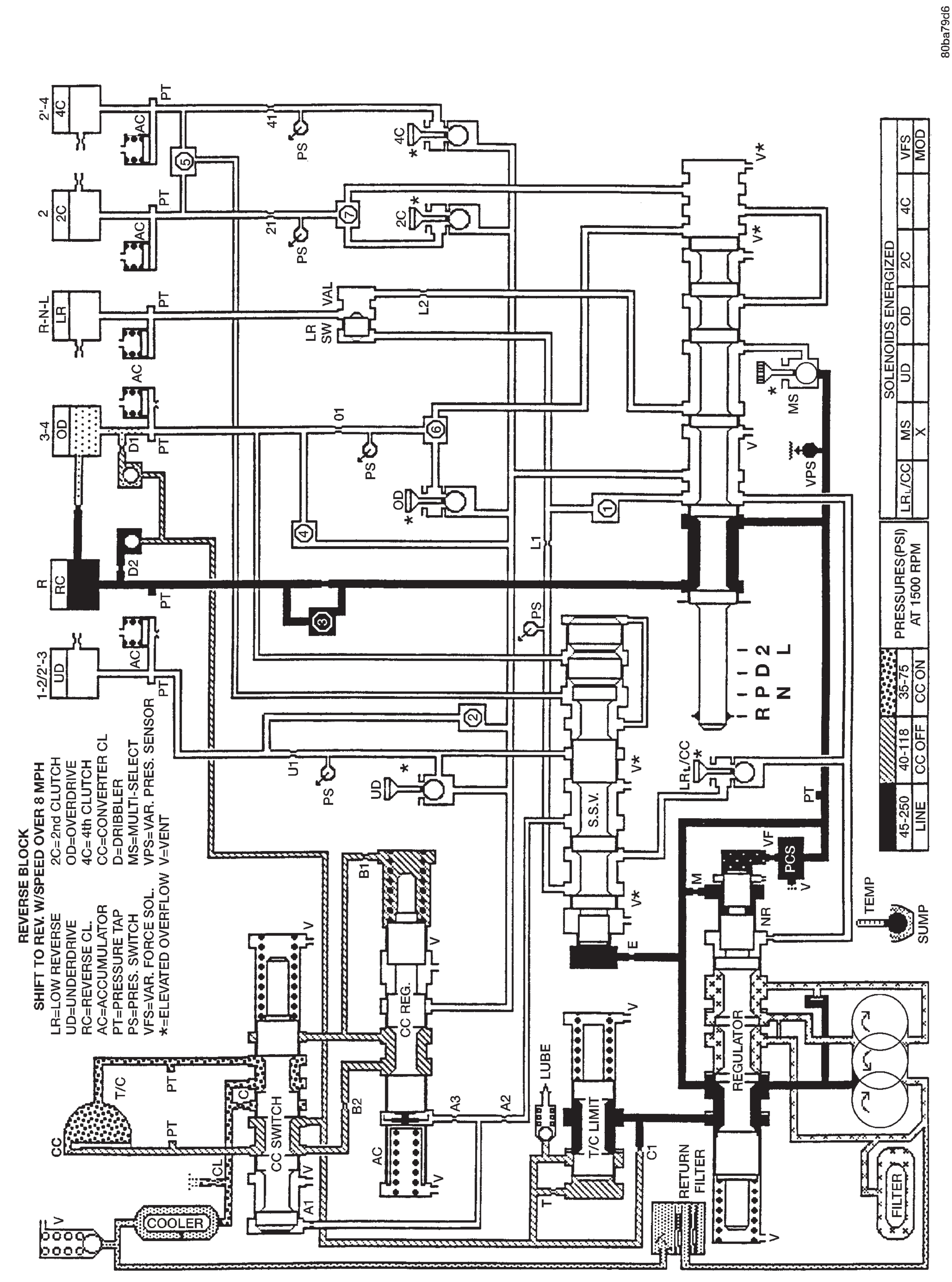

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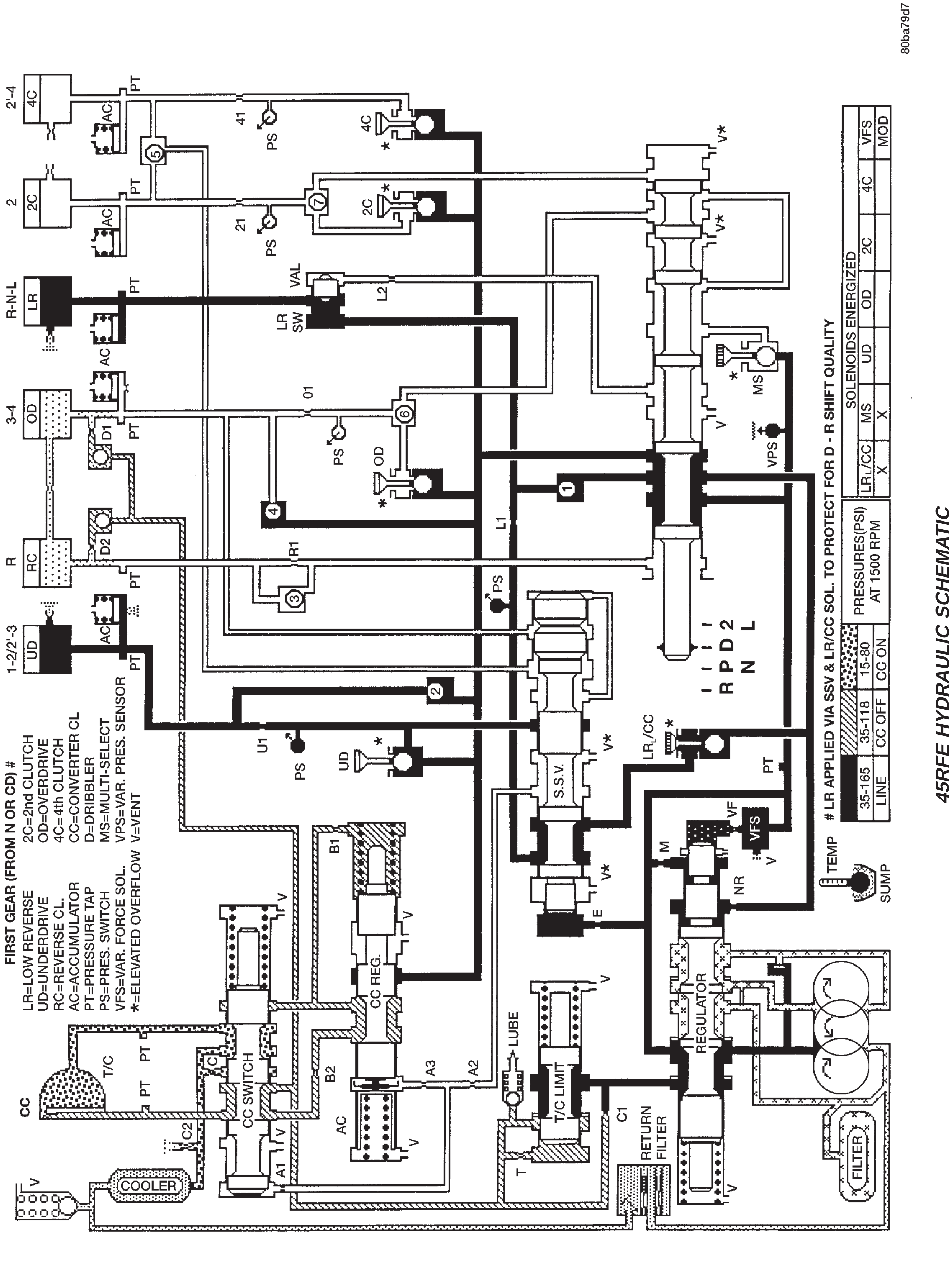

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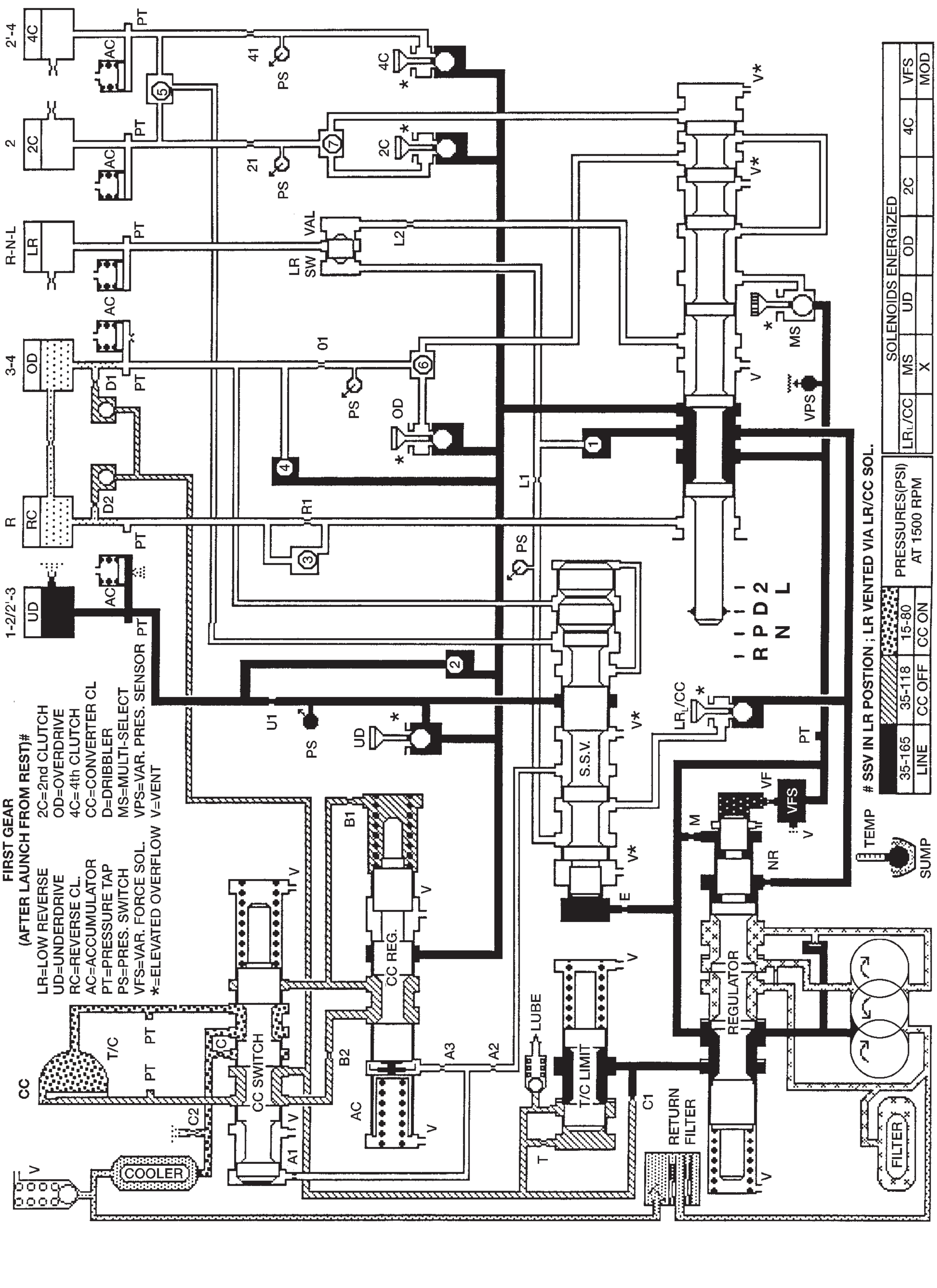

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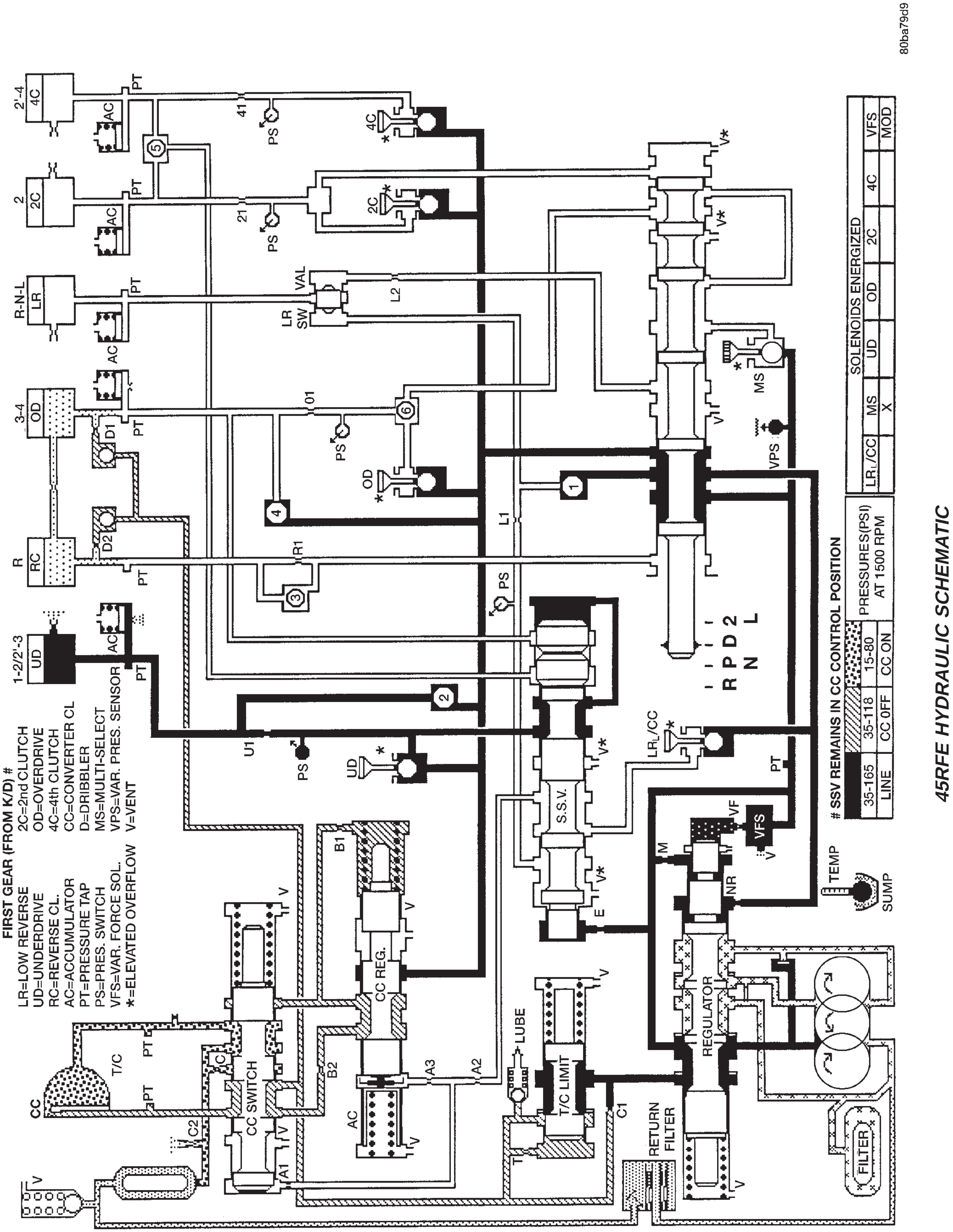

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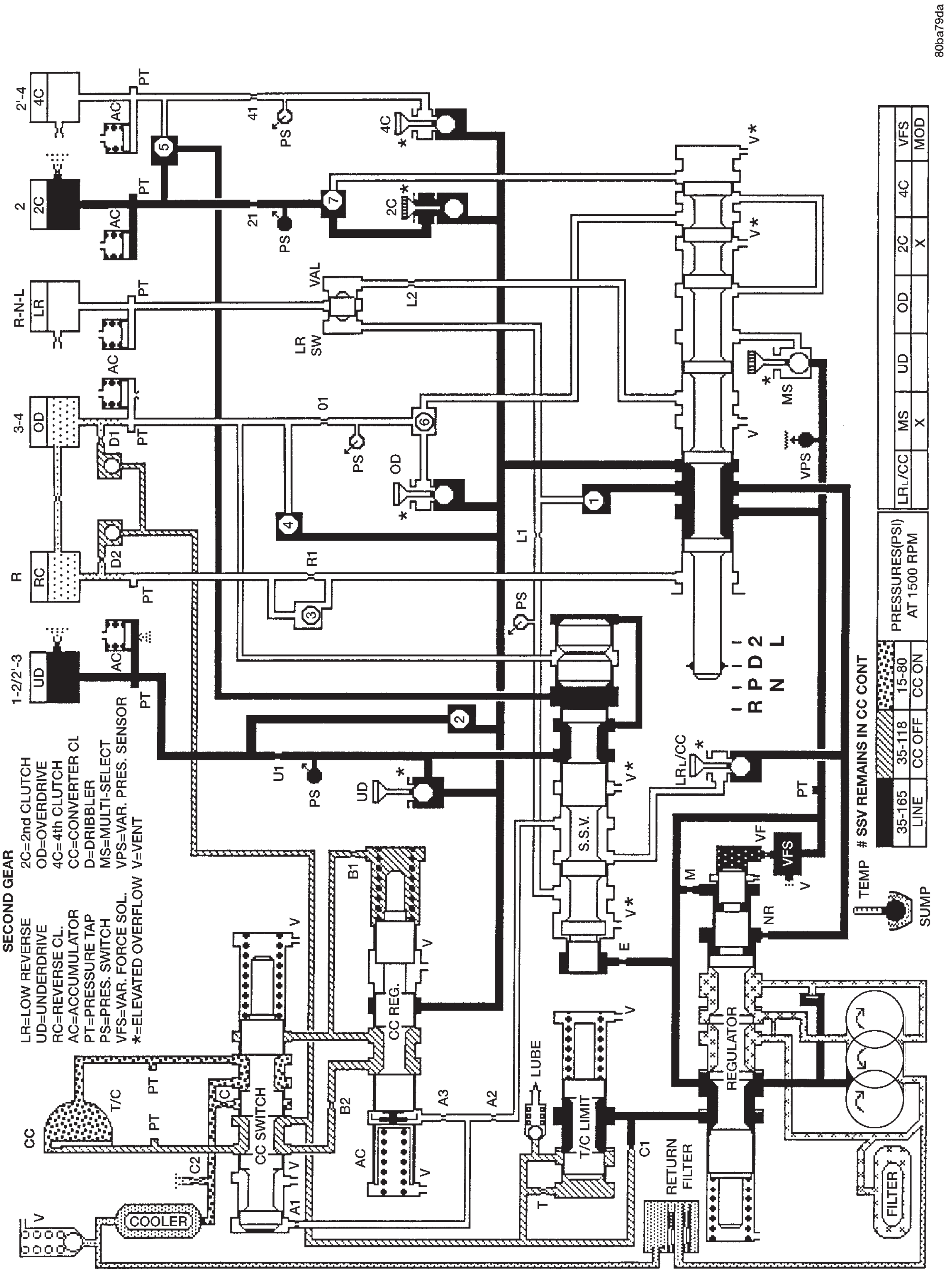

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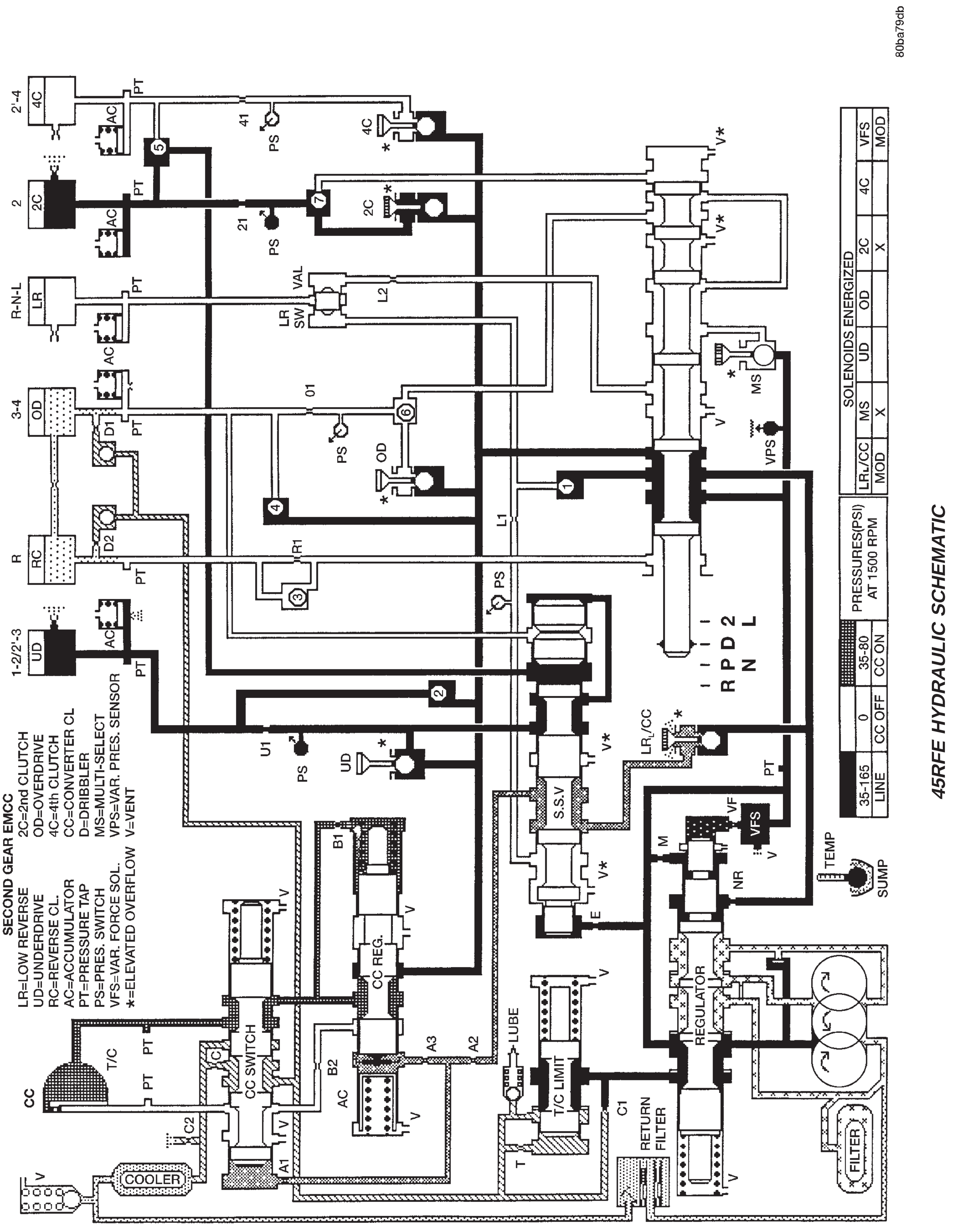

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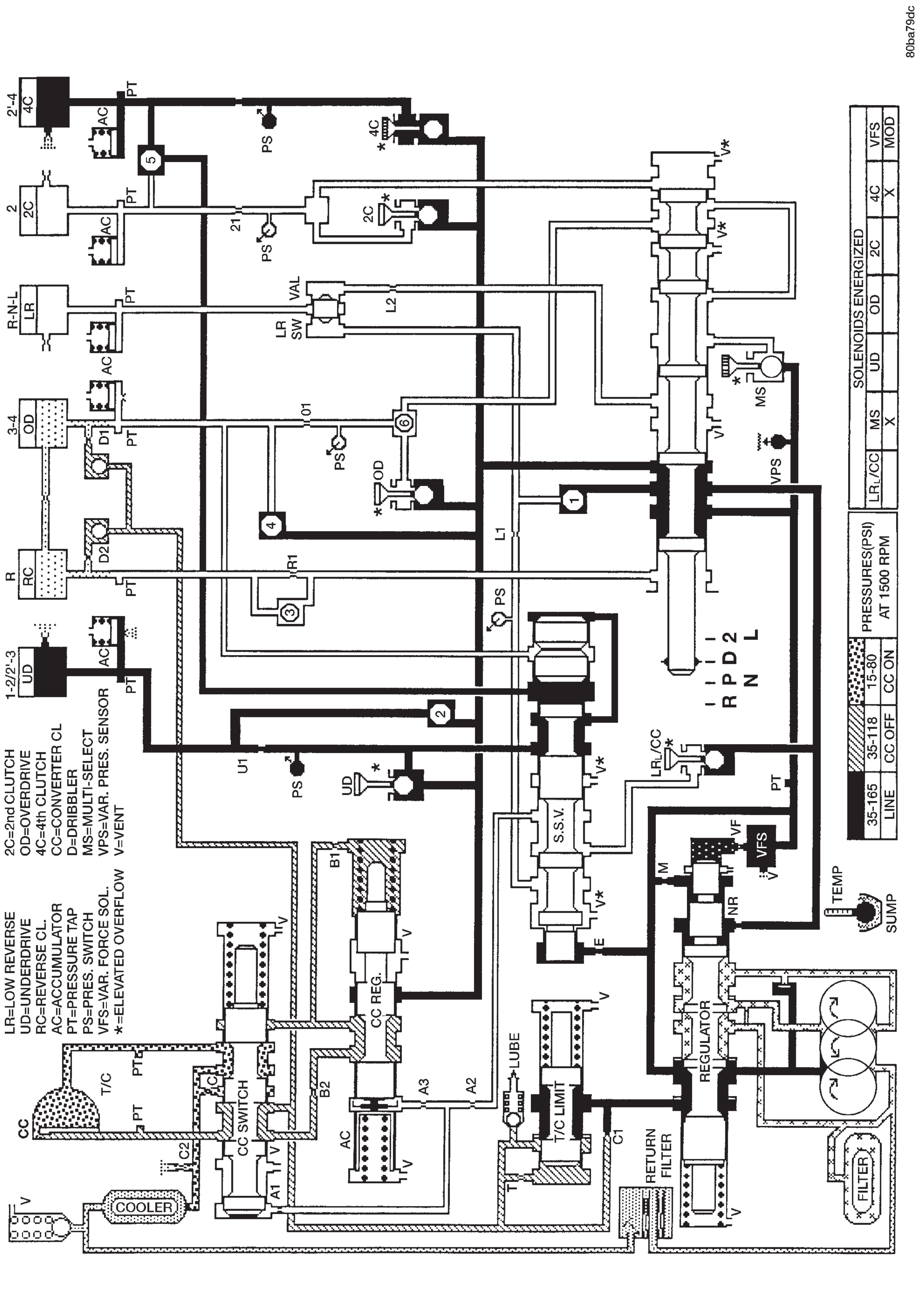

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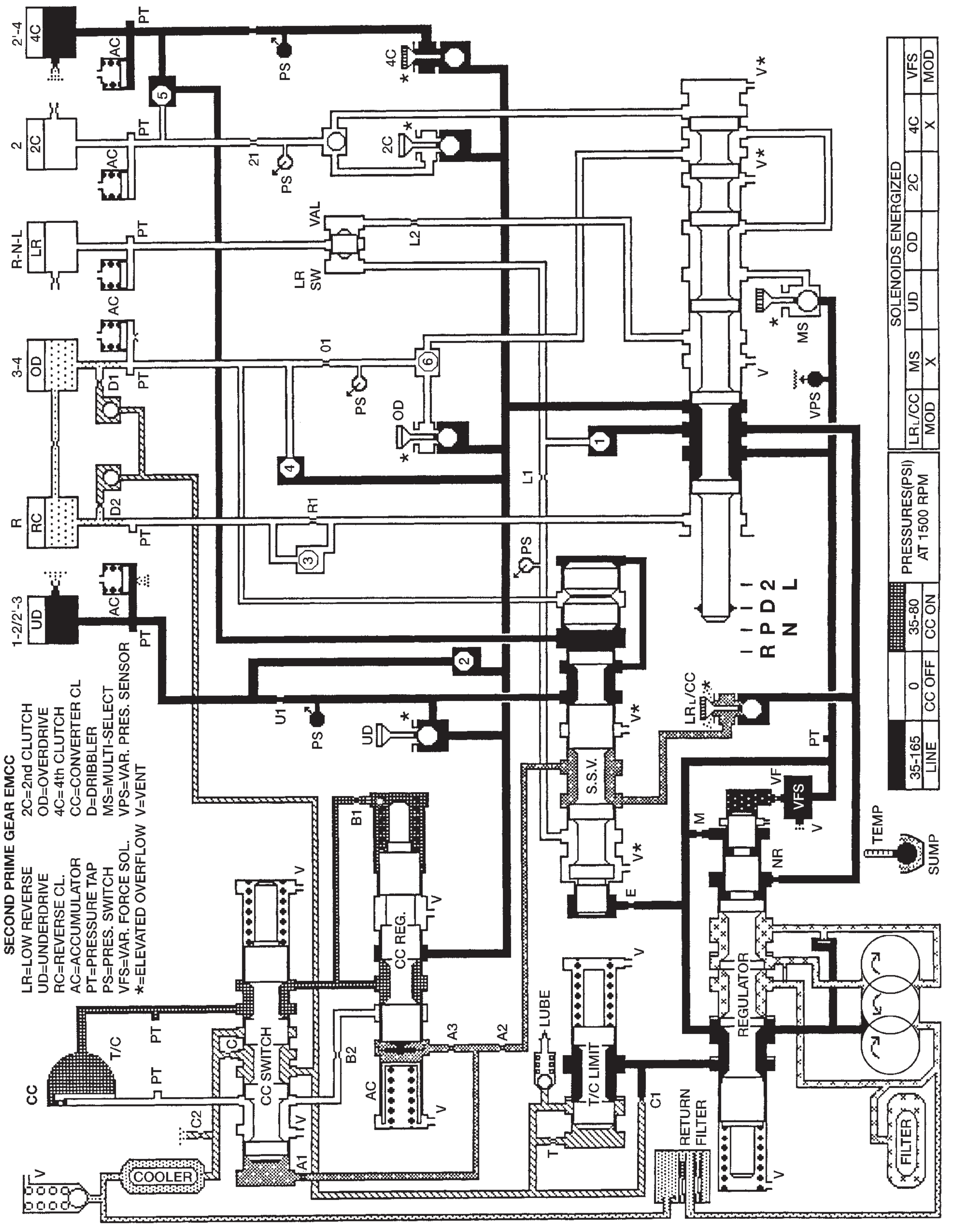

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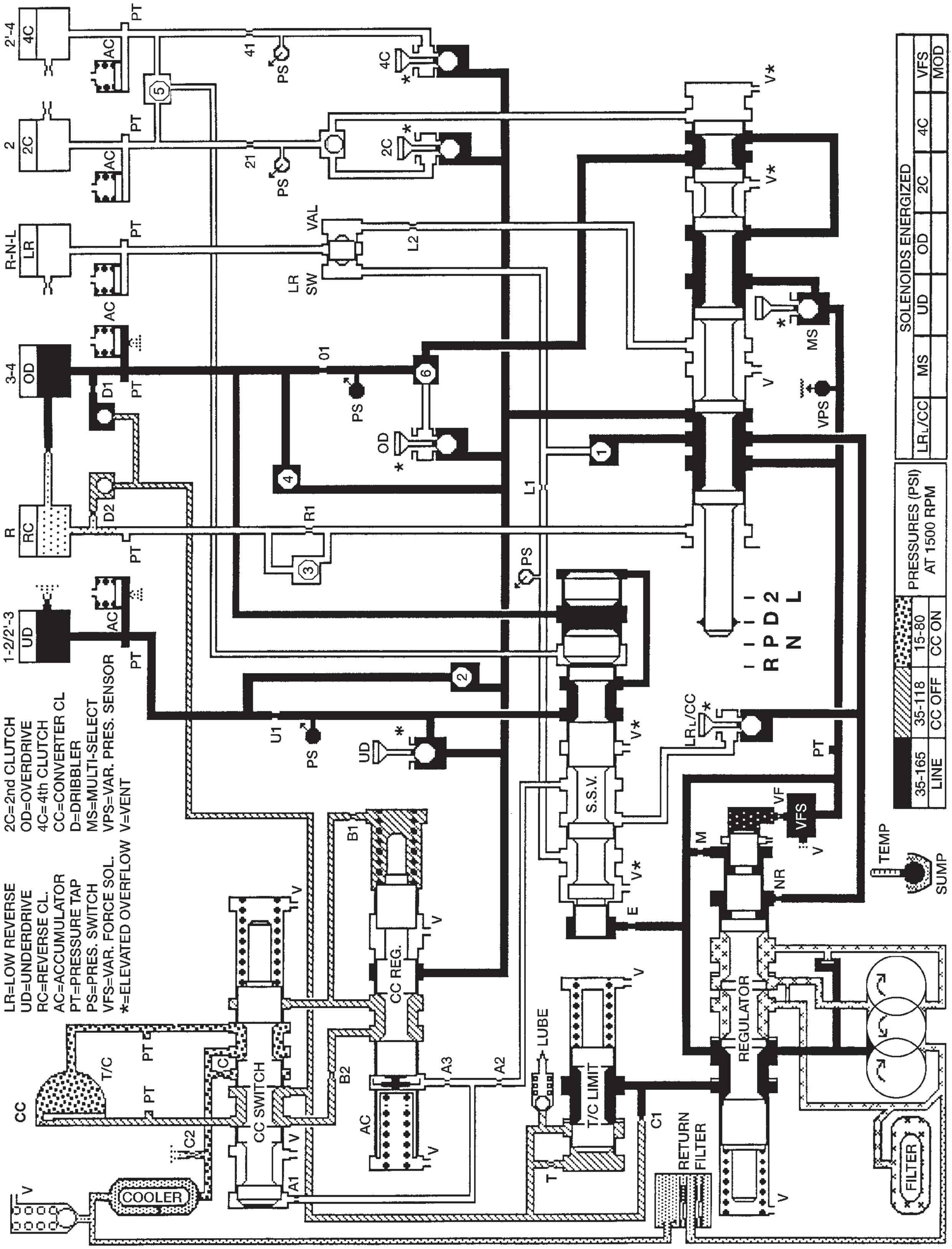

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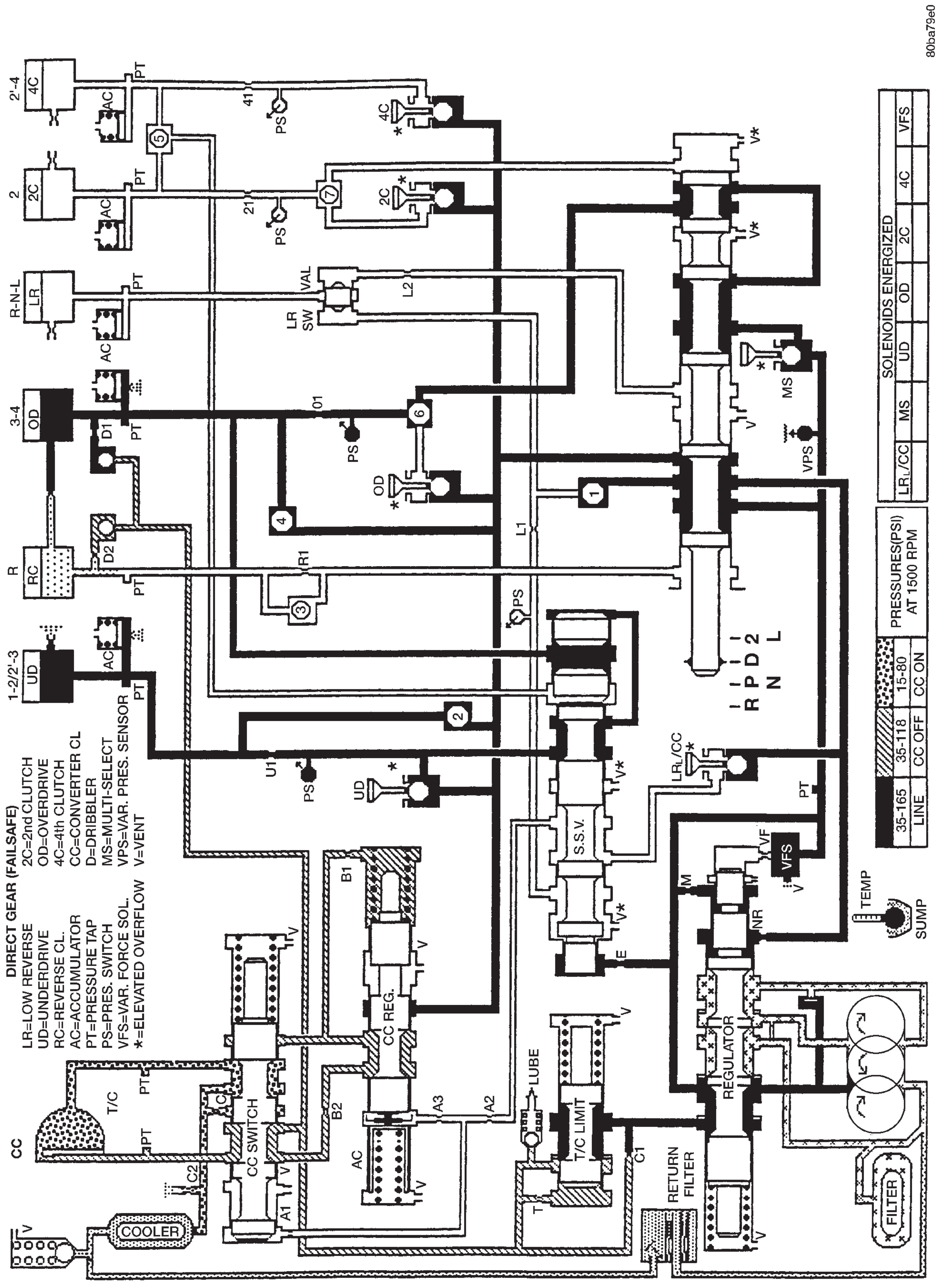

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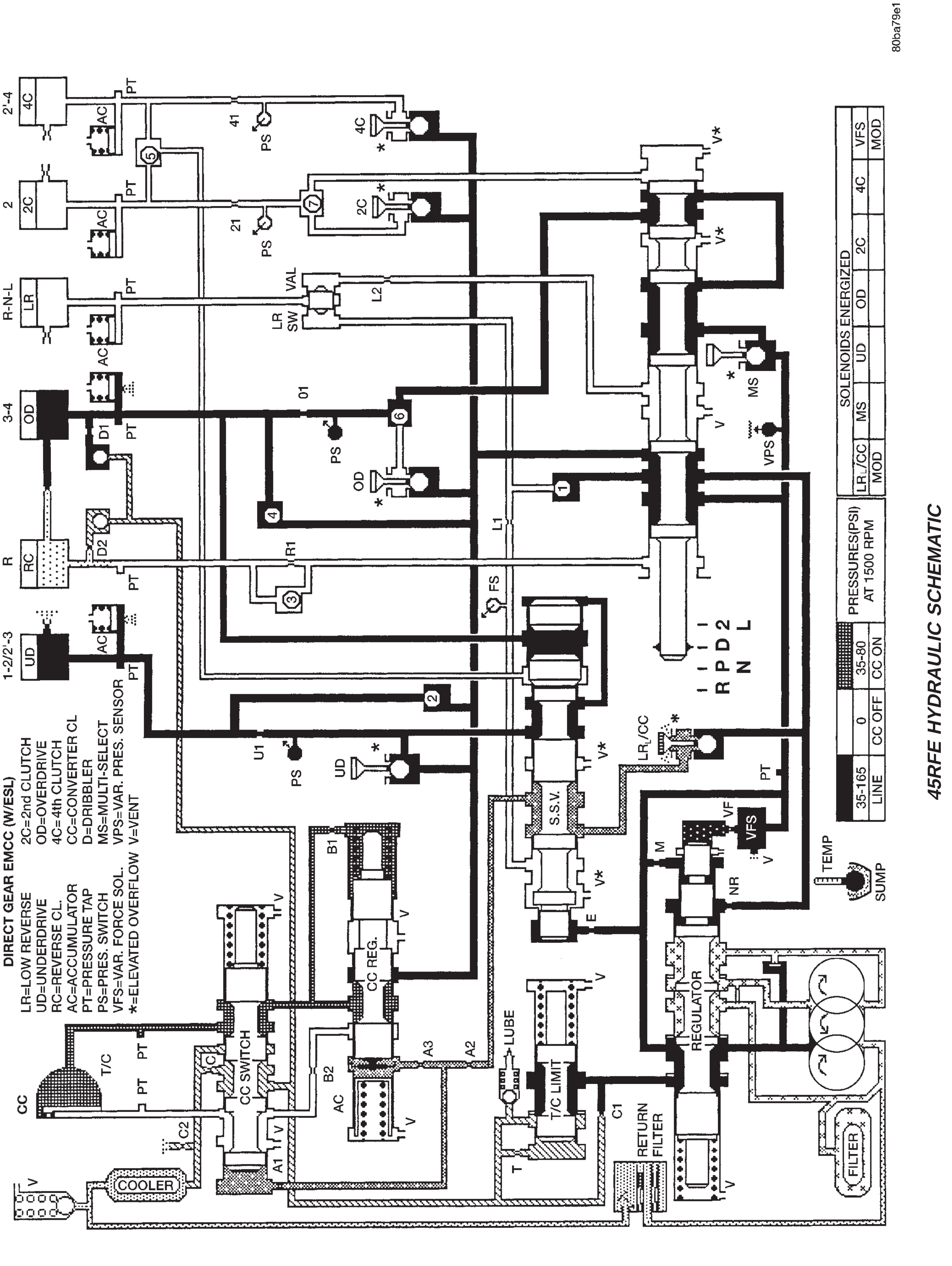

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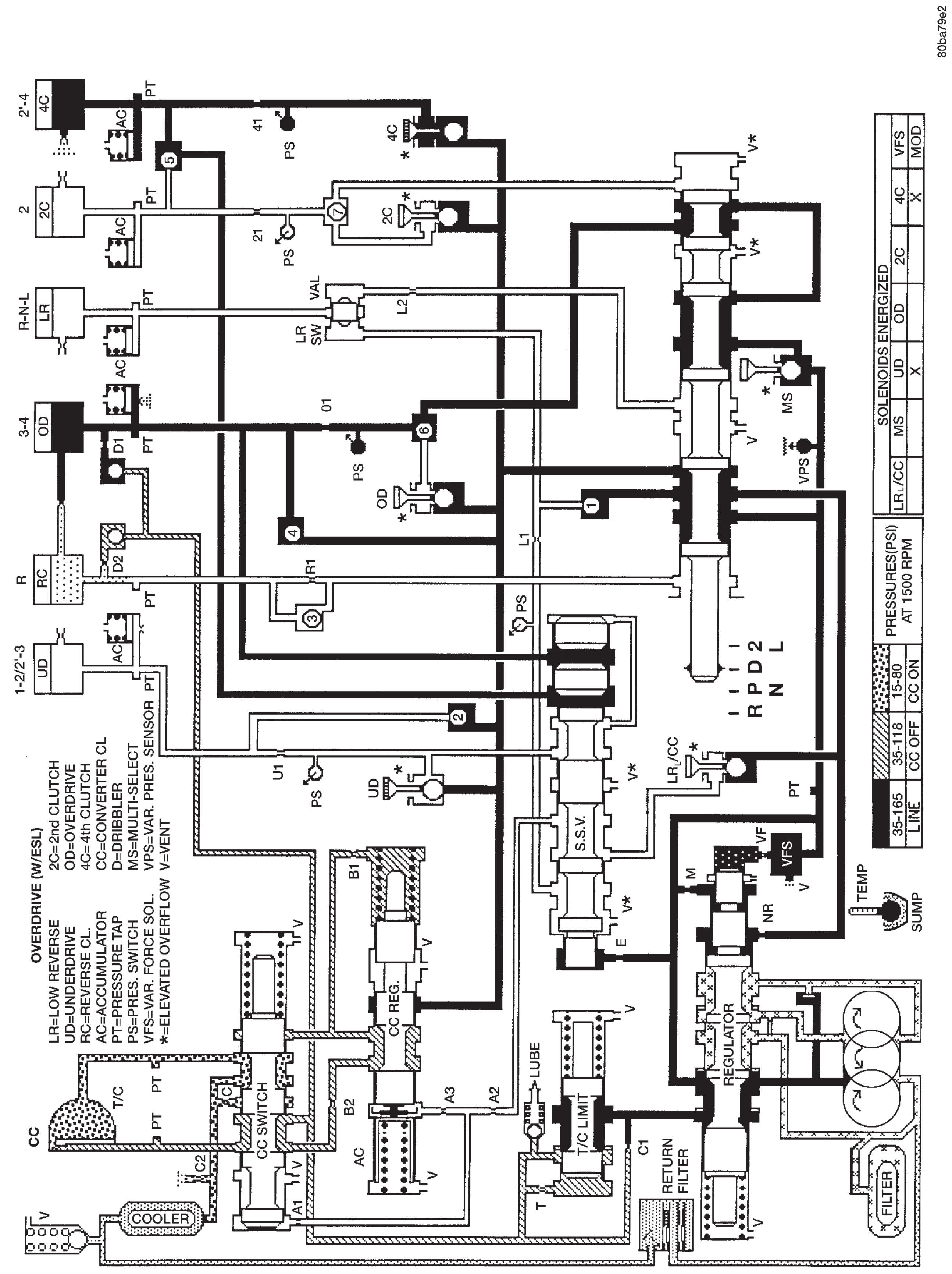

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SCHEMATICS AND DIAGRAMS (Continued)

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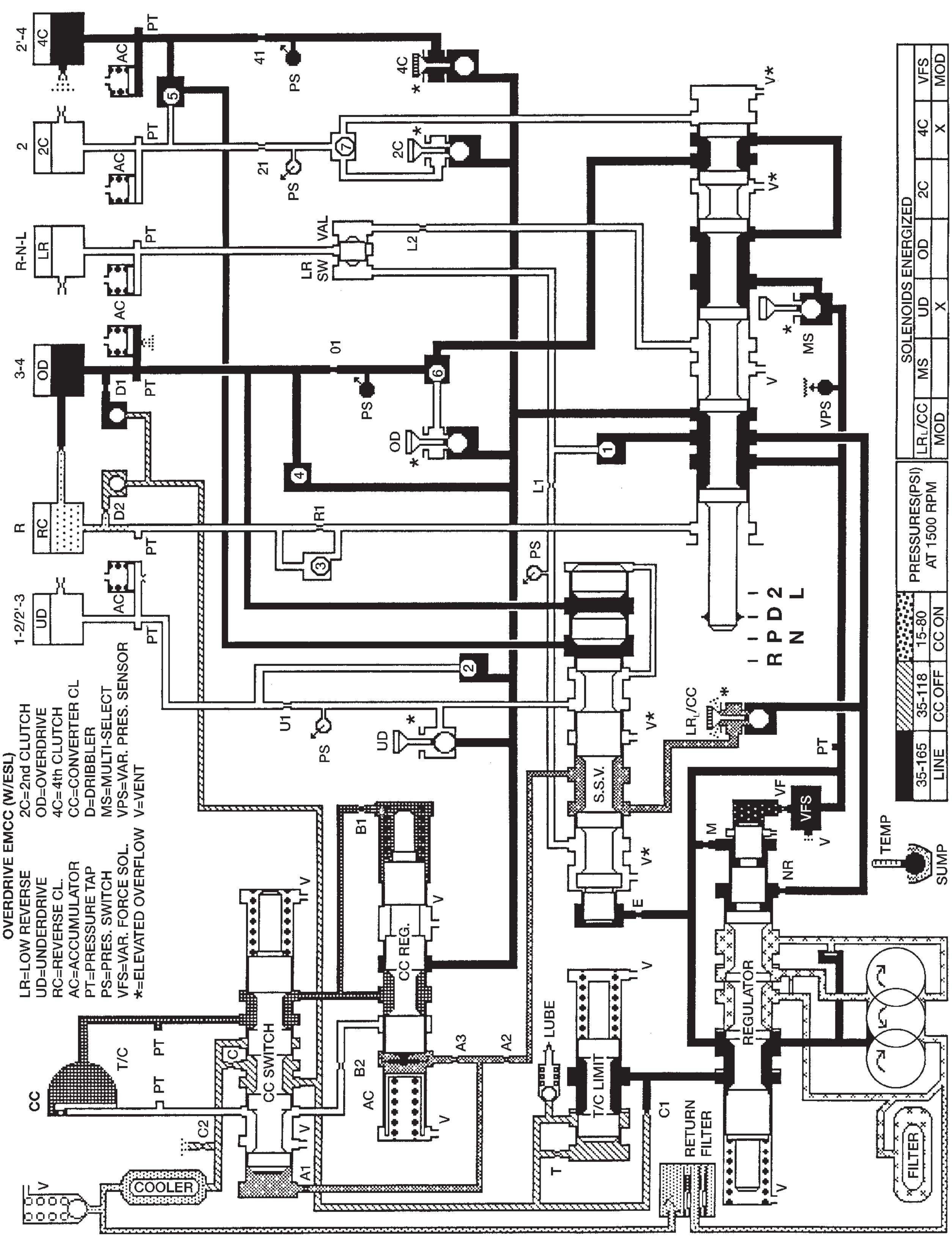

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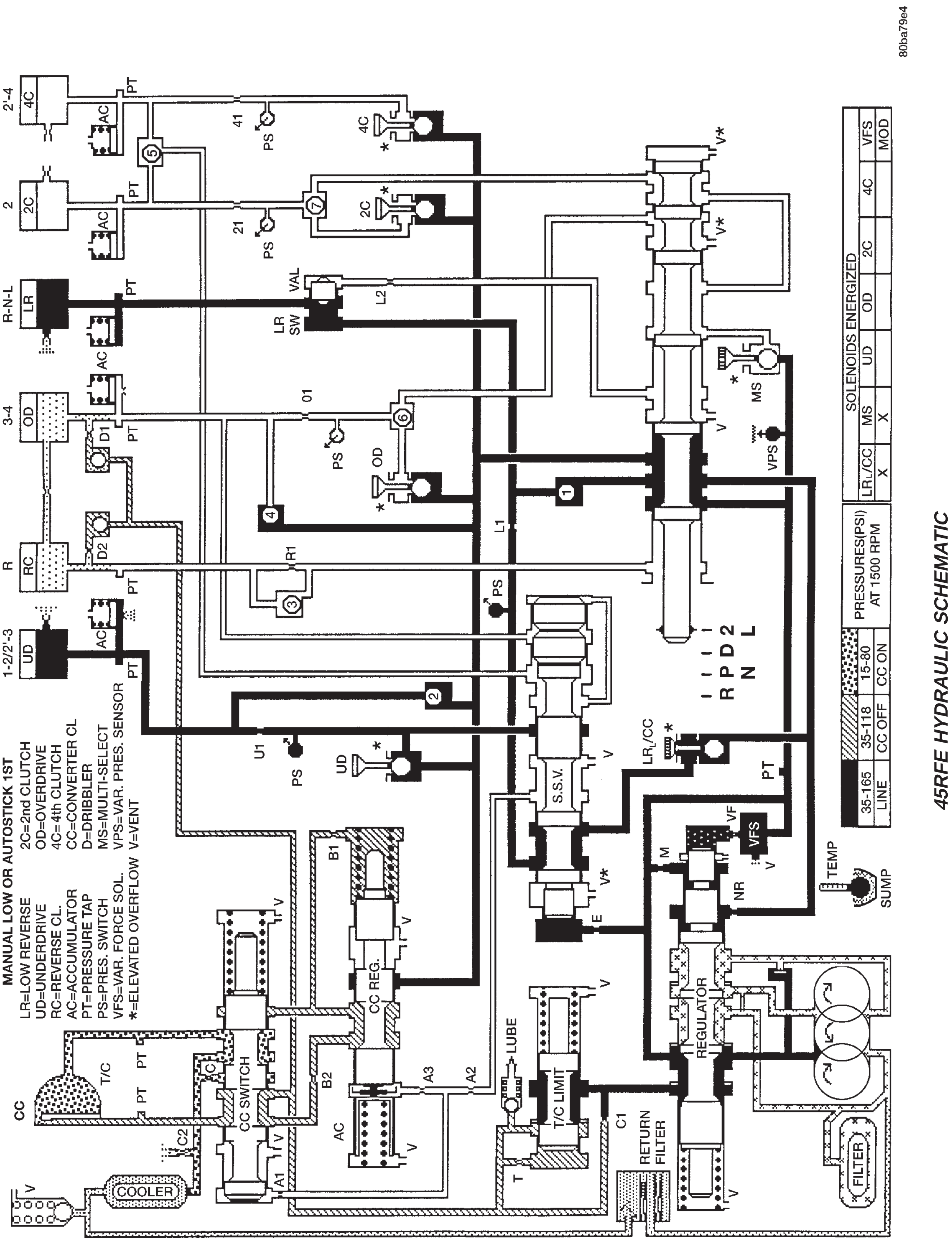

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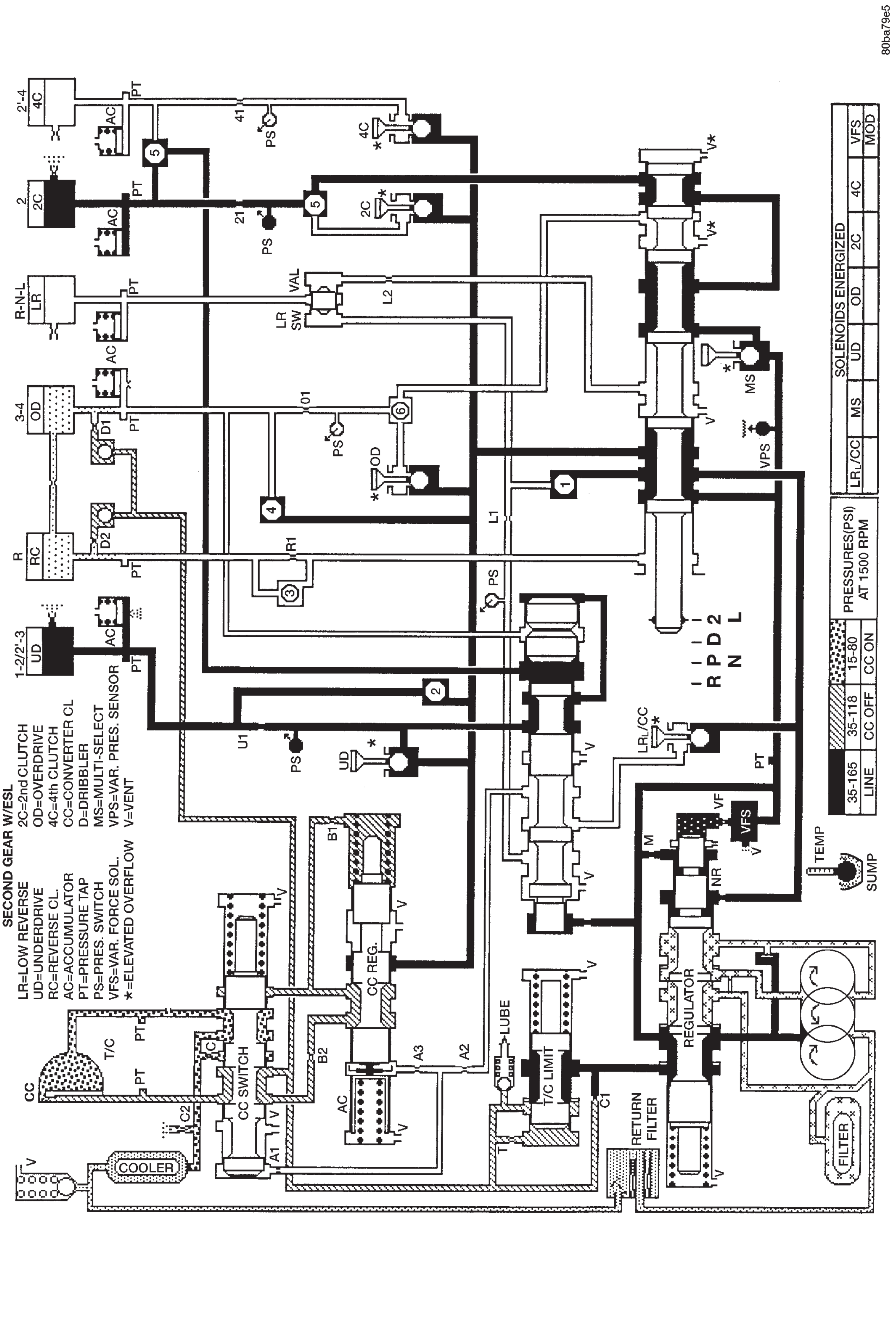

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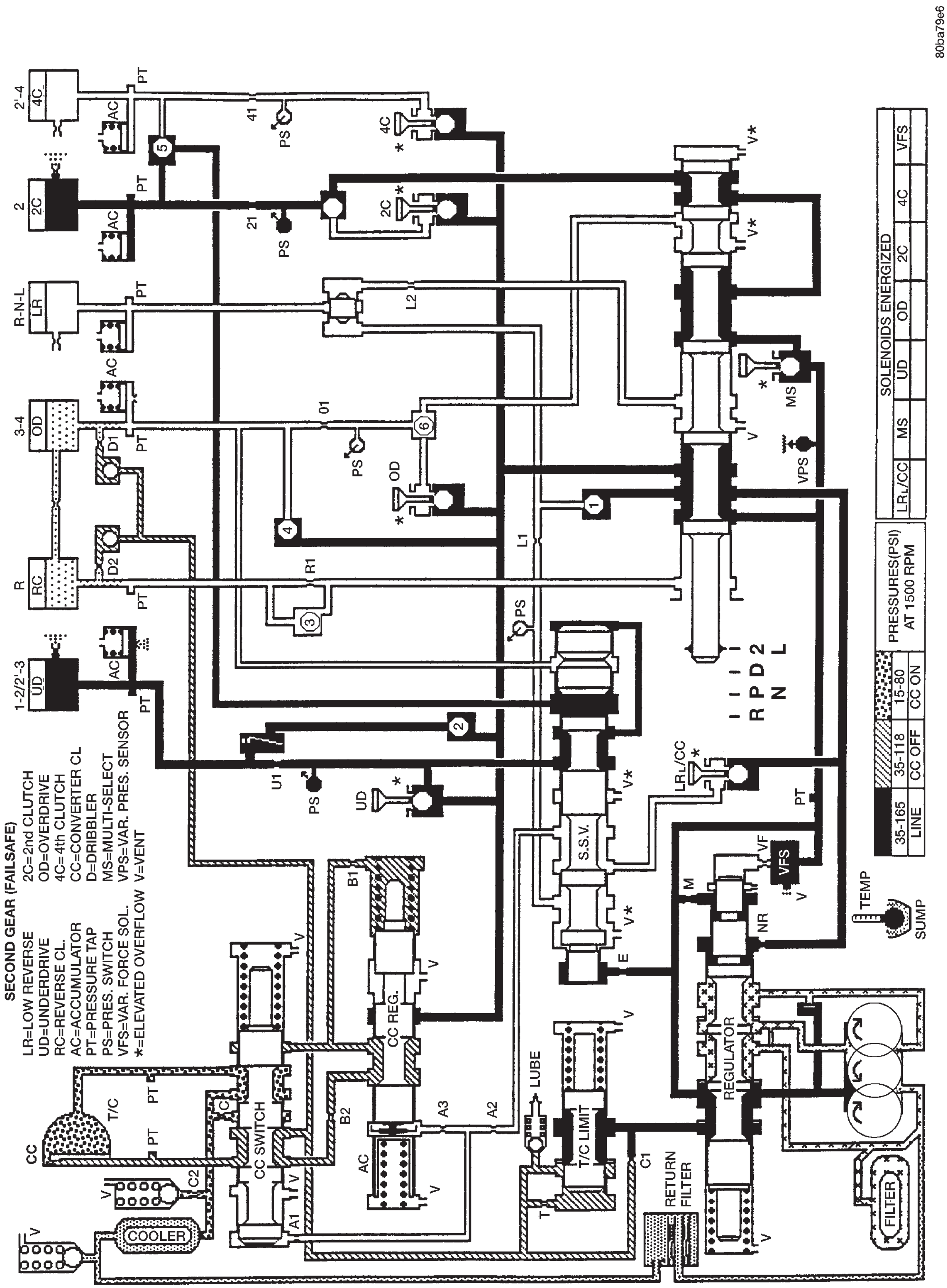


45RFE HYDRAULIC SCHEMATIC

SPECIFICATIONS

45RFE TRANSMISSION

GENERAL

Component	Metric	Inch
Output Shaft End Play	0.53-0.78 mm	0.021-0.031 in.
Input Shaft End Play	0.79-1.07 mm	0.031-0.042 in.
2C Clutch Pack Clearance	0.53-1.27 mm	0.021-0.050 in.
4C Clutch Pack Clearance	0.81-1.35 mm	0.032-0.053 in.
L/R Clutch Pack Clearance	1.14-1.91 mm	0.045-0.075 in.
OD Clutch Pack Clearance	1.016-1.65 mm	0.040-0.065 in.
UD Clutch Pack Clearance	0.76-1.160 mm	0.030-0.063 in.
Reverse Clutch Pack Clearance	0.81-1.24 mm	0.032-0.049 in.
Recommended fluid	Mopar® ATF Plus 3,type 7176	

GEAR RATIOS

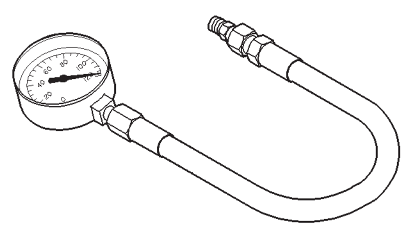
GEAR	RATIO
1ST	3.00:1
2ND	1.67:1
2ND PRIME	1.50:1
3RD	1.00:1
4TH	0.75:1
REVERSE	3.00:1

TORQUE

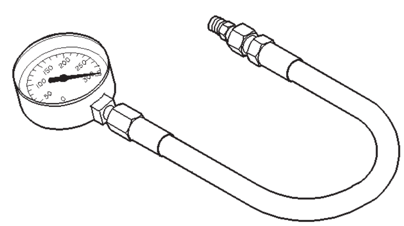
DESCRIPTION	TORQUE
Fitting, Cooler Line	17.5 N·m (155 in. lbs.)
Bolt, Torque Convertor	31 N·m (23 ft. lbs.)
Bolt, Driveplate	75 N·m (55 ft. lbs.)
Bolt/nut, Crossmember	68 N·m (50 ft. lbs.)
Bolt, Oil Pan	11.8 N·m (105 in. lbs.)
Screw, Primary Oil Filter	4.5 N·m (40 in. lbs.)
Filter, Cooler Return	14 N·m (125 in. lbs.)
Bolt, Oil Pump	28.2 N·m (250 in. lbs.)
Bolt, Oil Pump Body to Cover	4.5 N·m (40 in. lbs.)
Screw, Plate to Oil Pump Body	4.5 N·m (40 in. lbs.)
Plug, Pressure Test Port	5.1 N·m (45 in. lbs.)
Bolt, Reaction Shaft Support	11.8 N·m (105 in. lbs.)
Bolt, Valve Body	11.8 N·m (105 in. lbs.)
Screw, Valve Body to Transfer Plate	4.5 N·m (40 in. lbs.)
Screw, Solenoid Module to Transfer Plate	5.7 N·m (50 in. lbs.)
Screw, Accumulator Cover	4.5 N·m (40 in. lbs.)
Screw, Detent Spring	4.5 N·m (40 in. lbs.)
Bolt, Input Speed Sensor	11.8 N·m (105 in. lbs.)
Bolt, Output Speed Sensor	11.8 N·m (105 in. lbs.)
Bolt, Line Pressure Sensor	11.8 N·m (105 in. lbs.)
Bolt, Extension Housing	54 N·m (40 ft. lbs.)
Fitting, Vent	12 N·m (100 in. lbs.)
Screw, Manual Valve Cam Retaining	4.5 N·m (40 in. lbs.)
Bolt, Manual Lever	28.2 N·m (250 in. lbs.)

SPECIAL TOOLS

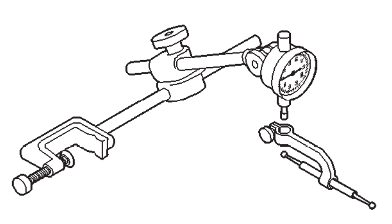
45RFE TRANSMISSION



Pressure Gauge—C-3292

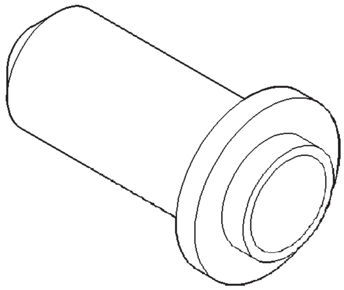


Pressure Gauge—C-3293SP

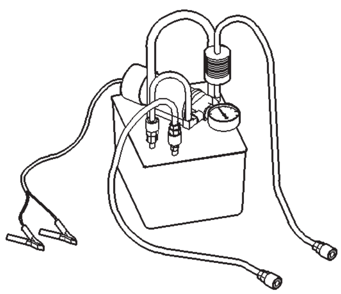


Dial Indicator—C-3339

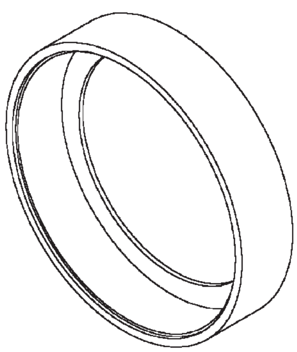
SPECIAL TOOLS (Continued)



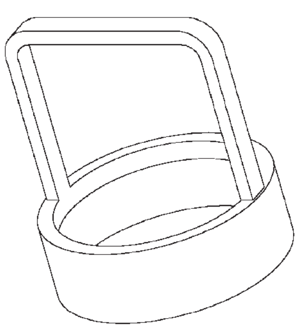
Seal Installer—C-3860–A



Flusher—6906



Spring Compressor—8249



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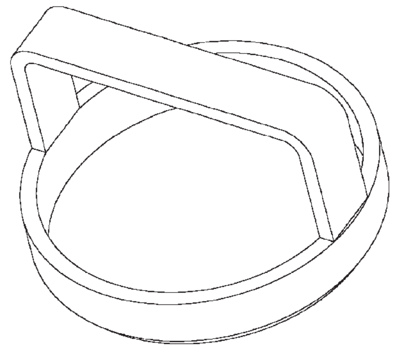

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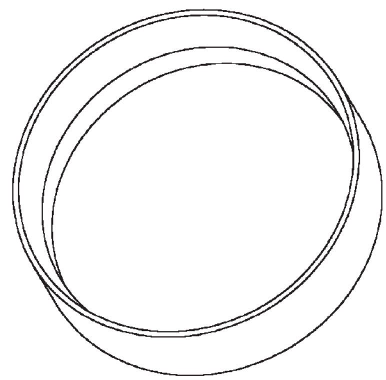
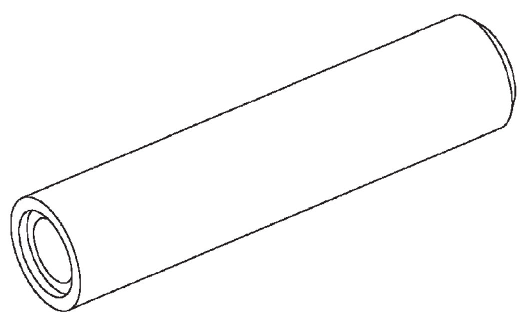
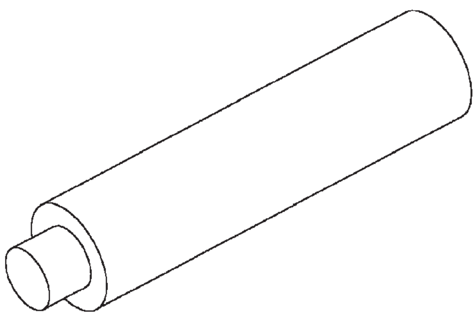


Piston Installer—8252



Seal Installer—8253

SPECIAL TOOLS (Continued)



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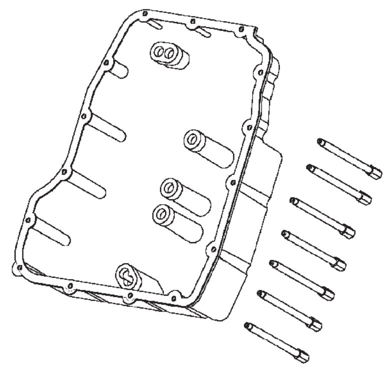
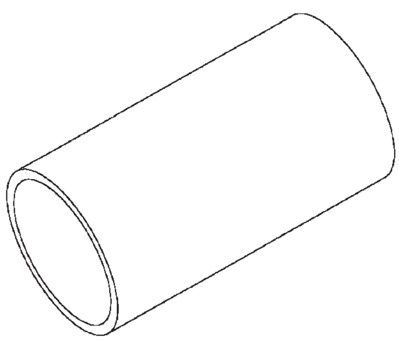
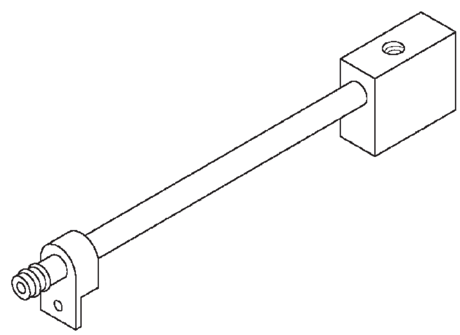


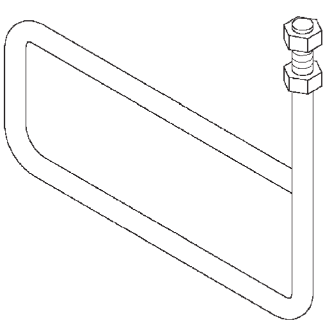
Pressure Tap Adapter—8258



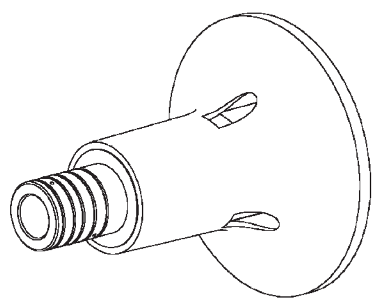
Installer—8255



Line Pressure Adapter—8259

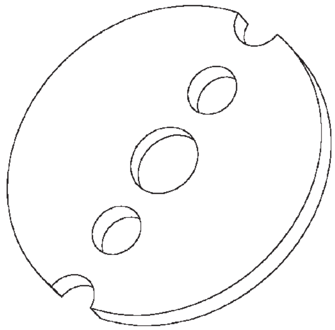


Support Stand—8257

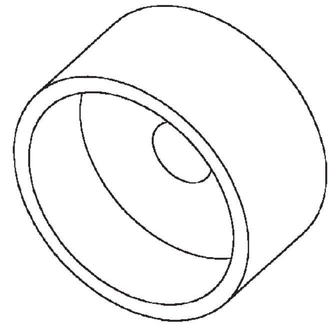


Input Clutch Pressure Fixture—8260

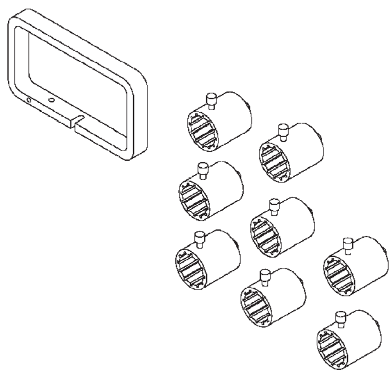
SPECIAL TOOLS (Continued)



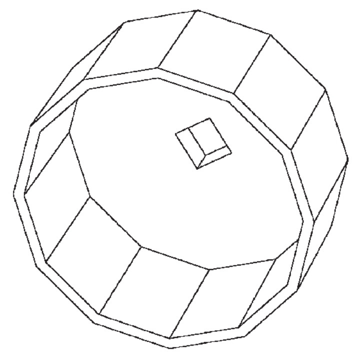
Alignment Plate—8261



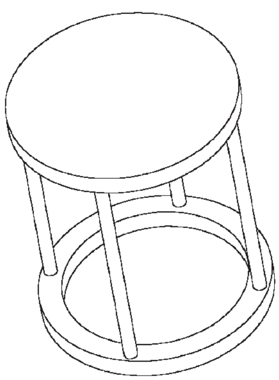
Bearing Installer—8320



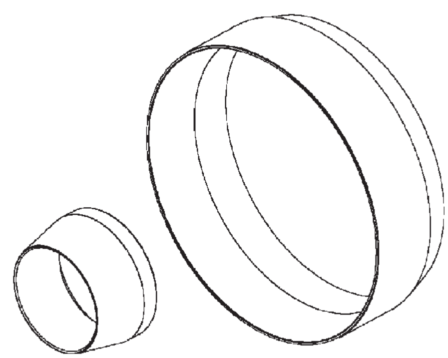
End Play Set—8266



Filter Wrench—8321



Spring Compressor—8285



Piston Installer—8504

NV242 TRANSFER CASE

INDEX

GENERAL INFORMATION

NV242 TRANSFER CASE

The NV242 is a full and part-time transfer case (Fig. 1). It provides full time 2-wheel, or 4-wheel drive operation.

A differential in the transfer case is used to control torque transfer to the front and rear axles. A low range gear provides increased low speed torque capability for off road operation. The low range provides a 2.72:1 reduction ratio.

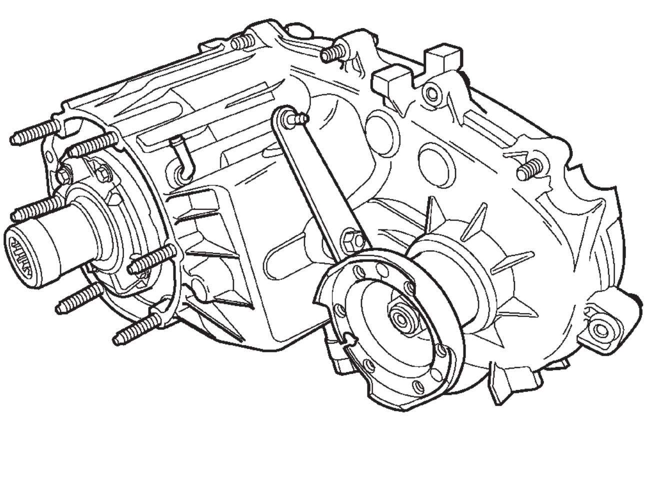


Fig. 1 NV242 Transfer Case

The input gear is splined to the transmission output shaft. It drives the mainshaft through the planetary gear and range hub. The front output shaft is operated by a drive chain that connects the shaft to a drive sprocket on the mainshaft. The drive sprocket is engaged/disengaged by the mode fork, which operates the mode sleeve and hub. The sleeve and hub are not equipped with a synchro mechanism for shifting.

The geartrain is mounted in two aluminum case halves attached with bolts. The mainshaft front and rear bearings are mounted in aluminum retainer housings bolted to the case halves.

OPERATING RANGES

NV242 operating ranges are 2WD (2-wheel drive), 4x4 part-time, 4x4 full time, and 4 Lo.

The 2WD and 4x4 full time ranges can be used at any time and on any road surface.

The 4x4 part-time and 4 Lo ranges are for off road use only. The only time these ranges can be used on hard surface roads, is when the surface is covered with snow and ice.

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 bezel cover plate, or on the shift knob.

TRANSFER CASE IDENTIFICATION

A circular ID tag is attached to the rear case of each 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.

GENERAL INFORMATION (Continued)

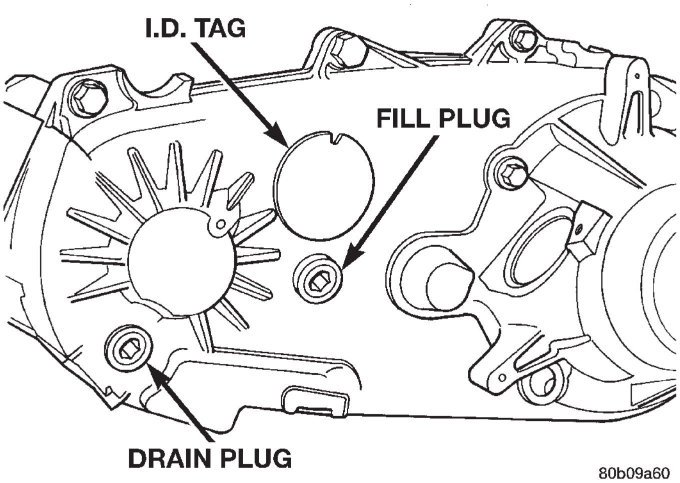


Fig. 2 Fill/Drain Plug And I.D. Tag Locations

RECOMMENDED LUBRICANT AND FILL LEVEL

Recommended lubricant for the NV242 transfer case is Mopar® Dexron II, or ATF Plus, type 7176. Approximate lubricant fill capacity is 1.35 liters (2.85 pints).

The fill and drain plugs are both in the rear case (Fig. 2). Correct fill level is to the bottom edge of the fill plug hole. Be sure the vehicle is level to ensure an accurate fluid level check.

DIAGNOSIS AND TESTING

NV242 DIAGNOSIS

DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
Transfer case difficult to shift or will not shift into desired range.	1) Transfer case shift linkage binding.	1) Repair or replace linkage as necessary.
	2) Insufficient or incorrect lubricant.	2) Drain and refill transfer case with the correct type and quantity of lubricant.
	3) Internal transfer case components binding, worn, or damaged.	3) Repair or replace components as necessary.
Transfer case noisy in all drive modes.	1) Insufficient or incorrect lubricant.	1) Drain and refill transfer case with the correct type and quantity of lubricant.
Lubricant leaking from transfer case seals or vent.	1) Transfer case overfilled.	1) Drain lubricant to the correct level.
	2) Transfer case vent closed or restricted.	2) Clean or replace vent as necessary.
	3) Transfer case seals damaged or installed incorrectly.	3) Replace suspect seal.
Transfer case will not shift through 4X4 part time range (light remains on)	1) Incomplete shift due to drivetrain torque load.	1) Momentarily release the accelerator pedal to complete the shift.
	2) Incorrect tire pressure.	2) Correct tire pressure as necessary.
	3) Excessive Tire wear.	3) Correct tire condition as necessary.
	4) Excessive vehicle loading.	4) Correct as necessary.

REMOVAL AND INSTALLATION

TRANSFER CASE

REMOVAL

(1) Shift transfer case into Neutral.
(2) Raise vehicle.
(3) Remove transfer case drain plug and drain transfer case lubricant.
(4) Mark front and rear propeller shaft yokes for alignment reference.
(5) Support transmission with jack stand.
(6) Remove rear crossmember and skid plate, if equipped (Fig. 3).

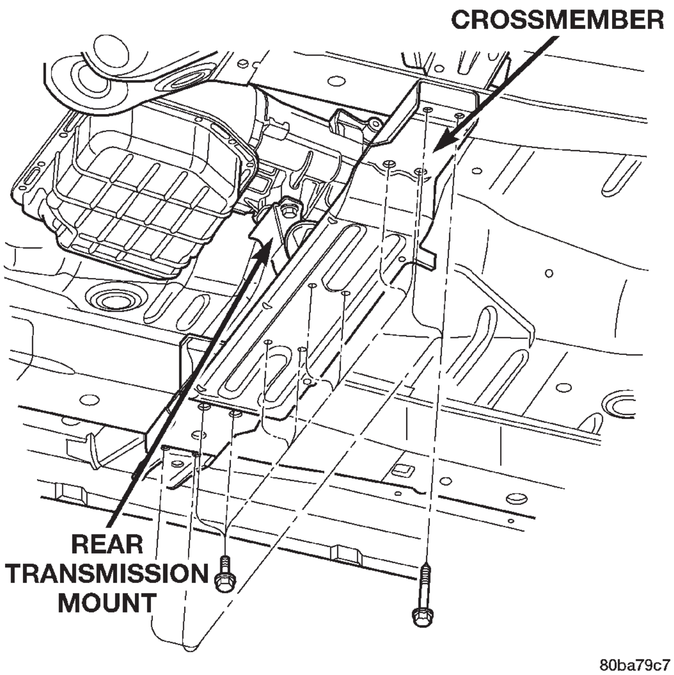


Fig. 3 Crossmember Removal/Installation

(7) Disconnect front/rear propeller shafts at transfer case. Refer to Group 3, Differential and Driveline for the correct procedures.
(8) Disconnect transfer case cable from range lever.
(9) Disconnect transfer case vent hose (Fig. 4) and indicator switch harness, if necessary.
(10) Support transfer case with transmission jack.
(11) Secure transfer case to jack with chains.
(12) Remove nuts attaching transfer case to transmission.
(13) Pull transfer case and jack rearward to disengage transfer case.
(14) Remove transfer case from under vehicle.

INSTALLATION

(1) Mount transfer case on a transmission jack.
(2) Secure transfer case to jack with chains.

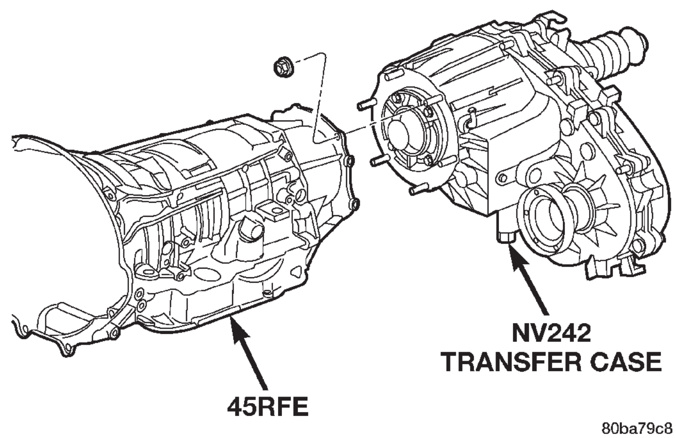


Fig. 4 Transfer Case Mounting

(3) Position transfer case under vehicle.
(4) Align transfer case and transmission shafts and install transfer case on transmission.
(5) Install and tighten transfer case attaching nuts to 35 N·m (26 ft. lbs.) torque (Fig. 4).
(6) Align and connect propeller shafts. Refer to Group 3, Differential and Driveline, for proper procedures and specifications.
(7) Fill transfer case with correct fluid. Check transmission fluid level. Correct as necessary.
(8) Install rear crossmember and skid plate, if equipped. Tighten crossmember bolts to 41 N·m (30 ft. lbs.) torque.
(9) Remove transmission jack and support stand.
(10) Connect shift rod to transfer case range lever.
(11) Adjust transfer case shift cable.
(12) Lower vehicle and verify transfer case shift operation.

FRONT OUTPUT SHAFT SEAL

REMOVAL

(1) Raise vehicle.
(2) Remove front propeller shaft. Refer to Group 3, Differential and Driveline, for proper procedure.
(3) Remove front output shaft companion flange.
(4) Remove seal from front case with pry tool (Fig. 5).

INSTALLATION

(1) Install new front output seal in front case with Installer Tool 6952-A as follows:
(a) Place new seal on tool. Garter spring on seal goes toward interior of case.
(b) Start seal in bore with light taps from hammer (Fig. 6). Once seal is started, continue tapping seal into bore until installer tool seats against case.
(2) Install companion flange and tighten nut to 122–176 (90–130 ft. lbs.) torque.

REMOVAL AND INSTALLATION (Continued)

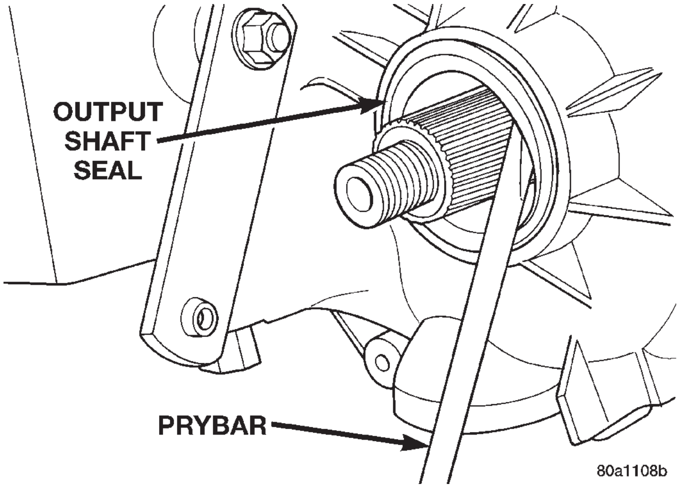


Fig. 5 Remove Front Output Shaft Seal

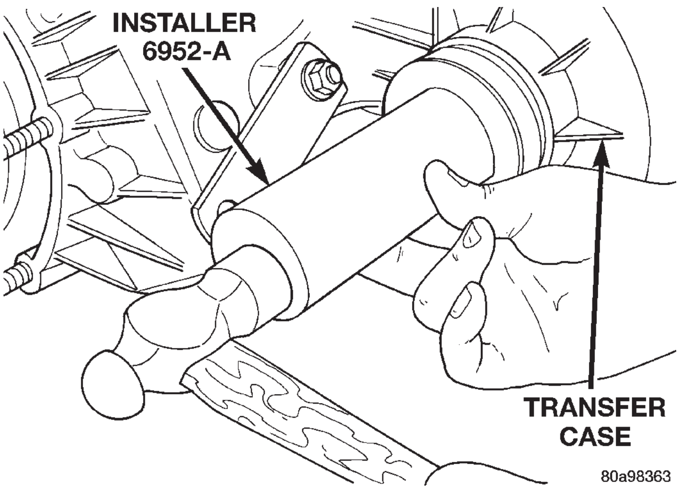


Fig. 6 Front Output Seal Installation

(3) Install front propeller shaft. Refer to Group 3, Differential and Driveline for the correct procedure and torque specification.

TRANSFER CASE SHIFT CABLE

REMOVAL

(1) Shift transfer case into neutral.

(2) Raise vehicle.

(3) Disconnect the shift cable eyelet from the transfer case shift lever (Fig. 7).

(4) Remove shift cable from the cable support bracket.

(5) Lower vehicle.

(6) Remove shift lever bezel and necessary console parts for access to shift lever assembly and shift cable.

(7) Disconnect cable at shift lever and shifter assembly bracket (Fig. 8).

(8) Remove the nuts holding the shift cable seal plate to the floor pan (Fig. 9).

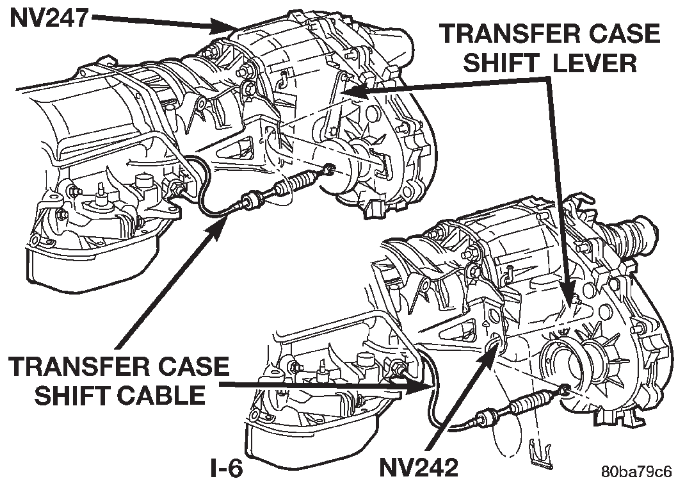


Fig. 7 Transfer Case Shift Cable at Transfer Case

(9) Pull cable through floor panel opening.

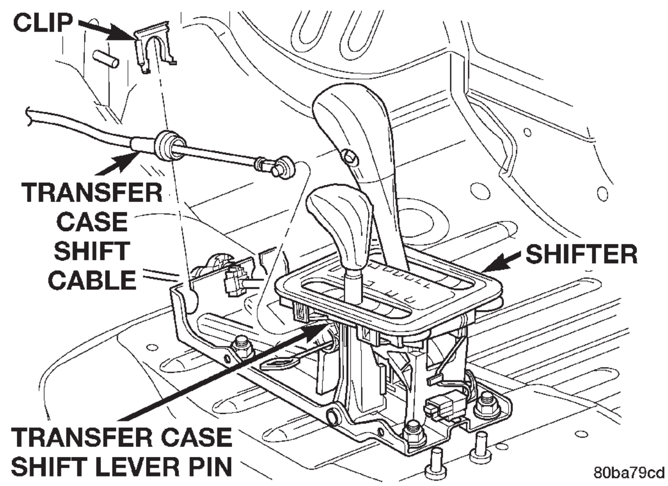


Fig. 8 Transfer Case Shift Cable at Shifter

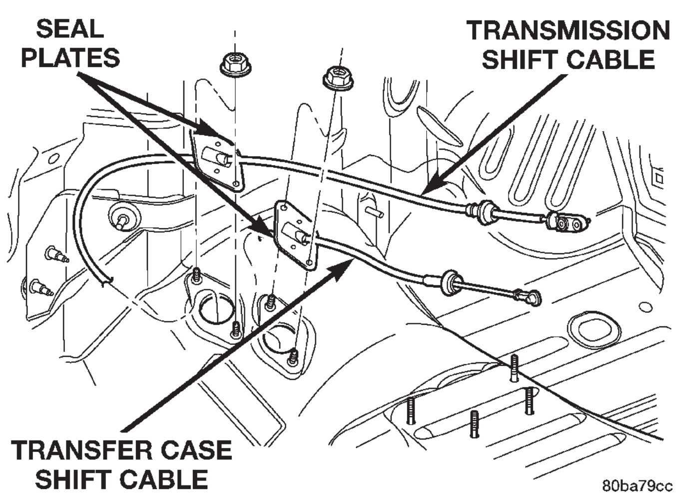


Fig. 9 Shift Cables at Floor Pan

(10) Remove transfer case shift cable from vehicle.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Route cable through hole in floor pan.

(2) Install seal plate to studs in floor pan.

(3) Install nuts to hold seal plate to floor pan (Fig. 9). Tighten nuts to 7 N·m (65 in. lbs.).

(4) Install the transfer case shift cable to the shifter assembly bracket. Seat cable in bracket and install clip (Fig. 8).

(5) Verify the transfer case shift lever (at console) is in the NEUTRAL position.

(6) Snap the cable onto the shift lever pin (Fig. 8).

(7) Raise the vehicle.

(8) Install the shift cable to the shift cable support bracket and install clip (Fig. 7).

(9) Verify that the transfer case is still in the NEUTRAL position.

(10) Snap the shift cable onto the transfer case shift lever (Fig. 7).

(11) Lower vehicle.

(12) Verify correct transfer case operation in all ranges.

(13) Install shift lever bezel and any console parts removed for access to transfer case shift cable.

DISASSEMBLY AND ASSEMBLY

NV242 TRANSFER CASE

DISASSEMBLY

REAR RETAINER REMOVAL

(1) Remove output shaft boot. Spread band clamp that secures boot on slinger with a suitable awl. Then slide boot off shaft (Fig. 10).

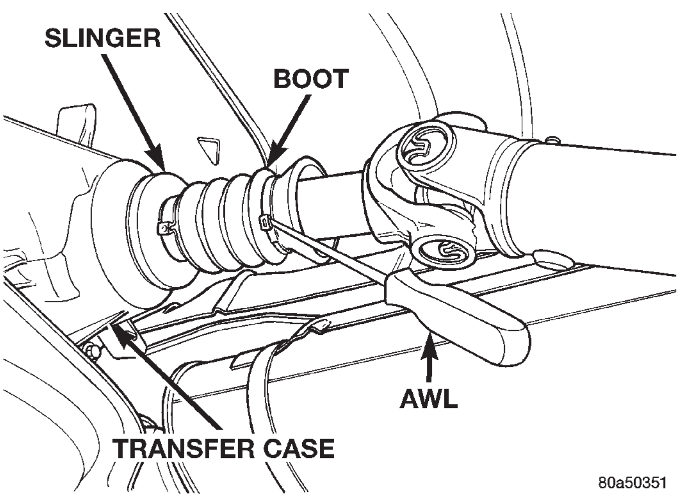


Fig. 10 Output Boot—Typical

(2) Using puller MD-998056-A, remove rear slinger (Fig. 11).

(3) Remove slinger stop spacer and snap-ring from output shaft (Fig. 12).

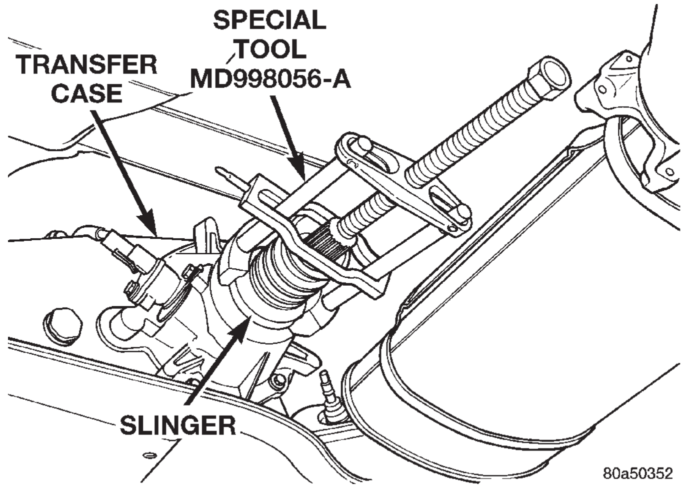


Fig. 11 Rear Slinger Removal

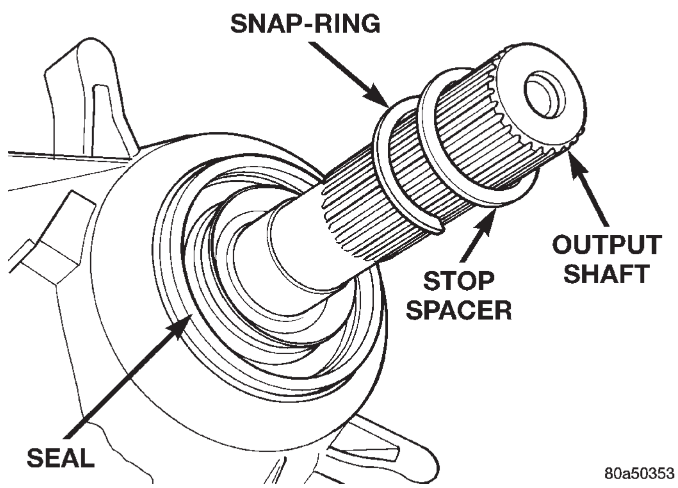


Fig. 12 Slinger Stop Spacer and Snap-ring

(4) Remove rear seal from retainer (Fig. 13). Use pry tool, or collapse seal with punch to remove it.

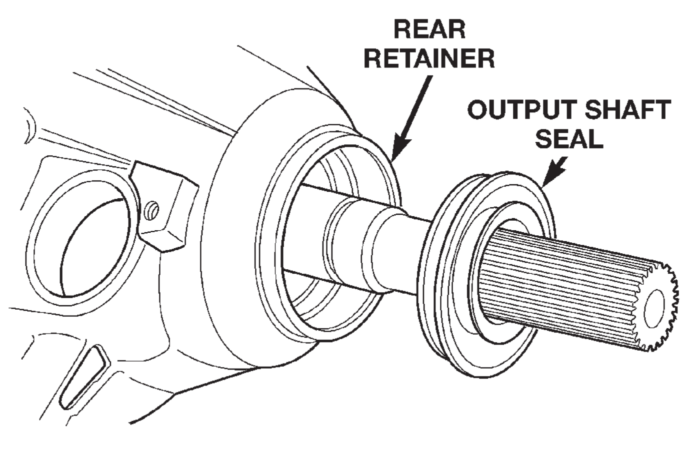


Fig. 13 Rear Seal Removal

(5) Remove rear output bearing I.D. retaining ring (Fig. 14).

DISASSEMBLY AND ASSEMBLY (Continued)

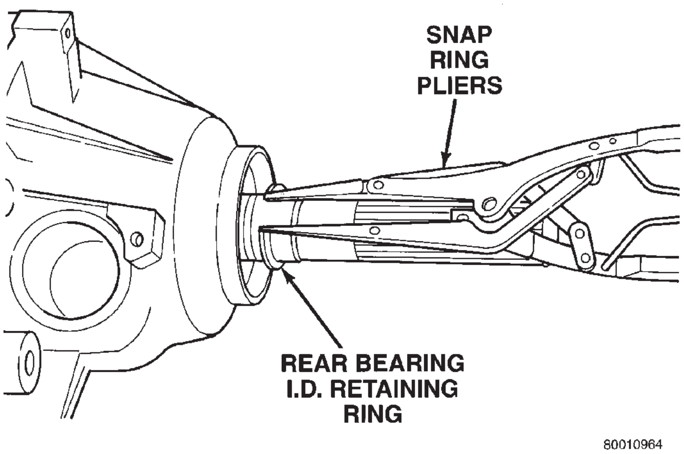


Fig. 14 Rear Bearing I.D. Retaining Ring Removal

(6) Remove speedometer adapter.

(7) Remove rear retainer bolts.

(8) Remove rear retainer. Tap retainer with mallet and pry upward to break sealer bead. Then slide retainer off case and output shaft (Fig. 15).

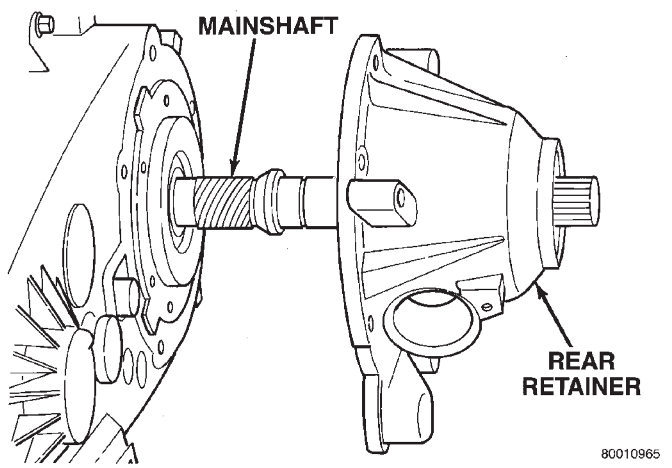


Fig. 15 Rear Retainer Removal

(9) Remove rear bearing O.D. retaining ring with snap ring pliers. Then tilt pump and slide it off output shaft (Fig. 16)

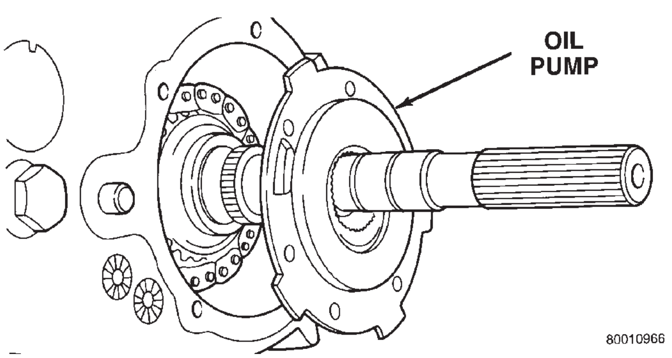


Fig. 16 Oil Pump Removal

(10) Remove pickup tube O-ring from pump (Fig. 17) but do not disassemble pump; it is not a repairable part.

(11) Remove seal from oil pump with pry tool.

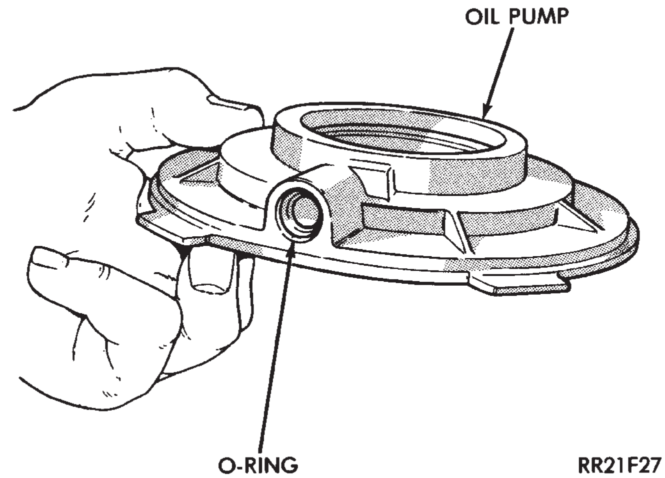


Fig. 17 Pickup Tube O-Ring Location

(12) Remove bolts attaching rear case to front case (Fig. 18). Note position of the two black finish bolts at each end of the case. These bolts go through the case dowels and require a washer under the bolt head.

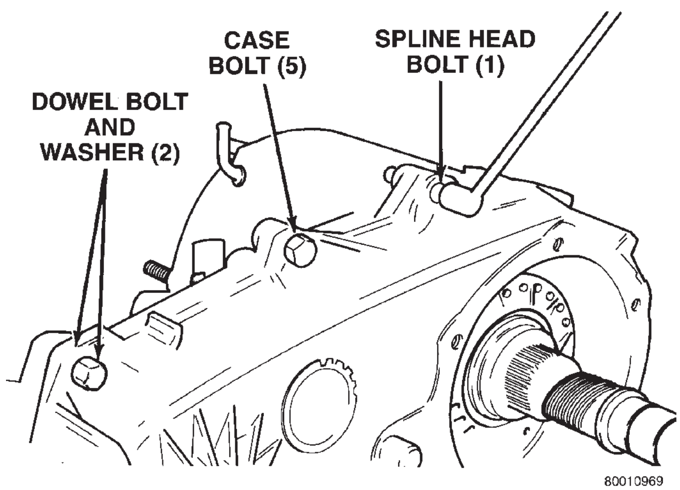


Fig. 18 Spline And Dowel Bolt Locations

(13) Remove rear case from front case (Fig. 19). Insert screwdrivers into slots cast into each end of case. Then pry upward to break sealer bead and remove rear case.

CAUTION: Do not pry on the sealing surface of either case half as the surfaces will become damaged.

(14) Remove oil pickup tube and screen from rear case (Fig. 20).

DISASSEMBLY AND ASSEMBLY (Continued)

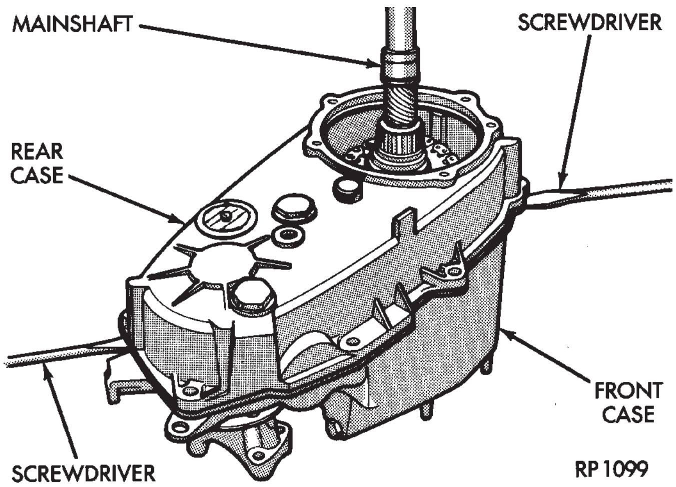


Fig. 19 Loosening/Removing Rear case

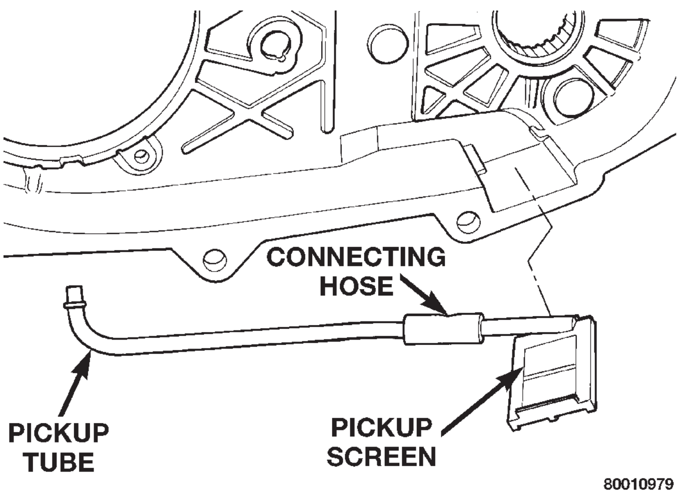


Fig. 20 Oil Pickup Screen, Hose And Tube Removal

COMPANION FLANGE AND RANGE LEVER REMOVAL

(1) Remove front companion flange nut:

(a) Move range lever to 4L position.

(b) Remove nut with socket and impact wrench.

(2) Remove companion flange. If flange is difficult to remove by hand, remove it with bearing splitter, or with standard two jaw puller. Be sure puller tool is positioned on yoke and not on slinger as slinger will be damaged.

(3) Remove seal washer from front output shaft. Discard washer as it should not be reused.

(4) Remove nut and washer that attach range lever to sector shaft. Then move sector to neutral position and remove range lever from shaft (Fig. 21).

FRONT OUTPUT SHAFT AND DRIVE CHAIN REMOVAL

(1) Remove drive sprocket snap-ring (Fig. 22).

(2) Remove drive sprocket and chain (Fig. 23).

(3) Remove front output shaft (Fig. 24).

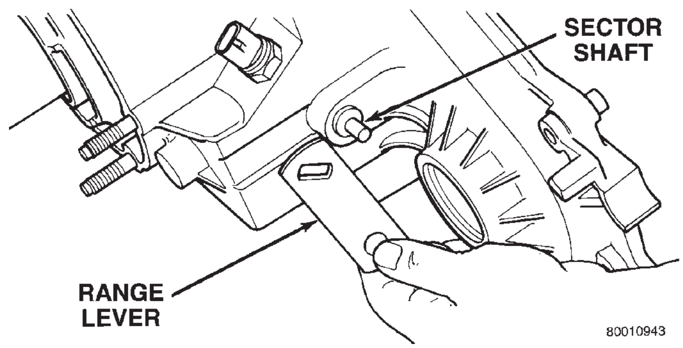


Fig. 21 Range Lever Removal—Typical

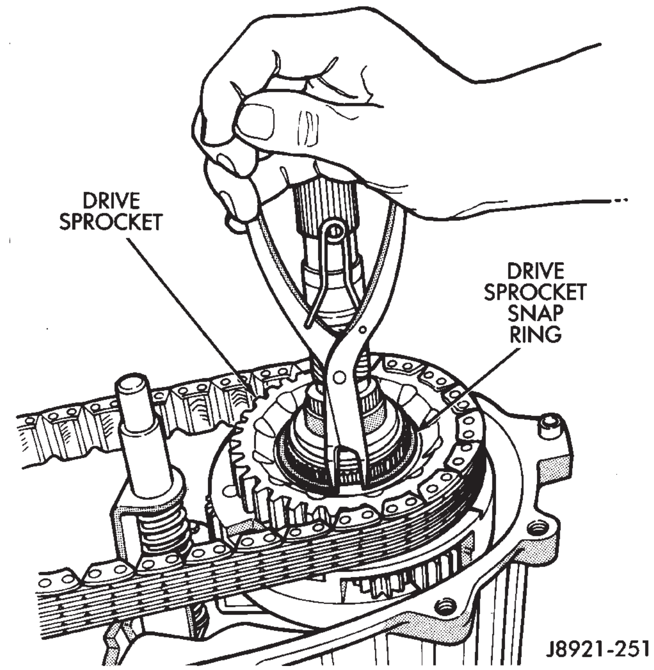


Fig. 22 Drive Sprocket Snap-Ring Removal

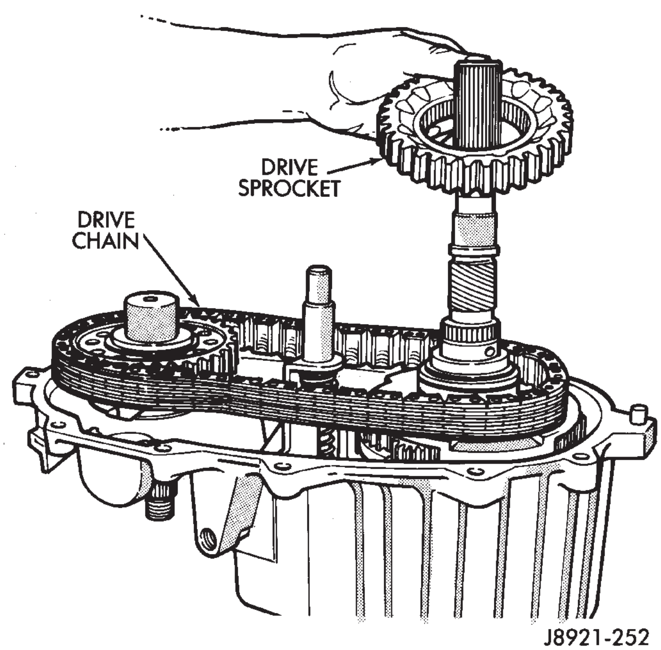


Fig. 23 Drive Sprocket And Chain Removal

DISASSEMBLY AND ASSEMBLY (Continued)

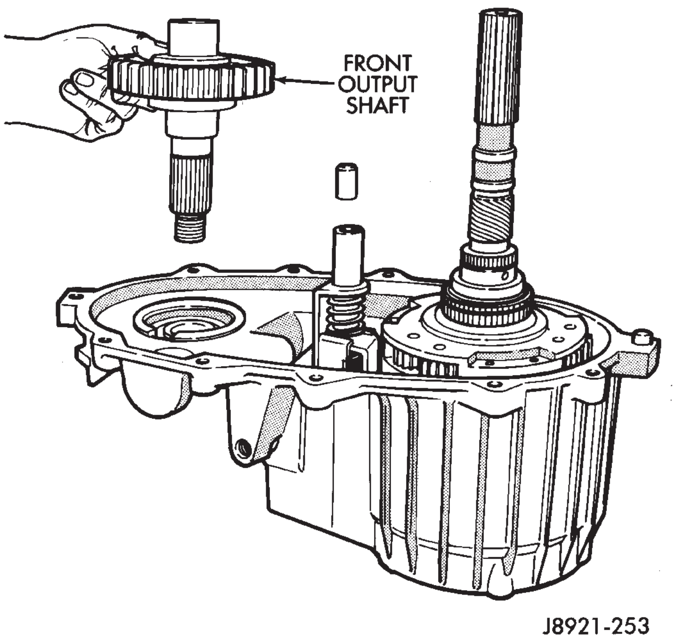


Fig. 24 Removing Front Output Shaft

SHIFT FORKS AND MAINSHAFT REMOVAL AND DISASSEMBLY

(1) Remove shift detent plug, spring and pin (Fig. 25).

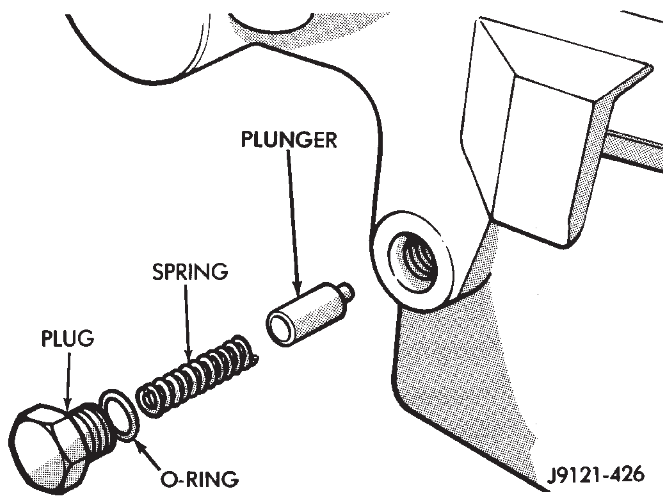


Fig. 25 Detent Component Removal

(2) Remove seal plug from low range fork lockpin access hole. Then move shift sector to align low range fork lockpin with access hole.

(3) Remove range fork lockpin with size number one easy-out tool as follows:

(a) Insert easy-out tool through access hole in side of transfer case and into lock-pin.

(b) Tap easy-out tool into lock-pin with hammer until tool is securely engaged into the lock-pin.

(c) Install a t-handle, such as from a tap and die set, onto the easy-out tool.

(d) Securely tighten the t-handle onto the tool.

(e) In one motion, pull upward and turn the t-handle counter-clockwise to remove the lock-pin.

(4) Remove shift rail by pulling it straight up and out of fork (Fig. 26).

(5) Remove mode fork and mainshaft as assembly (Fig. 27).

(6) Remove mode shift sleeve and mode fork assembly from mainshaft (Fig. 28). Note position of mode sleeve in fork and remove sleeve.

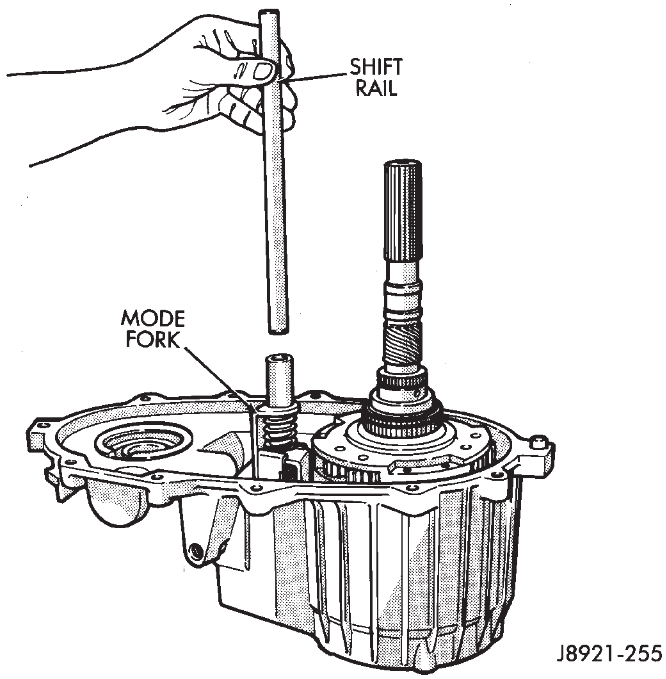


Fig. 26 Shift Rail Removal

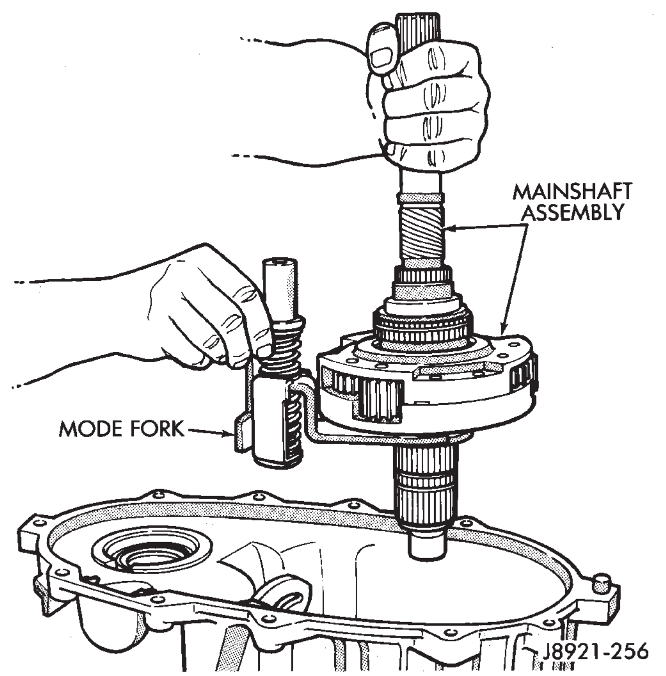


Fig. 27 Mode Fork And Mainshaft Removal

DISASSEMBLY AND ASSEMBLY (Continued)

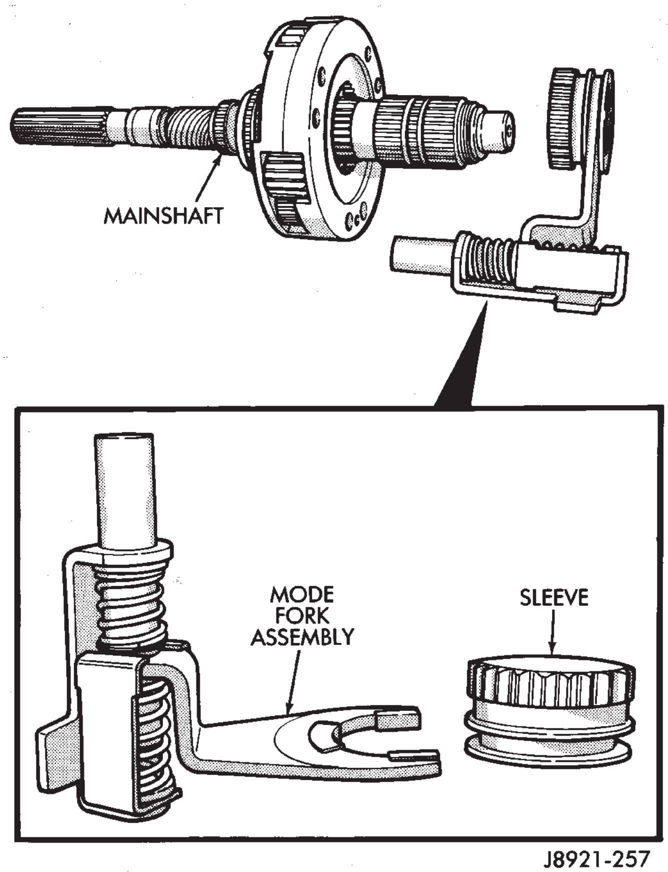


Fig. 28 Mode Fork And Sleeve Removal

(7) Remove intermediate clutch shaft snap-ring (Fig. 29).

(8) Remove clutch shaft thrust ring (Fig. 30).

(9) Remove intermediate clutch shaft (Fig. 31).

(10) Remove differential snap-ring (Fig. 32).

(11) Remove differential (Fig. 33).

(12) Remove differential needle bearings and both needle bearing thrust washers from mainshaft.

(13) Slide low range fork pin out of shift sector slot (Fig. 34).

(14) Remove low range fork and hub (Fig. 35).

(15) Remove shift sector (Fig. 36).

(16) Remove shift sector bushing and O-ring (Fig. 37).

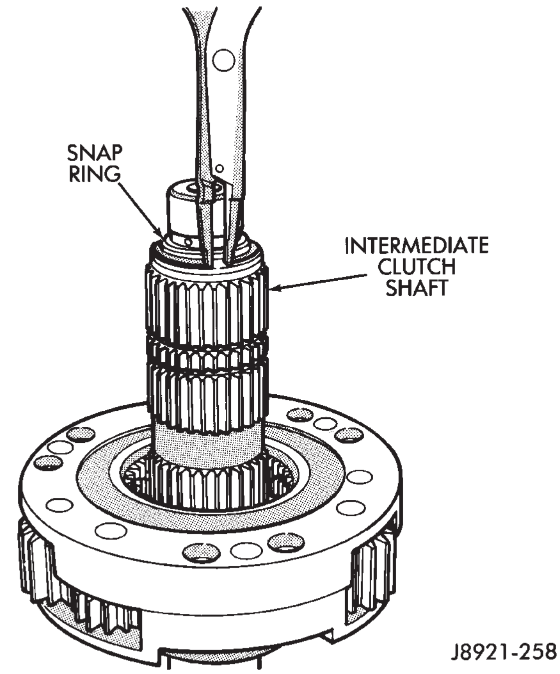


Fig. 29 Intermediate Clutch Shaft Snap-Ring Removal

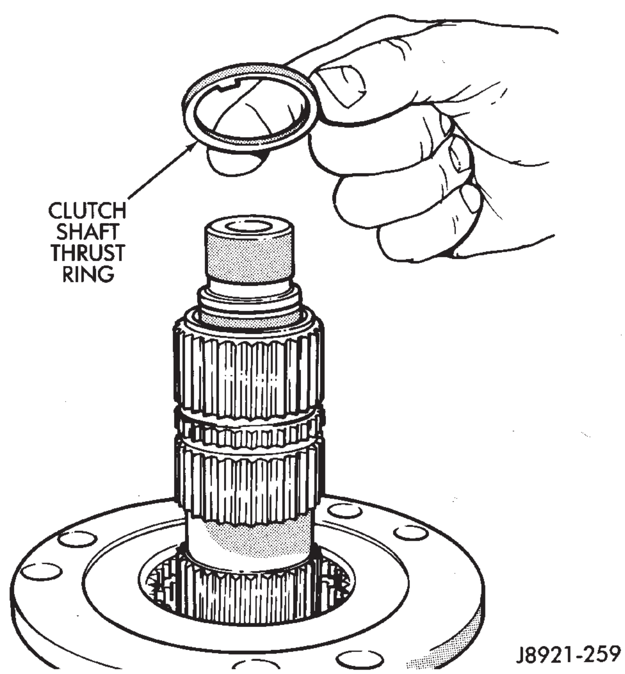


Fig. 30 Clutch Shaft Thrust Ring Removal

DISASSEMBLY AND ASSEMBLY (Continued)

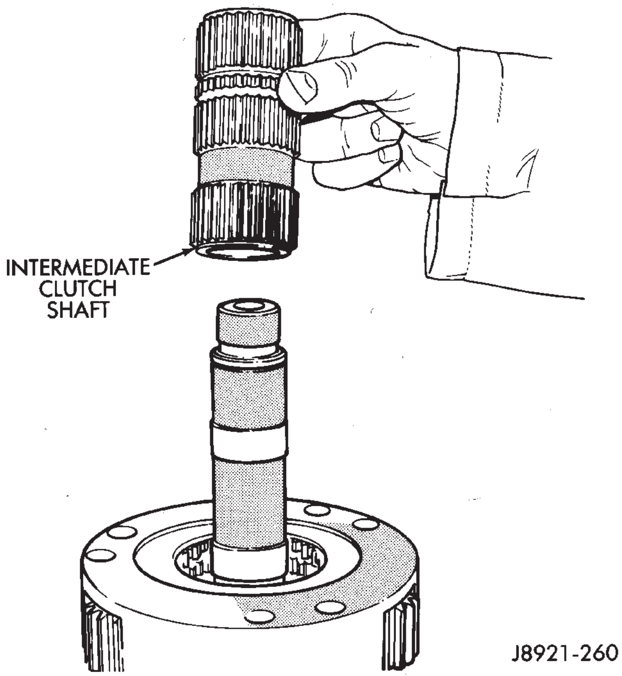


Fig. 31 Intermediate Clutch Shaft Removal

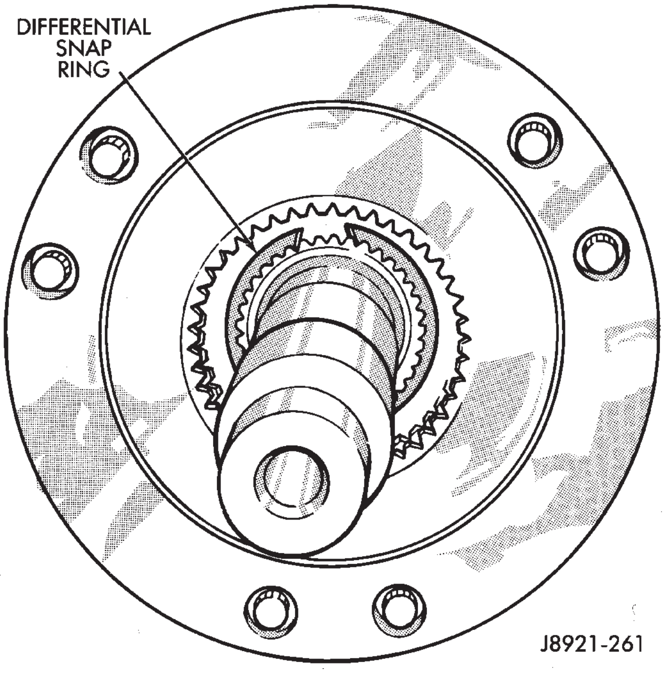


Fig. 32 Differential Snap-Ring Removal

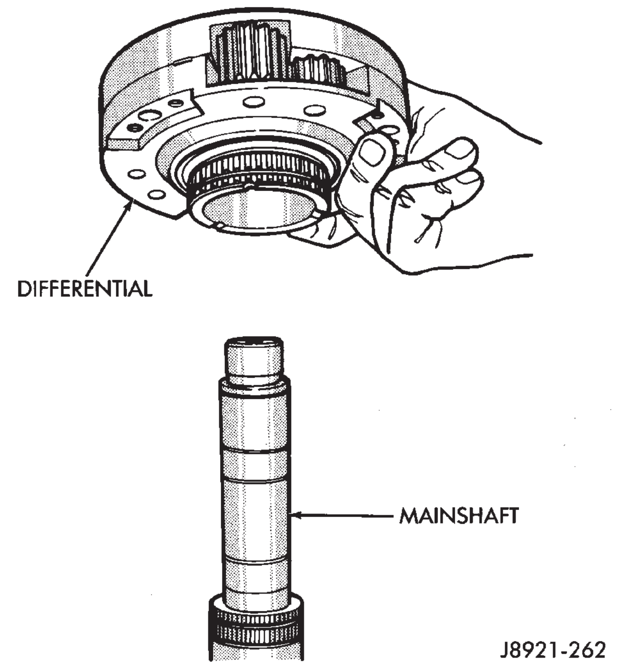


Fig. 33 Differential Removal

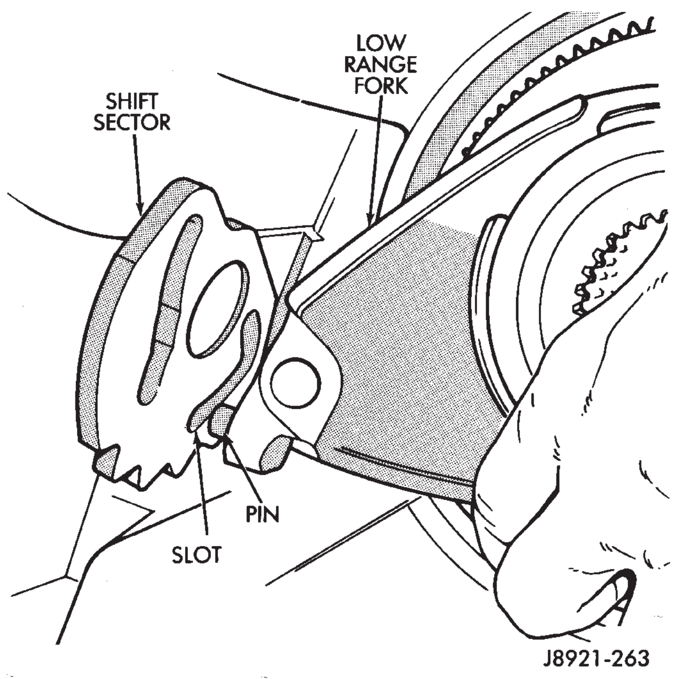


Fig. 34 Disengaging Low Range Fork

DISASSEMBLY AND ASSEMBLY (Continued)

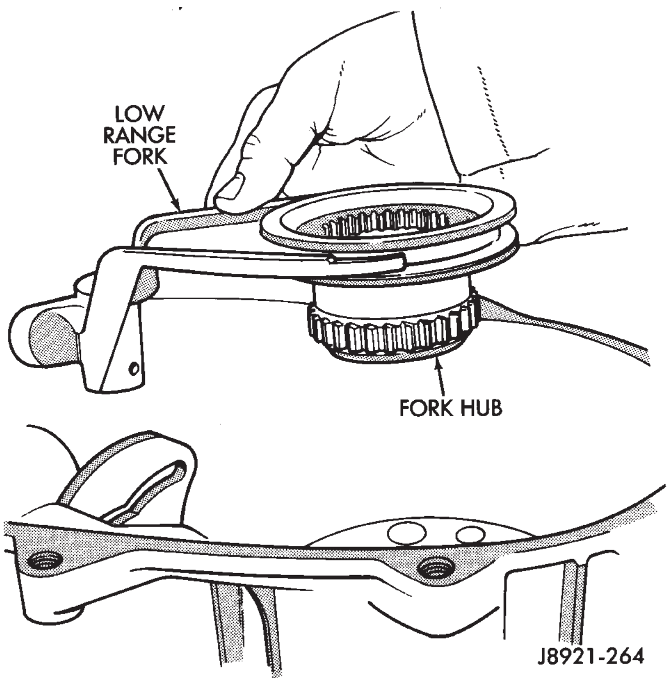


Fig. 35 Low Range Fork And Hub Removal

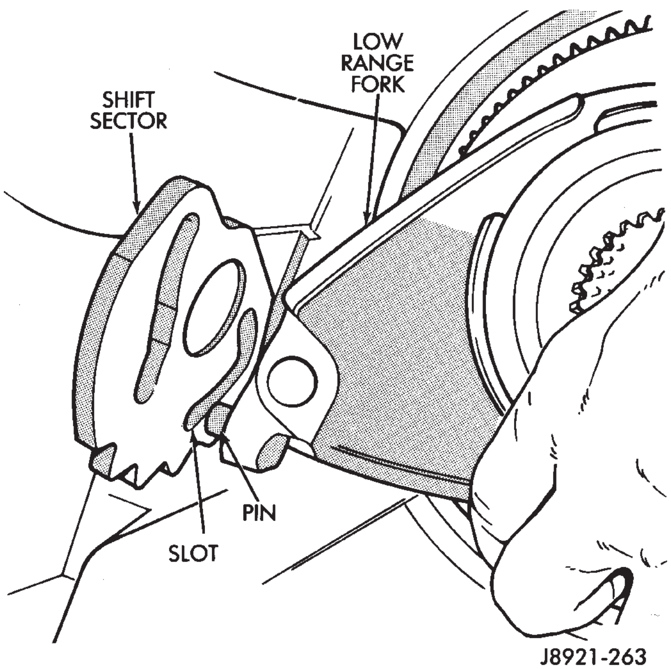


Fig. 36 Shift Sector Position

INPUT GEAR/LOW RANGE ASSEMBLY REMOVAL AND DISASSEMBLY

(1) Remove front bearing retainer bolts.

(2) Remove front bearing retainer. Carefully pry retainer loose with screwdriver (Fig. 38). Position screwdriver in slots cast into retainer.

(3) Remove input gear snap-ring (Fig. 39).

(4) Remove input/low range gear assembly from bearing with Tool Handle C-4171 and Tool 7829A (Fig. 40).

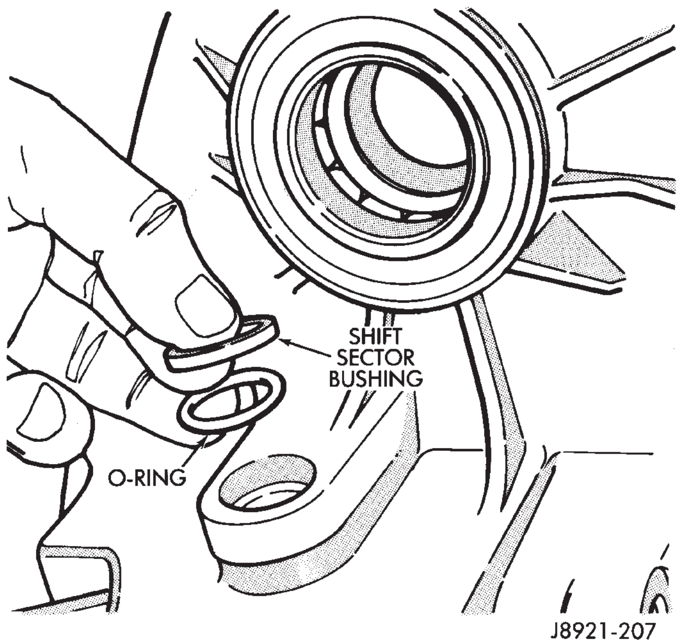


Fig. 37 Sector Bushing And O-Ring Removal

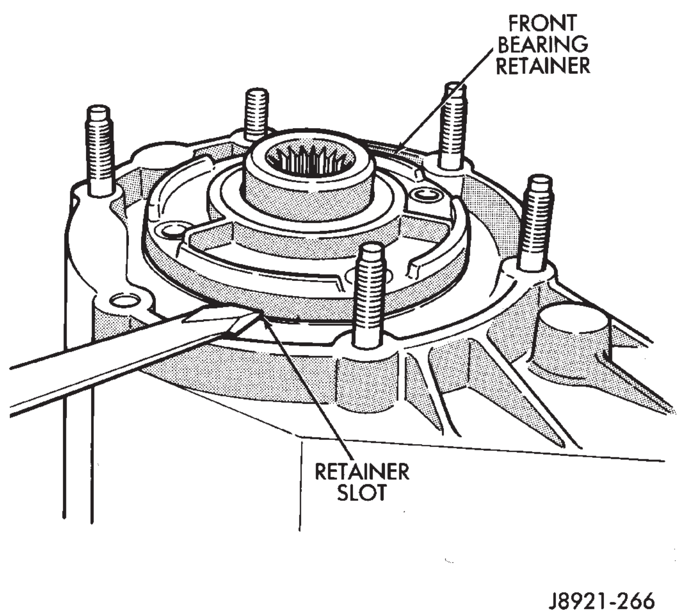


Fig. 38 Front Bearing Retainer Removal

(5) Remove low range gear snap-ring (Fig. 41).

(6) Remove input gear retainer, thrust washers and input gear from low range gear (Fig. 42).

(7) Inspect low range annulus gear (Fig. 43). **Gear is not a serviceable component. If damaged, replace gear and front case as assembly.**

(8) Remove oil seals from following components:

- front bearing retainer.
- rear retainer.
- oil pump.
- case halves.

DISASSEMBLY AND ASSEMBLY (Continued)

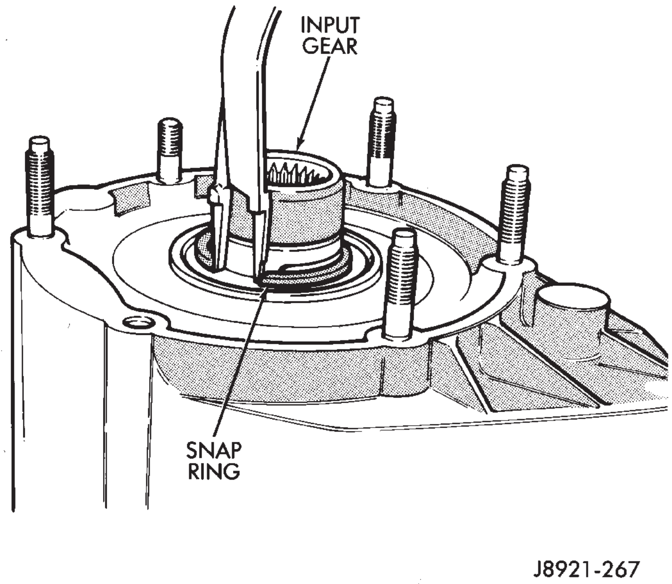


Fig. 39 Input Gear Snap-Ring Removal

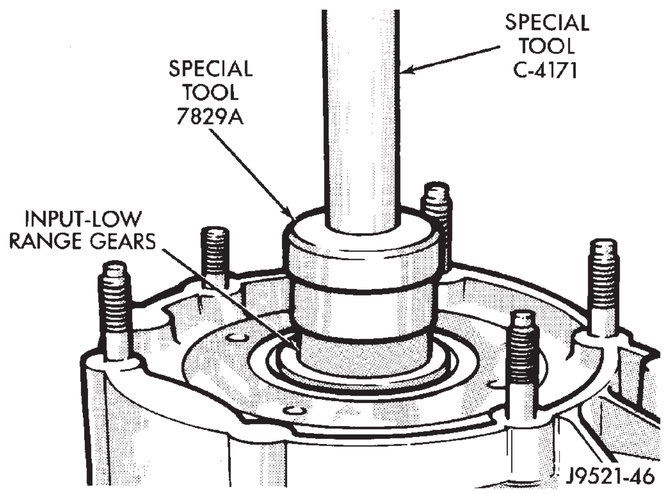


Fig. 40 Input And Low Range Gear Assembly Removal

DIFFERENTIAL DISASSEMBLY

(1) Mark differential case halves for reference.

(2) Remove differential case bolts.

(3) Invert differential on workbench.

(4) Separate top case from bottom case. Use slots in case halves to pry them apart (Fig. 44).

(5) Remove thrust washers and planet gears from case pins (Fig. 45).

(6) Remove mainshaft and sprocket gears from bottom case (Fig. 46). Note gear position for reference before separating them.

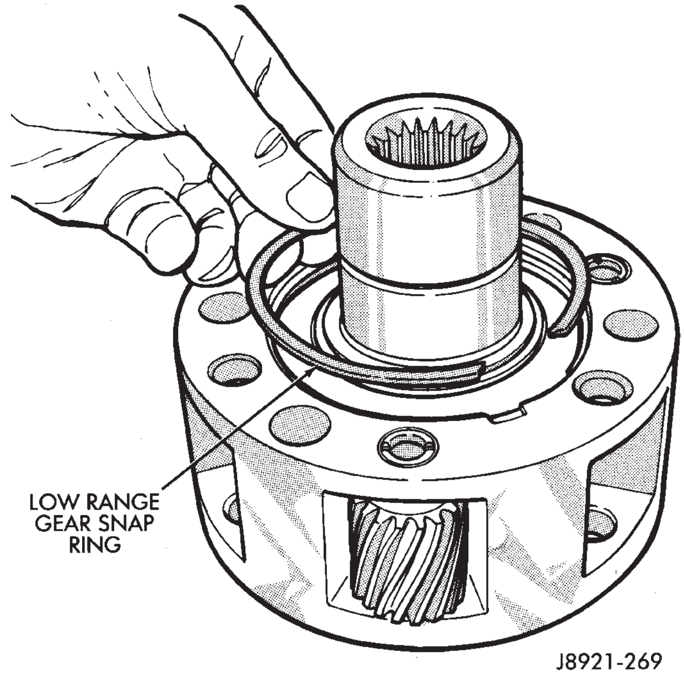


Fig. 41 Low Range Gear Snap-Ring Removal/ Installation

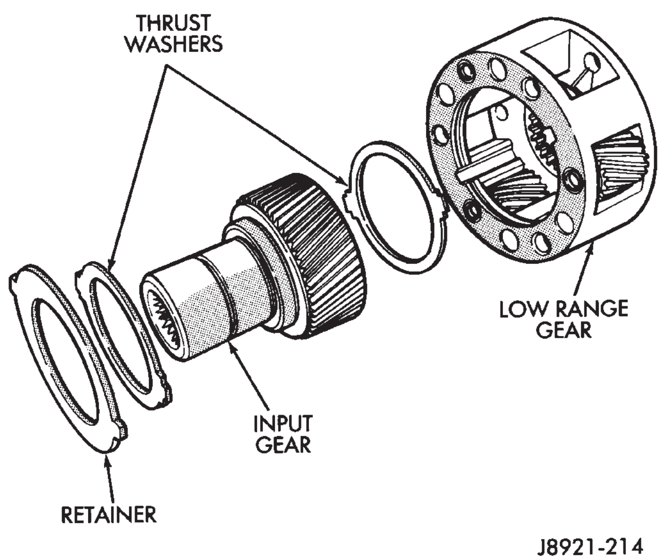


Fig. 42 Low Range Gear Disassembly

ASSEMBLY

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. Make sure replacement bearings do not block the holes.

DISASSEMBLY AND ASSEMBLY (Continued)

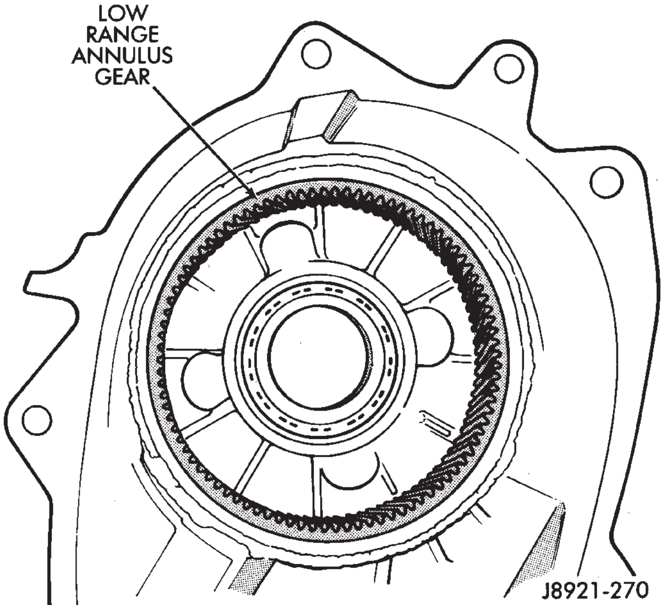


Fig. 43 Inspecting Low Range Annulus Gear

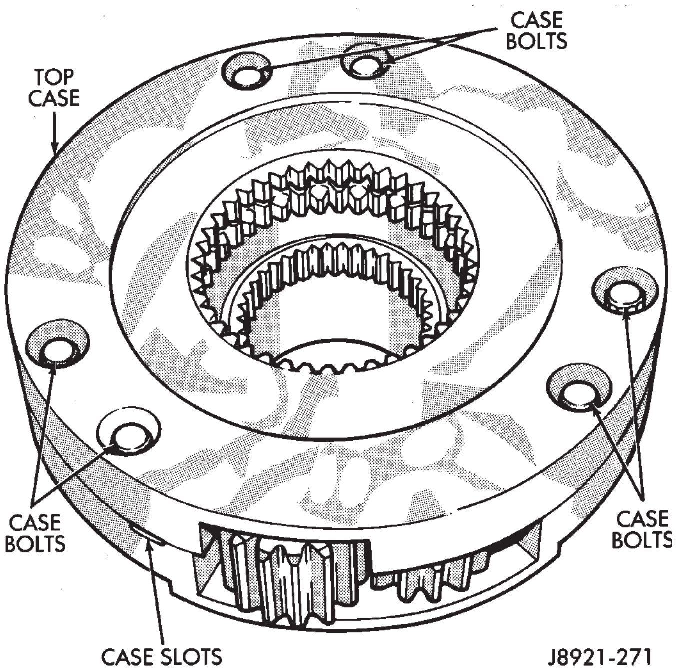


Fig. 44 Separating Differential Case Halves

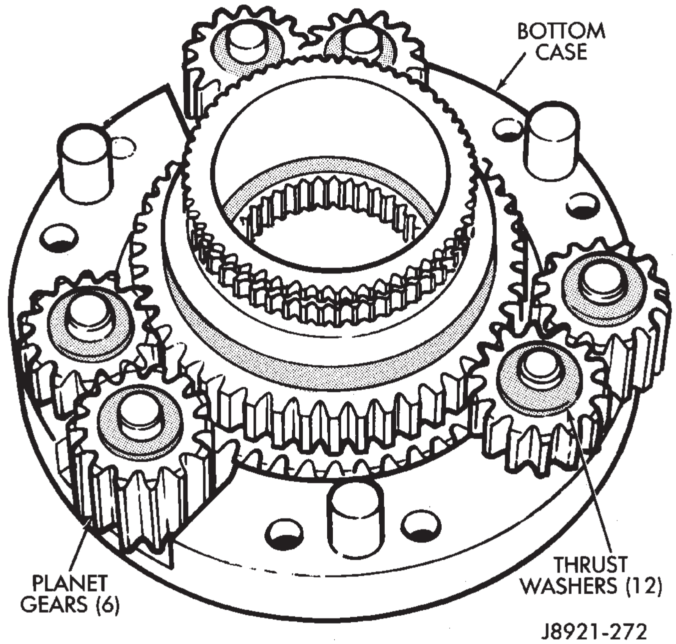


Fig. 45 Planet Gears And Thrust Washer Removal

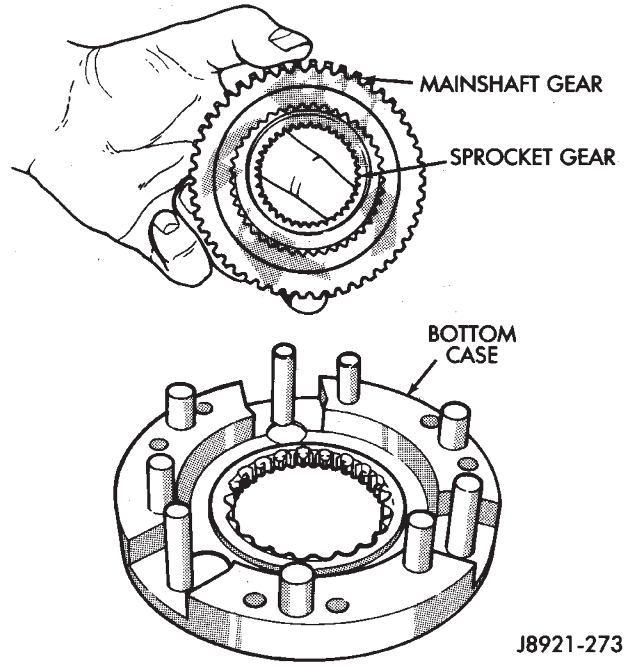


Fig. 46 Mainshaft And Sprocket Gear Removal

BEARING AND SEAL INSTALLATION

(1) Remove snap-ring that retains front output shaft front bearing in case (Fig. 47). Then remove bearing. Use hammer handle, or hammer and brass punch to tap bearing out of case.

(2) Install new front output shaft front bearing with Tool Handle C-4171 and Installer 8033A with the tapered cone upward (Fig. 48).

(3) Install front bearing snap-ring (Fig. 47).

(4) Remove front output shaft seal using an appropriate pry tool (Fig. 49) or slide-hammer mounted screw.

(5) Install new front output shaft oil seal with Installer 6952-A (Fig. 50).

(6) Remove input gear bearing with Tool Handle C-4171 and Remover C-4210 (Fig. 51).

(7) Install snap-ring on new input gear bearing.

(8) Install new input gear bearing with Tool Handle C-4171 and Remover C-4210. Install bearing far enough to seat snap-ring against case (Fig. 52).

(9) Remove the input gear pilot bearing by inserting a suitably sized drift into the splined end of the

DISASSEMBLY AND ASSEMBLY (Continued)

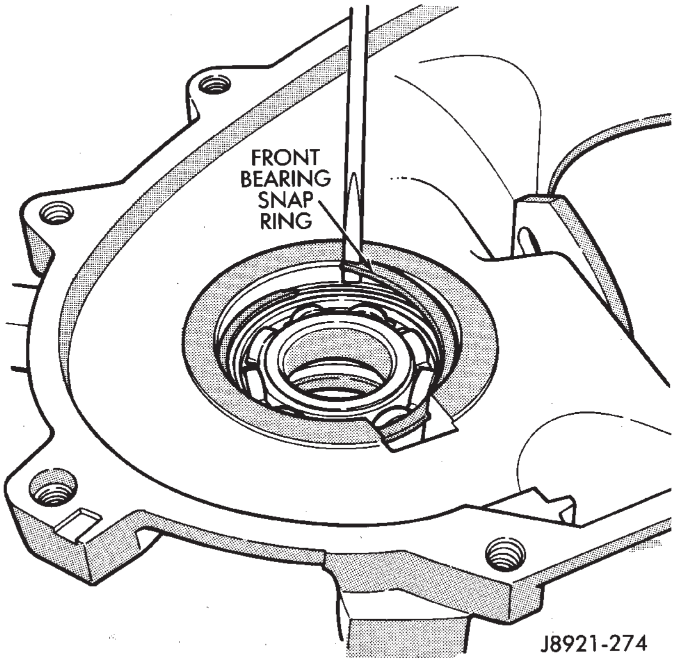


Fig. 47 Front Output Shaft Front Bearing Snap-Ring Removal

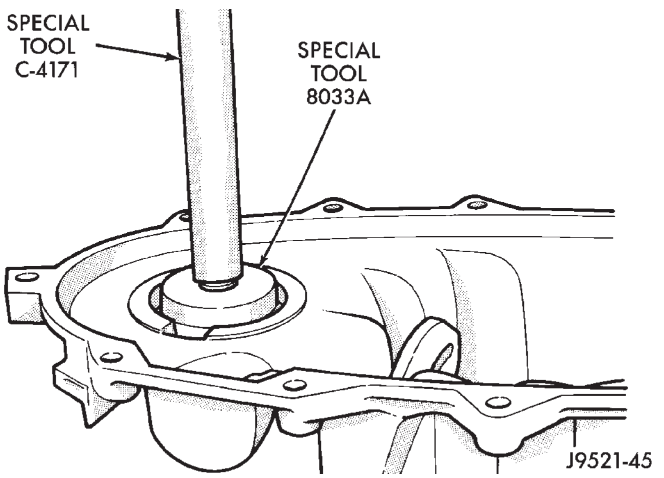


Fig. 48 Front Output Shaft Front Bearing Installation

input gear and driving the bearing out with the drift and a hammer (Fig. 53).

(10) Install new pilot bearing with Installer 8128 and Handle C-4171 (Fig. 54).

(11) Install new seal in front bearing retainer with Installer 7884 (Fig. 55).

(12) Remove output shaft rear bearing with the screw and jaws from Remover L-4454 and Cup 8148 (Fig. 56).

(13) Install new bearing with Tool Handle C-4171 and Installer 5066 (Fig. 57). Lubricate bearing after installation.

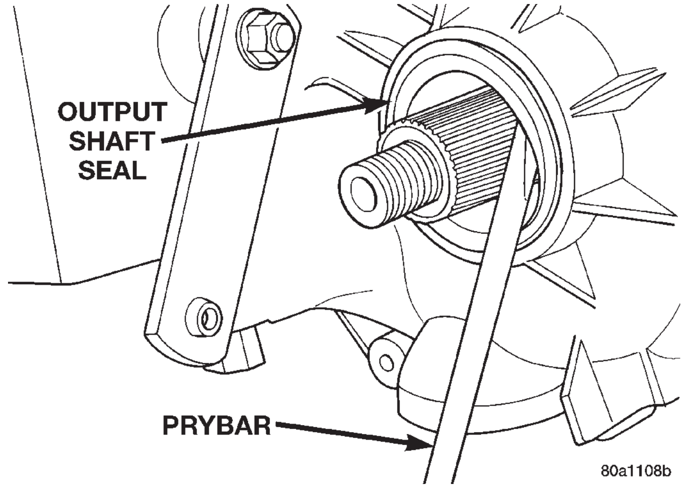


Fig. 49 Remove Front Output Shaft Seal

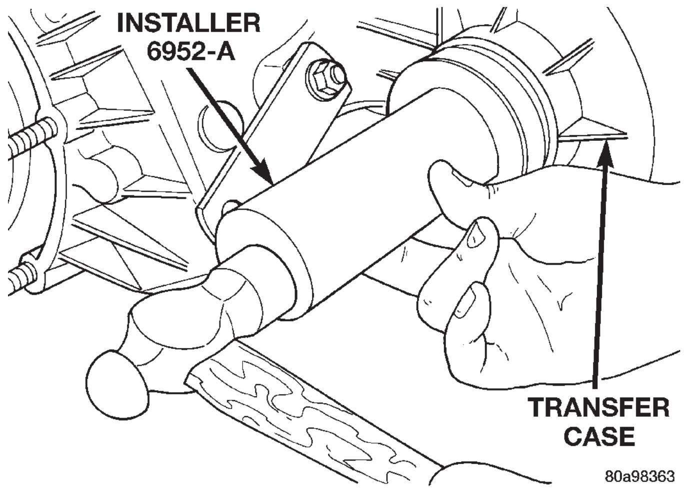


Fig. 50 Install Front Output Shaft Seal

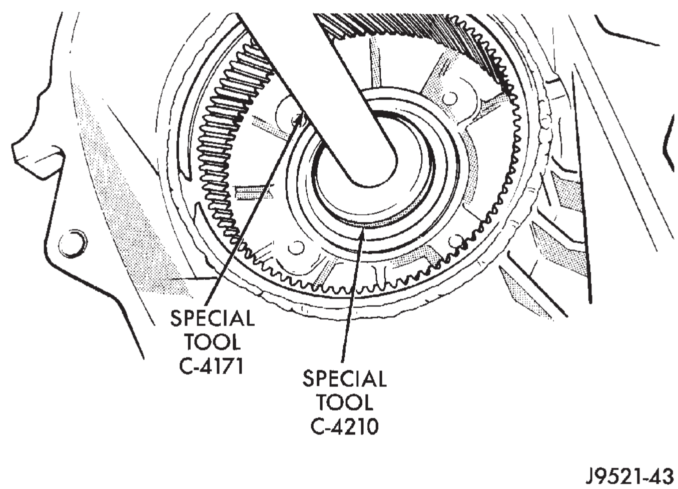


Fig. 51 Input Gear Bearing Removal

DISASSEMBLY AND ASSEMBLY (Continued)

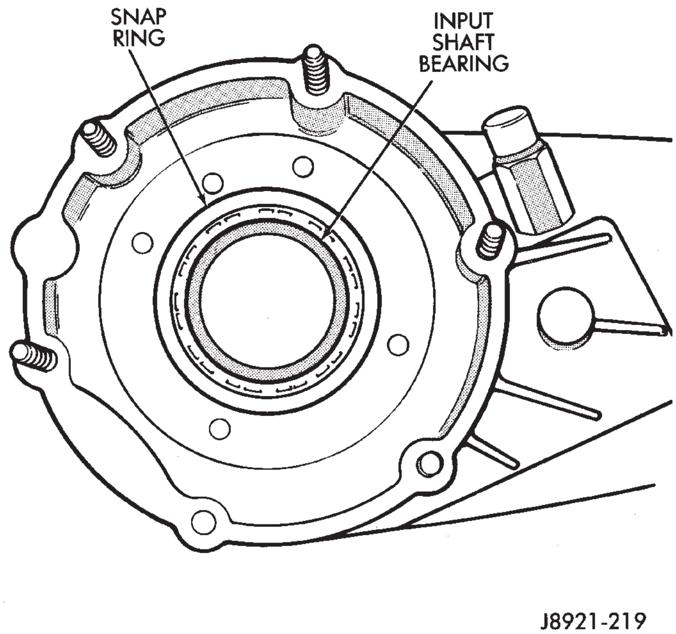


Fig. 52 Seating Input Gear Bearing

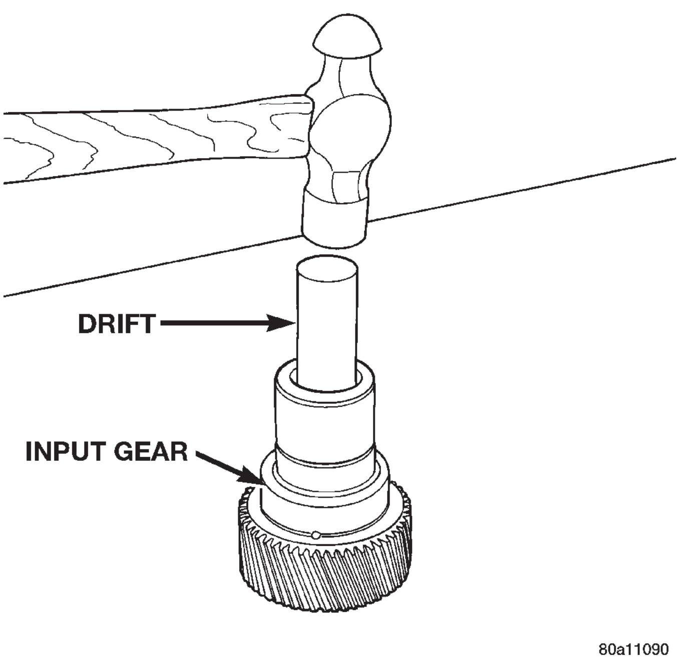


Fig. 53 Remove Input Gear Pilot Bearing

(14) Install new seal in oil pump feed housing with Special Tool 7888 (Fig. 58).

(15) Install new pickup tube O-ring in oil pump (Fig. 59).

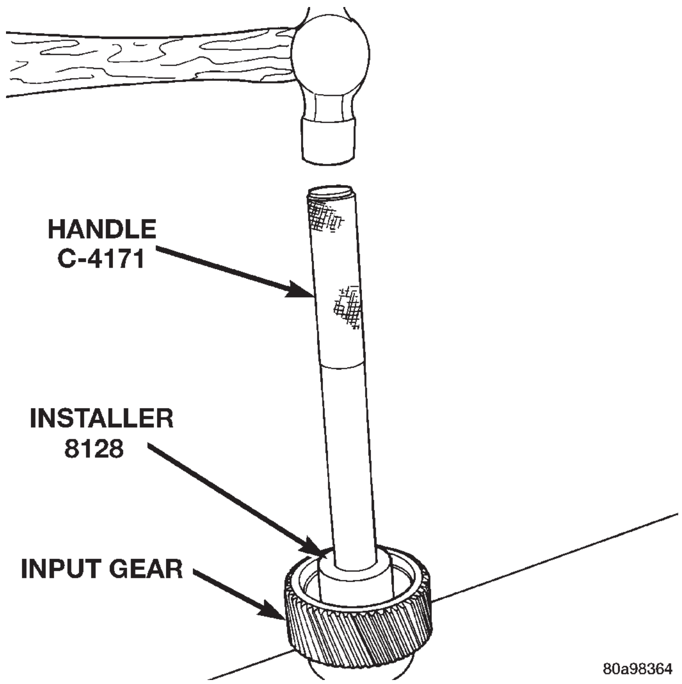


Fig. 54 Install Input Gear Pilot Bearing

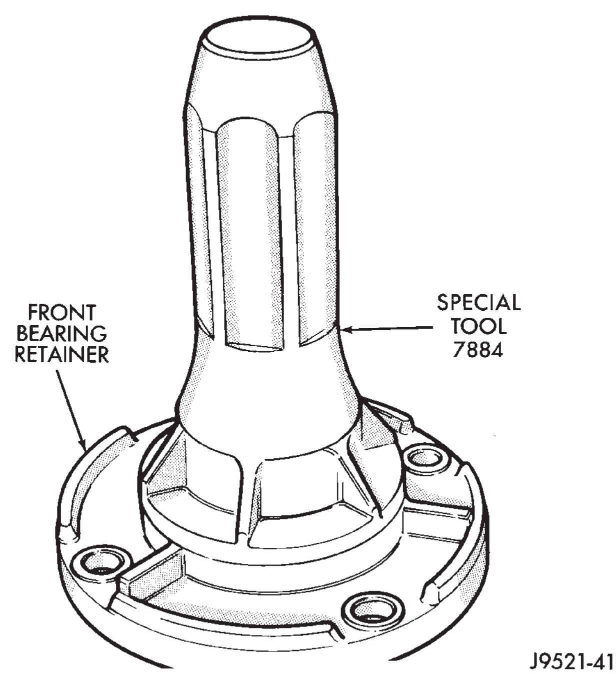


Fig. 55 Front Bearing Retainer Seal Installation

DISASSEMBLY AND ASSEMBLY (Continued)

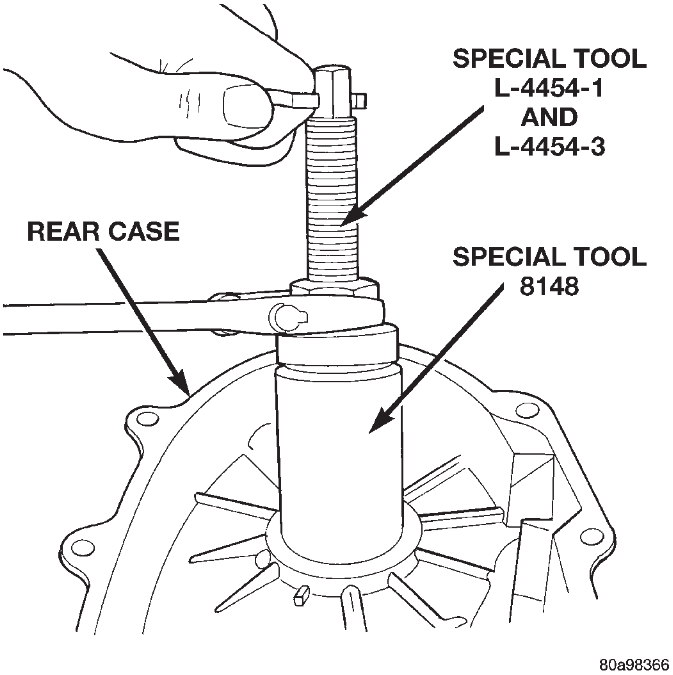


Fig. 56 Remove Front Output Shaft Rear Bearing

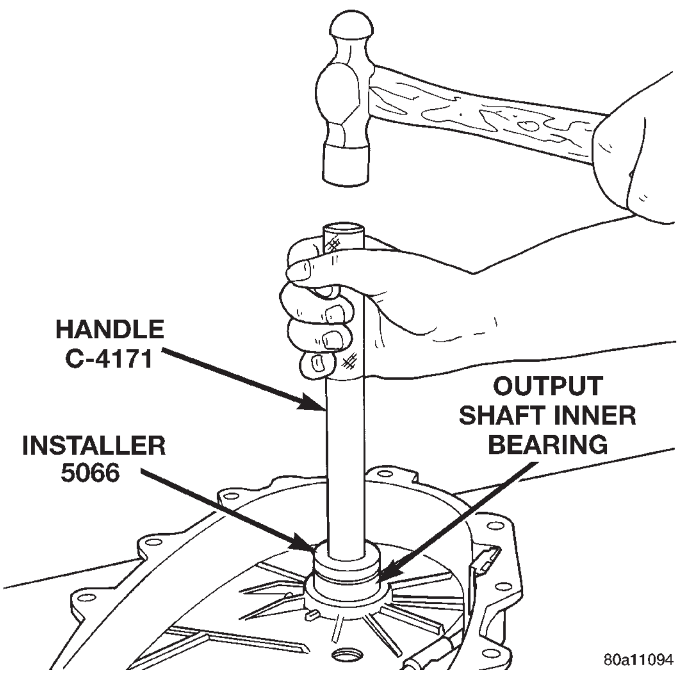


Fig. 57 Install Front Output Shaft Rear Bearing

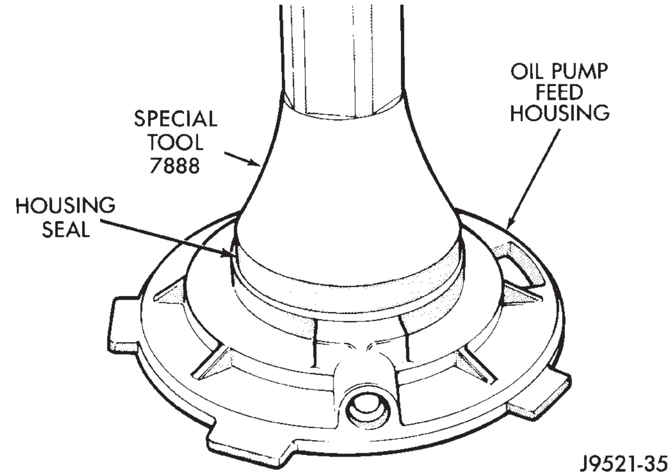


Fig. 58 Oil Pump Seal Installation

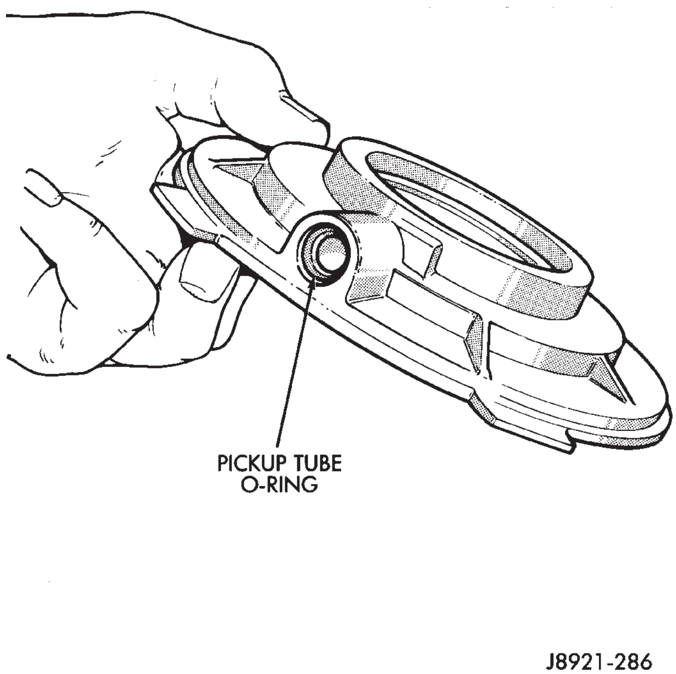


Fig. 59 Pickup Tube O-Ring Installation

DIFFERENTIAL ASSEMBLY

(1) Lubricate differential components with automatic transmission fluid.

(2) Install sprocket gear in differential bottom case (Fig. 60).

(3) Install differential planet gears and new thrust washers (Fig. 61). **Be sure thrust washers are installed at top and bottom of each planet gear.**

(4) Install differential mainshaft gear (Fig. 61).

(5) Align and position differential top case on bottom case (Fig. 62). Align using scribe marks made at disassembly.

(6) While holding differential case halves together, invert the differential and start the differential case bolts.

(7) Tighten differential case bolts to specified torque.

INPUT GEAR/LOW RANGE ASSEMBLY

(1) Assemble low range gear, input gear thrust washers, input gear and input gear retainer (Fig. 63).

(2) Install low range gear snap ring (Fig. 64).

(3) Lubricate input gear and low range gears with automatic transmission fluid.

(4) Start input gear shaft into front case bearing.

DISASSEMBLY AND ASSEMBLY (Continued)

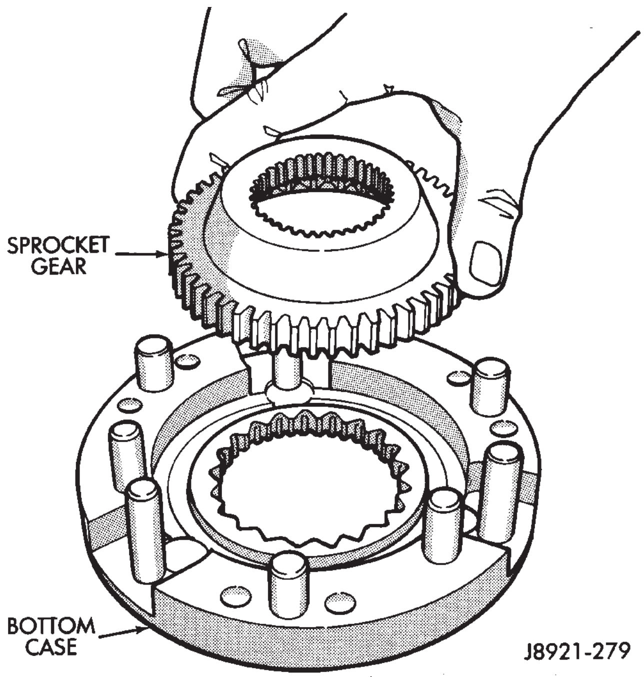


Fig. 60 Installing Differential Sprocket Gear

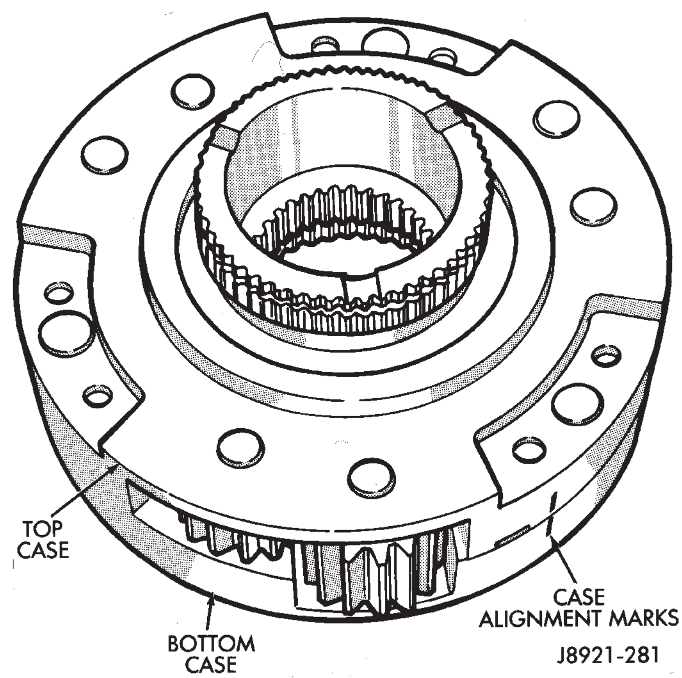


Fig. 62 Differential Case Assembly

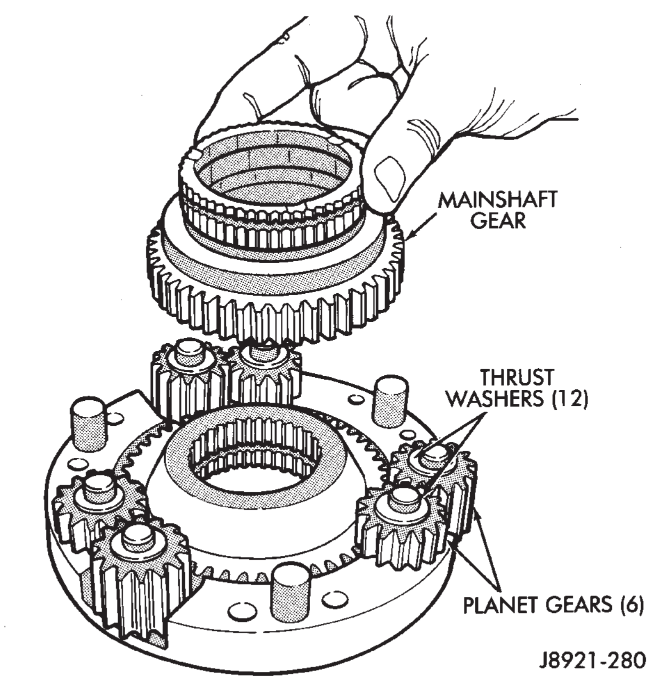


Fig. 61 Installing Mainshaft And Planet Gears

(5) Press input gear shaft into front bearing.

(6) Install new input gear snap ring (Fig. 65).

(7) Apply 3 mm (1/8 in.) wide bead of Mopar® gasket maker or silicone adhesive sealer to seal surface of front bearing retainer.

(8) Install front bearing retainer (Fig. 66). Tighten retainer bolts to 16 ft. lbs. (21 N·m) torque.

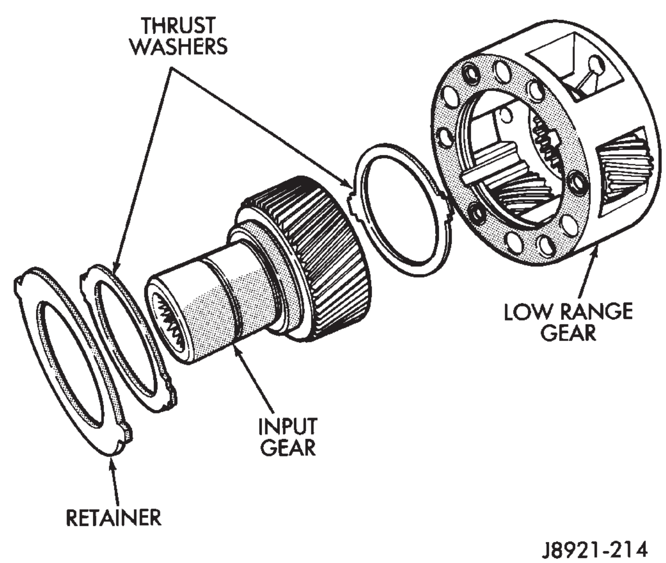


Fig. 63 Low Range And Input Gear Assembly

SHIFT FORKS AND MAINSHAFT INSTALLATION

(1) Install new sector shaft O-ring and bushing (Fig. 67).

(2) Install shift sector.

(3) Install new pads on low range fork, if necessary, (Fig. 68).

(4) Assemble low range fork and hub (Fig. 68).

(5) Position low range fork and hub in case. Be sure low range fork pin is engaged in shift sector slot (Fig. 69).

DISASSEMBLY AND ASSEMBLY (Continued)

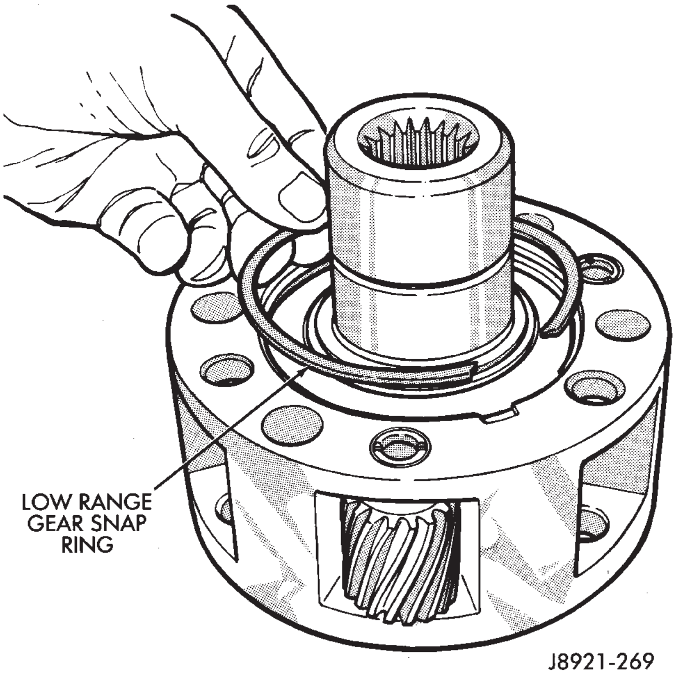


Fig. 64 Install Low Range Gear Snap Ring

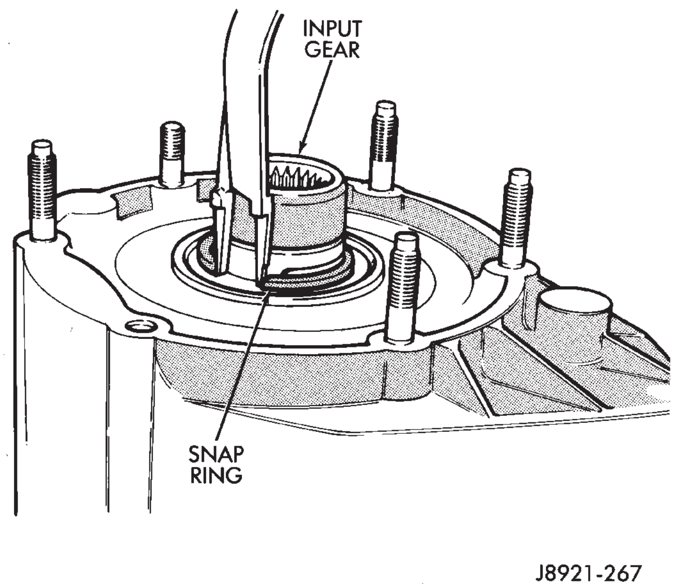


Fig. 65 Input Gear Snap Ring Installation

(6) Install first mainshaft bearing spacer on mainshaft (Fig. 70).

(7) Install bearing rollers on mainshaft (Fig. 70). **Coat bearing rollers with generous quantity of petroleum jelly to hold them in place.**

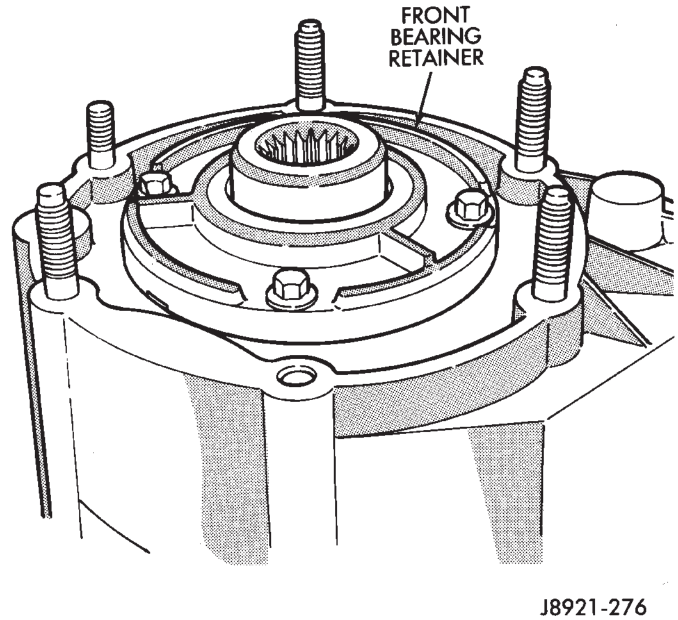


Fig. 66 Installing Front Bearing Retainer

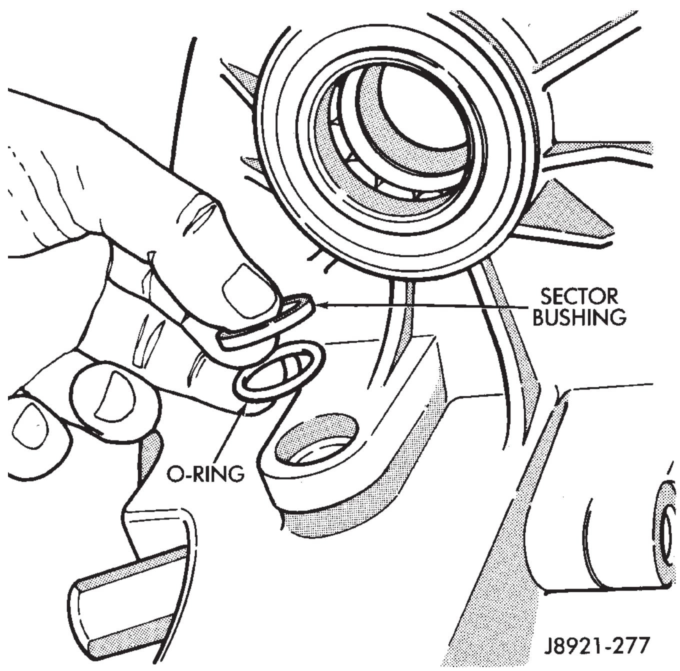


Fig. 67 Sector O-Ring And Bushing Installation

(8) Install remaining bearing spacer on mainshaft (Fig. 70). Do not displace any bearings while installing spacer.

DISASSEMBLY AND ASSEMBLY (Continued)

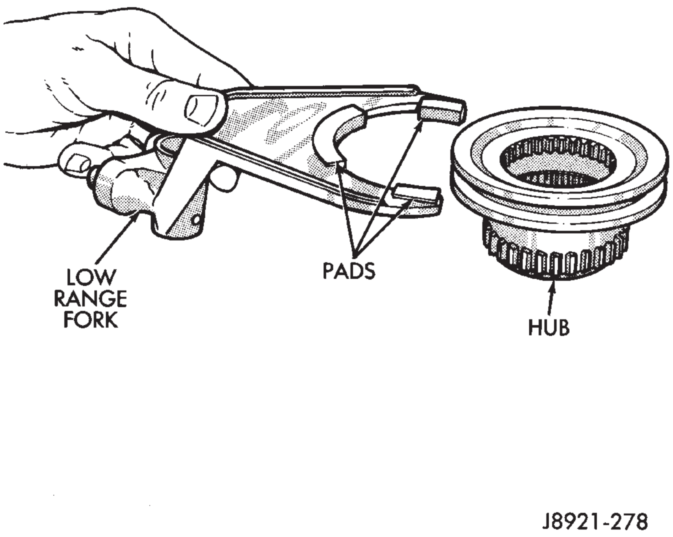


Fig. 68 Assembling Low Range Fork And Hub

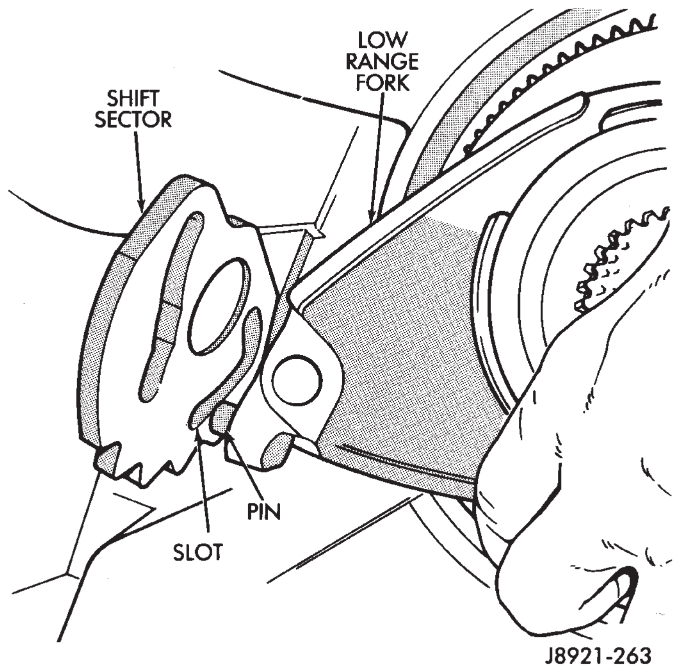


Fig. 69 Positioning Low Range Fork

(9) Install differential (Fig. 71). **Do not displace mainshaft bearings when installing differential.**

(10) Install differential snap-ring (Fig. 72).

(11) Install intermediate clutch shaft (Fig. 73).

(12) Install clutch shaft thrust washer (Fig. 74).

(13) Install clutch shaft snap-ring (Fig. 75).

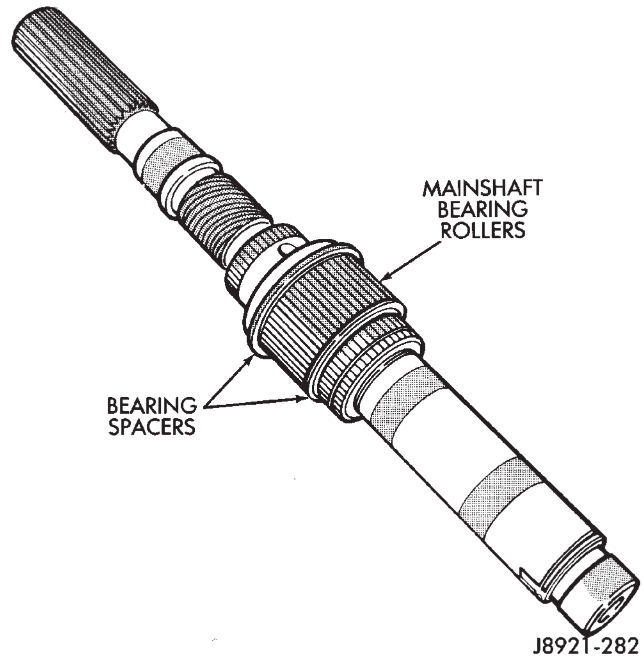


Fig. 70 Installing Mainshaft Bearing Rollers and Spacers

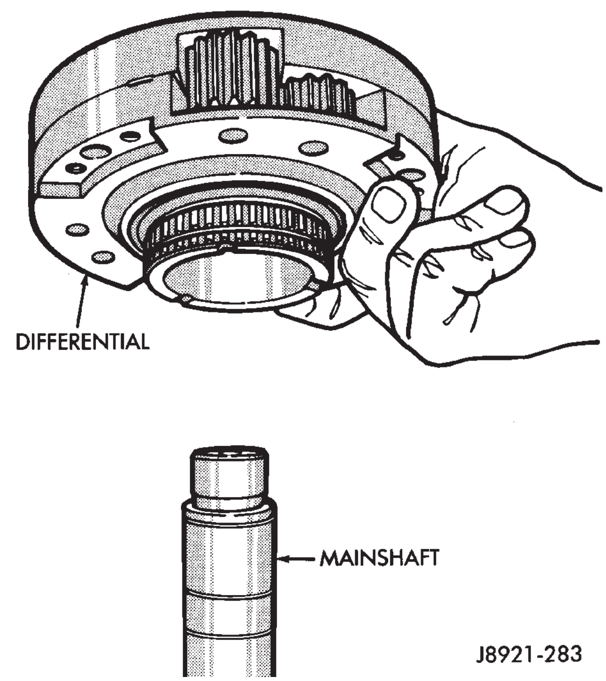


Fig. 71 Differential Installation

DISASSEMBLY AND ASSEMBLY (Continued)

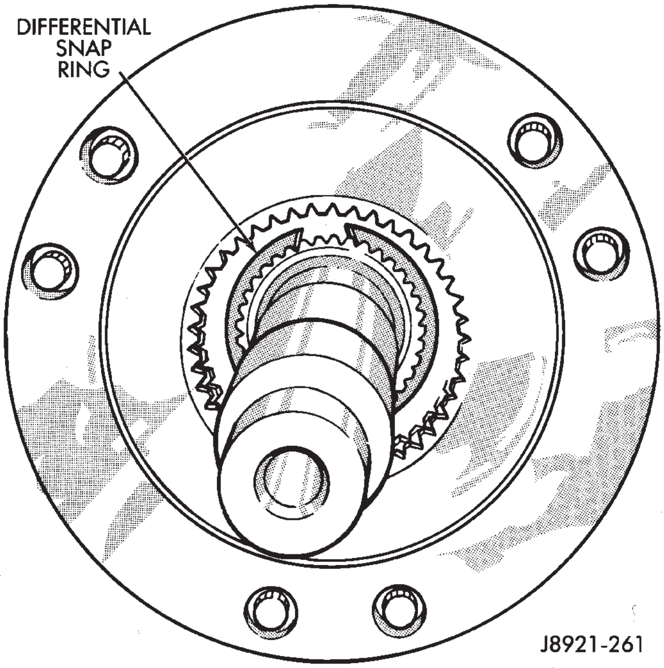


Fig. 72 Installing Differential Snap-Ring

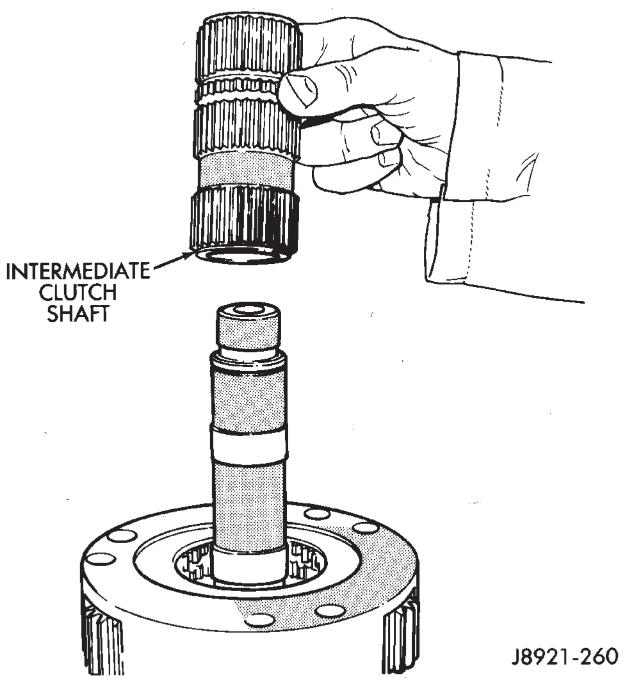


Fig. 73 Installing Intermediate Clutch Shaft

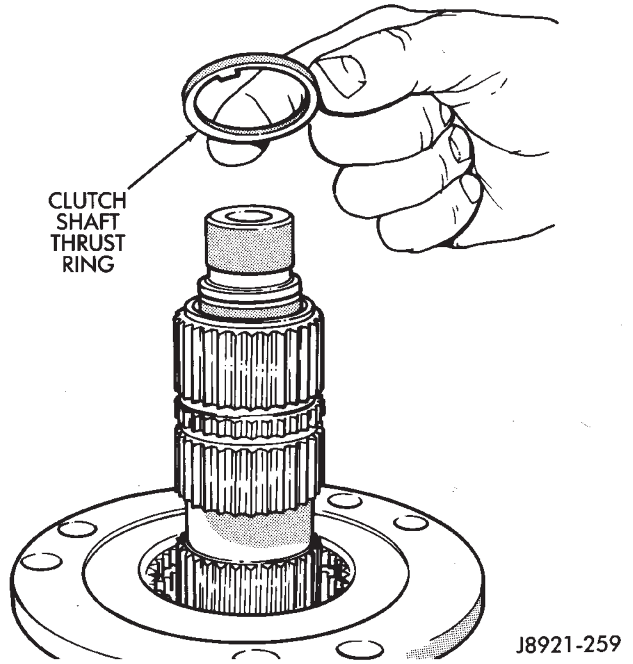


Fig. 74 Installing Clutch Shaft Thrust Washer

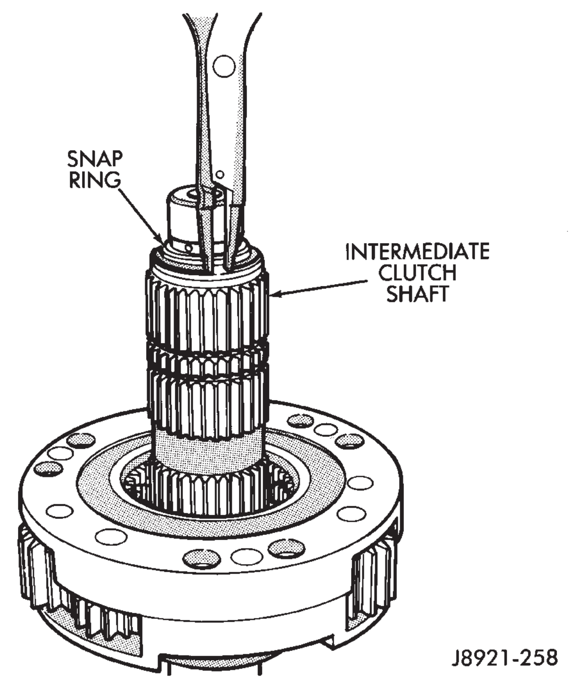


Fig. 75 Installing Clutch Shaft Snap-Ring

(14) Inspect mode fork assembly (Fig. 76). Replace pads and bushing if necessary. Replace fork tube if bushings inside tube are worn or damaged. Also check springs and slider bracket (Fig. 76). Replace worn, damaged components.

(15) Install mode sleeve in mode fork (Fig. 77). Then install assembled sleeve and fork on mainshaft. Be sure mode sleeve splines are engaged in differential splines.

(16) Install mode fork and mainshaft assembly in case (Fig. 78). Rotate mainshaft slightly to engage shaft with low range gears.

(17) Rotate mode fork pin into shift sector slot.

(18) Install shift rail (Fig. 79). **Be sure rail is seated in both shift forks.**

(19) Rotate shift sector to align lockpin hole in low range fork with access hole in case.

DISASSEMBLY AND ASSEMBLY (Continued)

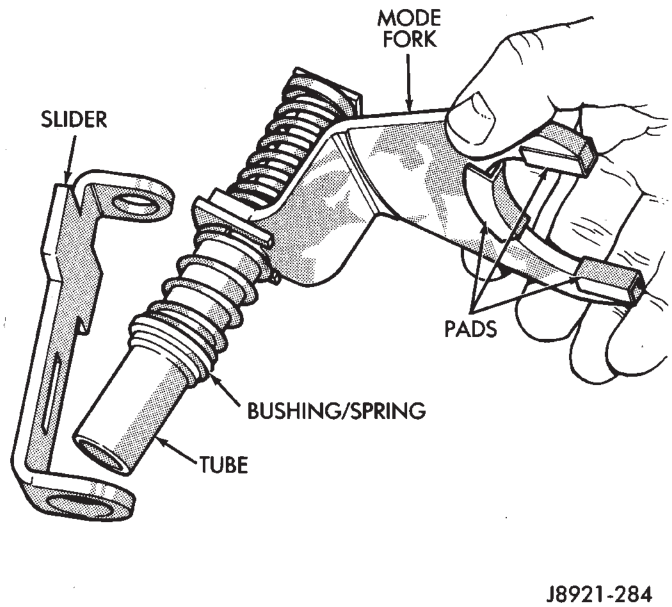


Fig. 76 Mode Fork Assembly Inspection

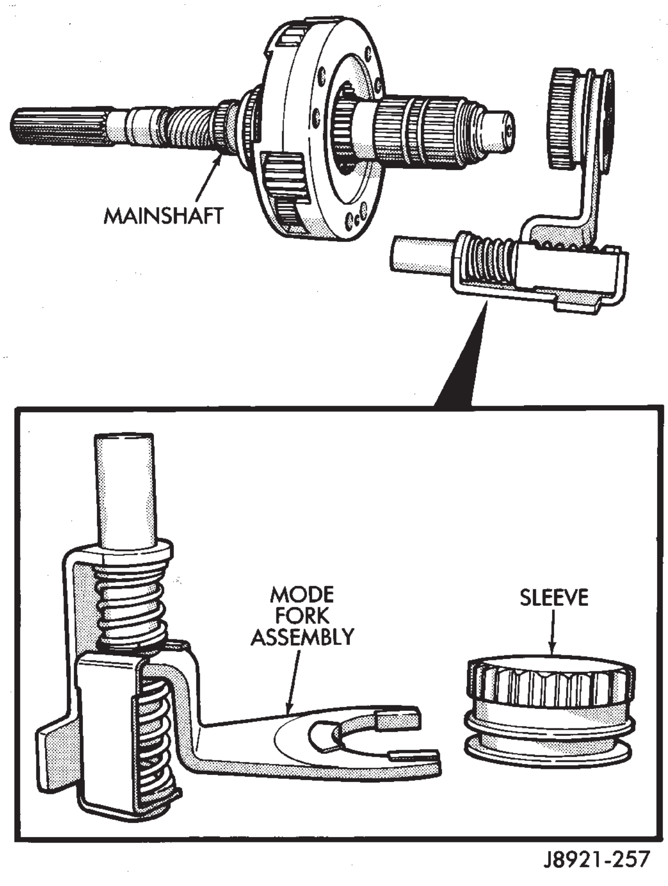


Fig. 77 Installing Mode Fork And Sleeve

(20) Insert an easy-out in range fork lockpin to hold it securely for installation (Fig. 80). **Lockpin is slightly tapered on one end. Insert tapered end into fork and rail.**

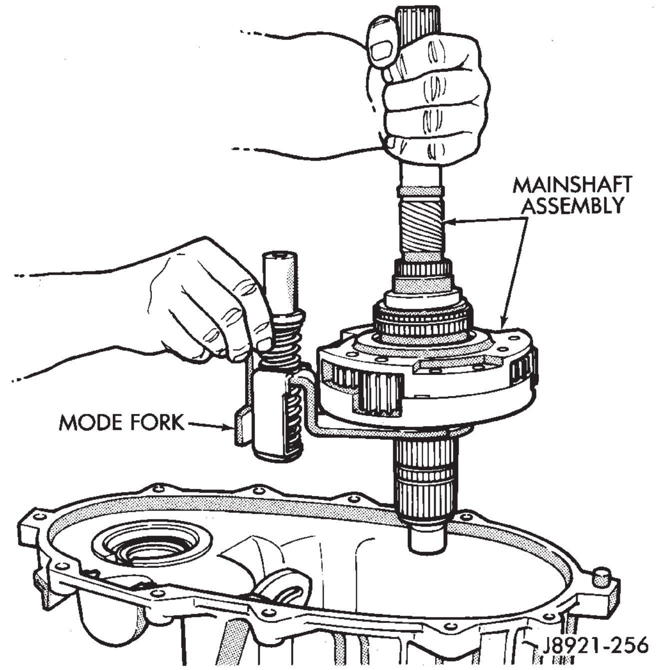


Fig. 78 Assembled Mainshaft And Mode Fork Installation

(21) Insert lockpin through access hole and into shift fork (Fig. 80). Then remove easy-out and seat the pin with pin punch.

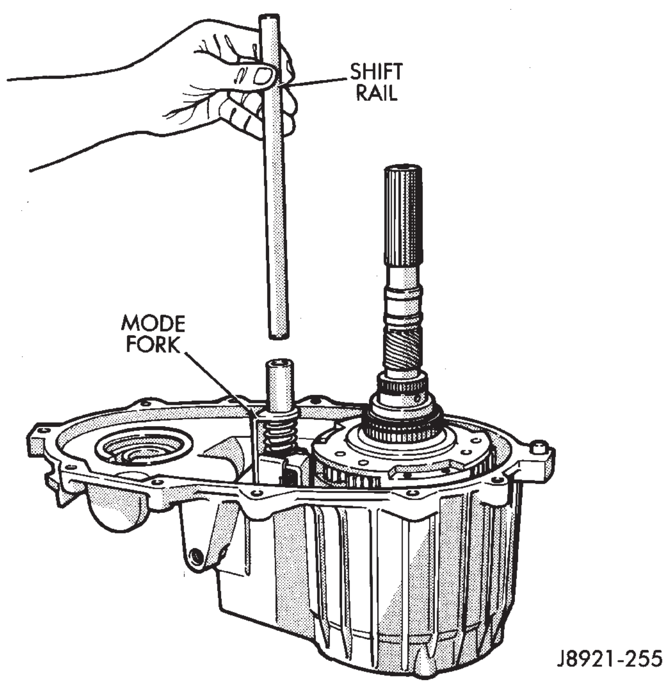


Fig. 79 Shift Rail Installation

(22) Install plug in lockpin access hole.

(23) Install detent plunger, detent spring and detent plug in case (Fig. 81).

DISASSEMBLY AND ASSEMBLY (Continued)

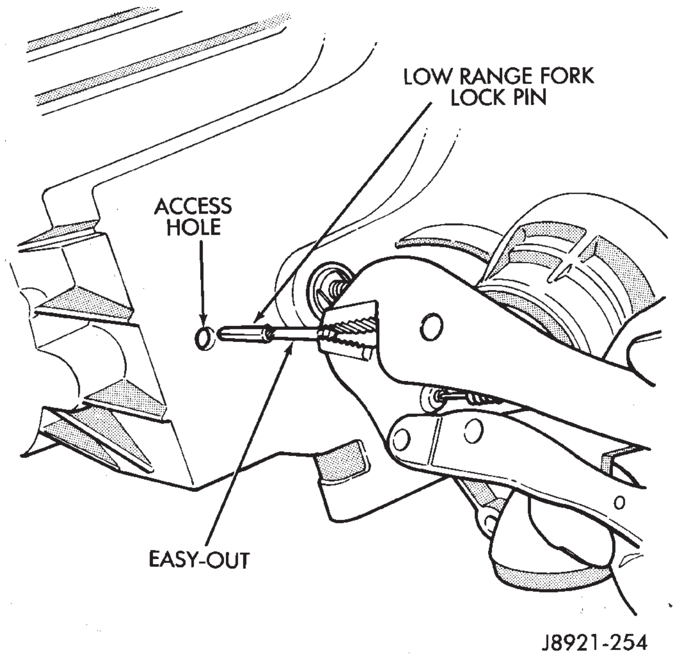


Fig. 80 Installing Low Range Fork Lockpin

FRONT OUTPUT SHAFT AND DRIVE CHAIN INSTALLATION

(1) Install front output shaft (Fig. 82).

(2) Install drive chain (Fig. 82). Engage chain with front output shaft sprocket teeth.

(3) Install drive sprocket (Fig. 82). Engage drive sprocket teeth with chain. Then engage sprocket splines with mainshaft splines.

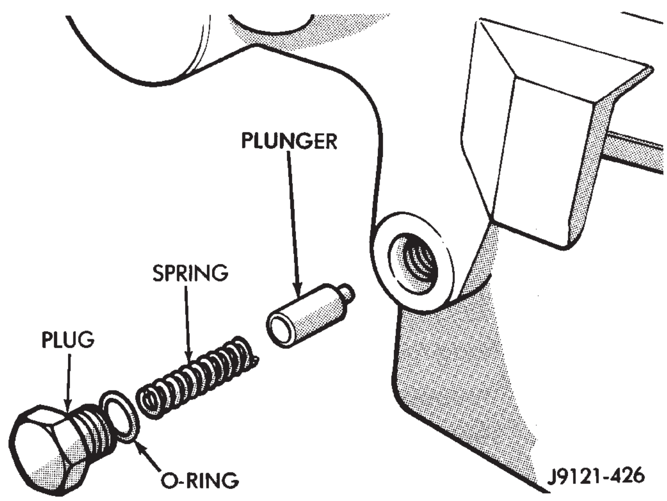


Fig. 81 Detent Pin, Spring And Plug Installation

(4) Install drive sprocket snap-ring (Fig. 83).

OIL PUMP AND REAR CASE INSTALLATION

(1) Insert oil pickup tube in oil pump and attach oil screen and connector hose to pickup tube. Then install assembled pump, tube and screen in rear case (Fig. 84). Be sure screen is seated in case slot as shown.

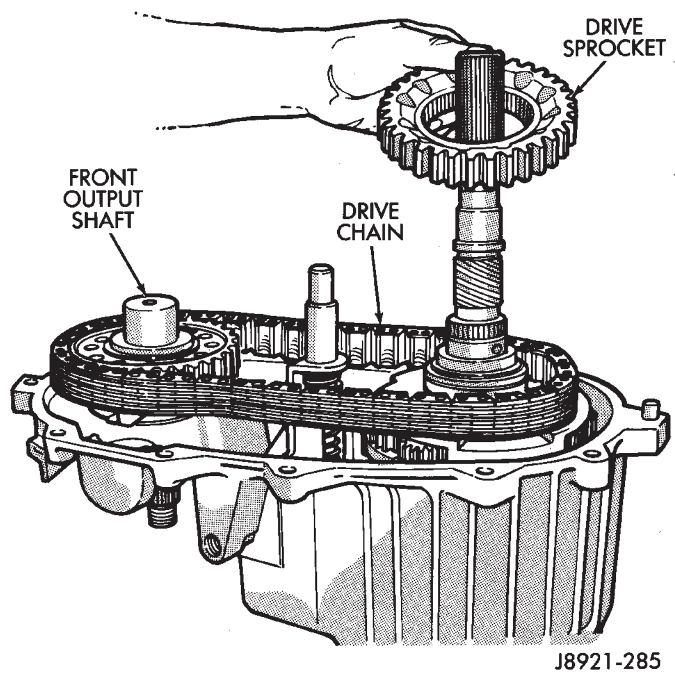


Fig. 82 Drive Chain And Sprocket Installation

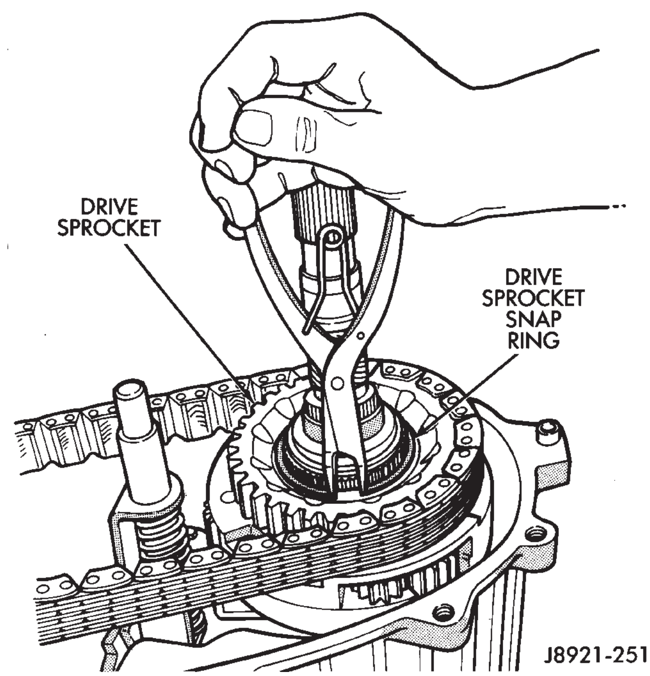


Fig. 83 Drive Sprocket Snap-Ring Installation

(2) Install magnet in front case pocket (Fig. 85).

(3) Apply 3 mm (1/8 in.) wide bead of Mopar gasket maker or silicone adhesive sealer to seal surface of front case.

(4) 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.

(5) 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.**

DISASSEMBLY AND ASSEMBLY (Continued)

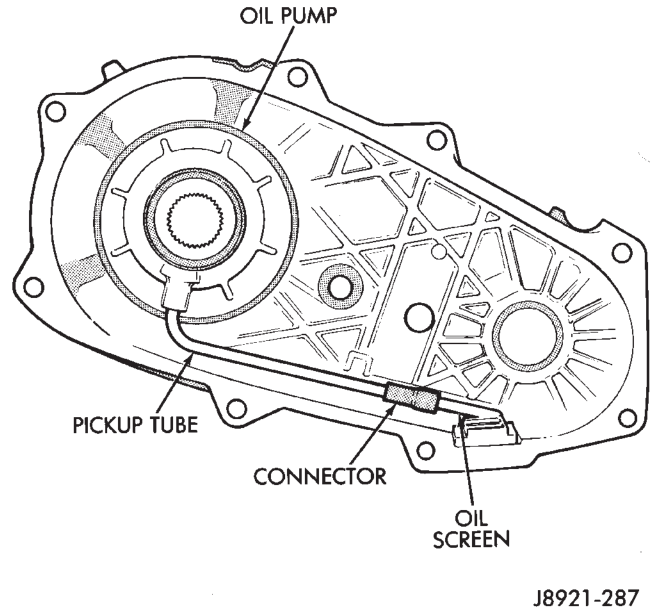


Fig. 84 Oil Screen And Pickup Tube Installation

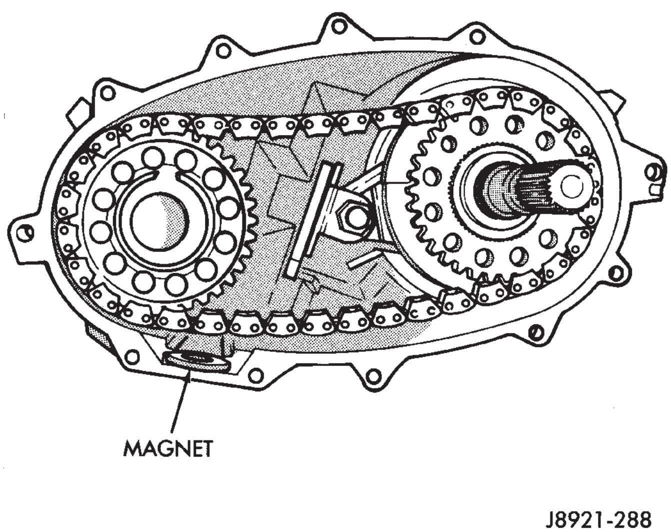


Fig. 85 Installing Case Magnet

REAR RETAINER INSTALLATION

(1) Remove rear bearing in retainer using Installer 8128 and Handle C-4171.

(2) Install rear bearing in retainer with Tools C-4171 and 5064 (Fig. 86).

(3) Install rear bearing O.D. retaining ring with snap-ring pliers (Fig. 87). Be sure retaining ring is fully seated in retainer groove.

(4) Apply bead of Mopar® Sealer P/N 82300234, or Loctite™ Ultra Gray, to mating surface of rear retainer. Sealer bead should be a maximum of 3/16 in.

(5) Install rear retainer on rear case. Tighten retainer bolts to 20–27 N·m (15–20 ft. lbs.) torque.

(6) Install rear bearing I.D. retaining ring and spacer on output shaft.

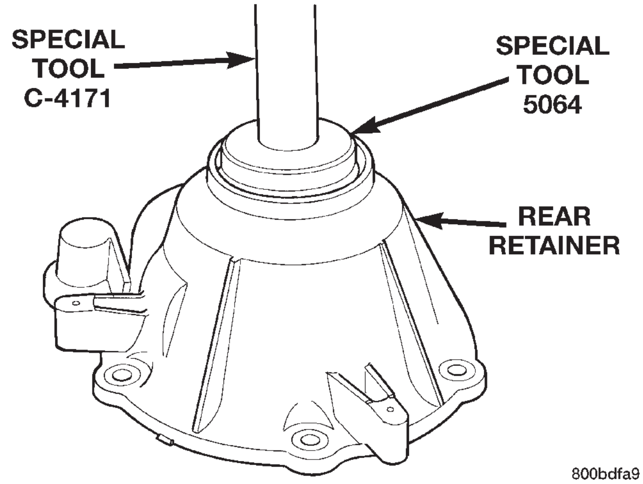


Fig. 86 Installing Rear Bearing In Retainer

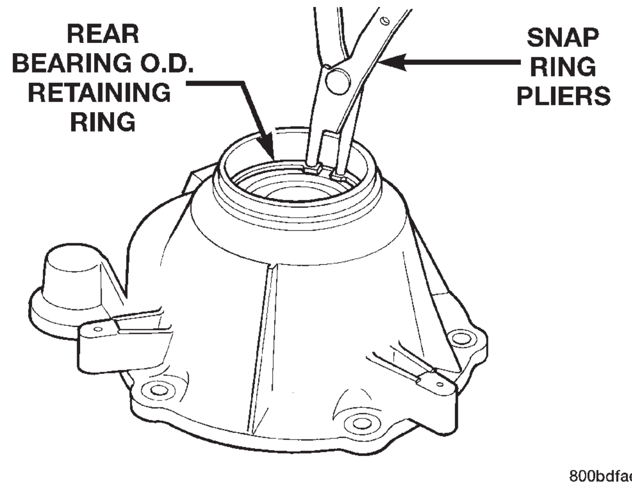


Fig. 87 Rear Bearing Retaining Ring Installation

(7) Apply liberal quantity of petroleum jelly to new rear seal and to output shaft. Petroleum jelly is needed to protect seal lips during installation.

(8) Slide seal onto Seal Protector 6992 (Fig. 88). Slide seal protector and seal onto output shaft.

(9) Slide Installer C-4076-B onto seal protector with the recessed side of the tool toward the seal. Drive seal into rear bearing retainer with installer C-4076-B and handle MD-998323 (Fig. 89).

(10) Install rear slinger with installer C-4076-A and handle MD-998323 (Fig. 89).

(11) Install boot on output shaft slinger and crimp retaining clamp with tool C-4975-A (Fig. 90).

COMPANION FLANGE INSTALLATION

(1) Lubricate companion flange hub with transmission fluid and install flange on front shaft.

(2) Install new seal washer on front shaft.

(3) Install flange on front shaft and tighten nut to 122–176 N·m (90–130 ft. lbs.).

DISASSEMBLY AND ASSEMBLY (Continued)

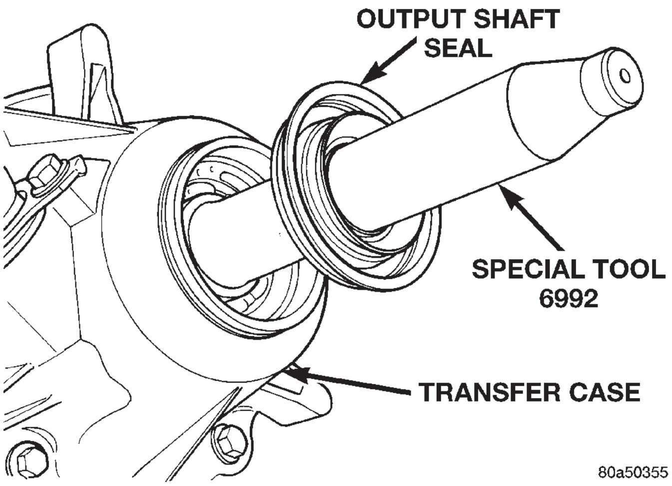


Fig. 88 Output Shaft Seal and Protector

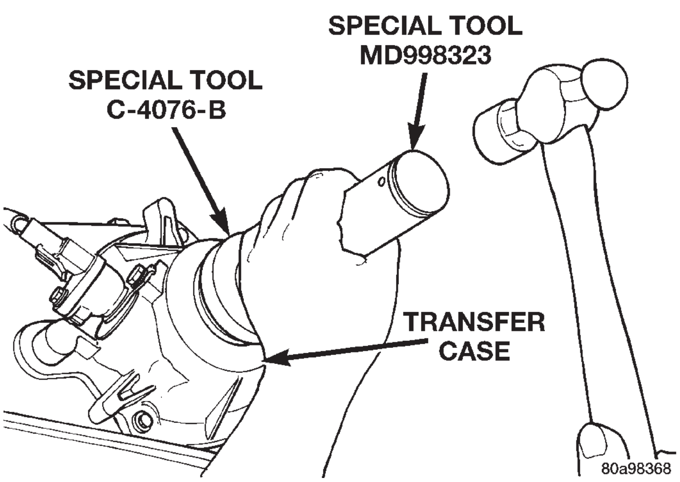


Fig. 89 Rear Seal Installation

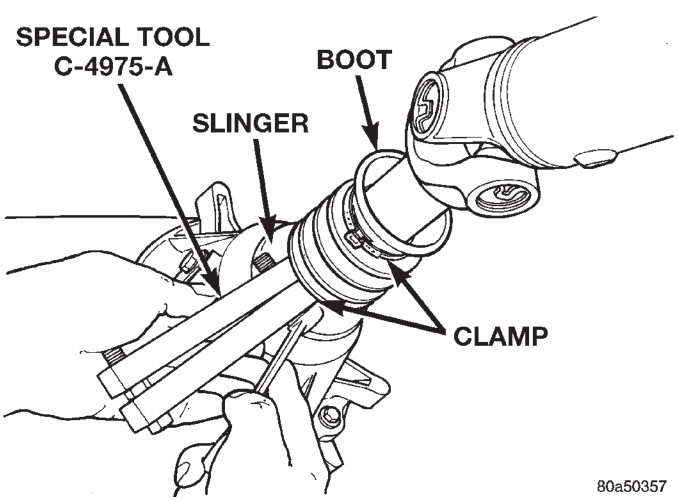


Fig. 90 Slinger Boot Installation

CLEANING AND INSPECTION

NV242 TRANSFER CASE

Clean the transfer case parts with a standard parts cleaning solvent. Remove all traces of sealer from the cases and retainers with a scraper and all purpose cleaner. Use compressed air to remove solvent residue from oil feed passages in the case halves, retainers, gears, and shafts.

The oil pickup screen can be cleaned with solvent. Shake excess solvent from the screen after cleaning and allow it to air dry. Do not use compressed air.

MAINSHAFT/SPROCKET/HUB INSPECTION

Inspect the splines on the hub and shaft and the teeth on the sprocket. Minor nicks and scratches can be smoothed with an oilstone. However, replace any part is damaged.

Check the contact surfaces in the sprocket bore and on the mainshaft. Minor nicks and scratches can be smoothed with 320–400 grit emery cloth but do not try to salvage the shaft if nicks or wear is severe.

INPUT GEAR AND PLANETARY CARRIER

Check the teeth on the gear (Fig. 91). Minor nicks can be dressed off with an oilstone but replace the gear if any teeth are broken, cracked, or chipped. The bearing surface on the gear can be smoothed with 300–400 grit emery cloth if necessary.

Examine the carrier body and pinion gears for wear or damage. The carrier will have to be replaced as an assembly if the body, pinion pins, or pinion gears are damaged.

Check the lock ring and both thrust washers for wear or cracks. Replace them if necessary. Also replace the lock retaining ring if bent, distorted, or broken.

SHIFT FORKS/HUBS/SLEEVES

Check condition of the shift forks and mode fork shift rail (Fig. 92). Minor nicks on the shift rail can be smoothed with 320–400 grit emery cloth.

Inspect the shift fork wear pads. The mode fork pads are serviceable and can be replaced if necessary. The range fork pads are also serviceable.

Check both of the sleeves for wear or damage, especially on the interior teeth. Replace the sleeves if wear or damage is evident.

REAR RETAINER/BEARING/ SEAL/SLINGER/BOOT

Inspect the retainer components (Fig. 93). Replace the bearing if rough or noisy. Check the retainer for cracks or wear in the bearing bore. Clean the retainer sealing surfaces with a scraper and all purpose cleaner. This will ensure proper adhesion of the sealer during reassembly.

CLEANING AND INSPECTION (Continued)

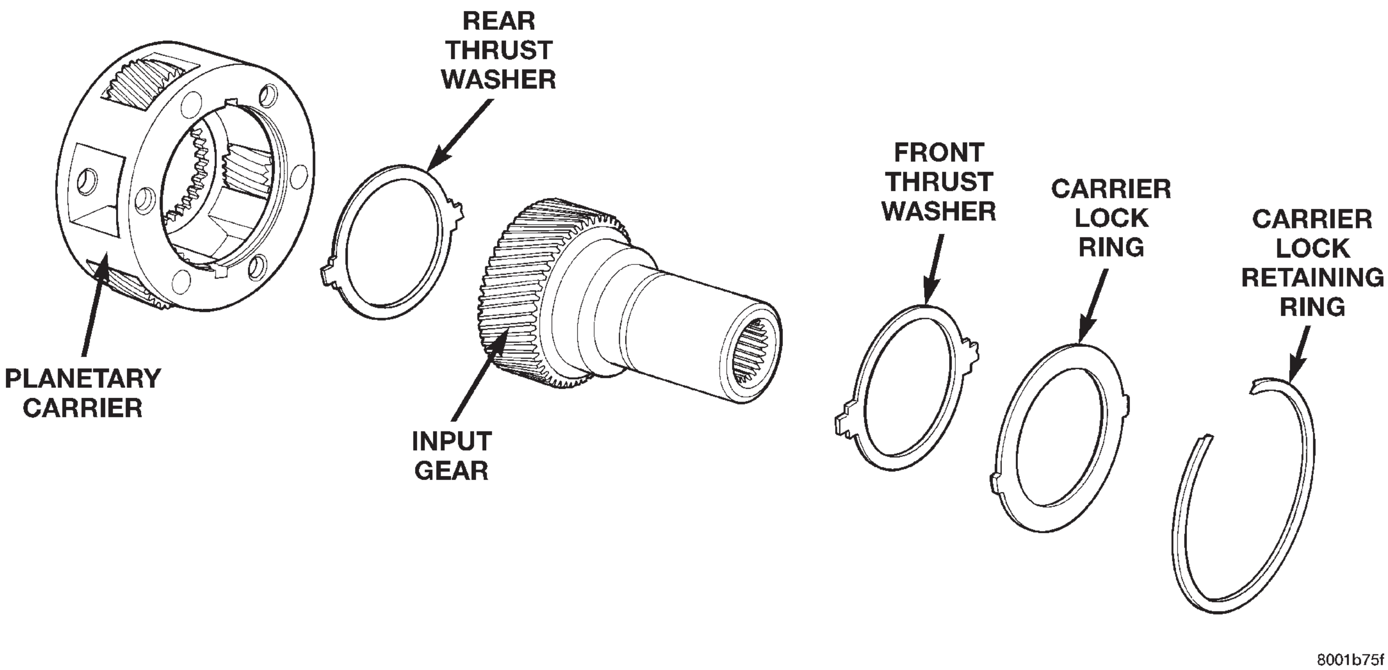


Fig. 91 Input Gear And Carrier Components

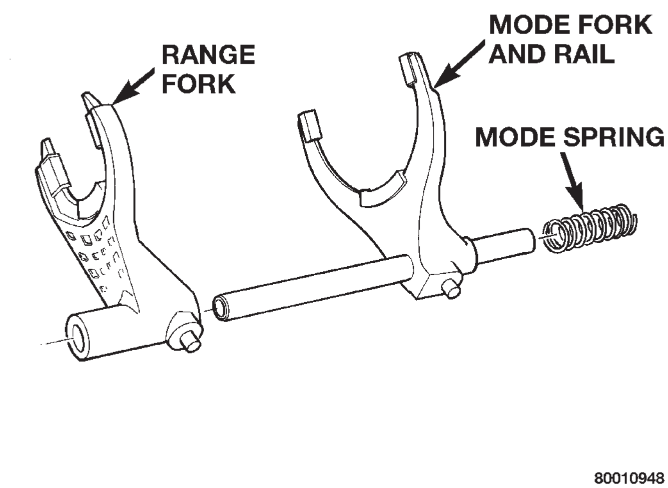


Fig. 92 Shift forks

Replace the slinger and seal outright; do not reuse either part.

Inspect the retaining rings and washers. Replace any part if distorted, bent, or broken. Reuse is not recommended. Also replace the boot if cut or torn. Replace the boot band clamps, do not reuse them.

REAR OUTPUT SHAFT/YOKE/DRIVE CHAIN

Check condition of the seal contact surfaces of the yoke slinger (Fig. 94). This surface must be clean and smooth to ensure proper seal life. Replace the yoke nut and seal washer as neither part should be reused.

Inspect the shaft threads, sprocket teeth, and bearing surfaces. Minor nicks on the teeth can be smoothed with an oilstone. Use 320–400 grit emery to smooth minor scratches on the shaft bearing surfaces. Rough threads on the shaft can be chased if necessary. Replace the shaft if the threads are damaged, bearing surfaces are scored, or if any sprocket teeth are cracked or broken.

Examine the drive chain and shaft bearings. Replace the chain and both sprockets if the chain is stretched, distorted, or if any of the links bind. Replace the bearings if rough, or noisy.

LOW RANGE ANNULUS GEAR

Inspect annulus gear condition carefully. The gear is only serviced as part of the front case. If the gear is damaged, it will be necessary to replace the gear and front case as an assembly. Do not attempt to remove the gear (Fig. 95).

FRONT-REAR CASES AND FRONT RETAINER

Inspect the cases and retainer for wear and damage. Clean the sealing surfaces with a scraper and all purpose cleaner. This will ensure proper sealer adhesion at assembly. Replace the input retainer seal; do not reuse it.

Check case condition. If leaks were a problem, look for gouges and severe scoring of case sealing surfaces. Also make sure the front case mounting studs are in good condition.

CLEANING AND INSPECTION (Continued)

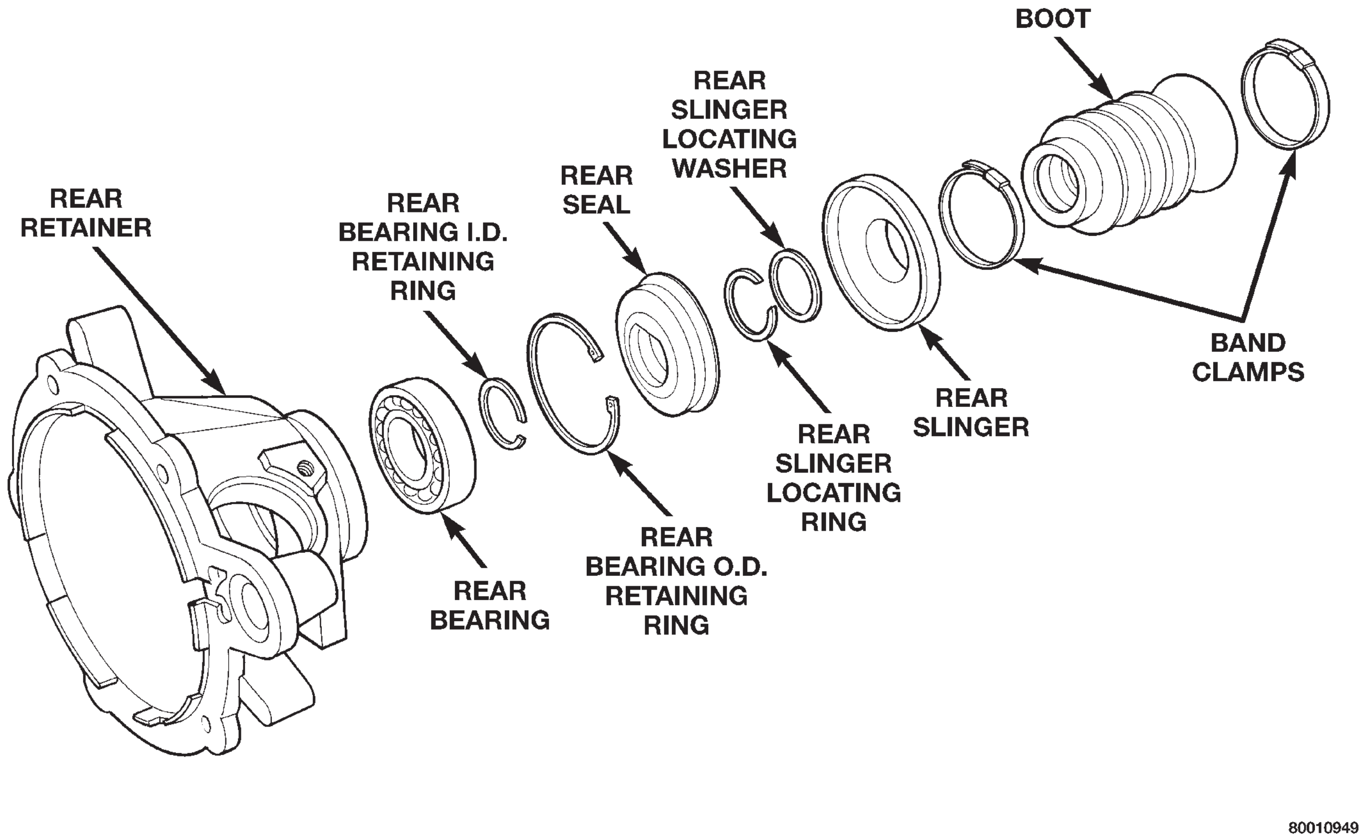


Fig. 93 Rear Retainer Components

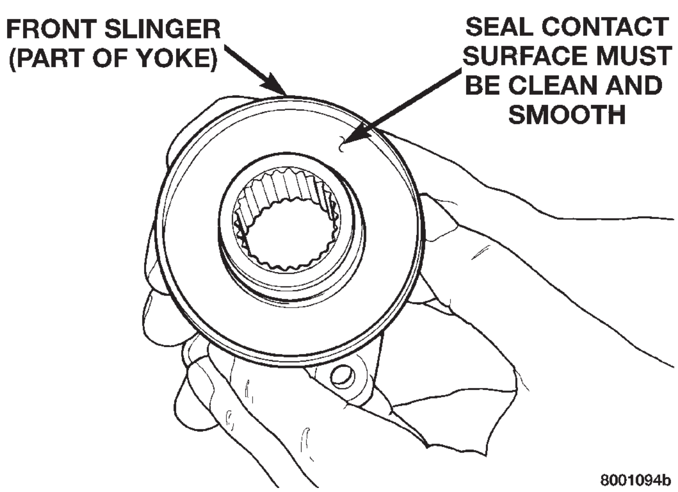


Fig. 94 Seal Contact Surface Of Yoke Slinger

Check the front case mounting studs and vent tube. The tube can be secured with Loctite™ 271 or 680 if loose. The stud threads can be cleaned up with a die if necessary. Also check condition of the fill/drain plug threads in the rear case. The threads can be repaired with a thread chaser or tap if necessary. Or the threads can be repaired with Helicoil stainless steel inserts if required.

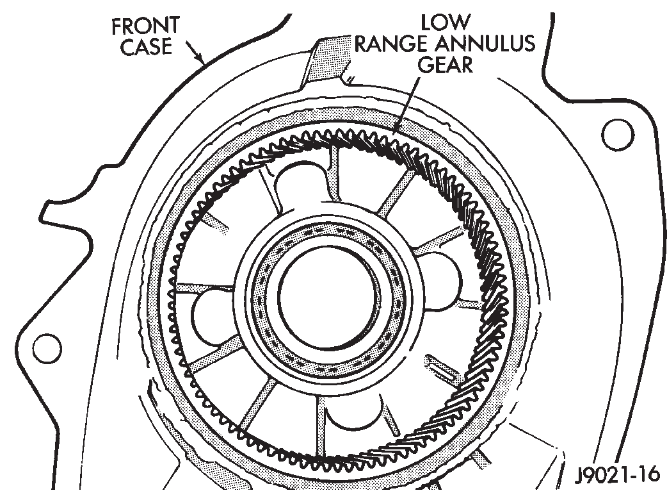


Fig. 95 Low Range Annulus Gear

OIL PUMP/OIL PICKUP

Examine the oil pump pickup parts. Replace the pump if any part appears to be worn or damaged. Do not disassemble the pump as individual parts are not available. The pump is only available as a complete assembly. The pickup screen, hose, and tube are the only serviceable parts and are available separately.

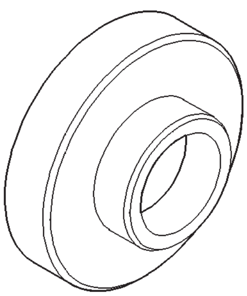
SPECIFICATIONS

TORQUE

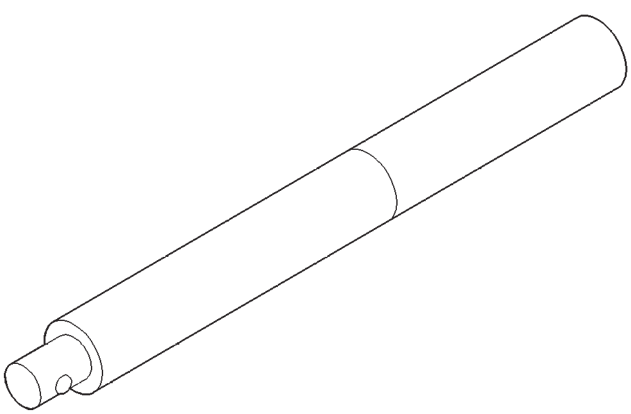
DESCRIPTION	TORQUE
Plug, Detent	16–24 N·m (12–18 ft. lbs.)
Bolt, Diff. Case	17–27 N·m (15–24 ft. lbs.)
Plug, Drain/Fill	20–25 N·m (15–25 ft. lbs.)
Bolt, Front Brg. Retainer	16–27 N·m (12–20 ft. lbs.)
Bolt, Case Half	35–46 N·m (26–34 ft. lbs.)
Nut, Front Yoke	122–176 N·m (90–130 ft. lbs.)
Screw, Oil Pump	1.2–1.8 N·m (12–15 in. lbs.)
Nut, Range Lever	27–34 N·m (20–25 ft. lbs.)
Bolt, Rear Retainer	35–46 N·m (26–34 ft. lbs.)
Nuts, Mounting	35 N·m (26 ft. lbs.)
Bolts, U-Joint	19 N·m (17 ft. lbs.)

SPECIAL TOOLS

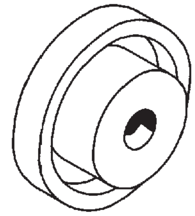
NV242



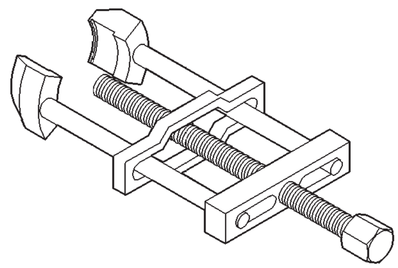
Installer—C-4076-B



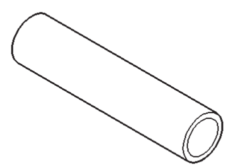
Handle, Universal—C-4171



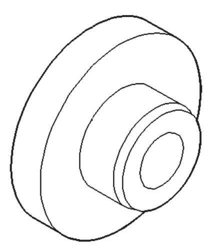
Remover—C-4210



Puller, Slinger—MD-998056–A

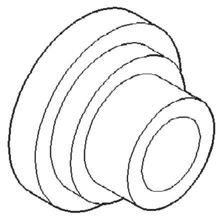


Installer—MD-998323

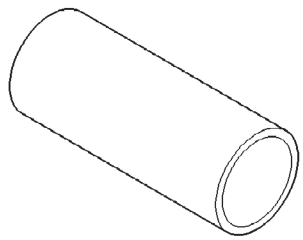


Installer, Bearing—5064

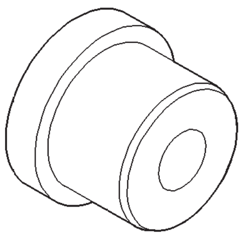
SPECIAL TOOLS (Continued)



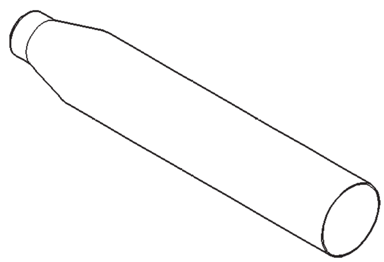
Installer—8128



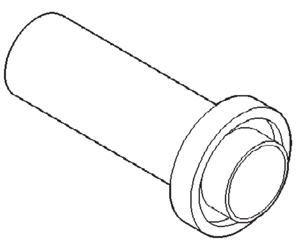
Cup—8148



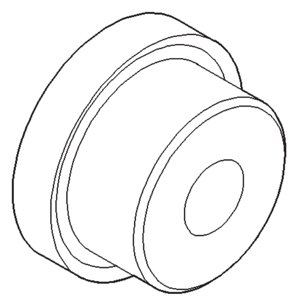
Installer—5066



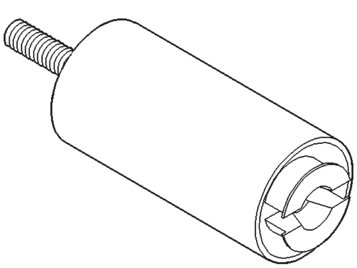
Seal Protector—6992



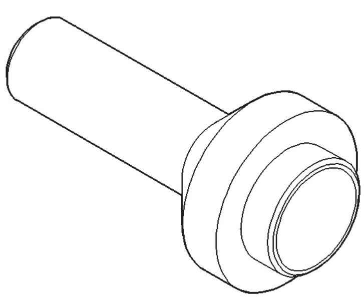
Installer—6952-A



Installer, Input Gear Bearing—7829-A

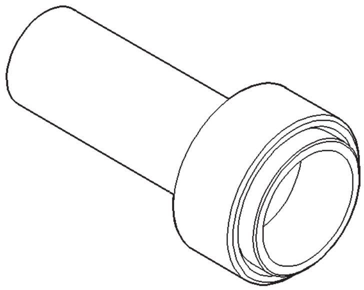


Remover—L-4454

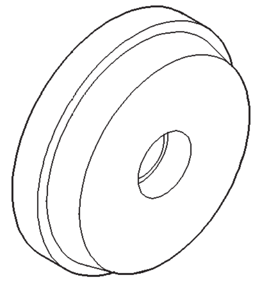


Installer, Seal—7884

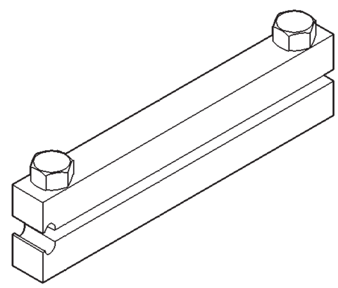
SPECIAL TOOLS (Continued)



Installer, Pump Housing Seal—7888



Installer, Bearing—8033-A



Installer, Boot Clamp—C-4975-A

NV247 TRANSFER CASE

INDEX

GENERAL INFORMATION

GENERAL INFORMATION

NV247 TRANSFER CASE OPERATION

The NV247 (Fig. 2) is an on-demand 4-wheel drive transfer case with two operating ranges and a neutral position. Operating ranges are 4-high and 4-low. The 4-low range is used for extra pulling power in off-road situations.

Under normal driving conditions, the system operates conventionally, and the majority of available torque is applied to the rear wheels. However, when front-to-rear wheel speed variations exist, the progressive differential transfers torque to the axle with the better traction, thus minimizing wheel spin and maximizing control.

The key to this design is a progressive coupling (Fig. 1), which is supplied with pressurized oil by a gerotor style pump. The pump rotor and case are driven by the front and rear driveshafts respectively, and deliver pressurized oil flow to the coupling in proportion to their speed difference. The progressive coupling contains a multi-disc clutch pack that is alternately splined to the front and rear driveshafts, and controls torque variation between the front and rear driveshafts as dictated by the pump.

A set of orifices and valves control the speed-differential starting point and rate of torque transfer rise in the clutch. This allows the system to disregard the normal speed differences between axles that result from variations in front-to-rear loading and typical cornering.

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 cable. Range positions are marked on the shifter bezel plate.

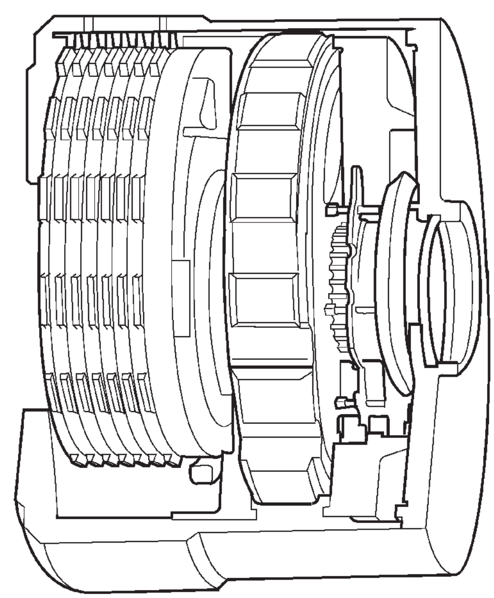


Fig. 1 Progressive Coupling

GENERAL INFORMATION (Continued)

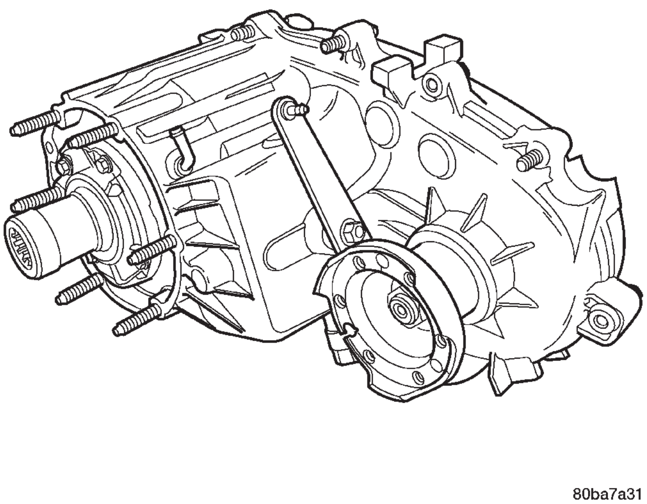


Fig. 2 NV247 Transfer Case

TRANSFER CASE IDENTIFICATION

A circular I.D. tag is attached to the rear case of each NV247 transfer case (Fig. 3). The tag indicates the following information:

- Model number
- Serial number
- Assembly number
- Gear ratio
- Location of manufacture

The transfer case serial number also represents the date of build.

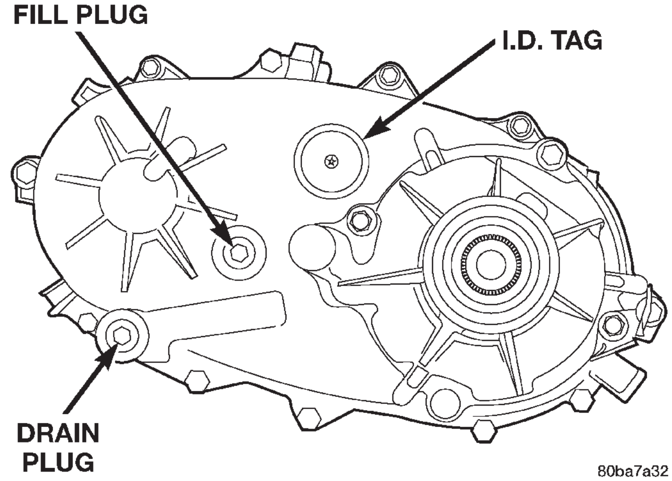


Fig. 3 Transfer Case I.D. Tag

RECOMMENDED LUBRICANT AND FILL LEVEL

Mopar® Dexron II, or ATF Plus are the only lubricants recommended for the NV247 transfer case. Approximate fluid refill capacity is approximately 1.18 liters (2.50 pints).

The fill and drain plugs are both in the rear case. Correct fill level is to the bottom edge of the fill plug hole. Be sure that the vehicle is level to ensure an accurate fluid level check.

DIAGNOSIS AND TESTING

NV247 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	1. Reduce speed to 3-4 km/h (2-3 mph) before attempting to shift
	2. Transfer case external shift cable binding	2. Lubricate, repair or replace cable, or tighten loose components as necessary
	3. Insufficient or incorrect lubricant	3. Drain and refill to edge of fill hole with Mopar ATF PLUS (Type 7176) or DEXRON II Automatic Transmission Fluid
	4. Internal components binding, worn, or damaged	4. Disassemble unit and replace worn or damaged components as necessary
TRANSFER CASE NOISY IN ALL MODES	1. Insufficient or incorrect lubricant	1. Drain and refill to edge of fill hole with Mopar ATF PLUS (Type 7176) or DEXRON II Automatic Transmission Fluid. **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 4WD LOW RANGE	1. Transfer case not completely engaged in 4WD LOW (possibly from shift to 4L while rolling)	1. Stop vehicle, shift transfer case to neutral, then shift back to 4WD LOW
	2. Shift linkage loose, binding, or is misadjusted	2. Tighten, lubricate, or repair linkage as necessary. Adjust linkage if necessary
	3. Range fork cracked, inserts worn, or fork is binding on shift rail	3. Disassemble unit and repair as necessary
	4. Annulus gear or lockplate worn or damaged	4. Disassemble unit and repair as necessary
LUBRICANT LEAKING FROM OUTPUT SHAFT SEALS OR FROM VENT	1. Transfer case over filled	1. Drain to correct level
	2. Vent closed or restricted	2. Clear or replace vent if necessary
	3. Output shaft seals damaged or installed correctly	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.

REMOVAL AND INSTALLATION

TRANSFER CASE

REMOVAL

(1) Shift transfer case into Neutral.
(2) Raise vehicle.
(3) Remove transfer case drain plug and drain transfer case lubricant.
(4) Mark front and rear propeller shaft yokes for alignment reference.
(5) Support transmission with jack stand.
(6) Remove rear crossmember and skid plate, if equipped (Fig. 4).

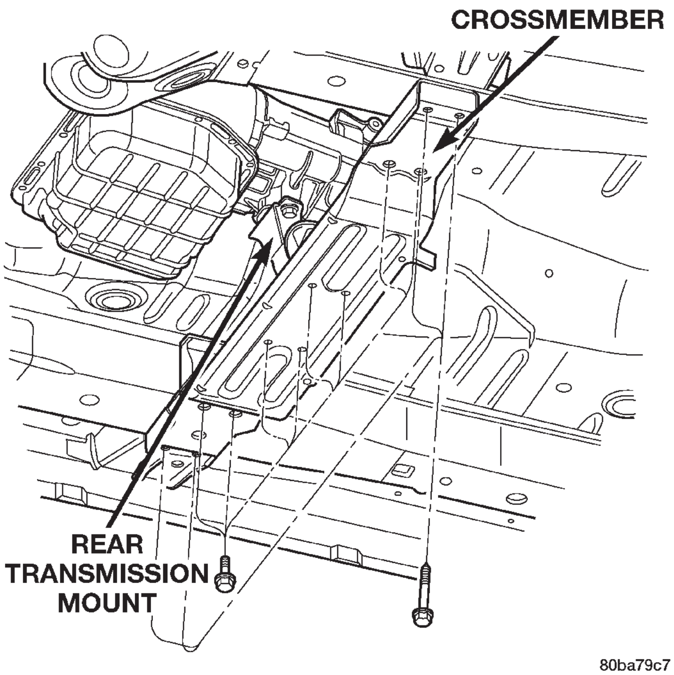


Fig. 4 Crossmember Removal/Installation

(7) Disconnect front propeller shaft from transfer case at companion flange. Remove rear propeller shaft from vehicle. Refer to Group 3, Differential and Driveline for the correct procedures.

CAUTION: Do not allow propshafts to hang at attached end. Damage to joint can result.

(8) Disconnect transfer case cable from range lever.
(9) Disconnect transfer case vent hose (Fig. 5).
(10) Support transfer case with transmission jack.
(11) Secure transfer case to jack with chains.
(12) Remove nuts attaching transfer case to transmission.
(13) Pull transfer case and jack rearward to disengage transfer case (Fig. 5).
(14) Remove transfer case from under vehicle.

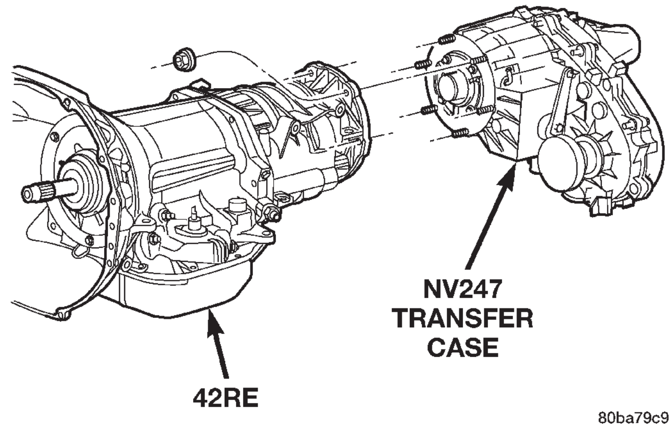


Fig. 5 Transfer Case Mounting

INSTALLATION

(1) Mount transfer case on a transmission jack.
(2) Secure transfer case to jack with chains.
(3) Position transfer case under vehicle.
(4) Align transfer case and transmission shafts and install transfer case on transmission.
(5) Install and tighten transfer case attaching nuts to 35 N·m (26 ft. lbs.) torque (Fig. 5).
(6) Connect front propeller shaft and install rear propeller shaft. Refer to Group 3, Differential and Driveline, for proper procedures and torque specifications.
(7) Fill transfer case with correct fluid. Check transmission fluid level. Correct as necessary.
(8) Install rear crossmember (Fig. 4) and skid plate, if equipped. Tighten crossmember bolts to 41 N·m (30 ft. lbs.) torque.
(9) Remove transmission jack and support stand.
(10) Verify transfer case is in Neutral. Connect shift cable to transfer case range lever.
(11) Lower vehicle and verify transfer case shift operation.
(12) Adjust the transfer case shift cable, if necessary.

TRANSFER CASE SHIFT CABLE

REMOVAL

(1) Shift transfer case into neutral.
(2) Raise vehicle.
(3) Disconnect the shift cable eyelet from the transfer case shift lever (Fig. 6).
(4) Remove shift cable from the cable support bracket.
(5) Lower vehicle.
(6) Remove shift lever bezel and necessary console parts for access to shift lever assembly and shift cable.

REMOVAL AND INSTALLATION (Continued)

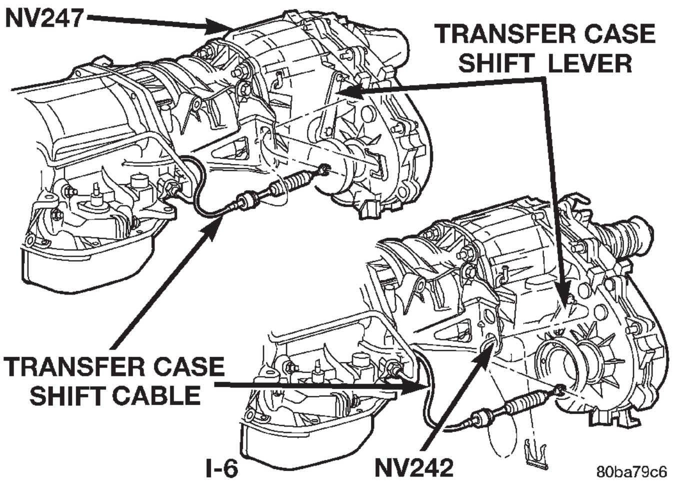


Fig. 6 Transfer Case Shift Cable at Transfer Case

(7) Disconnect cable at shift lever and shifter assembly bracket (Fig. 7).

(8) Remove the nuts holding the shift cable seal plate to the floor pan (Fig. 8).

(9) Pull cable through floor panel opening.

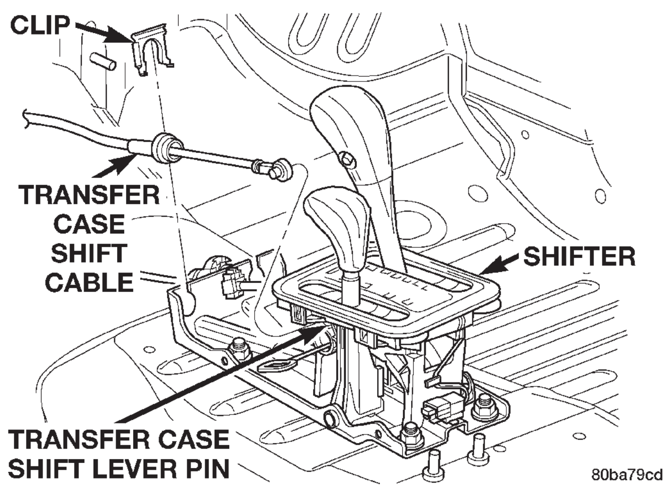


Fig. 7 Transfer Case Shift Cable at Shifter

(10) Remove transfer case shift cable from vehicle.

INSTALLATION

(1) Route cable through hole in floor pan.

(2) Install seal plate to studs in floor pan.

(3) Install nuts to hold seal plate to floor pan (Fig. 8). Tighten nuts to 7 N·m (65 in. lbs.).

(4) Install the transfer case shift cable to the shifter assembly bracket. Seat cable in bracket and install clip (Fig. 7).

(5) Verify the transfer case shift lever (at console) is in the NEUTRAL position.

(6) Snap the cable onto the shift lever pin (Fig. 7).

(7) Raise the vehicle.

(8) Install the shift cable to the shift cable support bracket and install clip (Fig. 6).

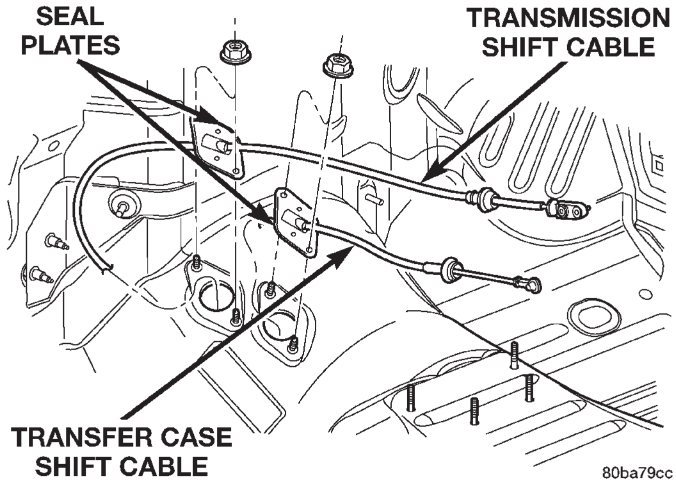


Fig. 8 Shift Cables at Floor Pan

(9) Verify that the transfer case is still in the NEUTRAL position.

(10) Snap the shift cable onto the transfer case shift lever (Fig. 6).

(11) Lower vehicle.

(12) Verify correct transfer case operation in all ranges.

(13) Install shift lever bezel and any console parts removed for access to transfer case shift cable.

FRONT OUTPUT SHAFT SEAL

REMOVAL

(1) Raise vehicle on hoist.

(2) Remove front propeller shaft. Refer to Group 3, Differential and Driveline, for proper procedure.

(3) Remove front output shaft companion shaft.

(4) Remove seal from front case with pry tool (Fig. 9).

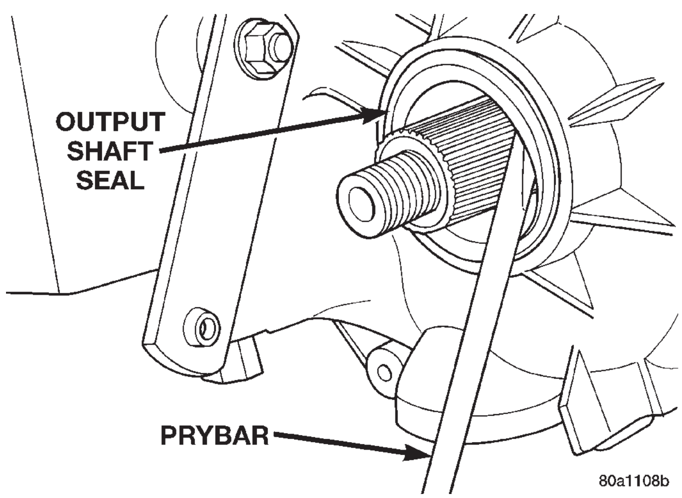


Fig. 9 Remove Front Output Shaft Seal

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Install new front output seal in front case with Installer Tool 6952-A as follows:

(a) Place new seal on tool. Garter spring on seal goes toward interior of case.

(b) Start seal in bore with light taps from hammer (Fig. 10). Once seal is started, continue tapping seal into bore until installer tool seats against case.

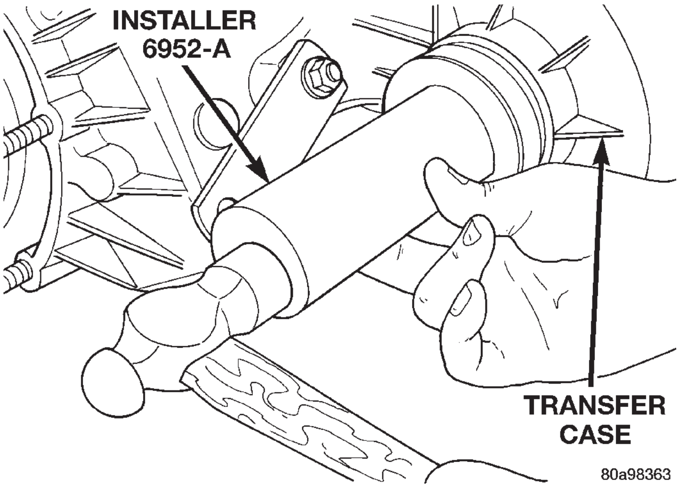


Fig. 10 Front Output Seal Installation

(2) Install companion flange and torque nut to 122–176 N·m (90–130 ft. lbs.).

(3) Install front propeller shaft. Refer to Group 3, Differential and Driveline for proper procedures and torque specifications.

REAR RETAINER BUSHING AND SEAL

REMOVAL

(1) Raise vehicle on hoist.

(2) Remove rear propeller shaft. Refer to Group 3, Differential and Driveline, for proper procedure.

(3) Using a suitable pry tool or slide-hammer mounted screw, remove the rear retainer seal.

(4) Using Remover 6957, remove bushing from rear retainer (Fig. 11).

INSTALLATION

(1) Clean fluid residue from sealing surface and inspect for defects.

(2) Position replacement bushing in rear retainer with fluid port in bushing aligned with slot in retainer.

(3) Using Installer 8145, drive bushing into retainer until installer seats against case (Fig. 12).

(4) Using Installer C-3995-A, install seal in rear retainer (Fig. 13).

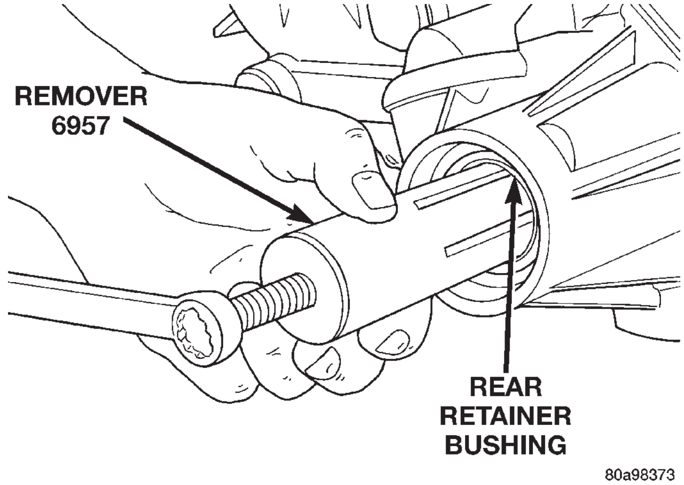


Fig. 11 Rear Retainer Bushing Removal

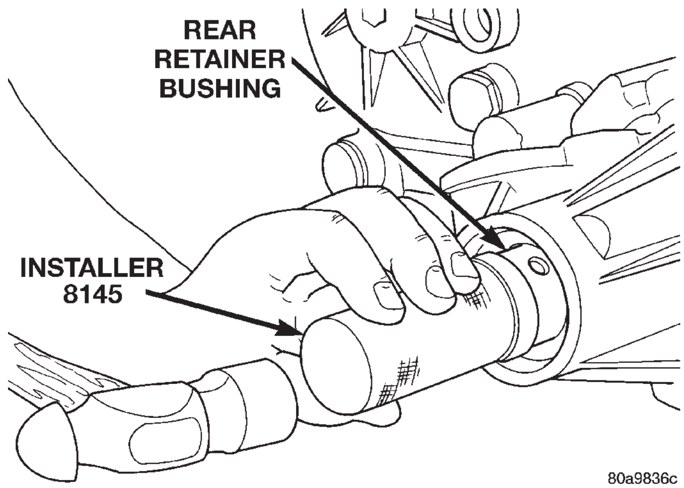


Fig. 12 Rear Retainer Bushing Install

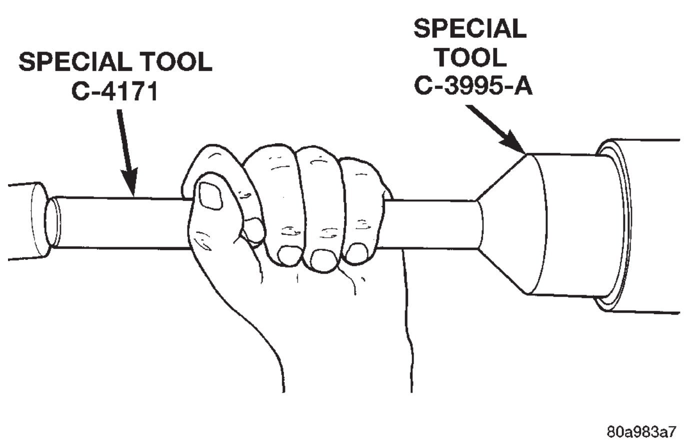


Fig. 13 Install Rear Retainer Seal

(5) Install rear propeller shaft. Refer to Group 3, Differential and Driveline for proper procedures and specifications.

(6) Verify proper fluid level.

(7) Lower vehicle.

DISASSEMBLY AND ASSEMBLY

NV247 TRANSFER CASE

DISASSEMBLY

Position transfer case on shallow drain pan. Remove drain plug and drain lubricant remaining in case.

REAR RETAINER AND OIL PUMP REMOVAL

(1) Remove rear retainer bolts (Fig. 14).

(2) Remove rear bearing locating ring access plug (Fig. 15).

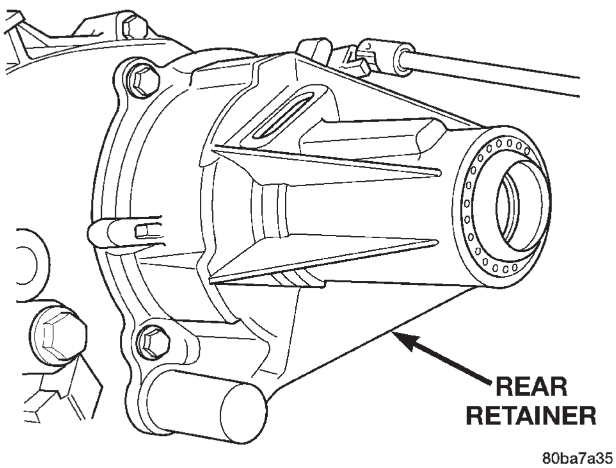


Fig. 14 Rear Retainer Bolt Removal

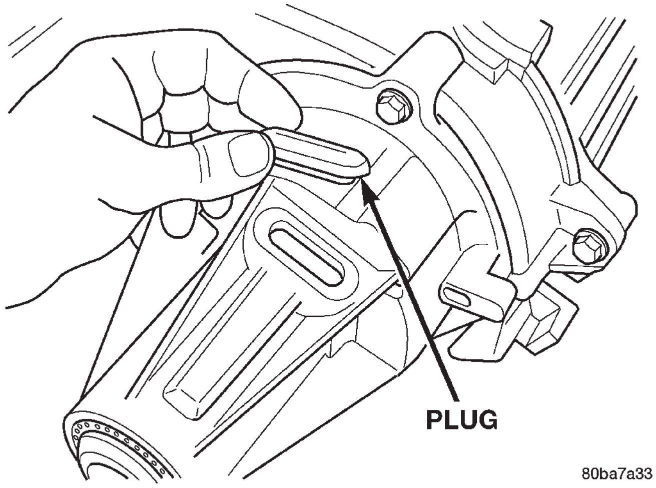


Fig. 15 Remove Rubber Access Plug

(3) Loosen rear retainer with pry tool to break sealer bead. Pry only against retainer boss as shown (Fig. 16).

(4) Remove rear retainer as follows:

(a) Spread rear bearing locating ring with snap ring pliers (Fig. 17).

(b) Then slide retainer off mainshaft and rear bearing (Fig. 18).

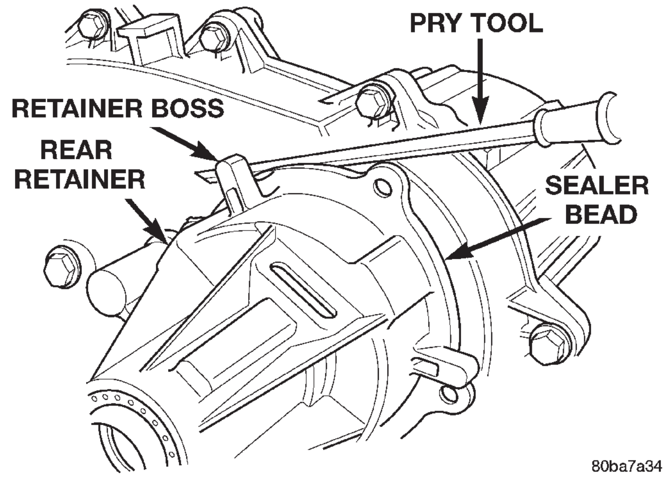


Fig. 16 Loosening Rear Retainer

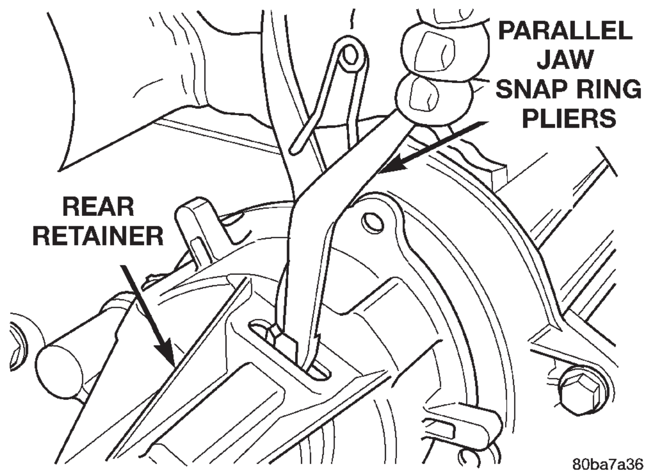


Fig. 17 Disengaging Rear Bearing Locating Ring

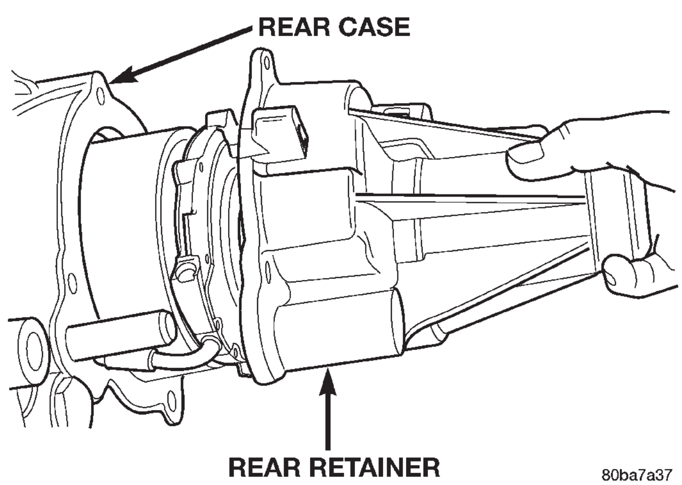


Fig. 18 Rear Retainer Removal

(5) Remove rear bearing snap-ring.

(6) Remove rear bearing. Note position of bearing locating ring groove for assembly reference.

DISASSEMBLY AND ASSEMBLY (Continued)

(7) Disengage oil pickup tube from oil pump and remove oil pump assembly (Fig. 19).

(8) Remove pick-up tube o-ring from oil pump (Fig. 20), if necessary. Do not disassemble the oil pump, it is not serviceable.

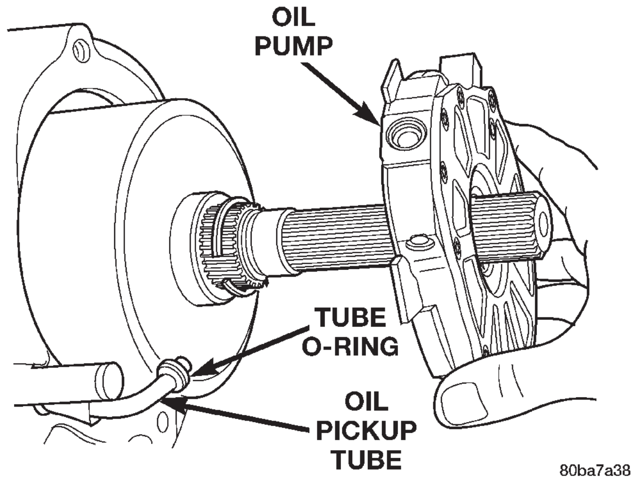


Fig. 19 Rear Bearing and Oil Pump Removal

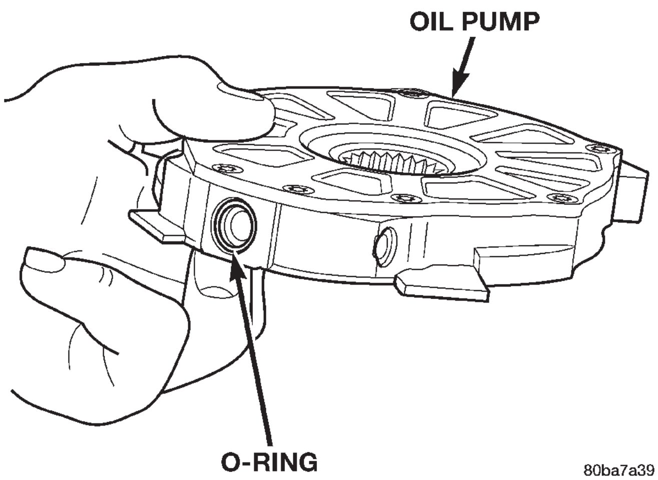


Fig. 20 Pick-up Tube O-ring Location

PROGRESSIVE COUPLING REMOVAL

(1) Remove oil pump locating snap-ring and progressive coupling snap-ring from mainshaft (Fig. 21).

(2) Remove progressive coupling from mainshaft (Fig. 21).

COMPANION FLANGE AND RANGE LEVER REMOVAL

(1) Remove front companion flange nut as follows:

(a) Move range lever to 4L position.

(b) Remove nut with socket and impact wrench.

(2) Remove companion flange. If flange is difficult to remove by hand, remove it with bearing splitter, or with standard two jaw puller. Be sure puller tool is positioned on flange and not on slinger as slinger will be damaged.

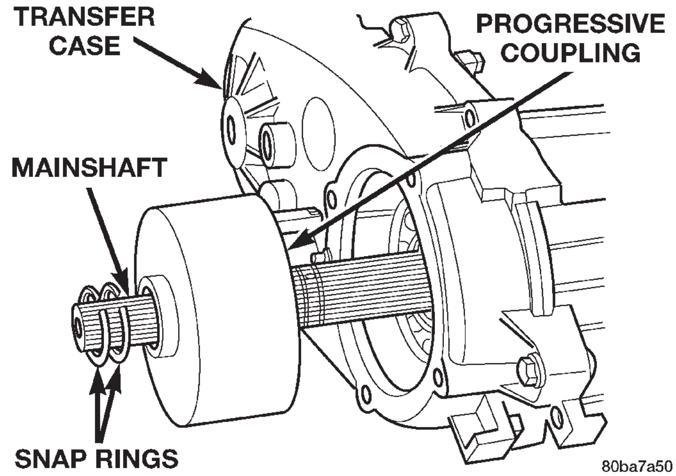


Fig. 21 Progressive Coupling Removal

(3) Remove seal washer from front output shaft. Discard washer as it should not be reused.

(4) Remove nut and washer that attach range lever to sector shaft. Then move sector to neutral position and remove range lever from shaft.

NOTE: Note position of range lever so it can be re-installed correctly.

FRONT OUTPUT SHAFT AND DRIVE CHAIN REMOVAL

(1) Support transfer case so rear case is facing upward.

(2) Remove bolts holding front case to rear case. The case alignment bolt require flat washers (Fig. 22).

(3) Loosen rear case with flat blade screwdriver to break sealer bead. Insert screwdriver blade only into notches provided at each end of case (Fig. 23).

(4) Remove rear case (Fig. 24).

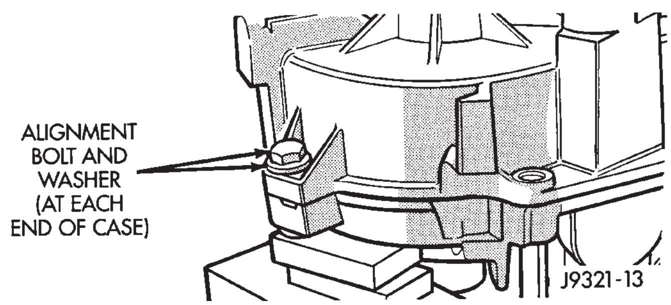


Fig. 22 Rear Case Alignment Bolt Locations

(5) Remove oil pickup tube from rear case (Fig. 25).

(6) Remove drive gear snap-ring (Fig. 26).

(7) Disengage drive gear (Fig. 26). Pry gear upward and off mainshaft as shown.

(8) Remove front output shaft, drive chain and drive gear as assembly (Fig. 26).

(9) Remove output shaft drive gear snap ring.

DISASSEMBLY AND ASSEMBLY (Continued)

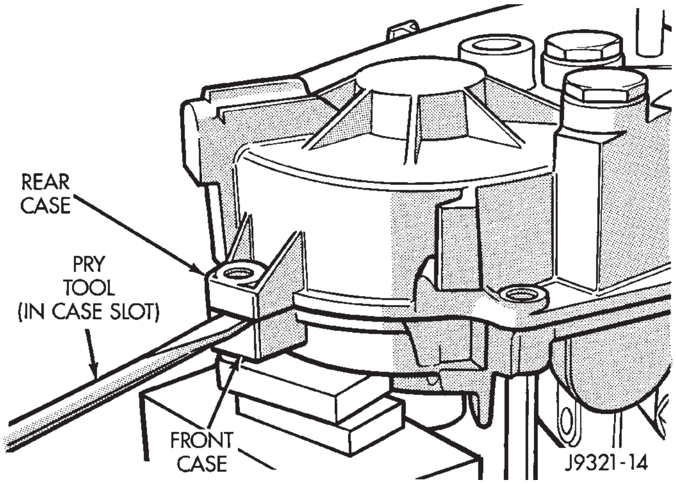


Fig. 23 Loosening Rear Case

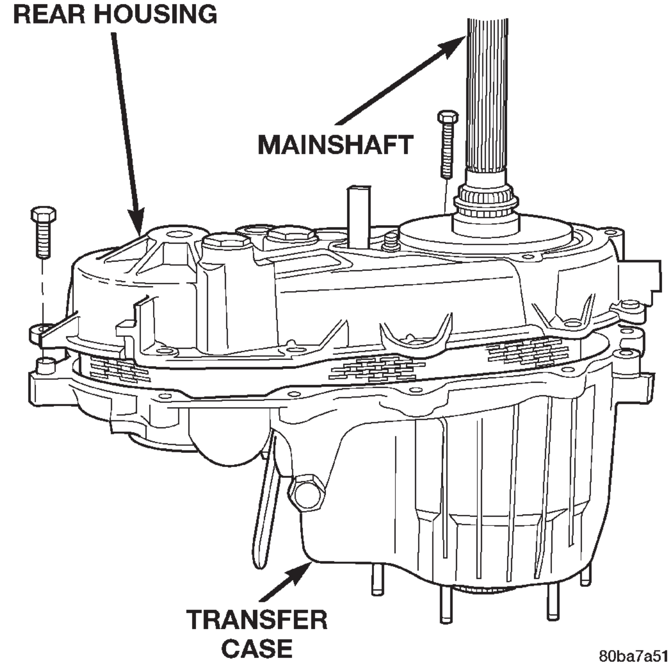


Fig. 24 Rear Case Removal

(10) Remove output shaft drive gear from output shaft.

SHIFT FORKS AND MAINSHAFT REMOVAL

(1) Remove detent plug, O-ring, detent spring and detent plunger (Fig. 27).

(2) Remove shift rail from shift fork and transfer case housing.

(3) Rotate range shift fork until it disengages from shift sector.

(4) Remove mainshaft and shift fork from input gear pilot bearing.

NOTE: Loose needle bearings are used to support the drive sprocket hub on the mainshaft. Do not lift mainshaft by drive sprocket hub or needle bearings will become dislodged.

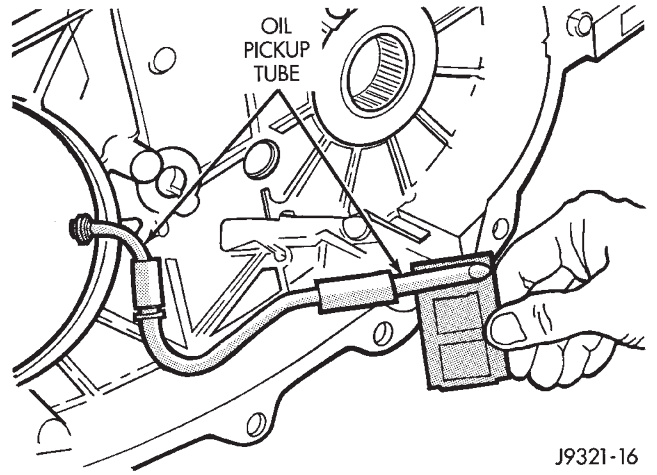


Fig. 25 Oil Pickup Tube Removal

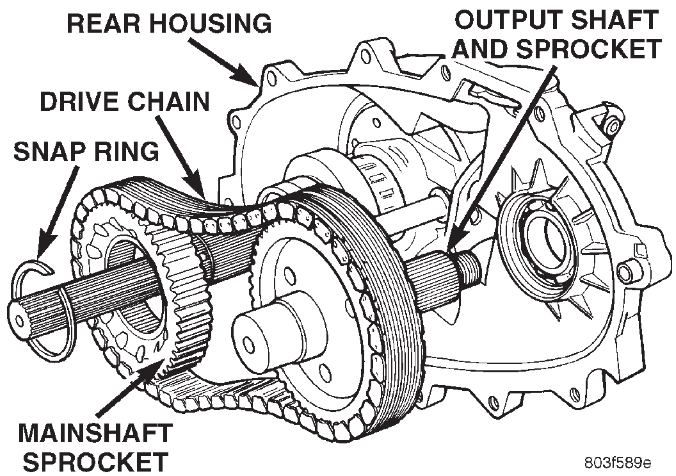


Fig. 26 Front Output Shaft, Drive Gear And Chain Removal

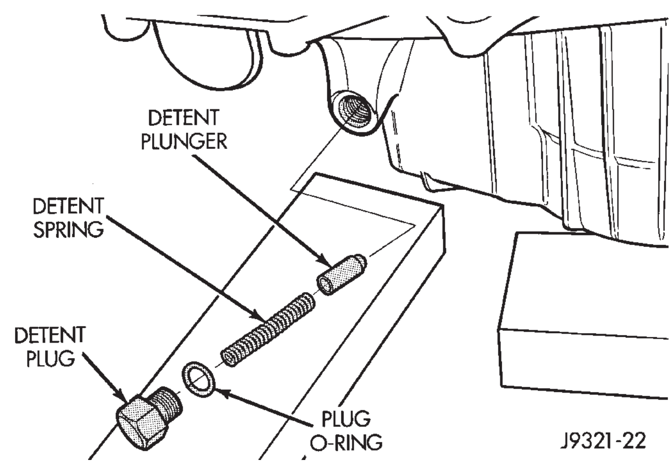


Fig. 27 Detent Plug, Spring And Plunger Removal

(5) Wrap rag around mainshaft underneath drive sprocket hub and remove drive sprocket hub from mainshaft. Be sure to retrieve all the drive sprocket hub needle bearings.

DISASSEMBLY AND ASSEMBLY (Continued)

(6) Remove snap ring holding clutch sleeve onto mainshaft.

(7) Remove range clutch sleeve, blockout spring, locking clutch, and locking clutch spring from mainshaft (Fig. 28).

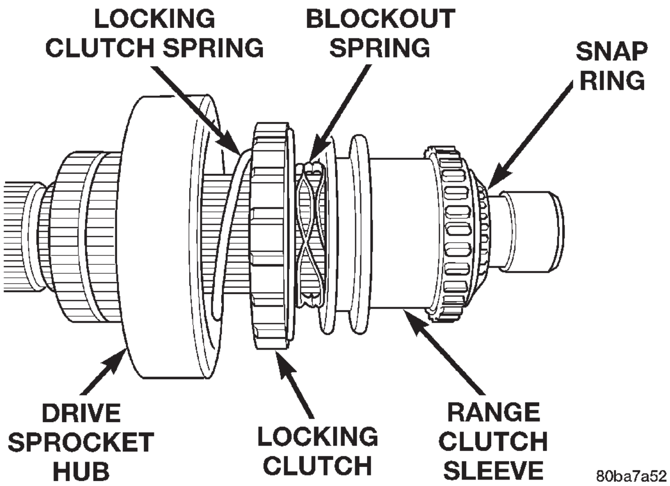


Fig. 28 Range Clutch Sleeve, Blockout Spring, Locking Clutch and Spring

(8) Remove shift sector. Rotate and tilt sector as needed to remove it (Fig. 29).

(9) Remove shift sector bushing and O-ring (Fig. 30).

