GROUP TAB LOCATOR

	Introduction
0	Lubrication & Maintenance
2	Suspension
3	Differential & Driveline
5	Brakes
7	Cooling
8A	Audio/Video
8B	Chime/Buzzer
8E	Electronic Control Modules
8F	Engine Systems
8G	Heated Systems
8H	Horn
8I	Ignition Control
8J	Instrument Cluster
8L	Lamps
8N	Power Systems
8O	Restraints
8P	Speed Control
8Q	Vehicle Theft Security
8R	Wipers/Washers
8W	Wiring
9	Engine
11	Exhaust System
13	Frame & Bumpers
14	Fuel System
19	Steering
21	Transmission
22	Tires/Wheels
23	Body
24	Heating & Air Conditioning
25	Emissions Control
	Component and System Index

Service Manual Comment Forms (Rear of Manual)

INTRODUCTION

TABLE OF CONTENTS

page

VEHICLE IDENTIFICATION NUMBER
DESCRIPTION 1
INTERNATIONAL SYMBOLS
DESCRIPTION 2
FASTENER IDENTIFICATION
DESCRIPTION 2
FASTENER USAGE
DESCRIPTION - FASTENER USAGE 5

page

THREADED HOLE REPAIR
DESCRIPTION - THREADED HOLE REPAIR 5
METRIC SYSTEM
DESCRIPTION 5
TORQUE REFERENCES
DESCRIPTION 7

VEHICLE IDENTIFICATION NUMBER

DESCRIPTION

The Vehicle Identification Number (VIN) plate is located on the lower windshield fence next to the left a-pillar. The VIN contains 17 characters that provide data concerning the vehicle. Refer to the VIN DECODING INFORMATION table to determine the identification of a vehicle.

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

VIN DECODING INFORMATION

POSITION	INTERPRETATION	CODE = DESCRIPTION
1, 2 & 3	World Manufacturer Code	WD2 = Truck WD5 = Multi-purpose vehicle
4	Model	Y = Truck W = Multi-purpose vehicle
5 & 6	Model, Cab, Weight	D1 = Sprinter, 3000 mm (118 in.) wheelbase, 8,001 up to 9,000 lbs. class G D2 = Sprinter, 3550 mm (140 in.) wheelbase, 8,001 up to 9,000 lbs. class G D3 = Sprinter, 4025 mm (158 in.) wheelbase, 8,001 up to 9,000 lbs. class G D4 = Sprinter, 3550 mm (140 in.) wheelbase, Van 10,001 up to 14,000 lbs. Class 3 D5 = Sprinter, 4025 mm (158 in.) wheelbase, Van 10,001 up to 14,000 lbs. Class 3 D6 = Sprinter, 3567 mm (140 in.) in connection with 16″ wheels, Van 8,001 to 9,000 lbs. class G D7 = Sprinter, 4042 mm (159 in.) in connection with 16″ wheels, Van 8,001 to 9,000 lbs. class G
7 & 8	Engine	41 = 2.7L 5 cyl. Diesel
9	Check Digit	
10	Model Year	3 = 2003
11	Assembly Plant	5 = Düsseldorf Plant, Germany
12 Thru 17	Vehicle Build Sequence	

INTERNATIONAL SYMBOLS

DESCRIPTION

The graphic symbols illustrated in the following International Control and Display Symbols Chart (Fig. 1) are used to identify various instrument controls. The symbols correspond to the controls and displays that are located on the instrument panel.

FASTENER IDENTIFICATION

DESCRIPTION

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 (Fig. 2) and (Fig. 3).

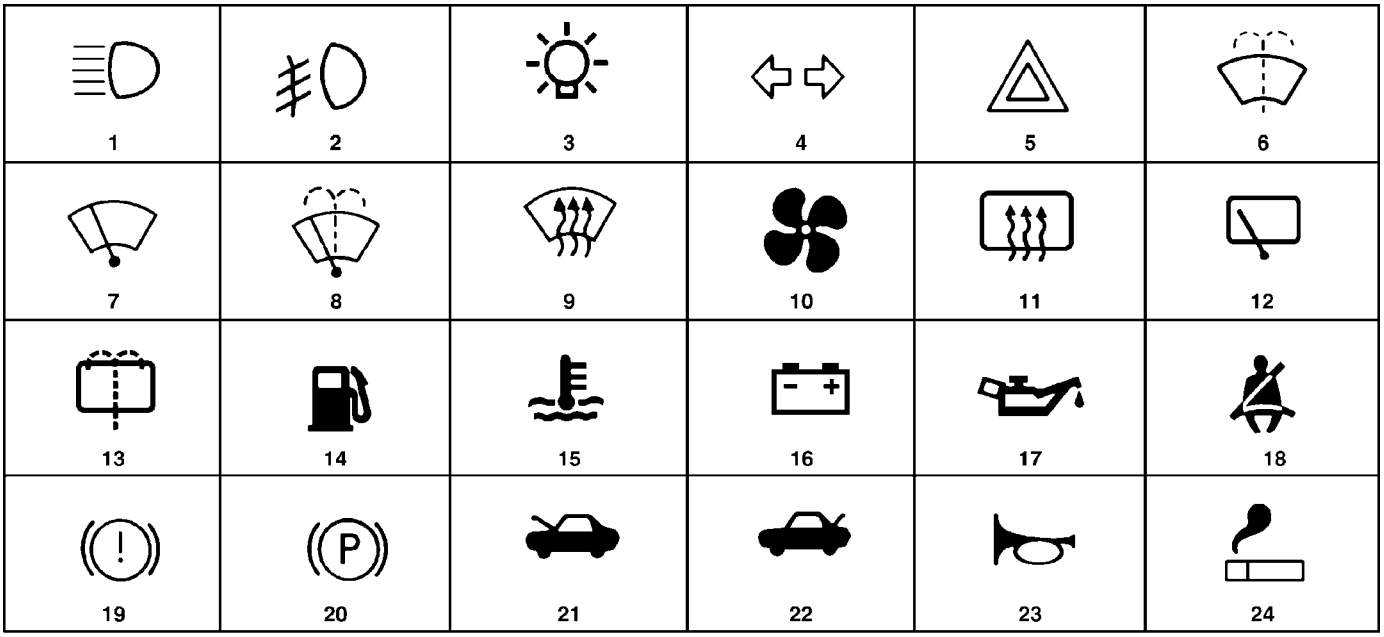


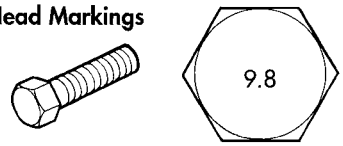
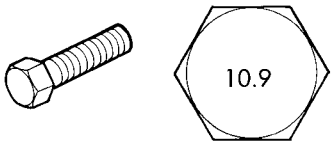
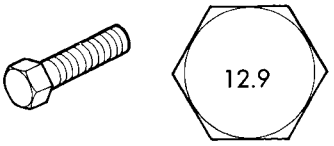
Fig. 1 INTERNATIONAL CONTROL AND DISPLAY SYMBOLS

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

FASTENER IDENTIFICATION (Continued)

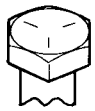
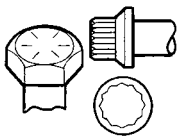
Bolt Markings and Torque - Metric

Commercial Steel Class

	9.8	10.9	12.9
Bolt Head Markings			

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

Bolt Markings and Torque Values - U.S. Customary

SAE Grade Number	5	8
Bolt Head Markings These are all SAE Grade 5 (3) line		

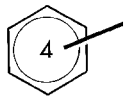
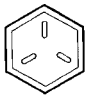
Body Size	Bolt Torque - Grade 5 Bolt				Bolt Torque - Grade 8 Bolt			
	Cast Iron		Aluminum		Cast Iron		Aluminum	
	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb
1/4 - 20	9	7	8	6	15	11	12	9
- 28	12	9	9	7	18	13	14	10
5/16 - 18	20	15	16	12	30	22	24	18
- 24	23	17	19	14	33	24	25	19
3/8 - 16	40	30	25	20	55	40	40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

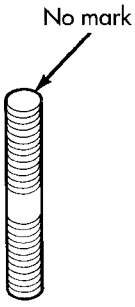
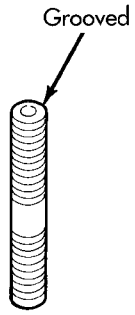
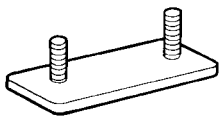
80bdbd8c

Fig. 2 FASTENER IDENTIFICATION

FASTENER IDENTIFICATION (Continued)

HOW TO DETERMINE BOLT STRENGTH

	Mark	Class
Hexagon head bolt	 Bolt head No. 4 — 4T; 5 — 5T; 6 — 6T; 7 — 7T; 8 — 8T; 9 — 9T; 10 — 10T; 11 — 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		4T
		6T
Welded bolt		4T

95IN-4

Fig. 3 FASTENER STRENGTH

FASTENER USAGE

DESCRIPTION - FASTENER USAGE

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

Fasteners and torque specifications 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.

THREADED HOLE REPAIR

DESCRIPTION - THREADED HOLE REPAIR

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

METRIC SYSTEM

DESCRIPTION

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

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

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	x 1.0936	= Yards
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
mph	x 0.4470	= Meters/Sec (M/S)	M/S	x 2.237	= mph
Kilometers/ Hr. (Km/h)	x 0.27778	= Meters/Sec (M/S)	M/S	x 3.600	Kilometers/Hr. (Km/h)

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	

Refer to the Metric 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.) (Fig. 4).

METRIC SYSTEM (Continued)

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

Fig. 4 METRIC CONVERSION CHART

TORQUE REFERENCES

DESCRIPTION

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

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

Fig. 5 TORQUE SPECIFICATIONS

LUBRICATION & MAINTENANCE

TABLE OF CONTENTS

page

FLUID TYPES
DESCRIPTION
DESCRIPTION - FUEL REQUIREMENTS - DIESEL ENGINE 1
DESCRIPTION - ENGINE COOLANT 1
DESCRIPTION - HOAT COOLANT 2
DESCRIPTION - AXLE 3
DESCRIPTION - BRAKE FLUID 3
DESCRIPTION - POWER STEERING FLUID . . 3
DESCRIPTION - ENGINE OIL - DIESEL ENGINES 3
DESCRIPTION - AUTOMATIC TRANSMISSION FLUID - NAG1 4
OPERATION - AUTOMATIC TRANSMISSION FLUID 4
FLUID CAPACITIES
SPECIFICATIONS - FLUID CAPACITIES 4

page

FLUID FILL/CHECK LOCATIONS
INSPECTION - FLUID FILL/CHECK LOCATIONS 4
PARTS & LUBRICANT RECOMMENDATION
STANDARD PROCEDURE - PARTS & LUBRICANT RECOMMENDATIONS 5
HOISTING
STANDARD PROCEDURE - HOISTING 5
JUMP STARTING
STANDARD PROCEDURE - JUMP STARTING . . 6
TOWING
STANDARD PROCEDURE - TOWING 6
MAINTENANCE SCHEDULES
DESCRIPTION 7
INTERNATIONAL SYMBOLS
DESCRIPTION 9

FLUID TYPES

DESCRIPTION

DESCRIPTION - FUEL REQUIREMENTS - DIESEL ENGINE

DESCRIPTION

WARNING: Do not use alcohol or gasoline as a fuel blending agent. They can be unstable under certain conditions and hazardous or explosive when mixed with diesel fuel.

Use good quality diesel fuel from a reputable supplier in your Dodge truck. For most year-round service, number 2 diesel fuel meeting ASTM specification D-975 will provide good performance. If the vehicle is exposed to extreme cold (below 0°F/-18°C), or is required to operate at colder-than-normal conditions for prolonged periods, use climatized No. 2 diesel fuel or dilute the No. 2 diesel fuel with 50% No. 1 diesel fuel. This will provide better protection from fuel gelling or wax-plugging of the fuel filters.

Diesel fuel is seldom completely free of water. To prevent fuel system trouble, including fuel line freezing in winter, drain the accumulated water from the fuel/water separator using the fuel/water separator drain provided. If you buy good-quality fuel and follow the cold-weather advice above, fuel conditioners should not be required in your vehicle. If available in your area, a high cetane “premium” diesel fuel may offer improved cold starting and warm-up performance.

DESCRIPTION - ENGINE COOLANT

ETHYLENE-GLYCOL MIXTURES

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

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° C (-34° 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

FLUID TYPES (Continued)

engine to overheat because the specific heat of antifreeze is lower than that of water.

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. The increased temperature can result in engine detonation. In addition, 100 percent ethylene-glycol freezes at -22° C (-8° F).

PROPYLENE-GLYCOL MIXTURES

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), 10° 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. Propylene glycol also has slightly poorer heat transfer characteristics than ethylene glycol. This can increase cylinder head temperatures under certain conditions.

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.

DESCRIPTION - HOAT COOLANT

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

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

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

The use of aluminum cylinder blocks, cylinder heads, and water pumps requires special corrosion protection. Mopar® Antifreeze/Coolant, 5 Year/100,000 Mile Formula (MS-9769), or the equivalent ethylene-glycol base coolant with organic corrosion inhibitors (called HOAT, for Hybrid Organic Additive Technology) is recommended. This coolant offers the best engine cooling without corrosion when mixed with 50% ethylene-glycol and 50% distilled water to obtain a freeze point of -37°C (-34°F). If it loses color or becomes contaminated, drain, flush, and replace with fresh properly mixed coolant solution.

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

COOLANT PERFORMANCE

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

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

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

50/50 Ethylene-Glycol and Water-Is the recommended mixture, it provides protection against freezing to -37°C (-34°F). The antifreeze concentration **must always** be a minimum of 44 percent, year-round in all climates. If percentage is lower, engine parts may be eroded by cavitation. Maximum protection against freezing is provided with a 68 percent antifreeze concentration, which prevents freezing

FLUID TYPES (Continued)

down to -67.7°C (-90°F). A higher percentage will freeze at a warmer temperature. Also, a higher percentage of antifreeze can cause the engine to overheat because specific heat of antifreeze is lower than that of water.

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

COOLANT SELECTION AND ADDITIVES

The use of aluminum cylinder blocks, cylinder heads and water pumps requires special corrosion protection. Only Mopar® Antifreeze/Coolant, 5 Year/100,000 Mile Formula (glycol base coolant with corrosion inhibitors called HOAT, for Hybrid Organic Additive Technology) is recommended. This coolant offers the best engine cooling without corrosion when mixed with 50% distilled water to obtain to obtain a freeze point of -37°C (-34°F). If it loses color or becomes contaminated, drain, flush, and replace with fresh properly mixed coolant solution.

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

DESCRIPTION - AXLE

NOTE: DaimlerChrysler recommends Mopar® lubricant or lubricant conforming to MS-8985.

REAR AXLE

- Synthetic Gear & Axle Lubricant SAE 75W-140

DESCRIPTION - BRAKE FLUID

NOTE: DaimlerChrysler recommends using DOT- 4 or equivalent brake fluid.

BRAKE FLUID

- DOT-4 or equivalent brake fluid.

DESCRIPTION - POWER STEERING FLUID

NOTE: DaimlerChrysler recommends using Mopar ATF+4 Automatic Transmission fluid or equivalent.

POWER STEERING FLUID

- Mopar ATF+4 Automatic Transmission fluid or equivalent.

DESCRIPTION - ENGINE OIL - DIESEL ENGINES

SAE VISCOSITY GRADE

CAUTION: Low viscosity oils must have the proper API quality.

The engine manufacturer strongly recommends the use of synthetic engine oils, such as Mobil® 1 SAE 0W-40.

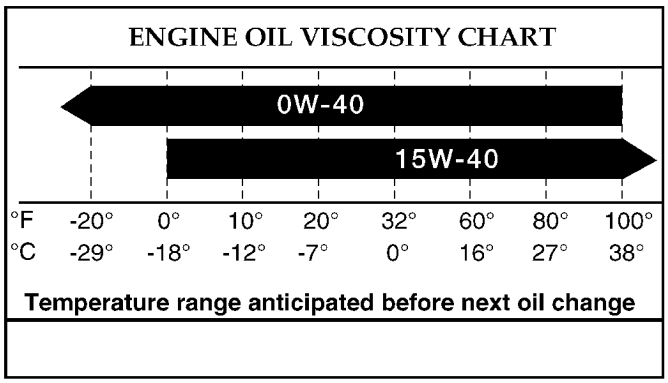
We strongly recommend engine oils that meet the requirements of the API Service Category CI-4 and meet the requirements of Material Standard MS-6395. Use Mopar or an equivalent oil meeting the specification MS-6395.

Do not add any materials (other than leak detection dyes) to the engine oil. Engine oil is an engineered product and it's performance may be impaired by supplemental additives.

When topping off engine oil, only use oil of the same quality grade and SAE classification.

The SAE class **(viscosity)** should be selected in accordance with the average air temperature for the season of the year.

The temperature limits given for the different SAE classes should be regarded as guidelines which may be exceeded temporarily to avoid excessively frequent engine oil changes.



8112d6f6

OIL VISCOSITY CHART

FLUID TYPES (Continued)

Full synthetic oils, such as Mobil® 1 0W-40, is required if the ASSYST Oil Service Reminder is followed. Use of a lower quality oil on this service schedule may cause severe engine damage.

DESCRIPTION - AUTOMATIC TRANSMISSION FLUID - NAG1

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

Shell® 3403 Automatic Transmission Fluid is the recommended fluid for the NAG1 DaimlerChrysler automatic transmission.

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

Mopar® ATF+4, Automatic Transmission Fluid, or other fluids meeting MS-9602, may be used if Shell® 3403 Automatic Transmission Fluid is not available.

Shell® 3403 Automatic Transmission Fluid when new is red in color. The ATF is dyed red so it can be identified from other fluids used in the vehicle such as engine oil or antifreeze. The red color is not permanent and is not an indicator of fluid condition. As the vehicle is driven, the ATF will begin to look darker in color and may eventually become brown. **This is normal.**

FLUID ADDITIVES

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

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

OPERATION - AUTOMATIC TRANSMISSION FLUID

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

FLUID CAPACITIES

SPECIFICATIONS - FLUID CAPACITIES

DESCRIPTION	SPECIFICATION
ENGINE COOLANT	
10 Liters	10.5 Quarts
ENGINE OIL	
9.0L with Filter Replacement	9.5 Quarts with Filter Replacement
AUTOMATIC TRANSMISSION	
Service Fill - NAG1	5.0 L (10.6 pts.)
O-haul Fill - NAG1	7.7 L (16.3 pts.)
Dry fill capacity 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 appropriate 21 - TRANSMISSION/ AUTOMATIC/FLUID - STANDARD PROCEDURE).	
REAR AXLE ± .03L (1 oz.)	
8 1/2	1.8 L (4.0 pts.)
FUEL TANK	
Primary	100 L (26.4 gal.)*
Reserve	10.5 L (2.8 gal.)*
*Nominal refill capacities are shown. A variation may be observed from vehicle to vehicle due to manufacturing tolerance and refill procedure	
POWER STEERING SYSTEM	
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 19, Steering for proper fill and bleed procedures.	

FLUID FILL/CHECK LOCATIONS

INSPECTION - FLUID FILL/CHECK LOCATIONS

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

PARTS & LUBRICANT RECOMMENDATION

STANDARD PROCEDURE - PARTS & LUBRICANT RECOMMENDATIONS

Lubricating grease is rated for quality and usage by the NLGI. All approved products have the NLGI symbol (Fig. 1) 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.

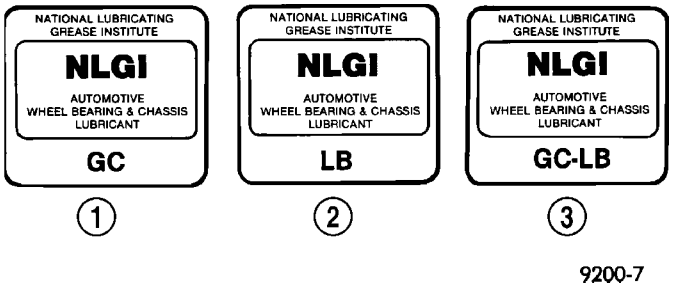


Fig. 1 NLGI Symbol

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

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

HOISTING

STANDARD PROCEDURE - HOISTING

Refer to the Owner's Manual for emergency vehicle lifting procedures.

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.

FLOOR JACK

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

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

- **An axle tube.**
- **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. The forward lifting pads should be positioned against the forward flange of the transmission crossmember brackets at the bottom of the frame rail. The real lifting pads should be wedged between the forward flange of the leaf spring bracket and the frame rail. Safety stands should be placed under the frame rails at the front and rear ends (Fig. 2).

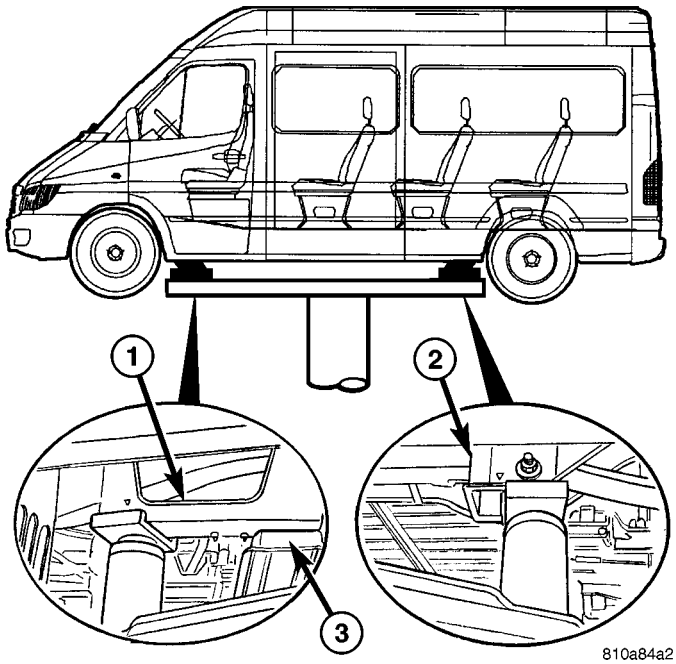


Fig. 2 HOIST LOCATIONS

1 - TRANSMISSION CROSSMEMBER SUPPORT
2 - REAR LEAF SPRING MOUNT - FRONT
3 - TRANSMISSION CROSSMEMBER

JUMP STARTING

STANDARD PROCEDURE - JUMP STARTING

WARNING: REVIEW ALL SAFETY PRECAUTIONS AND WARNINGS IN THE BATTERY SYSTEM SECTION OF THE SERVICE MANUAL. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE)

- **DO NOT JUMP START A FROZEN BATTERY, PERSONAL INJURY CAN RESULT.**
- **IF EQUIPPED, 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.**

FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.

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.

(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.

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

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

STANDARD PROCEDURE - TOWING

WARNING: Do not tow the vehicle if the key cannot be turned in the ignition lock. If the key cannot be turned, the ignition lock remains locked and the vehicle cannot be steered. With the engine not running there is no power assistance for the braking and steering systems. In this case, it is important to keep in mind that a considerably higher degree of effort is necessary to brake and steer the vehicle. The vehicle must not be towed with the front axle raised and the key in position 2 in the ignition lock as the drive wheels could then lock due to the acceleration skid control (ASR)

TOWING (Continued)

If the Engine is Damaged

For towing distances up to 30 miles (about 50 km)

- Shift selector lever in "N" position.
- Do not exceed a towing speed of 30 m.p.h. (50 km/h).

For towing distances greater than 30 mile (about 50 km)

- Remove the propeller shafts leading to the drive axles. The vehicle can be towed without restriction.

If the Transmission is Damaged

- Remove the propeller shafts leading to the drive axles. The vehicle can be towed without restriction.

If the Front Axle is Damaged

- Raise the front axle.
- Observe the same towing restrictions as for engine damage.

If the Rear Axle is Damaged

- Raise the rear axle.

NOTE: Comply with local legal regulations regarding towing vehicles.

SAFETY PRECAUTIONS

NOTE: 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, J-hooks, or a tow sling to a bumper, steering linkage, drive shafts or a non-reinforced frame hole.
- Remove exhaust pipe tips that interfere with the tow sling and crossbar
- Padding should be placed between the tow sling/crossbar and any painted surfaces
- When placing tow hooks on the rear axle, position them so they do not damage the brake tubing or hoses
- Do not tow the vehicle by connecting to the front or rear shock absorbers
- Do not tow a heavily loaded vehicle. Damage to the vehicle may result. 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, steep rises in the road or if the vehicle is equipped with air dams, spoilers, and/or ground effect panels. 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.

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 or Sling-type device can be used provided all the wheels are lifted off the ground using tow dollies.

MAINTENANCE SCHEDULES

DESCRIPTION

The use of Special lubricant additives is not recommended. The use of such additives may affect the warranty rights. With regard to legal stipulations concerning emissions control, please note that engines have to be serviced and adjusted in accordance with special instructions and using special measuring equipment. Modifications to or interference with the emissions control systems are not permissible.

MAINTENANCE - WITHOUT ASSYST MAINTENANCE COMPUTER

Maintenance Intervals

- Oil service – **Normal Operation** every 10,000 miles or 16,000 km or 12 months.
- Maintenance service every 20,000 miles or 32,000 km.

Additional work must be carried out at yearly intervals.

MAINTENANCE SCHEDULES (Continued)

MAINTENANCE - WITH ASSYST MAINTENANCE COMPUTER

ASSYST provides information on the best possible timing for maintenance work.

NOTE: The engine manufacturer strongly recommends the use of synthetic engine oils, such as ®Mobil 1 SAE 0W-40.

When the next maintenance service is due, this will be indicated in the multi-function display with the wrench icon symbol displayed in km/miles or days.

- One wrench icon showing indicates Oil Service is necessary.
- Two wrench icons showing indicates Maintenance Service is necessary – displayed in km/miles or days.

If the display shows the number of days, a clock symbol will also appear in the multi-function display.

You should have the maintenance performed within the stated period/distance.

The service indicator should be reset after an oil service and/or maintenance service has been performed.

REGULAR CHECK-UPS

To maintain the safe operation of the vehicle, it is recommended that the following tasks be performed on a regular basis (i.e. weekly or whenever the vehicle is refueled). Check:

- Engine oil level
- Brake system, clutch mechanism – fluid level
- Battery – acid level
- Windshield washer system and headlamp cleaning system – fluid level
- Mechanical assemblies (e. g. engine, transmission, etc.) – check for leaks
- Condition of tires and tires pressures
- All exterior lights

SPECIAL MAINTENANCE REQUIREMENTS

If bodies built by manufacturers other than DaimlerChrysler Corporation are fitted to the vehicle, the maintenance requirements and lubrication intervals specified by the body manufacturer must be adhered to, in addition to all standard maintenance requirements.

Brake Fluid

Only use brake fluids approved by the manufacturer (DOT 4 plus).

Coolant

Corrosion inhibitor/antifreeze concentration in the coolant should be checked before the onset of winter (once year in countries with high prevailing temperatures).

Replace the coolant every five years or 100,000 miles.

Dust Filter for Heating/Ventilation Replacement

The dust filter and the tailgate interior filter are to be renewed during routine maintenance service. If operating conditions are dusty, these filters should be renewed more frequently.

ENGINE OIL CHANGE AND FILTER REPLACEMENT

At the minimum, change the engine oil and oil filter once a year – even if the vehicle mileage per year is extremely low. For standard oil service schedules refer to the chapter oil service and maintenance service.

Once a Year

Select the viscosity of the engine oil (SAE classes) according to the outside air temperature.

Only use engine oil approved by DaimlerChrysler Corporation if following the ASSYST system guidelines.

If the fuel used has a sulphur content exceeding 0.05% by weight, the service intervals should be split in half.

SCOPE OF WORK FOR MAINTENANCE SERVICE

Oil Service

- Engine:

Oil change and filter replacement

Check fluid levels of the following system, refill as necessary.

- If fluid is lost, trace and eliminate cause – as a separate order.
- Power-assisted steering

Lubrication work:

- Trailer tow hitch (original equipment)

Maintenance

- ASSYST maintenance computer reset

Function check

- Signalling system, warning and indicator lamps
- Headlamps, exterior lighting
- Windshield wipers, windshield washer system

Check for leaks and damage.

- Check for abrasion points and ensure that lines are correctly routed!
- All lines and hoses, sensor cables
- Rubber boots on front axle drive shafts, rubber boots on front axle suspension ball joints, shock absorbers

Check fluid levels for the following systems, correct as necessary.

NOTE: Should there be a loss of fluid which cannot be explained by regular use, trace and eliminate the cause.

MAINTENANCE SCHEDULES (Continued)

- Engine cooling system. Check corrosion inhibitor/antifreeze, refill as necessary.
- Hydraulic brake system
- Battery
- Windshield washer system

Engine

- Fuel filter renewal
- Air cleaner with maintenance indicator:
- Check degree of contamination.
- Air cleaner filter element renewed as necessary.

Chassis and body

- Trailer coupling:

Check operation, play and retaining fixtures

- Secondary rubber springs:

Visual check

- Tire pressures:

Correct as necessary, including spare tire

- Check thickness of brake pads
- Brake test
- Check condition of steering mechanism
- Heating/ventilation dust filter renewal

ADDITIONAL MAINTENANCE WORK

Automatic transmission once only at 80,000 miles/128000 km

Oil and filter change

During every second maintenance service

Air cleaner without maintenance indicator:

Air cleaner filter element renewal

Check poly-V-belt for wear and signs of damage

During every 6th maintenance service

Rear axle

ADDITIONAL MAINTENANCE WORK AFTER YEARS

Every 3 years

Air cleaner filter element renewal (note installation date)

Every 5 years or 100,000 miles

Coolant renewal

Note coolant composition

INTERNATIONAL SYMBOLS

DESCRIPTION

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

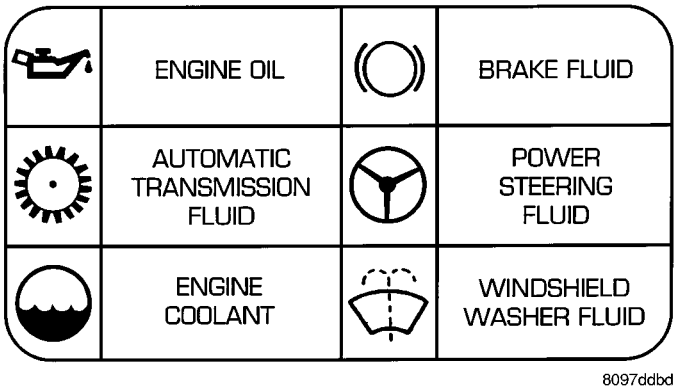


Fig. 3 INTERNATIONAL SYMBOLS

SUSPENSION

TABLE OF CONTENTS

page

FRONT 1
REAR 11
WHEEL ALIGNMENT 17

FRONT

TABLE OF CONTENTS

page

FRONT
SPECIFICATIONS - TORQUE CHART 2
SPECIAL TOOLS
FRONT SUSPENSION 2
BUSHINGS
REMOVAL 3
INSTALLATION 3
HUB / BEARING
DIAGNOSIS AND TESTING - 4
REMOVAL 4
INSTALLATION 5
KNUCKLE
REMOVAL 5
INSTALLATION 5
LOWER BALL JOINT
REMOVAL 6
INSTALLATION 6
LOWER CONTROL ARM
REMOVAL 6
INSTALLATION 6
SPRING
REMOVAL 7
INSTALLATION 8
SPRING CLAMP PLATES
REMOVAL 8
INSTALLATION 8
SPRING STOP PLATES
REMOVAL 9
INSTALLATION 9
STABILIZER BAR
DESCRIPTION 9
OPERATION 9
REMOVAL 9
INSTALLATION 9
STABILIZER LINK
REMOVAL 9
INSTALLATION 9
STRUT
REMOVAL 10
INSTALLATION 10

FRONT

SPECIFICATIONS - TORQUE CHART

TORQUE SPECIFICATIONS

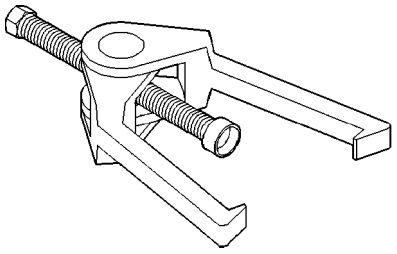
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Lower Ball Joint To Steering Knuckle	280	206	—
Strut To Steering Knuckle	185	136	—
Strut To Body	100	74	—
Bottom Spring Clamp Plate To Front Axle M12 X 1.5 Bolt	130	96	—
Bottom Spring Clamp Plate To Front Axle M10 Bolt	65	48	—
Sway Bar Clamp To The Front Axle	30	22	—
Hexagon Socket Bolt For Clamping Nut To Adjust Wheel Bearing Play	12	9	106
Lower Control Arm To Front Axle Beam	150	110	—
Stop Plate For Lower Control Arm	60	44	—
Outer Tie Rod End Nut	130	96	—
Outer Tie Rod End Nut Jam Nut	50	37	—

SPECIAL TOOLS

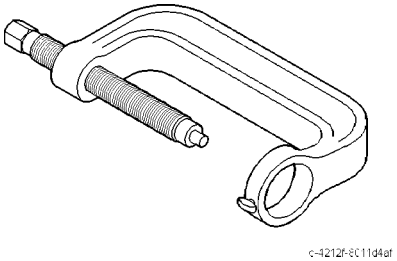
FRONT SUSPENSION

SPECIAL TOOL CROSS REFERENCE CHART

MB TOOL #	MILLER TOOL #	DESCRIPTION
N/A	9288	LEAF SPRING WEDGE BLOCK
N/A	9294	LOWER BALL JOINT REMOVE/INSTALLER
N/A	9302	BUSHING REMOVER /INSTALLER
N/A	C-3894-A	PULLER TIE ROD
730 589 02 33 00	9282	BALL JOINT SEPARATOR
N/A	C-4212F	BALL JOINT PRESS

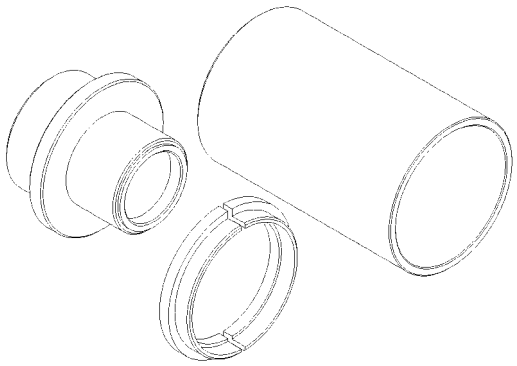


Puller Tie Rod C-3894-A

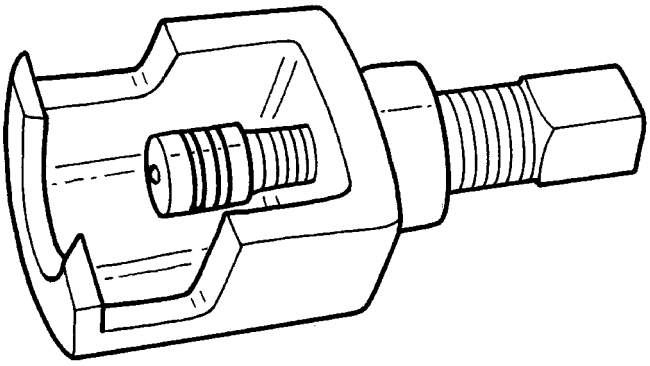


BALL JOINT PRESS - C-4212F

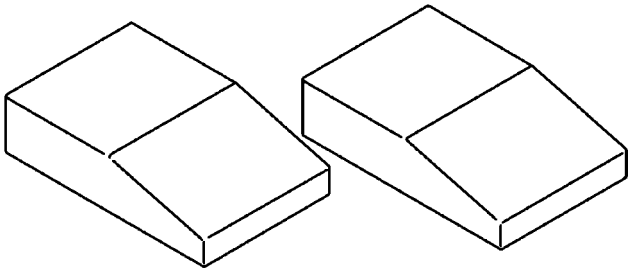
FRONT (Continued)



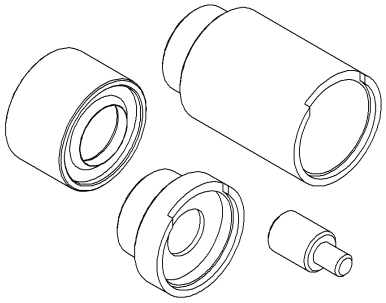
LOWER BALL JOINT REMOVE / INSTALL - 9294



BALL JOINT SEPARATOR - 9282



LEAF SPRING WEDGE BLOCK - 9288



BUSHING REMOVER / INSTALLER-9302

BUSHINGS

REMOVAL

(1) Remove the lower control arm (Refer to 2 - SUSPENSION/FRONT/LOWER CONTROL ARM - REMOVAL).

(2) Install the lower control arm in a vise.

(3) Install special tool C-4212F (Press) with special tool 9302-1 (Driver) and 9302–3 (Receiver) (Fig. 1).

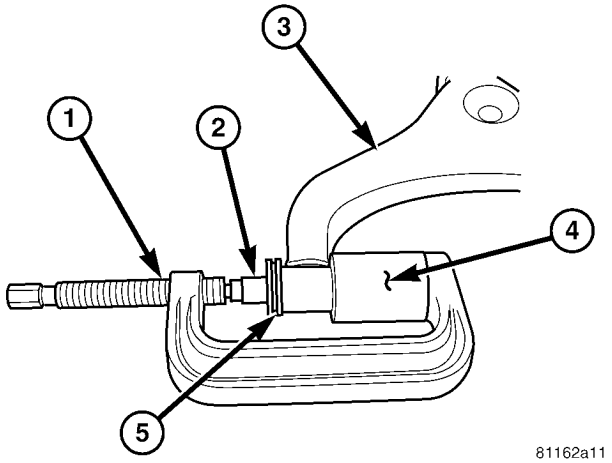


Fig. 1 LCA BUSHING REMOVAL

1 - SPECIAL TOOL C-4212F (PRESS)
2 - SPECIAL TOOL 9302-1 (DRIVER)
3 - LOWER CONTROL ARM
4 - SPECIAL TOOL 9302-3 (RECEIVER CUP)
5 - BUSHING

(4) Press out the old control arm bushing.

INSTALLATION

(1) Install the new control arm bushing into the control arm.

(2) Press the new bushing into the control arm using special tool C-4212F and 9302-1 (Driver) with 9302-2 (Sizer cup) and 9302-4 (Receiver) (Fig. 2).

(3) Press the bushing in all the way until the lip is seated properly into the control arm.

(4) Install the lower control arm to the vehicle (Refer to 2 - SUSPENSION/FRONT/LOWER CONTROL ARM - INSTALLATION).

BUSHINGS (Continued)

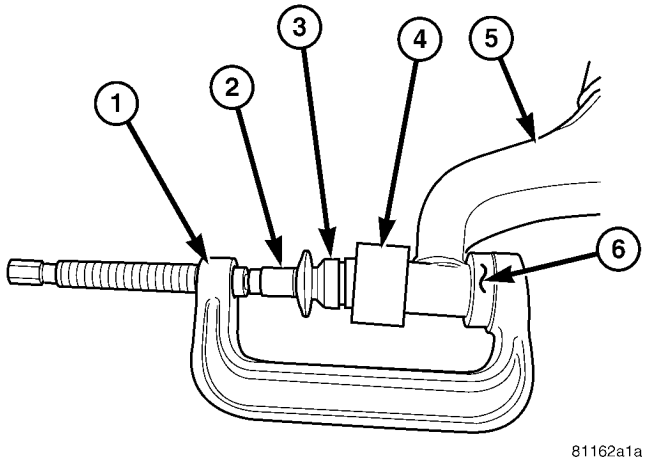


Fig. 2 LCA BUSHING INSTALL

1 - SPECIAL TOOL C-4212F (PRESS)
2 - SPECIAL TOOL 9302-1 (DRIVER)
3 - BUSHING
4 - SPECIAL TOOL 9302-2 (SIZER CUP)
5 - LOWER CONTROL ARM
6 - SPECIAL TOOL 9302-4 (RECEIVER CUP)

HUB / BEARING

DIAGNOSIS AND TESTING -

(1) Raise and support the vehicle.
(2) Remove the grease cap.
(3) Position a dial indicator against the face of the wheel hub (Fig. 3).
(4) Tighten the locking screw on the clamping nut (Fig. 3).
(5) Pull the wheel hub firmly back and forth and read off the wheel bearing play on the dial gauge. (Wheel bearing play should be 0.02 - 0.04 mm (0.000787 - 0.00158 in.).
(6) If necessary, loosen the locking screw and adjust the wheel bearing play by loosing or tightening the clamping nut.
(7) Retighten the locking screw and recheck the wheel bearing play.

REMOVAL

(1) Raise and support the vehicle.
(2) Remove the front wheels (Refer to 22 - TIRES/WHEELS/WHEELS - REMOVAL).
(3) Remove the disc brake caliper adapter (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPER ADAPTER - REMOVAL).
(4) Remove the wheel flange ring (if equipped with dual rear wheels) (Fig. 5).
(5) Remove the disc brake rotor (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - REMOVAL).
(6) Remove the grease cap (Fig. 4).

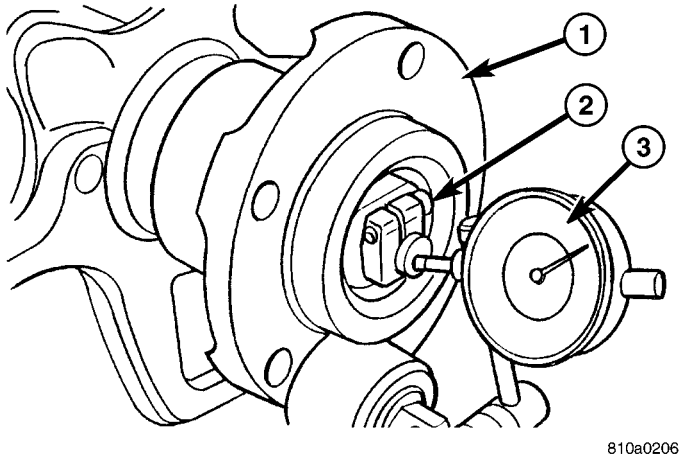


Fig. 3 MEASURING & ADJUSTING WHEEL BEARING

1 - WHEEL HUB
2 - LOCKING SCREW
3 - DIAL INDICATOR

(7) Loosen the bolt on the clamping nut and remove the clamping nut (Fig. 4).
(8) Remove the thrust washer (Fig. 4).
(9) Remove the wheel hub and tapered roller bearing from the stub axle assembly (Fig. 4).

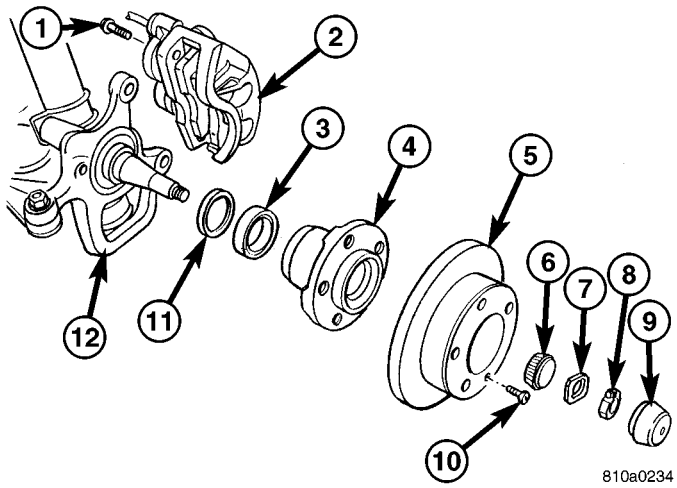


Fig. 4 FRONT WHEEL HUB WITH SINGLE REAR WHEELS (SRW)

1 - CALIPER ADAPTER BOLT
2 - DISC BRAKE CALIPER
3 - INNER BEARING
4 - WHEEL HUB
5 - DISC BRAKE ROTOR
6 - OUTER BEARING
7 - THRUST WASHER
8 - CLAMPING NUT
9 - GREASE CAP
10 - LOCKING BOLT
11 - GREASE SEAL
12 - STEERING KNUCKLE

HUB / BEARING (Continued)

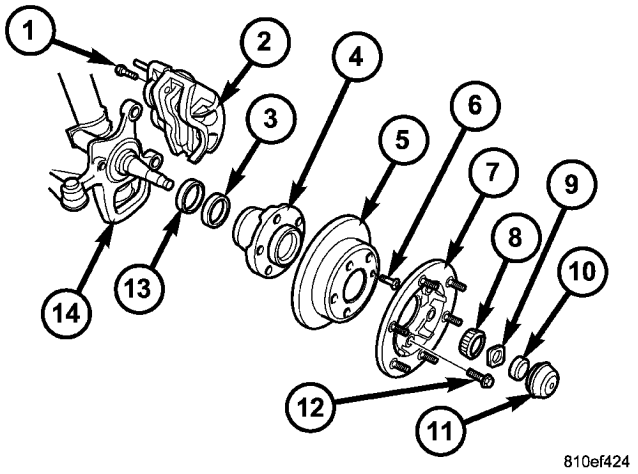


Fig. 5 FRONT WHEEL HUB WITH DUAL REAR WHEELS (DRW)

1 - ADAPTER BOLT
2 - DISC BRAKE CALIPER
3 - INNER BEARING RACE
4 - WHEEL HUB
5 - DISC BRAKE ROTOR
6 - LOCKING BOLT
7 - WHEEL FLANGE RING
8 - OUTER BEARING
9 - THRUST WASHER
10 - CLAMPING NUT
11 - GREASE CAP
12 - WHEEL FLANGE RING MOUNTING BOLT
13 - GREASE SEAL
14 - STEERING KNUCKLE

INSTALLATION

(1) Install the wheel hub with the tapered roller bearing on the stub axle (Fig. 4).

(2) Grease the outer tapered roller bearing thoroughly and push onto the steering knuckle (Fig. 4).

NOTE: The smooth side of the thrust washer must point toward the wheel bearing.

(3) Install the thrust washer (Fig. 4).

(4) Install the clamping nut (Fig. 4). Tighten to 12 N·m (9 ft. lbs.) and then loosen a half of a turn.

(5) Check for wheel bearing end play. End play should be 0.02- 0.04 mm (0.000787 - 0.00158 in.) (Fig. 3) (Refer to 2 - SUSPENSION/FRONT/HUB / BEARING - DIAGNOSIS AND TESTING).

(6) Pack the grease cap half with grease and coat at the edge with sealant and install the cap (Fig. 4).

(7) Install the disc brake rotor (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - INSTALLATION).

(8) Install the disc brake caliper adapter (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPER ADAPTER - INSTALLATION).

(9) Install the wheel flange ring (if equipped with dual rear wheels) (Fig. 5).

(10) Install the front tire & wheels assembly (Refer to 22 - TIRES/WHEELS/WHEELS - INSTALLATION).

(11) Lower the vehicle.

KNUCKLE

REMOVAL

(1) Raise and support the vehicle.

(2) Remove the front wheels (Refer to 22 - TIRES/WHEELS/WHEELS - REMOVAL).

(3) Remove the disc brake caliper adapter (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPER ADAPTER - REMOVAL).

(4) Remove the hub/bearing (Refer to 2 - SUSPENSION/FRONT/HUB / BEARING - REMOVAL).

(5) Separate the outer tie rod from the steering knuckle (Fig. 6) using special tool C-3894–A.

(6) Raise the lower control arm approximately 10 mm using a jack. **In order to eliminate tensile force in the damper strut.**

(7) Remove the ABS sensor from the knuckle by pulling straight out.

(8) Remove the strut at the knuckle (Fig. 6).

(9) Separate the lower ball joint from the steering knuckle using special tool 9282 (Fig. 6).

(10) Remove the steering knuckle from the vehicle (Fig. 6).

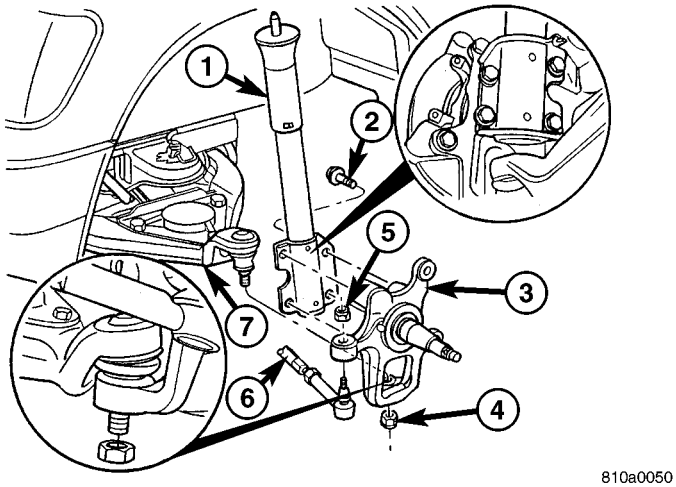


Fig. 6 STEERING KNUCKLE

1 - STRUT
2 - STRUT BOLT
3 - STEERING KNUCKLE
4 - LOWER BALL JOINT NUT
5 - OUTER TIE ROD END RETAINING NUT
6 - INNER TIE ROD END
7 - LOWER CONTROL ARM

INSTALLATION

(1) Install the steering knuckle on the lower ball joint stud (Fig. 6).

KNUCKLE (Continued)

(2) Install the lower ball joint nut (Fig. 6). Tighten to 280 N·m (206 ft. lbs.)

(3) Install the strut to the steering knuckle (Fig. 6). Tighten to 185 N·m (136 ft. lbs.).

(4) Install the outer tie rod end to the steering knuckle (Fig. 6) and tighten the nut to 130 N·m (96 ft. lbs.).

(5) Install the ABS sensor by pushing the sensor all the way into the knuckle and the sensor will self adjust when the wheel is turned.

(6) Install the hub/bearing (Refer to 2 - SUSPENSION/FRONT/HUB / BEARING - INSTALLATION).

(7) Install the disc brake caliper adapter with the brake caliper (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPER ADAPTER - INSTALLATION).

(8) Install the front wheels (Refer to 22 - TIRES/WHEELS/WHEELS - INSTALLATION).

(9) Lower the vehicle.

(10) Check and set toe if necessary (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE).

LOWER BALL JOINT

REMOVAL

(1) Raise and support the vehicle.

(2) Remove the front tire and wheel assembly.

(3) Remove the front strut (Refer to 2 - SUSPENSION/FRONT/STRUT - REMOVAL).

(4) Remove the steering knuckle (Refer to 2 - SUSPENSION/FRONT/KNUCKLE - REMOVAL).

(5) Remove the lower ball joint using special tool 9294-1 (Driver) with 9294-2 (Reciever) and C-4212–F. (Fig. 7).

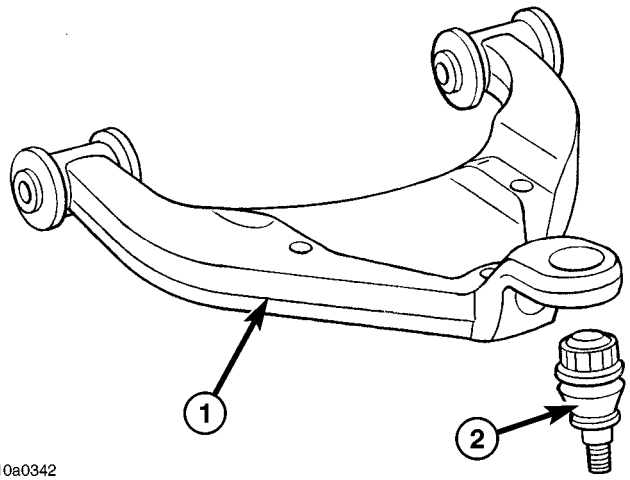


Fig. 7 LOWER BALL JOINT

1 - LOWER CONTROL ARM
2 - LOWER BALL JOINT

INSTALLATION

(1) Install the ball joint into the lower control arm using special tool 9294-3 (Installer ring) inserted in 9294-2 (Reciever) and C-4212–F (Fig. 7).

(2) Install the front strut (Refer to 2 - SUSPENSION/FRONT/STRUT - INSTALLATION).

(3) Install the steering knuckle (Refer to 2 - SUSPENSION/FRONT/KNUCKLE - INSTALLATION).

(4) Install the tire and wheel assembly (Refer to 22 - TIRES/WHEELS/WHEELS - INSTALLATION).

(5) Lower the vehicle.

(6) Check the front wheel alignment (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - SPECIFICATIONS).

LOWER CONTROL ARM

REMOVAL

(1) Insert spring blocks special tool 9288 between the spring and the spring clamp plates, While the vehicles wheels are on the ground.

(2) Raise and support the vehicle.

(3) Remove the front wheels (Refer to 22 - TIRES/WHEELS/WHEELS - REMOVAL).

(4) Remove the disc brake caliper adapter (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPER ADAPTER - REMOVAL).**Hang the caliper. Do not allow brake hose to support the caliper weight.**

(5) Remove the retaining nut holding the tie rod to the steering knuckle (Fig. 8).

(6) Seperate the tie rod off the steering knuckle (Fig. 8) using special tool C-3894–A.

NOTE: In order to remove tension from the strut, Raise the lower control arm approximately 10 mm with a jack.

(7) Remove the strut bolts from the steering knuckle (Fig. 8).

(8) Remove the stop plate bolts and rotate the plate upwards with the stabilizer link attached (Fig. 8).

(9) Lower the lower control arm.

(10) Remove the lower ball joint nut from the steering knuckle (Fig. 8).

(11) Separate the lower ball joint from the knuckle using special tool 9282.

(12) Remove the lower control arm nuts and bolts from the frame (Fig. 8).

(13) Remove the lower control arm.

INSTALLATION

(1) Install the lower control arm to the frame. Hand tighten the nuts and bolts.

LOWER CONTROL ARM (Continued)

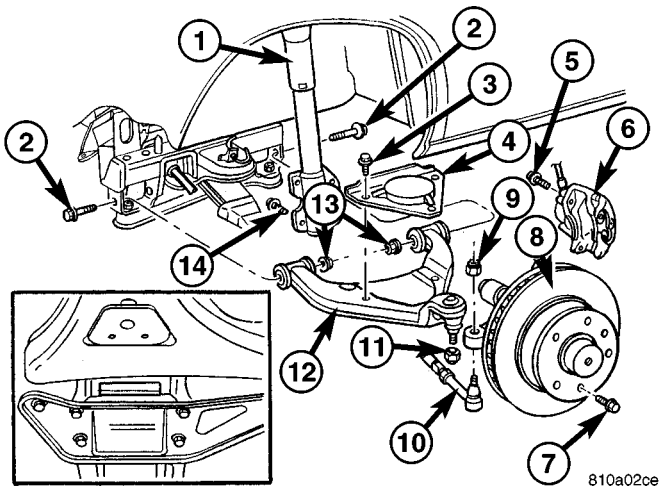


Fig. 8 LOWER CONTROL ARM

1 - STRUT
2 - LOWER CONTROL ARM BOLT
3 - STOP PLATE BOLT
4 - STOP PLATE
5 - CALIPER ADPTER BOLT
6 - DISC BRAKE CALIPER
7 - LOCKING BOLT
8 - DISC BRAKE ROTOR
9 - OUTER TIE ROD END RETAINING NUT
10 - OUTER TIE ROD END
11 - LOWER BALL JOINT NUT
12 - LOWER BALL JOINT
13 - LOWER CONTROL ARM NUTS
14 - STRUT BOLT

NOTE: In order to remove tension from the strut, Raise the lower control arm approximately 10 mm with a jack.

(2) Install the lower ball joint into the steering knuckle. Tighten to 280 N·m (206 ft. lbs.).

(3) Install the strut bolts to the steering knuckle (Fig. 8). Tighten to 185 N·m (136 ft. lbs.).

(4) Install the stop plate (Refer to 2 - SUSPENSION/FRONT/SPRING STOP PLATES - INSTALLATION).

(5) Lower the lower control arm.

(6) Attach the tie rod to the steering knuckle (Fig. 8). Tighten the nut to 130 N·m (96 ft. lbs.)

(7) Install the disc brake caliper adapter (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPER ADAPTER - INSTALLATION) (Fig. 8).

(8) Install the front tire & wheel assembly (Refer to 22 - TIRES/WHEELS/WHEELS - INSTALLATION).

(9) Lower the vehicle.

(10) Remove the spring blocks between the spring and the spring clamp plates, While the vehicles wheels are on the ground.

(11) Roll the vehicle approximately 1 mm forwards and the backwards, and rock firmly.

(12) Tighten the lower control arm nuts and bolts to the frame to 150 N·m (110 ft. lbs.) (Fig. 8).

(13) Apply brake to actuate brake pressure.

SPRING

REMOVAL

(1) **To do this next step the vehicle must be on the ground.** Remove the front and rear bolts on the left and right spring clamp plates (Fig. 9).

(2) Raise and support the vehicle.

(3) Remove the front wheels.

(4) Remove the brake caliper adapter (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPER ADAPTER - REMOVAL).**Do not allow the caliper to hang by the hose, support the caliper accordingly.**

(5) Remove the ABS sensor from the mounting bore in the steering knuckle (Fig. 9).

(6) Remove the outer tie rod retaining nut and separate the tie rod from the knuckle (Fig. 9) using special tool C-3894–A.

NOTE: In order to remove tension from the strut, Raise the lower control arm approximately 10 mm with a jack.

(7) Remove the strut bolts from the steering knuckle.

(8) Remove both stop plate bolts and rotate the plates upwards with the stabilizer link attached.

(9) Lower the lower control arm.

(10) Remove the lower ball joint nut from the steering knuckle.

(11) Separate the lower ball joint from the knuckle using special tool 9282.

(12) Remove the lower control arm nuts and bolts from the frame.

(13) Remove the lower control arm from the frame (Fig. 9).

NOTE: To avoid damaging the transverse leaf spring, cushion the pad on the jack accordingly.

(14) Support the transverse leaf spring in the center with a jack.

(15) Remove the left and right spring clamp plates (Refer to 2 - SUSPENSION/FRONT/SPRING CLAMP PLATES - REMOVAL) (Fig. 9).

NOTE: The upper spring blocks between the engine cradle and the spring are color coded, Make sure not to mix the blocks per sides. The blocks are different in sizes to accommodate the weight of the vehicle and driver in order for the vehicle to sit level.

SPRING (Continued)

(16) Lower the jack and remove the transverse leaf spring towards the side.

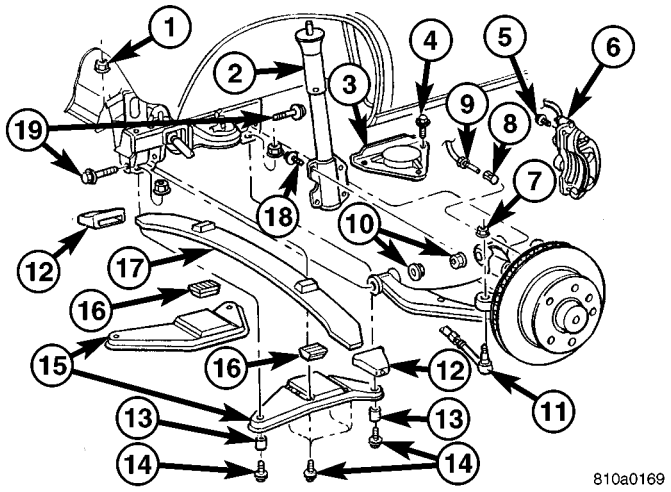


Fig. 9 FRONT SPRING

1 - NUT
2 - STRUT
3 - STOP PLATE
4 - STOP PLATE BOLT
5 - CALIPER ADAPTER BOLT
6 - DISC BRAKE CALIPER
7 - OUTER TIE ROD END NUT
8 - ABS SENSOR
9 - SPEED SENSOR
10 - LOWER CONTROL ARM RETAINING NUTS
11 - OUTER TIE ROD END
12 - RUBBER SPRING MOUNT
13 - SHEAR BUSHING
14 - SPRING CLAMP PLATE BOLT
15 - SPRING CLAMP PLATE
16 - LOWER RUBBER SPRING MOUNT
17 - SPRING
18 - STRUT BOLTS
19 - LOWER CONTROL ARM BOLTS

INSTALLATION

NOTE: To avoid damaging the transverse leaf spring, cushion the pad on the jack accordingly.

NOTE: Hand tighten all bolts until vehicle is on the ground, unless the bushings may become distorted.

NOTE: The height blocks between the engine cradle and the spring are color coded, Make sure not to mix the blocks per sides. The blocks are different in sizes to accommodate the weight of the vehicle and driver in order for the vehicle to sit level.

(1) Install the transverse leaf spring in the center with a jack with all the rubber mounts attached.

(2) Install the lower control arm to the frame (Fig. 9).

(3) Install the knuckle on the lower ball joint.

(4) Raise the lower control arm approximately 10 mm with a jack.

(5) Install both stop plate bolts to the lower control arm

(6) Install the strut bolts to the steering knuckle.

(7) Reinstall the tie rod to the steering knuckle (Fig. 9). Tighten to 150 N·m (110 ft. lbs.).

(8) Install the ABS sensor all the way into the steering knuckle, the sensor will adjust automatically when the vehicle is moved (Fig. 9).

(9) Install the disc brake caliper adapter (Fig. 9). Tighten to 170 N·m (125 ft. lbs.).

(10) Install the front wheels.

(11) Lower the vehicle.

(12) Install the spring clamp plates (Fig. 9). Tighten (M-10 bolts) to 65 N·m (48 ft. lbs.) (M-12 bolts) to 130 N·m (96 ft. lbs.).

(13) Roll the vehicle approximately 1 mm forwards and the backwards, and rock firmly.

(14) Tighten the nuts on the lower control arm to the frame to 150 N·m (110 ft. lbs.).

(15) Apply brake to actuate brake pressure.

SPRING CLAMP PLATES

REMOVAL

(1) Raise and support the vehicle.

(2) Install a jack under the lower ball joint and lower the weight of the vehicle enough to allow a wrench between the lower control arm and the bracket tighten the nut.

(3) Remove the front and rear bolts to the spring clamp plates.

(4) Remove the four inner retaining bolts and nuts.

(5) Remove the spring clamp plate and rubber block.

(6) Remove the shear bushings from the front and rear bolts.

INSTALLATION

(1) Install a jack under the lower ball joint and lower the weight of the vehicle enough to allow a wrench between the lower control arm and the bracket tighten the nut.

(2) Fit one spring clamp plate together with the lower spring rubber block.

(3) Install the bolt with the shear bushing on the rear mounting, **Do not tighten yet.**

(4) Install the four retaining bolts for the spring clamp plate. Tighten to 65 N·m (48 ft.lbs.).

(5) Align the holes for the front clamp plate joint using a suitable drift (shear bushing not installed).

(6) Remove the alignment drift.

SPRING CLAMP PLATES (Continued)

(7) Insert the shear bushing and retaining bolt into the hole and tighten to 130 N·m (96 ft.lbs.).
(8) Remove the jack and lower the vehicle.

SPRING STOP PLATES

REMOVAL

(1) Raise and support the vehicle.
(2) Remove the tire and wheel assembly.
(3) Remove the lower end of the stabilizer link from the stop plate.
(4) Remove the three bolts retaining the spring stop plate from the lower control arm.

INSTALLATION

(1) Install the spring stop plate to the lower control arm. Tighten the bolts to 60 N·m (44 ft. lbs.).
(2) Install the stabilizer link to the spring stop plate.
(3) Install the tire and wheel assembly.
(4) Lower the vehicle.

STABILIZER BAR

DESCRIPTION

The bar extends across the front underside of the chassis and connects to the frame crossmember. The ends of the bar mount to the lower suspension arm. All mounting points of the stabilizer bar are isolated by bushings (Fig. 10).

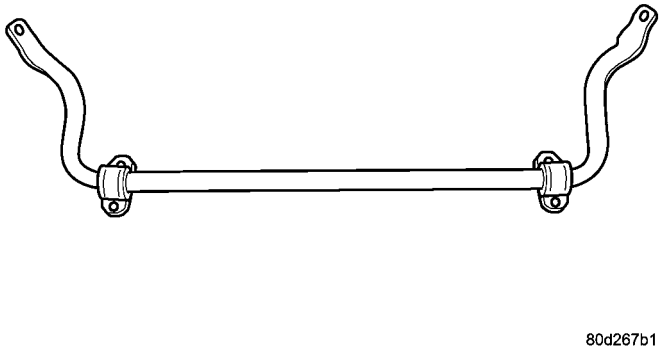


Fig. 10 STABILIZER BAR

OPERATION

The stabilizer bar is used to minimize vehicle front sway during turns. The bar helps to maintain a flat attitude to the road surface.

REMOVAL

(1) Raise and support the vehicle.
(2) Remove the stabilizer bar clamp bolts at the front axle (Fig. 11).
(3) Press the rubber mount outwards out of the brackets (Fig. 11).
(4) Remove the stabilizer links from the stabilizer bar (Fig. 11).

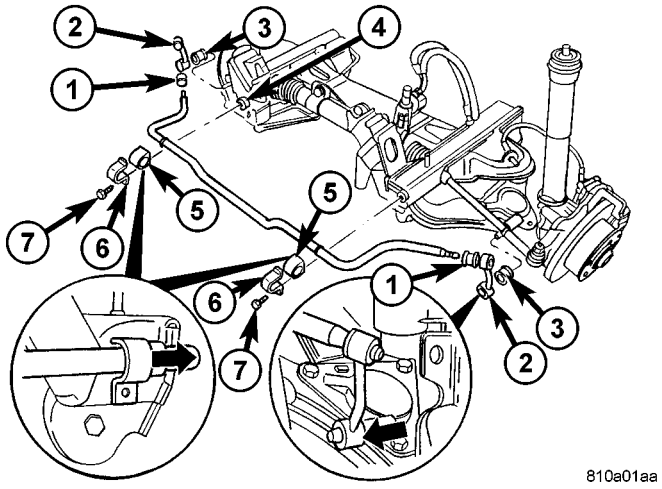


Fig. 11 STABILIZER BAR

1 - RUBBER MOUNT
2 - STABILIZER LINK
3 - RUBBER MOUNT
4 - NUT
5 - RUBBER MOUNT
6 - CLAMP BRACKET
7 - BOLT

INSTALLATION

(1) Install the stabilizer links to the stabilizer bar (Fig. 11).
(2) Install the stabilizer to the front axle (Fig. 11).
(3) Install the stabilizer bar clamp and bolts (Fig. 11). Tighten the bolts to 30 N·m (22 ft. lbs.).
(4) Lower the vehicle.

STABILIZER LINK

REMOVAL

(1) Raise and support the vehicle.
(2) Insert a pry bar between the stabilizer link and something solid to pry on.
(3) Pry the stabilizer link off the stabilizer bar and the spring stop plate.

INSTALLATION

(1) Install a mild detergent soap the to rubber bushings on the stabilizer link.
(2) Install the stabilizer links onto the stabilizer bar and spring stop plate by pushing on the link.
(3) Lower the vehicle.

STRUT

REMOVAL

(1) On the drivers side remove the floor covering off to the side.
(2) On the passengers side take off the cover for the tools.
(3) Remove the cover for the upper strut mounting (Fig. 12).
(4) Remove the nut on the upper strut mounting (Fig. 12).
(5) Raise and support the vehicle.
(6) Remove the front wheels.
(7) Raise the lower control arm approximately 10 mm with a jack to remove the tension from the strut.
(8) Remove the strut from the steering knuckle (Fig. 12).

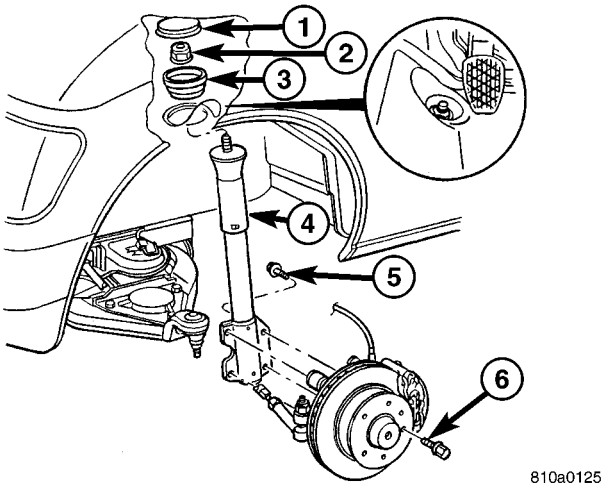


Fig. 12 STRUT

1 - COVER
2 - NUT
3 - RUBBER MOUNT
4 - STRUT
5 - STRUT BOLT
6 - LOCKING BOLT

INSTALLATION

NOTE: Hand tighten the strut upper mounting nut until the vehicle is on the ground, otherwise the bushings may become distorted.

(1) Install strut to the steering knuckle (Fig. 12). Tighten to 185 N·m (136 ft. lbs.).
(2) Raise the lower control to install the upper part of the strut into the footwell. Tighten to 100 N·m (74 ft. lbs.).
(3) Install wheels (Refer to 22 - TIRES/WHEELS/ WHEELS - INSTALLATION).
(4) Lower the vehicle.
(5) Install the nut covers (Fig. 12).
(6) Refit the floor covering and the tool cover.

REAR

TABLE OF CONTENTS

page

REAR
DESCRIPTION 11
DIAGNOSIS AND TESTING - SPRING AND SHOCK 11
SPECIFICATIONS - TORQUE CHART 12
SHOCK
DIAGNOSIS AND TESTING - SHOCK 13
REMOVAL 13
INSTALLATION 13
SPRING
DESCRIPTION 14
OPERATION 14
REMOVAL
REMOVAL - (SRW) 14
REMOVAL - (DRW) 14
INSTALLATION
INSTALLATION - (SRW) 14
INSTALLATION - (DRW) 15
SPRING SHACKLE
REMOVAL 15
INSTALLATION 15
STABILIZER BAR
REMOVAL 15
INSTALLATION 15
STABILIZER LINK
REMOVAL 16
INSTALLATION 16

REAR

DESCRIPTION

The rear suspension is comprised of:

- Shock Absorbers
- Jounce Bumpers
- Stabilizer Bar
- Leaf Springs
- Drive Axle

CAUTION: A vehicle should always be loaded so the vehicle weight center-line is located immediately forward of the rear axle. Correct vehicle loading provides proper front tire-to-road contact. This results in maximum vehicle handling stability and safety. Incorrect vehicle weight distribution can cause excessive tire tread wear, spring fatigue or failure, and erratic steering.

CAUTION: Suspension components with rubber/urethane bushings (except stabilizer bar) 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. If springs are not at their normal ride position, vehicle ride comfort could be affected and premature bushing wear may occur.

DIAGNOSIS AND TESTING - SPRING AND SHOCK

A knocking or rattling noise from a shock absorber may be caused by movement between mounting bushings and metal brackets or attaching components. These noises can usually be stopped by tightening the attaching nuts. If the noise persists, inspect for damaged and worn bushings, and attaching components. Repair as necessary if any of these conditions exist.

A squeaking noise from the shock absorber may be caused by the hydraulic valving and may be intermittent. This condition is not repairable and the shock absorber must be replaced.

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

The spring eye and shock absorber bushings do not require any type of lubrication. Do not attempt to stop spring bushing noise by lubricating them. Grease and mineral oil-base lubricants will deteriorate the bushing rubber.

If the vehicle is used for severe, off-road operation, the springs should be examined periodically. Check for broken and shifted leafs, loose and missing clips, and broken center bolts. Refer to Spring and Shock Absorber Diagnosis chart for additional information.

REAR (Continued)

SPRING AND SHOCK ABSORBER

CONDITION	POSSIBLE CAUSES	CORRECTION
SPRING SAGS	1. Broken leaf. 2. Spring fatigue.	1. Replace spring. 2. Replace spring.
SPRING NOISE	1. Loose spring clamp bolts. 2. Worn bushings. 3. Worn or missing spring tip inserts.	1. Tighten to specification. 2. Replace bushings. 3. Replace spring tip inserts.
SHOCK NOISE	1. Loose mounting fastener. 2. Worn bushings. 3. Leaking shock.	1. Tighten to specification. 2. Replace shock. 3. Replace shock.

SPECIFICATIONS - TORQUE CHART

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Sway Bar Link	95	60	—
Sway Bar Clamp To Axle (SRW)	25	18	—
Sway Bar Clamp To Axle (DRW)	70	52	—
Rear Spring To Front Spring Bracket (SRW)	95	70	—
Rear Spring To Front Spring Bracket (DRW)	185	136	—
Rear Spring To Rear Spring Bracket (SRW)	85	63	—
Rear Spring To Rear Spring Bracket (DRW)	185	136	—
Spring Shackle To Rear Spring Bracket (SRW)	90	66	—
Spring Shackle To Rear Spring Bracket (DRW)	185	136	—
U-Bolt To Spring Plate & Axle (SRW&DRW)	170	125	—
Lower Shock Mounting To Rear Axle M12 X 1.5 Bolt	70	52	—

REAR (Continued)

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Lower Shock Mounting To Rear Axle M14 X 1.5 Bolt (SRW&DRW)	110	81	—
Upper Shock Mounting To Frame (SRW)	80	59	—
Upper Shock Mounting To Frame (DRW)	140	103	—

SHOCK

DIAGNOSIS AND TESTING - SHOCK

A knocking or rattling noise from a shock absorber may be caused by movement between mounting bushings and metal brackets or attaching components. These noises can usually be stopped by tightening the attaching nuts. If the noise persists, inspect for damaged and worn bushings, and attaching components. Repair as necessary if any of these conditions exist.

A squeaking noise from the shock absorber may be caused by the hydraulic valving and may be intermittent. This condition is not repairable and the shock absorber must be replaced.

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

The shock absorber bushings do not require any type of lubrication. Do not attempt to stop bushing noise by lubricating them. Grease and mineral oil-base lubricants will deteriorate the bushing.

REMOVAL

(1) Raise and support the vehicle.

(2) Remove the shock absorber bolt from the rear axle (Fig. 1).

(3) Unsnap the clip for the ALB lever (left hand side) (Fig. 1).

(4) Remove the ALB lever from the upper shock bolt/stud (Fig. 1).

(5) Remove the shock absorber bolt from the frame side (Fig. 1).

(6) Remove the shock absorber (Fig. 1).

INSTALLATION

(1) Install the shock absorber (Fig. 1).

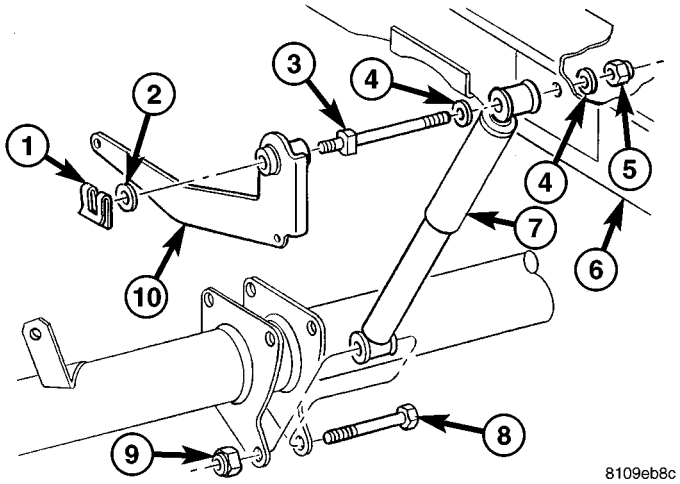


Fig. 1 SHOCK ABSORBER (LEFT SIDE SHOWN)

1 - CLIP
2 - WASHER
3 - MOUNTING STUD/BOLT
4 - WASHER
5 - NUT
6 - FRAME
7 - SHOCK ABSORBER
8 - BOLT
9 - NUT
10 - ALB LEVER

(2) Install the shock absorber bolt to the frame side (Fig. 1) Tighten to 80 N·m (59 ft.lbs.) for (SRW) or Tighten to 140 N·m (103 ft.lbs.) for (DRW).

(3) Install the ALB lever to the upper shock bolt/stud (left hand side only) (Fig. 1).

(4) Snap the clip for the ALB lever (Fig. 1).

(5) Install the shock absorber bolt to the rear axle (Fig. 1) Tighten to 70 N·m (52 ft.lbs.) for (M12X1.5 bolt) or Tighten to 110 N·m (81 ft.lbs.) for (M14X1.5 bolt).

(6) Lower the vehicle.

SPRING

DESCRIPTION

The rear suspension system uses a multi-leaf springs and a solid drive axle. The forward end of the springs are mounted to the body rail hangers through rubber bushings. The rearward end of the springs are attached to the body by the use of shackles. The spring and shackles use rubber bushings.

OPERATION

The springs control ride quality and maintain vehicle ride height. The shackles allow the springs to change their length as the vehicle moves over various road conditions.

REMOVAL

REMOVAL - (SRW)

(1) Raise and support the vehicle.
(2) Support the rear axle.
(3) Remove the U-bolt and spring plate (Fig. 2).
(4) Remove the spring from the front spring bracket (Fig. 2).
(5) Remove the rear spring with the spring shackle from the spring bracket (Fig. 2).
(6) Lower the rear axle and remove the rear spring.
(7) Remove the spring shackle from the spring (if needed) (Fig. 2).

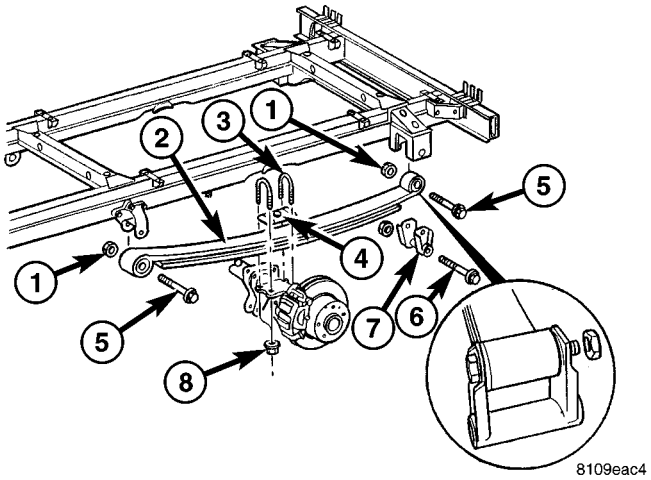


Fig. 2 REAR LEAF SPRING WITH SINGLE REAR WHEELS

1 - NUT
2 - LEAF SPRING
3 - U-BOLTS
4 - PLATE
5 - SPRING BOLT
6 - SHACKLE BOLT
7 - SPRING SHACKLE
8 - U-BOLT NUTS

REMOVAL - (DRW)

(1) Raise and support the vehicle.
(2) Support the rear axle.
(3) Remove the U-bolt and spring plate (Fig. 3).
(4) Remove the spring from the front spring bracket (Fig. 3).
(5) Remove the rear spring with the spring shackle from the spring bracket (Fig. 3).
(6) Lower the rear axle and remove the rear spring.
(7) Remove the spring shackle from the spring (if needed) (Fig. 3).

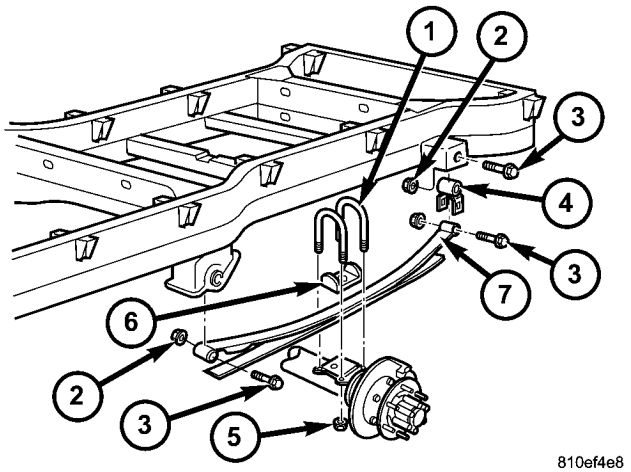


Fig. 3 REAR LEAF SPRING WITH DUAL REAR WHEELS

1 - U-BOLTS
2 - NUT
3 - BOLT
4 - SPRING SHACKLE
5 - U-BOLT MOUNTING NUT
6 - U-BOLT BRACKET ALIGNING PLATE
7 - LEAF SPRING

INSTALLATION

INSTALLATION - (SRW)

NOTE: Larger spring bushing goes toward the front.

(1) Install the spring shackle to the spring (if removed) (Fig. 2). Tighten to 90 N·m (66 ft. lbs.).
(2) Install the spring to the front spring bracket (Fig. 2). Tighten to 95 N·m (70 ft. lbs.).
(3) Install the spring to the rear spring bracket (Fig. 2). Tighten to 85 N·m (63 ft. lbs.).
(4) Raise the rear axle and attach the spring plate and U-bolts (Fig. 2). Tighten to 170 N·m (125 ft. lbs.).
(5) Lower the vehicle.

SPRING (Continued)

INSTALLATION - (DRW)

NOTE: Larger spring bushing goes toward the front.

(1) Install the spring shackle to the spring (if removed) (Fig. 3). Tighten to 185 N·m (136 ft. lbs.).
(2) Install the spring to the front spring bracket (Fig. 3). Tighten to 185 N·m (136 ft. lbs.).
(3) Install the spring to the rear spring bracket (Fig. 3). Tighten to 185 N·m (136 ft. lbs.).
(4) Raise the rear axle and attach the spring plate and U-bolts (Fig. 3). Tighten to 170 N·m (125 ft. lbs.).
(5) Lower the vehicle.

SPRING SHACKLE

REMOVAL

(1) Raise and support the vehicle.
(2) Support the rear axle.
(3) Remove both the rear spring shackles from the spring bracket.
(4) Lower the rear axle and remove the rear spring shackle from the spring.

INSTALLATION

(1) Install the spring shackle to the spring. Tighten to 90 N·m (66 ft. lbs.).
(2) Raise the rear axle while installing the spring shackle to the spring bracket. Tighten to 85 N·m (63 ft. lbs.).
(3) Lower the vehicle.

STABILIZER BAR

REMOVAL

(1) Raise and support the vehicle.
(2) Remove the stabilizer links at the bar (Fig. 4).
(3) Remove the stabilizer bar clamp at the axle (Fig. 4).
(4) Remove the bracket (Fig. 4)
(5) Remove the stabilizer bar from the vehicle.

INSTALLATION

(1) Install the stabilizer bar to the axle.
(2) Install the stabilizer bar clamps and bracket, center the bar then tighten to 25 N·m (18ft. lbs.) (SRW) (Fig. 4) or Tighten to 70 N·m (52 ft. lbs.) for (DRW) (Fig. 5).
(3) Install the stabilizer bar to the stabilizer links and tighten to 95 N·m (60 ft. lbs.) (Fig. 4) or (Fig. 5).
(4) Lower the vehicle.

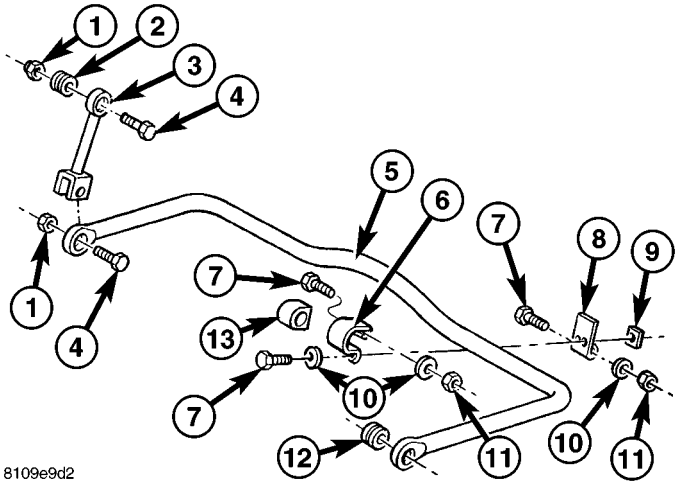


Fig. 4 SWAY BAR WITH SINGLE REAR WHEELS (SRW)

1 - M12 NUT
2 - BUSHING
3 - SWAY BAR LINK
4 - M12 BOLT
5 - SWAY BAR
6 - CLAMP
7 - M8 BOLT
8 - BRACKET
9 - FOUR POINT NUT M8
10 - WASHER
11 - M8 NUT
12 - BUSHING
13 - MOUNT

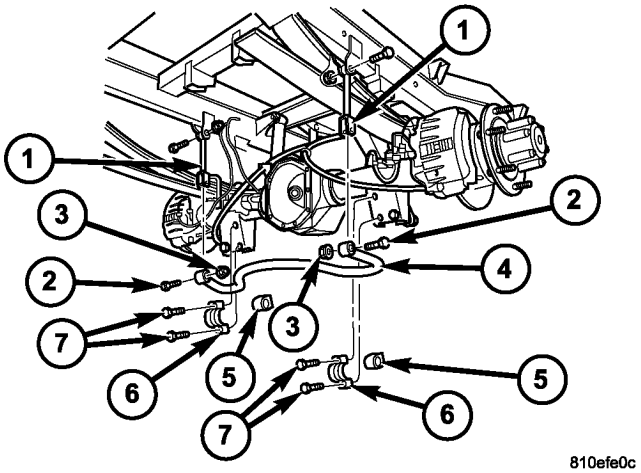


Fig. 5 SWAY BAR WITH DUAL REAR WHEELS (DRW)

1 - STABILIZER LINK
2 - SWAY BRA BOLT
3 - SWAY BAR NUT
4 - SWAY BAR
5 - RUBBER MOUNT
6 - SWAY BAR CLAMP
7 - CLAMP MOUNTING BOLTS

STABILIZER LINK

REMOVAL

(1) Raise and support the vehicle.
(2) Remove the stabilizer links at the bar (Fig. 4).
(3) Remove the stabilizer link at the frame.

INSTALLATION

(1) Install the stabilizer bar to the stabilizer links and tighten to 95 N·m (60 ft. lbs.) (Fig. 4).
(2) Lower the vehicle.
(3) Install the stabilizer link to the frame. Tighten to 95 N·m (60 ft. lbs.).

WHEEL ALIGNMENT

TABLE OF CONTENTS

page

WHEEL ALIGNMENT
DESCRIPTION 17
DIAGNOSIS AND TESTING - PRE-ALIGNMENT INSPECTION 17
STANDARD PROCEDURE - TOE ADJUSTMENT 19
SPECIFICATIONS 19

WHEEL ALIGNMENT

DESCRIPTION

NOTE: Camber and Caster are not adjustable on this vehicle. (TOE ONLY).

NOTE: 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. If springs are not at their normal ride position, vehicle ride comfort could be affected and premature bushing wear may occur.

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 (Fig. 1).

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

DIAGNOSIS AND TESTING - PRE-ALIGNMENT INSPECTION

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

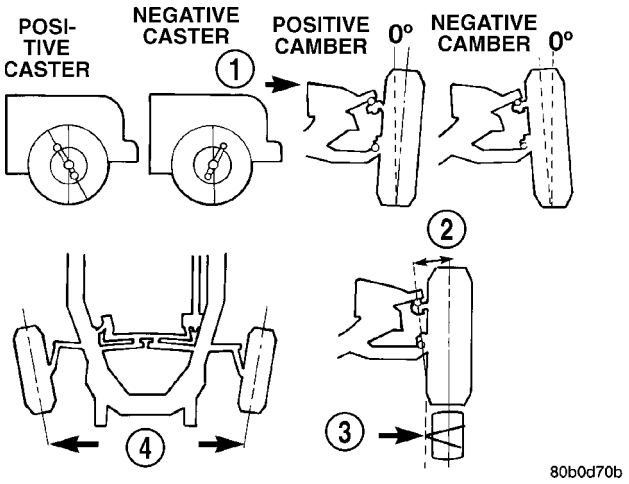


Fig. 1 Wheel Alignment Measurements

1 - FRONT OF VEHICLE
2 - STEERING AXIS INCLINATION
3 - PIVOT POINT
4 - TOE-IN

(1) Inspect tires for size, air pressure and tread wear.

(2) Inspect front wheel bearings for wear.

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

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

(5) Inspect suspension components for wear and noise.

(6) Road test the vehicle.

WHEEL ALIGNMENT (Continued)

SUSPENSION AND STEERING SYSTEM DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
FRONT END NOISE	1. Loose or worn wheel bearing.	1. Replace wheel bearing.
	2. Loose or worn steering or suspension components.	2. Tighten or replace components as necessary.
	3. Loose or worn steering or suspension components.	3. Tighten or replace components as necessary.
EXCESSIVE PLAY IN STEERING	1. Loose or worn wheel bearing.	1. Replace wheel bearing.
	2. Loose or worn steering or suspension components.	2. Tighten or replace components as necessary.
	3. Loose or worn steering gear.	3. Replace steering gear.
FRONT WHEELS SHIMMY	1. Loose or worn wheel bearing.	1. Replace wheel bearing.
	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.
VEHICLE INSTABILITY	1. Loose or worn wheel bearing.	1. Replace wheel bearing.
	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. Replace steering gear.
	2. Column coupler binding.	2. Replace coupler.
	3. Tire pressure.	3. Adjust tire pressure.
	4. Alignment.	4. Align vehicle to specifications.
VEHICLE PULLS TO ONE SIDE	1. Tire pressure.	1. Adjust tire pressure.
	2. Tire.	2. Criss-Cross Front Tires.
	3. Alignment.	3. Align vehicle to specifications.
	4. Loose or worn steering or suspension components.	4. Tighten or replace components as necessary.
	5. Radial tire lead.	5. Rotate or replace tire as necessary.
	6. Brake pull.	6. Repair brake as necessary.
	7. Weak or broken spring.	7. Replace spring.

WHEEL ALIGNMENT (Continued)

STANDARD PROCEDURE - TOE ADJUSTMENT

CAMBER AND CASTER ARE NOT ADJUSTABLE (TOE ONLY)..

The wheel toe position adjustment is the final adjustment.

(1) Start the engine and turn wheels both ways before straightening the wheels. Secure the steering wheel with the front wheels in the straight-ahead position.

(2) Loosen the tie rod jam nuts.

NOTE: Each front wheel should be adjusted for one-half of the total toe position specification. This will ensure the steering wheel will be centered when the wheels are positioned straight-ahead.

(3) Adjust the wheel toe position by turning the inner tie rod as necessary.

(4) Tighten the tie rod jam nut to 50 N·m (37 ft. lbs.).

(5) Verify the specifications

(6) Turn off engine.

SPECIFICATIONS

FRONT SPECIFICATIONS

DESCRIPTION	FRONT SPECIFICATION
Toe-In	±.16°

DESCRIPTION	FRONT SPECIFICATION
Camber	±.75°
Camber Left to Right Difference Max	1.33°
Caster	±.5°
Steering Knuckle Inclination	±.5°
Steering Knuckle Inclination Left to Right Difference Max	1°

REAR SPECIFICATIONS

DESCRIPTION	REAR SPECIFICATION
Toe-In Max	0° (±.25°)
Camber Max	0° (-.66°/+.33°)
Inclination of Rear Wheels (Individual Wheel Toe)= Maximum Inclination of Rear Axle Max	0° (±.25°)

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Outer Tie Rod End Jam Nut	50	37	—

DIFFERENTIAL & DRIVELINE

TABLE OF CONTENTS

	page		page
PROPELLER SHAFT	1	**REAR AXLE**	10

PROPELLER SHAFT

TABLE OF CONTENTS

	page		page
PROPELLER SHAFT		INSTALLATION	6
DIAGNOSIS AND TESTING	1	**CENTER BEARING**	
STANDARD PROCEDURE	3	REMOVAL	8
SPECIFICATIONS	5	INSTALLATION	9
SPECIAL TOOLS	5		
PROPELLER SHAFT			
REMOVAL	6		

PROPELLER SHAFT

DIAGNOSIS AND TESTING

PROPELLER SHAFT VIBRATION

Out-of-round tires or wheels that are out of balance, will cause a low frequency vibration.

Driveline vibration can be from loose or damaged engine mounts.

Propeller shaft vibration increases with vehicle speed. A vibration within a specific speed is not usually caused by a out of balanced propeller shaft. Worn universal joints or an incorrect propeller shaft angle, usually cause such a vibration.

PROPELLER SHAFT (Continued)

DRIVELINE VIBRATION

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

PROPELLER SHAFT BALANCE

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

If propeller shaft is suspected of being out of balance, verify with the following procedure:

(1) Place vehicle in netrual.

(2) Raise and support the vehicle by the axles as level as possible.

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

(4) Inspect propeller shaft for missing balance weights, broken welds, and bent areas.

NOTE: If propeller shaft is bent, it must be replaced.

(5) Inspect universal joints for wear, properly installed and correct alignment with the shaft.

(6) Check universal joint clamp screws torque.

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

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

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

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

(11) Start engine and re-check for vibration. If little or no change in vibration is evident, move clamp to the next positions and repeat vibration test.

NOTE: If there is no difference in vibration at the other positions, the vibration may not be propeller shaft.

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

(13) If additional clamp causes additional vibration, separate clamps 1/2 inch above and below the mark. Repeat the vibration test (Fig. 3).

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

PROPELLER SHAFT (Continued)

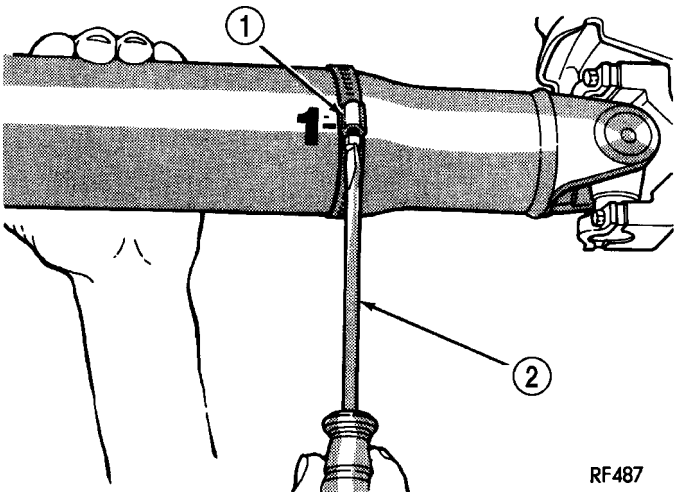


Fig. 1 Clamp Screw At Position 1

1 - CLAMP
2 - SCREWDRIVER

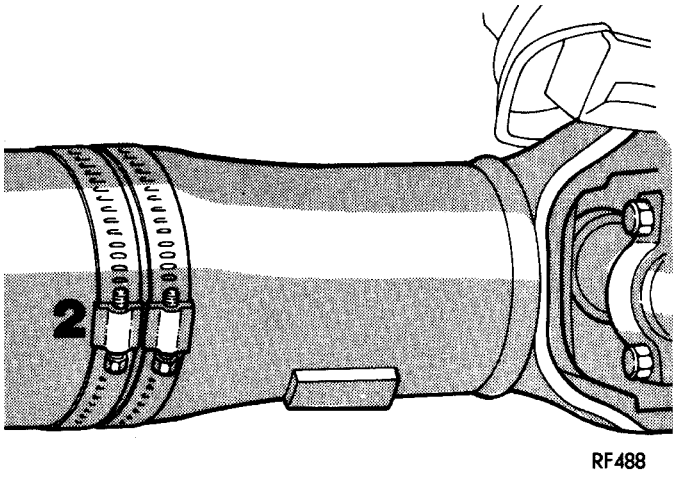


Fig. 2 Two Clamp Screws At The Same Position

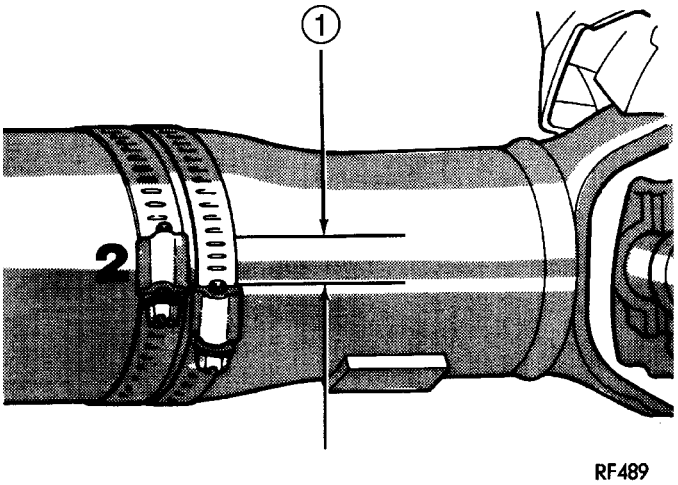


Fig. 3 Clamp Screws Separated

1 - ½ INCH

(15) If vibration remains unacceptable, preform the procedure to the front end of the propeller shaft.

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

PROPELLER SHAFT RUNOUT

(1) Clean 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 away from weld areas, to ensure weld process will not effect the measurements.

(4) Refer to Runout Specifications chart.

(5) If propeller shaft is out of specification, remove propeller shaft and index the shaft 180°. Install the propeller shaft and measure shaft runout again.

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

(7) If propeller shaft runout is not within specifications, check runout of the transmission and axle. Correct as necessary and repeat propeller shaft runout measurement.

(8) Replace 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)
note: Measure front/rear runout approximately 76 mm (3 in.) 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 0.50 mm (0.020 in.) for the full length of the tube.	

STANDARD PROCEDURE

PROPELLER SHAFT ANGLE

This procedure applies the front and rear propeller shafts.

(1) Place vehicle in netural.

(2) Raise and support vehicle at the axles as level as possible.

(3) Remove universal joint snap rings if equipped, so Inclinometer 7663 base sits flat.

(4) Rotate shaft until transmission case output yoke bearing is facing downward.

NOTE: Always make measurements from front to rear and from the same side of the vehicle.

(5) Place Inclinometer 7663 on yoke bearing (A) parallel to the shaft. Center bubble in sight glass and record measurement.

PROPELLER SHAFT (Continued)

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

(6) Rotate propeller shaft 90 degrees and place inclinometer on yoke bearing parallel to the shaft. 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).

(7) Rotate propeller shaft 90 degrees and place inclinometer on companion flange yoke bearing parallel to the shaft. Center bubble in sight glass and record measurement.

This measurement will give you the Pinion Flange Input Angle (B).

(8) Subtract smaller figure from larger (C minus A) to obtain Transmission **Output Operating Angle**.

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

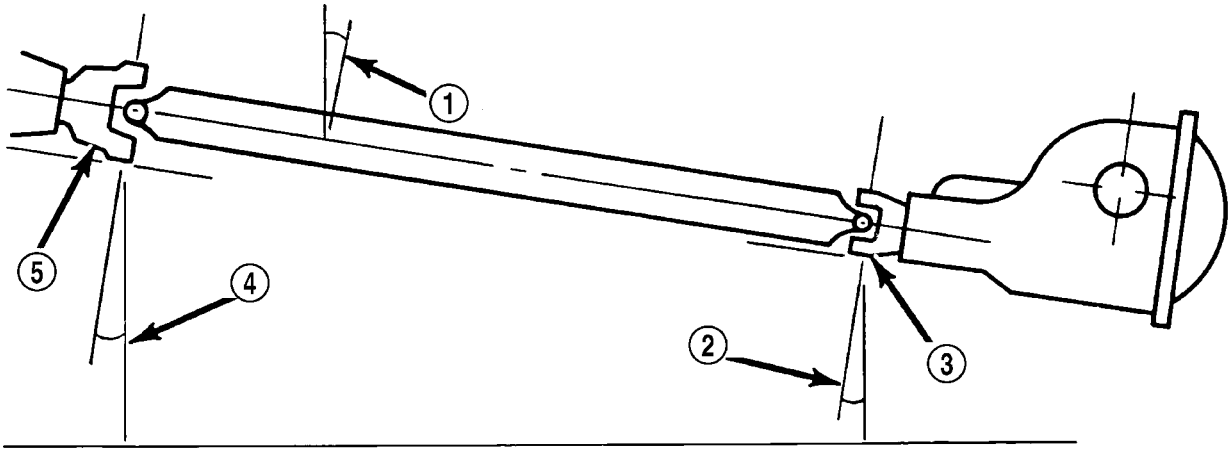
Refer to rules and example in (Fig. 4) for additional information.

RULES

- Good cancellation of U-joint operating angles should be within 1degree.
- Operating angles should be less than 3 degrees.
- At least 1/2 of one degree continuous operating (propeller shaft) angle.

TWO/THREE-PIECE PROPELLER SHAFT

The procedure to measure the propeller shaft angles involved with a two/three-piece (Fig. 5) propeller shaft is the same as those for a one-piece propeller shaft.



(A) Output Yoke	= 3.0°	or	4.9°
(C) Prop. Shaft	= 4.9°		-3.0°
Transmission Output Operating Angle			1.9°

(B) Axle Input Yoke	= 3.2°	or	4.9°
(C) Prop. Shaft	= 4.9°		-3.2°
Axle Input Operating Angle			1.7°

Trans. Output Operating Angle	1.9°
Axle Input Operating Angle	-1.7°
Amount of U-Joint Cancellation	0.2°

J9316-3

Fig. 4 UNIVERSAL JOINT ANGLE EXAMPLE

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

PROPELLER SHAFT (Continued)

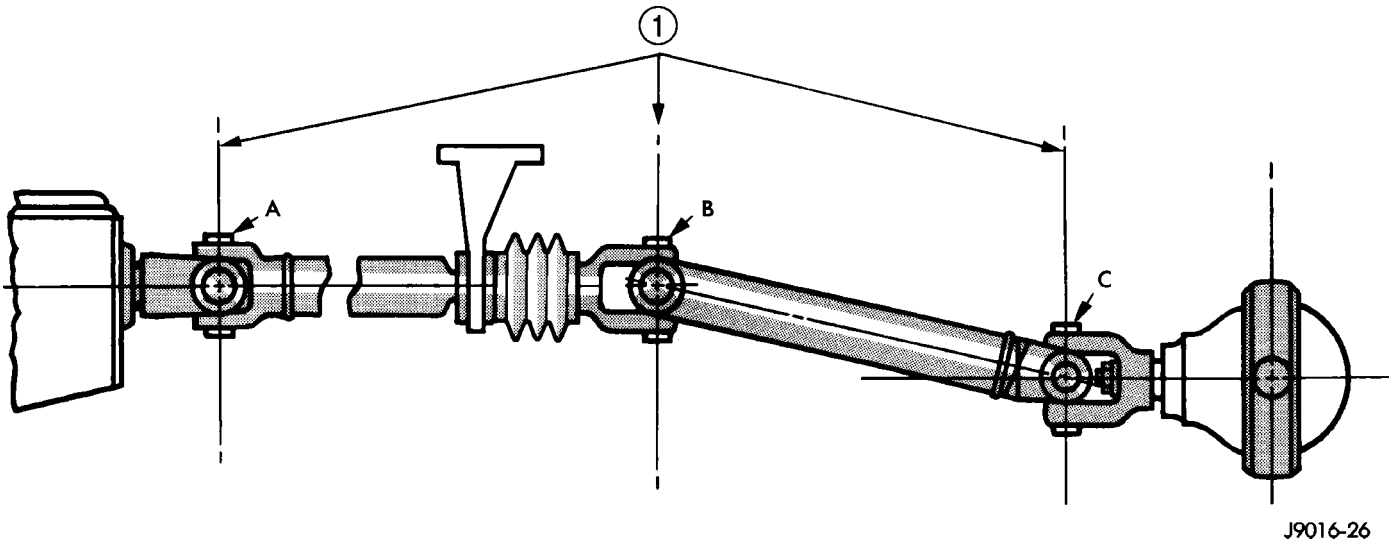


Fig. 5 UNIVERSAL JOINT ANGLE

1 - YOKES MUST BE IN SAME PLANE

SPECIFICATIONS

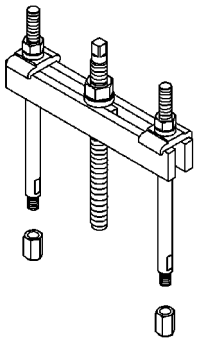
TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Propeller shaft to transmission bolt	70	52	-
Propeller shaft to axle bolt	70	52	-
Retaining bracket to frame floor bolt	100	74	-
Center Bearing support to frame floor bolt	95	70	-
Center Bearing to support nut	105	77	-

SPECIAL TOOLS

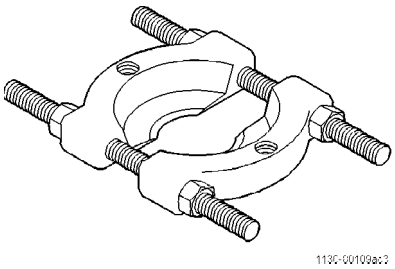
SPECIAL TOOL CROSS-REFERENCE CHART

MB TOOL #	MILLER TOOL #	DESCRIPTION
N/A	938	BRIGE
N/A	1130	SPLITTER
387 589 05 15 00	9275	INSTALLER
N/A	7663	INCLINOMETER

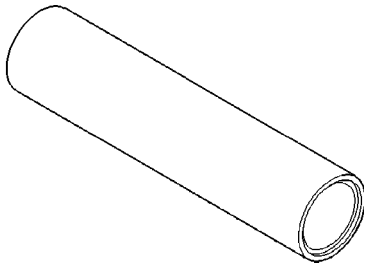


BRIDGE 938

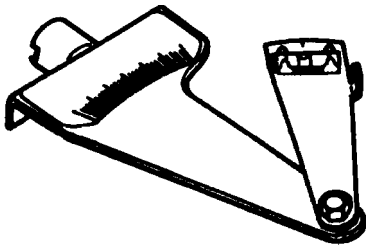
PROPELLER SHAFT (Continued)



SPLITTER 1130



INSTALLER 9275



INCLINOMETER 7663

PROPELLER SHAFT

REMOVAL

(1) Secure vehicle to prevent it from rolling.

(2) Make installing reference marks on propeller shaft (Fig. 6) and (Fig. 7).

(3) Remove retaining bracket bolts (Fig. 8) and (Fig. 9).

(4) Remove propeller shaft bolts from rear axle and transmission at the flange.

(5) Remove propeller shaft intermediate bearing nuts from retaining bracket and bracket for brake cable.

NOTE: The brake cable bracket is only installed in vehicles with wheelbase 3550 mm

(6) Remove shaft from the vehicle.

INSTALLATION

(1) Install propeller shaft intermediate bearing/ bearings to support and tighten nuts to 105 N·m (77 ft. lbs.).

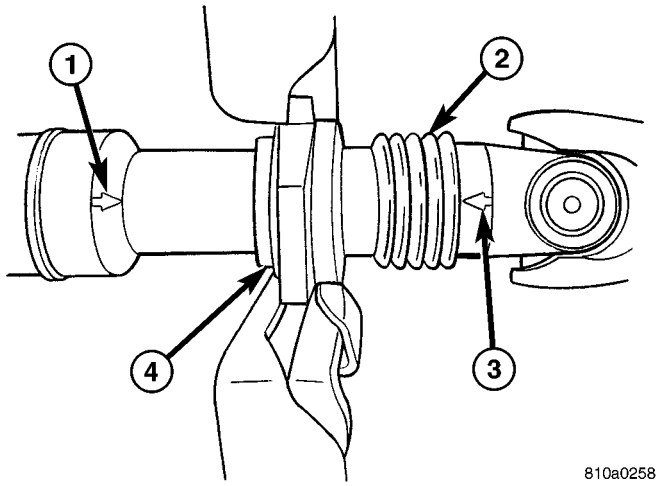


Fig. 6 ALIGNMENT MARKS

1 - ALIGNMENT MARK
2 - BOOT
3 - ALIGNMENT MARK
4 - CENTER BEARING

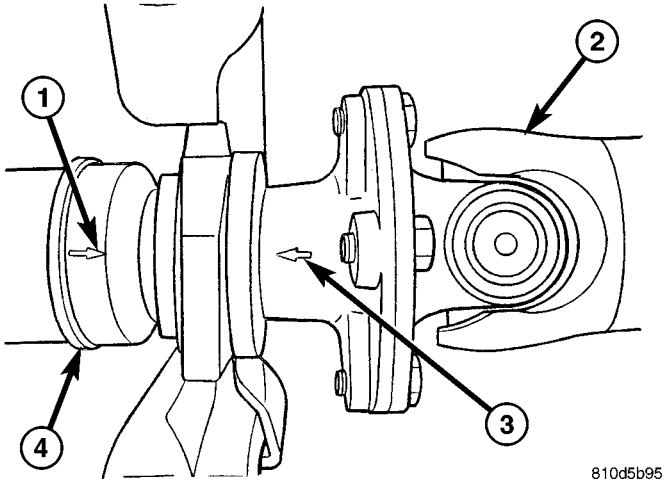


Fig. 7 ALIGNMENT MARKS 3 PIECE SHAFT

1 - REFERNCE MARK
2 - CENTER SHAFT
3 - REFERENCE MARK
4 - REAR SHAFT

(2) Install propeller shaft intermediate bearing support/supports to frame floor and tighten bolts to 95 N·m (70 ft. lbs.).

(3) Install propeller shaft intermediate bearing with retaining bracket and bracket for brake cable.

NOTE: The bracket is only installed on vehicles with wheelbase 3550 mm.

(4) Install propeller shaft to rear axle and transmission flange with installation marks are aligned. Tighten bolts to 70 N·m (66 ft. lbs.).

(5) Install retaining bracket and tighten bolts to 100 N·m (74 ft. lbs.).

PROPELLER SHAFT (Continued)

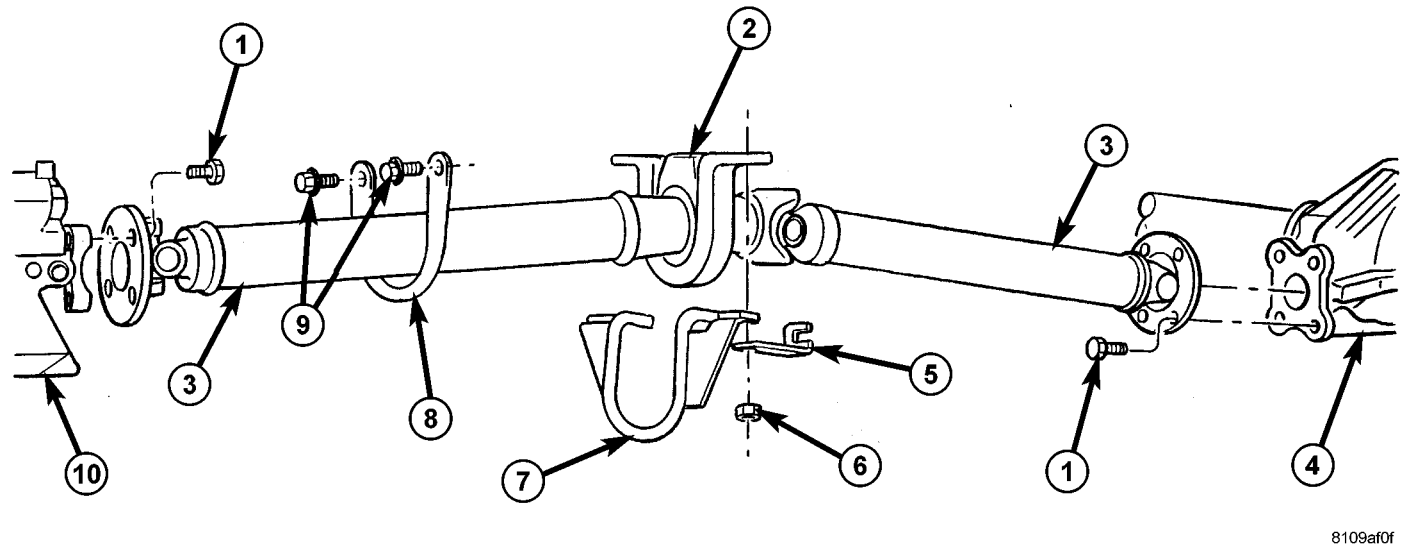


Fig. 8 2 PIECE PROPELLER SHAFT

1 - FLANGE BOLT
2 - BEARING
3 - PROPELLER SHAFT
4 - REAR AXLE
5 - CABLE BRACKET
6 - NUT
7 - BRACKET
8 - RETAINING BRACKET
9 - COLLARED BOLT
10 - TRANSMISSION

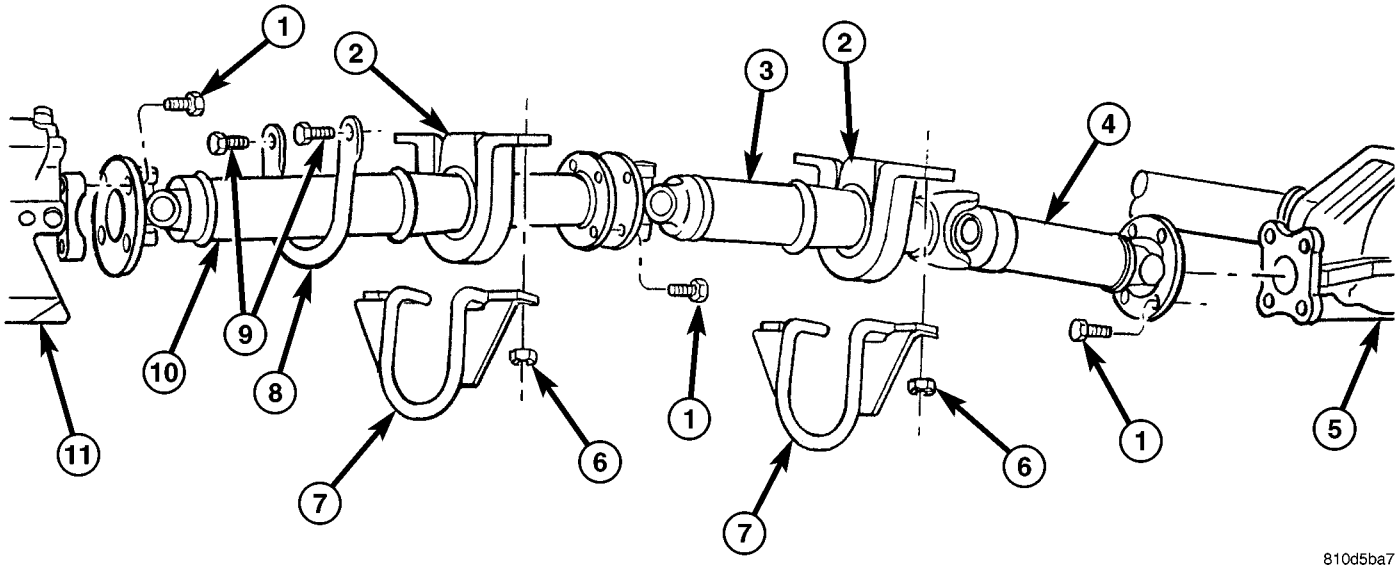


Fig. 9 3 PIECE PROPELLER SHAFT

1 - FLANGE BOLT
2 - INTERMEDIATE BEARING
3 - CENTER SHAFT
4 - REAR SHAFT
5 - REAR AXLE
6 - NUT
7 - BRACKET
8 - RETAINING BRACKET
9 - BOLT
10 - FRONT SHAFT
11 - TRANSMISSION

CENTER BEARING

REMOVAL

(1) Remove propeller shaft.
(2) Mark shafts for installation alignment (Fig. 10).

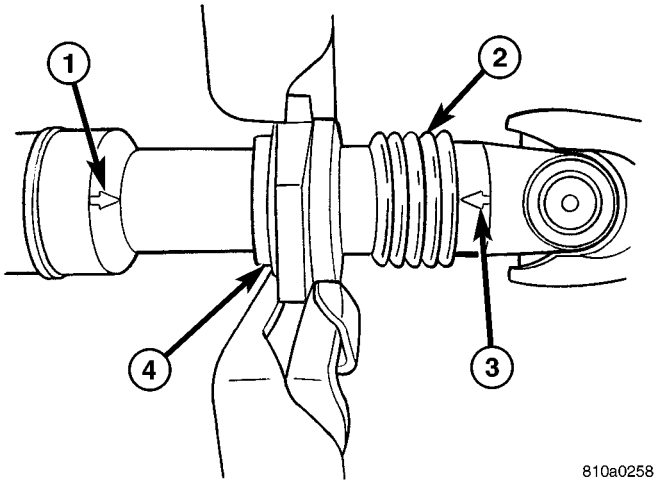


Fig. 10 ALIGNMENT MARKS

1 - ALIGNMENT MARK
2 - BOOT
3 - ALIGNMENT MARK
4 - CENTER BEARING

(3) Loosen both collar clamps (Fig. 11).

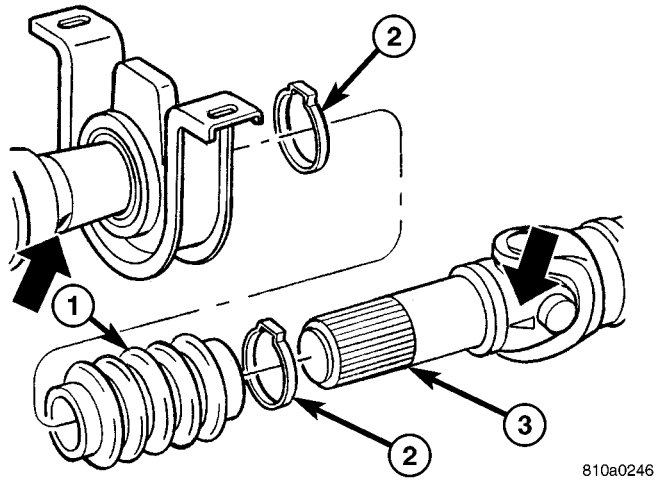


Fig. 11 BOOT

1 - BOOT
2 - CLAMP
3 - SHAFT

(4) Pull apart propeller shaft.
(5) Remove snap-ring (Fig. 12).
(6) Pull off center bearing with a Bearing Splitter 1130 and Bridge 938, with a plug on the end of the shaft (Fig. 13).

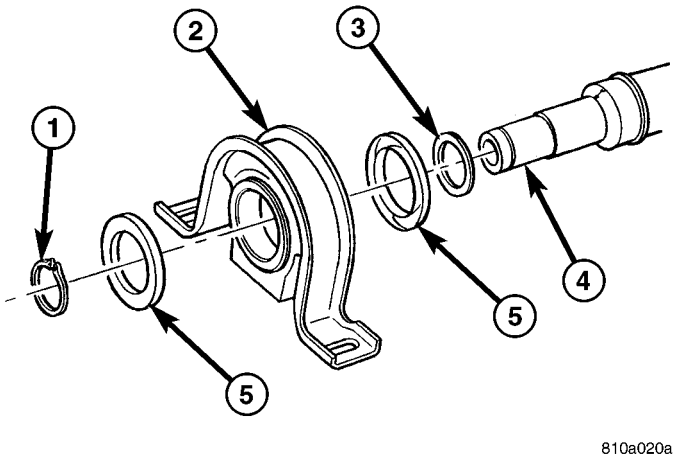


Fig. 12 CENTER BEARING

1 - SNAP-RING
2 - CENTER BEARING
3 - WASHER
4 - SHAFT
5 - PROTECTIVE CAP

NOTE: The bearing splitter must be positioned behind the thrust washer of the bearing.

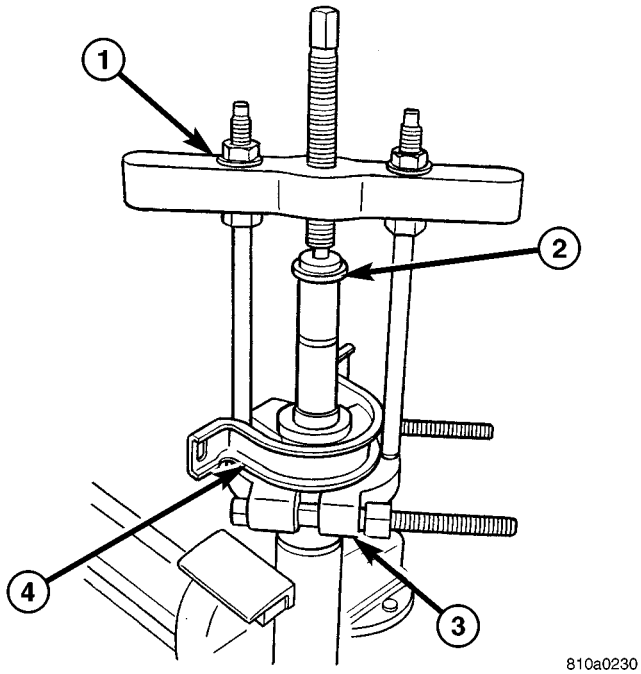


Fig. 13 CENTER BEARING REMOVAL

1 - BRIDGE
2 - PLUG
3 - BEARING SPLITTER
4 - CENTER BEARING

CENTER BEARING (Continued)

INSTALLATION

(1) Press center bearing on propeller shaft with protective caps and washer with Installer 9275 (Fig. 14).

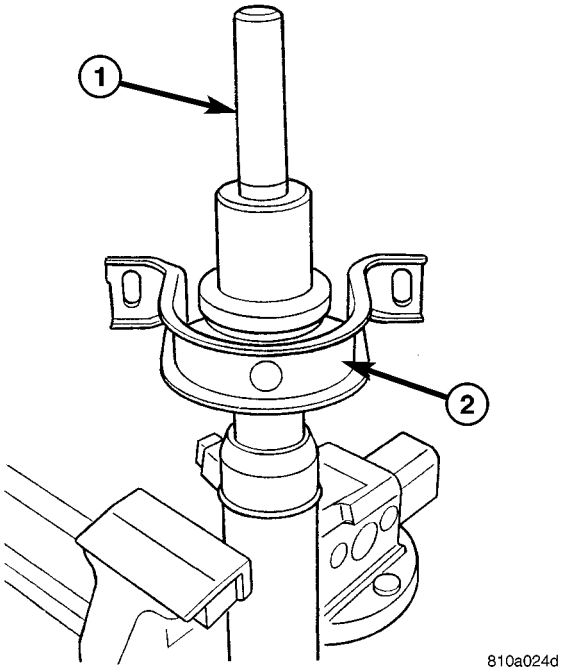


Fig. 14 CENTER BEARING INSTALLATION

1 - INSTALLER
2 - CENTER BEARING

(2) Install snap-ring.
(3) Coat propeller shaft spline with universal grease.
(4) Push rubber boot onto propeller shaft.
(5) Push together propeller shaft. Pay attention to alignment markings for installation position.
(6) Ensure rubber seal is correctly installed and attach **new** collar clamps.
(7) Install propeller shaft.

REAR AXLE

TABLE OF CONTENTS

	page
REAR AXLE	
DESCRIPTION	10
OPERATION	10
DIAGNOSIS AND TESTING	10
STANDARD PROCEDURE - DRAIN AND FILL	11
REMOVAL	11
INSTALLATION	12
SPECIFICATIONS	13
SPECIAL TOOLS	14
AXLE SHAFTS	
REMOVAL	15
INSTALLATION	15
AXLE BEARINGS/SEALS	
REMOVAL	17
INSTALLATION	17
AXLE SHAFTS - DUAL REAR WHEELS	
REMOVAL	19
INSTALLATION	19
AXLE HUB BEARINGS/SEALS	
REMOVAL	20
INSTALLATION	20
PINION SEAL	
REMOVAL	22
INSTALLATION	22

REAR AXLE

DESCRIPTION

The axle housings consist of a cast iron center section with axle tubes extending from either side. The tubes are pressed into and welded to the differential housing to form a one-piece axle housing. The SRW axle has semi-floating axle shafts, DRW has full-floating axle shafts.

NOTE: Axle seals, axle bearings, pinion seal and differential cover are the only serviceble components. If differential is damaged/noisy the axle must be replaced.

OPERATION

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

DIAGNOSIS AND TESTING

NOTE: Axle seals, axle bearings, pinion seals and differential cover are the only serviceble components. If differential is damaged/noisy the axle must be replaced.

GEAR NOISE

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

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

When road testing, first warm-up the axle fluid by driving the vehicle at least 5 miles and then 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 gears and pinions 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 shaft can also cause a snapping or a knocking noise.

BEARING NOISE

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

Pinion bearings have a constant-pitch noise. This noise changes only with vehicle speed. Pinion bearing noise will be higher pitched 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

REAR AXLE (Continued)

heard during a coast, the front pinion bearing is the source.

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 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 rearend vibration. Do not overlook engine accessories, brackets and drive belts.

NOTE: All driveline components should be examined before starting any repair.

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.
- Transmission shift operation.
- 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 to case clearance.

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

STANDARD PROCEDURE - DRAIN AND FILL

NOTE: Drain oil when warm.

(1) Clean area around oil fill plug and drain plug.
(2) Remove oil drain plug and drain oil (Fig. 1).
(3) Install oil drain plug and tighten to N·m 100 (74 ft. lbs.).
(4) Remove oil fill plug and fill housing up to bottom edge of oil fill hole (Fig. 1).
(5) Install oil fill plug and tighten to N·m 100 (74 ft. lbs.).

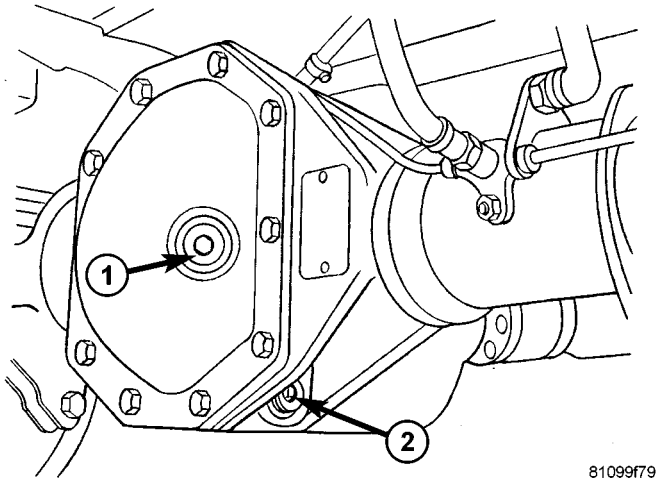


Fig. 1 FILL PLUG

1 - FILL PLUG
2 - DRAIN PLUG

REMOVAL

(1) Raise and support the vehicle.
(2) Position a suitable lifting device under the axle and secure axle to device.
(3) Remove wheels and tires.
(4) Unplug wear indicator cable (Fig. 2) and (Fig. 3).
(5) Detach cable connector for brake pad wear indicator.
(6) Remove ABS sensor and clamp bushing from mounting bore.

NOTE: The right-hand ABS sensor cable is labeled at the factory with a white tag.

(7) Remove cable ties from the park brake cables. Release connection cable of brake pad wear indicator and ABS sensor cable up to the relay unit of the parking brake.
(8) Remove brake cables from adjuster.
(9) Remove brake calipers with adapters and lines.

REAR AXLE (Continued)

(10) Remove stablizer bar from axle brackets.
(11) Remove shock absorber bolts from rear axle.
(12) Remove ALB lever from rear axle bracket.
(13) Pull off hold-down clips and remove brake hoses.
(14) Pull vent line of rear axle out of frame.
(15) Remove propeller shaft.
(16) Remove U-brackets and plates (Fig. 2) and (Fig. 3).
(17) Remove axle from the vehicle.

INSTALLATION

(1) Raise axle into position.
(2) Install plates and U-brackets with **new** nuts. Tighten nuts to 170 N·m (125 ft. lbs.).
(3) Install propeller shaft and tighten bolts to 70 N·m (52 ft. lbs.).

NOTE: On installation of the propeller shaft, joint arrows must be flush and must point towards the frame floor. Tighten the propeller shaft in this position.

(4) Install ALB lever to axle bracket and tighten **new** nut 34 N·m (46 ft. lbs.).
(5) Install shock absorbers to rear axle and tighten bolts to:
- M12 x 1.5 Bolt - 70 N·m (52 ft. lbs.)
- M14 x 1.5 Bolt - 110 N·m (81 ft. lbs.)

(6) Install stabilizer bar to axle and tighten bolts to:
- SRW Axle - 25 N·m (18 ft. lbs.)
- DRW Axle - 70 N·m (52 ft. lbs.)

(7) Install calipers with adapters and lines.
(8) Install brake hoses and hold-down clips.
(9) Install and adjust park brake cables.

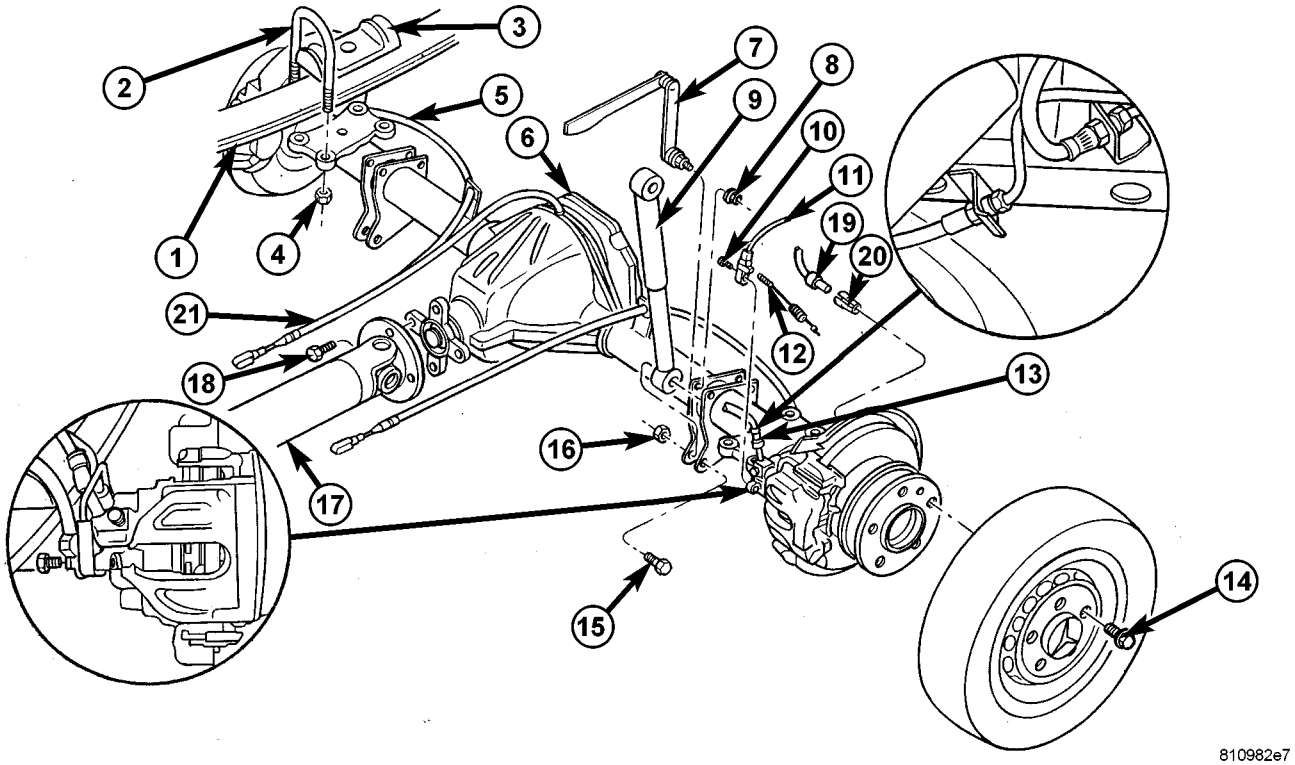


Fig. 2 SINGLE REAR WHEEL AXLE

1 - REAR SPRING
2 - U-BRACKET
3 - PLATE
4 - NUT
5 - BRAKE CABLE
6 - REAR AXLE
7 - ABL LEVER
8 - NUT
9 - SHOCK ABSORBER
10 - BOLT
11 - WEAR INDICATOR CABLE
12 - WEAR INDICATOR CONNECTOR
13 - BRAKE HOSE
14 - WHEEL BOLT
15 - BOLT
16 - NUT
17 - PROPELLER SHAFT
18 - BOLT
19 - ABS SENSOR
20 - SENSOR BUSHING
21 - VENT LINE

REAR AXLE (Continued)

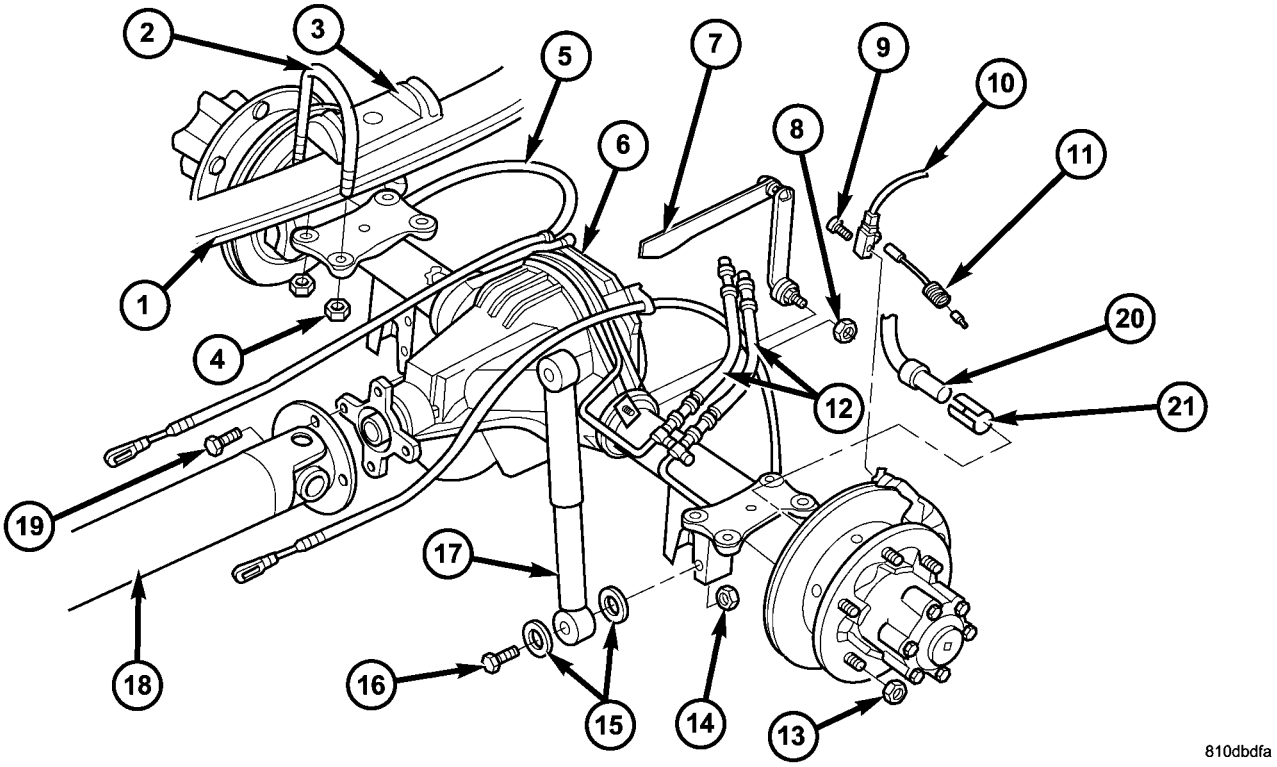


Fig. 3 DUAL REAR WHEEL AXLE

1 - SPRING
2 - SPRING SHACKLE
3 - PLATE
4 - COLLAR NUT
5 - BRAKE CABLE
6 - REAR AXLE
7 - ALB LEVER
8 - NUT
9 - BOLT
10 - WEAR INDICATOR CABLE
11 - WEAR INDICATOR CONNECTOR
12 - BRAKE HOSE
13 - LUG NUT
14 - NUT
15 - WASHER
16 - BOLT
17 - SHOCK ABSORBER
18 - PROPELLER SHAFT
19 - BOLT
20 - ABS SENSOR
21 - SENSOR BUSHING

(10) Install connection cable of brake pad wear indicator and ABS sensor cable up to the relay unit of the parking brake.

(11) Install cable ties to the park brake cables.

(12) Install ABS sensor and clamp bushing to mounting bore.

NOTE: The right-hand ABS sensor cable is labeled at the factory with a white tag.

(13) Attach connector cable for brake pad wear indicator.

(14) Plug in cable of brake pad wear indicator.

(15) Install the wheels and tires.

(16) Fill axle with appropriate lubricant.

(17) Remove lifting device from under the axle.

(18) Remove support and lower vehicle.

SPECIFICATIONS

AXLE SPECIFICATIONS

DESCRIPTION	SPECIFICATION
Axle Ratio	3.73, 4.11
Ring Gear Diameter	216 mm (8.5 in.)

REAR AXLE (Continued)

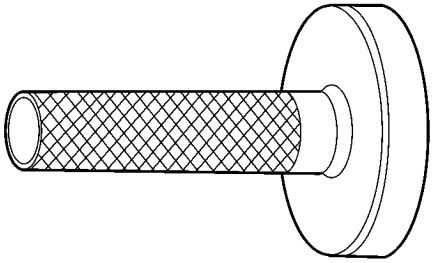
TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Drain Plug	100	74	-
Fill Plug	100	74	-
Differential Cover Bolts	65	48	-
Axle Bearing Cap Bolts	72	53	-
Axle Grooved Nut	500	369	-
Axle Shaft Hub Nut	65	48	-
*Hub Inner Nut	300	221	-
Hub Outer Nut	250	184	-
*Follow service procedure for torque sequence.			

SPECIAL TOOLS

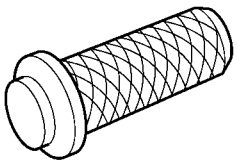
SPECIAL TOOL CROSS-REFERENCE CHART

MB TOOL #	MILLER TOOL #	DESCRIPTION
460-589-15-15-00	9276	INSTALLER
741 589 01 15 00	9278	INSTALLER
741 589 00 35 00	9277	PLATE
460 589 01 07 00	9279	WRENCH
N/A	8992	FLANGE PULLER
309 589 01 07 00	9290	WRENCH
389 589 02 15 00	9291	INSTALLER
N/A	C-3281	WRENCH



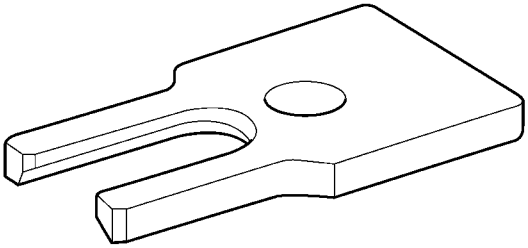
811187f1

INSTALLER 9276



810abab2

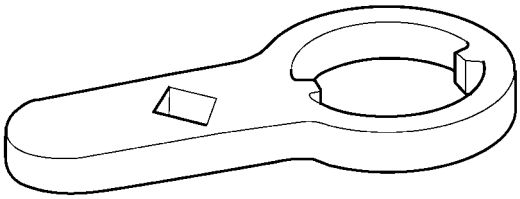
INSTALLER 9278



810abab6

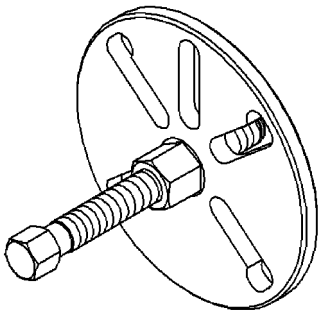
PLATE 9277

REAR AXLE (Continued)

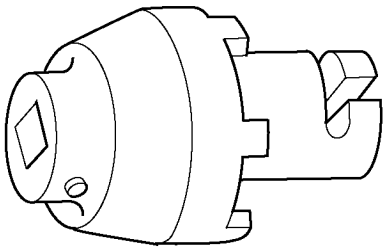


810abac2

WRENCH 9279

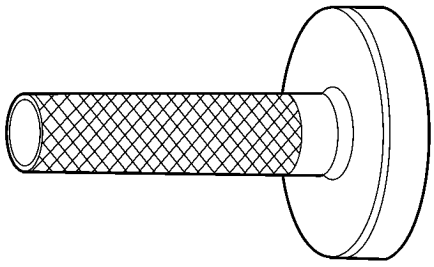


FLANGE PULLER 8992



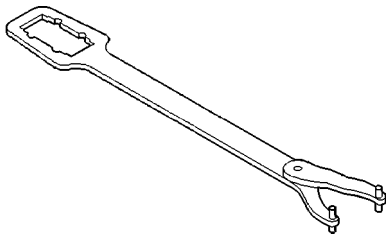
811187e2

WRENCH 9290



811187f1

INSTALLER 9291



WRENCH C-3281

AXLE SHAFTS

REMOVAL

(1) Remove wheels.
(2) Detach front brake cable.
(3) Pull ABS sensor together with clamp bushing out of bearing cap (Fig. 4).
(4) Remove brake disk at rear axle. Attach brake caliper with lines connected in wheel house.
(5) Remove brake shoes of parking brake.
(6) Remove brake control cable lock.
(7) Remove bearing cap bolts and pull axle shaft out of axle tube (Fig. 4).
(8) Remove seal/gasket.

INSTALLATION

(1) Install sealing ring.
(2) Install rear axle shaft in the axle tube (Fig. 5).
(3) Install **new** bearing cap bolts and tighten to 72 N·m (53 ft. lbs.) (Fig. 6).

NOTE: Tighten bolts diagonally across.

(4) Install brake control cable lock.
(5) Install parking brake shoes.
(6) Install brake disk and calipers.
(7) Coat clamping bush with acid-free grease. Insert ABS sensor with clamping bush fully into the mounting hole.
(8) Install front brake cable.
(9) Operate brake pedal several times until brake pads contact brake discs (brake pressure built up).
(10) Install wheels.

AXLE SHAFTS (Continued)

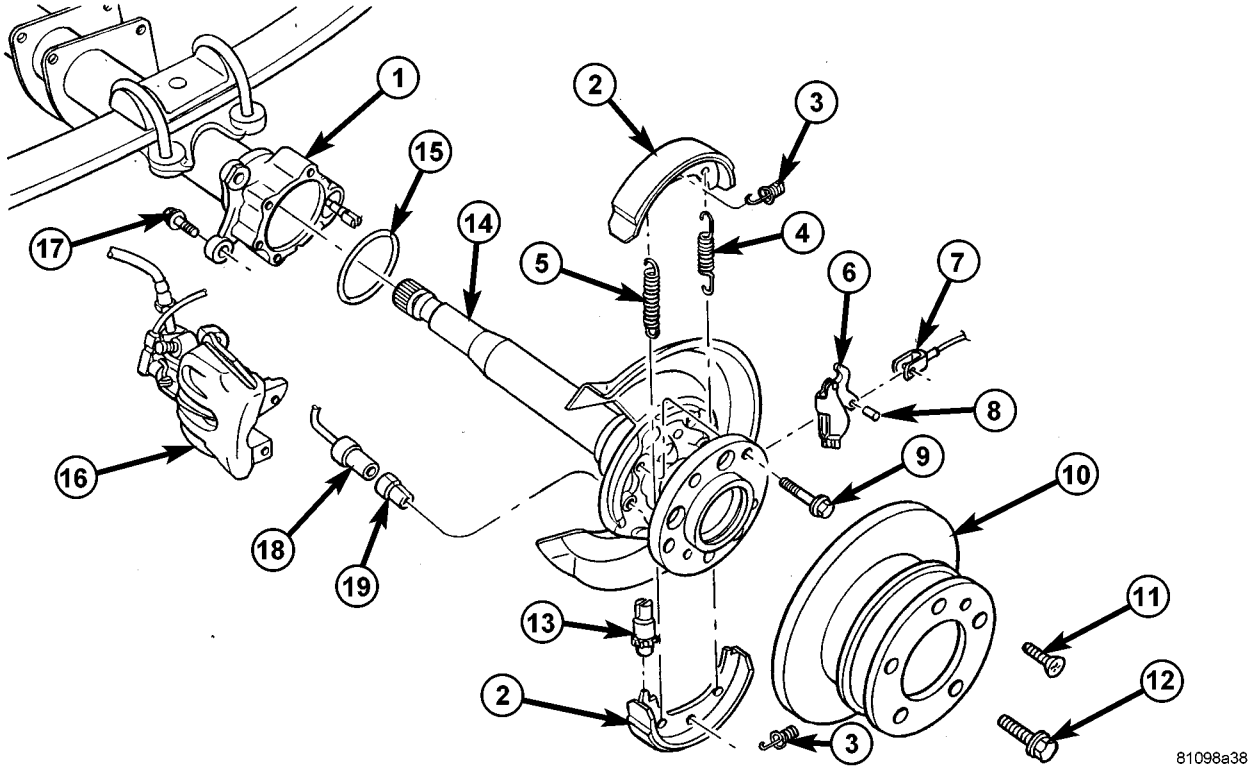


Fig. 4 AXLE SHAFT

1 - REAR AXLE
2 - BRAKE SHOE
3 - PRESSURE SPRING
4 - RETURN SPRING
5 - RETURN SPRING
6 - CABLE LOCK
7 - PARK BRAKE CABLE
8 - LOCKING PIN
9 - BOLT
10 - BRAKE DISC
11 - BOLT
12 - WHEEL BOLT
13 - BRAKE ADJUSTER
14 - REAR AXLE SHAFT
15 - GASKET
16 - BRAKE CABLE
17 - BOLT
18 - ABS SENSOR
19 - SENSOR BUSHING

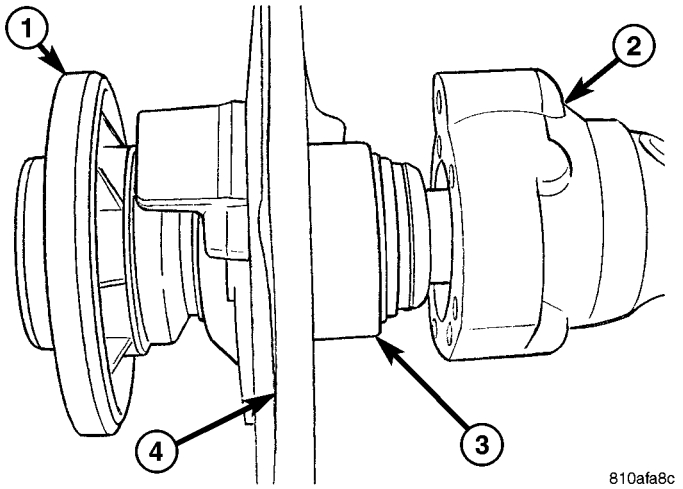


Fig. 5 AXLE SHAFT AND TUBE

1 - AXLE SHAFT FLANGE
2 - AXLE TUBE
3 - AXLE BEARINGS
4 - DUST SHIELD

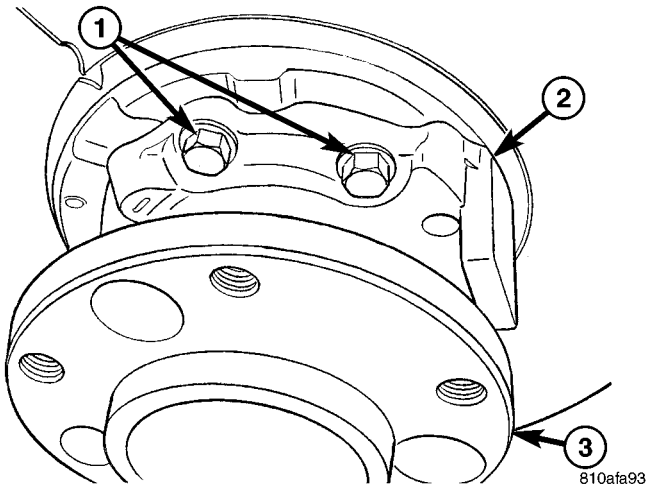


Fig. 6 BEARING CAP BOLTS

1 - BEARING CAP BOLTS
2 - BEARING CAP
3 - AXLE SHAFT FLANGE

AXLE BEARINGS/SEALS

REMOVAL

(1) Remove rear axle shaft.
(2) With a punch and hammer straighten locking ring (Fig. 7).

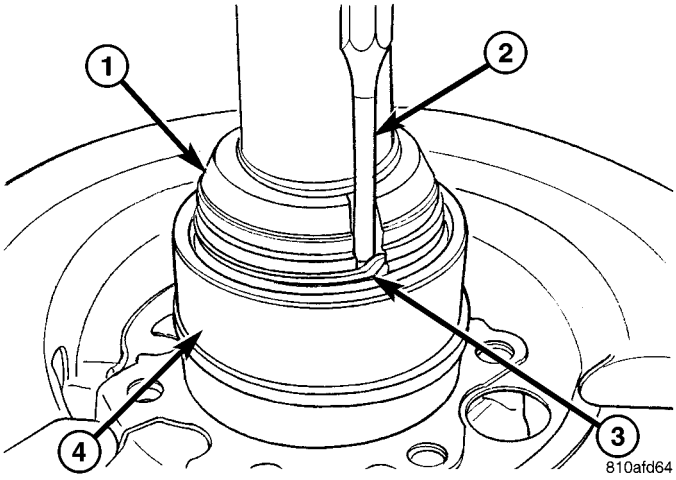


Fig. 7 LOCKING RING

1 - BEARING NUT
2 - PUNCH
3 - LOCKING RING
4 - BEARING

(3) Loosen bearing nut with Wrench 9279 (Fig. 8).

NOTE: Bearing nut with groove on left rear axle shaft has a left-hand thread. Bearing nut without groove on right rear axle shaft has a right-hand thread. To dismantling insert two wheel mounting bolts into the axle shaft and clamp in a vise.

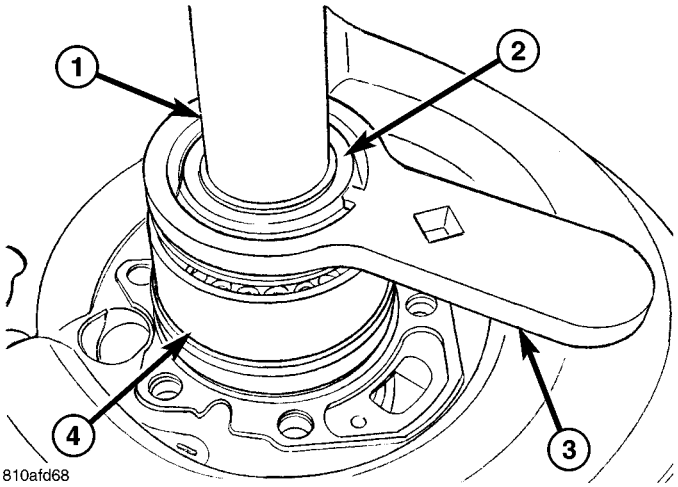


Fig. 8 BEARING NUT WRENCH

1 - AXLE SHAFT
2 - BEARING NUT
3 - WRENCH
4 - BEARING

(4) Remove bearing nut and locking ring from axle shaft (Fig. 9).

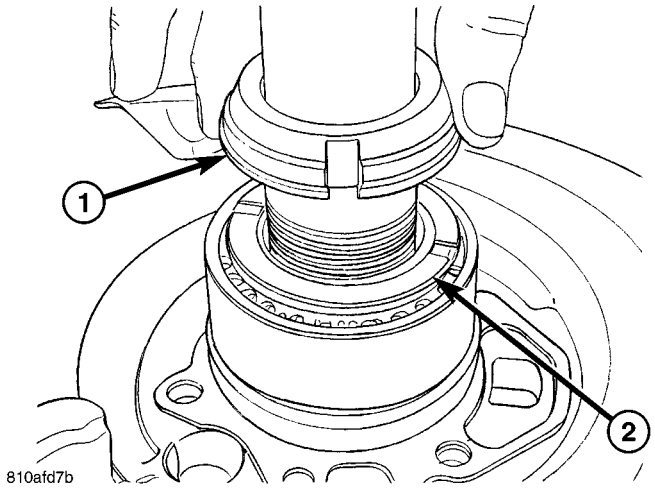


Fig. 9 BEARING NUT AND LOCKING RING

1 - BEARING NUT
2 - LOCKING RING

(5) Push Plate 9277 between bearing cover and rear axle shaft (Fig. 10).

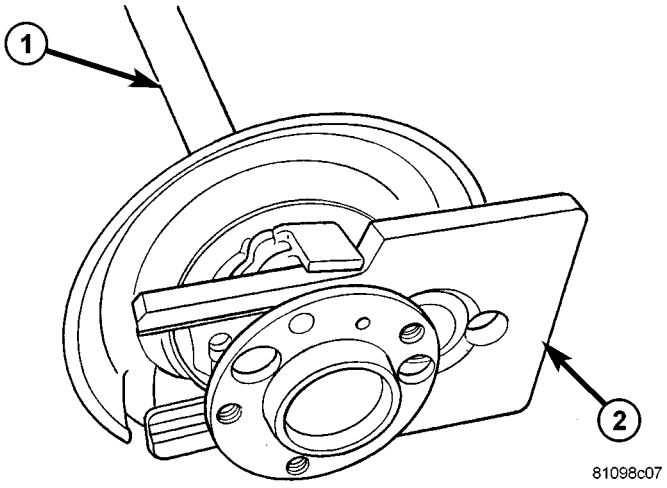


Fig. 10 AXLE BEARING REMOVAL TOOL

1 - AXLE SHAFT
2 - PLATE

(6) Place axle shaft with plate in a press.
(7) Press axle shaft through the bearing cover and tapered roller bearings (Fig. 11).
(8) Remove tapered roller bearing, sealing ring, dust shield and bearing cap from axle shaft (Fig. 12).
(9) Drive shaft seal out of bearing cover with a hammer and drift.

INSTALLATION

(1) Clean sealing surface of bearing cap.
(2) Drive axle shaft seal into bearing cover using Installer 9278 (Fig. 13).

AXLE BEARINGS/SEALS (Continued)

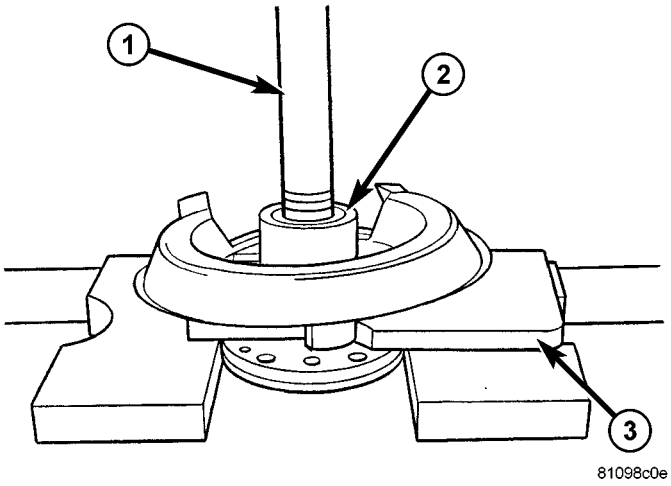


Fig. 11 PRESSING BEARING

1 - AXLE SHAFT
2 - BEARING
3 - PLATE

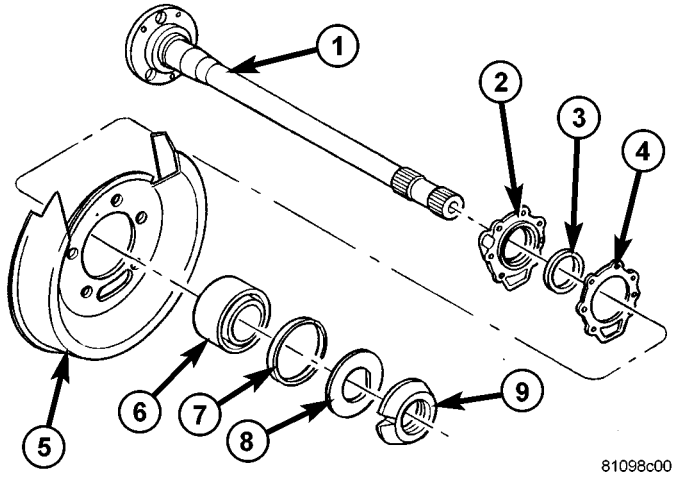


Fig. 12 AXLE SHAFT ASSEMBLY

1 - AXLE SHAFT
2 - BEARING COVER
3 - RADIAL SHAFT SEAL
4 - GASKET
5 - DUST SHIELD
6 - BEARING
7 - SEALING RING
8 - LOCKING RING
9 - BEARING NUT

NOTE: Install flush to a max. 3 mm (0.12 in.) deep inside the bearing cover.

(3) Check roller bearing, replace according to condition.

NOTE: Thoroughly grease roller bearings prior to installation.

(4) Install bearing cover with axle shaft seal, **new** gasket and dust shield on the axle shaft.
(5) Install tapered roller bearings and race on the axle shaft (Fig. 14).
(6) Install **new** locking ring on axle shaft.

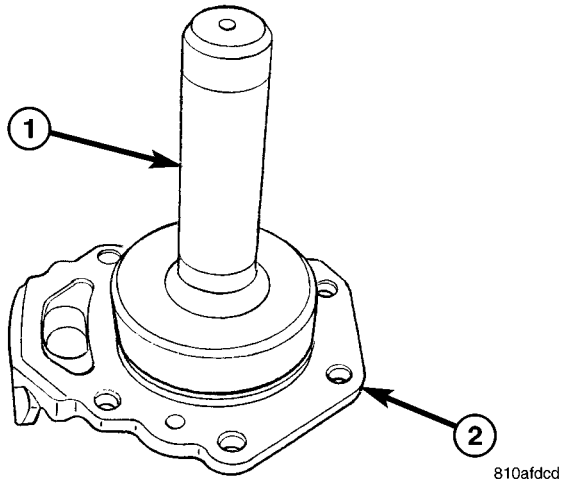


Fig. 13 SEAL INSTALLER

1 - INSTALLER
2 - BEARING COVER

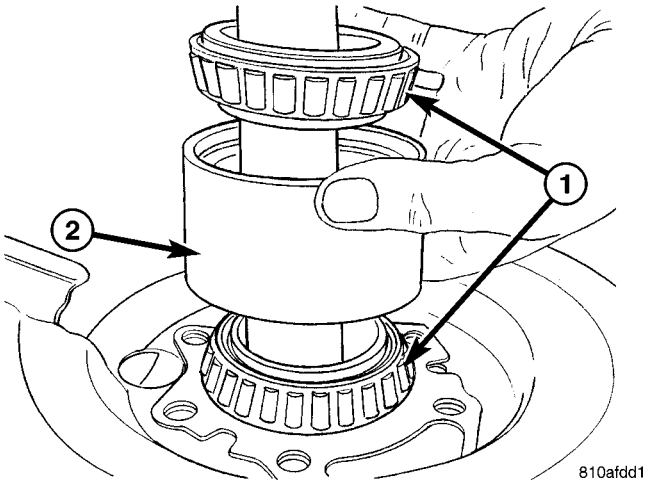


Fig. 14 BEARINGS AND RACE

1 - BEARINGS
2 - RACE

NOTE: The flat side of the locking ring must point towards the nut (Fig. 15). The locking ring is fitted to ensure that the pressing is done over the inner bearing race only. The flat on the locking ring must be aligned with the flat on the axle shaft otherwise the axle shaft will be damaged.

(7) Place axle shaft through the hole in Plate 9277 and position the assembly in a press (Fig. 16).
(8) Press tapered roller bearing onto rear axle shaft as far as the stop.

CAUTION: In order to avoid damaging the bearing, the outer race must be turned while pressing on.

(9) Screw on bearing nut and tighten nut with Wrench 9279 to 500 N·m (369 ft. lbs.).

AXLE BEARINGS/SEALS (Continued)

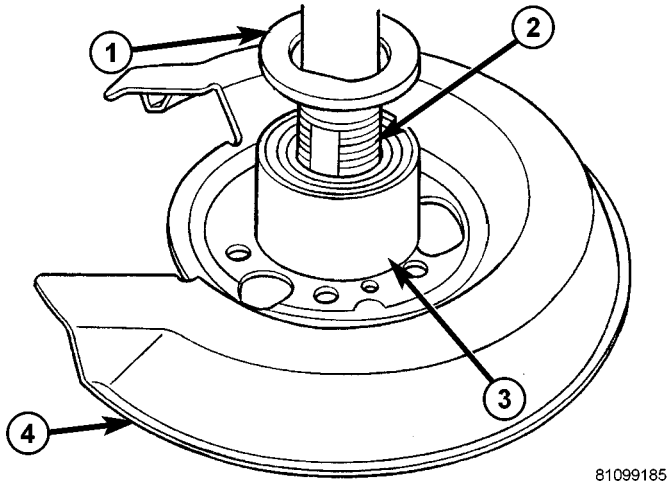


Fig. 15 BEARING AND SHAFT

1 - LOCKING RING
2 - AXLE SHAFT
3 - BEARING
4 - DUST SHIELD

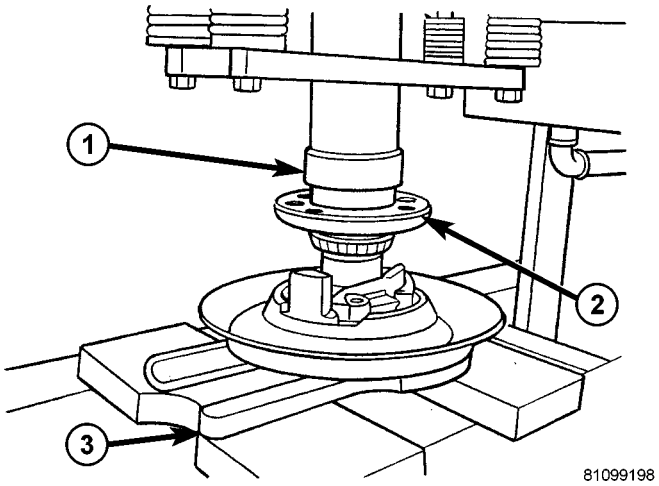


Fig. 16 PRESSING AXLE SHAFT

1 - PRESS
2 - AXLE SHAFT
3 - PLATE

NOTE: Bearing nut with groove on left rear axle shaft has a left-hand thread. Bearing nut without groove on right rear axle shaft has a right-hand thread.

(10) Bend locking ring with a hammer and punch at both grooves in the bearing nut (Fig. 17).

NOTE: The grooved nut must be locked in both directions of rotation.

(11) Install sealing ring onto roller bearing race (Fig. 17).
(12) Install rear axle shaft.

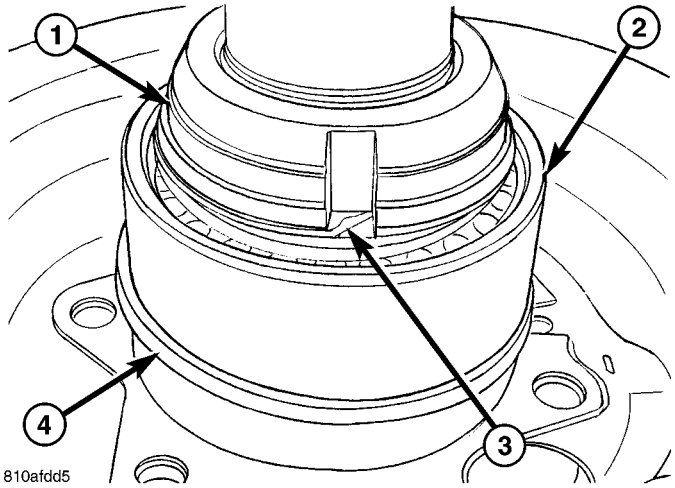


Fig. 17 LOCKING RING

1 - BEARING NUT
2 - BEARING
3 - LOCKING RING
4 - SEALING RING

AXLE SHAFTS - DUAL REAR WHEELS

REMOVAL

(1) Remove wheels
(2) Remove axle shaft hub nuts (Fig. 18).
(3) Pull out axle shaft.

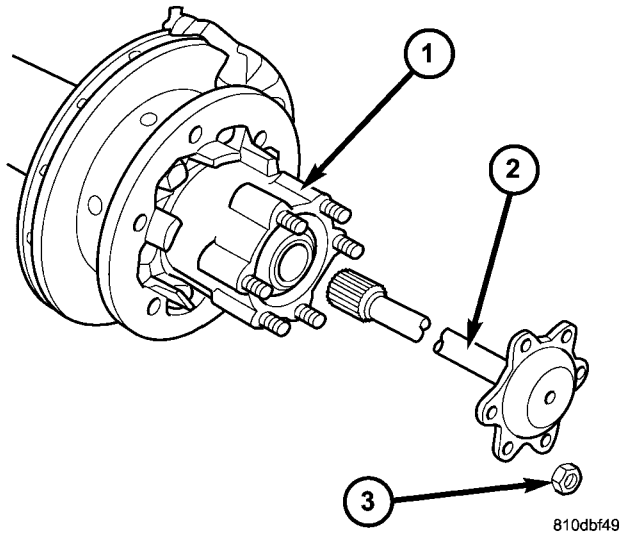


Fig. 18 AXLE SHAFT

1 - WHEEL HUB
2 - AXLE SHAFT
3 - AXLE NUT

INSTALLATION

(1) Coat axle shaft flange with Hylomar SQ 32 M sealant.