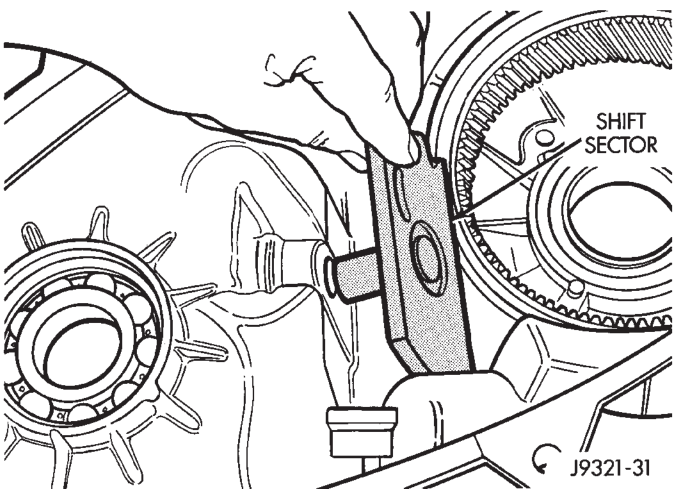


Fig. 29 Shift Sector Removal

INPUT GEAR/LOW RANGE ASSEMBLY REMOVAL

(1) Turn front case on side so front bearing retainer is accessible.

(2) Remove front bearing retainer bolts (Fig. 31).

(3) Remove front bearing retainer as follows:

(a) Loosen retainer with flat blade screwdriver to break sealer bead. **To avoid damaging case and retainer, position screwdriver blade only in slots provided in retainer (Fig. 32).**

(b) Then remove retainer from case and gear.

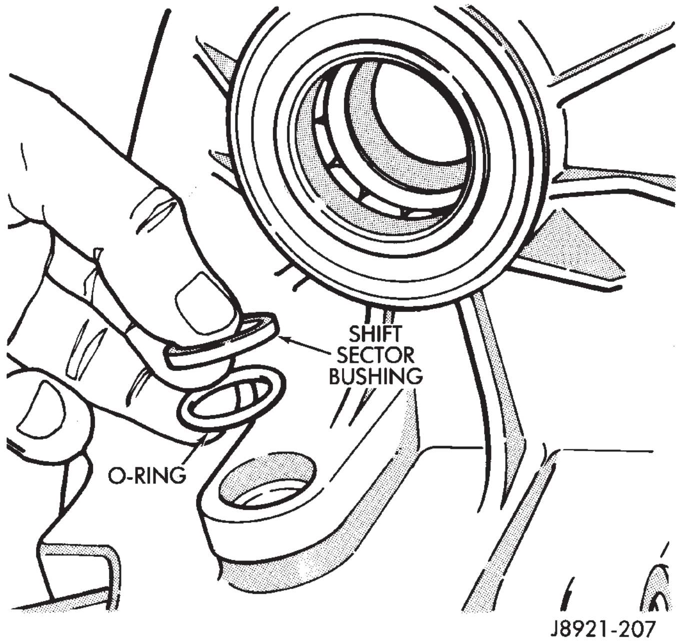


Fig. 30 Sector Bushing And O-Ring Removal

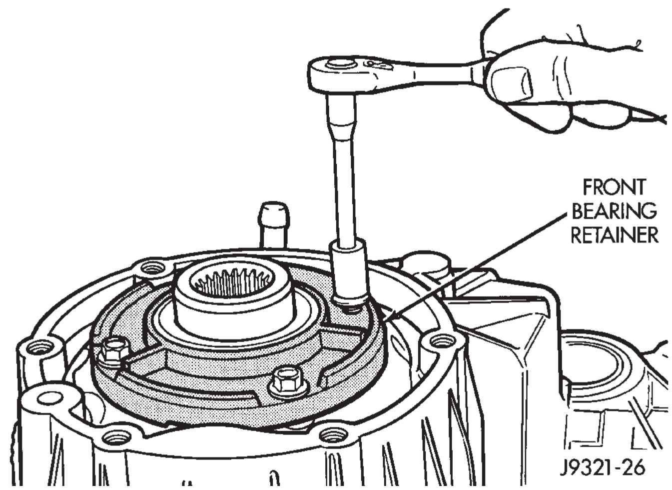


Fig. 31 Front Bearing Retainer Bolt Removal

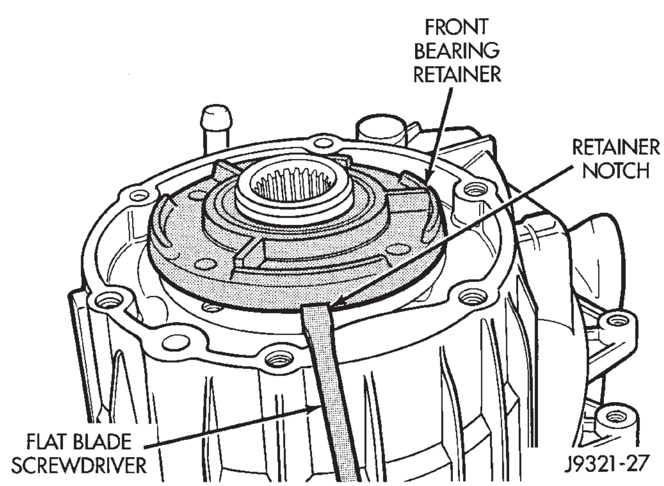


Fig. 32 Front Bearing Retainer Removal

(4) Remove snap-ring that retains input gear shaft in front bearing (Fig. 33).

DISASSEMBLY AND ASSEMBLY (Continued)

(5) Remove input and low range gear assembly (Fig. 34).

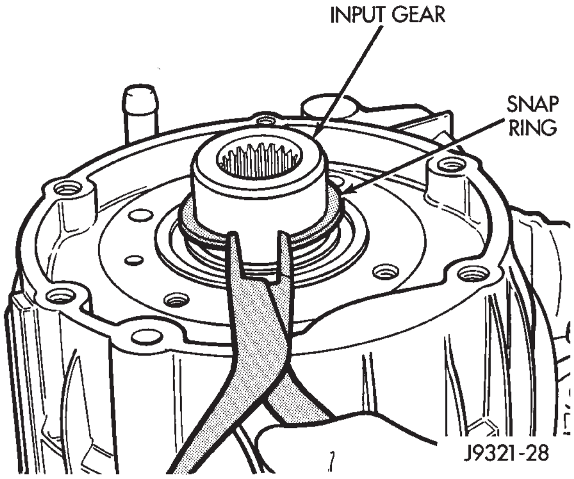


Fig. 33 Input Gear Snap-Ring Removal

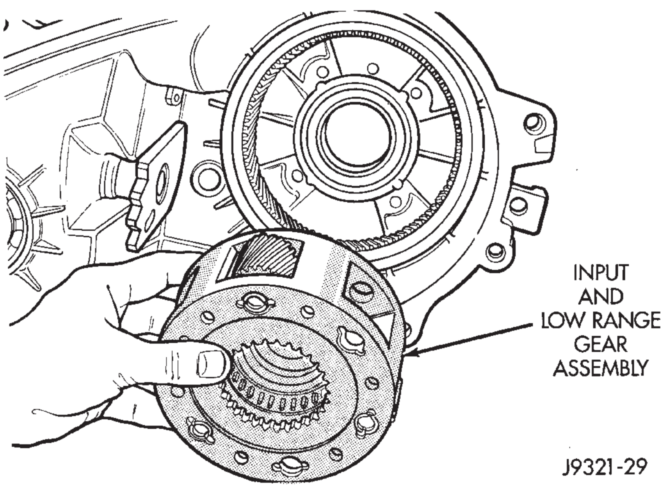


Fig. 34 Input And Low Range Gear Assembly Removal

(6) Remove oil seals from following components:
- front bearing retainer.
- rear retainer.
- case halves.

INPUT AND LOW RANGE GEAR DISASSEMBLY

(1) Remove snap-ring that retains input gear in low range gear (Fig. 35).
(2) Remove retainer (Fig. 36).
(3) Remove front tabbed thrust washer (Fig. 37).
(4) Remove input gear (Fig. 38).
(5) Remove rear tabbed thrust washer from low range gear (Fig. 39).

ASSEMBLY

Lubricate transfer case components with Mopar® Dexron II automatic transmission fluid or petroleum jelly (where indicated) during assembly.

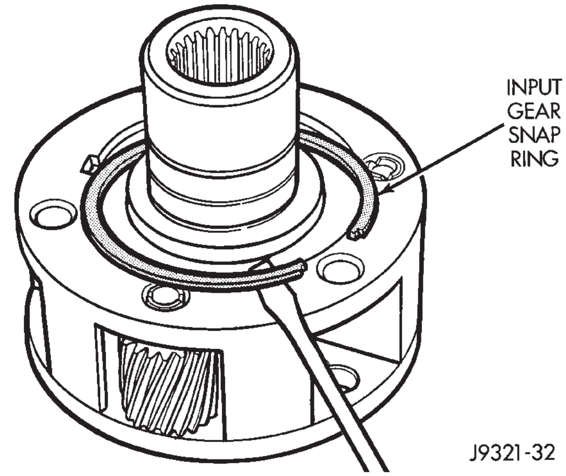


Fig. 35 Input Gear Snap-Ring Removal

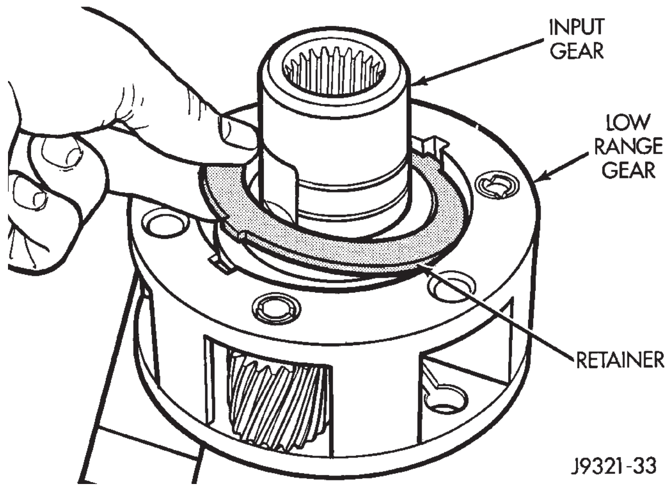


Fig. 36 Input Gear Retainer Removal

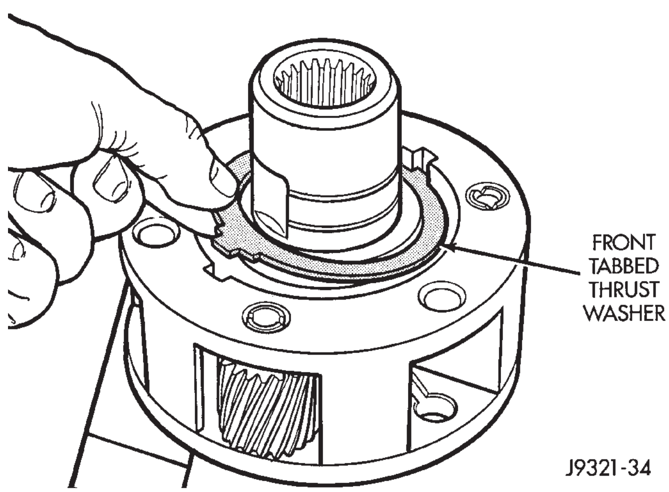


Fig. 37 Front Tabbed Thrust Washer Removal

CAUTION: The bearing bores in various transfer case components contain oil feed holes. Make sure replacement bearings do not block the holes.

DISASSEMBLY AND ASSEMBLY (Continued)

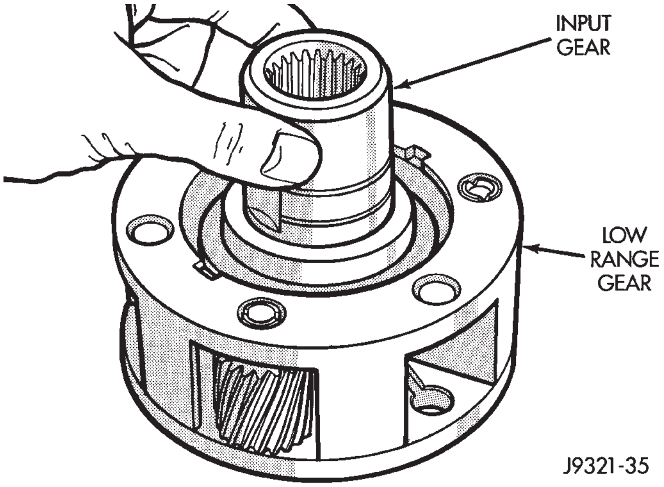


Fig. 38 Input Gear Removal

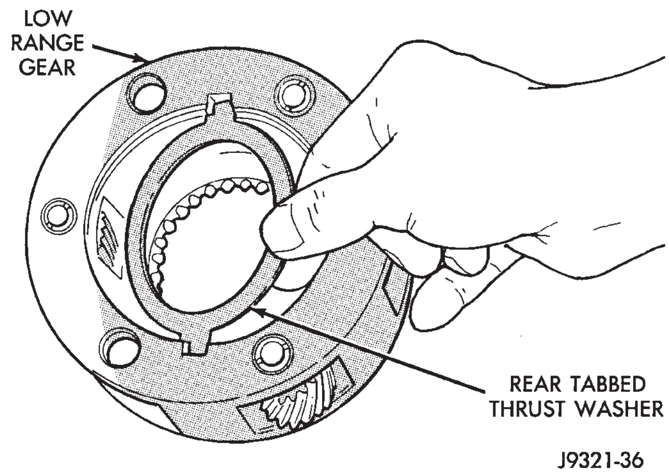


Fig. 39 Rear Tabbed Thrust Washer Removal

BEARING AND SEAL INSTALLATION

(1) Remove front output shaft seal from front case with pry tool (Fig. 40).

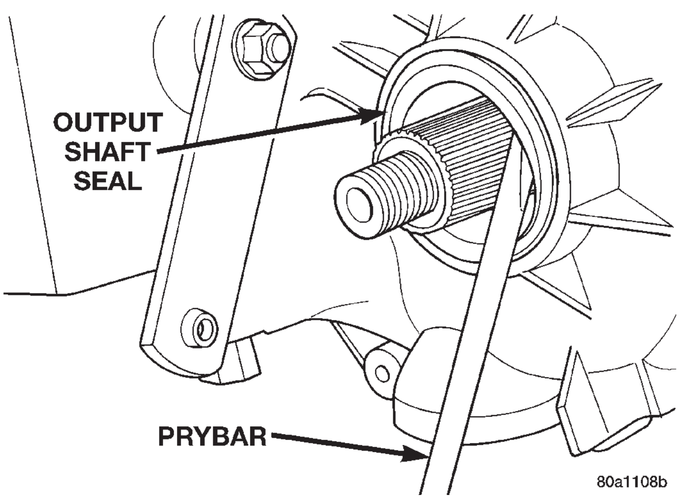


Fig. 40 Remove Front Output Shaft Seal

(2) Remove snap-ring that retains front output shaft bearing in front case (Fig. 41).

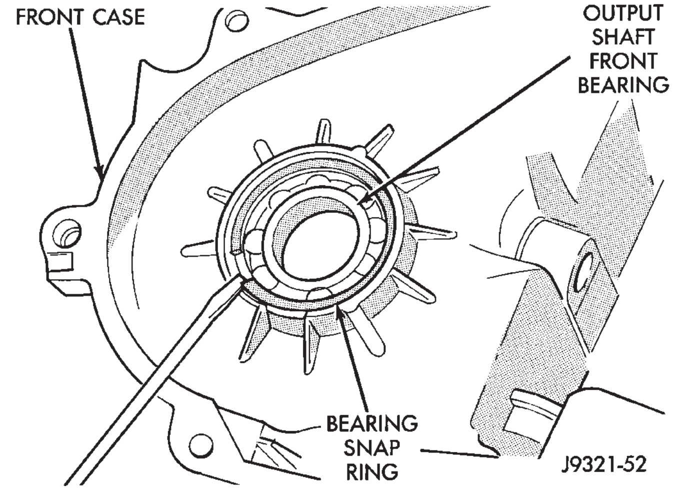


Fig. 41 Output Shaft Front Bearing Snap-Ring Removal

(3) Using tool 6953, remove bearing from front case (Fig. 42).

(4) Using tool 6953, install new bearing.

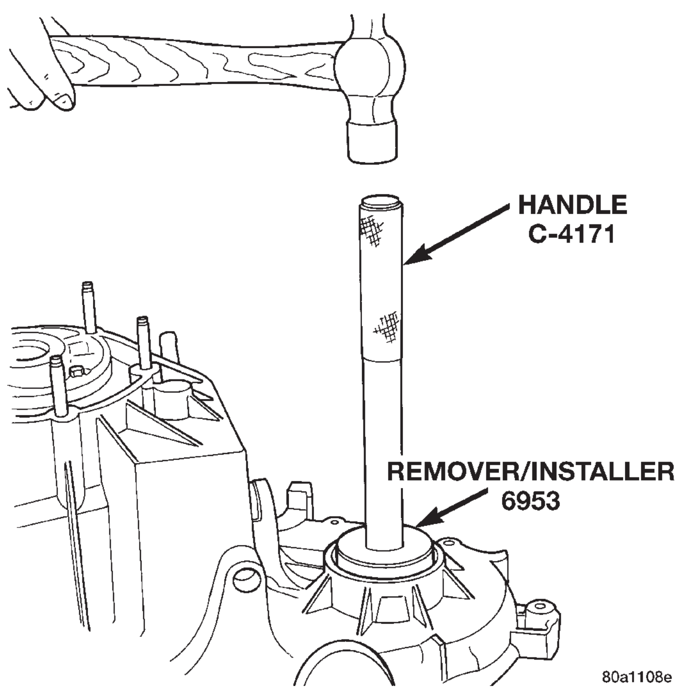


Fig. 42 Remove Output Shaft Front Bearing

(5) Install snap-ring to hold bearing into case.

(6) Install new front output seal in front case with Installer Tool 6952-A as follows:

(a) Place new seal on tool. **Garter spring on seal goes toward interior of case.**

(b) Start seal in bore with light taps from hammer (Fig. 43). Once seal is started, continue tapping seal into bore until installer tool bottoms against case.

DISASSEMBLY AND ASSEMBLY (Continued)

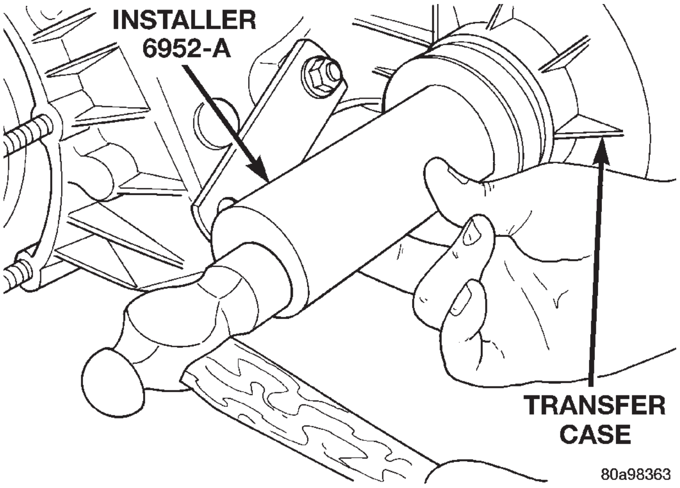


Fig. 43 Front Output Seal Installation

(7) Remove the output shaft rear bearing with the screw and jaws from Remover L-4454 and Cup 8148 (Fig. 44).

(8) Install new bearing with Tool Handle C-4171 and Installer 5066 (Fig. 45). **The bearing bore is chamfered at the top. Install the bearing so it is flush with the lower edge of this chamfer (Fig. 46).**

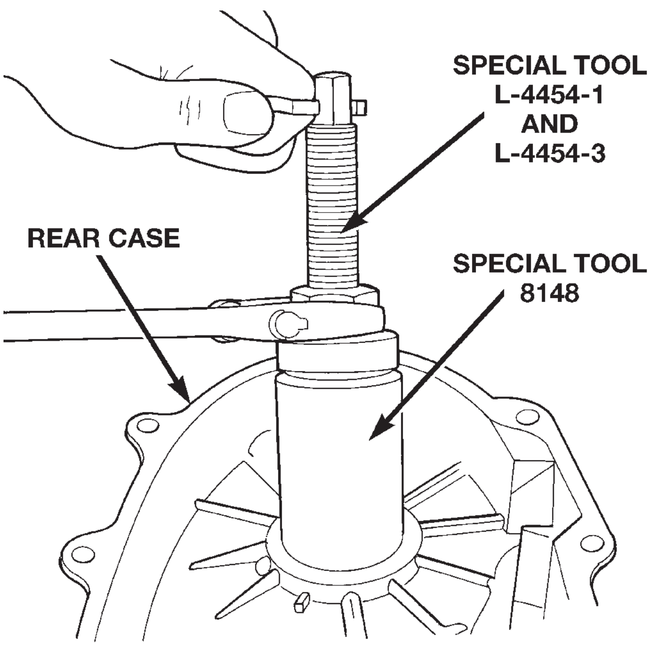


Fig. 44 Output Shaft Rear Bearing Removal

(9) Using Remover C-4210 and Handle C-4171, drive input shaft bearing from inside the annulus gear opening in the case. (Fig. 47).

(10) Install locating ring on new bearing.

(11) Position case so forward end is facing upward.

(12) Using Remover C-4210 and Handle C-4171, drive input shaft bearing into case. The bearing locating ring must be fully seated against case surface (Fig. 48).

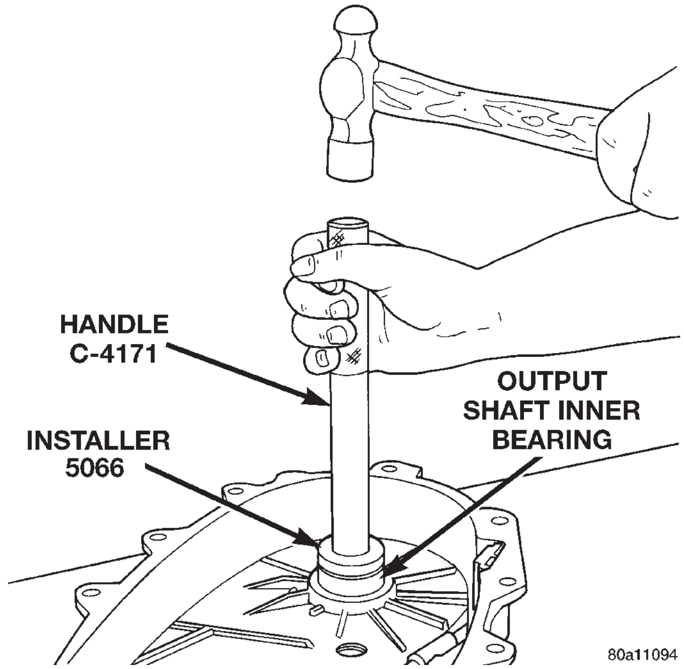


Fig. 45 Output Shaft Rear Bearing Installation

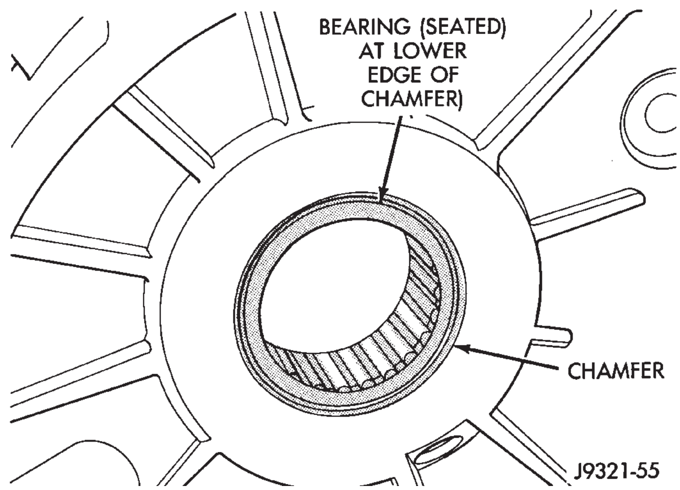


Fig. 46 Output Shaft Rear Bearing Installation Depth

(13) Remove input gear pilot bearing by inserting a suitably sized drift into the splined end of the input gear and driving the bearing out with the drift and a hammer (Fig. 49).

(14) Install new pilot bearing with Installer 8128 and Handle C-4171 (Fig. 50).

(15) Remove front bearing retainer seal with suitable pry tool.

(16) Install new front bearing retainer with Installer 7884 (Fig. 51).

INPUT AND LOW RANGE GEAR ASSEMBLY

(1) Lubricate gears and thrust washers (Fig. 52) with recommended transmission fluid.

DISASSEMBLY AND ASSEMBLY (Continued)

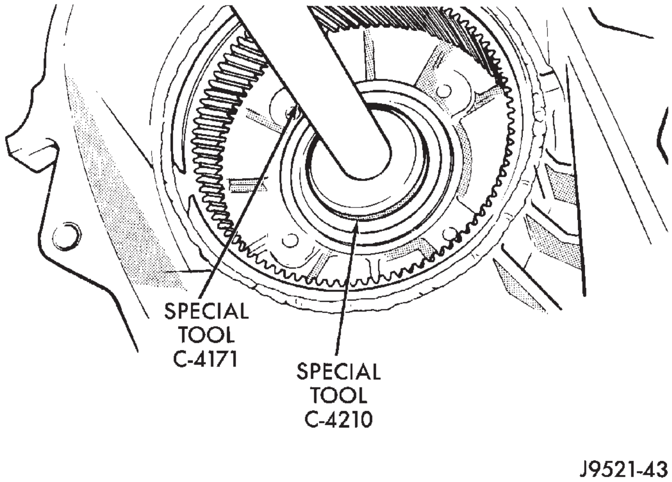


Fig. 47 Input Shaft Bearing Removal

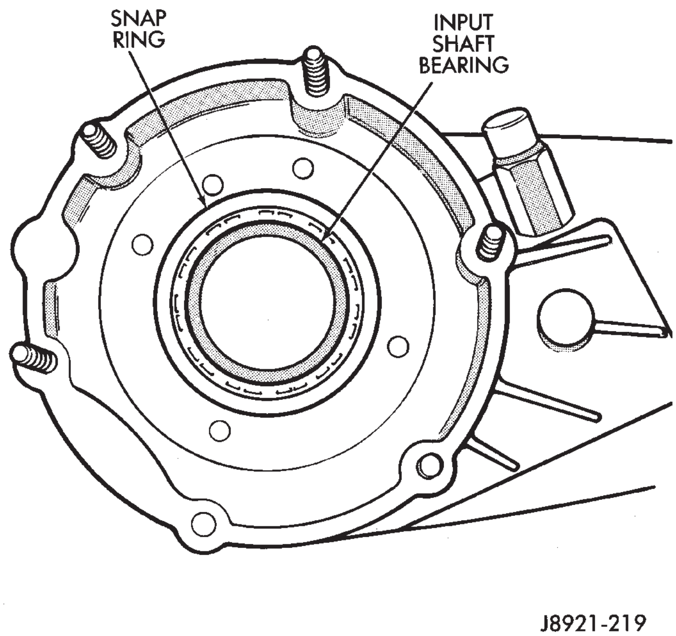


Fig. 48 Seating Input Shaft Bearing

(2) Install first thrust washer in low range gear (Fig. 52). Be sure washer tabs are properly aligned in gear notches.

(3) Install input gear in low range gear. Be sure input gear is fully seated.

(4) Install remaining thrust washer in low range gear and on top of input gear. Be sure washer tabs are properly aligned in gear notches.

(5) Install retainer on input gear and install snap-ring.

INPUT GEAR/LOW RANGE INSTALLATION

(1) Align and install low range/input gear assembly in front case (Fig. 53). Be sure low range gear pinions are engaged in annulus gear and that input gear shaft is fully seated in front bearing.

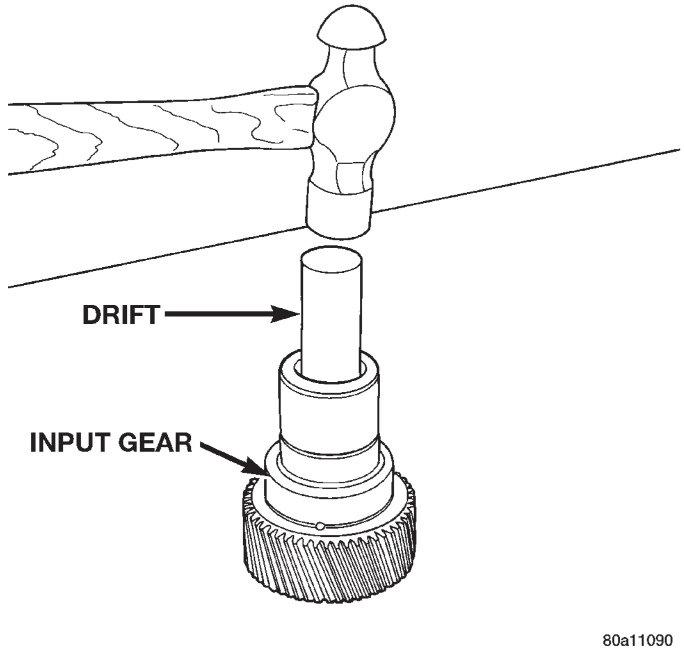


Fig. 49 Remove Input Gear Pilot Bearing

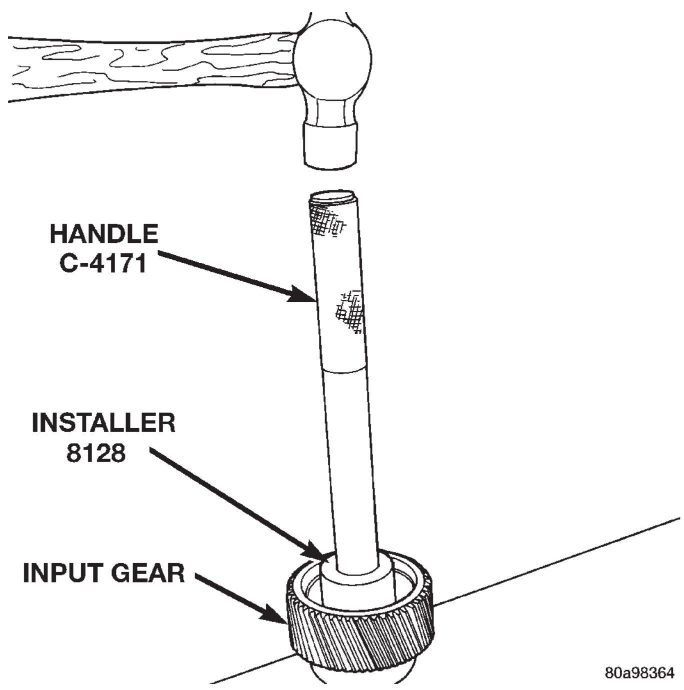


Fig. 50 Install Input Gear Pilot Bearing

(2) Install snap-ring to hold input/low range gear into front bearing (Fig. 54).

(3) Clean gasket sealer residue from retainer and inspect retainer for cracks or other damage.

(4) Apply a 3 mm (1/8 in.) bead of Mopar® gasket maker or silicone adhesive to sealing surface of retainer.

(5) Align cavity in seal retainer with fluid return hole in front of case.

DISASSEMBLY AND ASSEMBLY (Continued)

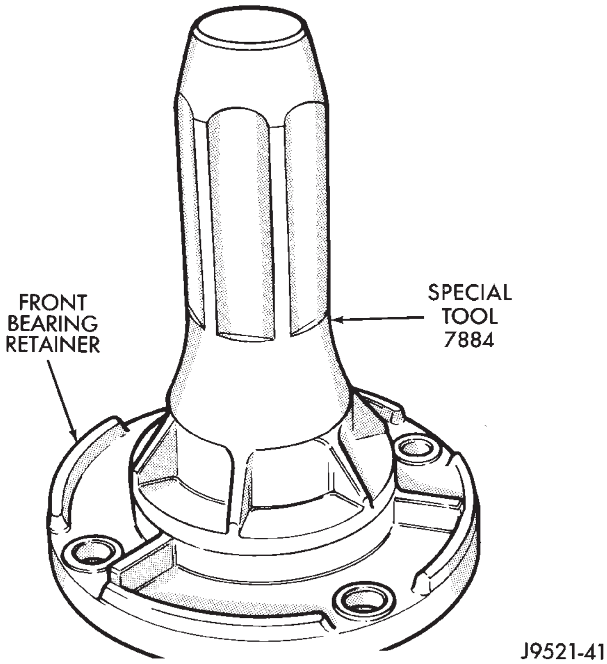


Fig. 51 Install Front Bearing Retainer Seal

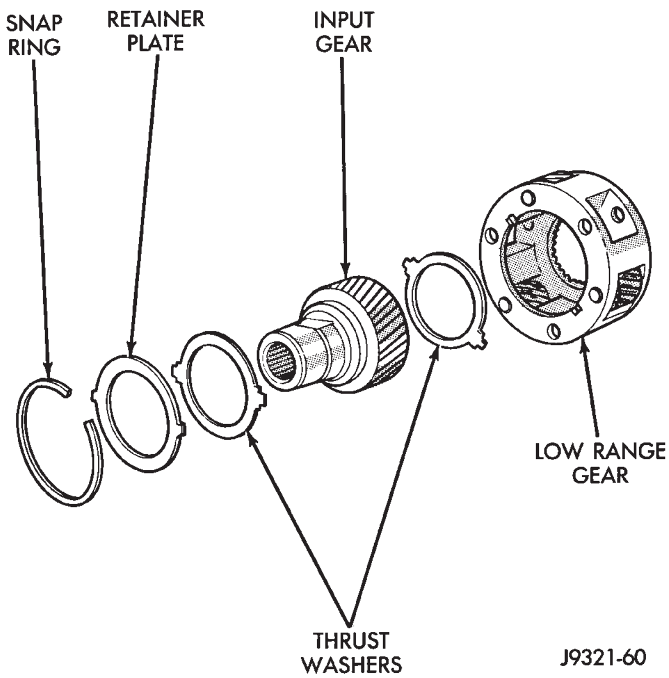


Fig. 52 Input/Low Range Gear Components

CAUTION: Do not block fluid return cavity on sealing surface of retainer when applying Mopar® gasket maker or silicone adhesive sealer. Seal failure and fluid leak can result.

(6) Install bolts to hold retainer to transfer case (Fig. 55). Tighten to 21 N·m (16 ft. lbs.) of torque.

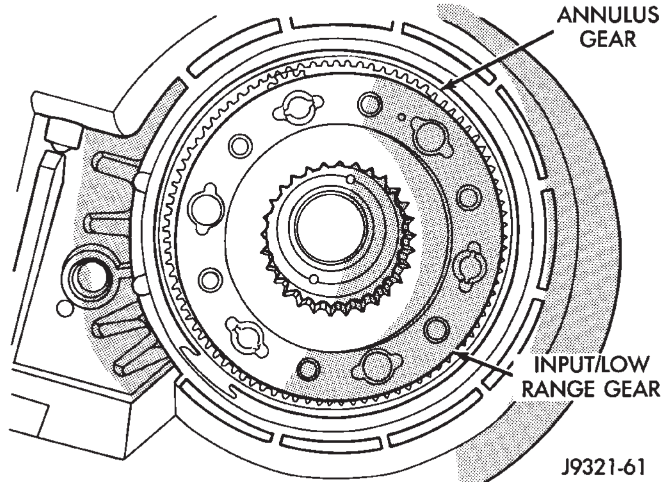


Fig. 53 Input/Low Range Gear Installation

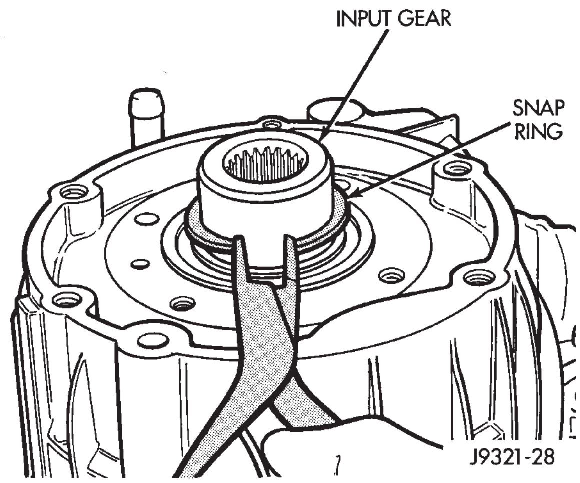


Fig. 54 Install Snap-Ring

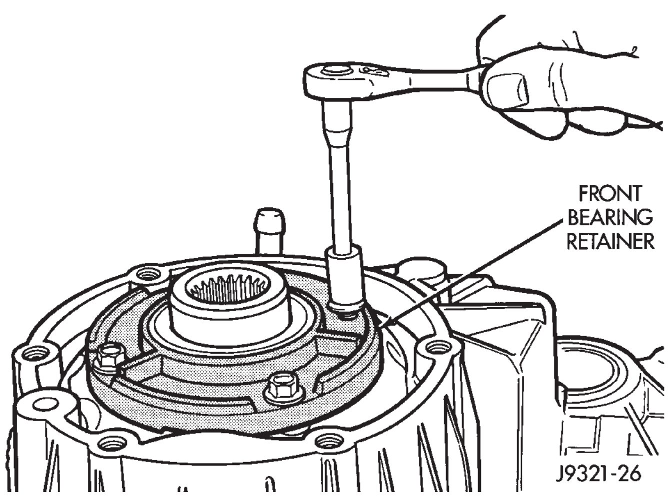


Fig. 55 Install Front Bearing Retainer

SHIFT FORKS AND MAINSHAFT INSTALLATION

(1) Install new sector shaft O-ring and bushing (Fig. 56).

(2) Install shift sector (Fig. 57).

DISASSEMBLY AND ASSEMBLY (Continued)

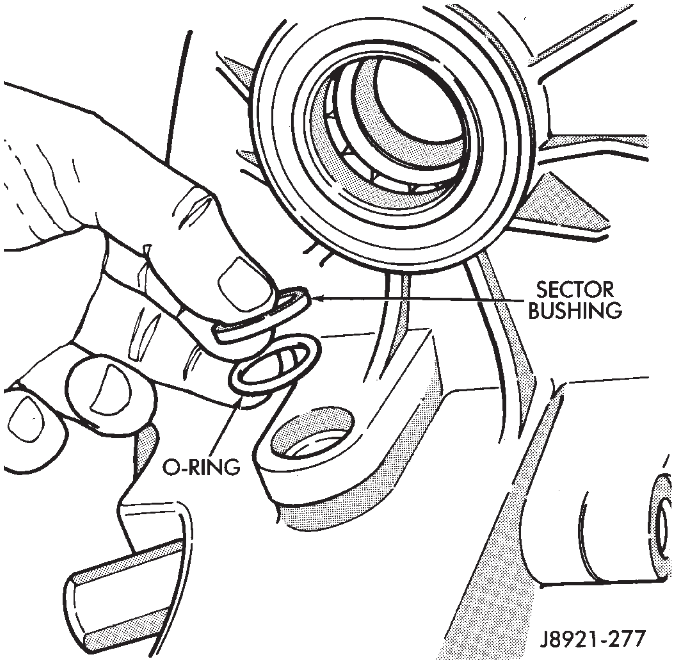


Fig. 56 Sector O-Ring And Bushing Installation

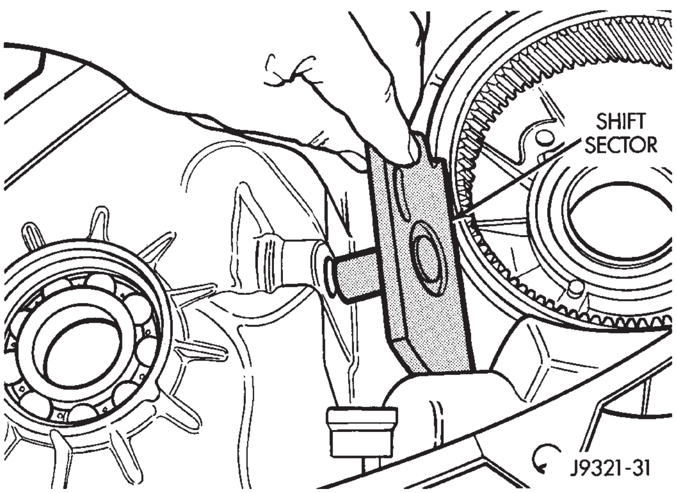


Fig. 57 Shift Sector Installation

(3) Install locking clutch spring, locking clutch, blockout spring, and range clutch sleeve, to mainshaft as shown in (Fig. 58). Install snap ring.

(4) Install drive sprocket hub to mainshaft and manually load the needle bearings.

(5) Install new pads on range fork, if necessary.

(6) Install range shift fork to range clutch sleeve. Install mainshaft/range shift fork assembly into transfer case and input planetary assembly. Rotate fork until it engages with slot in shift sector.

(7) Install shift rail to shift range fork and transfer case housing.

(8) Rotate shift sector to Neutral position.

(9) Install new O-ring on detent plug (Fig. 59).

(10) Lubricate detent plunger with transmission fluid or light coat of petroleum jelly.

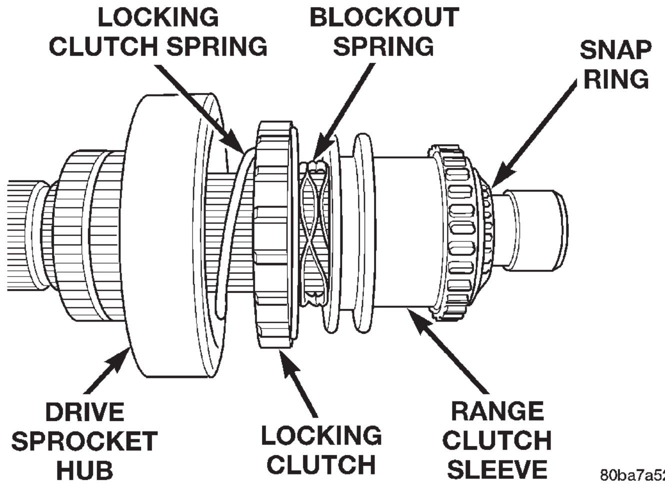


Fig. 58 Range Clutch Sleeve, Blockout Spring, Locking Clutch and Spring

(11) Install detent plunger, spring and plug (Fig. 59).

(12) Verify that plunger is properly engaged in sector.

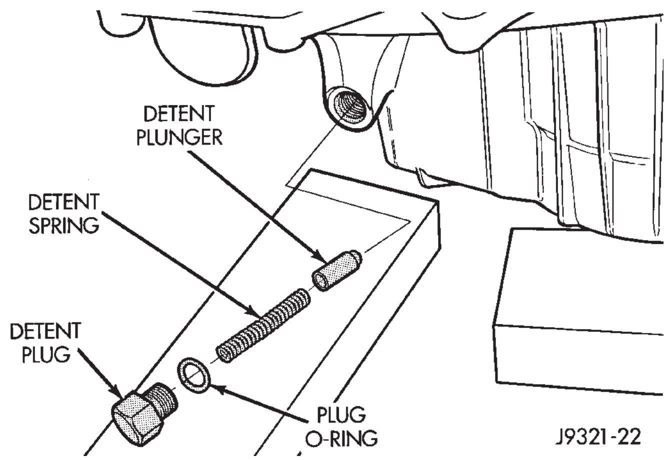


Fig. 59 Shift Detent Components

FRONT OUTPUT SHAFT AND DRIVE CHAIN 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. 60).

(3) Start drive sprocket on mainshaft.

(4) Guide front shaft into bearing and drive sprocket onto mainshaft drive gear (Fig. 60).

(5) Install drive sprocket snap-ring (Fig. 61).

(6) Install roller bearings if removed.

(7) Install progressive coupling (Fig. 62).

(8) Install oil pickup tube in rear case. Be sure tube is seated in case notch as shown (Fig. 63).

(9) Install magnet in front case pocket (Fig. 64).

DISASSEMBLY AND ASSEMBLY (Continued)

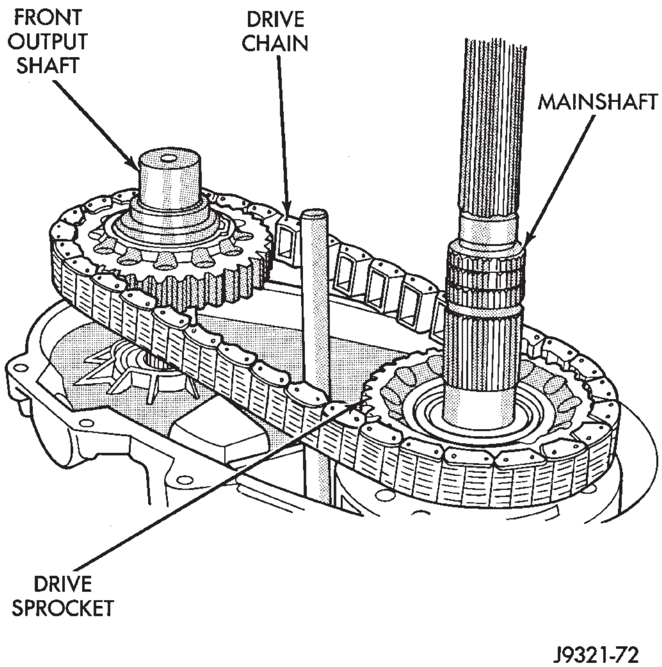


Fig. 60 Installing Drive Chain, Front Output Shaft And Drive Sprocket

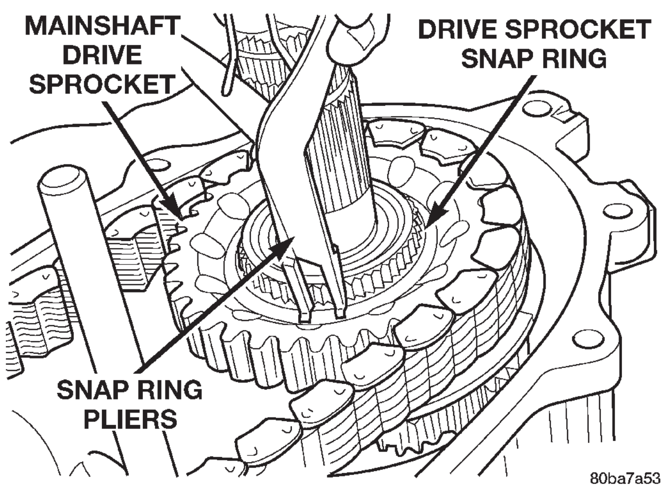


Fig. 61 Installing Drive Sprocket Snap-Ring

(10) Clean sealing flanges of front case and rear case with a wax and grease remover.

(11) Apply 3 mm (1/8 in.) wide bead of Mopar® gasket maker or silicone adhesive sealer to mounting flange of front case. Work sealer bead around bolt holes as shown (Fig. 65).

(12) Align and install rear case on front case (Fig. 66).

(13) Verify that oil pickup tube is still seated in case notch and tube end is pointed toward mainshaft (Fig. 67).

(14) Install case attaching bolts. Alignment bolts at each end of case are only ones requiring washers (Fig. 68).

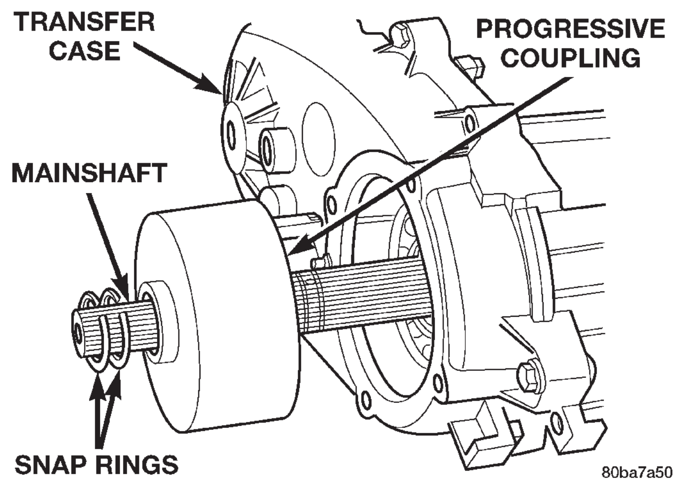


Fig. 62 Progressive Coupling Installation

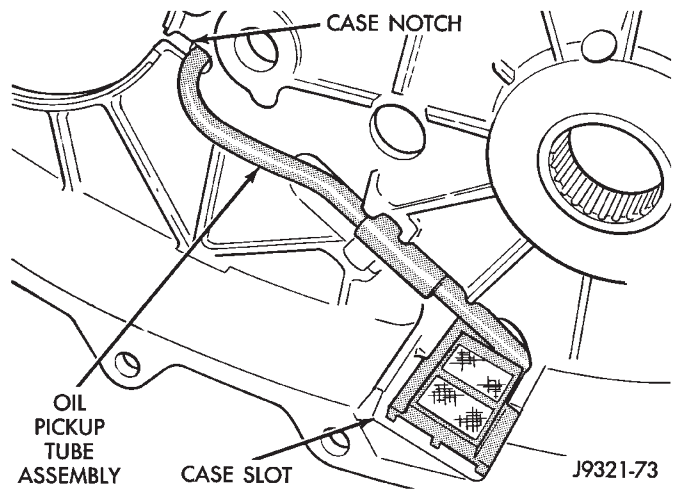


Fig. 63 Oil Pickup Tube Installation

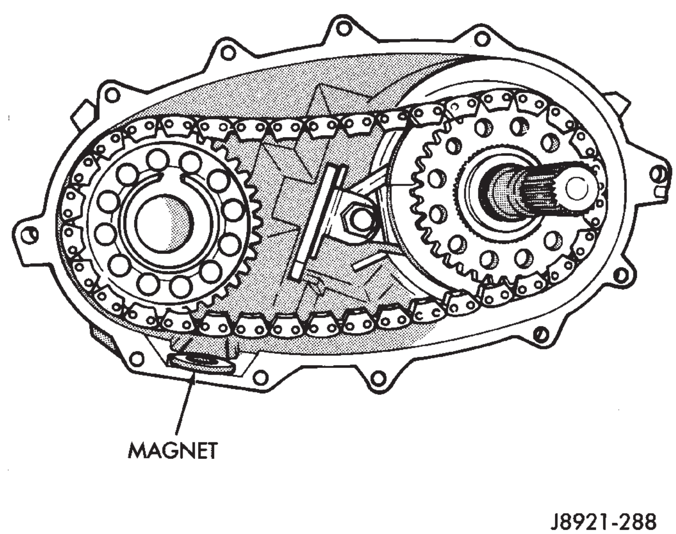


Fig. 64 Installing Case Magnet

(15) Tighten case bolts to 27-34 N·m (20-25 ft. lbs.) torque.

DISASSEMBLY AND ASSEMBLY (Continued)

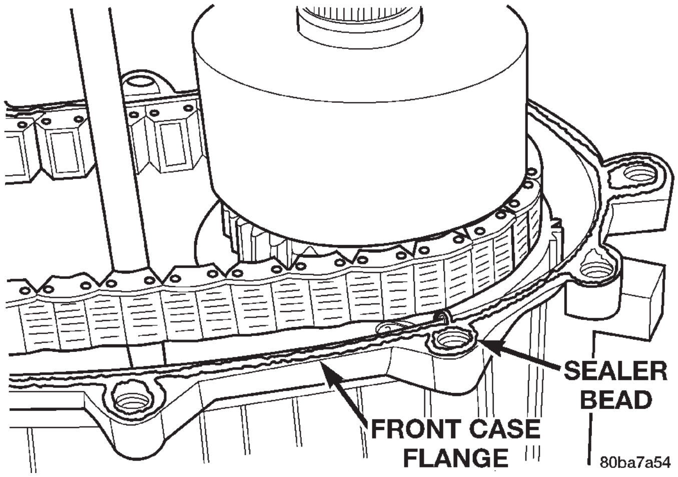


Fig. 65 Applying Sealer To Front Case Flange

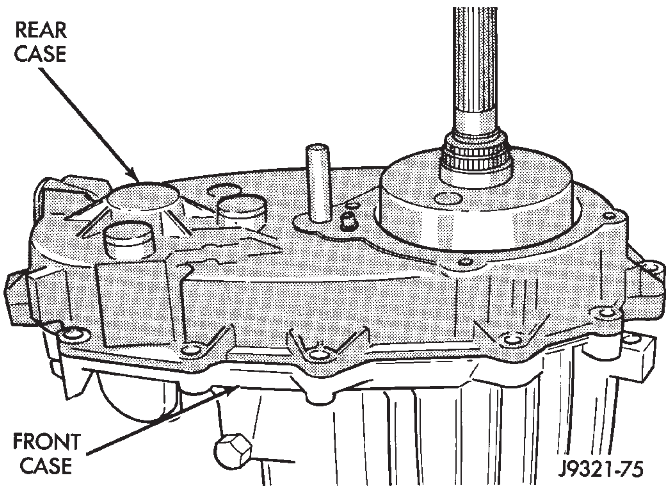


Fig. 66 Rear Case Installation

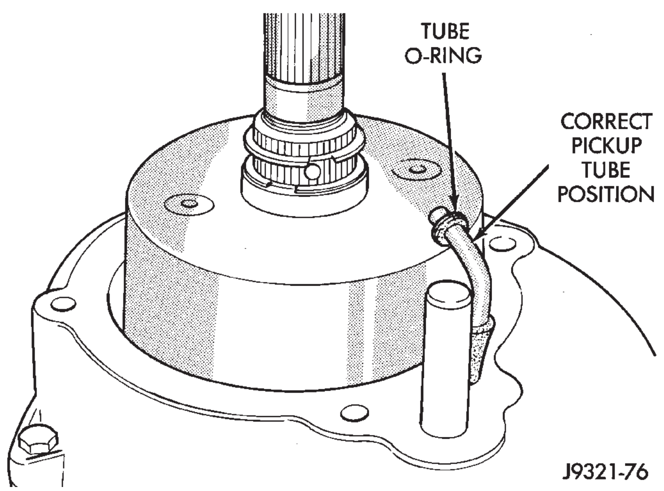


Fig. 67 Checking Position Of Oil Pickup Tube

COMPANION FLANGE AND RANGE LEVER INSTALLATION

(1) Install range lever, washer and locknut on sector shaft (Fig. 69). Tighten locknut to 27-34 N·m (20-25 ft. lbs.) torque.

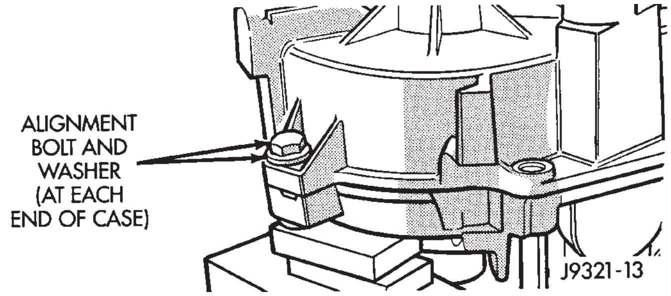


Fig. 68 Alignment Bolt Location

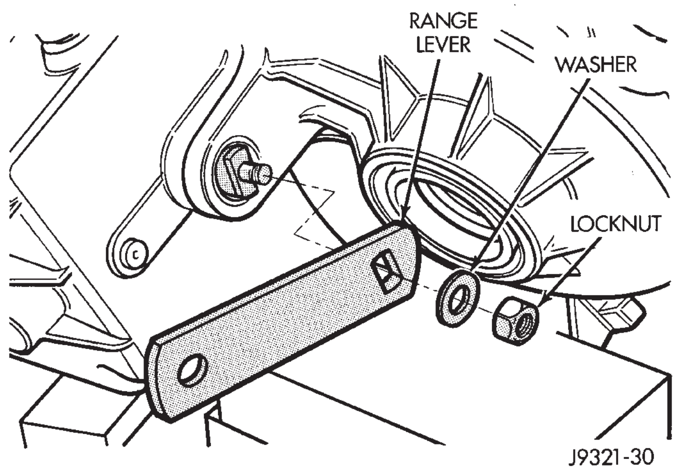


Fig. 69 Range Lever Installation (Typical)

(2) Install new seal washer on front output shaft (Fig. 70).

(3) Lubricate flange hub with transmission fluid and install flange on front shaft.

(4) Install new seal washer on front shaft.

(5) Install companion flange and new nut on front output shaft.

(6) Tighten flange nut to 122-176 N·m (90-130 ft. lbs.) torque. Use Tool C-3281, or similar tool to hold flange while tightening yoke nut.

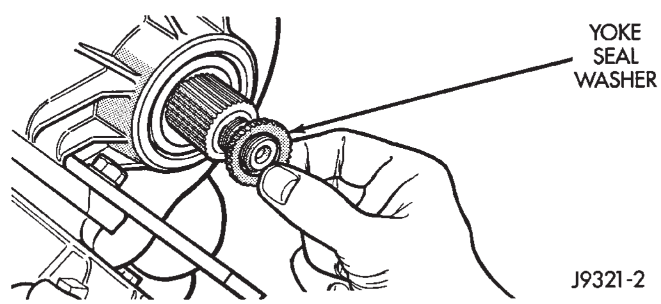


Fig. 70 Flange Seal Washer Installation

PROGRESSIVE COUPLER

(1) Install coupling on mainshaft (Fig. 71).

(2) Install coupling retaining snap-ring first (Fig. 71). Be sure snap ring is fully seated before proceeding.

DISASSEMBLY AND ASSEMBLY (Continued)

(3) Install oil pump locating snap-ring on mainshaft (Fig. 71).

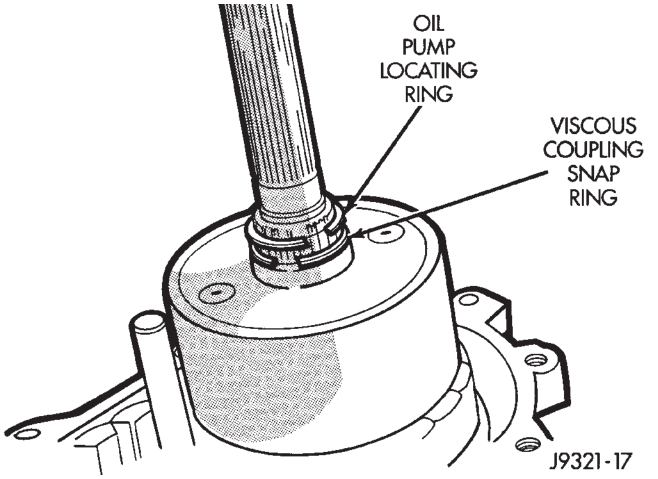


Fig. 71 Progressive Coupling And Oil Pump Snap-Ring Installation

REAR RETAINER AND OIL PUMP INSTALLATION

(1) Install new O-ring on flanged end of oil pickup tube.
(2) Install oil pump (Fig. 72).
(3) Insert oil pickup tube in pump (Fig. 73).
(4) Install rear bearing on mainshaft (Fig. 73). Locating ring groove in bearing goes toward end of mainshaft.
(5) Install rear bearing retaining snap-ring (Fig. 74).

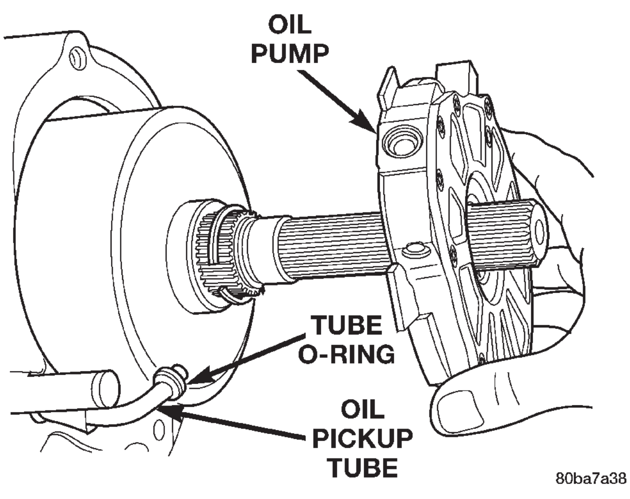


Fig. 72 Installing Oil Pump

(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 or silicone adhesive sealer to mounting surface of rear retainer. Allow sealer to set-up slightly before proceeding.
(8) Slide rear retainer onto mainshaft (Fig. 75).

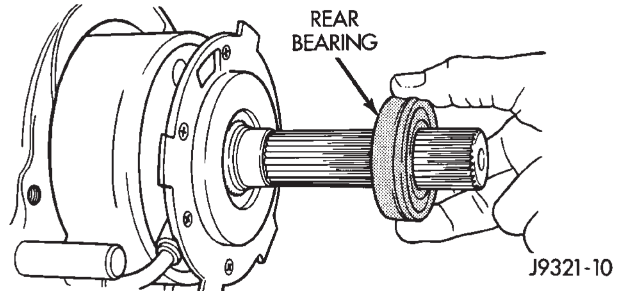


Fig. 73 Rear Bearing Installation

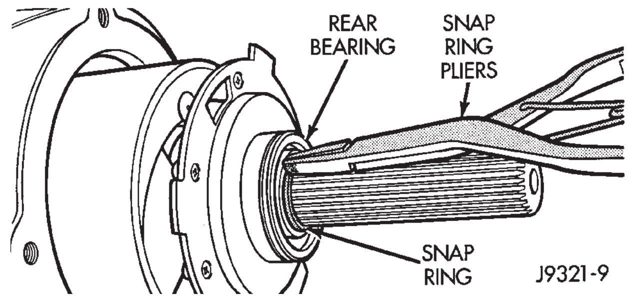


Fig. 74 Rear Bearing Snap-Ring Installation

(9) Spread rear bearing locating ring and slide rear retainer into place on rear case (Fig. 76).
(10) Install and tighten rear retainer bolts to 27-34 N·m (20-25 ft. lbs.).
(11) Install rubber access plug (Fig. 77).

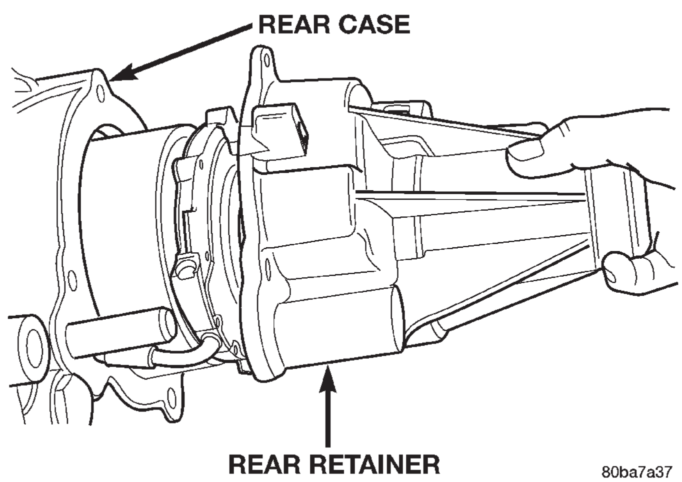


Fig. 75 Rear Retainer Installation

FINAL ASSEMBLY

(1) Install drain plug. Tighten plug to 41-54 N·m (30-40 ft. lbs.) torque.
(2) Level transfer case and fill it with Mopar® Dexron II automatic transmission fluid. Correct fill level is to bottom edge of fill plug hole.
(3) Install and tighten fill plug to 41-54 N·m (30-40 ft. lbs.) torque.

DISASSEMBLY AND ASSEMBLY (Continued)

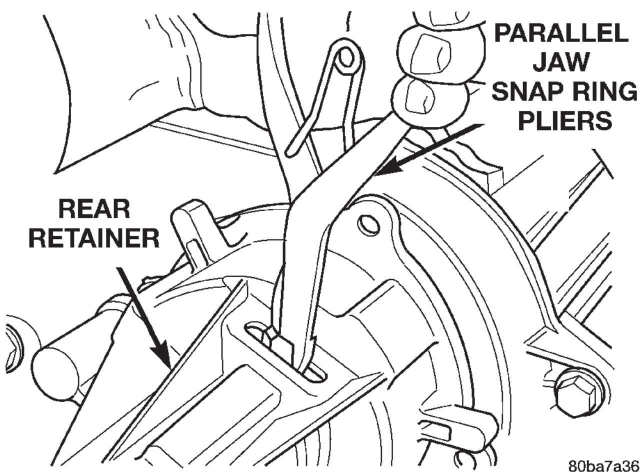


Fig. 76 Engaging Rear Bearing Locating Ring

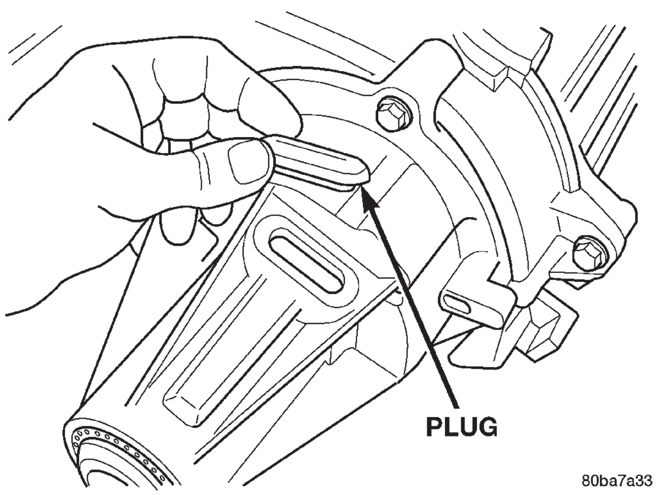


Fig. 77 Installing Rubber Access Plug

CLEANING AND INSPECTION

NV247 COMPONENTS

GENERAL

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

Examine the mainshaft components carefully for evidence of wear or damage.

Replace the thrust washers if worn or 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, brinelled, or damaged in any way.

Replace the mainshaft if it is bent, 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 CASE AND RETAINERS

Examine both case halves and retainers carefully. Replace any retainer or 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. 78). 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.

Check the bushing in the rear retainer. Replace the bushing if worn or scored.

Examine the sealing surfaces of both case halves and retainers. 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

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

CLEANING AND INSPECTION (Continued)

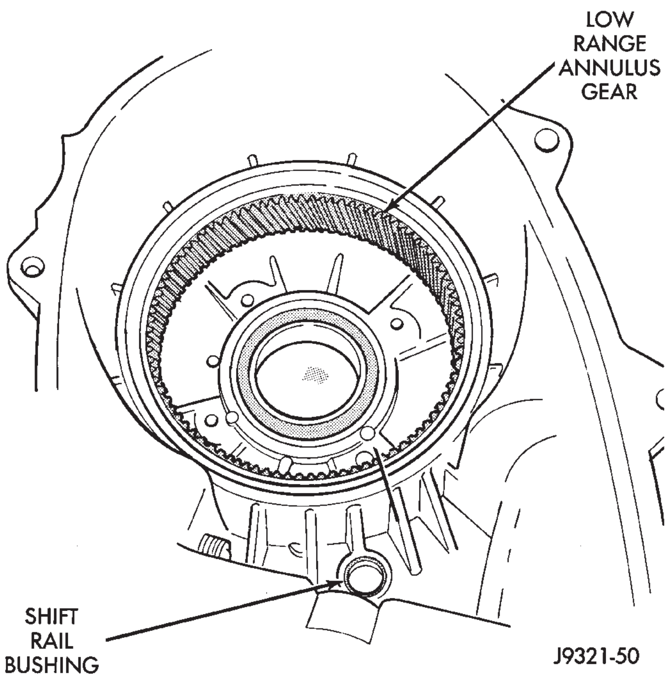


Fig. 78 Low Range Annulus Gear Location

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.

OIL PUMP AND PROGRESSIVE COUPLING

The oil pump and progressive 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 retainer. 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.

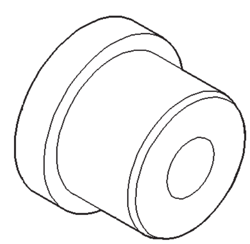
SPECIFICATIONS

TORQUE

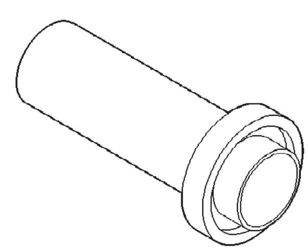
DESCRIPTION	TORQUE
Bolt, crossmember	41-47 N·m (30-35 ft. lbs.)
Plug, Detent	16-24 N·m (12-18 ft. lbs.)
Plugs, drain/fill	41-54 N·m (30-40 ft. lbs.)
Bolts, front brg. retainer	16-24 N·m (12-18 ft. lbs.)
Bolts, case half	27-34 N·m (20-25 ft. lbs.)
Nut, companion flange	122–176 N·m (90-130 ft. lbs.)
Bolts, rear extension	27-34 N·m (20-25 ft. lbs.)
Lock-nut, shift	27-34 N·m (20-25 ft. lbs.)
Nuts, T-case mount stud	33-41 N·m (24-30 ft. lbs.)

SPECIAL TOOLS

NV247 TRANSFER CASE

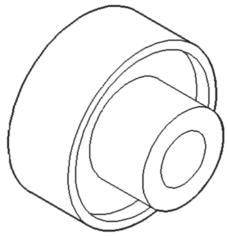


Installer—5066

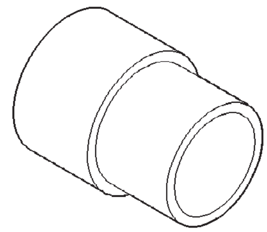


Installer—6952-A

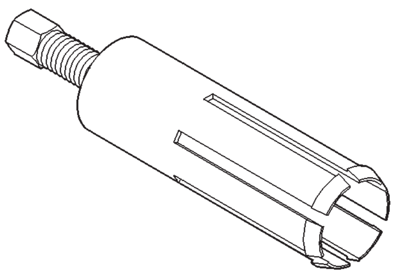
SPECIAL TOOLS (Continued)



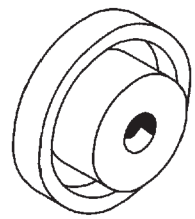
Installer—6953



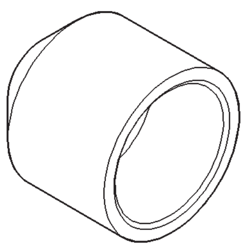
Installer—8145



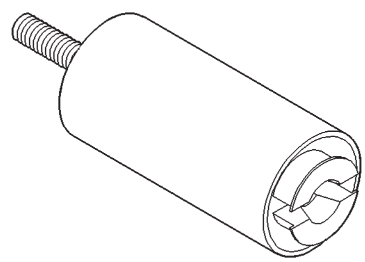
Remover—6957



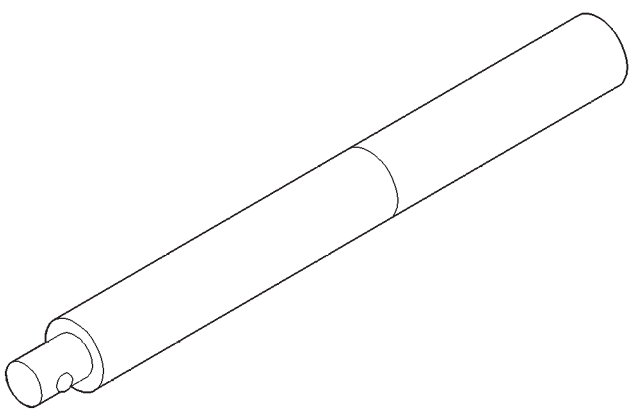
Remover—C-4210



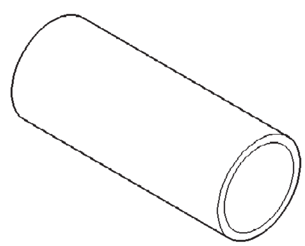
Installer—C-3995-A



Remover—L-4454

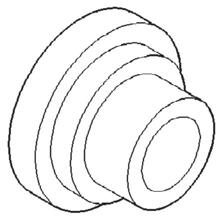


Handle—C-4171



Cup—8148

SPECIAL TOOLS (Continued)



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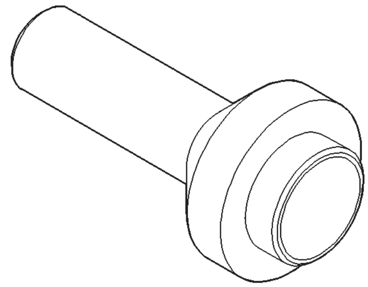

Installer—7884

TRANSMISSION AND TRANSFER CASE

CONTENTS

44RE AUTOMATIC TRANSMISSION

INDEX

GENERAL INFORMATION (Continued)

GENERAL INFORMATION

44 RE TRANSMISSION

Vehicles equipped with the 3.1L turbo diesel engine use the 44RE automatic transmission.

The 44RE is a four speed fully automatic transmission (Fig. 1) with an electronic governor. First through third gear ranges are provided by the clutches, bands, overrunning clutch, and planetary gear sets in the transmission. Fourth gear range is provided by the overdrive unit that 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 torque converter clutch is controlled by the Powertrain Control Module (PCM). The torque converter clutch is hydraulically applied and is released when fluid is vented from the hydraulic circuit by the torque converter control (TCC) solenoid on the valve body. The torque converter clutch engages in fourth gear, and in third gear when the O/D switch is OFF. Engagement occurs when the vehicle is moving at a steady speed after the vehicle has warmed up. The torque converter clutch disengages when the accelerator is applied. The 44 RE transmission is cooled by an integral fluid cooler inside the radiator.

GENERAL INFORMATION (Continued)

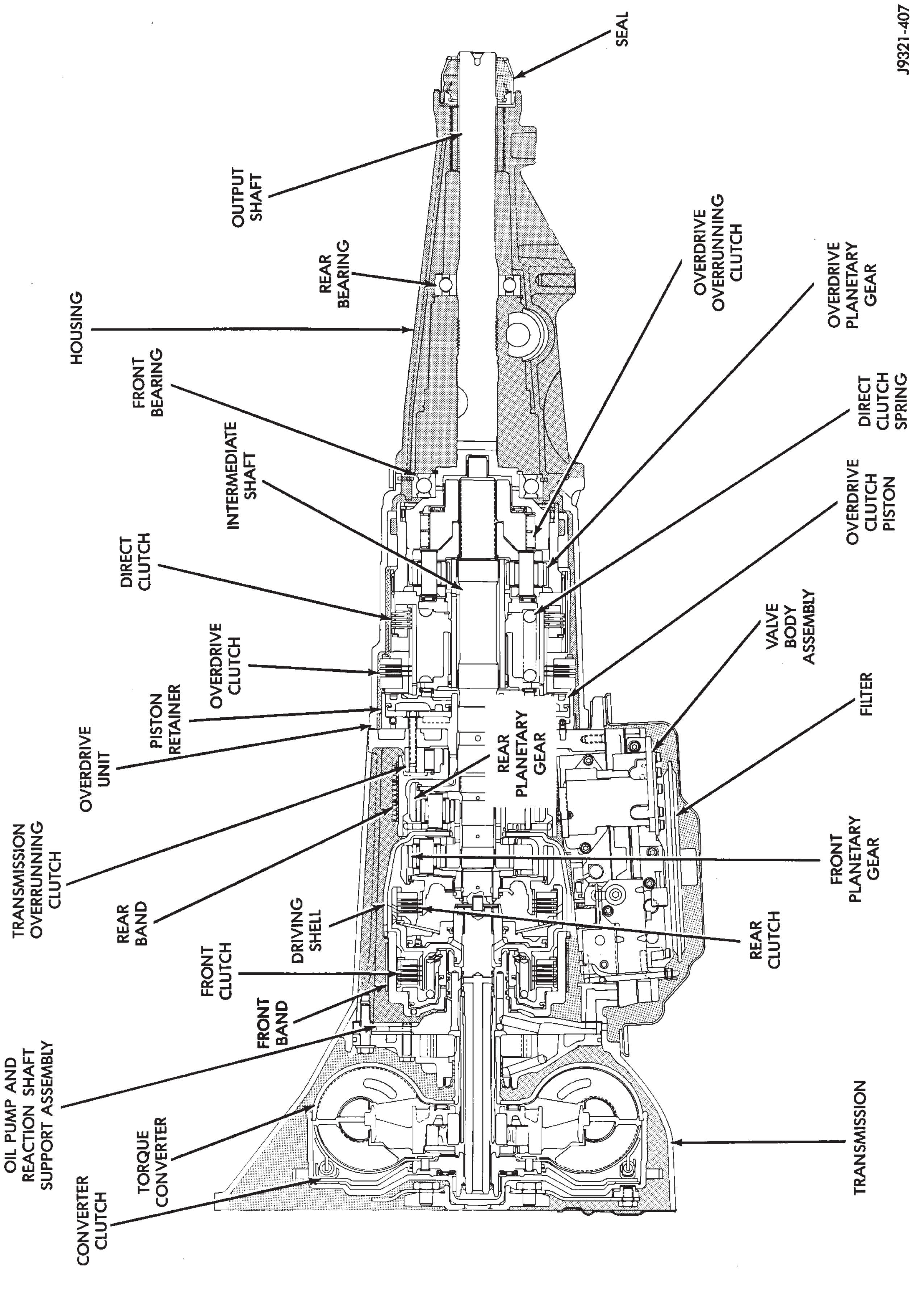

Fig. 1 44 RE Transmission

GENERAL INFORMATION (Continued)

TRANSMISSION IDENTIFICATION

Transmission identification numbers are stamped on the left side of the case just above the oil pan gasket surface (Fig. 2). Refer to this information when ordering replacement parts.

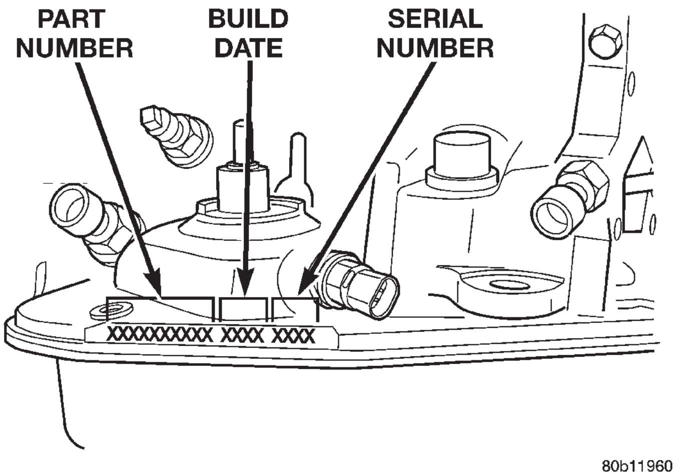

Fig. 2 Transmission Part And Serial Number Location

RECOMMENDED FLUID

NOTE: Refer to the Service Procedures section of this Group for fluid level checking procedures.

FLUID TYPE

Mopar® ATF Plus 3, Type 7176 automatic transmission fluid is the recommended fluid for Chrysler automatic transmissions.

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

FLUID ADDITIVES

Fluid additives other than Mopar® approved fluorescent leak detection dyes are not to be used in this transmission.

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. This aerates the fluid and causing the same conditions occurring 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 BURNT FLUID

Burnt, discolored fluid is a result of overheating which has two primary causes.

(1) 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 or kinked lines.

(2) 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

Transmission fluid contamination is generally a result of:

- adding incorrect fluid
- failure to clean dipstick and fill tube when checking level
- engine coolant entering the 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 after 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 recontamination. Flushing applies to auxiliary cool-

GENERAL INFORMATION (Continued)

ers as well. The torque converter should also be replaced whenever a failure generates sludge and debris. This is necessary because normal converter flushing procedures will not remove all contaminants.

ELECTRONIC LOCK-UP TORQUE CONVERTER

The torque converter is a hydraulic device that couples the engine crankshaft to the transmission. The torque converter consists of an outer shell with an internal turbine, a stator, an overrunning clutch, an impeller, and an electronically applied converter clutch. Torque multiplication is created when the stator directs the hydraulic flow from the turbine to rotate the impeller in the direction the engine crankshaft is turning. The turbine transfers power to the planetary gear sets in the transmission. The transfer of power into the impeller assists torque multiplication. At low vehicle-speed, the overrunning clutch holds the stator stationary (during torque multiplication) and allows the stator to freewheel at high vehicle speed. The converter clutch engagement reduces engine speed. Clutch engagement also provides reduced transmission fluid temperatures. The torque converter hub drives the transmission oil (fluid) pump.

The torque converter is a sealed, welded unit that is not repairable and is serviced as an assembly.

CAUTION: The torque converter must be replaced if a transmission failure results in large amounts of metal or fiber contamination in the fluid.

TRANSMISSION GEAR RATIOS

Gear ratios are:

- **1st** 2.74:1
- **2nd** 1.54:1
- **3rd** 1.00:1
- **4th** 0.69:1
- **Rev.** 2.21

GEARSHIFT MECHANISM

The shift mechanism is cable operated and provides six shift positions. The shift positions 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 mechanism is required to complete the 3-4 shift.

DESCRIPTION AND OPERATION

ELECTRONIC GOVERNOR

Governor pressure is controlled electronically. Components used for governor pressure control include:

- Governor body
- Valve body transfer plate
- Governor pressure solenoid valve
- Governor pressure sensor
- Fluid temperature thermistor
- Throttle position sensor (TPS)
- Transmission speed sensor
- Powertrain control module (PCM)

GOVERNOR PRESSURE SOLENOID VALVE

The solenoid valve is a duty-cycle solenoid which regulates the governor pressure needed for upshifts and downshifts. It is an electro-hydraulic device 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 powertrain control module (PCM) turns on the trans control relay which supplies electrical power to the solenoid valve. Operating voltage is 12 volts (DC). The PCM controls the ground side of the solenoid using the governor pressure solenoid control circuit.

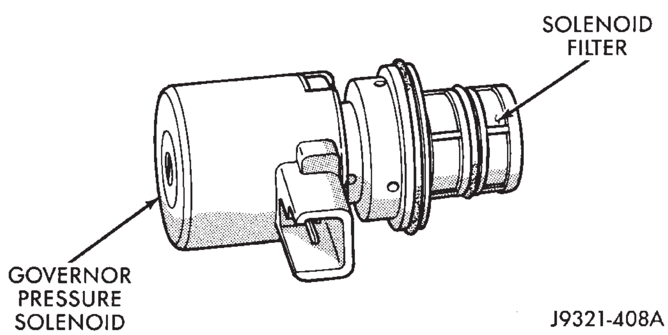

Fig. 3 Governor Pressure Solenoid Valve

DESCRIPTION AND OPERATION (Continued)

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 PCM. This feedback is needed to adequately control governor pressure.

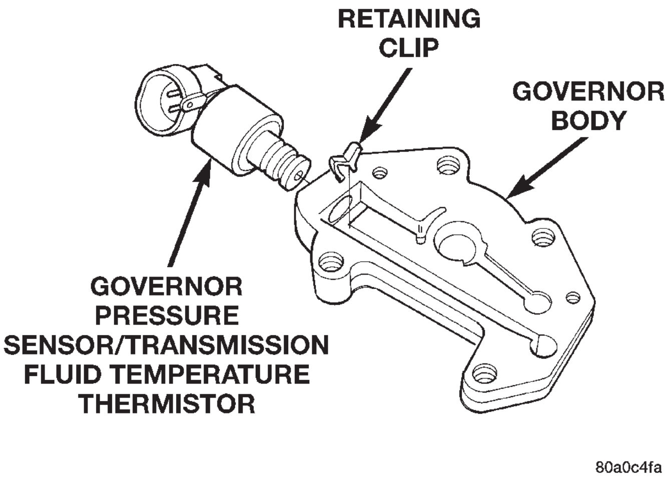

Fig. 4 Governor Pressure Sensor

GOVERNOR BODY AND TRANSFER PLATE

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. 4). 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 the necessary governor pressure.

TRANSMISSION FLUID TEMPERATURE THERMISTOR

Transmission fluid temperature readings are supplied to the transmission control module by the thermistor. 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 thermistor at room temperature is approximately 1000 ohms.

The PCM prevents engagement of the converter clutch and overdrive clutch, when fluid temperature is below approximately 10°C (50°F).

If fluid temperature exceeds 126°C (260°F), the PCM causes 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 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 part of the governor pressure sensor assembly and is immersed in transmission fluid at all times.

TRANSMISSION SPEED SENSOR

The speed sensor (Fig. 5) is located in the overdrive gear case. The sensor is positioned over the park gear and monitors transmission output shaft rotating speed. 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 a backup for the transmission speed sensor. Signals from this sensor are shared with the powertrain control module.

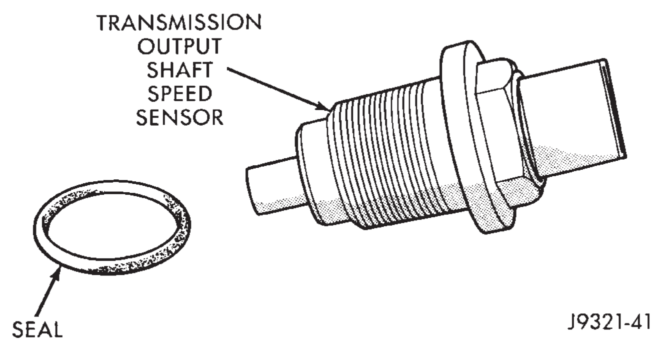

Fig. 5 Transmission Output Speed Sensor

THROTTLE POSITION SENSOR (TPS)

The TPS provides throttle position input signals to the PCM. This input signal is used to determine overdrive and converter clutch shift schedule and to select the proper governor curve.

POWERTRAIN CONTROL MODULE (PCM)

The PCM 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, throttle position sensor, and battery temperature sensor.

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, 1°C (30°F). A second curve is used when fluid temperature is at, or above, 10°C (50°F) during nor-

DESCRIPTION AND OPERATION (Continued)

mal 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.

SHIFT VALVE OPERATION

The shift valves are moved by a combination of throttle and governor pressure. The governor pressure is generated by electrical components.

The conditions under which a shift to fourth will not occur are:

- Overdrive switch is Off
- Transmission fluid temperature is below 10°C (50°F) or above 121°C (250°F)
- Shift to third not yet completed
- Vehicle speed too low for 3-4 shift to occur
- Battery temperature below –5°F.

HYDRAULIC CONTROL SYSTEM

The 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, quick fill, and timing valves plus the 3-4 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 valves. The check ball either diverts line pressure away from or directly to the 3-4 valves.

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. The 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 valve.

The 3-4 accumulator is mounted on the overdrive housing and performs the same function as the 2-3 accumulator; it is used to smooth engagement during a 3-4 shift.

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.

OVERDRIVE OFF SWITCH

The overdrive OFF (control) switch is located in the instrument panel. The switch is a momentary contact device that signals the PCM 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 overdrive OFF mode defaults to ON after the ignition switch is cycled OFF and ON. 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 3-4 upshift. The control switch indicator light illuminates only when the overdrive switch is turned to the OFF position, or when illuminated by the transmission control module.

3-4 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

DESCRIPTION AND OPERATION (Continued)

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 control switch must be in the ON position to transmit overdrive status to the PCM. A 3-4 upshift occurs only when the overdrive solenoid is energized by the PCM. The PCM energizes the overdrive solenoid during the 3-4 upshift. This causes the solenoid check ball to close the vent port allowing line pressure from the 2-3 shift valve to act directly on the 3-4 upshift valve. Line pressure on the 3-4 shift valve overcomes valve spring pressure 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 direct clutch is disengaged before the overdrive clutch is engaged. The boost valve provides increased fluid for lubrication and torque convertor clutch capacity. The 3-4 accumulator cushions overdrive clutch engagement to smooth 3-4 upshifts. The accumulator is charged at the same time as apply pressure acts against the overdrive piston.

CONVERTER CLUTCH ENGAGEMENT

Converter clutch engagement in third or fourth gear range is controlled by sensor inputs to the powertrain control module. Inputs that determine clutch engagement are: coolant temperature, engine rpm, vehicle speed, throttle position, and manifold vacuum. 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.

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. All valves have an arrow (or similar mark) to indicate direction of flow through the valve.

BRAKE TRANSMISSION SHIFT INTERLOCK MECHANISM

The Brake Transmission Shifter/Ignition Interlock (BTSI), is a cable and solenoid operated system. It interconnects the automatic transmission floor mounted shifter to the steering column ignition switch (Fig. 6). 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. An additional electrically activated feature will prevent shifting out of the PARK position unless the brake pedal is depressed at least one-half an inch. A magnetic holding device in line with the park lock cable is energized when the ignition is in the RUN position. When the key is in the RUN position and the brake pedal is depressed, the shifter is unlocked and will move into any position. The interlock system also prevents the ignition switch from being turned to the LOCK or ACCESSORY position (Fig. 6), unless the shifter is fully locked into the PARK position.

DIAGNOSIS AND TESTING

AUTOMATIC TRANSMISSION DIAGNOSIS

Automatic transmission problems can be a result of poor engine performance, incorrect fluid level, incorrect linkage or cable adjustment, band or hydraulic control pressure adjustments, hydraulic system malfunctions or electrical/mechanical component malfunctions. Begin diagnosis by checking the easily accessible items such as: fluid level and condition, linkage adjustments and electrical connections. A road test will determine if further diagnosis is necessary.

PRELIMINARY DIAGNOSIS

Two basic procedures are required. One procedure for vehicles that are drivable and an alternate procedure for disabled vehicles (will not back up or move forward).

VEHICLE IS DRIVEABLE

(1) Check for transmission fault codes using DRB scan tool.

DIAGNOSIS AND TESTING (Continued)

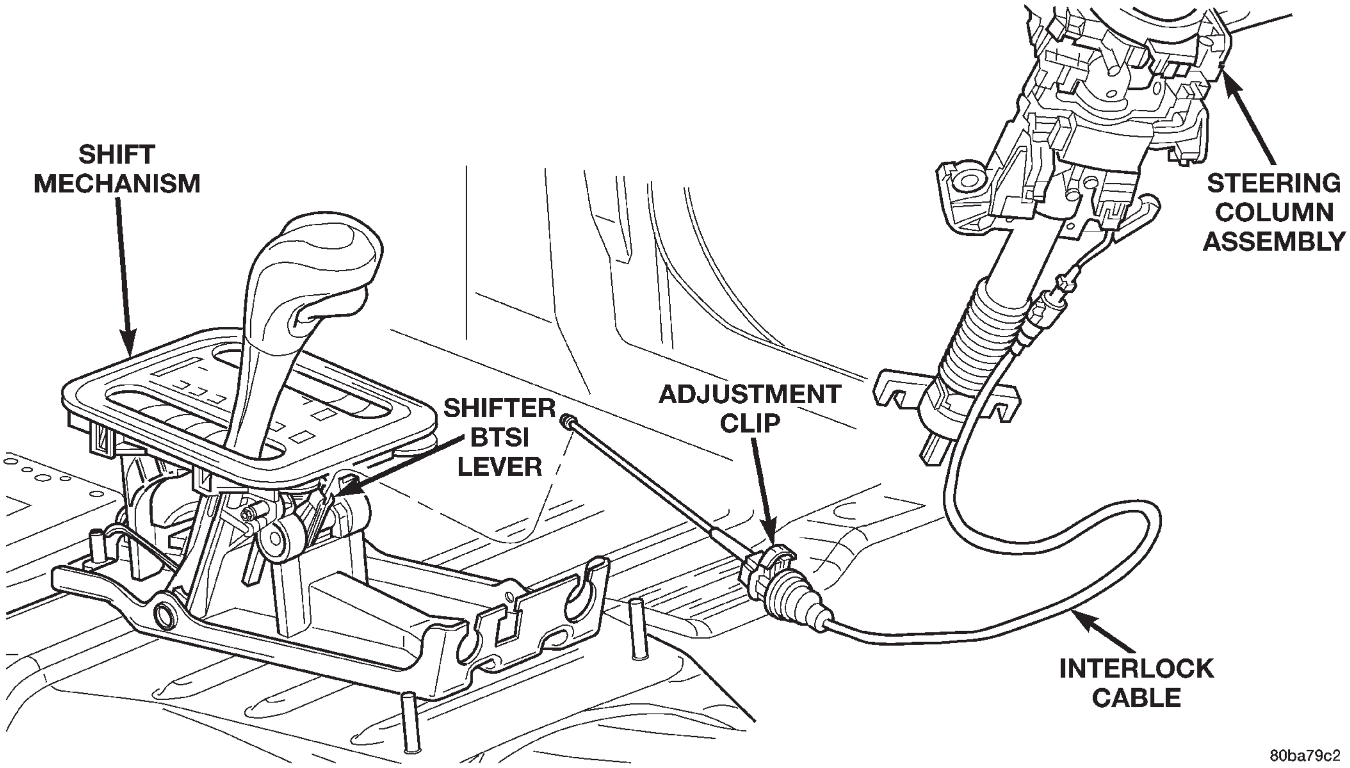

Fig. 6 Ignition Interlock Cable

(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 or disconnected gearshift or throttle linkage.

(3) Check for cracked, leaking cooler lines, or loose or missing pressure-port plugs.

(4) Raise and support vehicle on safety stands, 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 shaft 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, or input shaft.

(c) If propeller shaft does not turn and transmission is not noisy, perform hydraulic-pressure test to determine if problem is hydraulic or mechanical.

PARK/NEUTRAL POSITION SWITCH

The center terminal of the park/neutral position switch is the sense/starter-circuit terminal. It provides the ground for the starter solenoid circuit when the transmission selector lever is in PARK or NEUTRAL positions only. The outer terminals on the switch are for the backup lamp circuit.

SWITCH TEST

To test the switch, remove the wiring connector. Test for continuity between the center terminal and the transmission case. Continuity should exist when the transmission is in PARK or NEUTRAL only. Continuity should not exist any other time or with the transmission in any other gear.

Shift the transmission into REVERSE and test continuity at the switch outer terminals. Continuity should exist when the transmission is in REVERSE only. Continuity should not exist between the outer terminals and the case.

Check gearshift linkage adjustment before replacing a switch that tests faulty.

OVERDRIVE ELECTRICAL CONTROLS

The overdrive off switch, valve body solenoid, case connectors and related wiring can all be tested with

DIAGNOSIS AND TESTING (Continued)

a 12 volt test lamp or a volt/ohmmeter. Check continuity of each component when diagnosis indicates this is necessary. Refer to Group 8W, Wiring Diagrams, for component locations and circuit information.

Switch and solenoid continuity should be checked whenever the transmission fails to shift into fourth gear range.

BRAKE TRANSMISSION SHIFT INTERLOCK

(1) Verify that the key can only be removed in the PARK position.

(2) When the shift lever is in PARK And the shift handle pushbutton is in the “OUT” position, the ignition key cylinder should rotate freely from OFF to LOCK. When the shifter is in any other gear or neutral position, the ignition key cylinder should not rotate to the LOCK position.

(3) Shifting out of PARK should be possible when the ignition key cylinder is in the OFF position.

(4) Shifting out of PARK should not be possible while applying 25 lb. maximum handle pushbutton force and ignition key cylinder is in the RUN or START positions unless the foot brake pedal is depressed approximately 1/2 inch (12mm).

(5) Shifting out of PARK should not be possible when the ignition key cylinder is in the ACCESSORY or LOCK positions.

(6) Shifting between any gears, NEUTRAL or into PARK may be done without depressing foot brake pedal with ignition switch in RUN or START positions and vehicle stationary or in motion.

GEARSHIFT CABLE

(1) The floor shifter lever and gate positions should be in alignment with all transmission PARK, NEUTRAL, and gear detent positions.

(2) Engine starts must be possible with floor shift lever in PARK or NEUTRAL gate positions only. Engine starts must not be possible in any other gear position.

(3) With floor shift lever handle push-button not depressed and lever in:

(a) PARK position—Apply forward force on center of handle and remove pressure. Engine starts must be possible.

(b) PARK position—Apply rearward force on center of handle and remove pressure. Engine starts must be possible.

(c) NEUTRAL position—Normal position. Engine starts must be possible.

(d) NEUTRAL position—Engine running and brakes applied, apply forward force on center of shift handle. Transmission shall not be able to shift from neutral to reverse.

THROTTLE VALVE CABLE

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 loose, early shifts and slippage between shifts may occur. If the setting is too tight, shifts may be delayed and part throttle downshifts may be very sensitive. Refer to the Adjustments section for the proper adjustment procedure.

ROAD TESTING

Before road testing, be sure the fluid level and control cable adjustments have been checked and adjusted if necessary. Verify that diagnostic trouble codes have been resolved.

Observe engine performance during the road test. A poorly tuned engine will not allow 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 will 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 provides a basis for analyzing road test results.

ANALYZING ROAD TEST

Refer to the Clutch and Band Application chart 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.

DIAGNOSIS AND TESTING (Continued)

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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Clutch And Band Application Chart

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 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 determine the probable 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 pressure test gauges are required. Test Gauge C-3292 has a 100 psi range. Test Gauge C-3293-SP has a 300 psi range and is used where pressures exceed 100 psi.

Pressure Test Port Locations

Test ports are located at both sides of the transmission case (Fig. 7).

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.

Test One - Transmission In Manual Low

NOTE: This test checks pump output, pressure regulation, and condition of the rear clutch and servo circuit. Both test gauges are required for this test.

(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.

DIAGNOSIS AND TESTING (Continued)

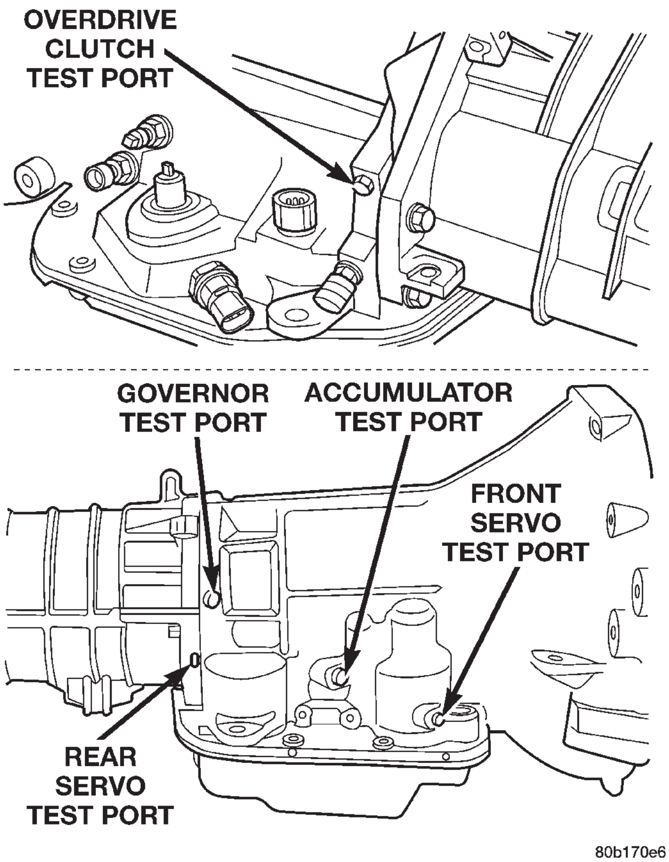


Fig. 7 Pressure Test Port Locations

(2) Connect 100 psi Gauge C-3292 to accumulator port. Then connect 300 psi Gauge C-3293-SP to rear servo port.

(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:

- 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.
- Rear servo pressure should be same as line pressure within 3 psi (20.68 kPa).

Test Two—Transmission In 2 Range

NOTE: 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

NOTE: This test checks pressure regulation and condition of the clutch circuits. Both test gauges are required for this test.

(1) Turn OD switch off.

(2) Leave vehicle on hoist and 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:

- 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. If the torque convertor is allowed to lock up pressure can rise to 130 psi (900 kPa). Be certain to maintain the correct RPM during testing.
- 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

NOTE: 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.

DIAGNOSIS AND TESTING (Continued)

(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

NOTE: 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 the road or on a hoist that will allow the rear wheels to rotate freely.

(1) Move 100 psi Test Gauge C-3292 to governor pressure port.

(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:

- Governor pressure should be no more than 20.6 kPa (3 psi) at curb idle speed and wheels not rotating.
- 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 (do not exceed 30 mph on speedometer). Governor pressure should increase in proportion to vehicle speed. Or approximately 6.89 kPa (1 psi) for every 1 mph.

(6) Governor 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.

Test Six—Transmission In Overdrive Fourth Gear

NOTE: 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 is not needed 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.

PRESSURE TEST ANALYSIS CHART

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 (seal rings, clutch seals)
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
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, low oil level
Governor pressure too high at idle speed	Governor pressure solenoid valve system fault. Refer to diagnostic book.
Governor pressure low at all mph figures	Faulty governor pressure solenoid, transmission control module, or governor pressure sensor
Lubrication pressure low at all throttle positions	Clogged fluid cooler or lines, seal rings leaking, worn pump bushings, pump, clutch retainer, or clogged filter.
Line pressure high	Output shaft plugged, sticky regulator valve
Line pressure low	Sticky regulator valve, clogged filter, worn pump

DIAGNOSIS AND TESTING (Continued)

AIR TESTING TRANSMISSION CLUTCH AND BAND OPERATION

Air-pressure testing can be used to check transmission front/rear clutch and band operation. The test can be conducted 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 (Fig. 8).

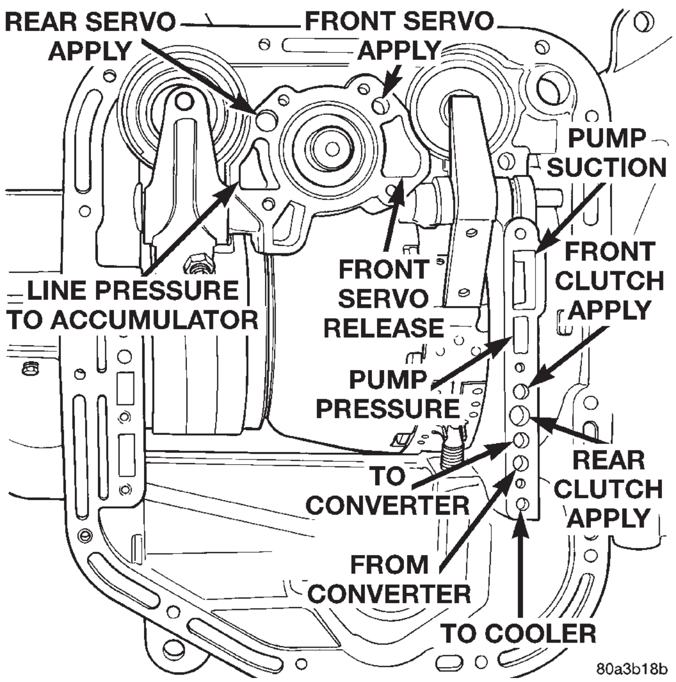


Fig. 8 Air Pressure Test Passages

Front Clutch Air Test

Place one or two fingers on the clutch housing and apply air pressure through front clutch apply passage. Piston movement can be felt and a soft thump 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 thump heard as the clutch applies.

Front Servo Apply 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 pressure 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 pressure should release the servo when air pressure is removed.

CONVERTER HOUSING FLUID LEAK DIAGNOSIS

When diagnosing converter housing fluid leaks, three items must be established before repair.

(1) Verify the correct fluid level in the transmission.

(2) Verify that a leak condition actually exists.

(3) Determined the true source of the leak.

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, excessive fluid fill or excess fluid spilled during factory fill or fill 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. 9). Pump vent or pump attaching bolt leaks are generally deposited on the inside of the converter housing and not on the converter itself (Fig. 9). 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.

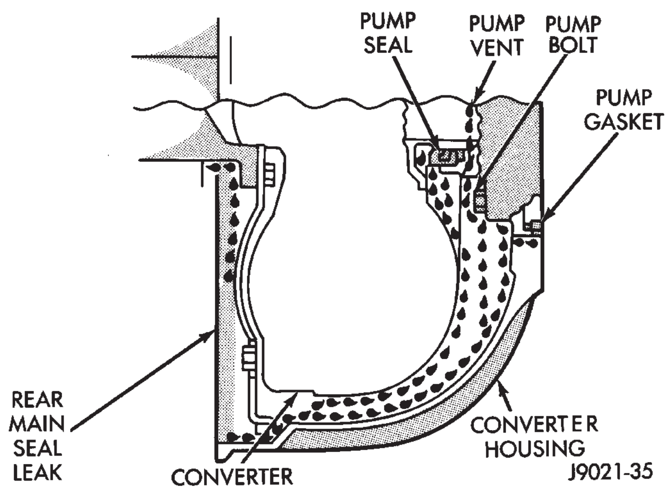


Fig. 9 Converter Housing Leak Paths

TORQUE CONVERTER LEAK POINTS

Possible sources of converter leaks are:

(1) Leaks at the weld joint around the outside diameter weld (Fig. 10).

(2) Leaks at the converter hub weld (Fig. 10).

CONVERTER HOUSING AREA LEAK CORRECTION

(1) Remove the transmission and torque converter. Refer to the procedure in this group.

(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.

DIAGNOSIS AND TESTING (Continued)

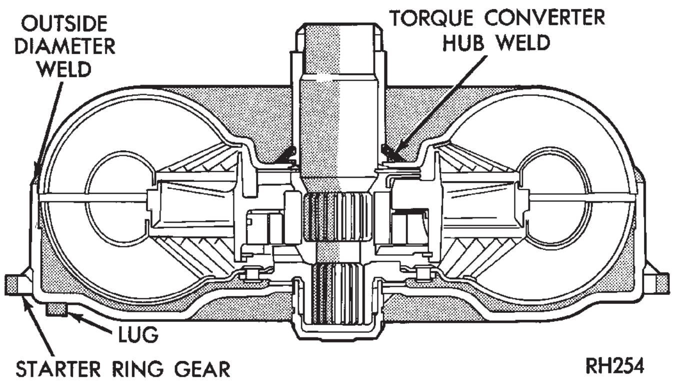


Fig. 10 Converter Leak Points—Typical

(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.

(5) Install new pump seal, O-ring, and gasket. Replace oil pump if cracked, porous or damaged in any way. Be sure to loosen the front band before installing the oil pump, damage to the oil pump seal rings may occur if the band is still tightened to the front clutch retainer.

(6) Loosen kickdown lever pin access plug three turns. Apply Loctite 592, or Permatex No. 2 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 TABLES AND CHARTS—RE TRANSMISSION

The diagnosis charts provide additional reference when diagnosing a transmission fault. The charts provide general information on a variety of transmission, overdrive unit and converter clutch fault conditions.

The hydraulic flow charts in the Schematics and Diagrams section of this group, outline fluid flow and hydraulic circuitry. Circuit operation is provided for neutral, third, fourth and reverse gear ranges. Normal working pressures are also supplied for each of the gear ranges.

DIAGNOSIS AND TESTING (Continued)

DIAGNOSIS CHARTS

CONDITION	POSSIBLE CAUSES	CORRECTION
HARSH ENGAGEMENT (FROM NEUTRAL TO DRIVE OR REVERSE)	1. Fluid Level Low.	1. Add Fluid.
	2. Throttle Linkage Misadjusted.	2. Adjust linkage - setting may be too long.
	3. Mount and Driveline Bolts Loose.	3. Check engine mount, transmission mount, propeller shaft, rear spring to body bolts, rear control arms, crossmember and axle bolt torque. Tighten loose bolts and replace missing bolts.
	4. U-Joint Worn/Broken.	4. Remove propeller shaft and replace U-Joint.
	5. Axle Backlash Incorrect.	5. Check per Service Manual. Correct as needed.
	6. Hydraulic Pressure Incorrect.	6. Check pressure. Remove, overhaul or adjust valve body as needed.
	7. Band Misadjusted.	7. Adjust rear band.
	8. Valve Body Check Balls Missing.	8. Inspect valve body for proper check ball installation.
	9. Axle Pinion Flange Loose.	9. Replace nut and check pinion threads before installing new nut. Replace pinion gear if threads are damaged.
	10. Clutch, band or planetary component damaged.	10. Remove, disassemble and repair transmission as necessary.
	11. Converter Clutch Faulty.	11. Replace converter and flush cooler and line before installing new converter.
DELAYED ENGAGEMENT (FROM NEUTRAL TO DRIVE OR REVERSE)	1. Fluid Level Low .	1. Correct level and check for leaks.
	2. Filter Clogged.	2. Change filter.
	3. Gearshift Linkage Misadjusted .	3. Adjust linkage and repair linkage if worn or damaged.
	4. Torque Converter Drain Back (Oil drains from torque converter into transmission sump).	4. If vehicle moves normally after 5 seconds after shifting into gear, no repair is necessary. If longer, inspect pump bushing for wear. Replace pump house.
	5. Rear Band Misadjusted.	5. Adjust band.
	6. Valve Body Filter Plugged.	6. Replace fluid and filter. If oil pan and old fluid were full of clutch disc material and/or metal particles, overhaul will be necessary.
	7. Oil Pump Gears Worn/Damaged.	7. Remove transmission and replace oil pump.
	8. Governor Circuit and Solenoid Valve Electrical Fault.	8. Test with DRB scan tool and repair as required.
	9. Hydraulic Pressure Incorrect.	9. Perform pressure test, remove transmission and repair as needed.
	10. Reaction Shaft Seal Rings Worn/ Broken.	10. Remove transmission, remove oil pump and replace seal rings.
	11. Rear Clutch/Input Shaft, Rear Clutch Seal Rings Damaged.	11. Remove and disassemble transmission and repair as necessary.
	12. Regulator Valve Stuck.	12. Clean.
	13. Cooler Plugged.	13. Transfer case failure can plug cooler.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NO DRIVE RANGE (REVERSE OK)	1. Fluid Level Low.	1. Add fluid and check for leaks if drive is restored.
	2. Gearshift Linkage/Cable Loose/ Misadjusted.	2. Repair or replace linkage components.
	3. Rear Clutch Burnt.	3. Remove and disassemble transmission and rear clutch and seals. Repair/replace worn or damaged parts as needed.
	4. Valve Body Malfunction.	4. Remove and disassemble valve body. Replace assembly if any valves or bores are damaged.
	5. Transmission Overrunning Clutch Broken.	5. Remove and disassemble transmission. Replace overrunning clutch.
	6. Input Shaft Seal Rings Worn/Damaged.	6. Remove and disassemble transmission. Replace seal rings and any other worn or damaged parts.
	7. Front Planetary Failed Broken.	7. Remove and repair.
NO DRIVE OR REVERSE (VEHICLE WILL NOT MOVE)	1. Fluid Level Low.	1. Add fluid and check for leaks if drive is restored.
	2. Gearshift Linkage/Cable Loose/ Misadjusted.	2. Inspect, adjust and reassemble linkage as needed. Replace worn/damaged parts.
	3. U-Joint/Axle/Transfer Case Broken.	3. Perform preliminary inspection procedure for vehicle that will not move. Refer to procedure in diagnosis section.
	4. Filter Plugged.	4. Remove and disassemble transmission. Repair or replace failed components as needed. Replace filter. If filter and fluid contained clutch material or metal particles, an overhaul may be necessary. Perform lube flow test. Flush oil. Replace cooler as necessary.
	5. Oil Pump Damaged.	5. Perform pressure test to confirm low pressure. Replace pump body assembly if necessary.
	6. Valve Body Malfunctioned.	6. Check 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.
	7. Transmission Internal Component Damaged.	7. Remove and disassemble transmission. Repair or replace failed components as needed.
	8. Park Sprag not Releasing - Check Stall Speed, Worn/Damaged/Stuck.	8. Remove, disassemble, repair.
	9. Torque Converter Damage.	9. Inspect and replace as required.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
SHIFTS DELAYED OR ERRATIC (SHIFTS ALSO HARSH AT TIMES)	1. Fluid Level Low/High.	1. Correct fluid level and check for leaks if low.
	2. Fluid Filter Clogged.	2. Replace filter. If filter and fluid contained clutch material or metal particles, an overhaul may be necessary. Perform lube flow test.
	3. Throttle Linkage Misadjusted.	3. Adjust linkage as described in service section.
	4. Throttle Linkage Binding.	4. Check cable for binding. Check for return to closed throttle at transmission.
	5. Gearshift Linkage/Cable Misadjusted.	5. Adjust linkage/cable as described in service section.
	6. Clutch or Servo Failure.	6. Remove valve body and air test clutch, and band servo operation. Disassemble and repair transmission as needed.
	7. Governor Circuit Electrical Fault.	7. Test using DRB scan tool and repair as required.
	8. Front Band Misadjusted.	8. Adjust band.
	9. Pump Suction Passage Leak.	9. Check for excessive foam on dipstick after normal driving. Check for loose pump bolts, defective gasket. Replace pump assembly if needed.
NO REVERSE (D RANGES OK)	1. Gearshift Linkage/Cable Misadjusted/ Damaged.	1. Repair or replace linkage parts as needed.
	2. Park Sprag Sticking.	2. Replace overdrive annulus gear.
	3. Rear Band Misadjusted/Worn.	3. Adjust band; replace.
	4. Valve Body Malfunction.	4. Remove and service valve body. Replace valve body if any valves or valve bores are worn or damaged.
	5. Rear Servo Malfunction.	5. Remove and disassemble transmission. Replace worn/damaged servo parts as necessary.
	6. Direct Clutch in Overdrive Worn.	6. Disassemble overdrive. Replace worn or damaged parts.
	7. Front Clutch Burnt.	7. Remove and disassemble transmission. Replace worn, damaged clutch parts as required.
HAS FIRST/ REVERSE ONLY (NO 1-2 OR 2-3 UPSHIFT)	1. Governor Circuit Electrical Fault.	1. Test using DRB scan tool and repair as required.
	2. Valve Body Malfunction.	2. Repair stuck 1-2 shift valve or governor plug.
	3. Front Servo/Kickdown Band Damaged/ Burned.	3. Repair/replace.
MOVES IN 2ND OR 3RD GEAR, ABRUPTLY DOWNSHIFTS TO LOW	1. Valve Body Malfunction.	1. Remove, clean and inspect. Look for stuck 1-2 valve or governor plug.
	2. Governor Components Sticking.	2. Remove, clean and inspect. Replace faulty parts.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NO LOW GEAR (MOVES IN 2ND OR 3RD GEAR ONLY)	1. Governor Components Sticking.	1. Remove clean, inspect and repair as required.
	2. Governor Circuit Electrical Fault.	2. Test with DRB scan tool and repair as required.
	3. Valve Body Malfunction.	3. Remove, clean and inspect. Look for sticking 1-2 shift valve, 2-3 shift valve, governor plug or broken springs.
	4. Front Servo Piston Cocked in Bore.	4. Inspect servo and repair as required.
	5. Front Band Linkage Malfunction.	5. Inspect linkage and look for bind in linkage.
NO KICKDOWN OR NORMAL DOWNSHIFT	1. Throttle Linkage Misadjusted.	1. Adjust linkage.
	2. Accelerator Pedal Travel Restricted.	2. Verify floor mat is not under pedal, repair worn accelerator cable or bent brackets.
	3. Valve Body Hydraulic Pressures Too High or Too Low Due to Valve Body Malfunction or Incorrect Hydraulic Control Pressure Adjustments.	3. Perform hydraulic pressure tests to determine cause and repair as required. Correct valve body pressure adjustments as required.
	4. Governor Circuit Electrical Fault.	4. Test with DRB scan tool and repair as required.
	5. Valve Body Malfunction.	5. Perform hydraulic pressure tests to determine cause and repair as required. Correct valve body pressure adjustments as required.
	6. TPS Malfunction.	6. Replace sensor, check with DRB scan tool.
	7. PCM Malfunction.	7. Check with DRB scan tool and replace if required.
	8. Valve Body Malfunction.	8. Repair sticking 1-2, 2-3 shift valves, governor plugs, 3-4 solenoid, 3-4 shift valve, 3-4 timing valve.
STUCK IN LOW GEAR (WILL NOT UPSHIFT)	1. Throttle Linkage Misadjusted/Stuck.	1. Adjust linkage and repair linkage if worn or damaged. Check for binding cable or missing return spring.
	2. Gearshift Linkage Misadjusted.	2. Adjust linkage and repair linkage if worn or damaged.
	3. Governor Component Electrical Fault.	3. Check operating pressures and test with DRB scan tool, repair faulty component.
	4. Front Band Out of Adjustment.	4. Adjust Band.
	5. Clutch or Servo Malfunction.	5. Air pressure check operation of clutches and bands. Repair faulty component.
CREEPS IN NEUTRAL	1. Gearshift Linkage Misadjusted.	1. Adjust linkage.
	2. Rear Clutch Dragging/Warped.	2. Disassemble and repair.
	3. Valve Body Malfunction.	3. Perform hydraulic pressure test to determine cause and repair as required.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
BUZZING NOISE	1. Fluid Level Low.	1. Add fluid and check for leaks.
	2. Shift Cable Misassembled.	2. Route cable away from engine and bell housing.
	3. Valve Body Misassembled.	3. Remove, disassemble, inspect valve body. Reassemble correctly if necessary. Replace assembly if valves or springs are damaged. Check for loose bolts or screws.
	4. Pump Passages Leaking.	4. Check pump for porous casting, scores on mating surfaces and excess rotor clearance. Repair as required. Loose pump bolts.
	5. Cooling System Cooler Plugged.	5. Flow check cooler circuit. Repair as needed.
	6. Overrunning Clutch Damaged.	6. Replace clutch.
SLIPS IN REVERSE ONLY	1. Fluid Level Low.	1. Add fluid and check for leaks.
	2. Gearshift Linkage Misadjusted.	2. Adjust linkage.
	3. Rear Band Misadjusted.	3. Adjust band.
	4. Rear Band Worn.	4. Replace as required.
	5. Overdrive Direct Clutch Worn.	5. Disassemble overdrive. Repair as needed.
	6. Hydraulic Pressure Too Low.	6. Perform hydraulic pressure tests to determine cause.
	7. Rear Servo Leaking.	7. Air pressure check clutch-servo operation and repair as required.
	8. Band Linkage Binding.	8. Inspect and repair as required.
SLIPS IN FORWARD DRIVE RANGES	1. Fluid Level Low.	1. Add fluid and check for leaks.
	2. Fluid Foaming.	2. Check for high oil level, bad pump gasket or seals, dirt between pump halves and loose pump bolts. Replace pump if necessary.
	3. Throttle Linkage Misadjusted.	3. Adjust linkage.
	4. Gearshift Linkage Misadjusted.	4. Adjust linkage.
	5. Rear Clutch Worn.	5. Inspect and replace as needed.
	6. Low Hydraulic Pressure Due to Worn Pump, Incorrect Control Pressure Adjustments, Valve Body Warpage or Malfunction, Sticking, Leaking Seal Rings, Clutch Seals Leaking, Servo Leaks, Clogged Filter or Cooler Lines.	6. Perform hydraulic and air pressure tests to determine cause.
	7. Rear Clutch Malfunction, Leaking Seals or Worn Plates.	7. Air pressure check clutch-servo operation and repair as required.
	8. Overrunning Clutch Worn, Not Holding (Slips in 1 Only).	8. Replace Clutch.
SLIPS IN LOW GEAR ″D″ ONLY, BUT NO IN 1 POSITION	Overrunning Clutch Faulty.	Replace overrunning clutch.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
GROWLING, GRATING OR SCRAPING NOISES	1. Drive Plate Broken.	1. Replace.
	2. Torque Converter Bolts Hitting Dust Shield.	2. Dust shield bent. Replace or repair.
	3. Planetary Gear Set Broken/Seized.	3. Check for debris in oil pan and repair as required.
	4. Overrunning Clutch Worn/Broken.	4. Inspect and check for debris in oil pan. Repair as required.
	5. Oil Pump Components Scored/Binding.	5. Remove, inspect and repair as required.
	6. Output Shaft Bearing or Bushing Damaged.	6. Remove, inspect and repair as required.
	7. Clutch Operation Faulty.	7. Perform air pressure check and repair as required.
	8. Front and Rear Bands Misadjusted.	8. Adjust bands.
DRAGS OR LOCKS UP	1. Fluid Level Low.	1. Check and adjust level.
	2. Clutch Dragging/Failed.	2. Air pressure check clutch operation and repair as required.
	3. Front or Rear Band Misadjusted.	3. Adjust bands.
	4. Case Leaks Internally.	4. Check for leakage between passages in case.
	5. Servo Band or Linkage Malfunction.	5. Air pressure check servo operation and repair as required.
	6. Overrunning Clutch Worn.	6. Remove and inspect clutch. Repair as required.
	7. Planetary Gears Broken.	7. Remove, inspect and repair as required (look for debris in oil pan).
NO 4-3 DOWNSHIFT	1. Circuit Wiring and/or Connectors Shorted.	1. Test wiring and connectors with test lamp and volt/ohmmeter. Repair wiring as necessary. Replace connectors and/or harnesses as required.
	2. PCM Malfunction.	2. Check PCM operation with DRB scan tool. Replace PCM only if faulty.
	3. TPS Malfunction.	3. Check TPS with DRB scan tool at PCM.
	4. Lockup Solenoid Not Venting.	4. Remove valve body and replace solenoid assembly if plugged or shorted.
	5. Overdrive Solenoid Not Venting.	5. Remove valve body and replace solenoid if plugged or shorted.
	6. Valve Body Valve Sticking.	6. Repair stuck 3-4 shift valve or lockup timing valve.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NO 4-3 DOWNSHIFT WHEN CONTROL SWITCH IS TURNED OFF	1. Control Switch Open/Shorted.	1. Test and replace switch if faulty.
	2. Overdrive Solenoid Connector Shorted.	2. Test solenoids and replace if seized or shorted.
	3. PCM Malfunction.	3. Test with DRB scan tool. Replace PCM if faulty.
	4. Valve Body Stuck Valves.	4. Repair stuck 3-4, lockup or lockup timing valve.
CLUNK NOISE FROM DRIVELINE ON CLOSED THROTTLE 4-3 DOWNSHIFT	1. Transmission Fluid Low.	1. Add Fluid.
	2. Throttle Cable Misadjusted.	2. Adjust cable.
	3. Overdrive Clutch Select Spacer Wrong Spacer.	3. Replace overdrive piston thrust plate spacer.
3-4 UPSHIFT OCCURS IMMEDIATELY AFTER 2-3 SHIFT	1. Overdrive Solenoid Connector or Wiring Shorted.	1. Test connector and wiring for loose connections, shorts or ground and repair as needed.
	2. TPS Malfunction.	2. Test TPS and replace as necessary. Check with DRB scan tool.
	3. PCM Malfunction.	3. Test PCM with DRB scan tool and replace controller if faulty.
	4. Overdrive Solenoid Malfunction.	4. Replace solenoid.
	5. Valve Body Malfunction.	5. 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.
WHINE/NOISE RELATED TO ENGINE SPEED	1. Fluid Level Low.	1. Add fluid and check for leaks.
	2. Shift Cable Incorrect Routing.	2. Check shift cable for correct routing. Should not touch engine or bell housing.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NO 3-4 UPSHIFT	1. O/D Switch 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 or grounds in circuit).
	3. O/D Switch Wire Shorted/Open Cut.	3. Check wires/connections with 12V test lamp and voltmeter. Repair damaged or loose wire/connection as necessary.
	4. Distance or Coolant Sensor Malfunction.	4. Test both sensors with test lamp or volt/ohmmeter and replace faulty sensor.
	5. TPS Malfunction.	5. Check with DRB scan tool and replace if necessary.
	6. Neutral Switch to PCM Wire Shorted/ Cut.	6. Test switch as described in service section and replace if necessary. Engine no start.
	7. PCM Malfunction.	7. Check with DRB scan tool and replace if necessary.
	8. Overdrive Solenoid Shorted/Open.	8. Replace solenoid if shorted or open and repair loose or damaged wires (DRB scan tool).
	9. Solenoid Feed Orifice in Valve Body Blocked.	9. Remove, disassemble, and clean valve body thoroughly. Check feed orifice.
	10. Overdrive Clutch Failed.	10. Disassemble overdrive and repair as needed.
	11. Hydraulic Pressure Low.	11. Pressure test transmission to determine cause.
	12. Valve Body Valve Stuck.	12. Repair stuck 3-4 shift valve, 3-4 timing valve.
	13. O/D Piston Incorrect Spacer.	13. Remove unit, check end play and install correct spacer.
	14. Overdrive Piston Seal Failure.	14. Replace both seals.
	15. O/D Check Valve/Orifice Failed.	15. Check for free movement and secure assembly (in piston retainer). Check ball bleed orifice.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
SLIPS IN OVERDRIVE FOURTH GEAR	1. Fluid Level Low.	1. Add fluid and check for leaks.
	2. Overdrive Clutch Pack Worn.	2. Remove overdrive unit and rebuild clutch pack.
	3. Overdrive Piston Retainer Bleed Orifice Blown Out.	3. Disassemble transmission, remove retainer and replace orifice.
	4. Overdrive Piston or Seal Malfunction.	4. Remove overdrive unit. Replace seals if worn. Replace piston if damaged. If piston retainer is damaged, remove and disassemble the transmission.
	5. 3-4 Shift Valve, Timing Valve or Accumulator Malfunction.	5. 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.
	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. 3 thrust bearing is between overrunning clutch hub and output shaft).
	7. O/D Check Valve/Bleed Orifice Failure.	7. Check for function/secure orifice insert in O/D piston retainer.
DELAYED 3-4 UPSHIFT (SLOW TO ENGAGE)	1. Fluid Level Low.	1. Add fluid and check for leaks.
	2. Throttle Valve Cable Misadjusted.	2. Adjust throttle valve cable.
	3. Overdrive Clutch Pack Worn/Burnt.	3. Remove unit and rebuild clutch pack.
	4. TPS Faulty.	4. Test with DRB scan tool and replace TPS.
	5. Overdrive Clutch Bleed Orifice Plugged.	5. Disassemble transmission and replace orifice.
	6. Overdrive Solenoid or Wiring Shorted/ Open.	6. Test solenoid and check wiring for loose/corroded connections or shorts/ grounds. Replace solenoid if faulty and repair wiring if necessary.
	7. Overdrive Excess Clearance.	7. Remove unit. Measure end play and select proper spacer.
	8. O/D Check Valve Missing or Stuck.	8. Check for presence of check valve. Repair or replace as required.
TORQUE CONVERTER LOCKS UP IN SECOND AND/OR THIRD GEAR	Lockup Solenoid, Relay or Wiring Shorted/Open.	Test solenoid, relay and wiring for continuity, shorts or grounds. Replace solenoid and relay if faulty. Repair wiring and connectors as necessary.
HARSH 1-2, 2-3, 3-4 OR 3-2 SHIFTS	Lockup Solenoid Malfunction.	Remove valve body and replace solenoid assembly.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NO START IN PARK OR NEUTRAL	1. Gearshift Linkage/Cable Misadjusted.	1. Adjust linkage/cable.
	2. Neutral Switch Wire Open/Cut.	2. Check continuity with test lamp. Repair as required.
	3. Neutral Switch Faulty.	3. Refer to service section for test and replacement procedure.
	4. Neutral Switch Connect Faulty.	4. Connectors spread open. Repair.
	5. Valve Body Manual Lever Assembly Bent/Worn/Broken.	5. Inspect lever assembly and replace if damaged.
NO REVERSE (OR SLIPS IN REVERSE)	1. Direct Clutch Pack (front clutch) Worn.	1. Disassemble unit and rebuild clutch pack.
	2. Rear Band Misadjusted.	2. Adjust band.
	3. Front Clutch Malfunctioned/Burned.	3. Air-pressure test clutch operation. Remove and rebuild if necessary.
	4. Overdrive Thrust Bearing Failure.	4. Disassemble geartrain and replace bearings.
	5. Direct Clutch Spring Collapsed/Broken.	5. Remove and disassemble unit. Check clutch position and replace spring.
OIL LEAKS.	1. Fluid Lines and Fittings Loose/Leaks/ Damaged.	1. Tighten fittings. If leaks persist, replace fittings and lines if necessary.
	2. Fill Tube (where tube enters case) Leaks/Damaged.	2. Replace O-ring seal. Inspect tube for cracks in fill tube.
	3. Pressure Port Plug Loose Loose/ Damaged.	3. Tighten to correct torque. Replace plug or reseal if leak persists.
	4. Pan Gasket Leaks.	4. Tighten pan screws (150 in. lbs.). If leaks persist, replace gasket.
	5. Valve Body Manual Lever Shaft Seal Leaks/Worn.	5. Replace shaft seal.
	6. Rear Bearing Access Plate Leaks.	6. Replace gasket. Tighten screws.
	7. Gasket Damaged or Bolts are Loose.	7. Replace bolts or gasket or tighten both.
	8. Adapter/Extension Gasket Damaged Leaks/Damaged.	8. Replace gasket.
	9. Neutral Switch Leaks/Damaged.	9. Replace switch and gasket.
	10. Converter Housing Area Leaks.	10. Check for leaks at seal caused by worn seal or burr on converter hub (cutting seal), worn bushing, missing oil return hole 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.
	11. Pump Seal Leaks/Worn/Damaged.	11. Replace seal.
	12. Torque Converter Weld Leak/Cracked Hub.	12. Replace converter.
	13. Case Porosity Leaks.	13. Replace case.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
NOISY OPERATION IN FOURTH GEAR ONLY	1. Overdrive Clutch Discs, Plates or Snap Rings Damaged.	1. Remove unit and rebuild clutch pack.
	2. Overdrive Piston or Planetary Thrust Bearing Damaged.	2. Remove and disassemble unit. Replace either thrust bearing if damaged.
	3. Output Shaft Bearings Scored/Damaged.	3. Remove and disassemble unit. Replace either bearing if damaged.
	4. Planetary Gears Worn/Chipped.	4. Remove and overhaul overdrive unit.
	5. Overdrive Unit Overrunning Clutch Rollers Worn/Scored.	5. Remove and overhaul overdrive unit.

SERVICE PROCEDURES

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 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.

(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 (Fig. 11) and check fluid level as follows:

(a) Correct acceptable level is in crosshatch area.

(b) Correct maximum level is to MAX arrow mark.

(c) Incorrect level is at or below MIN line.

(d) If fluid is low, add only enough Mopar® ATF Plus 3 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.

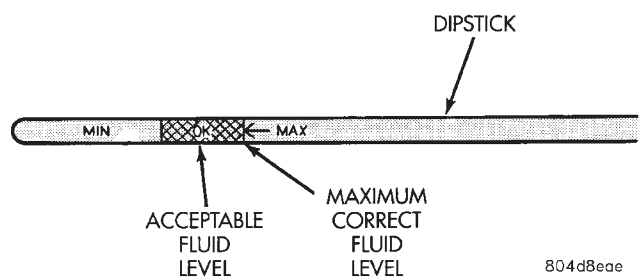


Fig. 11 Dipstick Fluid Level Marks—Typical

FLUID AND FILTER REPLACEMENT

Refer to the Maintenance Schedules in Group 0, Lubrication and Maintenance, for proper service intervals. The service fluid fill after a filter change is approximately 3.8 liters (4.0 quarts).

REMOVAL

(1) Hoist and support vehicle on safety stands.

(2) Place a large diameter shallow drain pan beneath the transmission pan.

(3) Remove bolts holding front and sides of pan to transmission (Fig. 12).

(4) Loosen bolts holding rear of pan to transmission.

(5) Slowly separate front of pan away from transmission allowing the fluid to drain into drain pan.

(6) Hold up pan and remove remaining bolt holding pan to transmission.

(7) While holding pan level, lower pan away from transmission.

(8) Pour remaining fluid in pan into drain pan.

(9) Remove screws holding filter to valve body (Fig. 13).

(10) Separate filter from valve body and pour fluid in filter into drain pan.

(11) Dispose of used trans fluid and filter properly.

SERVICE PROCEDURES (Continued)

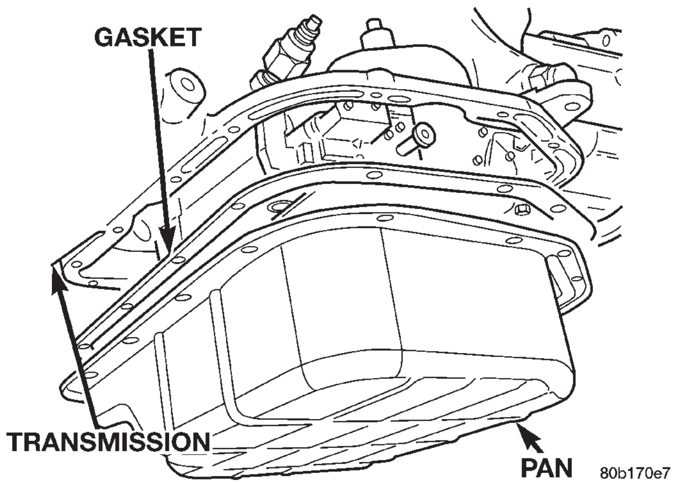


Fig. 12 Transmission Pan—Typical

INSPECTION

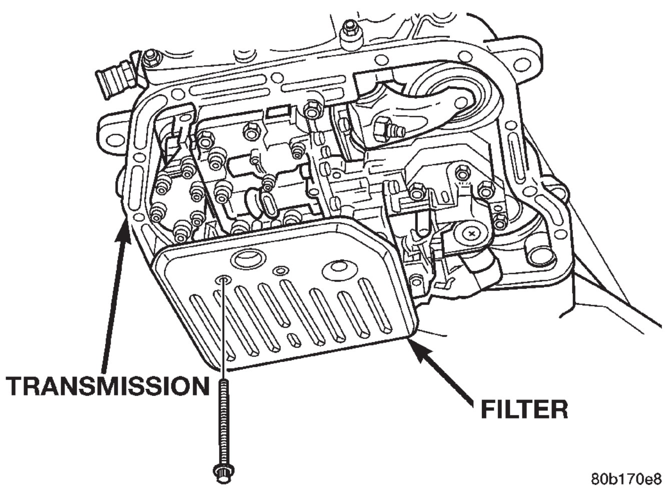


Fig. 13 Transmission Filter—Typical

Inspect bottom of pan and magnet for excessive amounts of metal. A light coating of clutch or band material on the bottom of the pan does not indicate a problem unless accompanied by slipping condition or shift lag. If fluid and pan are contaminated with excessive amounts or debris, refer to the diagnosis section of this group.

Check the adjustment of the front and rear bands, adjust if necessary.

CLEANING

(1) Using a suitable solvent, clean pan and magnet.

(2) Using a suitable gasket scraper, clean gasket material from gasket surface of transmission case and the gasket flange around the pan.

INSTALLATION

(1) Place replacement filter in position on valve body.

(2) Install screws to hold filter to valve body (Fig. 13). Tighten screws to 4 N·m (35 in. lbs.) torque.

(3) Place new gasket in position on pan and install pan on transmission.

(4) Place pan in position on transmission.

(5) Install screws to hold pan to transmission (Fig. 12). Tighten bolts to 17 N·m (150 in. lbs.) torque.

(6) Lower vehicle and fill transmission with Mopar® ATF Plus 3, type 7176 fluid.

TRANSMISSION FILL PROCEDURE

To avoid overfilling transmission after a fluid change or overhaul, perform the following procedure:

(1) Remove dipstick and insert clean funnel in transmission fill tube.

(2) Add following initial quantity of Mopar® ATF Plus 3 to transmission:

(a) If only fluid and filter were changed, add **6 pints (3 quarts)** of ATF Plus 3 to transmission.

(b) If transmission was completely overhauled, torque converter was replaced or drained, and cooler was flushed, add **16 pints (8 quarts)** of ATF Plus 3 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, set parking brake, and leave engine running at curb idle speed.

(6) Remove funnel, insert dipstick and check fluid level. If level is low, **add fluid to bring level to MIN mark on dipstick.** Check to see if the oil level is equal on both sides of the dipstick. If one side is noticeable higher than the other, the dipstick has picked up some oil from the dipstick tube. Allow the oil to drain down the dipstick tube and re-check.

(7) Drive vehicle until transmission fluid is at normal operating temperature.

(8) With the engine running at curb idle speed, the gear selector in NEUTRAL, and the parking brake applied, check the transmission fluid level.

CAUTION: Do not overfill transmission, fluid leaks, foaming and shifting problems can result.

(9) Add fluid to bring level up to MAX arrow mark.

When fluid level is correct, shut engine off, release park brake, remove funnel, and install dipstick in fill tube.

CONVERTER DRAINBACK CHECK VALVE SERVICE

The converter drainback check valve is located in the cooler outlet (pressure) line near the radiator

SERVICE PROCEDURES (Continued)

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 significant amounts of 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 overheating condition and possible transmission failure.

CAUTION: The drainback valve is a one-way flow device. It must be properly oriented in terms of flow direction for the cooler to function properly. The valve must be installed in the pressure line. Otherwise flow will be blocked and would cause an overheating condition and eventual transmission failure.

OIL PUMP VOLUME CHECK

After the new or repaired transmission has been installed, fill to the proper level with Mopar® ATF PLUS 3 (Type 7176) automatic transmission fluid. The volume should be checked using the following procedure:

(1) Disconnect the **cooler outlet** line at the rear of the transmission and place a drainpan under the disconnected line.

CAUTION: With the fluid set at the proper level, fluid collection should not exceed (1) quart or internal damage to the transmission may occur.

(2) Run the engine **at curb idle speed**, with the shift selector in neutral.

(3) If fluid flow is intermittent or it takes more than 20 seconds to collect one quart of ATF PLUS 3, disconnect the **cooler inlet** line at the front of the transmission.

(4) Refill the transmission to the proper level and recheck pump volume.

(5) If flow is found to be within acceptable limits, replace the cooler. Then fill transmission to the proper level, using Mopar® ATF PLUS 3 (Type 7176) automatic transmission fluid.

(6) If fluid flow is still found to be inadequate, check the line pressure using the Transaxle Hydraulic Pressure Test procedure.

FLUSHING COOLERS AND TUBES

When a transmission failure has contaminated the fluid, the oil cooler(s) must be flushed. The torque converter must also be replaced. This will insure that metal particles or sludged oil are not later transferred back into the reconditioned (or replaced) transmission.

The only recommended procedure for flushing coolers and lines is to use Tool 6906 Cooler Flusher.

WARNING: WEAR PROTECTIVE EYEWEAR THAT MEETS THE REQUIREMENTS OF OSHA AND ANSI Z87.1–1968. WEAR STANDARD INDUSTRIAL RUBBER GLOVES.

KEEP LIGHTED CIGARETTES, SPARKS, FLAMES, AND OTHER IGNITION SOURCES AWAY FROM THE AREA TO PREVENT THE IGNITION OF COMBUSTIBLE LIQUIDS AND GASES. KEEP A CLASS (B) FIRE EXTINGUISHER IN THE AREA WHERE THE FLUSHER WILL BE USED.

KEEP THE AREA WELL VENTILATED.

DO NOT LET FLUSHING SOLVENT COME IN CONTACT WITH YOUR EYES OR SKIN: IF EYE CONTAMINATION OCCURS, FLUSH EYES WITH WATER FOR 15 TO 20 SECONDS. REMOVE CONTAMINATED CLOTHING AND WASH AFFECTED SKIN WITH SOAP AND WATER. SEEK MEDICAL ATTENTION.

COOLER FLUSH USING TOOL 6906

(1) Remove cover plate filler plug on Tool 6906. Fill reservoir 1/2 to 3/4 full of fresh flushing solution. Flushing solvents are petroleum based solutions generally used to clean automatic transmission components. **DO NOT** use solvents containing acids, water, gasoline, or any other corrosive liquids.

(2) Reinstall filler plug on Tool 6906.

(3) Verify pump power switch is turned OFF. Connect red alligator clip to positive (+) battery post. Connect black (-) alligator clip to a good ground.

(4) Disconnect the cooler lines at the transmission.

NOTE: When flushing transmission cooler and lines, ALWAYS reverse flush.

NOTE: The converter drainback valve must be removed and an appropriate replacement hose installed to bridge the space between the transmission cooler line and the cooler fitting. Failure to remove the drainback valve will prevent reverse flushing the system.

(5) Connect the BLUE pressure line to the OUTLET (From) cooler line.

(6) Connect the CLEAR return line to the INLET (To) cooler line.

SERVICE PROCEDURES (Continued)

(7) Turn pump ON for two to three minutes to flush cooler(s) and lines. Monitor pressure readings and clear return lines. Pressure readings should stabilize below 20 psi. for vehicles equipped with a single cooler and 30 psi. for vehicles equipped with dual coolers. If flow is intermittent or exceeds these pressures, replace cooler.

(8) Turn pump OFF.

(9) Disconnect CLEAR suction line from reservoir at cover plate. Disconnect CLEAR return line at cover plate, and place it in a drain pan.

(10) Turn pump ON for 30 seconds to purge flushing solution from cooler and lines. Turn pump OFF.

(11) Place CLEAR suction line into a one quart container of Mopar® ATF Plus 3, type 7176 automatic transmission fluid.

(12) Turn pump ON until all transmission fluid is removed from the one quart container and lines. This purges any residual cleaning solvent from the transmission cooler and lines. Turn pump OFF.

(13) Disconnect alligator clips from battery. Reconnect flusher lines to cover plate, and remove flushing adapters from cooler lines.

ALUMINUM THREAD REPAIR

Damaged or worn threads in the aluminum transmission case and valve body can be repaired by the use of Heli-Coils, or equivalent. This repair consists of drilling out the worn-out damaged threads. Then tap the hole with a special Heli-Coil tap, or equivalent, and installing a Heli-Coil insert, or equivalent, into the hole. This brings the hole back to its original thread size.

Heli-Coil, or equivalent, tools and inserts are readily available from most automotive parts suppliers.

REMOVAL AND INSTALLATION

TRANSMISSION

CAUTION: The transmission and torque converter must be removed as an assembly to avoid component damage. The converter drive plate, pump bushing, or oil seal can be damaged if the converter is left attached to the driveplate during removal. Be sure to remove the transmission and torque converter as an assembly.

REMOVAL

(1) Open the hood and disconnect the negative battery cable.

(2) Remove the (2) upper fan shroud retaining bolts.

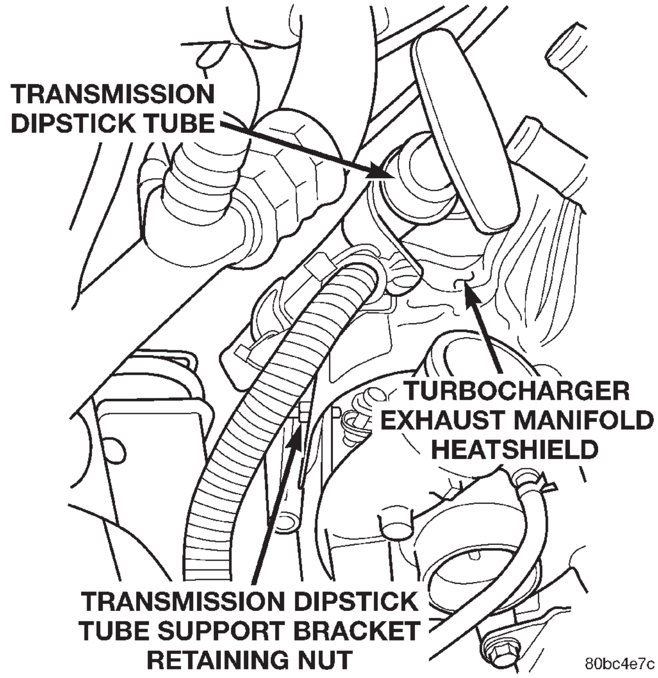


Fig. 14 Transmission Dipstick Tube Support Bracket Position & Orientation

(3) Remove the transmission dipstick tube support bracket nut from the turbocharger heatshield (Fig. 14).

(4) Position a drainpan under the transmission.

(5) Pull the transmission dipstick tube from the transmission housing.

(6) Raise the vehicle on a hoist.

(7) Remove the (2) lower fan shroud retaining bolts.

CAUTION: Mark the position of the driveshaft in relation to its companion flange prior to disassembly. Driveshaft must be reinstalled in the same position it was in prior to disassembly.

(8) Remove the front driveshaft retaining bolts (Fig. 15) and remove the driveshaft from the transfer case companion flange. Support the driveshaft with mechanics wire.

(9) Remove the rear driveshaft retaining bolts and remove the driveshaft from the transfer case companion flange. Support the driveshaft with mechanics wire (Fig. 16).

(10) Disconnect the transfer case shift cable from the shifter arm (Fig. 17).

(11) Disconnect the vent tube from the transfer case (Fig. 17).

(12) Remove the transmission oil pan and drain the transmission fluid. Reinstall the transmission oil pan.

(13) Remove the drainpan.

REMOVAL AND INSTALLATION (Continued)

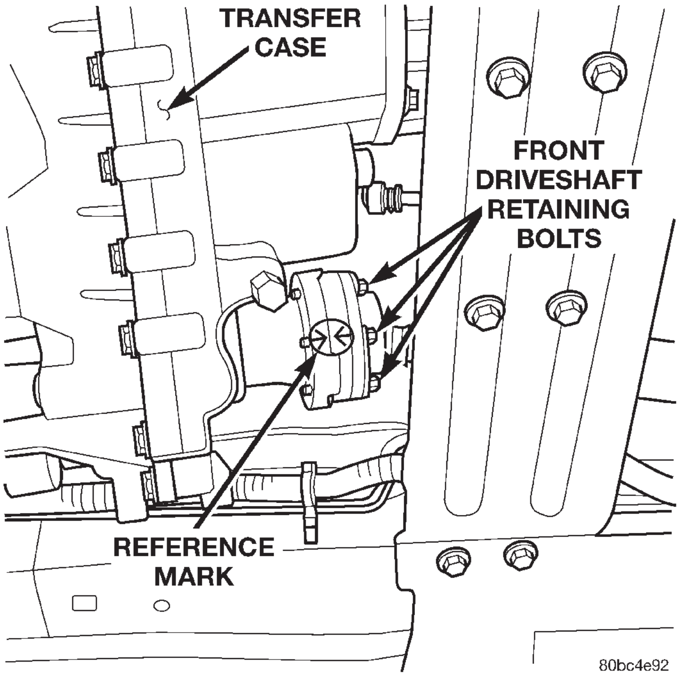


Fig. 15 Front Driveshaft Retaining Bolts

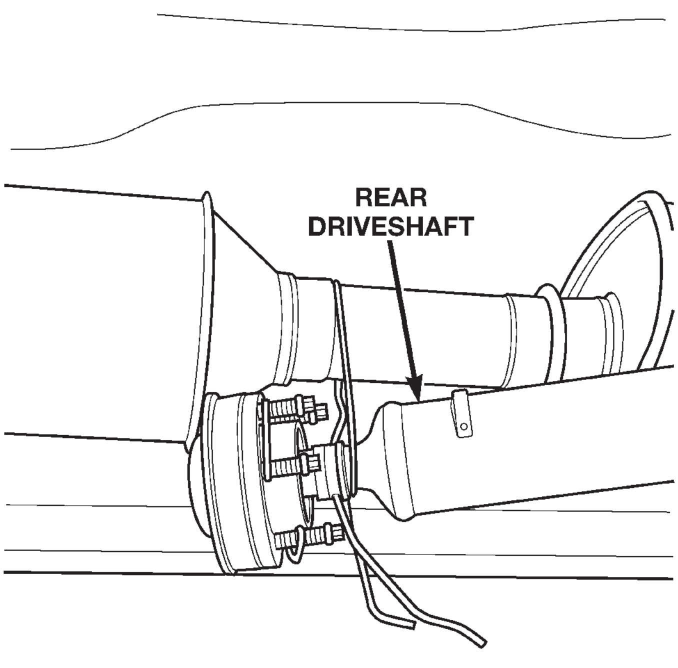


Fig. 16 Rear Driveshaft - Supported

(14) Remove the (4) exhaust system support bracket retaining bolts from the transmission support crossmember (Fig. 18).

(15) Unclip the wire harness from the transmission support crossmember.

(16) Position a jack under the transmission support crossmember.

(17) Remove the (8) transmission support crossmember retaining bolts (Fig. 18).

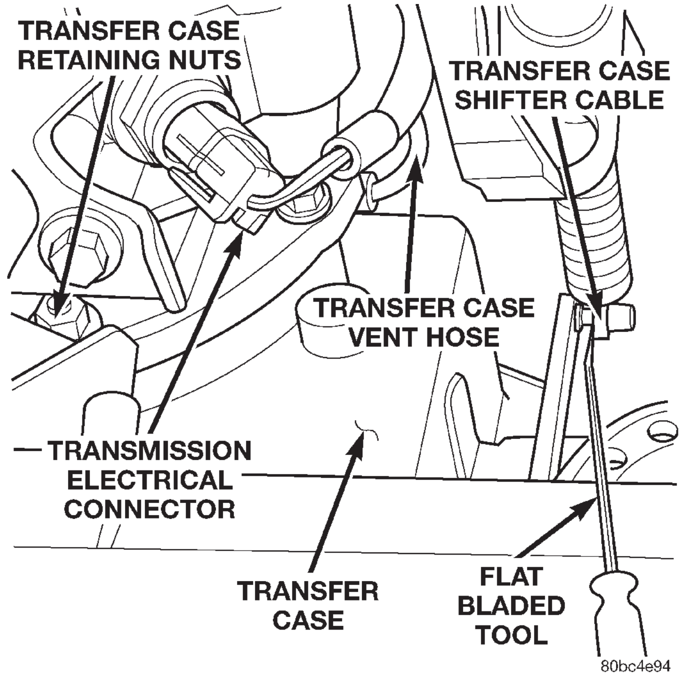


Fig. 17 Disconnecting Transfer Case Shift Linkage

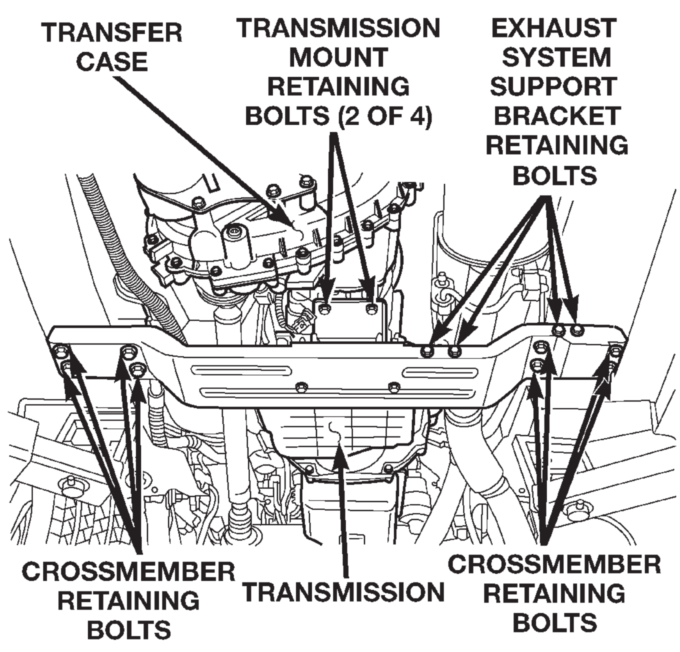


Fig. 18 Transmission Support Crossmember Position & Orientation

(18) Position a transmission jack under the transfer case.

(19) Lower the transmission assembly enough to gain access and remove the transfer case to transmission retaining nuts.

(20) Remove the transfer case from the vehicle.

(21) Remove the jack from the transmission support crossmember.

REMOVAL AND INSTALLATION (Continued)

(22) Remove the (4) transmission mount retaining bolts (Fig. 18) and remove the transmission support crossmember and mount from the vehicle.

(23) Remove the transfer case shift cable bracket from the transmission housing (Fig. 19).

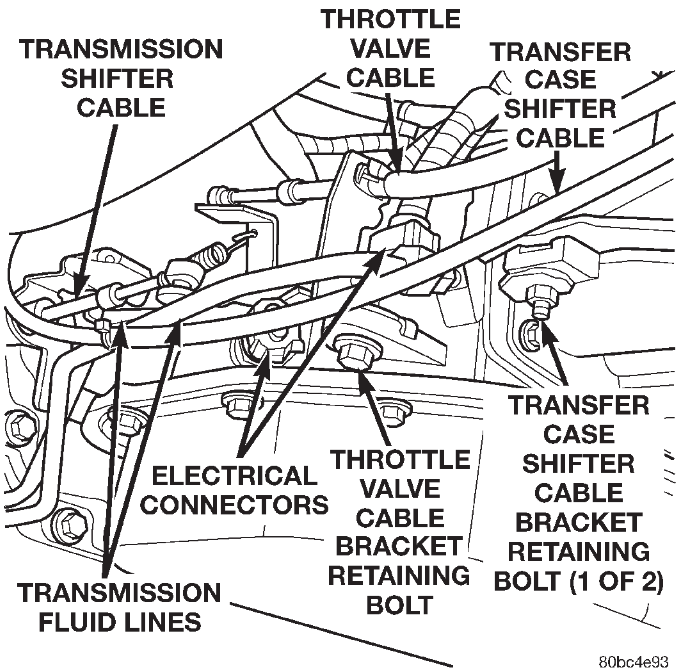


Fig. 19 Transmission Control Cables & Fluid Lines

(24) Disconnect the throttle valve cable at the ball and socket connection by gently pulling straight apart (Fig. 19).

(25) Remove the throttle valve cable bracket retaining fasteners and position the cable assembly out of the way (Fig. 19).

(26) Remove the spring from the shift lever arm (Fig. 19).

(27) Disconnect the shifter cable at the ball and socket connection by gently pulling straight apart (Fig. 19).

(28) Remove the shifter cable bracket retaining bolt from the transmission housing (Fig. 19).

(29) Remove the transmission fluid cooler lines from the transmission (Fig. 19).

(30) Disconnect all the transmission electrical connectors and unclip the wire harness from the transmission housing (Fig. 19).

(31) Remove the exhaust system inlet pipe retaining bolts from the turbocharger down pipe (Fig. 20). Support the front portion of the exhaust system with mechanics wire. Be certain to position the pipe out of the way of the torque converter bolt access hole. Located in the transmission bellhousing.

(32) Disconnect the engine speed sensor. Located on the upper right side of the transmission bellhousing.

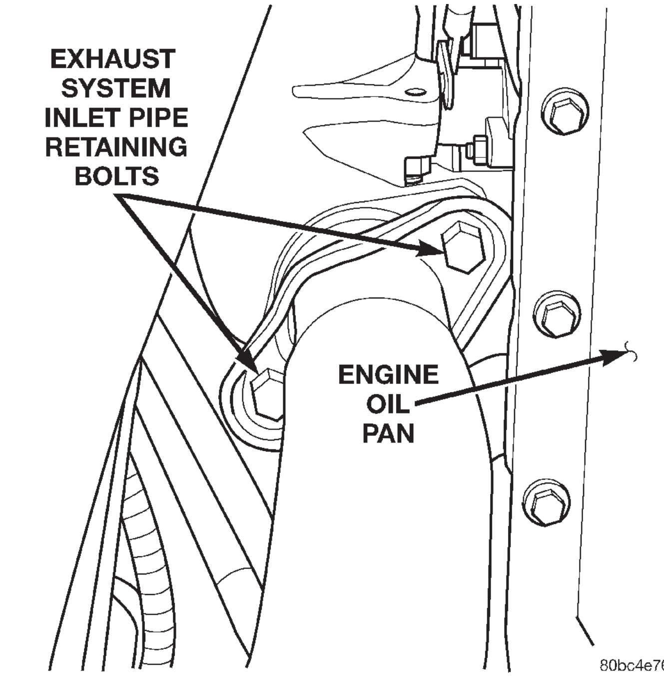


Fig. 20 Exhaust System Inlet Pipe Retaining Bolts

(33) Remove the starter motor from the vehicle. Refer to Group 8B, Starting Systems for the procedure.

NOTE: Mark the position of the torque convertor in relation to the driveplate so they can be reassembled in there original position.

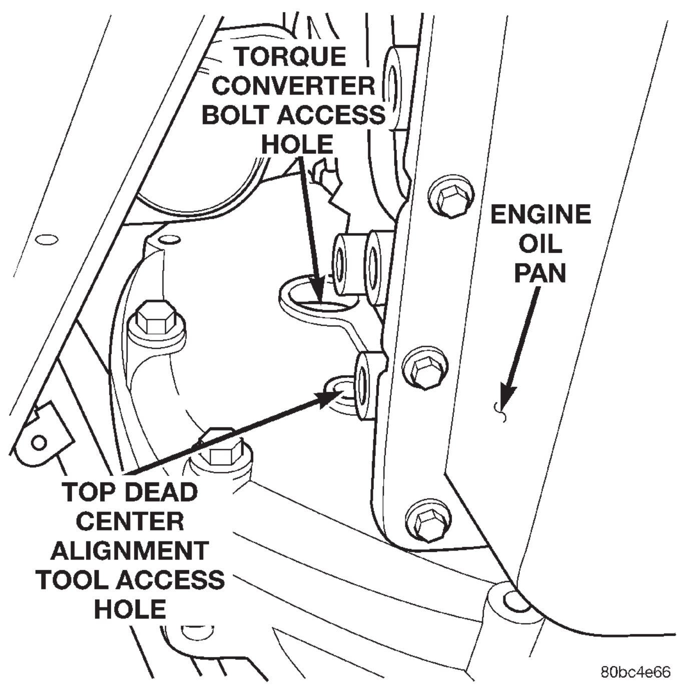


Fig. 21 Torque Converter Bolt Access Hole

REMOVAL AND INSTALLATION (Continued)

(34) Working through the torque convertor bolt access hole (Fig. 21), remove the (4) torque convertor to driveplate retaining bolts. Rotate the engine in a clockwise direction to access the converter bolts.

(35) Place a jack under the transmission.

CAUTION: Be certain the engine speed sensor has been disconnected before proceeding.

(36) Remove the (10) engine to transmission bellhousing retaining bolts.

(37) Remove the transmission and torque converter from the vehicle.

INSTALLATION

CAUTION: This engine is equipped with a engine speed sensor. Located in the top of the bellhousing. Care must be taken not to damage the sensor or corresponding wires during transmission removal and installation.

CAUTION: Check the torque converter hub and hub drive notches for sharp edges, burrs, scratches or nicks. Polish the hub and notches with 320 / 400 grit sandpaper, if necessary. The hub must be smooth to avoid damaging the pump seal at torque converter installation.

CAUTION: Lubricate the front pump seal and install at least one quart of the approved transmission fluid directly into the torque converter prior to its installation.

(1) Install the torque converter in the transmission. Refer to the procedure in this group for detailed instructions.

(2) Lubricate the rear of the crankshaft or the converter pilot hub with lithium grease.

(3) Position the transmission / converter assembly on a transmission jack and secure with chains.

NOTE: Be sure the engine block mounted dowel pins are installed and protrude far enough to hold the transmission in alignment.

(4) Using the transmission jack, position the transmission assembly so the engine block mounted dowel pins are perfectly aligned with the corresponding holes in the transmission bellhousing.

CAUTION: Be certain the torque convertor is properly installed in the transmission. If the torque convertor is not installed correctly the engine will not rotate upon installation. Refer to the Torque Converter removal and installation procedure in this group for the procedure.

(5) Install the (10) engine to transmission bellhousing retaining bolts. Torque the bolts to 102 N·m (75 ft. lbs.).

(6) Connect the engine speed sensor. Located on the upper right side of the transmission bellhousing.

NOTE: When installing the torque convertor to driveplate retaining bolts, the torque convertor can be rotated into position with a flat-bladed screwdriver through the starter motor access hole. Then working through the torque convertor bolt access hole, thread a longer than original bolt into the convertor and pull the convertor up against the driveplate by hand. Remove the longer bolt and install the original bolts one by one until all bolts are installed. Then go back and torque all bolts to specification.

(7) Rotate the converter so the previously scribed alignment mark is aligned with the mark on the driveplate.

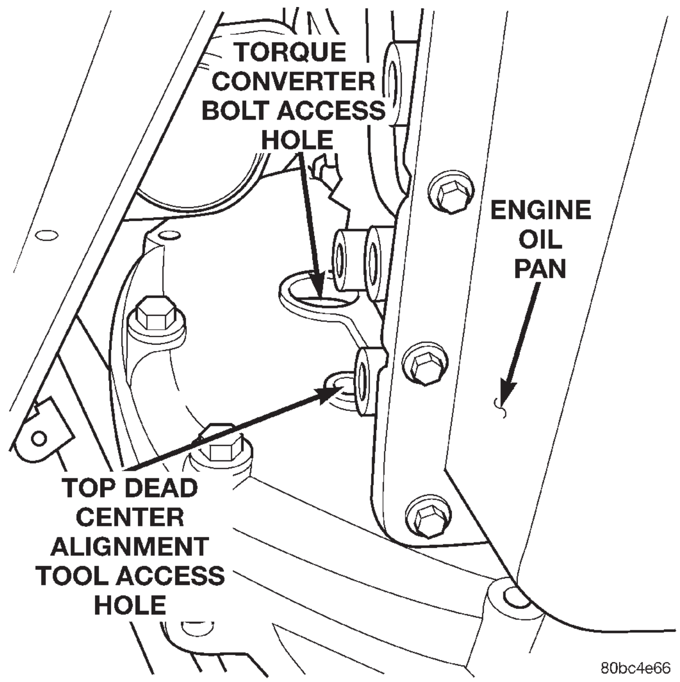


Fig. 22 Torque Converter Bolt Access Hole

(8) Working through the torque convertor bolt access hole (Fig. 22), install the (4) torque convertor to driveplate retaining bolts. Torque the bolts to 32 N·m (24 ft. lbs.) after all bolts are installed.

(9) Install the starter motor in the vehicle. Refer to Group 8B, Starting Systems for the procedure.

(10) Install the exhaust system inlet pipe and retaining bolts (Fig. 23). Torque the bolts to 41 N·m (30 ft. lbs.).

REMOVAL AND INSTALLATION (Continued)

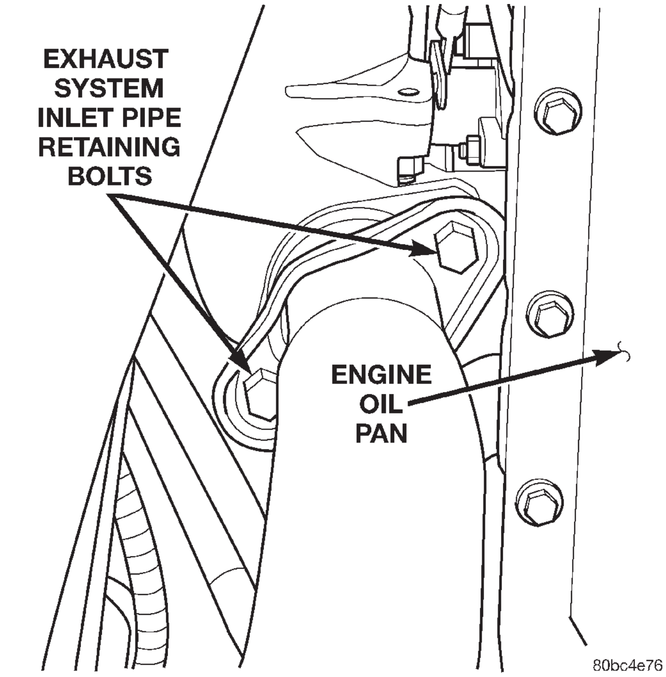


Fig. 23 Exhaust System Inlet Pipe Retaining Bolts

(11) Connect the transmission electrical connectors and clip the wire harness on the transmission housing.

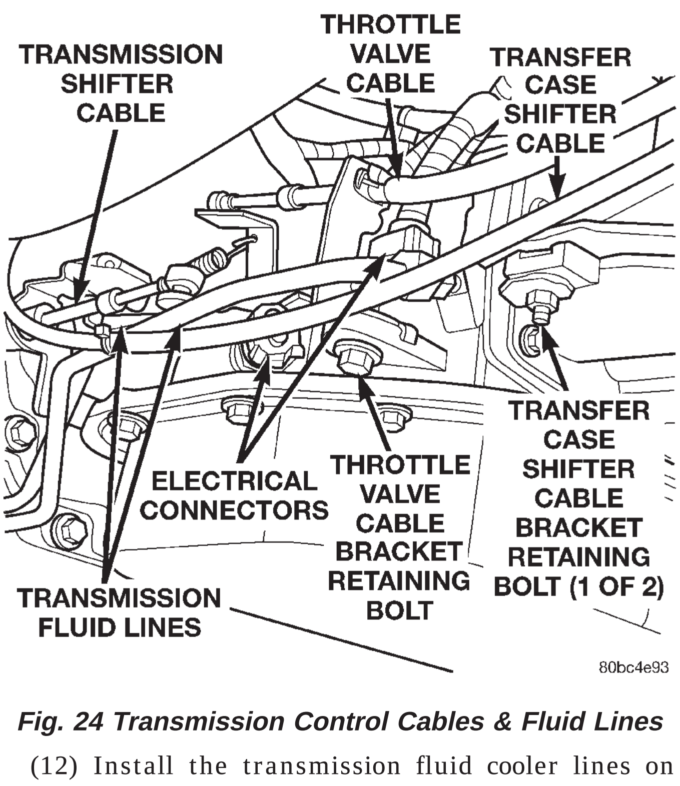


Fig. 24 Transmission Control Cables & Fluid Lines

(12) Install the transmission fluid cooler lines on the transmission (Fig. 24). Torque the nuts to 18 N·m (13 ft. lbs.).

(13) Install the shifter cable bracket and retaining bolt (Fig. 24).

(14) Connect the shifter cable (Fig. 24).

(15) Install the spring on the shift lever arm (Fig. 24).

(16) Install the throttle valve cable bracket and retaining fasteners (Fig. 24).

(17) Connect the throttle valve cable (Fig. 24).

(18) Install the transfer case shift cable bracket on the transmission housing (Fig. 24).

(19) Position the transmission support crossmember/mount assembly and install the (4) transmission mount retaining bolts (Fig. 25). Torque the bolts to 75 N·m (55 ft. lbs.).

(20) Install a jack under the transmission support crossmember and raise slightly.

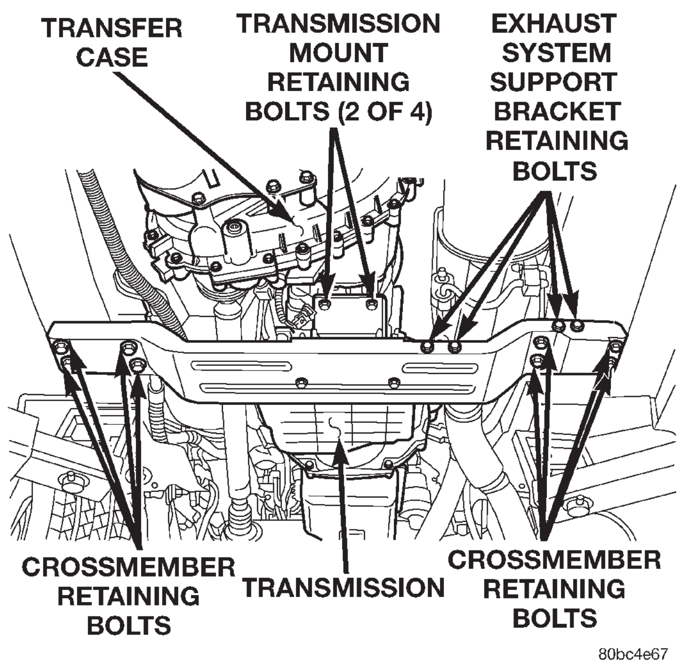


Fig. 25 Transmission Support Crossmember Position & Orientation

(21) Install the transfer case on the transmission. Torque the transfer case retaining nuts to 75 N·m (55 ft. lbs.).

(22) Using the jack, raise the transmission assembly into position and install the (8) transmission support crossmember retaining bolts (Fig. 25). Torque the bolts to 41 N·m (30 ft. lbs.).

(23) Unclip the wire harness from the transmission support crossmember.

(24) Position the exhaust system support brackets and install the retaining bolts. Torque the bolts to 41 N·m (30 ft. lbs.) (Fig. 25).

(25) Install the vent tube on the transfer case.

(26) Connect the transfer case shift cable on the shifter arm.

(27) Install the rear driveshaft. Torque the bolts to 32 N·m (24 ft. lbs.). Be certain to install the driveshaft in the same position as before removal.

REMOVAL AND INSTALLATION (Continued)

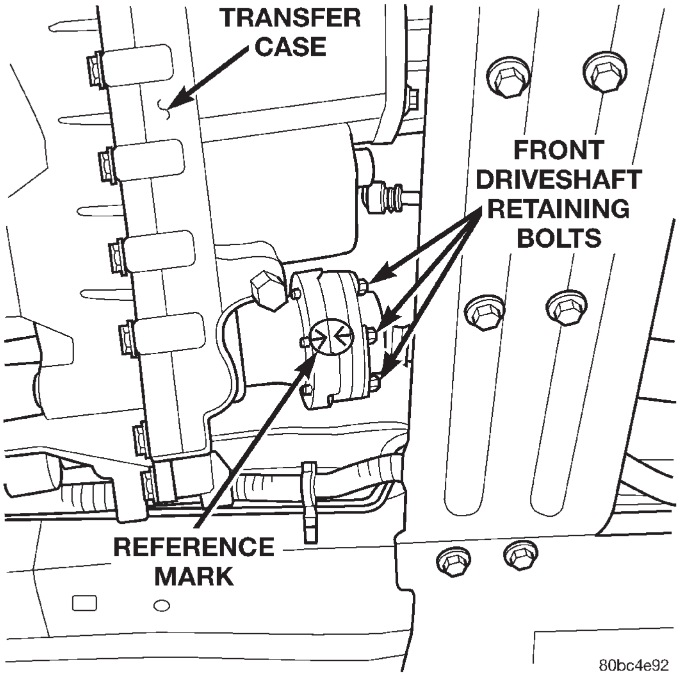


Fig. 26 Front Driveshaft Retaining Bolts

(28) Install the front driveshaft. Torque the bolts to 32 N·m (24 ft. lbs.) (Fig. 26). Be certain to install the driveshaft in the same position as before removal.

(29) Install the (2) lower fan shroud retaining bolts. Torque the bolts to 15 N·m (132 in. lbs.).

(30) Lower the vehicle on the hoist.

(31) Install the transmission dipstick tube in the transmission housing.

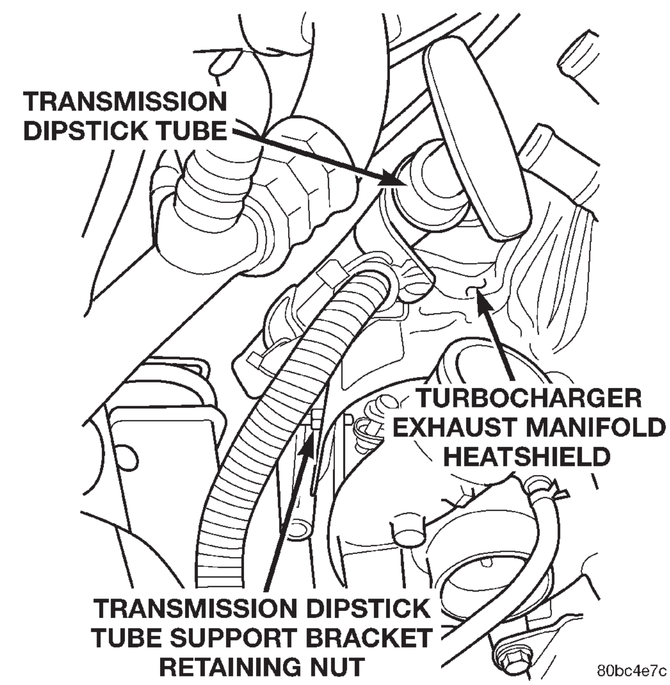


Fig. 27 Transmission Dipstick Tube Support Bracket Position & Orientation

(32) Install the transmission dipstick tube support bracket retaining nut (Fig. 27). Torque the nut to 25 N·m (221 in. lbs.).

(33) Install the (2) upper fan shroud retaining bolts. Torque the bolts to 15 N·m (132 in. lbs.).

(34) Connect the negative battery cable.

TORQUE CONVERTER

REMOVAL

(1) Remove transmission and torque converter from vehicle.

(2) Place a suitable drain pan under the converter housing end of the transmission.

CAUTION: Verify that transmission is secure on the lifting device or work surface, the center of gravity of the transmission will shift when the torque converter is removed creating an unstable condition.

The torque converter is a heavy unit. Use caution when separating the torque converter from the transmission.

(3) Pull the torque converter forward until the center hub clears the oil pump seal.

(4) Separate the torque converter from the transmission.

INSTALLATION

Check converter hub and drive notches for sharp edges, burrs, scratches, or nicks. Polish the hub and notches with 320/400 grit paper or crocus cloth if necessary. The hub must be smooth to avoid damaging the pump seal at installation.

(1) Lubricate converter hub and oil pump seal lip with transmission fluid.

(2) Place torque converter in position on transmission.

CAUTION: Do not damage oil pump seal or bushing while inserting torque converter into the front of the transmission.

(3) Align torque converter to oil pump seal opening.

(4) Insert torque converter hub into oil pump.

(5) While pushing torque converter inward, rotate converter until converter is fully seated in the oil pump gears.

(6) Check converter seating with a scale and straightedge (Fig. 28). Surface of converter lugs should be 1/2 in. to rear of straightedge when converter is fully seated.

(7) If necessary, temporarily secure converter with C-clamp attached to the converter housing.

(8) Install the transmission in the vehicle.

(9) Fill the transmission with the recommended fluid.

REMOVAL AND INSTALLATION (Continued)

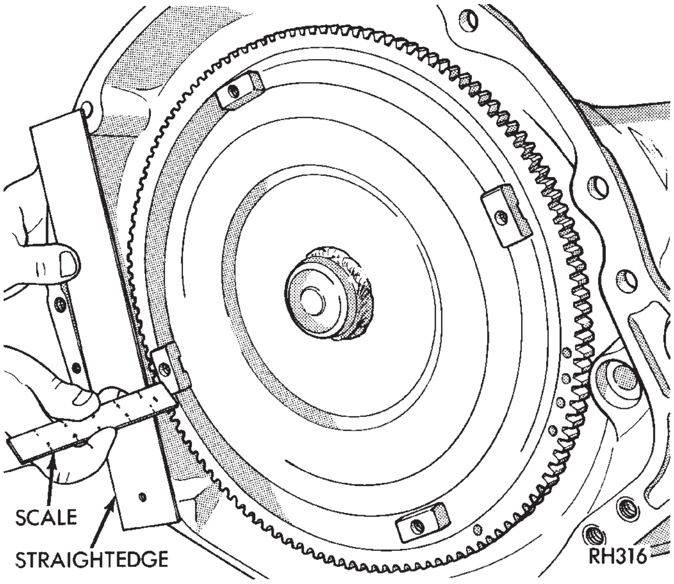


Fig. 28 Checking Torque Converter Seating

YOKE SEAL REPLACEMENT

REMOVAL

(1) Raise vehicle.

(2) Mark propeller shaft and axle yoke for alignment reference.

(3) Disconnect and remove propeller shaft.

(4) Remove old seal with Seal Remover C-3985-B (Fig. 29) from overdrive housing.

INSTALLATION

(1) Place seal in position on overdrive housing.

(2) Drive seal into overdrive housing with Seal Installer C-3995-A (Fig. 30).

(3) Carefully guide propeller shaft slip yoke into housing and onto output shaft splines. Align marks made at removal and connect propeller shaft to rear axle pinion yoke.

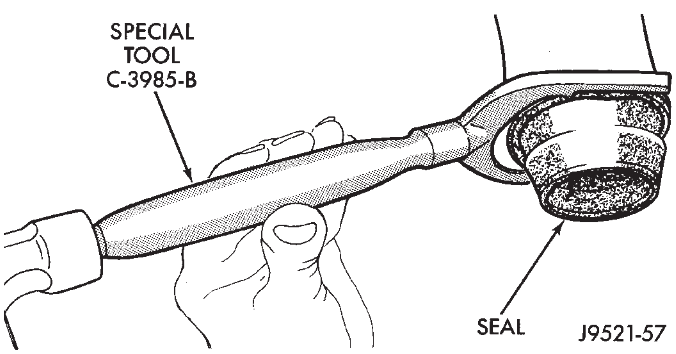


Fig. 29 Removing Overdrive Housing Yoke Seal

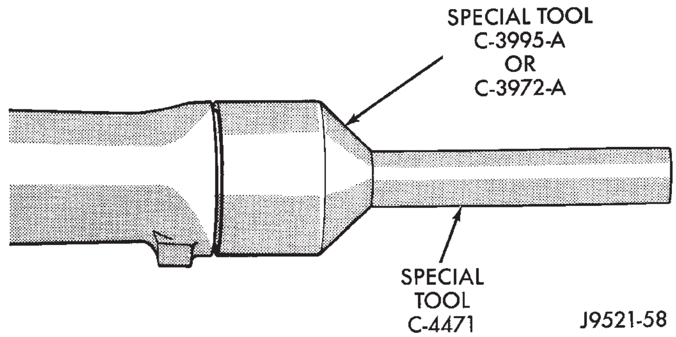


Fig. 30 Installing Overdrive Housing Yoke Seal

PARK/NEUTRAL POSITION SWITCH

REMOVAL

(1) Raise vehicle and position drain pan under switch.

(2) Disconnect switch wires.

(3) Remove switch from case.

INSTALLATION

(1) Move shift lever to Park and Neutral positions. Verify that switch operating lever fingers are centered in switch opening in case (Fig. 31).

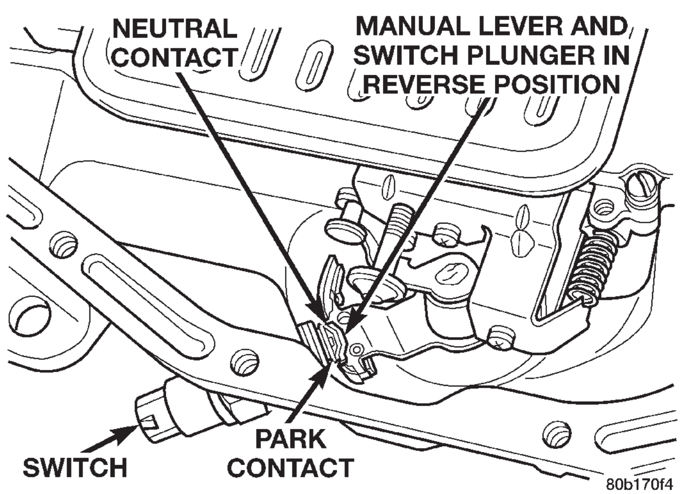


Fig. 31 Park/Neutral Position Switch

(2) Install new seal on switch and install switch in case. Tighten switch to 34 N·m (25 ft. lbs.) torque.

(3) Test continuity of new switch with 12V test lamp.

(4) Connect switch wires and lower vehicle.

(5) Top off transmission fluid level.

REMOVAL AND INSTALLATION (Continued)

GEARSHIFT CABLE

REMOVAL

(1) Place the transmission gear selector in the "PARK" position.

(2) Raise the vehicle on a hoist.

(3) Disconnect the shift cable eyelet from the transmission shift lever (Fig. 32).

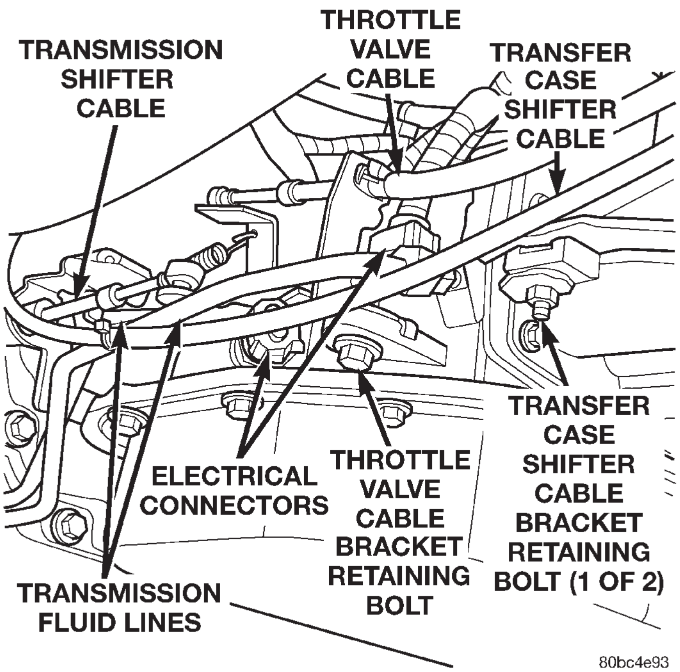


Fig. 32 Shift Cable at Transmission

(4) Remove the shift cable from the shift cable support bracket.

(5) Lower the vehicle from the hoist.

(6) Remove shift lever bezel and necessary console parts for access to shifter and cable assembly.

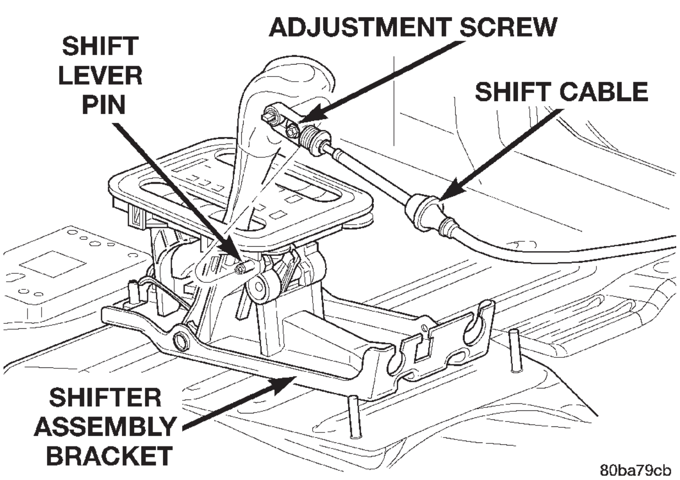


Fig. 33 Transmission Shift Cable at Shifter

(7) Disconnect the shift cable from the shifter assembly (Fig. 33).

(8) Remove the shift cable seal plate retaining nuts from the floor pan studs (Fig. 34).

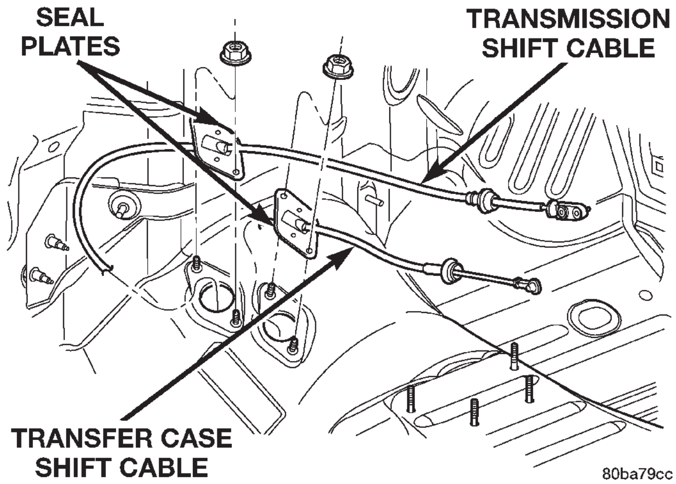


Fig. 34 Shift Cables at Floor Pan

(9) Remove the shifter cable through the floor pan opening.

INSTALLATION

(1) Route the shift cable through hole in floor pan.

(2) Install the shift cable seal plate retaining nuts on the floor pan studs (Fig. 35). Torque the nuts to 7 N·m (65 in. lbs.).

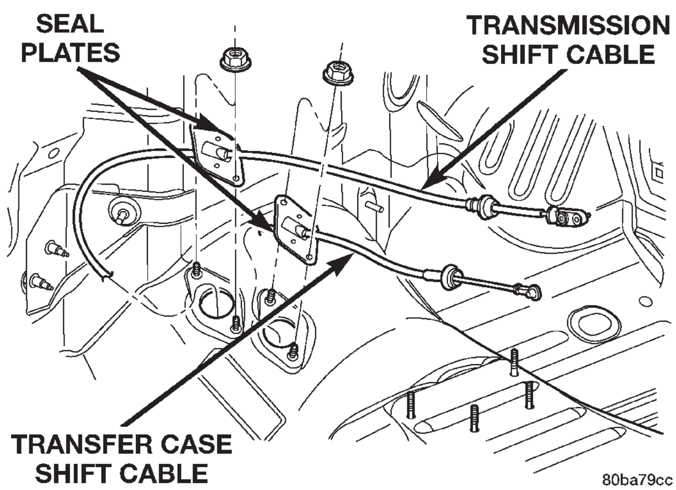


Fig. 35 Shift Cables at Floor Pan

(3) Install the shift cable in the shifter bracket assembly.

(4) Place the floor shifter in the "PARK" position.

(5) Loosen the adjustment screw on the shifter cable (Fig. 36).

(6) Snap the shift cable onto the shift lever pin. Located on the shifter assembly (Fig. 36).

(7) Raise the vehicle on a hoist.

(8) Install the shift cable on the shift cable support bracket (Fig. 37).

REMOVAL AND INSTALLATION (Continued)

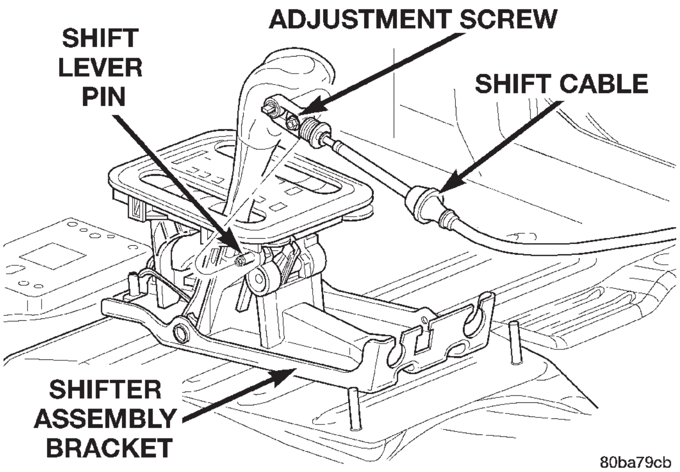


Fig. 36 Transmission Shift Cable at Shifter

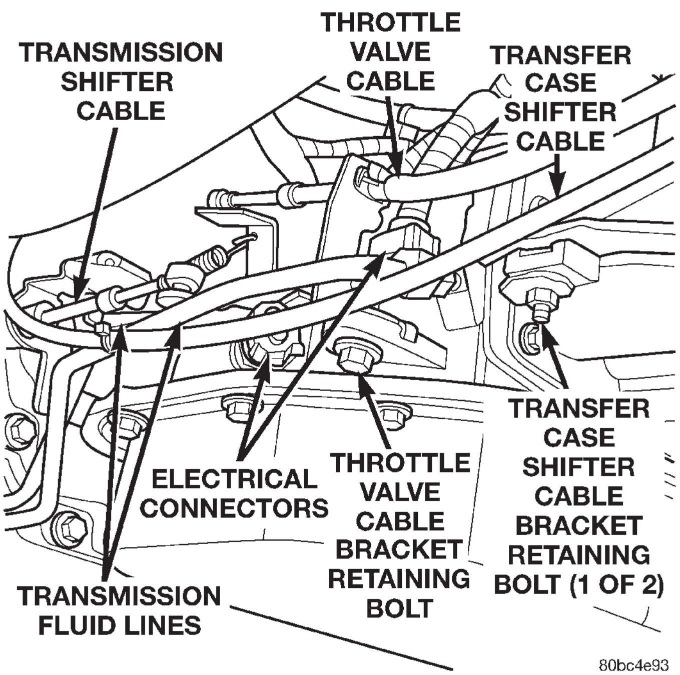


Fig. 37 Shift Cable at Transmission

(9) Place the transmission shift lever in the "PARK" position. Park is the rearmost detent position on the transmission manual shift lever (Fig. 37).

(10) Snap the shifter cable on the shift control lever (Fig. 37).

CAUTION: Be certain shift cable is routed correctly, free of binding, sharp edges and hot exhaust system components.

(11) Lower the vehicle from the hoist.

(12) Verify the transmission and shifter are in the "PARK" position.

(13) Torque the adjustment screw to 7 N·m (65 in. lbs.) (Fig. 36).

(14) Verify correct shifter operation.

(15) Install the shift lever bezel and any console parts removed to access the shift control cable.

FLOOR SHIFTER

REMOVAL

(1) Shift the transmission into the "PARK" position.

(2) Remove the shift lever bezel and any necessary console parts for access to the shift lever assembly and shift cables.

(3) Disconnect the shift cable from the shifter and support bracket assembly (Fig. 38).

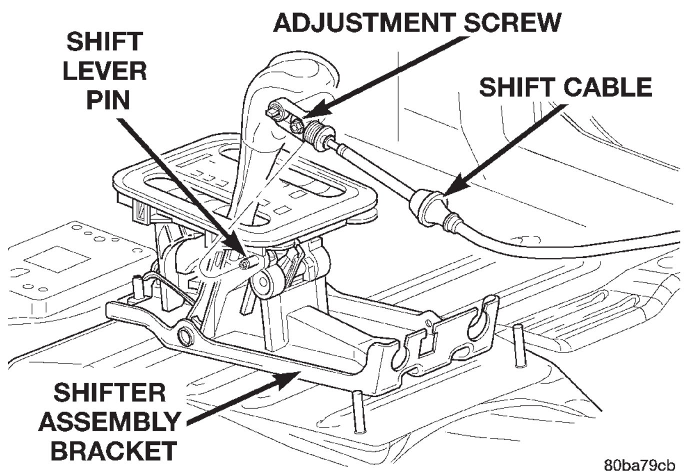


Fig. 38 Shift Cable at Shifter

(4) Disconnect the brake transmission shift interlock cable from the shifter BTSI lever and the shifter bracket assembly.

(5) Disconnect the transfer case shift cable from the transfer case shift lever pin (Fig. 39).

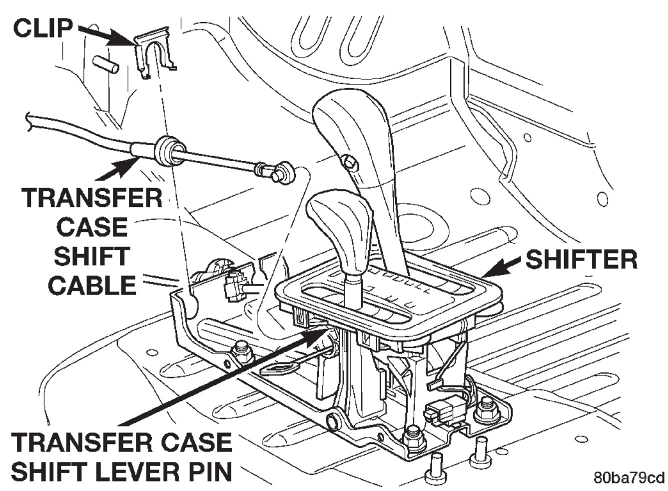


Fig. 39 Transfer Case Shift Cable

(6) Remove the clip retaining the transfer case shift cable to the shifter bracket assembly.

REMOVAL AND INSTALLATION (Continued)

(7) Remove the transfer case shift cable from the shifter assembly.

(8) Disconnect all wiring connectors from the shifter assembly.

(9) Remove the shifter assembly retaining nuts from the floor pan (Fig. 40).

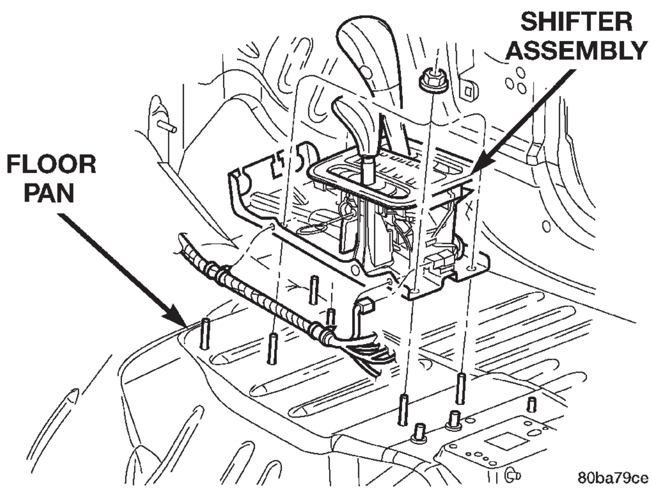


Fig. 40 Shifter Assembly

(10) Remove the shifter from the vehicle.

INSTALLATION

(1) Install the shifter in the vehicle.

(2) Install the shifter assembly retaining nuts on the floor pan mounted studs (Fig. 41). Torque to 28 N·m (250 in. lbs.).

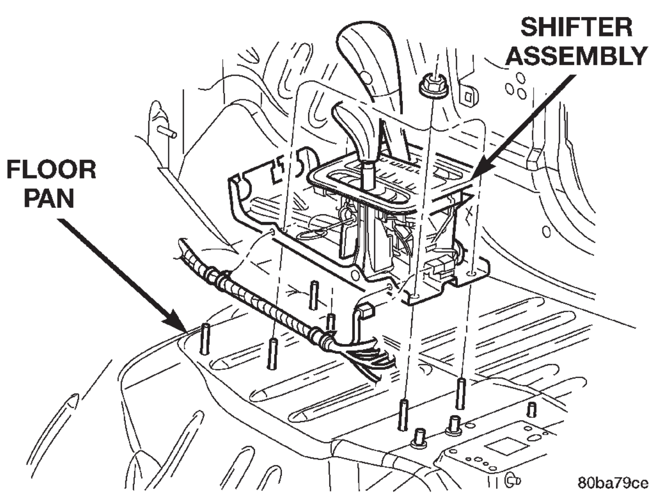


Fig. 41 Shifter Assembly

(3) Connect all wiring on the shifter assembly.

(4) Install the transfer case shift cable on the shifter bracket assembly and secure with clip (Fig. 42).

(5) Snap the transfer case shift cable onto the shift lever pin (Fig. 42).

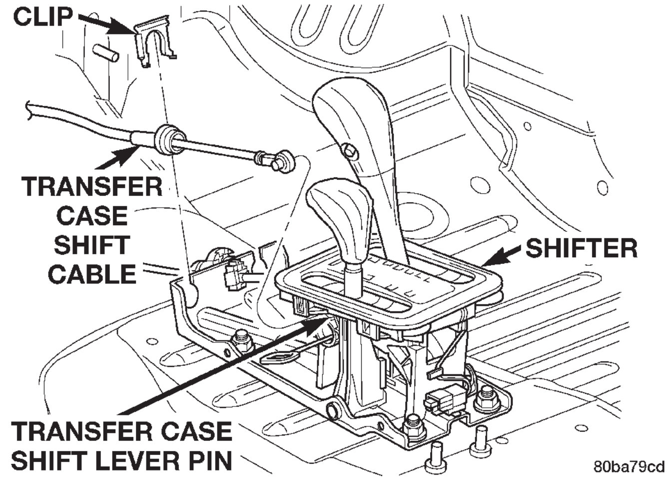


Fig. 42 Transfer Case Shift Cable

(6) Install the brake transmission interlock cable into the shifter assembly bracket and connect on the BTSI lever.

(7) Install the shift cable on the shifter bracket and snap in place (Fig. 43).

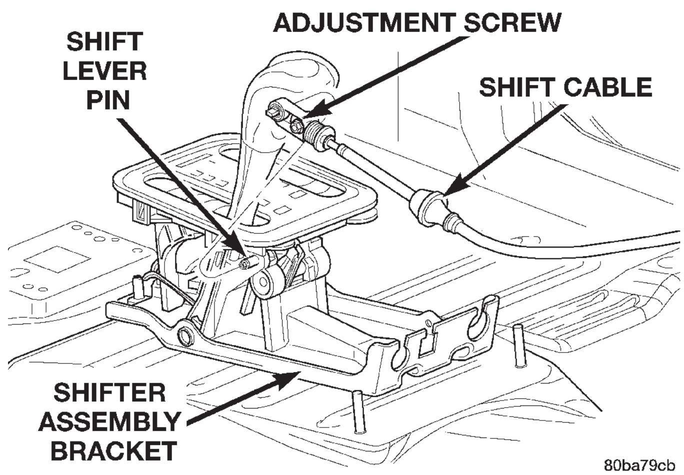


Fig. 43 Transmission Shift Cable at Shifter

(8) With the shifter in the “PARK” position, loosen the shift cable adjustment screw.

(9) Snap the shift cable on the shift lever pin (Fig. 43).

(10) Torque the adjustment screw to 7 N·m (65 in. lbs.).

(11) Verify correct shifter operation.

(12) Install the shift lever bezel and any console parts removed for access to the shift lever assembly and shift cables.

REMOVAL AND INSTALLATION (Continued)

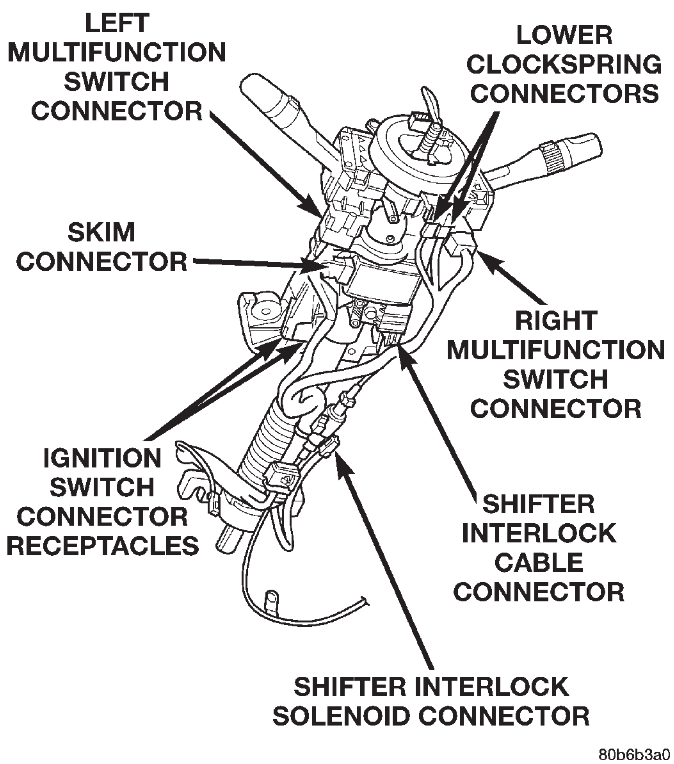


Fig. 44 B.T.S.I. Solenoid Connector Location

BRAKE TRANSMISSION SHIFT INTERLOCK CABLE

REMOVAL

(1) Remove the steering column opening cover. Refer to Group 8E, Instrument Panel Systems for the procedure.

(2) Remove the lower steering column shroud from the vehicle.

(3) Disconnect the brake transmission shift interlock (B.T.S.I.) cable solenoid electrical connector (Fig. 44).

(4) With the ignition switch in the “RUN” position depress the B.T.S.I. cable locking tab, located on top of the cable connector (Fig. 44) at the steering column and pull the B.T.S.I. cable straight out.

(5) Remove the center console from the vehicle. Refer to Group 23, Body for the procedure.

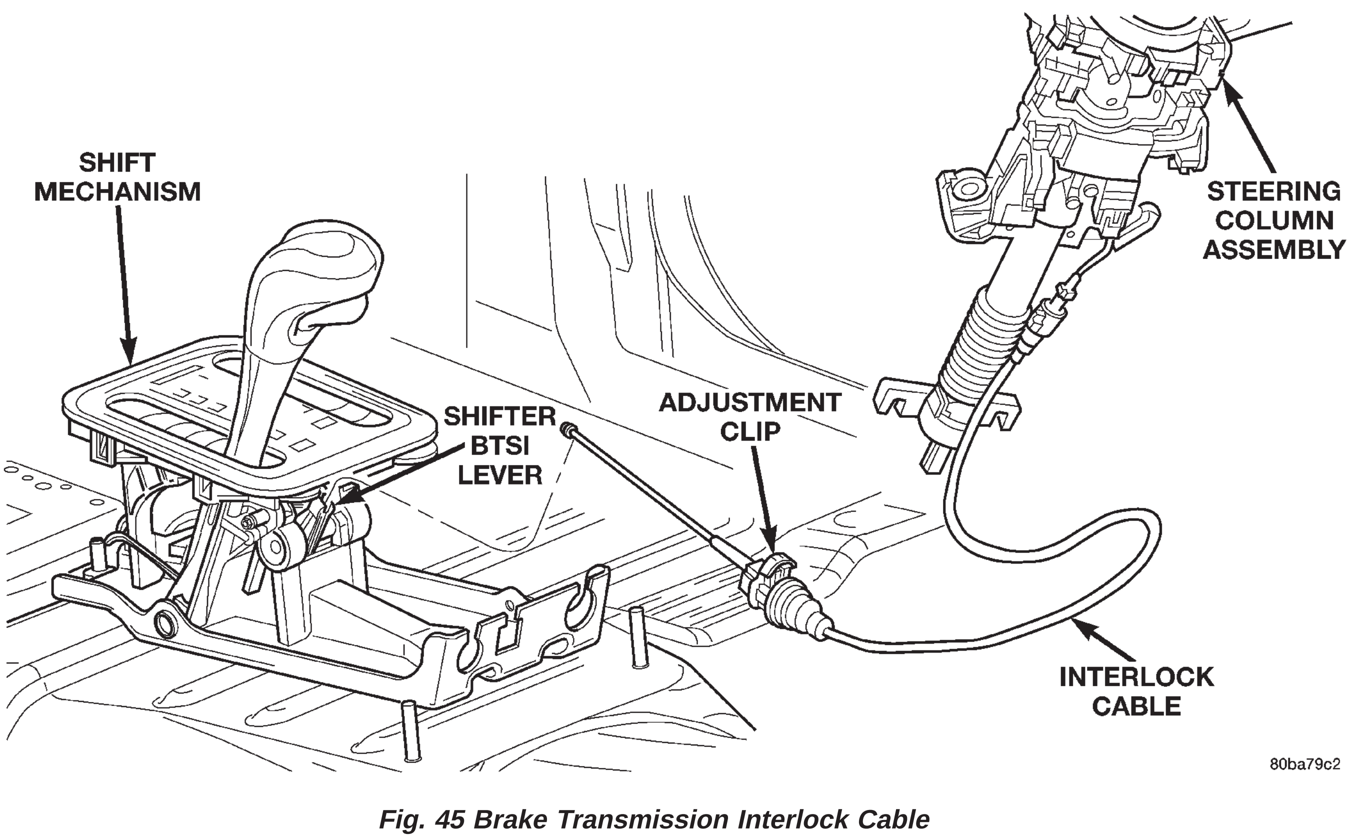


Fig. 45 Brake Transmission Interlock Cable

REMOVAL AND INSTALLATION (Continued)

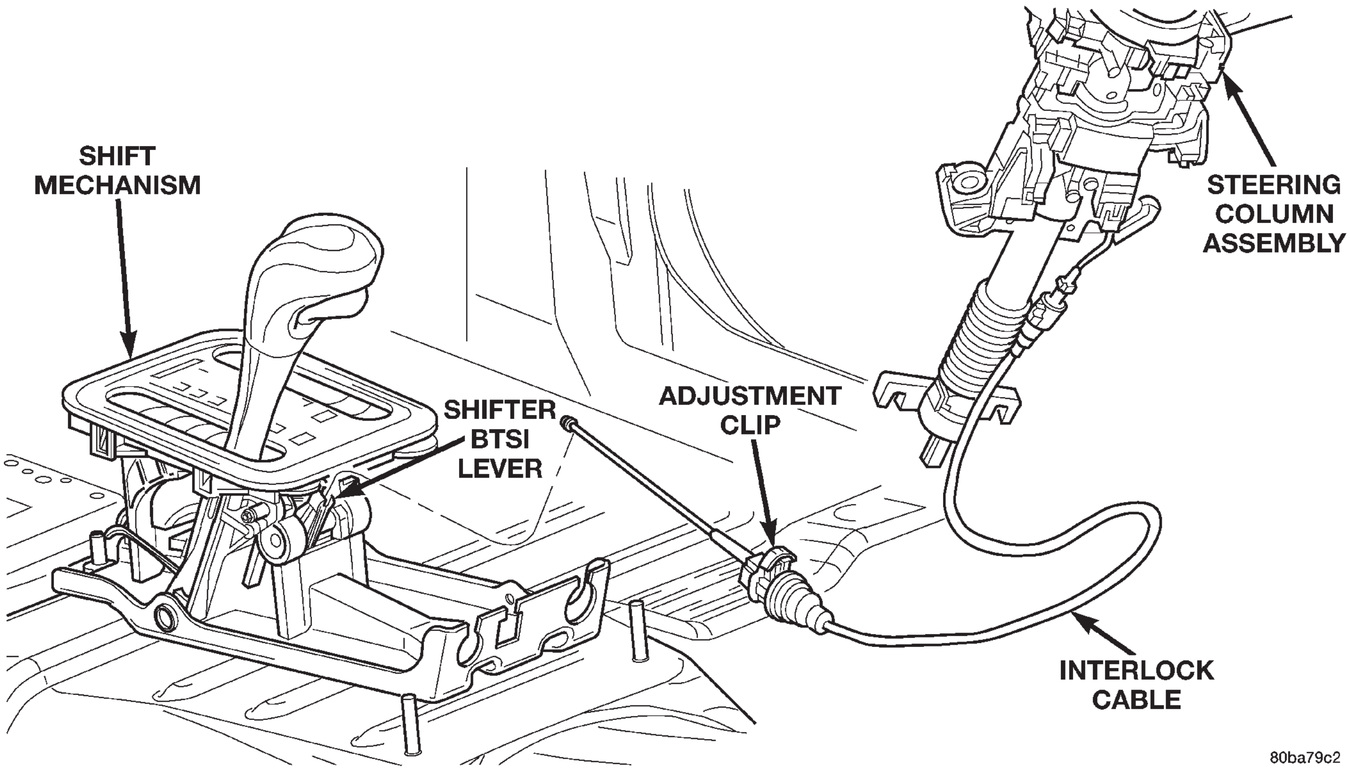


Fig. 46 Brake Transmission Shift Interlock

(6) Disconnect the B.T.S.I. cable from the shifter B.T.S.I. lever and remove the cable from the shifter bracket (Fig. 45).

(7) Disconnect the B.T.S.I. cable from any routing clips.

(8) Remove the B.T.S.I. cable from the vehicle.

INSTALLATION

(1) Position the cable in the vehicle and secure in the original position with appropriate retaining clips.

(2) Install the B.T.S.I. cable on the shifter bracket and connect at the shifter B.T.S.I. lever (Fig. 46).

(3) Install the center console in the vehicle. Refer to Group 23, Body for the procedure.

(4) Push the B.T.S.I. cable straight into the square mounting hole in the steering column until cable snaps in place (Fig. 47).

(5) Connect the brake transmission shift interlock (B.T.S.I.) cable solenoid electrical connector (Fig. 47).

(6) Install the lower steering column shroud in the vehicle.

(7) Install the steering column opening cover. Refer to Group 8E, Instrument Panel Systems for the procedure.

(8) Verify correct B.T.S.I. cable operation.

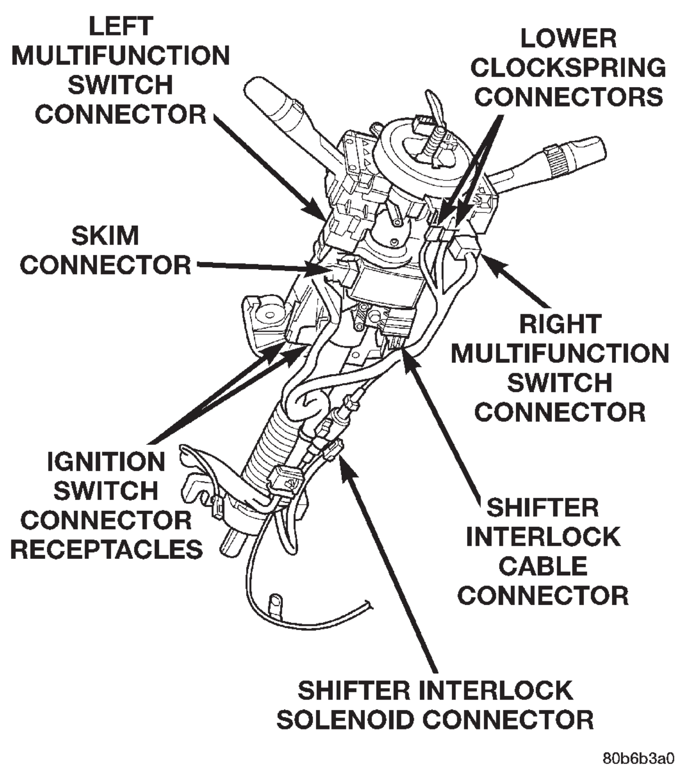


Fig. 47 B.T.S.I. Solenoid Connector Location

REMOVAL AND INSTALLATION (Continued)

GOVERNOR SOLENOID AND PRESSURE SENSOR

REMOVAL

(1) Hoist and support vehicle on safety stands.
(2) Remove transmission fluid pan and filter.
(3) Disengage wire connectors from pressure sensor and solenoid (Fig. 48).
(4) Remove screws holding pressure solenoid retainer to governor body.
(5) Separate solenoid retainer from governor (Fig. 49).
(6) Pull solenoid from governor body (Fig. 50).
(7) Remove bolts holding governor body to valve body.
(8) Separate governor body from valve body (Fig. 51).
(9) Remove governor body gasket.
(10) Remove retainer holding pressure sensor to governor body.
(11) Pull pressure sensor from governor body (Fig. 52).

INSTALLATION

Before installing the pressure sensor and solenoid in the governor body, replace O-ring seals, clean the gasket surfaces and replace gasket.
(1) Lubricate O-ring on pressure sensor with transmission fluid.
(2) Align pressure sensor to bore in governor body (Fig. 52).
(3) Push pressure sensor into governor body.
(4) Install retainer to hold pressure sensor to governor body.
(5) Place gasket in position on back of governor body (Fig. 51).
(6) Place governor body in position on valve body.
(7) Install bolts to hold governor body to valve body.
(8) Lubricate O-ring, on pressure solenoid, with transmission fluid.
(9) Align pressure solenoid to bore in governor body (Fig. 50).
(10) Push solenoid into governor body.
(11) Place solenoid retainer in position on governor (Fig. 49).
(12) Install screws to hold pressure solenoid retainer to governor body.
(13) Engage wire connectors into pressure sensor and solenoid (Fig. 48).
(14) Install transmission fluid pan and (new) filter.
(15) Lower vehicle and road test to verify repair.

VALVE BODY

The valve body can be removed for service without having to remove the transmission assembly.

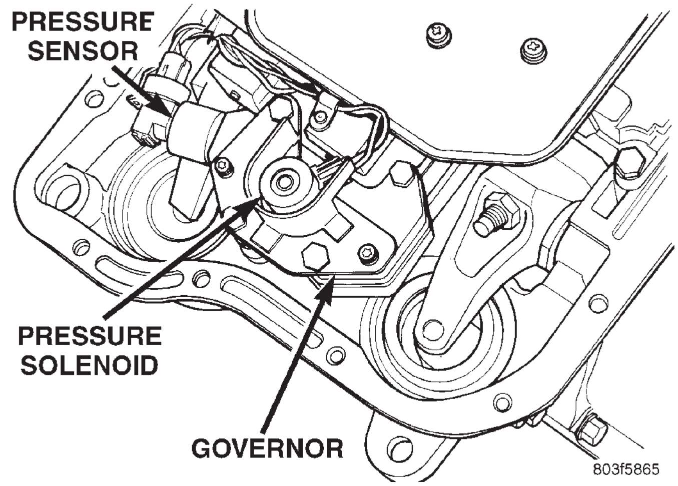


Fig. 48 Governor Solenoid And Pressure Sensor

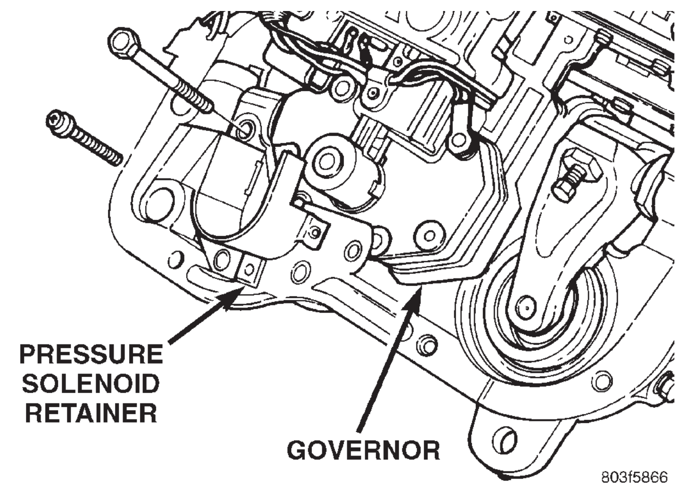


Fig. 49 Pressure Solenoid Retainer

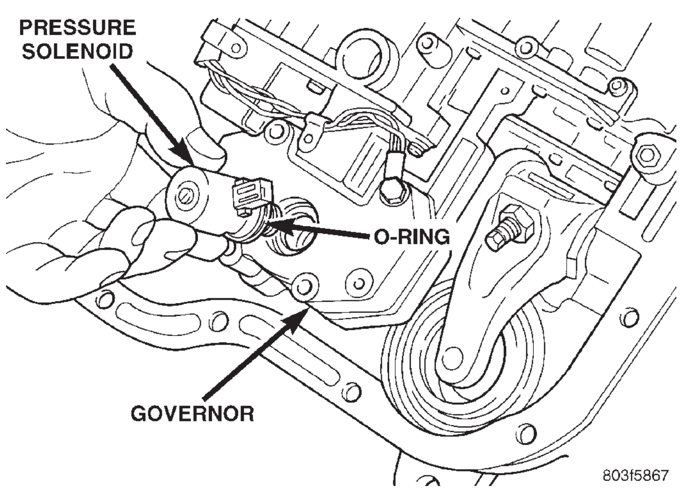


Fig. 50 Pressure Solenoid and O-ring

The valve body can be disassembled for cleaning and inspection of the individual components. Refer to Disassembly and Assembly section for proper procedures.

REMOVAL AND INSTALLATION (Continued)

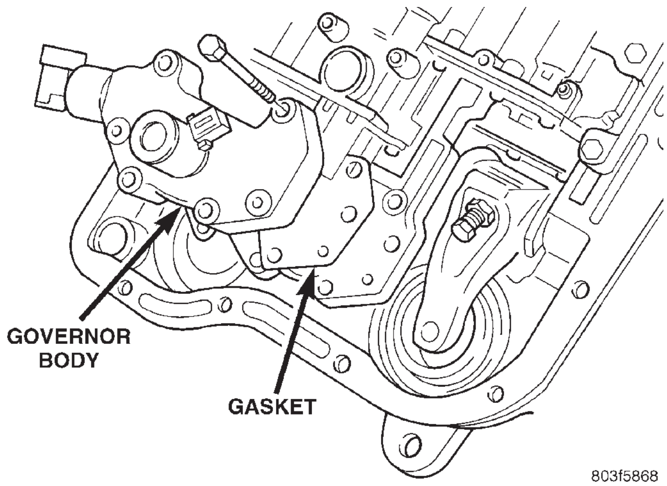


Fig. 51 Governor Body and Gasket

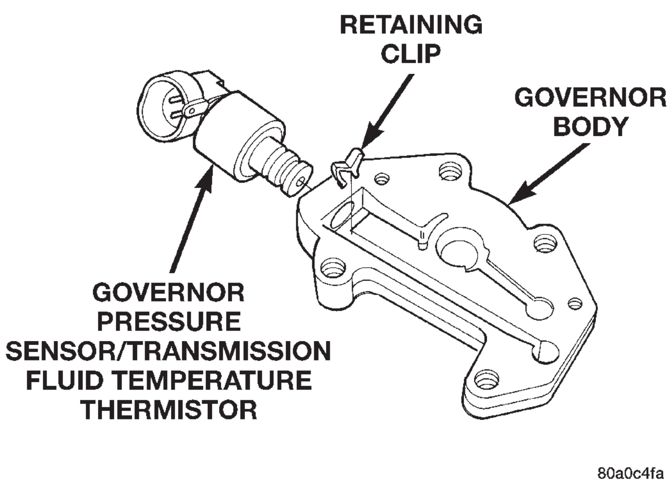


Fig. 52 Pressure Sensor and Retainer

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.
- Pressure adjusting screw bracket.
- Governor pressure solenoid.
- Governor pressure sensor.
- Converter clutch/overdrive solenoid assembly and harness (includes sump temperature thermistor).
- Governor housing gasket.
- Solenoid case connector O-rings.

The remaining valve body components are serviced only as part of a complete valve body assembly.

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 solenoid case connector (Fig. 53).

(5) Position drain pan under transmission oil pan.

(6) Remove transmission oil pan and gasket.

(7) Remove fluid filter from valve body.

(8) Remove bolts attaching valve body to transmission case.

(9) Lower valve body enough to remove accumulator piston and springs.

(10) Work manual lever shaft and electrical connector out of transmission case.

(11) Lower valve body, rotate valve body away from case, pull park rod out of sprag, and remove valve body (Fig. 54).

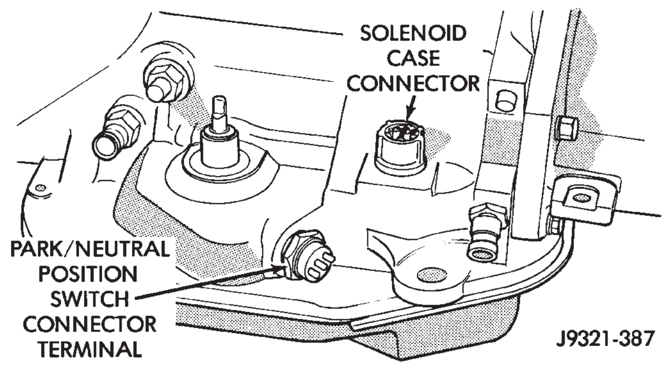


Fig. 53 Transmission Case Connector

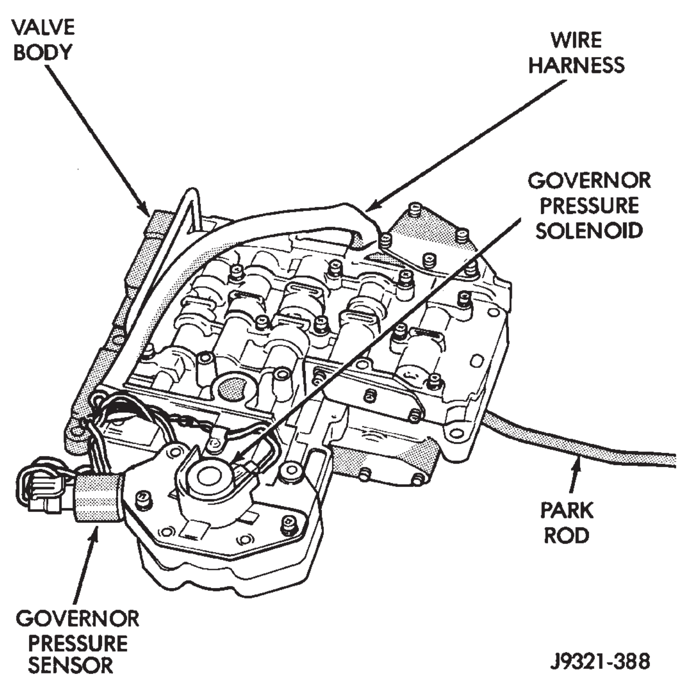


Fig. 54 Valve Body

INSTALLATION

(1) Check condition of O-ring seals on valve body harness connector (Fig. 55). Replace seals on connector body if cut or worn.

REMOVAL AND INSTALLATION (Continued)

(2) 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. 56).

(3) Check condition of seals on accumulator piston (Fig. 57). Install new piston seals, if necessary.

(4) Place valve body manual lever in low (1 position) so ball on park lock rod will be easier to install in sprag.

(5) Lubricate shaft of manual lever with petroleum jelly. This will ease inserting shaft through seal in case.

(6) Lubricate seal rings on valve body harness connector with petroleum jelly.

(7) Position valve body in 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. The rod will click 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.

(8) Install accumulator springs and piston into case. Then swing valve body over piston and outer spring to hold it in place.

(9) Align accumulator piston and outer spring, manual lever shaft and electrical connector in case.

(10) Then seat valve body in 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 throttle and gearshift levers on valve body manual lever shaft.

(14) Check and adjust front and rear bands if necessary.

(15) Connect solenoid case connector wires.

(16) Install oil pan and new gasket. Tighten pan bolts to 17 N·m (13 ft. lbs.) torque.

(17) Lower vehicle and fill transmission with Mopar® ATF Plus 3, type 7176 fluid.

(18) Check and adjust gearshift and throttle valve cables, if necessary.

OVERDRIVE UNIT

REMOVAL

(1) Shift transmission into Park.

(2) Raise vehicle.

(3) Mark propeller shaft universal joint(s) and axle pinion yoke for alignment reference at installation.

(4) Disconnect and remove propeller shaft(s).

(5) Remove transmission oil pan, remove gasket, drain oil and reinstall pan.

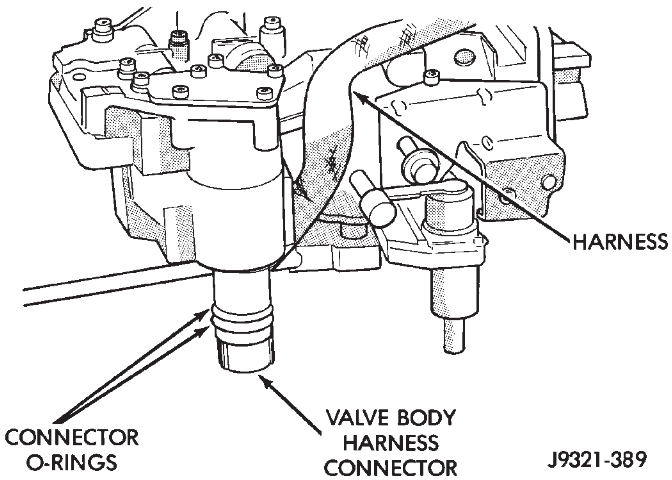


Fig. 55 Valve Body Harness Connector O-Ring Seal

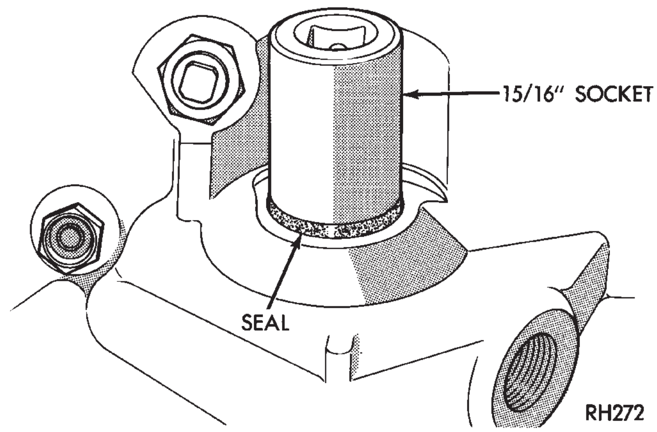


Fig. 56 Manual Lever Shaft Seal

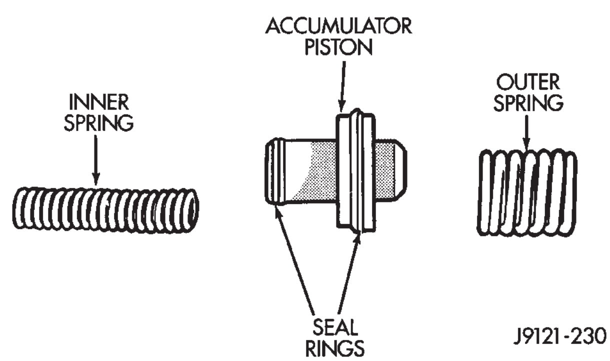


Fig. 57 Accumulator Piston Components

(6) If overdrive unit had malfunctioned, or if fluid is contaminated, remove entire transmission. If diagnosis indicated overdrive problems only, remove just the overdrive unit.

(7) Support transmission with transmission jack.

(8) Remove vehicle speed sensor.

(9) Remove bolts attaching overdrive unit to transmission (Fig. 58).

REMOVAL AND INSTALLATION (Continued)

CAUTION: Support the overdrive unit with a jack before moving it rearward. This is necessary to prevent damaging the intermediate shaft. Do not allow the shaft to support the entire weight of the overdrive unit.

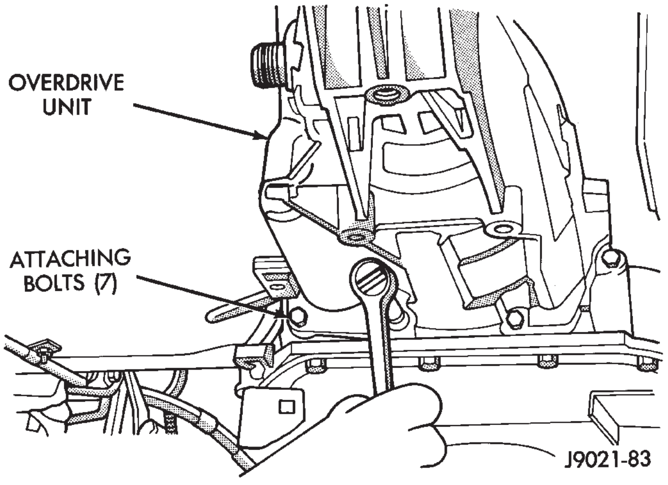


Fig. 58 Overdrive Unit Bolts

(10) Carefully work overdrive unit off intermediate shaft. Do not tilt unit during removal. Keep it as level as possible.

(11) If overdrive unit does not require service, immediately insert Alignment Tool 6227-2 in splines of planetary gear and overrunning clutch to prevent splines from rotating out of alignment. If misalignment occurs, overdrive unit will have to be disassembled in order to realign splines.

(12) Remove and retain overdrive piston thrust bearing. Bearing may remain on piston or in clutch hub during removal.

(13) Position drain pan on workbench.

(14) Place overdrive unit over drain pan. Tilt unit to drain residual fluid from case.

(15) Examine fluid for clutch material or metal fragments. If fluid contains these items, overhaul will be necessary.

(16) If overdrive unit does not require any service, leave alignment tool in position. Tool will prevent accidental misalignment of planetary gear and overrunning clutch splines.

INSTALLATION

(1) Be sure overdrive unit Alignment Tool 6227-2 is fully seated before moving unit. If tool is not seated and gear splines rotate out of alignment, overdrive unit will have to be disassembled in order to realign splines.

(2) If overdrive piston retainer was not removed during service and original case gasket is no longer reusable, prepare new gasket by trimming it.

(3) Cut out old case gasket around piston retainer with razor knife (Fig. 59).

(4) Use old gasket as template and trim new gasket to fit.

(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.

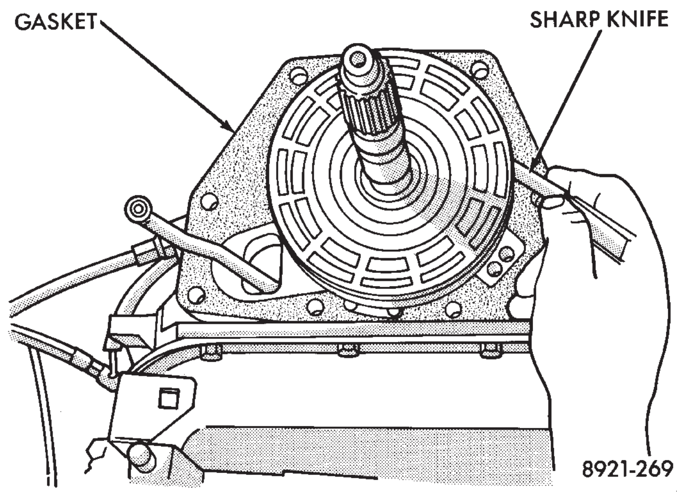


Fig. 59 Trimming Overdrive Case Gasket

(6) Install selective spacer on intermediate shaft, if removed. Spacer goes in groove just rearward of shaft rear splines (Fig. 60).

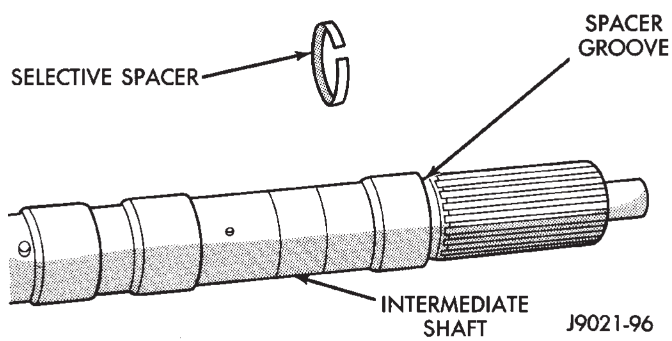


Fig. 60 Intermediate Shaft Selective Spacer Location

(7) Install thrust bearing in overdrive unit sliding hub. Use petroleum jelly to hold bearing in position.

CAUTION: Be sure the shoulder on the inside diameter of the bearing is facing forward.

(8) Verify that splines in overdrive planetary gear and overrunning clutch hub are aligned with Alignment Tool 6227-2. Overdrive unit cannot be installed if splines are not aligned. If splines have rotated out of alignment, unit will have to be disassembled to realign splines.

(9) Carefully slide Alignment Tool 6227-2 out of overdrive planetary gear and overrunning clutch splines.

REMOVAL AND INSTALLATION (Continued)

(10) Raise overdrive unit and carefully slide it straight onto intermediate shaft. Insert park rod into park lock reaction plug at same time. Avoid tilting overdrive during installation as this could cause planetary gear and overrunning clutch splines to rotate out of alignment. If this occurs, it will be necessary to remove and disassemble overdrive unit to realign splines.

(11) Work overdrive unit forward on intermediate shaft until seated against transmission case.

(12) Install bolts attaching overdrive unit to transmission unit. Tighten bolts in diagonal pattern to 34 N·m (25 ft-lbs).

(13) Install speed sensor.

(14) Connect speed sensor and overdrive wires.

(15) Align and install propeller shaft.

OVERDRIVE HOUSING BUSHING

REMOVAL

(1) Remove overdrive housing yoke seal.

(2) Insert Remover 6957 into overdrive housing. Tighten tool to bushing and remove bushing (Fig. 61).

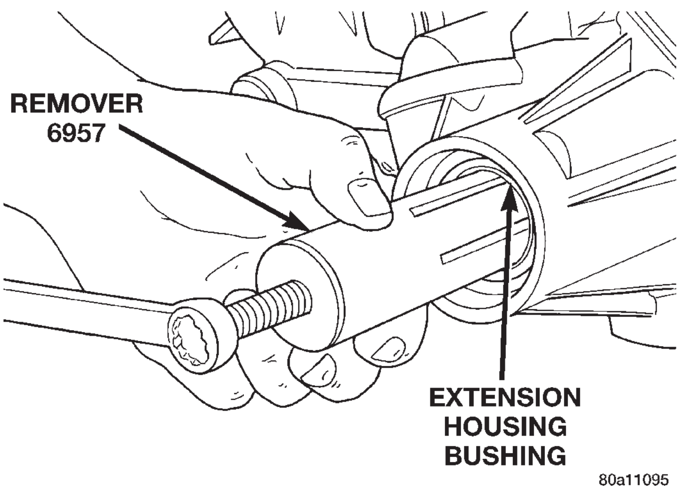


Fig. 61 Bushing Removal—Typical

INSTALLATION

(1) Align bushing oil hole with oil slot in overdrive housing.

(2) Tap bushing into place with Installer 6951 and Handle C-4171.

(3) Install new oil seal in housing using Seal Installer C-3995–A (Fig. 62).

OUTPUT SHAFT REAR BEARING

REMOVAL

(1) Remove overdrive unit from the vehicle.

(2) Remove overdrive geartrain from housing.

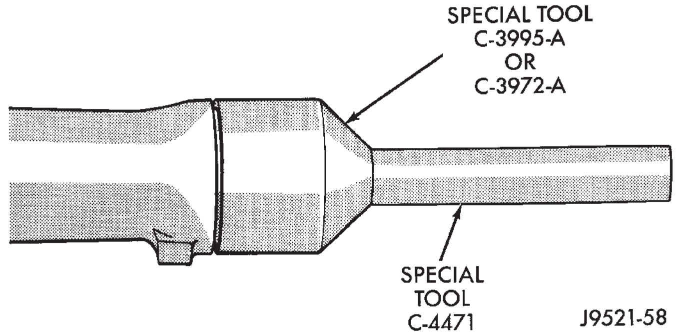


Fig. 62 Overdrive Housing Seal Installation

(3) Remove snap ring holding output shaft rear bearing into overdrive housing (Fig. 63).

(4) Using a suitable driver inserted through the rear end of housing, drive bearing from housing.

INSTALLATION

(1) Place replacement bearing in position in housing.

(2) Using a suitable driver, drive bearing into housing until the snap ring groove is visible.

(3) Install snap ring to hold bearing into housing (Fig. 63).

(4) Install overdrive geartrain into housing.

(5) Install overdrive unit in vehicle.

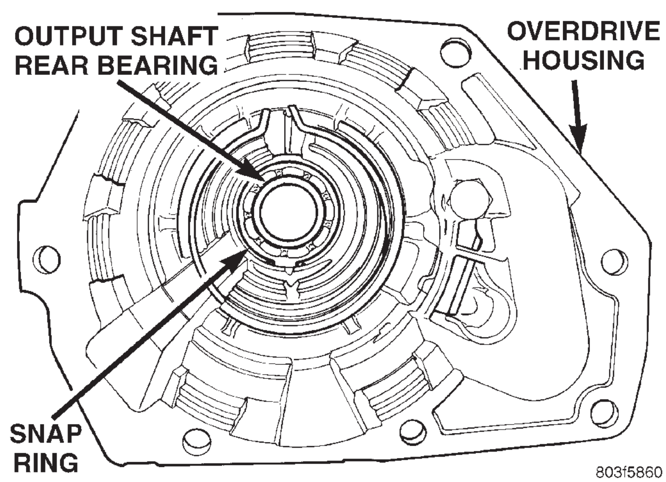


Fig. 63 Output Shaft Rear Bearing

OUTPUT SHAFT FRONT BEARING

REMOVAL

(1) Remove overdrive unit from the vehicle.

(2) Remove overdrive geartrain from housing.

(3) Remove snap ring holding output shaft front bearing to overdrive geartrain (Fig. 64).

(4) Pull bearing from output shaft.

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Place replacement bearing in position on geartrain with locating retainer groove toward the rear.

(2) Push bearing onto shaft until the snap ring groove is visible.

(3) Install snap ring to hold bearing onto output shaft (Fig. 64).

(4) Install overdrive geartrain into housing.

(5) Install overdrive unit in vehicle.

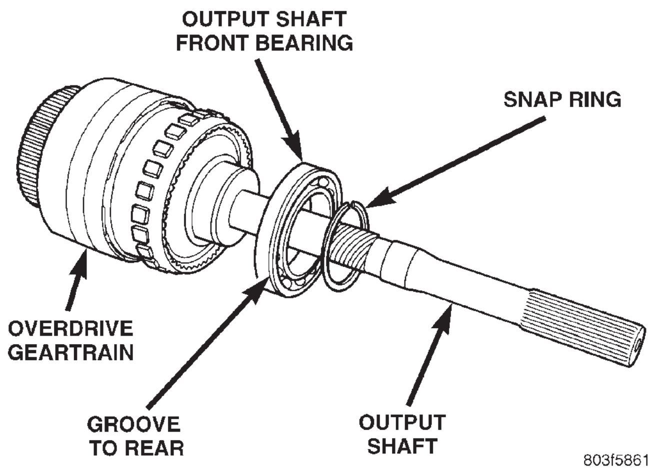


Fig. 64 Output Shaft Front Bearing

DISASSEMBLY AND ASSEMBLY

VALVE BODY

Remove the valve body from the transmission, refer to Removal and Installation procedures section in this group.

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) Remove fluid filter.

(2) Disconnect wires from governor pressure sensor and solenoid.

(3) Remove screws attaching governor body and retainer plate to transfer plate.

(4) Remove retainer plate, governor body and gasket from transfer plate.

(5) Disconnect wires from governor pressure sensor, if not done previously.

(6) Remove governor pressure sensor from governor body. Sensor is retained in body with M-shaped spring clip. Remove clip with small pointed tool and slide sensor out of body.

(7) Remove governor pressure solenoid by pulling it straight out of bore in governor body. Remove and discard solenoid O-rings if worn, cut, or torn.

(8) Remove small shoulder bolt that secures solenoid harness case connector to 3-4 accumulator housing (Fig. 65). **Retain shoulder bolt. Either tape it to harness or thread it back into accumulator housing after connector removal.**

(9) Unhook overdrive/converter solenoid harness from 3-4 accumulator cover plate (Fig. 66).

(10) Turn valve body over and remove screws that attach overdrive/converter solenoid assembly to valve body (Fig. 67).

(11) Remove solenoid and harness assembly from valve body (Fig. 68).

(12) Remove boost valve cover (Fig. 69).

(13) Remove boost valve retainer, valve spring and boost valve (Fig. 70).

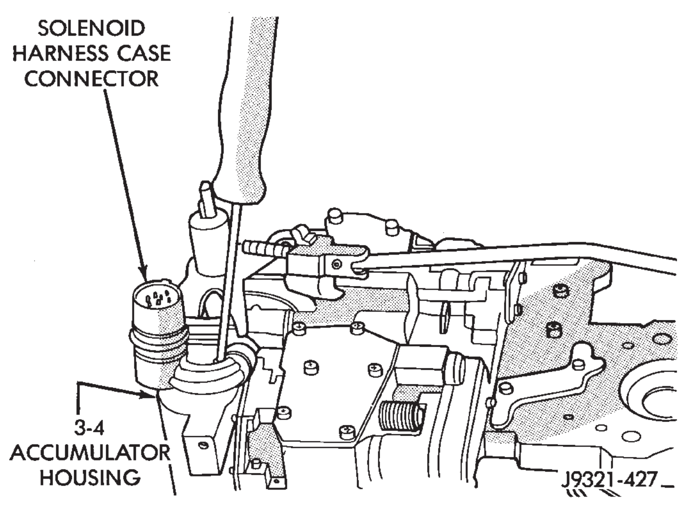


Fig. 65 Solenoid Harness Case Connector Shoulder Bolt

DISASSEMBLY AND ASSEMBLY (Continued)

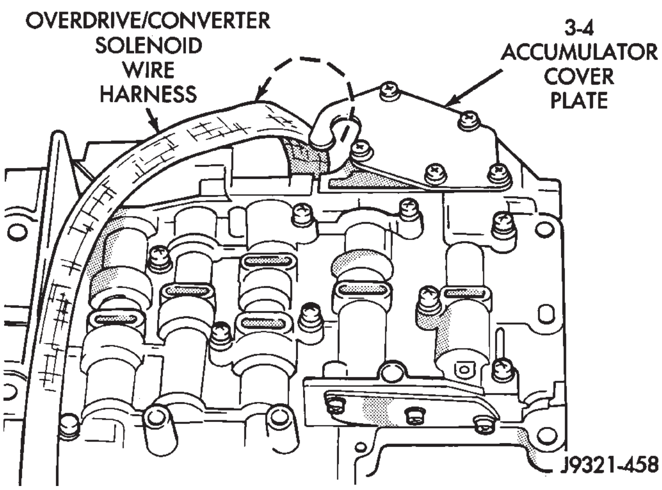


Fig. 66 Unhooking Solenoid Harness From Accumulator Cover Plate

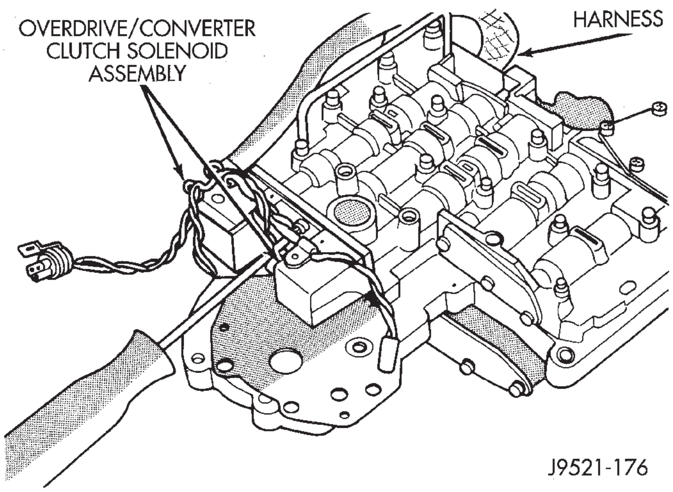


Fig. 67 Solenoid Assembly Screws

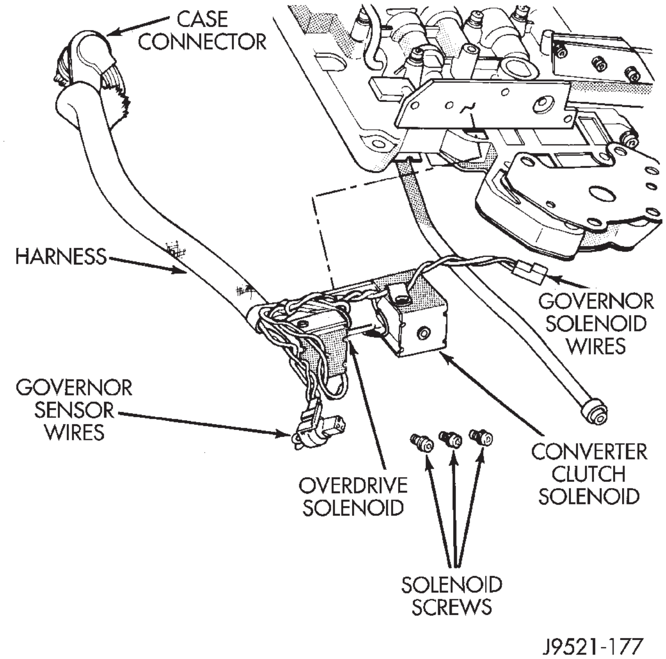


Fig. 68 Solenoid Assembly

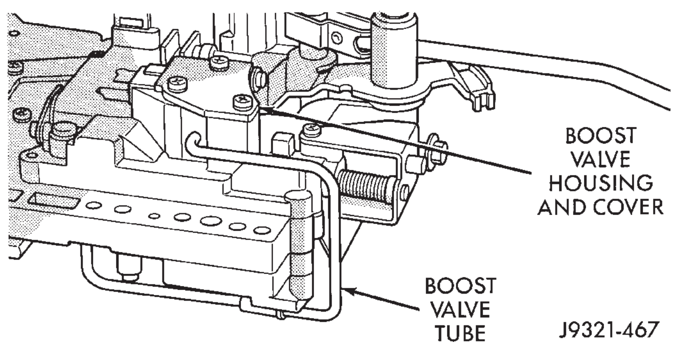


Fig. 69 Boost Valve Cover Location

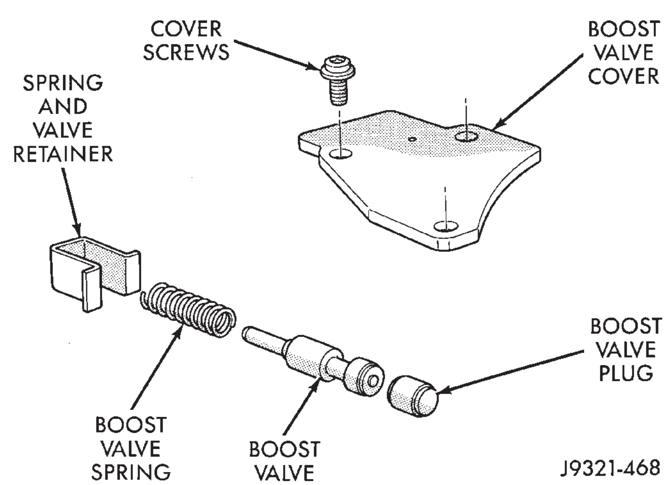


Fig. 70 Boost Valve Components

DISASSEMBLY AND ASSEMBLY (Continued)

(14) Secure detent ball and spring with Retainer Tool 6583 (Fig. 71).

(15) Remove park rod E-clip and separate rod from manual lever (Fig. 72).

(16) Remove E-clip and washer that retains throttle lever shaft in manual lever (Fig. 73).

(17) Remove manual lever and throttle lever (Fig. 74). Rotate and lift manual lever off valve body and throttle lever shaft. Then slide throttle lever out of valve body.

(18) 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. 75).

(19) Remove screws attaching pressure adjusting screw bracket to valve body and transfer plate (Fig. 76). Hold bracket firmly against spring tension while removing last screw.

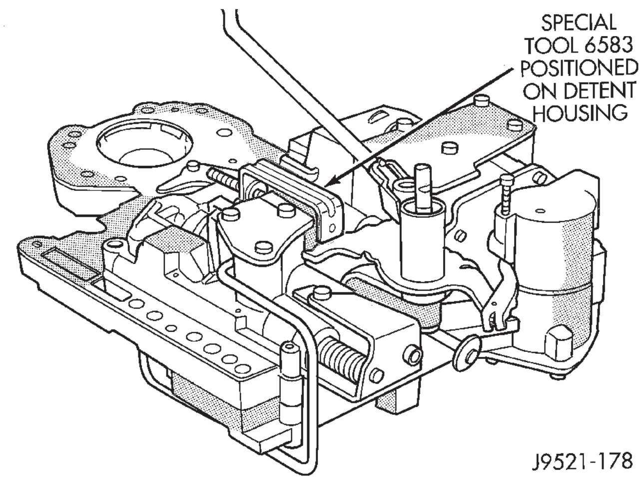


Fig. 71 Detent Ball And Spring

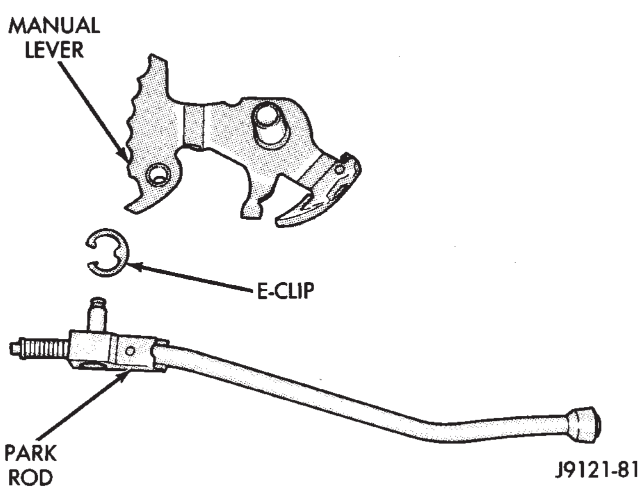


Fig. 72 Park Rod

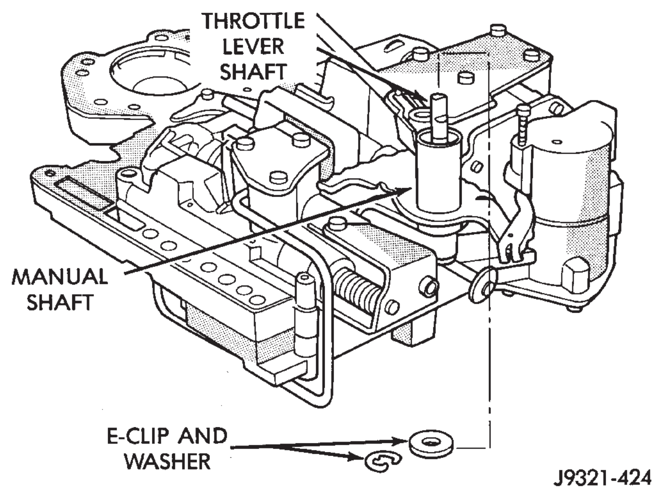


Fig. 73 Throttle Lever E-Clip And Washer

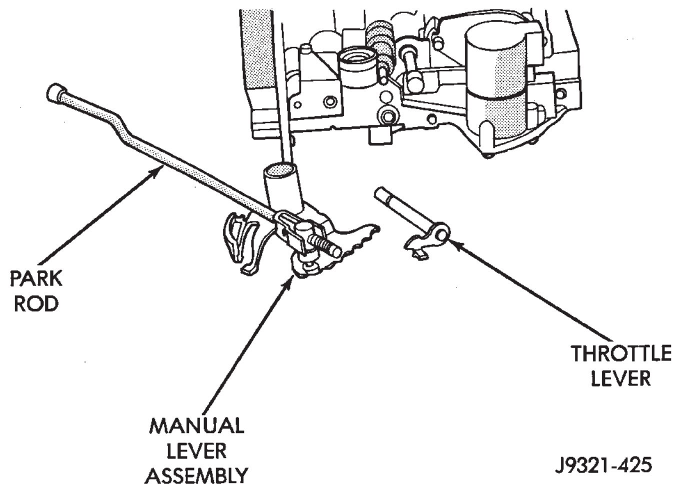


Fig. 74 Manual And Throttle Lever

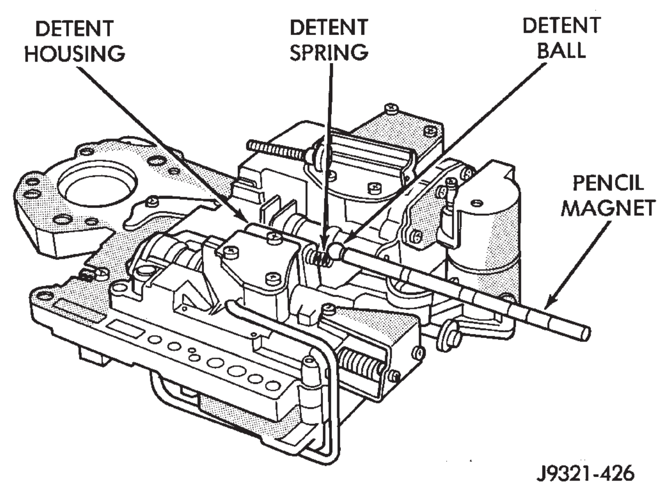


Fig. 75 Detent Ball And Spring

DISASSEMBLY AND ASSEMBLY (Continued)

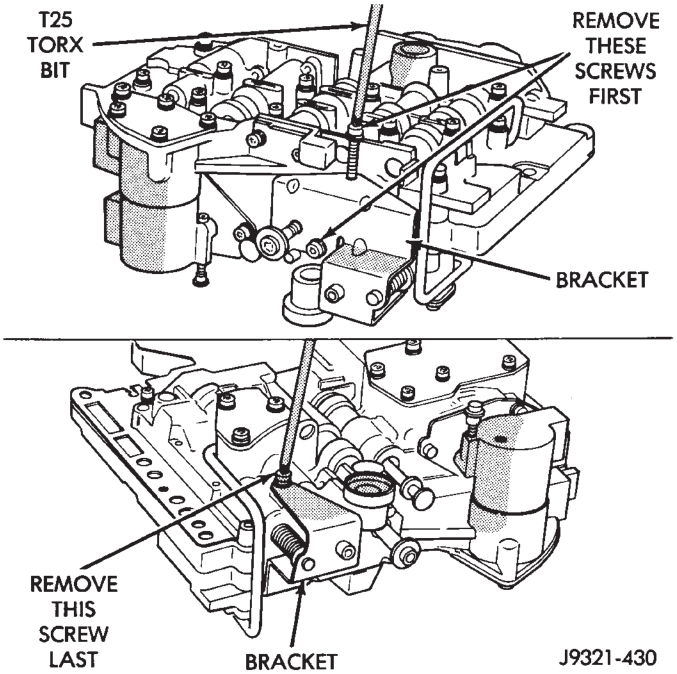


Fig. 76 Adjusting Screw Bracket Fastener

(20) Remove adjusting screw bracket, line pressure adjusting screw, pressure regulator valve spring and switch valve spring (Fig. 77). **Do not remove throttle pressure adjusting screw from bracket and do not disturb setting of either adjusting screw during removal.**

(21) Turn upper housing over and remove switch valve, regulator valve and spring, and manual valve (Fig. 78).

(22) Remove kickdown detent, kickdown valve, and throttle valve and spring (Fig. 78).

(23) Loosen left-side 3-4 accumulator housing attaching screw about 2-3 threads. Then remove center and right-side housing attaching screws (Fig. 79).

(24) Carefully rotate 3-4 accumulator housing upward and remove 3-4 shift valve spring and converter clutch valve plug and spring (Fig. 80).

(25) Remove left-side screw and remove 3-4 accumulator housing from valve body (Fig. 81).

(26) Bend back tabs on boost valve tube brace (Fig. 82).

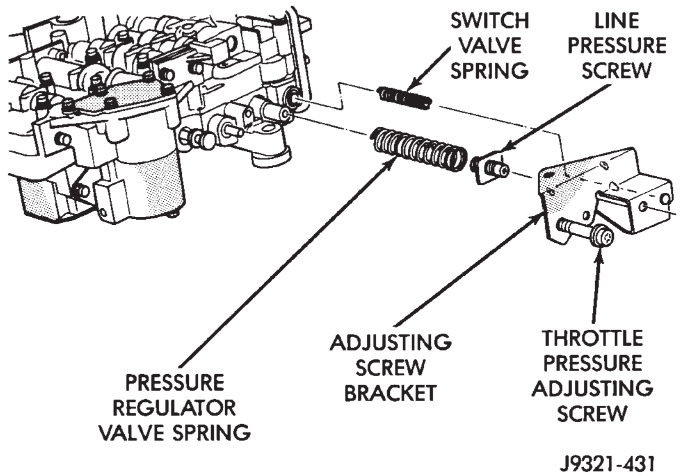


Fig. 77 Adjusting Screw Bracket And Spring

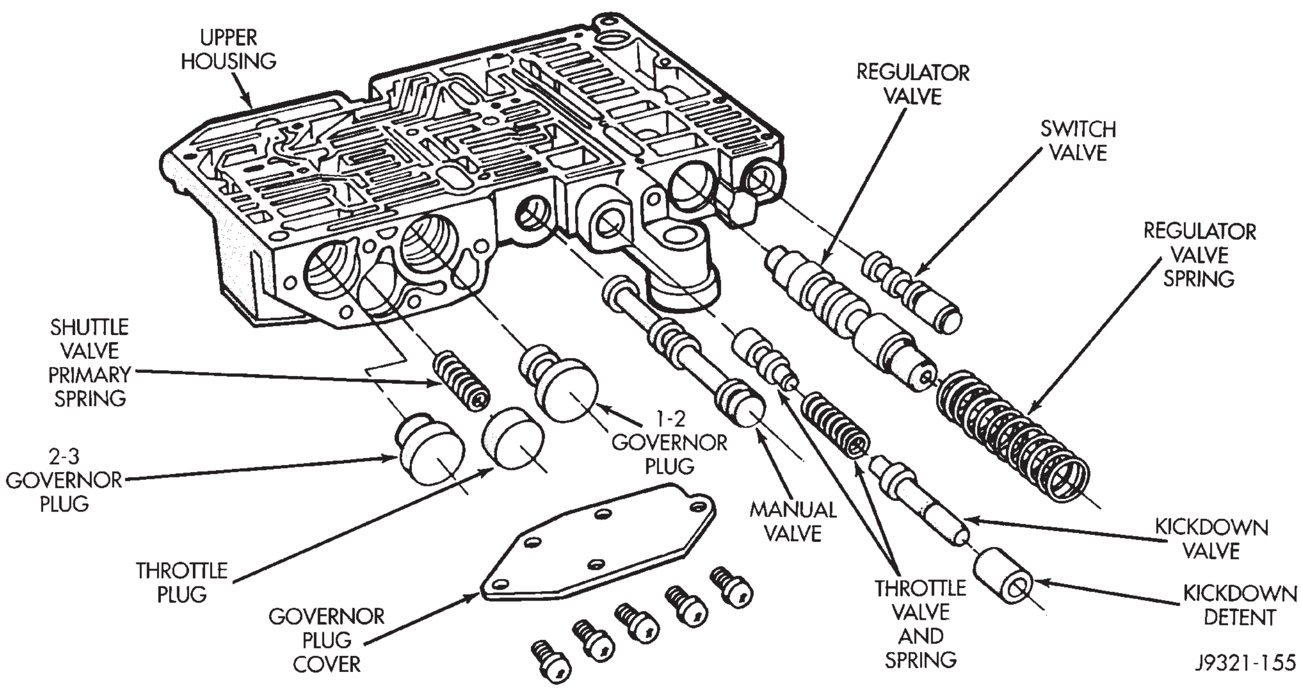


Fig. 78 Upper Housing Control Valve Locations

DISASSEMBLY AND ASSEMBLY (Continued)

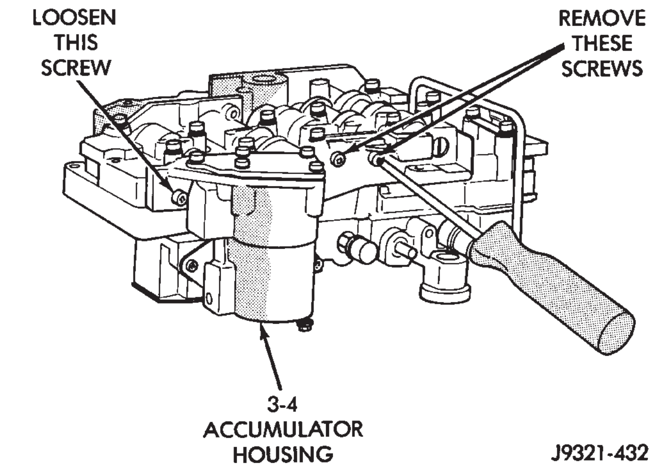


Fig. 79 Accumulator Housing Screw Locations

(27) Remove boost valve connecting tube (Fig. 83).

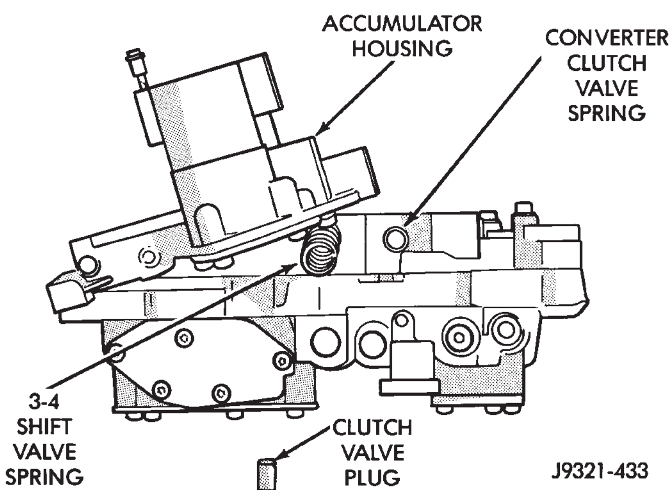


Fig. 80 3-4 Shift And Converter Clutch Valve Springs And Plug

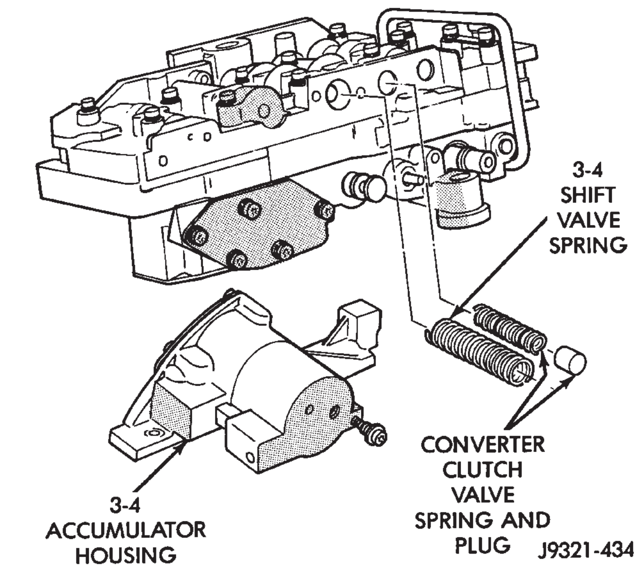


Fig. 81 Accumulator Housing, Valve Springs And Plug

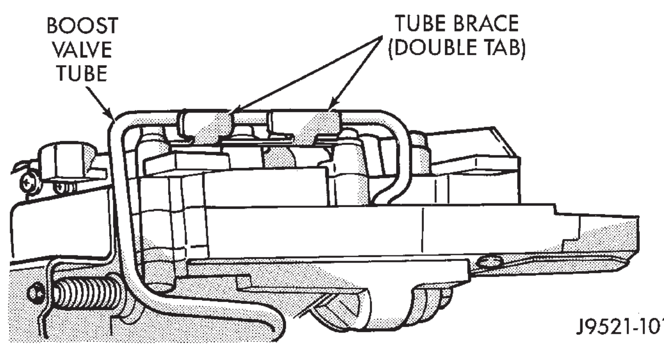


Fig. 82 Boost Valve Tube Brace

DISASSEMBLY AND ASSEMBLY (Continued)

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.

(28) Turn valve body over so lower housing is facing upward (Fig. 84). 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.

(29) Remove screws attaching valve body lower housing to upper housing and transfer plate (Fig. 84). **Note position of boost valve tube brace for assembly reference.**

(30) Remove lower housing and overdrive separator plate from transfer plate (Fig. 84).

(31) Remove the ECE check ball from the transfer plate (Fig. 85). The ECE check ball is approximately 4.8 mm (3/16 in.) in diameter.

(32) Remove transfer plate from upper housing (Fig. 86).

(33) Turn transfer plate over so upper housing separator plate is facing upward.

(34) Remove upper housing separator plate from transfer plate (Fig. 87). Note position of filter in separator plate for assembly reference.

(35) Remove rear clutch and rear servo check balls from transfer plate. Note check ball location for assembly reference (Fig. 88).

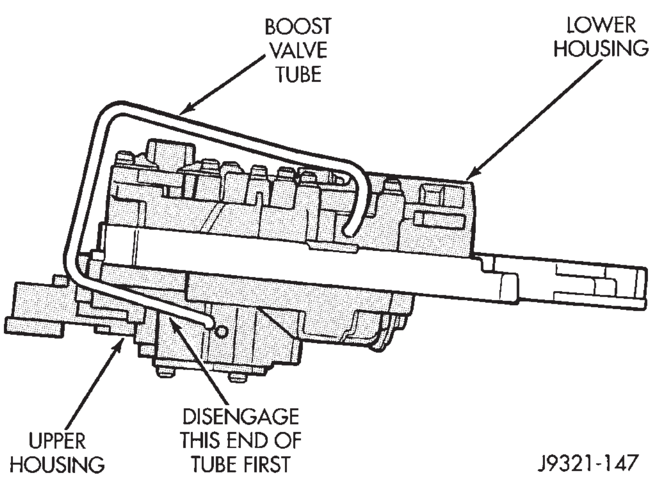


Fig. 83 Boost Valve Tube

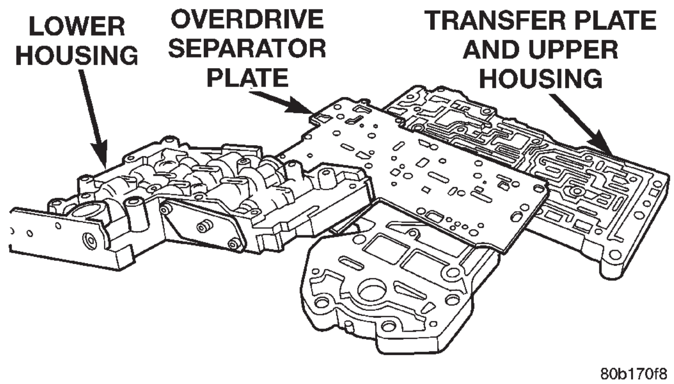


Fig. 84 Lower Housing

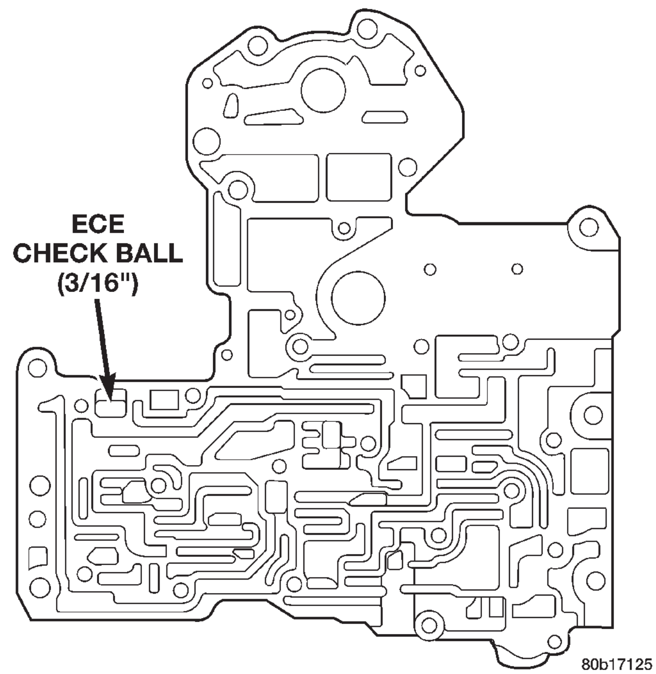


Fig. 85 ECE Check Ball

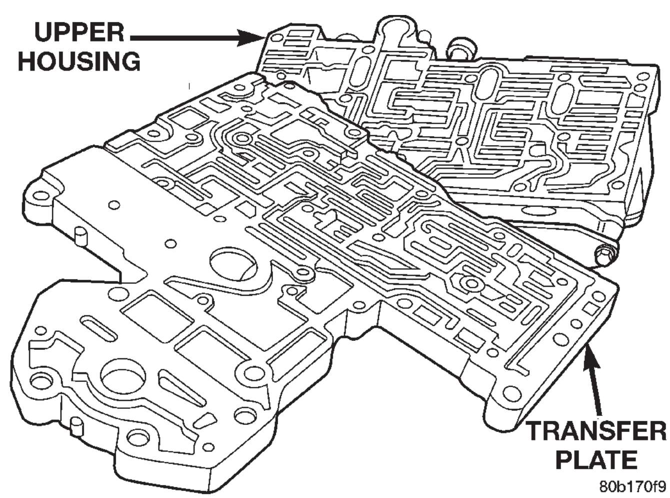


Fig. 86 Transfer Plate

DISASSEMBLY AND ASSEMBLY (Continued)

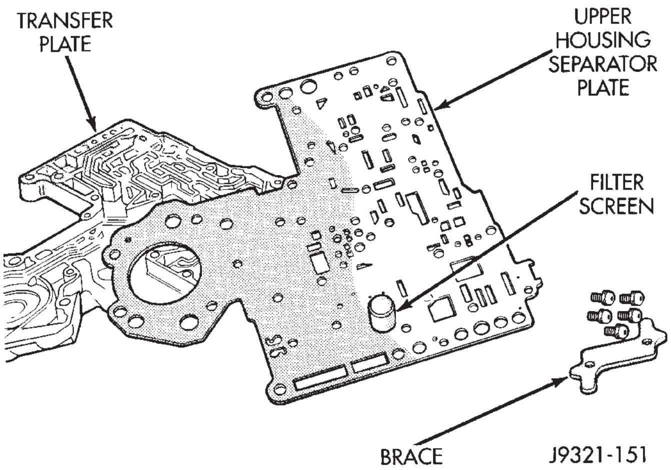


Fig. 87 Upper Housing Separator Plate

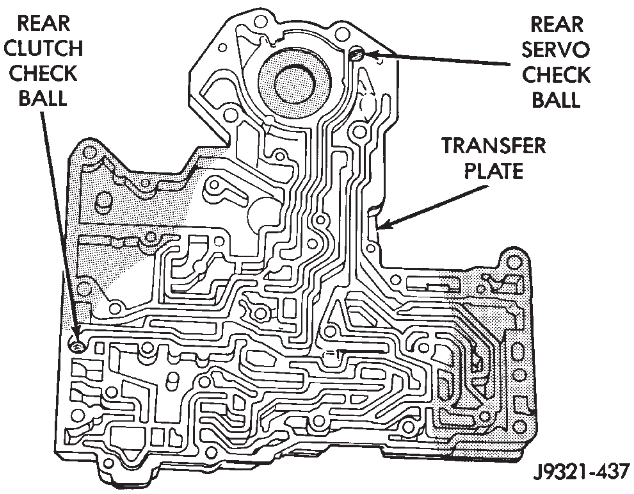


Fig. 88 Rear Clutch And Rear Servo Check Ball Locations

VALVE BODY UPPER HOUSING

(1) Note location of check balls in valve body upper housing (Fig. 89). Then remove the one large diameter and the six smaller diameter check balls.

(2) Remove governor plug and shuttle valve covers (Fig. 91).

(3) Remove E-clip that secures shuttle valve secondary spring on valve stem (Fig. 90).

(4) Remove throttle plug, primary spring, shuttle valve, secondary spring, and spring guides (Fig. 91).

(5) Remove boost valve retainer, spring and valve if not previously removed.

(6) Remove throttle plug and 1-2 and 2-3 governor plugs (Fig. 78).

(7) Turn upper housing around and remove limit valve and shift valve covers (Fig. 92).

(8) Remove limit valve housing. Then remove retainer, spring, limit valve, and 2-3 throttle plug from limit valve housing (Fig. 92).

(9) Remove 1-2 shift control valve and spring (Fig. 92).

(10) Remove 1-2 shift valve and spring (Fig. 92).

(11) Remove 2-3 shift valve and spring from valve body (Fig. 92).

(12) Remove pressure plug cover (Fig. 92).

(13) Remove line pressure plug, sleeve, throttle pressure plug and spring (Fig. 92).

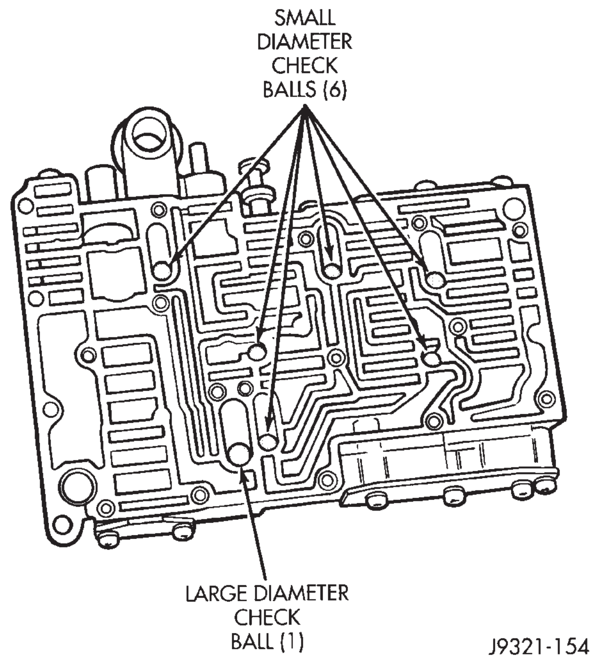


Fig. 89 Check Ball Locations In Upper Housing

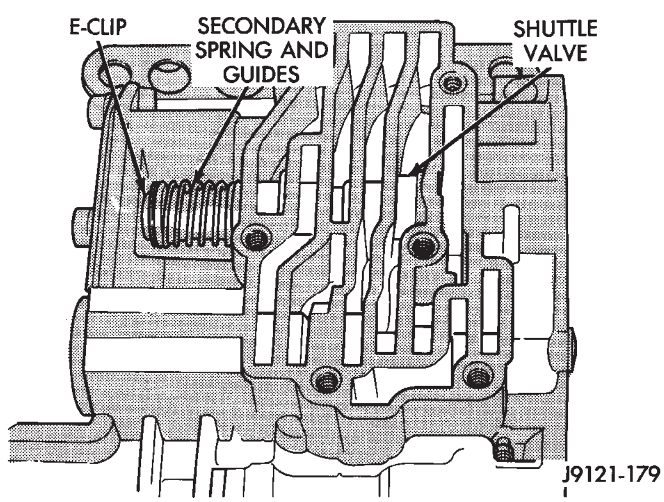


Fig. 90 Shuttle Valve E-Clip And Secondary Spring Location

VALVE BODY LOWER HOUSING

(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 (Fig. 93).

(6) Remove converter clutch timing valve, retainer and valve spring.

DISASSEMBLY AND ASSEMBLY (Continued)

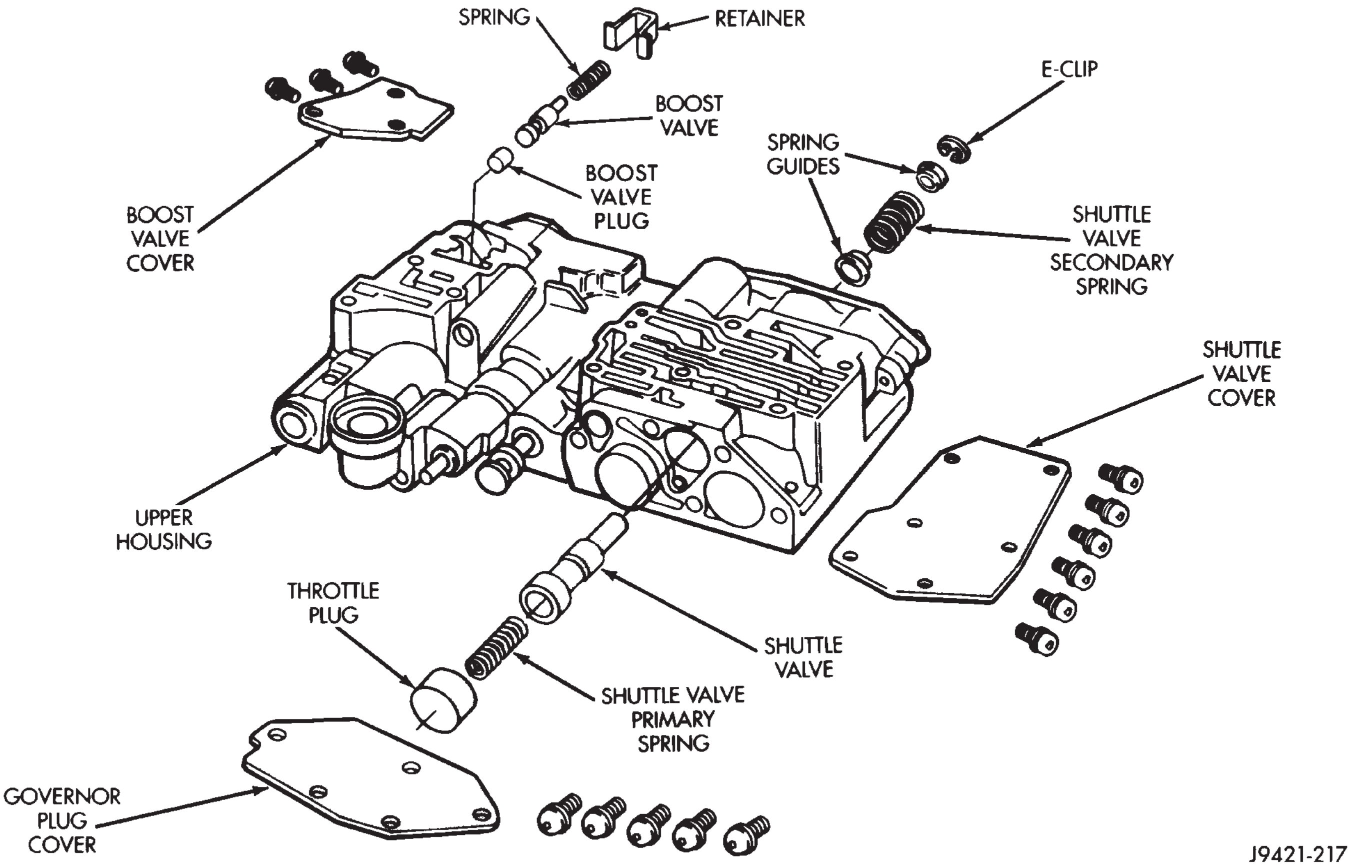


Fig. 91 Shuttle And Boost Valve Components

DISASSEMBLY AND ASSEMBLY (Continued)

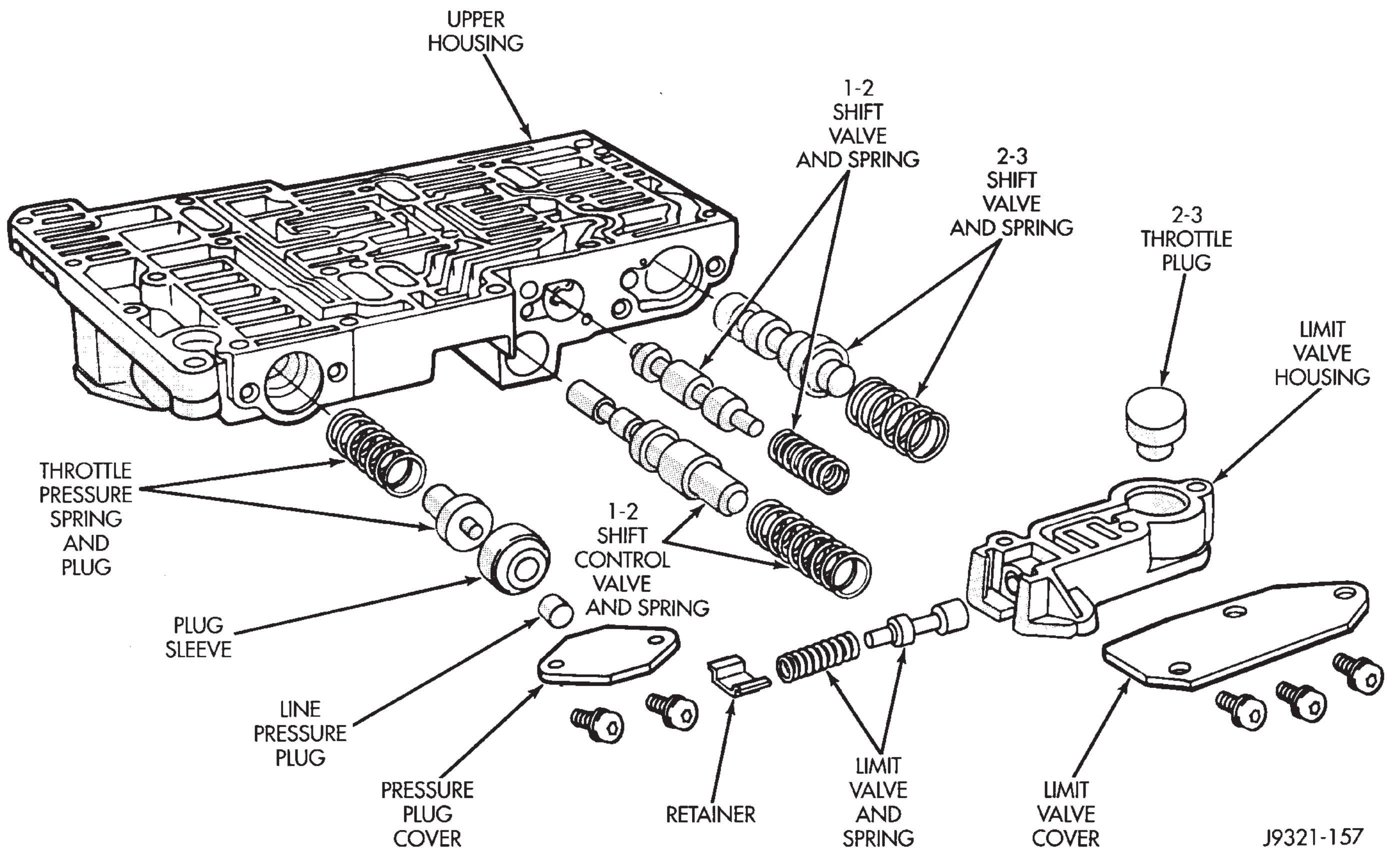


Fig. 92 Upper Housing Shift Valve And Pressure Plug Locations

DISASSEMBLY AND ASSEMBLY (Continued)

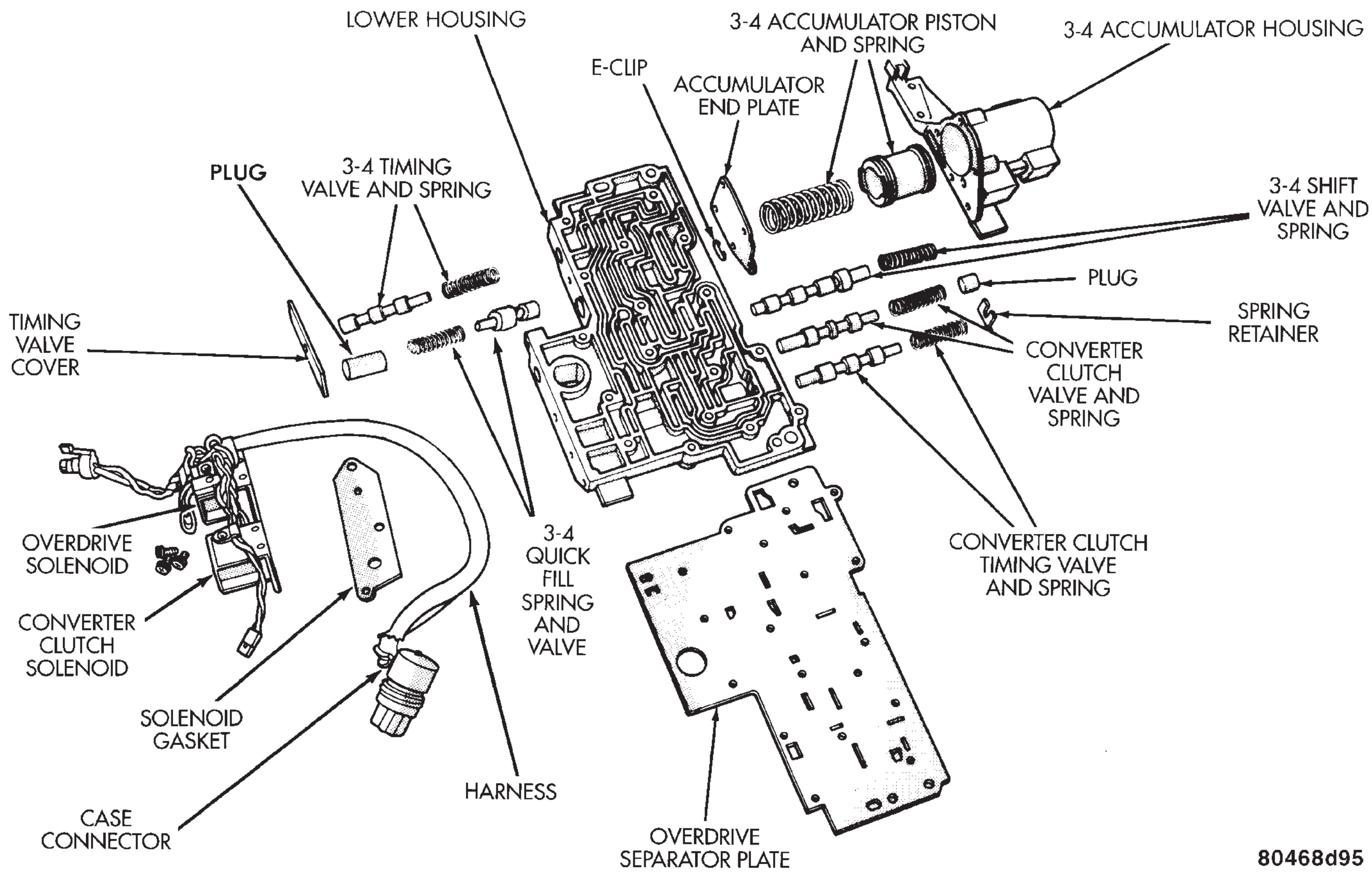


Fig. 93 Lower Housing Shift Valves And Springs

3-4 ACCUMULATOR HOUSING

(1) Remove end plate from housing.