AXLE SHAFTS - DUAL REAR WHEELS (Continued)

(2) Slide axle shaft into axle tube.
(3) Install axle shaft hub nuts and tighten to N·m 65 (48 ft. lbs.).
(4) Install wheels.

AXLE HUB BEARINGS/SEALS

REMOVAL

(1) Remove brake caliper with support.
(2) Remove axle shaft.
(3) Back-off parking brakes.
(4) Remove outer hub nut with Wrench 9290 (Fig. 19).
(5) Remove locking plate, inner hub nut and thrust washer (Fig. 19).

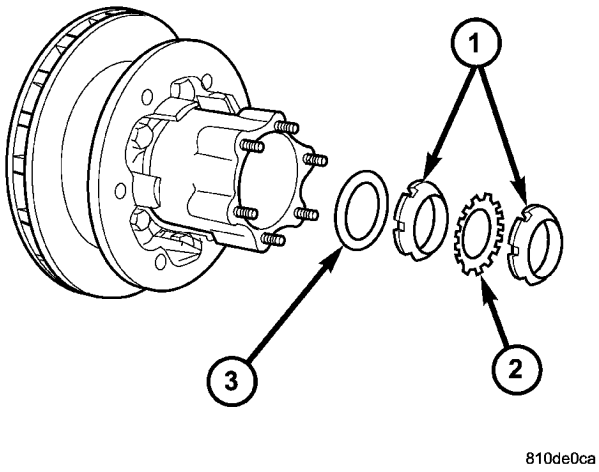


Fig. 19 HUB NUTS

1 - NUTS
2 - LOCKING PLATE
3 - THRUST WASHER

(6) Pull hub off axle tube.
(7) Pry out ABS sensor and remove seal from hub (Fig. 20).
(8) Remove hub bearings from hub (Fig. 21).
(9) Remove inner and outer bearing cups from hub with a hammer and drift.

INSTALLATION

(1) Install hub bearing cups with Installer 9291 and a hammer.
(2) Clean and thoroughly grease bearings with Multi-purpose grease.
(3) Install inner wheel bearing.
(4) Coat outer circumference of **new** seal with Hylomar SQ 32 M sealant.

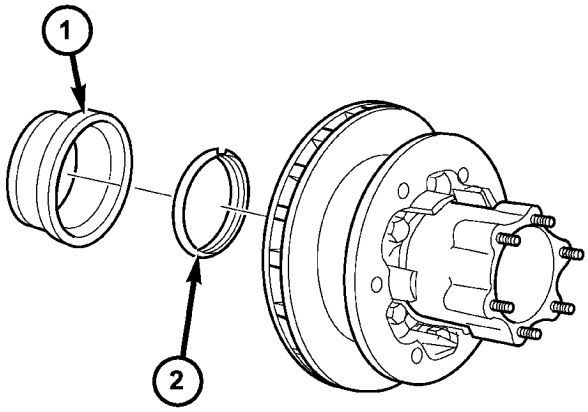


Fig. 20 SENSOR RING & OIL SEAL

1 - ABS SENSOR RING
2 - SEAL

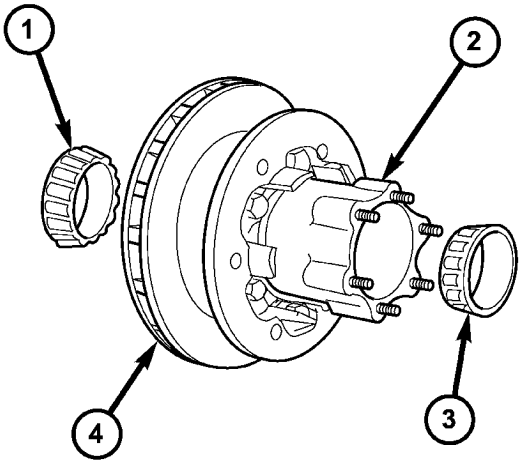


Fig. 21 AXLE HUB BEARINGS

1 - REAR BEARING
2 - HUB
3 - FRONT BEARING
4 - ROTOR

CAUTION: Do not coat seals rubberized sealing surfaces with sealant.

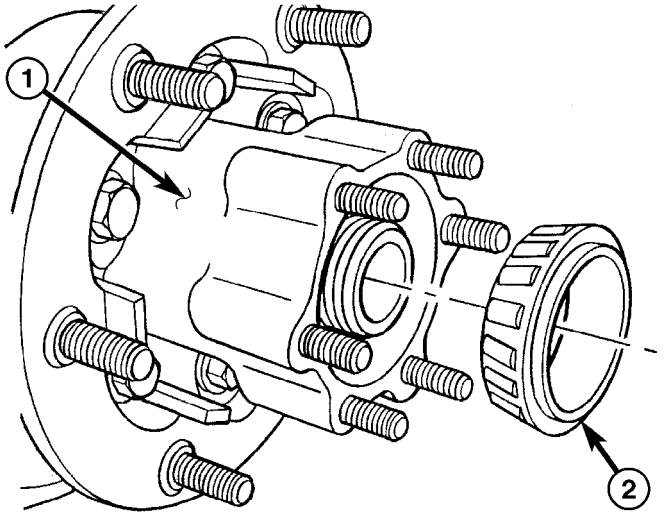
(5) Install seal into hub with an appropriate installer.

NOTE: Sealing ring should be flush with wheel hub or max. 3mm (0.12 in.) deep.

(6) Coat contact surface of ABS sensor ring with Hylomar SQ 32 M sealant.

AXLE HUB BEARINGS/SEALS (Continued)

(7) Drive ABS sensor ring ring in as far as the stop with a plastic hammer.
(8) Install hub on axle tube.
(9) Install outer hub bearing (Fig. 22).

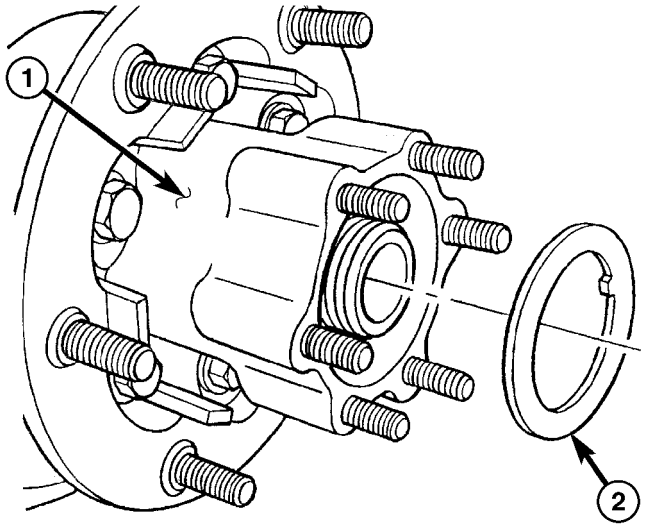


810de564

Fig. 22 OUTER HUB BEARING

1 - HUB
2 - BEARING

(10) Install thrust washer (Fig. 23).

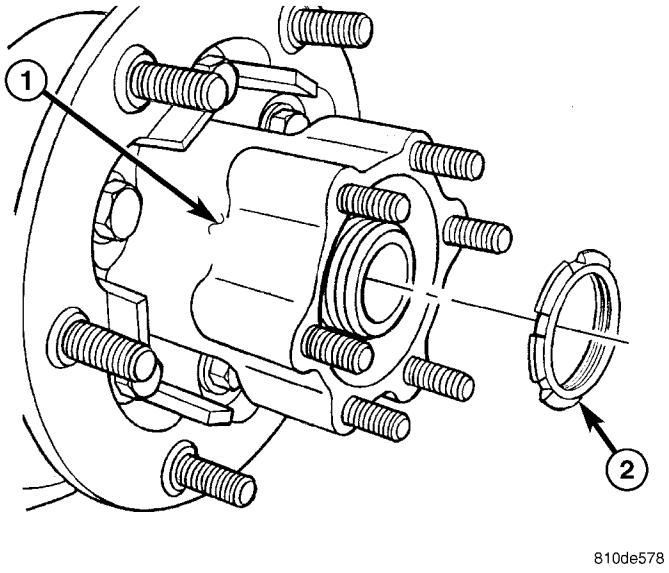


810de56b

Fig. 23 THRUST WASHER

1 - HUB
2 - WASHER

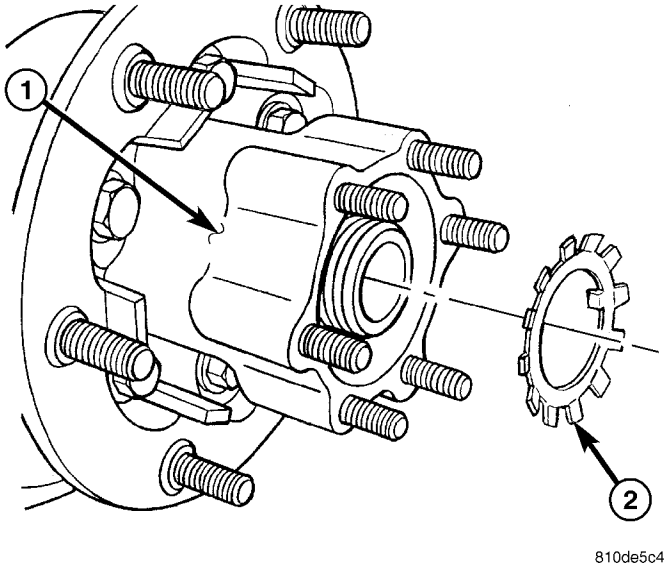
(11) Install inner hub nut (Fig. 24).
(12) Tighten inner hub nut with Wrench 9290 to 300 N·m (221 ft. lbs.) while spinning the wheel hub constantly. Turn back inner nut and then tighten until it touches the thrust washer without play. Then tighten 1/8 turn.
(13) Install locking plate (Fig. 25).



810de578

Fig. 24 INNER HUB NUT

1 - HUB
2 - NUT



810de5c4

Fig. 25 LOCKING PLATE

1 - HUB
2 - PLATE

(14) Install outer hub nut and tighten with Wrench 9290 to 250 N·m (184 ft. lbs.).
(15) Install axle shaft.
(16) Install brake caliper and support.
(17) Adjust parking brakes.

PINION SEAL

REMOVAL

(1) Remove wheels.
(2) Push back brake pads and release hand brake.

NOTE: If it is not possible to spin rear axle shafts manually, detach rear brake cables.

(3) Drain rear axle oil.
(4) Remove propeller shaft.
(5) Spin pinion flange by hand and check axial play of bearing.

CAUTION: There must not be any thrust bearing play. If play excess or there are particles (shavings) in the drained oil, replace gear assembly.

(6) Mark installation position of collared nut (Fig. 26) with respect to drive pinion.

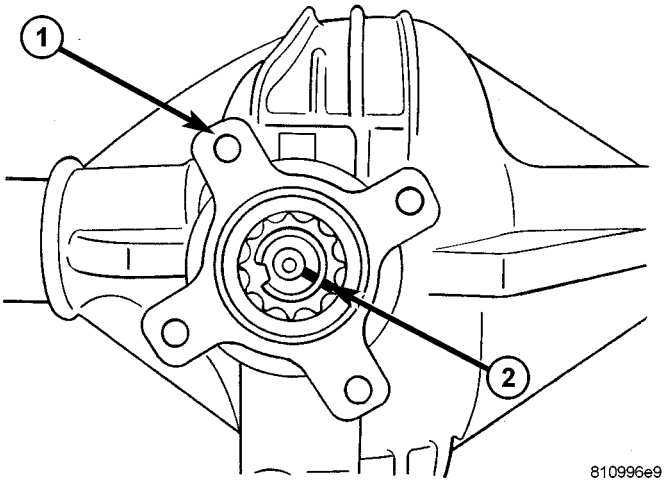


Fig. 26 COLLARED NUT

1 - PINION FLANGE
2 - COLLARED NUT

(7) Unlock collared nut.
(8) Hold pinion flange with Flange Wrench C-3281 and remove nut.
(9) Remove pinion flange from pinion shaft with Flange Puller 8992 (Fig. 27).
(10) Check sealing surfaces of joint flange for score marks and replace joint flange if necessary.
(11) Remove both pinion radial seals (Fig. 28).

INSTALLATION

(1) Pack space between dust lip and sealing lip on radial seal ring with multi-purpose grease.
(2) On radial seal rings without rubberized external surface, coat outer circumference with sealant.

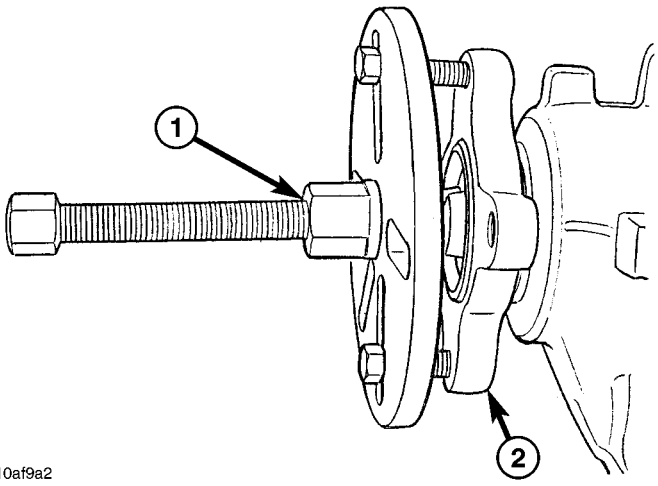


Fig. 27 FLANGE PULLER

1 - FLANGE PULLER
2 - PINION FLANGE

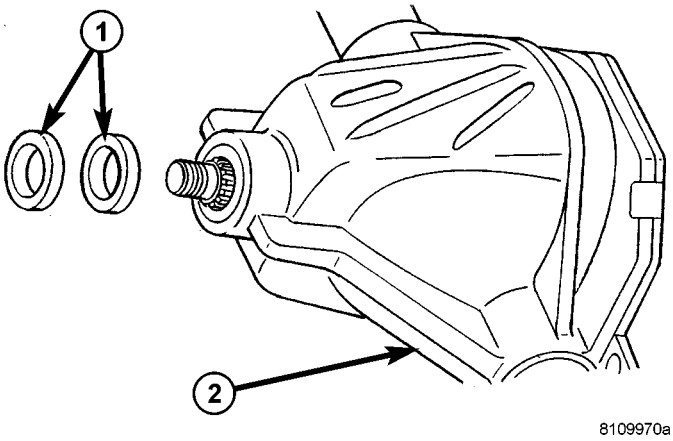


Fig. 28 PINION SEALS

1 - SEALS
2 - AXLE

CAUTION: Do not coat partially rubberized seals with sealant.

(3) Drive **new** pinion radial seals into rear axle housing as far as the stop using Installer 9276 (Fig. 29).
(4) Fit coupling flange on drive pinion shaft.

NOTE: The groove in the drive pinion and the groove in the joint flange must be in alignment.

(5) Hold pinion flange with Flange Wrench C-3281.
(6) Screw on the collared nut illustrated up to the marking applied beforehand.
(7) Detach retainer wrench from joint flange.
(8) With a torque wrench, measure torque to rotate pinion and record measurement.

PINION SEAL (Continued)

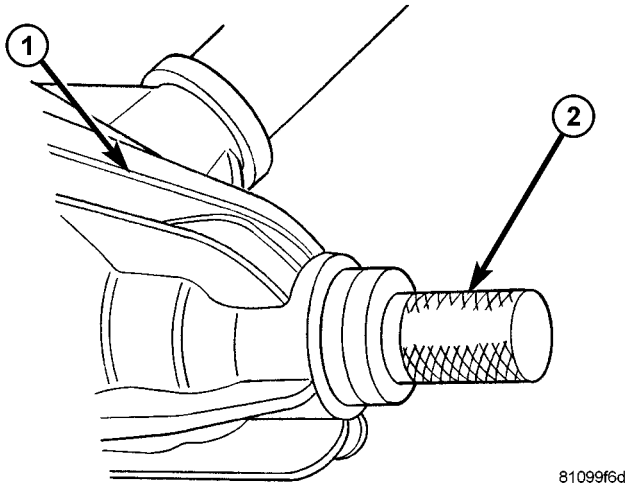


Fig. 29 PINION SEAL INSTALLER

1 - AXLE
2 - INSTALLER

(9) Unscrew the marked nut.

(10) Reattach retainer wrench to joint flange.

(11) Screw on **new** collared nut and tighten carefully in stages until the previously value of torque to rotate is exceeded by 0.5 N·m. (4.4 in. lbs.).

CAUTION: The total friction moment must not be obtained by slackening the collared nut. Avoid overtightening the collared nut otherwise the compression ring inside will be compressed and will have to be replaced. This requires total disassembly of the gear set.

(12) Cut the collar of the tightened collared nut (Fig. 30).

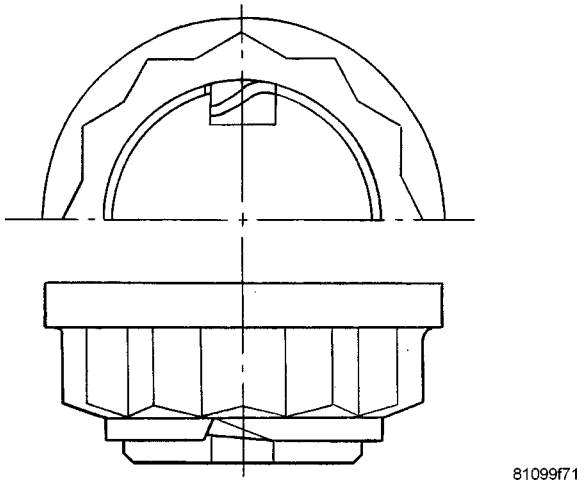


Fig. 30 COLLARED NUT

(13) Bend collar so it touches the wall of the slot in the pinion shaft (Fig. 31).

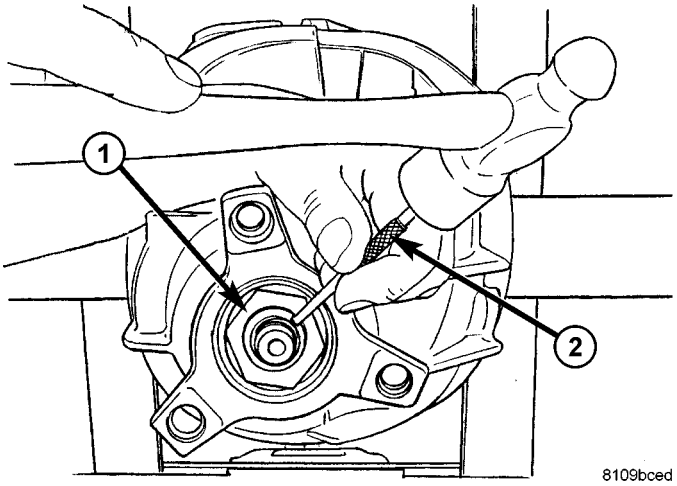


Fig. 31 BEND COLLAR OF NUT

1 - COLLARED NUT
2 - DRIFT

(14) Connect propeller shaft to pinion flange.

(15) Pour in oil up to bottom edge of oil filler hole (Fig. 32).

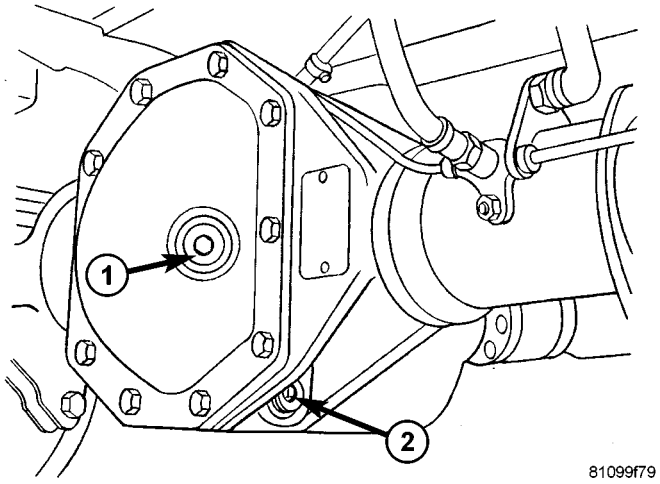


Fig. 32 FILL PLUG

1 - FILL PLUG
2 - DRAIN PLUG

(16) Screw in oil filler plug and tighten to 100 N·m (74 ft. lbs.).

(17) Install wheels at rear axle.

(18) Operate brake pedal several times until brake pads contact brake discs (brake pressure built up).

(19) Attach rear brake cables if removed and adjust parking brake.

BRAKES

TABLE OF CONTENTS

page

BRAKES - BASE 1

page

BRAKES - ABS 29

BRAKES - BASE

TABLE OF CONTENTS

page

BRAKES - BASE
DIAGNOSIS AND TESTING - BASE BRAKE SYSTEM 2
STANDARD PROCEDURE
STANDARD PROCEDURE - MANUAL BLEEDING 4
STANDARD PROCEDURE - PRESSURE BLEEDING 5
HYDRAULIC/MECHANICAL
SPECIFICATIONS
SPECIFICATIONS - TORQUE CHART 5
BASE BRAKE 6
SPECIAL TOOLS
BRAKES 7
BRAKE LINES
STANDARD PROCEDURE
STANDARD PROCEDURE - ISO FLARING . . . 8
STANDARD PROCEDURE - DOUBLE INVERTED FLARING 8
BRAKE PADS/SHOES
REMOVAL
REMOVAL - FRONT (SRW) 9
REMOVAL - FRONT (DRW) 9
REMOVAL - REAR (16” WHEELS) (SRW) 9
REMOVAL - REAR (15” WHEELS) (SRW) 9
REMOVAL - REAR (DRW) 10
INSTALLATION
INSTALLATION - FRONT (SRW) 10
INSTALLATION - FRONT (DRW) 11
INSTALLATION - REAR (16” WHEELS) (SRW) 11
INSTALLATION - REAR (16” WHEELS) (SRW) 11
INSTALLATION - REAR (DRW) 11
DISC BRAKE CALIPERS
REMOVAL
REMOVAL - FRONT (SRW) 11

page

REMOVAL - FRONT (DRW) 12
REMOVAL - REAR (SRW) 12
REMOVAL - REAR (DRW) 12
INSTALLATION
INSTALLATION - FRONT (SRW) 12
INSTALLATION - FRONT (DRW) 13
INSTALLATION - REAR (SRW) 13
INSTALLATION - REAR (DRW) 13
DISC BRAKE CALIPER ADAPTER
REMOVAL
REMOVAL - FRONT 13
REMOVAL - REAR 13
INSTALLATION
INSTALLATION - FRONT 14
INSTALLATION - REAR 14
FLUID
DIAGNOSIS AND TESTING - BRAKE FLUID CONTAMINATION 14
STANDARD PROCEDURE - BRAKE FLUID LEVEL 14
SPECIFICATIONS
BRAKE FLUID 14
FLUID RESERVOIR
REMOVAL 15
INSTALLATION 15
ALB LEVER
REMOVAL 15
INSTALLATION 15
ALB CONTROLLER
REMOVAL 15
INSTALLATION 15
ADJUSTMENTS
ADJUSTMENT 16
MASTER CYLINDER
DIAGNOSIS AND TESTING - MASTER CYLINDER/POWER BOOSTER 16

STANDARD PROCEDURE - MASTER CYLINDER BLEEDING 17
REMOVAL 17
INSTALLATION 18
PEDAL
REMOVAL 18
INSTALLATION 19
POWER BRAKE BOOSTER
DESCRIPTION 19
OPERATION 19
REMOVAL 19
INSTALLATION 19
ROTORS
REMOVAL
REMOVAL - FRONT (SRW) 19
REMOVAL - REAR (SRW) 20
REMOVAL - FRONT (DRW) 20
REMOVAL - REAR (DRW) 20
INSTALLATION
INSTALLATION - FRONT (SRW) 21
INSTALLATION - REAR (SRW) 21
INSTALLATION - FRONT (DRW) 21
INSTALLATION - REAR (DRW) 21
SUPPORT PLATE
REMOVAL - REAR 22
INSTALLATION - REAR 22
PARKING BRAKE
SPECIFICATIONS
TORQUE CHART 22
SPECIAL TOOLS
PARK BRAKE 23
CABLE TENSIONER
REMOVAL 23
INSTALLATION 23
CABLES
REMOVAL
REMOVAL - FRONT 24
REMOVAL - REAR 24
INSTALLATION
INSTALLATION - FRONT 24
INSTALLATION - REAR 25
ADJUSTMENTS
ADJUSTMENT - PARKING BRAKE CABLES . 25
LEVER
REMOVAL 26
INSTALLATION 26
SHOES
REMOVAL
REMOVAL - (SRW) 26
REMOVAL - (DRW) 26
CLEANING - REAR DRUM IN HAT BRAKE 27
INSTALLATION
INSTALLATION - (SRW) 27
INSTALLATION - (DRW) 27
ADJUSTMENTS
ADJUSTMENT 27

BRAKES - BASE

DIAGNOSIS AND TESTING - BASE BRAKE SYSTEM

Base brake components consist of the brake pads, calipers, brake drum in hat rotor in the rear, rotors, brake lines, master cylinder, booster, and parking brake components.

Brake diagnosis involves determining if the problem is related to a mechanical, hydraulic, 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, wheel cylinders, brake lines, and master cylinder.

(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 and cups 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 pedal. 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.

BRAKES - BASE (Continued)

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.

(4) Attempt to stop the vehicle with the parking brake only 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/wheel cylinder. 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 or RWAL system may also be the problem with no physical evidence.

LOW PEDAL

If a low pedal is experienced, pump the pedal several times. If the pedal comes back up worn linings, rotors, drums, or rear brakes out of adjustment are the most likely causes. 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, thin brake drums or substandard brake lines and hoses can also cause a spongy pedal. The proper course of action is to bleed the system, and replace thin drums and 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 or check valve could also be faulty.

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, or out of round brake drums. 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 shoe release. Drag can be minor or severe enough to overheat the linings, rotors and drums.

Minor drag will usually cause slight surface charring of the lining. It can also generate hard spots in rotors and drums from the overheat-cool down process. In most cases, the rotors, drums, 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 and drums to the point of replacement. The wheels, tires and brake components will be extremely hot. In severe cases, the lining may generate smoke as it chars from overheating.

Common causes of brake drag are:

- Seized or improperly adjusted parking brake cables.
- Loose/worn wheel bearing.
- Seized caliper or wheel cylinder piston.
- Caliper binding on corroded bushings or rusted slide surfaces.
- Loose caliper mounting.
- Drum brake shoes binding on worn/damaged support plates.
- Mis-assembled components.
- Long booster output rod.

If brake drag occurs at all wheels, the problem may be related to a blocked master cylinder return port, or faulty power booster (binds-does not release).

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 pads
- Damaged rotor

A worn, damaged wheel bearing or suspension component are further causes of pull. A damaged front tire (bruised, ply separation) can also cause 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 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 GRAB OR PULL

Rear grab or pull is usually caused by improperly adjusted or seized parking brake cables, contaminated lining, bent or binding shoes and support plates, 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 proportioning valve 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.

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. A tire with internal damage such as a severe bruise, cut, or ply separation can cause pull and vibration.

BRAKE NOISES

Some brake noise is common with rear drum brakes and 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 pads in spots, metal-to-metal contact occurs. If the condition is allowed to continue, rotors can become so scored that replacement is necessary.

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. However, calipers that bind on the slide surfaces can generate a thump or clunk noise.

STANDARD PROCEDURE

STANDARD PROCEDURE - MANUAL BLEEDING

Use Mopar brake fluid, or an equivalent quality fluid meeting SAE and DOT 4 standards only. Use fresh, clean fluid from a sealed container at all times.

(1) Remove reservoir filler caps and fill reservoir.

(2) If calipers, or wheel cylinders were overhauled, open all caliper and wheel cylinder 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. 1). Be sure end of bleed hose is immersed in fluid.

BRAKES - BASE (Continued)

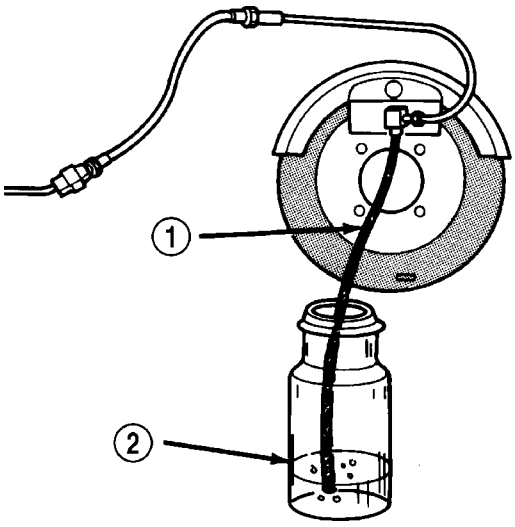


Fig. 1 Bleed Hose Setup

1 - BLEED HOSE
2 - FLUID CONTAINER PARTIALLY FILLED WITH 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.

STANDARD PROCEDURE - PRESSURE BLEEDING

Use Mopar brake fluid, or an equivalent quality fluid meeting SAE and DOT 4 standards only. Use fresh, clean fluid from a sealed container at all times.

Follow the manufacturers instructions carefully when using pressure equipment. Do not exceed the tank manufacturers pressure recommendations. Generally, a tank pressure of 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.

HYDRAULIC/MECHANICAL

SPECIFICATIONS

SPECIFICATIONS - TORQUE CHART

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Brake Lines	14	—	124
Master Cylinder To Brake Booster Nut	28	—	248
Brake Caliper Adapter Rear M12 X 1.5 Bolt	90	66	—
Brake Caliper Adapter Rear M14 X 1.5 Bolt	170	125	—
Brake Caliper Adapter Front	170	125	—
Disc Brake Rotor Locking Bolt Front or Rear	23	—	204
Wear Indicator To Caliper Bolt Front or Rear	10	—	89

HYDRAULIC/MECHANICAL (Continued)

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Pedal Bracket to Firewall	23	—	204
Booster To Pedal Bracket	25	—	221
Brake Caliper Guide Pins M8 Bolt	25	—	221
Brake Caliper Guide Pins M10 Bolt	30	—	266
ALB Operating Linkage Lever To The Rear Axle	34	25	300
Wheel Flange Ring To Rotor Rear	200	148	—
Wheel Flange Ring To Rotor Front	180	133	—

BASE BRAKE

NOTE: Do not resurface the disc brake rotors if they are out of specifications. (Sprinter Van Rotors must be replaced with new disc brake rotors only).

SPECIFICATIONS

DESCRIPTION	SPECIFICATION
Front Disc Brake Caliper Type	Dual Piston Sliding
Rear Disc Brake Caliper Type	Single Piston Sliding
Disc Brake Caliper	Bosch
Rear Disc Brake Rotor New DRW	22 mm (0.866 in.)
Rear Disc Brake Rotor Wear Limit DRW	19 mm (0.748 in.)
Rear Disc Brake Rotor Max. Lateral Runout DRW	.1 mm (0.0007 in.)
Rear Disc Brake Rotor Max. Axial Runout DRW	.02 mm (0.0039 in.)
Front Disc Brake Rotor New DRW	22 mm (0.866 in.)
Front Disc Brake Rotor Wear Limit DRW	19 mm (0.748 in.)

DESCRIPTION	SPECIFICATION
Front Disc Brake Rotor Max. Lateral Runout DRW	0.05 mm (0.0019 in.)
Front Disc Brake Rotor Max. Axial Runout DRW	0.02 mm (0.0007 in.)
Front Disc Brake Rotor New SRW	22 mm (0.866 in.)
Front Disc Brake Rotor Wear Limit SRW	19 mm (0.748 in.)
Front Disc Brake Rotor Max. Lateral Runout SRW	0.05 mm (0.0019 in.)
Front Disc Brake Rotor Max. Axial Runout SRW	0.02 mm (0.0007 in.)
Rear Disc Brake Rotor New Models 901,902	12 mm (0.47 in.)
Rear Disc Brake Rotor Wear Limit Models 901,902	10 mm (0.40 in.)
Rear Disc Brake Rotor Max. Lateral Runout Models 901,902	.1 mm (0.0007 in.)
Rear Disc Brake Rotor Max. Axial Runout Models 901,902	0.02 mm (0.0007 in.)

HYDRAULIC/MECHANICAL (Continued)

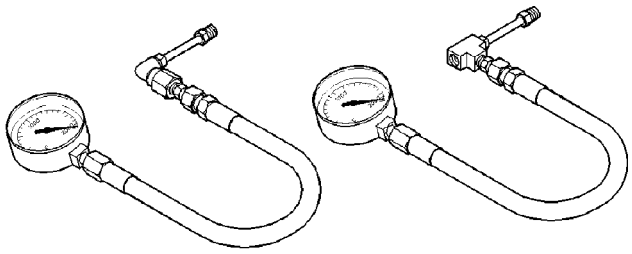
DESCRIPTION	SPECIFICATION
Rear Disc Brake Rotor New Models 690.611/63/64, 903	16 mm (0.629 in.)
Rear Disc Brake Rotor Wear Limit Models 690.611/63/64, 903	14 mm (0.55 in.)
Rear Disc Brake Rotor Max. Lateral Runout Models 690.611/63/64, 903	.1 mm (0.0007 in.)
Rear Disc Brake Rotor Max. Axial Runout Models 690.611/63/64, 903	0.02 mm (0.0007 in.)
Rear Disc Brake Rotor New Models WD2.YD141, YD241, YD341, YD441, YD541, WD5.WD141, WD241, WD341	16 mm (0.629 in.)
Rear Disc Brake Rotor Wear Limit Models WD2.YD141, YD241, YD341, YD441, YD541, WD5.WD141, WD241, WD341	14 mm (0.55 in.)
Rear Disc Brake Rotor Max. Lateral Runout Models WD2.YD141, YD241, YD341, YD441, YD541, WD5.WD141, WD241, WD341	.1 mm (0.0007 in.)
Rear Disc Brake Rotor Max. Axial Runout Models WD2.YD141, YD241, YD341, YD441, YD541, WD5.WD141, WD241, WD341	0.02 mm (0.0007 in.)
Brake Booster Type	Vacuum Diaphragm

SPECIAL TOOLS

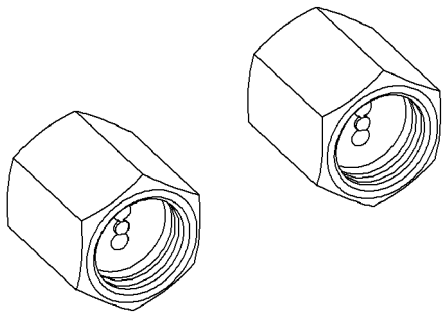
BRAKES

SPECIAL TOOL CROSS REFERENCE CHART

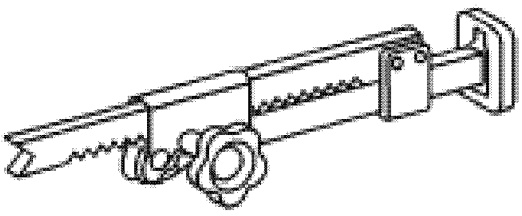
MB TOOL #	MILLER TOOL #	DESCRIPTION
N/A	C-4007-A	GAUGE SET
N/A	9297	ADAPTERS, BRAKE PRESSURE
000 589 18 31 00	99296	BRAKE PEDAL WINCH



GAUGE SET - C-4007-A



ADAPTERS, BRAKE PRESSURE - 9297



BRAKE PEDAL WINCH - 9296

BRAKE LINES

STANDARD PROCEDURE

STANDARD PROCEDURE - ISO 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.

To make a ISO flare use an ISO flaring tool kit.

(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. 2). Then tighten the tool bar on the tube.

(5) Install the correct size adaptor on the flaring tool yoke screw.

(6) Lubricate the adaptor.

(7) Align the adaptor and yoke screw over the tube (Fig. 2).

(8) Turn the yoke screw in until the adaptor is squarely seated on the tool bar.

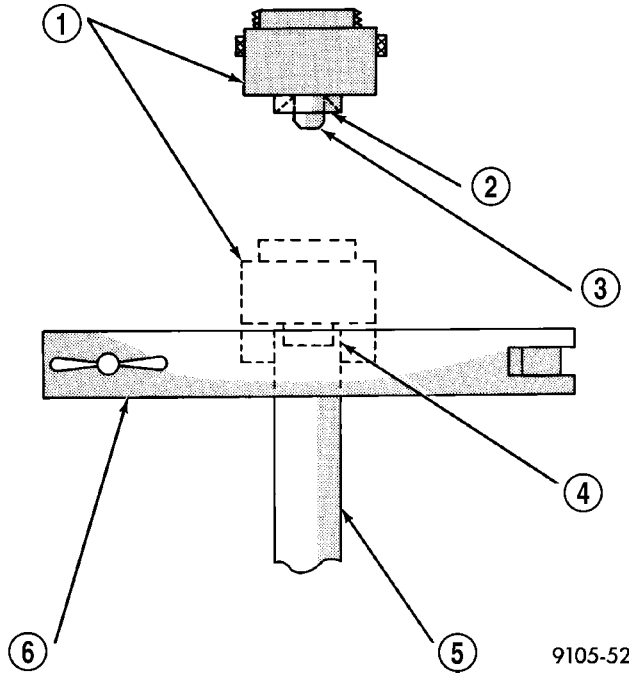


Fig. 2 ISO Flaring

1 - ADAPTER
2 - LUBRICATE HERE
3 - PILOT
4 - FLUSH WITH BAR
5 - TUBING
6 - BAR ASSEMBLY

STANDARD PROCEDURE - DOUBLE INVERTED 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.

(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. 3).

(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.

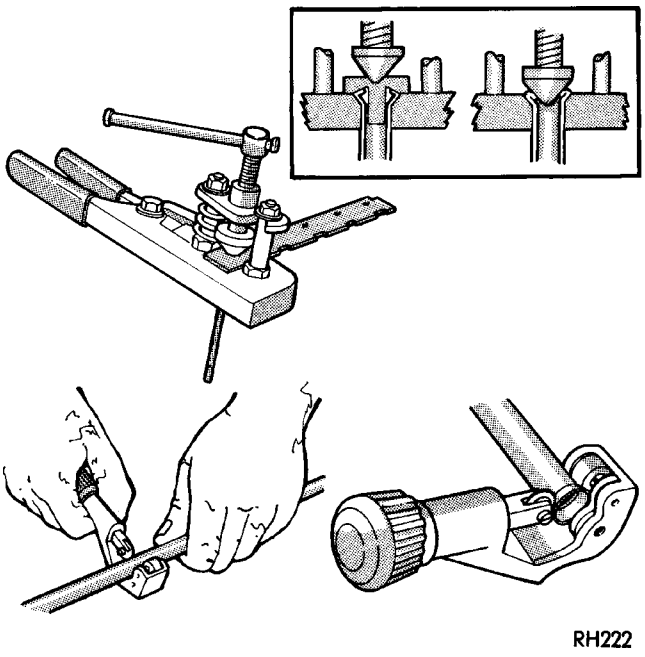


Fig. 3 Inverted Flare Tools

BRAKE PADS/SHOES

REMOVAL

REMOVAL - FRONT (SRW)

(1) Unscrew the cap from the brake fluid reservoir.
(2) Raise and support the vehicle.
(3) Remove the front wheels (Refer to 22 - TIRES/WHEELS/WHEELS - REMOVAL).
(4) Remove the wear indicator cable and the wear indicator (Fig. 4).

NOTE: Seal off the line ends and connection threads in the brake calipers with plugs. Also check brake hoses for signs of cracks.

(5) Remove the brake caliper guide bolt (Fig. 4).
(6) Remove the brake caliper (Fig. 4).
(7) Remove the brake pads (Fig. 4).

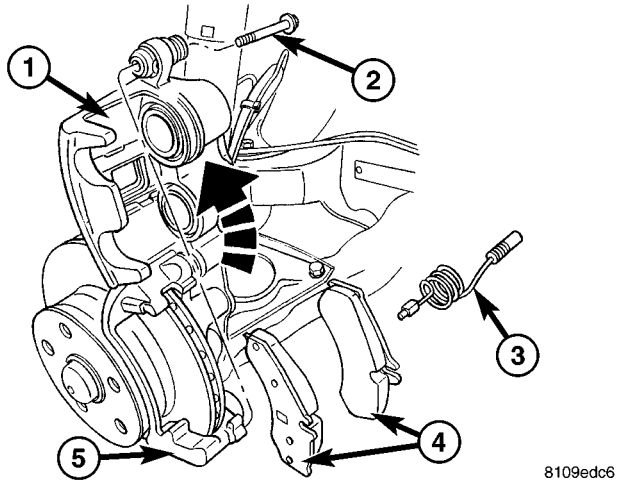


Fig. 4 FRONT BRAKE PADS

1 - DISC BRAKE CALIPER
2 - GUIDE BOLT
3 - WEAR INDICATOR
4 - DISC BRAKE PADS
5 - CALIPER ADAPTER

REMOVAL - FRONT (DRW)

(1) Unscrew the cap from the brake fluid reservoir.
(2) Raise and support the vehicle.
(3) Remove the front wheels (Refer to 22 - TIRES/WHEELS/WHEELS - REMOVAL).
(4) Remove the wear indicator cable and the wear indicator (Fig. 5).

NOTE: Seal off the line ends and connection threads in the brake calipers with plugs. Also check brake hoses for signs of cracks.

(5) Remove the brake caliper guide bolt (Fig. 5).
(6) Remove the brake caliper (Fig. 5).
(7) Remove the brake pads (Fig. 5).

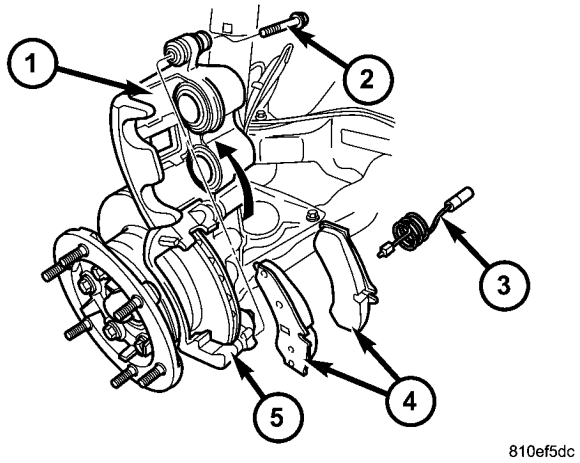


Fig. 5 FRONT DISC BRAKE PADS WITH DUAL REAR WHEELS

1 - DISC BRAKE CALIPER
2 - GUIDE PIN/BOLT
3 - WEAR INDICATOR
4 - BRAKE PADS
5 - BRAKE CALIPER ADAPTER

REMOVAL - REAR (16” WHEELS) (SRW)

(1) Unscrew the cap from the brake fluid reservoir.
(2) Raise and support the vehicle.
(3) Remove the rear wheels (Refer to 22 - TIRES/WHEELS/WHEELS - INSTALLATION).
(4) Remove the wear indicator cable and the wear indicator (Fig. 6).

NOTE: Seal off the line ends and connection threads in the brake calipers with plugs. Also check brake hoses for signs of cracks.

(5) Remove the brake caliper guide pins (Fig. 6).
(6) Remove the brake caliper from the caliper adapter (Fig. 6).
(7) Remove the retaining spring (Fig. 6).
(8) Remove the pads (Fig. 6).

REMOVAL - REAR (15” WHEELS) (SRW)

(1) Unscrew the cap from the brake fluid reservoir.
(2) Raise and support the vehicle.
(3) Remove the rear wheels (Refer to 22 - TIRES/WHEELS/WHEELS - INSTALLATION).
(4) Remove the wear indicator cable and the wear indicator (Fig. 7).

NOTE: Seal off the line ends and connection threads in the brake calipers with plugs. Also check brake hoses for signs of cracks.

(5) Remove the brake caliper guide pin (Fig. 7).

BRAKE PADS/SHOES (Continued)

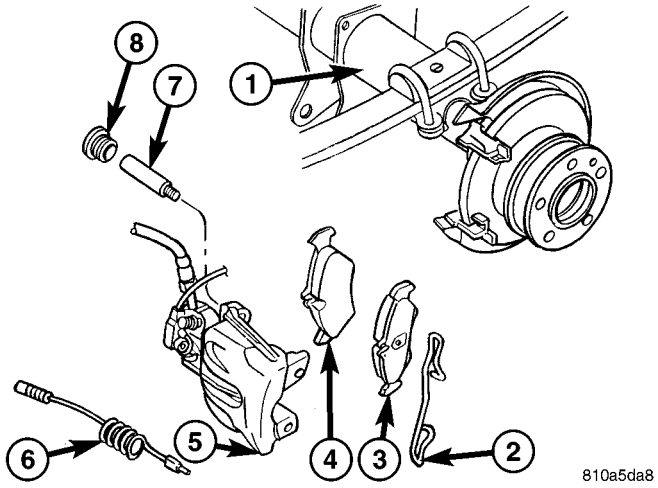


Fig. 6 REAR DISC BRAKE PADS - 16" WHEELS (SRW)

1 - AXLE
2 - RETAINING SPRING
3 - OUTBOARD PADS
4 - INBOARD PAD
5 - DISC BRAKE CALIPER
6 - WEAR INDICATOR
7 - GUIDE PIN
8 - DUST CAP

(6) Fold the top section of the brake caliper up (Fig. 7).

(7) Remove the pads (Fig. 7).

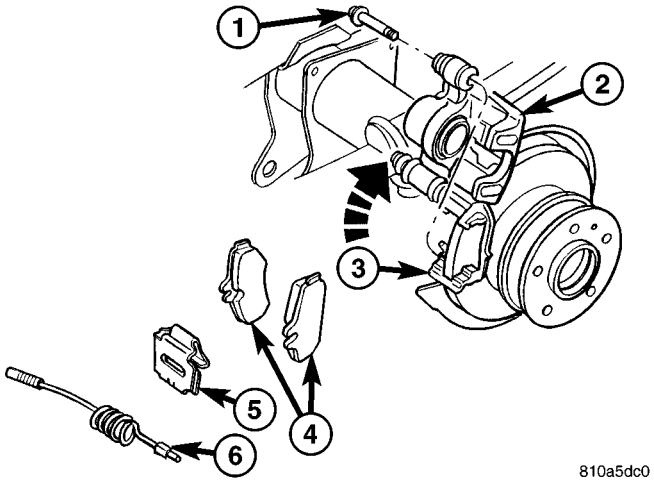


Fig. 7 REAR DISC BRAKE PADS - 15" WHEELS (SRW)

1 - CALIPER GUIDE PIN
2 - DISC BRAKE CALIPER
3 - CALIPER ADAPTER
4 - DISC BRAKE PADS
5 - RETAINING SPRING
6 - WEAR INDICATOR

REMOVAL - REAR (DRW)

(1) Unscrew the cap from the brake fluid reservoir.

(2) Raise and support the vehicle.

(3) Remove the rear wheels (Refer to 22 - TIRES/WHEELS/WHEELS - INSTALLATION).

(4) Remove the wear indicator cable and the wear indicator (Fig. 8).

NOTE: Seal off the line ends and connection threads in the brake calipers with plugs. Also check brake hoses for signs of cracks.

(5) Remove the brake caliper guide pins (Fig. 8).

(6) Remove the brake caliper from the caliper adapter (Fig. 8).

(7) Remove the retaining spring (Fig. 8).

(8) Remove the pads (Fig. 8).

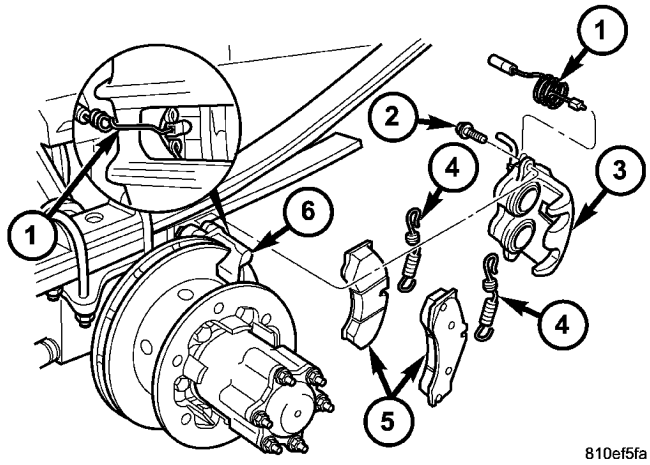


Fig. 8 REAR DISC BRAKE PADS WITH DUAL REAR WHEELS

1 - WEAR INDICATOR
2 - GUIDE PIN/BOLT
3 - DISC BRAKE CALIPER
4 - RETAINING SPRING
5 - DISC BRAKE PADS
6 - CALIPER ADAPTER

INSTALLATION

INSTALLATION - FRONT (SRW)

(1) Install the brake pads (Fig. 4).

(2) Install the wear indicator cable and the wear indicator (Fig. 4). Tighten to 10 N·m (89 in. lbs.).

NOTE: Do not install the brake hose twisted and ensure freedom of movement.

(3) Install the brake caliper to the brake caliper adapter (Fig. 4). Tighten the guide bolt to 25 N·m (221 in. lbs.).

(4) Bleed the brake system.

(5) Check the brake system for any leaks.

(6) Install the front wheels.

(7) Lower the vehicle.

BRAKE PADS/SHOES (Continued)

INSTALLATION - FRONT (DRW)

(1) Install the brake pads (Fig. 5).
(2) Install the wear indicator cable and the wear indicator (Fig. 5). Tighten to 10 N·m (89 in. lbs.).

NOTE: Do not install the brake hose twisted and ensure freedom of movement.

(3) Install the brake caliper to the brake caliper adapter (Fig. 5). Tighten the guide bolt to 25 N·m (221 in. lbs.)(M8 bolt) or Tighten the guide bolt to 30 N·m (265 in. lbs.)(M10 10.9 bolt).
(4) Bleed the brake system.
(5) Check the brake system for any leaks.
(6) Install the front wheels.
(7) Lower the vehicle.

INSTALLATION - REAR (16" WHEELS) (SRW)

(1) Install the brake pads (Fig. 6).
(2) Install the wear indicator cable and the wear indicator (Fig. 6). Tighten to 10 N·m (89 in. lbs.).

NOTE: Do not install the brake hose twisted and ensure freedom of movement.

(3) Install the brake caliper to brake caliper adapter (Fig. 6). Tighten the guide pins to 25 N·m (221 in. lbs.) for M8 bolt or 30 N·m (266 in. lbs.) for M10 bolt.
(4) Install the retaining spring (Fig. 6).
(5) Install the rear wheels (Refer to 22 - TIRES/ WHEELS/WHEELS - INSTALLATION).
(6) Lower the vehicle.

INSTALLATION - REAR (16" WHEELS) (SRW)

(1) Install the brake pads (Fig. 7).
(2) Install the wear indicator cable and the wear indicator (Fig. 7). Tighten to 10 N·m (89 in. lbs.).

NOTE: Do not install the brake hose twisted and ensure freedom of movement.

(3) Install the brake caliper to brake caliper adapter (Fig. 7). Tighten the guide pin to 30 N·m (266 in. lbs.) for M10 bolt.
(4) Install the rear wheels (Refer to 22 - TIRES/ WHEELS/WHEELS - INSTALLATION).
(5) Lower the vehicle.

INSTALLATION - REAR (DRW)

(1) Install the brake pads (Fig. 8).
(2) Install the wear indicator cable and the wear indicator (Fig. 8). Tighten to 10 N·m (89 in. lbs.).

NOTE: Do not install the brake hose twisted and ensure freedom of movement.

(3) Install the brake caliper to brake caliper adapter (Fig. 8). Tighten the guide pins to 25 N·m (221 in. lbs.) for M8 bolt or 30 N·m (266 in. lbs.) for M10 10.9 bolt.
(4) Install the retaining spring (Fig. 8).
(5) Install the rear wheels (Refer to 22 - TIRES/ WHEELS/WHEELS - INSTALLATION).
(6) Lower the vehicle.

DISC BRAKE CALIPERS

REMOVAL

REMOVAL - FRONT (SRW)

(1) Unscrew the cap from the brake fluid reservoir.
(2) Raise and support the vehicle.
(3) Remove the front wheels (Refer to 22 - TIRES/ WHEELS/WHEELS - REMOVAL).
(4) Remove the wear indicator cable and the wear indicator (Fig. 9).

NOTE: Seal off the line ends and connection threads in the brake calipers with plugs. Also check brake hoses for signs of cracks.

(5) Remove the brake hose at the brake caliper (Fig. 9).
(6) Remove the brake caliper guide bolt (Fig. 9).
(7) Remove the brake caliper (Fig. 9).

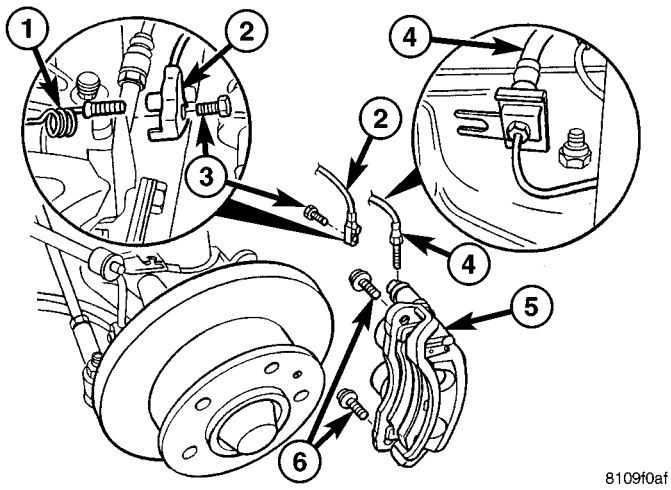


Fig. 9 FRONT DISC BRAKE CALIPER

1 - WEAR INDICATOR CABLE
2 - WEAR INDICATOR
3 - BOLT
4 - BRAKE HOSE
5 - DISC BRAKE CALIPER/ADAPTER
6 - ADAPTER BOLTS

DISC BRAKE CALIPERS (Continued)

REMOVAL - FRONT (DRW)

(1) Unscrew the cap from the brake fluid reservoir.
(2) Raise and support the vehicle.
(3) Remove the front wheels (Refer to 22 - TIRES/WHEELS/WHEELS - REMOVAL).
(4) Remove the wear indicator cable and the wear indicator (Fig. 10).

NOTE: Seal off the line ends and connection threads in the brake calipers with plugs. Also check brake hoses for signs of cracks.

(5) Remove the brake hose at the brake caliper (Fig. 10).
(6) Remove the brake caliper guide bolt (Fig. 10).
(7) Remove the brake caliper (Fig. 10).

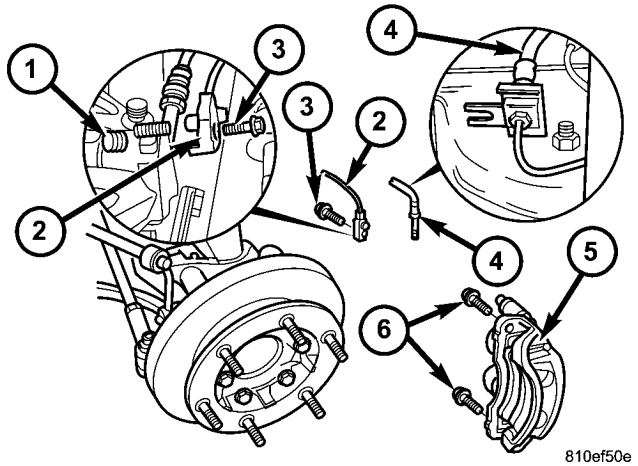


Fig. 10 DISC BRAKE CALIPER WITH DUAL REAR WHEELS

1 - WEAR INDICATOR WIRE
2 - WEAR INDICATOR
3 - MOUNTING BOLT
4 - BRAKE HOSE
5 - DISC BRAKE CALIPER
6 - ADAPTOR BOLTS

REMOVAL - REAR (SRW)

(1) Unscrew the cap from the brake fluid reservoir.
(2) Raise and support the vehicle.
(3) Remove the rear wheels (Refer to 22 - TIRES/WHEELS/WHEELS - INSTALLATION).
(4) Remove the wear indicator cable and the wear indicator (Fig. 11).

NOTE: Seal off the line ends and connection threads in the brake calipers with plugs. Also check brake hoses for signs of cracks.

(5) Remove the brake hose at the brake caliper (Fig. 11).
(6) Remove the brake caliper guide bolt (Fig. 11).
(7) Remove the brake caliper (Fig. 11).

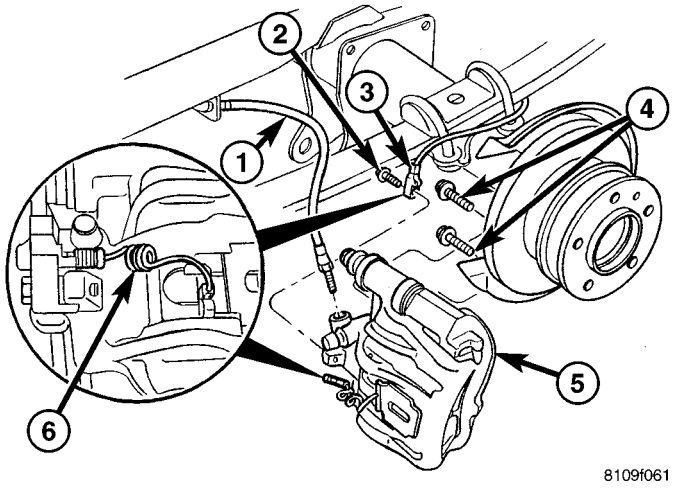


Fig. 11 REAR DISC BRAKE CALIPER

1 - BRAKE HOSE
2 - BANJO BOLT
3 - WEAR INDICATOR
4 - CALIPER ADAPTER BOLTS
5 - DISC BRAKE CALIPER
6 - WEAR INDICATOR

REMOVAL - REAR (DRW)

(1) Unscrew the cap from the brake fluid reservoir.
(2) Raise and support the vehicle.
(3) Remove the rear wheels (Refer to 22 - TIRES/WHEELS/WHEELS - INSTALLATION).
(4) Remove the wear indicator cable and the wear indicator (Fig. 12).

NOTE: Seal off the line ends and connection threads in the brake calipers with plugs. Also check brake hoses for signs of cracks.

(5) Remove the brake hose at the brake caliper (Fig. 12).
(6) Remove the brake caliper guide bolt (Fig. 12).
(7) Remove the brake caliper (Fig. 12).

INSTALLATION

INSTALLATION - FRONT (SRW)

(1) Install the brake caliper to the brake caliper adapter (Fig. 9). Tighten the guide pins to 25 N·m (221 in. lbs.).

NOTE: Do not install the brake hose twisted and ensure freedom of movement.

(2) Install the brake hose at the brake caliper (Fig. 9). Tighten the bolt to 14 N·m (124 in. lbs.).
(3) Install the wear indicator cable and the wear indicator (Fig. 9). Tighten to 10 N·m (89 in. lbs.).
(4) Bleed the brake system.
(5) Check the brake system for any leaks.

DISC BRAKE CALIPERS (Continued)

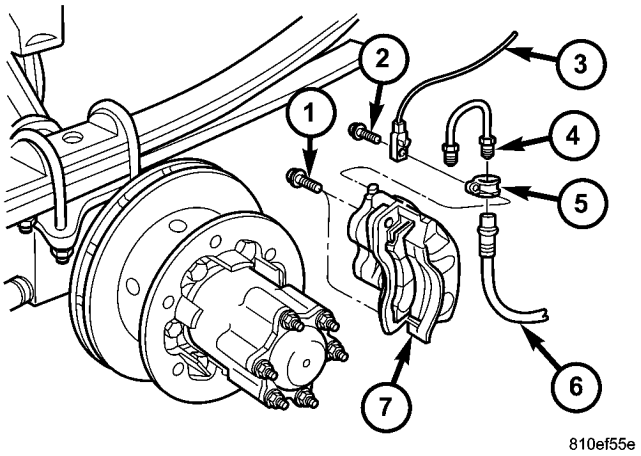


Fig. 12 REAR DISC BRAKE CALIPER WITH DUAL REAR WHEELS

1 - ADAPTER BOLT
2 - WEAR INDICATOR MOUNTING BOLT
3 - WEAR INDICATOR
4 - BRAKE LINE
5 - CLAMP
6 - BRAKE HOSE
7 - BRAKE CALIPER

(6) Install the front wheels.
(7) Lower the vehicle.

INSTALLATION - FRONT (DRW)

(1) Install the brake caliper to the brake caliper adapter (Fig. 10). Tighten the guide pins to 25 N·m (221 in. lbs.)(M8 bolt) or Tighten the guide pins to 30 N·m (265 in. lbs.)(M10 10.9 bolt).

NOTE: Do not install the brake hose twisted and ensure freedom of movement.

(2) Install the brake hose at the brake caliper (Fig. 10). Tighten the bolt to 14 N·m (124 in. lbs.).
(3) Install the wear indicator cable and the wear indicator (Fig. 10). Tighten to 10 N·m (89 in. lbs.).
(4) Bleed the brake system.
(5) Check the brake system for any leaks.
(6) Install the front wheels.
(7) Lower the vehicle.

INSTALLATION - REAR (SRW)

(1) Install the brake caliper to brake caliper adapter (Fig. 11). Tighten the guide bolt to 25 N·m (221 in. lbs.) for M8 bolt or 30 N·m (266 in. lbs.) for M10 bolt.

NOTE: Do not install the brake hose twisted and ensure freedom of movement.

(2) Install the brake hose at the brake caliper (Fig. 11). Tighten the bolt to 14 N·m (124 in. lbs.).
(3) Install the wear indicator cable and the wear indicator (Fig. 11). Tighten to 10 N·m (89 in. lbs.).
(4) Bleed the brake system.
(5) Check the brake system for any leaks.
(6) Install the rear wheels (Refer to 22 - TIRES/WHEELS/WHEELS - INSTALLATION).
(7) Lower the vehicle.

INSTALLATION - REAR (DRW)

(1) Install the brake caliper to brake caliper adapter (Fig. 12). Tighten the guide bolt to 25 N·m (221 in. lbs.) for M8 bolt or 30 N·m (266 in. lbs.) for M10 bolt.

NOTE: Do not install the brake hose twisted and ensure freedom of movement.

(2) Install the brake hose at the brake caliper (Fig. 12). Tighten the bolt to 14 N·m (124 in. lbs.).
(3) Install the wear indicator cable and the wear indicator (Fig. 12). Tighten to 10 N·m (89 in. lbs.).
(4) Bleed the brake system.
(5) Check the brake system for any leaks.
(6) Install the rear wheels (Refer to 22 - TIRES/WHEELS/WHEELS - INSTALLATION).
(7) Lower the vehicle.

DISC BRAKE CALIPER ADAPTER

REMOVAL

REMOVAL - FRONT

(1) Unscrew the cap from the brake fluid reservoir.
(2) Raise and support the vehicle.
(3) Remove the front wheels (Refer to 22 - TIRES/WHEELS/WHEELS - REMOVAL).
(4) Remove the disc brake caliper from the caliper adapter (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL).
(5) Remove the disc brake pads (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/BRAKE PADS/SHOES - REMOVAL).
(6) Remove the disc brake caliper adapter.

REMOVAL - REAR

(1) Unscrew the cap from the brake fluid reservoir.
(2) Raise and support the vehicle.
(3) Remove the rear wheels (Refer to 22 - TIRES/WHEELS/WHEELS - INSTALLATION).
(4) Remove the disc brake caliper.
(5) Remove the disc brake pads.
(6) Remove the disc brake caliper adapter.

DISC BRAKE CALIPER ADAPTER (Continued)

INSTALLATION

INSTALLATION - FRONT

(1) Install the brake caliper adapter to the steering knuckle. Tighten to 170 N·m (125 ft. lbs.).

(2) Install the disc brake shoes (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/BRAKE PADS/SHOES - INSTALLATION).

NOTE: Do not install the brake hose twisted and ensure freedom of movement.

(3) Install the disc brake caliper. Tighten the bolt to 14 N·m (124 in. lbs.) (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION).

(4) Install the front wheels (Refer to 22 - TIRES/WHEELS/WHEELS - INSTALLATION).

(5) Lower the vehicle.

INSTALLATION - REAR

(1) Install the brake caliper adapter to the axle mount. Tighten to 90 N·m (66 ft. lbs.) for M12X1.5 bolt or 170 N·m (125 ft. lbs.) for M14X1.5 bolt.

(2) Install the disc brake pads (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/BRAKE PADS/SHOES - INSTALLATION).

NOTE: Do not install the brake hose twisted and ensure freedom of movement.

(3) Install the disc brake caliper (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION).

(4) Install the rear wheels (Refer to 22 - TIRES/WHEELS/WHEELS - INSTALLATION).

(5) Lower the vehicle.

FLUID

DIAGNOSIS AND TESTING - BRAKE FLUID CONTAMINATION

Indications of fluid contamination are swollen or deteriorated rubber parts.

Swollen rubber parts indicate the presence of petroleum in the brake fluid.

To test for contamination, put a small amount of drained brake fluid in clear glass jar. If fluid separates into layers, there is mineral oil or other fluid contamination of the brake fluid.

If brake fluid is contaminated, drain and thoroughly flush system. Replace master cylinder, ALB Controller, caliper seals, Antilock Brakes hydraulic unit and all hydraulic fluid hoses.

STANDARD PROCEDURE - BRAKE FLUID LEVEL

Always clean the master cylinder reservoir and caps before checking fluid level. If not cleaned, dirt could enter the fluid.

The fluid fill level is indicated on the side of the master cylinder reservoir (Fig. 13).

The correct fluid level is to the MAX indicator on the side of the reservoir. If necessary, add fluid to the proper level.

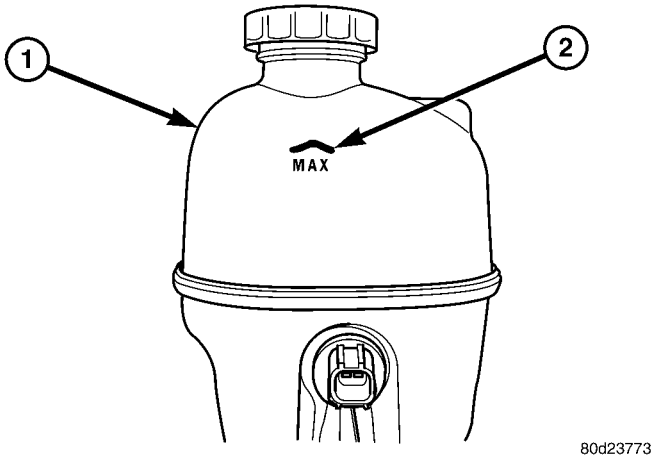


Fig. 13 FLUID LEVEL TYPICAL

1 - FLUID RESERVOIR
2 - MAX LEVEL MARK

SPECIFICATIONS

BRAKE FLUID

The brake fluid used in this vehicle must conform to DOT 4 specifications and SAE 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 of brake fluid 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.

FLUID RESERVOIR

REMOVAL

(1) Using a suction gun remove as much brake fluid from the reservoir as possible (Fig. 14).

(2) Disconnect the electrical connector for the brake fluid level indicator (Fig. 14).

(3) Remove the fluid reservoir (Fig. 14). **Seal off the ends and bore holes with plugs.**

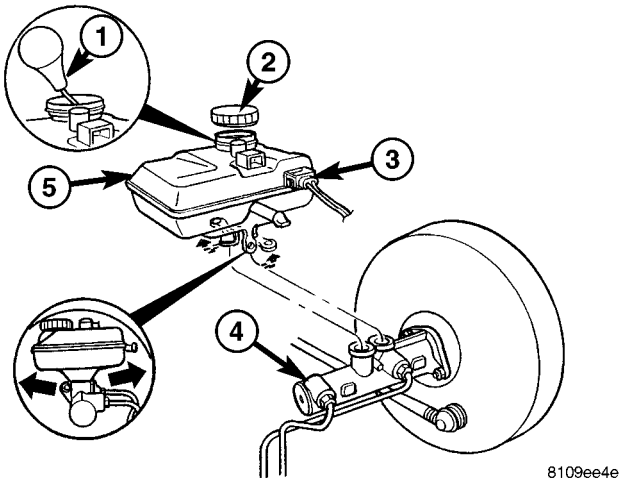


Fig. 14 FLUID RESERVOIR

1 - SUCTION GUN
2 - BRAKE FLUID CAP
3 - BRAKE FLUID LEVEL INDICATOR
4 - MASTER CYLINDER
5 - FLUID RESERVOIR

INSTALLATION

(1) Install the fluid reservoir and fill with fluid (Fig. 14).

(2) Bleed the brake system.

(3) Check the brake system for any leaks.

(4) Reconnect the electrical connector to the brake fluid level indicator (Fig. 14).

ALB LEVER

REMOVAL

(1) Raise and support the vehicle.

(2) Remove the retaining clip for the ALB lever (Fig. 15).

(3) Remove the bolt for the lever at the axle (Fig. 15).

(4) Remove the lever.

INSTALLATION

(1) Install the lever to the vehicle.

(2) Install the lower mounting bolt to the axle (Fig. 15).

(3) Install the lever to the shock bolt and then install the clip (Fig. 15).

(4) Check the side deflection of the ALB lever with a straight edge from Point-A to Point-B as the graphic shows. Max deflection play of the actuator rod should be no more than 15 mm (.60 in) (Fig. 15).

(5) Lower the vehicle.

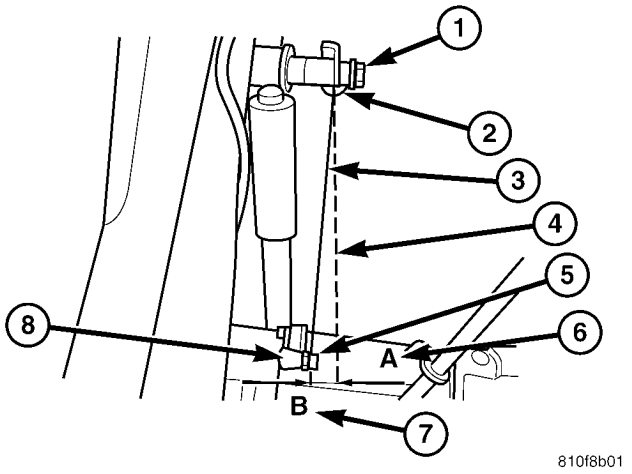


Fig. 15 ALB LEVER DEFLECTION

1 - CLIP
2 - SPRING
3 - LEVER
4 - STRIAGHT EDGE
5 - NUT
6 - POINT -A
7 - POINT - B
8 - SUSPENSION POINT

ALB CONTROLLER

REMOVAL

(1) Install the brake pedal rod to hold the brake pressure.

(2) Raise and support the vehicle.

(3) Remove the brake lines to the (automatic load-dependant brake pressure control) ALB controller.

(4) Remove the adjusting nut and the spring from the ALB controller.

(5) Remove the mounting bolts.

(6) Remove the ALB controller.

INSTALLATION

(1) Install the ALB controller to the vehicle.

(2) Install the mounting bolts for the controller.

(3) Install the brake lines. Tighten the lines to 16 N·m (142 in. lbs.)

(4) Install the adjusting rod, nut and spring to the ALB controller.

(5) Lower the vehicle.

(6) Remove the brake pedal hold down rod.

(7) Fill and bleed the brake system (Refer to 5 - BRAKES - STANDARD PROCEDURE).

ALB CONTROLLER (Continued)

(8) Raise the vehicle and adjust the ALB controller (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ ALB CONTROLLER - ADJUSTMENTS).

(9) Lower the vehicle and test drive.

ADJUSTMENTS

ADJUSTMENT

(1) Clean any debris away from the test ports caps at the ALB controller.

(2) Connect brake adapters special tool 9297 to the test ports at the ALB controller.

(3) Install a Pressure Gauge, Special Tool C-4007-A, to the adapters.

(4) Tighten all tube nut fittings to 17 N·m (145 in. lbs.) torque.

(5) Bleed any air out of the system. This includes bleeding the air from the hose between the pressure test fitting and pressure gauge, which is done at the pressure gauge.

NOTE: Adjustment is determined for the automatic load-dependent brake power control system according to the ALB plate. This is housed in the stowage compartment under the front passenger's door panel. The part number of the rear spring is stamped into the spring eye. This must correspond to the part number of the rear spring on the ALB plate.

(6) To accurately adjust the rear axle load you must first determine the rear axle load by weighing the vehicle at a local scale.

(7) Install the brake pedal winch Special tool 9296 between the brake pedal and the driver seat and slowly turn the dial until the specified inlet brake pressure is indicated at the gauge.

NOTE: The pressure gauge, connected at the ALB controller must indicate the outlet pressure which is assigned on the ALB plate to the rear axle load determined.

NOTE: If the rear axle load determined is between two figures indicated on the ALB plate, the outlet pressure should be determined accordingly.

(8) If the pressure measured differs from the specification, adjust the ALB controller (Fig. 16).

(9) Loosen the brake pedal winch.

(10) Adjust the outlet pressure by turning the adjusting nut (Fig. 16) **To increase pressure - tighten the adjusting nut. To reduce pressure - loosen the adjusting nut.**

(11) After adjustment reinstall the brake pedal winch and recheck the pressures and readjust if needed.

(12) Tighten the lock adjusting nut.

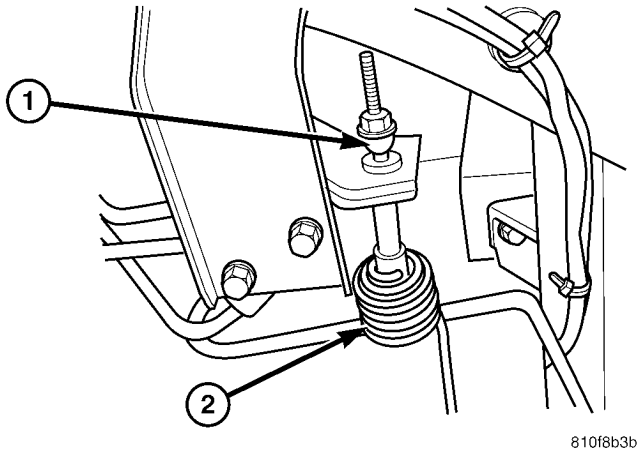


Fig. 16 ALB CONTROLLER ADJUSTER NUT

1 - ALB ADJUSTER NUT
2 - SPRING

MASTER CYLINDER

DIAGNOSIS AND TESTING - MASTER CYLINDER/POWER BOOSTER

(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 master cylinder is 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 immediately turn off ignition to stop 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, booster is faulty.

MASTER CYLINDER (Continued)

POWER BOOSTER VACUUM TEST

(1) Connect vacuum gauge to booster check valve with short length of hose and T-fitting (Fig. 17).

(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 or check valve is faulty.

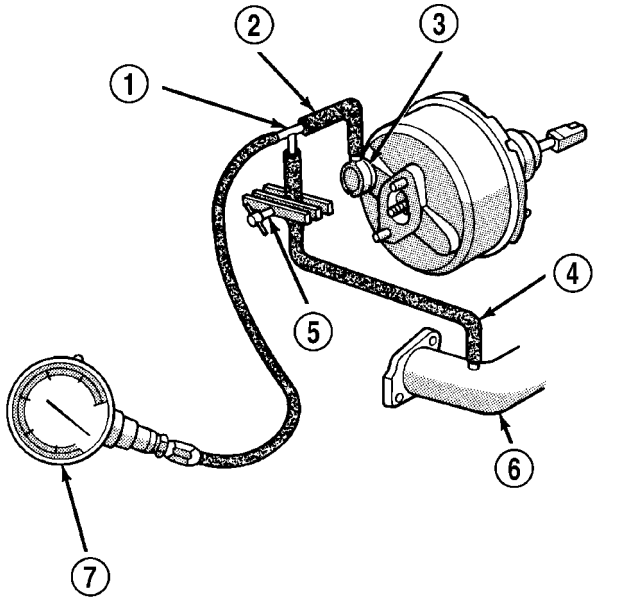


Fig. 17 Typical Booster Vacuum Test Connections

1 - TEE FITTING
2 - SHORT CONNECTING HOSE
3 - CHECK VALVE
4 - CHECK VALVE HOSE
5 - CLAMP TOOL
6 - INTAKE MANIFOLD
7 - VACUUM GAUGE

POWER BOOSTER CHECK VALVE TEST

(1) Disconnect vacuum hose from check valve.

(2) Remove check valve and valve seal from booster.

(3) Use a hand operated vacuum pump for test.

(4) Apply 15-20 inches vacuum at large end of check valve (Fig. 18).

(5) Vacuum should hold steady. If gauge on pump indicates vacuum loss, check valve is faulty and should be replaced.

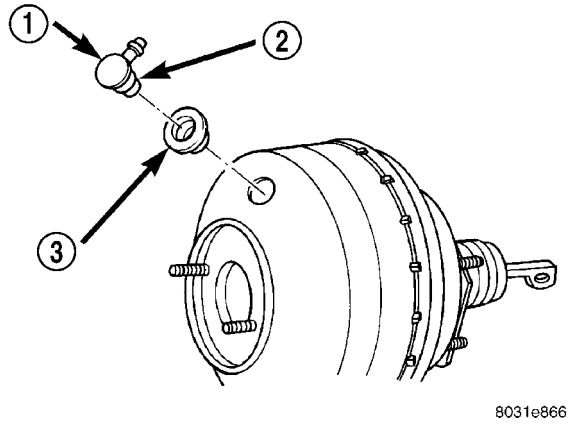


Fig. 18 Vacuum Check Valve And Seal

1 - BOOSTER CHECK VALVE
2 - APPLY TEST VACUUM HERE
3 - VALVE SEAL

STANDARD PROCEDURE - 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.

(1) Mount master cylinder in vise.

(2) Attach bleed tubes to cylinder outlet ports. Then position each tube end into reservoir (Fig. 19).

(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.

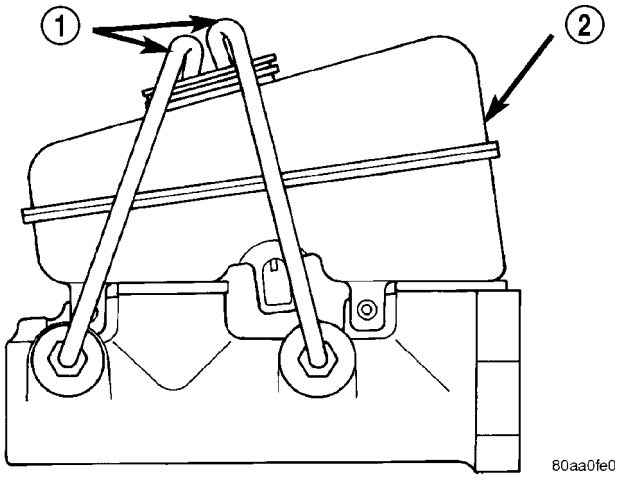


Fig. 19 Master Cylinder Bleeding–Typical

1 - BLEEDING TUBES
2 - RESERVOIR

REMOVAL

(1) Using a suction gun remove as much brake fluid from the reservoir as possible (Fig. 20).

MASTER CYLINDER (Continued)

(2) Remove the fluid reservoir (Fig. 20) or (Fig. 21)(Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/FLUID RESERVOIR - REMOVAL).

(3) Remove the brake lines **Seal off the ends and bore holes with plugs.** (Fig. 20) or (Fig. 21)

(4) Remove the master cylinder mounting nuts (Fig. 20) or (Fig. 21). **Check brake booster for damage due to leaking master cylinder. It is not possible to repair the master cylinder.**

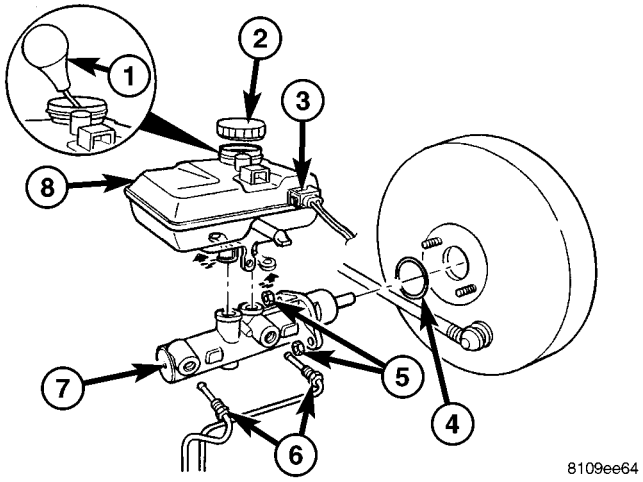


Fig. 20 MASTER CYLINDER

1 - SUCTION GUN
2 - BRAKE FLUID CAP
3 - BRAKE FLUID LEVEL INDICATOR
4 - O-RING
5 - NUT
6 - BRAKE LINE
7 - MASTER CYLINDER
8 - FLUID RESERVOIR

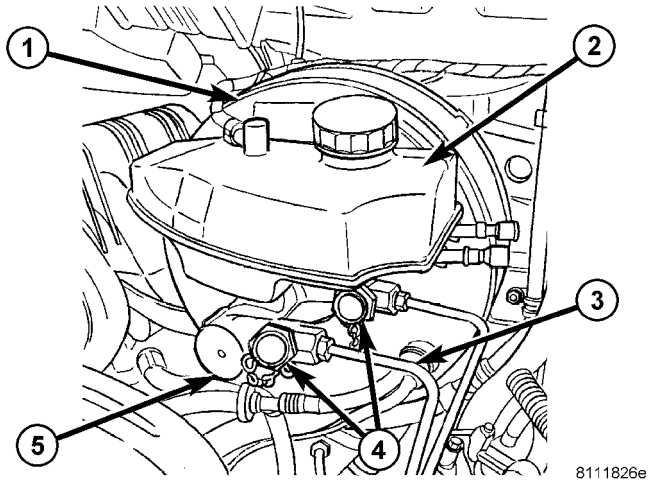


Fig. 21 MASTER CYLINDER (DRW)

1 - POWER BRAKE BOOSTER
2 - RESERVOIR
3 - BRAKE LINES
4 - PRESSURE PORTS
5 - MASTER CYLINDER

INSTALLATION

(1) Install the master cylinder to the brake booster (Fig. 20). Tighten to 28 N·m (248 in. lbs.).

(2) Install the brake lines (Fig. 20). Tighten to 14 N·m (124 in. lbs.).

(3) Install the fluid reservoir (Fig. 20) (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/FLUID RESERVOIR - INSTALLATION).

(4) Bleed the brake system.

(5) Check the brake system for any leaks.

PEDAL

REMOVAL

(1) Remove the master cylinder (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/MASTER CYLINDER - REMOVAL).

(2) Remove the retainer and pin for the master cylinder push rod (Fig. 22).

(3) Remove the retainer and pin for the brake pedal pivot bolt (Fig. 22).

(4) Unhook the spring and remove the brake pedal (Fig. 22).

(5) Disconnect the plug connector on the stop lamp switch (Fig. 22).

(6) Remove the bolts and remove the pedal bearing bracket (Fig. 22).

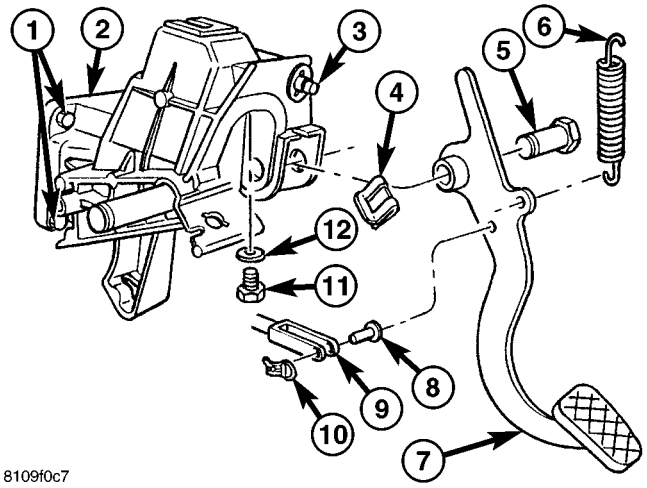


Fig. 22 BRAKE PEDAL

1 - MOUNTING BOLT
2 - PEDAL BEARING BRACKET
3 - STOP LAMP SWITCH
4 - CLIP
5 - PIVOT BOLT
6 - RETURN SPRING
7 - PEDAL
8 - PUSH ROD BOLT
9 - PUSH ROD
10 - CLIP
11 - BOLT
12 - WASHER

PEDAL (Continued)

INSTALLATION

(1) Install the bolts for the pedal bearing bracket (Fig. 22). Tighten to 23 N·m (204 in. lbs.)
(2) Reconnect the plug connector for the stop lamp switch (Fig. 22).
(3) Install the brake pedal and hook the spring (Fig. 22).
(4) Install the retainer and pin for the brake pedal (Fig. 22).
(5) Install the retainer and pin for the master cylinder push rod (Fig. 22).
(6) Install the master cylinder (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/MASTER CYLINDER - INSTALLATION).

POWER BRAKE BOOSTER

DESCRIPTION

All models use a tandem diaphragm, power brake booster.

NOTE: The power brake booster is not a repairable component. The booster must be replaced as an assembly if diagnosis indicates a malfunction has occurred.

OPERATION

The booster unit consists of a single housing divided into two by a tandem diaphragm. The outer edge of the diaphragm is secured to the housing. The booster push rod, which connects the booster to the brake pedal and master cylinder, is attached to the center of the diaphragm. A check valve is used in the booster outlet connected to the engine intake manifold. Power assist is generated by utilizing a combination of vacuum and atmospheric pressure to boost brake assist.

REMOVAL

(1) Using a suction gun remove as much brake fluid from the reservoir as possible.
(2) Disconnect the brake level switch electrical connector.
(3) Remove the brake lines from the master cylinder **Seal off the ends and bore holes with plugs.**
(4) Remove the master cylinder from the booster.
(5) Remove the booster vacuum hose and check valve (Fig. 23).
(6) Remove the pedal push rod clip (Fig. 23).
(7) Remove the booster mounting nuts (Fig. 23).
(8) Remove the booster from the vehicle.

INSTALLATION

(1) Install the brake booster to the vehicle.

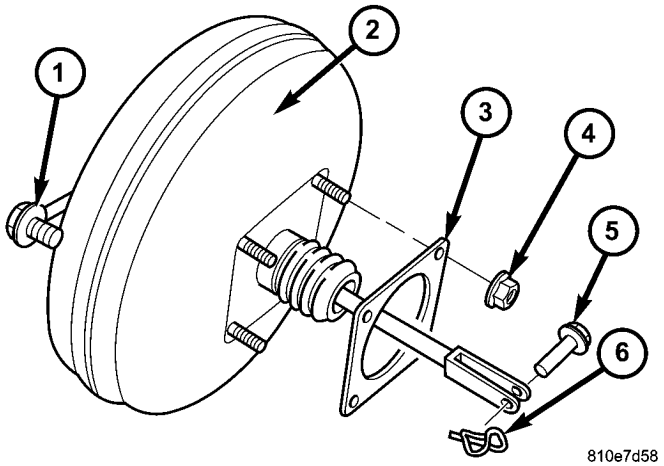


Fig. 23 POWER BRAKE BOOSTER

1 - VACUUM LINE & CHECK VALVE
2 - BRAKE BOOSTER
3 - GASKET
4 - MOUNTING NUTS (4)
5 - PUSH ROD PIN
6 - SECURING CLIP

(2) Install the booster mounting nuts (Fig. 23). Tighten to 25 N·m (221 in.lbs.).
(3) Install the push rod pin & clip (Fig. 23).
(4) Install the brake booster vacuum line and check valve (Fig. 23).
(5) Install the master cylinder to the brake booster. Tighten to 28 N·m (248 in.lbs.).
(6) Install the brake lines to the master cylinder. Tighten to 14 N·m (124 in.lbs.).
(7) Install the brake level switch electrical connector.
(8) Bleed the base brake system (Refer to 5 - BRAKES - STANDARD PROCEDURE).

ROTORS

REMOVAL

REMOVAL - FRONT (SRW)

(1) Raise and support the vehicle.
(2) Remove the front wheels.
(3) Remove the front brake pads (Fig. 24).
(4) Remove the caliper adapter (Fig. 24).
(5) Install two lug studs to secure the disc brake rotor when the locking bolt is removed.
(6) Remove the locking bolt for the disc brake rotor (Fig. 24).
(7) Remove the two lug nuts.
(8) Remove the disc brake rotor (Fig. 24).

ROTORS (Continued)

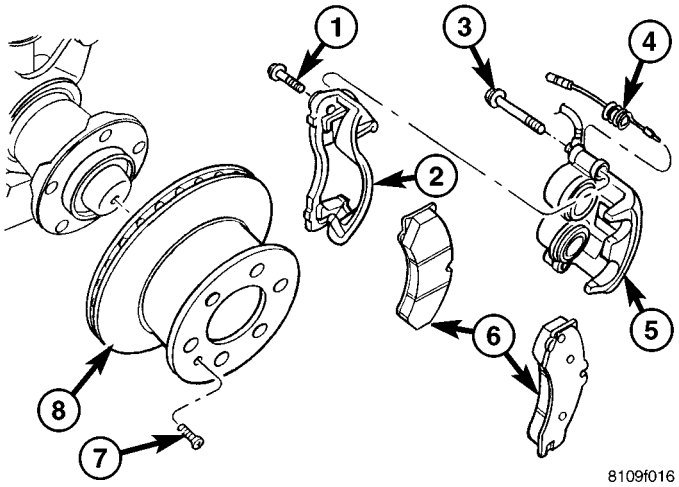


Fig. 24 FRONT DISC BRAKE ROTOR

1 - CALIPER ADAPTER BOLT
2 - CALIPER ADAPTER
3 - GUIDE BOLT
4 - WEAR INDICATOR
5 - DISC BRAKE CALIPER
6 - DISC BRAKE PADS
7 - LOCKING BOLT
8 - DISC BRAKE ROTOR

REMOVAL - REAR (SRW)

(1) Raise and support the vehicle.
(2) Remove the rear wheels.
(3) Remove the rear disc brake pads (Fig. 25).
(4) Remove the disc brake caliper adapter (Fig. 25).
(5) Apply the parking brake.
(6) Install two lug studs to secure the disc brake rotor when the locking bolt is removed.
(7) Remove the locking bolt for the disc brake rotor (Fig. 25).
(8) Remove the two lug nuts.
(9) Release the parking brake.
(10) loosen the park brake adjuster to allow clearance for the rotor removal (Fig. 25).
(11) Remove the rear disc brake rotor.

REMOVAL - FRONT (DRW)

(1) Raise and support the vehicle.
(2) Remove the front wheels.
(3) Remove the front brake pads (Fig. 26).
(4) Remove the caliper adapter (Fig. 26).
(5) Remove the wheel flange ring (Fig. 26).
(6) Install two lug studs to secure the disc brake rotor when the locking bolt is removed.
(7) Remove the locking bolt for the disc brake rotor (Fig. 26).
(8) Remove the two lug nuts.
(9) Remove the disc brake rotor (Fig. 26).

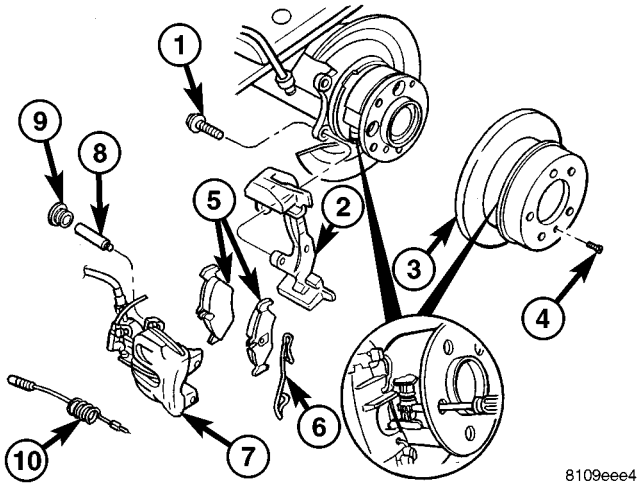


Fig. 25 REAR DISC BRAKE ROTOR

1 - M8 BOLT
2 - CALIPER ADAPTER
3 - DISC BRAKE ROTOR
4 - LOCKING BOLT
5 - DISC BRAKE PADS
6 - RATTLE SPRING
7 - DISC BRAKE CALIPER
8 - GUIDE BOLT
9 - COVER
10 - WEAR INDICATOR

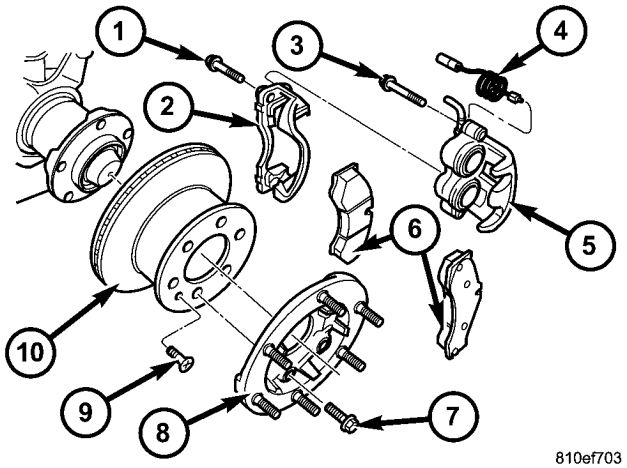


Fig. 26 FRONT DISC BRAKE ROTOR WITH DUAL REAR WHEELS

1 - ADAPTER BOLT
2 - ADAPTER
3 - GUIDE PIN/BOLT
4 - WEAR INDICATOR WIRE
5 - DISC BRAKE CALIPER
6 - DISC BRAKE PADS
7 - WHEEL FLANGE RING MOUNTING BOLT
8 - WHEEL FLANGE RING
9 - LOCKING BOLT
10 - DISC BRAKE ROTOR

REMOVAL - REAR (DRW)

(1) Raise and support the vehicle.
(2) Remove the rear wheels.
(3) Remove the rear disc brake pads (Fig. 27).

ROTORS (Continued)

(4) Remove the disc brake caliper adapter (Fig. 27).
(5) Apply the parking brake.
(6) Install two lug studs to secure the disc brake rotor when the locking bolt is removed.
(7) Remove the wheel flange ring (Fig. 27).
(8) Remove the locking bolt for the disc brake rotor (Fig. 27).
(9) Remove the two lug nuts.
(10) Release the parking brake.
(11) loosen the park brake adjuster to allow clearance for the rotor removal (Fig. 27).
(12) Remove the rear disc brake rotor.

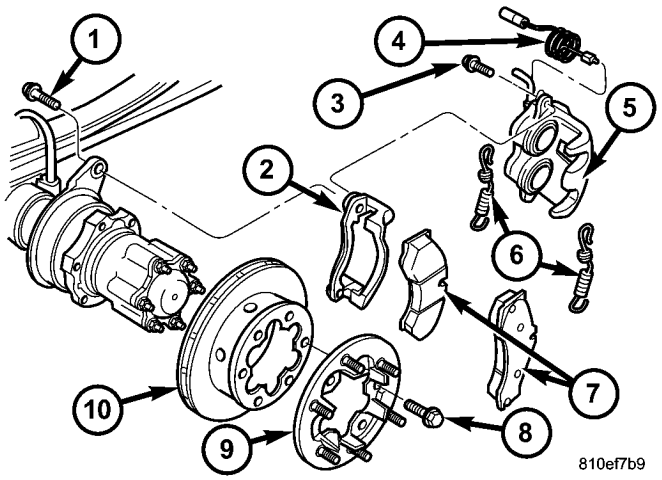


Fig. 27 REAR DISC BRAKE ROTOR WITH DUAL REAR WHEELS

1 - ADAPTER BOLT
2 - ADAPTER
3 - GUIDE PIN/BOLT
4 - WEAR INDICATOR
5 - DISC BRAKE CALIPER
6 - RETAINING SPRING
7 - DISC BRAKE PADS
8 - WHEEL FLANGE RING MOUNITNG BOLT
9 - WHEEL FLANGE RING
10 - DISC BRAKE ROTOR

INSTALLATION

INSTALLATION - FRONT (SRW)

(1) Install the disc brake rotor to the hub and install two lug studs to hold rotor in place.
(2) Install the locking bolt for the rotor (Fig. 24). Tighten to 23 N·m (204 in. lbs.).
(3) Install the disc brake caliper adapter (Fig. 24). Tighten to 170 N·m (125 ft. lbs.) (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPER ADAPTER - INSTALLATION).
(4) Install the brake pads (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/BRAKE PADS/SHOES - INSTALLATION) (Fig. 24).
(5) Press and release the brake pedal several times until pressure has built up.
(6) Check fluid in reservoir and correct if necessary.
(7) Install the front wheels (Refer to 22 - TIRES/WHEELS/WHEELS - INSTALLATION).
(8) Lower the vehicle.

INSTALLATION - REAR (SRW)

(1) Install the disc brake rotor to the hub and install two lug studs to hold rotor in place (Fig. 25).
(2) Apply the parking brake.
(3) Install the locking bolt for the rotor (Fig. 25). Tighten to 23 N·m (204 in. lbs.).
(4) Install the disc brake caliper adapter (Fig. 25). Tighten to 90 N·m (66 ft. lbs.) (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPER ADAPTER - INSTALLATION).
(5) Install the brake pads (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/BRAKE PADS/SHOES - INSTALLATION) (Fig. 25).
(6) Release the parking brake.
(7) Adjust the parking brake (Refer to 5 - BRAKES/PARKING BRAKE/SHOES - ADJUSTMENTS).
(8) Press and release the brake pedal several times until pressure has built up.
(9) Check fluid in reservoir and correct if necessary.
(10) Install the rear wheels.
(11) Lower the vehicle.

INSTALLATION - FRONT (DRW)

(1) Install the disc brake rotor to the hub and install two lug studs to hold rotor in place.
(2) Install the locking bolt for the rotor (Fig. 26). Tighten to 23 N·m (204 in. lbs.).
(3) Install the disc brake caliper adapter (Fig. 26). Tighten to 170 N·m (125 ft. lbs.) (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPER ADAPTER - INSTALLATION).
(4) Install the wheel flange ring. Tighten to 180 N·m (133 ft. lbs.)
(5) Install the brake pads (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/BRAKE PADS/SHOES - INSTALLATION) (Fig. 26).
(6) Press and release the brake pedal several times until pressure has built up.
(7) Check fluid in reservoir and correct if necessary.
(8) Install the front wheels (Refer to 22 - TIRES/WHEELS/WHEELS - INSTALLATION).
(9) Lower the vehicle.

INSTALLATION - REAR (DRW)

(1) Install the disc brake rotor to the hub and install two lug studs to hold rotor in place (Fig. 27).
(2) Apply the parking brake.

ROTORS (Continued)

(3) Install the locking bolt for the rotor (Fig. 27). Tighten to 23 N·m (204 in. lbs.).

(4) Install the disc brake caliper adapter (Fig. 27). Tighten to 170 N·m (125 ft. lbs.) (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPER ADAPTER - INSTALLATION).

(5) Install the wheel flange ring (Fig. 27) Tighten to 200 N·m (148 ft. lbs.).

(6) Install the brake pads (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/BRAKE PADS/SHOES - INSTALLATION) (Fig. 27).

(7) Release the parking brake.

(8) Adjust the parking brake (Refer to 5 - BRAKES/PARKING BRAKE/SHOES - ADJUSTMENTS).

(9) Press and release the brake pedal several times until pressure has built up.

(10) Check fluid in reservoir and correct if necessary.

(11) Install the rear wheels.

(12) Lower the vehicle.

SUPPORT PLATE

REMOVAL - REAR

(1) Raise and support the vehicle.

(2) Remove the disc brake caliper adapter (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPER ADAPTER - REMOVAL).

(3) Remove the disc brake rotor (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - REMOVAL).

(4) Remove the rear park brake shoes (Refer to 5 - BRAKES/PARKING BRAKE/SHOES - REMOVAL).

(5) Remove the park brake cable from he support plate.

(6) Remove the rear axle bearing (Refer to 3 - DIFFERENTIAL & DRIVELINE/REAR AXLE/AXLE BEARINGS - REMOVAL).

(7) Remove brake support plate.

INSTALLATION - REAR

(1) Press the brake support plate with the axle bearing onto the axle shaft (Refer to 3 - DIFFERENTIAL & DRIVELINE/REAR AXLE/AXLE BEARINGS - INSTALLATION).

(2) Install the park brake cable to the support plate.

(3) Install the rear park brake shoes (Refer to 5 - BRAKES/PARKING BRAKE/SHOES - INSTALLATION).

(4) Install the disc brake rotor (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/ROTORS - INSTALLATION).

(5) Install the disc brake caliper adapter (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPER ADAPTER - INSTALLATION).

(6) Adjust the rear park brake shoes (Refer to 5 - BRAKES/PARKING BRAKE/SHOES - ADJUSTMENTS).

(7) Install the rear wheels (Refer to 22 - TIRES/WHEELS/WHEELS - INSTALLATION).

PARKING BRAKE

SPECIFICATIONS

TORQUE CHART

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Pressure Transformer Unit For Brake Cables To Frame Crossmember	25	—	221
Hand Brake Lever To Seat Frame	25	—	221

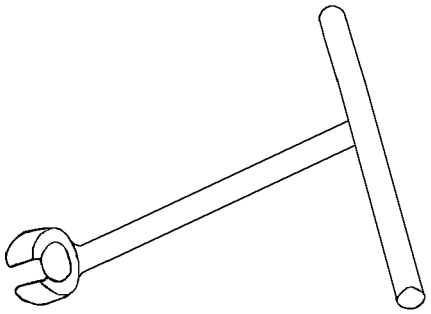
PARKING BRAKE (Continued)

SPECIAL TOOLS

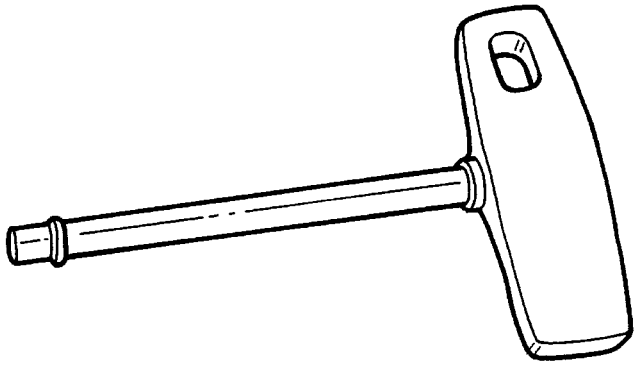
PARK BRAKE

SPECIAL TOOL CROSS REFERENCE CHART

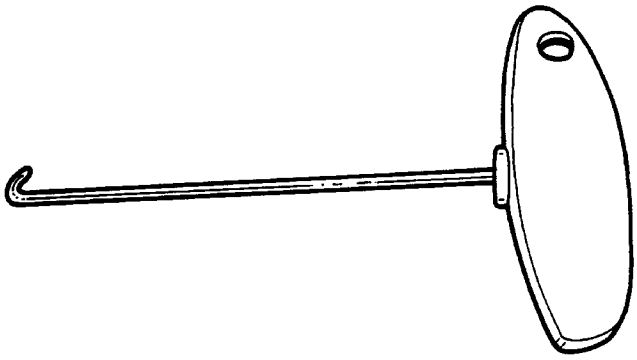
MB TOOL #	MILLER TOOL #	DESCRIPTION
116 589 01 62 00	9280	RETURN SPRING PULLING HOOK
112 589 09 61 00	9281	RETAINING SPRING TOOL
901 589 00 63 00	9289	RETAINING CLIP RELEASE TOOL



RETAINING CLIP RELEASE TOOL - 9289



RETAINING SPRING TOOL - 9281



RETURN SPRING PULLING HOOK - 9280

CABLE TENSIONER

REMOVAL

NOTE: Observe the installation position of the brake control cable lock, for a reference on installation.

(1) Open the brake control cable lock (Fig. 28).
(2) Press out the safety bolt and remove the brake control cable lock (Fig. 28).

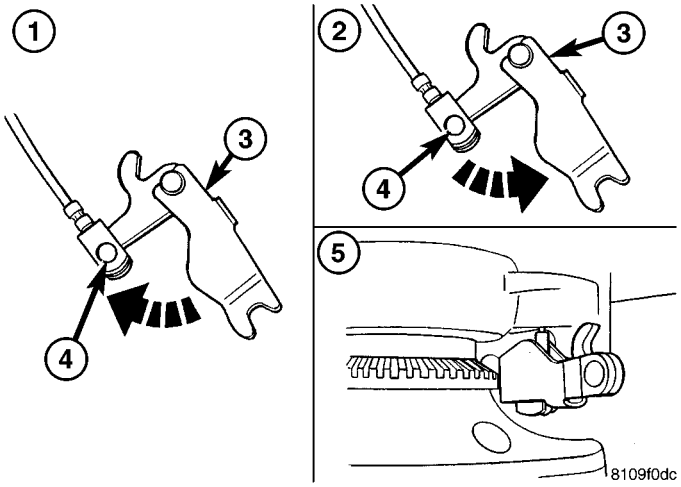


Fig. 28 CONTROL CABLE LOCK

1 - BRAKE CABLE CONTROL LOCK OPEN
2 - BRAKE CABLE CONTROL LOCK CLOSED
3 - BRAKE CONTROL CABLE LOCK
4 - SAFETY BOLT
5 - INSTALLATION POSITION OF BRAKE CONTROL CABLE LOCK

INSTALLATION

(1) Push the brake control cable lock onto the brake cable (Fig. 28).
(2) Insert the safety bolt and snap shut the brake control cable lock.**Observe the installation position of the brake control cable lock (Fig. 28).**

CABLES

REMOVAL

REMOVAL - FRONT

(1) Raise and support the vehicle.
(2) Disconnect the front park brake cable from the pulley unit.
(3) Remove the front park brake cable from the hand brake lever (Fig. 29).

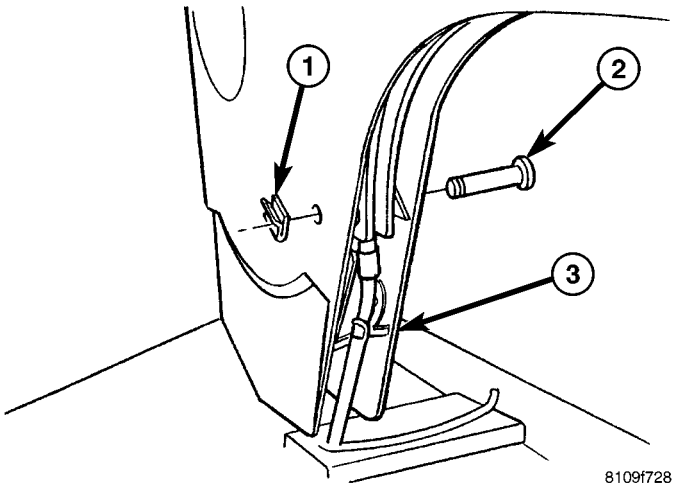


Fig. 29 FRONT PARK BRAKE CABLE AT LEVER

1 - LOCKING CLIP
2 - LOCKING PIN
3 - CABLE STRAP

(4) Unclip the guides at the frame cross members for the front cable at the vehicle (Fig. 30).
(5) Pull off the locking clips at the floor opening and pull the front brake cable down and out (Fig. 30).
(6) Press together the locking ring and pull out the front brake cable to the front (Fig. 30).
(7) Remove the front park brake cable at the vehicle using special tool 9289.

REMOVAL - REAR

(1) Raise and support the vehicle.
(2) Remove the rear tires.
(3) Remove the park brake shoes.
(4) Remove the park brake cables from the shoe (Fig. 31).
(5) Remove all the connections on the hand brake cable (Fig. 31).
(6) Remove the park brake cable lock (Fig. 31). **Observe the installed position of the brake cable lock for reference on installation.**
(7) Remove the hand brake cable from the anchor plate (Fig. 31).

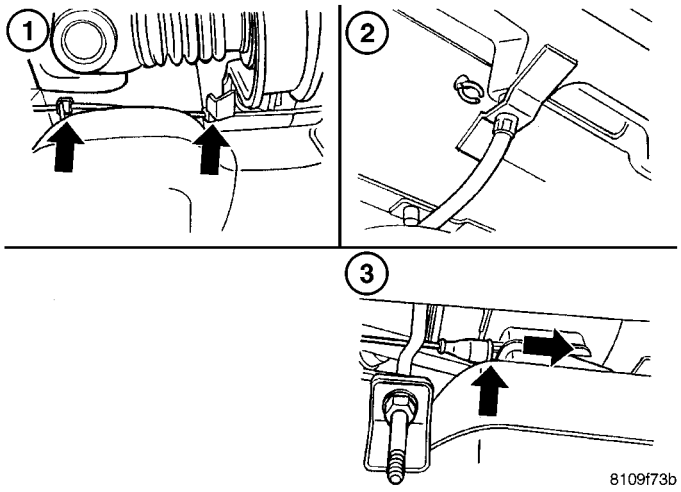


Fig. 30 REMOVING FRONT PARK BRAKE CABLE AT THE VEHICLE

1 - UNCLIP CABLE GUIDES
2 - LOCKING CLIP
3 - LOCKING RING PRESSED TOGETHER

(8) Remove the park brake cable from the vehicle. **Compress the locking ring on the pulley unit.**

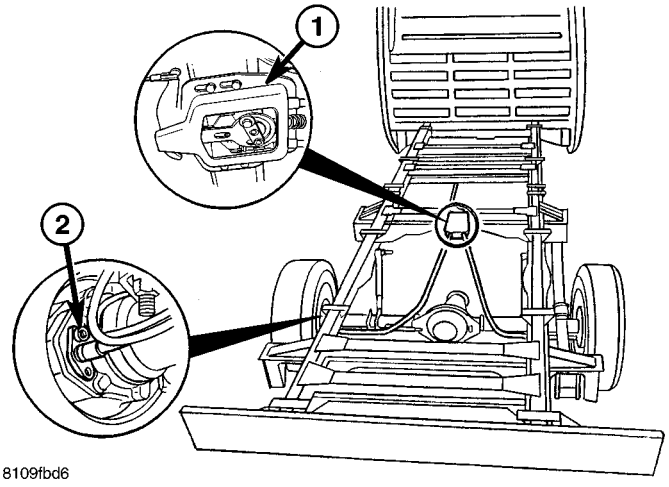


Fig. 31 REAR PARK BRAKE CABLE REMOVE / INSTALL

1 - PARK BRAKE ADJUSTER
2 - PARK BRAKE CABLE MOUNTING

INSTALLATION

INSTALLATION - FRONT

(1) Install the front park brake cable to the vehicle.
(2) Clip the cable guides at the frame cross members (Fig. 32).
(3) Install the front park brake cable to the hand brake lever (Fig. 29).
(4) Reconnect the front park brake cable to the pulley unit (Fig. 32).

CABLES (Continued)

(5) Adjust the parking park.
(6) Lower the vehicle.

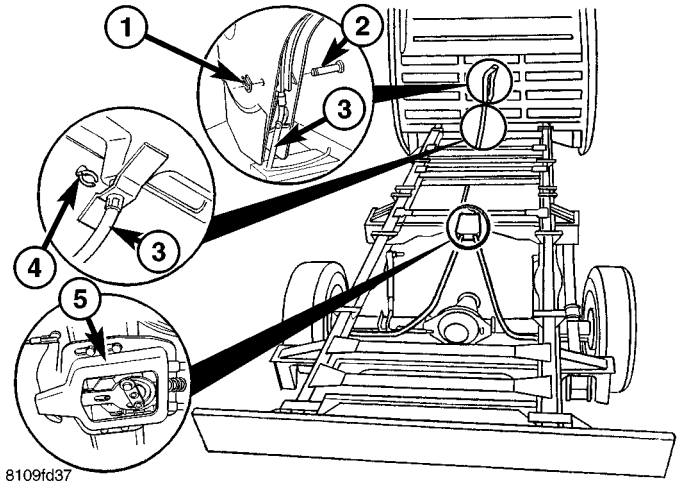


Fig. 32 FRONT PARK BRAKE CABLE

1 - RETAINING CLIP
2 - LOCKING PIN
3 - FRONT PARK BRAKE CABLE
4 - RETAINING CLIP
5 - PARK BRAKE CABLE ADJUSTER

INSTALLATION - REAR

NOTE: Route the park brake cable free of tension and the risk of chafing.

(1) Install the hand brake cable to the anchor plate (Fig. 31).
(2) Install the park brake cable lock (Fig. 31).
(3) Install all connections on the hardware cable (Fig. 31).
(4) Install the park brake cables to the shoe (Fig. 31).
(5) Install the park brake shoes.
(6) Install the rear wheels.
(7) Adjust the park brakes.
(8) Lower the vehicle.

ADJUSTMENTS

ADJUSTMENT - PARKING BRAKE CABLES

(1) Loosen the bolts of the mounting brackets (Fig. 33).
(2) Insert a drill bit or an allen wrench with a 6 mm diameter between the mounting bracket and front lever (Fig. 33).
(3) Push the mounting bracket back until the front brake cable is free of play and without tension (Fig. 33).
(4) Tighten the bolts to the mounting bracket Tighten to 25 N·m (221 in. lbs.) (Fig. 33).
(5) Remove the 6 mm diameter drill bit or allen wrench (Fig. 33).
(6) Tighten the hand brake lever one notch (Fig. 33).

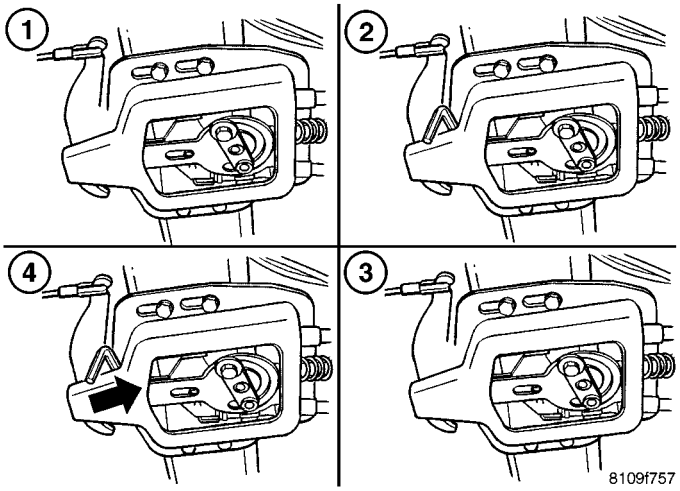


Fig. 33 PARK BRAKE ADJUSTER

1 - LOOSEN MOUNTING BOLTS
2 - 6 mm ALLEN WRENCH
3 - MOUNTING BOLTS TIGHTENED
4 - FREEPLAY WITH NO TENSION

(7) Clamp the eccentric clockwise until the wheels/ disc brake rotors can still be turned with the force of the hand (Fig. 34).
(8) Tighten the clamp bolt (Fig. 34).

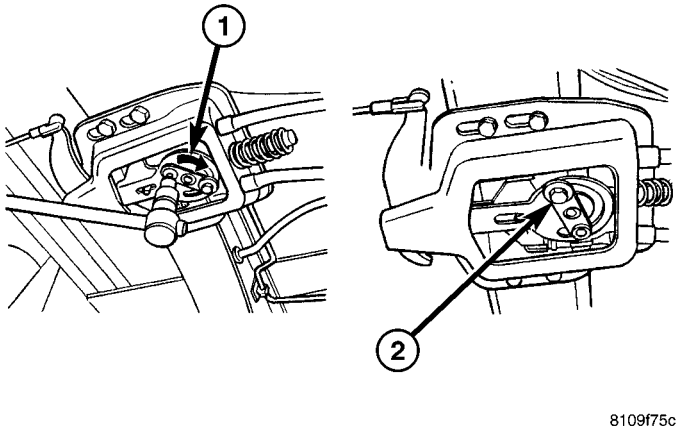


Fig. 34 PARK BRAKE ADJUSTMENT

1 - ECCENTRIC CLOCKWISE
2 - CLAMP SCREW TIGHTENED

(9) Release the hand brake lever.
(10) Check the wheel for free movement.

LEVER

REMOVAL

(1) Disconnect the front brake cable from the pulley unit.
(2) Remove the front brake cable from the hand brake lever (Fig. 29).
(3) Remove the circle cover (Fig. 35).
(4) Remove the bolts on the hand brake lever (Fig. 35).
(5) Pull the cover off the hand brake lever (Fig. 35).
(6) Disconnect the hand brake check switch and wiring harness from the hand brake lever (Fig. 35).
(7) Remove the hand brake lever (Fig. 35).

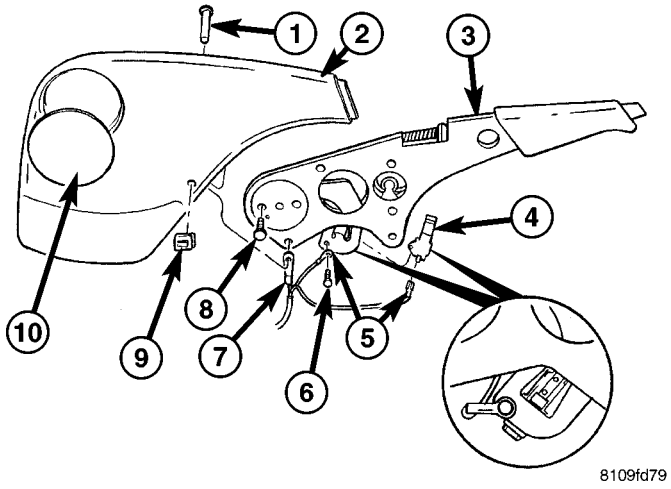


Fig. 35 HAND BRAKE LEVER

1 - LOCKING PIN
2 - COVER
3 - HAND BRAKE LEVER
4 - HAND BRAKE CHECK SWITCH
5 - WIRING HARNESS
6 - BOLT
7 - HAND BRAKE CABLE
8 - BOLT
9 - RETAINING CLIP
10 - CIRCLE COVER

INSTALLATION

(1) Install the hand brake lever (Fig. 35).
(2) Reconnect the hand brake check switch and the wiring harness to the hand brake lever (Fig. 35).
(3) Install the cover to the hand brake lever (Fig. 35).
(4) Install the bolts on the hand brake lever. Tighten to 25 N·m (221 in. lbs.) (Fig. 35).
(5) Install the circle cover (Fig. 35).
(6) Install the front brake cable to the hand brake lever.
(7) Connect the front brake cable to the pulley unit (Fig. 35).

SHOES

REMOVAL

REMOVAL - (SRW)

(1) Raise and support the vehicle.
(2) Remove the rear wheels.
(3) Remove the disc brake rotor.
(4) Disconnect the front park brake cable from the pulley unit. **Do not remove the rear park brake cables.**
(5) Remove the retracting springs using special tool 9280 (Fig. 36).
(6) Remove the adjuster (Fig. 36).
(7) Remove the pressure springs using special tool 9281 (Fig. 36).
(8) Remove the rear park brake shoes (Fig. 36). **Pull the park brake shoes apart at the bottom and remove them together with the adjuster.**

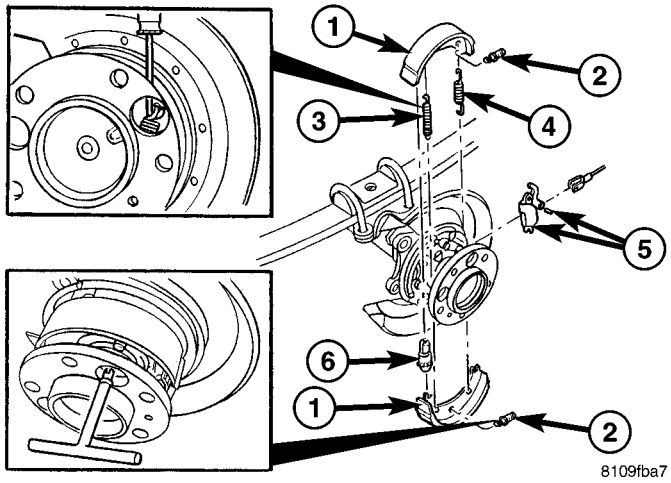


Fig. 36 PARK BRAKE SHOES

1 - PARK BRAKE SHOES
2 - PRESSURE SPRING
3 - RETRACTING SPRING (SHORT HOOK EYE)
4 - RETRACTING SPRING (LONG HOOK EYE)
5 - CABLE LOCK
6 - ADJUSTER

REMOVAL - (DRW)

(1) Raise and support the vehicle.
(2) Remove the rear wheels.
(3) Remove the wheel flange ring.
(4) Remove the disc brake rotor.
(5) Disconnect the front park brake cable from the pulley unit. **Do not remove the rear park brake cables.**
(6) Remove the retracting springs (Fig. 37).

SHOES (Continued)

(7) Remove the adjuster (Fig. 37).
(8) Remove the pressure springs (Fig. 37). by depressing with your fingers and twisting.
(9) Remove the rear park brake shoes (Fig. 37). **Pull the park brake shoes apart at the bottom and remove them together with the adjuster.**

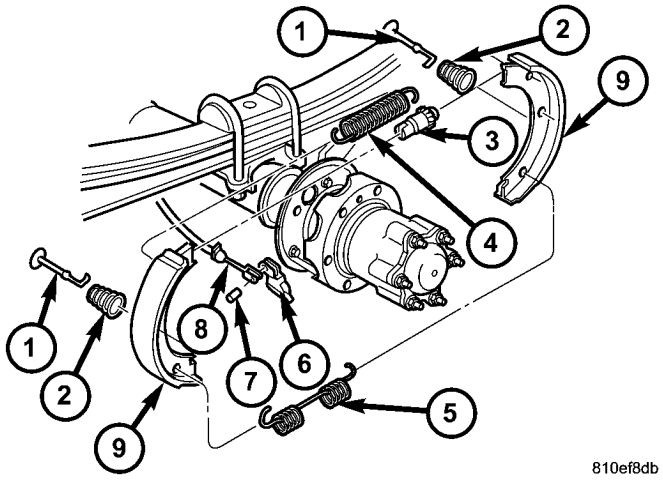


Fig. 37 PARK BRAKE SHOES WITH DUAL REAR WHEELS

1 - HOLD DOWN PIN
2 - PRESSURE SPRING
3 - ADJUSTER
4 - UPPER RETRACTING SPRING
5 - LOWER RETRACTING SPRING
6 - CABLE LOCK
7 - LOCKING PIN
8 - BRAKE CABLE
9 - PARK BRAKE SHOE

CLEANING - REAR DRUM IN HAT BRAKE

Clean the individual brake components, including the support plate exterior, with a water dampened cloth or with brake cleaner. Do not use any other cleaning agents. Remove light rust and scale from the brake shoe contact pads on the support plate with fine sandpaper.

INSTALLATION

INSTALLATION - (SRW)

NOTE: Preassemble the retracting spring with the short hook eye from the inside together with the adjuster wheel at the bottom. Fit the preassembled park brake shoes on the brake carrier.

(1) **Ensure that the cable lock moves easily before installing shoes.**Install the park brake shoes.
(2) Install the lower retracting spring using special tool 9280.
(3) Install the hold down springs using special tool 9281.
(4) Install the upper retracting spring using special tool 9280.
(5) Install the adjuster.
(6) Install the front park brake cable to the pulley unit.
(7) Install the disc brake rotor.
(8) Install the rear wheels.
(9) Adjust the parking brakes.
(10) Lower the vehicle.
(11) Pump the brake pedal several times to check the operation of the brakes before moving vehicle.

INSTALLATION - (DRW)

NOTE: Preassemble the retracting spring with the short hook eye from the inside together with the adjuster wheel at the bottom. Fit the preassembled park brake shoes on the brake carrier.

(1) **Ensure that the cable lock moves easily before installing shoes.**Install the park brake shoes.
(2) Install the lower retracting spring.
(3) Install the pressure hold down springs by depressing with your fingers and twisting to lock in place.
(4) Install the upper retracting spring.
(5) Install the adjuster.
(6) Install the front park brake cable to the pulley unit.
(7) Install the disc brake rotor.
(8) Install the rear wheel flange ring. Tighten to 200 N·m (148 ft. lbs.).
(9) Install the rear wheels.
(10) Adjust the parking brakes.
(11) Lower the vehicle.
(12) Pump the brake pedal several times to check the operation of the brakes before moving vehicle.

ADJUSTMENTS

ADJUSTMENT

(1) Raise and support the vehicle.
(2) Remove the rear wheels.
(3) Turn the adjusting wheel through the hole of the wheel lug bolt until it is no longer possible to rotate the rear wheel (Fig. 38).

SHOES (Continued)

(4) Loosen the adjusting wheel 3-4 teeth divisions (Fig. 38).

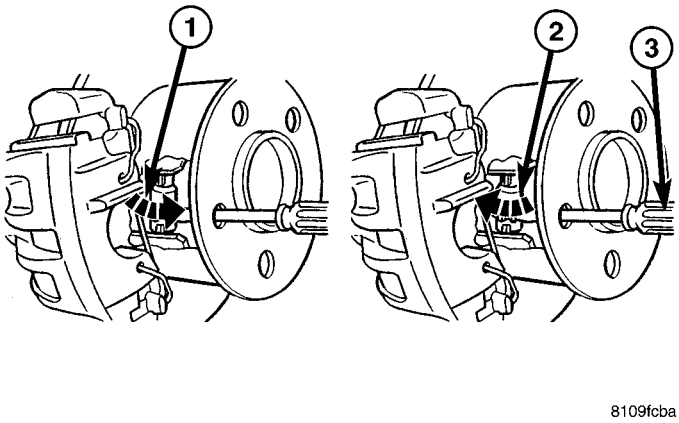


Fig. 38 STAR WHEEL ADJUSTER

1 - LEFT HAND PARK BRAKE SHOES APPLIED
2 - RIGHT HAND PARK BRAKE SHOES RELEASED
3 - FLAT BLADED TOOL

(5) Inspect the clearance, or a slight drag when rotating the wheel/rear disc brake rotor (Fig. 39).

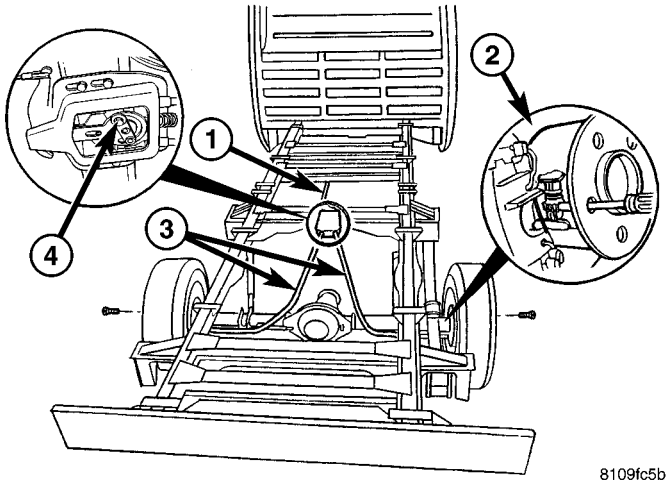


Fig. 39 ADJUSTING REAR PARK BRAKE SHOES

1 - FRONT BRAKE CABLE
2 - SHOE ADJUSTER
3 - REAR BRAKE CABLES
4 - PARK BRAKE CABLE ADJUSTER

(6) Install rear wheels.

(7) Lower the vehicle and test the park brake system to hold the vehicle.

BRAKES - ABS

TABLE OF CONTENTS

page

BRAKES - ABS
SPECIFICATIONS - TORQUE CHART 29
ELECTRICAL
DESCRIPTION 29
OPERATION 29
FRONT WHEEL SPEED SENSOR
REMOVAL 30
INSTALLATION 30
REAR WHEEL SPEED SENSOR
REMOVAL 30
INSTALLATION 31
TONE WHEEL
REMOVAL 31
INSTALLATION 31
HCU (HYDRAULIC CONTROL UNIT)
DESCRIPTION 31
REMOVAL 31
INSTALLATION 32

BRAKES - ABS

SPECIFICATIONS - TORQUE CHART

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Brake Lines To Hydraulic unit	16	—	12

ELECTRICAL

DESCRIPTION

NOTE: Wheel speed sensor should be installed all the way into the clamping bushings, the wheel speed sensor will self adjust when the vehicle is moved.

The ABS brake system uses 4 wheel speed sensors. A sensor is mounted to each front hub/bearings in the front. A rear sensor is mounted to each rear support plate.

OPERATION

The Wheel Speed Sensor consists of a magnet surrounded by windings from a single strand of wire. The sensor sends a small AC signal to the CAB. This signal is generated by magnetic induction. The magnetic induction is created when a toothed sensor ring (exciter ring or tone wheel) passes the stationary magnetic WSS.

When the ring gear is rotated, the exciter ring passes the tip of the WSS. As the exciter ring tooth approaches the tip of the WSS, the magnetic lines of force expand, causing the magnetic field to cut across the sensor's windings. This, in turn causes current to flow through the WSS circuit (Fig. 1) in one direction. When the exciter ring tooth moves away from the sensor tip, the magnetic lines of force collapse cutting the winding in the opposite direction. This causes the current to flow in the opposite direction. Every time a tooth of the exciter ring passes the tip of the WSS, an AC signal is generated. Each AC signal (positive to negative signal or sinewave) is interpreted by the CAB. It then compares the frequency of the sinewave to a time value to calculate vehicle speed. The CAB continues to monitor the frequency to determine a deceleration rate that would indicate a possible wheel-locking tendency.

The signal strength of any magnetic induction sensor is directly affected by:

- Magnetic field strength; the stronger the magnetic field, the stronger the signal

ELECTRICAL (Continued)

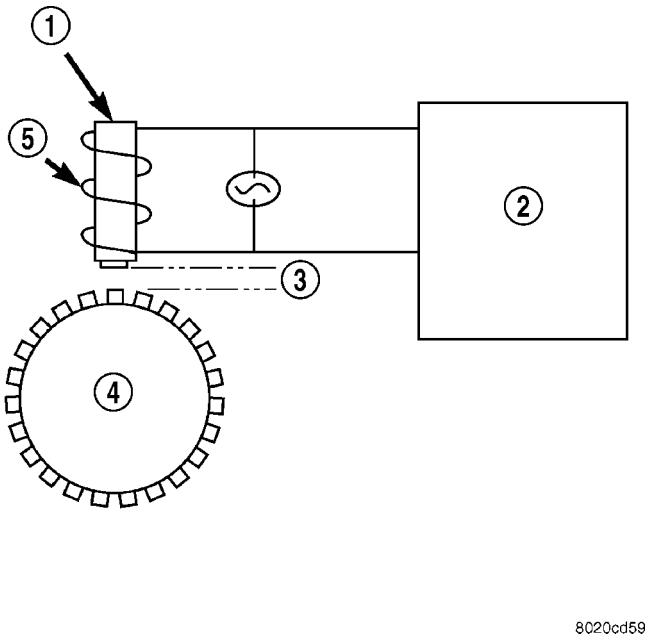


Fig. 1 Operation of the Wheel Speed Sensor

1 - MAGNETIC CORE
2 - CAB
3 - AIR GAP
4 - EXCITER RING
5 - COIL

- Number of windings in the sensor; more windings provide a stronger signal
- Exciter ring speed; the faster the exciter ring/tone wheel rotates, the stronger the signal will be
- Distance between the exciter ring teeth and WSS; the closer the WSS is to the exciter ring/tone wheel, the stronger the signal will be.

FRONT WHEEL SPEED SENSOR

REMOVAL

(1) Raise and support the vehicle.
(2) Remove the front wheels.
(3) Pull the wheel speed sensor out of the front wheel hub (Fig. 2).
(4) **Only due this step if sensor replacement is necessary.** Cut through the wheel speed sensor cable at an easily accessible point (Fig. 2)

INSTALLATION

(1) Connect separate wheel speed sensor cables with shrink-fit sleeves and shrink-fit tubing (Fig. 2).**Only due this step if replacing the sensor.**
(2) Install the wheel speed sensor all the way into the front wheel hub the wheel speed sensor will self adjust when the vehicle is moved (Fig. 2).
(3) Install the front wheels.

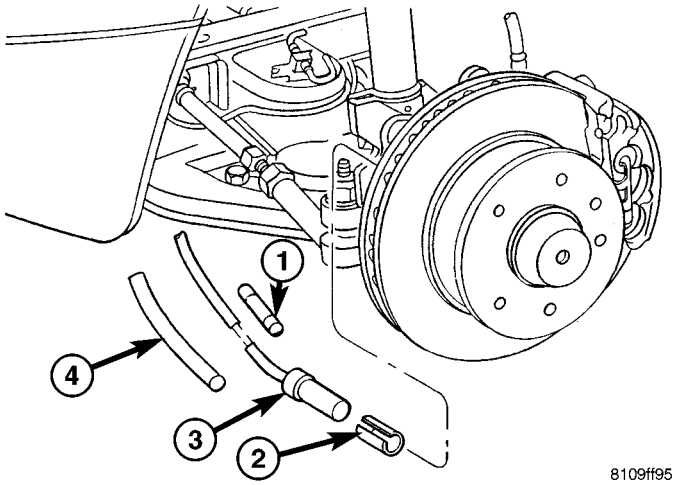


Fig. 2 FRONT WHEEL SPEED SENSOR

1 - SHRINK-FIT SLEEVE
2 - CLAMPING BUSHING
3 - SPEED SENSOR
4 - SHRINK TUBE

(4) Lower the vehicle.

REAR WHEEL SPEED SENSOR

REMOVAL

(1) Raise and support the vehicle.
(2) Remove the rear wheels.
(3) Pull the wheel speed sensor out of the mounting hole in the axle supporting tube (Fig. 3).
(4) **Only due this step if sensor replacement is necessary.** Cut through the wheel speed sensor cable at an easily accessible point (Fig. 3)

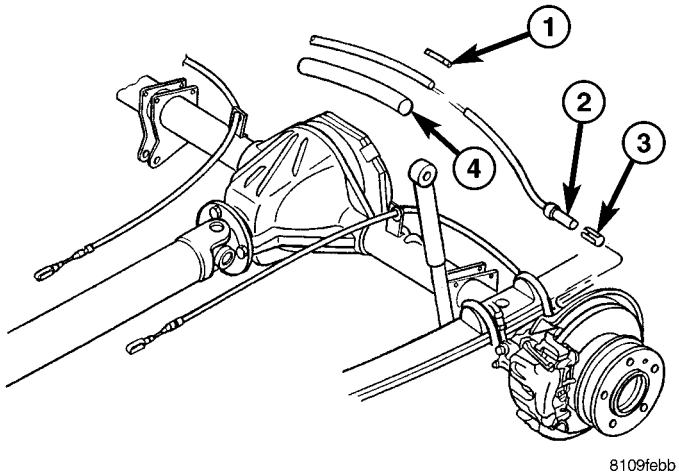


Fig. 3 REAR WHEEL SPEED SENSORS

1 - SHRINK-FIT SLEEVE
2 - SPEED SENSOR
3 - CLAMPING BUSHING
4 - SHRINK TUBE

REAR WHEEL SPEED SENSOR (Continued)

INSTALLATION

(1) Connect separate wheel speed sensor cables with shrink-fit sleeves and shrink-fit tubing (Fig. 3).**Only due this step if replacing the sensor.**

(2) Install the wheel speed sensor all the way into the axle tube, the wheel speed sensor will self adjust when the vehicle is moved (Fig. 3).

(3) Install the rear wheels.

(4) Lower the vehicle.

TONE WHEEL

REMOVAL

(1) Remove the hub/bearing assembly (DRW) (Refer to 3 - DIFFERENTIAL & DRIVELINE/REAR AXLE/AXLE BEARINGS - REMOVAL).

(2) Insert a hooked prybar between the hub/bearing and the inside of the tone wheel and pry upwards slightly and work your way around the tone wheel until the wheel is loose (Fig. 4).

(3) Remove the tone wheel.

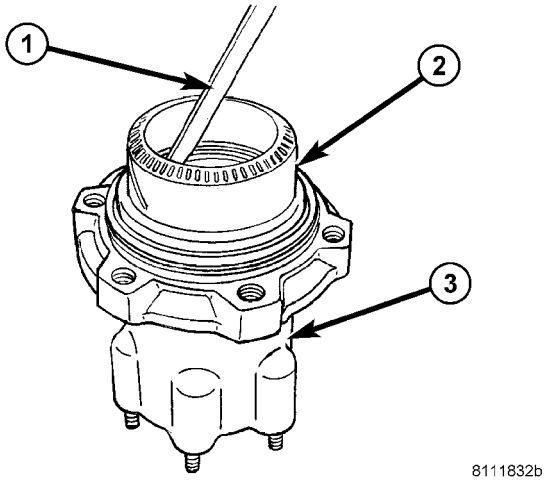


Fig. 4 TONE WHEEL REMOVAL

1 - HOOKED PRYBAR
2 - TONE WHEEL
3 - HUB/BEARING ASSEMBLY

INSTALLATION

(1) Install the tone wheel to the hub/bearing with a thin bead of silicone around the tone wheel.

(2) Tap the tone wheel down with a soft hammer until seated.

(3) Install the hub/bearing (DRW) (Refer to 3 - DIFFERENTIAL & DRIVELINE/REAR AXLE/AXLE BEARINGS - INSTALLATION).

HCU (HYDRAULIC CONTROL UNIT)

DESCRIPTION

The HCU consists of a valve body, pump motor, low pressure accumulators, inlet valves, outlet valves and noise attenuators.

REMOVAL

NOTE: Store the Hydraulic Control Unit in an upright position only.

(1) Disconnect the ground cable at the battery. **The ignition switch must be switched to the off position when disconnecting the battery cable.**

(2) Disconnect the multiplug from the control module (Fig. 5).

(3) Disconnect the brake lines from the hydraulic control unit (Fig. 5). **Mark the brake lines for reinstallation, also seal off the connections and lines to prevent contamination.**

(4) Remove the hydraulic control unit from the bracket (Fig. 5).

(5) Check the rubber mounts on the bracket. (Replace if necessary) (Fig. 5).

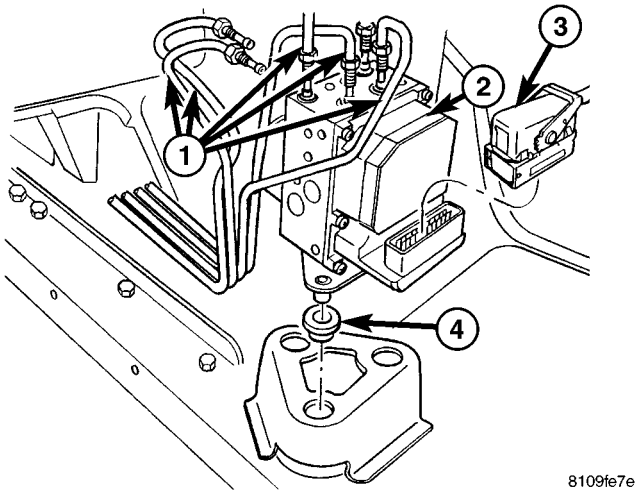


Fig. 5 HYDRAULIC CONTROL UNIT (ABS)

1 - BRAKE LINES
2 - HCU WITH CONTROL MODULE
3 - ABS/ABD CONTROL MODULE MULTIPLUG
4 - RUBBER SUPPORT

HCU (HYDRAULIC CONTROL UNIT) (Continued)

INSTALLATION

(1) Install the hydraulic control unit into the rubber mounts (Fig. 5).

(2) Reconnect the brake lines to the hydraulic control unit (Fig. 5). **Do not mix up the brake lines.** Tighten the lines to 16 N·m (142 in. lbs.)

(3) Reconnect the multiplug to the control module (Fig. 5).

(4) Reconnect the ground cable on the battery.

(5) Bleed the brake system.

(6) Check the fluid in the reservoir and correct if necessary.

(7) Perform function test.

COOLING

TABLE OF CONTENTS

page

COOLING
OPERATION—COOLING SYSTEM 1
DIAGNOSIS AND TESTING
DIAGNOSIS AND TESTING - PRELIMINARY CHECKS 1
DIAGNOSIS AND TESTING - COOLING SYSTEM 2
ACCESSORY DRIVE 5
ENGINE 9

COOLING

OPERATION—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.

DIAGNOSIS AND TESTING

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:

- 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.

TRAILER TOWING:

Consult Trailer Towing section of owners manual. Do not exceed limits.

AIR CONDITIONING; ADD-ON OR AFTER MARKET:

A maximum cooling package should have been ordered with vehicle if add-on or after market A/C is installed. If not, maximum cooling system components should be installed for model involved per manufacturer's specifications.

RECENT SERVICE OR ACCIDENT REPAIR:

Determine if any recent service has been performed on vehicle that may effect cooling system. This may be:

- Engine adjustments (incorrect timing)
- Slipping engine accessory drive belt(s)
- Brakes (possibly dragging)
- Changed parts. Incorrect water pump or pump rotating in wrong direction due to belt not correctly routed
- 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 7 - COOLING - DIAGNOSIS AND TESTING)

COOLING (Continued)

DIAGNOSIS AND TESTING - COOLING SYSTEM

COOLING SYSTEM DIAGNOSIS—DIESEL ENGINE

CONDITION	POSSIBLE CAUSES	CORRECTION
TEMPERATUREGAUGE READS LOW	1. Vehicle is equipped with a heavy duty cooling system.	1. None. System operating normaly.
	2. Temperature gauge not connected	2. Connect gauge.
	3. Temperature gauge connected but not operating.	3. Check gauge. Refer (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING)
	4. Coolant level low.	4. Fill cooling system. (Refer to 7 - COOLING - STANDARD PROCEDURE)
TEMPERATURE GAUGE READS HIGH. COOLANT MAY OR MAY NOT BE LEAKING FROM SYSTEM	1. Vehicle overloaded, high ambient (outside) temperatures with A/C turned on, stop and go driving or prolonged operation at idle speeds.	1. Temporary condition, repair not required. Notify customer of vehicle operation instructions located in Owners Manual.
	2. Temperature gauge not functioning correctly.	2. Check gauge. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING)
	3. Air traped in cooling	3. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE) and refill (Refer to 7 - COOLING - STANDARD PROCEDURE)
	4. Radiator cap faulty.	4. Replace radiator cap.
	5. Plugged A/C or radiator cooling fins.	5. Clean all debre away from A/C and radiator cooling fins.
	6. Coolant mixture incorrect.	6. Drain cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE) refill with correct mixture (Refer to 7 - COOLING - STANDARD PROCEDURE).
	7. Thermostat stuck shut.	7. Replace thermostat.
	8. Bug screen or winter front being used.	8. Remove bug screen or winter front.
	9. Viscous fan drive not operating properly.	9. Check viscous fan (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - DIAGNOSIS AND TESTING)
	10. Cylinder head gasket leaking.	10. Check for leaking head gaskets (Refer to 7 - COOLING - DIAGNOSIS AND TESTING).
	11. Heater core leaking.	11. Replace heater core.
	12. cooling system hoses leaking.	12. Tighten clamps or Replace hoses.

COOLING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
	13. Brakes dragging.	13. Check brakes. (Refer to 5 - BRAKES/HYDRAULIC/ MECHANICAL - DIAGNOSIS AND TESTING)
TEMPERATURE GAUGE READING INCONSISTENT (ERRATIC, CYCLES OR FLUCTUATES)	1. Heavy duty cooling system, extream cold ambient (outside) temperature or heater blower motor in high position.	1. None. System operating normaly.
	2. Temperature gauge or gauge sensor defective.	2. Check gauge. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING)
	3. Temporary heavy usage or load.	3. None. Normal condition.
	4. Air traped in cooling system.	4. Fill cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
	5. Water pump	5. Replace water pump.
	6. Air leak on suction side of water pump.	6. Check for leak. (Refer to 7 - COOLING - DIAGNOSIS AND TESTING)
RADIATOR CAP LEAKING STEAM AND /OR COOLANT INTO RESERVOIR BOTTLE. (TEMPERATURE GAUGE MAY READ HIGH)	1. Radiator cap defective.	1. Replace radiator cap.
	2. Radiator neck surface damaged.	2. Replace radiator.
HOSE OR HOSES COLLAPSE WHEN ENGINE IS COOLING.	1. Vacuum created in cooling system on engine cool-down is not being relieved through coolant reservior/overflow system.	1. Replace radiator cap, check vent hose between radiator and reservoir bottle for blockage also check reservoir bottle vent for blockage.
NOISY FAN	1. Fan blade(s) loose, damaged.	1. Replace fan blade assembly.
	2. Thermal viscous fan drive.	2. None. Normal condition.
	3. Fan blades striking surrounding objects.	3. Locate contact point and repair as necessary.
	4. Thermal viscous fan drive bearing.	4. Replace viscous fan drive assembly.
	5. Obstructed air flow through radiator.	5. Remove obstruction.
INADEQUATE AIR CONDITIONER PERFORMANCE (COOLING SYSTEM SUSPECTED)	1. Radiator and/or A/C condenser air flow obstructed.	1. Remove obstruction and/or clean.

COOLING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
	2. Thermal viscous fan drive not working.	2. Check fan drive. (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - DIAGNOSIS AND TESTING)
	3. Air seals around radiator damaged or missing.	3. Inspect air seals, repair or replace as necessary.
INADEQUATE HEATER PERFORMANCE. GUAGE MAY OR MAY NOT READ LOW.	1. Heavy duty cooling system, and cooler ambient temperatures.	1. None. Normal condition.
	2. Obstruction in heater hoses.	2. Remove hoses, remove obstruction.
	3. Water pump damaged.	3. Replace water pump.
HEAT ODOR	1. Damaged or missing drive line heat shields.	1. Repair or replace damaged or missing heat shields.
	2. Thermal viscous fan drive damaged.	2. Check thermal viscous fan drive. (Refer to 7 - COOLING/ENGINE/ FAN DRIVE VISCOUS CLUTCH - DIAGNOSIS AND TESTING)

ACCESSORY DRIVE

TABLE OF CONTENTS

page

BELT TENSIONERS
DESCRIPTION 5
OPERATION 5
DRIVE BELTS
DIAGNOSIS AND TESTING - ACCESSORY DRIVE BELT 5
REMOVAL 8
INSTALLATION 8

BELT TENSIONERS

DESCRIPTION

CAUTION: Do not attempt to check belt tension with a belt tension gauge on vehicles equipped with an automatic belt tensioner.

Drive belts on all engines are equipped with a spring loaded automatic belt tensioner. This tensioner maintains constant belt tension at all times and requires no maintenance or adjustment.

OPERATION

WARNING: THE AUTOMATIC BELT TENSIONER ASSEMBLY IS SPRING LOADED. DO NOT ATTEMPT TO DISASSEMBLE THE TENSIONER ASSEMBLY.

The automatic belt tensioner maintains correct belt tension using a coiled spring within the tensioner housing. The spring applies pressure to the tensioner arm pressing the arm into the belt, tensioning the belt.

If a new belt is being installed, the arrow must be within approximately 3 mm (1/8 in.) of indexing mark. Belt is considered new if it has been used 15 minutes or less. If this specification cannot be met, check for:

- The wrong belt being installed (incorrect length/ width)
- Worn bearings on an engine accessory (A/C compressor, power steering pump, water pump, idler pulley or generator)
- A pulley on an engine accessory being loose
- Misalignment of an engine accessory
- Belt incorrectly routed.

DRIVE BELTS

DIAGNOSIS AND TESTING - ACCESSORY DRIVE BELT

VISUAL DIAGNOSIS

When diagnosing serpentine accessory drive belts, small cracks that run across the ribbed surface of the belt from rib to rib (Fig. 1), are considered normal. These are not a reason to replace the belt. However, cracks running along a rib (not across) are **not** normal. Any belt with cracks running along a rib must be replaced (Fig. 1). Also replace the belt if it has excessive wear, frayed cords or severe glazing.

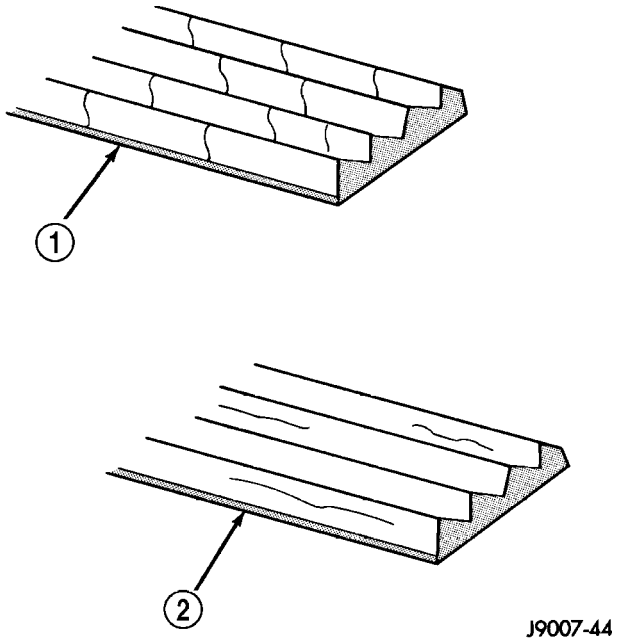


Fig. 1 Belt Wear Patterns

1 - NORMAL CRACKS BELT OK
2 - NOT NORMAL CRACKS REPLACE BELT

DRIVE BELTS (Continued)

Refer to ACCESSORY DRIVE BELT DIAGNOSIS CHART for further belt diagnosis.

NOISE DIAGNOSIS

Noises generated by the accessory drive belt are most noticeable at idle. Before replacing a belt to resolve a noise condition, inspect all of the accessory drive pulleys for contamination, alignment, glazing, or excessive end play.

ACCESSORY DRIVE BELT DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSES	CORRECTION
RIB CHUNKING (One or more ribs has separated from belt body)	1. Foreign objects imbedded in pulley grooves.	1. Remove foreign objects from pulley grooves. Replace belt.
	2. Installation damage	2. Replace belt
RIB OR BELT WEAR	1. Pulley misaligned	1. Align pulley(s)
	2. Abrasive environment	2. Clean pulley(s). Replace belt if necessary
	3. Rusted pulley(s)	3. Clean rust from pulley(s)
	4. Sharp or jagged pulley groove tips	4. Replace pulley. Inspect belt.
	5. Belt rubber deteriorated	5. Replace belt
BELT SLIPS	1. Belt slipping because of insufficient tension	1. Inspect/Replace tensioner if necessary
	2. Belt or pulley exposed to substance that has reduced friction (belt dressing, oil, ethylene glycol)	2. Replace belt and clean pulleys
	3. Driven component bearing failure (seizure)	3. Replace faulty component or bearing
	4. Belt glazed or hardened from heat and excessive slippage	4. Replace belt.
LONGITUDAL BELT CRACKING	1. Belt has mistracked from pulley groove	1. Replace belt
	2. Pulley groove tip has worn away rubber to tensile member	2. Replace belt
″GROOVE JUMPING″ (Belt does not maintain correct position on pulley)	1. Incorrect belt tension	1. Inspect/Replace tensioner if necessary
	2. Pulley(s) not within design tolerance	2. Replace pulley(s)
	3. Foreign object(s) in grooves	3. Remove foreign objects from grooves
	4. Pulley misalignment	4. Align component
	5. Belt cordline is broken	5. Replace belt

DRIVE BELTS (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
BELT BROKEN (Note: Identify and correct problem before new belt is installed)	1. Incorrect belt tension	1. Replace Inspect/Replace tensioner if necessary
	2. Tensile member damaged during belt installation	2. Replace belt
	3. Severe misalignment	3. Align pulley(s)
	4. Bracket, pulley, or bearing failure	4. Replace defective component and belt
NOISE (Objectional squeal, squeek, or rumble is heard or felt while drive belt is in operation)	1. Incorrect belt tension	1. Inspect/Replace tensioner if necessary
	2. Bearing noise	2. Locate and repair
	3. Belt misalignment	3. Align belt/pulley(s)
	4. Belt to pulley mismatch	4. Install correct belt
	5. Driven component induced vibration	5. Locate defective driven component and repair
	6. System resonent frequency induced vibration	6. Vary belt tension within specifications
TENSION SHEETING FABRIC FAILURE (Woven fabric on outside, circumference of belt has cracked or separated from body of belt)	1. Tension sheeting contacting stationary object	1. Correct rubbing condition
	2. Excessive heat causing woven fabric to age	2. Replace belt
	3. Tension sheeting splice has fractured	3. Replace belt
CORD EDGE FAILURE (Tensile member exposed at edges of belt or separated from belt body)	1. Incorrect belt tension	1. Inspect/Replace tensioner if necessary
	2. Belt contacting stationary object	2. Replace belt
	3. Pulley(s) out of tolerance	3. Replace pulley
	4. Insufficient adhesion between tensile member and rubber matrix	4. Replace belt

DRIVE BELTS (Continued)

REMOVAL

CAUTION: Do not attempt to check belt tension with a belt tension gauge on vehicles equipped with an automatic belt tensioner.

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.

(1) A 3/8 inch square hole is provided in the automatic belt tensioner. Attach a 3/8 inch drive-long handle ratchet to this hole (Fig. 2).

(2) Rotate ratchet and tensioner assembly counterclockwise (as viewed from front) until tension has been relieved from belt (Fig. 2).

(3) Remove belt from water pump pulley first.

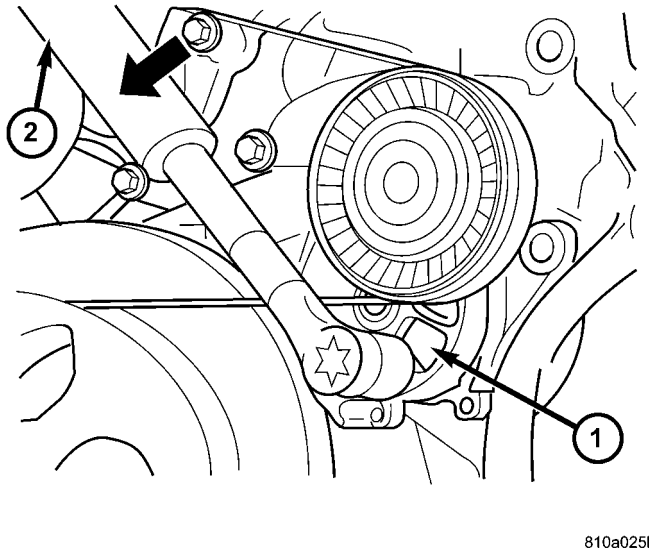


Fig. 2 DRIVE BELT TENSIONER

1 - ACCESSORY DRIVE BELT TENSIONER
2 - RATCHET WRENCH

(4) Remove belt from vehicle.

INSTALLATION

CAUTION: When installing the accessory drive belt, the belt must be the correct length and routed correctly. If not, engine may overheat due to water pump rotating in wrong direction.

(1) Position drive belt over all pulleys **except** water pump pulley (Fig. 3).

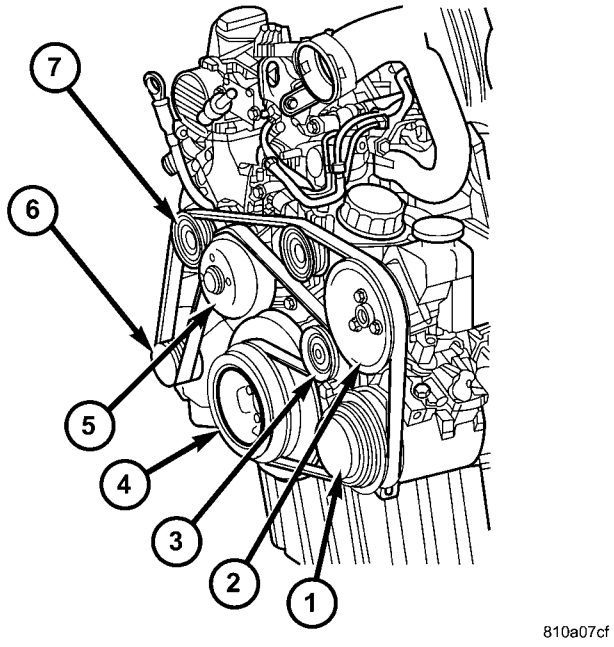


Fig. 3 ACCESSORY DRIVE BELT ROUTING

1 - A/C COMPRESSOR
2 - POWER STEERING
3 - DRIVE BELT TENSIONER
4 - CRANKSHAFT PULLEY
5 - WATER PUMP PULLEY
6 - GENERATOR
7 - IDLER PULLEY

(2) Attach a 3/8 inch ratchet to tensioner.

(3) Rotate ratchet and belt tensioner counterclockwise. Place belt over water pump pulley. Let tensioner rotate back into place. Remove ratchet. Be sure belt is properly seated on all pulleys.

ENGINE

TABLE OF CONTENTS

page

COOLANT
DESCRIPTION 9
DIAGNOSIS AND TESTING - COOLING SYSTEM LEAKS 10
STANDARD PROCEDURE
STANDARD PROCEDURE - ADDING ADDITIONAL COOLANT 11
STANDARD PROCEDURE - DRAINING COOLING SYSTEM 12
STANDARD PROCEDURE - REFILLING COOLING SYSTEM 12
COOLANT LEVEL SENSOR
REMOVAL 13
INSTALLATION 13
RADIATOR FAN
REMOVAL 13
INSTALLATION 13
ENGINE BLOCK HEATER
REMOVAL 14
INSTALLATION 14
ENGINE COOLANT TEMP SENSOR
DESCRIPTION 14

page

REMOVAL 14
INSTALLATION 15
ENGINE COOLANT THERMOSTAT
REMOVAL 15
INSTALLATION 16
FAN DRIVE VISCOUS CLUTCH
REMOVAL 16
INSTALLATION 16
RADIATOR
REMOVAL 16
INSTALLATION 17
RADIATOR PRESSURE CAP
DESCRIPTION 18
OPERATION 18
DIAGNOSIS AND TESTING - RADIATOR PRESSURE CAP 19
WATER PUMP
REMOVAL 19
INSTALLATION 20

COOLANT

DESCRIPTION

Coolant flows through the engine water jackets and cylinder heads absorbing heat produced by the engine during 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 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 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 char-

COOLANT (Continued)

acteristics 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.

DIAGNOSIS AND TESTING - COOLING SYSTEM LEAKS

ULTRAVIOLET LIGHT METHOD

A leak detection additive is available through the parts department that can be added to cooling system. The additive is highly visible under ultraviolet light (black light). Pour one ounce of additive into cooling system. Place heater control unit in HEAT position. Start and operate engine until radiator upper hose is warm to touch. Aim the commercially available black light tool at components to be checked. If leaks are present, black light will cause additive to glow a bright green color.

The black light can be used in conjunction with a pressure tester to determine if any external leaks exist (Fig. 1).

PRESSURE TESTER METHOD

The engine should be at normal operating temperature. Recheck the system cold if cause of coolant loss is not located during the warm engine examination.

WARNING: HOT, PRESSURIZED COOLANT CAN CAUSE INJURY BY SCALDING.

Carefully remove coolant recovery pressure container cap and check coolant level. Push down on cap to disengage it from stop tabs. Wipe inside of container and examine lower inside sealing seat for nicks, cracks, paint, dirt and solder residue. Inspect radiator-to- pressure container hose for internal obstructions. Insert a wire through the hose to be sure it is not obstructed.

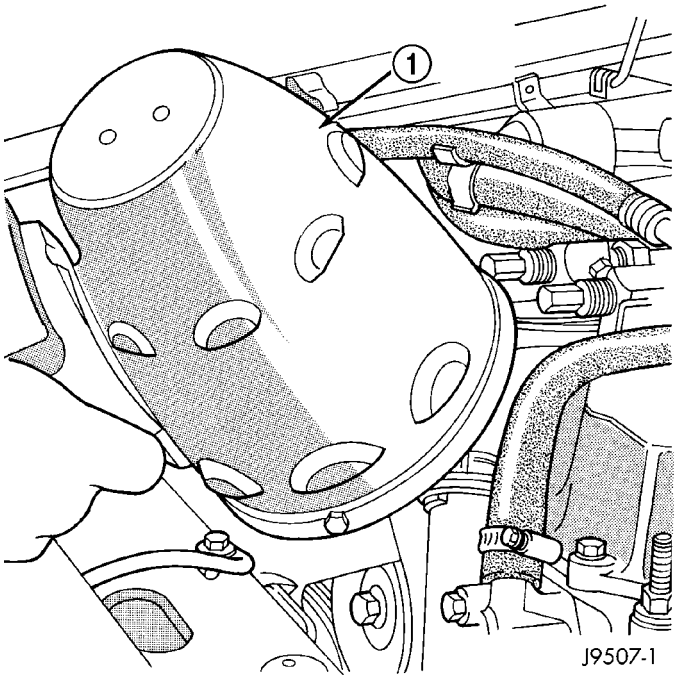


Fig. 1 Leak Detection Using Black Light - Typical

1 - TYPICAL BLACK LIGHT TOOL

Inspect cams on outside of pressure container. If cams are damaged, seating of pressure cap valve and tester seal will be affected.

Attach pressure tester (7700 or an equivalent) to coolant pressure container (Fig. 2).

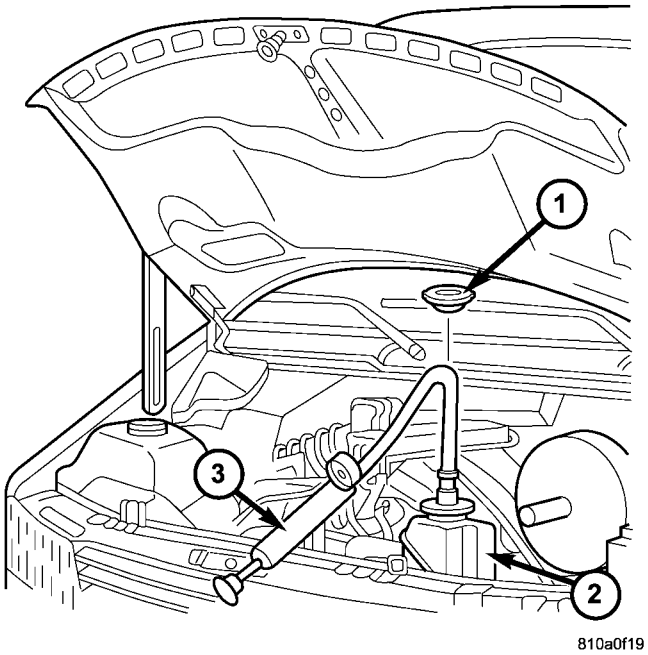


Fig. 2 PRESSURE TESTING

1 - PRESSURE RESERVOIR CAP
2 - PRESSURE RESERVOIR
3 - PRESSURE TESTER

COOLANT (Continued)

Operate tester pump to apply 103.4 kPa (15 psi) pressure to system. If hoses enlarge excessively or bulges while testing, replace as necessary. Observe gauge pointer and determine condition of cooling system according to following criteria:

Holds Steady: If pointer remains steady for two minutes, serious coolant leaks are not present in system. However, there could be an internal leak that does not appear with normal system test pressure. If it is certain that coolant is being lost and leaks cannot be detected, inspect for interior leakage or perform Internal Leakage Test.

Drops Slowly: Indicates a small leak or seepage is occurring. Examine all connections for seepage or slight leakage with a flashlight. Inspect radiator, hoses, gasket edges and heater. Seal small leak holes with a Sealer Lubricant (or equivalent). Repair leak holes and inspect system again with pressure applied.

Drops Quickly: Indicates that serious leakage is occurring. Examine system for external leakage. If leaks are not visible, inspect for internal leakage. Large radiator leak holes should be repaired by a reputable radiator repair shop.

INTERNAL LEAKAGE INSPECTION

Remove engine oil pan drain plug and drain a small amount of engine oil. If coolant is present in the pan, it will drain first because it is heavier than oil. An alternative method is to operate engine for a short period to churn the oil. After this is done, remove engine dipstick and inspect for water globules. Also inspect transmission dipstick for water globules and transmission fluid cooler for leakage.

WARNING: WITH RADIATOR PRESSURE TESTER TOOL INSTALLED ON RADIATOR, DO NOT ALLOW PRESSURE TO EXCEED 110 KPA (20 PSI). PRESSURE WILL BUILD UP QUICKLY IF A COMBUSTION LEAK IS PRESENT. TO RELEASE PRESSURE, ROCK TESTER FROM SIDE TO SIDE. WHEN REMOVING TESTER, DO NOT TURN TESTER MORE THAN 1/2 TURN IF SYSTEM IS UNDER PRESSURE.

Operate engine without pressure cap on coolant container until thermostat opens. Attach a Pressure Tester to container. If pressure builds up quickly it indicates a combustion leak exists. This is usually the result of a cylinder head gasket leak or crack in engine. Repair as necessary.

If there is not an immediate pressure increase, pump the Pressure Tester. Do this until indicated pressure is within system range of 110 kPa (16 psi). Fluctuation of gauge pointer indicates compression or combustion leakage into cooling system.

Because the vehicle is equipped with a catalytic converter, **do not** remove spark plug cables or short out cylinders to isolate compression leak.

If the needle on dial of pressure tester does not fluctuate, race engine a few times to check for an abnormal amount of coolant or steam. This would be emitting from exhaust pipe. Coolant or steam from exhaust pipe may indicate a faulty cylinder head gasket, cracked engine cylinder block or cylinder head.

A convenient check for exhaust gas leakage into cooling system is provided by a commercially available Block Leak Check tool. Follow manufacturers instructions when using this product.

COMBUSTION LEAKAGE TEST - WITHOUT PRESSURE TESTER

DO NOT WASTE reusable coolant. If solution is clean, drain coolant into a clean and suitably marked container for reuse.

WARNING: DO NOT REMOVE CYLINDER BLOCK DRAIN PLUGS OR LOOSEN RADIATOR DRAIN WITH SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR.

Drain sufficient coolant to allow thermostat removal.

Remove accessory drive belt.

Add coolant to pressure container to bring level to within 6.3 mm (1/4 in) of top of thermostat housing.

CAUTION: Avoid overheating. Do not operate engine for an excessive period of time. Open draincock immediately after test to eliminate boil over.

Start engine and accelerate rapidly three times, to approximately 3000 rpm while observing coolant. If internal engine combustion gases are leaking into cooling system, bubbles will appear in coolant. If bubbles do not appear, internal combustion gas leakage is not present.

STANDARD PROCEDURE

STANDARD PROCEDURE - ADDING ADDITIONAL COOLANT

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

COOLANT (Continued)

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

STANDARD PROCEDURE - DRAINING COOLING SYSTEM

WARNING: DO NOT REMOVE THE CYLINDER BLOCK DRAIN PLUG OR LOOSEN THE RADIATOR DRAIN PLUG WITH SYSTEM HOT AND UNDER PRESSURE. SERIOUS BURNS FROM COOLANT CAN OCCUR.

(1) DO NOT remove coolant recovery pressure container cap first. With engine cold, raise vehicle on a hoist and locate radiator draincock.

NOTE: Radiator draincock is located on the left/ lower side of radiator.

(2) Attach one end of a hose to the draincock (Fig. 3). Put the other end into a clean and appropriately marked container. Open draincock and drain coolant from radiator. This will empty the coolant recovery pressure container first. The coolant does not have to be removed from the container unless the system is being refilled with a fresh mixture. When container is empty, remove cap and continue draining cooling system.

To drain the engine of coolant, loosen the cylinder block drain plug located on the side of cylinder block (Fig. 3).

STANDARD PROCEDURE - REFILLING COOLING SYSTEM

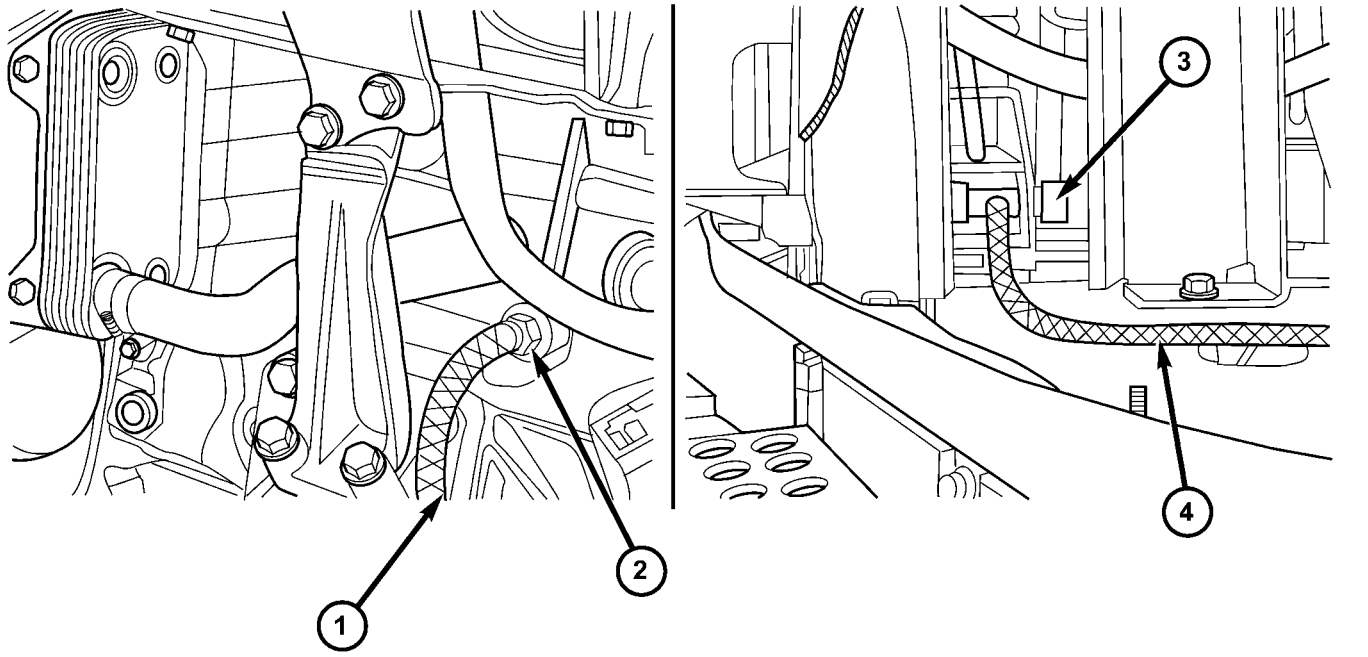
(1) Tighten the radiator drain and the cylinder block drain plug(s) (if removed). Tighten the engine drain plug to 22 lbs. ft. (30 N·m)

(2) Fill system using a 50/50 mixture of ethylene-glycol antifreeze and low mineral content water. Fill radiator to top and add sufficient coolant to the coolant recovery pressure container to raise level to COLD MINIMUM mark.

(3) With heater control unit in the HEAT position, operate engine with container cap in place.

(4) After engine has reached normal operating temperature, shut engine off and allow it to cool. When engine is cooling down, coolant will be drawn into the radiator from the pressure container.

(5) Add coolant to pressure container as necessary. **Only add coolant to the container when the engine is cold. Coolant level in a warm engine will be higher due to thermal expansion.** To purge the cooling system of all air, this heat up/cool down cycle (adding coolant to cold engine) must be performed three times. Add necessary coolant to raise container level to the COLD MINIMUM mark after each cool down period.



810a0bfc

Fig. 3 DRAINING COOLANT SYSTEM

1 - DRAIN HOSE
2 - ENGINE DRAIN PLUG
3 - RADIATOR DRAIN PLUG
4 - DRAIN HOSE

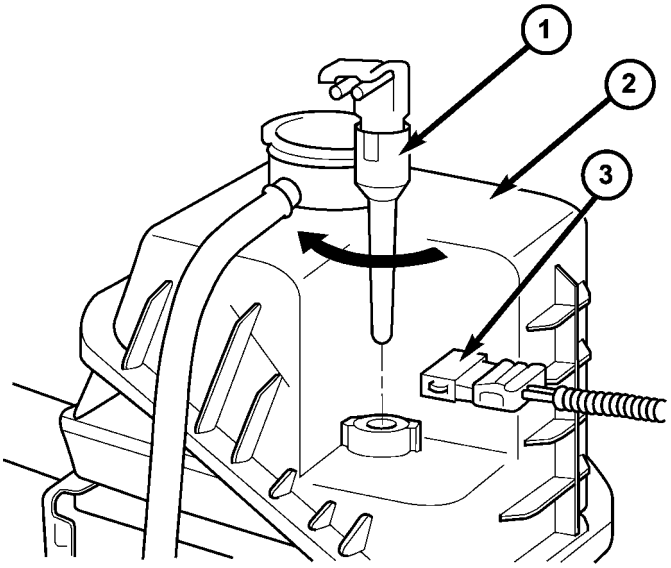
COOLANT LEVEL SENSOR

REMOVAL

WARNING: RISK OF INJURY TO SKIN AND EYES DUE TO SCALDING FROM HOT COOLANT. DO NOT OPEN THE COOLING SYSTEM UNLESS THE TEMPERATURE IS BELOW 194°F (90°C). WEAR PROTECTIVE CLOTHING AND EYE WEAR. RISK OF POISONING IF COOLANT IS SWALLOWED. STORE COOLANT IN PROPER AND APPROPRIATELY MARKED CONTAINERS.

NOTE: Drain coolant from radiator drain plug only.

(1) Drain coolant until the coolant reservoir is emptied.
(2) Disconnect the wiring harness electrical connector.
(3) Turn the level sensor 90 degrees clockwises, lift up and out of the container.



810a125d

Fig. 4 COOLANT LEVEL SENSOR

1 - COOLANT LEVEL SENSOR
2 - COOLANT RESERVIOR
3 - ELECTRICAL CONNECTOR

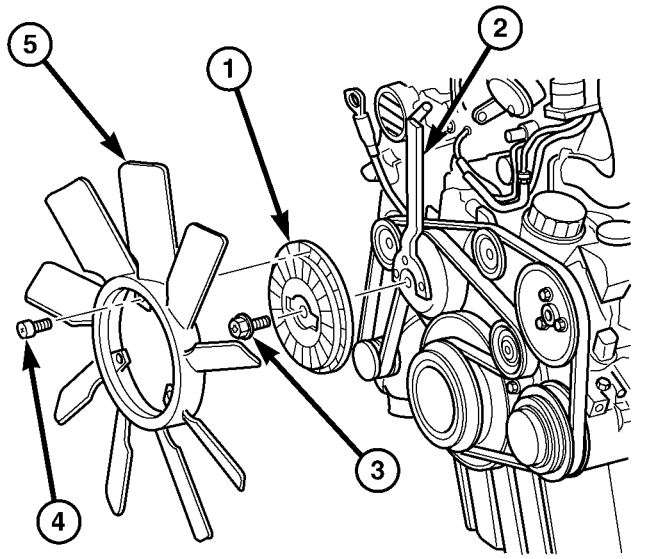
INSTALLATION

(1) Align coolant level sensor with coolant reservior access whole, press down while turning counterclockwise 90 degrees to seat sensor (Fig. 4).
(2) Connect coolant level sensor electrical connector (Fig. 4).
(3) Refill cooling system to proper level.
(4) Inspect for leaks.

RADIATOR FAN

REMOVAL

(1) Disconnect the negative battery cable.
(2) Remove the front end cross member.
(3) Push complete radiator assembly forward and unclip the fan shroud at the radiator.
(4) Detach coolant line from lower radiator shroud.
(5) Retain accessory drive belt pulley of water pump with a counterholder (Fig. 5).



810a5185

Fig. 5 RADIATOR FAN

1 - VISCOUS CLUTCH
2 - COUNTERHOLDER
3 - CLUTCH BOLT
4 - FAN BOLT
5 - FAN

(6) Unscrew the central bolt of the viscous fan clutch and lift fan and shroud up and out (Fig. 5).

NOTE: Store the viscous fan clutch in the upright position. DO NOT place down flat.

(7) Remove radiator fan from viscous fan clutch (Fig. 5).

INSTALLATION

(1) Install fan blade to viscous clutch. Tighten bolts to 80 lbs. in. (9 N·m) (Fig. 5).
(2) Install fan and clutch along with fan shroud in to engine bay area (Fig. 5).
(3) Install the center bolt of the viscous clutch. Tighten bolt to 33 lbs. ft. (45 N·m) (Fig. 5)
(4) Attach coolant line to lower radiator shroud.
(5) Properly align and clip the fan shroud into place.

RADIATOR FAN (Continued)

(6) Properly align the radiator assembly and install the front end cross member.
(7) Connect negative battery cable.

ENGINE BLOCK HEATER

REMOVAL

WARNING: RISK OF INJURY TO SKIN AND EYES DUE TO SCALDING FROM HOT COOLANT. DO NOT OPEN THE COOLING SYSTEM UNLESS THE TEMPERATURE IS BELOW 194°F (90°C). WEAR PROTECTIVE CLOTHING AND EYE WEAR. RISK OF POISONING IF COOLANT IS SWALLOWED. STORE COOLANT IN PROPER AND APPROPRIATELY MARKED CONTAINERS.

(1) Disconnect the negative battery cable.
(2) Drain the cooling system.
(3) Record the location and snip the wire ties.
(4) Unscrew the engine block heater from the core plug hole and remove (Fig. 6).

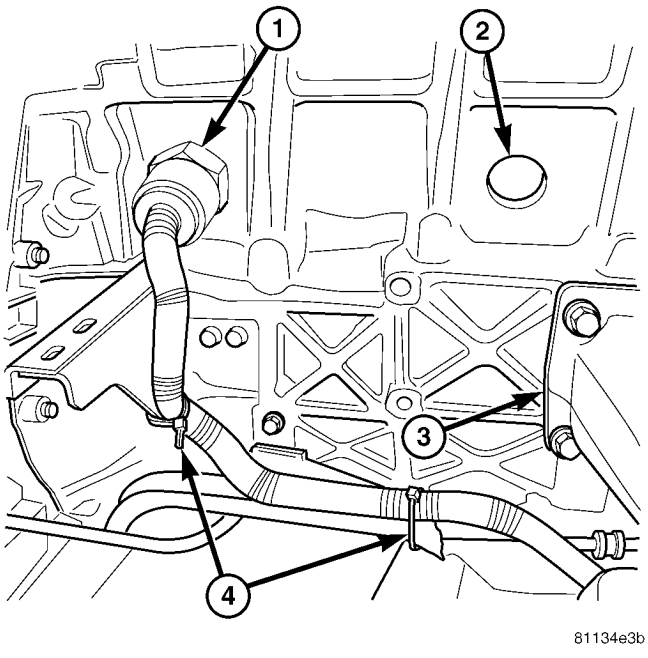


Fig. 6 ENGINE BLOCK HEATER

1 - ENGINE BLOCK HEATER
2 - CORE PLUG
3 - ENGINE MOUNT
4 - WIRING TIE STRAPS

INSTALLATION

(1) Screw the block heater into the appropriate core hole (Fig. 6).
(2) Route the heater wiring harness away from and interference and secure with wiring tie straps.
(3) Refill the cooling system.
(4) Connect the negative battery cable.
(5) Start the engine and inspect for leaks.

ENGINE COOLANT TEMP SENSOR

DESCRIPTION

The ECM determines the operating temperature of the engine by using the signal from the coolant temperature sensor. The coolant temperature sensor has a negative temperature coefficient (NTC) resistor contained in the plastic housing. NTC means; the higher the temperature, then the lower the resistance. The ECM also uses the coolant temperature sensor signal to calculate glow plug relay triggering. If the coolant temperature sensor fails during operation, the ECM will switch on the cooling fan to prevent engine overheating (A/C models only).

REMOVAL

WARNING: RISK OF INJURY TO SKIN AND EYES FROM SCALDING WITH HOT COOLANT. RISK OF POISONING FROM SWALLOWING COOLANT. DO NOT OPEN COOLING SYSTEM UNLESS COOLANT TEMPERATURE IS BELOW 90°C. OPEN CAP SLOWLY TO RELEASE PRESSURE. STORE COOLANT IN SUITABLE AND APPROPRIATELY MARKED CONTAINER. WEAR PROTECTIVE GLOVES, CLOTHES AND EYE WEAR.

(1) Disconnect negative battery cable.
(2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).
(3) Partailly drain coolant system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
(4) Unplug coolant temperature sensor electrical connector.

ENGINE COOLANT TEMP SENSOR (Continued)

NOTE: Capture any residual coolant that may flow.

(5) Remove coolant temperature sensor (Fig. 7).

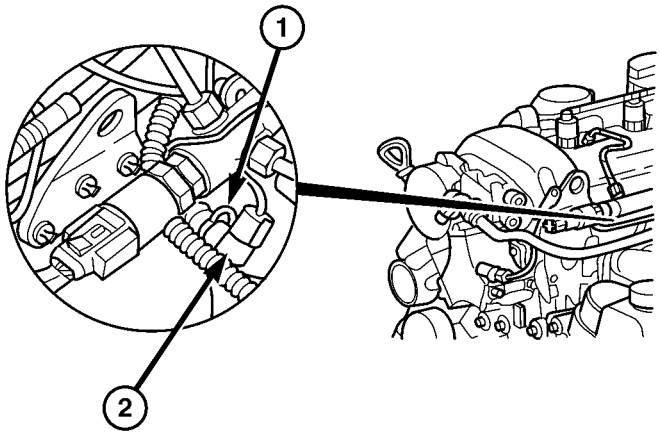


Fig. 7 ENGINE COOLANT TEMPERATURE SENSOR

1 - RETAINING CLAMP
2 - ENGINE COOLANT TEMPERATURE SENSOR

INSTALLATION

WARNING: RISK OF INJURY TO SKIN AND EYES FROM SCALDING WITH HOT COOLANT. RISK OF POISONING FROM SWALLOWING COOLANT. DO NOT OPEN COOLING SYSTEM UNLESS COOLANT TEMPERATURE IS BELOW 90°C (194°F). OPEN CAP SLOWLY TO RELEASE PRESSURE. STORE COOLANT IN SUITABLE AND APPROPRIATELY MARKED CONTAINER. WEAR PROTECTIVE GLOVES, CLOTHES AND EYE WEAR.

(1) Position and install coolant temperature sensor (Fig. 7).
(2) Connect coolant temperature sensor electrical connector (Fig. 7).
(3) Refill coolant system to proper level with proper mixture of coolant (Refer to 7 - COOLING/ ENGINE/COOLANT - STANDARD PROCEDURE).
(4) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).
(5) Connect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH FAN. DO NOT PUT YOUR HANDS NEAR PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

(6) Start engine and inspect for leaks.

ENGINE COOLANT THERMOSTAT

REMOVAL

WARNING: RISK OF INJURY TO SKIN AND EYES FROM SCALDING WITH HOT COOLANT. RISK OF POISONING FROM SWALLOWING COOLANT. DO NOT OPEN COOLING SYSTEM UNLESS COOLANT TEMPERATURE IS BELOW 90°C (194°F). OPEN CAP SLOWLY TO RELEASE PRESSURE. STORE COOLANT IN SUITABLE AND APPROPRIATELY MARKED CONTAINER. WEAR PROTECTIVE GLOVES, CLOTHES AND EYE WEAR.

NOTE: Inspect condition of all clamps and hoses, replace as necessary.

(1) Disconnect negative battery cable.
(2) Drain engine coolant (Refer to 7 - COOLING/ ENGINE/COOLANT - STANDARD PROCEDURE).
(3) Unplug connector, pull off locking element and pull out coolant temperature sensor.
(4) Detach air intake hose at charge air distribution pipe.
(5) Detach coolant hoses at thermostat housing.
(6) Remove bracket for fuel line.
(7) Unscrew cap at oil filter housing.
(8) Remove thermostat housing (Fig. 8).
(9) Clean all sealing surfaces.

ENGINE COOLANT THERMOSTAT (Continued)

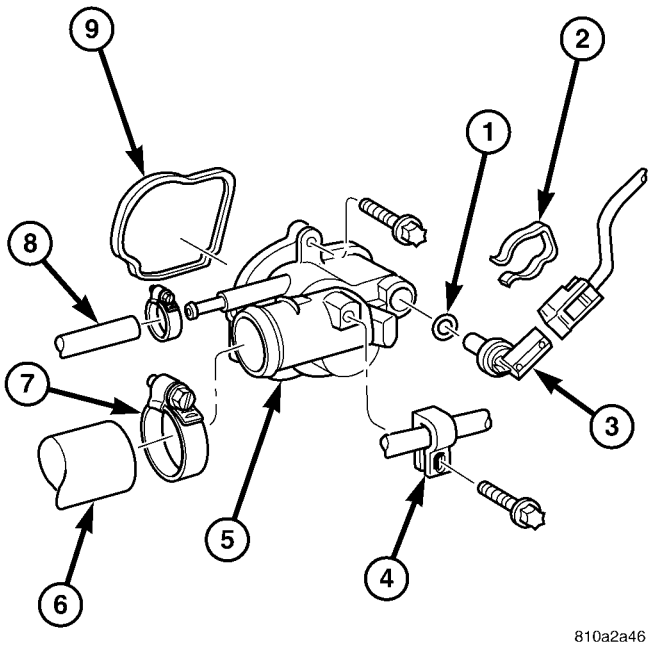


Fig. 8 THERMOSTAT HOUSING ASSEMBLY

1 - O-RING
2 - CLAMP
3 - COOLANT TEMPERATURE SENSOR
4 - FUEL LINE W/BRACKET
5 - THERMOSTAT HOUSING ASSEMBLY
6 - COOLANT HOSE
7 - CLAMP
8 - COOLANT HOSE
9 - GASKET

INSTALLATION

(1) Clean all sealing surfaces.

(2) Position and install thermostat housing with new gasket (Fig. 8). Tighten bolts to 9N·m (80 lbs.in.).

NOTE: Inspect condition of all clamps and hoses, replace as necessary.

(3) Install cap at oil filter housing.

(4) Connect coolant hoses and vent hose (Fig. 8).

(5) Install bracket for fuel line (Fig. 8).

(6) Attach air intake hose at charge air distribution pipe.

(7) Close coolant drain.

(8) Connect negative battery cable.

(9) Fill coolant system to proper level with appropriate coolant mixture (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

WARNING: USE EXTREME CAUTION WHEN ENGINE IS OPERATING. DO NOT STAND IN DIRECT LINE WITH FAN. DO NOT PUT YOUR HANDS NEAR PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

(10) Start engine and inspect for leaks.

FAN DRIVE VISCOUS CLUTCH

REMOVAL

(1) For fan drive viscous clutch removal refer to (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - REMOVAL).

INSTALLATION

(1) For fan drive viscous clutch installation refer to (Refer to 7 - COOLING/ENGINE/RADIATOR FAN - INSTALLATION).

RADIATOR

REMOVAL

WARNING: RISK OF INJURY TO SKIN AND EYES FROM SCALDING WITH HOT COOLANT. RISK OF POISONING FROM SWALLOWING COOLANT. DO NOT OPEN COOLING SYSTEM UNLESS COOLANT TEMPERATURE IS BELOW 90°C (194°F). OPEN CAP SLOWLY TO RELEASE PRESSURE. STORE COOLANT IN SUITABLE AND APPROPRIATELY MARKED CONTAINER. WEAR PROTECTIVE GLOVES, CLOTHES AND EYE WEAR.

NOTE: Capture all residual fluid spillage and store in suitably marked containers. Inspect condition of all clamps and hoses, replace as necessary.

(1) Drain coolant from radiator only(Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(2) Remove headlamp.

(3) Remove front cross member together with front grille.

(4) Remove front bumper.

(5) Evacuate air conditioning.

(6) Remove A/C condenser.

(7) Detach charge air hose at turbocharger (Fig. 9).

(8) Detach charge air hose at air intake pipe (Fig. 9).

(9) Detach air intake pipe at the body (Fig. 9).

(10) Detach coolant hoses at the coolant reservoir (Fig. 9).

(11) Unplug wiring connector at coolant level sensor (Fig. 9).

(12) Drain steering gear oil from reservoir of power steering pump.

(13) Detach the hydraulic oil hose at reservoir of power steering pump.

(14) Detach the hydraulic oil hose at hydraulic oil line.

RADIATOR (Continued)

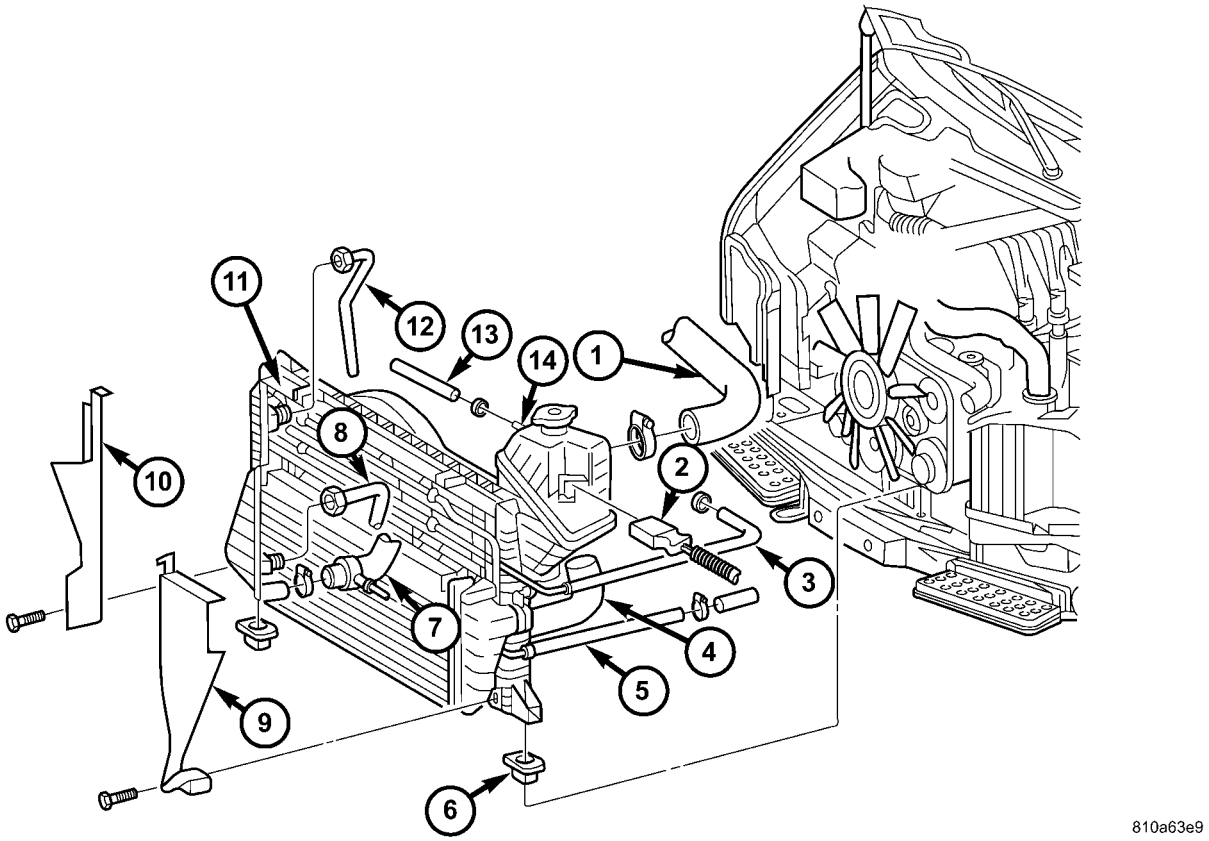


Fig. 9 RADIATOR ASSEMBLY

1 - COOLANT HOSE
2 - SENSOR HARNESS CONNECTOR
3 - HYDRAULIC HOSE
4 - CHARGE AIR HOSE
5 - HYDRAULIC HOSE
6 - RUBBER GROMMET
7 - COOLANT HOSE
8 - ATF LINE
9 - LEFT RADIATOR TRIM PANEL
10 - RIGHT RADIATOR TRIM PANEL
11 - RADIATOR
12 - ATF LINE
13 - COOLANT HOSE
14 - COOLANT RESERVOIR

(15) Detach coolant hose at bottom right of radiator (Fig. 9).
(16) Detach transmission cooler lines (Fig. 9).
(17) Remove the radiator trim from the left and right (Fig. 9).
(18) Lift the radiator assembly up and out of the rubber grommets (Fig. 9).
(19) Remove top radiator trim.
(20) Take off charge air cooler together with cooling loop of the steering at the radiator (Fig. 10).
(21) Remove bottom radiator trim (Fig. 10).
(22) Detach coolant hose at radiator.
(23) Detach coolant pipe together with coolant hose at the fan shroud.
(24) Remove radiator fan shroud (Fig. 10).

INSTALLATION

(1) Install fan shroud to radiator (Fig. 10).
(2) Attach coolant pipe with hoses to fan shroud (Fig. 10).
(3) Attach coolant hose at radiator (Fig. 10).
(4) Install bottom radiator trim (Fig. 10).
(5) Install charge air cooler along with cooling loop of the power steering, to radiator (Fig. 10).
(6) Install radiator assembly into the rubber grommets (Fig. 9).
(7) Install both right and left side radiator trim panels (Fig. 9).
(8) Attach the transmission cooler lines (Fig. 9).
(9) Attach coolant hose to the bottom right of the radiator (Fig. 9).
(10) Attach both power steering hydraulic lines (Fig. 9).
(11) Connect coolant level sensor electrical connector (Fig. 9).
(12) Connect coolant hoses to the coolant reservoir, radiator and water pump (Fig. 9).
(13) Attach air intake pipe at the body.
(14) Attach charge air hose at air intake.
(15) Attach charge air hose at turbocharger.

RADIATOR (Continued)

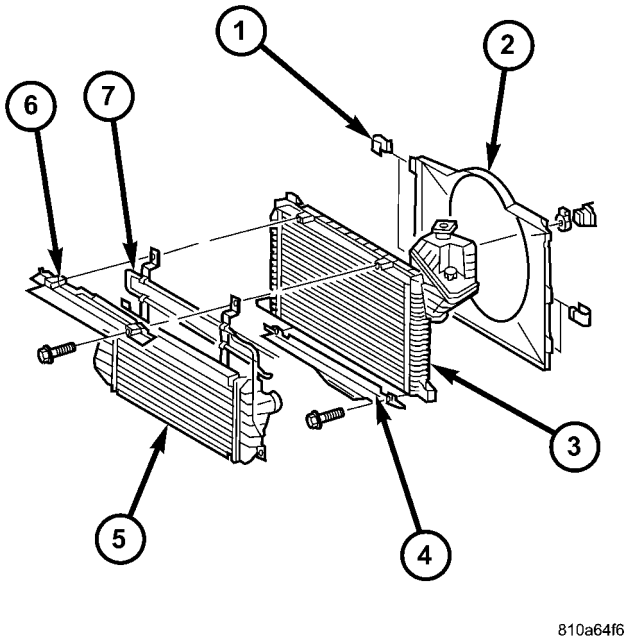


Fig. 10 RADIATOR AND FAN SHROUD

1 - CLIP
2 - SHROUD
3 - RADIATOR
4 - BOTTOM RADIATOR TRIM PANEL
5 - CHARGE AIR COOLER
6 - TOP RADIATOR TRIM PANEL
7 - POWER STEERING COOLER LOOP

(16) Install A/C condenser.
(17) Install front bumper.
(18) Install front end cross member.
(19) Refill power steering to proper level.
(20) Refill transmission to proper level.
(21) Close radiator drain plug and refill the cooling system to the correct level with the appropriate coolant mixture.
(22) Recharge air conditioning.
(23) Run engine until warm and check for leaks.

RADIATOR PRESSURE CAP

DESCRIPTION

All vehicles are equipped with a pressure cap (Fig. 11). 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

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 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 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.

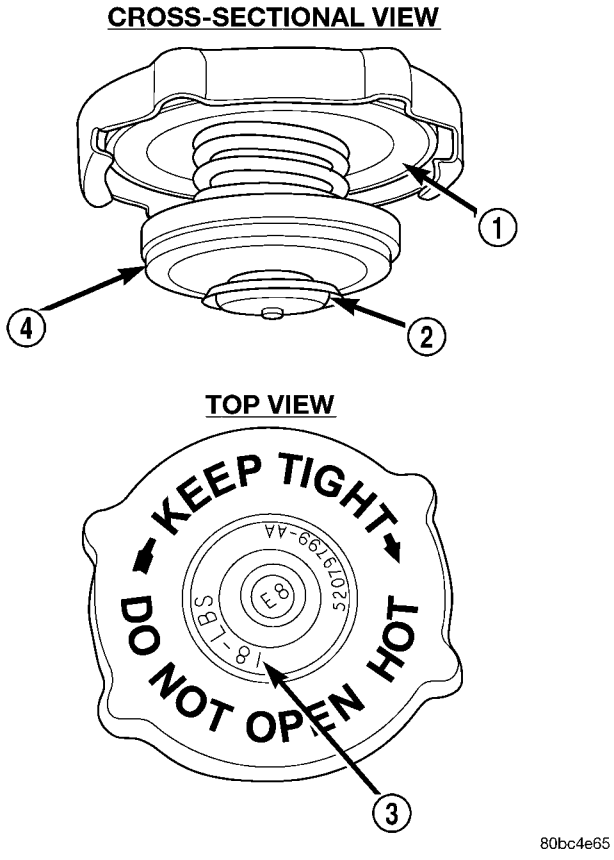


Fig. 11 Radiator Pressure Cap - Typical

1 - FILLER NECK SEAL
2 - VACUUM VENT VALVE
3 - PRESSURE RATING
4 - PRESSURE VALVE

OPERATION

A vent valve in the center of the cap will remain shut as long as the cooling system is pressurized. 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, or overflow hose is kinked, radiator hoses will collapse on cool-down.

RADIATOR PRESSURE CAP (Continued)

DIAGNOSIS AND TESTING - RADIATOR PRESSURE CAP

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. 12).

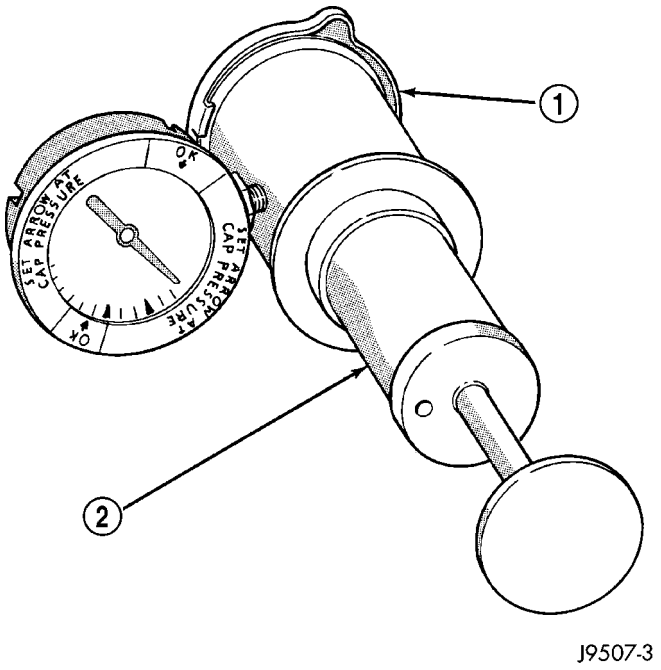


Fig. 12 Pressure Testing Radiator Pressure Cap - Typical

1 - PRESSURE CAP
2 - TYPICAL COOLING SYSTEM PRESSURE TESTER

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.

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.

WATER PUMP

REMOVAL

WARNING: RISK OF INJURY TO SKIN AND EYES FROM SCALDING WITH HOT COOLANT. RISK OF POISONING FROM SWALLOWING COOLANT. DO NOT OPEN COOLING SYSTEM UNLESS COOLANT TEMPERATURE IS BELOW 90°C (194°F). OPEN CAP SLOWLY TO RELEASE PRESSURE. STORE COOLANT IN SUITABLE AND APPROPRIATELY MARKED CONTAINER. WEAR PROTECTIVE GLOVES, CLOTHES AND EYE WEAR.

NOTE: Inspect condition of all clamps and hoses, replace as necessary.

(1) Disconnect the negative battery cable.
(2) Drain cooling system (Refer to 7 - COOLING/ ENGINE/COOLANT - STANDARD PROCEDURE).
(3) Remove viscous fan clutch.
(4) Detach fuel lines from the brackets at the water pump.
(5) Detach the coolant hoses at the water pump (Fig. 13).

WATER PUMP (Continued)

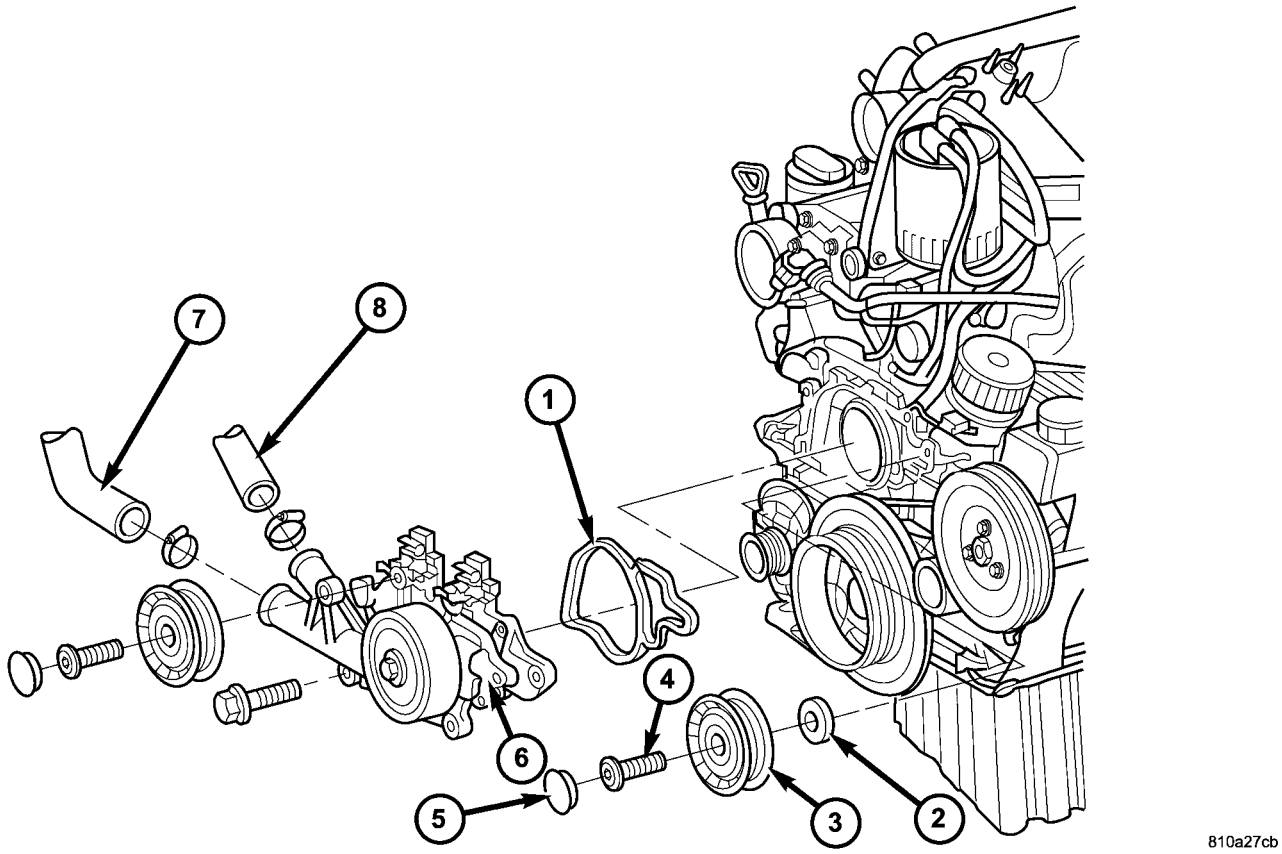


Fig. 13 WATER PUMP

1 - GASKET
2 - WASHER
3 - GUIDE PULLEY
4 - BOLT
5 - CAP
6 - WATER PUMP
7 - COOLANT HOSE
8 - COOLANT HOSE

(6) Press off cap at belt guide pulleys.
(7) Remove belt guide pulleys.
(8) Remove water pump retaining bolts and remove water pump.

INSTALLATION

NOTE: Clean all mating surfaces.

(1) Fit existing accessory drive belt pulley onto the water pump.
(2) Properly position water pump with new gasket to the engine and tighten bolts to 124 lbs. in. (14 N·m), M8 177 lbs. in. (20 N·m) (Fig. 13).

NOTE: Be sure to install the washer behind the guide pulley to assure proper alignment.

(3) Install belt guide pulleys. Tighten bolts to 26 lbs. ft. (35 N·m) (Fig. 13).
(4) Attach the coolant hoses to the water pump and tighten clamps (Fig. 13).
(5) Attach fuel lines to the brackets at the water pump.
(6) Install accessory drive belt.
(7) Install viscous fan clutch.
(8) Close radiator and or engine drain plug.
(9) Refill cooling system to proper level with the correct coolant and mixture. Check for leaks.

AUDIO/VIDEO

TABLE OF CONTENTS

page

AUDIO
SPECIAL TOOLS
AUDIO 1
ANTENNA BODY & CABLE
REMOVAL 1
INSTALLATION 1
INSTRUMENT PANEL ANTENNA CABLE
REMOVAL 1
INSTALLATION 2
RADIO
REMOVAL 2
INSTALLATION 2
SPEAKER
REMOVAL 2
INSTALLATION 2

AUDIO

SPECIAL TOOLS

AUDIO

SPECIAL TOOL CROSS REFERENCE CHART

MB TOOL #	MILLER TOOL #	DESCRIPTION
000 589 88 63 00	9241	RADIO EXTRACTION TOOL

ANTENNA BODY & CABLE

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the portion of the headliner over the front seat passengers (Refer to 23 - BODY/INTERIOR/HEADLINER - REMOVAL).

(3) Disconnect the antenna and electrical connections near the windshield (Fig. 1).

(4) Remove the mounting nut.

(5) Remove the antenna assembly from the roof and pull wire harness and cable through roof opening.

INSTALLATION

(1) Feed wire harness and cable through roof opening and position antenna to roof panel.

(2) Install and tighten antenna mounting nut.

(3) Connect the antenna and electrical connections near the windshield.

(4) Install the headliner (Refer to 23 - BODY/INTERIOR/HEADLINER - INSTALLATION).

(5) Connect the battery negative cable.

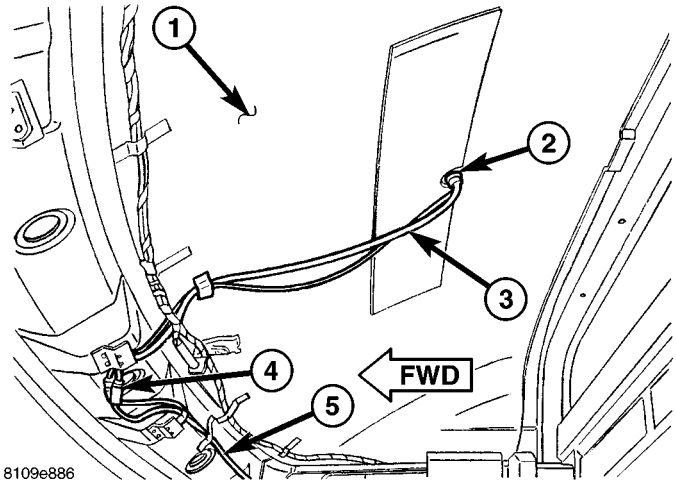


Fig. 1 ANTENNA CABLE

1 - ROOF PANEL
2 - MOUNTING NUT
3 - ANTENNA CABLE
4 - ELECTRICAL CONNECTOR
5 - INSTRUMENT PANEL ANTENNA CABLE

INSTRUMENT PANEL ANTENNA CABLE

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the A-pillar trim (Refer to 23 - BODY/INTERIOR/A-PILLAR TRIM - REMOVAL).

(3) Remove the portion of the headliner over the front seat passengers (Refer to 23 - BODY/INTERIOR/HEADLINER - REMOVAL).

(4) Disconnect the antenna and electrical connections near the windshield.

(5) Remove the glove box (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - REMOVAL).

(6) Remove the radio (Refer to 8 - ELECTRICAL/AUDIO/RADIO - REMOVAL).

INSTRUMENT PANEL ANTENNA CABLE (Continued)

(7) Cut both ends of existing cable close to the instrument panel (Fig. 2).

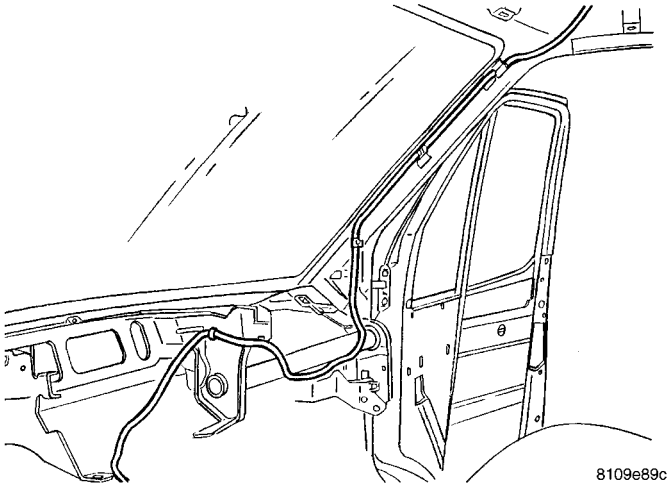


Fig. 2 INSTRUMENT PANEL ANTENNA CABLE

INSTALLATION

(1) Insert new cable through glove box opening to the radio opening in the instrument panel.

(2) Route cable up the A-pillar and connect to the antenna body and cable.

(3) Connect the antenna and electrical connections near the windshield.

(4) Attach antenna cable to instrument panel wire harness.

(5) Install glove box (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - INSTALLATION).

(6) Install the headliner (Refer to 23 - BODY/INTERIOR/HEADLINER - INSTALLATION).

(7) Install the A-pillar trim (Refer to 23 - BODY/INTERIOR/A-PILLAR TRIM - INSTALLATION).

(8) Install the radio (Refer to 8 - ELECTRICAL/AUDIO/RADIO - INSTALLATION).

(9) Connect the battery negative cable.

RADIO

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Using special tool 9241 or equivalent, insert one into each slot on the face of the radio (Fig. 3).

(3) Disconnect wire harness connector and antenna from radio.

INSTALLATION

(1) Connect wire harness connector and antenna to radio.

(2) Position radio to instrument panel and push into place.

(3) Connect battery negative cable.

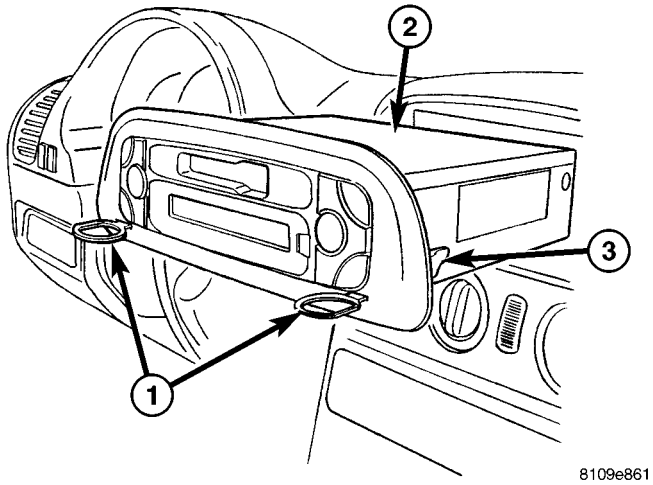


Fig. 3 RADIO

1 - SPECIAL TOOL 9241
2 - RADIO
3 - RETAINING TAB

SPEAKER

REMOVAL

(1) Disconnect and isolate the battery cable.

(2) Remove the A-pillar trim (Refer to 23 - BODY/INTERIOR/A-PILLAR TRIM - REMOVAL).

(3) Remove speaker grill (Fig. 4).

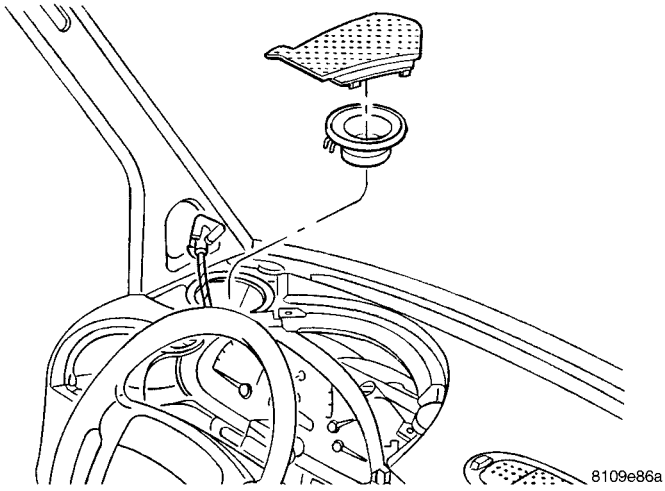


Fig. 4 INSTRUMENT PANEL SPEAKER

(4) Using a trim stick (C-4755 or equivalent), pry up on the speaker.

(5) Disconnect electrical harness connector and remove speaker.

INSTALLATION

(1) Install wire harness connector.

(2) Place speaker into instrument panel.

(3) Install speaker grille.

(4) Install the A-pillar trim (Refer to 23 - BODY/INTERIOR/A-PILLAR TRIM - INSTALLATION).

(5) Connect the battery negative cable.

CHIME/BUZZER

TABLE OF CONTENTS

page

CHIME/BUZZER
DESCRIPTION 1
OPERATION 1
DIAGNOSIS AND TESTING - CHIME WARNING SYSTEM 2

CHIME/BUZZER

DESCRIPTION

A chime warning system is standard factory-installed equipment. The chime warning system uses a chime tone generator and a contactless relay that are soldered onto the electronic circuit board inside the ElectroMechanical Instrument Cluster (EMIC) to provide audible indications of various vehicle conditions that may require the attention of the vehicle operator or occupants. The microprocessor-based EMIC utilizes electronic messages received from other modules in the vehicle over the Controller Area Network (CAN) data bus network along with hard wired inputs to the cluster to monitor many sensors and switches throughout the vehicle. In response to those inputs, the circuitry and internal programming of the EMIC allow it to control audible outputs that are produced through its on-board chime tone generator and contactless relay.

The EMIC circuitry and its chime tone generator are capable of producing the following audible outputs:

- **Single Chime Tone** - A single, extended “beep-like” chime tone is issued as a seat belt reminder.
- **Fast Rate Repetitive Chime Tone** - Repeated “beep-like” tones that are issued at a fast rate as an audible alert and to support various visual warnings.
- **Slow Rate Repetitive Click Tone** - Repeated “click-like” tones that are issued at a slow rate to emulate turn signal and hazard flasher operation.
- **Fast Rate Repetitive Click Tone** - Repeated “click-like” tones that are issued at a fast rate to emulate turn signal flasher operation with a bulb out.

Hard wired circuitry connects the EMIC and the various chime warning switch and sensor inputs to their respective modules and to each other through the electrical system of the vehicle. These hard wired circuits are integral to the vehicle wire harness, which is routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the EMIC through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

The EMIC chime tone generator and contactless relay cannot be adjusted or repaired. If the chime tone generator or contactless relay are damaged or faulty, the entire EMIC unit must be replaced.

OPERATION

The chime warning system components operate on battery current received through a non-switched fused B(+) circuit so that the system may operate regardless of the ignition switch position. The Electro-Mechanical Instrument Cluster (EMIC) also monitors the ignition switch position so that some chime features will only occur with ignition switch in the On position, while others occur regardless of the ignition switch position.

The chime warning system provides an audible indication to the vehicle operator or occupants under the following conditions:

- **Engine Oil Level Low Warning** - Each time the ignition switch is turned to the On position, the EMIC chime tone generator will generate a fast rate repetitive chime tone if electronic messages are received over the Controller Area Network (CAN) data bus from the Engine Control Module (ECM) indicating that the engine level is too low. The ECM uses internal programming and hard wired inputs from the engine oil level and temperature sensor to determine the engine oil level. This audible warning occurs in concert with the visual warning provided by the multi-function indicator in the cluster.
- **Fasten Seat Belt Reminder** - Each time the ignition switch is turned to the On position, the EMIC chime tone generator will generate a single extended chime tone for a duration of about six seconds, or until the driver side front seat belt is fastened, whichever occurs first. The EMIC uses internal programming and a hard wired input from the driver side front seat belt switch to determine the status of the driver side front seat belt. This audible warning occurs independent of the visual warning provided by the EMIC “Seatbelt” indicator.

- **Lights-On Warning** - The EMIC chime tone generator will generate repetitive chime tones at a fast rate when either front door is opened with the ignition switch in any position except On, and the exterior lights are turned On. The EMIC uses internal programming and hard wired inputs from the left (lighting) control stalk of the multi-function switch, the ignition switch, and both front door jamb switches to determine the current status of these switches. This chime will continue to sound until the exterior lighting is turned Off, until the ignition switch is turned to the On position, or until both front doors are closed, whichever occurs first.
- **Key-In-Ignition Warning** - The EMIC chime tone generator will generate repetitive chime tones at a fast rate when the key is in the ignition lock cylinder, the ignition switch is in any position except On, and either front door is opened. The EMIC uses internal programming and hard wired inputs from the key-in ignition switch, the ignition switch, and both front door jamb switches to determine the current status of these switches. The chime will continue to sound until the key is removed from the ignition lock cylinder, until the ignition switch is turned to the On position, or until both front doors are closed, whichever occurs first.
- **Audible Turn Signal/Hazard Warning Support** - The EMIC contactless relay will generate repetitive clicks at a slow rate during normal turn signal/hazard warning operation, or at a fast rate when a turn signal lamp bulb or circuit is inoperative, in concert with the operation of the turn signal indicators in the cluster. These clicks are designed to emulate the sound of the opening and closing of the contact points in a conventional electro-mechanical turn signal or hazard warning flasher. The EMIC uses a hard wired input received from the turn signal relay in the fuse block beneath the steering column through the turn signal or hazard warning switch circuitry of the multi-function switch to determine when to flash the turn signal indicators and activate the contactless relay on the cluster electronic circuit board. The turn signal clicks will continue to sound until the turn signal switch is turned Off, or until the ignition switch is turned to the Off position, whichever occurs first. The hazard warning clicks will continue to sound until the hazard warning switch is turned Off.

The EMIC provides chime service for all available features in the chime warning system. The EMIC relies upon its internal programming and hard wired inputs from the front door ajar switches, the key-in ignition switch, the ignition switch, the seat belt switch, and the turn signal/hazard warning (multi-function) switches. The EMIC relies upon electronic message inputs received from other electronic modules over the CAN data bus network to provide chime service for the low engine oil level warning. Upon receiving the proper inputs, the EMIC activates the chime tone generator or the contactless relay to provide the audible warning to the vehicle operator. The internal programming of the EMIC determines the priority of each chime request input that is received, as well as the rate and duration of each tone that is to be generated. See the owner's manual in the vehicle glove box for more information on the features provided by the chime warning system.

The hard wired chime warning system inputs to the EMIC, as well as other hard wired circuits for this system may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods may not prove conclusive in the diagnosis of the EMIC, the CAN data bus network, or the electronic message inputs used by the EMIC to provide chime warning system service. The most reliable, efficient, and accurate means to diagnose the EMIC, the CAN data bus network, and the electronic message inputs for the chime warning system requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

DIAGNOSIS AND TESTING - CHIME WARNING SYSTEM

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

The hard wired chime warning system inputs to the Electro-Mechanical Instrument Cluster (EMIC), as well as other hard wired circuits for this system may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods may not prove conclusive in the diagnosis of the EMIC, the Controller Area Network (CAN) data bus network, or the electronic message inputs used by the EMIC to provide chime warning system service. The most reliable, efficient, and accurate means to diagnose the EMIC, the CAN data bus network, and the electronic message inputs for the chime warning system requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

ELECTRONIC CONTROL MODULES

TABLE OF CONTENTS

page

CENTRAL TIMER MODULE
DESCRIPTION 1
OPERATION 2
DIAGNOSIS AND TESTING - CENTRAL TIMER MODULE 2
REMOVAL 2
INSTALLATION 2
CONTROLLER ANTILOCK BRAKE
DESCRIPTION 3
REMOVAL 3
INSTALLATION 3
ENGINE CONTROL MODULE
DESCRIPTION 3
REMOVAL 4
INSTALLATION 4
TRANSMISSION CONTROL MODULE
DESCRIPTION 5
OPERATION 5
STANDARD PROCEDURE - TCM ADAPTATION . 8

CENTRAL TIMER MODULE

DESCRIPTION

The central timer module (CTM) is located beneath the driver seat. The CTM uses information carried on the programmable communications interface (PCI) data bus network along with many hard wired inputs to monitor many sensor and switch inputs. In response to those inputs, the circuitry and programming of the CTM allow it to supply the vehicle occupants with audible and visual information, and to control and integrate many functions and features of the vehicle through both hard wired outputs and the transmission of message outputs to other modules in the vehicle over the PCI data bus.

The features that the CTM supports or controls include the following:

- **Central Locking** - The CTM on vehicles equipped with the optional Vehicle Theft Security System (VTSS) includes a central locking/unlocking feature.
- **Enhanced Accident Response** - The CTM provides an optional enhanced accident response feature. This is a programmable feature.
- **Panic Mode** - The CTM provides support for the optional RKE system panic mode including horn, headlamp, and park lamp flash features.
- **Power Lock Control** - The CTM provides the optional power lock system features, including support for the automatic door lock and door lock inhibit modes.
- **Programmable Features** - The CTM provides support for certain programmable features.
- **Remote Keyless Entry** - The CTM provides the optional Remote Keyless Entry (RKE) system features, including support for the RKE Lock (with optional horn and park lamps flash), Unlock (with park lamps flash, driver-door-only unlock, and unlock-all-doors), Panic, and illuminated entry modes, as well as the ability to be programmed to recognize up to four RKE transmitters. The RKE horn, driver-door-only unlock, and unlock-all-doors features are programmable.
- **Vehicle Theft Security System** - The CTM provides control of the optional Vehicle Theft Security System (VTSS) features, including support for the central locking/unlocking mode and control of the Security indicator in the instrument cluster.

Hard wired circuitry connects the CTM to the electrical system of the vehicle. Refer to the appropriate wiring information.

Many of the features in the vehicle controlled or supported by the CTM are programmable using the DRBIII® scan tool. However, if any of the CTM hardware components are damaged or faulty, the entire CTM unit must be replaced. The hard wired inputs or outputs of all CTM versions can be diagnosed using conventional diagnostic tools and methods; however, for diagnosis of the CTM or the PCI data bus, the use of a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

CENTRAL TIMER MODULE (Continued)

OPERATION

The central timer module (CTM) monitors many hard wired switch and sensor inputs as well as those resources it shares with other modules in the vehicle through its communication over the programmable communications interface (PCI) data bus network. The internal programming and all of these inputs allow the CTM to determine the tasks it needs to perform and their priorities, as well as both the standard and optional features that it should provide. The CTM then performs those tasks and provides those features through both PCI data bus communication with other modules and hard wired outputs through a number of driver circuits, relays, and actuators.These outputs allow the CTM the ability to control numerous accessory systems in the vehicle.

The CTM monitors its own internal circuitry as well as many of its input and output circuits, and will store a Diagnostic Trouble Code (DTC) in electronic memory for any failure it detects. These DTCs can be retrieved and diagnosed using a DRBIII® scan tool. Refer to the appropriate diagnostic information.

HARD WIRED INPUTS

The hard wired inputs to the CTM include the following:

- Fused B(+)
- Fused ignition switch output (run-acc)
- Fused ignition switch output (run-start)
- Ground
- Key-in ignition switch sense
- Sliding door switch sense
- Passenger door switch sense
- Driver door switch sense
- PCI bus circuit

HARD WIRED OUTPUTS

The hard wired outputs of the CTM include the following:

- Door lock relay output
- Door unlock relay output
- VTSS indicator driver

MESSAGING

The CTM uses the following messages received from other electronic modules over the PCI data bus:

- Airbag Deploy (ACM)
- Beep request (CMTC)
- Charging System Failure (PCM)
- Chime request (EMIC)
- Engine RPM (PCM)
- OK to Arm VTSS (PCM)
- Security indicator request (SKIM)
- System Voltage (PCM)
- Valid/Invalid Key (SKIM)
- Vehicle Distance (PCM)
- Vehicle Speed (PCM)

DIAGNOSIS AND TESTING - CENTRAL TIMER MODULE

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

The hard wired inputs to and outputs from the central timer module (CTM) may be diagnosed and tested using conventional diagnostic tools and methods. Refer to the appropriate wiring information.

However, conventional diagnostic methods may not prove conclusive in the diagnosis of the CTM. In order to obtain conclusive testing of the CTM, the programmable communications interface (PCI) data bus network and all of the modules that provide inputs to or receive outputs from the CTM must also be checked. The most reliable, efficient, and accurate means to diagnose the CTM, the PCI data bus network, and the modules that provide inputs to, or receive outputs from, the CTM requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Slide the driver seat to the full forward position.

(3) Disconnect the wire harness connector for the seat belt latch. (Fig. 1).

(4) Remove the screws that secure the closeout panel beneathe the driver seat cushion and remove the panel.

(5) Remove the screws that secure the central timer module to the bracket.

(6) Disconnect the wire harness connectors from the central timer module.

(7) Remove the central timer module from the vehicle.

INSTALLATION

(1) Position the central timer module in the vehicle

CENTRAL TIMER MODULE (Continued)

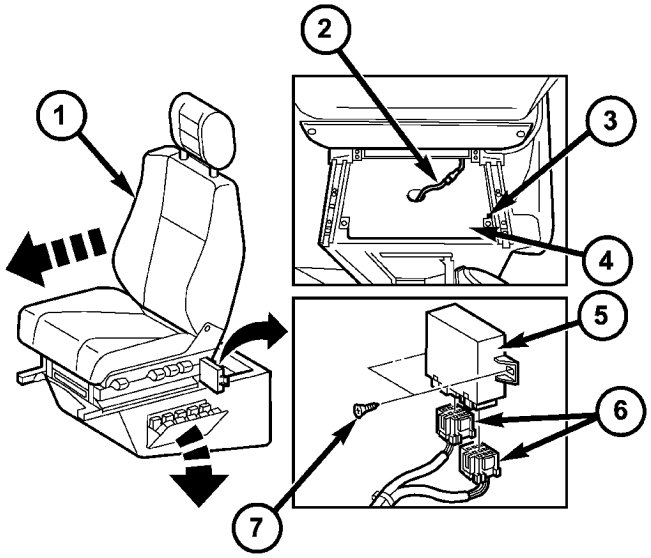


Fig. 1 Central Timer Module

1 - DRIVER SEAT
2 - WIRE HARNESS CONNECTOR
3 - SCREW (2)
4 - CLOSEOUT PANEL
5 - CENTRAL TIMER MODULE
6 - WIRE HARNESS CONNECTOR (2)
7 - SCREW (2)

(2) Connect the wire harness connectors to the central timer module.

(3) Install the screws that secure the central timer module. Tighten the screws securely.

(4) Route the seat belt latch wire lead through the hole in the closeout panel and position the panel beneath the driver seat cushion

(5) Install the screws that secure the closeout panel beneath the driver seat cushion. Tighten the screws securely.

(6) Connect the wire harness connector to the seat belt latch connector.

(7) Slide the driver seat to back to its original position.

(8) Reconnect the negative battery cable.

CONTROLLER ANTILOCK BRAKE

DESCRIPTION

The Controler Antilock Brake (CAB) is mounted to the Hydraulic Control Unit (HCU) and operates the ABS system.

REMOVAL

(1) Remove the negative battery cable from the battery.

(2) Pull up on the CAB harness connector release and remove connector.

(3) Remove the CAB mounting bolts.

(4) Remove the CAB from the HCU.

INSTALLATION

(1) Install CAB to the HCU.

(2) Install mounting bolts. Tighten to 2 N·m (16 in. lbs.).

(3) Install the wiring harness connector to the CAB and push down on the release to secure the connector.

(4) Install negative battery cable to the battery.

ENGINE CONTROL MODULE

DESCRIPTION

The electronic control module (ECM) is mounted to the left lower dash panel and consists of an electronic printed circuit board which is designed as a multilayer board assembly fitted on both sides. The routing of the five wiring harness connectors at the ECM connectors are split into interfering cables and sensitive cables in order to achieve improved electromagnetic compatibility. The ECM stores engine specific data, monitors the connected sensor and analyzes their measurement (Fig. 2).

Its task consists in controlling the following systems in line with the analysis of the input signals:

- Fuel Supply System
- Injected Quantity Control
- Emission Control System
- Charge Pressure Control
- Cruise Control
- A/C Compressor Shut-Off
- Pre-Heating Output Relay for the Glow Plugs
- Vehicle Theft
- Air Bag
- Monitors inputs/outputs, checks plausibility and stores faults
- Share information with other control modules
- Diagnosis

If a sensor should fail, provided the fault is not serious, the ECM will continue to operate the engine in Limp-Home Mode (emergency mode) using a default value for the missing signal. The ECM ensures that continuing to operate the engine will not cause damage or effect safety,otherwise a Engine shut-off process will be carried out.

ENGINE CONTROL MODULE (Continued)

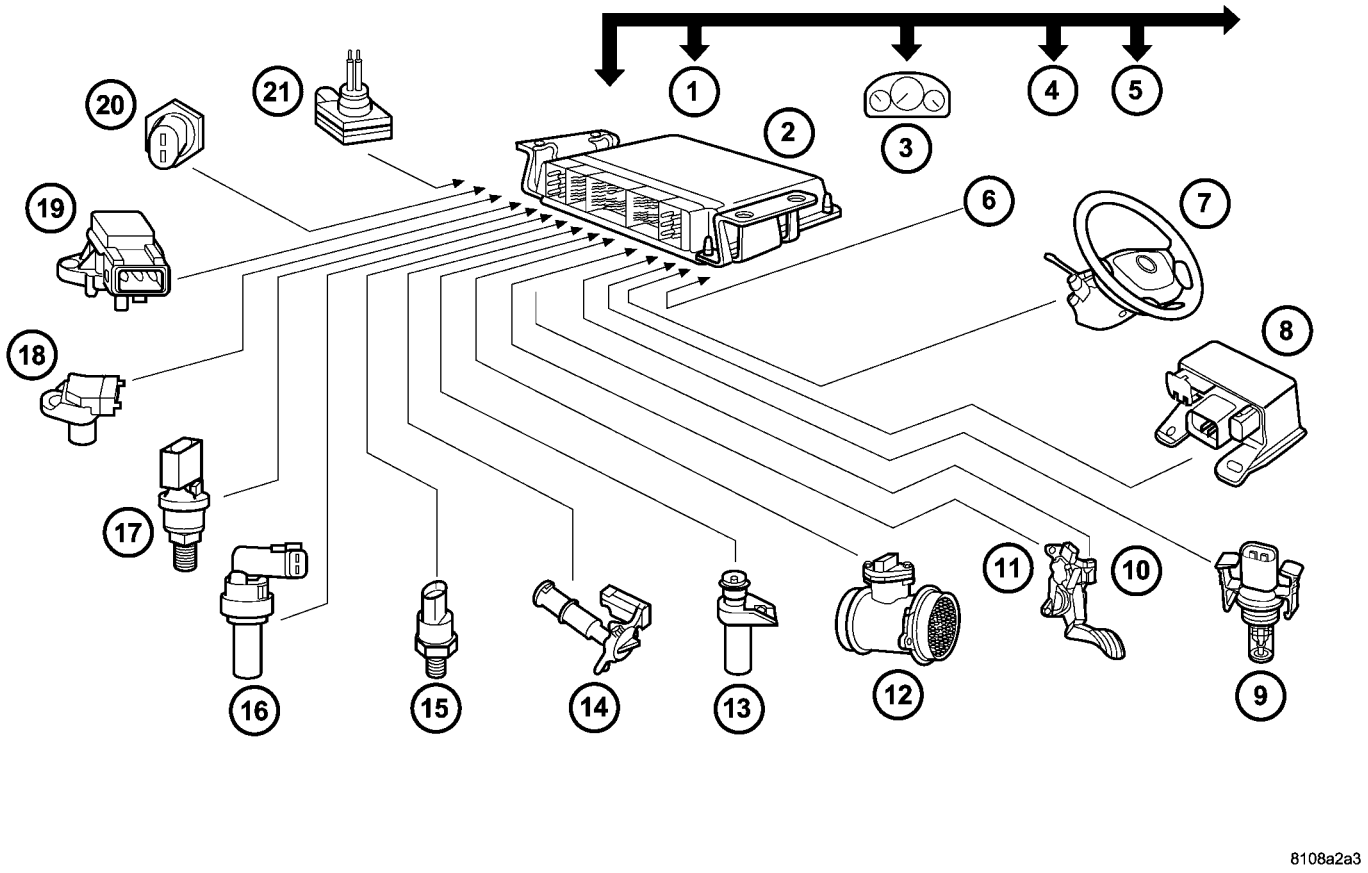


Fig. 2 ECM

1 - A/C PUSH BUTTON CONTROL
2 - ECM
3 - INSTRUMENT CLUSTER
4 - ABS/ASR CONTROLLER
5 - ANTI-THEFT CONTROLLER
6 - AIR BAG CONTROLLER
7 - IGNITION CYLINDER TRANSCEIVER RING
8 - GLOW PLUG RELAY
9 - INTAKE AIR TEMPERATURE SENSOR
10 - KICK DOWN SWITCH
11 - ACCELERATOR PEDAL SENSOR
12 - MASS AIR FLOW SENSOR
13 - CRANKSHAFT POSITION SENSOR
14 - OIL LEVEL, OIL TEMPERATURE AND OIL QUALITY SENSOR
15 - LOW FUEL PRESSURE SENSOR
16 - COOLANT TEMPERATURE SENSOR
17 - FUEL RAIL PRESSURE SENSOR
18 - CAMSHAFT POSITION SENSOR
19 - CHARGE AIR PRESSURE SENSOR
20 - FUEL TEMPERATURE SENSOR
21 - WATER IN FUEL SENSOR

REMOVAL

(1) Disconnect the negative battery cable.

(2) Disconnect the ECM harness connectors (5) (Fig. 3).

(3) Grasp ECM and pull down firmly to release ECM from the retaining bracket tensioning springs (Fig. 3).

INSTALLATION

NOTE: THE ECM MUST BE PROGRAMMED TO SUPPORT THE VEHICLE OPTIONS PACKAGE.

(1) Position the ECM into the guide of the retaining bracket (Fig. 3).

(2) Carefully push the ECM in to the bracket until the bracket tensioning springs engage (Fig. 3).

(3) Connect the ECM wiring harness connectors (5) (Fig. 3).

(4) Connect negative battery cable.

ENGINE CONTROL MODULE (Continued)

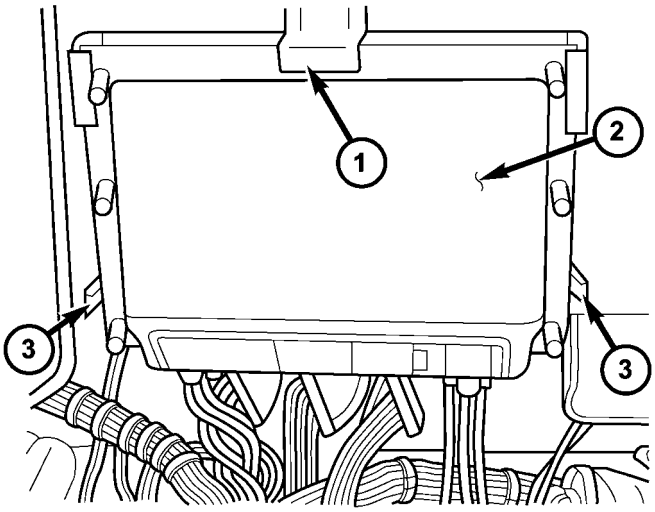


Fig. 3 ECM

1 - BRACKET
2 - ECM
3 - BRACKET TENSIONING SPRINGS

TRANSMISSION CONTROL MODULE

DESCRIPTION

The transmission control module (TCM) receives, processes and sends various digital and analog signals related to the automatic transmission. In addition, it processes information received from other vehicle systems, such as engine torque and speed, accelerator pedal position, wheel speed, kick-down switch, traction control information, etc.

The TCM is located under the driver's seat and is connected to other control modules via a CAN bus. It controls all shift functions to achieve smooth shift comfort in all driving situations considering:

- Vehicle speed.
- Transmission status.
- Position of selector lever.
- Selected shift range.
- CAN signals.
- Engine Status.

Engine speed limits may be reached in all gears with full throttle or in kick-down operation. In forward driving, the shift range of the forward gears can be adjusted by the operator by tipping the selector lever to the left or right (AutoStick). However, the TCM features a downshift inhibitor to prevent the engine from overspeeding.

OPERATION

The transmission control module (TCM) determines the current operating conditions of the vehicle and controls the shifting process for shift comfort and driving situations. It receives this operating data from sensors and broadcast messages from other modules.

The TCM uses inputs from several sensors that are directly hardwired to the controller and it uses several indirect inputs that are used to control shifts. This information is used to actuate the proper solenoids in the valve body to achieve the desired gear.

The shift lever assembly (SLA) has several items that are monitored by the TCM to calculate shift lever position. The reverse light switch, an integral part of the SLA, controls the reverse light relay control circuit. The Brake/Transmission Shift Interlock (BTSI) solenoid and the park lockout solenoid (also part of the SLA) are controlled by the TCM.

The ECM and ABS broadcast messages over the controller area network (CAN C) bus for use by the TCM. The TCM uses this information, with other inputs, to determine the transmission operating conditions.

The TCM:

- determines the momentary operating conditions of the vehicle.
- controls all shift processes.
- considers shift comfort and the driving situation.

The TCM controls the solenoid valves for modulating shift pressures and gear changes. Relative to the torque being transmitted, the required pressures are calculated from load conditions, engine rpm, vehicle speed, and ATF temperature.

The following functions are contained in the TCM:

- Shift Program
- Downshift Safety
- Torque Converter Lock-Up Clutch.
- Adaptation.

This transmission does not have a TCM relay. Power is supplied to the SLA and the TCM directly from the ignition.

TRANSMISSION CONTROL MODULE (Continued)

The TCM continuously checks for electrical problems, mechanical problems, and some hydraulic problems. When a problem is sensed, the TCM stores a diagnostic trouble code (DTC). Some of these codes cause the transmission to go into ″Limp-In″ or ″default″ mode. Some DTCs cause permanent Limp-In and others cause temporary Limp-In. The NAG1 defaults in the current gear position if a DTC is detected, then after a key cycle the transmission will go into Limp-in, which is mechanical 2nd gear. Some DTCs may allow the transmission to resume normal operation (recover) if the detected problem goes away. A permanent Limp-In DTC will recover when the key is cycled, but if the same DTC is detected for three key cycles the system will not recover and the DTC must be cleared from the TCM with the DRBIII® scan tool.

TCM SIGNALS

The TCM registers one part of the input signals by direct inputs, the other part by CAN C bus. In addition to the direct control of the actuators, the TCM sends various output signals by CAN C bus to other control modules.

Selector Lever Position

The TCM monitors the SLA for all shift lever positions via the CAN bus.

ATF Temperature Sensor

The ATF temperature sensor is a positive temperature co-efficient (PTC) thermistor. It measures the temperature of the transmission fluid and is a direct input signal for the TCM. The temperature of the ATF has an influence on the shifttime and resulting shift quality. As the temperature rises, resistance rises, and therefore, the probing voltage is decreasing. Because of its registration, the shifting process can be optimized in all temperature ranges.

The ATF temperature sensor is wired in series with the park/neutral contact. The temperature signal is transmitted to the TCM only when the reed contact of the park/neutral contact is closed because the TCM only reads ATF temperature while in any forward gear, or REVERSE. When the transmission is in PARK or NEUTRAL, the TCM will substitute the engine temperature for the ATF temperature.

Starter Interlock

The TCM monitors a contact switch wired in series with the transmission temperature sensor to determine PARK and NEUTRAL positions. The contact switch is open in PARK and NEUTRAL. The TCM senses transmission temperature as high (switch supply voltage), confirming switch status as open. The TCM then broadcasts a message over CAN bus to confirm switch status. The PCM receives this information and allows operation of the starter circuit.

N2 and N3 Speed Sensors

The N2 and N3 Input Speed Sensors are two Hall-effect speed sensors that are mounted internally in the transmission and are used by the TCM to calculate the transmission's input speed. Since the input speed cannot be measured directly, two of the drive elements are measured. Two input speed sensors were required because both drive elements are not active in all gears.

CAN C Bus Indirect Input Signals

A 2.5-volt bias (operating voltage) is present on the CAN C bus any time the ignition switch is in the RUN position. Both the TCM and the ABS apply this bias. On this vehicle, the CAN C bus is used for module data exchange only. The indirect inputs used on the NAG1 electronic control system are:

- Wheel Speed Sensors.
- Brake Switch.
- Engine RPM.
- Engine Temperature.
- Cruise Control Status.
- Gear Limit Request.
- Throttle Position - 0% at idle, 100% at WOT. If open, TCM assumes idle (0% throttle opening).
- Odometer Mileage
- Maximum Effective Torque.
- Engine in Limp-In Mode/Mileage Where DTC Was Set.

BRAKE TRANSMISSION SHIFT INTERLOCK (BTSI)

The BTSI solenoid prevents shifting out of the PARK position until the ignition key is in the RUN position and the brake pedal is pressed. The TCM controls the ground while the ignition switch supplies power to the BTSI solenoid. The PCM monitors the brake switch and broadcasts brake switch status messages over the CAN C bus. If the park brake is depressed and there is power (Run/Start) to SLA, the BTSI solenoid deactivates.

SHIFT SCHEDULES

The basic shift schedule includes up and downshifts for all five gears. The TCM adapts the shift program according to driving style, accelerator pedal position and deviation of vehicle speed. Influencing factors are:

- Road Conditions.
- Incline, Decline and Altitude.
- Trailer Operation, Loading.
- Engine Coolant Temperature.
- Cruise Control Operation.
- Sporty Driving Style.

TRANSMISSION CONTROL MODULE (Continued)

- Low and High ATF Temperature.

Upshift To:	1-2	2-3	3-4	4-5
Activated By Solenoid:	1-2/4-5	2-3	3-4	1-2/4-5
Shift Point (at 35.2% of throttle)	17.8 km/h (11.6 mph)	32.1 km/h (19.95 mph)	67.5 km/h (41.94 mph)	73.8 km/h (45.86 mph)

Downshift From:	5-4	4-3	3-2	2-1
Activated By Solenoid:	1-2/4-5	3-4	2-3	1-2/4-5
Shift Point	55.7 km/h (34.61 mph)	40.5 km/h (25.17 mph)	24.4 km/h (15.16 mph)	15.1 km/h (9.38 mph)

DOWNSHIFT SAFETY

Selector lever downshifts are not performed if inadmissible high engine rpm is sensed.

ADAPTATION

To equalize tolerances and wear, an automatic adaptation takes place for:

- Shift Time.
- Clutch Filling Time.
- Clutch Filling Pressure.
- Torque Converter Lock-Up Control.

Adaptation data may be stored permanently and to some extent, can be diagnosed.

Driving Style Adaptation

The shift point is modified in steps based on the information from the inputs. The control module looks at inputs such as:

- vehicle acceleration and deceleration (calculated by the TCM).
- rate of change as well as the position of the throttle pedal (fuel injection information from the ECM).
- lateral acceleration (calculated by the TCM).
- gear change frequency (how often the shift occurs).

Based on how aggressive the driver is, the TCM moves up the shift so that the present gear is held a little longer before the next upshift. If the driving style is still aggressive, the shift point is modified up to ten steps. If the driving returns to normal, then the shift point modification also returns to the base position.

This adaptation has no memory. The adaptation to driving style is nothing more than a shift point modification meant to assist an aggressive driver. The shift points are adjusted for the moment and return to base position as soon as the inputs are controlled in a more rational manner.

Shift Time Adaptation (Shift Overlap Adaptation, Working Pressure)

Shift time adaptation is the ability of the TCM to electronically alter the time it takes to go from one gear to another. Shift time is defined as the time it takes to disengage one shift member while another is being applied. Shift time adaptation is divided into four categories:

33. Accelerating upshift, which is an upshift under a load. For shift time adaptation for the 1-2 upshift to take place, the transmission must shift from 1st to 2nd in six different engine load ranges vs. transmission output speed ranges.

34. Decelerating upshift, which is an upshift under no load. This shift is a rolling upshift and is accomplished by letting the vehicle roll into the next gear.

35. Accelerating downshift, which is a downshift under load. This shift can be initiated by the throttle, with or without kickdown. The shift selector can also be used.

36. Decelerating downshift, which is accomplished by coasting down. As the speed of the vehicle decreases, the transmission downshifts.

Fill Pressure Adaptation (Apply Pressure Adaptation, Modulating Pressure)

Fill pressure adaptation is the ability of the TCM to modify the pressure used to engage a shift member. The value of this pressure determines how firm the shift will be.

- If too much pressure is used, the shift will be hard.
- If too little pressure is used, the transmission may slip.

The pressure adjustment is needed to compensate for the tolerances of the shift pressure solenoid valve. The amount the solenoid valve opens as well as how quickly the valve can move, has an effect on the pressure. The return spring for the shift member provides a resistance that must be overcome by the pressure in order for shift member to apply. These return springs have slightly different values. This also affects the application pressure and is compensated for by fill pressure adaptation.

Fill Time Adaptation (Engagement Time Adaptation)

Fill time is the time it takes to fill the piston cavity and take up any clearances for a friction element

(clutch or brake). Fill time adaptation is the ability of the TCM to modify the time it takes to fill the shift member by applying a preload pressure.

CONTROLLER MODES OF OPERATION

Permanent Limp-In Mode

When the TCM determines there is a non-recoverable condition present that does not allow proper transmission operation, it places the transmission in permanent Limp-In Mode. When the condition occurs the TCM turns off all solenoids as well as the solenoid supply output circuit. If this occurs while the vehicle is moving, the transmission remains in the current gear position until the ignition is turned off or the shifter is placed in the ″P″ position. When the shifter has been placed in ″P,″ the transmission only allows 2nd gear operation. If this occurs while the vehicle is not moving, the transmission only allows operation in 2nd gear.

Temporary Limp-In Mode

This mode is the same as the permanent Limp-In Mode except if the condition is no longer present, the system resumes normal operation.

Under Voltage Limp-In Mode

When the TCM detects that system voltage has dropped below 8.5 volts, it disables voltage-dependant diagnostics and places the transmission in the temporary Limp-In Mode. When the TCM senses that the voltage has risen above 9.0 volts, normal transmission operation is resumed.

Hardware Error Mode

When the TCM detects a major internal error, the transmission is placed in the permanent Limp-In Mode and ceases all communication over the CAN bus. When the TCM has entered this mode normal transmission operation does not resume until all DTCs are cleared from the TCM.

Loss of Drive

If the TCM detects a situation that has resulted or may result in a catastrophic engine or transmission problem, the transmission is placed in the neutral position. Improper Ratio, Input Sensor Overspeed or Engine Overspeed DTCs cause the loss of drive.

Controlled Limp-in Mode

When a failure does not require the TCM to shut down the solenoid supply, but the failure is severe enough that the TCM places the transmission into a predefined gear, there are several shift performance concerns. For instance, if the transmission is slipping, the controller tries to place the transmission into 3rd gear and maintain 3rd gear for all forward drive conditions.

STANDARD PROCEDURE - TCM ADAPTATION

The adaptation procedure requires the use of the DRBIII® scan tool. This program allows the electronic transmission system to re-calibrate itself. This will provide the proper baseline transmission operation. The adaptation procedure should be performed if any of the following procedures are performed:

- Transmission Assembly Replacement
- Transmission Control Module Replacement
- Clutch Plate and/or Seal Replacement
- Electrohydraulic Unit Replacement or Recondition

(1) With the DRBIII®, reset the Transmission adaptives. Resetting the adaptives will set the adaptives to factory settings.

NOTE: Perform the Coast Down Adaptations first. The Transmission Temperature must be greater than 60°C (140°F) and less than 70°C (158°F). Failure to stay within these temperature ranges will void the procedure.

(2) Drive the vehicle until the transmission temperature is in the specified range.

(3) Perform 4 to 5 coast downs from 5th to 4th gear and then 4th to 3rd gear.

NOTE: For Upshift adaptation, the Transmission temperature must be greater than 60°C (140°F) and less than 100°C (212°F). Failure to stay within these temperature ranges will void this procedure.

(4) From a stop, moderately accelerate the vehicle and obtain all forward gear ranges while keeping the Engine RPM below 1800 RPM. Repeat this procedure 4 to 5 times.

(5) Obtaining 5th gear may be difficult at 1800 RPM. Allow the transmission to shift into 5th gear at a higher RPM then lower the RPM to 1800 and perform manual shifts between 4th and 5th gears using the shift lever.

(6) The TCM will store the adaptives every 10 minutes. After completion of the adaptation procedure make sure the vehicle stays running for at least 10 minutes.

(7) It is possible to manually store the adaptives under the 10 minute time frame using the DRBIII® Store Adaptives procedure.

ENGINE SYSTEMS

TABLE OF CONTENTS

page

BATTERY SYSTEM 1
CHARGING SYSTEM 17
STARTING SYSTEM 24

BATTERY SYSTEM

TABLE OF CONTENTS

page

BATTERY SYSTEM
DESCRIPTION 1
OPERATION 2
DIAGNOSIS AND TESTING - BATTERY SYSTEM 2
CLEANING 5
INSPECTION 6
SPECIAL TOOLS
BATTERY SYSTEM SPECIAL TOOLS 6
BATTERY
DESCRIPTION 6
OPERATION 7
DIAGNOSIS AND TESTING - BATTERY 7
STANDARD PROCEDURE
STANDARD PROCEDURE - BATTERY CHARGING 8
STANDARD PROCEDURE - OPEN-CIRCUIT VOLTAGE TEST 10
STANDARD PROCEDURE - IGNITION-OFF DRAW TEST 10
STANDARD PROCEDURE - USING MICRO 420 BATTERY TESTER 11
STANDARD PROCEDURE - CHECKING BATTERY ELECTROLYTE LEVEL 12
REMOVAL
UNDER HOOD BATTERY REMOVAL 12
AUXILIARY BATTERY REMOVAL 13
INSTALLATION
UNDER HOOD BATTERY INSTALLATION . . . 13
AUXILIARY BATTERY INSTALLATION 13
BATTERY HOLDDOWN
DESCRIPTION 14
REMOVAL 14
INSTALLATION 14
BATTERY CABLES
DESCRIPTION 14
OPERATION 14
DIAGNOSIS AND TESTING - BATTERY CABLES 14
REMOVAL 16
INSTALLATION 16
BATTERY TRAY
DESCRIPTION 16
OPERATION 16
REMOVAL 16
INSTALLATION 16

BATTERY SYSTEM

DESCRIPTION

A single 12-volt battery is standard factory-installed equipment on this model. Some vehicles are equipped with a second auxiliary battery for running additional electrical equipment. The standard battery is located in the engine compartment, while the auxiliary battery (if equipped) is located under the passengers front seat. The battery system for this vehicle covers the following related components, which are covered in further detail later in this section of the service manual:

- **Battery** - The 12v storage battery(s) provides a reliable means of storing a renewable source of electrical energy within the vehicle.
- **Battery Cables** - The battery cables connect the battery terminal posts to the vehicle electrical system.

- **Battery Holddown** - The battery holddown hardware secures the battery in the battery tray in the engine compartment.
- **Battery Tray** - The battery tray provides a secure mounting location in the vehicle for the battery and an anchor point for the battery holddown hardware.

For battery system maintenance schedules and jump starting procedures, see the owner's manual in the vehicle glove box. Optionally, refer to the Lubrication and Maintenance section of this manual for the recommended battery maintenance schedules and for the proper battery jump starting procedure. While battery charging can be considered a maintenance procedure, the battery charging procedure and related information are located later in this section of this service manual. This was done because the battery must be fully-charged before any battery system diagnosis or testing procedures can be performed.

OPERATION

The battery system is designed to provide a safe, efficient, reliable and mobile means of delivering and storing electrical energy. This electrical energy is 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 battery system is also designed to provide a reserve of electrical energy to supplement the charging system for short durations while the engine is running and the electrical current demands of the vehicle exceed the output of the charging system. In addition to delivering, and storing electrical energy for the vehicle, the battery system serves as a capacitor and voltage stabilizer for the vehicle electrical system. It absorbs most abnormal or transient voltages caused by the switching of any of the electrical components or circuits in the vehicle.

DIAGNOSIS AND TESTING - BATTERY SYSTEM

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 engine to start and the battery to maintain its 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 battery discharge, overcharging or early battery failure must be diagnosed and corrected before a battery is replaced and before a vehicle is returned to service. The service information for these systems has been separated within this service manual to make it easier to locate the specific information you are seeking. However, when attempting to diagnose any of these systems, it is important that you keep their interdependency in mind.

The diagnostic procedures used for the battery, starting, and charging systems 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, a volt/ohmmeter, a battery charger, a carbon pile rheostat (load tester) and a 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 Charging System for the proper charging system onboard diagnostic test procedures.

MICRO 420 BATTERY TESTER

The Micro 420 automotive battery tester is designed to help the dealership technicians diagnose the cause of a defective battery. Follow the instruction manual supplied with the tester to properly diagnose a vehicle. If the instruction manual is not available refer to the standard procedure in this section, which includes the directions for using the Micro 420 battery tester.

BATTERY SYSTEM (Continued)

BATTERY SYSTEM DIAGNOSIS		
CONDITION	POSSIBLE CAUSES	CORRECTION
THE BATTERY SEEMS WEAK OR DEAD WHEN ATTEMPTING TO START THE ENGINE.	1. The electrical system ignition-off draw is excessive.	1. Refer to the IGNITION-OFF DRAW TEST Standard Procedure for the proper test procedures. Repair the excessive ignition-off draw, as required.
	2. The charging system is faulty.	2. Determine if the charging system is performing to specifications. Refer to Charging System for additional charging system diagnosis and testing procedures. Repair the faulty charging system, as required.
	3. The battery is discharged.	3. Determine the battery state-of-charge using the Micro 420 battery tester. Refer to the Standard Procedures in this section for additional test procedures. Charge the faulty battery, as required.
	4. The battery terminal connections are loose or corroded.	4. Refer to Battery Cables for the proper battery cable diagnosis and testing procedures. Clean and tighten the battery terminal connections, as required.
	5. The battery has an incorrect size or rating for this vehicle.	5. Refer to Battery System Specifications for the proper size and rating. Replace an incorrect battery, as required.
	6. The battery is faulty.	6. Determine the battery cranking capacity using the Micro 420 battery tester. Refer to the Standard Procedures in this section for additional test procedures. Replace the faulty battery, as required.
	7. The starting system is faulty.	7. Determine if the starting system is performing to specifications. Refer to Starting System for the proper starting system diagnosis and testing procedures. Repair the faulty starting system, as required.
	8. The battery is physically damaged.	8. Inspect the battery for loose terminal posts or a cracked and leaking case. Replace the damaged battery, as required.

BATTERY SYSTEM (Continued)

BATTERY SYSTEM DIAGNOSIS		
CONDITION	POSSIBLE CAUSES	CORRECTION
THE BATTERY STATE OF CHARGE CANNOT BE MAINTAINED.	1. The battery has an incorrect size or rating for this vehicle.	1. Refer to Battery System Specifications for the proper specifications. Replace an incorrect battery, as required.
	2. The battery terminal connections are loose or corroded.	2. Refer to Battery Cable for the proper cable diagnosis and testing procedures. Clean and tighten the battery terminal connections, as required.
	3. The electrical system ignition-off draw is excessive.	3. Refer to the IGNITION-OFF DRAW TEST Standard Procedure for the proper test procedures. Repair the faulty electrical system, as required.
	4. The battery is faulty.	4. Test the battery using the Micro 420 battery tester. Refer to Standard Procedures for additional test procedures. Replace the faulty battery, as required.
	5. The starting system is faulty.	5. Determine if the starting system is performing to specifications. Refer to Starting System for the proper starting system diagnosis and testing procedures. Repair the faulty starting system, as required.
	6. The charging system is faulty.	6. Determine if the charging system is performing to specifications. Refer to Charging System for additional charging system diagnosis and testing procedures. Repair the faulty charging system, as required.
	7. Electrical loads exceed the output of the charging system.	7. Inspect the vehicle for aftermarket electrical equipment which might cause excessive electrical loads.
	8. Slow driving or prolonged idling with high-amperage draw systems in use.	8. Advise the vehicle operator, as required.
THE BATTERY WILL NOT ACCEPT A CHARGE.	1. The battery is faulty.	1. Test the battery using the Micro 420 battery tester. Charge or replace the faulty battery, as required.

BATTERY SYSTEM (Continued)

ABNORMAL BATTERY DISCHARGING

Any of the following conditions can result in abnormal battery discharging:

1. A faulty or incorrect charging system component. Refer to Charging System for additional charging system diagnosis and testing procedures.
2. A faulty or incorrect battery. Use Micro 420 battery tester and refer to Battery System for additional battery diagnosis and testing procedures.
3. A faulty circuit or component causing excessive ignition-off draw.
4. Electrical loads that exceed the output of the charging system. This can be due to equipment installed after manufacture, or repeated short trip use.
5. A faulty or incorrect starting system component. Refer to Starting System for the proper starting system diagnosis and testing procedures.
6. Corroded or loose battery posts and/or terminal clamps.
7. Slow driving speeds (heavy traffic conditions) or prolonged idling, with high-amperage draw systems in use.

CLEANING

The following information details the recommended cleaning procedures for the battery and related components. In addition to the maintenance schedules found in this service manual and the owner's manual, it is recommended that these procedures be performed any time the battery or related components must be removed for vehicle service.

(1) Clean the battery cable terminal clamps of all corrosion. 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. 1).

(2) Clean the battery tray and battery hold down hardware of all corrosion. Remove any corrosion using a wire brush and a sodium bicarbonate (baking soda) and warm water cleaning solution. Paint any exposed bare metal.

(3) If the removed 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 using a stiff bristle parts cleaning brush to remove any acid film (Fig. 2). 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 System Specifications for the factory-installed battery specifications. Confirm that the replacement battery is the correct size and has the correct ratings for the vehicle.

(4) If the vehicle is so equipped, clean the battery thermal guard with a sodium bicarbonate (baking soda) and warm water cleaning solution using a stiff bristle parts cleaning brush to remove any acid film.

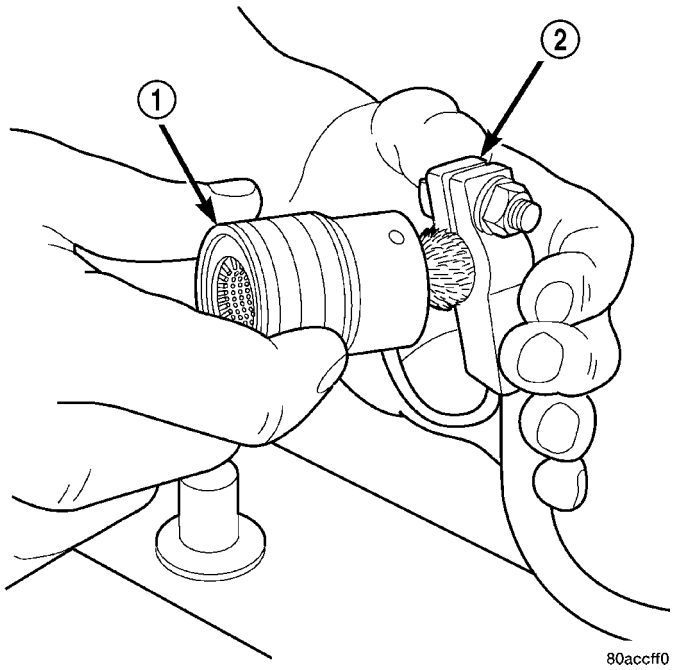


Fig. 1 Clean Battery Cable Terminal Clamp - Typical

1 - TERMINAL BRUSH
2 - BATTERY CABLE

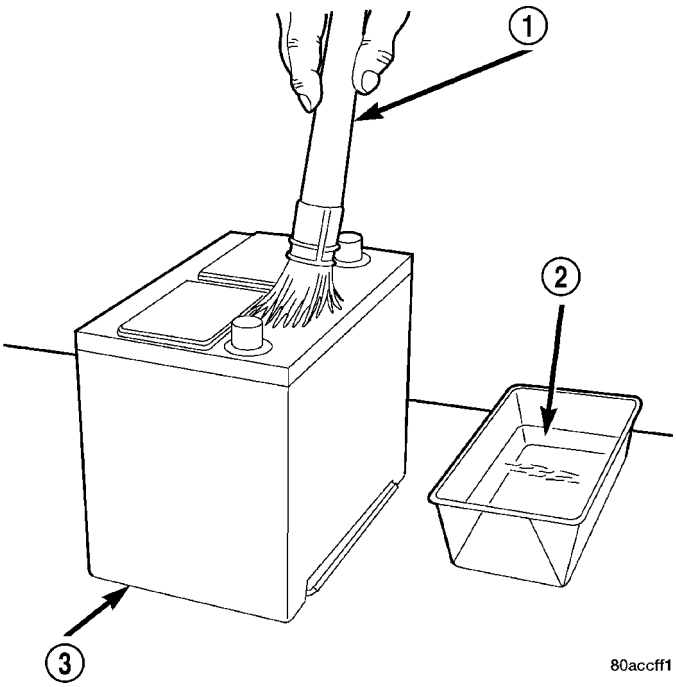


Fig. 2 Battery Cleaning - Typical

1 - CLEANING BRUSH
2 - WARM WATER AND BAKING SODA SOLUTION
3 - BATTERY

BATTERY SYSTEM (Continued)

(5) 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. 3).

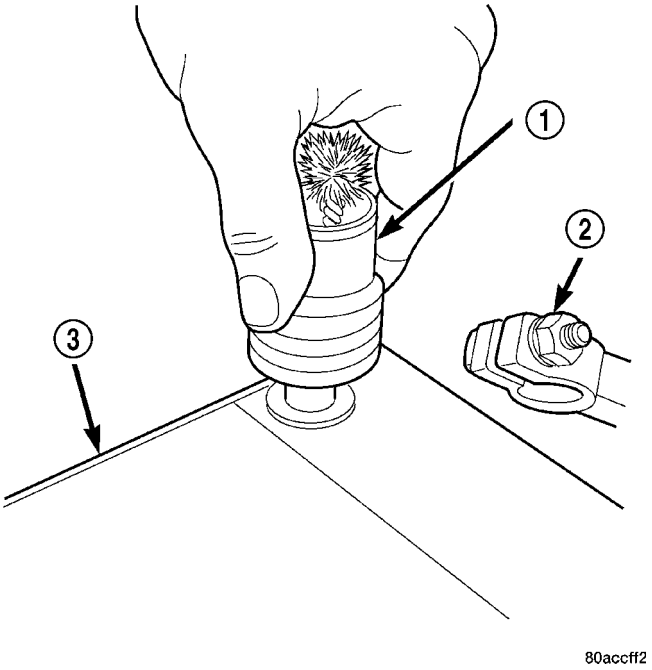


Fig. 3 Clean Battery Terminal Post - Typical

1 - TERMINAL BRUSH
2 - BATTERY CABLE
3 - BATTERY

INSPECTION

The following information details the recommended inspection procedures for the battery and related components. In addition to the maintenance schedules found in this service manual and the owner's manual, it is recommended that these procedures be performed any time the battery or related components must be removed for vehicle service.

(1) Inspect the battery cable terminal clamps for damage. Replace any battery cable that has a damaged or deformed terminal clamp.

(2) Inspect the battery tray and battery holddown hardware for damage. Replace any damaged parts.

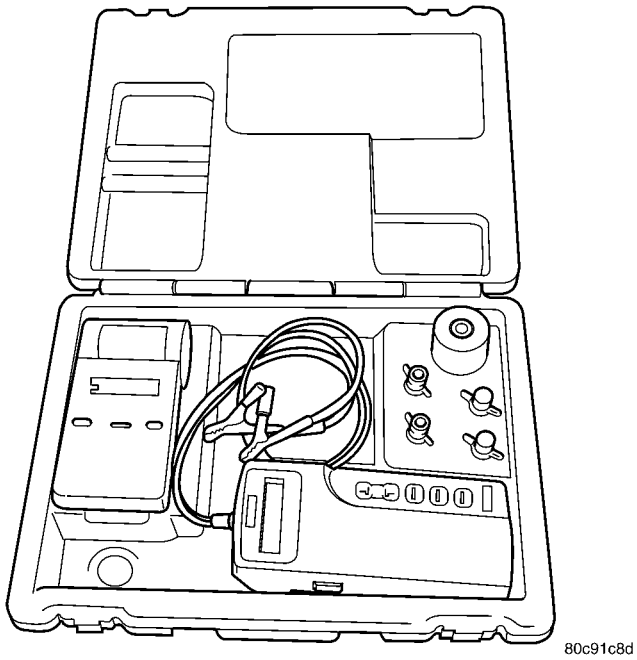
(3) Slide the thermal guard off of the battery case, if equipped. Inspect the battery case for cracks or other damage that could result in electrolyte leaks. Also, check the battery terminal posts for looseness. Batteries with damaged cases or loose terminal posts must be replaced.

(4) Inspect the battery thermal guard for tears, cracks, deformation or other damage. Replace any battery thermal guard that has been damaged.

(5) 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 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE).

SPECIAL TOOLS

BATTERY SYSTEM SPECIAL TOOLS



Micro 420 Battery Tester

BATTERY

DESCRIPTION

Large capacity, low-maintenance storage batteries are standard factory-installed equipment on this model. The primary battery is located in the engine compartment on all models. A second auxiliary battery may be installed under the passengers front seat for running additional electrical equipment.

Male post type terminals made of a soft lead material protrude from the top of the molded plastic battery case to provide the means for connecting the battery to the vehicle electrical system. The battery positive terminal post is physically larger in diameter than the negative terminal post to ensure proper battery connection. The letters **POS** and **NEG** are also molded into the top of the battery case adjacent to their respective positive and negative terminal posts for identification confirmation. Refer to Battery Cables for more information on the battery cables that connect the battery to the vehicle electrical system.

The battery is made up of six individual cells that are connected in series. Each cell contains positively charged plate groups that are connected with lead straps to the positive terminal post, and negatively charged plate groups that are connected with lead straps to the negative terminal post. Each plate consists of a stiff mesh framework or grid coated with

BATTERY (Continued)

lead dioxide (positive plate) or sponge lead (negative plate). Insulators or plate separators made of a non-conductive material are inserted between the positive and negative plates to prevent them from contacting or shorting against one another. These dissimilar metal plates are submerged in a sulfuric acid and water solution called an electrolyte.

The factory-installed low-maintenance battery has removable battery cell caps. Water can be added to this battery. The chemical composition of the metal coated plates within the low-maintenance battery reduces battery gassing and water loss, at normal charge and discharge rates. Therefore, the battery should not require additional water in normal service. Rapid loss of electrolyte can be caused by an overcharging condition. Be certain to diagnose the charging system before returning the vehicle to service.

OPERATION

The battery is designed to store electrical energy in a chemical form. When an electrical load is applied to the terminals of the battery, an electrochemical reaction occurs. This reaction causes the battery to discharge electrical current from its terminals. 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 itself, the battery discharging process is reversed. Charging the battery gradually changes the sulfated lead plates back into sponge lead and lead dioxide, 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.

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, 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.

DIAGNOSIS AND TESTING - BATTERY

The battery must be completely charged and the terminals should be properly cleaned and inspected before diagnostic procedures are performed. Refer to Battery System Cleaning for the proper cleaning procedures, and Battery System Inspection for the proper battery inspection procedures. Refer to Standard Procedures for the proper battery charging procedures.

MICRO 420 BATTERY TESTER

The Micro 420 automotive battery tester is designed to help the dealership technicians diagnose the cause of a defective battery. Follow the instruction manual supplied with the tester to properly diagnose a vehicle. If the instruction manual is not available refer to the standard procedure in this section, which includes the directions for using the Micro 420 battery tester.

WARNING: IF THE BATTERY SHOWS SIGNS OF FREEZING, LEAKING OR LOOSE POSTS, DO NOT TEST, ASSIST-BOOST, OR CHARGE. THE BATTERY MAY ARC INTERNALLY AND EXPLODE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.

WARNING: 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.

WARNING: 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.

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 tested to determine its cranking capacity. A battery that is fully-charged, but does not pass the Micro 420 or load test, is faulty and must be replaced.

BATTERY (Continued)

NOTE: Completely discharged batteries may take several hours to accept a charge. Refer to Standard Procedures for the proper battery charging procedures.

STANDARD PROCEDURE

STANDARD PROCEDURE - BATTERY CHARGING

Battery charging is the means by which the battery can be restored to its full voltage potential. A battery is fully-charged when:

- Micro 420 electrical system tester indicates battery is OK.
- Three hydrometer tests, taken at one-hour intervals, indicate no increase in the temperature-corrected specific gravity of the battery electrolyte.
- Passes Load test.
- Open-circuit voltage of the battery is 12.65 volts or above.

WARNING: IF THE BATTERY SHOWS SIGNS OF FREEZING, LEAKING OR LOOSE POSTS, DO NOT TEST, ASSIST-BOOST, OR CHARGE. THE BATTERY MAY ARC INTERNALLY AND EXPLODE. PERSONAL INJURY AND/OR VEHICLE DAMAGE MAY RESULT.

WARNING: 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.

WARNING: 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.

WARNING: 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.

CAUTION: 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.

CAUTION: 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 battery charger and 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 battery 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, retest the battery using the Micro 420 tester or perform a load test to determine the battery cranking capacity. If the battery will endure a load test, return the battery to service. 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 battery service. Refer to Battery System Cleaning for the proper battery system cleaning procedures, and Battery System Inspection for the proper battery system inspection procedures.

BATTERY (Continued)

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. 4). If the reading is below ten volts, the battery charging 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.

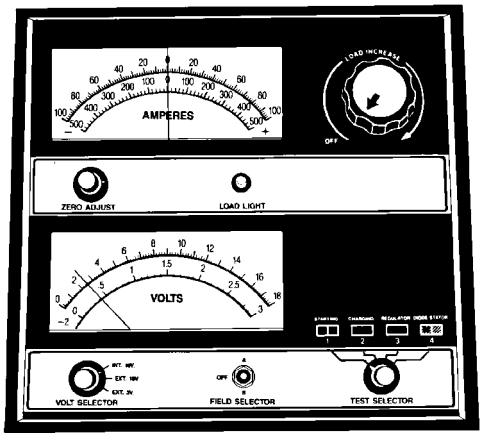


Fig. 4 Voltmeter - Typical

(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 battery charger and 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 battery 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 charging current at various voltages is shown in the Charge Rate Table. If the charging current is still not measurable at the end of the charging time, the battery is faulty and must be replaced. If the charging current is measurable during the charging time, the battery may be good and the charging should be completed in the normal manner.

CHARGE RATE TABLE	
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 battery 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.

The Battery Charging Time Table gives an indication of the time required to charge a typical battery at room temperature based upon the battery state-of-charge and the charger capacity.

BATTERY CHARGING TIME TABLE			
Charging Amperage	5 Amps	10 Amps	20 Amps
Open Circuit Voltage	Hours Charging @ 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

BATTERY (Continued)

STANDARD PROCEDURE - OPEN-CIRCUIT VOLTAGE TEST

A battery open-circuit voltage (no load) test will show the approximate 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.

Before proceeding with this test, completely charge the battery (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE).

(1) Before measuring the open-circuit voltage, the surface charge must be removed from the battery. Turn on the headlamps 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).

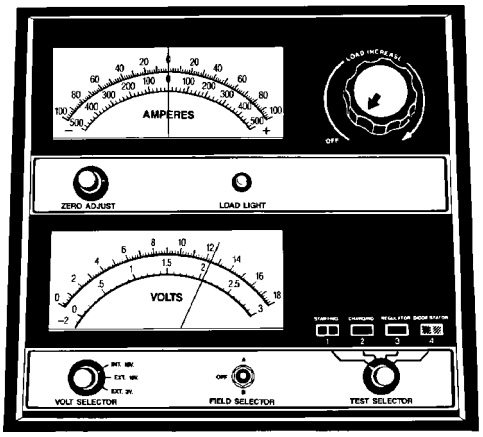


Fig. 5 Testing Open-Circuit Voltage - Typical

See the Open-Circuit Voltage Table. 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 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE).

OPEN CIRCUIT VOLTAGE TABLE	
Open Circuit Voltage	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%

STANDARD PROCEDURE - 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-five milliamperes (0.005 to 0.035 ampere) with the ignition switch in the Off position, and all non-ignition controlled circuits in proper working order. Up to thirty-five milliamperes are needed to enable the memory functions for the Powertrain Control Module (PCM), digital clock, electronically tuned radio, and other 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 fuseblock. 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-five 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.

(2) Determine that the underhood 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 terminal clamp and the battery negative terminal post. Make sure that the doors remain closed so that the illuminated entry system is not activated. The multimeter amperage reading may remain high for up to three minutes, or may not give any reading at all while set in the highest amperage scale, depending upon the electrical equipment in the vehicle. The multi-meter leads must be securely clamped to the battery negative cable terminal clamp and the battery negative terminal post. If continuity between the

BATTERY (Continued)

battery negative terminal post and the negative cable terminal 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, the high-amperage IOD reading on the multi-meter should become very low or nonexistent, depending upon the electrical equipment in the vehicle. If the amperage reading remains high, remove and replace each fuse or circuit breaker in the Fuse Blocks, one at a time until the amperage reading becomes very low, or nonexistent. Refer to the appropriate wiring information in this service manual for complete fuseblock fuse, circuit breaker, and circuit identification. This will isolate each circuit and identify the circuit that is 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 for the proper charging system diagnosis and testing procedures. 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-five milliamperes (0.035 ampere). If the current draw exceeds thirty-five milliamperes, isolate each circuit using the fuse and circuit breaker remove-and-replace process in Step 5. The multi-meter reading will drop to within the acceptable limit when the source of the excessive current draw is disconnected. Repair this circuit as required; whether a wiring short, incorrect switch adjustment, or a component failure is at fault.

STANDARD PROCEDURE - USING MICRO 420 BATTERY TESTER

Always use the Micro 420 Instruction Manual that was supplied with the tester as a reference. If the Instruction Manual is not available the following procedure can be used:

WARNING: ALWAYS WEAR APPROPRIATE EYE PROTECTION AND USE EXTREME CAUTION WHEN WORKING WITH BATTERIES.

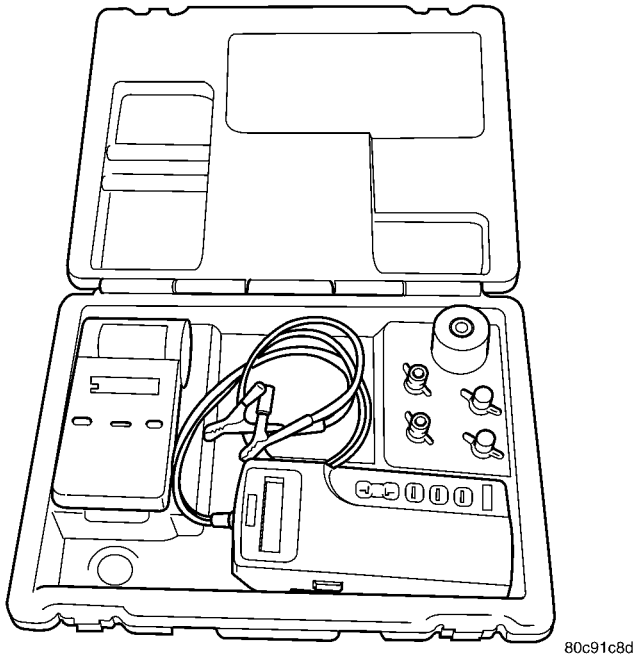


Fig. 6 Micro 420 Battery Tester

BATTERY TESTING

(1) If testing the battery OUT-OF-VEHICLE, clean the battery terminals with a wire brush before testing. If the battery is equipped with side post terminals, install and tighten the supplied lead terminal stud adapters. Do not use steel bolts. Failure to properly install the stud adapters, or using stud adapters that are dirty or worn-out may result in false test readings.

(2) If testing the battery IN-THE-VEHICLE, make certain all of the vehicle accessory loads are OFF, including the ignition. **The preferred test position is at the battery terminal**. If the battery is not accessible, you may test using both the positive and negative jumper posts. Select TESTING AT JUMPER POST when connecting to that location.

(3) Connect the tester (Fig. 6) to the battery or jumper posts, the red clamp to positive (+) and the black clamp to negative (–).

NOTE: Multiple batteries connected in parallel must have the ground cable disconnected to perform a battery test. Failure to disconnect may result in false battery test readings.

(4) Using the ARROW key select **in** or **out** of vehicle testing and press ENTER to make a selection.

(5) If not selected, choose the Cold Cranking Amp (CCA) battery rating. Or select the appropriate battery rating for your area (see menu). The tester will then run its self programmed test of the battery and display the results. Refer to the test result table noted below.

BATTERY (Continued)

CAUTION: If REPLACE BATTERY is the result of the test, this may mean a poor connection between the vehicle's cables and battery exists. After disconnecting the vehicle's battery cables from the battery, retest the battery using the OUT-OF-VEHICLE test before replacing.

(6) While viewing the battery test result, press the CODE button and the tester will prompt you for the last 4 digits of the VIN. Use the UP/DOWN arrow buttons to scroll to the correct character; then press ENTER to select and move to the next digit. Then press the ENTER button to view the SERVICE CODE. Pressing the CODE button a second time will return you to the test results.

BATTERY TEST RESULTS	
GOOD BATTERY	Return to service
GOOD - RECHARGE	Fully charge battery and return to service
CHARGE & RETEST	Fully charge battery and retest battery
REPLACE BATTERY	Replace the battery and retest complete system
BAD-CELL REPLACE	Replace the battery and retest complete system

NOTE: The SERVICE CODE is required on every warranty claim submitted for battery replacement.

STANDARD PROCEDURE - CHECKING BATTERY ELECTROLYTE LEVEL

(1) Remove the battery cell caps (Fig. 7).

(2) Look through the battery cap holes to determine the level of the electrolyte in the battery (Fig. 8). The electrolyte should be approximately 1 centimeter above the battery plates or until the hook inside the battery cap holes is covered.

(3) Add only distilled water until the electrolyte level is approx. one centimeter above the plates.

REMOVAL

UNDER HOOD BATTERY REMOVAL

(1) Turn the ignition switch to the Off position. Be certain that all electrical accessories are turned off.

(2) Loosen the battery negative cable terminal clamp pinch-bolt hex nut.

(3) Disconnect the battery negative cable terminal clamp from the battery negative terminal post. If necessary, use a battery terminal puller to remove the terminal clamp from the battery post.

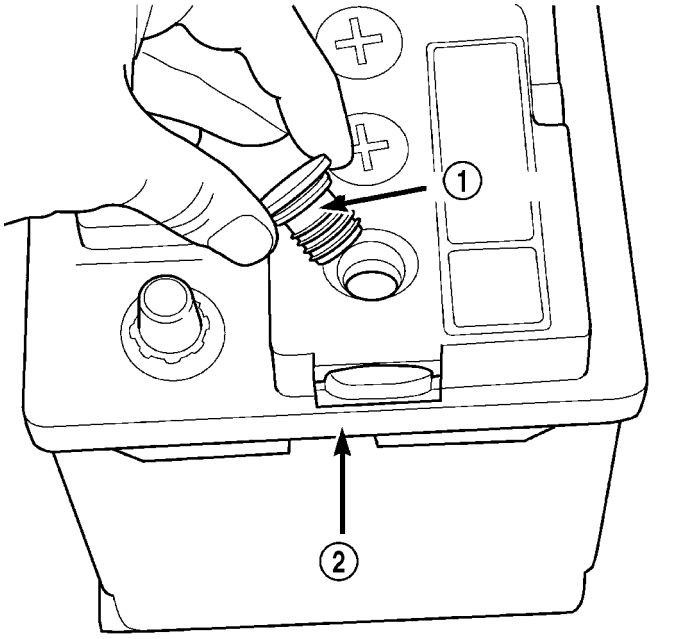


Fig. 7 Battery Cell Caps

1 - BATTERY CELL CAP
2 - BATTERY

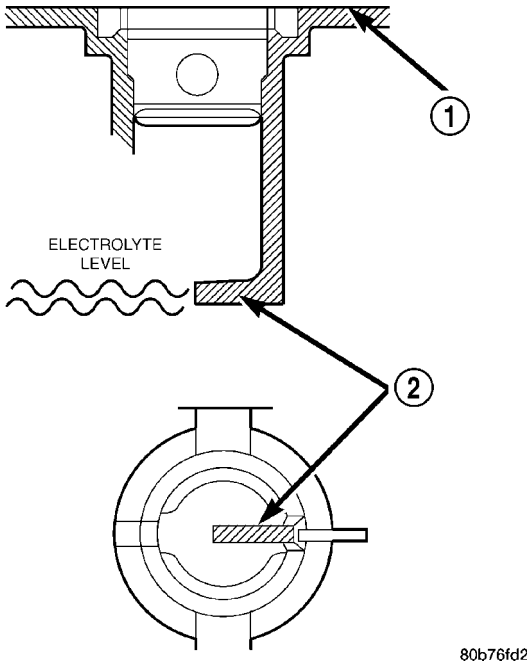


Fig. 8 Hook Inside Battery Cap Holes

1 - BATTERY SURFACE COVER
2 - HOOK

(4) Loosen the battery positive cable terminal clamp pinch-bolt hex nut.

(5) Disconnect the battery positive cable terminal clamp from the battery positive terminal post. If nec-

BATTERY (Continued)

essary, use a battery terminal puller to remove the terminal clamp from the battery post.

(6) Remove the battery hold downs from the battery (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/ BATTERY HOLDDOWN - REMOVAL).

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.

(7) Remove the battery from the battery tray.

AUXILIARY BATTERY REMOVAL

(1) Turn the ignition switch to the Off position. Be certain that all electrical accessories are turned off.

(2) Remove the passenger front seat assembly. Refer to the Body section for procedure.

(3) Remove the top cover from the seat base assembly.

(4) Loosen the battery negative cable terminal clamp pinch-bolt hex nut.

(5) Disconnect the battery negative cable terminal clamp from the battery negative terminal post. If necessary, use a battery terminal puller to remove the terminal clamp from the battery post.

(6) Loosen the battery positive cable terminal clamp pinch-bolt hex nut.

(7) Disconnect the battery positive cable terminal clamp from the battery positive terminal post. If necessary, use a battery terminal puller to remove the terminal clamp from the battery post.

(8) Remove the battery hold downs from the battery (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/ BATTERY HOLDDOWN - REMOVAL).

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.

(9) Remove the battery from the battery tray.

INSTALLATION

UNDER HOOD BATTERY INSTALLATION

(1) Position the battery onto the battery tray. Ensure that the battery positive and negative terminal posts are correctly positioned. The battery cable terminal clamps must reach the correct battery terminal post without stretching the cables.

(2) Reinstall the battery hold downs onto the battery (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/ BATTERY HOLDDOWN - INSTALLATION).

CAUTION: Be certain that the battery cable terminal clamps are connected to the correct battery terminal posts. Reverse battery polarity may damage electrical components of the vehicle.

(3) Reconnect the battery positive cable terminal clamp to the battery positive terminal post. Tighten the terminal clamp pinch-bolt hex nut to 11.8 N·m (105 in. lbs.).

(4) Reconnect the battery negative cable terminal clamp to the battery negative terminal post. Tighten the terminal clamp pinch-bolt hex nut to 7.9 N·m (70 in. lbs.).

(5) Apply a thin coating of petroleum jelly or chassis grease to the exposed surfaces of the battery cable terminal clamps and the battery terminal posts.

AUXILIARY BATTERY INSTALLATION

(1) Position the battery onto the battery tray. Ensure that the battery positive and negative terminal posts are correctly positioned. The battery cable terminal clamps must reach the correct battery terminal post without stretching the cables.

(2) Reinstall the battery hold downs onto the battery (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/ BATTERY HOLDDOWN - INSTALLATION).

CAUTION: Be certain that the battery cable terminal clamps are connected to the correct battery terminal posts. Reverse battery polarity may damage electrical components of the vehicle.

(3) Reconnect the battery positive cable terminal clamp to the battery positive terminal post. Tighten the terminal clamp pinch-bolt hex nut to 11.8 N·m (105 in. lbs.).

(4) Reconnect the battery negative cable terminal clamp to the battery negative terminal post. Tighten the terminal clamp pinch-bolt hex nut to 7.9 N·m (70 in. lbs.).

(5) Apply a thin coating of petroleum jelly or chassis grease to the exposed surfaces of the battery cable terminal clamps and the battery terminal posts.

(6) Install the top cover on the seat base assembly.

(7) Install the passenger front seat assembly. Refer to the Body section for procedure.

BATTERY HOLDDOWN

DESCRIPTION

The battery hold down hardware includes two hex nuts with washers and two hold down brackets. The battery hold down brackets are formed of stamped steel. The hold down assembly is coated for corrosion protection.

When installing a battery into the battery tray, be certain that the hold down hardware is properly installed and that the fasteners are tightened to the proper specifications. Improper hold down fastener tightness, whether too loose or too tight, can result in damage to the battery, the vehicle or both.

REMOVAL

(1) Turn the ignition switch to the Off position. Be certain that all electrical accessories are turned off.

(2) Remove the two nuts that secure the battery hold down brackets to the battery tray.

(3) Remove the battery hold down brackets.

INSTALLATION

(1) Install the battery hold down brackets.

(2) Install the two nuts that secure the battery hold down brackets to the battery tray. Tighten to 70 in. lbs.

BATTERY CABLES

DESCRIPTION

The battery cables are large gauge, stranded copper wires sheathed within a heavy plastic or synthetic rubber insulating jacket. The wire used in the battery cables combines excellent flexibility and reliability with high electrical current carrying capacity.

The battery cables cannot be repaired and, if damaged or faulty they must be replaced. Both the battery positive and negative cables are available for service replacement only as a unit with the battery positive cable wire harness or the battery negative cable wire harness, which may include portions of the wiring circuits for the generator and other components on some models.

The battery cables feature a stamped brass clamping type female battery terminal crimped onto one end of the battery cable wire and then solder-dipped. A square headed pinch-bolt and hex nut are installed at the open end of the female battery terminal clamp. The battery positive cable also includes a red molded rubber protective cover for the female battery terminal clamp. Large eyelet type terminals are crimped onto the opposite end of the battery cable wire and then solder-dipped. The battery positive cable wires have a red insulating jacket to provide visual identification and feature a larger female battery terminal clamp to allow connection to the larger battery positive terminal post. The battery negative cable wires have a black insulating jacket and a smaller female battery terminal clamp.

OPERATION

The battery cables connect the battery terminal posts to the vehicle electrical system. These cables also provide a return path for electrical current generated by the charging system for restoring the voltage potential of the battery. The female battery terminal clamps on the ends of the battery cable wires provide a strong and reliable connection of the battery cable to the battery terminal posts. The terminal pinch bolts allow the female terminal clamps to be tightened around the male terminal posts on the top of the battery. The eyelet terminals secured to the ends of the battery cable wires opposite the female battery terminal clamps provide secure and reliable connection of the battery to the vehicle electrical system.

DIAGNOSIS AND TESTING - BATTERY CABLES

A voltage drop test will determine if there is excessive resistance in the battery cable terminal connections or the battery cables. If excessive resistance is found in the battery cable connections, the connection point should be disassembled, cleaned of all corrosion or foreign material, then reassembled. Following reassembly, check the voltage drop for the battery cable connection and the battery cable again to confirm repair.

When performing the voltage drop test, 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 terminal clamp and to the battery positive cable eyelet terminal at the starter solenoid B(+) terminal stud. If you probe the battery positive terminal post and the battery positive cable eyelet terminal at the starter solenoid B(+) terminal stud, you are reading the combined voltage drop in the battery positive cable terminal clamp-to-terminal post connection and the battery positive cable.

VOLTAGE DROP TEST

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.

BATTERY CABLES (Continued)

WARNING: 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.

WARNING: 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.

WARNING: 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 this test, be certain that the following procedures are accomplished:

- The battery is fully-charged and tested. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - STANDARD PROCEDURE).
- 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.
- Prevent the engine from starting.

(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 terminal clamp (Fig. 9). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If voltage is detected, correct the poor connection between the battery negative cable terminal clamp and the battery negative terminal post.

(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 terminal clamp (Fig. 10). Rotate and hold the ignition switch in the Start position. Observe the voltmeter. If voltage is detected, correct the poor connection between the battery positive cable terminal clamp and the battery positive terminal post.

(3) Connect the voltmeter to measure between the battery positive cable terminal clamp and the starter solenoid B(+) terminal stud (Fig. 11). 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 positive cable eyelet terminal connection at the starter solenoid B(+) terminal stud. Repeat the test. If the reading is still above 0.2 volt, replace the faulty battery positive cable.

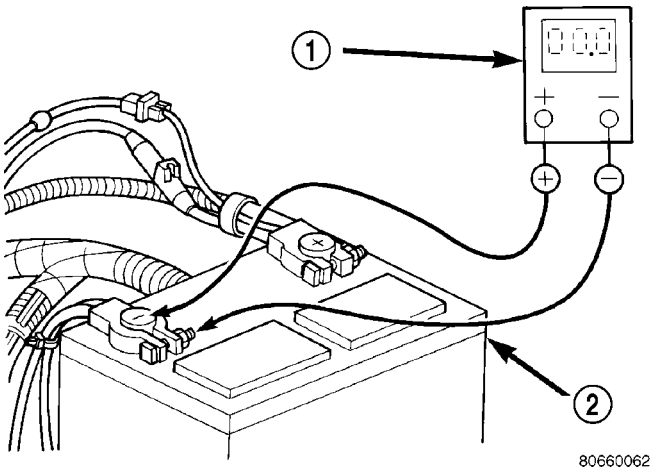


Fig. 9 Test Battery Negative Connection Resistance - Typical

1 - VOLTMETER
2 - BATTERY

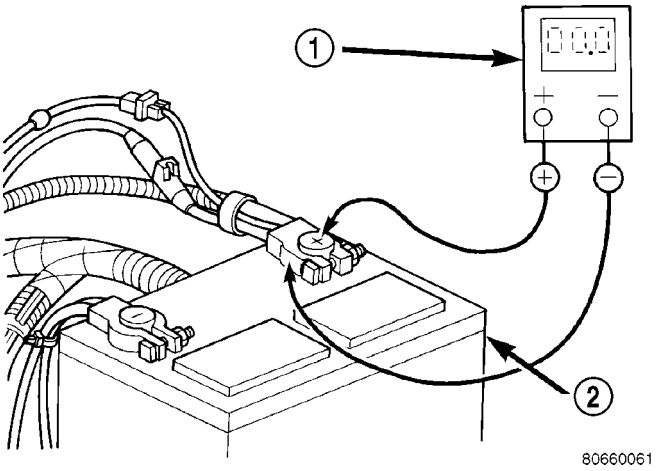


Fig. 10 Test Battery Positive Connection Resistance - Typical

1 - VOLTMETER
2 - BATTERY

(4) Connect the voltmeter to measure between the battery negative cable terminal clamp and a good clean ground on the engine block (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 negative cable eyelet terminal connection to the engine block. Repeat the test. If the reading is still above 0.2 volt, replace the faulty battery negative cable.

BATTERY CABLES (Continued)

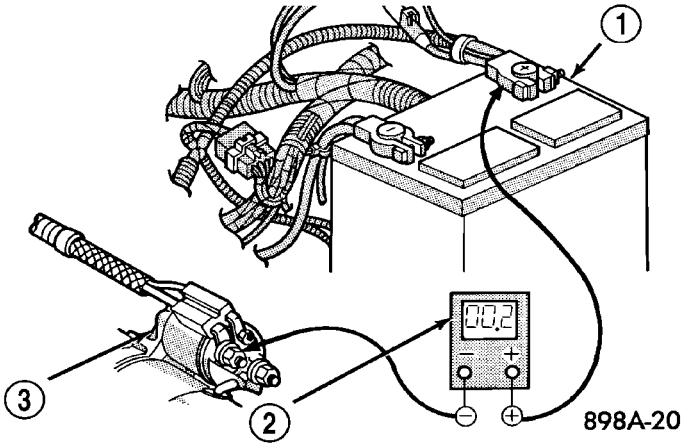


Fig. 11 Test Battery Positive Cable Resistance - Typical

1 - BATTERY
2 - VOLTMETER
3 - STARTER MOTOR

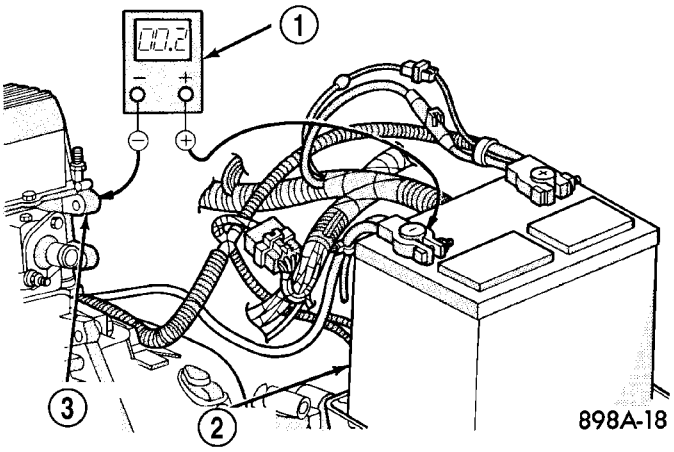


Fig. 12 Test Ground Circuit Resistance - Typical

1 - VOLTMETER
2 - BATTERY
3 - ENGINE GROUND

REMOVAL

(1) Turn the ignition switch to the Off position. Be certain that all electrical accessories are turned off.

(2) Disconnect and isolate the remote battery negative cable terminal.

(3) One at a time, trace and disconnect the battery cable retaining pushpins, fasteners and routing clips until the cables are free from the vehicle.

(4) Feed the battery cable assembly out of the vehicle.

INSTALLATION

(1) Position the battery cable in the vehicle.

(2) One at a time, install the battery cable retaining pushpins, fasteners and routing clips until the cable is installed exactly in the factory installed location in the vehicle. Refer to the Wiring Diagram section of the service manual for reference.

(3) Connect the battery negative cable terminal.

BATTERY TRAY

DESCRIPTION

The battery is mounted in a stamped steel battery tray located in the left front corner of the engine compartment. The battery tray is secured with bolts to the left front wheelhouse inner steel panel. A hole in the bottom of the battery tray is fitted with a formed drain tube. A second hole in the bottom of the tray is fitted with a battery temperature sensor.

OPERATION

The battery tray provides a mounting location and support for the vehicle battery. The battery tray support supports the battery tray and provides an anchor point for the inboard battery hold down hardware. The battery tray and the battery hold down hardware combine to secure and stabilize the battery in the engine compartment, which prevents battery movement during vehicle operation. Unrestrained battery movement during vehicle operation could result in damage to the vehicle, the battery or both. The battery tray drain tube directs spilled water or electrolyte from a leaking battery to the ground through another hole in the front extension of the left front wheelhouse inner panel.

REMOVAL

(1) Remove the battery from the battery tray. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - REMOVAL).

(2) Remove the battery temperature sensor from the battery tray. (Refer to 8 - ELECTRICAL/CHARGING/BATTERY TEMPERATURE SENSOR - REMOVAL).

(3) Remove the bolts that secure the battery tray to the battery tray support.

(4) Remove the battery tray from the vehicle.

INSTALLATION

(1) Clean and inspect the battery tray.(Refer to 8 - ELECTRICAL/BATTERY SYSTEM - CLEANING).

(2) Position the battery tray onto the battery tray support.

(3) Install and tighten the bolts that secure the battery tray to the battery tray support. Tighten the screws to 11.8 N·m (105 in. lbs.).

(4) Install the battery temperature sensor onto the battery tray. (Refer to 8 - ELECTRICAL/CHARGING/BATTERY TEMPERATURE SENSOR - INSTALLATION).

(5) Install the battery onto the battery tray. (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - INSTALLATION).

CHARGING SYSTEM

TABLE OF CONTENTS

page

CHARGING SYSTEM
SPECIFICATIONS
TORQUE – 2.7L DIESEL 17
SPECIAL TOOLS 17
GENERATOR
DESCRIPTION 18
OPERATION 18
REMOVAL 18
INSTALLATION 18

page

GENERATOR DECOUPLER PULLEY
DESCRIPTION 19
OPERATION 19
DIAGNOSIS AND TESTING - GENERATOR DECOUPLER 19
REMOVAL 20
INSTALLATION 21
VOLTAGE REGULATOR
DESCRIPTION 23

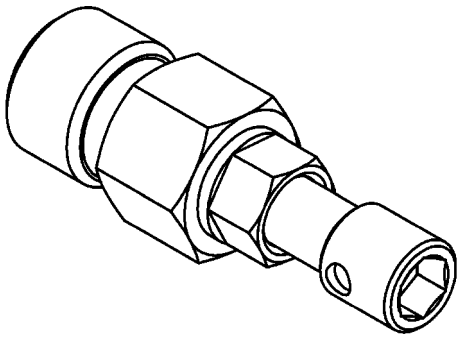
CHARGING SYSTEM

SPECIFICATIONS

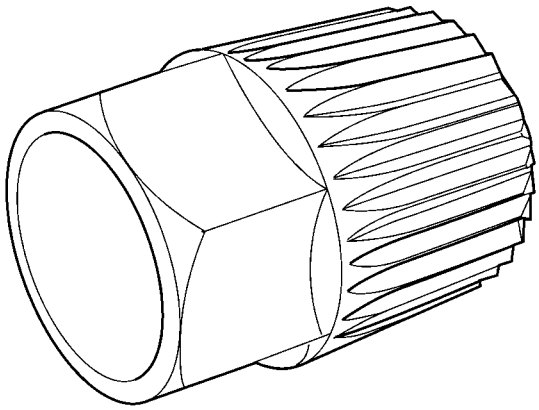
TORQUE – 2.7L DIESEL

DESCRIPTION	N-m	Ft. Lbs.	In. Lbs.
B+ Terminal Nut at Top of Generator	13	-	115
Generator Mounting Bolts/Nut	54	40	-
Rear Generator Support Bracket Bolts (to engine)	28	-	250
Generator Decoupler	110	81	-

SPECIAL TOOLS



GENERATOR DECOUPLER TOOL #8433



80cb8152

GENERATOR DECOUPLER TOOL #8823

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.

On certain engines, the decoupler pulley may be replaced separately.

OPERATION

As the energized rotor begins to rotate within the generator, the spinning magnetic field induces a current into the windings of the stator coil. Once the generator begins producing sufficient current, it also provides the current needed to energize the rotor.

The 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 Specifications and see Generator Ratings 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 (decoupler pulley); incorrect, worn, damaged or misadjusted fan drive belt; loose mounting bolts; a misaligned drive pulley or a defective stator or diode.

An instrument panel mounted, battery charge indicator lamp is used. When the key is in the on position, the lamp will be illuminated. This is done as a bulb check. If this lamp remains illuminated while the engine is running, a Diagnostic Trouble Code (DTC) has been detected for the charging system.

REMOVAL

CAUTION: DISCONNECT NEGATIVE CABLE FROM BATTERY BEFORE REMOVING BATTERY OUTPUT WIRE FROM GENERATOR. FAILURE TO DO SO CAN RESULT IN INJURY.

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 Cooling System.

(1) Disconnect and isolate negative battery cable.

(2) Remove generator drive belt. Refer to Cooling System for procedure.

(3) Raise and support vehicle.

(4) Remove protective plastic cover from B+ stud at top of generator.

(5) Remove nut securing battery output cable to B+ terminal at top of generator.

(6) Unplug field terminal connector at rear of generator.

(7) Remove 4 generator mounting bolts (Torx-style #12 bit) (Fig. 1).

(8) Remove generator from lower side of vehicle.

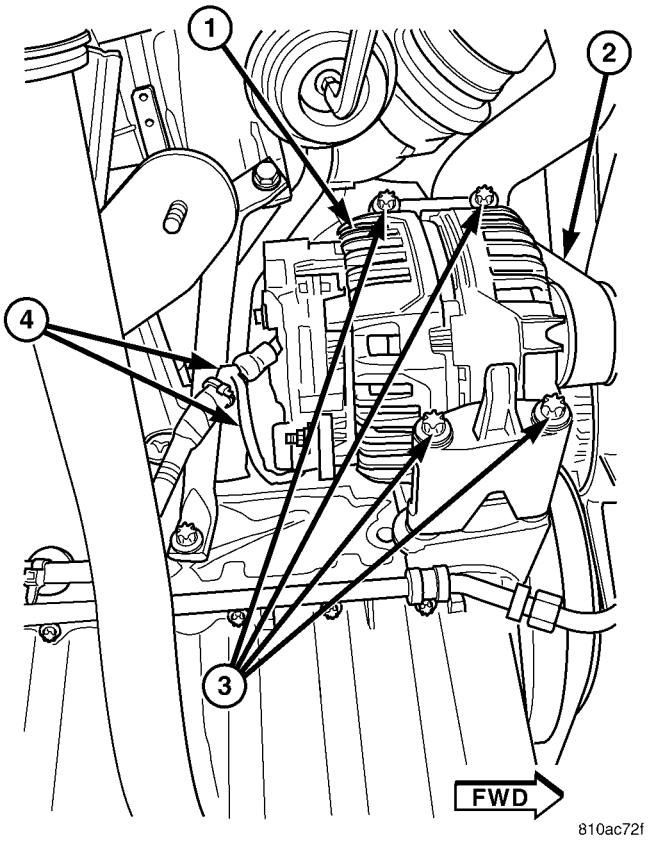


Fig. 1 GENERATOR MOUNTING - 2.7L DIESEL

1 - GENERATOR
2 - DRIVE BELT
3 - MOUNTING BOLTS (4)
4 - GENERATOR WIRING HARNESS

INSTALLATION

(1) Raise and support vehicle.

(2) Position generator to engine.

(3) Install 4 generator mounting bolts (Fig. 1). Refer to Torque Specifications.

GENERATOR (Continued)

(4) Connect field terminal connector at rear of generator.
(5) Install battery output cable and nut to B+ terminal at top of generator. Refer to Torque Specifications.
(6) Install protective plastic cover to B+ stud at top of generator.
(7) Lower vehicle.

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 Cooling System.

(8) Install generator drive belt. Refer to Cooling System for procedure.
(9) Connect negative battery cable.
(10) Check charging system for proper operation.

GENERATOR DECOUPLER PULLEY

DESCRIPTION

The generator decoupler is used only with certain engines. The decoupler is used in place of the standard generator drive pulley (Fig. 2).

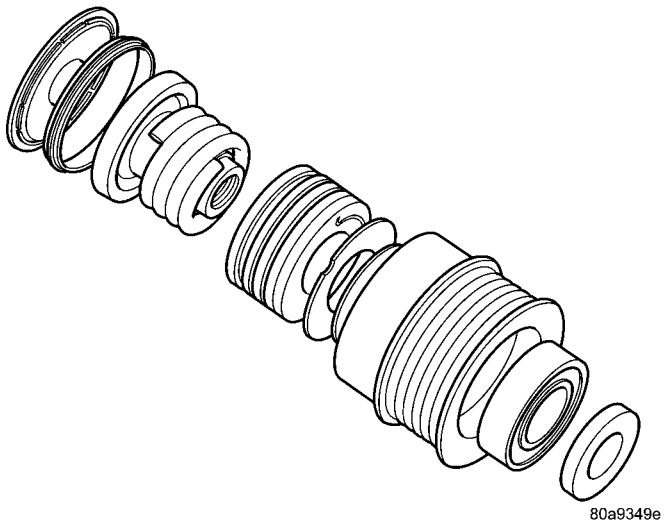


Fig. 2 GENERATOR DECOUPLER PULLEY

OPERATION

The generator decoupler is used only with certain engines. The decoupler (Fig. 2) is a one-way clutch designed to help reduce belt tension fluctuation, vibration, reduce fatigue loads, improve belt life, reduce hubloads on components, and reduce noise. Dry operation is used (no grease or lubricants). The decoupler is not temperature sensitive and also has a low sensitivity to electrical load. The decoupler is a non-serviceable item and is to be replaced as an assembly.

DIAGNOSIS AND TESTING - GENERATOR DECOUPLER

CONDITION	POSSIBLE CAUSES	CORRECTION
Does not drive generator (generator not charging)	Internal failure	Replace decoupler
Noise coming from decoupler	Internal failure	Replace decoupler

GENERATOR DECOUPLER PULLEY (Continued)

REMOVAL

The generator decoupler is used only with certain engines.

Two different type generator decoupler pulleys are used. One can be identified by the use of machined splines (Fig. 3). The other can be identified by a hex opening (Fig. 4) and will not use splines.

Different special tools are required to service each different decoupler. Refer to following procedure.

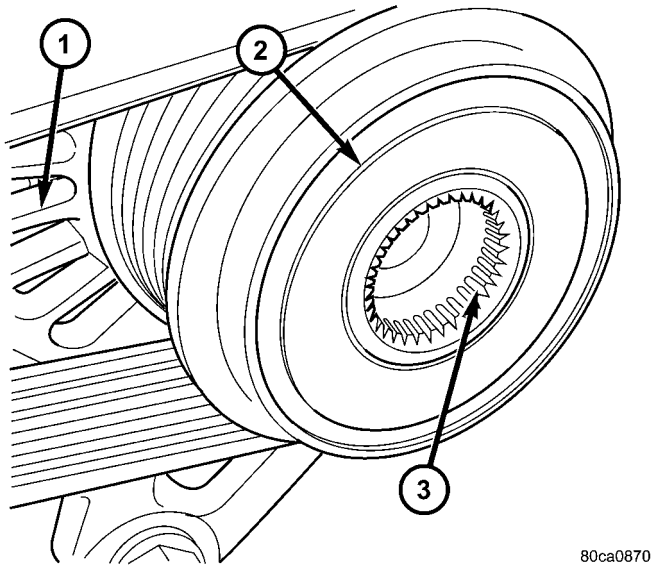


Fig. 3 GENERATOR DECOUPLER PULLEY (INA)

1 - GENERATOR
2 - DECOUPLER (INA)
3 - MACHINED SPLINES

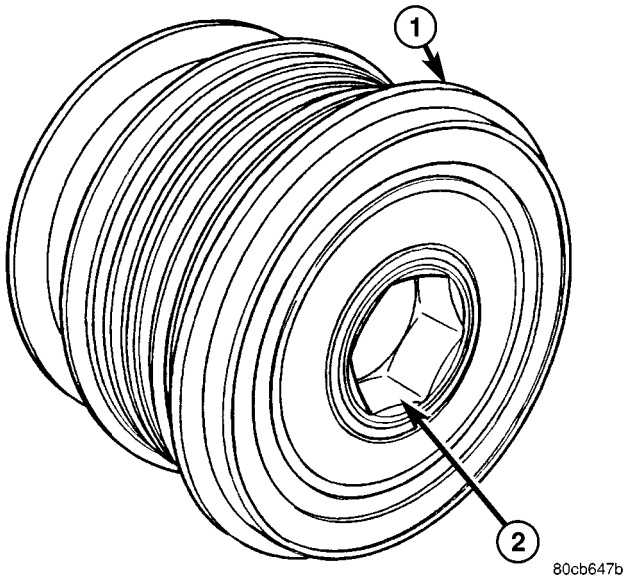


Fig. 4 GENERATOR DECOUPLER PULLEY (LITENS)

1 - DECOUPLER (LITENS)
2 - HEX OPENING

INA Decoupler

(1) Disconnect negative battery cable.

(2) Remove generator and accessory drive belt. Refer to Generator Removal.

(3) Position Special Tool #8823 (VM.1048) into decoupler (Fig. 5).

(4) Determine if end of generator shaft is hex shaped (Fig. 6) or is splined (Fig. 7). If hex is used,

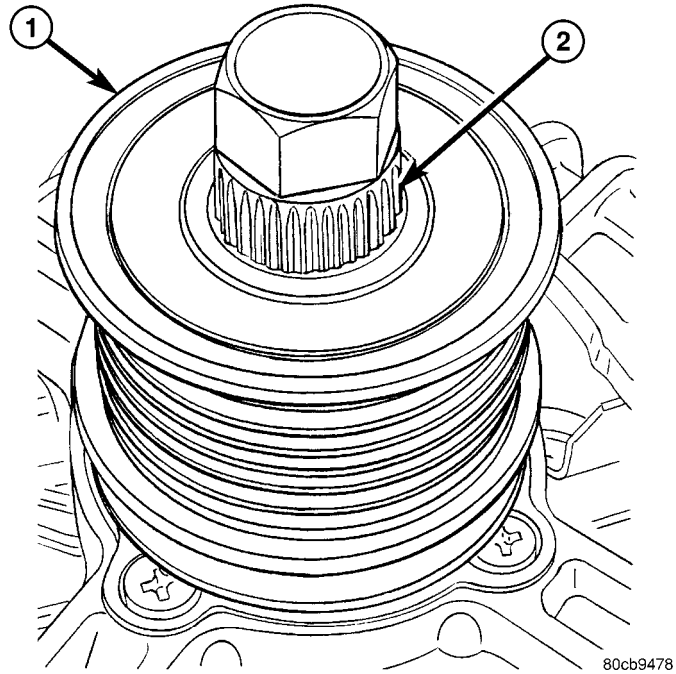


Fig. 5 #8823 TOOL AND INA DECOUPLER

1 - INA DECOUPLER
2 - TOOL #8823 (VM.1048)

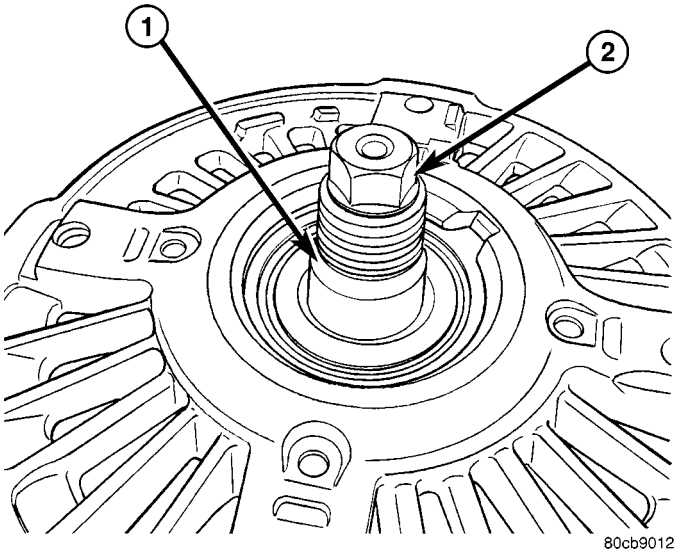


Fig. 6 END OF GENERATOR SHAFT (HEX)

1 - GENERATOR SHAFT
2 - HEX

GENERATOR DECOUPLER PULLEY (Continued)

insert a 10MM deep socket into tool #8823 (VM.1048) (Fig. 8). If splined, insert a 5/16" 6-point hex driver, or a 10MM 12-point triple square driver into tool #8823 (VM.1048) (Fig. 9).

(5) The generator shaft uses conventional right-hand threads to attach decoupler. To break decoupler loose from generator threads, rotate end of tool clockwise (Fig. 8) or, (Fig. 9).

(6) After breaking loose with tool, unthread decoupler by hand from generator.

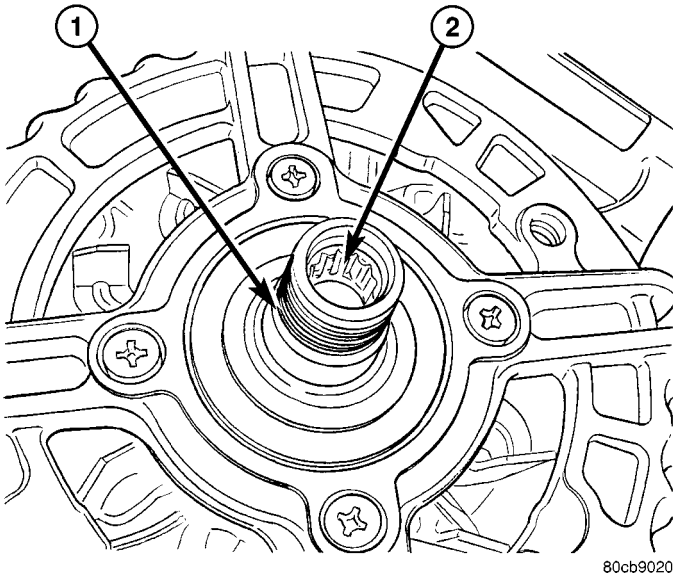


Fig. 7 END OF GENERATOR SHAFT (SPLINED)

1 - GENERATOR SHAFT
2 - SPLINES

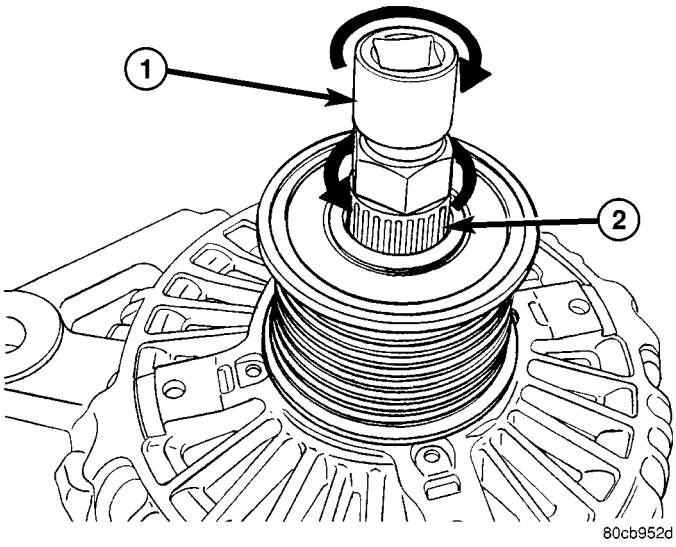


Fig. 8 DECOUPLER REMOVAL (INA-HEX)

1 - DEEP 10 MM SOCKET
2 - TOOL #8823 (VM.1048)

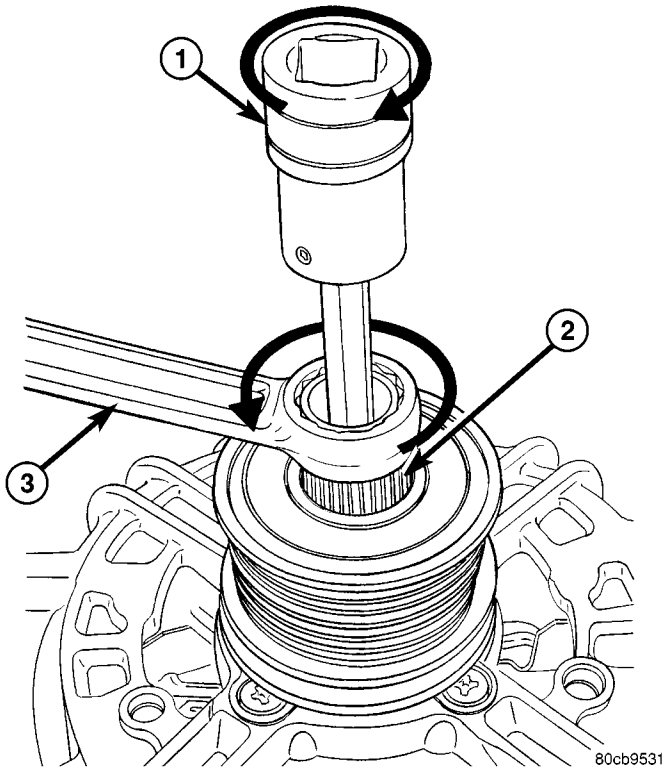


Fig. 9 DECOUPLER REMOVAL (INA-SPLINED)

1 - DRIVER
2 - TOOL #8823 (VM.1048)
3 - 17 MM WRENCH

Litens Decoupler

(1) Disconnect negative battery cable.

(2) Remove generator and accessory drive belt. Refer to Generator Removal.

(3) Position Special Tool #8433 (Fig. 10) into decoupler. Align to hex end of generator shaft.

(4) The generator shaft uses conventional right-hand threads to attach decoupler. To break decoupler loose from generator threads, rotate end of tool clockwise (Fig. 11).

(5) After breaking loose with tool, unthread decoupler by hand from generator.

INSTALLATION

INA Decoupler

(1) Thread decoupler pulley onto generator shaft by hand (right-hand threads).

(2) Position Special Tool #8823 (VM.1048) into decoupler (Fig. 5).

(3) Determine if end of generator shaft is hex shaped (Fig. 6) or is splined (Fig. 7). If hex is used, insert a 10MM deep socket into tool #8823 (VM.1048) (Fig. 12). If splined, insert a 5/16" 6-point hex driver, or a 10MM 12-point triple square driver into tool #8823 (VM.1048) (Fig. 13).

GENERATOR DECOUPLER PULLEY (Continued)

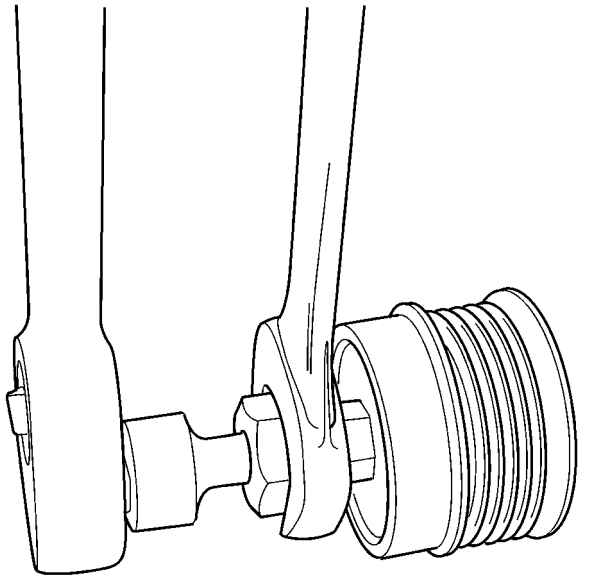


Fig. 10 # 8433 TOOL AND LITENS DECOUPLER

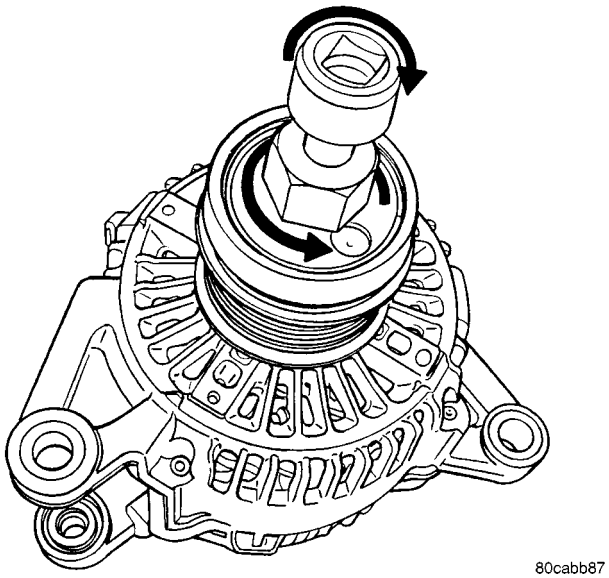


Fig. 11 DECOUPLER REMOVAL (LITENS)

(4) **Do not use an adjustable, ratcheting "click type" torque wrench. Most "click type" wrenches will only allow torque to be applied in a clockwise rotation. Use a dial-type or beam-type wrench.** Tighten in counter-clockwise rotation (Fig. 12) or, (Fig. 13). Refer to torque specifications.

(5) Install accessory drive belt, and generator. Refer to Generator Installation.

(6) Connect negative battery cable.

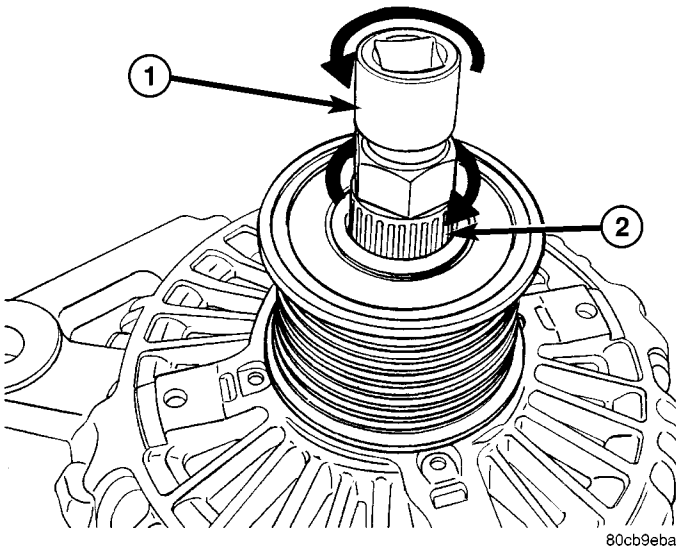


Fig. 12 DECOUPLER INSTALLATION (INA-HEX)

1 - 10MM DEEP SOCKET
2 - TOOL # 8823 (VM.1048)

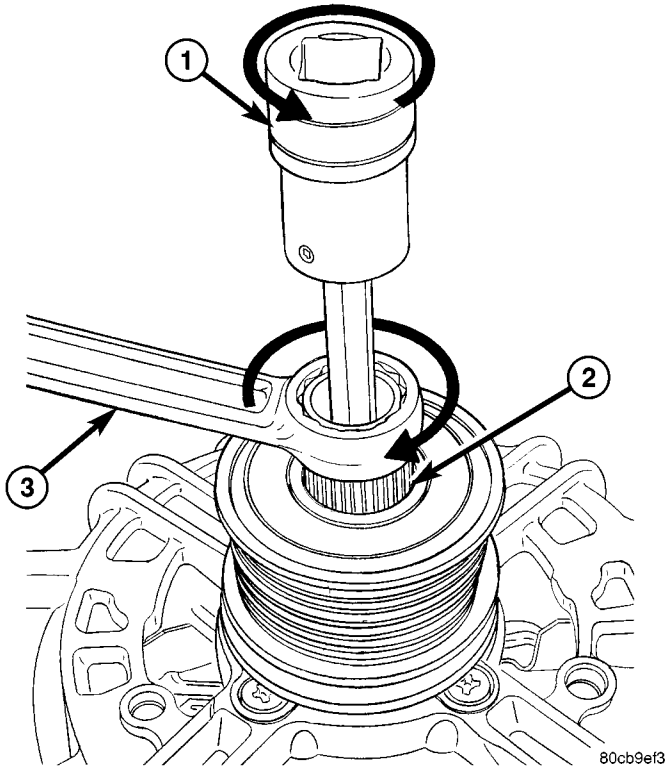


Fig. 13 DECOUPLER INSTALLATION (INA SPLINED)

1 - DRIVER
2 - TOOL # 8823 (VM.1048)

Litens Decoupler

(1) Thread decoupler pulley onto generator shaft by hand (right-hand threads).

GENERATOR DECOUPLER PULLEY (Continued)

(2) Position Special Tool 8433 (Fig. 10) into decoupler. Align tool to hex end of generator shaft.

(3) **Do not use an adjustable, ratcheting "click type" torque wrench. Most "click type" wrenches will only allow torque to be applied in a clockwise rotation. Use a dial-type or beam-type wrench.** Tighten in counter-clockwise rotation (Fig. 14). Refer to torque specifications.

(4) Install accessory drive belt, and generator. Refer to Generator Installation.

(5) Connect negative battery cable.

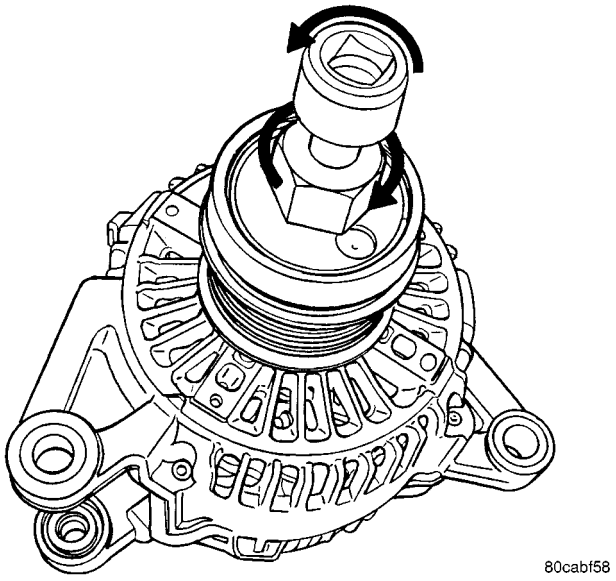


Fig. 14 DECOUPLER INSTALLATION (Litens)

VOLTAGE REGULATOR

DESCRIPTION

The electronic voltage regulator is attached to the back of the generator. It is not serviced as a separate component. If replacement is necessary, the generator must be replaced.

STARTING SYSTEM

TABLE OF CONTENTS

page

STARTING SYSTEM
DESCRIPTION 24
OPERATION 24
DIAGNOSIS AND TESTING - STARTING SYSTEM 25
SPECIFICATIONS
TORQUE - STARTER - DIESEL 29
SPECIFICATIONS - STARTER MOTOR - DIESEL 29

page

STARTER MOTOR
DIAGNOSIS AND TESTING - STARTER MOTOR 29
REMOVAL 30
INSTALLATION 31
STARTER MOTOR RELAY
DESCRIPTION 31
REMOVAL 31
INSTALLATION 32

STARTING SYSTEM

DESCRIPTION

The starting system consists of:

- Starter relay
- Starter motor (including an integral starter solenoid)

Other components to be considered as part of starting system are:

- Battery
- Battery cables
- Ignition switch and key lock cylinder
- Park/neutral position switch (automatic transmission)
- Wire harnesses and connections.

The Battery, Starting, and Charging systems operate in conjunction with one another, and must be tested as a complete system. For correct operation of starting/charging systems, all components used in these 3 systems must perform within specifications. When attempting to diagnose any of these systems, it is important that you keep their interdependency in mind.

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 Engine Control Module (ECM). Use of an induction-type milliampere ammeter, volt/ohmmeter, battery charger, carbon pile rheostat (load tester), and 12-volt test lamp may be required.

Certain starting system components are monitored by the ECM and may produce a Diagnostic Trouble Code (DTC).

OPERATION

The starting system components form two separate circuits. A high-amperage feed circuit that feeds the starter motor high-amperage, and a low-amperage control circuit that operates on less than 20 amperes. The high-amperage feed circuit components include the battery, the battery cables, the contact disc portion of the starter solenoid, and the starter motor itself. The low-amperage control circuit components include the ignition switch, the park/neutral position switch (automatic transmission), the starter relay, the electromagnetic windings of the starter solenoid, and the connecting wire harness components.

If the vehicle is equipped with an automatic transmission, battery voltage is supplied through the low-amperage control circuit to the coil battery terminal of the starter relay when the ignition switch is turned to the 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 manual transmission flywheel or on the automatic transmission torque converter or 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.

STARTING SYSTEM (Continued)

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.

DIAGNOSIS AND TESTING - STARTING SYSTEM

The battery, starting, and charging systems operate in conjunction with one another, and must be tested as a complete system. For correct starting/charging system operation, all of the components involved in these 3 systems must perform within specifications.

Starting System Diagnosis		
CONDITION	POSSIBLE CAUSE	CORRECTION
STARTER FAILS TO OPERATE.	1. Battery discharged or faulty.	1. Refer to Battery. Charge or replace battery, if required.
	2. Starting circuit wiring faulty.	2. Refer to 8, Wiring Diagrams. Test and repair starter feed and/or control circuits, if required.
	3. Starter relay faulty.	3. Refer to Starter Relay in Diagnosis and Testing. Replace starter relay if required.
	4. Ignition switch faulty.	4. Refer to Ignition Switch and Key Lock Cylinder. Replace ignition switch if required.
	5. Clutch pedal position switch faulty.	5. Refer to Clutch Pedal Position Switch.
	6. Park/Neutral position switch faulty or misadjusted.	6. Refer to Park/Neutral Position Switch. Replace park/neutral position switch if required.
	7. Starter solenoid faulty.	7. Refer to Starter Motor. Replace starter motor assembly if required.
	8. Starter motor faulty.	8. If all other starting system components and circuits test OK, replace starter motor.
STARTER ENGAGES, FAILS TO TURN ENGINE.	1. Battery discharged or faulty.	1. Refer to Battery. Charge or replace battery if required.
	2. Starting circuit wiring faulty.	2. Refer to 8, Wiring Diagrams. Test and repair starter feed and/or control circuits if required.
	3. Starter motor faulty.	3. If all other starting system components and circuits test OK, replace starter motor assembly.
	4. Engine seized.	4. Refer to Engine Diagnosis in the Diagnosis and Testing section of 9, Engine.
STARTER ENGAGES, SPINS OUT BEFORE ENGINE STARTS.	1. Starter ring gear faulty.	1. Refer to Starter Motor Removal and Installation. Remove starter motor to inspect starter ring gear. Replace starter ring gear if required.
	2. Starter motor faulty.	2. If all other starting system components and circuits test OK, replace starter motor assembly.