(2) Remove piston spring.

(3) Remove piston. Remove and discard piston seals (Fig. 94).

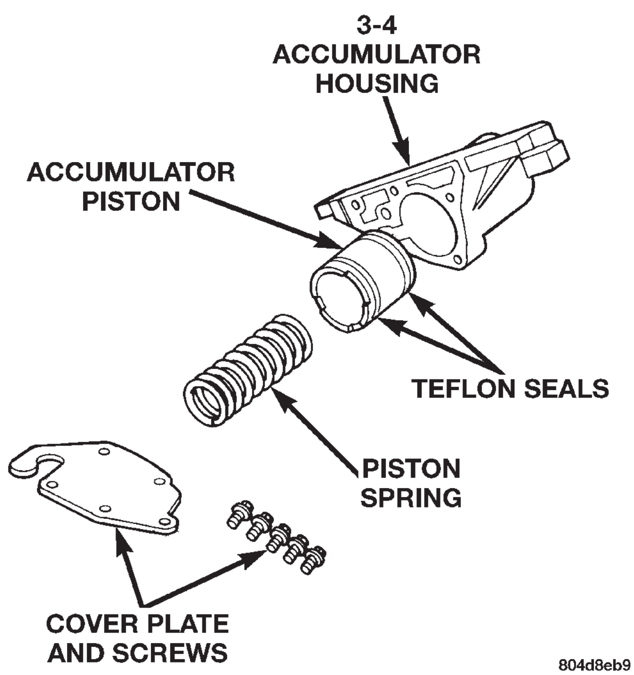


Fig. 94 Accumulator Housing Components

ASSEMBLY

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

(1) Lubricate valves, springs, and the housing valve and plug bores with clean transmission fluid (Fig. 93).

(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.

DISASSEMBLY AND ASSEMBLY (Continued)

3-4 ACCUMULATOR

(1) Lubricate accumulator piston, seals and housing piston bore with clean transmission fluid (Fig. 94).

(2) Install new seal rings on accumulator piston.

(3) Install piston and spring in housing.

(4) Install end plate on housing.

TRANSFER PLATE

(1) Install rear clutch and rear servo check balls in transfer plate (Fig. 95).

(2) Install filter screen in upper housing separator plate (Fig. 96).

(3) Align and position upper housing separator plate on transfer plate (Fig. 97).

(4) Install brace plate (Fig. 97). 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.

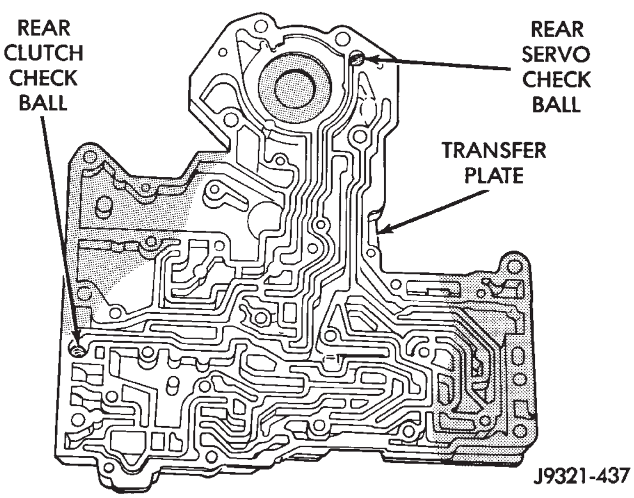


Fig. 95 Rear Clutch And Rear Servo Check Ball Locations

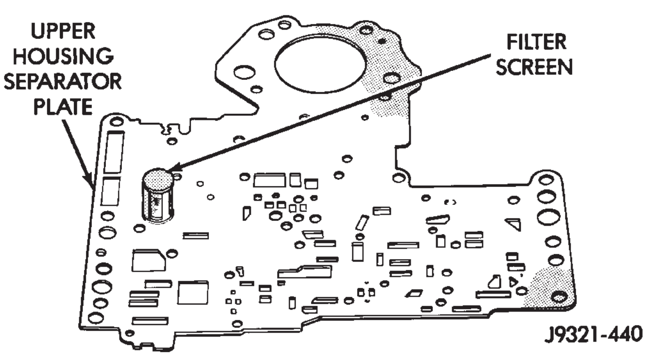


Fig. 96 Separator Plate Filter Screen Installation

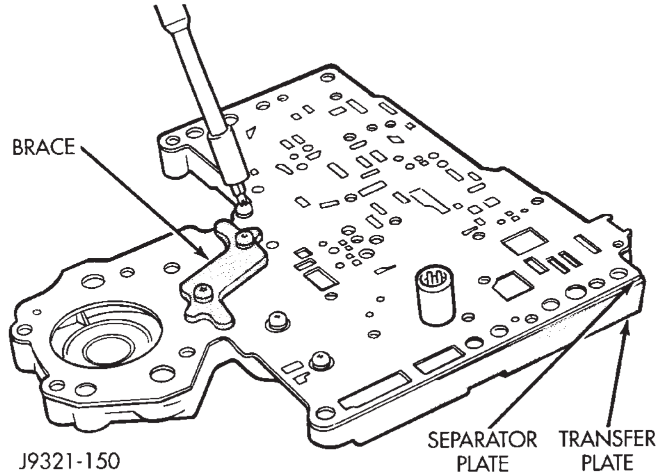


Fig. 97 Brace Plate

UPPER AND LOWER HOUSING

(1) Position upper housing so internal passages and check ball seats are facing upward. Then install check balls in housing (Fig. 98). Seven check balls are used. The single large check ball is approximately 8.7 mm (11/32 in.) diameter. The single small check ball is approximately 4.8 mm (3/16 in.) in diameter. The remaining 6 check balls are approximately 6.3 mm (1/4 in.) in diameter.

(2) Position assembled transfer plate and upper housing separator plate on upper housing (Fig. 99). Be sure filter screen is seated in proper housing recess.

(3) Install the ECE check ball into the transfer plate (Fig. 85). The ECE check ball is approximately 4.8 mm (3/16 in.) in diameter.

(4) Position lower housing separator plate on transfer plate (Fig. 100).

(5) Install lower housing on assembled transfer plate and upper housing (Fig. 101).

(6) Install and start all valve body screws by hand except for the screws to hold the boost valve tube brace. Save those screws for later installation. Then tighten screws evenly to 4 N·m (35 in. lbs.) torque. Start at center and work out to sides when tightening screws (Fig. 101).

DISASSEMBLY AND ASSEMBLY (Continued)

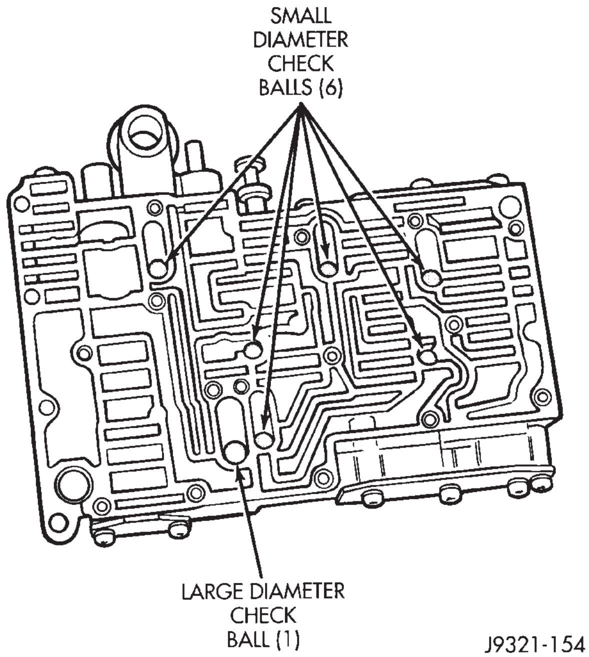


Fig. 98 Check Ball Locations In Upper Housing

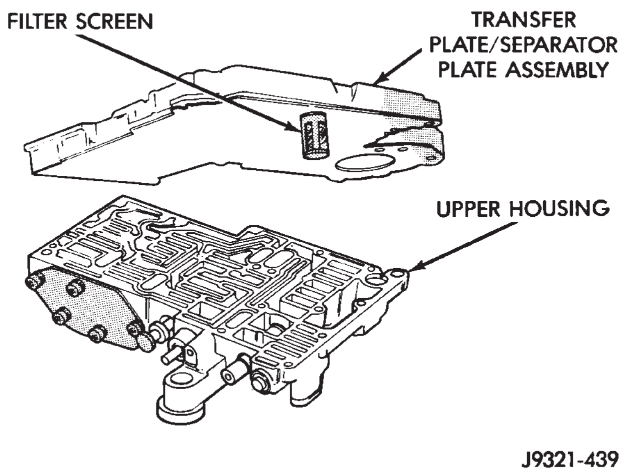


Fig. 99 Installing Transfer Plate On Upper Housing

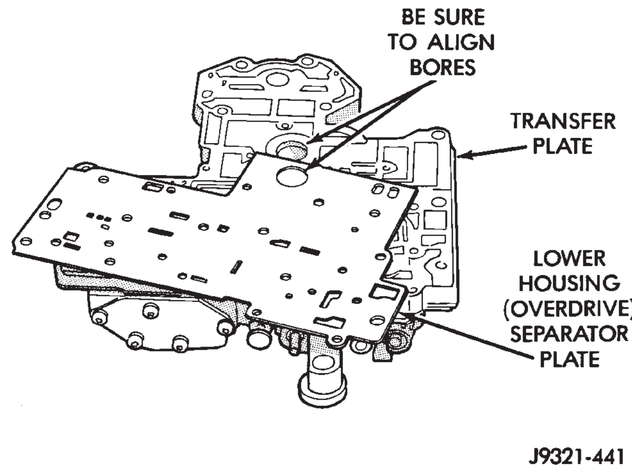


Fig. 100 Lower Housing Separator Plate

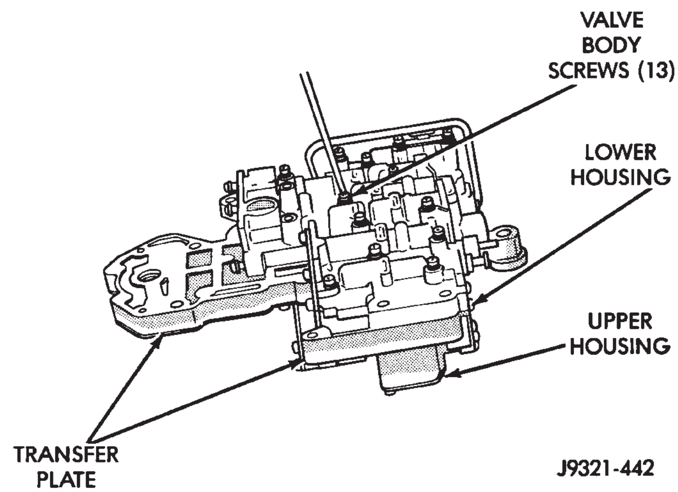


Fig. 101 Installing Lower Housing On Transfer Plate And Upper Housing

DISASSEMBLY AND ASSEMBLY (Continued)

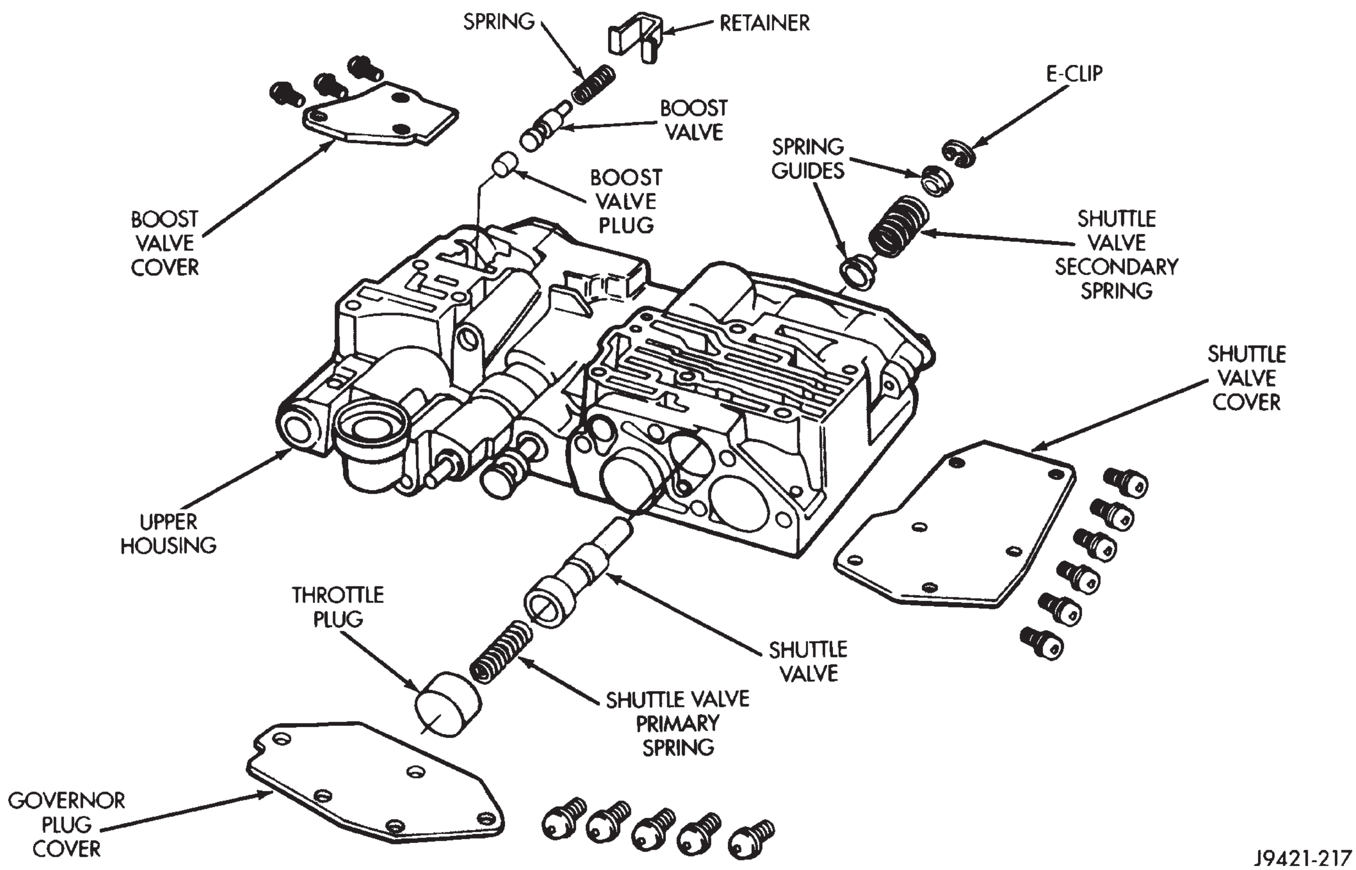


Fig. 102 Shuttle And Boost Valve Components

UPPER HOUSING VALVE AND PLUG

Refer to (Fig. 102), (Fig. 103) and (Fig. 104) to perform the following steps.

(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.

(5) Install retainer, spring, limit valve, and 2-3 throttle plug from limit valve housing.

(6) Install limit valve housing and cover plate. Tighten screws to 4 N·m (35 in. lbs.).

(7) Install shuttle valve as follows:

(a) Insert plastic guides in shuttle valve secondary spring and install spring on end of valve.

(b) Install shuttle valve into housing.

(c) Hold shuttle valve in place.

(d) Compress secondary spring and install E-clip in groove at end of shuttle valve.

(e) Verify that spring and E-clip are properly seated before proceeding.

(8) Install shuttle valve cover plate. Tighten cover plate screws to 4 N·m (35 in. lbs.) torque.

(9) Install 1-2 and 2-3 valve governor plugs in valve body.

(10) Install shuttle valve primary spring and throttle plug.

(11) Align and install governor plug cover. Tighten cover screws to 4 N·m (35 in. lbs.) torque.

DISASSEMBLY AND ASSEMBLY (Continued)

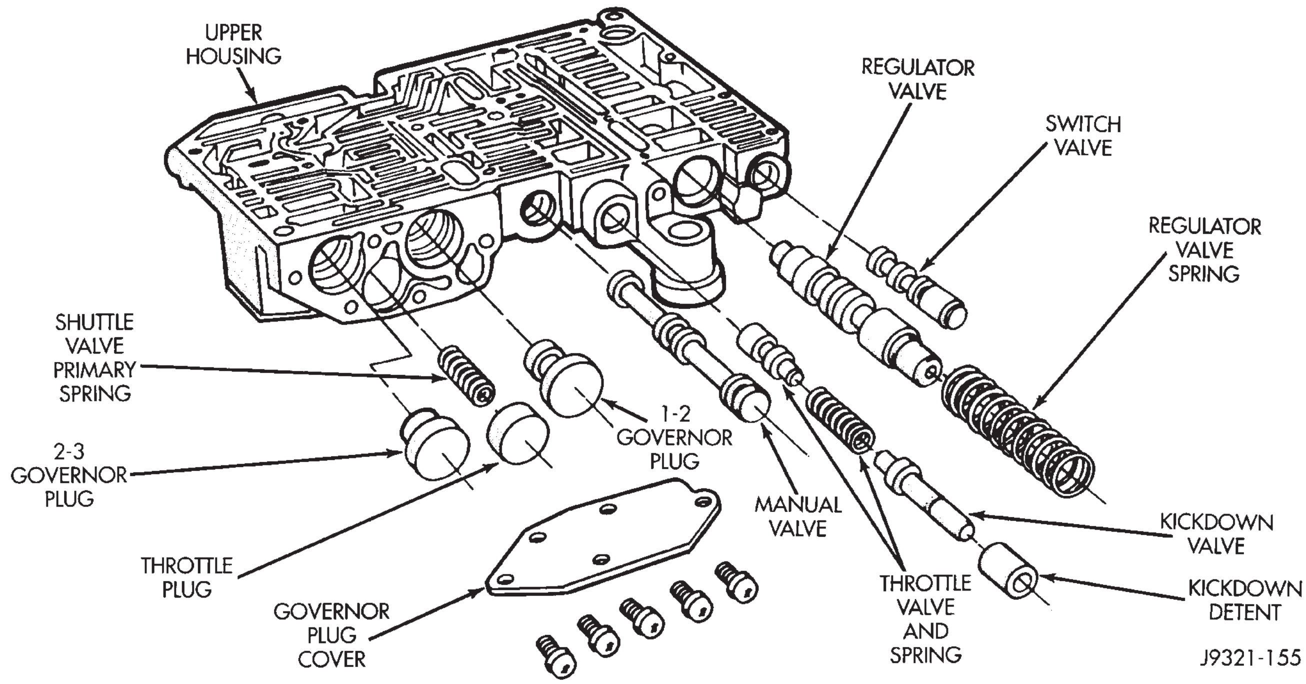


Fig. 103 Upper Housing Control Valve Locations

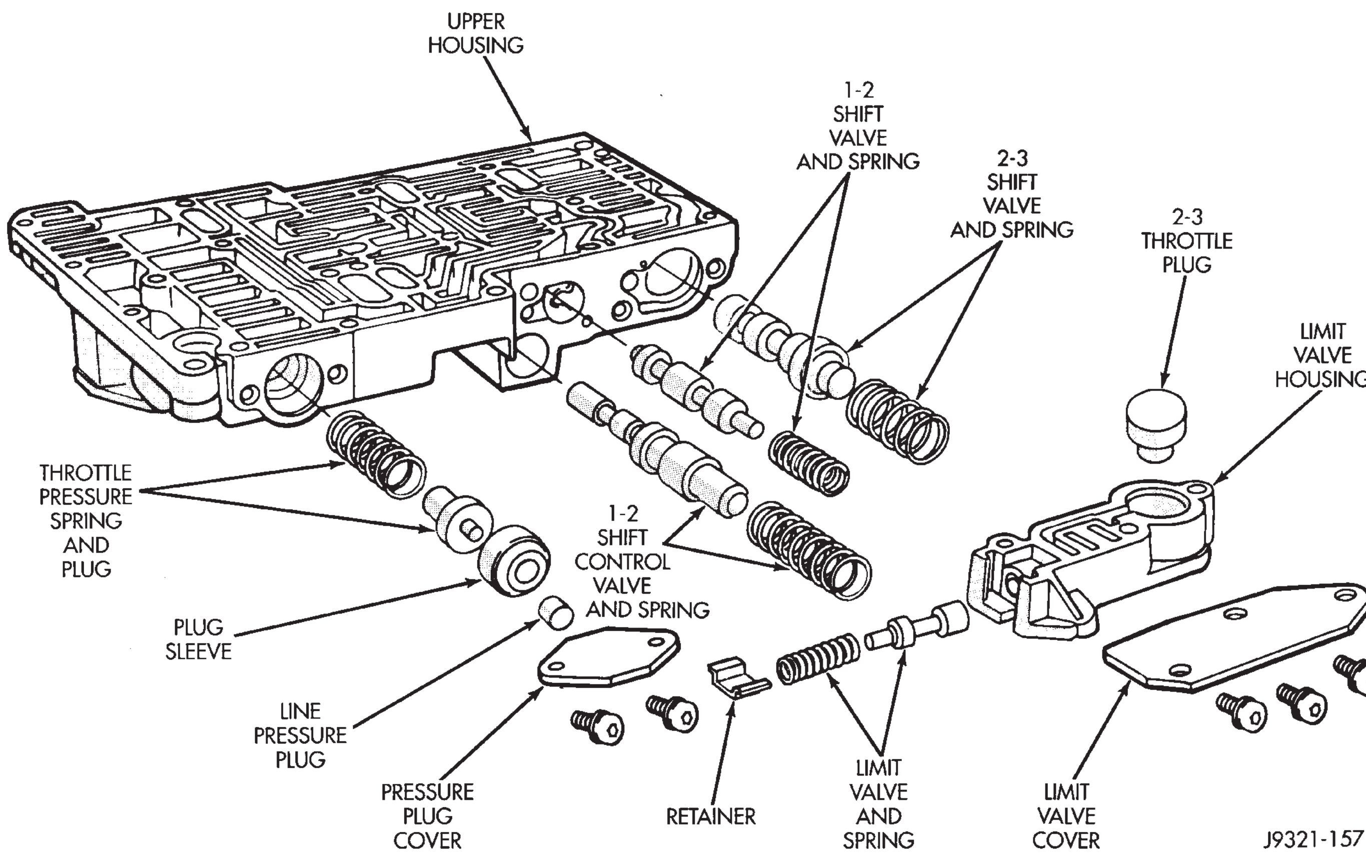


Fig. 104 Upper Housing Shift Valve And Pressure Plug Locations

DISASSEMBLY AND ASSEMBLY (Continued)

BOOST VALVE TUBE AND BRACE

(1) Position valve body assembly so lower housing is facing upward (Fig. 105).

(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. 105).

(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. 106).

(6) Install and finger tighten three screws that secure tube brace to valve body housings (Fig. 106).

(7) Bend tube brace tabs up and against tube to hold it in position (Fig. 107).

(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.

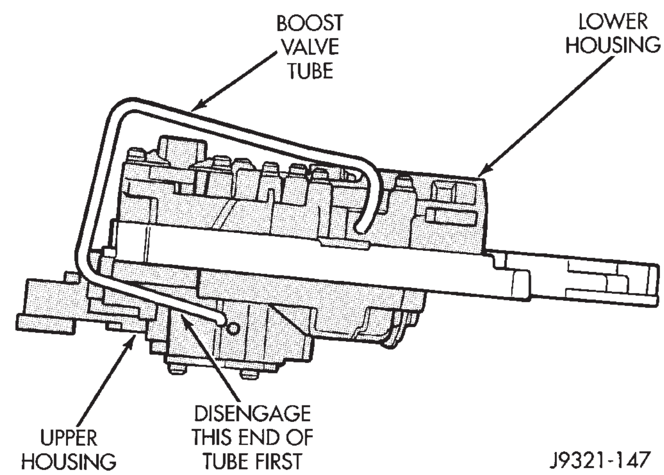


Fig. 105 Boost Valve Tube

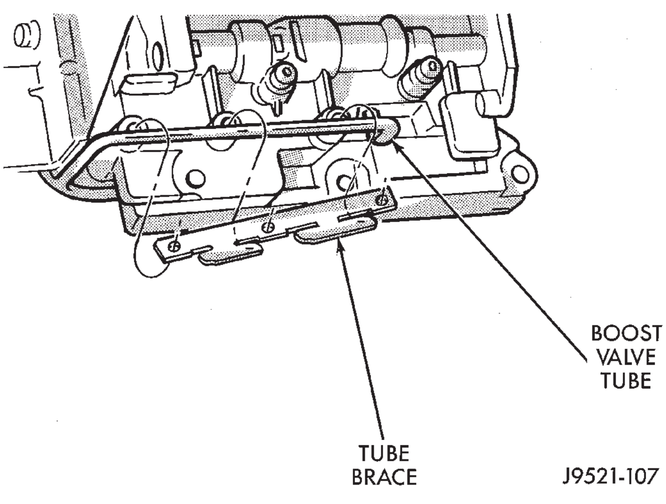


Fig. 106 Boost Valve Tube And Brace

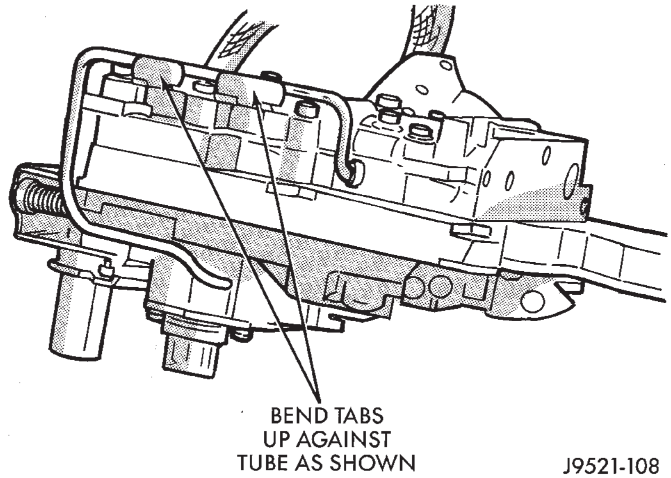


Fig. 107 Securing Boost Valve Tube With Brace Tabs

3-4 ACCUMULATOR

(1) Position converter clutch valve and 3-4 shift valve springs in housing (Fig. 108).

(2) Loosely attach accumulator housing with right-side screw (Fig. 108). Install only one screw at this time as accumulator must be free to pivot upward for ease of installation.

(3) Install 3-4 shift valve and spring.

(4) Install converter clutch timing valve and spring.

(5) Position plug on end of converter clutch valve spring. Then compress and hold springs and plug in place with fingers of one hand.

(6) Swing accumulator housing upward over valve springs and plug.

(7) Hold accumulator housing firmly in place and install remaining two attaching screws. Be sure springs and clutch valve plug are properly seated (Fig. 109). Tighten screws to 4 N·m (35 in. lbs.).

VALVE BODY FINAL

(1) Install boost valve, valve spring, retainer and cover plate. Tighten cover plate screws to 4 N·m (35 in. lbs.) torque.

(2) Insert manual lever detent spring in upper housing.

(3) Position detent ball on end of spring. Then hold detent ball and spring in detent housing with Retainer Tool 6583 (Fig. 110).

(4) Install throttle lever in upper housing. Then install manual lever over throttle lever and start manual lever into housing.

(5) 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.

(6) Then install manual lever seal, washer and E-clip.

DISASSEMBLY AND ASSEMBLY (Continued)

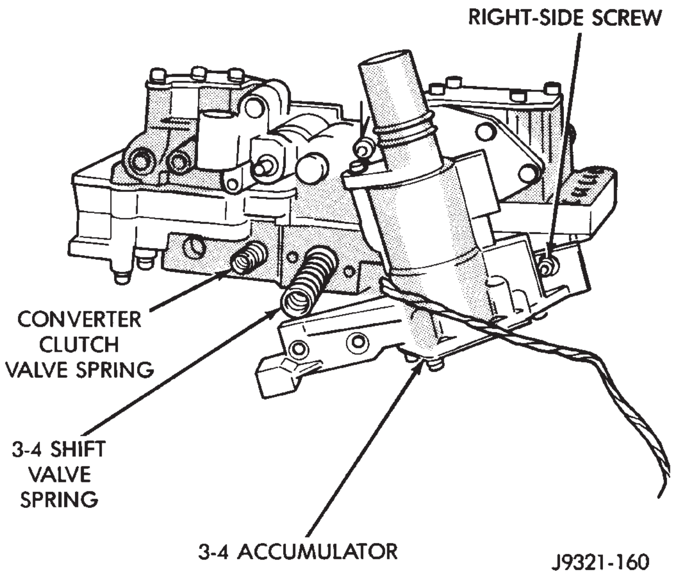


Fig. 108 Converter Clutch And 3-4 Shift Valve Springs

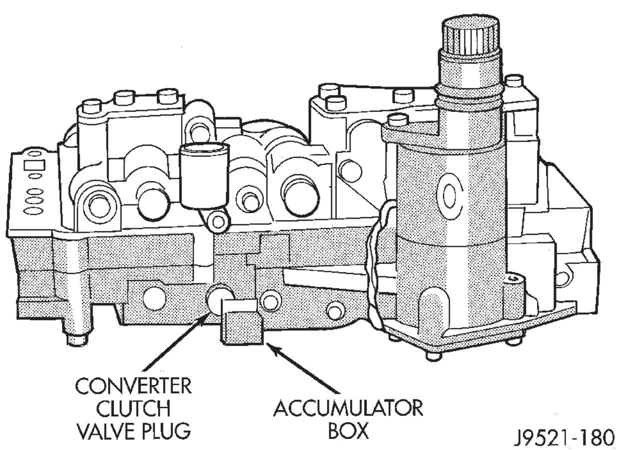


Fig. 109 Seating 3-4 Accumulator On Lower Housing

(7) Verify that throttle lever is aligned with end of kickdown valve stem and that manual lever arm is engaged in manual valve (Fig. 111).

(8) Position line pressure adjusting screw in adjusting screw bracket.

(9) Install spring on end of line pressure regulator valve.

(10) Install switch valve spring on tang at end of adjusting screw bracket.

(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.

(16) 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.

(17) Lubricate solenoid case connector O-rings and shaft of manual lever with light coat of petroleum jelly.

(18) Obtain new fluid filter for valve body but do not install filter at this time.

(19) 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.

(20) 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. 112). Seat tang in dimple before tightening connector screw.

(21) Install solenoid assembly and gasket. Tighten solenoid attaching screws to 8 N·m (72 in. lbs.) torque.

(22) Verify that solenoid wire harness is properly routed (Fig. 113). **Solenoid harness must be clear of manual lever and park rod and not be pinched between accumulator housing and cover.**

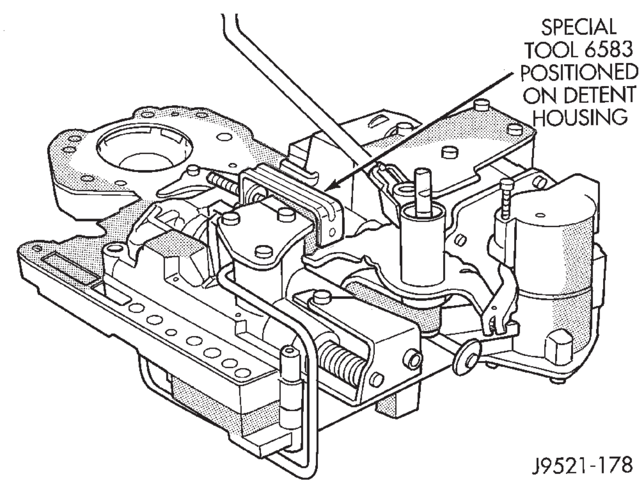


Fig. 110 Detent Ball Spring

GOVERNOR BODY, SENSOR AND SOLENOID

(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.

(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.

DISASSEMBLY AND ASSEMBLY (Continued)

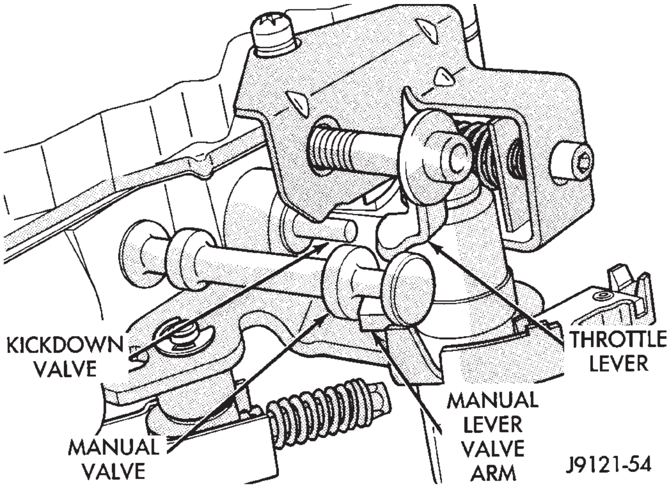


Fig. 111 Manual And Throttle Lever Alignment

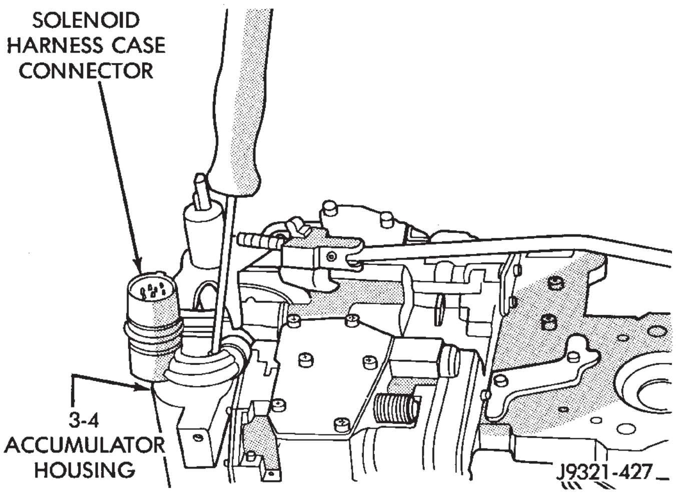


Fig. 112 Solenoid Harness Case Connector Shoulder Bolt

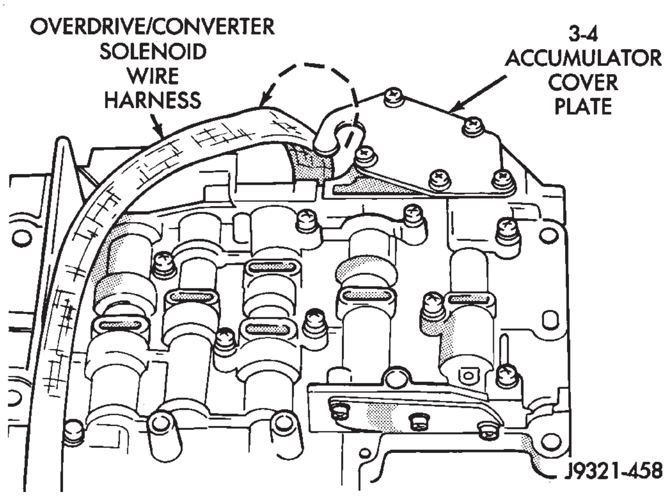


Fig. 113 Solenoid Harness Routing

(5) Install governor pressure solenoid in governor body. Push solenoid in until it snaps into place in body.

(6) Position governor body gasket on transfer plate.

(7) Install retainer plate on governor body and around solenoid. 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.

(10) Perform Line Pressure and Throttle Pressure adjustments. Refer to adjustment section of this group for proper procedures.

(11) Install fluid filter and pan.

(12) Lower vehicle.

(13) Fill transmission with recommended fluid and road test vehicle to verify repair.

TRANSMISSION

DISASSEMBLY

(1) Clean transmission exterior with steam gun or with solvent. Wear eye protection during cleaning operations.

(2) Place transmission in a vertical position.

(3) Measure and record input shaft end play readings.

(4) Remove shift and throttle levers from valve body manual lever shaft.

(5) Place transmission in horizontal position.

(6) Remove transmission oil pan and gasket.

(7) Remove filter from valve body (Fig. 114). Keep filter screws separate from other valve body screws. Filter screws are longer and should be kept with filter.

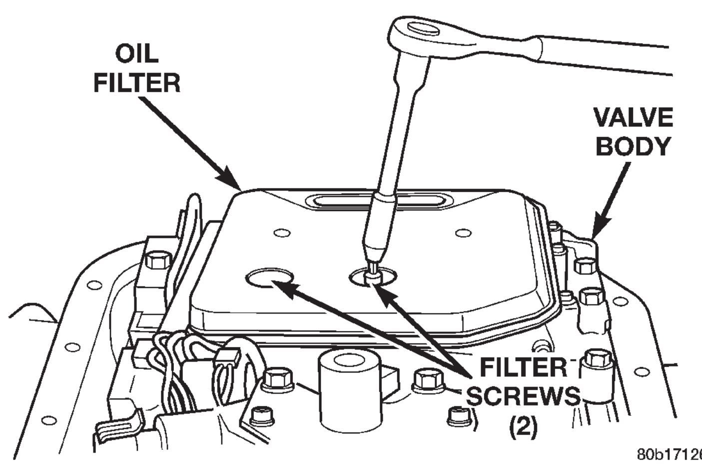


Fig. 114 Oil Filter Removal

DISASSEMBLY AND ASSEMBLY (Continued)

(8) Remove park/neutral position switch.

(9) Remove hex head bolts attaching valve body to transmission case (Fig. 115). A total of 10 bolts are used. Note different bolt lengths for assembly reference.

(10) Remove valve body assembly. Push valve body harness connector out of case. Then work park rod and valve body out of case (Fig. 116).

(11) Remove accumulator piston and inner and outer springs (Fig. 117).

(12) Remove pump oil seal with suitable pry tool or slide-hammer mounted screw.

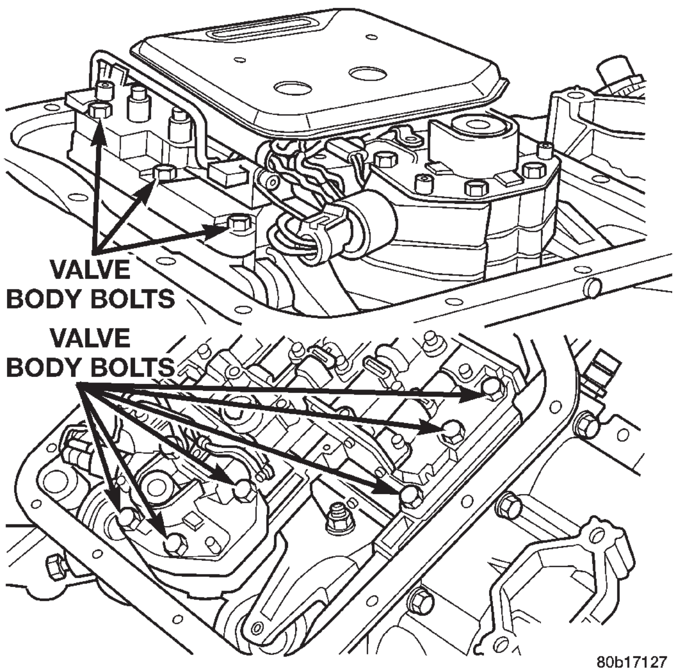


Fig. 115 Valve Body Bolt Locations

(13) 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.

(14) Remove oil pump bolts.

(15) Thread bolts of Slide Hammer Tools C-3752 into threaded holes in pump body flange (Fig. 118).

(16) Bump slide hammer weights outward to remove pump and reaction shaft support assembly from case (Fig. 118).

(17) Loosen front band adjusting screw until band is completely loose.

(18) Squeeze front band together and remove band strut (Fig. 119).

(19) Remove front band lever (Fig. 120).

(20) Remove front band lever shaft plug, if necessary, from converter housing.

(21) Remove front band lever shaft.

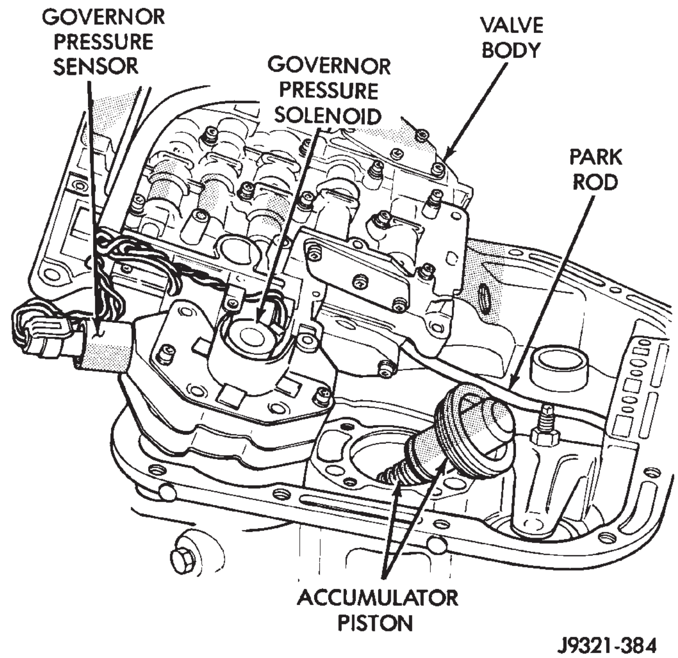


Fig. 116 Valve Body Removal

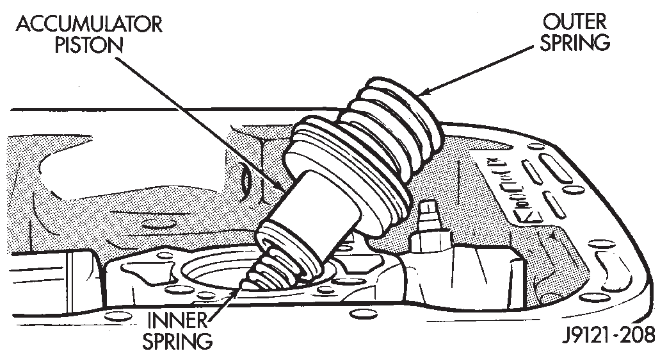


Fig. 117 Accumulator Piston And Springs

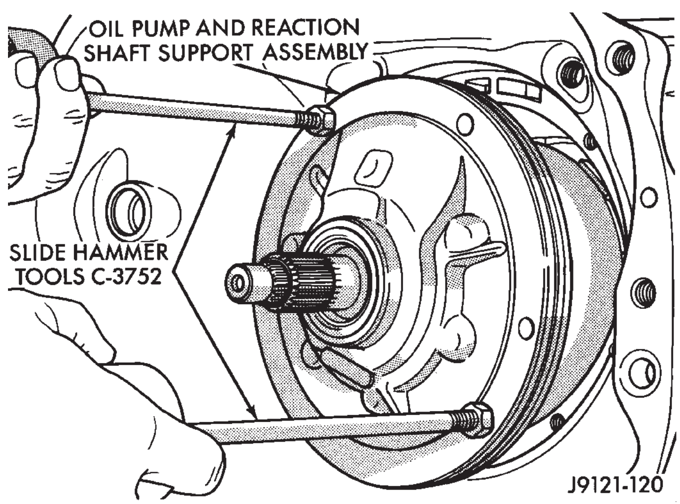


Fig. 118 Removing Oil Pump And Reaction Shaft Support Assembly

DISASSEMBLY AND ASSEMBLY (Continued)

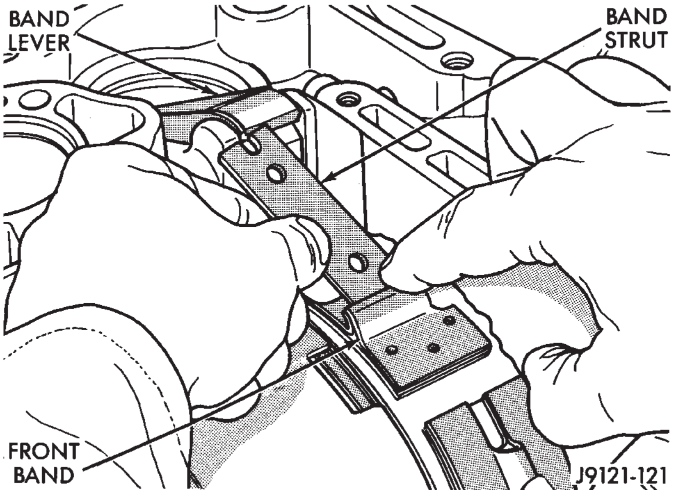


Fig. 119 Removing/Installing Front Band Strut

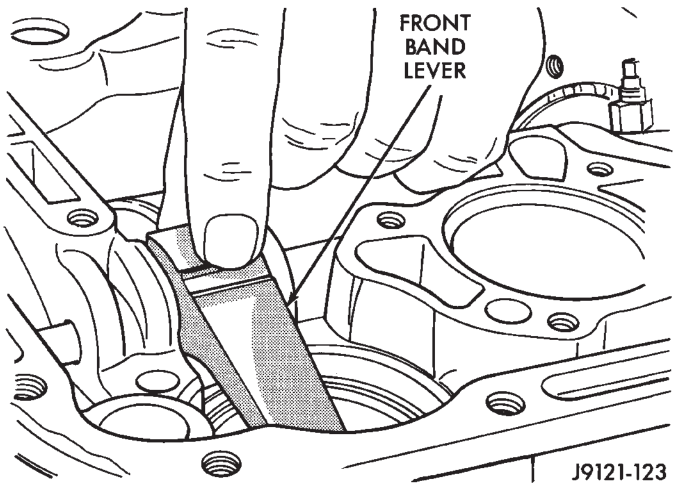


Fig. 120 Removing/Installing Front Band Lever

(22) Remove front and rear clutch units as assembly. Grasp input shaft, hold clutch units together and remove them from case (Fig. 121).

(23) Lift front clutch off rear clutch (Fig. 122). Set clutch units aside for overhaul.

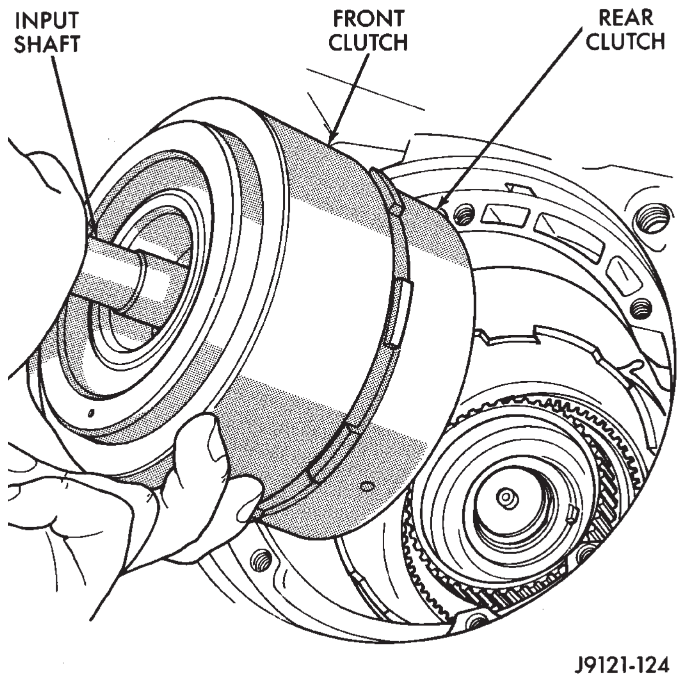


Fig. 121 Removing Front/Rear Clutch Assemblies

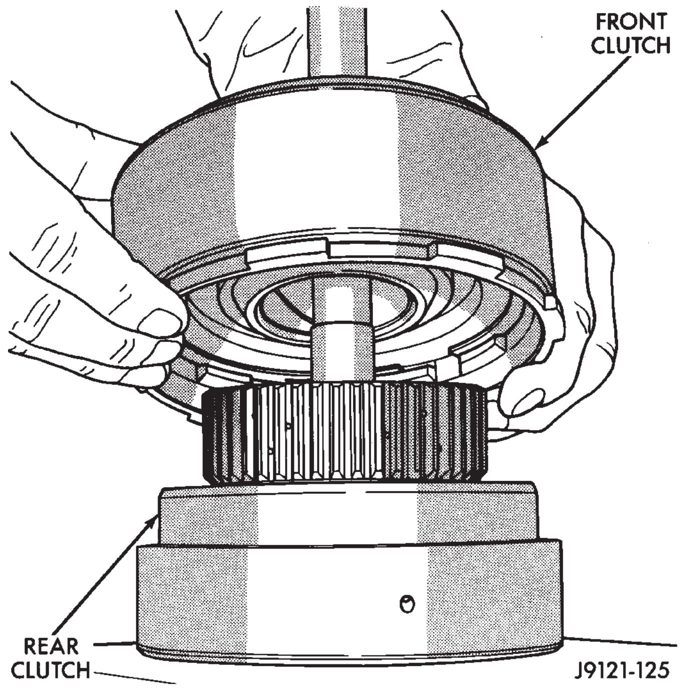


Fig. 122 Separating Front/Rear Clutch Assemblies

DISASSEMBLY AND ASSEMBLY (Continued)

(24) Remove intermediate shaft thrust washer from front end of shaft or from rear clutch hub (Fig. 123).

(25) Remove output shaft thrust plate from intermediate shaft hub (Fig. 124).

(26) Slide front band off driving shell (Fig. 125) and remove band from case.

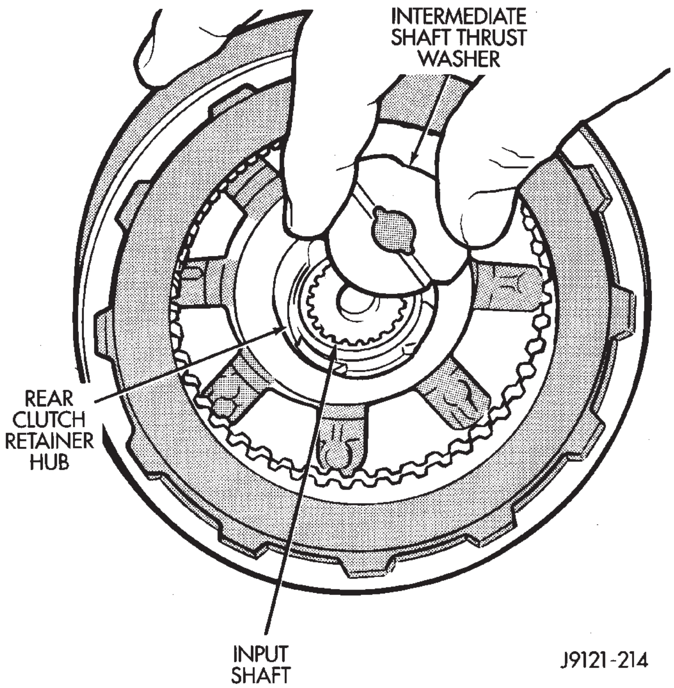


Fig. 123 Removing Intermediate Shaft Thrust Washer

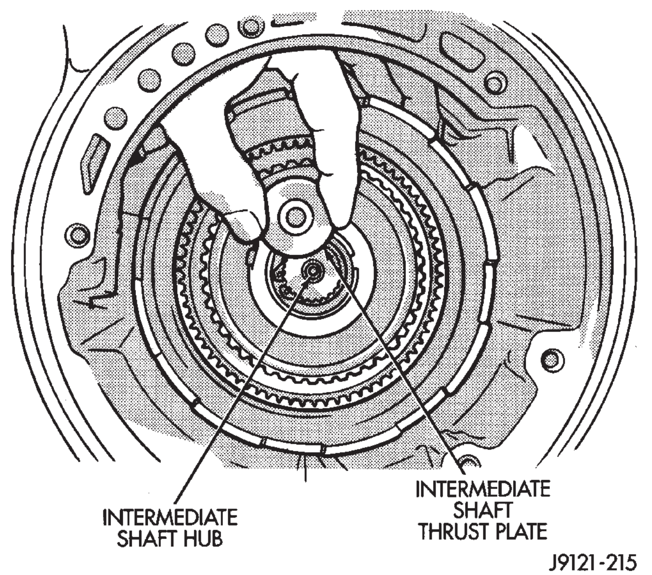


Fig. 124 Removing Intermediate Shaft Thrust Plate

(27) Remove planetary geartrain as assembly (Fig. 126). Support geartrain with both hands during removal. Do not allow machined surfaces on intermediate shaft or overdrive piston retainer to become nicked or scratched.

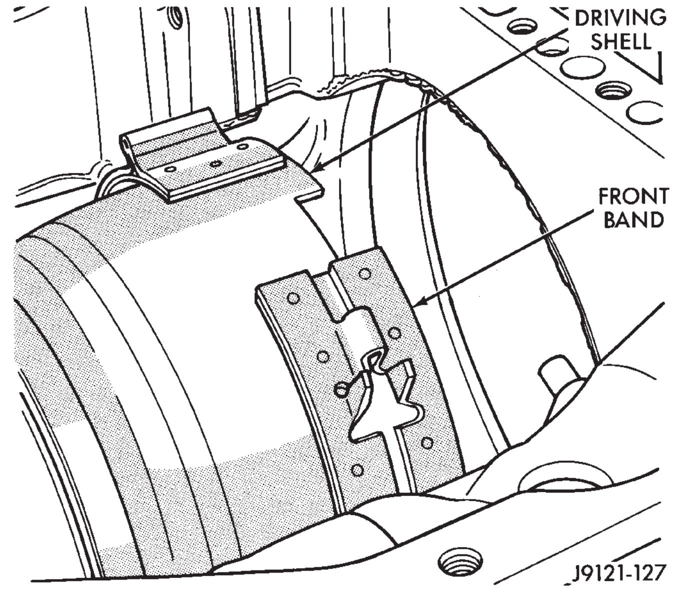


Fig. 125 Front Band Removal/Installation

(28) If overdrive unit is not to be serviced, install Alignment Shaft 6227-2 into the overdrive unit to prevent misalignment of the overdrive clutches during service of main transmission components.

(29) Loosen rear band adjusting screw 4-5 turns.

(30) Remove low-reverse drum snap ring (Fig. 127).

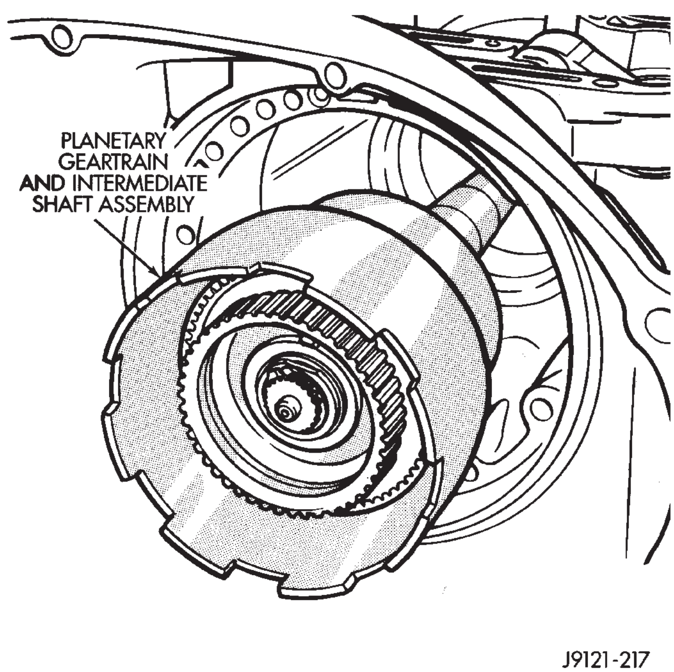


Fig. 126 Removing Planetary Geartrain And Intermediate Shaft Assembly

DISASSEMBLY AND ASSEMBLY (Continued)

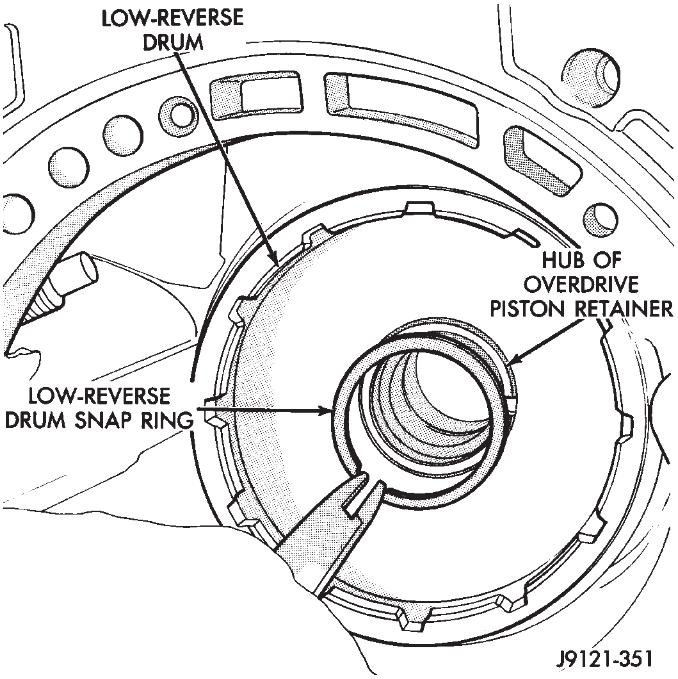


Fig. 127 Removing Low-Reverse Drum Snap Ring

(31) Remove low-reverse drum and reverse band.

(32) Remove overrunning clutch roller and spring assembly as a unit (Fig. 128).

(33) Compress front servo rod guide about 1/8 inch with Valve Spring Compressor C-3422-B (Fig. 129).

(34) 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.**

(35) Remove compressor tools and remove front servo rod guide, spring and servo piston.

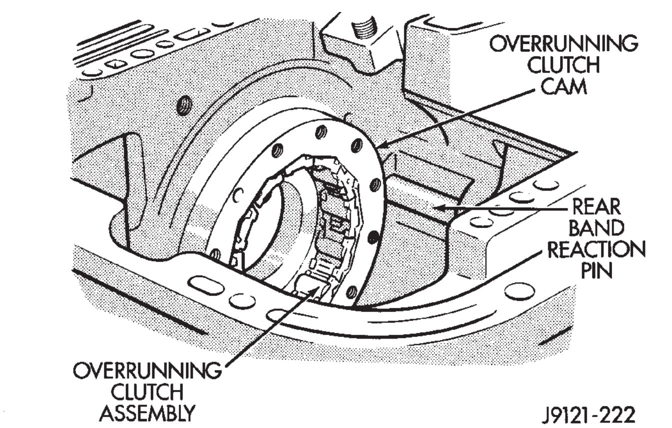


Fig. 128 Overrunning Clutch Assembly Removal

(36) Compress rear servo spring retainer about 1/16 inch with Valve Spring Compressor C-3422-B (Fig. 130).

(37) Remove rear servo spring retainer snap ring. Then remove compressor tools and remove rear servo spring and piston.

(38) Inspect transmission components.

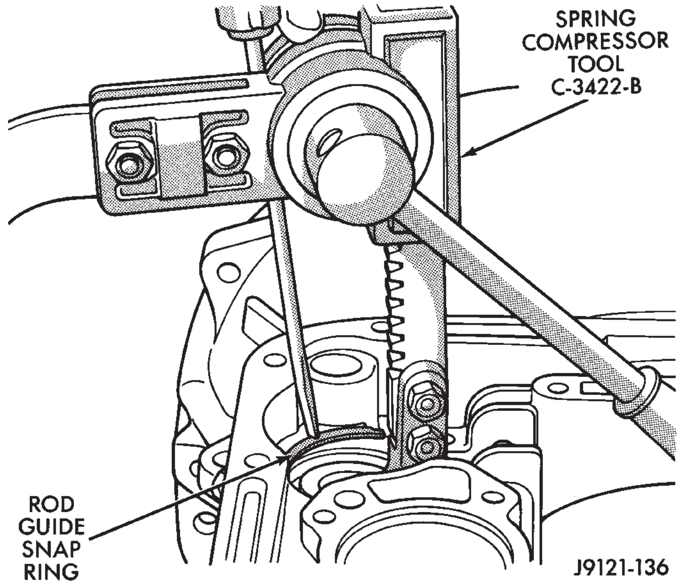


Fig. 129 Compressing Front Servo Rod Guide

NOTE: TO SERVICE THE OVERRUNNING CLUTCH CAM OR OVERDRIVE PISTON RETAINER, REFER TO OVERRUNNING CLUTCH CAM SERVICE IN THIS SECTION.

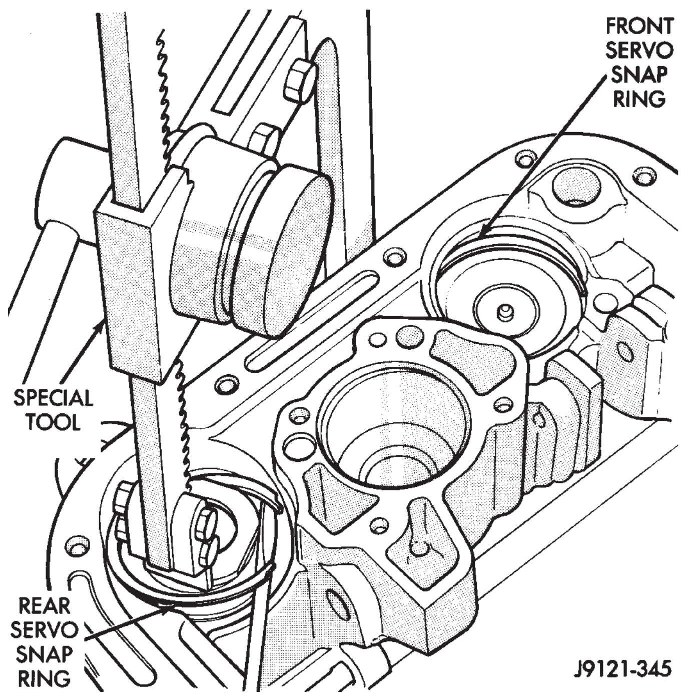


Fig. 130 Compressing Rear Servo Spring

ASSEMBLY

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.

DISASSEMBLY AND ASSEMBLY (Continued)

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 subassemblies 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 mis-positioned.

The planetary geartrain, front/rear clutch assemblies and oil pump are all much easier to install when the transmission case is upright.

(1) Install rear servo piston, spring and retainer (Fig. 131). Install spring on top of servo piston and install retainer on top of spring.

(2) Install front servo piston assembly, servo spring and rod guide (Fig. 132).

(3) Compress front/rear servo springs with Valve Spring Compressor C-3422-B and install each servo snap ring (Fig. 133).

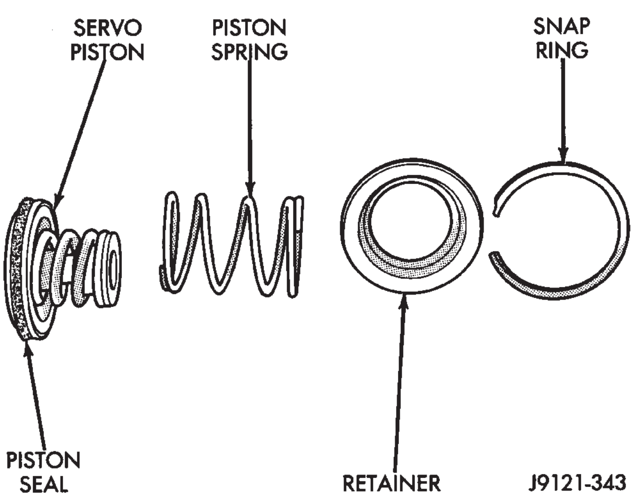


Fig. 131 Rear Servo Components

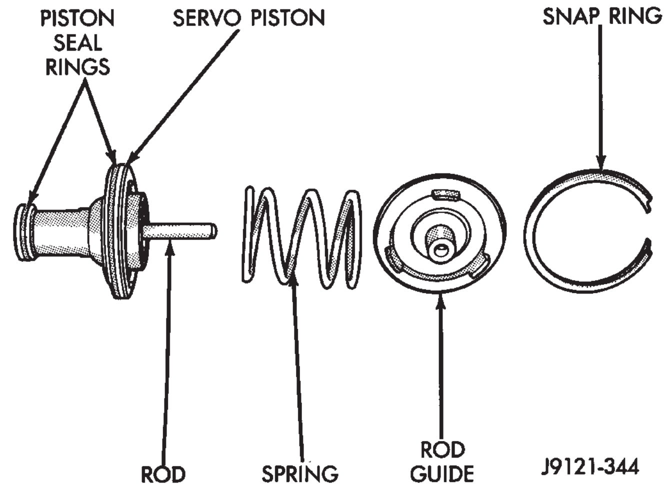


Fig. 132 Front Servo Components

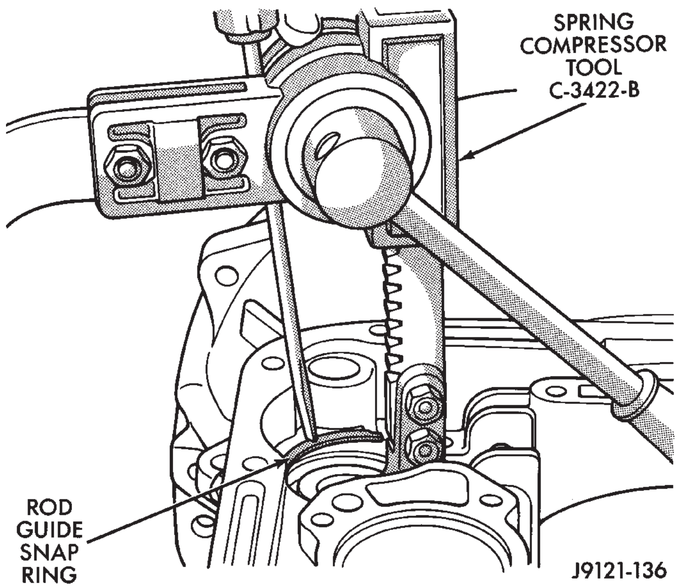


Fig. 133 Compressing Front/Rear Servo Springs

DISASSEMBLY AND ASSEMBLY (Continued)

(4) Lubricate clutch cam rollers with transmission fluid.

(5) Install rear band in case (Fig. 134). Be sure twin lugs on band are seated against reaction pin.

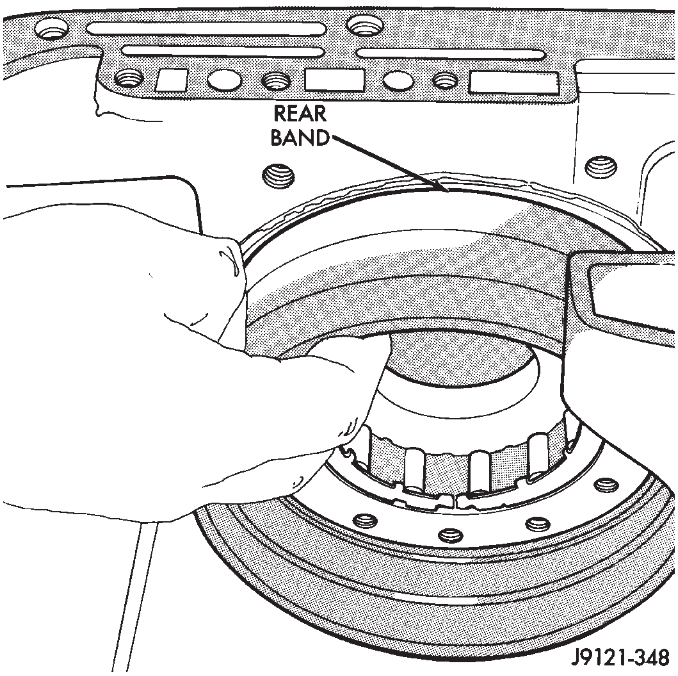


Fig. 134 Rear Band Installation

(6) Install low-reverse drum and check overrunning clutch operation as follows:

(a) Lubricate overrunning clutch race (on drum hub) with transmission fluid.

(b) Guide drum through rear band.

(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. 135).

(e) Turn drum back and forth. **Drum should rotate freely in clockwise direction and lock in counterclockwise direction (as viewed from front of case).**

(7) Install snap ring that secures low-reverse drum to hub of overdrive piston retainer (Fig. 136).

(8) Install rear band lever and pivot pin (Fig. 137). Align lever with pin bores in case and push pivot pin into place.

(9) Install planetary geartrain assembly (Fig. 138).

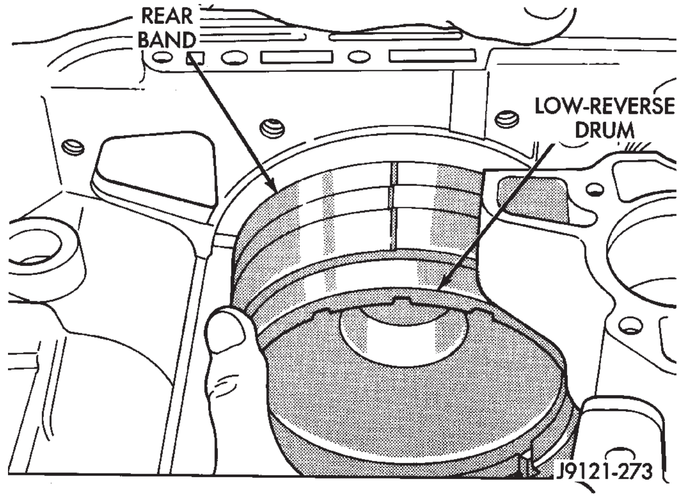


Fig. 135 Installing Low-Reverse Drum

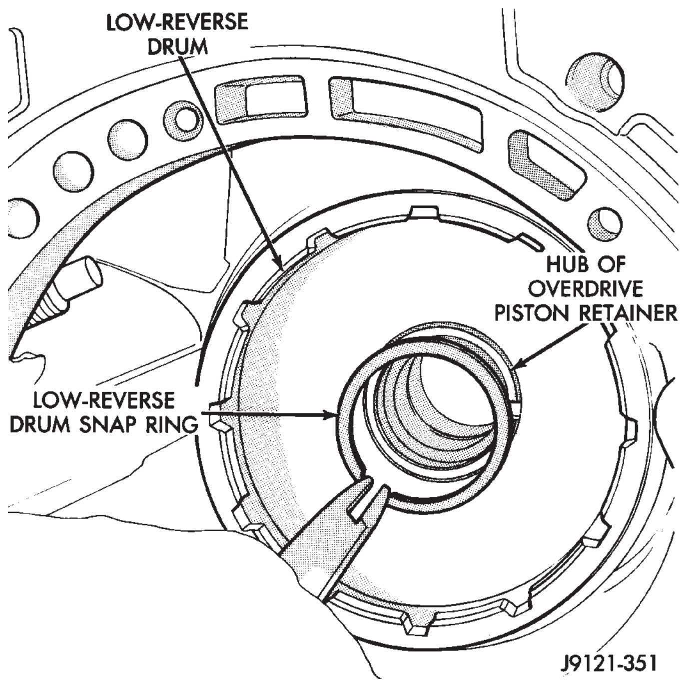


Fig. 136 Installing Low-Reverse Drum Retaining Snap Ring

DISASSEMBLY AND ASSEMBLY (Continued)

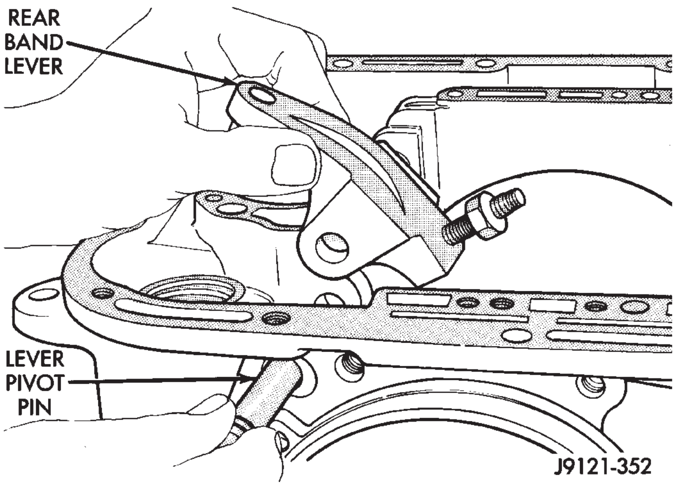


Fig. 137 Rear Band Lever And Pivot Pin Installation

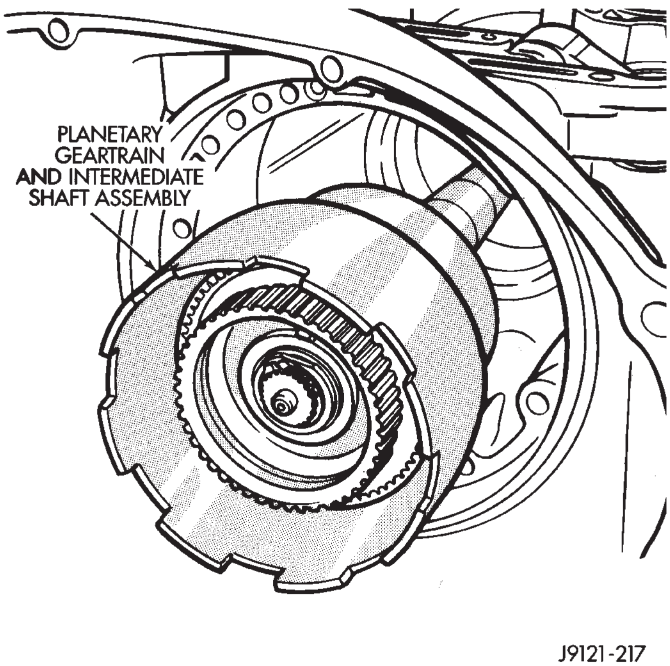


Fig. 138 Installing Planetary Geartrain

(10) Install thrust plate on intermediate shaft hub (Fig. 139). Use petroleum jelly to hold thrust plate in place.

(11) Check seal ring on rear clutch retainer hub and seal rings on input shaft (Fig. 140). Also verify that shaft seal rings are installed in sequence shown.

(12) Install rear clutch thrust washer (Fig. 141). Use additional petroleum jelly to hold washer in place if necessary.

(13) Align clutch discs in front clutch and install front clutch on rear clutch (Fig. 142). Rotate front clutch retainer back and forth until completely seated on rear clutch retainer.

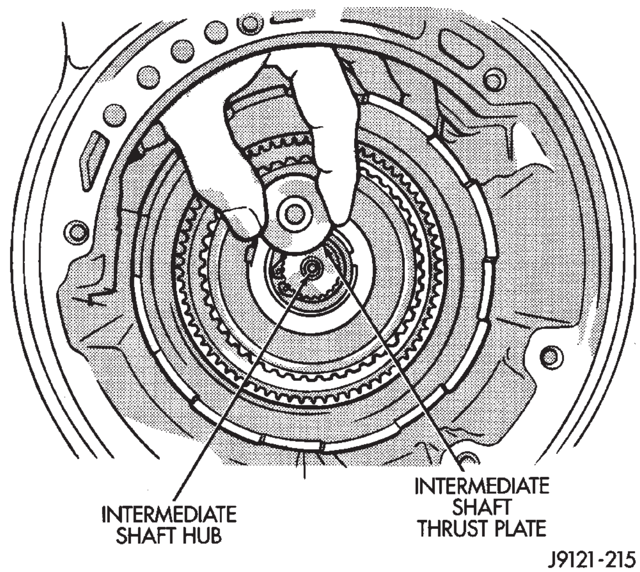


Fig. 139 Installing Intermediate Shaft Thrust Plate

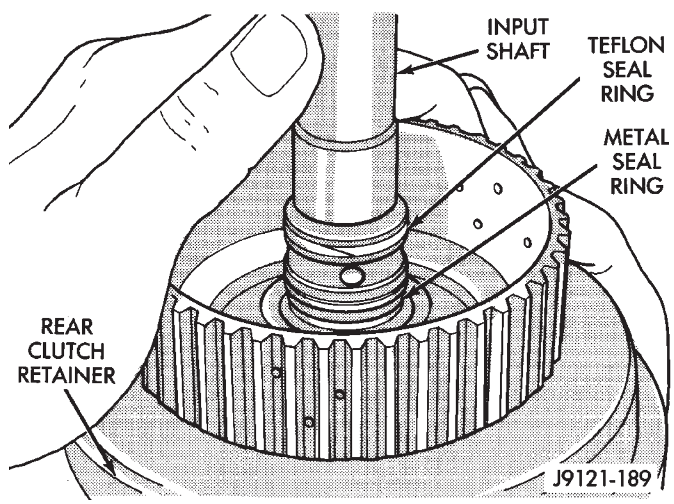


Fig. 140 Input Shaft Seal Ring Location

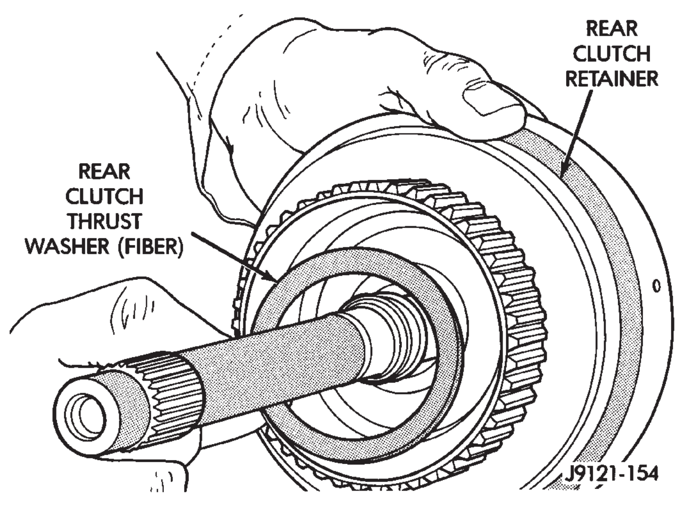


Fig. 141 Installing Rear Clutch Thrust Washer

DISASSEMBLY AND ASSEMBLY (Continued)

(14) Coat intermediate shaft thrust washer with petroleum jelly. Then install washer in rear clutch hub (Fig. 143). 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.

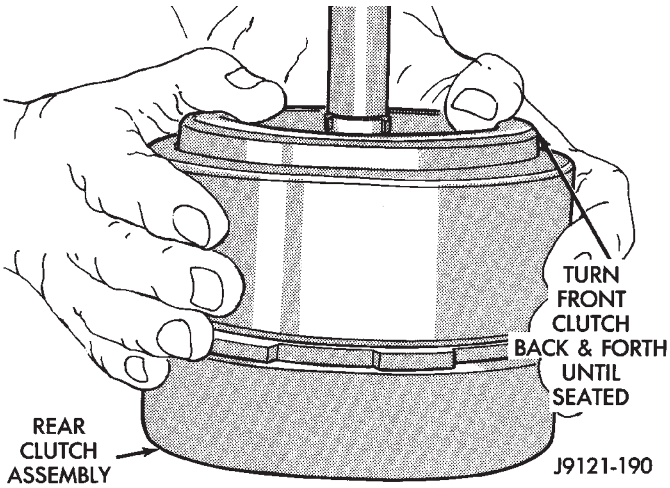


Fig. 142 Assembling Front And Rear Clutch Units

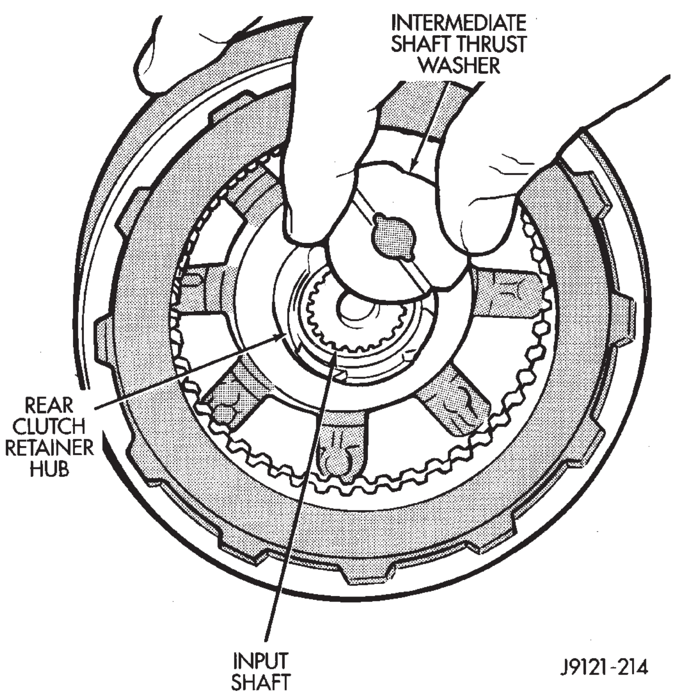


Fig. 143 Installing Intermediate Shaft Thrust Plate

(15) Align drive teeth on rear clutch discs with small screwdriver (Fig. 144). This makes installation on front planetary easier.

(16) 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.

(17) Slide front band into case.

(18) Install front and rear clutch units as assembly (Fig. 145). 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.**

(19) 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.

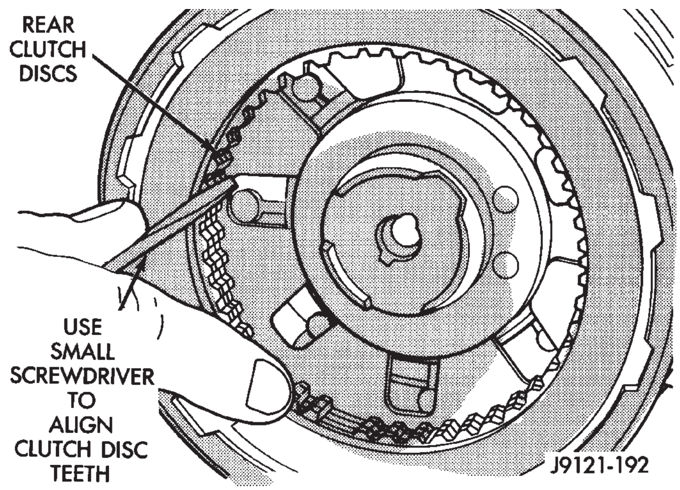


Fig. 144 Aligning Rear Clutch Disc Lugs

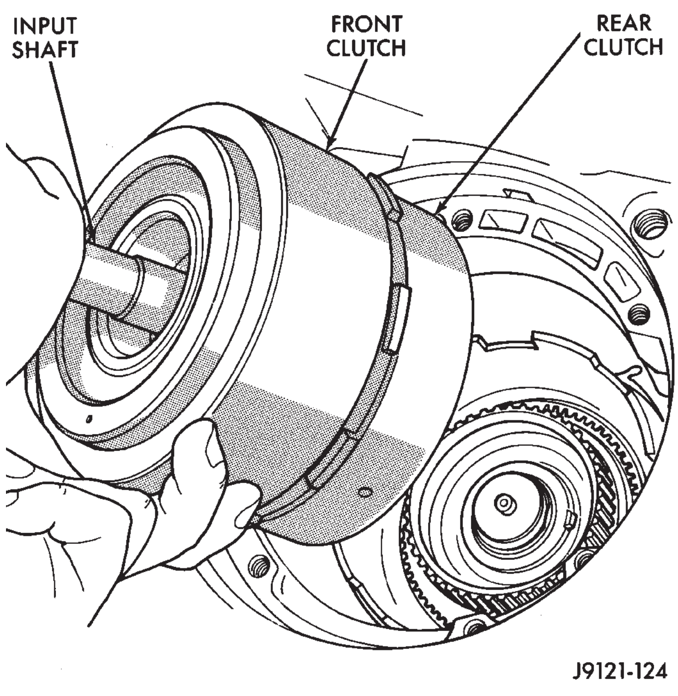


Fig. 145 Installing Front/Rear Clutch Assemblies

DISASSEMBLY AND ASSEMBLY (Continued)

(20) Assemble front band strut.

(21) Install front band adjuster, strut and adjusting screw (Fig. 146).

(22) Tighten band adjusting screw until band just grips clutch retainer. Verify that front/rear clutches are still seated before continuing.

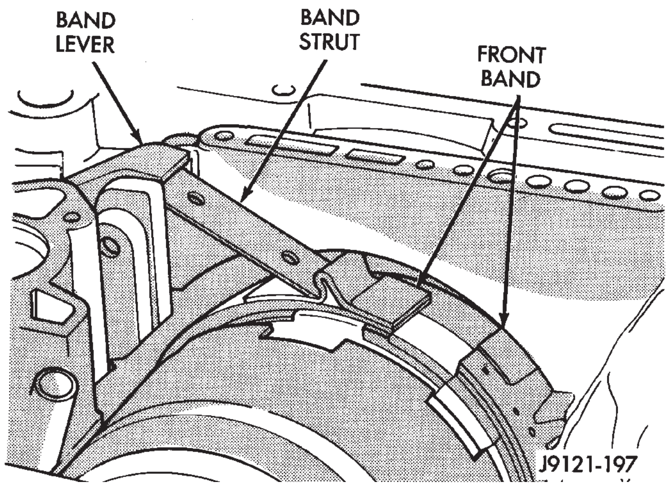


Fig. 146 Front Band Linkage Installation

(23) 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. 147). Use petroleum jelly to hold thrust washer in place if necessary.

(24) Lubricate oil pump body seal with petroleum jelly. Lubricate pump shaft seal lip with petroleum jelly.

(25) Thread two Pilot Stud Tools C-3288-B into bolt holes in oil pump bore flange (Fig. 148).

(26) Align and install oil pump gasket (Fig. 148).

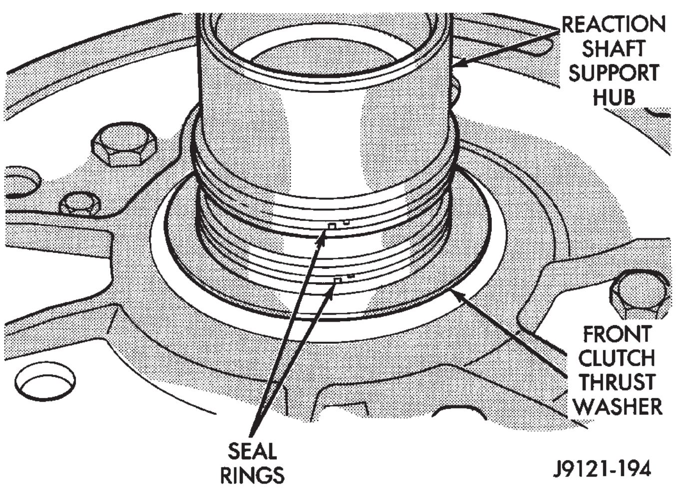


Fig. 147 Reaction Shaft Support Seal Rings And Front Clutch Thrust Washer

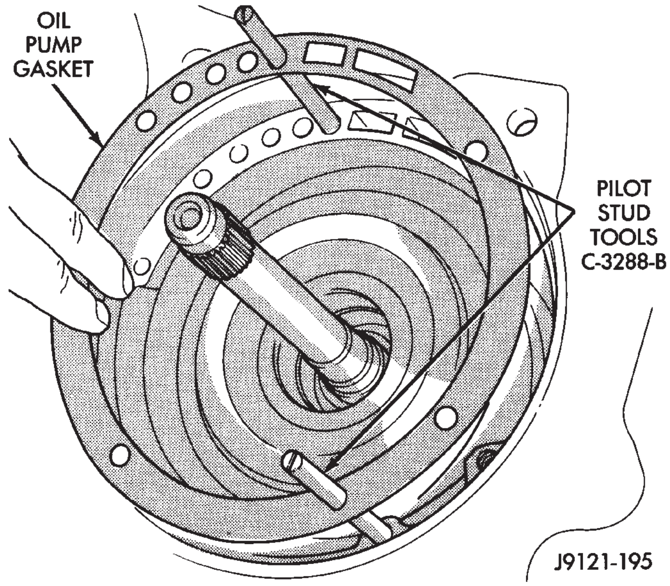


Fig. 148 Installing Pilot Studs And Oil Pump Gasket

(27) Install oil pump (Fig. 149). 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.

(28) Remove pilot stud tools and install remaining oil pump bolts. Tighten bolts alternately in diagonal pattern to 20 N·m (15 ft. lbs.).

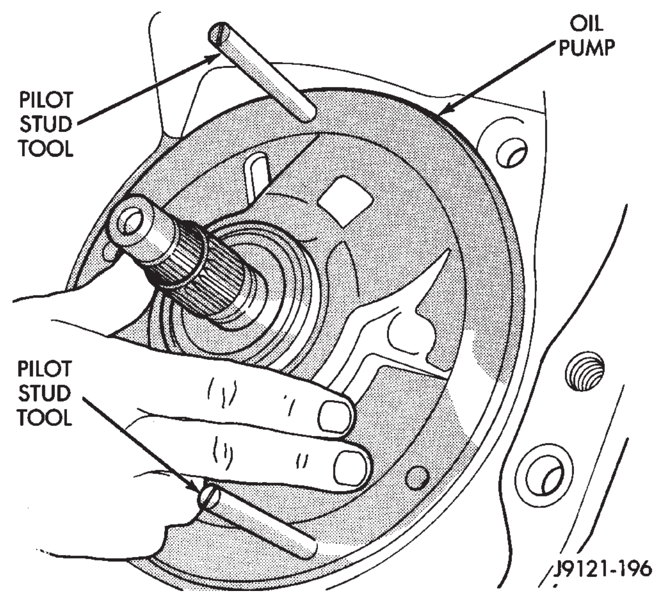


Fig. 149 Installing Oil Pump Assembly In Case

DISASSEMBLY AND ASSEMBLY (Continued)

(29) Measure and if necessary, correct input shaft end play as follows (Fig. 150):

(a) Attach dial indicator to converter housing.

(b) Position indicator plunger against input shaft and zero indicator.

(c) 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 next step if end play is not within specified limits.

(d) 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.

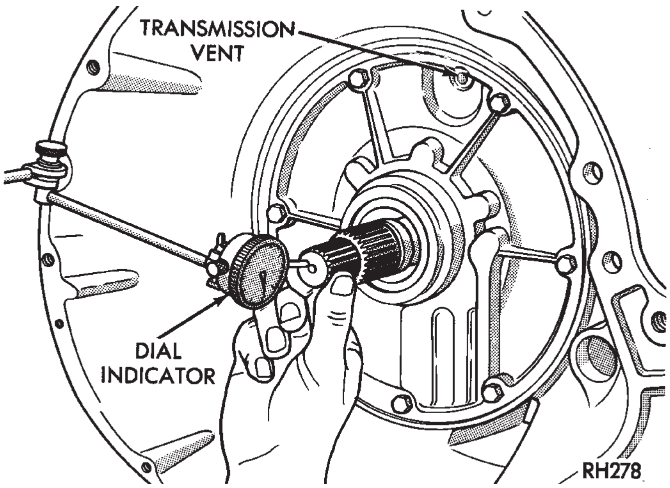


Fig. 150 Measuring Input Shaft End Play

(30) Install accumulator piston and inner and outer springs (Fig. 151).

(31) Verify that valve body solenoid harness is secured in 3-4 accumulator housing cover plate.

(32) 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.

(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.**

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.

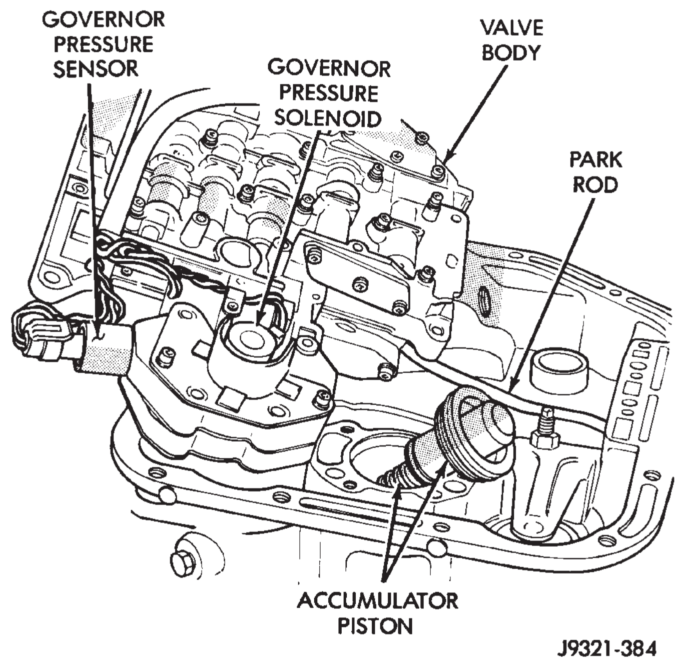


Fig. 151 Accumulator Piston And Springs

(33) Install new filter on valve body. Tighten filter screws to 4 N·m (35 in. lbs.).

(34) Adjust front and rear bands.

(35) Install seal on park/neutral position switch (Fig. 152). Then install and tighten switch to 34 N·m (25 ft. lbs.).

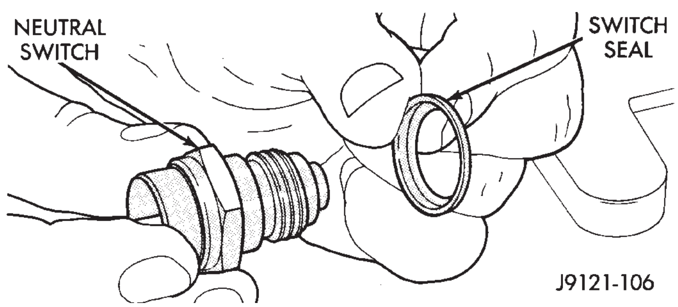


Fig. 152 Park/Neutral Position Switch Seal Position

(36) Install magnet in oil pan. Magnet goes on small protrusion at corner of pan.

(37) Position new oil pan gasket on case and install oil pan. Tighten pan bolts to 17 N·m (13 ft. lbs.).

(38) Install new valve body manual shaft seal in case (Fig. 153). 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.

(39) Install throttle valve and shift selector levers on valve body manual lever shaft.

DISASSEMBLY AND ASSEMBLY (Continued)

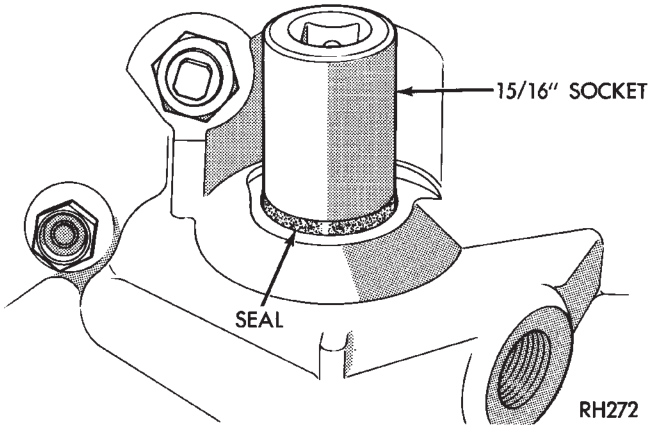


Fig. 153 Installing Manual Lever Shaft Seal

OVERRUNNING CLUTCH CAM/OVERDRIVE PISTON RETAINER

DISASSEMBLY

NOTE: TO SERVICE THE OVERRUNNING CLUTCH CAM AND THE OVERDRIVE PISTON RETAINER, THE TRANSMISSION GEARTRAIN AND OVERDRIVE UNIT MUST BE REMOVED FROM THE TRANSMISSION.

(1) Remove the overdrive piston (Fig. 154).
(2) Remove the overdrive piston retainer bolts.
(3) Remove overdrive piston retainer.
(4) Remove case gasket.
(5) Mark the position of the overrunning clutch cam in the case (Fig. 155).
(6) Remove the overrunning clutch cam bolts.
(7) Remove the overrunning clutch cam.

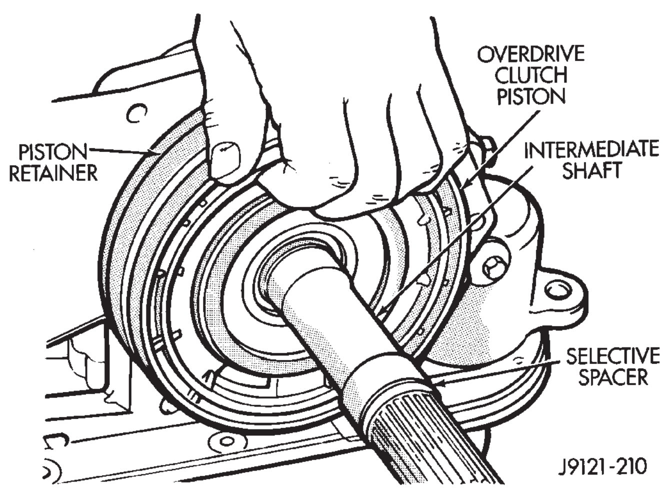


Fig. 154 Overdrive Piston Removal

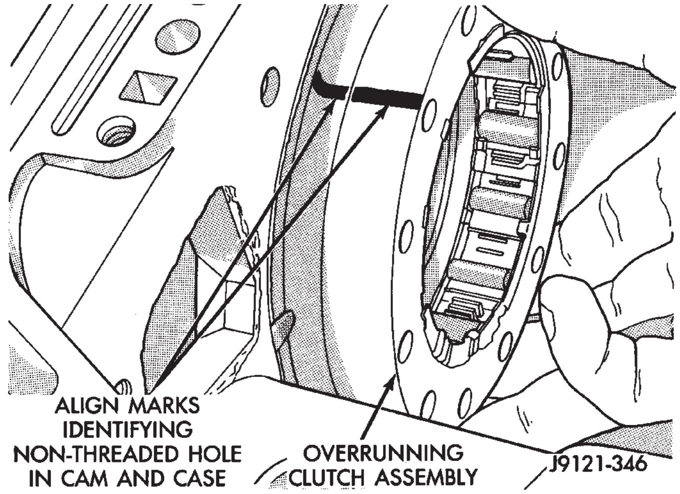


Fig. 155 Overrunning Clutch Cam Removal

ASSEMBLY

(1) Examine bolt holes in overrunning clutch cam. Note that one hole is **not threaded** (Fig. 156). This hole must align with blank area in clutch cam bolt circle (Fig. 157). Mark hole location on clutch cam and blank area in case with grease pencil, paint stripe, or scribe mark for assembly reference.
(2) Mark location of non-threaded hole in clutch cam and blank area in bolt circle with grease pencil.
(3) Align and install overrunning clutch and cam in case (Fig. 158). **Be sure cam is correctly installed. Bolt holes in cam are slightly countersunk on one side. Be sure this side of cam faces rearward (toward piston retainer).**

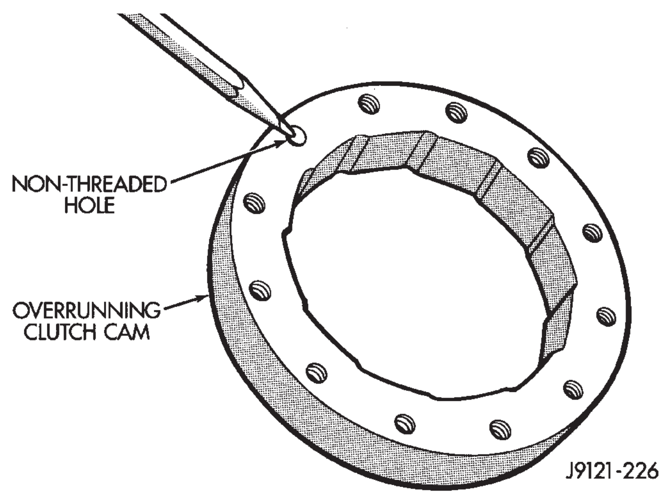


Fig. 156 Location Of Non-Threaded Hole In Clutch Cam

DISASSEMBLY AND ASSEMBLY (Continued)

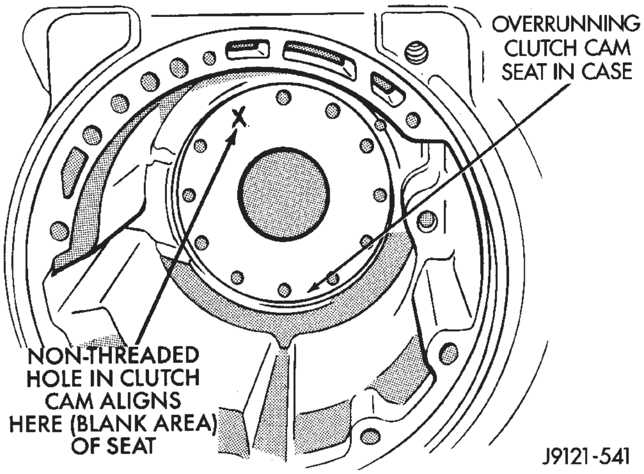


Fig. 157 Location Of Blank Area In Clutch Cam Bolt Circle

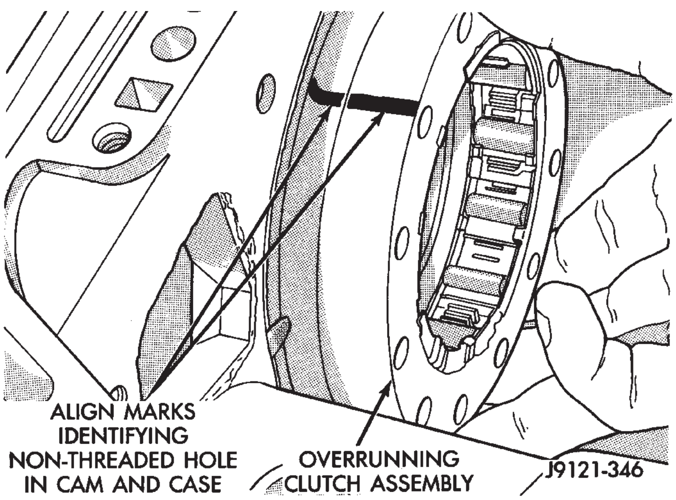


Fig. 158 Overrunning Clutch Installation

(4) 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.

(5) 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.

(6) 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. 159). Also install gasket before overdrive piston retainer. Center hole in gasket is smaller than retainer and cannot be installed over retainer.

(7) Position overdrive piston retainer on transmission case and align bolt holes in retainer, gasket and case (Fig. 160). Then install and tighten retainer bolts to 17 N·m (13 ft. lbs.) torque.

(8) Install new seals on over drive piston.

(9) Stand transmission case upright on bellhousing.

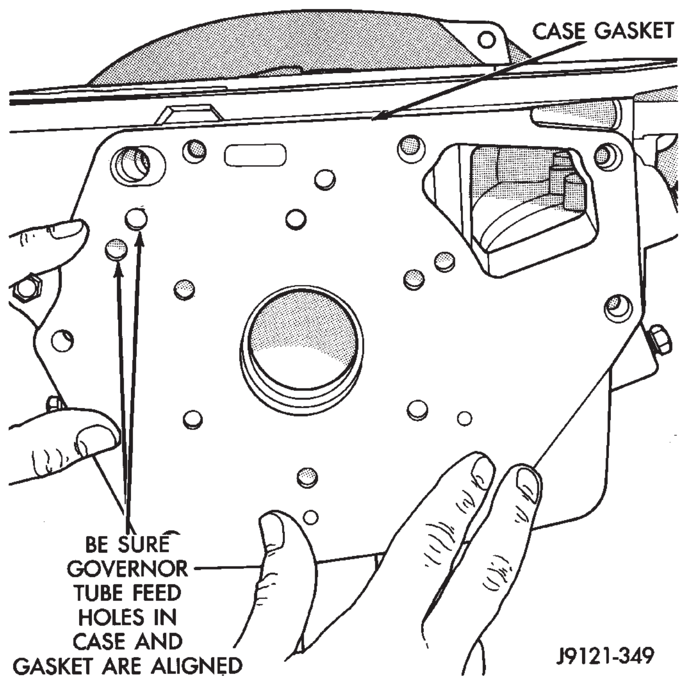


Fig. 159 Installing/Aligning Case Gasket

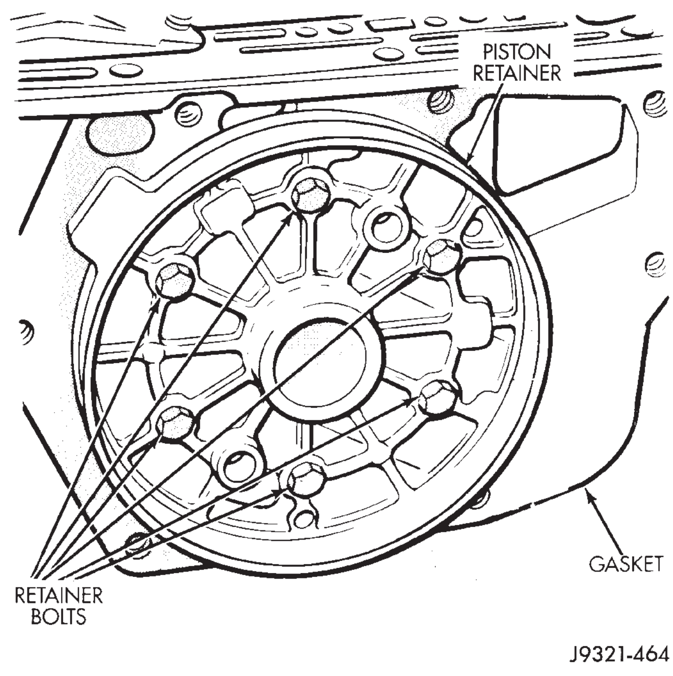


Fig. 160 Aligning Overdrive Piston Retainer

(10) Position Guide Ring 8114-1 on outer edge of overdrive piston retainer.

(11) Position Seal Guide 8114-2 on inner edge of overdrive piston retainer.

(12) Install overdrive piston in overdrive piston retainer by: aligning locating lugs on overdrive piston to the two mating holes in retainer.

(a) Aligning locating lugs on overdrive piston to the two mating holes in retainer.

DISASSEMBLY AND ASSEMBLY (Continued)

(b) Lubricate overdrive piston seals with Mopar® Door Ease, or equivalent.

(c) Install piston over Seal Guide 8114–2 and inside Guide Ring 8114–1.

(d) Push overdrive piston into position in retainer.

(e) Verify that the locating lugs entered the lug bores in the retainer.

NOTE: INSTALL THE REMAINING TRANSMISSION COMPONENTS AND OVERDRIVE UNIT.

FRONT SERVO PISTON

DISASSEMBLY

(1) Remove seal ring from rod guide (Fig. 161).

(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.

ASSEMBLY

Clean and inspect front servo components.

(1) Lubricate new O-ring and seal rings with petroleum jelly and install them on piston, guide and rod.

(2) Install rod in piston. Install spring and washer on rod. Compress spring and install snap ring (Fig. 161).

(3) Set servo components aside for installation during transmission reassembly.

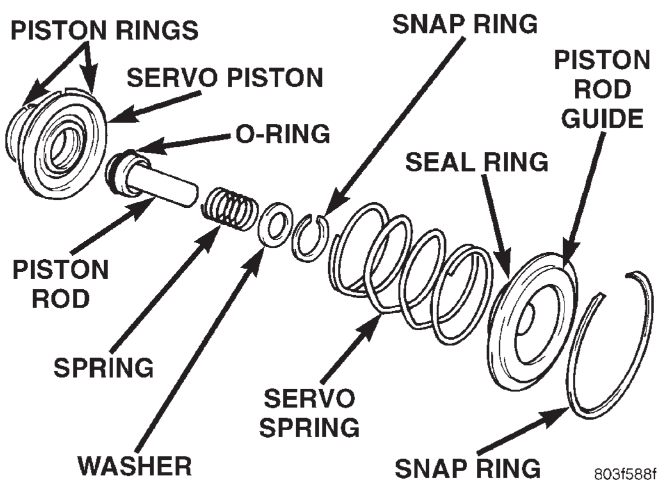


Fig. 161 Front Servo

REAR SERVO PISTON

DISASSEMBLY

(1) Remove small snap ring and remove plug and spring from servo piston (Fig. 162).

(2) Remove and discard servo piston seal ring.

ASSEMBLY

(1) Lubricate piston and guide seals with petroleum jelly. Lubricate other servo parts with Mopar® ATF Plus 3, Type 7176, transmission fluid.

(2) Install new seal ring on servo piston.

(3) Assemble piston, plug, spring and new snap ring.

(4) Lubricate piston seal lip with petroleum jelly.

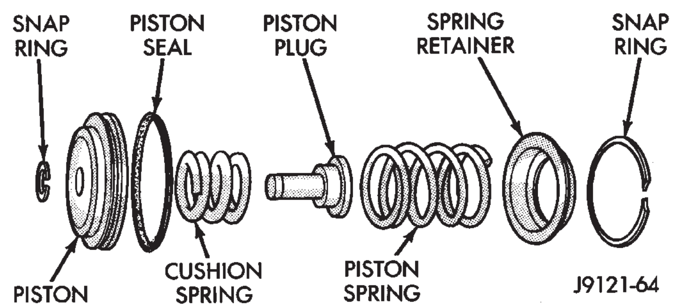


Fig. 162 Rear Servo Components

OIL PUMP AND REACTION SHAFT SUPPORT

DISASSEMBLY

(1) Remove seal ring from housing and reaction shaft support (Fig. 163).

(2) Mark pump housing and support assembly for alignment reference.

(3) Remove bolts attaching pump body to support (Fig. 164).

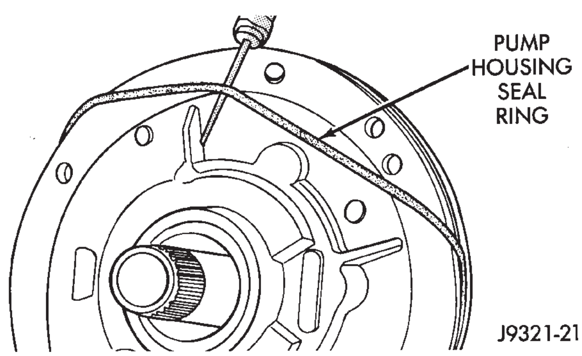


Fig. 163 Removing Pump Seal Ring

DISASSEMBLY AND ASSEMBLY (Continued)

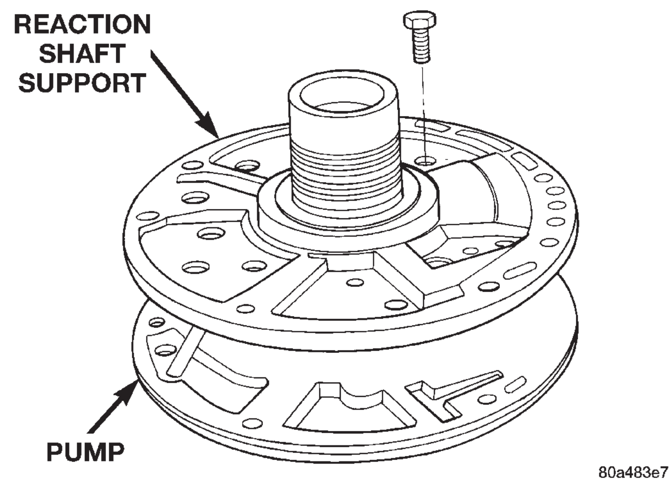


Fig. 164 Pump Support Bolts

(4) Separate support from pump housing (Fig. 165).

(5) Remove inner and outer gears from reaction shaft support (Fig. 166).

(6) If pump seal was not removed during transmission disassembly, remove seal with punch and hammer.

(7) Remove front clutch thrust washer from support hub (Fig. 167).

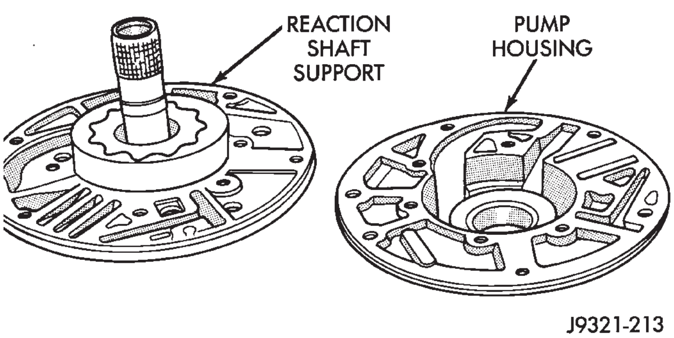


Fig. 165 Separating Pump Housing From Reaction Shaft Support

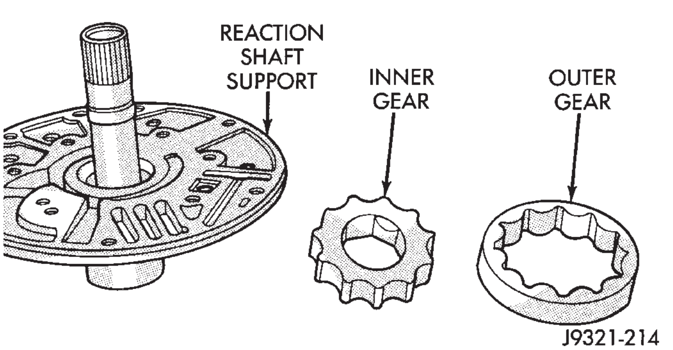


Fig. 166 Pump Gear Removal

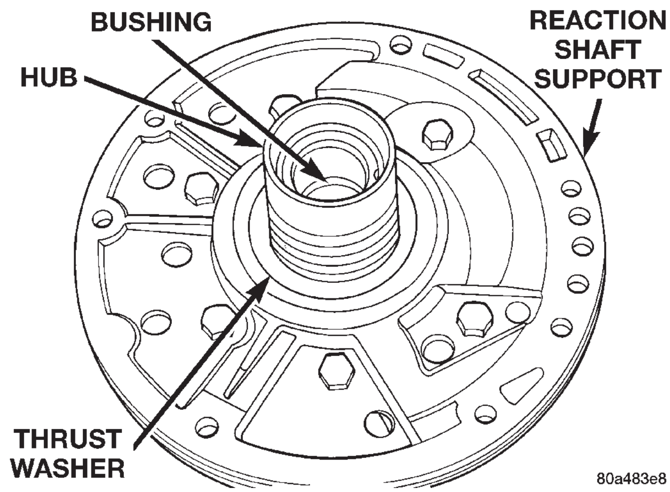


Fig. 167 Support Hub Thrust Washer

OIL PUMP BUSHING REPLACEMENT

(1) Remove pump bushing with Tool Handle C-4171 and Bushing Remover SP-3551 from Tool Set C-3887-J (Fig. 168).

(2) Install new pump bushing with Tool Handle C-4171 and Bushing Installer SP-5117 (Fig. 168). Bushing should be flush with pump housing bore.

(3) Stake new pump bushing in two places with blunt punch (Fig. 169). Remove burrs from stake points with knife blade afterward.

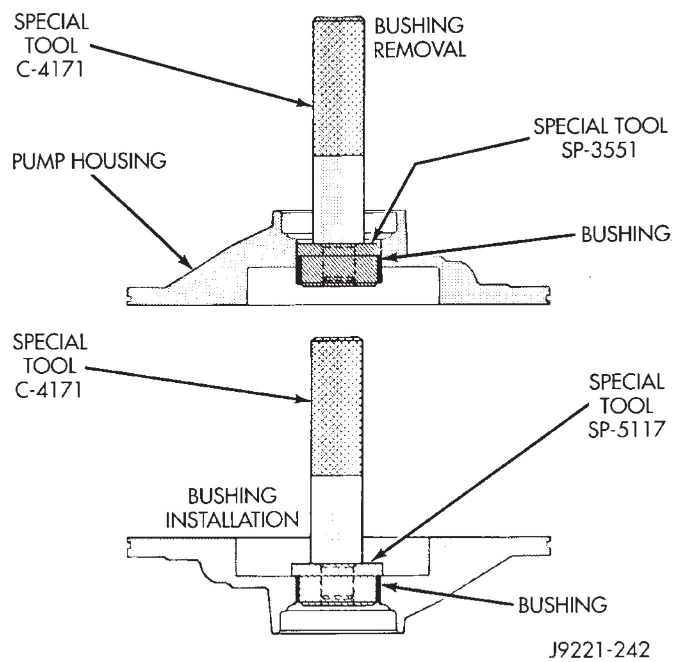


Fig. 168 Removing Oil Pump Bushing

DISASSEMBLY AND ASSEMBLY (Continued)

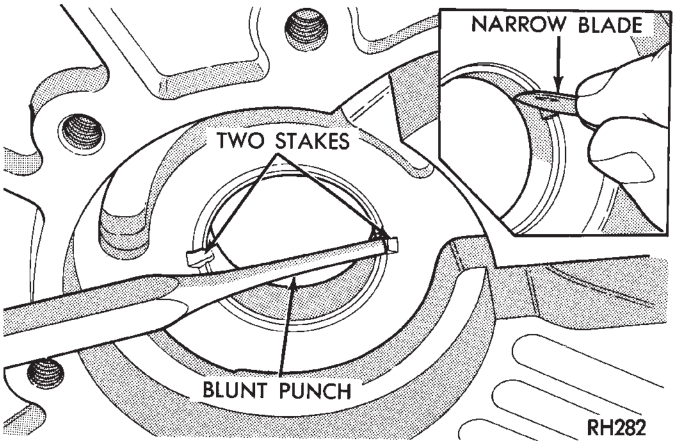


Fig. 169 Staking Oil Pump Bushing

REACTION SHAFT SUPPORT BUSHING REMOVAL

(1) Assemble Bushing Remover Tools SP-1191, 3633 and 5324 (Fig. 170). **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. 170).

(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.

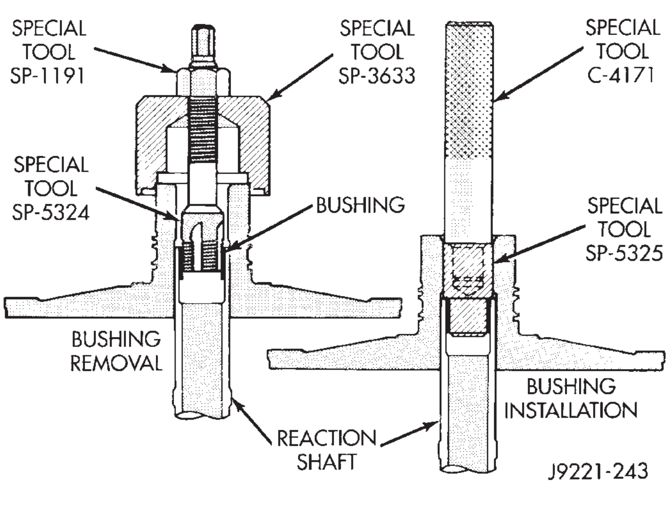


Fig. 170 Replacing Reaction Shaft Support Bushing

ASSEMBLY

(1) Lubricate gear bore in pump housing with transmission fluid.

(2) Lubricate pump gears with transmission fluid.

(3) Support pump housing on wood blocks (Fig. 171).

(4) Install outer gear in pump housing (Fig. 171). Gear can be installed either way (it is not a one-way fit).

(5) Install pump inner gear (Fig. 172).

CAUTION: The pump inner gear is a one way fit. The bore on one side of the gear inside diameter (I.D.) is chamfered. Be sure the chamfered side faces forward (to front of pump).

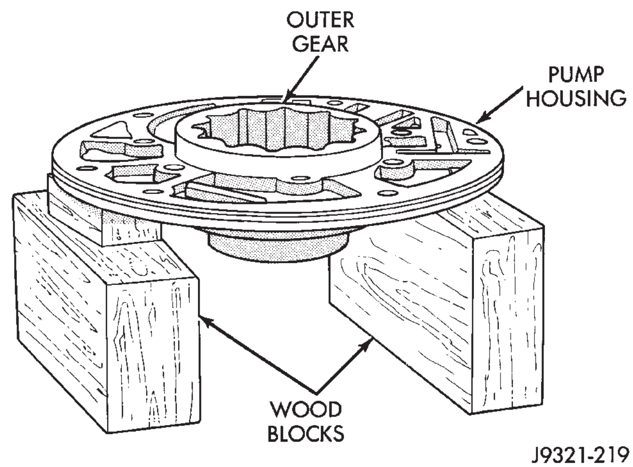


Fig. 171 Supporting Pump And Installing Outer Gear

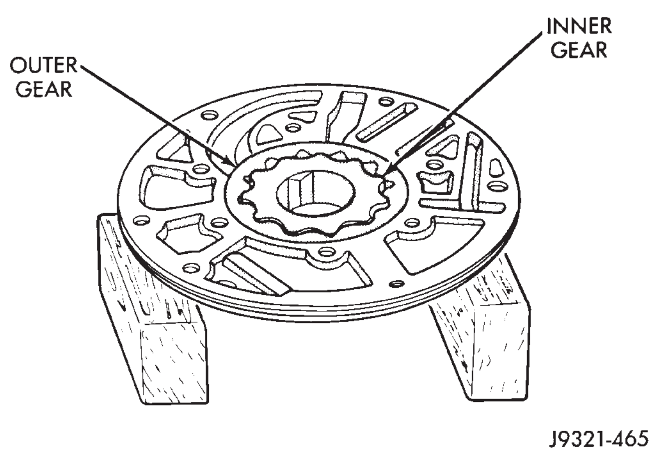


Fig. 172 Pump Inner Gear Installation

(6) Install new thrust washer on hub of reaction shaft support. Lubricate washer with transmission fluid or petroleum jelly.

(7) If reaction shaft seal rings are being replaced, install new seal rings on support hub (Fig. 173). Lubricate seal rings with transmission fluid or petroleum jelly after installation. Squeeze each ring until ring ends are securely hooked together.

DISASSEMBLY AND ASSEMBLY (Continued)

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.

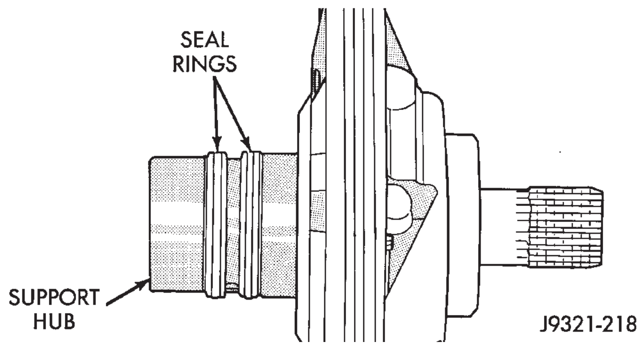


Fig. 173 Hub Seal Ring Position

(8) Install reaction shaft support on pump housing (Fig. 174).

(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).

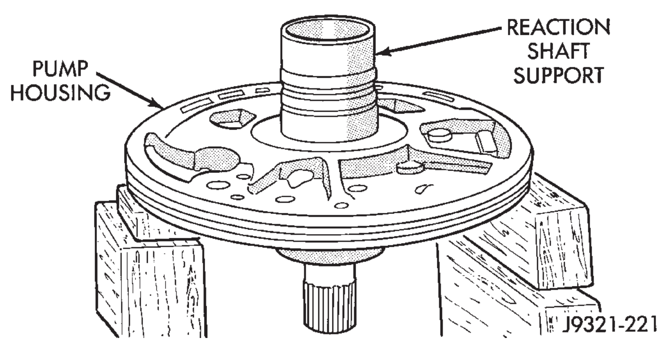


Fig. 174 Assembling Reaction Shaft Support And Pump Housing

(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.

(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. 175). 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 and O-ring seal with transmission fluid.

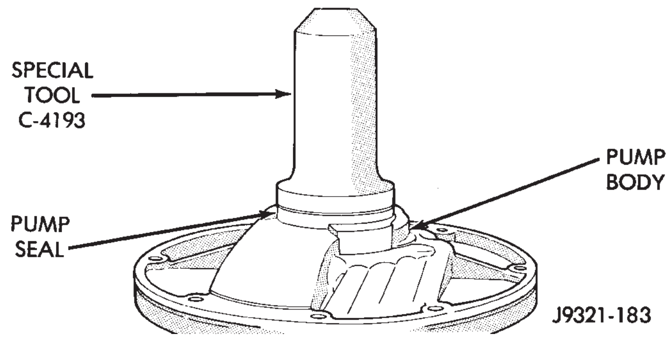


Fig. 175 Pump Oil Seal Installation

FRONT CLUTCH

NOTE: The 44RE uses five plates and discs for the front clutch.

DISASSEMBLY

(1) Remove waved snap ring and remove pressure plate, clutch plates and clutch discs.

(2) Compress clutch piston spring with Compressor Tool C-3575-A (Fig. 176). 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.

(6) Remove seals from clutch piston and clutch retainer hub. Discard both seals as they are not reusable.

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.

(3) Lubricate lips of piston and retainer seals with liberal quantity of Mopar® Door Ease. Then lubricate retainer hub, bore and piston with light coat of transmission fluid.

(4) Install clutch piston in retainer (Fig. 177). Use twisting motion to seat piston in bottom of retainer.

CAUTION: Never push the clutch piston straight in. This will fold the seals over causing leakage and clutch slip.

DISASSEMBLY AND ASSEMBLY (Continued)

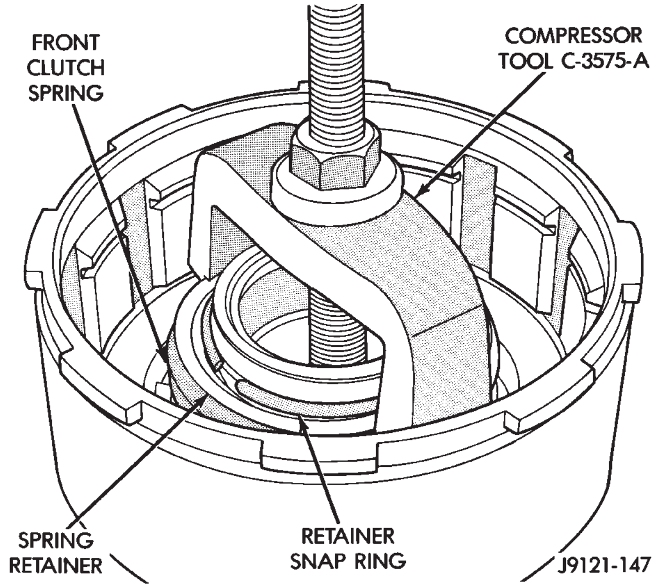


Fig. 176 Compressing Front Clutch Piston Spring

(5) Position spring in clutch piston (Fig. 178).

(6) Position spring retainer on top of piston spring (Fig. 179). **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.**

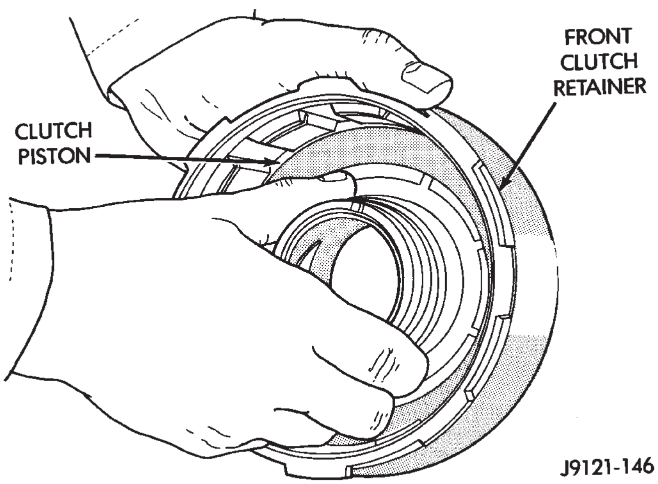


Fig. 177 Front Clutch Piston Installation

(7) Compress piston spring and retainer with Compressor Tool C-3575-A (Fig. 176). Then install new snap ring to secure spring retainer and spring.

(8) Install clutch plates and discs. Install steel plate then disc until all plates and discs are installed. The front clutch uses 5 clutch discs and plates.

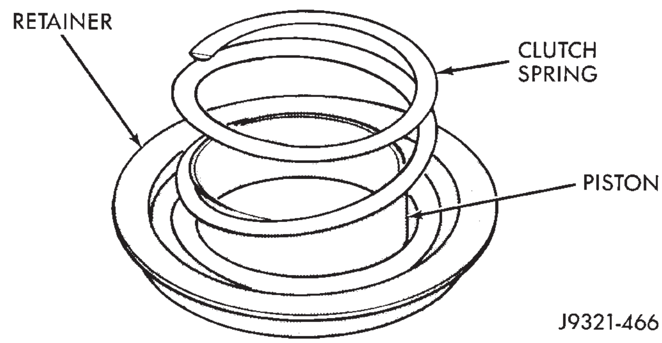


Fig. 178 Clutch Piston Spring Installation

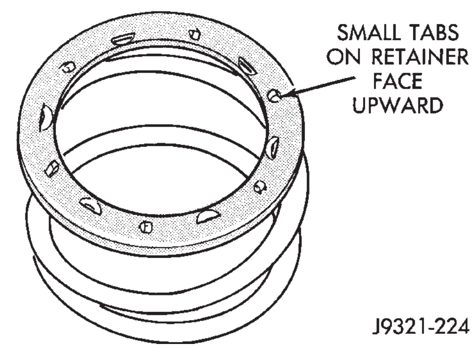


Fig. 179 Correct Spring Retainer Installed Position

(9) Install pressure plate and waved snap ring.

Front clutch clearance should be 1.70 to 3.40 mm (0.067 to 0.134 in.). If clearance is incorrect, clutch discs, plates, pressure plates and snap ring may have to be changed.

REAR CLUTCH

DISASSEMBLY

(1) Remove fiber thrust washer from forward side of clutch retainer.

(2) Remove input shaft front/rear seal rings.

(3) Remove selective clutch pack snap ring (Fig. 180).

(4) Remove top pressure plate, clutch discs, steel plates, bottom pressure plate and wave snap ring and wave spring (Fig. 180).

(5) Remove clutch piston with rotating motion.

(6) Remove and discard piston seals.

(7) Remove input shaft snap-ring (Fig. 181). It may be necessary to press the input shaft in slightly to relieve tension on the snap-ring.

(8) Press input shaft out of retainer with shop press and suitable size press tool. Use a suitably sized press tool to support the retainer as close to the input shaft as possible.

DISASSEMBLY AND ASSEMBLY (Continued)

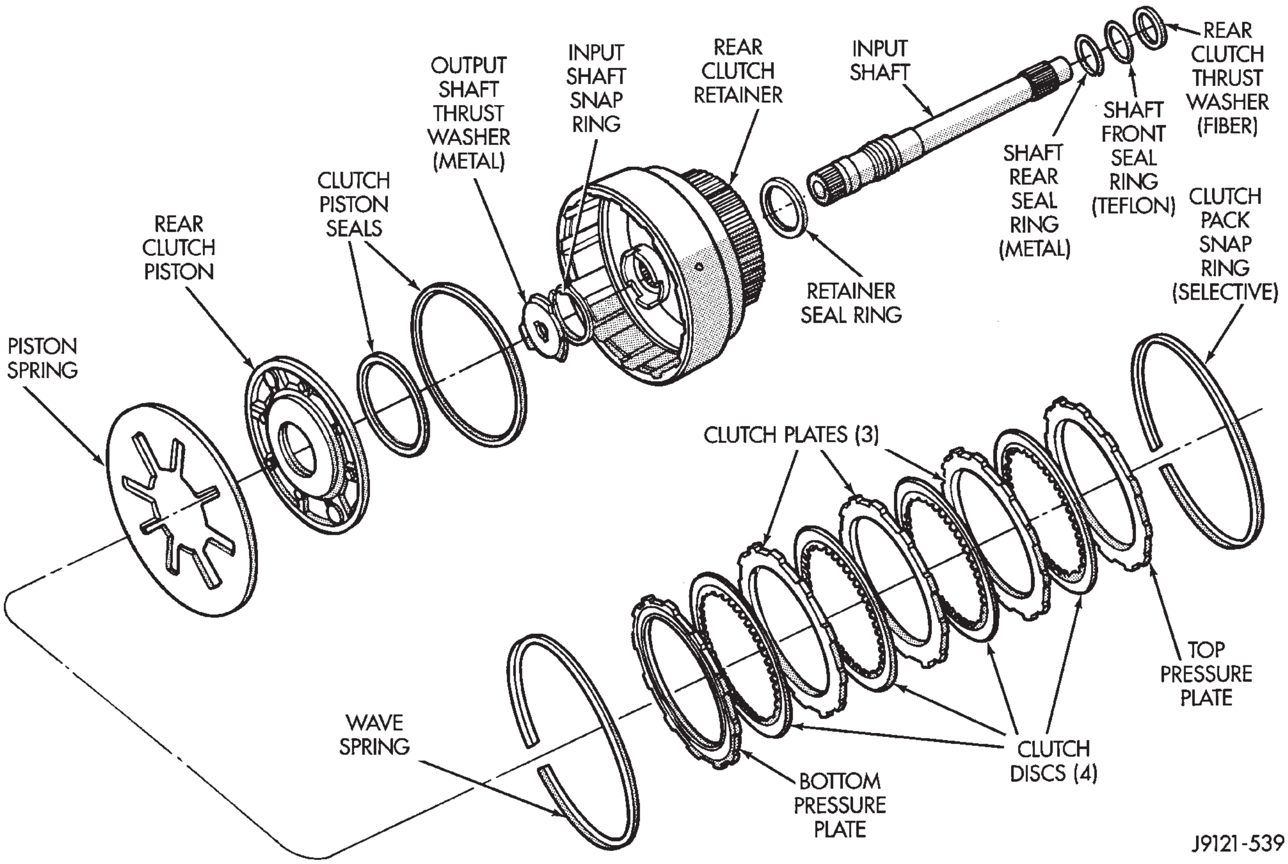


Fig. 180 Rear Clutch Components

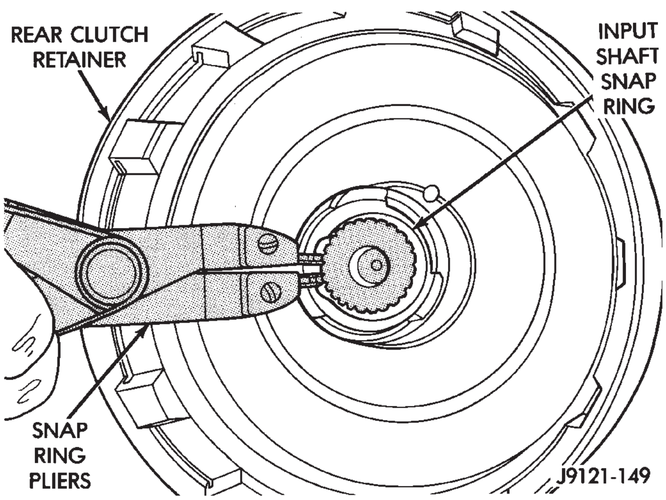


Fig. 181 Removing/Installing Input Shaft Snap-Ring

ASSEMBLY

(1) Soak clutch discs in transmission fluid while assembling other clutch parts.

(2) Install new seal rings on clutch retainer hub and input shaft if necessary (Fig. 182).

(a) Be sure clutch hub seal ring is fully seated in groove and is not twisted.

(3) Lubricate splined end of input shaft and clutch retainer with transmission fluid. Then press input shaft into retainer. Use a suitably sized press tool to support retainer as close to input shaft as possible.

(4) Install input shaft snap-ring (Fig. 181).

(5) Invert retainer and press input shaft in opposite direction until snap-ring is seated.

(6) Install new seals on clutch piston. Be sure lip of each seal faces interior of clutch retainer.

(7) Lubricate lip of piston seals with generous quantity of Mopar® Door Ease. Then lubricate retainer hub and bore with light coat of transmission fluid.

(8) 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.

(9) Install piston spring in retainer and on top of piston (Fig. 185). Concave side of spring faces downward (toward piston).

(10) Install wave spring in retainer (Fig. 185). Be sure spring is completely seated in retainer groove.

DISASSEMBLY AND ASSEMBLY (Continued)

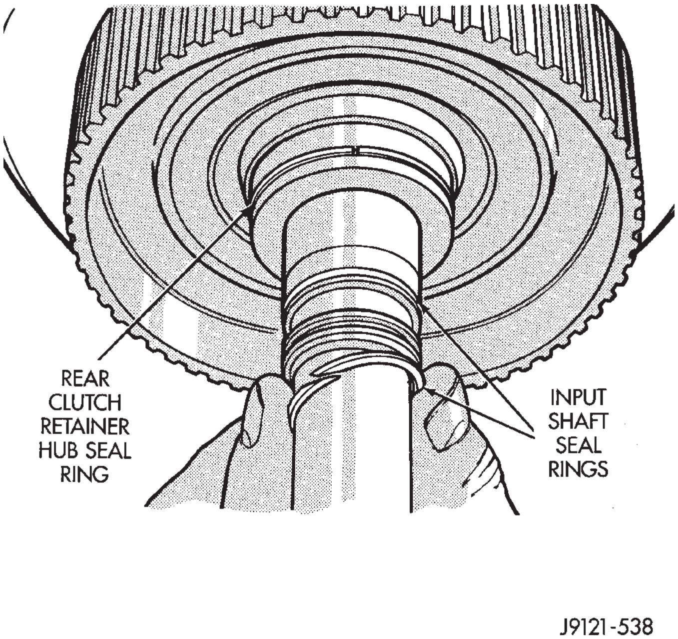


Fig. 182 Rear Clutch Retainer And Input Shaft Seal Ring Installation

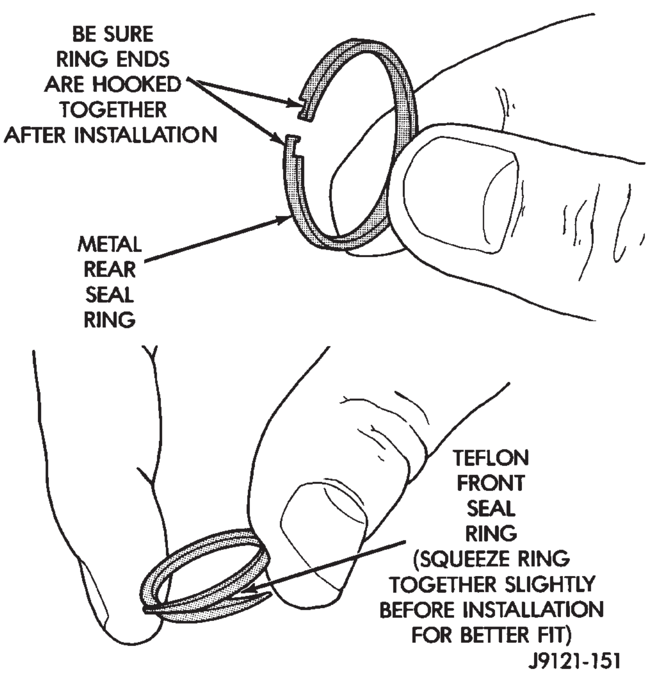


Fig. 183 Input Shaft Seal Ring Identification

(11) Install bottom pressure plate (Fig. 180). Ridged side of plate faces downward (toward piston) and flat side toward clutch pack.

(12) 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 (4 discs and 3 plates are required) (Fig. 180).

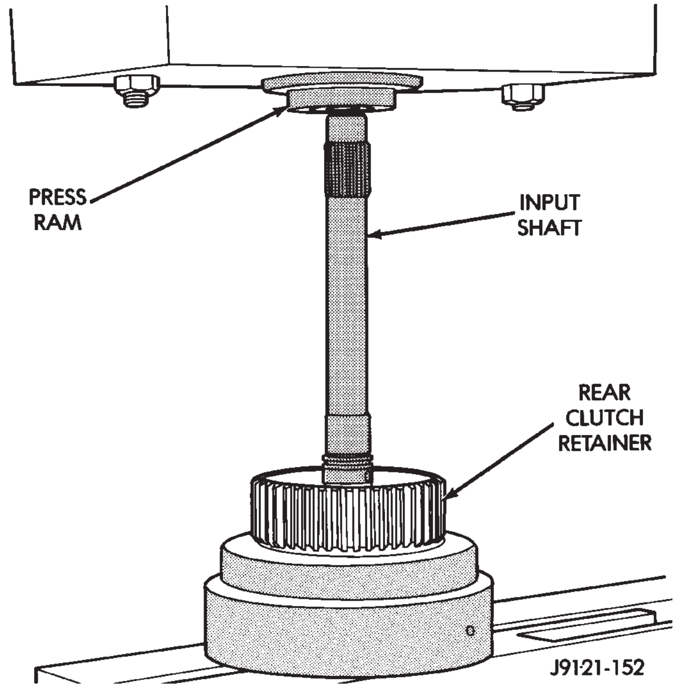


Fig. 184 Pressing Input Shaft Into Rear Clutch Retainer

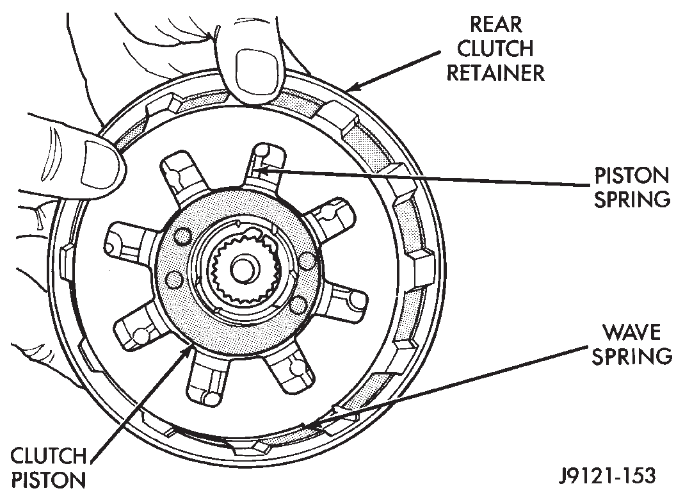


Fig. 185 Piston Spring/Wave Spring Position

(13) Install top pressure plate.

(14) Install selective snap ring. Be sure snap ring is fully seated in retainer groove.

(15) Using a suitable gauge bar and dial indicator, measure clutch pack clearance (Fig. 186).

(a) Position gauge bar across the clutch drum with the dial indicator pointer on the pressure plate (Fig. 186).

(b) Using two small screw drivers, lift the pressure plate and release it.

(c) Zero the dial indicator.

(d) Lift the pressure plate until it contacts the snap-ring and record the dial indicator reading.

DISASSEMBLY AND ASSEMBLY (Continued)

Clearance should be 0.64 - 1.14 mm (0.025 - 0.045 in.). If clearance is incorrect, steel plates, discs, selective snap ring and pressure plates may have to be changed.

The selective snap ring thicknesses are:

- .107–.109 in.
- .098–.100 in.
- .095–.097 in.
- .083–.085 in.
- .076–.078 in.
- .071–.073 in.
- .060–.062 in.

(16) Coat rear clutch thrust washer with petroleum jelly and install washer over input shaft and into clutch retainer (Fig. 187). Use enough petroleum jelly to hold washer in place.

(17) Set rear clutch aside for installation during final assembly.

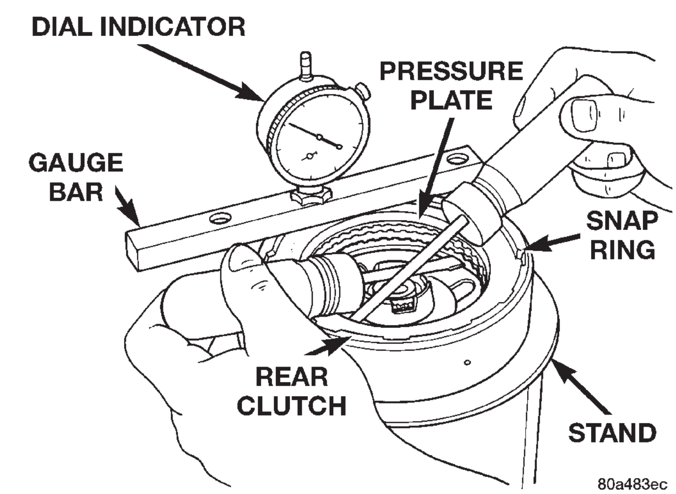


Fig. 186 Checking Rear Clutch Pack Clearance

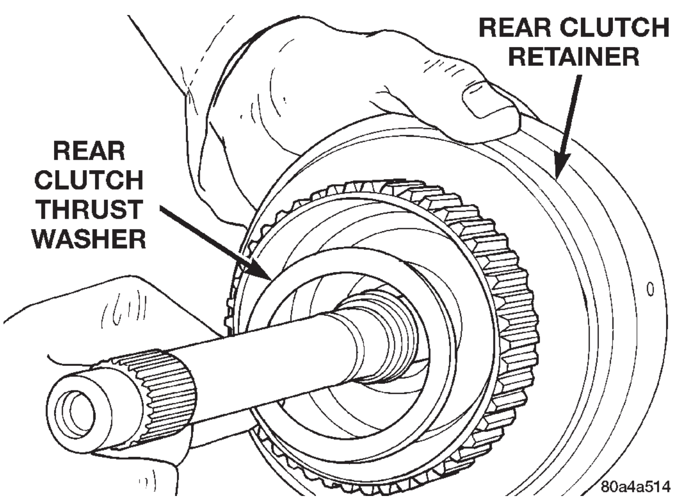


Fig. 187 Installing Rear Clutch Thrust Washer

PLANETARY GEARTRAIN/OUTPUT SHAFT

DISASSEMBLY

(1) Remove planetary snap ring (Fig. 188).

(2) Remove front annulus and planetary assembly from driving shell (Fig. 188).

(3) Remove snap ring that retains front planetary gear in annulus gear (Fig. 189).

(4) Remove tabbed thrust washer and tabbed thrust plate from hub of front annulus (Fig. 190).

(5) Separate front annulus and planetary gears (Fig. 190).

(6) Remove front planetary gear front thrust washer from annulus gear hub.

(7) Separate and remove driving shell, rear planetary and rear annulus from output shaft (Fig. 191).

(8) Remove front planetary rear thrust washer from driving shell.

(9) Remove tabbed thrust washers from rear planetary gear.

(10) Remove lock ring that retains sun gear in driving shell. Then remove sun gear, spacer and thrust plates.

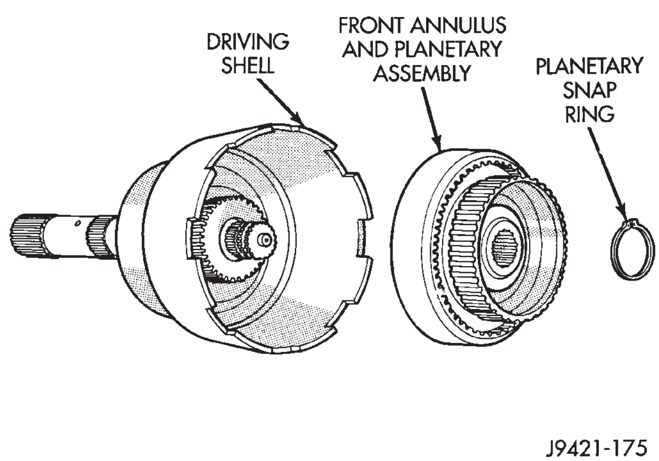


Fig. 188 Front Annulus And Planetary Assembly Removal

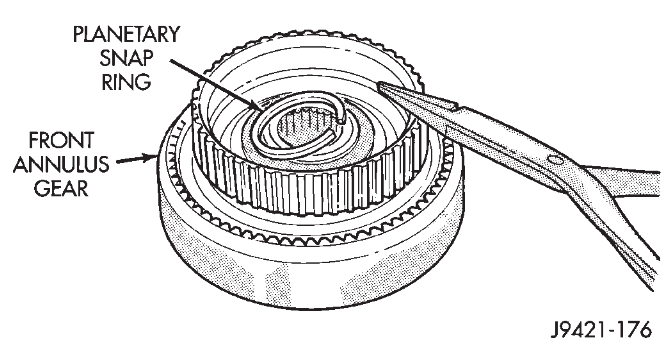


Fig. 189 Front Planetary Snap Ring Removal

DISASSEMBLY AND ASSEMBLY (Continued)

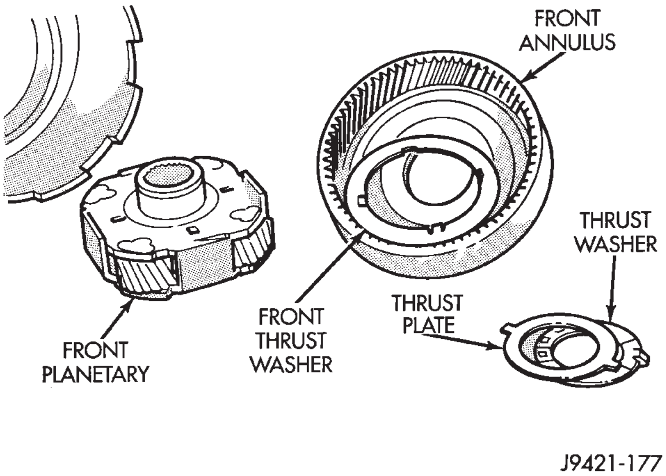


Fig. 190 Front Planetary And Annulus Gear Disassembly

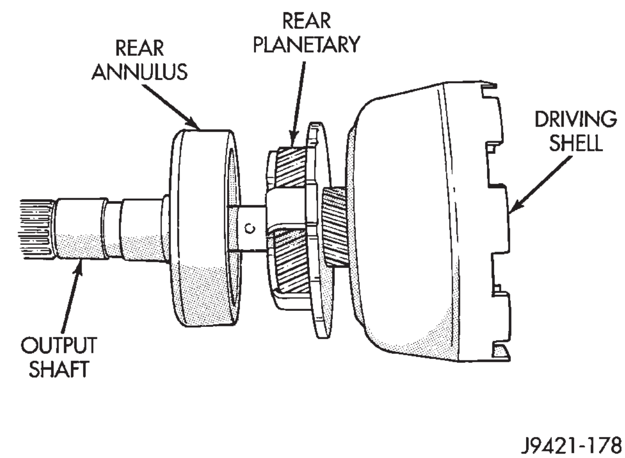


Fig. 191 Removing Driving Shell, Rear Planetary And Rear Annulus

ASSEMBLY

(1) Lubricate output 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 (Fig. 192).

(3) Install rear thrust washer on rear planetary gear. Use enough petroleum jelly to hold washer in place. Also be sure all four washer tabs are properly engaged in gear slots.

(4) Install rear annulus over and onto rear planetary gear (Fig. 192).

(5) Install assembled rear planetary and annulus gear on output shaft (Fig. 193). Verify that assembly is fully seated on shaft.

(6) Install front thrust washer on rear planetary gear (Fig. 194). Use enough petroleum jelly to hold washer on gear. Be sure all four washer tabs are seated in slots.

(7) Install spacer on sun gear (Fig. 195).

(8) Install thrust plate on sun gear (Fig. 196). Note that driving shell thrust plates are interchangeable. Use either plate on sun gear and at front/rear of shell.

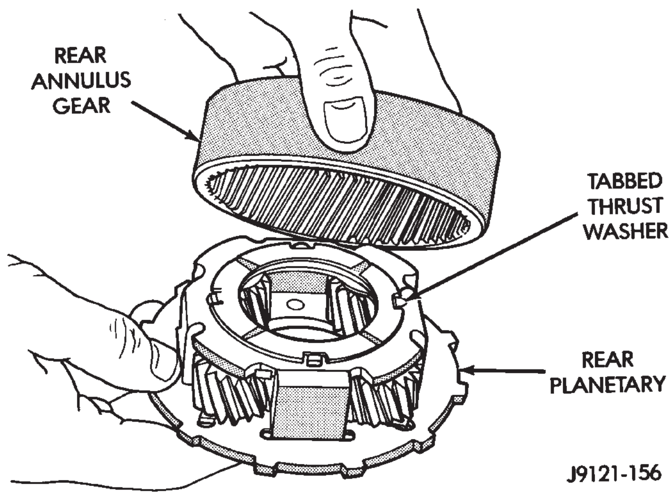


Fig. 192 Assembling Rear Annulus And Planetary Gear

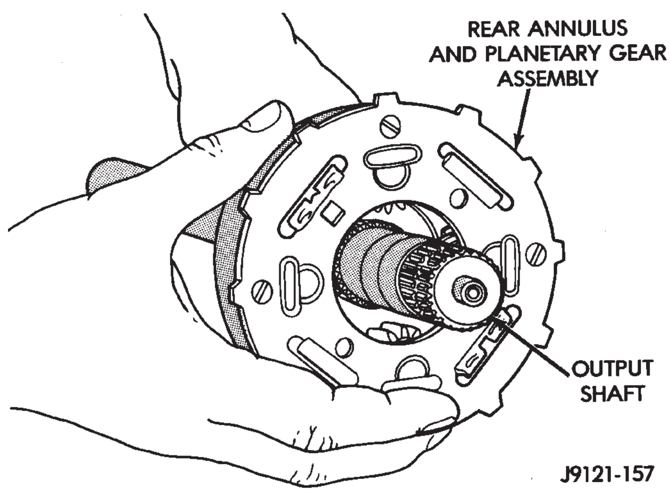


Fig. 193 Installing Rear Annulus And Planetary On Output Shaft

DISASSEMBLY AND ASSEMBLY (Continued)

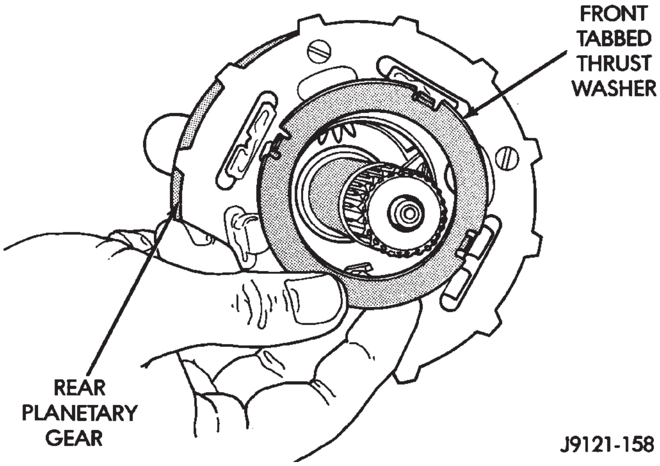


Fig. 194 Installing Rear Planetary Front Thrust Washer

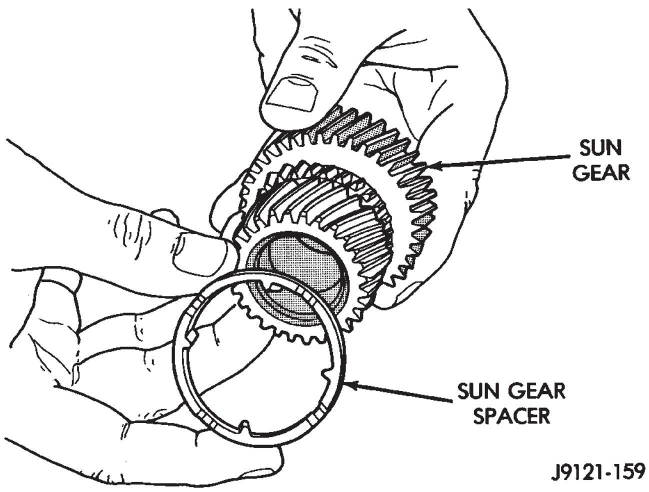


Fig. 195 Installing Spacer On Sun Gear

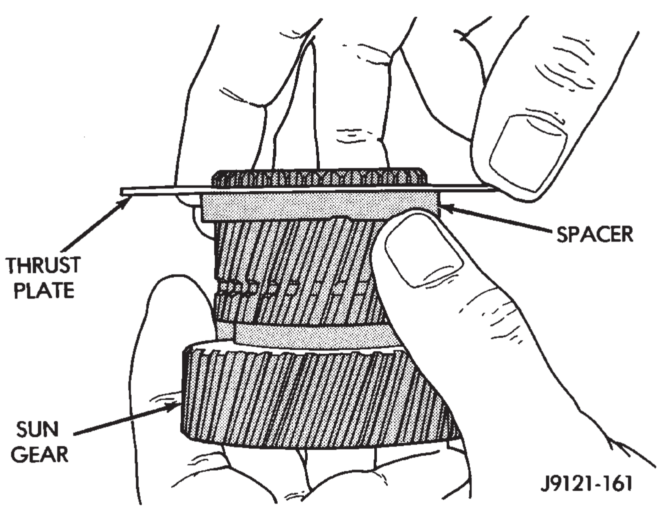


Fig. 196 Installing Driving Shell Front Thrust Plate On Sun Gear

(9) Hold sun gear in place and install thrust plate over sun gear at rear of driving shell (Fig. 197).

(10) Position wood block on bench and support sun gear on block (Fig. 198). 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.

(11) 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. 199).

(12) Install assembled driving shell and sun gear on output shaft (Fig. 200).

(13) Install rear thrust washer on front planetary gear (Fig. 201). Use enough petroleum jelly to hold washer in place and be sure all four washer tabs are seated.

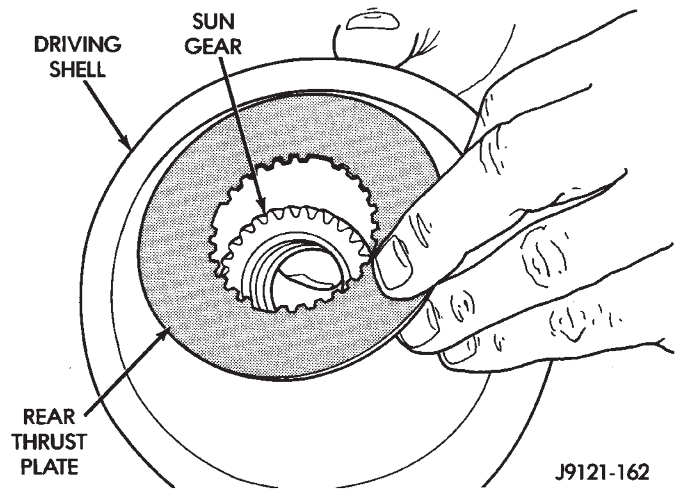


Fig. 197 Installing Driving Shell Rear Thrust Plate

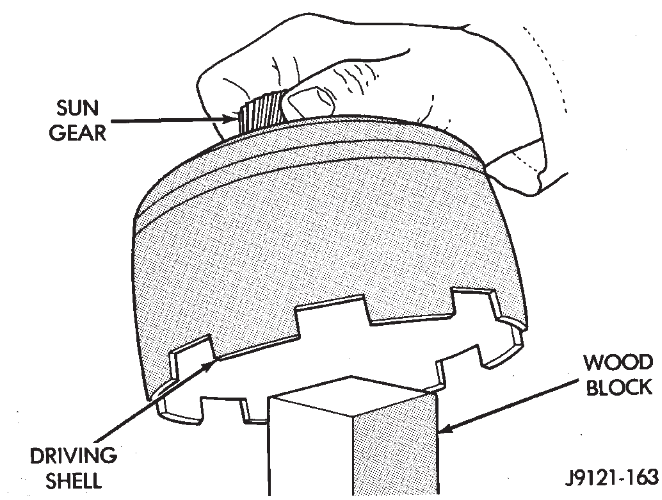


Fig. 198 Supporting Sun Gear On Wood Block

DISASSEMBLY AND ASSEMBLY (Continued)

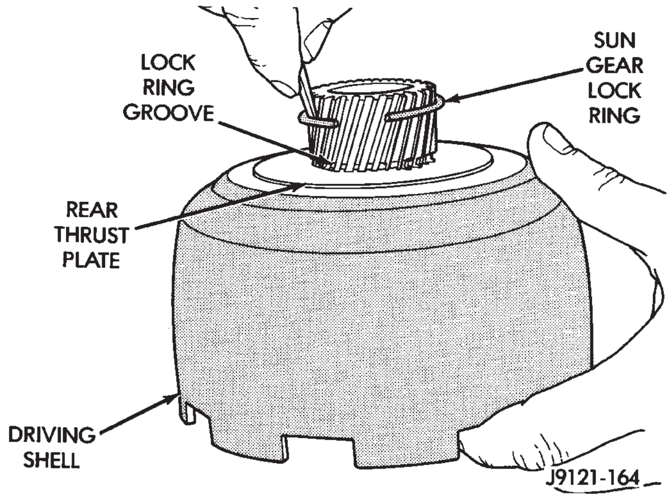


Fig. 199 Installing Sun Gear Lock Ring

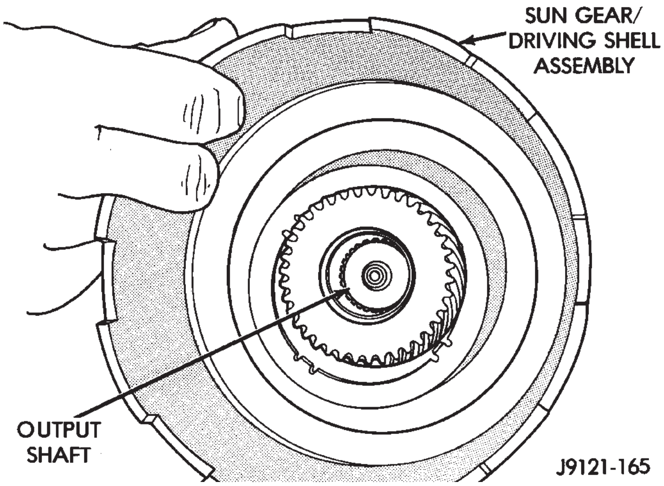


Fig. 200 Installing Assembled Sun Gear And Driving Shell On Output Shaft

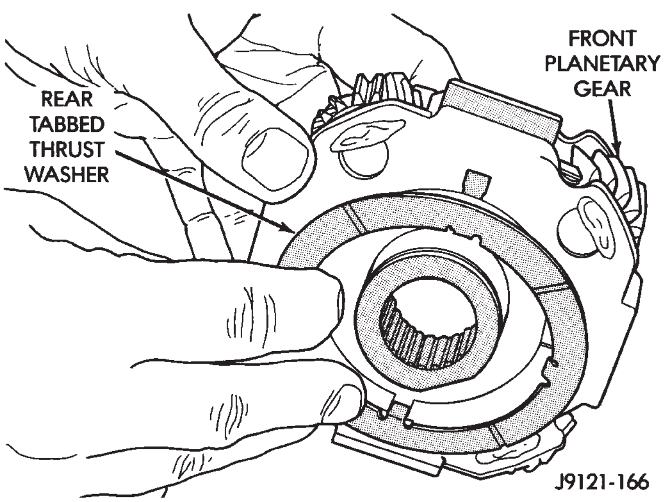


Fig. 201 Installing Rear Thrust Washer On Front Planetary Gear

(14) Install front planetary gear on output shaft and in driving shell (Fig. 202).

(15) Install front thrust washer on front planetary gear. Use enough petroleum jelly to hold washer in place and be sure all four washer tabs are seated.

(16) Assemble front annulus gear and support, if necessary. Be sure support snap ring is seated.

(17) Install front annulus on front planetary (Fig. 202).

(18) Position thrust plate on front annulus gear support (Fig. 203). **Note that plate has two tabs on it. These tabs fit in notches of annulus hub.**

(19) Install thrust washer in front annulus (Fig. 204). **Align flat on washer with flat on planetary hub. Also be sure washer tab is facing up.**

(20) Install front annulus snap ring (Fig. 205). Use snap ring pliers to avoid distorting ring during installation. Also be sure ring is fully seated.

(21) Install planetary selective snap ring with snap ring pliers (Fig. 206). Be sure ring is fully seated.

(22) 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 allows geartrain components to move forward for accurate end play check.

(23) Check planetary geartrain end play with feeler gauge (Fig. 207). Gauge goes between shoulder on output shaft and end of rear annulus support.

(24) 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.

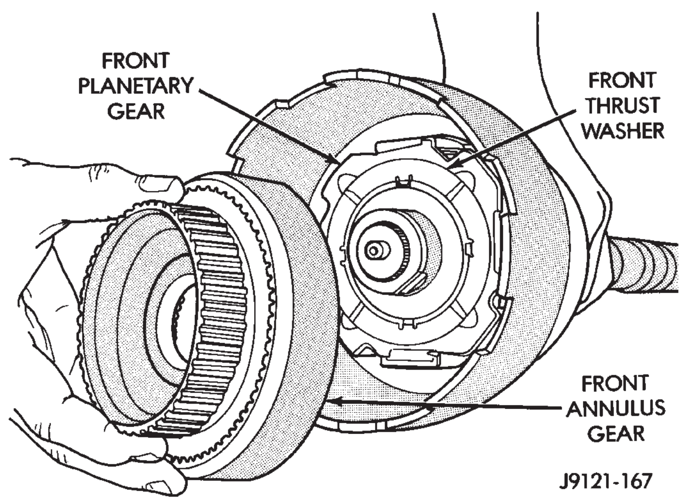


Fig. 202 Installing Front Planetary And Annulus Gears

DISASSEMBLY AND ASSEMBLY (Continued)

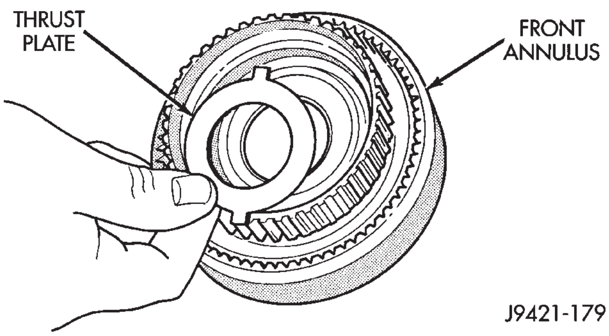


Fig. 203 Positioning Thrust Plate On Front Annulus Support

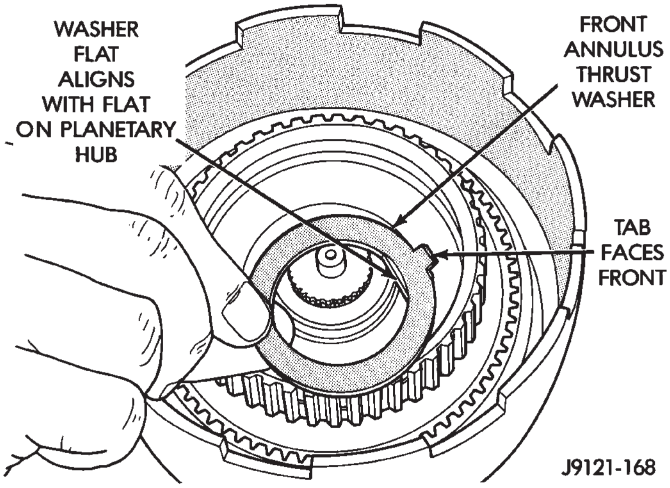


Fig. 204 Installing Front Annulus Thrust Washer

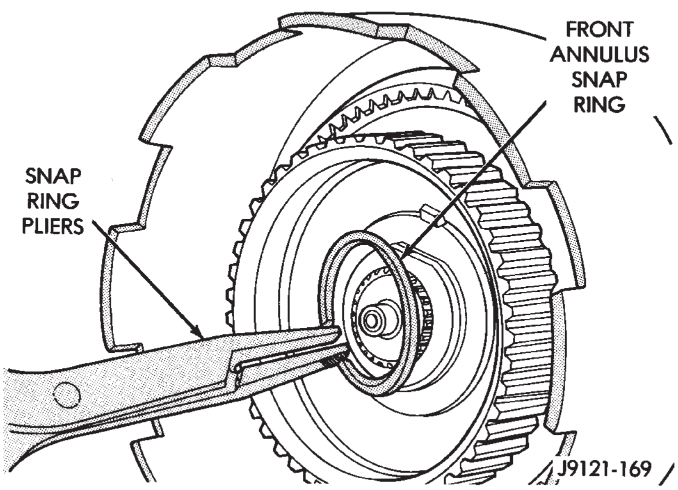


Fig. 205 Installing Front Annulus Snap Ring

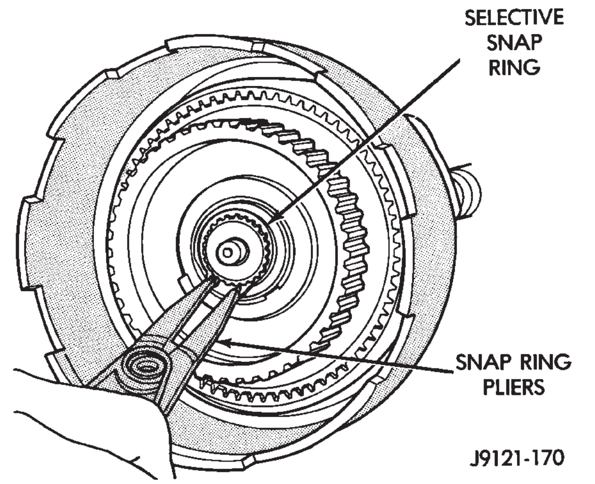


Fig. 206 Installing Planetary Selective Snap Ring

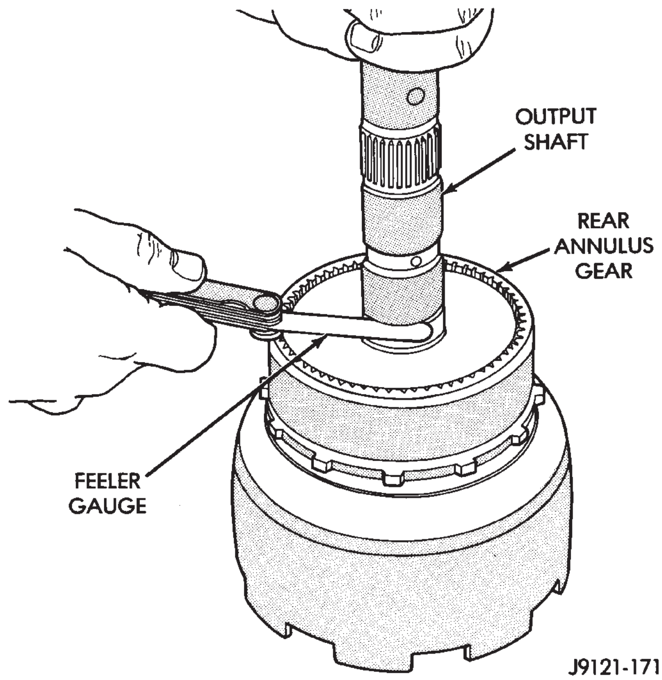


Fig. 207 Checking Planetary Geartrain End Play

DISASSEMBLY AND ASSEMBLY (Continued)

OVERDRIVE UNIT

DISASSEMBLY

(1) Remove transmission speed sensor and O-ring seal from overdrive case (Fig. 208).

(2) Remove overdrive piston thrust bearing (Fig. 209).

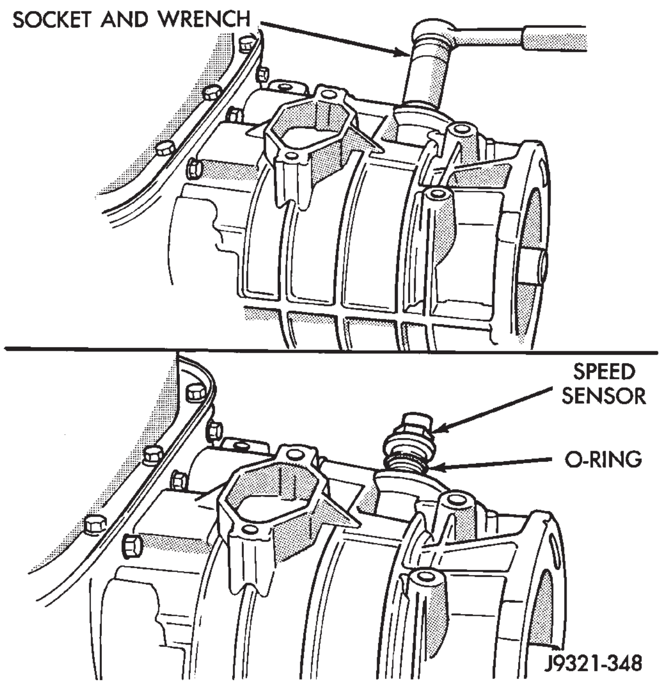


Fig. 208 Transmission Speed Sensor Removal/ Installation

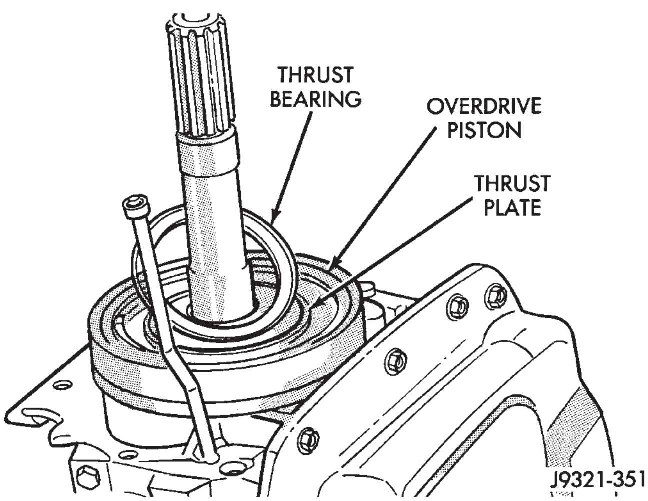


Fig. 209 Overdrive Piston Thrust Bearing Removal/ Installation

OVERDRIVE PISTON DISASSEMBLY

(1) Remove overdrive piston thrust plate (Fig. 210). Retain thrust plate. It is a select fit part and may possibly be reused.

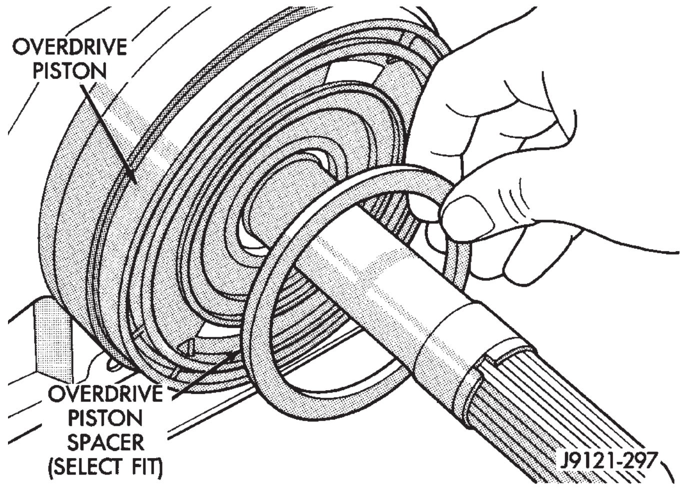


Fig. 210 Overdrive Piston Thrust Plate Removal/ Installation

(2) Remove intermediate shaft spacer (Fig. 211). Retain spacer. It is a select fit part and may possibly be reused.

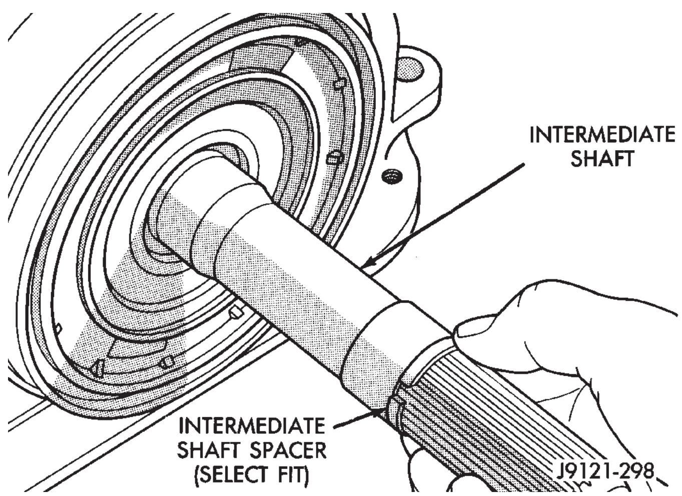


Fig. 211 Intermediate Shaft Spacer Location

DISASSEMBLY AND ASSEMBLY (Continued)

(3) Remove overdrive piston from retainer (Fig. 212).

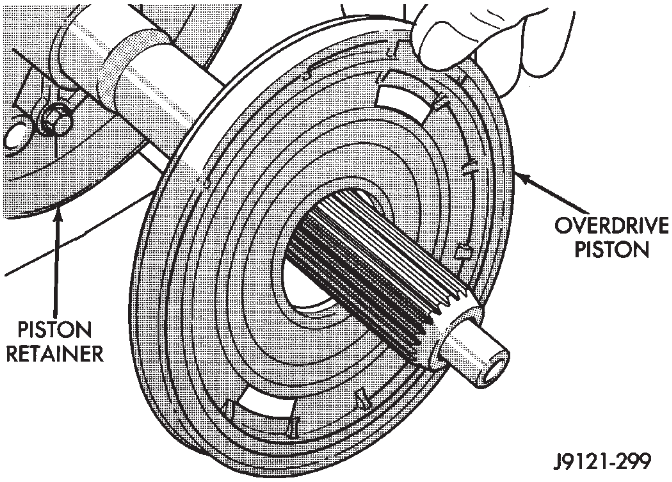


Fig. 212 Overdrive Piston Removal

OVERDRIVE CLUTCH PACK DISASSEMBLY

(1) Remove overdrive clutch pack wire retaining ring (Fig. 213).

(2) Remove overdrive clutch pack (Fig. 214).

NOTE: The 44RE transmission utilizes four clutch discs and three clutch plates.

(3) Note position of clutch pack components for assembly reference.

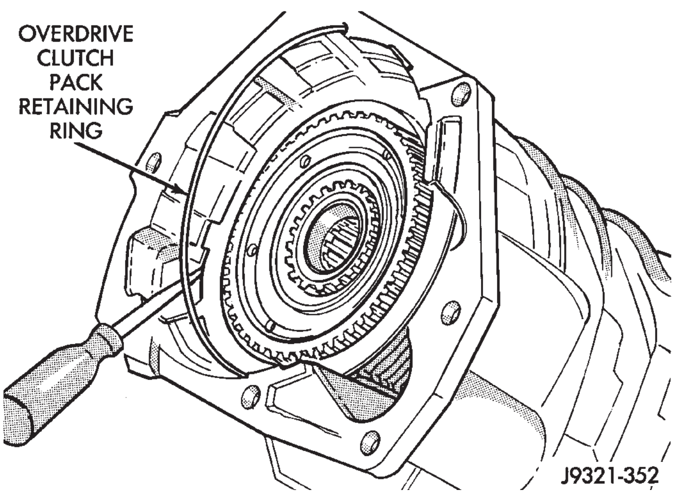


Fig. 213 Removing Overdrive Clutch Pack Retaining Ring

OVERDRIVE GEARTRAIN DISASSEMBLY

(1) Remove overdrive clutch wave spring (Fig. 215).

(2) Remove overdrive clutch reaction snap ring (Fig. 216). Note that snap ring is located in same groove as wave spring.

(3) Remove Torx head screws that attach access cover and gasket to overdrive case (Fig. 217).

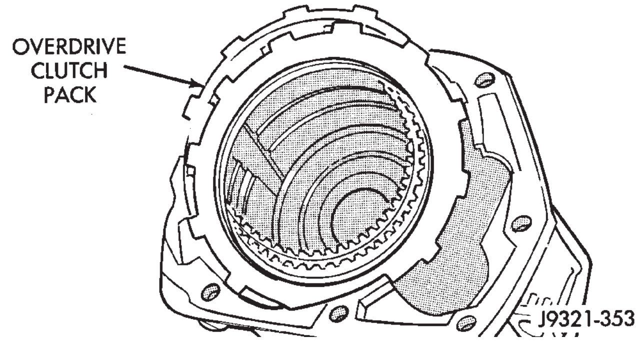


Fig. 214 Overdrive Clutch Pack Removal

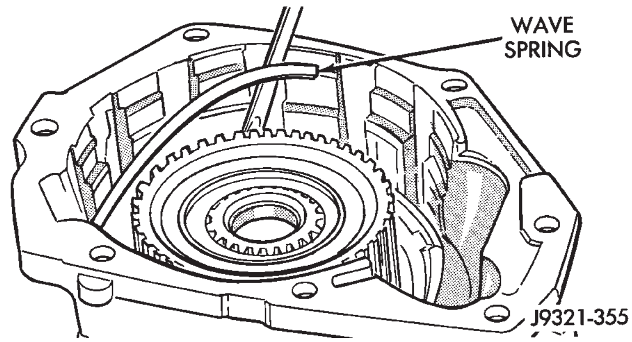


Fig. 215 Overdrive Clutch Wave Spring Removal/ Installation

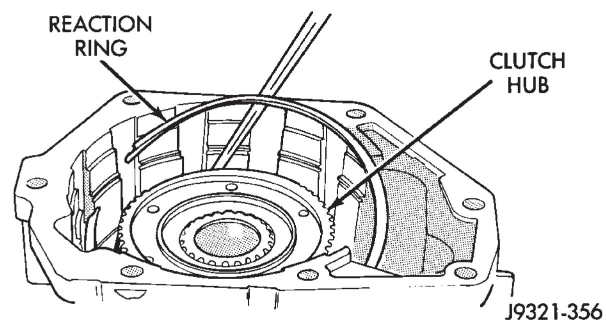


Fig. 216 Overdrive Clutch Reaction Snap Ring Removal/Installation

(4) Remove access cover and gasket (Fig. 218).

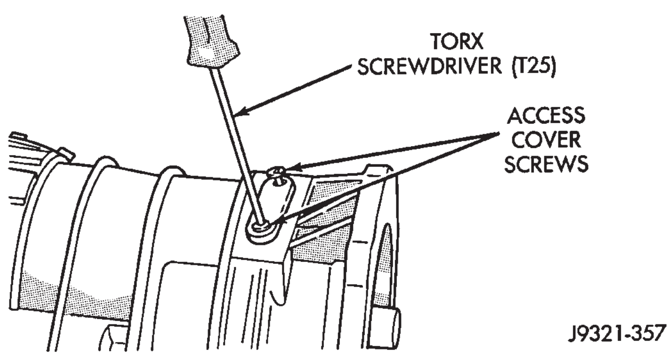


Fig. 217 Access Cover Screw Removal/Installation

DISASSEMBLY AND ASSEMBLY (Continued)

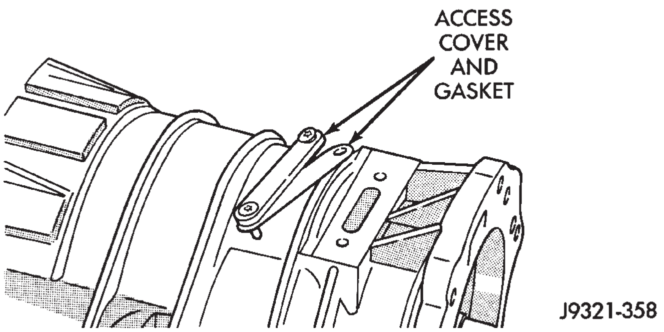


Fig. 218 Access Cover And Gasket Removal/ Installation

(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. 219).

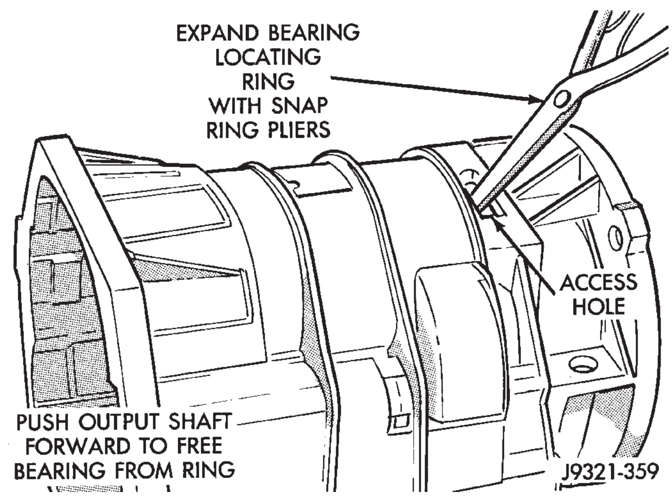


Fig. 219 Releasing Bearing From Locating Ring

(6) Lift gear case up and off geartrain assembly (Fig. 220).

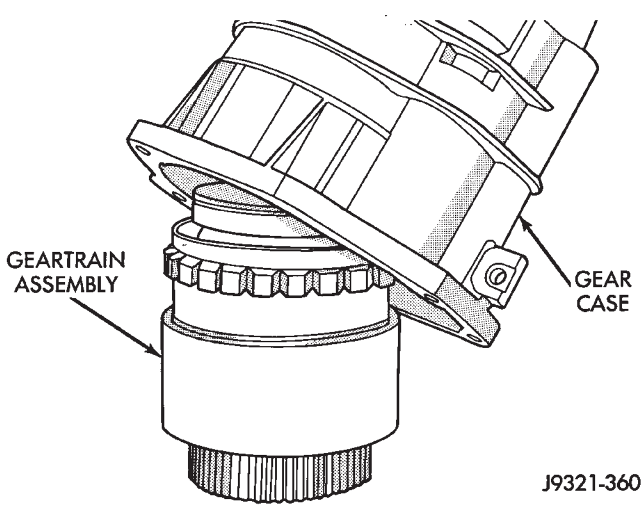


Fig. 220 Removing Gear Case From Geartrain Assembly

(7) Remove snap ring that retains rear bearing on output shaft.

(8) Remove rear bearing from output shaft (Fig. 221).

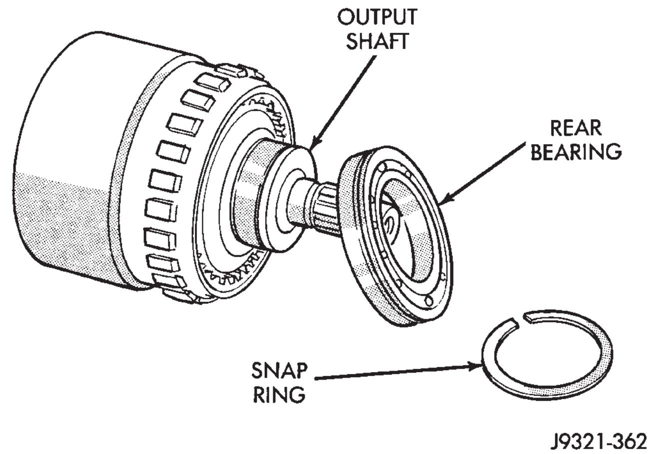


Fig. 221 Rear Bearing Removal

DIRECT CLUTCH, HUB AND SPRING DISASSEMBLY

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.

(1) Mount geartrain assembly in shop press (Fig. 222).

(2) Position Compressor Tool 6227-1 on clutch hub (Fig. 222). Support output shaft flange with steel press plates as shown and center assembly under press ram.

(3) 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. 222).

(4) Remove direct clutch pack snap ring (Fig. 223).

(5) Remove direct clutch hub retaining ring (Fig. 224).

(6) Release press load slowly and completely (Fig. 225).

(7) Remove Special Tool 6227-1. Then remove clutch pack from hub (Fig. 225).

DISASSEMBLY AND ASSEMBLY (Continued)

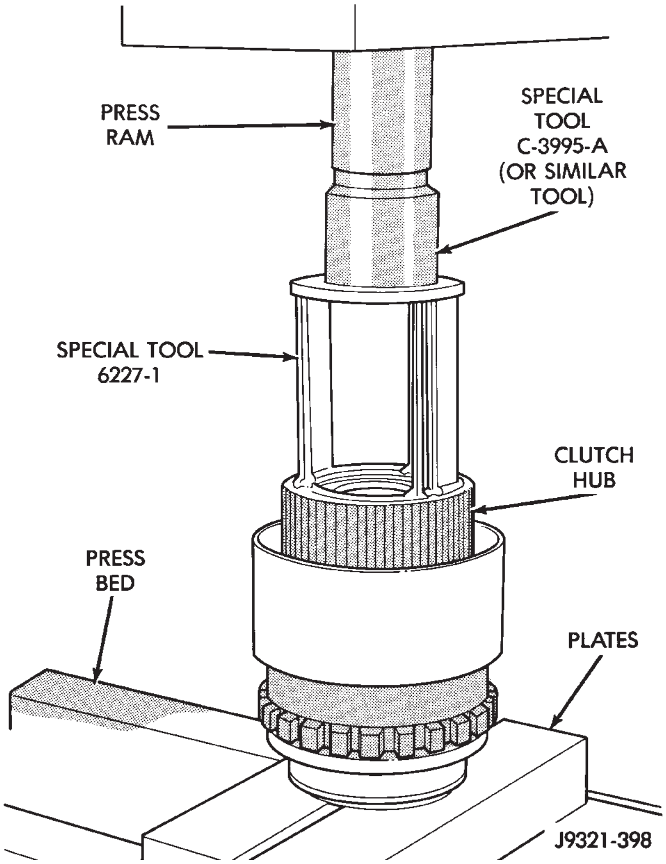


Fig. 222 Geartrain Mounted In Shop Press

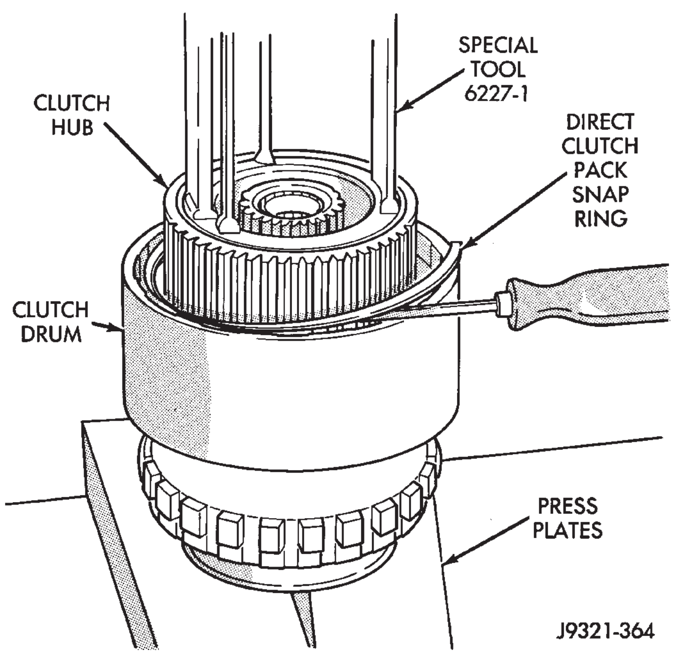


Fig. 223 Direct Clutch Pack Snap Ring Removal

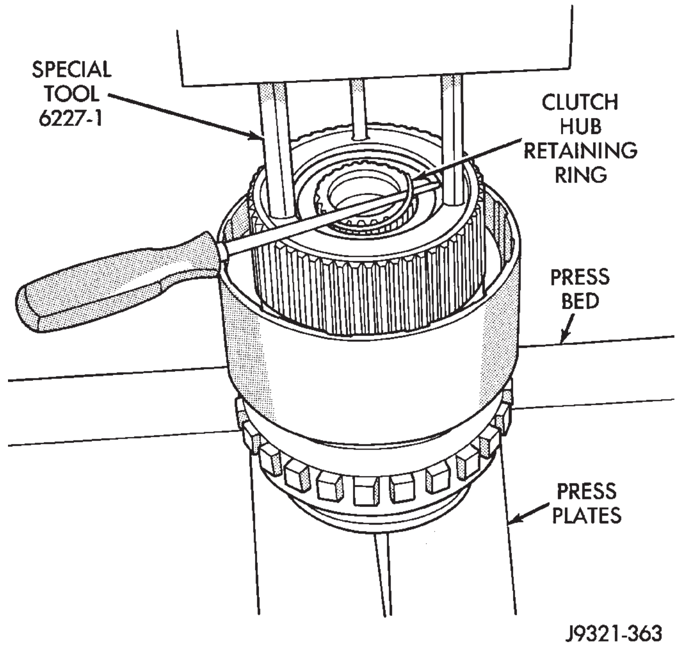


Fig. 224 Direct Clutch Hub Retaining Ring Removal

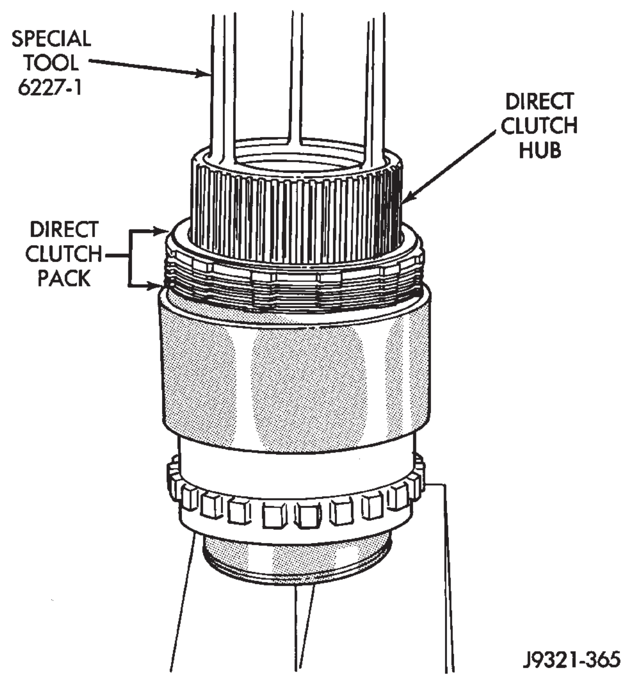


Fig. 225 Direct Clutch Pack Removal

DISASSEMBLY AND ASSEMBLY (Continued)

Geartrain Disassembly

(1) Remove direct clutch hub and spring (Fig. 226).

(2) Remove sun gear and spring plate. Then remove planetary thrust bearing and planetary gear (Fig. 227).

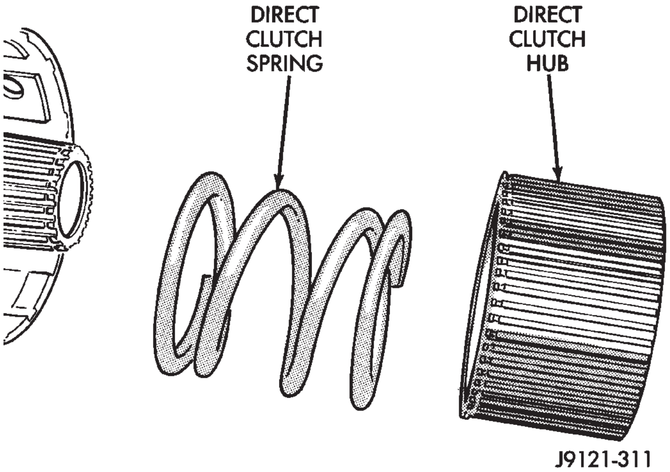


Fig. 226 Direct Clutch Hub And Spring Removal

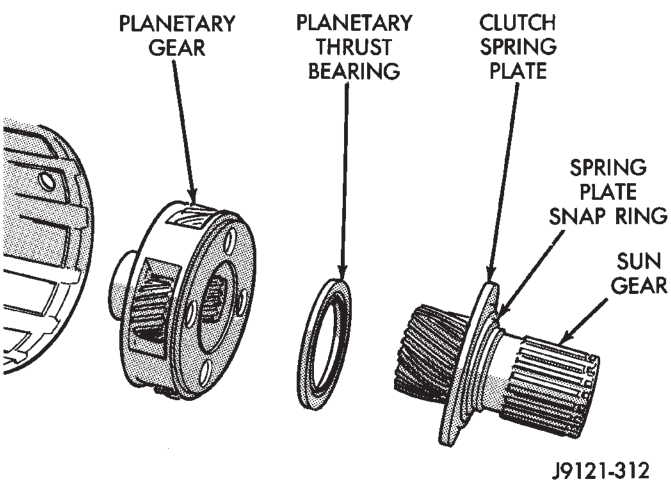


Fig. 227 Removing Sun Gear, Thrust Bearing And Planetary Gear

(3) Remove overrunning clutch assembly with expanding type snap ring pliers (Fig. 228). Insert pliers into clutch hub. Expand pliers to grip hub splines and remove clutch with counterclockwise, twisting motion.

(4) Remove thrust bearing from overrunning clutch hub.

(5) Remove overrunning clutch from hub.

(6) Mark position of annulus gear and direct clutch drum for assembly alignment reference (Fig. 229). Use small center punch or scriber to make alignment marks.

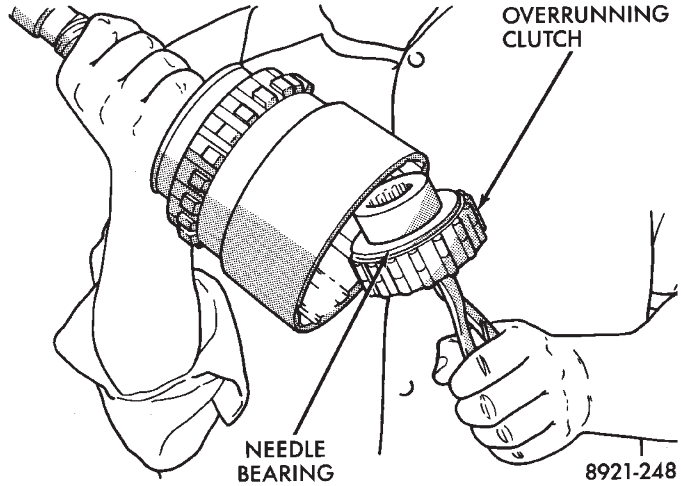


Fig. 228 Overrunning Clutch Assembly Removal/ Installation

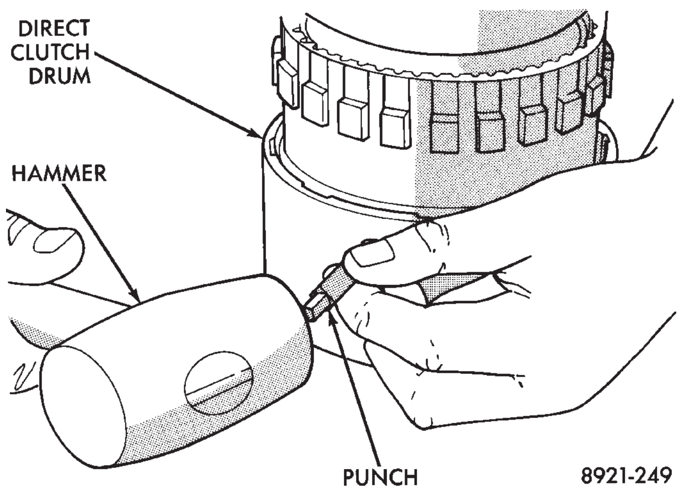


Fig. 229 Marking Direct Clutch Drum And Annulus Gear For Assembly Alignment

DISASSEMBLY AND ASSEMBLY (Continued)

(7) Remove direct clutch drum rear retaining ring (Fig. 230).

(8) Remove direct clutch drum outer retaining ring (Fig. 231).

(9) Mark annulus gear and output shaft for assembly alignment reference (Fig. 232). Use punch or scriber to mark gear and shaft.

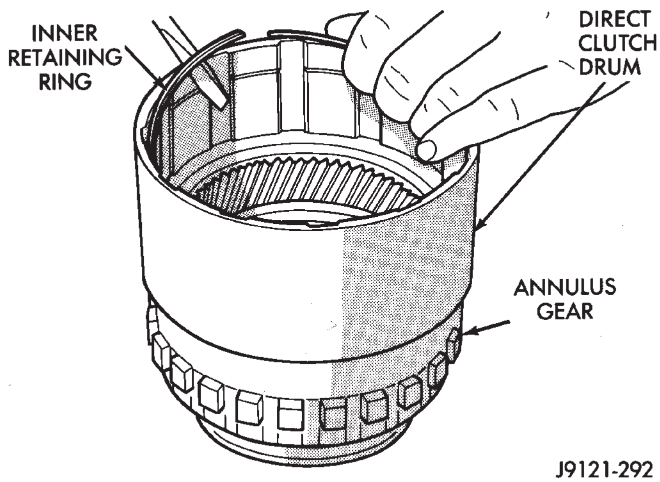


Fig. 230 Clutch Drum Inner Retaining Ring Removal

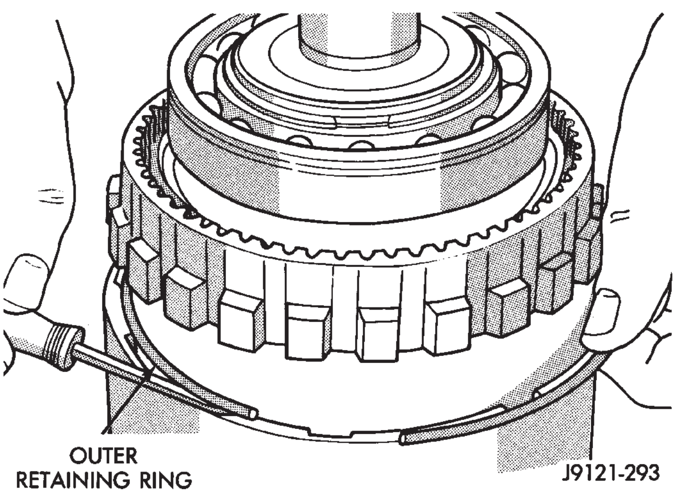


Fig. 231 Clutch Drum Outer Retaining Ring Removal

(10) Remove snap ring that secures annulus gear on output shaft (Fig. 233). Use two screwdrivers to unseat and work snap ring out of groove as shown.

(11) Remove annulus gear from output shaft (Fig. 234). Use rawhide or plastic mallet to tap gear off shaft.

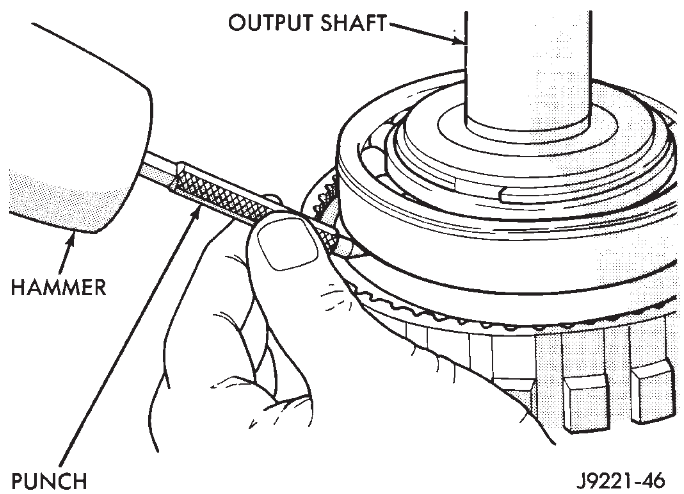


Fig. 232 Marking Annulus Gear And Output Shaft For Assembly Alignment

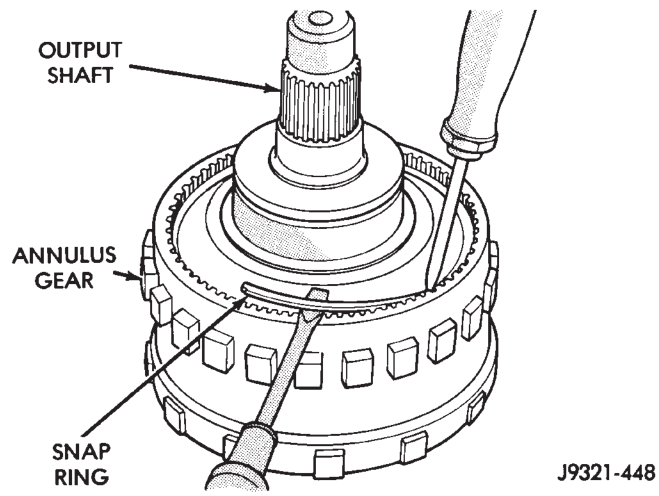


Fig. 233 Annulus Gear Snap Ring Removal

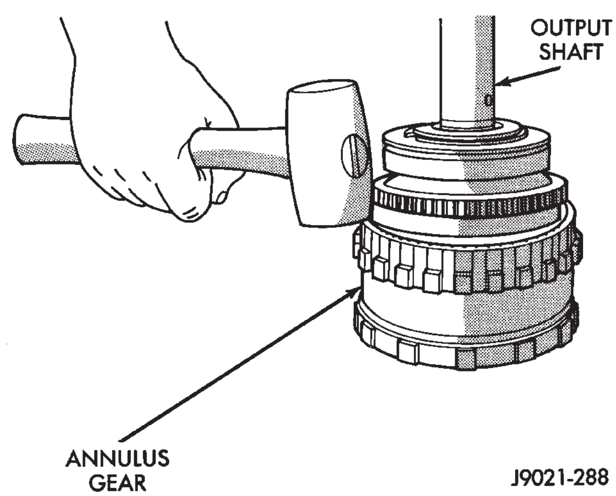


Fig. 234 Annulus Gear Removal

DISASSEMBLY AND ASSEMBLY (Continued)

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.

ASSEMBLY

GEARTRAIN AND DIRECT CLUTCH ASSEMBLY

(1) Soak direct clutch and overdrive clutch discs in Mopar® ATF Plus 3, type 7176, 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. 235). Lubricate bushings with petroleum jelly, or transmission fluid.

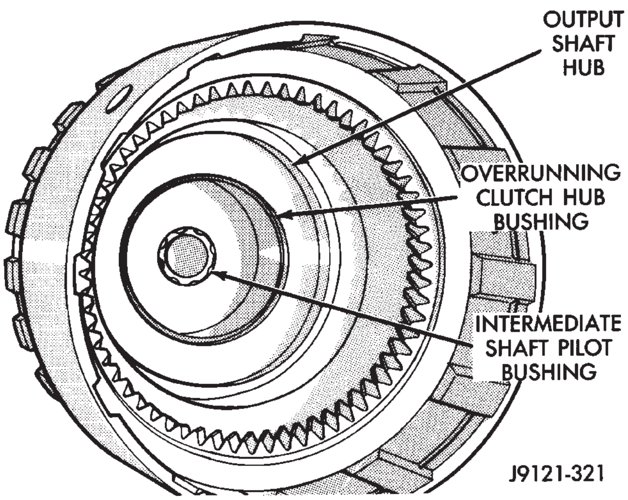


Fig. 235 Output Shaft Pilot Bushing

(3) Install annulus gear on output shaft, if removed. Then install annulus gear retaining snap ring (Fig. 236).

(4) Align and install clutch drum on annulus gear (Fig. 237). Be sure drum is engaged in annulus gear lugs.

(5) Install clutch drum outer retaining ring (Fig. 237).

(6) Slide clutch drum forward and install inner retaining ring (Fig. 238).

(7) Install rear bearing and snap ring on output shaft (Fig. 239). Be sure locating ring groove in bearing is toward rear.

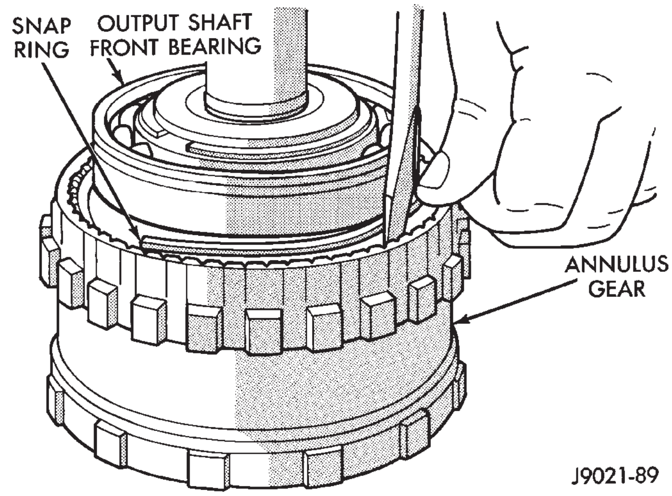


Fig. 236 Annulus Gear Installation

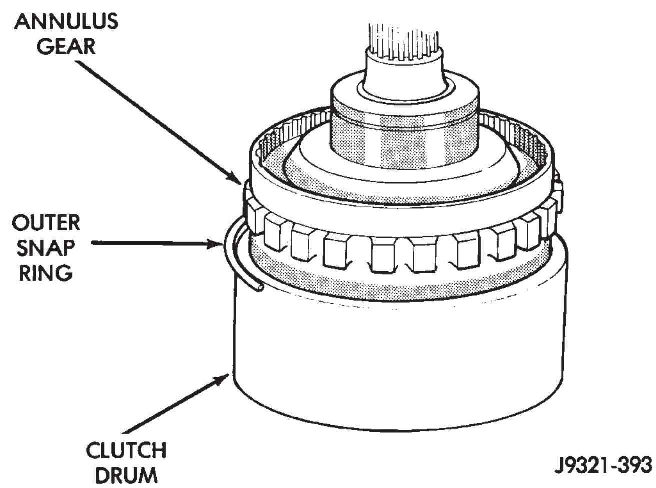


Fig. 237 Clutch Drum And Outer Retaining Ring Installation

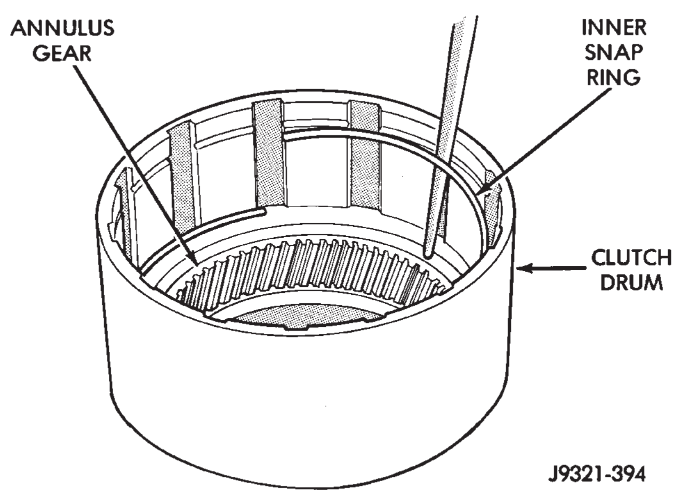


Fig. 238 Clutch Drum Inner Retaining Ring Installation

DISASSEMBLY AND ASSEMBLY (Continued)

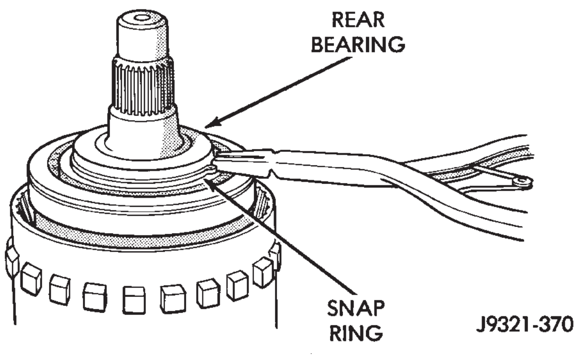


Fig. 239 Rear Bearing And Snap Ring Installation

(8) Install overrunning clutch on hub (Fig. 240). **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. 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.**

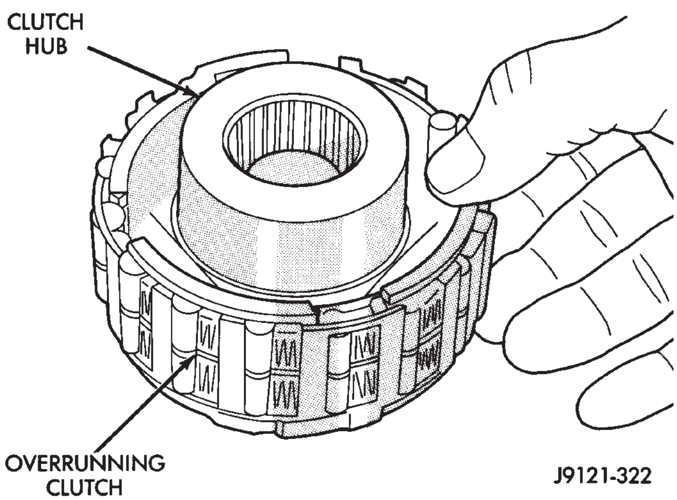


Fig. 240 Assembling Overrunning Clutch And Hub

(10) Install overrunning clutch in output shaft (Fig. 241). 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. 242). **Be sure planetary pinions are fully seated in annulus gear before proceeding.**

(12) 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.

(13) Install planetary thrust bearing on sun gear (Fig. 243). Slide bearing onto gear and seat it against spring plate as shown. **Bearing fits one way only.**

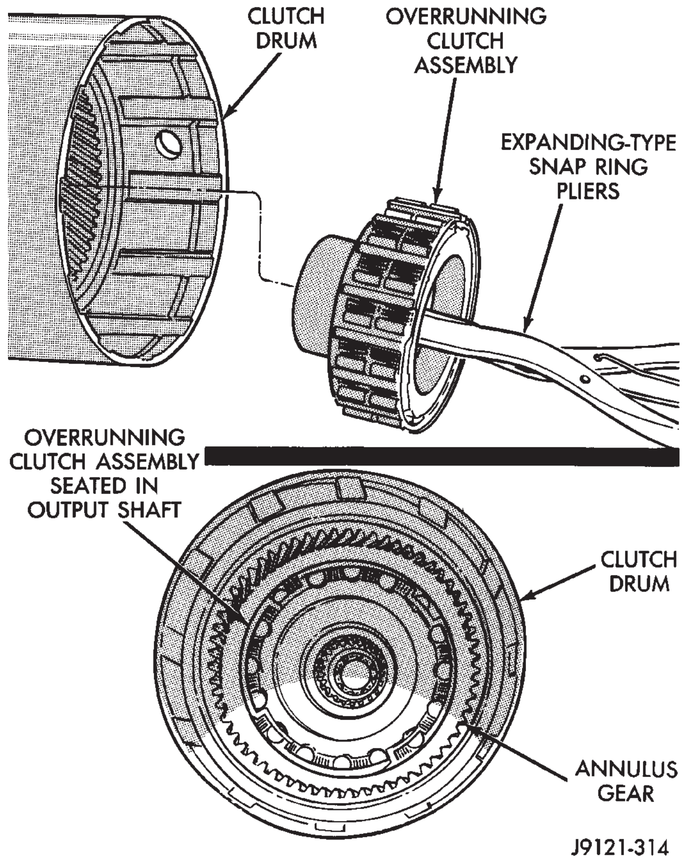


Fig. 241 Overrunning Clutch Installation

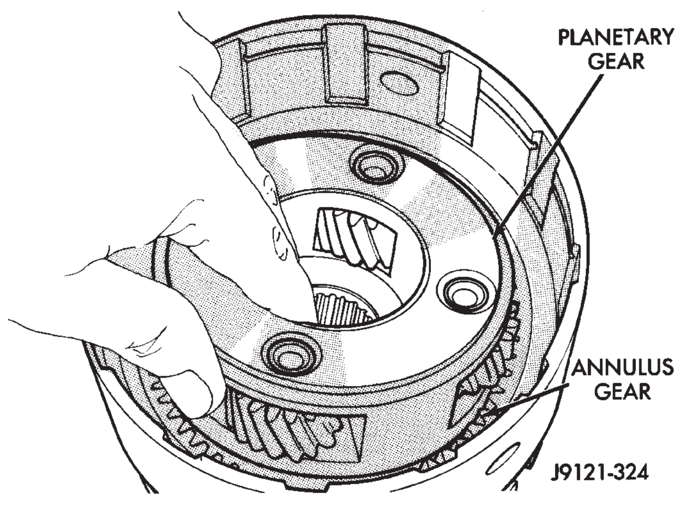


Fig. 242 Planetary Gear Installation

If it does not seat squarely against spring plate, remove and reposition bearing.

(14) Install assembled sun gear, spring plate and thrust bearing (Fig. 244). Be sure sun gear and thrust bearing are fully seated before proceeding.

(15) 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.

DISASSEMBLY AND ASSEMBLY (Continued)

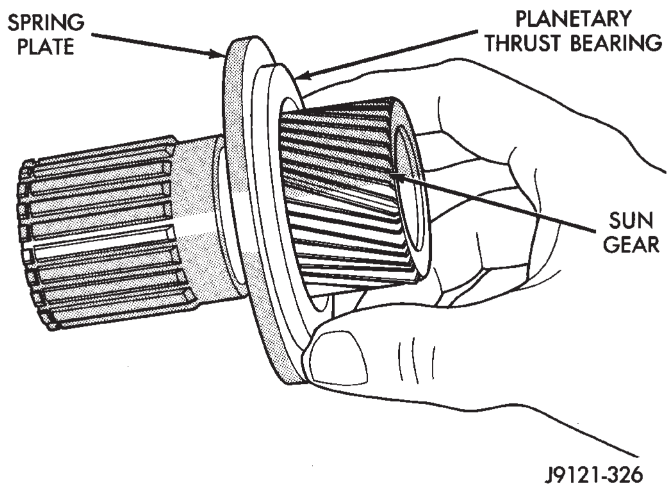


Fig. 243 Planetary Thrust Bearing Installation

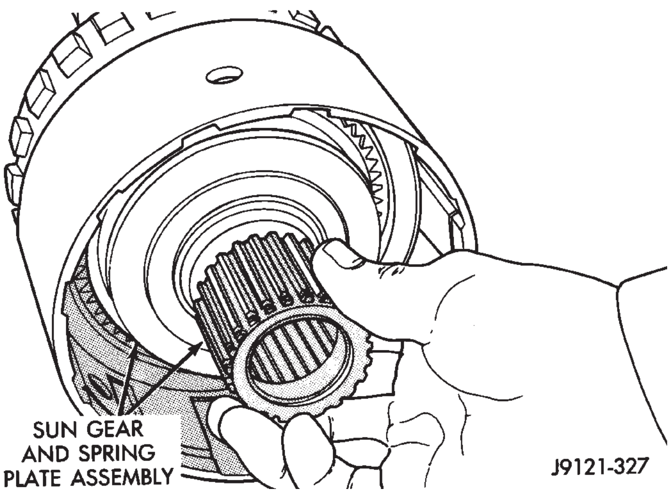


Fig. 244 Sun Gear Installation

(16) Align splines in hubs of planetary gear and overrunning clutch with Alignment tool 6227-2 (Fig. 245). Insert tool through sun gear and into splines of both hubs. Be sure alignment tool is fully seated before proceeding.

(17) Install direct clutch spring (Fig. 246). Be sure spring is properly seated on spring plate.

NOTE: The 44RE transmission has 8 direct clutch discs and 7 clutch plates.

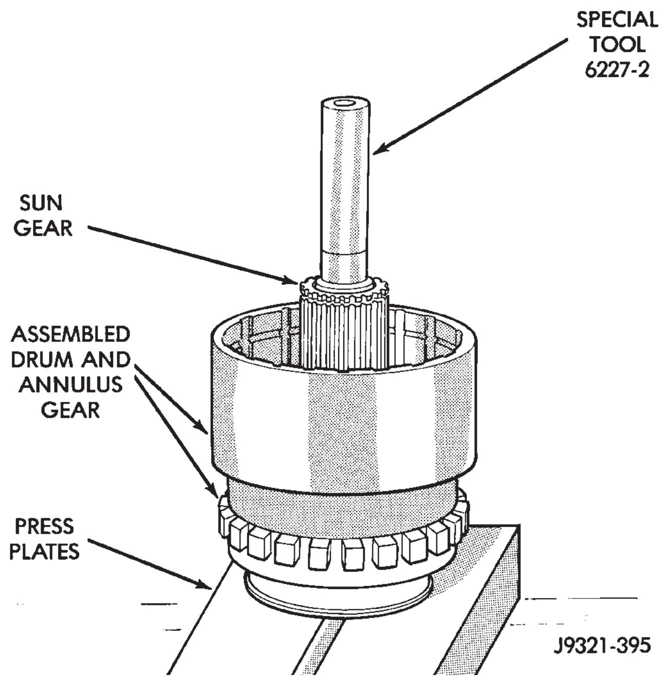


Fig. 245 Alignment Tool Installation

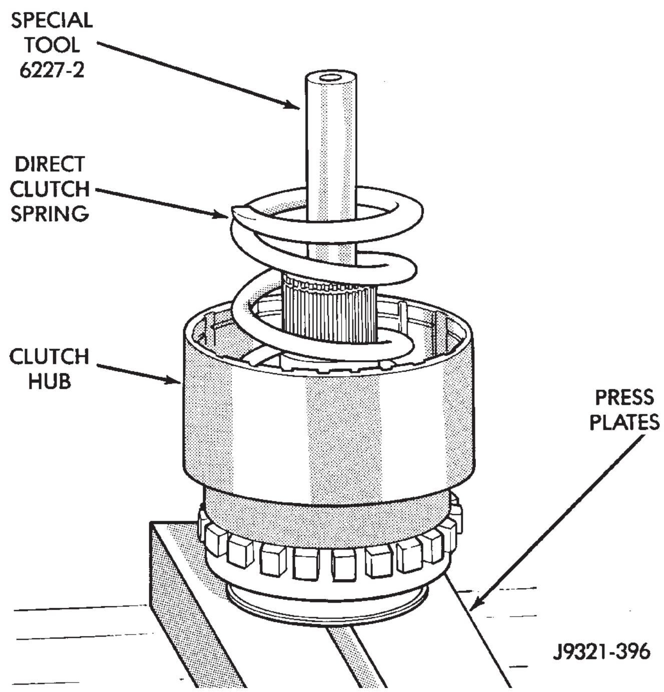


Fig. 246 Direct Clutch Spring Installation

DISASSEMBLY AND ASSEMBLY (Continued)

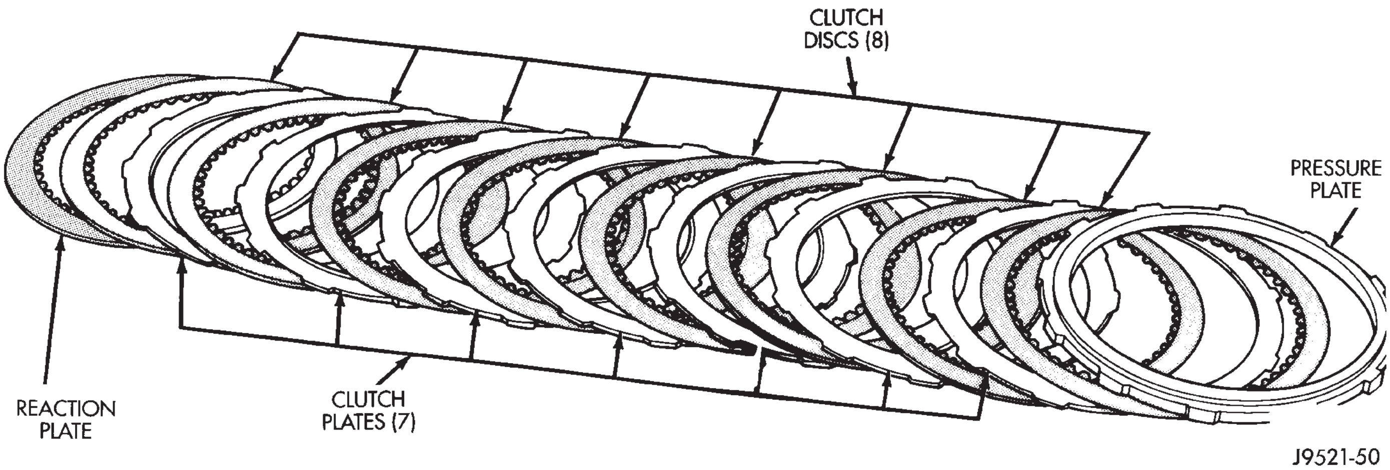


Fig. 247 44RE Direct Clutch Pack Components

(18) Assemble and install direct clutch pack on hub as follows:

(a) Assemble clutch pack components or (Fig. 247).

(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. 248).**

(c) Install first clutch disc followed by a steel plate until all discs and 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. 249).**

(19) Install clutch hub and clutch pack on direct clutch spring (Fig. 250). **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.

(20) Position Compressor Tool 6227-1 on clutch hub.

(21) Compress clutch hub and spring just enough to place tension on hub and hold it in place.

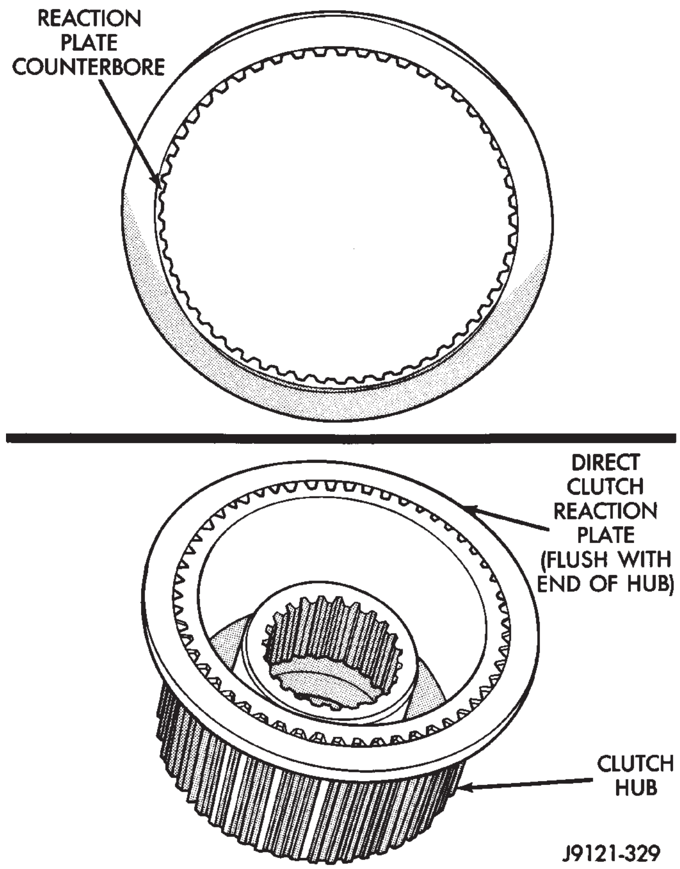


Fig. 248 Correct Position Of Direct Clutch Reaction Plate

(22) Slowly compress clutch hub and spring. Compress spring and hub only enough to expose ring grooves for clutch pack snap ring and clutch hub retaining ring.

(23) Realign clutch pack on hub and seat clutch discs and plates in clutch drum.

(24) Install direct clutch pack snap ring (Fig. 251). **Be very sure snap ring is fully seated in clutch drum ring groove.**

DISASSEMBLY AND ASSEMBLY (Continued)

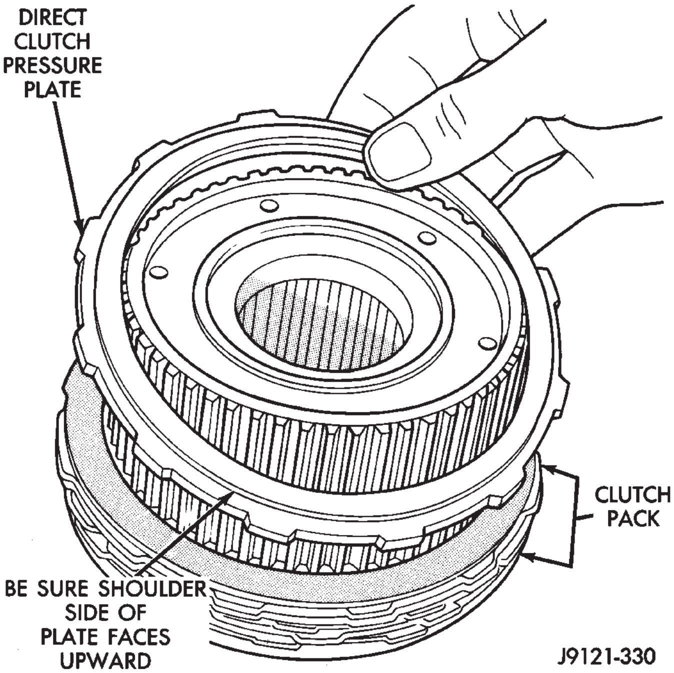


Fig. 249 Correct Position Of Direct Clutch Pressure Plate

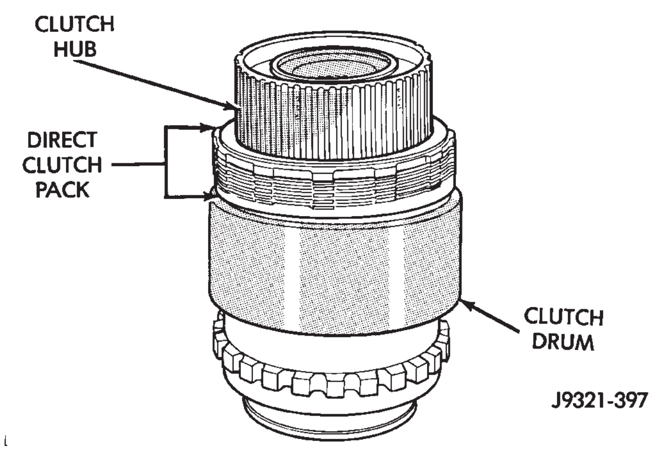


Fig. 250 Direct Clutch Pack And Clutch Hub Installation

(25) Install clutch hub retaining ring (Fig. 252). **Be very sure retaining ring is fully seated in sun gear ring groove.**

(26) Slowly release press ram, remove compressor tools and remove geartrain assembly.

GEAR CASE ASSEMBLY

(1) Position park pawl and spring in case and install park pawl shaft. Verify that end of spring with 90° bend is hooked to pawl and straight end of spring is seated against case.

(2) Install pawl shaft retaining bolt. Tighten bolt to 27 N·m (20 ft. lbs.) torque.

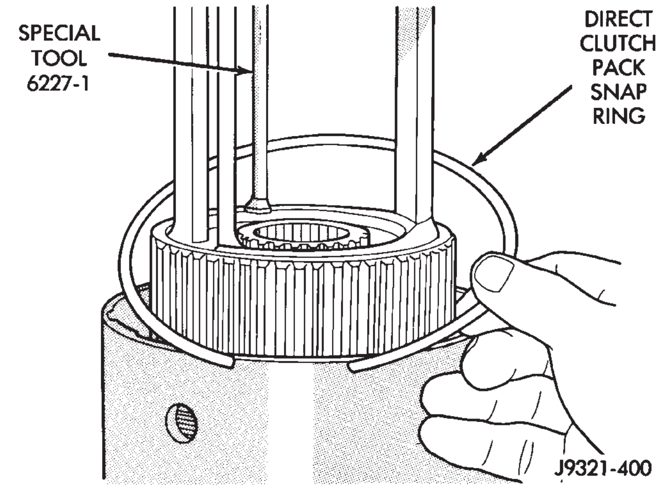


Fig. 251 Direct Clutch Pack Snap Ring Installation

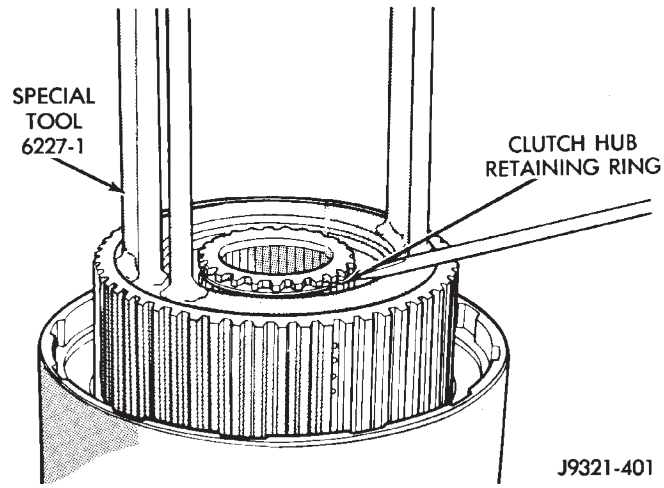


Fig. 252 Clutch Hub Retaining Ring Installation

(3) Install park lock reaction plug. **Note that plug has locating pin at rear (Fig. 253). Be sure pin is seated in hole in case before installing snap ring.**

(4) Install reaction plug snap-ring (Fig. 254). **Compress snap ring only enough for installation; do not distort it.**

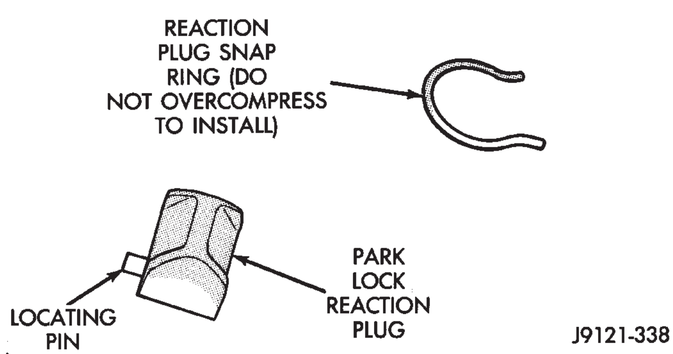


Fig. 253 Reaction Plug Locating Pin And Snap-Ring

DISASSEMBLY AND ASSEMBLY (Continued)

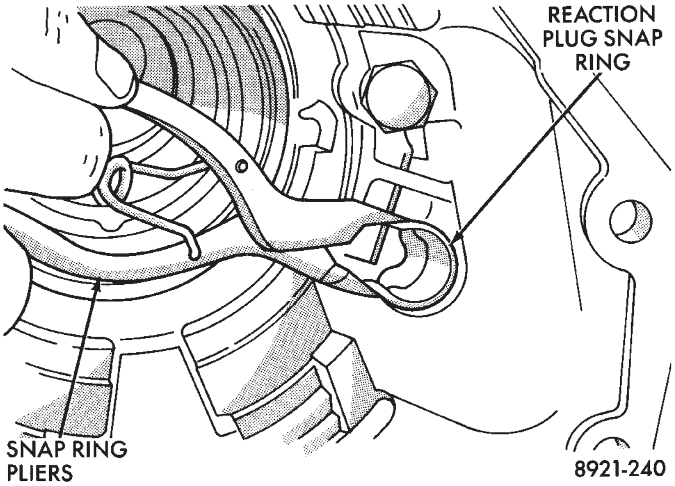


Fig. 254 Reaction Plug And Snap-Ring Installation

(5) Install new seal in gear case. On 4x4 gear case, use Tool Handle C-4171 and Installer C-3860-A to seat seal in case. On 4 x 2 gear case, use same Handle C-4171 and Installer C-3995-A to seat seal in case.

(6) Verify that tab ends of rear bearing locating ring extend into access hole in gear case (Fig. 255).

(7) Support geartrain on Tool 6227-1 (Fig. 256). Be sure tool is securely seated in clutch hub.

(8) Install overdrive gear case on geartrain (Fig. 256).

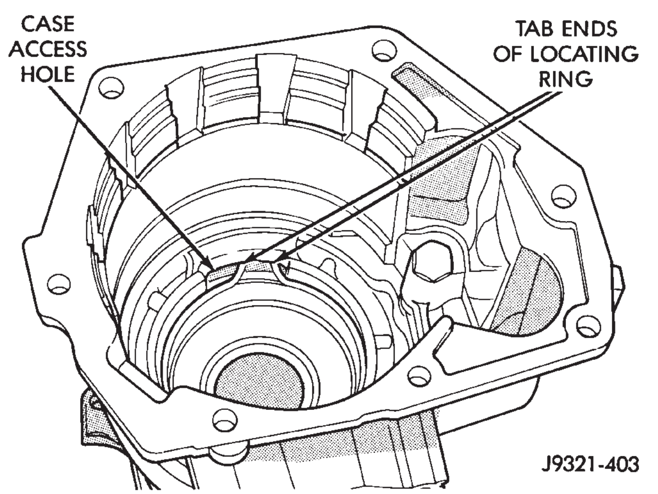


Fig. 255 Correct Rear Bearing Locating Ring Position

(9) Expand front bearing locating ring with snap ring pliers (Fig. 257). Then slide case downward until locating ring locks in bearing groove and release snap ring.

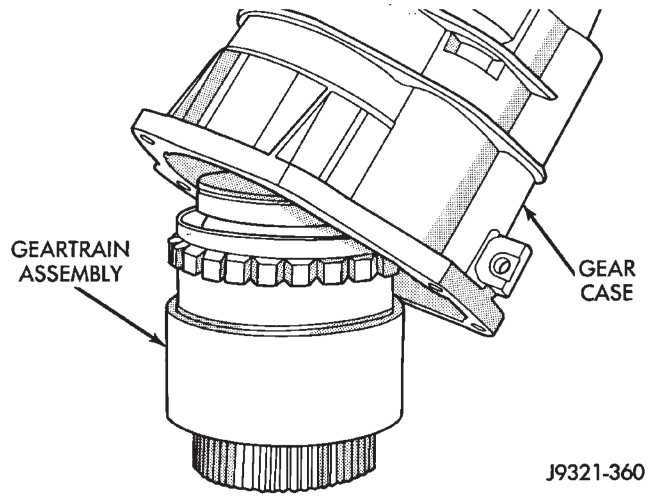


Fig. 256 Overdrive Gear Case Installation

(10) Install locating ring access cover and gasket in overdrive unit case (Fig. 258).

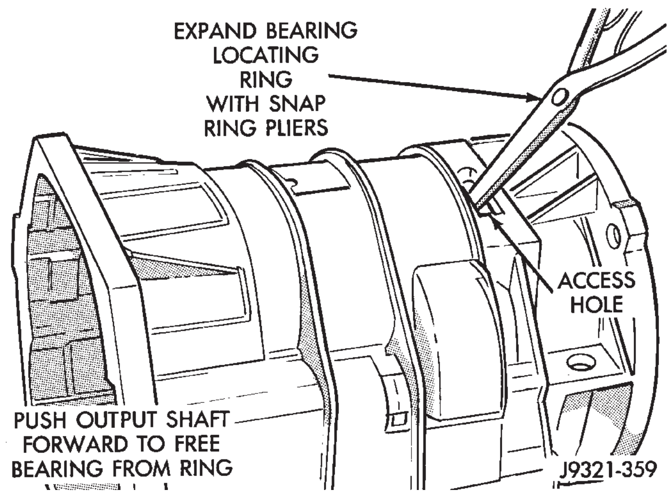


Fig. 257 Seating Locating Ring In Rear Bearing

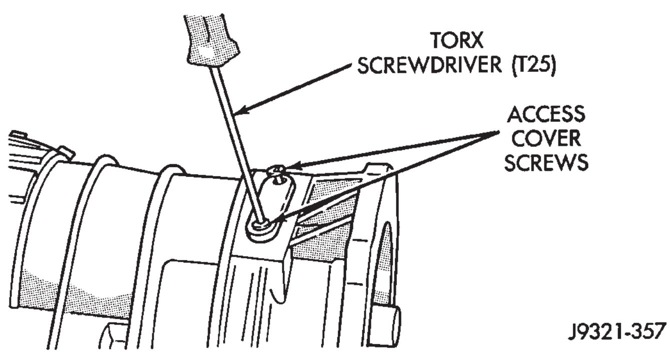


Fig. 258 Locating Ring Access Cover And Gasket Installation

DISASSEMBLY AND ASSEMBLY (Continued)

OVERDRIVE CLUTCH ASSEMBLY

(1) Install overdrive clutch reaction ring first. Reaction ring is flat with notched ends (Fig. 259).

(2) Install wave spring on top of reaction ring (Fig. 260). **Reaction ring and wave ring both fit in same ring groove.** Use screwdriver to seat each ring securely in groove. Also ensure that the ends of the two rings are offset from each other.

NOTE: The 44RE transmission has 4 overdrive clutch discs and 3 plates.

(3) Assemble overdrive clutch pack.

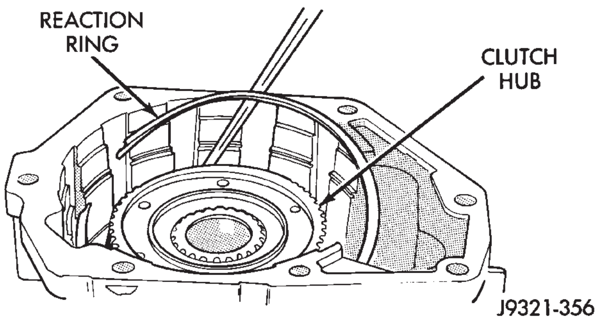


Fig. 259 Overdrive Clutch Reaction Ring Installation

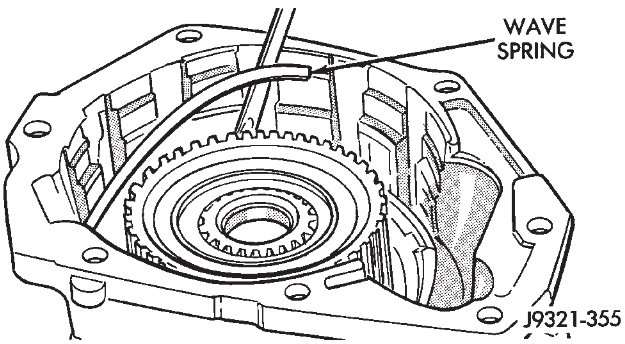


Fig. 260 Overdrive Clutch Wave Spring Installation

(4) Install overdrive clutch reaction plate first.

(5) Install first clutch disc followed by first clutch plate. Then install remaining clutch discs and plates in same order.

(6) Install clutch pack pressure plate.

(7) Install clutch pack wire-type retaining ring (Fig. 261).

INTERMEDIATE SHAFT SPACER SELECTION

(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.

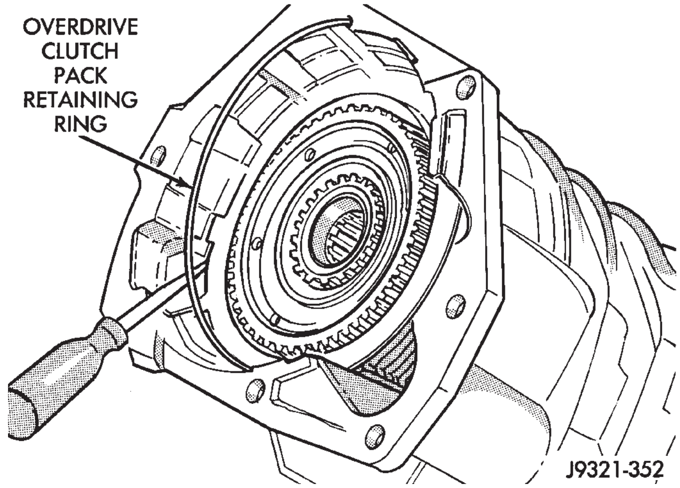


Fig. 261 Overdrive Clutch Pack Retaining Ring Installation

(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.

(b) Position Gauge Tool 6311 across face of overdrive case (Fig. 262). 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. 262).

(d) Select proper thickness end play spacer from spacer chart based on distance measured (Fig. 263).

(e) Remove Gauge Alignment Tool 6312.

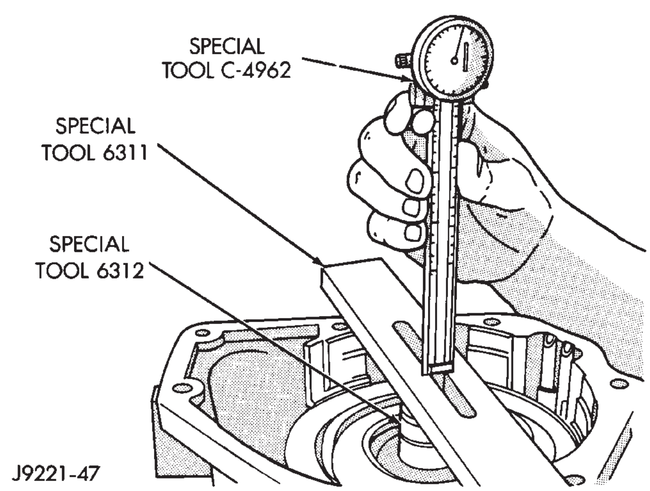


Fig. 262 Shaft End Play Measurement

DISASSEMBLY AND ASSEMBLY (Continued)

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. 263 Intermediate Shaft End Play Spacer Selection

OD THRUST PLATE SELECTION

(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 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. 264).

(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. 265).

(3) 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.

(4) 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.

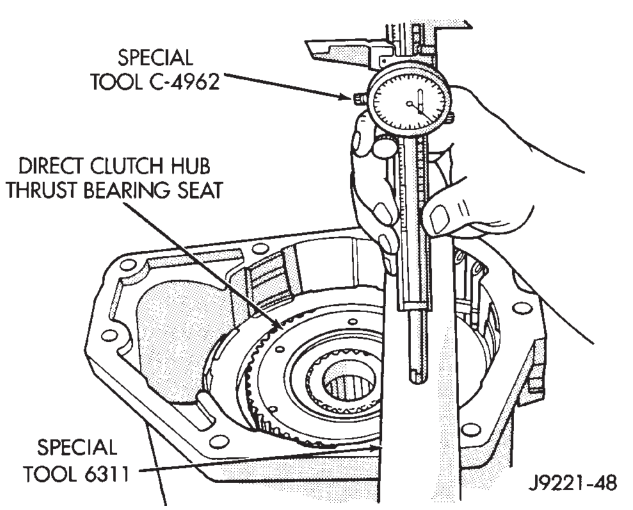


Fig. 264 Overdrive Piston Thrust Plate Measurement

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

J9121-342

Fig. 265 Overdrive Piston Thrust Plate Selection

OVERDRIVE PISTON ASSEMBLY

(1) Install new seals on over drive piston.

(2) Stand transmission case upright on bellhousing.

(3) Position Guide Ring 8114-1 on outer edge of overdrive piston retainer.

(4) Position Seal Guide 8114-2 on inner edge of overdrive piston retainer.

(5) Install overdrive piston in overdrive piston retainer by: aligning locating lugs on overdrive piston to the two mating holes in retainer.

(a) Aligning locating lugs on overdrive piston to the two mating holes in retainer.

(b) Lubricate overdrive piston seals with Mopar® Door Ease, or equivalent.

(c) Install piston over Seal Guide 8114–2 and inside Guide Ring 8114–1.

(d) Push overdrive piston into position in retainer.

(e) Verify that the locating lugs entered the lug bores in the retainer.

(6) Install intermediate shaft spacer on intermediate shaft.

(7) Install overdrive piston thrust plate on overdrive piston.

(8) Install overdrive piston thrust bearing on overdrive piston.

(9) Install transmission speed sensor and O-ring seal in overdrive case (Fig. 208).

CLEANING AND INSPECTION

VALVE BODY

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.

CLEANING AND INSPECTION (Continued)

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 all except the electrical 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 can stick to valve body parts, interfere with valve operation, and 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. Be sure the vent ports in the solenoid valve are open and not blocked by dirt or debris. Replace the valve and/or sensor only when DRB 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.

Inspect the throttle and manual valve levers and shafts. 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 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

TRANSMISSION

GENERAL INFORMATION

Inspect the transmission bushings during overhaul. Bushing condition is important as worn, scored bushings contribute to low pressures, clutch slip and

CLEANING AND INSPECTION (Continued)

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.

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-B.

Pre-sized service bushings are available for replacement purposes. Only the sun gear bushings are not serviced. Low cost of the sun gear assembly makes it easier to simply replace the gear and bushings as an assembly.

Heli-Coil inserts can be used to repair damaged, stripped or worn threads in aluminum parts. These inserts are available from most automotive parts suppliers. 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 3, Type 7176, transmission fluid during overhaul and assembly. Use petroleum jelly, Mopar® Door Ease, or Ru-Glyde to prelubricate seals, O-rings, and thrust washers. Petroleum jelly can also be used 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.

NOTE: 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/OVERDRIVE PISTON RETAINER

Clean the overrunning clutch assembly, clutch cam, low-reverse drum, and overdrive piston retainer in solvent. Dry them with compressed air after cleaning.

Inspect condition of each clutch part after cleaning. Replace the overrunning clutch roller and spring assembly if any rollers or springs are worn or damaged, or if the roller cage is distorted, or damaged. Replace the cam if worn, cracked or damaged.

Replace the low-reverse drum if the clutch race, roller surface or inside diameter is scored, worn or damaged. **Do not remove the clutch race from the low-reverse drum under any circumstances. Replace the drum and race as an assembly if either component is 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 drum. Replace the retainer if worn or damaged.

ACCUMULATOR

Inspect the accumulator piston and seal rings (Fig. 266). 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. 266). Replace the springs if the coils are cracked, distorted or collapsed.

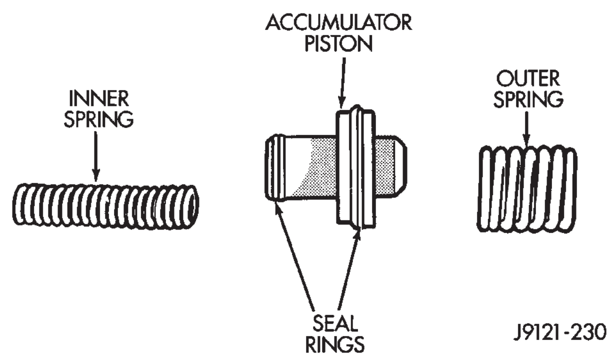


Fig. 266 Accumulator Components

FRONT SERVO

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,

CLEANING AND INSPECTION (Continued)

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.

REAR SERVO

Remove and discard the servo piston seal ring (Fig. 267). 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.

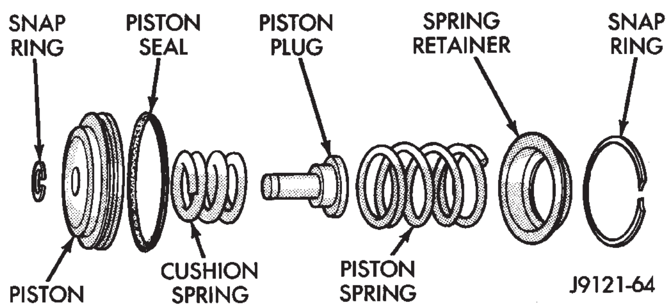


Fig. 267 Rear Servo Components

OIL PUMP AND REACTION SHAFT SUPPORT

(1) Clean pump and support components with solvent and dry them with compressed air.

(2) 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, broken, or severely worn.

(3) 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.

(4) Inspect the pump bushing. 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.

(5) Install the gears in the pump body and measure pump component clearances as follows:

(a) Clearance between outer gear and reaction shaft housing should be 0.010 to 0.063 mm (0.0004 to 0.0025 in.). Clearance between inner gear and reaction shaft housing should be 0.010 to 0.063 mm (0.0004 to 0.0025 in.). Both clearances can be measured at the same time by:

(I) Installing the pump gears in the pump housing.

(II) Position an appropriate piece of Plastigage™ across both gears.

(III) Align the plastigage to a flat area on the reaction shaft housing.

(IV) Install the reaction shaft to the pump housing.

(V) Separate the reaction shaft housing from the pump housing and measure the Plastigage™ following the instructions supplied with it.

(b) Clearance between inner gear tooth and outer gear should be 0.08 to 0.19 mm (0.0035 to 0.0075 in.). Measure clearance with an appropriate feeler gauge.

(c) Clearance between outer gear and pump housing should also be 0.010 to 0.19 mm (0.0035 to 0.0075 in.). Measure clearance with an appropriate feeler gauge.

FRONT CLUTCH

Clean and inspect the front clutch components. 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. 268). The ball must move freely and not stick.

NOTE: Inspect the clutch retainer bushings carefully (Fig. 269). 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.

REAR CLUTCH

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.

Replace the piston spring and wave spring if either part is distorted, warped or broken.

CLEANING AND INSPECTION (Continued)

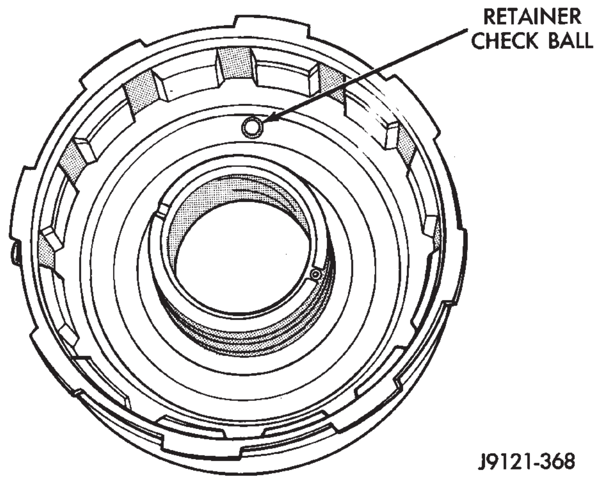


Fig. 268 Front Clutch Piston Retainer Check Ball Location

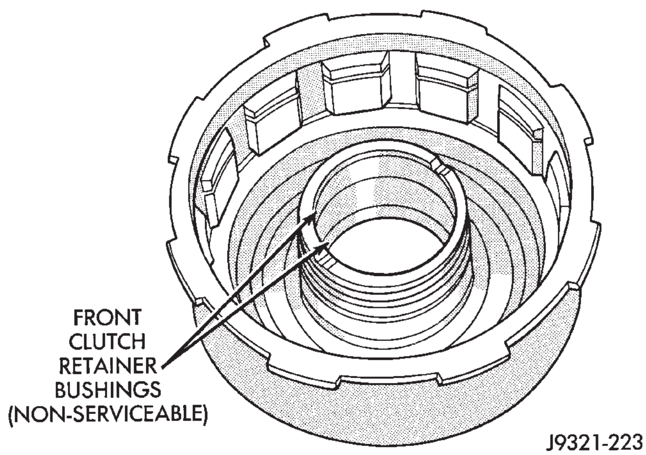


Fig. 269 Retainer Bushing Location/Inspection

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 balls in the retainer and piston. Each check ball must move freely and not stick.

Replace the retainer bushing if worn, scored, or doubt exists 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 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 worn, distorted, or 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.

PLANETARY GEARTRAIN

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 of these parts that are worn, distorted or damaged. Do not attempt to reuse these parts.

The planetary gear thrust washers are different sizes. The large diameter washers go on the front planetary and the smaller washers go on the rear planetary. All the washers have four locating tabs on them. These tabs fit in the holes or slots provided in each planetary gear.

Inspect the output shaft carefully. Pay particular attention to the machined bushing/bearing surfaces on the shaft and the governor valve shaft bore at the shaft rear.

Replace the output shaft if the 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 (especially at the governor valve shaft bore).

The annulus gears can be removed from their supports if necessary. Just remove the snap rings and separate the two parts when replacement is necessary. In addition, the annulus gear bushings can be replaced if severely worn, or scored. However it is not necessary to replace the bushings if they only exhibit normal wear. Check bushing fit on the output shaft to be sure.

OVERDRIVE UNIT

Clean the geartrain and case components 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

CLEANING AND INSPECTION (Continued)

abrasive materials. Replace severely scored components; do not try to salvage them.

Check condition of the park lock components and the overdrive case.

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. 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. 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. 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. 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. 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 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. 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.

ADJUSTMENTS

BRAKE TRANSMISSION SHIFT INTERLOCK

The park interlock cable is part of the brake/shift lever interlock system. Correct cable adjustment is important to proper interlock operation. The gear shift and park interlock cables must both be correctly adjusted in order to shift out of Park.

Park Interlock Cable Adjustment Procedure

(1) Shift the transmission into the Park position.

(2) Rotate the ignition switch to the LOCK position. **Be sure ignition key cylinder is in LOCK position. Cable will not adjust correctly in any other position.**

(3) Remove shift lever bezel and/or console assembly.

(4) Pull the cable lock button up to release cable.

(5) Pull cable rearward. Then release cable and press lock button down until it snaps in place.

BTSI FUNCTION CHECK

(1) Verify removal of ignition key allowed in park position only.

(2) When the shift lever is in park, and the shift handle push-button is in the out position, the ignition key cylinder should rotate freely from off to lock. When the shifter is in any other position, the ignition key should not rotate from off to lock.

(3) Shifting out of park should be possible when the ignition key cylinder is in the off position.

(4) Shifting out of park should not be possible while applying 25 lb. max. handle push-button force, and ignition key cylinder is in the run or start positions, unless the foot brake pedal is depressed approximately 1/2 inch (12mm).

(5) Shifting out of park should not be possible when the ignition key cylinder is in the accessory or lock position.

(6) Shifting between any gears neutral or park may be done without depressing foot brake with ignition switch in run or start positions and vehicle stationary or in motion.

(7) The floor shifter lever and gate positions should be in alignment with all transmission detent positions.

(8) Engine starts must be possible with floor shift lever in park or neutral positions only. Engine starts must not be possible in any other gate positions other than park or neutral.

(9) With floor shift lever handle push-button not depressed and lever detent in:

- PARK POSITION- apply forward force on center of handle and remove pressure. Engine start must be possible.

ADJUSTMENTS (Continued)

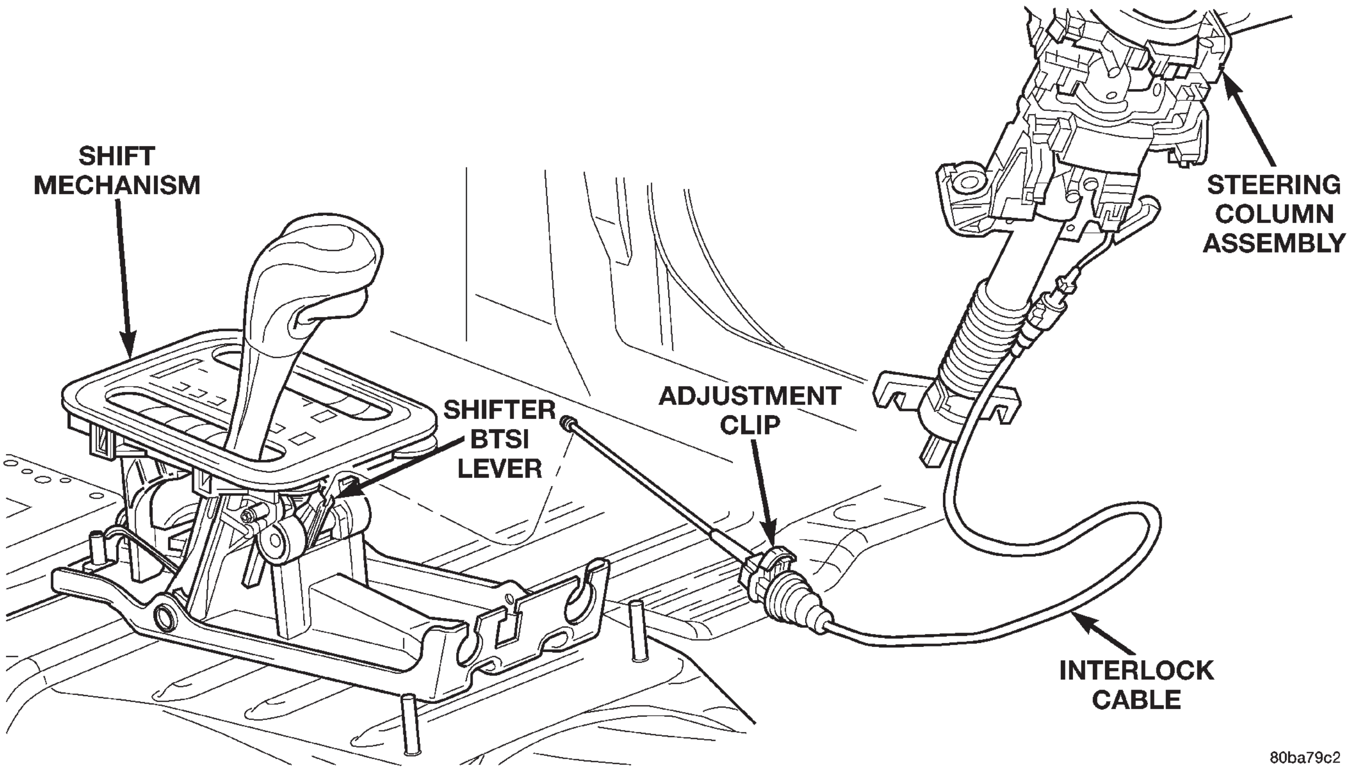


Fig. 270 Brake Transmission Shift Interlock Cable

- PARK POSITION- apply rearward force on center of handle and remove pressure. Engine start must be possible.
- NEUTRAL POSITION- engine start must be possible.
- NEUTRAL POSITION, ENGINE RUNNING AND BRAKES APPLIED- Apply forward force on center of shift handle. Transmission should not be able to shift into reverse detent.

TRANSMISSION THROTTLE VALVE CABLE ADJUSTMENT

The transmission throttle valve is controlled by a cable attached to the throttle linkage on one end and the transmission throttle valve control lever on the transmission end (Fig. 271).

A correctly adjusted throttle valve cable will cause the throttle valve control lever on the transmission to move simultaneously with the throttle linkage from the idle position. Proper adjustment will allow simultaneous movement without causing the transmission throttle valve lever to either move ahead of, or lag behind the throttle linkage bell crank lever.

Checking Throttle Valve Cable Adjustment

(1) Disconnect the negative battery cable.

(2) Remove the intercooler outlet hose from the engine and position it out of the way.

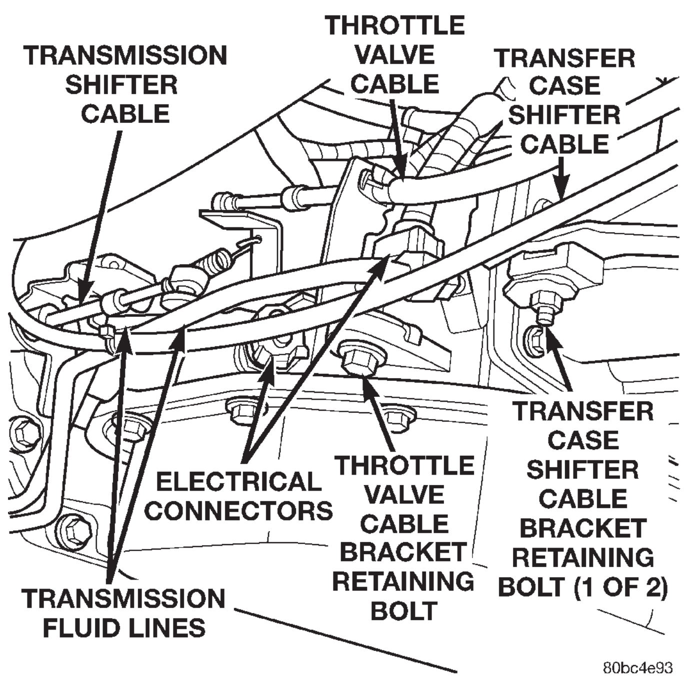


Fig. 271 Throttle Valve Cable at Transmission

(3) Raise the vehicle on a hoist and verify that the transmission throttle valve control lever is at the idle position (Fig. 272). This position can be verified by observing the throttle valve lever tension spring. Control lever should be at its stop in the direction being pulled by the tension spring.

ADJUSTMENTS (Continued)

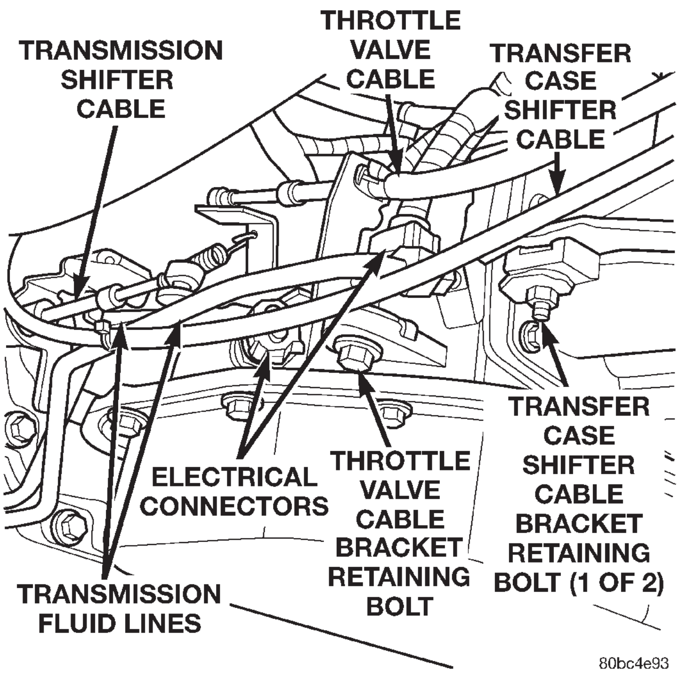


Fig. 272 Throttle Valve Cable at Transmission

(4) Lower the vehicle on the hoist.

(5) Disconnect the throttle valve cable end (B) from the throttle bell crank lever (C). **Carefully slide cable off stud. Do not pry or pull cable off.**

(6) Compare the position of cable end (B) to throttle bell crank lever (C) (Fig. 273).

• T.V. cable end (B) and throttle bell crank lever (C) should be aligned (or centered on one another) to within 1 mm (0.039 in.) in either direction (Fig. 273).

• If cable end and attachment stud are misaligned, the cable will have to be adjusted as described in Throttle Valve Cable Adjustment procedure.

(7) Reconnect the cable end (B) on the throttle bell crank lever (C). Then with aid of a helper, observe movement of transmission throttle lever and lever on throttle linkage.

• If the transmission throttle valve lever moves ahead of, or lags behind the throttle lever, cable adjustment will be necessary. Or, if the throttle lever prevents the transmission lever from returning to closed position, cable adjustment will be necessary.

(8) Install the intercooler outlet hose on the engine.

(9) Connect the negative battery cable.

Throttle Valve Cable Adjustment Procedure

(1) Disconnect the negative battery cable.

(2) Remove the intercooler outlet hose from the engine and position it out of the way.

(3) Disconnect the throttle valve cable end (B) from the throttle bell crank lever (C). **Carefully slide cable off stud. Do not pry or pull cable off.**

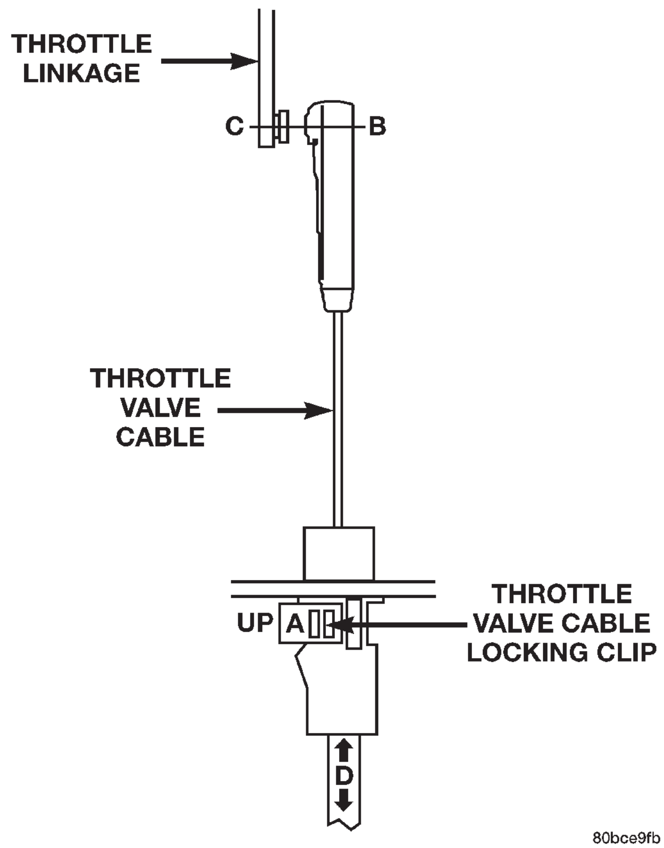


Fig. 273 Throttle Valve Cable at Throttle Linkage

(4) Pry the T.V. cable lock (A) into the UP position (Fig. 274). This will unlock the cable and allow for readjustment.

(5) Apply just enough tension on the T.V. cable (B) to remove any slack in the braided cable. **Pulling to tight will cause the T.V. lever on the transmission to move out of its idle position, which will result in an incorrect T.V. cable adjustment.** Slide the sheath of the T.V. cable (D) back and forth until the centerlines of the T.V. cable end (B) and the throttle bell crank lever (C) are aligned within one millimeter (1mm) (Fig. 274).

(6) While holding the T.V. cable in the set position push the T.V. cable lock (A) into the down position (Fig. 274). This will lock the present T.V. cable adjustment.

(7) Reconnect the T.V. cable (B) to the throttle bell crank lever (C) (Fig. 274).

(8) Double check cable operation and adjustment. Verify the transmission throttle valve lever and the throttle bell crank lever move simultaneously.

(9) Install the intercooler outlet hose on the engine.

(10) Connect the negative battery cable.

ADJUSTMENTS (Continued)

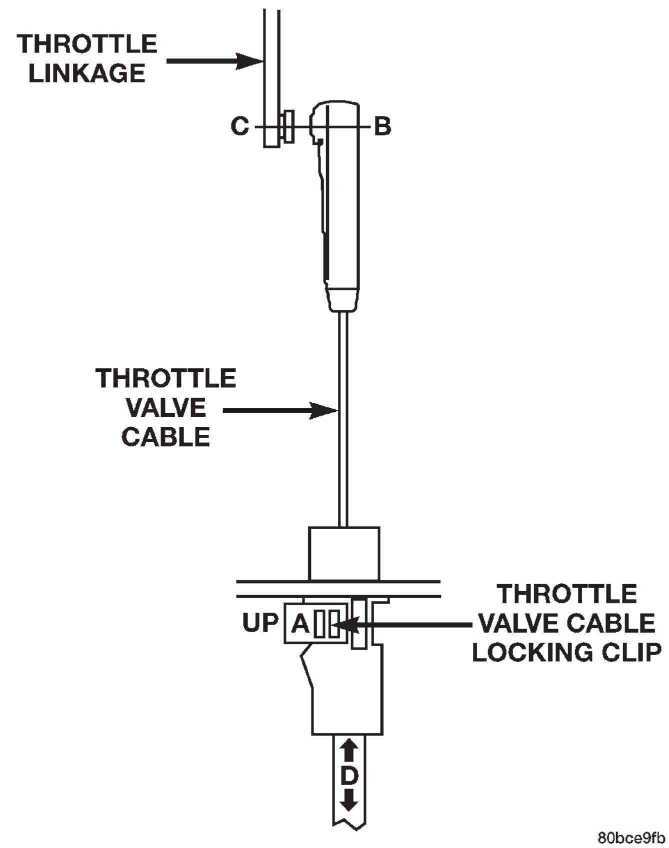


Fig. 274 Throttle Valve Cable at Throttle Linkage

GEARSHIFT CABLE

Check adjustment by starting the engine in Park and Neutral. Gearshift cable adjustment is CORRECT if the engine starts only in the Park and Neutral 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 or transmission range sensor may be faulty.

Gearshift Adjustment Procedure

(1) Shift the transmission into the "Park" position.

(2) Remove the shift lever bezel and floor console as necessary for access to the shift cable adjustment screw (Fig. 275). Located near the shifter assembly.

(3) Loosen the shift cable adjustment screw (Fig. 275).

(4) Raise the vehicle on a hoist.

(5) Unsnap the cable eyelet from the transmission shift lever (Fig. 276).

(6) Verify the transmission shift lever is in Park position by moving lever fully rearward. Last rearward detent is Park position (Fig. 276).

(7) Verify positive engagement of transmission park lock by attempting to rotate propeller shaft. Shaft will not rotate when park lock is engaged.

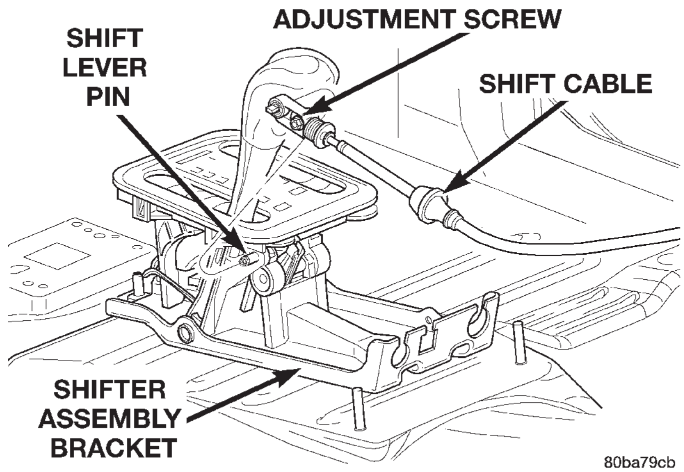


Fig. 275 Shift Cable at Shifter

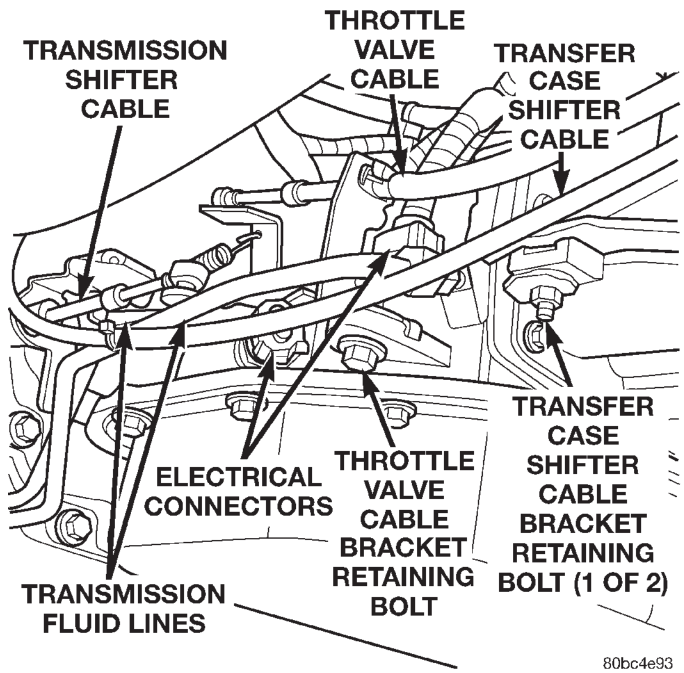


Fig. 276 Transmission Control Cables at Transmission

(8) Snap the shift cable eyelet onto the transmission shift lever (Fig. 276).

(9) Lower the vehicle on the hoist.

(10) Tighten the shift cable adjustment screw to 7 N·m (65 in. lbs.).

(11) Verify correct cable operation. Engine should start only in the Park and Neutral positions.

(12) Install the shifter bezel and floor console components removed for access.

ADJUSTMENTS (Continued)

BAND ADJUSTMENTS

FRONT BAND ADJUSTMENT

The front (kickdown) band adjusting screw is located on the left side of the transmission case above the manual valve and throttle valve levers.

(1) Raise vehicle.

(2) Loosen band adjusting screw locknut 3-5 turns (Fig. 277). Be certain the center adjusting screw turns freely in case. Apply lubricant to screw threads if necessary.

(3) Tighten the 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.

CAUTION: If Adapter C-3705 is needed to reach the adjusting screw (Fig. 278), tighten the screw to only 5 N·m (47-50 in. lbs.) torque.

44RE TRANSMISSION

- Back off front band adjusting screw 1- 7/8 turns.
- Hold the center adjusting screw in position and torque the locknut to 41 N·m (30 ft. lbs.) torque.

(4) Lower vehicle.

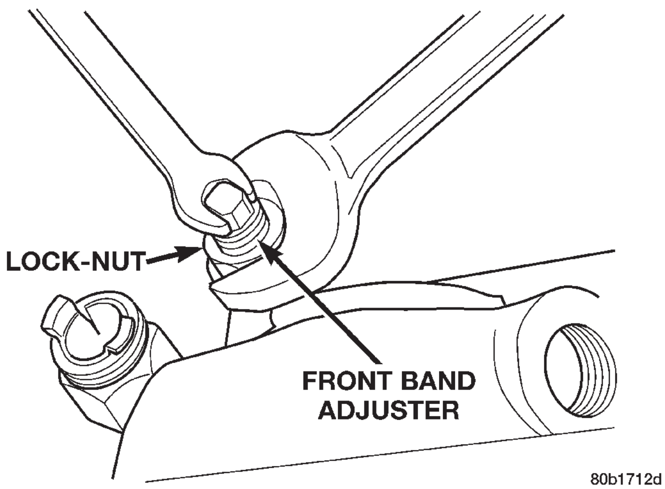


Fig. 277 Front Band Adjustment Screw Location

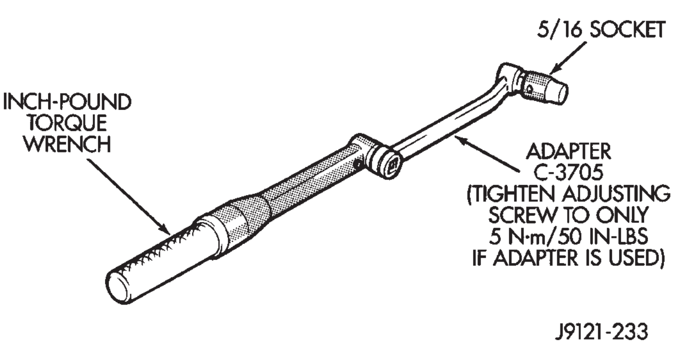


Fig. 278 Band Adjustment Adapter Tool

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 (Fig. 279). Be sure adjusting screw turns freely in lever.

(4) Tighten adjusting screw to 8 N·m (72 in. lbs.) torque.

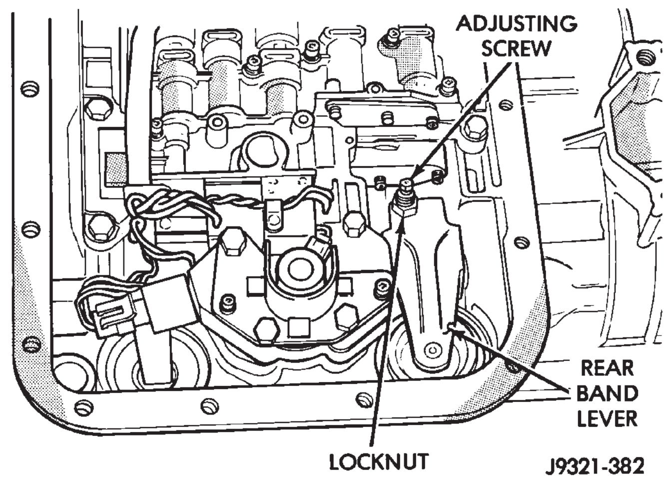


Fig. 279 Rear Band Adjusting Screw Location

44RE TRANSMISSION

- Back off adjusting screw 4 turns.
- Hold adjusting screw in place and tighten locknut to 34 N·m (25 ft. lbs.) torque.

(5) Position new gasket on oil pan and install pan on transmission. Tighten pan bolts to 17 N·m (13 ft. lbs.) torque.

(6) Lower vehicle and refill transmission with Mopar® ATF Plus 3, Type 7176 fluid.

VALVE BODY

CONTROL PRESSURE ADJUSTMENTS

There are two control pressure adjustments on the valve body;

- Line Pressure
- 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.

LINE PRESSURE ADJUSTMENT

Measure distance from the valve body to the inner edge of the adjusting screw with an accurate steel scale (Fig. 280).

Distance should be 33.4 mm (1-5/16 in.).

ADJUSTMENTS (Continued)

If adjustment is required, turn the adjusting screw in, or out, to obtain required distance setting.

NOTE: 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.

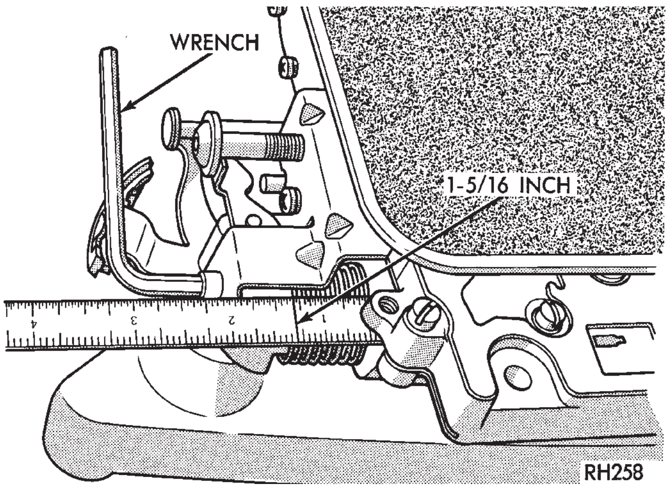


Fig. 280 Line Pressure Adjustment

THROTTLE PRESSURE ADJUSTMENT

Insert Gauge Tool C-3763 between the throttle lever cam and the kickdown valve stem (Fig. 281).

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.

NOTE: The kickdown valve spring must be fully compressed and the kickdown valve completely bottomed to obtain correct adjustment.

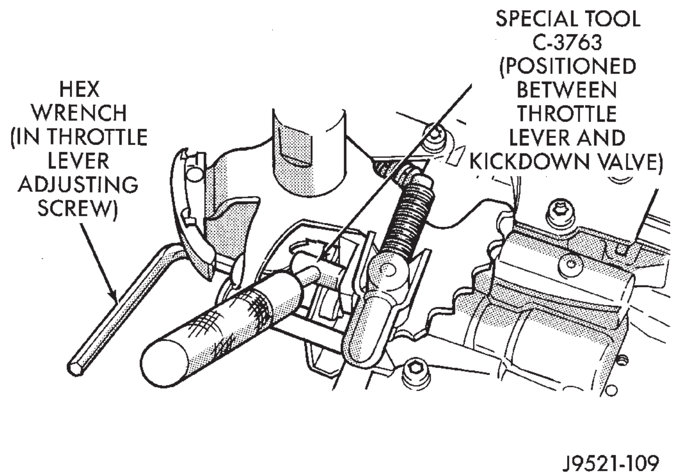
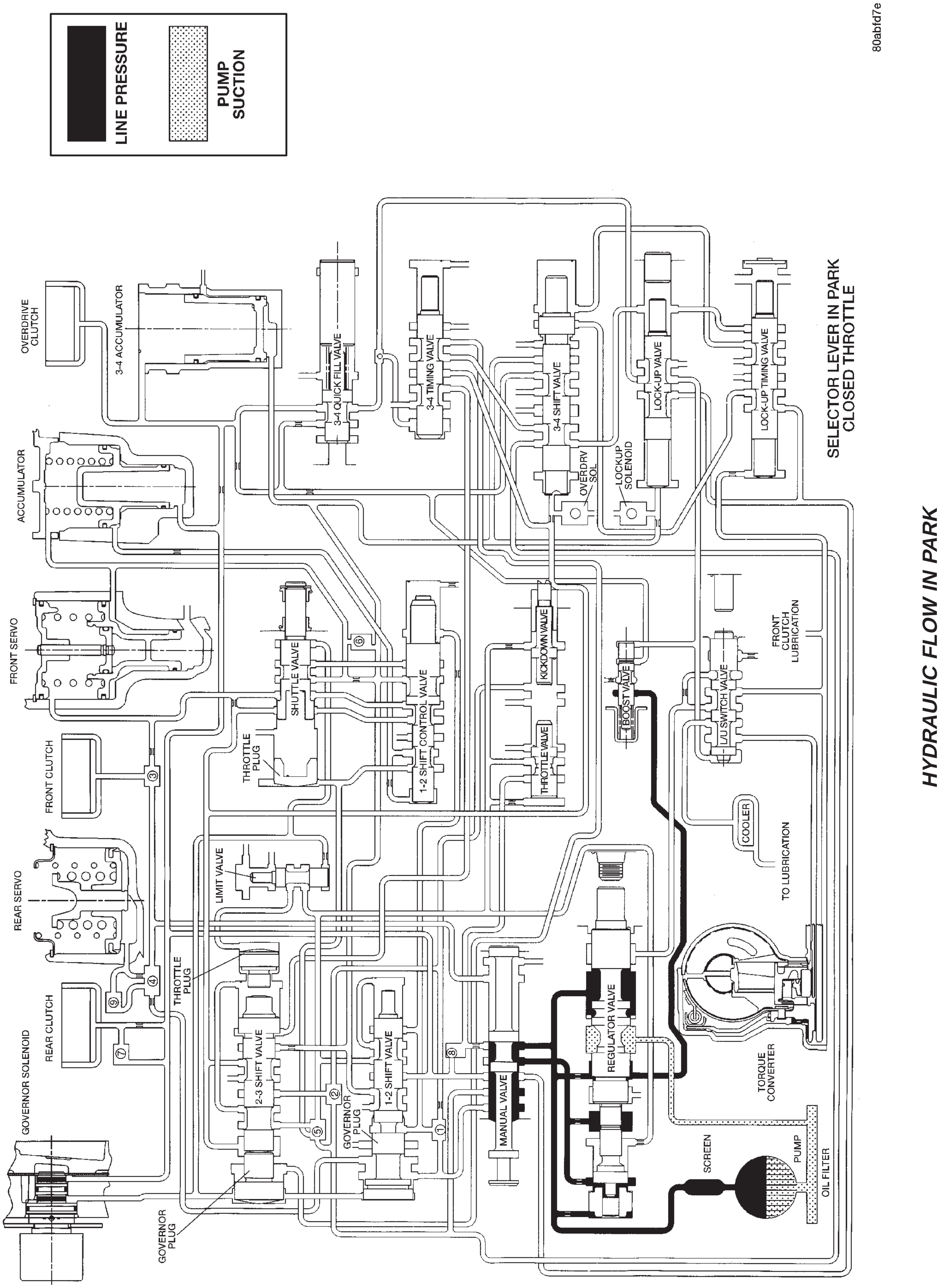


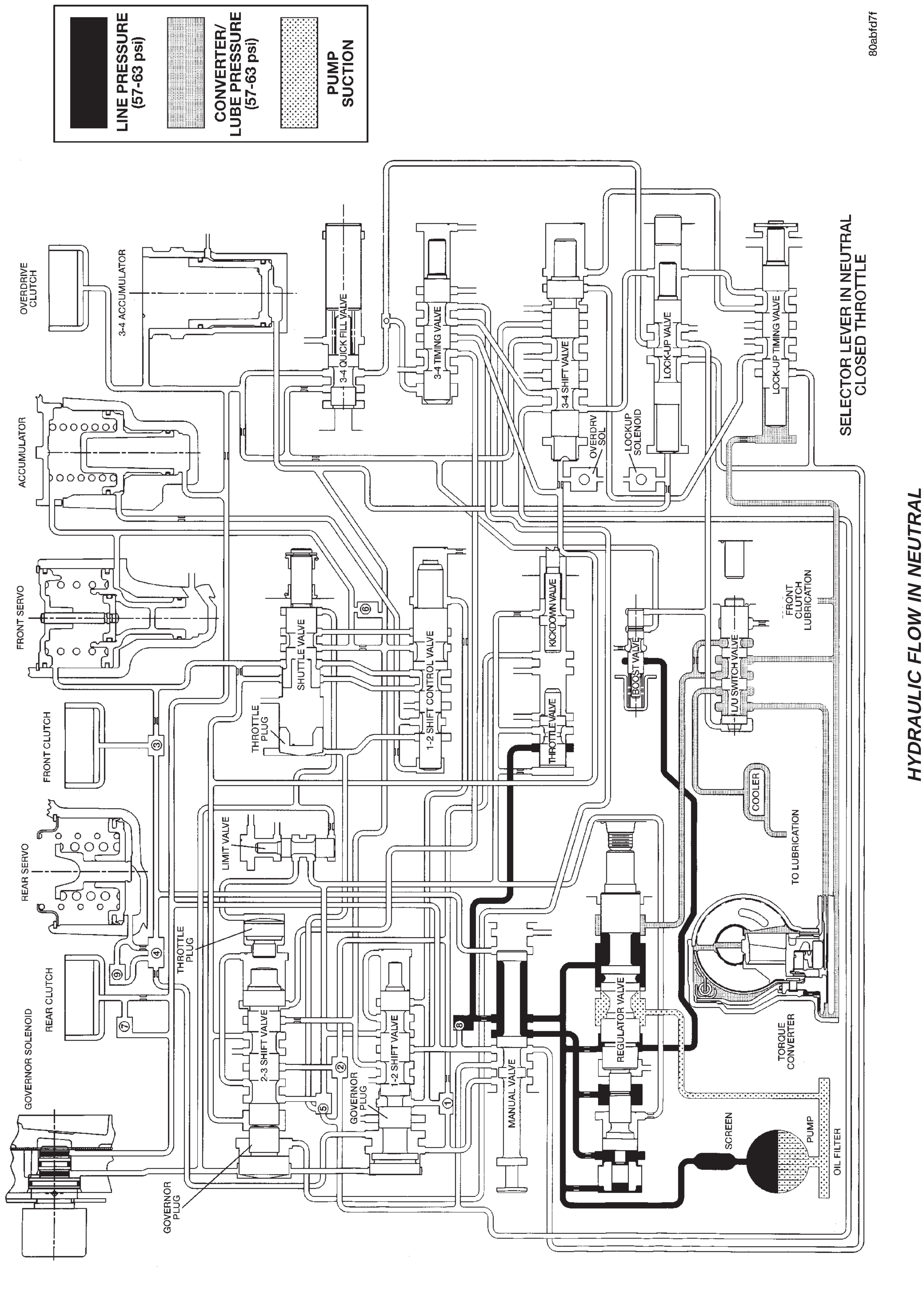
Fig. 281 Throttle Pressure Adjustment

SCHEMATICS AND DIAGRAMS

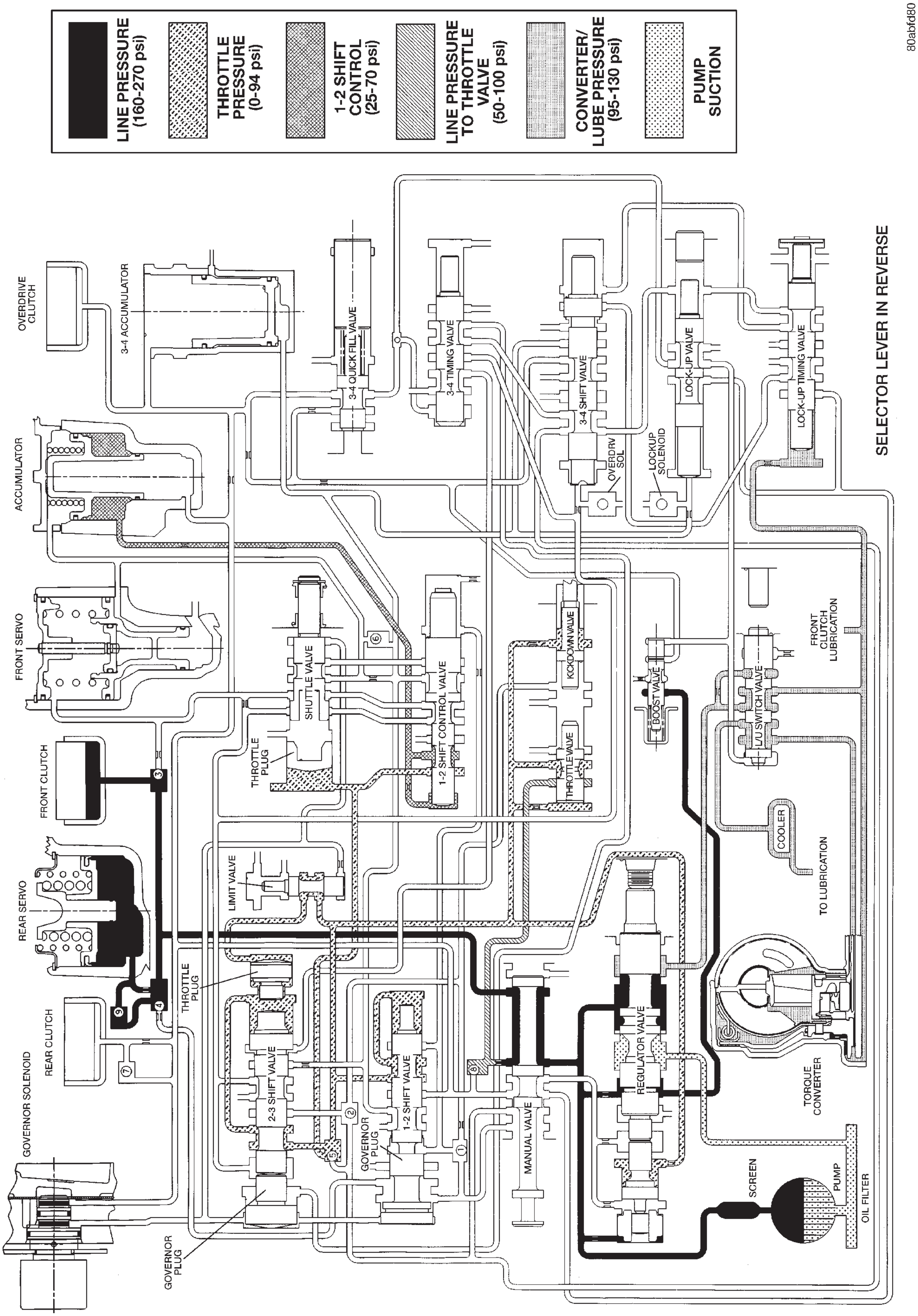
HYDRAULIC SCHEMATICS



SCHEMATICS AND DIAGRAMS (Continued)

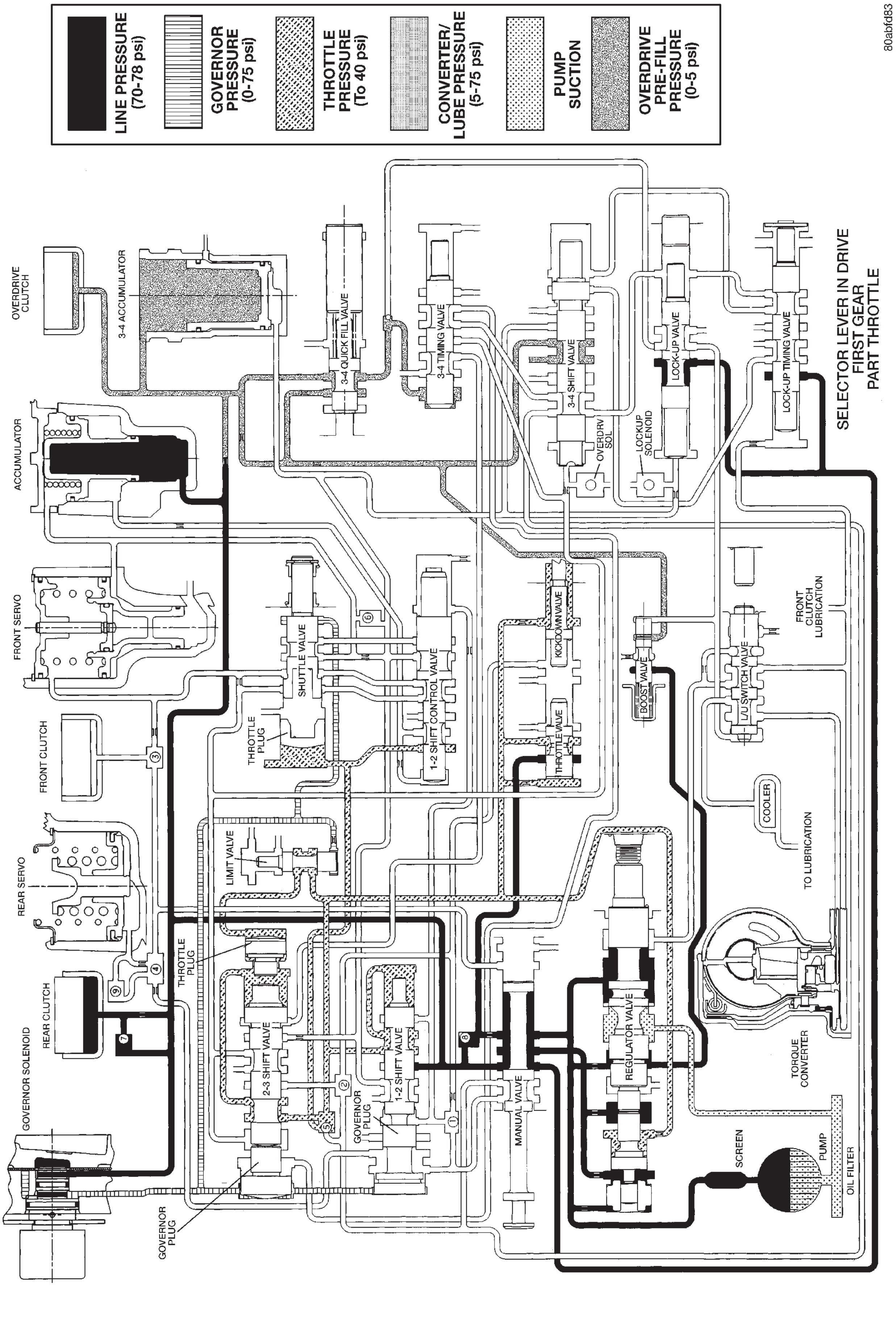


SCHEMATICS AND DIAGRAMS (Continued)



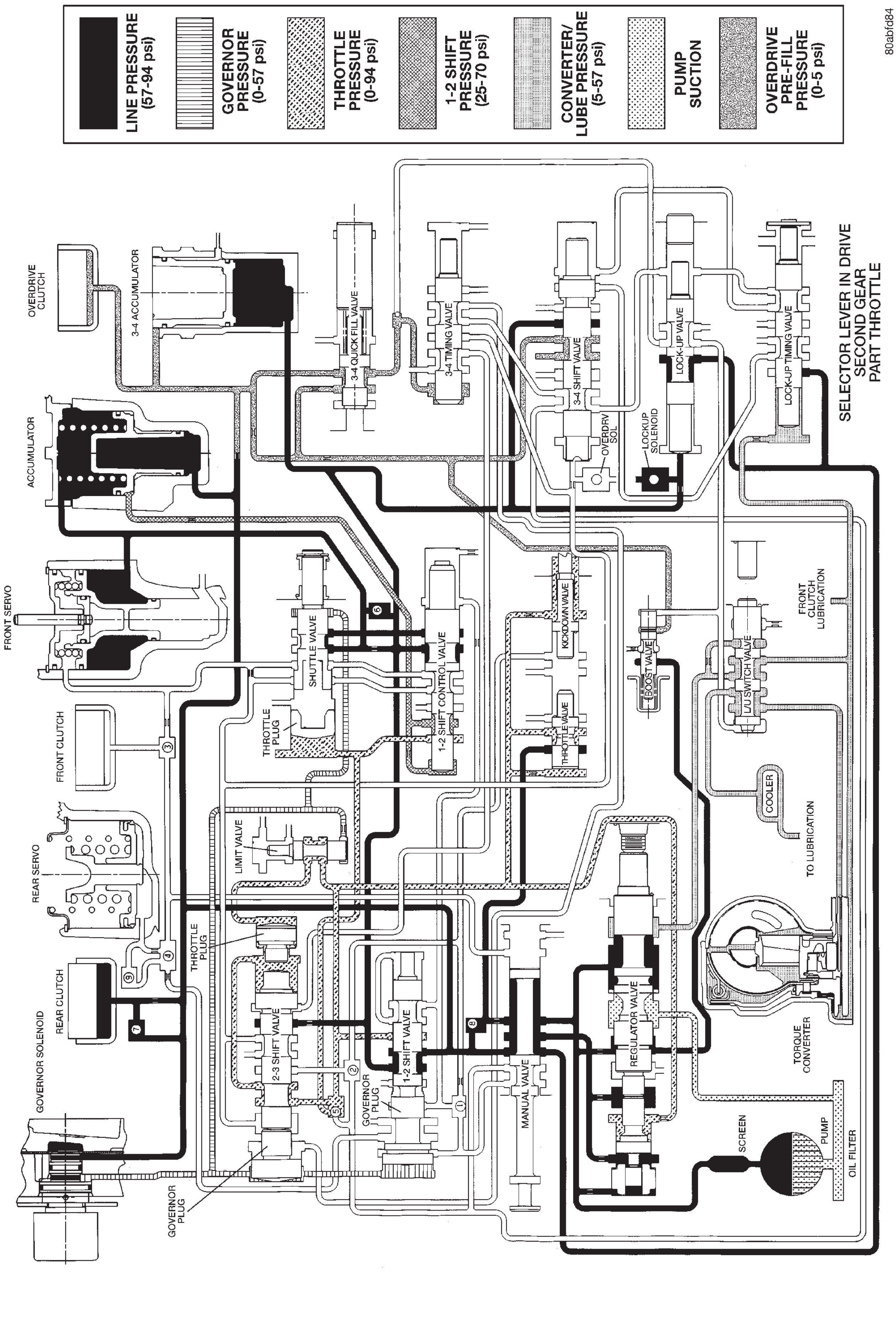
HYDRAULIC FLOW IN REVERSE

SCHEMATICS AND DIAGRAMS (Continued)



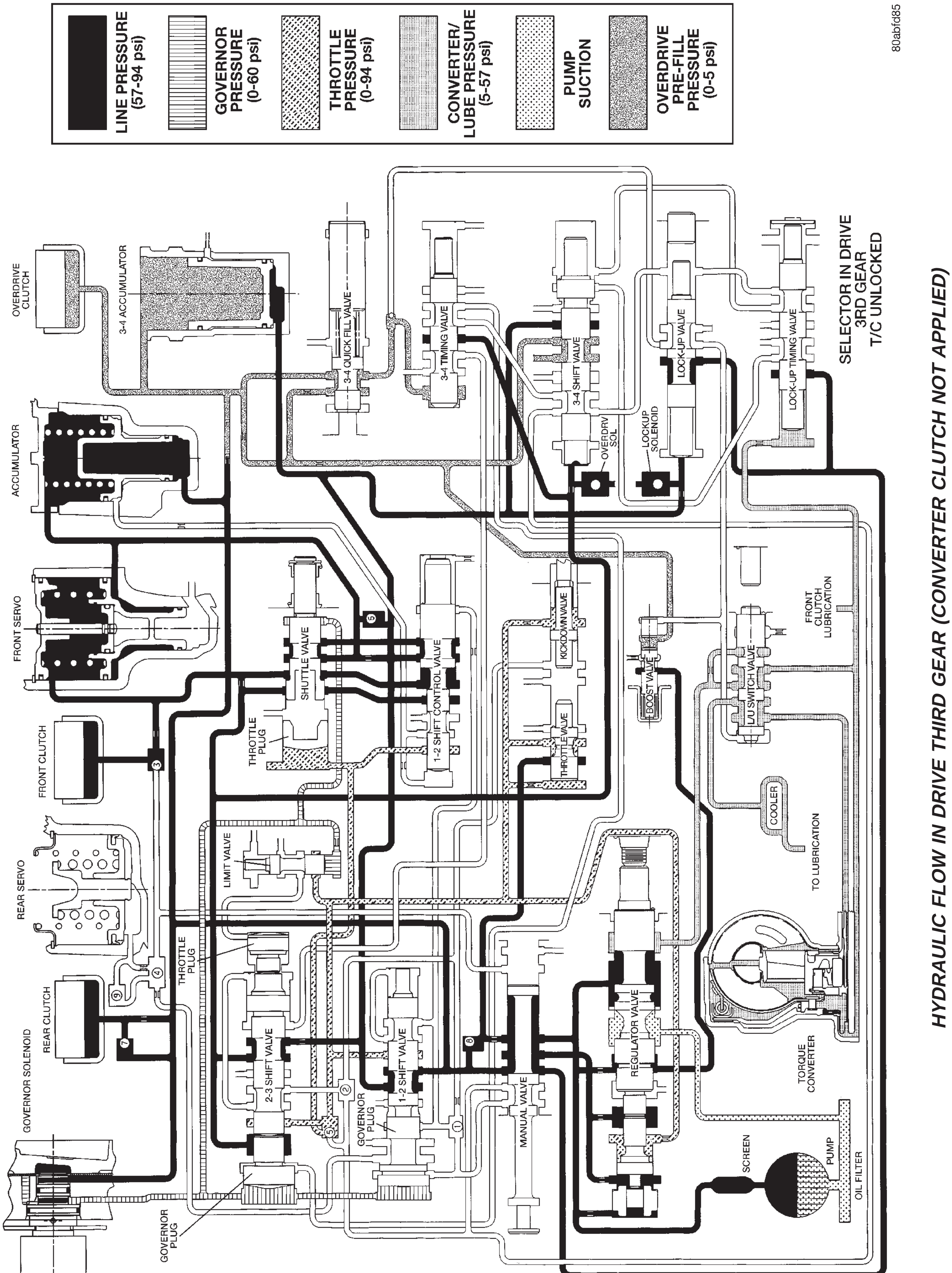
HYDRAULIC FLOW IN DRIVE FIRST GEAR

SCHEMATICS AND DIAGRAMS (Continued)



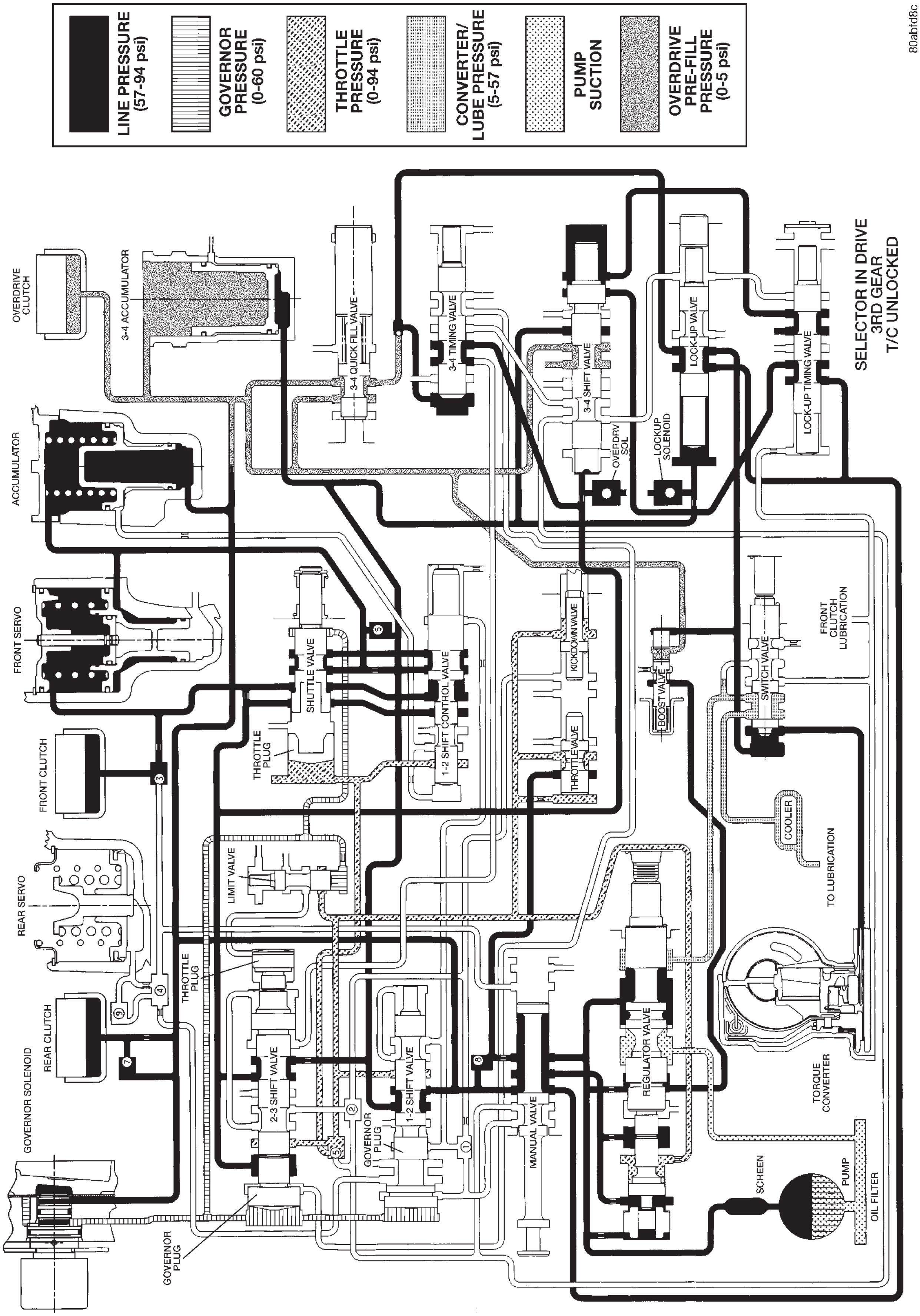
HYDRAULIC FLOW IN DRIVE SECOND GEAR

SCHEMATICS AND DIAGRAMS (Continued)



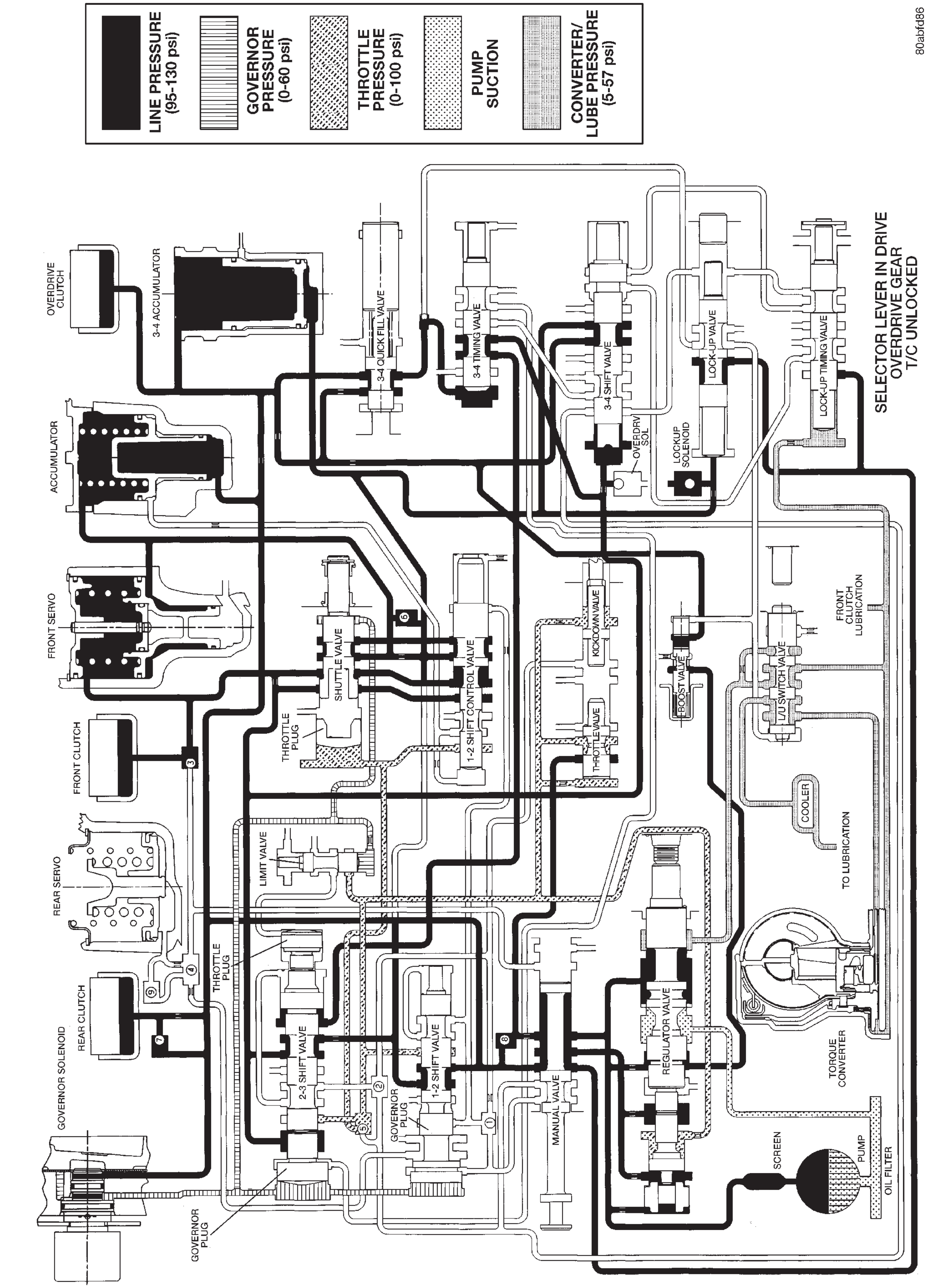
HYDRAULIC FLOW IN DRIVE THIRD GEAR (CONVERTER CLUTCH NOT APPLIED)

SCHEMATICS AND DIAGRAMS (Continued)



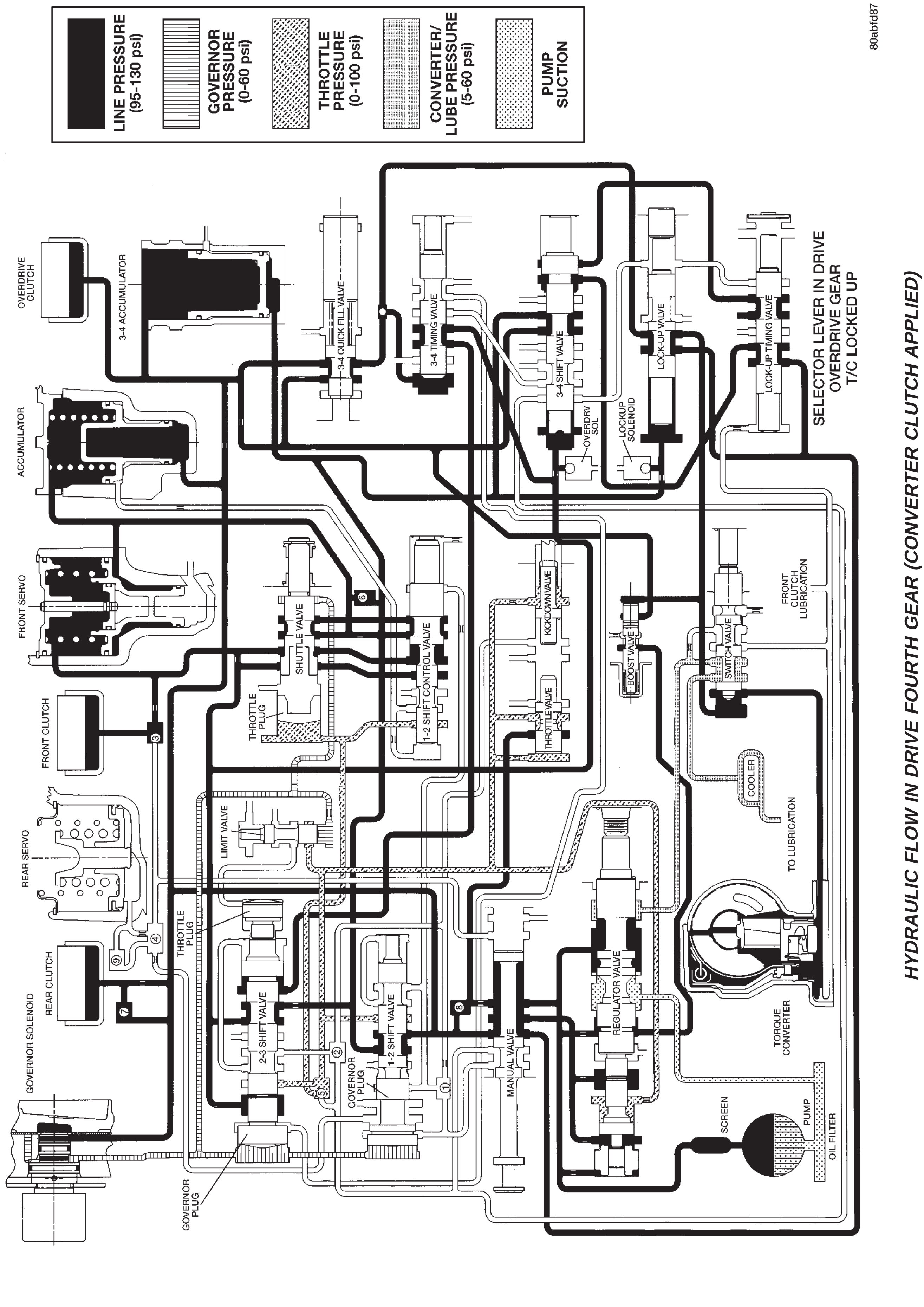
HYDRAULIC FLOW IN DRIVE THIRD GEAR (CONVERTER CLUTCH APPLIED)

SCHEMATICS AND DIAGRAMS (Continued)

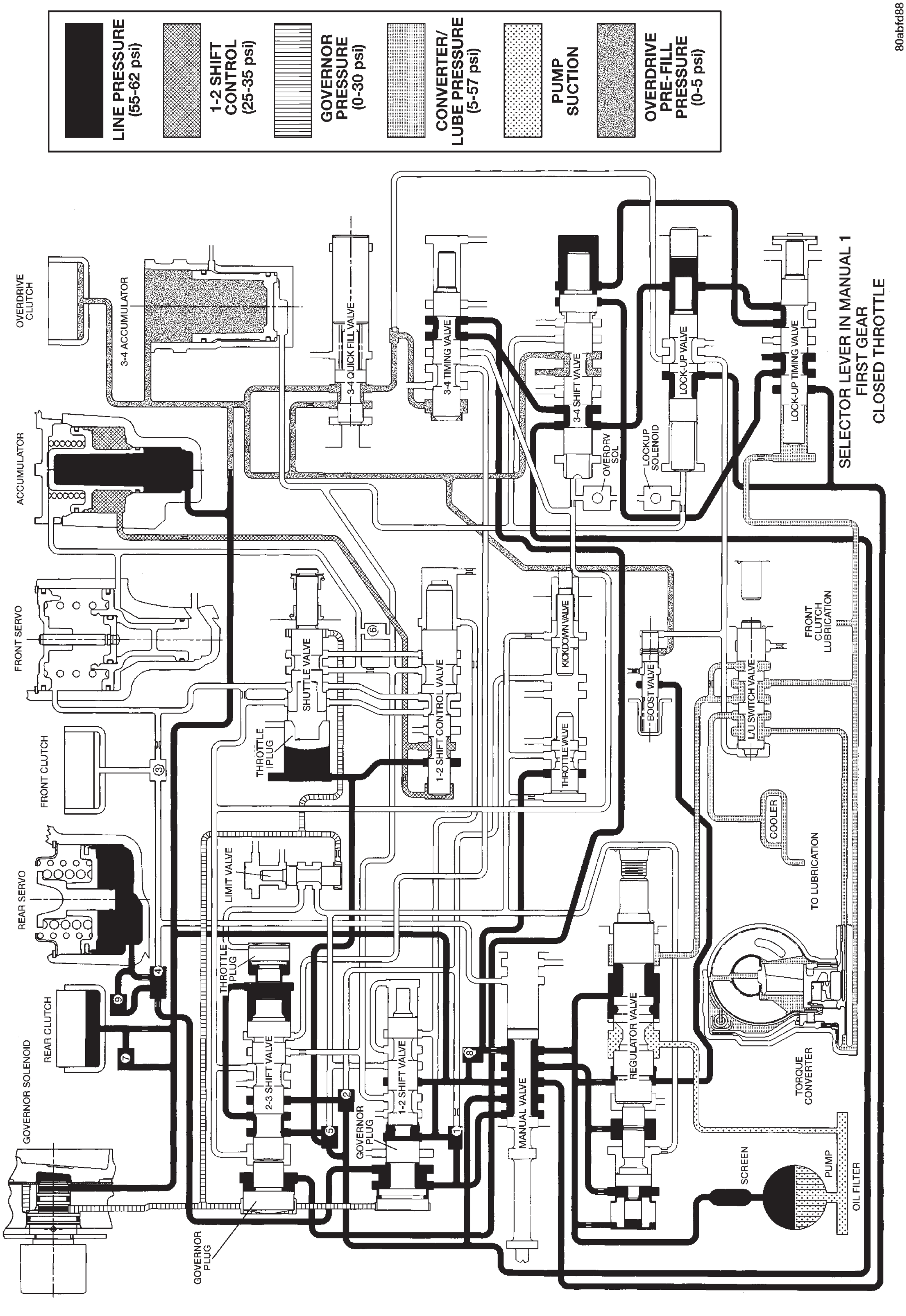


HYDRAULIC FLOW IN DRIVE FOURTH GEAR (CONVERTER CLUTCH NOT APPLIED)

SCHEMATICS AND DIAGRAMS (Continued)

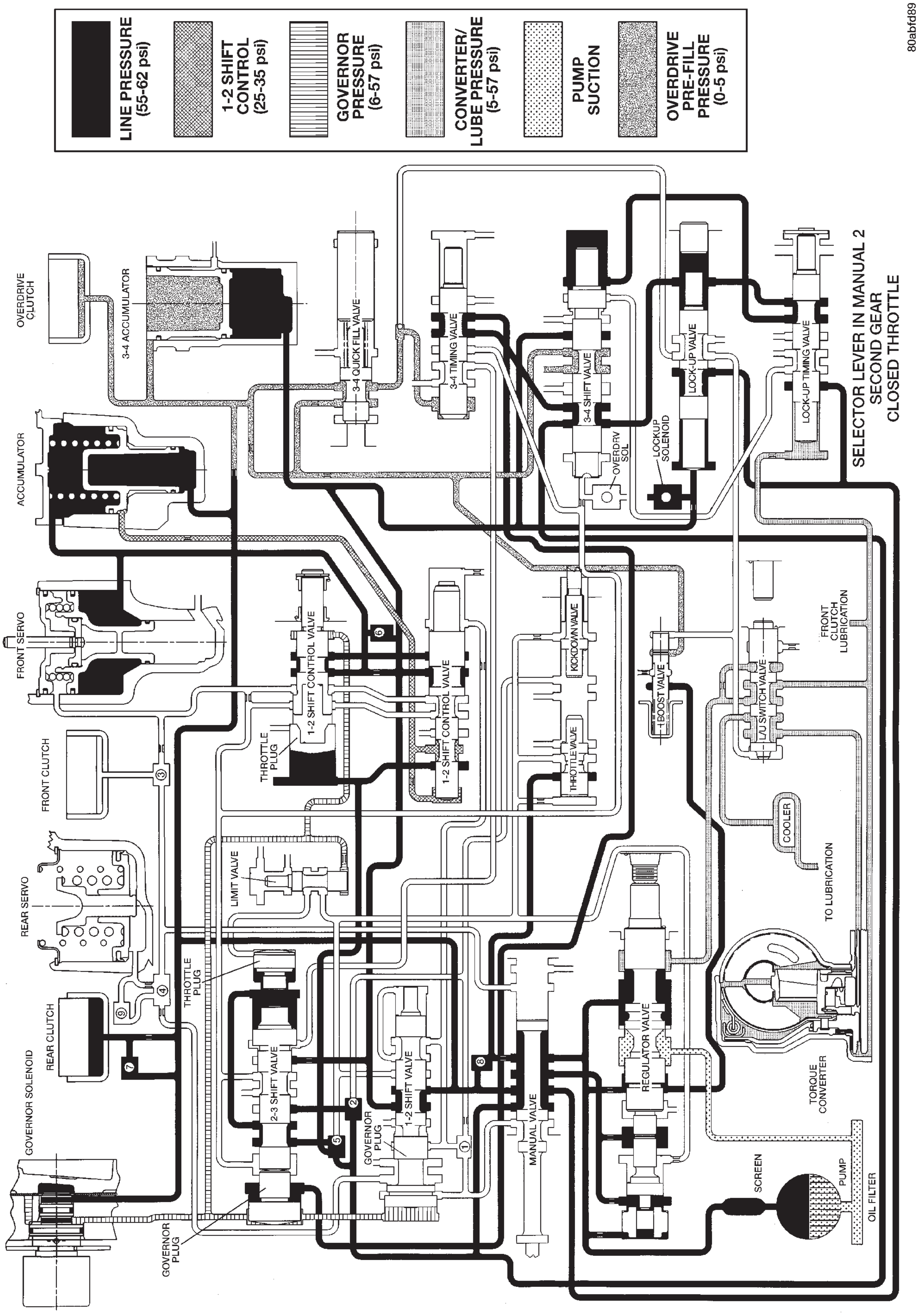


SCHEMATICS AND DIAGRAMS (Continued)



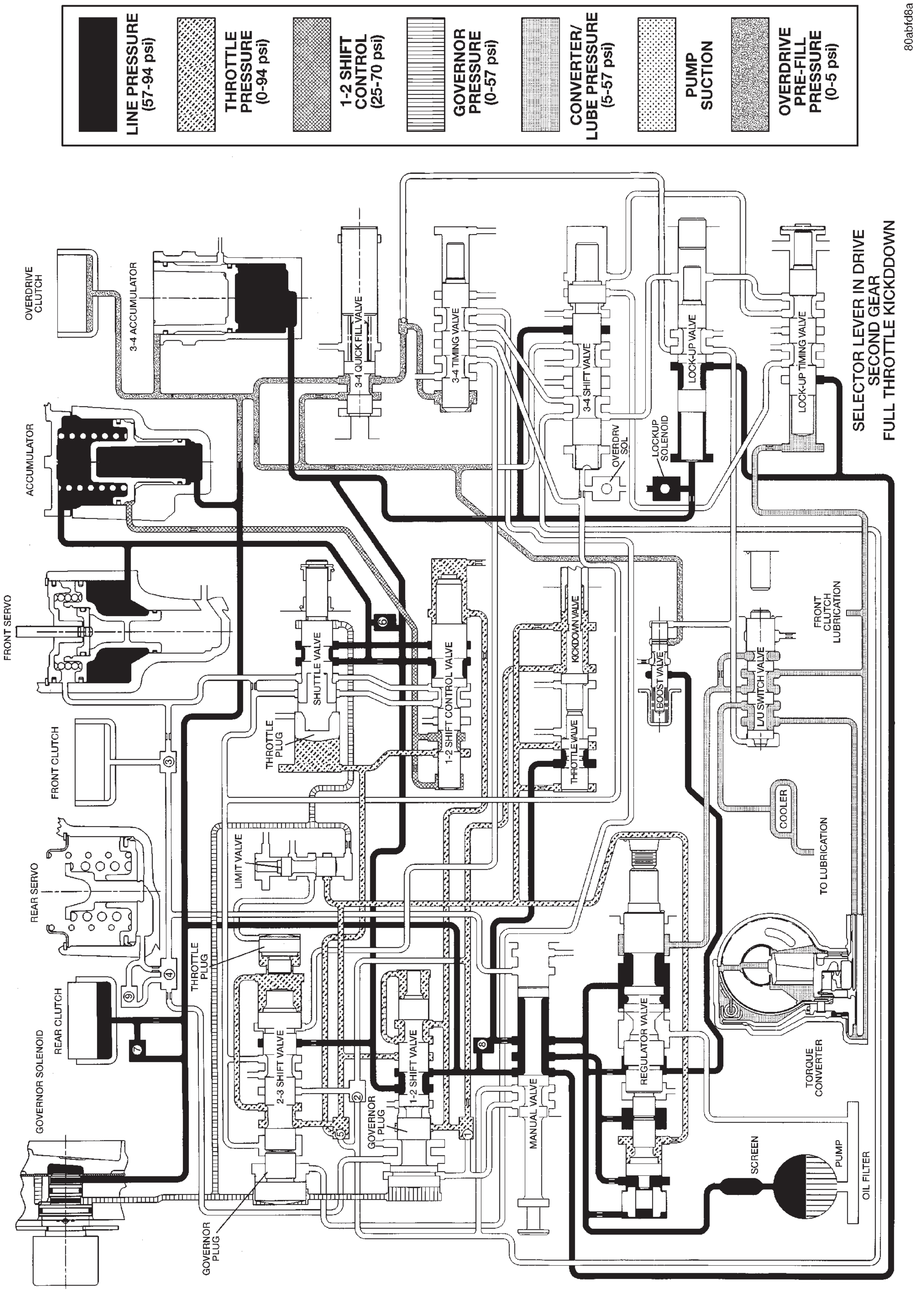
HYDRAULIC FLOW IN MANUAL LOW (1)

SCHEMATICS AND DIAGRAMS (Continued)



HYDRAULIC FLOW IN MANUAL SECOND (2)

SCHEMATICS AND DIAGRAMS (Continued)



HYDRAULIC FLOW DURING FULL THROTTLE 3–2 DOWNSHIFT (PASSING GEAR)

SPECIFICATIONS

TRANSMISSION

GENERAL

Component	Metric	Inch
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.	1.70-3.40mm	0.067-0.134 in.
Clutch pack clearance/ Rear.	0.81-1.40 mm	0.022-0.037 in.
Front Clutch	44RE-5 discs	
Rear Clutch	44RE-4 discs	
Overdrive clutch disc usage	44RE-4 discs	
Direct clutch disc usage	44RE-8 discs	
44RE Band adjustment from 72 in. lbs.		
Front band	Back off 1-7/8 turns	
Rear band	Back off 4 turns	
Recommended fluid	Mopar® ATF Plus 3, type 7176	

GEAR RATIOS

- 1ST GEAR-2.74
- 2ND GEAR-1.54
- 3RD GEAR-1.00
- 4TH GEAR-0.69
- REV.GEAR-2.21

TORQUE

DESCRIPTION	TORQUE
Fitting, cooler line at trans	18 N·m (13 ft. lbs.)
Bolt, torque convertor	31 N·m (23 ft. lbs.)
Bolt/nut, crossmember	68 N·m (50 ft. lbs.)
Bolt, driveplate to crankshaft	75 N·m (55 ft. lbs.)
Plug, front band reaction	17 N·m (13 ft. lbs.)
Locknut, front band adj.	34 N·m (25 ft. lbs.)
Switch, park/neutral	34 N·m (25 ft. lbs.)
Bolt, fluid pan	17 N·m (13 ft. lbs.)
Screws, fluid filter	4 N·m (35 in. lbs.)
Bolt, oil pump	20 N·m (15 ft. lbs.)
Bolt, overrunning clutch cam	17 N·m (13 ft. lbs.)
Bolt, O/D to trans.	34 N·m (25 ft. lbs.)
Bolt, O/D piston retainer	17 N·m (13 ft. lbs.)
Plug, pressure test port	14 N·m (10 ft. lbs.)
Bolt, reaction shaft support	20 N·m (15 ft. lbs.)
Locknut, rear band	41 N·m (30 ft. lbs.)
Bolt, valve body to case	12 N·m (100 in. lbs.)
Screw, solenoid wiring connector	4 N·m (35 in. lbs.)
Screw, solenoid to transfer plate	4 N·m (35 in. lbs.)

SPECIFICATIONS (Continued)

THRUST WASHER/SPACER/SNAP RING DIMENSIONS

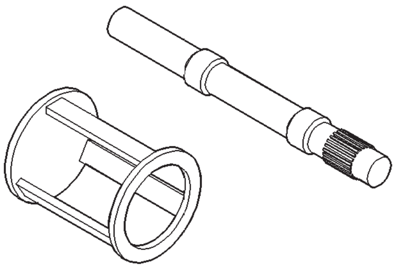
Component	Metric	Inch
Front clutch thrust washer (reaction shaft support hub)	1.55 mm	0.061 in.
Rear clutch thrust washer (clutch retainer)	1.55 mm	0.061 in.
Intermediate shaft thrust plate (shaft hub pilot)	1.5-1.6 mm	0.060-0.063 in.
Output shaft thrust washer (rear clutch hub)	Select fit to set end play	
Rear clutch pack snap ring	1.5 mm 1.95 mm 2.45 mm	0.060 in. 0.076 in. 0.098 in.
Planetary geartrain snap ring (at front of output shaft)	Select fit (three thicknesses available)	
Overdrive piston thrust plate	Thrust plate and spacer are select fit. Refer to size charts and selection procedures in Overdrive Unit D&A procedures	
Intermediate shaft spacer		

PRESSURE TEST

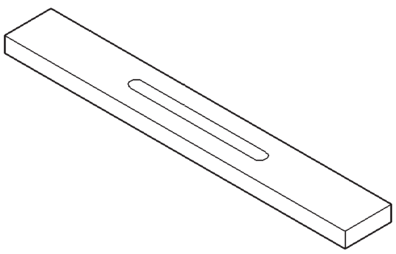
Overdrive clutch	Fourth gear only	Pressure should be 469-496 kPa (68-72 psi) with closed throttle and increase to 620-896 kPa (90-130 psi) at 1/2 to 3/4 throttle.
Line pressure (at accumulator)	Closed throttle	372-414 kPa (54-60 psi).
Front servo	Third gear only	No more than 21 kPa (3 psi) lower than 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 (0-1.5 psi) when stopped with transmission in D, 1, 2. Pressure above 7 kPa (1.5 psi) at stand still will prevent transmission from downshifting.

SPECIAL TOOLS

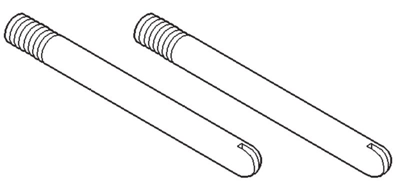
RE TRANSMISSIONS



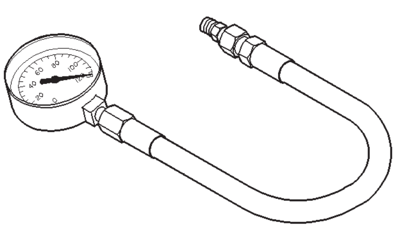
Spring Compressor and Alignment Shaft—6227



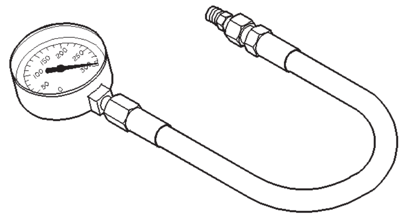
Gauge Bar—6311



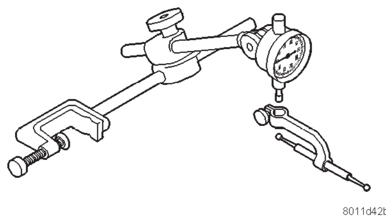
Extension Housing Pilot—C-3288-B



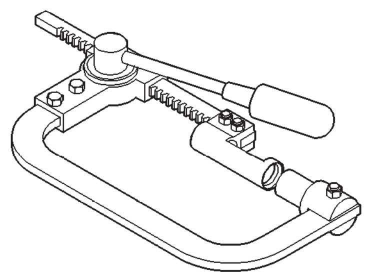
Pressure Gauge—C-3292



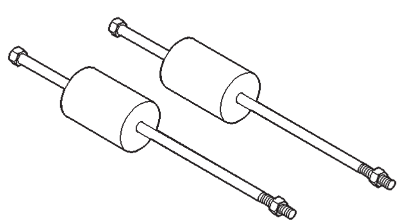
Pressure Gauge—C-3293SP



Dial Indicator—C-3339

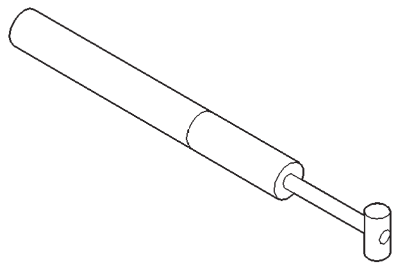


Spring Compressor—C-3422-B

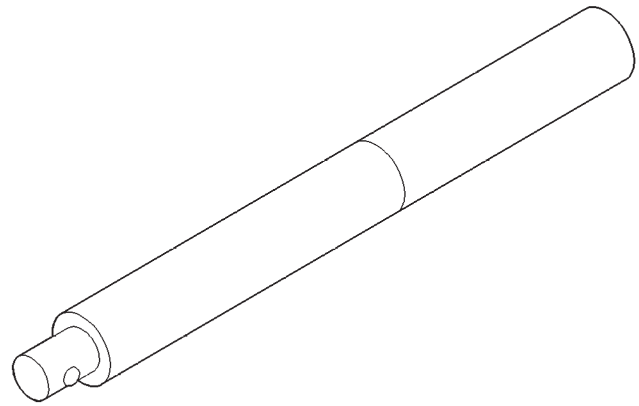


Puller, Slide Hammer—C-3752

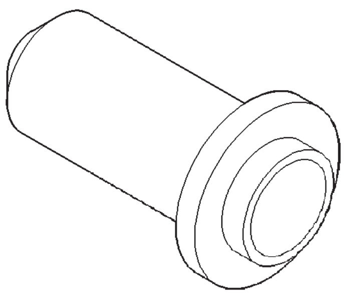
SPECIAL TOOLS (Continued)



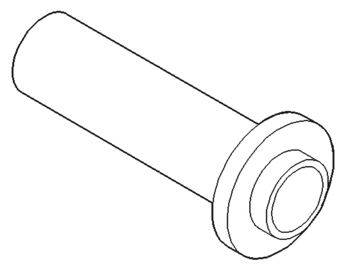
Gauge, Throttle Setting—C-3763



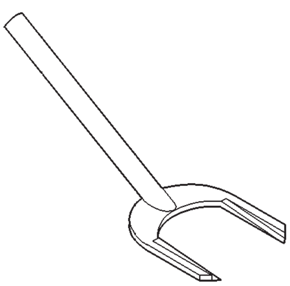
Universal Handle—C-4171



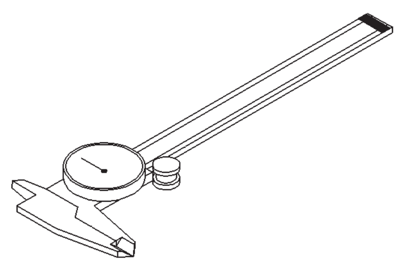
Seal Installer—C-3860–A



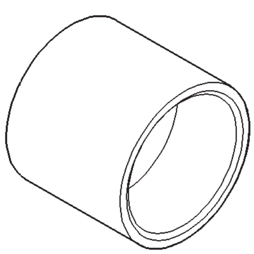
Seal Installer—C-4193-A



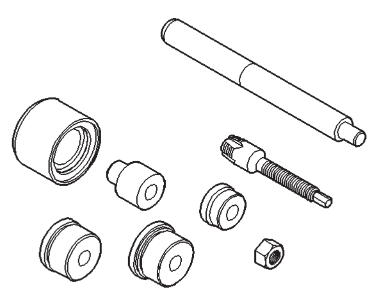
Seal Remover—C-3985-B



Dial Caliper—C-4962

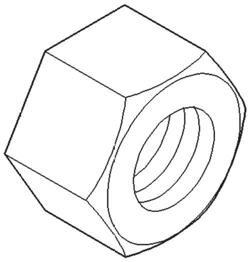


Installer—C-3995-A

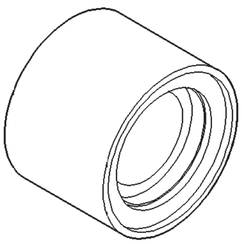


Bushing Remover/Installer Set—C-3887-J

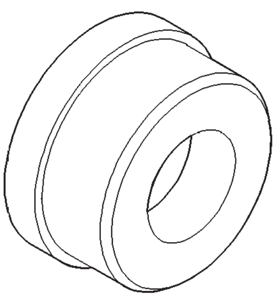
SPECIAL TOOLS (Continued)



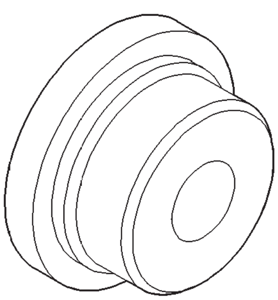
Nut, Bushing Remover—SP-1191, From kit C-3887-J



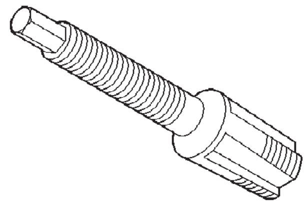
Cup, Bushing Remover—SP-3633, From kit C-3887-J



Remover, Bushing—SP-3551



Installer, Bushing—SP-5117



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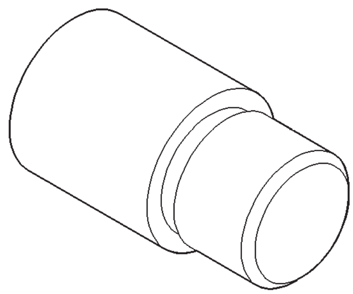
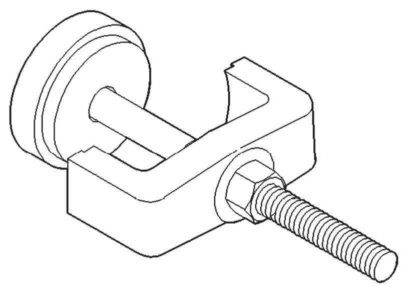
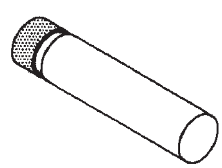


Installer, Bushing—SP-5325

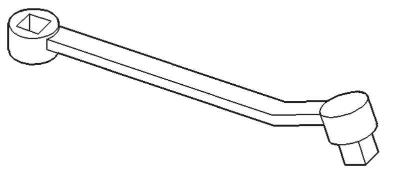


Compressor, Spring—C-3575-A

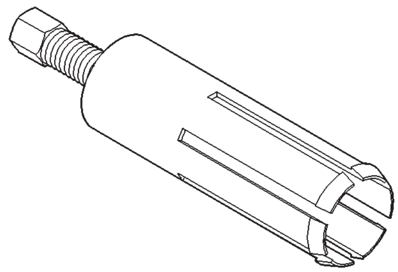


Gauge—6312

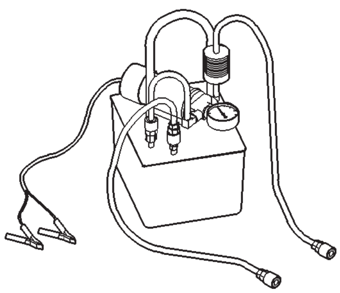
SPECIAL TOOLS (Continued)



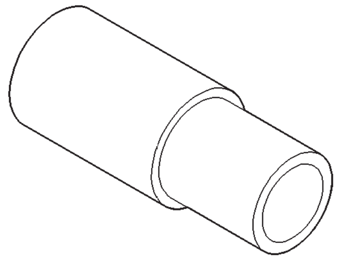
Adapter—C-3705



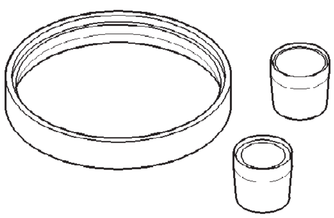
Remover—6957



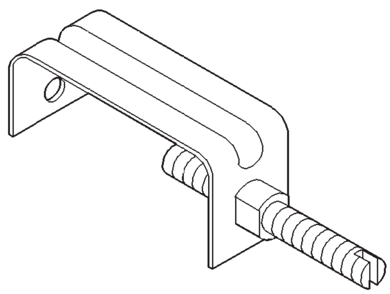
Flusher—6906



Installer—6951



Installer—8114



Retainer—6583

NV247 TRANSFER CASE

INDEX

GENERAL INFORMATION

NV247 TRANSFER CASE

The NV247 transfer case is used with the 3.1L turbo diesel engine. Refer to the service information in this group for the procedures.

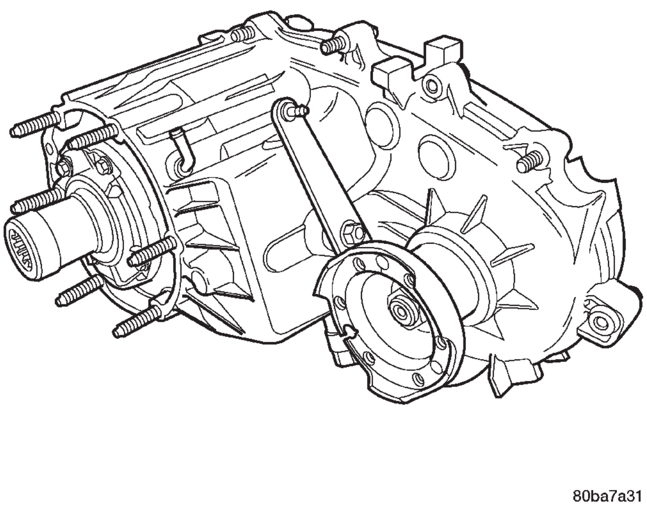


Fig. 1 NV247 Transfer Case

REMOVAL AND INSTALLATION

TRANSFER CASE

REMOVAL

(1) Open the hood and disconnect the negative battery cable.

(2) Remove the (2) upper fan shroud retaining bolts.

(3) Raise the vehicle on a hoist.

(4) Remove the (2) lower fan shroud retaining bolts.

CAUTION: Mark the position of the driveshaft in relation to its companion flange prior to disassembly. Driveshaft must be reinstalled in the same position it was in prior to disassembly.

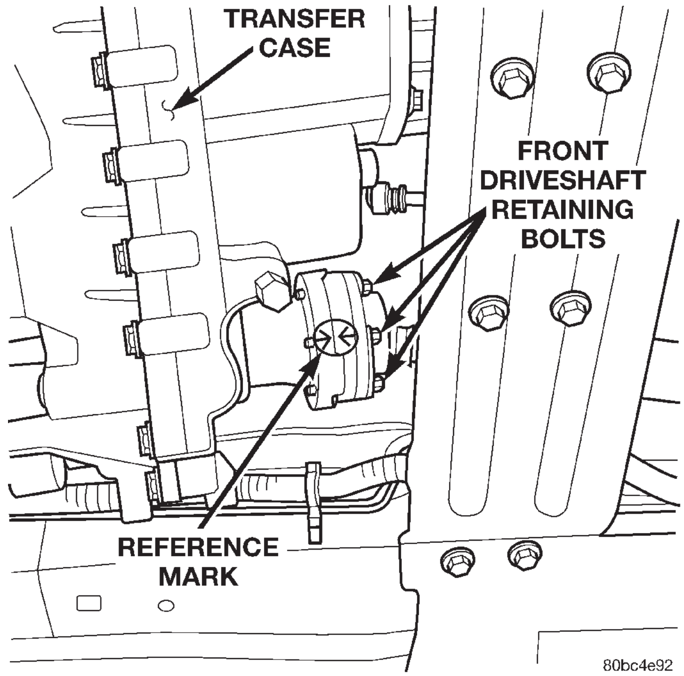


Fig. 2 Front Driveshaft Retaining Bolts

(5) Remove the front driveshaft retaining bolts (Fig. 2) and remove the driveshaft from the transfer case companion flange. Support the driveshaft with mechanics wire.

(6) Remove the rear driveshaft retaining bolts and remove the driveshaft from the transfer case companion flange. Support the driveshaft with mechanics wire (Fig. 3).

(7) Disconnect the transfer case shift cable from the shifter arm (Fig. 4).

(8) Disconnect the vent tube from the transfer case (Fig. 4).

(9) Remove the transmission oil pan and drain the transmission fluid. Reinstall the transmission oil pan.

(10) Position a jack under the transmission support crossmember and support the transmission and transfer case assembly.

(11) Remove the (8) transmission support crossmember retaining bolts (Fig. 5).

(12) Position a transmission jack under the transfer case.

REMOVAL AND INSTALLATION (Continued)

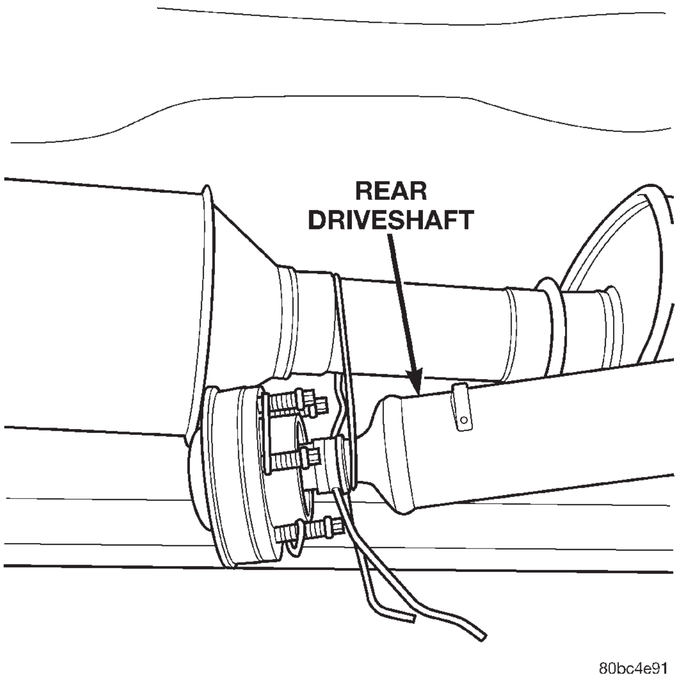


Fig. 3 Rear Driveshaft - Supported

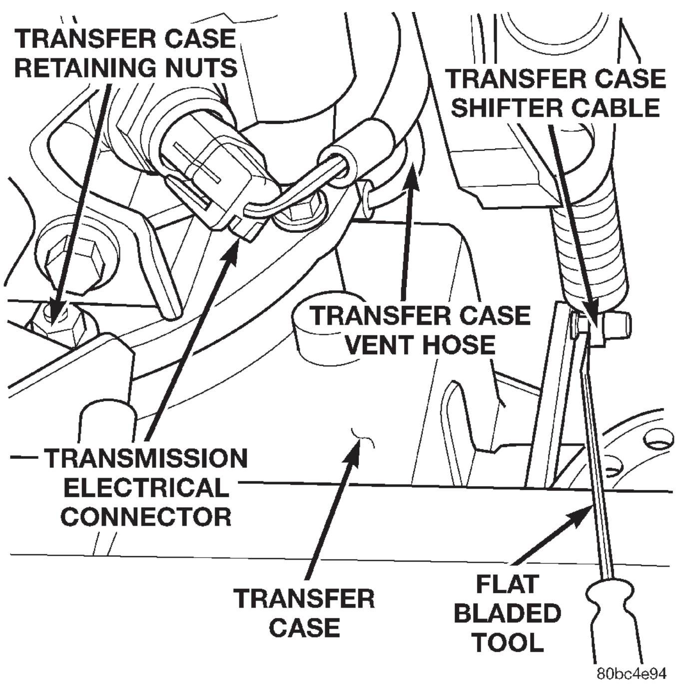


Fig. 4 Disconnecting Transfer Case Shift Linkage

(13) Lower the transmission assembly enough to gain access and remove the transfer case to transmission retaining nuts.

(14) Remove the transfer case from the vehicle.

INSTALLATION

NOTE: If a replacement transfer case is being installed, be certain the counter weight is installed on the transfer case housing prior to installation.

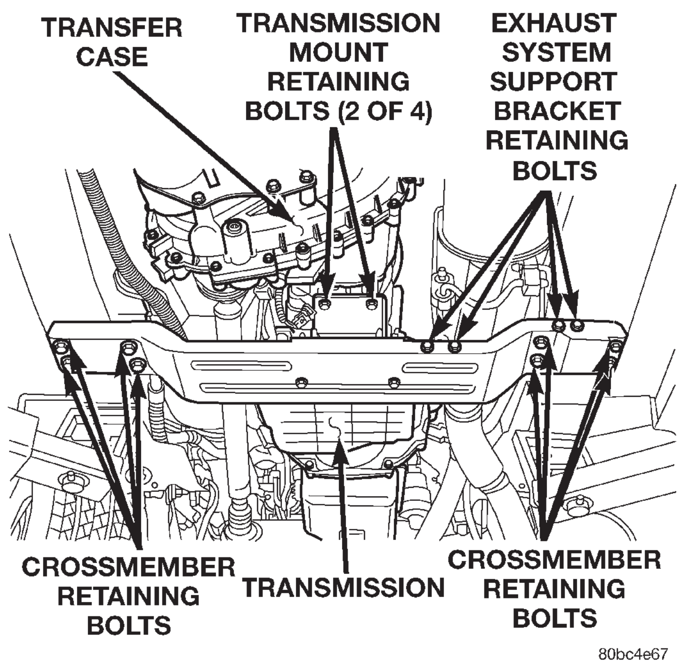


Fig. 5 Transmission Support Crossmember Position & Orientation

(1) Install the transfer case on the transmission. Torque the transfer case retaining nuts to 75 N·m (55 ft. lbs.) (Fig. 6).

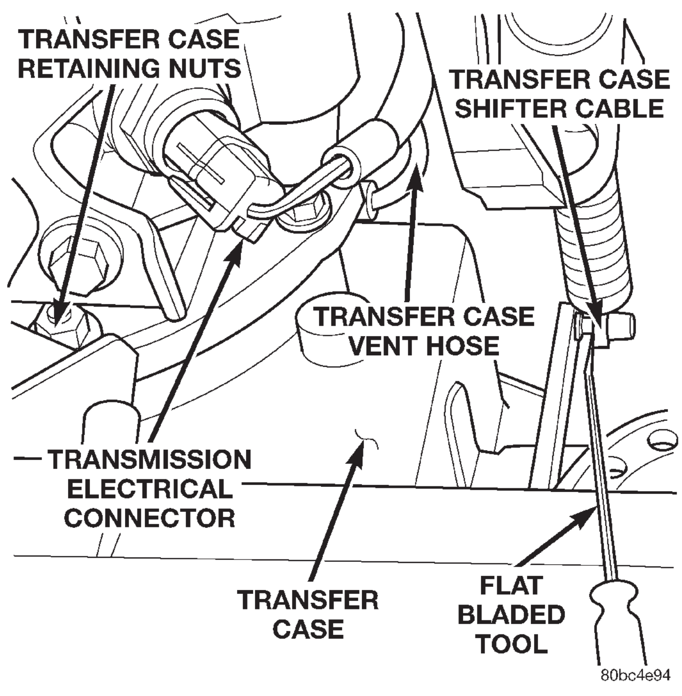


Fig. 6 Transfer Case Position & Orientation

(2) Install the vent tube on the transfer case (Fig. 6).

(3) Connect the transfer case shift cable on the shifter arm (Fig. 6).

REMOVAL AND INSTALLATION (Continued)

(4) Using the jack, raise the transmission assembly into position and install the (8) transmission support crossmember retaining bolts (Fig. 7). Torque the bolts to 41 N·m (30 ft. lbs.).

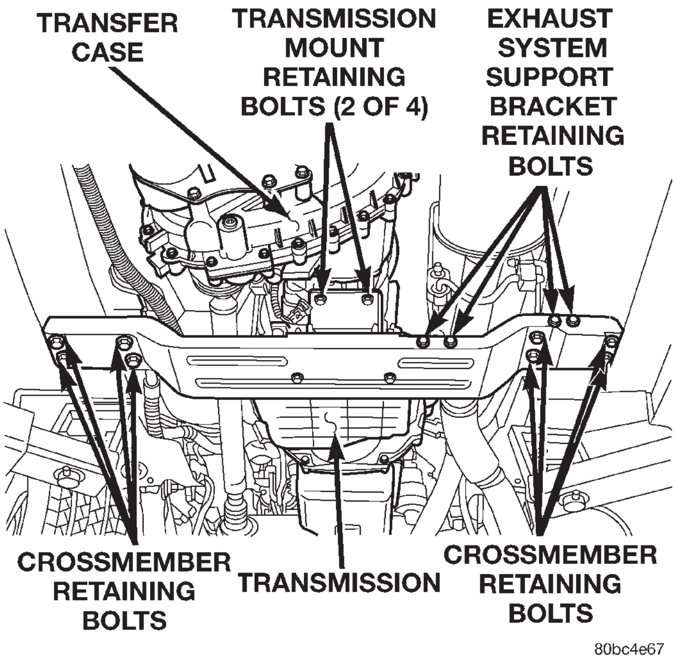


Fig. 7 Transmission Support Crossmember Position & Orientation

(5) Install the rear driveshaft. Torque the bolts to 32 N·m (24 ft. lbs.). Be certain to install the driveshaft in the same position as before removal.

(6) Install the front driveshaft. Torque the bolts to 32 N·m (24 ft. lbs.) (Fig. 8). Be certain to install the driveshaft in the same position as before removal.

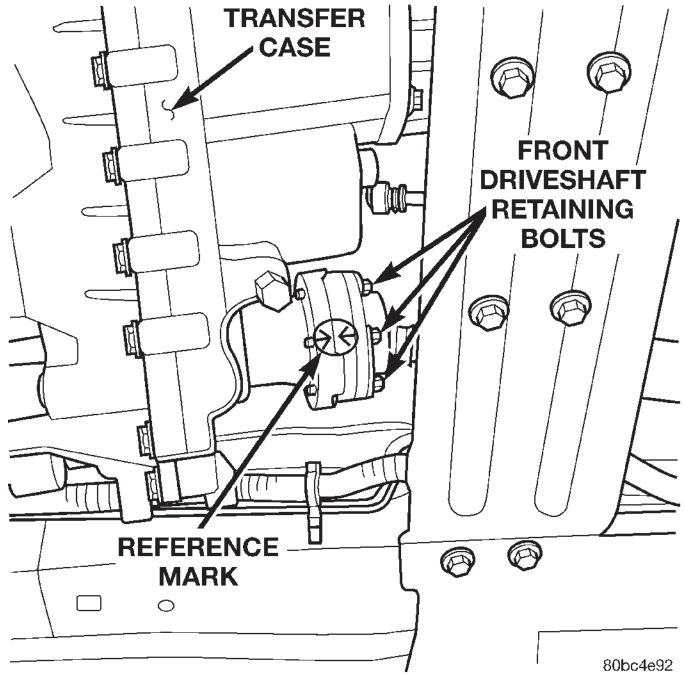


Fig. 8 Front Driveshaft Retaining Bolts

(7) Install the (2) lower fan shroud retaining bolts. Torque the bolts to 15 N·m (132 in. lbs.).

(8) Lower the vehicle on the hoist.

(9) Install the (2) upper fan shroud retaining bolts. Torque the bolts to 15 N·m (132 in. lbs.).

(10) Fill the transmission fluid to specification.

(11) Connect the negative battery cable.

TIRES AND WHEELS

CONTENTS

TIRES

INDEX

DESCRIPTION AND OPERATION

TIRES

Tires are designed and engineered for each specific vehicle. They provide the best overall performance for normal operation. The ride and handling characteristics match the vehicle's requirements. With proper care they will give excellent reliability, traction, skid resistance, and tread life.

Driving habits have more effect on tire life than any other factor. Careful drivers will obtain in most cases, much greater mileage than severe use or careless drivers. A few of the driving habits which will shorten the life of any tire are:

- Rapid acceleration
- Severe brake applications
- High speed driving
- Excessive speeds on turns
- Striking curbs and other obstacles

Radial-ply tires are more prone to irregular tread wear. It is important to follow the tire rotation interval shown in the section on Tire Rotation. This will help to achieve a greater tread life.

TIRE IDENTIFICATION

Tire type, size, aspect ratio and speed rating are encoded in the letters and numbers imprinted on the side wall of the tire. Refer to the chart to decipher the tire identification code (Fig. 1).

Performance tires have a speed rating letter after the aspect ratio number. The speed rating is not always printed on the tire sidewall. These ratings are:

- **Q** up to 100 mph
- **S** up to 112 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.

TIRE CHAINS

Tire snow chains may be used on **certain** models. Refer to the Owner's Manual for more information.

DESCRIPTION AND OPERATION (Continued)

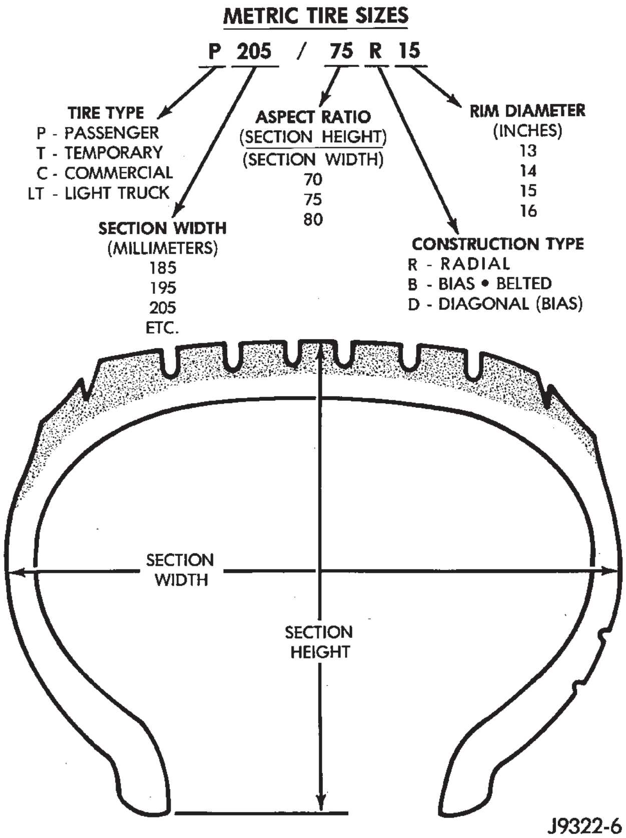


Fig. 1 Tire Identification

RADIAL-PLY TIRES

Radial-ply tires improve handling, tread life and ride quality, and decrease rolling resistance.

Radial-ply tires must always be used in sets of four. Under no circumstances should they be used on the front only. They may be mixed with temporary spare tires when necessary. A maximum speed of 50 MPH is recommended while a temporary spare is in use.

Radial-ply tires have the same load-carrying capacity as other types of tires of the same size. They also use the same recommended inflation pressures.

The use of oversized tires, either in the front or rear of the vehicle, can cause vehicle drive train failure. This could also cause inaccurate wheel speed signals when the vehicle is equipped with Anti-Lock Brakes.

The use of tires from different manufactures on the same vehicle is NOT recommended. The proper tire pressure should be maintained on all four tires.

SPARE TIRE–TEMPORARY

The temporary spare tire is designed for emergency use only. The original tire should be repaired or replaced at the first opportunity and reinstall. Do not exceed speeds of 50 MPH. Refer to Owner's Manual for complete details.

TIRE INFLATION PRESSURES

Under inflation will cause rapid shoulder wear, tire flexing, and possible tire failure (Fig. 2).

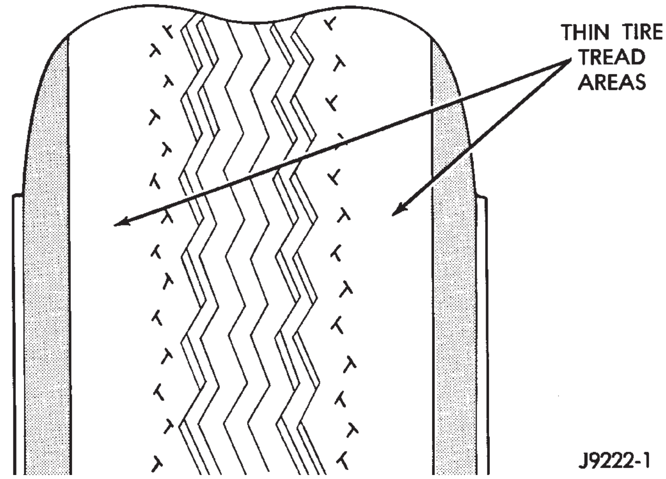


Fig. 2 Under Inflation Wear

Over inflation will cause rapid center wear and loss of the tire's ability to cushion shocks (Fig. 3).

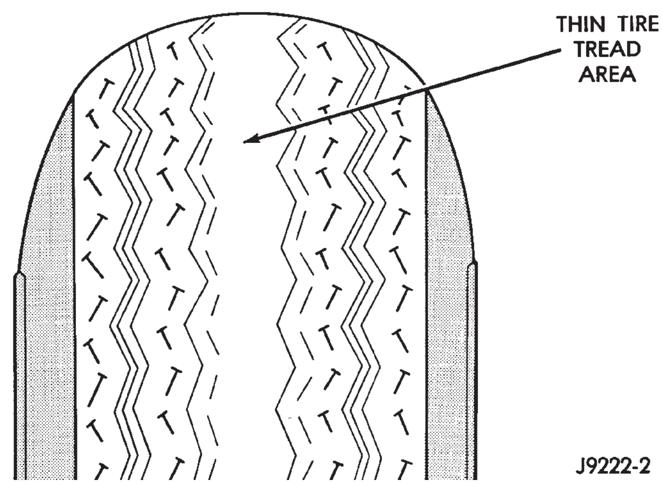


Fig. 3 Over Inflation Wear

Improper inflation can cause:

- Uneven wear patterns
- Reduced tread life
- Reduced fuel economy
- Unsatisfactory ride
- Vehicle drift

For proper tire pressure specification refer to the Tire Inflation Pressure Chart provided with the vehicles Owners Manual. A Certification Label on the drivers side door pillar provides the minimum tire and rim size for the vehicle. The label also list the cold inflation pressure for these tires at full load operation.

Tire pressures have been chosen to provide safe operation, vehicle stability, and a smooth ride. Tire pressure should be checked cold once a month. Tire

DESCRIPTION AND OPERATION (Continued)

pressure decreases as the ambient temperature drops. Check tire pressure frequently when ambient temperature varies widely.

Tire inflation pressures are cold inflation pressure. The vehicle must sit for at least 3 hours to obtain the correct cold inflation pressure reading. Or be driven less than one mile after sitting for 3 hours. Tire inflation pressures may increase from 2 to 6 pounds per square inch (psi) during operation. Do not reduce this normal pressure build-up.

WARNING: OVER OR UNDER INFLATED TIRES CAN AFFECT VEHICLE HANDLING AND TREAD WEAR. THIS MAY CAUSE THE TIRE TO FAIL SUDDENLY, RESULTING IN LOSS OF VEHICLE CONTROL.

TIRE PRESSURE FOR HIGH SPEED OPERATION

Chrysler Corporation advocates driving at safe speeds within posted speed limits. Where speed limits allow the vehicle to be driven at high speeds, correct tire inflation pressure is very important. For speeds up to and including 120 km/h (75 mph), tires must be inflated to the pressures shown on the tire placard. For continuous speeds in excess of 120 km/h (75 mph), tires must be inflated to the maximum pressure specified on the tire sidewall.

Vehicles loaded to the maximum capacity should not be driven at continuous speeds above 75 mph (120 km/h).

For emergency vehicles that are driven at speeds over 90 mph (144 km/h), special high speed tires must be used. Consult tire manufacturer for correct inflation pressure recommendations.

REPLACEMENT TIRES

The original equipment tires provide a proper balance of many characteristics such as:

- Ride
- Noise
- Handling
- Durability
- Tread life
- Traction
- Rolling resistance
- Speed capability

It is recommend that tires equivalent to the original equipment tires be used when replacement is needed.

Failure to use equivalent replacement tires may adversely affect the safety and handling of the vehicle.

The use of oversize tires not listed in the specification charts may cause interference with vehicle components. Under extremes of suspension and steering travel, interference with vehicle components may cause tire damage.

WARNING: FAILURE TO EQUIP THE VEHICLE WITH TIRES HAVING ADEQUATE SPEED CAPABILITY CAN RESULT IN SUDDEN TIRE FAILURE.

DIAGNOSIS AND TESTING

PRESSURE GAUGES

A quality air pressure gauge is recommended to check tire pressure. After checking the air pressure, replace valve cap finger tight.

TREAD WEAR INDICATORS

Tread wear indicators are molded into the bottom of the tread grooves. When tread depth is 1.6 mm (1/16 in.), the tread wear indicators will appear as a 13 mm (1/2 in.) band (Fig. 4).

Tire replacement is necessary when indicators appear in two or more grooves or if localized balding occurs.

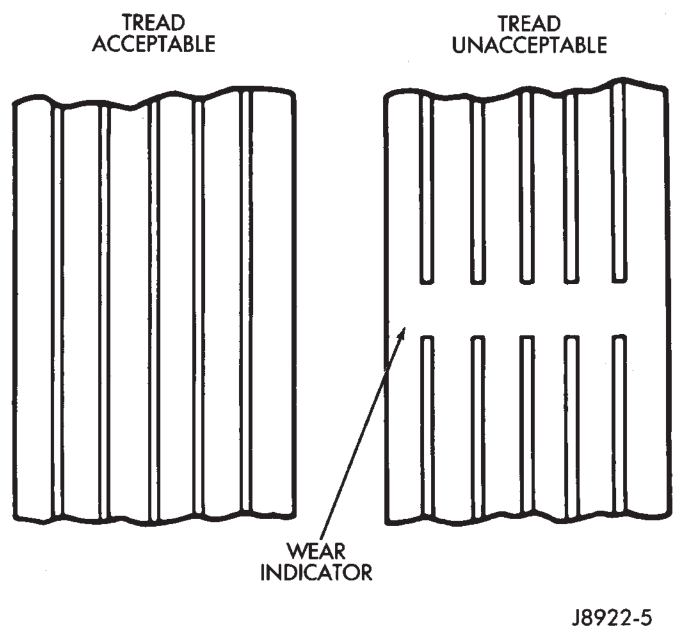


Fig. 4 Tread Wear Indicators

TIRE WEAR PATTERNS

Under inflation will cause wear on the shoulders of tire. Over inflation will cause wear at the center of tire.

Excessive camber causes the tire to run at an angle to the road. One side of tread is then worn more than the other (Fig. 5).

Excessive toe-in or toe-out causes wear on the tread edges and a feathered effect across the tread (Fig. 5).

DIAGNOSIS AND TESTING (Continued)

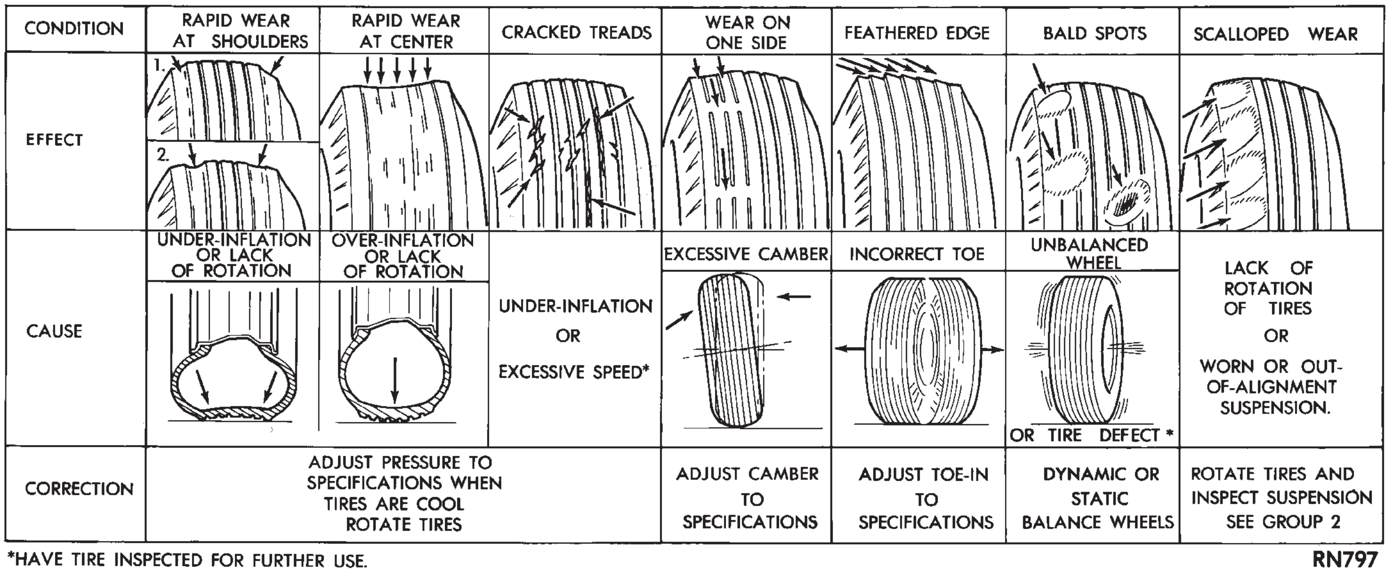


Fig. 5 Tire Wear Patterns

TIRE NOISE OR VIBRATION

Radial-ply tires are sensitive to force impulses caused by improper mounting, vibration, wheel defects, or possibly tire imbalance.

To find out if tires are causing the noise or vibration, drive the vehicle over a smooth road at varying speeds. Note the noise level during acceleration and deceleration. The engine, differential and exhaust noises will change as speed varies, while the tire noise will usually remain constant.

SERVICE PROCEDURES

ROTATION

Tires on the front and rear operate at different loads and perform different steering, driving, and braking functions. For these reasons they wear at unequal rates and tend to develop irregular wear patterns. These effects can be reduced by rotating the tires at regular intervals. The benefits of tire rotation are:

- Increase tread life
- Maintain traction levels
- A smooth, quiet ride

The suggested method of tire rotation is (Fig. 6). Other rotation methods can be used, but they will not provide all the tire longevity benefits.

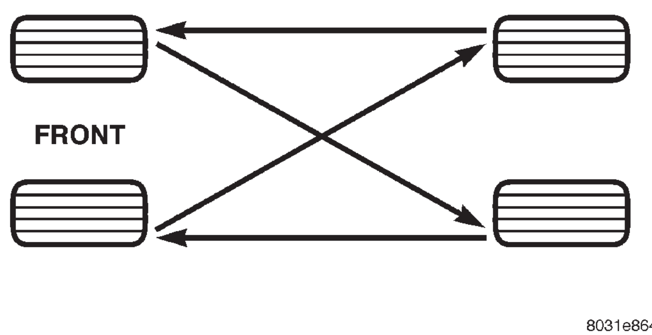


Fig. 6 Tire Rotation Pattern

MATCH MOUNTING

Tires and wheels are currently match mounted at the factory. Match mounting is a technique used to reduce runout in the wheel/tire assembly. This means that the high spot of the tire is aligned with the low spot on the wheel rim. The high spot on the tire is marked with a paint mark or a bright colored adhesive label on the outboard sidewall. The low spot on the rim is identified with a label on the outside of the rim and a dot on the inside of the rim. If the outside label has been removed the tire will have to be removed to locate the dot on the inside of the rim.

Before dismounting a tire from its wheel, a reference mark should be placed on the tire at the valve stem location. This reference will ensure that it is remounted in the original position on the wheel.

(1) Use a dial indicator to locate the high spot of the tire on the center tread rib (Fig. 7). Record the indicator reading and mark the high spot on the tire. Place a mark on the tire at the valve stem location (Fig. 8).

(2) Break down the tire and remount it 180 degrees on the rim (Fig. 9).

(3) Measure the total runout again and mark the tire to indicate the high spot.

(4) If runout is still excessive use the following procedures.

SERVICE PROCEDURES (Continued)

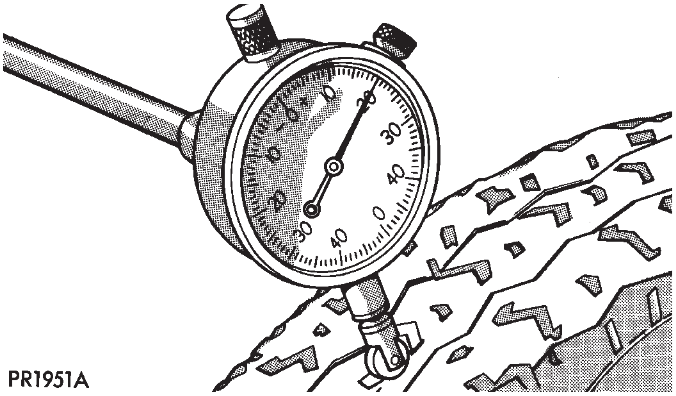


Fig. 7 Dial Indicator

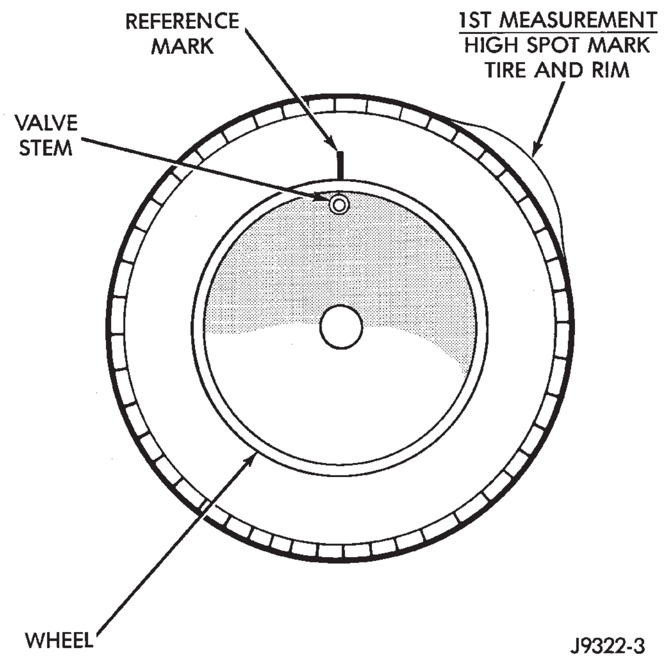


Fig. 8 First Measurement On Tire

(a) If the high spot is within 101.6 mm (4.0 in.) of the first spot and is still excessive, replace the tire.

(b) 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.

(c) 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 rim in that direction (Fig. 10). This procedure will normally reduce the runout to an acceptable amount.

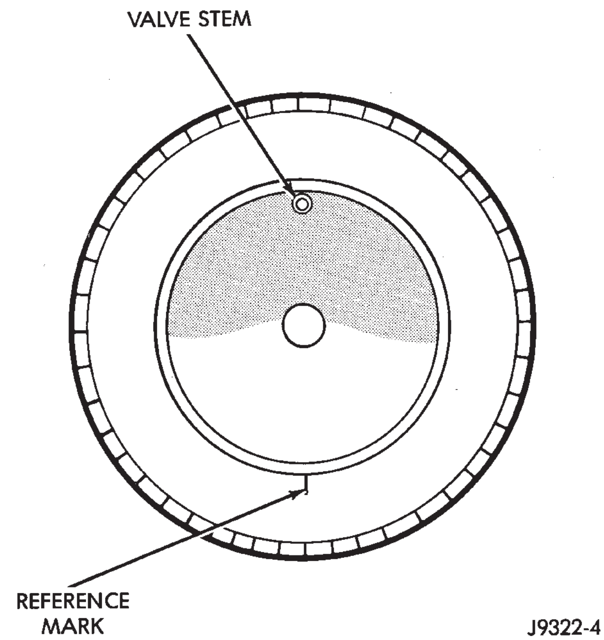


Fig. 9 Remount Tire 180 Degrees

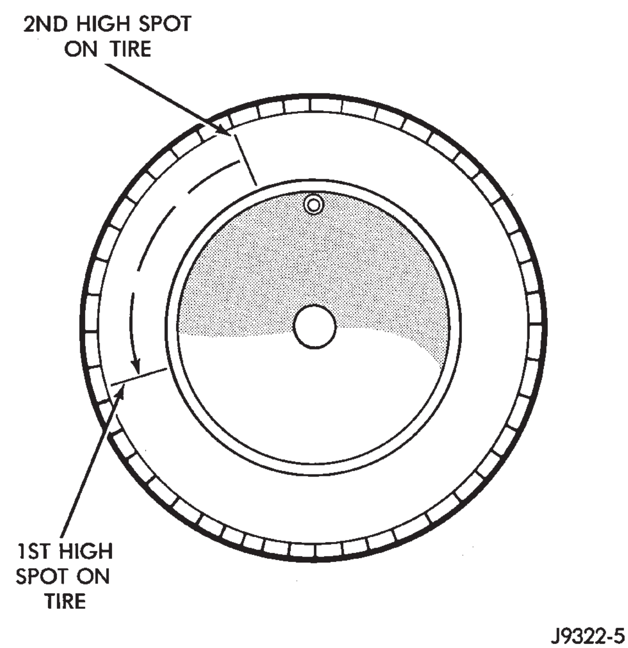


Fig. 10 Remount Tire 90 Degrees In Direction of Arrow

SERVICE PROCEDURES (Continued)

REPAIRING LEAKS

For proper repairing, a radial tire must be removed from the wheel. Repairs should only be made if the defect, or puncture, is in the tread area (Fig. 11). The tire should be replaced if the puncture is located in the sidewall.

Deflate tire completely before removing the 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 which could damage the tire or wheel rim.

Before mounting tire on wheel, make sure all rust is removed from the rim bead and repaint if necessary.

Install wheel on vehicle, and tighten to proper torque specification.

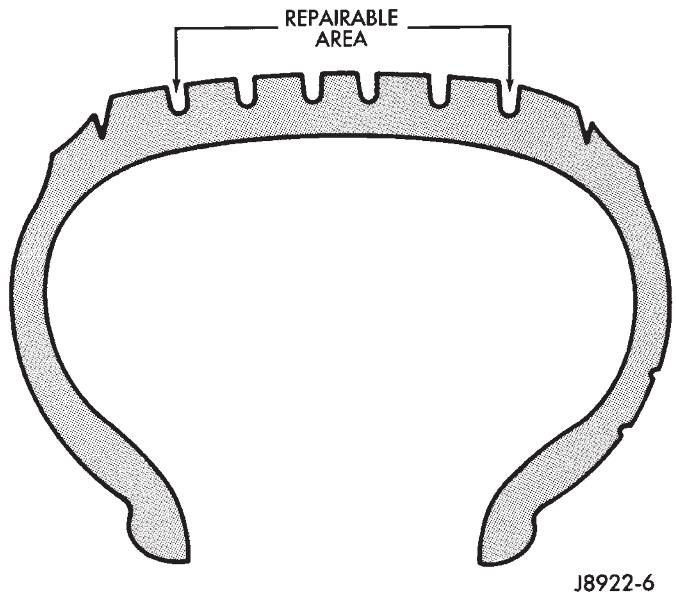


Fig. 11 Tire Repair Area

CLEANING AND INSPECTION

CLEANING TIRES

Remove protective coating on tires before delivery of vehicle. This coating may cause deterioration of tires.

To remove the protective coating applying warm water and let it soak for a few minutes. Then scrub the coating away with a soft bristle brush. Steam cleaning may also be used to remove the coating.

NOTE: DO NOT use gasoline, mineral oil, oil-based solvent or wire brush for cleaning.

SPECIFICATIONS

TIRES

TIRE SIZE	SUPPLIER
ST P225/75R16	GOODYEAR
LS P245/70R16	GOODYEAR

WHEELS

INDEX

DESCRIPTION AND OPERATION

WHEEL

The rim size is on the vehicle safety certification label located on the drivers door shut face. The size of the rim is determined by the drivetrain package. Original equipment wheels/rims are designed for operation up to the specified maximum vehicle capacity.

All models use stamped steel, cast aluminum or forged aluminum wheels. Every wheel has raised sections between the rim flanges and rim drop well called safety humps (Fig. 1).

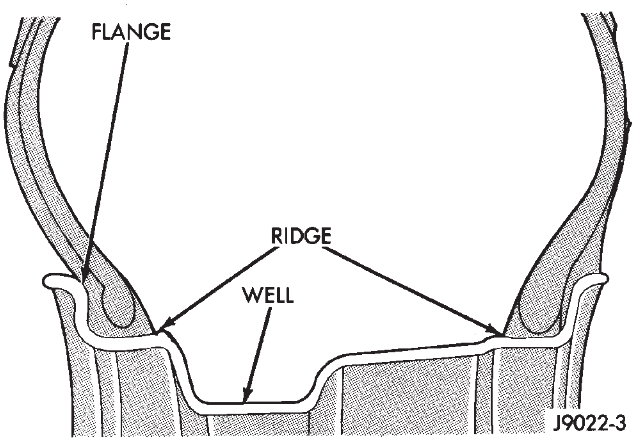


Fig. 1 Safety Rim

Initial inflation of the tire forces the bead over these raised sections. In case of rapid loss of air pressure, the raised sections help hold the tire on the wheel.

The wheel studs and nuts are designed for specific applications. All aluminum and some steel wheels have wheel stud nuts with an enlarged nose. This enlarged nose is necessary to ensure proper retention of the wheels. Do not use replacement studs or nuts with a different design or lesser quality.

DIAGNOSIS AND TESTING

WHEEL INSPECTION

Inspect wheels for:

- Excessive run out
- Dents or cracks
- Damaged wheel lug nut holes
- Air Leaks from any area or surface of the rim

NOTE: Do not attempt to repair a wheel by hammering, heating or welding.

If a wheel is damaged an original equipment replacement wheel should be used. When obtaining replacement wheels, they should be equivalent in load carrying capacity. The diameter, width, offset, pilot hole and bolt circle of the wheel should be the same as the original wheel.

WARNING: FAILURE TO USE EQUIVALENT REPLACEMENT WHEELS MAY ADVERSELY AFFECT THE SAFETY AND HANDLING OF THE VEHICLE. USED WHEELS ARE NOT RECOMMENDED. THE SERVICE HISTORY OF THE WHEEL MAY HAVE INCLUDED SEVERE TREATMENT OR VERY HIGH MILEAGE. THE RIM COULD FAIL WITHOUT WARNING.

TIRE AND WHEEL RUNOUT

Radial runout is the difference between the high and low points on the tire or wheel (Fig. 2).

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.

DIAGNOSIS AND TESTING (Continued)

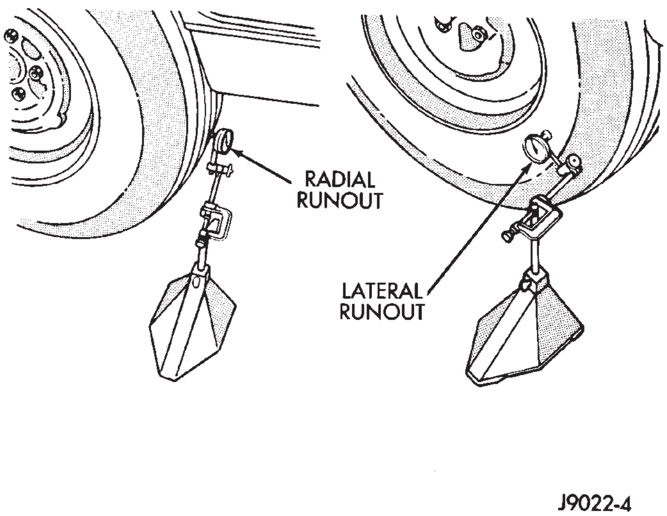


Fig. 2 Checking Tire/Wheel/Hub Runout

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)

(1) Drive vehicle a short distance to eliminate tire flat spotting from a parked position.

(2) Check wheel bearings and adjust if adjustable or replace if necessary.

(3) Check the wheel mounting surface.

(4) Relocate wheel on the mounting, two studs over from the original position.

(5) Tighten wheel nuts until all are properly torqued, to eliminate brake distortion.

(6) 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)

NOTE: Rotating the tire on wheel is particularly effective when there is runout in both tire and wheel.

(1) Remove tire from wheel and mount wheel on service dynamic balance machine.

(2) Check wheel radial runout (Fig. 3) and lateral runout (Fig. 4).

• STEEL WHEELS: Radial runout 0.040 in., Lateral runout 0.045 in. (maximum)

• ALUMINUM WHEELS: Radial runout 0.030 in., Lateral runout 0.035 in. (maximum)

(3) If point of greatest wheel lateral runout is near original chalk mark, remount tire 180 degrees. Recheck runout, Refer to match mounting procedure.

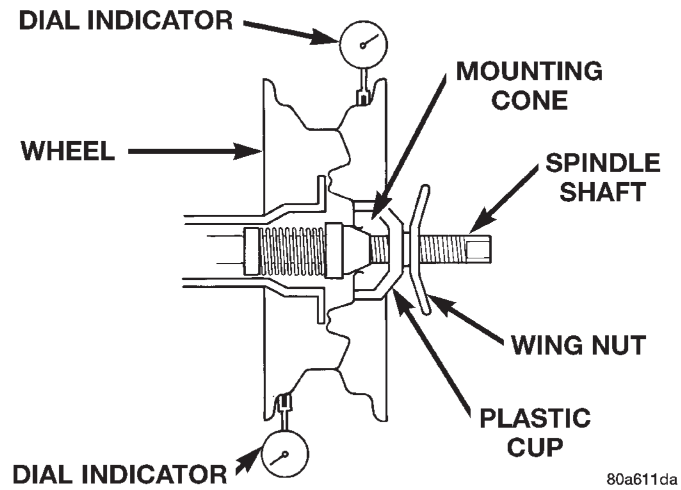


Fig. 3 Radial Runout

SERVICE PROCEDURES

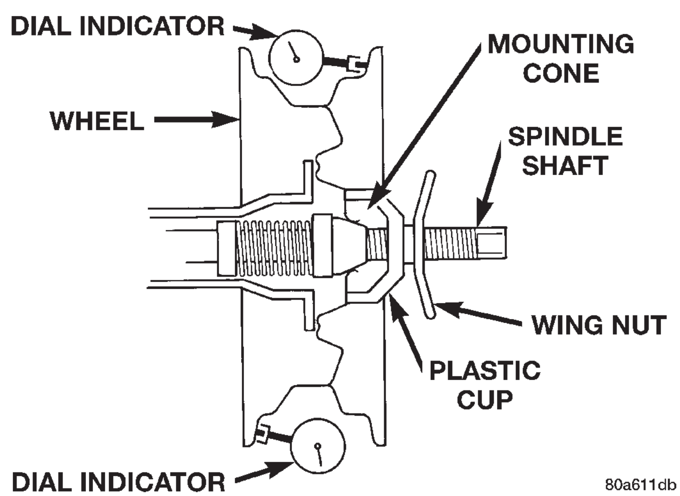


Fig. 4 Lateral Runout

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.

NOTE: Do not use chrome plated lug nuts with chrome plated 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

SERVICE PROCEDURES (Continued)

tightened just snug. Gradually tighten them in sequence to the proper torque specification (Fig. 5). **Never use oil or grease on studs or nuts.**

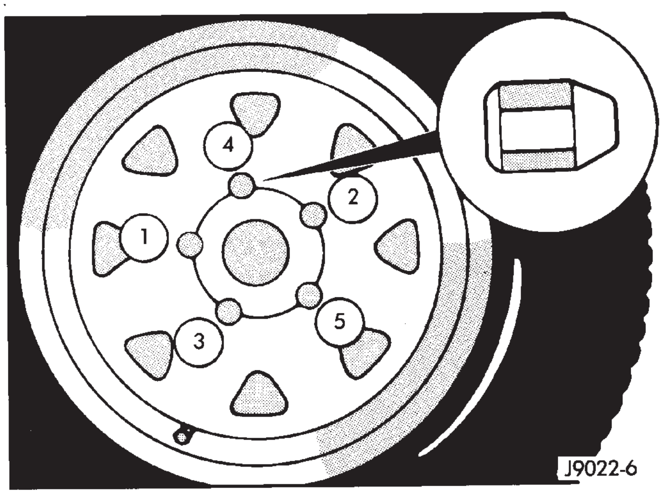


Fig. 5 Lug Nut Tightening Pattern

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.

TIRE AND WHEEL BALANCE

It is recommended that a two plane service dynamic balancer be used when a tire and wheel assembly require balancing. Refer to balancer operation instructions for proper cone mounting procedures. Typically use front cone mounting method for steel wheels. For aluminum wheel use back cone mounting method without cone spring.

NOTE: Static should be used only when a two plane balancer is not available.

NOTE: Cast aluminum and forged aluminum wheels require coated balance weights and special alignment equipment.

Wheel balancing can be accomplished with either on or off vehicle equipment. When using on-vehicle balancing equipment, remove the opposite wheel/tire. Off-vehicle balancing is recommended.

For static balancing, find location of heavy spot causing the imbalance. Counter balance wheel directly opposite the heavy spot. Determine weight required to counter balance the area of imbalance. Place half of this weight on the **inner** rim flange and the other half on the **outer** rim flange (Fig. 6).

For dynamic balancing, the balancing equipment is designed to locate the amount of weight to be applied to both the inner and outer rim flange (Fig. 7).

SERVICE PROCEDURES (Continued)

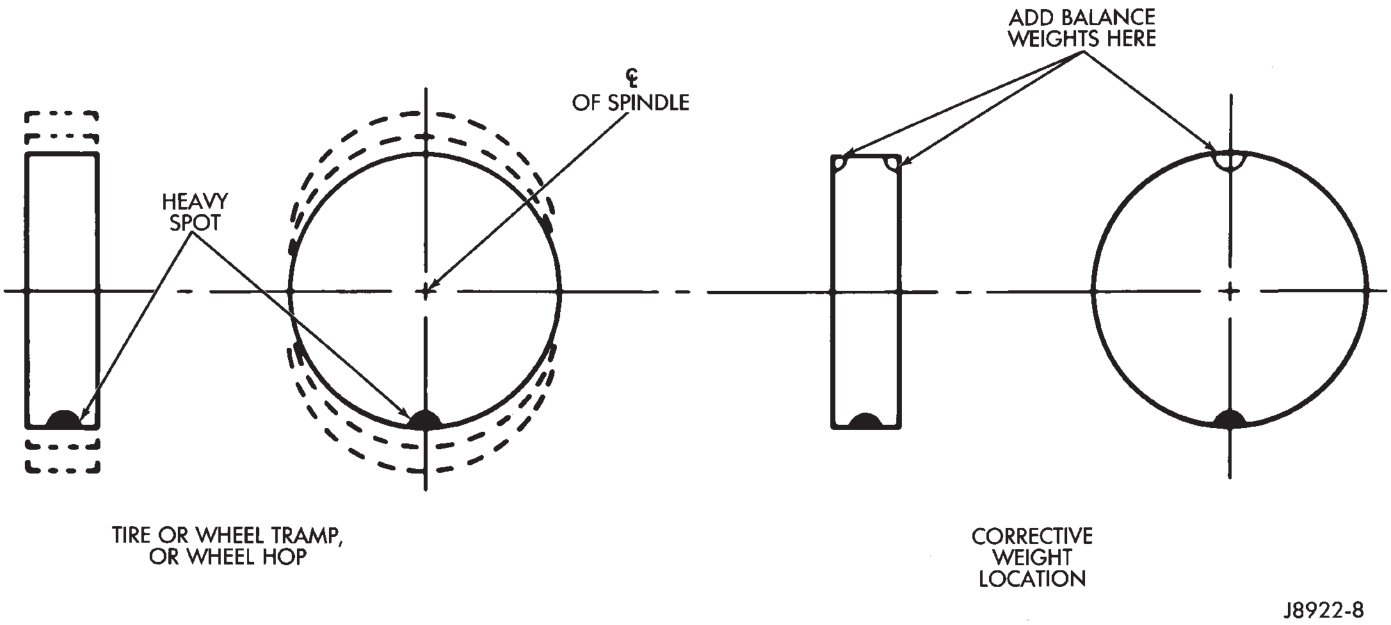


Fig. 6 Static Unbalance & Balance

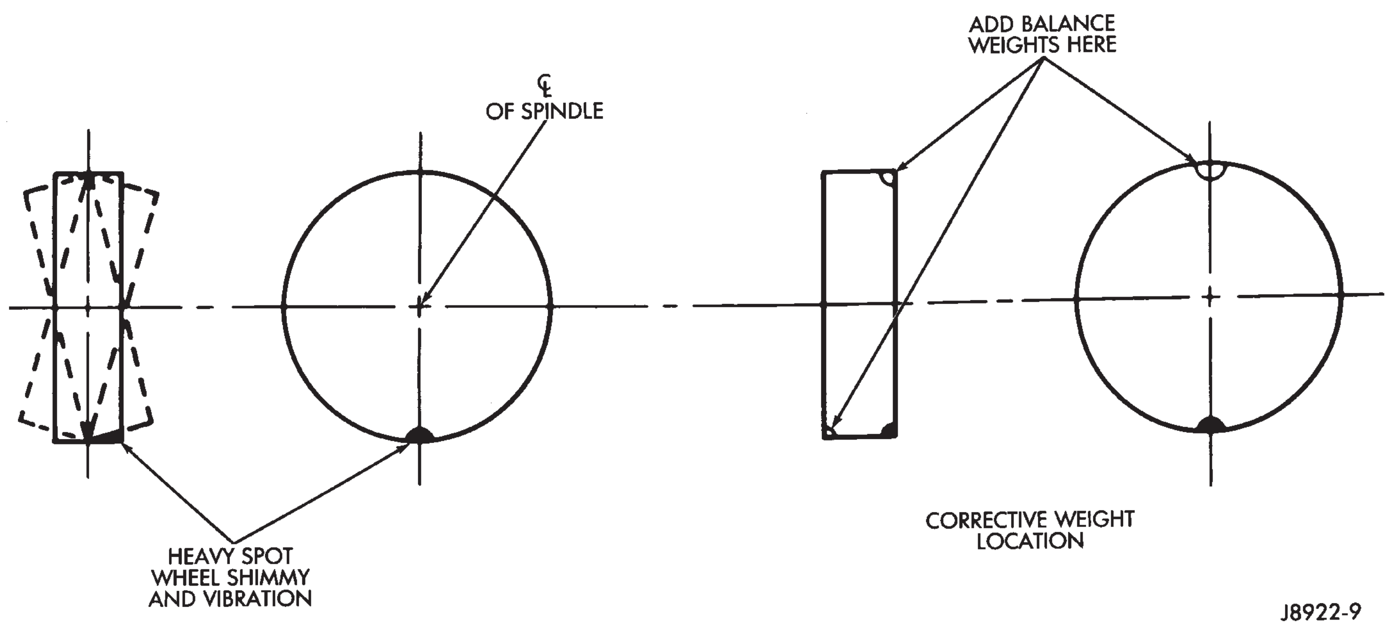


Fig. 7 Dynamic Unbalance & Balance

SPECIFICATIONS

TORQUE CHART

DESCRIPTION	TORQUE
Lug Nut	
1/2 X 20 with 60° Cone	115-150 N·m (85-115 ft. lbs.)

BODY

CONTENTS

PAINT

INDEX

DESCRIPTION AND OPERATION

PAINT CODE

Exterior vehicle body colors are identified on the Body Code plate. The plate is located on the in the engine compartment and attached to the top of the right frame rail. Refer to the Introduction section at the front of this manual for body code plate description. The paint code is also identified on the Vehicle Safety Certification Label which is located on the drivers door shut face. The first digit of the paint code listed on the vehicle indicates the sequence of application, ie: P= primary coat, Q= secondary coat. The codes listed in the Aftermarket Paint Repair Products chart are used for manufacturing purposes. The first digit may vary from the Body Code Plate. The color names provided in the Aftermarket Paint Repair Products chart are the color names used on most repair product containers.

BASE COAT/CLEAR COAT FINISH

On most vehicles a two-part paint application (base coat/clear coat) is used. Color paint that is applied to primer is called base coat. The clear coat protects the base coat from ultraviolet light and provides a durable high-gloss finish.

CAUTION: Do not use abrasive chemicals or compounds on painted surfaces. Damage to finish can result.

Do not use harsh alkaline based cleaning solvents on painted surfaces. Damage to finish or color can result.

WET SANDING, BUFFING, AND POLISHING

Minor acid etching, orange peel, or smudging in clear coat or single-stage finishes can be reduced with light wet sanding, hand buffing, and polishing. **If the finish has been wet sanded in the past, it cannot be repeated. Wet sanding operation should be performed by a trained automotive paint technician.**

CAUTION: Do not remove clear coat finish, if equipped. Base coat paint must retain clear coat for durability.

PAINTED SURFACE TOUCH-UP

When a painted metal surface has been scratched or chipped, it should be touched-up as soon as possible to avoid corrosion. For best results, use Mopar® Scratch Filler/Primer, Touch-Up Paints and Clear Top Coat. Refer to Introduction group of this manual for Body Code Plate information.

DESCRIPTION AND OPERATION (Continued)

CAUTION: USE A OSHA APPROVED BREATHING FILTER WHEN SPRAYING PAINT OR SOLVENTS IN A CONFINED AREA. PERSONAL INJURY CAN RESULT.

TOUCH-UP PROCEDURE

(1) Scrape loose paint and corrosion from inside scratch or chip.

(2) Clean affected area with Mopar® Tar/Road Oil Remover, and allow to dry.

(3) Fill the inside of the scratch or chip with a coat of filler/primer. Do not overlap primer onto good surface finish. The applicator brush should be wet enough to puddle-fill the defect without running. Do not stroke brush applicator on body surface. Allow the filler/primer to dry hard.

(4) Cover the filler/primer with color touch-up paint. Do not overlap touch-up color onto the original color coat around the scratch or chip. Butt the new color to the original color, if possible. Do not stroke applicator brush on body surface. Allow touch-up paint to dry hard.

(5) On vehicles without clear coat, the touch-up color can be lightly wet sanded (1500 grit) and polished with rubbing compound.

(6) On vehicles with clear coat, apply clear top coat to touch-up paint with the same technique as described in Step 4. Allow clear top coat to dry hard. If desired, Step 5 can be performed on clear top coat.

CAUTION: AVOID PROLONGED SKIN CONTACT WITH PETROLEUM OR ALCOHOL – BASED CLEANING SOLVENTS. PERSONAL INJURY CAN RESULT.

SPECIFICATIONS

AFTER MARKET PAINT REPAIR PRODUCTS

EXTERIOR COLOR

EXTERIOR COLOR	CHRY CODE *	PPG	DuPONT	S-W** M-S**	AKZO NOBEL SIKKENS	ICI**
Sienna Tinted Pearl Coat	WUL	5477	F7938	56687/ 56688	CHA99:WUL	LFF5B
Sienna Pearl Coat	WUR	5510	N/A	56369	CHA99:WUR	LFF7B
Flame Red Clear Coat	PR4	4679	B9326	46916	CHA93:PR4	2NN6B
Deep Slate Pearl Coat	VAW	5292	B9774	54118	CHA97:VAW	HMRB
Champagne Pearl Meallic Clear Coat	VTE	5360	B9825	55700	CHA98:VTE	JAF2B
Champagne Pearl Coat	WTH	5475	B9882	57056	CHA99:WTH	LLY7B
Everglade Pearl Coat	WPT	5472	F8200	56686	CHA99:WPT	LEC8B
Deep Amethyst Pearl Coat	TCN	5246	B9736	52026	CHA97:TCN	FNE4B
Bright Metallic Clear Coat	MS4	4820	B9642	48823	CHA94:MS4	6GG7B
Black Clear Coat	DX8	9700	99	34858 90-5950	CHA85:DX8	TC60B
Taupe Frost Pearl Coat	TTK	5244	B9750	52567	CHA97:TTK	FNE5B
Stone White Clear Coat	SW1	83542	B9622	51540	CHA96:SW1	8KY5B
Bright White Clear Coat	GW7	4037	B8833	37298	CHA88:GW7	TA45B

INTERIOR COLOR

INTERIOR COLOR	CHRY CODE	PPG	DuPONT	S-W** M-S**	AKZO NOBEL SIKKENS	ICI**
Agate	AZ	9856/2-1461	C9208	45994	CHALAZI	7WCB
Camel	K5	27731/2-1584	C9603	51541	CHARK5I	7VX6
Taupe	L5	28653/2-1652	C9873	54420	CHARL5I	KXE6

NOTE: *Herberts Standox, Spies Hecker, and BASF use the Chrysler paint code as listed on the Body Code Plate and the Vehicle Safety Certification label. ** S-W = Sherwin-Williams, M-S = Martin Senour, ICI = ICI Autocolor.

STATIONARY GLASS

INDEX

DESCRIPTION AND OPERATION

SAFETY PRECAUTIONS

WARNING: DO NOT OPERATE THE VEHICLE WITHIN 24 HOURS OF WINDSHIELD INSTALLATION. IT TAKES AT LEAST 24 HOURS FOR URETHANE ADHESIVE TO CURE. IF IT IS NOT CURED, THE WINDSHIELD MAY NOT PERFORM PROPERLY IN AN ACCIDENT.

URETHANE ADHESIVES ARE APPLIED AS A SYSTEM. USE GLASS CLEANER, GLASS PREP SOLVENT, GLASS PRIMER, PVC (VINYL) PRIMER AND PINCH WELD (FENCE) PRIMER PROVIDED BY THE ADHESIVE MANUFACTURER. IF NOT, STRUCTURAL INTEGRITY COULD BE COMPROMISED.

CHRYSLER DOES NOT RECOMMEND GLASS ADHESIVE BY BRAND. TECHNICIANS SHOULD REVIEW PRODUCT LABELS AND TECHNICAL DATA SHEETS, AND USE ONLY ADHESIVES THAT THEIR MANUFACTURES WARRANT WILL RESTORE A VEHICLE TO THE REQUIREMENTS OF FMVSS 212. TECHNICIANS SHOULD ALSO INSURE THAT PRIMERS AND CLEANERS ARE COMPATIBLE WITH THE PARTICULAR ADHESIVE USED.

BE SURE TO REFER TO THE URETHANE MANUFACTURER'S DIRECTIONS FOR CURING TIME SPECIFICATIONS, AND DO NOT USE ADHESIVE AFTER ITS EXPIRATION DATE.

VAPORS THAT ARE EMITTED FROM THE URETHANE ADHESIVE OR PRIMER COULD CAUSE PERSONAL INJURY. USE THEM IN A WELL-VENTILATED AREA.

SKIN CONTACT WITH URETHANE ADHESIVE SHOULD BE AVOIDED. PERSONAL INJURY MAY RESULT.

ALWAYS WEAR EYE AND HAND PROTECTION WHEN WORKING WITH GLASS.

CAUTION: Protect all painted and trimmed surfaces from coming in contact with urethane or primers.

Be careful not to damage painted surfaces when removing moldings or cutting urethane around windshield.

It is difficult to salvage a windshield during the removal operation. The windshield is part of the structural support for the roof. The urethane bonding used to secure the windshield to the fence is difficult to cut or clean from any surface. If the moldings are set in urethane, it would also be unlikely they could be salvaged. Before removing the windshield, check the availability of the windshield and moldings from the parts supplier.

REMOVAL AND INSTALLATION

WINDSHIELD

REMOVAL

(1) Remove inside rear view mirror.
(2) Remove cowl cover.
(3) Remove screws attaching windshield side molding to A-pillar (Fig. 1).
(4) Remove upper windshield molding.
(5) Cut urethane bonding from around windshield using a suitable sharp cold knife. A pneumatic cutting device can be used if available (Fig. 2).
(6) Separate windshield from vehicle.

INSTALLATION

WARNING: REVIEW ALL WARNINGS AND CAUTIONS IN THIS GROUP BEFORE PRECEDING WITH INSTALLATION.

CAUTION: Open a window before installing windshield. This will avoid pressurizing the passenger compartment. If a door or liftgate is slammed before urethane is cured, water leaks can result.

The windshield fence should be cleaned of old urethane bonding material. Support spacers should be

REMOVAL AND INSTALLATION (Continued)

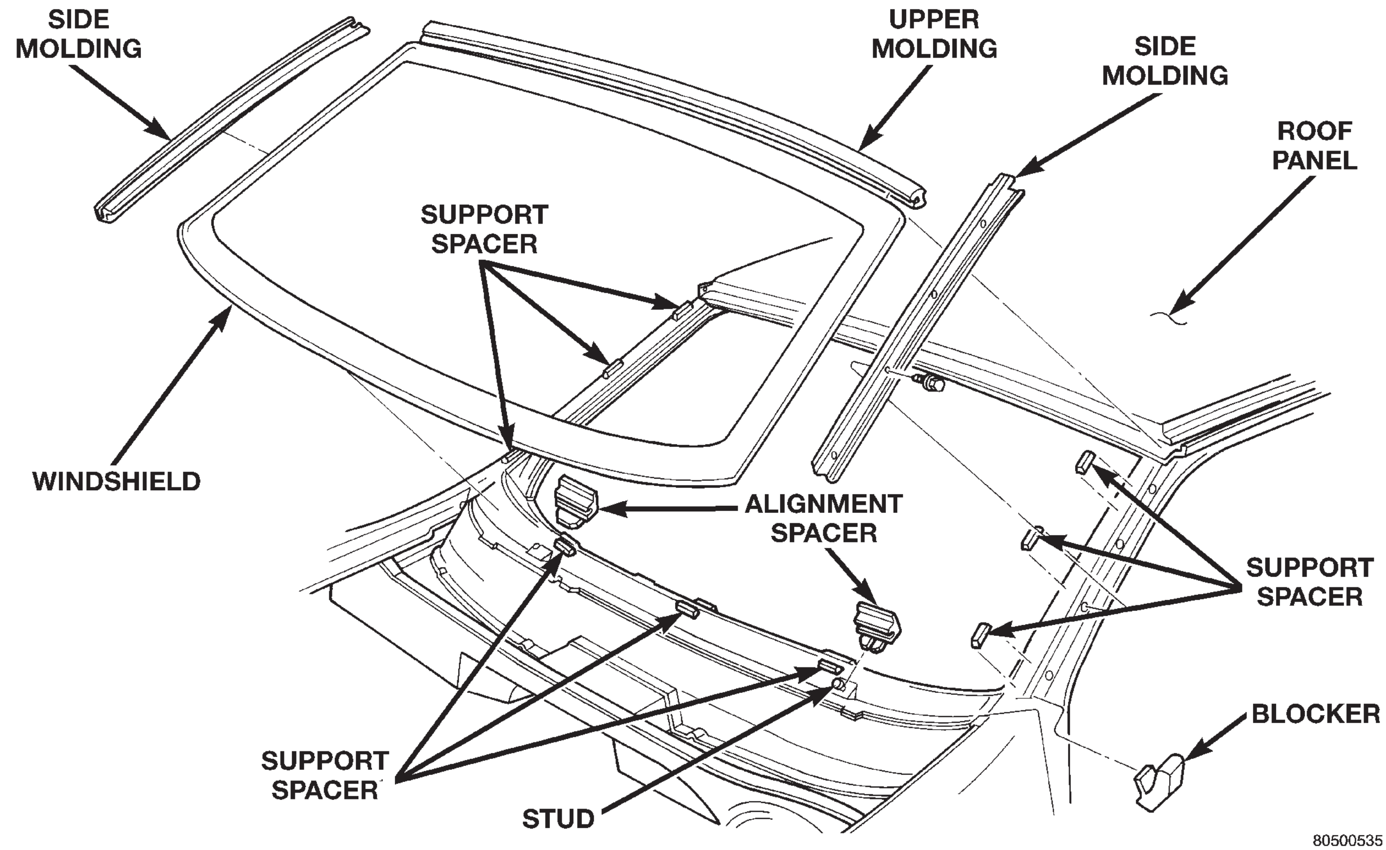


Fig. 1 Windshield

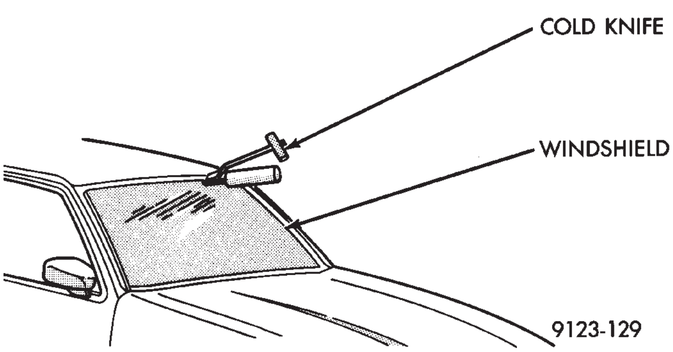


Fig. 2 Cut Urethane Around Windshield—Typical

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. 3).

(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. 4).

(3) Clean inside of windshield with Mopar Glass Cleaner and lint-free cloth.

(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. 1).

(7) Apply a 10 mm (0.4 in.) bead of urethane around perimeter of windshield along the inside of the moldings. Apply two beads along the bottom edge.

(8) Install upper molding onto windshield.

(9) Apply fence primer around the perimeter of the windshield opening fence. Allow at least 18 minutes drying time.

(10) With aid of a helper, position windshield over windshield opening. Align reference marks at bottom of windshield to support spacers.

(11) 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.

REMOVAL AND INSTALLATION (Continued)

(12) Clean excess urethane from exterior with Mopar Super Clean or equivalent.

(13) Install windshield side moldings.

(14) Install cowl cover and wipers.

(15) Install inside rear view mirror.

(16) After urethane has cured, water test windshield to verify repair.

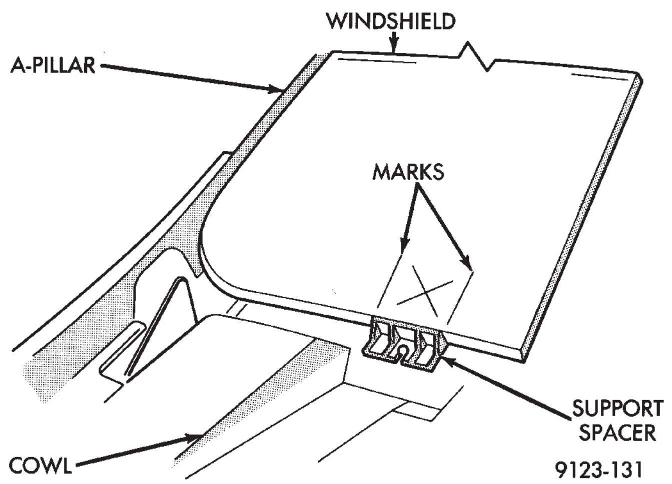


Fig. 3 Center Windshield and Mark at Support Spacers

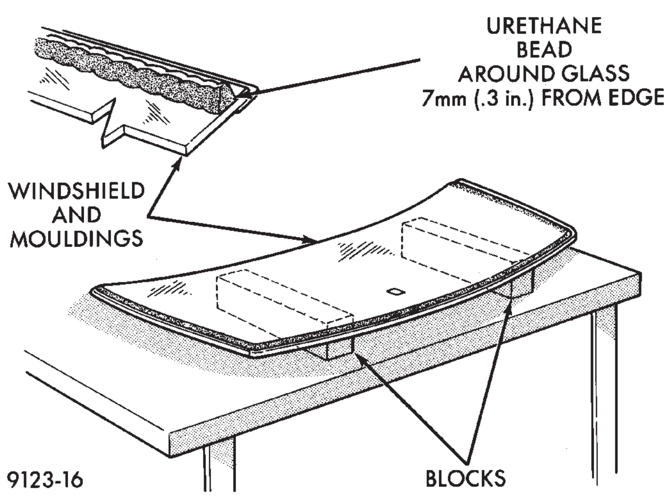


Fig. 4 Work Surface Set up and Molding Installation

QUARTER WINDOW GLASS

REMOVAL

(1) Cut urethane bonding from around quarter window glass using a suitable sharp cold knife. A pneumatic cutting device can be used if available.

(2) Separate glass from vehicle.

INSTALLATION

CAUTION: Open a window before installing glass. This will avoid pressurizing the passenger compartment. If a door or liftgate is slammed before urethane is cured, water leaks can result.

The window opening fence should be cleaned of old urethane bonding material.

(1) Clean inside of glass with Mopar Glass Cleaner and lint-free cloth.

(2) Apply PVC (vinyl) primer 25 mm (1 in.) wide around edge of glass. Wipe with clean/dry lint-free cloth.

(3) Apply fence primer around edge of fence. Allow at least eighteen minutes drying time.

(4) Apply a 10 mm (0.4 in.) bead of urethane around window vinyl border location.

Position glass into window opening and lock clips into place (Fig. 5).

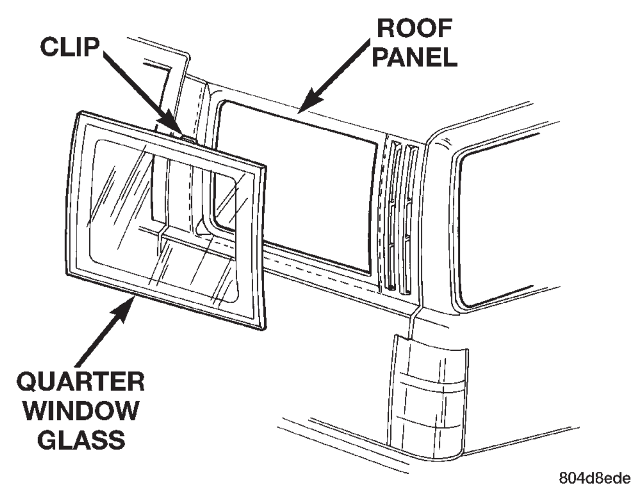


Fig. 5 Quarter Window Glass

POWER SUNROOF

INDEX

DESCRIPTION AND OPERATION

SUNROOF OPERATION

WARNING: Keep fingers and other body parts out of sunroof opening at all times.

The sunroof features a power sliding glass panel and a sunshade which can be manually positioned anywhere along its travel, rearward of glass panel front edge.

The sunroof is electrically operated from a switch located on the mini overhead console. To operate the sunroof the ignition switch must be in the On/Run position. The sunroof has both manual and Express Open modes of operation when opening. To open the sunroof in the Express Open mode, the switch is pressed rearward for less than **1 second** . This causes the sunroof glass to automatically retract and stop at the “Comfort Stop” position, a position approximately four inches forward of full open that reduces low speed wind buffeting. If desired, the sunroof glass can then be fully opened in Express Open mode by again pressing the switch reward for less than **1 second** . The sunroof can also be opened manually by pressing and holding the switch rearward. Once the switch is held reward for more than **1 second** , the glass will retract in the manual mode. Releasing the switch at any time during travel will cause the sunroof to stop at the current position.

To close the sunroof from an open position, the switch must be pushed forward and held until the sunroof reaches the fully closed position. Releasing the switch at any time in this mode will cause the sunroof to stop at the current position.

To vent the sunroof from the closed position, the switch is pushed forward and held. Releasing the switch at any time during travel will cause the sunroof to stop at the current vent position. To reach the fully vented position, continue to hold the switch forward until vent motion stops. To close the sunroof from the vent position, push and hold the switch rearward until the glass reaches the fully closed position.

SERVICE PROCEDURES

DIAGNOSTIC PROCEDURES

Before beginning sunroof diagnostics verify that all other power accessories are in proper operating condition. Refer to Sunroof Diagnostic Chart for possible causes. If not, a common electrical problem may exist. Refer to Group 8W, Wiring Diagrams, of this publication for circuit, splice and component descriptions. Check the condition of the circuit protection (20 amp high current fuse (battery feed) located in the Power Distribution Center (PDC). Check the cover of the PDC for location of the fuse. The ten amp fuse (ignition feed) located in cavity 14 of the Junction Block). Inspect all wiring connector pins for proper engagement and continuity. Check for battery voltage at battery and ignition pins of the power sunroof express module wiring connector. Refer to Group 8W, Wiring Diagrams, for circuit information. The controller will not operate at less than 10 volts. Check the ground at the sunroof express module.

Before beginning diagnosis for wind noise or water leaks, verify that the problem was not caused by releasing the control switch before the sunroof was fully closed. The sunroof module has a water-management system. During washing high-pressure water may be forced between the glass panel seal and the roof opening. Normally this water will drain. However, when some type of drying blower system is used, like those found in automatic car washes, the water may not have a chance to drain before the blower forces air between the seal and the roof opening. This causes the water to blow over the edge of the module and onto the headlining.

Refer to (Fig. 1) Sunroof Assembly for exploded view of the sunroof.

SERVICE PROCEDURES (Continued)

SUNROOF DIAGNOSIS CHART

SYMPTOM	POSSIBLE CAUSE
Sunroof motor inoperative.	Faulty control switch. Faulty circuit ground between sunroof express module, drive motor, control switch, and body harness. Faulty power circuit between sunroof express module, drive motor, switch, and body harness. Faulty sunroof drive motor. Faulty sunroof express module. Faulty sunroof drive motor connector.
Audible whine when switch is depressed, sunroof does not operate.	Faulty sunroof drive motor. Binding cable.
Audible clicking or ratcheting when switch is pressed, sunroof does not operate.	Broken or worn drive cable. Worn drive motor gear. Mechanisms not synchronized.
Sunroof vents and opens, but does not close.	Binding cable. Faulty circuit. Faulty control switch. Faulty sunroof express module. Faulty drive motor.
Sunroof vents, but does not open.	Binding linkage. Faulty circuit. Faulty switch. Faulty sunroof controller. Faulty drive motor.
Sunroof does not vent	Binding cable. Faulty circuit. Faulty control switch. Faulty sunroof express module.
Sunroof water leak.	Drain tubes cut, disconnected,clogged or kinked. Drain tube grommet loose at floorpan. Glass panel improperly adjusted. Faulty glass panel seal.
Wind noise from sunroof.	Front of glass panel too high or rear too low. Glass panel not centered in opening. Faulty glass panel seal. Roof rack crossbar to close to rear of suroof opening.
Rattles from open sunroof while driving	Loose or broken attaching hardware. Worn or broken mechanism.
Rattles from closed sunroof while driving	Loose or broken attaching hardware. Worn or broken mechanism. Loose wiring or wiring components.

SERVICE PROCEDURES (Continued)

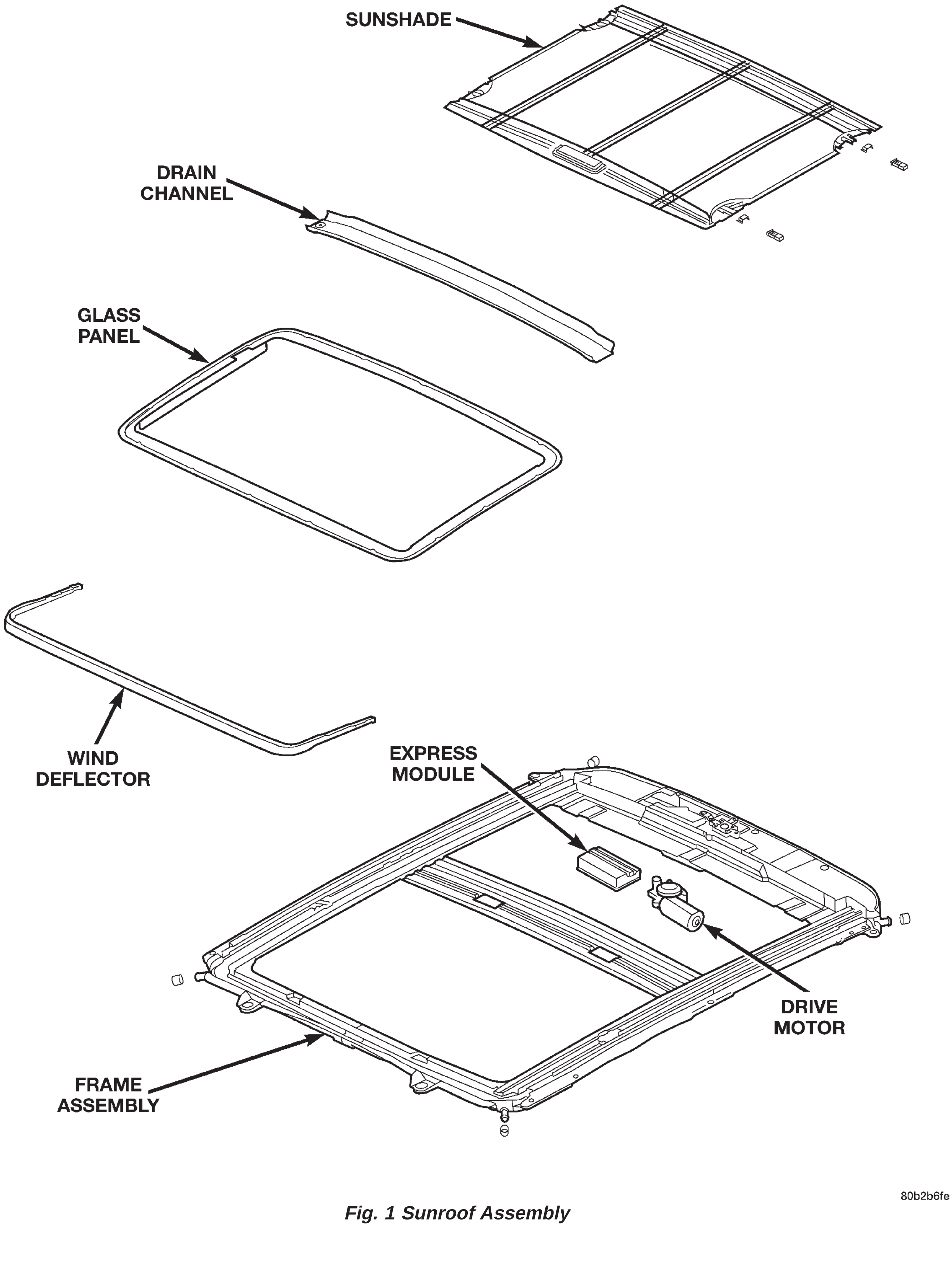


Fig. 1 Sunroof Assembly

REMOVAL AND INSTALLATION

SUNROOF WIND DEFLECTOR

REMOVAL

(1) Open sunroof glass panel.

(2) Push down one corner of the wind deflector and let the other corner rise up (Fig. 2).

(3) Push the low corner towards the opposite side of the vehicle until tab on sunshade clears the body. Then raise the corner up.

(4) Repeat the procedure to the other corner.

(5) Lift wind deflector to 90% of the way.

(6) Push the attaching ends of the deflector to the rear of the vehicle to disengage the deflector.

INSTALLATION

(1) Place wind deflector at 90% in the vertical position to the sunroof. With the sunroof open.

(2) Push ends of the deflector towards the front of the vehicle to engage ends.

(3) Lower wind deflector to normal position.

(4) Push one corner to the opposite side of the vehicle until tab clears vehicle body and lower deflector for that corner.

(5) Push the side that was just installed completely down.

(6) Push the opposite corner cross vehicle until tab clears the body. Then lower deflector to position.

(7) Test sunroof operation.

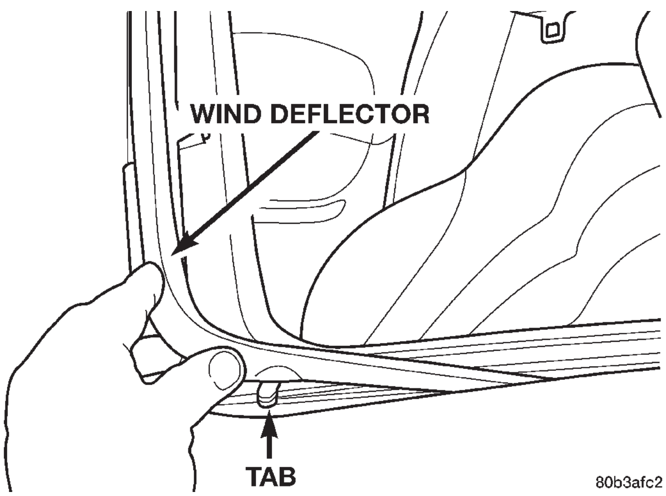


Fig. 2 Wind Deflector

SUNROOF GLASS PANEL

REMOVAL

(1) Slide sunshade rearward to the open position.

(2) Move the glass panel to the fully closed position.

(3) Remove the four attaching screws (Fig. 3).

(4) Lift off glass panel and remove from vehicle.

INSTALLATION

NOTE: Sunroof glass must be set in place and attached as close as possible to flush with the roof surface. For wind noise reasons, care must be taken to ensure that the glass is not remounted either a) Overflush to the roof surface at the front edge of the glass, or b) Underflush to the roof surface at the rear edge of the glass.

(1) Position glass panel in to opening.

(2) Start the four attaching screws.

(3) Tighten screws.

(4) Verify sunroof operation and alignment. Check fit and adjust as necessary, refer to Sunroof Glass Panel Adjustment for proper procedures.

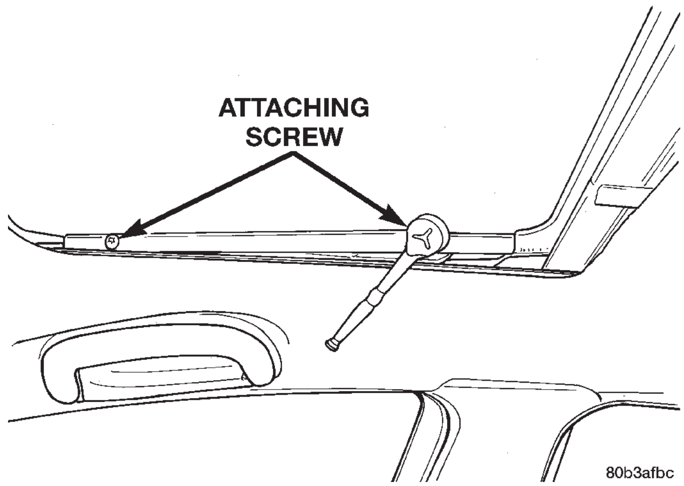


Fig. 3 Sunroof Glass Panel Removal

DRAIN TUBE

REMOVAL

(1) Remove the headliner to access clamps attaching drain tube to sunroof (Fig. 4).

(2) Disengage clamps attaching drain tube to sunroof .

(3) Tape the end of the old drain tube to the new drain tube. Ensure that the tape build up on the tube ends is not excessive.

(4) Remove front/rear trim panels as necessary to disengage clamps securing drain tube to body .

(5) Remove the drain tube plug from the underside of the vehicle.

(6) From the underside of the vehicle carefully, pull/route the drain tube through the body panel. Applying a soapy water solution to the new tube may aid in this procedure.

INSTALLATION

(1) Install the plug adapter to the bottom of the drain tube.

REMOVAL AND INSTALLATION (Continued)

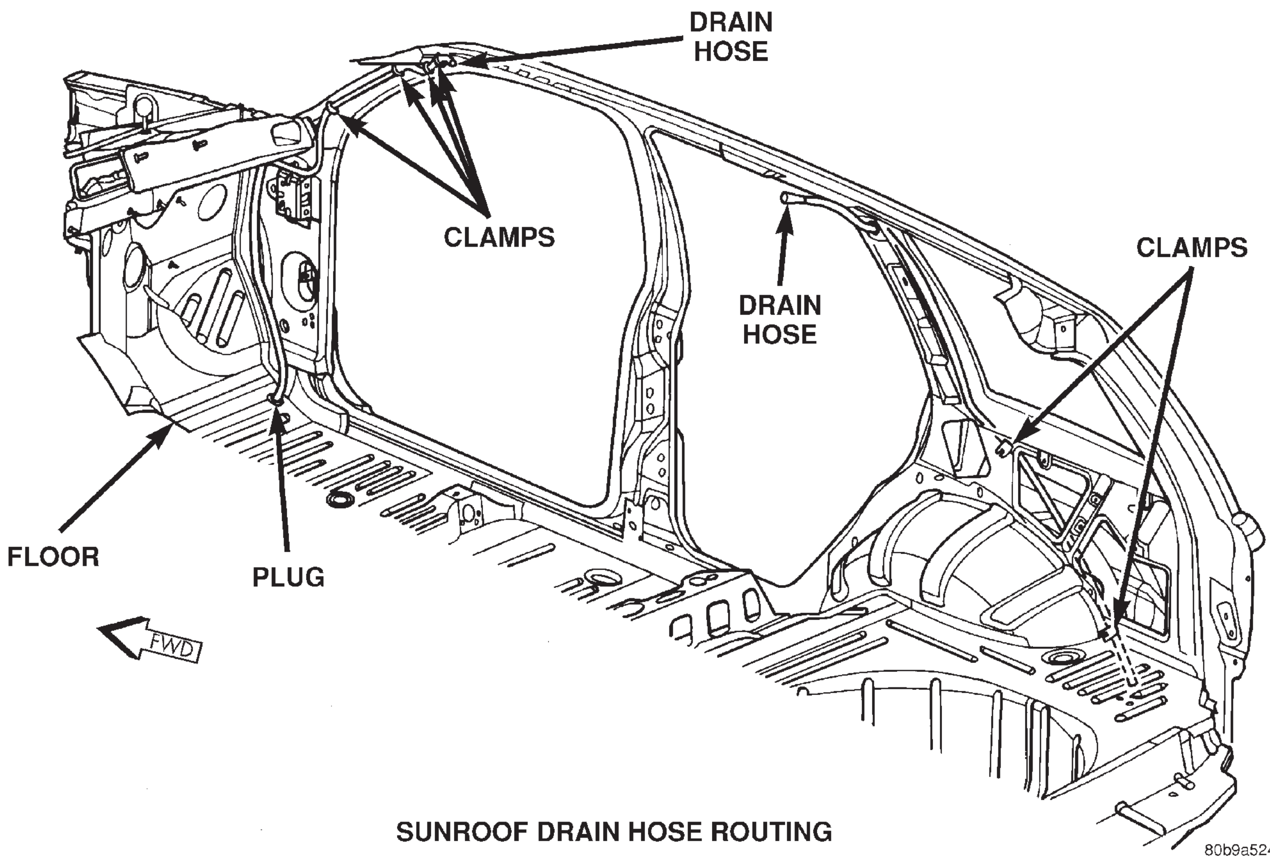


Fig. 4 Sunroof Drain Hose Routing

(2) Engage clamps securing drain tube to body (Fig. 4).

(3) Install front/rear trim panels as necessary.

(4) Install drain tube to sunroof and engage clamp.

(5) Install the headliner.

SUNROOF EXPRESS MODULE

REMOVAL

(1) Move the glass panel to the fully closed position.

(2) Remove A-pillar trim, sun visors, and map lamp/mini console.

(3) Lower headliner as necessary to gain access to the sunroof express module.

(4) Disconnect the express module wire harness connectors.

(5) Remove express module screw.

(6) Remove express module from the keyway by sliding module towards the center of the vehicle.

INSTALLATION

(1) Insert sunroof express module in the keyway located in the sunroof module and slide the module outward to lock it into position.

(2) Install the sunroof express module screw.

(3) Connect the wire connectors to the sunroof express module.

(4) Install the headliner into position.

(5) Install the A-pillar trim, sun visors, and map lamp/mini console.

(6) Test sunroof operation, adjust if necessary.

SUNROOF DRIVE MOTOR

REMOVAL

NOTE: The sunroof system is timed from the factory so that the motor shuts off automatically when the sunroof window reaches a certain position. Extreme care must be taken when removing the motor, timing may be thrown off causing possible damage to the sunroof system. Anytime the motor is removed from the sunroof assembly the sunroof glass panel must be in the FULLY CLOSED POSITION or the unit will be out of timing. The drive motor cannot be reset to the park position after being removed.

(1) Move glass panel to the fully closed position.

(2) Remove A,B,C, and D-pillar trim, sun visors, and map lamps/mini console.

(3) Disconnect the control switch wire connector.

REMOVAL AND INSTALLATION (Continued)

(4) Remove headliner as necessary to gain access to sunroof drive motor. Refer to Headliner Removal and Installation for proper procedures.

(5) Disconnect the drive motor wire harness connectors (Fig. 5).

(6) Remove drive motor fasteners and remove motor from the sunroof housing .

INSTALLATION

(1) Ensure that the window is in the fully closed position before mounting the motor. If motor fails with the window in the open position the sunroof glass panel timing will have to be timed. The new motor comes in the fully closed position and with a gage for setting cable timing. Refer to Sunroof Glass Panel Timing.

(2) Place drive motor into position on the sunroof housing and install fasteners.

(3) Connect express module, drive motor, and control switch wire connectors.

(4) Set headliner into position.

(5) Test sunroof operation, adjust as necessary.

(6) Finish installing the headliner.

(7) Connect the control switch wire connector.

(8) Install A,B, C, and D-pillar trim, sun visors, and map lamps/mini console.

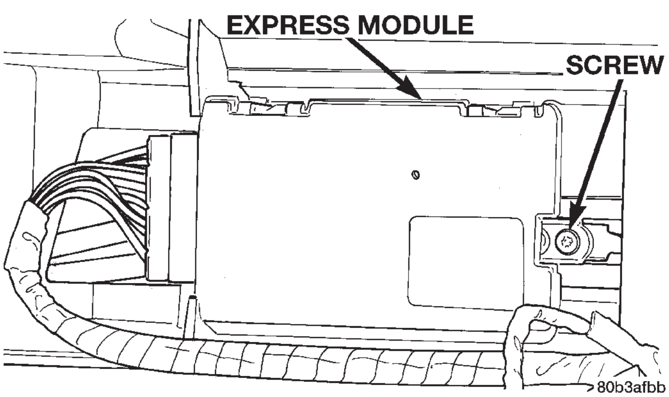


Fig. 5 Sunroof Drive Motor and Express Module

SUNROOF GLASS PANEL TIMING

Sunroof Drive Cable Timing

NOTE: A gage comes with the new motor.

(1) If the glass panel was not in the fully closed position, when the motor was removed, the sunroof glass panel needs to be timed, before the new motor is installed.

(2) Remove sunroof glass panel.

(3) Set gage into the track near the rear of the opening between the driver slide and the bracket (Fig. 6).

(4) Move the driver slide forward or aft to get proper setting.

(5) Repeat the operation on the other side.

(6) Install drive motor.

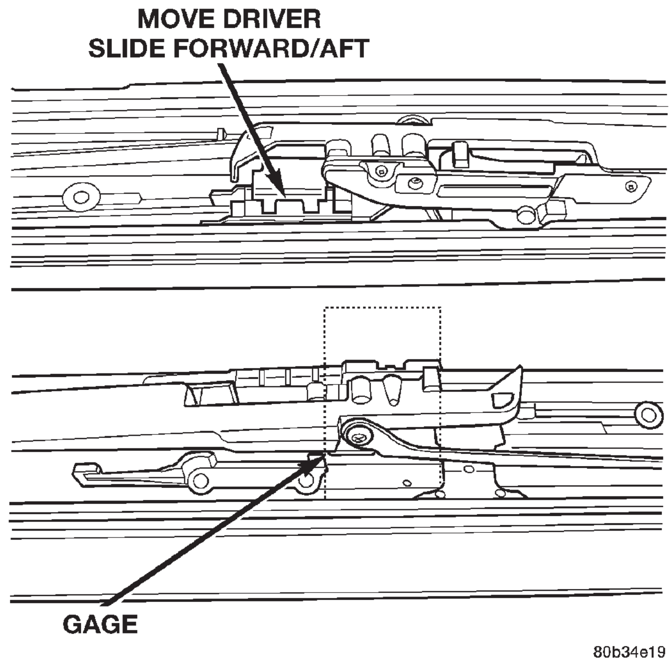


Fig. 6 Sunroof Drive Cable Timing

SUNROOF SUNSHADE

REMOVAL

(1) Open sunroof approximately 50% of the way.

(2) Push sunshade down until tabs clear glass.

(3) Move sunshade forward of glass panel.

(4) Compress the spring loaded plungers holding the guide blocks in the track.

(5) Slide the sunshade forward while lifting the front through the opening until the rear guide blocks are accessible.

CAUTION: Use care not to crease the sunshade when removing or installing.

(6) Disengage rear guide blocks from track.

INSTALLATION

(1) Install the sunshade from outside of the vehicle with the sunroof fully open.

(2) Put rear guide blocks into sunshade guide track .

(3) Push sunshade back and down through the sunroof opening.

(4) Using a flat blade tool, put front guide blocks into the sunshade track. By pushing the block towards the center of the vehicle.

(5) Move the glass panel to approximately halfway to the fully closed position.

REMOVAL AND INSTALLATION (Continued)

(6) Push sunshade down until the sunshade clears the glass then move sunshade rearward behind the glass panel.

SUNROOF HOUSING ASSEMBLY

REMOVAL

(1) Move glass panel to the fully closed position.
(2) Disconnect battery negative cable.
(3) Recline both front seats.
(4) Remove overhead console.
(5) Remove headliner
(6) Disconnect the drain tubes from sunroof housing (Fig. 7).
(7) Loosen fasteners attaching sunroof housing assembly.
(8) With the aid of a helper, remove fasteners attaching sunroof housing assembly to roof panel.

INSTALLATION

(1) Raise the sunroof housing assembly and guide into position and start fasteners (Fig. 7).
(2) Tighten the fasteners, front to rear, attaching the sunroof module to roof panel. Tighten the fasteners, front to rear, to 11 N·m (97 in. lbs.) torque.
(3) Connect the drain tubes to the sunroof housing.
(4) Set headliner into position.
(5) Connect express module, drive motor, and control switch wire connectors.
(6) Test sunroof operation, adjust as necessary.
(7) Finish installing the headliner.
(8) Connect battery negative cable.

ADJUSTMENTS

SUNROOF GLASS PANEL ADJUSTMENT

(1) Move the sunshade rearward to the open position.
(2) Move the sunroof glass panel to the fully closed position.

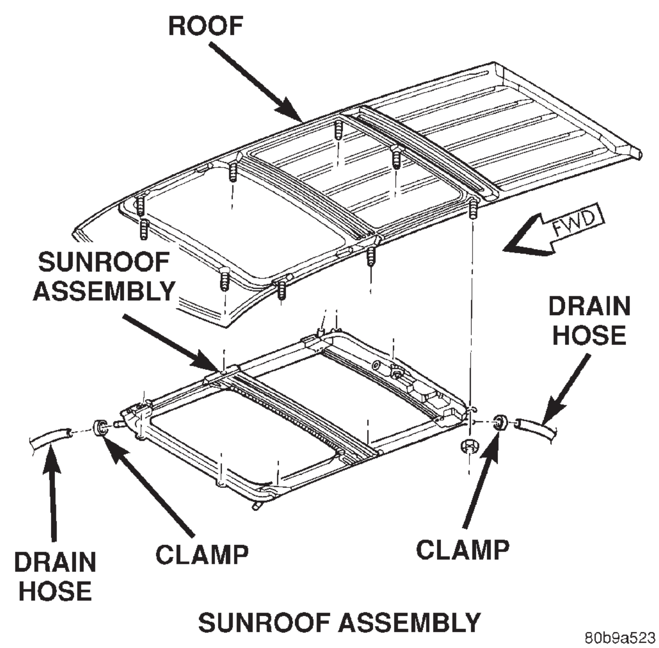


Fig. 7

(3) Loosen the forward screws on each side enough to make the front adjustment.
(4) Adjust the front of the sunroof glass panel 1 mm (1/32 inch) below the top surface of the roof panel.
(5) Tighten the front two screws.
(6) Loosen the rear screws on each side enough to make the rear adjustment.
(7) Adjust the rear of the sunroof glass panel 1 mm (1/32 inch) above the top surface of the roof panel.
(8) Tighten the rear two screws.
(9) Check for proper fit. If not OK, repeat glass panel adjustment.

SEATS

INDEX

REMOVAL AND INSTALLATION

FRONT BUCKET SEAT

REMOVAL

(1) Move seat to full rearward position.
(2) Remove front bolts attaching seat to floor pan (Fig. 1).
(3) Move seat to full forward position.
(4) Using a trim stick, pry cover from seat track (power seat only).
(5) Remove rear bolts attaching seat to floor pan.
(6) If equipped, disconnect power seat wire harness connector or belt buckle chime switch.
(7) Remove seat from vehicle.

INSTALLATION

(1) Position seat on floor pan.
(2) If equipped, connect power seat wire harness connector or belt buckle chime switch.
(3) Install rear bolts attaching seat to floor pan. Tighten bolts to 40 N·m (30 ft. lbs.) torque.
(4) If equipped, install cover on seat track.
(5) Move seat to full rearward position.
(6) Install front bolts attaching seat to floor pan. Tighten bolts to 40 N·m (30 ft. lbs.) torque.

BUCKET SEAT SIDE SHIELD

REMOVAL

(1) Remove screws attaching side shield to seat frame.
(2) Disconnect wire harness connectors from power seat and power lumbar switches, if equipped.

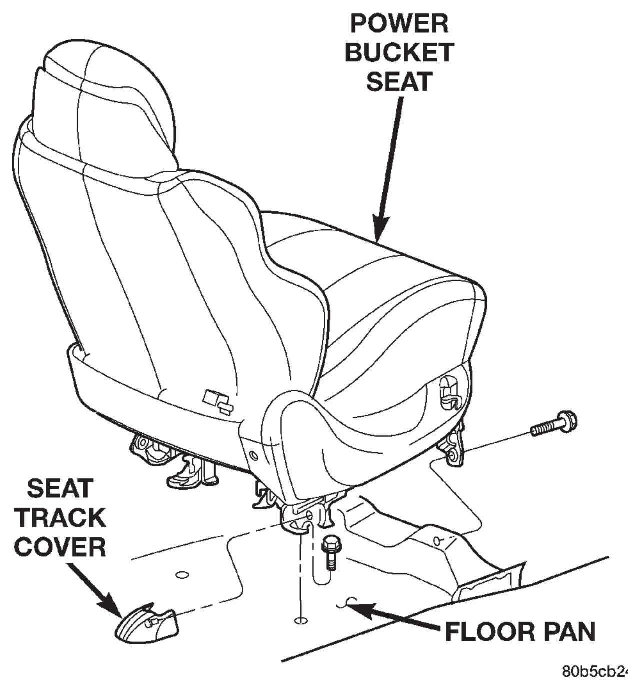


Fig. 1 Front Bucket Seat

(3) Separate side shield from seat.

INSTALLATION

(1) Position side shield on seat.
(2) Connect wire harness connectors to power seat and power lumbar switches, if equipped.
(3) Install screws attaching side shield to seat frame.

REMOVAL AND INSTALLATION (Continued)

BUCKET SEAT TRACK ADJUSTER

REMOVAL

(1) Remove seat.

(2) Remove nuts attaching seat track adjuster to seat cushion frame (Fig. 2) and (Fig. 3).

(3) Disengage clips attaching wire harness to adjuster.

(4) Disengage seat memory module connector, if equipped.

(5) Separate seat track from seat cushion frame.

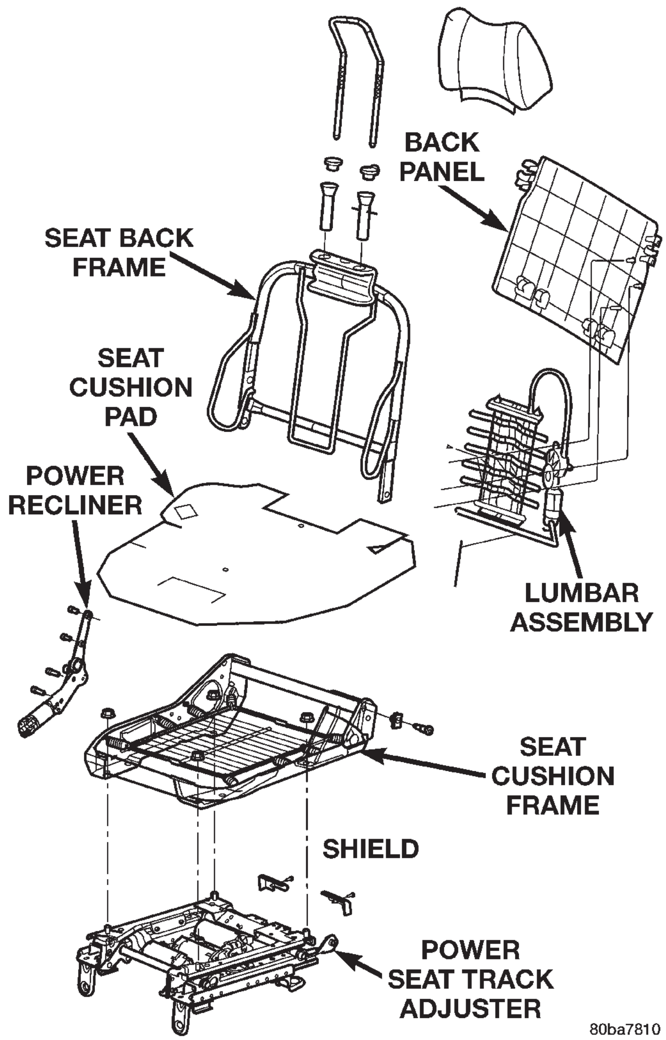


Fig. 2 Seat Track Adjuster—Power

INSTALLATION

(1) Transfer seat memory module, if equipped.

(2) Position seat track on seat cushion frame.

(3) Route harness through frame and engage clips attaching wire harness to adjuster.

(4) Engage seat memory module connector, if equipped.

(5) Install nuts attaching seat track adjuster to seat cushion frame. Tighten nuts to 28 N·m (20 ft. lbs.) torque.

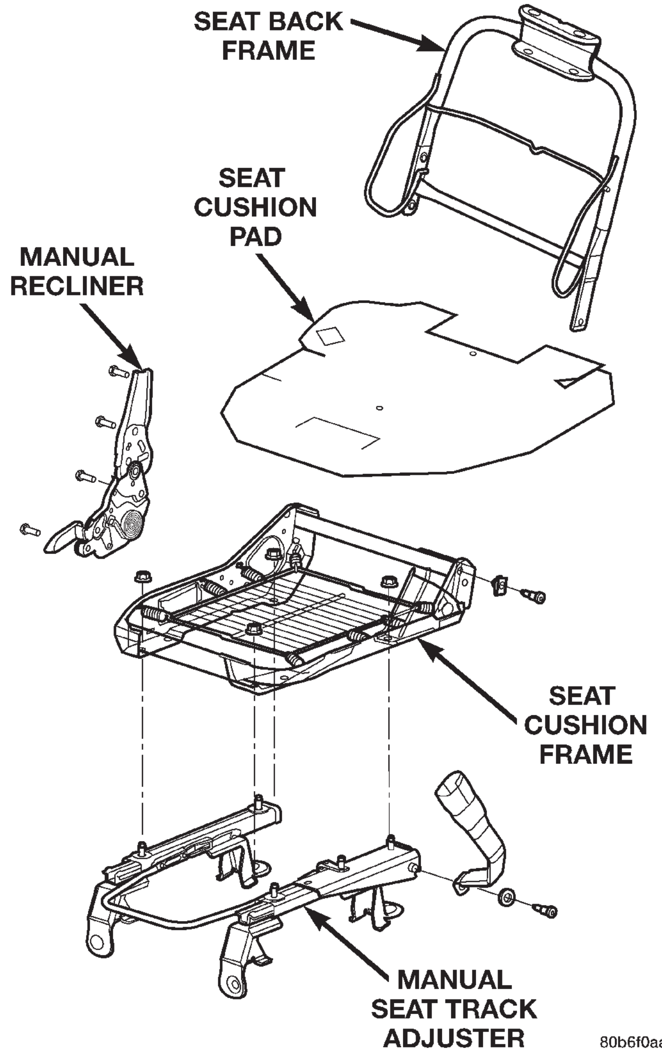


Fig. 3 Seat Track Adjuster — Manual

(6) Install seat.

BUCKET SEAT RECLINER

REMOVAL

(1) Remove seat back.

(2) Disengage J-strap at base of seat back.

(3) Roll seat back cover upward to access bolts attaching recliner to seat back frame.

(4) Remove bolts attaching recliner to seat back frame.

(5) Separate recliner from seat back.

INSTALLATION

(1) Position recliner on seat back.

(2) Install bolts attaching recliner to seat back frame. Tighten bolts to 28 N·m (20 ft. lbs.) torque.

(3) Roll seat back cover downward.

(4) Engage J-strap at base of seat back.

(5) Install seat back.

REMOVAL AND INSTALLATION (Continued)

BUCKET SEAT BACK

REMOVAL

(1) Move seat to full rearward position.

(2) Remove inboard bolt attaching seat back frame to seat cushion frame.

(3) Move seat to full forward position.

(4) Move seat back to full recline position.

(5) Remove screws attaching seat side shield to seat frame.

(6) Disconnect wire harness connector from recliner motor, if equipped.

(7) From the underside of the seat, disconnect the wire harness connector for the power lumber and/or heated seat, if equipped.

(8) Remove outboard bolts attaching recliner to seat cushion frame.

(9) Route the power lumber and/or heated seat harness through the seat cushion cover, if equipped.

(10) Separate seat back from seat cushion.

INSTALLATION

(1) Position seat back on seat cushion.

(2) Route the power lumber and heater harness through the seat cushion cover, if equipped.

(3) Install recliner bolts attaching seat back frame to seat cushion frame. Tighten bolts to 28 N·m (20 ft. lbs.) torque.

(4) Install the inboard bolt attaching seat back frame to seat cushion frame. Tighten bolt to 47N·m (35 ft.lbs.).

(5) Connect wire harness connector to recliner motor and/or heated seat, if equipped.

(6) From the underside of the seat, connect the power lumber and/or heated seat wire harness connector to the seat harness, if equipped.

(7) Install screws attaching seat side shield to seat frame.

BUCKET SEAT HEAD RESTRAINT

REMOVAL

(1) Depress head restraint release button and lift head restraint to full up position.

(2) Using a small flat blade, depress tab on right side head restraint release button and using your hand, simultaneously press tab on left side head restraint release button (Fig. 4) and pull head restraint up to separate from seat back.

INSTALLATION

(1) Position head restraint in seat back, press tab on left side head restraint release button and push down to secure.

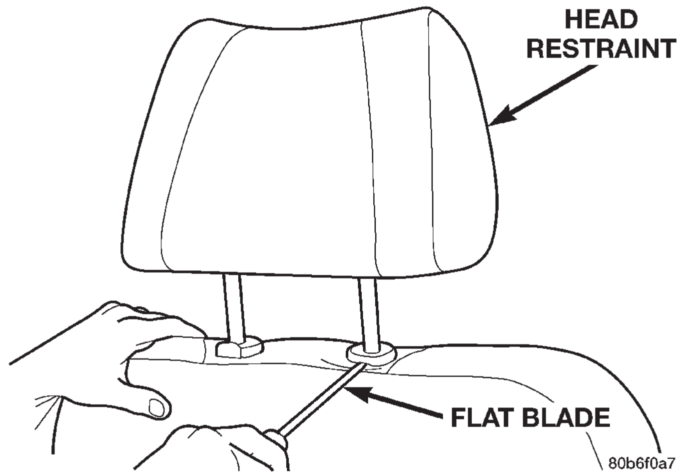


Fig. 4 Head Restraint

BUCKET SEAT HEAD RESTRAINT SLEEVE

REMOVAL

(1) Remove head restraint.

(2) Remove seat back.

(3) Remove seat back cover.

(4) Remove hog rings attaching cushion pad to seat back frame (Fig. 5).

(5) Remove cushion pad from seat back frame.

(6) Rotate head restraint sleeve 1/4 turn counter-clockwise to release retaining tab.

(7) Pull sleeve from seat back frame (Fig. 6).

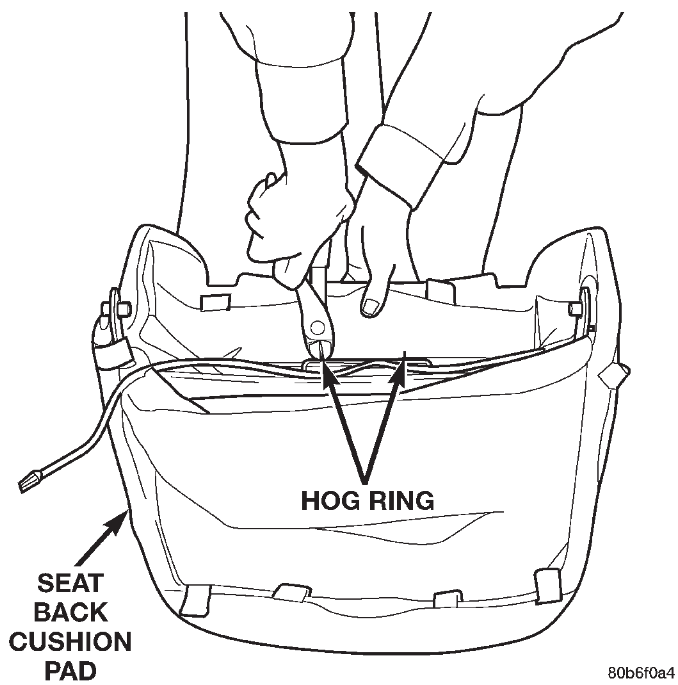


Fig. 5 Cushion Pad

INSTALLATION

(1) Position sleeve in seat back frame.

REMOVAL AND INSTALLATION (Continued)

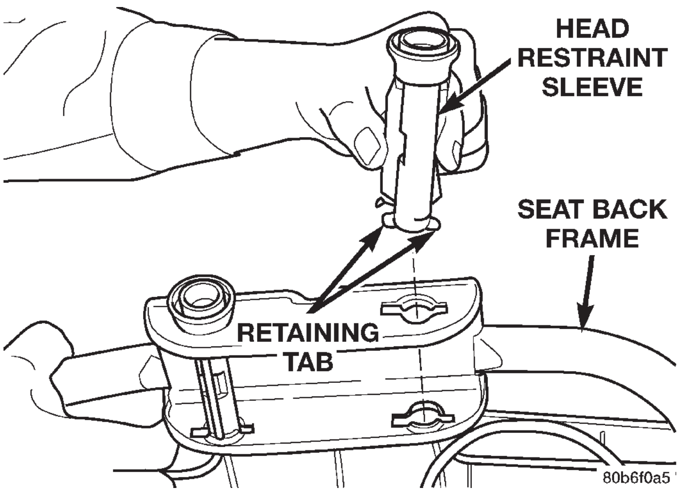


Fig. 6 Head Restraint Sleeve

(2) Rotate head restraint sleeve 1/4 turn clockwise to engage retaining tab.

(3) Install cushion pad onto seat back frame.

(4) Install hog rings attaching cushion pad to seat back frame.

(5) Install seat back cover.

(6) Install seat back.

(7) Install head restraint.

BUCKET SEAT BACK COVER

REMOVAL

(1) Remove head restraint.

(2) Using a trim stick, carefully pry head restraint release button caps from the top of seat back.

(3) Remove seat back.

(4) Disengage J-strap at base of seat back.

(5) Slide hand between the face of the seat back pad and the cushion cover and carefully separate hook and loop fastener (Fig. 7).

(6) Roll cover upward and disengage hog rings.

(7) Roll cover upward to top of seat back.

(8) Separate cover from seat back.

INSTALLATION

(1) Position cover inside-out at the top of seat back.

(2) Roll cover downward.

(3) Engage hog rings.

(4) Align seat back cover with hook and loop fasteners and secure.

(5) Roll cover downward.

(6) Engage J-strap at base of seat back.

(7) Install seat back.

NOTE: The taller head restraint release button cap is positioned on the left hand side and the head restraint button cap with the hidden button is positioned on the right hand side.

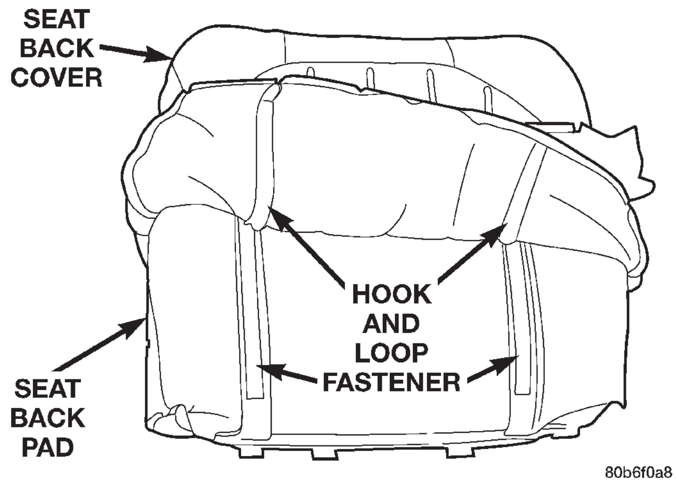


Fig. 7 Seat Back Cover

(8) Position head restraint release button caps on head restraint sleeves and press to secure.

(9) Install head restraint.

BUCKET SEAT CUSHION COVER

REMOVAL

(1) Remove seat from vehicle.

(2) Remove seat back.

(3) Disengage J-straps attaching cushion cover to seat cushion frame.

(4) Disengage hog rings attaching cushion cover to cushion frame (Fig. 8).

(5) Route seat function switches through access hole on outboard side of seat cushion, if equipped.

(6) Disengage seat cushion heater element connector, if equipped.

(7) Separate seat cushion cover from seat cushion.

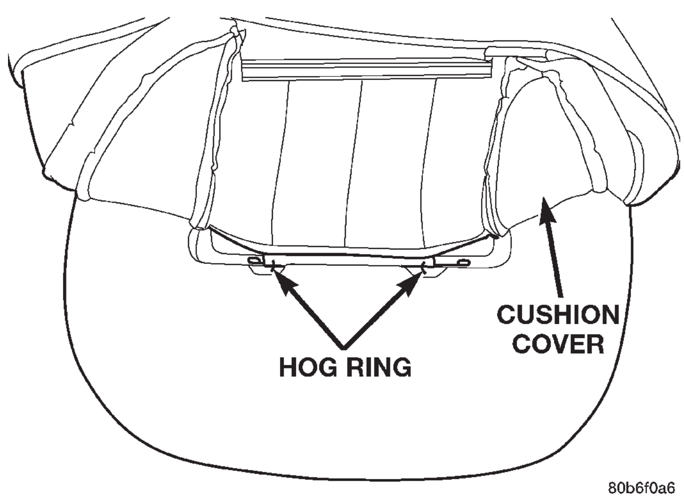


Fig. 8 Seat Cushion Cover

INSTALLATION

(1) Position seat cover on cushion.

REMOVAL AND INSTALLATION (Continued)

(2) Engage seat cushion heater element connector, if equipped.

(3) Route seat function switches through access hole on outboard side of seat cushion, if equipped.

(4) Engage J-straps attaching cushion cover to seat cushion frame.

(5) Engage hog rings attaching cushion cover to cushion frame.

(6) Install seat back.

(7) Install seat.

REAR SEAT CUSHION RELEASE LATCH

REMOVAL

(1) Unlatch seat and pivot seat upward.

(2) Disengage J-strap at seat cushion base panel.

(3) Roll back cushion cover.

(4) Remove screws attaching latch to base panel.

(5) Separate latch from base panel.

INSTALLATION

(1) Position latch on base panel.

(2) Install screws attaching latch to base panel. Tighten screws to 8 N·m (75 in. lbs.) torque.

(3) Route the cushion release strap from the loop on the latch through the slot in the trim cover.

(4) Engage J-strap at seat cushion base panel.

(5) Latch seat.

REAR SEAT CUSHION

REMOVAL

(1) Disengage seat cushion at rear by pulling upward on release strap.

(2) Remove bolts attaching seat cushion to floor pan (Fig. 9).

(3) Remove seat cushion from vehicle.

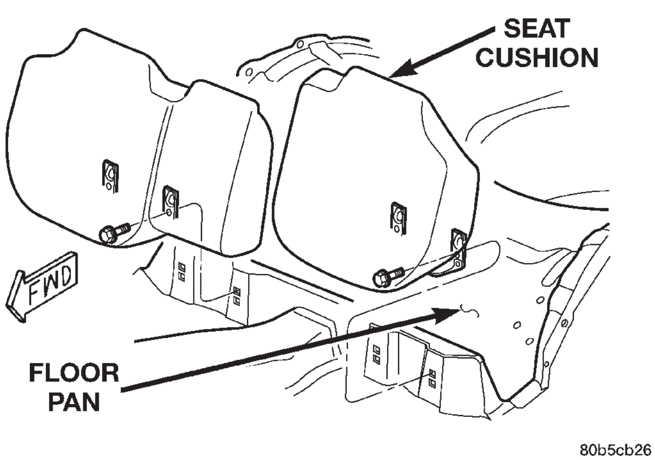


Fig. 9 Rear Seat Cushion

INSTALLATION

(1) Position seat cushion in vehicle.

(2) Install bolts attaching seat cushion to floor pan. Tighten bolts to 11 N·m (8 ft. lbs.) torque.

(3) Lock seat cushion down by pressing firmly on center of cushion until latch engages.

REAR SEAT CUSHION COVER

REMOVAL

(1) Remove rear seat cushion.

(2) From the underside of the seat, disengage J-straps attaching cover to seat cushion base panel.

(3) Remove push-in fasteners attaching cushion cover to seat cushion base panel (Fig. 10).

(4) Roll back cover.

(5) Disengage hog rings attaching cushion cover to seat cushion foam pad.

(6) Separate cushion cover from seat cushion base panel.

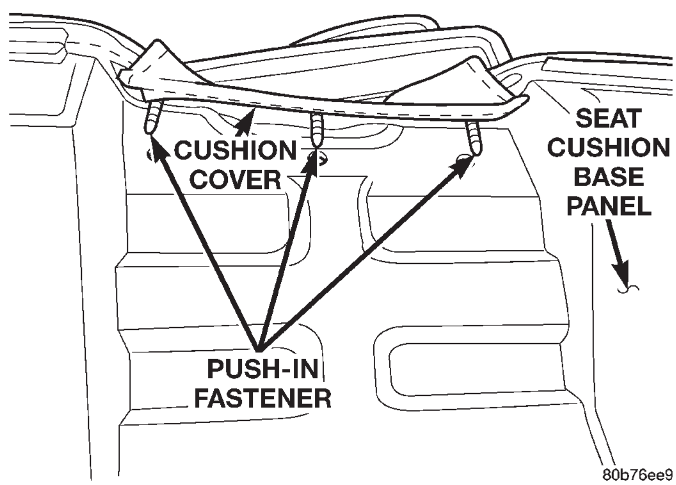


Fig. 10 Push-in Fasteners

INSTALLATION

(1) Position cushion cover on seat cushion base panel.

(2) Engage hog rings attaching cushion cover to seat cushion foam pad.

(3) Align cushion cover and engage J-straps attaching cushion cover to seat cushion base panel.

(4) Install push-in fasteners attaching cushion cover to seat cushion base panel.

(5) Install rear seat cushion.

REAR SEAT BACK LATCH RELEASE HANDLE

REMOVAL

(1) Pull handle to release latch.

(2) Remove screws attaching release handle to seat back frame.

REMOVAL AND INSTALLATION (Continued)

(3) Using a small flat blade, disengage retainers securing latch release cable housing to latch release handle.

(4) Rotate cable end until barrel end aligns with key hole slot in latch release handle.

(5) Disengage cable barrel end from release handle.

(6) Separate latch release handle from seat back (Fig. 11).

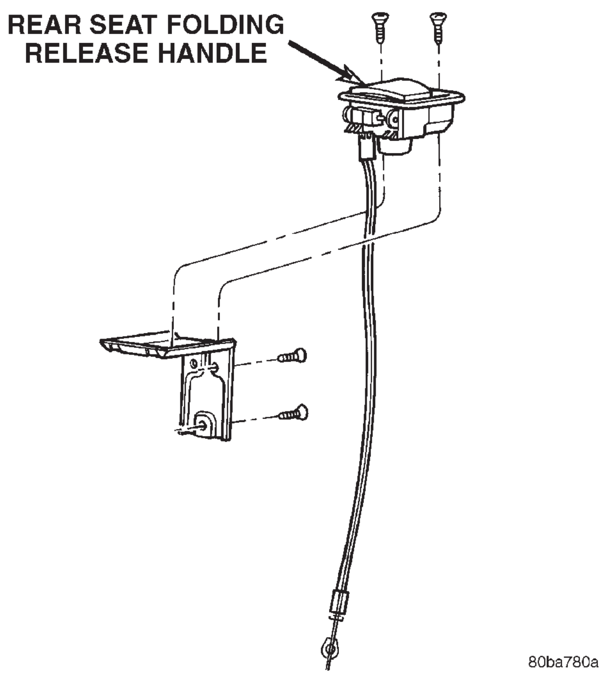


Fig. 11 Rear Seat Release Handle

INSTALLATION

(1) Route cable end into latch release handle.

(2) Rotate cable end until barrel end aligns with key hole slot in latch release handle and insert into handle.

(3) Engage retainers securing latch release cable housing to latch release handle.

(4) Position latch release handle in seat back. Ensure seat back cover is properly aligned.

(5) Install screws attaching release handle to seat back frame.

REAR SEATBACK

REMOVAL

(1) Move rear seat cushions to forward cargo position.

(2) Remove bolts attaching seatback side support bracket to floor pan (right side) (Fig. 12).

(3) Tilt seatback forward, and slide it outboard to detach it from pin on center pivot bracket.

(4) Remove right side (60%) seatback from vehicle.

(5) Remove bolts attaching seatback side support bracket and center pivot bracket to floor pan (left side).

(6) Remove left side (40%) seatback from vehicle.

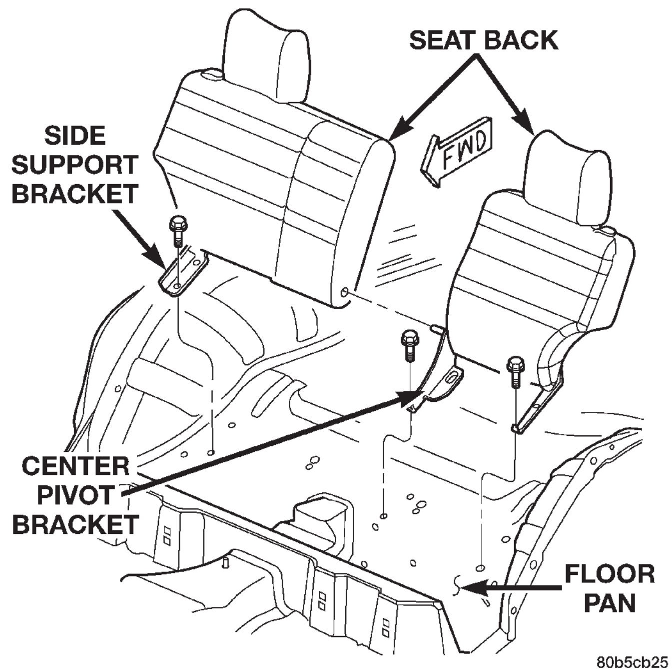


Fig. 12 Rear Seat Back

INSTALLATION

(1) Position left side (40%) seatback in vehicle.

(2) Position left side support bracket and center pivot bracket with bolt holes aligned and install bolts. Tighten bolts to 28 N·m (20 ft. lbs.) torque.

(3) Position right side (60%) seatback in vehicle.

(4) Install seatback onto center pivot bracket pin. Ensure seat back is properly engaged on the center pivot pin.

(5) Position right side support bracket with bolt holes aligned and install bolts. Tighten bolts to 28 N·m (20 ft. lbs.) torque.

(6) Return seat cushions to seating position.

REAR SEAT BACK LATCH/HINGE

REMOVAL

(1) Remove seat back.

(2) Disengage J-straps on outboard side of seat back.

(3) Disengage latch release cable.

(4) Remove bolts attaching latch/hinge to seat back frame.

(5) Separate latch/hinge from seat back frame.

INSTALLATION

(1) Position latch/hinge on seat back frame.

REMOVAL AND INSTALLATION (Continued)

(2) Install bolts attaching latch/hinge to seat back frame. Tighten bolts to 28 N·m (20 ft. lbs.) torque.
(3) Engage latch release cable.
(4) Engage J-straps on outboard side of seat back.
(5) Install seat back.

REAR SEAT BACK COVER

REMOVAL

(1) Remove seat back.
(2) Remove head restraint.
(3) Remove head restraint caps.
(4) Disengage J-straps on outboard side of seat back.
(5) Disengage J-straps at base of seat back.
(6) Remove screws attaching latch release handle to seat back frame.
(7) Roll seat back cover upward.
(8) Disengage hook and loop fasteners attaching seat back cover to seat back pad (Fig. 13).
(9) Roll seat back cover upward and route latch release handle through seat back cover.
(10) Separate seat back cover from seat back.
(11) Separate seat back pad from seat back frame.

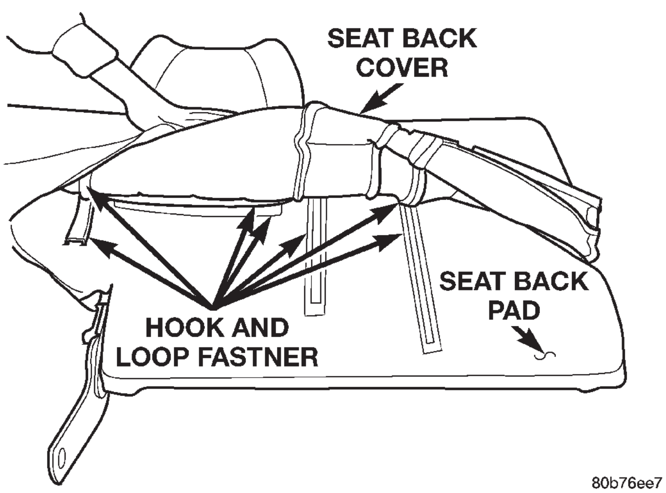


Fig. 13 Rear Seat Back Cover

INSTALLATION

(1) Position seat back cover on seat back.
(2) Route latch release handle through seat back cover.
(3) Roll seat back cover partially downward aligning holes in seat back cover for head restraint and latch release handle.
(4) Roll seat back cover downward align and engage hook and loop fasteners to seat back pad.
(5) Engage J-straps at base of seat back.
(6) Engage J-straps on outboard side of seat back.
(7) Install screws attaching latch release handle to seat back frame.
(8) Install head restraint.
(9) Install seat back.

REAR SEAT HEAD REST

REMOVAL

(1) Depress head rest release button and lift head rest to full up position.
(2) Using a small flat blade, depress tab on outboard side head rest release button and using your hand, simultaneously press tab on inboard side head rest release button (Fig. 14) and pull head rest up to separate from seat back.

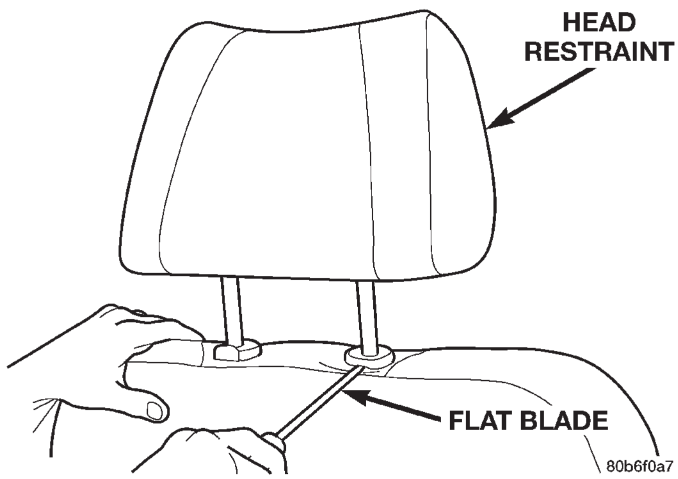


Fig. 14 Head Rest

INSTALLATION

(1) Position head rest in seat back, press tab on inboard side head rest release button cap and push down to secure.

REAR SEAT FOLDING HEAD REST RELEASE KNOB

The release knob is not salvageable during the removal process The knob should only be replaced if damaged or broken. Check availability before servicing.

REMOVAL

(1) Using a E-XACTO knife or equivalent, cut the release knob from the release lever.
(2) Pull the release knob from the lever (Fig. 15).

INSTALLATION

(1) Position the release knob on the lever and press to snap in place.

REAR SEAT HEAD REST SLEEVE

REMOVAL

(1) Remove seat back.
(2) Remove head rest.

REMOVAL AND INSTALLATION (Continued)

(3) Remove head rest caps.
(4) Remove seat back cover.
(5) Rotate head rest sleeve 1/4 turn counter-clockwise to release retaining tab.
(6) Pull sleeve from seat back frame.

INSTALLATION

(1) Position sleeve in seat back frame.
(2) Rotate head rest sleeve 1/4 turn clockwise to engage retaining tab.
(3) Install seat back cover.
(4) Install head rest caps.

NOTE: The head rest cap with the taller button is always on the inboard side of the seat back.

(5) Install the head rest.

NOTE: The folding head rest release knob is always on the outboard side.

(6) Install the seat back.

REAR SEAT HEAD REST FOLDING MECHANISM

REMOVAL

(1) Remove the head rest.
(2) Remove folding mechanism cover (Fig. 15).
(3) Remove the screws that secure the head rest bun to the folding mechanism.

NOTE: The folding release knob is always located on the outboard side.

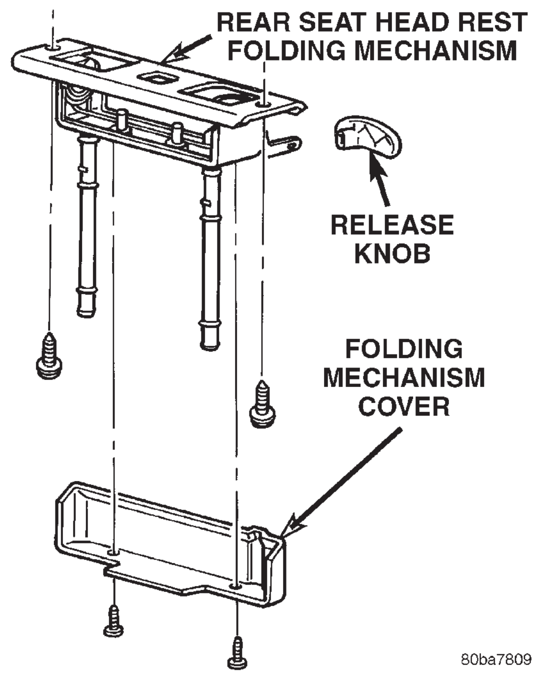


Fig. 15 Rear Seat Head Rest Folding Mechanism

INSTALLATION

(1) Position the head rest bun on the folding mechanism and install the screws.
(2) Install the folding mechanism cover.
(3) Install the head restraint.

BODY COMPONENTS

INDEX

DESCRIPTION AND OPERATION

COMPONENT FASTENERS

Chrysler Corporation uses many different types of push-in fasteners to secure the interior and exterior trim to the body. Most of these fasteners can be reused to assemble the trim during various repair procedures. At times, a push-in fastener cannot be removed without damaging the fastener or the component it is holding. If it is not possible to remove a fastener without damaging a component or body, cut or break the fastener and use a new one when installing the component. Never pry or pound on a plastic or pressed-board trim component. Using a suitable fork-type prying device, pry the fastener from the retaining hole behind the component being removed. When installing, verify fastener alignment with the retaining hole by hand. Push directly on or over the fastener until it seats. Apply a low-force pull to the panel to verify that it is secure.

When it is necessary to remove components to service another, it should not be necessary to apply excessive force or bend a component to remove it. Before damaging a trim component, verify hidden fasteners or captured edges holding the component in place.

DIAGNOSIS AND TESTING

WATER LEAKS

Water leaks can be caused by poor sealing, improper body component alignment, body seam porosity, missing plugs, or blocked drain holes. Centrifugal and gravitational force can cause water to drip from a location away from the actual leak point, making leak detection difficult. All body sealing points should be water tight in normal wet-driving conditions. Water flowing downward from the front of the vehicle should not enter the passenger or luggage compartment. Moving sealing surfaces will not always seal water tight under all conditions. At times, side glass or door seals will allow water to enter the passenger compartment during high pressure washing or hard driving rain (severe) conditions. Overcompensating on door or glass adjustments to stop a water leak that occurs under severe conditions can cause premature seal wear and excessive closing or latching effort. After completing a repair, water test vehicle to verify leak has stopped before returning vehicle to use.

VISUAL INSPECTION BEFORE WATER LEAK TESTS

Verify that floor and body plugs are in place, body drains are clear, and body components are properly aligned and sealed. If component alignment or sealing is necessary, refer to the appropriate section of this group for proper procedures.

WATER LEAK TESTS

WARNING: DO NOT USE ELECTRIC SHOP LIGHTS OR TOOLS IN WATER TEST AREA. PERSONAL INJURY CAN RESULT.

When the conditions causing a water leak have been determined, simulate the conditions as closely as possible.

- If a leak occurs with the vehicle parked in a steady light rain, flood the leak area with an open-ended garden hose.
- If a leak occurs while driving at highway speeds in a steady rain, test the leak area with a reasonable velocity stream or fan spray of water. Direct the spray in a direction comparable to actual conditions.
- If a leak occurs when the vehicle is parked on an incline, hoist the end or side of the vehicle to simulate this condition. This method can be used when the leak occurs when the vehicle accelerates, stops or turns. If the leak occurs on acceleration, hoist the front of the vehicle. If the leak occurs when braking, hoist the back of the vehicle. If the leak occurs on left turns, hoist the left side of the vehicle. If the leak occurs on right turns, hoist the right side of the vehicle. For hoisting recommendations refer to Group 0, Lubrication and Maintenance, General Information section.

DIAGNOSIS AND TESTING (Continued)

WATER LEAK DETECTION

To detect a water leak point-of-entry, do a water test and watch for water tracks or droplets forming on the inside of the vehicle. If necessary, remove interior trim covers or panels to gain visual access to the leak area. If the hose cannot be positioned without being held, have someone help do the water test.

Some water leaks must be tested for a considerable length of time to become apparent. When a leak appears, find the highest point of the water track or drop. The highest point usually will show the point of entry. After leak point has been found, repair the leak and water test to verify that the leak has stopped.

Locating the entry point of water that is leaking into a cavity between panels can be difficult. The trapped water may splash or run from the cavity, often at a distance from the entry point. Most water leaks of this type become apparent after accelerating, stopping, turning, or when on an incline.

MIRROR INSPECTION METHOD

When a leak point area is visually obstructed, use a suitable mirror to gain visual access. A mirror can also be used to deflect light to a limited-access area to assist in locating a leak point.

BRIGHT LIGHT LEAK TEST METHOD

Some water leaks in the luggage compartment can be detected without water testing. Position the vehicle in a brightly lit area. From inside the darkened luggage compartment inspect around seals and body seams. If necessary, have a helper direct a drop light over the suspected leak areas around the luggage compartment. If light is visible through a normally sealed location, water could enter through the opening.

PRESSURIZED LEAK TEST METHOD

When a water leak into the passenger compartment cannot be detected by water testing, pressurize the passenger compartment and soap test exterior of the vehicle. To pressurize the passenger compartment, close all doors and windows, start engine, and set heater control to high blower in HEAT position. If engine can not be started, connect a charger to the battery to ensure adequate voltage to the blower. With interior pressurized, apply dish detergent solution to suspected leak area on the exterior of the vehicle. Apply detergent solution with spray device or soft bristle brush. If soap bubbles occur at a body seam, joint, seal or gasket, the leak entry point could be at that location.

WIND NOISE

Wind noise is the result of most air leaks. Air leaks can be caused by poor sealing, improper body component alignment, body seam porosity, or missing plugs in the engine compartment or door hinge pillar areas. All body sealing points should be airtight in normal driving conditions. Moving sealing surfaces will not always seal airtight under all conditions. At times, side glass or door seals will allow wind noise to be noticed in the passenger compartment during high cross winds. Over compensating on door or glass adjustments to stop wind noise that occurs under severe conditions can cause premature seal wear and excessive closing or latching effort. After a repair procedure has been performed, test vehicle to verify noise has stopped before returning vehicle to use.

Wind noise can also be caused by improperly fitted exterior moldings or body ornamentation. Loose moldings can flutter, creating a buzzing or chattering noise. An open cavity or protruding edge can create a whistling or howling noise. Inspect the exterior of the vehicle to verify that these conditions do not exist.

VISUAL INSPECTION BEFORE TESTS

Verify that floor and body plugs are in place and body components are aligned and sealed. If component alignment or sealing is necessary, refer to the appropriate section of this group for proper procedures.

ROAD TESTING WIND NOISE

(1) Drive the vehicle to verify the general location of the wind noise.

(2) Apply 50 mm (2 in.) masking tape in 150 mm (6 in.) lengths along weatherstrips, weld seams or moldings. After each length is applied, drive the vehicle. If noise goes away after a piece of tape is applied, remove tape, locate, and repair defect.

POSSIBLE CAUSE OF WIND NOISE

- Moldings standing away from body surface can catch wind and whistle.
- Gaps in sealed areas behind overhanging body flanges can cause wind-rushing sounds.
- Misaligned movable components.
- Missing or improperly installed plugs in pillars.
- Weld burn through holes.

UNIVERSAL TRANSMITTER

Universal Transmitter will operate most:

- Garage door opener
- Gate opener
- Home/Office lighting and/or security system(s)

The transmitter is powered by the M1 circuit that supplies voltage to the driver side visor/vanity lamp.

DIAGNOSIS AND TESTING (Continued)

TRAINING THE UNIVERSAL TRANSMITTER

To train the transmitter refer to the Owner's Manual.

TESTING TRANSMITTER

(1) Check for battery voltage at the Universal Transmitter by pressing a button and seeing if a red lamp comes on. If OK, go to Step 6. If not OK, go to Step 2.

(2) Check if visor/vanity lamp lights. If lamp lights, replace visor. If lamp does not light go to Step 3.

(3) Check fuse. If OK, go to Step 4. If not OK, repair as necessary.

(4) Remove visor and test M1 wire for battery voltage at the visor connector. If voltage is OK, go to Step 5. If no voltage repair wire as necessary. Refer to Group 8W, Wiring Diagrams for proper terminals.

(5) Test Z1 wire for ground at the visor connector. If ground is OK, replace visor. If no ground repair wire as necessary.

(6) Check the instructions in the Owner's Manual and retrain the transmitter. If the transmitter can not be trained replace visor.

SERVICE PROCEDURES

BODY LUBRICATION

All mechanisms and linkages should be lubricated when necessary. This will maintain ease of operation and provide protection against rust and excessive wear. The weatherstrip seals should be lubricated to prolong their life as well as to improve door sealing.

All applicable exterior and interior vehicle operating mechanisms should be inspected and cleaned. Pivot/sliding contact areas on the mechanisms should then be lubricated.

(1) When necessary, lubricate the operating mechanisms with the specified lubricants.

(2) Apply silicone lubricant to a cloth and wipe it on door seals to avoid over-spray that can soil passenger's clothing.

(3) Before applying lubricant, the component should be wiped clean. After lubrication, any excess lubricant should be removed.

(4) The hood latch, latch release mechanism, latch striker, and safety latch should be lubricated periodically.

(5) The door lock cylinders should be lubricated twice each year (preferably autumn and spring).

- Spray a small amount of lock cylinder lubricant directly into the lock cylinder.
- Apply a small amount to the key and insert it into the lock cylinder.
- Rotate it to the locked position and then back to the unlocked position several times.
- Remove the key. Wipe the lubricant from it with a clean cloth to avoid soiling of clothing.

DRILLING AND WELDING PROCEDURES

When holes must be drilled or punched in an inner body panel, verify depth of space to the outer body panel, electrical wiring, or other components. Damage to vehicle can result.

Do not weld exterior panels unless combustible material on the interior of vehicle is removed from the repair area. Fire or hazardous conditions, can result.

Always have a fire extinguisher ready for use when welding.

REMOVAL AND INSTALLATION

GRILLE

The grille is incorporated into the fascia. To replace or service the grille, the fascia must be removed. The grille is equipped with an insert which can be serviced.

REMOVAL

(1) Remove fascia.

(2) Disengage retainers attaching grille insert to grille/fascia.

(3) Separate grille insert from grille/fascia (Fig. 1).

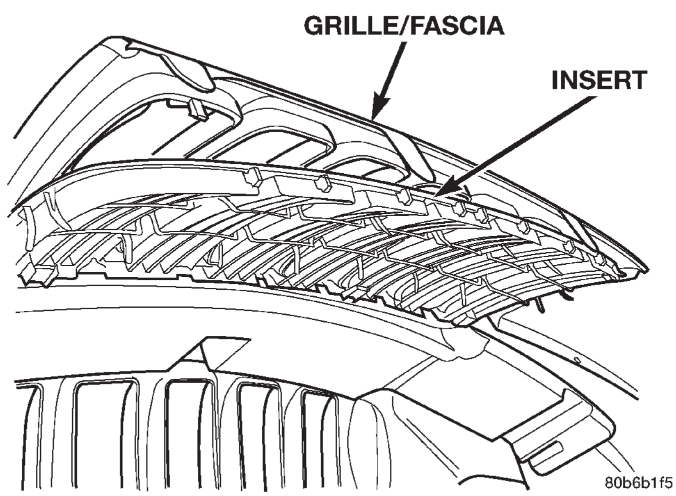


Fig. 1 Grille Insert

INSTALLATION

(1) Position grille insert in grille/fascia.

(2) Engage retainers attaching grille insert to grille/fascia.

(3) Install fascia.

REMOVAL AND INSTALLATION (Continued)

HOOD SEAL

REMOVAL

(1) Raise hood.

(2) Pull hood seal from upper radiator crossmember.

(3) Separate seal from upper radiator crossmember (Fig. 2).

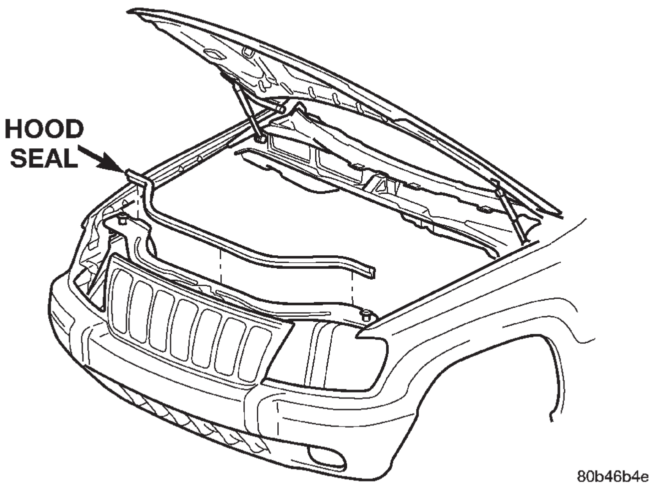


Fig. 2 Hood Seal

INSTALLATION

(1) Position seal on upper radiator crossmember.

(2) Press seal onto upper radiator crossmember to seat.

HEADLAMP MOUNTING MODULE (HMM)

REMOVAL

CAUTION: Take special care when handling the HMM not to damage the upper mounting tabs. Step #3 must be performed prior to removing HMM from the vehicle to prevent damage to HMM.

(1) Remove front fascia.

(2) Remove front wheelhouse splash shields.

(3) Reach into the wheelhouse opening and disengage the retainer attaching the HMM to each side of the body.

(4) Remove bolts attaching headlamp mounting module to body (Fig. 3).

(5) Disconnect headlamp wire harness connectors.

(6) Separate headlamp mounting module from vehicle.

INSTALLATION

(1) Position headlamp mounting module at vehicle.

(2) Connect headlamp wire harness connectors.

(3) Engage the retainer attaching the HMM to each side of the body.

(4) Install bolts attaching headlamp mounting module to body (Fig. 3).

(5) Install front wheelhouse splash shields.

(6) Install front fascia.

HOOD

REMOVAL

(1) Raise hood.

(2) If equipped, disconnect underhood lamp harness connector. (Connector is located under cowl cover).

(3) Using a wax crayon or equivalent, mark location of hood hinges on hood for installation alignment.

(4) Support hood in the open position.

(5) Remove hood support prop rods.

(6) Remove bolts attaching hinges to hood.

(7) With the aid of a helper, remove hood from vehicle.

INSTALLATION

(1) Position hood on hinges.

(2) Install bolts finger-tight.

(3) Align hinges with installation reference marks and tighten bolts.

(4) Install hood support prop rods.

(5) Connect underhood lamp connector.

(6) Inspect hood for proper alignment and adjust as necessary.

HOOD INSULATION PANEL

REMOVAL

(1) Raise the hood.

(2) Remove the insulation panel fasteners.

(3) Remove the hood insulation panel.

INSTALLATION

(1) Position the insulation panel on the underside of the hood.

(2) Install the insulation panel fasteners.

(3) Close the hood.

HOOD SUPPORT PROP

REMOVAL

(1) Raise and support hood.

(2) Using a small flat blade, pry the retainer attaching hood support prop to lower ball stud.

(3) Slide retainer attaching hood support prop upper ball stud downward.

(4) Disconnect hood support prop from lower ball stud and rotate support prop upward and disconnect from upper ball stud (Fig. 4).

REMOVAL AND INSTALLATION (Continued)

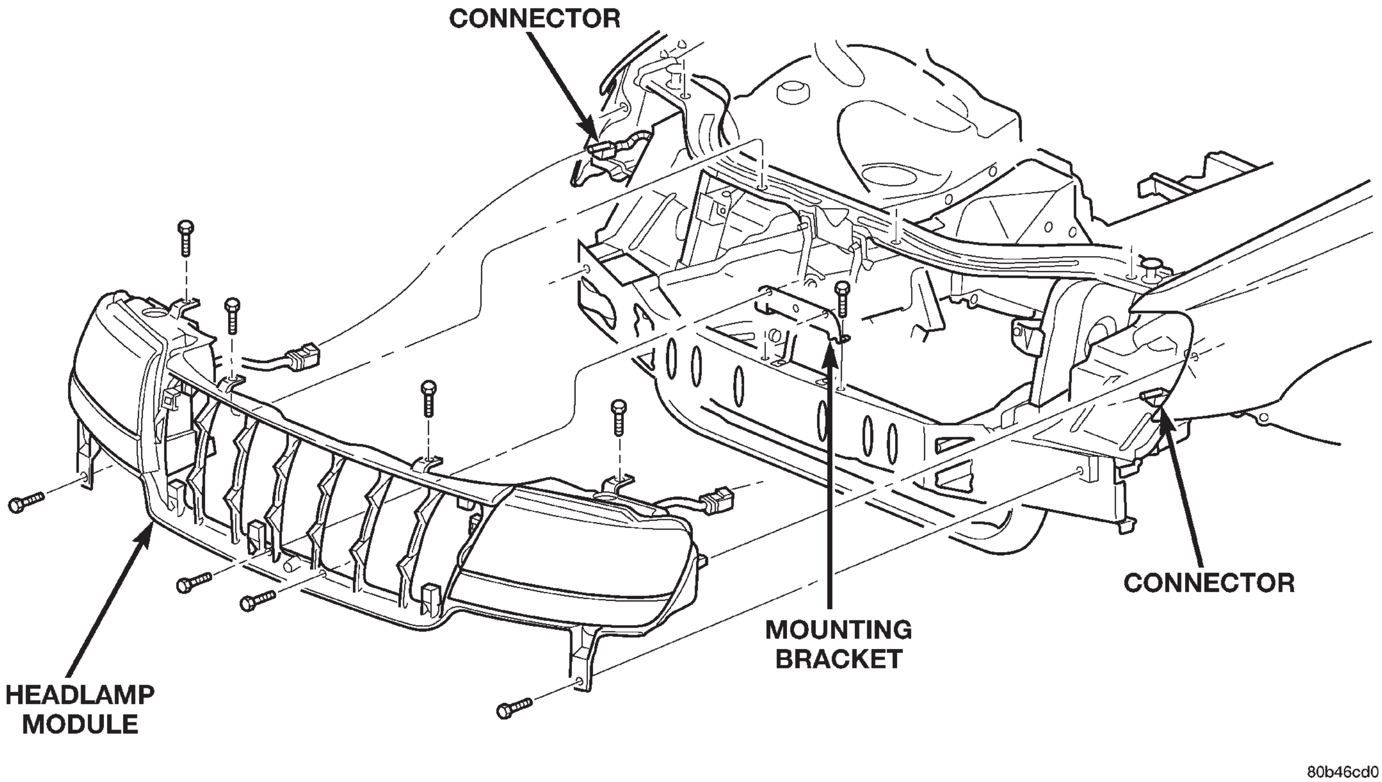


Fig. 3 Headlamp Mounting Module

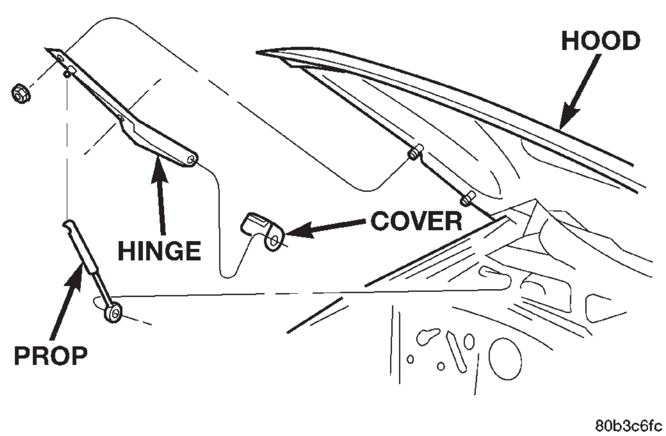


Fig. 4 Hood Support Prop

INSTALLATION

(1) Position hood support prop on upper ball stud.

(2) Slide retainer upward to secure support prop to upper ball stud.

(3) Position support prop on lower ball stud and press retainer inward to secure.

HOOD HINGE

REMOVAL

(1) Raise and support hood.

(2) Using a wax crayon or equivalent, mark position of hinge.

(3) Remove hood hinge prop rod.

(4) Remove nuts attaching hinge to hood (Fig. 4).

(5) Remove bolts attaching hinge to body.

(6) Separate hinge from vehicle.

INSTALLATION

(1) Position hinge on vehicle and align reference marks.

(2) Install bolts attaching hinge to body.

(3) Install nuts attaching hinge to hood.

(4) Install hood hinge prop rod.

HOOD LATCH

REMOVAL

(1) Remove nuts attaching latch to radiator crossmember support (Fig. 5).

(2) Disconnect hood release cable from latch.

(3) Separate latch from vehicle.

REMOVAL AND INSTALLATION (Continued)

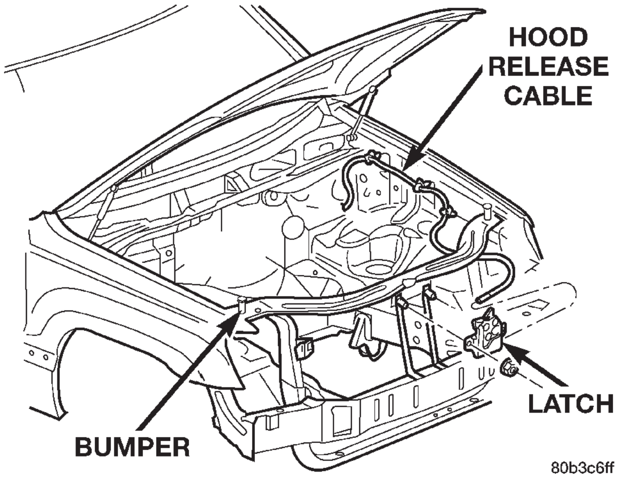


Fig. 5 Hood Latch

INSTALLATION

(1) Connect latch release cable to latch.

(2) Position latch on radiator crossmember support.

(3) Install nuts attaching latch to radiator crossmember support. Tighten nuts to 11 N·m (8 ft. lbs.) torque.

HOOD RELEASE CABLE

REMOVAL

(1) Disconnect cable from hood latch (Fig. 6).

(2) Disconnect cable from retaining clips on left inner fender panel.

(3) Remove left cowl side trim panel.

(4) Remove fasteners attaching cable bracket to cowl side panel (Fig. 7).

(5) Route cable through dash panel and remove it from under instrument panel.

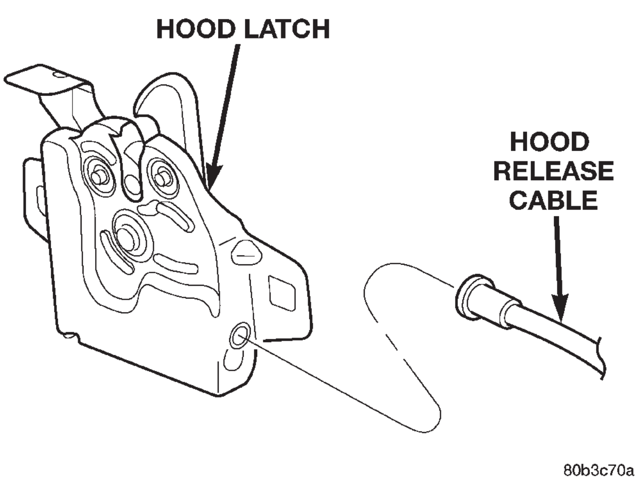


Fig. 6 Hood Latch

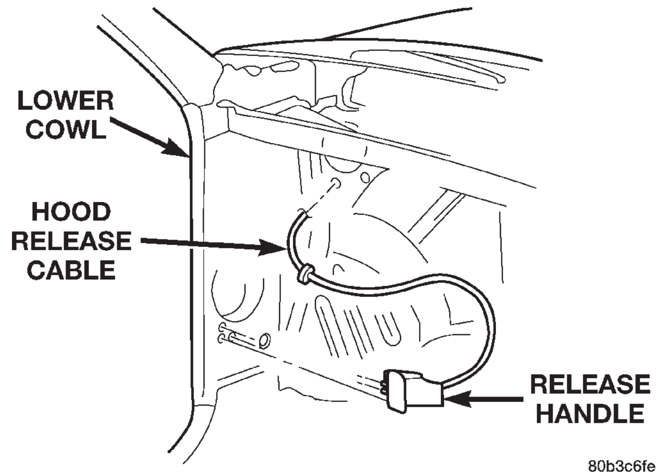


Fig. 7 Hood Release Cable

INSTALLATION

(1) Route cable through hole in dash panel into engine compartment.

(2) Pull cable forward and seat grommet in dash panel.

(3) Position cable bracket on cowl side panel and install fasteners.

(4) Install left cowl side trim panel.

(5) Route and install cable in retaining clips on left inner fender panel.

(6) Connect cable to hood latch.

COWL PLENUM SEAL

REMOVAL

(1) Raise hood.

(2) Pull cowl plenum seal from cowl.

(3) Separate cowl plenum seal from cowl (Fig. 8).

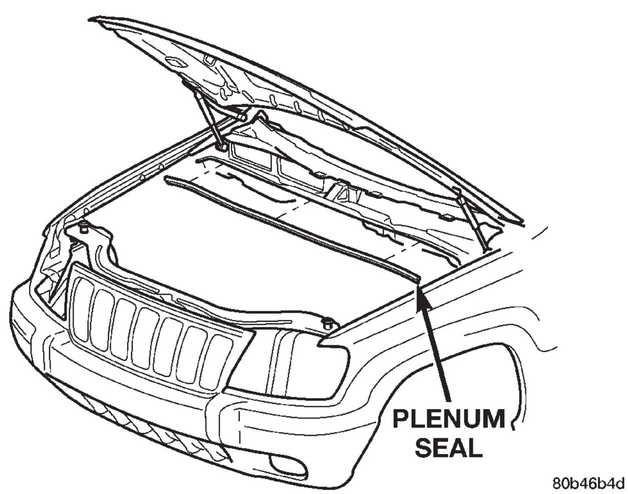


Fig. 8 Cowl Plenum Seal

INSTALLATION

(1) Position cowl plenum seal on cowl.

(2) Press cowl plenum seal to seat.

REMOVAL AND INSTALLATION (Continued)

COWL COVER

REMOVAL

(1) Remove wiper arms.
(2) Remove plenum seal.
(3) Remove plastic push nuts attaching cowl cover to cowl (Fig. 9).
(4) Remove windshield washer tubes at connector.
(5) Remove cowl cover from cowl.

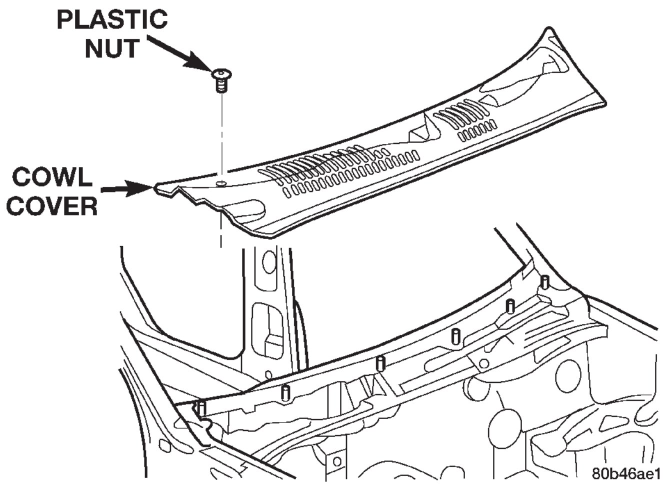


Fig. 9 Cowl Cover

INSTALLATION

(1) Position cowl cover on cowl.
(2) Install windshield washer tubes at connector.
(3) Install plastic push nuts attaching cowl cover to cowl.
(4) Install plenum seal.
(5) Install windshield wiper arms.

EXTERIOR NAMEPLATES

REMOVAL

NOTE: Exterior nameplates are attached to body panels with adhesive tape.

(1) Apply a length of masking tape on the body, parallel to the top edge of the nameplate to use as a guide, if necessary.
(2) If temperature is below 21°C (70°F) warm emblem with a heat lamp or gun. Do not exceed 52°C (120°F) when heating emblem.
(3) Insert a plastic trim stick or a hard wood wedge behind the emblem to separate the adhesive backing from the body.
(4) Clean adhesive residue from body with MOPAR Super Clean solvent or equivalent.

INSTALLATION

(1) Remove protective cover from adhesive tape on back of emblem.
(2) Position emblem properly on body (Fig. 10).
(3) Press emblem firmly to body with palm of hand.
(4) If temperature is below 21°C (70°F) warm emblem with a heat lamp or gun to assure adhesion. Do not exceed 52°C (120°F) when heating emblem.

SIDE VIEW MIRROR

REMOVAL

(1) Remove door trim panel.
(2) Disengage power mirror harness connector, if equipped.
(3) Remove mirror flag seal.
(4) Remove nuts attaching mirror to door (Fig. 11).
(5) Separate mirror from door.

INSTALLATION

(1) Position mirror on door. Verify that gasket seal is properly positioned.
(2) Install nuts attaching mirror to door.
(3) Install mirror retaining nuts.
(4) Install mirror flag seal.
(5) Engage power mirror harness connector, if equipped.
(6) Install door trim panel.

SIDE VIEW MIRROR GLASS

REMOVAL

(1) With damaged mirror still on vehicle, position mirror glass down and centered.
(2) Position a wide leverage device between the bottom edge of the glass and the mirror shell.
(3) Firmly apply pressure in an upward direction until glass assembly disengages from adapter plate.
(4) Disconnect the heater wire terminal, if equipped, or the EC plug, if equipped.

INSTALLATION

(1) Connect the heater wire terminal or the EC plug, if equipped.
(2) Position the replacement glass in the mirror shell and align the four snap tabs with the four cavities in the shell.
(3) Apply firm pressure inward until the replacement glass assembly engages with the adapter plate. Correct assembly will result in a firm click. Glass assembly should exhibit even gaps to the shell when complete.
(4) Pull lightly on corners of glass assembly to ensure all four snaps are engaged and there is no free play.

REMOVAL AND INSTALLATION (Continued)

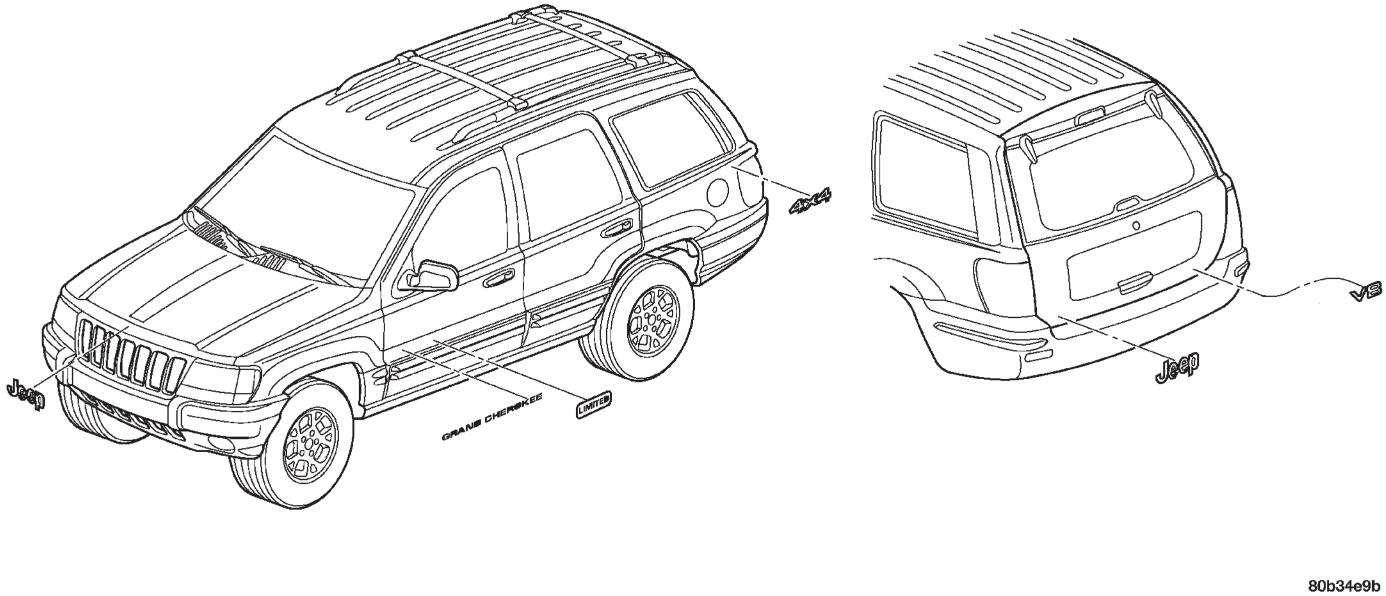


Fig. 10 Exterior Nameplates

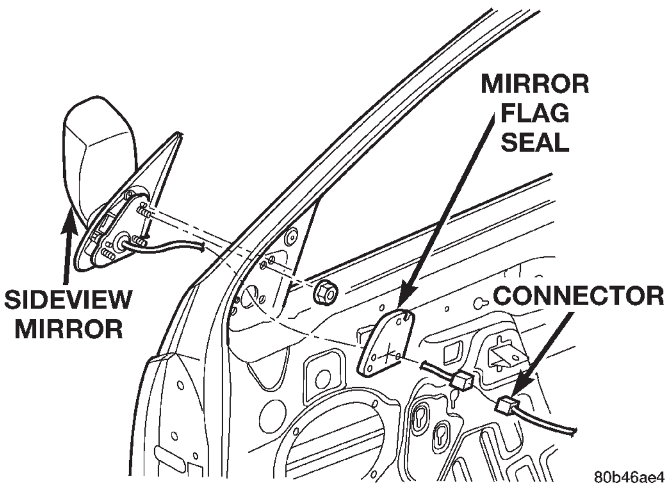


Fig. 11 Side View Mirror

FRONT FENDER

REMOVAL

(1) Using a wax crayon or equivalent, mark position of fender.

(2) Remove front fender liner.

(3) Pull back fascia and remove screws attaching fender to fascia.

(4) Remove screws attaching lower fender bracket located behind fascia.

(5) Remove screws attaching fender to rocker panel (Fig. 12).

(6) Remove screws attaching rear of fender to A-pillar brackets.

(7) Open hood.

(8) Loosen screw under hood hinge, attaching fender to engine compartment rail .

(9) Remove screws attaching fender to engine compartment rail (Fig. 13).

(10) Right fender only:

(a) If equipped, remove radio antenna.

(11) Separate fender from body.

INSTALLATION

(1) Position fender on body.

(2) Right fender only:

(a) If equipped, install radio antenna.

(3) Install all screws finger-tight.

(4) Align fender with adjacent body panels and wax crayon reference marks.

(5) Tighten all screws.

(6) Install inner fender liner.

FRONT DOOR TRIM PANEL

REMOVAL

(1) Remove trim plug from mirror flag bezel.

(2) Remove screws attaching trim panel to door (Fig. 14).

(3) Using trim remover (C-4829 or equivalent), detach trim panel perimeter push-in fasteners from door inner panel.

(4) Lift trim panel upward and separate from door.

(5) If equipped, disconnect harness connectors for power accessories.

(6) Disconnect latch rods from inside handle actuator.

(7) Separate trim panel from vehicle.

REMOVAL AND INSTALLATION (Continued)

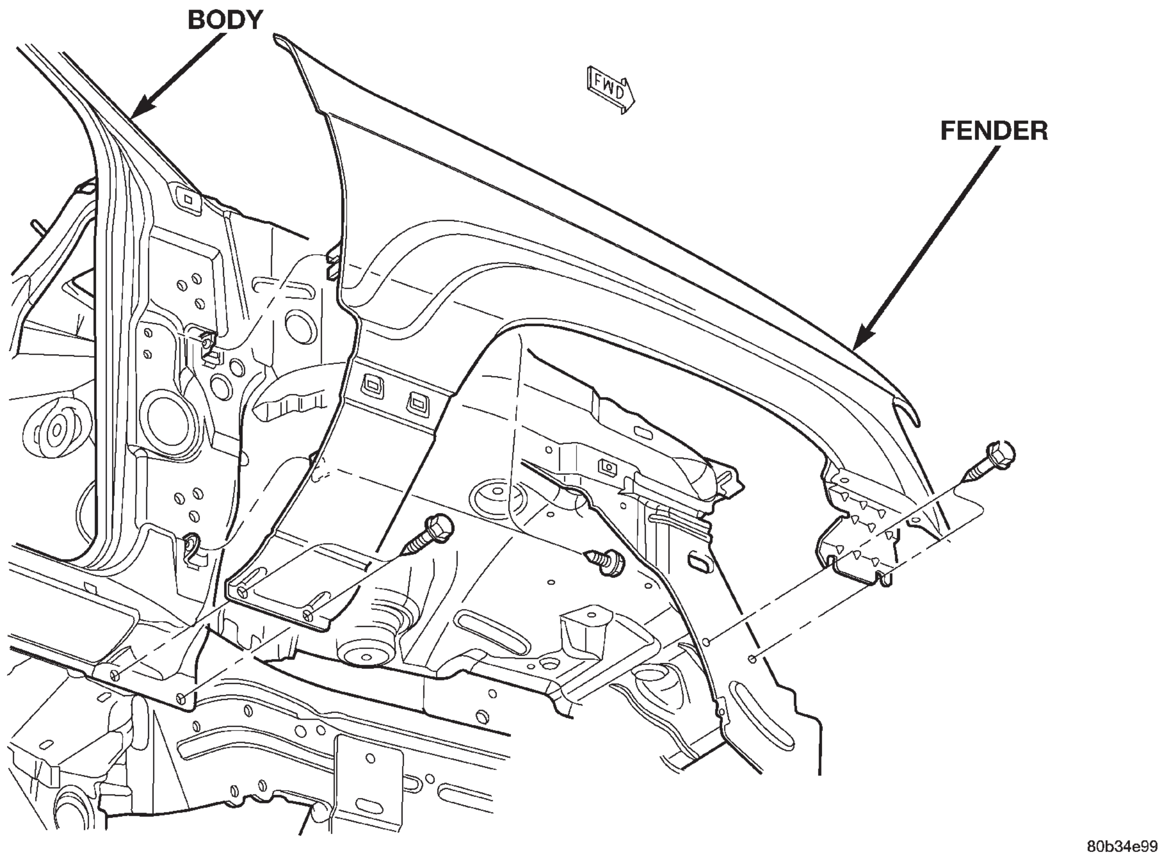


Fig. 12 Fender Mounting

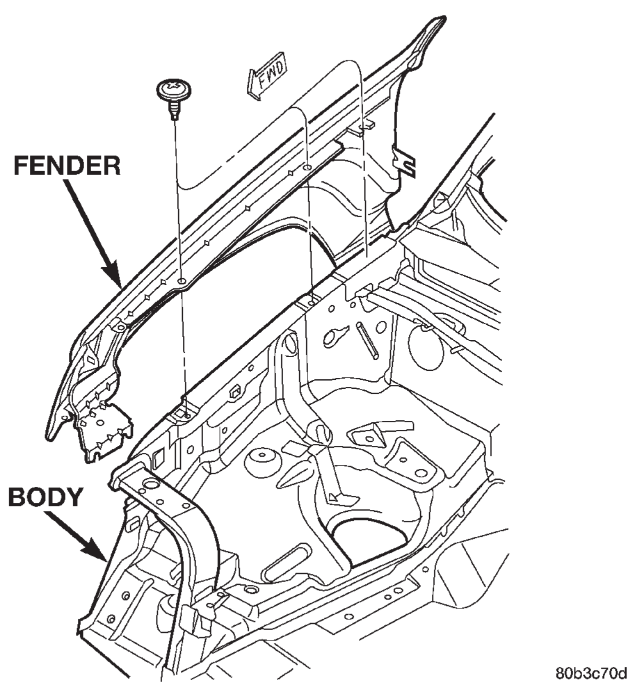


Fig. 13 Upper Fender Mounting

INSTALLATION

(1) Connect latch rods to inside handle actuator.

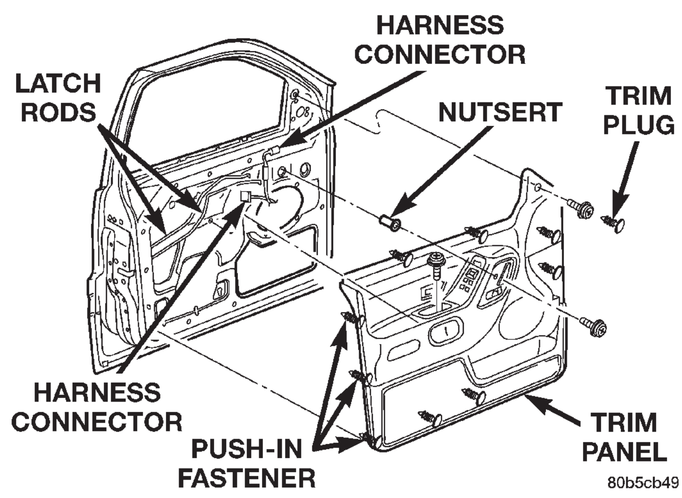


Fig. 14 Front Door Trim Panel

(2) If equipped, connect harness connectors to power accessories.

(3) Position trim panel on door inner panel.

(4) Press trim panel push-in fasteners inward around perimeter of door.

(5) Install screws attaching trim panel to door.

(6) Install trim plug in mirror flag bezel.

REMOVAL AND INSTALLATION (Continued)

FRONT DOOR WATERDAM

REMOVAL

(1) Remove door trim panel.
(2) Peel the waterdam from door.
(3) Route all harnesses and linkage rods through waterdam as necessary.
(4) Separate waterdam from door (Fig. 15).

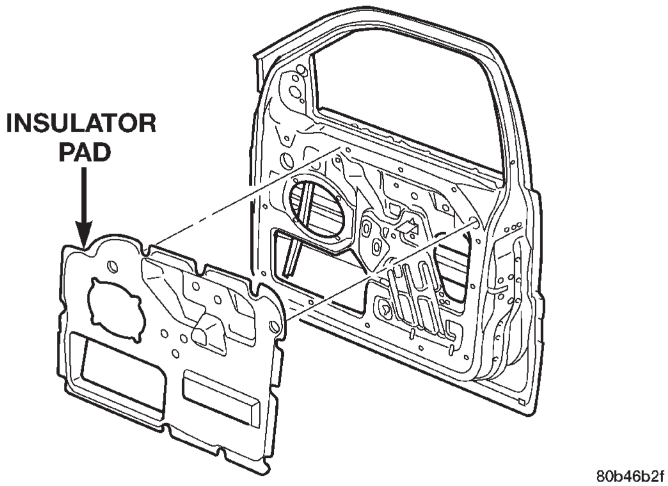


Fig. 15 Front Door Waterdam

INSTALLATION

(1) Waterdam contact surface must be free of contaminants. Clean as necessary.
(2) Route all harnesses and linkage rods through waterdam as necessary.
(3) Position waterdam on door and align all holes.
(4) Press waterdam on door.
(5) Install door trim panel.

FRONT DOOR CHECK

REMOVAL

(1) Remove trim panel.
(2) Remove waterdam.
(3) Remove speaker.
(4) Remove screws attaching door check to A-pillar.
(5) Remove nuts attaching door check to door (Fig. 16).
(6) Remove door check through speaker location hole.

INSTALLATION

(1) Position door check on door through speaker location hole.
(2) Install nuts attaching door check to door.
(3) Install screws attaching door check to A-pillar.
(4) Install speaker.
(5) Install waterdam.
(6) Install trim panel.

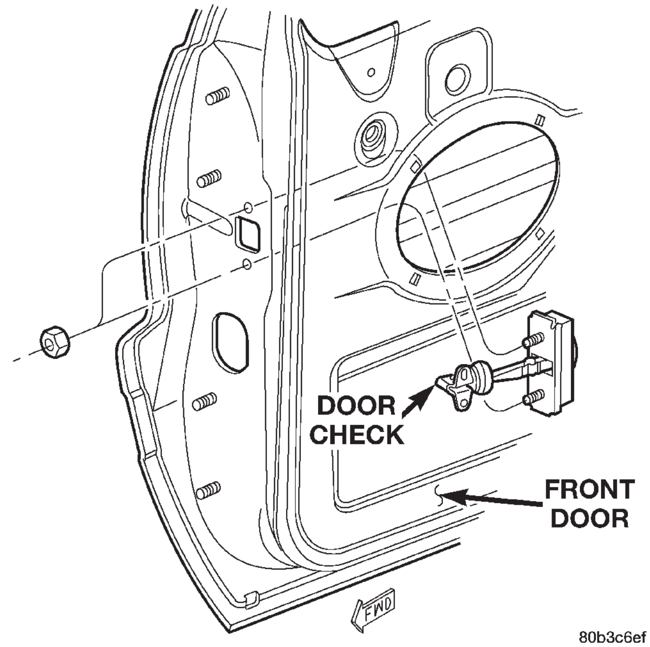


Fig. 16 Door Check

FRONT DOOR

REMOVAL

(1) Disconnect front door harness connector (Fig. 17).
(2) Support door with padded floor jack.
(3) Remove retaining clips from hinge pins.
(4) Tap out hinge pins.
(5) Separate door from vehicle.

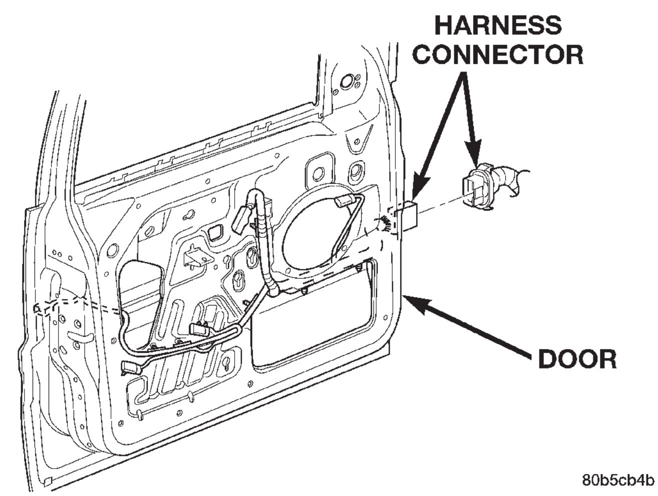


Fig. 17 Front Door Harness Connector

INSTALLATION

(1) Position door at vehicle and align hinges.
(2) Install hinge pins.
(3) Install retaining clips for hinge pins.
(4) Connect front door harness connector.

REMOVAL AND INSTALLATION (Continued)

FRONT DOOR HINGE

REMOVAL

(1) Open and support door.

(2) Using a wax pencil, or other suitable device, reference mark the hinge placement

(3) Disconnect the door wire harness.

(4) Remove the door check from the “A” pillar (Fig. 18).

(5) Remove the fasteners retaining the door hinge to the door (Fig. 19).

(6) Remove the door.

(7) Remove the hinge from the “A” pillar.

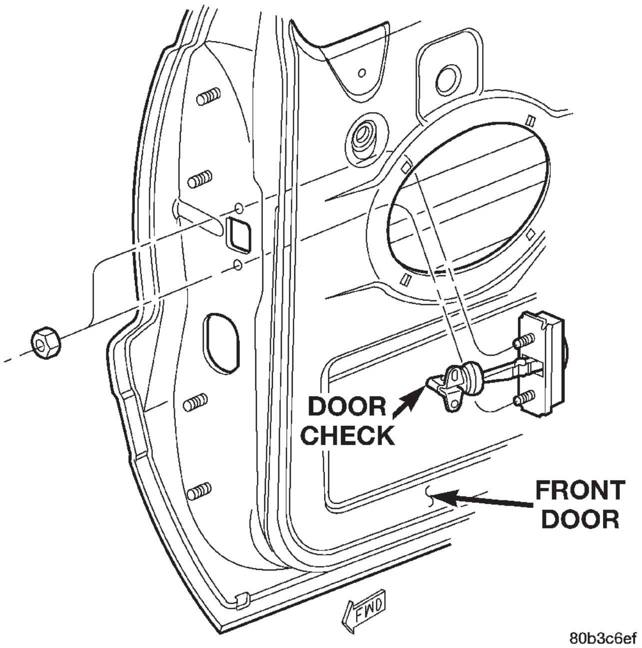


Fig. 18 Front Door Check

INSTALLATION

(1) Position hinge on “A” pillar. (Use 3M™ Fast and Firm or equivalent on the hinge to body mating surface as a sealant.)

(2) Install hinge to body bolts, but do not tighten.

(3) Align the hinge to the reference marks and torque the bolts to 35N·m (26 ft. lbs.).

(4) Install the door on the hinge and align with the reference marks.

(5) Tighten the door to hinge fasteners.

(6) For adjustment see door adjustment procedure.

FRONT DOOR OUTSIDE HANDLE

REMOVAL

(1) Remove door trim panel and waterdam.

(2) Locate glass to full up position.

(3) Remove glass run channel.

(4) Disconnect lock cylinder to latch rod.

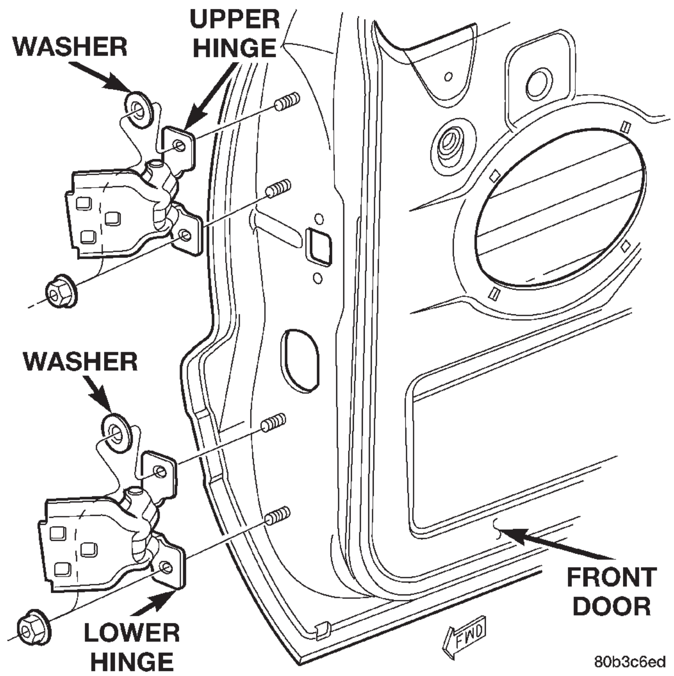


Fig. 19 Front Door Hinges

(5) Disconnect outside handle to latch rod

(6) Remove fasteners attaching outside handle to door (Fig. 20).

(7) Remove outside handle from door.

(8) Disconnect anti-theft harness connector, if equipped.

(9) Separate outside handle from vehicle.

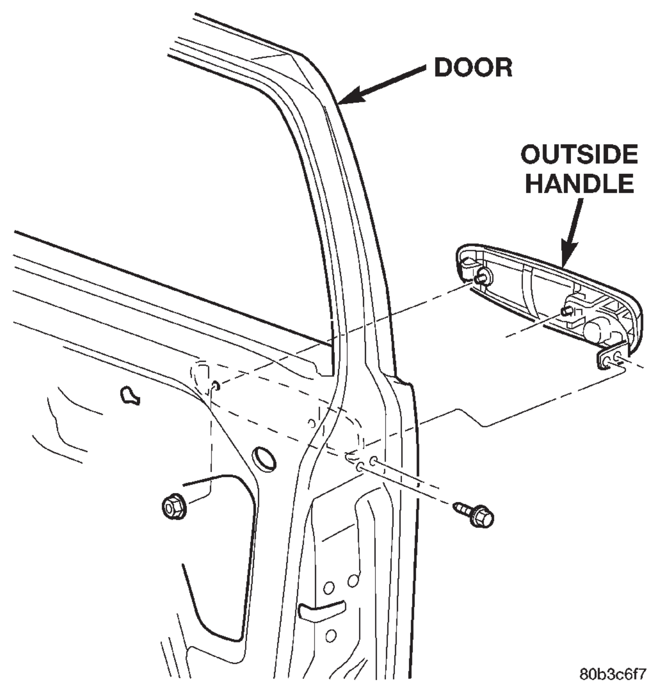


Fig. 20 Front Door Outside Handle

INSTALLATION

(1) Position outside handle at door.

REMOVAL AND INSTALLATION (Continued)

(2) Connect anti-theft harness connector, if equipped.
(3) Position outside handle in door.
(4) Install fasteners attaching outside handle to door.
(5) Connect outside handle to latch rod
(6) Connect lock cylinder to latch rod.
(7) Install glass run channel.
(8) Locate glass to full down position.
(9) Install waterdam and door trim panel.

FRONT DOOR LOCK CYLINDER

REMOVAL

(1) Remove door trim panel and insulator.
(2) Remove outside door handle.
(3) Remove screw securing lock cylinder retainer to outside door handle (Fig. 21).
(4) Separate lock cylinder from door handle.
(5) Disconnect lock cylinder switch, if equipped.

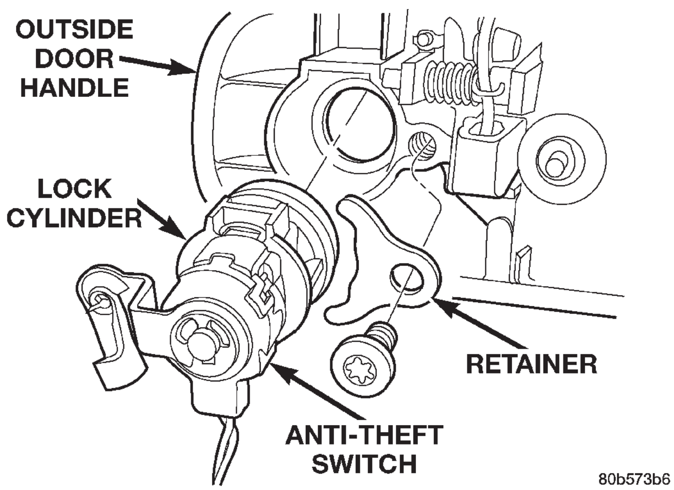


Fig. 21 Front Door Lock Cylinder

INSTALLATION

(1) Connect lock cylinder switch, if equipped.
(2) Position lock cylinder in door handle.
(3) Position lock cylinder retainer and install screw.
(4) Install outside door handle.
(5) Install insulator and trim panel.

FRONT DOOR LATCH

REMOVAL

(1) Locate glass in full up position.
(2) Remove door trim panel and isolator.
(3) Remove glass run channel.
(4) Remove screws attaching door latch to door (Fig. 22).
(5) Disconnect all rods from door latch.
(6) Disconnect wire harness connector, if equipped.
(7) Separate door latch from door.

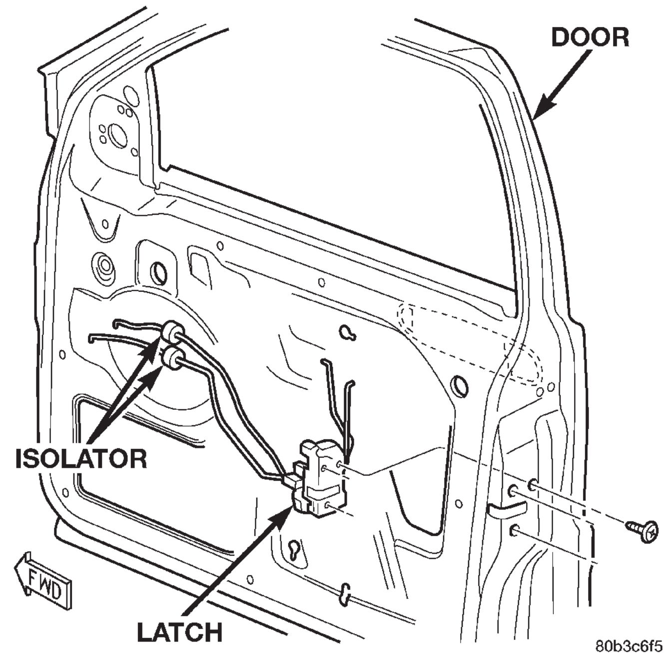


Fig. 22 Door Latch

INSTALLATION

(1) Position door latch at door.
(2) Connect wire harness connector, if equipped.
(3) Connect all rods to door latch.
(4) Install screws attaching door latch to door. Tighten screws to 10 N·m (7 ft. lbs.) torque.
(5) Install glass run channel.
(6) Install isolator and door trim panel.

FRONT DOOR LATCH STRIKER

REMOVAL

(1) Remove screws attaching striker to B-pillar.
(2) Separate striker and spacer from B-pillar (Fig. 23).

INSTALLATION

(1) Position striker and spacer on B-pillar.
(2) Install screws attaching striker to B-pillar. Tighten screws to 28 N·m (20 ft. lbs.) torque.

FRONT DOOR INSIDE HANDLE ACTUATOR

REMOVAL

(1) Remove door trim panel.
(2) Disconnect latch and lock rods from inside handle actuator.
(3) Remove screws attaching inside handle actuator to trim panel (Fig. 24).
(4) Separate inside handle actuator from trim panel.

REMOVAL AND INSTALLATION (Continued)

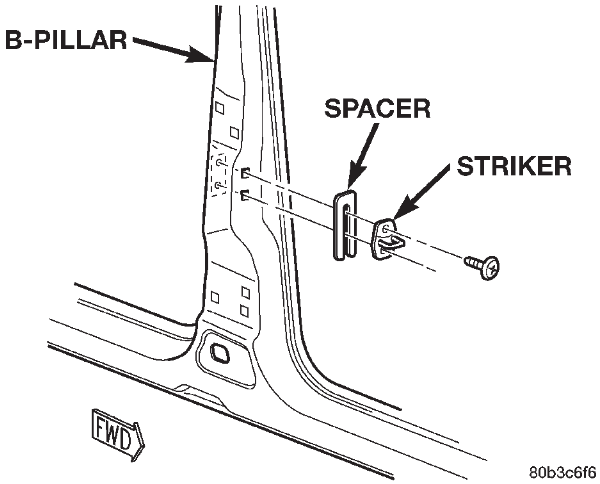


Fig. 23 Front Door Latch Striker

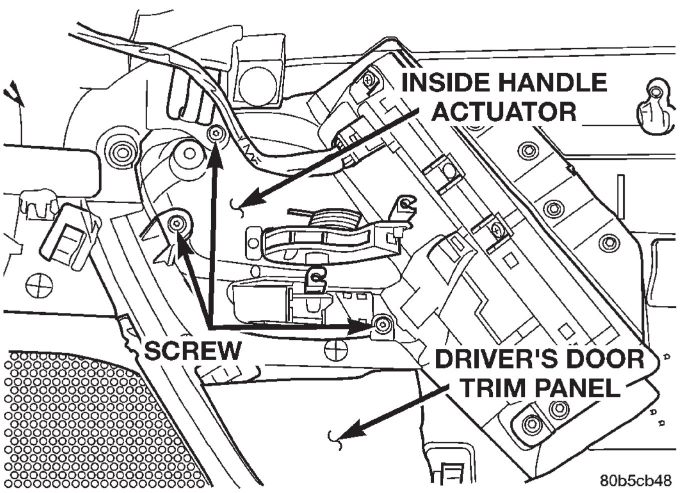


Fig. 24 Front Door Inside Handle Actuator

INSTALLATION

(1) Position inside handle actuator in trim panel.

(2) Install screws attaching inside handle actuator to trim panel.

(3) Connect latch and lock rods to inside handle actuator.

(4) Install door trim panel.

FRONT DOOR INNER BELT SEAL

REMOVAL

(1) Remove door trim panel.

(2) Using a trim stick or other suitable device, carefully pry up inner edge of seal (Fig. 25).

(3) Grasp the edge of the seal and pull upward to remove seal from door flange.

INSTALLATION

(1) Position the seal on the door flange.

(2) Firmly press downward to seat seal on the door flange.

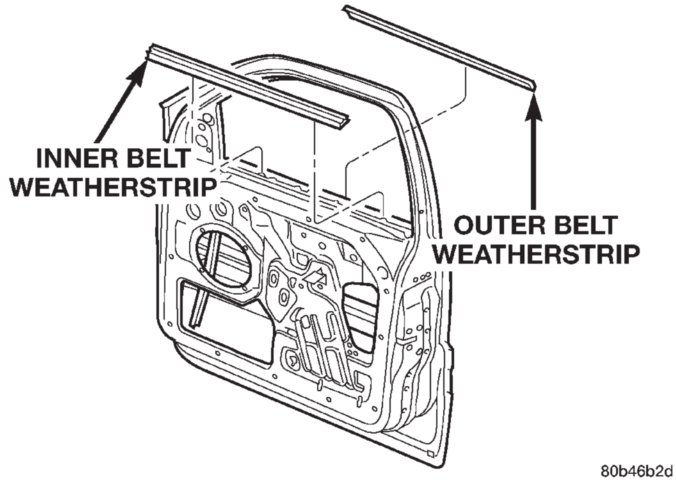


Fig. 25 Inner/Outer Belt Weather Strip

(3) Install the door trim panel.

FRONT DOOR OUTER BELT SEAL

REMOVAL

(1) Lower the door glass.

(2) Remove the screw from the inner door panel attaching the seal to outer door panel (Fig. 25).

(3) Pull the seal rearward to release from the side view mirror bezel.

(4) Lift seal and separate from door panel.

INSTALLATION

(1) Position seal on the door panel.

(2) Push the seal forward to install under the side view mirror bezel.

(3) Install the screw from the inner door panel attaching the seal to outer door panel.

(4) Raise the door glass.

FRONT DOOR GLASS RUN CHANNEL WEATHERSTRIP

REMOVAL

(1) Remove trim panel.

(2) Remove inner belt weatherstrip.

(3) Remove outer belt weatherstrip.

(4) Grasp seal from upper run channel corner and firmly pull weatherstrip from flange and run channel (Fig. 26).

INSTALLATION

NOTE: Soapy water may be used to aid in installation.

(1) Remove front door speaker.

(2) Position weatherstrip on flange aligning each corner.

REMOVAL AND INSTALLATION (Continued)

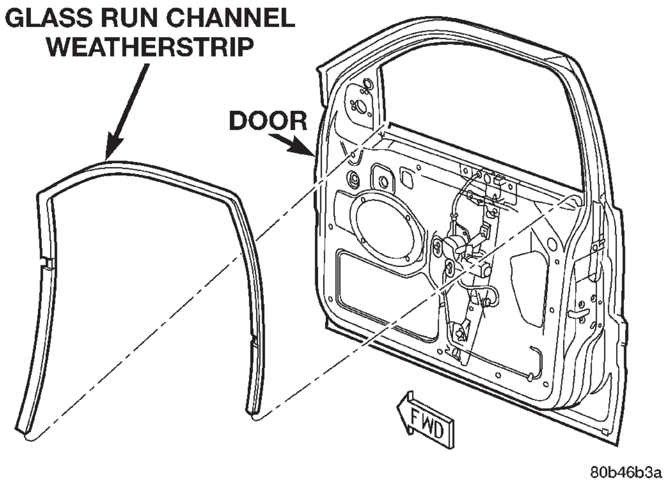


Fig. 26 Front Door Glass Run Channel Weatherstrip

(3) Press weatherstrip into position.

(4) Carefully move door glass for and aft and press weatherstrip into glass run channels.

(5) Install front door speaker.

(6) Install outer belt weatherstrip.

(7) Install inner belt weatherstrip.

(8) Install trim panel.

FRONT DOOR GLASS RUN CHANNEL

REMOVAL

NOTE: Only the rearward glass run channel is serviceable.

(1) Remove door trim panel.

(2) Remove isolator.

(3) Remove inner and outer belt weatherstrip.

(4) Remove bolt attaching run channel to inner door panel (Fig. 27).

(5) Peel back glass run channel weatherstrip on rear run channel.

(6) Pull glass run channel downward to separate from door.

(7) Remove glass run channel from door.

INSTALLATION

(1) Position glass run channel in door.

(2) Align glass run channel with door frame run channel and slide channel upward to secure door.

(3) Press glass run channel weatherstrip into rear run channel.

(4) Install bolt attaching run channel to inner door panel.

(5) Install inner and outer belt weatherstrip.

(6) Install isolator.

(7) Install door trim panel.

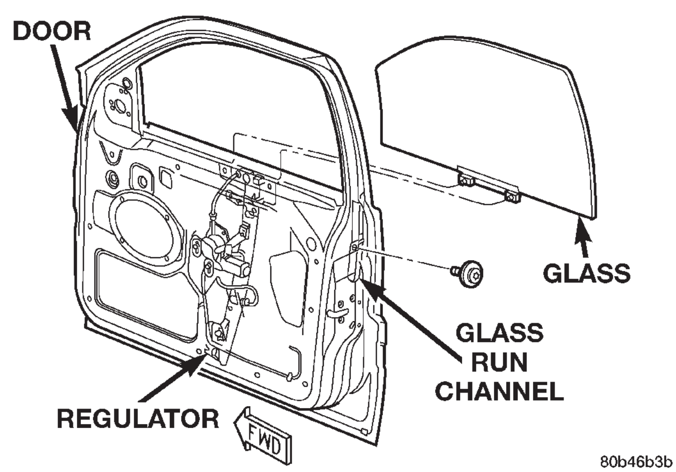


Fig. 27

FRONT DOOR OPENING WEATHERSTRIP

REMOVAL

(1) Remove A-pillar trim.

(2) Remove B-pillar upper trim.

(3) Remove B-pillar lower trim.

(4) Pull weatherstrip from door opening flange.

INSTALLATION

(1) Position weatherstrip at corners.

(2) Move upward and around edge of door opening seating weatherstrip onto flange (Fig. 28).

(3) Engage connector plug with each end of weatherstrip at bottom of door opening.

(4) Install B-pillar lower trim.

(5) Install B-pillar upper trim.

(6) Install A-pillar trim.

FRONT DOOR SECONDARY WEATHERSTRIP

REMOVAL

The front door secondary weatherstrip is attached to the door shutface with push-in fasteners.

(1) Open door.

(2) Using a trim panel removal tool, remove push-in fasteners attaching secondary weatherstrip to door shutface (Fig. 29).

(3) Separate secondary weatherstrip from door.

INSTALLATION

(1) Clean contact area as necessary.

(2) Position secondary weatherstrip on door shutface.

(3) Install push-in fasteners attaching secondary weatherstrip to door shutface.

REMOVAL AND INSTALLATION (Continued)

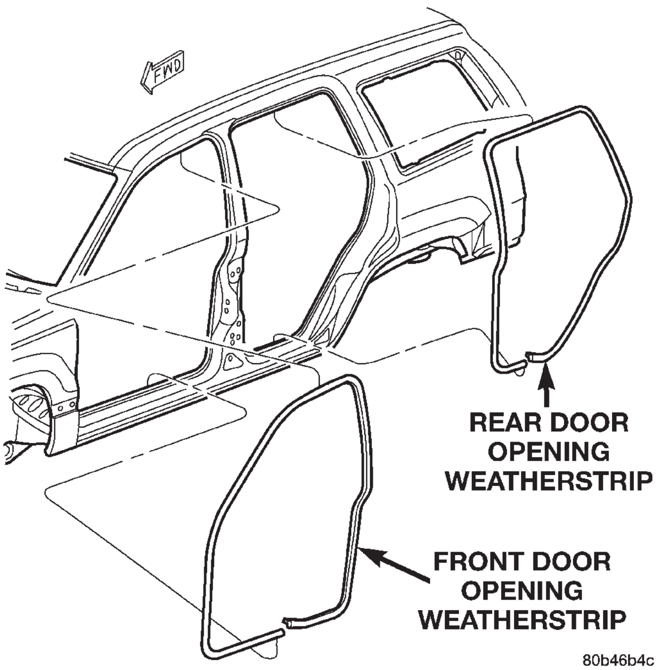


Fig. 28 Door Opening Weatherstrip

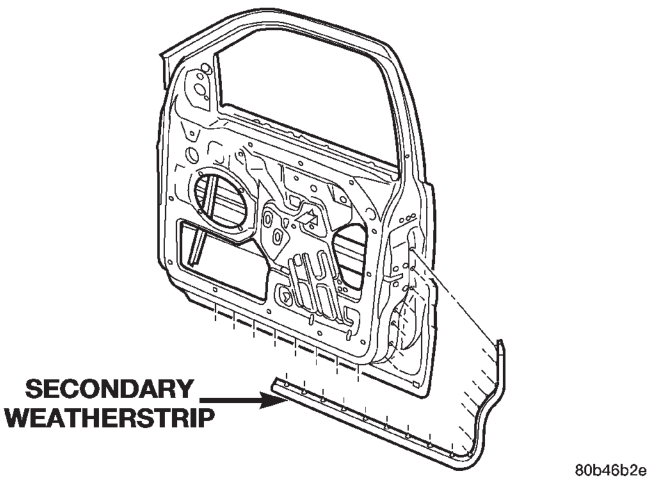


Fig. 29 Front Door Secondary Weatherstrip

FRONT DOOR WINDOW REGULATOR

REMOVAL

(1) Remove door trim panel.
(2) Remove isolator.
(3) Remove front door glass.
(4) Loosen bolts attaching regulator to inner door panel (Fig. 30).
(5) Remove bolt attaching regulator to inner door panel (Fig. 31).
(6) Lift regulator upward to disengage bolts from door inner panel.
(7) Disengage power window regulator harness connector, if equipped.
(8) Remove regulator through access hole in door.

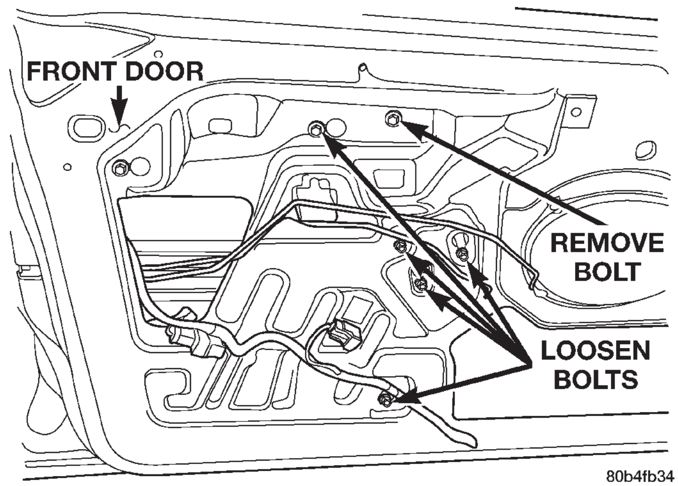


Fig. 30 Front Door Regulator Bolts

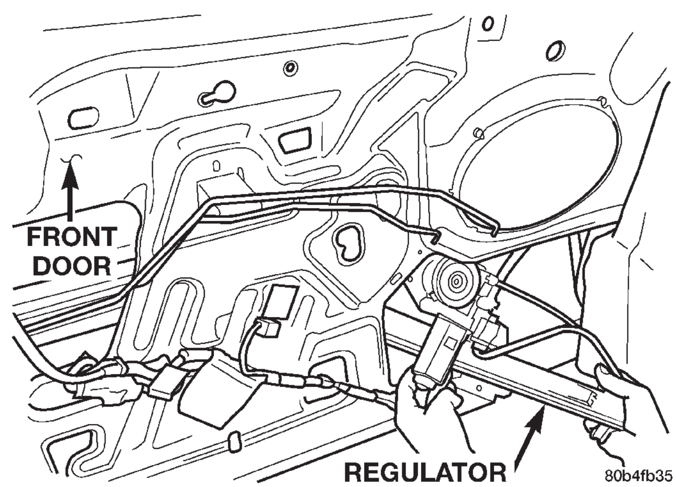


Fig. 31 Front Door Window Regulator

INSTALLATION

(1) Position regulator in door through access hole.
(2) Engage power window regulator harness connector, if equipped.
(3) Lift regulator upward and engage bolts in door inner panel key hole slots.
(4) Install bolt attaching regulator to inner door panel.
(5) Tighten bolts attaching regulator to inner door panel.
(6) Install front door glass.
(7) Install isolator.
(8) Install door trim panel.

FRONT DOOR GLASS

REMOVAL

(1) Locate glass to full down position.
(2) Remove trim panel.
(3) Remove inner belt weatherstrip.
(4) Remove outer belt weatherstrip.

REMOVAL AND INSTALLATION (Continued)

(5) Locate glass to 3/4 up position.
(6) Remove front door insulator.
(7) Using a long flat blade or hook type tool, disengage clips (Fig. 32) attaching glass retainer to glass lift plate.
(8) Carefully push bottom of glass panel outward to disengage glass retainer studs from lift plate (Fig. 33).
(9) Lift glass upward and out of door.

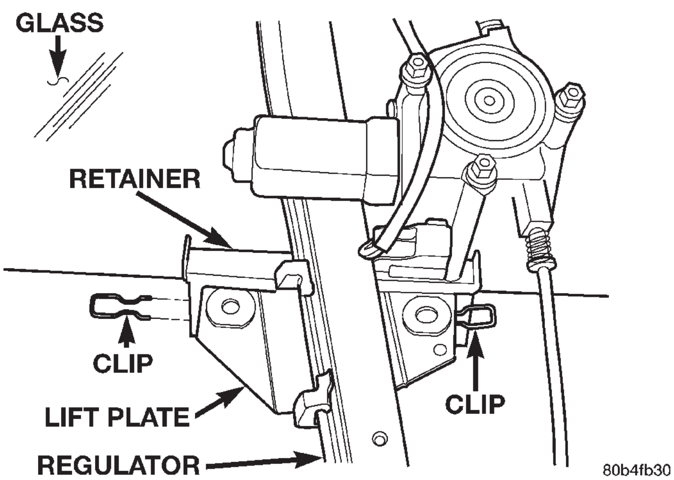


Fig. 32 Front Door Glass Clips

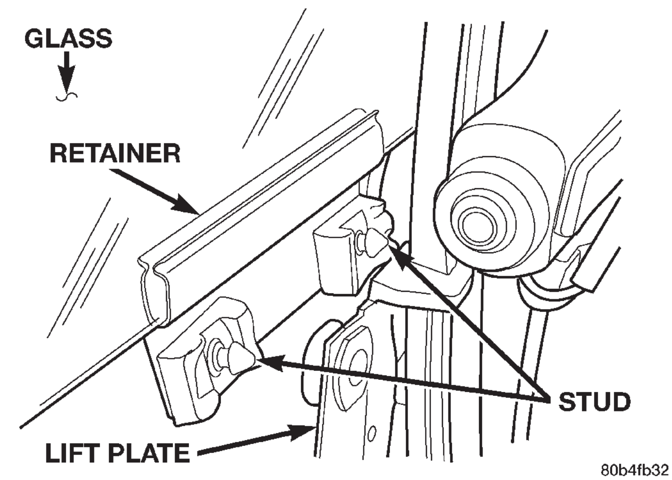


Fig. 33 Front Door Glass Retainer Studs

INSTALLATION

(1) Lower glass into position.
(2) Carefully align glass retainer studs with lift plate and insert studs into lift plate.
(3) Engage clips attaching glass retainer to glass lift plate.
(4) Install front door insulator.
(5) Locate glass to full down position.
(6) Install outer belt weatherstrip.
(7) Install inner belt weatherstrip.
(8) Install trim panel.

REAR DOOR B-PILLAR SEAL

REMOVAL

The B-pillar seal is attached to the rear door with adhesive tape.
(1) Peel seal from the door (Fig. 34).