STARTING SYSTEM (Continued)

Starting System Diagnosis		
CONDITION	POSSIBLE CAUSE	CORRECTION
STARTER DOES NOT DISENGAGE.	1. Starter motor improperly installed.	1. Refer to Starter Motor Removal and Installation. Tighten starter mounting hardware to correct torque specifications.
	2. Starter relay faulty.	2. Refer to Starter Relay Diagnosis and Testing. Replace starter relay if required.
	3. Ignition switch faulty.	3. Refer to Ignition Switch and Key Lock Cylinder. Replace ignition switch if required.
	4. Starter motor faulty.	4. If all other starting system components and circuits test OK, replace starter motor.

INSPECTION

For complete starter wiring circuit diagrams, refer to 8, Wiring Diagrams. Before removing any unit from starting system for repair or diagnosis, perform the following inspections:

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, REFER TO 8, 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 battery for indications of physical damage and loose or corroded cable connections. Determine state-of-charge and cranking capacity of battery. Charge or replace battery if required. Refer to **Battery** in 8, Battery.
- **Ignition Switch** - Visually inspect ignition switch for indications of physical damage and loose or corroded wire harness connections. Refer to **Ignition Switch and Key Lock Cylinder.**
- **Park/Neutral Position Switch** - Visually inspect park/neutral position switch for indications of physical damage and loose or corroded wire harness connections. Refer to **Park/Neutral Position Switch** in 21, Transmission.
- **Starter Relay** - Visually inspect starter relay for indications of physical damage and loose or corroded wire harness connections.
- **Starter Motor** - Visually inspect starter motor for indications of physical damage and loose or corroded wire harness connections.
- **Starter Solenoid** - Visually inspect starter solenoid for indications of physical damage and loose or corroded wire harness connections.
- **Wiring** - Visually inspect wire harnesses for damage or corrosion. Repair or replace any faulty wiring, as required. Refer to 8, Wiring Diagrams.

TESTING

COLD CRANKING TEST

For complete starter wiring circuit diagrams, refer to 8, Wiring Diagrams. The battery must be fully-charged and load-tested before proceeding. Refer to **Battery** in 8, Battery.

(1) Connect volt-ampere tester to battery terminals (Fig. 1). See instructions provided by manufacturer of volt-ampere tester being used.

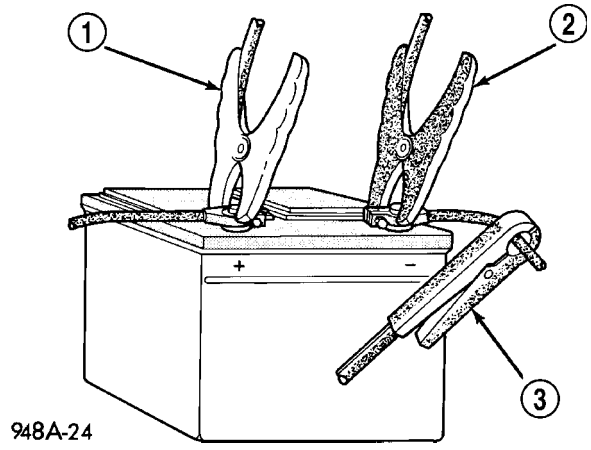


Fig. 1 VOLTS-AMPS TESTER CONNECTIONS - TYPICAL

1 - POSITIVE CLAMP
2 - NEGATIVE CLAMP
3 - INDUCTION AMMETER CLAMP

(2) Fully engage parking brake.

(3) Place gearshift selector lever in Park position.

(4) Verify that all lamps and accessories are turned off.

(5) To prevent engine from starting, remove Fuel Pump Relay. This relay is located in Power Distribution Center (PDC). Refer to label on PDC cover for relay location.

STARTING SYSTEM (Continued)

WARNING: IF EQUIPPED WITH DIESEL ENGINE, ATTEMPT TO START ENGINE A FEW TIMES BEFORE PROCEEDING WITH FOLLOWING STEP.

(6) Rotate and hold ignition switch in Start position. Note cranking voltage and current (amperage) draw readings shown on volt-ampere tester.

(a) If voltage reads below 9.6 volts, refer to **Starter Motor** in Diagnosis and Testing. If starter motor is OK, refer to **Engine Diagnosis** in 9, Engine for further testing of engine. If starter motor is not OK, replace faulty starter motor.

(b) If voltage reads above 9.6 volts and current (amperage) draw reads below specifications, refer to **Feed Circuit Test** in this section.

(c) If voltage reads 12.5 volts or greater and starter motor does not turn, refer to **Control Circuit Testing** in this section.

(d) If voltage reads 12.5 volts or greater and starter motor turns very slowly, refer to **Feed Circuit Test** in this section.

NOTE: A cold engine will increase starter current (amperage) draw reading, and reduce battery voltage reading.

FEED CIRCUIT TEST

The starter feed circuit test (voltage drop method) will determine if there is excessive resistance in high-amperage feed circuit. For complete starter wiring circuit diagrams, refer 8, Wiring Diagrams.

When performing these tests, it is important to remember that voltage drop is giving an indication of resistance between two points at which voltmeter probes are attached.

Example: When testing resistance of positive battery cable, touch voltmeter leads to positive battery cable clamp and cable connector at starter solenoid. If you probe positive battery terminal post and cable connector at starter solenoid, you are reading combined voltage drop in positive battery cable clamp-to-terminal post connection and positive battery cable.

The following operation will require a voltmeter accurate to 1/10 (0.10) volt. Before performing tests, be certain that following procedures are accomplished:

- Battery is fully-charged and load-tested. Refer to **Battery** in 8, Battery.
- Fully engage parking brake.
- Place gearshift selector lever in Park position.
- Verify that all lamps and accessories are turned off.
- To prevent engine from starting, remove Fuel Pump Relay. This relay is located in Power Distribution Center (PDC). Refer to label on PDC cover for relay location.

(1) Connect positive lead of voltmeter to negative battery cable terminal post. Connect negative lead of voltmeter to negative battery cable clamp (Fig. 2). Rotate and hold ignition switch in Start position. Observe voltmeter. If voltage is detected, correct poor contact between cable clamp and terminal post.

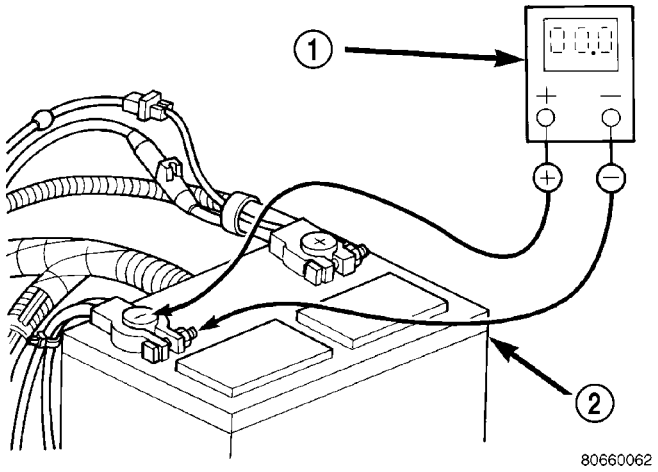


Fig. 2 TEST NEGATIVE BATTERY CABLE CONNECTION RESISTANCE - TYPICAL

1 - VOLTMETER
2 - BATTERY

(2) Connect positive lead of voltmeter to positive battery terminal post. Connect negative lead of voltmeter to battery positive cable clamp (Fig. 3). Rotate and hold ignition switch in Start position. Observe voltmeter. If voltage is detected, correct poor contact between cable clamp and terminal post.

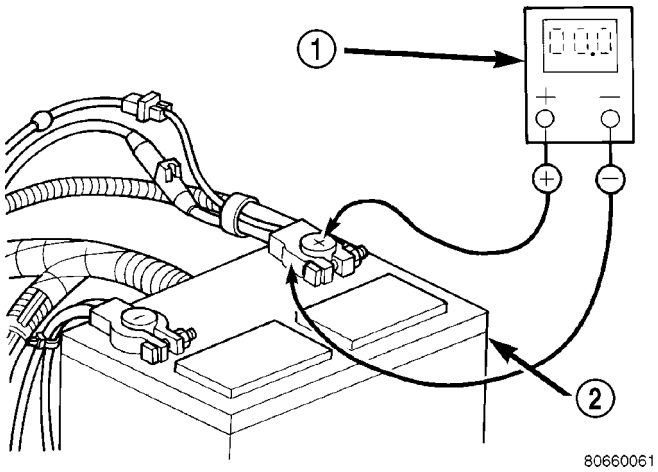


Fig. 3 TEST POSITIVE BATTERY CABLE CONNECTION RESISTANCE - TYPICAL

1 - VOLTMETER
2 - BATTERY

(3) Connect voltmeter to measure between battery positive terminal post and starter solenoid battery terminal stud (Fig. 4). Rotate and hold ignition

STARTING SYSTEM (Continued)

switch in Start position. Observe voltmeter. If reading is above 0.2 volt, clean and tighten battery cable connection at solenoid. Repeat test. If reading is still above 0.2 volt, replace faulty positive battery cable.

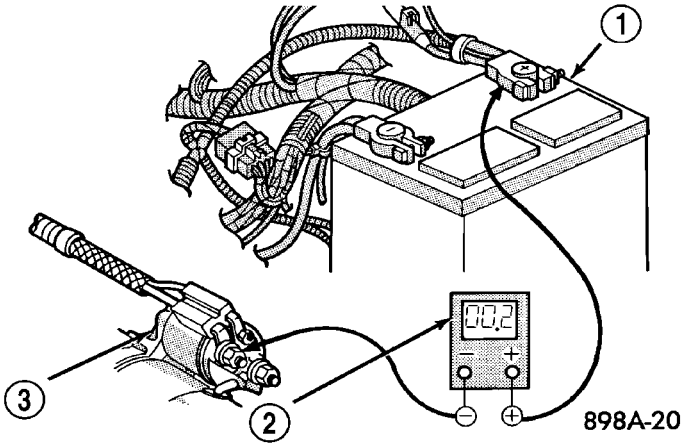


Fig. 4 TEST POSITIVE BATTERY CABLE

1 - BATTERY
2 - VOLTMETER
3 - STARTER MOTOR

(4) Connect voltmeter to measure between negative battery terminal post and a good clean ground on engine block (Fig. 5). Rotate and hold ignition switch in Start position. Observe voltmeter. If reading is above 0.2 volt, clean and tighten negative battery cable attachment on engine block. Repeat test. If reading is still above 0.2 volt, replace faulty negative battery cable.

(5) Connect positive lead of voltmeter to starter housing. Connect negative lead of voltmeter to negative battery terminal post (Fig. 6). Rotate and hold ignition switch in Start position. Observe voltmeter. If reading is above 0.2 volt, correct poor starter to engine block ground contact.

If resistance tests detect no feed circuit problems, refer to **Starter Motor** in the Diagnosis and Testing.

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** Diagnosis and Testing.
- **Starter Solenoid** - Refer to **Starter Motor** Diagnosis and Testing.

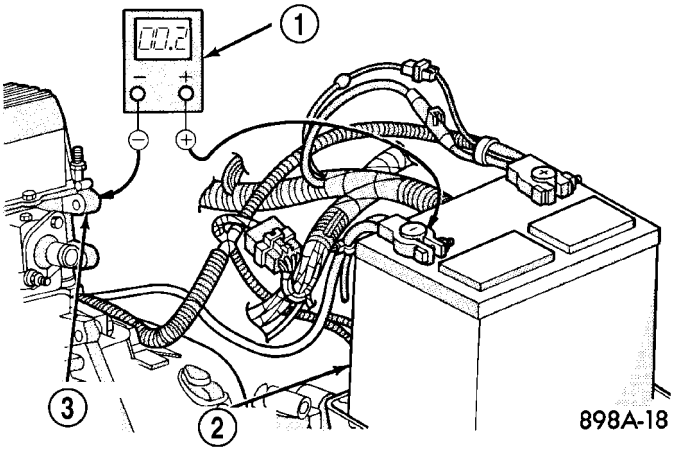


Fig. 5 TEST GROUND CIRCUIT RESISTANCE - TYPICAL

1 - VOLTMETER
2 - BATTERY
3 - ENGINE GROUND

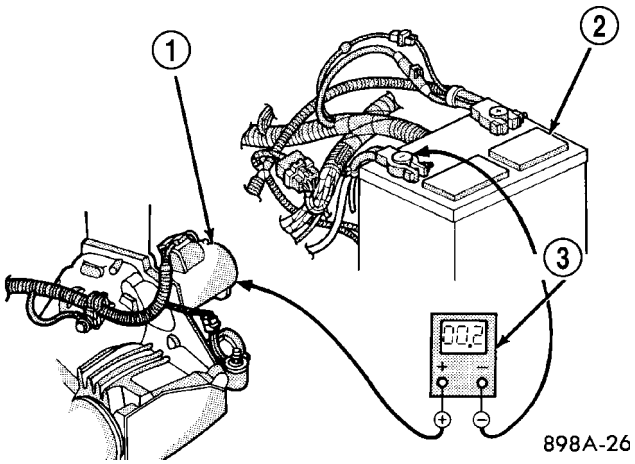


Fig. 6 TEST STARTER GROUND - TYPICAL

1 - STARTER MOTOR
2 - BATTERY
3 - VOLTMETER

- **Ignition Switch** - Refer to **Ignition Switch and Key Lock Cylinder**
- **Park/Neutral Position Switch** - If equipped with automatic transmission, refer to **Park/Neutral Position Switch** in 21, Transmission.
- **Wire harnesses and connections** - Refer to 8, Wiring Diagrams.

STARTING SYSTEM (Continued)

SPECIFICATIONS

TORQUE - STARTER - DIESEL

DESCRIPTION	N-m	Ft. Lbs.	In. Lbs.
Battery Cable Nut at Starter Solenoid (larger nut)	14	-	124
Starter Mounting Bolts	40	30	-
Starter Solenoid (smaller nut)	6	-	52

SPECIFICATIONS - STARTER MOTOR - DIESEL

ITEM	SPECIFICATION
ENGINE	2.7L TURBO DIESEL
RATED VOLTAGE	12 VOLTS
NUMBER OF FIELDS	4
NUMBER OF POLES	4
NUMBER OF BRUSHES	4
DRIVE TYPE	GEAR REDUCTION
FREE RUNNING TEST VOLTAGE	11.5 VOLTS
FREE RUNNING TEST MAXIMUM AMPERAGE DRAW	160 AMPS
FREE RUNNING TEST MINIMUM SPEED	5500 RPM
SOLENOID CLOSING MAXIMUM VOLTAGE	7.8 VOLTS
MAXIMUM CRANKING AMPERAGE DRAW	* 500 AMPS

* A COLD OR NEW ENGINE WILL INCREASE STARTER AMPERAGE DRAW. THE USE OF HEAVY WEIGHT ENGINE OIL WILL ALSO INCREASE STARTER AMPERAGE DRAW.

STARTER MOTOR

DIAGNOSIS AND TESTING - STARTER MOTOR

Correct starter motor operation can be confirmed by performing the following free running bench test. This test can only be performed with starter motor removed from vehicle. Refer to Starter Specifications for specifications.

(1) Remove starter motor from vehicle. Refer to Starter Motor Removal and Installation.

(2) Mount starter motor securely in a soft-jawed bench vise. The vise jaws should be clamped on the mounting flange of starter motor. Never clamp on starter motor by field frame.

(3) Connect a suitable volt-ampere tester and a 12-volt battery to starter motor in series, and set ammeter to 100 ampere scale. See instructions provided by manufacturer of volt-ampere tester being used.

(4) Install jumper wire from solenoid terminal to solenoid battery terminal. The starter motor should operate. If starter motor fails to operate, replace faulty starter motor assembly.

(5) Adjust carbon pile load of tester to obtain free running test voltage. Refer to Specifications for starter motor free running test voltage specifications.

(6) Note reading on ammeter and compare reading to free running test maximum amperage draw. Refer to Specifications for starter motor free running test maximum amperage draw specifications.

(7) If ammeter reading exceeds maximum amperage draw specification, replace faulty starter motor assembly.

STARTER MOTOR (Continued)

STARTER SOLENOID

This test can only be performed with starter motor removed from vehicle.

(1) Remove starter motor from vehicle. Refer to Starter Motor Removal and Installation.

(2) Disconnect wire from solenoid field coil terminal.

(3) Check for continuity between solenoid terminal and solenoid field coil terminal with a continuity tester (Fig. 7). There should be continuity. If OK, go to Step 4. If not OK, replace faulty starter motor assembly.

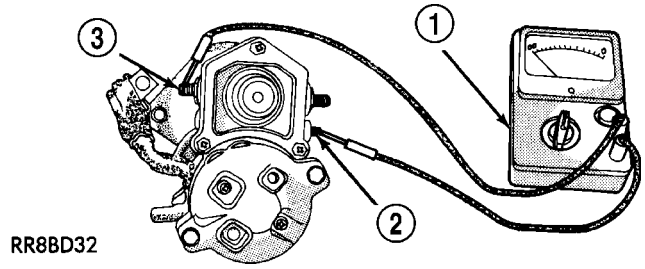


Fig. 7 CONTINUITY BETWEEN SOLENOID AND FIELD COIL TERMINALS - TYPICAL

1 - OHMMETER
2 - SOLENOID TERMINAL
3 - FIELD COIL TERMINAL

(4) Check for continuity between solenoid terminal and solenoid case (Fig. 8). There should be continuity. If not OK, replace faulty starter motor assembly.

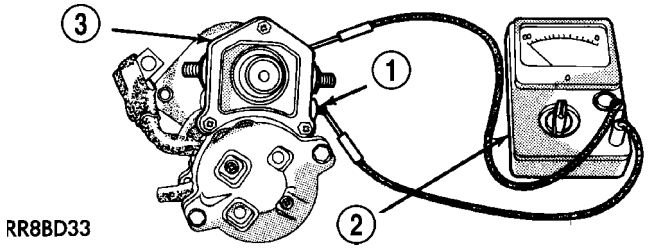


Fig. 8 CONTINUITY BETWEEN SOLENOID TERMINAL AND CASE - TYPICAL

1 - SOLENOID TERMINAL
2 - OHMMETER
3 - SOLENOID

REMOVAL

The starter motor and solenoid assembly is located at the left/rear side of engine (Fig. 9).

(1) Disconnect and isolate negative battery cable.

(2) Working from under vehicle hood, remove bolt retaining wiring trough (Fig. 11) to transmission bellhousing.

(3) Working from under vehicle hood, cut necessary nylon; wiring trough tie-wraps near starter motor. Temporarily position wiring harness trough for access to starter.

(4) Working from under vehicle hood, remove 2 starter solenoid wiring harness nuts (Fig. 10).

(5) Remove solenoid wire connector from solenoid stud, and battery cable from solenoid stud.

(6) Raise and support vehicle.

(7) Remove 2 starter mounting bolts (E14Torx) (Fig. 10).

(8) Remove starter from transmission bellhousing.

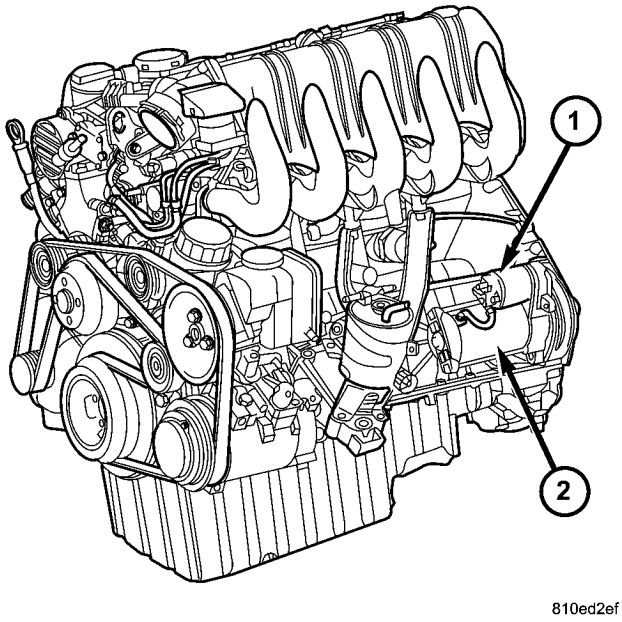


Fig. 9 STARTER AND SOLENOID LOCATION

1 - STARTER SOLENOID LOCATION
2 - STARTER MOTOR LOCATION

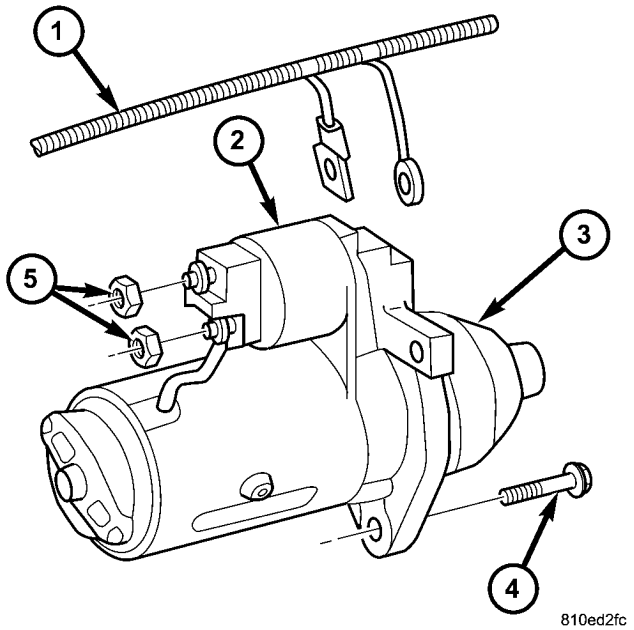


Fig. 10 STARTER REMOVAL/INSTALLATION

1 - WIRING HARNESS
2 - STARTER SOLENOID
3 - STARTER MOTOR
4 - MOUNTING BOLTS (2)
5 - SOLENOID NUTS (2)

STARTER MOTOR (Continued)

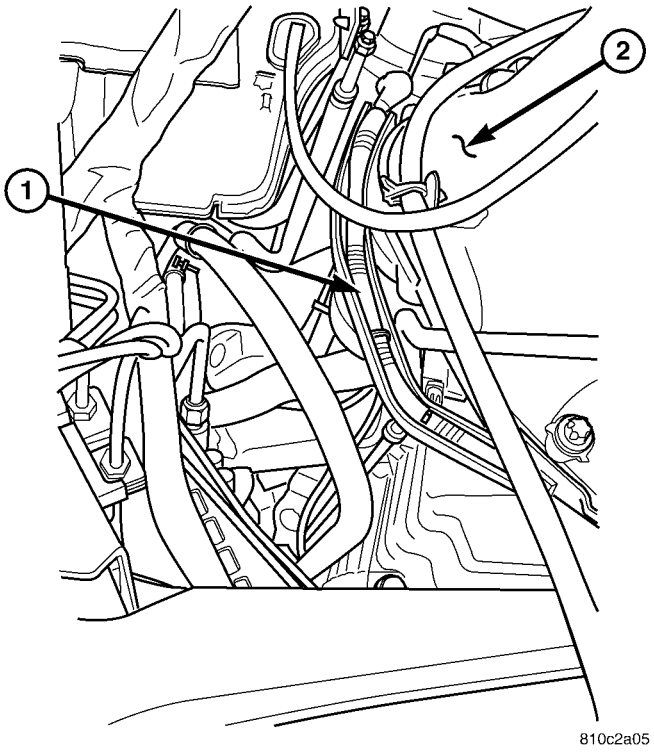


Fig. 11 WIRING TROUGH - FOR STARTER REMOVAL (VIEW FROM REAR)

1 - WIRING TROUGH
2 - REAR/LEFT END OF TRANS. BELLHOUSING (VIEW FROM REAR)

INSTALLATION

(1) Raise and support vehicle.
(2) Position starter motor to transmission housing.
(3) Install 2 mounting bolts. Refer to Torque Specifications.
(4) Lower vehicle.
(5) Connect battery cable and solenoid wiring to solenoid (2 nuts). Refer to Torque Specifications.
(6) Position wiring harness trough and install retaining bolt.
(7) Install new nylon tie-wraps to wiring trough.
(8) Connect negative battery cable.

STARTER MOTOR RELAY

DESCRIPTION

The starter relay is an electromechanical device that switches battery current to the pull-in coil of the starter solenoid when ignition switch is turned to Start position. The starter relay is located in the Fuse/Relay Block. The Fuse/Relay Block is located under, and to the left side of the drivers seat. See Fuse/Relay Block cover for relay identification and location.

The starter relay is an International Standards Organization (ISO) relay. Relays conforming to ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions.

The starter relay cannot be repaired or adjusted and, if faulty or damaged, it must be replaced.

REMOVAL

The starter relay is located in the Fuse/Relay Block. The Fuse/Relay Block is located under, and to the left side of the drivers seat. See Fuse/Relay Block cover for relay identification and location, or refer to (Fig. 12).

(1) Remove Fuse/Relay Block cover by pushing down on two tabs located at top of cover (Fig. 13).
(2) Remove relay from Fuse/Relay Block.
(3) Check condition of relay terminals and Fuse/Relay Block 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 Fuse/Relay Block connector). Repair if necessary before installing relay.

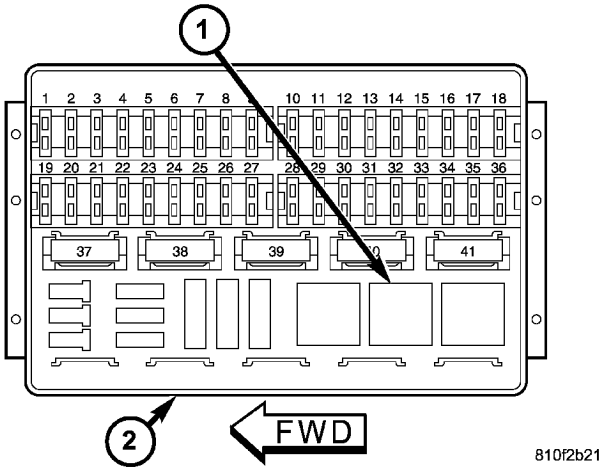


Fig. 12 FUSE / RELAY BLOCK

1 - STARTER RELAY LOCATION
2 - FUSE / RELAY BLOCK

STARTER MOTOR RELAY (Continued)

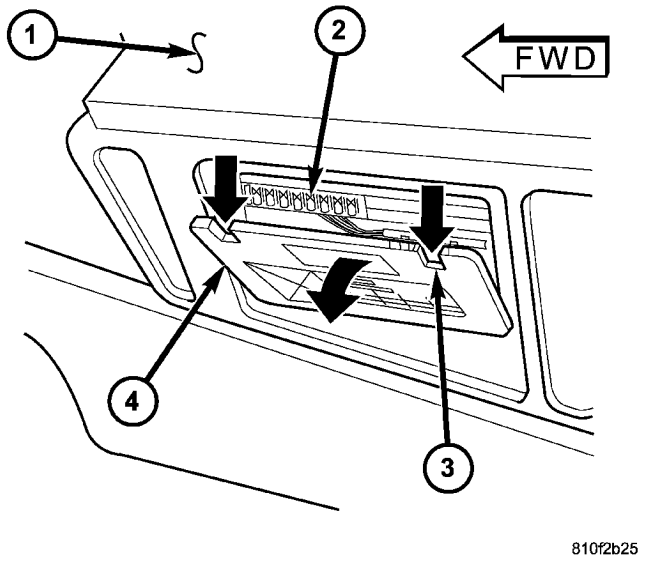


Fig. 13 FUSE / RELAY BLOCK COVER

1 - LEFT SIDE OF DRIVERS SEAT
2 - FUSE / RELAY BLOCK
3 - RELEASE TABS (2)
4 - COVER (ACCESS PANEL)

INSTALLATION

The starter relay is located in the Fuse/Relay Block. The Fuse/Relay Block is located under, and to the left side of the drivers seat. See Fuse/Relay Block cover for relay identification and location, or refer to (Fig. 12).

(1) Install relay into Fuse/Relay Block.

(2) Install cover to side of Fuse/Relay Block (snaps on).

HEATED SYSTEMS

TABLE OF CONTENTS

page

HEATED SEATS
DESCRIPTION 1
OPERATION 2
DIAGNOSIS AND TESTING - HEATED SEATS . . 2
DRIVER HEATED SEAT SWITCH
DESCRIPTION 2
OPERATION 2
DIAGNOSIS AND TESTING - DRIVER HEATED SEAT SWITCH 2
REMOVAL 3
INSTALLATION 3
HEATED SEAT ELEMENT
DESCRIPTION 3
OPERATION 3
DIAGNOSIS AND TESTING - HEATED SEAT ELEMENT 3
HEATED SEAT RELAY
DESCRIPTION 4
OPERATION 4
DIAGNOSIS AND TESTING - HEATED SEAT RELAY 4
REMOVAL 4
INSTALLATION 4
HEATED SEAT SENSOR
DESCRIPTION 4
DIAGNOSIS AND TESTING - HEATED SEAT SENSOR 4
PASSENGER HEATED SEAT SWITCH
DESCRIPTION 5
OPERATION 5
DIAGNOSIS AND TESTING - PASSENGER HEATED SEAT SWITCH 5
REMOVAL 5
INSTALLATION 5

HEATED SEATS

DESCRIPTION

Individually controlled, electrically heated front seats are available factory-installed optional equipment on this model. Vehicles with this option can be visually identified by the two separate heated seat switches mounted in the instrument panel. The heated seat system allows the front seat driver and passenger to select from two different levels of supplemental electrical seat heating, or no seat heating to suit their individual comfort requirements. The heated seat system for this vehicle includes the following major components, which are described in further detail later in this section:

- **Heated Seat Elements** - Four heated seat elements are used per vehicle, two for each front seat. One heating element in the seat back and one in the seat cushion. The heated seat sensor is integral to the seat cushion heating element. The heated seat elements are integral to the front seat and seat back cushions. Refer to heated seat elements later in this section for additional information.
- **Heated Seat Relay** - One heated seat relay is used per vehicle. The relay is located in the fuse block and is responsible for distributing the voltage (B+) to the heated seat elements.
- **Heated Seat Sensors** - Two heated seat sensors are used per vehicle, one for each front seat. The heated seat sensors are integral to each of the heated seat element assemblies. Refer to heated seat sensor later in this section for additional information.
- **Heated Seat Switches** - Two heated seat switches are used per vehicle, one for each front seat. The switches are mounted in the instrument panel. Refer to heated seat switches later in this section for additional information.

Hard wired circuitry connects the heated seat system components to each other through the electrical system of the vehicle. Refer to Wiring for additional information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

HEATED SEATS (Continued)

OPERATION

The heated seat system is designed to provide individually controlled, supplemental heat to the seat cushion and seat back surfaces of both front seats. Because this system converts electrical current to heat, the heated seat system can provide a measure of warm comfort almost immediately upon entering a cold vehicle, rather than having to wait for the engine coolant to reach sufficient temperature to deliver heat through the conventional heater system. This system allows each front seat occupant to individually select one of two comfort levels, Hi or Lo, or to turn the heater for their seat off.

The heated seat system components operate on battery current received through a fuse in the Fuse Block on a fused ignition switch output (run-acc) circuit so that the system will only operate when the ignition switch is in the On or Accessory positions. The heated seat system will be turned Off automatically whenever the ignition switch is turned to any position except On or Accessory. Also, the heated seat system will not operate when the surface temperature of the seat cushion cover at either heated seat sensor is above the designed temperature set points of the system.

DIAGNOSIS AND TESTING - HEATED SEATS

Refer to **Wiring** for the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

HEATED SEAT SYSTEM DIAGNOSIS

CONDITION	POSSIBLE CAUSES	CORRECTION
NO HEATED SEAT SWITCH ILLUMINATION WITH IGNITION ON	1. Faulty fuse.	1. Check heated seat fuse in Fuse Block. Replace fuse, if required.
	2. Wiring faulty.	2. Check fused ignition switch output (run-acc) circuit from heated seat switch connector to ignition switch. Repair, if required.
	3. Ground faulty.	3. Check for ground at heated seat switch connector. Repair, if required.
	4. Faulty switch.	4. Refer to Heated Seat Switch for the proper switch diagnosis and testing procedures.

DRIVER HEATED SEAT SWITCH

DESCRIPTION

The heated seat switches are located on the instrument panel, in the accessory switch bezel. The two, momentary rocker type switches provide a signal to the Heated Seat Relay through separate hard wired circuits. Each switch contains two light emitting diodes (LED), one for each High and Low setting to let the occupant know that the seat heater system is on.

The heated seat switches and their LED's cannot be repaired. If either switch is faulty or damaged the entire switch must be replaced.

OPERATION

There are three modes that can be selected with each of the heated seat switches: Off, Low, and High. When the top of the switch rocker is depressed, the low mode is selected and the low mode LED indicator illuminates. Depressing the top of the switch rocker a second time will turn the heated seat to Off. This same process is repeated for High heat setting. The heated seats will automatically return to the Off mode anytime the vehicle ignition switch is turned Off.

Both switches provide separate hard wire inputs to the Heated Seat Relay to indicate the selected mode. The Heated Seat Relay responds to the heated seat switch messages by controlling the output to the seat heater elements of the selected seat.

DIAGNOSIS AND TESTING - DRIVER HEATED SEAT SWITCH

For circuit description and diagrams, refer to **Wiring**.

(1) Inspect the Heated Seat Switches for apparent damage or sticking/binding and replace if required. Refer to Heated Seat Switch Removal and Installation in this section.

(2) Replace the heated seat switch with a known good unit and retest the heated seat system.

DRIVER HEATED SEAT SWITCH (Continued)

REMOVAL

(1) Disconnect and isolate the negative battery cable.
(2) Remove the gear selector bezel trim. Refer to the Body section for the procedure.
(3) Remove the storage bin. Refer to the Body section for the procedure.
(4) Remove the switch bezel retaining screw and remove the switch bezel from the instrument panel. Refer to the Body section for the procedure.
(5) Disconnect electrical connections.
(6) Working from the underside of the switch, gently rock the switch back and forth out of its mounting location in the switch bezel.

INSTALLATION

(1) Install the heated seat switch in its mounting location in the switch bezel.
(2) Connect electrical connections.
(3) Position the switch bezel and install the retaining screw. Refer to the Body section for the procedure.
(4) Install the storage bin. Refer to the Body section for the procedure.
(5) Install the gear selector bezel trim. Refer to the Body section for the procedure.
(6) Connect the negative battery cable.

HEATED SEAT ELEMENT

DESCRIPTION

The heated seat system includes two seat heating elements in each front seat, one for the seat cushion (Fig. 1) and the other for the seat back. All models use two resistor wire heating elements for each seat that are connected in series with the Heated Seat Relay. The temperature sensor is a Negative Temperature Coefficient (NTC) thermistor. One temperature sensor is used for each seat, and it is located in the seat cushion heating element for all models.

The seat heating elements are glued onto the seat and seat back cushions. The heated seat elements and the temperature sensor cannot be adjusted or repaired and, if faulty or damaged a new seat assembly must be installed.

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 is released in the form of heat. The heated seat temperature sensor is a NTC thermistor. When the temperature of the seat cushion cover rises, the resistance of the sensor decreases. The heated seat relay uses this temperature sensor input to monitor the temperature of the seat, and regulates the current flow to the seat heating elements accordingly.

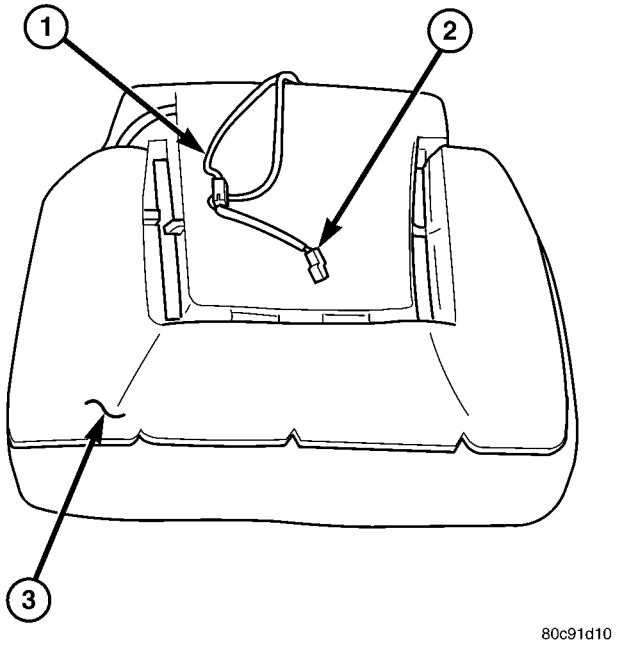


Fig. 1 Heated Seat Element - Typical

1 - Seat Back Wire Harness
2 - Heated Seat Wire Harness Connector
3 - Heated Seat Cushion Element

DIAGNOSIS AND TESTING - HEATED SEAT ELEMENT

For complete circuit diagrams, refer to **Wiring**.

NOTE: When checking heated seat elements for continuity, be certain to move the heating element being checked. Moving the element, such as sitting in the seat will eliminate the possibility of an intermittent open in the element which would only be evident if the element was in a certain position. Failure to check the element in various positions could result in an incomplete test.

(1) Disconnect and isolate the battery negative cable. Disconnect the heated seat element wire harness connector from under the seat cushion. Check for continuity between the seat heater driver circuit and ground. There should be continuity, less than 7 ohms. If OK, go to Step 2. If not OK, replace the seat assembly.
(2) Check for continuity between the seat heater B+ driver circuit cavity and the seat back frame. There should be **no** continuity. If OK, heating element is OK at this time. If not OK, replace the seat assembly.

HEATED SEAT RELAY

DESCRIPTION

The heated seat relay is an electromechanical device that switches 12v battery current to the heated seat elements when the relay control coil is energized. The heated seat relay is located in the Fuse Block, under the drivers seat. The heated seat 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 heated seat 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 - HEATED SEAT RELAY

The heated seat relay is located in the Fuse Block, under the drivers seat. Refer to **Wiring** for the location of complete heated seat system wiring diagrams.

(1) Remove the heated seat relay from the fuse block.

(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, check the relay supply circuits. If not OK, replace the faulty relay.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) The heated seat relay is located in the fuse block, under the drivers seat. Refer to wiring for detailed location.

(3) Grasp the heated seat relay firmly and pull it straight out from the fuse block. A slight rocking motion will aid in removal.

INSTALLATION

(1) Grasp the heated seat relay firmly and push it straight in the fuse block.

(2) Reconnect the battery negative cable.

HEATED SEAT SENSOR

DESCRIPTION

The heated seat temperature sensor is a Negative Temperature Coefficient (NTC) thermistor. One temperature sensor is used for each seat. The sensor is located in the seat cushion heating element for all models.

The heated seat sensor cannot be adjusted or repaired and if it is found to be faulty, the complete heated seat element must be replaced.

DIAGNOSIS AND TESTING - HEATED SEAT SENSOR

For complete circuit diagrams, refer to **Wiring**.

NOTE: Any resistance values (ohms Ω) given in the following text are supplied using the automatic range generated by a FLUKE® automotive meter. If another type of measuring device is used the values generated may not be the same as the results shown here, or may have to be converted to the range used here.

(1) Backprobe the heated seat relay wire harness connector, do not disconnect. Using an voltmeter, check the voltage of the seat temperature sensor input cavity of the heated seat relay wire harness connector. The seat sensor input voltage should be between 1.7 volts and 3.0 volts with the system ON. If OK, sensor is OK at this time. If not OK, replace the faulty seat cushion heating element and sensor assembly.

PASSENGER HEATED SEAT SWITCH

DESCRIPTION

The heated seat switches are located on the instrument panel, in the accessory switch bezel. The two, momentary rocker type switches provide a signal to the Heated Seat Relay through separate hard wired circuits. Each switch contains two light emitting diodes (LED), one for each High and Low setting to let the occupant know that the seat heater system is on.

The heated seat switches and their LED's cannot be repaired. If either switch is faulty or damaged the entire switch must be replaced.

OPERATION

There are three modes that can be selected with each of the heated seat switches: Off, Low, and High. When the top of the switch rocker is depressed, the low mode is selected and the low mode LED indicator illuminates. Depressing the top of the switch rocker a second time will turn the heated seat to Off. This same process is repeated for High heat setting. The heated seats will automatically return to the Off mode anytime the vehicle ignition switch is turned Off.

Both switches provide separate hard wire inputs to the Heated Seat Relay to indicate the selected mode. The Heated Seat Relay responds to the heated seat switch messages by controlling the output to the seat heater elements of the selected seat.

DIAGNOSIS AND TESTING - PASSENGER HEATED SEAT SWITCH

For circuit description and diagrams, refer to **Wiring**.

(1) Inspect the Heated Seat Switches for apparent damage or sticking/binding and replace if required. Refer to Heated Seat Switch Removal and Installation in this section.

(2) Replace the heated seat switch with a known good unit and retest the heated seat system.

REMOVAL

(1) Disconnect and isolate the negative battery cable.

(2) Remove the gear selector bezel trim. Refer to the Body section for the procedure.

(3) Remove the storage bin. Refer to the Body section for the procedure.

(4) Remove the switch bezel retaining screw and remove the switch bezel from the instrument panel. Refer to the Body section for the procedure.

(5) Disconnect electrical connections.

(6) Working from the underside of the switch, gently rock the switch back and forth out of its mounting location in the switch bezel.

INSTALLATION

(1) Install the heated seat switch in its mounting location in the switch bezel.

(2) Connect electrical connections.

(3) Position the switch bezel and install the retaining screw. Refer to the Body section for the procedure.

(4) Install the storage bin. Refer to the Body section for the procedure.

(5) Install the gear selector bezel trim. Refer to the Body section for the procedure.

(6) Connect the negative battery cable.

HORN

TABLE OF CONTENTS

page

HORN
REMOVAL 1
INSTALLATION 1

HORN SWITCH
REMOVAL 1
INSTALLATION 1

HORN

REMOVAL

(1) Disconnect and isolate the battery negative cable.
(2) Disconnect the wire harness connectors.
(3) Remove the mounting fastener and horns.

INSTALLATION

(1) Position horns and install mounting fasteners.
(2) Connect wire harness connector.
(3) Connect battery negative cable.

HORN SWITCH

REMOVAL

(1) Disconnect and isolate the battery negative cable.
(2) Remove the drivers side airbag (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - REMOVAL).
(3) Remove the electrical harness connector.
(4) Remove the mounting fasteners and horn switch.

INSTALLATION

(1) Connect the wire harness connector.
(2) Position the horn switch and install the mounting fasteners.
(3) Install the drivers side airbag (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - INSTALLATION).
(4) Connect the battery negative cable.

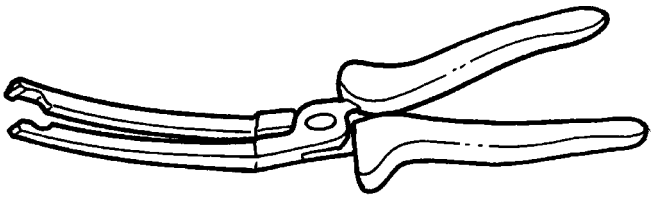
IGNITION CONTROL

TABLE OF CONTENTS

	page
IGNITION CONTROL	
SPECIAL TOOLS	1
GLOW PLUG	
REMOVAL	1
INSTALLATION	1
GLOW PLUG RELAY	
DESCRIPTION	2
OPERATION	2
DIAGNOSIS AND TESTING - GLOW PLUG RELAYS	2

IGNITION CONTROL

SPECIAL TOOLS



GLOW PLUG PLIERS

GLOW PLUG

REMOVAL

(1) Disconnect the negative battery cable.
(2) Use special tool #9286 pliers to unplug the glow plug wiring harness connector(s).
(3) Remove the glow plug(s) (Fig. 1).

INSTALLATION

(1) Screw glow plug(s) into cylinder head and tighten to 12 N·m (115 lbs. in) (Fig. 1).
(2) Connect the glow plug wiring harness connector(s)
(3) Connect negative battery cable.

GLOW PLUG (Continued)

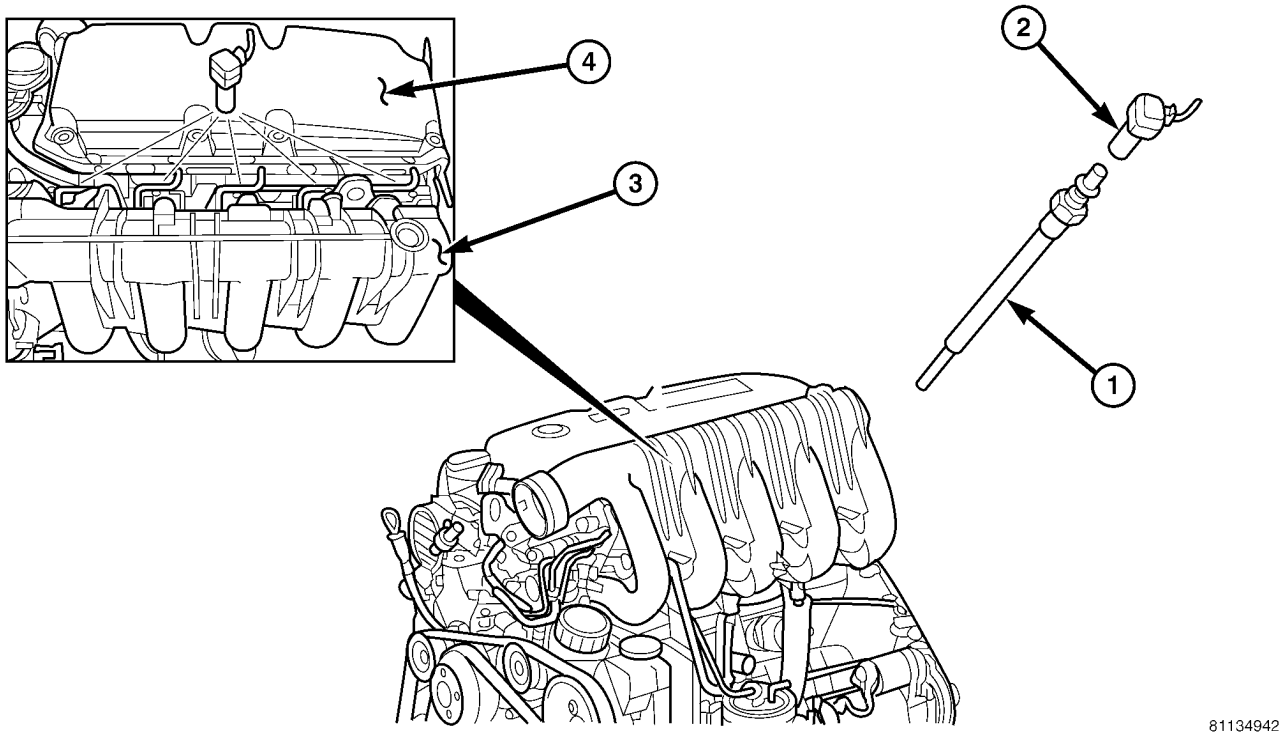


Fig. 1 GLOW PLUG(S)

1 - GLOW PLUG
2 - WIRING HARNESS CONNECTOR
3 - INTAKE MANIFOLD
4 - CYLINDER HEAD COVER

GLOW PLUG RELAY

DESCRIPTION

The glow plug relay supplies battery voltage to the glow plug through a timed cycle that is related to coolant temperature. The glow plug relay is located under the battery. The purpose of a glow plug system is to improve combustion for low emissions and to achieve easy starting at low temperatures.

OPERATION

When the ignition key is turned to the ON position, the glow plug output stage and pre-glow indicator lamp are actuated by the ECM. The duration of the signal depends on the coolant temperature. The glow plug relay has processing that communicates with the ECM. If no data exchange occurs at the triggering stage, the preheating is switched off after 2 seconds.

Start glowing is initiated when the key is in the start position. The glow plugs (R13–R17) continue to be supplied with voltage. This makes it possible to stabilize the cold starting speed. (After glowing is initiated when the starter reject speed is reached).

After the engine starts, the ECM determines the afterglow period in line with coolant temperature. If no signal is received from the coolant temperature sensor, afterglow is maintained for thirty seconds.

The following aims are reached by the afterglow :

- Improvement in warming-up properties
- Prevention of white exhaust smoke after cold start
- Stabilizing of the cold starting speed

The glow plug output stage constantly signals the current operating state and faults. The following are faults detected and transmitted to the ECM :

- Open circuit at one or several glow plugs
- Short circuit in the glow plug circuit
- Relay fault

If the Glow plug relay detects an open circuit at a glow plug, it is stored and indicated only once the engine is running by the preglow indicator lamp coming on for about one minute and a fault is stored in the ECM. If a short circuit, a glow plug output stage faulty or a temperature related switching off of output stages is detected, the fault is stored and indicated immediately by the preglow indicator lamp coming on. Once the fault is no longer current, the indicator is immediately switched off, but the fault is stored in the ECM. If the fault is constantly current, the preglow indicator lamp remains on until the ignition is switched off.

DIAGNOSIS AND TESTING - GLOW PLUG RELAYS

Refer to the appropriate Diesel Powertrain Diagnosis Manual for information on diagnosing the glow plug relays.

INSTRUMENT CLUSTER

TABLE OF CONTENTS

page

INSTRUMENT CLUSTER
DESCRIPTION 2
OPERATION 5
DIAGNOSIS AND TESTING - INSTRUMENT CLUSTER 7
REMOVAL 7
INSTALLATION 9
ABS INDICATOR
DESCRIPTION 9
OPERATION 9
AIRBAG INDICATOR
DESCRIPTION 10
OPERATION 10
AMBIENT TEMPERATURE INDICATOR
DESCRIPTION 11
OPERATION 11
BRAKE/PARK BRAKE INDICATOR
DESCRIPTION 11
OPERATION 12
BRAKE WEAR INDICATOR
DESCRIPTION 12
OPERATION 12
CHARGING INDICATOR
DESCRIPTION 13
OPERATION 13
CLOCK
DESCRIPTION 13
OPERATION 14
COOLANT LOW INDICATOR
DESCRIPTION 14
OPERATION 14
ENGINE TEMPERATURE GAUGE
DESCRIPTION 15
OPERATION 15
FUEL FILTER CLOGGED INDICATOR
DESCRIPTION 15
OPERATION 15
FUEL GAUGE
DESCRIPTION 16
OPERATION 16
GEAR SELECTOR INDICATOR
DESCRIPTION 17
OPERATION 17
HIGH BEAM INDICATOR
DESCRIPTION 17
OPERATION 17

page

LOW FUEL INDICATOR
DESCRIPTION 18
OPERATION 18
LOW OIL LEVEL INDICATOR
DESCRIPTION 18
OPERATION 18
MAINTENANCE INDICATOR
DESCRIPTION 19
OPERATION 19
MALFUNCTION INDICATOR LAMP (MIL)
DESCRIPTION 20
OPERATION 20
MULTI-FUNCTION INDICATOR
DESCRIPTION 20
OPERATION 21
ODOMETER
DESCRIPTION 21
OPERATION 22
SEATBELT INDICATOR
DESCRIPTION 22
OPERATION 22
SPEEDOMETER
DESCRIPTION 23
OPERATION 23
TACHOMETER
DESCRIPTION 23
OPERATION 24
TRACTION CONTROL INDICATOR
DESCRIPTION 24
OPERATION 24
TRACTION CONTROL MALFUNCTION INDICATOR
DESCRIPTION 25
OPERATION 25
TURN SIGNAL INDICATOR
DESCRIPTION 25
OPERATION 25
WAIT-TO-START INDICATOR
DESCRIPTION 26
OPERATION 26
WASHER FLUID INDICATOR
DESCRIPTION 27
OPERATION 27
WATER-IN-FUEL INDICATOR
DESCRIPTION 27
OPERATION 28

INSTRUMENT CLUSTER

DESCRIPTION

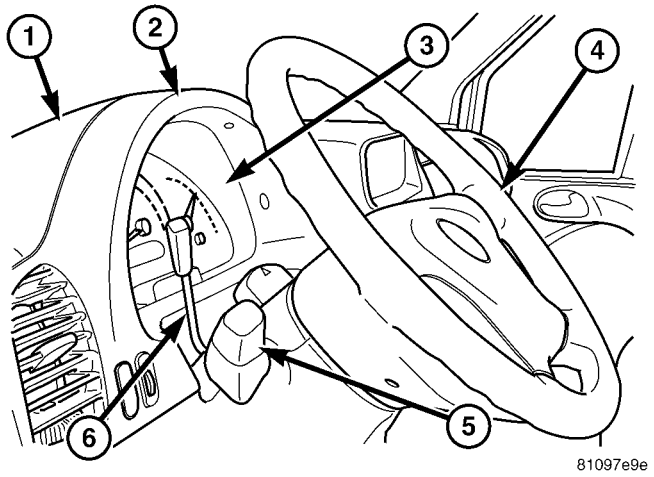


Fig. 1 Instrument Cluster

1 - COVER
2 - BEZEL
3 - INSTRUMENT CLUSTER
4 - STEERING WHEEL
5 - MULTI-FUNCTION SWITCH
6 - SPEED CONTROL SWITCH

The instrument cluster for this model is an ElectroMechanical Instrument Cluster (EMIC) that is located above the steering column opening in the instrument panel, directly in front of the driver (Fig. 1). The remainder of the EMIC, including the mounts and the electrical connections, are concealed within the instrument panel behind the cluster bezel and beneath the instrument panel top cover for the cluster. The instrument cluster includes analog gauges, meters, indicators, and acoustic signal transmitters.

The EMIC module also incorporates a multi-function indicator that consists of a digital Liquid Crystal Display (LCD) unit for displaying odometer/trip odometer information, an electronic digital clock, engine oil level information, automatic transmission gear selector position (PRNDL), and certain diagnostic information. The multi-function indicator also has four push button switches, which provide the vehicle operator with an interface to adjust certain inputs to the instrument cluster and to select from multiple display options. If the vehicle is equipped with the appropriate options, the multi-function indicator also provides an outside ambient temperature indicator display and an Active Service SYStem (ASSYST) engine oil maintenance indicator to display engine oil level and maintenance reminders.

The EMIC gauges and indicators are visible through a dedicated opening in the cluster bezel on the instrument panel and are protected by a clear plastic cluster lens (Fig. 2) that is secured by eight

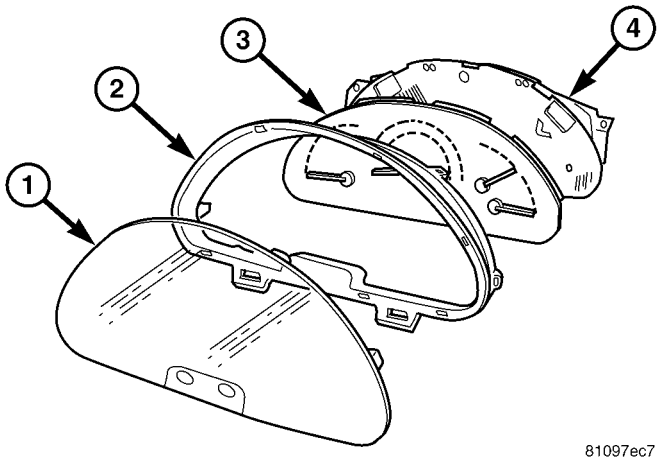


Fig. 2 Instrument Cluster Components

1 - LENS
2 - HOOD
3 - CLUSTER HOUSING
4 - REAR COVER

integral latches to the molded black plastic cluster hood. Four, black plastic multi-function indicator switch push buttons protrude through dedicated holes in a rectangular black plastic switch bezel that is integral to the cluster lens and located near the lower edge of the cluster directly below the multi-function indicator LCD unit. The cluster hood serves as a visor and shields the face of the cluster from ambient light and reflections to reduce glare. The cluster hood has eight integral latches that engage eight integral latch tabs on the cluster rear cover, sandwiching the cluster housing unit between the hood and the rear cover. The cluster hood also has two integral pivot loops molded into its underside that engage two pairs of molded pivot hooks that are integral to the top of the instrument panel base structure. These pivots allow the cluster to be rolled rearward to ease service access to the wire harness connectors at the back of the cluster.

The rear of the cluster housing and the EMIC electronic circuitry are protected by the molded plastic rear cover. A mounting ear at each upper corner of the rear cover are used to secure the EMIC to the molded plastic instrument panel base unit with two screws. The rear cover includes clearance holes for the two cluster connector receptacles on the cluster electronic circuit board. The connector receptacles on the back of the cluster electronic circuit board connect the EMIC to the vehicle electrical system through two take outs with connectors from the vehicle wire harness. The EMIC rear cover includes a molded mounting tab and a latch feature that secures the RKE/immobilizer module to the back of the cluster. The RKE/immobilizer module is connected to the vehicle electrical system through a sep-

INSTRUMENT CLUSTER (Continued)

arate take out and connector of the vehicle wire harness.

Located between the rear cover and the cluster hood is the cluster housing. The molded plastic cluster housing serves as the carrier for the cluster electronic circuit board and circuitry, the cluster connector receptacles, the gauges, a Light Emitting Diode (LED) for each cluster indicator and general illumination lamp, the multi-function indicator LCD unit, electronic tone generators, the cluster overlay, the gauge pointers, the multi-function indicator switches and the four switch push buttons.

The cluster overlay is a laminated plastic unit. The dark, visible, outer surface of the overlay is marked with all of the gauge dial faces and graduations, but this layer is also translucent. The darkness of this outer layer prevents the cluster from appearing cluttered or busy by concealing the cluster indicators that are not illuminated, while the translucence of this layer allows those indicators and icons that are illuminated to be readily visible. The underlying layer of the overlay is opaque and allows light from the LED for each of the various indicators and illumination lamps behind it to be visible through the outer layer of the overlay only through predetermined cutouts. A rectangular opening in the overlay at the base of the speedometer provides a window through which the illuminated multi-function indicator LCD unit can be viewed.

Several versions of the EMIC module are offered on this model. These versions accommodate all of the variations of optional equipment and regulatory requirements for the various markets in which the vehicle will be offered. The microprocessor-based EMIC utilizes integrated circuitry, Electrically Erasable Programmable Read Only Memory (EEPROM) type memory storage, information carried on the Controller Area Network (CAN) data bus, along with several hard wired analog and multiplexed inputs to monitor systems, sensors and switches throughout the vehicle.

In response to those inputs, the hardware and software of the EMIC allow it to control and integrate many electronic functions and features of the vehicle through both hard wired outputs and the transmission of electronic message outputs to other electronic modules in the vehicle over the CAN data bus. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/COMMUNICATION - DESCRIPTION - CAN BUS).

Besides typical instrument cluster gauge and indicator support, the electronic functions and features that the EMIC supports or controls include the following:

- **Active Service System** - In vehicles equipped with the Active Service SYSTem (ASSYST) engine oil maintenance indicator option, the EMIC electronic circuit board includes a second dedicated microprocessor. This second microprocessor evaluates various data including time, mileage, and driving conditions to calculate the required engine oil service intervals, and provides both visual and audible alerts to the vehicle operator when certain engine oil maintenance services are required.
- **Audible Warnings** - The EMIC electronic circuit board is equipped with an audible tone generator and programming that allows it to provide various audible alerts to the vehicle operator, including buzzing and chime tones. An audible contactless electronic relay is also soldered onto the circuit board to produce audible clicks that is synchronized with turn signal indicator flashing to emulate the sounds of a conventional turn signal or hazard warning flasher. These audible clicks can occur at one of two rates to emulate both normal and bulb-out turn or hazard flasher operation. (Refer to 8 - ELECTRICAL/ CHIME/BUZZER - DESCRIPTION).
- **Panel Lamps Dimming Control** - The EMIC provides a hard wired 12-volt Pulse-Width Modulated (PWM) output that synchronizes the dimming level of all panel lamps dimmer controlled lamps with that of the cluster general illumination lamps and multi-function indicator.

The EMIC houses four analog gauges and has provisions for up to nineteen indicators (Fig. 3). The EMIC includes the following analog gauges:

- **Coolant Temperature Gauge**
- **Fuel Gauge**
- **Speedometer**
- **Tachometer**

The EMIC includes provisions for the following indicators (Fig. 3):

- **Airbag (SRS) Indicator**
- **Antilock Brake System (ABS) Indicator**
- **Brake Indicator**
- **Brake Wear Indicator**
- **Charging Indicator**
- **Clogged Fuel Filter Indicator**
- **Coolant Low Indicator**
- **High Beam Indicator**
- **Low Fuel Indicator**
- **Malfunction Indicator Lamp (MIL)**
- **Multi-Function Indicator (LCD)**
- **Seatbelt Indicator**
- **Traction Control (ASR) Indicator**
- **Traction Control (ASR) Malfunction Indicator**
- **Turn Signal (Right and Left) Indicators**
- **Washer Fluid Indicator**
- **Wait-To-Start Indicator**
- **Water-In-Fuel Indicator**

INSTRUMENT CLUSTER (Continued)

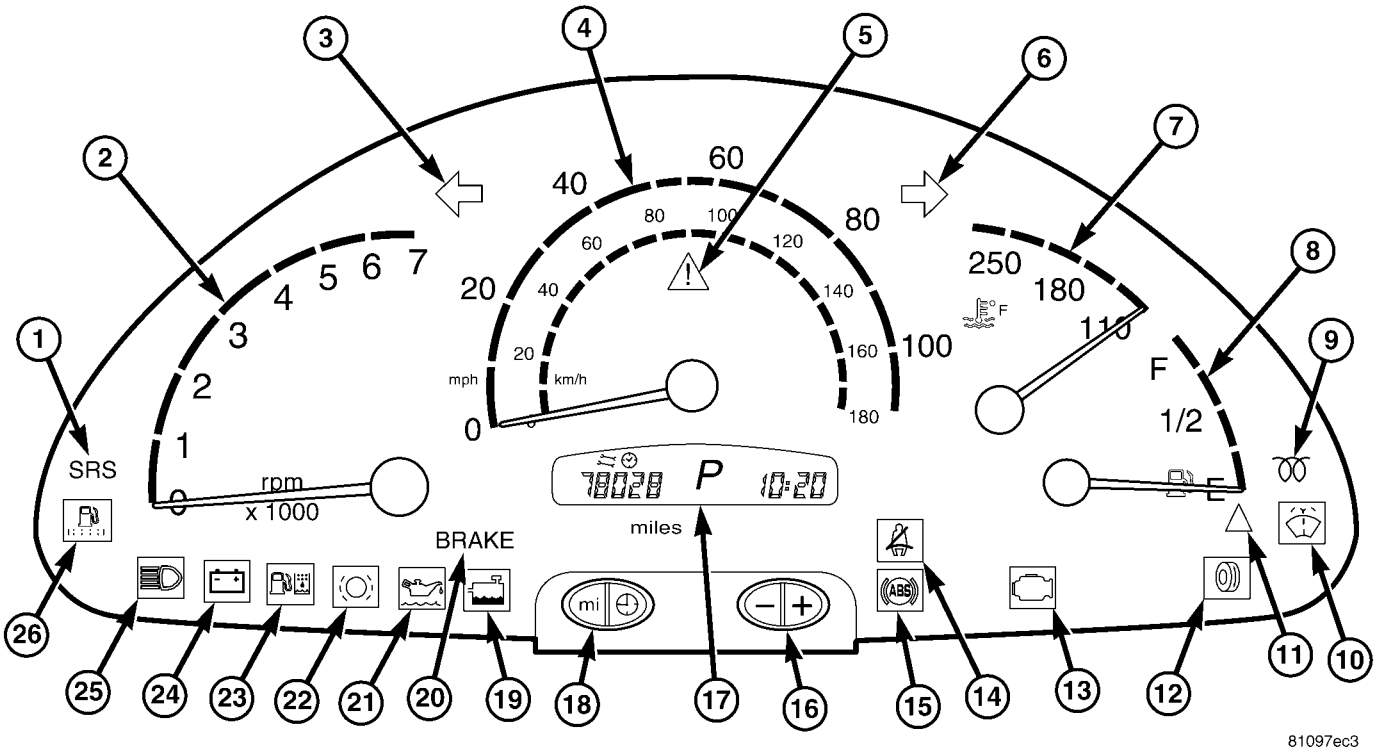


Fig. 3 Gauges & Indicators

1 - AIRBAG INDICATOR
2 - TACHOMETER
3 - LEFT TURN INDICATOR
4 - SPEEDOMETER
5 - TRACTION CONTROL INDICATOR
6 - RIGHT TURN INDICATOR
7 - ENGINE TEMPERATURE GAUGE
8 - FUEL GAUGE
9 - WAIT-TO-START INDICATOR
10 - WASHER FLUID INDICATOR (OPTIONAL)
11 - LOW FUEL INDICATOR
12 - TRACTION CONTROL MALFUNCTION INDICATOR
13 - MALFUNCTION INDICATOR LAMP
14 - SEATBELT INDICATOR
15 - ABS INDICATOR
16 - MULTI-FUNCTION INDICATOR PLUS/MINUS SWITCH PUSH BUTTONS
17 - MULTI-FUNCTION INDICATOR (INCLUDES: CLOCK, GEAR SELECTOR INDICATOR, ODOMETER, TRIP ODOMETER, ENGINE OIL LEVEL DATA, AMBIENT TEMPERATURE INDICATOR [OPTIONAL], & ACTIVE SERVICE SYSTEM [ASSYST] ENGINE OIL MAINTENANCE INDICATOR [OPTIONAL])
18 - MULTI-FUNCTION INDICATOR MODE (MILES [KILOMETERS]/TIME) SWITCH PUSH BUTTONS
19 - COOLANT LOW INDICATOR
20 - BRAKE INDICATOR
21 - OIL LEVEL INDICATOR
22 - BRAKE WEAR INDICATOR
23 - WATER-IN-FUEL INDICATOR
24 - CHARGING INDICATOR
25 - HIGH BEAM INDICATOR
26 - FUEL FILTER CLOGGED INDICATOR

Except for the indications provided within the multi-function indicator LCD unit, each indicator in the EMIC is illuminated by a dedicated LED that is soldered onto the EMIC electronic circuit board. Cluster illumination is accomplished by dimmable LED back lighting, which illuminates the gauges for visibility when the exterior lighting is turned on. The cluster general illumination LED units are also soldered onto the EMIC electronic circuit board. The LED units are not available for service replacement and, if damaged or faulty, the entire EMIC must be replaced.

Hard wired circuitry connects the EMIC to the electrical system of the vehicle. These hard wired circuits are integral to the vehicle wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the EMIC through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

INSTRUMENT CLUSTER (Continued)

The EMIC modules for this model are serviced only as complete units. The EMIC module cannot be adjusted or repaired. If a gauge, an LED indicator, the multi-fuction indicator LCD unit, an electronic tone generator, the electronic circuit board, the circuit board hardware, the cluster overlay, the cluster housing, the cluster hood, the cluster lens, or the cluster rear cover are damaged or faulty, the entire EMIC module must be replaced.

OPERATION

The ElectroMechanical Instrument Cluster (EMIC) is designed to allow the vehicle operator to monitor the conditions of many of the vehicle components and operating systems. The gauges, meters and indicators in the EMIC provide valuable information about the powertrain, fuel and emissions systems, cooling system, lighting systems, safety systems and many other convenience items. The EMIC is installed in the instrument panel so that all of these monitors can be easily viewed by the vehicle operator when driving, while still allowing relative ease of access for service. The microprocessor-based EMIC hardware and software uses various inputs to control the gauges and indicators visible on the face of the cluster. Some of these inputs are hard wired, but many are in the form of electronic messages that are transmitted by other electronic modules over the Controller Area Network (CAN) data bus network. (Refer to 8 - ELECTRICAL/ELECTRONIC CONTROL MODULES/COMMUNICATION - OPERATION).

The EMIC 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 are consistent with customer expectations. However, when abnormal conditions exist such as high coolant temperature, the algorithm can drive the gauge pointer to an extreme position and the microprocessor can sound a chime through the on-board audible tone generator to provide distinct visual and audible indications of a problem to the vehicle operator. The instrument cluster circuitry also provides audible turn signal and hazard warning support by emulating the “ticking” sound associated with a conventional electro-mechanical flasher using a contactless relay. The relay will also provide an indication of a turn signal failure by sounding at double the usual frequency. Each audible warning is provided to the vehicle operator to supplement a visual indication.

The EMIC circuitry operates on battery current received through a non-switched fused B(+) circuit, and on a fused ignition switch output circuit. The EMIC circuitry is grounded through a ground circuit and take out of the frame wire harness with an eyelet terminal connector that is secured to a stud by a nut at a ground location on the dash panel just forward of the instrument cluster. Separate switched ground inputs from the key-in ignition switch and the front door jamb switches provide wake-up signals to the EMIC circuitry. This arrangement allows the EMIC to provide some features regardless of the ignition switch position, while other features will operate only with the ignition switch in the On position.

Proper diagnosis and testing of the EMIC, the CAN data bus, the data bus electronic message inputs to and outputs from the EMIC, as well as the retrieval or erasure of a Diagnostic Trouble Code (DTC) requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information. See the owner’s manual in the vehicle glove box for more information on the features, use and operation of the EMIC.

GAUGES

All gauges receive battery current through the EMIC circuitry only when the instrument cluster detects the ignition switch is in the On position. With the ignition switch in the Off position, battery current is not supplied to any gauges and the EMIC circuitry is programmed to move all of the gauge needles back to the low end of their respective scales. Therefore, the gauges do not accurately indicate any vehicle condition unless the ignition switch is in the On position.

All of the EMIC gauges are air core magnetic units. Two fixed electromagnetic coils are located within each 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 pivot shaft, while 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 EMIC circuitry in response to messages received over the CAN data bus. The gauge needle moves as the movable permanent magnet aligns itself to the changing magnetic fields created around it by the electromagnets.

Proper diagnosis and testing of the gauges, the CAN data bus and the electronic data bus message inputs to the EMIC that control each gauge require the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information. Specific operation details for each gauge may be found elsewhere in this service information.

INSTRUMENT CLUSTER (Continued)

INDICATORS

Indicators are located in various positions within the EMIC and are all connected to the EMIC electronic circuit board. The ambient temperature indicator (optional), brake indicator, brake wear indicator, charging indicator, coolant low indicator, high beam indicator, low fuel indicator, seatbelt indicator, turn signal indicators, and washer fluid indicator operate based upon hard wired inputs to the EMIC. The airbag (SRS) indicator is normally controlled by a hard wired input from the Airbag Control Module (ACM); however, if the EMIC sees an abnormal or no input from the ACM, it will automatically turn the airbag indicator On until the hard wired input from the ACM has been restored. The Malfunction Indicator Lamp (MIL) is normally controlled by CAN data bus messages from the Engine Control Module (ECM); however, if the EMIC loses CAN data bus communication, the EMIC circuitry will automatically turn the MIL on until CAN data bus communication is restored. The EMIC uses CAN data bus messages from the ECM, the ACM, and the Controller Antilock Brake to control all of the remaining indicators.

The various EMIC indicators are controlled by different strategies; some receive battery feed from the EMIC circuitry and have a switched ground, while others are grounded through the EMIC circuitry and have a switched battery feed. However, all indicators are completely controlled by the EMIC microprocessor based upon various hard wired and electronic message inputs. Except for the indications provided by the multi-function indicator Liquid Crystal Display (LCD) unit, all indicators are illuminated at a fixed intensity, which is not affected by the selected illumination intensity of the EMIC general illumination lamps.

The hard wired indicator inputs may be diagnosed using conventional diagnostic methods. However, proper testing of the EMIC circuitry and the CAN bus message controlled indicators requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information. Specific details of the operation for each indicator may be found elsewhere in this service information.

CLUSTER ILLUMINATION

The EMIC has several general illumination lamps that are illuminated when the exterior lighting is turned on with the multi-function switch. The illumination intensity of these lamps is adjusted by a dimming level input received from the multi-function indicator “+” (plus) and “–” (minus) switch push buttons that extend through the lower edge of the cluster lens below the right end of the multi-function indicator. When the exterior lighting is turned Off, the display is illuminated at maximum brightness. When the exterior lighting is turned On and the transmission gear selector is in the Park position, depressing the plus switch push button brightens the display lighting, and depressing the minus switch push button dims the display lighting. The EMIC also provides a Pulse-Width Modulated (PWM) panel lamps dimmer output that can be used to synchronize the illumination lighting levels of external illumination lamps (up to about 23 to 30 watts) with that of the EMIC.

The hard wired multi-function switch input and the EMIC panel lamps dimmer output may be diagnosed using conventional diagnostic methods. However, proper testing of the PWM control of the EMIC and the electronic dimming level inputs from the multi-function indicator push buttons requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

INPUT AND OUTPUT CIRCUITS

HARD WIRED INPUTS

The hard wired inputs to the EMIC include the following:

NOTE: Final approved circuit names were not yet available at the time this information was compiled.

- **Airbag Indicator Driver**
- **Ambient Temperature Sensor Signal (Optional)**
- **Brake Wear Indicator Sense**
- **Charging Indicator Driver**
- **Coolant Level Switch Sense**
- **Front Door Jamb Switch Sense**
- **Fuel Level Sensor Signal**
- **Fused B(+)**
- **Fused Ignition Switch Output**
- **High Beam Indicator Driver**
- **Key-In Ignition Switch Sense**
- **Left Turn Signal**
- **Park Brake Switch Sense**
- **Right Turn Signal**
- **Seat Belt Switch Sense**
- **Washer Fluid Switch Sense (Optional)**

Refer to the appropriate wiring information for additional details.

HARD WIRED OUTPUTS

The hard wired outputs of the EMIC include the following:

NOTE: Final approved circuit names were not yet available at the time this information was compiled.

- **Engine Running Relay Control**
- **Panel Lamps Driver**

INSTRUMENT CLUSTER (Continued)

Refer to the appropriate wiring information for additional details.

GROUNDS

The EMIC receives and supplies a ground path to several switches and sensors through the following hard wired circuits:

NOTE: Final approved circuit names were not yet available at the time this information was compiled.

- **Ambient Temperature Sensor Return (Optional)**
- **Fuel Level Sensor Return**
- **Ground**

Refer to the appropriate wiring information for additional details.

COMMUNICATION

The EMIC has provisions for the following communication circuits:

NOTE: Final approved circuit names were not yet available at the time this information was compiled.

- **CAN Data Bus - High**
- **CAN Data Bus - Low**
- **Diagnostic Serial Communication Interface (SCI) Data Bus Line**

Refer to the appropriate wiring information for additional details.

DIAGNOSIS AND TESTING - INSTRUMENT CLUSTER

The hard wired inputs to and outputs from the instrument cluster may be diagnosed and tested using conventional diagnostic tools and procedures. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

If the instrument cluster is completely inoperative, be certain to check the fused B(+) circuit fuses and wiring for the instrument cluster. If the cluster general illumination is inoperative, be certain to check the instrument lighting fuse and the input circuit to the instrument cluster from the exterior lighting circuitry of the multi-function switch on the steering column.

Conventional diagnostic methods may not prove conclusive in the diagnosis of the instrument cluster. In order to obtain conclusive testing of the instrument cluster, the Controller Area Network (CAN) data bus network and all of the electronic modules that provide inputs to or receive outputs from the instrument cluster must also be checked. The most reliable, efficient, and accurate means to diagnose the instrument cluster, the CAN data bus network, and the electronic modules that provide inputs to or receive outputs from the instrument cluster requires the use of a DRBIII® scan tool and the appropriate diagnostic information. The DRBIII® scan tool can provide confirmation that the CAN data bus network is functional, that all of the modules are sending and receiving the proper electronic messages over the CAN data bus, and that the instrument cluster is receiving the proper hard wired inputs and responding with the proper hard wired outputs needed to perform its many functions.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL SUPPLEMENTAL RESTRAINT DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL SUPPLEMENTAL RESTRAINT DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the cluster bezel from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/ CLUSTER BEZEL - REMOVAL).

INSTRUMENT CLUSTER (Continued)

(3) Remove the cluster top cover from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/TOP COVER - CLUSTER - REMOVAL).

(4) Remove the two screws that secure the instrument cluster mounting ears to the instrument panel base structure (Fig. 4).

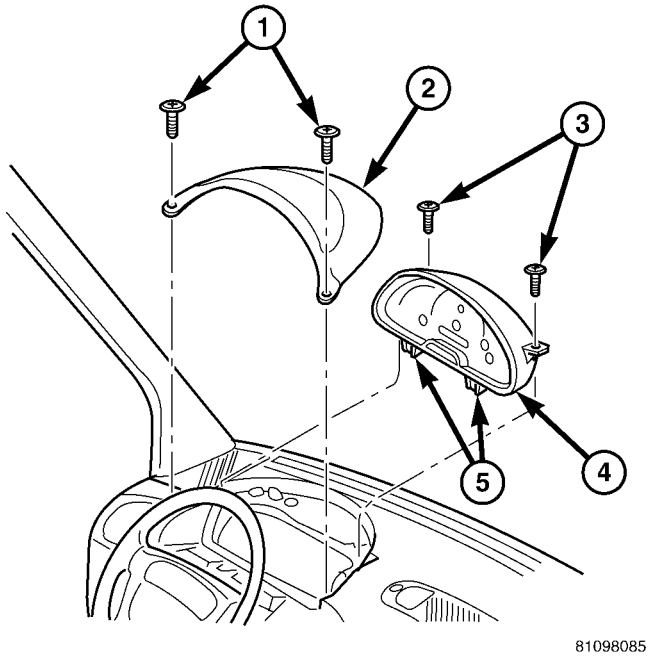


Fig. 4 Instrument Cluster Remove/Install

1 - SCREW (2)
2 - COVER
3 - SCREW (2)
4 - INSTRUMENT CLUSTER
5 - LOOP (2)

(5) Roll the top of the instrument cluster rearward far enough to access and release the latch that secures the RKE/immobilizer module to the back of the instrument cluster rear cover and disengage the module from the cluster (Fig. 5).

(6) Depress the release (Arrow A) and lift the lever arm (Arrow B) to disconnect each of the two frame wire harness connectors for the cluster from the connector receptacles on the back of the cluster housing (Fig. 6).

(7) Lift the instrument cluster upward far enough to disengage the two molded plastic pivot loops integral to the base of the cluster hood from the two pairs of molded plastic pivot hooks that are integral to the top of the instrument panel base structure.

(8) Remove the instrument cluster from the instrument panel.

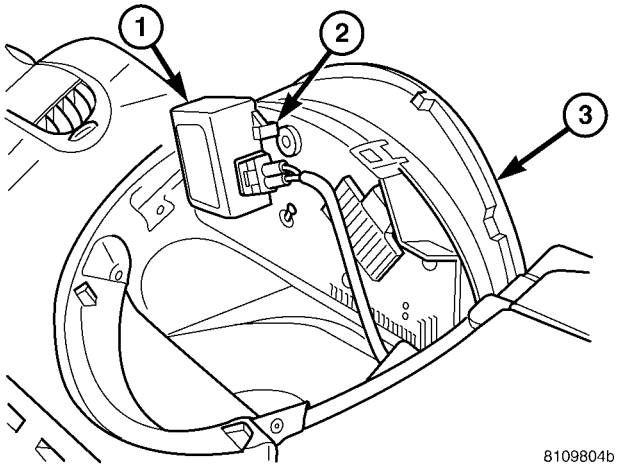


Fig. 5 RKE/Immobilizer Module

1 - RKE/IMMOBILIZER MODULE
2 - LATCH
3 - INSTRUMENT CLUSTER

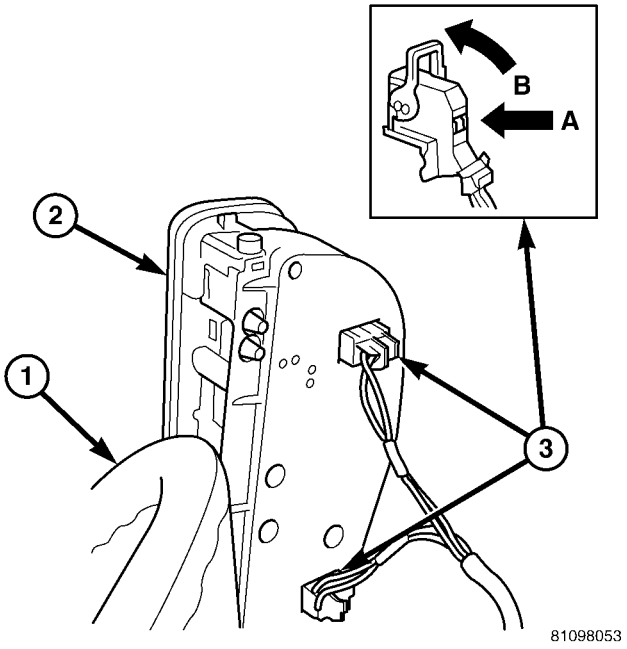


Fig. 6 Cluster Connectors

1 - STEERING WHEEL
2 - INSTRUMENT CLUSTER
3 - CONNECTOR (2)

INSTRUMENT CLUSTER (Continued)

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL SUPPLEMENTAL RESTRAINT DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Position the instrument cluster to the instrument panel.

(2) Align the two molded plastic pivot loops integral to the base of the cluster hood between the two pairs of molded plastic pivot hooks that are integral to the top of instrument panel base structure, then push downward on the top of the cluster until the loops snap into engagement with the hooks (Fig. 6).

(3) Roll the top of the instrument cluster rearward to access, reconnect, and latch the two frame wire harness connectors for the cluster to the connector receptacles on the back of the cluster housing.

(4) Engage and latch the RKE/immobilizer module to the back of the instrument cluster rear cover (Fig. 5)

(5) Roll the top of the instrument cluster forward to position the instrument cluster into the instrument panel.

(6) Install and tighten the two screws that secure the instrument cluster mounting ears to the instrument panel base structure (Fig. 4). Tighten the screws to 2 N·m (20 in. lbs.).

(7) Reinstall the cluster top cover onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/TOP COVER - CLUSTER - INSTALLATION).

(8) Reinstall the cluster bezel onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/CLUSTER BEZEL - INSTALLATION).

(9) Reconnect the battery negative cable.

ABS INDICATOR

DESCRIPTION

An Anti-lock Brake System (ABS) indicator is standard equipment on all instrument clusters. The ABS indicator is located near the lower edge of the instrument cluster, to the right of the multi-function indicator display. The ABS indicator consists of the International Control and Display Symbol icon for “Failure of Anti-lock Braking System” imprinted within a rectangular cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear silhouetted against an amber field through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The ABS indicator is serviced as a unit with the instrument cluster.

OPERATION

The ABS indicator gives an indication to the vehicle operator when the ABS or the electronic brake force distribution (EBV) systems are faulty or inoperative. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Controller Antilock Brake (CAB) over the Controller Area Network (CAN) data bus. The ABS indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster detects that the ignition switch is in the On position. Therefore, the LED will always be off when the ignition switch is in any position except On. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the ABS indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the ABS indicator is illuminated by the cluster for about two seconds as a bulb test.

ABS INDICATOR (Continued)

- **ABS Lamp-On Message** - Each time the cluster receives a lamp-on message from the CAB, the ABS indicator will be illuminated. The indicator remains illuminated until the cluster receives a lamp-off message from the CAB, or until the ignition switch is turned to the Off position, whichever occurs first.

The CAB continually monitors the ABS and EBV circuits and sensors to decide whether the systems are in good operating condition. The CAB then sends the proper lamp-on or lamp-off messages to the instrument cluster. If the CAB sends a lamp-on message after the bulb test, it indicates that the CAB has detected a system malfunction and/or that the ABS or EBV systems have become inoperative. The CAB will store a Diagnostic Trouble Code (DTC) for any malfunction it detects. For proper diagnosis of the ABS and EBV systems, the CAB, the CAN data bus, the electronic message inputs to the instrument cluster, or the instrument cluster circuitry that controls the ABS indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

AIRBAG INDICATOR

DESCRIPTION

An airbag indicator is standard equipment on all instrument clusters. The airbag indicator is located near the left edge of the instrument cluster, next to the tachometer. The airbag indicator consists of a stencil-like cutout of the letters “SRS” in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the “SRS” text to appear in red through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The airbag indicator is serviced as a unit with the instrument cluster.

OPERATION

The airbag (SRS) indicator gives an indication to the vehicle operator when the Airbag Control Module (ACM) has recorded a Diagnostic Trouble Code (DTC) for a Supplemental Restraint System (SRS) circuit or component malfunction. Such a DTC may indicate that the SRS is faulty or inoperative. The airbag indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and a hard wired input received by the cluster from the ACM. The airbag indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster detects that the ignition switch is in the On position. Therefore, the LED will always be off when the ignition switch is in any position except On. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the airbag indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the airbag indicator is illuminated for about four seconds. The entire four second bulb test is a function of the ACM.
- **Airbag Lamp-On Input** - Each time the cluster receives a lamp-on input from the ACM, the airbag indicator will be illuminated. The indicator can be flashed on and off, or illuminated solid, as dictated by the ACM input. For some DTC’s, if the problem does not recur, the ACM will send a lamp-off input automatically. Other DTC’s may require that a fault be repaired and the ACM be reset before a lamp-off input will be sent. For more information on the ACM and the DTC set and reset parameters, refer to 8 - ELECTRICAL/RESTRAINTS/AIRBAG CONTROL MODULE - OPERATION). The indicator remains illuminated until the cluster receives a lamp-off input from the ACM, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Airbag Indicator Malfunction** - Following the seatbelt reminder function, each time the cluster detects a malfunction in the airbag (SRS) indicator or the airbag indicator circuit, the cluster will flash the seatbelt indicator on and off. The cluster will continue to flash the seatbelt indicator until the airbag indicator circuit fault is resolved, or until the ignition switch is turned to the Off position, whichever occurs first.

The ACM continually monitors the SRS circuits and sensors to decide whether the system is in good operating condition. The ACM then provides the proper lamp-on or lamp-off inputs to the instrument cluster. If the ACM provides a lamp-on input after the bulb test, it indicates that the ACM has detected a system malfunction and/or that the airbags and seat belt tensioners may not deploy when required, or may deploy when not required. The ACM will store a DTC for any malfunction it detects. The ACM input circuit to the instrument cluster can be diagnosed using conventional diagnostic tools and methods. For proper diagnosis of the SRS, the ACM, or the instrument cluster circuitry that controls the airbag indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

AMBIENT TEMPERATURE INDICATOR

DESCRIPTION

An ambient temperature indicator is optional equipment on all instrument clusters. In vehicles so equipped, the ambient temperature indication can be toggled with the clock indication on the right side of the multi-function indicator Liquid Crystal Display (LCD) located near the lower edge of the instrument cluster, directly below the speedometer. The ambient temperature indication consists of a numeric value with a "+" (plus) or "−" (minus) prefix, and the unit of measure is identified with the characters "°C" (Canadian vehicles only) or "°F" (United States vehicles only) located directly above the temperature indication. The indications of the ambient temperature indicator are not visible when the LCD is not illuminated. When illuminated the indications appear as dark characters and icons silhouetted against an amber field. When the exterior lighting is turned Off, the display is illuminated at maximum brightness. When the exterior lighting is turned On the display illumination level can be adjusted in concert with the cluster general illumination lighting using the "+" (plus) and "−" (minus) multi-function indicator push buttons. The ambient temperature indicator is serviced as a unit with the instrument cluster.

OPERATION

The optional ambient temperature indicator gives an indication to the vehicle operator of the outside air temperature. This indicator is controlled by the instrument cluster microprocessor based upon cluster programming and a hard wired input received by the cluster from the ambient temperature sensor. The ambient temperature indicator is completely controlled by the instrument cluster logic circuit, and that logic will allow this indicator to operate whenever the multi-function indicator Liquid Crystal Display (LCD) is activated. Therefore, the ambient temperature indicator remains functional regardless of the ignition switch position.

The vehicle operator can choose to have the ambient temperature indicator displayed instead of the clock information, but the clock and ambient temperature indicator cannot be displayed at the same time. The clock or ambient temperature indicator display option is selected using the multi-function indicator clock switch on the instrument cluster circuit board. This switch is actuated manually by depressing the clock switch push button that extends through the lower edge of the cluster lens below the left end of the multi-function indicator. Actuating this switch momentarily will toggle the display between the clock and ambient temperature indicator modes. Actuating this switch twice within about one second will cause the display to toggle, but then automatically revert to the originally selected mode after about twenty seconds.

The ambient temperature sensor located below the front bumper is a Negative Temperature Coefficient (NTC) thermistor. The internal resistance of the sensor is reduced as the ambient temperature rises. The instrument cluster continually monitors the resistance through the sensor to determine the temperature value to be displayed. The current value is displayed immediately after the LCD is activated. The display value will remain static regardless of decreases in the sensor resistance (temperature rising) below vehicle speeds of 10 to 15 kilometers-per-hour (6 to 9 miles-per-hour). Decreases in the sensor resistance above 15 kilometers-per-hour (9 miles-per-hour) and increases the sensor resistance (temperature falling) regardless of vehicle speed are displayed subject to a sixty second delay.

The ambient temperature sensor is connected to the instrument cluster in series between the ambient temperature sensor return and sense circuits. The ambient temperature sensor and the return and sense circuits to the instrument cluster can be diagnosed using conventional diagnostic tools and methods. For proper diagnosis of the instrument cluster circuitry that controls the ambient temperature indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

BRAKE/PARK BRAKE INDICATOR

DESCRIPTION

A brake indicator is standard equipment on all instrument clusters. The brake indicator is located near the lower edge of the instrument cluster, to the left of the multi-function indicator display. In vehicles built for the United States market, the brake indicator consists of stencil-like cutout of the word "BRAKE" in the opaque layer of the instrument cluster overlay. In vehicles built for the Canadian market, the brake indicator consists of the International Control and Display Symbol icon for "Brake Failure" imprinted within a rectangular cutout in the opaque layer of the instrument cluster overlay. In either case, the dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the "BRAKE" text to appear in red, or the icon to appear silhouetted against a red field through

the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The brake indicator is serviced as a unit with the instrument cluster.

OPERATION

The brake indicator gives an indication to the vehicle operator when the parking brake is applied, or when there are certain brake hydraulic system malfunctions as indicated by a low brake hydraulic fluid level condition. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and hard wired inputs from the park brake switch and the brake fluid level switch. The brake indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster detects that the ignition switch is in the On position. Therefore, the LED will always be off when the ignition switch is in any position except On. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the brake indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the brake indicator is illuminated by the instrument cluster for about two seconds as a bulb test.
- **Brake Fluid Level Switch Input** - Each time the cluster detects ground on the park brake/brake fluid level switch sense circuit (brake fluid level switch closed = brake fluid level low) while the ignition switch is in the On position, the brake indicator is illuminated. The indicator remains illuminated until the brake fluid level switch sense input to the cluster is an open circuit (brake fluid level switch open = brake fluid level okay), or until the ignition switch is turned to the Off position, whichever occurs first.
- **Park Brake Switch Input** - Each time the cluster detects ground on the park brake/brake fluid level switch sense circuit (park brake switch closed = park brake applied or not fully released) while the ignition switch is in the On position, the brake indicator is illuminated. The indicator remains illuminated until the park brake switch sense input to the cluster is an open circuit (park brake switch open = park brake fully released), or until the ignition switch is turned to the Off position, whichever occurs first.

The park brake switch on the park brake pedal mechanism and the brake fluid level switch in the brake master cylinder provide a hard wired ground input to the instrument cluster circuitry through the park brake/brake fluid level switch sense circuit whenever the park brake is applied or not fully released, or whenever the fluid level in the brake master cylinder is low. The two switches are connected in parallel between ground and the instrument cluster. The park brake switch, brake fluid level switch, and their input circuit to the instrument cluster can be diagnosed using conventional diagnostic tools and methods. For proper diagnosis of the instrument cluster circuitry that controls the brake indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

BRAKE WEAR INDICATOR

DESCRIPTION

A brake wear indicator is standard equipment on all instrument clusters. The brake wear indicator is located near the lower edge of the instrument cluster, to the left of the multi-function indicator display. The brake wear indicator consists of the International Control and Display Symbol icon for “Worn Brake Linings” imprinted within a rectangular cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear silhouetted against an amber field through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The brake wear indicator is serviced as a unit with the instrument cluster.

OPERATION

The brake wear indicator gives an indication to the vehicle operator when the brake linings have reached their wear limits. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and a hard wired input from the four brake wear sensors, one at each wheel. The brake wear indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster detects that the ignition switch is in the On position. Therefore, the LED will always be off when the ignition switch is in any position except On. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the brake wear indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the brake wear indicator is

BRAKE WEAR INDICATOR (Continued)

illuminated by the instrument cluster for about two seconds as a bulb test.

- **Brake Wear Sensor Input** - Each time the cluster detects ground on the brake wear sense circuit (brake wear sensor closed = brake lining wear limit exceeded) while the ignition switch is in the On position, the brake wear indicator is illuminated. The indicator remains illuminated until the brake wear sense input to the cluster is an open circuit (brake wear sensor open = brake lining wear within limits), or until the ignition switch is turned to the Off position, whichever occurs first.

A brake wear sensor located at each wheel provides a hard wired ground input to the instrument cluster circuitry through the brake wear sense circuit whenever the brake linings for that wheel have exceeded their wear limits. The four normally open brake wear sensors are connected in parallel between ground and instrument cluster. The brake wear sensors and their input circuit to the instrument cluster can be diagnosed using conventional diagnostic tools and methods. For proper diagnosis of the instrument cluster circuitry that controls the brake wear indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

CHARGING INDICATOR

DESCRIPTION

A charging indicator is standard equipment on all instrument clusters. The charging indicator is located near the lower edge of the instrument cluster, to the left of the multi-function indicator display. The charging indicator consists of the International Control and Display Symbol icon for “Battery Charging Condition” imprinted within a rectangular cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear silhouetted against a red field through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The charging indicator is serviced as a unit with the instrument cluster.

OPERATION

The charging indicator gives an indication to the vehicle operator when the electrical system voltage is too low. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and a hard wired input from the generator. The charging indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster detects that the ignition switch is in the On position. Therefore, the LED will always be off when the ignition switch is in any position except On. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the charging indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position with the engine not running the charging indicator is illuminated by the instrument cluster as a bulb test.
- **Generator Input** - Each time the cluster detects that the voltage of the generator input is 12.7 volts or lower while the engine is running, the charging indicator will be illuminated. The indicator remains illuminated until the cluster detects that the voltage of the generator input is above 12.7 volts, or until the ignition switch is turned to the Off position, whichever occurs first.

The generator provides a hard wired input to the instrument cluster circuitry on the engine running (D+) circuit. If the instrument cluster turns on the indicator while the engine is running, it may indicate that the charging system requires service. The generator input circuit to the instrument cluster can be diagnosed using conventional diagnostic tools and methods. For proper diagnosis of the charging system, or the instrument cluster circuitry that controls the charging indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

CLOCK

DESCRIPTION

An electronic digital clock is standard equipment on all instrument clusters. In vehicles equipped with the optional ambient temperature indicator, the clock indication can be toggled with the ambient temperature indication on the right side of the multi-function indicator Liquid Crystal Display (LCD) located near the lower edge of the instrument cluster, directly below the speedometer. The clock provides a 12 hour-based, digital indication of the current hours and minutes. The indications of the clock are not visible when the LCD is not illuminated. When illuminated the indications appear as dark characters silhouetted against an amber field. When the exterior lighting is turned Off, the display is illuminated at maximum brightness. When the exterior lighting is turned On the display illumination level can be adjusted in concert with the cluster general illumination lighting

CLOCK (Continued)

using the "+" (plus) and "−" (minus) multi-function indicator push buttons. The clock is serviced as a unit with the instrument cluster.

OPERATION

The clock gives an indication to the vehicle operator of the current time. The electronic digital clock is controlled by the instrument cluster microprocessor based upon cluster programming. The clock display is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indication to be viewed when the multi-function indicator Liquid Crystal Display (LCD) is activated. However, the clock remains functional regardless of the ignition switch position.

The vehicle operator can choose to have the optional ambient temperature indicator displayed instead of the clock information, but the clock and ambient temperature indicator cannot be displayed at the same time. The clock or ambient temperature indicator display option is selected using the multi-function indicator clock switch on the instrument cluster circuit board. This switch is actuated manually by depressing the clock switch push button that extends through the lower edge of the cluster lens below the left end of the multi-function indicator. Actuating this switch momentarily will toggle the display between the clock and ambient temperature indicator modes. Actuating this switch twice within about one second will cause the display to toggle, but then automatically revert to the originally selected mode after about twenty seconds.

See the owner's manual in the vehicle glove box for more information on the features, use, operation and setting procedures for the clock. For proper testing of the instrument cluster circuitry that controls the clock functions, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

COOLANT LOW INDICATOR

DESCRIPTION

A coolant low indicator is standard equipment on all instrument clusters. The coolant low indicator is located near the lower edge of the instrument cluster, to the left of the multi-function indicator display. The coolant low indicator consists of the International Control and Display Symbol icon for "Low Engine Coolant" imprinted within a rectangular cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear silhouetted against a red field through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The coolant low indicator is serviced as a unit with the instrument cluster.

OPERATION

The coolant low indicator gives an indication to the vehicle operator when the engine coolant level is low. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and a hard wired input received by the cluster from the engine coolant level switch. The coolant low indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster detects that the ignition switch is in the On position. Therefore, the LED will always be off when the ignition switch is in any position except On. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the coolant low indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the coolant low indicator is illuminated for about two seconds as a bulb test.
- **Engine Coolant Level Switch Input** - Each time the cluster detects an appropriate input on the low coolant fluid level sense circuit (engine coolant level switch resistance low = engine coolant level low) while the ignition switch is in the On position, the coolant low indicator will be illuminated. The indicator remains illuminated until the low coolant fluid level sense input to the cluster changes (engine coolant level switch resistance high = engine coolant level full), or until the ignition switch is turned to the Off position, whichever occurs first. The engine coolant level switch also features a diagnostic resistor connected in parallel between the switch input and output to provide the cluster with verification that the low coolant fluid level sense circuit is not open or shorted.

The engine coolant level switch integral to the coolant bottle provides a hard wired input to the instrument cluster circuitry through the low coolant fluid level sense circuit. The engine coolant level switch and the low coolant fluid level sense circuit to the instrument cluster can be diagnosed using conventional diagnostic tools and methods. For proper diagnosis of the instrument cluster circuitry that controls the coolant low indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

ENGINE TEMPERATURE GAUGE

DESCRIPTION

An engine coolant temperature gauge is standard equipment on all instrument clusters. The engine coolant temperature gauge is located in the upper right corner of the instrument cluster, to the right of the speedometer. The engine coolant temperature gauge consists of a movable gauge needle or pointer controlled by the instrument cluster circuitry and a fixed 45 degree scale on the cluster overlay that reads left-to-right from 120° C to 40° C for Canadian vehicles, or from 250° F to 110° F for United States vehicles. An International Control and Display Symbol icon for “Engine Coolant Temperature” is located on the cluster overlay, directly below the high end of the scale. Just to the right of the icon, the nomenclature “°C” or “°F” confirms the unit of measure for the gauge readings.

The engine coolant temperature gauge graphics are white against a black field, except for a single red graduation at the far left (high) end of the gauge scale, making them clearly visible within the instrument cluster in daylight. When illuminated from behind by the panel lamps dimmer controlled cluster illumination lighting with the exterior lamps turned On, the white graphics appear amber and the red graphics appear red. The orange gauge needle is internally illuminated. Gauge illumination is provided by Light Emitting Diode (LED) units soldered onto the instrument cluster electronic circuit board. The engine coolant temperature gauge is serviced as a unit with the instrument cluster.

OPERATION

The engine coolant temperature gauge gives an indication to the vehicle operator of the engine coolant temperature. This gauge is controlled by the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Engine Control Module (ECM) over the Controller Area Network (CAN) data bus. The engine coolant temperature gauge is an air core magnetic unit that receives battery current on the instrument cluster electronic circuit board when the instrument cluster detects that the ignition switch is in the On position. The cluster is programmed to move the gauge needle back to the low end of the scale after the ignition switch is turned to the Off position. The instrument cluster circuitry controls the gauge needle position and provides the following features:

- **Engine Temperature Normal Message** - Each time the cluster receives a message from the ECM indicating the engine coolant temperature is within the normal operating range [up to about 120° C (250° F), the gauge needle is moved to the actual relative temperature position on the gauge scale.
- **Engine Temperature High Message** - Each time the cluster receives a message from the ECM indicating the engine coolant temperature is high [above about 120° C (250° F) the gauge needle is moved into the red warning zone on the gauge scale.

The ECM continually monitors the engine coolant temperature sensor to determine the engine operating temperature. The ECM then sends the proper engine coolant temperature messages to the instrument cluster. If the instrument cluster moves the engine coolant temperature gauge needle to red area of the gauge scale, it may indicate that the engine or the engine cooling system require service. For proper diagnosis of the engine coolant temperature sensor, the ECM, the CAN data bus, the electronic message inputs to the instrument cluster, or the instrument cluster circuitry that controls the engine coolant temperature gauge, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

FUEL FILTER CLOGGED INDICATOR

DESCRIPTION

A fuel filter clogged indicator is standard equipment on all instrument clusters. The fuel filter clogged indicator is located near the left edge of the instrument cluster, next to the tachometer. The fuel filter clogged indicator consists of the International Control and Display Symbol icon for “Fuel Filter” imprinted within a rectangular cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear silhouetted against an amber field through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The fuel filter clogged indicator is serviced as a unit with the instrument cluster.

OPERATION

The fuel filter clogged indicator gives an indication to the vehicle operator when the pressure in the fuel system is low, which could indicate that the fuel filter is clogged. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Engine Control Mod-

FUEL FILTER CLOGGED INDICATOR (Continued)

ule (ECM) over the Controller Area Network (CAN) data bus. The fuel filter clogged indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster detects that the ignition switch is in the On position. Therefore, the LED will always be off when the ignition switch is in any position except On. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the fuel filter clogged indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the fuel filter clogged indicator is illuminated by the cluster for about two seconds as a bulb test.
- **Fuel Filter Clogged Lamp-On Message** - Each time the cluster receives a lamp-on message from the ECM, the fuel filter clogged indicator will be illuminated. The indicator remains illuminated until the cluster receives a lamp-off message from the ECM, or until the ignition switch is turned to the Off position, whichever occurs first.

The ECM continually monitors the low fuel pressure sensor located at the inlet of the high pressure fuel pump to decide whether the fuel system is in good operating condition. The ECM then sends the proper lamp-on or lamp-off messages to the instrument cluster. If the ECM sends a lamp-on message after the bulb test, it indicates that the ECM has detected a low pressure condition in the fuel system, which could result from a clogged fuel filter or from any other restrictions in the fuel delivery system. The ECM will store a Diagnostic Trouble Code (DTC) for any malfunction it detects. For proper diagnosis of the low fuel pressure sensor, the ECM, the CAN data bus, the electronic message inputs to the instrument cluster, or the instrument cluster circuitry that controls the fuel filter clogged indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

FUEL GAUGE

DESCRIPTION

A fuel gauge is standard equipment on all instrument clusters. The fuel gauge is located in the lower right corner of the instrument cluster, to the right of the speedometer. The fuel gauge consists of a movable gauge needle or pointer controlled by the instrument cluster circuitry and a fixed 45 degree scale on the cluster overlay that reads left-to-right from “F” (or Full) to “E” (or Empty). An International Control and Display Symbol icon for “Fuel” is located on the cluster overlay, directly to the left of the low end of the scale.

The fuel gauge graphics are white against a black field, making them clearly visible within the instrument cluster in daylight. When illuminated from behind by the panel lamps dimmer controlled cluster illumination lighting with the exterior lamps turned On, the white graphics appear amber. The orange gauge needle is internally illuminated. Gauge illumination is provided by Light Emitting Diode (LED) units soldered onto the instrument cluster electronic circuit board. The fuel gauge is serviced as a unit with the instrument cluster.

OPERATION

The fuel gauge gives an indication to the vehicle operator of the level of fuel in the fuel tank. This gauge is controlled by the instrument cluster circuit board based upon cluster programming and a hard wired input received by the cluster from the fuel level sensor in the fuel tank. The fuel gauge is an air core magnetic unit that receives battery current on the instrument cluster electronic circuit board when the instrument cluster detects that the ignition switch is in the On position. The cluster is programmed to move the gauge needle back to the low end of the scale after the ignition switch is turned to the Off position. The instrument cluster circuitry controls the gauge needle position and provides the following features:

- **Fuel Level Sensor Input (At Ignition On)** - When the cluster detects the ignition switch has been turned to the On position, the cluster moves the gauge needle to the proper relative position on the gauge scale as signaled by the fuel level sensor without any electronic damping.
- **Fuel Level Sensor Input (After Ignition On)** - After the ignition switch has been turned to the On position, the cluster applies an algorithm to the input from the fuel level sensor to electronically dampen gauge needle movement against the negative effect that fuel sloshing within the fuel tank can have on accurate gauge readings.
- **Fuel Level Sensor Input Open** - If the fuel level sensor input to the instrument cluster is an open circuit, the cluster will move the fuel gauge needle to the “E” (Empty) position on the gauge scale, but the low fuel indicator will not be illuminated.

The fuel level sensor in the fuel tank provides a hard wired input to the instrument cluster circuitry through the fuel level sense circuit. The fuel level sensor is a potentiometer that changes resistance according to the fuel level. As the fuel level decreases, the resistance through the fuel level sensor increases. The fuel level sensor and the fuel level sense circuit to the instrument cluster can be diag-

FUEL GAUGE (Continued)

nosed using conventional diagnostic tools and methods. For proper diagnosis of the instrument cluster circuitry that controls the fuel gauge, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

GEAR SELECTOR INDICATOR

DESCRIPTION

An electronic automatic transmission gear selector indicator is standard equipment on all instrument clusters. The gear selector indicator information is displayed in the center of the multi-function indicator Liquid Crystal Display (LCD) located near the lower edge of the instrument cluster, directly below the speedometer. The gear selector indicator displays the following characters as they are selected: “P,” “R,” “N,” “D,” “4,” “3,” “2,” and “1.” Respectively, these characters represent the currently selected park, reverse, neutral, drive, fourth gear, third gear, second gear, and first gear positions of the transmission gear selector lever on the instrument panel.

The indications of the gear selector indicator are not visible unless the multi-function indicator LCD is illuminated and the engine is running. When illuminated, each indication appears as a dark character silhouetted against an amber field. When the exterior lighting is turned Off, the display is illuminated at maximum brightness. When the exterior lighting is turned On, the display illumination level can be adjusted in concert with the cluster general illumination lighting using the “+” (plus) and “−” (minus) multi-function indicator push buttons. The gear selector indicator is serviced as a unit with the instrument cluster.

OPERATION

The electronic gear selector indicator gives an indication to the vehicle operator of the transmission gear that is currently selected with the automatic transmission gear selector lever. This indicator is controlled by the instrument cluster circuit board based upon cluster programming and electronic messages received from the Transmission Control Module (TCM) over the Controller Area Network (CAN) data bus. The gear selector indicator information is displayed by the multi-function indicator Liquid Crystal Display (LCD) unit on the instrument cluster electronic circuit board. The multi-function indicator LCD is completely controlled by the instrument cluster logic circuit, and that logic will only allow the gear selector indicator information to be displayed when the instrument cluster detects that the ignition switch is in the On position. Therefore, the gear selector indicator will always be off when the ignition switch is in any position except On.

The TCM continually monitors the transmission range sensor, then sends the proper gear selector indicator position messages to the instrument cluster. For proper diagnosis of the transmission range sensor, the TCM, the CAN data bus, or the electronic message inputs to the instrument cluster that control the gear selector indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

HIGH BEAM INDICATOR

DESCRIPTION

A high beam indicator is standard equipment on all instrument clusters. The high beam indicator is located near the lower edge of the instrument cluster, to the left of the multi-function indicator display. The high beam indicator consists of the International Control and Display Symbol icon for “High Beam” imprinted within a rectangular cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A blue Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear silhouetted against a blue field through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The high beam indicator is serviced as a unit with the instrument cluster.

OPERATION

The high beam indicator gives an indication to the vehicle operator whenever the headlamp high beams are illuminated. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and a hard wired input from the multi-function switch. The high beam indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will allow this indicator to operate whenever the instrument cluster receives battery current on the fused B(+) circuit. Therefore, the LED can be illuminated regardless of the ignition switch position. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the high beam indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the high beam indicator is illuminated by the cluster for about two seconds as a bulb test.

HIGH BEAM INDICATOR (Continued)

- **High Beams On Input** - Each time the cluster receives a high beam headlamps-on input from the multi-function switch, the high beam indicator will be illuminated. The indicator remains illuminated until the cluster receives a high beam headlamps-off input from the multi-function switch.

The instrument cluster continually monitors the multi-function switch input to determine whether the high beam indicator should be illuminated or extinguished. The multi-function switch and the multi-function switch input circuit to the instrument cluster can be diagnosed using conventional diagnostic tools and methods. For proper diagnosis of the instrument cluster circuitry that controls the high beam indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

LOW FUEL INDICATOR

DESCRIPTION

A low fuel indicator is standard equipment on all instrument clusters. The low fuel indicator is located directly below the low end of the fuel gauge scale. The low fuel indicator consists of a small triangular cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the triangle to appear in amber through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The low fuel indicator is serviced as a unit with the instrument cluster.

OPERATION

The low fuel indicator gives an indication to the vehicle operator when the level of fuel in the fuel tank becomes low. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and a hard wired input received by the cluster from the fuel level sensor in the fuel tank. The low fuel indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster detects that the ignition switch is in the On position. Therefore, the LED will always be off when the ignition switch is in any position except On. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the low fuel indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the low fuel indicator is illuminated for about two seconds as a bulb test.
- **Fuel Level Sensor Input** - Each time the cluster receives an input from the fuel level sensor indicating that the fuel level has reached about 12 liters (3 gallons) or less, the low fuel indicator is illuminated. The indicator remains illuminated until the cluster receives an input from the fuel level sensor indicating that the fuel level is above 12 liters (3 gallons), or until the ignition switch is turned to the Off position, whichever occurs first.

The fuel level sensor in the fuel tank provides a hard wired input to the instrument cluster circuitry through the fuel level sense circuit. The fuel level sensor is a potentiometer that changes resistance according to the fuel level. As the fuel level decreases, the resistance through the fuel level sensor increases. The fuel level sensor and the fuel level sense circuit to the instrument cluster can be diagnosed using conventional diagnostic tools and methods. For proper diagnosis of the instrument cluster circuitry that controls the fuel gauge, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

LOW OIL LEVEL INDICATOR

DESCRIPTION

A low oil level indicator is standard equipment on all instrument clusters. The low oil level indicator is located near the lower edge of the instrument cluster, to the left of the multi-function indicator display. The low oil level indicator consists of the International Control and Display Symbol icon for “Engine Oil” imprinted within a rectangular cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear silhouetted against a red field through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The low oil level indicator is serviced as a unit with the instrument cluster.

OPERATION

The low oil level indicator gives an indication to the vehicle operator when the engine oil level is low. This indicator is controlled by a transistor on the instrument cluster electronic circuit board based upon cluster programming and electronic messages received by the cluster from the Engine Control Mod-

LOW OIL LEVEL INDICATOR (Continued)

ule (ECM) over the Controller Area Network (CAN) data bus. The low oil level indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster detects that the ignition switch is in the On position. Therefore, the LED will always be off when the ignition switch is in any position except On. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the low oil level indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the low oil level indicator is illuminated for about two seconds as a bulb test.
- **Engine Oil Level Low Message** - Once the engine has been started, each time the cluster receives a message from the ECM indicating that the engine oil level is at or near the "Minimum" mark on the dipstick, the low oil level indicator is illuminated. The indicator remains illuminated briefly at first, but will remain illuminated for longer periods as subsequent messages indicate that the oil level has dropped further. Eventually, the indicator will remain illuminated solid until the engine oil level is corrected, or until the ignition switch is turned to the Off position, whichever occurs first.

The instrument cluster also supplements the oil level indicator by displaying an engine oil icon along with alpha-numeric messages in the multi-function indicator Liquid Crystal Display (LCD) advising the vehicle operator how much oil is required to correct the engine oil level, and when the "Maximum" engine oil level has been exceeded. See the owner's manual in the vehicle glove box for more information on this feature.

The ECM continually monitors the engine oil level and temperature sensor to determine the engine oil level. The ECM then sends the proper engine oil level messages to the instrument cluster. If the instrument cluster turns on the indicator after the bulb test, even after the engine oil level is sufficient, it may indicate that the engine or the engine oiling system requires service. For proper diagnosis of the engine oil level and temperature sensor, the ECM, the CAN data bus, or the electronic message inputs to the instrument cluster that control the low oil level indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

MAINTENANCE INDICATOR

DESCRIPTION

An Active Service SYSTem (ASSYST) engine oil maintenance indicator is optional equipment on all instrument clusters. In vehicles so equipped, a second, dedicated ASSYST microprocessor is integral to the cluster electronic circuit board. The ASSYST indications are displayed and can be toggled with the clock indication on the right side of the multi-function indicator Liquid Crystal Display (LCD) located near the lower edge of the instrument cluster, directly below the speedometer. The ASSYST displays include numeric values combined with several icons to indicate actual engine oil level, and reminders in time (days) or distance (miles or kilometers) until the next required engine oil maintenance is anticipated. ASSYST also provides several audible indications using the electronic tone generator on the instrument cluster circuit board to supplement these visual displays.

The indications of the ASSYST engine oil maintenance indicator are not visible when the LCD is not illuminated. When illuminated, the ASSYST indications appear as dark characters and icons silhouetted against an amber field. When the exterior lighting is turned Off, the display is illuminated at maximum brightness. When the exterior lighting is turned On, the display illumination level can be adjusted in concert with the cluster general illumination lighting using the "+" (plus) and "−" (minus) multi-function indicator push buttons. The ASSYST engine oil maintenance indicator is serviced as a unit with the instrument cluster.

OPERATION

The ASSYST engine oil maintenance indicator microprocessor uses numerous criteria besides time and mileage to evaluate vehicle maintenance requirements. Time data is taken from the electronic digital clock integral to the instrument cluster. Vehicle distance data is obtained from the Controller Antilock Brake (CAB) over the Controller Area Network (CAN) data bus. Coolant temperature, engine oil temperature, engine oil level, engine oil quality, engine speed, and engine load data are obtained from the Engine Control Module (ECM) over the CAN data bus. Using all of the available data and internal programming, the ASSYST microprocessor then calculates the estimated time and distance to the next required engine oil maintenance interval. The ASSYST uses the multi-function indicator LCD to display that data and, when necessary, issues audible alerts to the vehicle operator through the electronic tone generator on the cluster circuit board.

See the owner's manual in the vehicle glove box for more information on the features, use, operation and resetting procedures for the ASSYST maintenance computer. Proper diagnosis and testing of the ASSYST engine oil maintenance computer, the CAN data bus and the electronic data bus message inputs to the EMIC that are used by the ASSYST computer for its calculations requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

MALFUNCTION INDICATOR LAMP (MIL)

DESCRIPTION

A Malfunction Indicator Lamp (MIL) is standard equipment on all instrument clusters. The MIL is located near the lower edge of the instrument cluster, to the right of the multi-function indicator display. The MIL consists of the International Control and Display Symbol icon for "Engine" imprinted within a rectangular cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear silhouetted against an amber field through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The MIL is serviced as a unit with the instrument cluster.

OPERATION

The Malfunction Indicator Lamp (MIL) gives an indication to the vehicle operator when the Engine Control Module (ECM) has recorded a Diagnostic Trouble Code (DTC) for an On-Board Diagnostics II (OBDII) emissions-related circuit or component malfunction. The MIL is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the ECM over the Controller Area Network (CAN) data bus. The MIL Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster detects that the ignition switch is in the On position. Therefore, the LED will always be off when the ignition switch is in any position except On. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the MIL for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the MIL is illuminated as a bulb test. The indicator will remain illuminated until the engine is started, or until the ignition switch is turned to the Off position, whichever occurs first.
- **MIL Lamp-On Message** - Each time the cluster receives a MIL lamp-on message from the ECM, the indicator will be illuminated. The indicator will remain illuminated until the detected fault is repaired, or until the ignition switch is turned to the Off position, whichever occurs first. For more information on the ECM and the DTC set and reset parameters, (Refer to 25 - EMISSIONS CONTROL - OPERATION).
- **Communication Error** - If the cluster receives no lamp-on or lamp-off message from the ECM, the MIL is illuminated by the instrument cluster. The indicator remains controlled and illuminated by the cluster until a valid lamp-on or lamp-off message is received from the ECM.

The ECM continually monitors the fuel and emissions system circuits and sensors to decide whether the system is in good operating condition. The ECM then sends the proper lamp-on or lamp-off messages to the instrument cluster. If the instrument cluster turns on the MIL after the bulb test, it may indicate that a malfunction has occurred and that the fuel and emissions systems may require service. For proper diagnosis of the fuel and emissions systems, the ECM, the CAN data bus, or the electronic message inputs to the instrument cluster that control the MIL, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

MULTI-FUNCTION INDICATOR

DESCRIPTION

A multi-function indicator is standard equipment on all instrument clusters. The multi-function indicator is located near the lower edge of the instrument cluster, directly below the speedometer. The multi-function indicator consists of a Liquid Crystal Display (LCD) unit and four push button-controlled switches that are soldered onto the instrument cluster electronic circuit board. The LCD is visible through a large rectangular cutout in the instrument cluster overlay, while the four switch push buttons extend through a black plastic switch bezel located on the cluster lens directly below the LCD. The four multi-function indicator push buttons allow the vehicle operator to configure and adjust several of the display features. The buttons are labeled from left to right: "mi" (miles) or "km" (kilometers), an icon depicting an analog clock face (clock), "−" (minus), and "+" (plus).

The multi-function indicator LCD displays both alpha-numeric characters and numerous icons to provide information to the vehicle operator. The indications of the multi-function indicator are not visible when the LCD is not illuminated. When illuminated the indications appear as dark characters and icons silhouetted against an amber field. When the exterior lighting is turned Off, the display is illuminated at maximum brightness. When the exterior lighting is turned On the display illumination level can be adjusted in concert with the cluster general illumination lighting using the "+" (plus) and "−" (minus) multi-function indicator push buttons. The multi-function indicator LCD unit and push button switches are serviced as a unit with the instrument cluster.

MULTI-FUNCTION INDICATOR (Continued)

OPERATION

The multi-function indicator has several display capabilities including odometer, trip odometer, clock, engine oil level data, gear selector indicator (PRNDL), certain diagnostic information and, on vehicles so equipped, an optional Active Service SYS-Tem (ASSYST) engine oil maintenance indicator and an optional outside ambient temperature indicator. The multi-function indicator is completely controlled by the instrument cluster logic circuit, and that logic will allow this indication to be viewed whenever the multi-function indicator Liquid Crystal Display (LCD) is activated. Therefore, the indicator remains functional regardless of the ignition switch position. With the ignition switch in the Off or Accessory positions and the key removed from the ignition lock cylinder, the display is activated when the park lamps are turned On or, for about thirty seconds after any one of the multi-function indicator switch push buttons is depressed. Otherwise, the display unit is active for about thirty seconds after the key is inserted into the ignition lock cylinder, and inactive about thirty seconds after the key is removed from the ignition lock cylinder.

The multi-function indicator “mi” (miles) or “km”(kilometers) switch push button is used to control the odometer/trip odometer display modes. The multi-function indicator clock switch push button is used to control the clock/outside temperature display modes. The multi-function indicator “+” (plus) and “−” (minus) switch push buttons are used to adjust the cluster general illumination dimming level, the clock, and other cluster settings. See the owner’s manual in the vehicle glove box for more information on the features, use, operation and setting procedures for the various standard and optional multi-function indicator displays.

Proper testing of the multi-function indicator LCD unit, the CAN data bus and the electronic data bus message inputs to the instrument cluster that control some of the multi-function indicator functions requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information. Additional details for the odometer/trip odometer, the clock, the gear selector indicator, the ambient temperature indicator and the ASSYST warning and reminder functions of the multi-function indicator may be found elsewhere in this service information.

ODOMETER

DESCRIPTION

An odometer and trip odometer are standard equipment in all instrument clusters. The odometer and trip odometer values are displayed on the left side of the multi-function indicator Liquid Crystal Display (LCD). The LCD is soldered onto the cluster electronic circuit board and is visible through a window with a clear lens located near the lower edge of the instrument cluster, directly below the speedometer. However, the odometer and trip odometer information are not displayed simultaneously. The “mi” (miles) or “km” (kilometers) switch on the instrument cluster circuit board toggles the display between odometer and trip odometer modes by depressing the switch push button that extends through the lower edge of the cluster lens, directly below the multi-function indicator LCD.

The odometer and trip odometer information is stored in the instrument cluster memory. This information can be increased when the proper inputs are provided to the instrument cluster, but the information cannot be decreased. The odometer can display values up to 999,999 kilometers (999,999 miles). The odometer latches at these values, and will not roll over to zero. The trip odometer can display values up to 999.9 kilometers (999.9 miles) before it rolls over to zero. The odometer display does not have a decimal point and will not show values less than a full unit (kilometer or mile), while the trip odometer display does have a decimal point and will show tenths of a unit (kilometer or mile). The unit of measure (kilometers or miles) for the odometer and trip odometer display is imprinted on the cluster overlay below the left end of the LCD. The unit of measure for the instrument cluster odometer/trip odometer is selected at the time that it is manufactured, and cannot be changed.

The indications of the odometer/trip odometer are not visible when the LCD is not illuminated. When illuminated the indications appear as dark characters silhouetted against an amber field. When the exterior lighting is turned Off, the display is illuminated at maximum brightness. When the exterior lighting is turned On the display illumination level can be adjusted in concert with the cluster general illumination lighting using the plus and minus multi-function indicator push buttons. The odometer has a “Rental Car” mode, which will activate the multi-function indicator LCD and illuminate the odometer information for about thirty seconds after one of the multi-function indicator push buttons is momentarily depressed, or after the key is inserted into the ignition switch lock cylinder with the ignition switch in the Off position.

The odometer/trip odometer and the miles/kilometers switch, and the miles/kilometers switch push button are serviced as a unit with the instrument cluster.

ODOMETER (Continued)

OPERATION

The odometer and trip odometer give an indication to the vehicle operator of the distance the vehicle has traveled. This indicator is controlled by the instrument cluster circuitry based upon cluster programming and electronic messages received by the cluster from the Controller Anti-lock Brake (CAB) over the Controller Area Network (CAN) data bus. The odometer and trip odometer information is displayed by the multi-function indicator Liquid Crystal Display (LCD). The LCD will display the odometer information whenever it is activated, and will display the last previously selected odometer or trip odometer information when the ignition switch is turned to the On position. The instrument cluster circuitry controls the LCD and provides the following features:

- **Odometer/Trip Odometer Display Toggling** - Actuating the multi-function indicator "mi" (miles) or "km" (kilometers) switch push button momentarily with the LCD illuminated will toggle the display between the odometer and trip odometer information. Each time the LCD is illuminated with the ignition switch in the On or Start positions, the display will automatically return to the last mode previously selected (odometer or trip odometer).
- **Trip Odometer Reset** - When the multi-function indicator "mi" (miles) or "km" (kilometers) switch push button is pressed and held for longer than about two seconds, the trip odometer will be reset to 000.0 kilometers (miles). The LCD must be displaying the trip odometer information in order for the trip odometer information to be reset.

The CAB continually monitors the vehicle speed pulse information received from the four wheel speed sensors, then sends the proper distance messages to the instrument cluster. For proper diagnosis of the wheel speed sensors, the CAB, the CAN data bus, or the electronic message inputs to the instrument cluster that control the odometer/trip odometer, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

SEATBELT INDICATOR

DESCRIPTION

A seatbelt indicator is standard equipment on all instrument clusters. The seatbelt indicator is located near the lower edge of the instrument cluster, to the right of the multi-function indicator display. The seatbelt indicator consists of the International Control and Display Symbol icon for "Seat Belt" imprinted within a rectangular cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. A red Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear silhouetted against a red field through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The seatbelt indicator is serviced as a unit with the instrument cluster.

OPERATION

The seatbelt indicator gives an indication to the vehicle operator of the status of the driver side front seat belt. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and a hard wired input received from the seat belt switch on the driver side front seat belt. The seatbelt indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster detects that the ignition switch is in the On position. Therefore, the LED will always be off when the ignition switch is in any position except On. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the seatbelt indicator for the following reasons:

- **Seatbelt Reminder Function** - Each time the cluster detects that the ignition switch has been turned to the On position the seatbelt indicator will be illuminated as a reminder for about six seconds, or until the ignition switch is turned to the Off position, whichever occurs first. This reminder function will occur regardless of the status of the input received by the cluster from the driver side front seat belt switch.
- **Driver Side Front Seat Belt Switch Input** - Following the seatbelt reminder function, each time the cluster detects ground on the seatbelt indicator driver circuit (seat belt switch closed = seatbelt unbuckled) with the ignition switch in the On position, the seatbelt indicator will be illuminated. The seatbelt indicator remains illuminated until the seat belt switch input to the cluster is an open circuit (seat belt switch open = seatbelt buckled), or until the ignition switch is turned to the Off position, whichever occurs first.
- **Airbag Indicator Malfunction** - Following the seatbelt reminder function, each time the cluster detects a malfunction in the airbag (SRS) indicator or the airbag indicator circuit, the cluster will flash the seatbelt indicator on and off. The cluster will continue to flash the seatbelt indicator until the airbag indicator circuit fault is resolved, or until the ignition switch is turned to the Off position, whichever occurs first.

SEATBELT INDICATOR (Continued)

The instrument cluster continually monitors the status of the driver side front seat belt switch and the airbag indicator circuit to determine the proper seatbelt indicator response. The seat belt switch is connected in series between the instrument cluster and ground. The seat belt switch and the seatbelt indicator driver circuit to the instrument cluster can be diagnosed using conventional diagnostic tools and methods. For proper diagnosis of the ACM, the airbag (SRS) indicator, or the instrument cluster circuitry that controls the seatbelt indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

SPEEDOMETER

DESCRIPTION

A speedometer is standard equipment on all instrument clusters. The speedometer is located in the center of the instrument cluster. The speedometer consists of a movable gauge needle or pointer controlled by the instrument cluster circuitry and a fixed 210 degree primary outer scale on the gauge dial face that reads left-to-right either from “0” to “100” miles-per-hour, or from “0” to “180” kilometers-per-hour, depending upon the market for which the vehicle is manufactured. Each version also has a secondary inner scale on the gauge dial face that provides the equivalent opposite units from the primary scale. Text appearing on the cluster overlay near the left end of each scale abbreviates the unit of measure, either “mph” or “km/h”.

The speedometer graphics are white against a black field, making them clearly visible within the instrument cluster in daylight. When illuminated from behind by the panel lamps dimmer controlled cluster illumination lighting with the exterior lamps turned On, the white graphics appear amber. The orange gauge needle is internally illuminated. Gauge illumination is provided by Light Emitting Diode (LED) units soldered onto the instrument cluster electronic circuit board. The speedometer is serviced as a unit with the instrument cluster.

OPERATION

The speedometer gives an indication to the vehicle operator of the vehicle road speed. This gauge is controlled by the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Controller Anti-lock Brake (CAB) over the Controller Area Network (CAN) data bus. The speedometer is an air core magnetic unit that receives battery current on the instrument cluster electronic circuit board when the instrument cluster detects that the ignition switch is in the On position. The cluster is programmed to move the gauge needle back to the low end of the scale after the ignition switch is turned to the Off position. The instrument cluster circuitry controls the gauge needle position and provides the following features:

- **Vehicle Speed Message** - Each time the cluster receives a vehicle speed message from the CAB it will calculate the correct vehicle speed reading and position the gauge needle at that relative speed position on the gauge scale. The gauge needle will continue to be positioned at the actual vehicle speed position on the gauge scale until the ignition switch is turned to the Off position.
- **Communication Error** - If the cluster fails to receive a speedometer message, it will hold the gauge needle at the last indication for about three seconds, or until the ignition switch is turned to the Off position, whichever occurs first. After three seconds, the gauge needle will return to the left end of the gauge scale.

The CAB continually monitors the four wheel speed sensors to determine the vehicle road speed. The CAB then sends the proper vehicle speed messages to the instrument cluster. For proper diagnosis of the wheel speed sensors, the CAB, the CAN data bus, or the electronic message inputs to the instrument cluster that control the speedometer, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

TACHOMETER

DESCRIPTION

A tachometer is standard equipment on all instrument clusters. The tachometer is located to the left of the speedometer, to the left of center in the instrument cluster. The tachometer consists of a movable gauge needle or pointer controlled by the instrument cluster circuitry and a fixed 45 degree scale on the gauge dial face that reads left-to-right from “0” to “7”. The text “rpm X 1000” imprinted on the cluster overlay near the left end of the gauge scale identifies that each number on the tachometer scale is to be multiplied by 1000 rpm.

The tachometer graphics are white against a black field, making them clearly visible within the instrument cluster in daylight. When illuminated from behind by the panel lamps dimmer controlled cluster illumination lighting with the exterior lamps turned On, the white graphics appear amber. The orange gauge needle is internally illuminated. Gauge illumination is provided by Light Emitting Diode (LED) units soldered onto the instrument cluster electronic circuit board. The tachometer is serviced as a unit with the instrument cluster.

TACHOMETER (Continued)

OPERATION

The tachometer gives an indication to the vehicle operator of the engine speed. This gauge is controlled by the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Engine Control Module (ECM) over the Controller Area Network (CAN) data bus. The tachometer is an air core magnetic unit that receives battery current on the instrument cluster electronic circuit board when the instrument cluster detects that the ignition switch is in the On position. The cluster is programmed to move the gauge needle back to the low end of the scale after the ignition switch is turned to the Off position. The instrument cluster circuitry controls the gauge needle position and provides the following features:

- **Engine Speed Message** - Each time the cluster receives an engine speed message from the ECM it will calculate the correct engine speed reading and position the gauge needle at that relative speed position on the gauge scale. The gauge needle will continually be repositioned at the relative engine speed position on the gauge scale until the engine stops running, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Communication Error** - If the cluster fails to receive an engine speed message, it will hold the gauge needle at the last indication for about three seconds, or until the ignition switch is turned to the Off position, whichever occurs first. After three seconds, the gauge needle will return to the left end of the gauge scale.

The ECM continually monitors the crankshaft position sensor to determine the engine speed. The ECM then sends the proper engine speed messages to the instrument cluster. For proper diagnosis of the crankshaft position sensor, the ECM, the CAN data bus, or the electronic message inputs to the instrument cluster that control the tachometer, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

TRACTION CONTROL INDICATOR

DESCRIPTION

A traction control (ASR) indicator is standard equipment on all instrument clusters. The traction control indicator is located near the center of the speedometer in the instrument cluster. The traction control indicator consists of an "!" (exclamation point) imprinted within a triangular cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the exclamation point to appear silhouetted against an amber field through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The traction control indicator is serviced as a unit with the instrument cluster.

OPERATION

The traction control (ASR) indicator gives several indications to the vehicle operator concerning the operating status of the traction control (ASR) system. The traction control indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Controller Anti-lock Brake (CAB) over the Controller Area Network (CAN) data bus. The traction control indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster detects that the ignition switch is in the On position. Therefore, the LED will always be off when the ignition switch is in any position except On. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the traction control indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the traction control indicator is illuminated for about two seconds as a bulb test.
- **Traction Control (ASR) Indicator Lamp-On Message** - Each time the cluster receives a traction control indicator lamp-on message from the CAB, the indicator will be illuminated. This indicator can be flashed on and off, or illuminated solid, as dictated by the CAB message. The indicator is illuminated solid when the traction control system has been deactivated; and is flashed when the traction control is activated or when the driven wheels lose traction with the traction control deactivated. The indicator remains flashing or illuminated solid until the cluster receives a lamp-off message from the CAB, or until the ignition switch is turned to the Off position, whichever occurs first.

The CAB continually monitors the traction control (ASR) switch and the four wheel speed sensors to determine the correct operating mode for the traction control system. The CAB then sends the proper lamp-on or lamp-off messages to the instrument cluster. See the owner's manual in the vehicle glove box for more information on the features, use, activation and deactivation of the traction control (ASR) system. For proper diagnosis of the traction control system, the CAB, the CAN data bus, or the electronic message inputs to the instrument cluster that control the traction control indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

TRACTION CONTROL MALFUNCTION INDICATOR

DESCRIPTION

A traction control (ASR) malfunction indicator is standard equipment on all instrument clusters. The traction control malfunction indicator is located near the lower edge of the instrument cluster, to the right of the multi-function indicator display. The traction control malfunction indicator consists of an icon that graphically depicts a tire and two skid marks imprinted within a rectangular cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear silhouetted against an amber field through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The traction control malfunction indicator is serviced as a unit with the instrument cluster.

OPERATION

The traction control (ASR) malfunction indicator gives the vehicle operator an indication when the traction control system is faulty or inoperative. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Controller Antilock Brake (CAB) over the Controller Area Network (CAN) data bus. The traction control malfunction indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster detects that the ignition switch is in the On position. Therefore, the LED will always be off when the ignition switch is in any position except On. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the traction control malfunction indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the traction control indicator is illuminated as a bulb test until the engine is started.
- **Traction Control (ASR) Malfunction Indicator Lamp-On Message** - Each time the cluster receives a traction control malfunction indicator lamp-on message from the CAB, the indicator will be illuminated. The indicator remains illuminated until the cluster receives a lamp-off message from the CAB, or until the ignition switch is turned to the Off position, whichever occurs first.

The CAB continually monitors the traction control (ASR) system circuits and sensors to decide whether the system is in good operating condition. The CAB then sends the proper lamp-on or lamp-off messages to the instrument cluster. If the CAB sends a lamp-on message after the bulb test, it indicates that the CAB has detected a system malfunction and that the traction control (ASR) system has become inoperative. The CAB will store a Diagnostic Trouble Code (DTC) for any malfunction it detects. In addition, if the traction control malfunction indicator is illuminated, the CAB will deactivate an activated traction control system and engine power output may be reduced. See the owner's manual in the vehicle glove box for more information on the features, use, activation and deactivation of the traction control (ASR) system. For proper diagnosis of the traction control system, the CAB, the CAN data bus, or the electronic message inputs to the instrument cluster that control the traction control malfunction indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

TURN SIGNAL INDICATOR

DESCRIPTION

Two turn signal indicators, one right and one left, are standard equipment on all instrument clusters. The turn signal indicators are located near the upper edge of the instrument cluster, one to each side of the speedometer. Each turn signal indicator consists of a arrow-shaped cutout of the International Control and Display Symbol icon for "Turn Warning" in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents these icons from being clearly visible when they are not illuminated. A green Light Emitting Diode (LED) behind each turn signal indicator cutout in the opaque layer of the overlay causes the icon to appear in green through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The turn signal indicators are serviced as a unit with the instrument cluster.

OPERATION

The turn signal indicators give an indication to the vehicle operator that the turn signal (left or right indicator flashing) or hazard warning (both left and right indicators flashing) have been selected and are operating. These indicators are controlled by transistors on the instrument cluster electronic circuit board based upon the cluster programming and a hard

TURN SIGNAL INDICATOR (Continued)

wired input received by the cluster from the turn signal relay through the turn signal and hazard warning switch circuitry of the multi-function switch on the left and right turn signal circuits. Each turn signal indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will allow this indicator to operate whenever the instrument cluster receives a battery current input on the fused B(+) circuit. Therefore, each LED can be illuminated regardless of the ignition switch position. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the turn signal indicators for the following reasons:

- **Turn Signal Input** - Each time the cluster detects a turn signal input from the turn signal relay through the closed turn signal switch circuitry of the multi-function switch on the hard wired left or right turn signal circuit, the requested turn signal lamps and turn signal indicator will be flashed on and off, and a contactless relay soldered onto the cluster electronic circuit board will produce a clicking sound to emulate a conventional turn signal flasher. The turn signals and the turn signal indicators continue to flash on and off until the turn signal switch circuitry of the multi-function switch is opened, or until the ignition switch is turned to the Off position, whichever occurs first.
- **Hazard Warning Input** - Each time the cluster detects a hazard warning input from the turn signal relay through the closed hazard warning switch circuitry of the multi-function switch on the hard wired left and right turn signal circuits, all of the turn signal lamps and both turn signal indicators will be flashed on and off, and a contactless relay soldered onto the cluster electronic circuit board will produce a clicking sound to emulate a conventional hazard warning flasher. The turn signals and the turn signal indicators continue to flash on and off until the hazard warning switch circuitry of the multi-function switch is opened.

An electronic wipers, turn signals and engine start control module located within the fuse block beneath the steering column monitors the turn signal circuits and controls the flash rate of the turn signal relay. The instrument cluster continually monitors the right and left turn signal circuits to determine the proper turn signal and hazard warning indicator operation, then flashes the proper turn signal indicators and the contactless relay on and off accordingly. The multi-function switch, the turn signal relay and the left and right turn signal circuits to the instrument cluster can be diagnosed using conventional diagnostic tools and methods. For proper diagnosis of the wipers, turn signals and engine start control module within the fuse block or the instrument cluster circuitry that controls the turn signal indicators and the contactless relay, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

WAIT-TO-START INDICATOR

DESCRIPTION

A wait-to-start indicator is standard equipment in all instrument clusters. The wait-to-start indicator is located near the lower edge of the instrument cluster, to the right of the multi-function indicator display. The wait-to-start indicator consists of the International Control and Display Symbol icon for “Diesel Preheat” imprinted within a rectangular cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear silhouetted against an amber field through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The wait-to-start indicator is serviced as a unit with the instrument cluster.

OPERATION

The wait-to-start indicator gives an indication to the vehicle operator when the diesel engine glow plugs are energized in their pre-heat operating mode. This indicator is controlled by a transistor on the instrument cluster circuit board based upon cluster programming and electronic messages received by the cluster from the Engine Control Module (ECM) over the Controller Area Network (CAN) data bus. The wait-to-start indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster detects that the ignition switch is in the On position. Therefore, the LED will always be off when the ignition switch is in any position except On. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the wait-to-start indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the wait-to-start indicator is illuminated for about two seconds as a bulb test.
- **Wait-To-Start Lamp-On Message** - Each time the cluster receives a wait-to-start lamp-on message from the ECM indicating that the diesel engine glow plugs are energized in their pre-heat operating mode,

WAIT-TO-START INDICATOR (Continued)

the wait-to-start indicator will be illuminated. The indicator remains illuminated until the cluster receives a wait-to-start lamp-off message indicating that the pre-heat mode of the glow plugs has been completed, until the ECM detects that the engine is running, or until the ignition switch is turned to the Off position, whichever occurs first.

The ECM continually monitors the engine coolant temperature sensor to determine when the glow plugs need to be energized in their pre-heat operating mode. The ECM then sends the proper wait-to-start lamp-on and lamp-off messages to the instrument cluster. If the instrument cluster turns on the indicator after the engine is started, it may indicate that a malfunction has occurred and that the engine glow control system requires service. The ECM will store a Diagnostic Trouble Code (DTC) for any malfunction it detects. For proper diagnosis of the engine coolant temperature sensor, the engine glow control system and circuits, the ECM, the CAN data bus, or the electronic message inputs to the instrument cluster that control the wait-to-start indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

WASHER FLUID INDICATOR

DESCRIPTION

A washer fluid indicator is standard equipment on all instrument clusters. However, this indicator is only functional on vehicles equipped with an optional washer fluid level switch integral to the washer pump/motor unit on the washer reservoir. The washer fluid indicator is located near the lower edge of the instrument cluster, to the right of the multi-function indicator display. The washer fluid indicator consists of the International Control and Display Symbol icon for “Windshield Washer Fluid” imprinted within a rectangular cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout in the opaque layer of the overlay causes the icon to appear silhouetted against an amber field through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The washer fluid indicator is serviced as a unit with the instrument cluster.

OPERATION

The washer fluid indicator gives an indication to the vehicle operator that the fluid level in the washer reservoir is low. This indicator is controlled by the instrument cluster circuit board based upon cluster programming and a hard wired input from the optional washer fluid level switch that is integral to the washer pump/motor unit. The washer fluid indicator is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster detects that the ignition switch is in the On position. Therefore, the indicator will always be off when the ignition switch is in any position except On. The indicator only illuminates when it is switched to ground by the instrument cluster circuitry. The instrument cluster will turn on the washer fluid indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the brake wear indicator is illuminated by the instrument cluster for about two seconds as a bulb test.
- **Washer Fluid Level Switch Input** - Each time the cluster detects ground on the washer fluid switch sense circuit (washer fluid level switch closed = washer fluid level low) while the ignition switch is in the On position, the washer fluid indicator is illuminated. The indicator remains illuminated until the washer fluid level switch input to the cluster is an open circuit (washer fluid level switch open = washer fluid level acceptable), or until the ignition switch is turned to the Off position, whichever occurs first.

The instrument cluster continually monitors the washer fluid level switch to determine the level of the washer fluid. The instrument cluster logic applies a delay strategy to this input to reduce the negative effect that fluid sloshing within the reservoir can have on reliable indicator operation. The washer fluid level switch and circuit can be diagnosed using conventional diagnostic tools and methods. For proper diagnosis of the instrument cluster circuitry that controls the washer fluid indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

WATER-IN-FUEL INDICATOR

DESCRIPTION

A water-in-fuel indicator is standard equipment in all instrument clusters. The water-in-fuel indicator is located near the lower edge of the instrument cluster, to the left of the multi-function indicator display. The water-in-fuel indicator consists of the International Control and Display Symbol icon for “Water In Fuel” imprinted within a rectangular cutout in the opaque layer of the instrument cluster overlay. The dark outer layer of the overlay prevents the indicator from being clearly visible when it is not illuminated. An amber Light Emitting Diode (LED) behind the cutout

in the opaque layer of the overlay causes the icon to appear silhouetted against an amber field through the translucent outer layer of the overlay when the indicator is illuminated from behind by the LED, which is soldered onto the instrument cluster electronic circuit board. The water-in-fuel indicator is serviced as a unit with the instrument cluster.

OPERATION

The water-in-fuel indicator gives an indication to the vehicle operator when there is excessive water detected in the fuel filter. This indicator is controlled by a transistor on the instrument cluster circuit board based upon the cluster programming and electronic messages received by the cluster from the Engine Control Module (ECM) over the Controller Area Network (CAN) data bus. The water-in-fuel indicator Light Emitting Diode (LED) is completely controlled by the instrument cluster logic circuit, and that logic will only allow this indicator to operate when the instrument cluster detects that the ignition switch is in the On position. Therefore, the LED will always be off when the ignition switch is in any position except On. The LED only illuminates when it is provided a path to ground by the instrument cluster transistor. The instrument cluster will turn on the water-in-fuel indicator for the following reasons:

- **Bulb Test** - Each time the ignition switch is turned to the On position the water-in-fuel indicator is illuminated for about seven seconds as a bulb test.
- **Water-In-Fuel Lamp-On Message** - Each time the cluster receives a water-in-fuel lamp-on message from the ECM indicating that there is excessive water in the fuel filter with the engine running, the water-in-fuel indicator will be illuminated. The indicator remains illuminated until the cluster receives a water-in-fuel lamp-off message, or until the ignition switch is turned to the Off position, whichever occurs first.

The ECM continually monitors the water-in-fuel sensor to determine whether there is excessive water in the fuel filter. The ECM then sends the proper water-in-fuel lamp-on and lamp-off messages to the instrument cluster. If the water-in-fuel indicator remains illuminated with the engine running, excess water should be drained from the fuel filter. If the indicator remains illuminated with the engine running after the water has been drained from the fuel filter, it may indicate that a malfunction has occurred in the water-in-fuel sensor or circuits. The ECM will store a Diagnostic Trouble Code (DTC) for any malfunction it detects. For proper diagnosis of the water-in-fuel sensor and circuits, the ECM, the CAN data bus, or the electronic message inputs to the instrument cluster that control the water-in-fuel indicator, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

LAMPS

TABLE OF CONTENTS

	page		page
LAMPS/LIGHTING - EXTERIOR	**1**	**LAMPS/LIGHTING - INTERIOR**	**25**

LAMPS/LIGHTING - EXTERIOR

TABLE OF CONTENTS

page

LAMPS/LIGHTING - EXTERIOR
DESCRIPTION . . . 2
OPERATION . . . 3
SPECIFICATIONS - LAMPS/LIGHTING - EXTERIOR . . . 5
BACKUP LAMP BULB
REMOVAL . . . 5
INSTALLATION . . . 6
BRAKE LAMP SWITCH
REMOVAL . . . 6
INSTALLATION . . . 6
BRAKE/PARK LAMP BULB
REMOVAL . . . 7
INSTALLATION . . . 7
CENTER HIGH MOUNTED STOP LAMP BULB
REMOVAL . . . 7
INSTALLATION . . . 7
CENTER HIGH MOUNTED STOP LAMP UN
REMOVAL . . . 8
INSTALLATION . . . 8
CLEARANCE LAMP BULB
REMOVAL . . . 8
INSTALLATION . . . 8
CLEARANCE LAMP UNIT
REMOVAL . . . 8
INSTALLATION . . . 9
DAYTIME RUNNING LAMP RELAY
REMOVAL . . . 9
INSTALLATION . . . 9
FOG LAMP BULB
REMOVAL . . . 10
INSTALLATION . . . 10
FOG LAMP RELAY
REMOVAL . . . 10
INSTALLATION . . . 11
FOG LAMP SWITCH
REMOVAL . . . 11
INSTALLATION . . . 12
FRONT LAMP UNIT
REMOVAL . . . 12
INSTALLATION . . . 12
ADJUSTMENTS
ADJUSTMENT - FRONT LAMP UNIT . . . 12
FRONT POSITION LAMP BULB
REMOVAL . . . 14
INSTALLATION . . . 14
FRONT TURN/PARK/SIDE MARKER LAMP BULB
REMOVAL . . . 14
INSTALLATION . . . 15
HEADLAMP LEVELING MOTOR
REMOVAL . . . 15
INSTALLATION . . . 16
HEADLAMP LEVELING SWITCH
REMOVAL . . . 16
INSTALLATION . . . 17
HIGH BEAM HEADLAMP BULB
REMOVAL . . . 17
INSTALLATION . . . 17
LICENSE PLATE LAMP BULB
REMOVAL . . . 17
INSTALLATION . . . 18
LICENSE PLATE LAMP UNIT
REMOVAL . . . 18
INSTALLATION . . . 18
LOW BEAM HEADLAMP BULB
REMOVAL . . . 18
INSTALLATION . . . 19
MULTI-FUNCTION SWITCH
REMOVAL . . . 19
INSTALLATION . . . 20
PARK BRAKE SWITCH
REMOVAL . . . 20
INSTALLATION . . . 20

REAR SIDE MARKER LAMP BULB
REMOVAL 21
INSTALLATION 21
REAR TURN LAMP BULB
REMOVAL 21
INSTALLATION 22
REPEATER LAMP BULB
REMOVAL 22
INSTALLATION 22
REPEATER LAMP UNIT
REMOVAL 22
INSTALLATION 23
TAIL LAMP UNIT
REMOVAL 23
INSTALLATION 23
TURN SIGNAL RELAY
REMOVAL 24
INSTALLATION 24

LAMPS/LIGHTING - EXTERIOR

DESCRIPTION

The exterior lighting system for this model includes the following exterior lamps:

- **Backup Lamps** - The backup (or reverse) lamps are integral to the tail lamp units mounted to the back of the quarter panel on each side of the tailgate at the rear of the vehicle.
- **Brake Lamps** - The brake (or stop) lamps include a bulb and reflector that are integral to the tail lamp units mounted to the back of the quarter panel on each side of the tailgate opening, and the Center High Mounted Stop Lamp (CHMSL) that is centered on the rear edge of the roof panel above the tailgate opening.
- **Daytime Running Lamps** - Vehicles manufactured for sale in Canada have a Daytime Running Lamps (DRL) relay that illuminates the low beam headlamp bulbs whenever the engine is running.
- **Fog Lamps** - Fog lamp bulbs and reflectors are included in both front lamp units of vehicles equipped with this option.
- **Hazard Warning Lamps** - The hazard warning lamps include all of the right and left turn signal and repeater lamps.
- **Headlamps** - Separate low beam and high beam headlamp bulbs are installed in the front lamp unit on each side of the front grille opening. A headlamp leveling actuator motor is also integral to each front lamp unit.
- **Park Lamps** - The park lamps include the front park/side marker lamps and front position lamps that are integral to the front lamp units mounted on either side of the front grille opening, as well as the rear park lamps and rear side marker lamps that are integral to the tail lamp units mounted to the back of the quarter panel on each side of the tailgate opening. Included in the park lamps circuit are two rear license plate lamp units mounted on the left rear tailgate door. The park lamps may also include optional clearance lamps, which are located on each side of a vehicle that is so equipped.
- **Turn Signal Lamps** - The turn signal lamps include the front turn lamps that are integral to the front lamp units, the rear turn lamps that are integral to the tail lamp units, and a repeater lamp mounted to each front fender just above the front wheel opening.

Other components of the exterior lighting system for this model include:

- **Brake Lamp Switch** - A plunger-type brake lamp switch is located on the steering column support bracket under the instrument panel and actuated by the brake pedal arm.
- **Daytime Running Lamp Relays** - Vehicles manufactured for sale in Canada have two Daytime Running Lamps (DRL) relays. Dedicated right and left side relays illuminate the low beam headlamp bulb installed in each front lamp unit whenever the engine is running. These relays are located in dedicated vehicle wire harness connectors within the driver side front seat riser.
- **Fog Lamp Relay** - Vehicles equipped with the optional fog lamps have a fog lamp relay located in a dedicated vehicle wire harness connector within the driver side front seat riser.
- **Fog Lamp Switch** - A fog lamp switch is mounted in the instrument cluster bezel, below the cluster and outboard of the steering column on vehicles equipped with this option.
- **Headlamp Leveling Motor** - A headlamp leveling actuator motor is located on the back of each headlamp housing and adjusts both the low beam headlamp, high beam headlamp, and fog lamp (if equipped) reflector frames in unison.
- **Headlamp Leveling Switch** - A thumbwheel actuated headlamp leveling switch is mounted in the instrument cluster bezel, below the cluster and outboard of the steering column.
- **Multi-Function Switch** - The multi-function switch is located on the top of the steering column, just below the steering wheel. The multi-function switch is connected directly to the fuse block located below the steering column through an integral interface connector. Only the left (lighting), right (wiper) control stalks and the hazard warning switch button for the multi-function switch are visible, the remainder of the switch is concealed beneath the steering column shrouds. The multi-function switch includes a left (lighting) control stalk and a right (wiper) control stalk. The left control stalk is dedicated to providing almost all of the driver controls for the exterior lighting system.

- **Trailer Tow Connector** - Vehicles equipped with a factory-approved, field-installed trailer towing electrical package have a heavy duty 7-way trailer tow connector installed in a bracket on the trailer hitch receiver. This package includes a 7-way to 4-way connector adapter unit.
- **Trailer Tow Control Module** - Vehicles equipped with a factory-approved, field-installed trailer towing electrical package have a trailer tow brake/turn control module located within the driver side front seat riser that controls the brake lamp and turn signal lamp outputs to the trailer lighting circuits.
- **Turn Signal Relay** - A turn signal relay is installed in the fuse block located on the underside of the steering column behind a fuse access panel in the steering column opening cover on the instrument panel. The electronic circuitry of the wipers, turn signals and engine start control module within the fuse block controls the turn signal relay.
- **Wipers, Turn Signals, Engine Start Control Module** - The wipers, turn signals and engine start control module is integral to the fuse block located on the underside of the steering column behind a fuse access panel in the steering column opening cover on the instrument panel. This module includes active electronic elements that control the operation of the turn signal relay based upon inputs from the multi-function switch and feedback from the turn signal circuits. (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/FUSE BLOCK - DESCRIPTION).

Hard wired circuitry connects the exterior lighting system components to the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the exterior lighting system components through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

OPERATION

Following are paragraphs that briefly describe the operation of each of the major exterior lighting systems. The hard wired circuits and components of the exterior lighting systems may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods may not prove conclusive in the diagnosis of the wipers, turn signals and engine start control module located within the fuse block underneath the steering column, the ElectroMechanical Instrument Cluster (EMIC), the Engine Control Module (ECM), or the Controller Area Network (CAN) data bus network. The most reliable, efficient, and accurate means to diagnose the electronic module within the fuse block, the EMIC, the ECM, and the CAN data bus network inputs and outputs related to the various exterior lighting systems requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

BACKUP LAMPS

The backup (or reverse) lamps have a path to ground received at all times through the vehicle wire harness from a ground point located on the frame near the left end of the tailgate sill. The backup lamps receive battery current on the backup lamp supply circuit only when the backup lamp switch circuit of the Transmission Range Sensor (TRS) integral to the gear shifter assembly is closed by the gear shifter mechanism.

BRAKE LAMPS

The brake (or stop) lamps have a path to ground at all times through the vehicle wire harness from a ground point located on the frame near the left end of the tailgate sill. The Center High Mounted Stop Lamp (CHMSL) has a path to ground at all times through the vehicle wire harness from a ground point on the left side of the dash panel. The brake lamps and CHMSL receive battery current on the brake lamp switch output circuit when the brake lamp switch is closed by the brake pedal arm.

DAYTIME RUNNING LAMPS

Vehicles manufactured for sale in Canada illuminate the low beam headlamp bulb when the engine is running and the exterior lamps are turned off. This feature is enabled by the right and left Daytime Running Lamps (DRL) relays. When the DRL relays are de-energized, they provide fused battery current from the circuit K26 relay to the headlamp low beams. When the headlamps are turned On using the left (lighting) control stalk of the multi-function switch the DRL relays are energized, which returns control of the headlamps to the headlamp switch circuitry of the multi-function switch. The circuit K26 relay is energized by the Electro-Mechanical Instrument Cluster (EMIC) whenever it receives an electronic message from the Engine Control Module (ECM) over the Controller Area Network (CAN) data bus indicating that the engine is running. The DRL and circuit K26 relays are installed in a relay bracket located below the forward edge of the driver side front seat cushion within the driver side front seat riser.

LAMPS/LIGHTING - EXTERIOR (Continued)

FRONT FOG LAMPS

Vehicles equipped with optional front fog lamps have a front fog lamp relay installed in a relay bracket located below the forward edge of the driver side front seat cushion within the driver side front seat riser, a fog lamp switch installed in the cluster bezel on the instrument panel outboard of the steering column, and a fog lamp bulb installed in each of the two front lamp units. The front fog lamps have a path to ground at all times through their connection to the vehicle wire harness. The headlamp switch circuitry of the left (lighting) control stalk of the multi-function switch controls front fog lamp operation by providing battery current to the front fog lamp relay only when the low beam headlamps are selected. The fog lamp switch controls front fog lamp operation by energizing or de-energizing the front fog lamp relay control coil.

HAZARD WARNING LAMPS

With the hazard switch in the On position, the hazard switch button illuminates and the right and left turn signal indicators as well as the right and left turn signal lamps begin to flash on and off. When the hazard warning system is activated, the hazard switch circuitry within the multi-function switch and the wipers, turn signals and engine start control module electronic circuitry within the fuse block will repeatedly energize and de-energize the turn signal relay located in the fuse block. The turn signal relay switches battery current from a fused B(+) fuse in the fuse block to the turn signal indicators and the turn signal lamps. The flashing of the hazard switch button illumination lamp is also controlled by the output from the turn signal relay.

HEADLAMPS

The headlamp system includes the exterior lighting switches integral to the left (lighting) control stalk of the multi-function switch as well as the low and high beam bulbs installed in the right and left front lamp units (Fig. 1). The headlamp bulbs have a path to ground at all times through the vehicle wire harness. The exterior lighting switches control headlamp operation by providing battery current to the selected low or high beam bulbs. Each front lamp unit includes two integral adjustment screws to be used for static horizontal and vertical aiming of the headlamp beam reflectors.

HEADLAMP LEVELING

The headlamp leveling system includes a leveling actuator motor integral to each front lamp unit, and a rotary thumbwheel actuated headlamp leveling switch in the cluster bezel on the instrument panel outboard of the steering column. The headlamp leveling system allows the headlamp beam reflectors to be adjusted to one of four vertical positions to compensate for changes in inclination caused by the loading of the vehicle suspension. The actuator motors are mechanically connected through an integral pushrod to an adjustable headlamp reflector. The headlamp leveling switch is a resistor multiplexed unit that provides one of four voltage outputs to the headlamp leveling motors. The headlamp leveling motors will move the headlamps to the selected position based upon the voltage input received from the switch. The headlamp leveling motors and switch have a path to ground at all times. The headlamp leveling components operate on battery current received through the park lamps circuit so that the system will only operate when the exterior lighting is turned on.

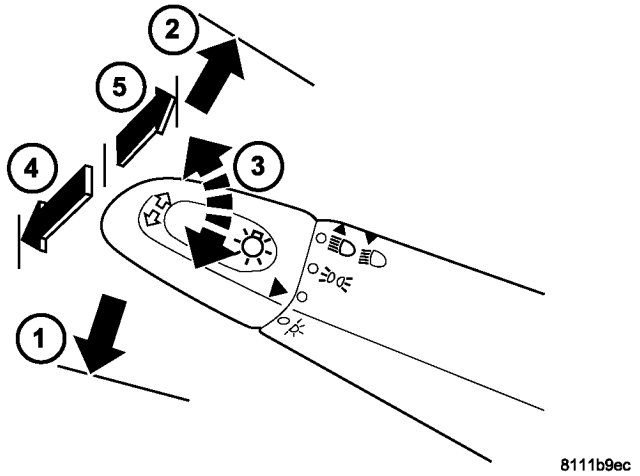


Fig. 1 Lighting Switch

1 - LEFT TURN SIGNAL
2 - RIGHT TURN SIGNAL
3 -EXTERIOR LIGHTING
4 - BEAM SELECT (DIMMER)
5 - OPTICAL HORN

PARK LAMPS

The park lamps system includes the exterior lighting switches integral to the left (lighting) control stalk of the multi-function switch (Fig. 1), the front park/side marker lamps, the front position lamps, the rear park lamps, the rear side marker lamps, the optional clearance lamps, and the license plate lamps. Each of these lamps are provided with a path to ground at all times through the vehicle wire harness. The exterior lighting switches control the park lamp operation by providing battery current through the park lamps circuit to the appropriate lamp bulbs.

TURN SIGNAL LAMPS

When the left (lighting) control stalk of the multi-function switch is activated (Fig. 1), the turn signal

system illuminates the selected right or left turn signal indicator and the turn signal lamps begin to flash. The turn signal lamps include a bulb integral to each front lamp unit and each tail lamp unit, as well as a repeater lamp bulb located on each front fender above the front wheels. When the turn signal system is activated, the turn signal switch circuitry within the multi-function switch and the electronic circuitry of the wipers, turn signals and engine start control module within the fuse block will repeatedly energize and de-energize the turn signal relay located in the fuse block. The turn signal relay switches battery current from a fused ignition switch output fuse in the fuse block to the appropriate turn signal indicator and turn signal lamps.

The ElectroMechanical Instrument Cluster (EMIC) contactless relay will generate repetitive, audible turn signal "click" sounds to emulate the sounds of a conventional electro-mechanical turn signal flasher at one of two rates to coincide with the flashing of the turn signals. The slow rate emulates normal turn signal operation, while the fast rate emulates "bulb out" turn signal operation.

SPECIFICATIONS - LAMPS/LIGHTING - EXTERIOR

BULB SPECIFICATIONS

LAMP	BULB
Backup	P21W - 12V 21W
Brake & Rear Park	P21/5W - 12V 21/5W
Center High Mounted Stop	P21W - 12V 21W
Clearance	W3W - 12V 3W
Front Fog	H1 - 12V 55W
Front Position	W5W - 12V 5W
Front Turn, Park & Side Marker	3457 NA - 12V 28/7.5W Amber Glass
Low Beam Headlamp	H7 - 12V 55W
High Beam Headlamp	H1 - 12V 55W
License Plate	C5W - 12V 5W
Rear Side Marker	R5W - 12V 5W
Rear Turn	P21W - 12V 21W
Side Repeater	W5W - 12V 3W

BACKUP LAMP BULB

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) If the vehicle is so equipped, remove the trim from the inside of the right or left rear corner pillar.

(3) From inside the vehicle, use hand pressure to push the two latch tabs toward the center of the tail lamp unit socket plate and pull the socket plate straight out from the inner rear pillar (Fig. 2).

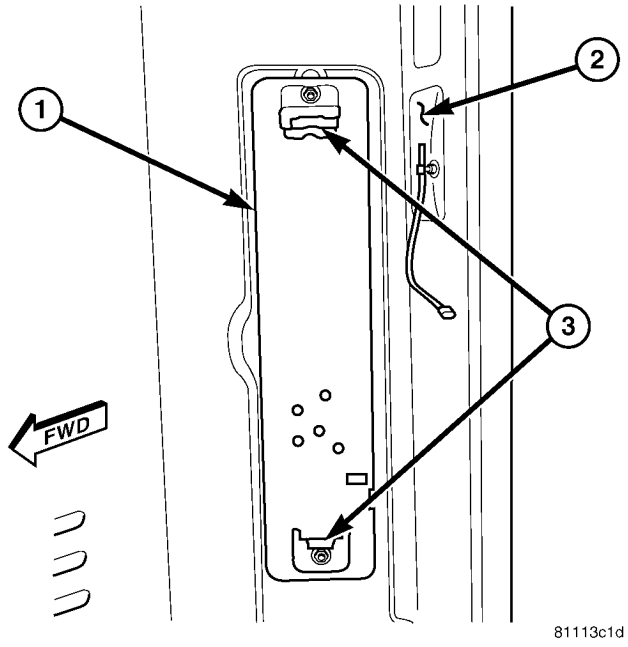


Fig. 2 Tail Lamp Socket Plate Remove/Install

1 - SOCKET PLATE
2 - INNER REAR PILLAR
3 - LATCH TAB (2)

(4) Pull the socket plate away from the inner rear pillar far enough to access the backup lamp bulb (Fig. 3).

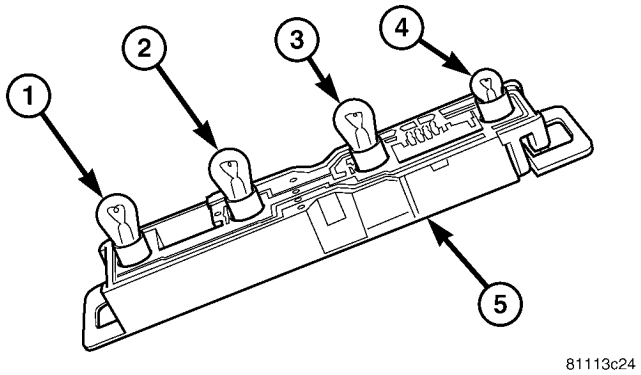


Fig. 3 Tail Lamp Bulb Remove/Install

1 - BRAKE/PARK LAMP BULB
2 - BACKUP LAMP BULB
3 - TURN SIGNAL LAMP BULB
4 - SIDE MARKER LAMP BULB
5 - TAIL LAMP SOCKET PLATE

(5) Remove the backup lamp bulb from the tail lamp socket plate.

BACKUP LAMP BULB (Continued)

INSTALLATION

(1) Install the backup lamp bulb into the tail lamp socket plate (Fig. 3).

(2) Align the socket plate with the mounting hole in the inner rear pillar.

(3) Using hand pressure, push the socket plate gently and evenly into the inner rear pillar mounting hole until both latch tabs are fully engaged (Fig. 2).

(4) If the vehicle is so equipped, reinstall the trim onto the inside of the right or left rear corner pillar.

(5) Reconnect the battery negative cable.

BRAKE LAMP SWITCH

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Locate the brake lamp switch on the pedal bracket underneath the instrument panel (Fig. 4).