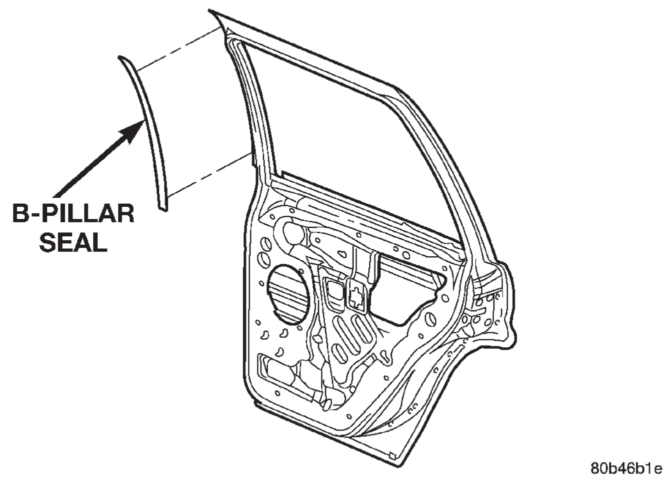


Fig. 34 B-Pillar Seal

INSTALLATION

(1) Clean contact area with Mopar Super Kleen or equivalent.
(2) Remove carrier from seal.
(3) Align seal on door and press into place.

REAR DOOR TRIM PANEL

REMOVAL

(1) Remove screws attaching trim panel to door (Fig. 35).
(2) Using trim remover (C-4829 or equivalent), detach trim panel perimeter push-in fasteners from door inner panel.
(3) Lift trim panel upward and separate from door.
(4) If equipped, disconnect harness connectors for power accessories.
(5) Disconnect latch rods from inside handle actuator.
(6) Separate trim panel from vehicle.

INSTALLATION

(1) Connect latch rods to inside handle actuator.
(2) If equipped, connect harness connectors to power accessories.
(3) Position trim panel on door inner panel.
(4) Press trim panel push-in fasteners inward around perimeter of door.
(5) Install screws attaching trim panel to door.

REMOVAL AND INSTALLATION (Continued)

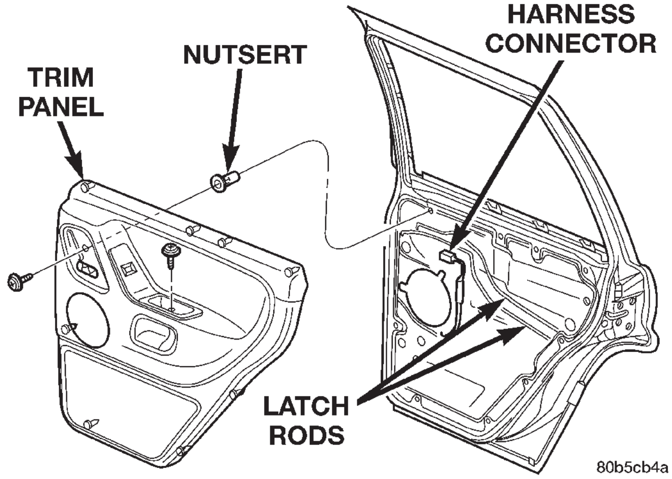


Fig. 35 Rear Door Trim Panel

REAR DOOR WATERDAM

REMOVAL

(1) Remove door trim panel.
(2) Peel the waterdam from door.
(3) Route all harnesses and linkage rods through waterdam as necessary.
(4) Separate waterdam from door (Fig. 36).

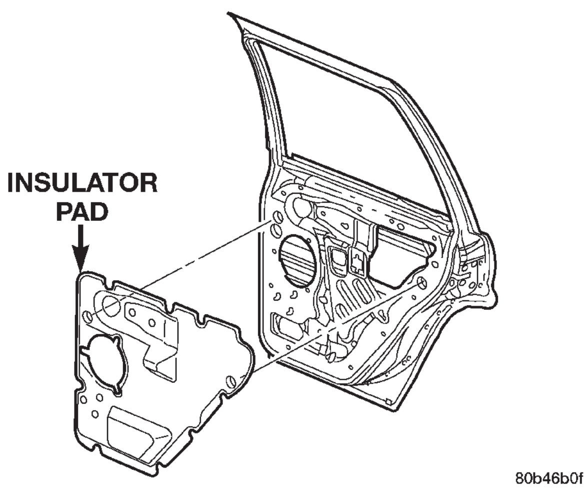


Fig. 36 Rear Door Waterdam

INSTALLATION

(1) Waterdam contact surface must be free of contaminants. Clean as necessary.
(2) Route all harnesses and linkage rods through waterdam as necessary.
(3) Position waterdam on door and align all holes.
(4) Press waterdam on door.
(5) Install door trim panel.

REAR DOOR CHECK

REMOVAL

(1) Remove trim panel.
(2) Remove waterdam.
(3) Remove speaker.
(4) Remove screws attaching door check to B-pillar.
(5) Remove nuts attaching door check to door (Fig. 37).
(6) Remove door check through speaker location hole.

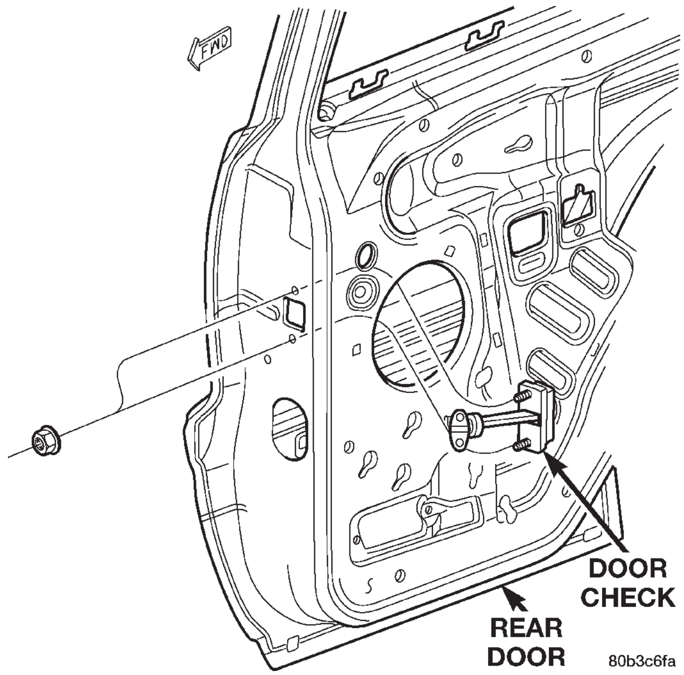


Fig. 37 Door Check

INSTALLATION

(1) Position door check on door through speaker location hole.
(2) Install nuts attaching door check to door.
(3) Install screws attaching door check to B-pillar.
(4) Install speaker.
(5) Install waterdam.
(6) Install trim panel.

REAR DOOR

REMOVAL

(1) Disconnect rear door harness connector (Fig. 38).
(2) Support door with padded floor jack.
(3) Remove retaining clips from hinge pins.
(4) Tap out hinge pins.
(5) Separate door from vehicle.

REMOVAL AND INSTALLATION (Continued)

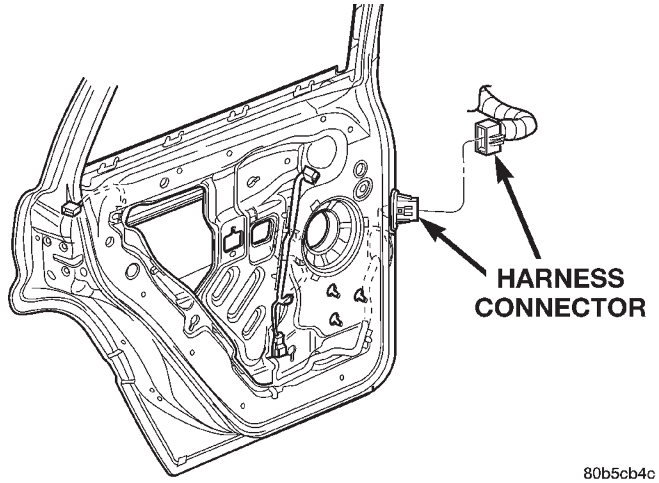


Fig. 38 Rear Door Harness Connector

INSTALLATION

(1) Position door at vehicle and align hinges.
(2) Install hinge pins.
(3) Install retaining clips for hinge pins.
(4) Connect rear door harness connector.

REAR DOOR HINGE

REMOVAL

(1) Open front door and rear door.
(2) Reference mark hinges for installation (Fig. 39).
(3) Support rear door for removal of hinges.
(4) Remove B pillar trim.
(5) Remove nuts holding door to hinge.
(6) Remove door.
(7) Remove bolts holding hinge to B pillar.

INSTALLATION

(1) Install hinge on B pillar and align reference marks.
(2) Install bolts holding hinge to B pillar. Tighten bolts to 35N·m (23 ft. lbs.).
(3) Install door on hinge and align reference marks. Install bolts and tighten to 35N·m (26 ft. lbs.).
(4) Check door for fit and ease of operation. Adjust as necessary. See adjustment section.
(5) Install B pillar trim.

REAR DOOR OUTSIDE HANDLE

REMOVAL

(1) Remove door trim panel and waterdam.
(2) Locate glass to full up position.
(3) Disconnect lock knob to latch rod.
(4) Disconnect outside handle to latch rod.
(5) Remove fasteners attaching outside handle to door (Fig. 40).

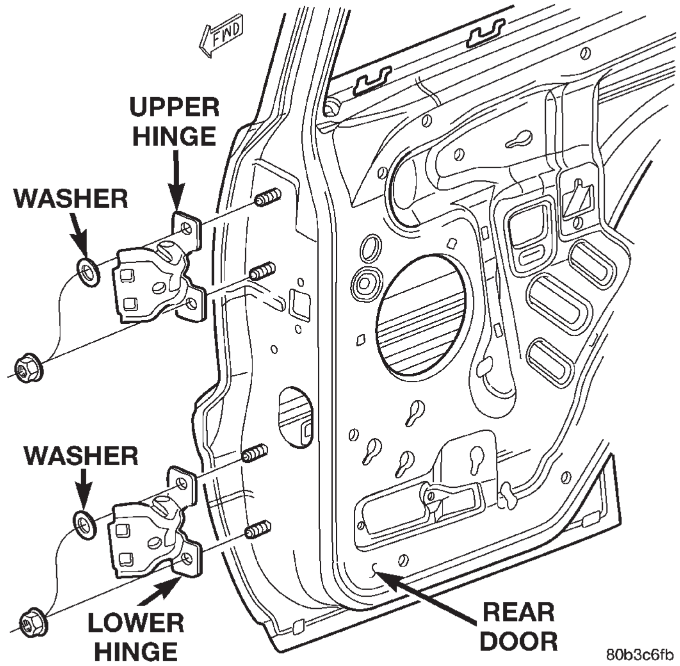


Fig. 39 Rear Door Hinge

(6) Remove outside handle from door.
(7) Separate outside handle from vehicle.

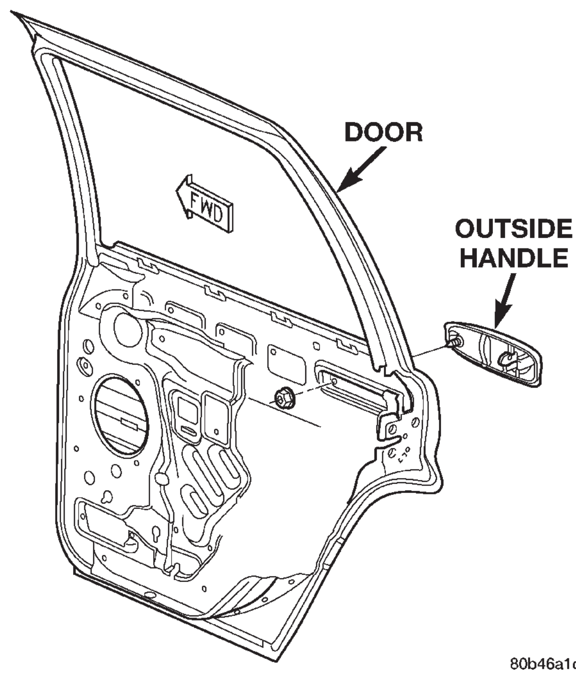


Fig. 40 Front Door Outside Handle

INSTALLATION

(1) Position outside handle at door.
(2) Position outside handle in door.
(3) Install fasteners attaching outside handle to door.
(4) Connect outside handle to latch rod.
(5) Connect lock knob to latch rod.

REMOVAL AND INSTALLATION (Continued)

(6) Locate glass to full down position.
(7) Install waterdam and door trim panel.

REAR DOOR LATCH

REMOVAL

(1) Remove door trim panel and waterdam.
(2) Remove screws attaching latch to door (Fig. 41).
(3) Disconnect rods from door latch.
(4) Separate door latch from door.

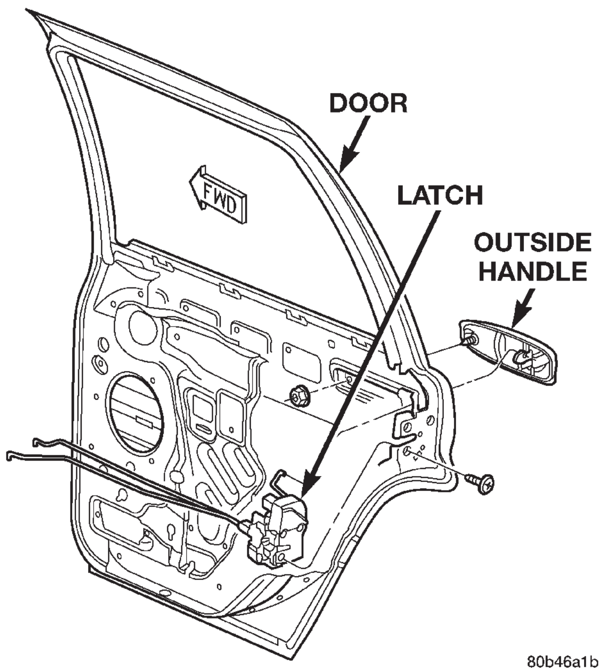


Fig. 41 Rear Door Latch

INSTALLATION

(1) position latch in door.
(2) Connect rods to door latch.
(3) Install screws attaching latch to door. Tighten screws to 10 N·m (95 in. lbs.) torque.
(4) Install waterdam and door trim panel.

REAR DOOR LATCH STRIKER

REMOVAL

(1) Open door.
(2) Remove screws attaching striker to C-pillar (Fig. 42).
(3) Separate striker and spacer from vehicle.

INSTALLATION

(1) Position striker and spacer on C-pillar.
(2) Install screws. Tighten to 28 N·m (250 in. lbs.) torque.

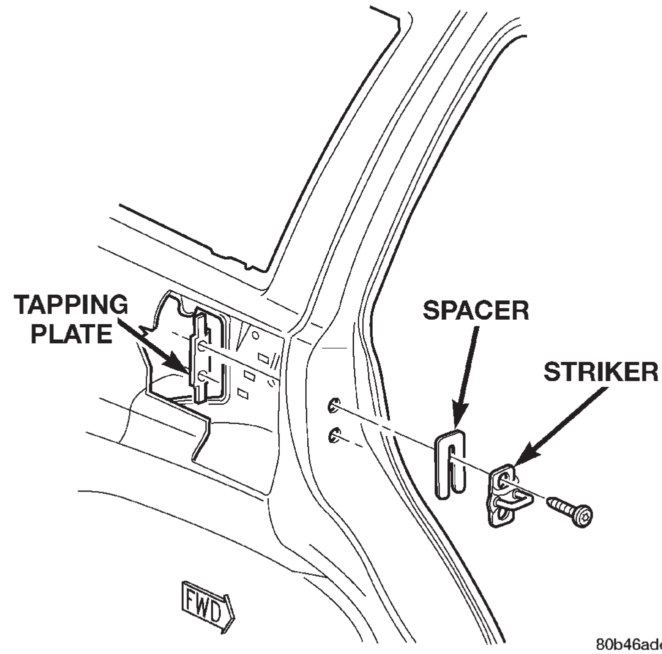


Fig. 42 Rear Door Latch Striker

REAR DOOR INSIDE HANDLE ACTUATOR

REMOVAL

(1) Remove door trim panel.
(2) Disconnect latch and lock rods from inside handle actuator.
(3) Remove screws attaching inside handle actuator to trim panel (Fig. 43).
(4) Separate inside handle actuator from trim panel.

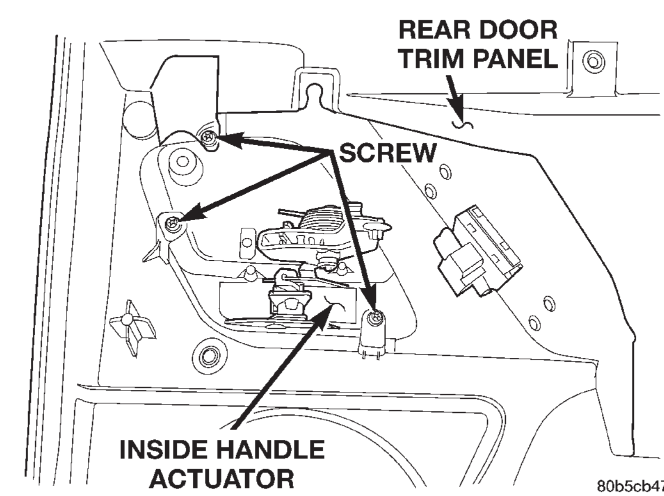


Fig. 43 Rear Door Inside Handle Actuator

INSTALLATION

(1) Position inside handle actuator in trim panel.
(2) Install screws attaching inside handle actuator to trim panel.

REMOVAL AND INSTALLATION (Continued)

(3) Connect latch and lock rods to inside handle actuator.

(4) Install door trim panel.

REAR DOOR INNER BELT WEATHERSTRIP

REMOVAL

(1) Remove door trim panel.

(2) Using a trim stick, carefully pry rear inner edge of inner belt weatherstrip upward.

(3) Grasp weatherstrip and pull upward to separate from door flange (Fig. 44).

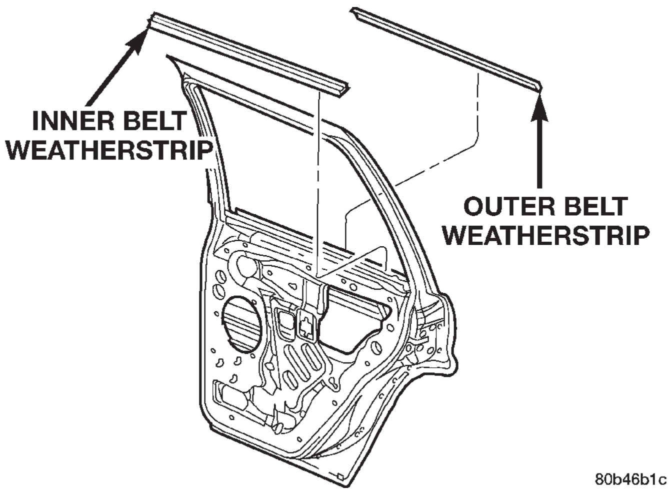


Fig. 44 Rear Door Inner/Outer Belt Weatherstrip

INSTALLATION

(1) Position weatherstrip on door flange.

(2) Firmly press downward to seat weatherstrip on flange.

(3) Install trim panel.

REAR DOOR OUTER BELT WEATHERSTRIP

REMOVAL

(1) Remove trim panel.

(2) Using a small flat blade, disengage tangs attaching outer belt weatherstrip to inner door panel.

(3) Lift weatherstrip upward and separate from door (Fig. 44).

INSTALLATION

(1) Position the weatherstrip onto the door flange.

(2) Force the weatherstrip onto door flange and engage tangs. Continue rearward until it is seated on flange.

(3) Instal trim panel.

REAR DOOR OPENING WEATHERSTRIP

REMOVAL

(1) Remove C-pillar trim.

(2) Remove B-pillar upper trim.

(3) Remove B-pillar lower trim.

(4) Remove screws at front of quarter trim panel.

(5) Pull weatherstrip from door opening flange.

INSTALLATION

(1) Position weatherstrip at corners.

(2) Move upward and around edge of door opening seating weatherstrip onto flange (Fig. 28).

(3) Engage connector plug with each end of weatherstrip at bottom of door opening.

(4) Install screws at front of quarter trim panel.

(5) Install B-pillar lower trim.

(6) Install B-pillar upper trim.

(7) Install C-pillar trim.

REAR DOOR SECONDARY WEATHERSTRIP

REMOVAL

The rear door secondary weatherstrip is attached to the door shutface with push-in fasteners.

(1) Open door.

(2) Using a trim panel removal tool, remove push-in fasteners attaching secondary weatherstrip to door shutface.

(3) Separate secondary weatherstrip from door (Fig. 45).

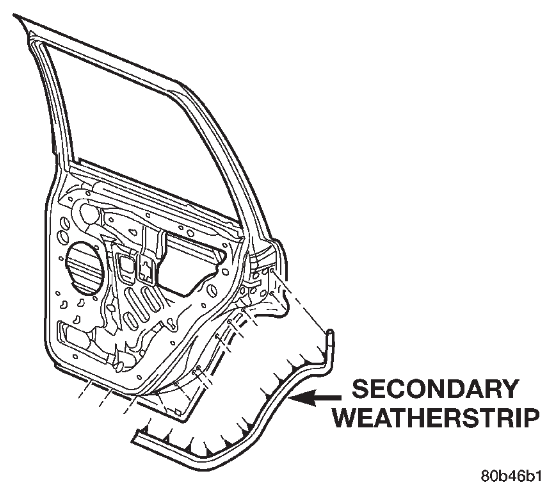


Fig. 45 Rear Door Secondary Weatherstrip

INSTALLATION

(1) Clean contact area as necessary.

(2) Position secondary weatherstrip on door shutface.

(3) Install push-in fasteners attaching secondary weatherstrip to door shutface.

REMOVAL AND INSTALLATION (Continued)

REAR DOOR WINDOW REGULATOR

REMOVAL

(1) Remove door trim panel and waterdam. Disconnect the speaker harness and power window harness, if equipped. If necessary, refer to removal procedure.
(2) Lower window glass.
(3) Pull run weatherstrip from fixed glass.
(4) Remove fasteners retaining fixed glass module.
(5) Remove the fixed glass module.
(6) Raise the door glass and support.
(7) Remove the window clips retaining regulator (Fig. 46).
(8) Remove the door glass.
(9) Remove the fasteners retaining the regulator (Fig. 47).
(10) Remove the regulator.

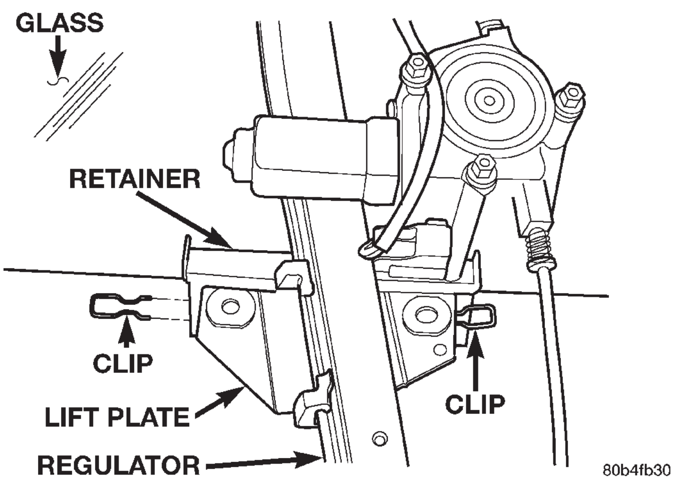


Fig. 46 Window Regulator Retainer Clips

INSTALLATION

(1) Position the window regulator in the door.
(2) Install the fasteners retaining the regulator.
(3) Install the door glass.
(4) Install the window clips retaining regulator.
(5) Lower the door glass.
(6) Install the fixed glass module. Tighten the fasteners.
(7) Install the run weatherstrip.
(8) Install the waterdam, door panel, and connect the power window and speaker harness if equipped.
(9) Cycle the glass and check for proper operation.

REAR DOOR WINDOW GLASS

REMOVAL

(1) Lower window glass.
(2) Remove trim panel.
(3) Remove waterdam.
(4) Remove inner belt weatherstrip.
(5) Remove stationary glass.

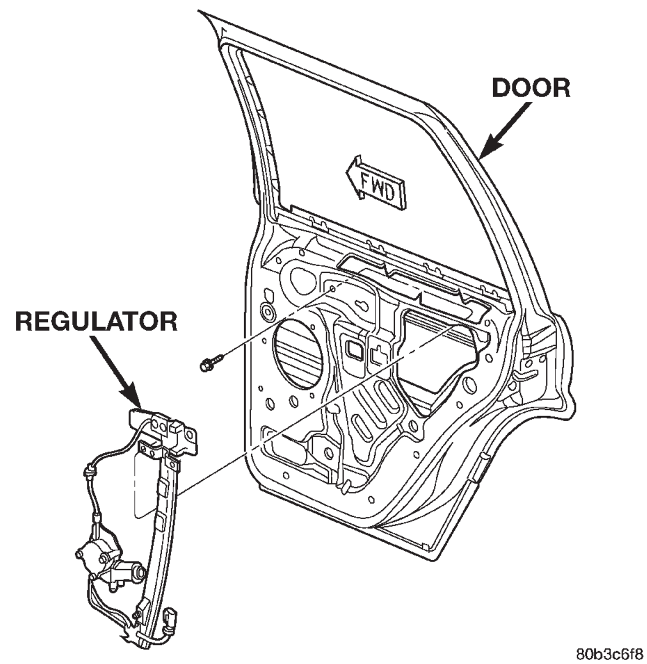


Fig. 47 Rear Door Window Regulator

(6) Disengage clips attaching window glass to lift plate.
(7) Press studs out of lift plate.
(8) Lift window glass from door (Fig. 48).

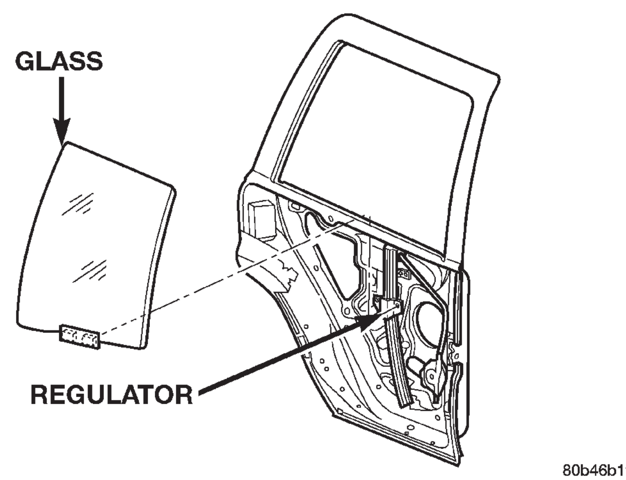


Fig. 48 Glass Channel

INSTALLATION

(1) Position window glass in door.
(2) Engage studs into lift plate.
(3) Engage clips attaching window glass to lift plate.
(4) Install stationary glass.
(5) Install inner belt weatherstrip.
(6) Install waterdam.
(7) Install trim panel.

REMOVAL AND INSTALLATION (Continued)

REAR DOOR STATIONARY GLASS

REMOVAL

(1) Remove door trim panel.
(2) Remove waterdam.
(3) Remove inner belt weatherstrip.
(4) Remove bolt attaching bottom of rear glass run channel to door.
(5) Pull run channel downward and separate from door.
(6) Remove screws attaching stationary door glass frame to door (Fig. 49) and (Fig. 50).
(7) Separate stationary door glass from door.

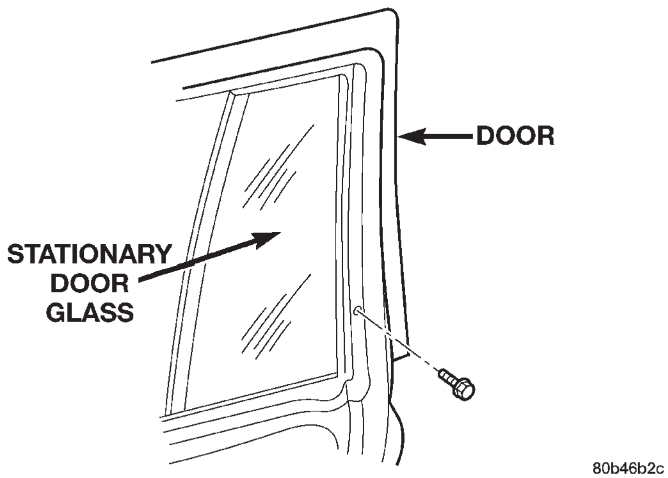


Fig. 49 Stationary Door Glass

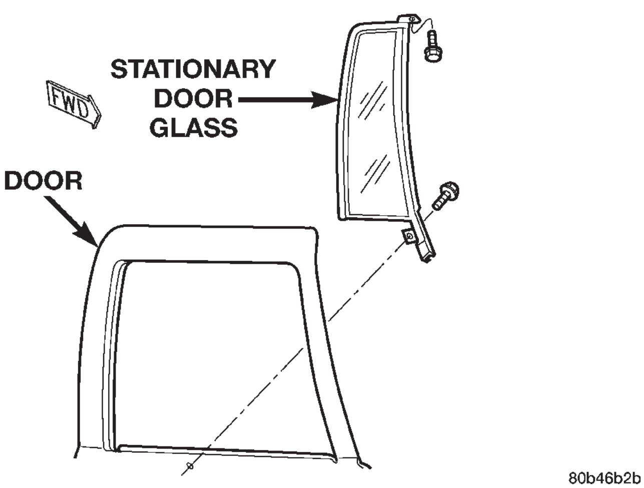


Fig. 50 Stationary Door Glass

INSTALLATION

(1) Position stationary door glass in door.
(2) Install screws attaching stationary door glass frame to door.
(3) Install glass run channel.
(4) Install inner belt weatherstrip.
(5) Install waterdam.
(6) Install door trim panel.

ROOF RAIL WEATHERSTRIP W/RETAINER

REMOVAL

(1) Open front and rear doors.
(2) Remove secondary seal from retainer to access the screws holding the retainer to the A pillar and roof panel.
(3) Remove the screws holding the retainer in place (Fig. 51).
(4) Remove the retainer.

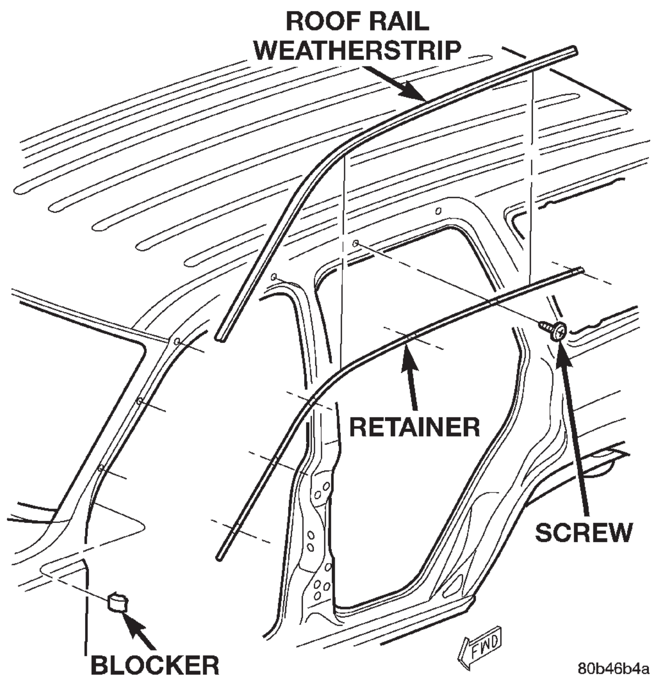


Fig. 51 Upper Body Seal With Retainer

INSTALLATION

(1) Position the retainer on the A pillar and roof panel.
(2) Align the screw holes and install the screws.
(3) Install secondary seal.

FUEL FILL DOOR

REMOVAL

(1) Open the fuel filler door.
(2) Remove the screws attaching the door to the quarter panel (Fig. 52).
(3) Remove the door from the panel.

INSTALLATION

(1) Position the fuel filler door on the quarter panel with the screw holes aligned.
(2) Install the screws attaching the fuel filler door to the quarter panel.

REMOVAL AND INSTALLATION (Continued)

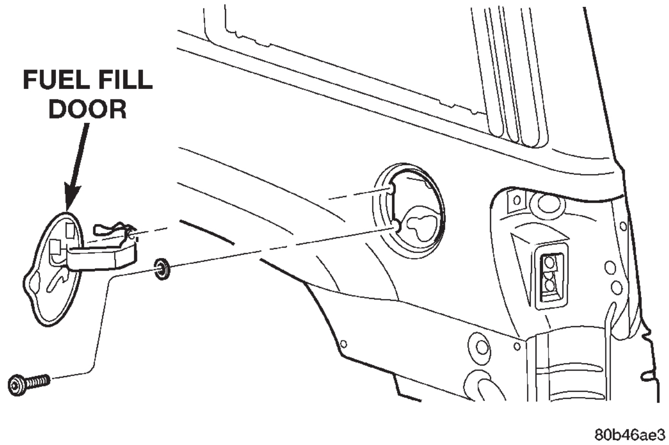


Fig. 52 Fuel Filler Door

BODY SIDE CLADDING

REMOVAL–FENDER/QUARTER PANEL

(1) Remove the screws at wheel opening (Fig. 53).
(2) Using a trim stick, gently pry bottom of cladding up.
(3) Lift upwards and remove cladding.

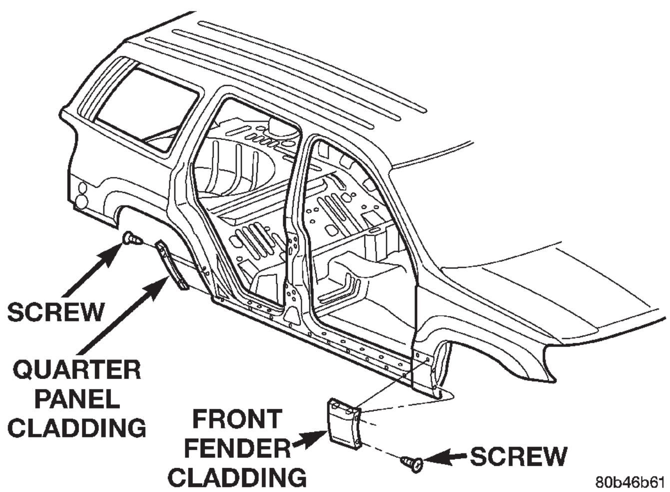


Fig. 53 Front Fender/ Quarter Panel

INSTALLATION–FENDER/QUARTER PANEL

(1) Thoroughly clean the area with Mopar Super Kleen or equivalent.
(2) Align the cladding with the screw holes in the fender.
(3) Press the cladding in place.
(4) Install the screws at the wheel opening.

REMOVAL–REAR DOOR

(1) Open the rear door.
(2) Using a trim stick, pry the upper rear edge off the door. Continue towards the front edge of the rear door (Fig. 54).
(3) Using a heat gun, warm the adhesive tape on the bottom of the cladding and remove the cladding.

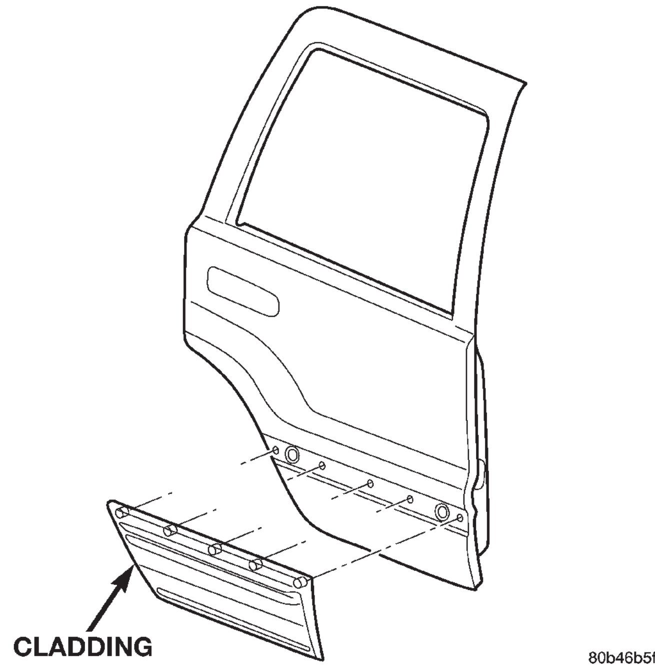


Fig. 54 Rear Door Cladding

INSTALLATION–REAR DOOR

(1) Clean the area thoroughly with Mopar Super Kleen, or equivalent.
(2) Align the body side cladding with the slots in the door. Press the adhesive pad to the door and snap the retainers into the slots.

REMOVAL–FRONT DOOR

(1) Open the front door.
(2) Using a trim stick, pry the upper rear edge off the door. Continue to the front edge of the front door (Fig. 55).
(3) Using a heat gun, warm the adhesive tape on the lower edge of the cladding and pull the cladding from the door.

INSTALLATION–FRONT DOOR

(1) Clean the area thoroughly with Mopar Super Kleen, or equivalent.
(2) Align the body side cladding with the slots in the door. Press the adhesive pad to the door and snap the retainers into the slots.

SILL MOLDING

REMOVAL

The sill trim molding is held in place with molded in snap retainers (Fig. 56).
(1) Using a trim stick or other suitable device, carefully pry up one corner of the sill trim.

REMOVAL AND INSTALLATION (Continued)

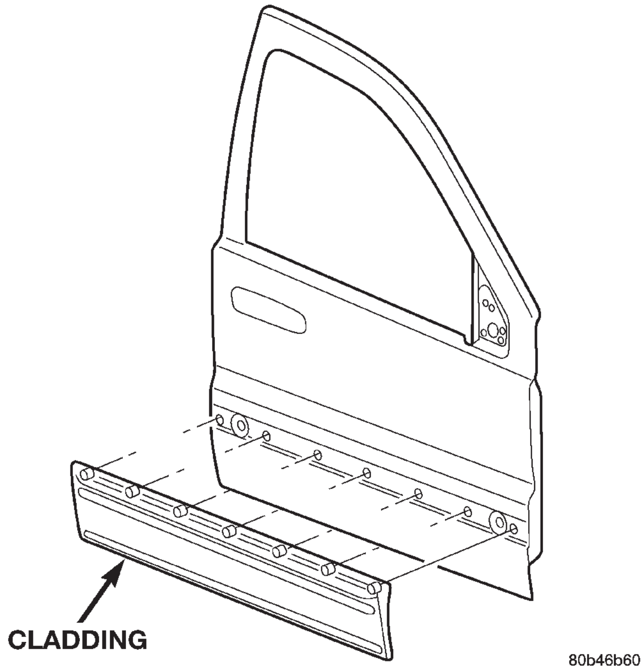


Fig. 55 Front Door Cladding

(2) Grasp the edge of the trim and pull up gently to release the snap retainers.

INSTALLATION

(1) Position the sill molding on the door sill.
(2) Press the snap retainers into place.

A-PILLAR TRIM

REMOVAL

The A-pillar trim is attached to the A-pillar with spring clips.
(1) Grasp A-pillar trim and pull trim outward from A-pillar (Fig. 57).
(2) Separate A-pillar trim from A-pillar.

INSTALLATION

(1) Position A-pillar trim on A-pillar and, starting at the bottom, press into place.
(2) Using a trim stick or other suitable tool, carefully cover the edge of the trim with weatherstrip.

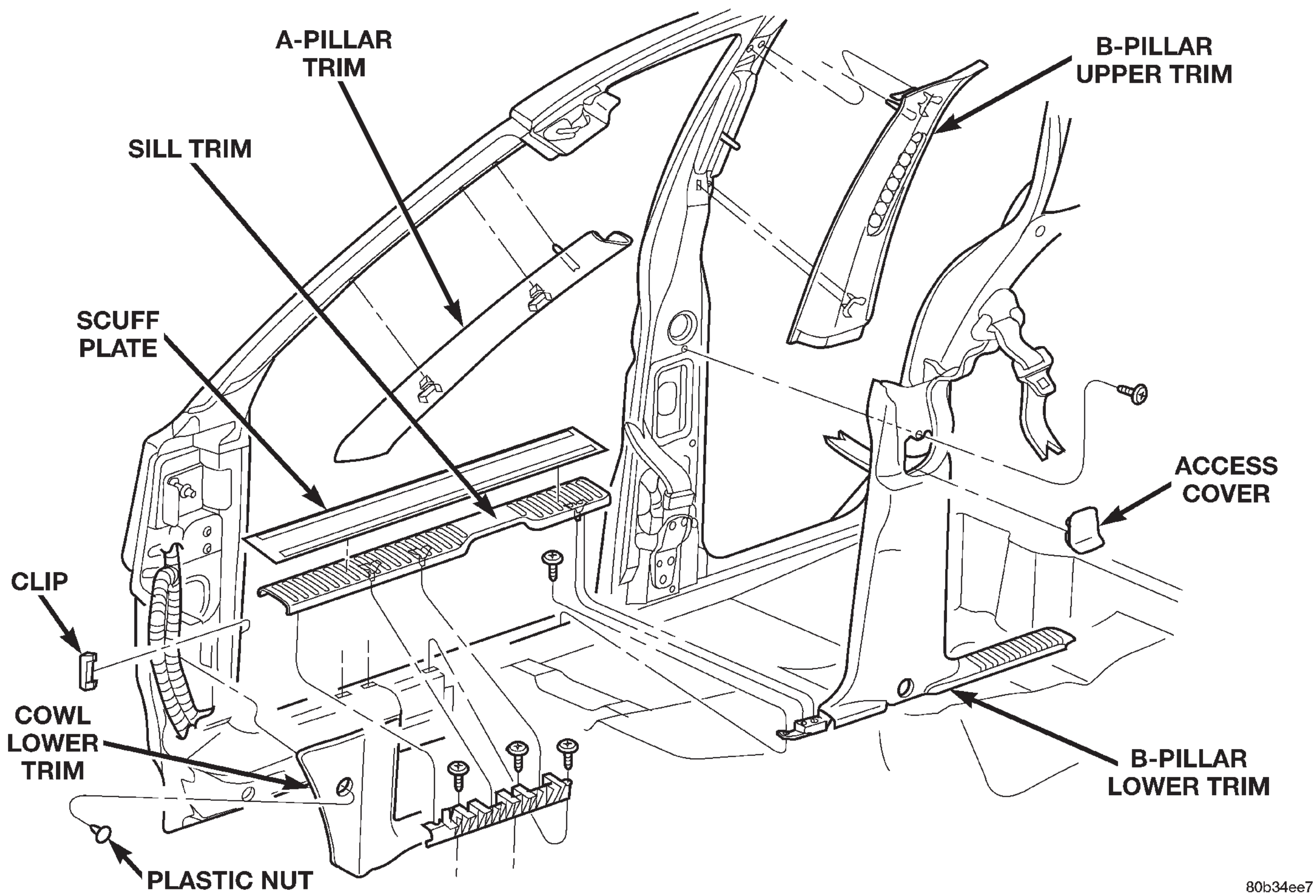


Fig. 56 Sill Trim Molding

REMOVAL AND INSTALLATION (Continued)

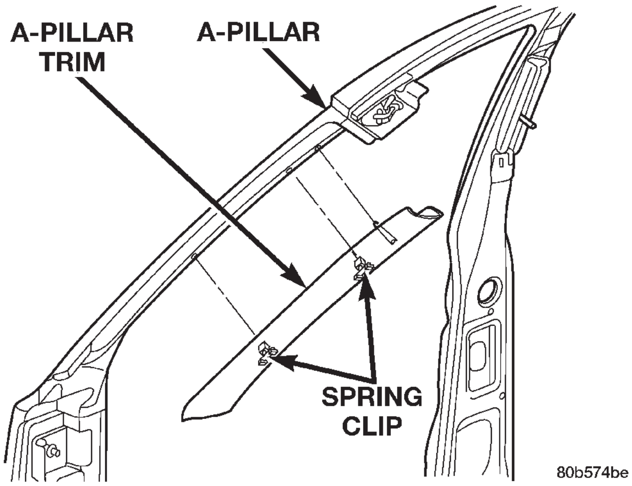


Fig. 57 A-Pillar Trim

COWL LOWER TRIM

REMOVAL

(1) Remove front door sill trim.
(2) Remove screws attaching cowl trim to floor.
(3) Remove plastic nut.
(4) Grasp cowl trim and pull outward to separate from clip.
(5) Separate cowl trim from vehicle.

INSTALLATION

(1) Position cowl trim and press into place.
(2) Install screws attaching cowl trim to floor.
(3) Install plastic nut.
(4) Install front door sill trim.

OVERHEAD ASSIST HANDLE

REMOVAL

(1) Remove the screws holding the assist handle to the roof panel.
(2) Remove the assist handle from the roof panel.

INSTALLATION

(1) Align the assist handle with the screw holes in the roof panel.
(2) Install the screws holding the assist handle to the roof panel.

FRONT DOOR SCUFF PLATE

REMOVAL

(1) Using a trim stick or other suitable tool, carefully pry up the scuff plate from the door sill (Fig. 58).
(2) Remove the scuff plate.

INSTALLATION

(1) Install the scuff plate on the door sill.

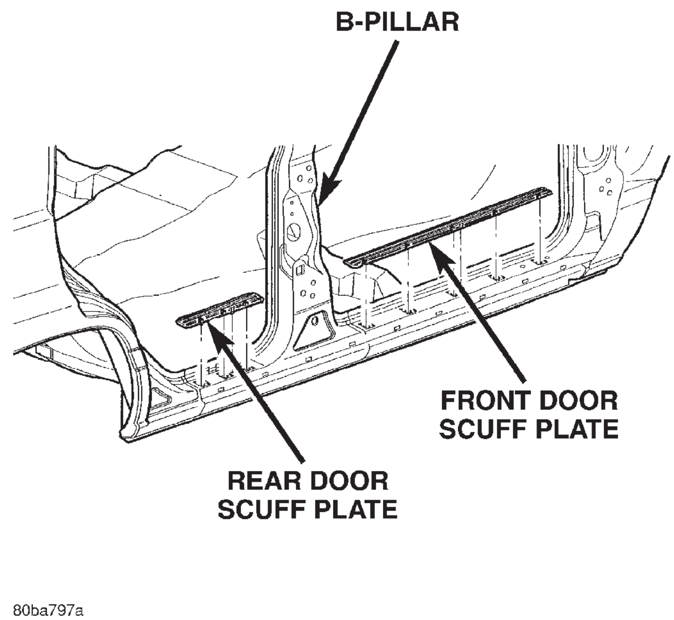


Fig. 58 Door Sill Scuff Plates

(2) Press the molded in snap retainers into the door sill.

B-PILLAR UPPER TRIM

REMOVAL

(1) Remove shoulder belt height adjustment knob.
(2) Remove front seat belt turning loop.
(3) Remove the screw attaching lower B pillar trim.
(4) Pull lower B pillar trim out far enough to remove upper trim panel.
(5) Grasp upper B-pillar trim and pull outward to detach from B-pillar (Fig. 59).

INSTALLATION

(1) Position trim panel on B-pillar.
(2) Ensure trim panel covers inner edge of door opening weatherstrip and press inward to seat.
(3) Install screw attaching lower B pillar trim panel.
(4) Install front seat belt turning loop.
(5) Install shoulder belt height adjustment knob.

B-PILLAR LOWER TRIM

REMOVAL

(1) Remove front door sill trim.
(2) Remove front seat shoulder belt anchor bolt.
(3) Remove front seat shoulder belt height adjustment knob and turning loop.
(4) Remove screw attaching front of quarter panel trim to floor.

REMOVAL AND INSTALLATION (Continued)

(5) Remove screws attaching front and rear of B-pillar lower trim to floor.

(6) Remove screw attaching B-pillar lower trim to B-pillar (Fig. 59).

(7) Grasp B-pillar lower trim and pull outward to separate from B-pillar.

(8) Route seat/shoulder belt through access slot in B-pillar lower trim.

(9) Separate B-pillar lower trim from B-pillar.

INSTALLATION

(1) Position B-pillar lower trim panel at B-pillar.

(2) Route seat/shoulder belt through access slot in B-pillar lower trim.

(3) Press B-pillar lower trim onto B-pillar.

(4) Install screw attaching B-pillar lower trim to B-pillar.

(5) Install screw attaching front of B-pillar lower trim to floor.

(6) Install screw attaching front of quarter panel trim to floor.

(7) Install front seat shoulder belt anchor bolt.

(8) Install front seat shoulder belt height adjustment knob and turning loop.

(9) Install front door sill trim.

REAR DOOR SCUFF PLATE

REMOVAL

(1) The rear door scuff plate is attached with molded-in snap retainers.

(2) Using a trim stick or other suitable tool, carefully pry the scuff plate from the sill (Fig. 58).

INSTALLATION

(1) Position the scuff plate on the sill and snap into place.

C-PILLAR UPPER TRIM

REMOVAL

(1) Remove rear shoulder belt turning loop.

(2) Remove rear shoulder belt height adjustment knob.

(3) Remove screws attaching quarter panel trim.

(4) Pull quarter panel trim outward as necessary.

(5) Grasp C-pillar upper trim and pull outward to disengage from C-pillar (Fig. 60).

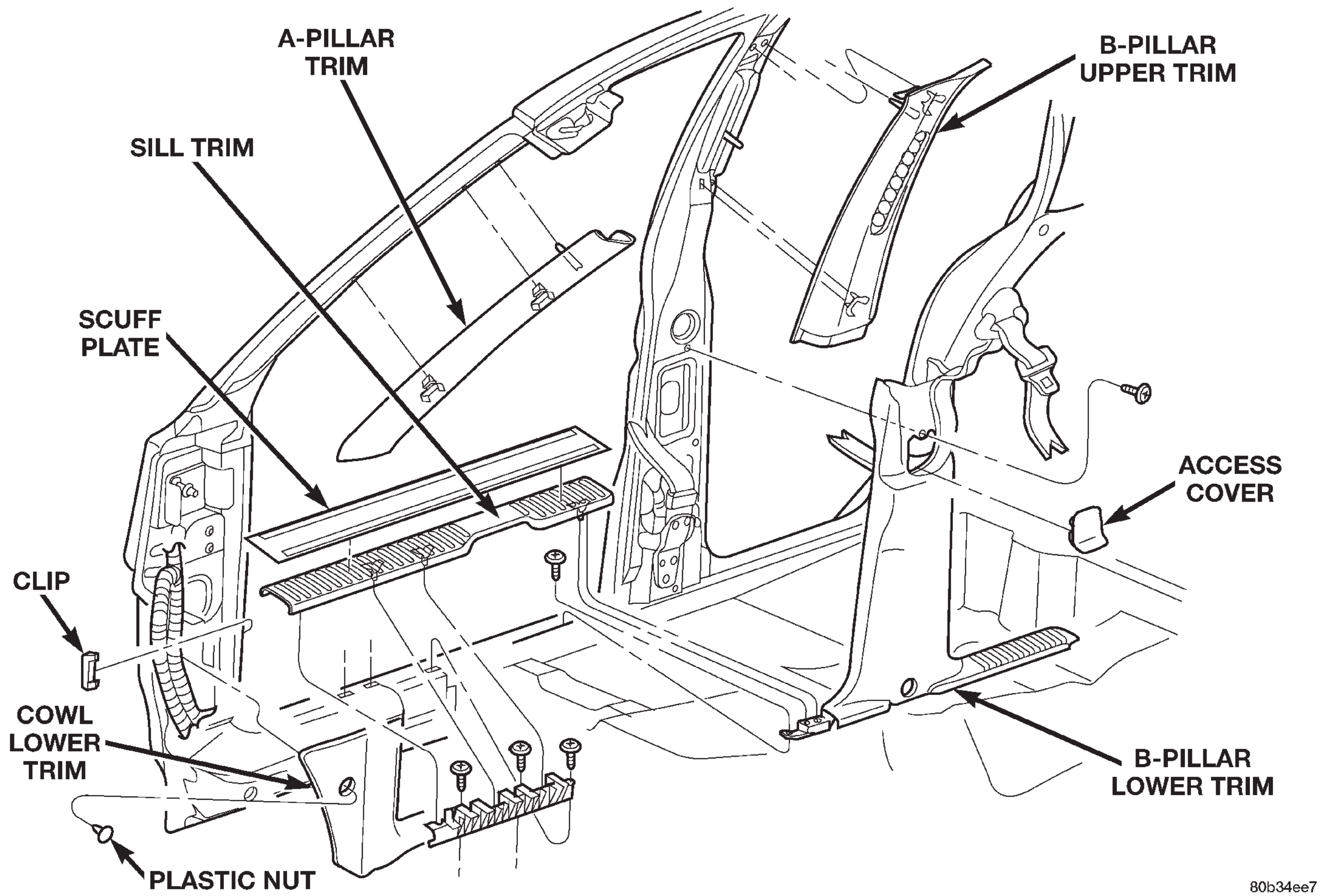


Fig. 59 B-Pillar Trim Panel

REMOVAL AND INSTALLATION (Continued)

(6) Route rear shoulder belt through access hole.
(7) Separate C-pillar upper trim from vehicle.

INSTALLATION

(1) Position C-pillar upper trim at C-pillar.
(2) Route rear shoulder belt through access hole.
(3) Press C-pillar upper trim onto C-pillar.
(4) Press quarter panel trim into place as necessary.
(5) Ensure front edge of trim is covered by weatherstrip.
(6) Install screws attaching quarter panel trim.
(7) Install rear shoulder belt height adjustment knob.
(8) Install rear shoulder belt turning loop.

QUARTER PANEL TRIM

REMOVAL

(1) Move rear sear to cargo position.
(2) If equipped, remove sunshade cover.
(3) Remove screw attaching quarter panel trim to lower B pillar trim (Fig. 60).
(4) Open liftgate.
(5) Remove upper and lower liftgate opening trim panels.
(6) Remove D-pillar upper trim.
(7) Remove storage bin (right side only).
(8) Remove C-pillar upper trim panel.
(9) Remove mounting screws.
(10) Pull quarter trim panel forward and disengage connectors for CD player and power outlet, if equipped.
(11) Pull quarter trim panel extension in the rear door opening upward.
(12) Remove rear quarter trim panel.

INSTALLATION

(1) Position quarter trim panel, engage connectors for CD player and power outlet, if equipped, and align screw holes.
(2) Install quarter trim panel.
(3) Install C-pillar upper trim panel.
(4) Install storage bin.
(5) Install D-pillar upper trim panel.
(6) Install upper and lower liftgate opening trim panels.
(7) Install screw at lower B pillar.

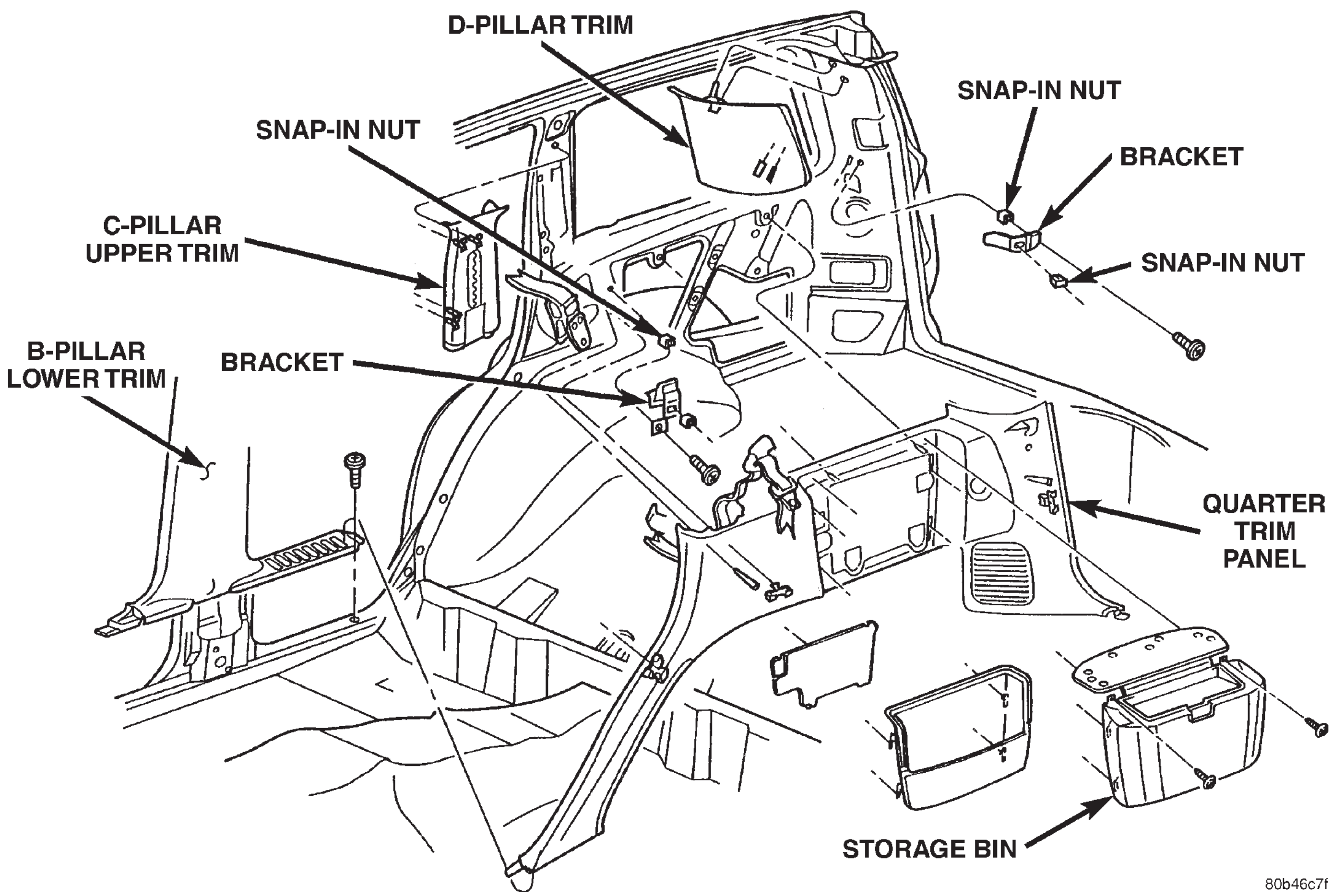


Fig. 60 Right Side Trim Panel

REMOVAL AND INSTALLATION (Continued)

(8) If equipped, install sunshade cover.
(9) Install cargo loops.
(10) Move the rear seat to the upright position.

STORAGE BIN

REMOVAL

(1) Open the storage bin lid and remove screws on each side of the lid hinge.
(2) Pull upward sharply on the bottom of the bin to disengage hooks.
(3) Raise bin and move inboard to disengage the quarter trim panel.

INSTALLATION

(1) Position the bin hooks high in the slots on the quarter trim panel.
(2) Push downward until the bin snaps into place.
(3) Install the hinge screws.

D-PILLAR TRIM

REMOVAL

The D-pillar trim is attached to the D-pillar with spring clips.
(1) Remove liftgate opening upper trim panel.
(2) Grasp D-pillar trim and pull outward from D-pillar (Fig. 61).
(3) Separate D-pillar trim from D-pillar.

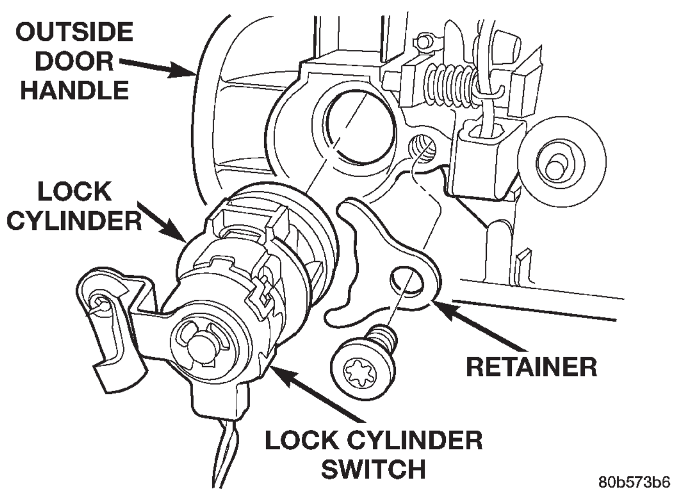


Fig. 61 D-Pillar Trim

INSTALLATION

(1) Position D-pillar trim panel at D-pillar and press into place.
(2) Install upper liftgate opening trim panel.

FRONT SHOULDER BELT

REMOVAL

(1) Move the seat to the fully forward position.
(2) Unsnap turning loop cover.
(3) Remove upper anchor bolt.
(4) Remove the B pillar trim.
(5) Remove the bolt attaching the retractor to the B pillar.
(6) Remove the bolt attaching the belt anchor to the B pillar.
(7) Disengage retractor wire harness.
(8) Remove the belt and retractor assembly.

INSTALLATION

(1) Position the belt and retractor assembly on the B pillar.
(2) Install the bolt attaching the belt anchor to the B pillar.
(3) Install the bolt attaching the retractor to the B pillar.
(4) Tighten the anchor bolts to 37N·m (27ft. lbs.).
(5) Install the B pillar trim.
(6) Install the upper anchor bolt. Tighten the anchor bolt to 37N·m (27ft. lbs.).
(7) Close the turning loop cover.

FRONT SHOULDER BELT BUCKLE

REMOVAL

NOTE: The shoulder belt buckle is fastened to the seat frame.

(1) Move the seat to the fully rearward position.
(2) Remove the bolt holding the seat belt buckle to the seat frame.
(3) Separate the seat belt buckle from the vehicle.

INSTALLATION

(1) Install the seat belt buckle on the seat frame.
(2) Tighten the anchor bolt to 37N·m (27 ft. lbs.).

REAR SEAT BELT BUCKLE

The rear seat belt buckle is integral with the seat frame and not serviced as a separate part.

REMOVAL AND INSTALLATION (Continued)

FLOOR CONSOLE

CAUTION: The ACM should be depowered by disconnecting the negative battery cable in any operation requiring the key to be turned "ON", while working in the console area. E.G. console, carpet, or seat removal or installation; shifter linkage adjustment or replacement; parking brake cable replacement or adjustment. Failure to take proper precautions could result in accidental airbag deployment and possible personal injury.

REMOVAL

(1) Set park brake.
(2) Place transmission shift lever and transfer case lever in full rearward position.
(3) Remove mat from front bin and remove screws attaching front of console to floor (Fig. 62).
(4) Remove screws attaching rear bin to console.
(5) Remove rear bin.
(6) Pull rear passenger cupholder outward to access screws.
(7) Remove screws attaching rear of console to floor.
(8) Lift the console upward and rearward.
(9) Remove console from vehicle.

INSTALLATION

(1) Position console in vehicle. Ensure rear passenger HEVAC duct is engaged.
(2) Install screws attaching rear of console to floor.
(3) Position rear bin in console.
(4) Install screws attaching rear bin to console.
(5) Install screws attaching front of console to floor and place front bin mat in front bin.
(6) Return transmission shift lever and transfer case lever to original position.
(7) Release park brake.

FRONT CARPET

REMOVAL

(1) Remove door sill trim and lower "B" pillar trim.
(2) Remove front seats and lower cushions of rear seats.
(3) Remove center floor console.
(4) Remove any other interfering trim or molding.
(5) Lift carpet and mat from floor panel.

INSTALLATION

(1) Clean the floor panel area as necessary.
(2) Carefully lay the carpet and mat on the floor panel. Align the carpet to allow installation of the components fastened to the floor panel.
(3) Install the center console.
(4) Install the front and rear seat units.

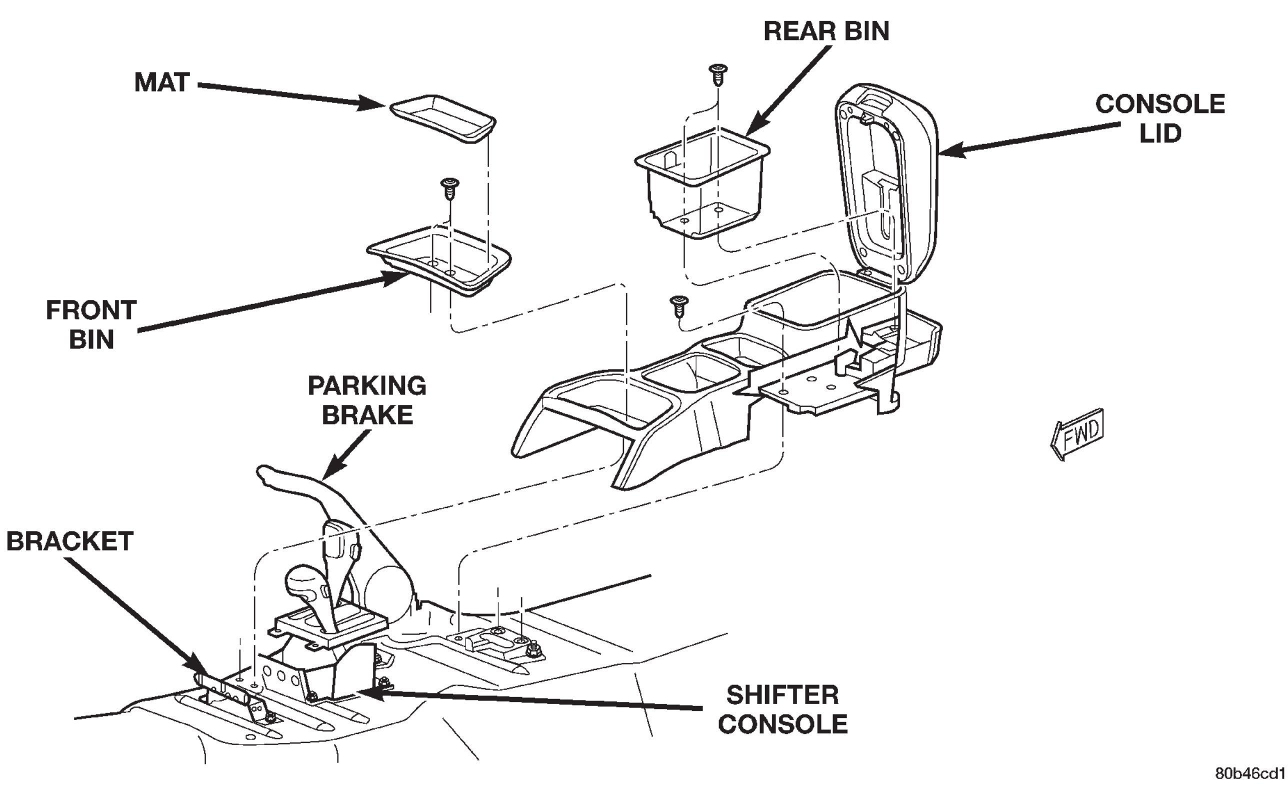


Fig. 62 Floor Console

(5) Install the lower “B” pillar trim and the door sill trim.

(6) Install any other moldings or trim panels removed.

CARGO AREA CARPET

REMOVAL

(1) Lift tailgate.

(2) Fold rear seat cushions forward.

(3) Remove rear seat backs, shoulder belts and buckles.

(4) Remove the retractable security cargo cover assembly.

(5) Remove the spare tire cover.

(6) Remove the rear cargo tie down footman loops. The side mounted footman loops are retained by screws. The floor footman loops are riveted (Fig. 63).

(7) Remove the “C” pillar trim and CD changer, if equipped.

(8) Remove the Infinity amp, if equipped.

(9) Lift the carpet.

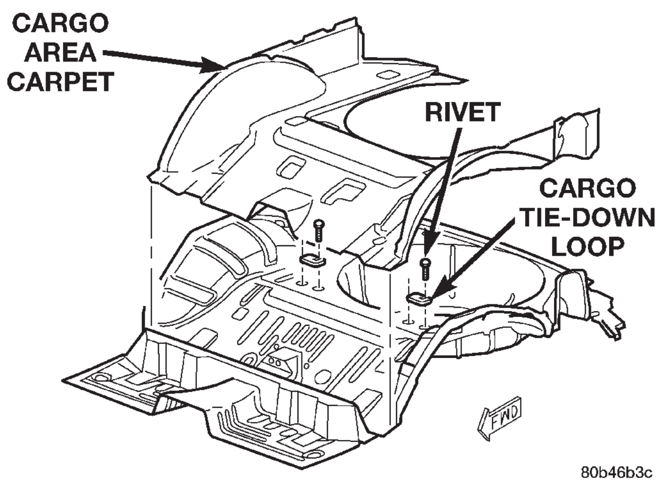


Fig. 63 Cargo Area Carpet

INSTALLATION

(1) Thoroughly clean the area with Mopar Super Kleen, or equivalent.

(2) Lay the new carpet in.

(3) Install the “C” pillar trim and CD changer, if equipped.

(4) Install the footman loops.

(5) Install the seat backs, shoulder belts and buckles.

(6) Install the Infinity amp, if equipped.

(7) Install the spare tire cover.

(8) Install the retractable security cover.

REARVIEW MIRROR

REMOVAL

(1) If equipped, disconnect mirror harness connector.

(2) Loosen the mirror base setscrew (Fig. 64).

(3) Slide the mirror base upward and off the bracket.

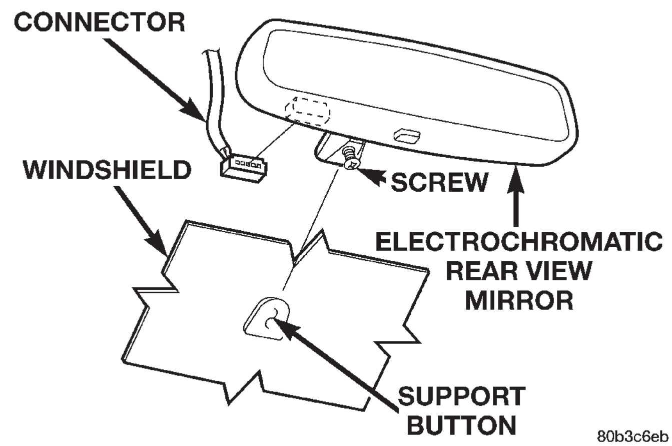


Fig. 64 Rearview Mirror

INSTALLATION

(1) Position the mirror base at the bracket and slide it downward onto the support bracket.

(2) Tighten the setscrew 1 N·m (15 in. lbs.) torque.

(3) If equipped, connect mirror harness connector.

REARVIEW MIRROR SUPPORT BRACKET

INSTALLATION

(1) Mark the position for the mirror bracket on the outside of the windshield glass with a wax pencil.

(2) Clean the bracket contact area on the glass. Use a mild powdered cleanser on a cloth saturated with isopropyl (rubbing) alcohol. Finally, clean the glass with a paper towel dampened with alcohol.

(3) Sand the surface on the support bracket with fine grit-sandpaper. Wipe the bracket surface clean with a paper towel.

(4) Apply accelerator to the surface on the bracket according to the following instructions:

- Crush the vial to saturate the felt applicator.
- Remove the paper sleeve.
- Apply accelerator to the contact surface on the bracket.
- Allow the accelerator to dry for five minutes.
- Do not touch the bracket contact surface after the accelerator has been applied.

(5) Apply adhesive accelerator to the bracket contact surface on the windshield glass. Allow the accelerator to dry for one minute. Do not touch the glass

REMOVAL AND INSTALLATION (Continued)

contact surface after the accelerator has been applied.

(6) Install the bracket according to the following instructions:

- Apply one drop of adhesive at the center of the bracket contact-surface on the windshield glass.
- Apply an even coat of adhesive to the contact surface on the bracket.
- Align the bracket with the marked position on the windshield glass.
- Press and hold the bracket in place for at least one minute.

NOTE: Verify that the mirror support bracket is correctly aligned, because the adhesive will cure rapidly.

(7) Allow the adhesive to cure for 8-10 minutes. Remove any excess adhesive with an alcohol-dampened cloth.

(8) Allow the adhesive to cure for an additional 8-10 minutes before installing the mirror.

SUNVISOR

REMOVAL

(1) Remove screws attaching sunvisor arm support bracket to headliner and roof panel.

(2) Disengage electrical connections for vanity mirror, if equipped.

(3) Detach sunvisor from support bracket.

(4) Remove sunvisor from vehicle.

(5) Remove retaining screw and support bracket.

INSTALLATION

(1) Install the retaining screw and support bracket.

(2) Position the sunvisor in the vehicle.

(3) Connect the electrical harness for the lighted vanity mirror, if equipped.

(4) Attach the sunvisor to the support bracket.

(5) Install the support bracket w/sunvisor onto the headliner and roof panel.

HEADLINER

REMOVAL

CAUTION: The headliner is a one-piece, molded component. It has limited flexibility and must not be bent. Damage may possibly result.

(1) Record radio presets and disconnect negative battery cable.

(2) Remove “A”, “B”, “C”, and “D” pillar trim moldings.

(3) Remove the sun visors. Disconnect vanity lamp wiring.

(4) Remove assist handles from roof rails.

(5) Remove dome lamp and overhead console, if equipped.

(6) Remove rear cargo/dome lamp.

(7) Remove sun roof pinch welt, if equipped.

(8) Disengage rear washer hose from liftgate (Fig. 65).

(9) Disengage the wire harness connectors at rear of headliner.

(10) Disconnect the rear washer hose at the left “A” pillar (Fig. 66).

(11) Disengage the wire harness for the sunroof, if equipped.

(12) Fold down the rear seats, move the front seats full forward, and lower the front seat backs.

(13) Partially lower the headliner and disengage the sunroof drain hoses, if equipped (Fig. 67).

(14) With the aid of an assistant, remove the headliner through the liftgate opening.

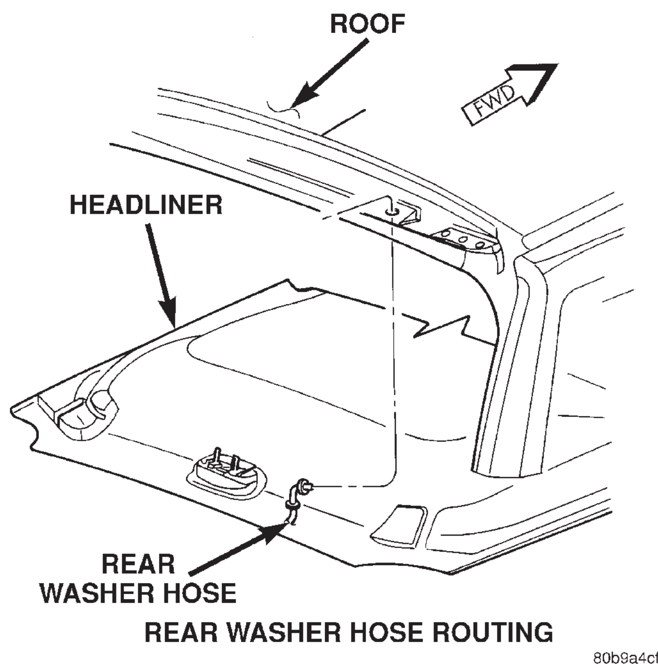


Fig. 65 Liftgate Washer Hose Routing at Rear of Headliner

INSTALLATION

(1) With the aid of an assistant, position the headliner in the vehicle.

(2) Connect the sunroof drain hoses, if equipped.

(3) Connect the sunroof harness, the rear wire harnesses, and the washer hose at the “A” pillar and at the liftgate.

(4) Install the sunroof pinch welt, if equipped.

(5) Install the roof rail assist handles.

(6) Install the sun visors and overhead console.

REMOVAL AND INSTALLATION (Continued)

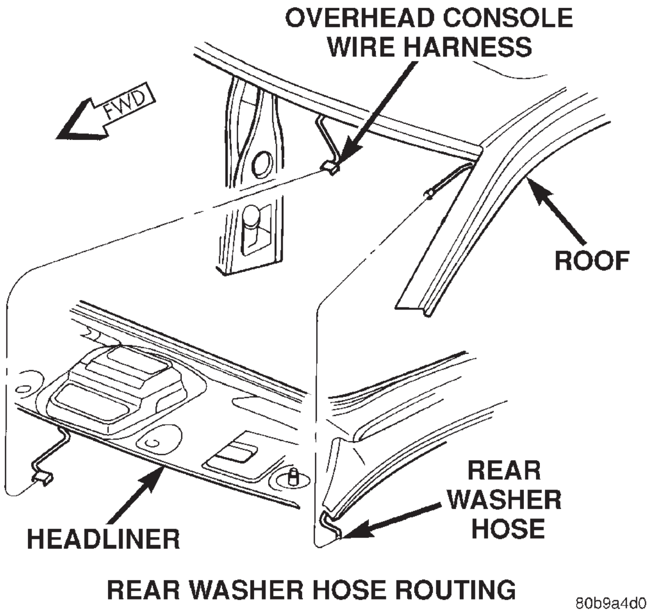


Fig. 66 Rear Liftgate Washer Hose Routing at A Pillar

(7) Install the rear cargo/dome lamp.
(8) Install the “A”, “B”, “C”, and “D” pillar trim.
(9) Connect the negative battery cable.

LIFTGATE TRIM PANEL

NOTE: The liftgate trim panel is attached with screws and spring clips.

REMOVAL

(1) Remove the screws securing the liftgate trim panel to the liftgate (Fig. 68).
(2) Disconnect the rear window defroster wires.
(3) Using a trim stick, or other suitable tool, pry the liftgate trim panel off the liftgate.

INSTALLATION

(1) Align the liftgate trim panel spring clips and press the panel into the liftgate.
(2) Install the trim panel screws.
(3) Connect the rear defroster wires.

LOWER LIFTGATE OPENING TRIM PANEL

REMOVAL

(1) Remove screws at outboard end of lower liftgate trim panel.
(2) Open the spare tire cover and remove the screws near the center of the lower liftgate trim panel (Fig. 69).
(3) Remove the lower liftgate trim panel.

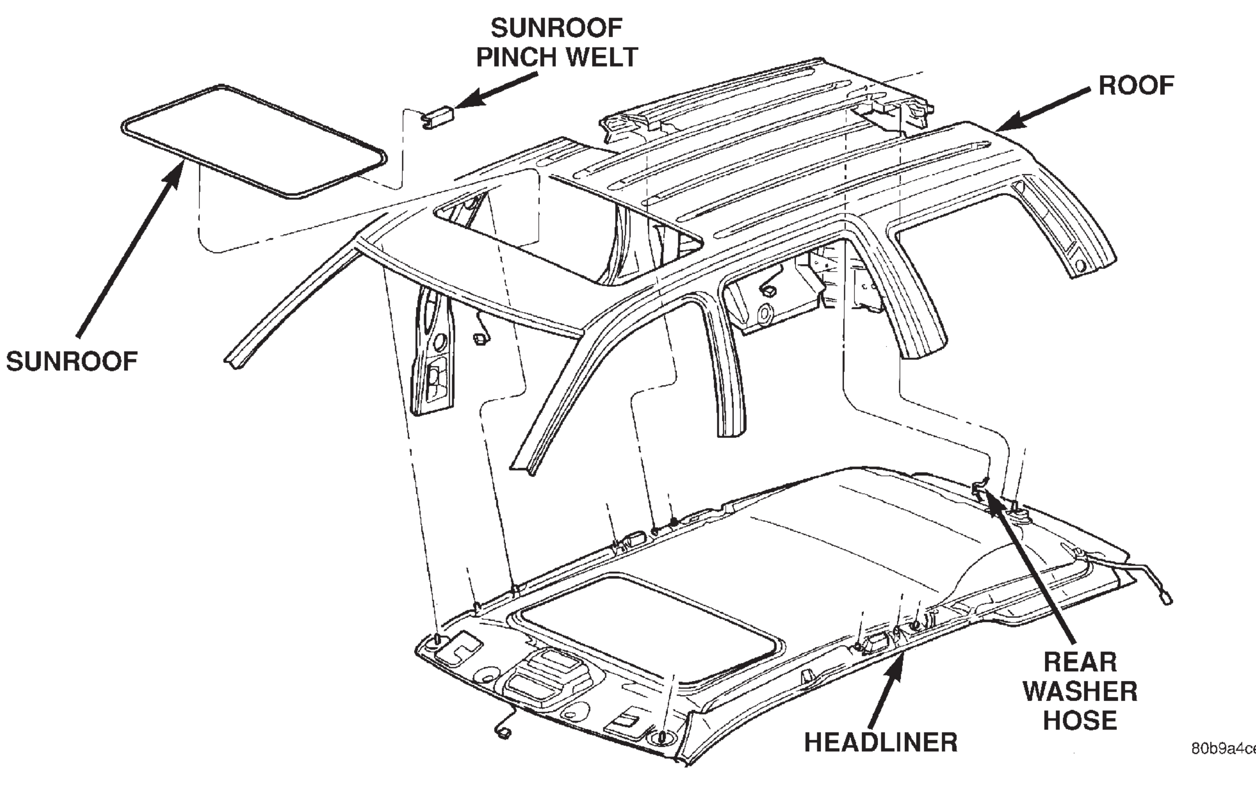


Fig. 67 Headliner

REMOVAL AND INSTALLATION (Continued)

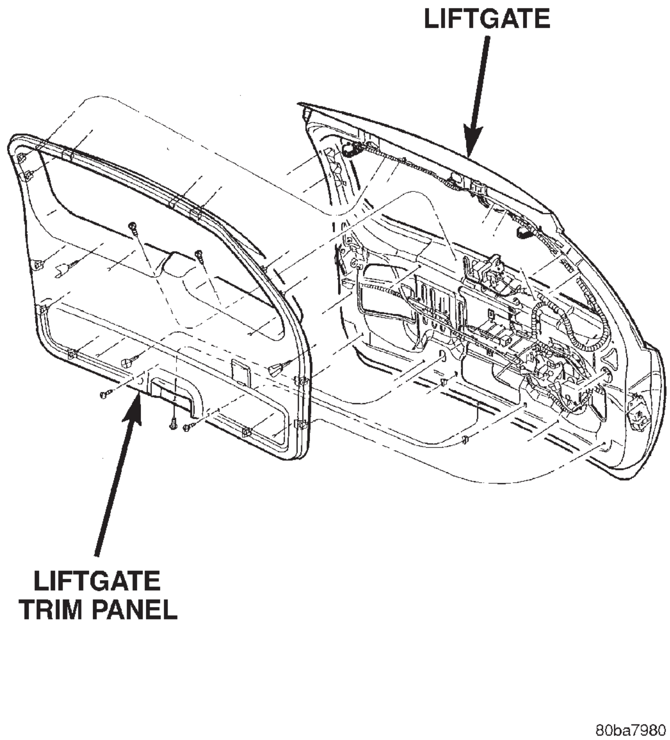


Fig. 68 Liftgate Trim Panel

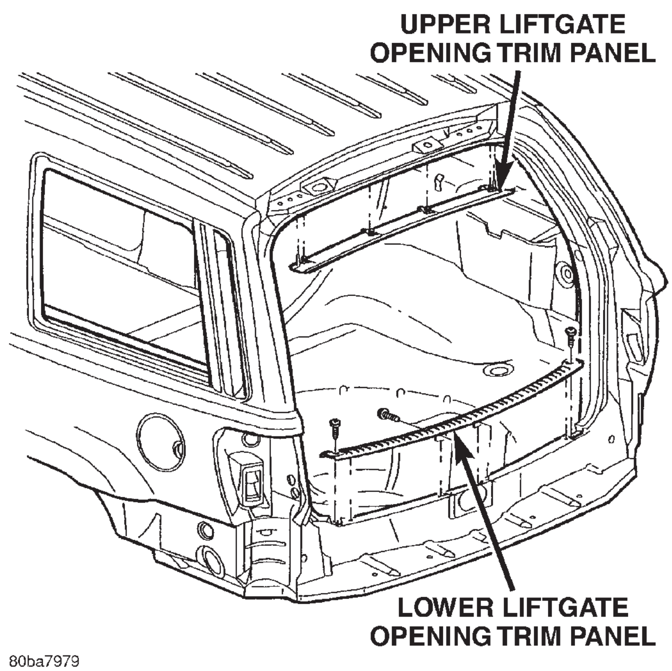


Fig. 69 Liftgate Opening Trim Panel

INSTALLATION

(1) Align the screw holes and locators to the holes in the liftgate opening.

(2) Install the screws in the liftgate opening trim panel.

(3) Install the spare tire cover.

UPPER LIFTGATE OPENING TRIM PANEL

REMOVAL

(1) Grasp the forward edge of the upper liftgate opening trim panel and pull downward to disengage the spring clips.

(2) Pull the upper liftgate opening trim panel rearward to disengage the hooks in the headliner (Fig. 69).

INSTALLATION

(1) Align the upper liftgate opening trim panel with the slots in the headliner and engage the hooks.

(2) Align the spring clips with the holes in the roof panel and press upward to engage the clips.

LIFTGATE INSULATOR

REMOVAL

(1) Remove the liftgate trim panel.

(2) Separate the liftgate insulator from the liftgate and trim panel (Fig. 70).

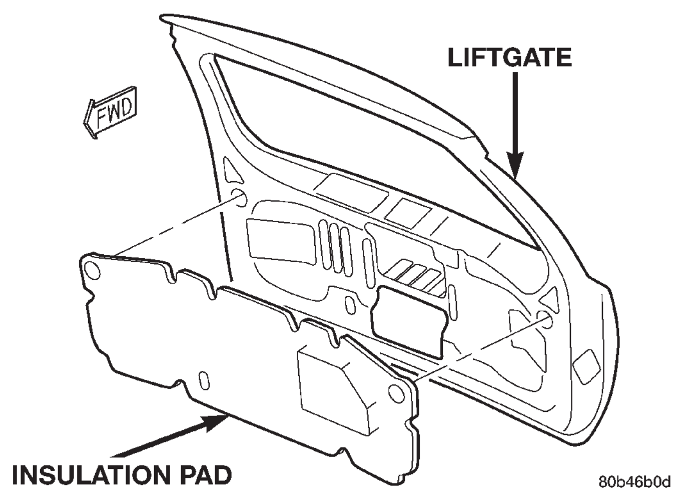


Fig. 70 Liftgate Insulator Pad

INSTALLATION

(1) Thoroughly clean the area of any adhesive or insulation material.

(2) Install the insulator in the liftgate.

(3) Install the liftgate trim panel.

(4) Close the liftgate and check the operation of the liftgate latch and rear wiper/washer, if equipped.

REMOVAL AND INSTALLATION (Continued)

LIFTGATE

REMOVAL

CAUTION: 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 the liftgate. Support the liftgate for ease of repair.
(2) Remove the liftgate trim panel.
(3) Remove the prop rods from the liftgate.
(4) Unplug the wire harnesses and disconnect the washer hose.
(5) Mark the hinge location with a wax pencil or other suitable device (Fig. 71).
(6) Remove the hinge screws and remove liftgate from vehicle.

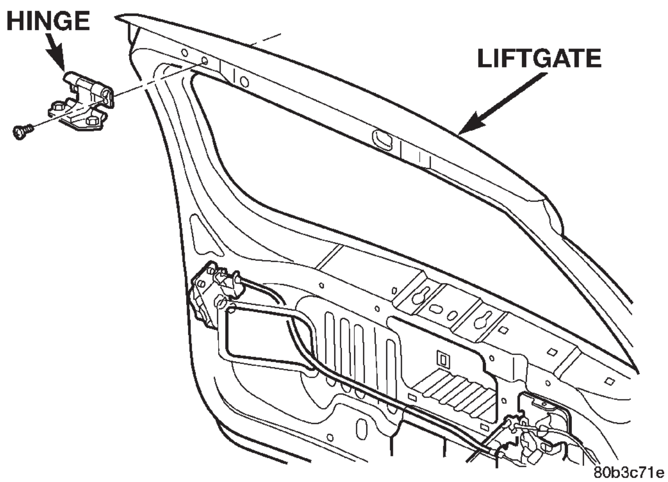


Fig. 71 Liftgate

INSTALLATION

(1) Position the liftgate on the vehicle and align the witness marks.
(2) Install the hinge screws at liftgate. Tighten hinge screws to 28N·m (21ft. lbs.).
(3) Connect the wire harnesses and the washer hose.
(4) Install the trim panel.
(5) Install the prop rods.
(6) Close the liftgate and check for proper latching and alignment.

LIFTGATE HINGE

NOTE: It is not necessary to remove the liftgate to replace one or both hinges. The hinges can be replaced one at a time.

REMOVAL

(1) Open the liftgate. Support the liftgate for ease of repair.
(2) Remove the liftgate header trim panel.
(3) Mark the hinge location with a grease pencil or other suitable device.
(4) Remove the hinge screws (Fig. 71).
(5) Remove hinge.

INSTALLATION

(1) Position the hinge on the roof panel and on the liftgate. (Use 3M™ Fast and Firm or equivalent on the hinge to body mating surfaces as a sealant.
(2) Install and tighten hinge screws at roof panel to 28N·m (21 ft. lbs.).
(3) Install hinge screws at liftgate. Tighten screws to 28N·m (21 ft. lbs.).
(4) Install liftgate header trim panel.
(5) Check the liftgate for proper alignment and operation.

LIFTGATE OUTSIDE HANDLE

REMOVAL

(1) Raise the liftgate.
(2) Remove the liftgate trim panel (Fig. 72).
(3) Remove the latch, outside handle linkage, and power lock connector.
(4) Remove the fasteners attaching the outside handle to the liftgate.
(5) Remove the outside handle from the liftgate.

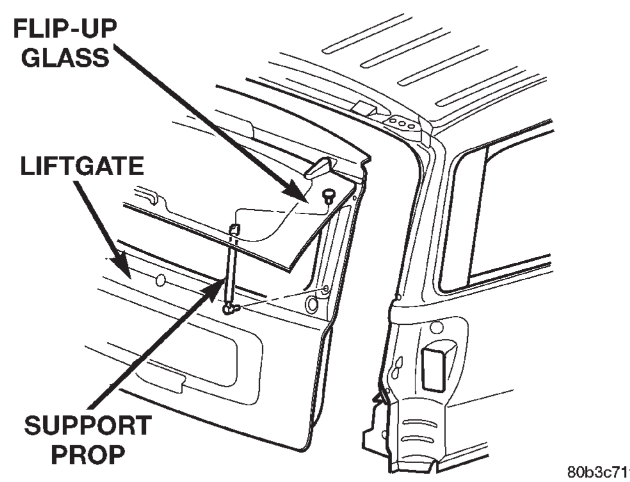


Fig. 72 Liftgate Outside Handle

INSTALLATION

(1) Position the outside handle on the liftgate.
(2) Install the fasteners attaching outside handle to liftgate.
(3) Connect outside handle link and power lock connector.
(4) Install liftgate trim panel.

REMOVAL AND INSTALLATION (Continued)

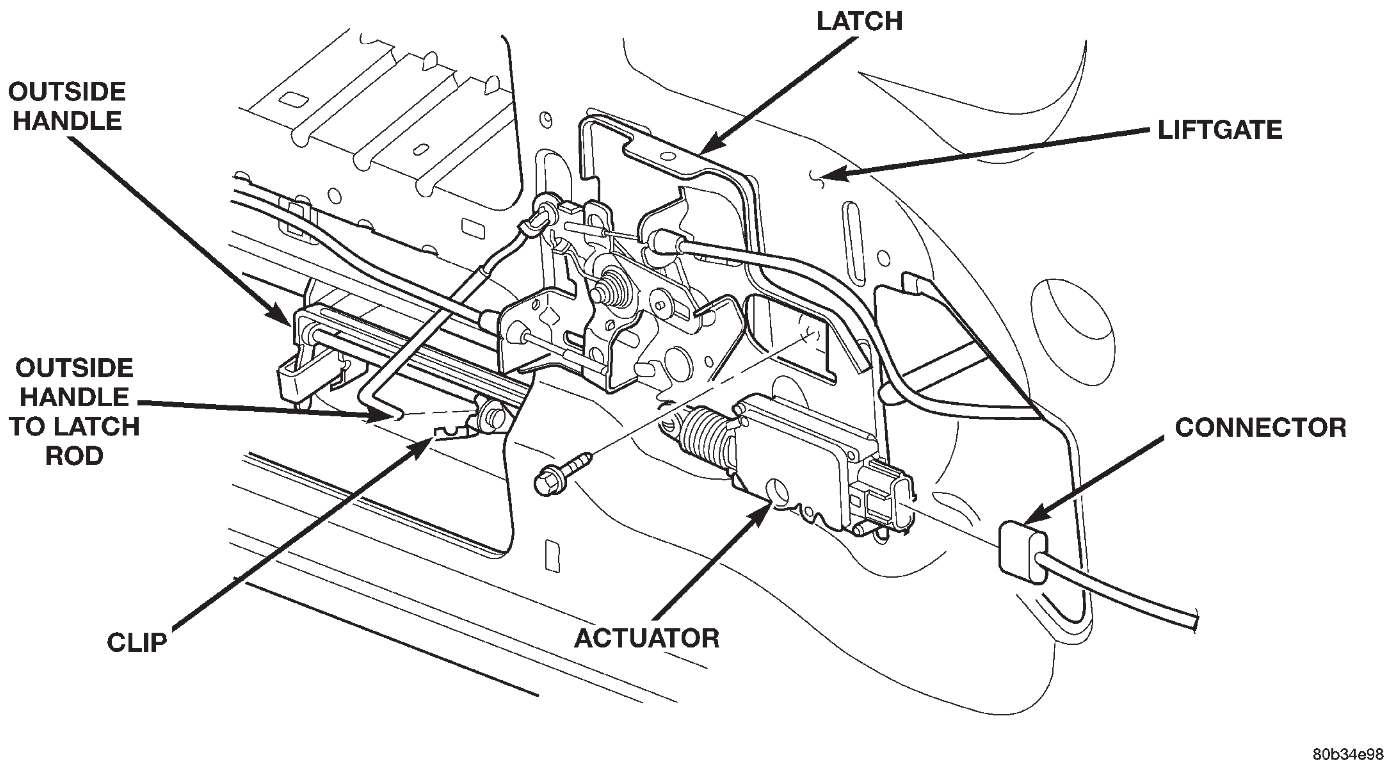


Fig. 73 Liftgate Latch

LIFTGATE LATCH

REMOVAL

(1) Raise the liftgate.
(2) Remove the liftgate trim panel (Fig. 73).
(3) Disconnect the power connector.
(4) Disconnect the outside handle link from the latch.
(5) Remove the latch screws and remove latch.

INSTALLATION

(1) Install the latch into the liftgate and tighten the screws to 7N·m (5 ft. lbs.).
(2) Connect the outside handle to the liftgate latch.
(3) Plug in the connector for the power .
(4) Install the liftgate trim panel.

LIFTGATE LATCH STRIKER

REMOVAL

(1) Raise liftgate.
(2) Remove tail lamp.
(3) Remove nuts attaching striker to D-pillar (Fig. 74).
(4) Separate striker from D-pillar.

INSTALLATION

(1) Position striker on D-pillar.

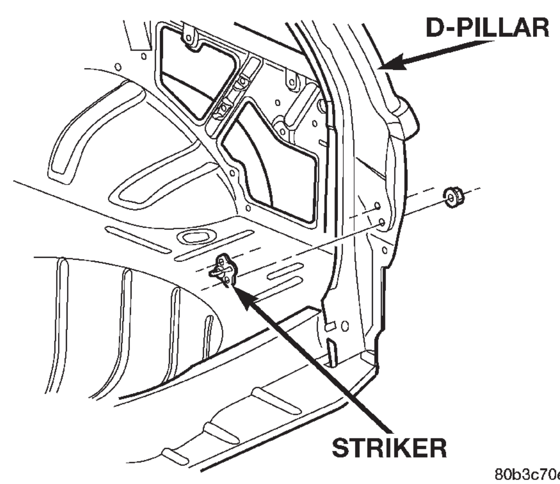


Fig. 74 Liftgate Latch Striker

(2) Install nuts attaching striker to D-pillar. Tighten nuts to 10 N·m (7 ft. lbs.) torque.
(3) Install tail lamp.

LIFTGATE OPENING WEATHERSTRIP

REMOVAL

(1) Pull seal away from flange around edge of liftgate opening.
(2) Separate weatherstrip from opening (Fig. 75).
(3) Clean weatherstrip flange as necessary.

REMOVAL AND INSTALLATION (Continued)

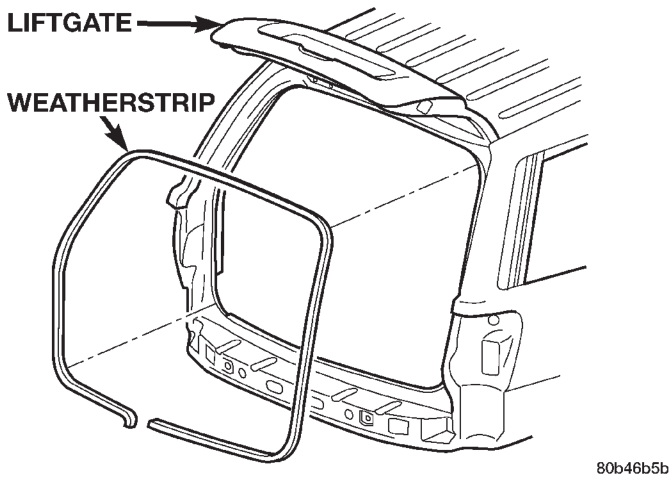


Fig. 75 Liftgate Opening Weatherstrip

INSTALLATION

(1) Position weatherstrip in opening with left end of seal at opening centerline.

(2) Press weatherstrip onto flange in a clockwise direction.

(3) Center and butt weatherstrip ends together at centerline.

(4) If necessary, cut surplus from weatherstrip (non-plug end only).

FLIP UP GLASS

REMOVAL

CAUTION: 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) Using a trim stick or other suitable device, separate the flip up glass hinge cover from the hinge on the liftgate (Fig. 76).

(2) Open liftgate flip up glass. Support the glass for ease of repair.

(3) Using a small flat blade or equivalent tool, gently pry open the locking caps on the end of the prop rods.

(4) Remove prop rod cylinders from ball studs.

(5) Lower the flip up glass.

(6) Remove hinge fasteners from liftgate.

(7) Separate flip up glass from liftgate.

INSTALLATION

(1) Position flip up glass on liftgate.

(2) Install hinge fasteners, hand tight only.

(3) With the glass panel in the fully open position, fully raised position, push the glass forward to com-

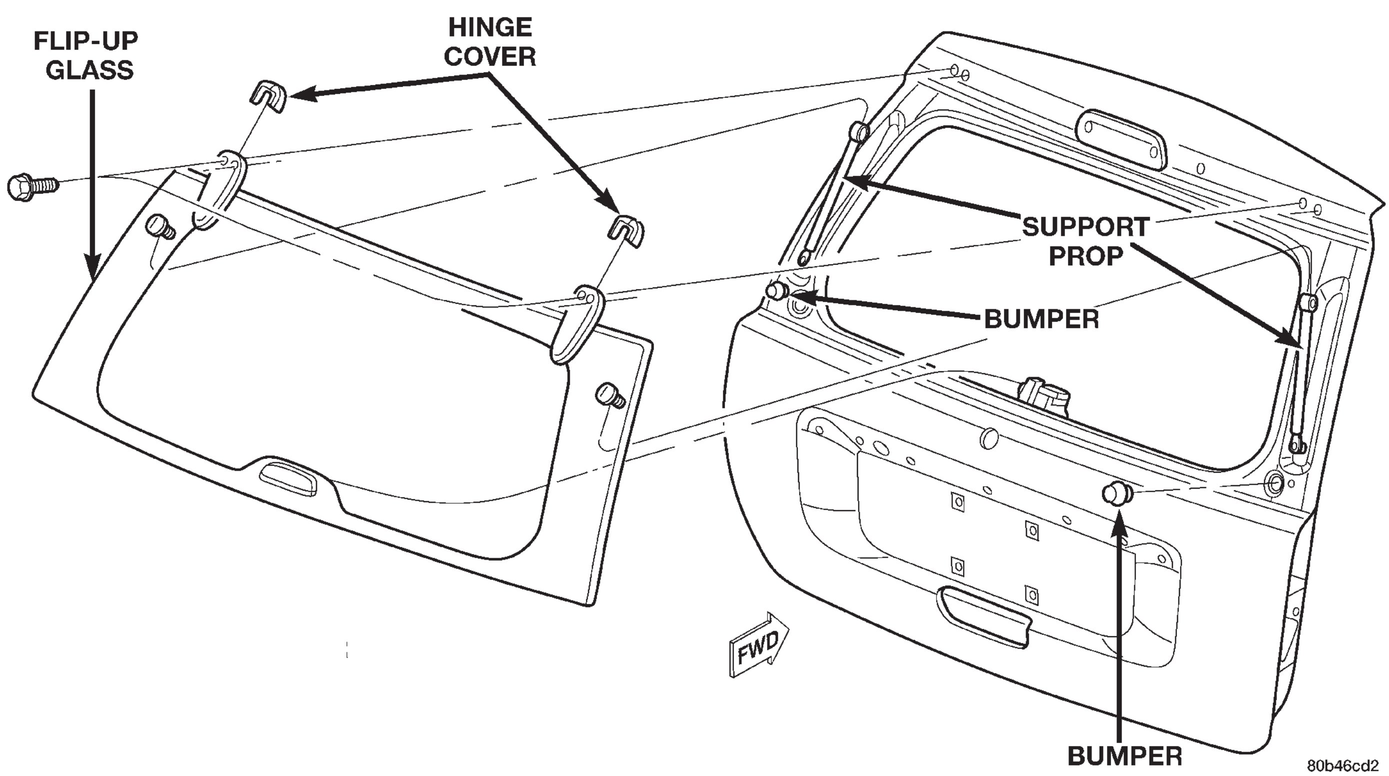


Fig. 76 Flip-Up Glass

REMOVAL AND INSTALLATION (Continued)

pletely seat the hinges. Tighten hinge fasteners to 6N·m (60 in. lbs.).

(4) Install prop rods on ball studs and compress locking caps to lock rods on ball studs.

(5) Lower the flip up glass and install the flip up glass hinge cover.

(6) Check the flip up glass for proper alignment and latching.

FLIP UP GLASS WEATHERSTRIP

REMOVAL

(1) Raise flip up glass.

(2) Carefully pull the seal away from the flange around the edge of the glass opening (Fig. 77).

(3) Remove it from the vehicle.

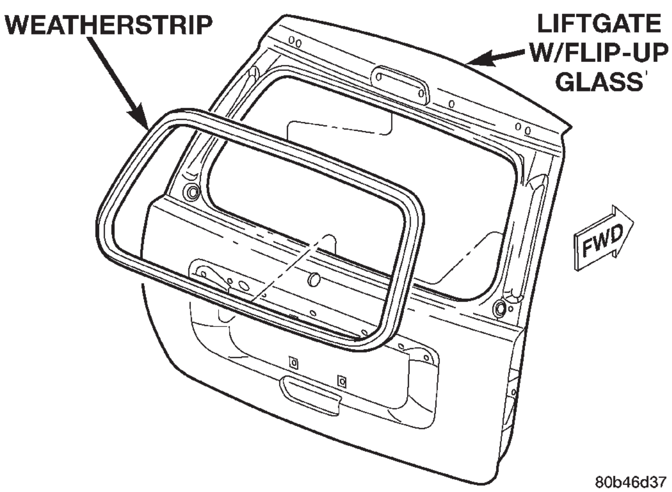


Fig. 77 Flip-up Glass Weatherstrip

INSTALLATION

(1) Thoroughly clean the surface of the flange as necessary.

(2) Align the weather strip seal with the window opening corners.

(3) Firmly seat the seal around the entire flange. But the seal ends together and smooth out any remaining length.

(4) Weatherstrip break should be 120mm left of latch opening. Cut any surplus from non-plug end only.

FLIP UP GLASS SWITCH

REMOVAL

(1) Remove license plate lamp housing/trim panel from liftgate.

(2) Squeeze the locking tabs inward to release the switch from the housing.

(3) Disconnect the switch harness connector, remove the switch from the housing.

INSTALLATION

(1) Install switch harness connector.

(2) Position switch in housing, snap switch into place.

(3) Install license plate lamp housing/trim panel onto liftgate.

FLIP UP GLASS LATCH

REMOVAL

(1) Open liftgate flip up glass.

(2) Open liftgate and remove trim panel (Fig. 78).

(3) Remove latch.

(4) Disconnect switch connectors.

(5) Remove latch from liftgate.

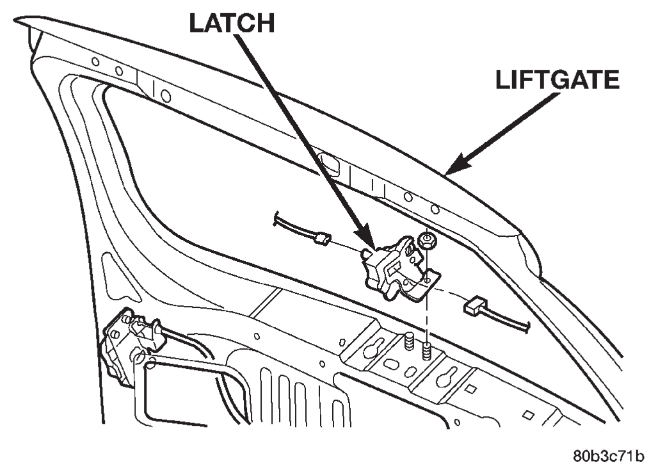


Fig. 78 Flip-up Glass Latch

INSTALLATION

(1) Position the latch on the liftgate.

(2) Connect switch connectors.

(3) Adjust latch to the proper position, and tighten the fasteners 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 LATCH STRIKER

REMOVAL

(1) Raise flip up glass panel.

(2) Mark the position of the handle/striker on the glass panel.

(3) Remove the screws attaching the handle/striker to the glass.

INSTALLATION

(1) Position the handle/striker on the glass panel and align the reference marks.

REMOVAL AND INSTALLATION (Continued)

(2) Install the screws attaching the handle/striker to the glass panel. Tighten the fasteners to 6 N·m (60 in. lbs.).

LICENSE PLATE LAMP HOUSING

REMOVAL

(1) Remove the screws retaining the lamp housing/trim panel to the liftgate (Fig. 79).

(2) Disconnect the wire harness for the license plate lamps and the flip up glass switch, if equipped.

(3) Remove the license plate lamps and the flip up glass switch, if equipped.

(4) Remove the license plate lamp housing.

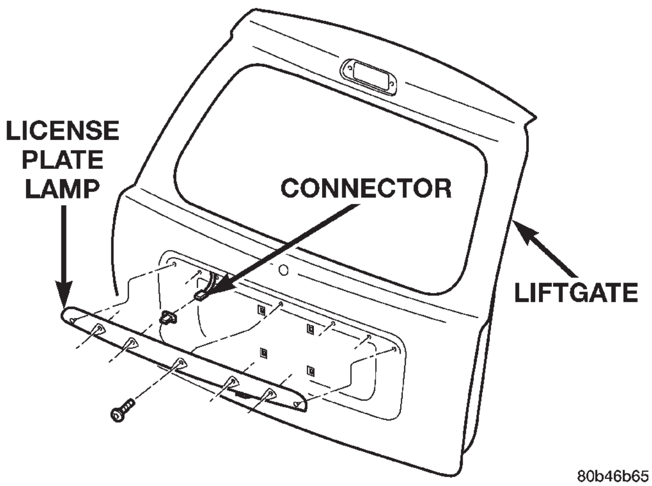


Fig. 79 License Plate Lamp Housing

INSTALLATION

(1) Install the license plate lamps, and the flip up glass switch, if equipped.

(2) Connect the wire harnesses for the license plate lamps and the flip up glass switch.

(3) Install the lamp housing/trim panel on the lift-gate.

D-PILLAR APPLIQUE

REMOVAL

(1) Using a trim stick, carefully pry applique from panel (Fig. 80).

INSTALLATION

(1) Position applique on panel with retainers aligned.

(2) Press applique firmly in place.

D-PILLAR AIR EXHAUSTER

REMOVAL

(1) Remove D-pillar applique.

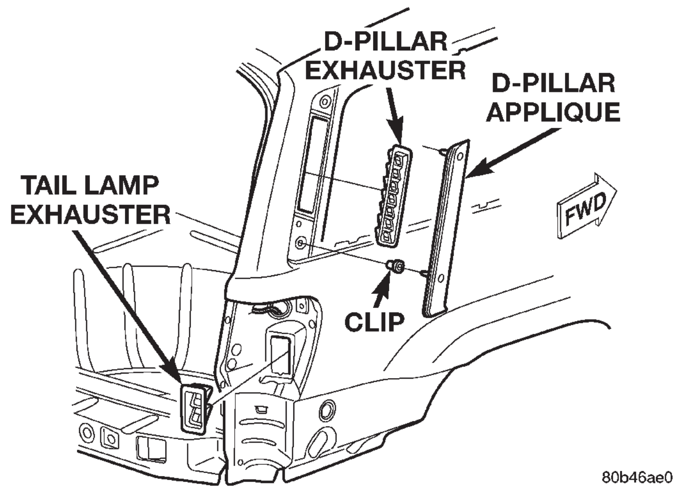


Fig. 80 D-Pillar Applique & Air Exhauster

(2) Carefully pry air exhauster from D-pillar using a flat blade screwdriver (Fig. 80).

INSTALLATION

(1) Reseal air exhauster using foam tape.

(2) Install air exhauster on D-pillar.

(3) Install D-pillar applique.

TAIL LAMP AIR EXHAUSTER

REMOVAL

(1) Remove tail lamp.

(2) Using a trim stick, pry the top of the air exhauster downward to detach the retaining clips.

(3) Separate air exhauster from vehicle (Fig. 80).

INSTALLATION

(1) Position air exhauster in opening.

(2) Press air exhauster inward to secure.

(3) Install tail lamp.

LUGGAGE RACK

REMOVAL

NOTE: The skid strips are attached to the roof panel with adhesive.

(1) Using a trim stick, or other suitable device, pry support cover off.

(2) If necessary, slide the crossbars to expose the screws attaching the slide rails to the supports.

(3) Remove the screws retaining the slide rails to the supports.

(4) Remove the screws attaching the supports to the roof panel.

(5) Separate the supports from the roof panel.

REMOVAL AND INSTALLATION (Continued)

NOTE: If a crossbar needs to be serviced, the forward or rearward supports will have to be removed.

INSTALLATION

(1) Position the supports on the roof panel and install the screw. Be sure that the gasket is properly seated.

(2) Position the luggage rack on the supports.

(3) Install the screws attaching the side rails to the supports.

(4) Position the supports covers on the supports and press into place.

ADJUSTMENTS

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 in or out to adjust hood-to-fender height alignment.

(3) Adjust the hood latch as necessary. Tighten the nuts to 11N·m (8 ft. lbs.).

(4) Align the latch striker so that striker enters the latch squarely and without binding.

DOOR ADJUSTMENT

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 the alignment. If correct, tighten striker to 28 N·m (21 ft. lbs.) .

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 the alignment. If correct, tighten to 28 N·m (21 ft. lbs.).

DOOR LATCH

DOOR LATCH ADJUSTMENT

(1) Locate access hole (Fig. 81).

(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.

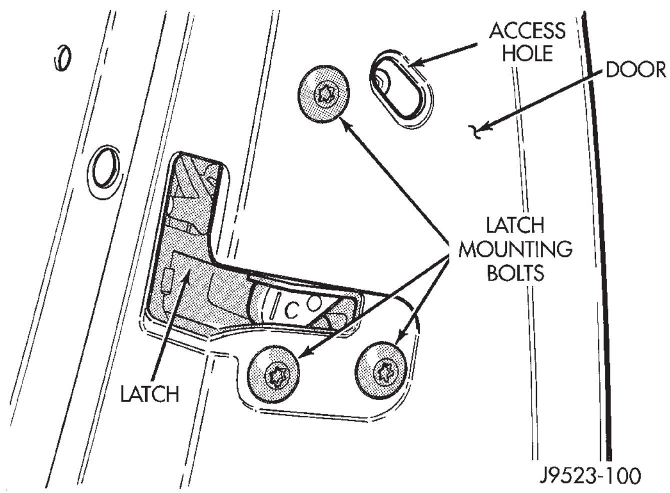


Fig. 81 Door Latch Adjustment

LIFTGATE ADJUSTMENT

The position of the liftgate can be adjusted upward or downward by the 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.

SPECIFICATIONS

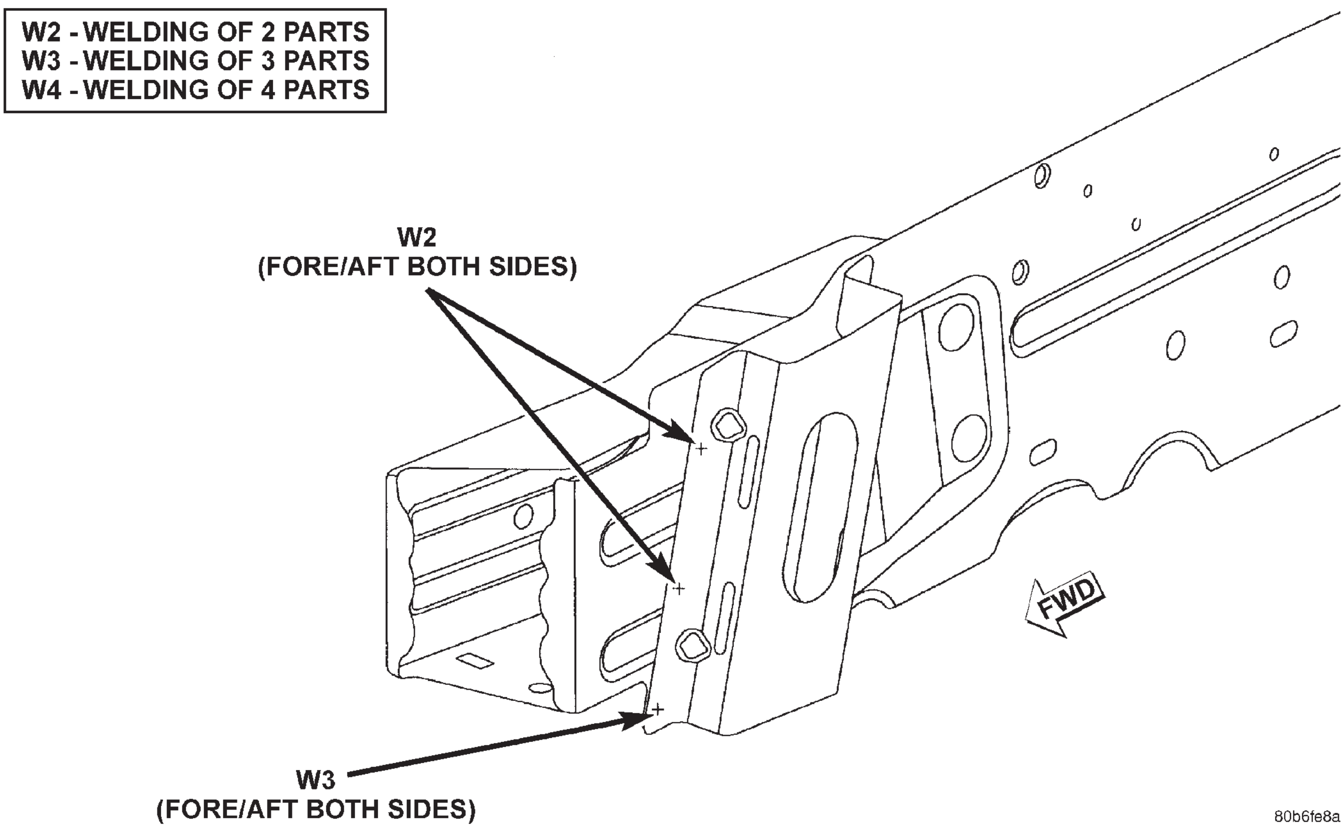
BODY LUBRICANTS

COMPONENT	SERVICE INTERVAL	LUBRICANT
Door Hinges	As Required	Multi-Purpose Grease NLGI GC-LB (Water Resistant) (1)
Door Latches	As Required	Multi-Purpose Grease NLGI GC-LB (Water Resistant) (1)
Hood Latch, Release Mechanism and Safety Latch	As Required (When Performing Other Underhood Service)	Multi-Purpose Grease NLGI GC-LB 2 EP (2)
Hood Hinges	As Required	Engine Oil
Seat Track and Release Mechanism	As Required	Multi-Purpose Grease NLGI GC-LB 2 EP (2)
Liftgate Hinge	As Required	Multi-Purpose Grease NLGI GC-LB 2 EP (2)
Liftgate Support Arms	As Required	Engine Oil
Liftgate Latches	As Required	White Spray Lubricant (3)
Liftgate Release Handle (Pivot and Slide Contact Surfaces)	As Required	Multi-Purpose Grease NLGI GC-LB 2 EP (2)
Window System Components	As Required	White Spray Lubricant (3)
Lock Cylinders	Twice a Year	Lock-Cylinder Lubricant (4)
Parking Brake Mechanism	As Required	Multi-Purpose Grease NLGI GC-LB 2 EP (1)
1 = Mopar Wheel Bearing Grease (High Temp) 2 = Mopar Multi-Mileage Lubricant 3 = Mopar Spray White Lube 4 = Mopar Lock Cylinder Lubricant		

SPECIFICATIONS (Continued)

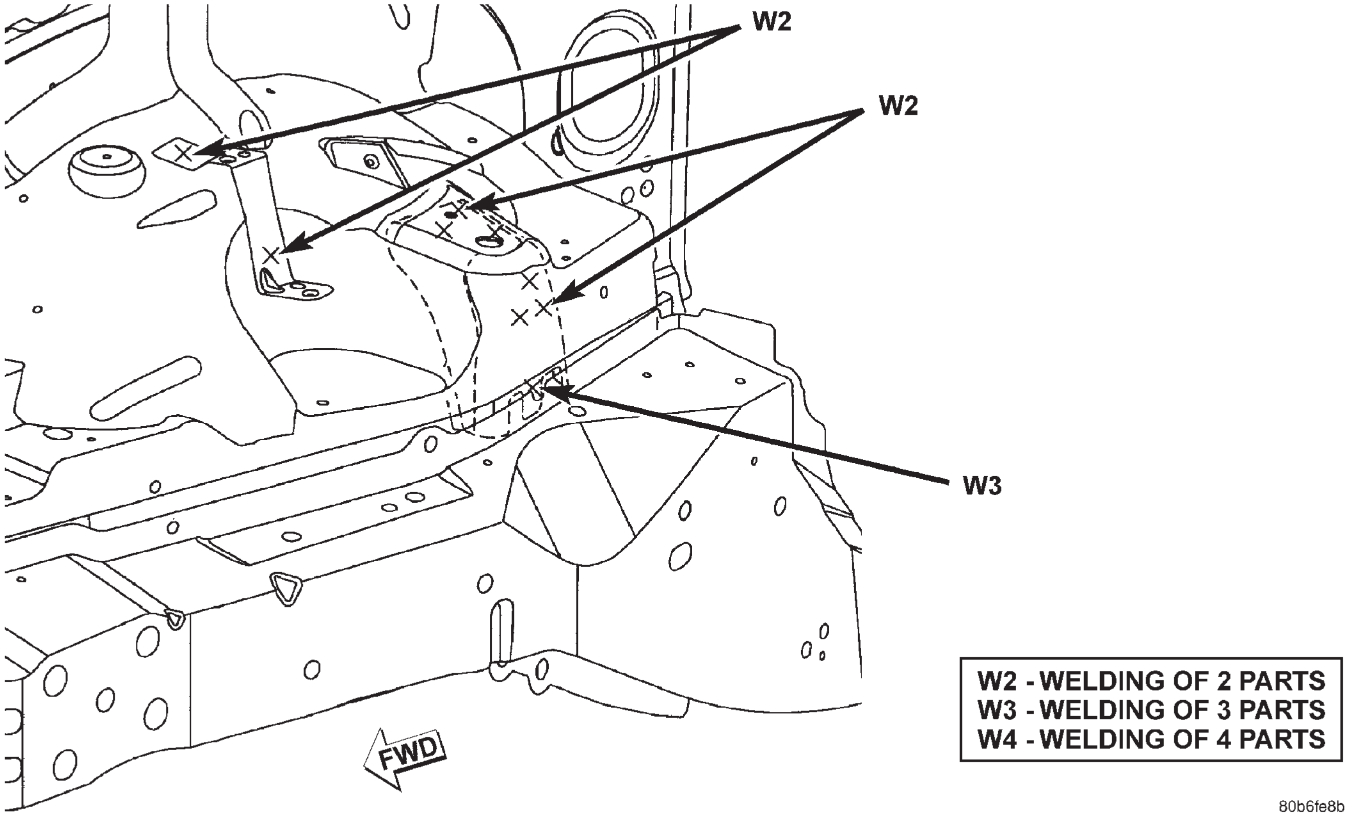
WELD LOCATIONS

RADIATOR SUPPORT BRACKETS



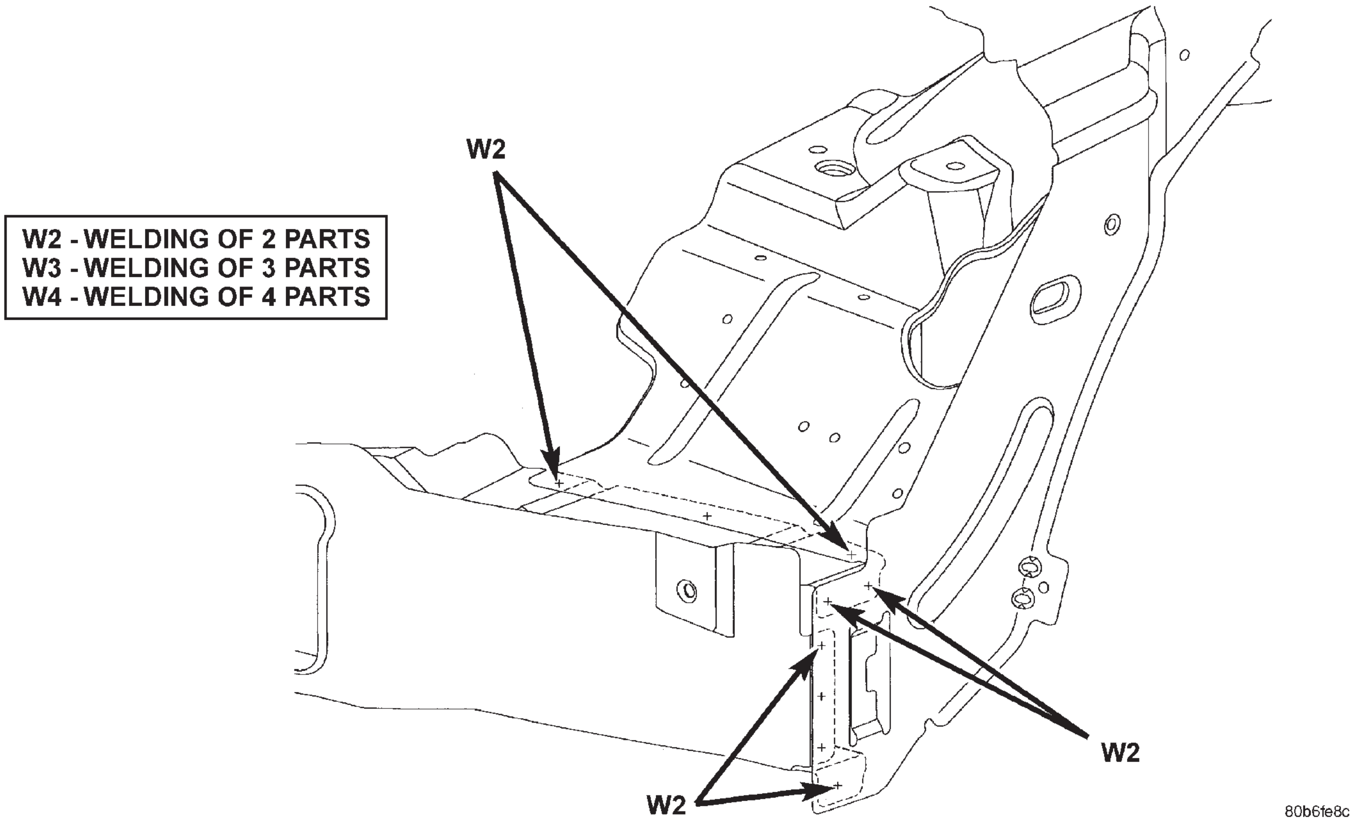
SPECIFICATIONS (Continued)

FRONT SUSPENSION SUPPORT REINFORCEMENT



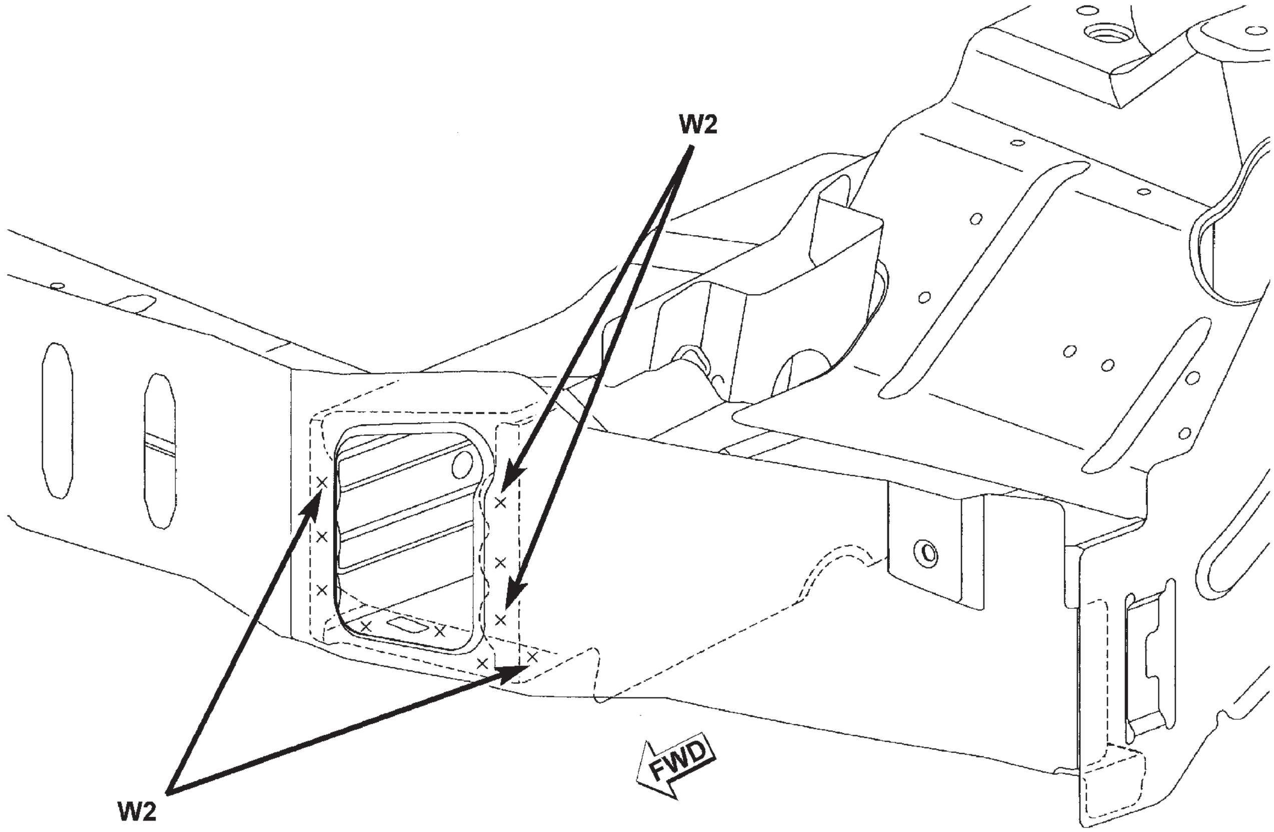
SPECIFICATIONS (Continued)

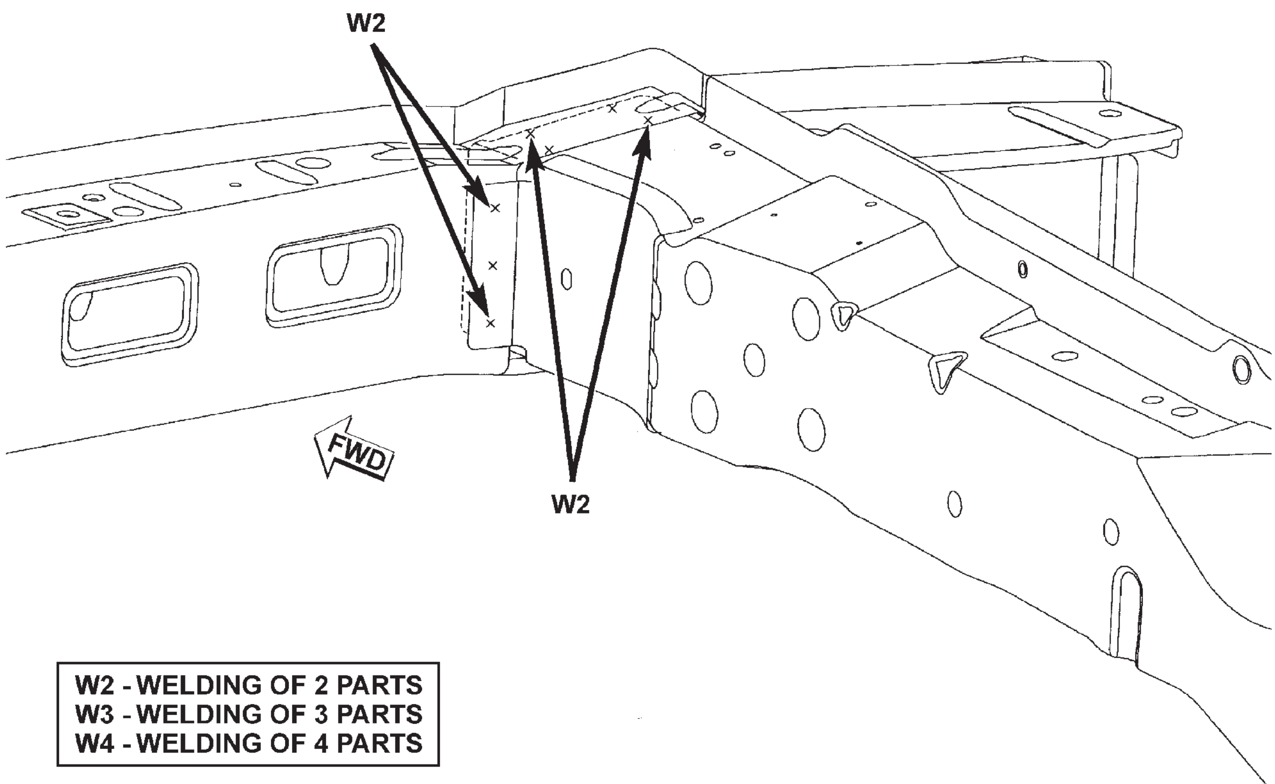
FRONT LOWER CROSSMEMBER TO COWL SIDE PANEL



SPECIFICATIONS (Continued)

FRONT SILL TO LOWER CROSSMEMBER





W2 - WELDING OF 2 PARTS
W3 - WELDING OF 3 PARTS
W4 - WELDING OF 4 PARTS

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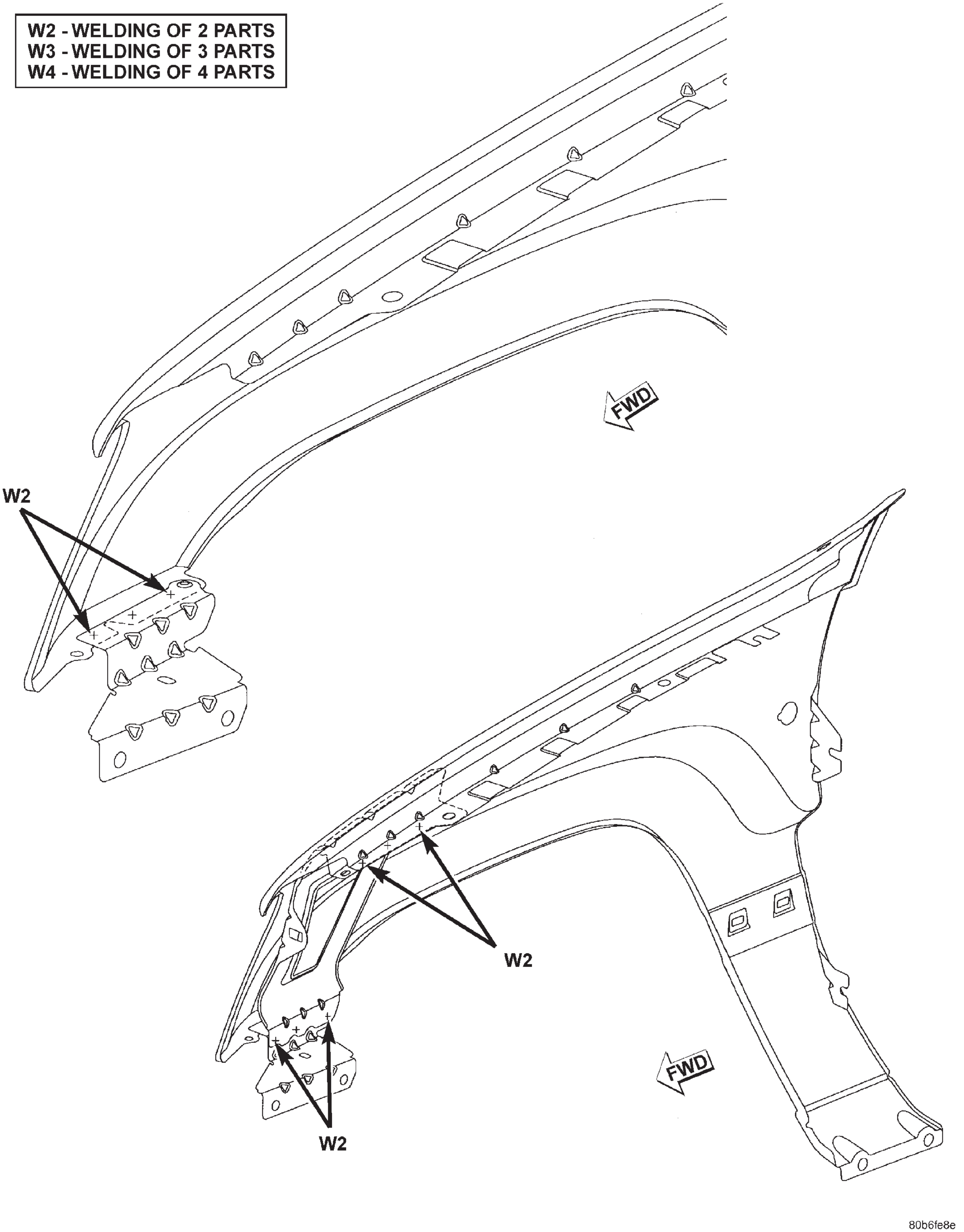
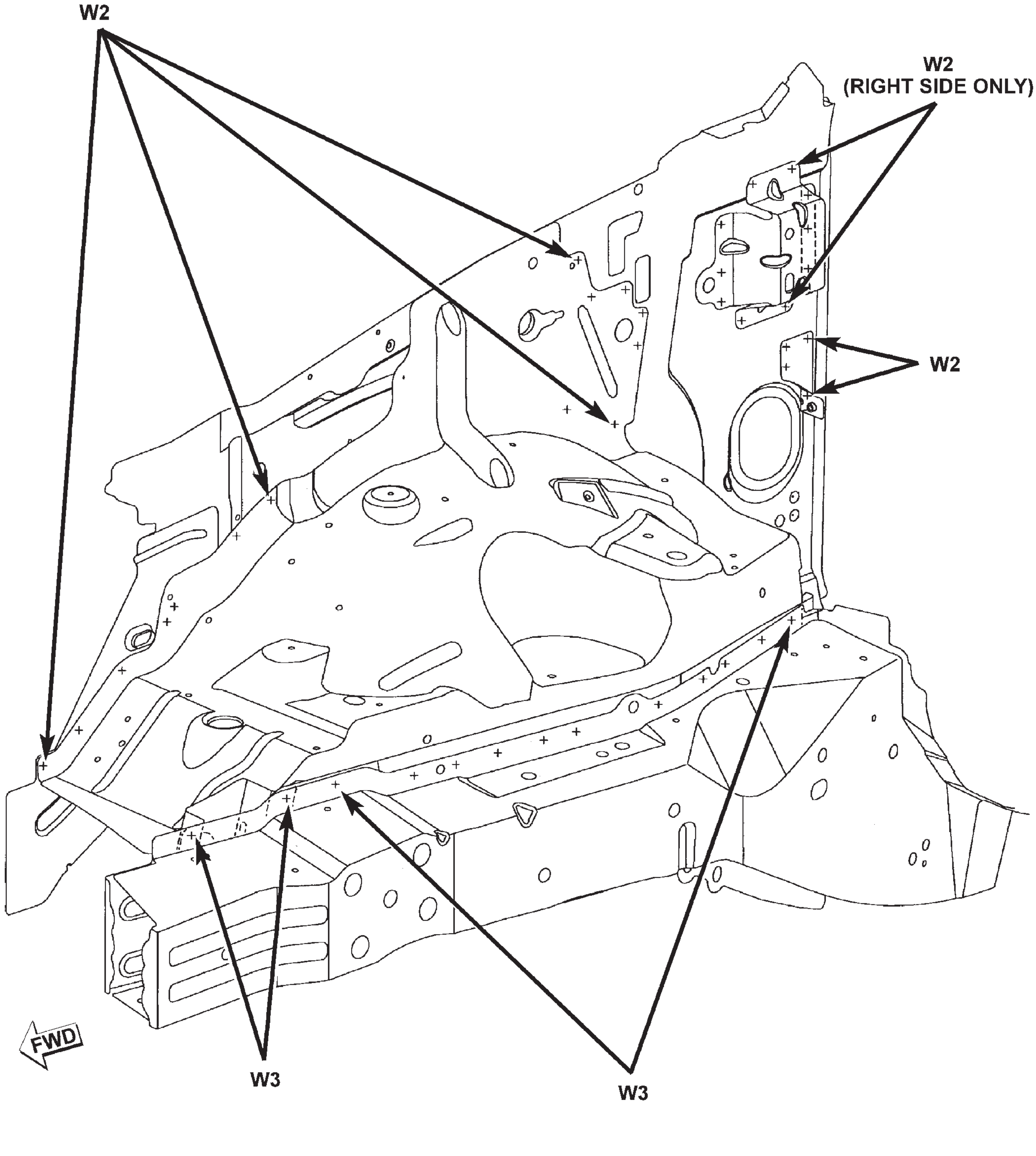
SPECIFICATIONS (Continued)

FRONT FENDER MOUNTING BRACKET AND REINFORCEMENT



SPECIFICATIONS (Continued)

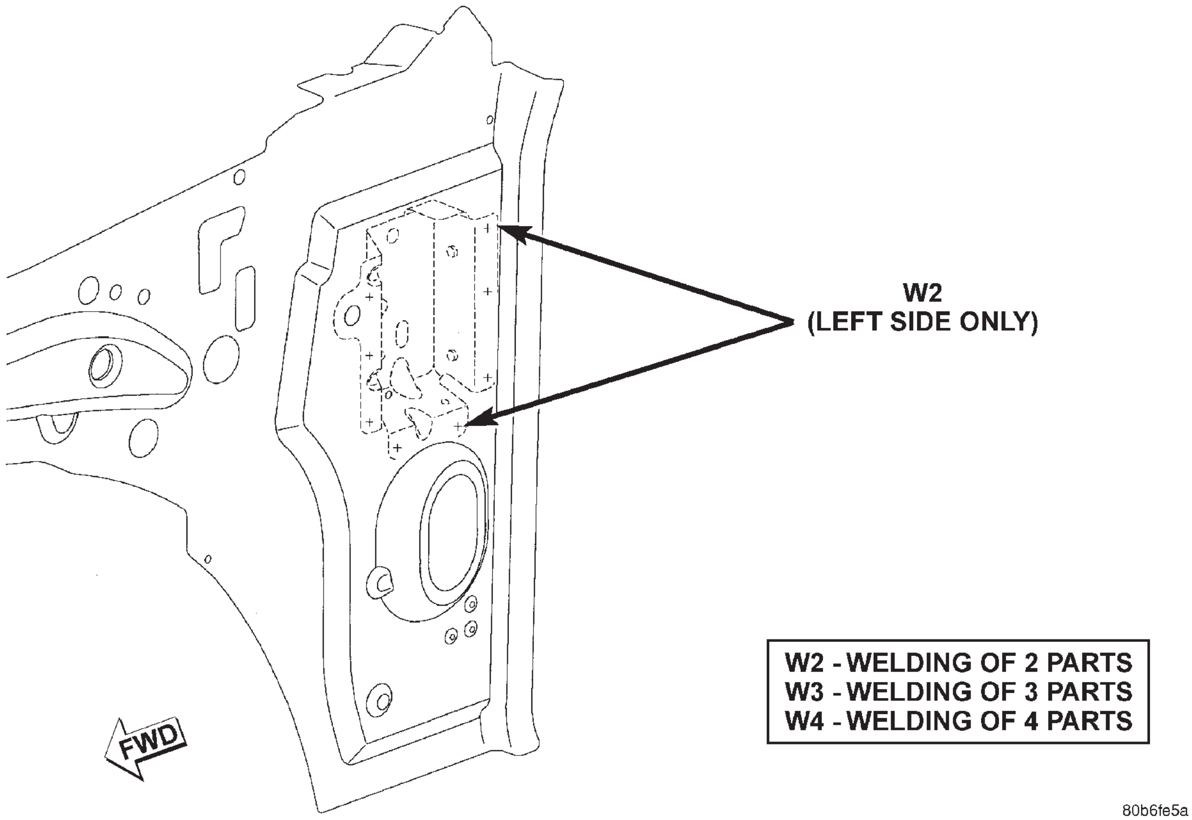
FRONT SUSPENSION SUPPORT TO SILLS AND COWL SIDE PANEL



W2 - WELDING OF 2 PARTS
W3 - WELDING OF 3 PARTS
W4 - WELDING OF 4 PARTS

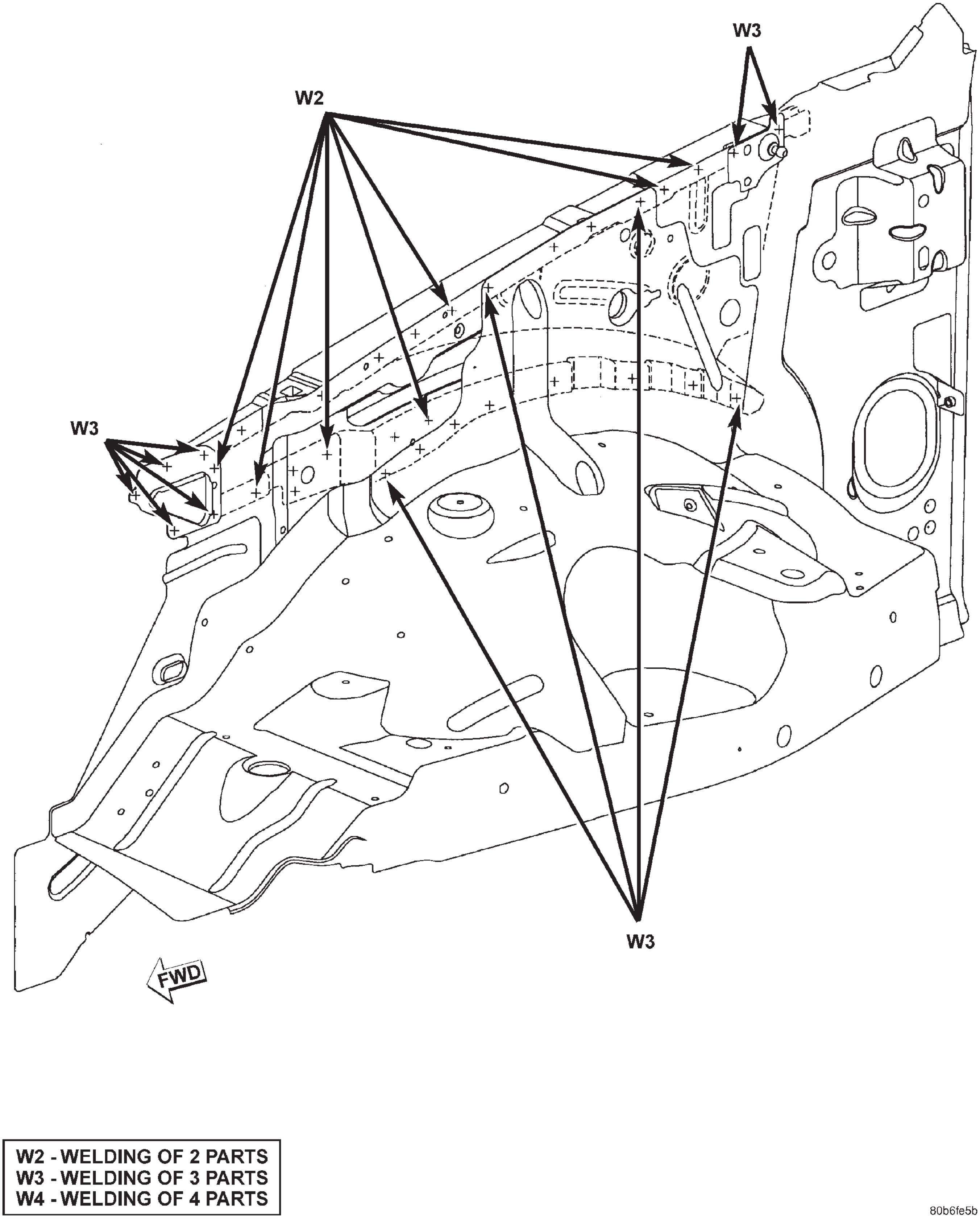
SPECIFICATIONS (Continued)

LEFT INSTRUMENT PANEL BRACKET TO COWL SIDE PANEL



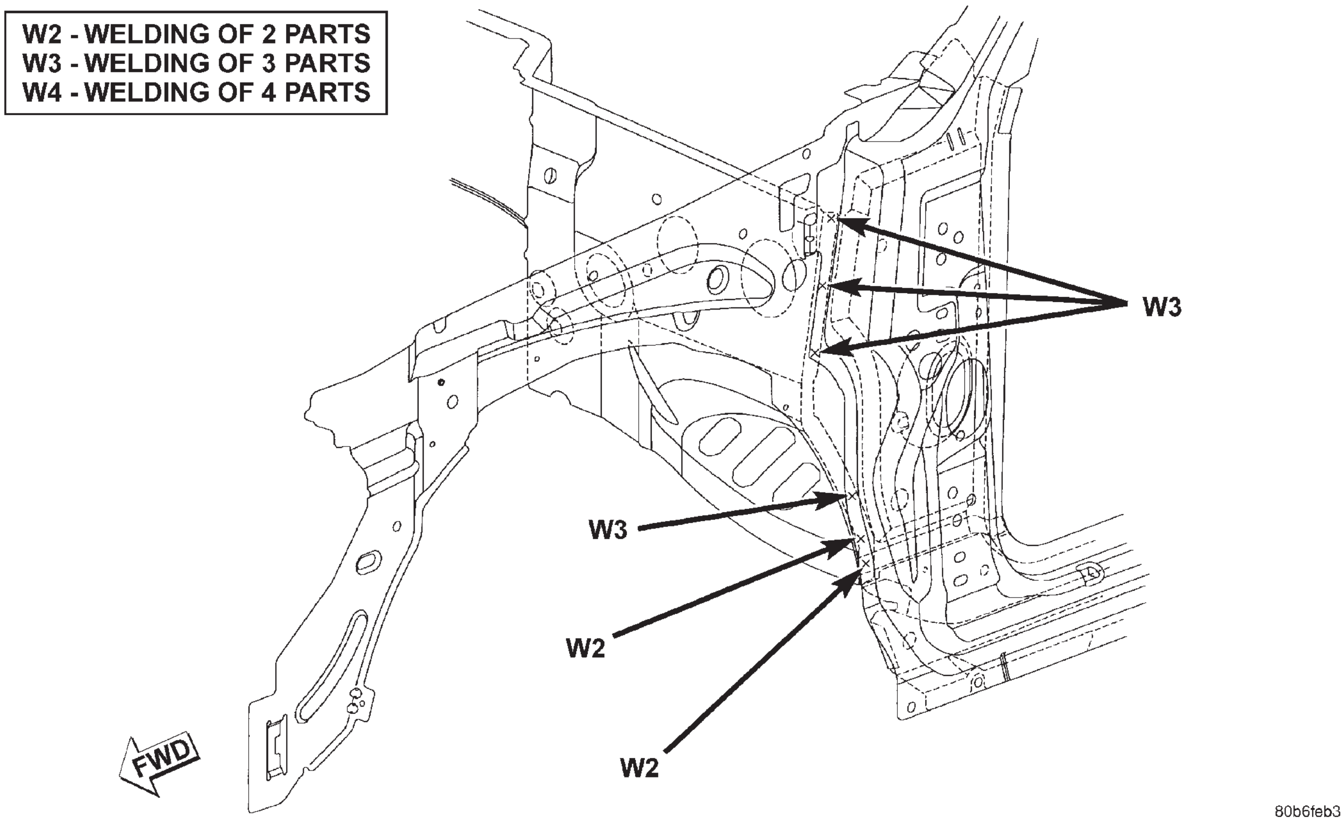
SPECIFICATIONS (Continued)

COWL SIDE UPPER REINFORCEMENT TO COWL SIDE AND FRONT SUSPENSION SUPPORT



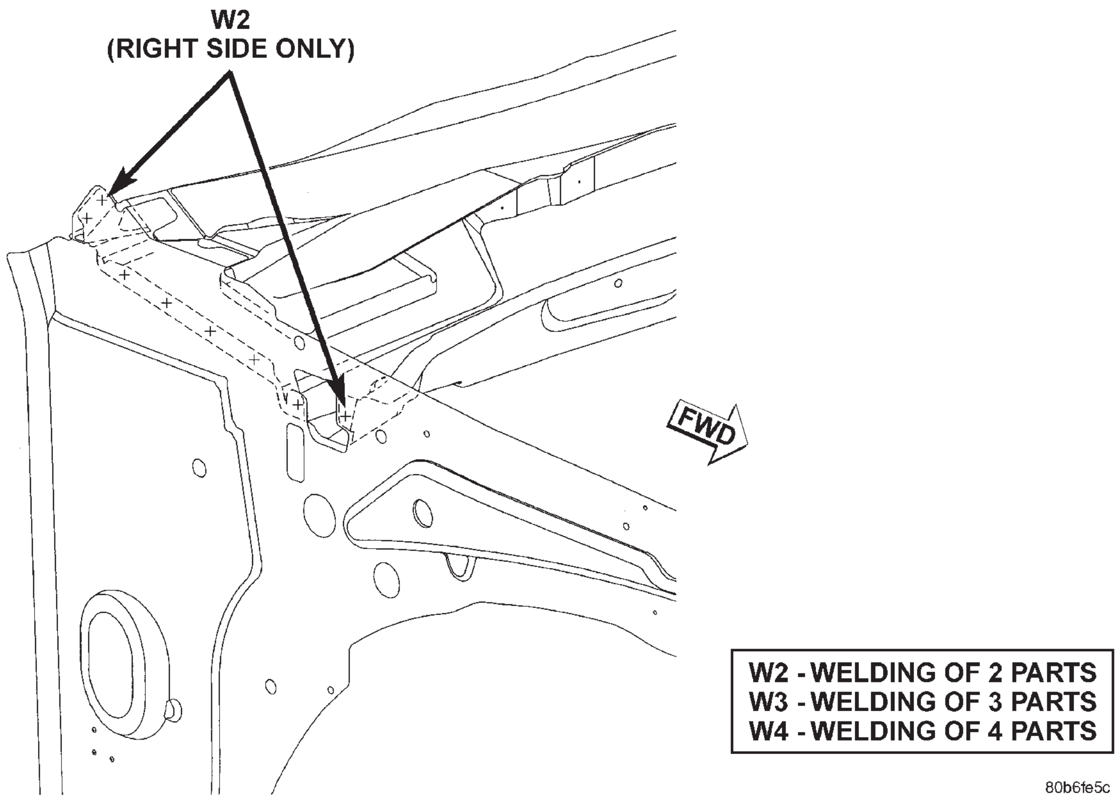
SPECIFICATIONS (Continued)

COWL SIDE PANEL TO DASH PANEL AND INNER BODYSIDE PANEL AND SILL



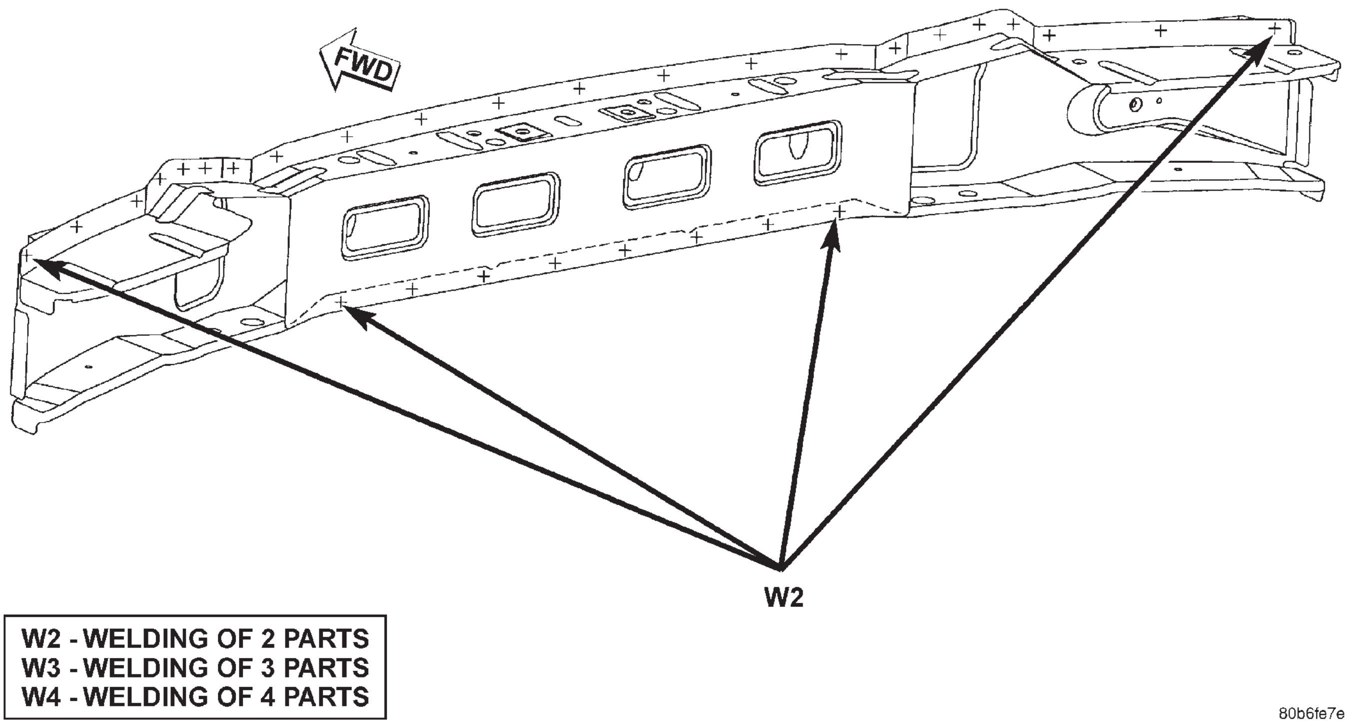
SPECIFICATIONS (Continued)

PLENUM ASSEMBLY TO COWL SIDE PANEL



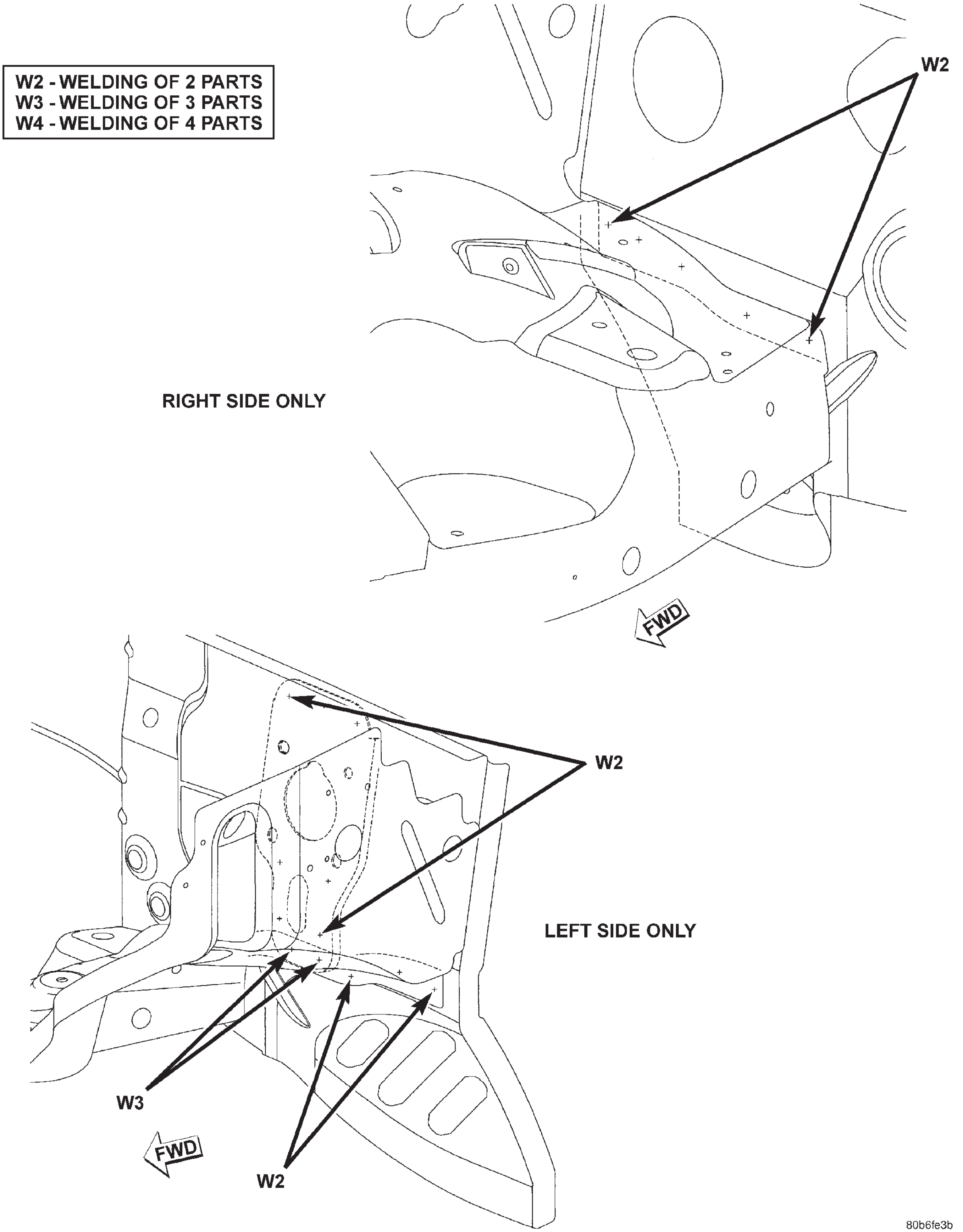
SPECIFICATIONS (Continued)

FRONT LOWER CROSSMEMBER



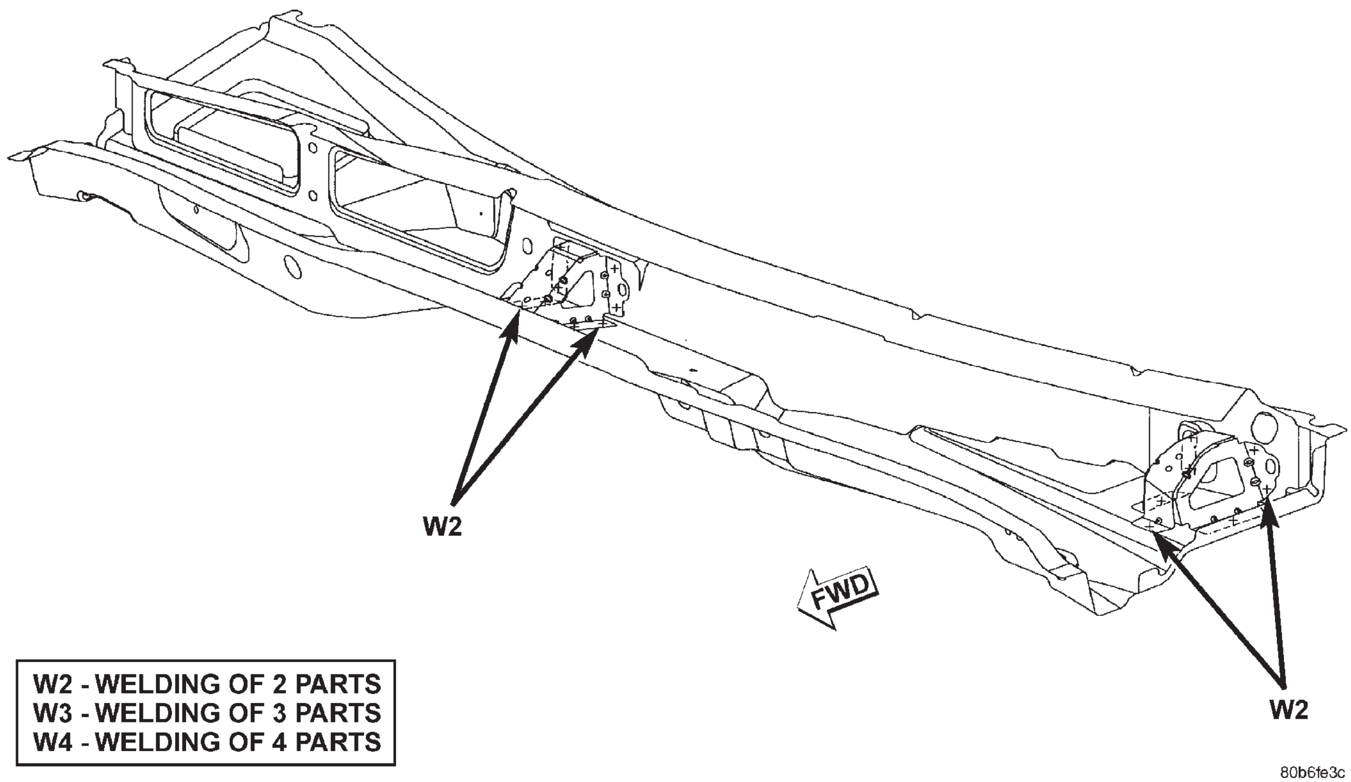
SPECIFICATIONS (Continued)

FRONT SUSPENSION SUPPORT TO DASH



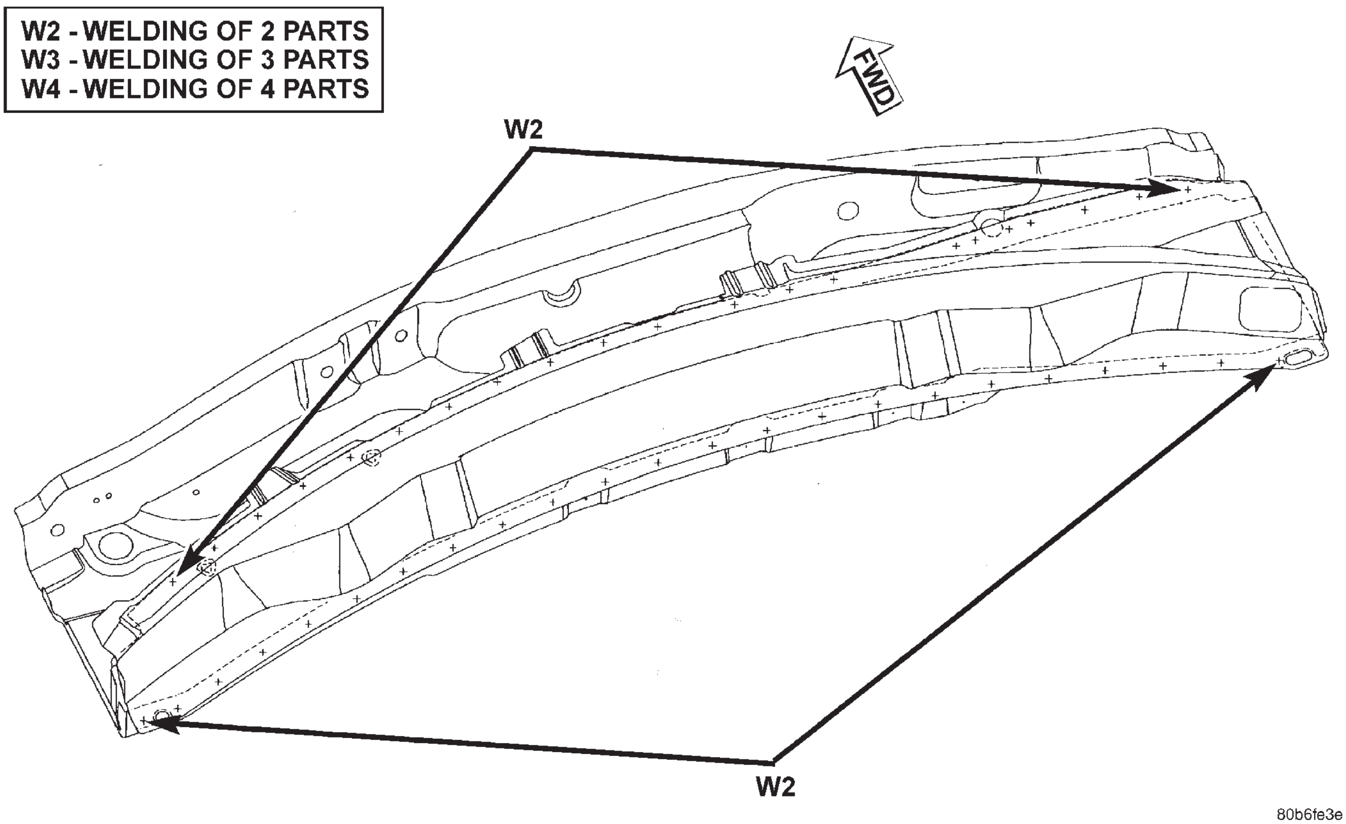
SPECIFICATIONS (Continued)

WIPER MOUNTING BRACKETS TO PLENUM ASSEMBLY



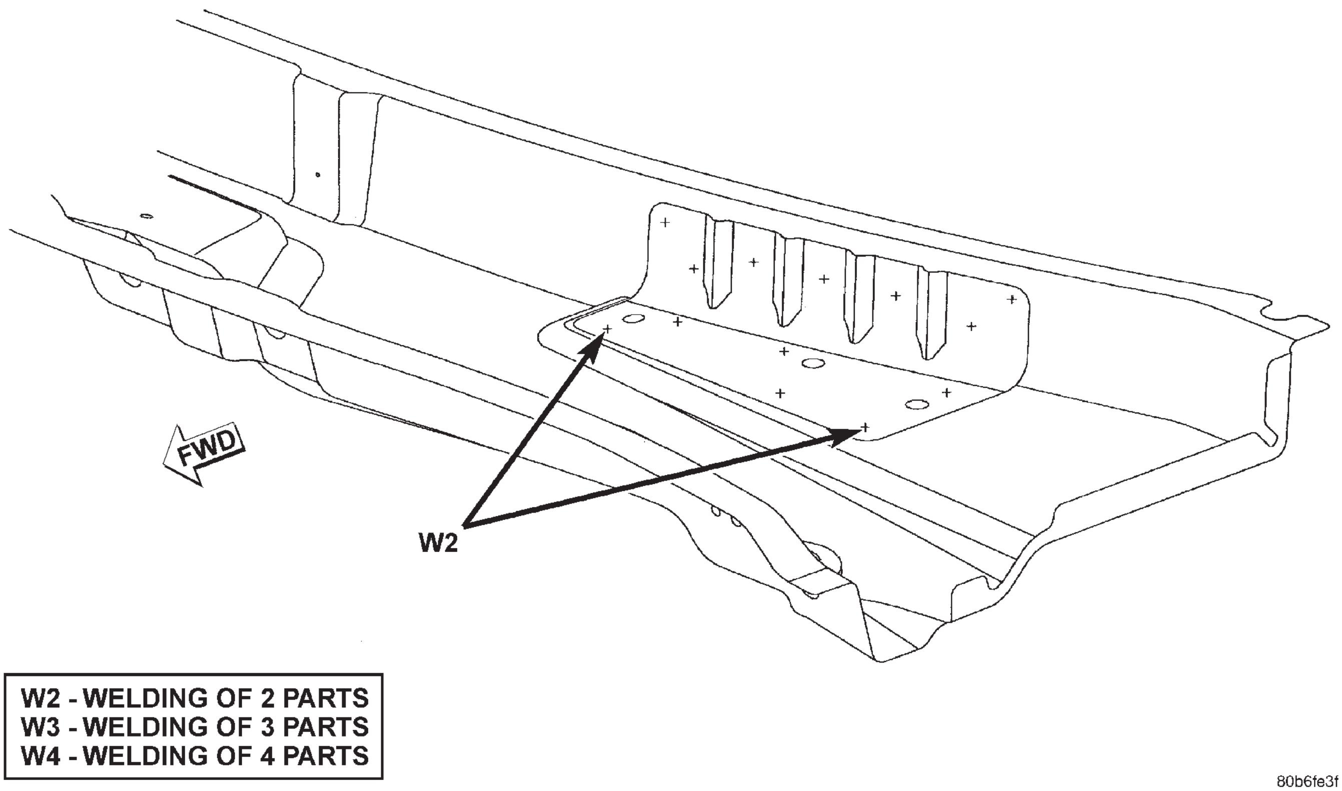
SPECIFICATIONS (Continued)

COWL TOP AND PLENUM ASSEMBLY



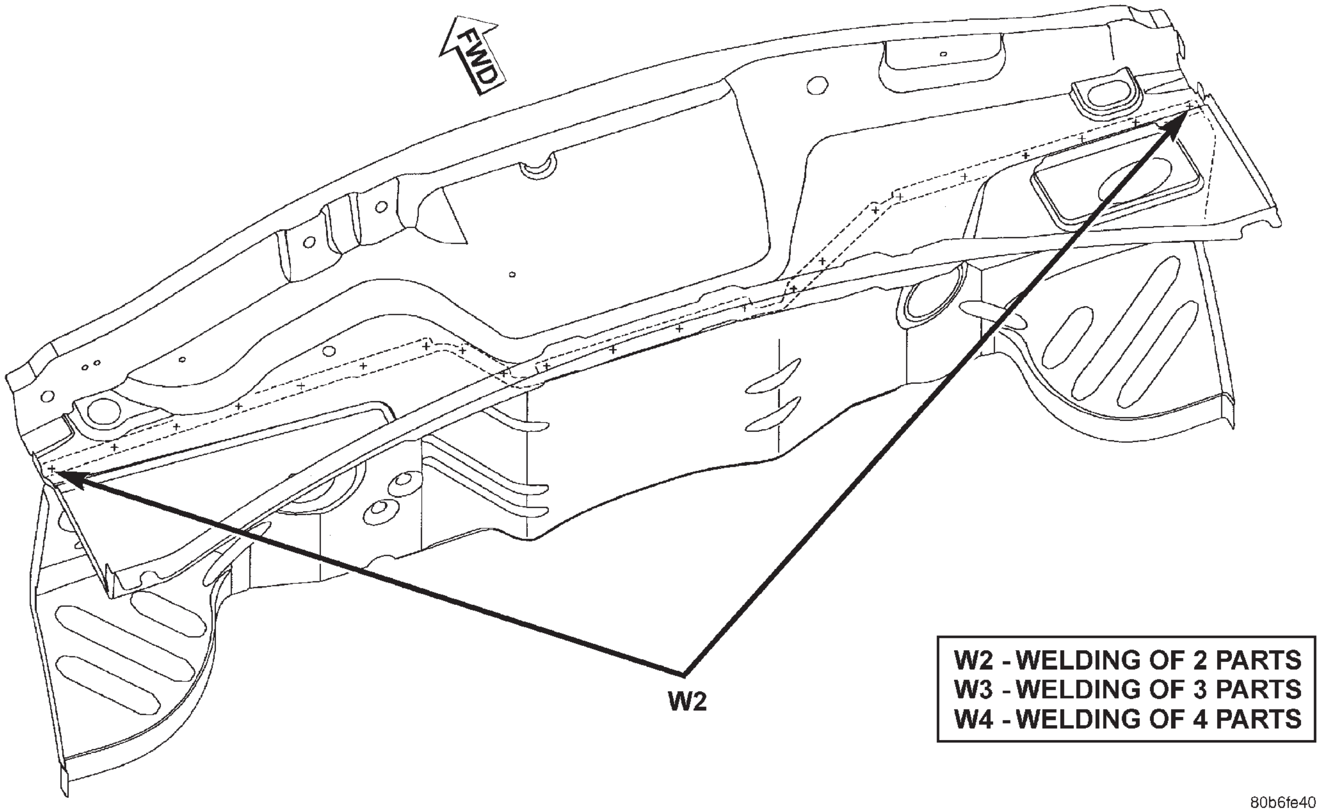
SPECIFICATIONS (Continued)

LOWER PLENUM REINFORCEMENT TO LOWER PLENUM PANEL



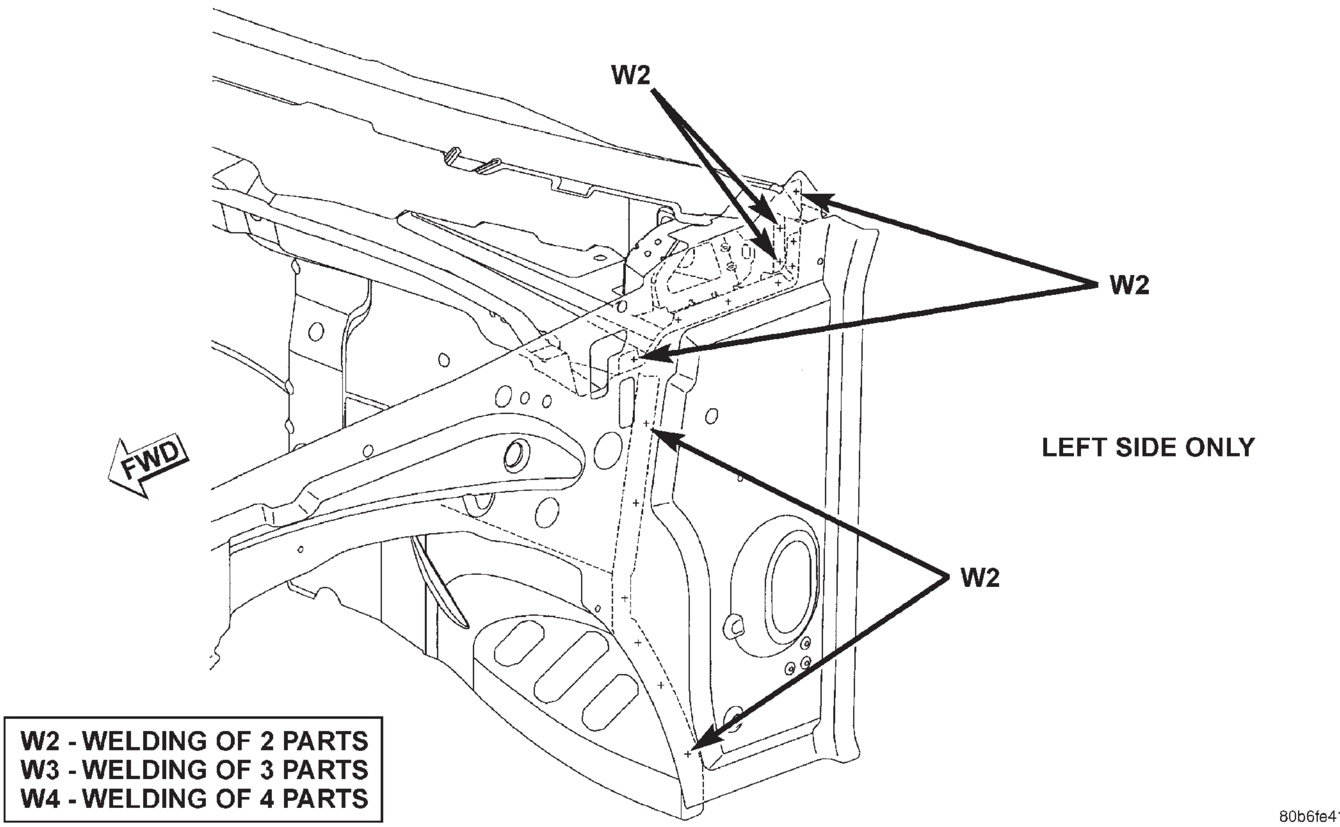
SPECIFICATIONS (Continued)

DASH PANEL TO LOWER PLENUM PANEL



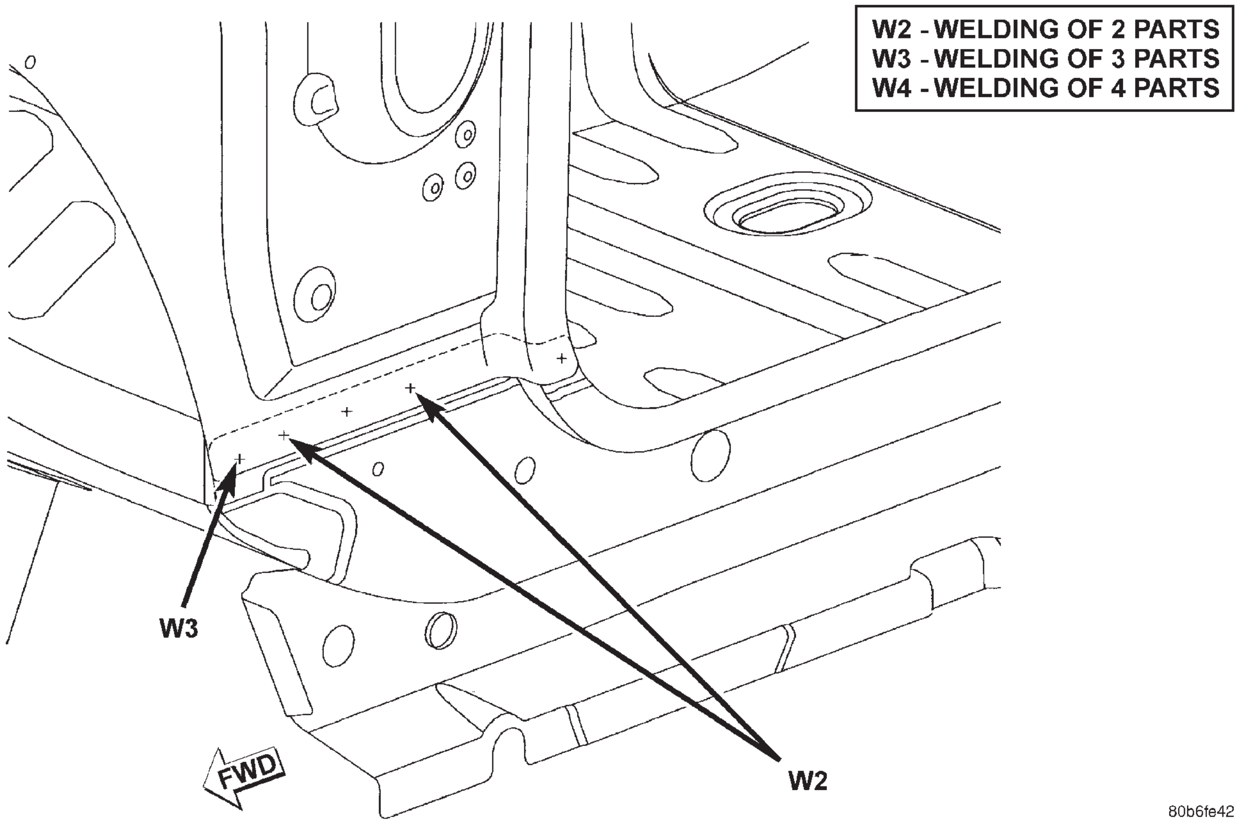
SPECIFICATIONS (Continued)

PLENUM ASSEMBLY TO COWL



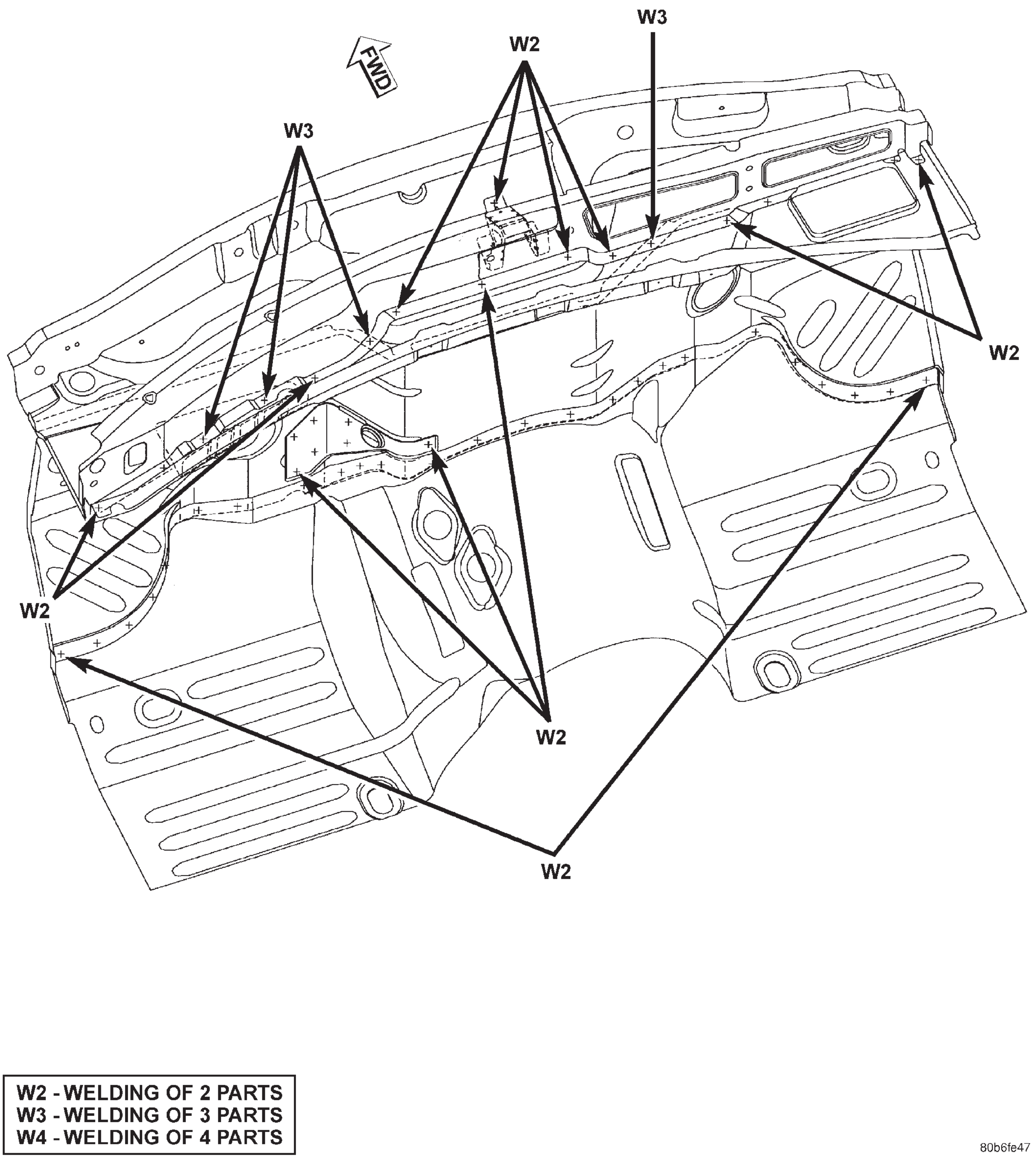
SPECIFICATIONS (Continued)

COWL PANEL TO BODYSIDE SILL



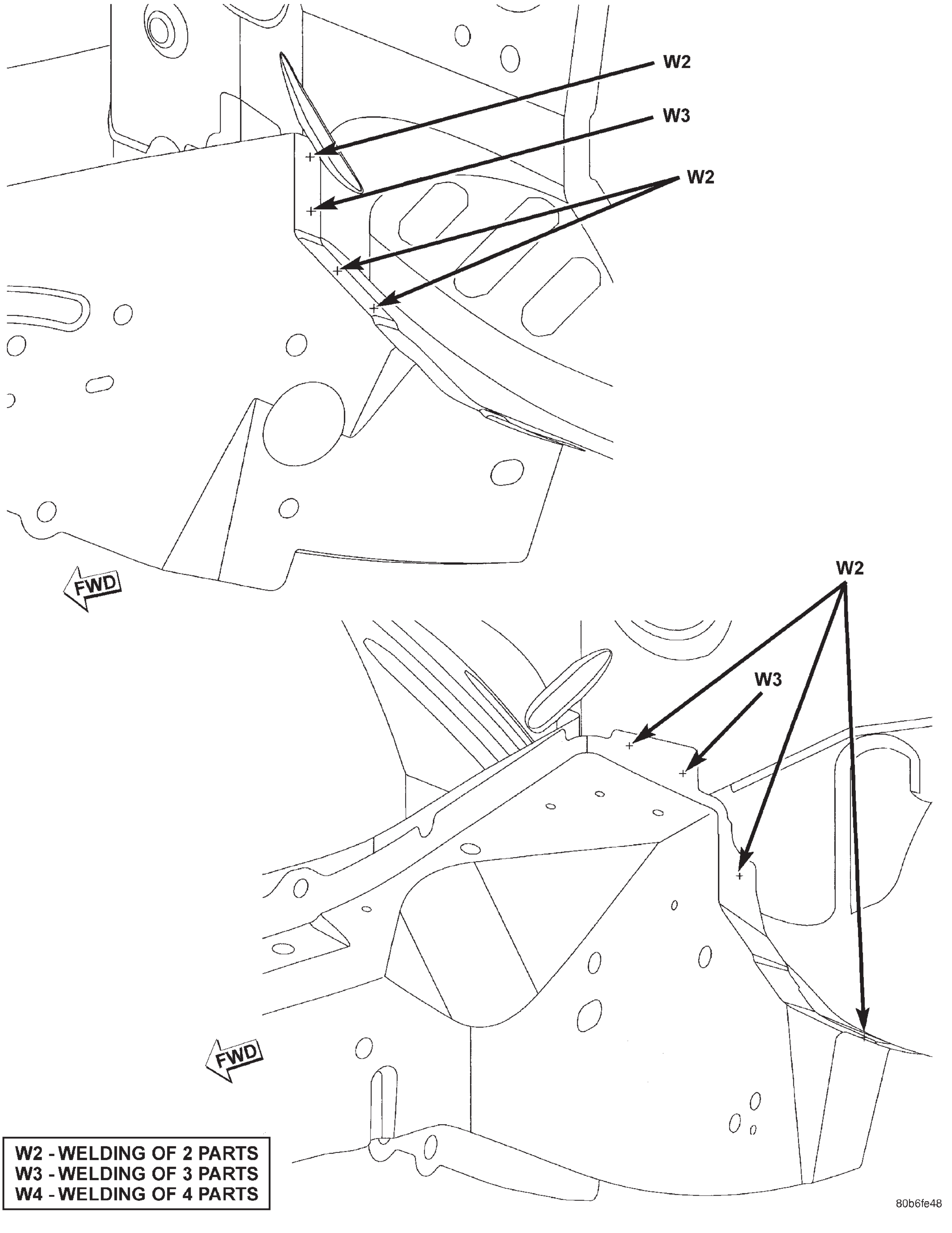
SPECIFICATIONS (Continued)

COWL PANEL TO FRONT FLOOR PAN



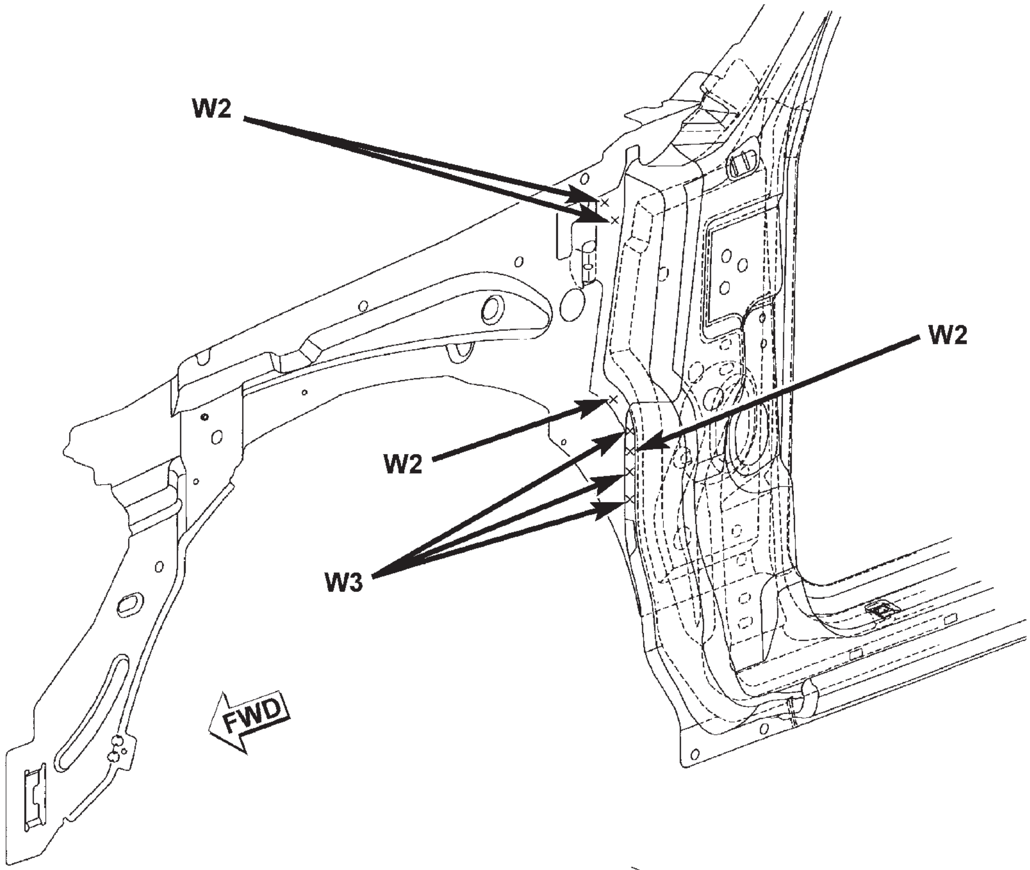
SPECIFICATIONS (Continued)

FRONT SILLS TO DASH AND FRONT FLOOR PAN

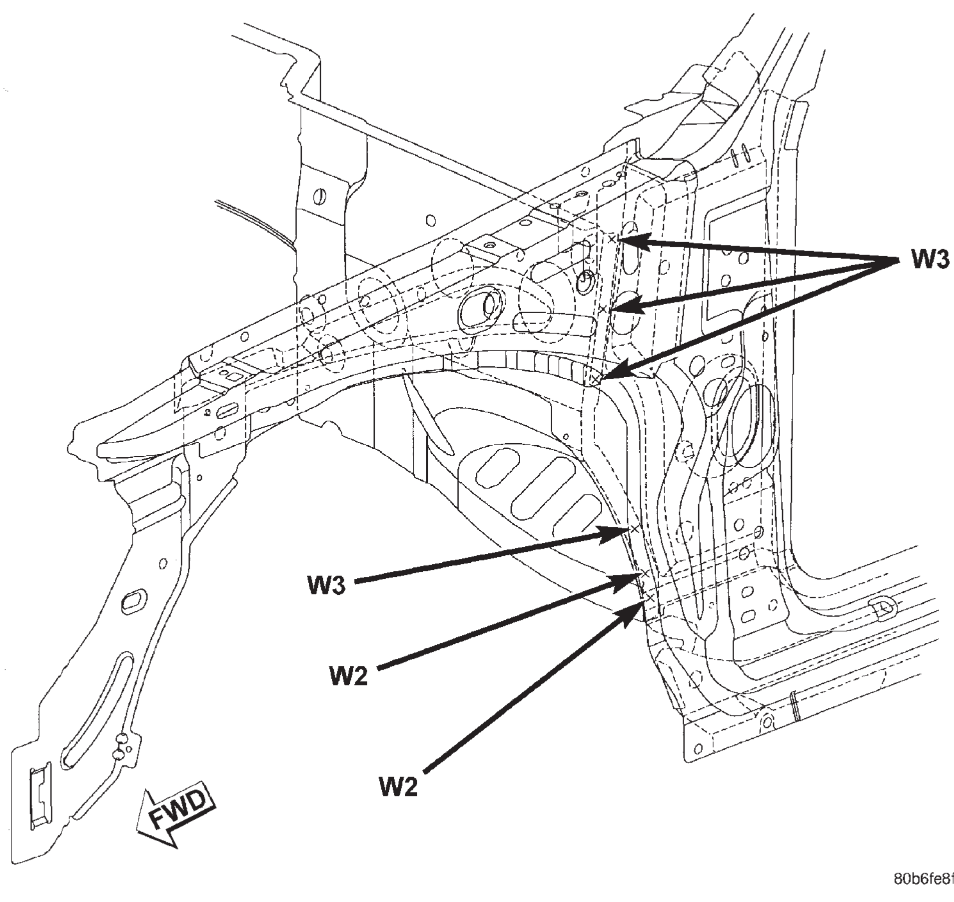


SPECIFICATIONS (Continued)

COWL SIDE PANEL DASH INNER BODYSIDE AND OUTER BODYSIDE PANELS



W2 - WELDING OF 2 PARTS
W3 - WELDING OF 3 PARTS
W4 - WELDING OF 4 PARTS



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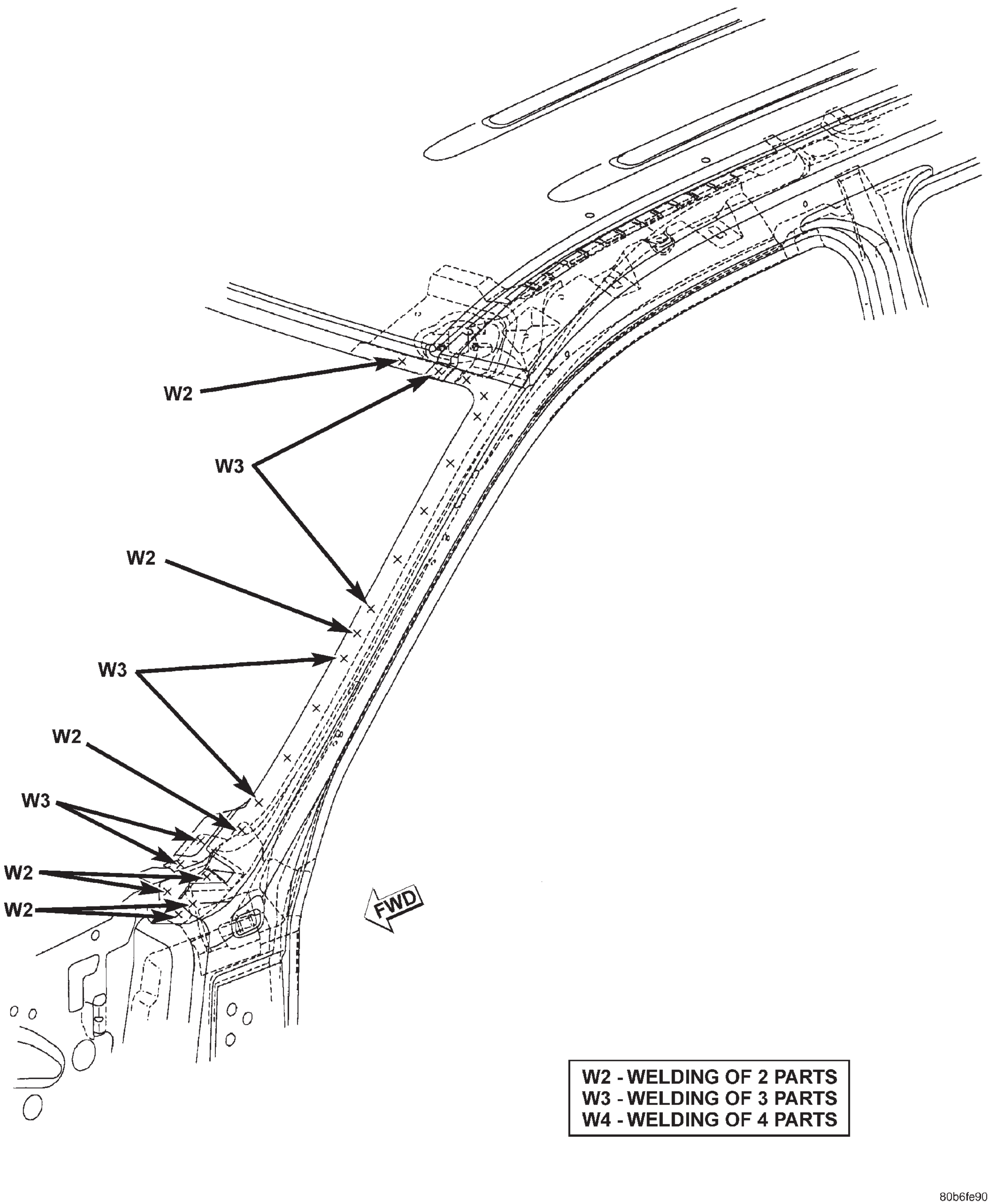
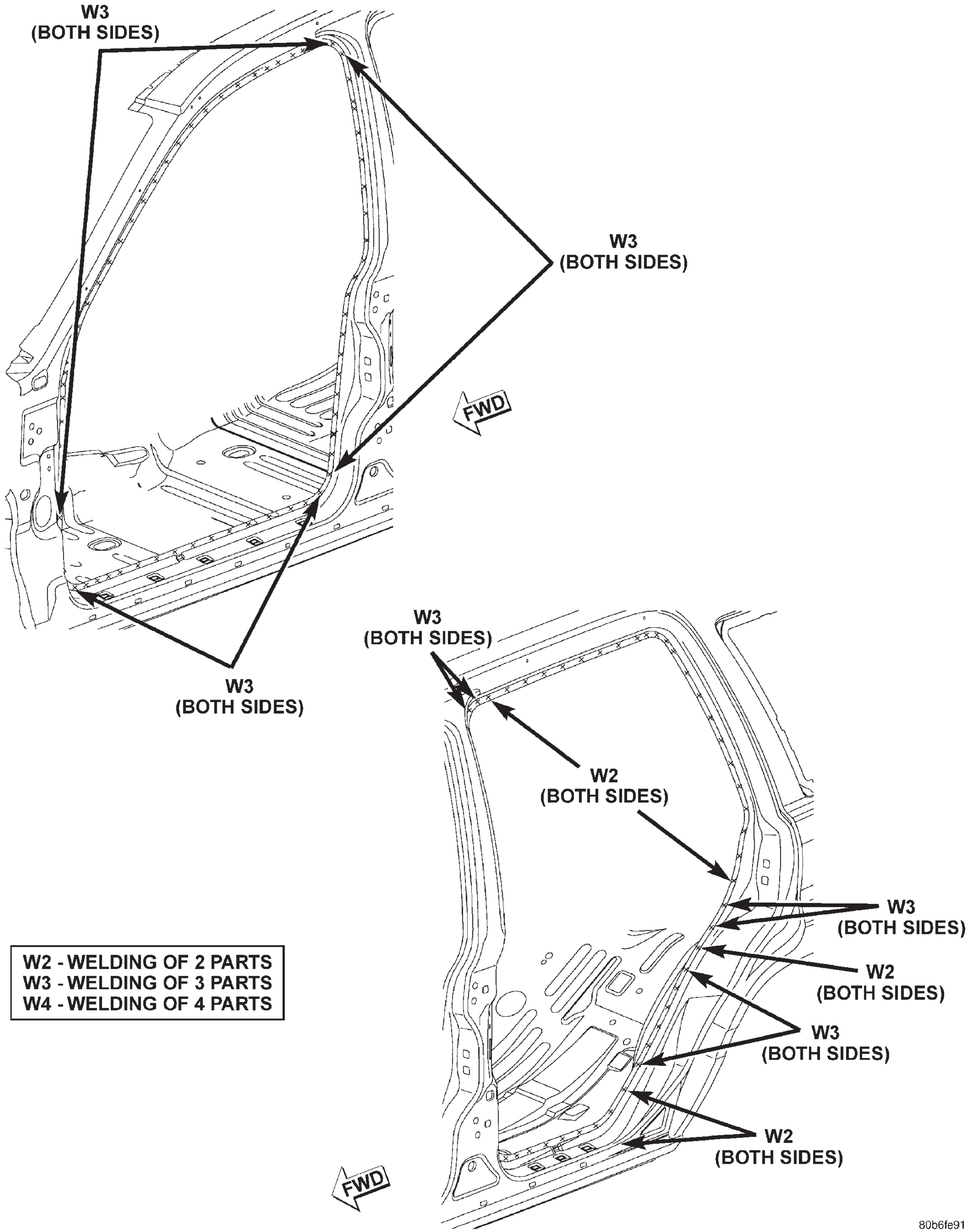
SPECIFICATIONS (Continued)

UPPER FRONT INNER PILLAR TO ROOF AND COWL



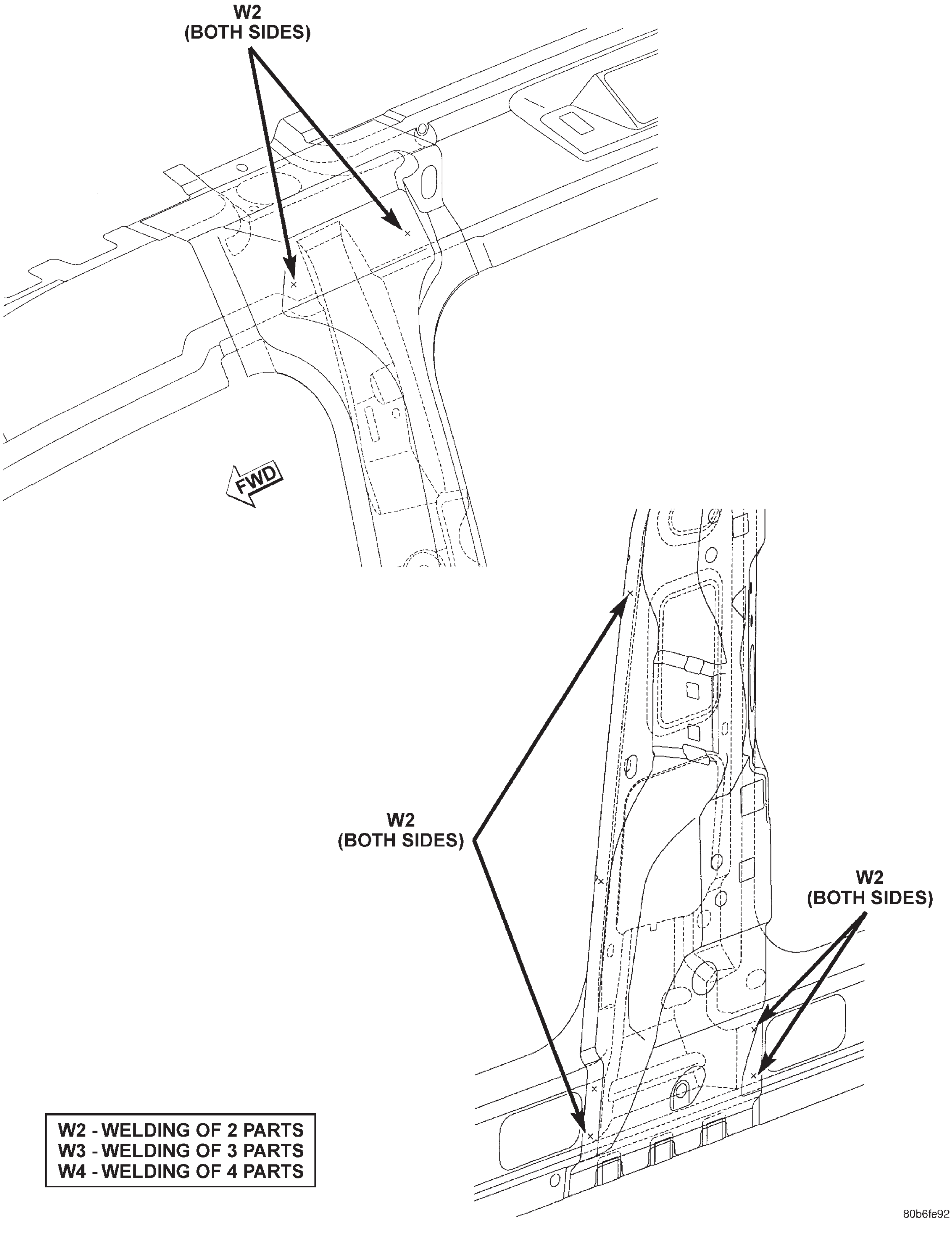
SPECIFICATIONS (Continued)

DOOR OPENINGS



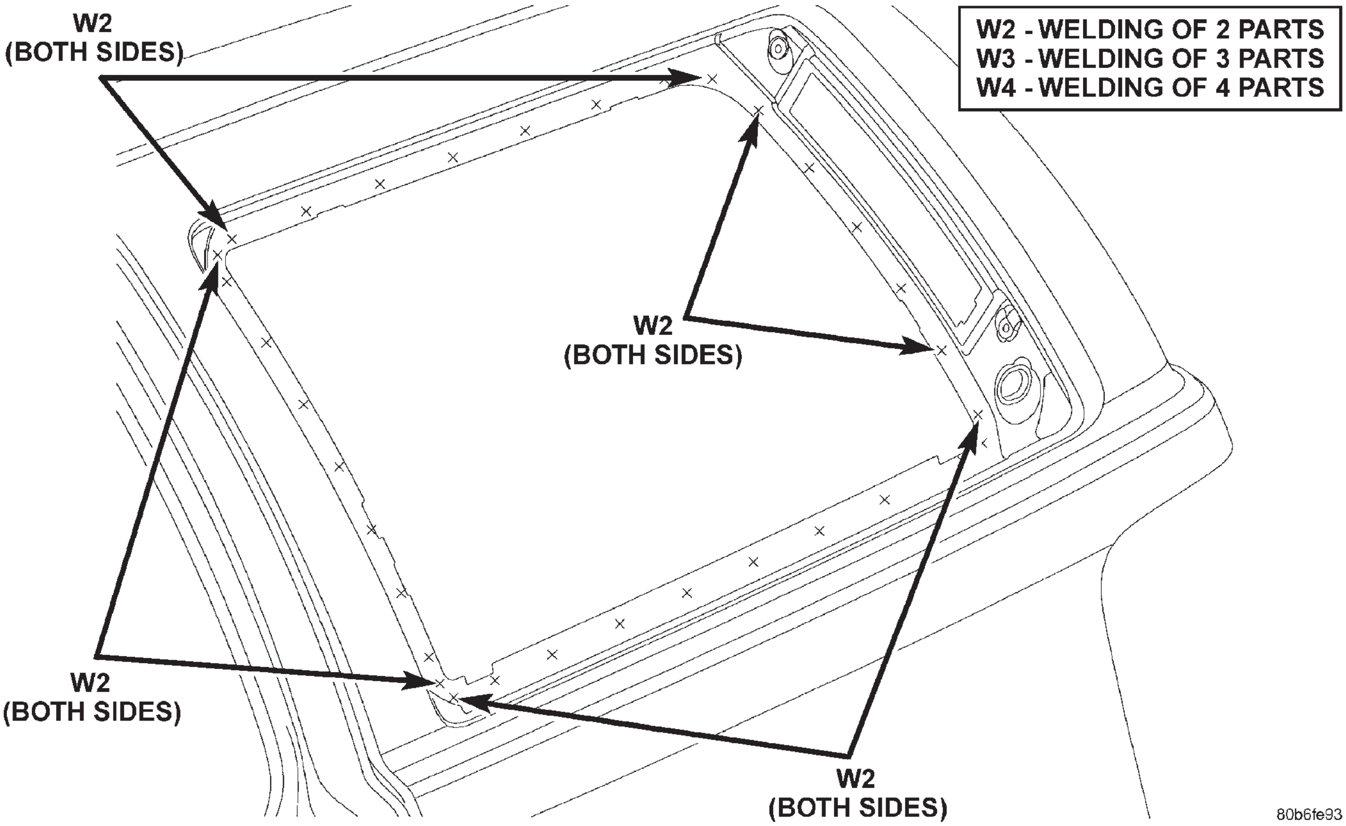
SPECIFICATIONS (Continued)

B-PILLAR REINFORCEMENT TO INNER BODYSIDE APERTURE



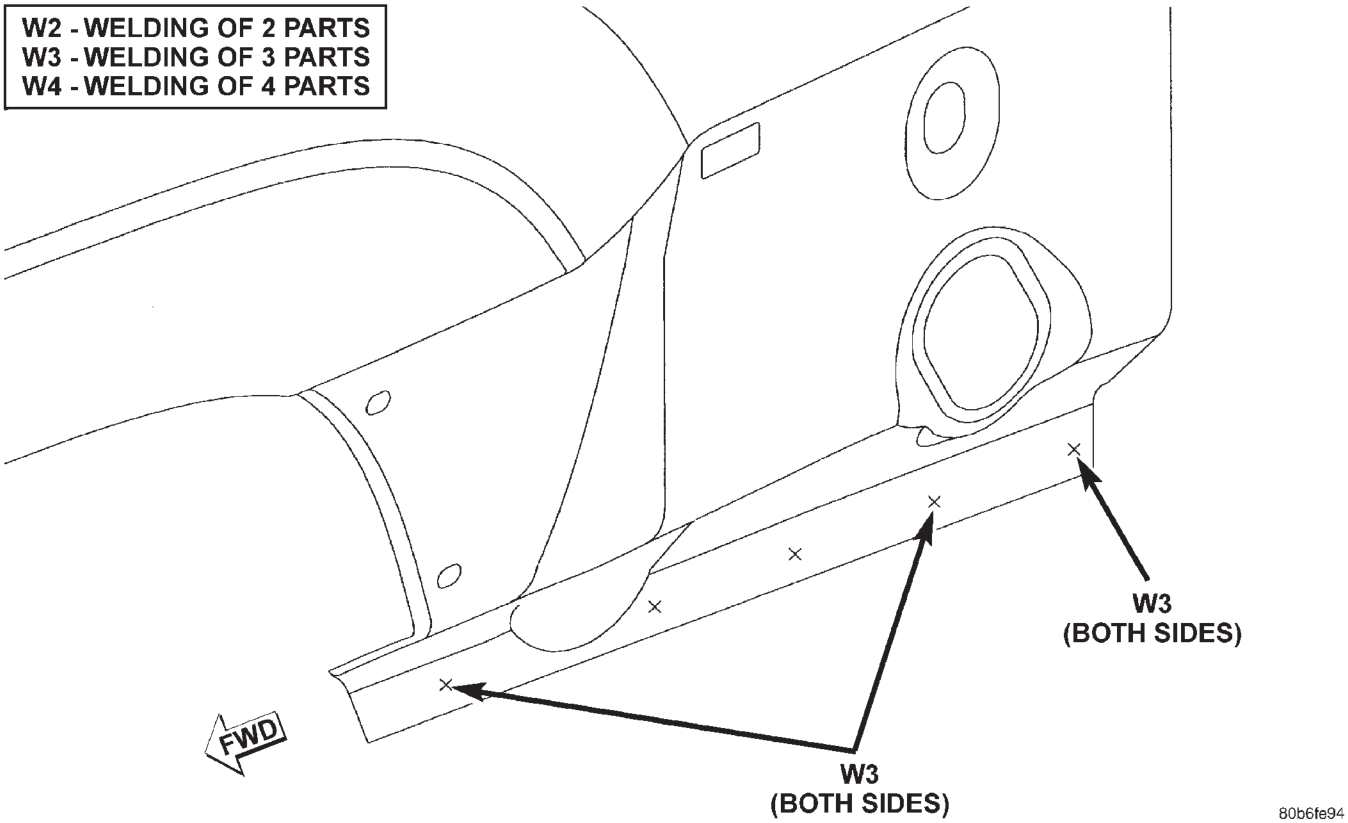
SPECIFICATIONS (Continued)

REAR QUARTER WINDOW TO BODYSIDE APERTURE INNER AND OUTER



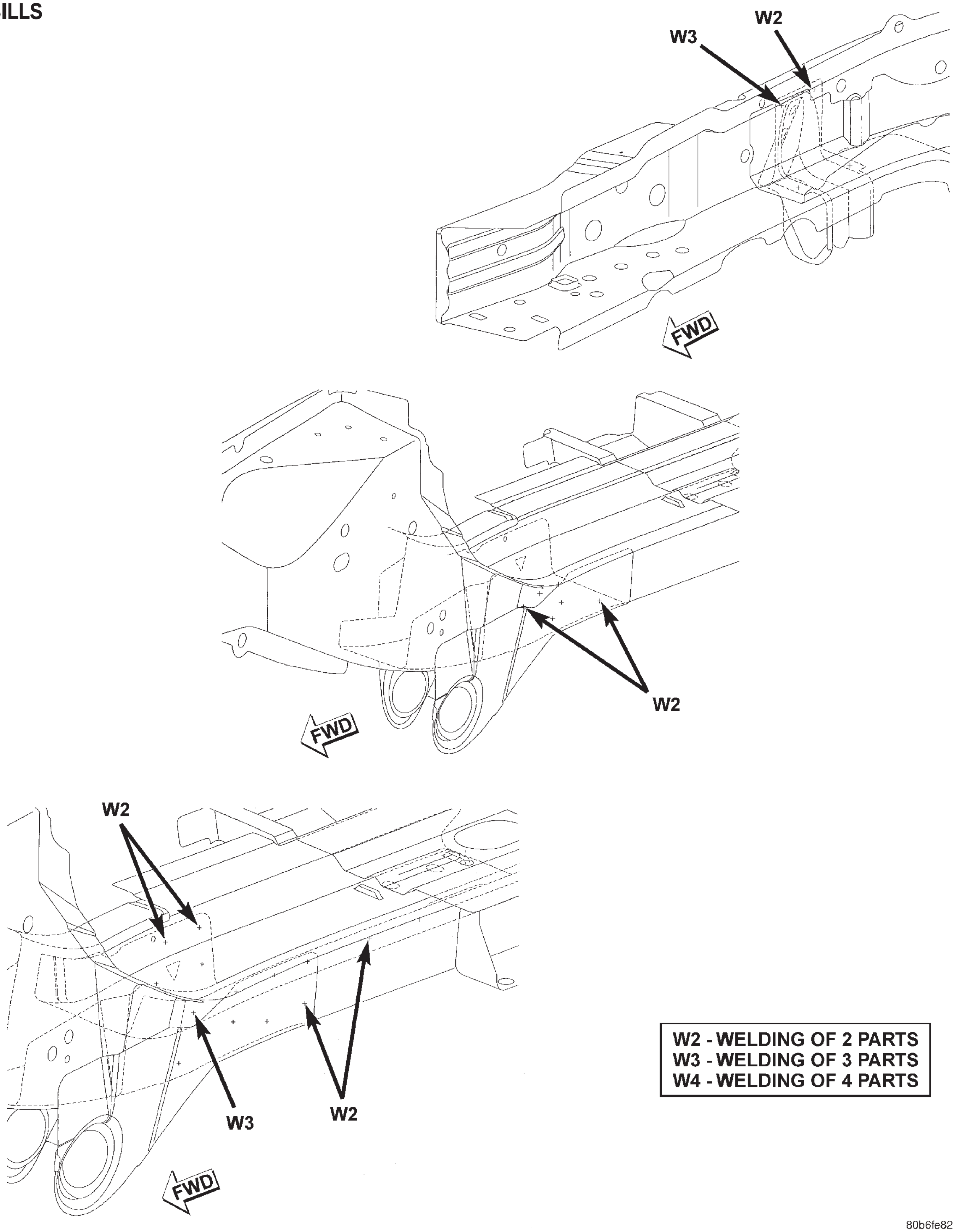
SPECIFICATIONS (Continued)

LOWER REAR QUARTER TO BODYSIDE APERTURE INNER AND OUTER



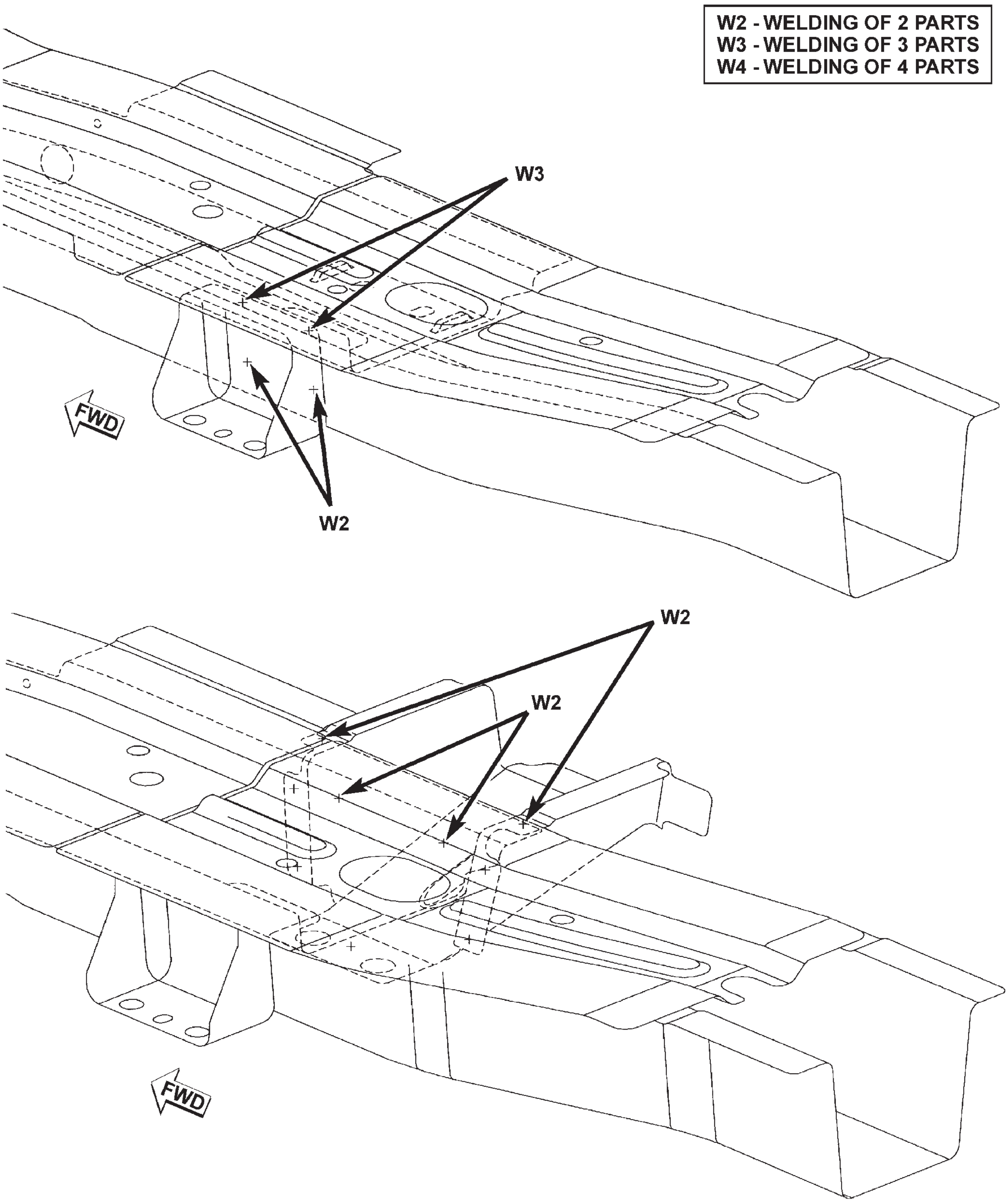
SPECIFICATIONS (Continued)

INNER TRACK BAR, LOWER CONTROL ARM AND TRANSMISSION CROSSMEMBER BRACKETS TO FRONT SILLS



SPECIFICATIONS (Continued)

TRANSMISSION CROSSMEMBER BRACKET AND REINFORCEMENT TO FRONT SILLS



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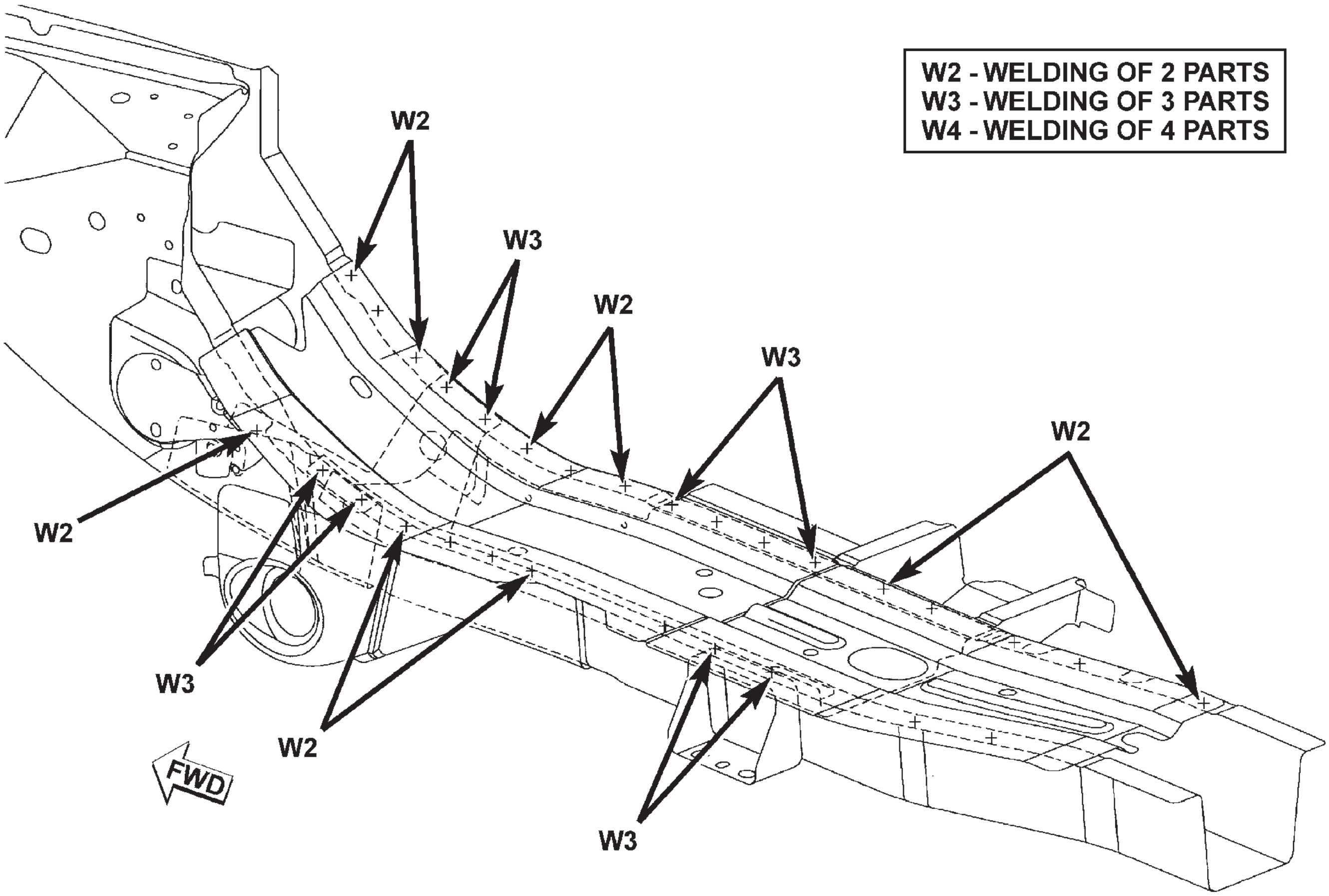
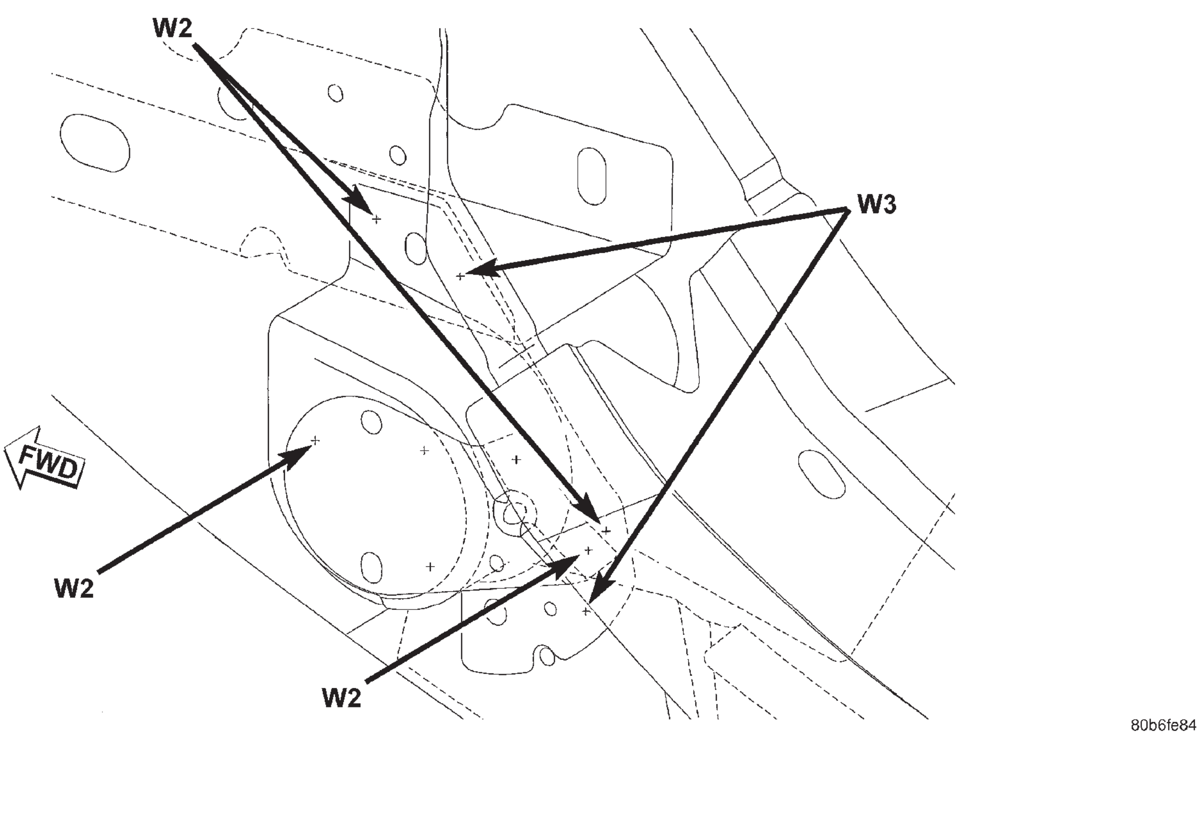
SPECIFICATIONS (Continued)

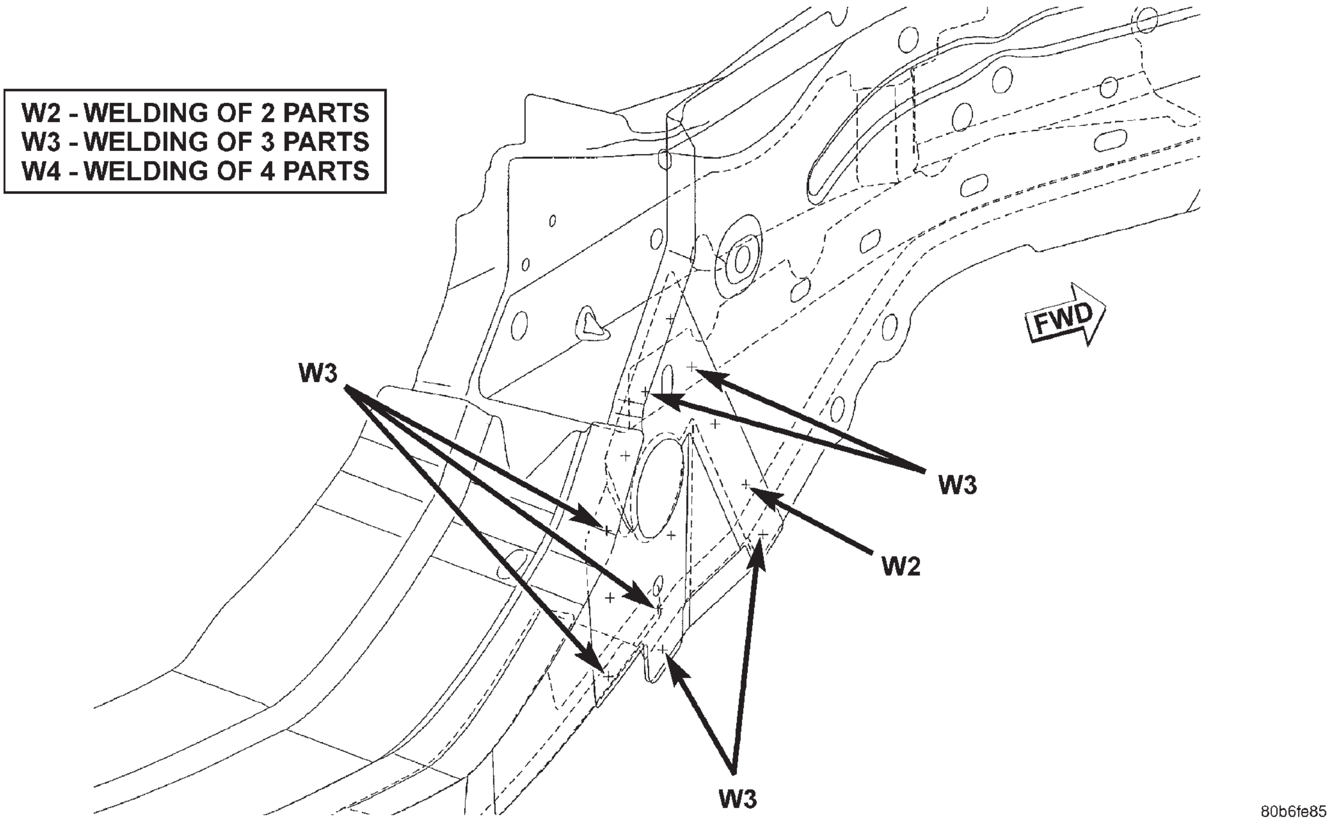
UPPER SILLS AND UPPER CONTROL ARM REINFORCEMENT AND BRACKETS TO FRONT SILLS





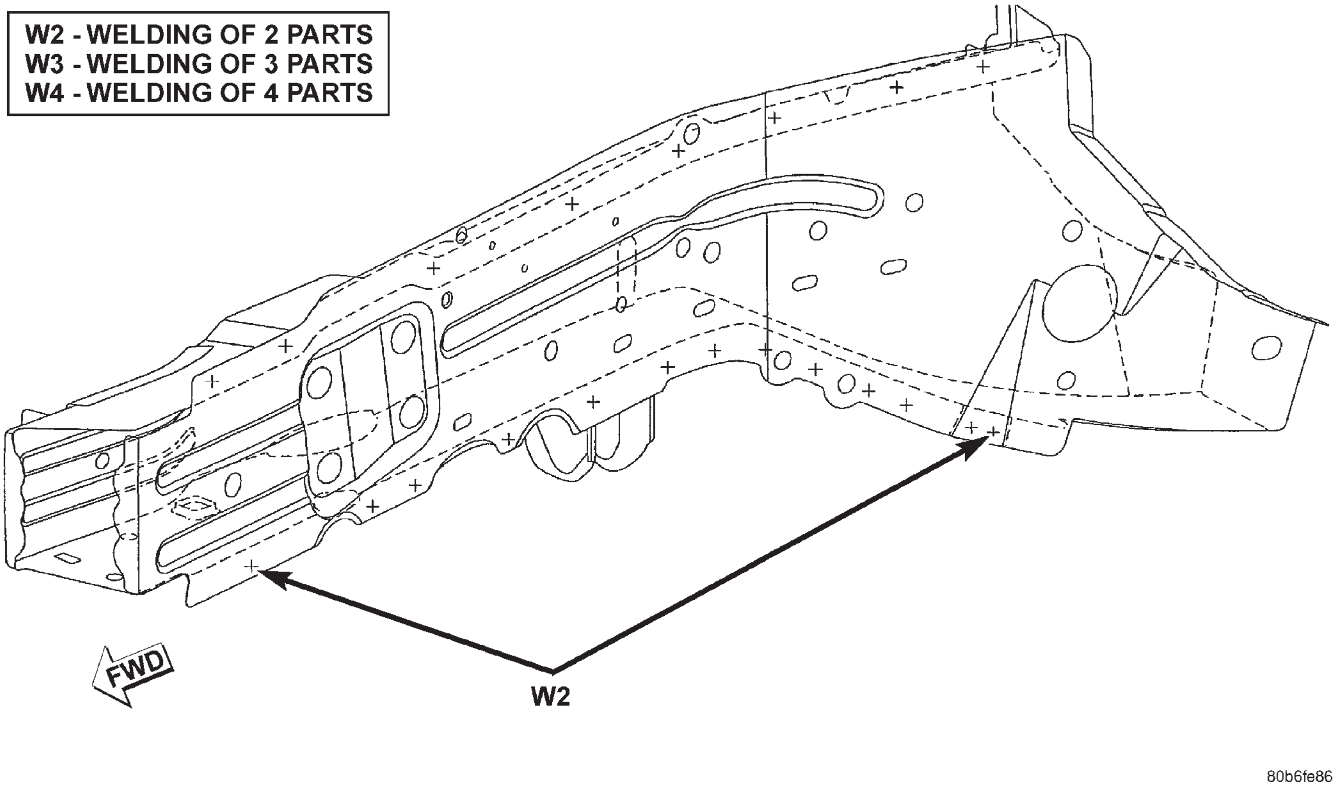
SPECIFICATIONS (Continued)

REINFORCEMENT TO FRONT OUTER SILLS



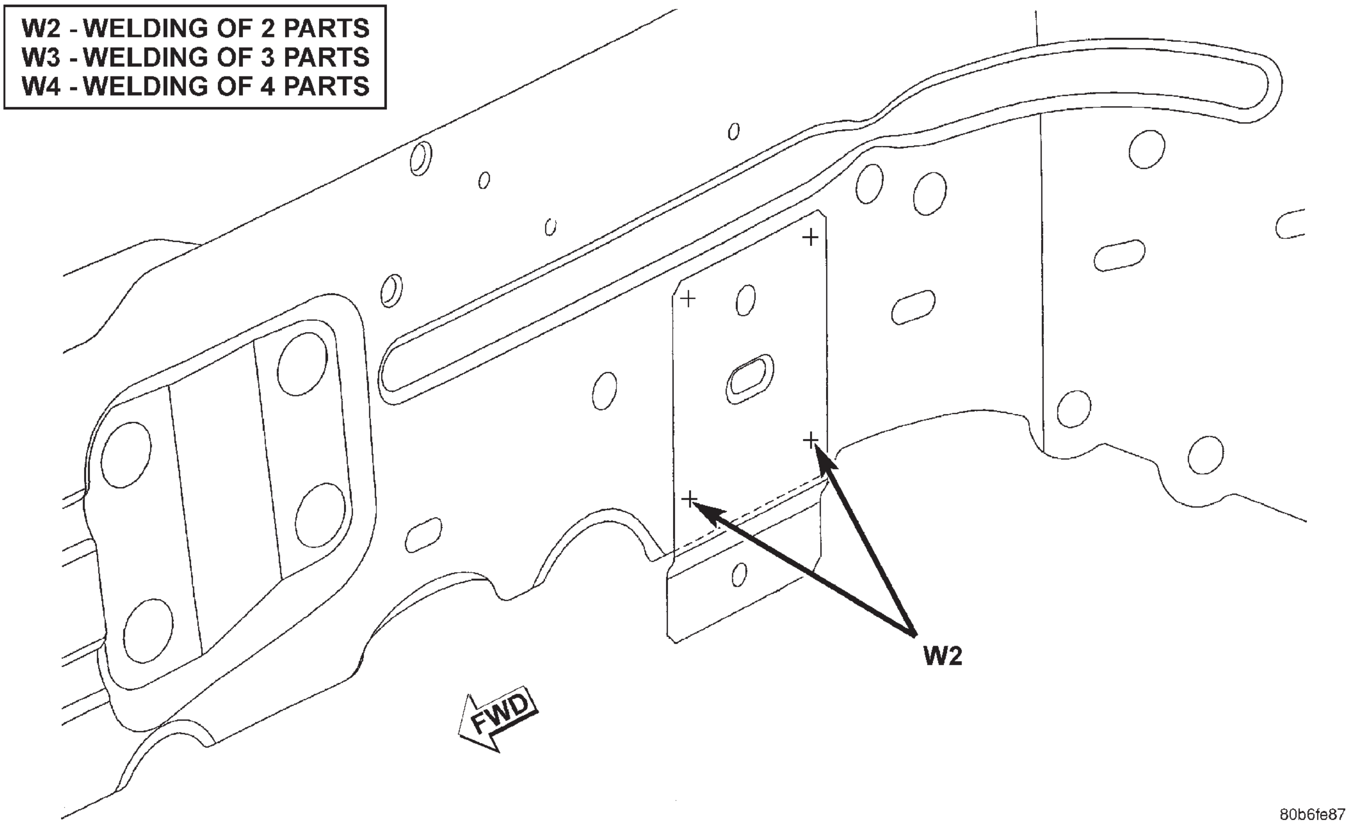
SPECIFICATIONS (Continued)

FRONT INNER SILL TO FRONT OUTER SILL



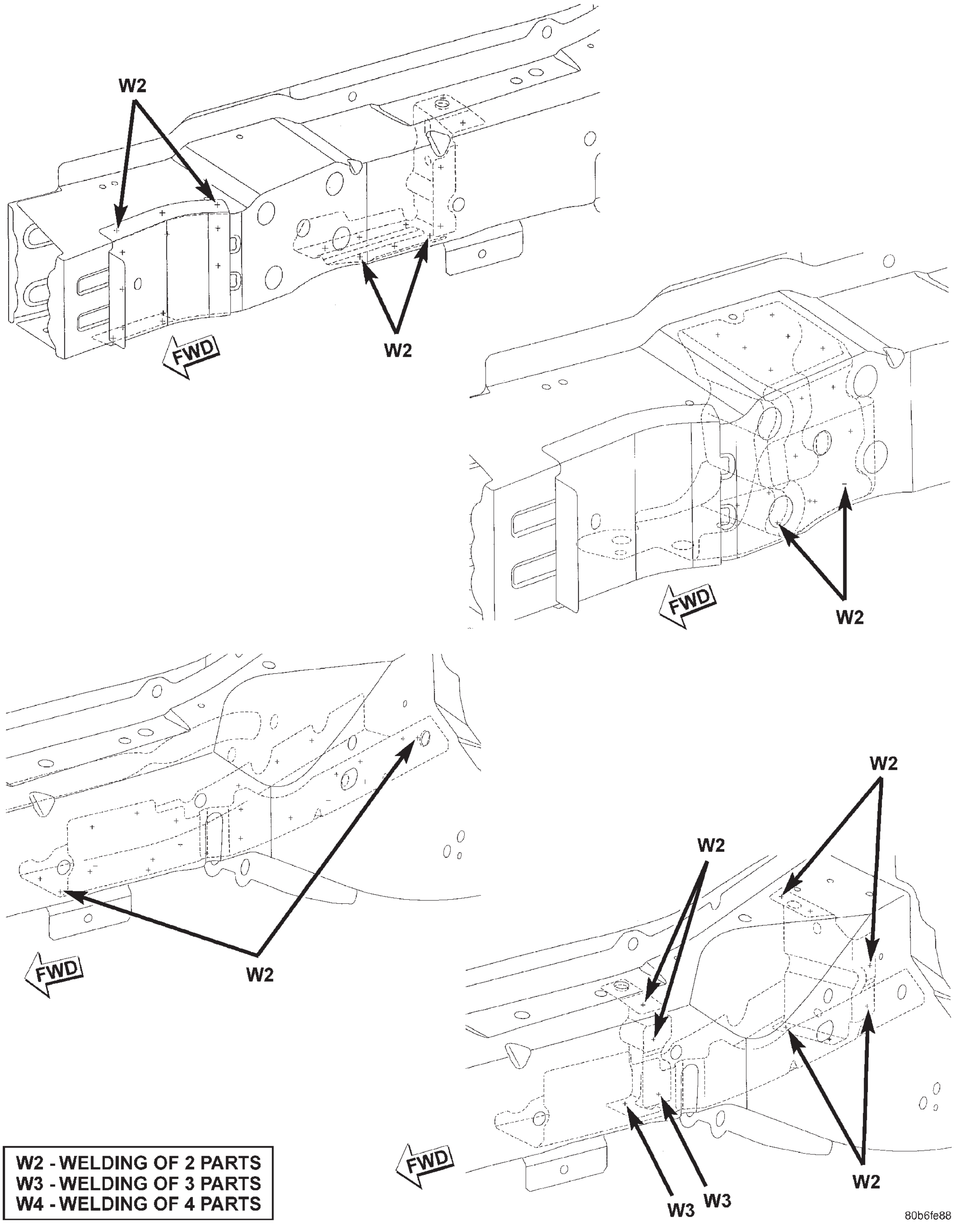
SPECIFICATIONS (Continued)

OUTER TRACK BAR BRACKET TO FRONT OUTER SILL



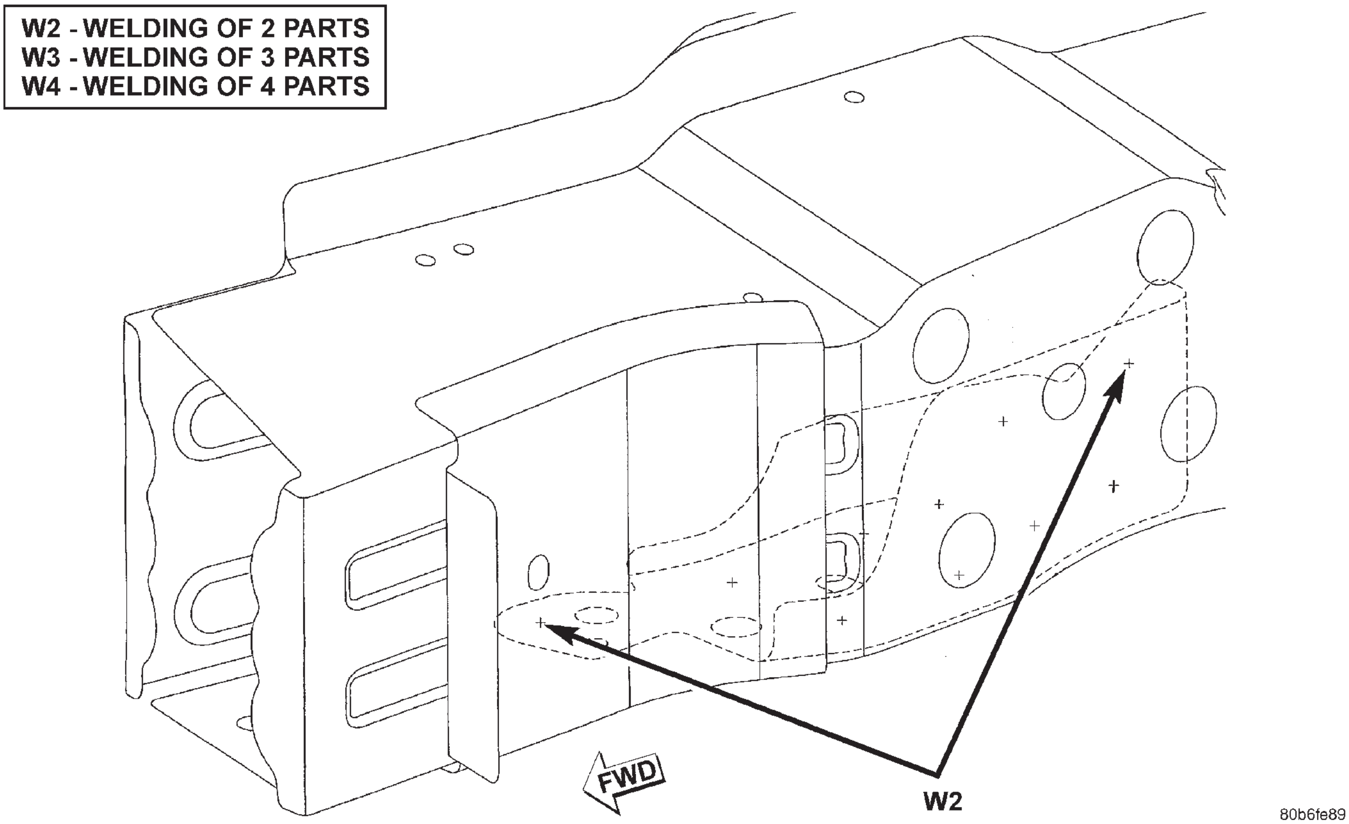
SPECIFICATIONS (Continued)

REINFORCEMENT FOR FRONT ENGINE MOUNTING AND STEERING GEAR TO FRONT INNER SILL



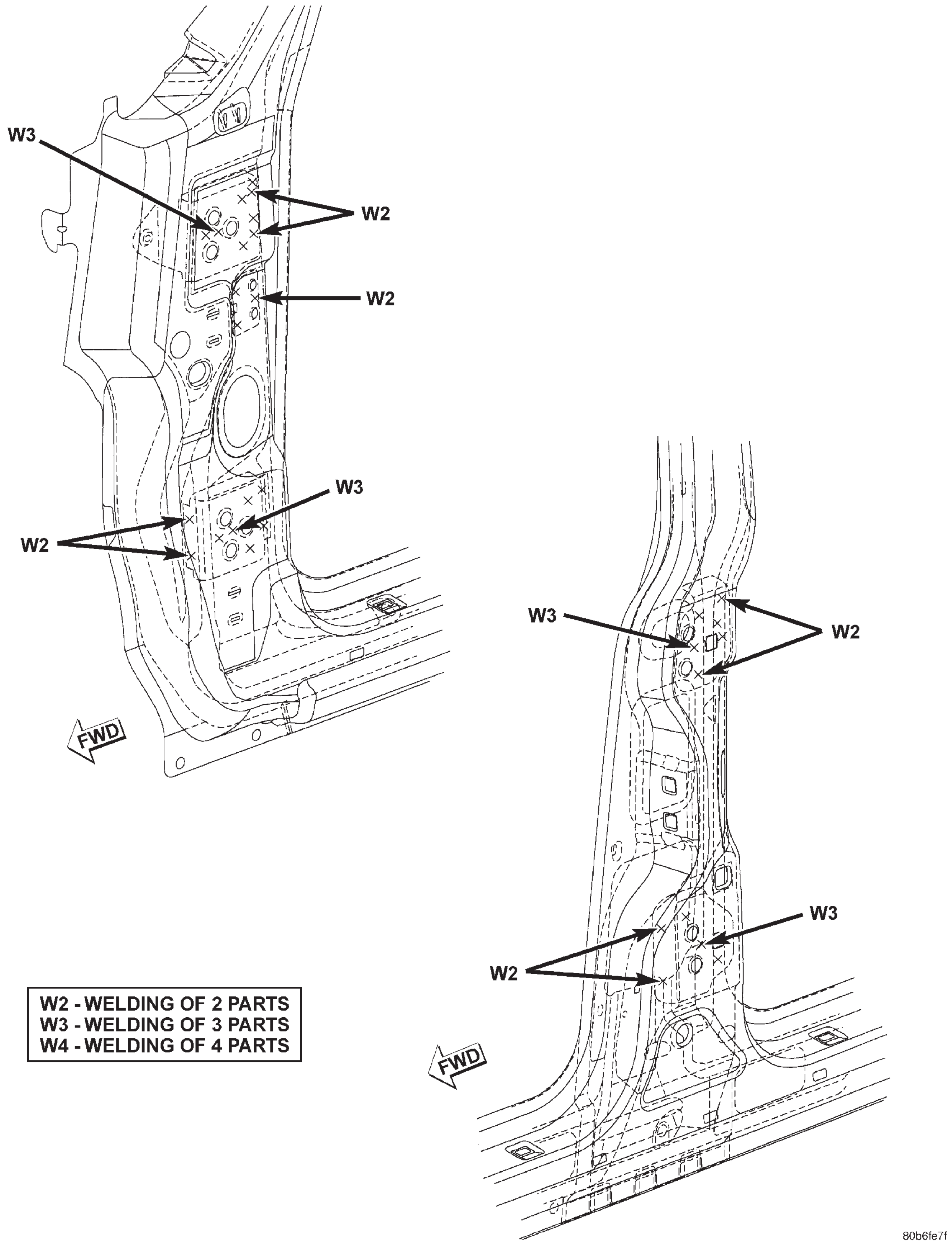
SPECIFICATIONS (Continued)

LARGE AND SMALL SWAY BAR TAPPING PLATES TO FRONT INNER SILLS



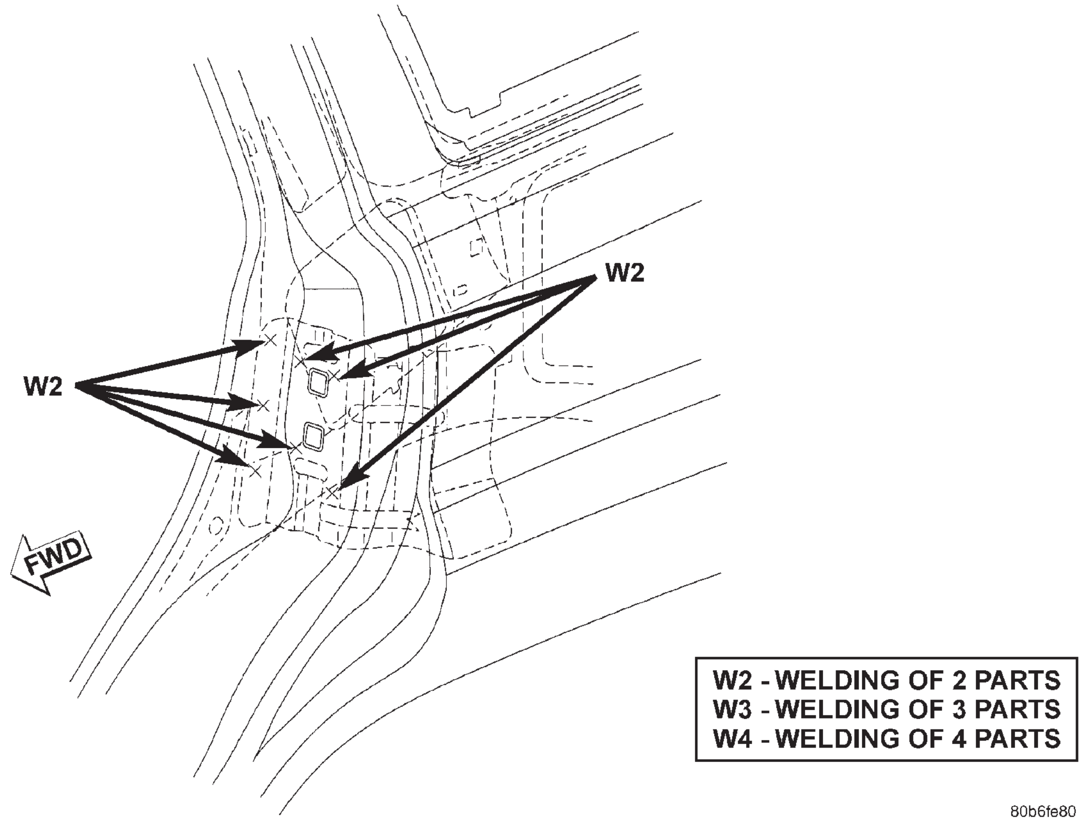
SPECIFICATIONS (Continued)

FRONT AND REAR DOOR HINGE TAPPING PLATES



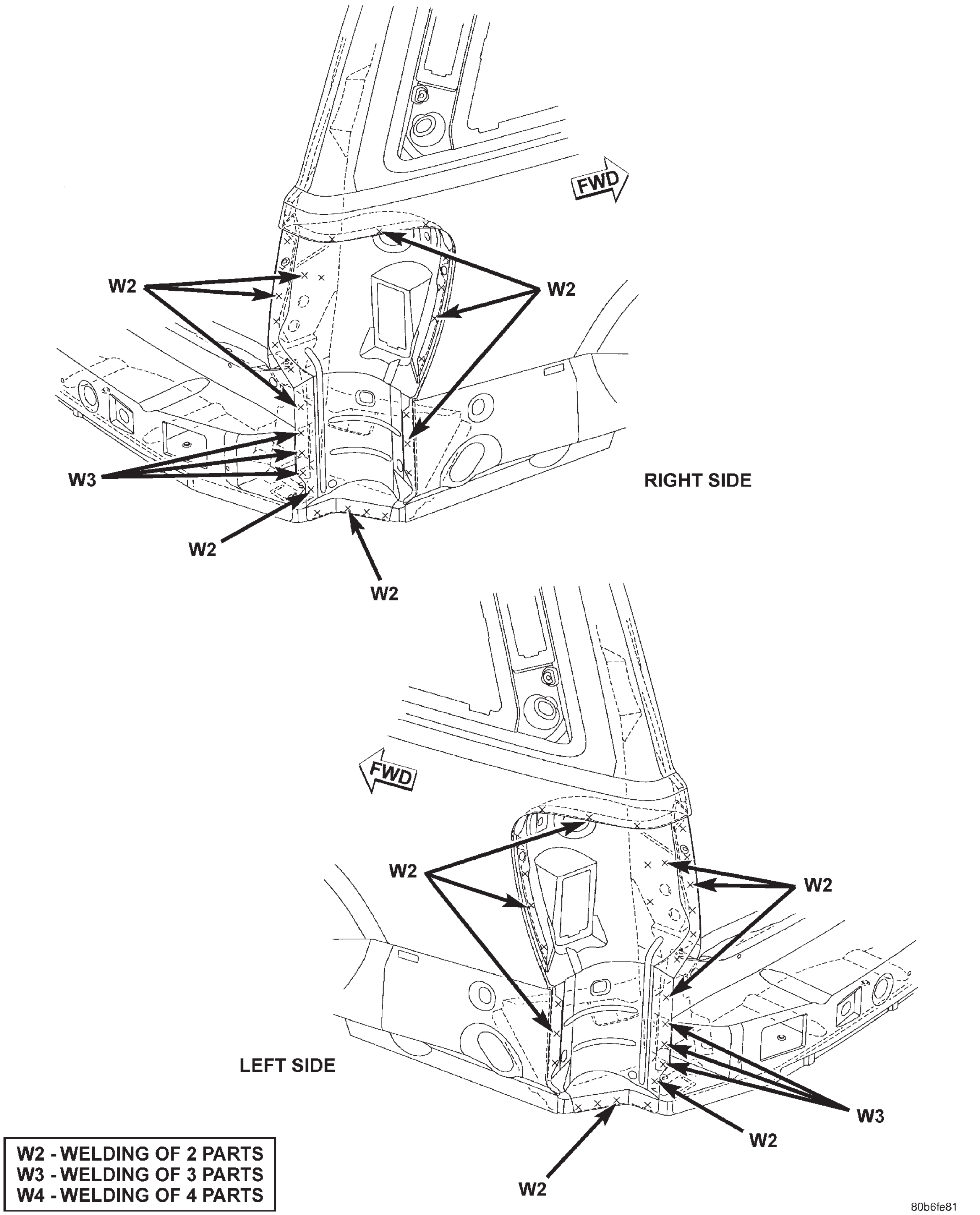
SPECIFICATIONS (Continued)

REAR DOOR STRIKER REINFORCEMENT



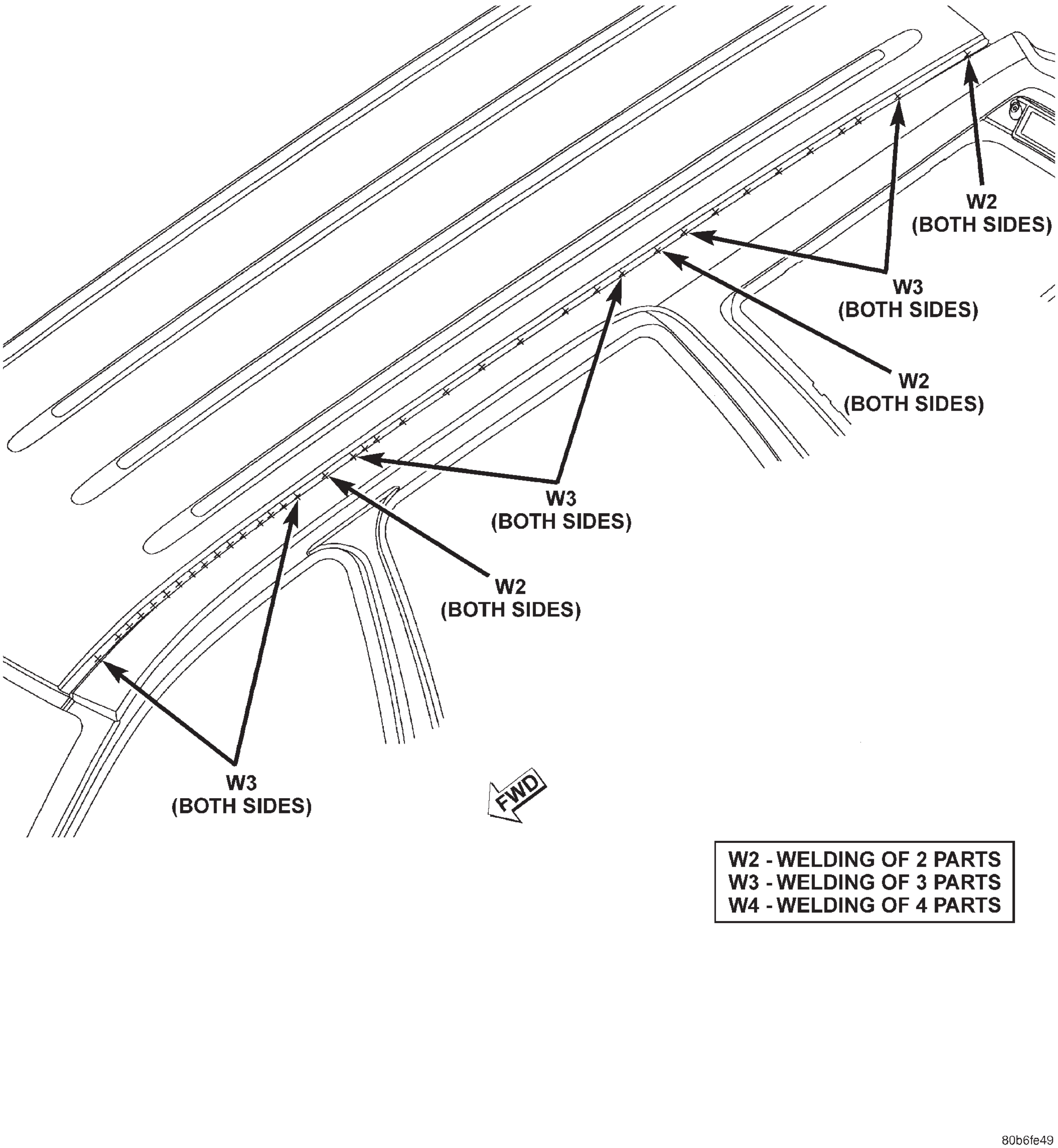
SPECIFICATIONS (Continued)

TAIL LAMP MOUNTING PANELS



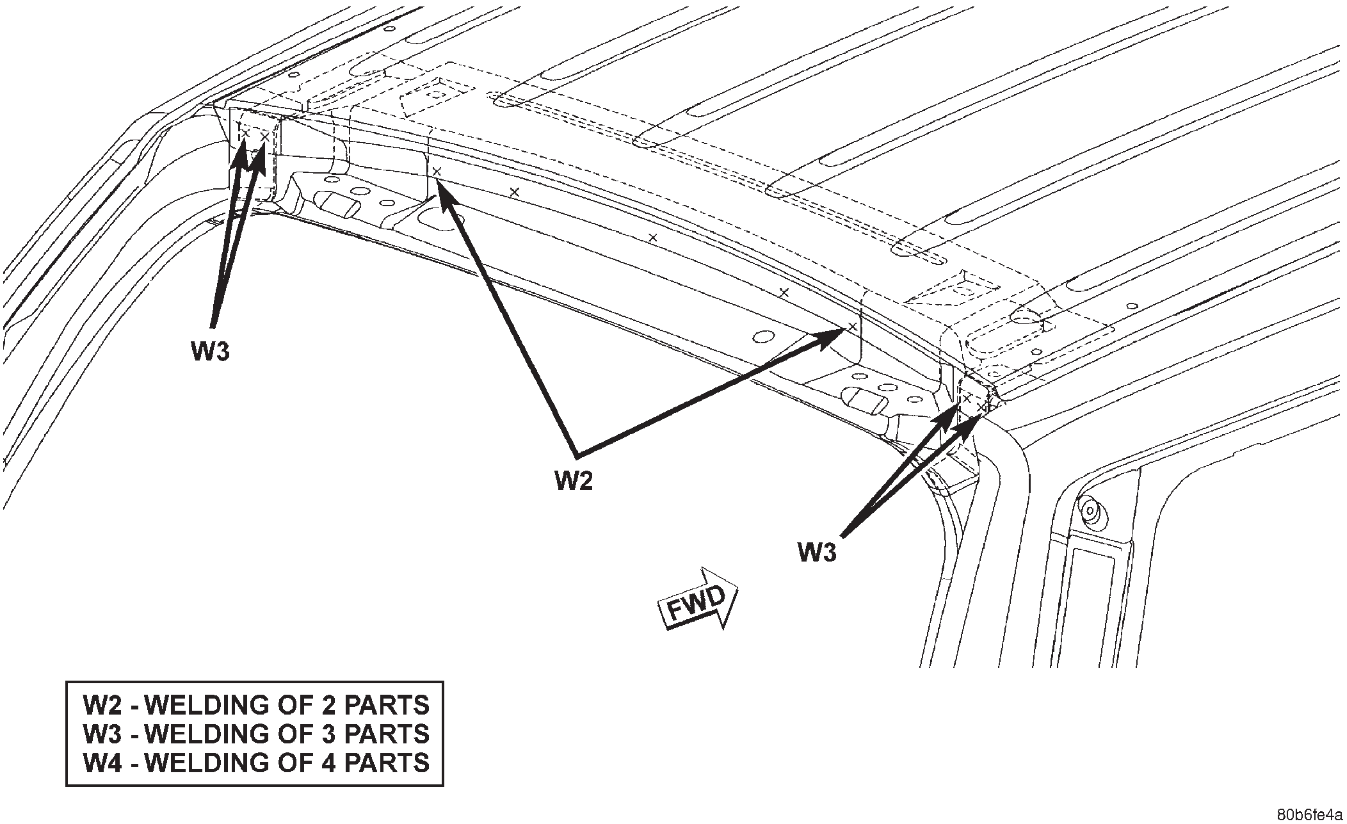
SPECIFICATIONS (Continued)

ROOF PANEL TO BODYSIDE APERTURE



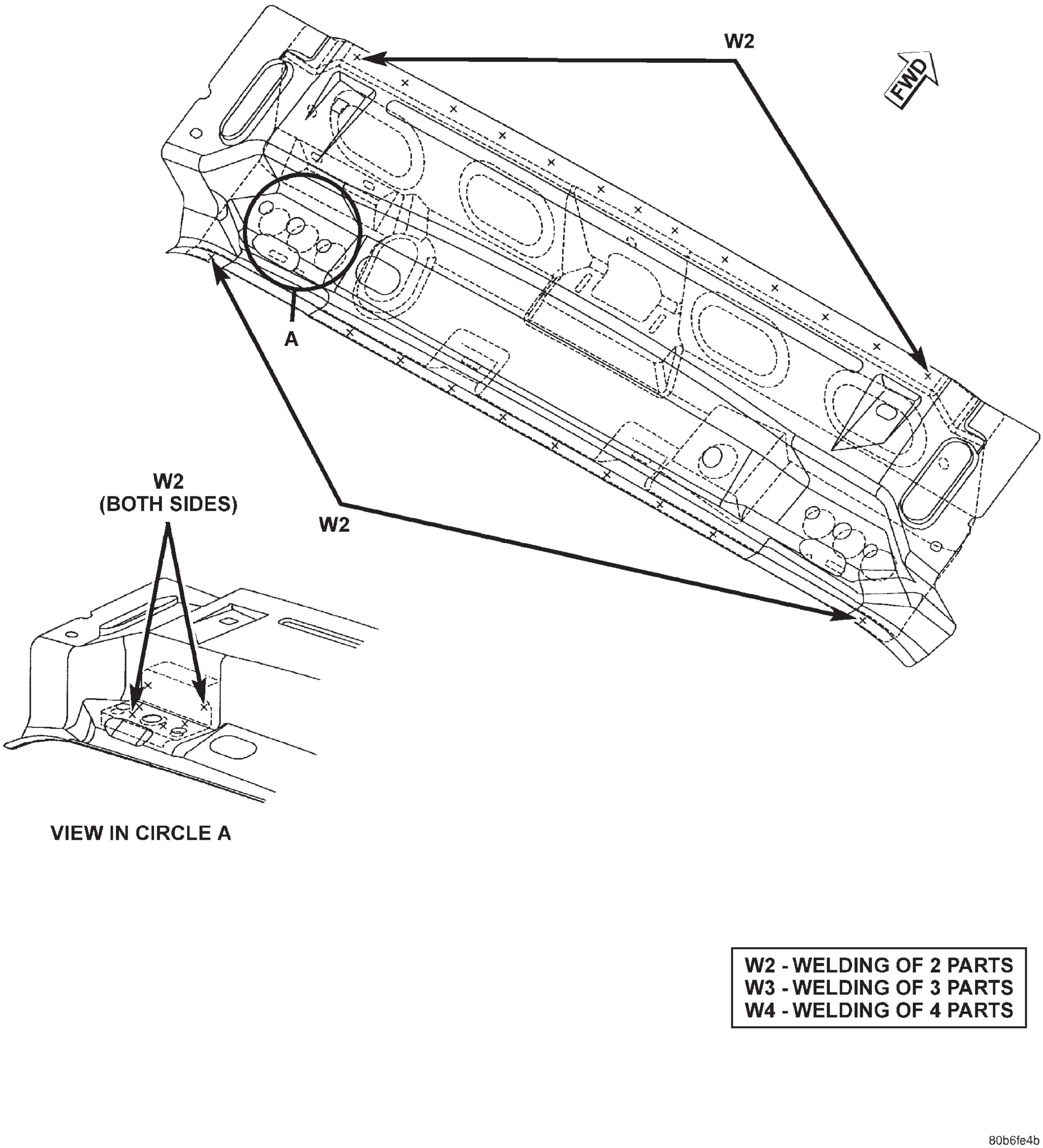
SPECIFICATIONS (Continued)

ROOF PANEL TO REAR HEADER



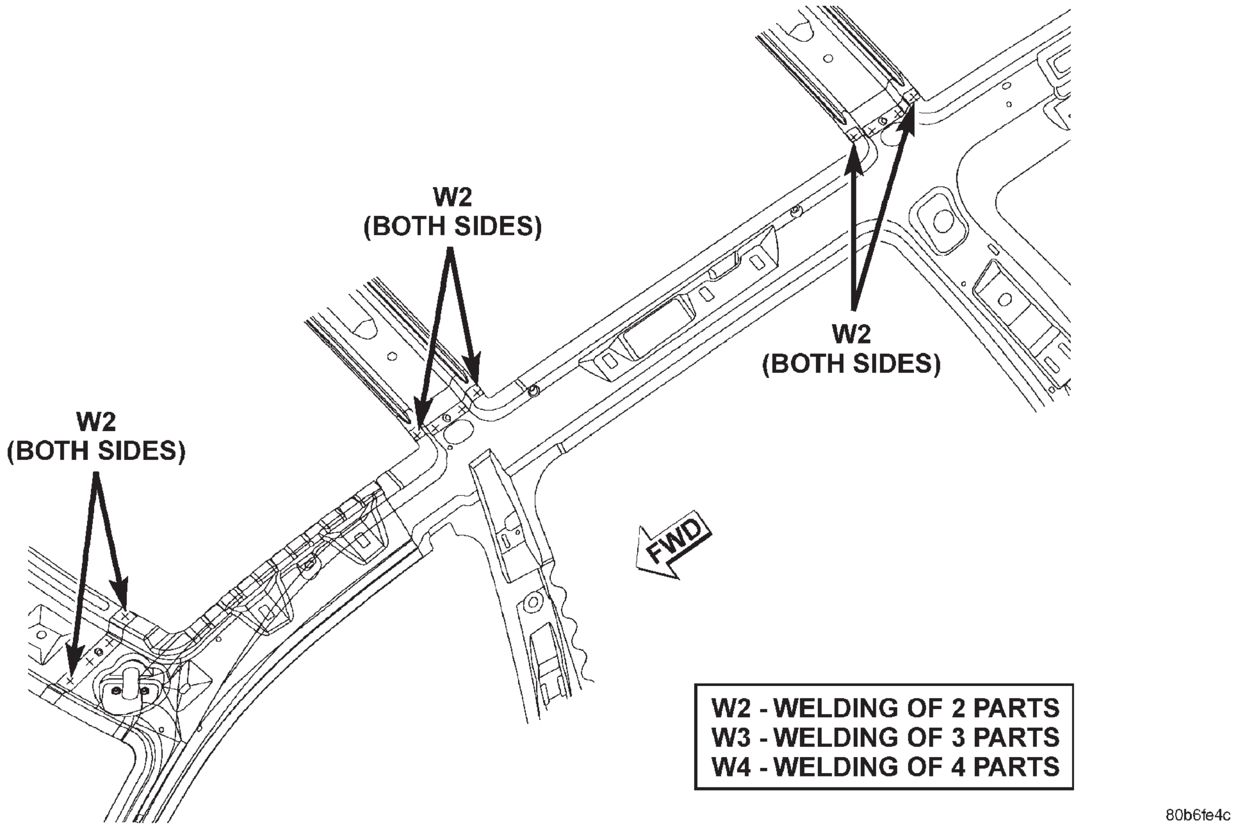
SPECIFICATIONS (Continued)

UPPER REAR HEADER TO LOWER HEADER



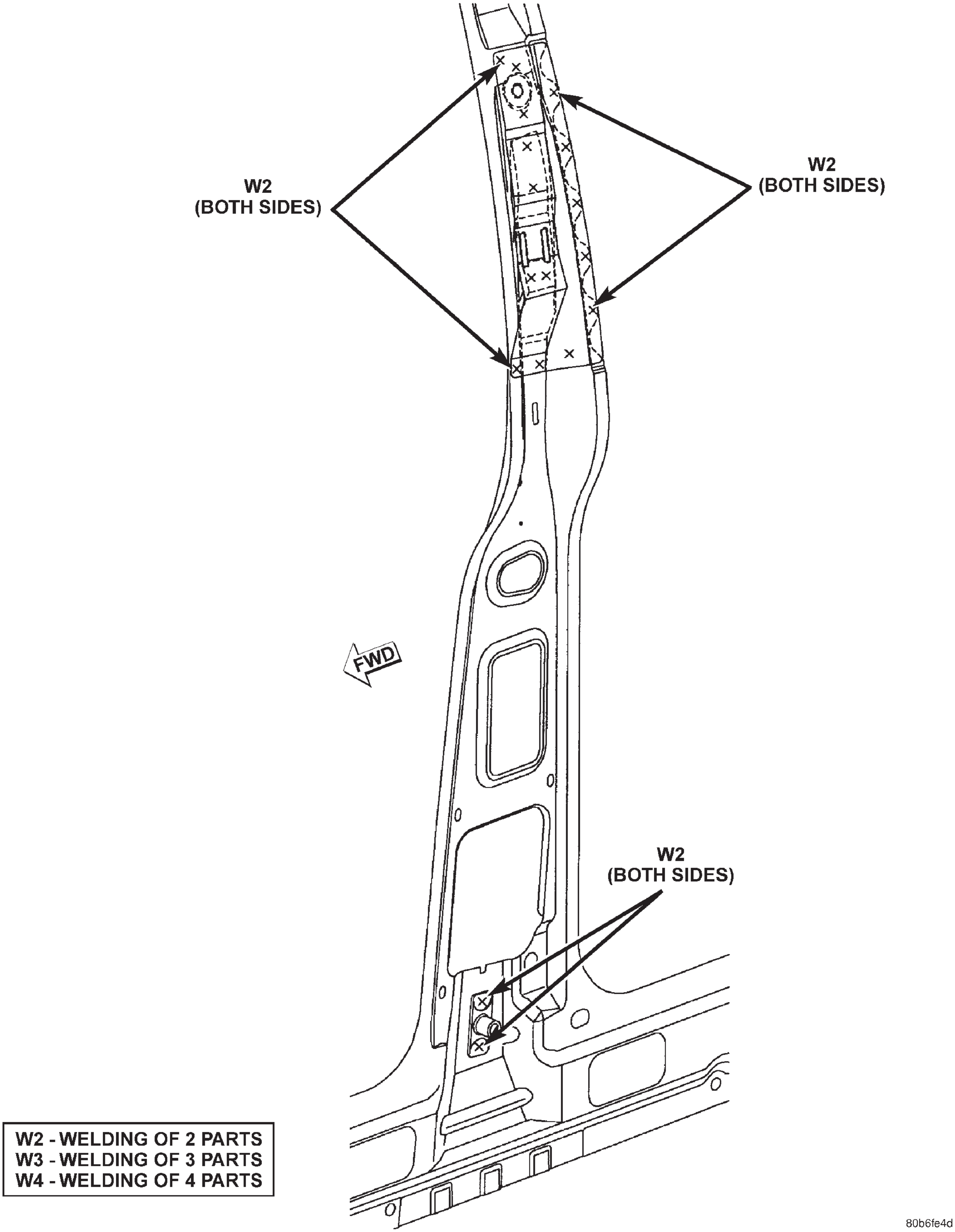
SPECIFICATIONS (Continued)

FRONT HEADER AND ROOF BOWS TO INNER PANEL



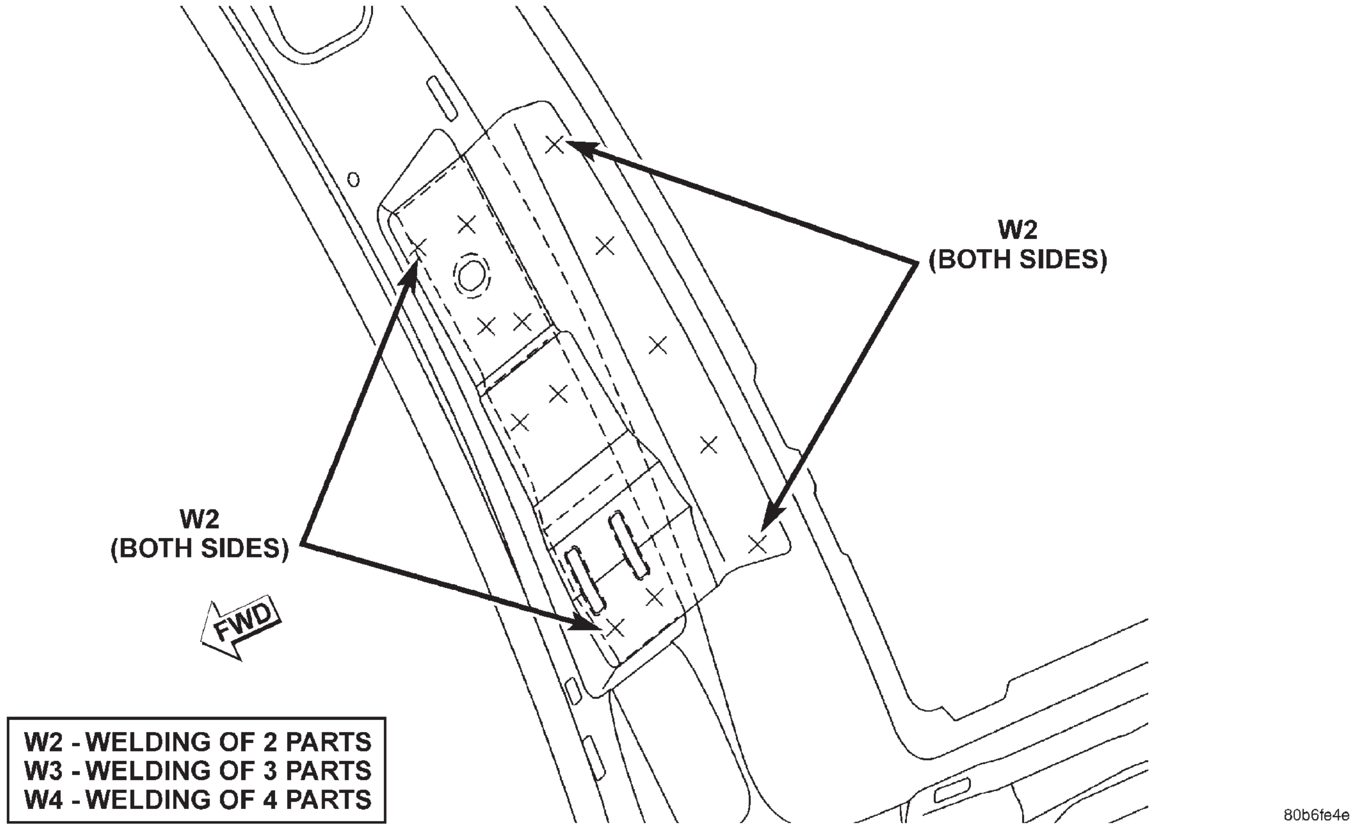
SPECIFICATIONS (Continued)