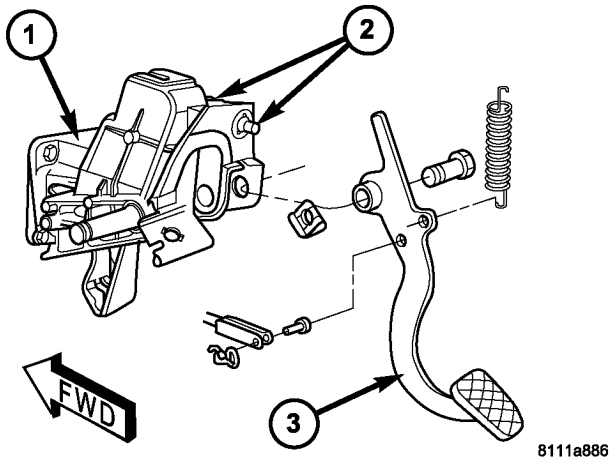


Fig. 4 Brake Lamp Switch Location

1 - PEDAL BRACKET
2 - BRAKE LAMP SWITCH
3 - BRAKE PEDAL

(3) Depress the locking tab on the brake lamp switch body behind the pedal bracket and rotate the switch counterclockwise about 30 degrees (Fig. 5).

(4) Pull the switch forward in the vehicle far enough to disengage the switch plunger from the mounting hole in the pedal bracket.

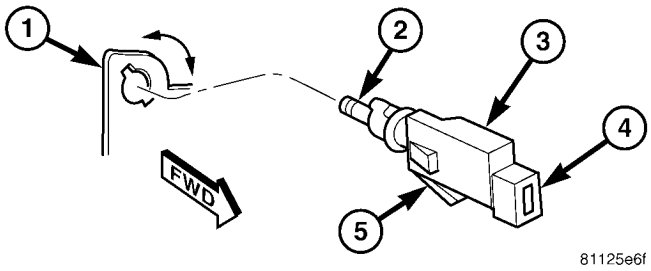


Fig. 5 Brake Lamp Switch Remove/Install

1 - PEDAL BRACKET
2 - PLUNGER
3 - BRAKE LAMP SWITCH
4 - CONNECTOR RECEPTACLE
5 - LOCKING TAB

(5) Disconnect the vehicle wire harness from the brake lamp switch connector receptacle.

(6) Remove the brake lamp switch from the vehicle.

INSTALLATION

(1) Pull the plunger of the brake lamp switch outward from the switch body to its travel limit (Fig. 5).

(2) Reconnect the vehicle wire harness to the brake lamp switch connector receptacle.

(3) Depress and hold the brake pedal in the depressed position until the brake lamp switch installation is completed (Fig. 4).

(4) Insert the brake lamp switch plunger through the mounting hole from behind until the switch locking collar is fully seated against the pedal bracket.

(5) Rotate the brake lamp switch clockwise until the locking tab on the switch body fully engages the pedal bracket. Full locking tab engagement will be accompanied by an audible click.

(6) Release the brake pedal from its depressed position to automatically adjust the brake lamp switch plunger.

(7) Reconnect the battery negative cable.

BRAKE/PARK LAMP BULB

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) If the vehicle is so equipped, remove the trim from the inside of the right or left rear corner pillar.

(3) From inside the vehicle, use hand pressure to push the two latch tabs toward the center of the tail lamp unit socket plate and pull the socket plate straight out from the inner rear pillar (Fig. 6).

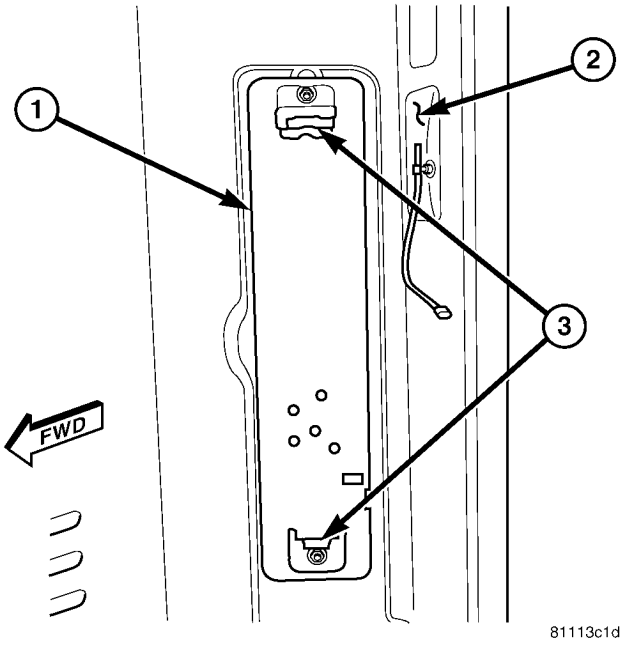


Fig. 6 Tail Lamp Socket Plate Remove/Install

1 - SOCKET PLATE
2 - INNER REAR PILLAR
3 - LATCH TAB (2)

(4) Pull the socket plate away from the inner rear pillar far enough to access the brake/park lamp bulb (Fig. 7).

(5) Remove the brake/park lamp bulb from the tail lamp socket plate.

INSTALLATION

(1) Install the brake/park lamp bulb into the tail lamp socket plate (Fig. 7).

(2) Align the socket plate with the mounting hole in the inner rear pillar.

(3) Using hand pressure, push the socket plate gently and evenly into the inner rear pillar mounting hole until both latch tabs are fully engaged (Fig. 6).

(4) If the vehicle is so equipped, reinstall the trim onto the inside of the right or left rear corner pillar.

(5) Reconnect the battery negative cable.

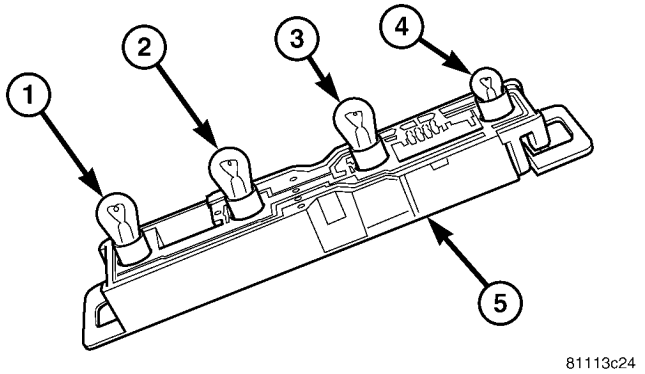


Fig. 7 Tail Lamp Bulb Remove/Install

1 - BRAKE/PARK LAMP BULB
2 - BACKUP LAMP BULB
3 - TURN SIGNAL LAMP BULB
4 - SIDE MARKER LAMP BULB
5 - TAIL LAMP SOCKET PLATE

CENTER HIGH MOUNTED STOP LAMP BULB

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the two screws that secure the CHMSL lamp to the vehicle, then remove the lens from the lamp housing (Fig. 8).

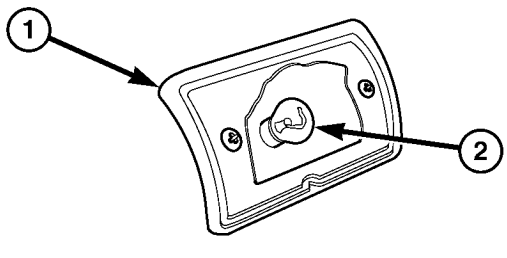


Fig. 8 CHMSL Bulb Remove/Install

1 - LAMP HOUSING
2 - BULB

(3) Push straight in on the CHMSL bulb and rotate it counterclockwise about 30 degrees to remove it from the lamp socket.

INSTALLATION

(1) Install the CHMSL bulb into the lamp socket (Fig. 8).

(2) Position the lens onto the CHMSL lamp housing

(3) Install and tighten the two screws that secure the CHMSL lamp to the vehicle.

(4) Reconnect the battery negative cable.

CENTER HIGH MOUNTED STOP LAMP UN

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the two screws that secure the CHMSL unit to the vehicle (Fig. 9).

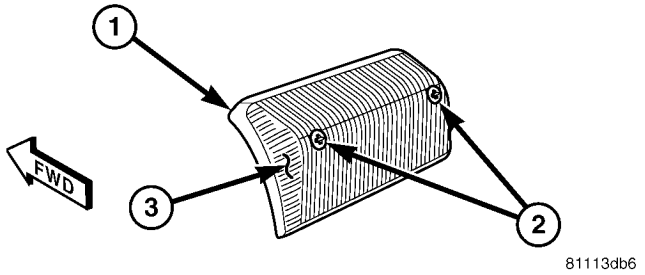


Fig. 9 Center High Mounted Stop Lamp Remove/ Install

1 - LAMP
2 - SCREW (2)
3 - LENS

(3) Pull the CHMSL unit away from the vehicle far enough to access and disconnect the vehicle wire harness from the lamp pigtail wire connector.

(4) Remove the CHMSL unit from the vehicle.

INSTALLATION

(1) Position the CHMSL unit close enough to the vehicle to reconnect the lamp pigtail wire connector to the vehicle wire harness.

(2) Position the CHMSL unit to the vehicle.

(3) Install and tighten the two screws that secure the CHMSL unit to the vehicle (Fig. 9).

(4) Reconnect the battery negative cable.

CLEARANCE LAMP BULB

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the clearance lamp unit from the vehicle, but do not disconnect it from the vehicle wire harness. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/CLEARANCE LAMP - REMOVAL).

(3) Pull the clearance lamp away from the vehicle far enough to access the bulb holder on the back of the lamp housing (Fig. 10).

(4) Rotate the bulb holder counterclockwise about 30 degrees and pull it straight out from the lamp housing.

(5) Remove the bulb from the clearance lamp bulb holder.

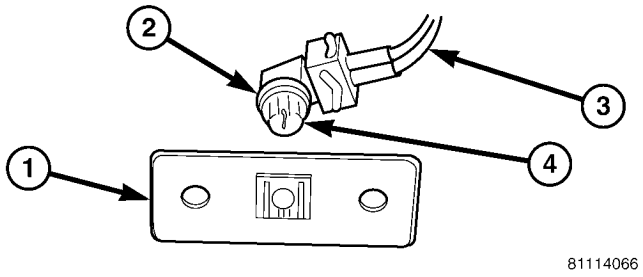


Fig. 10 Clearance Lamp Bulb Remove/Install

1 - LAMP HOUSING
2 - BULB HOLDER
3 - WIRE HARNESS
4 - BULB

INSTALLATION

(1) Install the bulb into the clearance lamp bulb holder (Fig. 10).

(2) Insert the bulb holder into the back of the clearance lamp housing and rotate it clockwise about 30 degrees to lock it into place.

(3) Reinstall the clearance lamp onto the vehicle. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/CLEARANCE LAMP - INSTALLATION).

(4) Reconnect the battery negative cable.

CLEARANCE LAMP UNIT

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the two screws that secure the clearance lamp unit to the vehicle (Fig. 11).

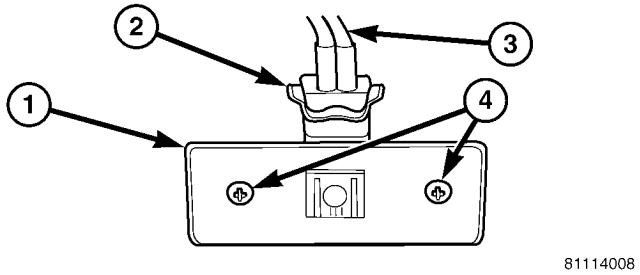


Fig. 11 Clearance Lamp Unit Remove/Install

1 - LAMP
2 - BULB HOLDER
3 - WIRE HARNESS
4 - SCREW (2)

(3) Pull the clearance lamp unit away from the vehicle far enough to access and disconnect the vehicle wire harness from the bulb holder connector receptacle.

(4) Remove the clearance lamp unit from the vehicle.

CLEARANCE LAMP UNIT (Continued)

INSTALLATION

(1) Position the clearance lamp unit close enough to the vehicle to reconnect the vehicle wire harness to the bulb holder connector receptacle (Fig. 11).

(2) Position the clearance lamp unit to the vehicle.

(3) Install and tighten the two screws that secure the clearance lamp unit to the vehicle.

(4) Reconnect the battery negative cable.

DAYTIME RUNNING LAMP RELAY

REMOVAL

Daytime Running Lamps (DRL) are only used in vehicles manufactured for the Canadian market, where this is required equipment. On vehicles equipped with DRL, a right and a left DRL relay are each located in a dedicated connector of the vehicle wire harness. Each connector is snapped into an opening in a stamped sheet metal bracket which is secured with screws within the driver side front seat riser just beneath the seat riser cover panel.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. 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) Move the driver side front seat to its most forward position for easiest access to the seat riser cover panel (Fig. 12).

(3) Remove the cover panel from the top of the driver side seat riser.

(4) Remove the DRL relay by grasping it firmly and pulling it straight out of the relay connector.

INSTALLATION

Daytime Running Lamps (DRL) are only used in vehicles manufactured for the Canadian market, where this is required equipment. On vehicles equipped with DRL, a right and a left DRL relay are each located in a dedicated connector of the vehicle wire harness. Each connector is snapped into an opening in a stamped sheet metal bracket which is secured with screws within the driver side front seat riser just beneath the seat riser cover panel.

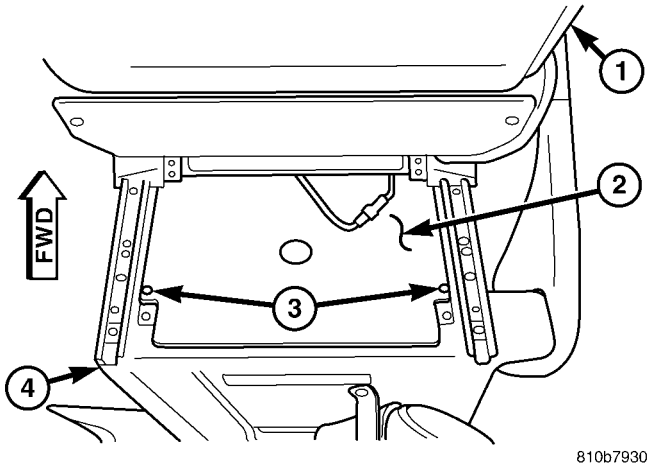


Fig. 12 Seat Riser Cover

1 - DRIVER SEAT BACK
2 - COVER PANEL
3 - SCREW (2)
4 - SEAT RISER

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Position the DRL relay to the relay connector.

(2) Align the DRL relay terminals with the terminal cavities in the relay connector.

(3) Using hand pressure, push firmly and evenly on the top of the DRL relay until the terminals are fully seated in the relay connector.

(4) Position the cover panel onto the top of the driver side seat riser (Fig. 12).

(5) Install and tighten the two screws that secure the cover panel to the top of the seat riser under the driver side front seat.

(6) Move the driver side front seat back to its driving position.

(7) Reconnect the battery negative cable.

FOG LAMP BULB

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Disengage and swing the retainers that secure the front lamp unit rear cover to each side of the lamp housing and remove the cover (Fig. 13).

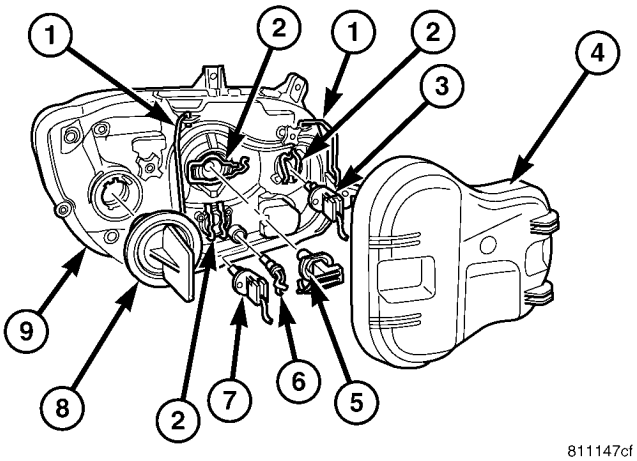


Fig. 13 Front Lamp Unit Bulbs Remove/Install

1 - COVER RETAINER (2)
2 - BULB RETAINER (3)
3 - FOG LAMP BULB (OPTIONAL)
4 - COVER
5 - LOW BEAM BULB
6 - POSITION BULB
7 - HIGH BEAM BULB
8 - TURN/PARK/SIDE MARKER BULB
9 - FRONT LAMP UNIT

(3) Disconnect the front lamp unit wire harness connector from the fog lamp bulb base (Fig. 14).

(4) Disengage the two fog lamp bulb retainers by pushing them slightly toward the front lamp unit housing, outward to each side of the bulb base, then pivot the retainers off of the bulb base.

(5) Remove the fog lamp bulb from the integral bulb holder on the front lamp unit reflector.

INSTALLATION

(1) Position the fog lamp bulb into the integral bulb holder on the front lamp unit reflector. Be certain that the lugs on the bulb base are engaged in the recesses of the bulb holder (Fig. 14).

(2) Engage the two fog lamp bulb retainers by pivoting them over the bulb base, pressing them slightly toward the front lamp unit housing, then inward on each side of the bulb base.

(3) Reconnect the front lamp unit wire harness connector to the fog lamp bulb base.

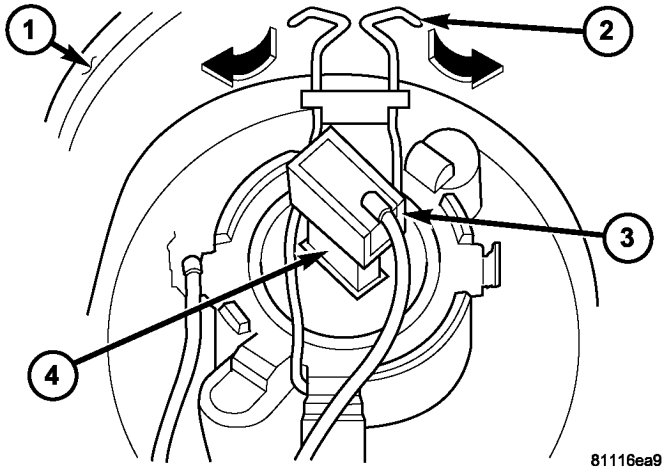


Fig. 14 Fog Lamp Bulb Remove/Install

1 - LAMP HOUSING
2 - BULB RETAINER
3 - CONNECTOR
4 - BULB BASE

(4) Position the front lamp unit rear cover onto the lamp housing and engage the retainers over each side of the cover to secure it (Fig. 13).

(5) Reconnect the battery negative cable.

FOG LAMP RELAY

REMOVAL

Fog lamps are optional equipment on this model. On vehicles equipped with fog lamps, a fog lamp relay is located in a dedicated connector of the vehicle wire harness. This connector is snapped into an opening in a stamped sheet metal bracket which is secured with screws within the driver side front seat riser just beneath the seat riser cover panel.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

FOG LAMP RELAY (Continued)

(1) Disconnect and isolate the battery negative cable.

(2) Move the driver side front seat to its most forward position for easiest access to the seat riser cover panel (Fig. 15).

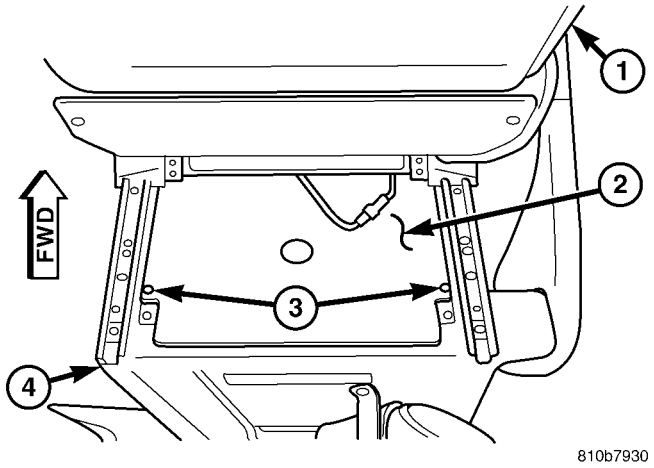


Fig. 15 Seat Riser Cover

1 - DRIVER SEAT BACK
2 - COVER PANEL
3 - SCREW (2)
4 - SEAT RISER

(3) Remove the cover panel from the top of the driver side seat riser.

(4) Remove the fog lamp relay by grasping it firmly and pulling it straight out of the relay connector.

INSTALLATION

Fog lamps are optional equipment on this model. On vehicles equipped with fog lamps, a fog lamp relay is located in a dedicated connector of the vehicle wire harness. This connector is snapped into an opening in a stamped sheet metal bracket which is secured with screws within the driver side front seat riser just beneath the seat riser cover panel.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Position the fog lamp relay to the relay connector.

(2) Align the fog lamp relay terminals with the terminal cavities in the relay connector.

(3) Using hand pressure, push firmly and evenly on the top of the fog lamp relay until the terminals are fully seated in the relay connector.

(4) Position the cover panel onto the top of the driver side seat riser (Fig. 15).

(5) Install and tighten the two screws that secure the cover panel to the top of the seat riser under the driver side front seat.

(6) Move the driver side front seat back to its driving position.

(7) Reconnect the battery negative cable.

FOG LAMP SWITCH

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the cluster bezel from the instrument panel (Fig. 16). (Refer to 23 - BODY/INSTRUMENT PANEL/CLUSTER BEZEL - REMOVAL).

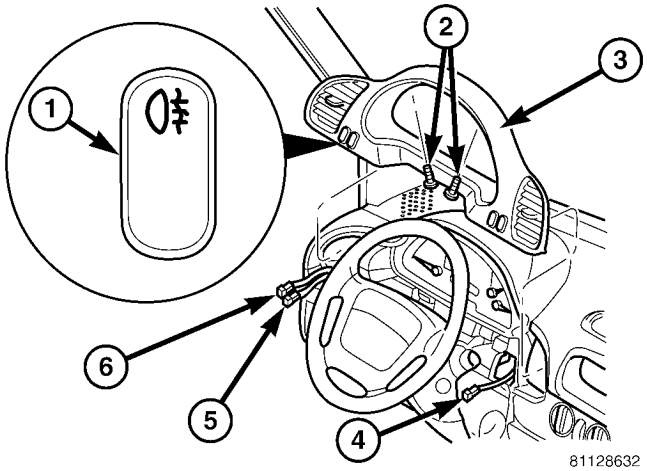


Fig. 16 Fog Lamp Switch

1 - FOG LAMP SWITCH
2 - SCREW (2)
3 - CLUSTER BEZEL
4 - TO REAR WINDOW DEFOGGER SWITCH (OPTION AL)
5 - TO HEADLAMP LEVELING SWITCH
6 - TO FOG LAMP SWITCH (OPTIONAL)

FOG LAMP SWITCH (Continued)

(3) From the back of the cluster bezel, squeeze the two latches on the fog lamp switch body and push the switch out through the face of the bezel (Fig. 17).

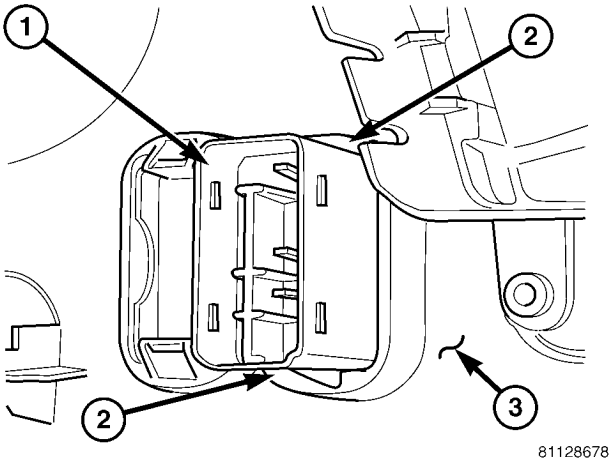


Fig. 17 Fog Lamp Switch Remove/Install

1 - FOG LAMP SWITCH
2 - LATCH (2)
3 - CLUSTER BEZEL

(4) Remove the fog lamp switch from the face of the cluster bezel.

INSTALLATION

(1) Position the fog lamp switch to the proper mounting hole on the face of the cluster bezel (Fig. 16).

(2) Using hand pressure, push the fog lamp switch firmly and evenly into the switch mounting hole of the cluster bezel until both of the latches on the switch body are fully engaged.

(3) Reinstall the cluster bezel onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/CLUSTER BEZEL - INSTALLATION).

(4) Reconnect the battery negative cable.

FRONT LAMP UNIT

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the front grille from the vehicle. (Refer to 23 - BODY/EXTERIOR/GRILLE - REMOVAL).

(3) Remove the two screws that secure the cover at the inboard side of the front lamp unit (Fig. 18).

(4) Remove the cover from the front lamp unit.

(5) From the engine compartment, disconnect the vehicle wire harness connector from the connector receptacle for the front lamp unit.

(6) Remove the four screws that secure the front lamp unit to the front of the vehicle.

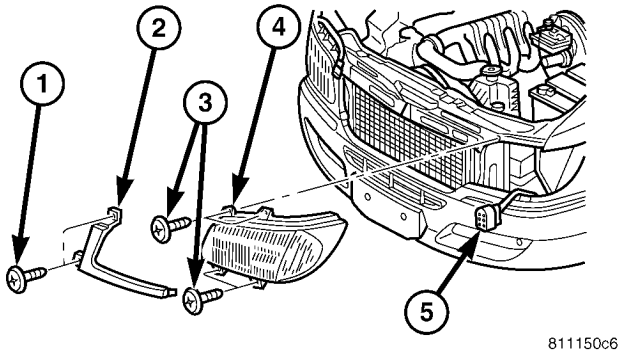


Fig. 18 Front Lamp Unit Remove/Install

1 - SCREW (2)
2 - COVER
3 - SCREW (4)
4 - LAMP UNIT
5 - WIRE HARNESS CONNECTOR

(7) Remove the front lamp unit from the front of the vehicle.

INSTALLATION

(1) Position the front lamp unit to the front of the vehicle (Fig. 18).

(2) Install and tighten the four screws that secure the front lamp unit to the front of the vehicle.

(3) From the engine compartment, reconnect the vehicle wire harness connector to the connector receptacle for the front lamp unit.

(4) Position the cover to the front lamp unit.

(5) Install and tighten the two screws that secure the cover at the inboard side of the front lamp unit.

(6) Reinstall the front grille onto the vehicle. (Refer to 23 - BODY/EXTERIOR/GRILLE - INSTALLATION).

(7) Reconnect the battery negative cable.

(8) Check and adjust the front lamp alignment as required. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/FRONT LAMP UNIT - ADJUSTMENTS).

ADJUSTMENTS

ADJUSTMENT - FRONT LAMP UNIT

VEHICLE PREPARATION FOR FRONT LAMP UNIT ALIGNMENT

(1) Verify headlamp dimmer (multi-function) switch, fog lamp switch (if equipped), and high beam indicator operation.

(2) Verify that the headlamp leveling switch is in the “0” position.

FRONT LAMP UNIT (Continued)

(3) Repair or replace any faulty or damaged components that could interfere with proper lamp alignment.
(4) Verify proper tire inflation.
(5) Clean front lamp unit lenses.
(6) Verify that the cargo compartment is not heavily loaded. Vehicle should be at or near curb weight.
(7) The fuel tank should be "Full." Add 2.94 kilograms (6.5 pounds) of weight over the fuel tank for each estimated gallon of missing fuel.
(8) Load the driver's seat with 75 kilograms (165 pounds) of weight.

FRONT LAMP UNIT ALIGNMENT

(1) Position the vehicle on a level surface.
(2) Turn On the headlamp low beams or the fog lamps (if equipped).
(3) Open the hood.
(4) Set up the headlamp adjuster according to the instructions provided by the manufacturer of the unit.
(5) Adjust the front lamp unit reflector as required by turning the adjustment screws in or out (Fig. 19).

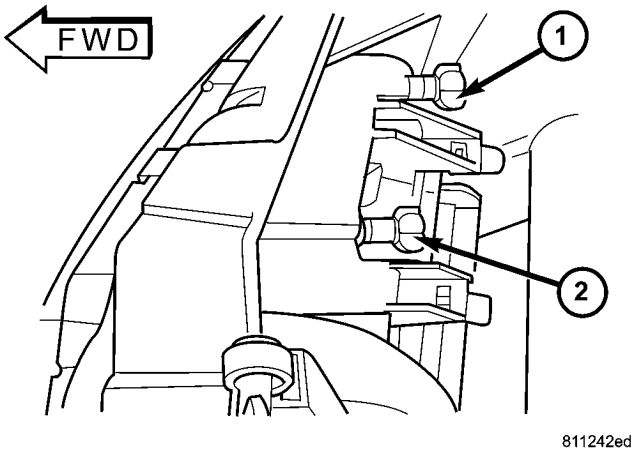


Fig. 19 Front Lamp Unit Adjusting Screws

1 - HORIZONTAL ADJUSTMENT
2 - VERTICAL ADJUSTMENT

(6) When properly aligned, the low beam headlamps and, if equipped, fog lamps should provide a cut-off pattern as shown in (Fig. 20) and (Fig. 21). Repeat the adjustment procedure as necessary to obtain the recommended cut-off patterns.

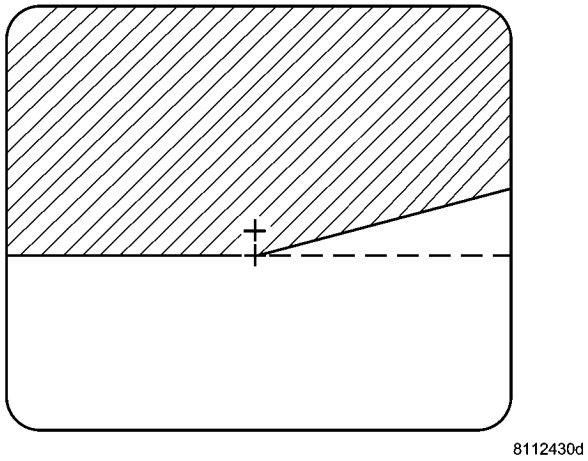


Fig. 20 Low Beam Headlamp Cut-Off Pattern

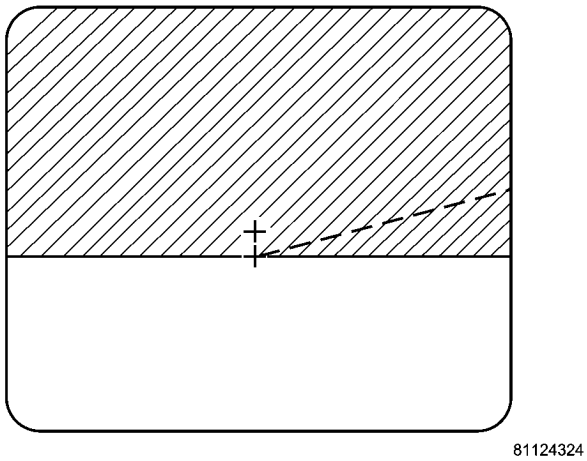


Fig. 21 Fog Lamp Cut-Off Pattern

FRONT POSITION LAMP BULB

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Disengage and swing the retainers that secure the front lamp unit rear cover to each side of the lamp housing and remove the cover (Fig. 22).

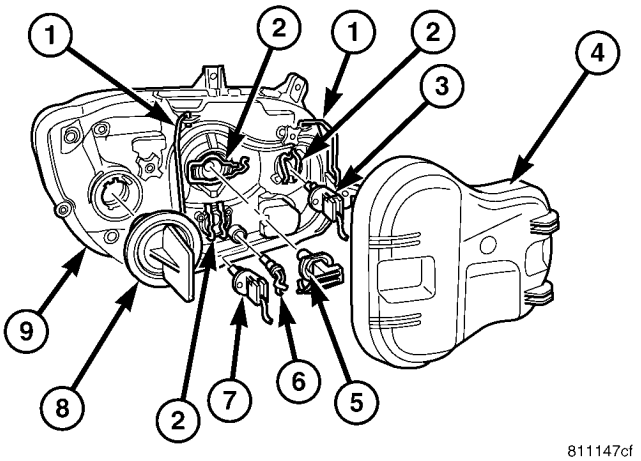


Fig. 22 Front Lamp Unit Bulbs Remove/Install

1 - COVER RETAINER (2)
2 - BULB RETAINER (3)
3 - FOG LAMP BULB (OPTIONAL)
4 - COVER
5 - LOW BEAM BULB
6 - POSITION BULB
7 - HIGH BEAM BULB
8 - TURN/PARK/SIDE MARKER BULB
9 - FRONT LAMP UNIT

(3) Pull the position lamp bulb holder straight out to remove it from the front lamp unit reflector (Fig. 23).

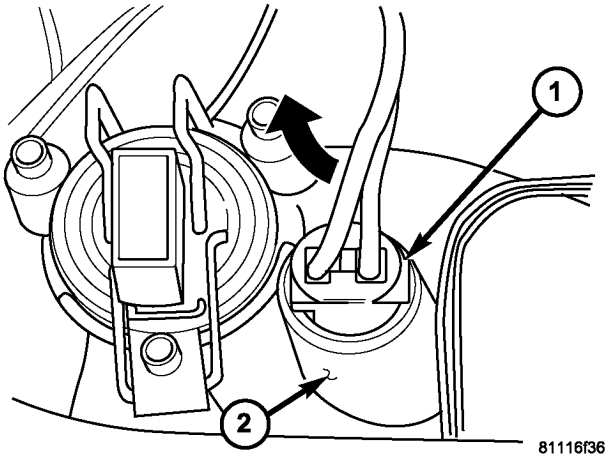


Fig. 23 Position Lamp Bulb Remove/Install

1 - BULB HOLDER
2 - LAMP REFLECTOR

(4) Remove the position lamp bulb from the bulb holder.

INSTALLATION

(1) Install the position lamp bulb into the bulb holder (Fig. 23).

(2) Push the position lamp bulb holder straight into the mounting hole in the front lamp unit reflector.

(3) Position the front lamp unit rear cover onto the lamp housing and engage the retainers over each side of the cover to secure it (Fig. 22).

(4) Reconnect the battery negative cable.

FRONT TURN/PARK/SIDE MARKER LAMP BULB

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Locate the turn/park/side marker bulb holder on the rear outboard side of the front lamp unit housing (Fig. 24).

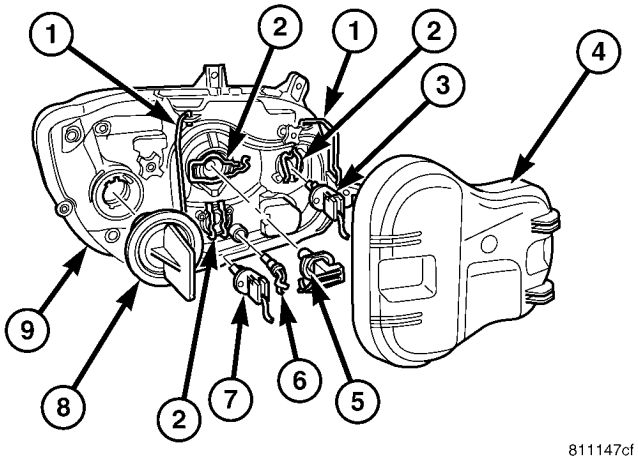


Fig. 24 Front Lamp Unit Bulbs Remove/Install

1 - COVER RETAINER (2)
2 - BULB RETAINER (3)
3 - FOG LAMP BULB (OPTIONAL)
4 - COVER
5 - LOW BEAM BULB
6 - POSITION BULB
7 - HIGH BEAM BULB
8 - TURN/PARK/SIDE MARKER BULB
9 - FRONT LAMP UNIT

FRONT TURN/PARK/SIDE MARKER LAMP BULB (Continued)

(3) Rotate the bulb holder counterclockwise about 30 degrees and pull it straight out from the lamp housing (Fig. 25).

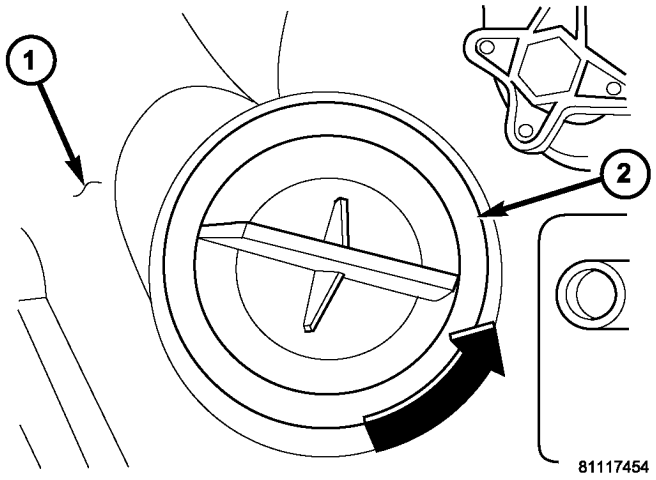


Fig. 25 Front Turn/Park/Side Marker Bulb Remove/Install

1 - LAMP HOUSING
2 - BULB HOLDER

(4) Remove the bulb from the front turn/park/side marker bulb holder.

INSTALLATION

(1) Install the bulb into the front turn/park/side marker bulb holder.

(2) Insert the bulb holder straight into the front lamp unit housing and rotate the bulb holder clockwise about 30 degrees to lock it into place (Fig. 25).

(3) Reconnect the battery negative cable.

HEADLAMP LEVELING MOTOR

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Disengage and swing the retainers that secure the front lamp unit rear cover to each side of the lamp housing and remove the cover (Fig. 26).

(3) Disconnect the front lamp unit wire harness connector from the connector receptacle for the headlamp leveling motor (Fig. 27).

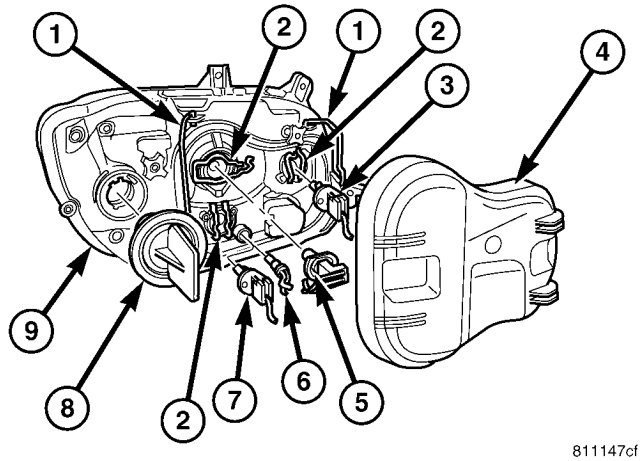


Fig. 26 Front Lamp Unit Bulbs Remove/Install

1 - COVER RETAINER (2)
2 - BULB RETAINER (3)
3 - FOG LAMP BULB (OPTIONAL)
4 - COVER
5 - LOW BEAM BULB
6 - POSITION BULB
7 - HIGH BEAM BULB
8 - TURN/PARK/SIDE MARKER BULB
9 - FRONT LAMP UNIT

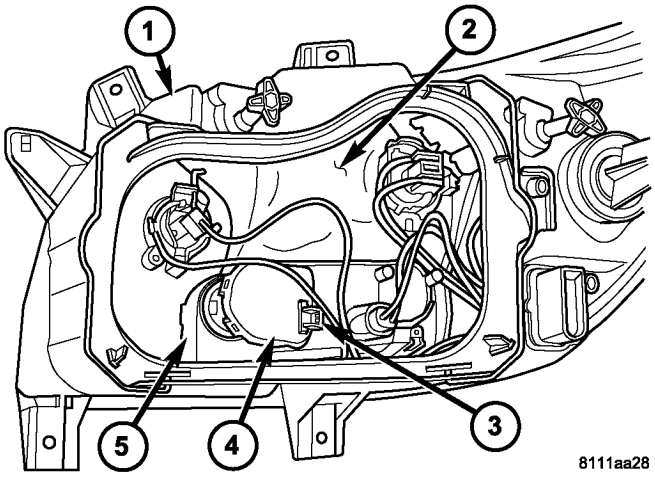


Fig. 27 Headlamp Leveling Motor

1 - HOUSING
2 - REFLECTOR
3 - CONNECTOR
4 - MOTOR
5 - MOUNT

HEADLAMP LEVELING MOTOR (Continued)

(4) Rotate the headlamp leveling motor counterclockwise about 30 degrees and pull it straight out from the mount integral to the front lamp unit housing (Fig. 28).

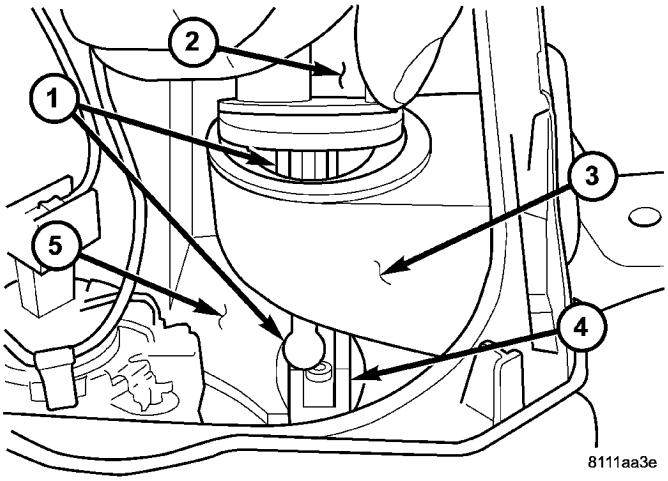


Fig. 28 Headlamp Leveling Motor Remove/Install

1 - PUSHROD
2 - MOTOR
3 - MOUNT
4 - BRACKET
5 - REFLECTOR

(5) Stabilize the front lamp unit reflector with one hand, then use the other hand to pull the headlamp leveling motor away from the reflector until the ball on the end of the motor pushrod unsnaps from the bracket on the reflector.

(6) Remove the headlamp leveling motor from the mount on the front lamp unit housing.

INSTALLATION

(1) Position the headlamp leveling motor to the mount on the front lamp unit housing (Fig. 28).

(2) Snap the ball on the end of the headlamp leveling motor into the bracket on the front lamp unit reflector.

(3) Push the headlamp leveling motor into the mount integral to the front lamp unit housing until it is fully seated, then rotate the motor clockwise about 30 degrees to lock it into place (Fig. 27).

(4) Reconnect the front lamp unit wire harness connector to the connector receptacle for the headlamp leveling motor.

(5) Position the front lamp unit rear cover onto the lamp housing and engage the retainers over each side of the cover to secure it (Fig. 26).

(6) Reconnect the battery negative cable.

HEADLAMP LEVELING SWITCH

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the cluster bezel from the instrument panel (Fig. 29). (Refer to 23 - BODY/INSTRUMENT PANEL/CLUSTER BEZEL - REMOVAL).

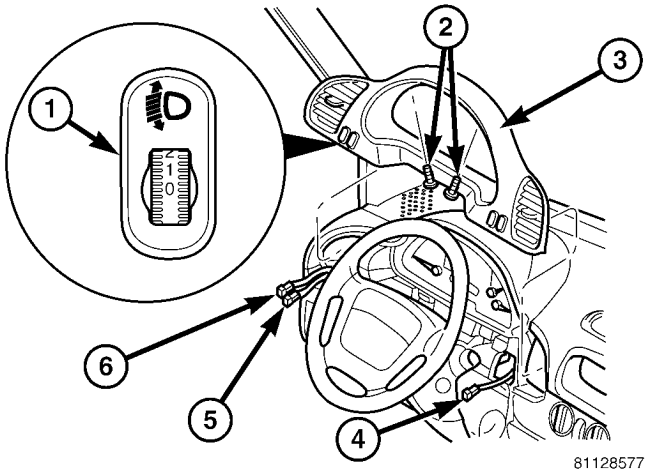


Fig. 29 Headlamp Leveling Switch

1 - HEADLAMP LEVELING SWITCH
2 - SCREW (2)
3 - CLUSTER BEZEL
4 - TO REAR WINDOW DEFOGGER SWITCH (OPTIONAL)
5 - TO HEADLAMP LEVELING SWITCH
6 - TO FOG LAMP SWITCH (OPTIONAL)

(3) From the back of the cluster bezel, squeeze the two latches on the headlamp leveling switch body and push the switch out through the face of the bezel (Fig. 30).

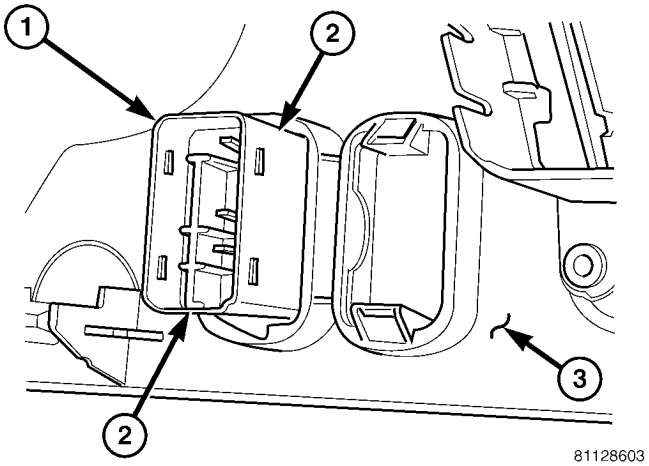


Fig. 30 Headlamp Leveling Switch Remove/Install

1 - FOG LAMP SWITCH
2 - LATCH (2)
3 - CLUSTER BEZEL

(4) Remove the headlamp leveling switch from the face of the cluster bezel.

HEADLAMP LEVELING SWITCH (Continued)

INSTALLATION

(1) Position the headlamp leveling switch to the proper mounting hole on the face of the cluster bezel (Fig. 29).

(2) Using hand pressure, push the headlamp leveling switch firmly and evenly into the switch mounting hole of the cluster bezel until both of the latches on the switch body are fully engaged.

(3) Reinstall the cluster bezel onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/CLUSTER BEZEL - INSTALLATION).

(4) Reconnect the battery negative cable.

HIGH BEAM HEADLAMP BULB

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Disengage and swing the retainers that secure the front lamp unit rear cover to each side of the lamp housing and remove the cover (Fig. 31).

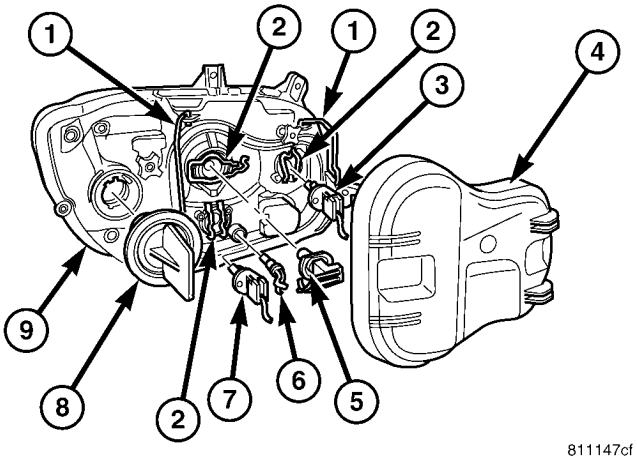


Fig. 31 Front Lamp Unit Bulbs Remove/Install

1 - COVER RETAINER (2)
2 - BULB RETAINER (3)
3 - FOG LAMP BULB (OPTIONAL)
4 - COVER
5 - LOW BEAM BULB
6 - POSITION BULB
7 - HIGH BEAM BULB
8 - TURN/PARK/SIDE MARKER BULB
9 - FRONT LAMP UNIT

(3) Disconnect the front lamp unit wire harness connector from the high beam headlamp bulb base (Fig. 32).

(4) Disengage the high beam headlamp bulb retainer by pushing it slightly toward the front lamp unit housing and outward from the bulb base, then pivot the retainer off of the bulb base.

(5) Remove the high beam headlamp bulb from the integral bulb holder on the front lamp unit reflector.

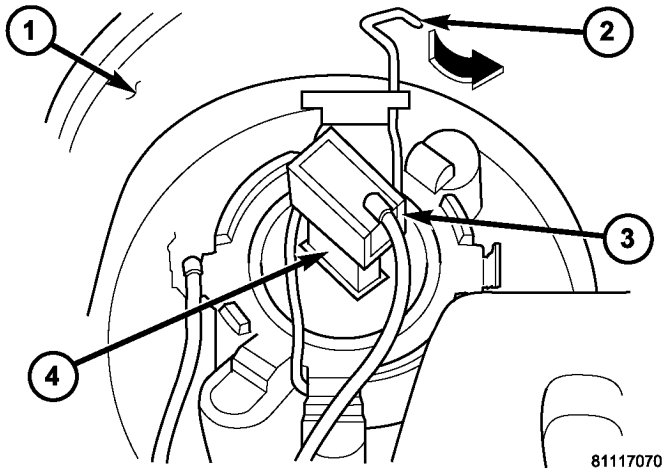


Fig. 32 High Beam Headlamp Bulb Remove/Install

1 - LAMP HOUSING
2 - BULB RETAINER
3 - CONNECTOR
4 - BULB BASE

INSTALLATION

(1) Position the high beam headlamp bulb into the integral bulb holder on the front lamp unit reflector. Be certain that the lugs on the bulb base are engaged in the recesses of the bulb holder (Fig. 31).

(2) Engage the high beam headlamp bulb retainer by pivoting it over the bulb base, pressing it slightly outward from the bulb base and toward the front lamp unit housing, then inward toward the side of the bulb base.

(3) Reconnect the front lamp unit wire harness connector to the high beam headlamp bulb base.

(4) Position the front lamp unit rear cover onto the lamp housing and engage the retainers over each side of the cover to secure it (Fig. 13).

(5) Reconnect the battery negative cable.

LICENSE PLATE LAMP BULB

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the license plate lamp unit from its mounting location, but do not disconnect it from the vehicle wire harness. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/LICENSE PLATE LAMP UNIT - REMOVAL).

(3) Grasp the lamp housing firmly in one hand, then disengage the bulb from between the bulb holders with the other hand (Fig. 33).

LICENSE PLATE LAMP BULB (Continued)

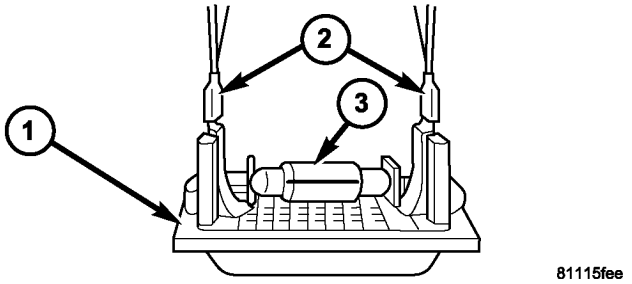


Fig. 33 License Plate Lamp Bulb Remove/Install

1 - LAMP HOUSING
2 - WIRE HARNESS CONNECTOR (1 or 2)
3 - BULB

INSTALLATION

(1) Grasp the license plate lamp housing firmly in one hand, then engage the bulb between the bulb holders with the other hand (Fig. 33).

(2) Reinstall the license plate lamp unit to its mounting location. (Refer to 8 - ELECTRICAL/ LAMPS/LIGHTING - EXTERIOR/LICENSE PLATE LAMP UNIT - INSTALLATION).

(3) Reconnect the battery negative cable.

LICENSE PLATE LAMP UNIT

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Using hand pressure, press the right side of the license plate lamp housing toward the left against the spring pressure of the retaining clip, then pull the right side of the lamp downward to disengage it from the mounting hole (Fig. 34).

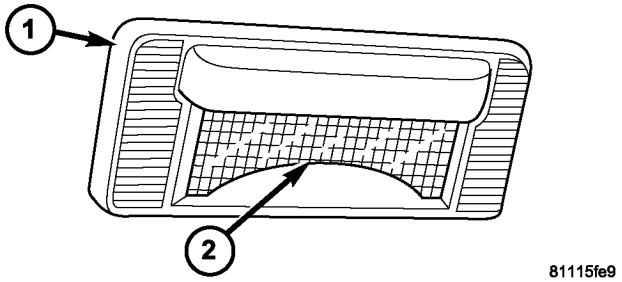


Fig. 34 License Plate Lamp Unit Remove/Install

1 - LAMP HOUSING
2 - LENS

(3) Pull the license plate lamp housing slightly to the right to disengage the left side of the unit from the mounting hole.

(4) Disconnect the one or two vehicle wire harness connections from the terminals on the back of the license plate lamp unit.

(5) Remove the license plate lamp unit from the vehicle.

INSTALLATION

(1) Position the license plate lamp unit to the mounting hole on the vehicle (Fig. 34).

(2) Reconnect the one or two vehicle wire harness connections to the terminals on the back of the license plate lamp unit.

(3) Engage the left side of the license plate lamp unit into the left side of the mounting hole.

(4) Using hand pressure, press the right side of the license plate lamp housing toward the left against the spring pressure of the retaining clip, then push the right side of the lamp upward to engage it into the right side of the mounting hole.

(5) Reconnect the battery negative cable.

LOW BEAM HEADLAMP BULB

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Disengage and swing the retainers that secure the front lamp unit rear cover to each side of the lamp housing and remove the cover (Fig. 35).

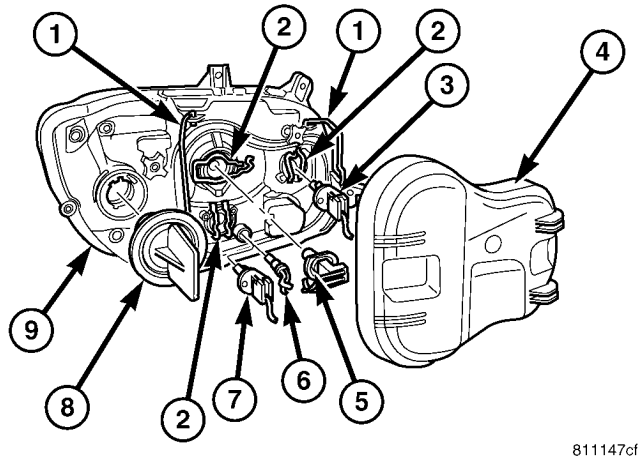


Fig. 35 Front Lamp Unit Bulbs Remove/Install

1 - COVER RETAINER (2)
2 - BULB RETAINER (3)
3 - FOG LAMP BULB (OPTIONAL)
4 - COVER
5 - LOW BEAM BULB
6 - POSITION BULB
7 - HIGH BEAM BULB
8 - TURN/PARK/SIDE MARKER BULB
9 - FRONT LAMP UNIT

LOW BEAM HEADLAMP BULB (Continued)

(3) Disconnect the front lamp unit wire harness connector from the low beam headlamp bulb base (Fig. 36).

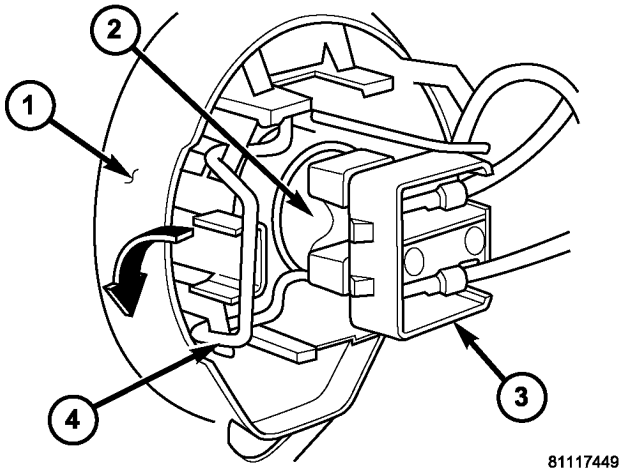


Fig. 36 Low Beam Headlamp Bulb Remove/Install

1 - LAMP HOUSING
2 - BULB BASE
3 - CONNECTOR
4 - BULB RETAINER

(4) Disengage the low beam headlamp bulb retainer by pushing it slightly toward the front lamp unit housing and downward from the bulb base, then pivot the retainer off of the bulb base.

(5) Remove the low beam headlamp bulb from the integral bulb holder on the front lamp unit reflector.

INSTALLATION

(1) Position the low beam headlamp bulb into the integral bulb holder on the front lamp unit reflector. Be certain that the lugs on the bulb base are engaged in the recesses of the bulb holder (Fig. 36).

(2) Engage the low beam headlamp bulb retainer by pivoting it over the bulb base, pressing it slightly toward the front lamp unit housing and upward toward the side of the bulb base.

(3) Reconnect the front lamp unit wire harness connector to the low beam headlamp bulb base.

(4) Position the front lamp unit rear cover onto the lamp housing and engage the retainers over each side of the cover to secure it (Fig. 35).

(5) Reconnect the battery negative cable.

MULTI-FUNCTION SWITCH

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the fuse block from the underside of the steering column. (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/FUSE BLOCK - REMOVAL).

(3) Remove the clockspring from the steering column. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - REMOVAL).

(4) Remove the two screws that secure the upper shroud to the top of the multi-function switch (Fig. 37).

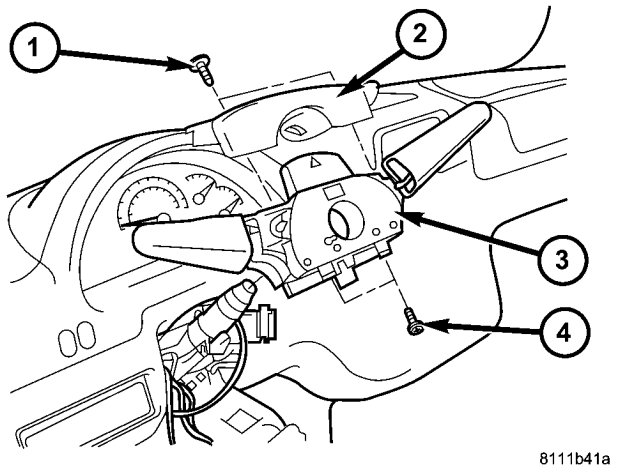


Fig. 37 Multi-Function Switch Remove/Install

1 - SCREW (2)
2 - UPPER SHROUD
3 - SWITCH
4 - SCREW (2)

(5) Remove the upper shroud from the top of the multi-function switch.

(6) Remove the two screws that secure the multi-function switch to the steering column.

(7) Remove the multi-function switch from the steering column.

(8) Remove the speed control switch from the back of the multi-function switch. (Refer to 8 - ELECTRICAL/SPEED CONTROL/SWITCH - REMOVAL).

MULTI-FUNCTION SWITCH (Continued)

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Reinstall the speed control switch onto the back of the multi-function switch. (Refer to 8 - ELECTRICAL/SPEED CONTROL/SWITCH - INSTALLATION).

(2) Position the multi-function switch onto the steering column (Fig. 37).

(3) Install and tighten the two screws that secure the multi-function switch to the steering column.

(4) Position the upper shroud onto the top of the multi-function switch.

(5) Install and tighten the two screws that secure the upper shroud to the top of the multi-function switch.

(6) Reinstall the clockspring onto the steering column. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - INSTALLATION).

(7) Reinstall the fuse block onto the underside of the steering column. (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/FUSE BLOCK - INSTALLATION).

(8) Reconnect the battery negative cable.

PARK BRAKE SWITCH

REMOVAL

(1) Remove the trim cover from the park brake lever (Fig. 38). (Refer to 5 - BRAKES/PARKING BRAKE/LEVER - REMOVAL).

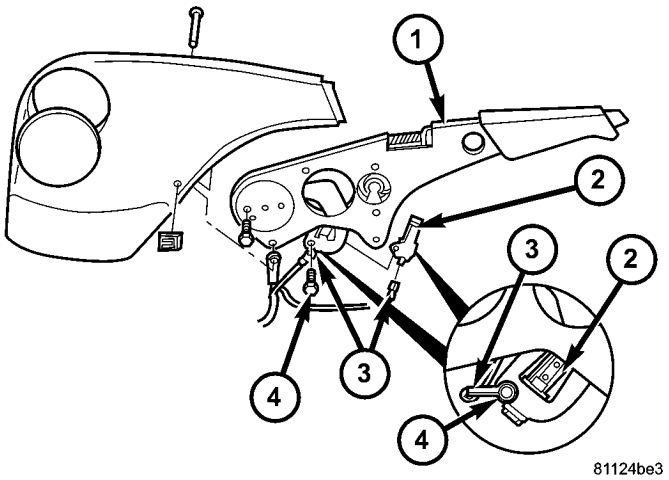


Fig. 38 Park Brake Switch Remove/Install

1 - LEVER
2 - SWITCH
3 - WIRE HARNESS
4 - SCREW

(2) Remove the screw that secures the park brake switch and the ground eyelet terminal to the park brake lever.

(3) Disengage the park brake switch from the park brake lever.

(4) Disconnect the vehicle wire harness connector for the park brake switch from the switch terminal.

(5) Remove the park brake switch from the park brake lever.

INSTALLATION

(1) Position the park brake switch near the park brake lever (Fig. 38).

(2) Reconnect the vehicle wire harness connector for the park brake switch to the switch terminal.

(3) Engage the park brake switch into the park brake lever.

(4) Install and tighten the screw that secures the park brake switch and the ground eyelet terminal to the park brake lever.

(5) Reinstall the trim cover onto the park brake lever. (Refer to 5 - BRAKES/PARKING BRAKE/LEVER - INSTALLATION).

REAR SIDE MARKER LAMP BULB

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) If the vehicle is so equipped, remove the trim from the inside of the right or left rear corner pillar.

(3) From inside the vehicle, use hand pressure to push the two latch tabs toward the center of the tail lamp unit socket plate and pull the socket plate straight out from the inner rear pillar (Fig. 39).

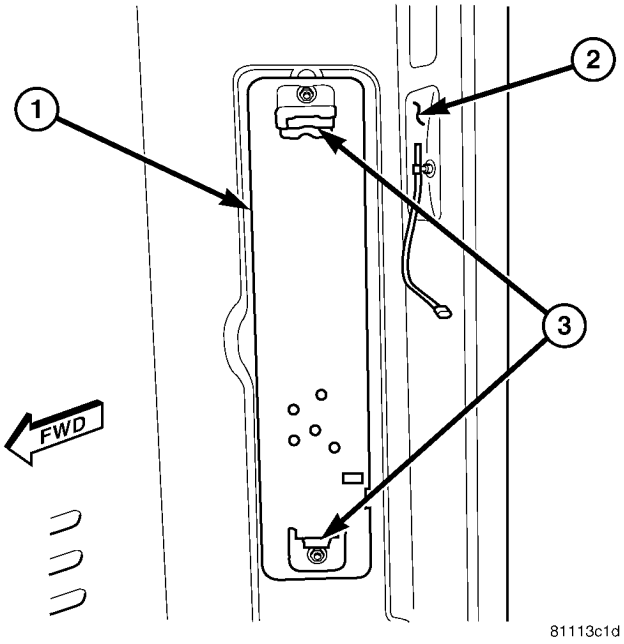


Fig. 39 Tail Lamp Socket Plate Remove/Install

1 - SOCKET PLATE
2 - INNER REAR PILLAR
3 - LATCH TAB (2)

(4) Pull the socket plate away from the inner rear pillar far enough to access the side marker lamp bulb (Fig. 40).

(5) Remove the side marker lamp bulb from the tail lamp socket plate.

INSTALLATION

(1) Install the side marker lamp bulb into the tail lamp socket plate (Fig. 40).

(2) Align the socket plate with the mounting hole in the inner rear pillar.

(3) Using hand pressure, push the socket plate gently and evenly into the inner rear pillar mounting hole until both latch tabs are fully engaged (Fig. 39).

(4) If the vehicle is so equipped, reinstall the trim onto the inside of the right or left rear corner pillar.

(5) Reconnect the battery negative cable.

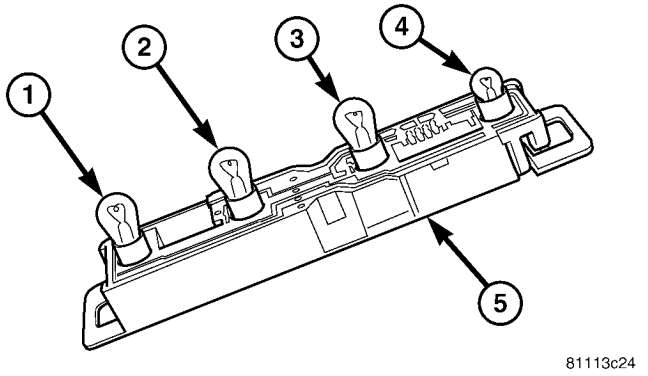


Fig. 40 Tail Lamp Bulb Remove/Install

1 - BRAKE/PARK LAMP BULB
2 - BACKUP LAMP BULB
3 - TURN SIGNAL LAMP BULB
4 - SIDE MARKER LAMP BULB
5 - TAIL LAMP SOCKET PLATE

REAR TURN LAMP BULB

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) If the vehicle is so equipped, remove the trim from the inside of the right or left rear corner pillar.

(3) From inside the vehicle, use hand pressure to push the two latch tabs toward the center of the tail lamp unit socket plate and pull the socket plate straight out from the inner rear pillar (Fig. 41).

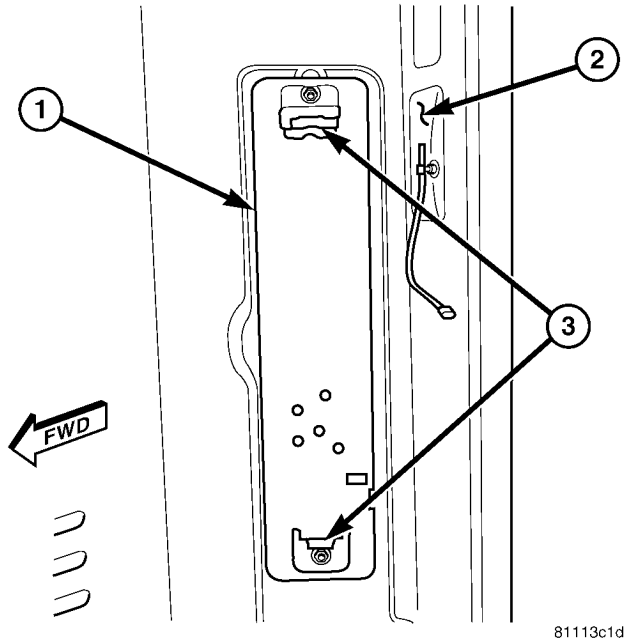


Fig. 41 Tail Lamp Socket Plate Remove/Install

1 - SOCKET PLATE
2 - INNER REAR PILLAR
3 - LATCH TAB (2)

REAR TURN LAMP BULB (Continued)

(4) Pull the socket plate away from the inner rear pillar far enough to access the turn signal lamp bulb (Fig. 42).

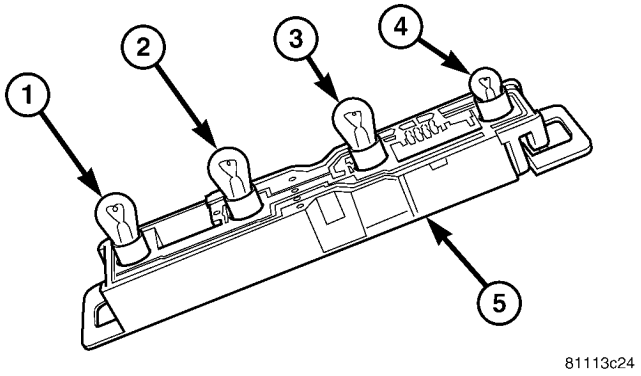


Fig. 42 Tail Lamp Bulb Remove/Install

1 - BRAKE/PARK LAMP BULB
2 - BACKUP LAMP BULB
3 - TURN SIGNAL LAMP BULB
4 - SIDE MARKER LAMP BULB
5 - TAIL LAMP SOCKET PLATE

(5) Remove the turn signal lamp bulb from the tail lamp socket plate.

INSTALLATION

(1) Install the turn signal lamp bulb into the tail lamp socket plate (Fig. 42).

(2) Align the socket plate with the mounting hole in the inner rear pillar.

(3) Using hand pressure, push the socket plate gently and evenly into the inner rear pillar mounting hole until both latch tabs are fully engaged (Fig. 41).

(4) If the vehicle is so equipped, reinstall the trim onto the inside of the right or left rear corner pillar.

(5) Reconnect the battery negative cable.

REPEATER LAMP BULB

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the repeater lamp unit from its mounting location, but do not disconnect it from the vehicle wire harness. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/REPEATER LAMP - REMOVAL).

(3) Pull the repeater lamp away from the vehicle far enough to access the bulb holder on the back of the lamp housing (Fig. 43).

(4) Grasp the lamp housing firmly in one hand, then pull the repeater lamp bulb holder straight out of the lamp housing.

(5) Remove the repeater lamp bulb from the bulb holder.

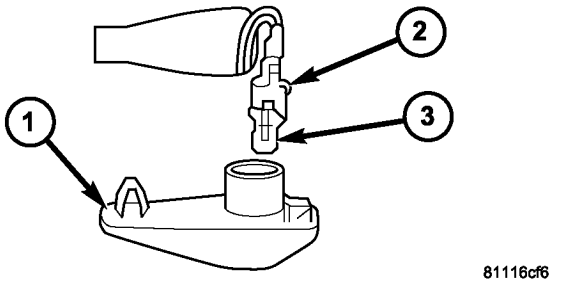


Fig. 43 Repeater Lamp Bulb Remove/Install

1 - LAMP HOUSING
2 - BULB HOLDER
3 - BULB

INSTALLATION

(1) Install the repeater lamp bulb into the bulb holder.

(2) Grasp the lamp housing firmly in one hand, then push the repeater lamp bulb holder straight into the lamp housing (Fig. 43).

(3) Reinstall the repeater lamp unit into its mounting location. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/REPEATER LAMP - INSTALLATION).

(4) Reconnect the battery negative cable.

REPEATER LAMP UNIT

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Using hand pressure, press the rear edge of the repeater lamp housing toward the front of the vehicle against the spring pressure of the retaining clip, then pull the rear edge of the lamp outward to disengage it from the mounting hole (Fig. 44).

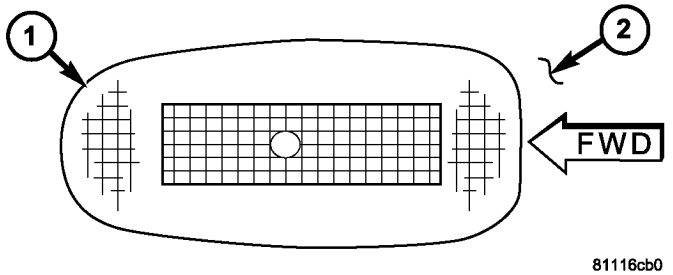


Fig. 44 Repeater Lamp Unit Remove/Install

1 - LAMP HOUSING
2 - FENDER PANEL

(3) Pull the repeater lamp housing slightly to the rear to disengage the front edge of the unit from the mounting hole.

REPEATER LAMP UNIT (Continued)

(4) Disconnect the vehicle wire harness connector from the connector receptacle of the bulb holder on the back of the repeater lamp unit.

(5) Remove the repeater lamp unit from the vehicle.

INSTALLATION

(1) Position the repeater lamp unit to the mounting hole on the vehicle (Fig. 44).

(2) Reconnect the vehicle wire harness connector to the connector receptacle of the bulb holder on the back of the repeater lamp unit.

(3) Engage the front edge of the repeater lamp unit into the front edge of the mounting hole.

(4) Using hand pressure, press the rear edge of the repeater lamp housing toward the front of the vehicle against the spring pressure of the retaining clip, then push the rear edge of the lamp into the rear of the mounting hole.

(5) Reconnect the battery negative cable.

TAIL LAMP UNIT

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) If the vehicle is so equipped, remove the trim from the inside of the right or left rear corner pillar.

(3) From inside the vehicle, use hand pressure to push the two latch tabs toward the center of the tail lamp unit socket plate and pull the socket plate straight out from the inner rear pillar (Fig. 45).

(4) Pull the socket plate away from the inner rear pillar far enough to access the tail lamp unit mounting nuts (Fig. 46).

(5) From the inside of the vehicle, remove the four nuts that secure the tail lamp unit housing to the vehicle.

(6) Remove the tail lamp unit housing and gasket from the outside of the vehicle.

INSTALLATION

(1) Position the tail lamp unit housing and gasket to the outside of the vehicle (Fig. 46).

(2) From the inside of the vehicle, install and tighten the four nuts that secure the tail lamp unit housing to the vehicle.

(3) Align the socket plate with the mounting hole in the inner rear pillar.

(4) Using hand pressure, push the socket plate gently and evenly into the inner rear pillar mounting hole until both latch tabs are fully engaged.

(5) If the vehicle is so equipped, reinstall the trim onto the inside of the right or left rear corner pillar.

(6) Reconnect the battery negative cable.

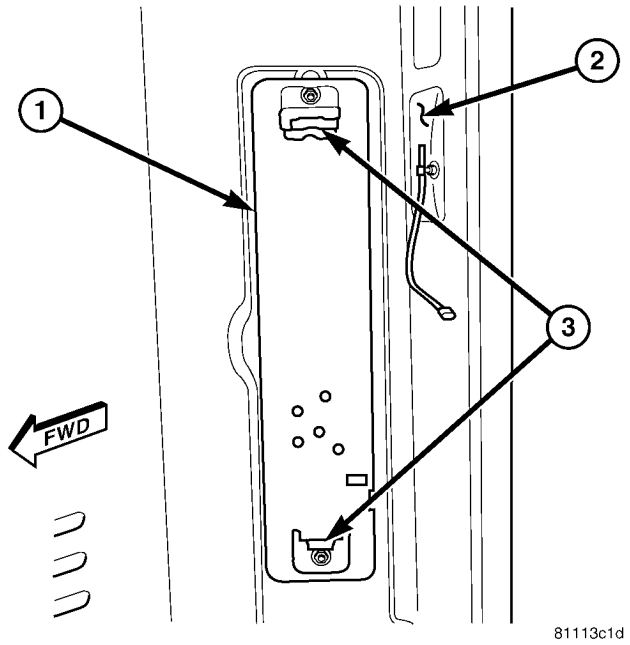


Fig. 45 Tail Lamp Socket Plate Remove/Install

1 - SOCKET PLATE
2 - INNER REAR PILLAR
3 - LATCH TAB (2)

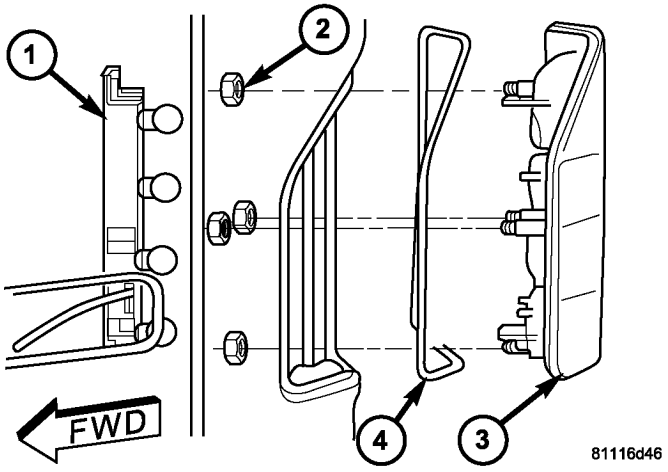


Fig. 46 Tail Lamp Unit Remove/Install

1 - SOCKET PLATE
2 - NUT (4)
3 - LAMP HOUSING
4 - GASKET

TURN SIGNAL RELAY

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the fuse access panel from the steering column opening cover below the steering column on the instrument panel.

(3) Reach through and below the inboard side of the fuse access opening to access the turn signal relay (Fig. 47).

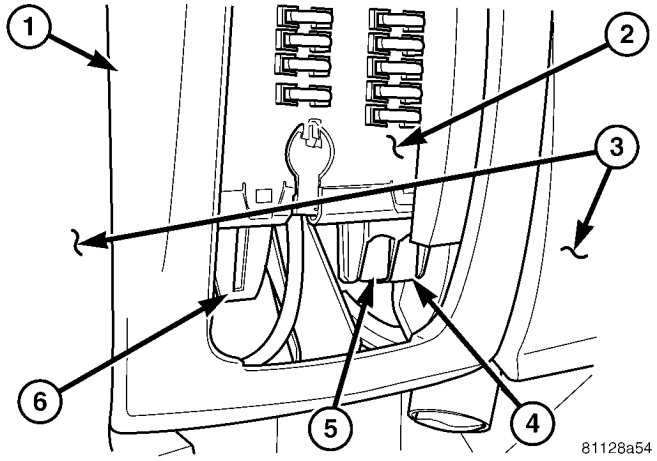


Fig. 47 Turn Signal Relay

1 - STEERING COLUMN OPENING COVER
2 - FUSE BLOCK
3 - LOWER INSTRUMENT PANEL
4 - TURN SIGNAL RELAY
5 - ENGINE CONTROL MODULE RELAY
6 - WIPER RELAY

(4) Remove the turn signal relay by grasping it firmly, releasing the latches and pulling it straight down from the receptacle on the bottom of the fuse block.

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Position the turn signal relay to the receptacle on the bottom of the fuse block (Fig. 47).

(2) Align the turn signal relay terminals with the terminal cavities in the fuse block receptacle.

(3) Push firmly and evenly on the top of the turn signal relay until the terminals are fully seated in the terminal cavities in the receptacle of the fuse block and both latches are fully engaged.

(4) Reinstall the fuse access panel onto the steering column opening cover below the steering column on the instrument panel.

(5) Reconnect the battery negative cable.

LAMPS/LIGHTING - INTERIOR

TABLE OF CONTENTS

page

LAMPS/LIGHTING - INTERIOR
DESCRIPTION 25
OPERATION 26
SPECIFICATIONS - INTERIOR LIGHTING 26
ASH RECEIVER/CIGAR LIGHTER LAMP UNIT
REMOVAL 27
INSTALLATION 27
CARGO/DOME LAMP BULB
REMOVAL 27
INSTALLATION 27
CARGO/DOME LAMP UNIT
REMOVAL 28
INSTALLATION 28
CARGO LAMP SWITCH
REMOVAL
REMOVAL - INSTRUMENT PANEL 28
REMOVAL - BULKHEAD 28
REMOVAL - REAR PILLAR 28
INSTALLATION
INSTALLATION - INSTRUMENT PANEL 29
INSTALLATION - BULKHEAD 29
INSTALLATION - REAR PILLAR 29
DOME/READING LAMP BULB
REMOVAL 29
INSTALLATION 29
DOME/READING LAMP UNIT
REMOVAL 30
INSTALLATION 30
DOME LAMP/INTRUSION SENSOR BULB
REMOVAL 30
INSTALLATION 30
DOME LAMP/INTRUSION SENSOR
REMOVAL 31
INSTALLATION 31
DOOR JAMB SWITCH
REMOVAL 31
INSTALLATION 31
ENTRY/EXIT LAMP BULB
REMOVAL 31
INSTALLATION 32
ENTRY/EXIT LAMP UNIT
REMOVAL 32
INSTALLATION 32
TIME DELAY RELAY
REMOVAL 32
INSTALLATION 33

LAMPS/LIGHTING - INTERIOR

DESCRIPTION

The interior lighting for this model includes the following standard and optional incandescent interior lamps and controls:

- **Ash Receiver/Cigar Lighter Lamp** - An available ash receiver/cigar lighter lamp is secured by an integral mount to the outside of the cigar lighter halo ring. A single lamp serves to illuminate both the translucent halo ring and the ash receiver.
- **Cargo/Dome Lamp** - Several cargo/dome lamp units located overhead in both the front and rear of the vehicle interior are standard equipment. These lamps feature a single incandescent bulb. An optional version of these lamps includes an integral three-position switch that protrudes through the lamp lens.
- **Cargo Lamp Switch** - Toggle-type remote cargo lamp switches located in the accessory switch bezel in the center of the instrument panel, on the back side of the cargo compartment bulkhead panel, and on the rear cargo door pillar are an available option on all van models. The instrument panel switch has two Light-Emitting Diode (LED) units, one for illumination and a second that provides an indication. The switches mounted in the cargo compartment also have two LED units, but only the indication LED unit is functional in this application.
- **Dome/Reading Lamp** - An optional equipment dome/reading lamp unit is located in the windshield header area between the driver and passenger sun visors. This lamp features two incandescent bulbs, one dome lamp bulb and a second, dedicated reading lamp bulb. An integral four-position switch protrudes through the lamp lens.
- **Dome Lamp/Intrusion Sensor** - An optional equipment dome lamp/intrusion sensor unit is located overhead in the vehicle interior. This lamp features four incandescent bulbs, two for dome lamps and two for dedicated right and left reading lamps. This lamp has two integral three-position switches, one to control interior lamp operation and one to control reading lamp operation. This lamp also houses three intrusion sensors that are part of an optional vehicle theft security system.
- **Door Jamb Switch** - A door jamb switch for each front door is standard equipment on all models.

A door jamb switch for each sliding side door and the right rear door is standard equipment on wagon models. The sliding and rear door jamb switches are not available for van models.

- **Entry/Exit Lamp** - An entry/exit lamp to illuminate each front and sliding side door step well is optional equipment on wagon models.
- **Time Delay Relay** - Vehicles equipped with the optional remote cargo lamp switches also have a time delay relay located in the electrical center within the driver side front seat riser.

Hard wired circuitry connects the interior lighting system components to the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the interior lighting system components through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

OPERATION

The interior lighting systems can be divided into two general classifications based upon the circuit that controls their operation: The interior lighting circuit, or the exterior lighting circuit. The hard wired circuits and components of the interior lighting systems may be diagnosed and tested using conventional diagnostic tools and procedures.

INTERIOR LIGHTING CIRCUIT

Depending upon the vehicle model (van or wagon) and the selected vehicle options the interior lighting circuit may include dome/cargo lamps located overhead in the front and rear of the vehicle, a dome/reading lamp located in the header area above the windshield between the sun visors, and entry/exit lamps located in the front and sliding side door step wells.

WAGON MODELS

In all wagon models, the lamps in the interior lighting circuit are provided with battery current at all times by a fuse in the fuse block beneath the steering column. The front, side, and rear door jamb switches control a ground path for each of these lamps, except for the optional reading lamp. If the lamp has an optional integral switch, that switch has three separate positions. The first position provides a ground path independent of the door jamb switches to turn the lamp On. The second, or center position allows the door jamb switches to control the lamp. The third position segregates that lamp from the door jamb switch input, turning the lamp Off. In the case of the optional dome/reading lamp, the integral lamp switch has a fourth position which will illuminate only the reading lamp bulb.

VAN MODELS

Unless a van model is equipped with an optional remote cargo lamp switch, all of the lamps in the interior lighting circuit operate the same way as the wagon models except that there are only two door jamb switches, one for each front door. If the vehicle is equipped with an optional remote cargo lamp switch, the lamps in the rear of the vehicle on the interior lighting circuit are provided with battery current by the time delay relay. The time delay relay is a smart relay containing active electronic elements that comprise an electronic timer logic circuit. When the remote cargo lamp switches provide the proper input to the time delay relay, the relay logic responds by energizing the relay control coil. The energized relay control coil provides battery current to all of the lamps on the rear interior lighting circuit and to the indicator Light-Emitting Diode (LED) units in the remote cargo switches causing each to illuminate. If a remote cargo lamp switch remains On for more than about fifteen minutes, the time delay relay will then automatically de-energize the rear interior lighting circuits until the remote cargo lamp switch is cycled Off and then back On.

EXTERIOR LIGHTING CIRCUIT

The exterior lighting circuit provides battery current to the optional ash receiver/cigar lighter lamp and to the illumination Light-Emitting Diode (LED) unit within the remote cargo lamp switch in the instrument panel accessory switch bezel whenever the exterior lamps are turned On.

SPECIFICATIONS - INTERIOR LIGHTING

BULB SPECIFICATIONS

LAMP	BULB
Cargo/Dome Lamp	K - 12V 18W
Dome/Reading Lamp	K - 12V 10W
Dome Lamp w/Intrusion Sensor	K - 12V 6W
Entry/Exit Lamp	W5W - 12V 5W

ASH RECEIVER/CIGAR LIGHTER LAMP UNIT

REMOVAL

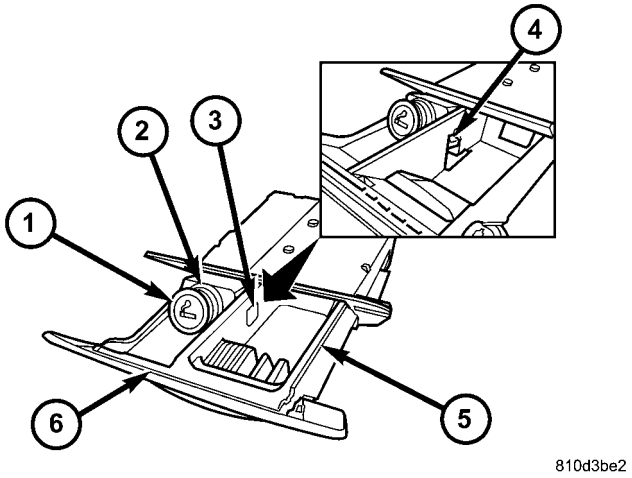


Fig. 1 Ash Receiver/Cigar Lighter Lamp Unit

1 - CIGAR LIGHTER
2 - HALO RING
3 - LENS
4 - LAMP UNIT (BIN REMOVED)
5 - ASH RECEIVER BIN
6 - ASH RECEIVER

An ash receiver/cigar lighter lamp unit is optional equipment on this model (Fig. 1). The bulb and bulb holder are secured by an integral mount to the outside of the cigar lighter halo ring, and serves to illuminate both the translucent halo ring and the ash receiver. A small lens that is snap-fit into the inboard side of the ash receiver bin allows light from the lamp on the halo ring to also illuminate the ash receiver. The ash receiver/cigar lighter lamp is serviced only as a unit with the ash receiver housing and cigar lighter receptacle. If the lamp is faulty or damaged, the entire ash receiver housing and cigar lighter receptacle unit must be replaced. (Refer to 23 - BODY/INSTRUMENT PANEL/ASH RECEIVER - REMOVAL).

INSTALLATION

An ash receiver/cigar lighter lamp unit is optional equipment on this model (Fig. 1). The bulb and bulb holder are secured by an integral mount to the outside of the cigar lighter halo ring, and serves to illuminate both the translucent halo ring and the ash receiver. A small lens that is snap-fit into the inboard side of the ash receiver bin allows light from the lamp on the halo ring to also illuminate the ash receiver. The ash receiver/cigar lighter lamp is serviced only as a unit with the ash receiver housing and cigar lighter receptacle. If the lamp is faulty or damaged, the entire ash receiver housing and cigar lighter receptacle unit must be replaced. (Refer to 23 - BODY/INSTRUMENT PANEL/ASH RECEIVER - INSTALLATION).

CARGO/DOME LAMP BULB

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the cargo/dome lamp unit from its mounting location, but do not disconnect the vehicle wire harness from the lamp connector receptacle. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/CARGO/DOME LAMP UNIT - REMOVAL).

(3) Grasp the lamp housing in one hand and carefully pull the bulb out of the bulb holder with the other hand (Fig. 2).

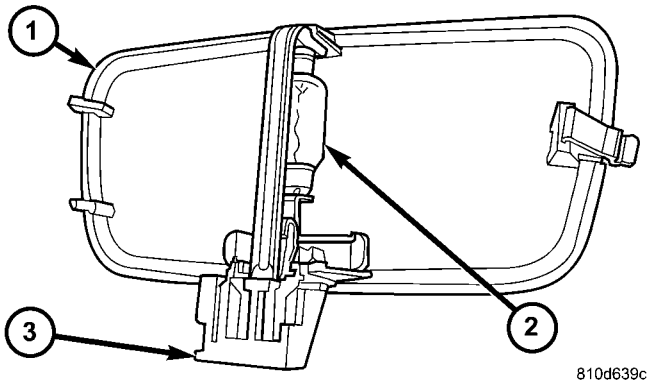


Fig. 2 Cargo/Dome Lamp Bulb Remove/Install

1 - LAMP HOUSING
2 - BULB
3 - CONNECTOR RECEPTACLE

INSTALLATION

(1) Grasp the cargo/dome lamp housing in one hand and carefully insert the bulb into the bulb holder with the other hand (Fig. 2).

(2) Reinstall the cargo/dome lamp unit into its mounting location. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/CARGO/DOME LAMP UNIT - INSTALLATION).

(3) Reconnect the battery negative cable.

CARGO/DOME LAMP UNIT

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Insert the tip of a small flat-bladed screwdriver into the notch on one edge of the cargo/dome lamp housing to depress the retainer clip and pull that edge of the lamp away from its mounting location (Fig. 3).

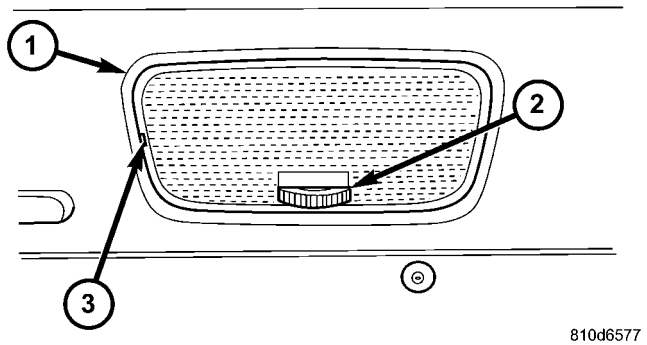


Fig. 3 Cargo/Dome Lamp Unit Remove/Install

1 - LAMP HOUSING
2 - SWITCH BUTTON
3 - NOTCH

(3) Pull the cargo/dome lamp unit from its mounting location far enough to access and disconnect the vehicle wire harness from the lamp connector receptacle.

(4) Remove the cargo/dome lamp unit from its mounting location.

INSTALLATION

(1) Position the cargo/dome lamp unit to its mounting location.

(2) Reconnect the vehicle wire harness connector to the cargo/dome lamp connector receptacle (Fig. 3).

(3) Position the edge of the cargo/dome lamp housing opposite from the retainer clip into the mounting hole.

(4) Push firmly and evenly on the notched edge of the cargo/dome lamp housing until the retainer clip latches into place.

(5) Reconnect the battery negative cable.

CARGO LAMP SWITCH

REMOVAL

REMOVAL - INSTRUMENT PANEL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the accessory switch bezel from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/ACCESSORY SWITCH BEZEL - REMOVAL).

(3) From the back of the accessory switch bezel, disconnect the vehicle wire harness connector for the cargo lamp switch from the receptacle on the back of the switch (Fig. 4).

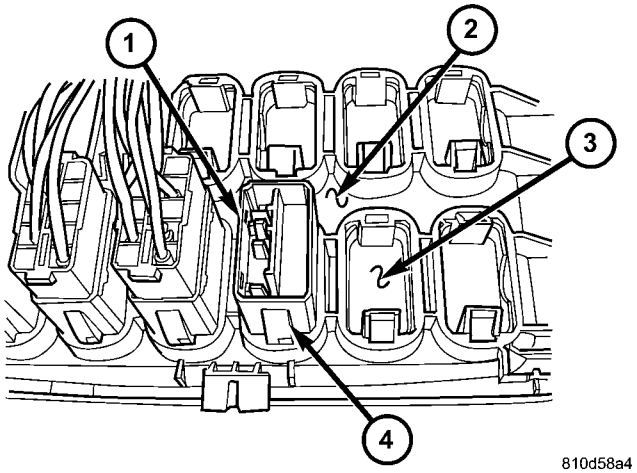


Fig. 4 Cargo Lamp Switch - Accessory Switch Bezel Mounted Remove/Install

1 - SWITCH (TYPICAL)
2 - ACCESSORY SWITCH BEZEL
3 - BLOCK-OUT PLATE
4 - LATCH (2)

(4) From the back of the accessory switch bezel, depress the two latches on the outside of the switch body and push the switch out through the front of the bezel.

REMOVAL - BULKHEAD

(1) Disconnect and isolate the battery negative cable.

(2) Carefully pry the cargo lamp switch and switch bezel out of the switch box on the back of the cargo compartment bulkhead panel.

(3) Pull the cargo lamp switch and bezel away from the switch box far enough to access and disconnect the vehicle wire harness connector for the switch from the receptacle on the back of the switch.

(4) From the back of the switch bezel, depress the two latches on the outside of the cargo lamp switch body and push the switch out through the top of the switch bezel.

REMOVAL - REAR PILLAR

(1) Disconnect and isolate the battery negative cable.

(2) Carefully pry the cargo lamp switch and switch bezel out of the switch mounting hole on the inside of the rear door opening pillar.

CARGO LAMP SWITCH (Continued)

(3) Pull the cargo lamp switch and bezel away from the pillar far enough to access and disconnect the vehicle wire harness connector for the switch from the receptacle on the back of the switch.

(4) From the back of the switch bezel, depress the two latches on the outside of the cargo lamp switch body and push the switch out through the top of the switch bezel.

INSTALLATION

INSTALLATION - INSTRUMENT PANEL

(1) From the front of the accessory switch bezel, align the cargo lamp switch body with the opening in the bezel and push the switch into the bezel until the two latches on the outside of the switch body snap into place (Fig. 4).

(2) From the back of the accessory switch bezel, reconnect the vehicle wire harness connector for the cargo lamp switch to the receptacle on the back of the switch.

(3) Reinstall the accessory switch bezel onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/ACCESSORY SWITCH BEZEL - INSTALLATION).

(4) Reconnect the battery negative cable.

INSTALLATION - BULKHEAD

(1) From the front of the switch bezel, align the cargo lamp switch body with the opening in the bezel and push the switch into the bezel until the two latches on the outside of the switch body snap into place.

(2) Reconnect the vehicle wire harness connector for the cargo lamp switch to the receptacle on the back of the switch.

(3) Using hand pressure, firmly and evenly press the cargo lamp switch and switch bezel into the switch box on the back of the cargo compartment bulkhead panel.

(4) Reconnect the battery negative cable.

INSTALLATION - REAR PILLAR

(1) From the front of the switch bezel, align the cargo lamp switch body with the opening in the bezel and push the switch into the bezel until the two latches on the outside of the switch body snap into place.

(2) Reconnect the vehicle wire harness connector for the cargo lamp switch to the receptacle on the back of the switch.

(3) Using hand pressure, firmly and evenly press the cargo lamp switch and switch bezel into the switch mounting hole on the inside of the rear door opening pillar.

(4) Reconnect the battery negative cable.

DOME/READING LAMP BULB

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the dome/reading lamp unit from its mounting location, but do not disconnect the vehicle wire harness from the lamp connector receptacle. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/DOME/READING LAMP UNIT - REMOVAL).

(3) Grasp the lamp housing in one hand and carefully pull the bulb out of the bulb holder with the other hand (Fig. 5).

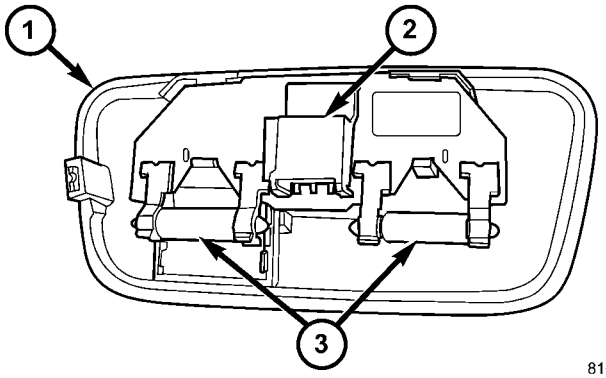


Fig. 5 Dome/Reading Lamp Bulb Remove/Install

1 - LAMP HOUSING
2 - CONNECTOR RECEPTACLE
3 - BULB (2)

INSTALLATION

(1) Grasp the dome/reading lamp housing in one hand and carefully insert the bulb into the bulb holder with the other hand (Fig. 5).

(2) Reinstall the dome/reading lamp unit into its mounting location. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/DOME/READING LAMP UNIT - INSTALLATION).

(3) Reconnect the battery negative cable.

DOME/READING LAMP UNIT

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Insert the tip of a small flat-bladed screwdriver into the notch on one edge of the dome/reading lamp housing to depress the retainer clip and pull that edge of the lamp away from its mounting location (Fig. 6).

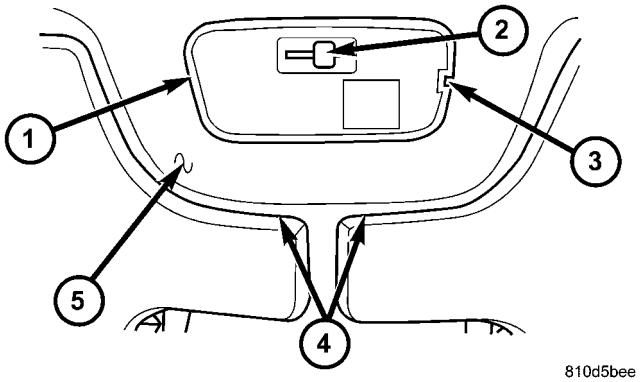


Fig. 6 Dome/Reading Lamp Unit Remove/Install

1 - LAMP HOUSING
2 - SWITCH BUTTON
3 - NOTCH
4 - SUN VISOR (2)
5 - HEADLINER

(3) Pull the dome/reading lamp unit from its mounting location far enough to access and disconnect the vehicle wire harness from the lamp connector receptacle.

(4) Remove the dome/reading lamp unit from its mounting location.

INSTALLATION

(1) Position the dome/reading lamp unit to its mounting location.

(2) Reconnect the vehicle wire harness connector to the dome/reading lamp connector receptacle (Fig. 6).

(3) Position the edge of the dome/reading lamp housing opposite from the retainer clip into the mounting hole.

(4) Push firmly and evenly on the notched edge of the dome/reading lamp housing until the retainer clip latches into place.

(5) Reconnect the battery negative cable.

DOME LAMP/INTRUSION SENSOR BULB

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the dome lamp/intrusion sensor unit from its mounting location, but do not disconnect the vehicle wire harness from the lamp connector receptacle. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/DOME LAMP/INTRUSION SENSOR UNIT - REMOVAL).

(3) Grasp the lamp housing in one hand and rotate the bulb holder and bulb unit counterclockwise about 30 degrees on the circuit board (Fig. 7).

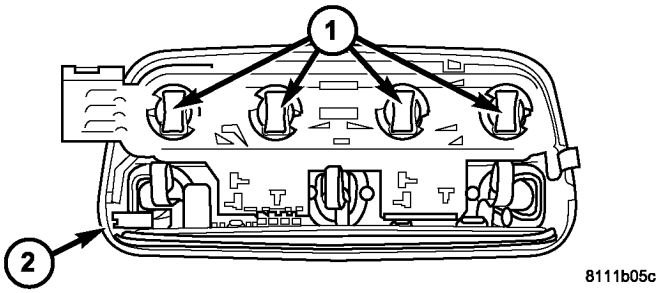


Fig. 7 Dome Lamp/Intrusion Sensor Bulb Remove/ Install

1 - BULB HOLDER/BULB (4)
2 - LAMP HOUSING

(4) Pull the bulb holder and bulb unit straight out from the mounting hole in the circuit board.

INSTALLATION

(1) Grasp the dome lamp/intrusion sensor unit housing in one hand and align the bulb holder and bulb unit with the bulb mounting hole in the circuit board with the other hand (Fig. 7).

(2) Insert the bulb holder and bulb unit straight into the circuit board bulb mounting hole until it is firmly seated.

(3) Rotate the bulb holder and bulb unit clockwise about 30 degrees on the circuit board.

(4) Reinstall the dome lamp/intrusion sensor unit into its mounting location. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/DOME LAMP/INTRUSION SENSOR UNIT - INSTALLATION).

(5) Reconnect the battery negative cable.

DOME LAMP/INTRUSION SENSOR

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Insert the tip of a small flat-bladed screwdriver into the notch on one edge of the dome lamp/intrusion sensor unit housing to depress the retainer clip and pull that edge of the lamp away from its mounting location (Fig. 8).

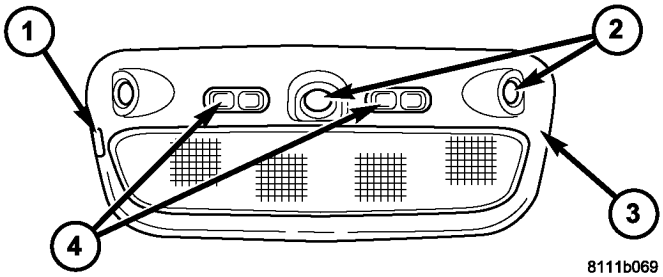


Fig. 8 Dome Lamp/Intrusion Sensor Unit Remove/Install

1 - NOTCH
2 - SENSOR (3)
3 - HOUSING
4 - SWITCH (2)

(3) Pull the dome lamp/intrusion sensor unit from its mounting location far enough to access and disconnect the vehicle wire harness from the lamp connector receptacle.

(4) Remove the dome lamp/intrusion sensor unit from its mounting location.

INSTALLATION

(1) Position the dome lamp/intrusion sensor unit to its mounting location (Fig. 8).

(2) Reconnect the vehicle wire harness connector to the dome lamp/intrusion sensor unit connector receptacle.

(3) Position the edge of the dome lamp/intrusion sensor unit housing opposite from the retainer clip into the mounting hole.

(4) Push firmly and evenly on the notched edge of the dome lamp/intrusion sensor unit housing until the retainer clip latches into place.

(5) Reconnect the battery negative cable.

DOOR JAMB SWITCH

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Open the door and remove the screw that secures the door jamb switch to the hinge pillar of the door opening (Fig. 9).

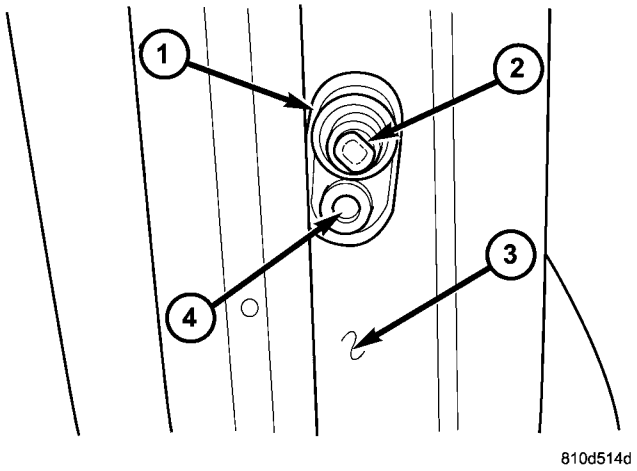


Fig. 9 Door Jamb Switch Remove/Install

1 - DOOR JAMB SWITCH
2 - PLUNGER
3 - PILLAR
4 - SCREW

(3) Pull the door jamb switch away from the mounting hole in the pillar far enough to access and disconnect the vehicle wire harness connector from the back of the switch.

INSTALLATION

(1) Position the door jamb switch close enough to the mounting hole in the hinge pillar of the door opening to reconnect the vehicle wire harness connector to the back of the switch.

(2) Position the door jamb switch into the mounting hole in the hinge pillar (Fig. 9).

(3) Install and tighten the screw that secures the door jamb switch to the hinge pillar.

(4) Reconnect the battery negative cable.

ENTRY/EXIT LAMP BULB

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the entry/exit lamp unit from its mounting location. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/ENTRY/EXIT LAMP UNIT - REMOVAL).

(3) Grasp the lamp housing firmly in one hand, then rotate the bulb holder counterclockwise and pull it straight out from the housing with the other hand (Fig. 10).

(4) Remove the bulb from the bulb holder.

ENTRY/EXIT LAMP BULB (Continued)

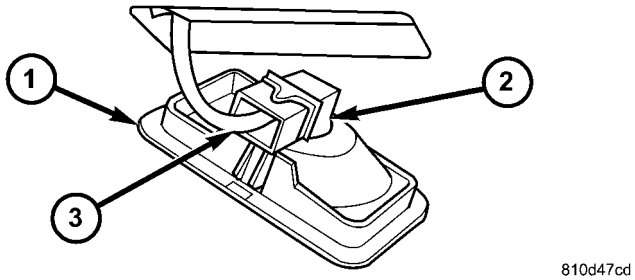


Fig. 10 Entry/Exit Lamp Bulb Remove/Install

1 - LAMP HOUSING
2 - BULB HOLDER
3 - CONNECTOR

INSTALLATION

(1) Insert the bulb into the entry/exit lamp bulb holder (Fig. 10).

(2) Grasp the entry/exit lamp housing firmly in one hand, then insert the bulb holder into the housing and rotate it clockwise to lock it in place with the other hand.

(3) Reinstall the entry/exit lamp unit into its mounting location. (Refer to 8 - ELECTRICAL/ LAMPS/LIGHTING - INTERIOR/ENTRY/EXIT LAMP UNIT - INSTALLATION).

(4) Reconnect the battery negative cable.

ENTRY/EXIT LAMP UNIT

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Insert the tip of a small flat-bladed screwdriver into the notch on one edge of the entry/exit lamp housing to depress the retainer clip and pull that edge of the lamp away from its mounting location (Fig. 11).

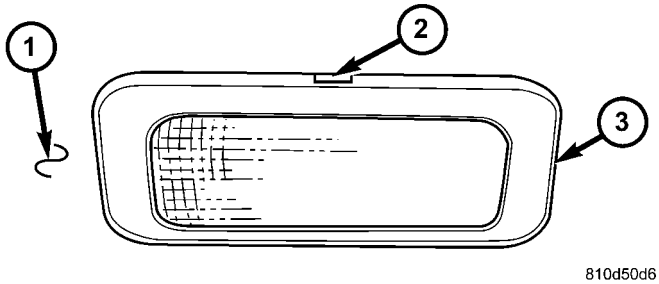


Fig. 11 Entry/Exit Lamp Unit Remove/Install

1 - STEP WELL SCUFF PAD
2 - NOTCH
3 - ENTRY/EXIT LAMP UNIT

(3) Pull the entry/exit lamp unit from its mounting location far enough to access and disconnect the vehicle wire harness from the lamp connector receptacle.

(4) Remove the entry/exit lamp unit from its mounting location.

INSTALLATION

(1) Position the entry/exit lamp unit to its mounting location.

(2) Reconnect the vehicle wire harness connector to the entry/exit lamp connector receptacle (Fig. 11).

(3) Position the edge of the entry/exit lamp housing opposite from the retainer clip into the mounting hole.

(4) Push firmly and evenly on the notched edge of the entry/exit lamp housing until the retainer clip latches into place.

(5) Reconnect the battery negative cable.

TIME DELAY RELAY

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Move the driver side front seat to its most forward position for easiest access to the seat riser cover panel.

(3) Remove the two screws that secure the cover panel to the top of the seat riser under the driver side front seat (Fig. 12).

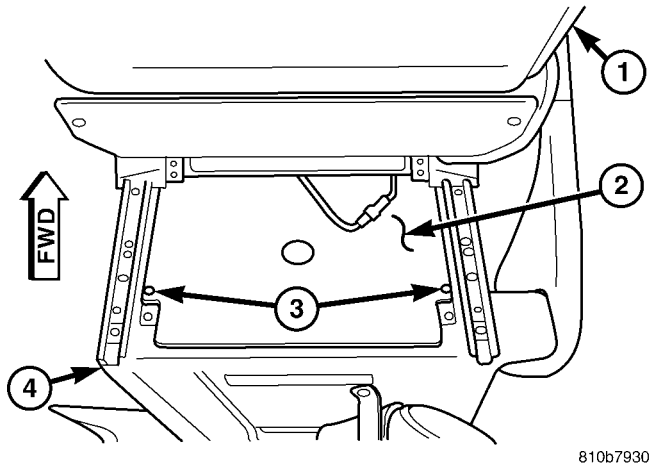


Fig. 12 Seat Riser Cover

1 - DRIVER SEAT BACK
2 - COVER PANEL
3 - SCREW (2)
4 - SEAT RISER

(4) Remove the cover panel from the top of the driver side seat riser.

(5) Remove the time delay relay from its vehicle wire harness connector by grasping it firmly and pulling it straight out from the connector within the driver side seat riser.

TIME DELAY RELAY (Continued)

INSTALLATION

(1) Position the time delay relay to its vehicle wire harness connector within the driver side seat riser.

(2) Align the time delay relay terminals with the terminal cavities in the vehicle wire harness connector.

(3) Push firmly and evenly on the top of the time delay relay until the terminals are fully seated in the terminal cavities in the vehicle wire harness connector.

(4) Position the cover panel onto the top of the driver side seat riser (Fig. 12).

(5) Install and tighten the two screws that secure the cover panel to the top of the seat riser under the driver side front seat. Tighten the screws to 2 N·m (18 in. lbs.).

(6) Move the driver side front seat back to its driving position.

(7) Reconnect the battery negative cable.

POWER SYSTEMS

TABLE OF CONTENTS

page

POWER LOCKS 1
POWER MIRRORS 3
POWER WINDOWS 5

POWER LOCKS

TABLE OF CONTENTS

page

POWER LOCKS
DESCRIPTION 1
DOOR LOCK MOTOR
REMOVAL 1
INSTALLATION 1
REMOTE KEYLESS ENTRY TRANSMITTER
DESCRIPTION 2
MASTER LOCK SWITCH
DESCRIPTION 2
DIAGNOSIS AND TESTING - MASTER LOCK SWITCH 2
REMOVAL 2
INSTALLATION 2

POWER LOCKS

DESCRIPTION

CENTRAL LOCKING

The central locking system locks all vehicle doors if any door is locked from the inside or mechanically locked with the key from the outside. the master door lock switch on the instrument panel enables the operator to lock/unlock all doors.

REMOTE KEYLESS ENTRY

The SKREEM is a combination of the Remote Keyless Entry (RKE) module and the Sentry Key Immobilizer (SKIM) module. It is located behind the instrument cluster and has an antenna that mounts to the A-pillar.

AUTO DOOR LOCKS

Whenever the engine is started, the CTM receivers a message to lock all doors except the drivers door. This is accomplished through a relay. The relay is controlled by the Instrument Cluster which receives a command from the ECM.

ACCIDENT RESPONSE

The CTM is hardwired to the Airbag Control Module through the Enhanced Accident Report Driver circuit. Anytime the vehicles airbags are deployed, the CTM will unlock all doors and a “crash” DTC will be stored in memory. The door locks will be inoperative until that code is cleared.

DOOR LOCK MOTOR

REMOVAL

(1) Disconnect and isolate the battery negative cable.
(2) Remove the door trim panel.
(3) Remove the door lock.
(4) Remove the door lock motor from the door lock.

INSTALLATION

(1) Install the door lock motor to the door lock.
(2) Install the door lock.
(3) Install the door trim panel.
(4) Connect the battery negative cable.

REMOTE KEYLESS ENTRY TRANSMITTER

DESCRIPTION

Pressing the unlock button on the transmitter will unlock the drivers door, pressing it a second time within 2.5 seconds will unlock all other doors. The transmitter has a range of 10 meters. A key is integral to the transmitter.

When a transmitter is lost, it is necessary to disable the affected transmitter so that it can no longer be used to operate the vehicle. It will then be necessary to program a new transmitter to the vehicle.

MASTER LOCK SWITCH

DESCRIPTION

The master lock switch is a momentary contact switch. Pressing the once in the up direction unlocks the driver door. Pressing it again in the same direction unlocks all doors. Pressing the button in the down direction locks all doors.

DIAGNOSIS AND TESTING - MASTER LOCK SWITCH

(1) Disconnect and isolate the battery negative cable.

(2) Remove the switch to be tested.

(3) Using an ohmmeter, test switch for continuity (Fig. 1).

(4) If test results are not obtained as shown in the test table, replace the switch.

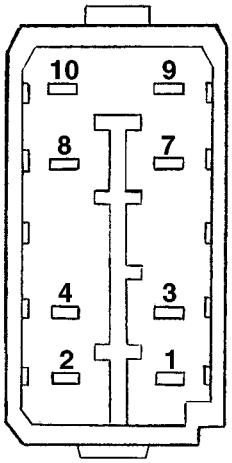


Fig. 1 POWER LOCK SWITCH

MASTER LOCK SWITCH

SWITCH POSITION	CONTINUITY BETWEEN
OPEN	4 AND 7
	4 AND 10
	7 AND 10
LOCK/UNLOCK	3 AND 4
	3 AND 7
	3 AND 10
	4 AND 7
	4 AND 10
	4 AND 8
	7 AND 8
	7 AND 10

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the instrument panel center bezel (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL CENTER BEZEL - REMOVAL).

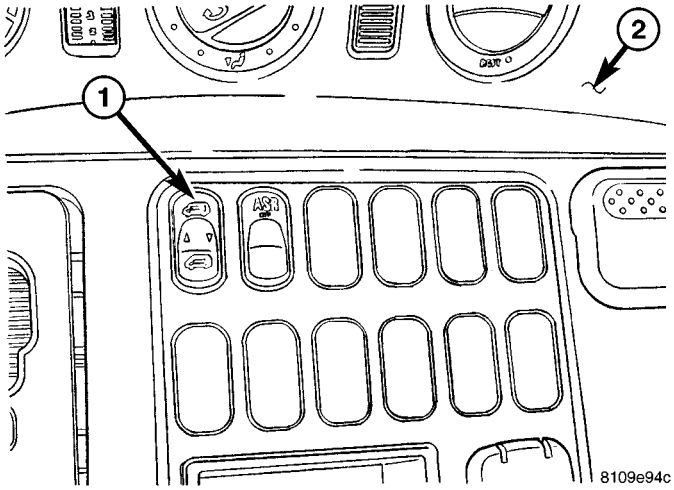


Fig. 2 POWER LOCK SWITCH

1 - CENTRAL LOCKING SWITCH
2 - INSTRUMENT PANEL

(3) Remove the central locking switch from the bezel (Fig. 2).

INSTALLATION

(1) Install switch to bezel.

(2) Install instrument panel center bezel (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL CENTER BEZEL - INSTALLATION).

(3) Connect battery negative cable.

POWER MIRRORS

TABLE OF CONTENTS

page

POWER MIRRORS
DESCRIPTION 3
POWER MIRROR SWITCH
DIAGNOSIS AND TESTING - POWER MIRROR SWITCH 3
REMOVAL 3
INSTALLATION 4

POWER MIRRORS

DESCRIPTION

The power operated outside rear view mirrors allow the driver to adjust both outside mirrors electrically from the driver side front seat position by operating a switch on the driver side front door trim panel. The power mirrors receive a non-switched battery feed through a fuse so that the system will remain operational, regardless of the ignition switch position.

POWER MIRROR SWITCH

DIAGNOSIS AND TESTING - POWER MIRROR SWITCH

(1) Disconnect and isolate the battery negative cable.

(2) Remove power mirror switch (Refer to 8 - ELECTRICAL/POWER MIRRORS/POWER MIRROR SWITCH - REMOVAL).

(3) Using an ohmmeter, test for continuity between the terminals of the switch (Fig. 1).

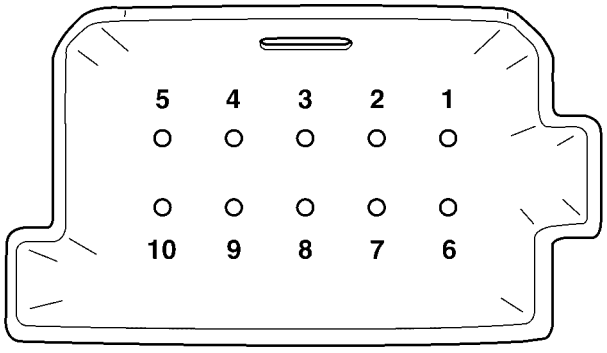


Fig. 1 POWER MIRROR SWITCH

MIRROR SWITCH TEST

MIRROR SELECT SWITCH IN "LEFT" POSITION	
BUTTON POSITION	**CONTINUITY BETWEEN**
UP	PIN 6 AND 9 PIN 6 AND 8
DOWN	PIN 2 AND 4 PIN 6 AND 10
LEFT	PIN 2 AND 3 PIN 6 AND 10
RIGHT	PIN 2 AND 3 PIN 6 AND 2
MIRROR SELECT SWITCH IN "RIGHT" POSITION	
BUTTON POSITION	**CONTINUITY BETWEEN**
UP	PIN 6 AND 8 PIN 6 AND 9
DOWN	PIN 6 AND 3
LEFT	PIN 1 AND 7
RIGHT	PIN 1 AND 8

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the door handle trim.

(3) Remove the mirror switch/power window switch trim (Fig. 2).

(4) Disconnect the electrical wire harness and remove switch.

POWER MIRROR SWITCH (Continued)

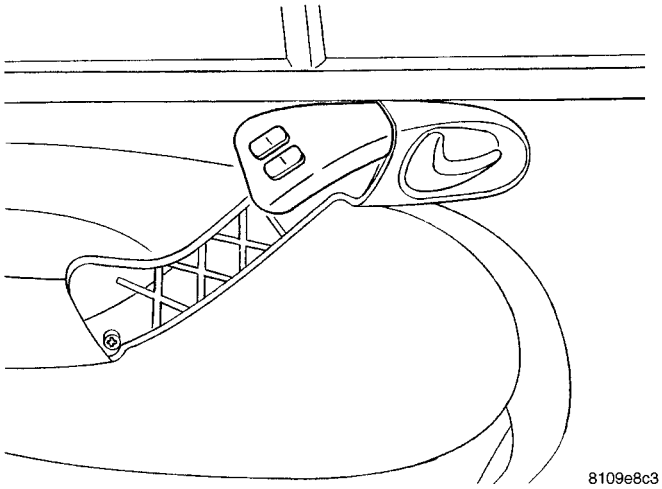


Fig. 2 POWER MIRROR SWITCH

INSTALLATION

(1) Connect electrical harness connector to switch.
(2) install the mirror switch/power window switch trim.
(3) Install the door handle trim.
(4) Connect the battery negative cable.

POWER WINDOWS

TABLE OF CONTENTS

page

POWER WINDOWS
DESCRIPTION 5
OPERATION 5
WINDOW MOTOR
REMOVAL 5

page

POWER WINDOW SWITCH
DIAGNOSIS AND TESTING - POWER WINDOW SWITCH 5
REMOVAL 6
INSTALLATION 6

POWER WINDOWS

DESCRIPTION

The power window system allows each of the door windows to be raised and lowered electrically by actuating a switch on each door panel. A master switch on the drivers door allows the driver to raise or lower each door window. The power window system operates only when the ignition switch is in the RUN or ACCESSORY position.

OPERATION

WINDOW SWITCH

The power window switches control the battery and ground feeds to the power window motors. The passenger door power window switches receive their battery and ground feeds through the circuitry of the drivers window switch.

WINDOW MOTOR

Window motors use permanent type magnets. The B+ and ground applied at the motor terminal pins will cause the motor to rotate in one direction. Reversing current through the motor terminals will cause the motor to rotate in the opposite direction.

Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

WINDOW MOTOR

REMOVAL

The window motor is serviced with the window regulator.

POWER WINDOW SWITCH

DIAGNOSIS AND TESTING - POWER WINDOW SWITCH

Test the power window switch continuity. Refer to the Power Window Switch Continuity chart to determine if the continuity is correct in the Off, Up and Down switch positions (Fig. 1).

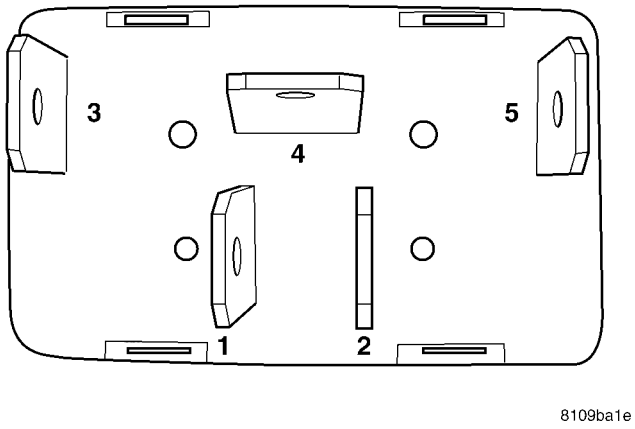


Fig. 1 POWER WINDOW SWITCH

POWER WINDOW SWITCH CONTINUITY CHART

SWITCH POSITION	CONTINUITY BETWEEN
UP	PIN 1 AND 3
	PIN 2 AND 4
DOWN	PIN 1 AND 4
	PIN 2 AND 5
NEUTRAL (OFF)	PIN 1AND 3
	PIN 2 AND 5

POWER WINDOW SWITCH (Continued)

REMOVAL

(1) Disconnect and isolate the battery negative cable.
(2) Remove door handle cover.
(3) Remove power window switch trim from door trim panel.
(4) disconnect wire harness connectors from switches.
(5) Remove power window switch from trim.

INSTALLATION

(1) Install switch to trim.
(2) Connect wire harness connectors to switches.
(3) Install power window switch trim to door trim panel.
(4) Install door handle cover.
(5) Connect battery negative cable.

RESTRAINTS

TABLE OF CONTENTS

page

RESTRAINTS
DESCRIPTION 2
OPERATION 4
WARNING
WARNINGS - RESTRAINT SYSTEM 5
DIAGNOSIS AND TESTING - SUPPLEMENTAL RESTRAINT SYSTEM 5
STANDARD PROCEDURE
STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS 6
STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT 6
STANDARD PROCEDURE - VERIFICATION TEST 7
AIRBAG CONTROL MODULE
DESCRIPTION 8
OPERATION 9
REMOVAL 10
INSTALLATION 11
CLOCKSPRING
DESCRIPTION 12
OPERATION 13
STANDARD PROCEDURE - CLOCKSPRING CENTERING 13
REMOVAL 14
INSTALLATION 15
DRIVER AIRBAG
DESCRIPTION 16
OPERATION 17
REMOVAL 17
INSTALLATION 18

page

FRONT SEAT BELT & RETRACTOR
REMOVAL 19
INSTALLATION 21
FRONT SEAT BELT BUCKLE
REMOVAL 22
INSTALLATION 23
PASSENGER AIRBAG
DESCRIPTION 23
OPERATION 24
REMOVAL 24
INSTALLATION 26
PASSENGER AIRBAG BRACKET
REMOVAL 27
INSTALLATION 27
REAR SEAT BELT & RETRACTOR
REMOVAL 27
INSTALLATION 29
REAR SEAT BELT BUCKLE
REMOVAL
REMOVAL - INBOARD 29
REMOVAL - OUTBOARD 30
INSTALLATION
INSTALLATION - INBOARD 30
INSTALLATION - OUTBOARD 31
SEAT BELT SWITCH
DESCRIPTION 31
OPERATION 31
SEAT BELT TENSIONER
DESCRIPTION 31
OPERATION 32
SEAT BELT TURNING LOOP ADJUSTER
REMOVAL 33
INSTALLATION 34

RESTRAINTS

DESCRIPTION

An occupant restraint system is standard factory-installed safety equipment on this model. Available occupant restraints for this model include both active and passive types. Active restraints are those which require the vehicle occupants to take some action to employ, such as fastening a seat belt; while passive restraints require no action by the vehicle occupants to be employed (Fig. 1).

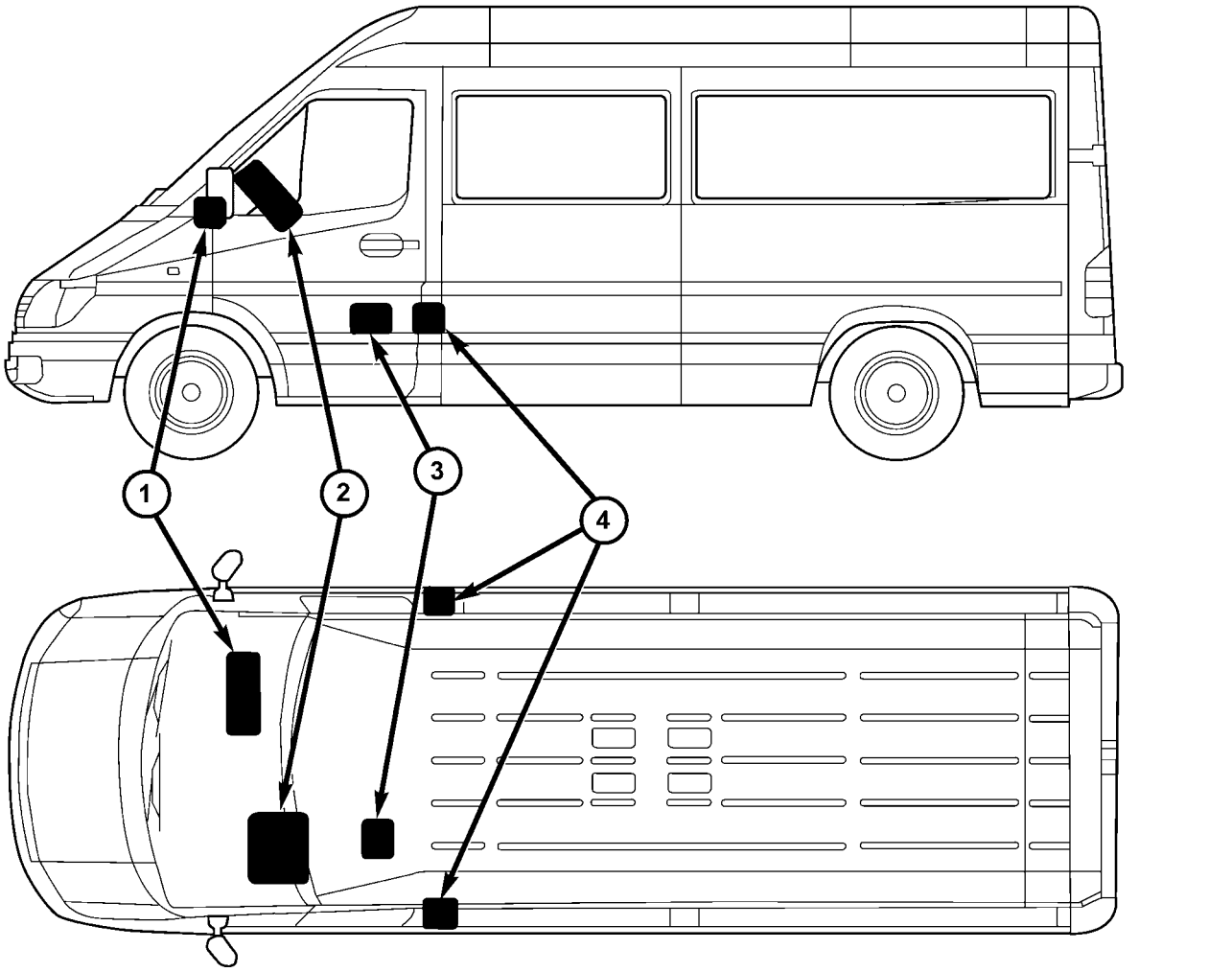


Fig. 1 Supplemental Restraint System

1 - PASSENGER AIRBAG (OPTIONAL)
2 - DRIVER AIRBAG
3 - AIRBAG CONTROL MODULE
7 - SEAT BELT TENSIONER (DRIVER SIDE - STANDARD, PASSENGER SIDE - OPTIONAL WITH PASSENGER AIRBAG ONLY)

RESTRAINTS (Continued)

ACTIVE RESTRAINTS

The active restraints for this model include:

- **Front Seat Belts** - Both outboard front seating positions are equipped with three-point seat belt systems employing a lower B-pillar mounted inertia latch-type retractors, height-adjustable upper B-pillar mounted turning loops, travelling lower seat belt anchors secured to the outboard seat tracks, and travelling end-release seat belt buckles secured to the inboard seat track. The driver side front seat belt buckle of all models includes an integral seat belt switch that detects whether its seat belt has been fastened.
- **Rear Seat Belts** - All rear seating positions are equipped with three-point seat belt systems. Each rear seating position belt employs an integral seat cushion frame mounted inertia latch-type retractor, a fixed position upper seat back frame mounted turning loop, and a fixed lower seat belt anchor secured to the seat cushion frame. All rear seat belts have fixed end-release seat belt buckles that are also secured to the seat cushion frame.

PASSIVE RESTRAINTS

A Next Generation driver airbag is standard factory-installed safety equipment on this model, while a passenger side front airbag is optional. This airbag system is a passive, inflatable, Supplemental Restraint System (SRS) and vehicles with this equipment can be readily identified by the “SRS - AIRBAG” logo molded into the driver airbag trim cover in the center of the steering wheel and, if the vehicle is so equipped, also into the passenger airbag door on the instrument panel above the glove box (Fig. 2). Vehicles with the airbag system can also be identified by the airbag indicator, which will illuminate in the instrument cluster for about six seconds as a bulb test each time the ignition switch is turned to the On position. A pyrotechnic-type seat belt tensioner is integral to the front seat belt retractor mounted on the lower B-pillar on the driver side, and to the passenger side retractor of vehicles equipped with the optional passenger side airbag.

The supplemental restraint system includes the following major components, which are described in further detail elsewhere in this service information:

- **Airbag Control Module** - The Airbag Control Module (ACM) is located on a mount on the floor panel within the driver side seat riser, beneath the driver seat in the passenger compartment.
- **Airbag (SRS) Indicator** - The airbag indicator is integral to the ElectroMechanical Instrument Cluster (EMIC), which is located on the instrument panel in front of the driver.

8098029e

Fig. 2 SRS Logo

- **Clockspring** - The clockspring is located near the top of the steering column, directly beneath the steering wheel.
- **Driver Airbag** - The driver airbag is located in the center of the steering wheel, beneath the driver airbag trim cover.
- **Driver Knee Blocker** - The structure of the lower instrument panel serves as a knee blocker for the driver.
- **Passenger Airbag** - The optional passenger airbag is located within the instrument panel, behind the passenger airbag door on the instrument panel above the glove box on the passenger side of the vehicle.
- **Passenger Knee Blocker** - The structure of the glove box door and the lower instrument panel serve as a knee blocker for the front seat passenger.
- **Seat Belt Tensioner** - A seat belt tensioner is integral to the driver side front seat belt retractor unit, and to the passenger side front seat belt retractor unit on vehicles equipped with an optional passenger airbag.

The ACM contains a central processing unit and programming that allows it to communicate on a serial data bus diagnostic circuit connected to the 16-way Data Link Connector (DLC) located below the left end of the instrument panel. This method of communication is used for initialization of the ACM and for diagnosis of the SRS circuits and components using a DRBIII® scan tool.

Hard wired circuitry connects the supplemental restraint system components to each other through the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system, and to the supplemental restraint system components through the use of a combination of soldered

splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

OPERATION

ACTIVE RESTRAINTS

The primary passenger restraints in this or any other vehicle are the standard equipment factory-installed seat belts. Seat belts are referred to as an active restraint because the vehicle occupants are required to physically fasten and properly adjust these restraints in order to benefit from them. 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 active restraints.

PASSIVE RESTRAINTS

The passive restraints are referred to as a supplemental restraint system because they were designed and are intended to enhance the protection for the occupants of the vehicle **only** when used in conjunction with the seat belts. They are referred to as passive restraints because the vehicle occupants are not required to do anything to make them operate; however, the vehicle occupants must be wearing their seat belts in order to obtain the maximum safety benefit from the factory-installed supplemental restraint system.

The supplemental restraint system electrical circuits are continuously monitored and controlled by a microprocessor and software contained within the Airbag Control Module (ACM). An airbag indicator in the ElectroMechanical Instrument Cluster (EMIC) illuminates for about four seconds as a bulb test each time the ignition switch is turned to the On or Start positions. Following the bulb test, the airbag indicator is turned on or off by the ACM to indicate the status of the supplemental restraint system. If the airbag indicator comes on either solid or flashing at any time other than during the bulb test, it indicates that there is a problem in the supplemental restraint system electrical circuits. Such a problem may cause airbags not to deploy when required, or to deploy when not required.

Deployment of the supplemental restraints depends upon the angle and severity of an impact. Deployment is not based upon vehicle speed; rather, deployment is based upon the rate of deceleration as measured by the forces of gravity (G force) upon the impact sensor. When an impact is severe enough, the microprocessor in the ACM signals the inflator of the appropriate airbag units to deploy their airbag cushions. The front seat belt tensioners are provided with a deployment signal by the ACM in conjunction with the driver and passenger airbags. During a frontal vehicle impact, the knee blockers work in concert with properly fastened and adjusted seat belts to restrain both the driver and the front seat passenger in the proper position for an airbag deployment. The knee blockers also absorb and distribute the crash energy from the driver and the front seat passenger to the structure of the instrument panel. The seat belt tensioners remove the slack from the front seat belts to provide further assurance that the driver and front seat passenger are properly positioned and restrained for an airbag deployment.

Typically, the vehicle occupants recall more about the events preceding and following a collision than they do of an airbag deployment itself. This is because the airbag deployment and deflation occur so rapidly. In a typical 48 kilometer-per-hour (30 mile-per-hour) barrier impact, from the moment of impact until the airbags are fully inflated takes only a few milliseconds. Within one to two seconds from the moment of impact, the airbags are almost entirely deflated. The times cited for these events are approximations, which apply only to a barrier impact at the given speed. Actual times will vary somewhat, depending upon the vehicle speed, impact angle, severity of the impact, and the type of collision.

When the ACM monitors a problem in any of the front airbag system circuits or components, including the seat belt tensioners, it stores a fault code or Diagnostic Trouble Code (DTC) in its memory circuit and sends a hard wired output to the EMIC to turn on the airbag indicator. If the EMIC detects a problem in the airbag indicator or airbag indicator circuit, the cluster will flash the seatbelt indicator on and off. Proper testing of the supplemental restraint system components as well as the retrieval or erasure of a DTC from the ACM requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

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 passive restraints.

RESTRAINTS (Continued)

WARNING

WARNINGS - RESTRAINT SYSTEM

WARNING: DURING AND FOLLOWING ANY SEAT BELT SERVICE, CAREFULLY INSPECT ALL SEAT BELTS, BUCKLES, MOUNTING HARDWARE, RETRACTORS, TETHER STRAPS, AND ANCHORS FOR PROPER INSTALLATION, OPERATION, OR DAMAGE. REPLACE ANY BELT THAT IS CUT, FRAYED, OR TORN. STRAIGHTEN ANY BELT THAT IS TWISTED. TIGHTEN ANY LOOSE FASTENERS. REPLACE ANY BELT THAT HAS A DAMAGED OR INOPERATIVE BUCKLE OR RETRACTOR. REPLACE ANY BELT THAT HAS A BENT OR DAMAGED LATCH PLATE OR ANCHOR PLATE. NEVER ATTEMPT TO REPAIR A SEAT BELT COMPONENT. ALWAYS REPLACE DAMAGED OR FAULTY SEAT BELT COMPONENTS WITH THE CORRECT, NEW AND UNUSED REPLACEMENT PARTS LISTED IN THE DAIMLERCHRYSLER MOPAR PARTS CATALOG.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, BEFORE PERFORMING ANY WELDING OPERATIONS DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE AND DISCONNECT ALL WIRE HARNESS CONNECTORS FROM THE AIRBAG CONTROL MODULE (ACM). FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND OTHER POSSIBLE DAMAGE TO THE SUPPLEMENTAL RESTRAINT SYSTEM CIRCUITS AND COMPONENTS.

WARNING: AN AIRBAG INFLATOR UNIT MAY CONTAIN 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. AN AIRBAG INFLATOR UNIT MAY ALSO CONTAIN A GAS CANISTER PRESSURIZED TO OVER 2500 PSI. DO NOT ATTEMPT TO DISMANTLE AN AIRBAG UNIT 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).

WARNING: WHEN HANDLING A SEAT BELT TENSIONER RETRACTOR, PROPER CARE SHOULD BE EXERCISED TO KEEP FINGERS OUT FROM UNDER THE RETRACTOR COVER AND AWAY FROM THE SEAT BELT WEBBING WHERE IT EXITS FROM THE RETRACTOR COVER.

WARNING: REPLACE ALL RESTRAINT SYSTEM COMPONENTS ONLY WITH PARTS SPECIFIED IN THE DAIMLERCHRYSLER MOPAR PARTS CATALOG. SUBSTITUTE PARTS MAY APPEAR INTERCHANGEABLE, BUT INTERNAL DIFFERENCES MAY RESULT IN INFERIOR OCCUPANT PROTECTION.

WARNING: THE FASTENERS, SCREWS, AND BOLTS ORIGINALLY USED FOR THE RESTRAINT SYSTEM COMPONENTS HAVE SPECIAL COATINGS AND ARE SPECIFICALLY DESIGNED FOR THE RESTRAINT 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 DAIMLERCHRYSLER MOPAR PARTS CATALOG.

WARNING: WHEN A STEERING COLUMN HAS AN AIRBAG UNIT ATTACHED, NEVER PLACE THE COLUMN ON THE FLOOR OR ANY OTHER SURFACE WITH THE STEERING WHEEL OR AIRBAG UNIT FACE DOWN.

DIAGNOSIS AND TESTING - SUPPLEMENTAL RESTRAINT SYSTEM

Proper diagnosis and testing of the supplemental restraint system components or the Airbag Control Module (ACM), initialization of the ACM, as well as the retrieval or erasure of a Diagnostic Trouble Code (DTC) from the ACM requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

STANDARD PROCEDURE

STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS

At no time should any source of electricity be permitted near the inflator on the back of a non-deployed airbag or seat belt tensioner. When carrying a non-deployed airbag, the trim cover or airbag cushion side of the unit should be pointed away from the body to minimize injury in the event of an accidental deployment. If the airbag unit is placed on a bench or any other surface, the trim cover or airbag cushion side of the unit should be face up to minimize movement in the event of an accidental deployment. When handling a non-deployed seat belt tensioner, take proper care to keep fingers out from under the retractor cover and away from the seat belt webbing where it exits from the retractor cover. In addition, the supplemental restraint system should be disarmed whenever any steering wheel, steering column, seat belt tensioner, driver airbag, passenger airbag, or instrument panel components require diagnosis or service. Failure to observe this warning could result in accidental deployment and possible personal injury.

All damaged, faulty or non-deployed airbags and seat belt tensioners which are replaced on vehicles are to be handled and disposed of properly. If an airbag or seat belt tensioner unit is faulty or damaged and non-deployed, refer to the Hazardous Substance Control System for proper disposal. Dispose of all non-deployed and deployed airbags and seat belt tensioners in a manner consistent with state, provincial, local and federal regulations.

SUPPLEMENTAL RESTRAINT STORAGE

Airbags and seat belt tensioners must be stored in their original, special container until they are used for service. Also, they must be stored in a clean, dry environment; away from sources of extreme heat, sparks, and high electrical energy. Always place or store any airbag on a surface with its trim cover or airbag cushion side facing up, to minimize movement in case of an accidental deployment.

STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT

Any vehicle which is to be returned to use following a supplemental restraint deployment, must have the deployed restraints replaced. In addition, if the driver airbag has been deployed, the clockspring and the steering wheel must be replaced. The seat belt tensioners are deployed by the same signal that deploys the driver and passenger airbags and must also be replaced if either airbag has been deployed. These components are not intended for reuse and will be damaged or weakened as a result of a supplemental restraint deployment, which may or may not be obvious during a visual inspection.

It is also critical that the mounting surfaces and/or mounting brackets for the Airbag Control Module (ACM) be closely inspected and restored to their original conditions following any vehicle impact damage. Because the ACM contains the impact sensor that is used by the supplemental restraint system to monitor or confirm the direction and severity of a vehicle impact, improper orientation or insecure fastening of this component may cause airbags not to deploy when required, or to deploy when not required. All other vehicle components should be closely inspected following any supplemental restraint deployment, but are to be replaced only as required by the extent of the visible damage incurred.

CLEANUP PROCEDURE

Following a supplemental restraint deployment, the vehicle interior will contain a powdery residue. This residue consists primarily of harmless particulate by-products of the small pyrotechnic charge that initiates the propellant used to deploy a supplemental restraint. However, this residue may also contain traces of sodium hydroxide powder, a chemical by-product of the propellant material that is used to generate the inert gas that inflates the airbag. Since sodium hydroxide powder can irritate the skin, eyes, nose, or throat, be certain to wear safety glasses, rubber gloves, and a long-sleeved shirt during cleanup (Fig. 3).

RESTRAINTS (Continued)

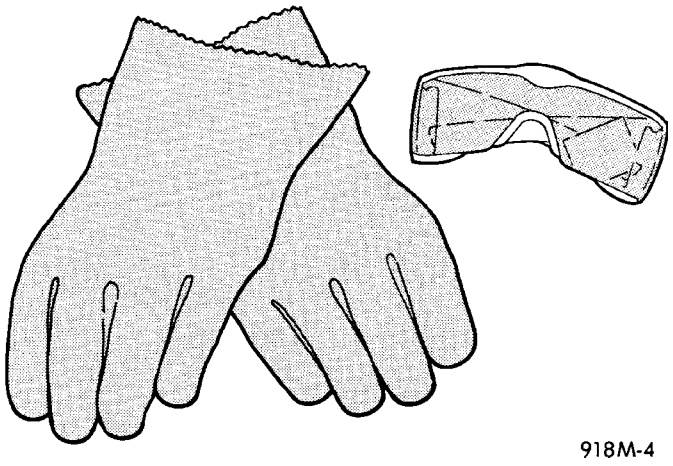


Fig. 3 Wear Safety Glasses and Rubber Gloves - Typical

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.

(1) Begin the cleanup by using 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.

(2) Be certain to vacuum the heater and air conditioning outlets as well (Fig. 4). Run the heater and air conditioner blower on the lowest speed setting and vacuum any powder expelled from the outlets.

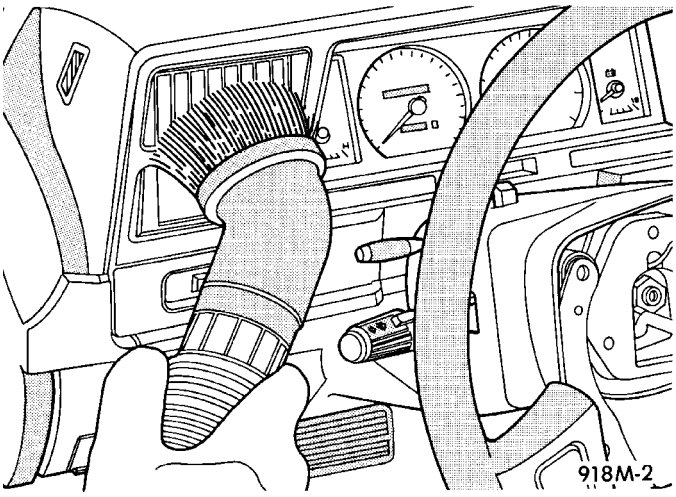


Fig. 4 Vacuum Heater and A/C Outlets - Typical

CAUTION: All damaged, faulty, or non-deployed supplemental restraints which are replaced on vehicles are to be handled and disposed of properly. If an airbag unit or seat belt tensioner unit is faulty or damaged and non-deployed, refer to the Hazardous Substance Control System for proper disposal. Be certain to dispose of all non-deployed and deployed supplemental restraints in a manner consistent with state, provincial, local and federal regulations.

(3) Next, remove the deployed supplemental restraints from the vehicle. Refer to the appropriate service removal procedures.

(4) You may need to vacuum the interior of the vehicle a second time to recover all of the powder.

STANDARD PROCEDURE - VERIFICATION TEST

The following procedure should be performed using a DRBIII® scan tool to verify proper supplemental restraint system operation following the service or replacement of any supplemental restraint system component.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) During the following test, the battery negative cable remains disconnected and isolated, as it was during the supplemental restraint system component removal and installation procedures.

(2) Be certain that the DRBIII® scan tool contains the latest version of the proper DRBIII® software. Connect the DRBIII® to the 16-way Data Link Connector (DLC). The DLC is located on the dash panel beneath the driver side lower edge of the instrument panel, outboard of the steering column (Fig. 5).

(3) Turn the ignition switch to the On position and exit the vehicle with the DRBIII® scan tool.

(4) Check to be certain that nobody is in the vehicle, then reconnect the battery negative cable.

(5) Using the DRBIII®, read and record the active (current) Diagnostic Trouble Code (DTC) data.

(6) Next, use the DRBIII® to read and record any stored (historical) DTC data.

(7) If any DTC is found in Step 5 or Step 6, refer to the appropriate diagnostic information.

(8) Use the DRBIII® to erase the stored DTC data. If any problems remain, the stored DTC data will not

RESTRAINTS (Continued)

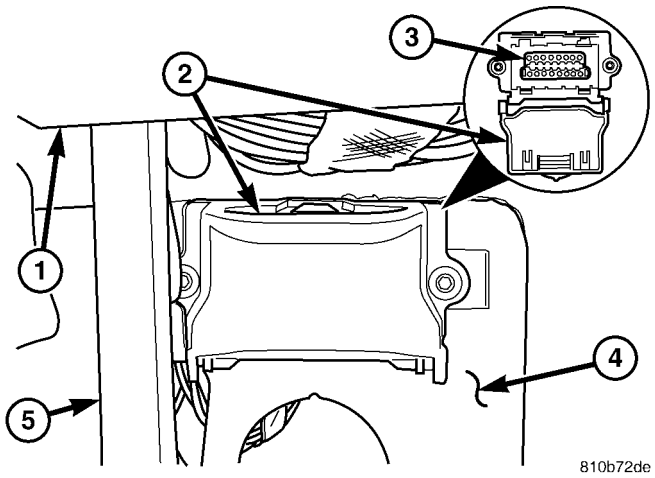


Fig. 5 16-Way Data Link Connector

1 - BOTTOM OF INSTRUMENT PANEL
2 - CONNECTOR COVER
3 - 16-WAY DATA LINK CONNECTOR
4 - DASH PANEL
5 - INSIDE HOOD RELEASE LEVER

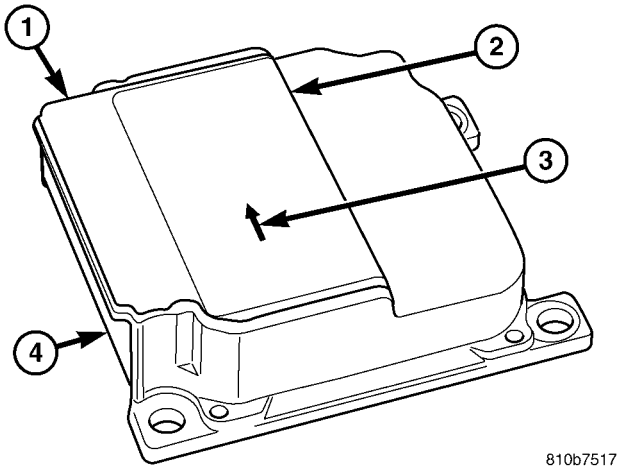


Fig. 6 Airbag Control Module

1 - AIRBAG CONTROL MODULE
2 - LABEL
3 - ORIENTATION ARROW
4 - CONNECTOR RECEPTACLE

erase. Refer to the appropriate diagnostic information to diagnose any stored DTC that will not erase. If the stored DTC information is successfully erased, go to Step 9.

(9) Turn the ignition switch to the Off position for about fifteen seconds, and then back to the On position. Observe the airbag indicator in the instrument cluster. It should illuminate for four seconds, then go out. This indicates that the supplemental restraint system is functioning normally and that the repairs are complete. If the airbag indicator fails to light, or lights and stays on, there is still an active supplemental restraint system fault or malfunction. Refer to the appropriate diagnostic information to diagnose the problem.

NOTE: If the Airbag Control Module (ACM) has been replaced with a new unit, it will be necessary to initialize the new ACM. In order to function properly, the ACM must be programmed for the correct standard and optional supplemental restraint system components installed in the vehicle. To initialize the ACM, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

AIRBAG CONTROL MODULE

DESCRIPTION

The Airbag Control Module (ACM) is secured with three screws to the top mounting surface of a stamped steel bracket that is welded onto the floor panel within the seat riser underneath the driver side front seat in the passenger compartment of the vehicle (Fig. 6). A molded plastic protective cover is installed over the ACM and secured with integral snap features to a flat metal base plate sandwiched between the bottom of the ACM and the mounting bracket on the floor panel (Fig. 7). This cover is designed to shield the ACM and its wire harness connection from other electrical components and wiring located within the seat riser area beneath the driver seat, and must always be reinstalled following service removal.

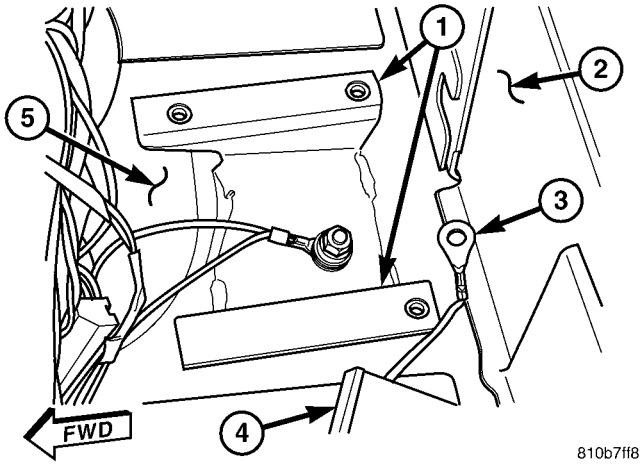


Fig. 7 ACM Bracket

1 - ACM BRACKET
2 - SEAT RISER
3 - EYELET TERMINAL
4 - ACM CONNECTOR
5 - FLOOR PANEL

Concealed within a hollow in the center of the die cast white metal ACM housing is the electronic circuitry of the ACM which includes a microprocessor,

AIRBAG CONTROL MODULE (Continued)

an electronic impact sensor, and an energy storage capacitor. The ACM housing has three integral mounting tabs. A stamped metal cover plate is permanently secured to the bottom of the ACM housing to enclose and protect the internal electronic circuitry and components. An arrow printed on a label on the top of the ACM housing near the rear provides a visual verification of the proper orientation of the unit, and should always be pointed toward the front of the vehicle. A molded plastic electrical connector receptacle containing numerous terminal pins is integral to the left facing side of the ACM housing. These terminal pins connect the ACM to the vehicle electrical system through a dedicated take out and connector of the vehicle wire harness.

The impact sensor internal to the ACM is calibrated for the specific vehicle, and is only serviced as a unit with the ACM. The ACM cannot be repaired or adjusted and, if damaged or faulty, it must be replaced.

OPERATION

The microprocessor in the Airbag Control Module (ACM) contains the supplemental restraint system logic circuits and controls all of the supplemental restraint system components. The ACM uses On-Board Diagnostics (OBD) and can communicate with the DRBIII® scan tool using a diagnostic Serial Communication Interface (SCI) data bus line for supplemental restraint system programming or diagnosis and testing through the 16-way Data Link Connector (DLC) located on the dash panel below the driver side end of the instrument panel. A hard wired output from the ACM is used for control of the airbag indicator in the ElectroMechanical Instrument Cluster (EMIC). (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER/AIRBAG INDICATOR - OPERATION).

The ACM microprocessor continuously monitors all of the supplemental restraint system electrical circuits to determine the system readiness. If the ACM detects a monitored system fault, it sets an appropriate Diagnostic Trouble Code (DTC) and sends an output to the EMIC to turn on the airbag indicator. The ACM illuminates the indicator for about four seconds each time the ignition switch is turned to the On position as a bulb test. If the indicator remains illuminated for about ten seconds after the ignition switch is turned to the On position, the ACM has detected a non-critical fault that poses no danger to the vehicle occupants. If the airbag indicator illuminates solid (not flashing) while driving or stays on longer than ten seconds following the bulb test, the ACM has detected a critical fault that may cause the airbags not to deploy when required or to deploy when not required. An active fault only remains for the duration of the fault, or in some cases, for the duration of the current ignition switch cycle, while a stored fault causes a DTC to be stored in memory by the ACM.

The ACM receives battery current through a fused ignition switch output circuit. The ACM receives ground through a ground circuit and take out of the vehicle wire harness. This take out has an eyelet terminal connector secured by a nut to a ground stud on the floor panel directly below the ACM within the driver side seat riser. A case ground is also provided for the ACM through a ground circuit and eyelet terminal connector secured under the left rear ACM mounting screw. These connections allow the ACM to be operational whenever the ignition switch is in the On position. The ACM also contains an energy-storage capacitor. When the ignition switch is in the On position, this capacitor is continually being charged with enough electrical energy to deploy the supplemental restraint components for up to one second following a battery disconnect or failure. The purpose of the capacitor is to provide backup supplemental restraint system protection in case there is a loss of battery current supply to the ACM during an impact.

An electronic impact sensor is contained within the ACM. The electronic impact sensor is an accelerometer that senses the rate of vehicle deceleration, which provides verification of the direction and severity of an impact. 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 supplemental restraint system protection. When the programmed conditions are met, the ACM sends the proper electrical signals to deploy the seat belt tensioners and front airbags.

The ACM also provides a hard wired electrical crash signal output following a supplemental restraint deployment event. This output is used to signal other electronic modules in the vehicle to provide their enhanced accident response features, which include automatically disabling the engine from running and unlocking all of the doors. However, these responses are each dependent upon the circuits, components, and modules controlling these features remaining intact from collateral damage incurred during the vehicle impact.

A single ACM is used for all variations of the supplemental restraint system available in this vehicle. This ACM is programmable and in order to function properly it must be programmed for the correct vehicle supplemental restraint system equipment using an initialization procedure. The initialization procedure requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information. The hard wired inputs and outputs for the ACM may be diag-

AIRBAG CONTROL MODULE (Continued)

nosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods will not prove conclusive in the diagnosis of the ACM or the supplemental restraint system. The most reliable, efficient, and accurate means to diagnose the ACM or the supplemental restraint system requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: THE AIRBAG CONTROL MODULE CONTAINS THE IMPACT SENSOR, WHICH ENABLES THE SYSTEM TO DEPLOY THE SUPPLEMENTAL RESTRAINTS. NEVER STRIKE OR DROP 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 SUPPLEMENTAL RESTRAINT DEPLOYMENT AND POSSIBLE OCCUPANT INJURIES.

(1) Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.

(2) Move the driver side front seat to its most forward position for easiest access to the seat riser cover panel (Fig. 8).

(3) Remove the two screws that secure the cover panel to the top of the seat riser under the driver side front seat (Fig. 9).

(4) Remove the cover panel from the top of the driver side seat riser.

(5) Remove the two screws that secure the control module bracket to the top of the seat riser under the driver side front seat (Fig. 10).

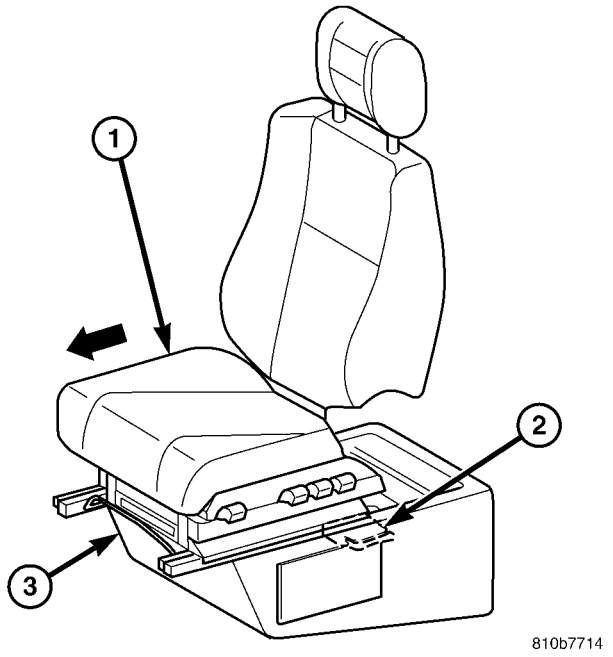


Fig. 8 Airbag Control Module Location

1 - DRIVER SEAT
2 - AIRBAG CONTROL MODULE
3 - SEAT RISER

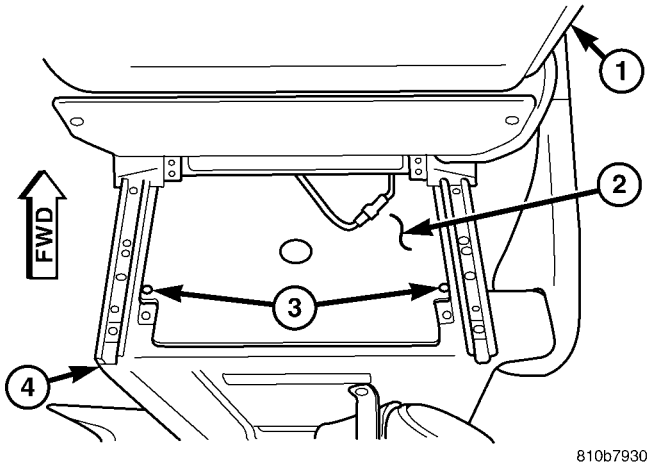


Fig. 9 Seat Riser Cover

1 - DRIVER SEAT BACK
2 - COVER PANEL
3 - SCREW (2)
4 - SEAT RISER

(6) Remove the control module bracket from the top of the driver side seat riser.

(7) Locate the Airbag Control Module (ACM) in the right rear corner of the area within the driver side seat riser. Firmly grasp and pull upward on the molded plastic cover to unsnap it from over the ACM (Fig. 11).

AIRBAG CONTROL MODULE (Continued)

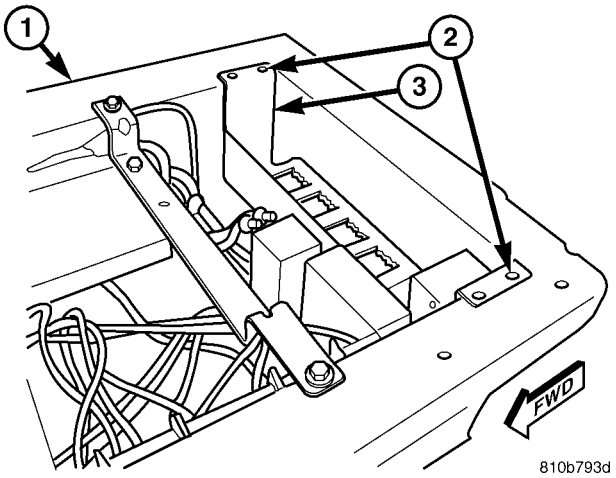


Fig. 10 Control Module Bracket

1 - SEAT RISER
2 - SCREW (2)
3 - CONTROL MODULE BRACKET

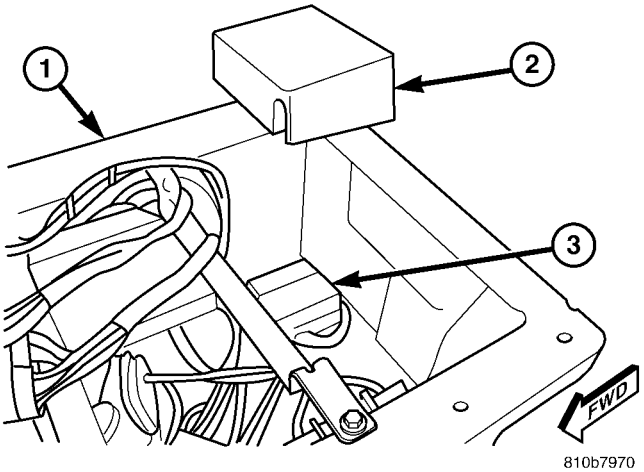


Fig. 11 ACM Cover

1 - SEAT RISER
2 - COVER
3 - ACM

(8) Remove the three screws that secure the ACM to the bracket that is welded onto the floor panel under the driver side front seat (Fig. 12).

(9) Lift the ACM upward far enough to access the ACM wiring connection. Depress the release and lift the lever arm to disconnect the vehicle wire harness connector for the ACM from the ACM connector receptacle located on the left facing side of the module.

(10) Remove the ACM from within the driver side front seat riser.

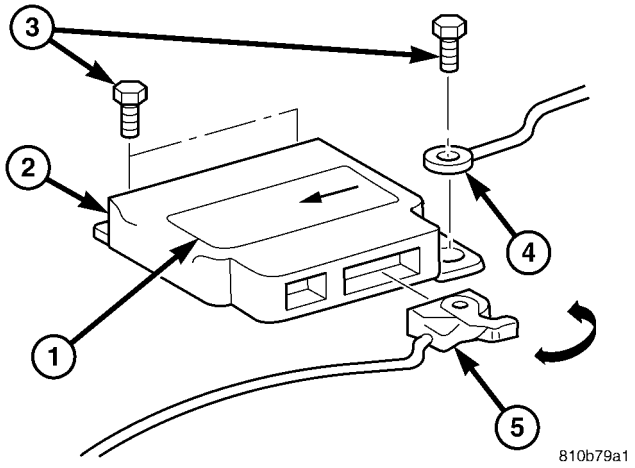


Fig. 12 Airbag Control Module Remove/Install

1 - ACM LABEL
2 - ACM
3 - SCREW (3)
4 - GROUND EYELET
5 - CONNECTOR

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: THE AIRBAG CONTROL MODULE CONTAINS THE IMPACT SENSOR, WHICH ENABLES THE SYSTEM TO DEPLOY THE SUPPLEMENTAL RESTRAINTS. NEVER STRIKE OR DROP 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 SUPPLEMENTAL RESTRAINT DEPLOYMENT AND POSSIBLE OCCUPANT INJURIES.

AIRBAG CONTROL MODULE (Continued)

(1) Reconnect and latch the vehicle wire harness connector for the ACM to the ACM connector receptacle located on the left facing side of the module (Fig. 12).

(2) Carefully position the ACM cover base plate onto the mounting bracket that is welded onto the floor panel under the driver side front seat (Fig. 13).

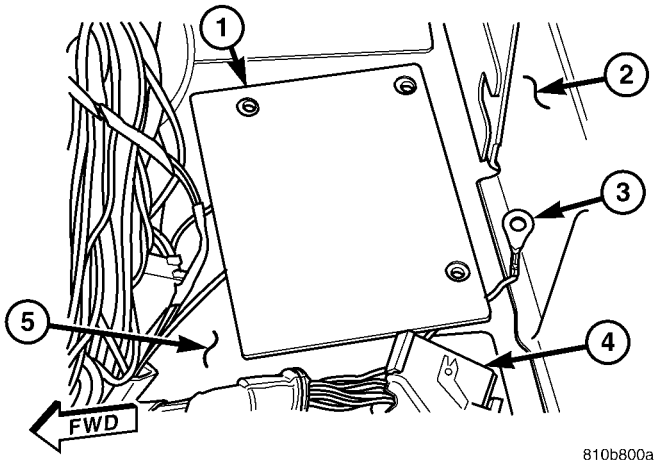


Fig. 13 ACM Cover Base Plate

1 - BASE PLATE
2 - SEAT RISER
3 - GROUND EYELET TERMINAL
4 - ACM CONNECTOR
5 - FLOOR PANEL

(3) Carefully position the ACM onto the ACM cover base plate. When the ACM is correctly positioned, the three ACM mounting tabs will be aligned with the holes in the cover base plate and the mounting bracket, and the orientation arrow on the ACM label will be pointed forward in the vehicle.

(4) Install and tighten the three screws that secure the ACM to the mounting bracket that is welded onto the floor panel within the driver side front seat riser. Be certain that the ground eyelet terminal is installed under the screw for the left rear mounting tab. Tighten the screws to 12 N·m (105 in. lbs.).

(5) Position the ACM cover over the ACM and press it down firmly and evenly until it snaps into position over the ACM cover base plate (Fig. 11).

(6) Position the control module bracket onto the top of the driver side seat riser (Fig. 10).

(7) Install and tighten the two screws that secure the control module bracket to the top of the seat riser under the driver side front seat. Tighten the screws to 2 N·m (18 in. lbs.).

(8) Position the cover panel onto the top of the driver side seat riser (Fig. 9).

(9) Install and tighten the two screws that secure the cover panel to the top of the seat riser under the driver side front seat. Tighten the screws to 2 N·m (18 in. lbs.).

(10) Move the driver side front seat back to its driving position.

(11) Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

NOTE: If the Airbag Control Module (ACM) has been replaced with a new unit, it will be necessary to initialize the new ACM. In order to function properly, the ACM must be programmed for the correct standard and optional supplemental restraint system components installed in the vehicle. To initialize the ACM, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

CLOCKSPRING

DESCRIPTION

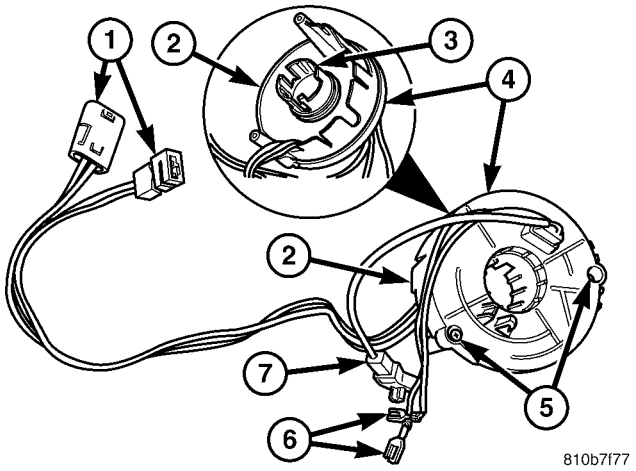


Fig. 14 Clockspring

1 - PIGTAIL WIRE CONNECTOR (2)
2 - CASE
3 - CANCEL CAM
4 - ROTOR
5 - SCREW (2)
6 - HORN SWITCH CONNECTOR (2)
7 - AIRBAG CONNECTOR

The clockspring assembly is secured with two screws onto the multi-function switch housing near the top of the steering column directly below the steering wheel (Fig. 14). The clockspring consists of a flat, round molded plastic case that contains a spool-like molded plastic rotor with a large exposed hub covering the entire upper surface of the case. The rotor hub has a large center hole that is internally ribbed to engage splines on the upper steering column shaft, and two small clearance holes that pro-

CLOCKSPRING (Continued)

vide access to the case mounting screws. The lower side of the rotor hub also serves as an integral molded plastic turn signal cancel cam.

A single connector receptacle on the upper surface of the rotor has pigtail wires that connect to the horn switch and the driver airbag on the steering wheel, while a single connector receptacle on the lower surface of the case has pigtail wires that connect the clockspring to the vehicle wire harness on the steering column. Within the plastic case and wound around the rotor spool is a long ribbon-like tape that consists of several thin copper wire leads sandwiched between two thin plastic membranes. The outer end of the tape terminates at the connector receptacle that faces the steering column, while the inner end of the tape terminates at the connector receptacle on the hub of the clockspring rotor that faces the steering wheel.

Service replacement clocksprings are shipped precentered and with the mounting screws backed out from the case far enough to engage the access holes in the upper surface of the rotor. The mounting screws secure the centered clockspring rotor to the clockspring case during shipment, but allow free rotation of the rotor once the clockspring is properly installed on the steering column. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - STANDARD PROCEDURE - CLOCKSPRING CENTERING).

The clockspring cannot be repaired. If the clockspring is faulty, damaged, or if the driver airbag has been deployed, the clockspring must be replaced.

OPERATION

The clockspring is a mechanical electrical circuit component that is used to provide continuous electrical continuity between the fixed vehicle wire harness and the electrical components mounted on or in the rotating steering wheel. On this model the rotating electrical components include the driver airbag and the horn switch. The clockspring case is positioned and secured to the multi-function switch housing near the top of the steering column. The connector receptacle on the underside of the fixed clockspring case connects the clockspring to the vehicle electrical system through two take outs with connectors from the vehicle wire harness.

The clockspring rotor is movable and is keyed by integral molded ribs on the inner circumference of the rotor hub to the splines on the external circumference of the upper steering column shaft. The two integral lobes of the turn signal cancel cam formation on the lower surface of the clockspring rotor hub contact the turn signal cancel actuator of the multi-function switch to provide automatic turn signal cancellation. The yellow sleeved pigtail wire on the upper surface of the clockspring rotor connects the clockspring to the driver airbag, while two single pigtail wires connect to the feed and ground terminals of the horn switch located within the hub cavity of the steering wheel.

Like the clockspring in a timepiece, the clockspring tape has travel limits and can be damaged by being wound too tightly during full stop-to-stop steering wheel rotation. 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 the movable steering components so that the tape can operate within its designed travel limits. However, if the clockspring is removed from the steering column or if the steering shaft is disconnected from the steering gear, the clockspring spool can change position relative to the movable steering components. The clockspring must be re-centered following completion of this service or the tape may be damaged.

Service replacement clocksprings are shipped precentered and with the mounting screws backed out from the case far enough to engage the access holes in the upper surface of the rotor. The mounting screws secure the centered clockspring rotor to the clockspring case during shipment, but allow free rotation of the rotor once the clockspring is properly installed on the steering column. The clockspring mounting screws should not be tightened into the clockspring case until the clockspring has been installed on the steering column. If the screws are tightened into or removed from the case before the clockspring is installed on a steering column, the clockspring centering procedure must be performed. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - STANDARD PROCEDURE - CLOCKSPRING CENTERING).

STANDARD PROCEDURE - 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 six to seven 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 three to three 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 com-

CLOCKSPRING (Continued)

pletion of such service or the clockspring tape may be damaged. Service replacement clocksprings are shipped pre-centered and with the mounting screws backed out from the case far enough to engage the access holes in the upper surface of the rotor (Fig. 15). The clockspring mounting screws should not be tightened into the clockspring case until the clockspring has been installed on the steering column. If the screws are tightened into or removed from the case before the clockspring is installed on a steering column, the clockspring centering procedure must be performed.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

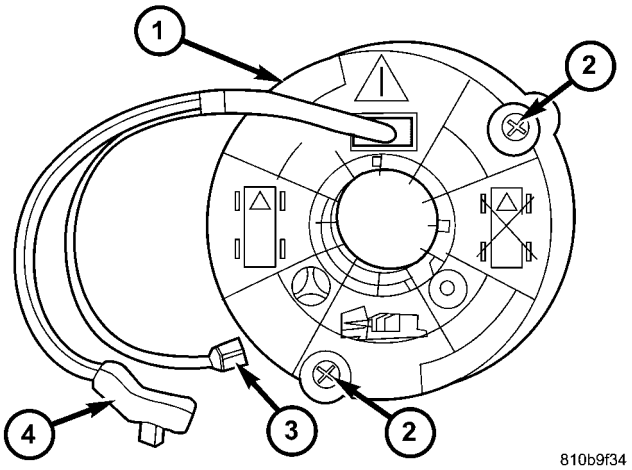


Fig. 15 Clockspring Centering

1 - CLOCKSPRING ROTOR
2 - SCREW (2)
3 - HORN SWITCH CONNECTOR (2)
4 - AIRBAG CONNECTOR

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 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - REMOVAL).

(3) Tighten the two clockspring mounting screws all the way into the clockspring case.

(4) Rotate the clockspring rotor counterclockwise to the end of its travel. **Do not apply excessive torque.**

(5) From the end of the counterclockwise travel, rotate the rotor about three to three and one-half turns clockwise, until the clearance holes in the clockspring rotor are aligned with the two mounting screws in the clockspring case. The clockspring is now centered.

(6) Loosen the two clockspring mounting screws far enough so that they extend into the clearance holes in the upper surface of the clockspring rotor, preventing the rotor from changing position relative to the clockspring case.

(7) The front wheels should still be in the straight-ahead position. Reinstall the clockspring onto the steering column. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - INSTALLATION).

REMOVAL

The clockspring cannot be repaired. It must be replaced if faulty or damaged, or if the driver airbag has been deployed.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

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 airbag from the steering wheel. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - REMOVAL).

CLOCKSPRING (Continued)

(3) Disconnect the clockspring upper pigtail wire connectors from the terminals of the horn switch located in the hub cavity of the steering wheel.

(4) Remove the steering wheel from the steering column. (Refer to 19 - STEERING/COLUMN/STEERING WHEEL - REMOVAL).

(5) Remove the steering column opening cover from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - REMOVAL).

(6) Disconnect the two clockspring lower pigtail connectors from the vehicle wire harness connectors located between the steering column and the back of the fuse block underneath the steering column (Fig. 16).

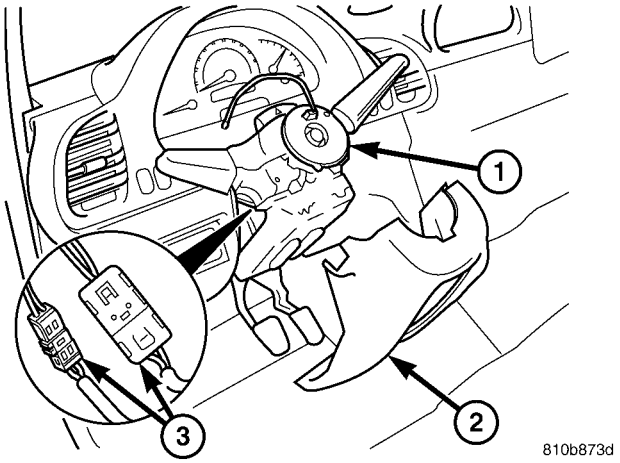


Fig. 16 Clockspring Remove/Install

1 - CLOCKSPRING
2 - SHROUD
3 - LOWER PIGTAIL CONNECTOR (2)

(7) Loosen the two screws that secure the clockspring to the multi-function switch housing far enough to engage the clearance holes in the clockspring rotor and to disengage the clockspring case from the switch housing.

(8) Remove the clockspring from the multi-function switch housing. The clockspring cannot be repaired. It must be replaced if faulty or damaged, or if the driver airbag has been deployed.

(9) If the removed clockspring is to be reused, be certain that the clockspring rotor is secured to the clockspring case to maintain clockspring centering until it is reinstalled on the steering column. If clockspring centering is not maintained, the clockspring must be centered again before it is reinstalled. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - STANDARD PROCEDURE - CLOCKSPRING CENTERING).

INSTALLATION

The clockspring cannot be repaired. It must be replaced if faulty or damaged, or if the driver airbag has been deployed.

If the clockspring is not properly centered in relation to the steering wheel, steering shaft and steering gear, it may be damaged. (Refer to 8 - ELECTRICAL/RESTRAINTS/CLOCKSPRING - STANDARD PROCEDURE - CLOCKSPRING CENTERING). Service replacement clocksprings are shipped pre-centered and with the mounting screws backed out from the case far enough to engage the access holes in the upper surface of the rotor. The clockspring mounting screws should not be tightened into the clockspring case until the clockspring has been installed on the steering column. If the screws are tightened into or removed from the case before the clockspring is installed on a steering column, the clockspring centering procedure must be performed.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

NOTE: Before starting this procedure, be certain that the front wheels are still in the straight-ahead position.

(1) Carefully slide the centered clockspring down over the steering column upper shaft until the screws in the clockspring case are aligned with the mounting holes on the multi-function switch housing.

(2) Tighten the two screws that secure the clockspring to the multi-function switch mounting housing. Tighten the screws to 2 N·m (18 in. lbs.).

(3) Reconnect the two clockspring lower pigtail connectors to the vehicle wire harness connectors located between the steering column and the back of the fuse block underneath the steering column (Fig. 16).

(4) Route the clockspring lower pigtail wires around the lug on the bottom of the multi-function

CLOCKSPRING (Continued)

switch housing and behind the fuse block underneath the steering column (Fig. 17).

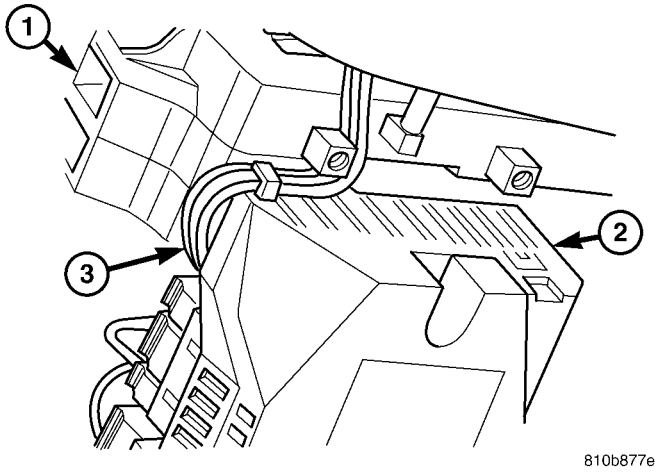


Fig. 17 Clockspring Pigtail Routing

1 - MULTI-FUNCTION SWITCH
2 - FUSE BLOCK
3 - CLOCKSPRING LOWER PIGTAILS (2)

(5) Reinstall the steering column opening cover onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/STEERING COLUMN OPENING COVER - INSTALLATION).

(6) Reinstall the steering wheel onto the steering column. (Refer to 19 - STEERING/COLUMN/STEERING WHEEL - INSTALLATION).

(7) Reconnect the clockspring upper pigtail wire connectors to the terminals of the horn switch located in the hub cavity of the steering wheel.

(8) Reinstall the driver airbag onto the steering wheel. (Refer to 8 - ELECTRICAL/RESTRAINTS/DRIVER AIRBAG - INSTALLATION).

DRIVER AIRBAG

DESCRIPTION

The color-keyed, injection molded, thermoplastic driver airbag protective trim cover is the most visible part of the driver airbag (Fig. 18). The driver airbag is located in the center of the steering wheel, where it is secured with two screws to the armature of the horn switch within the hub cavity of the four-spoke steering wheel. Concealed beneath the driver airbag trim cover are the folded airbag cushion, the airbag cushion retainer, the airbag housing, the airbag inflator, and the retainers that secure the inflator to the airbag housing (Fig. 19). The airbag cushion, housing, and inflator are secured within an integral receptacle molded into the back of the trim cover.

The airbag used in this model is a Next Generation-type that complies with revised federal airbag standards to deploy with less force than those used

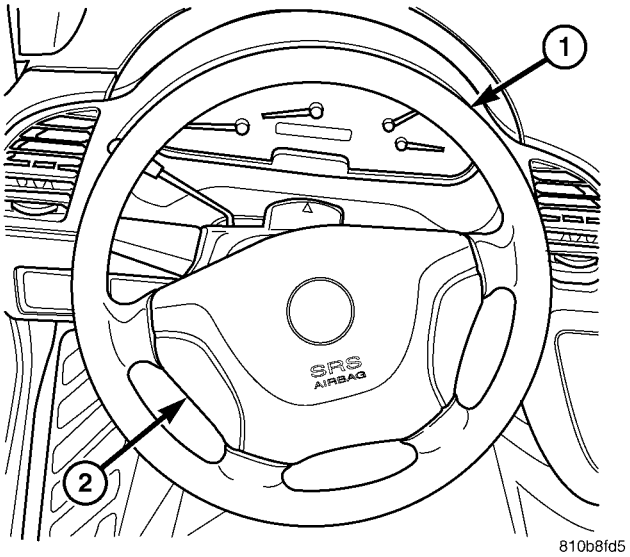


Fig. 18 Driver Airbag Trim Cover

1 - STEERING WHEEL
2 - TRIM COVER

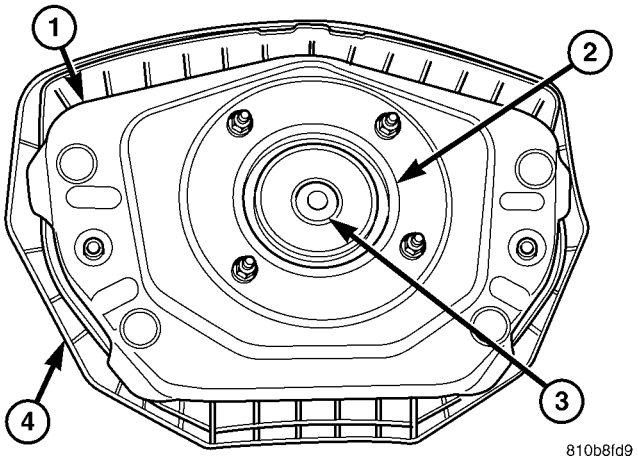


Fig. 19 Driver Airbag Housing

1 - HOUSING
2 - INFLATOR
3 - CONNECTOR RECEPTACLE
4 - TRIM COVER

in some prior models. A radial deploying fabric cushion with internal tethers is used. The airbag inflator is a solid fuel, pyrotechnic-type unit with four studs and is secured by four hex nuts to four studs on the airbag cushion retainer ring to the back of the stamped metal airbag housing. A keyed connector receptacle on the driver airbag inflator connects the inflator initiator to the vehicle electrical system through a yellow-jacketed, two-wire pigtail harness of the clockspring.

The driver airbag and trim cover unit cannot be repaired, and must be replaced if deployed, faulty, or in any way damaged.

DRIVER AIRBAG (Continued)

OPERATION

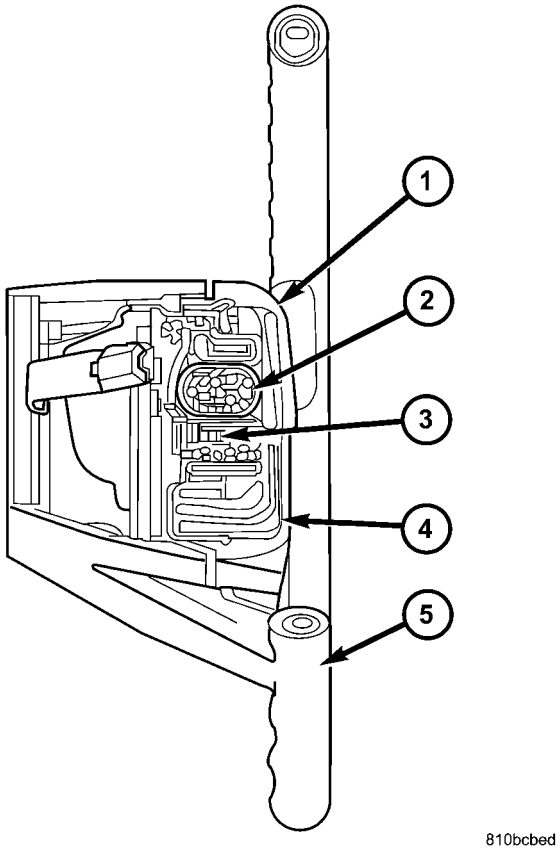


Fig. 20 Driver Airbag Operation

1 - TRIM COVER
2 - INFLATOR
3 - INITIATOR
4 - CUSHION (FOLDED)
5 - STEERING WHEEL

The driver airbag is deployed by electrical signals generated by the Airbag Control Module (ACM) through the driver airbag squib circuit to the initiator in the airbag inflator (Fig. 20). When the ACM sends the proper electrical signal to the initiator the electrical energy generates enough heat to initiate a small pyrotechnic charge which, in turn, ignites chemical pellets within the inflator. Once ignited, these chemical pellets burn rapidly and produce a large quantity of inert gas. The inflator is sealed to the back of the airbag housing and a diffuser in the inflator directs all of the inert gas into the airbag cushion, causing the cushion to inflate. As the cushion inflates, the driver airbag trim cover will split at predetermined breakout lines, then fold back out of the way. Following an airbag deployment, the airbag cushion quickly deflates by venting the inert gas towards the instrument panel through filtered vents within the fabric used to construct the back (steering wheel side) panel of the airbag cushion.

Some of the chemicals used to create the inert gas may be considered hazardous while in their solid state before they are burned, but they are securely sealed within the airbag inflator. Typically, all potentially hazardous chemicals are burned during an airbag deployment event. The inert gas that is produced when the chemicals are burned is harmless. However, a small amount of residue from the burned chemicals may cause some temporary discomfort if it contacts the skin, eyes, or breathing passages. If skin or eye irritation is noted, rinse the affected area with plenty of cool, clean water. If breathing passages are irritated, move to another area where there is plenty of clean, fresh air to breath. If the irritation is not alleviated by these actions, contact a physician.

REMOVAL

The following procedure is for replacement of a faulty or damaged driver airbag. If the airbag is faulty or damaged, but not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/ RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the driver airbag has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the airbag from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: WHEN REMOVING A DEPLOYED AIRBAG, RUBBER GLOVES, EYE PROTECTION, AND A LONG-SLEEVED SHIRT SHOULD BE WORN. THERE MAY BE DEPOSITS ON THE AIRBAG CUSHION AND OTHER INTERIOR SURFACES. IN LARGE DOSES, THESE DEPOSITS MAY CAUSE IRRITATION TO THE SKIN AND EYES.

DRIVER AIRBAG (Continued)

(1) Disconnect and isolate the battery negative cable. 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 airbag to the horn switch armature within the hub cavity of the steering wheel (Fig. 21).

(3) Pull the driver airbag away from the steering wheel far enough to access the electrical connection at the back of the airbag housing.

CAUTION: Do not pull on the clockspring pigtail wires to disengage the connector from the driver airbag inflator connector receptacle. Improper removal of these pigtail wires and their connector insulator can result in damage to the airbag circuits or the connector insulator.

(4) The clockspring driver airbag pigtail wire connector is a tight snap-fit into the airbag inflator connector receptacle, which is located on the back of the driver airbag housing. Firmly grasp and pull or gently pry on the connector insulator and pull the connector straight out from the airbag inflator to disconnect it from the connector receptacle.

(5) Remove the driver airbag from the steering wheel.

(6) If the driver airbag has been deployed, the clockspring and the steering wheel must also be replaced. (Refer to 8 - ELECTRICAL/RESTRAINTS/ CLOCKSPRING - REMOVAL) and (Refer to 19 - STEERING/COLUMN/STEERING WHEEL - REMOVAL).

INSTALLATION

The following procedure is for replacement of a faulty or damaged driver airbag. If the airbag is faulty or damaged, but not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/ RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the driver airbag has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the airbag from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

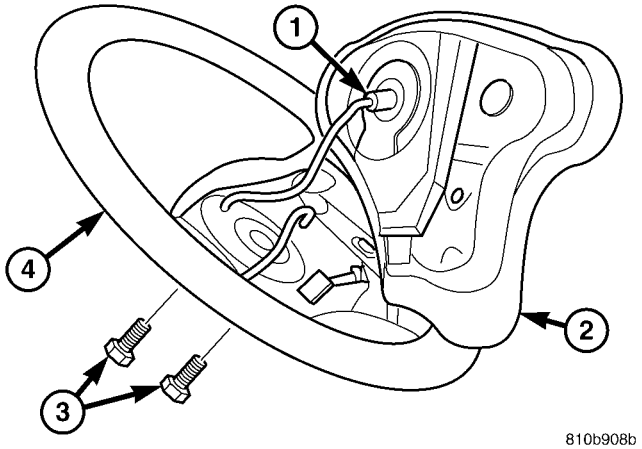


Fig. 21 Driver Airbag Remove/Install

1 - AIRBAG CONNECTOR
2 - DRIVER AIRBAG
3 - SCREW (2)
4 - STEERING WHEEL

DRIVER AIRBAG (Continued)

WARNING: USE EXTREME CARE TO PREVENT ANY FOREIGN MATERIAL FROM ENTERING THE DRIVER AIRBAG, OR BECOMING ENTRAPPED BETWEEN THE DRIVER AIRBAG CUSHION AND THE DRIVER AIRBAG TRIM COVER. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.

WARNING: THE DRIVER AIRBAG TRIM COVER MUST NEVER BE PAINTED. REPLACEMENT AIRBAGS ARE SERVICED WITH TRIM COVERS 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) Position the driver airbag close enough to the steering wheel to reconnect the clockspring driver airbag pigtail wire connector at the back of the airbag housing.

(2) When installing the driver airbag, reconnect the clockspring driver airbag pigtail wire connector to the airbag inflator connector receptacle by pressing straight in on the connector (Fig. 21). You can be certain that the connector is fully engaged by listening carefully for a distinct, audible click as the connector snaps into place.

(3) Carefully position the driver airbag in the steering wheel. Be certain that the clockspring pigtail wire and horn switch wires in the steering wheel hub area are not pinched between the driver airbag and the horn switch armature.

(4) From the underside of the steering wheel, install and tighten the two screws that secure the driver airbag to the horn switch armature within the hub cavity of the steering wheel. Tighten the screws to 6 N·m (53 in. lbs.).

(5) Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

FRONT SEAT BELT & RETRACTOR

REMOVAL

The following procedure is for replacement of a faulty or damaged front seat belt and retractor unit, which includes a seat belt tensioner for the driver side as standard equipment. Vehicles equipped with an optional passenger airbag also have a seat belt tensioner for the passenger side. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT TENSIONER - DESCRIPTION). If the seat belt or retractor is faulty or damaged, but the seat belt tensioner is not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the seat belt tensioner has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the front seat belt and retractor from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: DURING AND FOLLOWING ANY SEAT BELT SERVICE, CAREFULLY INSPECT ALL SEAT BELTS, BUCKLES, MOUNTING HARDWARE, RETRACTORS, AND ANCHORS FOR PROPER INSTALLATION, OPERATION, OR DAMAGE. REPLACE ANY BELT THAT IS CUT, FRAYED, OR TORN. STRAIGHTEN ANY BELT THAT IS TWISTED. TIGHTEN ANY LOOSE FASTENERS. REPLACE ANY BELT THAT HAS A DAMAGED OR INOPERATIVE BUCKLE OR RETRACTOR. REPLACE ANY BELT THAT HAS A BENT OR DAMAGED LATCH PLATE OR ANCHOR PLATE. NEVER ATTEMPT TO REPAIR A SEAT BELT COMPONENT. ALWAYS REPLACE DAMAGED OR FAULTY SEAT BELT COMPONENTS WITH THE CORRECT, NEW AND UNUSED REPLACEMENT PARTS LISTED IN THE DAIMLERCHRYSLER MOPAR PARTS CATALOG.

(1) Move the front seat to its most forward position for easiest access to the B-pillar trim.

FRONT SEAT BELT & RETRACTOR (Continued)

(2) Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.

(3) If the vehicle is so equipped, unsnap and remove the plastic cover from the screw that secures the front seat belt lower anchor to the outboard side of the seat frame (Fig. 22).

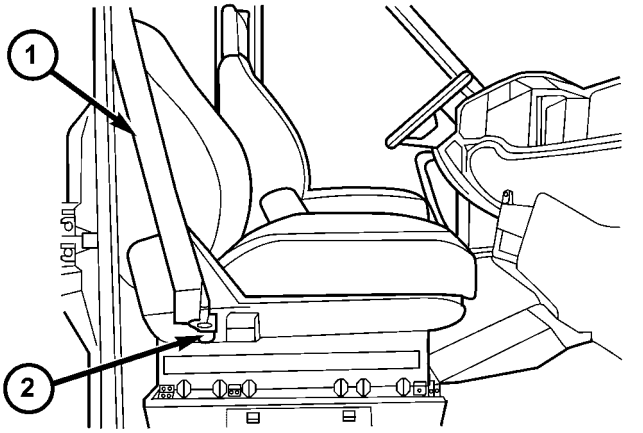


Fig. 22 Front Seat Belt Lower Anchor

1 - FRONT SEAT BELT
2 - COVER AND/OR SCREW

(4) Remove the screw that secures the front seat belt lower anchor to the outboard side of the seat frame.

(5) Remove the front seat belt lower anchor from the outboard side of the seat frame.

(6) Remove the trim panel from the inside of the B-pillar. (Refer to 23 - BODY/INTERIOR/B-PILLAR TRIM - REMOVAL).

(7) Pull the height adjuster trim away from the upper B-pillar to disengage the driver from the lug of the height adjuster (Fig. 23).

(8) Pull the front seat belt and lower anchor through the back of the height adjuster trim.

(9) Remove the nut that secures the front seat belt turning loop to the height adjuster (Fig. 24).

(10) Remove the front seat belt turning loop from the height adjuster.

CAUTION: Do not pull on the wires to disengage the connector from the seat belt tensioner initiator connector receptacle. Improper removal of the connector insulator can result in damage to the seat belt tensioner circuits or the connector insulator.

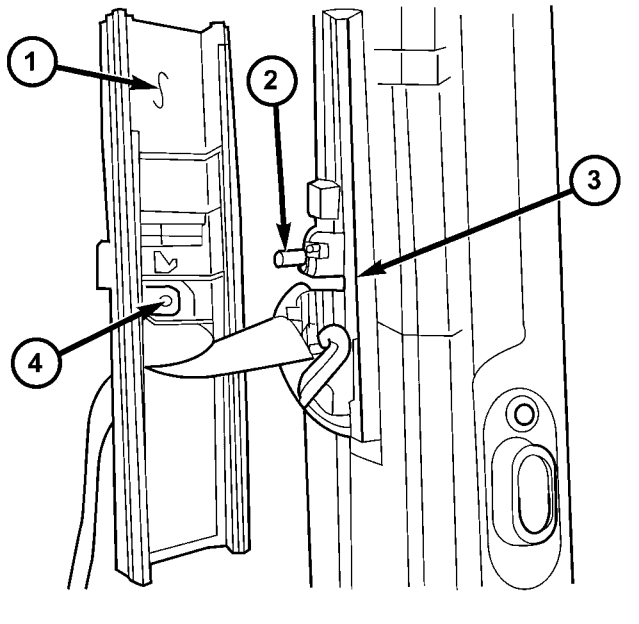


Fig. 23 Turning Loop Height Adjuster

1 - HEIGHT ADJUSTER TRIM
2 - LUG
3 - HEIGHT ADJUSTER
4 - DRIVER

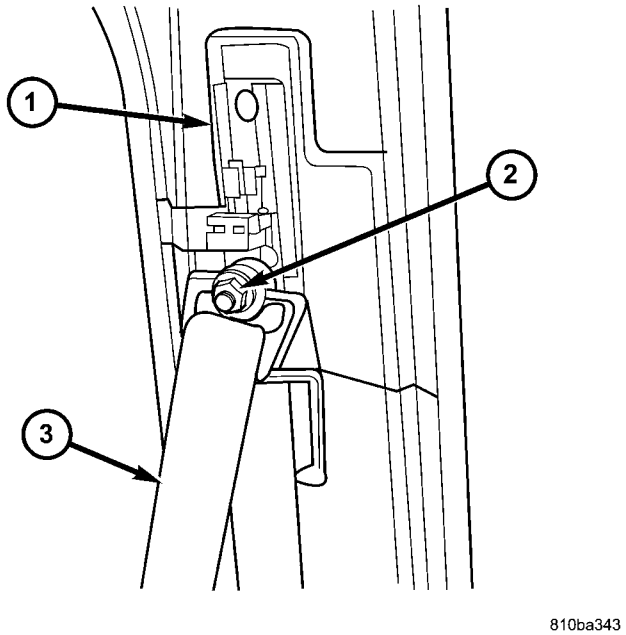


Fig. 24 Front Seat Belt Turning Loop

1 - HEIGHT ADJUSTER
2 - NUT
3 - FRONT SEAT BELT

FRONT SEAT BELT & RETRACTOR (Continued)

(11) If so equipped, disconnect the vehicle wire harness connector for the seat belt tensioner from the initiator receptacle of the retractor located on the lower inner B-pillar (Fig. 25). The connector is a tight snap-fit into the initiator receptacle. Firmly grasp and pull or gently pry on the connector insulator and pull the connector straight out from the initiator to disconnect it from the receptacle.

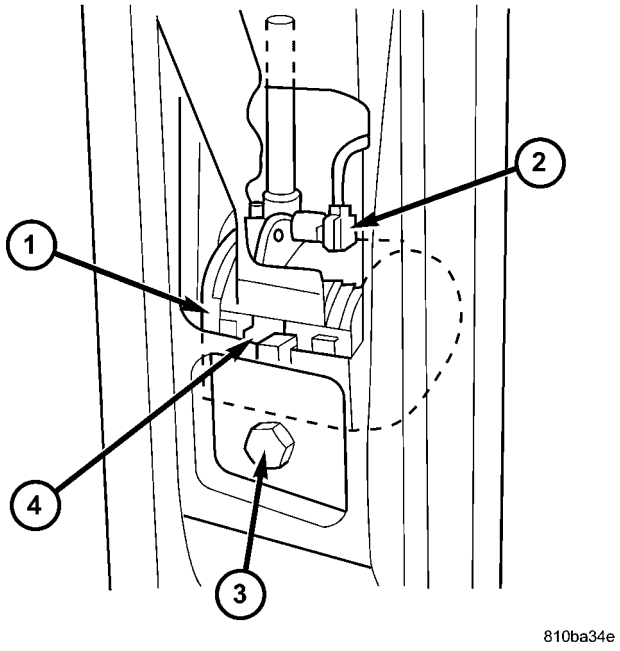


Fig. 25 Front Seat Belt Retractor

1 - RETRACTOR
2 - CONNECTOR
3 - SCREW
4 - GUIDE

(12) Remove the screw that secures the front seat belt retractor to the lower inner B-pillar.

(13) Remove the front seat belt and retractor unit from the B-pillar.

INSTALLATION

The following procedure is for replacement of a faulty or damaged front seat belt and retractor unit, which includes a seat belt tensioner for the driver side as standard equipment. Vehicles equipped with an optional passenger airbag also have a seat belt tensioner for the passenger side. (Refer to 8 - ELECTRICAL/RESTRAINTS/SEAT BELT TENSIONER - DESCRIPTION). If the seat belt or retractor is faulty or damaged, but the seat belt tensioner is not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the seat belt tensioner has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the front seat belt and retractor from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: DURING AND FOLLOWING ANY SEAT BELT SERVICE, CAREFULLY INSPECT ALL SEAT BELTS, BUCKLES, MOUNTING HARDWARE, RETRACTORS, AND ANCHORS FOR PROPER INSTALLATION, OPERATION, OR DAMAGE. REPLACE ANY BELT THAT IS CUT, FRAYED, OR TORN. STRAIGHTEN ANY BELT THAT IS TWISTED. TIGHTEN ANY LOOSE FASTENERS. REPLACE ANY BELT THAT HAS A DAMAGED OR INOPERATIVE BUCKLE OR RETRACTOR. REPLACE ANY BELT THAT HAS A BENT OR DAMAGED LATCH PLATE OR ANCHOR PLATE. NEVER ATTEMPT TO REPAIR A SEAT BELT COMPONENT. ALWAYS REPLACE DAMAGED OR FAULTY SEAT BELT COMPONENTS WITH THE CORRECT, NEW AND UNUSED REPLACEMENT PARTS LISTED IN THE DAIMLERCHRYSLER MOPAR PARTS CATALOG.

(1) Position the front seat belt and retractor to the lower inner (Fig. 25). Be certain to engage the guide on the retractor into the locating notch on the B-pillar.

(2) Install and tighten the screw that secures the front seat belt retractor to the lower inner B-pillar. Tighten the screw to 35 N·m (26 ft. lbs.).

(3) If so equipped, reconnect the vehicle wire harness connector for the seat belt tensioner to the initiator receptacle of the retractor located on the lower inner B-pillar. The connector is a tight snap-fit into the initiator receptacle. Reconnect the connector by pressing the connector insulator straight into the ini-

tiator receptacle. You can be certain that the connector is fully engaged by listening carefully for a distinct, audible click as the connector snaps into place.

(4) Position the front seat belt turning loop onto the height adjuster on the upper B-pillar (Fig. 24).

(5) Install and tighten the nut that secures the front seat belt turning loop to the height adjuster. Tighten the nut to 35 N·m (26 ft. lbs.).

(6) Route the front seat belt and lower anchor through the back of the height adjuster trim (Fig. 23).

(7) Position the height adjuster trim to the upper B-pillar so that the driver on the back of the trim engages the lug of the height adjuster.

(8) Reinstall the trim panel onto the inside of the B-pillar. (Refer to 23 - BODY/INTERIOR/B-PILLAR TRIM - INSTALLATION).

(9) Position the front seat belt lower anchor to the outboard side of the seat frame (Fig. 22).

(10) Install and tighten the screw that secures the front seat belt lower anchor to the outboard side of the seat frame. Tighten the screw to 35 N·m (26 ft. lbs.).

(11) If the vehicle is so equipped, snap the plastic cover over the screw that secures the front seat belt lower anchor to the outboard side of the seat frame.

(12) Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

FRONT SEAT BELT BUCKLE

REMOVAL

WARNING: DURING AND FOLLOWING ANY SEAT BELT SERVICE, CAREFULLY INSPECT ALL SEAT BELTS, BUCKLES, MOUNTING HARDWARE, RETRACTORS, AND ANCHORS FOR PROPER INSTALLATION, OPERATION, OR DAMAGE. REPLACE ANY BELT THAT IS CUT, FRAYED, OR TORN. STRAIGHTEN ANY BELT THAT IS TWISTED. TIGHTEN ANY LOOSE FASTENERS. REPLACE ANY BELT THAT HAS A DAMAGED OR INOPERATIVE BUCKLE OR RETRACTOR. REPLACE ANY BELT THAT HAS A BENT OR DAMAGED LATCH PLATE OR ANCHOR PLATE. NEVER ATTEMPT TO REPAIR A SEAT BELT COMPONENT. ALWAYS REPLACE DAMAGED OR FAULTY SEAT BELT COMPONENTS WITH THE CORRECT, NEW AND UNUSED REPLACEMENT PARTS LISTED IN THE DAIMLERCHRYSLER MOPAR PARTS CATALOG.

(1) On the driver side only, move the seat to its most forward position for easiest access to the seat belt switch pigtail wire and connector.

(2) On the driver side only, remove the wire ties that secure the seat belt switch pigtail wire to the seat frame (Fig. 26).

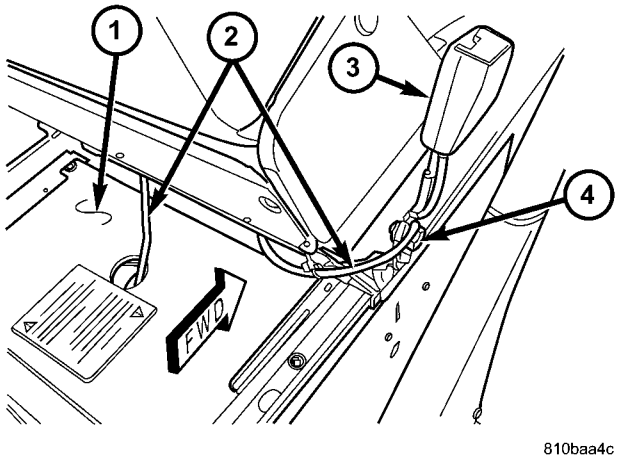


Fig. 26 Front Seat Belt Buckle Remove/Install

1 - SEAT RISER COVER PANEL
2 - SEAT BELT SWITCH PIGTAIL WIRE (DRIVER SIDE ONLY)
3 - BUCKLE
4 - SCREW AND/OR COVER

(3) On the driver side only, pull the seat belt switch pigtail wire out through the clearance hole in the seat riser cover far enough to access and disconnect the pigtail wire from the vehicle wire harness.

(4) If the vehicle is so equipped, unsnap and remove the plastic cover from the screw that secures the front seat belt buckle lower anchor to the inboard side of the seat frame.

(5) Remove the screw that secures the front seat belt buckle lower anchor to the inboard side of the seat frame.

(6) Remove the front seat belt buckle from the inboard side of the front seat frame.

FRONT SEAT BELT BUCKLE (Continued)

INSTALLATION

WARNING: DURING AND FOLLOWING ANY SEAT BELT SERVICE, CAREFULLY INSPECT ALL SEAT BELTS, BUCKLES, MOUNTING HARDWARE, RETRACTORS, AND ANCHORS FOR PROPER INSTALLATION, OPERATION, OR DAMAGE. REPLACE ANY BELT THAT IS CUT, FRAYED, OR TORN. STRAIGHTEN ANY BELT THAT IS TWISTED. TIGHTEN ANY LOOSE FASTENERS. REPLACE ANY BELT THAT HAS A DAMAGED OR INOPERATIVE BUCKLE OR RETRACTOR. REPLACE ANY BELT THAT HAS A BENT OR DAMAGED LATCH PLATE OR ANCHOR PLATE. NEVER ATTEMPT TO REPAIR A SEAT BELT COMPONENT. ALWAYS REPLACE DAMAGED OR FAULTY SEAT BELT COMPONENTS WITH THE CORRECT, NEW AND UNUSED REPLACEMENT PARTS LISTED IN THE DAIMLERCHRYSLER MOPAR PARTS CATALOG.

(1) Position the front seat belt buckle to the inboard side of the front seat frame (Fig. 26).

(2) Install and tighten the screw that secures the front seat belt buckle lower anchor to the inboard side of the front seat frame. Tighten the screw to 35 N·m (26 ft. lbs.).

(3) If the vehicle is so equipped, snap the plastic cover over the screw that secures the front seat belt buckle lower anchor to the inboard side of the seat frame.

(4) On the driver side only, reconnect the seat belt switch pigtail wire to the vehicle wire harness and push the joined connectors through the clearance hole in the seat riser cover.

(5) On the driver side only, route and secure the seat belt switch pigtail wire to the seat frame with wire ties.

PASSENGER AIRBAG

DESCRIPTION

The rearward facing surface of the injection molded, thermoplastic passenger airbag door is the most visible part of the optional passenger airbag (Fig. 27). The passenger airbag door is located above the glove box opening in front of the front seat passenger seating position on the instrument panel. The upper and lower edges of the airbag door are secured by a snap-fit to molded plastic clips. The two clips at the top are each secured by a screw to the instrument panel base trim, while the clips at the bottom are integral to the panel that surrounds the passenger airbag door opening in the instrument panel base trim. The airbag door is also secured to the airbag housing by two wide woven straps that serve as hinges for the door upon an airbag deployment.

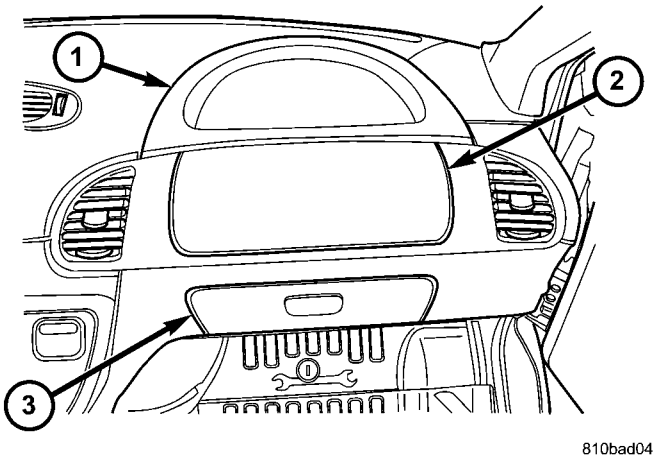


Fig. 27 Passenger Airbag Door

1 - INSTRUMENT PANEL TRAY
2 - PASSENGER AIRBAG DOOR
3 - GLOVE BOX DOOR

Located behind the passenger airbag door is the passenger airbag unit (Fig. 28). The airbag housing is constructed of a long U-shaped aluminum extrusion with two stamped steel end plates. A stepped flange that extends from the back of the extrusion serves as the airbag mounting flange. This mounting flange is secured with screws to a stamped steel airbag mounting bracket that is secured with screws to the tubular steel instrument panel structural support above the glove box opening. The end plates are secured to each side of the passenger airbag housing with screws.

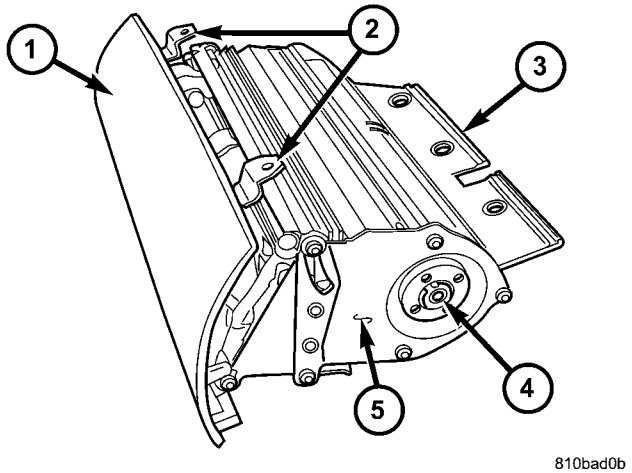


Fig. 28 Passenger Airbag Unit

1 - DOOR
2 - CLIP (2)
3 - HOUSING
4 - CONNECTOR RECEPTACLE
5 - END PLATE (2)

PASSENGER AIRBAG (Continued)

The passenger airbag unit used in this model is a Next Generation-type that complies with revised federal airbag standards to deploy with less force than those used in some prior models. The airbag housing contains the folded airbag cushion, the airbag retainer, and the airbag inflator. The airbag is a rectangular fabric cushion. The airbag inflator is a solid fuel, pyrotechnic-type unit that is secured to and sealed within the airbag housing along with the folded airbag cushion. The inflator initiator connector receptacle is connected to the vehicle electrical system through a dedicated take out of the vehicle wire harness with a yellow connector insulator.

The passenger airbag and airbag door unit cannot be repaired, and must be replaced if deployed, faulty or in any way damaged.

OPERATION

The passenger airbag is deployed by an electrical signal generated by the Airbag Control Module (ACM) through the passenger airbag squib circuits to the initiator in the airbag inflator. When the ACM sends the proper electrical signal to the initiator the electrical energy generates enough heat to initiate a small pyrotechnic charge which, in turn, ignites chemical pellets within the inflator. Once ignited, these chemical pellets burn rapidly and produce a large quantity of inert gas. The inflator is sealed to the back of the airbag housing and a diffuser in the inflator directs all of the inert gas into the airbag cushion, causing the cushion to inflate.

As the airbag cushion inflates, the passenger airbag door will unsnap from the clips that retain it to the instrument panel at the top and bottom, then pivot towards the top of the instrument panel and out of the way on the woven straps. Following a passenger airbag deployment, the airbag cushion quickly deflates by venting the inert gas through the loose weave of the fabric used to construct the back (instrument panel side) of the airbag cushion.

Some of the chemicals used to create the inert gas may be considered hazardous while in their solid state before they are burned, but they are securely sealed within the airbag inflator. However, the gas that is produced when the chemicals are burned is harmless. A small amount of residue from the burned chemicals may cause some temporary discomfort if it contacts the skin, eyes, or breathing passages. If skin or eye irritation is noticed, rinse the affected area with plenty of cool, clean water. If breathing passages are irritated, move to another area where there is plenty of clean, fresh air to breath. If the irritation is not alleviated by these actions, contact a physician immediately.

REMOVAL

The following procedure is for replacement of a faulty or damaged passenger airbag. If the airbag is faulty or damaged, but not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/ RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the passenger airbag has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the airbag from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: WHEN REMOVING A DEPLOYED AIRBAG, RUBBER GLOVES, EYE PROTECTION, AND A LONG-SLEEVED SHIRT SHOULD BE WORN. THERE MAY BE DEPOSITS ON THE AIRBAG UNIT AND OTHER INTERIOR SURFACES. IN LARGE DOSES, THESE DEPOSITS MAY CAUSE IRRITATION TO THE SKIN AND EYES.

(1) Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.

(2) Remove the instrument panel top cover tray from over the passenger airbag (Fig. 29). (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL TOP COVER - TRAY - REMOVAL).

(3) Remove the two screws that secure the passenger airbag door upper clips to the instrument panel base trim.

PASSENGER AIRBAG (Continued)

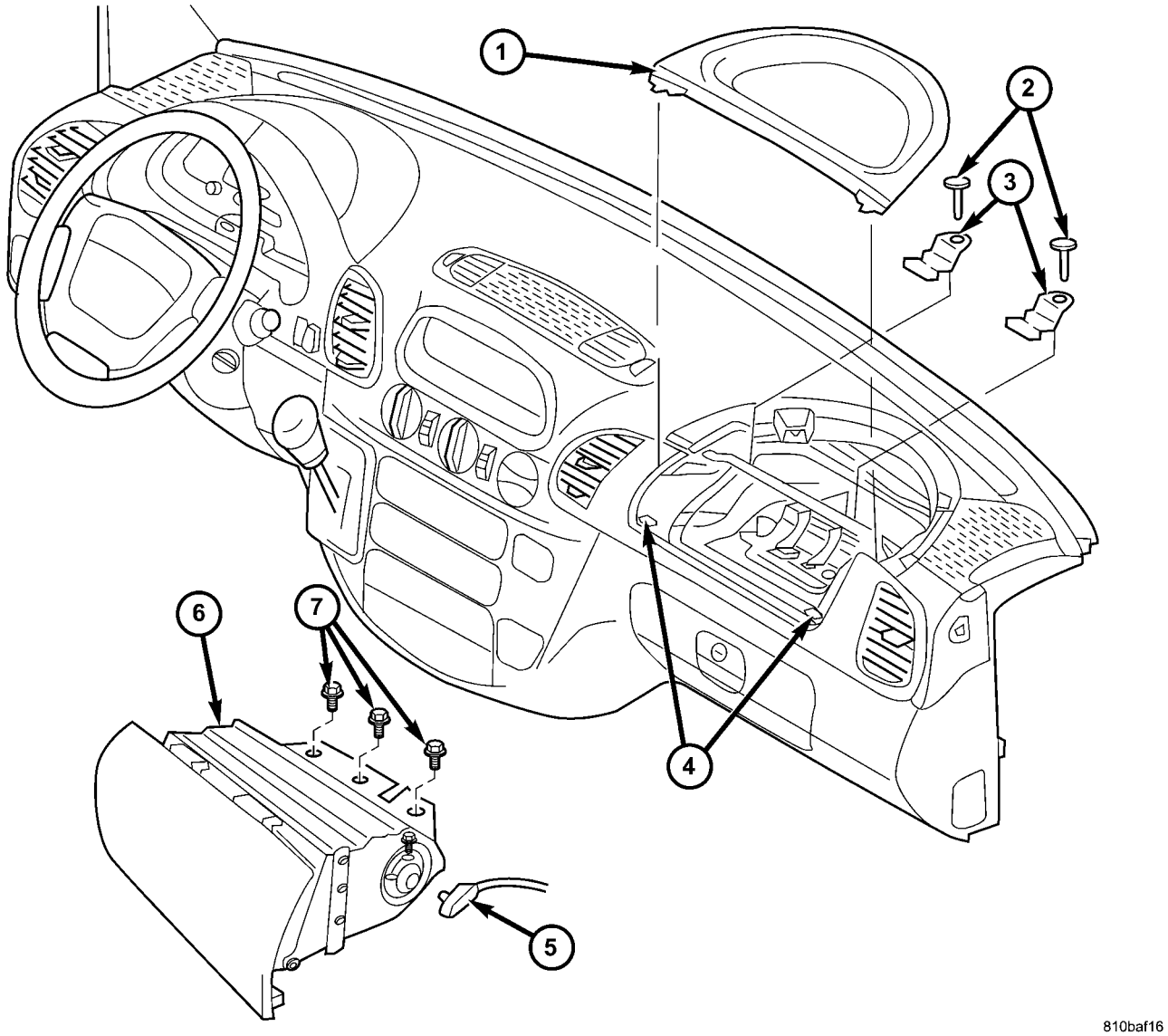


Fig. 29 Passenger Airbag Remove/Install

1 - TRAY
2 - SCREW (2)
3 - UPPER CLIP (2)
4 - LOWER CLIP (2)
5 - CONNECTOR
6 - PASSENGER AIRBAG
7 - SCREW (3)

(4) Remove the three screws that secure the flange of the passenger airbag housing to the bracket on the instrument panel structural support.

(5) Pull the passenger airbag unit rearward to disengage the airbag door from the lower clips and far enough to access the electrical connection on the right end of the unit.

CAUTION: Do not pull on the wires to disengage the connector from the passenger airbag inflator connector receptacle. Improper removal of the connector insulator can result in damage to the airbag circuits or the connector insulator.

(6) The vehicle wire harness connector is a tight snap-fit into the airbag inflator connector receptacle, which is located on the right end of the passenger airbag housing. Firmly grasp and pull or gently pry on the connector insulator and pull the connector straight out from the inflator to disconnect it from the receptacle.

(7) Remove the passenger airbag and airbag door from the instrument panel as a unit.

PASSENGER AIRBAG (Continued)

INSTALLATION

The following procedure is for replacement of a faulty or damaged passenger airbag. If the airbag is faulty or damaged, but not deployed, review the recommended procedures for handling non-deployed supplemental restraints. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS). If the passenger airbag has been deployed, review the recommended procedures for service after a supplemental restraint deployment before removing the airbag from the vehicle. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - SERVICE AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT).

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: WHEN REMOVING A DEPLOYED AIRBAG, RUBBER GLOVES, EYE PROTECTION, AND A LONG-SLEEVED SHIRT SHOULD BE WORN. THERE MAY BE DEPOSITS ON THE AIRBAG UNIT AND OTHER INTERIOR SURFACES. IN LARGE DOSES, THESE DEPOSITS MAY CAUSE IRRITATION TO THE SKIN AND EYES.

WARNING: USE EXTREME CARE TO PREVENT ANY FOREIGN MATERIAL FROM ENTERING THE PASSENGER AIRBAG, OR BECOMING ENTRAPPED BETWEEN THE PASSENGER AIRBAG CUSHION AND THE PASSENGER AIRBAG DOOR. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.

WARNING: THE PASSENGER AIRBAG DOOR MUST NEVER BE PAINTED. REPLACEMENT PASSENGER AIRBAGS ARE SERVICED WITH DOORS IN THE ORIGINAL COLORS. PAINT MAY CHANGE THE WAY IN WHICH THE MATERIAL OF THE AIRBAG DOOR RESPONDS TO AN AIRBAG DEPLOYMENT. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.

(1) Carefully position the passenger airbag and airbag door unit to the instrument panel (Fig. 29).

(2) When installing the passenger airbag, reconnect the vehicle wire harness connector to the airbag inflator 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.

(3) Push the passenger airbag unit forward far enough to engage the lower edge of the airbag door with the two lower clips in the instrument panel.

(4) Install and tighten the two screws that secure the flange of the passenger airbag housing to the bracket on the instrument panel structural support. Tighten the screws to 10 N·m (89 in. lbs.).

(5) Install and tighten the two screws that secure the passenger airbag door upper clips to the instrument panel base trim. Tighten the screws to 2 N·m (18 in. lbs.).

(6) Reinstall the instrument panel top cover tray onto the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL TOP COVER - TRAY - INSTALLATION).

(7) Do not reconnect the battery negative cable at this time. The supplemental restraint system verification test procedure should be performed following service of any supplemental restraint system component. (Refer to 8 - ELECTRICAL/RESTRAINTS - STANDARD PROCEDURE - VERIFICATION TEST).

PASSENGER AIRBAG BRACKET

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Remove the passenger airbag from the instrument panel. (Refer to 8 - ELECTRICAL/RESTRAINTS/PASSENGER AIRBAG - REMOVAL).

(2) Remove the four screws that secure the passenger airbag bracket to the instrument panel structural support (Fig. 30).

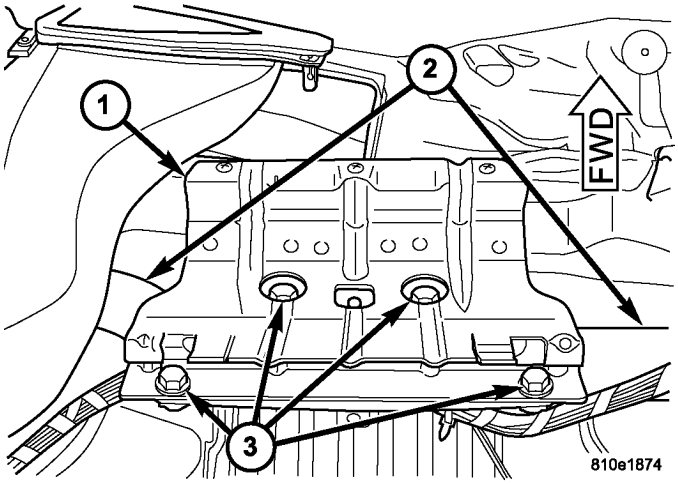


Fig. 30 Passenger Airbag Bracket Remove/Install

1 - BRACKET
2 - STRUCTURAL SUPPORT
3 - SCREW (4)

(3) Remove the passenger airbag bracket from the instrument panel structural support.

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Position the passenger airbag bracket onto the instrument panel structural support (Fig. 30).

(2) Install and tighten the four screws that secure the passenger airbag bracket to the instrument panel structural support. Tighten the screws to 10 N·m (89 in. lbs.).

(3) Reinstall the passenger airbag into the instrument panel. (Refer to 8 - ELECTRICAL/RESTRAINTS/PASSENGER AIRBAG - INSTALLATION).

REAR SEAT BELT & RETRACTOR

REMOVAL

WARNING: DURING AND FOLLOWING ANY SEAT BELT SERVICE, CAREFULLY INSPECT ALL SEAT BELTS, BUCKLES, MOUNTING HARDWARE, RETRACTORS, AND ANCHORS FOR PROPER INSTALLATION, OPERATION, OR DAMAGE. REPLACE ANY BELT THAT IS CUT, FRAYED, OR TORN. STRAIGHTEN ANY BELT THAT IS TWISTED. TIGHTEN ANY LOOSE FASTENERS. REPLACE ANY BELT THAT HAS A DAMAGED OR INOPERATIVE BUCKLE OR RETRACTOR. REPLACE ANY BELT THAT HAS A BENT OR DAMAGED LATCH PLATE OR ANCHOR PLATE. NEVER ATTEMPT TO REPAIR A SEAT BELT COMPONENT. ALWAYS REPLACE DAMAGED OR FAULTY SEAT BELT COMPONENTS WITH THE CORRECT, NEW AND UNUSED REPLACEMENT PARTS LISTED IN THE DAIMLERCHRYSLER MOPAR PARTS CATALOG.

(1) Remove the rear bench seat containing the rear seat belt and retractor unit to be serviced from the vehicle.

(2) Lift the seat belt webbing to access and remove the plastic push pin fastener that secures the rear seat belt turning loop trim cover to the turning loop bracket at the top of the seat back (Fig. 31).

REAR SEAT BELT & RETRACTOR (Continued)

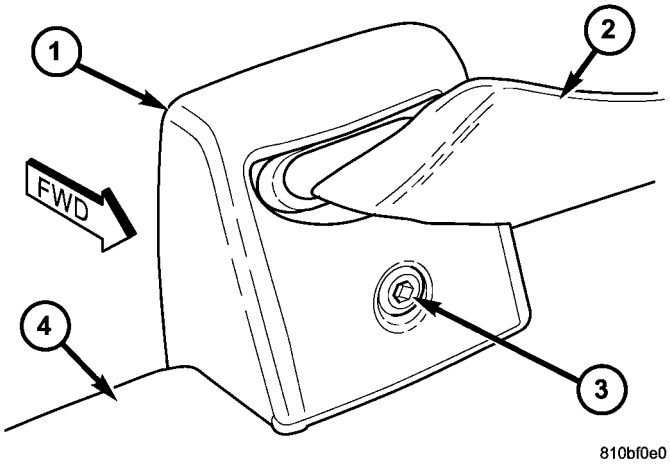


Fig. 31 Turning Loop Trim Cover

1 - TRIM COVER
2 - SEAT BELT
3 - RETAINER
4 - REAR SEAT BACK

(3) Remove the turning loop trim cover from the turning loop bracket.

(4) Remove the push nut at the back of the turning loop bracket that secures the pin on which the two turning loops pivot (Fig. 32).

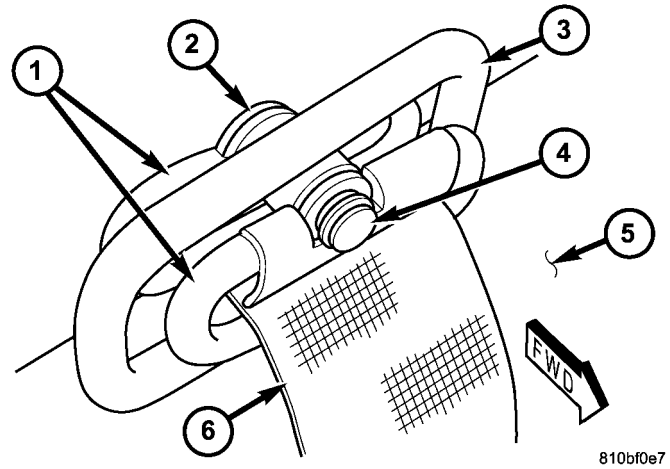


Fig. 32 Rear Seat Belt Turning Loop

1 - TURNING LOOP (2)
2 - PUSH NUT
3 - BRACKET
4 - PIN
5 - REAR SEAT BACK
6 - SEAT BELT

(5) Remove the pin and the two turning loops from the turning loop bracket.

(6) For a left outboard seating position only, unsnap and remove the plastic cover from the screw that secures the rear seat belt lower anchor to the left outboard side of the seat frame (Fig. 33).

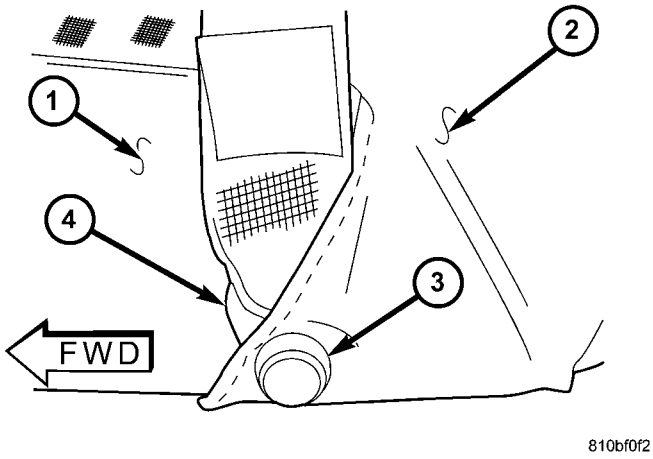


Fig. 33 Left Outboard Rear Seat Belt Lower Anchor

1 - REAR SEAT CUSHION TRIM
2 - REAR SEAT BACK TRIM
3 - SCREW AND COVER
4 - REAR SEAT BELT LOWER ANCHOR

(7) Remove the plastic shield from the back of the rear seat. (Refer to 23 - BODY/SEATS/REAR SEAT BACK SHIELD - REMOVAL).

(8) Remove the screw that secures the rear seat belt lower anchor to the rear seat cushion frame (Fig. 33) or (Fig. 34).

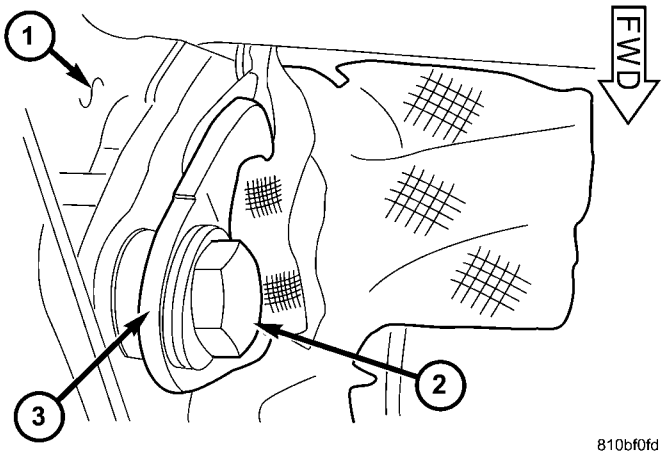


Fig. 34 Right Outboard or Center Rear Seat Belt Lower Anchor

1 - REAR SEAT CUSHION FRAME
2 - SCREW
3 - REAR SEAT BELT LOWER ANCHOR

(9) Pull the rear seat belt and lower anchor through the turning loop trim cover and the turning loop bracket.

(10) Remove the screw that secures the rear seat belt retractor to the bracket on the rear seat cushion frame (Fig. 35).

REAR SEAT BELT & RETRACTOR (Continued)

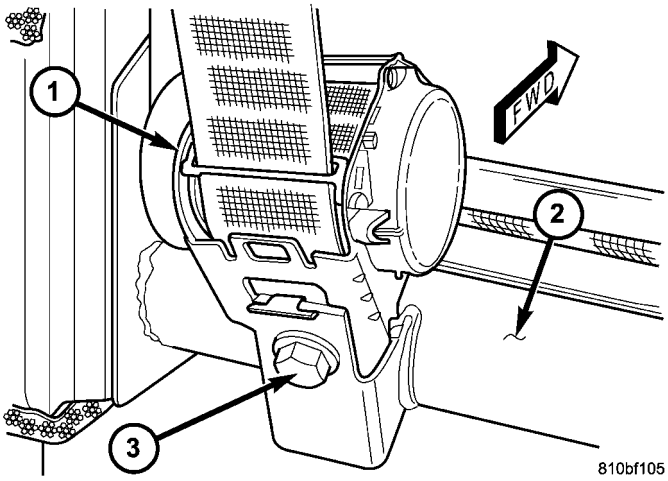


Fig. 35 Rear Seat Belt Retractor

1 - RETRACTOR
2 - REAR SEAT CUSHION FRAME
3 - SCREW

(11) Remove the rear seat belt and retractor unit from the bracket on the rear seat cushion frame.

INSTALLATION

WARNING: DURING AND FOLLOWING ANY SEAT BELT SERVICE, CAREFULLY INSPECT ALL SEAT BELTS, BUCKLES, MOUNTING HARDWARE, RETRACTORS, AND ANCHORS FOR PROPER INSTALLATION, OPERATION, OR DAMAGE. REPLACE ANY BELT THAT IS CUT, FRAYED, OR TORN. STRAIGHTEN ANY BELT THAT IS TWISTED. TIGHTEN ANY LOOSE FASTENERS. REPLACE ANY BELT THAT HAS A DAMAGED OR INOPERATIVE BUCKLE OR RETRACTOR. REPLACE ANY BELT THAT HAS A BENT OR DAMAGED LATCH PLATE OR ANCHOR PLATE. NEVER ATTEMPT TO REPAIR A SEAT BELT COMPONENT. ALWAYS REPLACE DAMAGED OR FAULTY SEAT BELT COMPONENTS WITH THE CORRECT, NEW AND UNUSED REPLACEMENT PARTS LISTED IN THE DAIMLERCHRYSLER MOPAR PARTS CATALOG.

(1) Position the rear seat belt and retractor unit onto the bracket of the rear seat cushion frame (Fig. 35). Be certain to engage the guide on the retractor into the locating notch on the bracket.

(2) Install and tighten the screw that secures the rear seat belt retractor to the bracket on the rear seat cushion frame. Tighten the screw to 35 N·m (26 ft. lbs.).

(3) Route the rear seat belt and lower anchor through the turning loop bracket and the turning loop trim cover.

(4) Position the rear seat belt lower anchor to the rear seat cushion frame (Fig. 33) or (Fig. 34).

(5) Install and tighten the screw that secures the rear seat belt lower anchor to the rear seat cushion frame. Tighten the screw to 35 N·m (26 ft. lbs.).

(6) For a left outboard seating position only, reinstall the plastic cover onto the screw that secures the rear seat belt lower anchor to the left outboard side of the seat frame.

(7) Position the two seat belt turning loops to the turning loop bracket so that one turning loop is located behind the bracket and one is located in front of the bracket (Fig. 32).

(8) From the front of the turning loop bracket, insert the pin through both turning loops and the bracket, then secure it from behind the bracket with a new push nut.

(9) Position the turning loop trim cover over the turning loop bracket.

(10) Lift the seat belt webbing to access and install the plastic push pin fastener that secures the rear seat belt turning loop trim cover to the turning loop bracket at the top of the seat back (Fig. 31).

(11) Reinstall the plastic shield onto the back of the rear seat. (Refer to 23 - BODY/SEATS/REAR SEAT BACK SHIELD - INSTALLATION).

(12) Reinstall the rear bench seat into the vehicle.

REAR SEAT BELT BUCKLE

REMOVAL

REMOVAL - INBOARD

WARNING: DURING AND FOLLOWING ANY SEAT BELT SERVICE, CAREFULLY INSPECT ALL SEAT BELTS, BUCKLES, MOUNTING HARDWARE, RETRACTORS, AND ANCHORS FOR PROPER INSTALLATION, OPERATION, OR DAMAGE. REPLACE ANY BELT THAT IS CUT, FRAYED, OR TORN. STRAIGHTEN ANY BELT THAT IS TWISTED. TIGHTEN ANY LOOSE FASTENERS. REPLACE ANY BELT THAT HAS A DAMAGED OR INOPERATIVE BUCKLE OR RETRACTOR. REPLACE ANY BELT THAT HAS A BENT OR DAMAGED LATCH PLATE OR ANCHOR PLATE. NEVER ATTEMPT TO REPAIR A SEAT BELT COMPONENT. ALWAYS REPLACE DAMAGED OR FAULTY SEAT BELT COMPONENTS WITH THE CORRECT, NEW AND UNUSED REPLACEMENT PARTS LISTED IN THE DAIMLERCHRYSLER MOPAR PARTS CATALOG.

(1) Remove the rear bench seat containing the inboard rear seat belt buckle unit to be serviced from the vehicle.

REAR SEAT BELT BUCKLE (Continued)

(2) Remove the plastic shield from the back of the rear seat. (Refer to 23 - BODY/SEATS/REAR SEAT BACK SHIELD - REMOVAL).

(3) Remove the screw that secures either the inboard rear seat belt buckle to the rear seat cushion frame (Fig. 36).

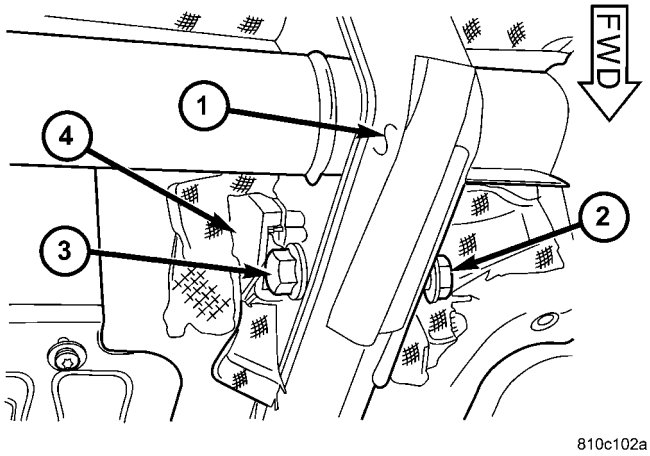


Fig. 36 Inboard Rear Seat Belt Buckle

1 - REAR SEAT CUSHION FRAME
2 - INBOARD REAR SEAT BELT LOWER ANCHOR
3 - SCREW
4 - INBOARD REAR SEAT BELT BUCKLE

(4) Remove the inboard rear seat belt buckle from the rear seat cushion frame.

REMOVAL - OUTBOARD

WARNING: DURING AND FOLLOWING ANY SEAT BELT SERVICE, CAREFULLY INSPECT ALL SEAT BELTS, BUCKLES, MOUNTING HARDWARE, RETRACTORS, AND ANCHORS FOR PROPER INSTALLATION, OPERATION, OR DAMAGE. REPLACE ANY BELT THAT IS CUT, FRAYED, OR TORN. STRAIGHTEN ANY BELT THAT IS TWISTED. TIGHTEN ANY LOOSE FASTENERS. REPLACE ANY BELT THAT HAS A DAMAGED OR INOPERATIVE BUCKLE OR RETRACTOR. REPLACE ANY BELT THAT HAS A BENT OR DAMAGED LATCH PLATE OR ANCHOR PLATE. NEVER ATTEMPT TO REPAIR A SEAT BELT COMPONENT. ALWAYS REPLACE DAMAGED OR FAULTY SEAT BELT COMPONENTS WITH THE CORRECT, NEW AND UNUSED REPLACEMENT PARTS LISTED IN THE DAIMLERCHRYSLER MOPAR PARTS CATALOG.

(1) Unsnap and remove the plastic cover from the screw that secures the outboard rear seat belt buckle to the right side of the seat cushion frame (Fig. 37).

(2) Remove the screw that secures the outboard rear seat belt buckle to the rear seat cushion frame.

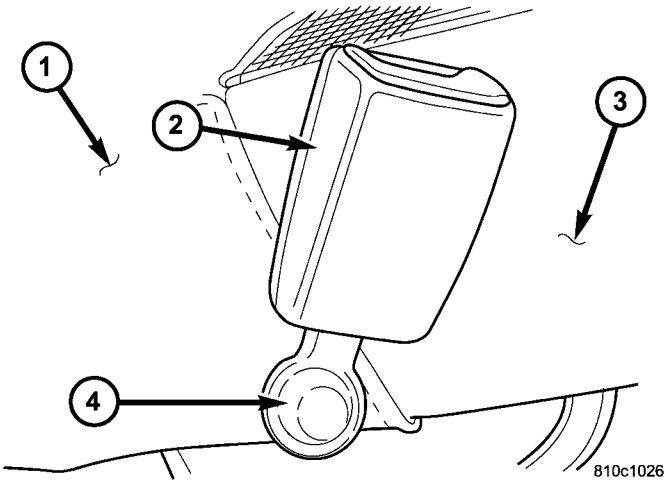


Fig. 37 Outboard Rear Seat Belt Buckle

1 - REAR SEAT BACK TRIM
2 - REAR SEAT BELT BUCKLE
3 - REAR SEAT CUSHION TRIM
4 - SCREW & COVER

(3) Remove the outboard rear seat belt buckle from the right side of the rear seat cushion frame.

INSTALLATION

INSTALLATION - INBOARD

WARNING: DURING AND FOLLOWING ANY SEAT BELT SERVICE, CAREFULLY INSPECT ALL SEAT BELTS, BUCKLES, MOUNTING HARDWARE, RETRACTORS, AND ANCHORS FOR PROPER INSTALLATION, OPERATION, OR DAMAGE. REPLACE ANY BELT THAT IS CUT, FRAYED, OR TORN. STRAIGHTEN ANY BELT THAT IS TWISTED. TIGHTEN ANY LOOSE FASTENERS. REPLACE ANY BELT THAT HAS A DAMAGED OR INOPERATIVE BUCKLE OR RETRACTOR. REPLACE ANY BELT THAT HAS A BENT OR DAMAGED LATCH PLATE OR ANCHOR PLATE. NEVER ATTEMPT TO REPAIR A SEAT BELT COMPONENT. ALWAYS REPLACE DAMAGED OR FAULTY SEAT BELT COMPONENTS WITH THE CORRECT, NEW AND UNUSED REPLACEMENT PARTS LISTED IN THE DAIMLERCHRYSLER MOPAR PARTS CATALOG.

(1) Position the inboard rear seat belt buckle to the rear seat cushion frame (Fig. 36).

(2) Install and tighten the screw that secures either the inboard rear seat belt buckle to the rear seat cushion frame. Tighten the screw to 35 N·m (26 ft. lbs.).

(3) Reinstall the plastic shield onto the back of the rear seat. (Refer to 23 - BODY/SEATS/REAR SEAT BACK SHIELD - INSTALLATION).

(4) Reinstall the rear bench seat into the vehicle.

REAR SEAT BELT BUCKLE (Continued)

INSTALLATION - OUTBOARD

WARNING: DURING AND FOLLOWING ANY SEAT BELT SERVICE, CAREFULLY INSPECT ALL SEAT BELTS, BUCKLES, MOUNTING HARDWARE, RETRACTORS, AND ANCHORS FOR PROPER INSTALLATION, OPERATION, OR DAMAGE. REPLACE ANY BELT THAT IS CUT, FRAYED, OR TORN. STRAIGHTEN ANY BELT THAT IS TWISTED. TIGHTEN ANY LOOSE FASTENERS. REPLACE ANY BELT THAT HAS A DAMAGED OR INOPERATIVE BUCKLE OR RETRACTOR. REPLACE ANY BELT THAT HAS A BENT OR DAMAGED LATCH PLATE OR ANCHOR PLATE. NEVER ATTEMPT TO REPAIR A SEAT BELT COMPONENT. ALWAYS REPLACE DAMAGED OR FAULTY SEAT BELT COMPONENTS WITH THE CORRECT, NEW AND UNUSED REPLACEMENT PARTS LISTED IN THE DAIMLERCHRYSLER MOPAR PARTS CATALOG.

(1) Position the rear seat belt buckle to the right outboard side of the rear seat cushion frame (Fig. 37).

(2) Install and tighten the screw that secures the outboard rear seat belt buckle to the rear seat cushion frame. Tighten the screw to 35 N·m (26 ft. lbs.).

(3) Reinstall the plastic cover onto the screw that secures the rear seat belt buckle to the right outboard side of the rear seat cushion frame.

SEAT BELT SWITCH

DESCRIPTION

The seat belt switch is a small, normally closed, single pole, single throw, leaf contact, momentary switch. Only one seat belt switch is installed in the vehicle, and it is integral to the driver side front seat belt buckle unit. The seat belt switch is connected to the vehicle electrical system through a two-wire pigtail wire harness and connector to a dedicated take out and connector of the vehicle wire harness located within the driver side front seat riser.

The seat belt switch cannot be adjusted or repaired and, if faulty or damaged, the entire driver side seat belt buckle unit must be replaced.

OPERATION

The seat belt switch is designed to control a path to ground for the seat belt switch sense input of the Electro-Mechanical Instrument Cluster (EMIC). The seat belt switch contact is actuated by the seat belt latch plate being inserted in to the buckle. When the seat belt latch plate is inserted into the buckle far enough to be engaged by the seat belt buckle latch, the switch leaf contact opens the seat belt switch sense circuit ground path; and, when the seat belt latch plate is released and extracted from the seat belt buckle latch the switch leaf contact is released, closing the circuit to ground.

The seat belt switch is connected is series between ground and the seat belt switch sense input of the instrument cluster. The seat belt switch receives ground at all times through its pigtail wire connection to the vehicle wire harness from another take out of the vehicle wire harness. An eyelet terminal connector on the vehicle wire harness ground take out is secured under a nut to a ground stud located on the floor panel within the driver side front seat riser. The seat belt switch may de diagnosed using conventional diagnostic tools and methods.

SEAT BELT TENSIONER

DESCRIPTION

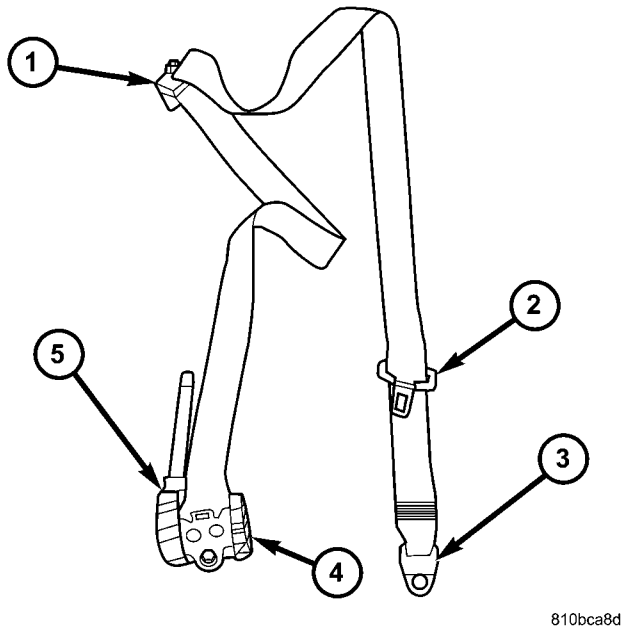


Fig. 38 Seat Belt Tensioner

1 - TURNING LOOP
2 - LATCH PLATE
3 - LOWER ANCHOR
4 - RETRACTOR
5 - TENSIONER

Front seating position seat belt tensioners supplement the standard driver and optional passenger airbags for all versions of this model. When equipped, the seat belt tensioner is integral to the front seat belt and retractor units, which are secured to the inner B-pillars of the vehicle (Fig. 38). Each retractor is concealed beneath the molded plastic B-pillar trim. The seat belt tensioner consists primarily of a tubu-

SEAT BELT TENSIONER (Continued)

lar steel housing, a piston, a cable, a torsion bar, and a small pyrotechnically activated gas generator. All of these components are located on one side of the retractor spool on the outside of the retractor housing except for the torsion bar, which serves as the spindle upon which the retractor spool rotates. The seat belt tensioner is controlled by the Airbag Control Module (ACM) and is connected to the vehicle electrical system through a dedicated take out of the vehicle wire harness by a keyed, snap-fit molded plastic connector insulator to ensure a secure connection.

The seat belt tensioner cannot be repaired and, if faulty or damaged, the entire front seat belt and retractor unit must be replaced. If the front airbags have been deployed, the seat belt tensioners have also been deployed. The seat belt tensioner is not intended for reuse and must be replaced following a deployment. A growling or grinding sound while attempting to operate the seat belt retractor is a sure indication that the seat belt tensioner has been deployed and requires replacement. (Refer to 8 - ELECTRICAL/RESTRAINTS/FRONT SEAT BELT & RETRACTOR - REMOVAL).

OPERATION

The seat belt tensioners are deployed in conjunction with the airbags by a signal generated by the Airbag Control Module (ACM) through the driver and passenger seat belt tensioner line 1 and line 2 (or squib) circuits (Fig. 39). When the ACM sends the proper electrical signal to the tensioners, the electrical energy generates enough heat to initiate a small pyrotechnic gas generator. The gas generator is installed so that it directs its expelled gas at the underside of the piston in the cylinder. The piston is connected to a cable that is wound around a pulley on one end of the retractor spool. As the gas expands, it propels the piston through the tube, which pulls the cable and rotates the retractor spool to take up slack in the seat belt webbing.

Once a seat belt tensioning sequence has been completed, the forward momentum of the occupant results in deformation of the torsion bar. Removing excess slack from the front seat belts not only keeps the occupants properly positioned for an airbag deployment following a frontal impact of the vehicle, but also helps to reduce injuries that the occupant might otherwise experience in a frontal impact event as a result of harmful contact with the steering wheel, steering column, instrument panel and/or windshield. The torsion bar is designed to deform in order to control the loads being applied to the occupant by the seat belt during a frontal impact, further reducing the potential for occupant injuries.

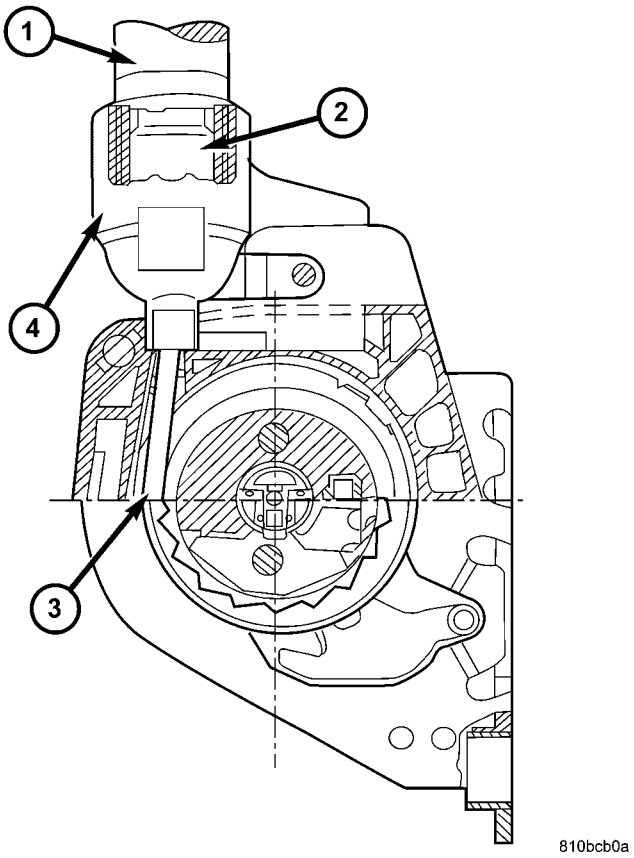


Fig. 39 Seat Belt Tensioner Operation

1 - TUBE
2 - PISTON
3 - CABLE
4 - CYLINDER

The ACM monitors the condition of the seat belt tensioners through circuit resistance. The ACM will illuminate the airbag indicator in the ElectroMechanical Instrument Cluster (EMIC) and store a Diagnostic Trouble Code (DTC) for any fault that is detected. For proper diagnosis of the seat belt tensioners, a DRBIII® scan tool is required. Refer to the appropriate diagnostic information.

SEAT BELT TURNING LOOP ADJUSTER

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: DURING AND FOLLOWING ANY SEAT BELT SERVICE, CAREFULLY INSPECT ALL SEAT BELTS, BUCKLES, MOUNTING HARDWARE, RETRACTORS, AND ANCHORS FOR PROPER INSTALLATION, OPERATION, OR DAMAGE. REPLACE ANY BELT THAT IS CUT, FRAYED, OR TORN. STRAIGHTEN ANY BELT THAT IS TWISTED. TIGHTEN ANY LOOSE FASTENERS. REPLACE ANY BELT THAT HAS A DAMAGED OR INOPERATIVE BUCKLE OR RETRACTOR. REPLACE ANY BELT THAT HAS A BENT OR DAMAGED LATCH PLATE OR ANCHOR PLATE. NEVER ATTEMPT TO REPAIR A SEAT BELT COMPONENT. ALWAYS REPLACE DAMAGED OR FAULTY SEAT BELT COMPONENTS WITH THE CORRECT, NEW AND UNUSED REPLACEMENT PARTS LISTED IN THE DAIMLERCHRYSLER MOPAR PARTS CATALOG.

(1) Move the front seat to its most forward position for easiest access to the B-pillar trim.

(2) Disconnect and isolate the battery negative cable. Wait two minutes for the system capacitor to discharge before further service.

(3) Remove the trim panel from the inside of the B-pillar. (Refer to 23 - BODY/INTERIOR/B-PILLAR TRIM - REMOVAL).

(4) Pull the height adjuster trim away from the upper B-pillar to disengage the driver from the lug of the height adjuster (Fig. 40).

(5) Remove the nut that secures the front seat belt turning loop to the height adjuster (Fig. 41).

(6) Remove the front seat belt turning loop from the height adjuster.

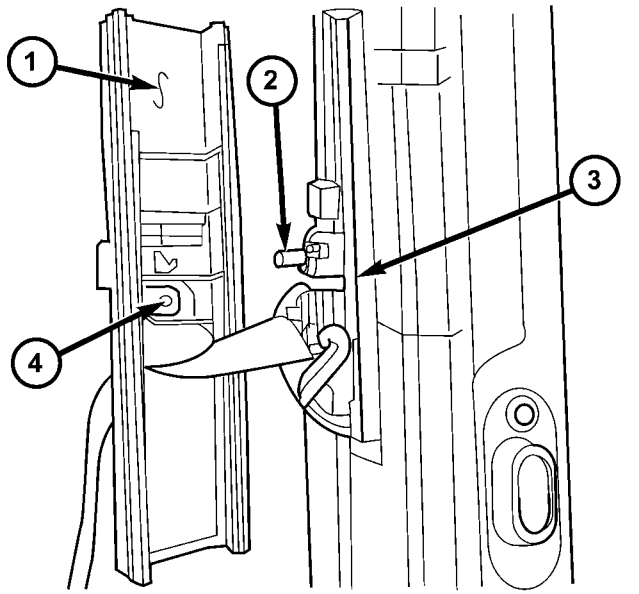


Fig. 40 Turning Loop Height Adjuster

1 - HEIGHT ADJUSTER TRIM
2 - LUG
3 - HEIGHT ADJUSTER
4 - DRIVER

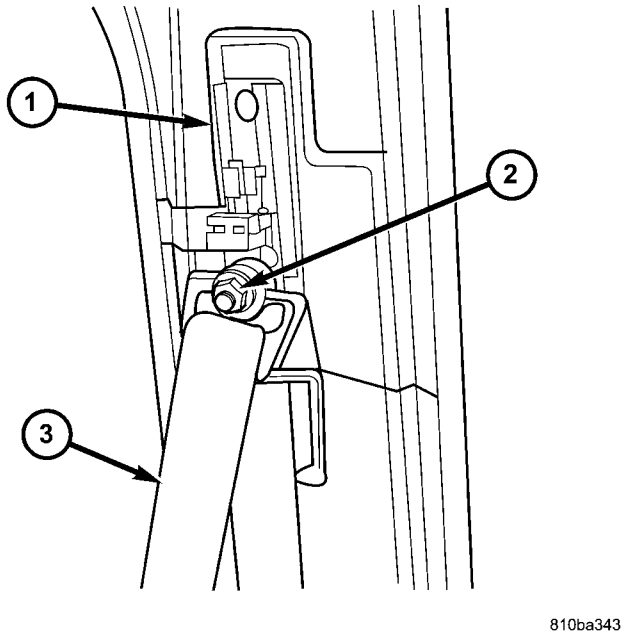


Fig. 41 Front Seat Belt Turning Loop

1 - HEIGHT ADJUSTER
2 - NUT
3 - FRONT SEAT BELT

(7) Remove the two screws that secure the seat belt turning loop height adjuster to the upper inner B-pillar (Fig. 42).

SEAT BELT TURNING LOOP ADJUSTER (Continued)

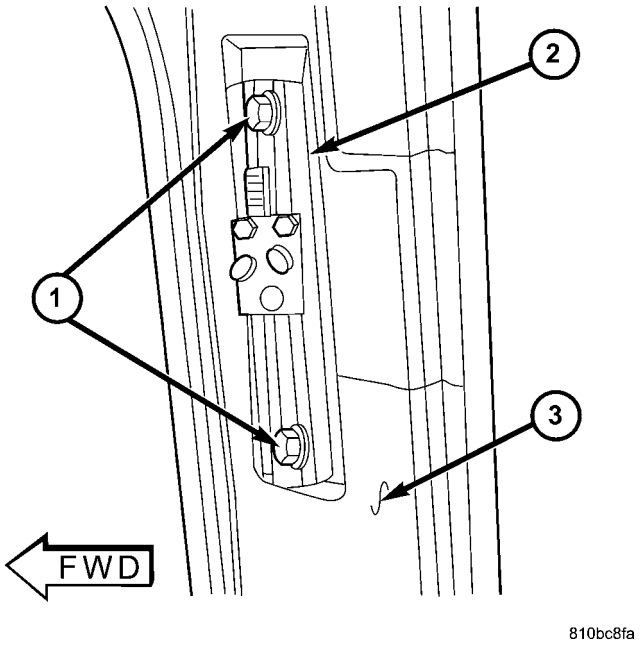


Fig. 42 Seat Belt Turning Loop Adjuster Remove/ Install

1 - SCREW (2)
2 - ADJUSTER
3 - B-PILLAR

(8) Remove the seat belt turning loop height adjuster from the inner B-pillar.

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: DURING AND FOLLOWING ANY SEAT BELT SERVICE, CAREFULLY INSPECT ALL SEAT BELTS, BUCKLES, MOUNTING HARDWARE, RETRACTORS, AND ANCHORS FOR PROPER INSTALLATION, OPERATION, OR DAMAGE. REPLACE ANY BELT THAT IS CUT, FRAYED, OR TORN. STRAIGHTEN ANY BELT THAT IS TWISTED. TIGHTEN ANY LOOSE FASTENERS. REPLACE ANY BELT THAT HAS A DAMAGED OR INOPERATIVE BUCKLE OR RETRACTOR. REPLACE ANY BELT THAT HAS A BENT OR DAMAGED LATCH PLATE OR ANCHOR PLATE. NEVER ATTEMPT TO REPAIR A SEAT BELT COMPONENT. ALWAYS REPLACE DAMAGED OR FAULTY SEAT BELT COMPONENTS WITH THE CORRECT, NEW AND UNUSED REPLACEMENT PARTS LISTED IN THE DAIMLERCHRYSLER MOPAR PARTS CATALOG.

(1) Position the seat belt turning loop height adjuster onto the inner B-pillar (Fig. 42).

(2) Install and tighten the two screws that secure the seat belt turning loop height adjuster to the upper inner B-pillar. Tighten the screws to 35 N·m (26 ft. lbs.).

(3) Position the front seat belt turning loop onto the height adjuster on the upper B-pillar (Fig. 41).

(4) Install and tighten the nut that secures the front seat belt turning loop to the height adjuster. Tighten the nut to 35 N·m (26 ft. lbs.).

(5) Position the height adjuster trim to the upper B-pillar so that the driver on the back of the trim engages the lug of the height adjuster (Fig. 40).

(6) Reinstall the trim panel onto the inside of the B-pillar. (Refer to 23 - BODY/INTERIOR/B-PILLAR TRIM - INSTALLATION).

(7) Reconnect the battery negative cable.

SPEED CONTROL

TABLE OF CONTENTS

	page
SPEED CONTROL	
DESCRIPTION	1
OPERATION	1
SPECIFICATIONS	
TORQUE	2
CABLE	
DESCRIPTION	3
SERVO	
DESCRIPTION	3
SWITCH	
REMOVAL	3
INSTALLATION	3

SPEED CONTROL

DESCRIPTION

The speed control system is electronically controlled by the Engine Control Module (ECM). **A cable and a vacuum controlled servo are not used. This is a servo-less system.** Control of the system is accomplished by a 4-position, instrument panel mounted switch (Fig. 1).

Switch settings (Fig. 2) are:

- 1. Set / Accelerate
- 2. Resume Set Speed
- 3. Set / Decelerate
- 4. Off

The system is designed to operate at speeds above 25 mph (40 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 operation is selected by the speed control switch, the ECM (Engine Control Module) allows a set speed to be stored in its RAM for speed control. To store a set speed, press either of the SET switch functions while the vehicle is moving, and above 25 mph (40 km/h). 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
- Pressing the speed control switch to OFF
- Depressing the clutch pedal (if equipped).

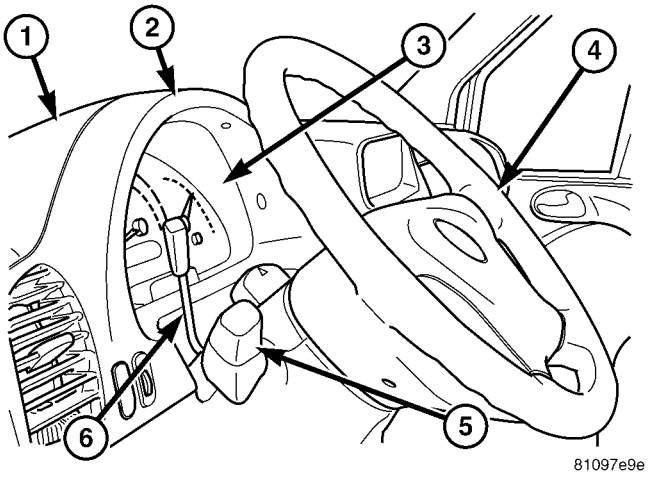


Fig. 1 INSTRUMENT CLUSTER

1 - COVER
2 - BEZEL
3 - INSTRUMENT CLUSTER
4 - STEERING WHEEL
5 - MULTI-FUNCTION SWITCH
6 - SPEED CONTROL SWITCH

NOTE: Depressing the OFF switch or turning off the ignition switch will erase the set speed stored in the ECM.

For added safety, the speed control system is programmed to disengage for any of the following conditions:

- An indication of Park or Neutral
- A 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)

SPEED CONTROL (Continued)

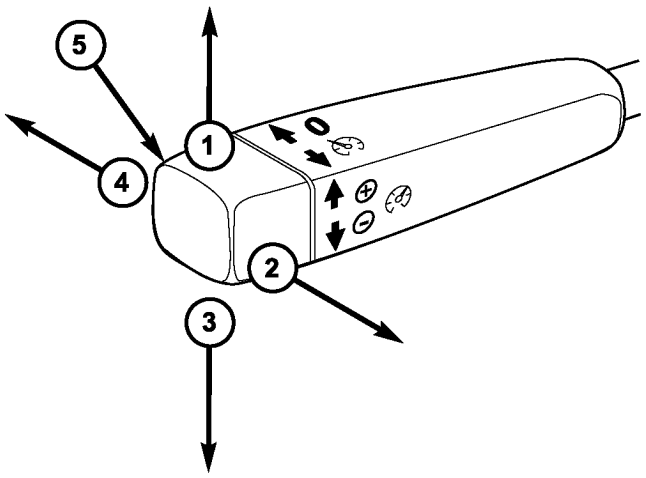


Fig. 2 SPEED CONTROL SWITCH FUNCTIONS

1 - SET / ACCELERATE
2 - RESUME SET SPEED
3 - SET / DECELERATE
4 - OFF
5 - SWITCH HANDLE

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 ECM.

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 ECM 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.

SPECIFICATIONS

TORQUE

DESCRIPTION	N-m	Ft. Lbs.	In. Lbs.
Switch Mounting Screw	.9-1.1	-	8-10

CABLE

DESCRIPTION

A cable and a vacuum controlled servo are not used with this package. This is a cable-less, servo-less system. The speed control system is electronically controlled by the Engine Control Module (ECM).

SERVO

DESCRIPTION

A vacuum controlled servo and control cable are not used with this package. This is a cable-less, servo-less system. The speed control system is electronically controlled by the Engine Control Module (ECM).

SWITCH

REMOVAL

The speed control switch is mounted to the back of the multi-function switch (Fig. 3). The multi-function switch must be removed first to gain access to the speed control switch mounting screw.

(1) Remove and isolate negative battery cable from battery.

(2) Remove multi-function switch. Refer to Multi-Function Switch Removal/Installation.

(3) Remove switch mounting screw (Fig. 4).

(4) Remove speed control switch from multi-function switch.

(5) Unplug pigtail electrical connector (Fig. 3) from instrument panel wiring harness.

INSTALLATION

The speed control switch is mounted to the back of the multi-function switch (Fig. 3).

(1) Position speed control switch to back of multi-function switch.

(2) Install switch mounting screw (Fig. 4). Refer to Torque Specifications.

Install multi-function switch. Refer to Multi-Function Switch Removal/Installation.

(3) Plug pigtail electrical connector (Fig. 3) into instrument panel wiring harness. Be sure wires are not pinched.

(4) Install negative battery cable to battery.

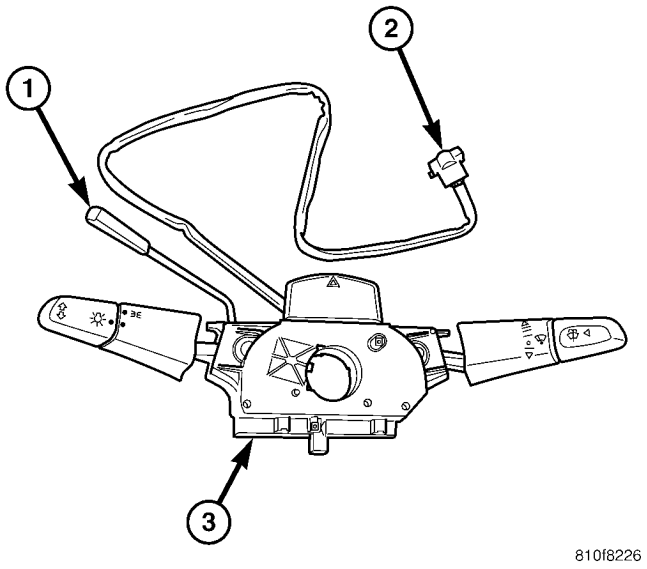


Fig. 3 SPEED CONTROL SWITCH LOCATION

1 - SWITCH HANDLE
2 - PIGTAIL ELECTRICAL CONNECTOR
3 - MULTI-FUNCTION SWITCH

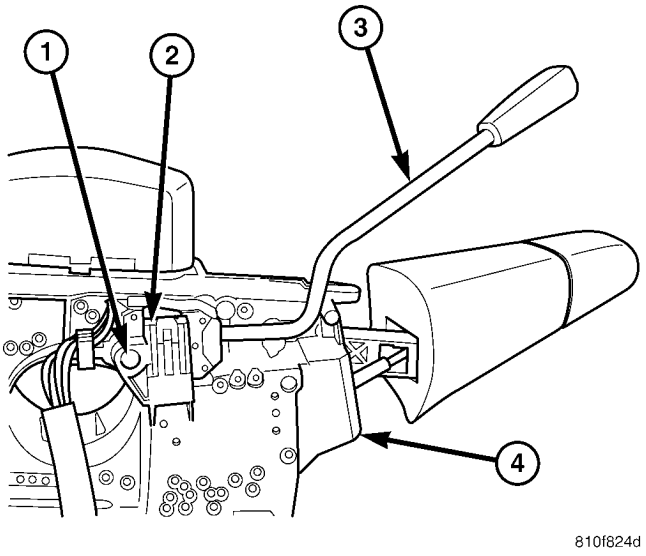


Fig. 4 SPEED CONTROL SWITCH REMOVAL / INSTALLATION

1 - SWITCH MOUNTING SCREW (1)
2 - SPEED CONTROL SWITCH
3 - SWITCH HANDLE
4 - MULTI-FUNCTION SWITCH

VEHICLE THEFT SECURITY

TABLE OF CONTENTS

page

VEHICLE THEFT SECURITY
DESCRIPTION 1
OPERATION 1
DIAGNOSIS AND TESTING - VEHICLE THEFT SECURITY 1
INTRUSION SENSOR
REMOVAL 2
INSTALLATION 2
SECURITY SYSTEM MODULE
REMOVAL 2
INSTALLATION 2

page

SENTRY KEY REMOTE ENTRY MODULE
DESCRIPTION 2
OPERATION 3
REMOVAL 3
INSTALLATION 4
SIREN
REMOVAL 4
INSTALLATION 4
TRANSPONDER KEY
DESCRIPTION 5
OPERATION 5

VEHICLE THEFT SECURITY

DESCRIPTION

An anti-theft alarm with battery powered horn is available as an option and includes interior monitoring, anti-tow away protection and rear window monitoring based on the heater wires. The alarm is automatically activated when the central locking system is operated.

The alarm will sound when any of the following occur:

- A door is opened
- A door is unlocked from inside the vehicle
- The hood is opened
- The vehicle is raised at the front or rear
- The trailer wire harness is disconnected
- Movements inside the vehicle
- The central locking is unlocked by a key at any other door than the driver's door

The alarm is functional about 30 seconds after the vehicle is locked using the RKE transmitter or the key in the driver's door. Activation is indicated by the indicator lights flashing three times and the warning lamp flashing in the switch. If persons or animals remain in the locked vehicle, the operator should switch off the interior monitor to avoid a false alarm.

OPERATION

The anti-theft alarm is activated/deactivated by locking/unlocking the vehicle with the remote transmitter or with the key at the driver's door. The key must be held in the locking position for more than two seconds. Activation is indicated by the turn signal lights flashing once. Unlocking the vehicle at one of the other doors will trigger an alarm.

The interior monitoring system included in the anti-theft alarm is based on ultrasonics and triggers an alarm if an object intrudes the interior of the vehicle or if any movement is detected inside the vehicle. For proper and effective protection, all windows and the sunroof must be closed.

To switch off the interior monitoring system and / or the anti-tow away protection, a switch with LED indicator light is provided in the switch panel. An alarm button enables the operator to trigger an alarm manually and to lock all doors if they are closed. Triggering an alarm makes the horn sound and the turn signals flash until the alarm is switched off.

The anti-theft alarm control unit includes a gradient indicator as anti-tow away protection. The gradient indicator triggers an audible and visual alarm if the vehicle is lifted (to tow away or to remove the wheels). The alarm remains effective even if the battery is disconnected as the horn is powered by its own battery. The interior monitoring system should be switched off if people and/or animals are left in the vehicle.

DIAGNOSIS AND TESTING - VEHICLE THEFT SECURITY

Any diagnosis of the Vehicle Theft Security system should begin with the use of the DRB III® diagnostic tool. For information on the use of the DRB III®, refer to the appropriate Diagnostic Service Manual.

INTRUSION SENSOR

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Insert the tip of a small flat-bladed screwdriver into the notch on one edge of the dome lamp/intrusion sensor unit housing to depress the retainer clip and pull that edge of the lamp away from its mounting location (Fig. 1).

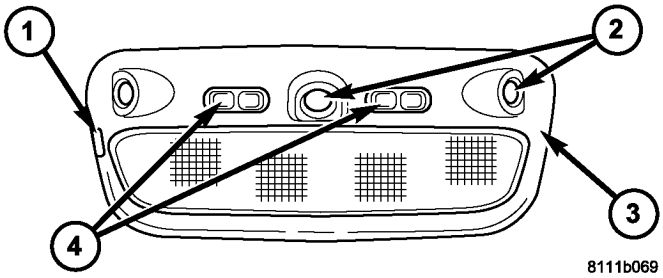


Fig. 1 DOME LAMP/INTRUSION SENSOR

1 - NOTCH
2 - SENSOR (3)
3 - HOUSING
4 - SWITCH (2)

(3) Pull the dome lamp/intrusion sensor unit from its mounting location far enough to access and disconnect the vehicle wire harness from the lamp connector receptacle.

(4) Remove the dome lamp/intrusion sensor unit from its mounting location.

INSTALLATION

(1) Position the dome lamp/intrusion sensor unit to its mounting location.

(2) Reconnect the vehicle wire harness connector to the dome lamp/intrusion sensor unit connector receptacle.

(3) Position the edge of the dome lamp/intrusion sensor unit housing opposite from the retainer clip into the mounting hole.

(4) Push firmly and evenly on the notched edge of the dome lamp/intrusion sensor unit housing until the retainer clip latches into place.

(5) Connect the battery negative cable.

SECURITY SYSTEM MODULE

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove driver seat cushion.

(3) Remove mounting fasteners.

(4) Disconnect wire harness connector.

INSTALLATION

(1) Connect wire harness connector.

(2) Position module. Install and tighten mounting fasteners.

(3) Install driver seat cushion.

(4) Connect battery negative cable.

SENTRY KEY REMOTE ENTRY MODULE

DESCRIPTION

The Sentry Key Remote Entry Module (SKREEM) (Fig. 2) performs the functions of the Sentry Key Immobilizer Module (SKIM) and the Remote Keyless Entry (RKE) module.

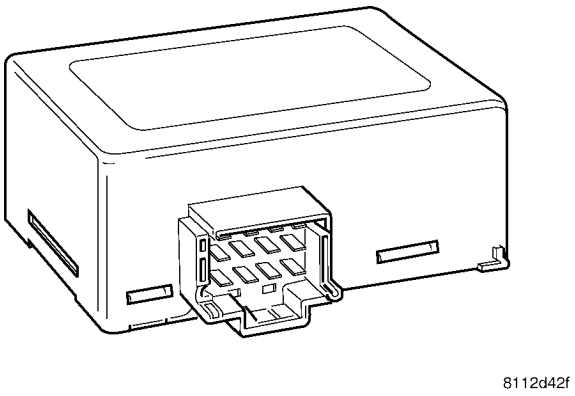


Fig. 2 SENTRY KEY REMOTE ENTRY MODULE (SKREEM)

SENTRY KEY REMOTE ENTRY MODULE (Continued)

SENTRY KEY IMMOBILIZER

The Sentry Key Immobilizer System (SKIS) authenticates an electronically coded Transponder Key placed into the ignition and sends a valid/invalid key message to the Engine Control Module (ECM) based upon the results. The "VALID/INVALID KEY" message communication is performed using a rolling code algorithm. A "VALID KEY" message must be sent to the ECM within two seconds of ignition ON to free the engine from immobilization. This Controller Area Network (CAN) data bus message is sent to the ECM after first going through the SKREEM. The SKREEM is located behind the instrument cluster and has a separately mounted antenna ring mounted around the ignition cylinder (Fig. 3) which picks up the transponder key signal.

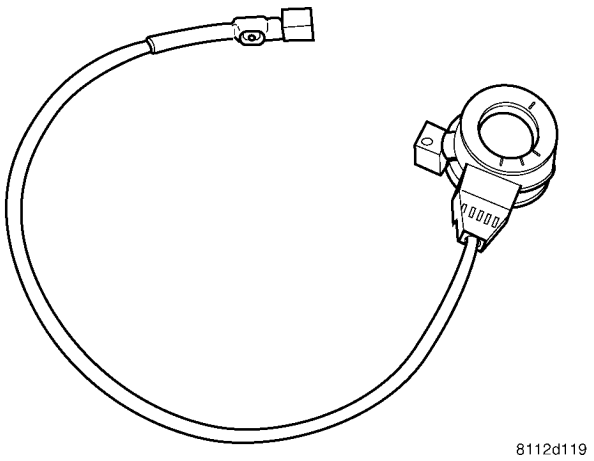


Fig. 3 TRANSPONDER RING

REMOTE KEYLESS ENTRY (RKE)

The RKE transmitter uses radio frequency signals to communicate with the Sentry Key Remote Entry Module (SKREEM). The SKREEM is hardwired to the Central Timer Module (CTM). When the operator presses a button on the transmitter, it sends a specific request to the SKREEM. In turn, the SKREEM sends the appropriate request to the CTM to unlock the vehicle doors.

OPERATION

SENTRY KEY IMMOBILIZER

The Sentry Key Remote Entry Module (SKREEM) receives an encrypted Radio Frequency (RF) signal from the transponder key which is read by the remotely mounted antenna ring at the ignition cylinder. The SKREEM then decrypts the signal and broadcasts the requested remote commands to the appropriate modules in the vehicle over the Controller Area Network (CAN) data bus. A valid transponder key ID must be incorporated into the RF signal in order for the SKREEM to pass the message on to the appropriate modules.

Automatic transponder key synchronization is done by the SKREEM if a valid transponder key is inserted into the ignition cylinder, and the ignition is turned ON. This provides a maximum operation window for RKE functions.

Each Sentry Key Remote Entry System (SKREES) consists of a SKREEM, an antenna ring mounted around the ignition cylinder, and a transponder key. Each system has a secret key code unique to that system. The secret key is electronically coded in the SKREEM and in all programmed transponder keys. It is used for immobilization and RKE functions for data security. In addition, each transponder key will have a unique identification.

REMOTE KEYLESS ENTRY

After pressing the lock button on the RKE transmitter, all of the door locks will lock, the illuminated entry will turn off (providing all doors are closed), and the VTSS (if equipped) will arm. After pressing the unlock button, on the RKE transmitter, one time, the driver door lock will unlock, the illuminated entry will turn on the courtesy lamps, and the VTSS (if equipped) will disarm. After pressing the unlock button a second time, the remaining door locks will unlock.

The SKREEM is capable of retaining up to 8 individual access codes (8 transmitters). If the PRNDL is in any position except park, the SKREEM will disable the RKE. Use the DRBIII® or the customer programming method to program the RKE system. However, the SKREEM will only allow RKE programming when the ignition is in the ON position, the PRNDL is in park position, and the VTSS (if equipped) is disarmed.

REMOVAL

SENTRY KEY REMOTE ENTRY MODULE

(1) Open hood, disconnect and isolate the battery negative cable.

(2) Wait two minutes for the system reserve capacitor to discharge before beginning any system or component service.

(3) Remove top cover - cluster (Refer to 23 - BODY/INSTRUMENT PANEL/TOP COVER - CLUSTER - REMOVAL).

SENTRY KEY REMOTE ENTRY MODULE (Continued)

(4) Disconnect the one electrical connector to the SKREEM (Fig. 4) which is the transponder ring connector.

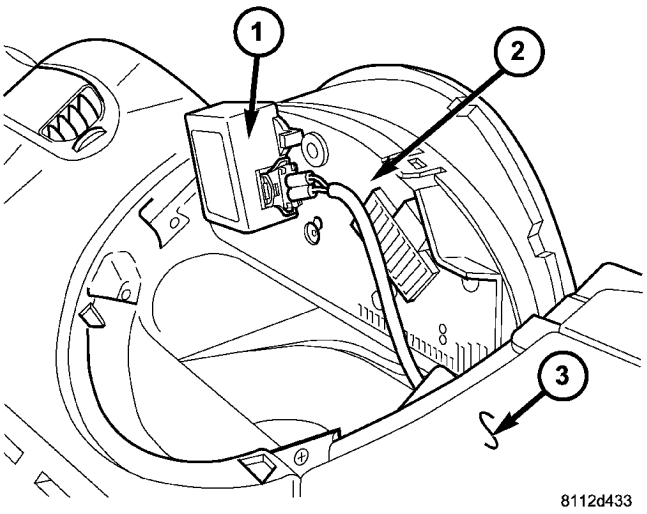


Fig. 4 SENTRY KEY REMOTE ENTRY MODULE (SKREEM) - REMOVE/INSTALL

1 - SENTRY KEY REMOTE ENTRY MODULE (SKREEM)
2 - INSTRUMENT CLUSTER (REAR)
3 - INSTRUMENT PANEL

(5) Pull SKREEM straight out of rear of instrument cluster (Fig. 4) and remove from vehicle.

SENTRY KEY REMOTE ENTRY MODULE TRANSPONDER RING

(1) Open hood, disconnect and isolate the battery negative cable.
(2) Wait two minutes for the system reserve capacitor to discharge before beginning any system or component service.
(3) Remove the steering column shrouds.
(4) Unsnap the SKREEM transponder from the ignition cylinder (Fig. 5).
(5) Remove top cover - cluster (Refer to 23 - BODY/INSTRUMENT PANEL/TOP COVER - CLUSTER - REMOVAL).
(6) Disconnect the transponder electrical connector from the SKREEM (Fig. 4).
(7) Maneuver wiring from instrument panel and remove transponder from vehicle.

INSTALLATION

SENTRY KEY REMOTE ENTRY MODULE

(1) Push SKREEM straight into the rear of instrument cluster (Fig. 4).
(2) Connect the one electrical connector to the SKREEM (Fig. 4).

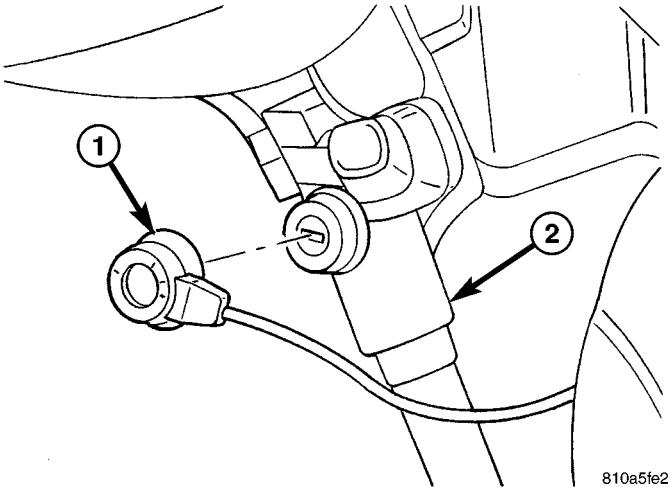


Fig. 5 TRANSPONDER RING

1 - TRANSPONDER RING
2 - STEERING COLUMN

(3) Install the top cover - cluster (Refer to 23 - BODY/INSTRUMENT PANEL/TOP COVER - CLUSTER - INSTALLATION)
(4) Connect the battery negative cable.
(5) Verify vehicle and system operation.
(6) Close hood.

SENTRY KEY REMOTE ENTRY MODULE TRANSPONDER RING

(1) Maneuver wiring through instrument panel (Fig. 5).
(2) Connect the transponder electrical connect or to the SKREEM (Fig. 4).
(3) Install the top cover - cluster (Refer to 23 - BODY/INSTRUMENT PANEL/TOP COVER - CLUSTER - INSTALLATION)
(4) Snap the SKREEM transponder in place around the ignition cylinder (Fig. 5).
(5) Install the steering column shrouds.
(6) Connect the battery negative cable.
(7) Verify vehicle and system operation.
(8) Close hood.

SIREN

REMOVAL

(1) Disconnect and isolate the battery negative cable.
(2) Remove mounting fasteners.
(3) Disconnect wire harness connector from siren.

INSTALLATION

(1) Connect wire harness connector to siren.
(2) Position siren. Install and tighten mounting fasteners.
(3) Connect battery negative cable.

TRANSPONDER KEY

DESCRIPTION

The Sentry Key Immobilizer System (SKIS) which communicates with the Sentry Key Remote Entry Module (SKREEM), uses a transponder chip that is integral to each key fob (Fig. 6). Ignition keys are supplied with the vehicle when it is shipped from the factory. The transponder chip is located within the Remote Keyless Entry (RKE) fob.

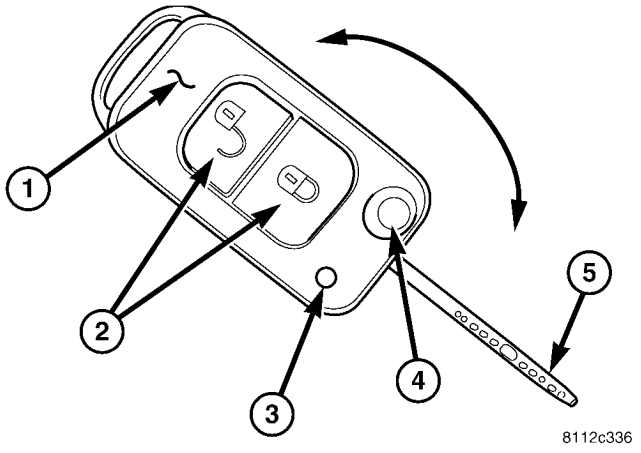


Fig. 6 TRANSPONDER KEY

1 - TRANSPONDER KEY FOB
2 - RKE BUTTONS
3 - INDICATOR LIGHT
4 - KEY BLADE RELEASE BUTTON
5 - KEY BLADE

OPERATION

Each Sentry Key has a unique transponder identification code permanently programmed into it by the manufacturer. Likewise, the Sentry Key Remote Entry Module (SKREEM) has a unique ″Secret Key″ code programmed into it by the manufacturer as well. When a Sentry Key is programmed into the memory of the SKREEM, the SKREEM stores the transponder identification code from the Sentry Key, and the Sentry Key learns the ″Secret Key″ code from the SKREEM. Once the Sentry Key learns the ″Secret Key″ code of the SKREEM, it is also permanently programmed into the transponder's memory.

The Sentry Key's transponder is within the range of the SKREEM's transponder ring when it is inserted into the ignition lock cylinder. When the ignition switch is turned to the ON position, the SKREEM communicates with the Sentry Key via a radio frequency (RF) signal. The SKREEM determines if a valid key is present based on the information it receives from the Sentry Key. If a valid key is detected, that fact is communicated to the Engine Control Module (ECM) via the Controller Area Network (CAN) data bus and the vehicle is allowed to continue running. If an invalid key is received by the ECM or no status at all is communicated, the vehicle will stall after two (2) seconds of running. The indicator light will be flashing at this point. The Sentry Key's transponder can not be repaired. If it is faulty or damaged, it must be replaced.

Common communication problems:

- Two transponder keys too close together.
- Speed Pass too close to transponder key.

Solid indicator that there is a system failure.

- Loss of ECM communication.
- Failed transponder ring circuit.

WIPERS/WASHERS

TABLE OF CONTENTS

page

WIPERS/WASHERS
DESCRIPTION 1
OPERATION 3
DIAGNOSIS AND TESTING - WIPER & WASHER SYSTEM 5
CLEANING - WIPER & WASHER SYSTEM 5
INSPECTION - WIPER & WASHER SYSTEM . . . 6
CHECK VALVE
DESCRIPTION 7
OPERATION 7
REMOVAL 7
INSTALLATION 7
WASHER FLUID LEVEL SWITCH
DESCRIPTION 7
OPERATION 8
WASHER HOSES/TUBES
DESCRIPTION 8
OPERATION 9
WASHER NOZZLE
DESCRIPTION 9
OPERATION 9
REMOVAL 9
INSTALLATION 9
WASHER PUMP/MOTOR
DESCRIPTION 9
OPERATION 10
REMOVAL 10
INSTALLATION 10
WASHER RESERVOIR
DESCRIPTION 11

page

OPERATION 11
REMOVAL 11
INSTALLATION 12
WIPER ARM
DESCRIPTION 13
OPERATION 14
REMOVAL 14
INSTALLATION 14
WIPER BLADE
DESCRIPTION 15
OPERATION 15
REMOVAL 16
INSTALLATION 16
WIPER LINKAGE
DESCRIPTION 17
OPERATION 17
REMOVAL 17
INSTALLATION 18
WIPER MOTOR
DESCRIPTION 19
OPERATION 19
REMOVAL 19
INSTALLATION 19
WIPER RELAY
DESCRIPTION 20
OPERATION 21
REMOVAL 22
INSTALLATION 22

WIPERS/WASHERS

DESCRIPTION

An electrically operated intermittent wiper and washer system is standard factory-installed safety equipment on this model (Fig. 1). The wiper and washer system includes the following major components, which are described in further detail elsewhere in this service information:

- **Check Valve** - The washer system check valve is integral to the plumbing fitting located in the washer plumbing between the cowl plenum washer hose and the two washer nozzle hoses, and is located beneath the cowl top panel at the base of the windshield in the engine compartment.
- **Multi-Function Switch** - The multi-function switch is secured to the top of the steering column, just below the steering wheel. Only the left (lighting), right (wiper) control stalks and the hazard warning switch button for the multi-function switch are visible, the remainder of the switch is concealed beneath the steering column shrouds. The multi-function switch contains all of the switches for both the wiper and washer systems.(Refer to 8 - ELECTRICAL/ LAMPS/LIGHTING - EXTERIOR/MULTI-FUNCTION SWITCH - DESCRIPTION)
- **Washer Fluid Level Switch** - The optional washer fluid level switch is integral to a unique version of the washer pump/motor unit, which is located in a dedicated hole on the top of the sump area near the back of the windshield washer reservoir on the right front fender wheel house in the engine compartment.
- **Washer Nozzle** - A single washer nozzle with three separate orifices is secured with integral snap

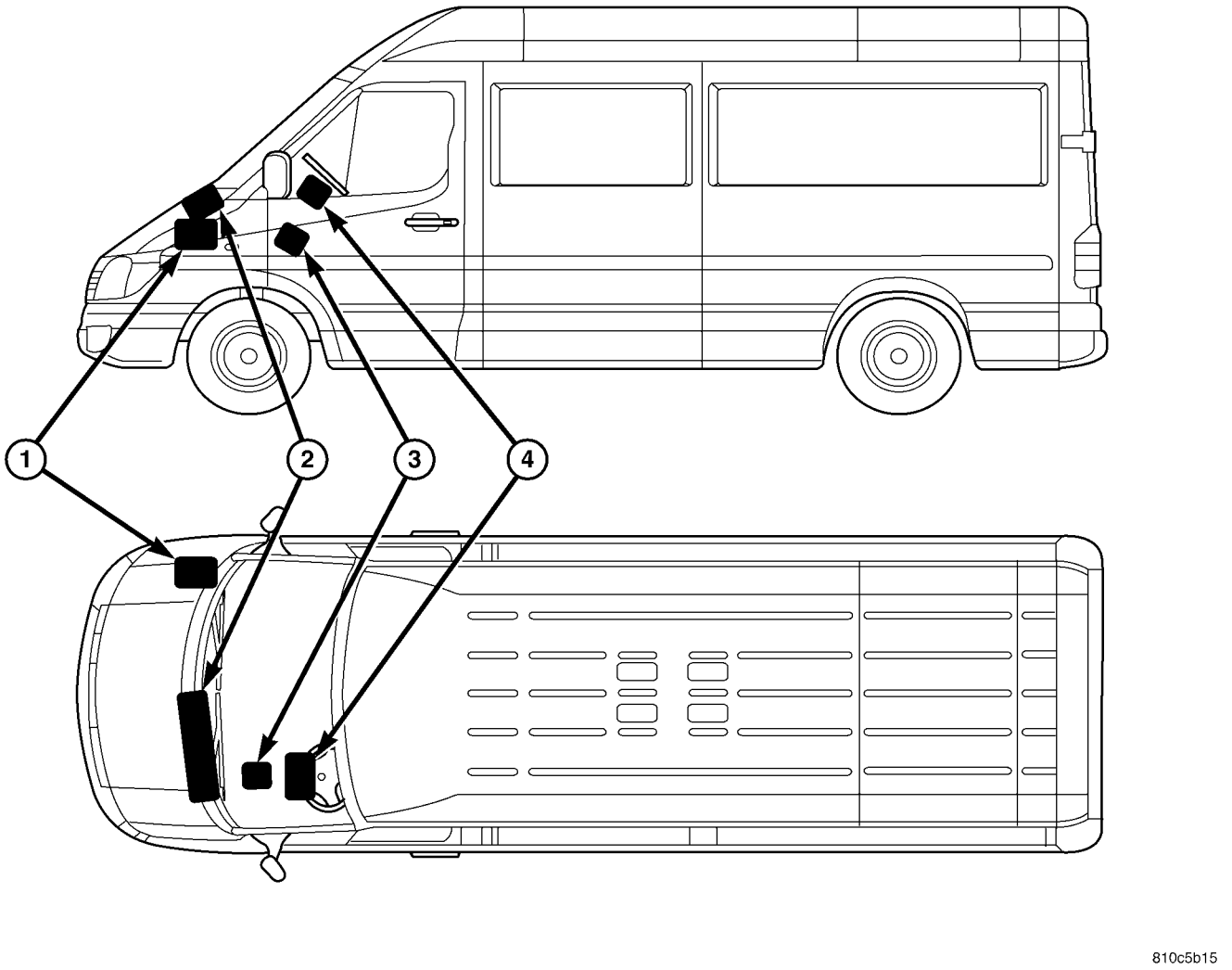


Fig. 1 Wiper & Washer System

1 - WASHER RESERVOIR, PUMP/MOTOR, FLUID LEVEL SWITCH
2 - WIPER MOTOR, LINKAGE & PIVOTS MODULE
3 - WIPER RELAY
4 - MULTI-FUNCTION (WIPER, WASHER, & LIGHTING) SWITCH

features to each wiper arm. The hoses for the washer nozzles are concealed beneath a molded plastic guide on the underside of each wiper arm and routed to the engine compartment through unique molded plastic elbow fittings located near each wiper pivot at the base of the windshield.

- **Washer Pump/Motor** - Two different washer pump/motor units are available for this model. One version has an integral washer fluid level switch that provides a hard wired input to the instrument cluster for control of the optional washer fluid indicator. The washer pump/motor unit is located in a dedicated hole on the top of the sump area near the back of the windshield washer reservoir on the right front fender wheel house in the engine compartment.
- **Washer Reservoir** - The washer reservoir is located on the right front fender wheel house in the engine compartment. The washer reservoir filler is accessed from the right front corner of the engine compartment.
- **Wiper Arm** - The two unequal length wiper arms are secured to the two wiper pivots, which extend through the cowl panel near the base of the windshield. The longer arm is installed on the left (driver) side of the windshield.
- **Wiper Blade** - The two unequal length wiper blades are secured to the two wiper arms, and are parked on the glass near the bottom of the windshield when the wiper system is not in operation.

WIPERS/WASHERS (Continued)

The longer blade is installed on the left (driver) side of the windshield.

- **Wiper Linkage** - The wiper pivots are the only visible components of the wiper linkage. The remainder of the linkage is concealed within the engine compartment just behind the hood opening. The wiper linkage module includes the two wiper drive links, the wiper motor crank arm, the two wiper pivots, and the linkage and motor mounting bracket.
- **Wiper Motor** - The wiper motor is secured to the wiper linkage module bracket on the underside of the cowl panel within the engine compartment. The wiper motor output shaft and crank arm extend through a clearance hole in the mounting bracket, where they are connected to a crank arm that drives the wiper linkage.
- **Wiper Relay** - The wiper relay is located in a dedicated receptacle on the lower left surface of the fuse block underneath the steering column behind the fuse access panel and the steering column opening panel.
- **Wiper, Turn Signals, Engine Start Control Module** - The wiper, turn signals and engine start control module is integral to the fuse block located underneath the steering column. The fuse block is concealed behind the fuse access panel and the steering column opening panel, where it is secured with screws to the steering column. The wiper, turn signals and engine start control module contains the intermittent wipe logic circuitry, which includes active electronic elements that allow it to provide the intermittent wipe delay and the wipe-after-wash features of the intermittent wipe system based upon numerous hard wired inputs, then provides the proper programmed hard wired control output to operate the wiper motor through the wiper relay.

Hard wired circuitry connects the wiper and washer system components to the electrical system of the vehicle. These hard wired circuits are integral to several wire harnesses, which are routed throughout the vehicle and retained by many different methods. These circuits may be connected to each other, to the vehicle electrical system and to the wiper and washer system components through the use of a combination of soldered splices, splice block connectors, and many different types of wire harness terminal connectors and insulators. Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, further details on wire harness routing and retention, as well as pin-out and location views for the various wire harness connectors, splices and grounds.

OPERATING MODES

The components of the wiper and washer system are designed to provide the following operating modes:

- **Continuous Wipe Mode** - The two-speed wiper motor, the internal circuitry of the multi-function switch, and the wiper relay work in concert to provide two continuous wipe cycles, low speed or high speed.
- **Intermittent Wipe Mode** - The internal circuitry of the multi-function switch, the intermittent wipe circuitry of the wiper, turn signals and engine start control module in the fuse block, and the wiper relay work in concert to provide an intermittent wipe mode with a single, fixed delay interval.
- **Pulse Wipe Mode** - The internal circuitry of the multi-function switch and the wiper relay work in concert to provide a pulse wipe mode that will allow the wiper motor to be operated for a single, complete wipe cycle.
- **Washer Mode** - When the washer system is activated with the multi-function switch while the wiper system is operating, washer fluid will be dispensed onto the windshield glass through the washer nozzles for as long as the washer pump/motor is energized.
- **Wipe-After-Wash Mode** - The intermittent wipe circuitry of the wiper, turn signals and engine start control module in the fuse block, and the wiper relay provide a wipe-after-wash feature. If the wipers are turned Off, this feature will operate the washer pump/motor and the wipers for as long as the washer system is activated, then provide several additional wipe cycles after the washer system is deactivated before parking the wiper blades near the base of the windshield.

OPERATION

The wiper and washer system is designed to provide the vehicle operator with a convenient, safe, and reliable means of maintaining visibility through the windshield glass. The various components of this system are designed to convert electrical energy produced by the vehicle electrical system into the mechanical action of the wiper blades to wipe the outside surface of the glass, as well as into the hydraulic action of the washer system to apply washer fluid stored in an on-board reservoir to the area of the glass to be wiped. When combined, these components provide the means to effectively maintain clear visibility for the vehicle operator by removing excess accumulations of rain, snow, bugs, mud, or other minor debris from the outside windshield glass surface that might be encountered while driving the vehicle under numerous types of inclement operating conditions.

WIPERS/WASHERS (Continued)

The vehicle operator initiates all wiper and washer system functions with the multi-function switch wiper control stalk that extends from the right side of the steering column, just below the steering wheel. Depressing, raising, or pulling the right control stalk of the multi-function switch selects the desired wiper system operating mode (Fig. 2). The wiper system allows the vehicle operator to select from two continuous wiper speeds, Hi or Lo, a fixed interval intermittent wipe mode, and a pulse wipe mode. Pushing the knob on the end of the control stalk towards the steering column activates the washer pump/motor, which dispenses washer fluid onto the windshield glass through the washer nozzles.

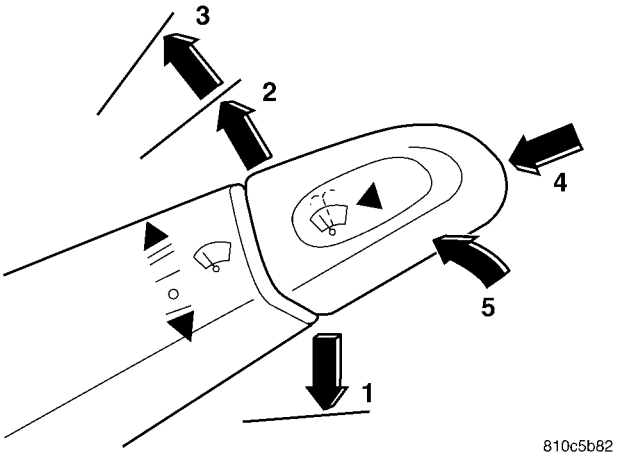


Fig. 2 Windshield Wiper/Washer Switch

1 - INTERMITTENT WIPE MODE
2 - CONTINUOUS LOW SPEED WIPE MODE
3 - CONTINUOUS HIGH SPEED WIPE MODE
4 - WASHER MODE
5 - PULSE WIPE MODE

When the ignition switch is in the On position, battery current from a fuse in the fuse block underneath the steering column is provided through a fused ignition switch output circuit to the wiper motor park switch, the intermittent wipe logic circuitry of the wiper, turn signals and engine start control module within the fuse block, the wiper relay, and the multi-function switch. The internal circuitry of the multi-function switch provides a direct hard wired battery current output to the low speed or high speed brushes of the wiper motor when the Lo, Hi, or Pulse position is selected, which causes the wipers to cycle at the selected speed for as long as that switch position remains selected.

In order to provide the intermittent wipe and wipe-after-wash features, the intermittent wipe logic circuitry within the fuse block monitors inputs from the intermittent wipe and washer switch circuitry of the multi-function switch and the park switch in the wiper motor. When the intermittent wipe position is selected with the multi-function switch control stalk, the intermittent wipe logic circuitry within the fuse block responds by energizing the wiper relay and calculating the correct delay interval. The energized wiper relay directs battery current through the intermittent wipe position circuitry of the multi-function switch to the low speed brush of the wiper motor. The intermittent wipe logic circuit monitors the wiper motor operation through the wiper park switch sense circuit, which allows it to determine the proper timing to begin the next wiper blade sweep. The normal delay interval is about five seconds.

When the Off position of the multi-function switch wiper control stalk is selected, one of two events is possible. The event that will occur depends upon the position of the wiper blades on the windshield at the moment that the Off position is selected. If the wiper blades are in the down position on the windshield when the Off position is selected, the park switch that is integral to the wiper motor is closed to ground, the intermittent wipe logic circuit de-energizes the wiper relay, and the wiper motor ceases to operate.

If the wiper blades are not in the down position on the windshield at the moment the Off position is selected, the park switch is closed to battery current through a fused ignition switch output circuit. The intermittent wipe logic circuit energizes the wiper relay and the park switch sense circuit directs battery current to the low speed brush of the wiper motor through the normally open contact of the wiper relay, then through the internal Off position circuitry of the multi-function switch. This causes the wiper motor to continue running until the wiper blades are in the down position on the windshield and the park switch is again closed to ground.

When the Wash position of the control knob on the right control stalk of the multi-function switch is selected, the Wash position circuitry within the switch directs a battery current signal input to the washer pump motor, and to the intermittent wipe logic circuitry. When the washer switch is closed with the wiper system turned Off, the intermittent wipe logic circuitry operates the wiper motor in the same manner as it does to provide the intermittent wipe mode operation. After the state of the washer switch changes to open, the intermittent wipe logic circuitry monitors the wiper motor through the wiper park switch sense circuit, which allows it to monitor the number of wiper blade sweeps. After the appropriate number of wiper sweeps, the intermittent wipe logic circuitry de-energizes the wiper relay once the wiper motor returns the wipers to their park position.

The hard wired inputs to and outputs from the wiper and washer system components may be diagnosed and tested using conventional diagnostic tools

and methods. Proper testing of the intermittent wipe logic circuitry within the fuse block requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information. Refer to the owner's manual in the vehicle glove box for more information on the features and operation of the wiper and washer system.

DIAGNOSIS AND TESTING - WIPER & WASHER SYSTEM

If the wiper motor operates, but the wipers do not move on the windshield, replace the faulty wiper linkage module. If the washer pump/motor operates, but no washer fluid is dispensed on the glass; or, if the wipers operate, but chatter, lift, or do not clear the glass, clean and inspect the wiper and washer system components as required. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - CLEANING) and (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - INSPECTION). For diagnosis and testing of the multi-function switch (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/MULTI-FUNCTION SWITCH - DIAGNOSIS AND TESTING). Refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

The hard wired circuits and components of the wiper and washer system may be diagnosed and tested using conventional diagnostic tools and procedures. However, conventional diagnostic methods may not prove conclusive in the diagnosis of the intermittent wipe logic circuitry contained within the fuse block underneath the steering column. The most reliable, efficient, and accurate means to diagnose the intermittent wipe logic circuitry requires the use of a DRBIII® scan tool. Refer to the appropriate diagnostic information.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

CLEANING - WIPER & WASHER SYSTEM

WIPER SYSTEM

The squeegees of wiper blades exposed to the elements for a long time tend to lose their wiping effectiveness. Periodic cleaning of the squeegees is suggested to remove any deposits of salt or road film. The wiper blades, arms, and windshield glass should only be cleaned using a sponge or soft cloth and windshield washer fluid, a mild detergent, or a non-abrasive cleaner. If the wiper blades continue to leave streaks, smears, hazing, or beading on the glass after thorough cleaning of the squeegees and the glass, the entire wiper blade assembly must be replaced.

CAUTION: Protect the rubber squeegees of the wiper blades from any petroleum-based cleaners, solvents, or contaminants. These products can rapidly deteriorate the rubber squeegees.

WASHER SYSTEM

If the washer system is contaminated with foreign material, drain the washer reservoir by removing the washer pump/motor from the reservoir. Clean foreign material from the inside of the washer pump/motor inlet nipple and the washer reservoir using clean washer fluid, a mild detergent, or a non-abrasive cleaner. Flush foreign material from the washer system plumbing by first disconnecting the washer hoses from the washer nozzles, then running the washer pump/motor to run clean washer fluid or water through the system. Plugged or restricted washer nozzles should be carefully back-flushed using compressed air. If the washer nozzle obstruction cannot be cleared, replace the washer nozzle.

CAUTION: Never introduce petroleum-based cleaners, solvents, or contaminants into the washer system. These products can rapidly deteriorate the rubber seals and hoses of the washer system, as well as the rubber squeegees of the wiper blades.

CAUTION: Never use compressed air to flush the washer system plumbing. Compressed air pressures are too great for the washer system plumbing components and will result in further system damage. Never use sharp instruments to clear a plugged washer nozzle or damage to the nozzle orifice and improper nozzle spray patterns will result.

WIPERS/WASHERS (Continued)

INSPECTION - WIPER & WASHER SYSTEM

WIPER SYSTEM

The wiper blades and wiper arms should be inspected periodically, not just when wiper performance problems are experienced. This inspection should include the following points:

(1) Inspect the wiper arms for any indications of damage, or contamination. If the wiper arms are contaminated with any foreign material, clean them as required. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - CLEANING). If a wiper arm is damaged or corrosion is evident, replace the wiper arm with a new unit. Do not attempt to repair a wiper arm that is damaged or corroded.

(2) Carefully lift the wiper blade off of the glass. Note the action of the wiper arm hinge. The wiper arm should pivot freely at the hinge, but with no lateral looseness evident. If there is any binding evident in the wiper arm hinge, or there is evident lateral play in the wiper arm hinge, replace the wiper arm.

CAUTION: Do not allow the wiper arm to spring back against the glass without the wiper blade in place or the glass may be damaged.

(3) Once proper hinge action of the wiper arm is confirmed, check the hinge for proper spring tension. Remove the wiper blade from the wiper arm. Either place a small postal scale between the blade end of the wiper arm and the glass, or carefully lift the blade end of the arm away from the glass using a small fish scale. Compare the scale readings between the right and left wiper arms. Replace a wiper arm if it has comparatively lower spring tension, as evidenced by a lower scale reading.

(4) Inspect the wiper blades and squeegees for any indications of damage, contamination, or rubber deterioration (Fig. 3). If the wiper blades or squeegees are contaminated with any foreign material, clean them and the glass as required. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - CLEANING). After cleaning the wiper blade and the glass, if the wiper blade still fails to clear the glass without smearing, streaking, chattering, hazing, or beading, replace the wiper blade. Also, if a wiper blade is damaged or the squeegee rubber is damaged or deteriorated, replace the wiper blade with a new unit. Do not attempt to repair a wiper blade that is damaged.

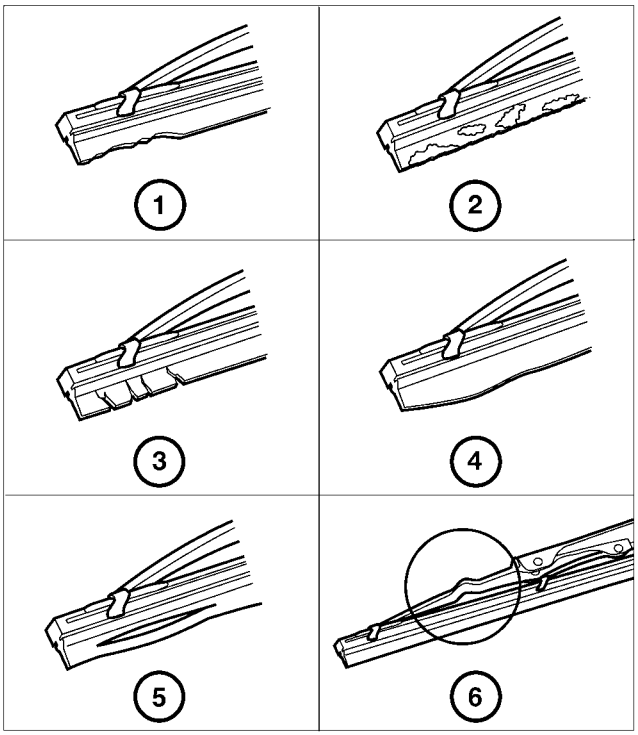


Fig. 3 Wiper Blade Inspection

1 - WORN OR UNEVEN EDGES
2 - ROAD FILM OR FOREIGN MATERIAL DEPOSITS
3 - HARD, BRITTLE, OR CRACKED
4 - DEFORMED OR FATIGUED
5 - SPLIT
6 - DAMAGED SUPPORT COMPONENTS

WASHER SYSTEM

The washer system components should be inspected periodically, not just when washer performance problems are experienced. This inspection should include the following points:

(1) Check for ice or other foreign material in the washer reservoir. If contaminated, clean and flush the washer system. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS - CLEANING).

(2) Inspect the washer plumbing for pinched, leaking, deteriorated, or incorrectly routed hoses and damaged or disconnected hose fittings. Replace damaged or deteriorated hoses and hose fittings. Leaking washer hoses can sometimes be repaired by cutting the hose at the leak and splicing it back together using an in-line connector fitting. Similarly, sections of deteriorated hose can be cut out and replaced by splicing in new sections of hose using in-line connector fittings. Whenever routing a washer hose or a wire harness containing a washer hose, it must be routed away from hot, sharp, or moving parts. Also, sharp bends that might pinch the washer hose must be avoided.

CHECK VALVE

DESCRIPTION

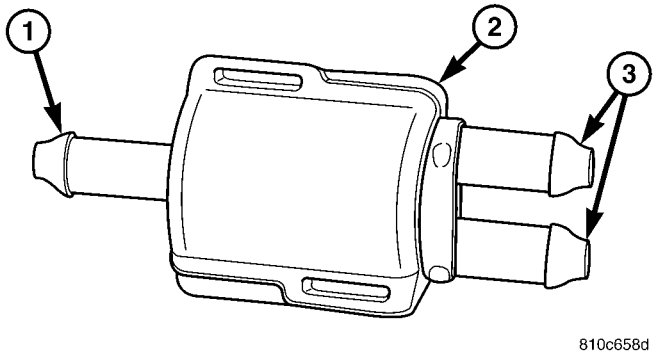


Fig. 4 Check Valve

1 - INLET NIPPLE
2 - CHECK VALVE
3 - OUTLET NIPPLE (2)

A single washer system check valve is standard equipment on this model, and is installed in the washer system plumbing (Fig. 4). The check valve is integral to the washer plumbing fitting located on the underside of the cowl top panel behind the rear of the hood panel opening in the engine compartment. The check valve consists of a molded plastic body with three barbed hose nipples, one at the inlet side of the valve body and two at the outlet side. The check valve cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

OPERATION

The check valve provides more than one function in this application. It serves as a plumbing connector fitting between the engine compartment and washer nozzle sections of the washer supply hose. It prevents washer fluid from draining out of the washer supply hoses back to the washer reservoir. This drain-back would result in a lengthy delay from when the washer switch is actuated until washer fluid was dispensed through the washer nozzles, because the washer pump would have to refill the washer plumbing from the reservoir to the nozzles. Such a drain-back condition could also result in water, dirt, or other outside contaminants being siphoned into the washer system through the washer nozzle orifice. This water could subsequently freeze and plug the nozzle, while other contaminants could interfere with proper nozzle operation and cause improper nozzle spray patterns. In addition, the check valve prevents washer fluid from siphoning through the washer nozzles after the washer system is turned Off.

When the washer pump pressurizes and pumps washer fluid from the reservoir through the washer plumbing, the fluid pressure unseats a diaphragm from over a sump well within the valve by overriding the spring pressure applied to it by a piston. With the diaphragm unseated, washer fluid is allowed to flow toward the two washer nozzles. When the washer pump stops operating, the spring pressure on the piston seats the diaphragm over the sump well in the valve and fluid flow in either direction within the washer plumbing is prevented. The check valve cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

REMOVAL

(1) Unlatch and open the hood panel.

(2) Disconnect the washer hoses from the three barbed nipples of the check valve unit (Fig. 5).

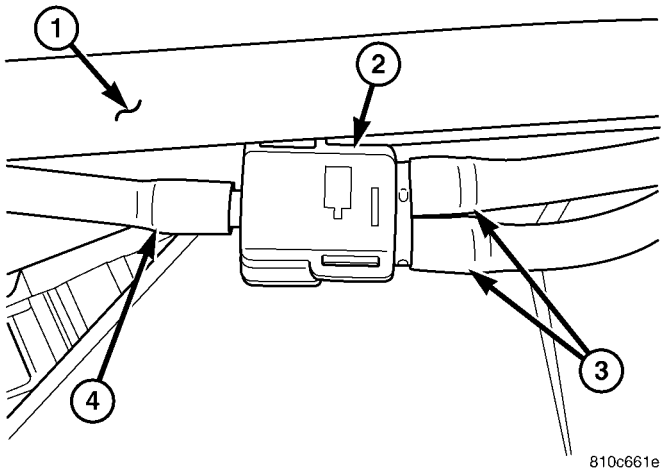


Fig. 5 Check Valve Remove/Install

1 - COWL HOOD SEAL
2 - CHECK VALVE
3 - HOSE TO WASHER NOZZLE (2)
4 - HOSE FROM WASHER PUMP

(3) Remove the check valve unit from the underside of the cowl top panel.

INSTALLATION

(1) Position the check valve unit to the underside of the cowl top panel (Fig. 5).

(2) Reconnect the three washer hoses to the barbed nipples of the check valve unit.

(3) Close and latch the hood.

WASHER FLUID LEVEL SWITCH

DESCRIPTION

The optional washer fluid level switch is a single pole, single throw switch that is integral to a unique version of the washer pump/motor unit, located rearward facing side of the washer reservoir, which is located in a dedicated hole on the top of the sump area near the back of the windshield washer reser-

WASHER FLUID LEVEL SWITCH (Continued)

voir on the right front fender wheel house in the engine compartment. Only a molded plastic nipple with a clear vent tube are visible near the top of the washer pump/motor unit that is equipped with the optional fluid level switch when it is installed in the reservoir. The vent tube is routed to and retained in an integral clip located behind the reservoir filler cap near the top of the reservoir. This version of the washer pump/motor unit also has a third terminal pin in its integral connector receptacle. The washer fluid level switch cannot be adjusted or repaired. If faulty or damaged, the entire washer pump/motor unit must be replaced.

OPERATION

The washer fluid level switch monitors the level of the washer fluid in the washer reservoir. When the fluid level in the washer reservoir is at or above the predetermined minimum, the switch contacts are open. When the fluid level in the washer reservoir falls below the predetermined minimum, the switch contacts of the normally open switch close. The washer fluid level switch is connected to the vehicle electrical system through the washer pump/motor unit take out and connector of the vehicle wire harness. The switch receives a path to ground at all times through another take out of the vehicle wire harness with a single eyelet terminal connector that is secured under a ground screw located near the right headlamp in the engine compartment.

The switch is connected in series between ground and the washer fluid switch sense input to the ElectroMechanical Instrument Cluster (EMIC). When the switch closes, the EMIC senses the ground on the washer fluid switch sense circuit. The EMIC is programmed to respond to this input by illuminating the washer fluid indicator. The washer fluid level switch input to the EMIC may be diagnosed using conventional diagnostic tools and methods.

WASHER HOSES/TUBES

DESCRIPTION

The washer plumbing consists of a small diameter rubber hose that is routed from the barbed outlet nipple of the washer pump/motor on the washer reservoir to the check valve just below the cowl top panel behind the rear of the hood opening in the engine compartment (Fig. 6). The other two barbed nipples of the check valve are connected to two short lengths of hose that each terminate at a molded plastic elbow that passes through a rubber grommet from the engine compartment to the outside of the cowl top panel near each wiper pivot. The two washer nozzle hoses are then connected from the elbow fittings on the outside of the cowl top panel along the underside of the wiper arms to the two washer nozzles.

Washer hose is available for service only as roll stock, which must then be cut to length. The molded plastic

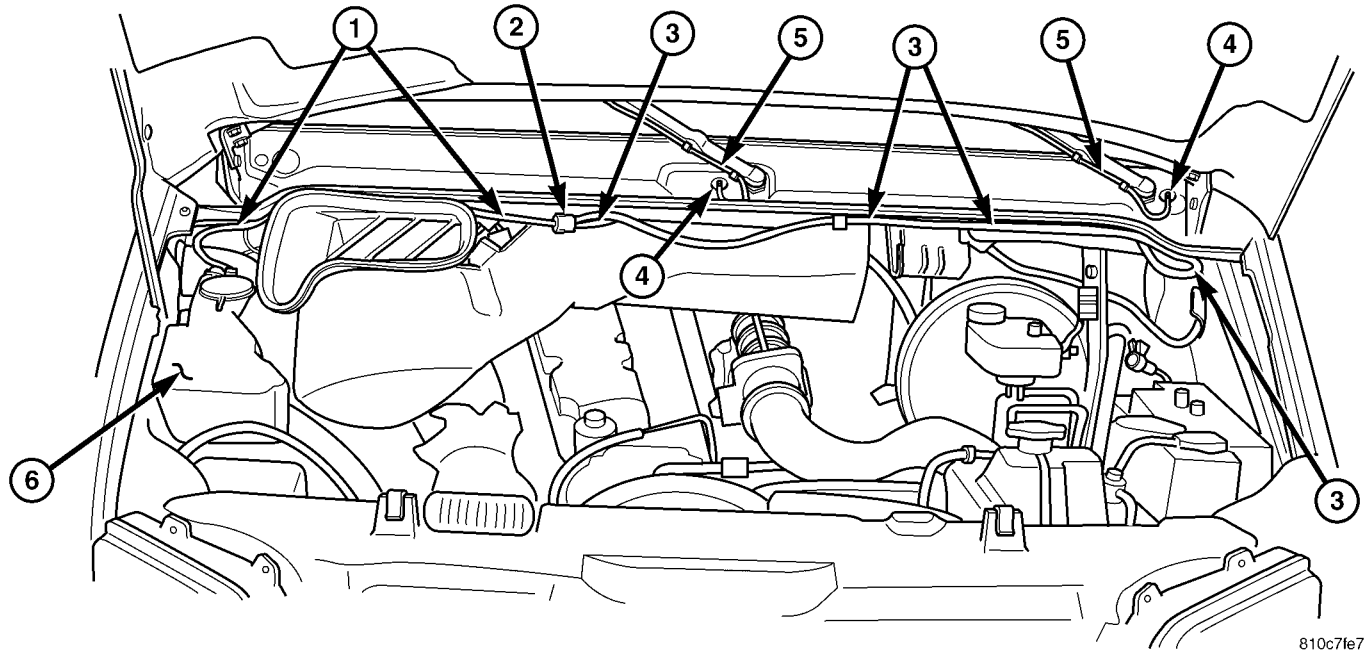


Fig. 6 Washer Plumbing

1 - WASHER SUPPLY HOSE
2 - CHECK VALVE
3 - WASHER NOZZLE HOSE (2)
4 - ELBOW FITTING (2)
5 - WIPER ARM WASHER HOSE (2)
6 - WASHER RESERVOIR

WASHER HOSES/TUBES (Continued)

washer hose fittings cannot be repaired. If these fittings are faulty or damaged, they must be replaced.

OPERATION

Washer fluid in the washer reservoir is pressurized and fed by the washer pump/motor through the washer system plumbing and fittings to the two washer nozzles. Whenever routing the washer hose or a wire harness containing a washer hose, it must be routed away from hot, sharp, or moving parts; and, sharp bends that might pinch the hose must be avoided.

WASHER NOZZLE

DESCRIPTION

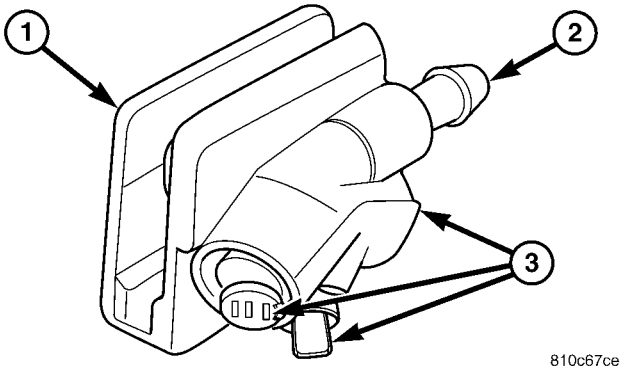


Fig. 7 Washer Nozzle

1 - WASHER NOZZLE
2 - NIPPLE
3 - ORIFICE (3)

The two washer nozzles have integral mounts with snap features that secure them near the tops of the two wiper arms on the windshield. The lower surface of the washer nozzle has an integral barbed nipple that connects to the washer hose, and three nozzle orifices are oriented to dispense the washer fluid on the windshield glass throughout the wiped area of the glass (Fig. 7). The washer nozzles are constructed entirely of molded plastic. The washer nozzles cannot be adjusted or repaired and, if faulty or damaged, they must be replaced.

OPERATION

The two washer nozzles are designed to dispense washer fluid into the wiper pattern area on the outside of the windshield glass. Pressurized washer fluid is fed to each nozzle from the washer reservoir by the washer pump/motor through rubber hoses, which are attached to a barbed nipple on the underside of each washer nozzle below the wiper arm. The three orifices of each nozzle causes the pressurized washer fluid to be emitted generously in several streams throughout the travel of the wiper arm to more effectively cover a larger area of the glass to be cleaned.

REMOVAL

(1) Using hand pressure, unsnap the washer nozzle from the wiper arm (Fig. 8).

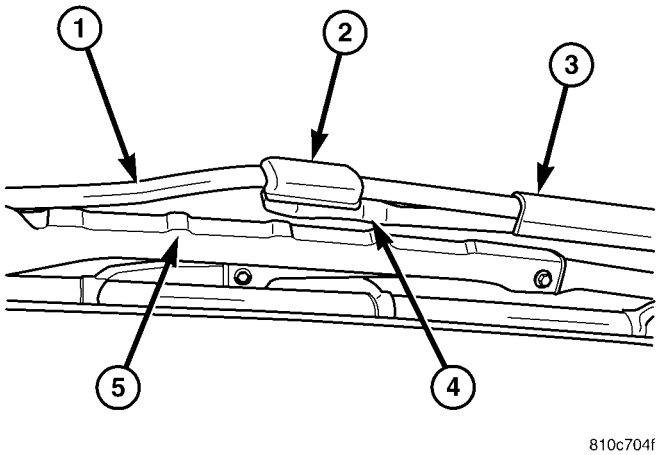


Fig. 8 Washer Nozzle Remove/Install

1 - WIPER ARM
2 - WASHER NOZZLE
3 - HOSE GUARD
4 - WASHER HOSE
5 - WIPER BLADE

(2) Disconnect the hose from the barbed nipple of the washer nozzle.

INSTALLATION

(1) Reconnect the hose to the barbed nipple of the washer nozzle (Fig. 8).

(2) Using hand pressure, slide the washer nozzle onto the wiper arm until it snaps into place. Be certain the nozzle snap feature is engaged in the locator hole on the wiper arm.

WASHER PUMP/MOTOR

DESCRIPTION

The washer pump/motor unit is located in a dedicated hole on the top of the sump area near the back of the windshield washer reservoir on the right front fender wheel house in the engine compartment (Fig. 9). A small permanently lubricated and sealed electric motor is coupled to the rotor-type washer pump. An inlet nipple on the bottom of the pump housing passes through a rubber grommet seal installed in the dedicated mounting hole in the washer reservoir. A small barbed outlet nipple near the bottom of the pump housing connects the unit to the washer hose. The washer pump/motor unit is retained on the reservoir by the interference fit between the inlet nipple

WASHER PUMP/MOTOR (Continued)

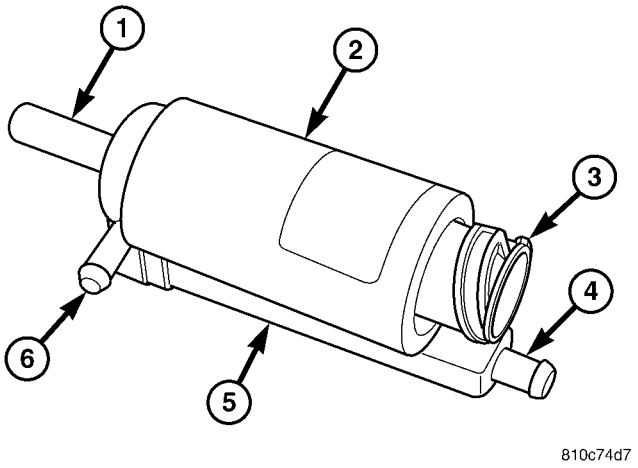


Fig. 9 Washer Pump/Motor

1 - INLET NIPPLE
2 - WASHER PUMP/MOTOR
3 - CONNECTOR RECEPTACLE
4 - VENT NIPPLE (W/FLUID LEVEL SWITCH ONLY)
5 - WASHER FLUID LEVEL SWITCH HOUSING
6 - OUTLET NIPPLE

and the grommet seal, which is a light press fit. An integral electrical connector receptacle is located on the top of the motor housing.

An optional version of the washer pump/motor unit incorporates an integral washer fluid level switch. This version can be distinguished from models without the switch by a vent nipple at the top of the switch housing that is connected to a vent hose that is retained in an integral clip behind the filler cap near the top of the reservoir, and by a third terminal pin in the washer pump/motor connector receptacle. The washer pump/motor unit cannot be repaired. If faulty or damaged, the entire washer pump/motor unit must be replaced.

OPERATION

The washer pump/motor unit is connected to the vehicle electrical system through a single take out and connector of the vehicle wire harness. The washer pump/motor is grounded at all times through a take out of the vehicle wire harness with a single eyelet terminal connector that is secured under a ground screw located near the right headlamp in the engine compartment. The washer pump/motor receives battery current on a washer switch sense circuit through the closed contacts of the momentary washer switch circuitry within the multi-function switch. When the pump motor is energized, the rotor-type pump pressurizes the washer fluid and forces it through the pump outlet nipple, the washer plumbing, and the washer nozzles onto the windshield glass. The washer pump/motor unit can be diagnosed using conventional diagnostic tools and methods.

REMOVAL

(1) Disconnect the vehicle wire harness connector for the washer pump/motor from the motor connector receptacle (Fig. 10).

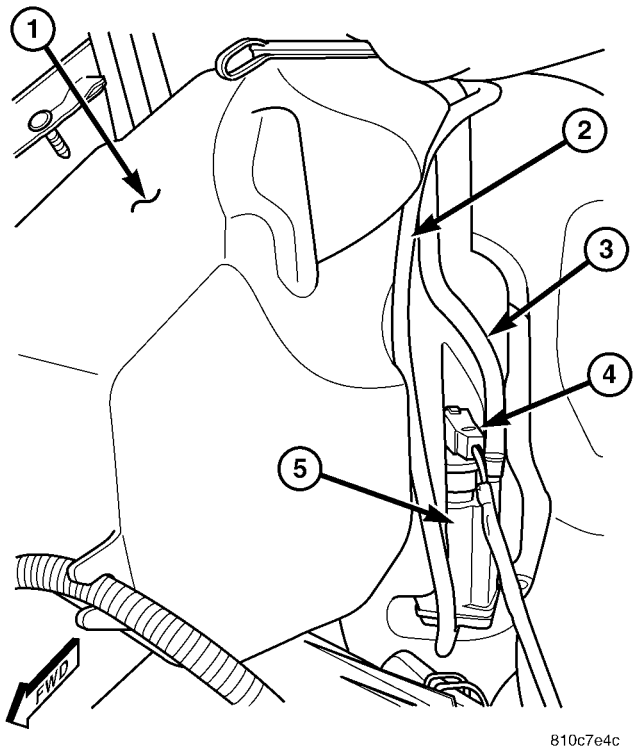


Fig. 10 Washer Pump/Motor Remove/Install

1 - WASHER RESERVOIR
2 - WASHER SUPPLY HOSE
3 - VENT HOSE (W/FLUID LEVEL SWITCH ONLY)
4 - WIRE HARNESS CONNECTOR
5 - WASHER PUMP/MOTOR

(2) Disconnect the washer supply hose from the barbed outlet nipple of the washer pump/motor and allow the washer fluid to drain into a clean container for reuse.

(3) If the vehicle is so equipped, disconnect the washer fluid level switch vent hose from the barbed vent nipple near the top of the washer pump/motor unit.

(4) Using hand pressure, firmly grasp and pull the washer pump out of the rubber grommet seal in the reservoir. Care must be taken not to damage the reservoir.

(5) 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 inlet nipple of the washer pump to the rubber grommet seal in the reservoir.

WASHER PUMP/MOTOR (Continued)

(3) Using hand pressure, press firmly and evenly on the washer pump until the inlet nipple is fully seated in the rubber grommet seal in the washer reservoir mounting hole (Fig. 10).

(4) If the vehicle is so equipped, reconnect the washer fluid level switch vent hose to the barbed vent nipple at the top of the washer pump/motor housing.

(5) Reconnect the washer hose to the barbed outlet nipple of the washer pump.

(6) Reconnect the vehicle wire harness connector for the washer pump/motor unit to the motor connector receptacle.

(7) Refill the washer reservoir with the washer fluid drained from the reservoir during the removal procedure.

WASHER RESERVOIR

DESCRIPTION

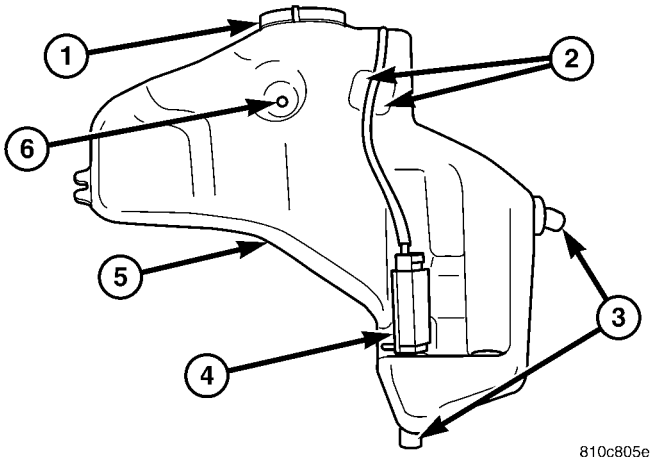


Fig. 11 Washer Reservoir

1 - CAP
2 - TROUGH (2)
3 - MOUNTING POST (2)
4 - WASHER PUMP/MOTOR
5 - RESERVOIR
6 - MOUNTING HOLE

The molded plastic washer fluid reservoir is located in the right rear corner of the engine compartment (Fig. 11). Two integral mounting posts, one on the bottom and one at the rear of the reservoir, each are engaged in rubber mounting grommets, one in the dash panel and one in the top of the right front wheel house. A single nut and washer secures an integral mounting hole near the top of the reservoir to a stud nut on the right inner fender shield. Also near the upper inboard side of the reservoir are two integral hose routing troughs, one for the standard washer supply hose and the second for the optional vent hose used when the washer pump/motor is equipped with an integral washer fluid level switch.

A molded blue plastic filler cap with an integral retainer ring and tether strap snaps over the open end of the filler neck, and hangs from the tether when it is removed for inspecting or adjusting the fluid level in the reservoir. There is a sump area near the bottom inboard side of the reservoir with a dedicated hole provided for the mounting of the washer/pump motor unit and rubber grommet seal.

The washer reservoir cannot be repaired and, if faulty or damaged, it must be replaced. The washer reservoir, the mounting grommets, the grommet seal for the washer pump/motor unit, and the filler cap are each available for service replacement.

OPERATION

The washer fluid reservoir provides a secure, on-vehicle storage location for a large reserve of washer fluid for operation of the washer system. The washer reservoir filler neck provides a clearly marked and readily accessible point from which to add washer fluid to the reservoir. The washer/pump motor unit is located in a sump area near the bottom of the reservoir to be certain that washer fluid will be available to the pump as the fluid level in the reservoir becomes depleted. The optional washer fluid level switch is designed to provide adequate warning to the vehicle operator that the washer fluid level is low, before the washer system will no longer operate.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the upper turbocharger heat shield and the upper air cleaner housing from the engine compartment (Fig. 12).

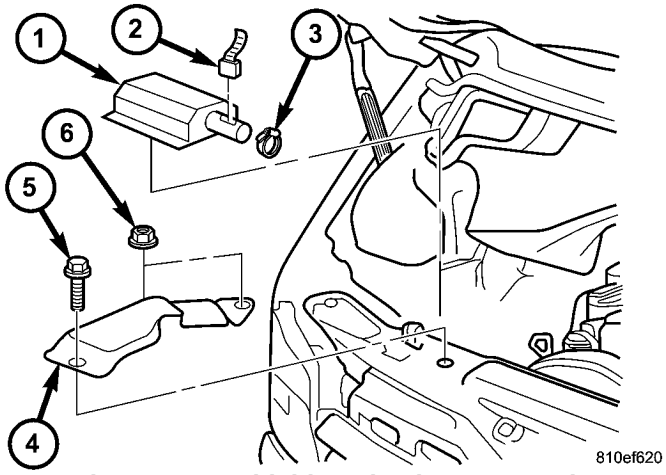


Fig. 12 Heat Shield & Air Cleaner Housing

1 - UPPER AIR CLEANER HOUSING
2 - VEHICLE WIRE HARNESS CONNECTOR
3 - CLAMP
4 - UPPER TURBO HEAT SHIELD
5 - SCREW
6 - NUT (2)

WASHER RESERVOIR (Continued)

(3) Disconnect the vehicle wire harness connector for the washer pump/motor unit from the motor connector receptacle.