FRONT SEAT/SHOULDER BELT TO INNER PANEL REINFORCEMENT



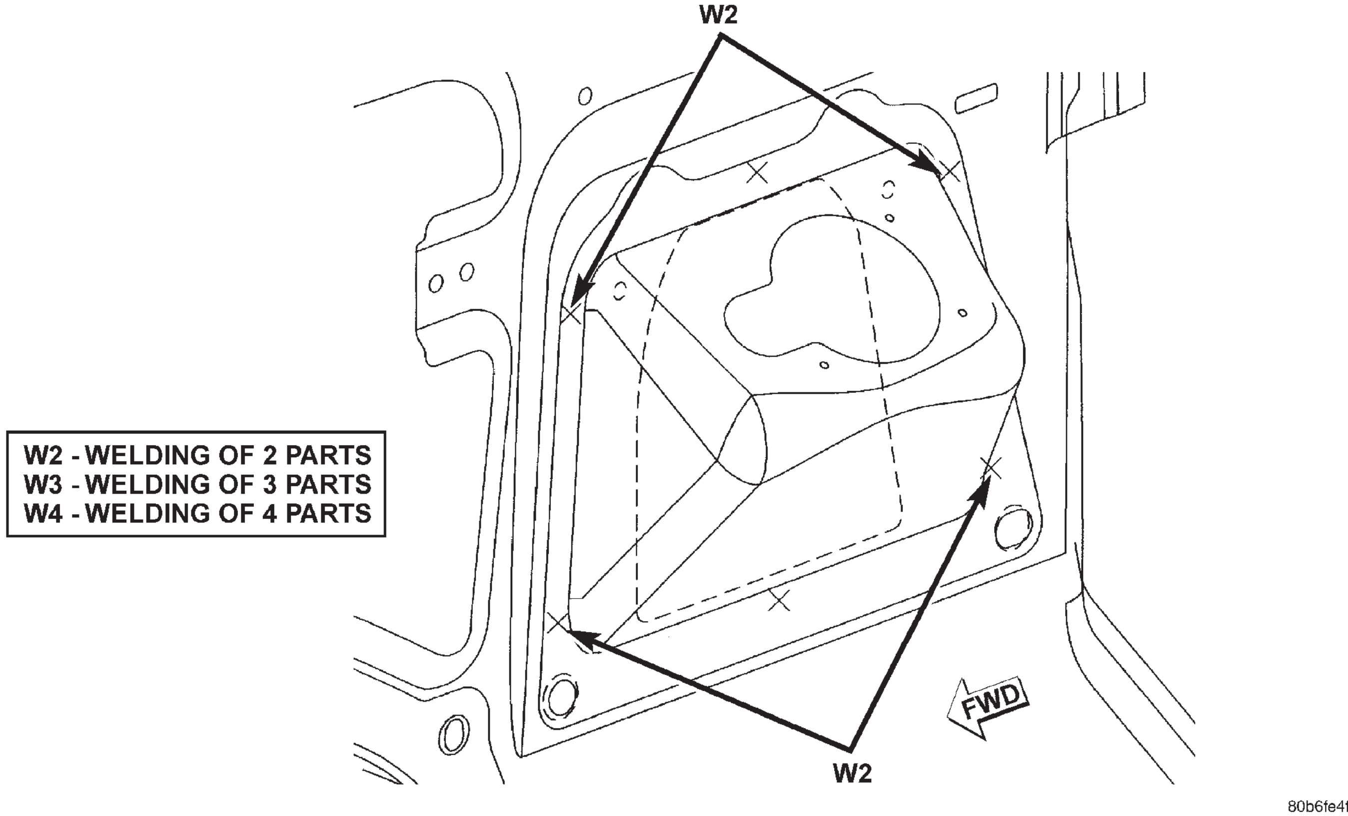
SPECIFICATIONS (Continued)

REAR SEAT/SHOULDER BELT TO INNER PANEL REINFORCEMENT



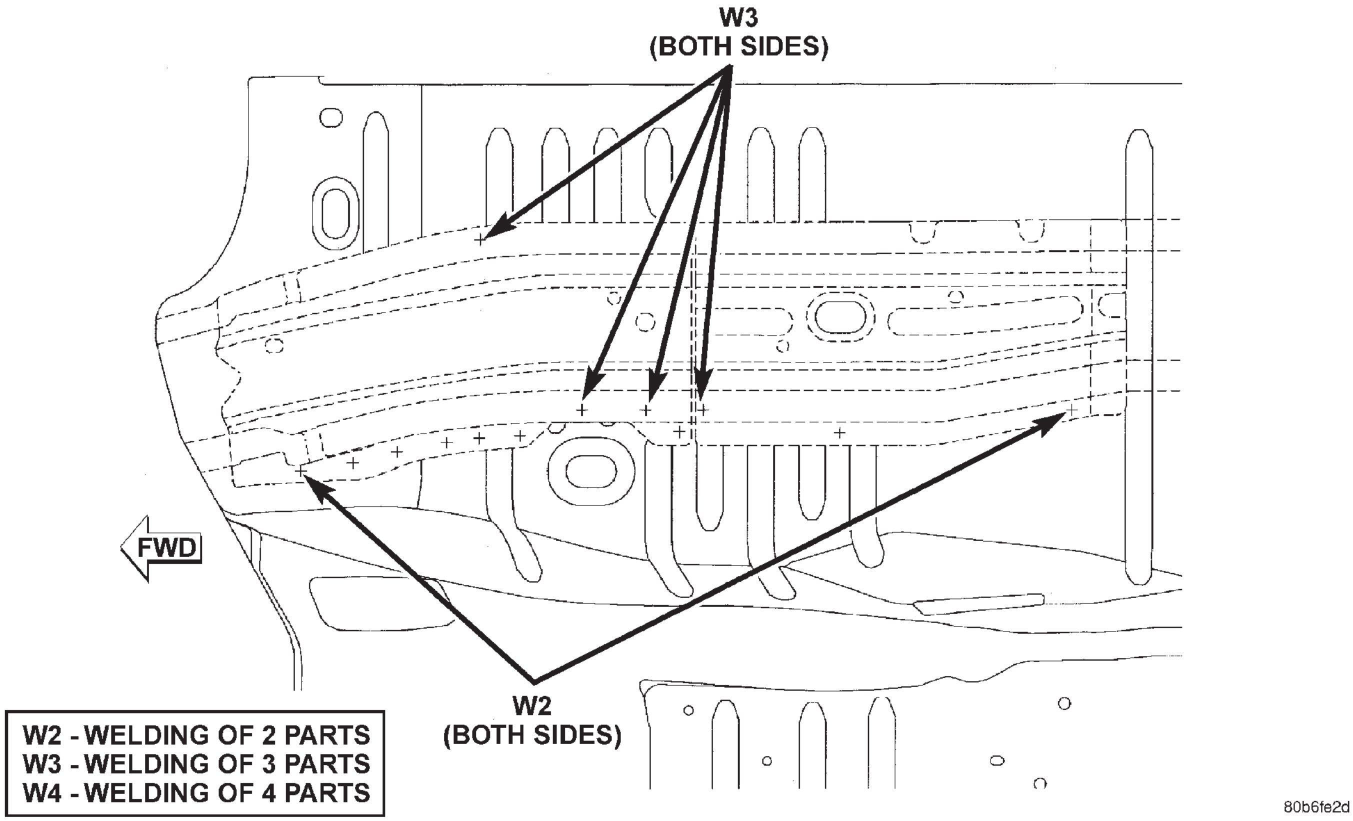
SPECIFICATIONS (Continued)

FUEL FILLER GUSSET TO INNER QUARTER PANEL



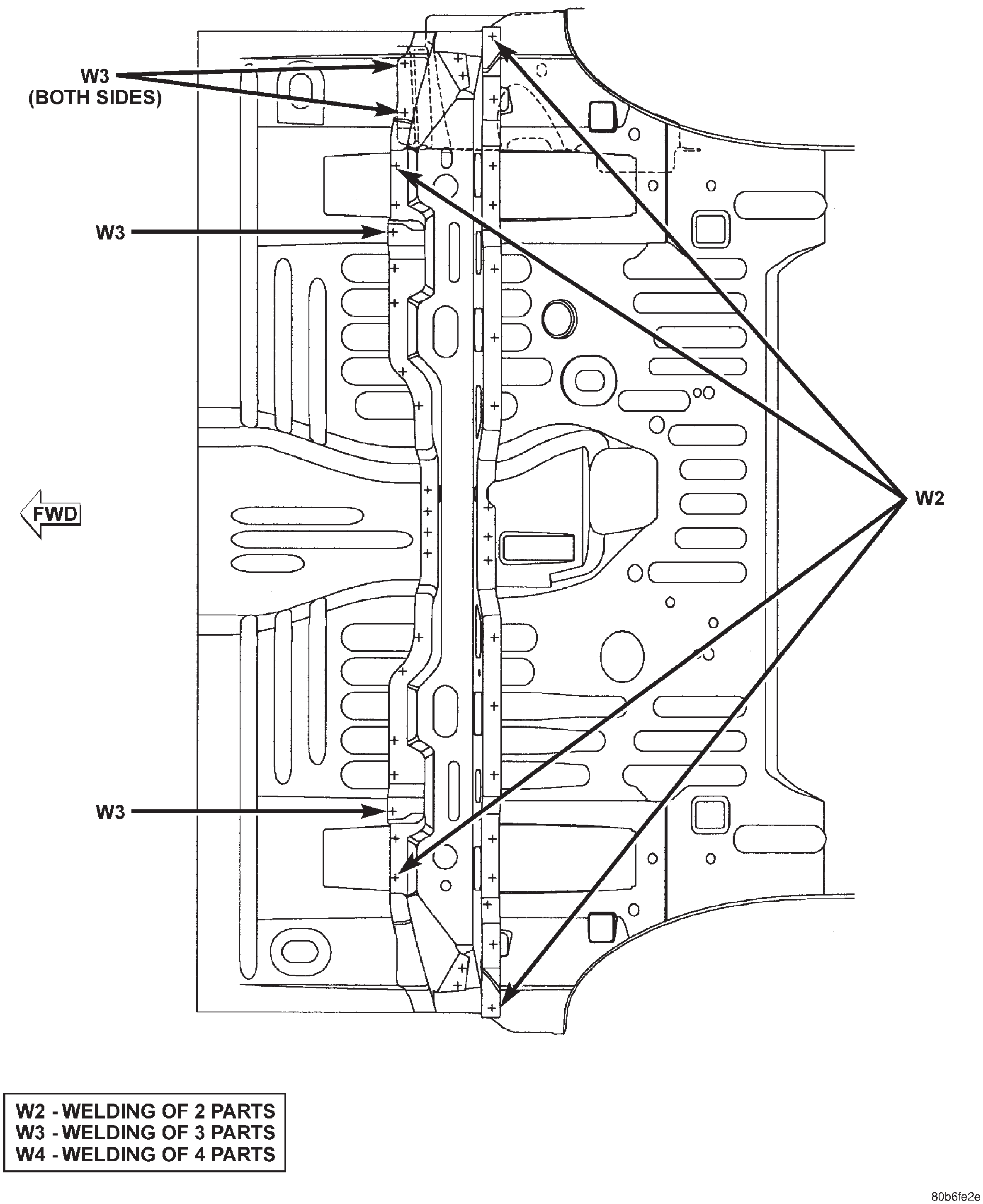
SPECIFICATIONS (Continued)

FRONT FLOOR PAN TO SILL REINFORCEMENT



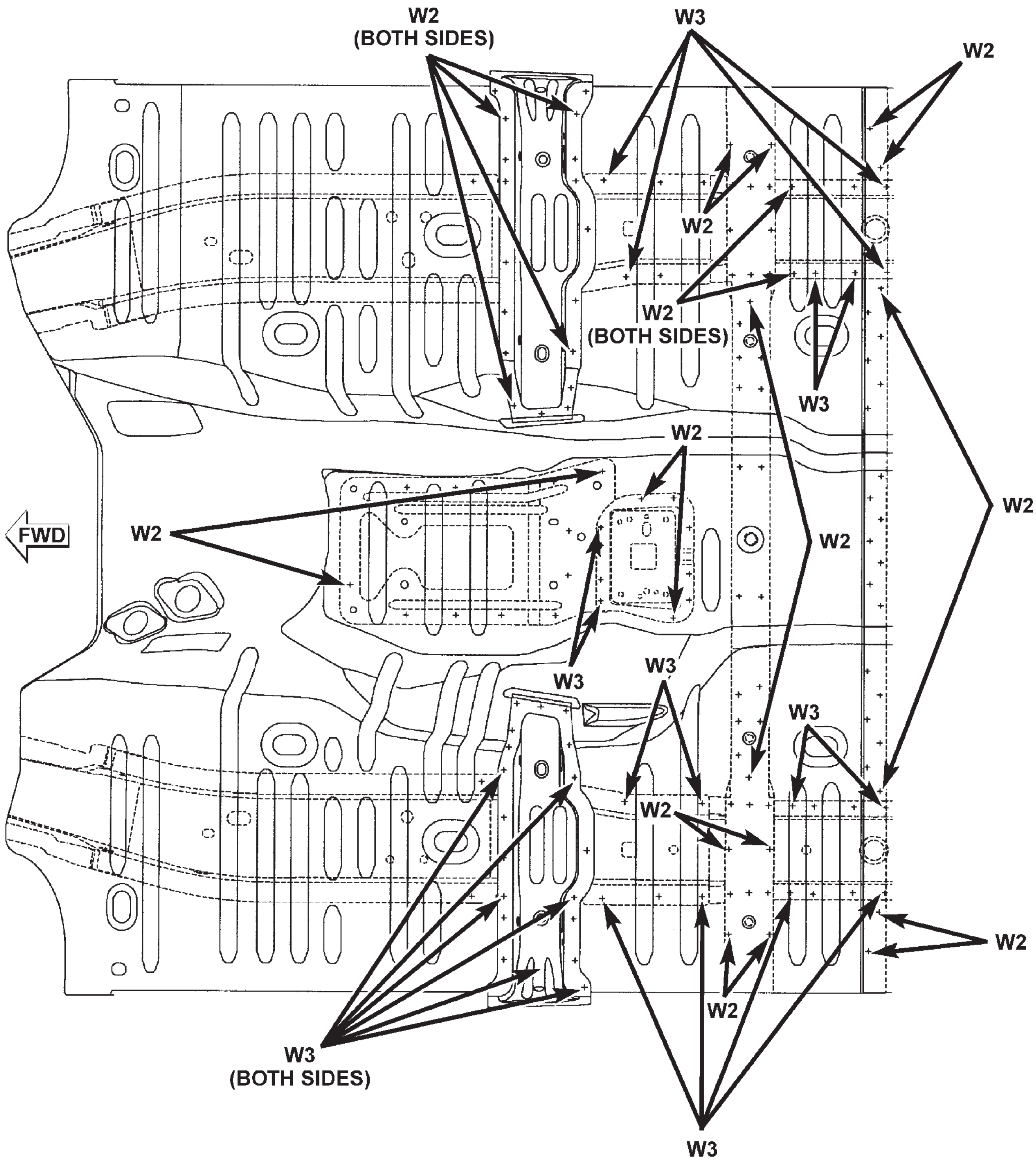
SPECIFICATIONS (Continued)

CENTER FLOOR PAN TO REAR SEAT CROSSMEMBER



SPECIFICATIONS (Continued)

FRONT FLOOR PAN TO FRONT SEAT REINFORCEMENT AND RAILS



W2 - WELDING OF 2 PARTS
W3 - WELDING OF 3 PARTS
W4 - WELDING OF 4 PARTS

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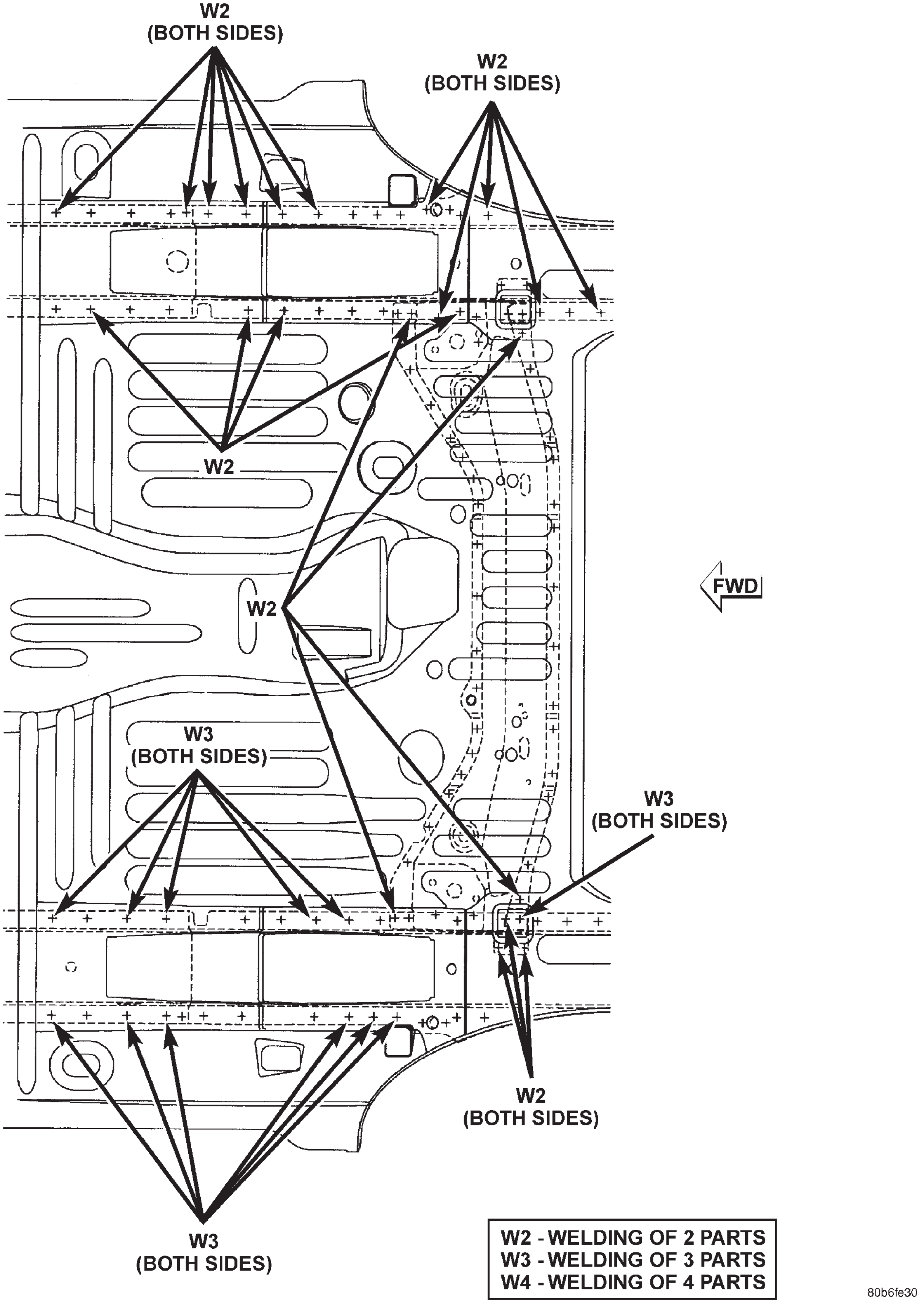
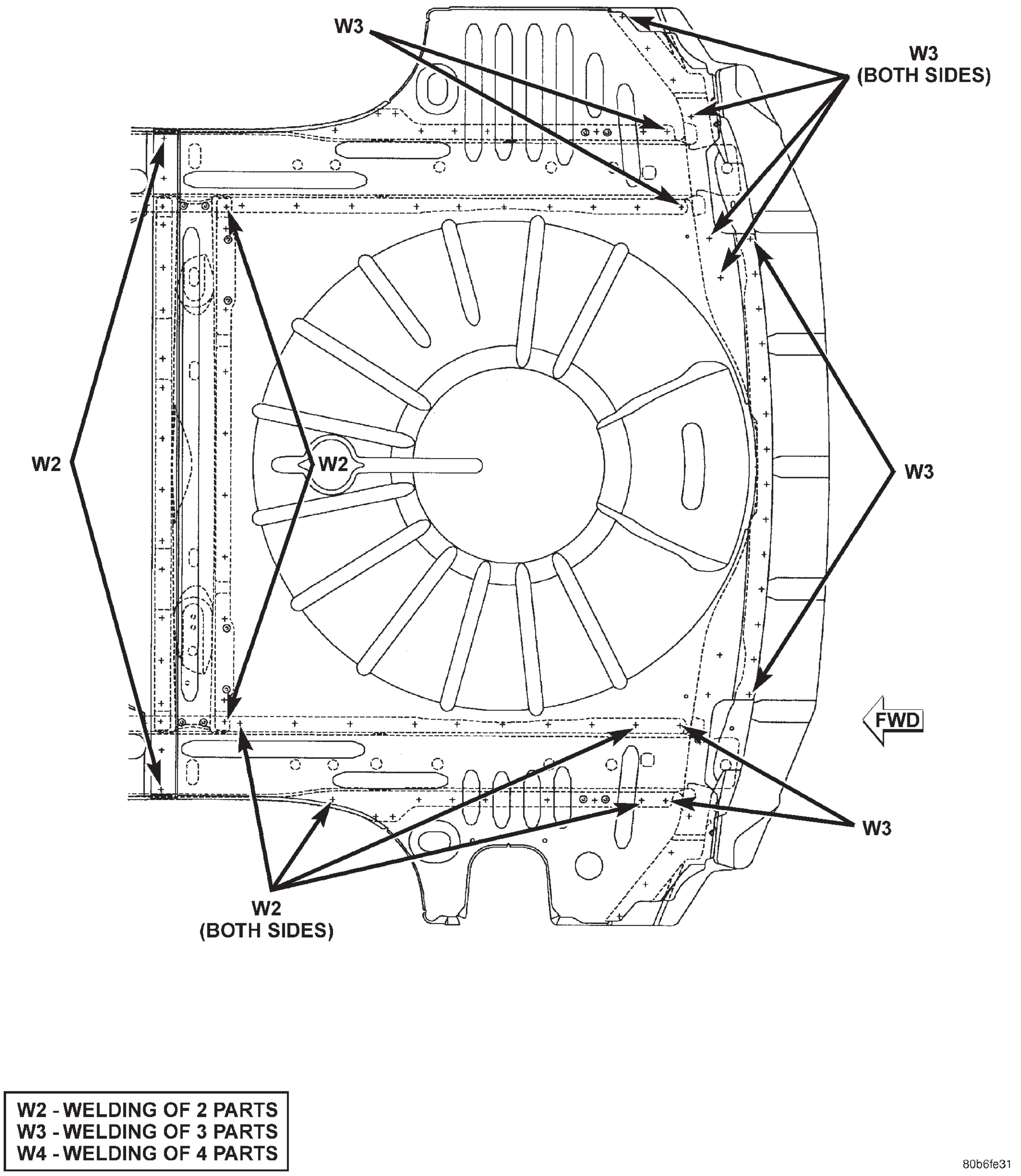
SPECIFICATIONS (Continued)

CENTER FLOOR PAN TO UPPER CONTROL ARM CROSSMEMBER AND RAILS



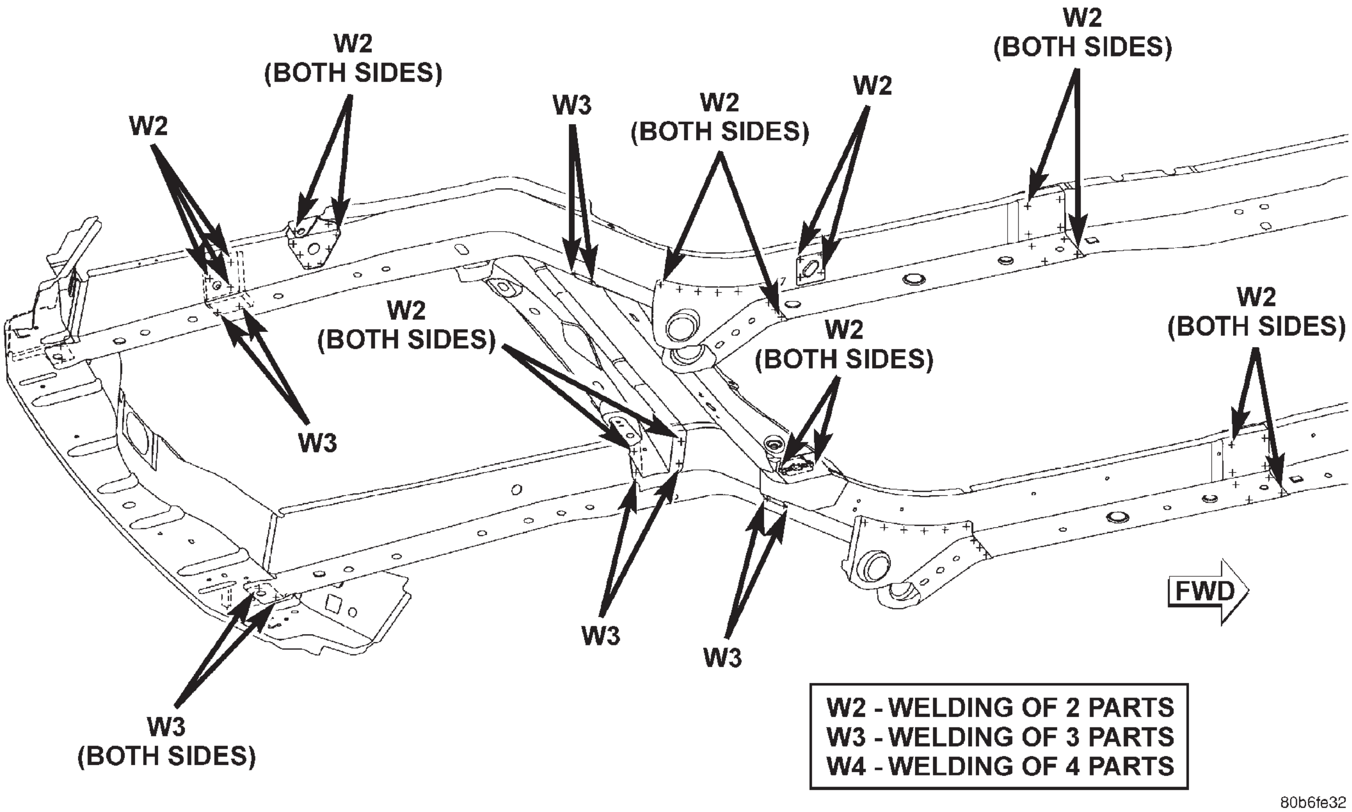
SPECIFICATIONS (Continued)

REAR FLOOR PAN TO RAILS AND SPRING GUIDE CROSSMEMBER



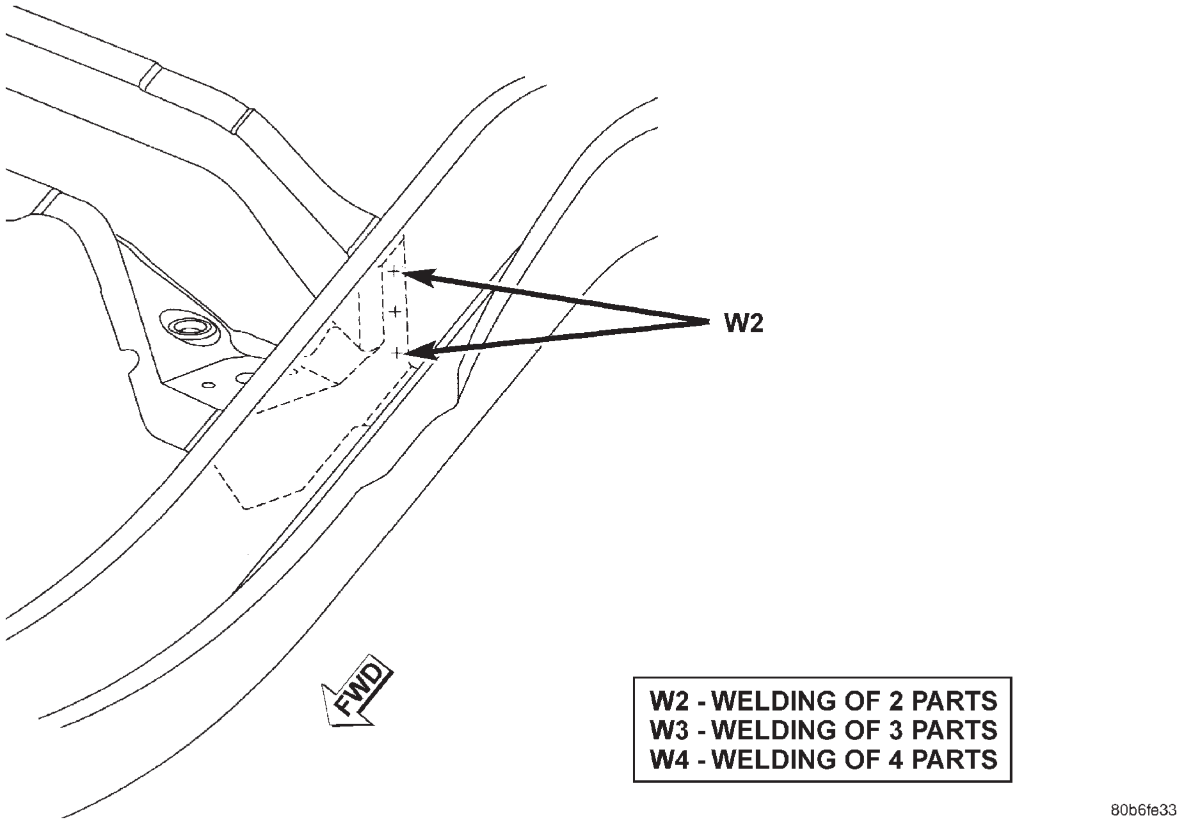
SPECIFICATIONS (Continued)

REAR RAILS



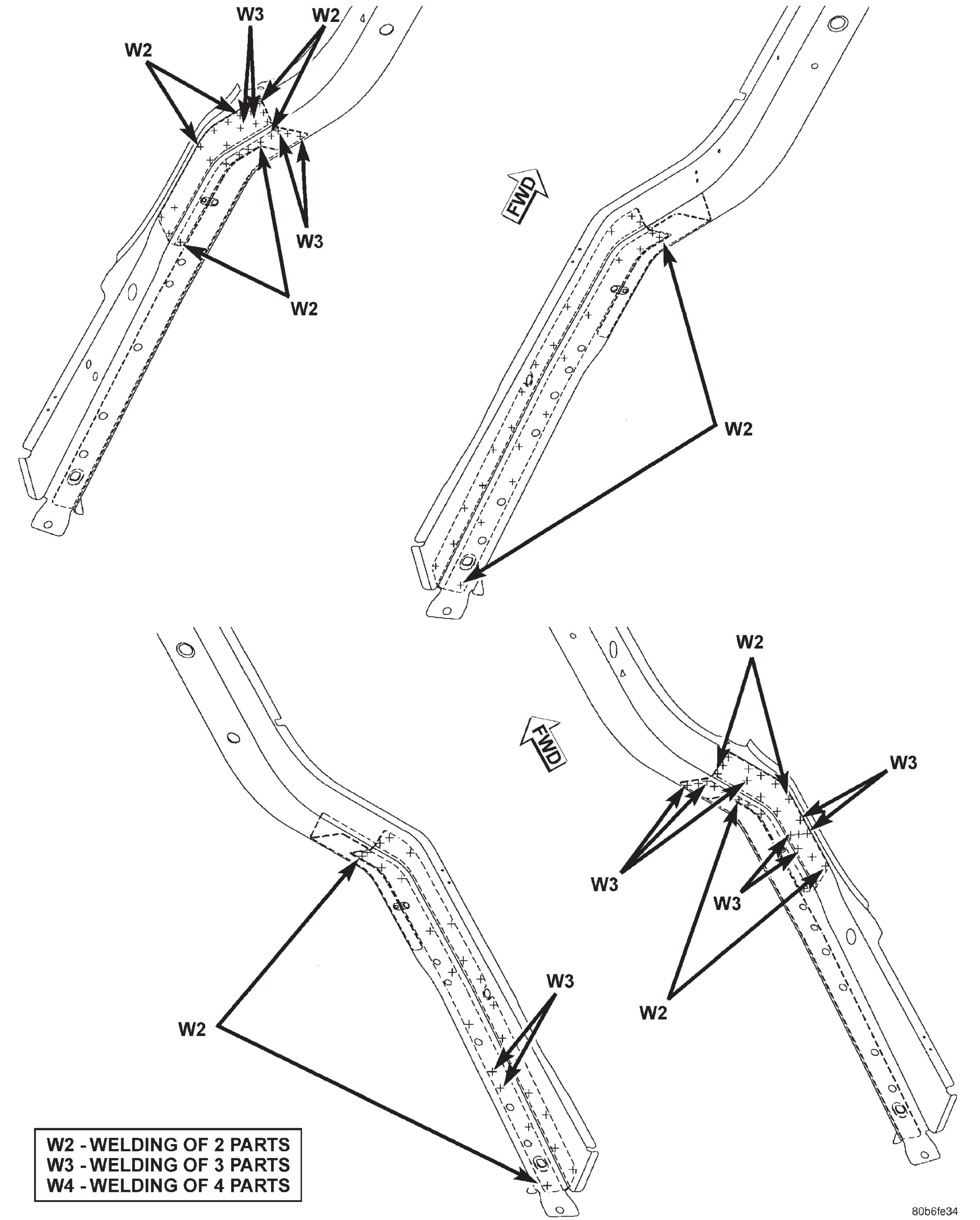
SPECIFICATIONS (Continued)

UPPER CONTROL ARM CROSSMEMBER TO REAR RAIL



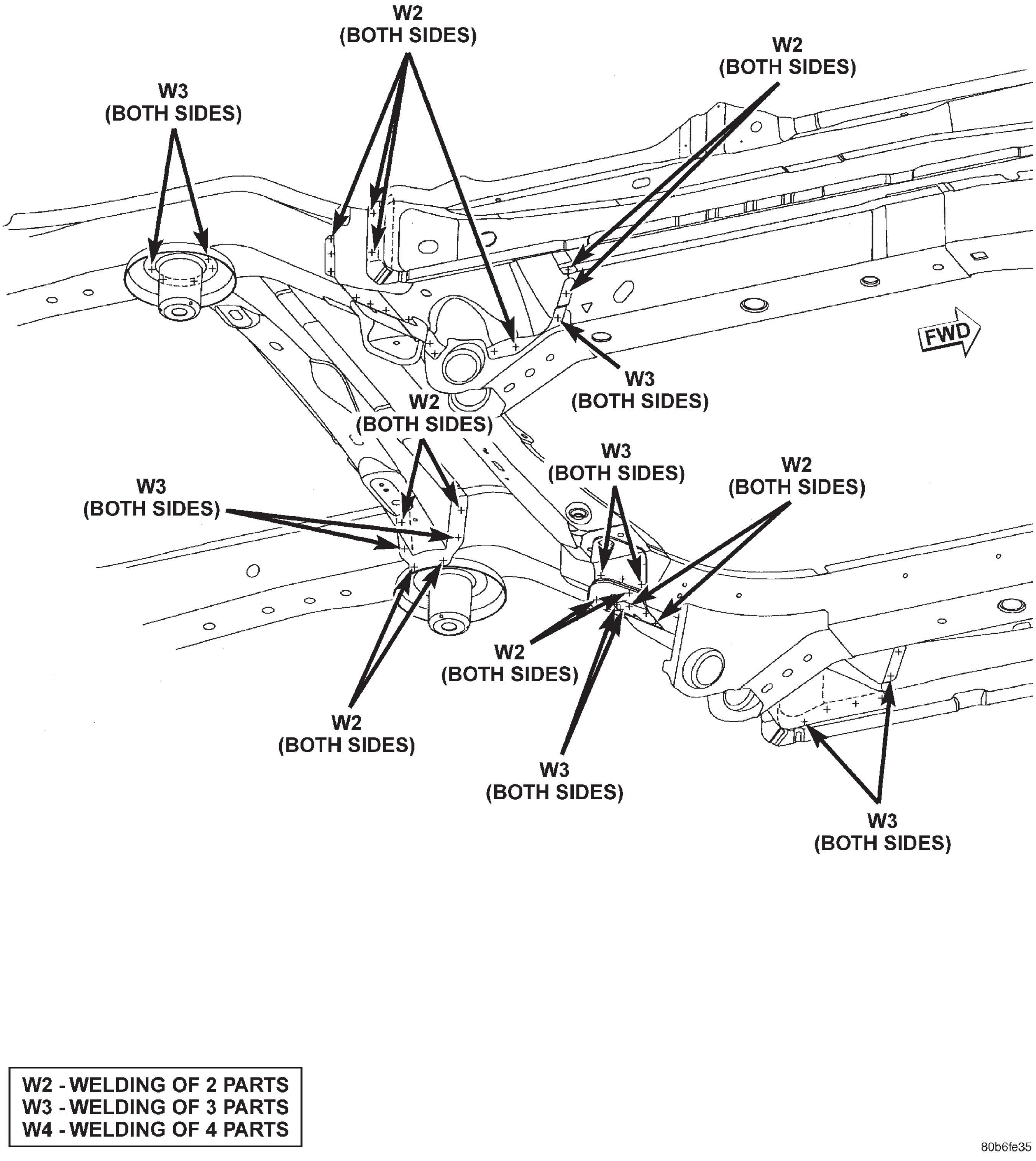
SPECIFICATIONS (Continued)

REAR RAIL REINFORCEMENT TO REAR RAILS



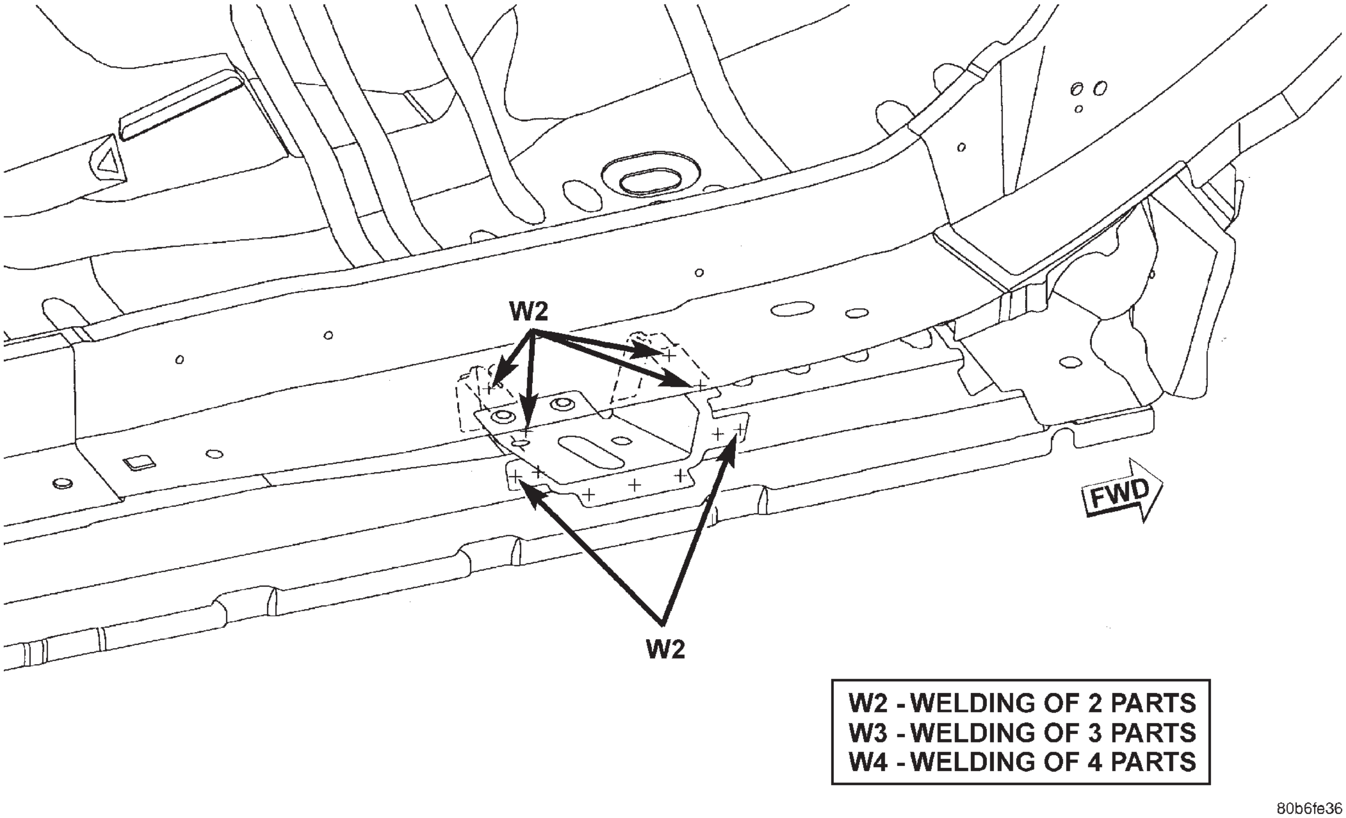
SPECIFICATIONS (Continued)

UPPER CONTROL ARM REINFORCEMENTS TO REAR RAIL



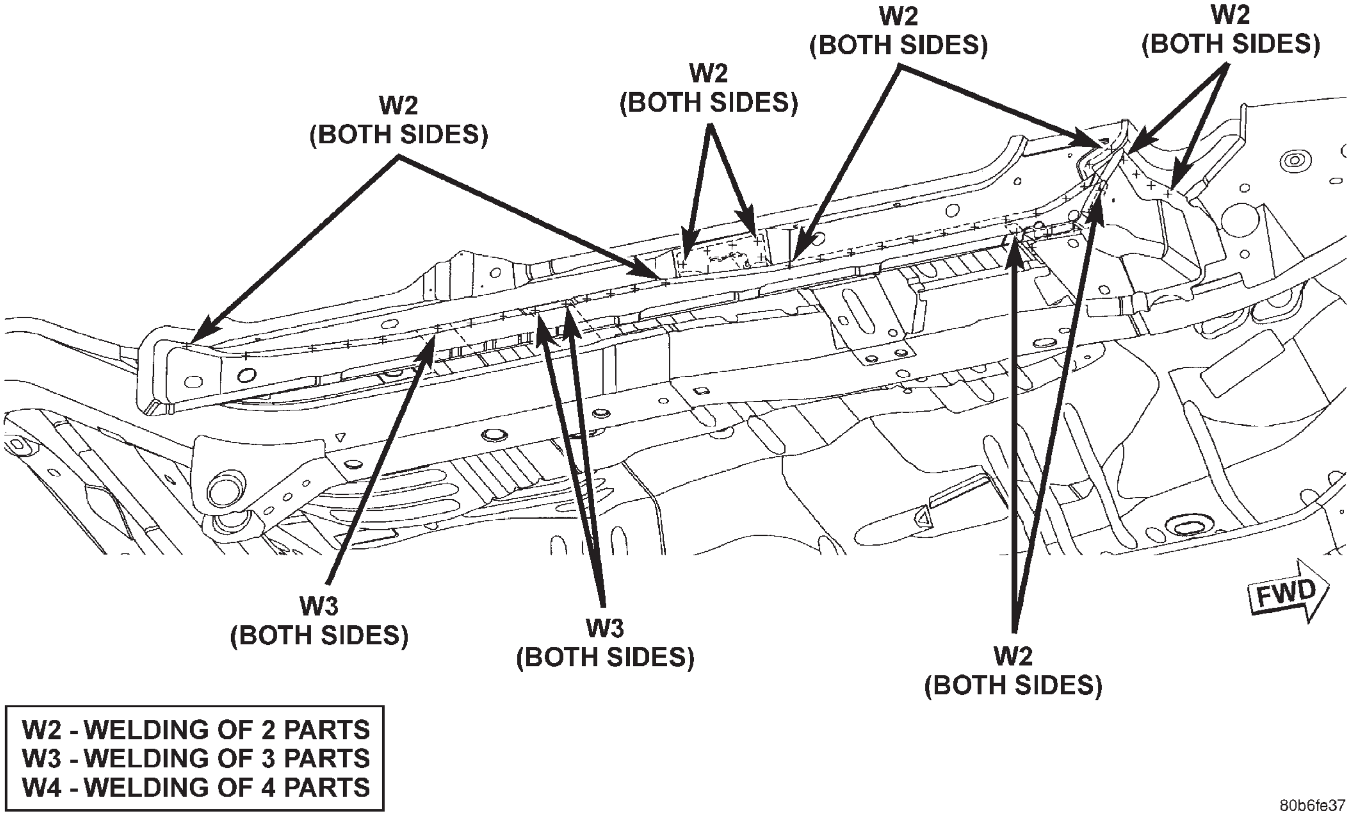
SPECIFICATIONS (Continued)

OUTER TRANSMISSION CROSSMEMBER REINFORCEMENT TO RAIL AND BODYSIDE SILL



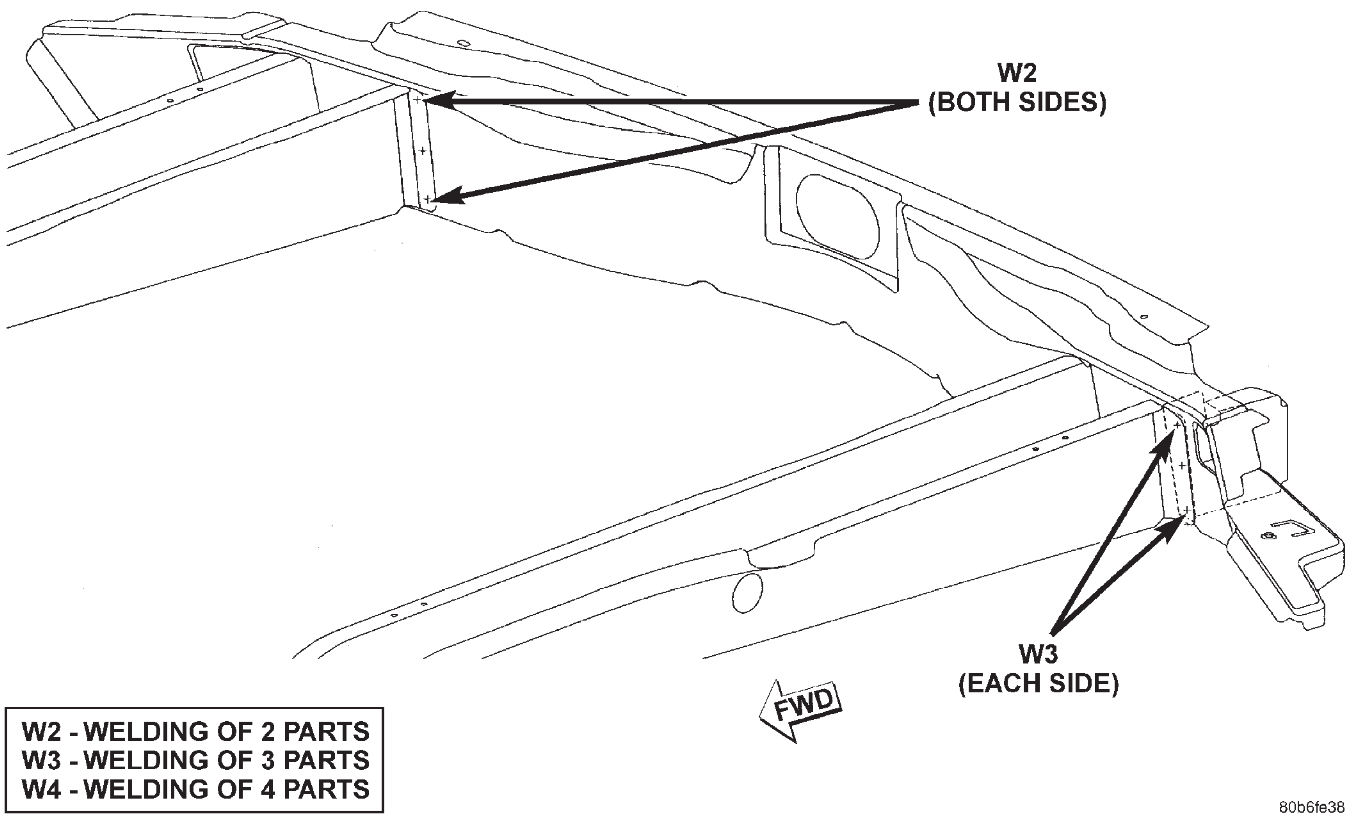
SPECIFICATIONS (Continued)

BODYSIDE SILL TO FLOOR PAN



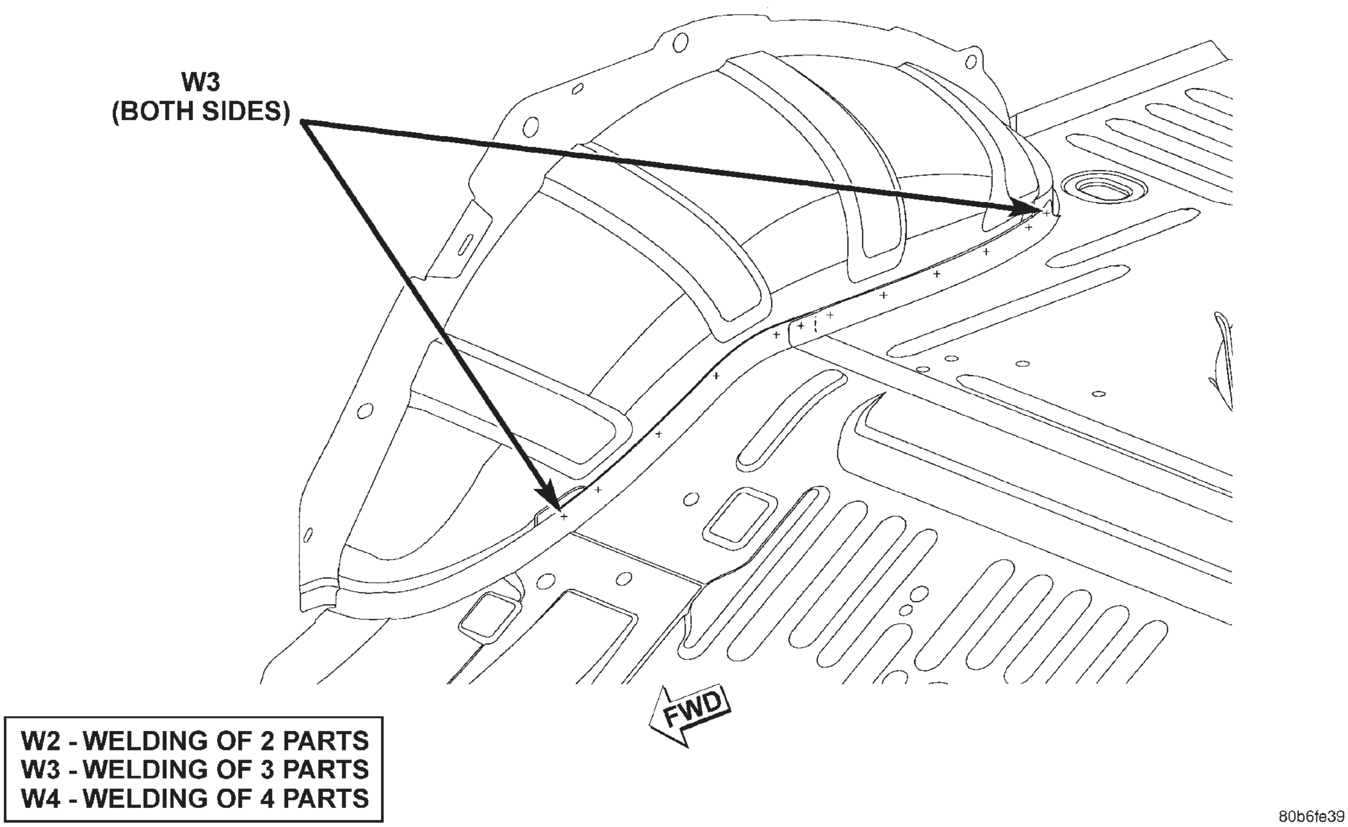
SPECIFICATIONS (Continued)

REAR RAILS TO REAR CROSSMEMBER



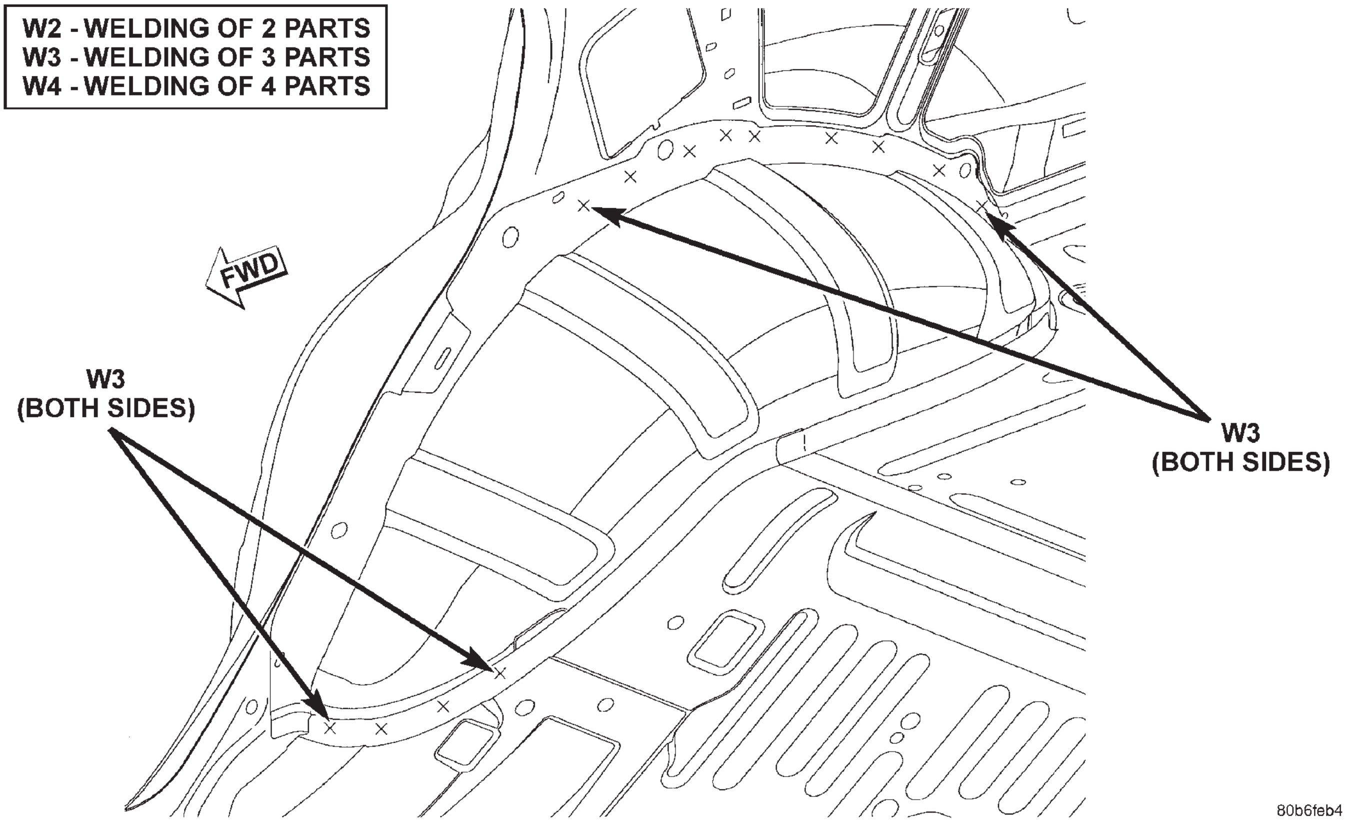
SPECIFICATIONS (Continued)

INNER WHEELHOUSE TO FLOOR PAN



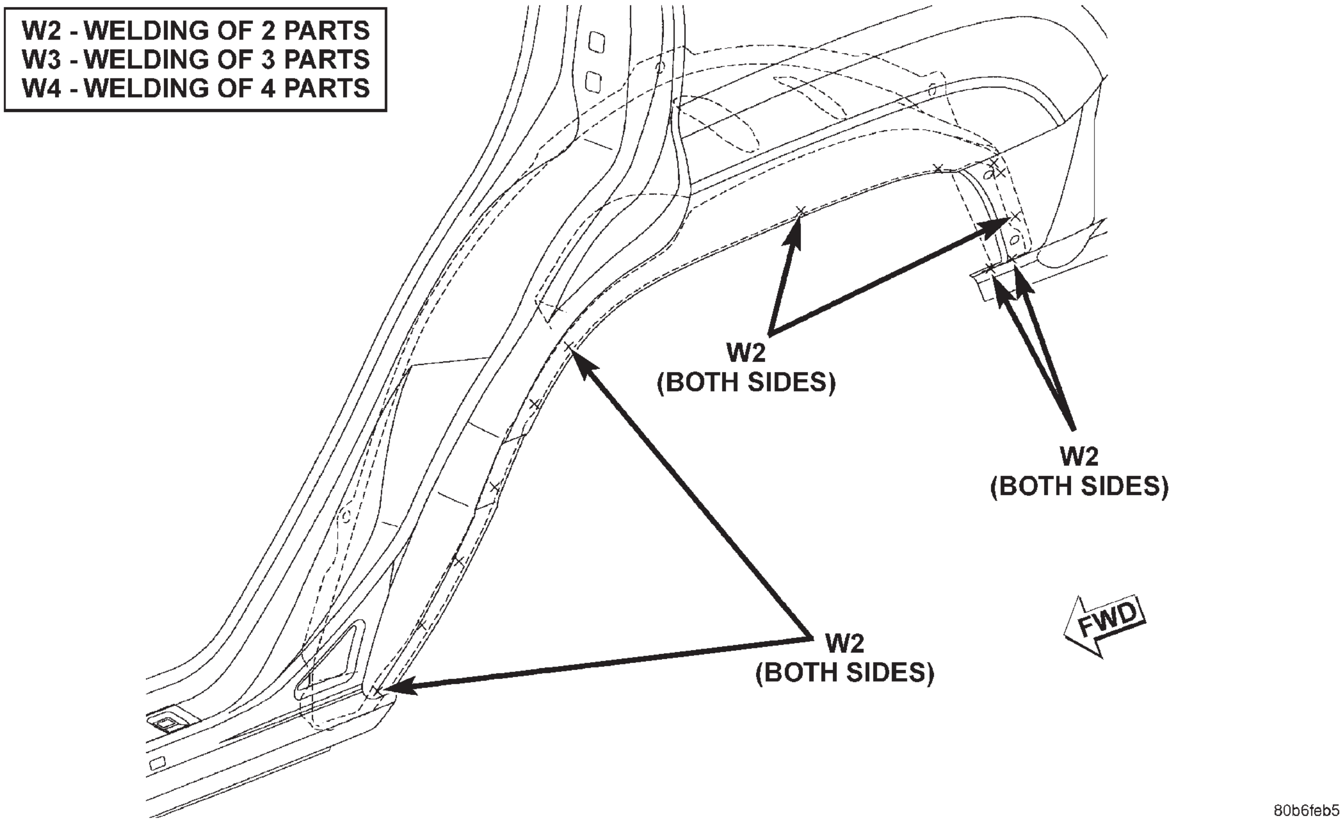
SPECIFICATIONS (Continued)

INNER WHEELHOUSE TO INNER BODYSIDE APERTURE AND FLOOR PAN



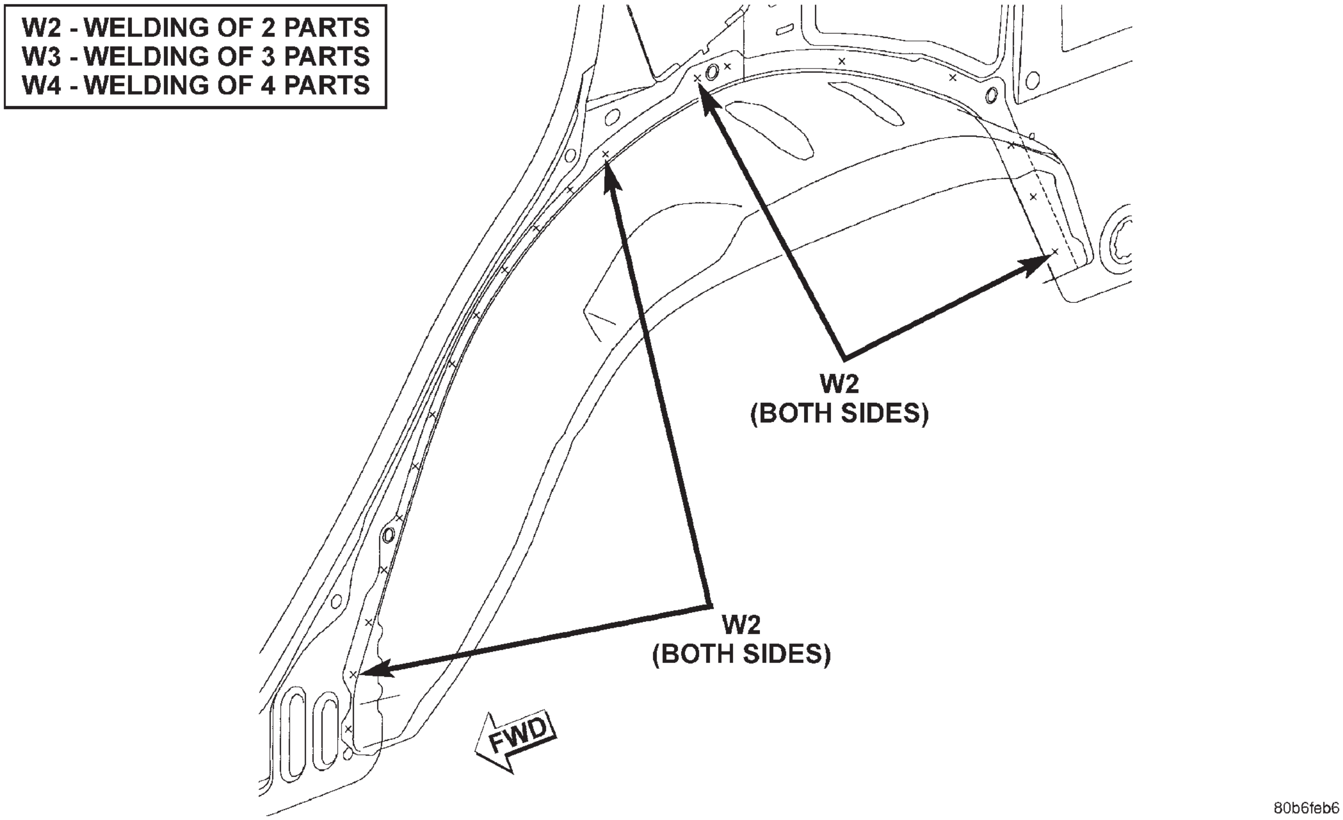
SPECIFICATIONS (Continued)

OUTER WHEELHOUSE TO OUTER BODYSIDE APERTURE



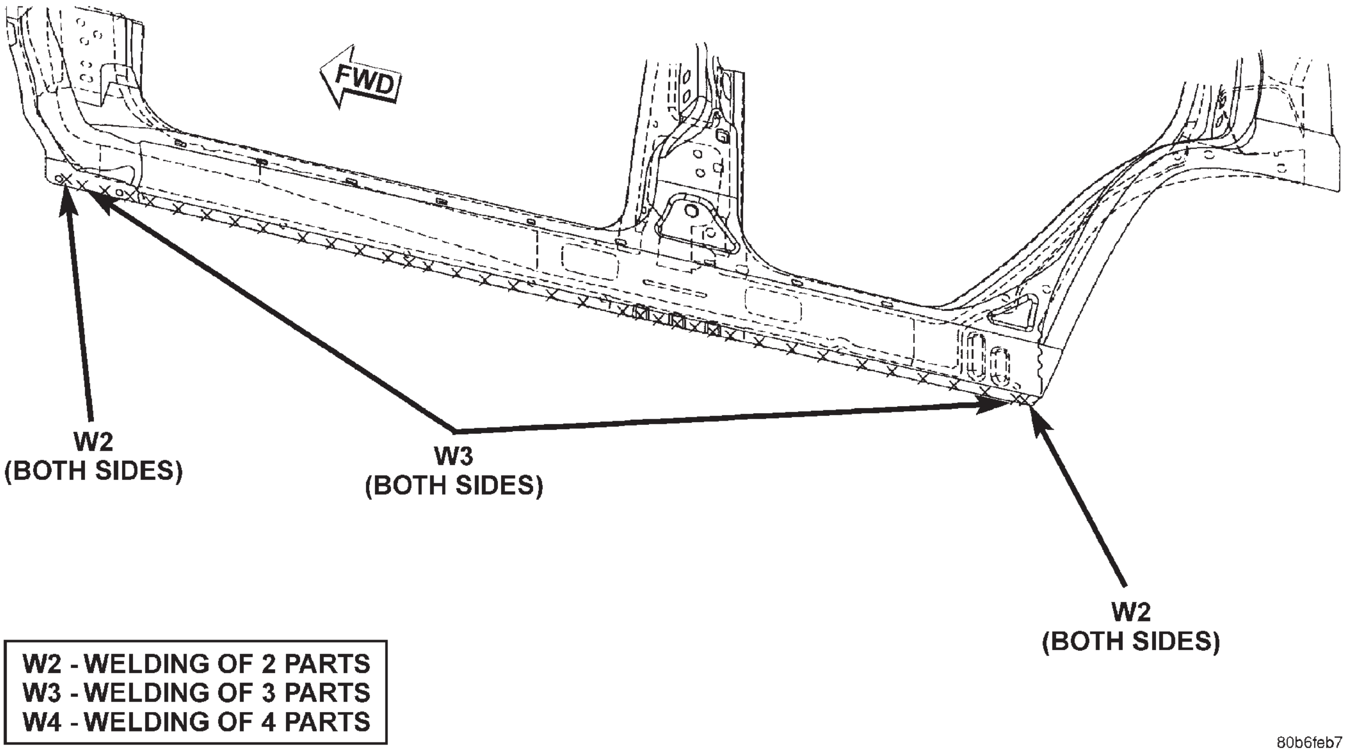
SPECIFICATIONS (Continued)

OUTER WHEELHOUSE TO INNER BODYSIDE APERTURE



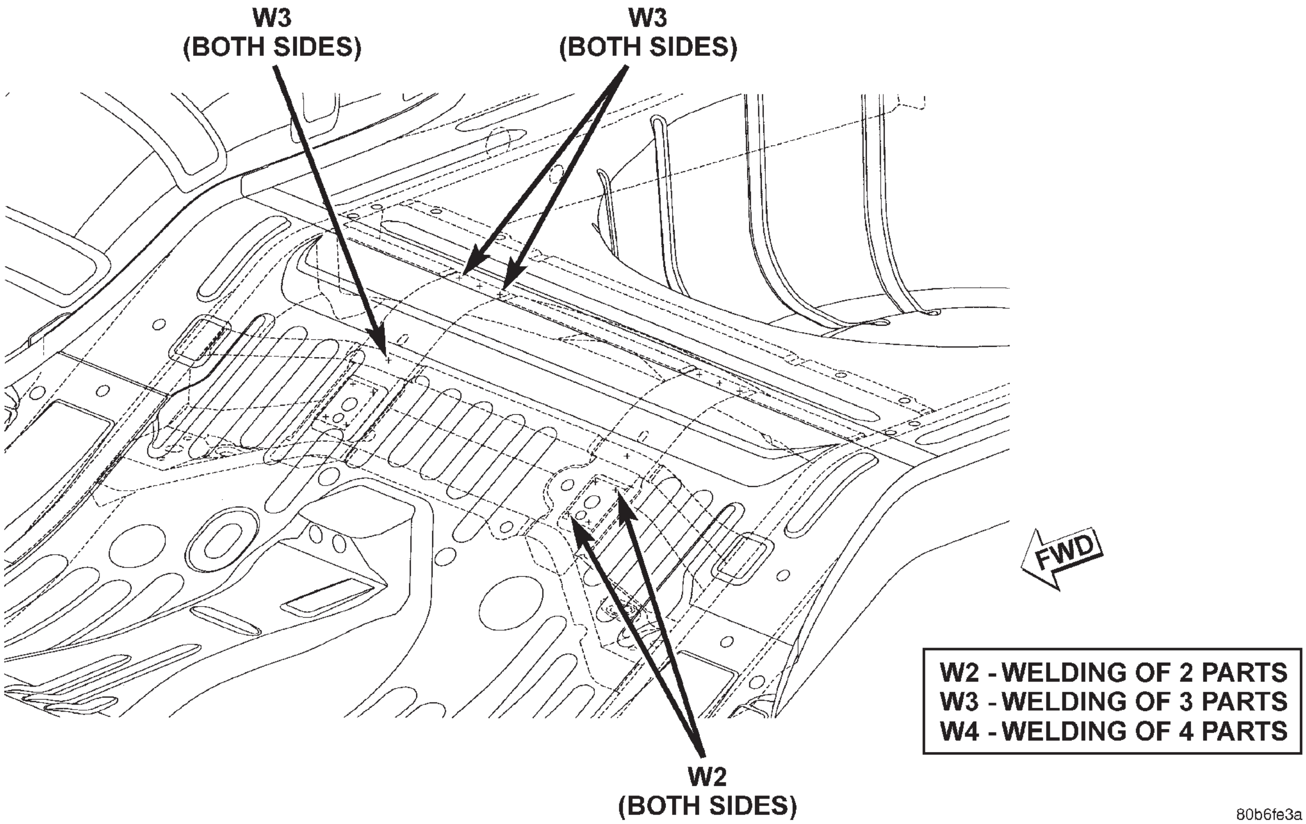
SPECIFICATIONS (Continued)

INNER BODYSIDE APERTURE TO OUTER BODYSIDE APERTURE



SPECIFICATIONS (Continued)

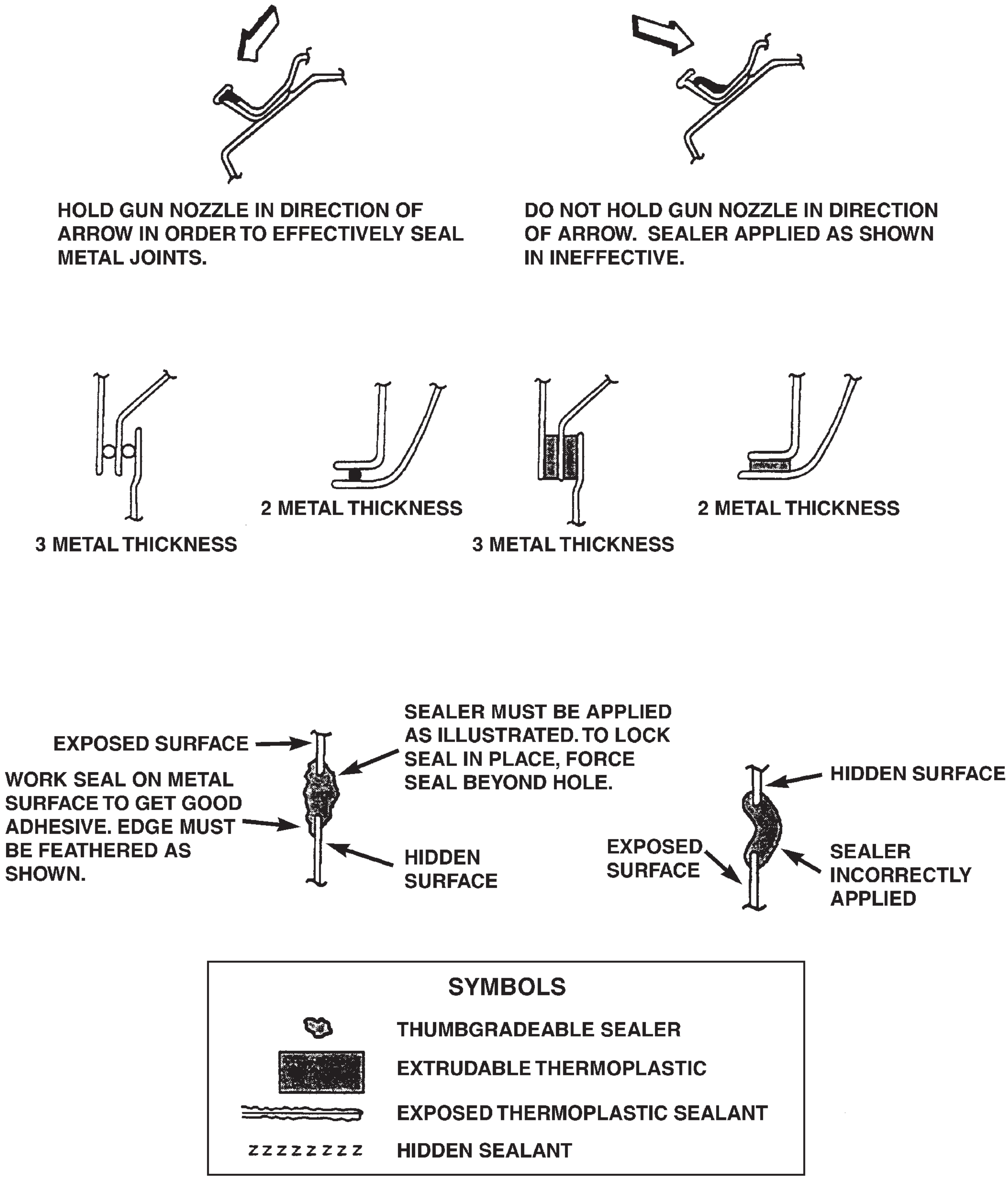
REAR INBOARD SEAT BELT REINFORCEMENT TO FLOOR PAN



SPECIFICATIONS (Continued)

SEALER LOCATIONS

APPLICATION METHODS



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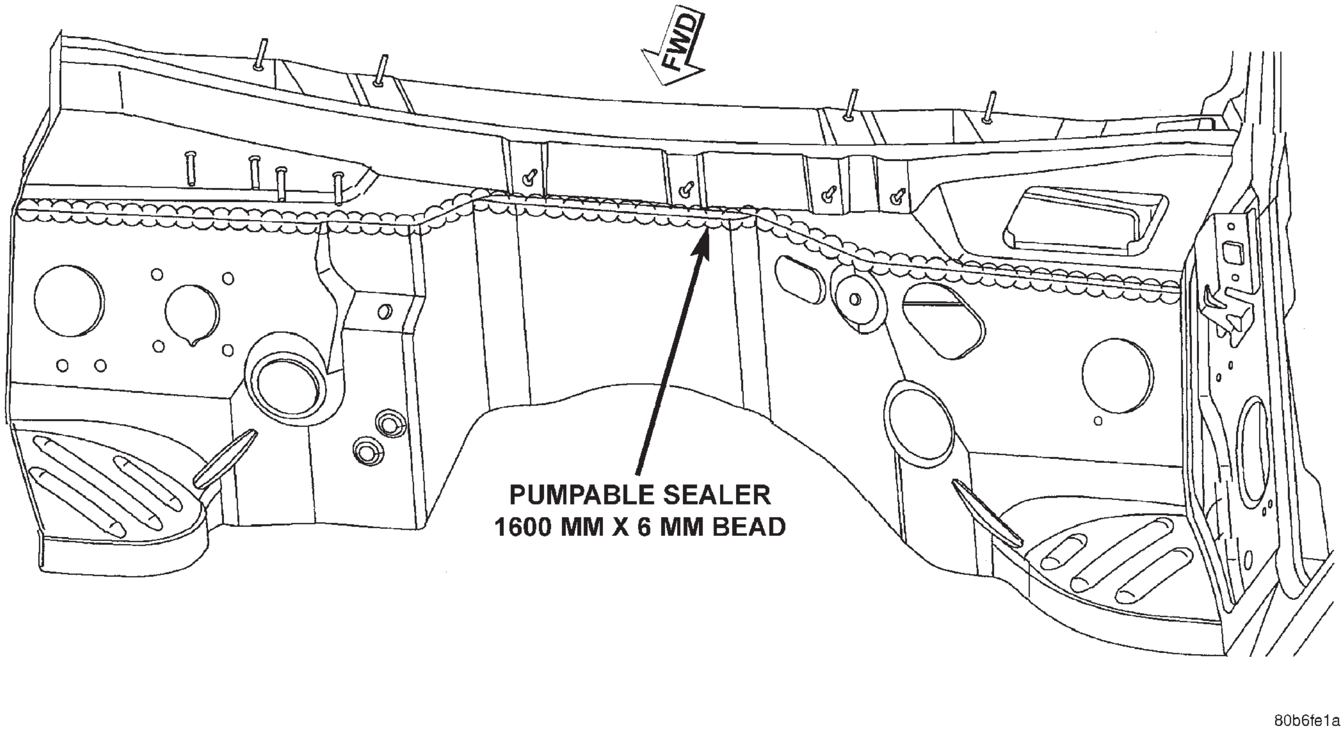
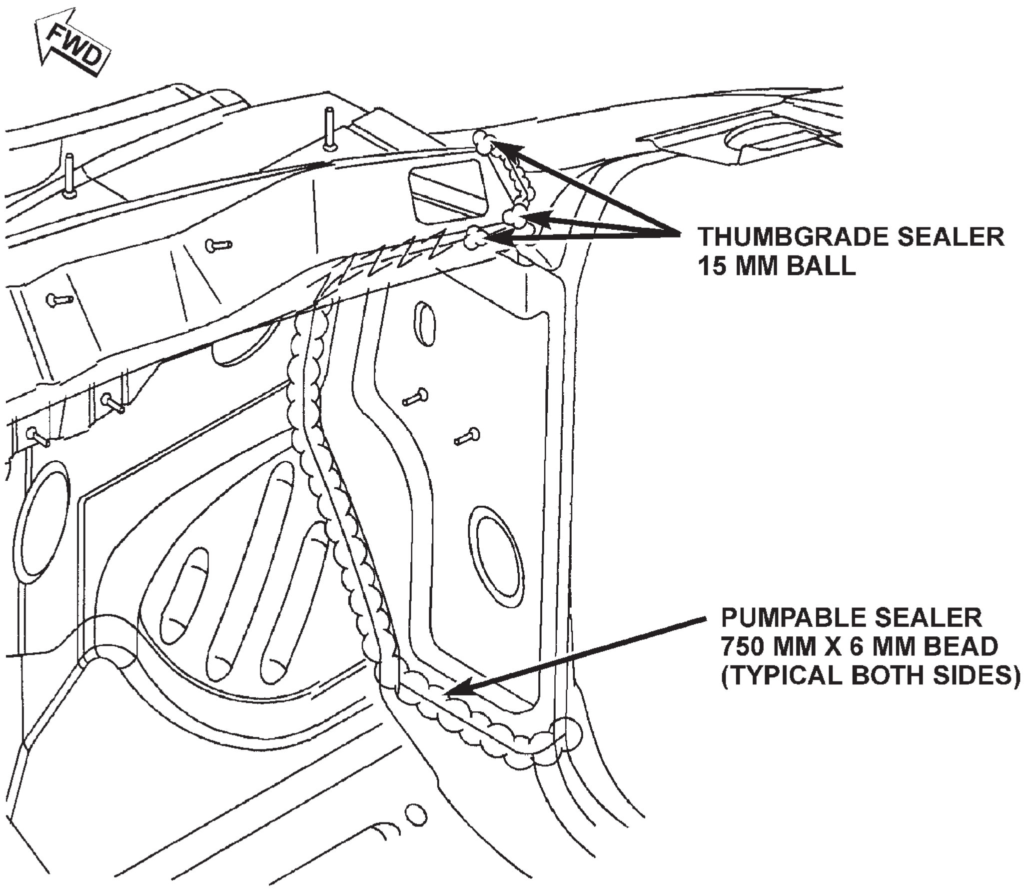
SPECIFICATIONS (Continued)

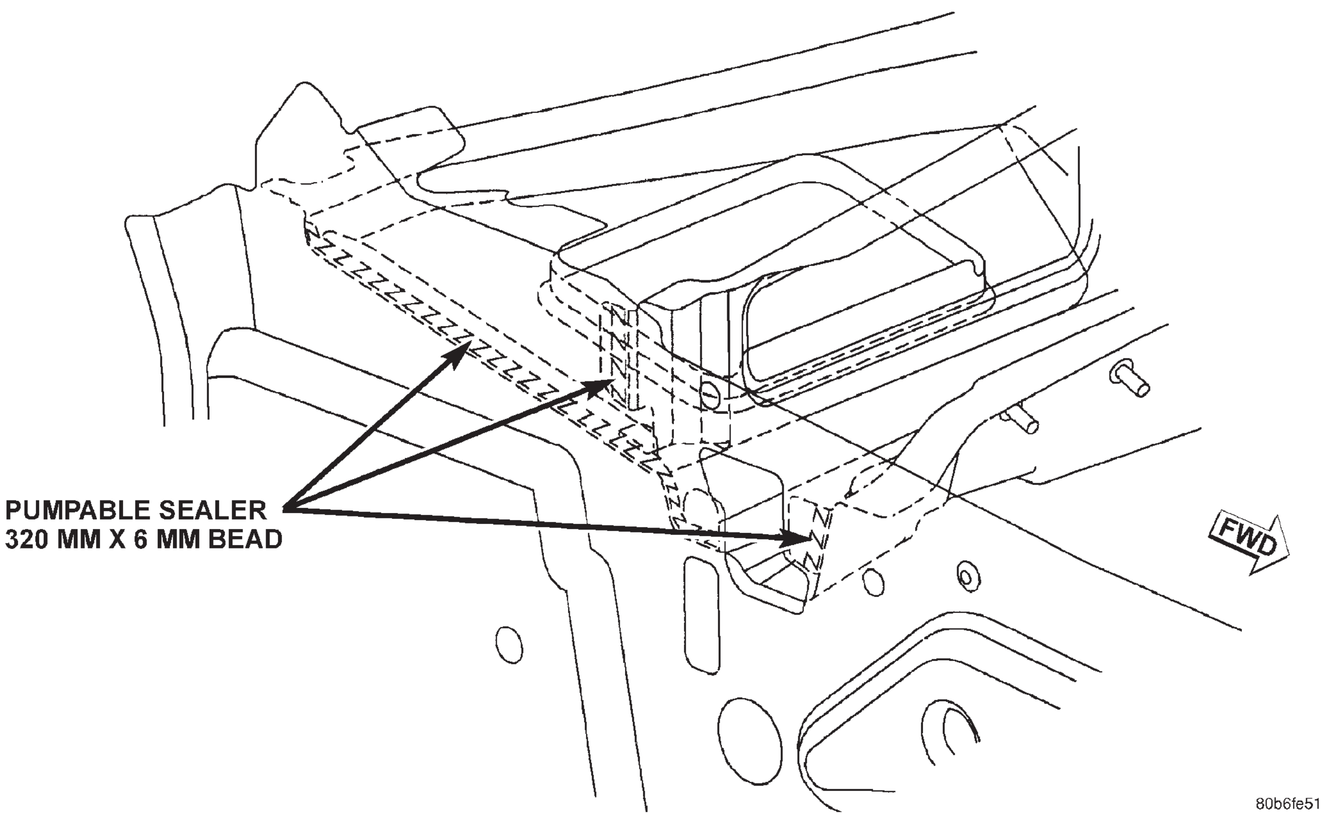
COWL PLENUM AND DASH PANEL



SPECIFICATIONS (Continued)

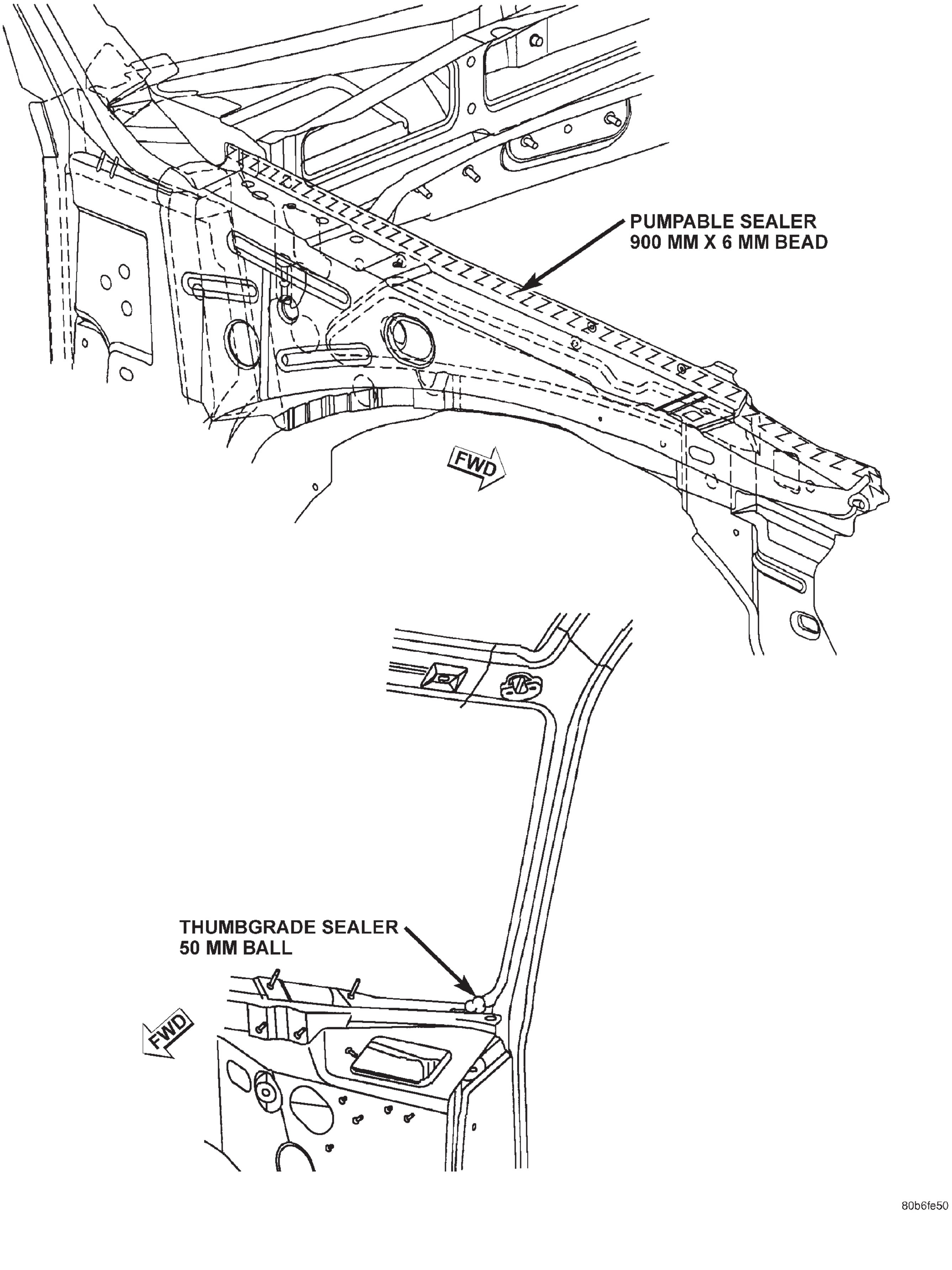
DASH, COWL AND PLENUM





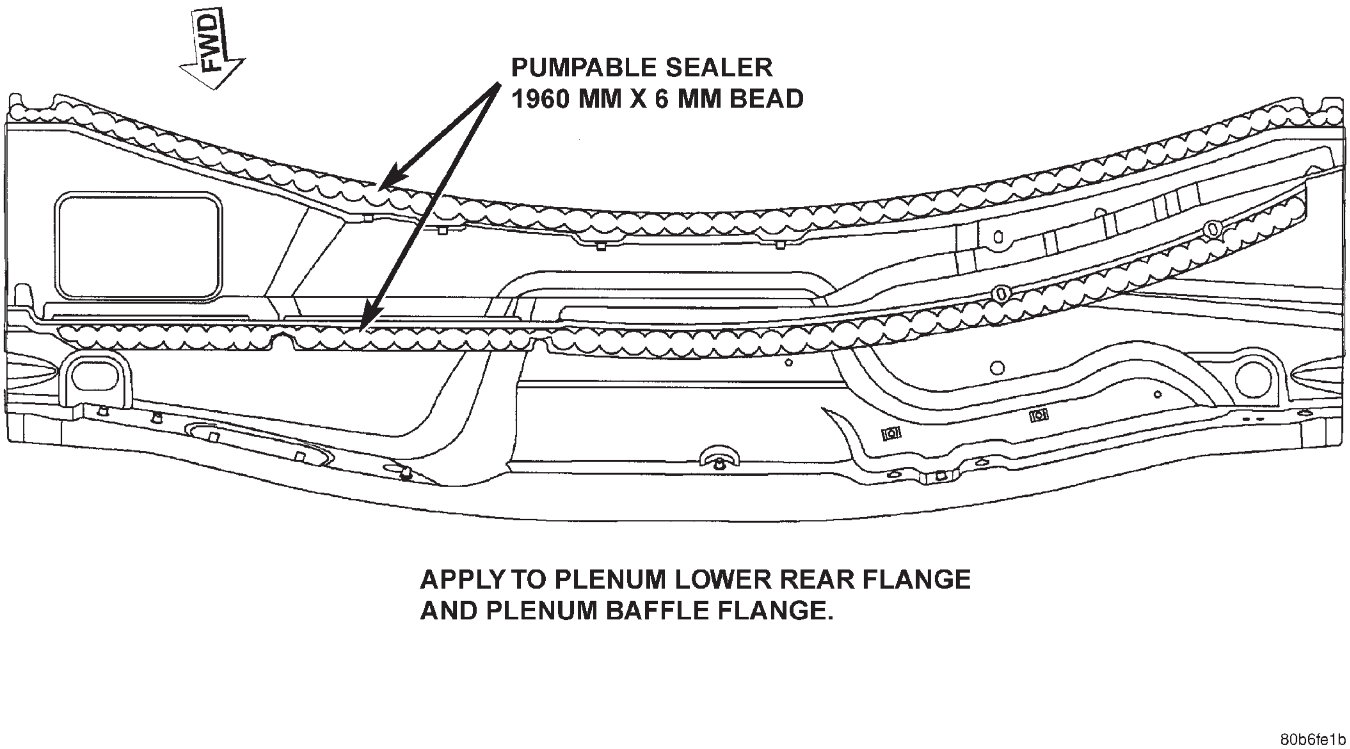
SPECIFICATIONS (Continued)

INNER FENDER AND COWL



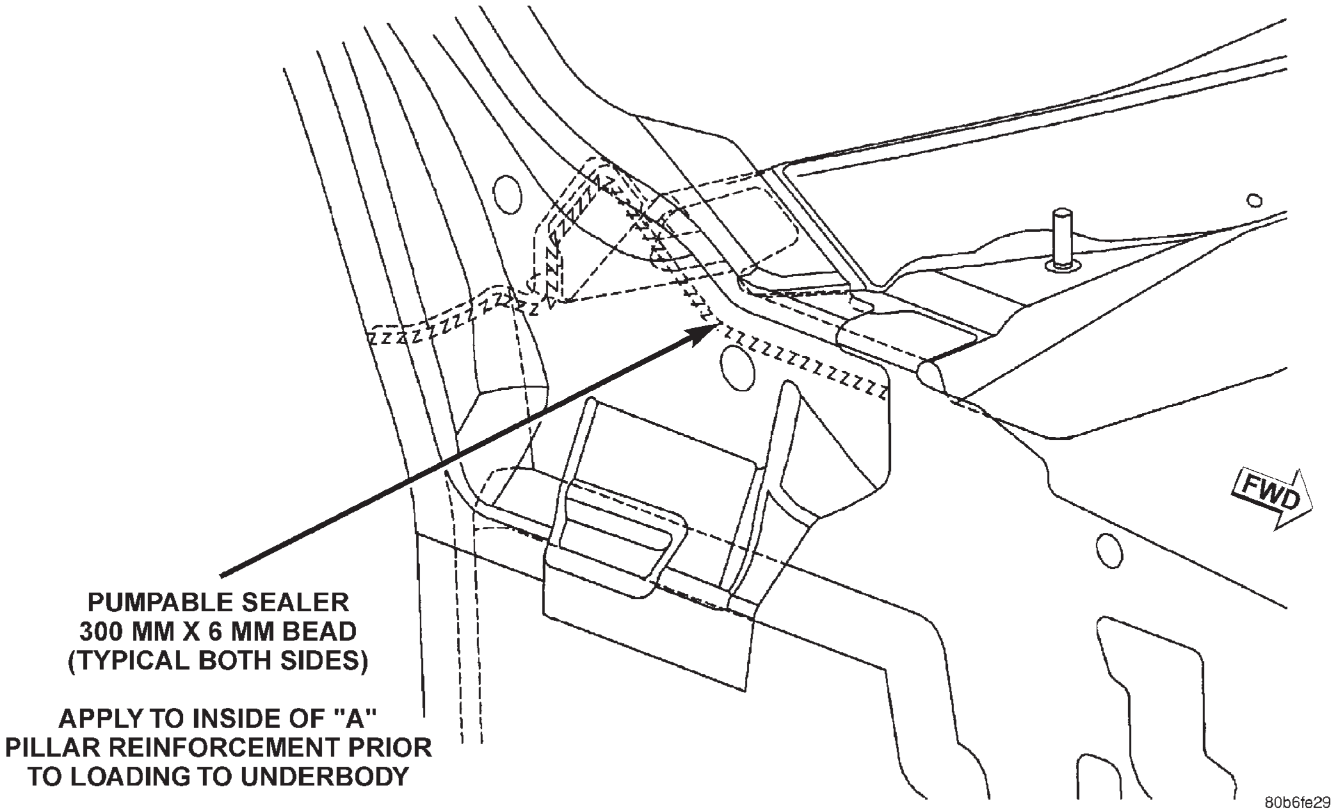
SPECIFICATIONS (Continued)

LOWER PLENUM AND BAFFLE



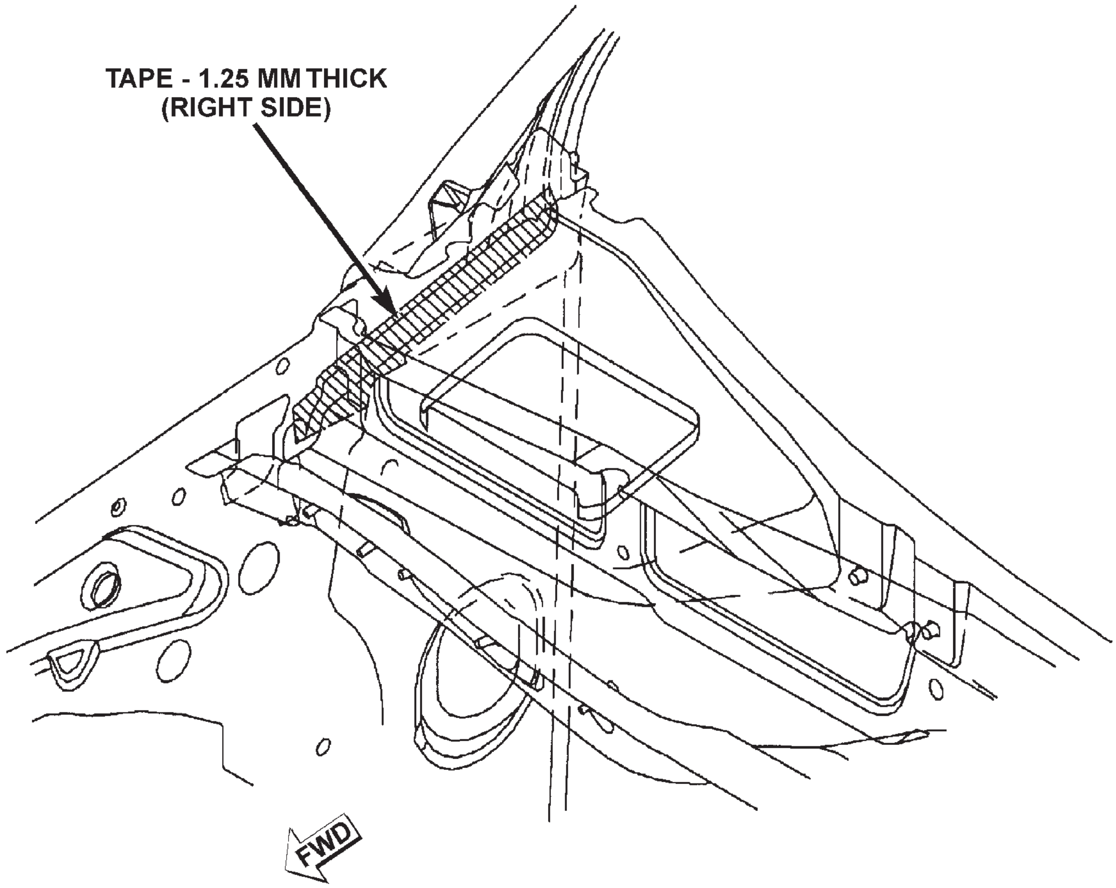
SPECIFICATIONS (Continued)

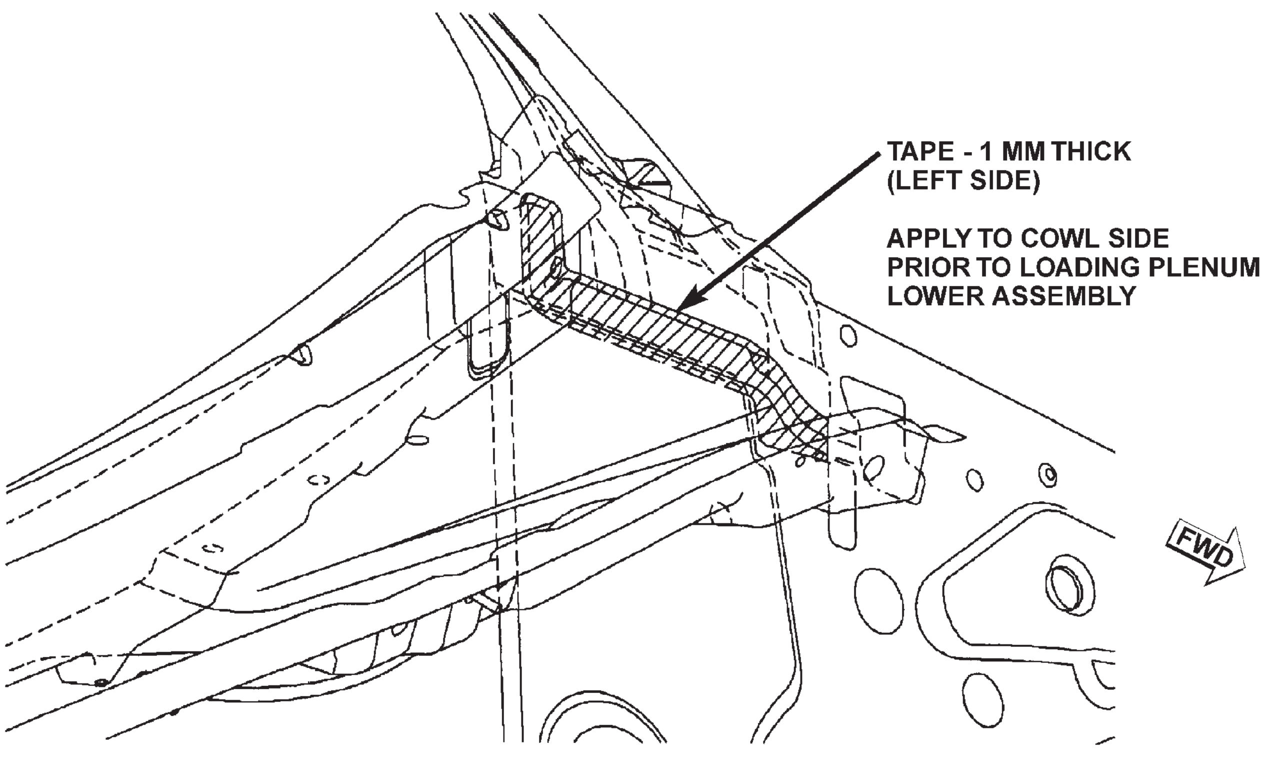
A-PILLAR



SPECIFICATIONS (Continued)

COWL SIDE ATTACHMENT





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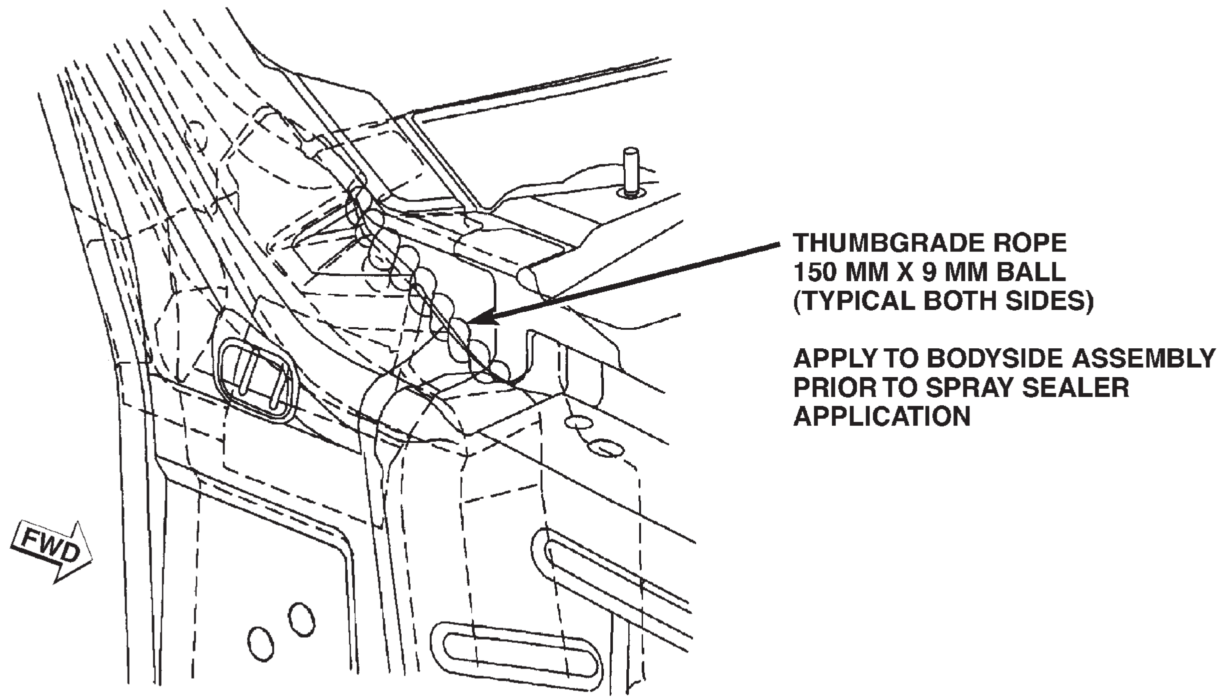
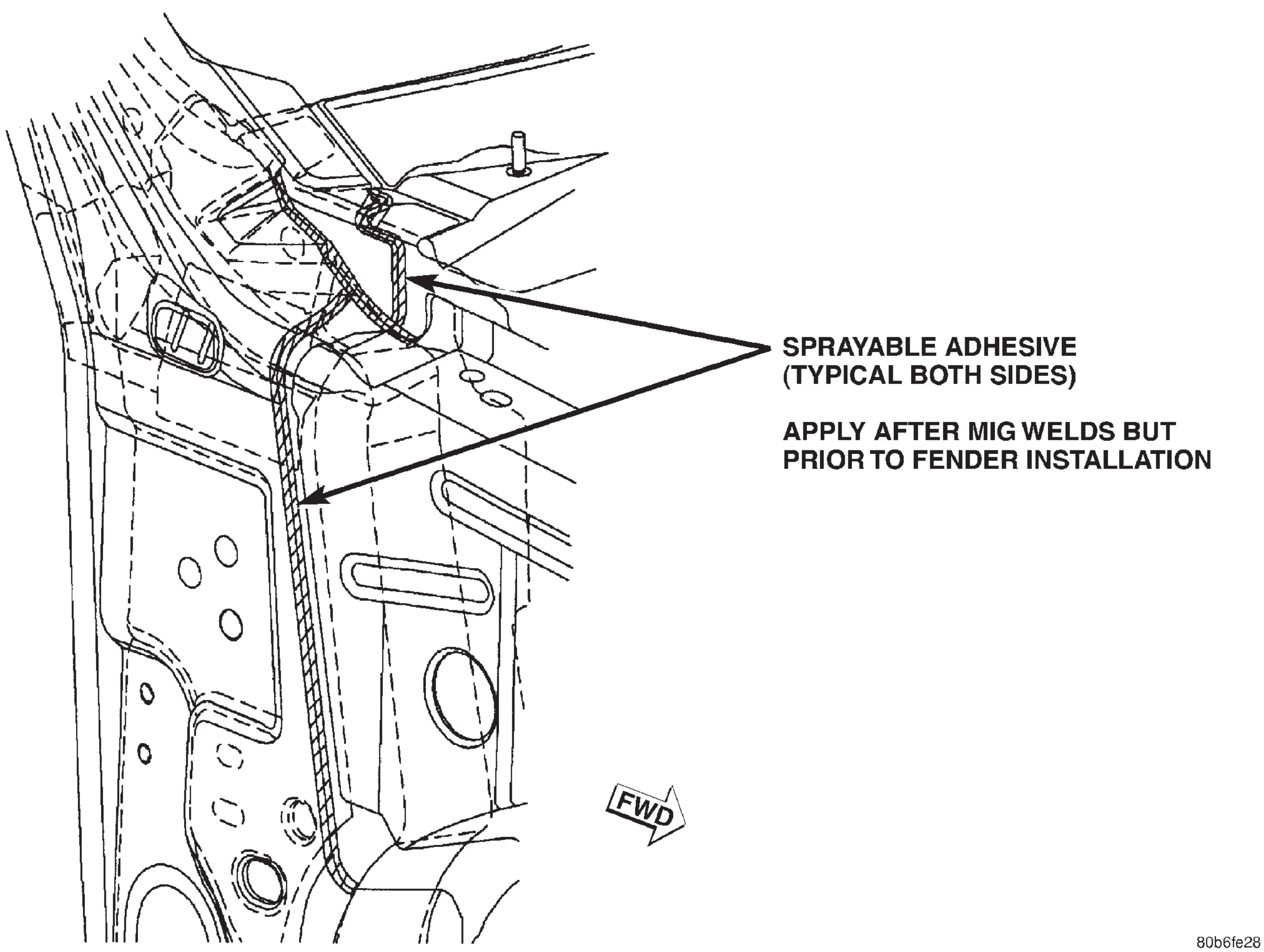
SPECIFICATIONS (Continued)

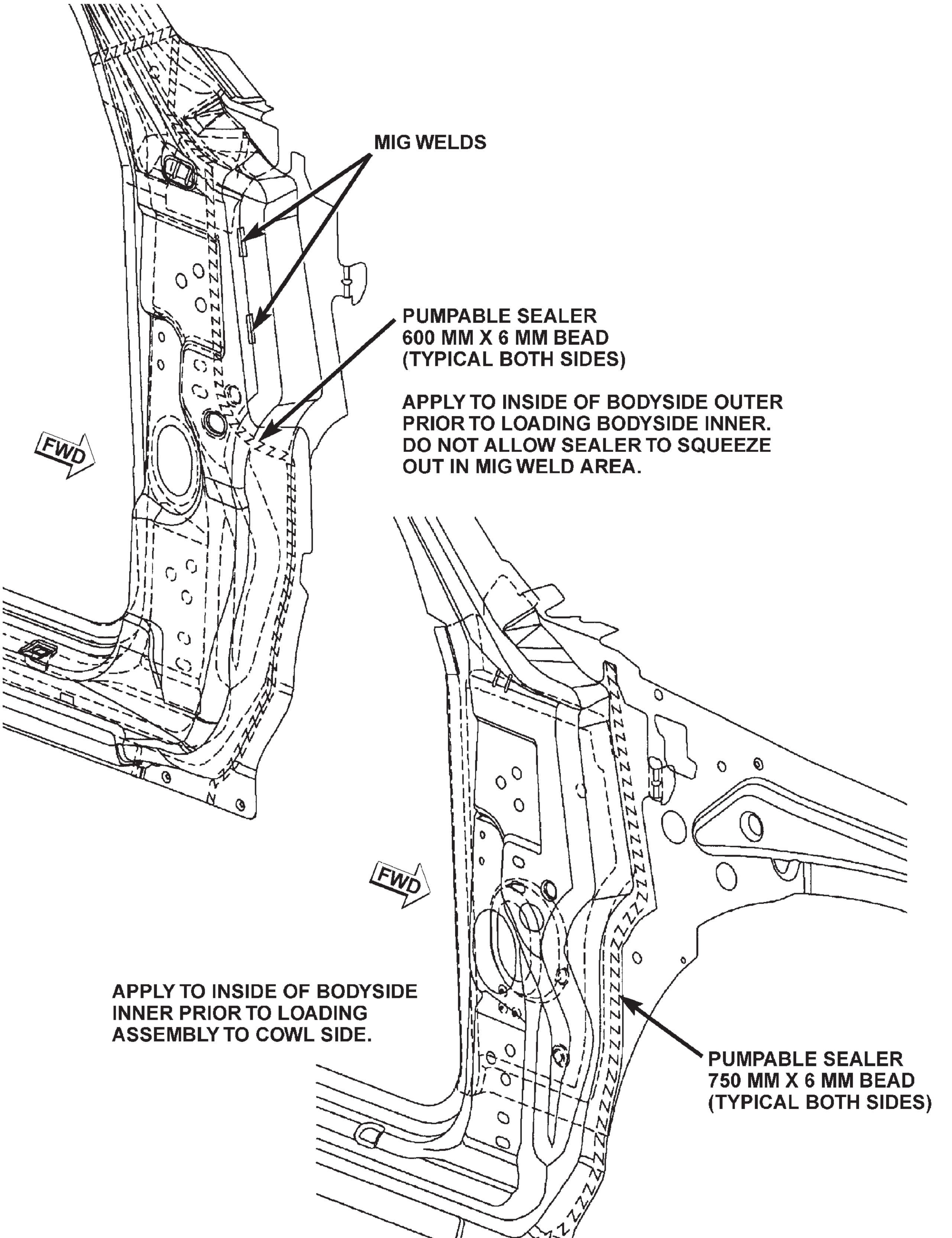
BODYSIDE ATTACHMENT





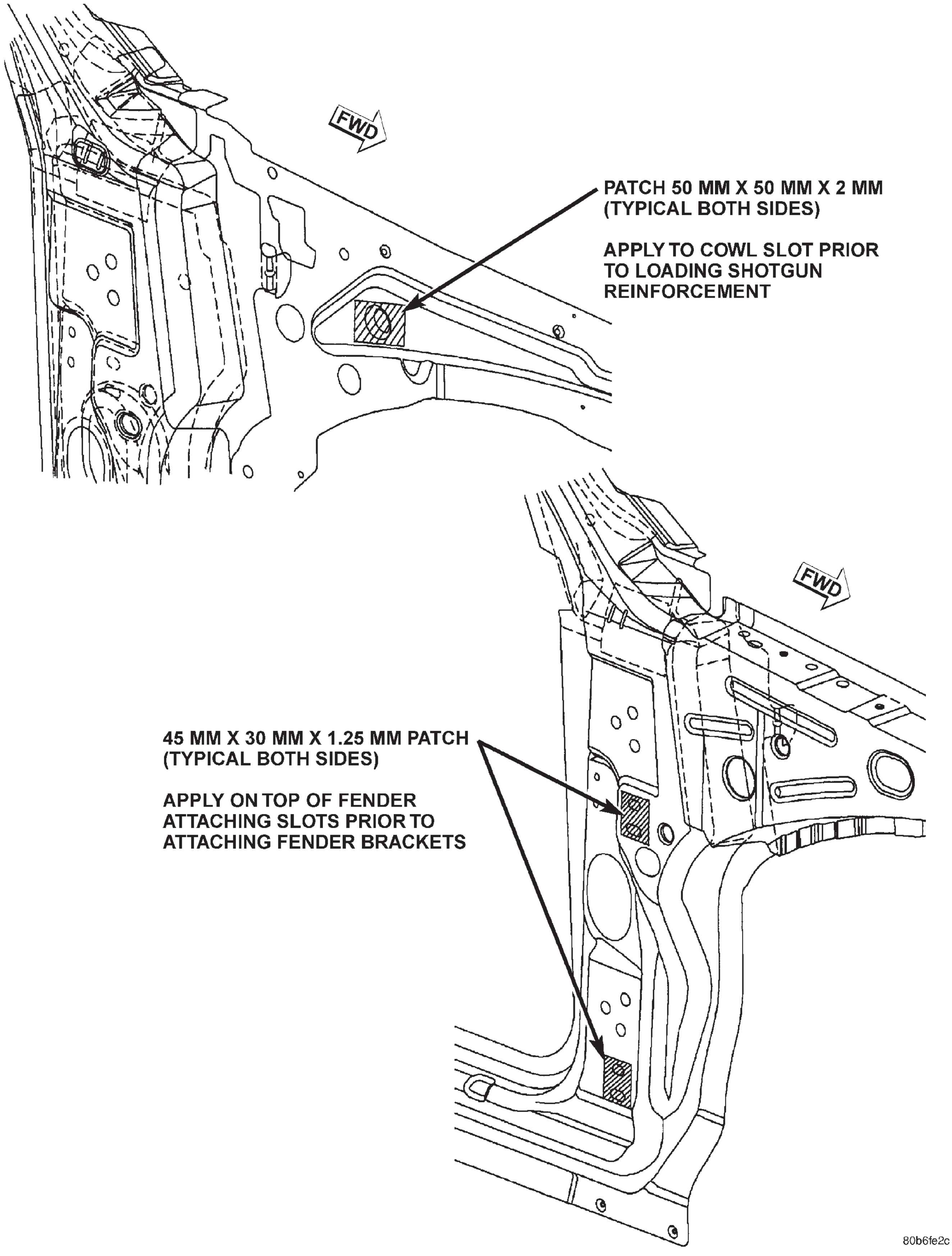
SPECIFICATIONS (Continued)

BODYSIDE INNER AND OUTER TO COWL



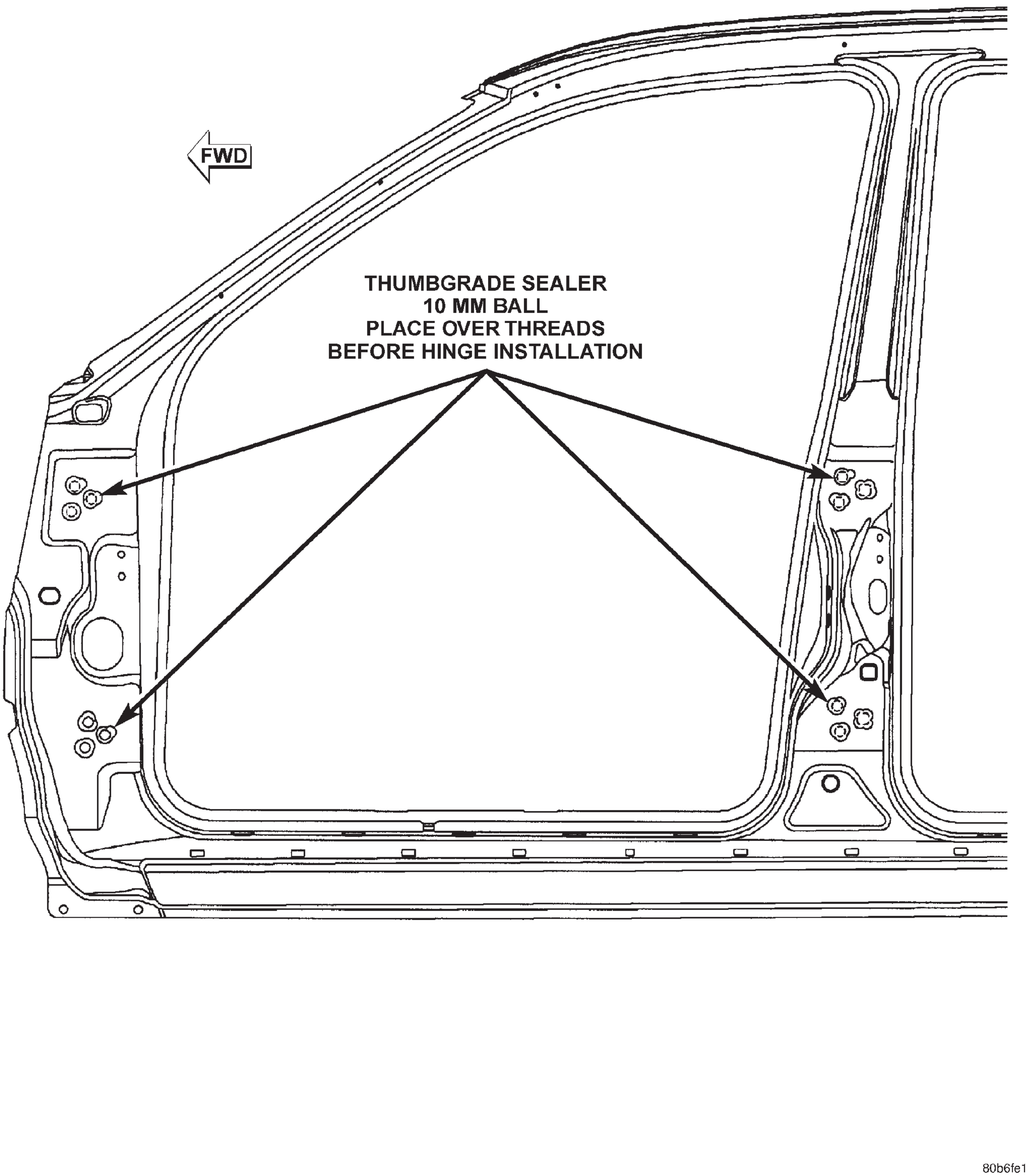
SPECIFICATIONS (Continued)

FENDER ATTACHMENT



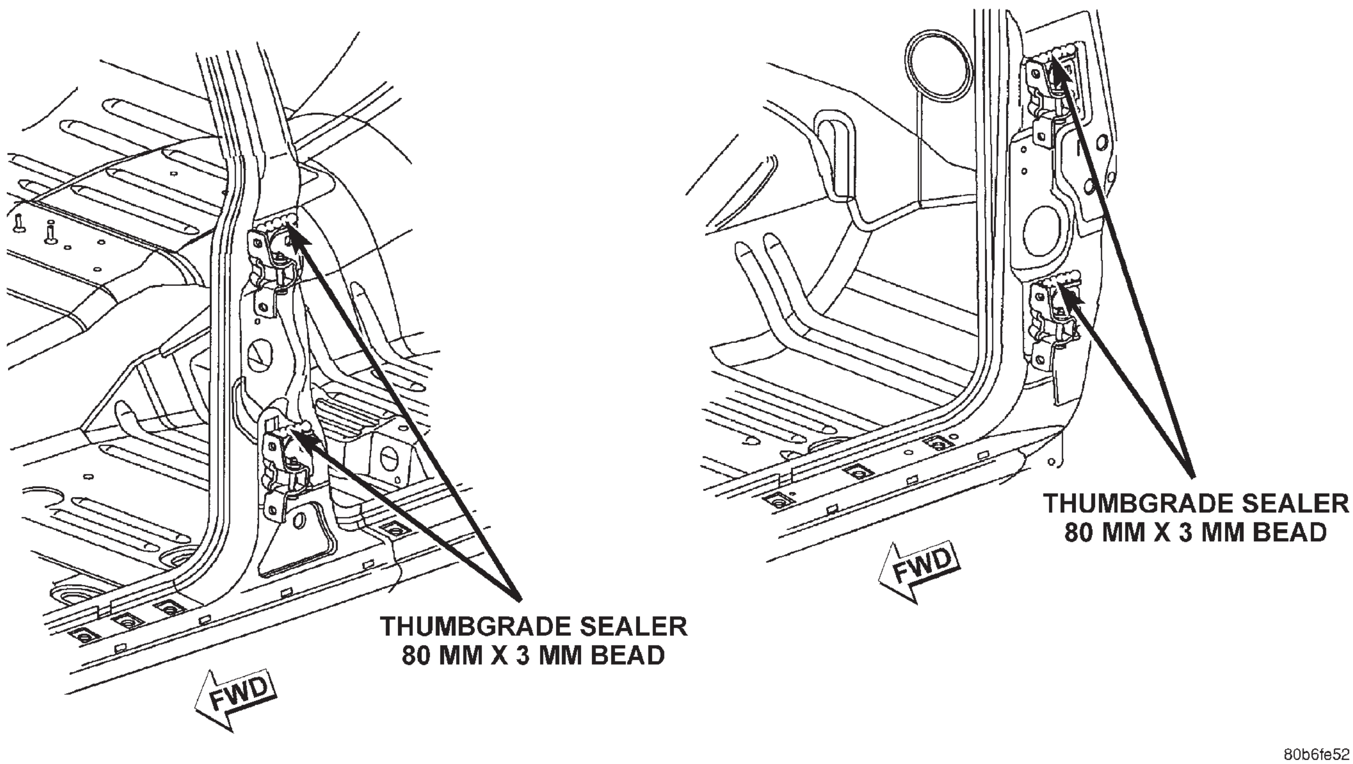
SPECIFICATIONS (Continued)

DOOR HINGE BOLT HOLES



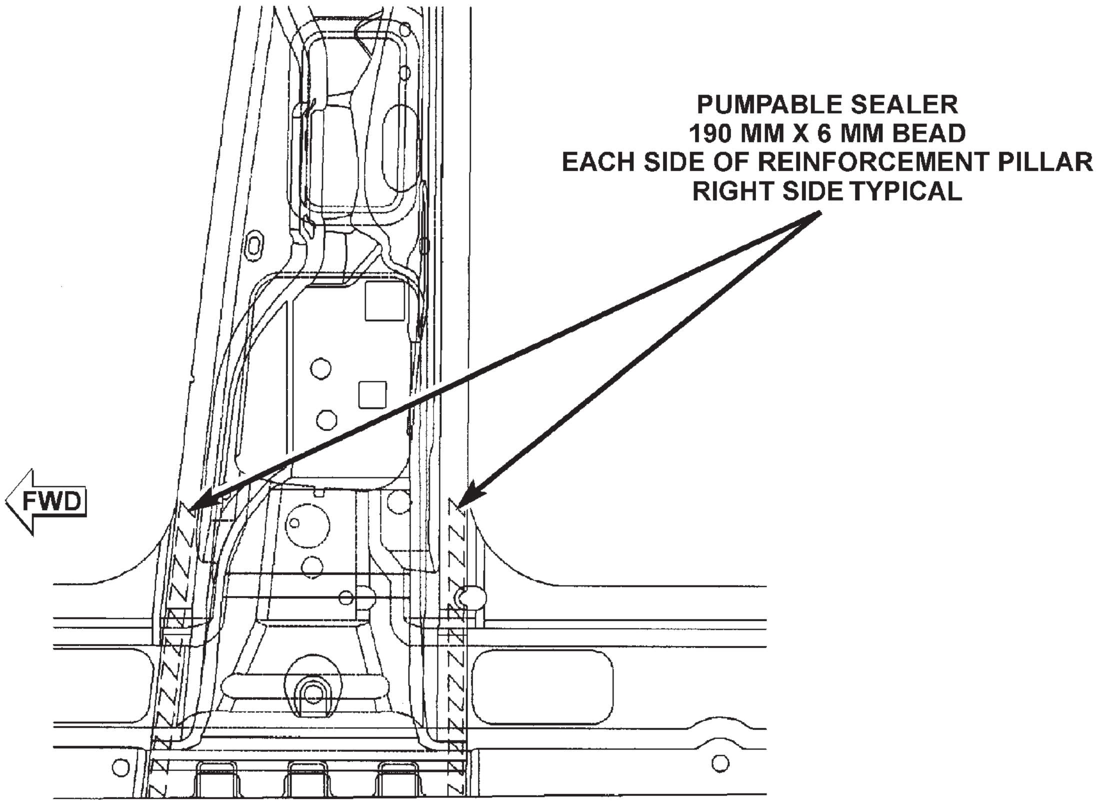
SPECIFICATIONS (Continued)

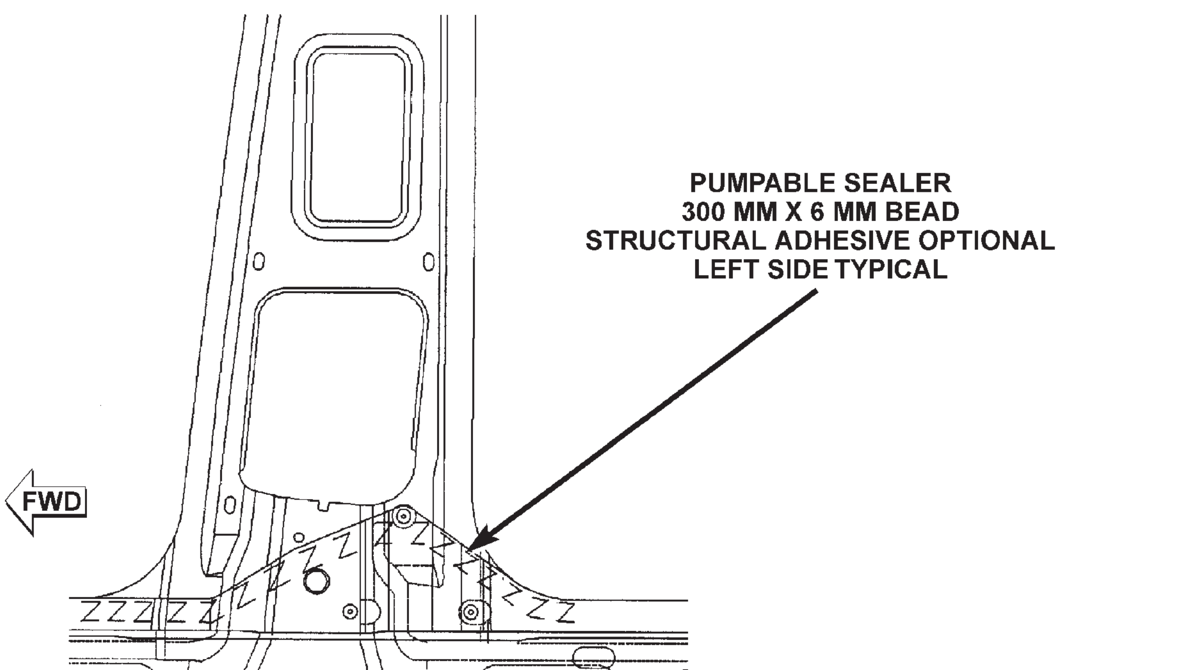
A-PILLAR AND B-PILLAR HINGE AREA



SPECIFICATIONS (Continued)

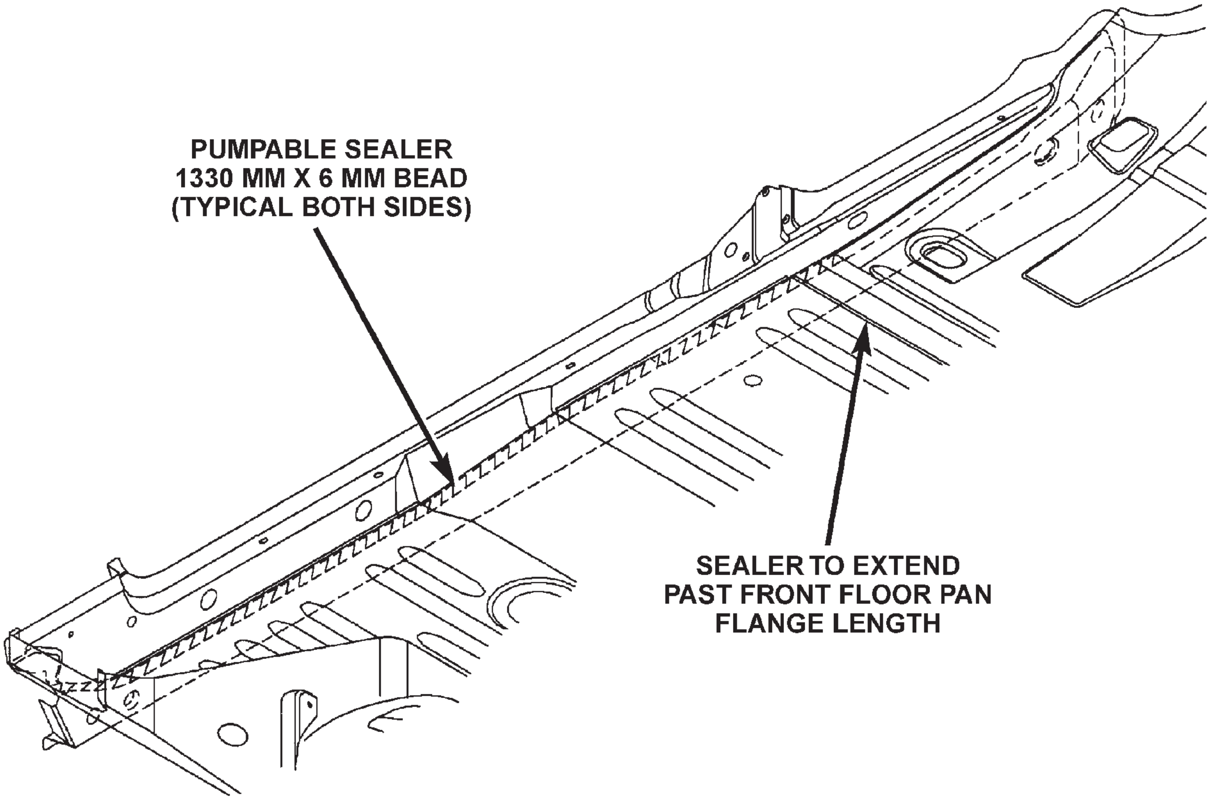
B-PILLAR AND SILL

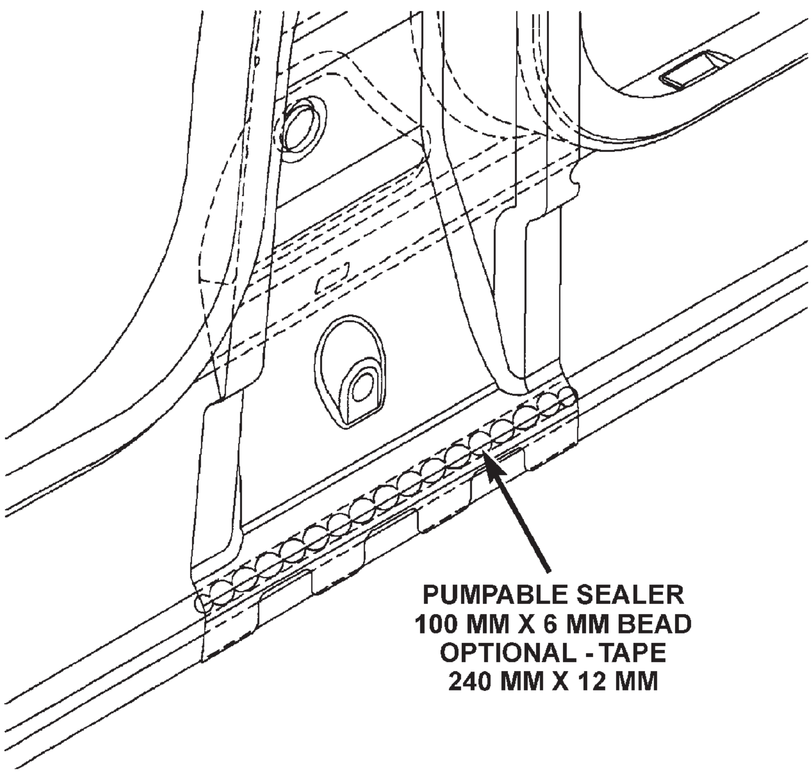




SPECIFICATIONS (Continued)

SILL AND B-PILLAR





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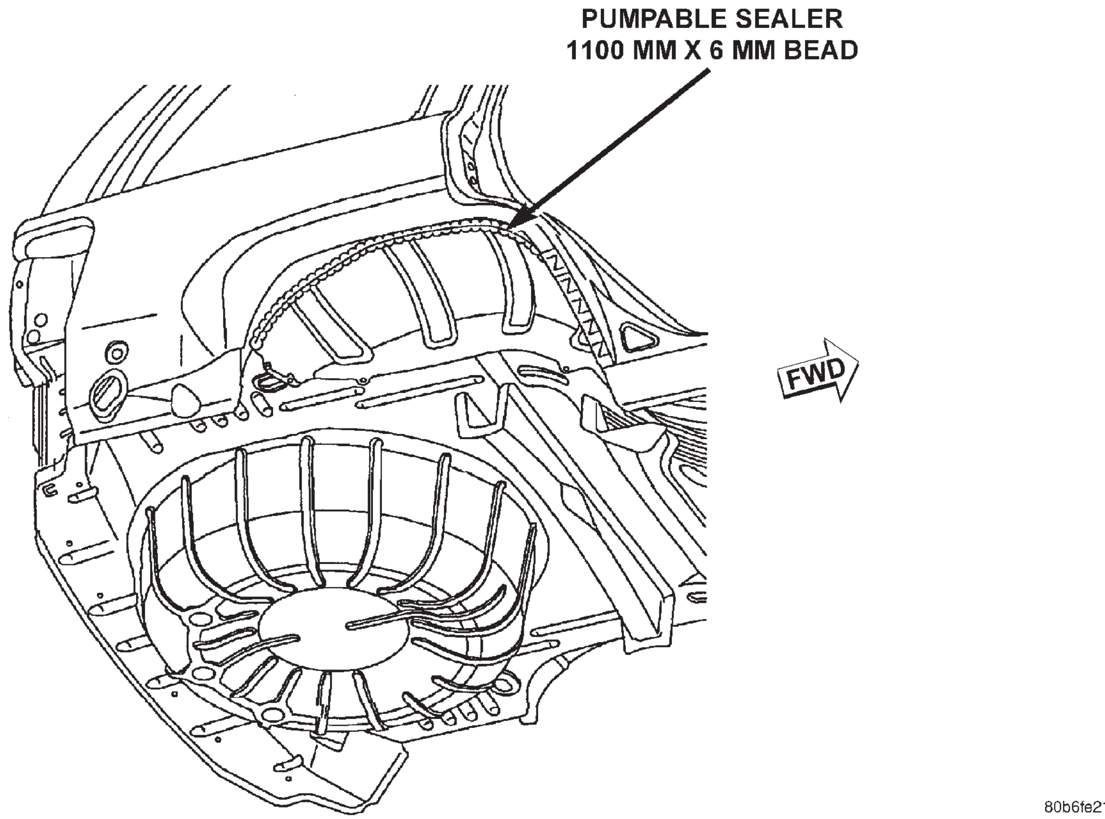
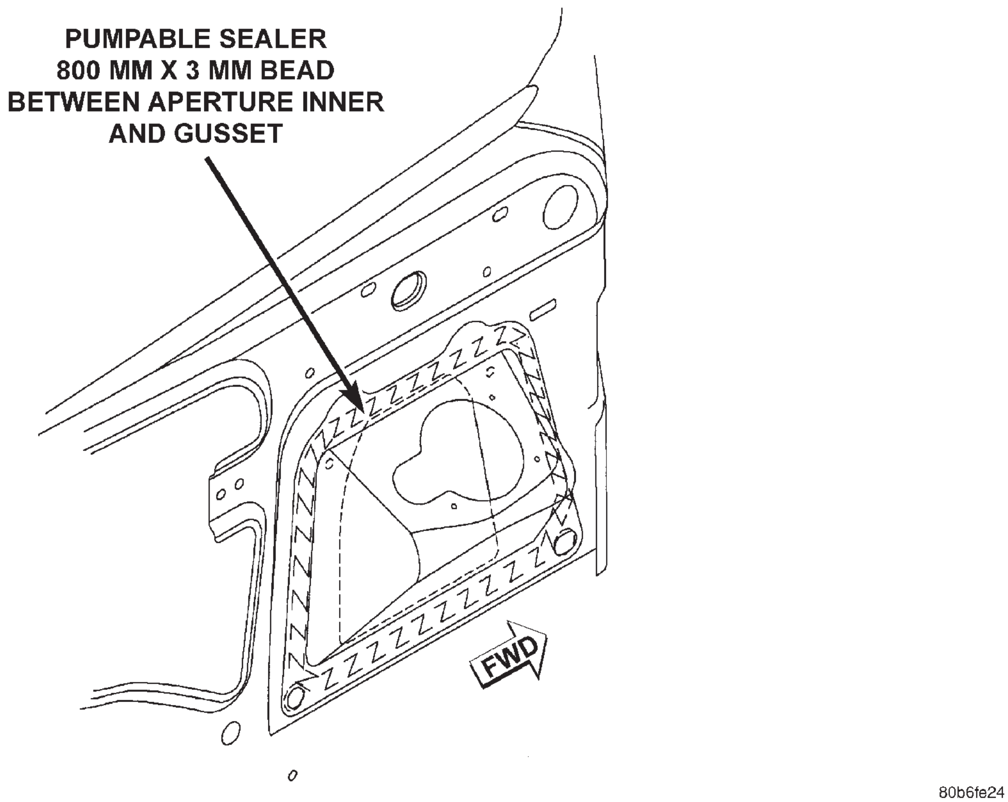
SPECIFICATIONS (Continued)

BODYSIDE APERTURE AND REAR WHEELHOUSE



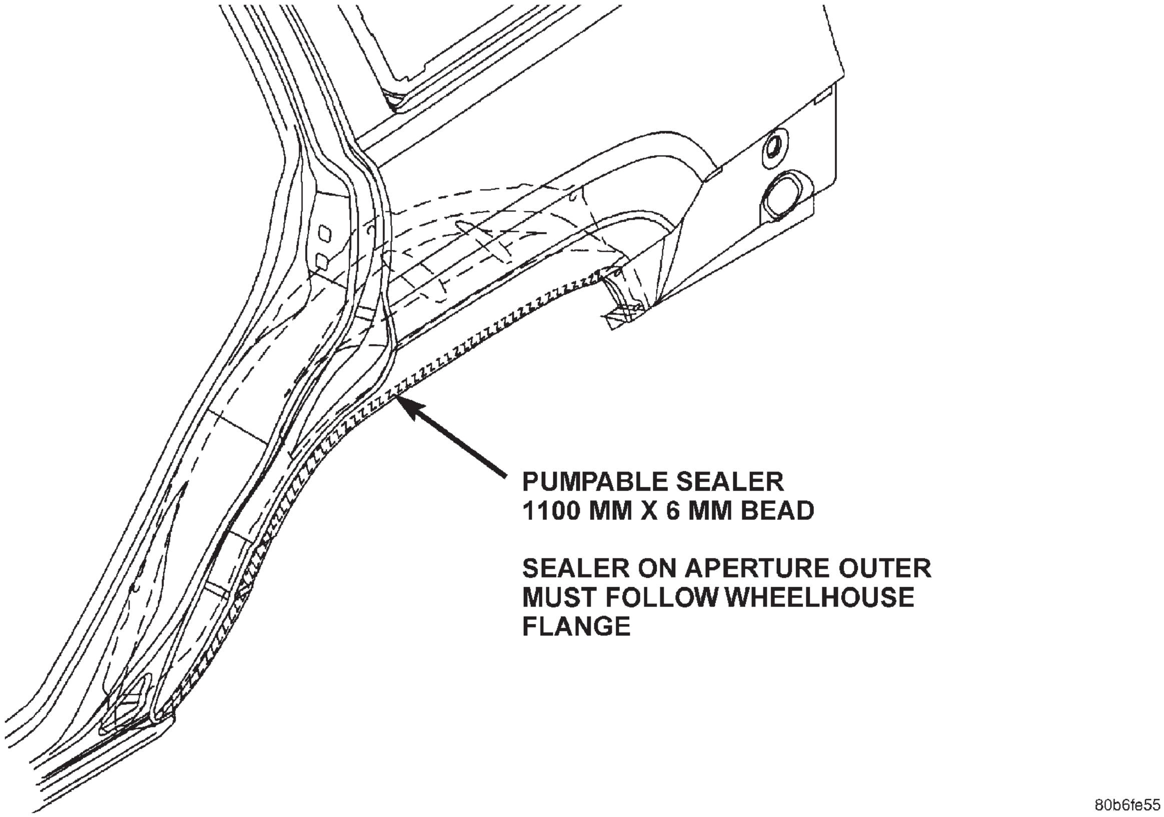
SPECIFICATIONS (Continued)

FUEL FILLER GUSSET



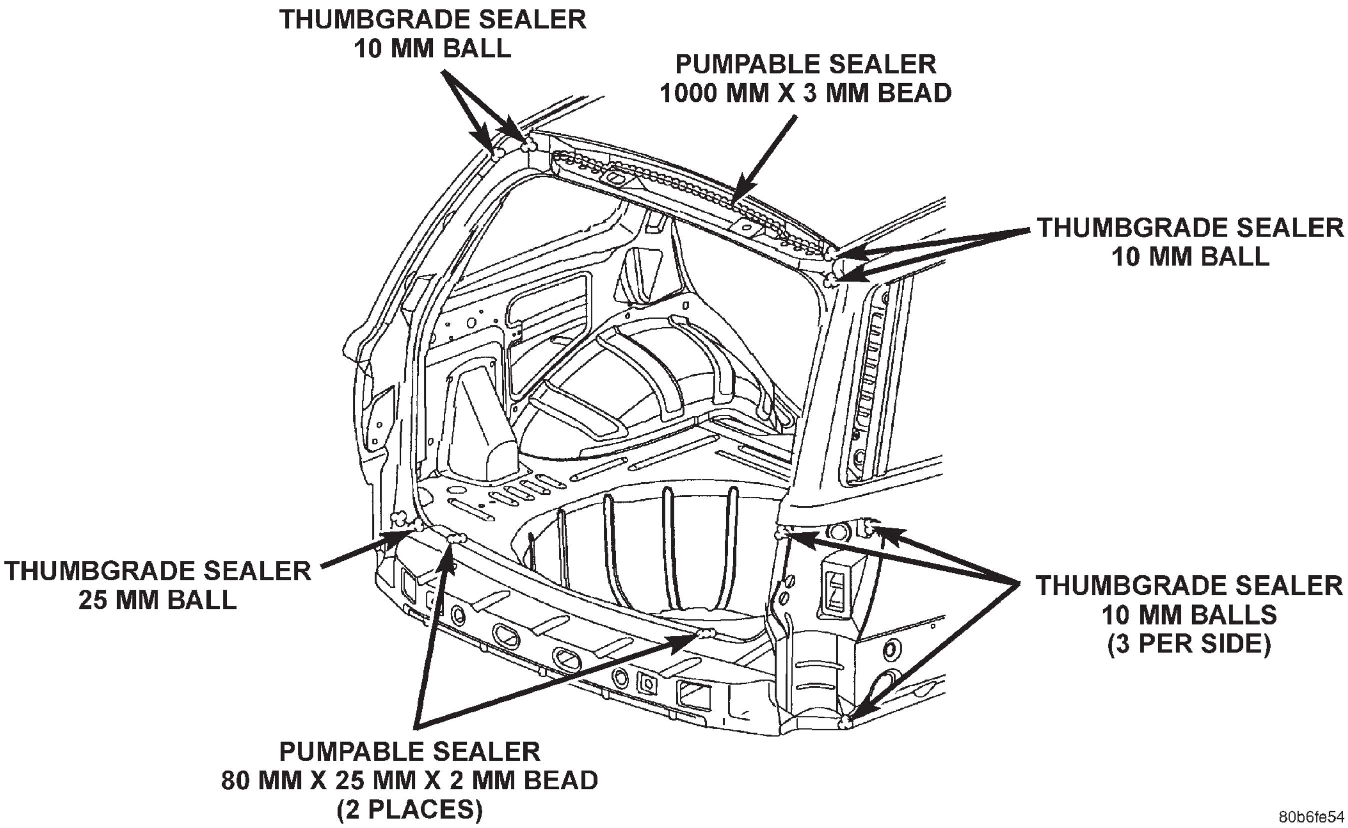
SPECIFICATIONS (Continued)

OUTER WHEELHOUSE FLANGE



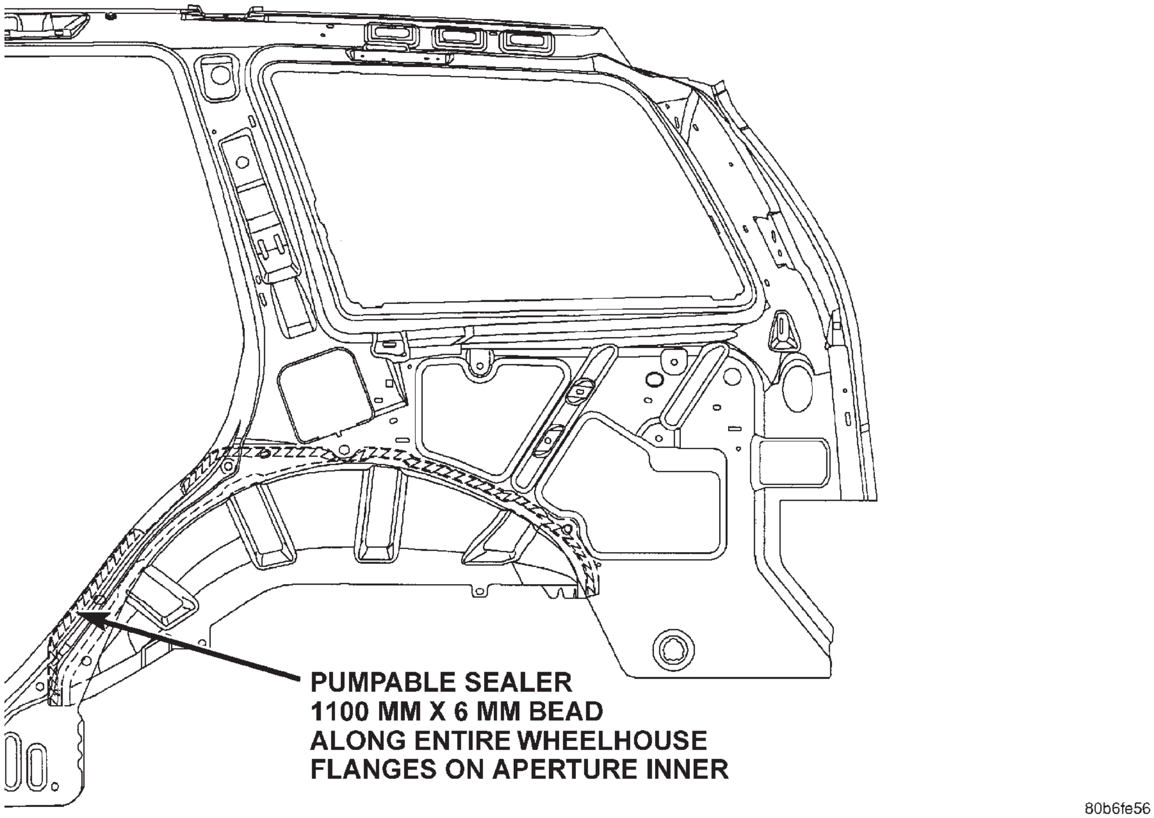
SPECIFICATIONS (Continued)

LIFTGATE OPENING



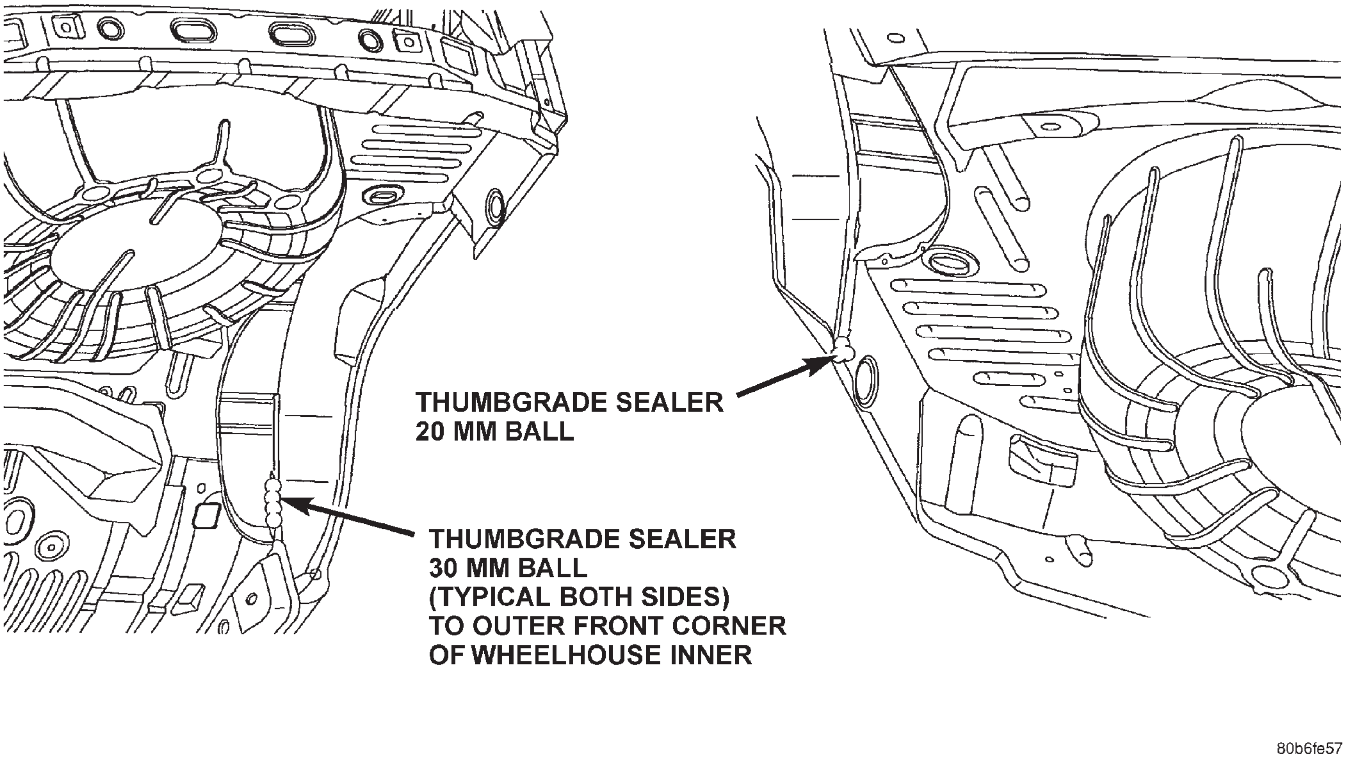
SPECIFICATIONS (Continued)

INNER WHEELHOUSE FLANGE TO BODYSIDE APERTURE



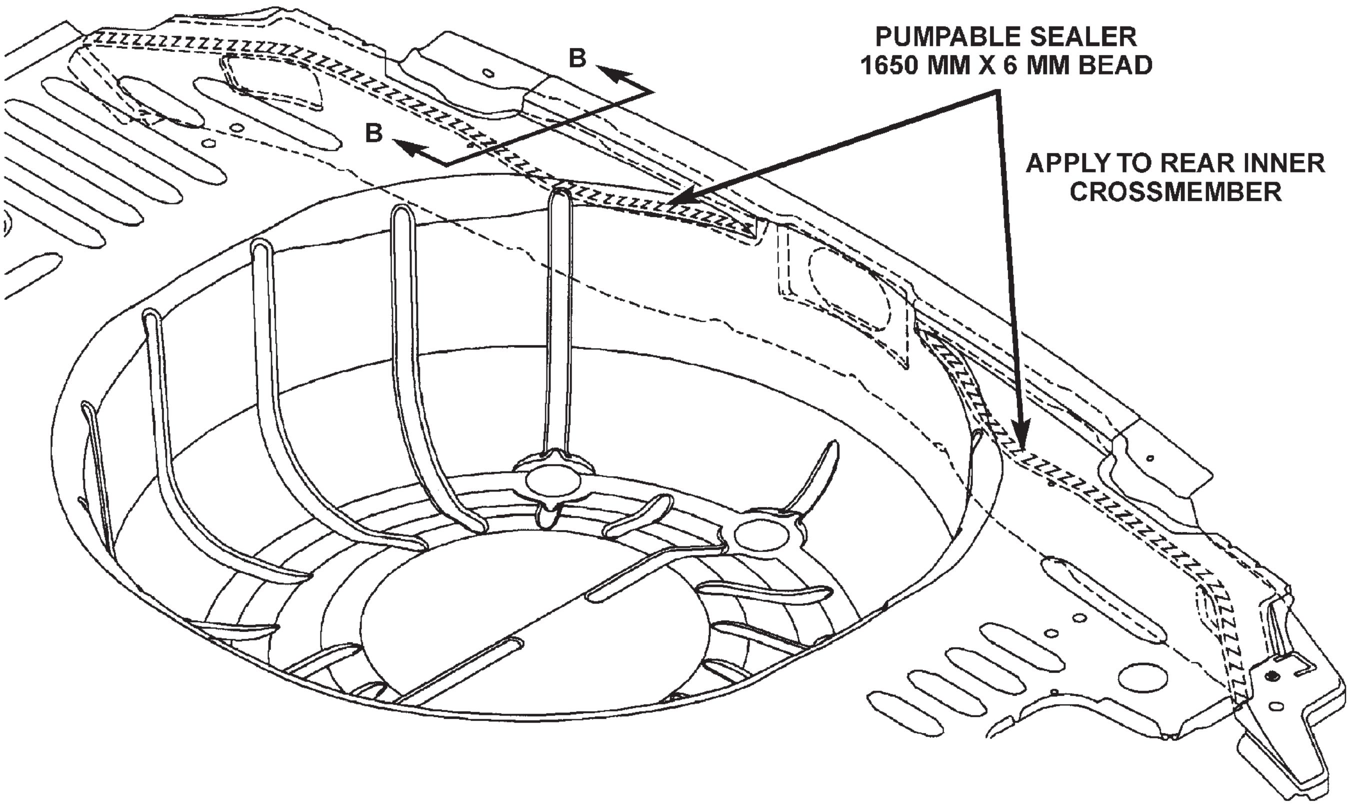
SPECIFICATIONS (Continued)

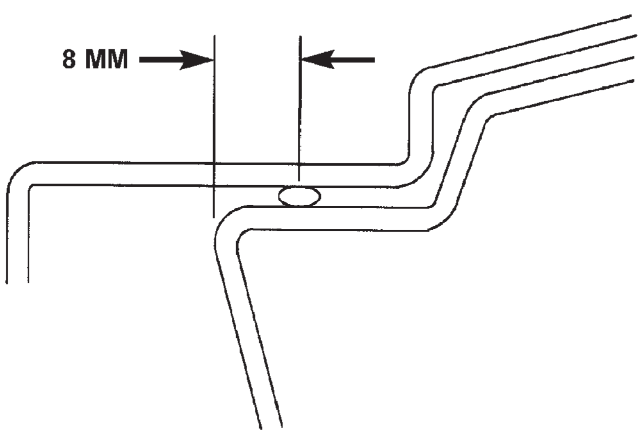
WHEELHOUSE LOWER



SPECIFICATIONS (Continued)

REAR INNER CROSSMEMBER





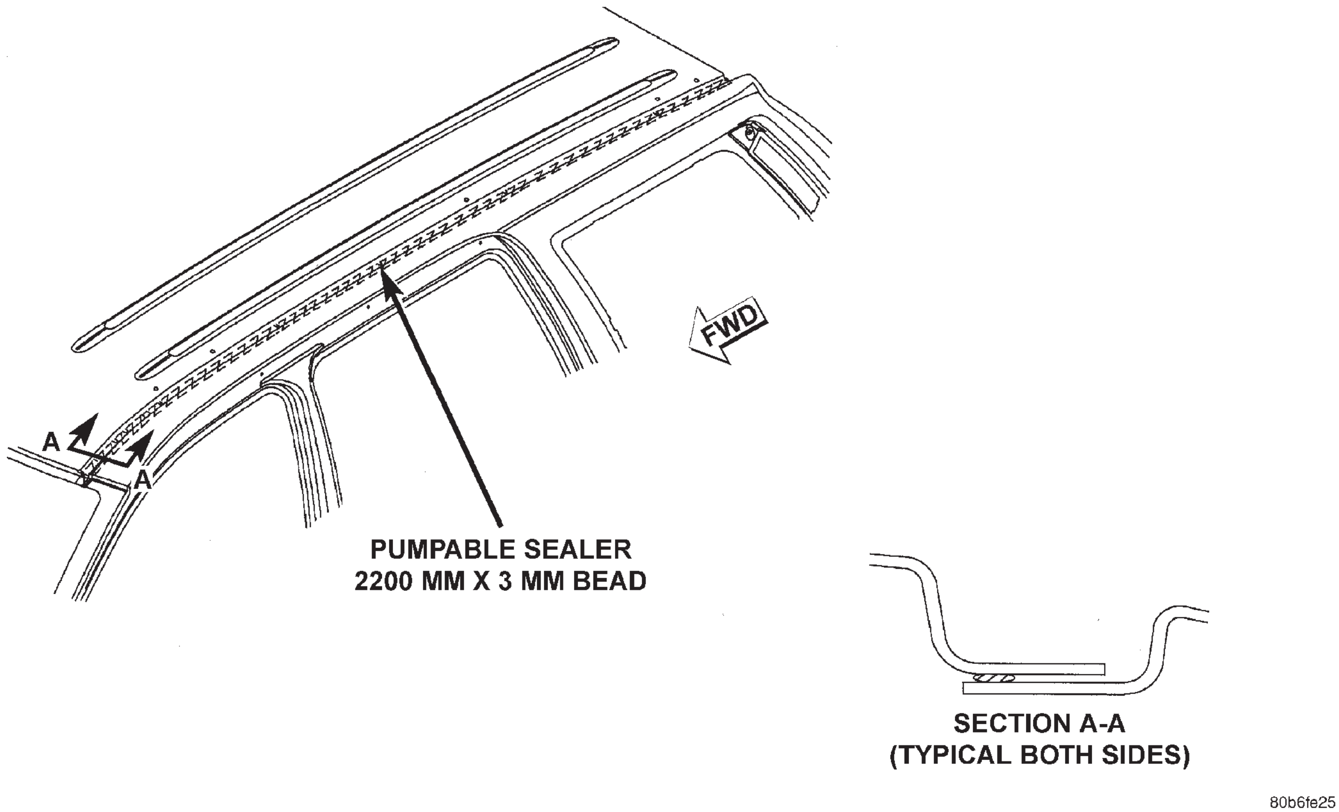
SECTION B - B

℄ OF SEALER BEAD
TO BE APPROXIMATELY 8 MM
REARWARD OF FRONT EDGE
OF REAR INNER CROSSMEMBER

80b6fe58

SPECIFICATIONS (Continued)

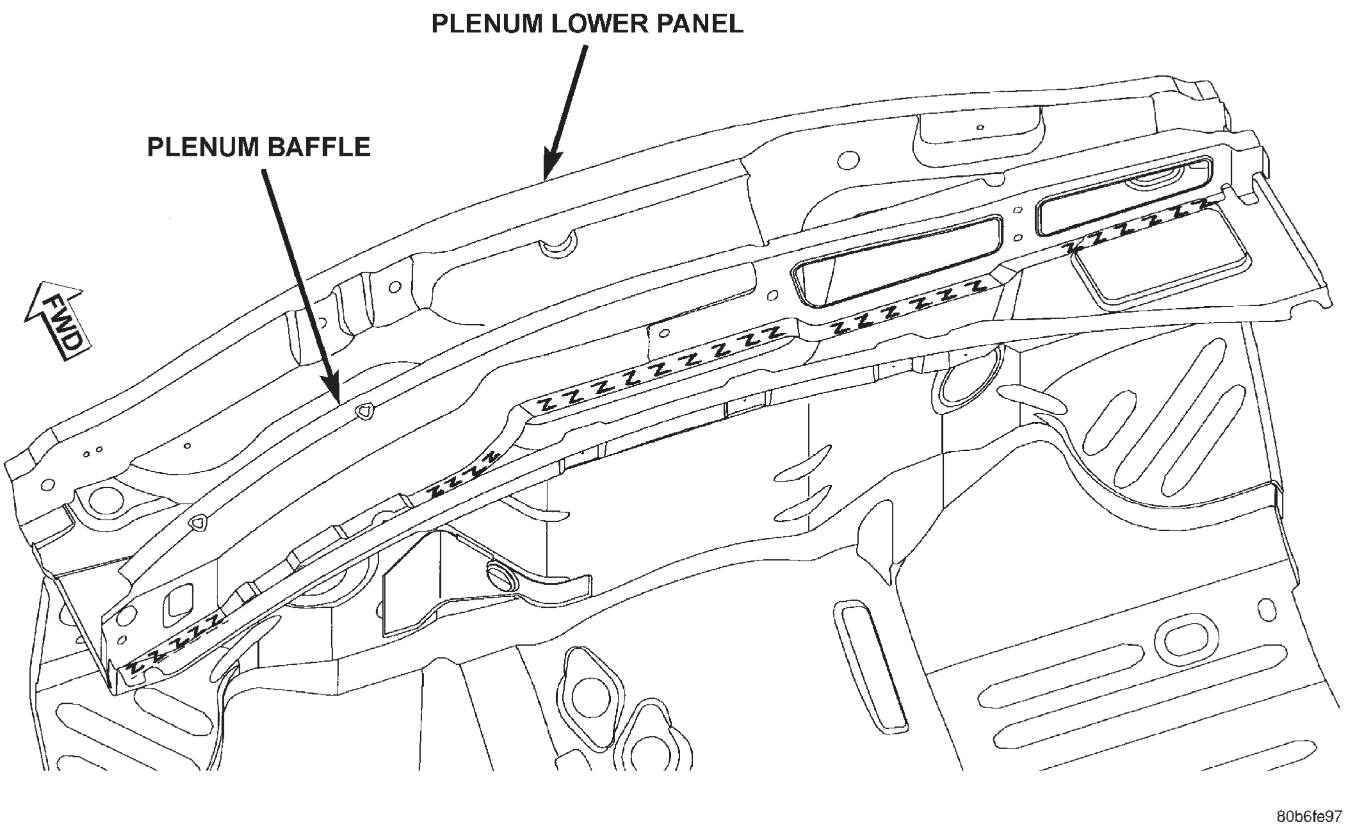
ROOF TO BODY SIDE APERTURE



SPECIFICATIONS (Continued)

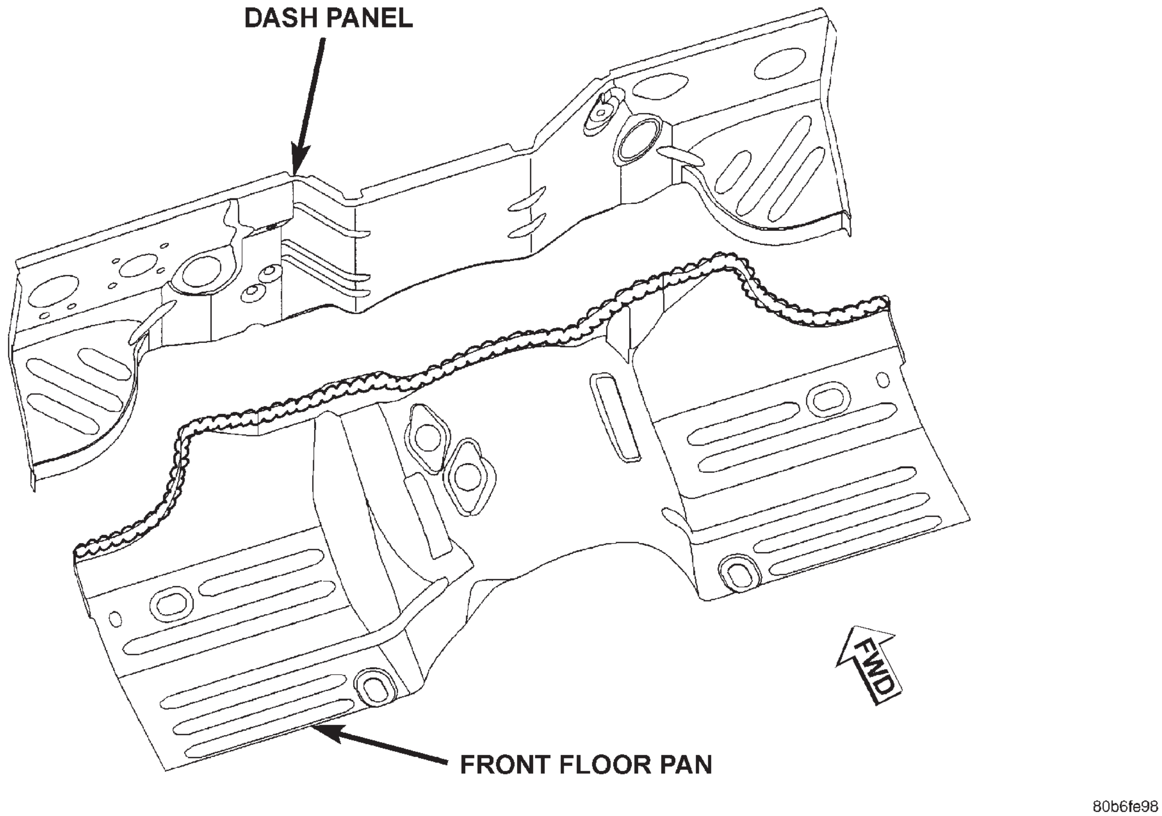
STRUCTURAL ADHESIVE LOCATIONS

COWL PLENUM



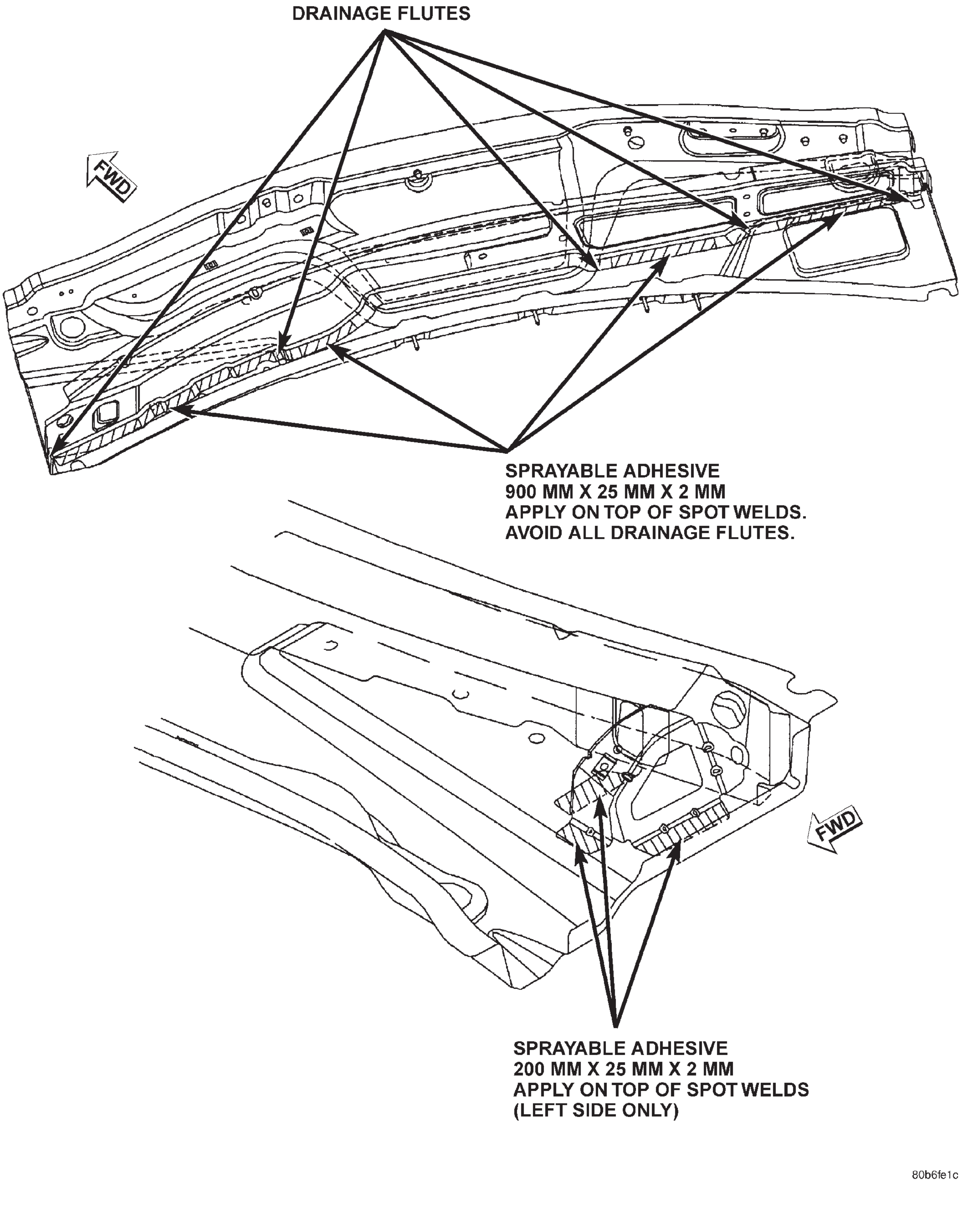
SPECIFICATIONS (Continued)

DASH PANEL AND FRONT FLOOR PAN



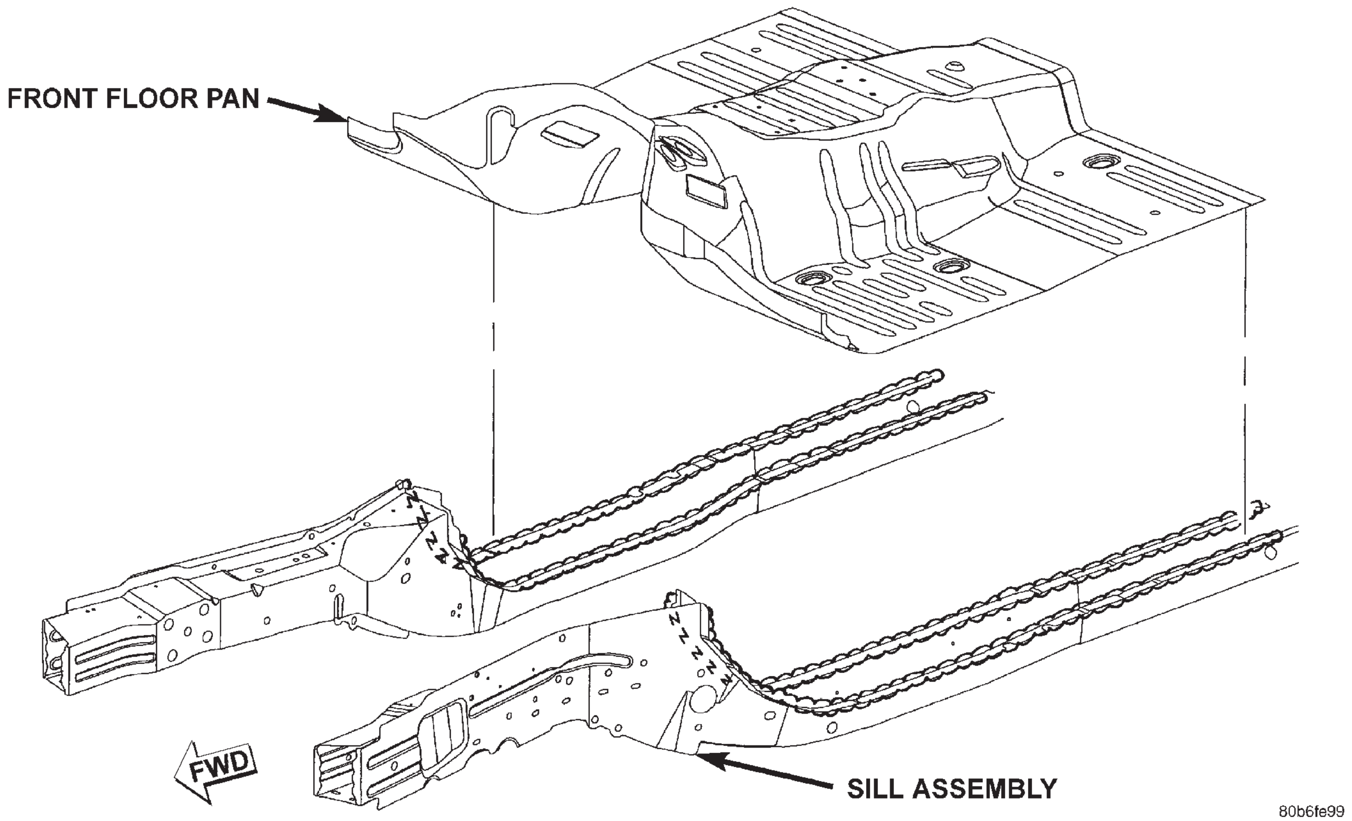
SPECIFICATIONS (Continued)

PLENUM AND WINDSHIELD WIPER MOUNTING



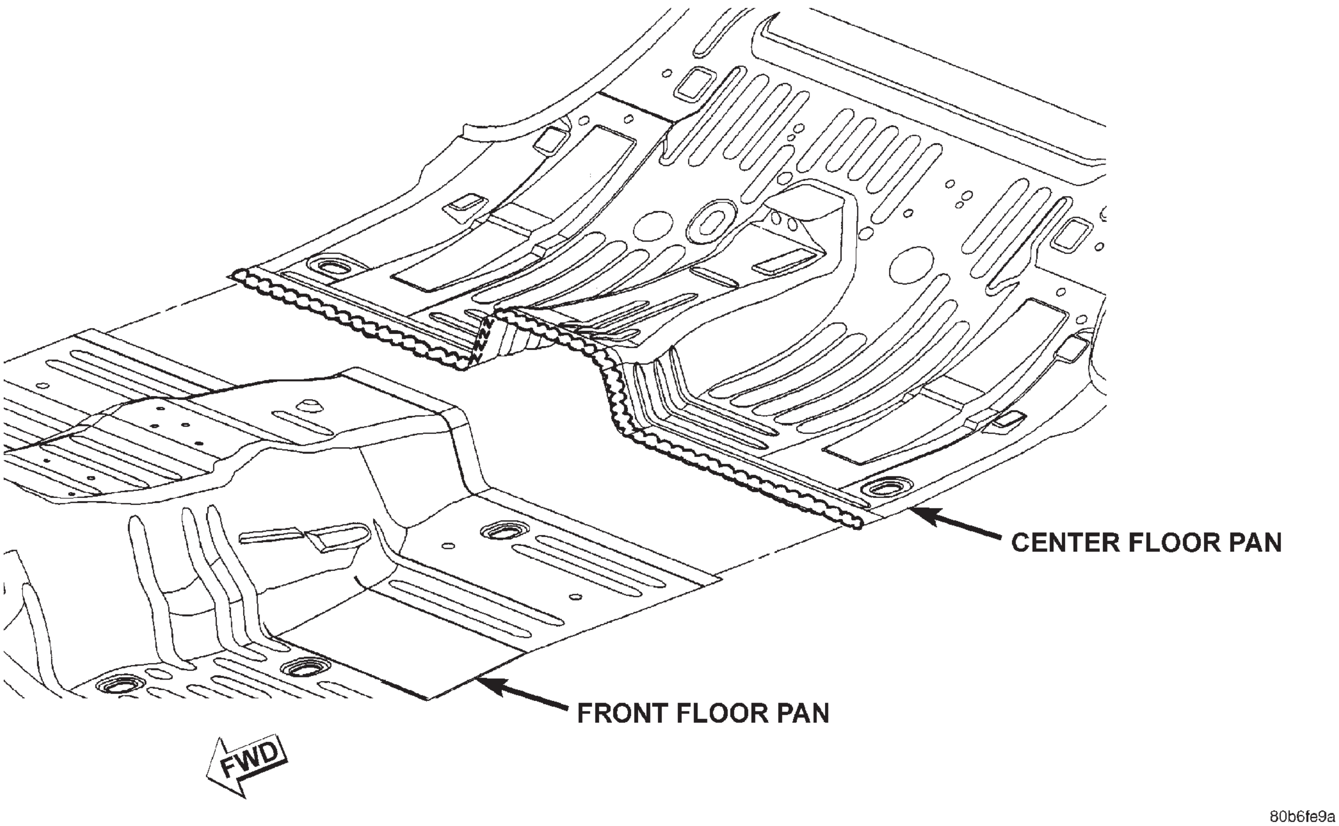
SPECIFICATIONS (Continued)

FRONT FLOOR PAN AND SILLS



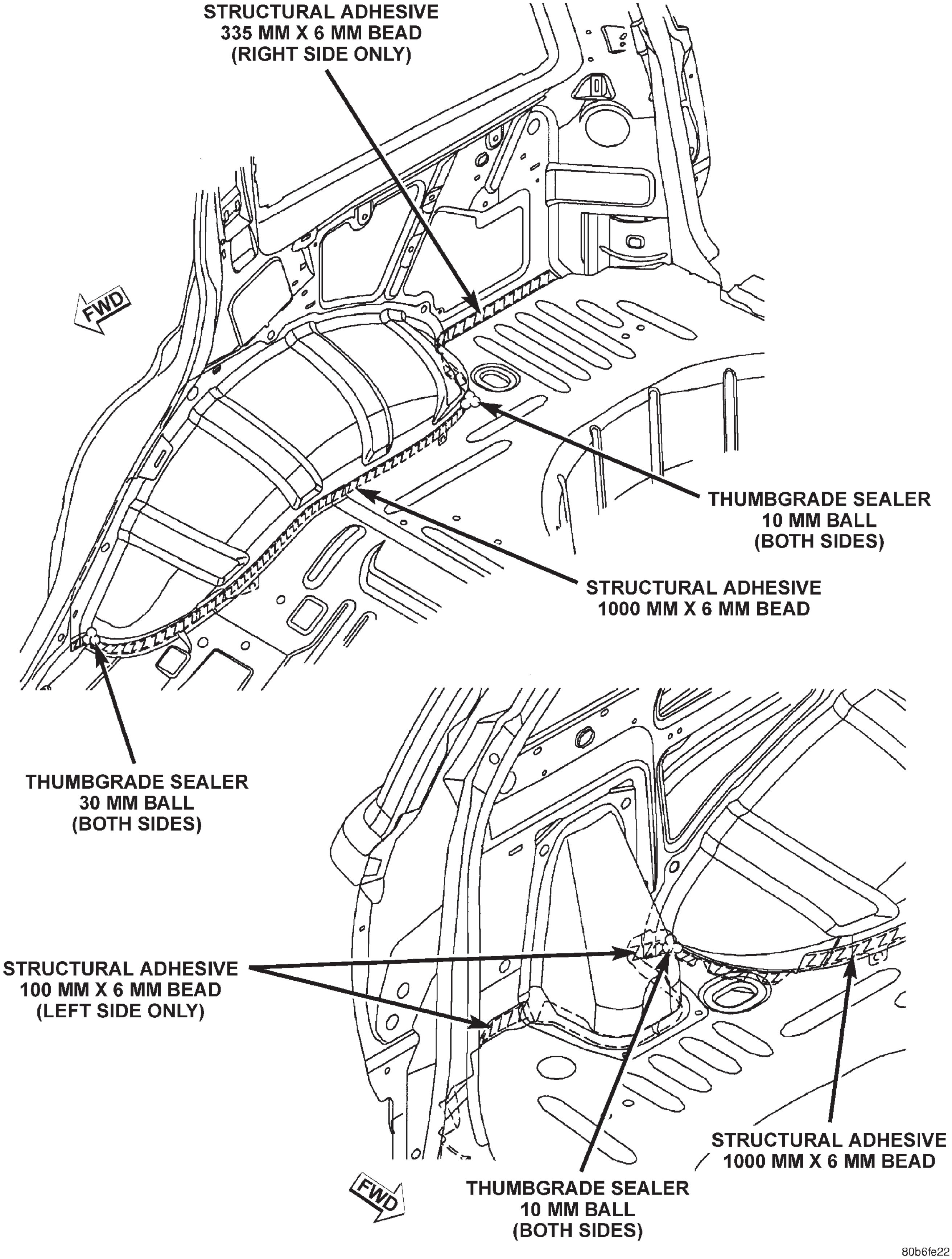
SPECIFICATIONS (Continued)

FRONT AND CENTER FLOOR PAN



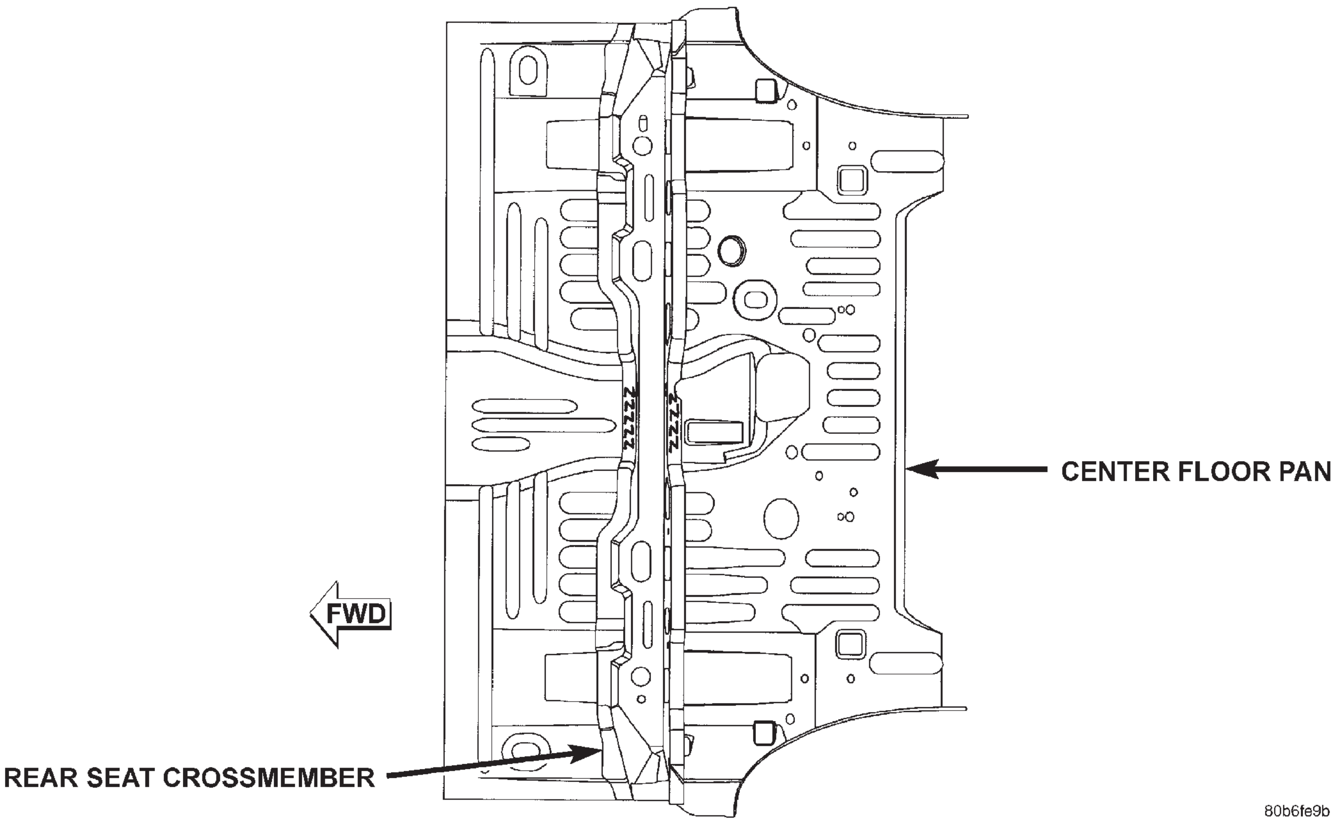
SPECIFICATIONS (Continued)

FRONT PAN AND INNER BODY SIDE APERTURE



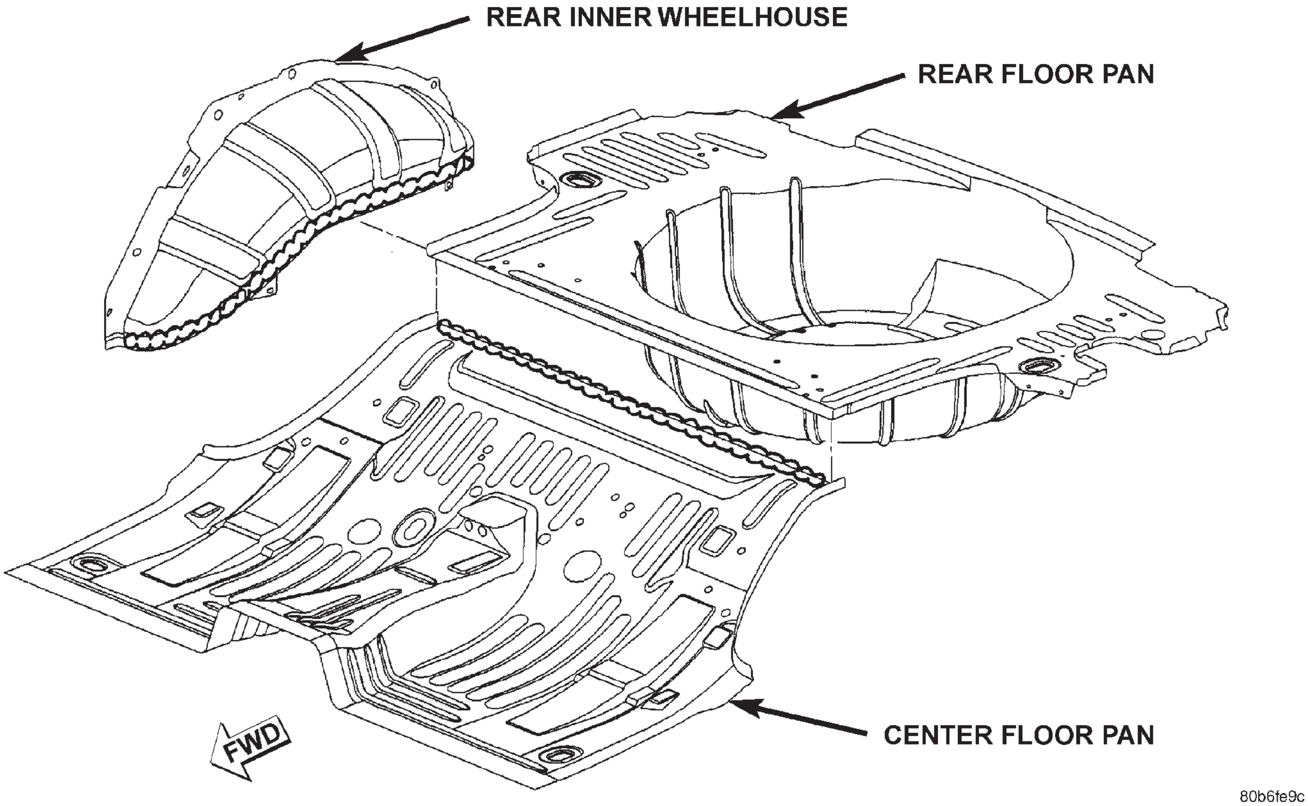
SPECIFICATIONS (Continued)

REAR SEAT CROSSMEMBER



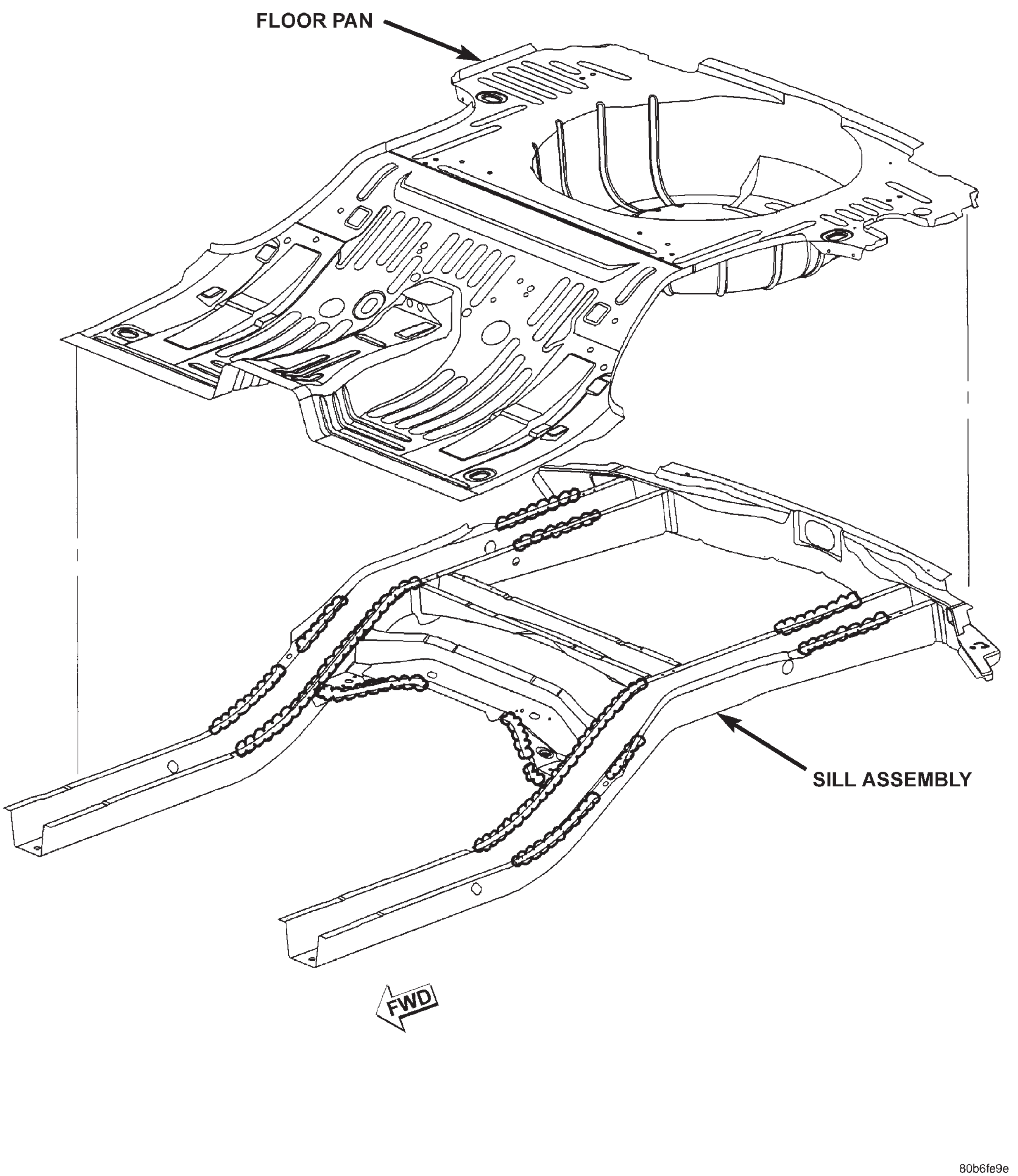
SPECIFICATIONS (Continued)

REAR INNER WHEELHOUSE



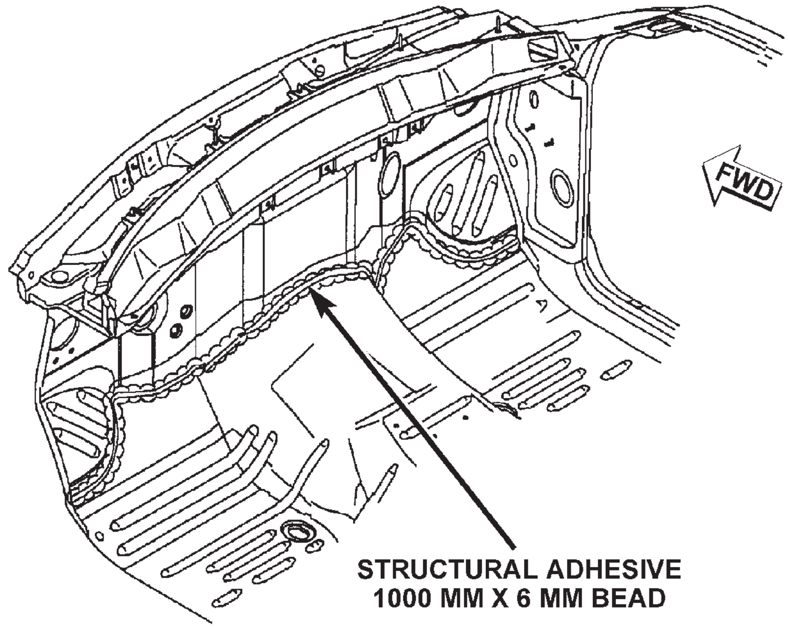
SPECIFICATIONS (Continued)

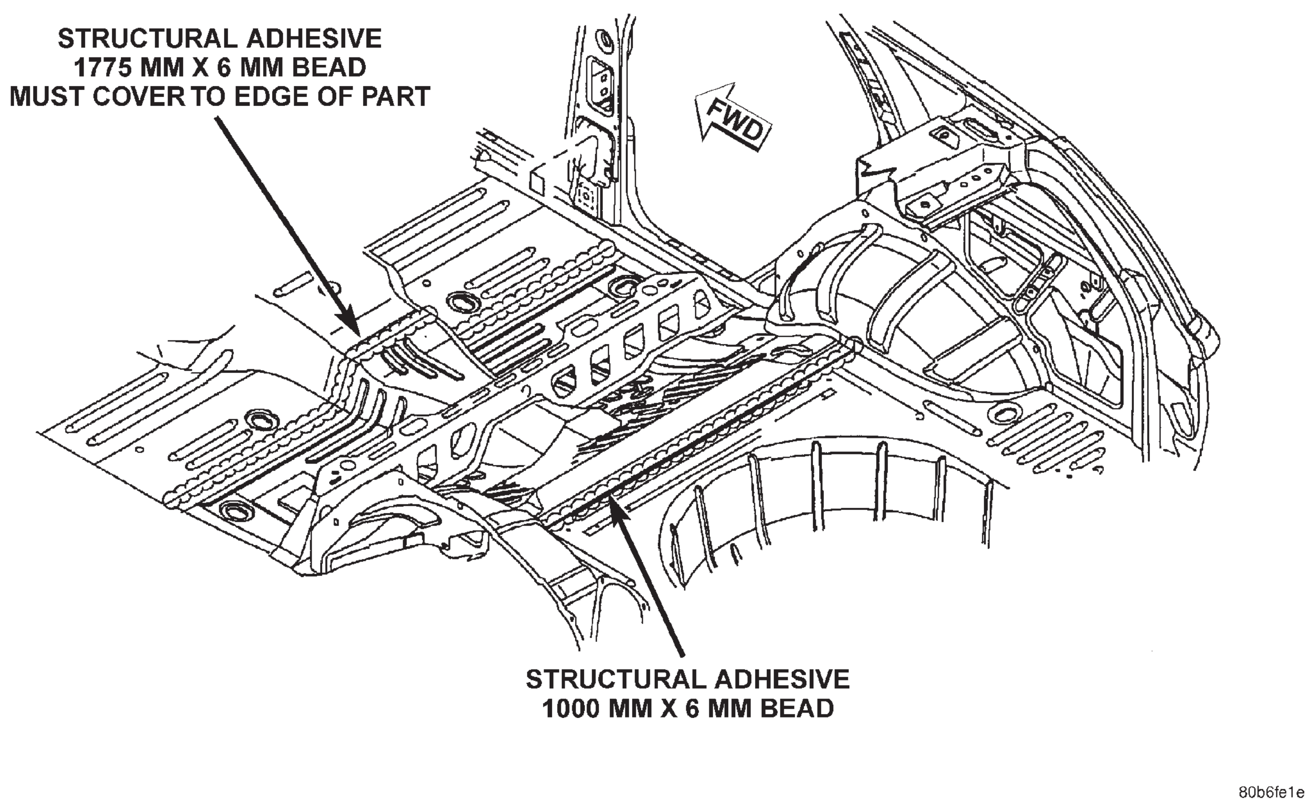
FLOOR PAN AND SILL ASSEMBLY



SPECIFICATIONS (Continued)

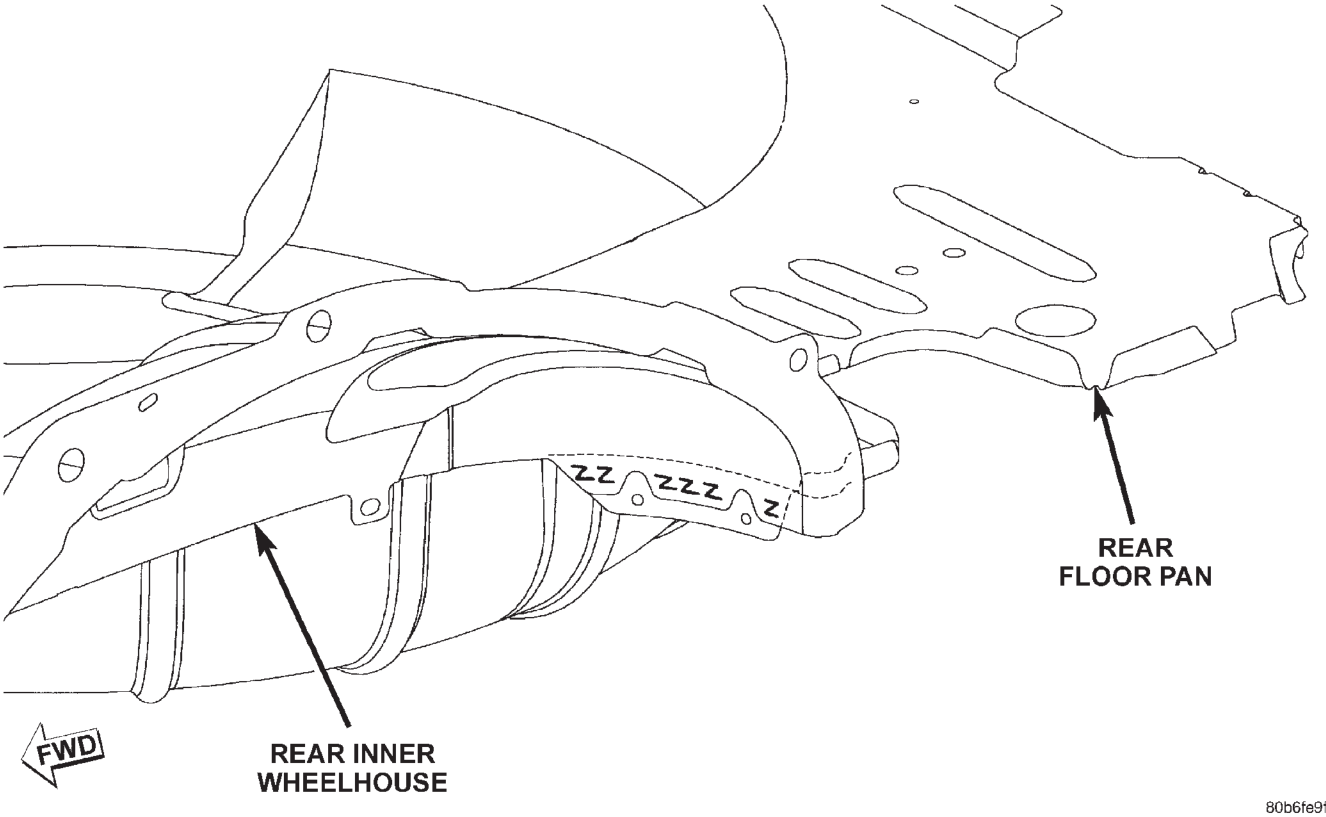
FLOOR PAN





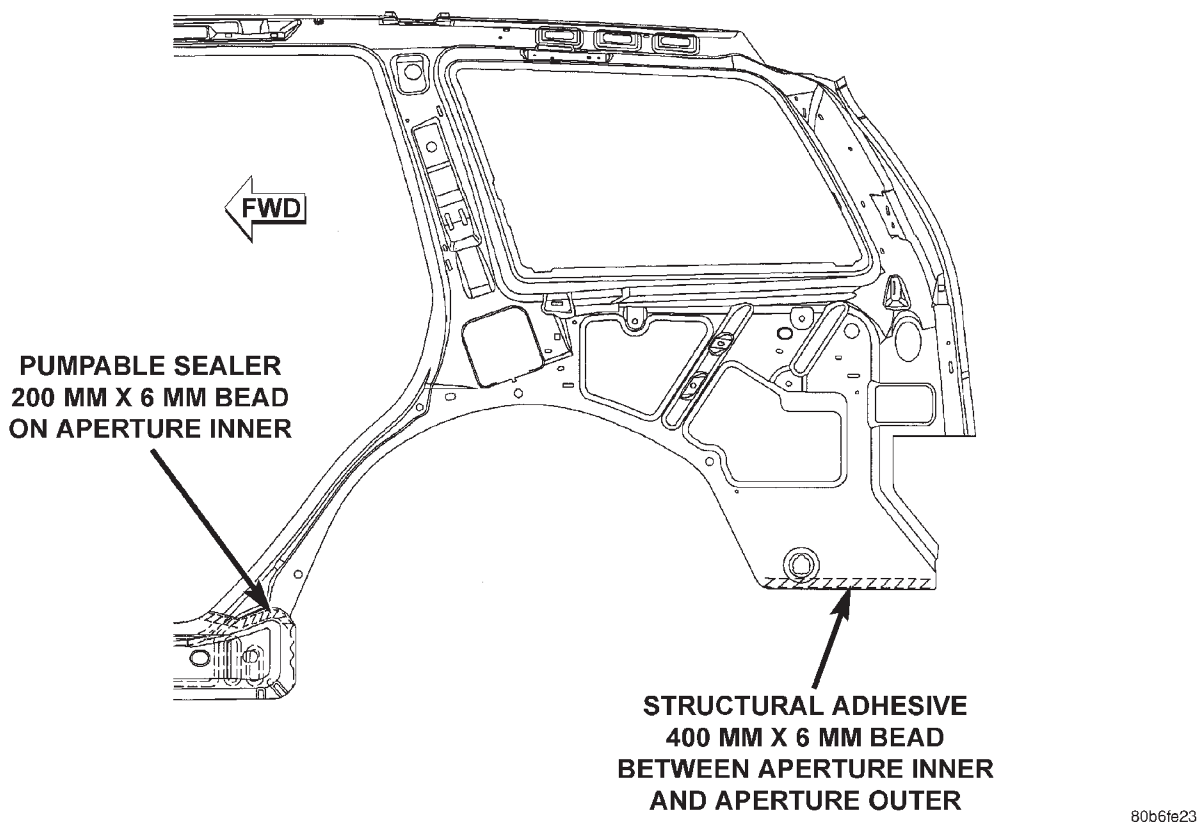
SPECIFICATIONS (Continued)

REAR INNER WHEELHOUSE AND REAR FLOOR PAN



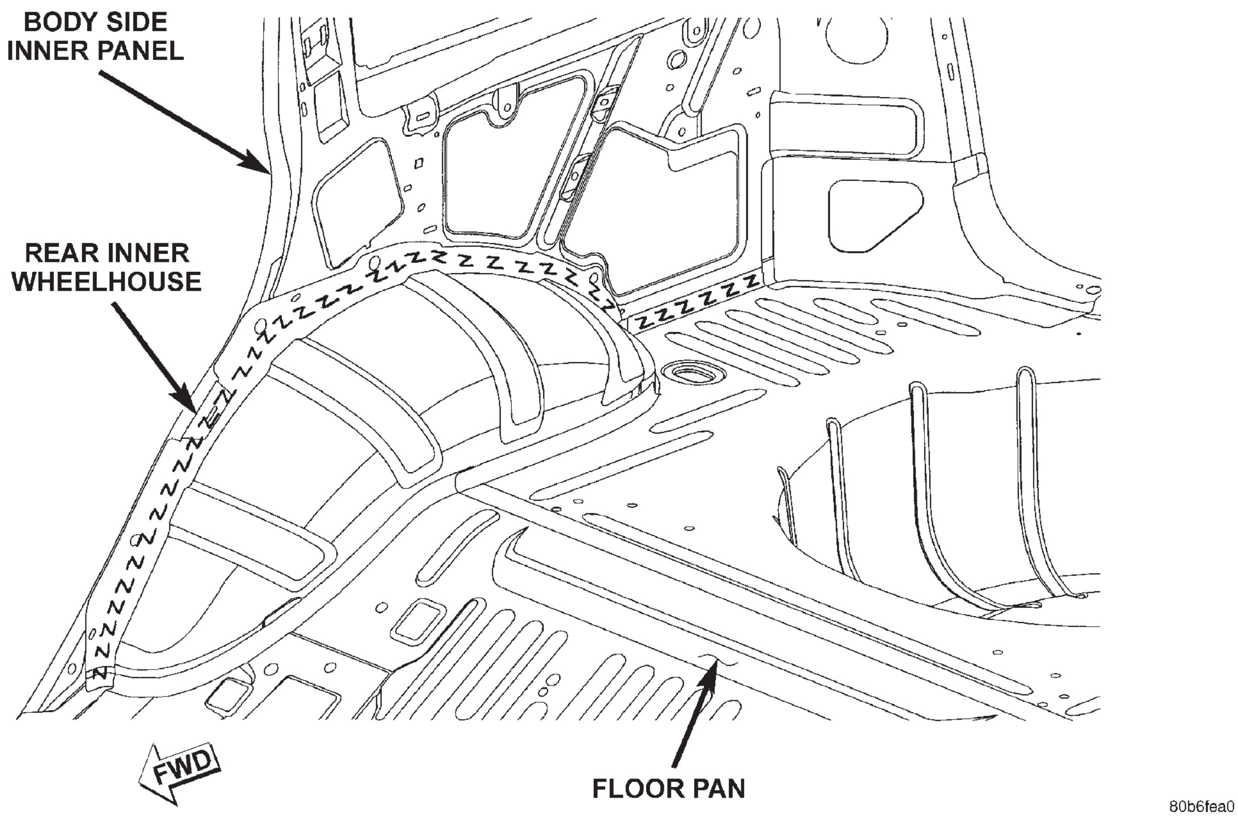
SPECIFICATIONS (Continued)

RIGHT INNER BODYSIDE APERTURE



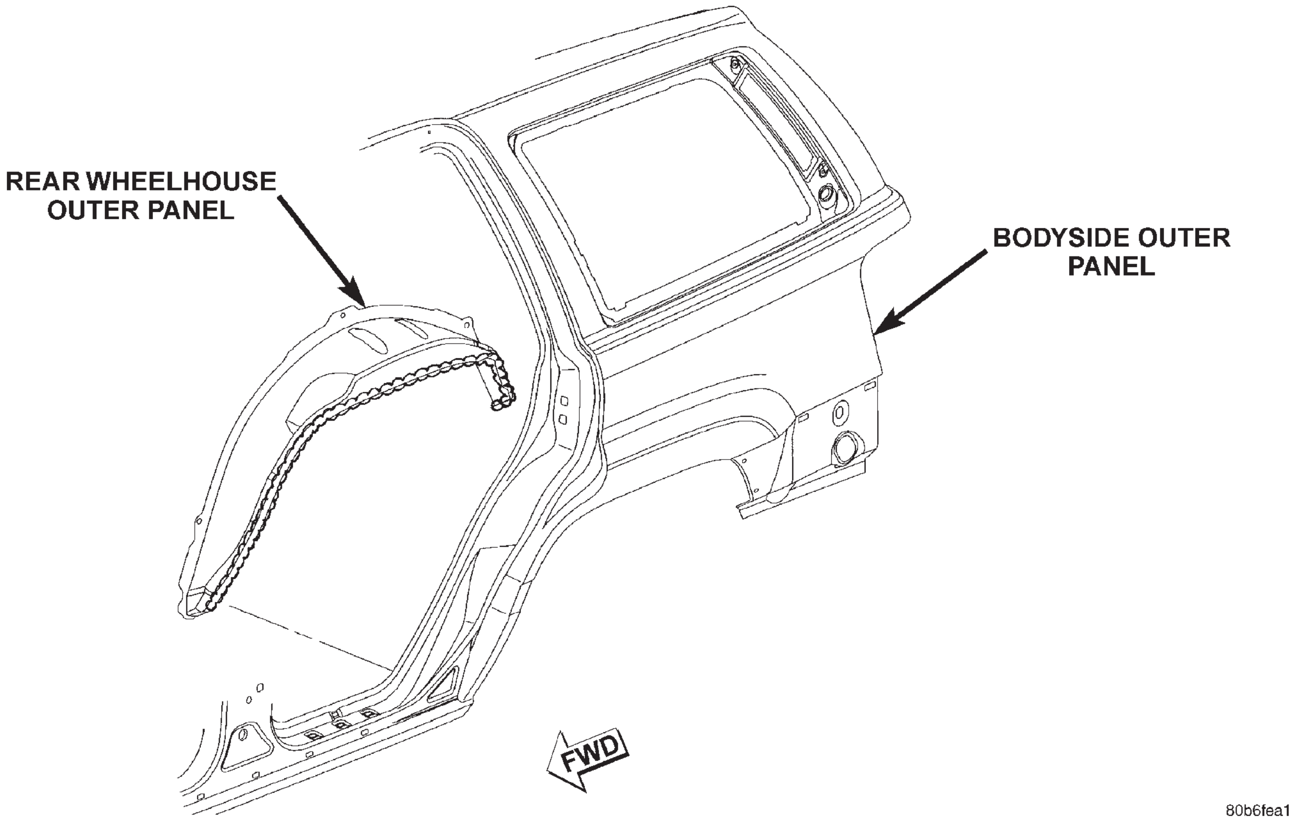
SPECIFICATIONS (Continued)

BODY SIDE INNER PANEL AND WHEELHOUSE



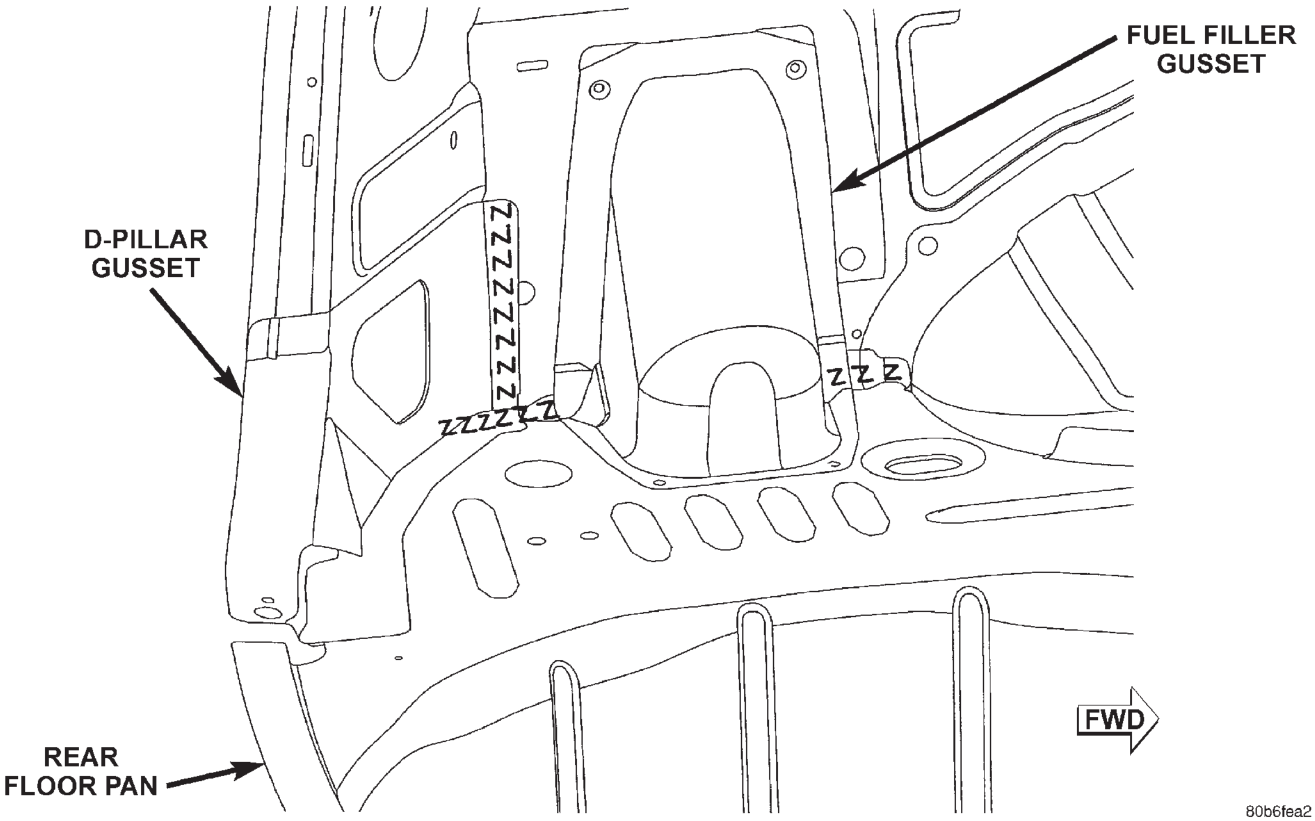
SPECIFICATIONS (Continued)

BODY SIDE OUTER PANEL AND REAR WHEELHOUSE OUTER PANEL



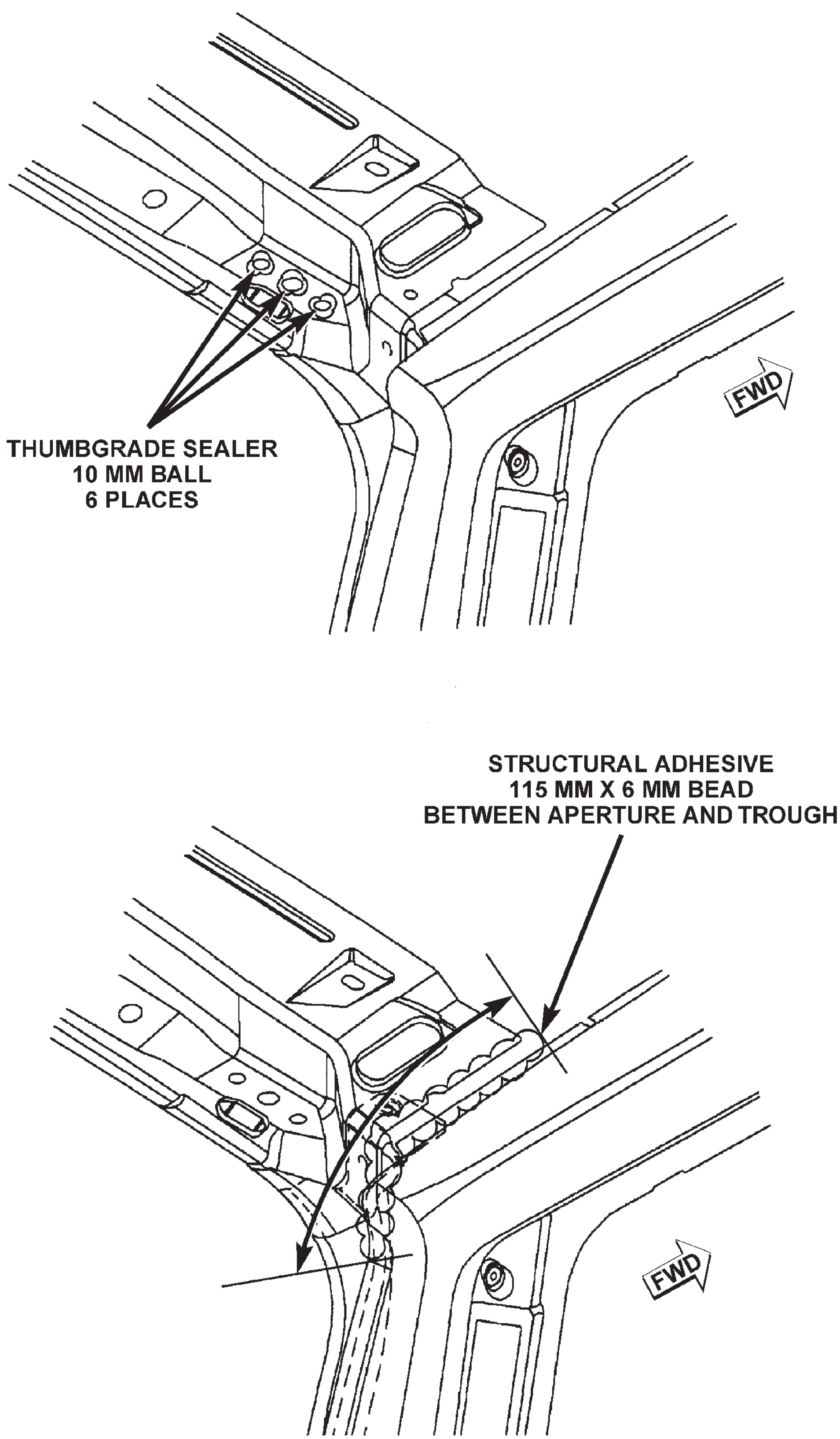
SPECIFICATIONS (Continued)

D-PILLAR AND FUEL FILLER GUSSETS



SPECIFICATIONS (Continued)

LIFTGATE



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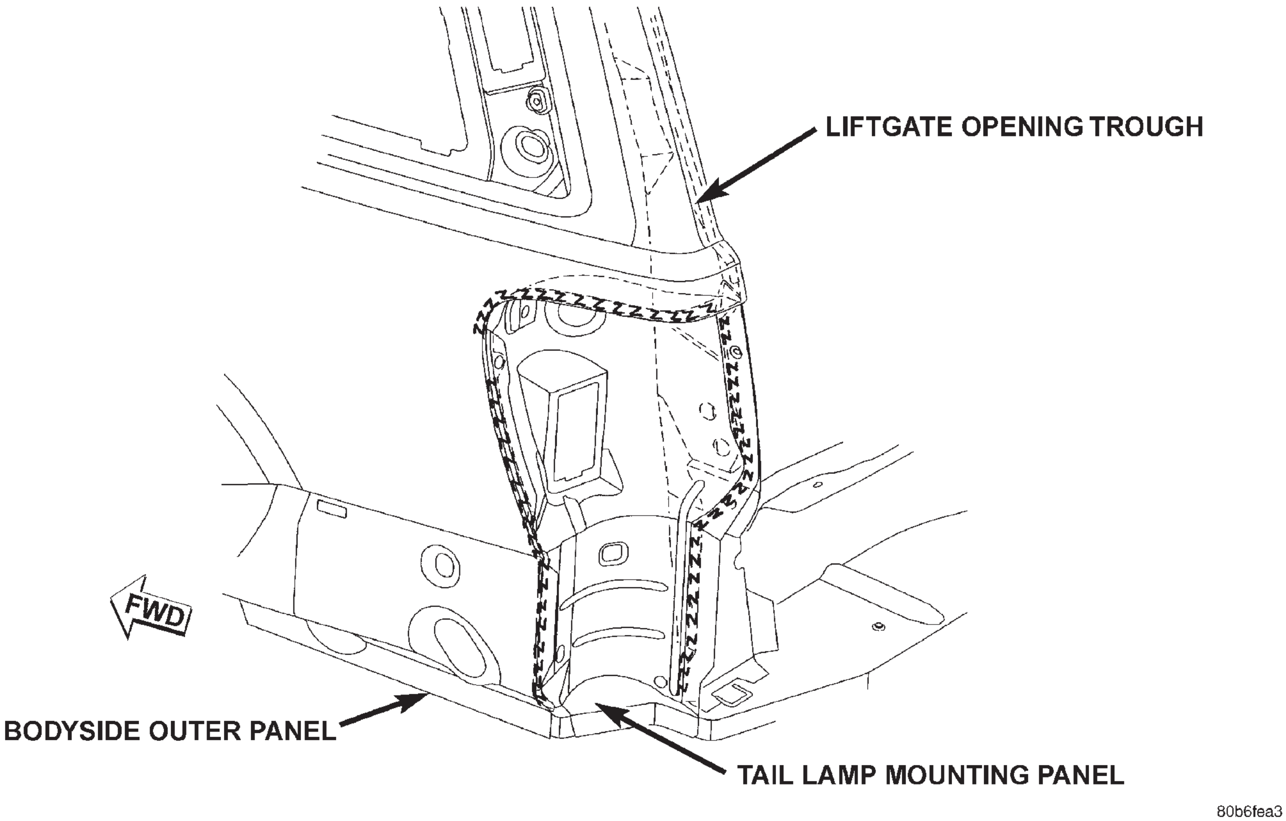
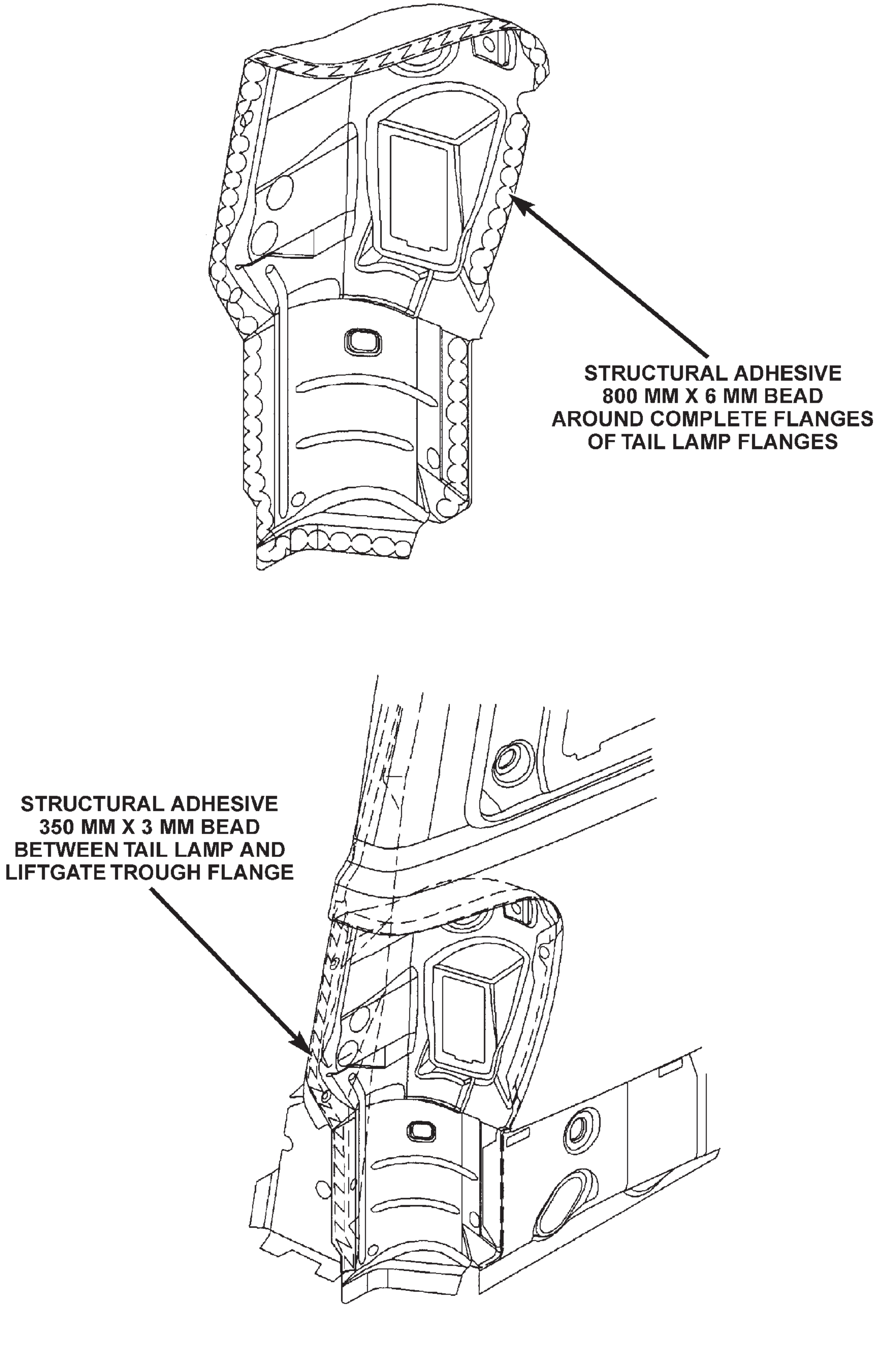
SPECIFICATIONS (Continued)

TAILLAMP MOUNTING PANEL



SPECIFICATIONS (Continued)

TAILLAMP



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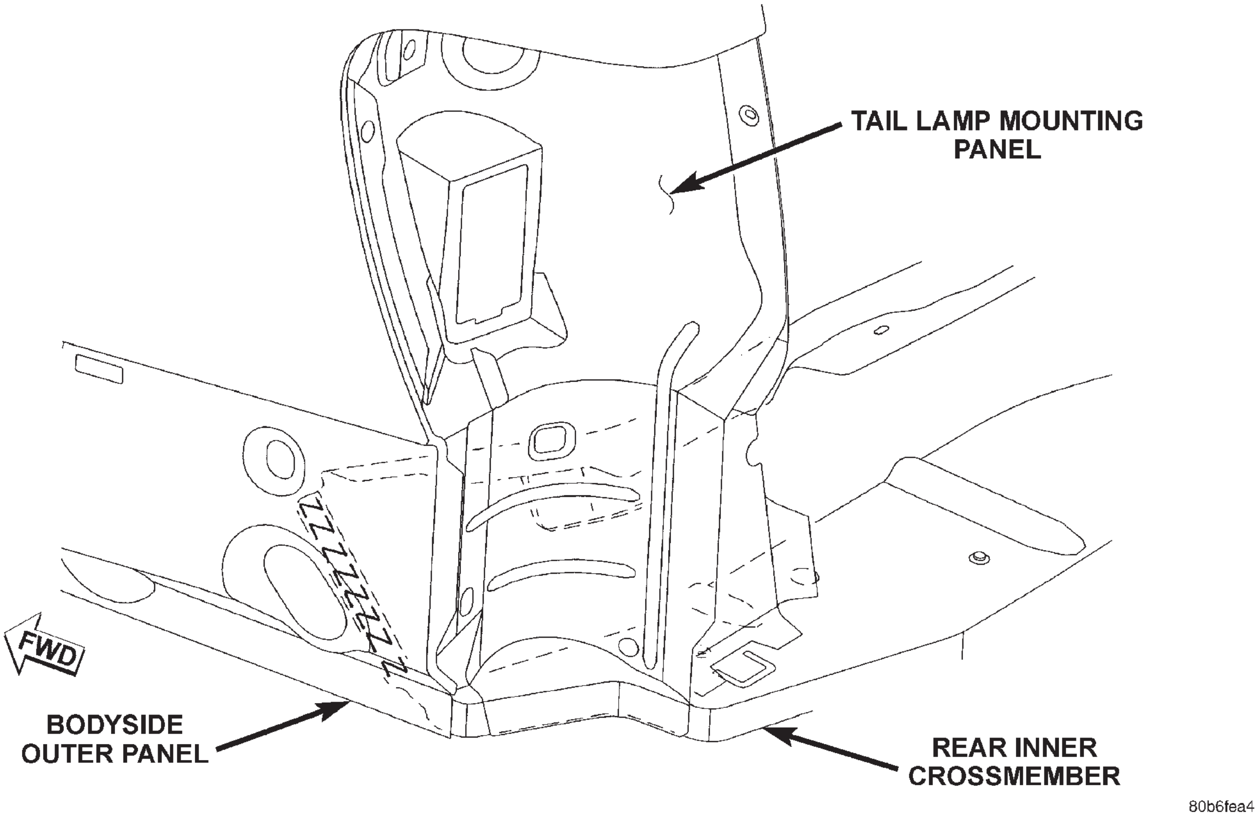
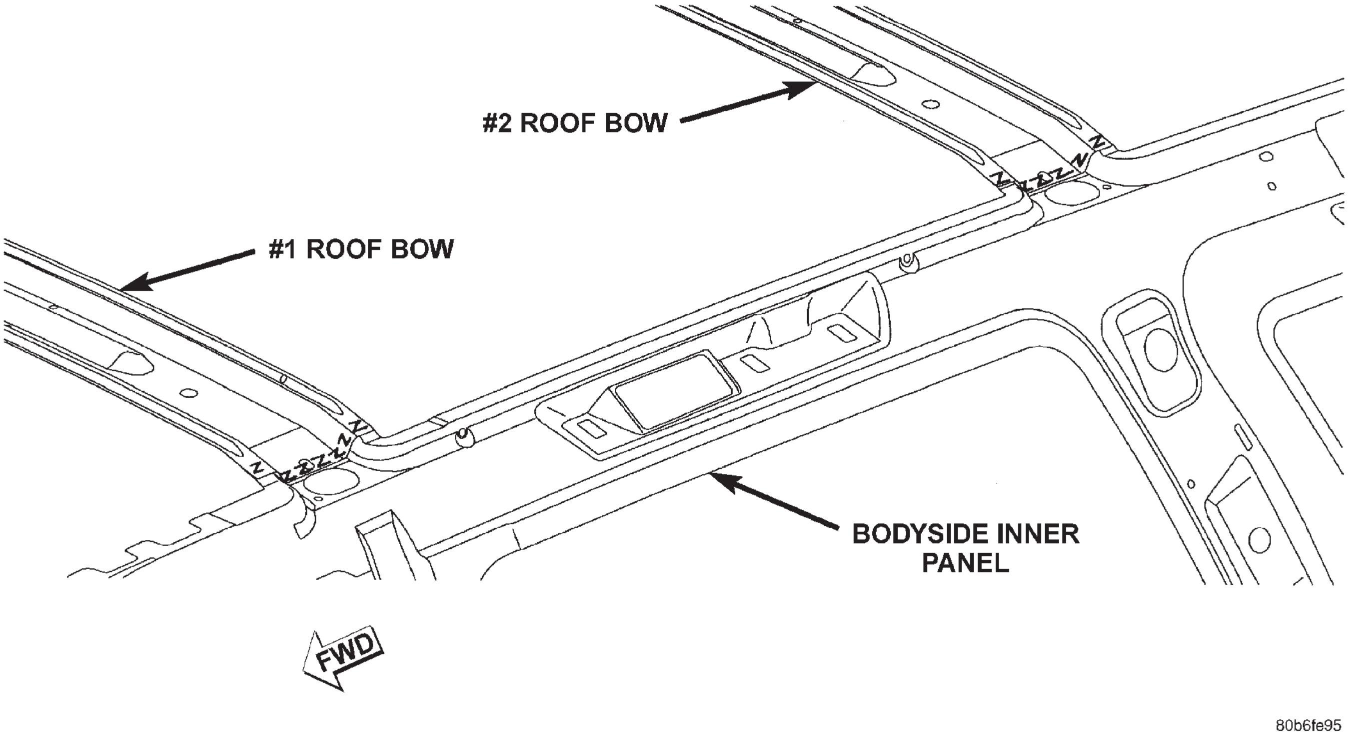
SPECIFICATIONS (Continued)

REAR INNER CROSSMEMBER



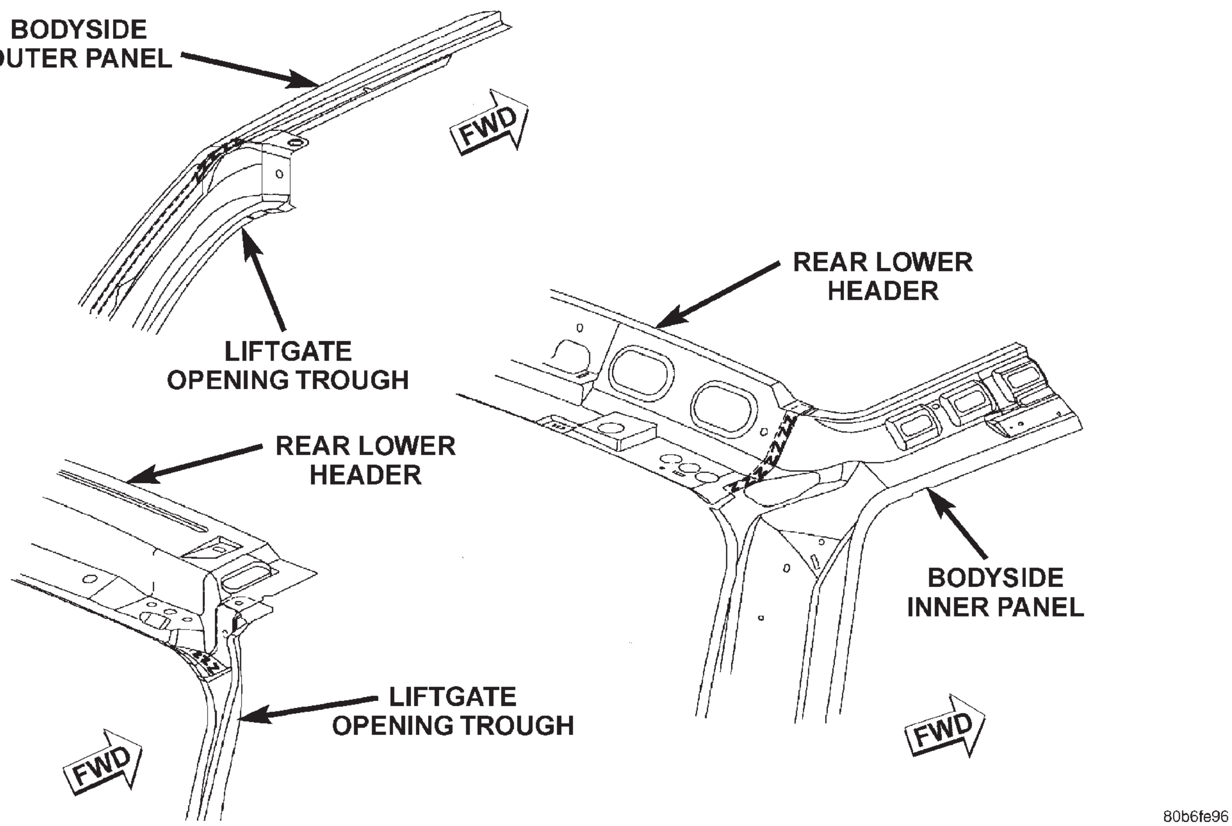
SPECIFICATIONS (Continued)

ROOF BOWS



SPECIFICATIONS (Continued)

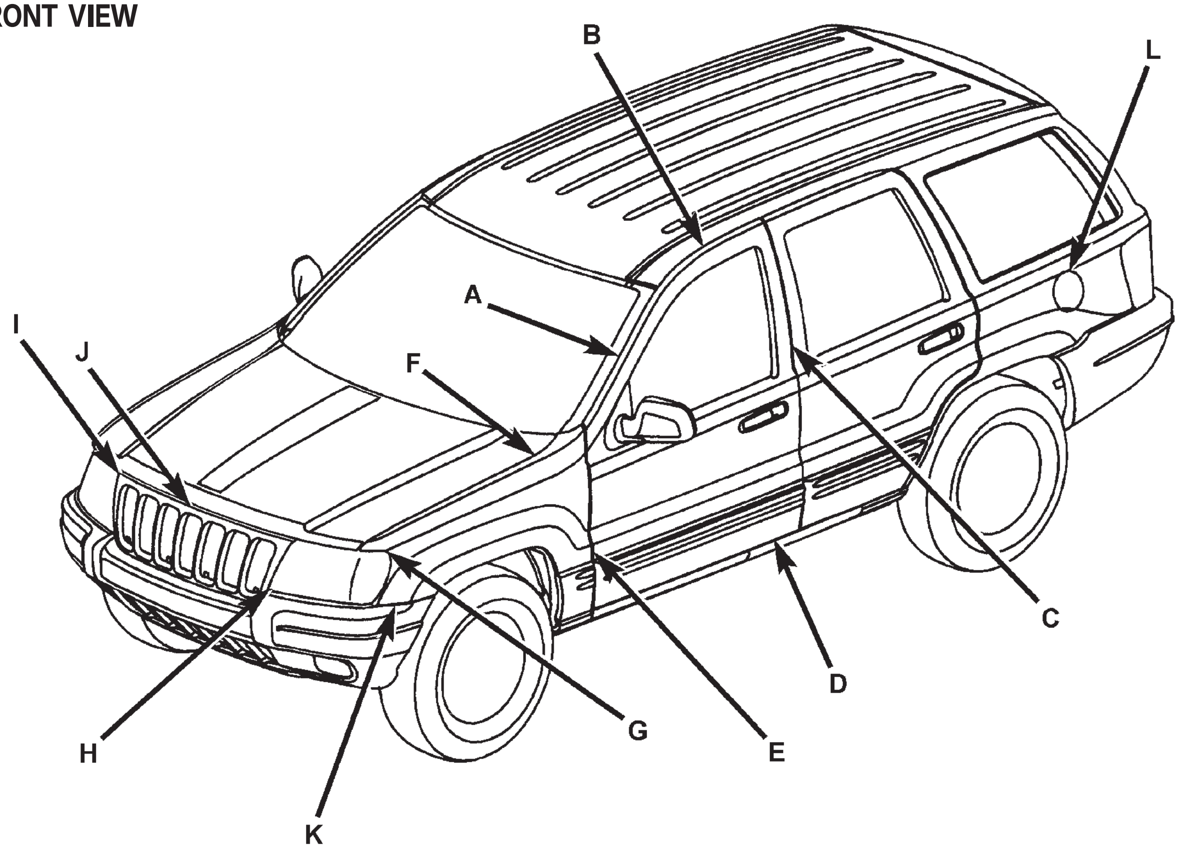
REAR LOWER HEADER



SPECIFICATIONS (Continued)

BODY GAP AND FLUSH MEASUREMENTS

WJ FRONT VIEW



	LOCATION	GAP	FLUSH
A	Front Door to Windshield Pillar	N/A	3.0 +/- 1.0
B	Front Door Header to Aperture	6.0 +/- 1.0	1.0 +/- 1.5
C	Front Door to Rear Door	5.0 +/- 1.0	0.0 +/- 1.0
D	Front Door to Aperture at Sill	7.0 +/- 1.5	N/A
E	Front Door to Fender	5.0 +/- 1.0	0.5 +/- 1.0
F	Hood to Fender	5.0 +/- 1.0	0.0 +/- 1.0
G	Headlamp to Fender	5.0 +/- 2.0	3.0 +/- 2.0
H	Headlamp to Grille	5.5 +/- 2.0	0.0 +/- 2.0
I	Grille to Headlamp	N/A	0.0 +/- 1.0
J	Grille to Hood	10.0 +/- 2.0	0.8 +/- 2.0
K	Front Fascia to Fender	Net + 1.0 - 0.0	3.0 +/- 3.0
L	Fuel Filler Door to Bodyside	3.0 +/- 0.75	0.5 +/- 0.75

NOTE: ALL MEASUREMENTS ARE IN MM.

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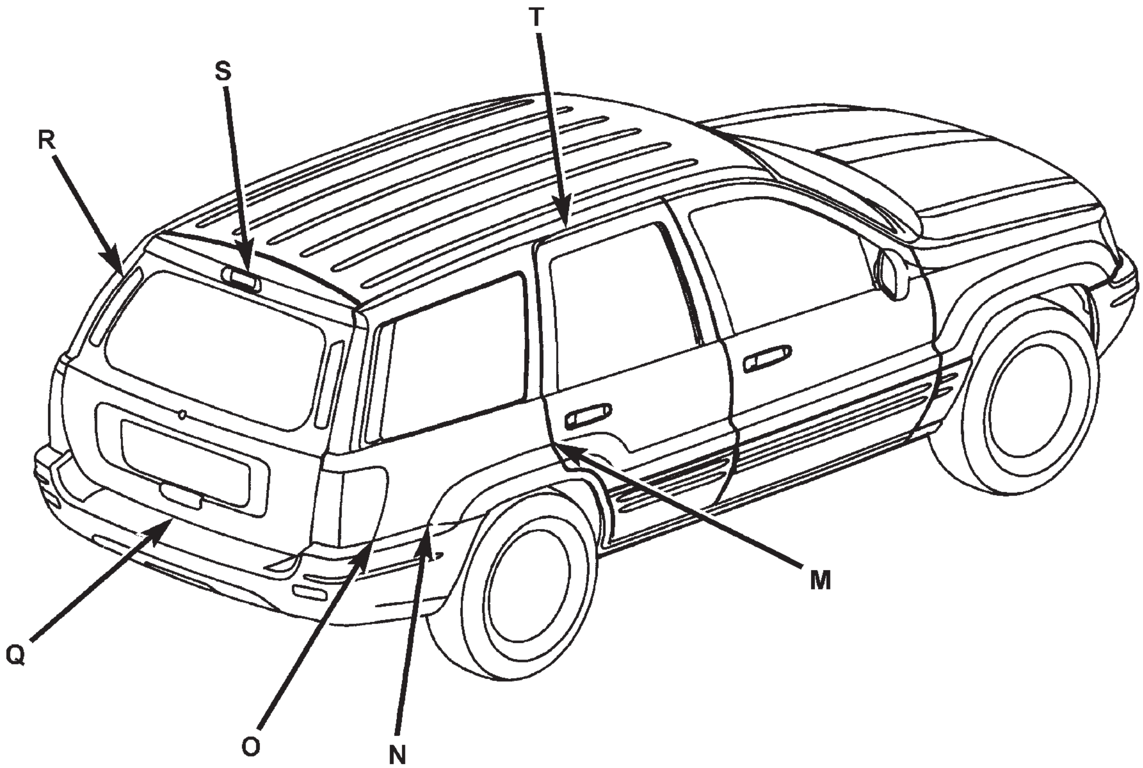
SPECIFICATIONS (Continued)

WJ REAR VIEW



	LOCATION	GAP	FLUSH
M	Rear Door to Quarter Panel	5.0 +/- 1.0	0.0 +/- 1.0
N	Aperture to Rear Fascia	Net to 1.0	3.0 +/- 2.0
O	Taillamp to Quarter Panel	2.0 +/- 1.0	3.0 +/- 1.5
P	Taillamp to Liftgate	5.0 +/- 1.5	3.0 +/- 1.5
Q	Liftgate to Fascia	10.0 +/- 3.0	N/A
R	Liftgate to Aperture	5.0 +/- 1.5	1.0 +/- 1.0
S	Liftgate to Roof	11.0 +/- 1.5	1.0 +/- 1.0
T	Rear Door Header to Aperture	6.0 +/- 1.0	1.0 +/- 1.5

NOTE: ALL MEASUREMENTS ARE IN MM.

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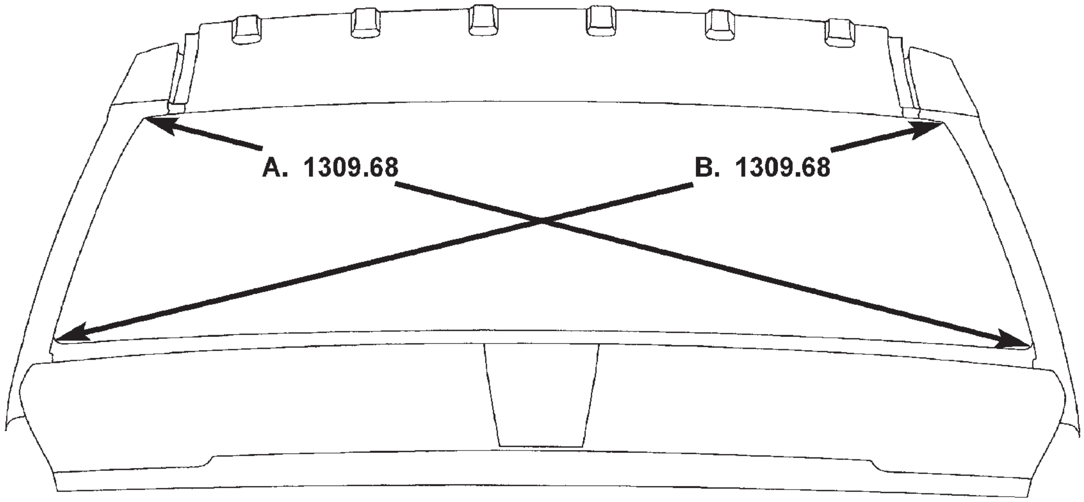
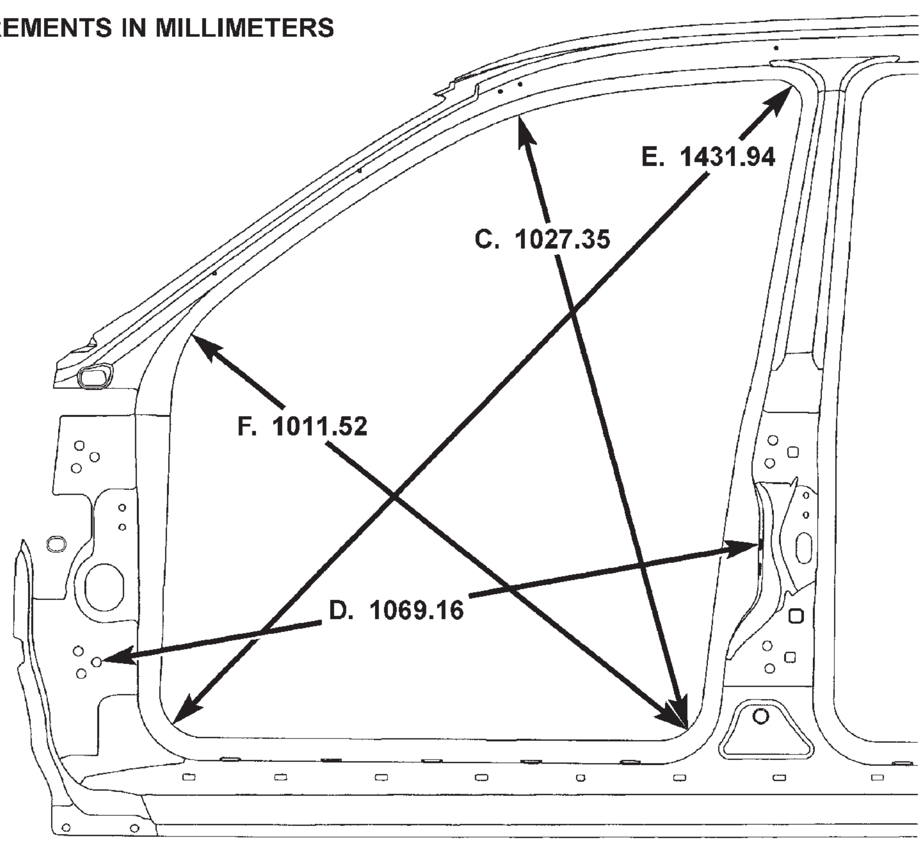
SPECIFICATIONS (Continued)

BODY OPENING DIMENSIONS

WINDSHIELD AND FRONT DOOR OPENING



ALL MEASUREMENTS IN MILLIMETERS



A. & B. Center of radius at bottom to center of radius at top.

C. Center of front door lower rear corner radius to center of A-pillar radius.

D. Center of door hinge mount to center of door striker mount.

E. Center of radius at bottom front to center of radius at top rear.

F. Center of radius at bottom rear to center of radius at lower A-pillar.

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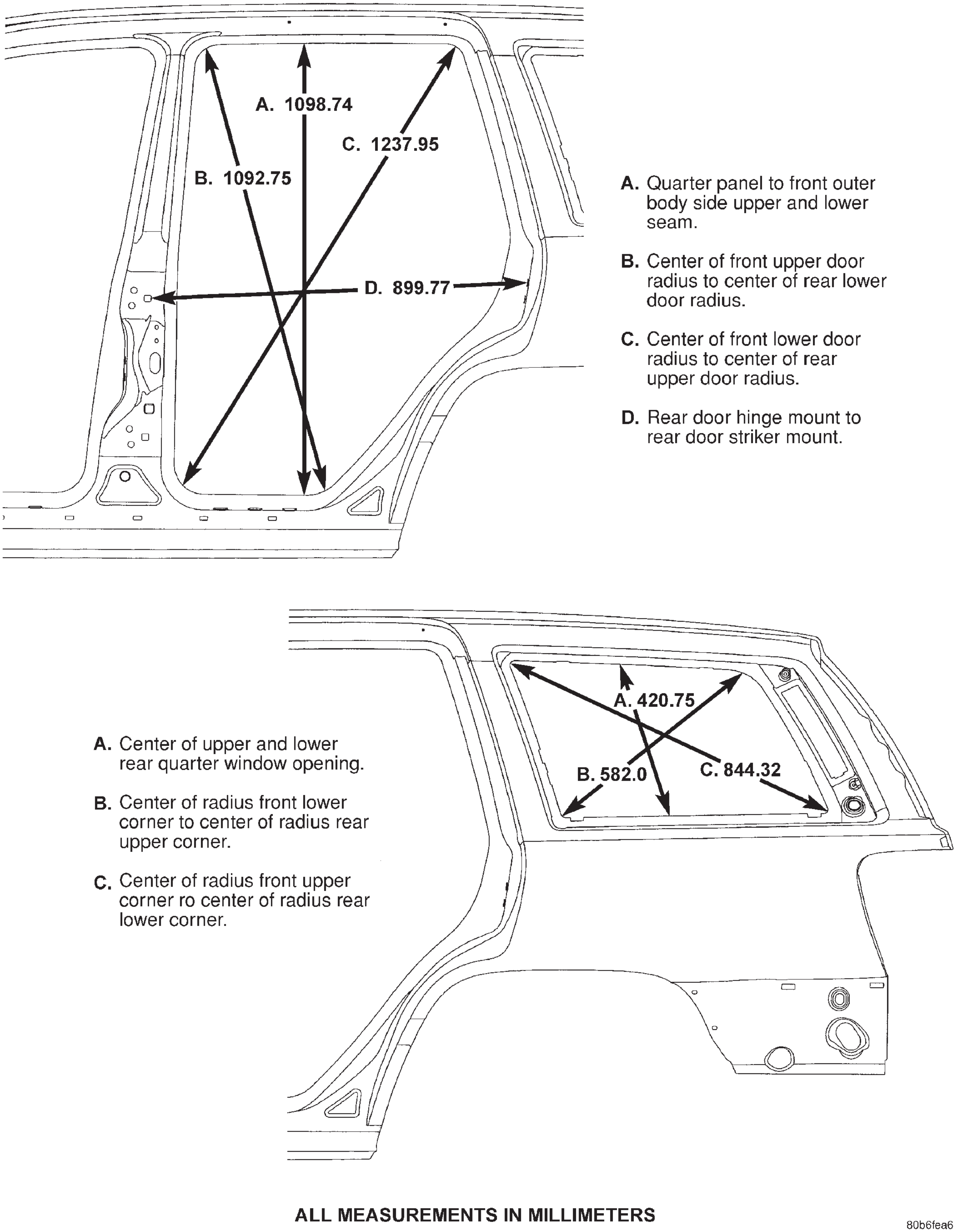
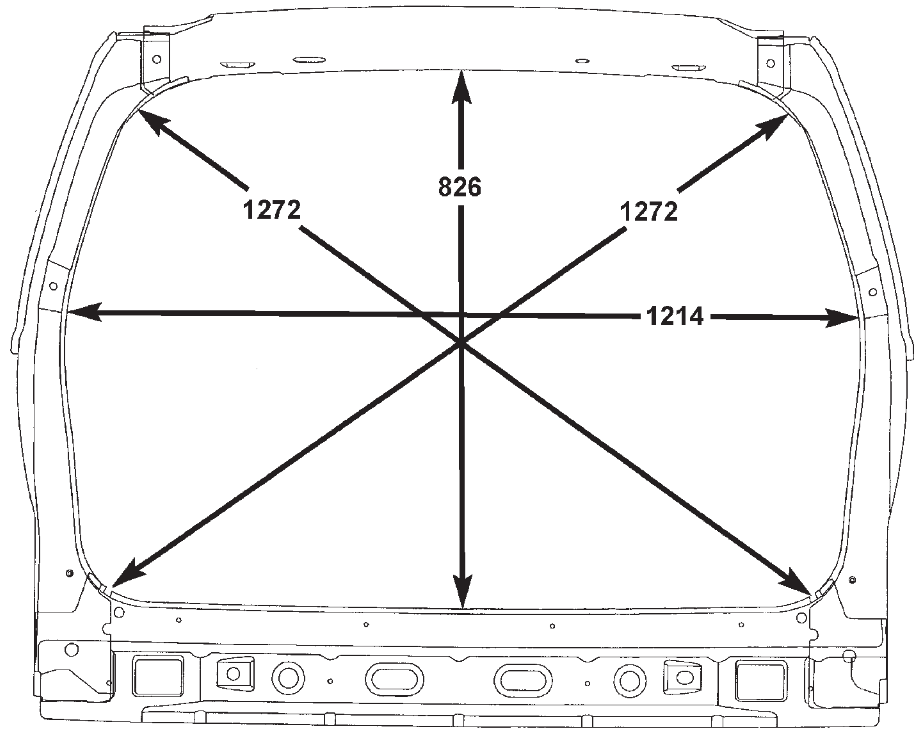
SPECIFICATIONS (Continued)

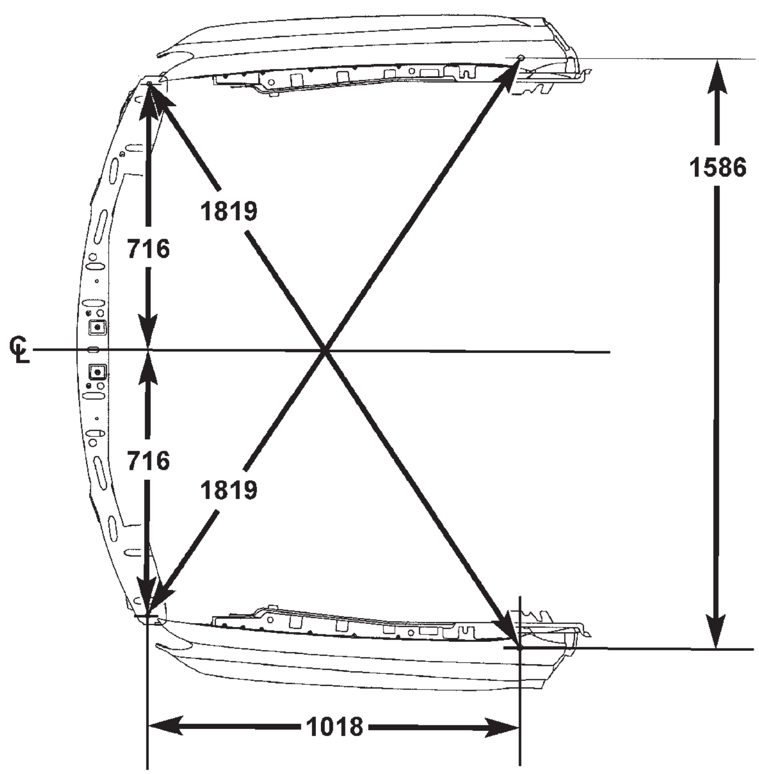
REAR DOOR AND QUARTER GLASS OPENING



SPECIFICATIONS (Continued)

LIFTGATE OPENING AND ENGINE COMPARTMENT





ALL MEASUREMENTS IN MILLIMETERS

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SPECIFICATIONS (Continued)

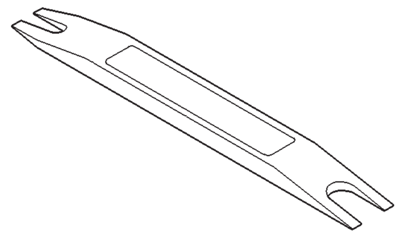
TORQUE SPECIFICATIONS

BODY COMPONENTS

DESCRIPTION	TORQUE
Sunroof module to roof panel	11N·m (97 in. lbs.).
Front bucket seat to floor pan bolts	40N·m (30 ft. lbs.).
Front bucket seat to floor pan front bolts	40N·m (30 ft. lbs.).
Bucket seat track adjuster nuts to seat cushion frame	28N·m (20 ft. lbs.).
Bucket seat recliner to seat back frame bolts	28N·m (20 ft. lbs.).
Bucket seat back frame recliner bolts to seat cushion frame	28N·m (20 ft. lbs.).
Rear seat cushion latch base panel screws	8 N·m (75 in. lbs.).
Rear seat cushion to floor pan bolts	11 N·m (8 ft. lbs.).
Rear seat back left side support bracket to center pivot bracket	28 N·m (20 ft. lbs.).
Rear seat back right side support bracket	28N·m (20 ft. lbs.).
Rear seat back latch/hinge to seat back frame	28N·m (20 ft.lbs.).
Hood latch to radiator crossmember	11N·m (8 ft.lbs.).
Front door hinge bolts	35N·m (26 ft. lbs.).
Front door latch to door screws	10N·m (7 ft. lbs.).
Front door striker to B pillar	28N·m (20 ft. lbs.).
Rear door latch to door screws	10N·m (95 in. lbs.).
Rear door striker to C pillar screws	28N·m (250 in. lbs.).
Rear view mirror set screw	1N·m (15 in. lbs.).
Lift gate latch striker to D pillar nuts	10N·m (7 ft. lbs.).
Door latch adjustment screw	3N·m (30 in. lbs.).

SPECIAL TOOLS

BODY



Remover, Moldings C-4829

HEATING AND AIR CONDITIONING

CONTENTS

DESCRIPTION AND OPERATION

A/C APPLICATION TABLE

Item	Description	Notes
VEHICLE	WJ Grand Cherokee	
SYSTEM	R134a w/variable orifice tube	
COMPRESSOR	Nippondenso 10PA17	ND-8 PAG oil
Freeze–up Control	Low Pressure Cycling Cutout Switch	accumulator mounted
Low psi Control	opens < 25 psi - resets > 34-38 psi	
High psi Control	opens > 450-490 psi - resets < 270-330 psi	line mounted
CONTROL HEAD	manual type	manual controls
	Automatic Zone Control (AZC)	Automatic Zone Control (AZC) with dual infrared sensing
Mode Doors	vacuum actuators	(electric actuator AZC)
Blend Air Door	electric actuator	(manual and AZC)
Blend Air Door (passenger)	electric actuator	(AZC only)
Fresh/Recirc door	vacuum	(electric actuator AZC)
Blower Motor	hardwired to control head	resistor block manual, power module (AZC)
COOLING FAN	Hybrid - viscous clutch/electric	PCM output
CLUTCH		
Control	relay	PCM
Draw	2.0-3.9 amps @ 12 V	± 0.5V@ 70° F
Gap	0.016″-0.031″	
DRB III®		
Reads	TPS, RPM, A/C switch	
Actuators	clutch relay	

ACCUMULATOR

The accumulator is mounted in the engine compartment between the evaporator coil outlet tube and the compressor inlet. Refrigerant enters the accumulator canister as a low pressure vapor through the inlet tube.

Any liquid, oil-laden refrigerant falls to the bottom of the canister, which acts as a separator. A desiccant bag is mounted inside the accumulator canister to absorb any moisture which may have entered and become trapped within the refrigerant system (Fig. 1).

BLOWER MOTOR

The blower motor and blower wheel are located in the passenger side end of the heater-A/C housing, below the glove box module. The blower motor controls the velocity of the air flowing through the heater-A/C housing by spinning a squirrel cage-type blower wheel within the housing at the selected speed. The blower motor and blower wheel can be serviced from the passenger compartment side of the housing.

The blower motor will only operate when the ignition switch is in the On position, and the heater-A/C mode control switch is in any position, except Off. The blower motor circuit is protected by a fuse in the junction block. On models with the standard manual temperature control system, the blower motor speed is controlled by regulating the battery feed through the blower motor switch and the blower motor resistor. On models with the optional Automatic Zone Control (AZC) system, the blower motor speed is controlled by using Pulse Width Modulation (PWM). The power module adjusts the battery feed voltage to the blower motor, based upon an input from the blower

DESCRIPTION AND OPERATION (Continued)

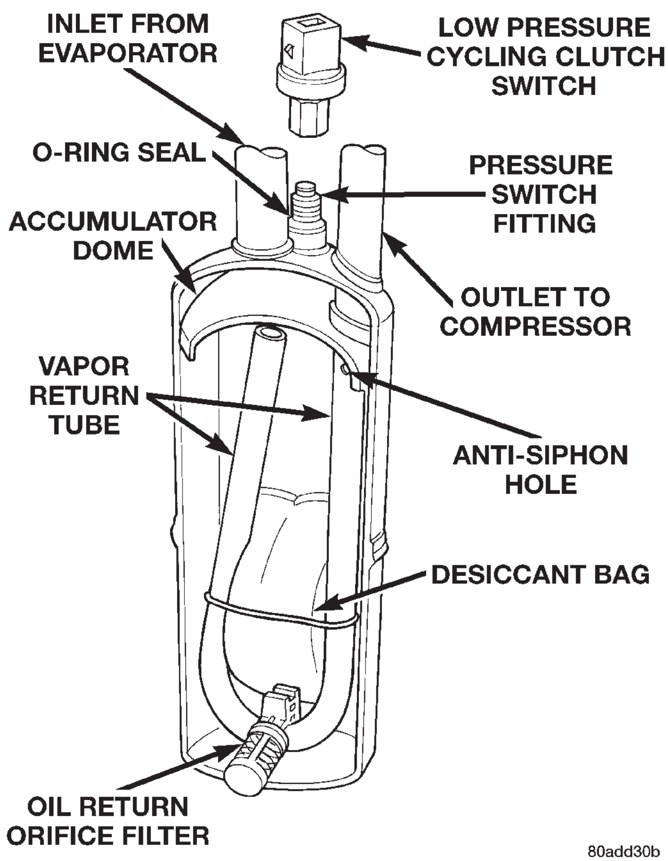


Fig. 1 Accumulator - Typical

motor switch, through the AZC control module. Pulse width modulation of blower power allows the blower to operate at any speed from stationary, to full speed.

The blower motor and blower motor wheel cannot be repaired, and if faulty or damaged, they must be replaced. The blower motor and blower wheel are each serviced separately.

BLOWER MOTOR CONTROLLER

Models equipped with the optional Automatic Zone Control (AZC) system have a blower motor controller (power module). The controller allows the selection of almost infinitely variable blower motor speeds. The controller is mounted to the heater-A/C housing, under the instrument panel and just inboard of the blower motor, in the same location used for the blower motor resistor on manual temperature control systems. It can be accessed without removing any other components.

The blower motor controller output to the blower motor can be adjusted by the blower motor speed switch knob on the AZC heater-A/C control panel, or it can be adjusted automatically by the logic circuitry and programming of the AZC control module. In either case, the AZC control module sends the correct pulse width modulated signal to the power module to obtain the selected or programmed blower motor speed.

The blower motor controller cannot be repaired and, if faulty or damaged, it must be replaced.

BLOWER MOTOR RESISTOR

Models with the standard manual temperature control system have a blower motor resistor. The blower motor resistor is mounted to the bottom of the heater-A/C housing, under the instrument panel and just inboard of the blower motor. It can be accessed for service without removing any other components.

The resistor has multiple resistor wires, each of which will reduce the current flow to the blower motor to change the blower motor speed by changing the resistance in the blower motor ground path. The blower motor switch directs the ground path through the correct resistor wire to obtain the selected speed.

With the blower motor switch in the lowest speed position, the ground path for the motor is applied through all of the resistor wires. Each higher speed selected with the blower motor switch applies the blower motor ground path through fewer of the resistor wires, increasing the blower motor speed. When the blower motor switch is in the highest speed position, the blower motor resistor is bypassed and the blower motor receives a direct path to ground.

The blower motor resistor cannot be repaired and, if faulty or damaged, it must be replaced.

BLOWER MOTOR SWITCH

The heater-A/C blower motor is controlled by a rotary-type blower motor switch, mounted in the heater-A/C control panel. On vehicles with manual temperature control systems, the switch allows the selection of four blower motor speeds, but will only operate with the ignition switch in the On position and the heater-A/C mode control switch in any position, except Off. On vehicles with the Automatic Zone Control (AZC) systems, the switch allows the selection of Lo Auto, Hi Auto, and an infinite number of manual speed settings between Lo and Hi.

On manual temperature control systems, the blower motor switch is connected in series with the blower motor ground path through the heater-A/C mode control switch. The blower motor switch directs this ground path to the blower motor through the blower motor resistor wires, or directly to the blower motor, as required to achieve the selected blower motor speed.

On AZC systems, the blower motor switch is just one of many inputs to the AZC control module. In the manual blower modes, the AZC control module adjusts the blower motor speed through the blower motor power module as required to achieve the selected blower switch position. In the auto blower

DESCRIPTION AND OPERATION (Continued)

modes, the AZC controller is programmed to select and adjust the blower motor speed through the blower motor power module as required to achieve and maintain the selected comfort level.

The blower motor switch cannot be repaired and, if faulty or damaged, it must be replaced. The switch is serviced only as a part of the heater-A/C control assembly.

COMPRESSOR

The air conditioning system uses a Nippondenso 10PA17 ten cylinder, double-acting swash plate-type compressor on all models. This compressor has a fixed displacement of 170 cubic centimeters (10.374 cubic inches), and has both the suction and discharge ports located on the cylinder head. A label identifying the use of R-134a refrigerant is located on the compressor.

The compressor is driven by the engine through an electric clutch, drive pulley and belt arrangement. The compressor is lubricated by refrigerant oil that is circulated throughout the refrigerant system with the refrigerant.

The compressor draws in low-pressure refrigerant vapor from the evaporator through its suction port. It then compresses the refrigerant into a high-pressure, high-temperature refrigerant vapor, which is then pumped to the condenser through the compressor discharge port.

The compressor cannot be repaired. If faulty or damaged, the entire compressor assembly must be replaced. The compressor clutch, pulley and clutch coil are available for service.

COMPRESSOR CLUTCH

The compressor clutch assembly consists of a stationary electromagnetic coil, a hub bearing and pulley assembly, and a clutch plate (Fig. 2). The electromagnetic coil unit and the hub bearing and pulley assembly are each retained on the nose of the compressor front housing with snap rings. The clutch plate is keyed to the compressor shaft and secured with a screw.

These components provide the means to engage and disengage the compressor from the engine serpentine accessory drive belt. When the clutch coil is energized, it magnetically draws the clutch into contact with the pulley and drives the compressor shaft. When the coil is not energized, the pulley freewheels on the clutch hub bearing, which is part of the pulley. The compressor clutch and coil are the only serviced parts on the compressor.

The compressor clutch engagement is controlled by several components: the A/C switch on the heater-A/C control panel, the Automatic Zone Control (AZC) control module (if the vehicle is so equipped), the low

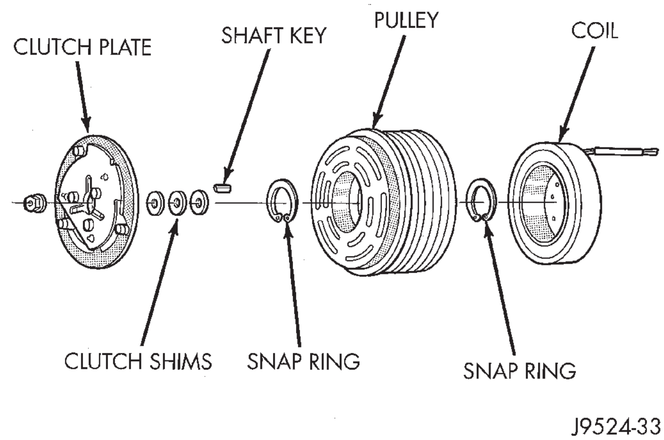


Fig. 2 Compressor Clutch - Typical

pressure cycling clutch switch, the high pressure cut-off switch, the compressor clutch relay, and the Powertrain Control Module (PCM). The PCM may delay compressor clutch engagement for up to thirty seconds. Refer to Group 14 - Fuel System for more information on the PCM controls.

COMPRESSOR CLUTCH RELAY

The compressor clutch relay is a International Standards Organization (ISO) micro-relay. The terminal designations and functions are the same as a conventional ISO relay. However, the micro-relay terminal orientation (footprint) is different, the current capacity is lower, and the relay case dimensions are smaller than those of the conventional ISO relay.

The compressor clutch relay is a electromechanical device that switches battery current to the compressor clutch coil when the Powertrain Control Module (PCM) grounds the coil side of the relay. The PCM responds to inputs from the A/C compressor switch on the heater-A/C control panel, the Automatic Zone Control (AZC) control module (if the vehicle is so equipped), the low pressure cycling clutch switch, and the high pressure cut-off switch. See Compressor Clutch Relay in the Diagnosis and Testing section of this group for more information.

The compressor clutch relay is located in the Power Distribution Center (PDC) in the engine compartment. Refer to the PDC label for relay identification and location.

The compressor clutch relay cannot be repaired and, if faulty or damaged, it must be replaced.

CONDENSER

The condenser is located in the air flow in front of the engine cooling radiator. The condenser is a heat exchanger that allows the high-pressure refrigerant gas being discharged by the compressor to give up its heat to the air passing over the condenser fins. When the refrigerant gas gives up its heat, it condenses.

DESCRIPTION AND OPERATION (Continued)

When the refrigerant leaves the condenser, it has become a high-pressure liquid refrigerant.

The volume of air flowing over the condenser fins is critical to the proper cooling performance of the air conditioning system. Therefore, it is important that there are no objects placed in front of the radiator grille openings in the front of the vehicle or foreign material on the condenser fins that might obstruct proper air flow. Also, any factory-installed air seals or shrouds must be properly reinstalled following radiator or condenser service.

The condenser cannot be repaired and, if faulty or damaged, it must be replaced.

EVAPORATOR COIL

The evaporator coil is located in the heater-A/C housing, under the instrument panel. The evaporator coil is positioned in the heater-A/C housing so that all air that enters the housing must pass over the fins of the evaporator before it is distributed through the system ducts and outlets. However, air passing over the evaporator coil fins will only be conditioned when the compressor is engaged and circulating refrigerant through the evaporator coil tubes.

Refrigerant enters the evaporator from the variable orifice tube as a low-temperature, low-pressure liquid. As air flows over the fins of the evaporator, the humidity in the air condenses on the fins, and the heat from the air is absorbed by the refrigerant. Heat absorption causes the refrigerant to boil and vaporize. The refrigerant becomes a low-pressure gas before it leaves the evaporator.

The evaporator coil cannot be repaired and, if faulty or damaged, it must be replaced.

HEATER CORE

The heater core is located in the heater-A/C housing, under the instrument panel. It is a heat exchanger made of rows of tubes and fins. Engine coolant is circulated through heater hoses to the heater core at all times. As the coolant flows through the heater core, heat removed from the engine is transferred to the heater core fins and tubes.

Air directed through the heater core picks up the heat from the heater core fins. The blend air door allows control of the heater output air temperature by controlling how much of the air flowing through the heater-A/C housing is directed through the heater core. The blower motor speed controls the volume of air flowing through the heater-A/C housing.

The heater core cannot be repaired and, if faulty or damaged, it must be replaced. Refer to Group 7 - Cooling System for more information on the engine cooling system, the engine coolant and the heater hoses.

HEATER AND AIR CONDITIONER

A manual temperature control type heating-air conditioning system is standard factory-installed equipment on this model. An electronically controlled Automatic Zone Control (AZC) type heating-air conditioning system is an available factory-installed option.

All vehicles are equipped with a common heater-A/C housing assembly (Fig. 3). The system combines air conditioning, heating, and ventilating capabilities in a single unit housing mounted under the instrument panel.

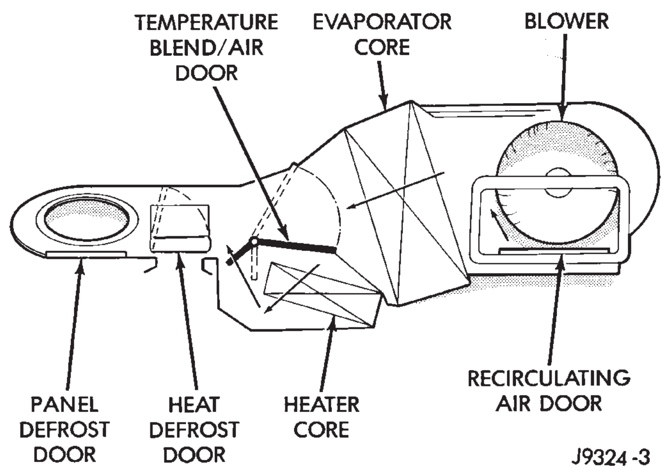


Fig. 3 Common Blend-Air Heater-Air Conditioner System

Outside fresh air enters the vehicle through the cowl top opening at the base of the windshield, and passes through a plenum chamber to the heater-A/C system blower housing. Air flow velocity can then be adjusted with the blower motor speed selector switch on the heater-A/C control panel. The air intake openings must be kept free of snow, ice, leaves, and other obstructions for the heater-A/C system to receive a sufficient volume of outside air.

It is also important to keep the air intake openings clear of debris because leaf particles and other debris that is small enough to pass through the cowl plenum screen can accumulate within the heater-A/C housing. The closed, warm, damp and dark environment created within the heater-A/C housing is ideal for the growth of certain molds, mildews and other fungi. Any accumulation of decaying plant matter provides an additional food source for fungal spores, which enter the housing with the fresh air. Excess debris, as well as objectionable odors created by decaying plant matter and growing fungi can be discharged into the passenger compartment during heater-A/C system operation.

Both the manual and AZC heater and air conditioner are blend-air type systems. In a blend-air system, a blend-air door controls the amount of

DESCRIPTION AND OPERATION (Continued)

unconditioned air (or cooled air from the evaporator) that is allowed to flow through, or around, the heater core. A temperature control knob on the heater-A/C control panel determines the discharge air temperature by energizing the blend-air door motor, which operates the blend-air door. This allows an almost immediate control of the output air temperature of the system. The AZC system will have separate blend-air doors and temperature controls for each front seat occupant.

The mode control knob on the heater-A/C control panel is used to direct the conditioned air to the selected system outlets. On manual temperature control systems, the mode control knob switches engine vacuum to control the mode doors, which are operated by vacuum actuator motors. On AZC systems, the mode control knob switches electrical current to control the mode doors, which are operated by electronic actuator motors.

The outside air intake can be shut off on manual temperature control systems by selecting the Recirculation Mode with the mode control knob. The outside air intake can be shut off on Automatic Zone Control (AZC) type system by pushing the Recirculation Mode button. This will operate the recirculating air door that closes off the outside fresh air intake and recirculates the air that is already inside the vehicle.

The air conditioner for all models is designed for the use of non-CFC, R-134a refrigerant. The air conditioning system has an evaporator to cool and dehumidify the incoming air prior to blending it with the heated air. This air conditioning system uses a variable orifice tube in the liquid line near the condenser outlet tube to meter refrigerant flow to the evaporator coil. To maintain minimum evaporator temperature and prevent evaporator freezing, a fixed pressure setting switch on the accumulator cycles the compressor clutch.

HEATER AND AIR CONDITIONER CONTROL

The manual temperature control heater-A/C system uses a combination of electrical, and vacuum controls. The Automatic Zone Control (AZC) heater-A/C system uses only electrical controls. These controls provide the vehicle operator with a number of setting options to help control the climate and comfort within the vehicle. Refer to the owner's manual in the vehicle glove box for more information on the suggested operation and use of these controls.

Both heater-A/C control panels are located on the instrument panel inboard of the steering column and below the radio (Fig. 4). Both control panels contain rotary-type temperature control knob(s), a rotary-type mode control switch knob, a rotary-type blower motor speed switch knob and an air conditioning compressor push button switch. The Rear Window Defogger push button switch is also located on heater–A/C control panel. The AZC control panel also features a Recirc push button switch and a vacuum fluorescent display area.

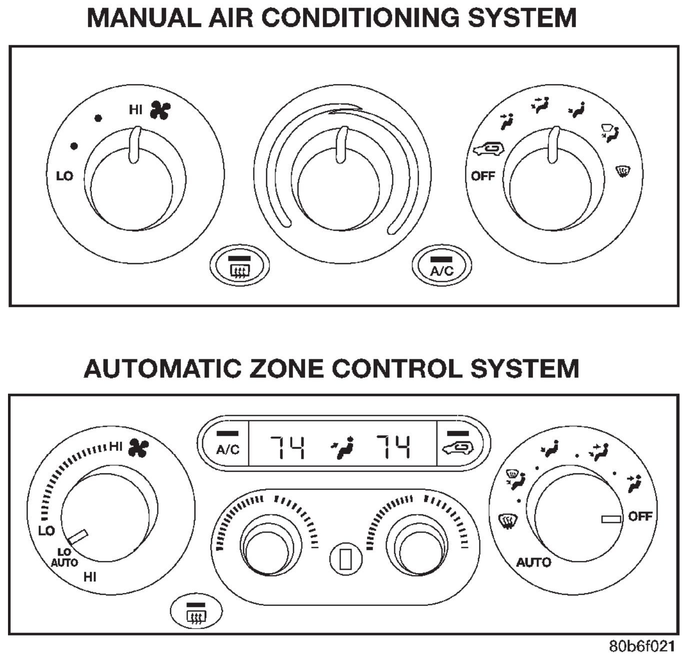


Fig. 4 Heater-Air Conditioner Control Panels

The AZC control module uses infrared sensing technology to control occupant comfort levels, not the actual passenger compartment air temperature. Dual infrared sensors mounted in the face of the control unit independently measure the surface temperature to maintain customer-perceived comfort temperature under changing conditions. Dual Zone temperature control provides wide side-to-side variation in comfort temperature to exceed the needs of either front seat occupant. This sensing system replaces interior air temperature and solar sensors used to approximate direct sensing control through complex control programs.