(4) Disengage the vehicle wire harness from the routing clip integral to the front of the washer reservoir (Fig. 13).

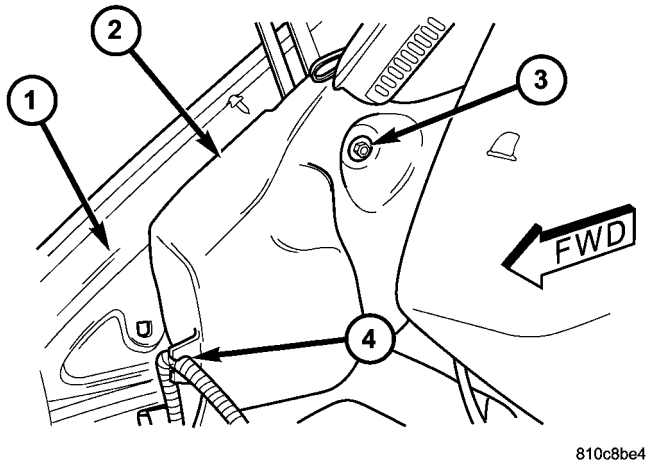


Fig. 13 Washer Reservoir Remove/Install

1 - RIGHT INNER FENDER
2 - WASHER RESERVOIR
3 - NUT & WASHER
4 - ROUTING CLIP

(5) Remove the washer supply hose from the barbed outlet nipple of the washer pump/motor and allow the washer fluid to drain into a clean container for reuse.

(6) Disengage the washer supply hose from the routing trough integral to the top of the washer reservoir.

(7) Remove the nut and washer that secures the top of the washer reservoir to the stud nut on the right inner fender.

(8) Pull the washer reservoir inboard far enough to disengage the reservoir from the stud nut.

(9) Tilt the washer reservoir forward far enough to disengage the rear mounting post from the grommet in the dash panel.

(10) Lift the washer reservoir upward far enough to disengage the lower mounting post from the grommet in the top of the right front wheel house.

(11) Remove the washer reservoir from the engine compartment.

INSTALLATION

(1) Position the washer reservoir into the engine compartment.

(2) Engage the lower mounting post of the washer reservoir into the grommet in the top of the right front wheel house (Fig. 14).

(3) Engage the rear mounting post of the washer reservoir into the grommet in the dash panel.

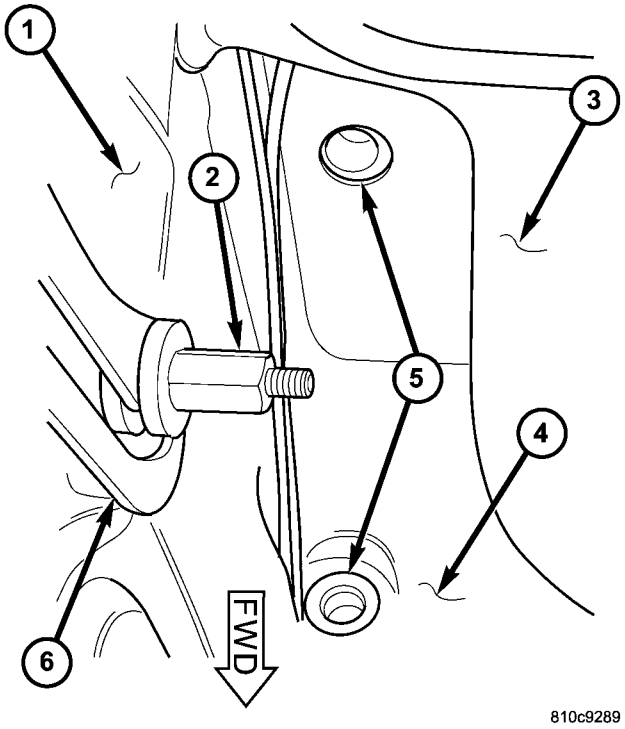


Fig. 14 Washer Reservoir Mounting

1 - RIGHT INNER FENDER
2 - STUD NUT
3 - DASH PANEL
4 - RIGHT FRONT WHEEL HOUSE
5 - GROMMET (2)
6 - HOOD PROP

(4) Position the washer reservoir mounting hole over the stud nut on the right inner fender (Fig. 13).

(5) Install and tighten the nut and washer that secures the top of the washer reservoir to the stud nut on the right inner fender. Tighten the nut to 6 N·m (50 in. lbs.).

(6) Reconnect the washer supply hose to the barbed outlet nipple of the washer pump/motor.

(7) Engage the washer supply hose into the routing trough integral to the top of the washer reservoir.

(8) Reconnect the vehicle wire harness connector for the washer pump/motor unit to the motor connector receptacle.

(9) Engage the vehicle wire harness into the routing clip integral to the front of the washer reservoir.

(10) Reinstall the upper turbocharger heat shield and the upper air cleaner housing into the engine compartment (Fig. 12).

(11) Refill the washer reservoir with the washer fluid drained from the reservoir during the removal procedure.

(12) Reconnect the battery negative cable.

WIPER ARM

DESCRIPTION

The wiper arms are the rigid members located between the wiper pivots that protrude from the cowl top panel near the base of the windshield and the wiper blades on the windshield glass (Fig. 15). These wiper arms feature an over-center hinge that allows easy access to the windshield glass for cleaning. The wiper arm has a die cast metal pivot end with a large tapered mounting hole at one end. A removable molded black plastic pivot cover fits loosely over and pivots on the wiper arm hinge pin, then snaps over the pivot end to conceal the wiper arm retaining nut.

The wide end of a tapered, stamped steel channel hinges on and is secured with a hinge pin to the pivot end of the wiper arm. One end of a long, rigid, stamped steel strap, with a small hole near its pivot end, is riveted and crimped within the narrow end of the stamped steel channel. The tip of the wiper blade end of this strap is bent back under itself to form a small hook. Concealed within the stamped steel channel, one end of a long spring is engaged with a wire hook on the underside of the die cast pivot end, while the other end of the spring is hooked through the small hole in the steel strap. The entire wiper arm has a satin black finish applied to all of its visible surfaces.

Near the hook of the wiper arm steel strap is a locating hole for the washer nozzle that is mounted on the wiper arm. A U-shaped molded plastic guard snaps onto the underside of the strap to conceal and protect the washer nozzle hose. There are also two small molded plastic washer nozzle hose routing brackets clipped onto the underside of the wiper arm pivot end.

The wiper arms for this model are unequal in length, with the longer arm being installed on the left (driver) side of the windshield. A wiper arm cannot be adjusted or repaired. If damaged or faulty, the entire wiper arm unit must be replaced. The washer nozzle, nozzle hose, routing brackets, and pivot end cover are available for individual service replacement.

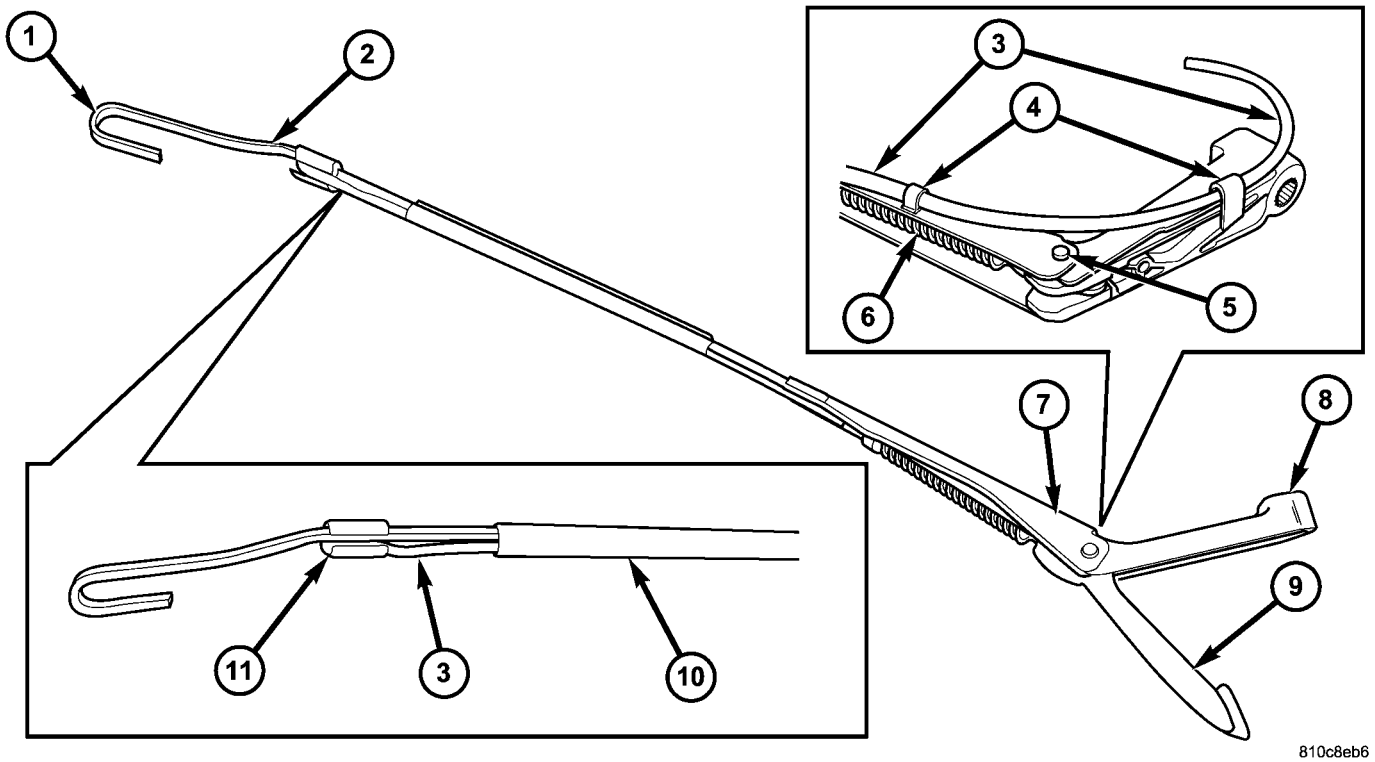


Fig. 15 Wiper Arm

1 - HOOK
2 - STRAP
3 - WASHER HOSE
4 - BRACKET (2)
5 - HINGE PIN
6 - TENSION SPRING
7 - CHANNEL
8 - COVER
9 - PIVOT END
10 - GUARD
11 - WASHER NOZZLE

WIPER ARM (Continued)

OPERATION

The wiper arms are designed to mechanically transmit the motion from the wiper pivots to the wiper blades. The wiper arm must be properly indexed to the wiper pivot in order to maintain the proper wiper blade travel on the glass. The tapered mounting hole in the wiper arm pivot end interlocks with the serrations on the outer circumference of the wiper pivot shaft, allowing positive engagement and finite adjustment of this connection. The mounting nut locks the wiper arm to the threaded end of the wiper pivot shaft. The spring-loaded wiper arm hinge controls the down-force applied through the tip of the wiper arm to the wiper blade on the glass. The hook formation on the tip of the wiper arm provides a cradle for securing and latching the wiper blade pivot block to the wiper arm.

REMOVAL

(1) Disconnect the washer nozzle hose from the elbow fitting on the cowl top panel near the pivot end of the wiper arm (Fig. 16).

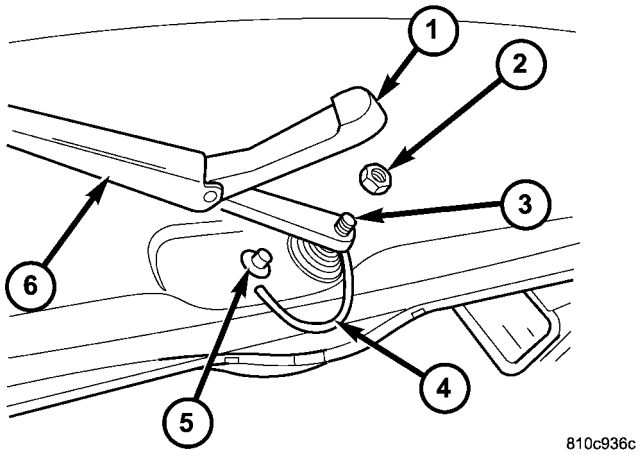


Fig. 16 Wiper Arm Remove/Install

1 - PIVOT COVER
2 - NUT
3 - PIVOT SHAFT
4 - WASHER NOZZLE HOSE
5 - ELBOW FITTING
6 - WIPER ARM

CAUTION: The use of a screwdriver or other prying tool to remove a wiper arm may distort it. This distortion could allow the arm to come off of the wiper pivot during wiper operation, regardless of how carefully it is reinstalled.

(2) Unsnap the end of the pivot cover from the wiper blade pivot end, then pull the cover away from the wiper arm hinge pin to remove the cover from the wiper blade.

(3) Remove the nut that secures the wiper arm to the wiper pivot shaft.

(4) If necessary, use a suitable battery terminal puller to disengage the wiper arm from the wiper pivot shaft (Fig. 17).

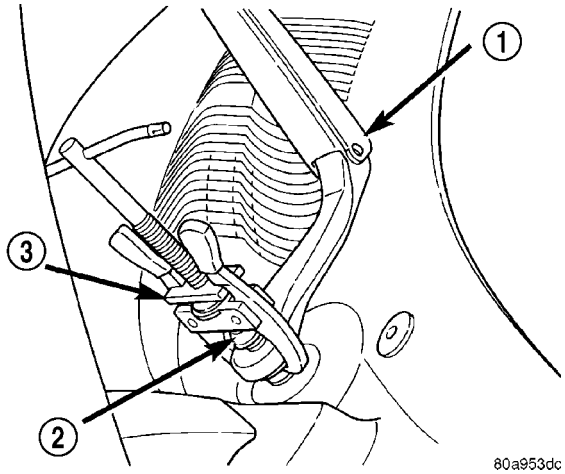


Fig. 17 Wiper Arm Puller - Typical

1 - WIPER ARM
2 - WIPER PIVOT SHAFT
3 - BATTERY TERMINAL PULLER

(5) Remove the wiper arm pivot end from the wiper pivot shaft.

INSTALLATION

NOTE: Be certain that the wiper motor is in the park position before attempting to install the wiper arms. Turn the ignition switch to the On position and move the right (wiper) control stalk of the multi-function switch to its Off position. If the wiper pivots move, wait until they stop moving, then turn the ignition switch back to the Off position. The wiper motor is now in its park position.

NOTE: The wiper arms and wiper blades for this model are both unequal in length, with the longer arm and blade being installed on the left (driver) side of the windshield.

(1) The wiper arms must be indexed to the wiper pivot shafts with the wiper motor in the park position to be properly installed. Position the wiper arm pivot ends onto the wiper pivots so that the lower edge of the wiper arm tip is aligned with the black wiper alignment line located near the lower edge of the windshield glass (Fig. 16).

(2) Once the wiper blade is aligned, lift the wiper arm away from the windshield slightly to relieve the spring tension on the pivot end and push the pivot hole in the pivot end of the arm down firmly and

WIPER ARM (Continued)

evenly over the wiper pivot shaft. Gently lower the wiper arm until the wiper blade rests on the glass.

(3) Install and tighten the nut that secures the wiper arm to the wiper pivot shaft. Tighten the nut to 24 N·m (18 ft. lbs.).

(4) Wet the windshield glass, then operate the wipers. Move the right (wiper) control stalk of the multifunction switch to the Off position, then check for the correct wiper arm position and readjust as required.

(5) Engage the pivot cover with the wiper arm hinge pin, then push the pivot end of the cover down firmly and evenly until it snaps over the wiper blade pivot end.

(6) Reconnect the washer nozzle hose to the elbow fitting on the cowl top panel near the pivot end of the wiper arm.

WIPER BLADE

DESCRIPTION

Each wiper blade is secured by an integral latching pivot block to the hook formation on the tip of the wiper arm, and rests on the glass near the base of the windshield when the wipers are not in operation (Fig. 18). The wiper blade consists of the following components:

- **Superstructure** - The superstructure includes several stamped steel bridges and links with claw formations that grip the wiper blade element. Also included in this unit is the latching, molded plastic pivot block that secures the superstructure to the wiper arm. All of the metal components of the wiper blade have a satin black finish applied.
- **Element** - The wiper element or squeegee is the resilient rubber member of the wiper blade that contacts the glass.
- **Flexor** - The flexor is a rigid metal component running along the length of the wiper element on each side, where it is gripped by the claws of the superstructure.

All Sprinter models have unequal length wiper blades with non-replaceable rubber elements (squeegees). The left (driver) side wiper blade is 60.0 centimeters (23.5 inches), and the right (passenger) side wiper blade is 55.0 centimeter (21.5 inches). These wiper blades also include an anti-lift feature. The wiper blades cannot be adjusted or repaired. If faulty, worn, or damaged the entire wiper blade unit must be replaced.

OPERATION

The wiper blades are moved back and forth across the glass by the wiper arms when the wipers are being operated. The wiper blade superstructure is the flexible frame that grips the wiper blade element and evenly distributes the force of the spring-loaded wiper arm along the length of the element. The combination of the wiper arm force and the flexibility of the superstructure makes the element conform to and maintain proper contact with the glass, even as the blade is moved over the varied curvature that may be encountered across the glass surface. The wiper element flexor provides the claws of the blade superstructure with a rigid, yet flexible component on the element which can be gripped. The rubber element is designed to be stiff enough to maintain an even cleaning edge as it is drawn across the glass, but resilient enough to conform to the glass surface and flip from one cleaning edge to the other each time the wiper blade changes directions.

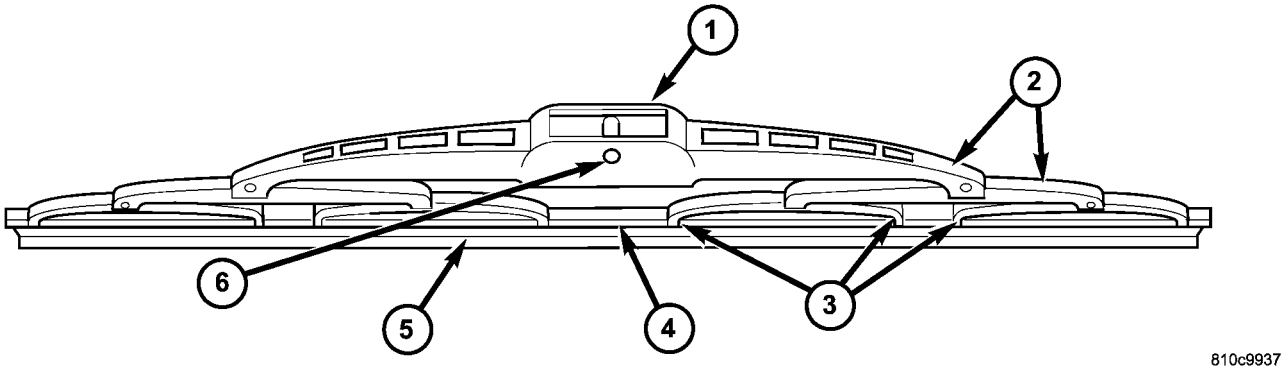


Fig. 18 Wiper Blade

1 - PIVOT BLOCK
2 - SUPERSTRUCTURE
3 - CLAWS
4 - FLEXOR
5 - ELEMENT
6 - PIVOT PIN

WIPER BLADE (Continued)

REMOVAL

NOTE: The wiper arms and wiper blades for this model are both unequal in length, with the longer arm and blade being installed on the left (driver) side of the windshield.

(1) Turn the wiper control knob on the end of the multi-function switch control stalk to the On position. Cycle the wiper blades to a convenient working location on the windshield by turning the ignition switch to the On and Off positions.

(2) Lift the wiper arm to raise the wiper blade and element off of the glass, until the wiper arm hinge is in its over-center position.

(3) To remove the wiper blade from the wiper arm, depress the pivot block latch release tab under the tip of the arm and slide the blade away from the tip towards the pivot end of the arm far enough to disengage the pivot block from the hook formation on the end of the arm (Fig. 19).

(4) Extract the hook formation on the tip of the wiper arm from the opening in the wiper blade superstructure ahead of the wiper blade pivot block/latch unit.

CAUTION: Do not allow the wiper arm to spring back against the glass without the wiper blade in place or the glass may be damaged.

(5) Gently lower the wiper arm tip onto the glass.

INSTALLATION

NOTE: The wiper arms and wiper blades for this model are both unequal in length, with the longer arm and blade being installed on the left (driver) side of the windshield.

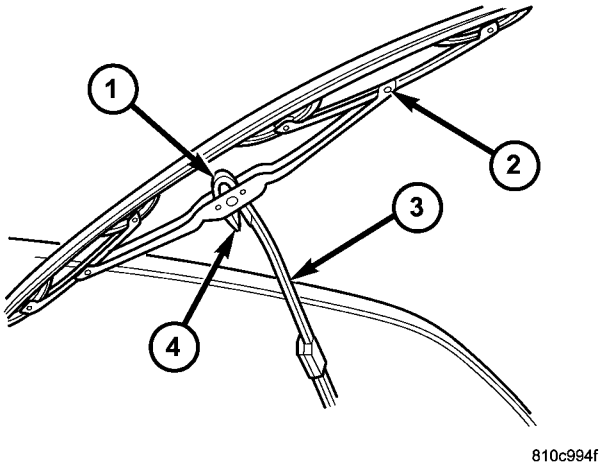


Fig. 19 Wiper Blade Remove/Install

1 - HOOK
2 - WIPER BLADE
3 - WIPER ARM
4 - RELEASE TAB

(1) Lift the wiper arm off of the windshield glass, until the wiper arm hinge is in its over-center position.

(2) Position the wiper blade near the hook formation on the tip of the arm.

(3) Insert the hook formation on the tip of the wiper arm through the opening in the wiper blade superstructure ahead of the wiper blade pivot block/latch unit far enough to engage the pivot block with the hook (Fig. 19).

(4) Slide the wiper blade pivot block/latch up into the hook formation on the tip of the wiper arm until the latch release tab snaps into its locked position. Latch engagement will be accompanied by an audible click.

(5) Gently lower the wiper blade onto the glass.

WIPER LINKAGE

DESCRIPTION

The wiper linkage and pivots are concealed within the engine compartment below the cowl top panel (Fig. 20). The ends of the wiper pivot shafts that protrude through dedicated openings in the cowl top panel to drive the wiper arms and blades are the only visible components of the wiper linkage module. The wiper linkage module consists of the following major components:

- **Linkage** - The two wiper drive links are each constructed of stamped steel. The left (driver) side drive link has a plastic socket-type bushing in one end, and a plastic sleeve-type bushing in the other end. The socket bushing is snap-fit over the ball stud on the left pivot crank arm, while the sleeve bushing is fit over the longer ball stud on the wiper motor crank arm. The right (passenger) side drive link has a plastic socket-type bushing on each end. One end of this drive link is snap-fit over the exposed end of the longer ball stud on the wiper motor crank arm and captures the sleeve bushing end of the left drive link beneath it, while the other end is snap-fit over the ball stud on the right pivot crank arm.
- **Module Bracket** - The linkage module bracket consists of a long tubular steel main member that is crimped to a molded plastic pivot bracket at each end where the wiper pivots are secured. A stamped steel mounting plate for the wiper motor is secured with welds near the center of the main member and is then secured with screws to the underside of the cowl top panel.
- **Motor Crank Arm** - The wiper motor crank arm is a stamped steel unit with a round hole on the driven end that is secured to the wiper motor output shaft with a nut, and a long ball stud secured to the drive end.
- **Pivot** - The two molded plastic wiper pivot brackets are secured to the ends of the linkage module bracket tubular member. The crank arms that extend from the bottom of the pivot shafts each have a ball stud on their end. The upper end of each pivot shaft where the wiper arms will be fastened each is tapered and externally serrated with a threaded stud at the top where the wiper arms are secured by a nut. Each pivot shaft operates within a housing formed in the pivot bracket featuring a large external flange near its center and external threads near the top. The pivot housings are secured to the outer surface of the cowl top panel by a large washer and a nut threaded onto the outside of the housing where it protrudes through the cowl top.

The wiper linkage module cannot be adjusted or repaired. If any component of the linkage module is faulty or damaged, the entire wiper linkage module unit must be replaced.

OPERATION

The wiper linkage operation is controlled by the output of the wiper motor through the wiper motor crank arm. The wiper motor crank arm, the two wiper drive links, and the two wiper pivots mechanically convert the rotary output of the wiper motor to the back and forth wiping motion of the wiper arms and blades on the glass.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the wiper arms from the wiper pivots. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ARM - REMOVAL).

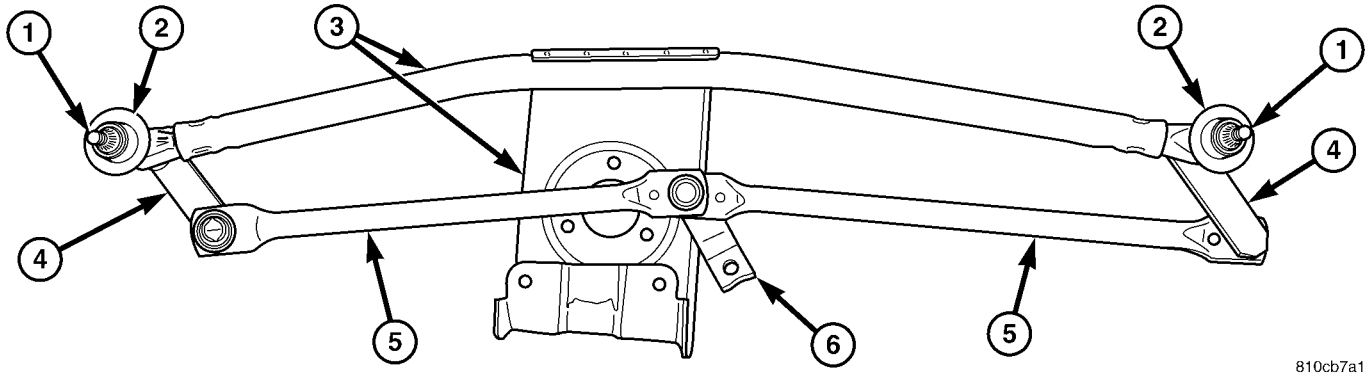


Fig. 20 Wiper Linkage Module

1 - PIVOT SHAFT (2)
2 - PIVOT SHAFT HOUSING (2)
3 - MODULE BRACKET
4 - PIVOT CRANK ARM (2)
5 - DRIVE LINK (2)
6 - MOTOR CRANK ARM

WIPER LINKAGE (Continued)

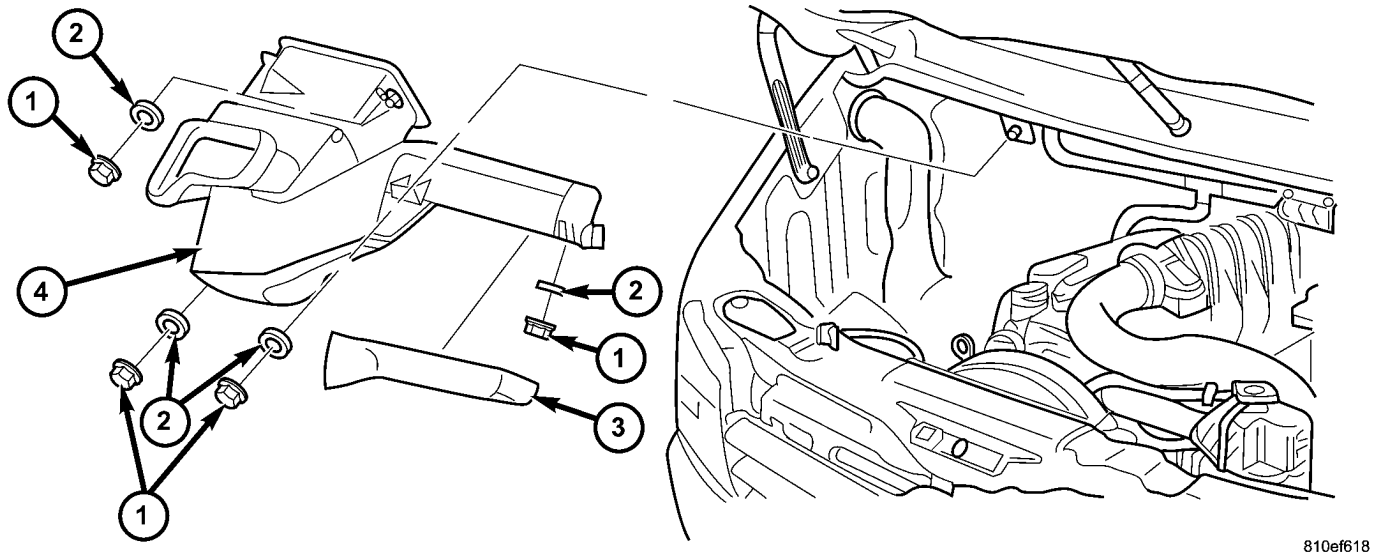


Fig. 21 Ventilation Housing

1 - NUT (5)
2 - WASHER (5)
3 - CABIN FILTER HOUSING
4 - VENTILATION HOUSING

(3) Remove the five nuts that secure the ventilation housing to the dash panel and the underside of the cowl top panel (Fig. 21).

(4) Pull the ventilation housing forward far enough to disengage the housing from the studs on the dash panel, then lower the housing until it rests on the top of the engine.

(5) Disconnect the wiper motor pigtail wire connector from the vehicle wire harness connector.

(6) Remove the nut and washer that secures each wiper pivot housing to the outside of the cowl top panel (Fig. 22).

(7) Remove the two screws that secure the wiper linkage module motor bracket to the flange on the underside of the cowl top panel.

(8) Remove the wiper linkage module and wiper motor from the underside of the cowl top panel as a unit.

(9) Remove the wiper motor from the wiper linkage module. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER MOTOR - REMOVAL).

INSTALLATION

(1) Reinstall the wiper motor onto the wiper linkage module. (Refer to 8 - ELECTRICAL/WIPERS/

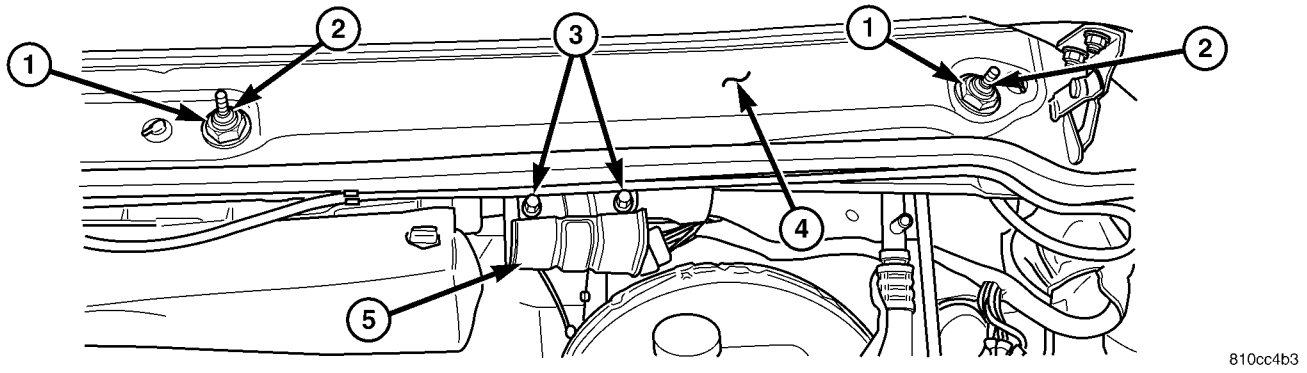


Fig. 22 Wiper Linkage Module Remove/Install

1 - NUT & WASHER (2)
2 - PIVOT (2)
3 - SCREW (2)
4 - COWL TOP PANEL
5 - MOTOR BRACKET

WIPER LINKAGE (Continued)

WASHERS/FRONT WIPER MOTOR - INSTALLATION).

(2) Carefully position the wiper linkage module and wiper motor to the underside of the cowl top panel as a unit (Fig. 22).

(3) Install and tighten the two screws that secure the wiper linkage module motor bracket to the flange on the underside of the cowl top panel. Tighten the screws to 6 N·m (50 in. lbs.).

(4) Install and tighten the nut and washer that secures each wiper pivot housing to the outside of the cowl top panel.

(5) Reconnect the wiper motor pigtail wire connector to the vehicle wire harness connector.

(6) Reinstall the ventilation housing onto the dash panel and the underside of the cowl top panel (Fig. 21).

(7) Reinstall the wiper arms onto the wiper pivots. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/ WIPER ARM - INSTALLATION).

(8) Reconnect the battery negative cable.

WIPER MOTOR

DESCRIPTION

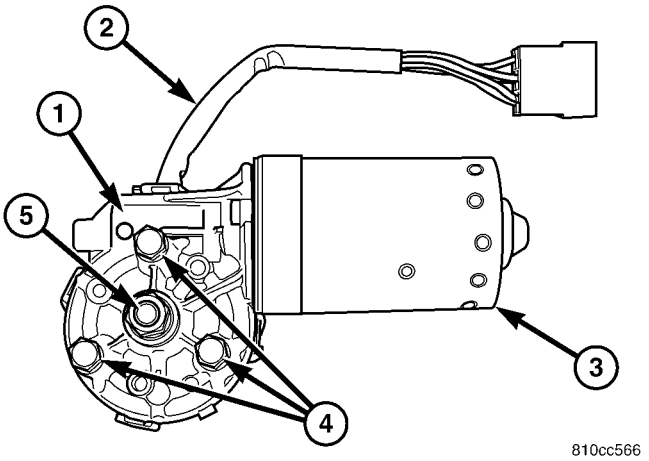


Fig. 23 Wiper Motor

1 - TRANSMISSION
2 - PIGTAIL WIRE
3 - MOTOR
4 - SCREW (3)
5 - OUTPUT SHAFT

The wiper motor is secured with three screws to a motor bracket integral to the wiper linkage module bracket located below the cowl top panel in the engine compartment (Fig. 23). The wiper motor output shaft passes through a hole in the motor bracket, where a nut secures the wiper motor crank arm to the motor output shaft. The two-speed permanent magnet wiper motor features an integral transmission, an internal park switch, and an internal Positive Temperature Coefficient (PTC) circuit breaker.

The wiper motor cannot be adjusted or repaired. If any component of the motor is faulty or damaged, the entire wiper motor unit must be replaced.

OPERATION

The wiper motor operation is controlled by the vehicle operator through battery current inputs received by the wiper motor from the wiper switch circuitry of the multi-function switch on the top of the steering column, and from the wiper relay on the fuse block underneath the steering column. The wiper motor speed is controlled by current flow to either the low speed or the high speed set of brushes. The automatic resetting circuit breaker protects the motor from overloads.

The park switch consists of a contact disc and three contacts. The contact disc is mechanically fastened to and rotated with a gear in the wiper motor transmission. Two input contacts alternately close the wiper park switch sense output circuit contact to ground or to battery current, depending upon the position of the wipers on the glass. This feature allows the intermittent wipe logic circuit to monitor the position and the cycles of the wiper motor to provide the intermittent wipe and wipe-after-wash modes, as well as allowing the motor to complete its current wipe cycle after the wiper system has been turned Off and park the wiper blades in the lowest portion of the wipe pattern.

The wiper motor may be diagnosed using conventional diagnostic tools and methods.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Disconnect the vehicle wire harness connector for the wiper motor from the motor pigtail wire connector (Fig. 24).

(3) Remove the nut that secures the motor crank arm to the wiper motor output shaft.

(4) If this wiper motor is to be reinstalled, make an index mark between the wiper motor output shaft and the motor crank arm using a suitable marker.

(5) Disengage the motor crank arm from the wiper motor output shaft.

(6) Remove the three screws that secure the wiper motor to the wiper linkage module motor bracket.

(7) Remove the wiper motor from the wiper linkage module motor bracket.

INSTALLATION

(1) Position the wiper motor to the underside of the wiper linkage module motor bracket (Fig. 24).

WIPER MOTOR (Continued)

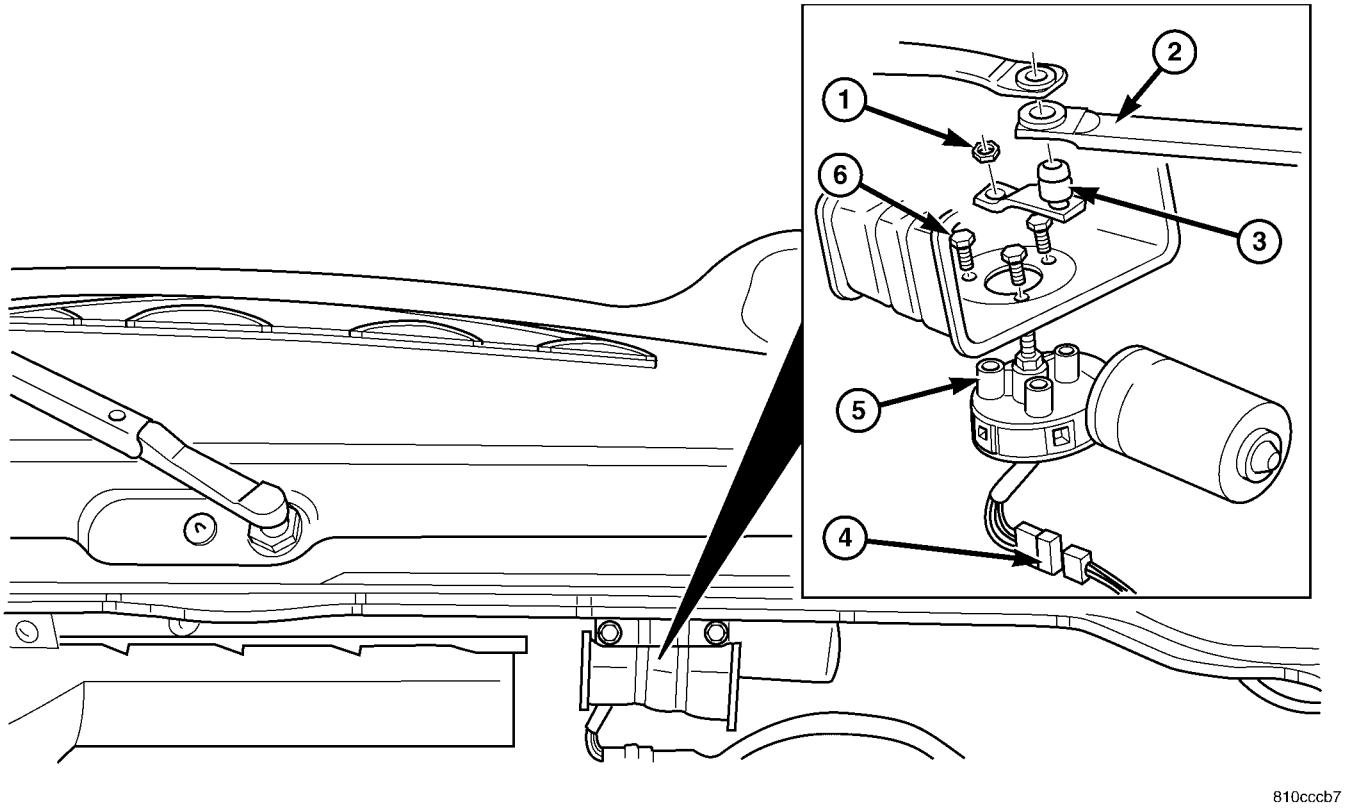


Fig. 24 Wiper Motor Remove/Install

1 - NUT
2 - LINK (2)
3 - MOTOR CRANK ARM
4 - PIGTAIL WIRE CONNECTOR
5 - WIPER MOTOR
6 - SCREW (3)

(2) Install and tighten the three screws that secure the wiper motor to the wiper linkage module motor bracket. Tighten the screws to 12 N·m (105 in. lbs.).

(3) If this wiper motor is being reinstalled, position the motor crank arm on the wiper motor output shaft so that the index marks made during the removal procedure are aligned. If this is a new wiper motor installation, the motor crank arm should be installed so that it is pointed toward the left (driver) side of the vehicle and parallel with the two wiper drive links while both wiper blades are positioned on their alignment marks near the lower edge of the windshield glass.

(4) Install and tighten the nut that secures the motor crank arm to the wiper motor output shaft. Tighten the nut to 12 N·m (105 in. lbs.).

(5) Reconnect the vehicle wire harness connector for the wiper motor to the motor pigtail wire connector.

(6) Reconnect the battery negative cable.

WIPER RELAY

DESCRIPTION

A wiper relay is standard equipment on all models. The wiper relay (or intermittent wipe relay) is located in a dedicated receptacle on the bottom left of the fuse block on the underside of the steering column (Fig. 25). The wiper relay is a conventional International Standards Organization (ISO) micro relay. Relays conforming to the ISO specifications have common physical dimensions, current capacities, terminal patterns, and terminal functions. The relay is contained within a small, rectangular, molded plastic housing. The relay is connected to all of the required inputs and outputs through the instrument panel wire harness connector by five male spade-type terminals that extend from the bottom of the relay base. The ISO designation for each terminal is molded into the base adjacent to the terminal. The ISO terminal designations are as follows:

- **30 (Common Feed)** - This terminal is connected to the movable contact point of the relay.

WIPER RELAY (Continued)

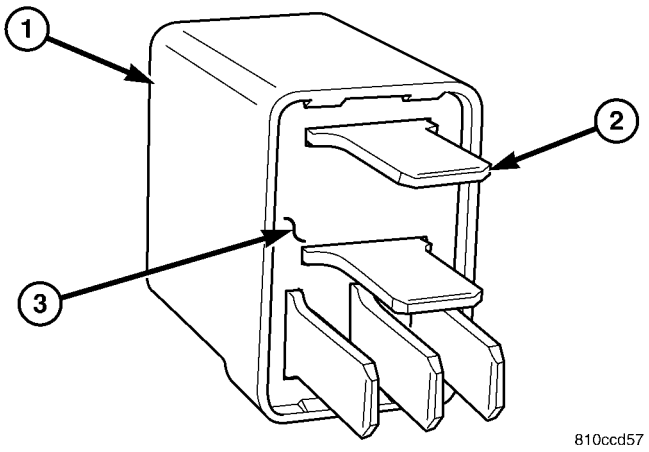


Fig. 25 Wiper Relay

1 - HOUSING
2 - TERMINAL (5)
3 - BASE

- **85 (Coil Ground)** - This terminal is connected to the ground feed side of the relay control coil.
- **86 (Coil Battery)** - This terminal is connected to the battery feed side of the relay control coil.
- **87 (Normally Open)** - This terminal is connected to the normally open fixed contact point of the relay.
- **87A (Normally Closed)** - This terminal is connected to the normally closed fixed contact point of the relay.

The wiper relay cannot be adjusted or repaired. If the relay is damaged or faulty, it must be replaced.

OPERATION

The wiper relay (or intermittent wipe relay) is an electromechanical switch that uses a low current input from the intermittent wipe logic circuitry within the fuse block underneath the steering column to control a high current output to the low speed brush of the wiper motor. The movable common feed contact point is held against the fixed normally closed contact point by spring pressure. When the relay coil is energized, an electromagnetic field is produced by the coil windings. This electromagnetic field draws the movable relay contact point away from the fixed normally closed contact point, and holds it against the fixed normally open contact point. When the relay coil is de-energized, spring pressure returns the movable contact point back against the fixed normally closed contact point. A resistor or diode is connected in parallel with the relay coil in the relay, and helps to dissipate voltage spikes and electromagnetic interference that can be generated as the electromagnetic field of the relay coil collapses.

The wiper relay terminals are connected to the vehicle electrical system through a connector receptacle in the fuse block. The inputs and outputs of the wiper relay include:

- The common feed terminal (30) provides an output to the wiper motor low speed brush through the wiper control circuitry of the multi-function switch on the steering column. When the wiper relay is de-energized, the common feed terminal is connected to the input of the relay normally closed terminal (87). When the wiper relay is energized, the common feed terminal is connected to the input of the relay normally open terminal (87A).
- The coil ground terminal (85) is connected to battery current through a fused ignition switch output circuit whenever the ignition switch is in the On position.
- The coil battery terminal (86) is connected to the relay control output of the wiper, turn signals and engine start control module within the fuse block through the wiper relay control circuit. This electronic circuitry controls the ground path for this circuit internally to energize or de-energize the wiper relay control coil based upon its programming and inputs from the wiper and washer control circuitry of the multi-function switch, the wiper motor park switch, and the ignition switch.
- The normally open terminal (87) is connected to the output of the wiper motor park switch through the wiper motor park switch sense circuit. This circuit can carry either battery current (wipers are not in park position) or ground (wipers are in park position), depending upon the status of the wiper park switch.
- The normally closed terminal (87A) is connected to battery current through a fused ignition switch output circuit whenever the ignition switch is in the On position.

The wiper relay can be diagnosed using conventional diagnostic tools and methods.

WIPER RELAY (Continued)

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the fuse access panel from the steering column opening cover below the steering column on the instrument panel.

(3) Reach through and below the outboard side of the fuse access opening to access the wiper relay (Fig. 26).

(4) Remove the wiper relay by grasping it firmly, releasing the latches and pulling it straight down from the receptacle on the bottom of the fuse block.

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

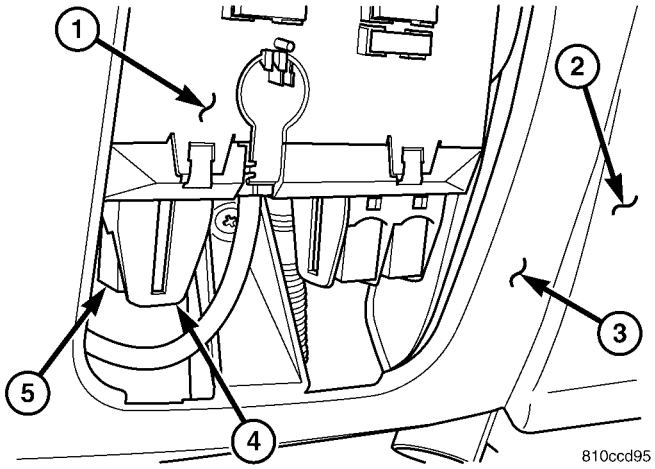


Fig. 26 Wiper Relay Remove/Install

1 - FUSE BLOCK
2 - LOWER INSTRUMENT PANEL
3 - STEERING COLUMN COVER
4 - LATCH (2)
5 - WIPER RELAY

(1) Position the wiper relay to the receptacle on the bottom of the fuse block (Fig. 26).

(2) Align the wiper relay terminals with the terminal cavities in the fuse block receptacle.

(3) Push firmly and evenly on the top of the wiper relay until the terminals are fully seated in the terminal cavities in the receptacle of the fuse block and both latches are fully engaged.

(4) Reinstall the fuse access panel onto the steering column opening cover below the steering column on the instrument panel.

(5) Reconnect the battery negative cable.

WIRING

TABLE OF CONTENTS

	page		page
WIRING DIAGRAM INFORMATION	8W-01-1	CENTRAL TIMER MODULE	8W-45-1
COMPONENT INDEX	8W-02-1	AUDIO SYSTEM	8W-47-1
POWER DISTRIBUTION	8W-10-1	REAR WINDOW DEFOGGER	8W-48-1
FUSE BLOCK	8W-11-1	FRONT LIGHTING	8W-50-1
GROUND DISTRIBUTION	8W-15-1	REAR LIGHTING	8W-51-1
BUS COMMUNICATIONS	8W-18-1	TURN SIGNALS	8W-52-1
CHARGING SYSTEM	8W-20-1	WIPERS	8W-53-1
STARTING SYSTEM	8W-21-1	TRAILER TOW	8W-54-1
FUEL/IGNITION SYSTEM	8W-30-1	NAVIGATION/TELECOMMUNICATIONS	8W-55-1
TRANSMISSION CONTROL SYSTEM	8W-31-1	POWER WINDOWS	8W-60-1
VEHICLE SPEED CONTROL	8W-33-1	POWER DOOR LOCKS	8W-61-1
ANTILOCK BRAKES	8W-35-1	POWER MIRRORS	8W-62-1
VEHICLE THEFT SECURITY SYSTEM	8W-39-1	POWER SEATS	8W-63-1
INSTRUMENT CLUSTER	8W-40-1	SPLICE INFORMATION	8W-70-1
HORN/CIGAR LIGHTER	8W-41-1	CONNECTOR PIN-OUTS	8W-80-1
AIR CONDITIONER/HEATER	8W-42-1	CONNECTOR/GROUND/SPLICE LOCATION	8W-91-1
AIRBAG SYSTEM	8W-43-1	POWER DISTRIBUTION	8W-97-1
INTERIOR LIGHTING	8W-44-1		

8W-01 WIRING DIAGRAM INFORMATION

TABLE OF CONTENTS

page

WIRING DIAGRAM INFORMATION
DESCRIPTION
DESCRIPTION - HOW TO USE WIRING DIAGRAMS 1
DESCRIPTION - CIRCUIT INFORMATION 5
DESCRIPTION - SECTION IDENTIFICATION AND INFORMATION 5
DESCRIPTION - CONNECTOR, GROUND AND SPLICE INFORMATION 5
WARNING
WARNINGS - GENERAL 6
DIAGNOSIS AND TESTING - WIRING HARNESS 6
STANDARD PROCEDURE
STANDARD PROCEDURE - ELECTROSTATIC DISCHARGE (ESD) SENSITIVE DEVICES 7
STANDARD PROCEDURE - TESTING OF VOLTAGE POTENTIAL 7
STANDARD PROCEDURE - TESTING FOR CONTINUITY 8

page

STANDARD PROCEDURE - TESTING FOR A SHORT TO GROUND 8
STANDARD PROCEDURE - TESTING FOR A SHORT TO GROUND ON FUSES POWERING SEVERAL LOADS 8
STANDARD PROCEDURE - TESTING FOR A VOLTAGE DROP 8
CONNECTOR
REMOVAL 8
INSTALLATION 9
DIODE
REMOVAL 9
INSTALLATION 9
TERMINAL
REMOVAL 9
INSTALLATION 10
WIRE
STANDARD PROCEDURE - WIRE SPLICING . . 10

WIRING DIAGRAM INFORMATION

DESCRIPTION

DESCRIPTION - HOW TO USE WIRING DIAGRAMS

DaimlerChrysler Corporation wiring diagrams are designed to provide information regarding the vehicles wiring content. In order to effectively use the wiring diagrams to diagnose and repair DaimlerChrysler Corporation vehicles, 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 (Fig. 1).

All switches, components, and modules are shown in the at rest position with the doors closed and the key removed from the ignition (Fig. 2).

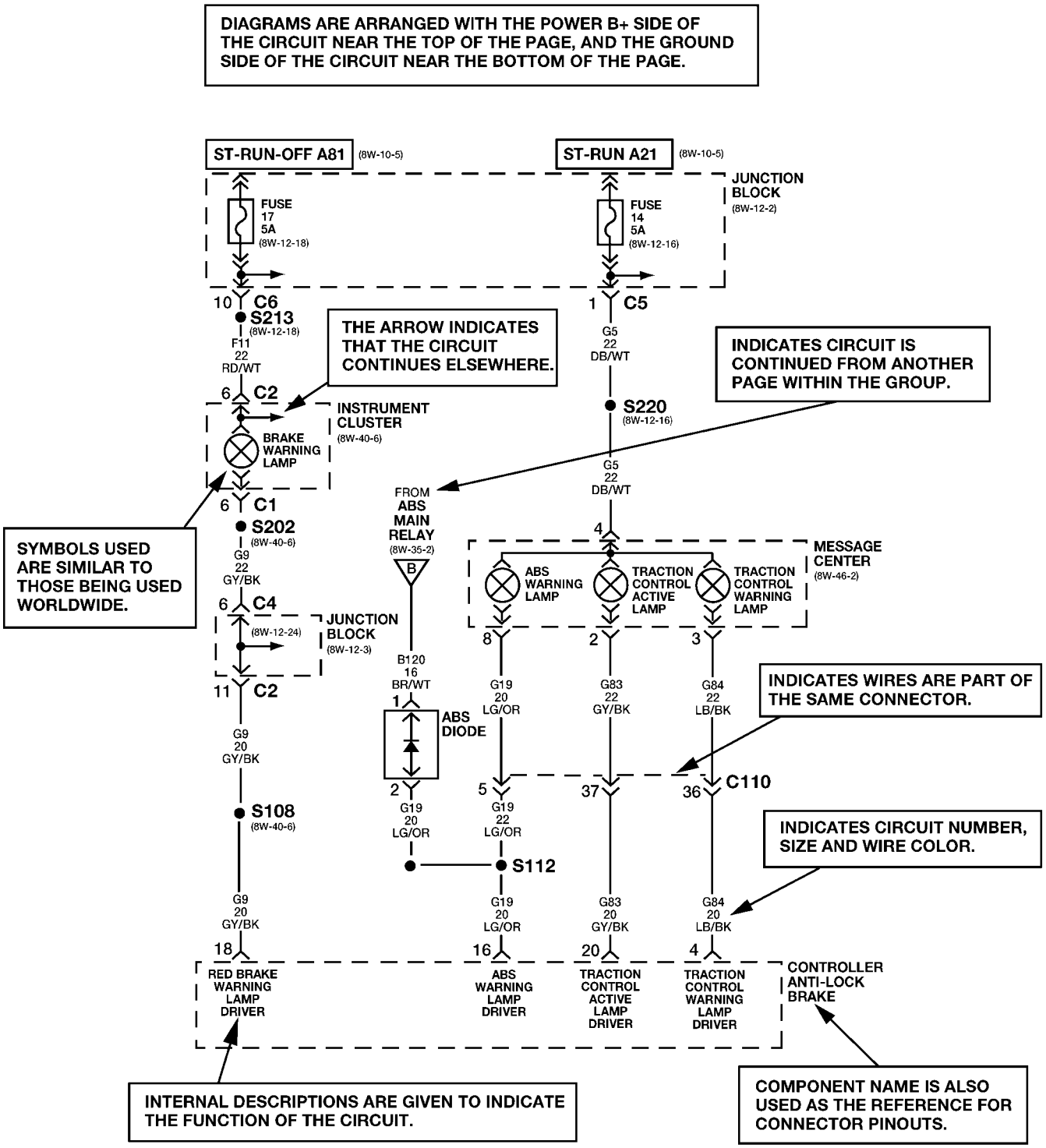
Components are shown two ways. A solid line around a component indicates that the component is complete. A dashed line around the component indicates that the component is being shown is not complete. Incomplete components have a reference number to indicate the page where the component is shown complete.

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.

SYMBOLS

International symbols are used throughout the wiring diagrams. These symbols are consistent with those being used around the world (Fig. 3).

WIRING DIAGRAM INFORMATION (Continued)

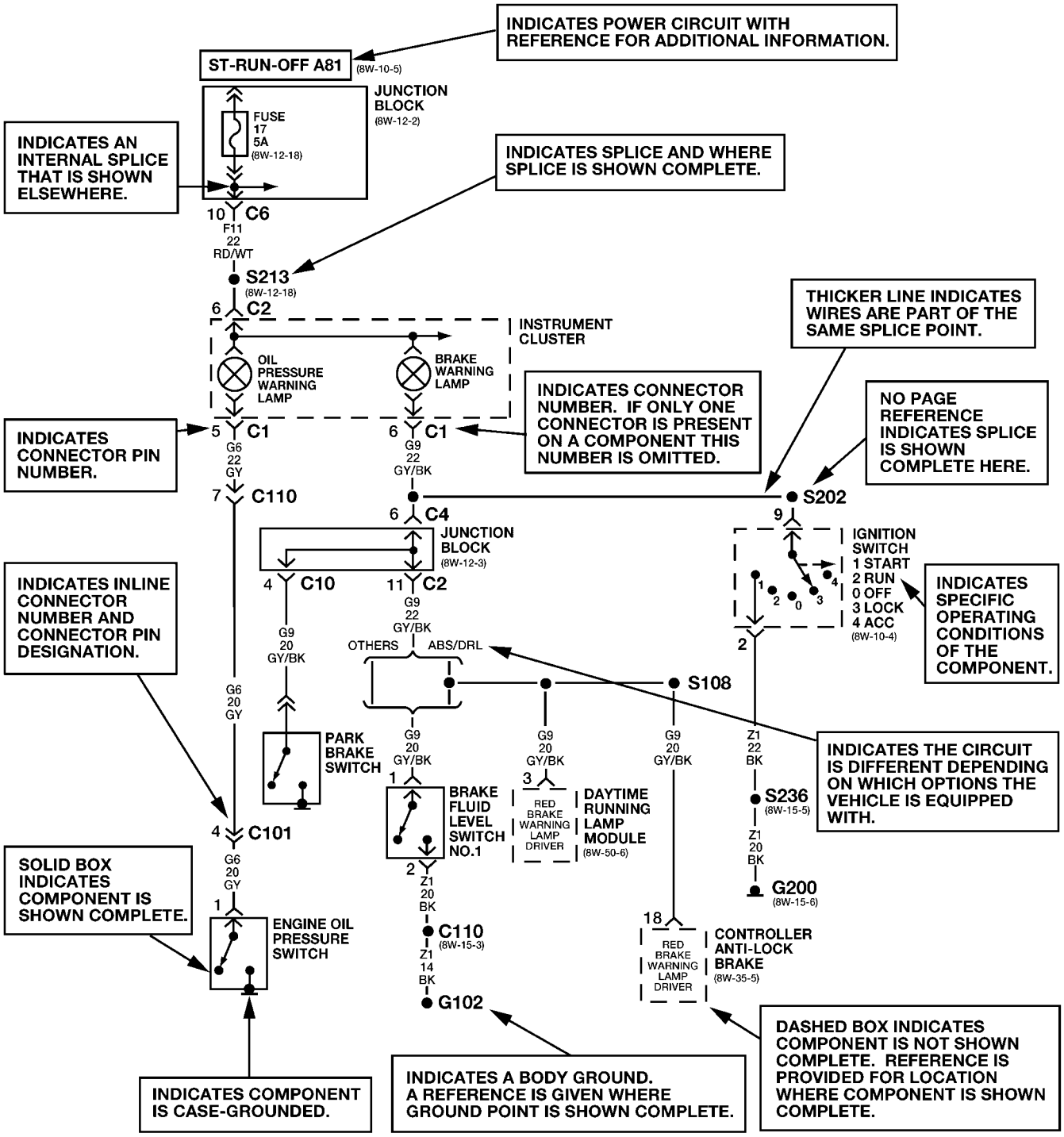


The System shown here is an EXAMPLE ONLY. It does not represent the actual circuit shown in the WIRING DIAGRAM SECTION.

80c06a01

Fig. 1 WIRING DIAGRAM EXAMPLE 1

WIRING DIAGRAM INFORMATION (Continued)



The System shown here is an EXAMPLE ONLY. It does not represent the actual circuit shown in the WIRING DIAGRAM SECTION.

80c06d02

Fig. 2 WIRING DIAGRAM EXAMPLE 2

WIRING DIAGRAM INFORMATION (Continued)

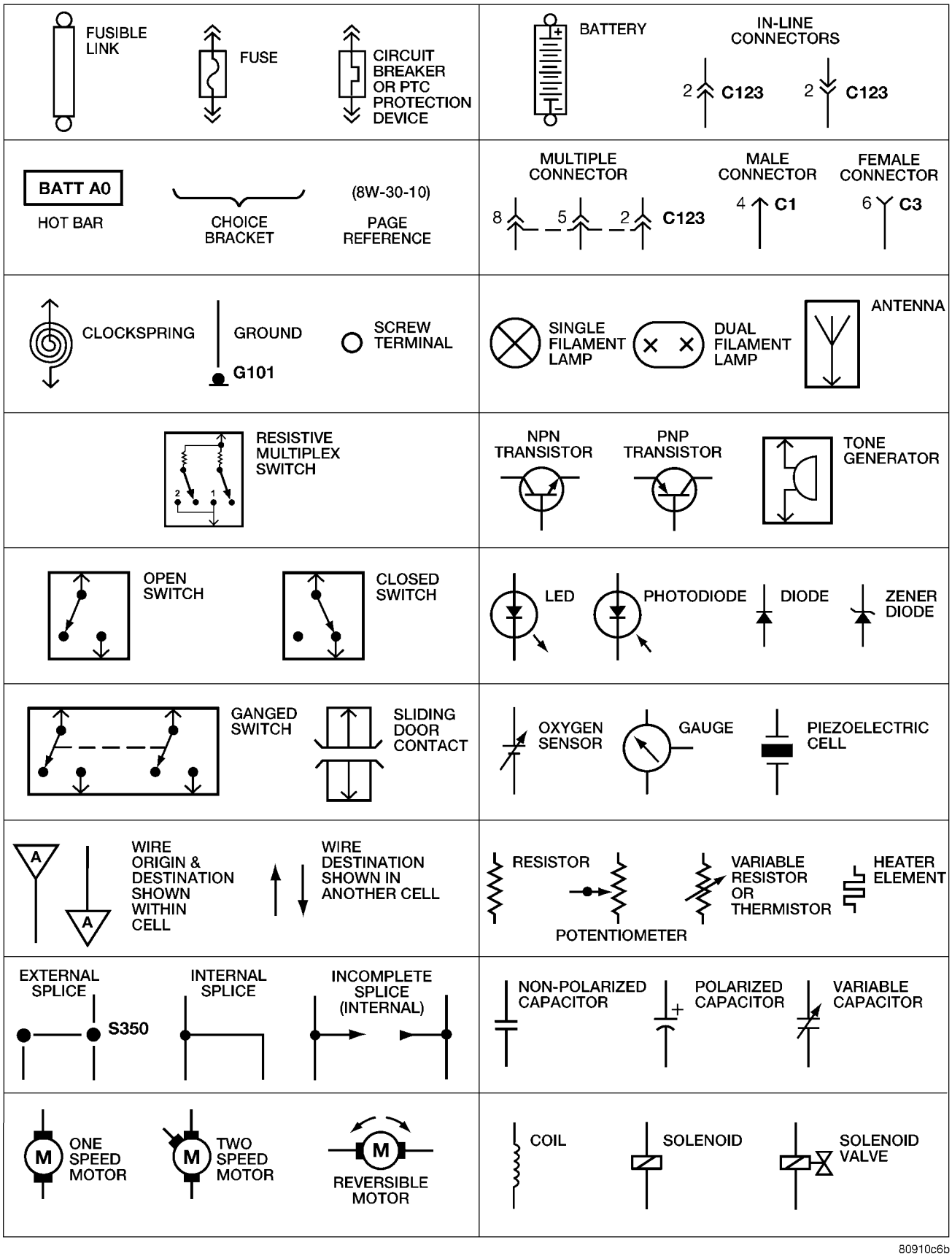


Fig. 3 Wiring Diagram Symbols

WIRING DIAGRAM INFORMATION (Continued)

TERMINOLOGY

This is a list of terms and definitions used in the wiring diagrams.

LHD . . . . . Left Hand Drive Vehicles
RHD . . . . . Right Hand Drive Vehicles
ATX . . Automatic Transmissions-Front Wheel Drive
MTX . . . Manual Transmissions-Front Wheel Drive
AT . . . . Automatic Transmissions-Rear Wheel Drive
MT . . . . . Manual Transmissions-Rear Wheel Drive
SOHC . . . . . Single Over Head Cam Engine
DOHC . . . . . Double Over Head Cam Engine
Built-Up-Export . . . . . Vehicles Built For Sale In Markets Other Than North America
Except Built-Up-Export . Vehicles Built For Sale In North America

DESCRIPTION - CIRCUIT INFORMATION

Each wire shown in the diagrams contains a code which identifies gage of wire, and color.

WIRE COLOR CODE CHART

COLOR CODE	COLOR
BL	BLUE
BK	BLACK
BR	BROWN
DB	DARK BLUE
DG	DARK GREEN
GY	GRAY
LB	LIGHT BLUE
LG	LIGHT GREEN
OR	ORANGE
PK	PINK
RD	RED
TN	TAN
VT	VIOLET
WT	WHITE
YL	YELLOW
*	WITH TRACER

DESCRIPTION - SECTION IDENTIFICATION AND INFORMATION

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.

Splice diagrams in Section 8W-70 show the entire splice and provide references to other sections the splices serves. Section 8W-70 only contains splice diagrams that are not shown in their entirety somewhere else in the wiring diagrams.

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.

WIRING SECTION CHART

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-91	Connector, Ground and Splice Locations

DESCRIPTION - CONNECTOR, GROUND AND SPLICE 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 in the engine compartment are C100 series numbers
- In-line connectors located in the Instrument Panel area are C200 series numbers.
- In-line connectors located in the body are C300 series numbers.
- Jumper harness connectors are C400 series numbers.

WIRING DIAGRAM INFORMATION (Continued)

- Grounds and ground connectors are identified with a "G" and follow the same series numbering as the in-line connectors.
- Splices are identified with an "S" and follow the same series numbering as the in-line connectors.
- Component connectors are identified by the component name instead of a number. Multiple connectors on a component use a C1, C2, etc. identifier.

LOCATIONS

Section 8W-91 contains connector/ground/splice location illustrations. The illustrations contain the connector name (or number)/ground number/splice number and component identification. Connector/ground/splice location charts in section 8W-91 reference the figure numbers of the illustrations.

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. The abbreviation N/S means Not Shown in the illustrations

WARNING

WARNINGS - GENERAL

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.

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 AVOID LOOSE CLOTHING.

DIAGNOSIS AND TESTING - WIRING HARNESS

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 vehicles 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 vehicles 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's electrical system can cause damage to the equipment and provide false readings.

WIRING DIAGRAM INFORMATION (Continued)

• Probing Tools - These tools are used for probing terminals in connectors (Fig. 4). 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.

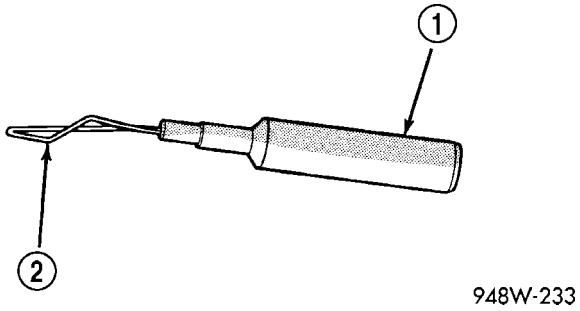


Fig. 4 Probing Tool

1 - SPECIAL TOOL 6801
2 - PROBING END

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 into 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 or moisture
- Wire insulation that has rubbed through causing a short to ground
- Some or all of the wiring strands broken inside of the insulation
- Wiring broken inside of the insulation

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 area.

(6) Verify the proper operation. For this step, check for proper operation of all items on the repaired circuit. Refer to the wiring diagrams.

STANDARD PROCEDURE

STANDARD PROCEDURE - ELECTROSTATIC DISCHARGE (ESD) SENSITIVE DEVICES

All ESD sensitive components are solid state and a symbol (Fig. 5) 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 form it's protective packing until it is time to install the part.

(5) Before removing the part from it's pakage, ground the pakage to a known good ground on the vehicle.

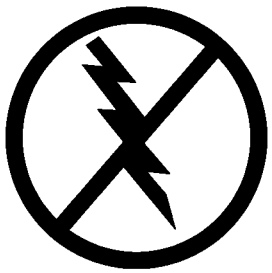


Fig. 5 ELECTROSTATIC DISCHARGE SYMBOL

STANDARD PROCEDURE - TESTING OF 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.

WIRING DIAGRAM INFORMATION (Continued)

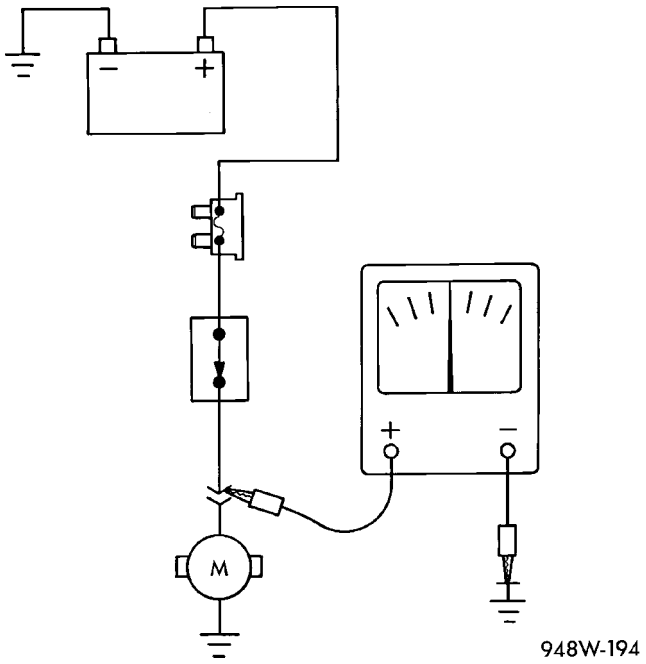


Fig. 6 Testing for Voltage Potential

STANDARD PROCEDURE - TESTING FOR CONTINUITY

(1) Remove the fuse for the circuit being checked or, disconnect the battery.

(2) Connect one lead of the ohmmeter to one side of the circuit being tested (Fig. 7).

(3) Connect the other lead to the other end of the circuit being tested. Low or no resistance means good continuity.

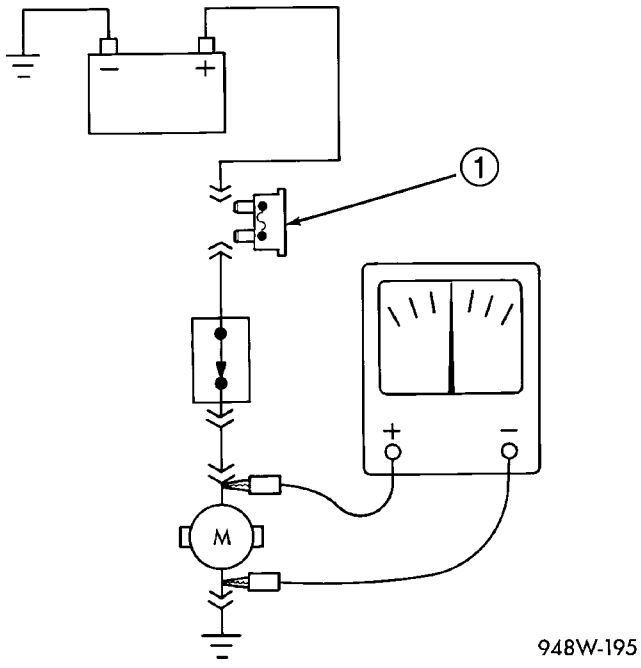


Fig. 7 Testing for Continuity

1 - FUSE REMOVED FROM CIRCUIT

STANDARD PROCEDURE - 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.

STANDARD PROCEDURE - 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 or energizing the items in the fuse circuit one at a time. When the fuse blows the circuit with the short to ground has been isolated.

STANDARD PROCEDURE - 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, component or circuit.

(3) Operate the item.

(4) The voltmeter will show the difference in voltage between the two points.

CONNECTOR

REMOVAL

(1) Disconnect battery.

(2) Release Connector Lock (Fig. 9).

(3) Disconnect the connector being repaired from its mating half/component.

(4) Remove the dress cover (if applicable) (Fig. 9).

(5) Release the Secondary Terminal Lock, if required.

(6) Position the connector locking finger away from the terminal using the proper special tool. Pull on the wire to remove the terminal from the connector.

CONNECTOR (Continued)

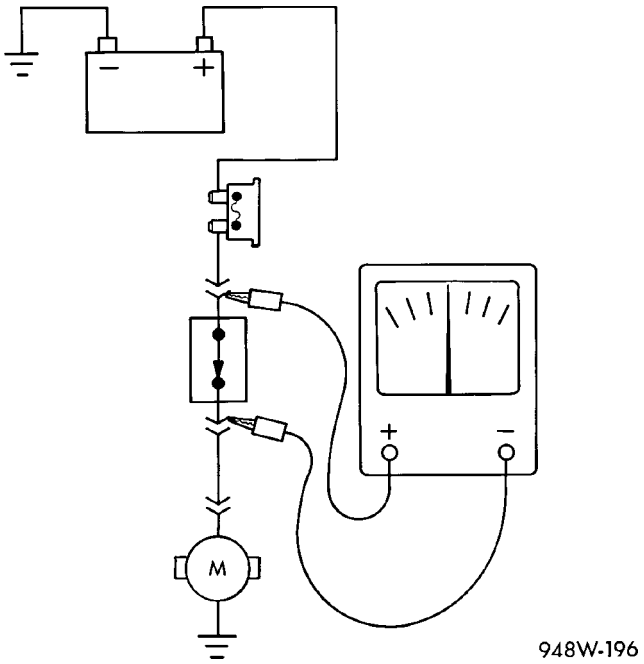


Fig. 8 Testing for Voltage Drop

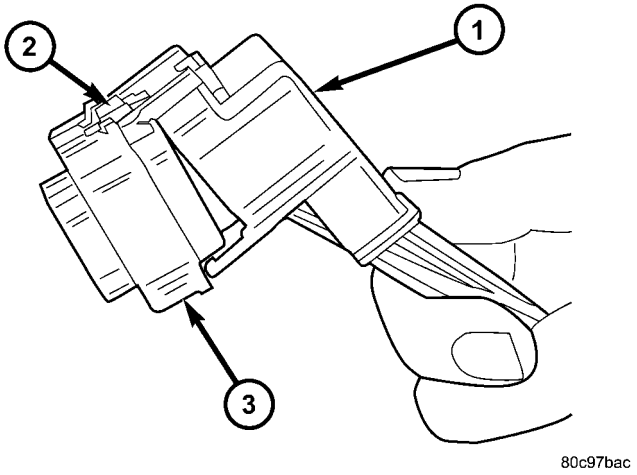


Fig. 9 REMOVAL OF DRESS COVER

1 - DRESS COVER
2 - CONNECTOR LOCK
3 - CONNECTOR

INSTALLATION

(1) Insert the removed terminal in the same cavity on the repair connector.

(2) Repeat steps for each terminal 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.

(3) When the connector is re-assembled, the secondary terminal lock must be placed in the locked position to prevent terminal push out.

(4) Replace dress cover (if applicable).

(5) Connect connector to its mating half/component.

(6) Connect battery and test all affected systems.

DIODE

REMOVAL

(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. 10).

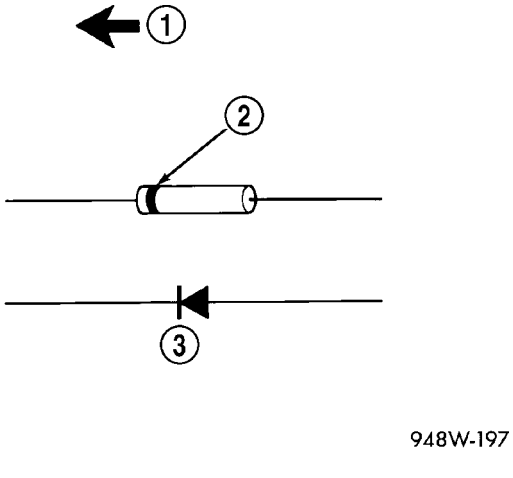


Fig. 10 Diode Identification

1 - CURRENT FLOW
2 - BAND AROUND DIODE INDICATES CURRENT FLOW
3 - DIODE AS SHOWN IN THE DIAGRAMS

INSTALLATION

(1) Remove the insulation from the wires in the harness. Only remove enough insulation to solder in the new diode.

(2) Install the new diode in the harness, making sure current flow is correct. If necessary, refer to the appropriate wiring diagram for current flow.

(3) Solder the connection together using rosin core type solder only. **Do not use acid core solder.**

(4) Tape the diode to the harness using electrical tape. Make sure the diode is completely sealed from the elements.

(5) Re-connect the battery and test affected systems.

TERMINAL

REMOVAL

(1) Follow steps for removing terminals described in the connector removal section.

(2) Cut the wire 6 inches from the back of the connector.

TERMINAL (Continued)

INSTALLATION

(1) Select a wire from the terminal repair kit that best matches the color and gage of the wire being repaired.

(2) Cut the repair wire to the proper length and remove one–half (1/2) inch of insulation.

(3) Splice the repair wire to the wire harness (see wire splicing procedure).

(4) Insert the repaired wire into the connector.

(5) Install the connector locking wedge, if required, and reconnect the connector to its mating half/component.

(6) Re-tape the wire harness starting at 1–1/2 inches behind the connector and 2 inches past the repair.

(7) Connect battery and test all affected systems.

WIRE

STANDARD PROCEDURE - WIRE SPLICING

When splicing a wire, it is important that the correct gage be used as shown in the wiring diagrams.

(1) Remove one-half (1/2) inch of insulation from each wire that needs to be spliced.

(2) Place a piece of adhesive lined heat shrink tubing on one side of the wire. Make sure the tubing will be long enough to cover and seal the entire repair area.

(3) Place the strands of wire overlapping each other inside of the splice clip (Fig. 11).

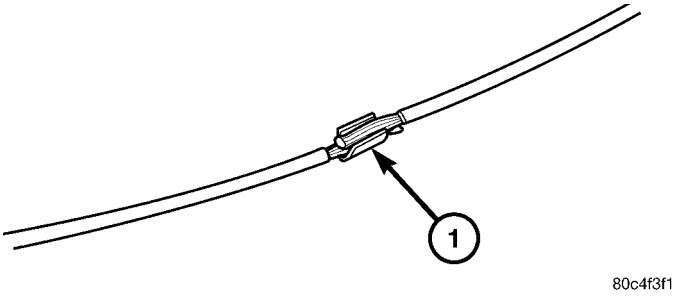


Fig. 11 1 SPLICE BAND

1 - SPLICE BAND

(4) Using crimping tool, Mopar p/n 05019912AA, crimp the splice clip and wires together (Fig. 12).

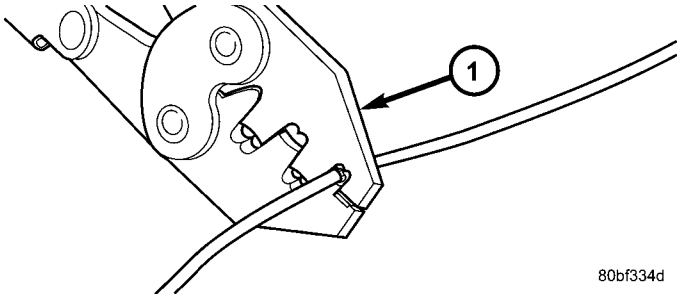


Fig. 12 2 CRIMPING TOOL

1 - CRIMPING TOOL

(5) Solder the connection together using rosin core type solder only (Fig. 13).

CAUTION: DO NOT USE ACID CORE SOLDER.

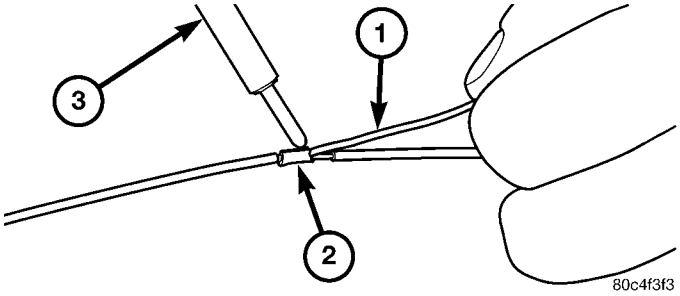


Fig. 13 3 SOLDER SPLICE

1 - SOLDER
2 - SPLICE BAND
3 - SOLDERING IRON

(6) 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 (Fig. 14).

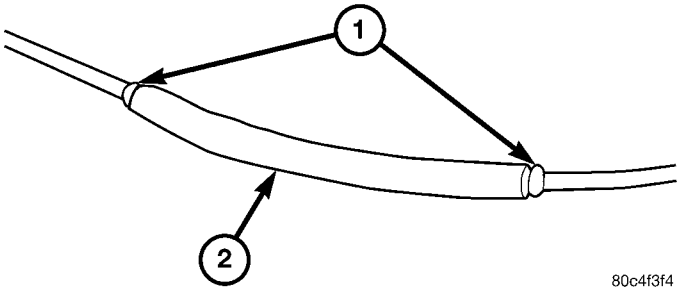


Fig. 14 4 HEAT SHRINK TUBE

1 - SEALANT
2 - HEAT SHRINK TUBE

8W-02 COMPONENT INDEX

Component	Page
A/C Auxiliary Fan Relay	8W-42
A/C Auxiliary Fan	8W-42
A/C Compressor Clutch	8W-42
A/C Control Module-Roof	8W-42
A/C Fan Switch	8W-42
A/C Switch-Roof	8W-42
Accelerator Pedal Position Sensor	8W-30
Air Outlet Temperature Sensor	8W-42
Airbag Control Module	8W-43
Airbag Squibs	8W-43
Ambient Temperature Sensor	8W-42
Ash Receiver Lamp	8W-44
Automatic Temperature Control Module	8W-42
Auxiliary Heater Relay	8W-42
Auxiliary Heater Switch	8W-42
Battery Relay-Auxiliary	8W-20
Batteries	8W-20
Beam Select Switch	8W-50
Blower Motors	8W-42
Body Plug Connector	8W-11
Boost Pressure Sensor	8W-30
Boost Pressure Solenoid	8W-30
Brake Fluid Level Switch	8W-35
Brake Lamp Switch	8W-35
Brake Wear Sensors	8W-35
Cabin Heater Assembly	8W-42
Cabin Heater Control Module	8W-42
Camshaft Position Sensor	8W-30
Center High Mounted Stop Lamp	8W-51
Central Timer Module	8W-45
Cigar Lighter Lamp	8W-44
Cigar Lighter	8W-41
Circulation Pump Diode	8W-42
Circulation Pump Relay	8W-42
Circulation Pump	8W-42
Clockspring	8W-41, 43
Contact Switch Door-Tailgate	8W-44
Controller Antilock Brake	8W-35
Courtesy Lamps	8W-44
Crankcase Heater	8W-30
Crankshaft Position Sensor	8W-30
Ctel Antenna Connector	8W-55
Ctel Connector	8W-47, 55
Cylinder Lock Switch-Driver	8W-61
D+ Relay No. 1	8W-10
D+ Relay No. 2	8W-11
Data Link Connector	8W-18
Daytime Running Lamp Relays	8W-50
Differential Lock Solenoid Valve	8W-31
Dome Lamp	8W-44
Door Jamb Switches	8W-44
Door Lock Motor/Ajar Switch Assemblies	8W-61
Dosing Pump	8W-42
EGR Valve	8W-30
Engine Control Module	8W-30
Engine Control Relay	8W-31
Engine Coolant Level Switch	8W-30
Engine Coolant Temperature Sensor	8W-30
Engine Oil Sensor	8W-30
Evaporator Temperature Sensor	8W-42
Fan Stage 1 Relay	8W-42
Fog Lamp Relay	8W-50
Fog Lamp Switch	8W-50
Fuel Injectors	8W-30
Fuel Level Sensor	8W-30
Fuel Pressure Sensor	8W-30
Fuel Pressure Solenoid	8W-30
Fuel Shutdown Solenoid	8W-30
Fuel Temperature Sensor	8W-30
Fuses	8W-10, 11
Fuse Blocks	8W-10
Fuse/Relay Block	8W-11
Fused Ignition Switch Run-Start Relay	8W-11
Grounds	8W-70
Generator	8W-20
Glow Plug Control Module	8W-30
Glow Plugs	8W-30
Hazard Warning Switch	8W-52
Headlamp Adjust Switch	8W-50
Headlamp Assemblies	8W-50, 52
Headlamp Switch	8W-50
Heat Exchanger Connector	8W-42
Heat Exchanger Switch	8W-42
Heated Seat Modules	8W-63
Heated Seat Switches	8W-63
Heater Timer-Auxiliary	8W-42
Hood Ajar Switch	8W-39
Horn Relay	8W-41
Horn Switch	8W-41
Horn	8W-41
Ignition Lock Switch	8W-40
Ignition Switch	8W-10
Instrument Cluster	8W-40
Instrument Panel Socket	8W-40
Intake Air Temperature Sensor	8W-30
Interior Lamps	8W-44
Interior Light Switches	8W-44
Interior Lighting Connector	8W-44
Intrusion Sensors	8W-39
Kickdown Switch	8W-30
Lamp Relays	8W-50
License Plate Lamps	8W-51
Locker Switches	8W-31
Low Fuel Pressure Sensor	8W-30

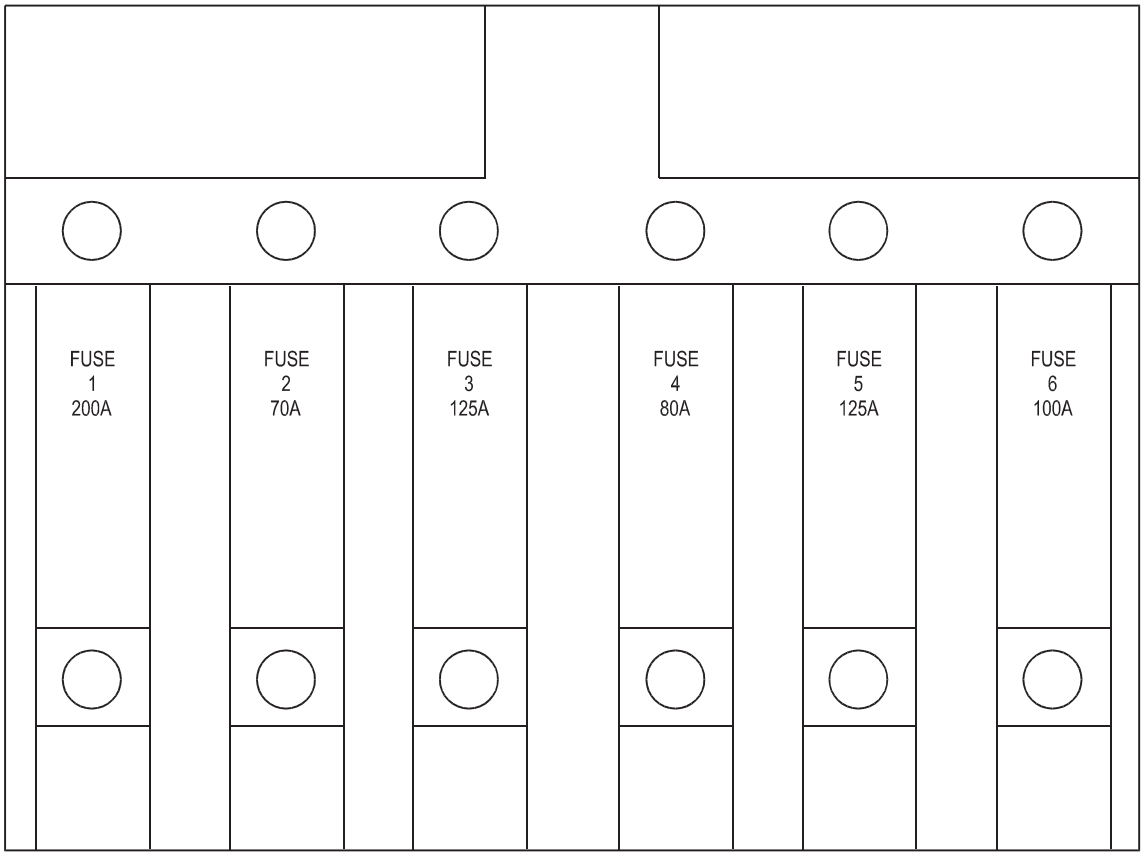
Component	Page
Map/Reading Lamp Switch	8W-44
Marker Lamp Connector	8W-51
Marker Lamps	8W-50
Mass Air Flow Sensor	8W-30
Master Door Lock Switch	8W-61
Metering Pump	8W-42
Microphone Connector	8W-55
Multi-Function Switch	8W-50, 52, 53, 54
Optional Equipment Relay	8W-11
Panic Alarm Switch	8W-39
Parking Brake Switch	8W-35
Power Distribution Center	8W-10
Power Mirror Motors	8W-62
Power Mirror Switch	8W-62
Power Window Motors	8W-60
Power Window Switches	8W-60
Radio Antenna	8W-47
Radio	8W-47
Radio/Cellular Antenna	8W-55
Reading Lamp Connector	8W-44
Recirculated Air Solenoid Valve	8W-42
Refrigerant Pressure Sensor	8W-42
Relay Block	8W-11
Roof Fan Motor	8W-42
Splices	8W-70
Seat Belt Switch	8W-43
Seatbelt Tensioners	8W-43
Security System Module	8W-39
Sensor	8W-30
Sentry Key Remote Entry Module	8W-39
Shifter Assembly	8W-31
Siren	8W-39, 41
SKREEM Antenna	8W-39
SKREEM Transponder	8W-39
Speakers	8W-47
Speed Control Switch	8W-33
Starter Motor Relay	8W-21
Starter Motor	8W-21
Tail Lamp Assemblies	8W-51
TCS Switch	8W-35
Temperature Switch	8W-42
Time Delay Relay	8W-44
Towing/Intrusion Sensor On/Off Switch	8W-39
Trailer Tow Connector	8W-54
Trailer Tow Control Module	8W-54
Transmission Control Module	8W-31
Transmission Relay	8W-31
Transmission Solenoid Assembly	8W-31
Turn Signals	8W-52
Turn Signal Relay	8W-52
Turn Signal Switch	8W-50
Turn Signal/Anti-Theft Alarm Relays	8W-39, 52
Warm Air Auxiliary Control Module	8W-42
Warm Air Auxiliary Heater Assembly	8W-42
Warm Air Heater Control Module	8W-42
Washer On/Off Switch	8W-53
Washer Pump Motor-Front	8W-53
Water Cycle Valve	8W-42
Water In Fuel Sensor	8W-30
Wheel Speed Sensors	8W-35
Window Defoggers	8W-48
Window Defogger Module-Rear	8W-48
Window Defogger Relays	8W-48
Window Defogger Switch-Rear	8W-48
Wiper Motor-Front	8W-53
Wiper On/Off Relay	8W-53
Wiper Switch	8W-53
Wiper/Turn Signal/Engine Start Control Module	8W-50

8W-10 POWER DISTRIBUTION

Component	Page
Airbag Control Module	8W-10-19
Automatic Temperature Control Module	8W-10-30
Auxiliary Heater Switch	8W-10-23
Battery	8W-10-6, 11
Battery Relay- Auxiliary	8W-10-6
Beam Select Switch	8W-10-12, 18, 28
Blower Motor Resistor Block	8W-10-12, 30
Brake Lamp Switch	8W-10-20
Central Timer Module	8W-10-16
Cigar Lighter	8W-10-23
Circulation Pump Diode	8W-10-30
Circulation Pump Relay	8W-10-22, 30
Controller Antilock Brake	8W-10-20
Courtesy Lamp- Driver Door	8W-10-24
Courtesy Lamp- Left Sliding Door	8W-10-24
Courtesy Lamp- Passenger Door	8W-10-24
Courtesy Lamp- Right Sliding Door	8W-10-24
Crankcase Heater	8W-10-29
D+ Relay No. 1	8W-10-9, 10
Data Link Connector	8W-10-20
Daytime Running Lamp Relay- Left Side	8W-10-10, 27
Daytime Running Lamp Relay- Right Side	8W-10-10, 27
Daytime Running Lamps Relay	8W-10-25
Dome Lamp	8W-10-24
EGR Valve	8W-10-29
Engine Control Module	8W-10-15, 19, 29, 34
Engine Control Relay	8W-10-12, 29, 34
Fog Lamp Relay	8W-10-28
Fuse 1	8W-10-6, 8, 9, 17, 18, 25
Fuse 2	8W-10-6, 8, 11, 18
Fuse 3	8W-10-6, 8, 9, 18
Fuse 4	8W-10-8, 9, 11, 13, 14, 19, 26
Fuse 5	8W-10-8, 9, 11, 14, 20
Fuse 6	8W-10-7, 8, 11, 12, 14, 21, 33
Fuse 7	8W-10-7, 8, 14, 17, 22
Fuse 8	8W-10-7, 9, 12, 23
Fuse 9	8W-10-8, 9, 10, 12, 21
Fuse 10	8W-10-9, 10, 11, 25
Fuse 11	8W-10-9, 10, 26
Fuse 12	8W-10-7, 27
Fuse 13	8W-10-7, 27
Fuse 14	8W-10-7, 28
Fuse 15	8W-10-7, 13, 16
Fuse 16	8W-10-29
Fuse 17	8W-10-12, 29
Fuse 18	8W-10-9, 14, 19
Fuse 19	8W-10-12, 30
Fuse 20	8W-10-7, 12, 30
Fuse 21	8W-10-12, 13, 30

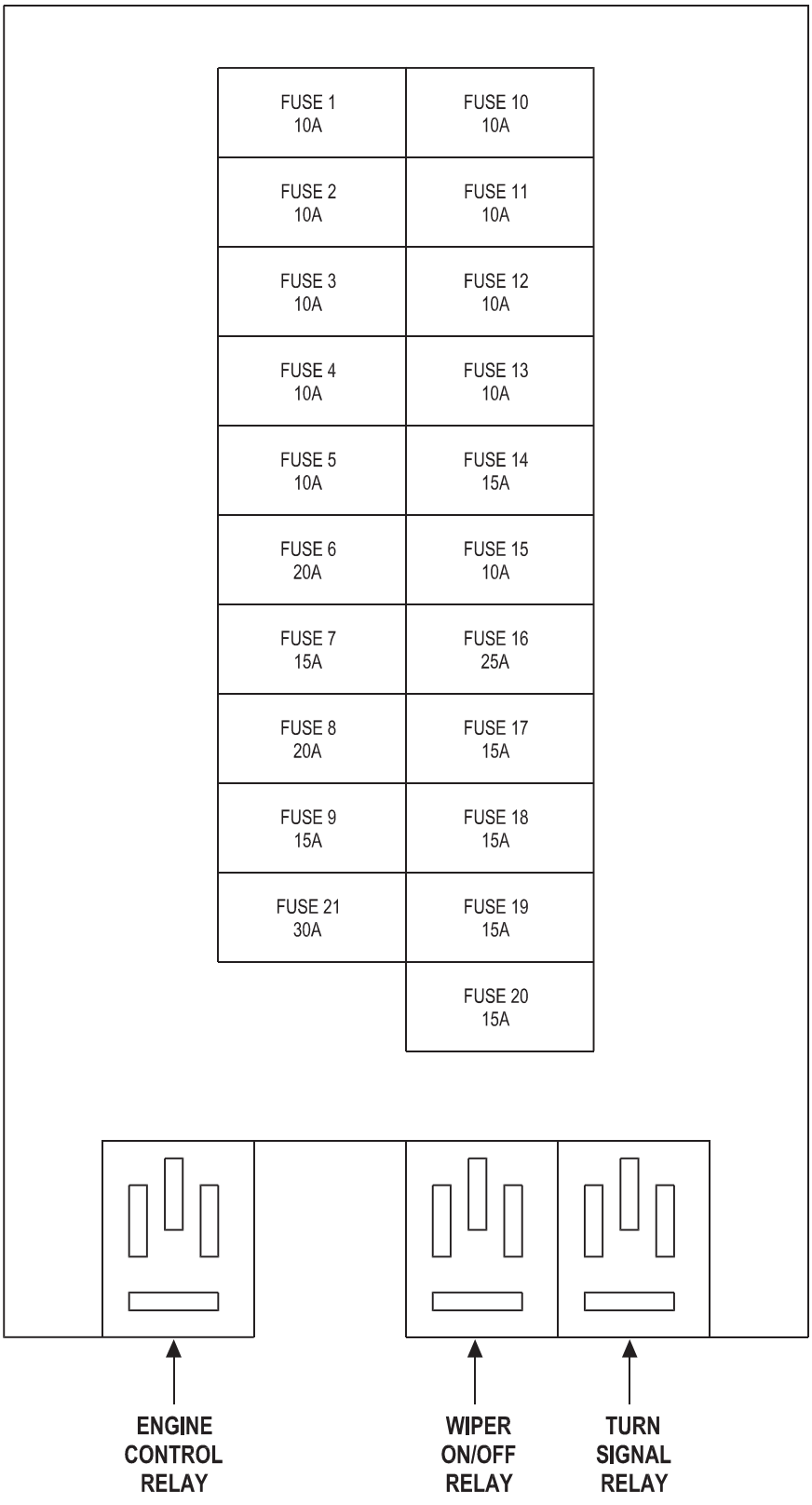
Component	Page
Fuse Block No. 1	8W-10-3, 11, 12, 13, 14, 15, 18, 19, 20, 21, 22, 23, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34
Fuse Block No. 2	8W-10-10, 17, 25, 26
Fused Ignition Switch Run-Start Relay	8W-10-19
G200	8W-10-32
G202	8W-10-10, 19
Generator	8W-10-6
Glow Plug Control Module	8W-10-11
Hazard Warning Switch	8W-10-14, 21, 31, 32
Headlamp Assembly- Left	8W-10-18, 26, 27, 28
Headlamp Assembly- Right	8W-10-17, 18, 27, 28
Headlamp Switch	8W-10-12, 18, 25, 26, 27
Horn	8W-10-22
Horn Relay	8W-10-22
Ignition Switch	8W-10-12, 13, 14
Instrument Cluster	8W-10-10, 18, 19
Interior Lamp- Left Side	8W-10-24
Interior Lamp- Middle Rear	8W-10-24
Interior Lamp- Rear No. 1	8W-10-24
Interior Lamp- Rear No. 2	8W-10-24
Interior Lamp- Right Side	8W-10-24
Lamp Relay- Left	8W-10-26
Lamp Relay- Right	8W-10-17
Multi- Function Switch	8W-10-12, 13, 14, 18, 21, 25, 26, 27, 28, 31, 32, 33, 34
Optional Equipment Relay	8W-10-6, 7, 22
Power Distribution Center	8W-10-2, 6, 11
Radio	8W-10-16, 23
Radio/Cellular Antenna	8W-10-16
Sentry Key Remote Entry Module	8W-10-22
Shifter Assembly	8W-10-14, 19, 20
Starter Motor	8W-10-11, 15
Starter Motor Relay	8W-10-15
Tail Lamp Assembly- Left	8W-10-26
Tail Lamp Assembly- Right	8W-10-17
Trailer Tow Connector	8W-10-17
Transmission Relay	8W-10-22
Turn Signal Relay	8W-10-31
Turn Signal Switch	8W-10-13, 26, 31
Turn Signal/Anti-Theft Alarm Relay- Left	8W-10-23
Turn Signal/Anti-Theft Alarm Relay- Right	8W-10-23
Washer On/Off Switch	8W-10-21, 34
Washer Pump Motor- Front	8W-10-34
Window Defogger Switch- Rear	8W-10-22
Wiper Motor- Front	8W-10-33
Wiper On/Off Relay	8W-10-21, 33
Wiper Switch	8W-10-21, 32, 33
Wiper/Turn Signal/Engine Start Control Module	8W-10-14, 21, 31, 32, 33, 34

POWER DISTRIBUTION CENTER



NOTE: THE FUSE POSITIONS SHOWN HERE MAY VARY FROM VEHICLE TO VEHICLE.

FUSE BLOCK NO. 1



NOTE: THE FUSE AND RELAY LOCATIONS SHOWN HERE MAY VARY FROM VEHICLE TO VEHICLE.

VA301003 J038W-24

FUSES
PDC

FUSE	AMPS	FUSED CIRCUIT	FUNCTION
1	200A	4BK	FUSED B(+)
2	70A	10RD	FUSED B(+)
3	125A	8RD	FUSED B(+)
4	80A	-	-
5	125A	8RD	FUSED B(+)
6	100A	8RD	FUSED B(+)

FUSES
FUSE BLOCK NO. 1

FUSE	AMPS	FUSED CIRCUIT	FUNCTION
1	10A	GY/RD 16	FUSED B(+)
2	10A	WT 16	FUSED HIGH BEAM SWITCH OUTPUT
3	10A	WT 16	FUSED HIGH BEAM SWITCH OUTPUT
4	10A	BK/BL 16	FUSED IGNITION SWITCH OUTPUT (RUN-START)
5	10A	BK/BL/WT 16	FUSED IGNITION SWITCH OUTPUT (RUN-START)
6	20A	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
7	15A	BK/YL 16	FUSED IGNITION SWITCH OUTPUT (RUN-START)
8	20A	RD/YL 16	FUSED IGNITION SWITCH OUTPUT (RUN-START)
9	15A	-	-
10	10A	GY/DG/RD 16	HEADLAMP SWITCH OUTPUT
11	10A	GY/BK 16	FUSED B(+)
12	10A	YL 18	HEADLAMP SWITCH OUTPUT
13	10A	YL 18	HEADLAMP SWITCH OUTPUT
14	15A	BK/YL/WT 16	FOG LAMP RELAY OUTPUT
15	10A	BK/RD 16	FUSED IGNITION SWITCH OUTPUT (ACC-RUN-START)
16	15A	BK/BL 12	ENGINE CONTROL RELAY OUTPUT
17	15A	BK/RD 16	ENGINE CONTROL RELAY OUTPUT
18	15A	BK 14	FUSED IGNITION SWITCH OUTPUT (RUN-START)
19	15A	-	FUSED B(+)
20	15A	RD/BL 16	FUSED B(+)
21	30A	RD 12	FUSED B(+)

TRANSMISSION CONTROL RELAY

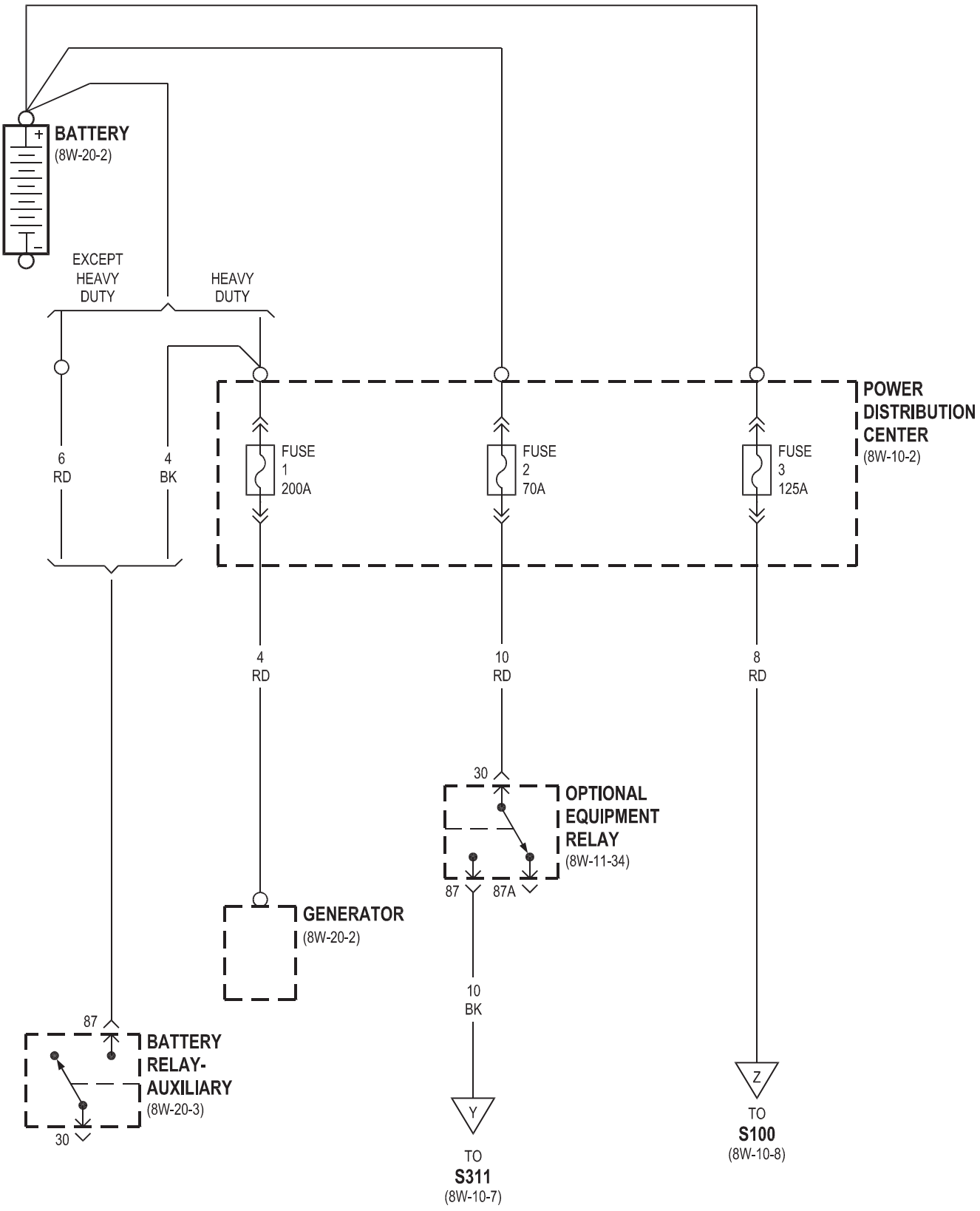
CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	FUSED B(+)
85	INTERNAL	ENGINE CONTROL RELAY CONTROL
86	INTERNAL	FUSED B(+)
87	INTERNAL	ENGINE CONTROL RELAY OUTPUT
87A	-	-

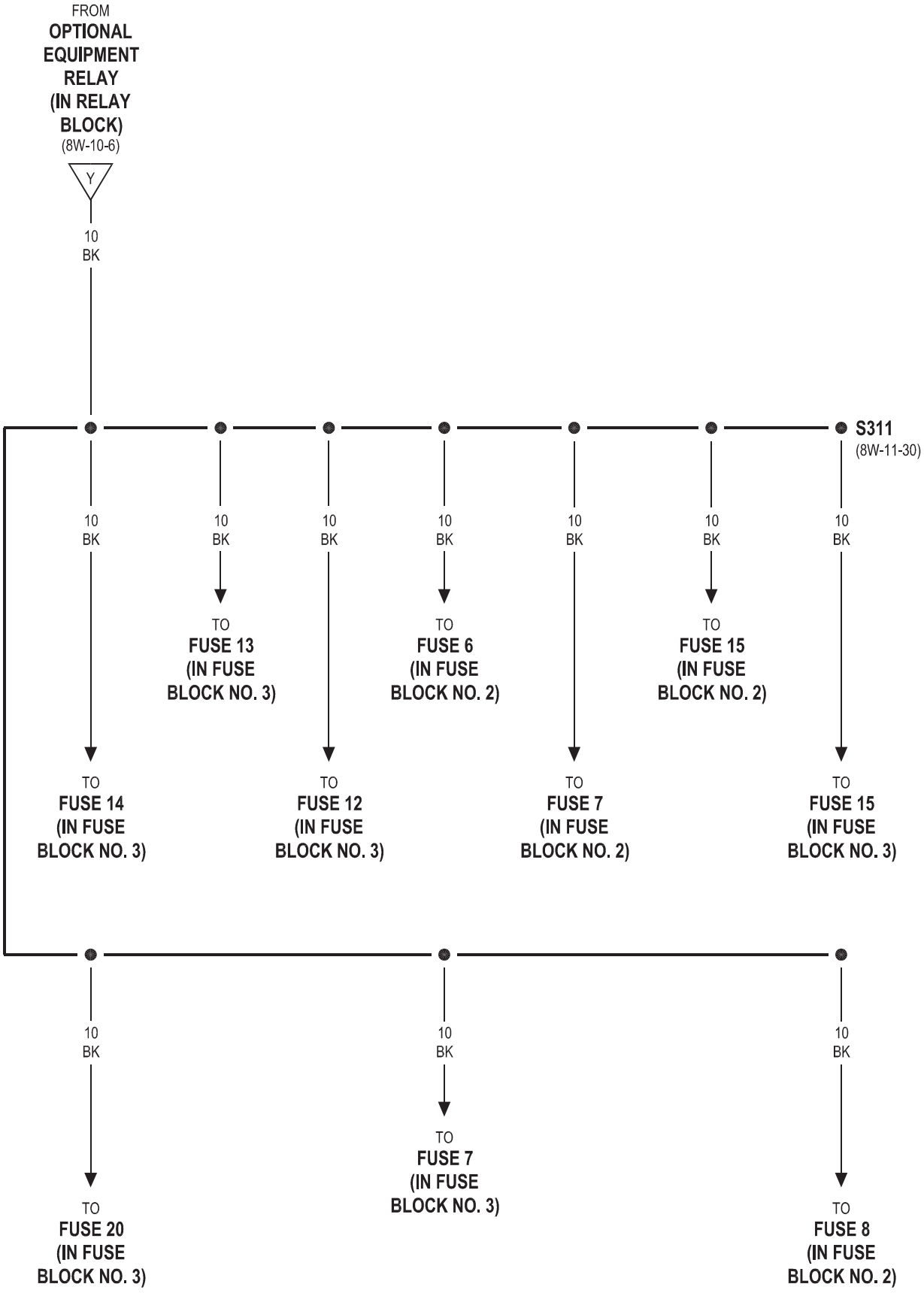
TURN SIGNAL RELAY

CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	TURN SIGNAL RELAY SIGNAL
85	INTERNAL	TURN SIGNAL RELAY CONTROL
86	INTERNAL	TURN SIGNAL RELAY FEED
87	INTERNAL	TURN SIGNAL RELAY OUTPUT
87A	-	-

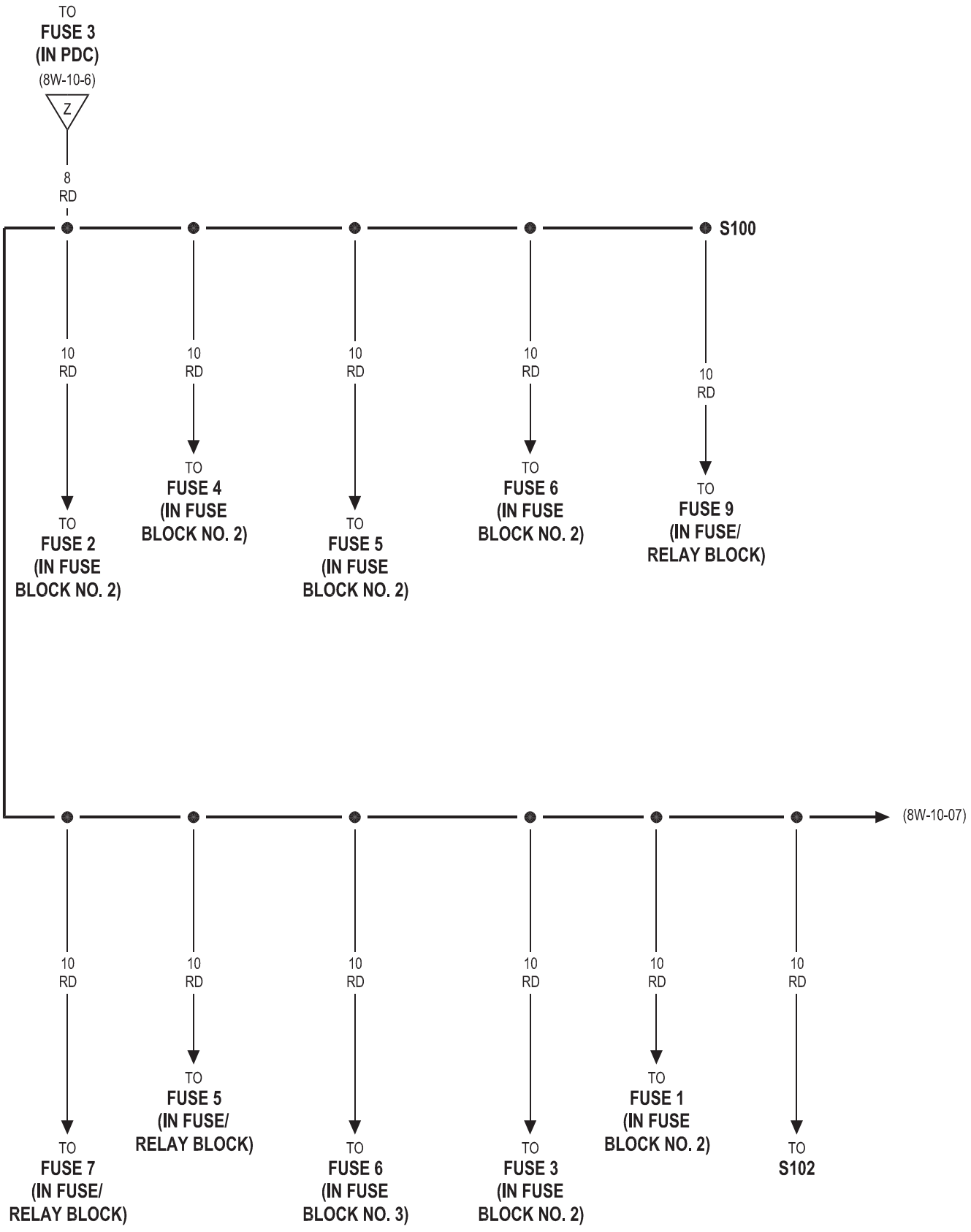
WIPER ON/OFF RELAY

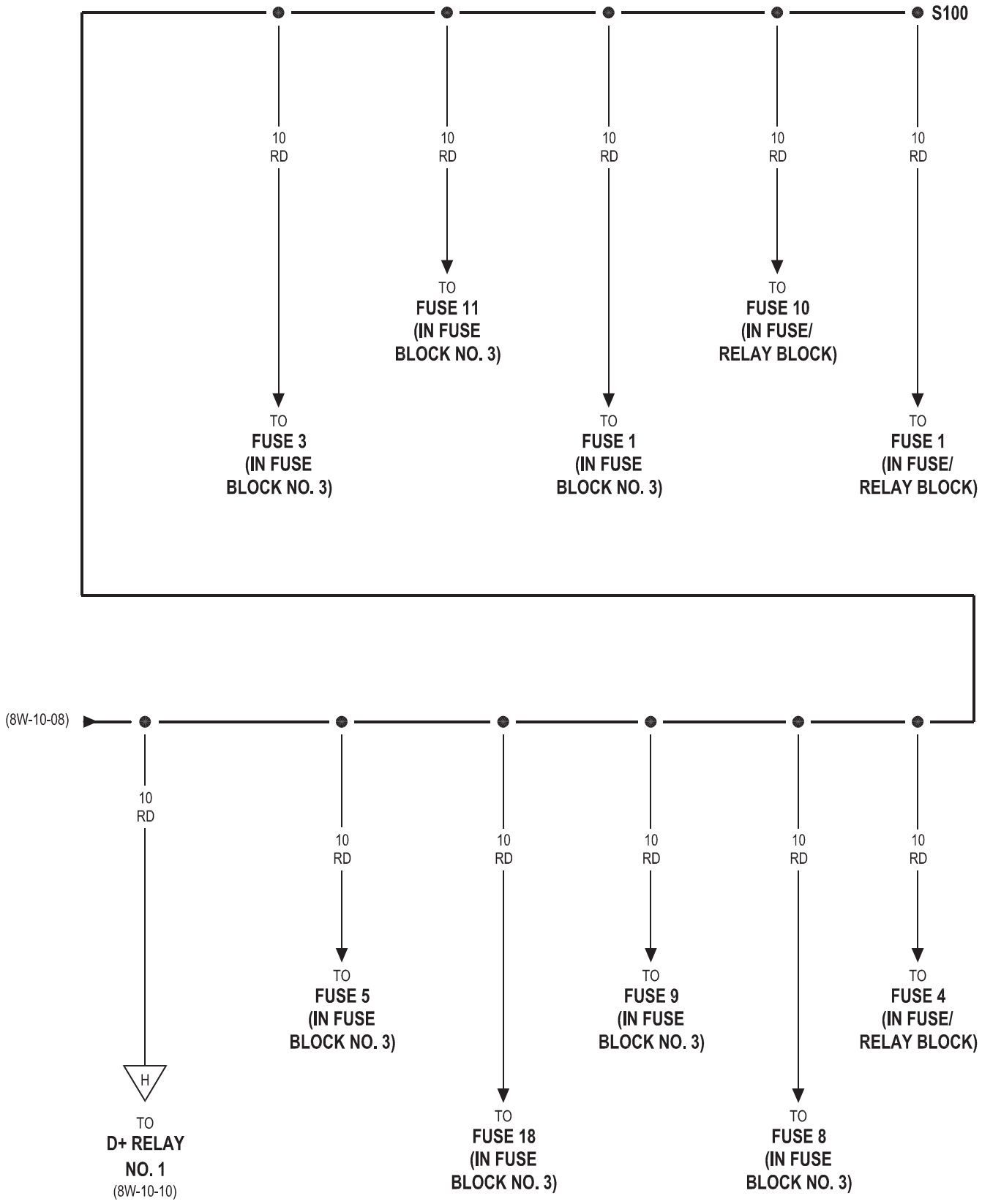
CAVITY	CIRCUIT	FUNCTION
30	INTERNAL	12 VOLT SUPPLY
85	BK/VT 16	FUSED IGNITION SWITCH OUTPUT (RUN-START)
86	INTERNAL	WIPER ON/OFF RELAY CONTROL
87	BK/VT 16	WIPER ON/OFF RELAY OUTPUT
87A	INTERNAL	WIPER MOTOR CONTROL


BATTERY
(8W-20-2)
EXCEPT HEAVY DUTY
HEAVY DUTY
6 RD
4 BK
FUSE 1 200A
FUSE 2 70A
FUSE 3 125A
POWER DISTRIBUTION CENTER
(8W-10-2)
4 RD
10 RD
8 RD
30
OPTIONAL EQUIPMENT RELAY
(8W-11-34)
87
87A
GENERATOR
(8W-20-2)
10 BK
87
BATTERY RELAY-AUXILIARY
(8W-20-3)
30
Y
TO
S311
(8W-10-7)
Z
TO
S100
(8W-10-8)

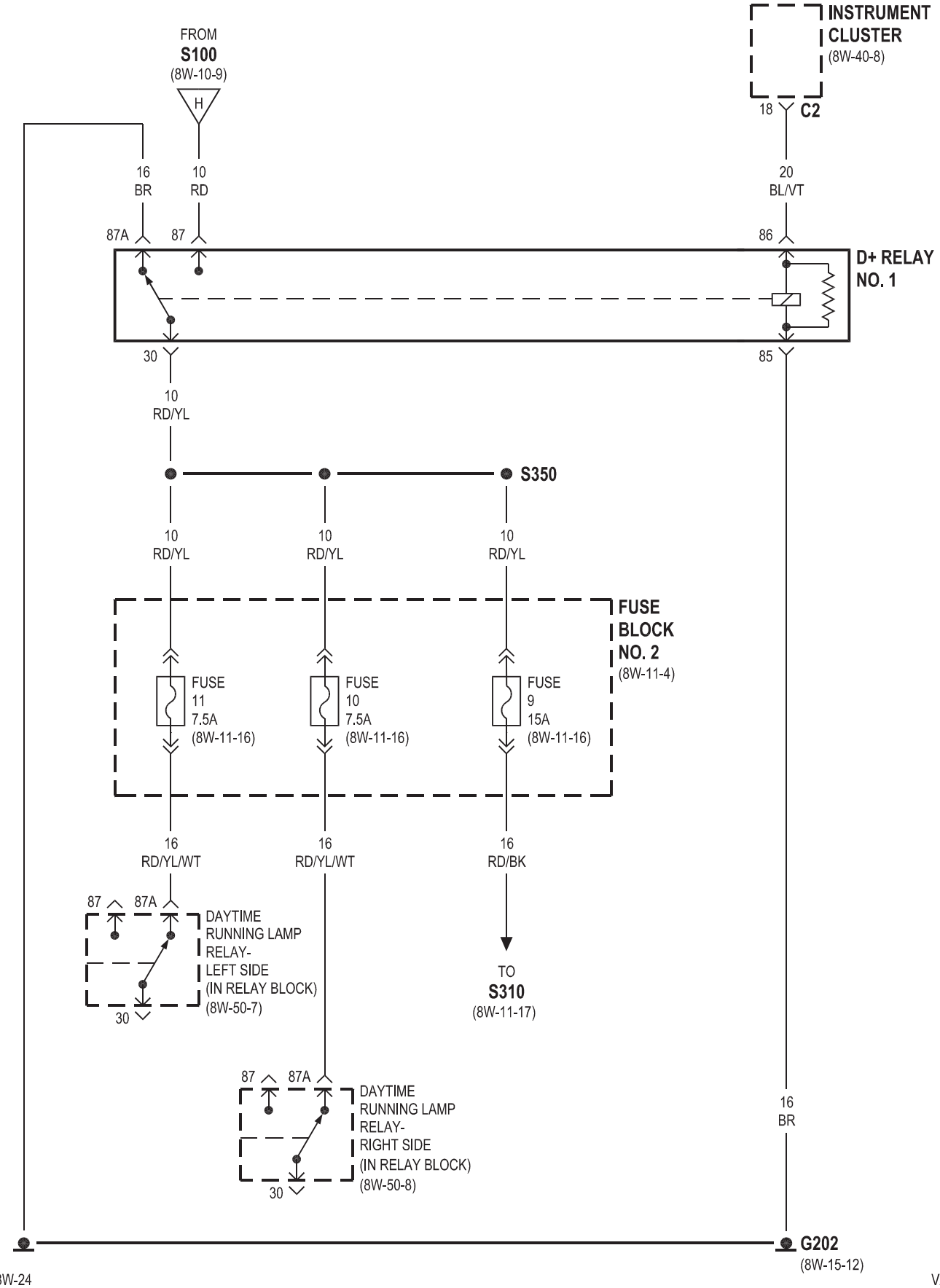


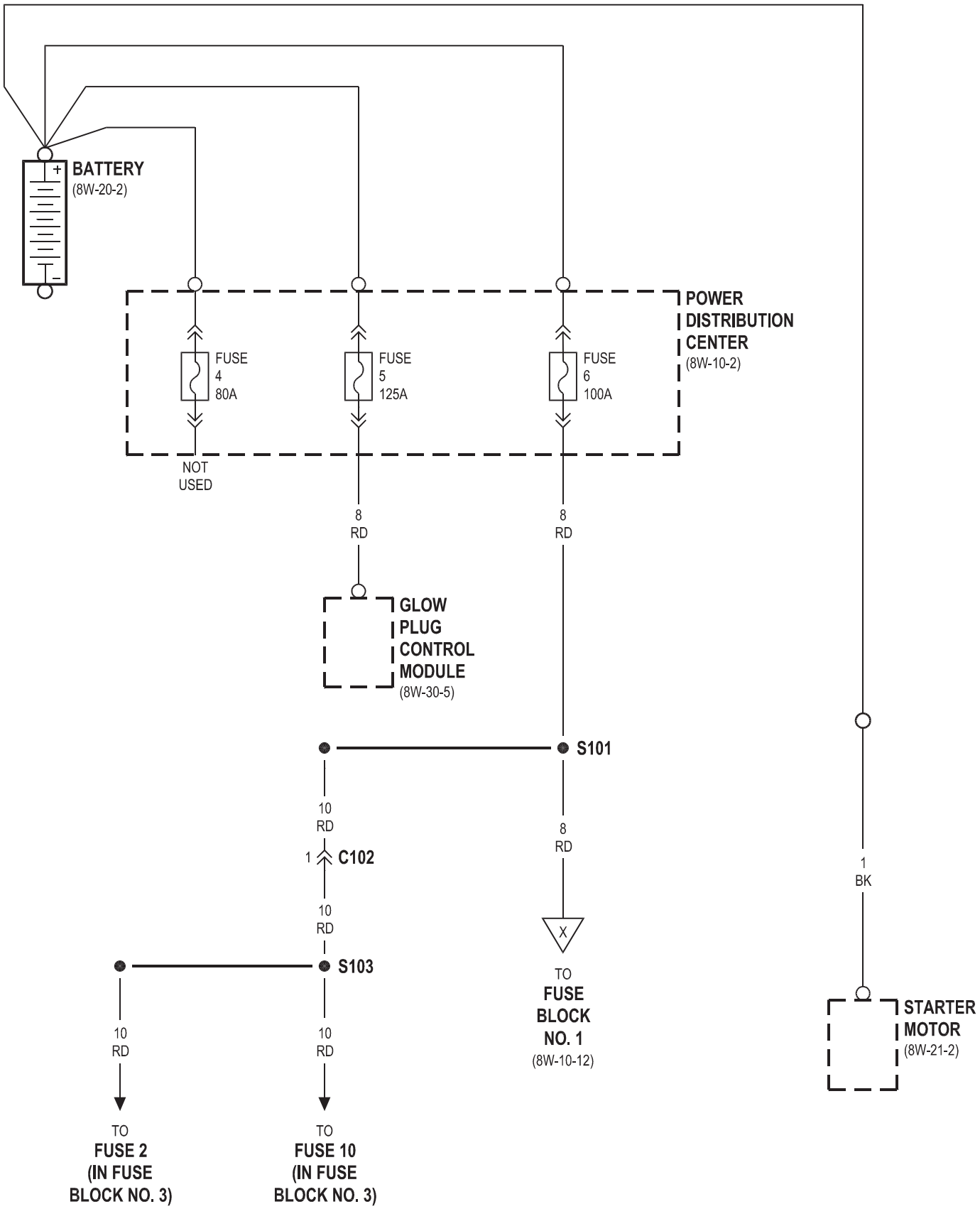
VA301007 J038W-24


TO
FUSE 3
(IN PDC)
(8W-10-6)
Z
8
RD
S100
10
RD
TO
FUSE 2
(IN FUSE
BLOCK NO. 2)
10
RD
TO
FUSE 4
(IN FUSE
BLOCK NO. 2)
10
RD
TO
FUSE 5
(IN FUSE
BLOCK NO. 2)
10
RD
TO
FUSE 6
(IN FUSE
BLOCK NO. 2)
10
RD
TO
FUSE 9
(IN FUSE/
RELAY BLOCK)
(8W-10-07)
10
RD
TO
FUSE 7
(IN FUSE/
RELAY BLOCK)
10
RD
TO
FUSE 5
(IN FUSE/
RELAY BLOCK)
10
RD
TO
FUSE 6
(IN FUSE
BLOCK NO. 3)
10
RD
TO
FUSE 3
(IN FUSE
BLOCK NO. 2)
10
RD
TO
FUSE 1
(IN FUSE
BLOCK NO. 2)
10
RD
TO
S102

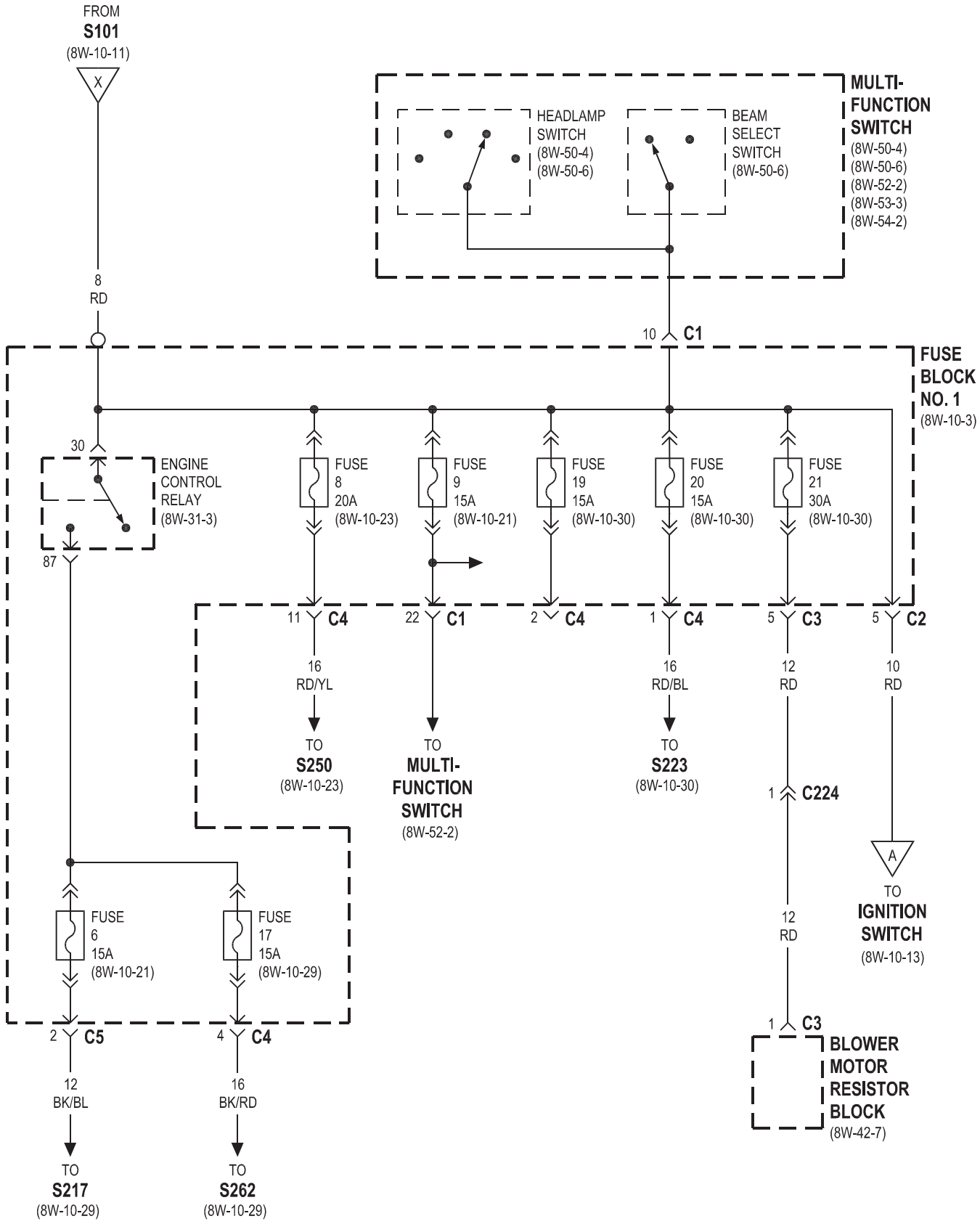


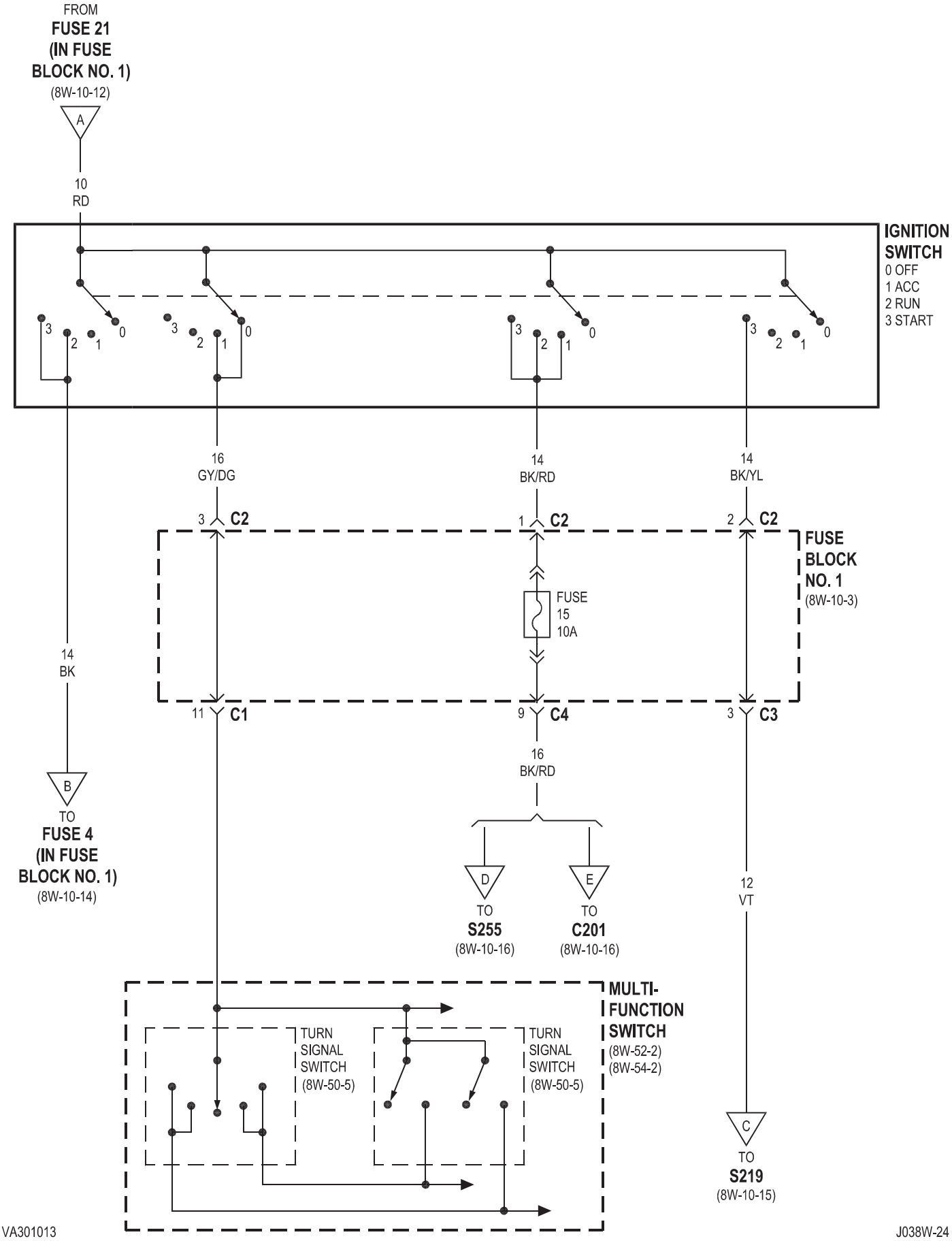
VA301009 J038W-24


INSTRUMENT CLUSTER
(8W-40-8)
18 C2
FROM S100
(8W-10-9)
H
16 BR
10 RD
20 BL/VT
87A
87
86
D+ RELAY NO. 1
30
85
10 RD/YL
S350
10 RD/YL
10 RD/YL
10 RD/YL
FUSE BLOCK NO. 2
(8W-11-4)
FUSE 11 7.5A (8W-11-16)
FUSE 10 7.5A (8W-11-16)
FUSE 9 15A (8W-11-16)
16 RD/YL/WT
16 RD/YL/WT
16 RD/BK
87
87A
DAYTIME RUNNING LAMP RELAY- LEFT SIDE (IN RELAY BLOCK)
(8W-50-7)
30
TO S310
(8W-11-17)
87
87A
DAYTIME RUNNING LAMP RELAY- RIGHT SIDE (IN RELAY BLOCK)
(8W-50-8)
30
16 BR
G202
(8W-15-12)

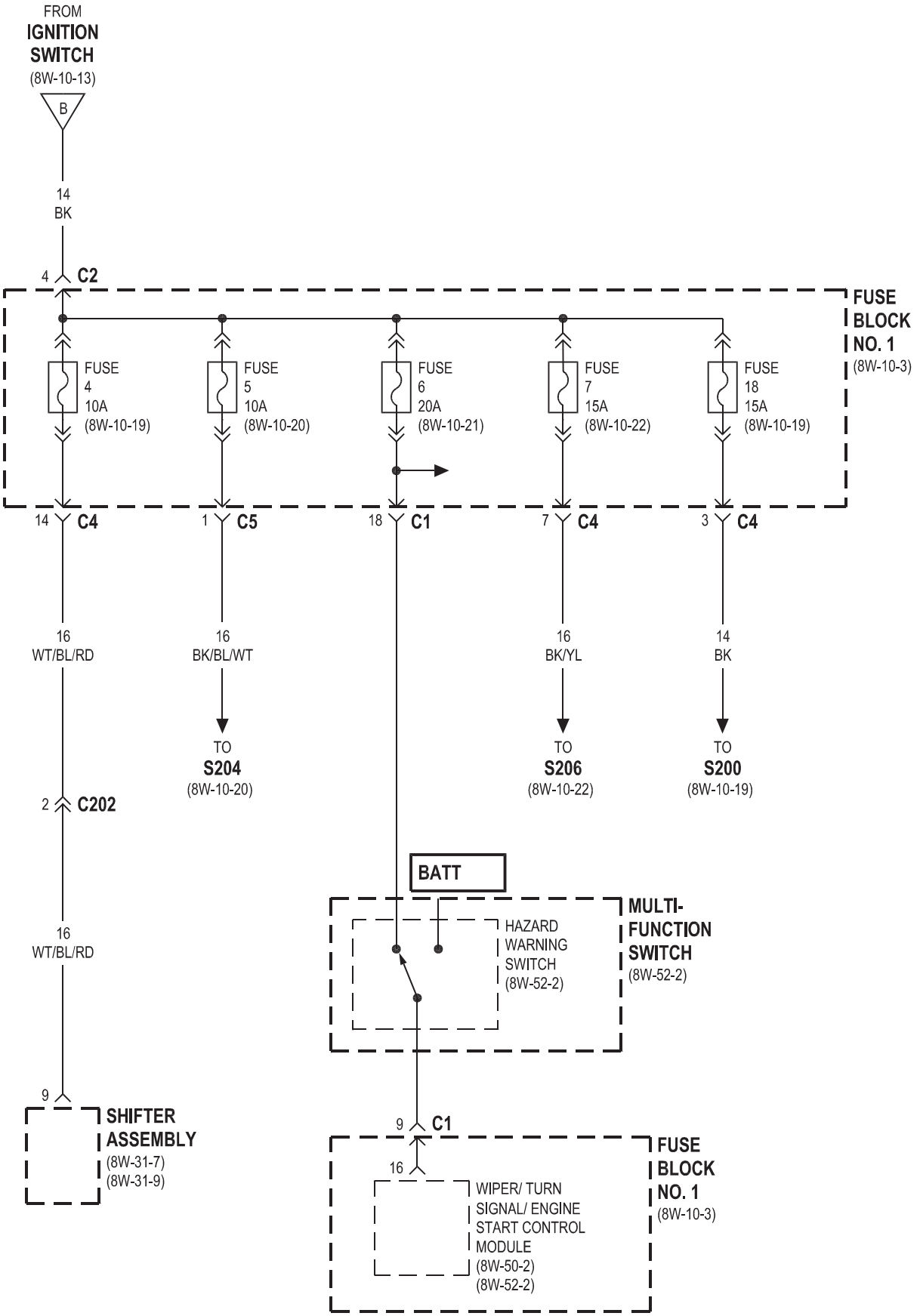


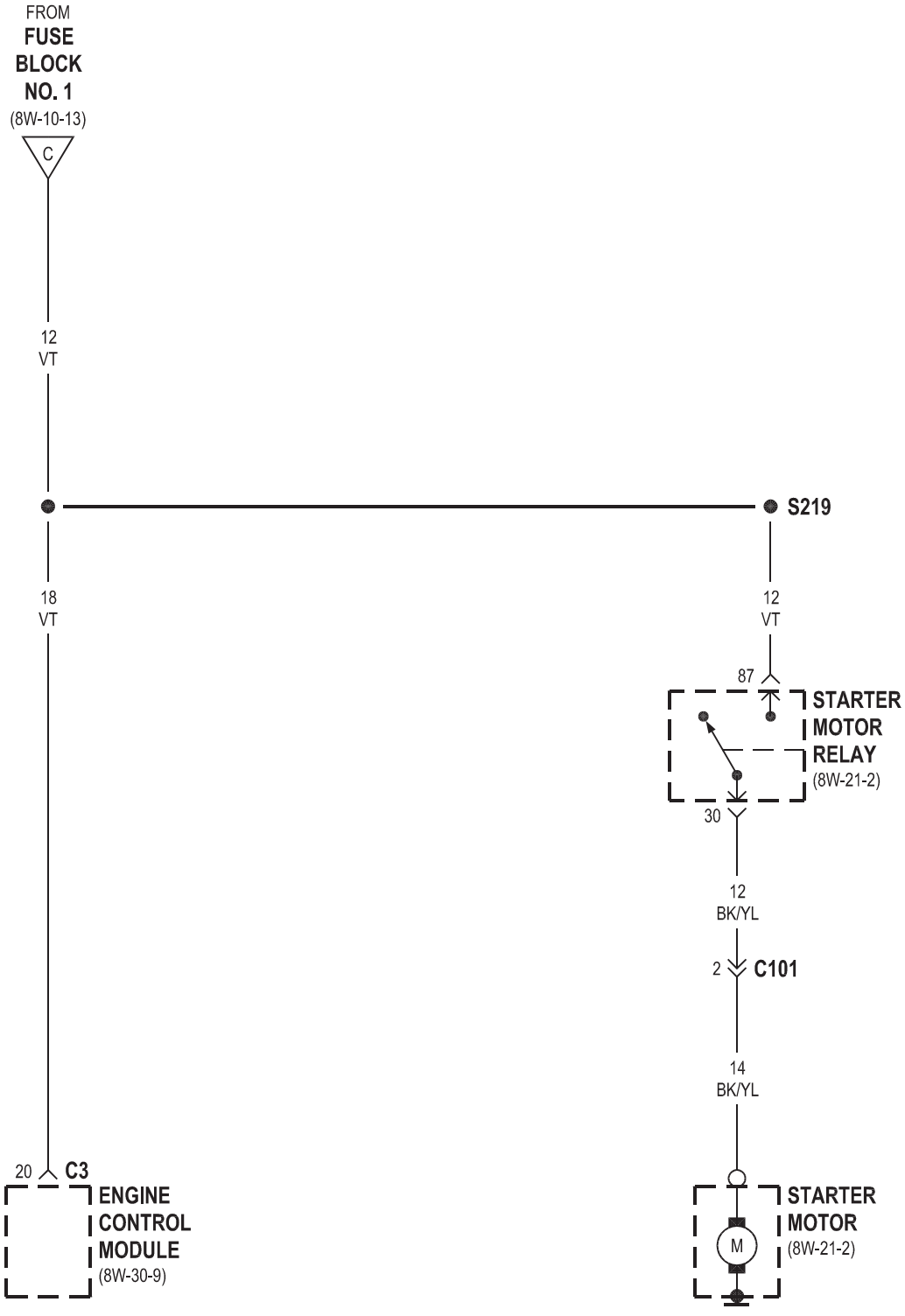
VA301011 J038W-24

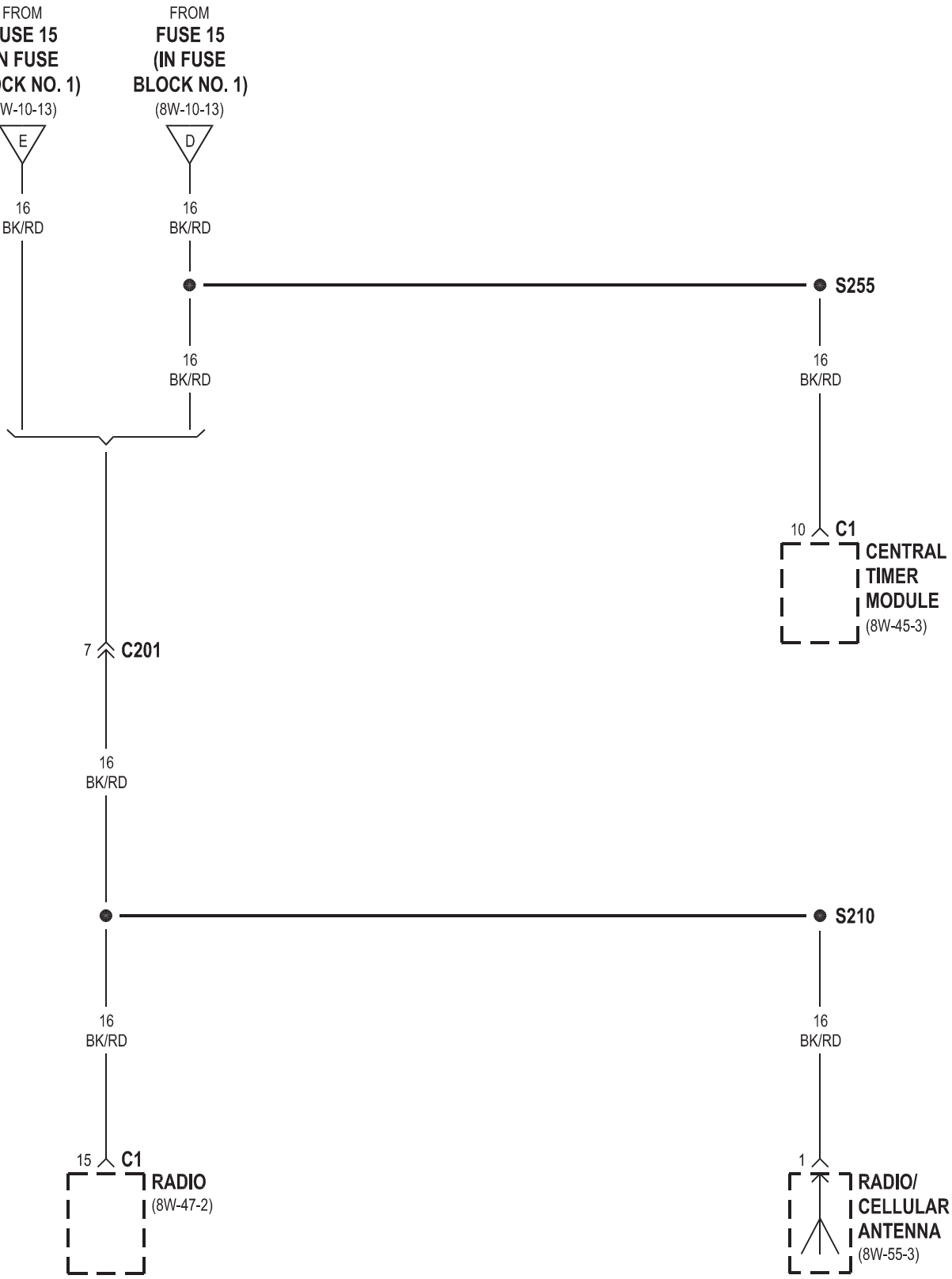

FROM
S101
(8W-10-11)
X
8
RD
MULTI-
FUNCTION
SWITCH
(8W-50-4)
(8W-50-6)
(8W-52-2)
(8W-53-3)
(8W-54-2)
HEADLAMP
SWITCH
(8W-50-4)
(8W-50-6)
BEAM
SELECT
SWITCH
(8W-50-6)
10 C1
FUSE
BLOCK
NO. 1
(8W-10-3)
30
ENGINE
CONTROL
RELAY
(8W-31-3)
87
FUSE
8
20A
(8W-10-23)
FUSE
9
15A
(8W-10-21)
FUSE
19
15A
(8W-10-30)
FUSE
20
15A
(8W-10-30)
FUSE
21
30A
(8W-10-30)
11 C4
22 C1
2 C4
1 C4
5 C3
5 C2
16
RD/YL
16
RD/BL
12
RD
10
RD
TO
S250
(8W-10-23)
TO
MULTI-
FUNCTION
SWITCH
(8W-52-2)
TO
S223
(8W-10-30)
1 C224
A
TO
IGNITION
SWITCH
(8W-10-13)
FUSE
6
15A
(8W-10-21)
FUSE
17
15A
(8W-10-29)
12
RD
1 C3
BLOWER
MOTOR
RESISTOR
BLOCK
(8W-42-7)
2 C5
4 C4
12
BK/BL
16
BK/RD
TO
S217
(8W-10-29)
TO
S262
(8W-10-29)

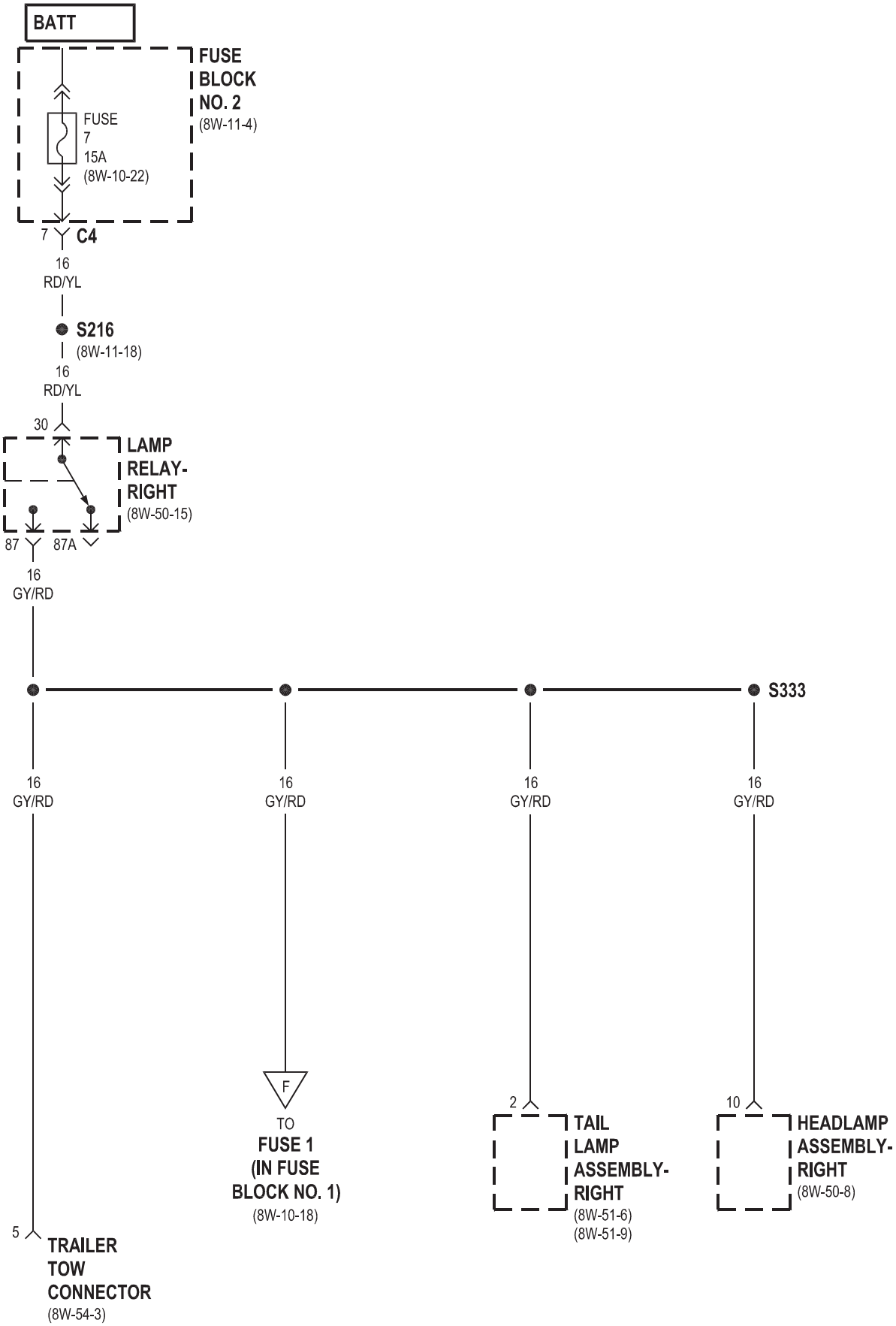


VA301013 J038W-24

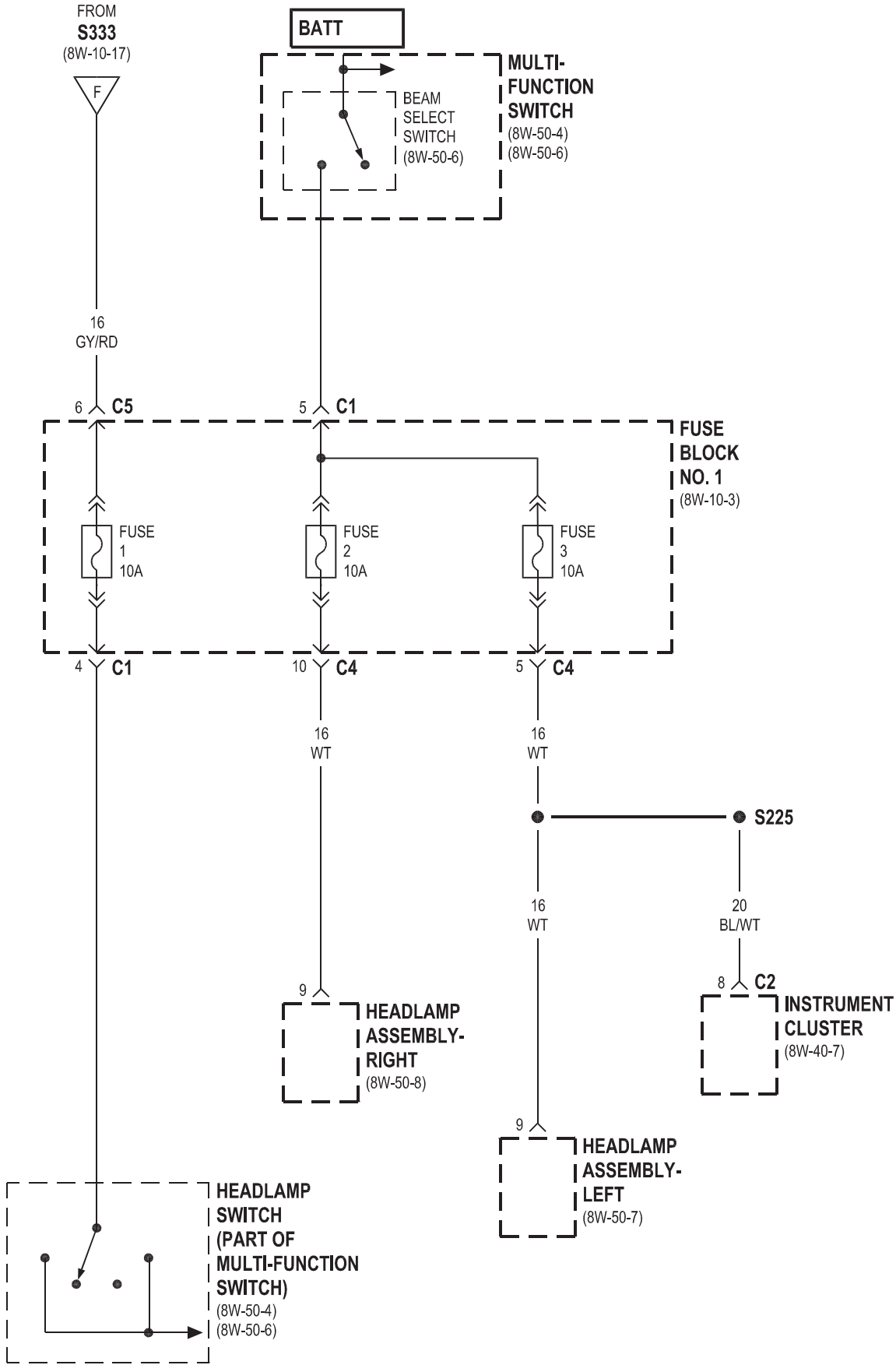

FROM
IGNITION
SWITCH
(8W-10-13)
B
14
BK
4 C2
FUSE BLOCK NO. 1
(8W-10-3)
FUSE 4 10A (8W-10-19)
FUSE 5 10A (8W-10-20)
FUSE 6 20A (8W-10-21)
FUSE 7 15A (8W-10-22)
FUSE 18 15A (8W-10-19)
14 C4
1 C5
18 C1
7 C4
3 C4
16 WT/BL/RD
16 BK/BL/WT
16 BK/YL
14 BK
TO S204 (8W-10-20)
TO S206 (8W-10-22)
TO S200 (8W-10-19)
2 C202
16 WT/BL/RD
BATT
MULTI-FUNCTION SWITCH (8W-52-2)
HAZARD WARNING SWITCH (8W-52-2)
9
SHIFTER ASSEMBLY
(8W-31-7)
(8W-31-9)
9 C1
16
FUSE BLOCK NO. 1
(8W-10-3)
WIPER/ TURN SIGNAL/ ENGINE START CONTROL MODULE
(8W-50-2)
(8W-52-2)

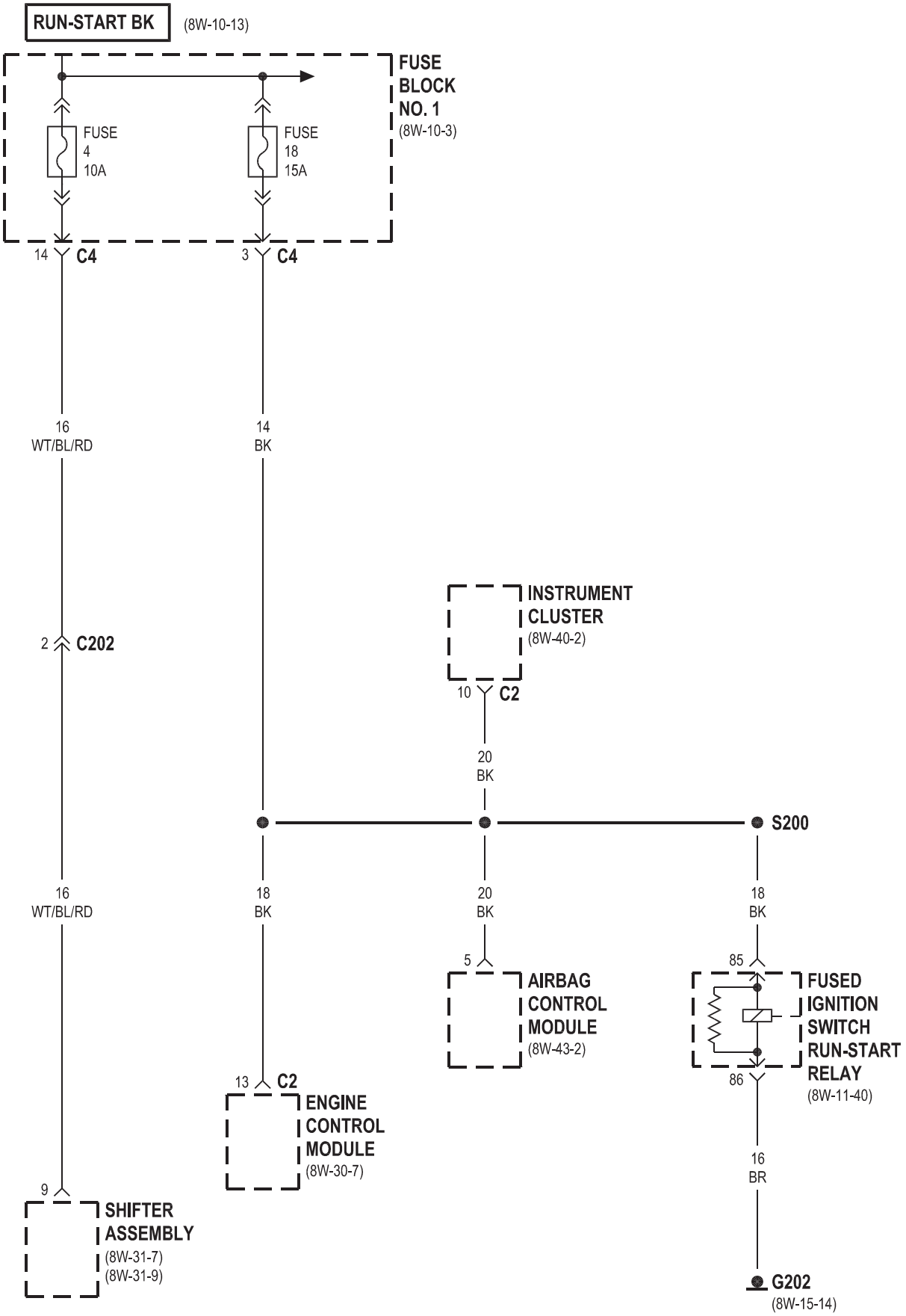

FROM
FUSE
BLOCK
NO. 1
(8W-10-13)
C
12
VT
S219
18
VT
12
VT
87
STARTER
MOTOR
RELAY
(8W-21-2)
30
12
BK/YL
2
C101
14
BK/YL
20
C3
ENGINE
CONTROL
MODULE
(8W-30-9)
M
STARTER
MOTOR
(8W-21-2)


FROM
FUSE 15
(IN FUSE
BLOCK NO. 1)
(8W-10-13)
E
FROM
FUSE 15
(IN FUSE
BLOCK NO. 1)
(8W-10-13)
D
16
BK/RD
16
BK/RD
S255
16
BK/RD
16
BK/RD
10 C1
CENTRAL
TIMER
MODULE
(8W-45-3)
7 C201
16
BK/RD
S210
16
BK/RD
16
BK/RD
15 C1
RADIO
(8W-47-2)
1
RADIO/
CELLULAR
ANTENNA
(8W-55-3)