Both the manual heater-A/C control panel and the AZC control panel are serviced only as complete units and cannot be repaired. If faulty or damaged, the entire control panel unit must be replaced.

HIGH PRESSURE RELIEF VALVE

A high pressure relief valve is located on the compressor manifold, which is on the side of the compressor. This mechanical valve is designed to vent refrigerant from the system to protect against damage to the compressor and other system components, caused by condenser air flow restriction or an overcharge of refrigerant.

The high pressure relief valve vents the system when a discharge pressure of 3445 to 4135 kPa (500 to 600 psi) or above is reached. The valve closes

DESCRIPTION AND OPERATION (Continued)

when a minimum discharge pressure of 2756 kPa (400 psi) is reached.

The high pressure relief valve vents only enough refrigerant to reduce the system pressure, and then re-seats itself. The majority of the refrigerant is conserved in the system. If the valve vents refrigerant, it does not mean that the valve is faulty.

The high pressure relief valve is a factory-calibrated unit. The valve cannot be adjusted or repaired, and must not be removed or otherwise disturbed. The valve is only serviced as a part of the compressor assembly.

HIGH PRESSURE SWITCH

The high pressure switch is located on the discharge line or discharge line block fitting near the compressor. The switch is screwed onto a fitting that contains a Schrader-type valve, which allows the switch to be serviced without discharging the refrigerant system. The discharge line fitting is equipped with an O-ring to seal the switch connection.

The high pressure switch is connected in series electrically with the low pressure switch between ground and the Powertrain Control Module (PCM). The switch contacts open and close causing the PCM to turn the compressor clutch on and off. This prevents compressor operation when the discharge line pressure approaches high levels.

The high pressure switch contacts are open when the discharge line pressure rises above 3100 to 3375 kPa (450 to 490 psi). The switch contacts will close when the discharge line pressure drops to 1860 to 2275 kPa (270 to 330 psi).

The high pressure switch is a factory-calibrated unit. The switch cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

INFRARED TEMPERATURE SENSOR

Models equipped with the optional Automatic Zone Control (AZC) system use automatic dual zone temperature control with infrared sensing technology. The temperature sensor is located in the center instrument panel, between the dual temperature knobs of the AZC.

The AZC module uses infrared sensing technology to control occupant comfort levels, not the actual passenger compartment air temperature. Dual infrared sensors mounted in the face of the control unit independently measure the surface temperature to maintain customer-perceived comfort temperature under changing conditions. Dual Zone temperature control provides wide side-to-side variation in comfort temperature to exceed the needs of either front seat occupant. This sensing system replaces interior air temperature and solar sensors used to approximate direct sensing control through complex control programs.

The infrared temperature sensor cannot be adjusted or repaired and, if faulty or damaged, the module must be replaced.

NOTE: The infrared sensor window may be permanently damaged if any type of cosmetic vinyl dressings are allowed to contact the lens. Avoid spraying or wiping this area with any cleaner or conditioner. This may result in impaired temperature sensing and control.

LOW PRESSURE SWITCH

The low pressure switch is located on the top of the accumulator. The switch is screwed onto an accumulator fitting that contains a Schrader-type valve, which allows the switch to be serviced without discharging the refrigerant system. The accumulator fitting is equipped with an O-ring to seal the switch connection.

The low pressure switch is connected in series electrically with the high pressure switch, between ground and the Powertrain Control Module (PCM). The switch contacts open and close causing the PCM to turn the compressor clutch on and off. This regulates the refrigerant system pressure and controls evaporator temperature. Controlling the evaporator temperature prevents condensate water on the evaporator fins from freezing and obstructing air conditioning system air flow.

The low pressure switch contacts are open when the suction pressure is approximately 141 kPa (20.5 psi) or lower. The switch contacts will close when the suction pressure rises to approximately 234 to 262 kPa (34 to 38 psi) or above. Lower ambient temperatures, below approximately -1° C (30° F), will also cause the switch contacts to open. This is due to the pressure/temperature relationship of the refrigerant in the system.

The low pressure switch is a factory-calibrated unit. It cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

REFRIGERANT

The refrigerant used in this air conditioning system is a HydroFluoroCarbon (HFC), type R-134a. Unlike R-12, which is a ChloroFluoroCarbon (CFC), R-134a refrigerant does not contain ozone-depleting chlorine. R-134a refrigerant is a non-toxic, non-flammable, clear, and colorless liquefied gas.

Even though R-134a does not contain chlorine, it must be reclaimed and recycled just like CFC-type refrigerants. This is because R-134a is a greenhouse gas and can contribute to global warming.

DESCRIPTION AND OPERATION (Continued)

R-134a refrigerant is not compatible with R-12 refrigerant in an air conditioning system. Even a small amount of R-12 added to an R-134a refrigerant system will cause compressor failure, refrigerant oil sludge or poor air conditioning system performance. In addition, the PolyAlkylene Glycol (PAG) synthetic refrigerant oils used in an R-134a refrigerant system are not compatible with the mineral-based refrigerant oils used in an R-12 refrigerant system.

R-134a refrigerant system service ports, service tool couplers and refrigerant dispensing bottles have all been designed with unique fittings to ensure that an R-134a system is not accidentally contaminated with the wrong refrigerant (R-12). There are also labels posted in the engine compartment of the vehicle and on the compressor identifying to service technicians that the air conditioning system is equipped with R-134a.

REFRIGERANT LINES

The refrigerant lines and hoses are used to carry the refrigerant between the various air conditioning system components. A barrier hose design with a nylon tube inner hose liner is used for the R-134a air conditioning system on this vehicle. This nylon liner helps to further contain the R-134a refrigerant, which has a smaller molecular structure than R-12 refrigerant. The ends of the refrigerant hoses are made from lightweight aluminum or steel, and use braze-less fittings.

Any kinks or sharp bends in the refrigerant plumbing will reduce the capacity of the entire air conditioning system. Kinks and sharp bends reduce the flow of refrigerant in the system. A good rule for the flexible hose refrigerant lines is to keep the radius of all bends at least ten times the diameter of the hose. In addition, the flexible hose refrigerant lines should be routed so they are at least 80 millimeters (3 inches) from the exhaust manifold.

High pressures are produced in the refrigerant system when the air conditioning compressor is operating. Extreme care must be exercised to make sure that each of the refrigerant system connections is pressure-tight and leak free. It is a good practice to inspect all flexible hose refrigerant lines at least once a year to make sure they are in good condition and properly routed.

The refrigerant lines and hoses are coupled with other components of the HVAC system with peanut-block style fittings. A stat-O seal type flat steel gasket with a captured compressible O-ring, is used to mate plumbing lines with A/C components to ensure the integrity of the refrigerant system.

The refrigerant lines and hoses cannot be repaired and, if faulty or damaged, they must be replaced.

REFRIGERANT OIL

The refrigerant oil used in R-134a refrigerant systems is a synthetic-based, PolyAlkylene Glycol (PAG), wax-free lubricant. Mineral-based R-12 refrigerant oils are not compatible with PAG oils, and should never be introduced to an R-134a refrigerant system.

There are different PAG oils available, and each contains a different additive package. The 10PA17 compressor used in this vehicle is designed to use an ND8 PAG refrigerant oil. Use only refrigerant oil of this same type to service the refrigerant system.

After performing any refrigerant recovery or recycling operation, always replenish the refrigerant system with the same amount of the recommended refrigerant oil as was removed. Too little refrigerant oil can cause compressor damage, and too much can reduce air conditioning system performance.

PAG refrigerant oil is much more hygroscopic than mineral oil, and will absorb any moisture it comes into contact with, even moisture in the air. The PAG oil container should always be kept tightly capped until it is ready to be used. After use, recap the oil container immediately to prevent moisture contamination.

REFRIGERANT SYSTEM SERVICE EQUIPMENT

WARNING: EYE PROTECTION MUST BE WORN WHEN SERVICING AN AIR CONDITIONING REFRIGERANT SYSTEM. TURN OFF (ROTATE CLOCKWISE) ALL VALVES ON THE EQUIPMENT BEING USED BEFORE CONNECTING TO, OR DISCONNECTING FROM THE REFRIGERANT SYSTEM. FAILURE TO OBSERVE THESE WARNINGS MAY RESULT IN PERSONAL INJURY.

When servicing the air conditioning system, a R-134a refrigerant recovery/recycling/charging station that meets SAE Standard J2210 must be used. Contact an automotive service equipment supplier for refrigerant recovery/recycling/charging equipment. Refer to the operating instructions supplied by the equipment manufacturer for proper care and use of this equipment.

A manifold gauge set may be needed with some recovery/recycling/charging equipment (Fig. 5). 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 released into the atmosphere.

MANIFOLD GAUGE SET CONNECTIONS

CAUTION: Do not use an R-12 manifold gauge set on an R-134a system. The refrigerants are not compatible and system damage will result.

DESCRIPTION AND OPERATION (Continued)

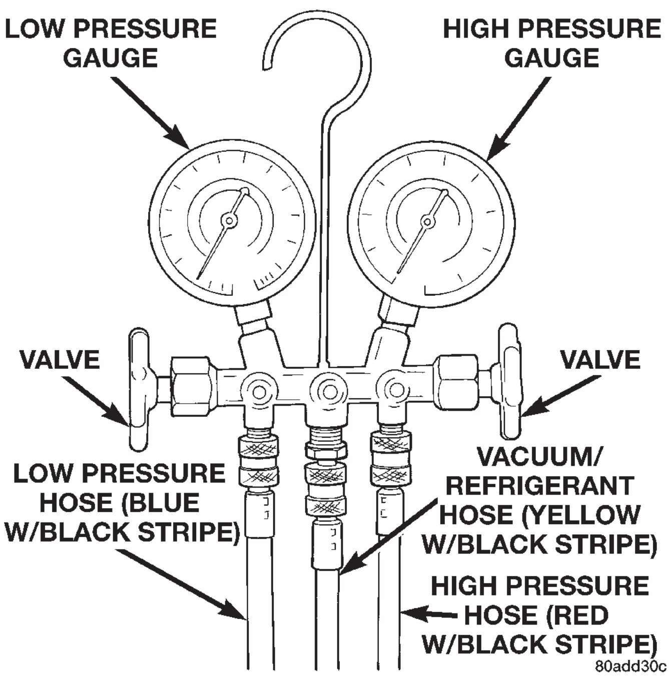


Fig. 5 Manifold Gauge Set - Typical

LOW PRESSURE GAUGE HOSE The low pressure hose (Blue with Black stripe) attaches to the suction service port. This port is located on the liquid line, near the evaporator at the rear of the engine compartment.

HIGH PRESSURE GAUGE HOSE The high pressure hose (Red with Black stripe) attaches to the discharge service port. This port is located on the compressor manifold on the side of the compressor.

RECOVERY/RECYCLING/EVACUATION/CHARGING HOSE The center manifold hose (Yellow, or White, with Black stripe) 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.

REFRIGERANT SYSTEM SERVICE PORT

The two refrigerant system service ports are used to charge, recover/recycle, evacuate, and test the air conditioning refrigerant system. Unique service port coupler sizes are used on the R-134a system, to ensure that the refrigerant system is not accidentally contaminated by the use of the wrong refrigerant (R-12), or refrigerant system service equipment.

The high pressure service port is located on the discharge line off the side of the compressor. The low pressure service port is located on the suction line near the evaporator at the rear of the engine compartment.

Each of the service ports has a threaded plastic protective cap installed over it from the factory. After servicing the refrigerant system, always reinstall both of the service port caps.

SERVICE WARNINGS AND PRECAUTIONS

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.**
- **AVOID BREATHING THE REFRIGERANT AND REFRIGERANT OIL VAPOR OR MIST. EXPOSURE MAY IRRITATE THE EYES, NOSE, AND/OR THROAT. WEAR EYE PROTECTION WHEN SERVICING THE AIR CONDITIONING REFRIGERANT SYSTEM. SERIOUS EYE INJURY CAN RESULT FROM DIRECT CONTACT WITH THE REFRIGERANT. IF EYE CONTACT OCCURS, SEEK MEDICAL ATTENTION IMMEDIATELY.**
- **DO NOT EXPOSE THE REFRIGERANT TO OPEN FLAME. POISONOUS GAS IS CREATED WHEN REFRIGERANT IS BURNED. AN ELECTRONIC LEAK DETECTOR IS RECOMMENDED.**
- **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.**
- **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 THE SKIN OR DELICATE OBJECTS FROM DIRECT CONTACT WITH THE REFRIGERANT.**
- **THE R-134a SERVICE EQUIPMENT OR THE VEHICLE REFRIGERANT 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.**

DESCRIPTION AND OPERATION (Continued)

CAUTION:

- **Liquid refrigerant is corrosive to metal surfaces. Follow the operating instructions supplied with the service equipment being used.**
- **Never add R-12 to a refrigerant system designed to use R-134a. Damage to the system will result.**
- **R-12 refrigerant oil must not be mixed with R-134a refrigerant oil. They are not compatible.**
- **Do not use R-12 equipment or parts on the R-134a system. Damage to the system will result.**
- **Do not overcharge the refrigerant system. This will cause excessive compressor head pressure and can cause noise and system failure.**
- **Recover the refrigerant before opening any fitting or connection. Open the fittings with caution, even after the system has been discharged. Never open or loosen a connection before recovering the refrigerant.**
- **Do not remove the secondary retention clip from any spring-lock coupler connection while the refrigerant system is under pressure. Recover the refrigerant before removing the secondary retention clip. Open the fittings with caution, even after the system has been discharged. Never open or loosen a connection before recovering the refrigerant.**
- **The refrigerant system must always 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, clean the outside of the fittings thoroughly to prevent contamination from entering the refrigerant system.**
- **Immediately after disconnecting a component from the refrigerant system, seal the open fittings with a cap or plug.**
- **Before connecting an open refrigerant fitting, always install a new seal or gasket. Coat the fitting and seal with clean refrigerant oil before connecting.**
- **Do not remove the sealing caps from a replacement component until it is to be installed.**
- **When installing a refrigerant line, avoid sharp bends that may restrict refrigerant flow. Position the refrigerant lines away from exhaust system components or any sharp edges, which may damage the line.**
- **Tighten refrigerant fittings only to the specified torque. The aluminum fittings used in the refrigerant system will not tolerate overtightening.**
- **When disconnecting a refrigerant fitting, use a wrench on both halves of the fitting. This will prevent twisting of the refrigerant lines or tubes.**
- **Refrigerant oil will absorb moisture from the atmosphere if left uncapped. Do not open a container of refrigerant oil until you are ready to use it. Replace the cap on the oil container immediately after using. Store refrigerant oil only in a clean, airtight, and moisture-free container.**
- **Keep service tools and the work area clean. Contamination of the refrigerant system through careless work habits must be avoided.**

COOLING SYSTEM REQUIREMENTS

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 will reduce the performance of the air conditioning and engine cooling systems.

The engine cooling system includes the heater core and the heater hoses. Refer to Group 7 - Cooling System for more information before the opening of, or attempting any service to the engine cooling system.

REFRIGERANT HOSES/LINES/TUBES PRECAUTIONS

Kinks or sharp bends in the refrigerant plumbing will reduce the capacity of the entire system. High pressures are produced in the system when it is operating. Extreme care must be exercised to make sure that all refrigerant system connections are pressure tight.

A good rule for the flexible hose refrigerant lines is to keep the radius of all bends at least ten times the diameter of the hose. Sharp bends will reduce the flow of refrigerant. The flexible hose lines should be routed so they are at least 80 millimeters (3 inches) from the exhaust manifold. It is a good practice to inspect all flexible refrigerant system hose lines at least once a year to make sure they are in good condition and properly routed.

There are two types of refrigerant fittings:

- All fittings with O-rings need to be coated with refrigerant oil before installation. Use only O-rings that are the correct size and approved for use with R-134a refrigerant. Failure to do so may result in a leak.
- Refrigerant line connections with Stat-O seal type gaskets cannot be serviced with O-rings. The gaskets are not reusable and should be replaced any time the connection has been opened for service.

Using the proper tools when making a refrigerant plumbing connection is very important. Improper tools or improper use of the tools can damage the refrigerant fittings. Always use two wrenches when loosening or tightening tube fittings. Use one wrench

DESCRIPTION AND OPERATION (Continued)

to hold one side of the connection stationary, while loosening or tightening the other side of the connection with a second wrench.

The refrigerant must be recovered completely from the system before opening any fitting or connection. Open the fittings with caution, even after the refrigerant has been recovered. If any pressure is noticed as a fitting is loosened, tighten the fitting and recover the refrigerant from the system again.

Do not discharge refrigerant into the atmosphere. Use an R-134a refrigerant recovery/recycling device that meets SAE Standard J2210.

The refrigerant system will remain chemically stable as long as pure, moisture-free R-134a refrigerant and refrigerant oil is used. Dirt, moisture, or air can upset this chemical stability. Operational troubles or serious damage can occur if foreign material is present in the refrigerant system.

When it is necessary to open the refrigerant system, have everything needed to service the system ready. The refrigerant system should not be left open to the atmosphere any longer than necessary. Cap or plug all lines and fittings as soon as they are opened to prevent the entrance of dirt and moisture. All lines and components in parts stock should be capped or sealed until they are to be installed.

All tools, including the refrigerant recycling equipment, the manifold gauge set, and test hoses should be kept clean and dry. All tools and equipment must be designed for R-134a refrigerant.

VACUUM CHECK VALVE

A vacuum check valve (non AZC only) is installed in the accessory vacuum supply line in the engine compartment, near the vacuum tap on the engine intake manifold. The vacuum check valve is designed to allow vacuum to flow in only one direction through the accessory vacuum supply circuits.

The use of a vacuum check valve helps to maintain the system vacuum needed to retain the selected heater-A/C mode settings. The check valve will prevent the engine from bleeding down system vacuum through the intake manifold during extended heavy engine load (low engine vacuum) operation.

The vacuum check valve cannot be repaired and, if faulty or damaged, it must be replaced.

VACUUM RESERVOIR

The vacuum reservoir is mounted in the right front of the vehicle behind the headlamp mounting module (Fig. 6). The headlamp mounting module and headlamp assembly must be removed from the vehicle to access the vacuum reservoir for service. Refer to Group 8L - Lamps for more information on component removal.

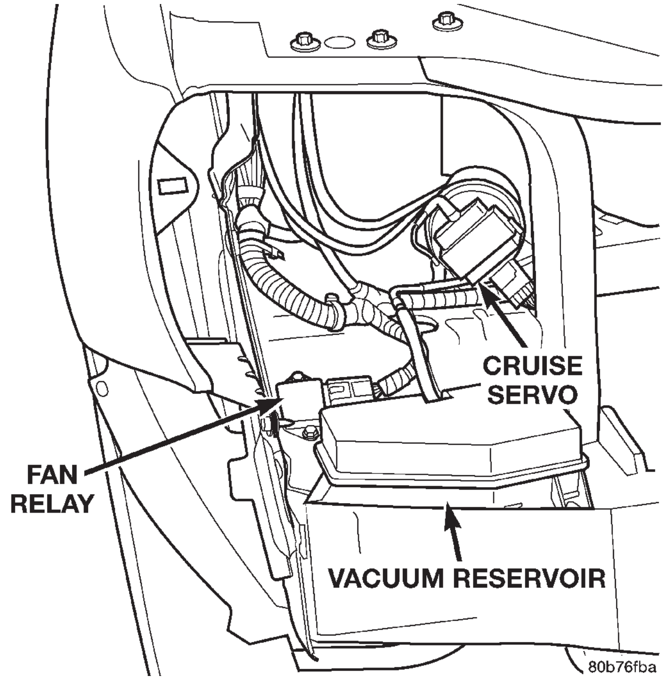


Fig. 6 Vacuum Reservoir

Engine vacuum is stored in the vacuum reservoir. The stored vacuum is used to operate the vacuum-controlled vehicle accessories during periods of low engine vacuum such as when the vehicle is climbing a steep grade, or under other high engine load operating conditions.

The vacuum reservoir cannot be repaired and, if faulty or damaged, it must be replaced.

VACUUM SYSTEM

Vacuum control is used to operate the mode doors in the standard equipment manual temperature control system heater-A/C housing. Testing of the heater-A/C mode control switch operation will determine if the vacuum, and electrical controls are functioning. However, it is possible that a vacuum control system that operates perfectly at engine idle (high engine vacuum) may not function properly at high engine speeds or loads (low engine vacuum). This can be caused by leaks in the vacuum system, or a faulty vacuum check valve.

A vacuum system test will help to identify the source of poor vacuum system performance or vacuum system leaks. Before starting this test, stop the engine and make certain that the problem isn't a disconnected vacuum supply tube at the engine intake manifold vacuum tap or the vacuum reservoir.

Use an adjustable vacuum test set (Special Tool C-3707-B) and a suitable vacuum pump to test the heater-A/C vacuum control system. With a finger placed over the end of the vacuum test hose probe (Fig. 7), adjust the bleed valve on the test set gauge to obtain a vacuum of exactly 27 kPa (8 in. Hg.).

DESCRIPTION AND OPERATION (Continued)

Release and block the end of the probe several times to verify that the vacuum reading returns to the exact 27 kPa (8 in. Hg.) setting. Otherwise, a false reading will be obtained during testing.

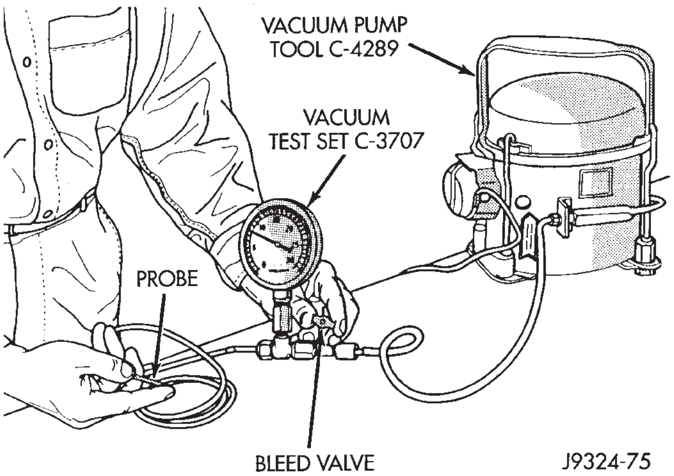


Fig. 7 Adjust Vacuum Test Bleed Valve-Typical

VACUUM CHECK VALVE

(1) Remove the vacuum check valve. The valve is located in the (black) vacuum supply tube at the engine intake manifold vacuum tap.

(2) Connect the test set vacuum supply hose to the heater-A/C control side of the valve. When connected to this side of the check valve, no vacuum should pass and the test set gauge should return to the 27 kPa (8 in. Hg.) setting. If OK, go to step Step 3. If not OK, replace the faulty valve.

(3) Connect the test set vacuum supply hose to the engine vacuum side of the valve. When connected to this side of the check valve, vacuum should flow through the valve without restriction. If not OK, replace the faulty valve.

HEATER-A/C CONTROLS

(1) Connect the test set vacuum probe to the heater-A/C vacuum supply (black) tube in the engine compartment. Position the test set gauge so that it can be viewed from the passenger compartment.

(2) Place the heater-A/C mode control switch knob in each mode position, one position at a time, and pause after each selection. The test set gauge should return to the 27 kPa (8 in. Hg.) setting shortly after each selection is made. If not OK, a component or vacuum line in the vacuum circuit of the selected mode has a leak. See the procedure in Locating Vacuum Leaks.

CAUTION: Do not use lubricant on the switch ports or in the holes in the plug, as lubricant will ruin the vacuum valve in the switch. A drop of clean water in the connector plug holes will help the connector slide onto the switch ports.

LOCATING VACUUM LEAKS

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect the vacuum harness connector from the back of the heater-A/C mode control switch on the control panel.

(2) Connect the test set vacuum hose probe to each port in the vacuum harness connector, one at a time, and pause after each connection (Fig. 8). The test set gauge should return to the 27 kPa (8 in. Hg.) setting shortly after each connection is made. If OK, replace the faulty mode control switch. If not OK, go to Step 3.

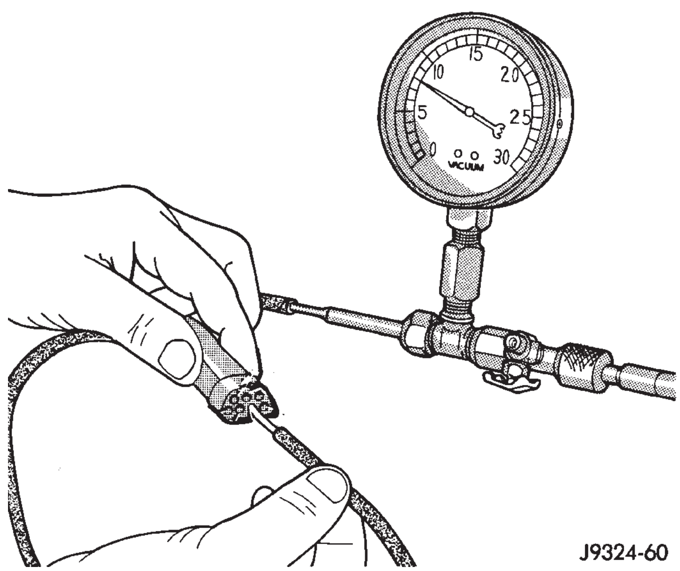


Fig. 8 Vacuum Circuit Test

(3) Determine the vacuum line color of the vacuum circuit that is leaking. To determine the vacuum line colors, refer to the Vacuum Circuits chart (Fig. 9).

(4) Disconnect and plug the vacuum line from the component (fitting, actuator, valve, switch, or reservoir) on the other end of the leaking circuit. Instrument panel disassembly or removal may be necessary to gain access to some components.

(5) Connect the test set hose or probe to the open end of the leaking circuit. The test set gauge should return to the 27 kPa (8 in. Hg.) setting shortly after each connection is made. If OK, replace the faulty disconnected component. If not OK, go to Step 6.

DESCRIPTION AND OPERATION (Continued)

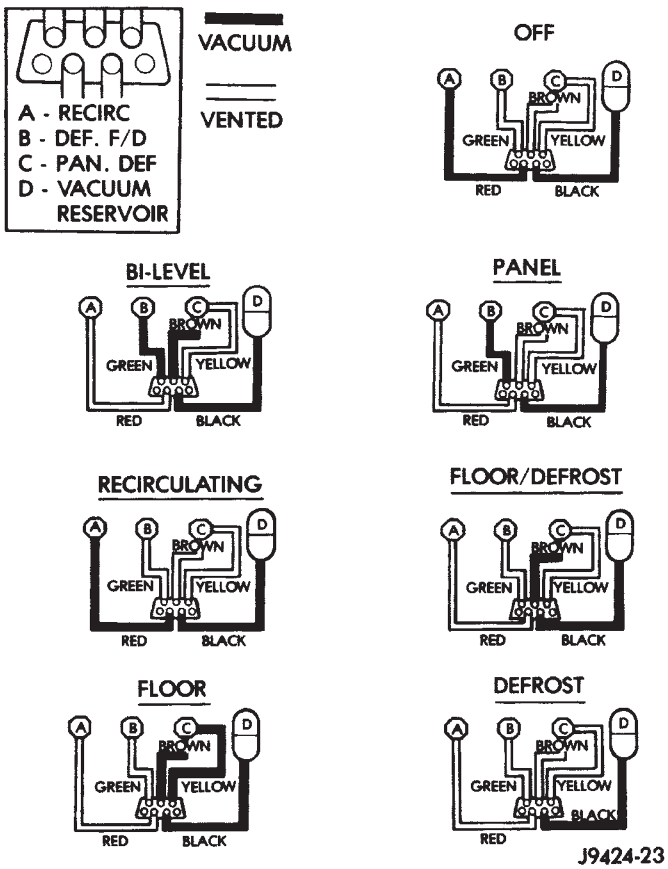


Fig. 9 Vacuum Circuits

(6) To locate a leak in a vacuum line, leave one end of the line plugged and connect the test set hose or probe to the other end. Run your fingers slowly along the line while watching the test set gauge. The vacuum reading will fluctuate when your fingers contact the source of the leak. To repair the vacuum line, cut out the leaking section of the line. Then, insert the loose ends of the line into a suitable length of 3 millimeter (1/8-inch) inside diameter rubber hose.

VARIABLE ORIFICE VALVE

The Variable Orifice Valve (VOV) is installed in the liquid line between the outlet of the condenser and the inlet of the evaporator. The VOV is only serviced as an integral part of the liquid line.

The VOV contains two orifices which work in parallel. The fixed orifice works along with the variable port, to regulate refrigerant expansion in the evaporator in a manner that is suitable for most operating conditions.

The inlet end of the Variable Orifice Valve has a nylon mesh filter screen, which filters the refrigerant and helps to reduce the potential for blockage of the metering orifices by refrigerant system contaminants (Fig. 10). The outlet end of the tube has a nylon mesh diffuser screen. The O-rings on the plastic body of the VOV seal the tube to the inside of the liquid line and prevent the refrigerant from bypassing the fixed metering orifices. A thermostatic bimetal coil wrapped around the valve body serves as a refrigerant regulator during temperature changes.

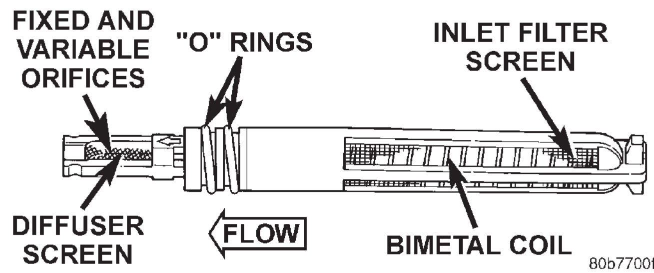


Fig. 10 Variable Orifice Valve

The VOV is used to meter the flow of liquid refrigerant into the evaporator coil. The high-pressure liquid refrigerant from the condenser expands into a low-pressure liquid/vapor as it passes through the metering orifices and diffuser screen of the valve.

The VOV varies the flow of refrigerant in response to the refrigerant temperature exiting the condenser. As condenser discharge refrigerant temperature increases, the variable port is progressively closed. A higher temperature (while idling) equals more restriction. A lower temperature (at road speed) will have less restriction.

The Variable Orifice Valve cannot be repaired and, if faulty or plugged, the liquid line assembly must be replaced.

DIAGNOSIS AND TESTING

A/C PERFORMANCE

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 housing on the dash panel below the instrument panel, is cooled to temperatures near the freezing point. As warm damp air passes through the cooled evaporator, the air transfers its heat to the refrigerant in the evaporator and the moisture in the air condenses on the evaporator fins. During periods of high heat and humidity, an air conditioning system will be more effective in the Recirculation Mode. With the system in the Recirculation Mode, only air from the passenger compartment passes through the evaporator. As the passenger compartment air dehumidifies, the air conditioning system performance levels improve.

Humidity has an important bearing on the temperature of the air delivered to the interior of the vehicle. It is important to understand the effect that

DIAGNOSIS AND TESTING (Continued)

humidity has on the performance of the air conditioning system. When humidity is high, the evaporator has to perform a double duty. It must lower the air temperature, and it must lower the temperature of the moisture in the air that condenses on the evaporator fins. Condensing the moisture in the air transfers heat energy into the evaporator fins and tubing. This reduces the amount of heat the evaporator can absorb from the air. High humidity greatly reduces the ability of the evaporator to lower the temperature of the air.

However, evaporator capacity used to reduce the amount of moisture in the air is not wasted. Wringing some of the moisture out of the air entering the vehicle adds to the comfort of the passengers. Although, an owner may expect too much from their air conditioning system on humid days. A performance test is the best way to determine whether the system is performing up to standard. This test also provides valuable clues as to the possible cause of trouble with the air conditioning system.

If the vehicle has the optional Automatic Zone Control (AZC) system, and has intermittent operational problems or fault codes, be certain that the 16-way wire harness connector on the heater-A/C housing is properly seated (Fig. 11). To check this condition, unplug the two wire harness connector halves, then plug them in again.

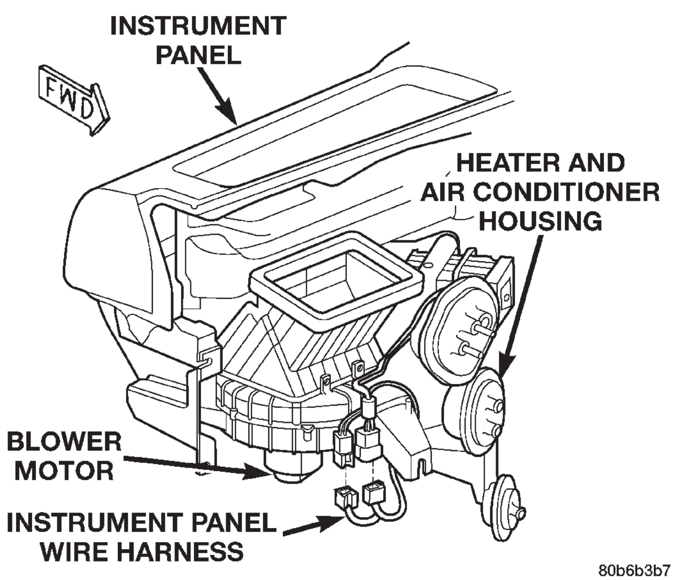


Fig. 11 16-Way Wire Harness Connector (AZC)

Review the Service Warnings and Precautions in the front of this group before performing this procedure. The air temperature in the test room and in the vehicle must be a minimum of 21° C (70° F) for this test.

(1) Connect a tachometer and a manifold gauge set.

(2) If the vehicle has the standard manual temperature control, set the heater-A/C mode control switch knob in the Panel position, the temperature control knob in the full cool (Recirculation Mode) position, the A/C button in the On position, and the blower motor switch knob in the highest speed position. If the vehicle has the optional AZC, set the heater-A/C mode control switch knob in the Panel position, the temperature control knob in the full cool position, the A/C and Recirc buttons in the On position, and the blower motor switch knob in the highest (manual) speed position.

(3) Start the engine and hold the idle at 1,000 rpm with the compressor clutch engaged.

(4) The engine should be at operating temperature. The doors and windows must be open.

(5) Insert a thermometer in the driver side center A/C (panel) outlet. Operate the engine for five minutes.

(6) The compressor clutch may cycle, depending upon the ambient temperature and humidity. If the clutch cycles, unplug the low pressure switch wire harness connector from the switch located on the accumulator (Fig. 12). Place a jumper wire across the terminals of the low pressure switch wire harness connector.

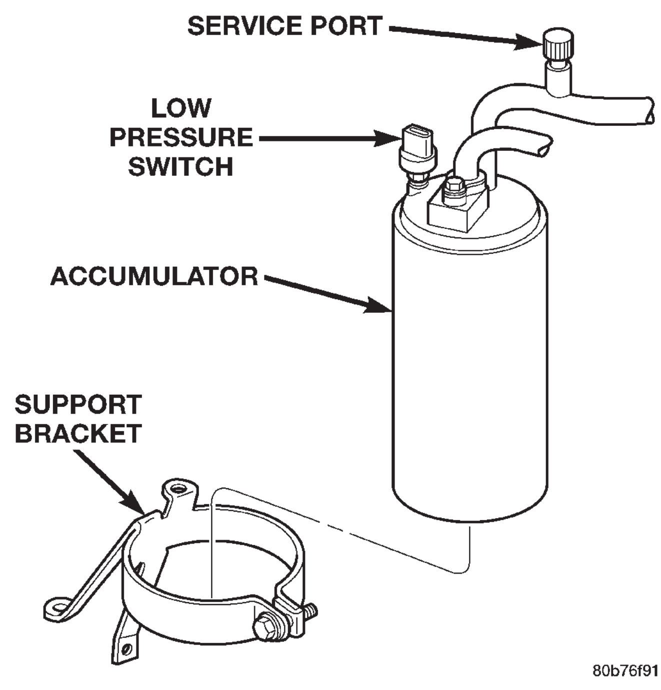


Fig. 12 Accumulator and Low Pressure Switch

(7) With the compressor clutch engaged, record the discharge air temperature and the compressor discharge pressure.

DIAGNOSIS AND TESTING (Continued)

(8) Compare the discharge air temperature to the Performance Temperature and Pressure chart. If the discharge air temperature is high, see Refrigerant System Leaks and Refrigerant System Charge in this group.

Performance Temperature and Pressure					
Ambient Air 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 to 38° F)	1 to 7° C (33 to 44° F)	3 to 9° C (37 to 48° F)	6 to 13° C (43 to 55° F)	10 to 18° C (50 to 64° F)
Evaporator Inlet Pressure at Charge Port	179 to 241 kPa (26 to 35 psi)	221 to 283 kPa (32 to 41 psi)	262 to 324 kPa (38 to 47 psi)	303 to 365 kPa (44 to 53 psi)	345 to 414 kPa (50 to 60 psi)
Compressor Discharge Pressure	1240 to 1655 kPa (180 to 240 psi)	1380 to 1790 kPa (200 to 260 psi)	1720 to 2070 kPa (250 to 300 psi)	1860 to 2345 kPa (270 to 340 psi)	2070 to 2690 kPa (300 to 390 psi)

(9) Compare the compressor discharge pressure to the Performance Temperature and Pressure chart. If the compressor discharge pressure is high, see the Pressure Diagnosis chart.

Pressure Diagnosis		
Condition	Possible Causes	Correction
Rapid compressor clutch cycling (ten or more cycles per minute).	1. Low refrigerant system charge.	1. See Refrigerant System Leaks in this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system, if required.
Equal pressures, but the compressor clutch does not engage.	1. No refrigerant in the refrigerant system. 2. Faulty fuse. 3. Faulty compressor clutch coil. 4. Faulty compressor clutch relay. 5. Improperly installed or faulty low pressure switch. 6. Faulty high pressure switch. 7. Faulty Powertrain Control Module (PCM).	1. See Refrigerant System Leaks in this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system, if required. 2. Check the fuses in the Power Distribution Center and the fuseblock module. Repair the shorted circuit or component and replace the fuses, if required. 3. See Compressor Clutch Coil in this group. Test the compressor clutch coil and replace, if required. 4. See Compressor Clutch Relay in this group. Test the compressor clutch relay and relay circuits. Repair the circuits or replace the relay, if required. 5. See Low Pressure Cycling Clutch Switch in this group. Test the low pressure switch and tighten or replace, if required. 6. See High Pressure Switch in this group. Test the high pressure switch and replace, if required. 7. Refer to the proper Diagnostic Procedures manual for testing of the PCM. Test the PCM and replace, if required.

DIAGNOSIS AND TESTING (Continued)

Pressure Diagnosis		
Condition	Possible Causes	Correction
Normal pressures, but A/C Performance Test air temperatures at center panel outlet are too high.	1. Excessive refrigerant oil in system. 2. Blend-air door motor, or wire harness improperly installed or faulty. 3. Blend-air door inoperative or sealing improperly.	1. See Refrigerant Oil Level in this group. Recover the refrigerant from the refrigerant system and inspect the refrigerant oil content. Restore the refrigerant oil to the proper level, if required. 2. See Blend-air door motor in this group. Inspect the motor, and wire harness for proper installation and operation and correct, if required. 3. See Blend-Air Door under Heater-A/C Housing Door in this group. Inspect the blend-air door for proper operation and sealing. Correct if required.
The low side pressure is normal or slightly low, and the high side pressure is too low.	1. Low refrigerant system charge. 2. Refrigerant flow through the accumulator is restricted. 3. Refrigerant flow through the evaporator coil is restricted. 4. Faulty compressor.	1. See Refrigerant System Leaks in this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system, if required. 2. See Accumulator in this group. Replace the restricted accumulator, if required. 3. See Evaporator Coil in this group. Replace the restricted evaporator coil, if required. 4. See Compressor in this group. Replace the compressor, if required.
The low side pressure is normal or slightly high, and the high side pressure is too high.	1. Condenser air flow restricted. 2. Inoperative cooling fan. 3. Refrigerant system overcharged. 4. Air in the refrigerant system. 5. Engine overheating.	1. Check the condenser for damaged fins, foreign objects obstructing air flow through the condenser fins, and missing or improperly installed air seals. Refer to Group 7 - Cooling System for more information on air seals. Clean, repair, or replace components as required. 2. Refer to Group 7 - Cooling System for more information. Test the cooling fan and replace, if required. 3. See Refrigerant System Charge in this group. Recover the refrigerant from the refrigerant system. Charge the refrigerant system to the proper level, if required. 4. See Refrigerant System Leaks in this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system, if required. 5. Refer to Group 7 - Cooling System for more information. Test the cooling system and repair, if required.
The low side pressure is too high, and the high side pressure is too low.	1. Accessory drive belt slipping. 2. Variable orifice tube not installed. 3. Faulty compressor.	1. Refer to Group 7 - Cooling System for more information. Inspect the accessory drive belt condition and tension. Tighten or replace the accessory drive belt, if required. 2. See Variable Orifice Tube in this group. Install the missing orifice tube and line if required. 3. See Compressor in this group. Replace the compressor, if required.

DIAGNOSIS AND TESTING (Continued)

Pressure Diagnosis		
Condition	Possible Causes	Correction
The low side pressure is too low, and the high side pressure is too high.	1. Restricted refrigerant flow through the refrigerant lines. 2. Restricted refrigerant flow through the variable orifice tube. 3. Restricted refrigerant flow through the condenser.	1. See Liquid Line and Suction and Discharge Line in this group. Inspect the refrigerant lines for kinks, tight bends or improper routing. Correct the routing or replace the refrigerant line, if required. 2. See Variable Orifice Tube in this group. Replace the restricted fixed orifice tube, if required. 3. See Condenser in this group. Replace the restricted condenser, if required.

AUTOMATIC ZONE CONTROL SYSTEM

The Automatic Zone Control (AZC) control module has a system self-diagnostic mode which continuously monitors various parameters during normal system operation. If a system fault is detected, a current and historical fault is recorded. When the current fault is cleared, the historical fault remains until reset (manually or automatically). Both the current and historical fault codes can be accessed through either the front panel, or over the Programmable Communications Interface (PCI) bus using a DRBIII® scan tool, and the proper Diagnostic Procedures manual.

The AZC control module is capable of three different types of self-diagnostic tests, as follows:

- Fault Code Tests
- Input Circuit Tests
- Output Circuit/Actuator Tests

The information that follows describes:

- How to read the self-diagnostic display
- How to enter the AZC control module self-diagnostic test mode
- How to select the self-diagnostic test types
- How to perform the different tests

ENTERING THE AZC SELF-DIAGNOSTIC MODE

To enter the AZC self-diagnostic mode, perform the following:

(1) Depress the A/C and Recirc buttons at the same time and hold. Rotate the left temperature control knob clockwise (CW) one detent.

(2) If you continue to hold the A/C and Recirc buttons depressed, the AZC control module will perform a Segment Test of the vacuum fluorescent (VF) display. In the Segment Test you should see all of the display segments illuminate as long as both buttons are held. If a display segment fails to illuminate, the vacuum fluorescent display is faulty and the heater-A/C control must be replaced.

(3) After viewing the Segment Test, release the A/C and Recirc buttons and the display will clear momentarily. If the display remains blank then no faults are set in the system. Should there be any faults, either ″current″ or ″historical″, all fault codes will be displayed in ascending numerical sequence (note no effort is made to display fault codes in chronological order). Each fault code is displayed for one second before the next code is displayed. Once all fault codes have been displayed, the system will then repeat the fault code numbers. This will continue until the left side set temperature control is moved at least one detent position in the CW direction or the ignition is turned ″OFF″.

FAULT CODE TESTS

Fault codes are two-digit numbers that identify a circuit that is malfunctioning. There are two different kinds of fault codes.

1. **Current Fault Codes -** Current means the fault is present right now. There are two types of current faults: input faults, and system faults. If the system has a current fault when the ignition is turned “ON”, or during normal operation a current fault occurs, the right side set temperature digits will display “ER” at maximum intensity, while the left side set temperature digits are blanked.

2. **Historical Fault Codes -** Historical or stored means that the fault occurred previously, but is not present right now. A majority of historical fault codes are caused by intermittent wire harness or wire harness connector problems.

NOTE: A battery disconnect will erase all faults stored in Random Access Memory (RAM) of the AZC control module. It is recommended that all faults be recorded before they are erased.

RETRIEVING FAULT CODES

(1) To begin the fault code tests, depress the A/C and Recirc buttons at the same time and rotate the left temperature control knob clockwise (CW) one detent, then release the push-button.

(2) **If there are no fault codes, the “00” display value will remain in the VF window.** Should there be any codes, each will be displayed for one second in ascending numerical sequence (note: no

DIAGNOSIS AND TESTING (Continued)

CURRENT FAULT CODES	
Input faults	01 = IR thermister circuit open
	02 = IR thermister circuit shorted
	03 = Fan pot shorted
	04 = Fan pot open
	05 = Mode pot shorted
	06 = Mode pot open
	07 = IR sensor delta too large
	08 = Reserved
	09 = Reserved
	10 = Reserved
	11 = Reserved
	12 = Reserved
System Faults	13 = AI (Recirc) motor not responding
	14 = Mode motor not responding
	15 = Left temperature door not responding
	16 = Right temperature door not responding
	17 = AI (Recirc) door travel too small
	18 = AI (Recirc) door travel too large
	19 = Mode door travel range too small
	20 = Mode door travel range too large
	21 = Left temperature door travel too small
	22 = Left temperature door travel too large
	23 = Right temperature door travel too small
	24 = Right temperature door travel too large
	25 = Calibration check sum error
	26 = Engine coolant temp bus message missing
	27 = Vehicle speed bus message missing
	28 = Engine RPM bus message missing
	29 = OAT bus message missing
	30 = Display intensity bus message missing
	31 = VIN number bus message missing
	32 = Reserved

effort is made to display faults in the order they occurred). The left side set temperature display will be blanked and the right side set temperature display will indicate current and historical codes (8 historical max) presently active. Once all codes have been displayed, the system will repeat the fault code numbers. This will continue until the left side set temperature control is moved at least one detent position in either direction, by pressing both the A/C and Recirc buttons at the same time, or the ignition is turned off. Record all of the fault codes, then see the Current and Historical Fault Code charts for the descriptions.

CLEARING FAULT CODES

Current faults cannot be electronically cleared. Repair must be made to the system to eliminate the fault causing code. Historical fault codes can be cleared manually, or automatically. To clear a historical fault manually, depress and hold either the A/C or Recirc button for at least three seconds while the display is in the fault code mode of operation. Historical fault codes are cleared automatically when the

DIAGNOSIS AND TESTING (Continued)

HISTORICAL FAULT CODES	
Input faults	33 = IR thermister circuit was open
	34 = IR thermister circuit was shorted
	35 = Fan pot was shorted
	36 = Fan pot was open
	37 = Mode pot was shorted
	38 = Mode pot was open
	39 = IR sensor delta was too large
	40 = Reserved
	41 = Reserved
	42 = Reserved
	43 = Reserved
	44 = Reserved
System Faults	45 = AI (Recirc) motor was not responding
	46 = Mode motor was not responding
	47 = Left temperature door was not responding
	48 = Right temperature door was not responding
	49 = AI (Recirc) door travel was too small
	50 = AI (Recirc) door travel too large
	51 = Mode door travel range too small
	52 = Mode door travel range too large
	53 = Left temperature door travel too small
	54 = Left temperature door travel too large
	55 = Right temperature door travel too small
	56 = Right temperature door travel too large
	57 = Calibration check sum error
	58 = Engine coolant temp bus message missing
	59 = Vehicle speed bus message missing
	60 = Engine RPM bus message missing
	61 = OAT bus message missing
	62 = Display intensity bus message missing
	63 = VIN number bus message missing
	64 = Reserved
	65 = Reserved
	66 = Reserved
	67 = Reserved

corresponding current fault code has been cleared, and has remained cleared for a number of ignition cycles. The faults have been cleared when two horizontal bars appear in the Test Selector display.

EXITING SELF-DIAGNOSTIC MODE

The self-diagnostic mode can be exited by pressing both the A/C and Recirc buttons at the same time, or turning off the ignition.

MONITOR CURRENT PARAMETERS

While in the display fault code mode of operation, current system parameters can also be monitored and/or forced. Rotating the left side set temperature control clockwise will increase the pointer number while rotating the control counter clockwise will decrease the pointer number. Rotating the right set temperature control will have no impact on pointer

DIAGNOSIS AND TESTING (Continued)

value or the value of the parameter being monitored. Once the desired pointer number has been selected, pressing either the AC or Recirc buttons will display the current value of the selected parameter. **The right side set temperature display is only capable of displaying only values ranging from 0 to 99, the left side set temperature display is used for values greater than 99. If the value is less than 99, the left side set temperature display remains blanked.** While a parameter is being overridden, the system will continue to function normally except for the parameter which is being manually controlled.

On a limited number of pointers, pressing just the AC button, will cause the system to automatically increment the selected parameter values in step sizes determined by pointer 15 at a rate selected by pointer 16. Pressing just the Recirc button, will cause the system to automatically decrement the selected parameter values in step sizes determined by pointer 15 at a rate selected by pointer 16. On a pointer which this is not allowed, pressing either of these button will have no effect. Pressing and holding both the AC and recirculation buttons while rotating the left set temperature control either direction, will cause the system to exit the selected parameter and will maintain the override parameter value selected. Rotating just left set temperature control without pressing any buttons will cause the system to revert back to automatic control of the selected parameter and will display the point number of the parameter just viewed. While displaying any pointer number and pressing both the AC and Recirc buttons will cause the system to exit the diagnostic mode of operation.

For values < 0, the ″G″ segment in the left side set temperature Most Significant Digit (MSD)(or left-most number in the pair) will be used to indicate a negative number. For values between -01 to -99 the Least Significant Digit (LSD)(or right-most number of the pair) in the left side set temperature will remain blank. System control of parameter being displayed can be overridden by rotating the right set temperature control in either direction. Rotating the right temperature control in the CW direction, the selected parameter value is overridden and incremented beginning at the value which was being displayed. Rotating the right temperature control in the CCW direction, the selected parameter value is overridden and decremented beginning at the value which was being displayed. The rate at which incrementing and decrement occurs is one unit value per set temperature detent position.

HVAC SYSTEM POINTER		
Pointer Number	DESCRIPTION	Value Displayed
01	A/C Enable	0 or 1
		0 = disabled 1 = enabled
02	Final fan PWM duty cycle	0 to 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
	Pressing the AC button will cause the system to begin a sweep decrementing this variable beginning at the value being displayed just prior to the button press.	
	Pressing the Rec button will cause the system to begin a sweep incrementing this variable beginning at the value being displayed just prior to the button press.	
	The rate and step size of the sweep is controlled by the value set in pointers 15 and 16.	
03	Left NPRG	0 to 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
	Pressing the AC button will cause the system to begin a sweep decrementing this variable beginning at the value being displayed just prior to the button press.	

DIAGNOSIS AND TESTING (Continued)

HVAC SYSTEM POINTER		
	Pressing the Rec button will cause the system to begin a sweep incrementing this variable beginning at the value being displayed just prior to the button press.	
	The rate and step size of the sweep is controlled by the value set in pointers 15 and 16.	
04	Right NPRG	0 to 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
	Pressing the AC button will cause the system to begin a sweep decrementing this variable beginning at the value being displayed just prior to the button press.	
	Pressing the Rec button will cause the system to begin a sweep incrementing this variable beginning at the value being displayed just prior to the button press.	
	The rate and step size of the sweep is controlled by the value set in pointers 15 and 16.	
05	Avg NPRG	0 TO 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
	Pressing the AC button will cause the system to begin a sweep decrementing this variable beginning at the value being displayed just prior to the button press.	
	Pressing the Rec button will cause the system to begin a sweep incrementing this variable beginning at the value being displayed just prior to the button press.	
	The rate and step size of the sweep is controlled by the value set in pointers 15 and 16.	
06	Primary control side	0 or 1
		0 = left 1 = right
07	EE Check sum (calculated)	0 to 255
08	Target intensity (in % ON time)	0 to 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
09	Not Used	0 to 0
10	number of indexes during ignition	0 to 255
	While the value of this pointer is being displayed, pressing the AC push button will zero the number of indexes during ignition OFF.	
11	Right NINC	0 to 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
	Pressing the AC button will cause the system to begin a sweep decrementing this variable beginning at the value being displayed just prior to the button press.	

DIAGNOSIS AND TESTING (Continued)

HVAC SYSTEM POINTER		
	Pressing the Rec button will cause the system to begin a sweep incrementing this variable beginning at the value being displayed just prior to the button press.	
	The rate and step size of the sweep is controlled by the value set in pointers 15 and 16.	
12	Left NINC	0 to 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
	Pressing the AC button will cause the system to begin a sweep decrementing this variable beginning at the value being displayed just prior to the button press.	
	Pressing the Rec button will cause the system to begin a sweep incrementing this variable beginning at the value being displayed just prior to the button press.	
	The rate and step size of the sweep is controlled by the value set in pointers 15 and 16.	
13	Right NMIX	0 to 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
	Pressing the AC button will cause the system to begin a sweep decrementing this variable beginning at the value being displayed just prior to the button press.	
	Pressing the Rec button will cause the system to begin a sweep incrementing this variable beginning at the value being displayed just prior to the button press.	
	The rate and step size of the sweep is controlled by the value set in pointers 15 and 16.	
14	Left NMIX	0 to 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
	Pressing the AC button will cause the system to begin a sweep decrementing this variable beginning at the value being displayed just prior to the button press.	
	Pressing the Rec button will cause the system to begin a sweep incrementing this variable beginning at the value being displayed just prior to the button press.	
	The rate and step size of the sweep is controlled by the value set in pointers 15 and 16.	
15	Scan Step Size	1 to 255
	The value displayed in this pointer is used to control step size used whenever the system is commanded (from the front panel) to conduct an automatic sweep. CW = increase; CCW = decrease; 0 is an illegal value min value =1	
16	Scan Step Time (in loop passes)	1 to 255
17	Reserved	

DIAGNOSIS AND TESTING (Continued)

HVAC SYSTEM POINTER		
18	Reserved	
19	Reserved	

MODE VALUE POINTER		
Pointer Number	DESCRIPTION	Value Displayed
20	mode range in delta counts	0 to 9999
21	Current mode position (in counts)	0 to 9999
22	mode target position in ratio	0 to 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
	Pressing the AC button will cause the system to begin a sweep decrementing this variable beginning at the value being displayed just prior to the button press.	
	Pressing the Rec button will cause the system to begin a sweep incrementing this variable beginning at the value being displayed just prior to the button press.	
	The rate and step size of the sweep is controlled by the value set in pointers 15 and 16.	
23	mode target position in counts	0 to 9999
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
24	elapsed time since last index in tenths of hours	0 to 255
25	number of valve moves since last index	0 to 9999
26	number of valve moves before last index	0 to 9999
27	number of ignition cycles since last index	0 to 255
28	number of ignition ON indexes	0 to 255
29	mode motor state	0 to 5
	While the value of this pointer is being displayed, pressing either the A/C or Recirc button will force the system to perform a calibration routine. 0 = searching range 1 = moving toward panel 2 = moving toward defrost 3 = in position 4 = stalled moving toward panel 5 = stalled moving toward defrost	

LEFT SIDE TEMPERATURE POINTER		
Pointer Number	DESCRIPTION	Value Displayed
30	Left side temp range in delta counts	0 to 9999
31	Current left side temp position (in counts)	0 to 9999
32	Left side temp target position (in ratio)	0 to 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
	Pressing the AC button will cause the system to begin a sweep decrementing this variable beginning at the value being displayed just prior to the button press.	

DIAGNOSIS AND TESTING (Continued)

LEFT SIDE TEMPERATURE POINTER		
	Pressing the Rec button will cause the system to begin a sweep incrementing this variable beginning at the value being displayed just prior to the button press.	
	The rate and step size of the sweep is controlled by the value set in pointers 15 and 16.	
33	Left side temp target in counts	0 to 9999
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
34	Elapsed time since last index in tenths of hours	0 to 255
35	number of valve moves since last index	0 to 9999
36	number of valve moves before last index	0 to 9999
37	number of ignition cycles since last index	0 to 255
38	number of ignition ON indexes	0 to 255
39	Left side temp motor state	0 to 5
	While the value of this pointer is being displayed, pressing either the A/C or Recirc button will force the system to perform a calibration routine. 0 = searching range 1 = moving toward panel 2 = moving toward defrost 3 = in position 4 = stalled moving toward panel 5 = stalled moving toward defrost	

RIGHT SIDE TEMPERATURE POINTER		
Pointer Number	DESCRIPTION	Value Displayed
40	Right side temp range in delta counts	0 to 9999
41	Current right side temp position (in counts)	0 to 9999
42	Right side temp target position (in ratio)	0 to 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
	Pressing the AC button will cause the system to begin a sweep decrementing this variable beginning at the value being displayed just prior to the button press.	
	Pressing the Rec button will cause the system to begin a sweep incrementing this variable beginning at the value being displayed just prior to the button press.	
	The rate and step size of the sweep is controlled by the value set in pointers 15 and 16.	
43	Right side temp target in counts	0 to 9999
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
44	Elapsed time since last index in tenths of hours	0 to 255
45	number of valve moves since last index	0 to 9999
46	number of valve moves before last index	0 to 9999
47	number of ignition cycles since last index	0 to 255
48	number of ignition ON indexes	0 to 255

DIAGNOSIS AND TESTING (Continued)

RIGHT SIDE TEMPERATURE POINTER		
49	Right side temp motor state	0 to 5
	While the value of this pointer is being displayed, pressing either the A/C or Recirc button will force the system to perform a calibration routine. 0 = searching range 1 = moving toward panel 2 = moving toward defrost 3 = in position 4 = stalled moving toward panel 5 = stalled moving toward defrost	

AIR INLET POINTER		
Pointer Number	DESCRIPTION	Value Displayed
50	Air inlet range (in counts)	0 to 9999
51	Current air inlet position (in counts)	0 to 9999
52	Air inlet target position (in ratio)	0 to 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
	Pressing the AC button will cause the system to begin a sweep decrementing this variable beginning at the value being displayed just prior to the button press.	
	Pressing the Rec button will cause the system to begin a sweep incrementing this variable beginning at the value being displayed just prior to the button press.	
	The rate and step size of the sweep is controlled by the value set in pointers 15 and 16.	
53	Air inlet target in counts	0 to 9999
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
54	Elapsed time since last index in tenths of hours	0 to 255
55	number of motor moves since last index	0 to 9999
56	number of motor moves before last index	0 to 9999
57	number of ignition cycles since last index	0 to 255
58	number of ignition ON indexes	0 to 255
59	Air inlet motor state	0 to 5
	While the value of this pointer is being displayed, pressing either the A/C or Recirc button will force the system to perform a calibration routine. 0 = searching range 1 = moving toward panel 2 = moving toward defrost 3 = in position 4 = stalled moving toward panel 5 = stalled moving toward defrost	
60	Reserved	
61	Actual Outside Air Temp (in degrees F)	-40 to 215
62	Engine Air Temp (in degrees F)	-40 to 215
63	Engine Intake Air Temperature (in degrees F)	-40 to 215
64	Vehicle speed in MPH	0 to 255
65	Engine RPM/100	-0 to 82
66	Engine Coolant Temp - 40 (in degrees F)	-40 to 215
67	Country Code	0 to 255

DIAGNOSIS AND TESTING (Continued)

AIR INLET POINTER		
68	User A/B	0, 1, 2
		0 = user A 1 = user B 2 = user undefined

IR SENSOR POINTER		
Pointer Number	DESCRIPTION	Value Displayed
70	Thermistor temp (in degrees)	-40 to 215
71	Left side sensor A/D (filtered)	0 to 255
72	Right side sensor A/D (filtered)	0 to 255
73	Left side temp (in degrees F)	-40 to 140
74	Right side temp (in degrees F)	-40 to 140

IDENTIFICATION POINTER		
Pointer Number	DESCRIPTION	Value Displayed
80	ROM bit pattern number (digits 1,2,3 & 4)	0 to 9999
81	ROM bit pattern number (digits 5,6,7 & 8)	0 to 9999
82	CAL bit pattern number (digits 1,2,3 & 4)	0 to 9999
83	CAL bit pattern number (digits 5,6,7 & 8)	0 to 9999
84	Software version Flash ROM	0 to 99
85	Software version revision	0 to 99
86	Not used	
87	Not used	
88	Not used	
89	Not used	

OUTPUT CIRCUIT/ACTUATOR TESTS

In the Output Circuit/Actuator Test mode, the output circuits can be viewed, monitored, overridden, and tested. If a failure occurs in an output circuit, test the circuit by overriding the system. Test the actuator through its full range of operation. When the override control has been activated, the Test Selector display will be flashing. The Test Selector will display feedback information about the output circuit being tested.

(1) To begin the Output Circuit/Actuator Tests you must be in the Select Test mode.

(2) With a “00” value displayed in the Test Selector and no stick man, turn the rotary temperature control knob until the test number you are looking for appears in the Test Selector display. See the Circuit Testing charts for a listing of the test numbers, test items, test types, system tested, and displayed values.

(3) To see the output value, depress the A/C or Recirc button. The values displayed will represent the output from the AZC control module.

(4) To enter the actuator test, depress the A/C or Recirc button. The Test Selector display will blink, indicating you are in the actuator test mode. Manual tests are those in which you will have to depress and hold the A/C or Recirc button to control the output. Automatic tests are those in which you will have to depress the A/C or Recirc button once to generate the output.

BLOWER MOTOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

DIAGNOSIS AND TESTING (Continued)

For circuit descriptions and diagrams, refer to 8W-42 - Air Conditioning/Heater in Group 8W - Wiring Diagrams. Possible causes of an inoperative blower motor include:

- Faulty fuse
- Faulty blower motor circuit wiring or wire harness connections
- Faulty blower motor resistor (if the vehicle is so equipped)
- Faulty blower motor power module (if the vehicle is so equipped)
- Faulty blower motor switch
- Faulty heater-A/C mode control switch
- Faulty blower motor.

Possible causes of the blower motor not operating in all speeds include:

- Faulty fuse
- Faulty blower motor switch
- Faulty blower motor resistor (if the vehicle is so equipped)
- Faulty blower motor controller (power module) (if the vehicle is so equipped)
- Faulty AZC module (if the vehicle is so equipped)
- Faulty blower motor circuit wiring or wire harness connections.

VIBRATION

Possible causes of blower motor vibration include:

- Improper blower motor mounting
- Improper blower wheel mounting
- Blower wheel out of balance or bent
- Blower motor faulty.

NOISE

To verify that the blower is the source of the noise, unplug the blower motor wire harness connector and operate the heater-A/C system. If the noise goes away, possible causes include:

- Foreign material in the heater-A/C housing
- Improper blower motor mounting
- Improper blower wheel mounting
- Blower motor faulty.

BLOWER MOTOR RESISTOR

For circuit descriptions and diagrams, refer to 8W-42 - Air Conditioning/Heater in Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Unplug the wire harness connector from the blower motor resistor.

(3) Check for continuity between each of the blower motor switch input terminals of the resistor and the resistor output terminal. In each case there should be continuity. If OK, repair the wire harness circuits between the blower motor switch and the blower motor resistor or blower motor as required. If not OK, replace the faulty blower motor resistor.

BLOWER MOTOR SWITCH

For circuit descriptions and diagrams, refer to 8W-42 - Air Conditioning/Heater in Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Check for battery voltage at the fuse in the Power Distribution Center (PDC). If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the heater-A/C control from the instrument panel. Check for continuity between the ground circuit cavity of the heater-A/C control wire harness connector and a good ground. There should be continuity. If OK, go to Step 3. If not OK, repair the open circuit to ground as required.

(3) With the heater-A/C control wire harness connector unplugged, place the heater-A/C mode control switch knob in any position except the Off position. Check for continuity between the ground circuit terminal and each of the blower motor driver circuit terminals of the heater-A/C control as you move the blower motor switch knob to each of the four speed positions. There should be continuity at each driver circuit terminal in only one blower motor switch speed position. If OK, test and repair the blower driver circuits between the heater-A/C control connector and the blower motor resistor as required. If not OK, replace the faulty heater-A/C control unit.

DIAGNOSIS AND TESTING (Continued)

COMPRESSOR

When investigating an air conditioning related noise, you must first know the conditions under which the noise occurs. These conditions include: weather, vehicle speed, transmission in gear or neutral, engine speed, engine temperature, and any other special conditions. Noises that develop during air conditioning operation can often be misleading. For example: What sounds like a failed front bearing or connecting rod, may be caused by loose bolts, nuts, mounting brackets, or a loose compressor clutch assembly.

Drive belts are speed sensitive. At different engine speeds and depending upon belt tension, belts can develop noises that are mistaken for a compressor noise. Improper belt tension can cause a misleading noise when the compressor clutch is engaged, which may not occur when the compressor clutch is disengaged. Check the serpentine drive belt condition and tension as described in Group 7 - Cooling System before beginning this procedure.

(1) Select a quiet area for testing. Duplicate the complaint conditions as much as possible. Switch the compressor on and off several times to clearly identify the compressor noise. Listen to the compressor while the clutch is engaged and disengaged. Probe the compressor with an engine stethoscope or a long screwdriver with the handle held to your ear to better localize the source of the noise.

(2) Loosen all of the compressor mounting hardware and retighten. Tighten the compressor clutch mounting nut. Be certain that the clutch coil is mounted securely to the compressor, and that the clutch plate and pulley are properly aligned and have the correct air gap. See Compressor and Compressor Clutch in the Removal and Installation section of this group for the procedures.

(3) To duplicate a high-ambient temperature condition (high head pressure), restrict the air flow through the condenser. Install a manifold gauge set to be certain that the discharge pressure does not exceed 2760 kPa (400 psi).

(4) Check the refrigerant system plumbing for incorrect routing, rubbing or interference, which can cause unusual noises. Also check the refrigerant lines for kinks or sharp bends that will restrict refrigerant flow, which can cause noises. See Suction and Discharge Line in the Removal and Installation section of this group for more information.

(5) If the noise is from opening and closing of the high pressure relief valve, evacuate and recharge the refrigerant system. See Refrigerant System Evacuate and Refrigerant System Charge in the Service Procedures section of this group. If the high pressure relief valve still does not seat properly, replace the compressor.

(6) If the noise is from liquid slugging on the suction line, replace the accumulator. See Accumulator in the Removal and Installation section of this group for the procedures. Check the refrigerant oil level and the refrigerant system charge. See Refrigerant Oil Level and Refrigerant System Charge in the Service Procedures section of this group. If the liquid slugging condition continues following accumulator replacement, replace the compressor.

(7) If the noise continues, replace the compressor and repeat Step 1.

COMPRESSOR CLUTCH COIL

For circuit descriptions and diagrams, refer to 8W-42 - Air Conditioning/Heater in Group 8W - Wiring Diagrams. The battery must be fully-charged before performing the following tests. Refer to Group 8A - Battery for more information.

(1) Connect an ammeter (0 to 10 ampere scale) in series with the clutch coil terminal. Use a voltmeter (0 to 20 volt scale) with clip-type leads for measuring the voltage across the battery and the compressor clutch coil.

(2) With the heater-A/C mode control switch in any A/C mode, the heater-A/C control A/C switch in the On position, and the blower motor switch in the lowest speed position, start the engine and run it at normal idle.

(3) The compressor clutch coil voltage should read within two volts of the battery voltage. If there is voltage at the clutch coil, but the reading is not within two volts of the battery voltage, test the clutch coil feed circuit for excessive voltage drop and repair as required. If there is no voltage reading at the clutch coil, use a DRBIII® scan tool and the proper Diagnostic Procedures manual for testing of the compressor clutch circuit. The following components must be checked and repaired as required before you can complete testing of the clutch coil:

- Fuses in the junction block and the Power Distribution Center (PDC)
- Heater-A/C mode control switch
- Compressor clutch relay
- High pressure switch
- Low pressure switch
- Powertrain Control Module (PCM)

(4) The compressor clutch coil is acceptable if the current draw measured at the clutch coil is 2.0 to 3.9 amperes with the electrical system voltage at 11.5 to 12.5 volts. This should only be checked with the work area temperature at 21° C (70° F). If system voltage is more than 12.5 volts, add electrical loads by turning on electrical accessories until the system voltage drops below 12.5 volts.

DIAGNOSIS AND TESTING (Continued)

(a) If the clutch coil current reading is four amperes or more, the coil is shorted and should be replaced.

(b) If the clutch coil current reading is zero, the coil is open and should be replaced.

COMPRESSOR CLUTCH RELAY

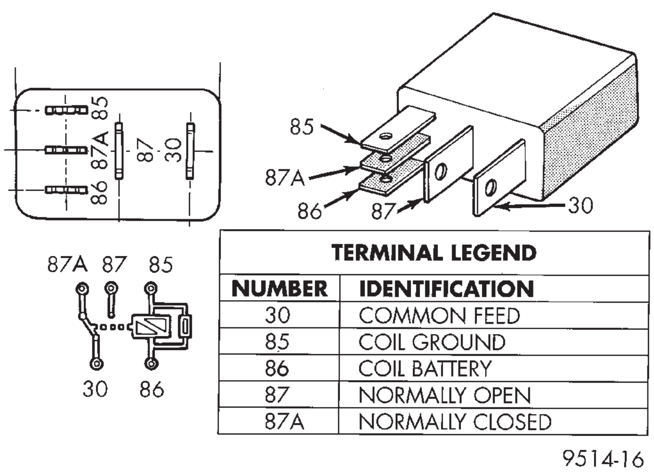
For circuit descriptions and diagrams, refer to 8W-42 - Air Conditioning/Heater in Group 8W - Wiring Diagrams.

The compressor clutch relay (Fig. 13) is located in the Power Distribution Center (PDC). Refer to the PDC label for relay identification and location. Remove the relay from the 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 Step 2. If not OK, replace the faulty relay.

(2) Resistance between terminals 85 and 86 (electromagnet) should be 75 ± 5 ohms. If OK, go to Step 3. If not OK, replace the faulty relay.

(3) Connect a battery 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, see the Relay Circuit Test procedure in this group. If not OK, replace the faulty relay.



TERMINAL LEGEND	
NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

Fig. 13 Compressor Clutch Relay

RELAY CIRCUIT TEST

For circuit descriptions and diagrams, refer to 8W-42 - Air Conditioning/Heater in Group 8W - Wiring Diagrams.

(1) The relay common feed terminal cavity (30) is connected to fused battery feed. There should be battery voltage at the cavity for relay terminal 30 at all times. If OK, go to Step 2. If not OK, repair the open circuit to the fuse in the PDC as required.

(2) The relay normally closed terminal (87A) is not used in this application. Go to Step 3.

(3) The relay normally open terminal cavity (87) is connected to the compressor clutch coil. There should be continuity between this cavity and the A/C compressor clutch relay output circuit cavity of the compressor clutch coil wire harness connector. If OK, go to Step 4. If not OK, repair the open circuit as required.

(4) The relay coil battery terminal (86) is connected to the fused ignition switch output (run/start) circuit. There should be battery voltage at the cavity for relay terminal 86 with the ignition switch in the On position. If OK, go to Step 5. If not OK, repair the open circuit to the fuse in the junction block as required.

(5) The coil ground terminal cavity (85) is switched to ground through the Powertrain Control Module (PCM). There should be continuity between this cavity and the A/C compressor clutch relay control circuit cavity of the PCM wire harness connector C (gray) at all times. If not OK, repair the open circuit as required.

HEATER PERFORMANCE

Before performing the following tests, refer to Group 7 - Cooling System for the procedures to check the radiator coolant level, serpentine drive belt tension, radiator air flow and the radiator fan operation. Also be certain that the accessory vacuum supply line is connected at the engine intake manifold.

MAXIMUM HEATER OUTPUT

Engine coolant is delivered to the heater core through two heater hoses. With the engine idling at normal operating temperature, set the temperature control knob in the full hot position, the mode control switch knob in the floor heat position, and the blower motor switch knob in the highest speed position. Using a test thermometer, check the temperature of the air being discharged at the heater-A/C housing floor outlets. Compare the test thermometer reading to the Temperature Reference chart.

DIAGNOSIS AND TESTING (Continued)

Temperature Reference				
Ambient Air Temperature	15.5° C (60° F)	21.1° C (70° F)	26.6° C (80° F)	32.2° C (90° F)
Minimum Air Temperature at Floor Outlet	62.2° C (144° F)	63.8° C (147° F)	65.5° C (150° F)	67.2° C (153° F)

If the floor outlet air temperature is too low, refer to Group 7 - Cooling System to check the engine coolant temperature specifications. Both of the heater hoses should be hot to the touch. The coolant return heater hose should be slightly cooler than the coolant supply heater hose. If the return hose is much cooler than the supply hose, locate and repair the engine coolant flow obstruction in the cooling system. Refer to Group 7 - Cooling System for the procedures.

OBSTRUCTED COOLANT FLOW

Possible locations or causes of obstructed coolant flow:

- Pinched or kinked heater hoses.
- Improper heater hose routing.
- Plugged heater hoses or supply and return ports at the cooling system connections.
- A plugged heater core.

If proper coolant flow through the cooling system is verified, and heater outlet air temperature is still low, a mechanical problem may exist.

MECHANICAL PROBLEMS

Possible locations or causes of insufficient heat:

- An obstructed cowl air intake.
- Obstructed heater system outlets.
- A blend-air door not functioning properly.

TEMPERATURE CONTROL

If the heater outlet air temperature cannot be adjusted with the temperature control knob(s) on the heater-A/C control panel, the following could require service:

- The heater-A/C control.
- The blend-air door motor(s).
- The wire harness circuits for the heater-A/C control or the blend air door motor(s).
- The blend-air door(s).
- Improper engine coolant temperature.

HIGH PRESSURE SWITCH

Before performing diagnosis of the high pressure switch, verify that the refrigerant system has the correct refrigerant charge. See Refrigerant System Charge in the Service Procedures section of this group for more information.

For circuit descriptions and diagrams, refer to 8W-42 - Air Conditioning/Heater in Group 8W - Wiring Diagrams.

(1) Disconnect and isolate the battery negative cable.

(2) Unplug the wire harness connector from the high pressure switch on the refrigerant system fitting.

(3) Check for continuity between the two terminals of the high pressure switch. There should be continuity. If OK, test and repair the A/C switch sense circuit as required. If not OK, replace the faulty switch.

LOW PRESSURE SWITCH

Before performing diagnosis of the low pressure switch, be certain that the switch is properly installed on the accumulator fitting. If the switch is too loose it may not open the Schrader-type valve in the accumulator fitting, which will prevent the switch from correctly monitoring the refrigerant system pressure.

Also verify that the refrigerant system has the correct refrigerant charge. See Refrigerant System Charge in this group for the procedures.

For circuit descriptions and diagrams, refer to 8W-42 - Air Conditioning/Heater in Group 8W - Wiring Diagrams.

(1) Disconnect and isolate the battery negative cable.

(2) Unplug the low pressure switch wire harness connector from the switch on the accumulator fitting.

(3) Install a jumper wire between the two cavities of the low pressure switch wire harness connector.

(4) Connect a manifold gauge set to the refrigerant system service ports. See Refrigerant System Service Equipment in this group for the procedures.

(5) Connect the battery negative cable.

(6) Place the heater-A/C mode control switch knob in any A/C position and start the engine.

(7) Check for continuity between the two terminals of the low pressure switch. There should be continuity with a suction pressure reading of 262 kPa (38 psi) or above, and no continuity with a suction pressure reading of 141 kPa (20.5 psi) or below. If OK, test and repair the A/C switch sense circuit as required. If not OK, replace the faulty switch.

REFRIGERANT SYSTEM LEAKS

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS GROUP BEFORE LEAK TESTING THE SYSTEM.

DIAGNOSIS AND TESTING (Continued)

If the air conditioning system is not cooling properly, determine if the refrigerant system is fully-charged. See A/C Performance in this group for the procedures. If the refrigerant system is low or empty; a leak at a refrigerant line, connector fitting, component, or component seal is likely.

An electronic leak detector designed for R-134a refrigerant is recommended for locating and confirming refrigerant system leaks. Refer to the operating instructions supplied by the equipment manufacturer for proper care and use of this equipment.

An oily residue on or near refrigerant system lines, connector fittings, components, or component seals can indicate the general location of a possible refrigerant leak. However, the exact leak location should be confirmed with an electronic leak detector prior to component repair or replacement.

To detect a leak in the refrigerant system, perform one of the following procedures:

SYSTEM EMPTY

(1) Evacuate the refrigerant system. See Refrigerant System Evacuate in this group for the procedures.

(2) Connect and dispense 0.283 kilograms (0.625 pounds or 10 ounces) of R-134a refrigerant into the evacuated refrigerant system. See Refrigerant System Charge in this group for the procedures.

(3) Position the vehicle in a wind-free work area. This will aid in detecting small leaks.

(4) With the engine not running, use a electronic R-134a leak detector and search for leaks. Because R-134a refrigerant is heavier than air, the leak detector probe should be moved slowly along the bottom side of all refrigerant lines, connector fittings and components.

(5) To inspect the evaporator coil for leaks, insert the electronic leak detector probe into the center instrument panel outlet. Set the blower motor switch to the lowest speed position, the A/C button in the On position, and select the Recirculation Mode.

SYSTEM LOW

(1) Position the vehicle in a wind-free work area. This will aid in detecting small leaks.

(2) Bring the refrigerant system up to operating temperature and pressure. This is done by allowing the engine to run with the air conditioning system turned on for five minutes.

(3) With the engine not running, use a electronic R-134a leak detector and search for leaks. Because R-134a refrigerant is heavier than air, the leak detector probe should be moved slowly along the bottom side of all refrigerant lines, connector fittings and components.

(4) To inspect the evaporator coil for leaks, insert the electronic leak detector probe into the center instrument panel outlet. Set the blower motor switch to the lowest speed position, the A/C button in the On position, and select the Recirculation Mode.

SERVICE PROCEDURES

REFRIGERANT OIL LEVEL

When an air conditioning system is assembled at the factory, all components except the compressor are refrigerant oil free. After the refrigerant system has been charged and operated, the refrigerant oil in the compressor is dispersed throughout the refrigerant system. The accumulator, evaporator, condenser, and compressor will each retain a significant amount of the needed refrigerant oil.

It is important to have the correct amount of oil in the refrigerant system. This ensures 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 air conditioning system.

It will not be necessary to check the oil level in the compressor or to add oil, unless there has been an oil loss. An oil loss may occur due to a rupture or leak from a refrigerant line, a connector fitting, a component, or a component seal. If a leak occurs, add 30 milliliters (1 fluid ounce) of refrigerant oil to the refrigerant system after the repair has been made. Refrigerant oil loss will be evident at the leak point by the presence of a wet, shiny surface around the leak.

Refrigerant oil must be added when a accumulator, evaporator coil, or condenser are replaced. See the Refrigerant Oil Capacities chart. When a compressor is replaced, the refrigerant oil must be drained from the old compressor and measured. Drain all of the refrigerant oil from the new compressor, then fill the new compressor with the same amount of refrigerant oil that was drained out of the old compressor.

Refrigerant Oil Capacities		
Component	ml	fl oz
A/C System	220	7.44
Accumulator	120	4
Condenser	30	1
Evaporator	60	2
Compressor	drain and measure the oil from the old compressor - see text.	

SERVICE PROCEDURES (Continued)

REFRIGERANT RECOVERY

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE GENERAL INFORMATION SECTION NEAR THE FRONT OF THIS GROUP BEFORE RECOVERING REFRIGERANT.

A R-134a refrigerant recovery/recycling/charging station that meets SAE Standard J2210 must be used to recover the refrigerant from an R-134a refrigerant system. Refer to the operating instructions supplied by the equipment manufacturer for the proper care and use of this equipment.

REFRIGERANT SYSTEM CHARGE

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS GROUP BEFORE CHARGING THE REFRIGERANT SYSTEM.

After the refrigerant system has been tested for leaks and evacuated, a refrigerant charge can be injected into the system. See Refrigerant Charge Capacity for the proper amount of the refrigerant charge.

A R-134a refrigerant recovery/recycling/charging station that meets SAE Standard J2210 must be used to charge the refrigerant system with R-134a refrigerant. Refer to the operating instructions supplied by the equipment manufacturer for proper care and use of this equipment.

REFRIGERANT CHARGE CAPACITY

The R-134a refrigerant system charge capacity for this vehicle is 0.737 kilograms (1.625 pounds/26 ounces).

PARTIAL CHARGE METHOD

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS GROUP BEFORE CHARGING THE REFRIGERANT SYSTEM.

The partial charge method is used to add a partial charge to a refrigerant system that is low on refrigerant. To perform this procedure the evaporator inlet and outlet tube temperatures are measured. The temperature difference is measured with a temperature meter with one or two clamp-on thermocouple probes. The difference between the evaporator inlet and outlet tube temperatures will determine the amount of refrigerant needed.

Before adding a partial refrigerant charge, check for refrigerant system leaks. See Refrigerant System Leaks in this group for the procedures. If a leak is found, make the necessary repairs before attempting a full or partial refrigerant charge.

(1) Attach a manifold gauge set to the refrigerant system service ports.

(2) Attach the two clamp-on thermocouple probes to the inlet and outlet tubes of the evaporator coil.

a. If a single thermocouple probe is used, attach the probe to the evaporator inlet tube just before the collar of the refrigerant line connector fitting. The probe must make contact with the bottom surface of the evaporator inlet tube.

b. If dual thermocouple probes are used, attach probe 1 to the evaporator inlet tube, and probe 2 to the evaporator outlet tube. Attach both probes to the evaporator tubes just before the collar of the refrigerant line connector fittings. The probes must make contact with the bottom surfaces of the evaporator inlet and outlet tubes.

(3) Open all of the windows or doors of the passenger compartment.

(4) Set the A/C button on the heater-A/C controls to the on position, the temperature control knob in the full cool position, select the Recirculation Mode, and place the blower motor switch in the highest speed position.

(5) Start the engine and hold the engine idle speed at 1,000 rpm. Allow the engine to warm up to normal operating temperature.

(6) The compressor clutch may cycle, depending upon ambient temperature, humidity, and the refrigerant system charge level. If the compressor clutch cycles, unplug the wire harness connector from the low pressure cycling clutch switch on the accumulator. Install a jumper wire between the two cavities of the switch wire harness connector.

(7) Hold the engine idle speed at 1,000 rpm.

(8) Allow three to five minutes for the refrigerant system to stabilize, then record the temperatures of the evaporator inlet and outlet tubes.

c. If a single probe is used, record the temperature of the evaporator inlet tube. Then remove the probe from the inlet tube and attach it to the evaporator outlet tube just before the collar of the refrigerant line connector fitting. The probe must make contact with the bottom surface of the evaporator outlet tube. Allow the thermocouple and meter time to stabilize, then record the temperature of the evaporator outlet tube. Subtract the inlet tube temperature reading from the outlet tube temperature reading.

d. If dual probes are used, record the temperatures of both the evaporator inlet and outlet tubes. Then subtract the inlet tube temperature reading from the outlet tube temperature reading.

(9) See the Low Charge Determination chart to determine the additional charge required. If the measured temperature differential is higher than 22° C to 26° C (40° F to 47° F), add 0.4 kilograms (14 ounces) of refrigerant.

SERVICE PROCEDURES (Continued)

(10) Allow three to five minutes for the refrigerant system to stabilize, then take a second set of thermocouple measurements. Record the temperature difference and see the Low Charge Determination chart (Fig. 14) to determine if an additional charge is required.

(11) Record the compressor discharge pressure. If the reading is higher than the pressure shown in the Compressor Discharge Pressure chart (Fig. 15), the system could be overcharged. If the reading is equal to, or lower, than the pressure shown in the chart, continue with this procedure.

(12) **EXAMPLE:** The ambient temperature is 21° C (70° F). The evaporator inlet tube temperature is 12° C (54° F) and the evaporator outlet tube temperature is 10° C (50° F). Subtract the inlet tube temperature from the outlet tube temperature. The difference is -2° C (-4° F). With a -2° C (-4° F) temperature differential at 21° C (70° F) ambient temperature, the system is fully charged.

(13) Add enough refrigerant to bring the refrigerant system up to a full charge.

(14) Remove the jumper wire from the low pressure cycling clutch switch wire harness connector and plug the connector back into the switch.

REFRIGERANT SYSTEM EVACUATE

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE GENERAL INFORMATION SECTION NEAR THE FRONT OF THIS GROUP BEFORE EVACUATING THE SYSTEM.

If the refrigerant system has been open to the atmosphere, it must be evacuated before the system can be charged. If moisture and air enters the system and becomes mixed with the refrigerant, the com-

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

Fig. 14 Low Charge Determination

SERVICE PROCEDURES (Continued)

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

Fig. 15 Compressor Discharge Pressure

pressor head pressure will rise above acceptable operating levels. This will reduce the performance of the air conditioner and damage the compressor. Evacuating the refrigerant system will remove the air and boil the moisture out of the system at near room temperature. To evacuate the refrigerant system, use the following procedure:

(1) Connect a R-134a refrigerant recovery/recycling/charging station that meets SAE Standard J2210 and a manifold gauge set to the refrigerant system of the vehicle.

(2) Open the low and high side valves and start the charging station vacuum pump. When the suction gauge reads 88 kPa (26 in. Hg.) vacuum or greater, close all of the valves and turn off the vacuum pump.

(a) If the refrigerant system fails to reach the specified vacuum, the system has a leak that must be corrected. See Refrigerant System Leaks in the Diagnosis and Testing section of this group for the procedures.

(b) If the refrigerant system maintains the specified vacuum for five minutes, restart the vacuum pump, open the suction and discharge valves and evacuate the system for an additional ten minutes.

(3) Close all of the valves, and turn off the charging station vacuum pump.

(4) The refrigerant system is now ready to be charged with R-134a refrigerant. See Refrigerant System Charge in the Service Procedures section of this group.

REMOVAL AND INSTALLATION

ACCUMULATOR

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS GROUP BEFORE PERFORMING THE FOLLOWING OPERATION.

The suction lines from the evaporator outlet tube to the accumulator, and from the accumulator to the suction port of the compressor manifold are integral to the accumulator. If either suction line or the accumulator is faulty or damaged, the accumulator assembly must be replaced.

Any kinks or sharp bends in the refrigerant plumbing will reduce the capacity of the entire air conditioning system. Kinks and sharp bends reduce the flow of refrigerant in the system. A good rule for the flexible hose refrigerant lines is to keep the radius of all bends at least ten times the diameter of the hose. In addition, the flexible hose refrigerant lines should be routed so they are at least 80 millimeters (3 inches) from the exhaust manifold.

High pressures are produced in the refrigerant system when the air conditioning compressor is operating. Extreme care must be exercised to make sure that each of the refrigerant system connections is pressure-tight and leak free. It is a good practice to inspect all flexible hose refrigerant lines at least once a year to make sure they are in good condition and properly routed.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the low pressure cycling clutch switch from the accumulator. See Low Pressure Cycling Clutch Switch in this group for the procedures.

(3) Recover the refrigerant from the refrigerant system. See Refrigerant Recovery in this group for the procedures.

(4) Disconnect the suction line refrigerant line fitting from the evaporator outlet tube. Install plugs in, or tape over all of the opened refrigerant line fittings.

(5) Remove the screw that secures the suction line block fitting to the manifold on the compressor. Install plugs in, or tape over all of the opened refrigerant line fittings.

(6) Loosen the screw that clamps the band of the accumulator support bracket around the accumulator (Fig. 16).

(7) Remove the accumulator from the support bracket.

INSTALLATION

(1) Install the accumulator through the band of the support bracket. Be certain that the index tab on

REMOVAL AND INSTALLATION (Continued)

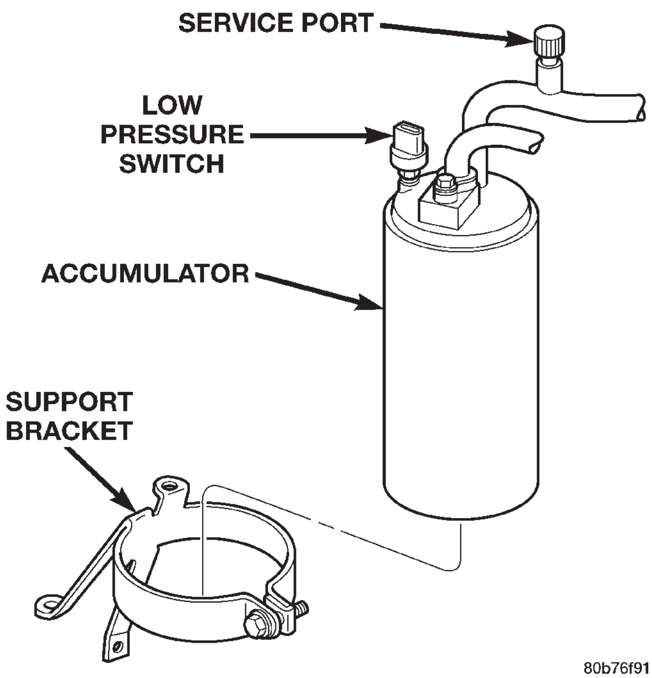


Fig. 16 Accumulator and Support Bracket

the side of the accumulator is aligned with the notch in the support bracket band.

(2) Tighten the clamp screw in the support bracket band to 12 N·m (105 in. lbs.).

(3) Remove the tape or plugs from the suction line block fitting and the manifold on the compressor. Install the suction line block fitting to the manifold on the compressor. Tighten the mounting screw to 28 N·m (250 in. lbs.).

(4) Remove the tape or plugs from the refrigerant line fittings on the suction line and the evaporator outlet tube.

(5) Install the low pressure cycling clutch switch onto the accumulator fitting. See Low Pressure Cycling Clutch Switch in this group for the procedures.

(6) Connect the battery negative cable.

(7) Evacuate the refrigerant system. See Refrigerant System Evacuate in this group for the procedures.

(8) Charge the refrigerant system. See Refrigerant System Charge in this group for the procedures.

NOTE: If the accumulator is replaced, add 120 milliliters (4 fluid ounces) of refrigerant oil to the refrigerant system. Use only refrigerant oil of the type recommended for the compressor in the vehicle.

BLEND-AIR DOOR(S)

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Remove the heater-A/C housing from the vehicle. See Heater-A/C Housing in this group for the procedures.

(2) Place the heater-A/C housing with the tubing side down on a work bench, making allowance for leakage of fluids.

(3) Using a sharp knife, split the foam seal surrounding the panel outlet opening, at the dividing line of the upper and lower cases (Fig. 17).

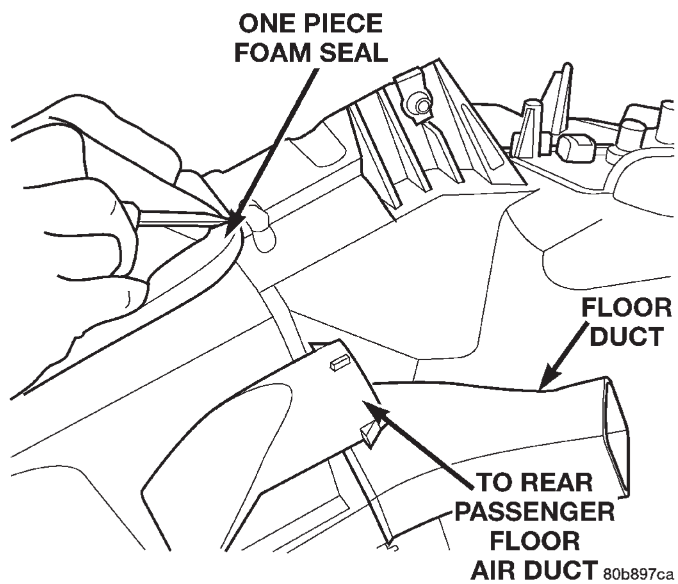


Fig. 17 Split Foam Seal at Panel Outlet

(4) Place the heater-A/C housing in the upright position on the work bench.

(5) Remove the mode door actuator on the left side of the housing, controlling the mode door in the top of the case (Fig. 18) (Fig. 19).

(6) Remove the screw with plastic washer holding the lever assembly to the upper case section, and move aside (Fig. 20).

(7) Remove the 5 clips that secure the two housing halves to each other. There are 2 on either side at the center, and 1 located at the forward end of the mode door side of the case (Fig. 21).

REMOVAL AND INSTALLATION (Continued)

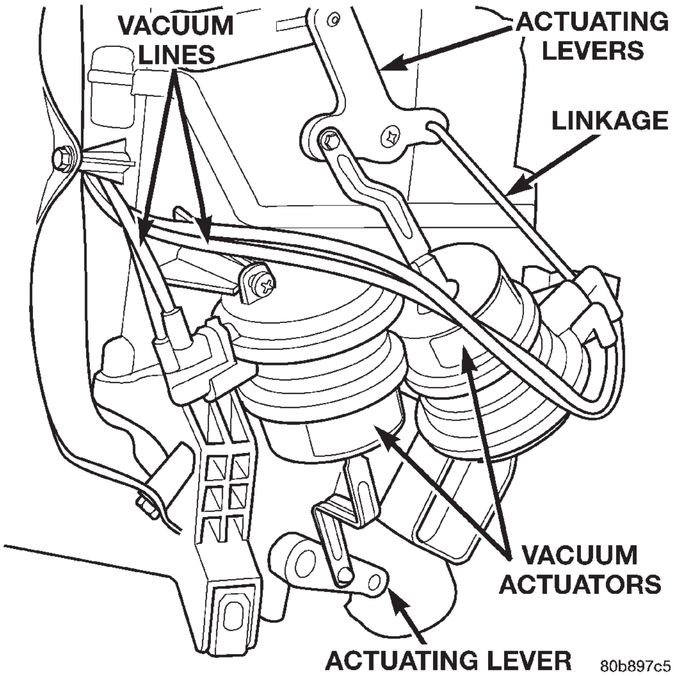


Fig. 18 Mode Door Actuators-Manual System

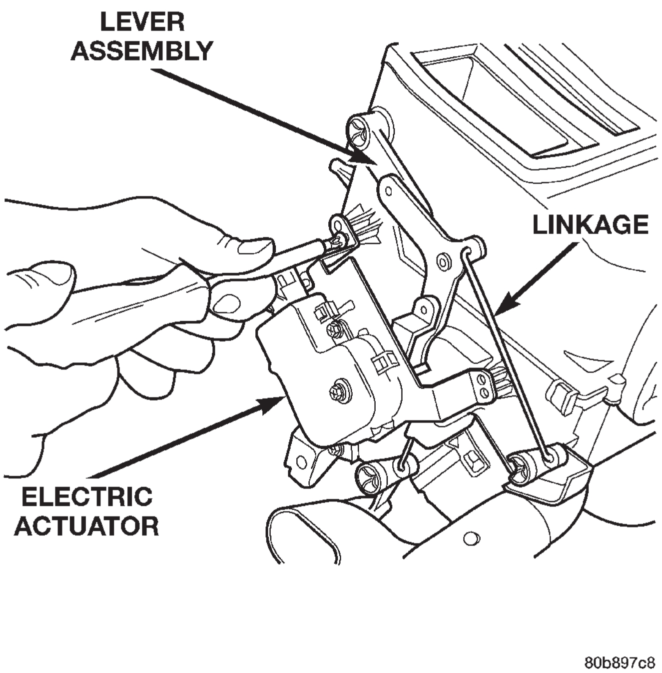


Fig. 19 Mode Door Actuator-AZC System

(8) Release the wire harness electrical connector(s) from the mounts on the lower case at the blower motor end of the unit (Fig. 22).

(9) Remove the 10 screws that secure the two housing halves to each other.

(10) Separate the top half of the heater-A/C housing from the bottom half (Fig. 23).

(11) Remove evaporator from lower case to ease access to plastic door shaft bushing.

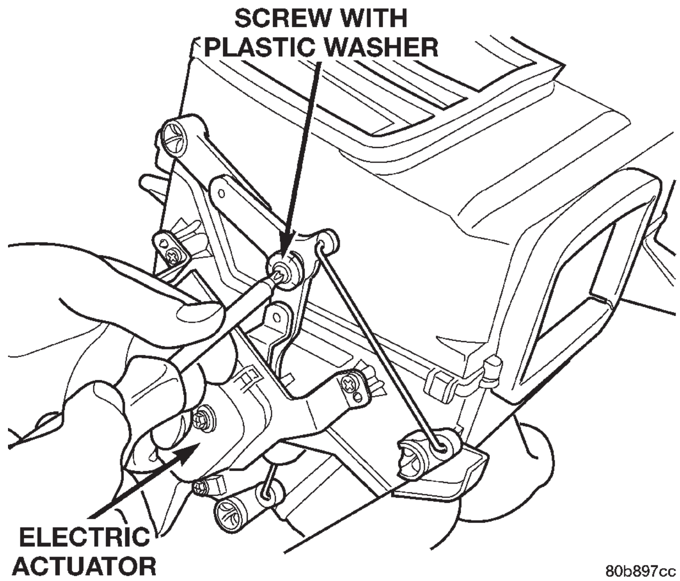


Fig. 20 Remove Screw with Plastic Washer

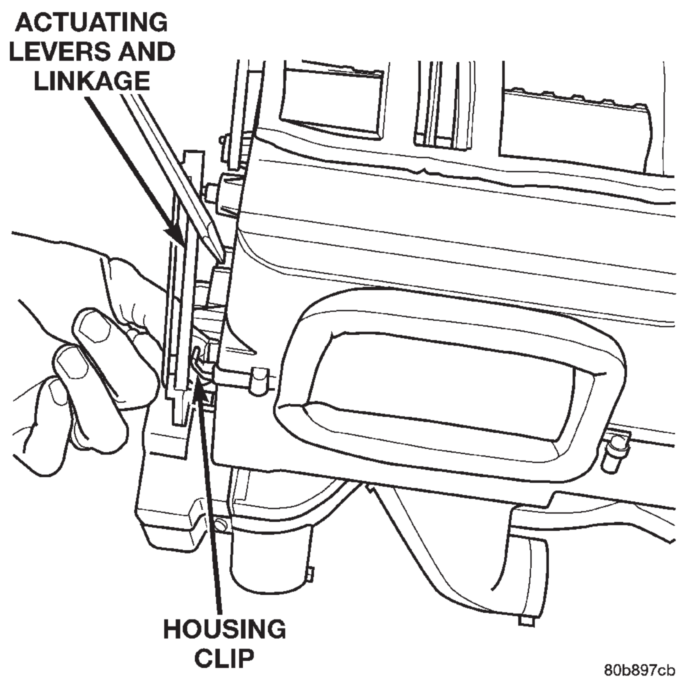


Fig. 21 HVAC Housing Clips

(12) Pinch the retention tabs holding the blend-air door pivot shaft bushing to the case. The 3 plastic tabs, located on the inside of the case, are part of the shaft retainer.

(13) Remove door(s).

NOTE: The blend-air door sub-assembly is attached to the housing with 2 screws, and may be removed for service (Fig. 24).

INSTALLATION

Reverse the removal procedures to install.

REMOVAL AND INSTALLATION (Continued)

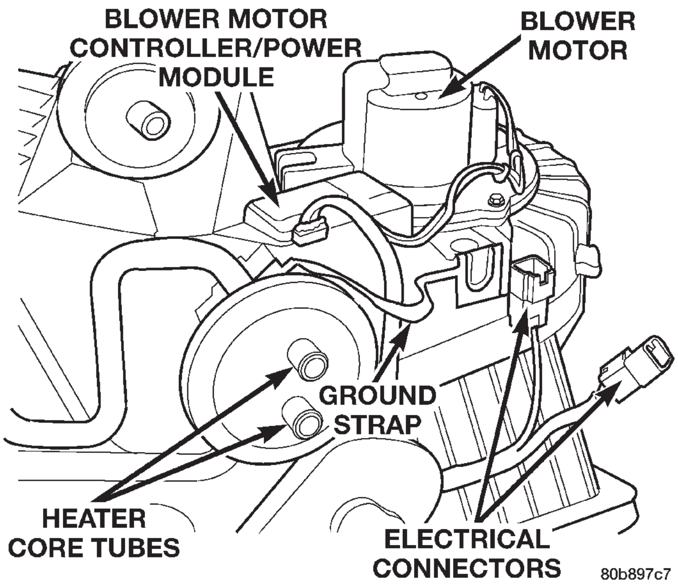


Fig. 22 Wire Harness Electrical Connector(s)

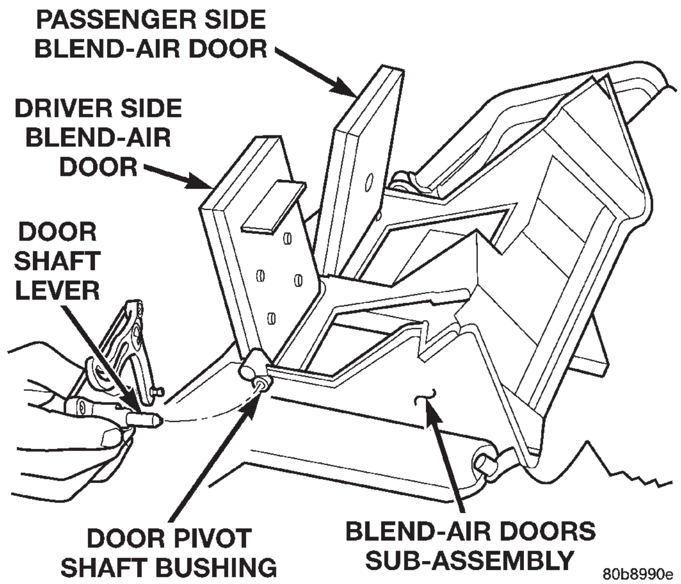


Fig. 24 Blend-Air Doors Sub-Assembly (AZC)

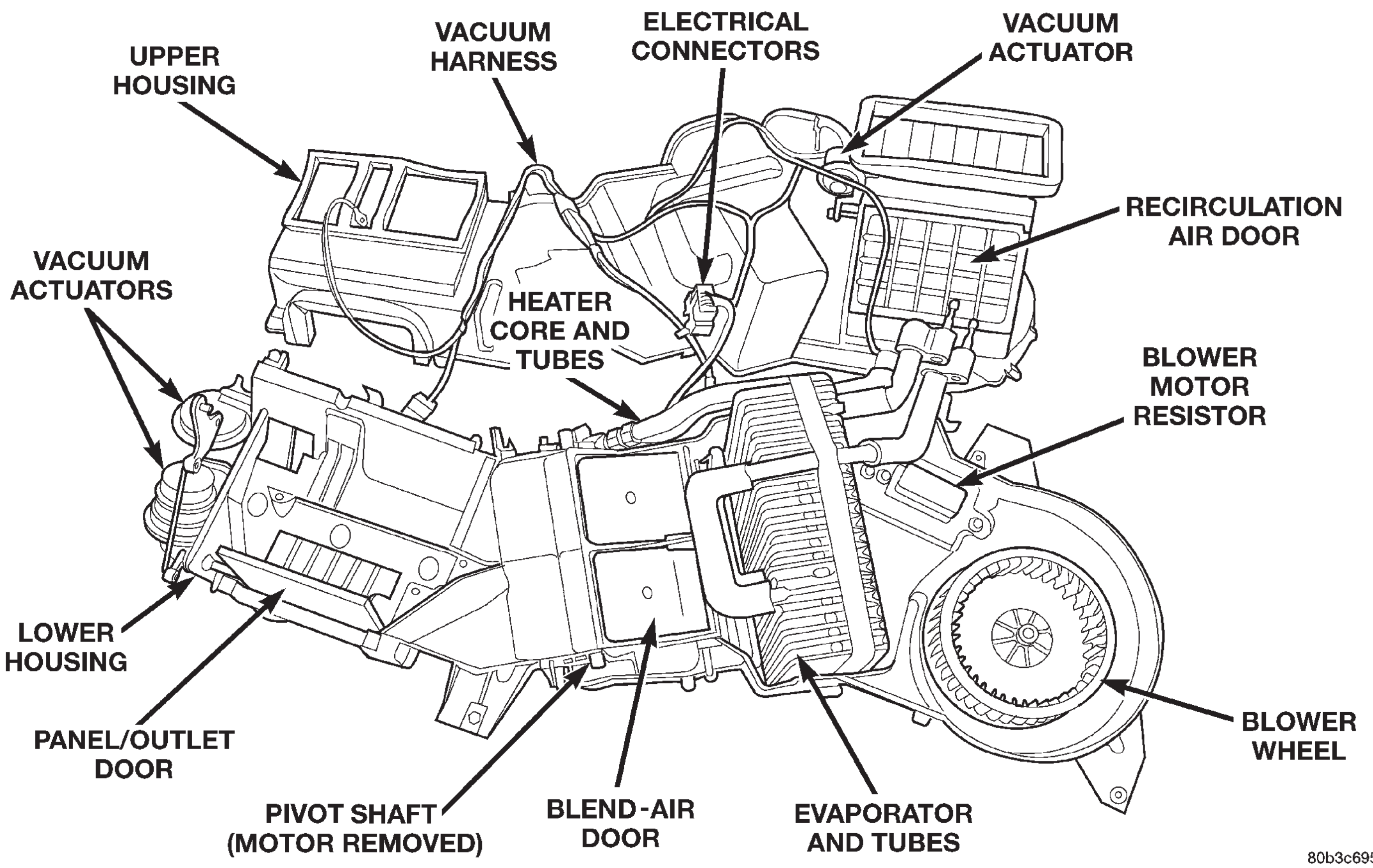


Fig. 23 Upper and Lower HVAC Housing-Separated

- Be certain that each of the door pivot pins align with the pivot holes in the heater-A/C housing.
- Tighten the heater-A/C housing screws to 2.2 N·m (20 in. lbs.).
- Check doors for binding after replacement, and after assembly of housing.

REMOVAL AND INSTALLATION (Continued)

BLOWER MOTOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Pinch the connector retainer and unplug the blower motor wire harness from the heater-A/C blower motor (Fig. 25).

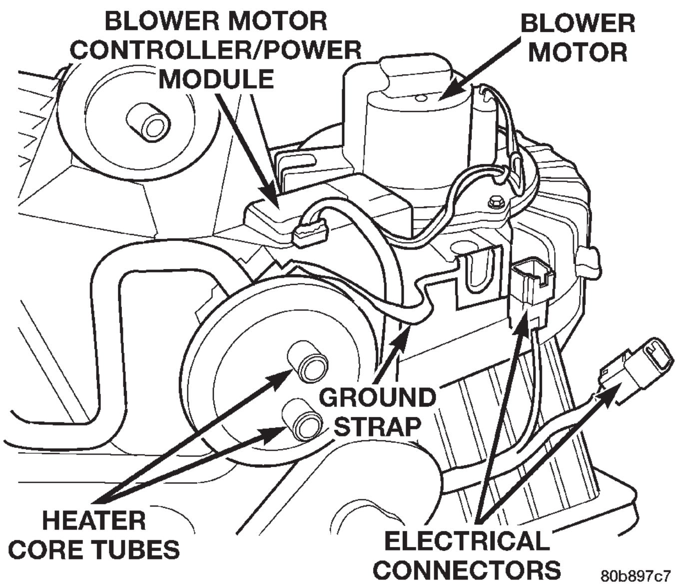


Fig. 25 Blower Motor (housing removed from vehicle)

(3) Remove the three screws that secure the blower motor and blower wheel assembly to the heater-A/C housing, using either a T-25 Torx® head or flat-bladed screwdriver.

(4) Lower the blower motor and wheel from the heater-A/C housing.

(5) Remove the blower wheel retainer clip (Fig. 26).

(6) Remove the wheel from the blower motor shaft.

INSTALLATION

(1) Press the blower wheel hub onto the blower motor shaft. Be sure the flat on the blower motor shaft is indexed to the flat on the inside of the blower wheel hub.

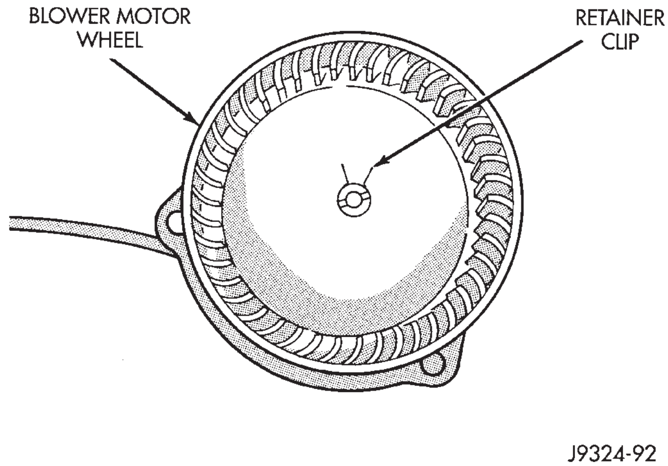


Fig. 26 Blower Motor Wheel Remove/Install

(2) Install the retainer clip over the blower wheel hub.

(3) Install the blower motor in the heater-A/C housing with three mounting screws. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

(4) Plug the blower motor wire harness connector into the blower motor socket.

(5) Connect the battery negative cable.

BLOWER MOTOR RESISTOR AND CONTROLLER

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Depress locking tab and unplug the wire harness connector from the blower motor resistor or controller (power module).

(3) Depress locking tab and unplug the resistor or controller connector from the blower motor.

(4) Remove the 2 screws that secure the blower motor resistor or controller to the heater-A/C housing.

(5) Remove the blower motor resistor or controller from the heater-A/C housing (Fig. 27).

INSTALLATION

(1) Install the blower motor resistor or controller to the heater-A/C housing. The housing is indexed to allow (controller/power module) mounting in only one position. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

(2) Plug in the wire harness connector to the blower motor resistor or controller.

(3) Plug in the connector from the blower motor resistor or controller to the blower motor.

(4) Connect the battery negative cable.

REMOVAL AND INSTALLATION (Continued)

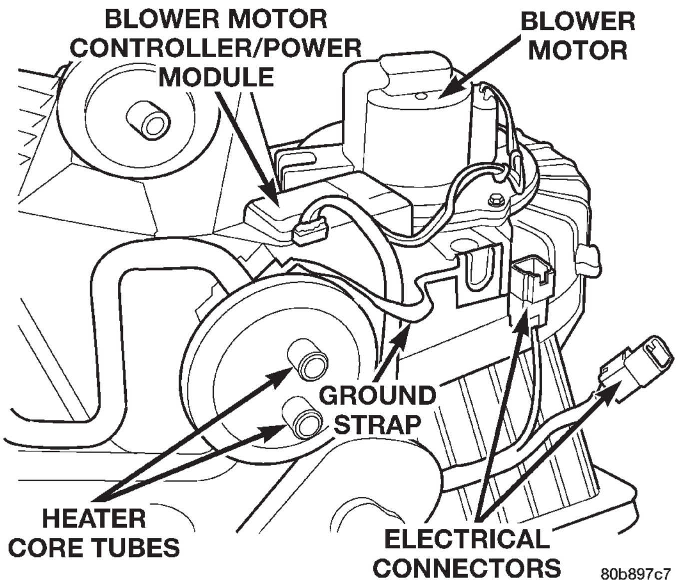


Fig. 27 Blower Motor Resistor or Controller/Power Module Remove/Install

COMPRESSOR

The compressor may be removed and repositioned without disconnecting the refrigerant lines or discharging the refrigerant system. Discharging is not necessary if servicing the compressor clutch or clutch coil, the engine, the cylinder head, or the generator.

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS GROUP BEFORE PERFORMING THE FOLLOWING OPERATION.

REMOVAL

(1) Recover the refrigerant from the refrigerant system. See Refrigerant Recovery in this group for the procedures.

(2) Disconnect and isolate the battery negative cable.

(3) Remove the serpentine drive belt. Refer to Group 7 - Cooling System for the procedures.

(4) Unplug the compressor clutch coil wire harness connector.

(5) Remove the screws that secure the suction line and discharge line block fittings to the manifold on the compressor. Install plugs in, or tape over all of the opened refrigerant fittings.

(6) Remove the screws that secure the compressor (Fig. 28) or (Fig. 29) and (Fig. 30).

(7) Remove the compressor.

INSTALLATION

NOTE: If a replacement compressor is being installed, be certain to check the refrigerant oil level. See Refrigerant Oil Level in this group for the procedures. Use only refrigerant oil of the type recommended for the compressor in the vehicle.

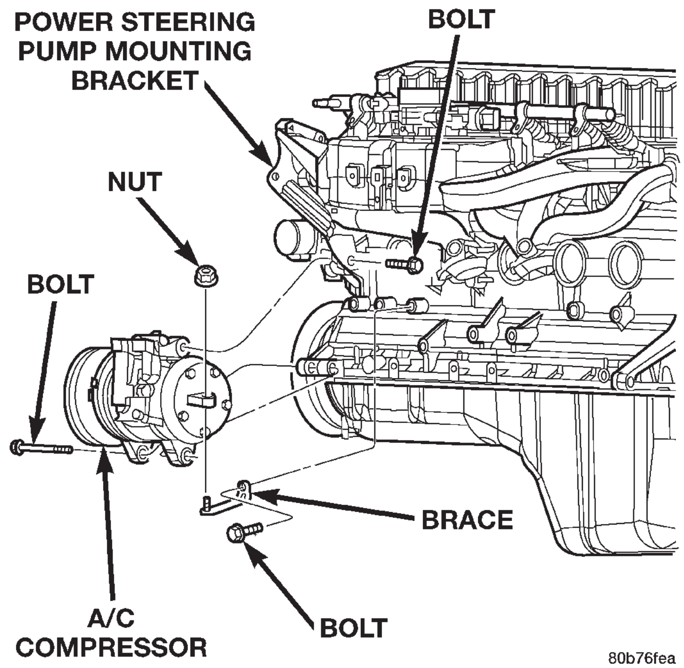


Fig. 28 Compressor Remove/Install - 6 Cylinder Engine

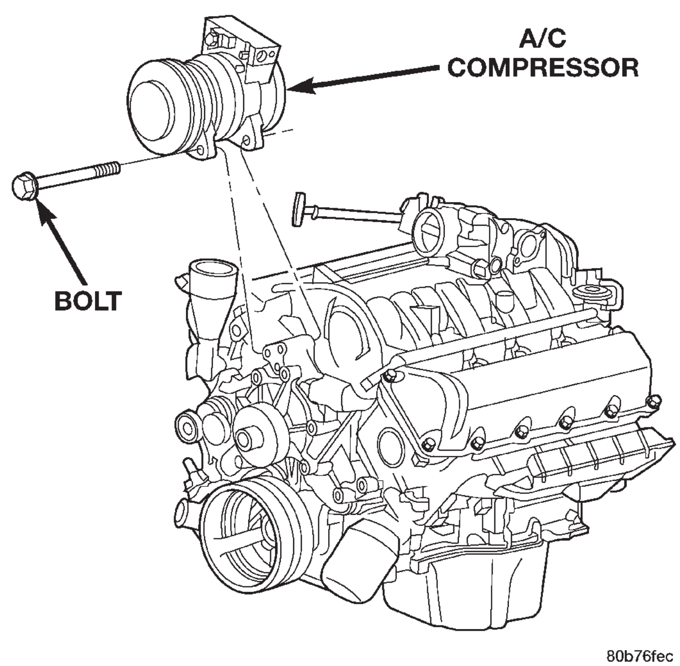


Fig. 29 Compressor Remove/Install - V8 Engine - Left View

(1) Install the compressor. Tighten the 4.0L mounting screws fastening the compressor to the block to 45-65 N·m (35-50 ft. lbs.). Tighten the mounting screws holding the rear brace to the compressor and block to 40-55 N·m (30-40 ft. lbs.).

REMOVAL AND INSTALLATION (Continued)

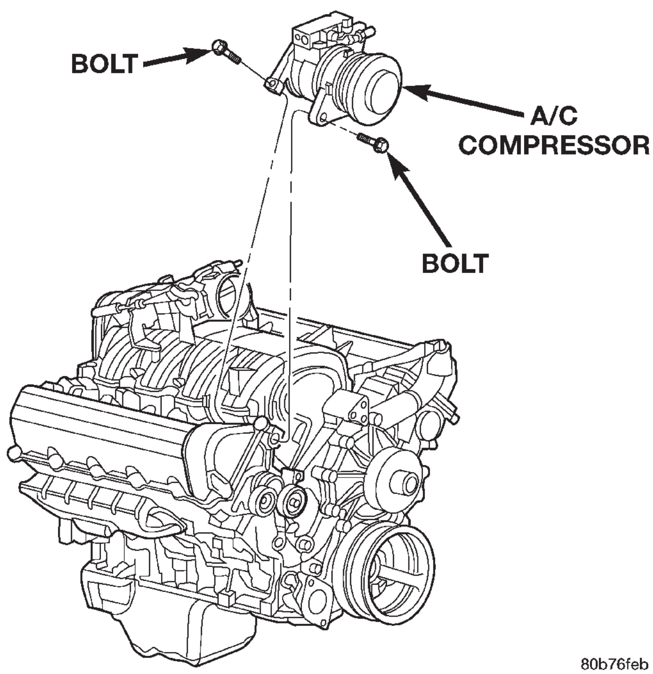


Fig. 30 Compressor Remove/Install - V8 Engine - Right View

Tighten the 4.7L compressor front mounting screws to 45-65 N·m (35-50 ft. lbs.), and the rear mounting screws to 35-45 N·m (25-35 ft. lbs.).

(2) Remove the tape or plugs from all of the opened refrigerant line fittings. Install the suction line and discharge line block fittings to the manifold on the compressor. Tighten the mounting screws to 25.4 N·m (225 in. lbs.).

(3) Install the serpentine drive belt. Refer to Group 7 - Cooling System for the procedures.

(4) Plug in the compressor clutch coil wire harness connector.

(5) Connect the battery negative cable.

(6) Evacuate the refrigerant system. See Refrigerant System Evacuate in this group for the procedures.

(7) Charge the refrigerant system. See Refrigerant System Charge in this group for the procedures.

COMPRESSOR CLUTCH

The refrigerant system can remain fully-charged during compressor clutch, pulley, or coil replacement. The compressor clutch can be serviced in the vehicle.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the serpentine drive belt. Refer to Group 7 - Cooling System for the procedures.

(3) Remove the bolt that secures the compressor clutch to the compressor shaft (Fig. 31). A band-type oil filter wrench may be used to secure the clutch during bolt removal.

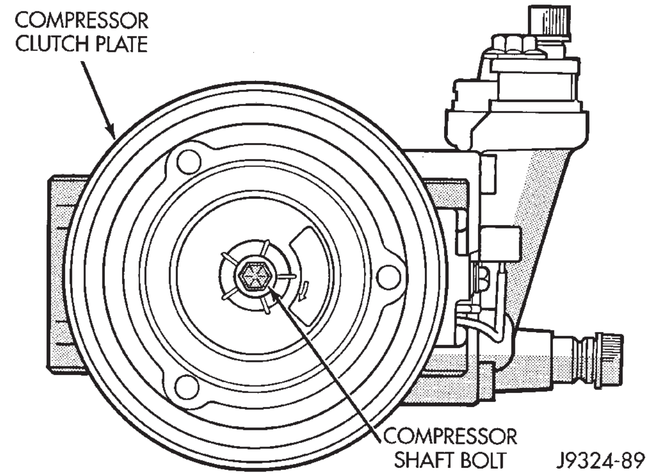


Fig. 31 Compressor Shaft Bolt

(4) Tap the clutch plate with a plastic mallet to release it from the splines on the compressor shaft. Remove the clutch plate and shim(s) from the compressor shaft (Fig. 32).

CAUTION: Do not pry between the clutch plate assembly and the pulley to remove it from the compressor shaft. Prying may damage the clutch plate assembly.

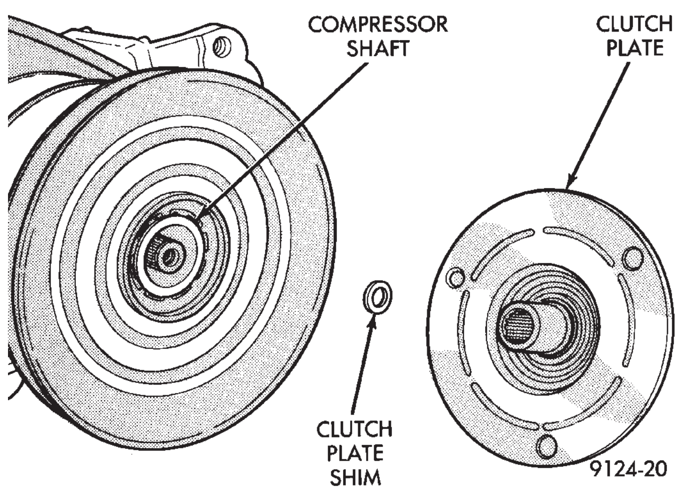


Fig. 32 Clutch Plate and Shim

(5) Remove the external snap ring that secures the compressor clutch pulley to the nose of the compressor front housing with snap ring pliers (Special Tool C-4574) and slide the pulley assembly off of the compressor (Fig. 33).

(6) Remove the screw and retainer from the clutch coil lead wire harness on the compressor front housing.

(7) Remove the external snap ring that secures the compressor clutch coil to the nose of the compressor front housing with snap ring pliers and slide the coil assembly off of the compressor (Fig. 34).

REMOVAL AND INSTALLATION (Continued)

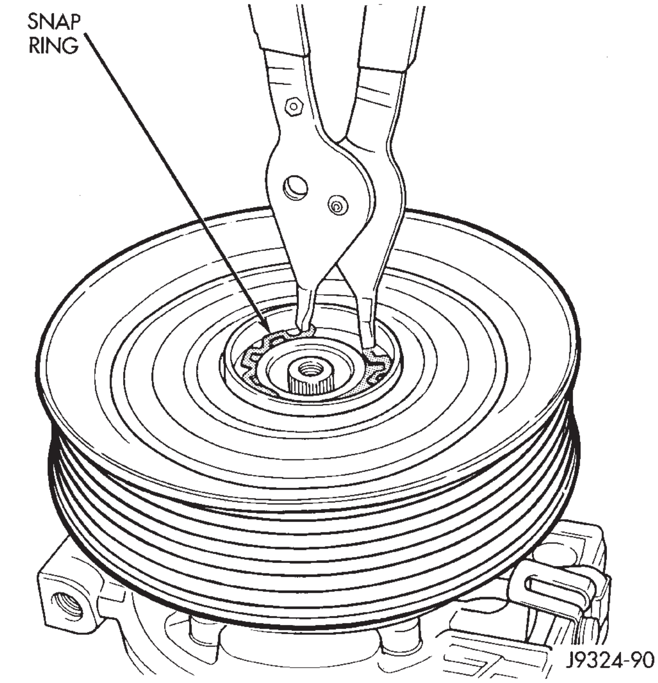


Fig. 33 Pulley Snap Ring Remove/Install

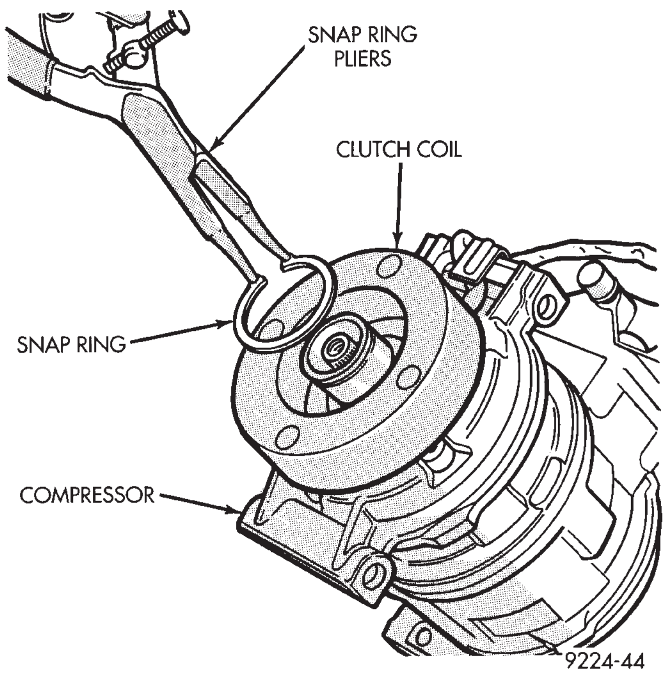


Fig. 34 Clutch Coil Snap Ring Remove/Install

INSPECTION

Examine the friction surfaces of the clutch pulley and the clutch plate for wear. The pulley and plate should be replaced if there is excessive wear or scoring.

If the friction surfaces are oily, inspect the shaft and nose area of the compressor for refrigerant oil. Remove the felt wick from around the shaft inside the nose of the compressor front housing. If the felt is saturated with refrigerant oil, the compressor shaft seal is leaking and the compressor must be replaced.

Check the clutch pulley bearing for roughness or excessive leakage of grease. Replace the bearing, if required.

INSTALLATION

(1) Align the dowel pin on the back of the clutch field coil with the hole in the compressor front housing and press the field coil into place over the nose of the compressor.

(2) Install the clutch coil lead wire harness retaining clip on the compressor front housing and tighten the retaining screw.

(3) Install the clutch field coil and snap ring with snap ring pliers (Special Tool C-4574). The bevel side of the snap ring must be facing outward. Also, both eyelets of the snap ring must be to the right or left of the pin on the compressor. Press in on the snap ring to be certain that it is properly seated in the groove.

CAUTION: If the snap ring is not fully seated in the groove it will vibrate out, resulting in a clutch failure and severe damage to the front housing of the compressor.

(4) Install the pulley assembly onto the compressor. If necessary, place a block of wood on the friction surface and tap gently with a hammer (Fig. 35).

CAUTION: Do not mar the pulley friction surface.

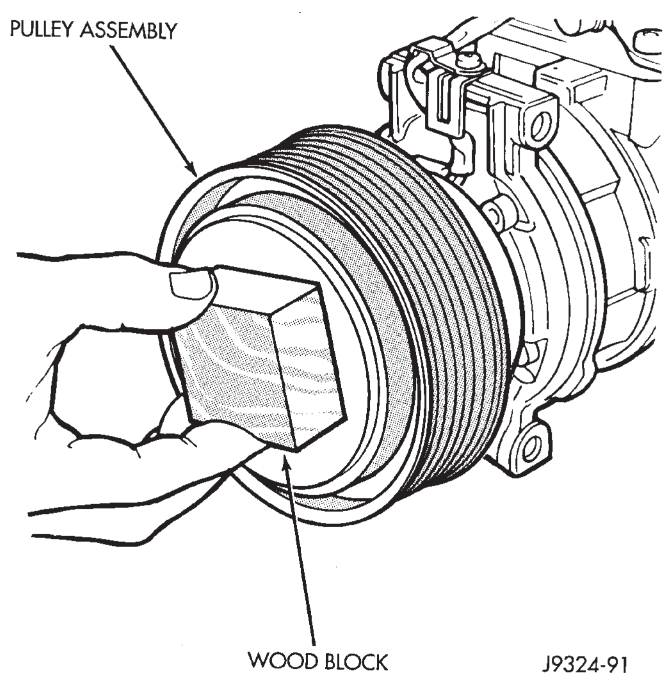


Fig. 35 Pulley Assembly Install

REMOVAL AND INSTALLATION (Continued)

(5) Install the pulley assembly retaining snap ring (bevel side outward) with snap ring pliers (Special Tool C-4574). Press in on the snap ring to be certain that it is properly seated in the groove.

(6) If the original clutch 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.

(7) Install the clutch plate assembly onto the shaft.

(8) With the clutch plate assembly tight against the shim(s), measure the air gap between the clutch plate and the pulley face with feeler gauges. The air gap should be between 0.35 to 0.65 millimeter (0.014 to 0.026 inch). If the proper air gap is not obtained, add or subtract shims as needed until the desired air gap is obtained.

(9) Install the compressor shaft bolt. Tighten the bolt to 13 N·m (115 in. lbs.).

NOTE: The shims may compress after tightening the shaft bolt. Check the air gap in four or more places to verify the air gap is still correct. Spin the pulley before performing a final check of the air gap.

(10) Reverse the remaining removal procedures to complete the installation.

CLUTCH BREAK-IN

After a new compressor clutch has been installed, cycle the compressor clutch approximately twenty times (five seconds on, then five seconds off). During this procedure, set the heater-A/C control in the Recirculation Mode, the A/C button in the on position, the blower motor switch in the highest speed position, and the engine speed at 1500 to 2000 rpm. This procedure (burnishing) will seat the opposing friction surfaces and provide a higher compressor clutch torque capability.

COMPRESSOR CLUTCH RELAY

(1) Disconnect and isolate the battery negative cable.

(2) Remove the cover from the Power Distribution Center (PDC) (Fig. 36).

(3) Refer to the label on the PDC for compressor clutch relay identification and location.

(4) Unplug the compressor clutch relay from the PDC.

(5) Install the compressor clutch relay by aligning the relay terminals with the cavities in the PDC and pushing the relay firmly into place.

(6) Install the PDC cover.

(7) Connect the battery negative cable.

(8) Test the relay operation.

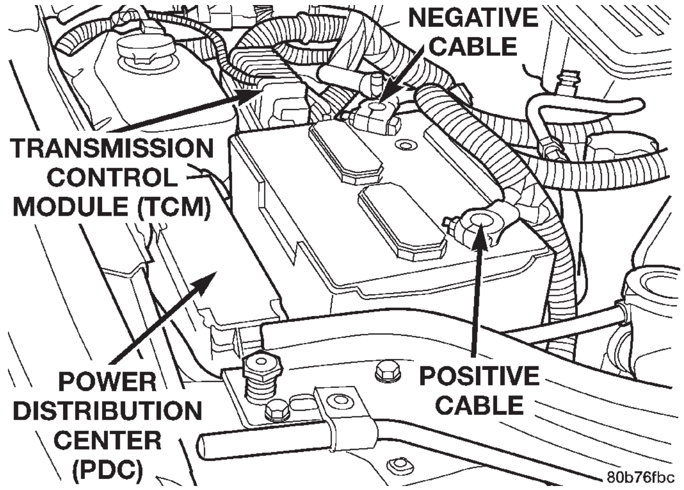


Fig. 36 Power Distribution Center (PDC)

CONDENSER

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS GROUP BEFORE PERFORMING THE FOLLOWING OPERATION.

CAUTION: Before removing the condenser, note the location of each of the radiator and condenser air seals. These seals are used to direct air through the condenser and radiator. The air seals must be reinstalled in their proper locations in order for the air conditioning and engine cooling systems to perform as designed (Fig. 37).

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Recover the refrigerant from the refrigerant system. See Refrigerant Recovery in this group for the procedures.

(3) Remove the screws attaching the grille and headlamp mounting module to the upper crossmember of the vehicle. Refer to Group 23 - Body for this and further steps in the procedure.

(4) Remove the headlamps from their mounts.

(5) Remove the nuts that secure the hood latch and brace to the upper crossmember.

(6) The radiator upper crossmember can be adjusted left or right through the use of its slotted mounting holes. Before removal, mark the original position of the crossmember.

(7) Remove the bolts that secure the radiator to the upper crossmember and set it aside (Fig. 38).

(8) Remove the engine air filter inlet duct secured at the headlamp mounting module.

(9) Remove the headlamp mounting module and front fascia for access to the condenser and fittings.

REMOVAL AND INSTALLATION (Continued)

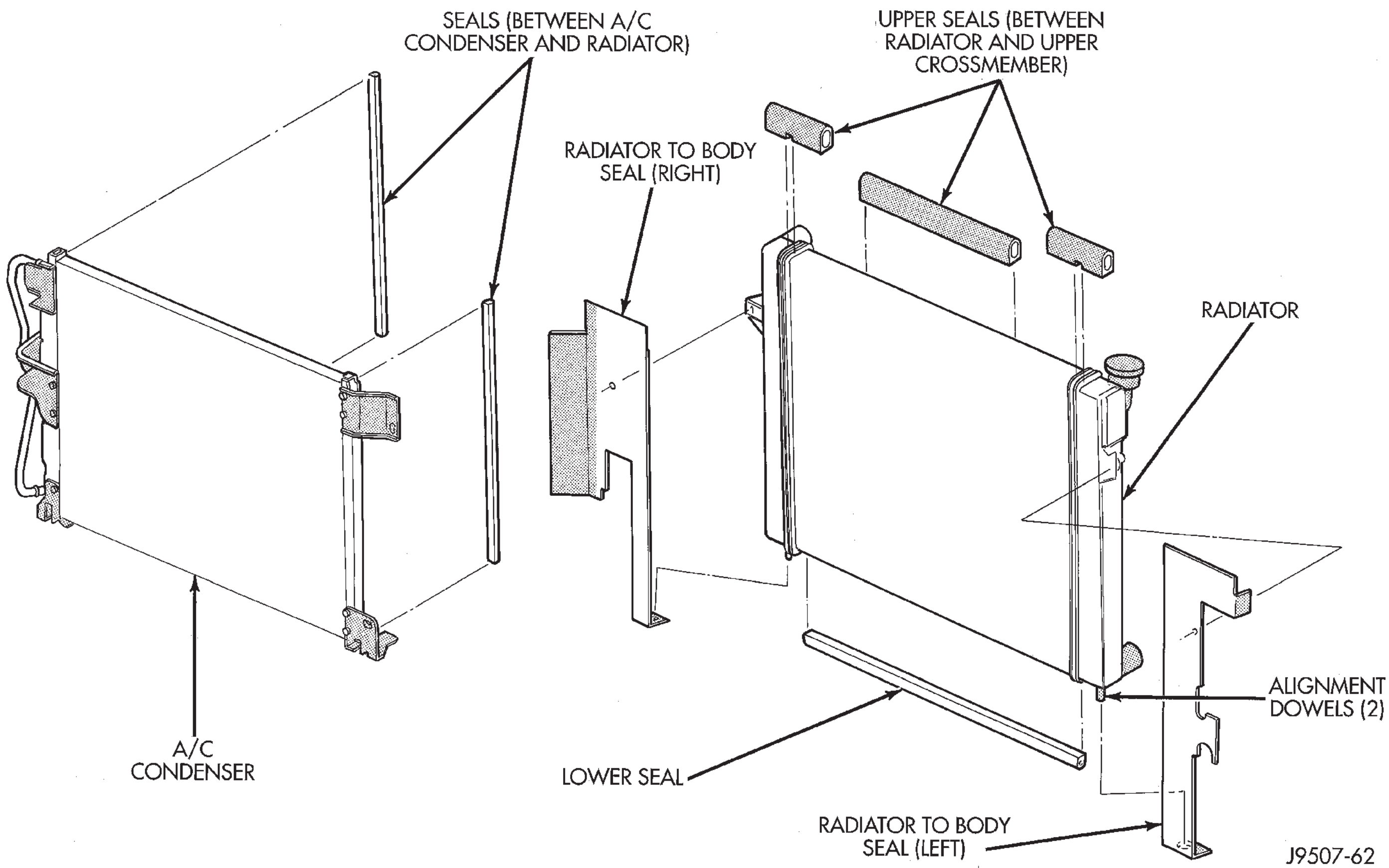


Fig. 37 Air Seals - Typical

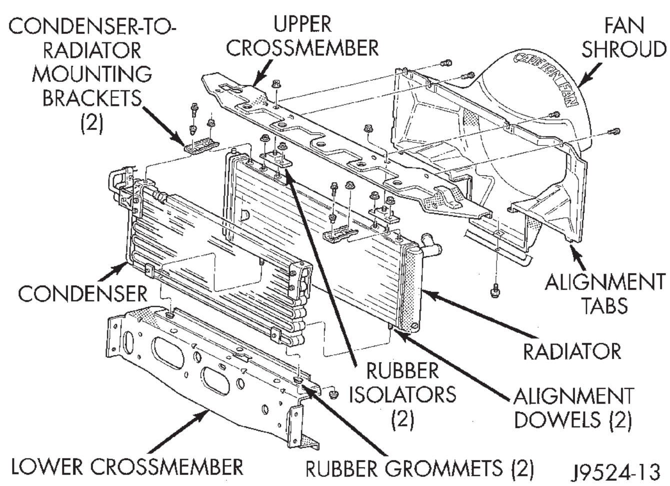


Fig. 38 Condenser Mounting - Typical

(10) Disconnect the discharge line and liquid line refrigerant line fittings from the condenser. See Refrigerant Line Coupler in this group for the procedures. Install plugs in, or tape over all of the opened refrigerant line fittings.

(11) Remove the bolts that secure the upper condenser and transmission cooler.

(12) Carefully lift the condenser out of the vehicle.

INSTALLATION

For installation, reverse the above procedures.

- Carefully position the condenser in the vehicle.
- Remove the tape or plugs from the refrigerant line fittings on the discharge line, liquid line and the condenser. Connect both of the refrigerant line couplers to the condenser. See Refrigerant Line Coupler in this group for the procedures.
- Evacuate and charge the refrigerant system. See Refrigerant System Evacuate and Charge procedures in this group.

NOTE: If the condenser is replaced, add 30 milliliters (1 fluid ounce) of refrigerant oil to the refrigerant system. Use only refrigerant oil of the type recommended for the compressor in the vehicle.

DISCHARGE LINE

Any kinks or sharp bends in the refrigerant plumbing will reduce the capacity of the entire air conditioning system. Kinks and sharp bends reduce the flow of refrigerant in the system. A good rule for the flexible hose refrigerant lines is to keep the radius of all bends at least ten times the diameter of the hose. In addition, the flexible hose refrigerant lines should be routed so they are at least 80 millimeters (3 inches) from the exhaust manifold.

REMOVAL AND INSTALLATION (Continued)

High pressures are produced in the refrigerant system when the air conditioning compressor is operating. Extreme care must be exercised to make sure that each of the refrigerant system connections is pressure-tight and leak free. It is a good practice to inspect all flexible hose refrigerant lines at least once a year to make sure they are in good condition and properly routed.

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS GROUP BEFORE PERFORMING THE FOLLOWING OPERATION.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Recover the refrigerant from the refrigerant system. See Refrigerant Recovery in this group for the procedures.

(3) Remove the high pressure cut-off switch. See High Pressure Cut-Off Switch in this group for the procedures.

(4) Disconnect the discharge line refrigerant line fitting from the condenser inlet tube. Install plugs in, or tape over all of the opened refrigerant line fittings.

(5) Remove the screw that secures the discharge line block fitting to the manifold on the compressor. Install plugs in, or tape over all of the opened refrigerant line fittings.

(6) Remove the discharge line assembly from the vehicle.

INSTALLATION

(1) Remove the tape or plugs from the discharge line block fitting and the manifold on the compressor. Install the discharge line block fitting to the manifold on the compressor. Tighten the mounting screw to 25.4 N·m (225 in. lbs.).

(2) Remove the tape or plugs from the refrigerant line fittings on the discharge line and the condenser inlet tube. Connect the discharge line refrigerant line coupler to the condenser inlet tube.

(3) Install the high pressure cut-off switch. See High Pressure Cut-Off Switch in this group for the procedures.

(4) Connect the battery negative cable.

(5) Evacuate the refrigerant system. See Refrigerant System Evacuate in this group for the procedures.

(6) Charge the refrigerant system. See Refrigerant System Charge in this group for the procedures.

DUCTS AND OUTLETS

DEFROSTER DUCT

(1) Remove the instrument panel assembly from the vehicle. See Instrument Panel Assembly in Group 8E - Instrument Panel Systems for the procedures.

(2) Remove the three screws that secure the defroster duct to the HVAC unit housing (Fig. 39).

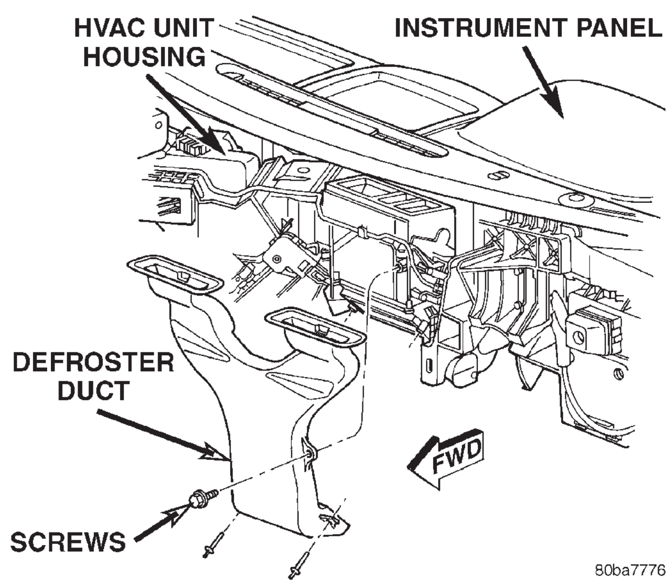


Fig. 39 HVAC Defroster Duct

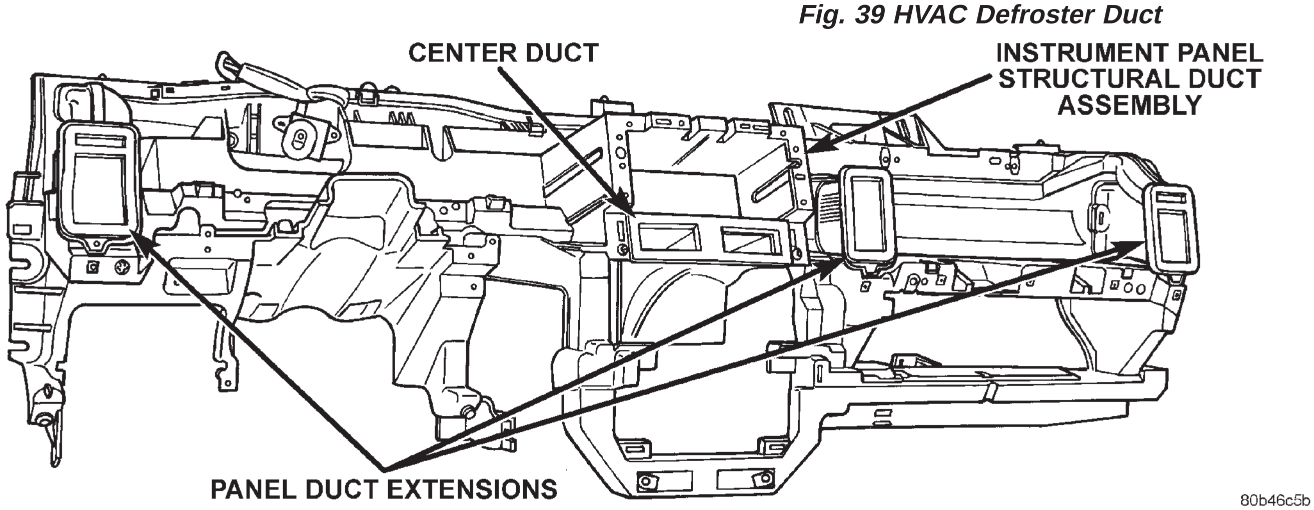


Fig. 40 Instrument Panel Structural Duct Assembly

REMOVAL AND INSTALLATION (Continued)

(3) Remove the defroster duct from the HVAC unit housing.

(4) Reverse the removal procedures to install. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

INSTRUMENT PANEL DUCT EXTENSIONS

(1) Remove the instrument panel top pad from the vehicle. See Instrument Panel Assembly in Group 8E - Instrument Panel Systems for the procedure.

(2) Unsnap the duct extension(s) from the instrument panel structural duct assembly (Fig. 40).

(3) Remove the duct extension(s) from the instrument panel (Fig. 41).

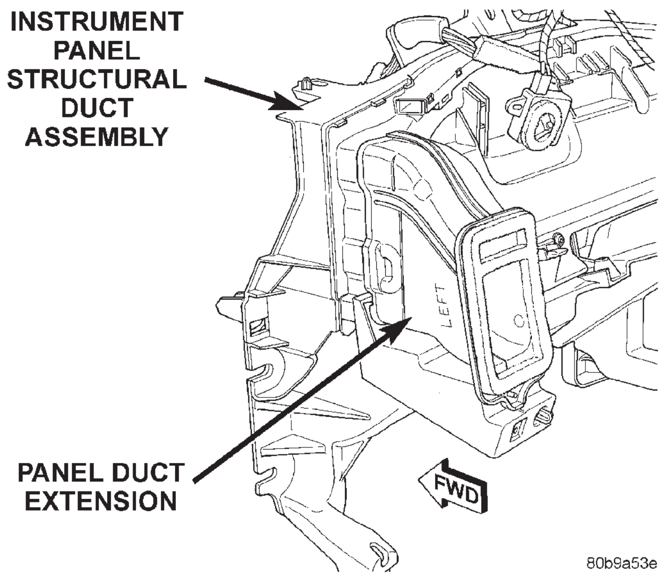


Fig. 41 Instrument Panel Duct Extension

(4) Reverse the removal procedures to install.

FLOOR DUCTS

(1) To remove the driver side floor duct from the vehicle, remove the knee blocker panel for access to attaching screw. See Instrument Panel Assembly in Group 8E - Instrument Panel Systems for the procedures.

(2) The passenger side floor duct fastener can be accessed under the right-center instrument panel.

(3) Remove the screw that secures the floor duct(s) to the HVAC housing (Fig. 42).

(4) Reverse the removal procedures to install. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

REAR FLOOR DUCTS

(1) To remove the rear floor ducts from the vehicle, remove the knee blocker panels for access, and pull carpeting back.

(2) Pull the floor ducts from the HVAC housing (Fig. 43).

NOTE: The ductwork running from the HVAC housing rearward through the passenger compartment is molded into the carpeting, and must be replaced as a unit if damaged.

(3) Reverse the removal procedures to install.

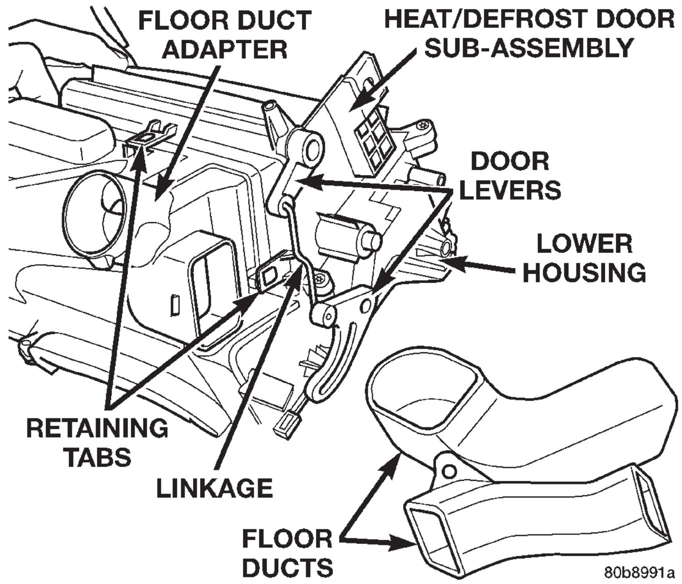


Fig. 42 Floor Ducts (Housing Removed)

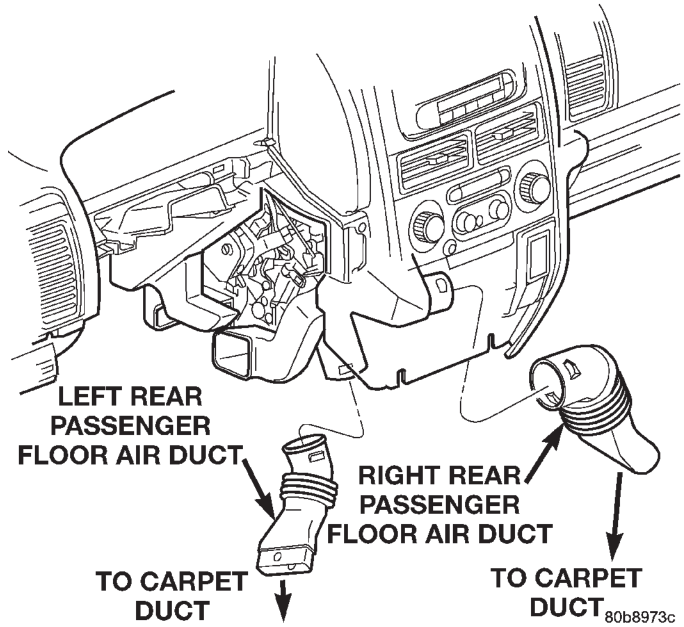


Fig. 43 Rear Floor Ducts

PANEL OUTLETS

The driver side, and passenger side panel outlets are available for service. The center outlets are only serviced as part of the instrument cluster center bezel unit.

(1) Remove the instrument panel top pad from the instrument panel. Refer to Instrument Panel Top Pad

REMOVAL AND INSTALLATION (Continued)

in Group 8E - Instrument Panel Systems for the procedures.

(2) Remove the two screws that secure each outlet to the backside of the instrument panel top pad (Fig. 44).

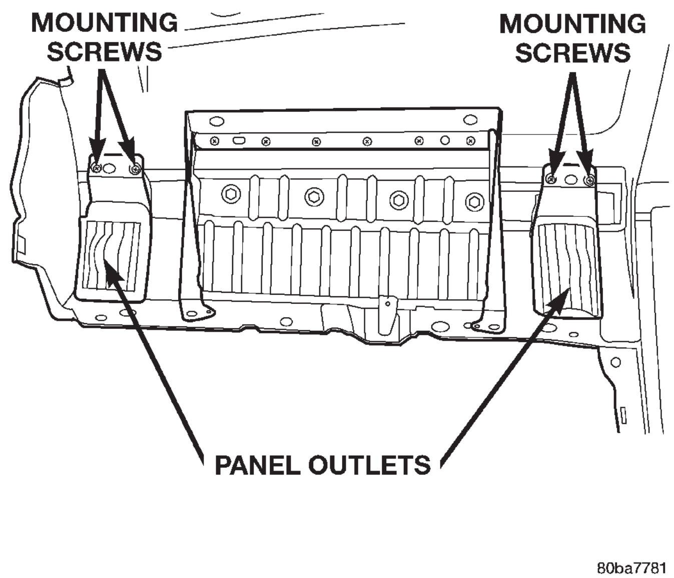


Fig. 44 Panel Outlets (Passenger Side)

(3) Remove the outlet from the top pad.

(4) Reverse the removal procedures to install. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

EVAPORATOR COIL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Remove the heater-A/C housing from the vehicle. See Heater-A/C Housing in this group for the procedures.

(2) Place the heater-A/C housing on the work bench.

(3) Remove the defroster duct from the heater-A/C housing.

(4) Remove the defrost door linkage from the top half the housing to enable separation of the two parts.

(5) Remove the screws and clips fastening the upper and lower heater-A/C housing halves.

(6) Remove the top half of the housing.

(7) Lift the evaporator coil unit out of the lower half of the heater-A/C housing (Fig. 45).

(8) Reverse the removal procedures to install. Be certain that the evaporator foam insulator wrap is reinstalled. Be certain that each of the door pivot pins align with the pivot holes in the heater-A/C housing. Tighten the heater-A/C housing screws to 2.2 N·m (20 in. lbs.).

NOTE: If the evaporator is replaced, add 60 milliliters (2 fluid ounces) of refrigerant oil to the refrigerant system.

HEAT/DEFROST DOOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Remove the heater-A/C housing from the vehicle. See Heater-A/C Housing in this group for the procedures.

(2) Place the heater-A/C housing with the tubing side down on a work bench, making allowance for leakage of fluids.

(3) Using a sharp knife, split the foam seal surrounding the panel outlet opening, at the dividing line of the upper and lower cases (Fig. 17).

(4) Place the heater-A/C housing in the upright position on the work bench.

(5) Remove the mode door actuator on the left side of the housing, controlling the mode door in the top of the case (Fig. 18) (Fig. 19).

(6) Remove the screw with plastic washer holding the lever assembly to the upper case section, and move aside (Fig. 20).

(7) Remove the 5 clips that secure the two housing halves to each other. There are 2 on either side at the center, and 1 located at the forward end of the mode door side of the case (Fig. 21).

(8) Release the wire harness electrical connector(s) from the mounts on the lower case at the blower motor end of the unit (Fig. 22).

(9) Remove the 10 screws that secure the two housing halves to each other.

(10) Separate the top half of the heater-A/C housing from the bottom half (Fig. 23).

(11) Remove the evaporator, and styrofoam tray from the lower case.

REMOVAL AND INSTALLATION (Continued)

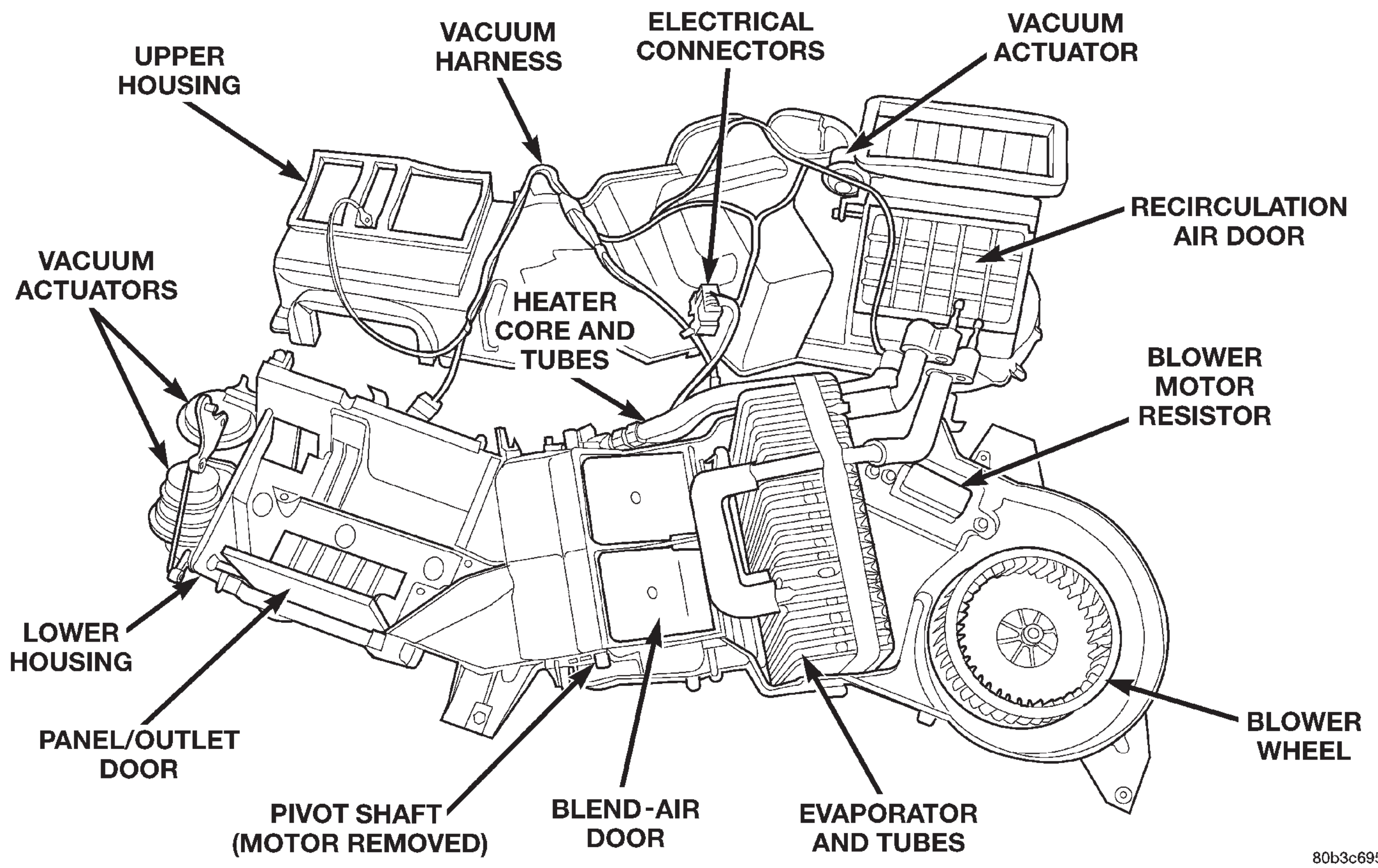


Fig. 45 HVAC Housing and Evaporator

(12) Place the heater-A/C housing upside down on a work bench.

(13) Unscrew and remove the 2 floor heat ducts.

(14) Unsnap and remove the duct adapter from the bottom of the heat/defrost door sub-assembly (Fig. 46).

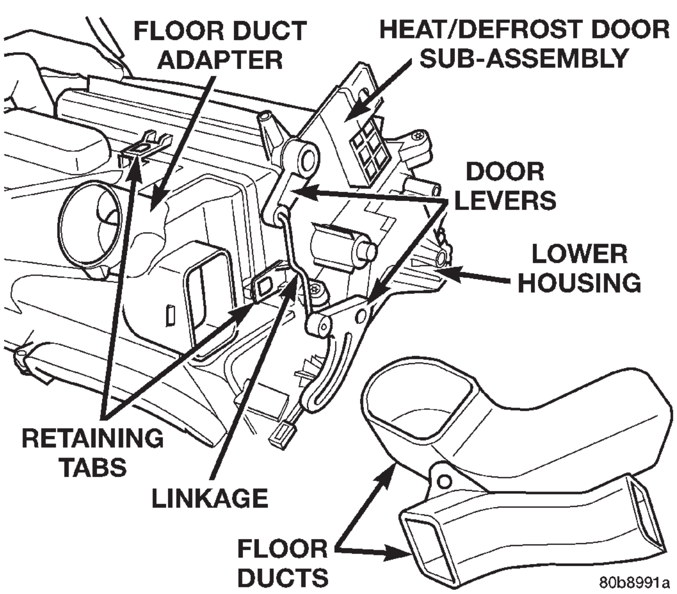


Fig. 46 Heat/Defrost Door Ducts, and Adapter

(15) Gently pry the metal linkage from the heat/defrost door lever.

Remove the heat/defrost door sub-assembly, which is attached to the housing with 4 screws (Fig. 47).

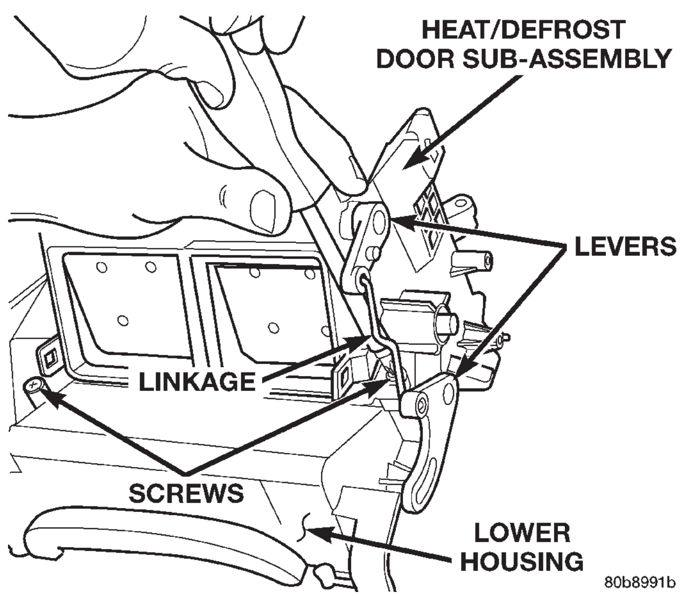


Fig. 47 Heat/Defrost Door Sub-Assembly Removal

(16) Pinch the retention tabs holding the heat/defrost door pivot shaft lever to the case. The 3 plastic

REMOVAL AND INSTALLATION (Continued)

tabs, located on the inside of the case, are part of the shaft retainer.

(17) Remove the heat/defrost door (Fig. 48).

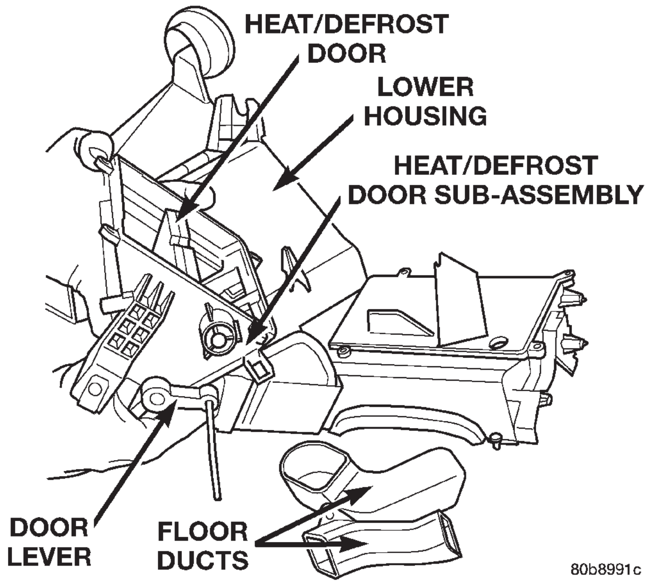


Fig. 48 Heat/Defrost Door Removal

INSTALLATION

(1) Reverse the removal procedures to install.

• Be certain that each of the door pivot pins align with the pivot holes in the heater-A/C housing.

• Tighten the heater-A/C housing screws to 2.2 N·m (20 in. lbs.).

• Check door for binding after replacement, and after assembly of housing.

HEATER-A/C CONTROL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the inboard switch pod bezel from the instrument panel. Refer to Switch Pod Bezel in Group 8E - Instrument Panel Systems for the procedures.

(3) Remove the 4 screws that secure the heater-A/C control to the instrument panel (Fig. 49).

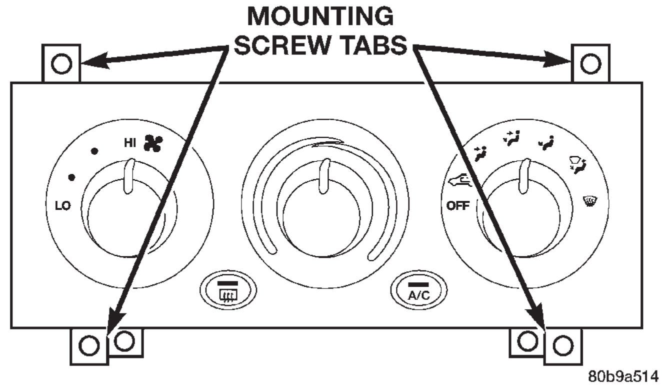


Fig. 49 Heater-A/C Control Remove/Install

(4) Pull the heater-A/C control assembly away from the instrument panel far enough to access the connections on the back of the control.

(5) Unplug the wire and/or vacuum harness connectors from the back of the heater-A/C control (Fig. 50).

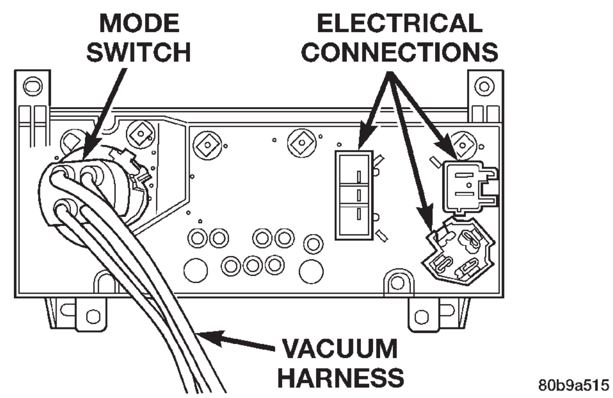


Fig. 50 Heater-A/C Control Connections

(6) Remove the heater-A/C control from the instrument panel.

INSTALLATION

(1) Plug the wire harness and/or vacuum harness connectors into the back of the heater-A/C control.

(2) Position the heater-A/C control in the instrument panel and secure it with 4 screws. Tighten the screws to 2.2 N·m (20 in. lbs.).

(3) Reinstall the inboard switch pod bezel onto the instrument panel. Refer to Switch Pod Bezel in Group 8E - Instrument Panel Systems for the procedures.

(4) Connect the battery negative cable.

HEATER-A/C HOUSING

The heater-A/C housing assembly must be removed from the vehicle and the two halves of the housing separated for service access of the heater core, evaporator coil, blend-air door(s), and each of the various mode control doors.

REMOVAL AND INSTALLATION (Continued)

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument panel from the vehicle. Refer to Instrument Panel Assembly in Group 8E - Instrument Panel Systems for the procedures.

(3) Recover the refrigerant from the refrigerant system. See Refrigerant Recovery in this group for the procedures.

(4) Disconnect the liquid line refrigerant line from the evaporator inlet tube. Install plugs in, or tape over all of the opened refrigerant line fittings.

(5) Disconnect the suction line refrigerant line from the evaporator outlet tube. Install plugs in, or tape over all of the opened refrigerant line fittings.

(6) Disconnect the heater hoses from the heater core tubes. Clamp off the heater hoses to prevent loss of coolant. Refer to Group 7-Cooling System for the procedures. Install plugs in, or tape over the opened heater core tubes.

(7) If the vehicle is equipped with the manual temperature control system, unplug the heater-A/C system vacuum supply line connector from the tee fitting near the heater core tubes.

(8) Remove the coolant reserve/overflow bottle from the passenger side inner fender shield. Refer to Group 7 - Cooling System for the procedures.

(9) Remove the Powertrain Control Module (PCM) from the passenger side dash panel in the engine compartment and set it aside. Do not unplug the PCM wire harness connectors. Refer to Group 14 - Fuel System for the procedures.

(10) Remove the nuts from the heater-A/C housing mounting studs on the engine compartment side of the dash panel (Fig. 51).

(11) Remove the rear floor heat ducts from the floor heat duct outlets (Fig. 52).

(12) Unplug the heater-A/C housing wire harness connectors.

(13) Remove the heater-A/C housing mounting nuts from the studs on the passenger compartment side of the dash panel (Fig. 53).

(14) Remove the heater-A/C housing from the vehicle, ensuring that the interior is covered in case of loss of fluids.

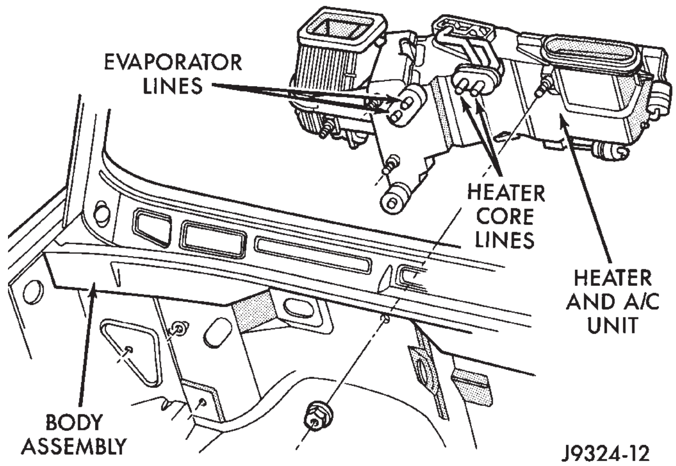


Fig. 51 Heater-A/C Housing Remove/Install

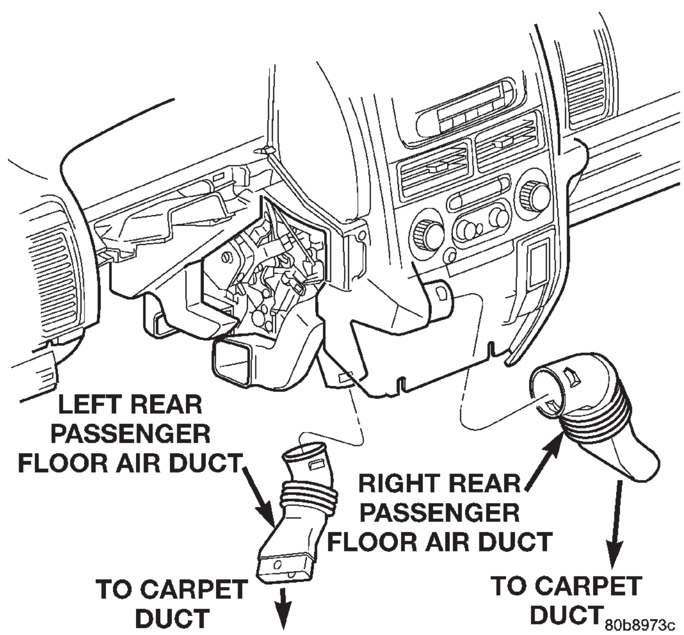


Fig. 52 Rear Floor Heat Ducts

INSTALLATION

(1) Position the heater-A/C housing to the dash panel. Be certain that the evaporator condensate drain tube and the housing mounting studs are inserted into their correct mounting holes.

(2) Install the heater-A/C housing mounting nuts to the studs on the passenger compartment side of the dash panel. Tighten the nuts to 4.5 N·m (40 in. lbs.).

(3) Connect the heater-A/C housing wire harness connectors.

(4) Reinstall the rear floor heat ducts to the center floor heat duct outlets.

(5) Install and tighten the nuts onto the heater-A/C housing mounting studs on the engine compart-

REMOVAL AND INSTALLATION (Continued)

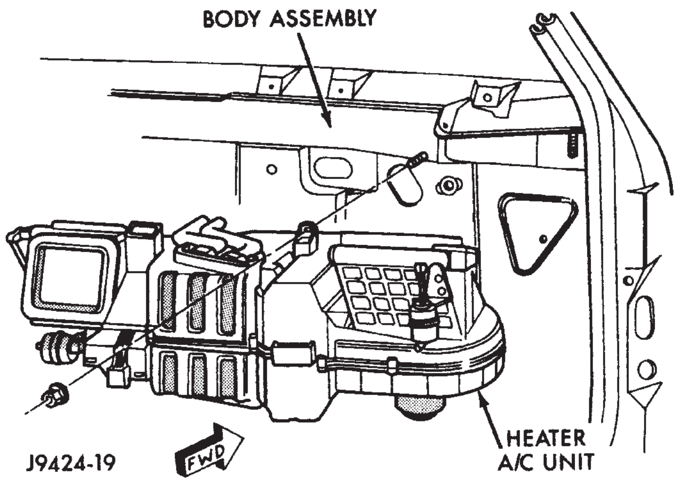


Fig. 53 Heater A/C Housing Remove/Install

ment side of the dash panel. Tighten the nuts to 7 N·m (60 in. lbs.).

(6) Reinstall the PCM to the passenger side dash panel in the engine compartment. Refer to Group 14 - Fuel System for the procedures.

(7) Reinstall the coolant reserve/overflow bottle to the passenger side inner fender shield. Refer to Group 7 - Cooling System for the procedures.

(8) If the vehicle is equipped with the manual temperature control system, connect the heater-A/C system vacuum supply line connector to the tee fitting near the heater core tubes.

(9) Unclamp/unplug the heater core hoses and tubes. Connect the heater hoses to the heater core tubes and fill the engine cooling system. Refer to Group 7-Cooling System for the procedures.

(10) Unplug or remove the tape from the suction line and the evaporator outlet tube fittings. Connect the suction line coupler to the evaporator outlet tube. See Refrigerant Line Coupler in this group for the procedures.

(11) Unplug or remove the tape from the liquid line and the evaporator inlet tube fittings. Connect the liquid line coupler to the evaporator inlet tube. See Refrigerant Line Coupler in this group for the procedures.

(12) Evacuate the refrigerant system. See Refrigerant System Evacuate in this group for the procedures.

(13) Charge the refrigerant system. See Refrigerant System Charge in this group for the procedures.

(14) Install the instrument panel in the vehicle. Refer to Group 8E - Instrument Panel Systems for the procedures.

(15) Connect the battery negative cable.

(16) Start the engine and check for proper operation of the heating and air conditioning systems.

HEATER CORE AND TUBES

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Remove the heater-A/C housing from the vehicle. See Heater-A/C Housing in this group for the procedures.

(2) Remove the foam gasket surrounding the core tubes.

NOTE: Notice the orientation of the irregularly shaped gasket on the tubes. The gasket must be placed correctly to ensure proper sealing against the body during reinstallation.

(3) Remove the screws and retainers that secure the heater core and tubes to the heater-A/C housing (Fig. 54).

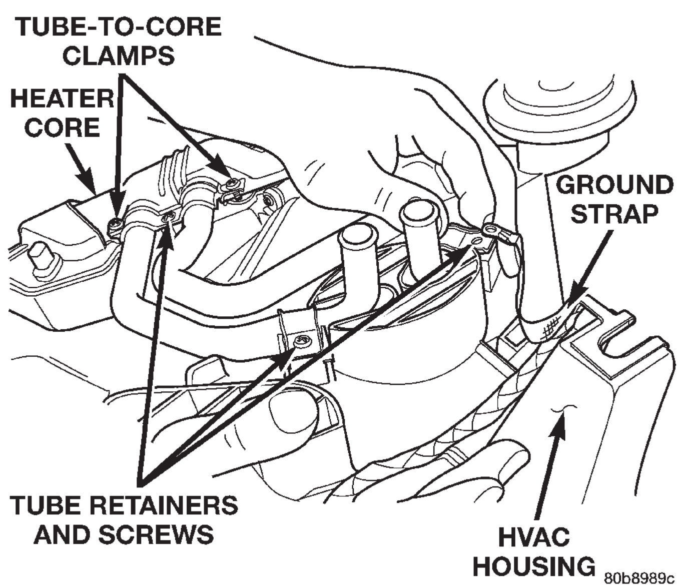


Fig. 54 Heater Core, Tubes, Retainers

(4) Remove the mode door actuator if necessary, for clearance to remove the core.

(5) Lift the heater core straight up and out of the heater-A/C housing (Fig. 55).

(6) When replacing individual tubes, loosen and remove the round tube-to-core clamp, and pull tube from core.

REMOVAL AND INSTALLATION (Continued)

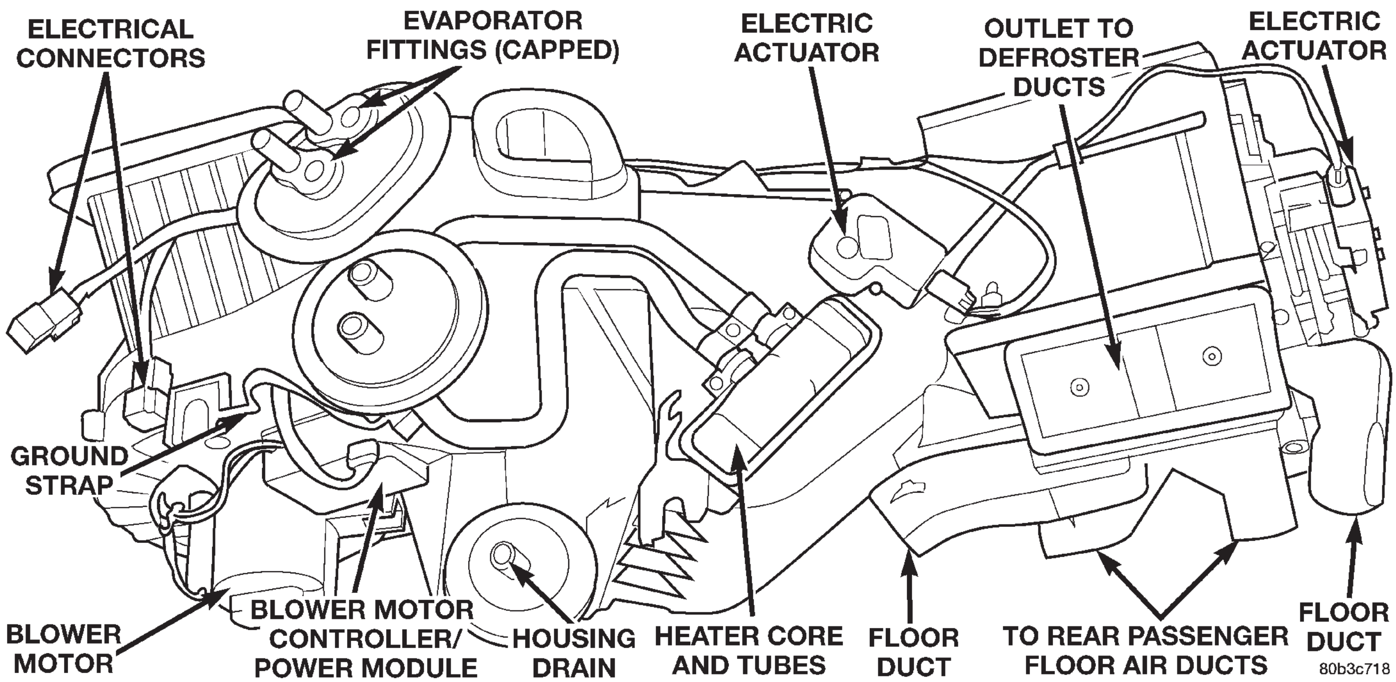


Fig. 55 Heater Core and Tubes

INSTALLATION

(1) When installing individual tubes, insert tube into core ensuring that tube O-ring is seated in core and not pinched. Hold tube in seated position while installing the round tube-to-core clamp (Fig. 56).

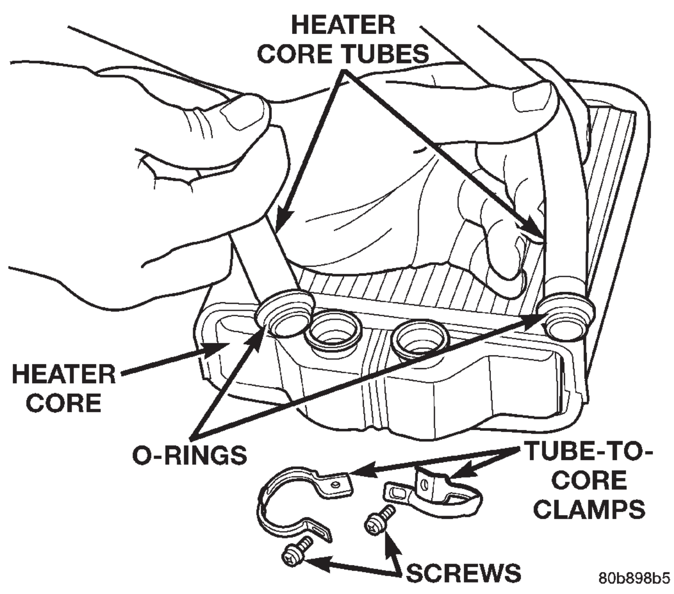


Fig. 56 Heater Core, Tubes, O-rings

NOTE: The round tube-to-heater-core clamp should be left loose enough to turn the tube in the core. Position the core in the housing, and then tighten the tube-to-heater-core clamp after orienting the tubes to the molded heater-A/C housing.

(2) Lower the heater core into the heater-A/C housing.

(3) Install the mode door actuator, if removed from housing for core removal.

(4) Position the retainers over the heater core tubes. Install and tighten the screws that secure the heater core and retainers to the heater-A/C housing. Tighten the screws to 2.2 N·m (20 in. lbs.).

NOTE: The grounding strap is to be attached to the lower heater core tube retainer.

(5) Reinstall the heater-A/C housing to the vehicle. See Heater-A/C Housing in this group for the procedures.

HIGH PRESSURE RELIEF VALVE

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS GROUP BEFORE PERFORMING THE FOLLOWING OPERATION.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Recover the refrigerant from the refrigerant system. See Refrigerant Recovery in this group for the procedures.

(3) Turn the relief valve counterclockwise to remove it from the compressor manifold (Fig. 57). Install a plug in, or tape over the opened relief valve fitting on the compressor manifold.

REMOVAL AND INSTALLATION (Continued)

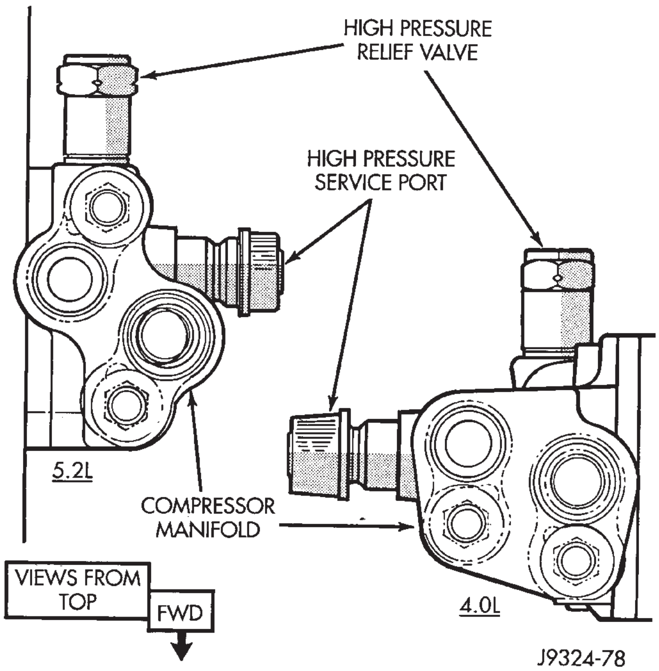


Fig. 57 High Pressure Relief Valve - Typical

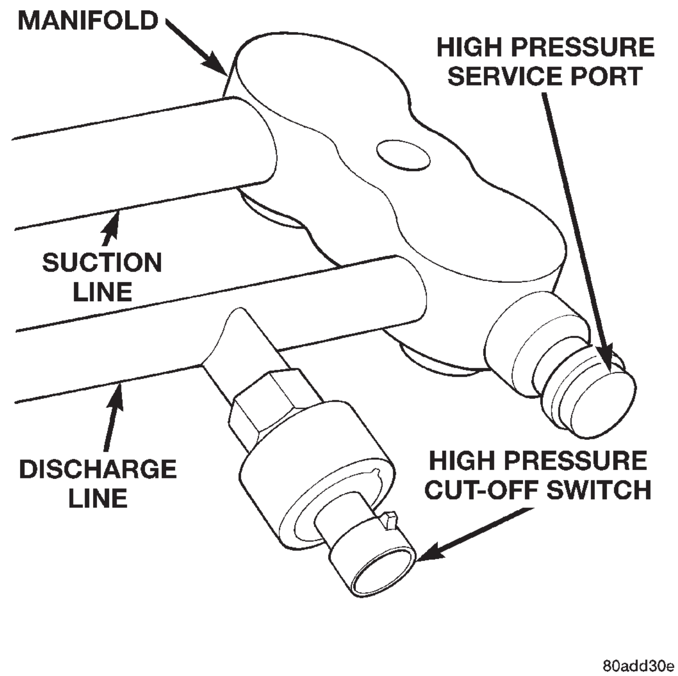


Fig. 58 High Pressure Switch - Typical

INSTALLATION

(1) Remove the tape or plug from the relief valve fitting on the compressor manifold.

(2) Install the high pressure relief valve in the compressor manifold fitting.

(3) Connect the battery negative cable.

(4) Evacuate the refrigerant system. See Refrigerant System Evacuate in this group for the procedures.

(5) Charge the refrigerant system. See Refrigerant System Charge in this group for the procedures.

HIGH PRESSURE SWITCH

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Unplug the wire harness connector from the high pressure switch, which is mounted to a fitting on the discharge line between the compressor, near the condenser inlet (Fig. 58).

(3) Unscrew the high pressure switch from the discharge line fitting.

(4) Remove the high pressure switch from the vehicle.

(5) Remove the O-ring seal from the discharge line fitting and discard.

INSTALLATION

(1) Lubricate a new O-ring seal with clean refrigerant oil and install it on the discharge line fitting. Use only the specified O-rings as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the compressor in the vehicle.

(2) Install and tighten the high pressure switch on the discharge line fitting.

(3) Plug the wire harness connector into the high pressure switch.

(4) Connect the battery negative cable.

LIQUID LINE

Any kinks or sharp bends in the refrigerant plumbing will reduce the capacity of the entire air conditioning system. Kinks and sharp bends reduce the flow of refrigerant in the system. High pressures are produced in the refrigerant system when the air conditioning compressor is operating. Extreme care must be exercised to make sure that each of the refrigerant system connections is pressure-tight and leak free.

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS GROUP BEFORE PERFORMING THE FOLLOWING OPERATION.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Recover the refrigerant from the refrigerant system. See Refrigerant Recovery in this group for the procedures.

(3) Unsnap the plastic retainer clips that secure the liquid line to the inner fender shield and the dash panel in the engine compartment.

REMOVAL AND INSTALLATION (Continued)

(4) Disengage the liquid line from the plastic retainer clips.

(5) Disconnect the liquid line refrigerant line fitting from the evaporator inlet tube. Install plugs in, or tape over all of the opened refrigerant line fittings.

(6) Disconnect the liquid line from the condenser outlet tube refrigerant line fitting. Install plugs in, or tape over all of the opened refrigerant line fittings.

(7) Remove the liquid line from the plastic clip that secures it to the right inner fender shield.

(8) Remove the liquid line from the vehicle.

INSTALLATION

(1) Remove the tape or plugs from the refrigerant line fittings on the condenser outlet tube and the condenser end of the liquid line.

(2) Remove the tape or plugs from the refrigerant line fittings on the evaporator end of the liquid line and from the evaporator inlet tube.

(3) Install the liquid line into the plastic retainer clips that secure it to the inner fender shield and the dash panel and snap the retainer clips closed.

(4) Connect the battery negative cable.

(5) Evacuate the refrigerant system. See Refrigerant System Evacuate in this group for the procedures.

(6) Charge the refrigerant system. See Refrigerant System Charge in this group for the procedures.

LOW PRESSURE CYCLING CLUTCH SWITCH

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Unplug the wire harness connector from the low pressure cycling clutch switch on the top of the accumulator.

(3) Unscrew the low pressure cycling clutch switch from the fitting on the top of the accumulator (Fig. 59).

(4) Remove the O-ring seal from the accumulator fitting and discard.

INSTALLATION

(1) Lubricate a new O-ring seal with clean refrigerant oil and install it on the accumulator fitting. Use only the specified O-rings as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the compressor in the vehicle.

(2) Install and tighten the low pressure cycling clutch switch on the accumulator fitting. The switch should be hand-tightened onto the accumulator fitting.

(3) Plug the wire harness connector into the low pressure cycling clutch switch.

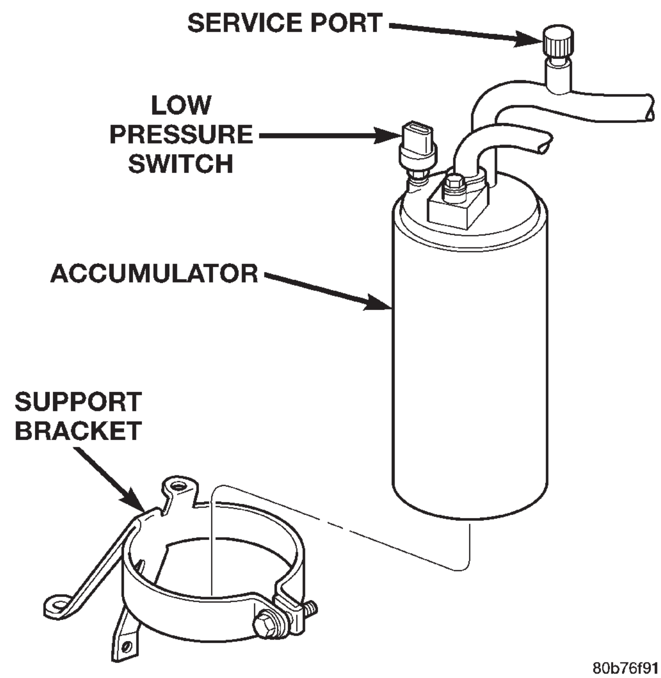


Fig. 59 Accumulator and Support Bracket

(4) Connect the battery negative cable.

MODE DOOR ACTUATORS

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

The mode door actuators for vehicles equipped with the standard equipment manual temperature control system are vacuum controlled. The optional Automatic Zone Control (AZC) system uses electric motors to actuate all mode doors. The temperature/blend-air door for all models is actuated by an electric motor, while the AZC system uses 2 separate motors to allow the driver and passenger to select individual comfort levels. The service procedures for both types of actuators are covered by the following procedures.

HEAT/DEFROST - PANEL/DEFROST DOOR MOTOR

This motor is used only on models equipped with the optional Automatic Zone Control (AZC) system.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the two bolts that secure the center instrument panel support bracket to the left side of the floor panel transmission tunnel.

REMOVAL AND INSTALLATION (Continued)

(3) Remove the two bolts that secure the center instrument panel support bracket to the instrument panel.

(4) Remove the center instrument panel support bracket from the vehicle.

(5) Unplug the wire harness connector from the heat/defrost - panel/defrost door motor (Fig. 60).

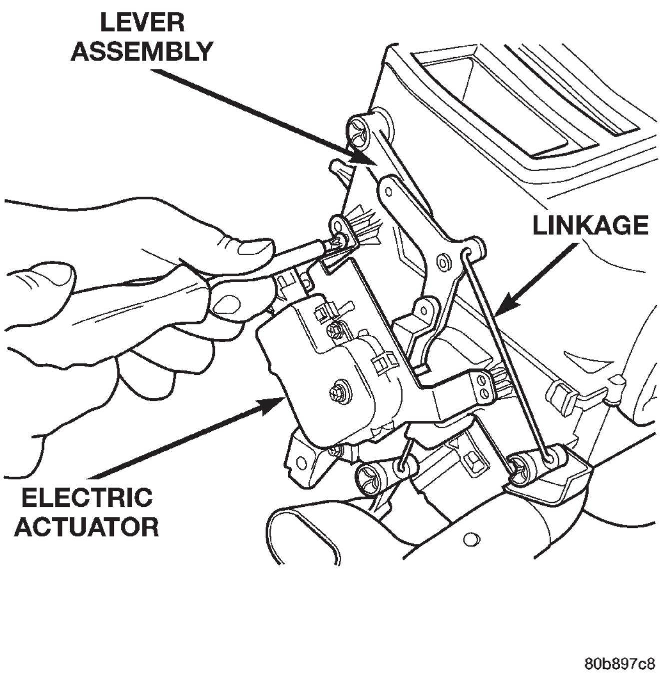


Fig. 60 Heat/Defrost - Panel/Defrost Door Motor

(6) Remove the three screws that secure the heat/defrost-panel/defrost door motor to the heater-A/C housing.

(7) Remove the heat/defrost-panel/defrost door motor from the heater-A/C housing.

(8) Reverse the removal procedures to install. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

HEAT/DEFROST DOOR VACUUM ACTUATOR

This actuator is used only on models equipped with the standard manual temperature control system.

(1) Remove the heater-A/C housing from the vehicle. See Heater-A/C Housing in this group for the procedures.

(2) Unplug the vacuum harness connector from the heat/defrost door vacuum actuator (Fig. 61).

(3) Disengage the heat/defrost door pivot connection from the heat/defrost door pivot pin.

(4) Remove the screws that secure the heat/defrost door vacuum actuator to the heater-A/C housing.

(5) Remove the heat/defrost door vacuum actuator from the heater-A/C housing.

(6) Reverse the removal procedures to install. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

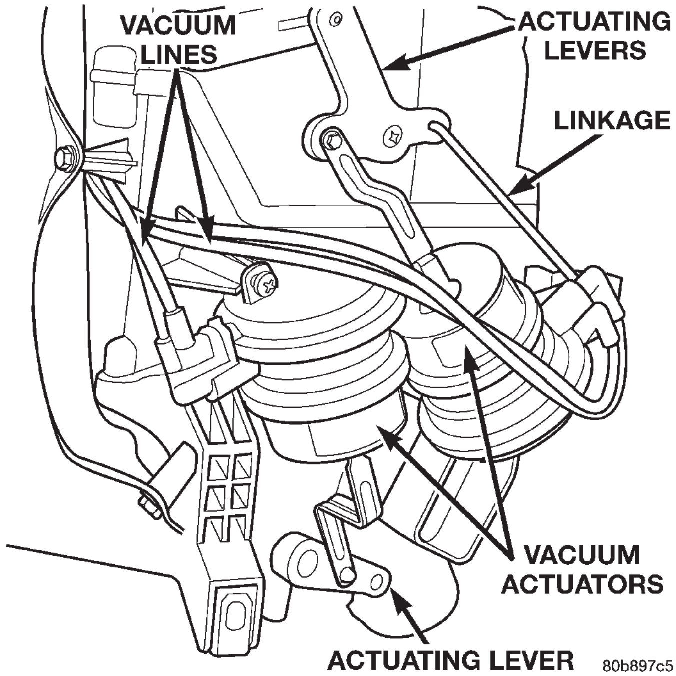


Fig. 61 Heat/Defrost Door Vacuum Actuator

PANEL/DEFROST DOOR VACUUM ACTUATOR

This actuator is used only on models equipped with the standard manual temperature control system.

(1) Remove the heater-A/C housing from the vehicle. See Heater-A/C Housing in this group for the procedures.

(2) Unplug the vacuum harness connector from the heat/defrost door vacuum actuator (Fig. 62).

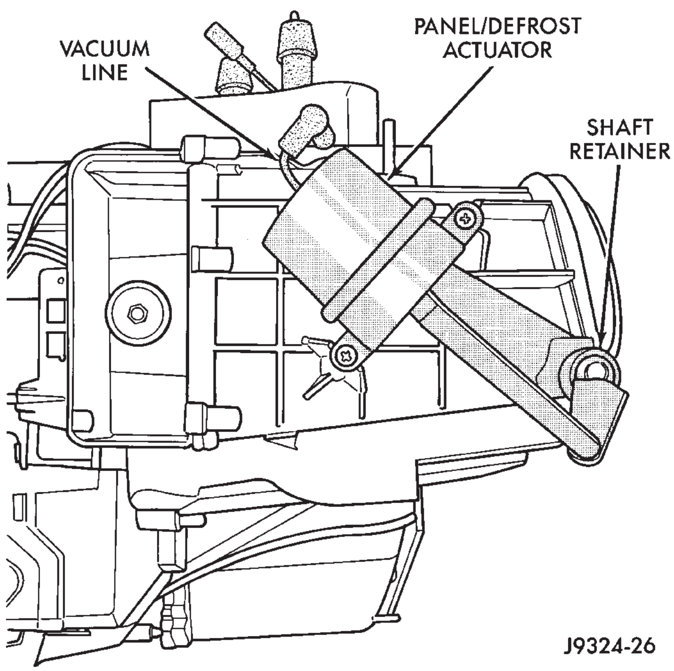


Fig. 62 Panel/Defrost Door Vacuum Actuator

REMOVAL AND INSTALLATION (Continued)

(3) Disengage the panel/defrost door pivot connection from the panel/defrost door pivot pin.

(4) Remove the screws that secure the panel/defrost door vacuum actuator to the heater-A/C housing.

(5) Remove the panel/defrost door vacuum actuator from the heater-A/C housing.

(6) Reverse the removal procedures to install. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

RECIRCULATION AIR DOOR MOTOR

This motor is used only on models equipped with the optional Automatic Zone Control (AZC) system.

(1) Remove the instrument panel from the vehicle. Refer to Instrument Panel Assembly in Group 8E - Instrument Panel Systems for the procedures.

(2) Unplug the wire harness connector from the recirculation air door motor.

(3) Remove the 2 screws securing the recirculation air door housing to the HVAC unit (Fig. 63). Tilt the front of the housing up while reaching around the back releasing 2 tangs holding the rear of the housing down.

(4) Remove the recirculation air door housing from the HVAC unit.

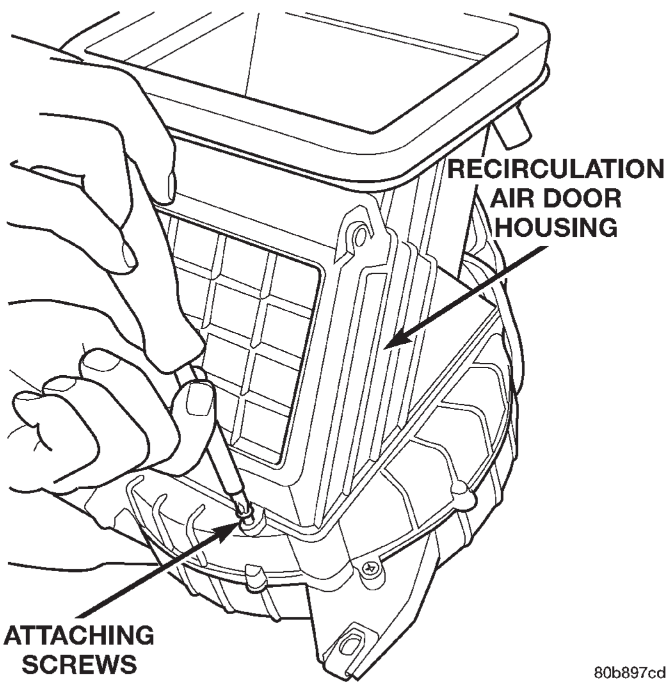


Fig. 63 Recirculation Air Door Housing

(5) Remove the screws that secure the recirculation air door motor to the heater-A/C housing.

(6) Remove the recirculation air door motor from the heater-A/C housing.

(7) Reverse the removal procedures to install. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

RECIRCULATION AIR DOOR VACUUM ACTUATOR

This actuator is used only on models equipped with the standard manual temperature control system.

(1) Remove the instrument panel from the vehicle. Refer to Instrument Panel Assembly in Group 8E - Instrument Panel Systems for the procedures.

(2) Unplug the vacuum harness connector from the recirculation air door vacuum actuator.

(3) Disengage the recirculation air door pivot connection from the door pivot pin.

(4) Disengage the recirculation air door actuating rod from the recirculation air door lever.

(5) Remove the screws that secure the recirculation air door vacuum actuator to the heater-A/C housing.

(6) Remove the recirculation air door vacuum actuator from the heater-A/C housing.

(7) Reverse the removal procedures to install. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

BLEND-AIR DOOR MOTOR(S)

The blend-air door motor is used on all models, whether equipped with manual or Automatic Zone Control (AZC). This motor is located on the front of the heater-A/C housing to the right of the floor panel transmission tunnel, and can be removed from the passenger compartment without instrument panel or heater-A/C housing removal.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the glove box door.

Remove the lower I/P glove box door surround panel.

(3) Unplug the wire harness connector from the temperature/blend-air door motor (Fig. 64).

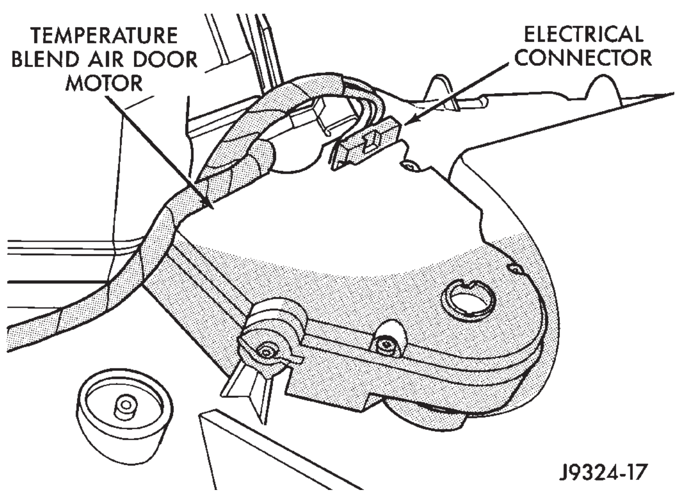


Fig. 64 Blend-Air Door Motor-Typical

(4) Remove the 2 screws that secure the blend-air door motor to the heater-A/C housing.

REMOVAL AND INSTALLATION (Continued)

(5) Remove the blend-air door motor from the heater-A/C housing.

(6) Reverse the removal procedures to install. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

PANEL/DEFROST DOOR AND LEVER

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Remove the heater-A/C housing from the vehicle. See Heater-A/C Housing in this group for the procedures.

(2) Place the heater-A/C housing with the tubing side down on a work bench, making allowance for leakage of fluids.

(3) Using a sharp knife, split the foam seal surrounding the panel outlet opening, at the dividing line of the upper and lower cases (Fig. 17).

(4) Place the heater-A/C housing in the upright position on the work bench.

(5) Remove the mode door actuator on the left side of the housing, controlling the mode door in the top of the case (Fig. 18) (Fig. 19).

(6) Remove the screw with plastic washer holding the lever assembly to the upper case section, and move aside (Fig. 20).

(7) Remove the 5 clips that secure the two housing halves to each other. There are 2 on either side at the center, and 1 located at the forward end of the mode door side of the case (Fig. 21).

(8) Release the wire harness electrical connector(s) from the mounts on the lower case at the blower motor end of the unit (Fig. 22).

(9) Remove the 10 screws that secure the two housing halves to each other.

(10) Separate the top half of the heater-A/C housing from the bottom half (Fig. 23).

(11) Pinch the retention tabs holding the panel/defrost door pivot shaft to the case. The 3 plastic tabs, located on the inside of the case, are part of the shaft retainer (Fig. 65).

(12) Using a trim stick or another suitable wide flat-bladed tool, gently pry the panel/defrost door pivot shaft retainer from the pivot shaft.

(13) Remove the panel/defrost door from the heater-A/C housing.

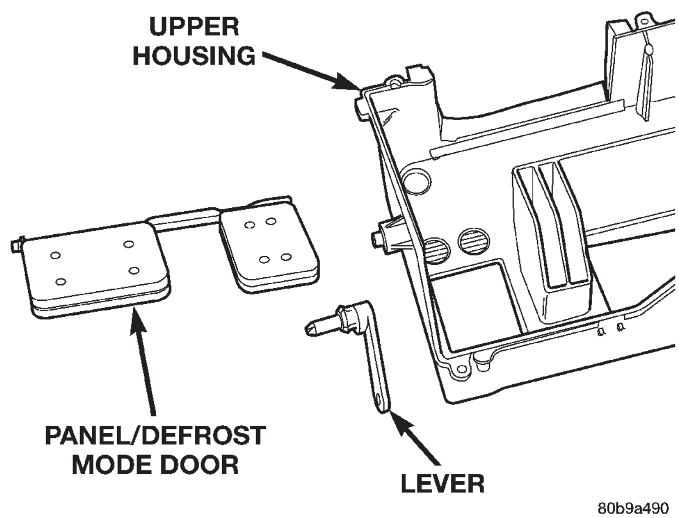


Fig. 65 Panel/Defrost Door

INSTALLATION

Reverse the removal procedures to install.

- Be certain that each of the door pivot pins align with the pivot holes in the heater-A/C housing.
- Tighten the heater-A/C housing screws to 2.2 N·m (20 in. lbs.).
- Check door for binding after replacement, and after assembly of housing.

PANEL OUTLET DOOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Remove the heater-A/C housing from the vehicle. See Heater-A/C Housing in this group for the procedures.

(2) Place the heater-A/C housing with the tubing side down on a work bench, making allowance for leakage of fluids.

(3) Using a sharp knife, split the foam seal surrounding the panel outlet opening, at the dividing line of the upper and lower cases (Fig. 17).

(4) Place the heater-A/C housing in the upright position on the work bench.

REMOVAL AND INSTALLATION (Continued)

(5) Remove the mode door actuator on the left side of the housing, controlling the mode door in the top of the case (Fig. 18) (Fig. 19).

(6) Remove the screw with plastic washer holding the lever assembly to the upper case section, and move aside (Fig. 20).

(7) Remove the 5 clips that secure the two housing halves to each other. There are 2 on either side at the center, and 1 located at the forward end of the mode door side of the case (Fig. 21).

(8) Release the wire harness electrical connector(s) from the mounts on the lower case at the blower motor end of the unit (Fig. 22).

(9) Remove the 10 screws that secure the two housing halves to each other.

(10) Separate the top half of the heater-A/C housing from the bottom half (Fig. 23).

(11) Pinch the retention tabs holding the panel outlet door pivot shaft to the case. The 3 plastic tabs, located on the inside of the case, are part of the shaft retainer (Fig. 66).

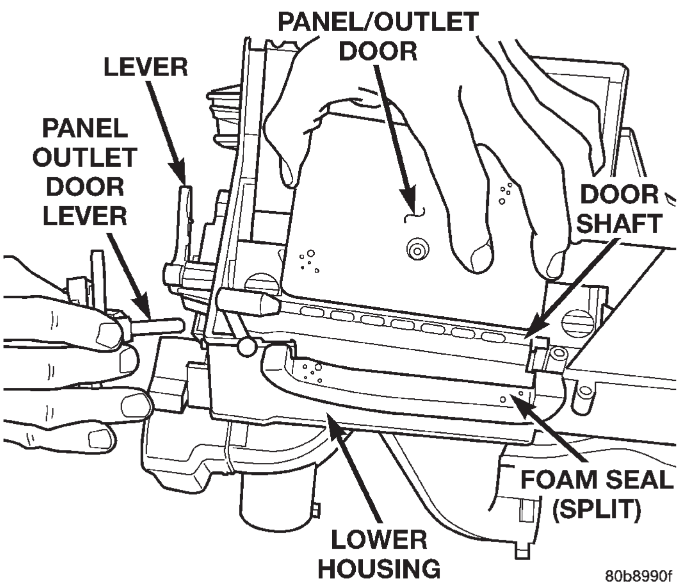


Fig. 66 Panel Outlet Door

(12) Using a trim stick or another suitable wide flat-bladed tool, gently pry the panel outlet door pivot shaft retainer from the pivot shaft.

(13) Remove the panel outlet door from the heater-A/C housing.

INSTALLATION

Reverse the removal procedures to install.

• Be certain that each of the door pivot pins align with the pivot holes in the heater-A/C housing.

• Tighten the heater-A/C housing screws to 2.2 N·m (20 in. lbs.).

• Check door for binding after replacement, and after assembly of housing.

RECIRCULATION AIR DOOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Remove the heater-A/C housing from the vehicle. See Heater-A/C Housing in this group for the procedures.

(2) Place the heater-A/C housing right side up on the work bench.

(3) Unplug the wire/vacuum connector from the recirculation air door actuator.

(4) Remove the 2 screws fastening the recirculation air door sub-assembly to the main housing (Fig. 67).

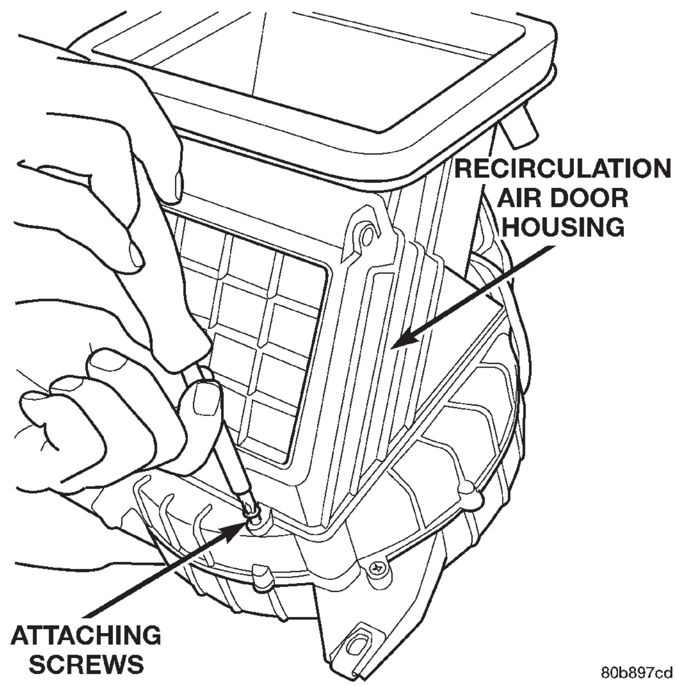


Fig. 67 Recirculation Air Door Housing

(5) Raise the front of the door sub-assembly while releasing the 2 tabs holding the rear to the main housing, and remove the recirculation air door housing.

(6) Remove the electric/vacuum actuator from the recirculation air door sub-assembly and set aside.

(7) Pinch the retention tabs holding the recirculation air door pivot shaft to the case. The 3 plastic

REMOVAL AND INSTALLATION (Continued)

tabs, located on the inside of the case, are part of the shaft retainer.

(8) Remove the recirculation air door from the recirculation air door housing.

INSTALLATION

Reverse the removal procedures to install.

- Be certain that each of the door pivot pins align with the pivot holes in the heater-A/C housing.
- Tighten the heater-A/C housing screws to 2.2 N·m (20 in. lbs.).
- Check door for binding after replacement, and after assembly of housing.

VACUUM CHECK VALVE

(1) Unplug the heater-A/C vacuum supply line connector at the vacuum check valve near the engine intake manifold vacuum adapter fitting.

(2) Note the orientation of the check valve in the vacuum supply line for correct installation.

(3) Unplug the vacuum check valve from the vacuum supply line fittings.

(4) Reverse the removal procedures to install.

VACUUM RESERVOIR

The vacuum reservoir is mounted in the right front of the vehicle behind the headlamp mounting module. The headlamp mounting module and headlamp assembly must be removed from the vehicle to access the vacuum reservoir for service. Refer to Group 8L - Lamps for more information on component removal (Fig. 68).

(1) Remove the two screws that secure the vacuum reservoir to the base of the radiator closure panel.

(2) Remove the vacuum reservoir.

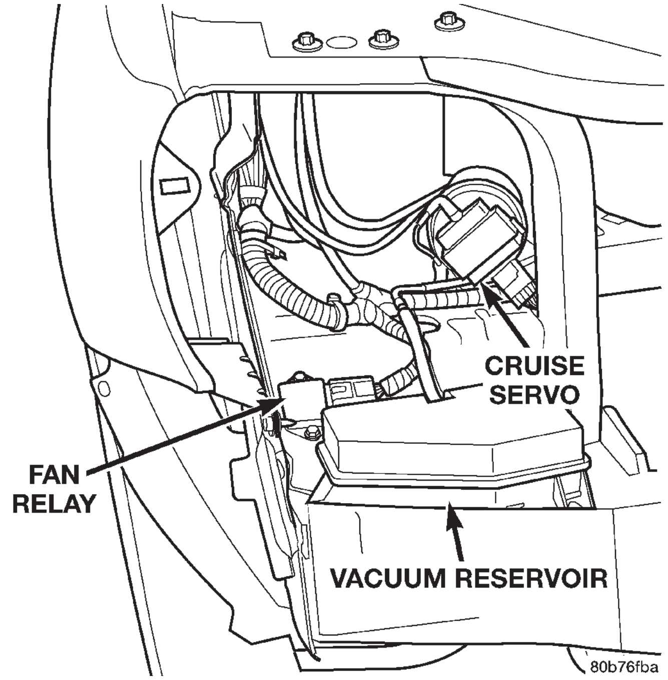


Fig. 68 Vacuum Reservoir

(3) Reverse the removal procedures to install. Tighten the mounting screws to 3.4 N·m (30 in. lbs.).

VARIABLE ORIFICE VALVE

The Variable Orifice Valve (VOV) is located in the liquid line near the condenser. If the orifice valve is faulty or plugged, the liquid line unit must be replaced. See Liquid Line in this group for the service procedures.

HEATING AND AIR CONDITIONING

CONTENTS

DESCRIPTION AND OPERATION

A/C APPLICATION TABLE

Item	Description	Notes
VEHICLE	WJ Grand Cherokee	
SYSTEM	R134a w/variable orifice tube	
COMPRESSOR	Nippondenso 10PA17	ND-8 PAG oil
Freeze–up Control	Low Pressure Cycling Cutout Switch	accumulator mounted
Low psi Control	opens < 25 psi - resets > 34-38 psi	
High psi Control	opens > 450-490 psi - resets < 270-330 psi	line mounted
CONTROL HEAD	manual type	manual controls
	Automatic Zone Control (AZC)	Automatic Zone Control (AZC) with dual infrared sensing
Mode Doors	vacuum actuators	(electric actuator AZC)
Blend Air Door	electric actuator	(manual and AZC)
Blend Air Door (passenger)	electric actuator	(AZC only)
Fresh/Recirc door	vacuum	(electric actuator AZC)
Blower Motor	hardwired to control head	resistor block manual, power module (AZC)
COOLING FAN	Hybrid - viscous clutch/electric	PCM output
CLUTCH		
Control	relay	PCM
Draw	2.0-3.9 amps @ 12 V	± 0.5V@ 70° F
Gap	0.016″-0.031″	
DRB III®		
Reads	TPS, RPM, A/C switch	
Actuators	clutch relay	

ACCUMULATOR

The accumulator is mounted in the engine compartment between the evaporator coil outlet tube and the compressor inlet. Refrigerant enters the accumulator canister as a low pressure vapor through the inlet tube.

Any liquid, oil-laden refrigerant falls to the bottom of the canister, which acts as a separator. A desiccant bag is mounted inside the accumulator canister to absorb any moisture which may have entered and become trapped within the refrigerant system (Fig. 1).

BLOWER MOTOR

The blower motor and blower wheel are located in the passenger side end of the heater-A/C housing, below the glove box module. The blower motor controls the velocity of the air flowing through the heater-A/C housing by spinning a squirrel cage-type blower wheel within the housing at the selected speed. The blower motor and blower wheel can be serviced from the passenger compartment side of the housing.

The blower motor will only operate when the ignition switch is in the On position, and the heater-A/C mode control switch is in any position, except Off. The blower motor circuit is protected by a fuse in the junction block. On models with the standard manual temperature control system, the blower motor speed is controlled by regulating the battery feed through the blower motor switch and the blower motor resistor. On models with the optional Automatic Zone Control (AZC) system, the blower motor speed is controlled by using Pulse Width Modulation (PWM). The power module adjusts the battery feed voltage to the blower motor, based upon an input from the blower motor switch, through the AZC control module. Pulse width modulation of blower power allows the blower to operate at any speed from stationary, to full speed.

The blower motor and blower motor wheel cannot be repaired, and if faulty or damaged, they must be replaced. The blower motor and blower wheel are each serviced separately.

BLOWER MOTOR CONTROLLER

Models equipped with the optional Automatic Zone Control (AZC) system have a blower motor controller (power module). The controller allows the selection of almost infinitely variable blower motor speeds. The controller is mounted to the heater-A/C housing, under the instrument panel and just inboard of the blower motor, in the same location used for the blower motor resistor on manual temperature control systems. It can be accessed without removing any other components.

DESCRIPTION AND OPERATION (Continued)

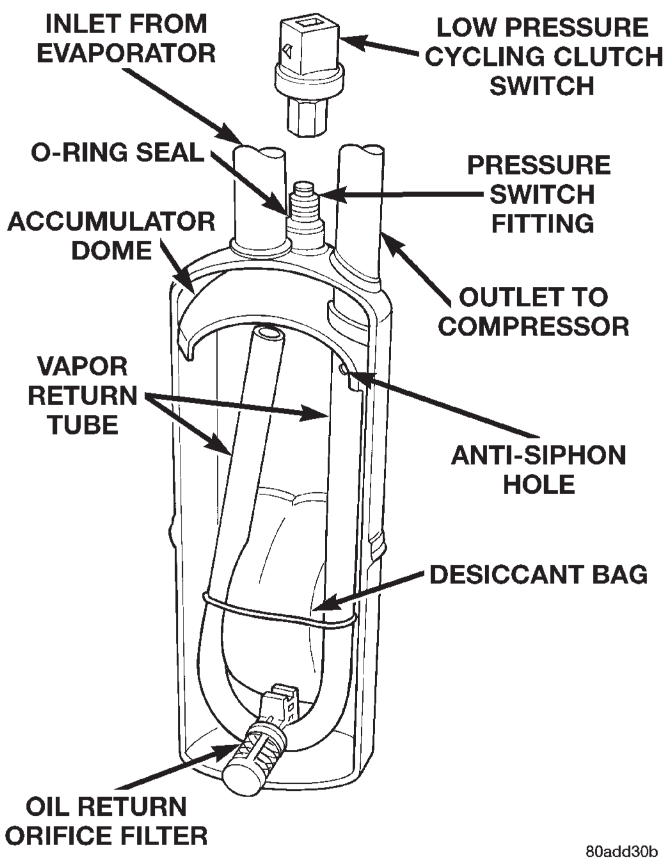


Fig. 1 Accumulator - Typical

The blower motor controller output to the blower motor can be adjusted by the blower motor speed switch knob on the AZC heater-A/C control panel, or it can be adjusted automatically by the logic circuitry and programming of the AZC control module. In either case, the AZC control module sends the correct pulse width modulated signal to the power module to obtain the selected or programmed blower motor speed.

The blower motor controller cannot be repaired and, if faulty or damaged, it must be replaced.

BLOWER MOTOR RESISTOR

Models with the standard manual temperature control system have a blower motor resistor. The blower motor resistor is mounted to the bottom of the heater-A/C housing, under the instrument panel and just inboard of the blower motor. It can be accessed for service without removing any other components.

The resistor has multiple resistor wires, each of which will reduce the current flow to the blower motor to change the blower motor speed by changing the resistance in the blower motor ground path. The blower motor switch directs the ground path through the correct resistor wire to obtain the selected speed.

With the blower motor switch in the lowest speed position, the ground path for the motor is applied through all of the resistor wires. Each higher speed selected with the blower motor switch applies the blower motor ground path through fewer of the resistor wires, increasing the blower motor speed. When the blower motor switch is in the highest speed position, the blower motor resistor is bypassed and the blower motor receives a direct path to ground.

The blower motor resistor cannot be repaired and, if faulty or damaged, it must be replaced.

BLOWER MOTOR SWITCH

The heater-A/C blower motor is controlled by a rotary-type blower motor switch, mounted in the heater-A/C control panel. On vehicles with manual temperature control systems, the switch allows the selection of four blower motor speeds, but will only operate with the ignition switch in the On position and the heater-A/C mode control switch in any position, except Off. On vehicles with the Automatic Zone Control (AZC) systems, the switch allows the selection of Lo Auto, Hi Auto, and an infinite number of manual speed settings between Lo and Hi.

On manual temperature control systems, the blower motor switch is connected in series with the blower motor ground path through the heater-A/C mode control switch. The blower motor switch directs this ground path to the blower motor through the blower motor resistor wires, or directly to the blower motor, as required to achieve the selected blower motor speed.

On AZC systems, the blower motor switch is just one of many inputs to the AZC control module. In the manual blower modes, the AZC control module adjusts the blower motor speed through the blower motor power module as required to achieve the selected blower switch position. In the auto blower modes, the AZC controller is programmed to select and adjust the blower motor speed through the blower motor power module as required to achieve and maintain the selected comfort level.

The blower motor switch cannot be repaired and, if faulty or damaged, it must be replaced. The switch is serviced only as a part of the heater-A/C control assembly.

COMPRESSOR

The air conditioning system uses a Nippondenso 10PA17 ten cylinder, double-acting swash plate-type compressor on all models. This compressor has a fixed displacement of 170 cubic centimeters (10.374 cubic inches), and has both the suction and discharge ports located on the cylinder head. A label identifying the use of R-134a refrigerant is located on the compressor.

The compressor is driven by the engine through an electric clutch, drive pulley and belt arrangement.

DESCRIPTION AND OPERATION (Continued)

The compressor is lubricated by refrigerant oil that is circulated throughout the refrigerant system with the refrigerant.

The compressor draws in low-pressure refrigerant vapor from the evaporator through its suction port. It then compresses the refrigerant into a high-pressure, high-temperature refrigerant vapor, which is then pumped to the condenser through the compressor discharge port.

The compressor cannot be repaired. If faulty or damaged, the entire compressor assembly must be replaced. The compressor clutch, pulley and clutch coil are available for service.

COMPRESSOR CLUTCH

The compressor clutch assembly consists of a stationary electromagnetic coil, a hub bearing and pulley assembly, and a clutch plate (Fig. 2). The electromagnetic coil unit and the hub bearing and pulley assembly are each retained on the nose of the compressor front housing with snap rings. The clutch plate is keyed to the compressor shaft and secured with a screw.

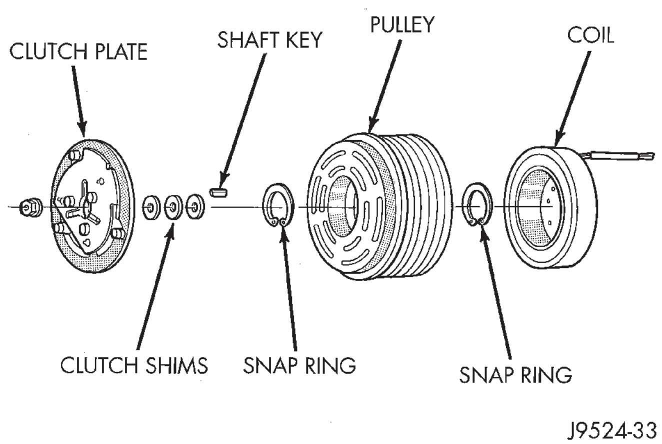


Fig. 2 Compressor Clutch - Typical

These components provide the means to engage and disengage the compressor from the engine serpentine accessory drive belt. When the clutch coil is energized, it magnetically draws the clutch into contact with the pulley and drives the compressor shaft. When the coil is not energized, the pulley freewheels on the clutch hub bearing, which is part of the pulley. The compressor clutch and coil are the only serviced parts on the compressor.

The compressor clutch engagement is controlled by several components: the A/C switch on the heater-A/C control panel, the Automatic Zone Control (AZC) control module (if the vehicle is so equipped), the low pressure cycling clutch switch, the high pressure cut-off switch, the compressor clutch relay, and the Powertrain Control Module (PCM). The PCM may delay compressor clutch engagement for up to thirty seconds. Refer to Group 14 - Fuel System for more information on the PCM controls.

COMPRESSOR CLUTCH RELAY

The compressor clutch relay is a International Standards Organization (ISO) micro-relay. The terminal designations and functions are the same as a conventional ISO relay. However, the micro-relay terminal orientation (footprint) is different, the current capacity is lower, and the relay case dimensions are smaller than those of the conventional ISO relay.

The compressor clutch relay is a electromechanical device that switches battery current to the compressor clutch coil when the Powertrain Control Module (PCM) grounds the coil side of the relay. The PCM responds to inputs from the A/C compressor switch on the heater-A/C control panel, the Automatic Zone Control (AZC) control module (if the vehicle is so equipped), the low pressure cycling clutch switch, and the high pressure cut-off switch. See Compressor Clutch Relay in the Diagnosis and Testing section of this group for more information.

The compressor clutch relay is located in the Power Distribution Center (PDC) in the engine compartment. Refer to the PDC label for relay identification and location.

The compressor clutch relay cannot be repaired and, if faulty or damaged, it must be replaced.

CONDENSER

The condenser is located in the air flow in front of the engine cooling radiator. The condenser is a heat exchanger that allows the high-pressure refrigerant gas being discharged by the compressor to give up its heat to the air passing over the condenser fins. When the refrigerant gas gives up its heat, it condenses. When the refrigerant leaves the condenser, it has become a high-pressure liquid refrigerant.

The volume of air flowing over the condenser fins is critical to the proper cooling performance of the air conditioning system. Therefore, it is important that there are no objects placed in front of the radiator grille openings in the front of the vehicle or foreign material on the condenser fins that might obstruct proper air flow. Also, any factory-installed air seals or shrouds must be properly reinstalled following radiator or condenser service.

The condenser cannot be repaired and, if faulty or damaged, it must be replaced.

EVAPORATOR COIL

The evaporator coil is located in the heater-A/C housing, under the instrument panel. The evaporator coil is positioned in the heater-A/C housing so that all air that enters the housing must pass over the fins of the evaporator before it is distributed through

DESCRIPTION AND OPERATION (Continued)

the system ducts and outlets. However, air passing over the evaporator coil fins will only be conditioned when the compressor is engaged and circulating refrigerant through the evaporator coil tubes.

Refrigerant enters the evaporator from the variable orifice tube as a low-temperature, low-pressure liquid. As air flows over the fins of the evaporator, the humidity in the air condenses on the fins, and the heat from the air is absorbed by the refrigerant. Heat absorption causes the refrigerant to boil and vaporize. The refrigerant becomes a low-pressure gas before it leaves the evaporator.

The evaporator coil cannot be repaired and, if faulty or damaged, it must be replaced.

HEATER CORE

The heater core is located in the heater-A/C housing, under the instrument panel. It is a heat exchanger made of rows of tubes and fins. Engine coolant is circulated through heater hoses to the heater core at all times. As the coolant flows through the heater core, heat removed from the engine is transferred to the heater core fins and tubes.

Air directed through the heater core picks up the heat from the heater core fins. The blend air door allows control of the heater output air temperature by controlling how much of the air flowing through the heater-A/C housing is directed through the heater core. The blower motor speed controls the volume of air flowing through the heater-A/C housing.

The heater core cannot be repaired and, if faulty or damaged, it must be replaced. Refer to Group 7 - Cooling System for more information on the engine cooling system, the engine coolant and the heater hoses.

HEATER AND AIR CONDITIONER

A manual temperature control type heating-air conditioning system is standard factory-installed equipment on this model. An electronically controlled Automatic Zone Control (AZC) type heating-air conditioning system is an available factory-installed option.

All vehicles are equipped with a common heater-A/C housing assembly (Fig. 3). The system combines air conditioning, heating, and ventilating capabilities in a single unit housing mounted under the instrument panel.

Outside fresh air enters the vehicle through the cowl top opening at the base of the windshield, and passes through a plenum chamber to the heater-A/C system blower housing. Air flow velocity can then be adjusted with the blower motor speed selector switch on the heater-A/C control panel. The air intake openings must be kept free of snow, ice, leaves, and other

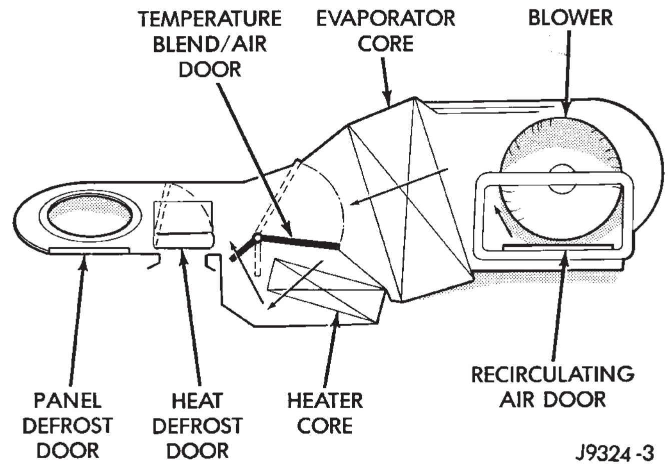


Fig. 3 Common Blend-Air Heater-Air Conditioner System

obstructions for the heater-A/C system to receive a sufficient volume of outside air.

It is also important to keep the air intake openings clear of debris because leaf particles and other debris that is small enough to pass through the cowl plenum screen can accumulate within the heater-A/C housing. The closed, warm, damp and dark environment created within the heater-A/C housing is ideal for the growth of certain molds, mildews and other fungi. Any accumulation of decaying plant matter provides an additional food source for fungal spores, which enter the housing with the fresh air. Excess debris, as well as objectionable odors created by decaying plant matter and growing fungi can be discharged into the passenger compartment during heater-A/C system operation.

Both the manual and AZC heater and air conditioner are blend-air type systems. In a blend-air system, a blend-air door controls the amount of unconditioned air (or cooled air from the evaporator) that is allowed to flow through, or around, the heater core. A temperature control knob on the heater-A/C control panel determines the discharge air temperature by energizing the blend-air door motor, which operates the blend-air door. This allows an almost immediate control of the output air temperature of the system. The AZC system will have separate blend-air doors and temperature controls for each front seat occupant.

The mode control knob on the heater-A/C control panel is used to direct the conditioned air to the selected system outlets. On manual temperature control systems, the mode control knob switches engine vacuum to control the mode doors, which are operated by vacuum actuator motors. On AZC systems, the mode control knob switches electrical current to control the mode doors, which are operated by electronic actuator motors.

DESCRIPTION AND OPERATION (Continued)

The outside air intake can be shut off on manual temperature control systems by selecting the Recirculation Mode with the mode control knob. The outside air intake can be shut off on Automatic Zone Control (AZC) type system by pushing the Recirculation Mode button. This will operate the recirculating air door that closes off the outside fresh air intake and recirculates the air that is already inside the vehicle.

The air conditioner for all models is designed for the use of non-CFC, R-134a refrigerant. The air conditioning system has an evaporator to cool and dehumidify the incoming air prior to blending it with the heated air. This air conditioning system uses a variable orifice tube in the liquid line near the condenser outlet tube to meter refrigerant flow to the evaporator coil. To maintain minimum evaporator temperature and prevent evaporator freezing, a fixed pressure setting switch on the accumulator cycles the compressor clutch.

HEATER AND AIR CONDITIONER CONTROL

The manual temperature control heater-A/C system uses a combination of electrical, and vacuum controls. The Automatic Zone Control (AZC) heater-A/C system uses only electrical controls. These controls provide the vehicle operator with a number of setting options to help control the climate and comfort within the vehicle. Refer to the owner's manual in the vehicle glove box for more information on the suggested operation and use of these controls.

Both heater-A/C control panels are located on the instrument panel inboard of the steering column and below the radio (Fig. 4). Both control panels contain rotary-type temperature control knob(s), a rotary-type mode control switch knob, a rotary-type blower motor speed switch knob and an air conditioning compressor push button switch. The Rear Window Defogger push button switch is also located on heater–A/C control panel. The AZC control panel also features a Recirc push button switch and a vacuum fluorescent display area.

The AZC control module uses infrared sensing technology to control occupant comfort levels, not the actual passenger compartment air temperature. Dual infrared sensors mounted in the face of the control unit independently measure the surface temperature to maintain customer-perceived comfort temperature under changing conditions. Dual Zone temperature control provides wide side-to-side variation in comfort temperature to exceed the needs of either front seat occupant. This sensing system replaces interior air temperature and solar sensors used to approximate direct sensing control through complex control programs.

Both the manual heater-A/C control panel and the AZC control panel are serviced only as complete units and cannot be repaired. If faulty or damaged, the entire control panel unit must be replaced.

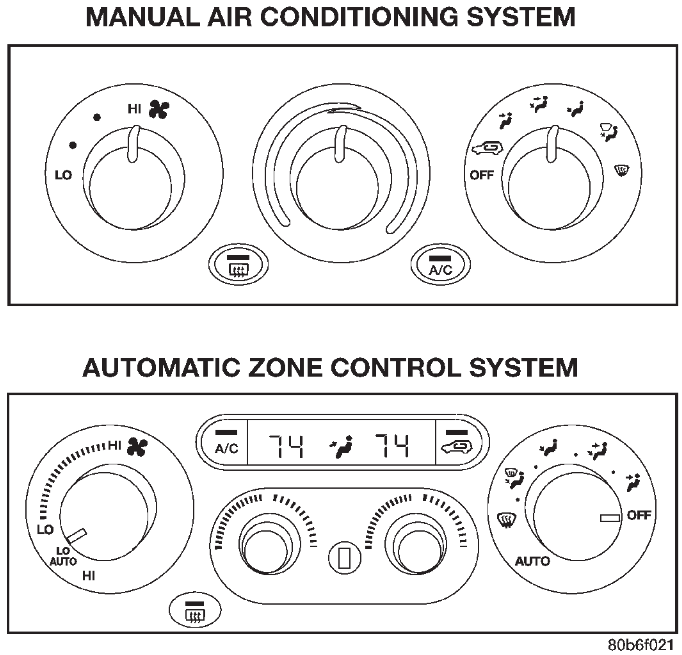


Fig. 4 Heater-Air Conditioner Control Panels

HIGH PRESSURE RELIEF VALVE

A high pressure relief valve is located on the compressor manifold, which is on the side of the compressor. This mechanical valve is designed to vent refrigerant from the system to protect against damage to the compressor and other system components, caused by condenser air flow restriction or an overcharge of refrigerant.

The high pressure relief valve vents the system when a discharge pressure of 3445 to 4135 kPa (500 to 600 psi) or above is reached. The valve closes when a minimum discharge pressure of 2756 kPa (400 psi) is reached.

The high pressure relief valve vents only enough refrigerant to reduce the system pressure, and then re-seats itself. The majority of the refrigerant is conserved in the system. If the valve vents refrigerant, it does not mean that the valve is faulty.

The high pressure relief valve is a factory-calibrated unit. The valve cannot be adjusted or repaired, and must not be removed or otherwise disturbed. The valve is only serviced as a part of the compressor assembly.

HIGH PRESSURE SWITCH

The high pressure switch is located on the discharge line or discharge line block fitting near the compressor. The switch is screwed onto a fitting that contains a Schrader-type valve, which allows the switch to be serviced without discharging the refrig-

DESCRIPTION AND OPERATION (Continued)

erant system. The discharge line fitting is equipped with an O-ring to seal the switch connection.

The high pressure switch is connected in series electrically with the low pressure switch between ground and the Powertrain Control Module (PCM). The switch contacts open and close causing the PCM to turn the compressor clutch on and off. This prevents compressor operation when the discharge line pressure approaches high levels.

The high pressure switch contacts are open when the discharge line pressure rises above 3100 to 3375 kPa (450 to 490 psi). The switch contacts will close when the discharge line pressure drops to 1860 to 2275 kPa (270 to 330 psi).

The high pressure switch is a factory-calibrated unit. The switch cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

INFRARED TEMPERATURE SENSOR

Models equipped with the optional Automatic Zone Control (AZC) system use automatic dual zone temperature control with infrared sensing technology. The temperature sensor is located in the center instrument panel, between the dual temperature knobs of the AZC.

The AZC module uses infrared sensing technology to control occupant comfort levels, not the actual passenger compartment air temperature. Dual infrared sensors mounted in the face of the control unit independently measure the surface temperature to maintain customer-perceived comfort temperature under changing conditions. Dual Zone temperature control provides wide side-to-side variation in comfort temperature to exceed the needs of either front seat occupant. This sensing system replaces interior air temperature and solar sensors used to approximate direct sensing control through complex control programs.

The infrared temperature sensor cannot be adjusted or repaired and, if faulty or damaged, the module must be replaced.

NOTE: The infrared sensor window may be permanently damaged if any type of cosmetic vinyl dressings are allowed to contact the lens. Avoid spraying or wiping this area with any cleaner or conditioner. This may result in impaired temperature sensing and control.

LOW PRESSURE SWITCH

The low pressure switch is located on the top of the accumulator. The switch is screwed onto an accumulator fitting that contains a Schrader-type valve, which allows the switch to be serviced without discharging the refrigerant system. The accumulator fitting is equipped with an O-ring to seal the switch connection.

The low pressure switch is connected in series electrically with the high pressure switch, between ground and the Powertrain Control Module (PCM). The switch contacts open and close causing the PCM to turn the compressor clutch on and off. This regulates the refrigerant system pressure and controls evaporator temperature. Controlling the evaporator temperature prevents condensate water on the evaporator fins from freezing and obstructing air conditioning system air flow.

The low pressure switch contacts are open when the suction pressure is approximately 141 kPa (20.5 psi) or lower. The switch contacts will close when the suction pressure rises to approximately 234 to 262 kPa (34 to 38 psi) or above. Lower ambient temperatures, below approximately -1° C (30° F), will also cause the switch contacts to open. This is due to the pressure/temperature relationship of the refrigerant in the system.

The low pressure switch is a factory-calibrated unit. It cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

REFRIGERANT

The refrigerant used in this air conditioning system is a HydroFluoroCarbon (HFC), type R-134a. Unlike R-12, which is a ChloroFluoroCarbon (CFC), R-134a refrigerant does not contain ozone-depleting chlorine. R-134a refrigerant is a non-toxic, non-flammable, clear, and colorless liquefied gas.

Even though R-134a does not contain chlorine, it must be reclaimed and recycled just like CFC-type refrigerants. This is because R-134a is a greenhouse gas and can contribute to global warming.

R-134a refrigerant is not compatible with R-12 refrigerant in an air conditioning system. Even a small amount of R-12 added to an R-134a refrigerant system will cause compressor failure, refrigerant oil sludge or poor air conditioning system performance. In addition, the PolyAlkylene Glycol (PAG) synthetic refrigerant oils used in an R-134a refrigerant system are not compatible with the mineral-based refrigerant oils used in an R-12 refrigerant system.

R-134a refrigerant system service ports, service tool couplers and refrigerant dispensing bottles have all been designed with unique fittings to ensure that an R-134a system is not accidentally contaminated with the wrong refrigerant (R-12). There are also labels posted in the engine compartment of the vehicle and on the compressor identifying to service technicians that the air conditioning system is equipped with R-134a.

DESCRIPTION AND OPERATION (Continued)

REFRIGERANT LINES

The refrigerant lines and hoses are used to carry the refrigerant between the various air conditioning system components. A barrier hose design with a nylon tube inner hose liner is used for the R-134a air conditioning system on this vehicle. This nylon liner helps to further contain the R-134a refrigerant, which has a smaller molecular structure than R-12 refrigerant. The ends of the refrigerant hoses are made from lightweight aluminum or steel, and use braze-less fittings.

Any kinks or sharp bends in the refrigerant plumbing will reduce the capacity of the entire air conditioning system. Kinks and sharp bends reduce the flow of refrigerant in the system. A good rule for the flexible hose refrigerant lines is to keep the radius of all bends at least ten times the diameter of the hose. In addition, the flexible hose refrigerant lines should be routed so they are at least 80 millimeters (3 inches) from the exhaust manifold.

High pressures are produced in the refrigerant system when the air conditioning compressor is operating. Extreme care must be exercised to make sure that each of the refrigerant system connections is pressure-tight and leak free. It is a good practice to inspect all flexible hose refrigerant lines at least once a year to make sure they are in good condition and properly routed.

The refrigerant lines and hoses are coupled with other components of the HVAC system with peanut-block style fittings. A stat-O seal type flat steel gasket with a captured compressible O-ring, is used to mate plumbing lines with A/C components to ensure the integrity of the refrigerant system.

The refrigerant lines and hoses cannot be repaired and, if faulty or damaged, they must be replaced.

REFRIGERANT OIL

The refrigerant oil used in R-134a refrigerant systems is a synthetic-based, PolyAlkylene Glycol (PAG), wax-free lubricant. Mineral-based R-12 refrigerant oils are not compatible with PAG oils, and should never be introduced to an R-134a refrigerant system.

There are different PAG oils available, and each contains a different additive package. The 10PA17 compressor used in this vehicle is designed to use an ND8 PAG refrigerant oil. Use only refrigerant oil of this same type to service the refrigerant system.

After performing any refrigerant recovery or recycling operation, always replenish the refrigerant system with the same amount of the recommended refrigerant oil as was removed. Too little refrigerant oil can cause compressor damage, and too much can reduce air conditioning system performance.

PAG refrigerant oil is much more hygroscopic than mineral oil, and will absorb any moisture it comes into contact with, even moisture in the air. The PAG oil container should always be kept tightly capped until it is ready to be used. After use, recap the oil container immediately to prevent moisture contamination.

REFRIGERANT SYSTEM SERVICE EQUIPMENT

WARNING: EYE PROTECTION MUST BE WORN WHEN SERVICING AN AIR CONDITIONING REFRIGERANT SYSTEM. TURN OFF (ROTATE CLOCKWISE) ALL VALVES ON THE EQUIPMENT BEING USED BEFORE CONNECTING TO, OR DISCONNECTING FROM THE REFRIGERANT SYSTEM. FAILURE TO OBSERVE THESE WARNINGS MAY RESULT IN PERSONAL INJURY.

When servicing the air conditioning system, a R-134a refrigerant recovery/recycling/charging station that meets SAE Standard J2210 must be used. Contact an automotive service equipment supplier for refrigerant recovery/recycling/charging equipment. Refer to the operating instructions supplied by the equipment manufacturer for proper care and use of this equipment.

A manifold gauge set may be needed with some recovery/recycling/charging equipment (Fig. 5). 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 released into the atmosphere.

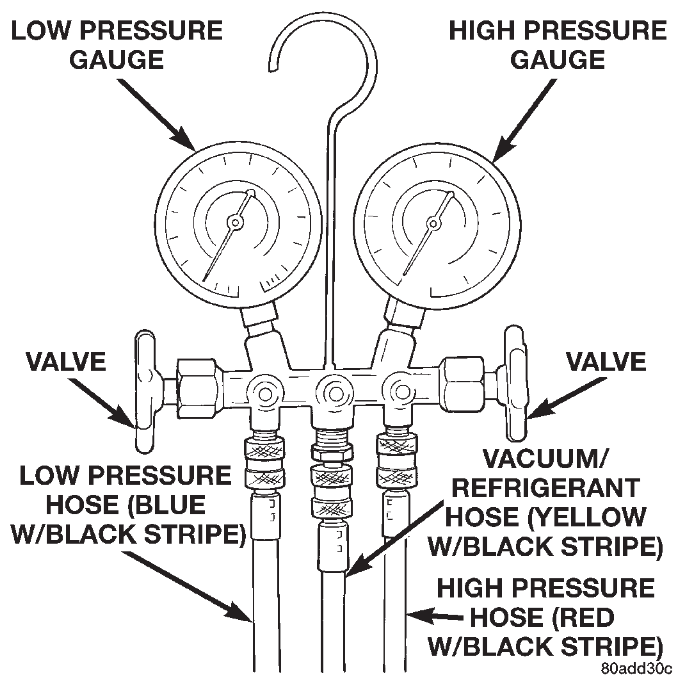


Fig. 5 Manifold Gauge Set - Typical

DESCRIPTION AND OPERATION (Continued)

MANIFOLD GAUGE SET CONNECTIONS

CAUTION: Do not use an R-12 manifold gauge set on an R-134a system. The refrigerants are not compatible and system damage will result.

LOW PRESSURE GAUGE HOSE The low pressure hose (Blue with Black stripe) attaches to the suction service port. This port is located on the liquid line, near the evaporator at the rear of the engine compartment.

HIGH PRESSURE GAUGE HOSE The high pressure hose (Red with Black stripe) attaches to the discharge service port. This port is located on the compressor manifold on the side of the compressor.

RECOVERY/RECYCLING/EVACUATION/CHARGING HOSE The center manifold hose (Yellow, or White, with Black stripe) 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.

REFRIGERANT SYSTEM SERVICE PORT

The two refrigerant system service ports are used to charge, recover/recycle, evacuate, and test the air conditioning refrigerant system. Unique service port coupler sizes are used on the R-134a system, to ensure that the refrigerant system is not accidentally contaminated by the use of the wrong refrigerant (R-12), or refrigerant system service equipment.

The high pressure service port is located on the discharge line off the side of the compressor. The low pressure service port is located on the suction line near the evaporator at the rear of the engine compartment.

Each of the service ports has a threaded plastic protective cap installed over it from the factory. After servicing the refrigerant system, always reinstall both of the service port caps.

SERVICE WARNINGS AND PRECAUTIONS

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.**
- **AVOID BREATHING THE REFRIGERANT AND REFRIGERANT OIL VAPOR OR MIST. EXPOSURE MAY IRRITATE THE EYES, NOSE, AND/OR THROAT. WEAR EYE PROTECTION WHEN SERVICING THE AIR CONDITIONING REFRIGERANT SYSTEM. SERIOUS EYE INJURY CAN RESULT FROM DIRECT CONTACT WITH THE REFRIGERANT. IF EYE CONTACT OCCURS, SEEK MEDICAL ATTENTION IMMEDIATELY.**
- **DO NOT EXPOSE THE REFRIGERANT TO OPEN FLAME. POISONOUS GAS IS CREATED WHEN REFRIGERANT IS BURNED. AN ELECTRONIC LEAK DETECTOR IS RECOMMENDED.**
- **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.**
- **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 THE SKIN OR DELICATE OBJECTS FROM DIRECT CONTACT WITH THE REFRIGERANT.**
- **THE R-134a SERVICE EQUIPMENT OR THE VEHICLE REFRIGERANT 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.**

DESCRIPTION AND OPERATION (Continued)

CAUTION:

- **Liquid refrigerant is corrosive to metal surfaces. Follow the operating instructions supplied with the service equipment being used.**
- **Never add R-12 to a refrigerant system designed to use R-134a. Damage to the system will result.**
- **R-12 refrigerant oil must not be mixed with R-134a refrigerant oil. They are not compatible.**
- **Do not use R-12 equipment or parts on the R-134a system. Damage to the system will result.**
- **Do not overcharge the refrigerant system. This will cause excessive compressor head pressure and can cause noise and system failure.**
- **Recover the refrigerant before opening any fitting or connection. Open the fittings with caution, even after the system has been discharged. Never open or loosen a connection before recovering the refrigerant.**
- **Do not remove the secondary retention clip from any spring-lock coupler connection while the refrigerant system is under pressure. Recover the refrigerant before removing the secondary retention clip. Open the fittings with caution, even after the system has been discharged. Never open or loosen a connection before recovering the refrigerant.**
- **The refrigerant system must always 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, clean the outside of the fittings thoroughly to prevent contamination from entering the refrigerant system.**
- **Immediately after disconnecting a component from the refrigerant system, seal the open fittings with a cap or plug.**
- **Before connecting an open refrigerant fitting, always install a new seal or gasket. Coat the fitting and seal with clean refrigerant oil before connecting.**
- **Do not remove the sealing caps from a replacement component until it is to be installed.**
- **When installing a refrigerant line, avoid sharp bends that may restrict refrigerant flow. Position the refrigerant lines away from exhaust system components or any sharp edges, which may damage the line.**
- **Tighten refrigerant fittings only to the specified torque. The aluminum fittings used in the refrigerant system will not tolerate overtightening.**
- **When disconnecting a refrigerant fitting, use a wrench on both halves of the fitting. This will prevent twisting of the refrigerant lines or tubes.**
- **Refrigerant oil will absorb moisture from the atmosphere if left uncapped. Do not open a container of refrigerant oil until you are ready to use it. Replace the cap on the oil container immediately after using. Store refrigerant oil only in a clean, airtight, and moisture-free container.**
- **Keep service tools and the work area clean. Contamination of the refrigerant system through careless work habits must be avoided.**

COOLING SYSTEM REQUIREMENTS

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 will reduce the performance of the air conditioning and engine cooling systems.

The engine cooling system includes the heater core and the heater hoses. Refer to Group 7 - Cooling System for more information before the opening of, or attempting any service to the engine cooling system.

REFRIGERANT HOSES/LINES/TUBES PRECAUTIONS

Kinks or sharp bends in the refrigerant plumbing will reduce the capacity of the entire system. High pressures are produced in the system when it is operating. Extreme care must be exercised to make sure that all refrigerant system connections are pressure tight.

A good rule for the flexible hose refrigerant lines is to keep the radius of all bends at least ten times the diameter of the hose. Sharp bends will reduce the flow of refrigerant. The flexible hose lines should be routed so they are at least 80 millimeters (3 inches) from the exhaust manifold. It is a good practice to inspect all flexible refrigerant system hose lines at least once a year to make sure they are in good condition and properly routed.

There are two types of refrigerant fittings:

- All fittings with O-rings need to be coated with refrigerant oil before installation. Use only O-rings that are the correct size and approved for use with R-134a refrigerant. Failure to do so may result in a leak.
- Refrigerant line connections with Stat-O seal type gaskets cannot be serviced with O-rings. The gaskets are not reusable and should be replaced any time the connection has been opened for service.

Using the proper tools when making a refrigerant plumbing connection is very important. Improper tools or improper use of the tools can damage the refrigerant fittings. Always use two wrenches when loosening or tightening tube fittings. Use one wrench

DESCRIPTION AND OPERATION (Continued)

to hold one side of the connection stationary, while loosening or tightening the other side of the connection with a second wrench.

The refrigerant must be recovered completely from the system before opening any fitting or connection. Open the fittings with caution, even after the refrigerant has been recovered. If any pressure is noticed as a fitting is loosened, tighten the fitting and recover the refrigerant from the system again.

Do not discharge refrigerant into the atmosphere. Use an R-134a refrigerant recovery/recycling device that meets SAE Standard J2210.

The refrigerant system will remain chemically stable as long as pure, moisture-free R-134a refrigerant and refrigerant oil is used. Dirt, moisture, or air can upset this chemical stability. Operational troubles or serious damage can occur if foreign material is present in the refrigerant system.

When it is necessary to open the refrigerant system, have everything needed to service the system ready. The refrigerant system should not be left open to the atmosphere any longer than necessary. Cap or plug all lines and fittings as soon as they are opened to prevent the entrance of dirt and moisture. All lines and components in parts stock should be capped or sealed until they are to be installed.

All tools, including the refrigerant recycling equipment, the manifold gauge set, and test hoses should be kept clean and dry. All tools and equipment must be designed for R-134a refrigerant.

VACUUM CHECK VALVE

A vacuum check valve (non AZC only) is installed in the accessory vacuum supply line in the engine compartment, near the vacuum tap on the engine intake manifold. The vacuum check valve is designed to allow vacuum to flow in only one direction through the accessory vacuum supply circuits.

The use of a vacuum check valve helps to maintain the system vacuum needed to retain the selected heater-A/C mode settings. The check valve will prevent the engine from bleeding down system vacuum through the intake manifold during extended heavy engine load (low engine vacuum) operation.

The vacuum check valve cannot be repaired and, if faulty or damaged, it must be replaced.

VACUUM RESERVOIR

The vacuum reservoir is mounted in the right front of the vehicle behind the headlamp mounting module (Fig. 6). The headlamp mounting module and headlamp assembly must be removed from the vehicle to access the vacuum reservoir for service. Refer to Group 8L - Lamps for more information on component removal.

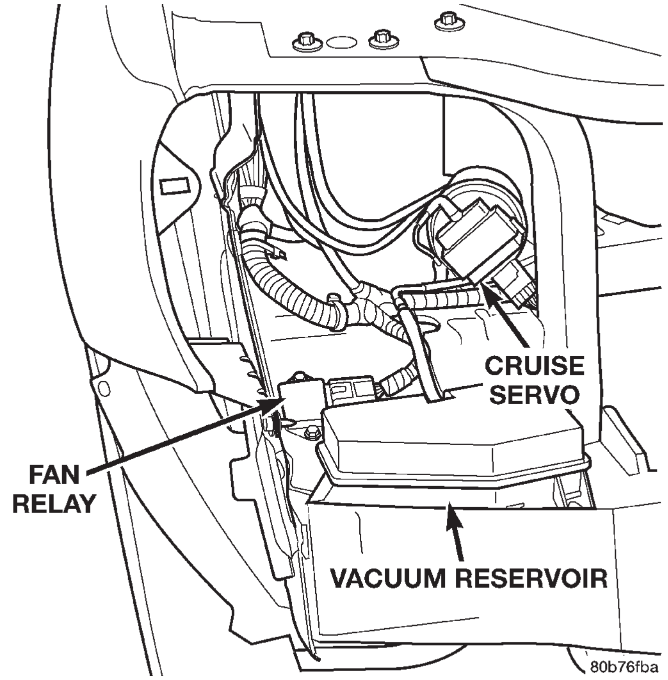


Fig. 6 Vacuum Reservoir

Engine vacuum is stored in the vacuum reservoir. The stored vacuum is used to operate the vacuum-controlled vehicle accessories during periods of low engine vacuum such as when the vehicle is climbing a steep grade, or under other high engine load operating conditions.

The vacuum reservoir cannot be repaired and, if faulty or damaged, it must be replaced.

VACUUM SYSTEM

Vacuum control is used to operate the mode doors in the standard equipment manual temperature control system heater-A/C housing. Testing of the heater-A/C mode control switch operation will determine if the vacuum, and electrical controls are functioning. However, it is possible that a vacuum control system that operates perfectly at engine idle (high engine vacuum) may not function properly at high engine speeds or loads (low engine vacuum). This can be caused by leaks in the vacuum system, or a faulty vacuum check valve.

A vacuum system test will help to identify the source of poor vacuum system performance or vacuum system leaks. Before starting this test, stop the engine and make certain that the problem isn't a disconnected vacuum supply tube at the engine intake manifold vacuum tap or the vacuum reservoir.

Use an adjustable vacuum test set (Special Tool C-3707-B) and a suitable vacuum pump to test the heater-A/C vacuum control system. With a finger placed over the end of the vacuum test hose probe (Fig. 7), adjust the bleed valve on the test set gauge to obtain a vacuum of exactly 27 kPa (8 in. Hg.).

DESCRIPTION AND OPERATION (Continued)

Release and block the end of the probe several times to verify that the vacuum reading returns to the exact 27 kPa (8 in. Hg.) setting. Otherwise, a false reading will be obtained during testing.

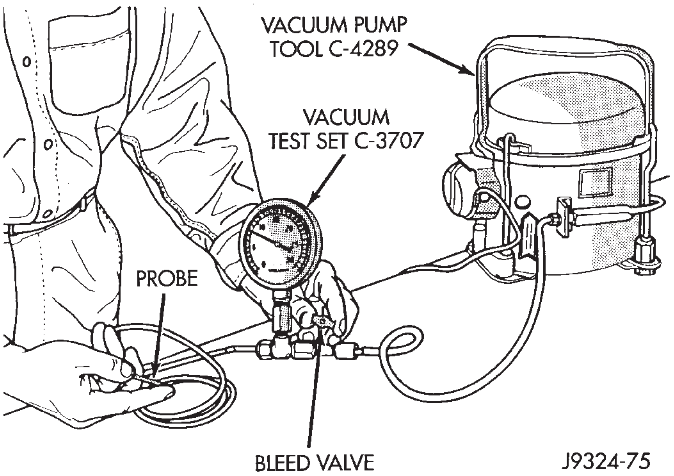


Fig. 7 Adjust Vacuum Test Bleed Valve-Typical

VACUUM CHECK VALVE

(1) Remove the vacuum check valve. The valve is located in the (black) vacuum supply tube at the engine intake manifold vacuum tap.

(2) Connect the test set vacuum supply hose to the heater-A/C control side of the valve. When connected to this side of the check valve, no vacuum should pass and the test set gauge should return to the 27 kPa (8 in. Hg.) setting. If OK, go to step Step 3. If not OK, replace the faulty valve.

(3) Connect the test set vacuum supply hose to the engine vacuum side of the valve. When connected to this side of the check valve, vacuum should flow through the valve without restriction. If not OK, replace the faulty valve.

HEATER-A/C CONTROLS

(1) Connect the test set vacuum probe to the heater-A/C vacuum supply (black) tube in the engine compartment. Position the test set gauge so that it can be viewed from the passenger compartment.

(2) Place the heater-A/C mode control switch knob in each mode position, one position at a time, and pause after each selection. The test set gauge should return to the 27 kPa (8 in. Hg.) setting shortly after each selection is made. If not OK, a component or vacuum line in the vacuum circuit of the selected mode has a leak. See the procedure in Locating Vacuum Leaks.

CAUTION: Do not use lubricant on the switch ports or in the holes in the plug, as lubricant will ruin the vacuum valve in the switch. A drop of clean water in the connector plug holes will help the connector slide onto the switch ports.

LOCATING VACUUM LEAKS

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect the vacuum harness connector from the back of the heater-A/C mode control switch on the control panel.

(2) Connect the test set vacuum hose probe to each port in the vacuum harness connector, one at a time, and pause after each connection (Fig. 8). The test set gauge should return to the 27 kPa (8 in. Hg.) setting shortly after each connection is made. If OK, replace the faulty mode control switch. If not OK, go to Step 3.

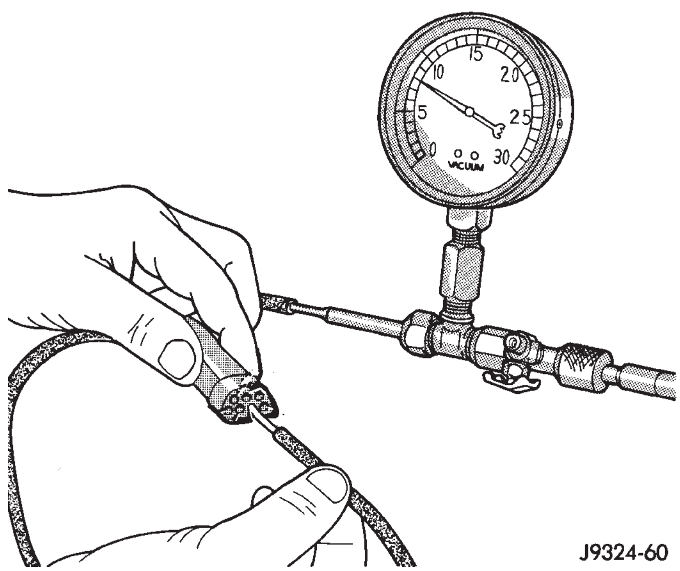


Fig. 8 Vacuum Circuit Test

(3) Determine the vacuum line color of the vacuum circuit that is leaking. To determine the vacuum line colors, refer to the Vacuum Circuits chart (Fig. 9).

(4) Disconnect and plug the vacuum line from the component (fitting, actuator, valve, switch, or reservoir) on the other end of the leaking circuit. Instrument panel disassembly or removal may be necessary to gain access to some components.

(5) Connect the test set hose or probe to the open end of the leaking circuit. The test set gauge should return to the 27 kPa (8 in. Hg.) setting shortly after each connection is made. If OK, replace the faulty disconnected component. If not OK, go to Step 6.

DESCRIPTION AND OPERATION (Continued)

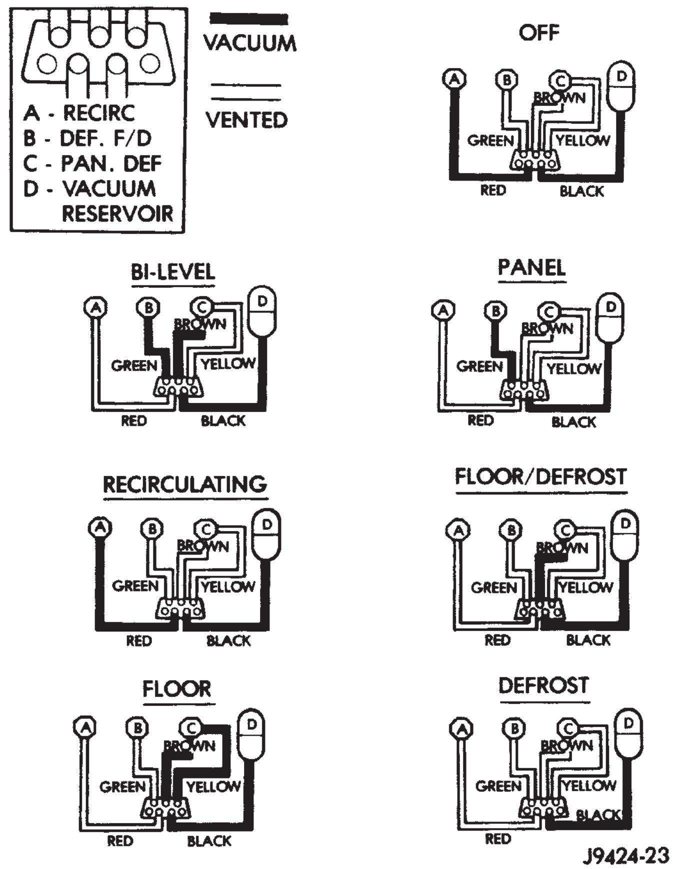


Fig. 9 Vacuum Circuits

(6) To locate a leak in a vacuum line, leave one end of the line plugged and connect the test set hose or probe to the other end. Run your fingers slowly along the line while watching the test set gauge. The vacuum reading will fluctuate when your fingers contact the source of the leak. To repair the vacuum line, cut out the leaking section of the line. Then, insert the loose ends of the line into a suitable length of 3 millimeter (1/8-inch) inside diameter rubber hose.

VARIABLE ORIFICE VALVE

The Variable Orifice Valve (VOV) is installed in the liquid line between the outlet of the condenser and the inlet of the evaporator. The VOV is only serviced as an integral part of the liquid line.

The VOV contains two orifices which work in parallel. The fixed orifice works along with the variable port, to regulate refrigerant expansion in the evaporator in a manner that is suitable for most operating conditions.

The inlet end of the Variable Orifice Valve has a nylon mesh filter screen, which filters the refrigerant and helps to reduce the potential for blockage of the metering orifices by refrigerant system contaminants (Fig. 10). The outlet end of the tube has a nylon mesh diffuser screen. The O-rings on the plastic body of the VOV seal the tube to the inside of the liquid line and prevent the refrigerant from bypassing the fixed metering orifices. A thermostatic bimetal coil wrapped around the valve body serves as a refrigerant regulator during temperature changes.

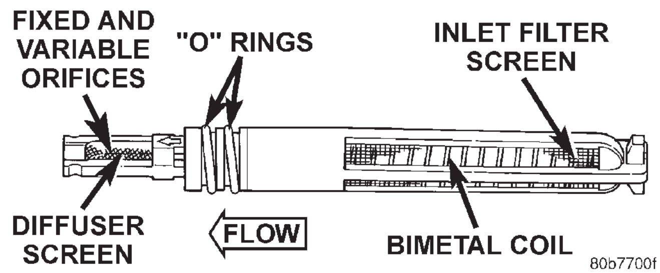


Fig. 10 Variable Orifice Valve

The VOV is used to meter the flow of liquid refrigerant into the evaporator coil. The high-pressure liquid refrigerant from the condenser expands into a low-pressure liquid/vapor as it passes through the metering orifices and diffuser screen of the valve.

The VOV varies the flow of refrigerant in response to the refrigerant temperature exiting the condenser. As condenser discharge refrigerant temperature increases, the variable port is progressively closed. A higher temperature (while idling) equals more restriction. A lower temperature (at road speed) will have less restriction.

The Variable Orifice Valve cannot be repaired and, if faulty or plugged, the liquid line assembly must be replaced.

DIAGNOSIS AND TESTING

A/C PERFORMANCE

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 housing on the dash panel below the instrument panel, is cooled to temperatures near the freezing point. As warm damp air passes through the cooled evaporator, the air transfers its heat to the refrigerant in the evaporator and the moisture in the air condenses on the evaporator fins. During periods of high heat and humidity, an air conditioning system will be more effective in the Recirculation Mode. With the system in the Recirculation Mode, only air from the passenger compartment passes through the evaporator. As the passenger compartment air dehumidifies, the air conditioning system performance levels improve.

Humidity has an important bearing on the temperature of the air delivered to the interior of the vehicle. It is important to understand the effect that humidity

DIAGNOSIS AND TESTING (Continued)

has on the performance of the air conditioning system. When humidity is high, the evaporator has to perform a double duty. It must lower the air temperature, and it must lower the temperature of the moisture in the air that condenses on the evaporator fins. Condensing the moisture in the air transfers heat energy into the evaporator fins and tubing. This reduces the amount of heat the evaporator can absorb from the air. High humidity greatly reduces the ability of the evaporator to lower the temperature of the air.

However, evaporator capacity used to reduce the amount of moisture in the air is not wasted. Wringing some of the moisture out of the air entering the vehicle adds to the comfort of the passengers. Although, an owner may expect too much from their air conditioning system on humid days. A performance test is the best way to determine whether the system is performing up to standard. This test also provides valuable clues as to the possible cause of trouble with the air conditioning system.

If the vehicle has the optional Automatic Zone Control (AZC) system, and has intermittent operational problems or fault codes, be certain that the 16-way wire harness connector on the heater-A/C housing is properly seated (Fig. 11). To check this condition, unplug the two wire harness connector halves, then plug them in again.

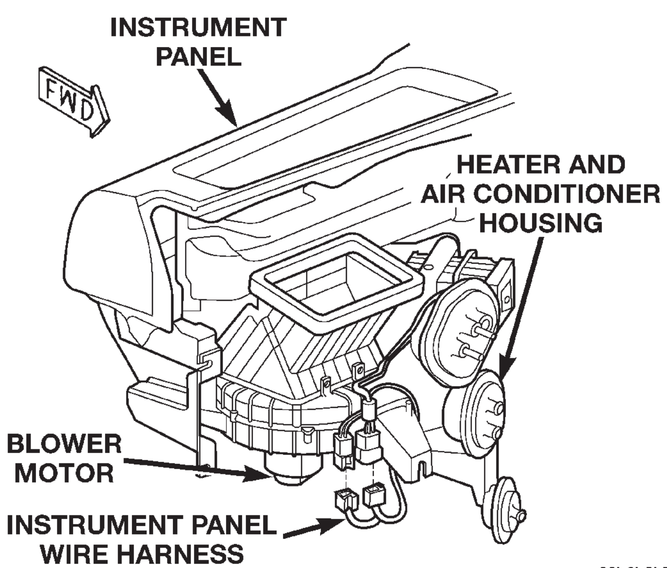


Fig. 11 16-Way Wire Harness Connector (AZC)

Review the Service Warnings and Precautions in the front of this group before performing this procedure. The air temperature in the test room and in the vehicle must be a minimum of 21° C (70° F) for this test.

(1) Connect a tachometer and a manifold gauge set.

(2) If the vehicle has the standard manual temperature control, set the heater-A/C mode control switch knob in the Panel position, the temperature control knob in the full cool (Recirculation Mode) position, the A/C button in the On position, and the blower motor switch knob in the highest speed position. If the vehicle has the optional AZC, set the heater-A/C mode control switch knob in the Panel position, the temperature control knob in the full cool position, the A/C and Recirc buttons in the On position, and the blower motor switch knob in the highest (manual) speed position.

(3) Start the engine and hold the idle at 1,000 rpm with the compressor clutch engaged.

(4) The engine should be at operating temperature. The doors and windows must be open.

(5) Insert a thermometer in the driver side center A/C (panel) outlet. Operate the engine for five minutes.

(6) The compressor clutch may cycle, depending upon the ambient temperature and humidity. If the clutch cycles, unplug the low pressure switch wire harness connector from the switch located on the accumulator (Fig. 12). Place a jumper wire across the terminals of the low pressure switch wire harness connector.

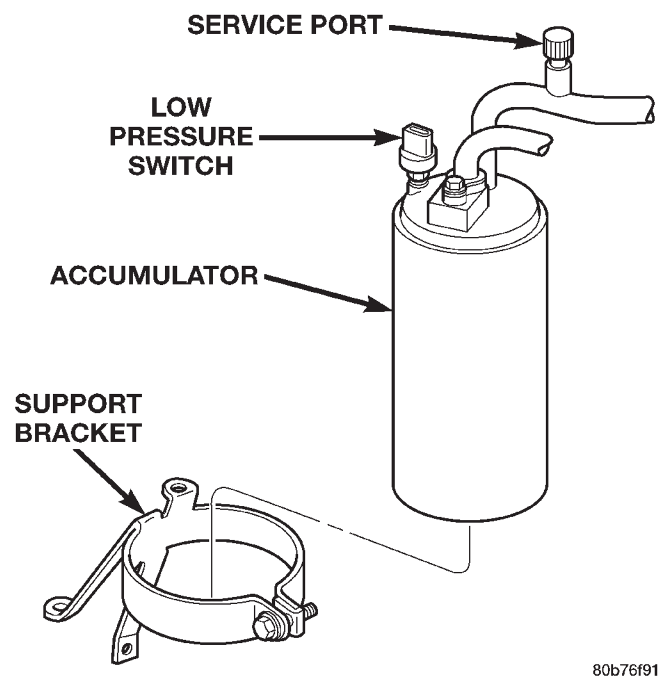


Fig. 12 Accumulator and Low Pressure Switch

(7) With the compressor clutch engaged, record the discharge air temperature and the compressor discharge pressure.

(8) Compare the discharge air temperature to the Performance Temperature and Pressure chart. If the discharge air temperature is high, see Refrigerant System Leaks and Refrigerant System Charge in this group.

DIAGNOSIS AND TESTING (Continued)

Performance Temperature and Pressure					
Ambient Air 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 to 38° F)	1 to 7° C (33 to 44° F)	3 to 9° C (37 to 48° F)	6 to 13° C (43 to 55° F)	10 to 18° C (50 to 64° F)
Evaporator Inlet Pressure at Charge Port	179 to 241 kPa (26 to 35 psi)	221 to 283 kPa (32 to 41 psi)	262 to 324 kPa (38 to 47 psi)	303 to 365 kPa (44 to 53 psi)	345 to 414 kPa (50 to 60 psi)
Compressor Discharge Pressure	1240 to 1655 kPa (180 to 240 psi)	1380 to 1790 kPa (200 to 260 psi)	1720 to 2070 kPa (250 to 300 psi)	1860 to 2345 kPa (270 to 340 psi)	2070 to 2690 kPa (300 to 390 psi)

(9) Compare the compressor discharge pressure to the Performance Temperature and Pressure chart. If the compressor discharge pressure is high, see the Pressure Diagnosis chart.

Pressure Diagnosis		
Condition	Possible Causes	Correction
Rapid compressor clutch cycling (ten or more cycles per minute).	1. Low refrigerant system charge.	1. See Refrigerant System Leaks in this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system, if required.
Equal pressures, but the compressor clutch does not engage.	1. No refrigerant in the refrigerant system. 2. Faulty fuse. 3. Faulty compressor clutch coil. 4. Faulty compressor clutch relay. 5. Improperly installed or faulty low pressure switch. 6. Faulty high pressure switch. 7. Faulty Powertrain Control Module (PCM).	1. See Refrigerant System Leaks in this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system, if required. 2. Check the fuses in the Power Distribution Center and the fuseblock module. Repair the shorted circuit or component and replace the fuses, if required. 3. See Compressor Clutch Coil in this group. Test the compressor clutch coil and replace, if required. 4. See Compressor Clutch Relay in this group. Test the compressor clutch relay and relay circuits. Repair the circuits or replace the relay, if required. 5. See Low Pressure Cycling Clutch Switch in this group. Test the low pressure switch and tighten or replace, if required. 6. See High Pressure Switch in this group. Test the high pressure switch and replace, if required. 7. Refer to the proper Diagnostic Procedures manual for testing of the PCM. Test the PCM and replace, if required.

DIAGNOSIS AND TESTING (Continued)

Pressure Diagnosis		
Condition	Possible Causes	Correction
Normal pressures, but A/C Performance Test air temperatures at center panel outlet are too high.	1. Excessive refrigerant oil in system. 2. Blend-air door motor, or wire harness improperly installed or faulty. 3. Blend-air door inoperative or sealing improperly.	1. See Refrigerant Oil Level in this group. Recover the refrigerant from the refrigerant system and inspect the refrigerant oil content. Restore the refrigerant oil to the proper level, if required. 2. See Blend-air door motor in this group. Inspect the motor, and wire harness for proper installation and operation and correct, if required. 3. See Blend-Air Door under Heater-A/C Housing Door in this group. Inspect the blend-air door for proper operation and sealing. Correct if required.
The low side pressure is normal or slightly low, and the high side pressure is too low.	1. Low refrigerant system charge. 2. Refrigerant flow through the accumulator is restricted. 3. Refrigerant flow through the evaporator coil is restricted. 4. Faulty compressor.	1. See Refrigerant System Leaks in this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system, if required. 2. See Accumulator in this group. Replace the restricted accumulator, if required. 3. See Evaporator Coil in this group. Replace the restricted evaporator coil, if required. 4. See Compressor in this group. Replace the compressor, if required.
The low side pressure is normal or slightly high, and the high side pressure is too high.	1. Condenser air flow restricted. 2. Inoperative cooling fan. 3. Refrigerant system overcharged. 4. Air in the refrigerant system. 5. Engine overheating.	1. Check the condenser for damaged fins, foreign objects obstructing air flow through the condenser fins, and missing or improperly installed air seals. Refer to Group 7 - Cooling System for more information on air seals. Clean, repair, or replace components as required. 2. Refer to Group 7 - Cooling System for more information. Test the cooling fan and replace, if required. 3. See Refrigerant System Charge in this group. Recover the refrigerant from the refrigerant system. Charge the refrigerant system to the proper level, if required. 4. See Refrigerant System Leaks in this group. Test the refrigerant system for leaks. Repair, evacuate and charge the refrigerant system, if required. 5. Refer to Group 7 - Cooling System for more information. Test the cooling system and repair, if required.
The low side pressure is too high, and the high side pressure is too low.	1. Accessory drive belt slipping. 2. Variable orifice tube not installed. 3. Faulty compressor.	1. Refer to Group 7 - Cooling System for more information. Inspect the accessory drive belt condition and tension. Tighten or replace the accessory drive belt, if required. 2. See Variable Orifice Tube in this group. Install the missing orifice tube and line if required. 3. See Compressor in this group. Replace the compressor, if required.

DIAGNOSIS AND TESTING (Continued)

Pressure Diagnosis		
Condition	Possible Causes	Correction
The low side pressure is too low, and the high side pressure is too high.	1. Restricted refrigerant flow through the refrigerant lines. 2. Restricted refrigerant flow through the variable orifice tube. 3. Restricted refrigerant flow through the condenser.	1. See Liquid Line and Suction and Discharge Line in this group. Inspect the refrigerant lines for kinks, tight bends or improper routing. Correct the routing or replace the refrigerant line, if required. 2. See Variable Orifice Tube in this group. Replace the restricted fixed orifice tube, if required. 3. See Condenser in this group. Replace the restricted condenser, if required.

AUTOMATIC ZONE CONTROL SYSTEM

The Automatic Zone Control (AZC) control module has a system self-diagnostic mode which continuously monitors various parameters during normal system operation. If a system fault is detected, a current and historical fault is recorded. When the current fault is cleared, the historical fault remains until reset (manually or automatically). Both the current and historical fault codes can be accessed through either the front panel, or over the Programmable Communications Interface (PCI) bus using a DRBIII® scan tool, and the proper Diagnostic Procedures manual.

The AZC control module is capable of three different types of self-diagnostic tests, as follows:

- Fault Code Tests
- Input Circuit Tests
- Output Circuit/Actuator Tests

The information that follows describes:

- How to read the self-diagnostic display
- How to enter the AZC control module self-diagnostic test mode
- How to select the self-diagnostic test types
- How to perform the different tests

ENTERING THE AZC SELF-DIAGNOSTIC MODE

To enter the AZC self-diagnostic mode, perform the following:

(1) Depress the A/C and Recirc buttons at the same time and hold. Rotate the left temperature control knob clockwise (CW) one detent.

(2) If you continue to hold the A/C and Recirc buttons depressed, the AZC control module will perform a Segment Test of the vacuum fluorescent (VF) display. In the Segment Test you should see all of the display segments illuminate as long as both buttons are held. If a display segment fails to illuminate, the vacuum fluorescent display is faulty and the heater-A/C control must be replaced.

(3) After viewing the Segment Test, release the A/C and Recirc buttons and the display will clear momentarily. If the display remains blank then no faults are set in the system. Should there be any faults, either ″current″ or ″historical″, all fault codes will be displayed in ascending numerical sequence (note no effort is made to display fault codes in chronological order). Each fault code is displayed for one second before the next code is displayed. Once all fault codes have been displayed, the system will then repeat the fault code numbers. This will continue until the left side set temperature control is moved at least one detent position in the CW direction or the ignition is turned ″OFF″.

FAULT CODE TESTS

Fault codes are two-digit numbers that identify a circuit that is malfunctioning. There are two different kinds of fault codes.

1. **Current Fault Codes -** Current means the fault is present right now. There are two types of current faults: input faults, and system faults. If the system has a current fault when the ignition is turned “ON”, or during normal operation a current fault occurs, the right side set temperature digits will display “ER” at maximum intensity, while the left side set temperature digits are blanked.

2. **Historical Fault Codes -** Historical or stored means that the fault occurred previously, but is not present right now. A majority of historical fault codes are caused by intermittent wire harness or wire harness connector problems.

NOTE: A battery disconnect will erase all faults stored in Random Access Memory (RAM) of the AZC control module. It is recommended that all faults be recorded before they are erased.

RETRIEVING FAULT CODES

(1) To begin the fault code tests, depress the A/C and Recirc buttons at the same time and rotate the left temperature control knob clockwise (CW) one detent, then release the push-button.

(2) **If there are no fault codes, the “00” display value will remain in the VF window.** Should there be any codes, each will be displayed for one second in ascending numerical sequence (note: no

DIAGNOSIS AND TESTING (Continued)

CURRENT FAULT CODES	
Input faults	01 = IR thermister circuit open
	02 = IR thermister circuit shorted
	03 = Fan pot shorted
	04 = Fan pot open
	05 = Mode pot shorted
	06 = Mode pot open
	07 = IR sensor delta too large
	08 = Reserved
	09 = Reserved
	10 = Reserved
	11 = Reserved
	12 = Reserved
System Faults	13 = AI (Recirc) motor not responding
	14 = Mode motor not responding
	15 = Left temperature door not responding
	16 = Right temperature door not responding
	17 = AI (Recirc) door travel too small
	18 = AI (Recirc) door travel too large
	19 = Mode door travel range too small
	20 = Mode door travel range too large
	21 = Left temperature door travel too small
	22 = Left temperature door travel too large
	23 = Right temperature door travel too small
	24 = Right temperature door travel too large
	25 = Calibration check sum error
	26 = Engine coolant temp bus message missing
	27 = Vehicle speed bus message missing
	28 = Engine RPM bus message missing
	29 = OAT bus message missing
	30 = Display intensity bus message missing
	31 = VIN number bus message missing
	32 = Reserved

HISTORICAL FAULT CODES	
Input faults	33 = IR thermister circuit was open
	34 = IR thermister circuit was shorted
	35 = Fan pot was shorted
	36 = Fan pot was open
	37 = Mode pot was shorted
	38 = Mode pot was open
	39 = IR sensor delta was too large
	40 = Reserved
	41 = Reserved
	42 = Reserved
	43 = Reserved
	44 = Reserved
System Faults	45 = AI (Recirc) motor was not responding
	46 = Mode motor was not responding
	47 = Left temperature door was not responding
	48 = Right temperature door was not responding
	49 = AI (Recirc) door travel was too small
	50 = AI (Recirc) door travel too large
	51 = Mode door travel range too small
	52 = Mode door travel range too large
	53 = Left temperature door travel too small
	54 = Left temperature door travel too large
	55 = Right temperature door travel too small
	56 = Right temperature door travel too large
	57 = Calibration check sum error
	58 = Engine coolant temp bus message missing
	59 = Vehicle speed bus message missing
	60 = Engine RPM bus message missing
	61 = OAT bus message missing
	62 = Display intensity bus message missing
	63 = VIN number bus message missing
	64 = Reserved
	65 = Reserved
	66 = Reserved
	67 = Reserved

DIAGNOSIS AND TESTING (Continued)

effort is made to display faults in the order they occurred). The left side set temperature display will be blanked and the right side set temperature display will indicate current and historical codes (8 historical max) presently active. Once all codes have been displayed, the system will repeat the fault code numbers. This will continue until the left side set temperature control is moved at least one detent position in either direction, by pressing both the A/C and Recirc buttons at the same time, or the ignition is turned off. Record all of the fault codes, then see the Current and Historical Fault Code charts for the descriptions.

CLEARING FAULT CODES

Current faults cannot be electronically cleared. Repair must be made to the system to eliminate the fault causing code. Historical fault codes can be cleared manually, or automatically. To clear a historical fault manually, depress and hold either the A/C or Recirc button for at least three seconds while the display is in the fault code mode of operation. Historical fault codes are cleared automatically when the corresponding current fault code has been cleared, and has remained cleared for a number of ignition cycles. The faults have been cleared when two horizontal bars appear in the Test Selector display.

EXITING SELF-DIAGNOSTIC MODE

The self-diagnostic mode can be exited by pressing both the A/C and Recirc buttons at the same time, or turning off the ignition.

MONITOR CURRENT PARAMETERS

While in the display fault code mode of operation, current system parameters can also be monitored and/or forced. Rotating the left side set temperature control clockwise will increase the pointer number while rotating the control counter clockwise will decrease the pointer number. Rotating the right set temperature control will have no impact on pointer value or the value of the parameter being monitored. Once the desired pointer number has been selected, pressing either the AC or Recirc buttons will display the current value of the selected parameter. **The right side set temperature display is only capable of displaying only values ranging from 0 to 99, the left side set temperature display is used for values greater than 99. If the value is less than 99, the left side set temperature display remains blanked.** While a parameter is being overridden, the system will continue to function normally except for the parameter which is being manually controlled.

On a limited number of pointers, pressing just the AC button, will cause the system to automatically increment the selected parameter values in step sizes determined by pointer 15 at a rate selected by pointer 16. Pressing just the Recirc button, will cause the system to automatically decrement the selected parameter values in step sizes determined by pointer 15 at a rate selected by pointer 16. On a pointer which this is not allowed, pressing either of these button will have no effect. Pressing and holding both the AC and recirculation buttons while rotating the left set temperature control either direction, will cause the system to exit the selected parameter and will maintain the override parameter value selected. Rotating just left set temperature control without pressing any buttons will cause the system to revert back to automatic control of the selected parameter and will display the point number of the parameter just viewed. While displaying any pointer number and pressing both the AC and Recirc buttons will cause the system to exit the diagnostic mode of operation.

For values < 0, the ″G″ segment in the left side set temperature Most Significant Digit (MSD)(or left-most number in the pair) will be used to indicate a negative number. For values between -01 to -99 the Least Significant Digit (LSD)(or right-most number of the pair) in the left side set temperature will remain blank. System control of parameter being displayed can be overridden by rotating the right set temperature control in either direction. Rotating the right temperature control in the CW direction, the selected parameter value is overridden and incremented beginning at the value which was being displayed. Rotating the right temperature control in the CCW direction, the selected parameter value is overridden and decremented beginning at the value which was being displayed. The rate at which incrementing and decrement occurs is one unit value per set temperature detent position.

DIAGNOSIS AND TESTING (Continued)

HVAC SYSTEM POINTER		
Pointer Number	DESCRIPTION	Value Displayed
01	A/C Enable	0 or 1
		0 = disabled 1 = enabled
02	Final fan PWM duty cycle	0 to 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
	Pressing the AC button will cause the system to begin a sweep decrementing this variable beginning at the value being displayed just prior to the button press.	
	Pressing the Rec button will cause the system to begin a sweep incrementing this variable beginning at the value being displayed just prior to the button press.	
	The rate and step size of the sweep is controlled by the value set in pointers 15 and 16.	
03	Left NPRG	0 to 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
	Pressing the AC button will cause the system to begin a sweep decrementing this variable beginning at the value being displayed just prior to the button press.	
	Pressing the Rec button will cause the system to begin a sweep incrementing this variable beginning at the value being displayed just prior to the button press.	
	The rate and step size of the sweep is controlled by the value set in pointers 15 and 16.	
04	Right NPRG	0 to 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
	Pressing the AC button will cause the system to begin a sweep decrementing this variable beginning at the value being displayed just prior to the button press.	
	Pressing the Rec button will cause the system to begin a sweep incrementing this variable beginning at the value being displayed just prior to the button press.	
	The rate and step size of the sweep is controlled by the value set in pointers 15 and 16.	
05	Avg NPRG	0 TO 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
	Pressing the AC button will cause the system to begin a sweep decrementing this variable beginning at the value being displayed just prior to the button press.	

DIAGNOSIS AND TESTING (Continued)

HVAC SYSTEM POINTER		
Pointer Number	DESCRIPTION	Value Displayed
	Pressing the Rec button will cause the system to begin a sweep incrementing this variable beginning at the value being displayed just prior to the button press.	
	The rate and step size of the sweep is controlled by the value set in pointers 15 and 16.	
06	Primary control side	0 or 1
		0 = left 1 = right
07	EE Check sum (calculated)	0 to 255
08	Target intensity (in % ON time)	0 to 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
09	Not Used	0 to 0
10	number of indexes during ignition	0 to 255
	While the value of this pointer is being displayed, pressing the AC push button will zero the number of indexes during ignition OFF.	
11	Right NINC	0 to 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
	Pressing the AC button will cause the system to begin a sweep decrementing this variable beginning at the value being displayed just prior to the button press.	
	Pressing the Rec button will cause the system to begin a sweep incrementing this variable beginning at the value being displayed just prior to the button press.	
	The rate and step size of the sweep is controlled by the value set in pointers 15 and 16.	
12	Left NINC	0 to 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
	Pressing the AC button will cause the system to begin a sweep decrementing this variable beginning at the value being displayed just prior to the button press.	
	Pressing the Rec button will cause the system to begin a sweep incrementing this variable beginning at the value being displayed just prior to the button press.	
	The rate and step size of the sweep is controlled by the value set in pointers 15 and 16.	
13	Right NMIX	0 to 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
	Pressing the AC button will cause the system to begin a sweep decrementing this variable beginning at the value being displayed just prior to the button press.	

DIAGNOSIS AND TESTING (Continued)

HVAC SYSTEM POINTER		
Pointer Number	DESCRIPTION	Value Displayed
	Pressing the Rec button will cause the system to begin a sweep incrementing this variable beginning at the value being displayed just prior to the button press.	
	The rate and step size of the sweep is controlled by the value set in pointers 15 and 16.	
14	Left NMIX	0 to 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
	Pressing the AC button will cause the system to begin a sweep decrementing this variable beginning at the value being displayed just prior to the button press.	
	Pressing the Rec button will cause the system to begin a sweep incrementing this variable beginning at the value being displayed just prior to the button press.	
	The rate and step size of the sweep is controlled by the value set in pointers 15 and 16.	
15	Scan Step Size	1 to 255
	The value displayed in this pointer is used to control step size used whenever the system is commanded (from the front panel) to conduct an automatic sweep. CW = increase; CCW = decrease; 0 is an illegal value min value =1	
16	Scan Step Time (in loop passes)	1 to 255
17	Reserved	
18	Reserved	
19	Reserved	

MODE VALUE POINTER		
Pointer Number	DESCRIPTION	Value Displayed
20	mode range in delta counts	0 to 9999
21	Current mode position (in counts)	0 to 9999
22	mode target position in ratio	0 to 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
	Pressing the AC button will cause the system to begin a sweep decrementing this variable beginning at the value being displayed just prior to the button press.	
	Pressing the Rec button will cause the system to begin a sweep incrementing this variable beginning at the value being displayed just prior to the button press.	
	The rate and step size of the sweep is controlled by the value set in pointers 15 and 16.	
23	mode target position in counts	0 to 9999

DIAGNOSIS AND TESTING (Continued)

MODE VALUE POINTER		
Pointer Number	DESCRIPTION	Value Displayed
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
24	elapsed time since last index in tenths of hours	0 to 255
25	number of valve moves since last index	0 to 9999
26	number of valve moves before last index	0 to 9999
27	number of ignition cycles since last index	0 to 255
28	number of ignition ON indexes	0 to 255
29	mode motor state	0 to 5
	While the value of this pointer is being displayed, pressing either the A/C or Recirc button will force the system to perform a calibration routine. 0 = searching range 1 = moving toward panel 2 = moving toward defrost 3 = in position 4 = stalled moving toward panel 5 = stalled moving toward defrost	

LEFT SIDE TEMPERATURE POINTER		
Pointer Number	DESCRIPTION	Value Displayed
30	Left side temp range in delta counts	0 to 9999
31	Current left side temp position (in counts)	0 to 9999
32	Left side temp target position (in ratio)	0 to 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
	Pressing the AC button will cause the system to begin a sweep decrementing this variable beginning at the value being displayed just prior to the button press.	
	Pressing the Rec button will cause the system to begin a sweep incrementing this variable beginning at the value being displayed just prior to the button press.	
	The rate and step size of the sweep is controlled by the value set in pointers 15 and 16.	
33	Left side temp target in counts	0 to 9999
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
34	Elapsed time since last index in tenths of hours	0 to 255
35	number of valve moves since last index	0 to 9999
36	number of valve moves before last index	0 to 9999
37	number of ignition cycles since last index	0 to 255
38	number of ignition ON indexes	0 to 255
39	Left side temp motor state	0 to 5
	While the value of this pointer is being displayed, pressing either the A/C or Recirc button will force the system to perform a calibration routine. 0 = searching range 1 = moving toward panel 2 = moving toward defrost 3 = in position 4 = stalled moving toward panel 5 = stalled moving toward defrost	

DIAGNOSIS AND TESTING (Continued)

RIGHT SIDE TEMPERATURE POINTER		
Pointer Number	DESCRIPTION	Value Displayed
40	Right side temp range in delta counts	0 to 9999
41	Current right side temp position (in counts)	0 to 9999
42	Right side temp target position (in ratio)	0 to 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
	Pressing the AC button will cause the system to begin a sweep decrementing this variable beginning at the value being displayed just prior to the button press.	
	Pressing the Rec button will cause the system to begin a sweep incrementing this variable beginning at the value being displayed just prior to the button press.	
	The rate and step size of the sweep is controlled by the value set in pointers 15 and 16.	
43	Right side temp target in counts	0 to 9999
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
44	Elapsed time since last index in tenths of hours	0 to 255
45	number of valve moves since last index	0 to 9999
46	number of valve moves before last index	0 to 9999
47	number of ignition cycles since last index	0 to 255
48	number of ignition ON indexes	0 to 255
49	Right side temp motor state	0 to 5
	While the value of this pointer is being displayed, pressing either the A/C or Recirc button will force the system to perform a calibration routine. 0 = searching range 1 = moving toward panel 2 = moving toward defrost 3 = in position 4 = stalled moving toward panel 5 = stalled moving toward defrost	

AIR INLET POINTER		
Pointer Number	DESCRIPTION	Value Displayed
50	Air inlet range (in counts)	0 to 9999
51	Current air inlet position (in counts)	0 to 9999
52	Air inlet target position (in ratio)	0 to 255
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
	Pressing the AC button will cause the system to begin a sweep decrementing this variable beginning at the value being displayed just prior to the button press.	
	Pressing the Rec button will cause the system to begin a sweep incrementing this variable beginning at the value being displayed just prior to the button press.	
	The rate and step size of the sweep is controlled by the value set in pointers 15 and 16.	

DIAGNOSIS AND TESTING (Continued)

AIR INLET POINTER		
Pointer Number	DESCRIPTION	Value Displayed
53	Air inlet target in counts	0 to 9999
	While the value of this pointer is being displayed, turning the right set temperature control either direction will manually control the value. CW = increase; CCW = decrease	
54	Elapsed time since last index in tenths of hours	0 to 255
55	number of motor moves since last index	0 to 9999
56	number of motor moves before last index	0 to 9999
57	number of ignition cycles since last index	0 to 255
58	number of ignition ON indexes	0 to 255
59	Air inlet motor state	0 to 5
	While the value of this pointer is being displayed, pressing either the A/C or Recirc button will force the system to perform a calibration routine. 0 = searching range 1 = moving toward panel 2 = moving toward defrost 3 = in position 4 = stalled moving toward panel 5 = stalled moving toward defrost	
60	Reserved	
61	Actual Outside Air Temp (in degrees F)	-40 to 215
62	Engine Air Temp (in degrees F)	-40 to 215
63	Engine Intake Air Temperature (in degrees F)	-40 to 215
64	Vehicle speed in MPH	0 to 255
65	Engine RPM/100	-0 to 82
66	Engine Coolant Temp - 40 (in degrees F)	-40 to 215
67	Country Code	0 to 255
68	User A/B	0, 1, 2
		0 = user A 1 = user B 2 = user undefined

IR SENSOR POINTER		
Pointer Number	DESCRIPTION	Value Displayed
70	Thermistor temp (in degrees)	-40 to 215
71	Left side sensor A/D (filtered)	0 to 255
72	Right side sensor A/D (filtered)	0 to 255
73	Left side temp (in degrees F)	-40 to 140
74	Right side temp (in degrees F)	-40 to 140

IDENTIFICATION POINTER		
Pointer Number	DESCRIPTION	Value Displayed
80	ROM bit pattern number (digits 1,2,3 & 4)	0 to 9999
81	ROM bit pattern number (digits 5,6,7 & 8)	0 to 9999
82	CAL bit pattern number (digits 1,2,3 & 4)	0 to 9999
83	CAL bit pattern number (digits 5,6,7 & 8)	0 to 9999
84	Software version Flash ROM	0 to 99

DIAGNOSIS AND TESTING (Continued)

IDENTIFICATION POINTER		
Pointer Number	DESCRIPTION	Value Displayed
85	Software version revision	0 to 99
86	Not used	
87	Not used	
88	Not used	
89	Not used	

OUTPUT CIRCUIT/ACTUATOR TESTS

In the Output Circuit/Actuator Test mode, the output circuits can be viewed, monitored, overridden, and tested. If a failure occurs in an output circuit, test the circuit by overriding the system. Test the actuator through its full range of operation. When the override control has been activated, the Test Selector display will be flashing. The Test Selector will display feedback information about the output circuit being tested.

(1) To begin the Output Circuit/Actuator Tests you must be in the Select Test mode.

(2) With a “00” value displayed in the Test Selector and no stick man, turn the rotary temperature control knob until the test number you are looking for appears in the Test Selector display. See the Circuit Testing charts for a listing of the test numbers, test items, test types, system tested, and displayed values.

(3) To see the output value, depress the A/C or Recirc button. The values displayed will represent the output from the AZC control module.

(4) To enter the actuator test, depress the A/C or Recirc button. The Test Selector display will blink, indicating you are in the actuator test mode. Manual tests are those in which you will have to depress and hold the A/C or Recirc button to control the output. Automatic tests are those in which you will have to depress the A/C or Recirc button once to generate the output.

BLOWER MOTOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

For circuit descriptions and diagrams, refer to 8W-42 - Air Conditioning/Heater in Group 8W - Wiring Diagrams. Possible causes of an inoperative blower motor include:

- Faulty fuse
- Faulty blower motor circuit wiring or wire harness connections
- Faulty blower motor resistor (if the vehicle is so equipped)
- Faulty blower motor power module (if the vehicle is so equipped)
- Faulty blower motor switch
- Faulty heater-A/C mode control switch
- Faulty blower motor.

Possible causes of the blower motor not operating in all speeds include:

- Faulty fuse
- Faulty blower motor switch
- Faulty blower motor resistor (if the vehicle is so equipped)
- Faulty blower motor controller (power module) (if the vehicle is so equipped)
- Faulty AZC module (if the vehicle is so equipped)
- Faulty blower motor circuit wiring or wire harness connections.

VIBRATION

Possible causes of blower motor vibration include:

- Improper blower motor mounting
- Improper blower wheel mounting
- Blower wheel out of balance or bent
- Blower motor faulty.

NOISE

To verify that the blower is the source of the noise, unplug the blower motor wire harness connector and operate the heater-A/C system. If the noise goes away, possible causes include:

- Foreign material in the heater-A/C housing
- Improper blower motor mounting
- Improper blower wheel mounting
- Blower motor faulty.

BLOWER MOTOR RESISTOR

For circuit descriptions and diagrams, refer to 8W-42 - Air Conditioning/Heater in Group 8W - Wiring Diagrams.

DIAGNOSIS AND TESTING (Continued)

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Unplug the wire harness connector from the blower motor resistor.

(3) Check for continuity between each of the blower motor switch input terminals of the resistor and the resistor output terminal. In each case there should be continuity. If OK, repair the wire harness circuits between the blower motor switch and the blower motor resistor or blower motor as required. If not OK, replace the faulty blower motor resistor.

BLOWER MOTOR SWITCH

For circuit descriptions and diagrams, refer to 8W-42 - Air Conditioning/Heater in Group 8W - Wiring Diagrams.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Check for battery voltage at the fuse in the Power Distribution Center (PDC). If OK, go to Step 2. If not OK, repair the shorted circuit or component as required and replace the faulty fuse.

(2) Turn the ignition switch to the Off position. Disconnect and isolate the battery negative cable. Remove the heater-A/C control from the instrument panel. Check for continuity between the ground circuit cavity of the heater-A/C control wire harness connector and a good ground. There should be continuity. If OK, go to Step 3. If not OK, repair the open circuit to ground as required.

(3) With the heater-A/C control wire harness connector unplugged, place the heater-A/C mode control switch knob in any position except the Off position. Check for continuity between the ground circuit terminal and each of the blower motor driver circuit terminals of the heater-A/C control as you move the blower motor switch knob to each of the four speed positions. There should be continuity at each driver circuit terminal in only one blower motor switch speed position. If OK, test and repair the blower driver circuits between the heater-A/C control connector and the blower motor resistor as required. If not OK, replace the faulty heater-A/C control unit.

COMPRESSOR

When investigating an air conditioning related noise, you must first know the conditions under which the noise occurs. These conditions include: weather, vehicle speed, transmission in gear or neutral, engine speed, engine temperature, and any other special conditions. Noises that develop during air conditioning operation can often be misleading. For example: What sounds like a failed front bearing or connecting rod, may be caused by loose bolts, nuts, mounting brackets, or a loose compressor clutch assembly.

Drive belts are speed sensitive. At different engine speeds and depending upon belt tension, belts can develop noises that are mistaken for a compressor noise. Improper belt tension can cause a misleading noise when the compressor clutch is engaged, which may not occur when the compressor clutch is disengaged. Check the serpentine drive belt condition and tension as described in Group 7 - Cooling System before beginning this procedure.

(1) Select a quiet area for testing. Duplicate the complaint conditions as much as possible. Switch the compressor on and off several times to clearly identify the compressor noise. Listen to the compressor while the clutch is engaged and disengaged. Probe the compressor with an engine stethoscope or a long screwdriver with the handle held to your ear to better localize the source of the noise.

(2) Loosen all of the compressor mounting hardware and retighten. Tighten the compressor clutch mounting nut. Be certain that the clutch coil is mounted securely to the compressor, and that the clutch plate and pulley are properly aligned and have the correct air gap. See Compressor and Compressor Clutch in the Removal and Installation section of this group for the procedures.

(3) To duplicate a high-ambient temperature condition (high head pressure), restrict the air flow through the condenser. Install a manifold gauge set to be certain that the discharge pressure does not exceed 2760 kPa (400 psi).

(4) Check the refrigerant system plumbing for incorrect routing, rubbing or interference, which can cause unusual noises. Also check the refrigerant lines for kinks or sharp bends that will restrict refrigerant flow, which can cause noises. See Suction and Discharge Line in the Removal and Installation section of this group for more information.

DIAGNOSIS AND TESTING (Continued)

(5) If the noise is from opening and closing of the high pressure relief valve, evacuate and recharge the refrigerant system. See Refrigerant System Evacuate and Refrigerant System Charge in the Service Procedures section of this group. If the high pressure relief valve still does not seat properly, replace the compressor.

(6) If the noise is from liquid slugging on the suction line, replace the accumulator. See Accumulator in the Removal and Installation section of this group for the procedures. Check the refrigerant oil level and the refrigerant system charge. See Refrigerant Oil Level and Refrigerant System Charge in the Service Procedures section of this group. If the liquid slugging condition continues following accumulator replacement, replace the compressor.

(7) If the noise continues, replace the compressor and repeat Step 1.

COMPRESSOR CLUTCH COIL

For circuit descriptions and diagrams, refer to 8W-42 - Air Conditioning/Heater in Group 8W - Wiring Diagrams. The battery must be fully-charged before performing the following tests. Refer to Group 8A - Battery for more information.

(1) Connect an ammeter (0 to 10 ampere scale) in series with the clutch coil terminal. Use a voltmeter (0 to 20 volt scale) with clip-type leads for measuring the voltage across the battery and the compressor clutch coil.

(2) With the heater-A/C mode control switch in any A/C mode, the heater-A/C control A/C switch in the On position, and the blower motor switch in the lowest speed position, start the engine and run it at normal idle.

(3) The compressor clutch coil voltage should read within two volts of the battery voltage. If there is voltage at the clutch coil, but the reading is not within two volts of the battery voltage, test the clutch coil feed circuit for excessive voltage drop and repair as required. If there is no voltage reading at the clutch coil, use a DRBIII® scan tool and the proper Diagnostic Procedures manual for testing of the compressor clutch circuit. The following components must be checked and repaired as required before you can complete testing of the clutch coil:

- Fuses in the junction block and the Power Distribution Center (PDC)
- Heater-A/C mode control switch
- Compressor clutch relay
- High pressure switch
- Low pressure switch
- Powertrain Control Module (PCM)

(4) The compressor clutch coil is acceptable if the current draw measured at the clutch coil is 2.0 to 3.9 amperes with the electrical system voltage at 11.5 to 12.5 volts. This should only be checked with the work area temperature at 21° C (70° F). If system voltage is more than 12.5 volts, add electrical loads by turning on electrical accessories until the system voltage drops below 12.5 volts.

(a) If the clutch coil current reading is four amperes or more, the coil is shorted and should be replaced.

(b) If the clutch coil current reading is zero, the coil is open and should be replaced.

COMPRESSOR CLUTCH RELAY

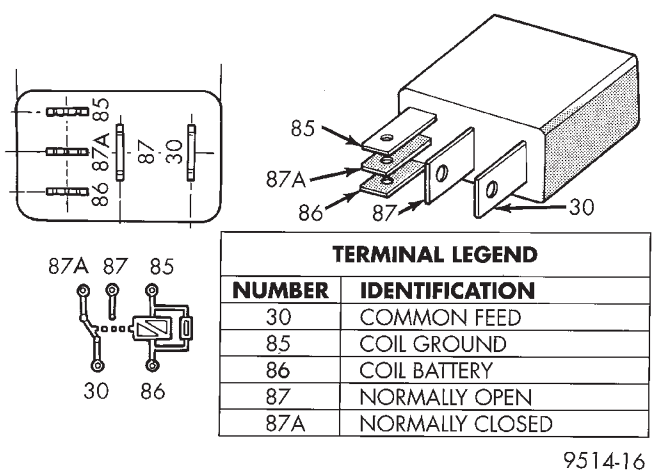
For circuit descriptions and diagrams, refer to 8W-42 - Air Conditioning/Heater in Group 8W - Wiring Diagrams.

The compressor clutch relay (Fig. 13) is located in the Power Distribution Center (PDC). Refer to the PDC label for relay identification and location. Remove the relay from the 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 Step 2. If not OK, replace the faulty relay.

(2) Resistance between terminals 85 and 86 (electromagnet) should be 75 ± 5 ohms. If OK, go to Step 3. If not OK, replace the faulty relay.

(3) Connect a battery 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, see the Relay Circuit Test procedure in this group. If not OK, replace the faulty relay.



TERMINAL LEGEND

NUMBER	IDENTIFICATION
30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

Fig. 13 Compressor Clutch Relay

RELAY CIRCUIT TEST

For circuit descriptions and diagrams, refer to 8W-42 - Air Conditioning/Heater in Group 8W - Wiring Diagrams.

(1) The relay common feed terminal cavity (30) is connected to fused battery feed. There should be battery voltage at the cavity for relay terminal 30 at all

DIAGNOSIS AND TESTING (Continued)

times. If OK, go to Step 2. If not OK, repair the open circuit to the fuse in the PDC as required.

(2) The relay normally closed terminal (87A) is not used in this application. Go to Step 3.

(3) The relay normally open terminal cavity (87) is connected to the compressor clutch coil. There should be continuity between this cavity and the A/C compressor clutch relay output circuit cavity of the compressor clutch coil wire harness connector. If OK, go to Step 4. If not OK, repair the open circuit as required.

(4) The relay coil battery terminal (86) is connected to the fused ignition switch output (run/start) circuit. There should be battery voltage at the cavity for relay terminal 86 with the ignition switch in the On position. If OK, go to Step 5. If not OK, repair the open circuit to the fuse in the junction block as required.

(5) The coil ground terminal cavity (85) is switched to ground through the Powertrain Control Module (PCM). There should be continuity between this cavity and the A/C compressor clutch relay control circuit cavity of the PCM wire harness connector C (gray) at all times. If not OK, repair the open circuit as required.

HEATER PERFORMANCE

Before performing the following tests, refer to Group 7 - Cooling System for the procedures to check the radiator coolant level, serpentine drive belt tension, radiator air flow and the radiator fan operation. Also be certain that the accessory vacuum supply line is connected at the engine intake manifold.

MAXIMUM HEATER OUTPUT

Engine coolant is delivered to the heater core through two heater hoses. With the engine idling at normal operating temperature, set the temperature control knob in the full hot position, the mode control switch knob in the floor heat position, and the blower motor switch knob in the highest speed position. Using a test thermometer, check the temperature of the air being discharged at the heater-A/C housing floor outlets. Compare the test thermometer reading to the Temperature Reference chart.

Temperature Reference				
Ambient Air Temperature	15.5° C (60° F)	21.1° C (70° F)	26.6° C (80° F)	32.2° C (90° F)
Minimum Air Temperature at Floor Outlet	62.2° C (144° F)	63.8° C (147° F)	65.5° C (150° F)	67.2° C (153° F)

If the floor outlet air temperature is too low, refer to Group 7 - Cooling System to check the engine coolant temperature specifications. Both of the heater hoses should be hot to the touch. The coolant return heater hose should be slightly cooler than the coolant supply heater hose. If the return hose is much cooler than the supply hose, locate and repair the engine coolant flow obstruction in the cooling system. Refer to Group 7 - Cooling System for the procedures.

OBSTRUCTED COOLANT FLOW

Possible locations or causes of obstructed coolant flow:

- Pinched or kinked heater hoses.
- Improper heater hose routing.
- Plugged heater hoses or supply and return ports at the cooling system connections.
- A plugged heater core.

If proper coolant flow through the cooling system is verified, and heater outlet air temperature is still low, a mechanical problem may exist.

MECHANICAL PROBLEMS

Possible locations or causes of insufficient heat:

- An obstructed cowl air intake.
- Obstructed heater system outlets.
- A blend-air door not functioning properly.

TEMPERATURE CONTROL

If the heater outlet air temperature cannot be adjusted with the temperature control knob(s) on the heater-A/C control panel, the following could require service:

- The heater-A/C control.
- The blend-air door motor(s).
- The wire harness circuits for the heater-A/C control or the blend air door motor(s).
- The blend-air door(s).
- Improper engine coolant temperature.

HIGH PRESSURE SWITCH

Before performing diagnosis of the high pressure switch, verify that the refrigerant system has the correct refrigerant charge. See Refrigerant System Charge in the Service Procedures section of this group for more information.

For circuit descriptions and diagrams, refer to 8W-42 - Air Conditioning/Heater in Group 8W - Wiring Diagrams.

DIAGNOSIS AND TESTING (Continued)

(1) Disconnect and isolate the battery negative cable.

(2) Unplug the wire harness connector from the high pressure switch on the refrigerant system fitting.

(3) Check for continuity between the two terminals of the high pressure switch. There should be continuity. If OK, test and repair the A/C switch sense circuit as required. If not OK, replace the faulty switch.

LOW PRESSURE SWITCH

Before performing diagnosis of the low pressure switch, be certain that the switch is properly installed on the accumulator fitting. If the switch is too loose it may not open the Schrader-type valve in the accumulator fitting, which will prevent the switch from correctly monitoring the refrigerant system pressure.

Also verify that the refrigerant system has the correct refrigerant charge. See Refrigerant System Charge in this group for the procedures.

For circuit descriptions and diagrams, refer to 8W-42 - Air Conditioning/Heater in Group 8W - Wiring Diagrams.

(1) Disconnect and isolate the battery negative cable.

(2) Unplug the low pressure switch wire harness connector from the switch on the accumulator fitting.

(3) Install a jumper wire between the two cavities of the low pressure switch wire harness connector.

(4) Connect a manifold gauge set to the refrigerant system service ports. See Refrigerant System Service Equipment in this group for the procedures.

(5) Connect the battery negative cable.

(6) Place the heater-A/C mode control switch knob in any A/C position and start the engine.

(7) Check for continuity between the two terminals of the low pressure switch. There should be continuity with a suction pressure reading of 262 kPa (38 psi) or above, and no continuity with a suction pressure reading of 141 kPa (20.5 psi) or below. If OK, test and repair the A/C switch sense circuit as required. If not OK, replace the faulty switch.

REFRIGERANT SYSTEM LEAKS

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS GROUP BEFORE LEAK TESTING THE SYSTEM.

If the air conditioning system is not cooling properly, determine if the refrigerant system is fully-charged. See A/C Performance in this group for the procedures. If the refrigerant system is low or empty; a leak at a refrigerant line, connector fitting, component, or component seal is likely.

An electronic leak detector designed for R-134a refrigerant is recommended for locating and confirming refrigerant system leaks. Refer to the operating instructions supplied by the equipment manufacturer for proper care and use of this equipment.

An oily residue on or near refrigerant system lines, connector fittings, components, or component seals can indicate the general location of a possible refrigerant leak. However, the exact leak location should be confirmed with an electronic leak detector prior to component repair or replacement.

To detect a leak in the refrigerant system, perform one of the following procedures:

SYSTEM EMPTY

(1) Evacuate the refrigerant system. See Refrigerant System Evacuate in this group for the procedures.

(2) Connect and dispense 0.283 kilograms (0.625 pounds or 10 ounces) of R-134a refrigerant into the evacuated refrigerant system. See Refrigerant System Charge in this group for the procedures.

(3) Position the vehicle in a wind-free work area. This will aid in detecting small leaks.

(4) With the engine not running, use a electronic R-134a leak detector and search for leaks. Because R-134a refrigerant is heavier than air, the leak detector probe should be moved slowly along the bottom side of all refrigerant lines, connector fittings and components.

(5) To inspect the evaporator coil for leaks, insert the electronic leak detector probe into the center instrument panel outlet. Set the blower motor switch to the lowest speed position, the A/C button in the On position, and select the Recirculation Mode.

SYSTEM LOW

(1) Position the vehicle in a wind-free work area. This will aid in detecting small leaks.

(2) Bring the refrigerant system up to operating temperature and pressure. This is done by allowing the engine to run with the air conditioning system turned on for five minutes.

(3) With the engine not running, use a electronic R-134a leak detector and search for leaks. Because R-134a refrigerant is heavier than air, the leak detector probe should be moved slowly along the bottom side of all refrigerant lines, connector fittings and components.

(4) To inspect the evaporator coil for leaks, insert the electronic leak detector probe into the center instrument panel outlet. Set the blower motor switch to the lowest speed position, the A/C button in the On position, and select the Recirculation Mode.

SERVICE PROCEDURES

REFRIGERANT OIL LEVEL

When an air conditioning system is assembled at the factory, all components except the compressor are refrigerant oil free. After the refrigerant system has been charged and operated, the refrigerant oil in the compressor is dispersed throughout the refrigerant system. The accumulator, evaporator, condenser, and compressor will each retain a significant amount of the needed refrigerant oil.

It is important to have the correct amount of oil in the refrigerant system. This ensures 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 air conditioning system.

It will not be necessary to check the oil level in the compressor or to add oil, unless there has been an oil loss. An oil loss may occur due to a rupture or leak from a refrigerant line, a connector fitting, a component, or a component seal. If a leak occurs, add 30 milliliters (1 fluid ounce) of refrigerant oil to the refrigerant system after the repair has been made. Refrigerant oil loss will be evident at the leak point by the presence of a wet, shiny surface around the leak.

Refrigerant oil must be added when a accumulator, evaporator coil, or condenser are replaced. See the Refrigerant Oil Capacities chart. When a compressor is replaced, the refrigerant oil must be drained from the old compressor and measured. Drain all of the refrigerant oil from the new compressor, then fill the new compressor with the same amount of refrigerant oil that was drained out of the old compressor.

Refrigerant Oil Capacities		
Component	ml	fl oz
A/C System	220	7.44
Accumulator	120	4
Condenser	30	1
Evaporator	60	2
Compressor	drain and measure the oil from the old compressor - see text.	

REFRIGERANT RECOVERY

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE GENERAL INFORMATION SECTION NEAR THE FRONT OF THIS GROUP BEFORE RECOVERING REFRIGERANT.

A R-134a refrigerant recovery/recycling/charging station that meets SAE Standard J2210 must be used to recover the refrigerant from an R-134a refrigerant system. Refer to the operating instructions supplied by the equipment manufacturer for the proper care and use of this equipment.

REFRIGERANT SYSTEM CHARGE

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS GROUP BEFORE CHARGING THE REFRIGERANT SYSTEM.

After the refrigerant system has been tested for leaks and evacuated, a refrigerant charge can be injected into the system. See Refrigerant Charge Capacity for the proper amount of the refrigerant charge.

A R-134a refrigerant recovery/recycling/charging station that meets SAE Standard J2210 must be used to charge the refrigerant system with R-134a refrigerant. Refer to the operating instructions supplied by the equipment manufacturer for proper care and use of this equipment.

REFRIGERANT CHARGE CAPACITY

The R-134a refrigerant system charge capacity for this vehicle is 0.737 kilograms (1.625 pounds/26 ounces).

PARTIAL CHARGE METHOD

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS GROUP BEFORE CHARGING THE REFRIGERANT SYSTEM.

The partial charge method is used to add a partial charge to a refrigerant system that is low on refrigerant. To perform this procedure the evaporator inlet and outlet tube temperatures are measured. The temperature difference is measured with a temperature meter with one or two clamp-on thermocouple probes. The difference between the evaporator inlet and outlet tube temperatures will determine the amount of refrigerant needed.

Before adding a partial refrigerant charge, check for refrigerant system leaks. See Refrigerant System Leaks in this group for the procedures. If a leak is found, make the necessary repairs before attempting a full or partial refrigerant charge.

(1) Attach a manifold gauge set to the refrigerant system service ports.

(2) Attach the two clamp-on thermocouple probes to the inlet and outlet tubes of the evaporator coil.

a. If a single thermocouple probe is used, attach the probe to the evaporator inlet tube just before the collar of the refrigerant line connector fitting. The

SERVICE PROCEDURES (Continued)

probe must make contact with the bottom surface of the evaporator inlet tube.

b. If dual thermocouple probes are used, attach probe 1 to the evaporator inlet tube, and probe 2 to the evaporator outlet tube. Attach both probes to the evaporator tubes just before the collar of the refrigerant line connector fittings. The probes must make contact with the bottom surfaces of the evaporator inlet and outlet tubes.

(3) Open all of the windows or doors of the passenger compartment.

(4) Set the A/C button on the heater-A/C controls to the on position, the temperature control knob in the full cool position, select the Recirculation Mode, and place the blower motor switch in the highest speed position.

(5) Start the engine and hold the engine idle speed at 1,000 rpm. Allow the engine to warm up to normal operating temperature.

(6) The compressor clutch may cycle, depending upon ambient temperature, humidity, and the refrigerant system charge level. If the compressor clutch cycles, unplug the wire harness connector from the low pressure cycling clutch switch on the accumulator. Install a jumper wire between the two cavities of the switch wire harness connector.

(7) Hold the engine idle speed at 1,000 rpm.

(8) Allow three to five minutes for the refrigerant system to stabilize, then record the temperatures of the evaporator inlet and outlet tubes.

a. If a single probe is used, record the temperature of the evaporator inlet tube. Then remove the probe from the inlet tube and attach it to the evaporator outlet tube just before the collar of the refrigerant line connector fitting. The probe must make contact with the bottom surface of the evaporator outlet tube. Allow the thermocouple and meter time to stabilize, then record the temperature of the evaporator outlet tube. Subtract the inlet tube temperature reading from the outlet tube temperature reading.

b. If dual probes are used, record the temperatures of both the evaporator inlet and outlet tubes. Then subtract the inlet tube temperature reading from the outlet tube temperature reading.

(9) See the Low Charge Determination chart to determine the additional charge required. If the measured temperature differential is higher than 22° C to 26° C (40° F to 47° F), add 0.4 kilograms (14 ounces) of refrigerant.

(10) Allow three to five minutes for the refrigerant system to stabilize, then take a second set of thermocouple measurements. Record the temperature difference and see the Low Charge Determination chart (Fig. 14) to determine if an additional charge is required.

(11) Record the compressor discharge pressure. If the reading is higher than the pressure shown in the Compressor Discharge Pressure chart (Fig. 15), the system could be overcharged. If the reading is equal to, or lower, than the pressure shown in the chart, continue with this procedure.

(12) **EXAMPLE:** The ambient temperature is 21° C (70° F). The evaporator inlet tube temperature is 12° C (54° F) and the evaporator outlet tube temperature is 10° C (50° F). Subtract the inlet tube temperature from the outlet tube temperature. The difference is -2° C (-4° F). With a -2° C (-4° F) temperature differential at 21° C (70° F) ambient temperature, the system is fully charged.

(13) Add enough refrigerant to bring the refrigerant system up to a full charge.

(14) Remove the jumper wire from the low pressure cycling clutch switch wire harness connector and plug the connector back into the switch.

REFRIGERANT SYSTEM EVACUATE

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE GENERAL INFORMATION SECTION NEAR THE FRONT OF THIS GROUP BEFORE EVACUATING THE SYSTEM.

If the refrigerant system has been open to the atmosphere, it must be evacuated before the system can be charged. If moisture and air enters the system and becomes mixed with the refrigerant, the compressor head pressure will rise above acceptable operating levels. This will reduce the performance of the air conditioner and damage the compressor. Evacuating the refrigerant system will remove the air and boil the moisture out of the system at near room temperature. To evacuate the refrigerant system, use the following procedure:

(1) Connect a R-134a refrigerant recovery/recycling/charging station that meets SAE Standard J2210 and a manifold gauge set to the refrigerant system of the vehicle.

(2) Open the low and high side valves and start the charging station vacuum pump. When the suction gauge reads 88 kPa (26 in. Hg.) vacuum or greater, close all of the valves and turn off the vacuum pump.

(a) If the refrigerant system fails to reach the specified vacuum, the system has a leak that must be corrected. See Refrigerant System Leaks in the Diagnosis and Testing section of this group for the procedures.

(b) If the refrigerant system maintains the specified vacuum for five minutes, restart the vacuum pump, open the suction and discharge valves and evacuate the system for an additional ten minutes.

SERVICE PROCEDURES (Continued)

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

Fig. 14 Low Charge Determination

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

Fig. 15 Compressor Discharge Pressure

(3) Close all of the valves, and turn off the charging station vacuum pump.

(4) The refrigerant system is now ready to be charged with R-134a refrigerant. See Refrigerant System Charge in the Service Procedures section of this group.

REMOVAL AND INSTALLATION

ACCUMULATOR

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS GROUP BEFORE PERFORMING THE FOLLOWING OPERATION.

REMOVAL AND INSTALLATION (Continued)

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Recover the refrigerant from the refrigerant system. See Refrigerant Recovery in this group for the procedures.

(3) Disconnect the low pressure switch. Located next to the fresh air inlet tube.

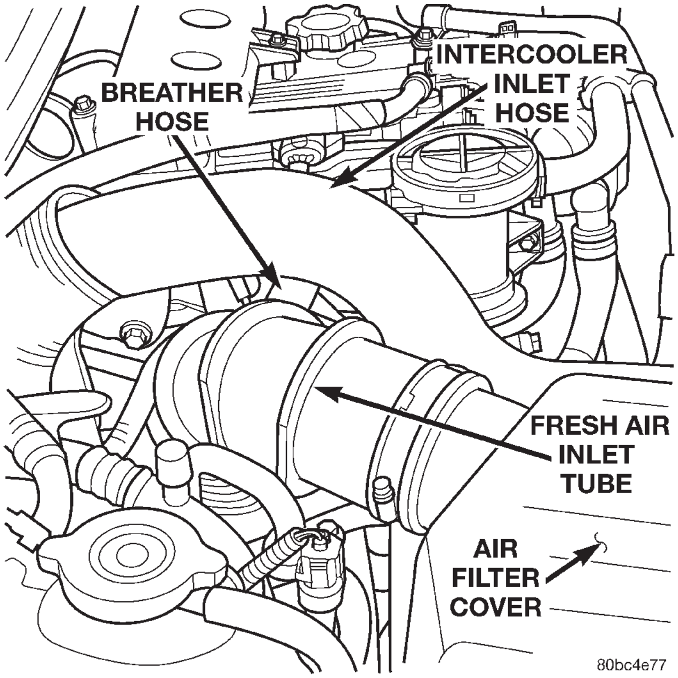


Fig. 16 Accumulator Position & Orientation

(4) Remove the low side refrigerant line retaining nut from the top of the accumulator. Remove the line from the accumulator.

(5) Remove the low side refrigerant line retaining nut from the bulkhead. Remove the line from the evaporator outlet tube.

(6) Cover the refrigerant line openings to prevent contamination.

(7) Loosen the accumulator retaining clamp screw until the accumulator can be removed from the vehicle.

(8) Remove the accumulator from the vehicle.

(9) Remove the low pressure switch from the accumulator for reuse.

INSTALLATION

CAUTION: If the accumulator is replaced, add 120 milliliters (4 fluid ounces) of refrigerant oil to the refrigerant system. Use only refrigerant oil of the type recommended for the compressor in the vehicle.

CAUTION: Accumulator must remain sealed from the atmosphere until it is installed in the vehicle. This will prevent moisture from collecting in the accumulator.

(1) Install the low pressure switch on the accumulator. Torque the switch to 18 N·m (159 in. lbs.).

(2) Install the accumulator in the retaining clamp. Do not tighten at this time.

(3) Install the low side refrigerant line on the evaporator coil outlet tube. Torque the retaining nut to 28 N·m (21 ft. lbs.). Be certain the sealing o-rings are well lubricated with PAG oil and free of tears.

(4) Install the low side refrigerant line on top of the accumulator. Torque the retaining nut to 28 N·m (21 ft. lbs.). Be certain the sealing o-rings are well lubricated with PAG oil and free of tears.

(5) Position the accumulator and refrigerant lines in there original position. Tighten the accumulator retaining clamp screw to 5 N·m (45 in. lbs.).

(6) Connect the low pressure switch electrical connector.

(7) Connect the negative battery cable.

(8) Evacuate and charge the refrigerant system. See Refrigerant System Service Procedures in this group for the procedure.

BLEND-AIR DOOR(S)

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Remove the heater-A/C housing from the vehicle. See Heater-A/C Housing in this group for the procedures.

(2) Place the heater-A/C housing with the tubing side down on a work bench, making allowance for leakage of fluids.

(3) Using a sharp knife, split the foam seal surrounding the panel outlet opening, at the dividing line of the upper and lower cases (Fig. 17).

(4) Place the heater-A/C housing in the upright position on the work bench.

(5) Remove the mode door actuator on the left side of the housing, controlling the mode door in the top of the case (Fig. 18) (Fig. 19).

REMOVAL AND INSTALLATION (Continued)

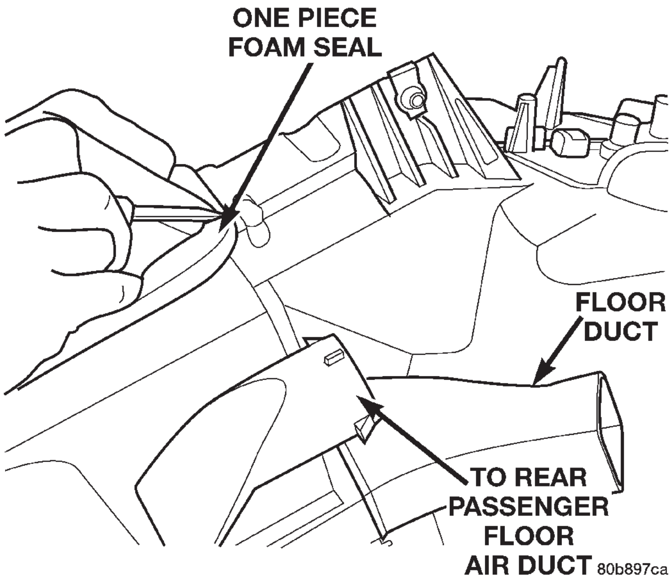


Fig. 17 Split Foam Seal at Panel Outlet

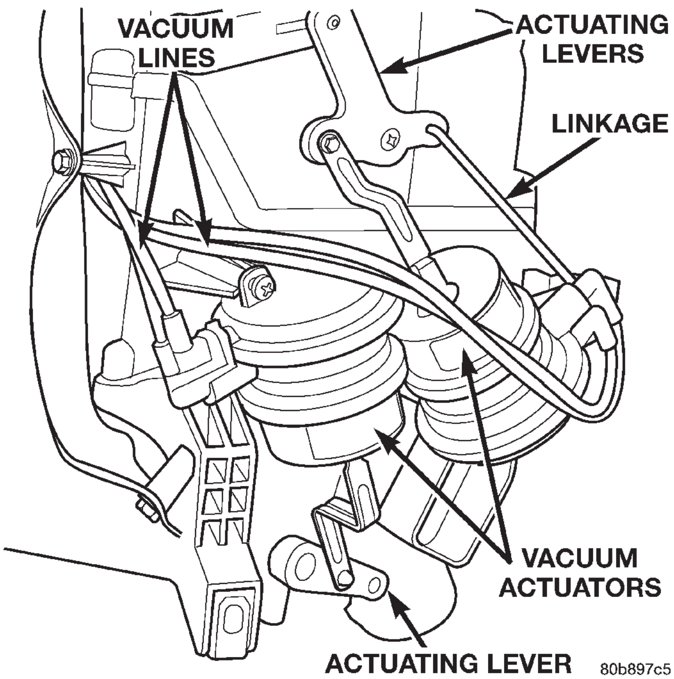


Fig. 18 Mode Door Actuators-Manual System

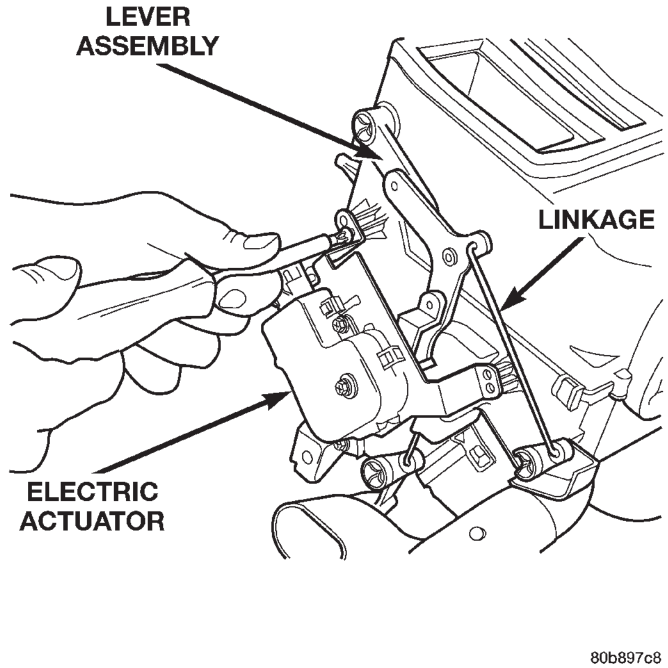


Fig. 19 Mode Door Actuator-AZC System

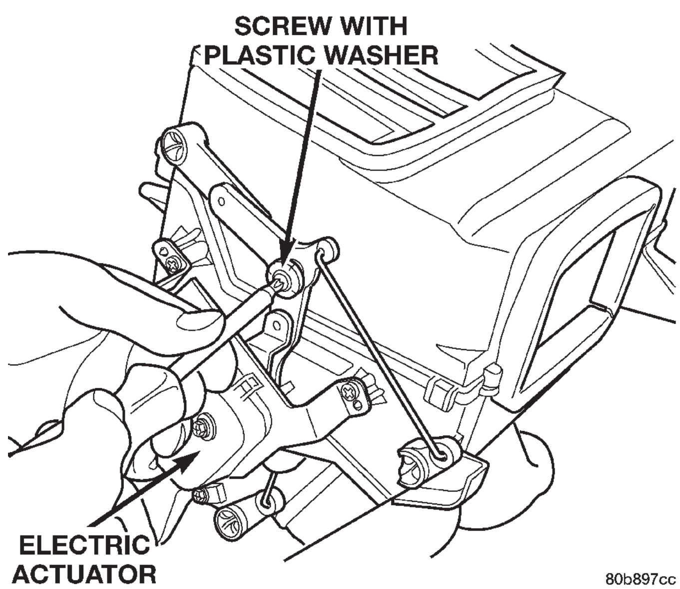


Fig. 20 Remove Screw with Plastic Washer

(6) Remove the screw with plastic washer holding the lever assembly to the upper case section, and move aside (Fig. 20).

(7) Remove the 5 clips that secure the two housing halves to each other. There are 2 on either side at the center, and 1 located at the forward end of the mode door side of the case (Fig. 21).

(8) Release the wire harness electrical connector(s) from the mounts on the lower case at the blower motor end of the unit (Fig. 22).

(9) Remove the 10 screws that secure the two housing halves to each other.

(10) Separate the top half of the heater-A/C housing from the bottom half (Fig. 23).

(11) Remove evaporator from lower case to ease access to plastic door shaft bushing.

(12) Pinch the retention tabs holding the blend-air door pivot shaft bushing to the case. The 3 plastic tabs, located on the inside of the case, are part of the shaft retainer.

(13) Remove door(s).

NOTE: The blend-air door sub-assembly is attached to the housing with 2 screws, and may be removed for service (Fig. 24).

REMOVAL AND INSTALLATION (Continued)

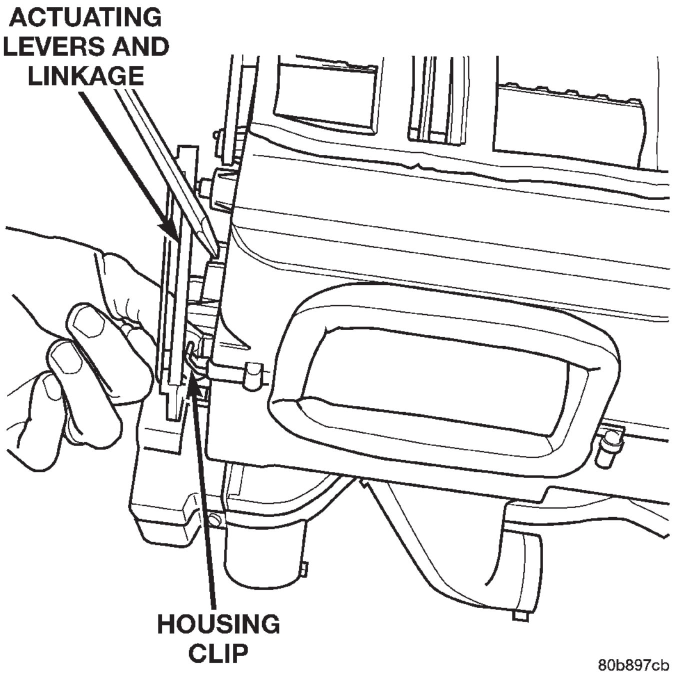


Fig. 21 HVAC Housing Clips

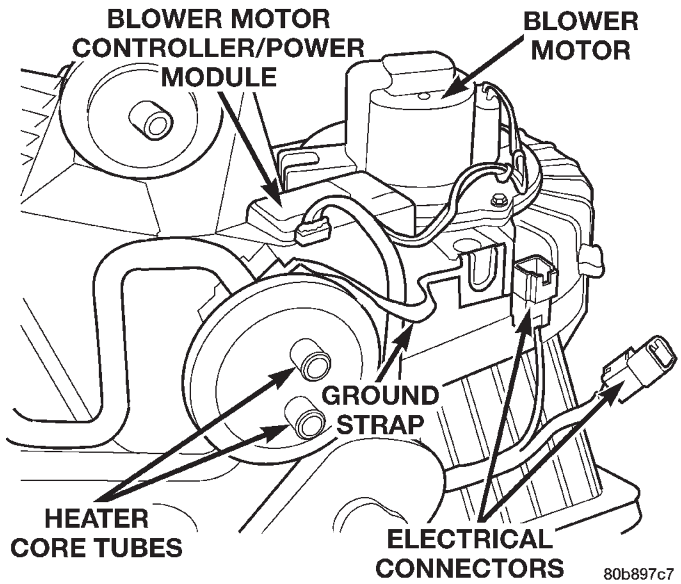


Fig. 22 Wire Harness Electrical Connector(s)

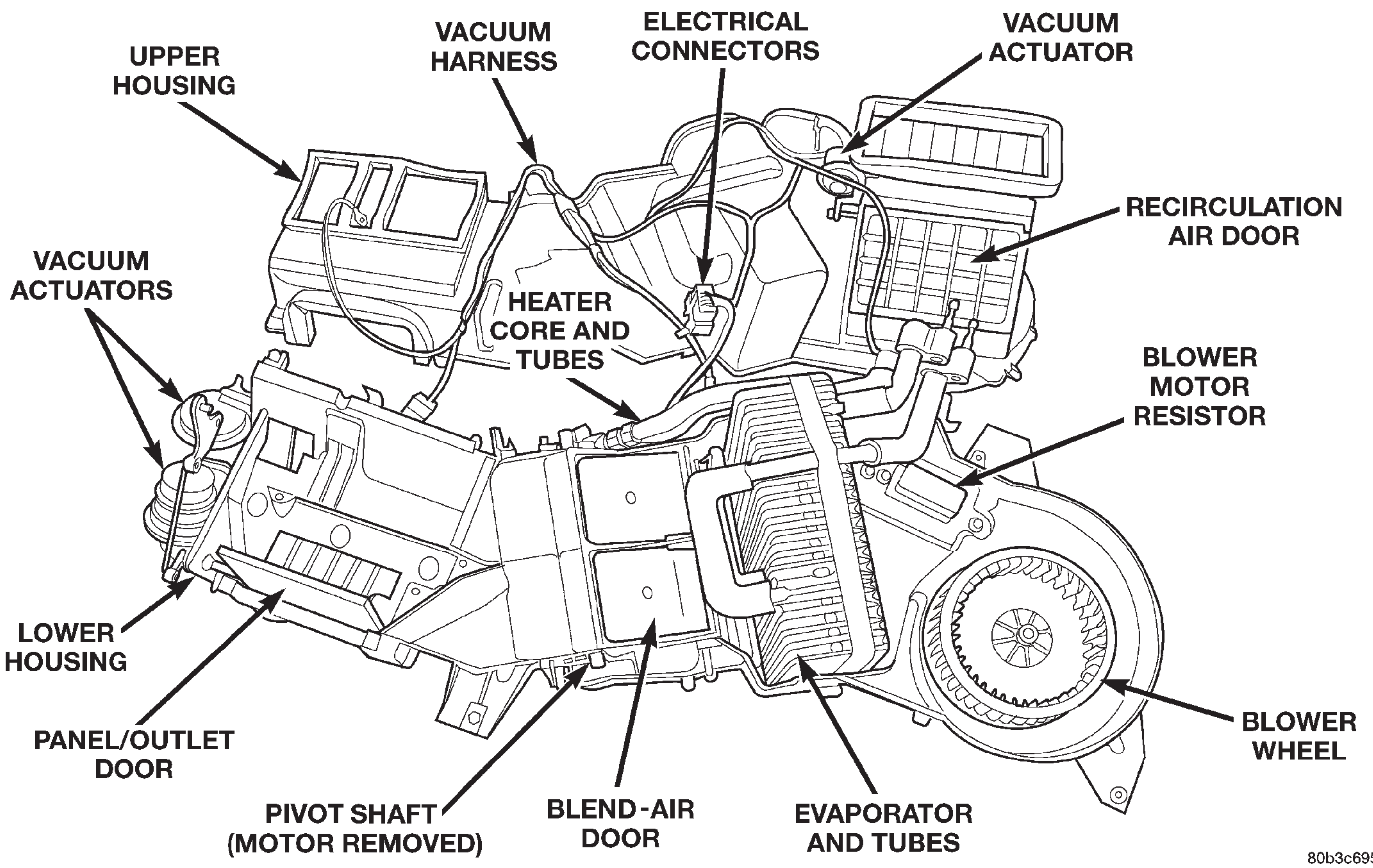


Fig. 23 Upper and Lower HVAC Housing-Separated

REMOVAL AND INSTALLATION (Continued)

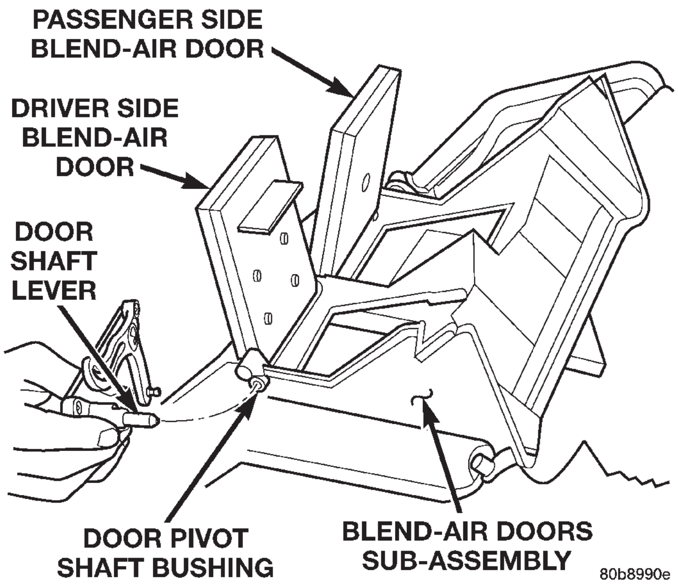


Fig. 24 Blend-Air Doors Sub-Assembly (AZC)

INSTALLATION

Reverse the removal procedures to install.

- Be certain that each of the door pivot pins align with the pivot holes in the heater-A/C housing.
- Tighten the heater-A/C housing screws to 2.2 N·m (20 in. lbs.).
- Check doors for binding after replacement, and after assembly of housing.

BLOWER MOTOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Pinch the connector retainer and unplug the blower motor wire harness from the heater-A/C blower motor (Fig. 25).

(3) Remove the three screws that secure the blower motor and blower wheel assembly to the heater-A/C housing, using either a T-25 Torx® head or flat-bladed screwdriver.

(4) Lower the blower motor and wheel from the heater-A/C housing.

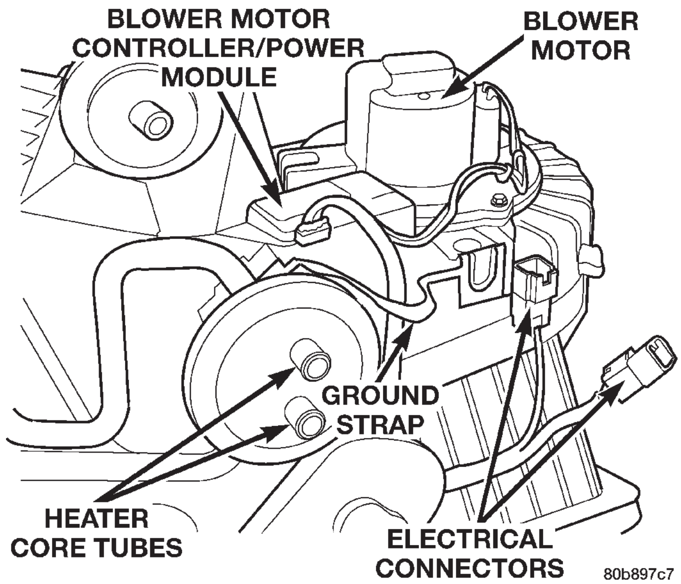


Fig. 25 Blower Motor (housing removed from vehicle)

(5) Remove the blower wheel retainer clip (Fig. 26).

(6) Remove the wheel from the blower motor shaft.

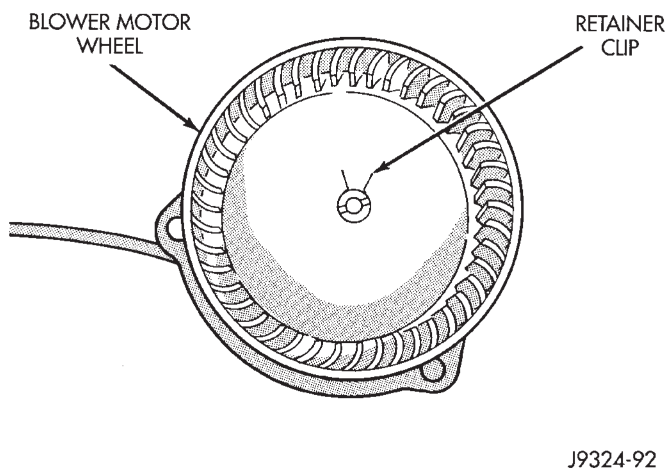


Fig. 26 Blower Motor Wheel Remove/Install

INSTALLATION

(1) Press the blower wheel hub onto the blower motor shaft. Be sure the flat on the blower motor shaft is indexed to the flat on the inside of the blower wheel hub.

(2) Install the retainer clip over the blower wheel hub.

(3) Install the blower motor in the heater-A/C housing with three mounting screws. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

(4) Plug the blower motor wire harness connector into the blower motor socket.

(5) Connect the battery negative cable.

REMOVAL AND INSTALLATION (Continued)

BLOWER MOTOR RESISTOR AND CONTROLLER

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Depress locking tab and unplug the wire harness connector from the blower motor resistor or controller (power module).

(3) Depress locking tab and unplug the resistor or controller connector from the blower motor.

(4) Remove the 2 screws that secure the blower motor resistor or controller to the heater-A/C housing.

(5) Remove the blower motor resistor or controller from the heater-A/C housing (Fig. 27).

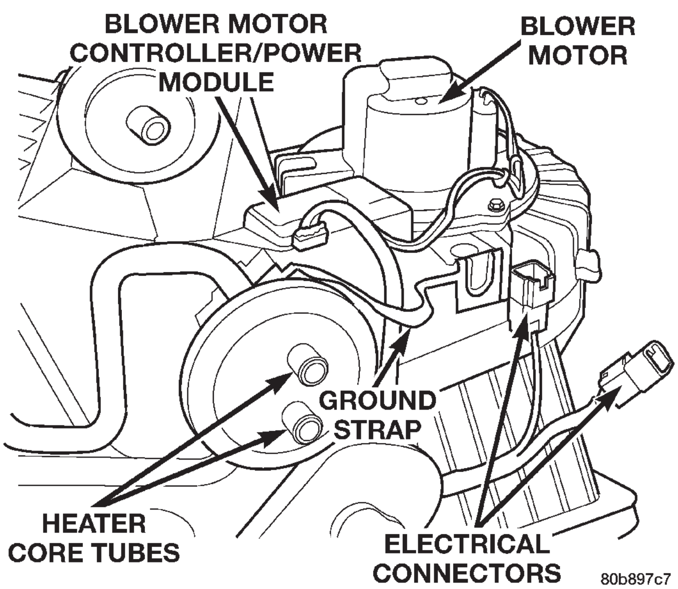


Fig. 27 Blower Motor Resistor or Controller/Power Module Remove/Install

INSTALLATION

(1) Install the blower motor resistor or controller to the heater-A/C housing. The housing is indexed to allow (controller/power module) mounting in only one position. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

(2) Plug in the wire harness connector to the blower motor resistor or controller.

(3) Plug in the connector from the blower motor resistor or controller to the blower motor.

(4) Connect the battery negative cable.

COMPRESSOR 3.1L DIESEL

REMOVAL

(1) Disconnect the negative battery cable.

(2) Recover the refrigerant from the refrigerant system. Refer to Refrigerant Recovery in the Service Procedures section of this group.

(3) Remove the accessory drive belt from the compressor clutch. Refer to Accessory Drive Belt in Group 7, Cooling System for the procedure.

(4) Raise the vehicle on the hoist.

(5) Remove the front splash shield.

(6) Remove the (2) refrigerant line retaining bolts from the compressor (Fig. 28). Remove both lines from the compressor and cover all openings.

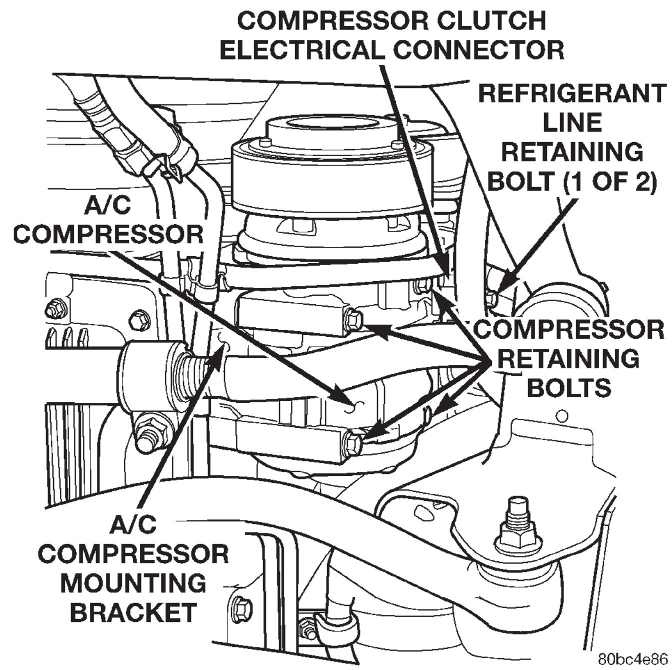


Fig. 28 Compressor Position & Orientation

(7) Disconnect the compressor electrical connector (Fig. 28).

(8) Remove the (4) compressor mounting bolts and remove the compressor from the vehicle.

INSTALLATION

CAUTION: Check the oil level before installing the new compressor. See refrigerant oil level in this group for the procedure.

(1) Lift the compressor into position and install the (4) mounting bolts (Fig. 29). Torque the bolts to 41 N·m (30 ft. lbs.).

(2) Connect the compressor electrical connector (Fig. 29).

(3) Install both refrigerant lines on the compressor (Fig. 29). Make certain the sealing 0-rings are free of tears and well lubricated with R-134a refrigerant oil. Torque the line retaining bolts to 22 N·m (200 in. lbs.).

(4) Install the front splash shield.

(5) Lower the vehicle from the hoist

(6) Install the accessory drive belt on the compressor clutch. Refer to Accessory Drive Belt in Group 7, Cooling System for the procedure.

REMOVAL AND INSTALLATION (Continued)

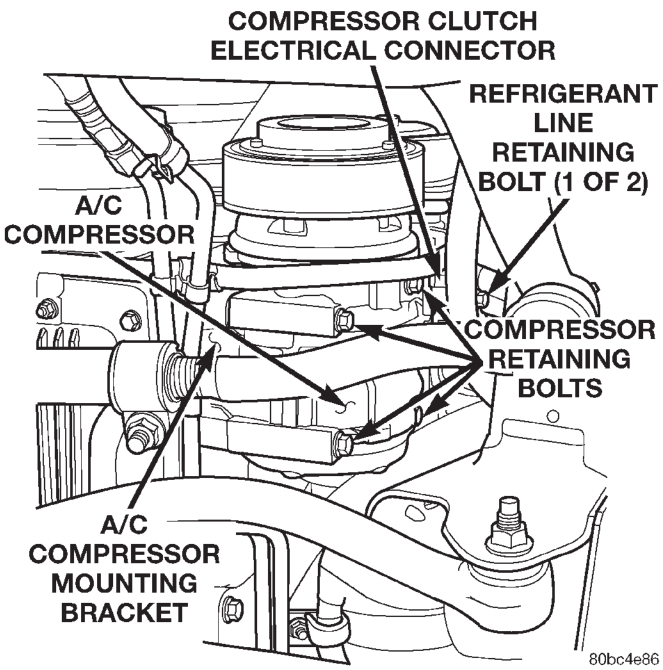


Fig. 29 Compressor Position & Orientation

(7) Charge the refrigerant system. Refer to Refrigerant System Charge under Service Procedures in this group for the procedure.

(8) Connect the negative battery cable

COMPRESSOR CLUTCH

The refrigerant system can remain fully-charged during compressor clutch, pulley, or coil replacement. The compressor clutch can be serviced in the vehicle.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the serpentine drive belt. Refer to Group 7 - Cooling System for the procedures.

(3) Remove the bolt that secures the compressor clutch to the compressor shaft (Fig. 30). A band-type oil filter wrench may be used to secure the clutch during bolt removal.

(4) Tap the clutch plate with a plastic mallet to release it from the splines on the compressor shaft. Remove the clutch plate and shim(s) from the compressor shaft (Fig. 31).

CAUTION: Do not pry between the clutch plate assembly and the pulley to remove it from the compressor shaft. Prying may damage the clutch plate assembly.

(5) Remove the external snap ring that secures the compressor clutch pulley to the nose of the compressor front housing with snap ring pliers (Special Tool C-4574) and slide the pulley assembly off of the compressor (Fig. 32).

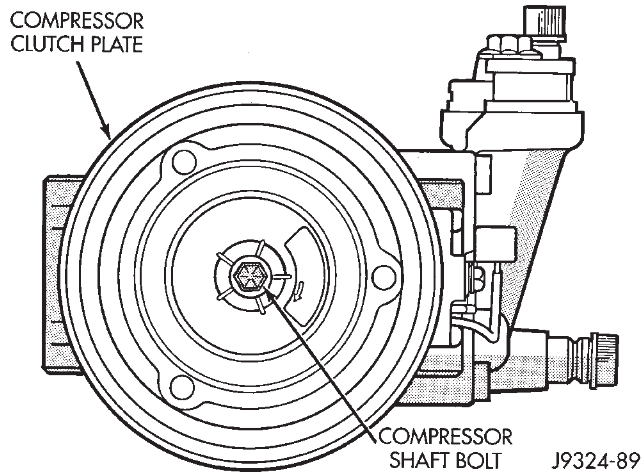


Fig. 30 Compressor Shaft Bolt

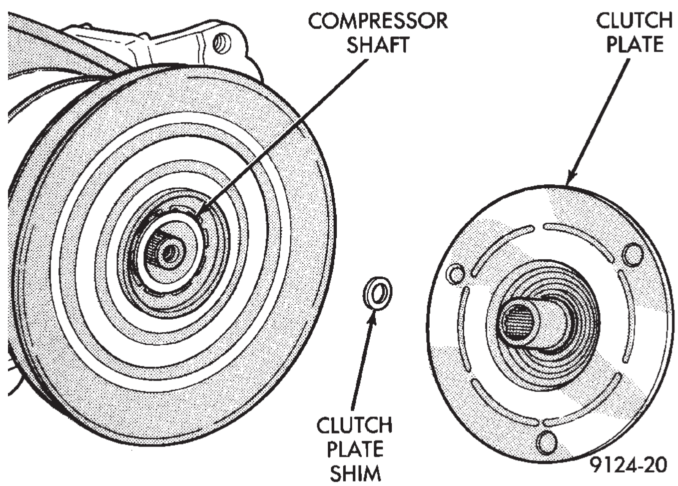


Fig. 31 Clutch Plate and Shim

(6) Remove the screw and retainer from the clutch coil lead wire harness on the compressor front housing.

(7) Remove the external snap ring that secures the compressor clutch coil to the nose of the compressor front housing with snap ring pliers and slide the coil assembly off of the compressor (Fig. 33).

INSPECTION

Examine the friction surfaces of the clutch pulley and the clutch plate for wear. The pulley and plate should be replaced if there is excessive wear or scoring.

If the friction surfaces are oily, inspect the shaft and nose area of the compressor for refrigerant oil. Remove the felt wick from around the shaft inside the nose of the compressor front housing. If the felt is saturated with refrigerant oil, the compressor shaft seal is leaking and the compressor must be replaced.

Check the clutch pulley bearing for roughness or excessive leakage of grease. Replace the bearing, if required.

REMOVAL AND INSTALLATION (Continued)

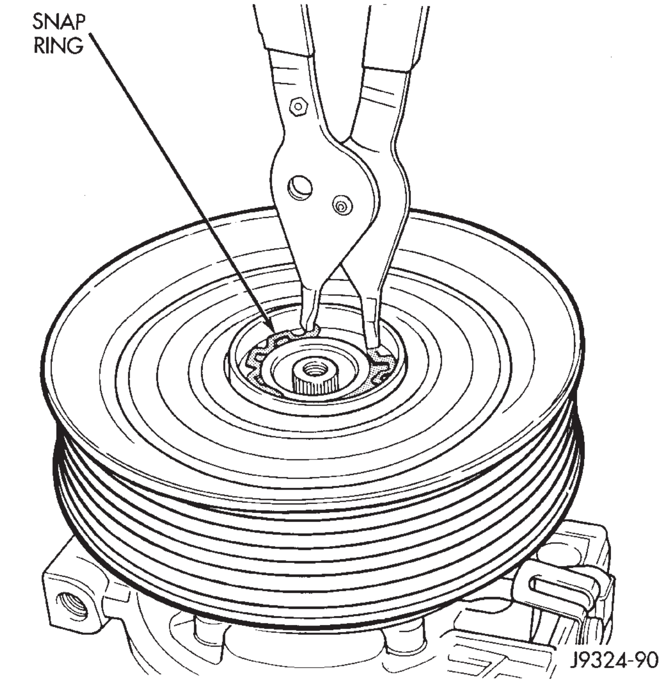


Fig. 32 Pulley Snap Ring Remove/Install

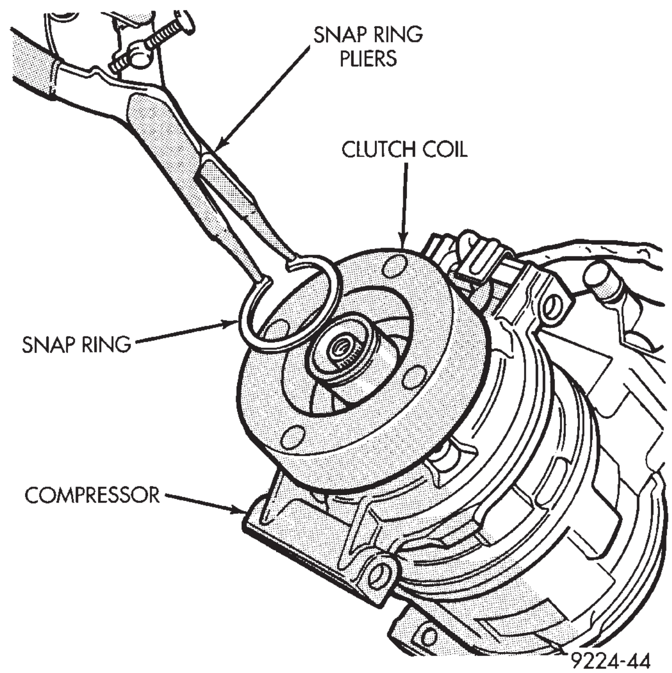


Fig. 33 Clutch Coil Snap Ring Remove/Install

INSTALLATION

(1) Align the dowel pin on the back of the clutch field coil with the hole in the compressor front housing and press the field coil into place over the nose of the compressor.

(2) Install the clutch coil lead wire harness retaining clip on the compressor front housing and tighten the retaining screw.

(3) Install the clutch field coil and snap ring with snap ring pliers (Special Tool C-4574). The bevel side of the snap ring must be facing outward. Also, both eyelets of the snap ring must be to the right or left of the pin on the compressor. Press in on the snap ring to be certain that it is properly seated in the groove.

CAUTION: If the snap ring is not fully seated in the groove it will vibrate out, resulting in a clutch failure and severe damage to the front housing of the compressor.

(4) Install the pulley assembly onto the compressor. If necessary, place a block of wood on the friction surface and tap gently with a hammer (Fig. 34).

CAUTION: Do not mar the pulley friction surface.

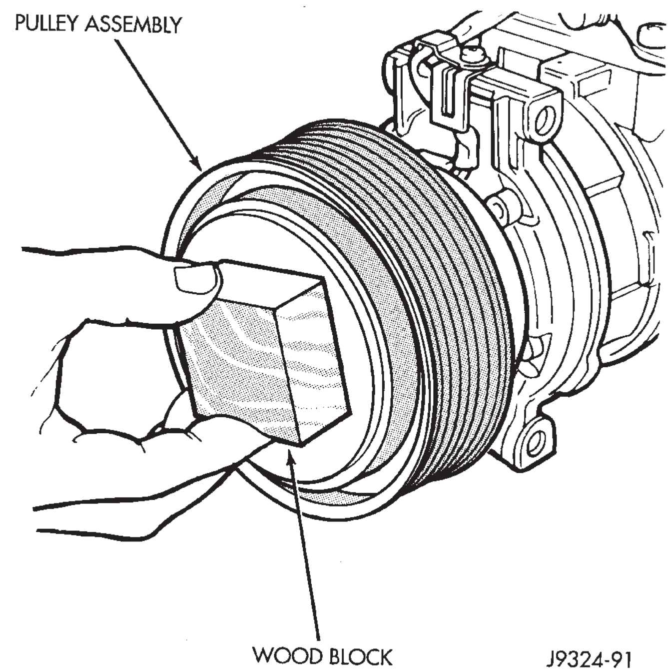


Fig. 34 Pulley Assembly Install

(5) Install the pulley assembly retaining snap ring (bevel side outward) with snap ring pliers (Special Tool C-4574). Press in on the snap ring to be certain that it is properly seated in the groove.

(6) If the original clutch 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.

(7) Install the clutch plate assembly onto the shaft.

(8) With the clutch plate assembly tight against the shim(s), measure the air gap between the clutch plate and the pulley face with feeler gauges. The air gap should be between 0.35 to 0.65 millimeter (0.014 to 0.026 inch). If the proper air gap is not obtained, add or subtract shims as needed until the desired air gap is obtained.

(9) Install the compressor shaft bolt. Tighten the bolt to 13 N·m (115 in. lbs.).

REMOVAL AND INSTALLATION (Continued)

NOTE: The shims may compress after tightening the shaft bolt. Check the air gap in four or more places to verify the air gap is still correct. Spin the pulley before performing a final check of the air gap.

(10) Reverse the remaining removal procedures to complete the installation.

CLUTCH BREAK-IN

After a new compressor clutch has been installed, cycle the compressor clutch approximately twenty times (five seconds on, then five seconds off). During this procedure, set the heater-A/C control in the Recirculation Mode, the A/C button in the on position, the blower motor switch in the highest speed position, and the engine speed at 1500 to 2000 rpm. This procedure (burnishing) will seat the opposing friction surfaces and provide a higher compressor clutch torque capability.

COMPRESSOR CLUTCH RELAY

(1) Disconnect and isolate the battery negative cable.
(2) Remove the cover from the Power Distribution Center (PDC) (Fig. 35).

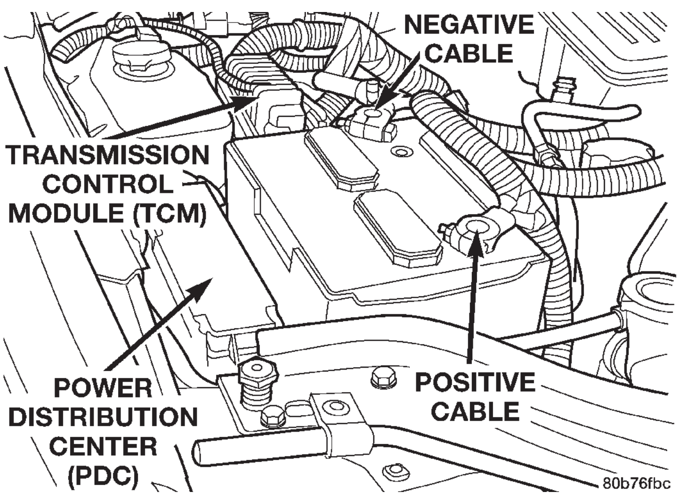


Fig. 35 Power Distribution Center (PDC)

(3) Refer to the label on the PDC for compressor clutch relay identification and location.
(4) Unplug the compressor clutch relay from the PDC.
(5) Install the compressor clutch relay by aligning the relay terminals with the cavities in the PDC and pushing the relay firmly into place.
(6) Install the PDC cover.
(7) Connect the battery negative cable.
(8) Test the relay operation.

CONDENSER

The cooling module assembly includes the radiator, charge air cooler (intercooler) and the A/C condenser. To replace any one of these components, the entire assembly must be removed from the vehicle and then disassembled. Refer to Group 7, Cooling System - Cooling Module removal and installation procedure for replacement of the A/C condenser.

DISCHARGE LINE - L.H.D. DIESEL

REMOVAL

(1) Disconnect the negative battery cable.
(2) Recover the refrigerant system. Refer to Service Procedures in this group for the procedure.
(3) Remove both headlamps from the vehicle. Refer to group 8L, Lamps for the procedure.
(4) Disconnect the A/C pressure transducer electrical connector.
(5) Remove the front fascia from the vehicle. Refer to group 13, Frame and Bumpers for the procedure.
(6) Remove the refrigerant line retaining fastener from the condenser inlet fitting. Remove the line and cap the condenser inlet tube to prevent contamination of the system.
(7) Raise the vehicle on a hoist.
(8) Remove the front splash shield.
(9) Remove the refrigerant line retaining fastener from the compressor outlet fitting. Remove the line and cap the compressor outlet opening to prevent contamination of the system.
(10) Unclip and remove the discharge line from the vehicle.

INSTALLATION

(1) Carefully position the discharge line in the vehicle.
(2) Remove the cap and install the discharge line on the compressor. Be certain the sealing o-ring is well lubricated with PAG oil and free of tears. Torque the retaining fastener to 28 N·m (21 ft. lbs.).
(3) Install the front splash shield.
(4) Lower the vehicle on the hoist.
(5) Remove the cap and install the discharge line on the condenser. Be certain the sealing o-ring is well lubricated with PAG oil and free of tears. Torque the retaining fastener to 28 N·m (21 ft. lbs.).
(6) Install the front fascia on the vehicle. Refer to group 13, Frame and Bumpers for the procedure.
(7) Install both headlamps in the vehicle. Refer to group 8L, Lamps for the procedure.
(8) Connect the A/C pressure transducer electrical connector.
(9) Evacuate and charge the refrigerant system. Refer to Service Procedures in this group for the procedures.

REMOVAL AND INSTALLATION (Continued)

(10) Check the refrigerant system for any leaks.

(11) Connect the negative battery cable.

DUCTS AND OUTLETS

DEFROSTER DUCT

(1) Remove the instrument panel assembly from the vehicle. See Instrument Panel Assembly in Group 8E - Instrument Panel Systems for the procedures.

(2) Remove the three screws that secure the defroster duct to the HVAC unit housing (Fig. 36).

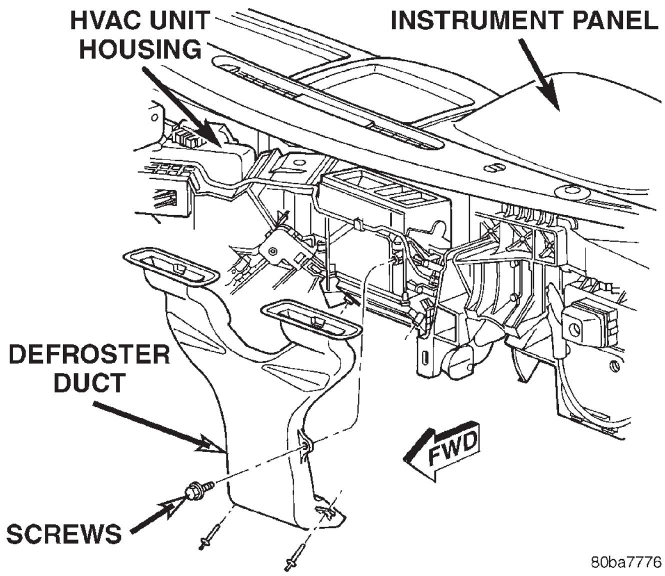


Fig. 36 HVAC Defroster Duct

(3) Remove the defroster duct from the HVAC unit housing.

(4) Reverse the removal procedures to install. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

INSTRUMENT PANEL DUCT EXTENSIONS

(1) Remove the instrument panel top pad from the vehicle. See Instrument Panel Assembly in Group 8E - Instrument Panel Systems for the procedure.

(2) Unsnap the duct extension(s) from the instrument panel structural duct assembly (Fig. 37).

(3) Remove the duct extension(s) from the instrument panel (Fig. 38).

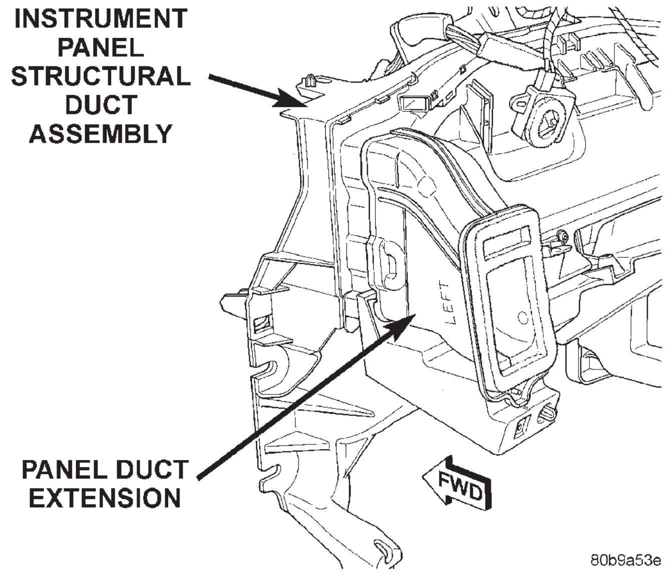


Fig. 38 Instrument Panel Duct Extension

(4) Reverse the removal procedures to install.

FLOOR DUCTS

(1) To remove the driver side floor duct from the vehicle, remove the knee blocker panel for access to attaching screw. See Instrument Panel Assembly in Group 8E - Instrument Panel Systems for the procedures.

(2) The passenger side floor duct fastener can be accessed under the right-center instrument panel.

(3) Remove the screw that secures the floor duct(s) to the HVAC housing (Fig. 39).

(4) Reverse the removal procedures to install. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

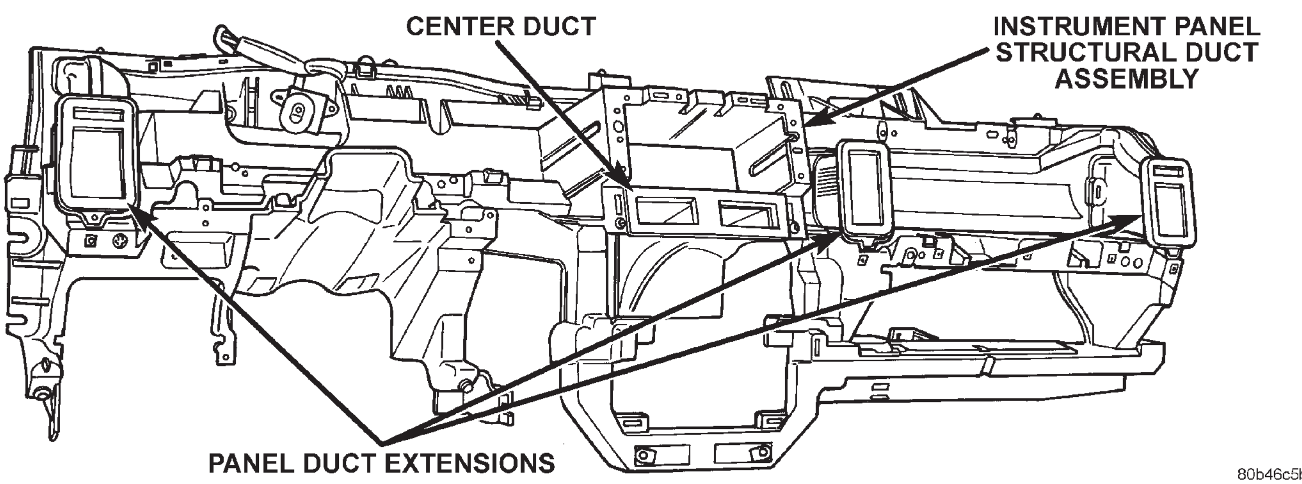


Fig. 37 Instrument Panel Structural Duct Assembly

REMOVAL AND INSTALLATION (Continued)

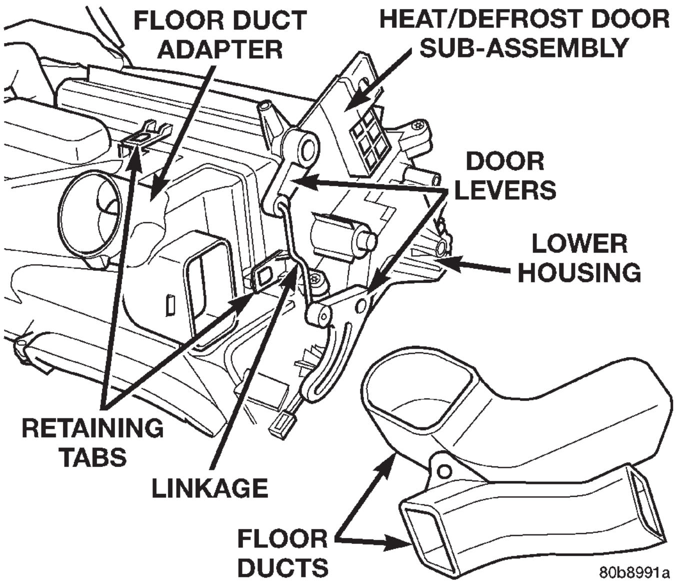


Fig. 39 Floor Ducts (Housing Removed)

REAR FLOOR DUCTS

(1) To remove the rear floor ducts from the vehicle, remove the knee blocker panels for access, and pull carpeting back.

(2) Pull the floor ducts from the HVAC housing (Fig. 40).

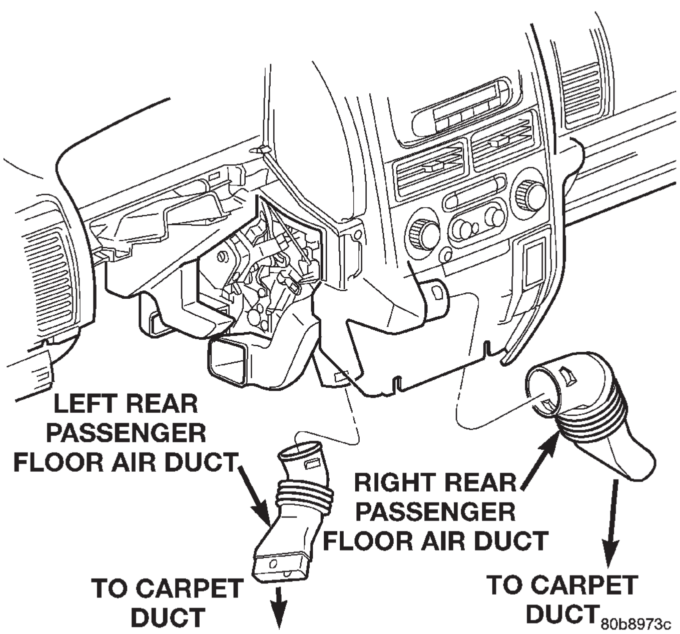


Fig. 40 Rear Floor Ducts

NOTE: The ductwork running from the HVAC housing rearward through the passenger compartment is molded into the carpeting, and must be replaced as a unit if damaged.

(3) Reverse the removal procedures to install.

PANEL OUTLETS

The driver side, and passenger side panel outlets are available for service. The center outlets are only serviced as part of the instrument cluster center bezel unit.

(1) Remove the instrument panel top pad from the instrument panel. Refer to Instrument Panel Top Pad in Group 8E - Instrument Panel Systems for the procedures.

(2) Remove the two screws that secure each outlet to the backside of the instrument panel top pad (Fig. 41).

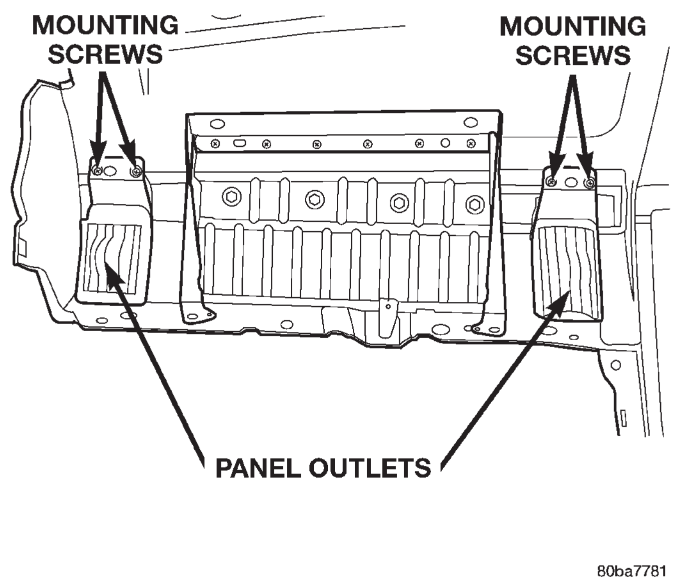


Fig. 41 Panel Outlets (Passenger Side)

(3) Remove the outlet from the top pad.

(4) Reverse the removal procedures to install. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

EVAPORATOR COIL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL AND INSTALLATION (Continued)

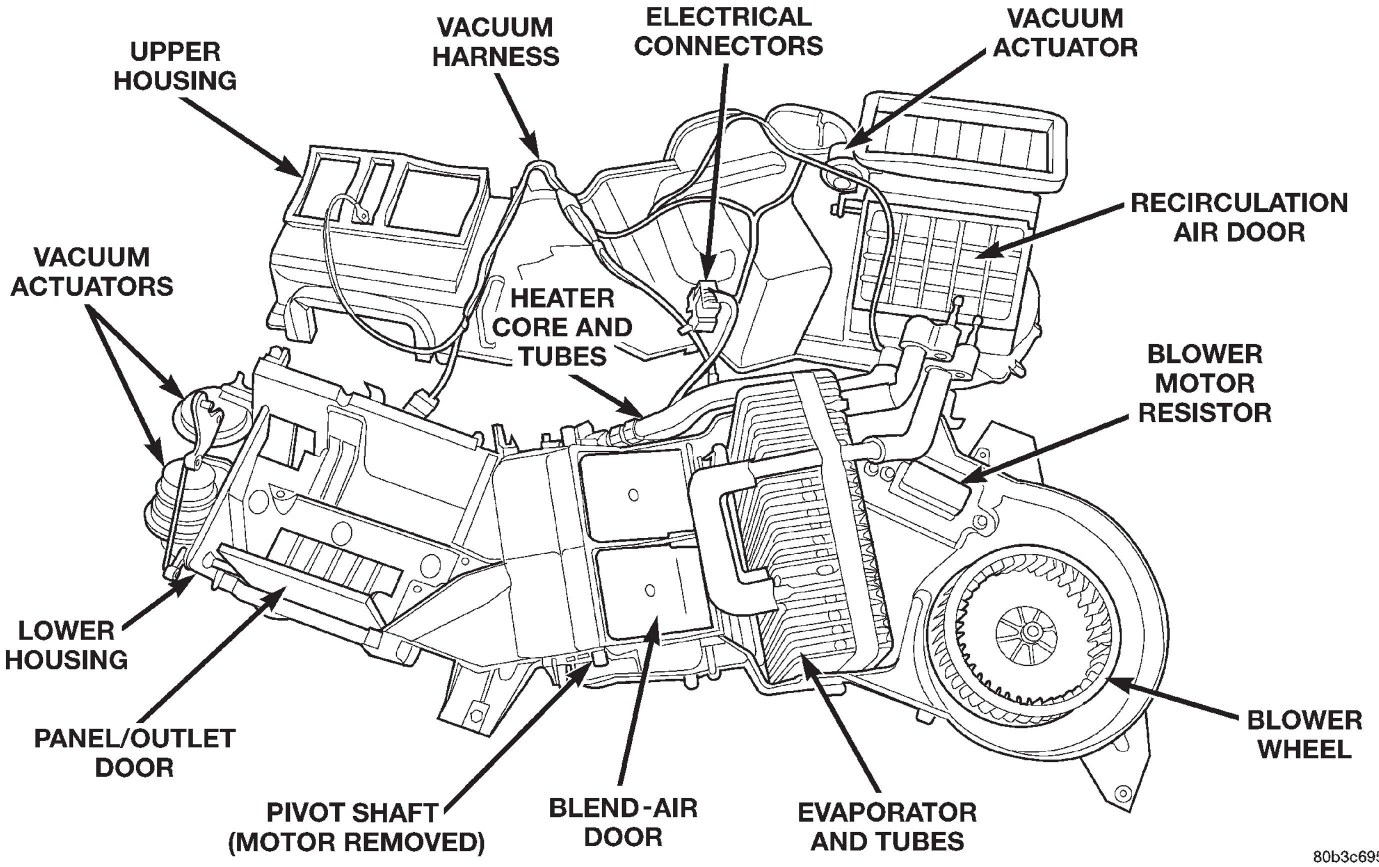


Fig. 42 HVAC Housing and Evaporator

(1) Remove the heater-A/C housing from the vehicle. See Heater-A/C Housing in this group for the procedures.

(2) Place the heater-A/C housing on the work bench.

(3) Remove the defroster duct from the heater-A/C housing.

(4) Remove the defrost door linkage from the top half the housing to enable separation of the two parts.

(5) Remove the screws and clips fastening the upper and lower heater-A/C housing halves.

(6) Remove the top half of the housing.

(7) Lift the evaporator coil unit out of the lower half of the heater-A/C housing (Fig. 42).

(8) Reverse the removal procedures to install. Be certain that the evaporator foam insulator wrap is reinstalled. Be certain that each of the door pivot pins align with the pivot holes in the heater-A/C housing. Tighten the heater-A/C housing screws to 2.2 N·m (20 in. lbs.).

NOTE: If the evaporator is replaced, add 60 milliliters (2 fluid ounces) of refrigerant oil to the refrigerant system.

HEAT/DEFROST DOOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Remove the heater-A/C housing from the vehicle. See Heater-A/C Housing in this group for the procedures.

(2) Place the heater-A/C housing with the tubing side down on a work bench, making allowance for leakage of fluids.

(3) Using a sharp knife, split the foam seal surrounding the panel outlet opening, at the dividing line of the upper and lower cases (Fig. 17).

(4) Place the heater-A/C housing in the upright position on the work bench.

REMOVAL AND INSTALLATION (Continued)

(5) Remove the mode door actuator on the left side of the housing, controlling the mode door in the top of the case (Fig. 18) (Fig. 19).

(6) Remove the screw with plastic washer holding the lever assembly to the upper case section, and move aside (Fig. 20).

(7) Remove the 5 clips that secure the two housing halves to each other. There are 2 on either side at the center, and 1 located at the forward end of the mode door side of the case (Fig. 21).

(8) Release the wire harness electrical connector(s) from the mounts on the lower case at the blower motor end of the unit (Fig. 22).

(9) Remove the 10 screws that secure the two housing halves to each other.

(10) Separate the top half of the heater-A/C housing from the bottom half (Fig. 23).

(11) Remove the evaporator, and styrofoam tray from the lower case.

(12) Place the heater-A/C housing upside down on a work bench.

(13) Unscrew and remove the 2 floor heat ducts.

(14) Unsnap and remove the duct adapter from the bottom of the heat/defrost door sub-assembly (Fig. 43).

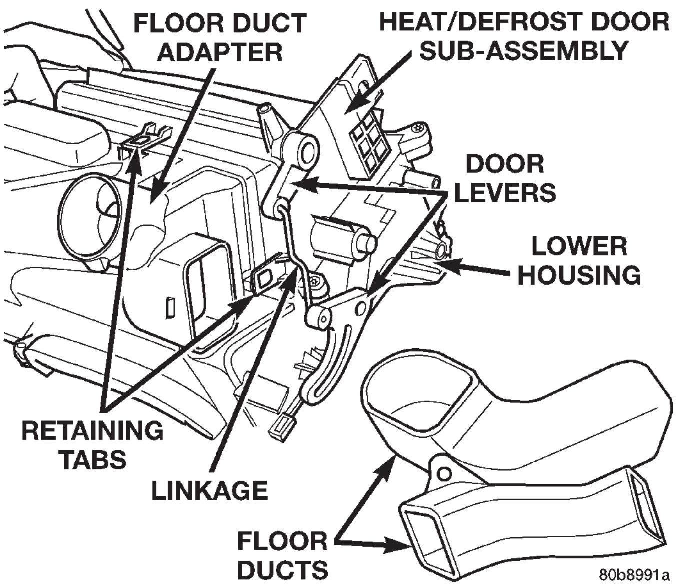


Fig. 43 Heat/Defrost Door Ducts, and Adapter

(15) Gently pry the metal linkage from the heat/defrost door lever.

Remove the heat/defrost door sub-assembly, which is attached to the housing with 4 screws (Fig. 44).

(16) Pinch the retention tabs holding the heat/defrost door pivot shaft lever to the case. The 3 plastic tabs, located on the inside of the case, are part of the shaft retainer.

(17) Remove the heat/defrost door (Fig. 45).

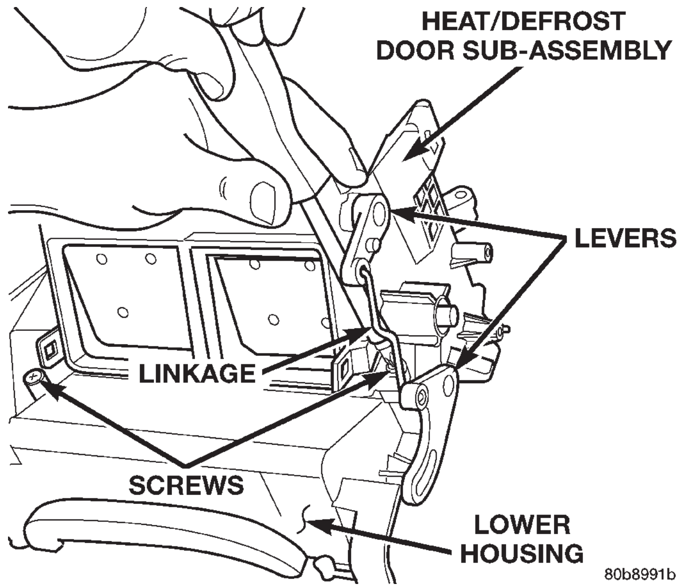


Fig. 44 Heat/Defrost Door Sub-Assembly Removal

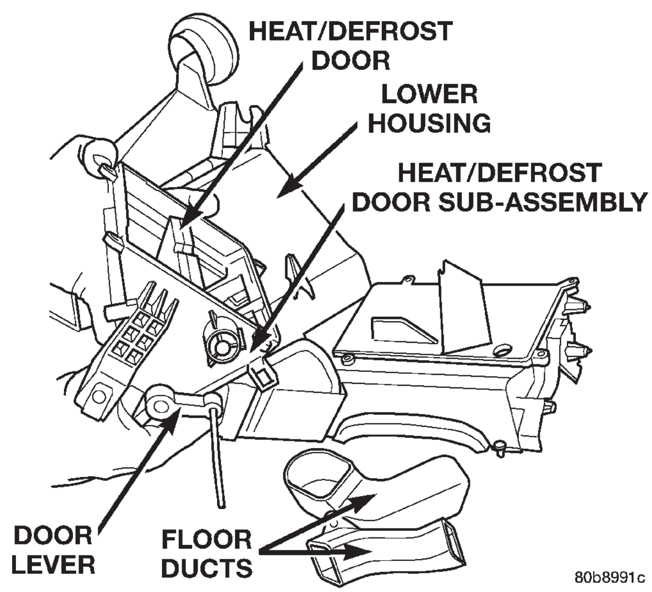


Fig. 45 Heat/Defrost Door Removal

INSTALLATION

(1) Reverse the removal procedures to install.

• Be certain that each of the door pivot pins align with the pivot holes in the heater-A/C housing.

• Tighten the heater-A/C housing screws to 2.2 N·m (20 in. lbs.).

• Check door for binding after replacement, and after assembly of housing.

REMOVAL AND INSTALLATION (Continued)

HEATER-A/C CONTROL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the inboard switch pod bezel from the instrument panel. Refer to Switch Pod Bezel in Group 8E - Instrument Panel Systems for the procedures.

(3) Remove the 4 screws that secure the heater-A/C control to the instrument panel (Fig. 46).

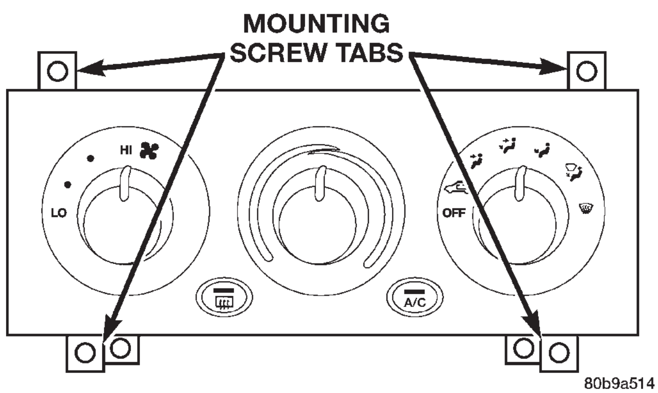


Fig. 46 Heater-A/C Control Remove/Install

(4) Pull the heater-A/C control assembly away from the instrument panel far enough to access the connections on the back of the control.

(5) Unplug the wire and/or vacuum harness connectors from the back of the heater-A/C control (Fig. 47).

(6) Remove the heater-A/C control from the instrument panel.

INSTALLATION

(1) Plug the wire harness and/or vacuum harness connectors into the back of the heater-A/C control.

(2) Position the heater-A/C control in the instrument panel and secure it with 4 screws. Tighten the screws to 2.2 N·m (20 in. lbs.).

(3) Reinstall the inboard switch pod bezel onto the instrument panel. Refer to Switch Pod Bezel in Group 8E - Instrument Panel Systems for the procedures.

(4) Connect the battery negative cable.

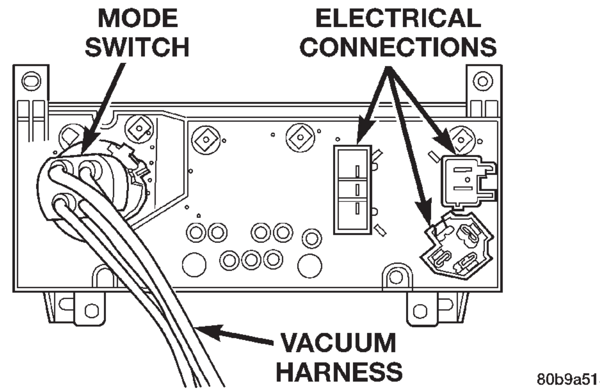


Fig. 47 Heater-A/C Control Connections

HEATER-A/C HOUSING

The heater-A/C housing assembly must be removed from the vehicle and the two halves of the housing separated for service access of the heater core, evaporator coil, blend-air door(s), and each of the various mode control doors.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument panel from the vehicle. Refer to Instrument Panel Assembly in Group 8E - Instrument Panel Systems for the procedures.

(3) Recover the refrigerant from the refrigerant system. See Refrigerant Recovery in this group for the procedures.

(4) Disconnect the liquid line refrigerant line from the evaporator inlet tube. Install plugs in, or tape over all of the opened refrigerant line fittings.

(5) Disconnect the suction line refrigerant line from the evaporator outlet tube. Install plugs in, or tape over all of the opened refrigerant line fittings.

(6) Disconnect the heater hoses from the heater core tubes. Clamp off the heater hoses to prevent loss of coolant. Refer to Group 7-Cooling System for the procedures. Install plugs in, or tape over the opened heater core tubes.

(7) If the vehicle is equipped with the manual temperature control system, unplug the heater-A/C system vacuum supply line connector from the tee fitting near the heater core tubes.

REMOVAL AND INSTALLATION (Continued)

(8) Remove the coolant reserve/overflow bottle from the passenger side inner fender shield. Refer to Group 7 - Cooling System for the procedures.

(9) Remove the Powertrain Control Module (PCM) from the passenger side dash panel in the engine compartment and set it aside. Do not unplug the PCM wire harness connectors. Refer to Group 14 - Fuel System for the procedures.

(10) Remove the nuts from the heater-A/C housing mounting studs on the engine compartment side of the dash panel (Fig. 48).

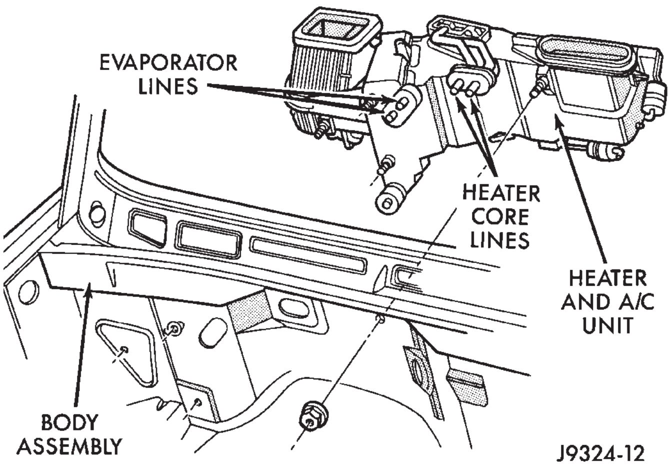


Fig. 48 Heater-A/C Housing Remove/Install

(11) Remove the rear floor heat ducts from the floor heat duct outlets (Fig. 49).

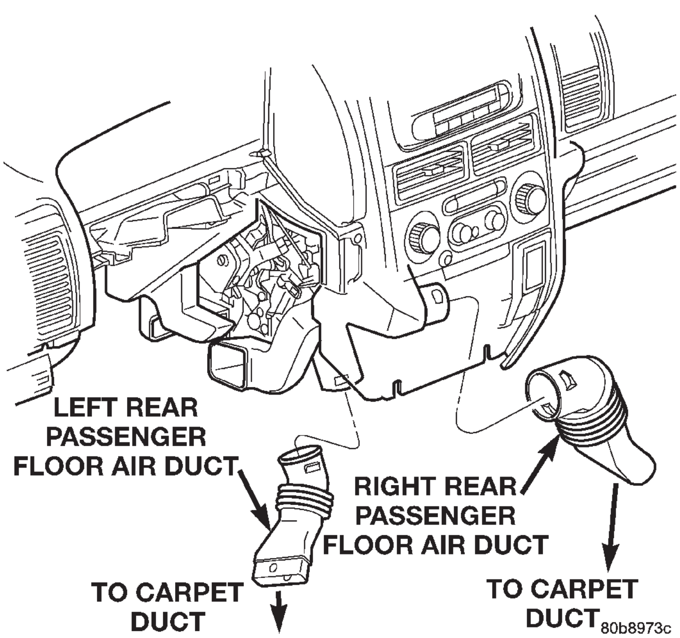


Fig. 49 Rear Floor Heat Ducts

(12) Unplug the heater-A/C housing wire harness connectors.

(13) Remove the heater-A/C housing mounting nuts from the studs on the passenger compartment side of the dash panel (Fig. 50).

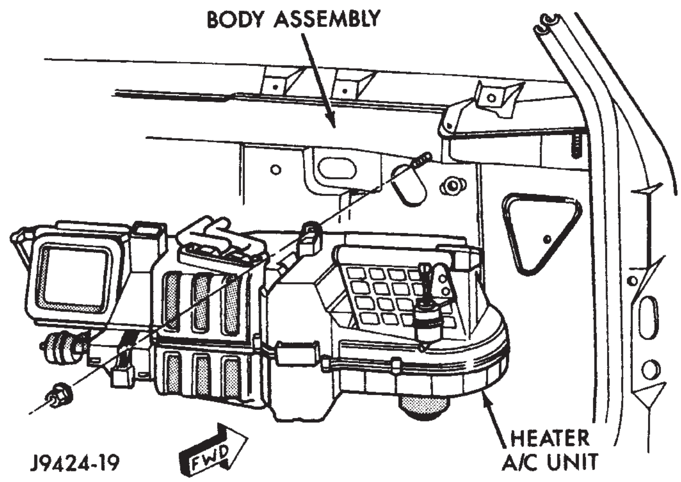


Fig. 50 Heater A/C Housing Remove/Install

(14) Remove the heater-A/C housing from the vehicle, ensuring that the interior is covered in case of loss of fluids.

INSTALLATION

(1) Position the heater-A/C housing to the dash panel. Be certain that the evaporator condensate drain tube and the housing mounting studs are inserted into their correct mounting holes.

(2) Install the heater-A/C housing mounting nuts to the studs on the passenger compartment side of the dash panel. Tighten the nuts to 4.5 N·m (40 in. lbs.).

(3) Connect the heater-A/C housing wire harness connectors.

(4) Reinstall the rear floor heat ducts to the center floor heat duct outlets.

(5) Install and tighten the nuts onto the heater-A/C housing mounting studs on the engine compartment side of the dash panel. Tighten the nuts to 7 N·m (60 in. lbs.).

(6) Reinstall the PCM to the passenger side dash panel in the engine compartment. Refer to Group 14 - Fuel System for the procedures.

(7) Reinstall the coolant reserve/overflow bottle to the passenger side inner fender shield. Refer to Group 7 - Cooling System for the procedures.

(8) If the vehicle is equipped with the manual temperature control system, connect the heater-A/C system vacuum supply line connector to the tee fitting near the heater core tubes.

(9) Unclamp/unplug the heater core hoses and tubes. Connect the heater hoses to the heater core tubes and fill the engine cooling system. Refer to Group 7-Cooling System for the procedures.

REMOVAL AND INSTALLATION (Continued)

(10) Unplug or remove the tape from the suction line and the evaporator outlet tube fittings. Connect the suction line coupler to the evaporator outlet tube. See Refrigerant Line Coupler in this group for the procedures.

(11) Unplug or remove the tape from the liquid line and the evaporator inlet tube fittings. Connect the liquid line coupler to the evaporator inlet tube. See Refrigerant Line Coupler in this group for the procedures.

(12) Evacuate the refrigerant system. See Refrigerant System Evacuate in this group for the procedures.

(13) Charge the refrigerant system. See Refrigerant System Charge in this group for the procedures.

(14) Install the instrument panel in the vehicle. Refer to Group 8E - Instrument Panel Systems for the procedures.

(15) Connect the battery negative cable.

(16) Start the engine and check for proper operation of the heating and air conditioning systems.

HEATER CORE AND TUBES

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Remove the heater-A/C housing from the vehicle. See Heater-A/C Housing in this group for the procedures.

(2) Remove the foam gasket surrounding the core tubes.

NOTE: Notice the orientation of the irregularly shaped gasket on the tubes. The gasket must be placed correctly to ensure proper sealing against the body during reinstallation.

(3) Remove the screws and retainers that secure the heater core and tubes to the heater-A/C housing (Fig. 51).

(4) Remove the mode door actuator if necessary, for clearance to remove the core.

(5) Lift the heater core straight up and out of the heater-A/C housing (Fig. 52).

(6) When replacing individual tubes, loosen and remove the round tube-to-core clamp, and pull tube from core.

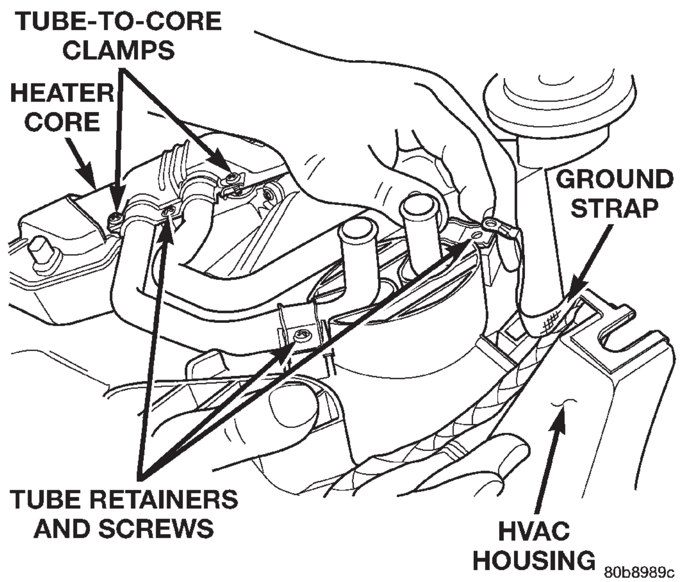


Fig. 51 Heater Core, Tubes, Retainers

INSTALLATION

(1) When installing individual tubes, insert tube into core ensuring that tube O-ring is seated in core and not pinched. Hold tube in seated position while installing the round tube-to-core clamp (Fig. 53).

NOTE: The round tube-to-heater-core clamp should be left loose enough to turn the tube in the core. Position the core in the housing, and then tighten the tube-to-heater-core clamp after orienting the tubes to the molded heater-A/C housing.

(2) Lower the heater core into the heater-A/C housing.

(3) Install the mode door actuator, if removed from housing for core removal.

(4) Position the retainers over the heater core tubes. Install and tighten the screws that secure the heater core and retainers to the heater-A/C housing. Tighten the screws to 2.2 N·m (20 in. lbs.).

NOTE: The grounding strap is to be attached to the lower heater core tube retainer.

(5) Reinstall the heater-A/C housing to the vehicle. See Heater-A/C Housing in this group for the procedures.

HIGH PRESSURE RELIEF VALVE

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS GROUP BEFORE PERFORMING THE FOLLOWING OPERATION.

REMOVAL AND INSTALLATION (Continued)

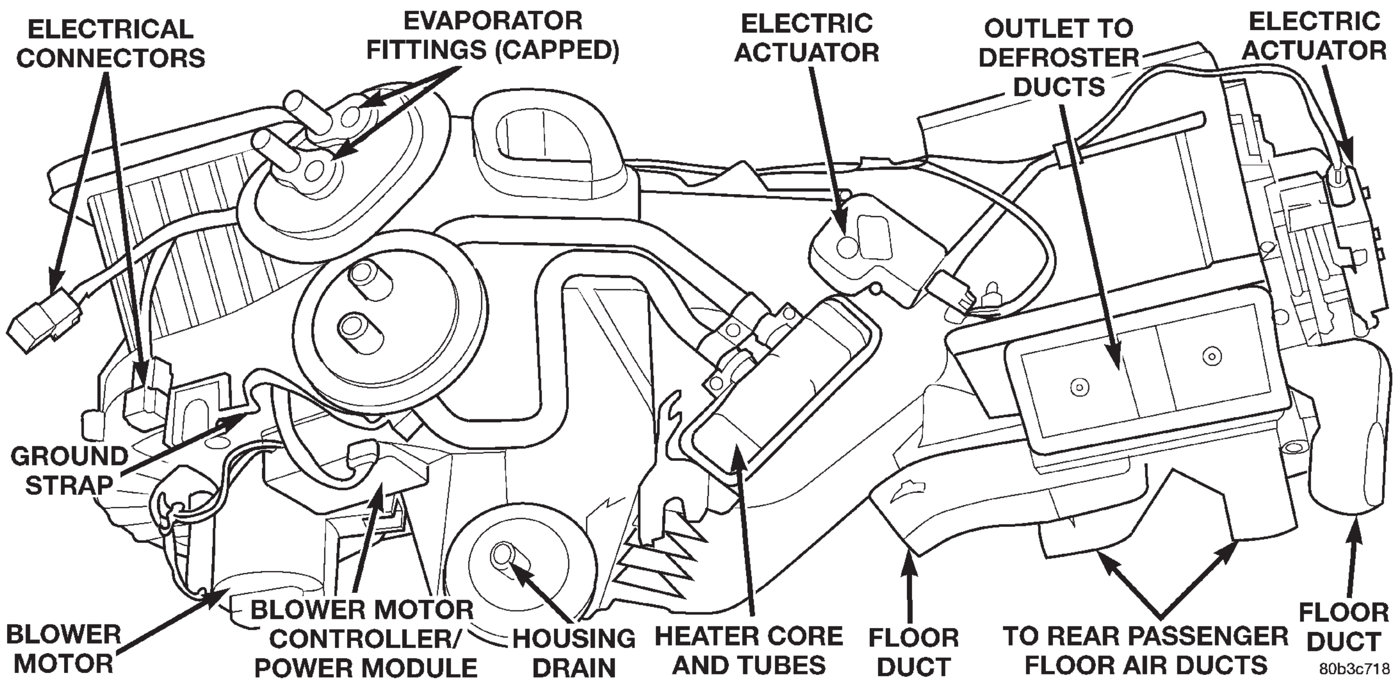


Fig. 52 Heater Core and Tubes

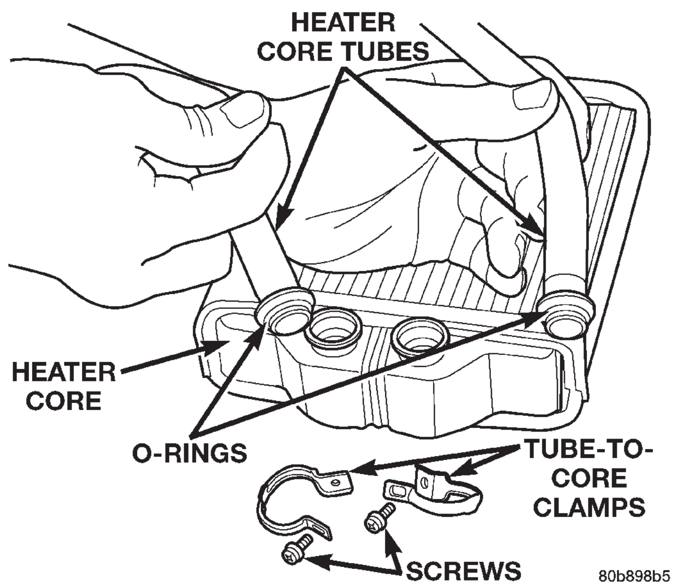


Fig. 53 Heater Core, Tubes, O-rings

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Recover the refrigerant from the refrigerant system. See Refrigerant Recovery in this group for the procedures.

(3) Turn the relief valve counterclockwise to remove it from the compressor manifold (Fig. 54). Install a plug in, or tape over the opened relief valve fitting on the compressor manifold.

INSTALLATION

(1) Remove the tape or plug from the relief valve fitting on the compressor manifold.

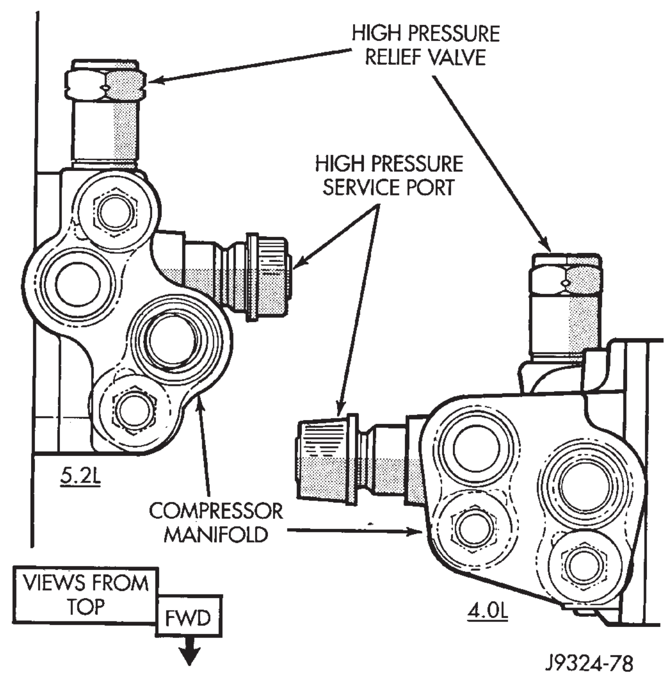


Fig. 54 High Pressure Relief Valve - Typical

(2) Install the high pressure relief valve in the compressor manifold fitting.

(3) Connect the battery negative cable.

(4) Evacuate the refrigerant system. See Refrigerant System Evacuate in this group for the procedures.

(5) Charge the refrigerant system. See Refrigerant System Charge in this group for the procedures.

REMOVAL AND INSTALLATION (Continued)

HIGH PRESSURE SWITCH

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Unplug the wire harness connector from the high pressure switch, which is mounted to a fitting on the discharge line between the compressor, near the condenser inlet (Fig. 55).

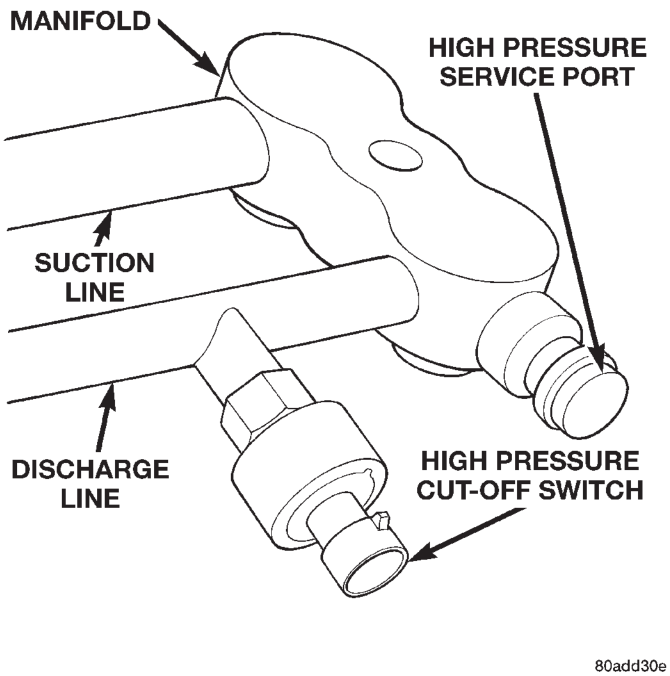


Fig. 55 High Pressure Switch - Typical

(3) Unscrew the high pressure switch from the discharge line fitting.

(4) Remove the high pressure switch from the vehicle.

(5) Remove the O-ring seal from the discharge line fitting and discard.

INSTALLATION

(1) Lubricate a new O-ring seal with clean refrigerant oil and install it on the discharge line fitting. Use only the specified O-rings as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the compressor in the vehicle.

(2) Install and tighten the high pressure switch on the discharge line fitting.

(3) Plug the wire harness connector into the high pressure switch.

(4) Connect the battery negative cable.

LIQUID LINE - L.H.D. DIESEL

REMOVAL

(1) Disconnect the negative battery cable.

(2) Recover the refrigerant system. Refer to Service Procedures in this group for the procedure.

(3) Remove the refrigerant line retaining fastener from the evaporator inlet tube fitting. Remove the line and cap the evaporator inlet tube to prevent contamination of the system.

(4) Remove the fresh air intake hose from the vehicle (Fig. 56).

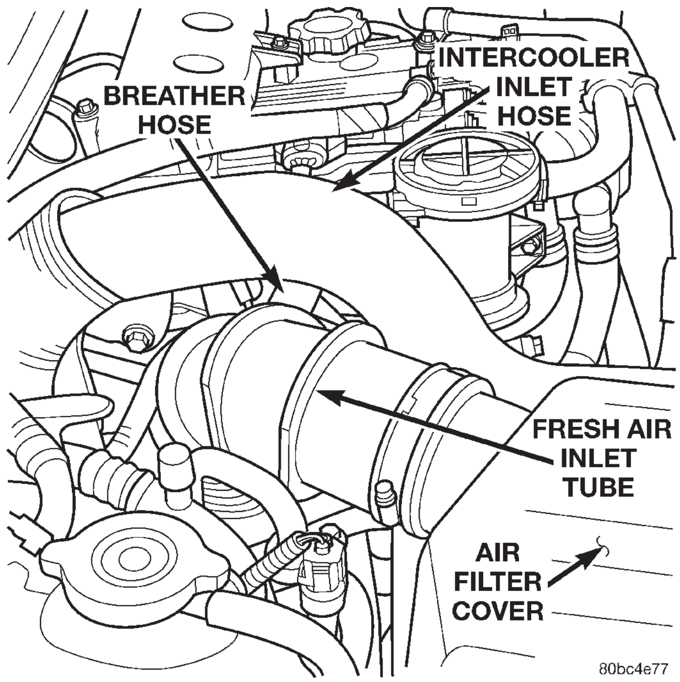


Fig. 56 Fresh Air Intake Hose

(5) Remove both headlamps from the vehicle. Refer to group 8L, Lamps for the procedure.

(6) Remove the front fascia from the vehicle. Refer to group 13, Frame and Bumpers for the procedure.

(7) Remove the refrigerant line retaining fastener from the condenser outlet tube fitting. Remove the line and cap the condenser outlet tube to prevent contamination of the system.

(8) Remove the liquid line from the vehicle.

INSTALLATION

(1) Carefully position the liquid line in the vehicle.

(2) Remove the cap and install the liquid line on the condenser. Be certain the sealing o-ring is well lubricated with PAG oil and free of tears. Torque the retaining fastener to 28 N·m (21 ft. lbs.).

(3) Install the front fascia on the vehicle. Refer to group 13, Frame and Bumpers for the procedure.

(4) Install both headlamps in the vehicle. Refer to group 8L, Lamps for the procedure.

REMOVAL AND INSTALLATION (Continued)

(5) Remove the cap and install the liquid line on the evaporator. Be certain the sealing o-ring is well lubricated with PAG oil and free of tears. Torque the retaining fastener to 28 N·m (21 ft. lbs.).

(6) Install the fresh air intake hose on the vehicle.

(7) Evacuate and charge the refrigerant system. Refer to Service Procedures in this group for the procedures.

(8) Check the refrigerant system for any leaks.

(9) Connect the negative battery cable.

LOW PRESSURE CYCLING CLUTCH SWITCH

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Unplug the wire harness connector from the low pressure cycling clutch switch on the top of the accumulator.

(3) Unscrew the low pressure cycling clutch switch from the fitting on the top of the accumulator (Fig. 57).

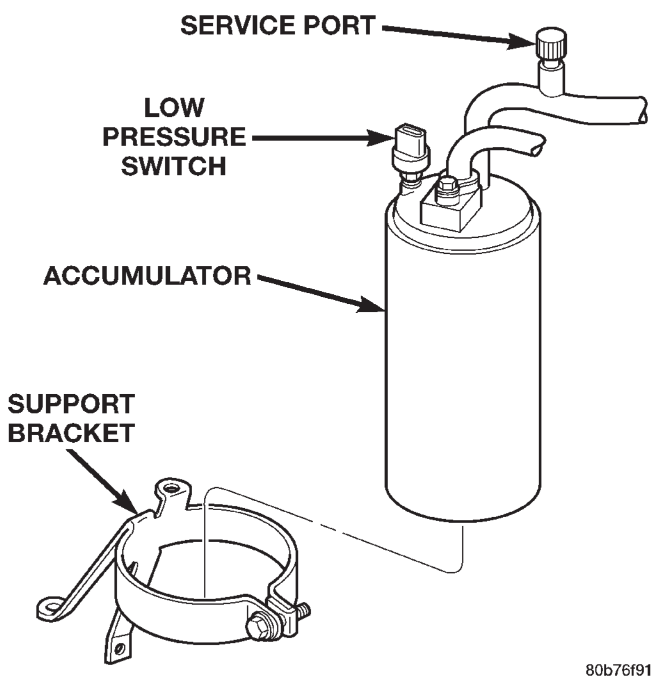


Fig. 57 Accumulator and Support Bracket

(4) Remove the O-ring seal from the accumulator fitting and discard.

INSTALLATION

(1) Lubricate a new O-ring seal with clean refrigerant oil and install it on the accumulator fitting. Use only the specified O-rings as they are made of a special material for the R-134a system. Use only refrigerant oil of the type recommended for the compressor in the vehicle.

(2) Install and tighten the low pressure cycling clutch switch on the accumulator fitting. The switch should be hand-tightened onto the accumulator fitting.

(3) Plug the wire harness connector into the low pressure cycling clutch switch.

(4) Connect the battery negative cable.

MODE DOOR ACTUATORS

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

The mode door actuators for vehicles equipped with the standard equipment manual temperature control system are vacuum controlled. The optional Automatic Zone Control (AZC) system uses electric motors to actuate all mode doors. The temperature/blend-air door for all models is actuated by an electric motor, while the AZC system uses 2 separate motors to allow the driver and passenger to select individual comfort levels. The service procedures for both types of actuators are covered by the following procedures.

HEAT/DEFROST - PANEL/DEFROST DOOR MOTOR

This motor is used only on models equipped with the optional Automatic Zone Control (AZC) system.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the two bolts that secure the center instrument panel support bracket to the left side of the floor panel transmission tunnel.

(3) Remove the two bolts that secure the center instrument panel support bracket to the instrument panel.

(4) Remove the center instrument panel support bracket from the vehicle.

(5) Unplug the wire harness connector from the heat/defrost - panel/defrost door motor (Fig. 58).

(6) Remove the three screws that secure the heat/defrost-panel/defrost door motor to the heater-A/C housing.

(7) Remove the heat/defrost-panel/defrost door motor from the heater-A/C housing.

(8) Reverse the removal procedures to install. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

HEAT/DEFROST DOOR VACUUM ACTUATOR

This actuator is used only on models equipped with the standard manual temperature control system.

REMOVAL AND INSTALLATION (Continued)

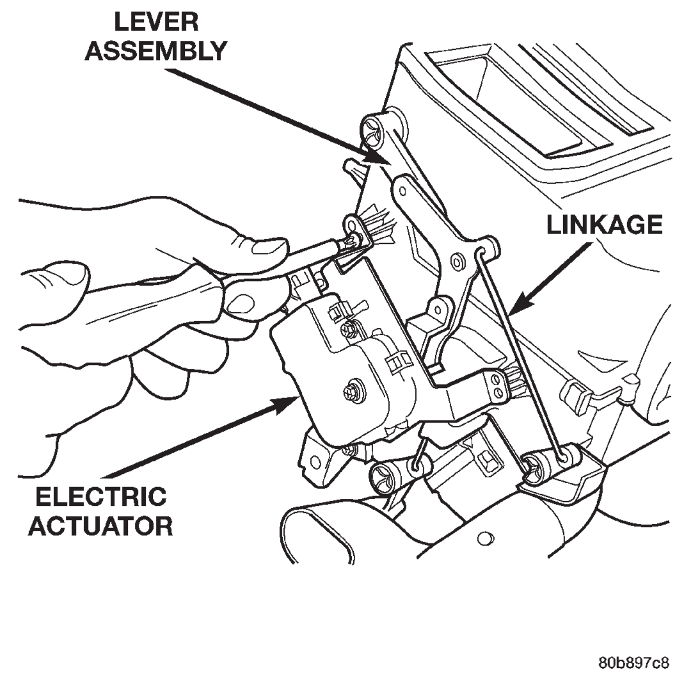


Fig. 58 Heat/Defrost - Panel/Defrost Door Motor

(1) Remove the heater-A/C housing from the vehicle. See Heater-A/C Housing in this group for the procedures.

(2) Unplug the vacuum harness connector from the heat/defrost door vacuum actuator (Fig. 59).

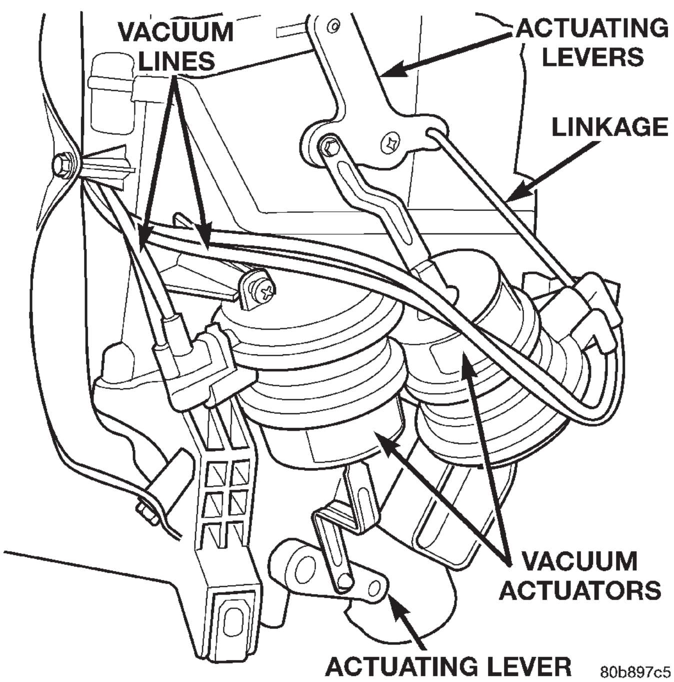


Fig. 59 Heat/Defrost Door Vacuum Actuator

(3) Disengage the heat/defrost door pivot connection from the heat/defrost door pivot pin.

(4) Remove the screws that secure the heat/defrost door vacuum actuator to the heater-A/C housing.

(5) Remove the heat/defrost door vacuum actuator from the heater-A/C housing.

(6) Reverse the removal procedures to install. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

PANEL/DEFROST DOOR VACUUM ACTUATOR

This actuator is used only on models equipped with the standard manual temperature control system.

(1) Remove the heater-A/C housing from the vehicle. See Heater-A/C Housing in this group for the procedures.

(2) Unplug the vacuum harness connector from the heat/defrost door vacuum actuator (Fig. 60).

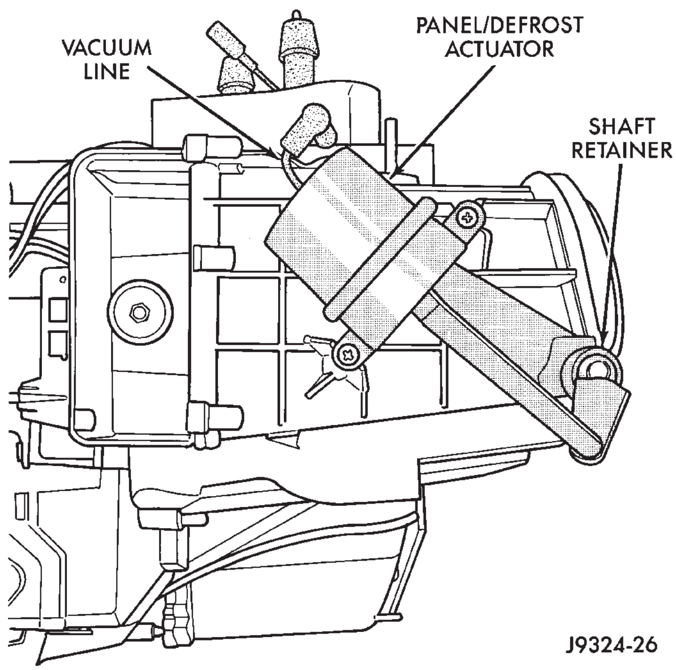


Fig. 60 Panel/Defrost Door Vacuum Actuator

(3) Disengage the panel/defrost door pivot connection from the panel/defrost door pivot pin.

(4) Remove the screws that secure the panel/defrost door vacuum actuator to the heater-A/C housing.

(5) Remove the panel/defrost door vacuum actuator from the heater-A/C housing.

(6) Reverse the removal procedures to install. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

RECIRCULATION AIR DOOR MOTOR

This motor is used only on models equipped with the optional Automatic Zone Control (AZC) system.

(1) Remove the instrument panel from the vehicle. Refer to Instrument Panel Assembly in Group 8E - Instrument Panel Systems for the procedures.

(2) Unplug the wire harness connector from the recirculation air door motor.

(3) Remove the 2 screws securing the recirculation air door housing to the HVAC unit (Fig. 61). Tilt the front of the housing up while reaching around the back releasing 2 tangs holding the rear of the housing down.

REMOVAL AND INSTALLATION (Continued)

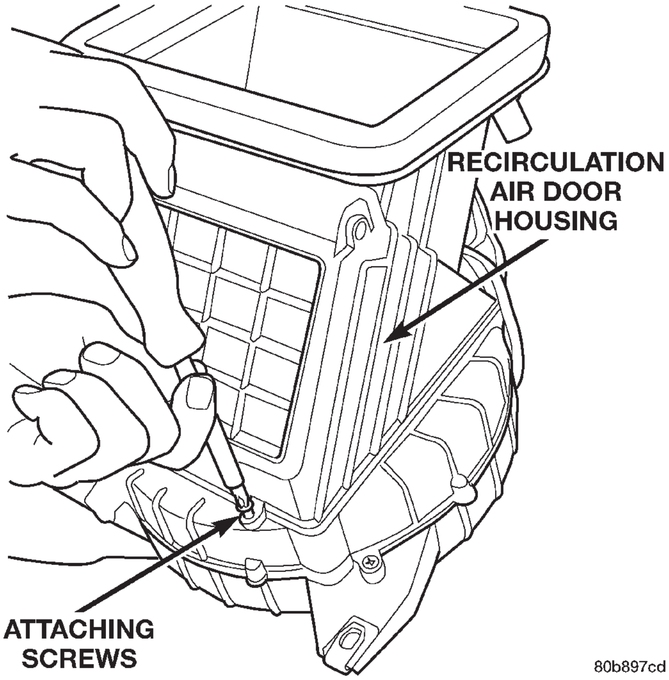


Fig. 61 Recirculation Air Door Housing

(4) Remove the recirculation air door housing from the HVAC unit.

(5) Remove the screws that secure the recirculation air door motor to the heater-A/C housing.

(6) Remove the recirculation air door motor from the heater-A/C housing.

(7) Reverse the removal procedures to install. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

RECIRCULATION AIR DOOR VACUUM ACTUATOR

This actuator is used only on models equipped with the standard manual temperature control system.

(1) Remove the instrument panel from the vehicle. Refer to Instrument Panel Assembly in Group 8E - Instrument Panel Systems for the procedures.

(2) Unplug the vacuum harness connector from the recirculation air door vacuum actuator.

(3) Disengage the recirculation air door pivot connection from the door pivot pin.

(4) Disengage the recirculation air door actuating rod from the recirculation air door lever.

(5) Remove the screws that secure the recirculation air door vacuum actuator to the heater-A/C housing.

(6) Remove the recirculation air door vacuum actuator from the heater-A/C housing.

(7) Reverse the removal procedures to install. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

BLEND-AIR DOOR MOTOR(S)

The blend-air door motor is used on all models, whether equipped with manual or Automatic Zone Control (AZC). This motor is located on the front of the heater-A/C housing to the right of the floor panel transmission tunnel, and can be removed from the passenger compartment without instrument panel or heater-A/C housing removal.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the glove box door.

Remove the lower I/P glove box door surround panel.

(3) Unplug the wire harness connector from the temperature/blend-air door motor (Fig. 62).

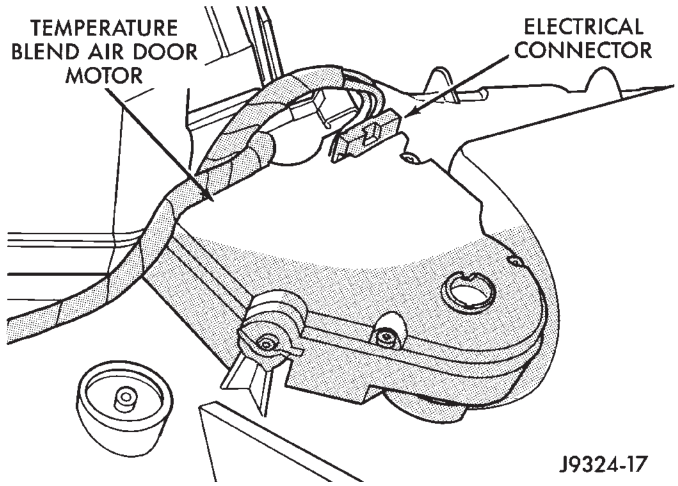


Fig. 62 Blend-Air Door Motor-Typical

(4) Remove the 2 screws that secure the blend-air door motor to the heater-A/C housing.

(5) Remove the blend-air door motor from the heater-A/C housing.

(6) Reverse the removal procedures to install. Tighten the mounting screws to 2.2 N·m (20 in. lbs.).

PANEL/DEFROST DOOR AND LEVER

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Remove the heater-A/C housing from the vehicle. See Heater-A/C Housing in this group for the procedures.

(2) Place the heater-A/C housing with the tubing side down on a work bench, making allowance for leakage of fluids.

(3) Using a sharp knife, split the foam seal surrounding the panel outlet opening, at the dividing line of the upper and lower cases (Fig. 17).

REMOVAL AND INSTALLATION (Continued)

(4) Place the heater-A/C housing in the upright position on the work bench.

(5) Remove the mode door actuator on the left side of the housing, controlling the mode door in the top of the case (Fig. 18) (Fig. 19).

(6) Remove the screw with plastic washer holding the lever assembly to the upper case section, and move aside (Fig. 20).

(7) Remove the 5 clips that secure the two housing halves to each other. There are 2 on either side at the center, and 1 located at the forward end of the mode door side of the case (Fig. 21).

(8) Release the wire harness electrical connector(s) from the mounts on the lower case at the blower motor end of the unit (Fig. 22).

(9) Remove the 10 screws that secure the two housing halves to each other.

(10) Separate the top half of the heater-A/C housing from the bottom half (Fig. 23).

(11) Pinch the retention tabs holding the panel/defrost door pivot shaft to the case. The 3 plastic tabs, located on the inside of the case, are part of the shaft retainer (Fig. 63).

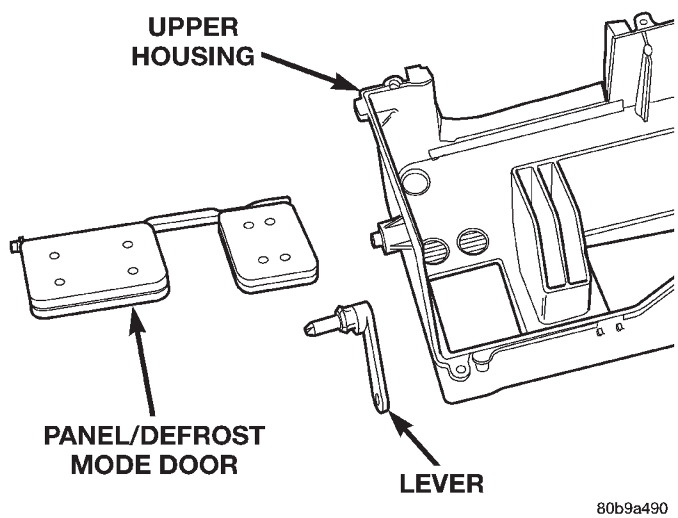


Fig. 63 Panel/Defrost Door

(12) Using a trim stick or another suitable wide flat-bladed tool, gently pry the panel/defrost door pivot shaft retainer from the pivot shaft.

(13) Remove the panel/defrost door from the heater-A/C housing.

INSTALLATION

Reverse the removal procedures to install.

- Be certain that each of the door pivot pins align with the pivot holes in the heater-A/C housing.
- Tighten the heater-A/C housing screws to 2.2 N·m (20 in. lbs.).
- Check door for binding after replacement, and after assembly of housing.

PANEL OUTLET DOOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Remove the heater-A/C housing from the vehicle. See Heater-A/C Housing in this group for the procedures.

(2) Place the heater-A/C housing with the tubing side down on a work bench, making allowance for leakage of fluids.

(3) Using a sharp knife, split the foam seal surrounding the panel outlet opening, at the dividing line of the upper and lower cases (Fig. 17).

(4) Place the heater-A/C housing in the upright position on the work bench.

(5) Remove the mode door actuator on the left side of the housing, controlling the mode door in the top of the case (Fig. 18) (Fig. 19).

(6) Remove the screw with plastic washer holding the lever assembly to the upper case section, and move aside (Fig. 20).

(7) Remove the 5 clips that secure the two housing halves to each other. There are 2 on either side at the center, and 1 located at the forward end of the mode door side of the case (Fig. 21).

(8) Release the wire harness electrical connector(s) from the mounts on the lower case at the blower motor end of the unit (Fig. 22).

(9) Remove the 10 screws that secure the two housing halves to each other.

(10) Separate the top half of the heater-A/C housing from the bottom half (Fig. 23).

(11) Pinch the retention tabs holding the panel outlet door pivot shaft to the case. The 3 plastic tabs, located on the inside of the case, are part of the shaft retainer (Fig. 64).

(12) Using a trim stick or another suitable wide flat-bladed tool, gently pry the panel outlet door pivot shaft retainer from the pivot shaft.

(13) Remove the panel outlet door from the heater-A/C housing.

INSTALLATION

Reverse the removal procedures to install.

- Be certain that each of the door pivot pins align with the pivot holes in the heater-A/C housing.

REMOVAL AND INSTALLATION (Continued)

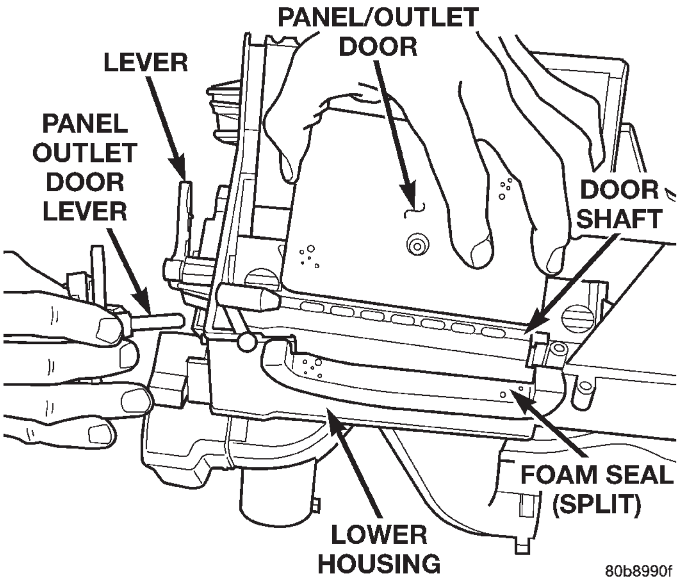


Fig. 64 Panel Outlet Door

• Tighten the heater-A/C housing screws to 2.2 N·m (20 in. lbs.).

• Check door for binding after replacement, and after assembly of housing.

RECIRCULATION AIR DOOR

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO GROUP 8M - PASSIVE RESTRAINT SYSTEMS BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

(1) Remove the heater-A/C housing from the vehicle. See Heater-A/C Housing in this group for the procedures.

(2) Place the heater-A/C housing right side up on the work bench.

(3) Unplug the wire/vacuum connector from the recirculation air door actuator.

(4) Remove the 2 screws fastening the recirculation air door sub-assembly to the main housing (Fig. 65).

(5) Raise the front of the door sub-assembly while releasing the 2 tabs holding the rear to the main housing, and remove the recirculation air door housing.

(6) Remove the electric/vacuum actuator from the recirculation air door sub-assembly and set aside.

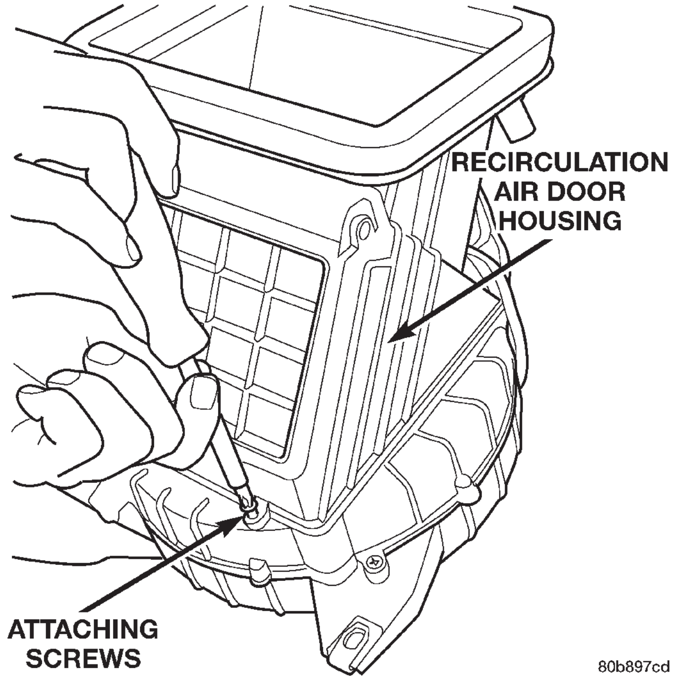


Fig. 65 Recirculation Air Door Housing

(7) Pinch the retention tabs holding the recirculation air door pivot shaft to the case. The 3 plastic tabs, located on the inside of the case, are part of the shaft retainer.

(8) Remove the recirculation air door from the recirculation air door housing.

INSTALLATION

Reverse the removal procedures to install.

• Be certain that each of the door pivot pins align with the pivot holes in the heater-A/C housing.

• Tighten the heater-A/C housing screws to 2.2 N·m (20 in. lbs.).

• Check door for binding after replacement, and after assembly of housing.

SUCTION LINE - L.H.D. DIESEL

REMOVAL

(1) Disconnect the negative battery cable.

(2) Recover the refrigerant system. Refer to Service Procedures in this group for the procedure.

(3) Remove the refrigerant line retaining fastener from the accumulator outlet fitting. Remove the line and cap the accumulator outlet opening to prevent contamination of the system.

(4) Remove the refrigerant line support bracket bolt from the cylinder head cap (Fig. 66).

(5) Cut the wire harness retaining tie-straps from the suction line. Located on the left side of the engine assembly.

(6) Raise the vehicle on a hoist.

(7) Remove the front splash shield.

REMOVAL AND INSTALLATION (Continued)

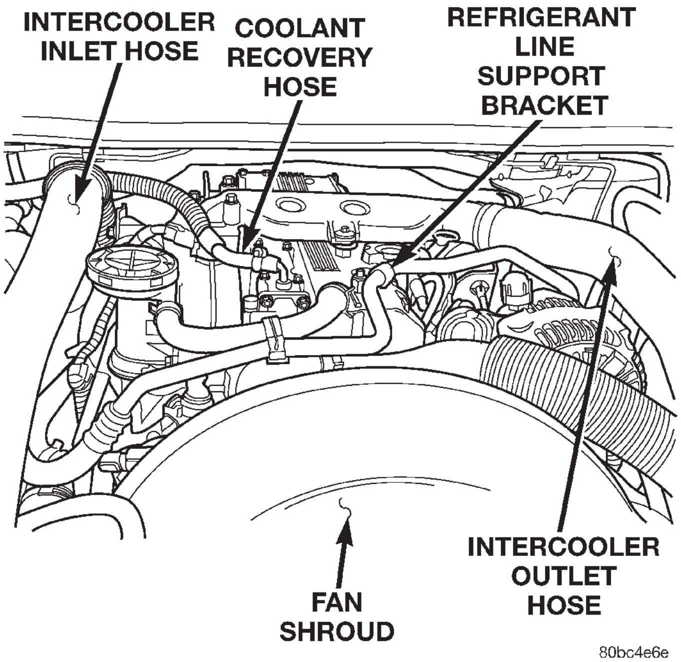


Fig. 66 Refrigerant Line Support Bracket

(8) Remove the refrigerant line retaining fastener from the compressor inlet fitting. Remove the line and cap the compressor outlet tube to prevent contamination of the system.

(9) Lower the vehicle on the hoist.

(10) Unclip and remove the suction line from the vehicle.

INSTALLATION

(1) Carefully position the suction line in the vehicle.

(2) Raise the vehicle on a hoist.

(3) Remove the cap and install the suction line on the compressor. Be certain the sealing o-ring is well lubricated with PAG oil and free of tears. Torque the retaining fastener to 28 N·m (21 ft. lbs.).

(4) Install the front splash shield.

(5) Lower the vehicle on the hoist.

(6) Position and install the refrigerant line support bracket bolt on the cylinder head cap. Toque the bolt to 20 N·m (177 in. lbs.).

(7) Remove the cap and install the suction line on the accumulator. Be certain the sealing o-ring is well lubricated with PAG oil and free of tears. Torque the retaining fastener to 28 N·m (21 ft. lbs.).

(8) Install the tie-straps retaining the wire harness on the suction line.

(9) Evacuate and charge the refrigerant system. Refer to Service Procedures in this group for the procedures.

(10) Connect the negative battery cable.

VACUUM CHECK VALVE

(1) Unplug the heater-A/C vacuum supply line connector at the vacuum check valve near the engine intake manifold vacuum adapter fitting.

(2) Note the orientation of the check valve in the vacuum supply line for correct installation.

(3) Unplug the vacuum check valve from the vacuum supply line fittings.

(4) Reverse the removal procedures to install.

VACUUM RESERVOIR

The vacuum reservoir is mounted in the right front of the vehicle behind the headlamp mounting module. The headlamp mounting module and headlamp assembly must be removed from the vehicle to access the vacuum reservoir for service. Refer to Group 8L - Lamps for more information on component removal (Fig. 67).

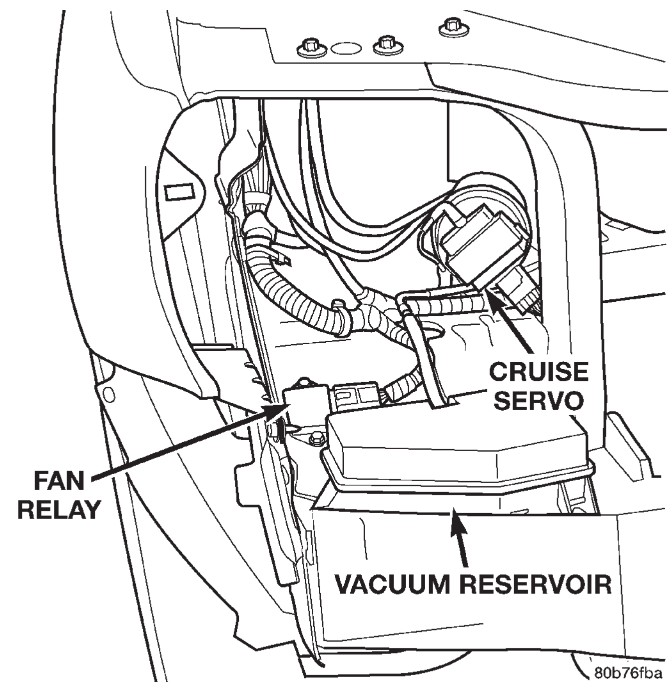


Fig. 67 Vacuum Reservoir

(1) Remove the two screws that secure the vacuum reservoir to the base of the radiator closure panel.

(2) Remove the vacuum reservoir.

(3) Reverse the removal procedures to install. Tighten the mounting screws to 3.4 N·m (30 in. lbs.).

VARIABLE ORIFICE VALVE

The Variable Orifice Valve (VOV) is located in the liquid line near the condenser. If the orifice valve is faulty or plugged, the liquid line unit must be replaced. See Liquid Line in this group for the service procedures.

EMISSION CONTROL SYSTEMS

CONTENTS

ON-BOARD DIAGNOSTICS

INDEX

DESCRIPTION AND OPERATION

EMISSION SYSTEM

OPERATION

The Powertrain Control Module (PCM) monitors many different circuits in the fuel injection, ignition, emission and engine systems. If the PCM senses a problem with a monitored circuit often enough to indicate an actual problem, it stores a Diagnostic Trouble Code (DTC) in the PCM's memory. If the code applies to a non-emissions related component or system, and the problem is repaired or ceases to exist, the PCM cancels the code after 40 warm-up cycles. Diagnostic trouble codes that affect vehicle emissions illuminate the Malfunction Indicator (check engine) Lamp. Refer to Malfunction Indicator Lamp in this section.

Certain criteria must be met before the PCM stores a DTC in memory. The criteria may be a specific range of engine RPM, engine temperature, and/or input voltage to the PCM.

The PCM might not store a DTC for a monitored circuit even though a malfunction has occurred. This may happen because one of the DTC criteria for the circuit has not been met. **For example**, assume the diagnostic trouble code criteria requires the PCM to monitor the circuit only when the engine operates between 750 and 2000 RPM. Suppose the sensor's output circuit shorts to ground when engine operates above 2400 RPM (resulting in 0 volt input to the PCM). Because the condition happens at an engine speed above the maximum threshold (2000 rpm), the PCM will not store a DTC.

There are several operating conditions for which the PCM monitors and sets DTC's. Refer to Monitored Systems, Components, and Non-Monitored Circuits in this section.

Technicians must retrieve stored DTC's by connecting the DRB scan tool (or an equivalent scan tool) to the 16–way data link connector (Fig. 1).

NOTE: Various diagnostic procedures may actually cause a diagnostic monitor to set a DTC. For instance, pulling a spark plug wire to perform a spark test may set the misfire code. When a repair is completed and verified, connect the DRB scan tool to the 16–way data link connector to erase all DTC's and extinguish the MIL (check engine lamp).

MALFUNCTION INDICATOR LAMP (MIL)

DESCRIPTION

The Malfunction Indicator Lamp (MIL) is located on the instrument panel. It is displayed as the CHECK ENGINE lamp.

DESCRIPTION AND OPERATION (Continued)

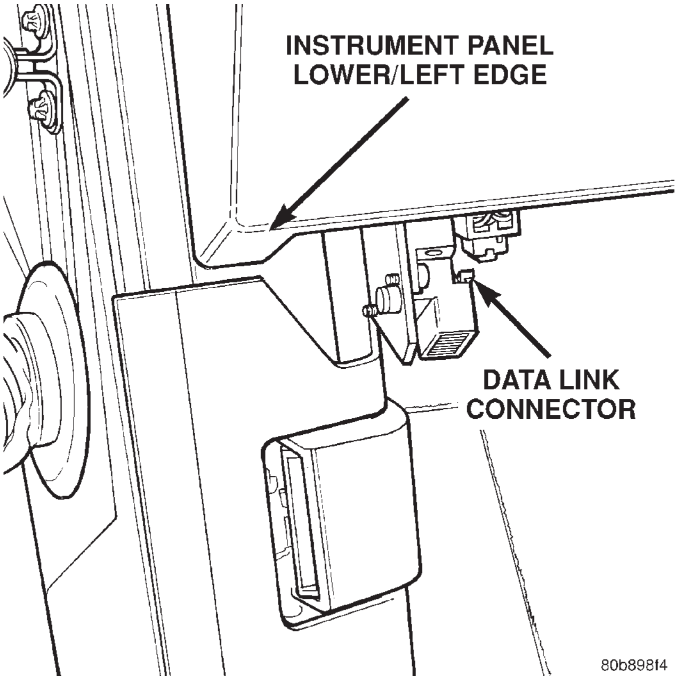


Fig. 1 Data Link (Diagnostic) Connector Location

OPERATION

As a functional test, the MIL illuminates at key-on before engine cranking. Whenever the Powertrain Control Module (PCM) sets a Diagnostic Trouble Code (DTC) that affects vehicle emissions, it illuminates the MIL. If a problem is detected, the PCM sends a message to the instrument cluster to illuminate the lamp. The PCM illuminates the MIL only for DTC's that affect vehicle emissions. There are some monitors that may take two consecutive trips, with a detected fault, before the MIL is illuminated. The MIL stays on continuously when the PCM has entered a Limp-In mode or identified a failed emission component. Refer to the Diagnostic Trouble Code charts in this group for emission related codes.

Also, the MIL either flashes or illuminates continuously when the PCM detects active engine misfire. Refer to Misfire Monitoring in this section.

Additionally, the PCM may reset (turn off) the MIL when one of the following occur:

- PCM does not detect the malfunction for 3 consecutive trips (except misfire and Fuel system Monitors).
- PCM does not detect a malfunction while performing three successive engine misfire or fuel system tests. The PCM performs these tests while the engine is operating within ± 375 RPM of and within 10 % of the load of the operating condition at which the malfunction was first detected.

STATE DISPLAY TEST MODE

OPERATION

The switch inputs to the Powertrain Control Module (PCM) have two recognized states; HIGH and LOW. For this reason, the PCM cannot recognize the difference between a selected switch position versus an open circuit, a short circuit, or a defective switch. If the State Display screen shows the change from HIGH to LOW or LOW to HIGH, assume the entire switch circuit to the PCM functions properly. Connect the DRB scan tool to the data link connector and access the state display screen. Then access either State Display Inputs and Outputs or State Display Sensors.

CIRCUIT ACTUATION TEST MODE

OPERATION

The Circuit Actuation Test Mode checks for proper operation of output circuits or devices the Powertrain Control Module (PCM) may not internally recognize. The PCM attempts to activate these outputs and allow an observer to verify proper operation. Most of the tests provide an audible or visual indication of device operation (click of relay contacts, fuel spray, etc.). Except for intermittent conditions, if a device functions properly during testing, assume the device, its associated wiring, and driver circuit work correctly. Connect the DRB scan tool to the data link connector and access the Actuators screen.

DIAGNOSTIC TROUBLE CODES

OPERATION

A Diagnostic Trouble Code (DTC) indicates that the Powertrain Control Module (PCM) has recognized an abnormal condition in the system.

DTC's are the results of a system or circuit failure, but do not directly identify the failed component or components.

Technicians must retrieve stored DTC's by connecting the DRB III scan tool (or an equivalent scan tool) to the 16–way data link connector. This connector is located on the lower edge of the instrument panel near the steering column.

OBTAINING DTC's

WARNING: APPLY PARKING BRAKE AND/OR BLOCK WHEELS BEFORE PERFORMING ANY TEST ON AN OPERATING ENGINE.

(1) Connect the DRB scan tool to data link (diagnostic) connector.

DESCRIPTION AND OPERATION (Continued)

(2) Turn the ignition switch on, access Read Fault Screen. Record all the DTC's shown on the DRB scan tool.

(3) To erase DTC's, use the Erase Trouble Code data screen on the DRB scan tool.

NOTE: For a list of DTC's, refer to the following charts.

DIAGNOSTIC TROUBLE CODE DESCRIPTIONS

(M) CHECK ENGINE lamp (Malfunction Indicator Lamp or MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA).

(G) Generator lamp illuminated

Generic Scan Tool P-Code	DRB Scan Tool Display	Brief Description of DTC
P0030 (M)	1/1 O2 Sensor Heater Relay Circuit	Problem detected in oxygen sensor heater relay circuit.
P0036 (M)	1/2 O2 Sensor Heater Relay Circuit	Problem detected in oxygen sensor heater relay circuit.
P0106	Barometric Pressure Out of Range	MAP sensor input voltage out of an acceptable range detected during reading of barometric pressure at key-on.
P0107 (M)	Map Sensor Voltage Too Low	MAP sensor input below minimum acceptable voltage.
P0108 (M)	Map Sensor Voltage Too High	MAP sensor input above maximum acceptable voltage.
P0112 (M)	Intake Air Temp Sensor Voltage Low	Intake air (charge) temperature sensor input below the minimum acceptable voltage.
P0113 (M)	Intake Air Temp Sensor Voltage High	Intake air (charge) temperature sensor input above the maximum acceptable voltage.
P0116		A rationatilty error has been detected in the coolant temp sensor.
P0117 (M)	ECT Sensor Voltage Too Low	Engine coolant temperature sensor input below the minimum acceptable voltage.
P0118 (M)	ECT Sensor Voltage Too High	Engine coolant temperature sensor input above the maximum acceptable voltage.
P0121 (M)	TPS Voltage Does Not Agree With MAP	TPS signal does not correlate to MAP sensor signal.
P0121 (M)	Accelerator Position Sensor (APPS) Signal Voltage Too Low	APPS voltage input below the minimum acceptable voltage.
P0122 (M)	Throttle Position Sensor Voltage Low	Throttle position sensor input below the acceptable voltage range.
P0122 (M)	Accelerator Position Sensor (APPS) Signal Voltage Too Low	APPS voltage input below the minimum acceptable voltage.
P0123 (M)	Throttle Position Sensor Voltage High	Throttle position sensor input above the maximum acceptable voltage.
P0123 (M)	Accelerator Position Sensor (APPS) Signal Voltage Too High	APPS voltage input above the maximum acceptable voltage.
P0125 (M)	Closed Loop Temp Not Reached	Time to enter Closed Loop Operation (Fuel Control) is excessive.
P0125 (M)	Engine is Cold Too Long	Engine does not reach operating temperature.
P0131 (M)	1/1 O2 Sensor Shorted To Ground	Oxygen sensor input voltage maintained below normal operating range.

DESCRIPTION AND OPERATION (Continued)

(M) **CHECK ENGINE lamp (Malfunction Indicator Lamp or MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA).**		
(G) **Generator lamp illuminated**		
Generic Scan Tool P-Code	**DRB Scan Tool Display**	**Brief Description of DTC**
P0132 (M)	1/1 O2 Sensor Shorted To Voltage	Oxygen sensor input voltage maintained above normal operating range.
P0133 (M)	1/1 O2 Sensor Slow Response	Oxygen sensor response slower than minimum required switching frequency.
P0134 (M)	1/1 O2 Sensor Stays at Center	Neither rich or lean condition is detected from the oxygen sensor input.
P0135 (M)	1/1 O2 Sensor Heater Failure	Oxygen sensor heater element malfunction.
P0137 (M)	1/2 O2 Sensor Shorted To Ground	Oxygen sensor input voltage maintained below normal operating range.
P0138 (M)	1/2 O2 Sensor Shorted To Voltage	Oxygen sensor input voltage maintained above normal operating range.
P0139 (M)	1/2 O2 Sensor Slow Response	Oxygen sensor response not as expected.
P0140 (M)	1/2 O2 Sensor Stays at Center	Neither rich or lean condition is detected from the oxygen sensor.
P0141 (M)	1/2 O2 Sensor Heater Failure	Oxygen sensor heater element malfunction.
P0143 (M)	1/3 O2 Sensor Shorted To Ground	Oxygen sensor input voltage maintained below normal operating range.
P0144 (M)	1/3 O2 Sensor Shorted To Voltage	Oxygen sensor input voltage maintained above normal operating range.
P0145 (M)	1/3 O2 Sensor Slow Response	Oxygen sensor response slower than minimum required switching frequency.
P0146 (M)	1/3 O2 Sensor Stays at Center	Neither rich or lean condition is detected from the oxygen sensor.
P0147 (M)	1/3 O2 Sensor Heater Failure	Oxygen sensor heater element malfunction.
P0151 (M)	2/1 O2 Sensor Shorted To Ground	Oxygen sensor input voltage maintained below normal operating range.
P0152 (M)	2/1 O2 Sensor Shorted To Voltage	Oxygen sensor input voltage sustained above normal operating range.
P0153 (M)	2/1 O2 Sensor Slow Response	Oxygen sensor response slower than minimum required switching frequency.
P0154 (M)	2/1 O2 Sensor Stays at Center	Neither rich or lean condition is detected from the oxygen sensor.
P0155 (M)	2/1 O2 Sensor Heater Failure	Oxygen sensor heater element malfunction.
P0157 (M)	2/2 O2 Sensor Shorted To Ground	Oxygen sensor input voltage maintained below normal operating range.
P0158 (M)	2/2 O2 Sensor Shorted To Voltage	Oxygen sensor input voltage maintained above normal operating range.
P0159	2/2 O2 Sensor Slow Response	Oxygen sensor response slower than minimum required switching frequency.
P0160 (M)	2/2 O2 Sensor Stays at Center	Neither rich or lean condition is detected from the oxygen sensor.

DESCRIPTION AND OPERATION (Continued)

(M) **CHECK ENGINE lamp (Malfunction Indicator Lamp or MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA).**		
(G) **Generator lamp illuminated**		
Generic Scan Tool P-Code	**DRB Scan Tool Display**	**Brief Description of DTC**
P0161 (M)	2/2 O2 Sensor Heater Failure	Oxygen sensor heater element malfunction.
P0168	Decreased Engine Performance Due To High Injection Pump Fuel Temp	Fuel temperature is above the engine protection limit. Engine power will be derated.
P0171 (M)	1/1 Fuel System Lean	A lean air/fuel mixture has been indicated by an abnormally rich correction factor.
P0172 (M)	1/1 Fuel System Rich	A rich air/fuel mixture has been indicated by an abnormally lean correction factor.
P0174 (M)	2/1 Fuel System Lean	A lean air/fuel mixture has been indicated by an abnormally rich correction factor.
P0175 (M)	2/1 Fuel System Rich	A rich air/fuel mixture has been indicated by an abnormally lean correction factor.
P0176	Loss of Flex Fuel Calibration Signal	No calibration voltage present from flex fuel sensor.
P0177	Water In Fuel	Excess water found in fuel by water-in-fuel sensor.
P0178	Flex Fuel Sensor Volts Too Low	Flex fuel sensor input below minimum acceptable voltage.
P0178	Water In Fuel Sensor Voltage Too Low	Loss of water-in-fuel circuit or sensor.
P0179	Flex Fuel Sensor Volts Too High	Flex fuel sensor input above maximum acceptable voltage.
P0181	Fuel Injection Pump Failure	Low power, engine derated, or engine stops.
P0182 (M)	CNG Temp Sensor Voltage Too Low	Compressed natural gas temperature sensor voltage below acceptable voltage.
P0183 (M)	CNG Temp Sensor Voltage Too High	Compressed natural gas temperature sensor voltage above acceptable voltage.
P0201 (M)	Injector #1 Control Circuit	An open or shorted condition detected in control circuit for injector #1 or the INJ 1 injector bank.
P0202 (M)	Injector #2 Control Circuit	An open or shorted condition detected in control circuit for injector #2 or the INJ 2 injector bank.
P0203 (M)	Injector #3 Control Circuit	An open or shorted condition detected in control circuit for injector #3 or the INJ 3 injector bank.
P0204 (M)	Injector #4 Control Circuit	Injector #4 or INJ 4 injector bank output driver stage does not respond properly to the control signal.
P0205 (M)	Injector #5 Control Circuit	Injector #5 output driver stage does not respond properly to the control signal.
P0206 (M)	Injector #6 Control Circuit	Injector #6 output driver stage does not respond properly to the control signal.
P0207 (M)	Injector #7 Control Circuit	Injector #7 output driver stage does not respond properly to the control signal.
P0208 (M)	Injector #8 Control Circuit	Injector #8 output driver stage does not respond properly to the control signal.
P0209 (M)	Injector #9 Control Circuit	Injector #9 output driver stage does not respond properly to the control signal.

DESCRIPTION AND OPERATION (Continued)

(M) **CHECK ENGINE lamp (Malfunction Indicator Lamp or MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA).**		
(G) **Generator lamp illuminated**		
Generic Scan Tool P-Code	**DRB Scan Tool Display**	**Brief Description of DTC**
P0210 (M)	Injector #10 Control Circuit	Injector #10 output driver stage does not respond properly to the control signal.
P0215	Fuel Injection Pump Control Circuit	Failure in fuel pump relay control circuit.
P0216 (M)	Fuel Injection Pump Timing Failure	High fuel supply restriction, low fuel pressure or possible wrong or incorrectly installed pump keyway.
P0217	Decreased Engine Performance Due To Engine Overheat Condition	Engine overheating. ECM will derate engine performance.
P0219	Crankshaft Position Sensor Overspeed Signal	Engine has exceeded rpm limits.
P0222 (M)	Idle Validation Signals Both Low	Problem detected with idle validation circuits within APPS.
P0223 (M)	Idle Validation Signals Both High (Above 5 Volts)	Problem detected with idle validation circuits within APPS.
P0230	Transfer Pump (Lift Pump) Circuit Out of Range	Problem detected in fuel transfer pump circuits.
P0232	Fuel Shutoff Signal Voltage Too High	Fuel shut-off signal voltage too high from ECM to fuel injection pump.
P0234 (M)	Turbo Boost Limit Exceeded	Problem detected in turbocharger wastegate.
P0236 (M)	Map Sensor Too High Too Long	Problem detected in turbocharger wastegate.
P0237 (M)	Map Sensor Voltage Too Low	MAP sensor voltage input below the minimum acceptable voltage.
P0238 (M)	Map Sensor Voltage Too High	MAP sensor voltage input above the maximum acceptable voltage.
P0251 (M)	Fuel Inj. Pump Mech. Failure Fuel Valve Feedback Circuit	Problem sensed with fuel circuit internal to fuel injection pump.
P0253 (M)	Fuel Injection Pump Fuel Valve Open Circuit	Problem sensed with fuel circuit internal to fuel injection pump.
P0254	Fuel Injection Pump Fuel Valve Current Too High	Problem caused by internal fuel injection pump failure.
P0300 (M)	Multiple Cylinder Mis-fire	Misfire detected in multiple cylinders.
P0301 (M)	CYLINDER #1 MISFIRE	Misfire detected in cylinder #1.
P0302 (M)	CYLINDER #2 MISFIRE	Misfire detected in cylinder #2.
P0303 (M)	CYLINDER #3 MISFIRE	Misfire detected in cylinder #3.
P0304 (M)	CYLINDER #4 MISFIRE	Misfire detected in cylinder #4.
P0305 (M)	CYLINDER #5 MISFIRE	Misfire detected in cylinder #5.
P0306 (M)	CYLINDER #6 MISFIRE	Misfire detected in cylinder #6.
P0307 (M)	CYLINDER #7 MISFIRE	Misfire detected in cylinder #7
P0308 (M)	CYLINDER #8 MISFIRE	Misfire detected in cylinder #8.
P0309 (M)	CYLINDER #9 MISFIRE	Misfire detected in cylinder #9.
P0310 (M)	CYLINDER #10 MISFIRE	Misfire detected in cylinder #10.

DESCRIPTION AND OPERATION (Continued)

(M) **CHECK ENGINE lamp (Malfunction Indicator Lamp or MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA).**		
(G) **Generator lamp illuminated**		
Generic Scan Tool P-Code	**DRB Scan Tool Display**	**Brief Description of DTC**
P0320 (M)	No Crank Referance Signal at PCM	No reference signal (crankshaft position sensor) detected during engine cranking.
P0320 (M)	No RPM Signal to PCM (Crankshaft Position Sensor Signal to JTEC)	A CKP signal has not been detected at the PCM.
P0325	Knock Sensor #1 Circuit	Knock sensor (#1) signal above or below minimum acceptable threshold voltage at particular engine speeds.
P0330	Knock Sensor #2 Circuit	Knock sensor (#2) signal above or below minimum acceptable threshold voltage at particular engine speeds.
P0336 (M)	Crankshaft Position (CKP) Sensor Signal	Problem with voltage signal from CKP.
P0340 (M)	No Cam Signal At PCM	No fuel sync
P0341 (M)	Camshaft Position (CMP) Sensor Signal	Problem with voltage signal from CMP.
P0350	Ignition Coil Draws Too Much Current	A coil (1-5) is drawing too much current.
P0351 (M)	Ignition Coil # 1 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time.
P0352 (M)	Ignition Coil # 2 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time.
P0353 (M)	Ignition Coil # 3 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time.
P0354 (M)	Ignition Coil # 4 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time (High Impedance).
P0355 (M)	Ignition Coil # 5 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time (High Impedance).
P0356 (M)	Ignition Coil # 6 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time (high impedance).
P0357 (M)	Ignition Coil # 7 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time (high impedance).
P0358 (M)	Ignition Coil # 8 Primary Circuit	Peak primary circuit current not achieved with maximum dwell time (high impedance).
P0370	Fuel Injection Pump Speed/Position Sensor Sig Lost	Problem caused by internal fuel injection pump failure.
P0380 (M)	Intake Air Heater Relay #1 Control Circuit	Problem detected in #1 air heater solenoid/relay circuit (not heater element)
P0381 (M)	Wait To Start Lamp Inoperative	Problem detected in wait-to-start bulb circuit.
P0382 (M)	Intake Air Heater Relay #2 Control Circuit	Problem detected in #2 air heater solenoid/relay circuit (not heater element)
P0387	Crankshaft Position Sensor Supply Voltage Too Low	CKP sensor voltage input below the minimum acceptable voltage.
P0388	Crankshaft Position Sensor Supply Voltage Too High	CKP sensor voltage input above the maximum acceptable voltage.

DESCRIPTION AND OPERATION (Continued)

(M) **CHECK ENGINE lamp (Malfunction Indicator Lamp or MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA).**		
(G) **Generator lamp illuminated**		
Generic Scan Tool P-Code	**DRB Scan Tool Display**	**Brief Description of DTC**
P0401	EGR System Failure	Required change in air/fuel ration not detected during diagnostic test.
P0403	EGR Solenoid Circuit	An open or shorted condition detected in the EGR solenoid control circuit.
P0404	EGR Position Sensor Rationality	EGR position sensor signal does not correlate to EGR duty cycle.
P0405	EGR Position Sensor Volts Too Low	EGR position sensor input below the acceptable voltage range.
P0406	EGR Position Sensor Volts Too High	EGR position sensor input above the acceptable voltage range.
P0412	Secondary Air Solenoid Circuit	An open or shorted condition detected in the secondary air (air switching/aspirator) solenoid control circuit.
P0420 (M)	1/1 Catalytic Converter Efficiency	Catalyst 1/1 efficiency below required level.
P0432 (M)	1/2 Catalytic Converter Efficiency	Catalyst 2/1 efficiency below required level.
P0441 (M)	Evap Purge Flow Monitor	Insufficient or excessive vapor flow detected during evaporative emission system operation.
P0442 (M)	Evap Leak Monitor Medium Leak Detected	A small leak has been detected in the evaporative system.
P0443 (M)	Evap Purge Solenoid Circuit	An open or shorted condition detected in the EVAP purge solenoid control circuit.
P0455 (M)	Evap Leak Monitor Large Leak Detected	A large leak has been detected in the evaporative system.
P0456 (M)	Evap Leak Monitor Small Leak Detected	Leak has been detected in the evaporative system.
P0460	Fuel Level Unit No Change Over Miles	During low fuel
P0460	Fuel Level Unit No Change Over Miles	Fuel level sending unit voltage does not change for more than 40 miles.
P0462	Fuel Level Sending Unit Volts Too Low	Fuel level sensor input below acceptable voltage.
P0462 (M)	Fuel Level Sending Unit Volts Too Low	Open circuit between PCM and fuel gauge sending unit.
P0463	Fuel Level Sending Unit Volts Too High	Fuel level sensor input above acceptable voltage.
P0463 (M)	Fuel Level Sending Unit Volts Too High	Circuit shorted to voltage between PCM and fuel gauge sending unit.
P0500 (M)	No Vehicle Speed Sensor Signal	No vehicle speed sensor signal detected during road load conditions.
P0500 (M)	No Vehicle Speed Sensor Signal	A vehicle speed signal was not detected.
P0505 (M)	Idle Air Control Motor Circuits	SBEC II
P0522	Oil Pressure Voltage Too Low	Oil pressure sending unit (sensor) voltage input below the minimum acceptable voltage.

DESCRIPTION AND OPERATION (Continued)

(M) CHECK ENGINE lamp (Malfunction Indicator Lamp or MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA).

(G) Generator lamp illuminated

Generic Scan Tool P-Code	DRB Scan Tool Display	Brief Description of DTC
P0523	Oil Pressure Voltage Too High	Oil pressure sending unit (sensor) voltage input above the maximum acceptable voltage.
P0524	Oil Pressure Too Low	Engine oil pressure is low. Engine power derated.
P0545	A/C Clutch Relay Circuit	Problem detected in air conditioning clutch relay control circuit.
P0551	Power Steering Switch Failure	Incorrect input state detected for the power steering switch circuit. PL: High pressure seen at high speed.
P0562	Charging System Voltage Too Low	Supply voltage sensed at ECM too low.
P0563	Charging System Voltage Too High	Supply voltage sensed at ECM too high.
P0600	PCM Failure SPI Communications	No communication detected between co-processors in the control module.
P0601 (M)	Internal Controller Failure	Internal control module fault condition (check sum) detected.
P0602 (M)	ECM Fueling Calibration Error	ECM Internal fault condition detected.
P0604	RAM Check Failure	Transmission control module RAM self test fault detected. -Aisin transmission
P0605	ROM Check Falure	Transmission control module ROM self test fault detected -Aisin transmission
P0606 (M)	ECM Failure	ECM Internal fault condition detected.
P0615	Starter Relay Control Circuit	An open or shorted condition detected in the starter relay control circuit.
P0622 (G)	Generator Field Not Switching Properly	An open or shorted condition detected in the generator field control circuit.
P0645	A/C Clutch Relay Circuit	An open or shorted condition detected in the A/C clutch relay control circuit.
P0700	EATX Controller DTC Present	This SBEC III or JTEC DTC indicates that the EATX or Aisin controller has an active fault and has illuminated the MIL via a CCD (EATX) or SCI (Aisin) message. The specific fault must be acquired from the EATX via CCD or from the Aisin via ISO-9141.
P0703	Brake Switch Stuck Pressed or Released	Incorrect input state detected in the brake switch circuit. (Changed from P1595)
P0711 (M)	Trans Temp Sensor, No Temp Rise After Start	Relationship between the transmission temperature and overdrive operation and/or TCC operation indicates a failure of the Transmission Temperature Sensor. OBD II Rationality. Was MIL code 37.
P0712	Trans Temp Sensor Voltage Too Low	Transmission fluid temperature sensor input below acceptable voltage. Was MIL code 37.
P0712 (M)	Trans Temp Sensor Voltage Too Low	Voltage less than 1.55 volts (4-speed auto. trans. only).
P0713	Trans Temp Sensor Voltage Too High	Transmission fluid temperature sensor input above acceptable voltage. Was MIL code 37.

DESCRIPTION AND OPERATION (Continued)

(M) **CHECK ENGINE lamp (Malfunction Indicator Lamp or MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA).**		
(G) **Generator lamp illuminated**		
Generic Scan Tool P-Code	**DRB Scan Tool Display**	**Brief Description of DTC**
P0713 (M)	Trans Temp Sensor Voltage Too High	Voltage greater than 3.76 volts (4-speed auto. trans. only).
P0720 (M)	Low Output SPD Sensor RPM, Above 15 MPH	The relationship between the Output Shaft Speed Sensor and vehicle speed is not within acceptable limits.
P0720 (M)	Low Output Spd Sensor RPM Above 15 mph	Output shaft speed is less than 60 rpm with vehicle speed above 15 mph (4-speed auto. trans. only).
P0740 (M)	Torq Con Clu, No RPM Drop at Lockup	Relationship between engine and vehicle speeds indicated failure of torque convertor clutch lock-up system (TCC/PTU solenoid)
P0743 (M)	Torque Converter Clutch Solenoid/ Trans Relay Circuits	An open or shorted condition detected in the torque converter clutch (part throttle unlock) solenoid control circuit. Shift solenoid C electrical fault - Aisin transmission
P0743 (M)	Torque Converter Clutch Solenoid/ Trans Relay Circuits	An open or shorted condition detected in the torque converter part throttle unlock solenoid control circuit (3 or 4-speed auto. trans. only).
P0748 (M)	Governor Pressur Sol Control/Trans Relay Circuits	An open or shorted condition detected in the Governor Pressure Solenoid circuit or Trans Relay Circuit in JTEC RE transmissions.
P0748 (M)	Governor Pressure Sol Control/Trans Relay Circuits	An open or shorted condition detected in the governor pressure solenoid or relay circuits (4-speed auto. trans. only).
P0751 (M)	O/D Switch Pressed (Lo) More Than 5 Minutes	Overdrive override switch input is in a prolonged depressed state.
P0751 (M)	O/D Switch Pressed (LO) More Than 5 Min	Overdrive Off switch input too low for more than 5 minutes (4-speed auto. trans. only).
P0753 (M)	Trans 3-4 Shift Sol/Trans Relay Circuits	An open or shorted condition detected in the overdrive solenoid control circuit or Trans Relay Circuit in JTEC RE transmissions. Was MIL code 45.
P0753 (M)	Trans 3-4 Shift Sol/Trans Relay Circuits	An open or shorted condition detected in the transmission 2-4 shift solenoid circuit (4-speed auto. trans. only).
P0756	AW4 Shift Sol B (2-3) Functional Failure	Shift solenoid B (2-3) functional fault - Aisin transmission
P0783 (M)	3-4 Shift Sol, No RPM Drop at Lockup	The overdrive solenoid is unable to engage the gear change from 3rd gear to the overdrive gear.
P0801	Reverse Gear Lockout Circuit Open or Short	An open or shorted condition detected in the transmission reverse gear lock-out solenoid control circuit.
P0830	Clutch Depressed Switch Circuit	Problem detected in clutch switch circuit.
P0833	Clutch Released Switch Circuit	Problem detected in clutch switch circuit.
P1110	Decrease Engine Performance Due To High Intake Air Temperature	Intake manifold air temperature is above the engine protection limit. Engine power will be derated.
P1180	Decreased Engine Performance Due To High Injection Pump Fuel Temp	Fuel temperature is above the engine protection limit. Engine power will be derated.

DESCRIPTION AND OPERATION (Continued)

(M) **CHECK ENGINE lamp (Malfunction Indicator Lamp or MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA).**		
(G) **Generator lamp illuminated**		
Generic Scan Tool P-Code	**DRB Scan Tool Display**	**Brief Description of DTC**
P1195 (M)	1/1 O2 Sensor Slow During Catalyst Monitor	A slow switching oxygen sensor has been detected in bank 1/1 during catalyst monitor test. (Also see SCI DTC $66) (was P0133)
P1196 (M)	2/1 O2 Sensor Slow During Catalyst Monitor	A slow switching oxygen sensor has been detected in bank 2/1 during catalyst monitor test. (Also see SCI DTC $7A) (was P0153)
P1197	1/2 O2 Sensor Slow During Catalyst Monitor	A slow switching oxygen sensor has been detected in bank 1/2 during catalyst monitor test. (Also see SCI DTC $68) (was P0139)
P1198	Radiator Temperature Sensor Volts Too High	Radiator coolant temperature sensor input above the maximum acceptable voltage.
P1199	Radiator Temperature Sensor Volts Too Low	Radiator coolant temperature sensor input below the minimum acceptable voltage.
P1281	Engine is Cold Too Long	Engine coolant temperature remains below normal operating temperatures during vehicle travel (Thermostat).
P1282	Fuel Pump Relay Control Circuit	An open or shorted condition detected in the fuel pump relay control circuit.
P1283	Idle Select Signal Invalid	ECM or fuel injection pump module internal fault condition detected.
P1284 (M)	Fuel Injection Pump Battery Voltage Out-Of-Range	Fuel injection pump module internal fault condition detected. Engine power will be derated.
P1285 (M)	Fuel Injection Pump Controller Always On	Fuel injection pump module relay circuit failure detected. Engine power will be derated.
P1286	Accelerator Position Sensor (APPS) Supply Voltage Too High	High voltage detected at APPS.
P1287	Fuel Injection Pump Controller Supply Voltage Low	ECM or fuel injection pump module internal fault condition detected. Engine power will be derated.
P1288	Intake Manifold Short Runner Solenoid Circuit	An open or shorted condition detected in the short runner tuning valve circuit.
P1289	Manifold Tune Valve Solenoid Circuit	An open or shorted condition detected in the manifold tuning valve solenoid control circuit.
P1290	CNG Fuel System Pressure Too High	Compressed natural gas system pressure above normal operating range.
P1291	No Temp Rise Seen From Intake Heaters	Energizing Heated Air Intake does not change intake air temperature sensor an acceptable amount.
P1291 (M)	No Temperature Rise Seen From Intake Air Heaters	Problem detected in intake manifold air heating system.
P1292	CNG Pressure Sensor Voltage Too High	Compressed natural gas pressure sensor reading above acceptable voltage.
P1293	CNG Pressure Sensor Voltage Too Low	Compressed natural gas pressure sensor reading below acceptable voltage.
P1294 (M)	Target Idle Not Reached	Target RPM not achieved during drive idle condition. Possible vacuum leak or IAC (AIS) lost steps.

DESCRIPTION AND OPERATION (Continued)

(M) **CHECK ENGINE lamp (Malfunction Indicator Lamp or MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA).**		
(G) **Generator lamp illuminated**		
Generic Scan Tool P-Code	**DRB Scan Tool Display**	**Brief Description of DTC**
P1295 (M)	No 5 Volts to TP Sensor	Loss of a 5 volt feed to the Throttle Position Sensor has been detected.
P1295 (M)	Accelerator Position Sensor (APPS) Supply Voltage Too Low	APPS supply voltage input below the minimum acceptable voltage.
P1296	No 5 Volts to MAP Sensor	Loss of a 5 volt feed to the MAP Sensor has been detected.
P1297 (M)	No Change in MAP From Start To Run	No difference is recognized between the MAP reading at engine idle and the stored barometric pressure reading.
P1298	Lean Operation at Wide Open Throttle	A prolonged lean condition is detected during Wide Open Throttle
P1299	Vacuum Leak Found (IAC Fully Seated)	MAP Sensor signal does not correlate to Throttle Position Sensor signal. Possible vacuum leak.
P1388	Auto Shutdown Relay Control Circuit	An open or shorted condition detected in the ASD or CNG shutoff relay control ckt.
P1388	Auto Shutdown Relay Control Circuit	An open or shorted condition detected in the auto shutdown relay circuit.
P1389	No ASD Relay Output Voltage At PCM	No Z1 or Z2 voltage sensed when the auto shutdown relay is energized.
P1389 (M)	No ASD Relay Output Voltage at PCM	An open condition detected In the ASD relay output circuit.
P1390	Timing Belt Skipped 1 Tooth or More	Relationship between Cam and Crank signals not correct
P1391 (M)	Intermittent Loss of CMP or CKP	Loss of the Cam Position Sensor or Crank Position sensor has occurred. For PL 2.0L
P1398 (M)	Mis-Fire Adaptive Numerator at Limit	PCM is unable to learn the Crank Sensor's signal in preparation for Misfire Diagnostics. Probable defective Crank Sensor
P1399	Wait To Start Lamp Cicuit	An open or shorted condition detected in the Wait to Start Lamp circuit.
P1403	No 5V to EGR Sens	Loss of 5v feed to the EGR position sensor.
P01475	Aux 5 Volt Supply Voltage High	Sensor supply voltage for ECM sensors is too high.
P1476	Too Little Secondary Air	Insufficient flow of secondary air injection detected during aspirator test (was P0411)
P1477	Too Much Secondary Air	Excessive flow of secondary air injection detected during aspirator test (was P0411).
P1478	Battery Temp Sensor Volts Out of Limit	Internal temperature sensor input voltage out of an acceptable range.
P1479	Transmission Fan Relay Circuit	An open or shorted condition detected in the transmission fan relay circuit.
P1480	PCV Solenoid Circuit	An open or shorted condition detected in the PCV solenoid circuit.
P1481	EATX RPM Pulse Perf	EATX RPM pulse generator signal for misfire detection does not correlate with expected value.

DESCRIPTION AND OPERATION (Continued)

(M) **CHECK ENGINE lamp (Malfunction Indicator Lamp or MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA).**		
(G) **Generator lamp illuminated**		
Generic Scan Tool P-Code	**DRB Scan Tool Display**	**Brief Description of DTC**
P1482	Catalyst Temperature Sensor Circuit Shorted Low	Catalyst temperature sensor circuit shorted low.
P1483	Catalyst Temperature Sensor Circuit Shorted High.	Catalyst temperature sensor circuit shorted high.
P1484	Catalytic Converter Overheat Detected	A catalyst overheat condition has been detected by the catalyst temperature sensor.
P1485	Air Injection Solenoid Circuit	An open or shorted condition detected in the air assist solenoid circuit.
P1486	Evap Leak Monitor Pinched Hose Found	LDP has detected a pinched hose in the evaporative hose system.
P1487	Hi Speed Rad Fan CTRL Relay Circuit	An open or shorted condition detected in the control circuit of the #2 high speed radiator fan control relay.
P1488	Auxiliary 5 Volt Supply Output Too Low	Auxiliary 5 volt sensor feed is sensed to be below an acceptable limit.
P1488	5 Volt Supply Voltage Low	Sensor supply voltage for ECM sensors is too low.
P1489	High Speed Fan CTRL Relay Circuit	An open or shorted condition detected in the control circuit of the high speed radiator fan control relay.
P1490	Low Speed Fan CTRL Relay Circuit	An open or shorted condition detected in control circuit of the low speed radiator fan control relay.
P1491	Rad Fan Control Relay Circuit	An open or shorted condition detected in the radiator fan control relay control circuit. This includes PWM solid state relays.
P1492	Ambient/Batt Temp Sen Volts Too High	External temperature sensor input above acceptable voltage.
P1492 (M)	Ambient/Batt Temp Sensor Volts Too High	Battery temperature sensor input voltage above an acceptable range.
P1493 (M)	Ambient/Batt Temp Sen Volts Too Low	External temperature sensor input below acceptable voltage.
P1493 (M)	Ambient/Batt Temp Sen Volts Too Low	Battery temperature sensor input voltage below an acceptable range.
P1494 (M)	Leak Detection Pump Sw or Mechanical Fault	Incorrect input state detected for the Leak Detection Pump (LDP) pressure switch.
P1495	Leak Detection Pump Solenoid Circuit	An open or shorted condition detected in the Leak Detection Pump (LDP) solenoid circuit.
P1496	5 Volt Supply, Output Too Low	5 volt sensor feed is sensed to be below an acceptable limit. (less than 4v for 4 sec)
P1498	High Speed Rad Fan Ground CTRL Rly Circuit	An open or shorted condition detected in the control circuit of the #3 high speed radiator fan control relay.
P1594 (G)	Charging System Voltage Too High	Battery voltage sense input above target charging voltage during engine operation.
P1594	Charging System Voltage Too High	Battery voltage sense input above target charging voltage during engine operation.

DESCRIPTION AND OPERATION (Continued)

(M) **CHECK ENGINE lamp (Malfunction Indicator Lamp or MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA).**		
(G) **Generator lamp illuminated**		
Generic Scan Tool P-Code	**DRB Scan Tool Display**	**Brief Description of DTC**
P1595	Speed Control Solenoid Circuits	An open or shorted condition detected in either of the speed control vacuum or vent solenoid control circuits.
P1595	Speed Control Solenoid Circuits	An open or shorted condition detected in the speed control vacuum or vent solenoid circuits.
P1596	Speed Control Switch Always High	Speed control switch input above maximum acceptable voltage.
P1597	Speed Control Switch Always Low	Speed control switch input below minimum acceptable voltage.
P1597	Speed Control Switch Always Low	Speed control switch input below the minimum acceptable voltage.
P1598	A/C Pressure Sensor Volts Too High	A/C pressure sensor input above maximum acceptable voltage.
P1598	A/C Sensor Input Hi	Problem detected in air conditioning electrical circuit.
P1599	A/C Pressure Sensor Volts Too Low	A/C pressure sensor input below minimum acceptable voltage.
P1599	A/C Sensor Input Lo	Problem detected in air conditioning electrical circuit.
P1680	Clutch Released Switch Circuit	Problem detected in clutch switch electrical circuit.
P1681	No I/P Cluster CCD/J1850 Messages Received	No CCD/J1850 messages received from the cluster control module.
P1682 (G)	Charging System Voltage Too Low	Battery voltage sense input below target charging voltage during engine operation and no significant change in voltage detected during active test of generator output circuit.
P1682	Charging System Voltage Too Low	Charging system output voltage low.
P1683	SPD CTRL PWR Relay; or S/C 12v Driver CKT	An open or shorted condition detected in the speed control servo power control circuit.
P1683	Spd ctrl pwr rly, or s/c 12v driver circuit	An open or shorted condition detected in the speed control servo power control circuit.
P1684	Batt Loss in 50 Star	The battery has been disconnected within the last 50 starts
P1685	SKIM Invalid Key	The engine controler has received an invalid key from the SKIM.
P1686	No SKIM BUS Messages Received	No CCD/J1850 messages received from the Smart Key Immobilizer Module (SKIM).
P1687	No MIC BUS Message	No CCD/J1850 messages received from the Mechanical Instrument Cluster (MIC) module.
P1688 (M)	Internal Fuel Injection Pump Controller Failure	Internal problem within the fuel injection pump. Low power, engine derated, or engine stops.
P1689 (M)	No Communication Between ECM and Injection Pump Module	Data link circuit failure between ECM and fuel injection pump. Low power, engine derated, or engine stops.

DESCRIPTION AND OPERATION (Continued)

(M) **CHECK ENGINE lamp (Malfunction Indicator Lamp or MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA).**		
(G) **Generator lamp illuminated**		
Generic Scan Tool P-Code	**DRB Scan Tool Display**	**Brief Description of DTC**
P1690 (M)	Fuel Injection Pump CKP Sensor Does Not Agree With ECM CKP Sensor	Problem in fuel sync signal. Possible injection pump timing problem. Low power, engine derated, or engine stops.
P1691	Fuel Injection Pump Controller Calibration Error	Internal fuel injection pump failure. Low power, engine derated, or engine stops.
P1692	DTC Set In ECM	A ″Companion DTC″ was set in both the ECM and PCM.
P1693 (M)	DTC Detected in Companion Module	A fault has been generated in the companion engine control module.
P1693 (M)	DTC Detected in PCM/ECM or DTC Detected in ECM	A ″Companion DTC″ was set in both the ECM and PCM.
P1694	Fault In Companion Module	No CCD/J1850 messages received from the powertrain control module-Aisin transmission
P1694 (M)	No CCD Messages received from ECM	Bus communication failure to PCM.
P1695	No CCD/J1850 Message From Body Control Module	No CCD/J1850 messages received from the body control module.
P1696	PCM Failure EEPROM Write Denied	Unsuccessful attempt to write to an EEPROM location by the control module.
P1697	PCM Failure SRI Mile Not Stored	Unsuccessful attempt to update Service Reminder Indicator (SRI or EMR) mileage in the control module EEPROM.
P1698	No CCD/J1850 Message From TCM	No CCD/J1850 messages received from the electronic transmission control module (EATX) or the Aisin transmission controller.
P1698	No CCD Messages received from PCM	Bus communication failure to PCM. A ″Companion DTC″ was set in both the ECM and PCM.
P1719	Skip Shift Solenoid Circuit	An open or shorted condition detected in the transmission 2-3 gear lock-out solenoid control circuit.
P1740	TCC or OD Sol Perf	A rationality error has been detected in either the TCC solenoid or overdrive solenoid systems.
P1740 (M)	TCC OR O/D Solenoid Performance	Problem detected in transmission convertor clutch and/or overdrive circuits (diesel engine with 4-speed auto. trans. only).
P1756 (M)	GOV Press Not Equal to Target @ 15-20 PSI	The requested pressure and the actual pressure are not within a tolerance band for the Governor Control System which is used to regulate governor pressure to control shifts for 1st, 2nd, and 3rd gear. (Mid Pressure Malfunction)
P1756 (M)	Governor Pressure Not Equal to Target @ 15-20 PSI	Governor sensor input not between 10 and 25 psi when requested (4-speed auto. trans. only).

DESCRIPTION AND OPERATION (Continued)

(M) **CHECK ENGINE lamp (Malfunction Indicator Lamp or MIL) illuminated during engine operation if this DTC was recorded (depending if required by CARB and/or EPA).**		
(G) **Generator lamp illuminated**		
Generic Scan Tool P-Code	**DRB Scan Tool Display**	**Brief Description of DTC**
P1757	GOV Press Not Equal to Target @ 15-20 PSI	The requested pressure and the actual pressure are not within a tolerance band for the Governor Control System which is used to regulate governor pressure to control shifts for 1st, 2nd, and 3rd gear (Zero Pressure Malfunction)
P1757 (M)	Governor Pressure Above 3 PSI In Gear With 0 MPH	Governor pressure greater than 3 psi when requested to be 0 psi (4-speed auto. trans. only).
P1762 (M)	Gov Press Sen Offset Volts Too Lo or High	The Governor Pressure Sensor input is greater than a calibration limit or is less than a calibration limit for 3 consecutive park/neutral calibrations.
P1762 (M)	Governor Press Sen Offset Volts Too Low or High	Sensor input greater or less than calibration for 3 consecutive Neutral/Park occurrences (4-speed auto. trans. only).
P1763	Governor Pressure Sensor Volts Too Hi	The Governor Pressure Sensor input is above an acceptable voltage level.
P1763 (M)	Governor Pressure Sensor Volts Too HI	Voltage greater than 4.89 volts (4-speed auto. trans. only).
P1764 (M)	Governor Pressure Sensor Volts Too Low	The Governor Pressure Sensor input is below an acceptable voltage level.
P1764 (M)	Governor Pressure Sensor Volts Too Low	Voltage less than .10 volts (4-speed auto. trans. only).
P1765 (M)	Trans 12 Volt Supply Relay CTRL Circuit	An open or shorted condition is detected in the Transmission Relay control circuit. This relay supplies power to the TCC
P1765 (M)	Trans 12 Volt Supply Relay Ctrl Circuit	Current state of solenoid output port is different than expected (4-speed auto. trans. only).
P1899 (M)	P/N Switch Stuck in Park or in Gear	Incorrect input state detected for the Park/Neutral switch.
P1899 (M)	P/N Switch Stuck in Park or in Gear	Incorrect input state detected for the Park/Neutral switch (3 or 4-speed auto. trans. only).

MONITORED SYSTEMS

OPERATION

There are new electronic circuit monitors that check fuel, emission, engine and ignition performance. These monitors use information from various sensor circuits to indicate the overall operation of the fuel, engine, ignition and emission systems and thus the emissions performance of the vehicle.

The fuel, engine, ignition and emission systems monitors do not indicate a specific component problem. They do indicate that there is an implied problem within one of the systems and that a specific problem must be diagnosed.

If any of these monitors detect a problem affecting vehicle emissions, the Malfunction Indicator (Check Engine) Lamp will be illuminated. These monitors generate Diagnostic Trouble Codes that can be displayed with the check engine lamp or a scan tool.

The following is a list of the system monitors:

- Misfire Monitor
- Fuel System Monitor
- Oxygen Sensor Monitor
- Oxygen Sensor Heater Monitor
- Catalyst Monitor
- Leak Detection Pump Monitor (if equipped)

All these system monitors require two consecutive trips with the malfunction present to set a fault.

DESCRIPTION AND OPERATION (Continued)

Refer to the appropriate Powertrain Diagnostics Procedures manual for diagnostic procedures.

The following is an operation and description of each system monitor:

OXYGEN SENSOR (O2S) MONITOR

Effective control of exhaust emissions is achieved by an oxygen feedback system. The most important element of the feedback system is the O2S. The O2S is located in the exhaust path. Once it reaches operating temperature 300° to 350°C (572° to 662°F), the sensor generates a voltage that is inversely proportional to the amount of oxygen in the exhaust. The information obtained by the sensor is used to calculate the fuel injector pulse width. This maintains a 14.7 to 1 Air Fuel (A/F) ratio. At this mixture ratio, the catalyst works best to remove hydrocarbons (HC), carbon monoxide (CO) and nitrogen oxide (NOx) from the exhaust.

The O2S is also the main sensing element for the Catalyst and Fuel Monitors.

The O2S can fail in any or all of the following manners:

- slow response rate
- reduced output voltage
- dynamic shift
- shorted or open circuits

Response rate is the time required for the sensor to switch from lean to rich once it is exposed to a richer than optimum A/F mixture or vice versa. As the sensor starts malfunctioning, it could take longer to detect the changes in the oxygen content of the exhaust gas.

The output voltage of the O2S ranges from 0 to 1 volt. A good sensor can easily generate any output voltage in this range as it is exposed to different concentrations of oxygen. To detect a shift in the A/F mixture (lean or rich), the output voltage has to change beyond a threshold value. A malfunctioning sensor could have difficulty changing beyond the threshold value.

OXYGEN SENSOR HEATER MONITOR

If there is an oxygen sensor (O2S) shorted to voltage DTC, as well as a O2S heater DTC, the O2S fault MUST be repaired first. Before checking the O2S fault, verify that the heater circuit is operating correctly.

Effective control of exhaust emissions is achieved by an oxygen feedback system. The most important element of the feedback system is the O2S. The O2S is located in the exhaust path. Once it reaches operating temperature 300° to 350°C (572° to 662°F), the sensor generates a voltage that is inversely proportional to the amount of oxygen in the exhaust. The information obtained by the sensor is used to calculate the fuel injector pulse width. This maintains a 14.7 to 1 Air Fuel (A/F) ratio. At this mixture ratio, the catalyst works best to remove hydrocarbons (HC), carbon monoxide (CO) and nitrogen oxide (NOx) from the exhaust.

The voltage readings taken from the O2S sensor are very temperature sensitive. The readings are not accurate below 300°C. Heating of the O2S sensor is done to allow the engine controller to shift to closed loop control as soon as possible. The heating element used to heat the O2S sensor must be tested to ensure that it is heating the sensor properly.

The O2S sensor circuit is monitored for a drop in voltage. The sensor output is used to test the heater by isolating the effect of the heater element on the O2S sensor output voltage from the other effects.

LEAK DETECTION PUMP MONITOR (IF EQUIPPED)

The leak detection assembly incorporates two primary functions: it must detect a leak in the evaporative system and seal the evaporative system so the leak detection test can be run.

The primary components within the assembly are: A three port solenoid that activates both of the functions listed above; a pump which contains a switch, two check valves and a spring/diaphragm, a canister vent valve (CVV) seal which contains a spring loaded vent seal valve.

Immediately after a cold start, between predetermined temperature thresholds limits, the three port solenoid is briefly energized. This initializes the pump by drawing air into the pump cavity and also closes the vent seal. During non test conditions the vent seal is held open by the pump diaphragm assembly which pushes it open at the full travel position. The vent seal will remain closed while the pump is cycling due to the reed switch triggering of the three port solenoid that prevents the diaphragm assembly from reaching full travel. After the brief initialization period, the solenoid is de-energized allowing atmospheric pressure to enter the pump cavity, thus permitting the spring to drive the diaphragm which forces air out of the pump cavity and into the vent system. When the solenoid is energized and de energized, the cycle is repeated creating flow in typical diaphragm pump fashion. The pump is controlled in 2 modes:

Pump Mode: The pump is cycled at a fixed rate to achieve a rapid pressure build in order to shorten the overall test length.

Test Mode: The solenoid is energized with a fixed duration pulse. Subsequent fixed pulses occur when the diaphragm reaches the Switch closure point.

The spring in the pump is set so that the system will achieve an equalized pressure of about 7.5” H20.

DESCRIPTION AND OPERATION (Continued)

The cycle rate of pump strokes is quite rapid as the system begins to pump up to this pressure. As the pressure increases, the cycle rate starts to drop off. If there is no leak in the system, the pump would eventually stop pumping at the equalized pressure. If there is a leak, it will continue to pump at a rate representative of the flow characteristic of the size of the leak. From this information we can determine if the leak is larger than the required detection limit (currently set at .040" orifice by CARB). If a leak is revealed during the leak test portion of the test, the test is terminated at the end of the test mode and no further system checks will be performed.

After passing the leak detection phase of the test, system pressure is maintained by turning on the LDP's solenoid until the purge system is activated. Purge activation in effect creates a leak. The cycle rate is again interrogated and when it increases due to the flow through the purge system, the leak check portion of the diagnostic is complete.

The canister vent valve will unseal the system after completion of the test sequence as the pump diaphragm assembly moves to the full travel position.

Evaporative system functionality will be verified by using the stricter evap purge flow monitor. At an appropriate warm idle the LDP will be energized to seal the canister vent. The purge flow will be clocked up from some small value in an attempt to see a shift in the 02 control system. If fuel vapor, indicated by a shift in the 02 control, is present the test is passed. If not, it is assumed that the purge system is not functioning in some respect. The LDP is again turned off and the test is ended.

MISFIRE MONITOR

Excessive engine misfire results in increased catalyst temperature and causes an increase in HC emissions. Severe misfires could cause catalyst damage. To prevent catalytic convertor damage, the PCM monitors engine misfire.

The Powertrain Control Module (PCM) monitors for misfire during most engine operating conditions (positive torque) by looking at changes in the crankshaft speed. If a misfire occurs the speed of the crankshaft will vary more than normal.

FUEL SYSTEM MONITOR

To comply with clean air regulations, vehicles are equipped with catalytic converters. These converters reduce the emission of hydrocarbons, oxides of nitrogen and carbon monoxide. The catalyst works best when the Air Fuel (A/F) ratio is at or near the optimum of 14.7 to 1.

The PCM is programmed to maintain the optimum air/fuel ratio of 14.7 to 1. This is done by making short term corrections in the fuel injector pulse width based on the O2S sensor output. The programmed memory acts as a self calibration tool that the engine controller uses to compensate for variations in engine specifications, sensor tolerances and engine fatigue over the life span of the engine. By monitoring the actual fuel-air ratio with the O2S sensor (short term) and multiplying that with the program long-term (adaptive) memory and comparing that to the limit, it can be determined whether it will pass an emissions test. If a malfunction occurs such that the PCM cannot maintain the optimum A/F ratio, then the MIL will be illuminated.

CATALYST MONITOR

To comply with clean air regulations, vehicles are equipped with catalytic converters. These converters reduce the emission of hydrocarbons, oxides of nitrogen and carbon monoxide.

Normal vehicle miles or engine misfire can cause a catalyst to decay. A meltdown of the ceramic core can cause a reduction of the exhaust passage. This can increase vehicle emissions and deteriorate engine performance, driveability and fuel economy.

The catalyst monitor uses dual oxygen sensors (O2S's) to monitor the efficiency of the converter. The dual O2S's sensor strategy is based on the fact that as a catalyst deteriorates, its oxygen storage capacity and its efficiency are both reduced. By monitoring the oxygen storage capacity of a catalyst, its efficiency can be indirectly calculated. The upstream O2S is used to detect the amount of oxygen in the exhaust gas before the gas enters the catalytic converter. The PCM calculates the A/F mixture from the output of the O2S. A low voltage indicates high oxygen content (lean mixture). A high voltage indicates a low content of oxygen (rich mixture).

When the upstream O2S detects a lean condition, there is an abundance of oxygen in the exhaust gas. A functioning converter would store this oxygen so it can use it for the oxidation of HC and CO. As the converter absorbs the oxygen, there will be a lack of oxygen downstream of the converter. The output of the downstream O2S will indicate limited activity in this condition.

As the converter loses the ability to store oxygen, the condition can be detected from the behavior of the downstream O2S. When the efficiency drops, no chemical reaction takes place. This means the concentration of oxygen will be the same downstream as upstream. The output voltage of the downstream O2S copies the voltage of the upstream sensor. The only difference is a time lag (seen by the PCM) between the switching of the O2S's.

To monitor the system, the number of lean-to-rich switches of upstream and downstream O2S's is counted. The ratio of downstream switches to

DESCRIPTION AND OPERATION (Continued)

upstream switches is used to determine whether the catalyst is operating properly. An effective catalyst will have fewer downstream switches than it has upstream switches i.e., a ratio closer to zero. For a totally ineffective catalyst, this ratio will be one-to-one, indicating that no oxidation occurs in the device.

The system must be monitored so that when catalyst efficiency deteriorates and exhaust emissions increase to over the legal limit, the MIL (check engine lamp) will be illuminated.

TRIP DEFINITION

OPERATION

The term "Trip" has different meanings depending on what the circumstances are. If the MIL (Malfunction Indicator Lamp) is OFF, a Trip is defined as when the Oxygen Sensor Monitor and the Catalyst Monitor have been completed in the same drive cycle.

When any Emission DTC is set, the MIL on the dash is turned ON. When the MIL is ON, it takes 3 good trips to turn the MIL OFF. In this case, it depends on what type of DTC is set to know what a "Trip" is.

For the Fuel Monitor or Mis-Fire Monitor (continuous monitor), the vehicle must be operated in the "Similar Condition Window" for a specified amount of time to be considered a Good Trip.

If a Non-Contiuous OBDII Monitor, such as:

- Oxygen Sensor
- Catalyst Monitor
- Purge Flow Monitor
- Leak Detection Pump Monitor (if equipped)
- EGR Monitor (if equipped)
- Oxygen Sensor Heater Monitor

fails twice in a row and turns ON the MIL, re-running that monitor which previously failed, on the next start-up and passing the monitor is considered to be a Good Trip.

If any other Emission DTC is set (not an OBDII Monitor), a Good Trip is considered to be when the Oxygen Sensor Monitor and Catalyst Monitor have been completed; or 2 Minutes of engine run time if the Oxygen Sensor Monitor or Catalyst Monitor have been stopped from running.

It can take up to 2 Failures in a row to turn on the MIL. After the MIL is ON, it takes 3 Good Trips to turn the MIL OFF. After the MIL is OFF, the PCM will self-erase the DTC after 40 Warm-up cycles. A Warm-up cycle is counted when the ECT (Engine Coolant Temperature Sensor) has crossed 160°F and has risen by at least 40°F since the engine has been started.

COMPONENT MONITORS

OPERATION

There are several components that will affect vehicle emissions if they malfunction. If one of these components malfunctions the Malfunction Indicator Lamp (Check Engine) will illuminate.

Some of the component monitors are checking for proper operation of the part. Electrically operated components now have input (rationality) and output (functionality) checks. Previously, a component like the Throttle Position sensor (TPS) was checked by the PCM for an open or shorted circuit. If one of these conditions occurred, a DTC was set. Now there is a check to ensure that the component is working. This is done by watching for a TPS indication of a greater or lesser throttle opening than MAP and engine rpm indicate. In the case of the TPS, if engine vacuum is high and engine rpm is 1600 or greater and the TPS indicates a large throttle opening, a DTC will be set. The same applies to low vacuum if the TPS indicates a small throttle opening.

All open/short circuit checks or any component that has an associated limp in will set a fault after 1 trip with the malfunction present. Components without an associated limp in will take two trips to illuminate the MIL.

Refer to the Diagnostic Trouble Codes Description Charts in this section and the appropriate Powertrain Diagnostic Procedure Manual for diagnostic procedures.

NON-MONITORED CIRCUITS

The PCM does not monitor the following circuits, systems and conditions that could have malfunctions causing driveability problems. The PCM might not store diagnostic trouble codes for these conditions. However, problems with these systems may cause the PCM to store diagnostic trouble codes for other systems or components. For example, a fuel pressure problem will not register a fault directly, but could cause a rich/lean condition or misfire. This could cause the PCM to store an oxygen sensor or misfire diagnostic trouble code.

OPERATION

FUEL PRESSURE

The fuel pressure regulator controls fuel system pressure. The PCM cannot detect a clogged fuel pump inlet filter, clogged in-line fuel filter, or a pinched fuel supply or return line. However, these could result in a rich or lean condition causing the PCM to store an oxygen sensor or fuel system diagnostic trouble code.

DESCRIPTION AND OPERATION (Continued)

SECONDARY IGNITION CIRCUIT

The PCM cannot detect an inoperative ignition coil, fouled or worn spark plugs, ignition cross firing, or open spark plug cables.

CYLINDER COMPRESSION

The PCM cannot detect uneven, low, or high engine cylinder compression.

EXHAUST SYSTEM

The PCM cannot detect a plugged, restricted or leaking exhaust system, although it may set a fuel system fault.

FUEL INJECTOR MECHANICAL MALFUNCTIONS

The PCM cannot determine if a fuel injector is clogged, the needle is sticking or if the wrong injector is installed. However, these could result in a rich or lean condition causing the PCM to store a diagnostic trouble code for either misfire, an oxygen sensor, or the fuel system.

EXCESSIVE OIL CONSUMPTION

Although the PCM monitors engine exhaust oxygen content when the system is in closed loop, it cannot determine excessive oil consumption.

THROTTLE BODY AIR FLOW

The PCM cannot detect a clogged or restricted air cleaner inlet or filter element.

VACUUM ASSIST

The PCM cannot detect leaks or restrictions in the vacuum circuits of vacuum assisted engine control system devices. However, these could cause the PCM to store a MAP sensor diagnostic trouble code and cause a high idle condition.

PCM SYSTEM GROUND

The PCM cannot determine a poor system ground. However, one or more diagnostic trouble codes may be generated as a result of this condition. The module should be mounted to the body at all times, also during diagnostic.

PCM CONNECTOR ENGAGEMENT

The PCM may not be able to determine spread or damaged connector pins. However, it might store diagnostic trouble codes as a result of spread connector pins.

HIGH AND LOW LIMITS

OPERATION

The PCM compares input signal voltages from each input device with established high and low limits for the device. If the input voltage is not within limits and other criteria are met, the PCM stores a diagnostic trouble code in memory. Other diagnostic trouble code criteria might include engine RPM limits or input voltages from other sensors or switches that must be present before verifying a diagnostic trouble code condition.

LOAD VALUE

OPERATION

ENGINE	IDLE/NEUTRAL	2500 RPM/ NEUTRAL
All Engines	2% to 8% of Maximum Load	9% to 17% of Maximum Load

EVAPORATIVE EMISSION CONTROLS

INDEX

DESCRIPTION AND OPERATION

EVAPORATION CONTROL SYSTEM

OPERATION

The evaporation control system prevents the emission of fuel tank vapors into the atmosphere. When fuel evaporates in the fuel tank, the vapors pass through vent hoses or tubes to a charcoal filled evaporative canister. The canister temporarily holds the vapors. The Powertrain Control Module (PCM) allows intake manifold vacuum to draw vapors into the combustion chambers during certain operating conditions.

All engines use a duty cycle purge system. The PCM controls vapor flow by operating the duty cycle EVAP purge solenoid. Refer to Duty Cycle EVAP Canister Purge Solenoid.

When equipped with certain emissions packages, a Leak Detection Pump (LDP) will be used as part of the evaporative system for OBD II requirements. Also refer to Leak Detection Pump.

NOTE: The evaporative system uses specially manufactured lines/hoses. If replacement becomes necessary, only use fuel resistant hose.

ROLLOVER VALVE

DESCRIPTION

The fuel tank is equipped with a rollover valve. The valve is located on the top of the fuel tank (Fig. 1).

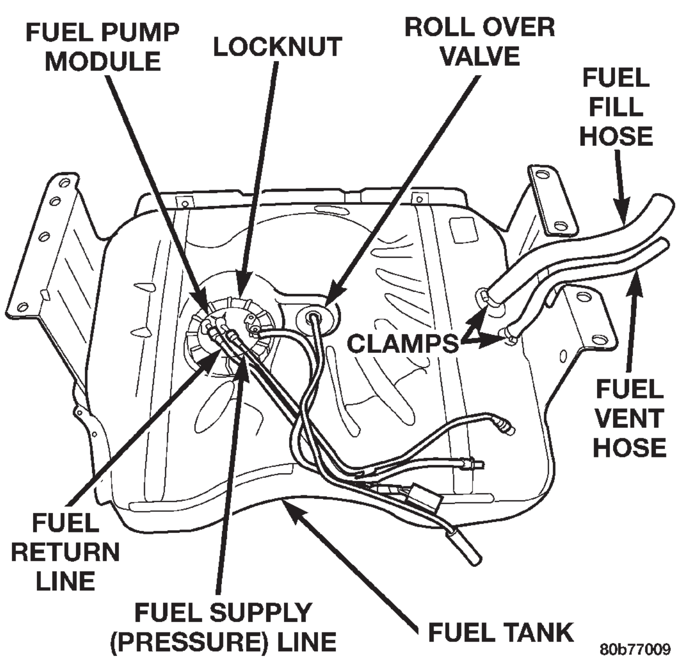


Fig. 1 Rollover Valve Location

OPERATION

The rollover valve will prevent fuel flow through the fuel tank vent (EVAP) hoses in the event of an accidental vehicle rollover. The EVAP canister draws fuel vapors from the fuel tank through this valve.

The valve cannot be serviced separately. If replacement is necessary, the fuel tank must be replaced. Refer to Fuel Tank Removal/Installation.

EVAPORATION (EVAP) CANISTER

OPERATION

A maintenance free, EVAP canister is used on all vehicles. The EVAP canister is filled with granules of an activated carbon mixture. Fuel vapors entering the EVAP canister are absorbed by the charcoal granules.

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 duty cycle EVAP canister purge solenoid allows the EVAP canister to be purged at predetermined times and at certain engine operating conditions.

DUTY CYCLE EVAP CANISTER PURGE SOLENOID

OPERATION

The duty cycle EVAP canister purge solenoid (DCP) regulates the rate of vapor flow from the EVAP canister to the intake manifold. The Powertrain Control Module (PCM) operates the solenoid.

During the cold start warm-up period and the hot start time delay, the PCM does not energize the solenoid. When de-energized, no vapors are purged. The PCM de-energizes the solenoid during open loop operation.

The engine enters closed loop operation after it reaches a specified temperature and the time delay ends. During closed loop operation, the PCM cycles (energizes and de-energizes) the solenoid 5 or 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 that the solenoid is energized. The PCM adjusts solenoid pulse width based on engine operating condition.

LEAK DETECTION PUMP (LDP)

OPERATION

The Leak Detection Pump (LDP) is used only with certain emission packages.

The LDP is a device used to detect a leak in the evaporative system.

The pump contains a 3 port solenoid, a pump that contains a switch, a spring loaded canister vent valve seal, 2 check valves and a spring/diaphragm.

Immediately after a cold start, engine temperature between 40°F and 86°F, the 3 port solenoid is briefly energized. This initializes the pump by drawing air into the pump cavity and also closes the vent seal. During non-test test conditions, the vent seal is held open by the pump diaphragm assembly which pushes it open at the full travel position. The vent seal will remain closed while the pump is cycling. This is due to the operation of the 3 port solenoid which prevents the diaphragm assembly from reaching full travel. After the brief initialization period, the solenoid is de-energized, allowing atmospheric pressure to enter the pump cavity. This permits the spring to drive the diaphragm which forces air out of the pump cavity and into the vent system. When the solenoid is energized and de-energized, the cycle is repeated creating flow in typical diaphragm pump fashion. The pump is controlled in 2 modes:

PUMP MODE: The pump is cycled at a fixed rate to achieve a rapid pressure build in order to shorten the overall test time.

TEST MODE: The solenoid is energized with a fixed duration pulse. Subsequent fixed pulses occur when the diaphragm reaches the switch closure point.

The spring in the pump is set so that the system will achieve an equalized pressure of about 7.5 inches of water.

When the pump starts, the cycle rate is quite high. As the system becomes pressurized pump rate drops. If there is no leak the pump will quit. If there is a leak, the test is terminated at the end of the test mode.

If there is no leak, the purge monitor is run. If the cycle rate increases due to the flow through the purge system, the test is passed and the diagnostic is complete.

The canister vent valve will unseal the system after completion of the test sequence as the pump diaphragm assembly moves to the full travel position.

A typical system schematic is shown in (Fig. 2).

DESCRIPTION AND OPERATION (Continued)

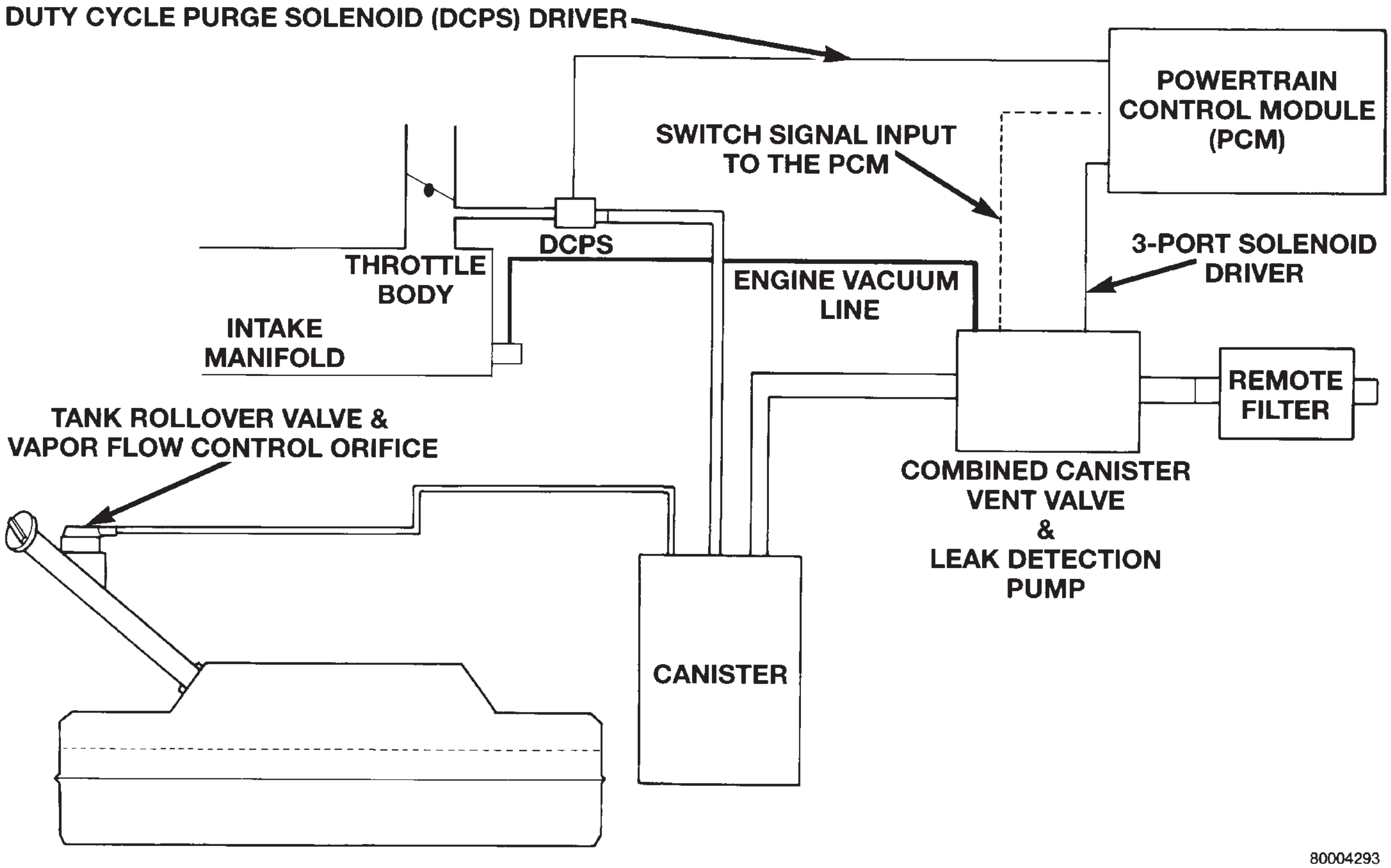


Fig. 2 Evaporative System Monitor Schematic—Typical

CRANKCASE VENTILATION (CCV) SYSTEM—4.0L ENGINE

DESCRIPTION

The 4.0L 6–cylinder engine is equipped with a Crankcase Ventilation (CCV) system. The system consists of:

- A fixed orifice fitting of a calibrated size. This fitting is pressed into a rubber grommet located on the top/rear of cylinder head (valve) cover (Fig. 3).
- a pair of breather tubes (lines) to connect the system components.
- the air cleaner housing.
- an air inlet fitting (Fig. 3).

OPERATION

The CCV system performs the same function as a conventional PCV system, but does not use a vacuum controlled PCV valve.

The fixed orifice fitting meters the amount of crankcase vapors drawn out of the engine.

When the engine is operating, fresh air enters the engine and mixes with crankcase vapors. Engine vacuum draws the vapor/air mixture through the fixed orifice and into the intake manifold. The vapors are then consumed during engine combustion.

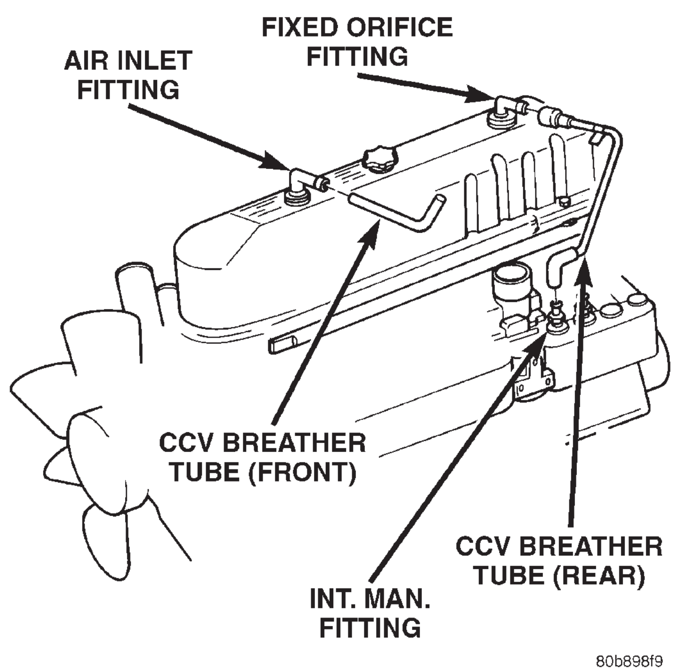


Fig. 3 CCV System—4.0L Engine

DESCRIPTION AND OPERATION (Continued)

POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM—4.7L ENGINE

DESCRIPTION

The 4.7L V-8 engine is equipped with a closed crankcase ventilation system and a Positive Crankcase Ventilation (PCV) valve.

This system consists of:

- a PCV valve mounted to the oil filler housing (Fig. 4). The PCV valve is sealed to the oil filler housing with an o-ring.
- the air cleaner housing
- two interconnected breathers threaded into the rear of each cylinder head (Fig. 5).
- tubes and hose to connect the system components.

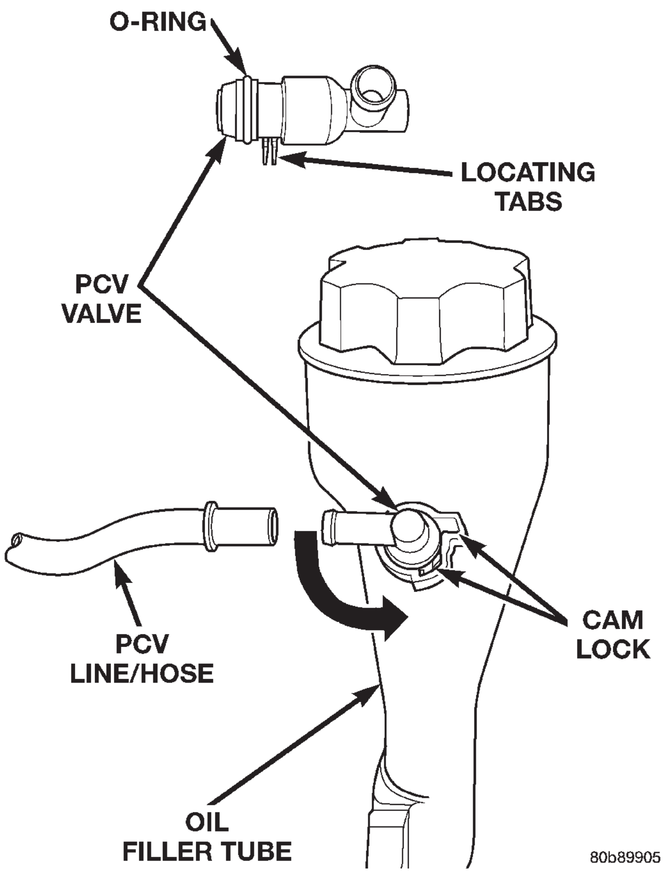


Fig. 4 PCV Valve/Oil Filler Tube (Housing)—4.7L Engine

OPERATION

The PCV system operates by engine intake manifold vacuum. Filtered air is routed into the crankcase through the air cleaner hose and crankcase breathers. The metered air, along with crankcase vapors, are drawn through the PCV valve and into a passage in the intake manifold. The PCV system manages crankcase pressure and meters blow-by gases to the intake system, reducing engine sludge formation.

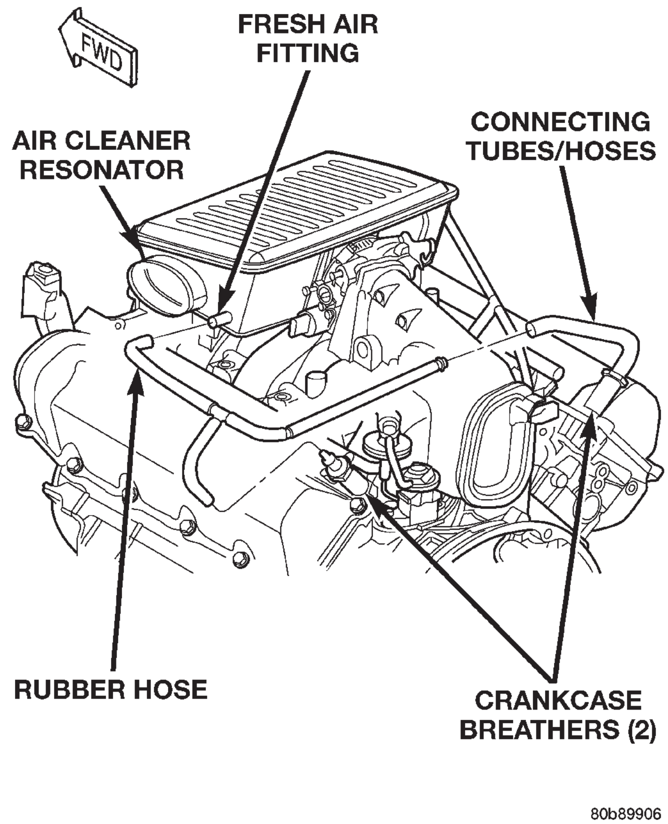


Fig. 5 PCV System Hoses/Tubes—4.7L Engine

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.

TYPICAL PCV valves are shown in (Fig. 6), (Fig. 7) and (Fig. 8).

When the engine is not operating, or during an engine pop-back, the spring forces the plunger back against the seat (Fig. 6). This will prevent vapors from flowing through the valve.

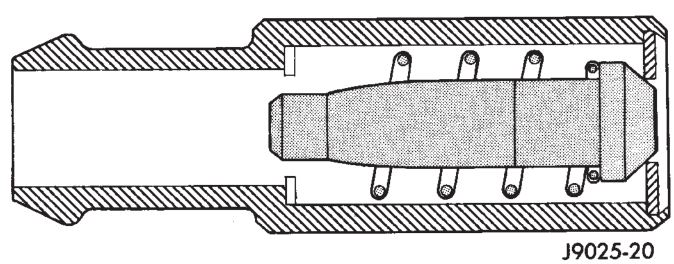


Fig. 6 Engine Off or Engine Pop-Back—No Vapor Flow

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

DESCRIPTION AND OPERATION (Continued)

to the top of the valve (Fig. 7). In this position there is minimal vapor flow through the valve.

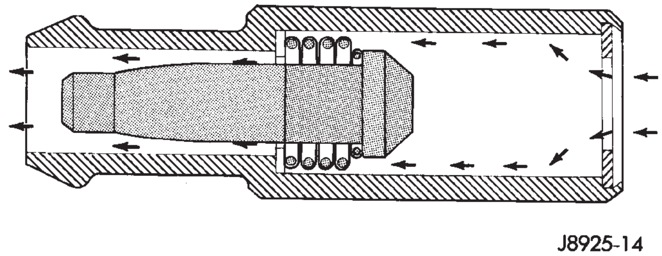


Fig. 7 High Intake Manifold Vacuum— Minimal Vapor Flow

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. 8).

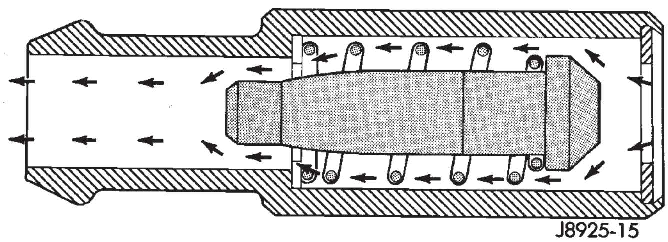


Fig. 8 Moderate Intake Manifold Vacuum— Maximum Vapor Flow

VEHICLE EMISSION CONTROL INFORMATION (VECI) LABEL

DESCRIPTION

All vehicles are equipped with a combined VECI label(s). The label is located in the engine compartment on the vehicle hood (Fig. 9). Two labels are used for vehicles built for sale in the country of Canada. The label(s) contains the following:

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

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.

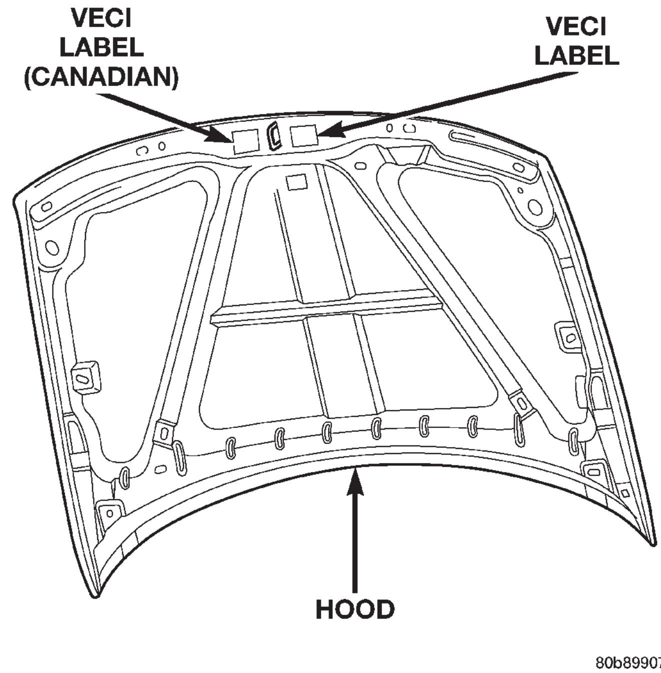


Fig. 9 VECI Label Location

DIAGNOSIS AND TESTING

FIXED ORIFICE FITTING/CCV SYSTEM TEST—4.0L ENGINE

Before attempting diagnosis, be sure locations of fixed orifice fitting and air inlet fitting (Fig. 10) have not been inadvertently exchanged. The fixed orifice fitting is light grey in color and is located at **rear** of valve cover. The air inlet fitting is black in color and is located at **front** of valve cover.

(1) Pull fixed orifice fitting (Fig. 10) from valve cover and leave tube attached.

(2) Start engine and bring to idle speed.

(3) If fitting is not plugged, a hissing noise will be heard as air passes through fitting orifice. Also, a strong vacuum should be felt with a finger placed at fitting inlet.

(4) If vacuum is not present, remove fitting orifice fitting from tube. Start engine. If vacuum can now be felt, replace fixed orifice fitting. Do not attempt to clean plastic fitting.

(5) If vacuum is still not felt at hose, check line/ hose for kinks or for obstruction. If necessary, clean out intake manifold fitting at intake manifold. Do this by turning a 1/4 inch drill (by hand) through the fitting to dislodge any solid particles. Blow out the fitting with shop air. If necessary, use a smaller drill to avoid removing any metal from the fitting.

(6) Return fixed orifice fitting to valve cover and leave tube attached.

(7) Disconnect air inlet fitting and its attached hose at front of valve cover (Fig. 10). Start engine

DIAGNOSIS AND TESTING (Continued)

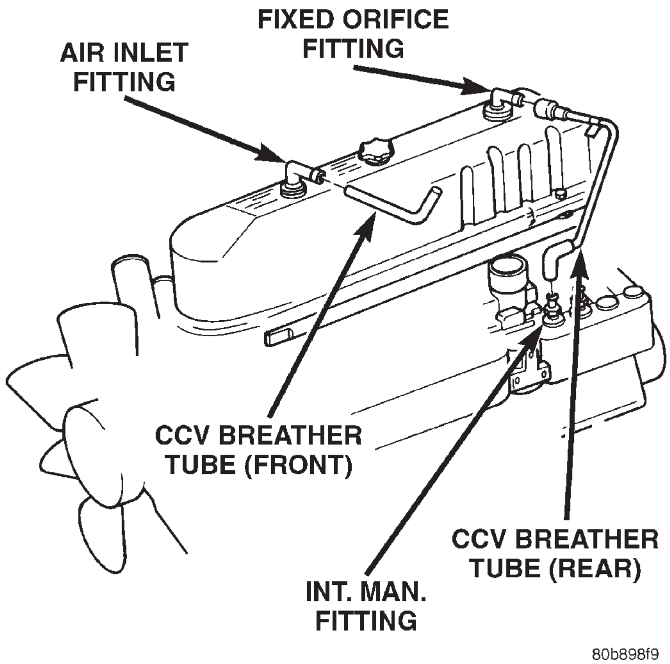


Fig. 10 Fixed Orifice Fitting and CCV System—4.0L Engine

and bring to idle speed. Hold a piece of stiff paper (such as a parts tag) loosely over the rubber grommet (opening) of the disconnected air inlet fitting.

(8) The paper should be drawn against the rubber grommet with noticeable force. This will be after allowing approximately one minute for crankcase pressure to reduce.

(9) If vacuum is not present, check breather hoses/tubes/lines for obstructions or restrictions.

(10) After testing, reconnect all system hoses/tubes/lines.

PCV VALVE/PCV SYSTEM TEST—4.7L V-8 ENGINE

(1) Disconnect PCV line/hose (Fig. 11) by disconnecting rubber connecting hose at PCV valve fitting.

(2) Remove PCV valve at oil filler tube by rotating PCV valve downward until locating tabs have been freed at cam lock (Fig. 11). After tabs have cleared, pull valve straight out from filler tube. **To prevent damage to PCV valve locating tabs, valve must be pointed downward for removal. Do not force valve from oil filler tube.**

(3) After valve is removed, check condition of valve o-ring (Fig. 11). Also, PCV valve should rattle when shaken.

(4) Reconnect PCV valve to its connecting line/hose.

(5) Start engine and bring to idle speed.

(6) If valve is not plugged, a hissing noise will be heard as air passes through valve. Also, a strong vacuum should be felt with a finger placed at valve inlet.

(7) If vacuum is not felt at valve inlet, check line/hose for kinks or for obstruction. If necessary, clean out intake manifold fitting at rear of manifold. Do this by turning a 1/4 inch drill (by hand) through the fitting to dislodge any solid particles. Blow out the fitting with shop air. If necessary, use a smaller drill to avoid removing any metal from the fitting.

(8) **Do not attempt to clean the old PCV valve.**

(9) Return PCV valve back to oil filler tube by placing valve locating tabs (Fig. 11) into cam lock. Press PCV valve in and rotate valve upward. A slight click will be felt when tabs have engaged cam lock. Valve should be pointed towards rear of vehicle.

(10) Connect PCV line/hose and connecting rubber hose to PCV valve.

(11) Disconnect rubber hose from fresh air fitting at left side of air cleaner resonator box (Fig. 12). Start engine and bring to idle speed. Hold a piece of stiff paper (such as a parts tag) loosely over the opening of the disconnected rubber hose.

(12) The paper should be drawn against the hose opening with noticeable force. This will be after allowing approximately one minute for crankcase pressure to reduce.

(13) If vacuum is not present, disconnect each PCV system hose at top of each breather (Fig. 12). Check for obstructions or restrictions.

(14) If vacuum is still not present, remove each PCV system breather (Fig. 12) from each cylinder head. Check for obstructions or restrictions. If plugged, replace breather. Tighten breather to 12 N·m (106 in. lbs.) torque. Do not attempt to clean breather.

(15) If vacuum is still not present, disconnect each PCV system hose at each fitting and check for obstructions or restrictions.

DIAGNOSIS AND TESTING (Continued)

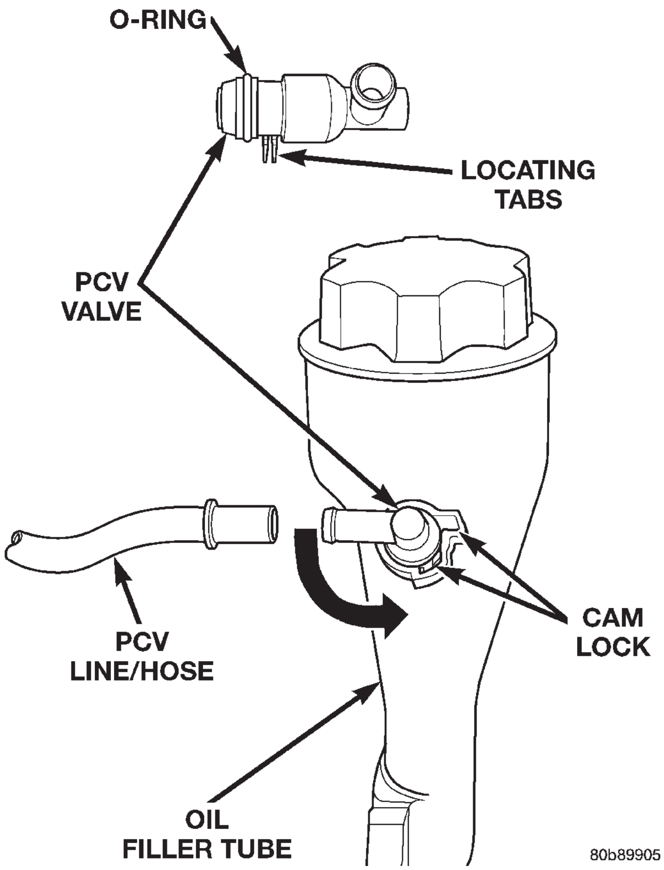


Fig. 11 PCV Valve/Oil Filler Tube—4.7L V-8 Engine

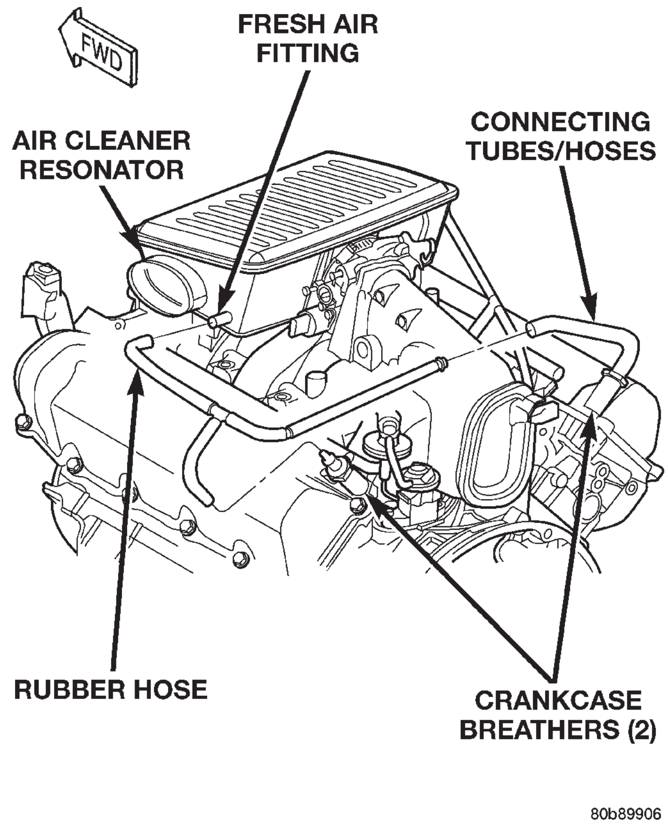


Fig. 12 PCV Breathers/Tubes/Hoses—4.7L V-8 Engine

VACUUM SCHEMATICS

A vacuum schematic for emission related items can be found on the Vehicle Emission Control Information (VECI) label. For label location, refer to Vehicle Emission Control Information (VECI) Label.

LEAK DETECTION PUMP (LDP)

Refer to the appropriate Powertrain Diagnostic Procedures service manual for LDP testing procedures.

REMOVAL AND INSTALLATION

FIXED ORIFICE FITTING—4.0L ENGINE

When installing fixed orifice fitting, be sure locations of fixed orifice fitting and air inlet fitting (Fig. 13) have not been inadvertently exchanged. The fixed orifice fitting is light grey in color and is located at **rear** of valve cover. The air inlet fitting is black in color and is located at **front** of valve cover.

REMOVAL

(1) Pull fixed orifice fitting (Fig. 13) from valve cover grommet.

(2) Separate fitting from CCV breather tube.

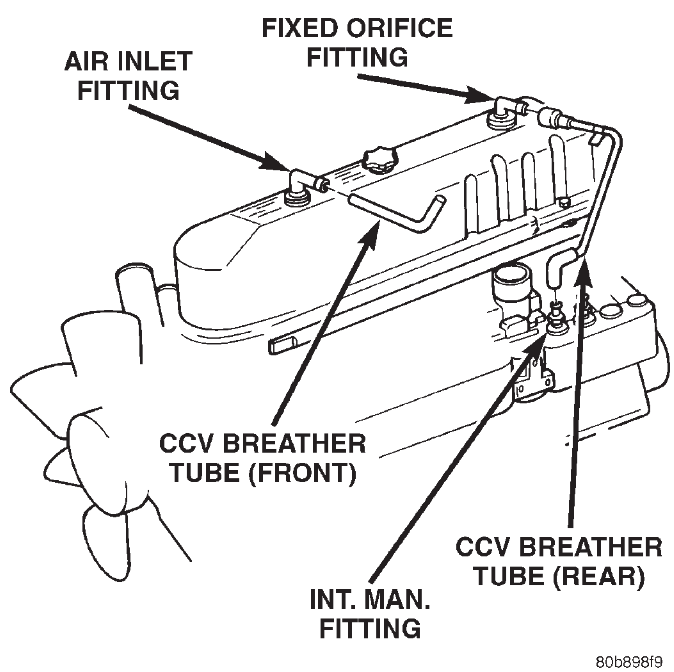


Fig. 13 Fixed Orifice Fitting—4.0L Engine

REMOVAL AND INSTALLATION (Continued)

INSTALLATION

(1) Connect fitting to CCV breather tube.

(2) Return fixed orifice fitting to valve cover grommet.

PCV VALVE—4.7L V-8 ENGINE

The PCV valve is located on the oil filler tube (Fig. 14). Two locating tabs are located on the side of the valve (Fig. 14). These 2 tabs fit into a cam lock in the oil filler tube. An o-ring seals the valve to the filler tube.

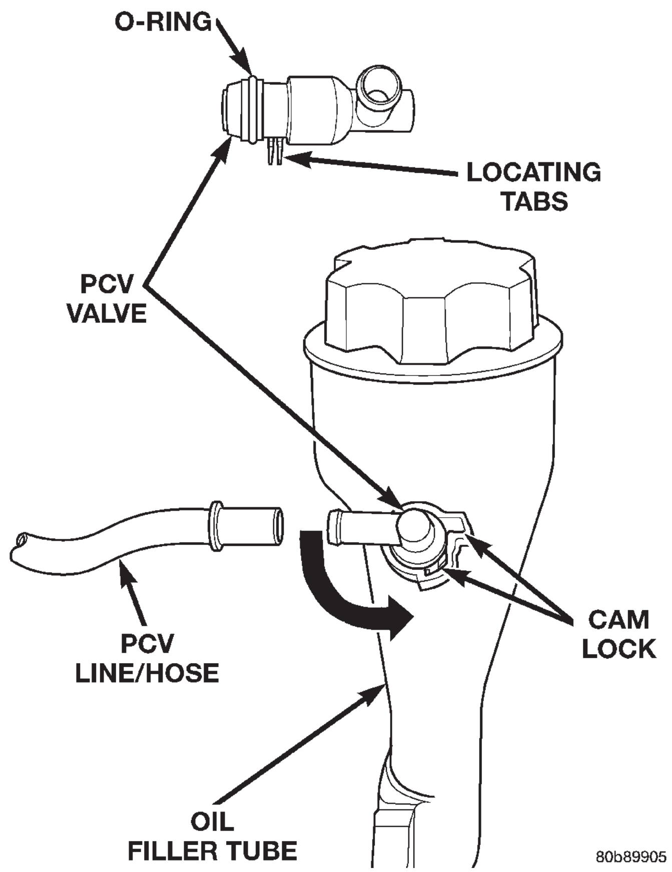


Fig. 14 PCV Valve/Oil Filler Tube Location

REMOVAL

(1) Disconnect PCV line/hose (Fig. 14) by disconnecting rubber hose at PCV valve fitting.

(2) Remove PCV valve at oil filler tube by rotating PCV valve downward (counter-clockwise) until locating tabs have been freed at cam lock (Fig. 14). After tabs have cleared, pull valve straight out from filler tube. **To prevent damage to PCV valve locating tabs, valve must be pointed downward for removal. Do not force valve from oil filler tube.**

(3) After valve is removed, check condition of valve o-ring (Fig. 14).

INSTALLATION

(1) Return PCV valve back to oil filler tube by placing valve locating tabs (Fig. 14) into cam lock. Press PCV valve in and rotate valve upward. A slight click will be felt when tabs have engaged cam lock. Valve should be pointed towards rear of vehicle.

(2) Connect PCV line/hose and rubber hose to PCV valve.

EVAPORATIVE (EVAP) CANISTER

The EVAP canister is located in the engine compartment near the brake power booster (Fig. 15).

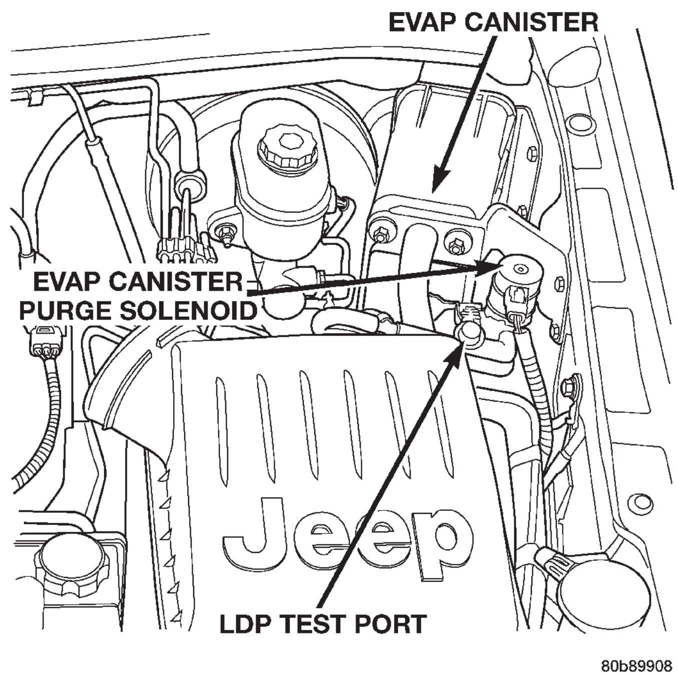


Fig. 15 EVAP Canister, EVAP Solenoid, LDP Test Port Locations

REMOVAL

(1) Remove duty cycle EVAP canister purge solenoid and its mounting bracket at front of EVAP canister (2 nuts).

(2) Disconnect vacuum lines at EVAP canister.

(3) Remove 2 canister mounting bolts at front mounting bracket (Fig. 16).

(4) Remove canister from rear mounting bracket (2 pins are used (Fig. 16) to align canister to rear bracket)

INSTALLATION

(1) Position canister to body. Guide pins into rear bracket.

(2) Install canister mounting bolts. Tighten bolts to 11 N·m (100 in. lbs.) torque.

(3) Connect vacuum lines. Be sure vacuum lines are firmly connected and not leaking or damaged. If

REMOVAL AND INSTALLATION (Continued)

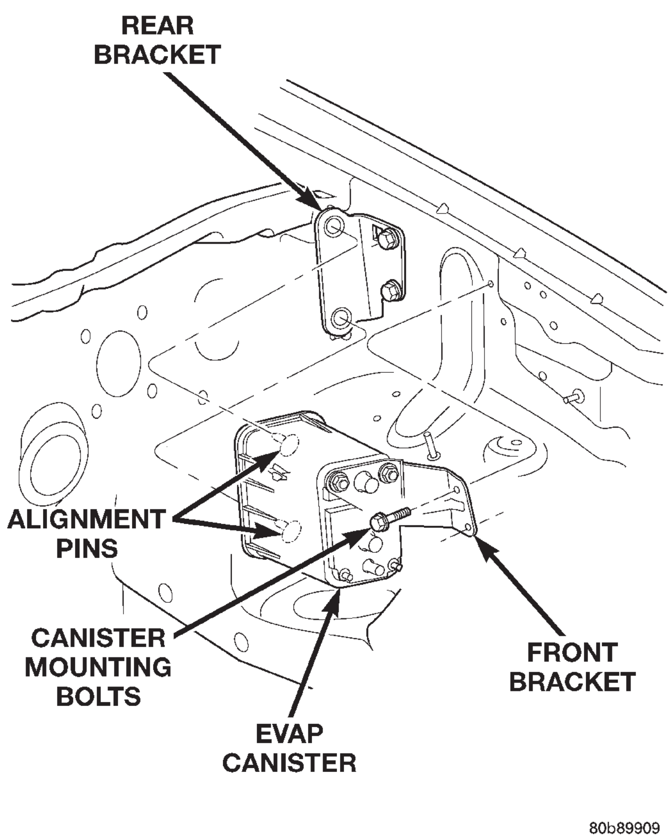


Fig. 16 EVAP Canister Removal/Installation

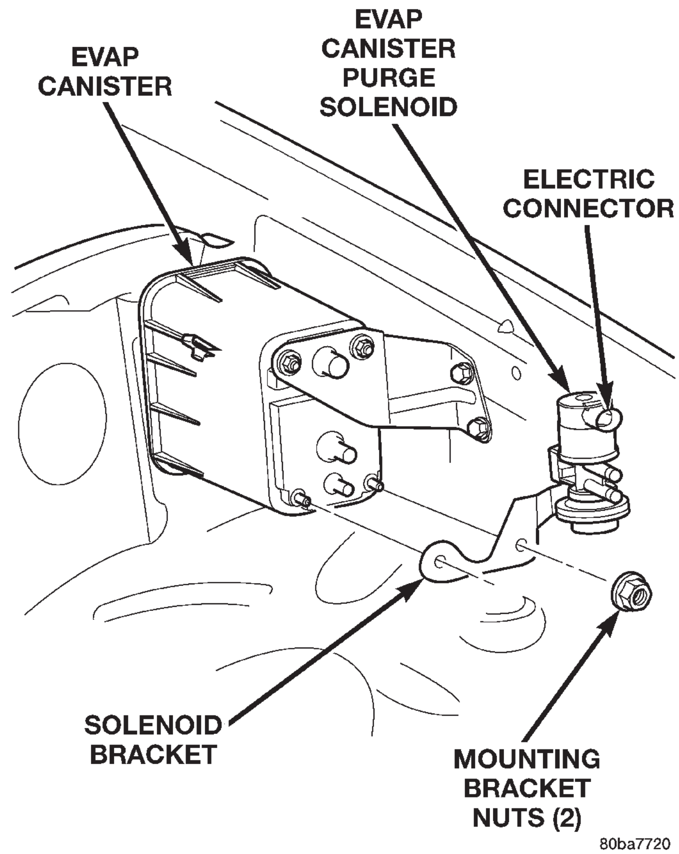


Fig. 17 EVAP Canister Purge Solenoid Removal/Installation

leaking, a Diagnostic Trouble Code (DTC) may be set with certain emission packages.

(4) Install duty cycle EVAP canister purge solenoid and its mounting bracket to front of EVAP canister (2 nuts). Tighten nuts to 9 N·m (80 in. lbs.) torque.

EVAPORATIVE CANISTER PURGE SOLENOID

REMOVAL

The duty cycle evaporative (EVAP) canister purge solenoid is located in the engine compartment in front of the EVAP canister (Fig. 15).

(1) Disconnect electrical connector at solenoid.

(2) Disconnect vacuum lines at solenoid.

(3) Remove two bracket mounting nuts (Fig. 17) and remove solenoid/solenoid bracket.

INSTALLATION

(1) Position solenoid/solenoid bracket to vehicle.

(2) Install and tighten 2 bracket mounting nuts to 9 N·m (80 in. lbs.) torque.

(3) Connect vacuum lines to solenoid. Be sure vacuum lines are firmly connected and not leaking or damaged. If leaking, a Diagnostic Trouble Code (DTC) may be set with certain emission packages.

(4) Connect electrical connector to solenoid.

ROLLOVER VALVE(S)

The rollover valves(s) are/is molded into the fuel tank and are not serviced separately. If replacement is necessary, the fuel tank must be replaced. Refer to Fuel Tank Removal/Installation.

LEAK DETECTION PUMP (LDP)

The LDP is located in the left/front corner of engine compartment below air cleaner housing (Fig. 18). It is mounted to left/front inner fender sheet metal. The LDP and LDP filter are replaced (serviced) as one unit.

REMOVAL

(1) Remove air cleaner housing. Refer to Air Cleaner Housing/Resonator/Ducts Removal/Installation.

(2) Disconnect electrical connector at LDP.

(3) Carefully remove vapor/vacuum lines at LDP.

(4) Remove 3 LDP mounting bolts (Fig. 18).

(5) Remove LDP from inner fender.

REMOVAL AND INSTALLATION (Continued)

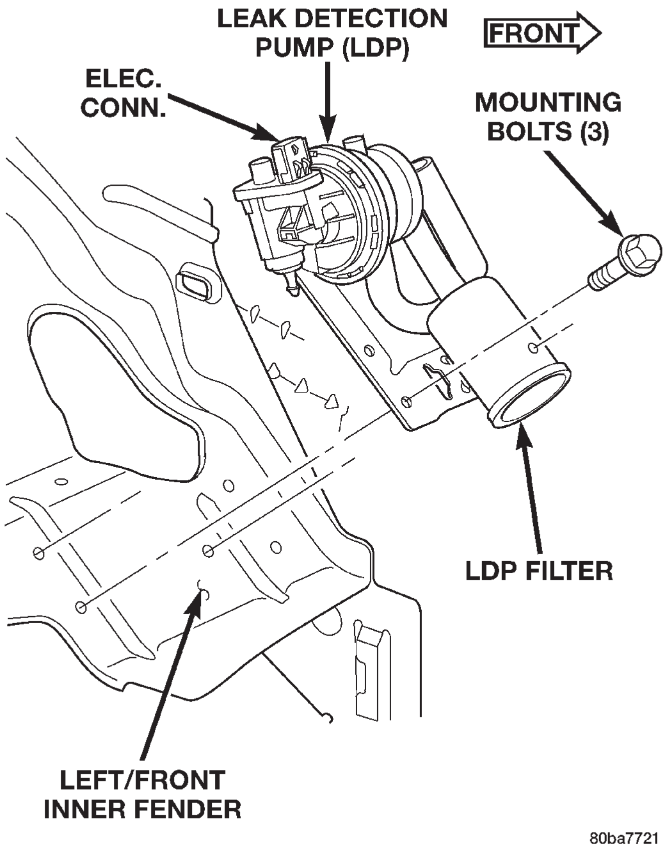


Fig. 18 Leak Detection Pump (LDP) Removal/ Installation

INSTALLATION

(1) Install LDP assembly to inner fender. Install 3 bolts and tighten to 2 N·m (20 in. lbs.) torque.

(2) Carefully install vapor/vacuum lines to LDP and LDP filter. **The vapor/vacuum lines and hoses must be firmly connected. Check the vapor/vacuum lines at the LDP, LDP filter and EVAP canister purge solenoid for damage or leaks. If a leak is present, a Diagnostic Trouble Code (DTC) may be set.**

(3) Connect electrical connector to LDP.

(4) Install air cleaner housing. Refer to Air Cleaner Housing/Resonator/Ducts Removal/Installation.

SPECIFICATIONS

TORQUE CHART

Description	Torque
Crankcase Breathers	12 N·m (106 in. lbs.)
EVAP Canister Mounting Bolts	11 N·m (100 in. lbs.)
EVAP Canister Purge Solenoid Mounting Nuts	9 N·m (80 in. lbs.)
LDP Pump Bracket Bolts	2 N·m (20 in. lbs.)

EMISSION CONTROL SYSTEM

CONTENTS

ON-BOARD DIAGNOSTICS—3.1L DIESEL ENGINE

INDEX

GENERAL INFORMATION

SYSTEM DESCRIPTION—3.1L DIESEL ENGINE

The 3.1L diesel Engine Control Module (ECM) and Powertrain Control Module (PCM) monitor and control many different circuits in the fuel injection pump and engine systems. If the ECM senses a problem with a monitored circuit that indicates an actual problem, a Diagnostic Trouble Code (DTC) will be stored in the PCM's memory, and eventually may illuminate the Check Engine Lamp constantly while the key is on. If the problem is repaired, or is intermittent, the ECM will erase the DTC after 40 warm-up cycles. A warm-up cycle consists of starting the vehicle when the engine is cold, then the engine to warms up to a certain temperature, and finally, the engine temperature falls to a normal operating temperature, then the key is turned off.

Certain criteria must be met for a DTC to be entered into ECM memory. The criteria may be a specific range of engine rpm, engine or fuel temperature and/or input voltage to the ECM. A DTC indicates that the ECM has identified 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 ECM does not monitor and set a DTC for. Refer to the following Monitored Circuits and Non–Monitored Circuits in this section.

ECM MONITORED SYSTEMS

The ECM can detect certain problems in the electrical system.

Open or Shorted Circuit – The ECM will not distiguish between an open or a short to ground, however the ECM can determine if sensor output (which is the input to ECM) is within proper range. It also determines if the circuit is open or shorted.

Output Device Current Flow – The ECM senses whether the output devices are electrically connected.

If there is a problem with the circuit, the ECM senses whether the circuit is open, shorted to ground (–), or shorted to (+) voltage.

ECM NON–MONITORED SYSTEMS

The ECM does not monitor the following circuits, systems or conditions that could have malfunctions that result in driveability problems. A DTC will not be displayed for these conditions.

Fuel Pressure: Fuel pressure is controlled by the fuel injection pump. The ECM cannot detect fuel pressure problems in this component. The ECM does a comparison analysis of fuel quantity, fuel timing, fuel temperature, and control sleeve sensor inputs to determine if a fuel problem exists.

Cylinder Compression: The ECM cannot detect uneven, low, or high engine cylinder compression.

Exhaust System: The ECM cannot detect a plugged, restricted or leaking exhaust system.

Fuel Injector Malfunctions: The ECM cannot determine if the fuel injector is clogged, or the wrong injector is installed. The fuel injectors on the diesel

GENERAL INFORMATION (Continued)

engine are **not controlled** by the ECM, although a defective fuel injector sensor **is monitored** by the ECM.

Vacuum Assist: Leaks or restrictions in the vacuum circuits of vacuum assisted engine control system devices are not monitored by the ECM.

ECM System Ground: The ECM cannot determine a poor system ground. However, a DTC may be generated as a result of this condition.

ECM/PCM Connector Engagement: The ECM cannot determine spread or damaged connector pins. However, a DTC may be generated as a result of this condition.

HIGH AND LOW LIMITS

The ECM compares input signals from each input device. It will establish high and low limits that are programmed into it for that device. If the inputs are not within specifications and other 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 ECM when it senses a high or low input voltage from the control system device in question.

DESCRIPTION AND OPERATION

DIAGNOSTIC TROUBLE CODES

On the following pages, a list of DTC's is provided for the 3.1L diesel engine. A DTC indicates that the ECM has recognized an abnormal signal in a circuit or the system. A DTC may indicate the result of a failure, but most likely will not identify the failed component directly.

ACCESSING DIAGNOSTIC TROUBLE CODES

A stored DTC can be displayed through the use of the DRB III® scan tool. The DRB III® connects to the data link connector. The data link connector is located under the instrument panel near bottom of the steering column (Fig. 1).

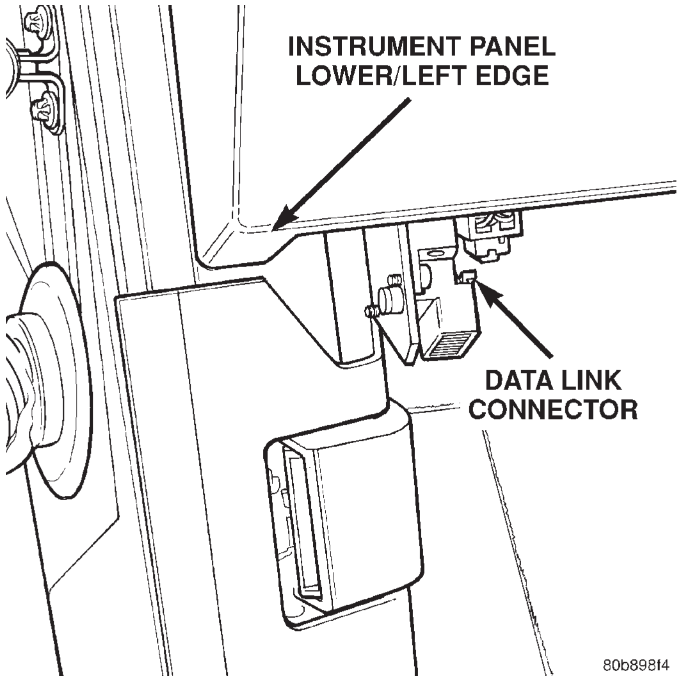


Fig. 1 Data Link Connector Location — LHD Typical

ERASING TROUBLE CODES

After the problem has been repaired, use the DRB III® scan tool to erase a DTC.

ENGINE CONTROL MODULE (ECM) DRBIII® CODES

Generic Scan Tool Code	DRB III® Scan Tool Display
P0115	Temperature of Engine Coolant SRC High Exceeded Temperature of Engine Coolant SRC Low Exceeded
P0180	Fuel Temperature Sensor SRC High Exceeded Fuel Temperature Sensor SRC Low Exceeded
P0235	Turbocharger Boost Sensor Signal High Exceeded Turbocharger Boost Sensor Signal Low Exceeded Turbocharger Boost Sensor Supply High Exceeded Turbocharger Boost Sensor Supply Low Exceeded Turbocharger Boost Sensor Plausibility
P0400	EGR Open Circuit

DESCRIPTION AND OPERATION (Continued)

Generic Scan Tool Code	DRB III® Scan Tool Display
	EGR Short Circuit
P0500	Veh. Speed Sensor PEC Frequency Too High Veh. Speed Sensor SRC High Exceeded Veh. Speed Sensor Plausibility
P0725	Engine Speed Sensor Dynamic Plausibility Engine Speed Sensor Over Speed Recognition Engine Speed Sensor Static Plausibilty
P1105	Atmosphere Pressure Sensor SRC High Exceeded Atmosphere Pressure Sensor SRC Low Exceeded
P1110	Air Temp. Sensor SRC High Exceeded Air Temp. Sensor SRC Low Exceeded
P1201	Needle Movement Sensor SRC High Exceeded Needle Movement Sensor SRC Low Exceeded
P1220	Fuel Quantity Actuator Negative Governor Deviation Cold Fuel Quantity Actuator Negative Governor Deviation Warm Fuel Quantity Actuator Positive Governor Deviation Cold Fuel Quantity Actuator Positive Governor Deviation Warm
P1225	Control Sleeve Sensor Signal High Exceeded Control Sleeve Sensor Signal Low Exceeded Control Sleeve Sensor Start End Position Not Attained Control Sleeve Sensor Stop End Position Not Attained
P1515	Accelerator Pedal Sensor PWG Plausibility With Potentiometer Accelerator Pedal Sensor PWG Plausibility With Low-Idle Switch Accelerator Pedal Sensor PWG Plausibility With Brake Input Accelerator Pedal Sensor Plausibility Accelerator Pedal Sensor Signal High Exceeded
P1600	Battery Voltage SRC High Exceeded
P1610	Regulator Lower Regulator Limit Regulator Upper Regulator Limit
P1615	Microcontroller Gate-Array Monitoring Microcontroller Gate-Array Watchdog Microcontroller Prepare Fuel Quantity Stop Microcontroller Recovery Has Occurred Microcontrller Redundant Overrun Monitoring
P1630	Solenoid Valve Controller Open Circuit Solenoid Valve Controller Short Circuit
P1635	Glow Relay #1Controller Open Circuit

DESCRIPTION AND OPERATION (Continued)

Generic Scan Tool Code	DRB III® Scan Tool Display
	Glow Relay #1Controller Short Circuit
1640	Glow Relay #2 Controller Open Circuit Glow Relay #2 Controller Short Circuit
P1655	A/C Control Open Circuit A/C Control Short Circuit
P1660	Redundant Emergency Stop Plausibility In After-Run Redundant Emergency Stop Powerstage Defective
P1680	EEPROM Plausibility Checksum Error for Adj. (EGR) EEPROM Plausibility Checksum Error in CC212 EEPROM Plausibility Communication With EEPROM EEPROM Plausibility Func. Switch Wrong or Missing EEPROM Plausibility VIN Checksum Error EEPROM Plausibility Ver Number Not Corresponding
P1703	Brake Signal Plausibility With Redundant Contact
P1725	Inductive Aux. Speed Sensor Dynamic Plausibilty Inductive Aux. Speed Sensor Overspeed Recognition Inductive Aux Speed Sensor Plausibilty Inductive Aux. Speed Sensor Static Plausibilty
P1740	Clutch Signal Plausibility

POWERTRAIN CONTROL MODULE (PCM) DRBIII® CODES

Generic Scan Tool Code	DRBIII Scan Tool Display
P0117	Engine Coolant Volts Low
P0118	Engine Coolant Volts High
P0122	Throttle Position Sensor Voltage Low
P0123	Throttle Position Sensor Voltage High
P0460	Fuel Level Unit No Change Over Miles
P0462	Fuel Level Sending Unit volts Too Low
P0463	Fuel Level Sending Unit volts Too High
P0522	Oil Pressure Voltage Too Low
P0523	Oil Pressure Voltage Too High
P0600	SPI Communications
P0601	Internal Self-Test
P0622	Generator Field Not Switching Properly
P0712	Trans Temperature Sensor Voltage Too Low
P0713	Trans Temperature Sensor Voltage Too High
P0720	Low Output Speed Sensor RPM Above 15 MPH

DESCRIPTION AND OPERATION (Continued)

Generic Scan Tool Code	DRBIII Scan Tool Display
P0743	Torque Converter Clutch Solenoid/Trans Relay Circuit
P0748	Govenor Pressure Solenoid/Trans Relay Circuits
P0751	O/D Switch Pressed (Lo) More Than 5 Miles
P0753	Trans 3-4 Shift Solenoid/Trans relay Circuit
P1491	Radiator Fan Control Relay Circuit
P1492	Ambient/Batt temp Sen Volts Too High
P1493	Ambient/Batt temp Sen Volts Too Low
P1594	Charging System Voltage Too High
P1595	Speed Control Soledoids Circuits
P1596	Speed Control Switch Always High
P1597	Speed Control Switch Always Low
P1682	Charging System Voltage Too Low
P1683	Speed Control Power Relay or S/C 12V Driver Circuit
P1685	SKIM Invalid Key
P1686	No SKIM Bus Message
P1687	No MIC Bus Message
P1696	PCM EEPROM Write Denied
P1762	Governor Pressure Sensor Offset Volts Too Lo Or High
P1763	Governor Pressure Sensor Volts Too High
P1764	Governor Pressure Sensor Volts Too Low
P1765	Trans 12 Volt Supply Relay Control Circuit