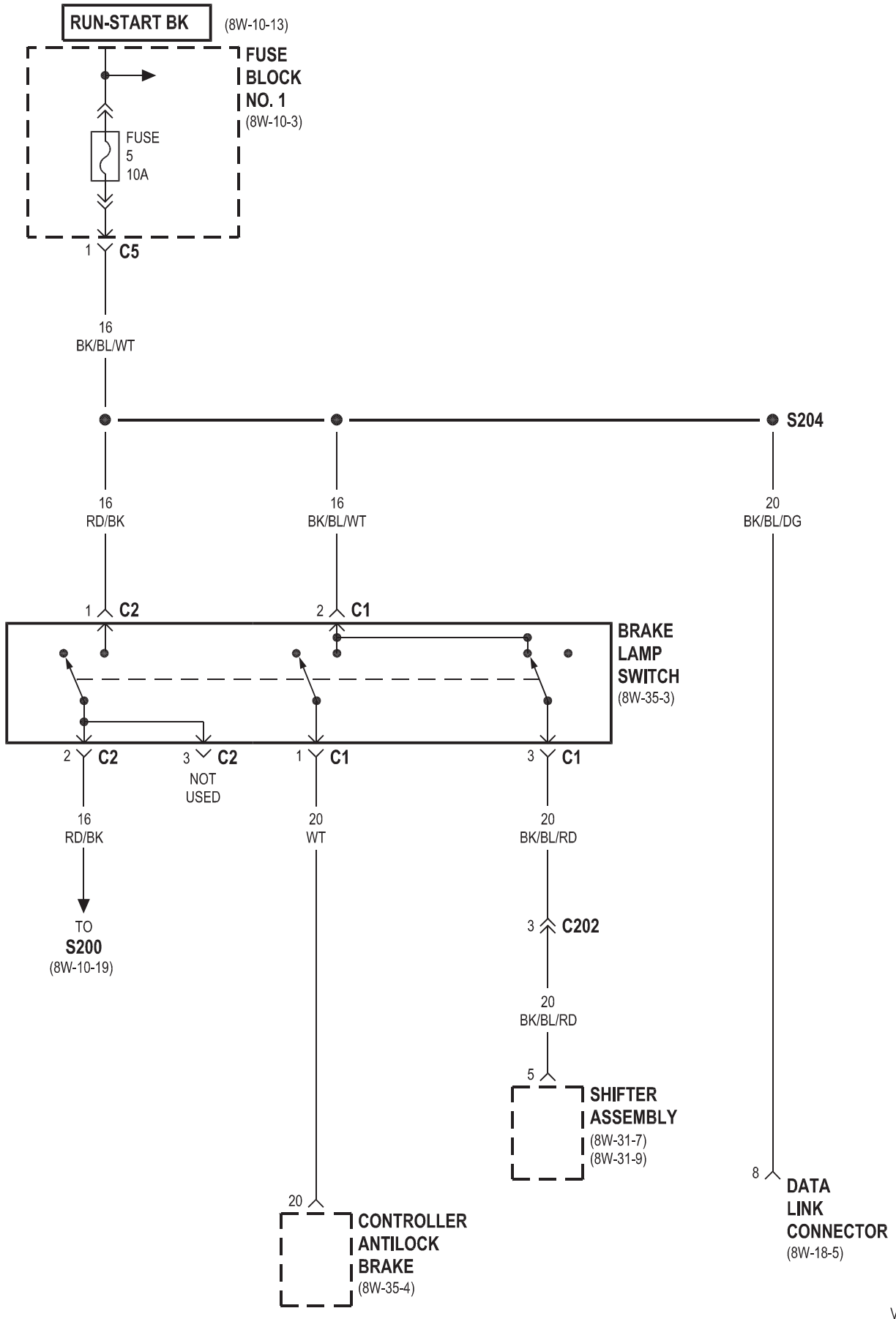


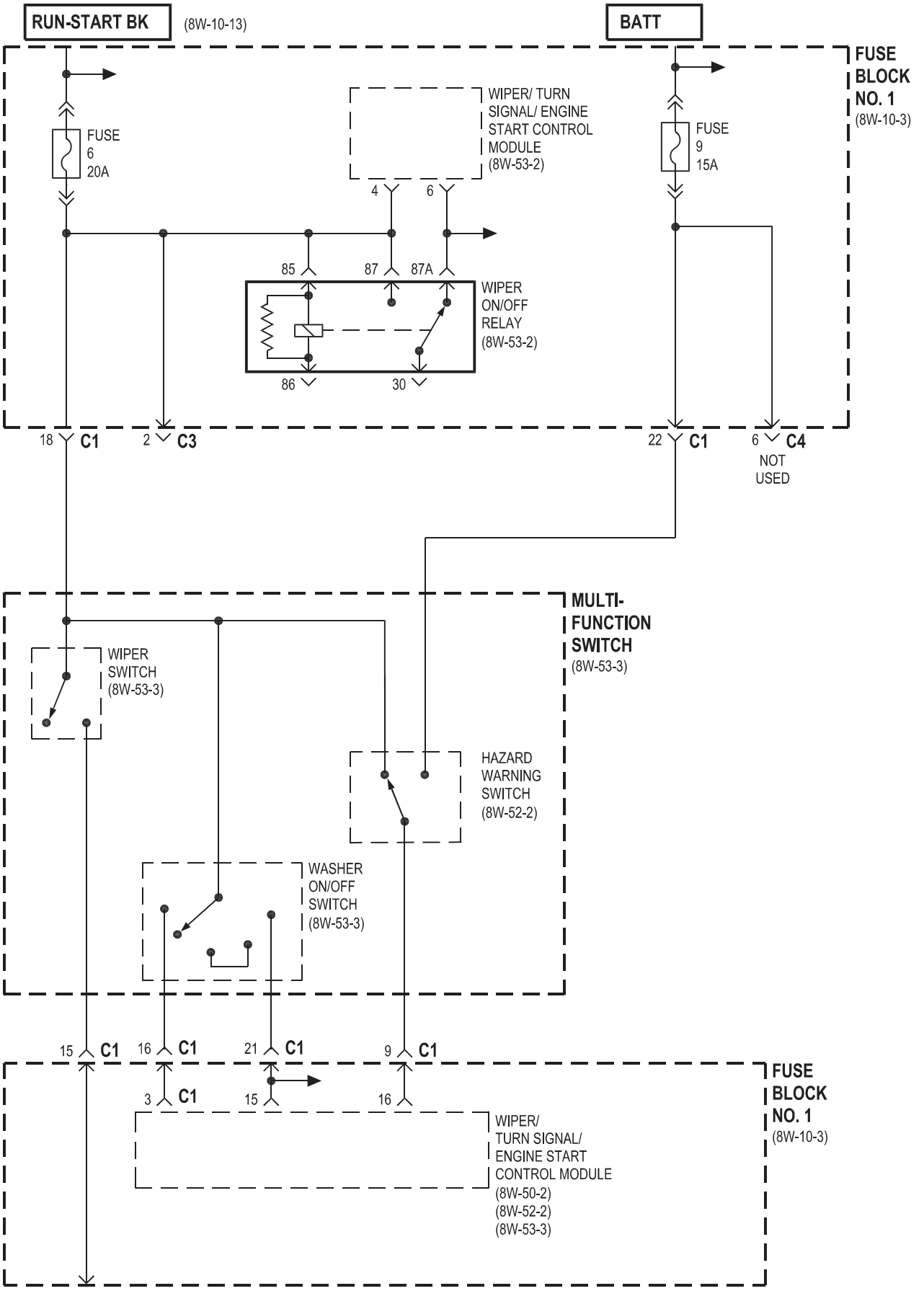
VA301017 J038W-24


FROM
S333
(8W-10-17)
F
BATT
MULTI-
FUNCTION
SWITCH
(8W-50-4)
(8W-50-6)
BEAM
SELECT
SWITCH
(8W-50-6)
16
GY/RD
6 C5
5 C1
FUSE
BLOCK
NO. 1
(8W-10-3)
FUSE
1
10A
FUSE
2
10A
FUSE
3
10A
4 C1
10 C4
5 C4
16
WT
16
WT
S225
16
WT
20
BL/WT
9
HEADLAMP
ASSEMBLY-
RIGHT
(8W-50-8)
8 C2
INSTRUMENT
CLUSTER
(8W-40-7)
9
HEADLAMP
ASSEMBLY-
LEFT
(8W-50-7)
HEADLAMP
SWITCH
(PART OF
MULTI-FUNCTION
SWITCH)
(8W-50-4)
(8W-50-6)

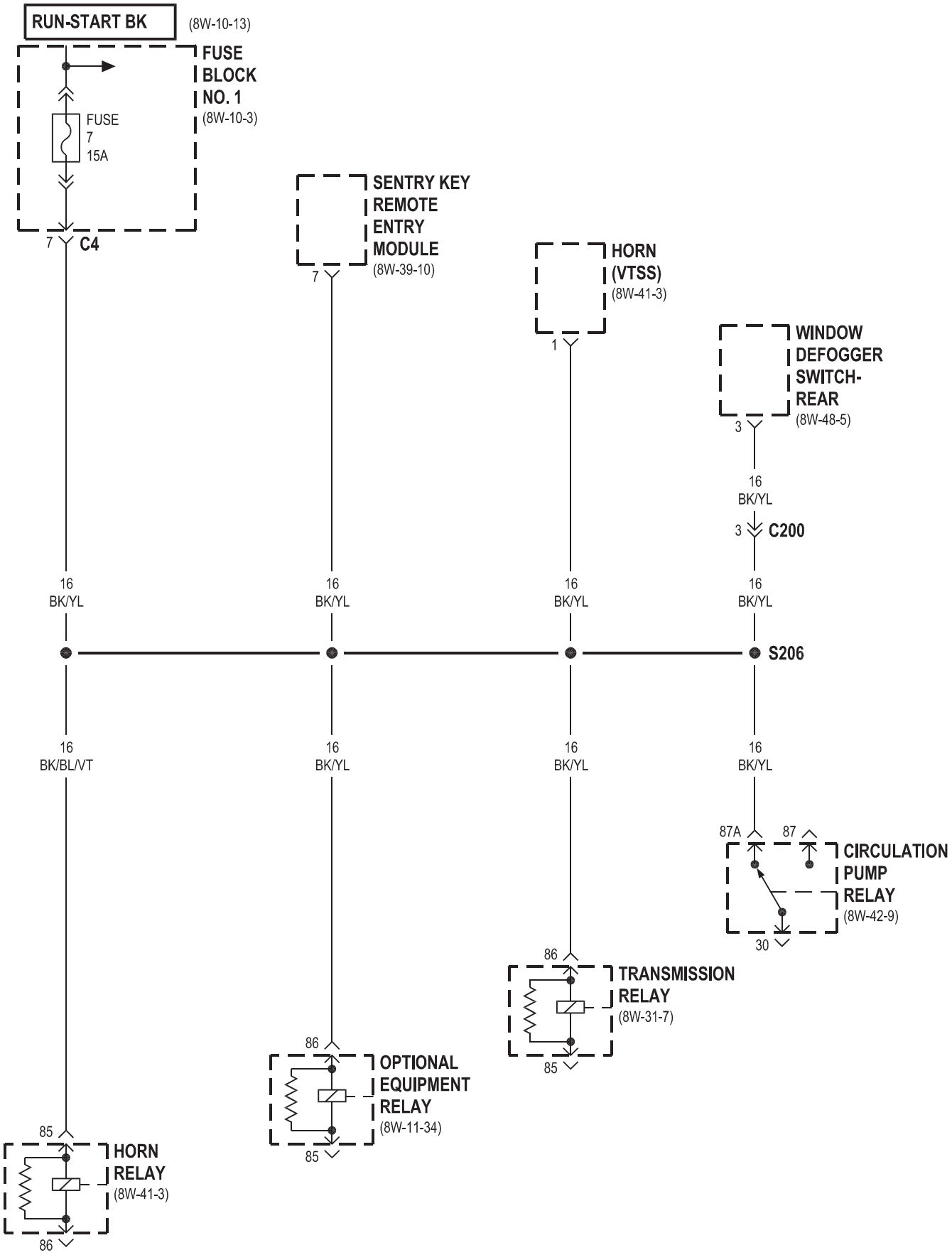


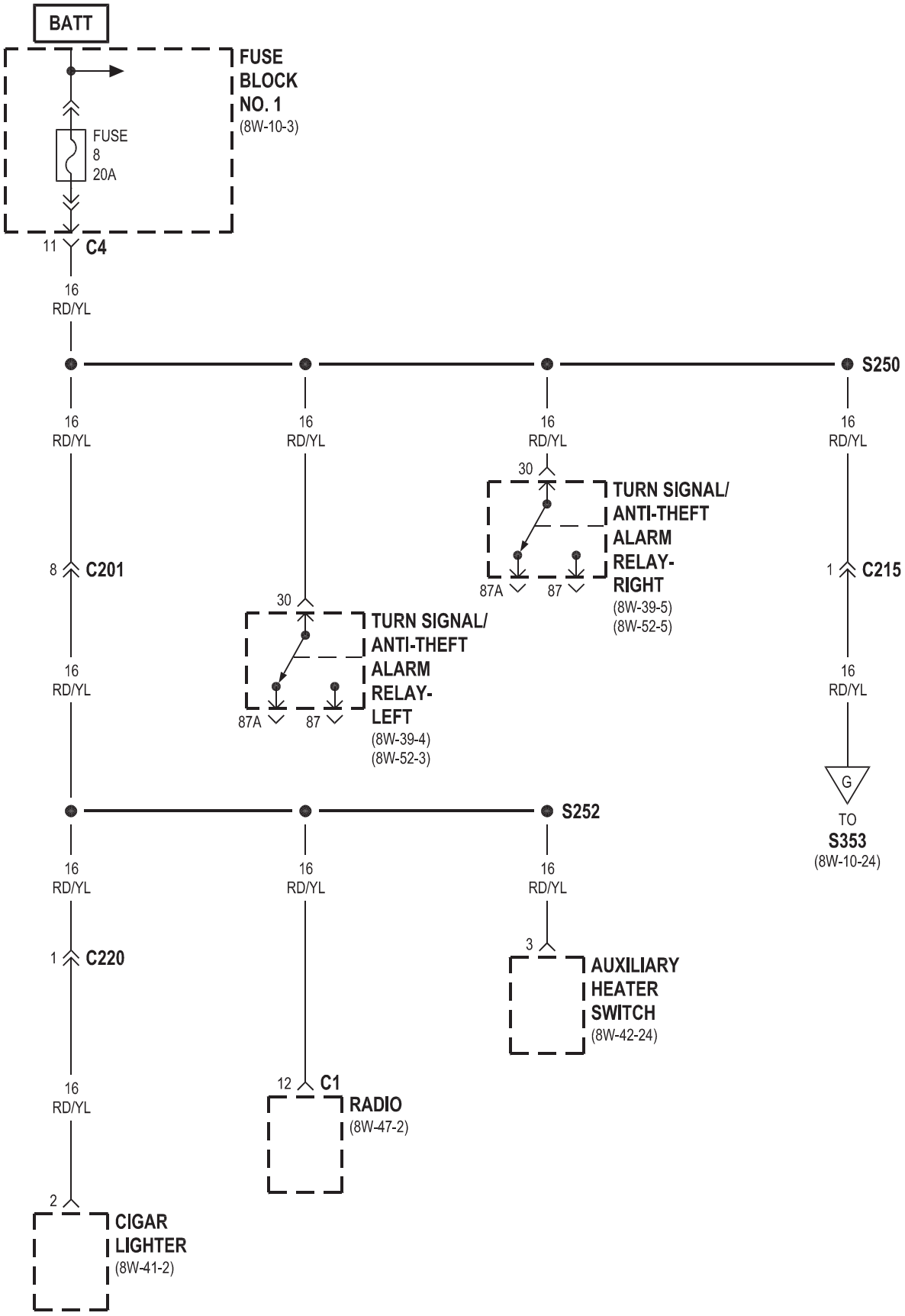
VA301019 J038W-24


RUN-START BK
(8W-10-13)
FUSE BLOCK NO. 1
(8W-10-3)
FUSE 5 10A
1 C5
16 BK/BL/WT
S204
16 RD/BK
16 BK/BL/WT
20 BK/BL/DG
1 C2
2 C1
BRAKE LAMP SWITCH
(8W-35-3)
2 C2
3 C2
NOT USED
1 C1
3 C1
16 RD/BK
20 WT
20 BK/BL/RD
TO S200
(8W-10-19)
3 C202
20 BK/BL/RD
5
SHIFTER ASSEMBLY
(8W-31-7)
(8W-31-9)
8
DATA LINK CONNECTOR
(8W-18-5)
20
CONTROLLER ANTILOCK BRAKE
(8W-35-4)

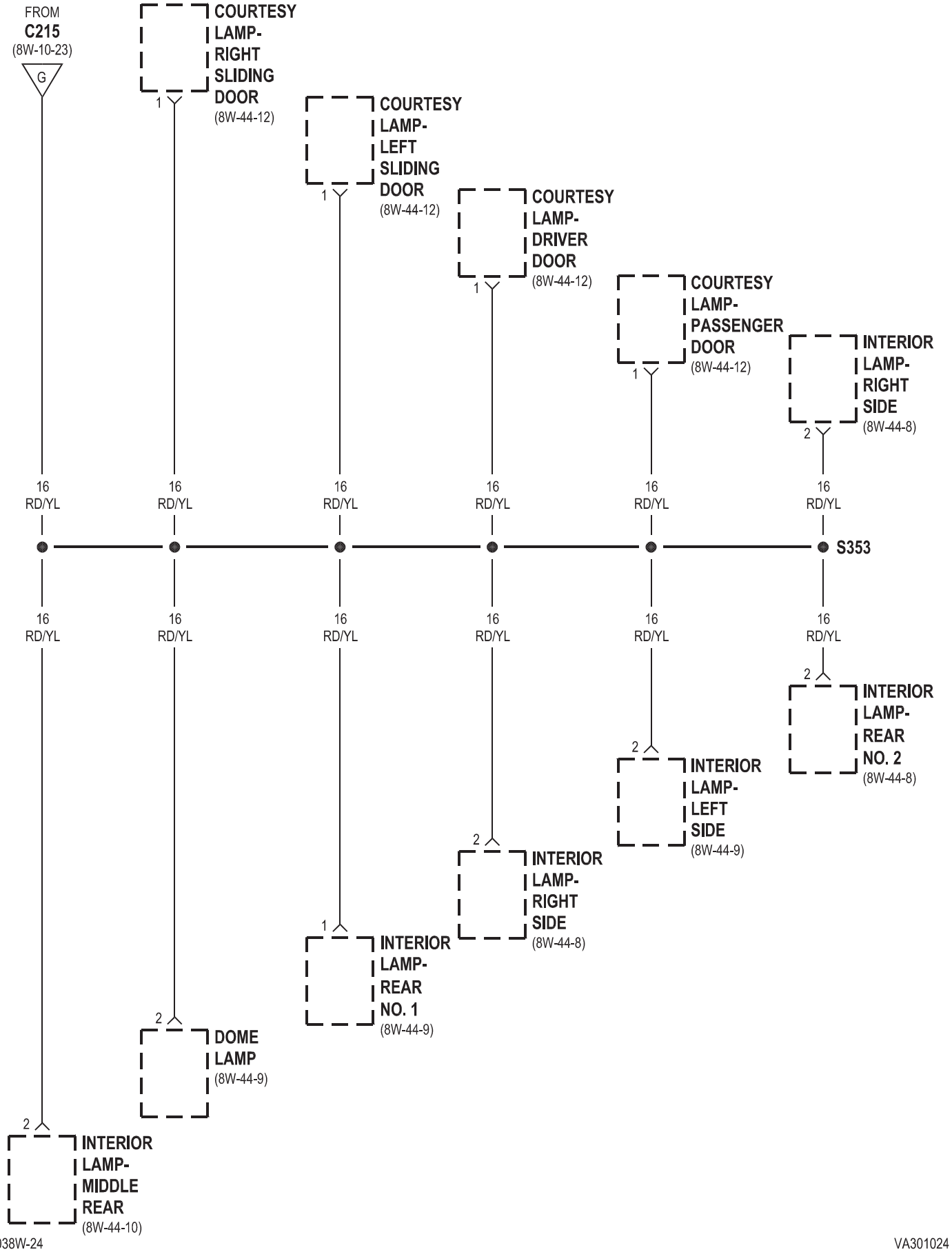


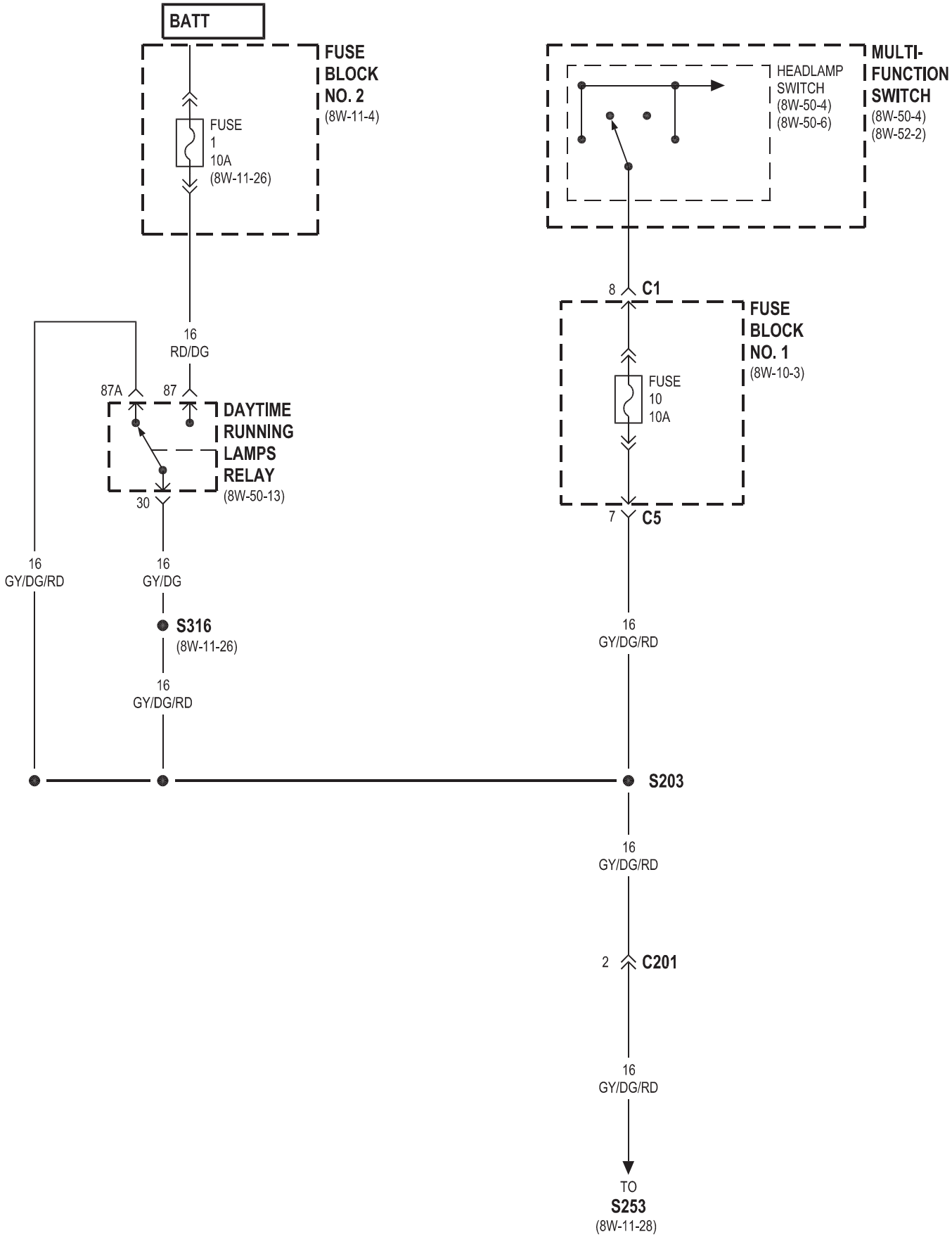
VA301021 J038W-24


RUN-START BK
(8W-10-13)
FUSE BLOCK NO. 1
(8W-10-3)
FUSE 7 15A
7
C4
SENTRY KEY REMOTE ENTRY MODULE
(8W-39-10)
7
HORN (VTSS)
(8W-41-3)
1
WINDOW DEFOGGER SWITCH-REAR
(8W-48-5)
3
16 BK/YL
3
C200
16 BK/YL
16 BK/YL
16 BK/YL
16 BK/YL
S206
16 BK/BL/VT
16 BK/YL
16 BK/YL
16 BK/YL
87A
87
CIRCULATION PUMP RELAY
(8W-42-9)
30
86
TRANSMISSION RELAY
(8W-31-7)
85
86
OPTIONAL EQUIPMENT RELAY
(8W-11-34)
85
85
HORN RELAY
(8W-41-3)
86

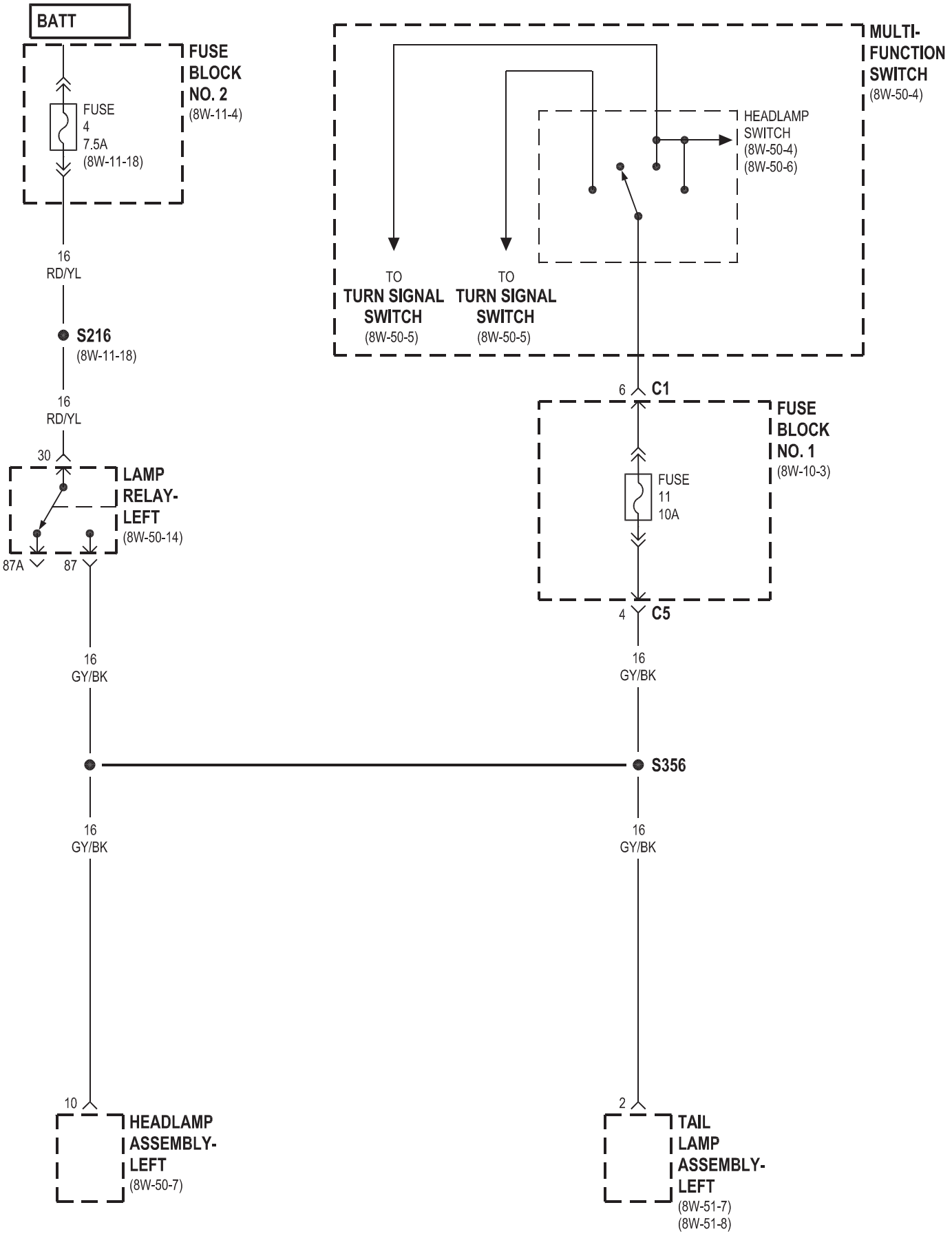


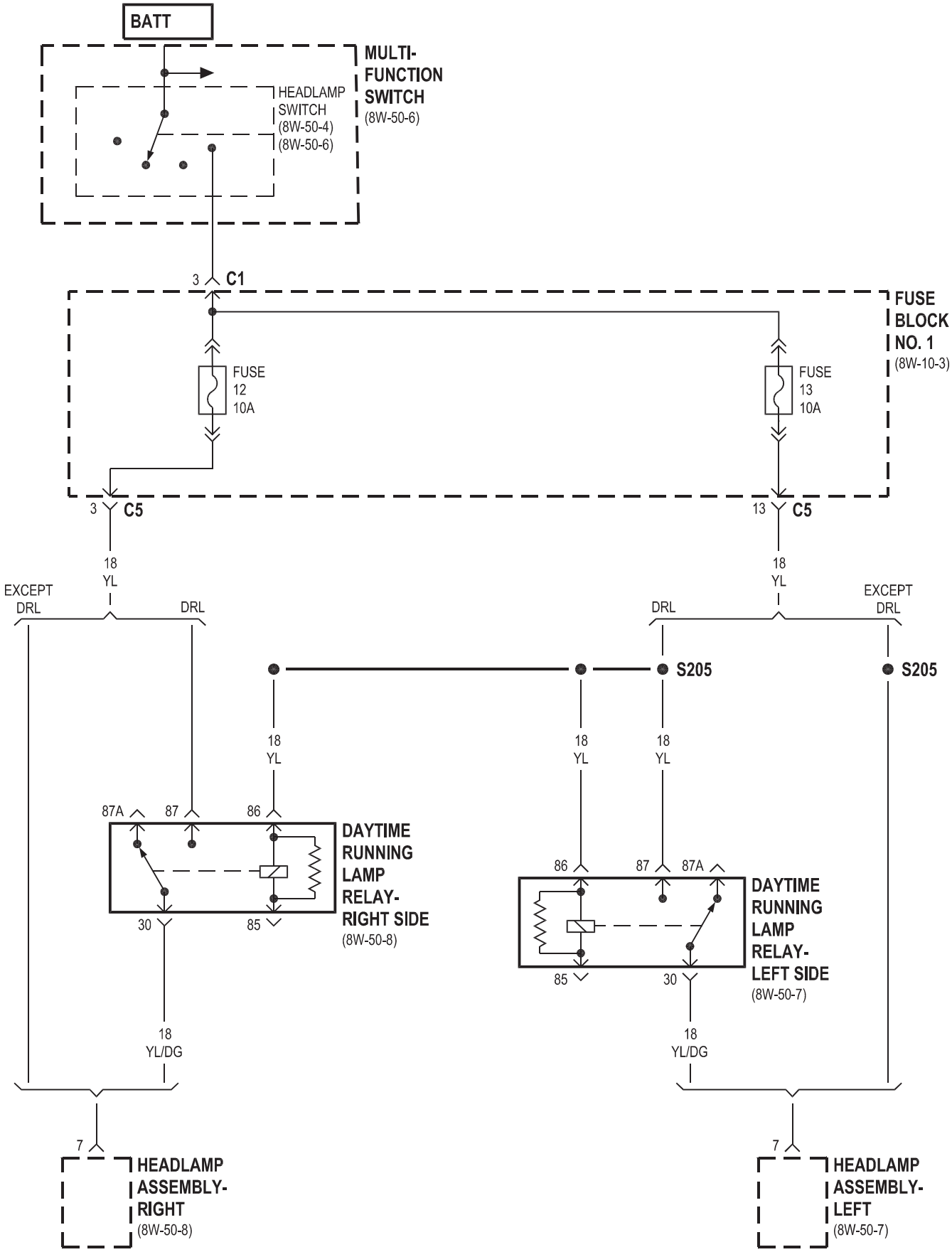
VA301023 J038W-24


FROM
C215
(8W-10-23)
G
COURTESY LAMP- RIGHT SLIDING DOOR
(8W-44-12)
COURTESY LAMP- LEFT SLIDING DOOR
(8W-44-12)
COURTESY LAMP- DRIVER DOOR
(8W-44-12)
COURTESY LAMP- PASSENGER DOOR
(8W-44-12)
INTERIOR LAMP- RIGHT SIDE
(8W-44-8)
16 RD/YL
S353
INTERIOR LAMP- REAR NO. 2
(8W-44-8)
INTERIOR LAMP- LEFT SIDE
(8W-44-9)
INTERIOR LAMP- RIGHT SIDE
(8W-44-8)
INTERIOR LAMP- REAR NO. 1
(8W-44-9)
DOME LAMP
(8W-44-9)
INTERIOR LAMP- MIDDLE REAR
(8W-44-10)

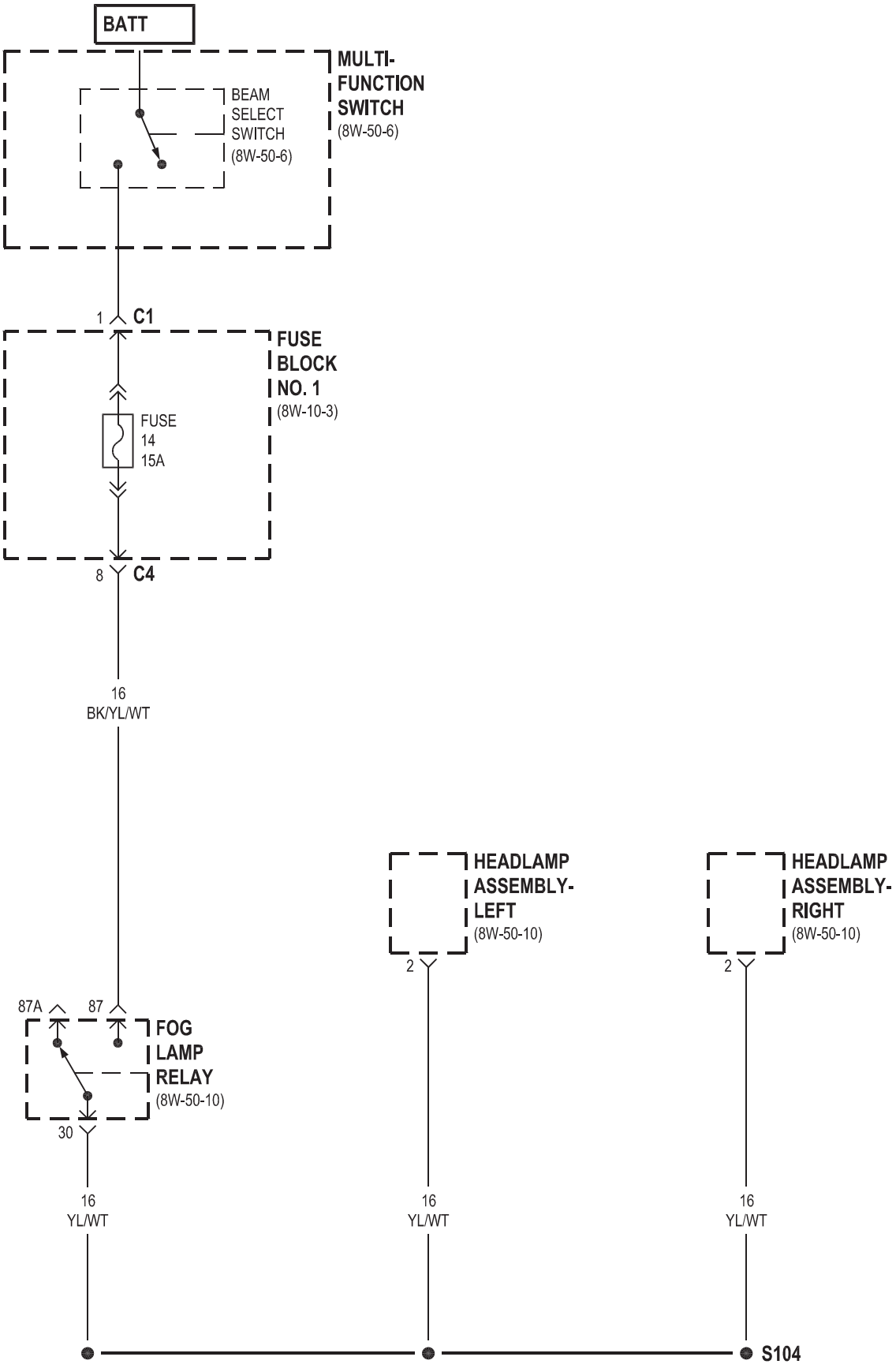


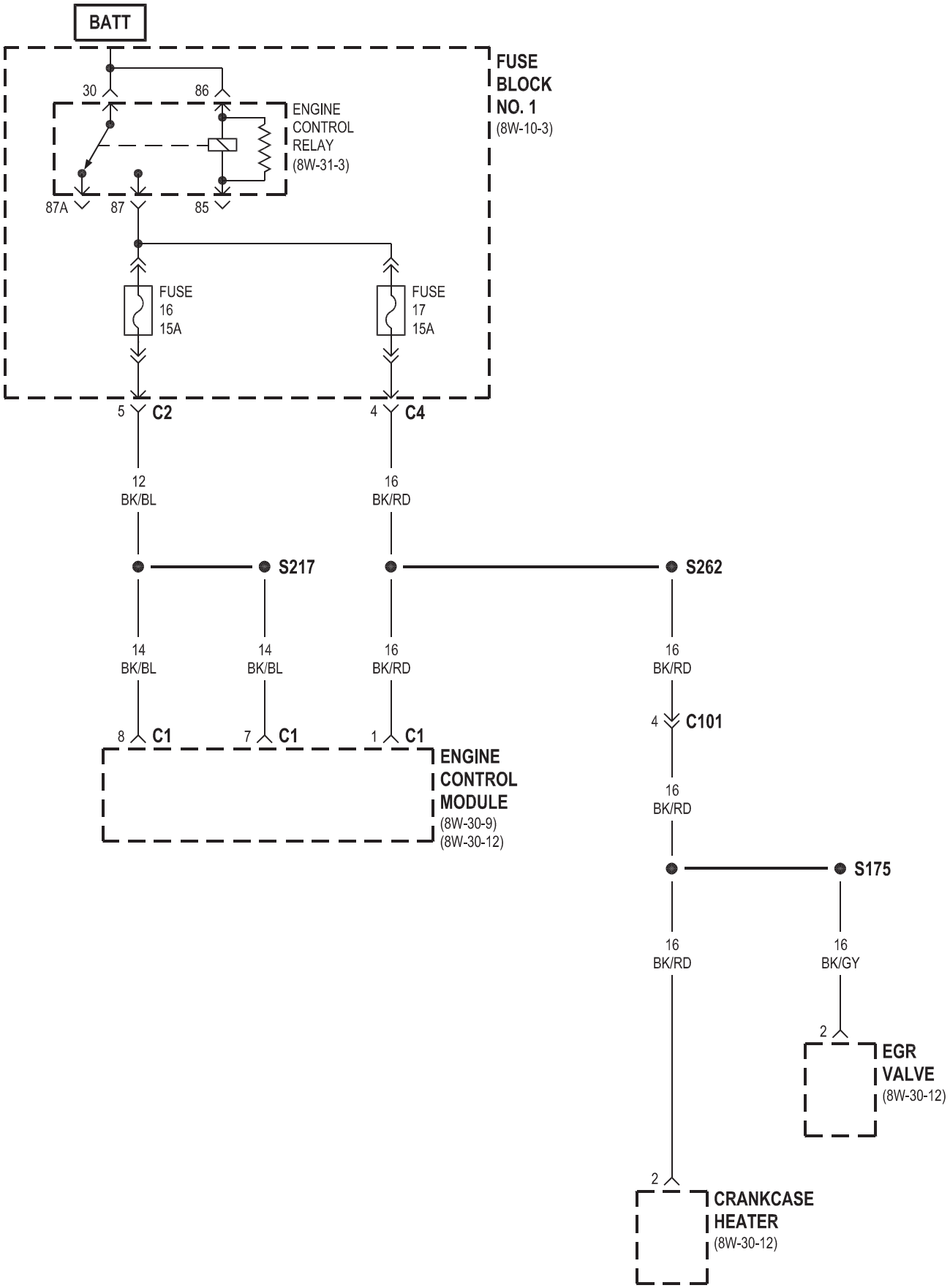
VA301025 J038W-24


BATT
FUSE BLOCK NO. 2
(8W-11-4)
FUSE 4 7.5A
(8W-11-18)
16 RD/YL
S216
(8W-11-18)
16 RD/YL
30
LAMP RELAY-LEFT
(8W-50-14)
87A
87
16 GY/BK
MULTI-FUNCTION SWITCH
(8W-50-4)
HEADLAMP SWITCH
(8W-50-4)
(8W-50-6)
TO TURN SIGNAL SWITCH
(8W-50-5)
TO TURN SIGNAL SWITCH
(8W-50-5)
6
C1
FUSE BLOCK NO. 1
(8W-10-3)
FUSE 11 10A
4
C5
16 GY/BK
S356
16 GY/BK
16 GY/BK
10
HEADLAMP ASSEMBLY-LEFT
(8W-50-7)
2
TAIL LAMP ASSEMBLY-LEFT
(8W-51-7)
(8W-51-8)

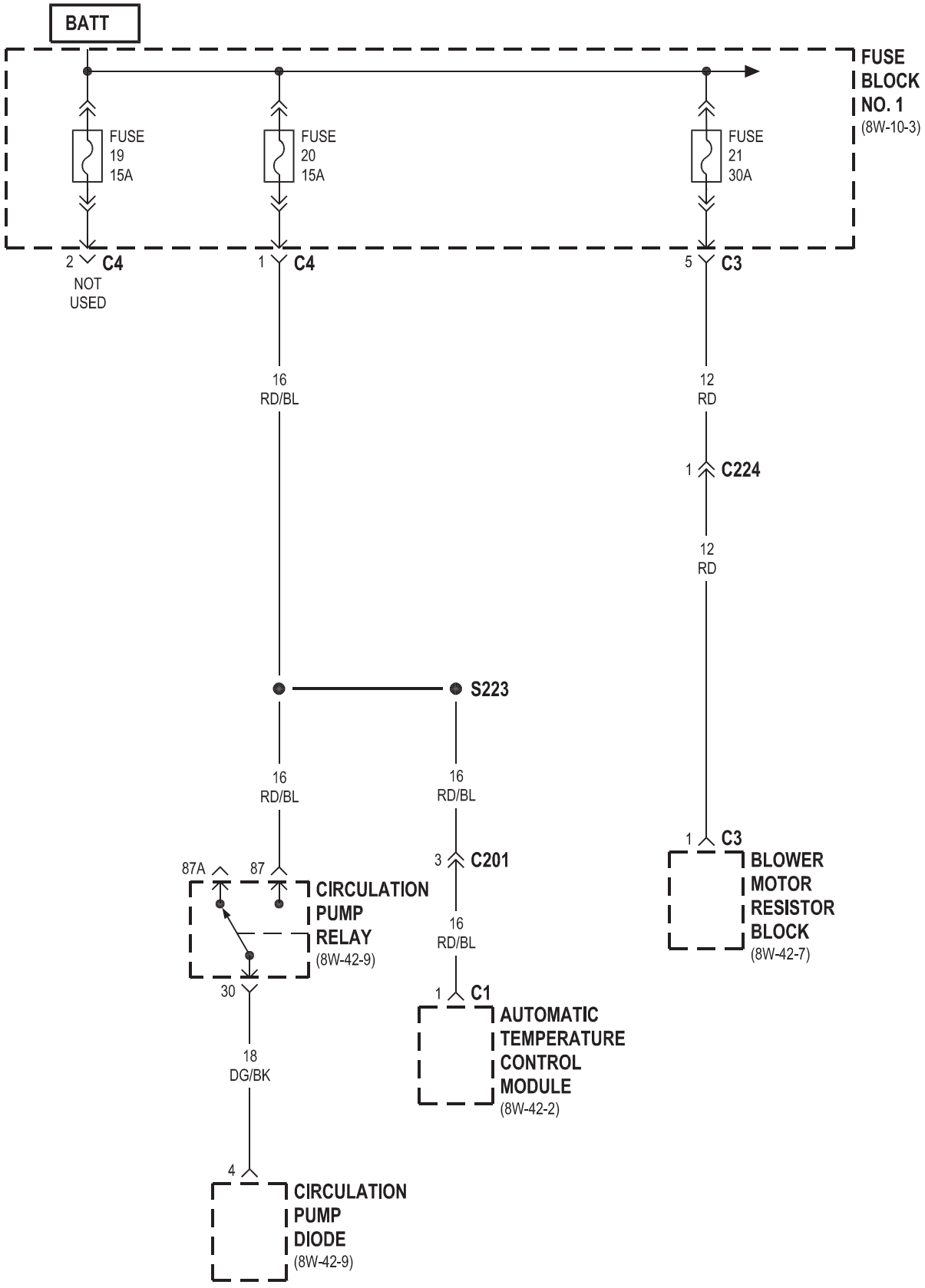


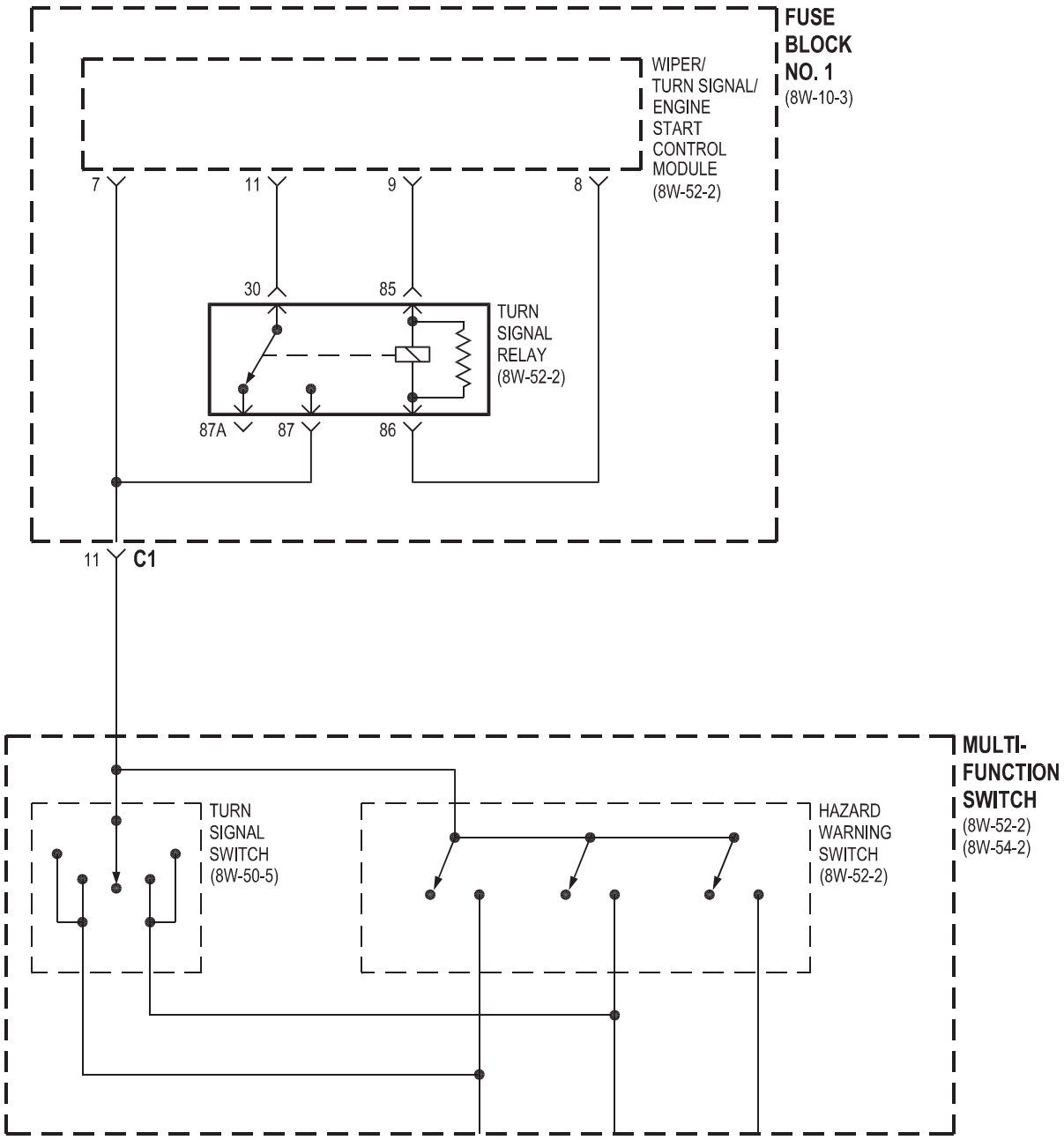
VA301027 J038W-24

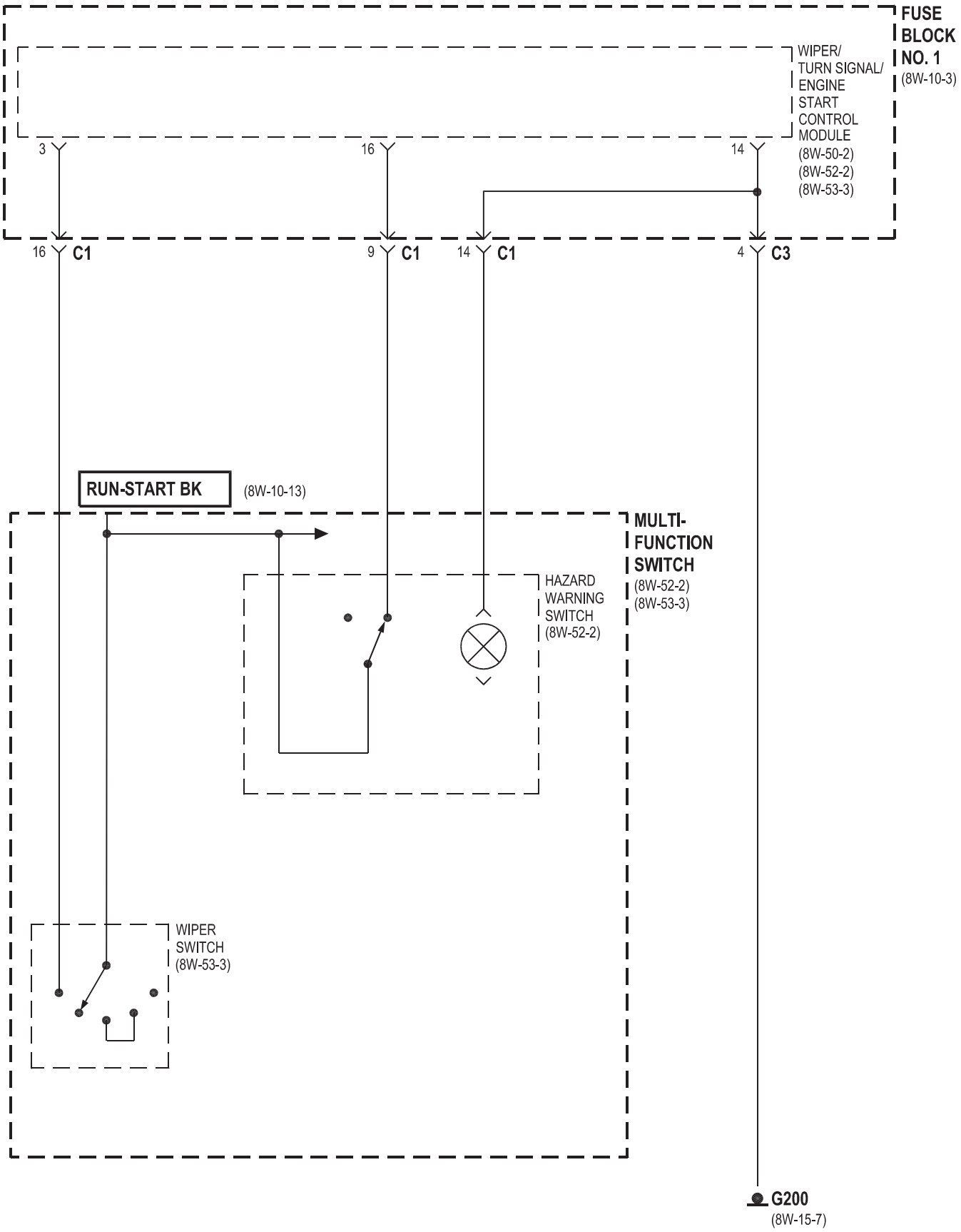

BATT
MULTI-
FUNCTION
SWITCH
(8W-50-6)
BEAM
SELECT
SWITCH
(8W-50-6)
1
C1
FUSE
BLOCK
NO. 1
(8W-10-3)
FUSE
14
15A
8
C4
16
BK/YL/WT
HEADLAMP
ASSEMBLY-
LEFT
(8W-50-10)
2
HEADLAMP
ASSEMBLY-
RIGHT
(8W-50-10)
2
87A
87
FOG
LAMP
RELAY
(8W-50-10)
30
16
YL/WT
16
YL/WT
16
YL/WT
S104

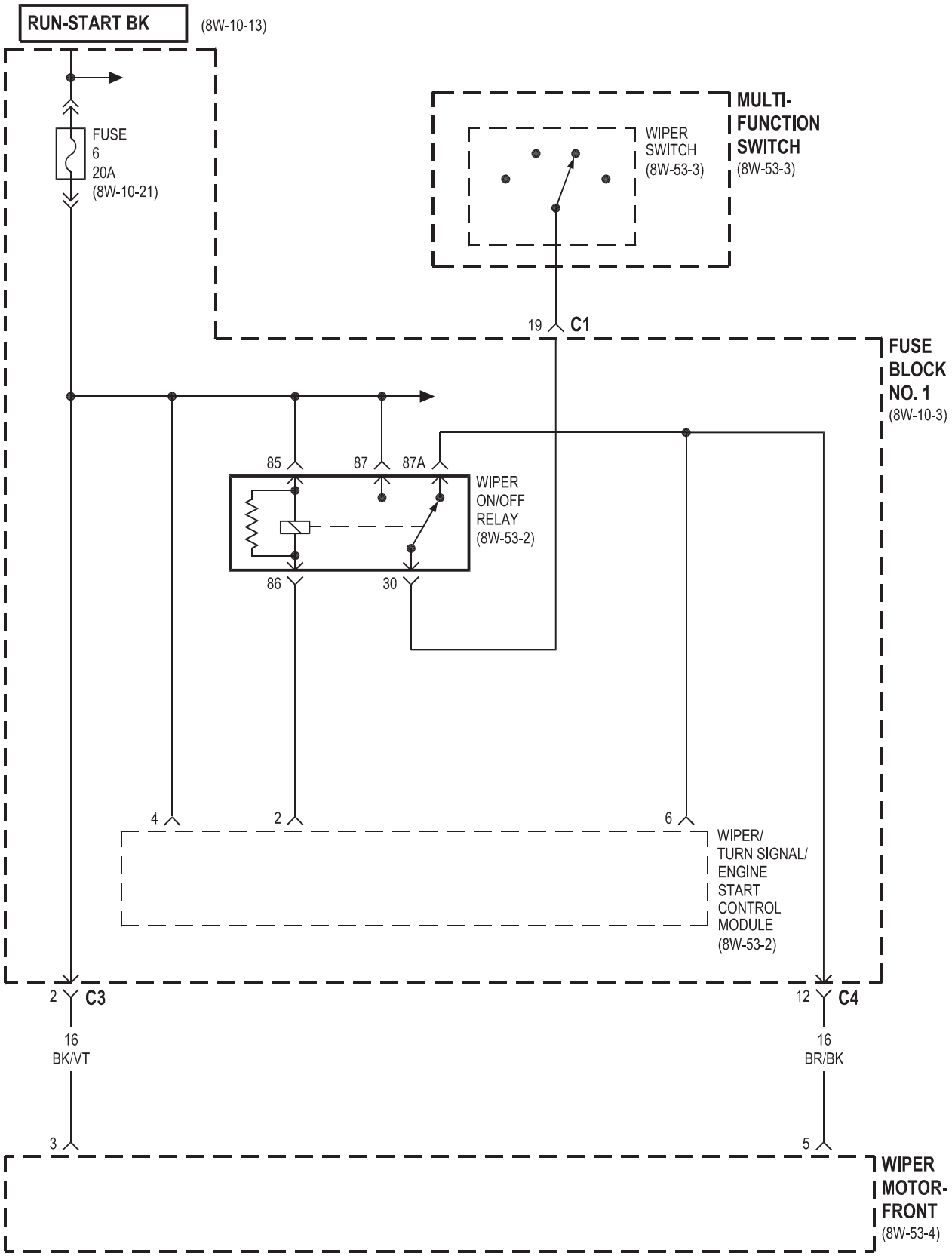


VA301029 J038W-24

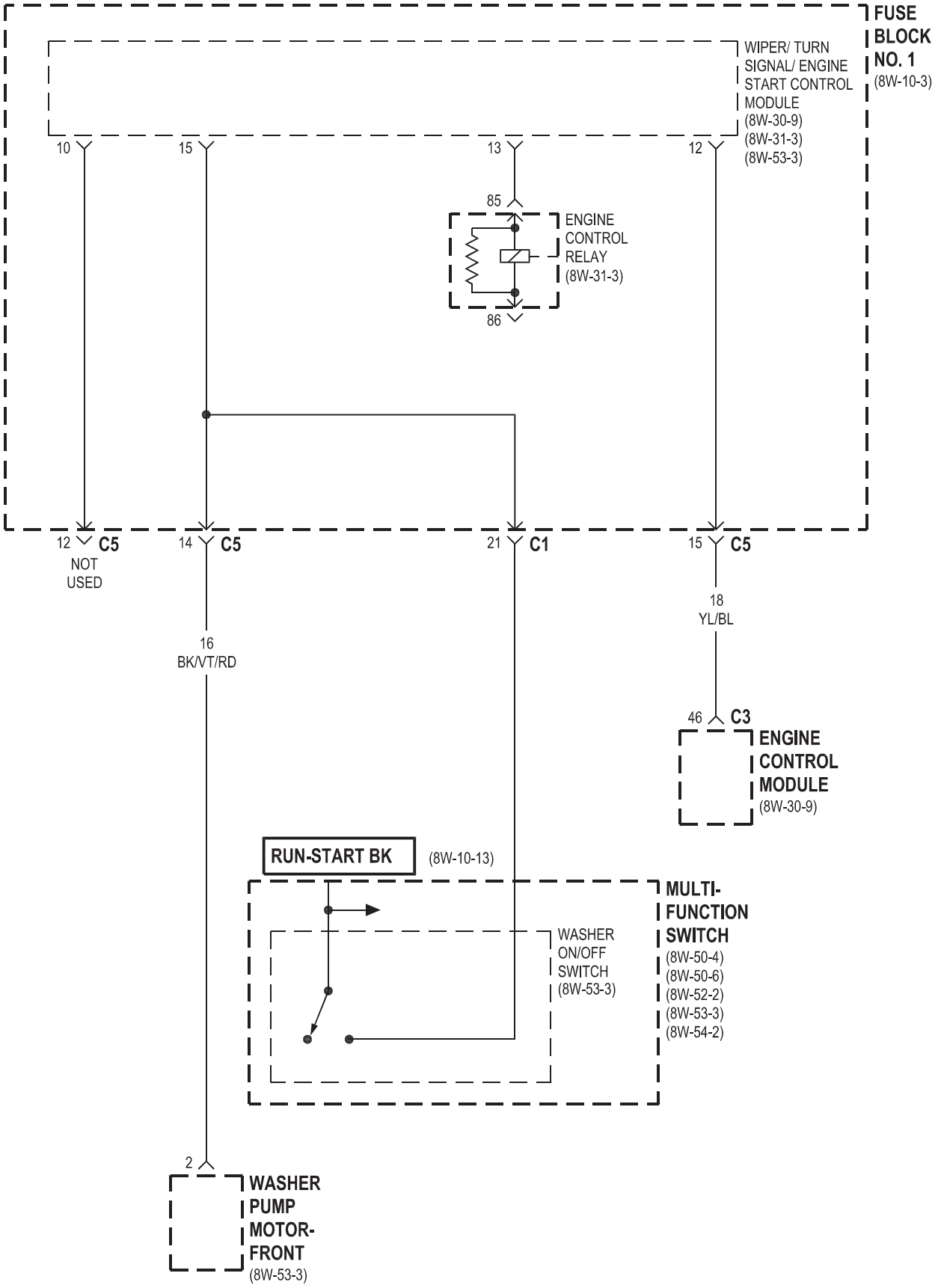

BATT
FUSE BLOCK NO. 1
(8W-10-3)
FUSE 19 15A
FUSE 20 15A
FUSE 21 30A
2 C4
NOT USED
1 C4
5 C3
16 RD/BL
12 RD
1 C224
12 RD
S223
16 RD/BL
16 RD/BL
1 C3
BLOWER MOTOR RESISTOR BLOCK
(8W-42-7)
87A
87
CIRCULATION PUMP RELAY
(8W-42-9)
3 C201
16 RD/BL
30
1 C1
AUTOMATIC TEMPERATURE CONTROL MODULE
(8W-42-2)
18 DG/BK
4
CIRCULATION PUMP DIODE
(8W-42-9)


FUSE BLOCK NO. 1
(8W-10-3)
WIPER/ TURN SIGNAL/ ENGINE START CONTROL MODULE
(8W-52-2)
7
11
9
8
30
85
TURN SIGNAL RELAY
(8W-52-2)
87A
87
86
11
C1
MULTI-FUNCTION SWITCH
(8W-52-2)
(8W-54-2)
TURN SIGNAL SWITCH
(8W-50-5)
HAZARD WARNING SWITCH
(8W-52-2)


FUSE BLOCK NO. 1
(8W-10-3)
WIPER/ TURN SIGNAL/ ENGINE START CONTROL MODULE
(8W-50-2)
(8W-52-2)
(8W-53-3)
3
16
14
16 C1
9 C1
14 C1
4 C3
RUN-START BK
(8W-10-13)
MULTI-FUNCTION SWITCH
(8W-52-2)
(8W-53-3)
HAZARD WARNING SWITCH
(8W-52-2)
WIPER SWITCH
(8W-53-3)
G200
(8W-15-7)



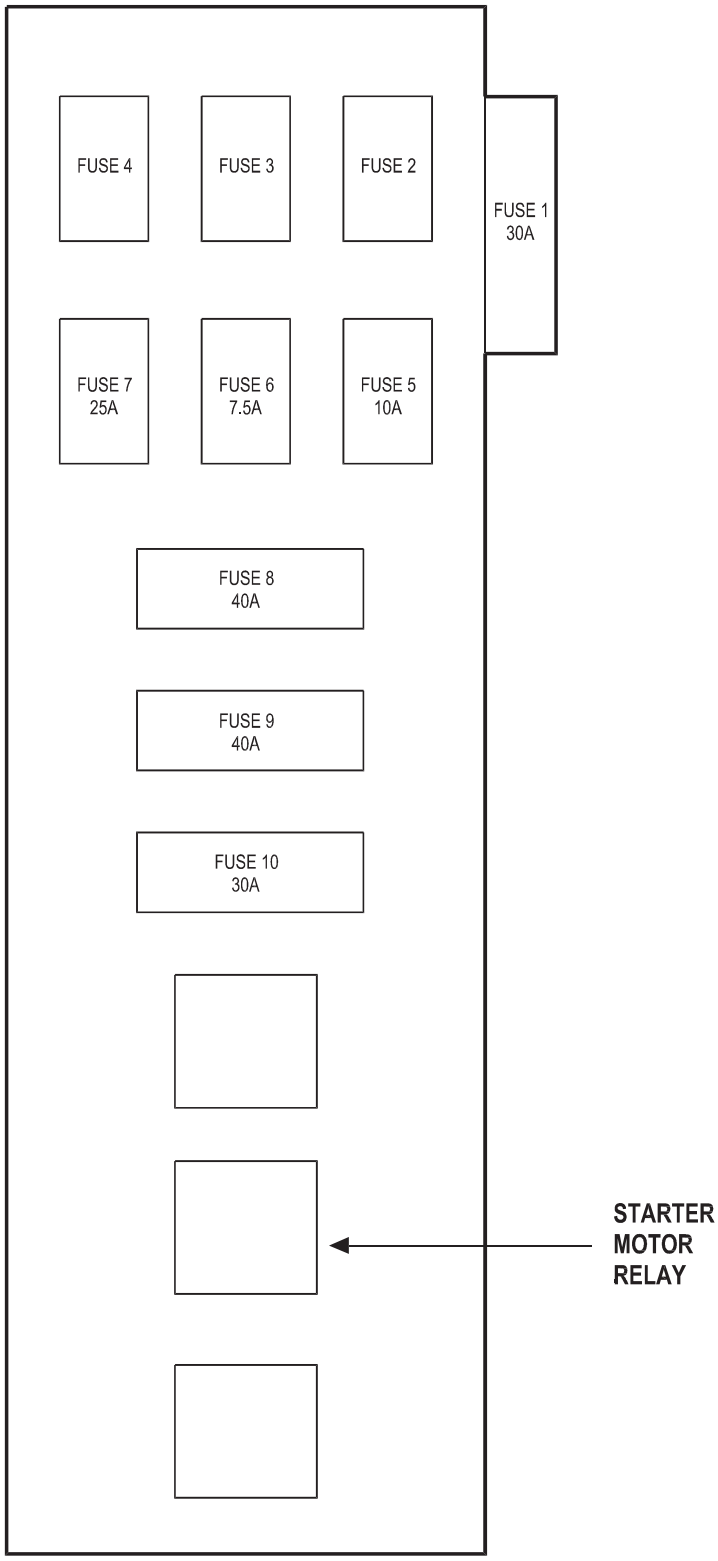
VA301033 J038W-24


FUSE BLOCK NO. 1
(8W-10-3)
WIPER/ TURN SIGNAL/ ENGINE START CONTROL MODULE
(8W-30-9)
(8W-31-3)
(8W-53-3)
10
15
13
12
85
ENGINE CONTROL RELAY
(8W-31-3)
86
12 C5
NOT USED
14 C5
21 C1
15 C5
16
BK/VT/RD
18
YL/BL
46 C3
ENGINE CONTROL MODULE
(8W-30-9)
RUN-START BK
(8W-10-13)
MULTI-FUNCTION SWITCH
(8W-50-4)
(8W-50-6)
(8W-52-2)
(8W-53-3)
(8W-54-2)
WASHER ON/OFF SWITCH
(8W-53-3)
2
WASHER PUMP MOTOR-FRONT
(8W-53-3)

8W-11 FUSE BLOCK

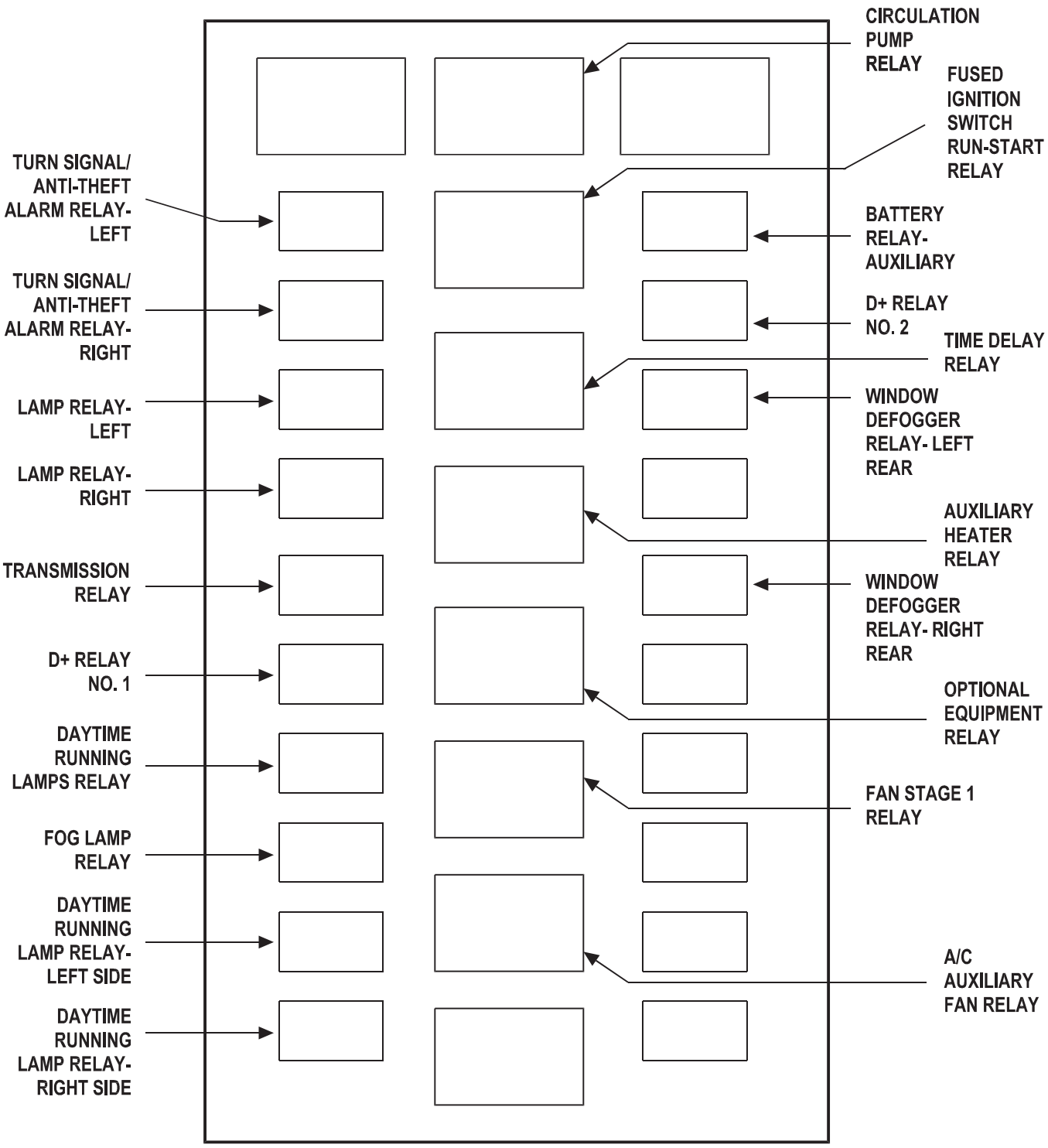
Component	Page
A/C Auxiliary Fan Relay	8W-11-20
A/C Control Module- Roof	8W-11-21
A/C Fan Switch	8W-11-28, 32
A/C Switch- Roof	8W-11-17, 28
Ash Receiver Lamp	8W-11-28
Automatic Temperature Control Module	8W-11-28
Auxiliary Heater Relay	8W-11-25, 35
Battery Relay- Auxiliary	8W-11-17
Body Plug Connector	8W-11-29
Body Plug Connector	8W-11-39, 40
Cabin Heater Assembly	8W-11-22, 35
Central Timer Module	8W-11-17, 19
Cigar Lighter Lamp	8W-11-28
Circulation Pump Diode	8W-11-35
Controller Antilock Brake	8W-11-22, 34
CTEL Connector	8W-11-22, 31
D+ Relay No. 1	8W-11-15, 16, 26, 39
D+ Relay No. 2	8W-11-17, 29, 39
Data Link Connector	8W-11-19
Daytime Running Lamp Relay- Left Side	8W-11-16
Daytime Running Lamp Relay- Right Side	8W-11-16
Daytime Running Lamps Relay	8W-11-17, 26, 27
Fan Stage 1 Relay	8W-11-25
Fog Lamp Switch	8W-11-22, 28
Fuse 1	8W-11-14, 15, 20, 21, 26, 27
Fuse 2	8W-11-14, 18, 30, 31, 32, 34, 35, 37, 38
Fuse 3	8W-11-14, 15, 18, 19, 20, 21, 22, 23, 24, 25, 26, 29
Fuse 4	8W-11-14, 15, 18, 22
Fuse 5	8W-11-14, 15, 19, 22, 24
Fuse 6	8W-11-14, 19, 25, 30, 34, 37
Fuse 7	8W-11-14, 22, 30, 31, 34, 35
Fuse 8	8W-11-15, 21, 25, 30, 35, 36
Fuse 9	8W-11-14, 15, 16, 17, 22, 26, 39
Fuse 10	8W-11-15, 16, 20, 27, 37
Fuse 11	8W-11-15, 16, 21
Fuse 12	8W-11-29, 30, 34
Fuse 13	8W-11-29, 30, 31, 40
Fuse 14	8W-11-29, 30, 31, 39
Fuse 15	8W-11-30, 32, 33
Fuse 18	8W-11-15, 23, 40
Fuse 19	8W-11-17
Fuse 20	8W-11-30, 32
Fuse Block No. 1	8W-11-27, 34, 40
Fuse Block No. 2	8W-11-4, 16, 18, 19, 26, 27, 29, 31, 32, 35, 39, 40
Fuse Block No. 3	8W-11-5, 17, 21, 22, 23, 25, 31, 32, 33, 34, 35, 37
Fuse/Relay Block	8W-11-2, 20, 21, 22, 24, 34
Fused Ignition Switch Run-Start Relay	8W-11-29, 40
G202	8W-11-17, 26, 34, 35, 39, 40
Headlamp Adjust Switch	8W-11-28
Headlamp Assembly- Left	8W-11-16, 26
Headlamp Assembly- Right	8W-11-16, 26
Headlamp Switch	8W-11-27
Heated Seat Switch- Driver	8W-11-33
Heated Seat Switch- Passenger	8W-11-33
Heater Timer- Auxiliary	8W-11-21
Instrument Cluster	8W-11-19, 26
Instrument Panel Socket	8W-11-26
Interior Light Switch	8W-11-23, 28
Interior Light Switch- Driver	8W-11-23
Interior Light Switch- Passenger	8W-11-23
Interior Light Switch- Rear	8W-11-23
Interior Lighting Connector	8W-11-23
Intrusion Sensor No. 1	8W-11-38
Intrusion Sensor No. 2	8W-11-38
Intrusion Sensor No. 3	8W-11-38
Lamp Relay- Left	8W-11-18
Lamp Relay- Right	8W-11-17, 18
License Plate Lamp No. 1	8W-11-26
License Plate Lamp No. 2	8W-11-26
Locker Switch No. 1	8W-11-28, 34
Locker Switch No. 2	8W-11-34
Map/Reading Lamp Switch	8W-11-23, 28
Master Door Lock Switch	8W-11-28
Multi- Function Switch	8W-11-27
Optional Equipment Relay	8W-11-30, 31, 32, 33, 34, 35
Panic Alarm Switch	8W-11-28
Power Distribution Center	8W-11-14, 18, 19, 20, 21, 22, 23, 24, 25, 26, 29, 30, 31, 32, 34, 35, 37
Power Mirror Motor- Driver	8W-11-36
Power Mirror Motor- Passenger	8W-11-36
Power Mirror Switch	8W-11-36
Power Window Switch- Driver	8W-11-31
Power Window Switch- Master	8W-11-32
Power Window Switch- Passenger	8W-11-32
Radio	8W-11-28
Relay Block	8W-11-3, 15, 16, 17, 18, 20, 24, 25, 26, 29, 30, 31, 32, 33, 34, 35
Security System Module	8W-11-31, 37, 38
Sentry Key Remote Entry Module	8W-11-24
Shifter Assembly	8W-11-28
Siren	8W-11-38
TCS Switch	8W-11-28
Temperature Switch	8W-11-28
Time Delay Relay	8W-11-23
Towing/Intrusion Sensor On/Off Switch	8W-11-28
Trailer Tow Connector	8W-11-25
Trailer Tow Control Module	8W-11-25
Transmission Relay	8W-11-18
Turn Signal/Anti-Theft Alarm Relay- Left	8W-11-24
Turn Signal/Anti-Theft Alarm Relay- Right	8W-11-24
Warm Air Auxiliary Heater Assembly	8W-11-21
Window Defogger Module- Rear	8W-11-17, 20
Window Defogger Relay- Left Rear	8W-11-20
Window Defogger Relay- Right Rear	8W-11-20
Window Defogger Switch- Rear	8W-11-28

FUSE/ RELAY BLOCK



NOTE: THE FUSE AND RELAY LOCATIONS SHOWN HERE MAY VARY FROM VEHICLE TO VEHICLE.

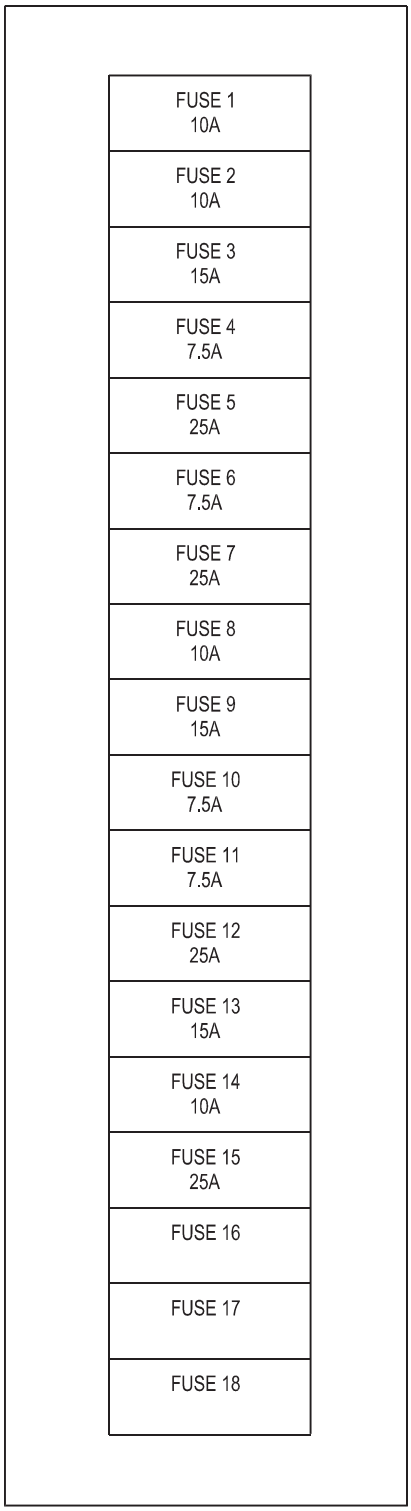
RELAY BLOCK



NOTE: THE RELAY LOCATIONS SHOWN HERE MAY VARY FROM VEHICLE TO VEHICLE.

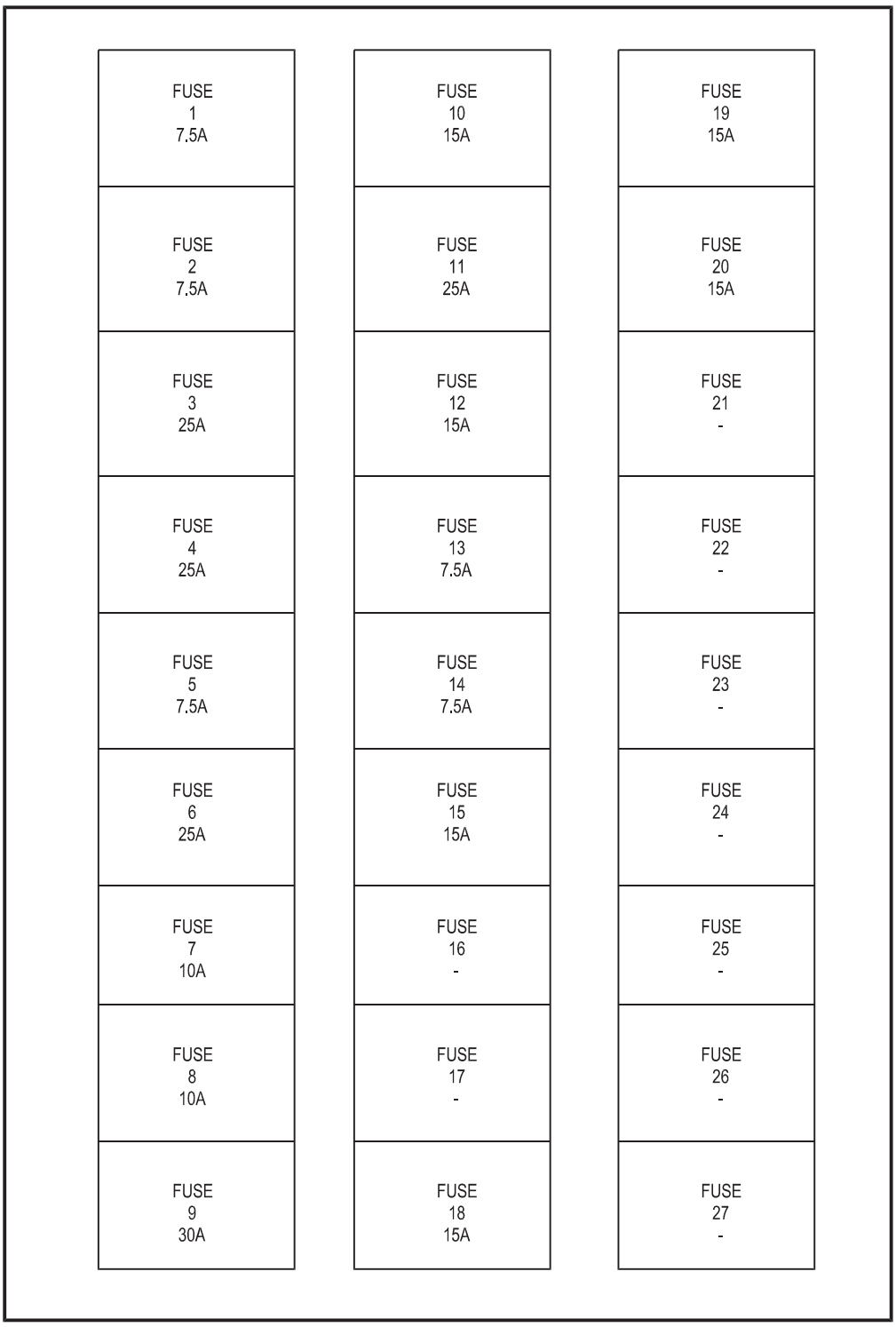
VA301103 J038W-24

FUSE BLOCK NO. 2



NOTE: THE FUSE LOCATIONS SHOWN HERE MAY VARY FROM VEHICLE TO VEHICLE.

FUSE BLOCK NO. 3



NOTE: THE FUSE LOCATIONS SHOWN HERE MAY VARY FROM VEHICLE TO VEHICLE.

VA301105 J038W-24

FUSES

FUSE/RELAY BLOCK

FUSE	AMPS	FUSED CIRCUIT	FUNCTION
1	30A	14BL/YL	FUSED B(+)
2	-	-	-
3	-	-	-
4	-	-	-
5	10A	16RD/YL	FUSED B(+)
6	7/5A	18BK/RD	OPTIONAL EQUIPMENT RELAY OUTPUT
7	25A	14RD	FUSED B(+)
8	40A	12RD	FUSED B(+)
9	40A	12RD	FUSED B(+)
10	30A	12RD/GY	FUSED B(+)

FUSES

FUSE BLOCK NO. 2

FUSE	AMPS	FUSED CIRCUIT	FUNCTION
1	10A	16RD/GY	FUSED B(+)
2	10A	16RD	FUSED B(+)
3	15A	16RD	FUSED B(+)
4	7.5A	16RD/YL	FUSED B(+)
5	25A	16RD/WT	FUSED B(+)
6	7.5A	16RD/YL	FUSED B(+)
7	25A	16BK/YL	OPTIONAL EQUIPMENT RELAY OUTPUT
8	10A	16WT/RD	OPTIONAL EQUIPMENT RELAY OUTPUT
9	15A	16RD/BK/WT	FUSED D+ RELAY NO. 1 OUTPUT
10	7.5A	16RD/YL/WT	FUSED D+ RELAY NO. 1 OUTPUT
11	7.5A	16RD/YL/WT	FUSED D+ RELAY NO. 1 OUTPUT
12	25A	14RD	FUSED B(+)
13	15A	14RD	FUSED B(+)
14	10A	14RD	FUSED B(+)
15	25A	16BK/YL	OPTIONAL EQUIPMENT RELAY OUTPUT

FUSES

FUSE BLOCK NO. 3

FUSE	AMPS	FUSED CIRCUIT	FUNCTION
1	7.5A	16RD	FUSED B(+)
2	7.5A	16RD/DG	FUSED B(+)
3	25A	12RD/DG	FUSED B(+)
4	7.5A	14RD	FUSED B(+)
5	7.5A	16RD	FUSED B(+)
6	25A	14RD	FUSED B(+)
7	10A	16BK	OPTIONAL EQUIPMENT RELAY OUTPUT
8	10A	12RD/WT	FUSED B(+)
9	25A	16RD/BK/WT	FUSED B(+)
10	15A	16RD/GY	FUSED B(+)
11	25A	14RD	FUSED B(+)
12	10A	10BK	OPTIONAL EQUIPMENT RELAY OUTPUT
13	7.5A	8BK/YL	OPTIONAL EQUIPMENT RELAY OUTPUT
14	7.5A	16BK/GY	OPTIONAL EQUIPMENT RELAY OUTPUT
15	15A	16VT/LYL	OPTIONAL EQUIPMENT RELAY OUTPUT
16	-	-	-
17	-	-	-
18	15A	16RD/YL	FUSED B(+)
19	15A	16RD/DG/VT	FUSED B(+)
20	15A	16RD/DG/VT	OPTIONAL EQUIPMENT RELAY OUTPUT

FUSE/RELAY BLOCK

STARTER MOTOR RELAY

CAVITY	CIRCUIT	FUNCTION
30	12BK/YL	STARTER MOTOR RELAY OUTPUT
85	18RD/BL	STARTER MOTOR RELAY 12 VOLT SUPPLY
86	18VT/DG	STARTER MOTOR RELAY CONTROL
87	12VT	IGNITION SWITCH OUTPUT
87A	-	-

RELAY BLOCK

A/C AUXILIARY FAN RELAY

CAVITY	CIRCUIT	FUNCTION
30	14BL/YL	FUSED B(+)
85	18BR	GROUND
86	18BK/RD	A/C AUXILIARY FAN RELAY HIGH SIDE CONTROL
87	14DG/WT	A/C AUXILIARY FAN RELAY OUTPUT
87A	-	-

AUXILIARY HEATER REALY

CAVITY	CIRCUIT	FUNCTION
30	12RD/DG	FUSED B(+)
85	18BK	FUSED OPTIONAL EQUIPMENT RELAY OUTPUT
86	18BR	GROUND
87	12RD/BL	AUXILIARY HEATER RELAY OUTPUT
87A	-	-

BATTERY RELAY-AUXILIARY

CAVITY	CIRCUIT	FUNCTION
30	4RD (HEAVY DUTY)	AUXILIARY B(+)
30	6YL (EXCEPT HEAVY DUTY)	AUXILIARY B(+)
85	16BR	GROUND
86	16RD/DG/VT (EXCEPT HEAVY DUTY)	FUSED B(+)
86	16BR/DG (HEAVY DUTY)	FUSED B(+)
87A	-	-
87	6RD (EXCEPT HEAVY DUTY)	B(+)
87	4RD (HEAVY DUTY)	B(+)

RELAY BLOCK

CIRCULATION PUMP RELAY

CAVITY	CIRCUIT	FUNCTION
30	18DG/BK	CIRCULATION PUMP RELAY OUTPUT
85	16BR	GROUND
86	16RD/BL	CIRCULATION PUMP RELAY HIGH SIDE CONTROL
87	16RD/BL	FUSED B(+)
87A	16RD/YL	FUSED IGNITION SWITCH OUTPUT (RUN-START)

DAYTIME RUNNING LAMPS RELAY

CAVITY	CIRCUIT	FUNCTION
30	16GY/DG	DAYTIME RUNNING LAMP RELAY OUTPUT
85	16BR	GROUND
86	16RD/BK	FUSED D+ RELAY NO. 1 OUTPUT
87	16GY/DG/RD	FUSED B(+)
87A	16GY/DG/RD	DAYTIME RUNNING LAMP RELAY OUTPUT

DAYTIME RUNNING LAMP RELAY-LEFT SIDE

CAVITY	CIRCUIT	FUNCTION
30	18YL/DG	DAYTIME RUNNING LAMP RELAY-LEFT SIDE OUTPUT
85	16BR	GROUND
86	16YL	HEADLAMP SWITCH OUTPUT
87	18YL	HEADLAMP SWITCH OUTPUT
87A	16RD/YL	D+ RELAY NO. 1 OUTPUT

DAYTIME RUNNING LAMP RELAY-RIGHT SIDE

CAVITY	CIRCUIT	FUNCTION
30	18YL/DG	DAYTIME RUNNING LAMP RELAY-RIGHT SIDE OUTPUT
85	16BR	GROUND
86	16YL	HEADLAMP SWITCH OUTPUT
87	18YL	HEADLAMP SWITCH OUTPUT
87A	16RD/YL/WT	D+ RELAY NO. 1 OUTPUT

FAN STAGE 1 RELAY

CAVITY	CIRCUIT	FUNCTION
30	14BK/VT	FAN STAGE 1 RELAY OUTPUT
85	16BR	GROUND
86	16BL/YL	FAN STAGE 1 RELAY HIGH SIDE CONTROL
87	16RD/WT	FUSED B(+)
87A	-	-

RELAY BLOCK

D+ RELAY NO. 1

CAVITY	CIRCUIT	FUNCTION
30	10RD/YL	D+ RELAY NO. 1 OUTPUT
85	16BR	GROUND
86	20BL/VT	D+ RELAY NO. 2 CONTROL
87	10RD	FUSED B(+)
87A	16BR	GROUND

D+ RELAY NO. 2

CAVITY	CIRCUIT	FUNCTION
30	14RD	FUSED B(+)
85	18RD/BK	FUSED D+ RELAY NO. 1 OUTPUT
86	16BR	GROUND
87	14BL/YL	D+ RELAY NO. 2 OUTPUT
87A	-	-

FOG LAMP RELAY

CAVITY	CIRCUIT	FUNCTION
30	16YL/WT	FOG LAMP RELAY OUTPUT
85	18BR	GROUND
86	18RD/BK	FUSED B(+)
87	16BK/YL/WT	BEAM SELECT SWITCH OUTPUT
87A	-	-

HORN RELAY

CAVITY	CIRCUIT	FUNCTION
30	16BR	GROUND
85	16BK/BL/VT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
86	16BK/YL	HORN RELAY CONTROL
87	16BK/BR	HORN RELAY OUTPUT
87A	-	-

RELAY BLOCK

FUSED IGNITION SWITCH RUN-START RELAY

CAVITY	CIRCUIT	FUNCTION
30	14RD	FUSED B(+)
85	18BK	FUSED IGNITION SWITCH OUTPUT (RUN-START)
86	16BR	GROUND
87	14BK/YL	FUSED B(+)
87A	-	-

LAMP RELAY-LEFT

CAVITY	CIRCUIT	FUNCTION
30	16RD/YL	FUSED B(+)
85	18BR	GROUND
86	16RD/BK	FUSED D+ RELAY NO. 1 OUTPUT
87	16GY/BK	LEFT LAMP RELAY OUTPUT
87A	-	-

LAMP RELAY-RIGHT

CAVITY	CIRCUIT	FUNCTION
30	16RD/YL	FUSED B(+)
85	16BR	GROUND
86	16RD/BK	FUSED D+ RELAY NO. 1 OUTPUT
87	16GY/RD	RIGHT LAMP RELAY OUTPUT
87A	-	-

RELAY BLOCK

OPTIONAL EQUIPMENT RELAY

CAVITY	CIRCUIT	FUNCTION
30	10RD	FUSED B(+)
85	16BR	GROUND
86	16BK/YL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
87	10BK	OPTIONAL EQUIPMENT RELAY OUTPUT
87A	-	-

TRANSMISSION RELAY

CAVITY	CIRCUIT	FUNCTION
30	16BK/DG	TRANSMISSION RELAY OUTPUT
85	16BR	GROUND
86	16BK/YL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
87	18RD	FUSED B(+)
87A	-	-

TURN SIGNAL/ ANTI-THEFT ALARM RELAY-LEFT

CAVITY	CIRCUIT	FUNCTION
30	16RD/YL	FUSED B(+)
85	18RD/YL	FUSED B(+)
86	18DG/YL	TURN SIGNAL/ANTI-THEFT ALARM RELAY- LEFT/RIGHT CONTROL
87	16BK/WT	LEFT TURN SIGNAL
87A	-	-

TURN SIGNAL/ ANTI-THEFT ALARM RELAY-RIGHT

CAVITY	CIRCUIT	FUNCTION
30	16RD/YL	FUSED B(+)
85	16RD/YL	FUSED B(+)
86	18DG/YL	TURN SIGNAL/ANTI-THEFT ALARM RELAY-LEFT/RIGHT CONTROL
87	16BK/DG	RIGHT TURN SIGNAL
87A	-	-

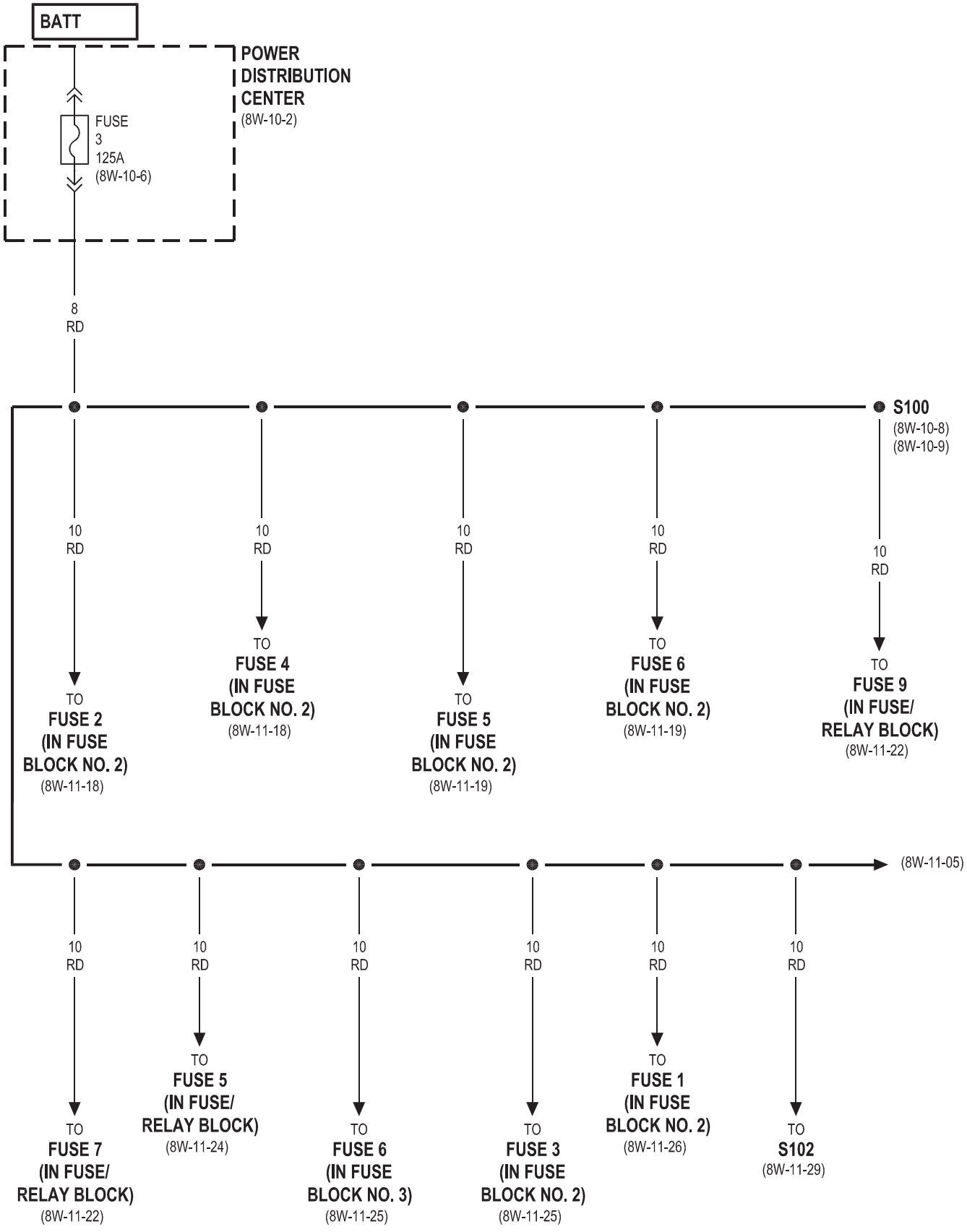
RELAY BLOCK

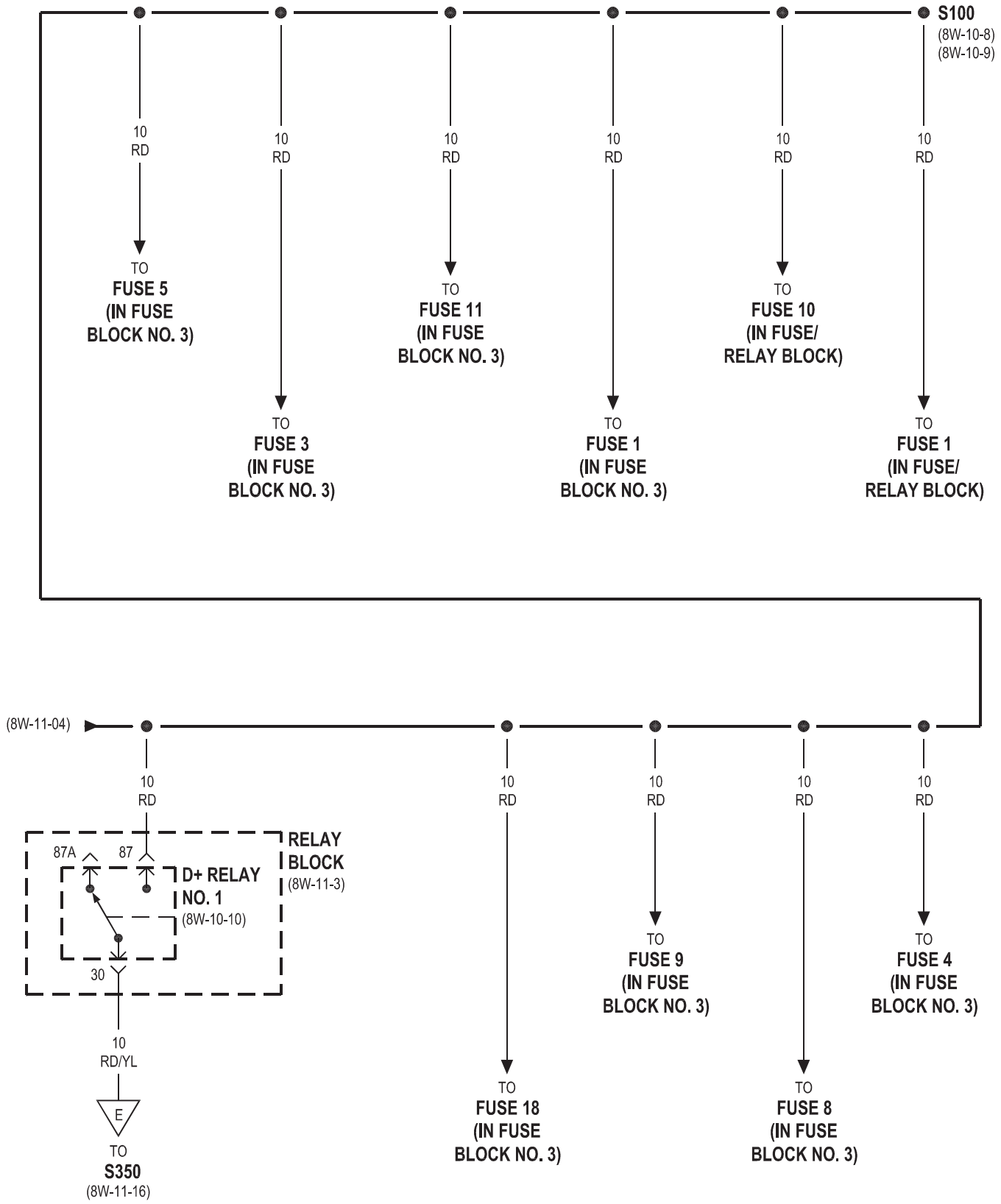
WINDOW DEFOGGER RELAY- LEFT REAR

CAVITY	CIRCUIT	FUNCTION
30	14RD/DG	FUSED B(+)
85	16GY/DG	WINDOW DEFOGGER RELAY- LEFT REAR CONTROL
86	16BR	GROUND
87	16GY/BL	WINDOW DEFOGGER RELAY- LEFT REAR OUTPUT
87A	-	-

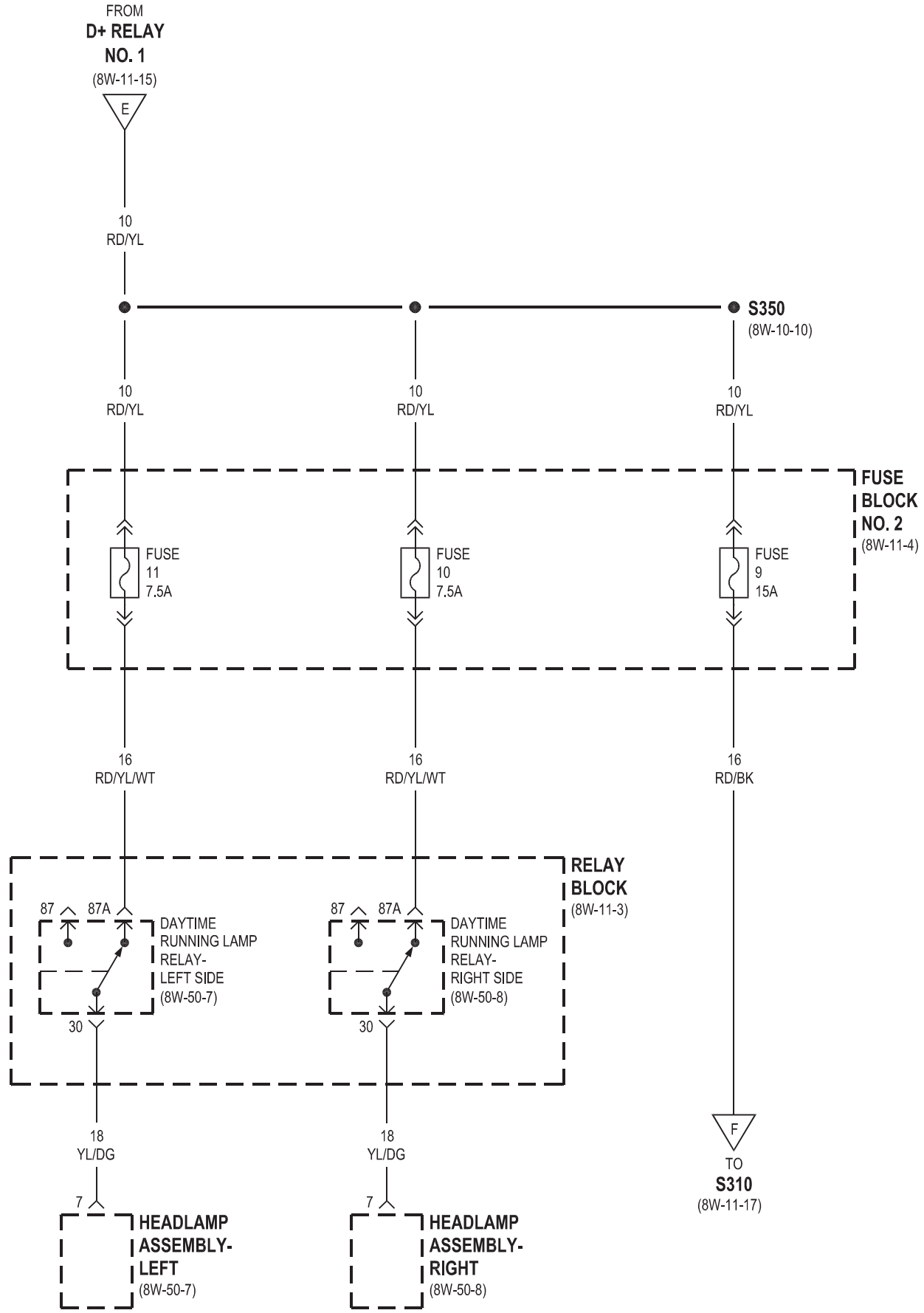
WINDOW DEFOGGER RELAY- RIGHT REAR

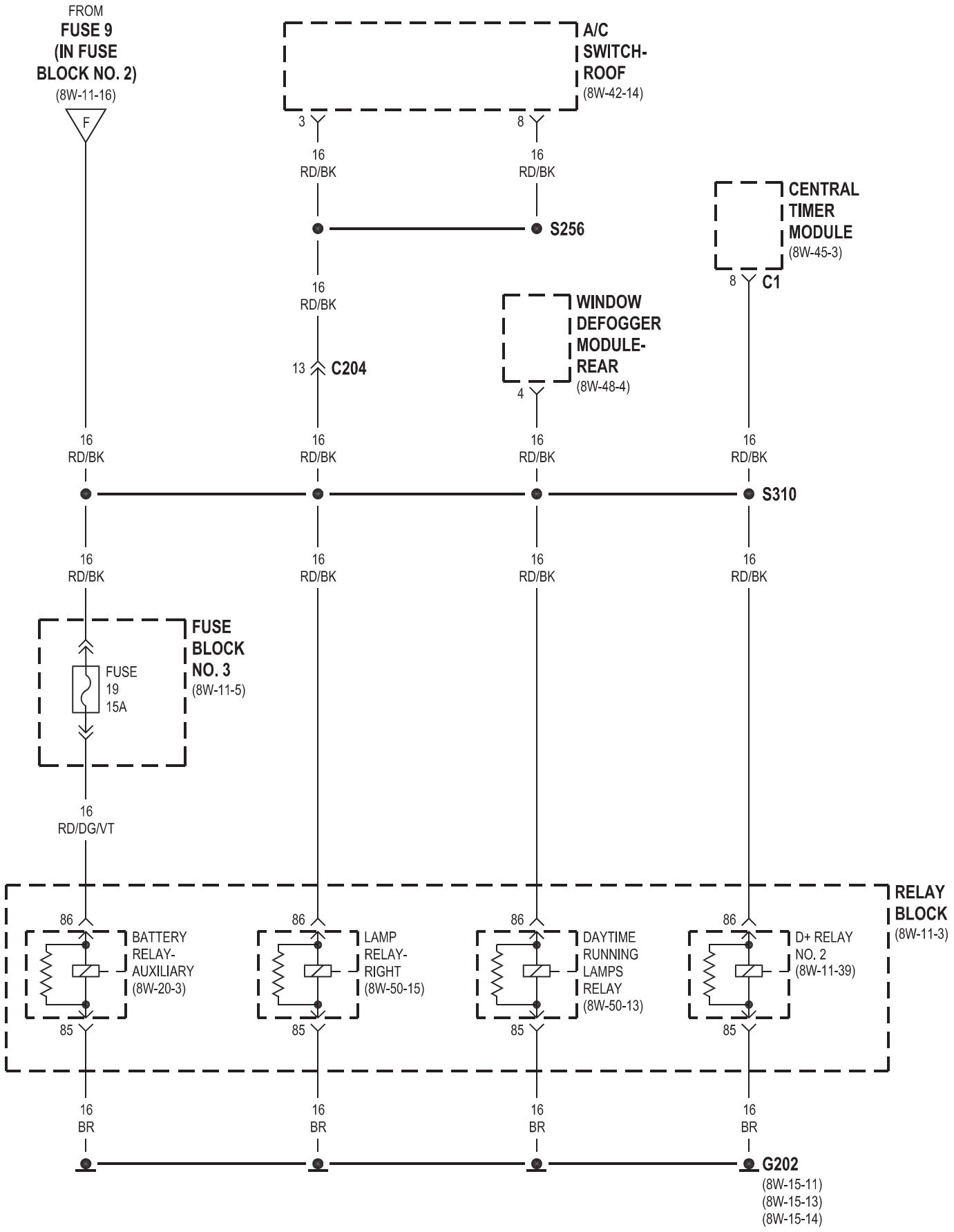
CAVITY	CIRCUIT	FUNCTION
30	14RD/DG	FUSED B(+)
85	16GY/RD	WINDOW DEFOGGER RELAY- RIGHT REAR CONTROL
86	16BR	GROUND
87	16GY	WINDOW DEFOGGER RELAY- RIGHT REAR OUTPUT
87A	-	-


BATT
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 3 125A
(8W-10-6)
8 RD
S100
(8W-10-8)
(8W-10-9)
10 RD
TO FUSE 2 (IN FUSE BLOCK NO. 2)
(8W-11-18)
TO FUSE 4 (IN FUSE BLOCK NO. 2)
(8W-11-18)
TO FUSE 5 (IN FUSE BLOCK NO. 2)
(8W-11-19)
TO FUSE 6 (IN FUSE BLOCK NO. 2)
(8W-11-19)
TO FUSE 9 (IN FUSE/ RELAY BLOCK)
(8W-11-22)
(8W-11-05)
TO FUSE 7 (IN FUSE/ RELAY BLOCK)
(8W-11-22)
TO FUSE 5 (IN FUSE/ RELAY BLOCK)
(8W-11-24)
TO FUSE 6 (IN FUSE BLOCK NO. 3)
(8W-11-25)
TO FUSE 3 (IN FUSE BLOCK NO. 2)
(8W-11-25)
TO FUSE 1 (IN FUSE BLOCK NO. 2)
(8W-11-26)
TO S102
(8W-11-29)

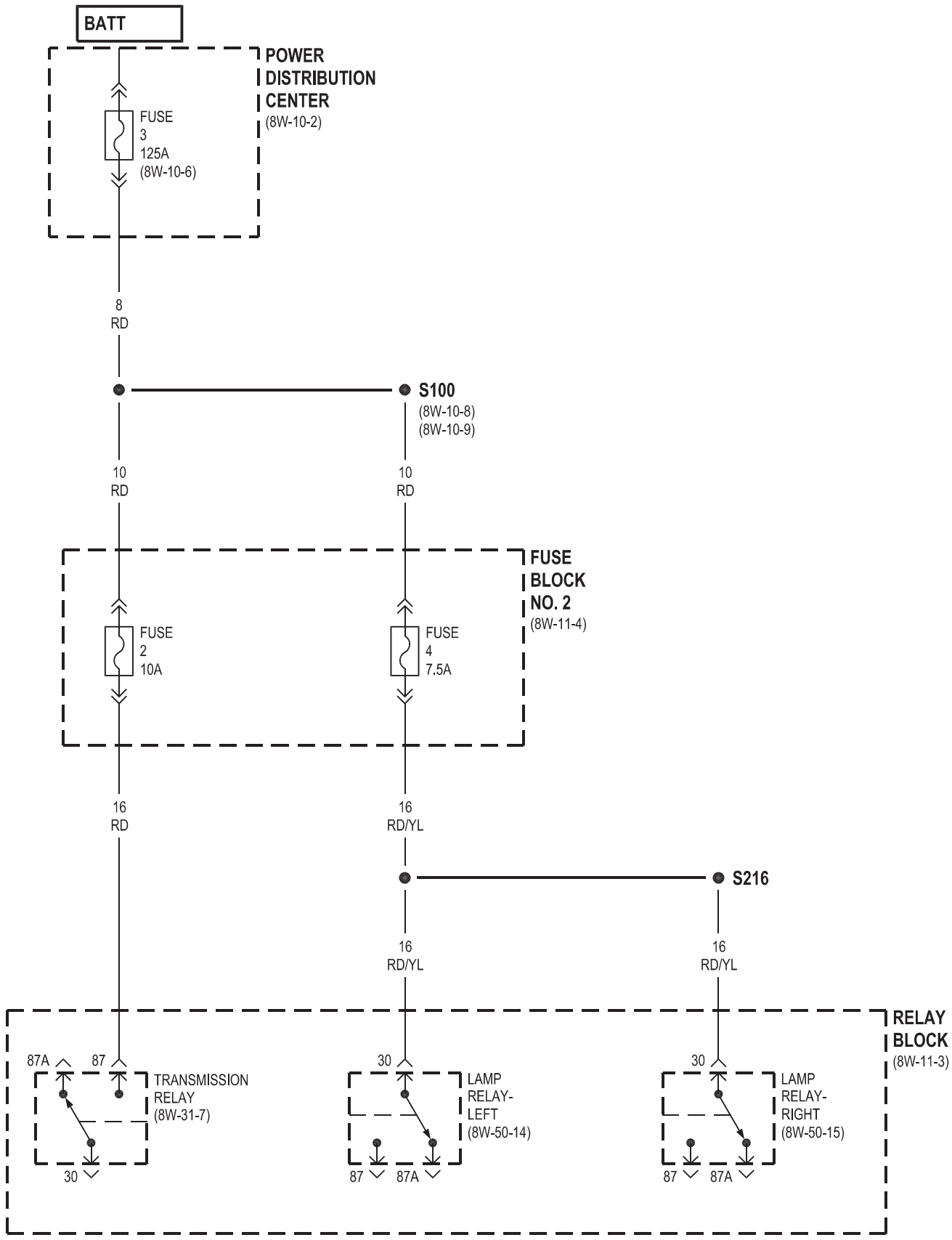


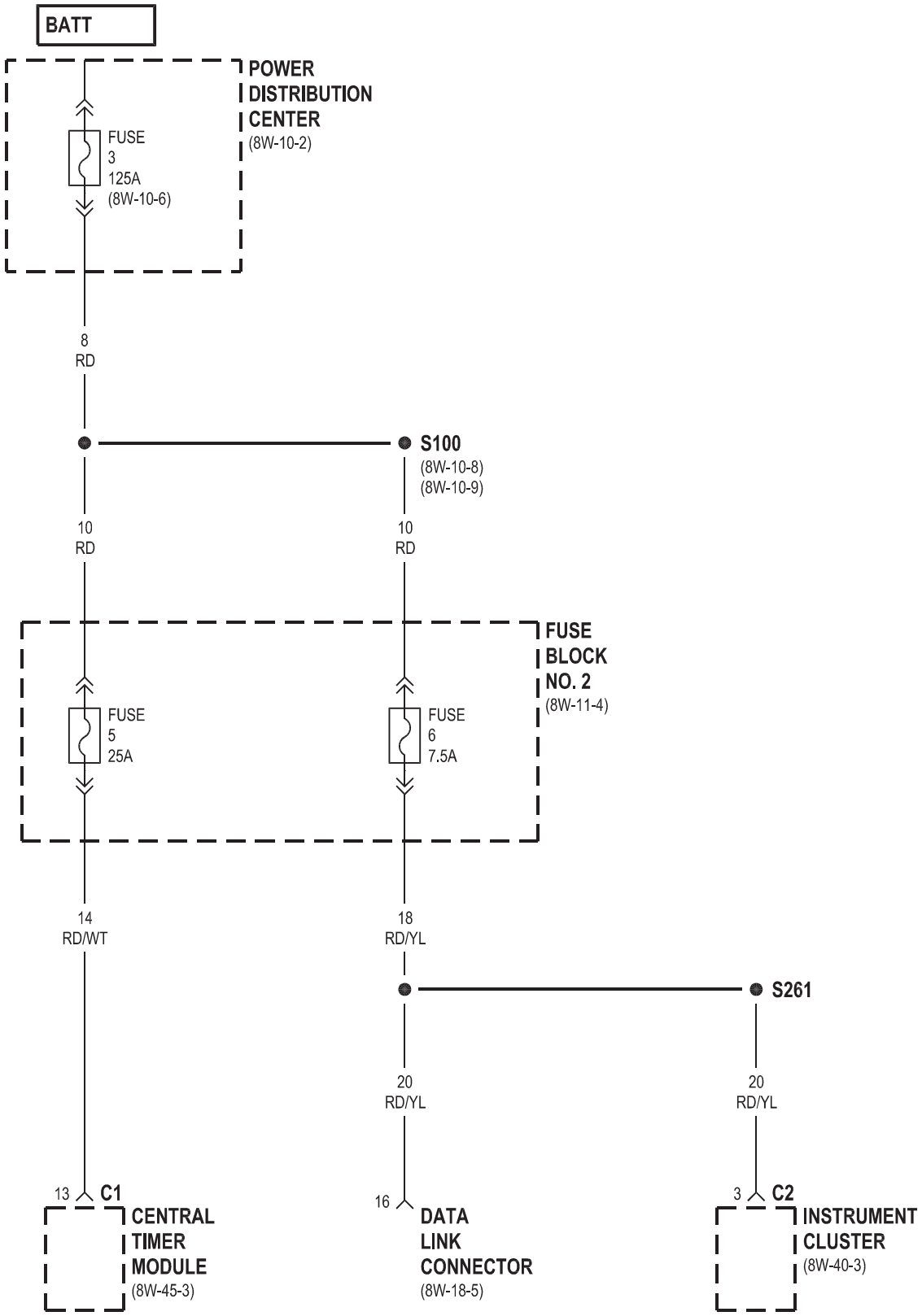
VA301115 J038W-24


FROM
D+ RELAY
NO. 1
(8W-11-15)
E
10
RD/YL
S350
(8W-10-10)
10
RD/YL
10
RD/YL
10
RD/YL
FUSE
BLOCK
NO. 2
(8W-11-4)
FUSE
11
7.5A
FUSE
10
7.5A
FUSE
9
15A
16
RD/YL/WT
16
RD/YL/WT
16
RD/BK
RELAY
BLOCK
(8W-11-3)
87
87A
DAYTIME
RUNNING LAMP
RELAY-
LEFT SIDE
(8W-50-7)
30
87
87A
DAYTIME
RUNNING LAMP
RELAY-
RIGHT SIDE
(8W-50-8)
30
18
YL/DG
18
YL/DG
F
TO
S310
(8W-11-17)
7
HEADLAMP
ASSEMBLY-
LEFT
(8W-50-7)
7
HEADLAMP
ASSEMBLY-
RIGHT
(8W-50-8)

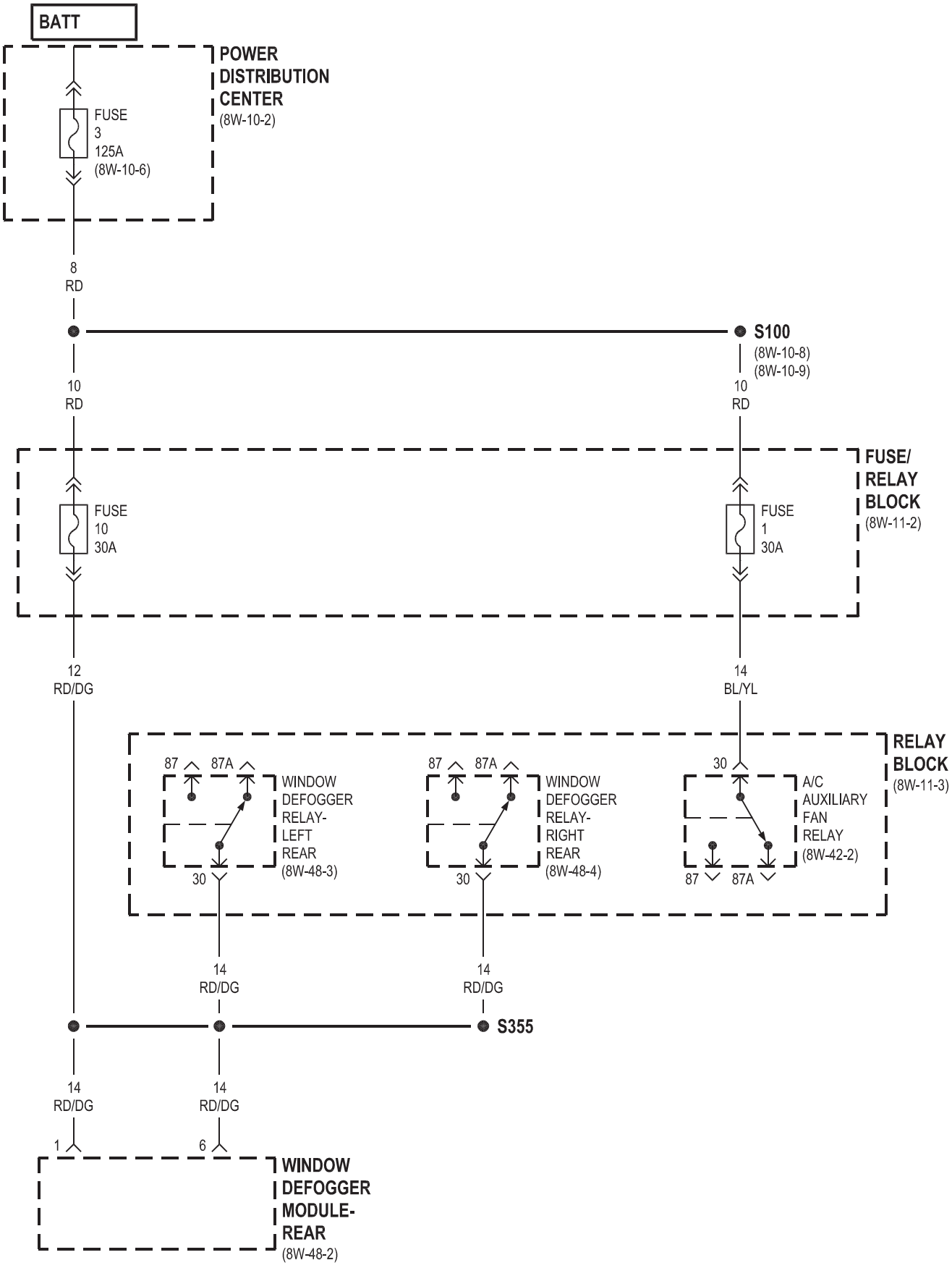


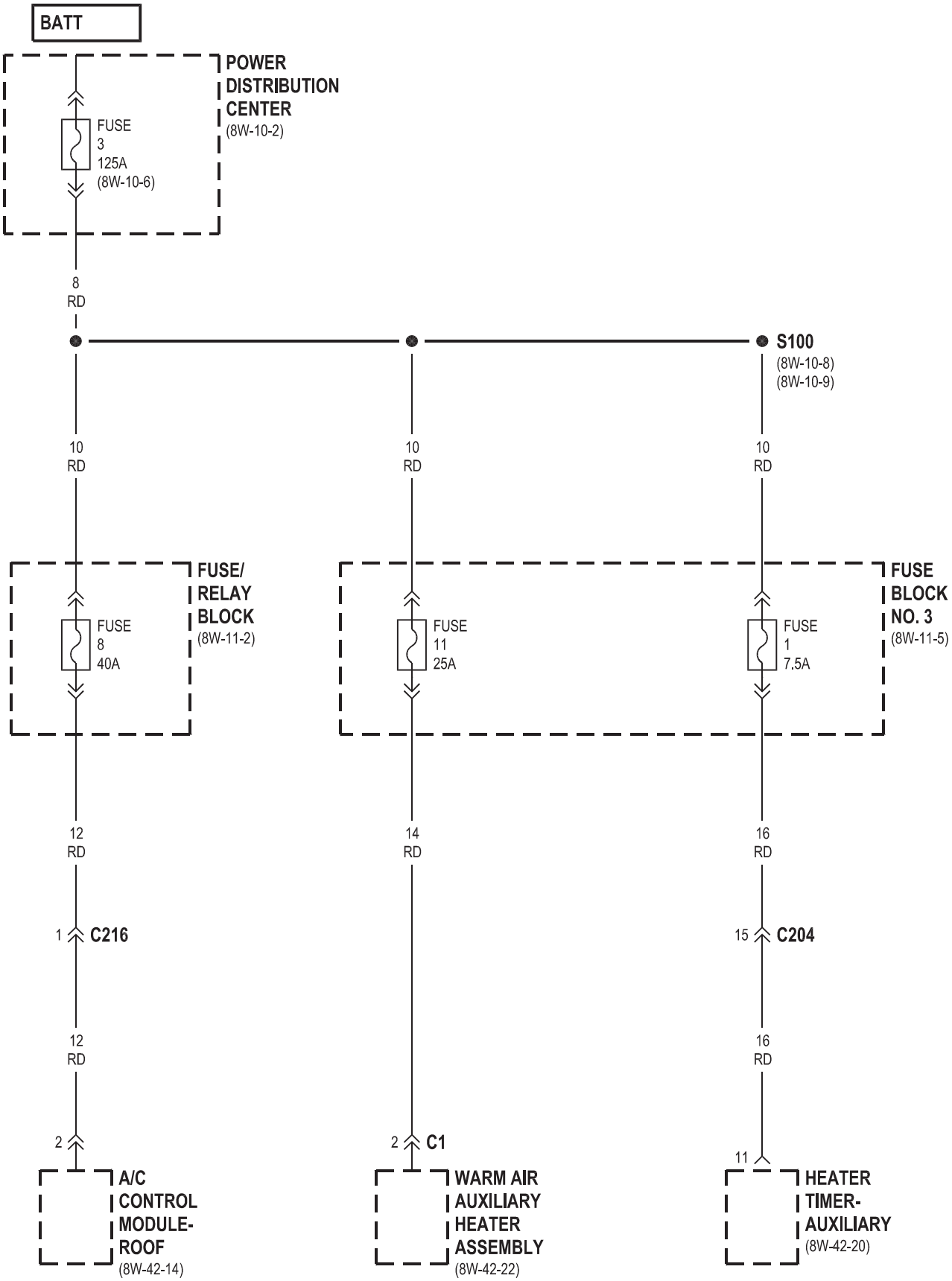
VA301117 J038W-24


BATT
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 3 125A (8W-10-6)
8 RD
S100
(8W-10-8)
(8W-10-9)
10 RD
10 RD
FUSE BLOCK NO. 2
(8W-11-4)
FUSE 2 10A
FUSE 4 7.5A
16 RD
16 RD/YL
S216
16 RD/YL
16 RD/YL
RELAY BLOCK
(8W-11-3)
87A
87
TRANSMISSION RELAY
(8W-31-7)
30
30
LAMP RELAY-LEFT
(8W-50-14)
87
87A
30
LAMP RELAY-RIGHT
(8W-50-15)
87
87A

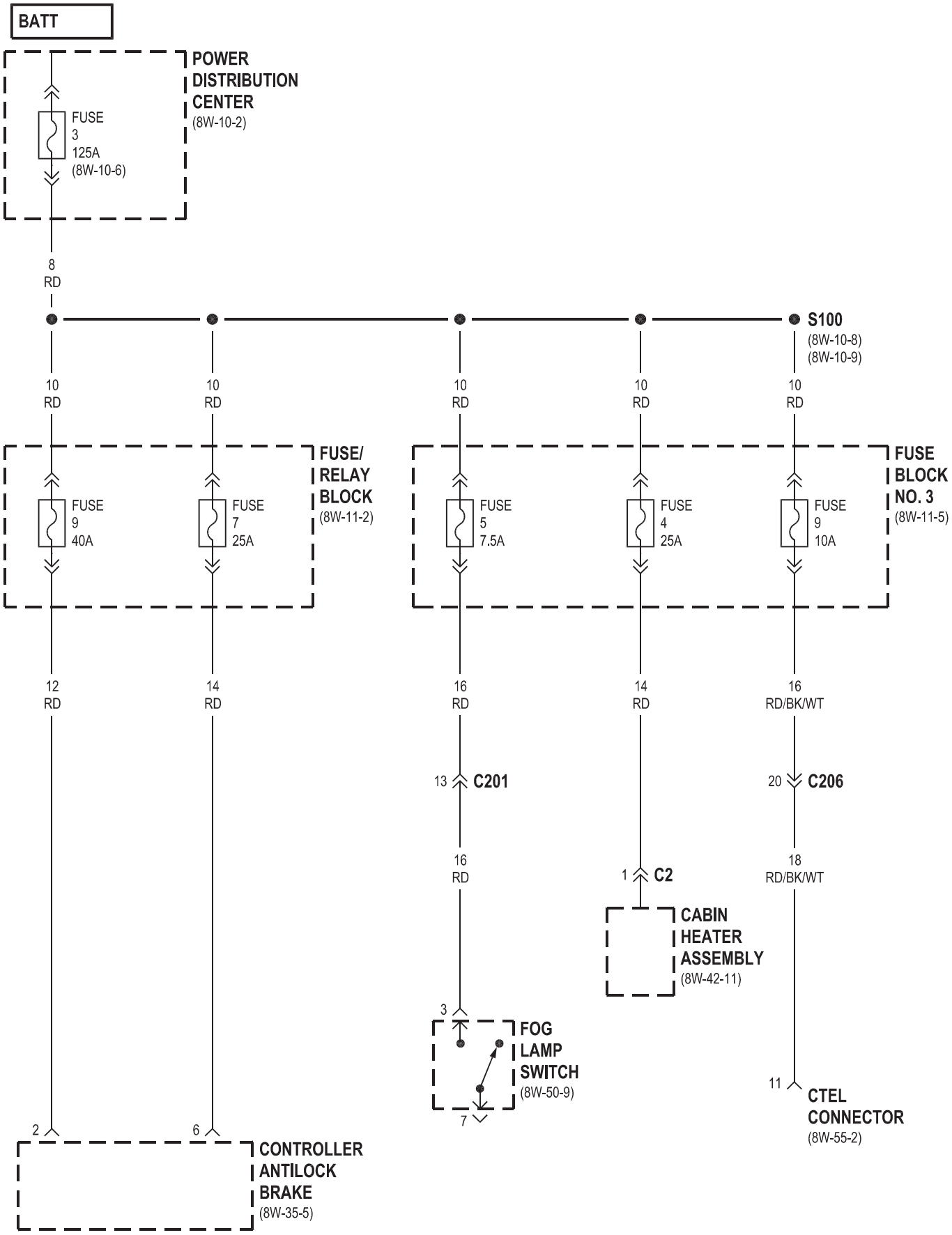


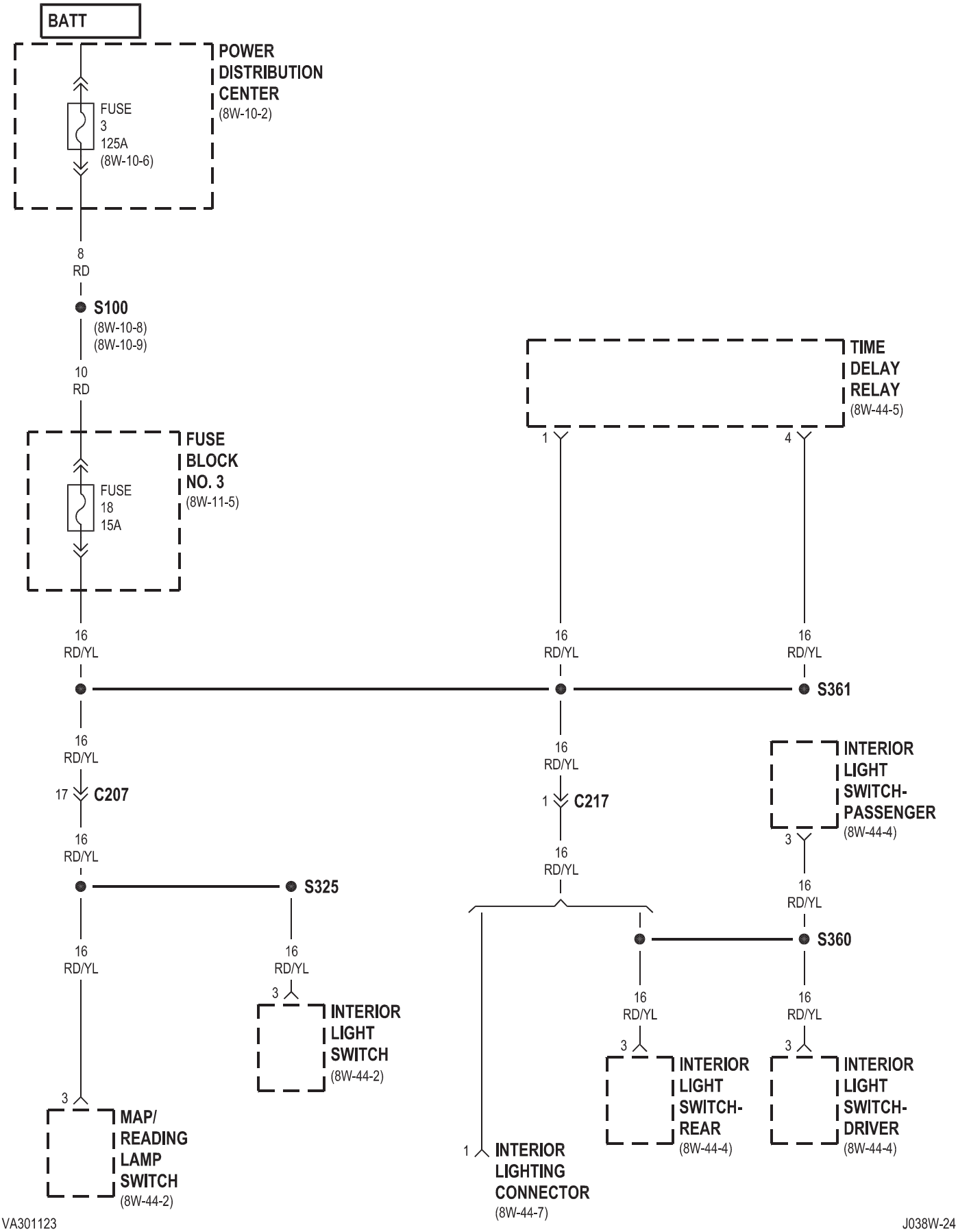
VA301119 J038W-24


BATT
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 3 125A (8W-10-6)
8 RD
S100
(8W-10-8)
(8W-10-9)
10 RD
10 RD
FUSE/ RELAY BLOCK
(8W-11-2)
FUSE 10 30A
FUSE 1 30A
12 RD/DG
14 BL/YL
RELAY BLOCK
(8W-11-3)
87 87A
WINDOW DEFOGGER RELAY- LEFT REAR
(8W-48-3)
30
87 87A
WINDOW DEFOGGER RELAY- RIGHT REAR
(8W-48-4)
30
30
A/C AUXILIARY FAN RELAY
(8W-42-2)
87 87A
14 RD/DG
14 RD/DG
S355
14 RD/DG
14 RD/DG
1
6
WINDOW DEFOGGER MODULE- REAR
(8W-48-2)

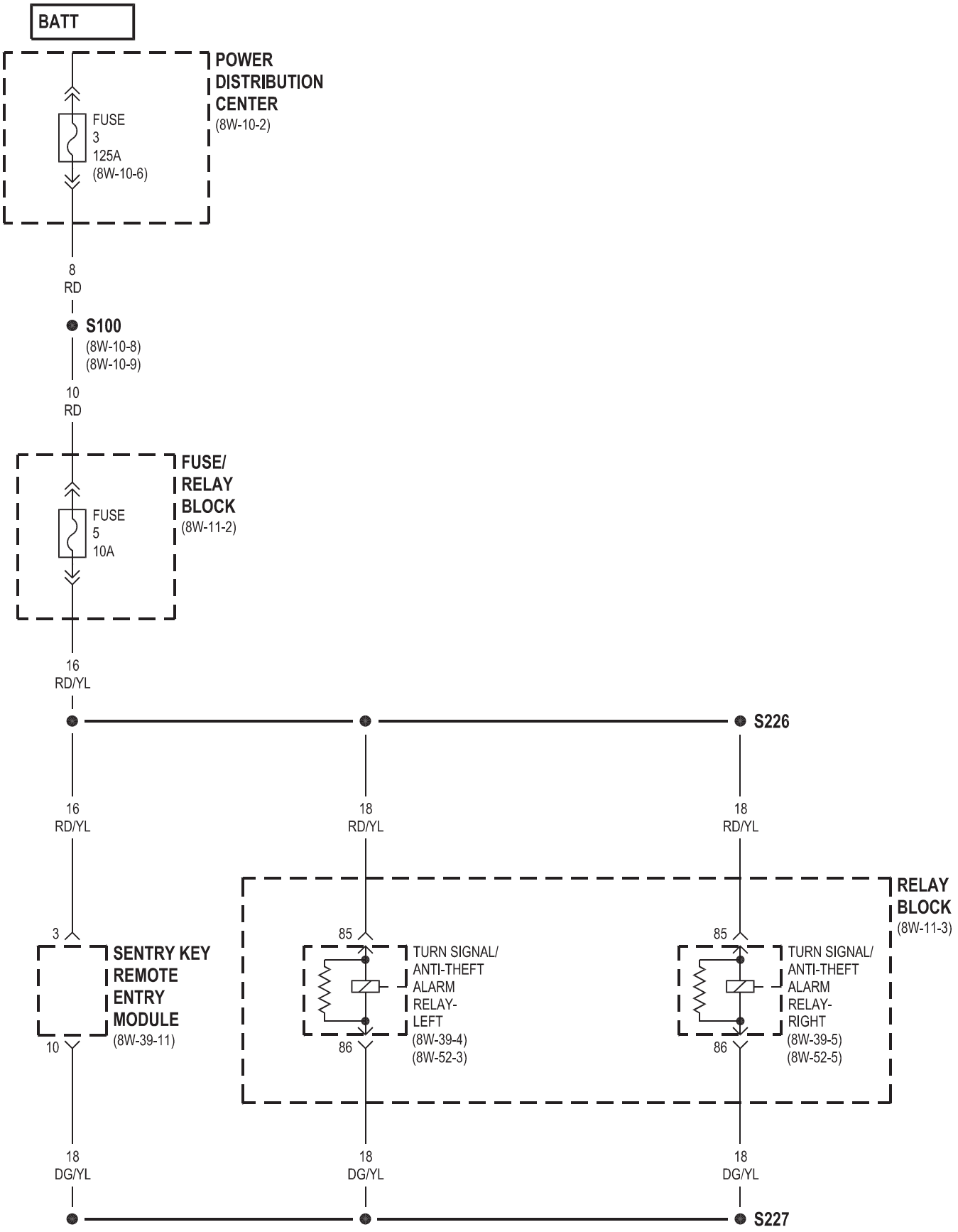


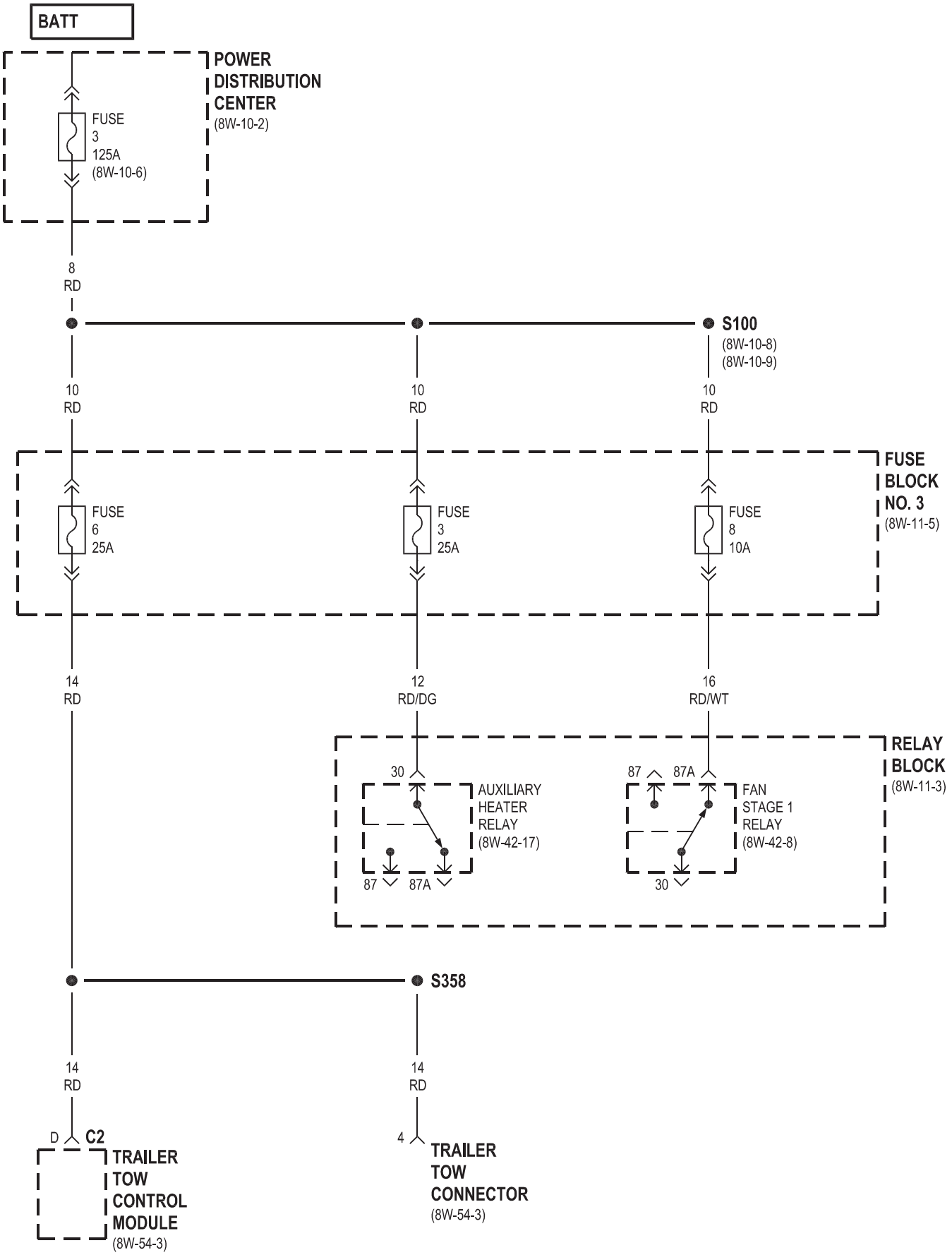
VA301121 J038W-24


BATT
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 3 125A (8W-10-6)
8 RD
S100
(8W-10-8)
(8W-10-9)
10 RD
10 RD
10 RD
10 RD
10 RD
FUSE/ RELAY BLOCK
(8W-11-2)
FUSE 9 40A
FUSE 7 25A
FUSE BLOCK NO. 3
(8W-11-5)
FUSE 5 7.5A
FUSE 4 25A
FUSE 9 10A
12 RD
14 RD
16 RD
14 RD
16 RD/BK/WT
13 C201
20 C206
16 RD
1 C2
18 RD/BK/WT
CABIN HEATER ASSEMBLY
(8W-42-11)
3
FOG LAMP SWITCH
(8W-50-9)
7
11
CTEL CONNECTOR
(8W-55-2)
2
6
CONTROLLER ANTILOCK BRAKE
(8W-35-5)

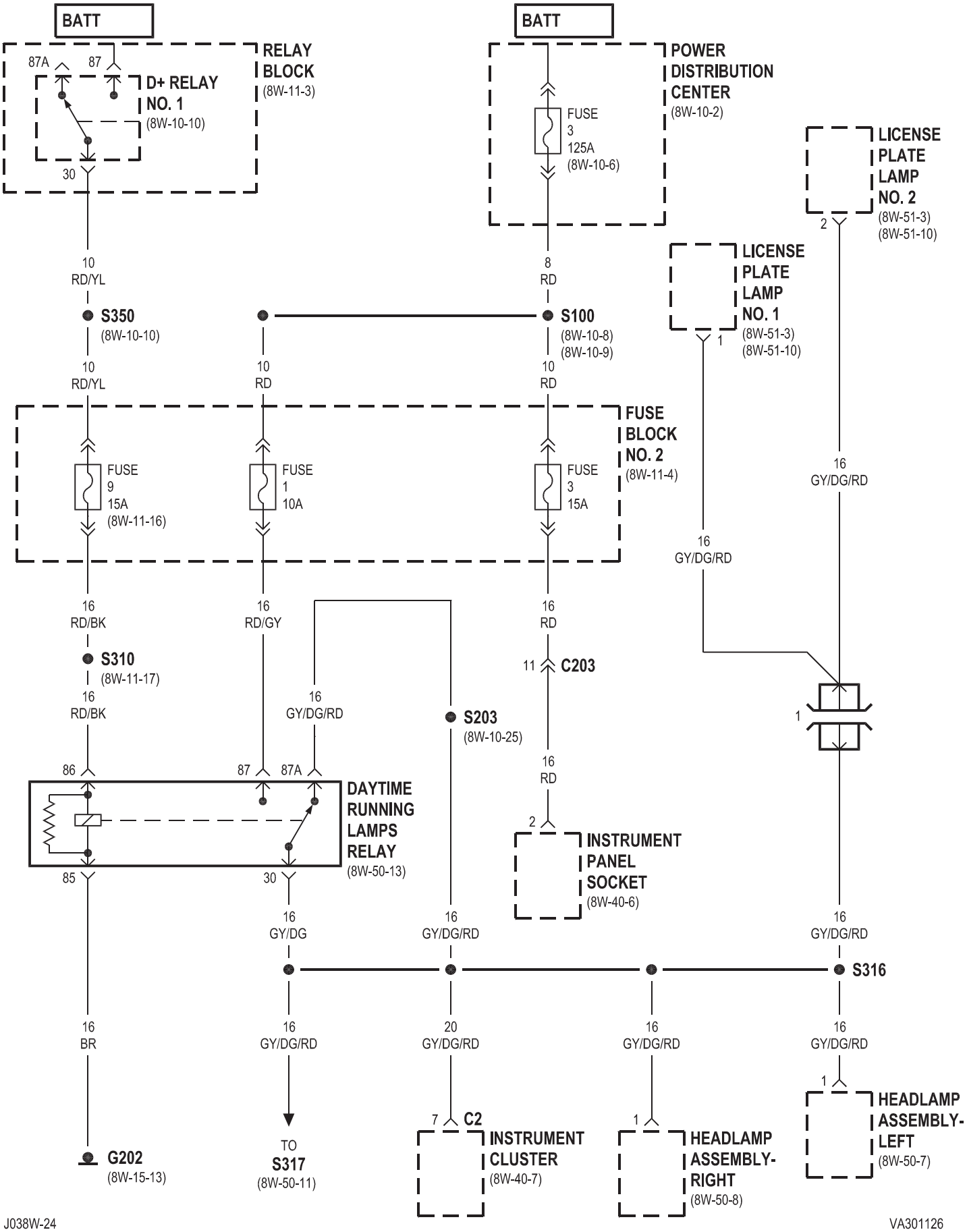


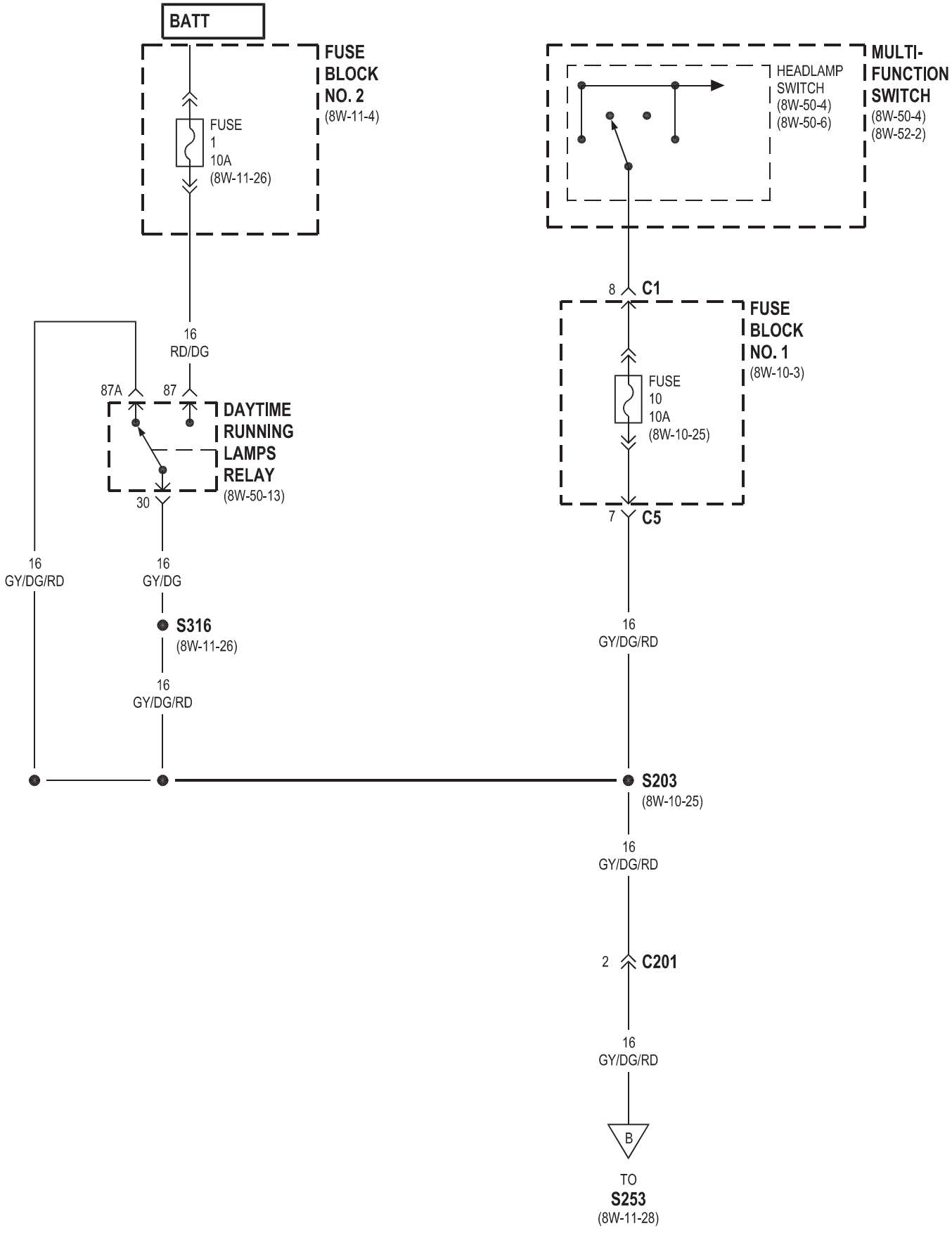
VA301123 J038W-24


BATT
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 3 125A (8W-10-6)
8 RD
S100
(8W-10-8)
(8W-10-9)
10 RD
FUSE/ RELAY BLOCK
(8W-11-2)
FUSE 5 10A
16 RD/YL
S226
16 RD/YL
18 RD/YL
18 RD/YL
RELAY BLOCK
(8W-11-3)
3
SENTRY KEY REMOTE ENTRY MODULE
(8W-39-11)
10
85
TURN SIGNAL/ ANTI-THEFT ALARM RELAY- LEFT
(8W-39-4)
(8W-52-3)
86
85
TURN SIGNAL/ ANTI-THEFT ALARM RELAY- RIGHT
(8W-39-5)
(8W-52-5)
86
18 DG/YL
18 DG/YL
18 DG/YL
S227

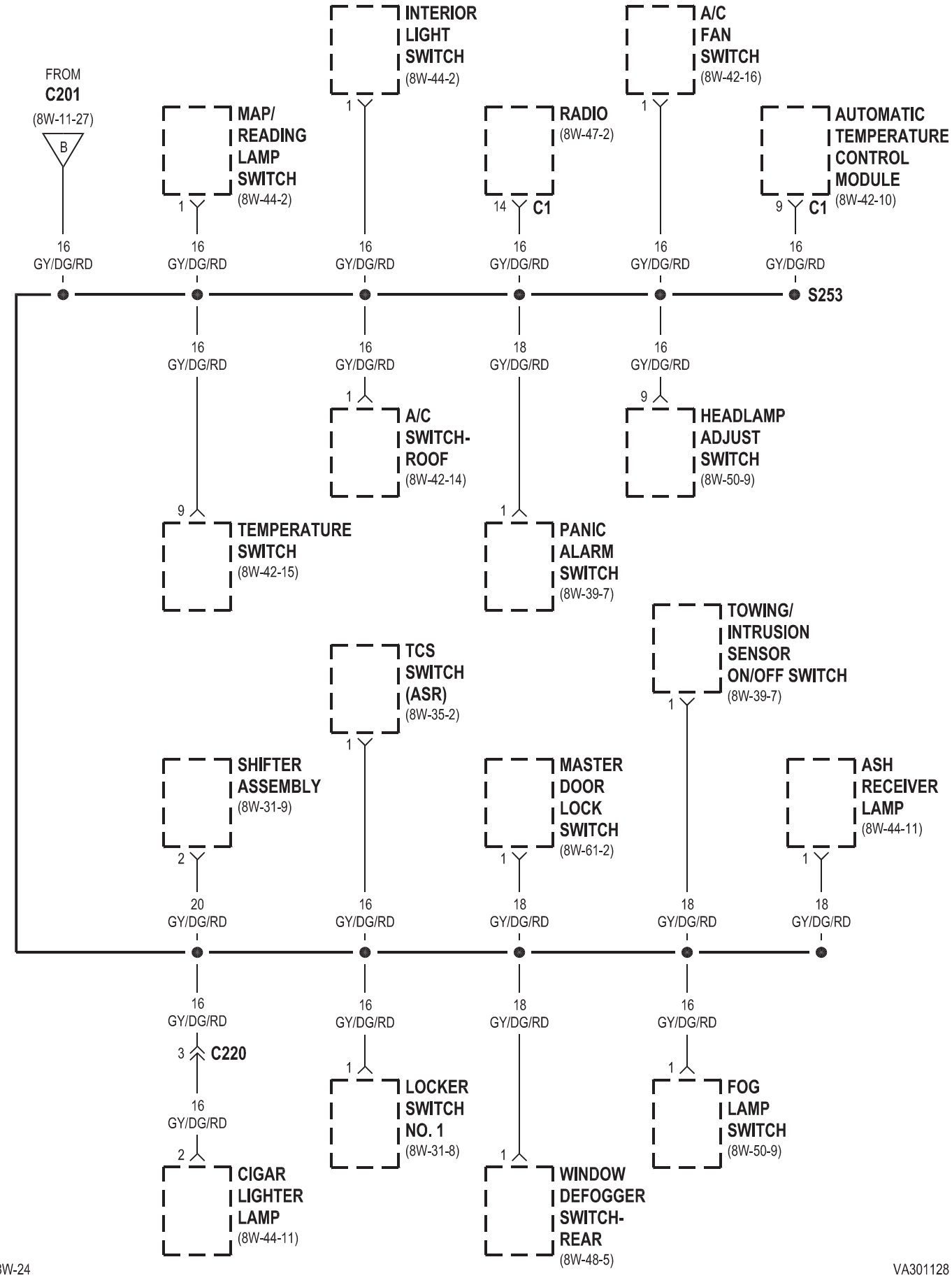


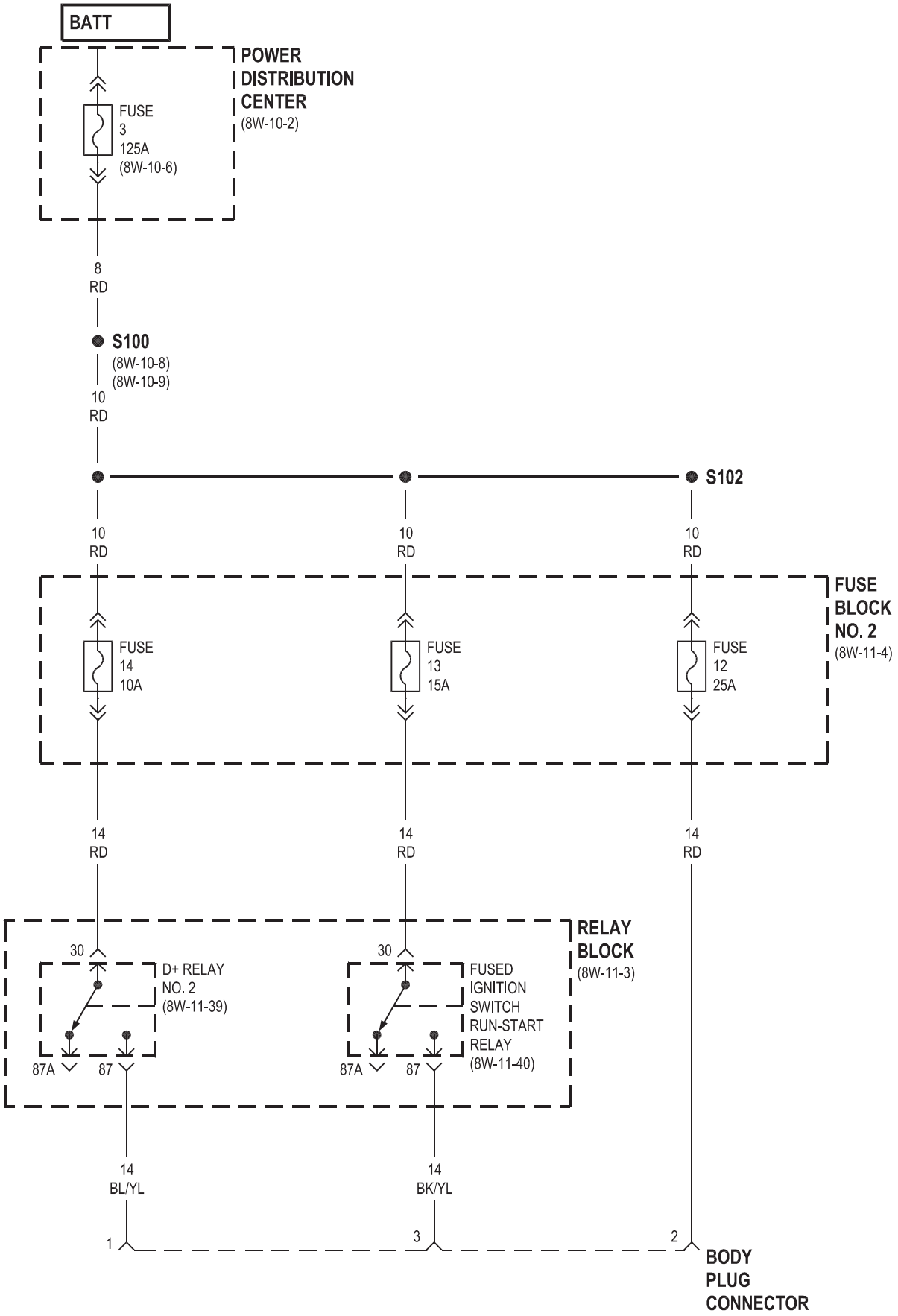
VA301125 J038W-24


BATT
87A
87
D+ RELAY NO. 1
(8W-10-10)
RELAY BLOCK
(8W-11-3)
30
BATT
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 3 125A
(8W-10-6)
LICENSE PLATE LAMP NO. 2
(8W-51-3)
(8W-51-10)
2
LICENSE PLATE LAMP NO. 1
(8W-51-3)
(8W-51-10)
1
10 RD/YL
8 RD
S350
(8W-10-10)
S100
(8W-10-8)
(8W-10-9)
10 RD/YL
10 RD
10 RD
FUSE BLOCK NO. 2
(8W-11-4)
FUSE 9 15A
(8W-11-16)
FUSE 1 10A
FUSE 3 15A
16 GY/DG/RD
16 GY/DG/RD
16 RD/BK
16 RD/GY
16 RD
S310
(8W-11-17)
11 C203
16 RD/BK
16 GY/DG/RD
S203
(8W-10-25)
1
86
87
87A
DAYTIME RUNNING LAMPS RELAY
(8W-50-13)
16 RD
2
INSTRUMENT PANEL SOCKET
(8W-40-6)
85
30
16 GY/DG
16 GY/DG/RD
16 GY/DG/RD
S316
16 BR
16 GY/DG/RD
20 GY/DG/RD
16 GY/DG/RD
16 GY/DG/RD
1
HEADLAMP ASSEMBLY-LEFT
(8W-50-7)
7 C2
INSTRUMENT CLUSTER
(8W-40-7)
1
HEADLAMP ASSEMBLY-RIGHT
(8W-50-8)
G202
(8W-15-13)
TO S317
(8W-50-11)

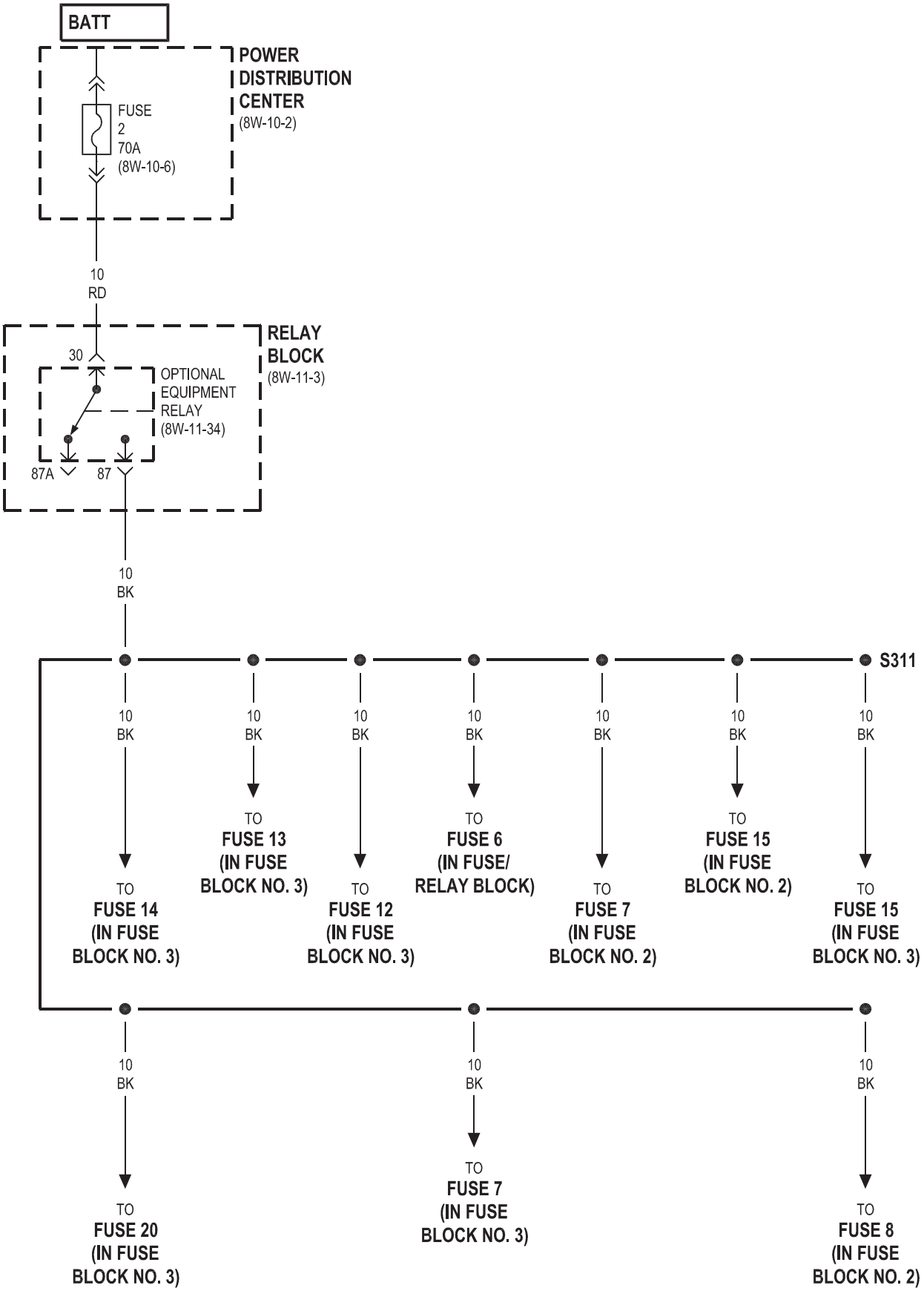


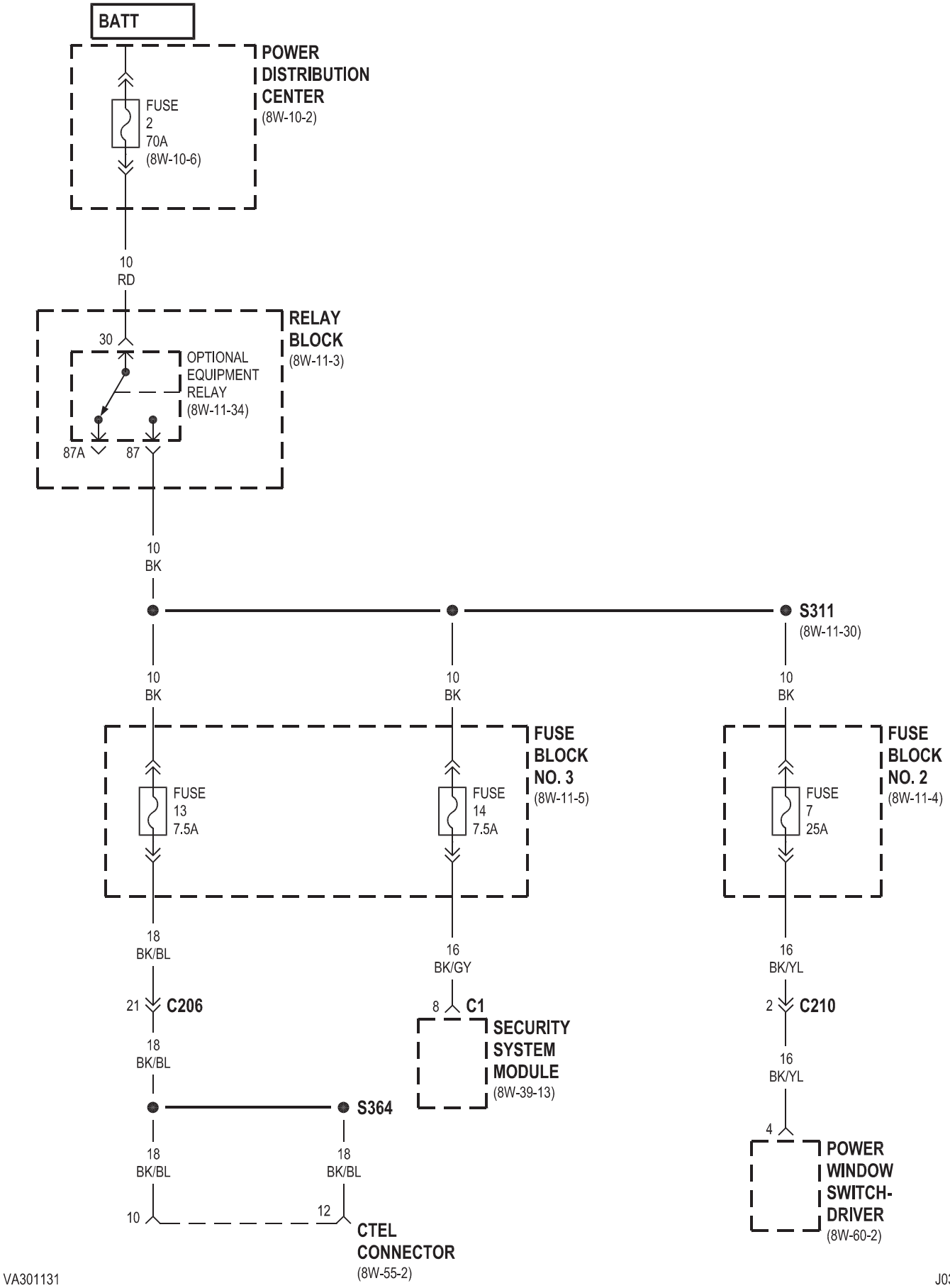
VA301127 J038W-24


FROM
C201
(8W-11-27)
B
16
GY/DG/RD
INTERIOR
LIGHT
SWITCH
(8W-44-2)
1
A/C
FAN
SWITCH
(8W-42-16)
1
MAP/
READING
LAMP
SWITCH
(8W-44-2)
1
RADIO
(8W-47-2)
14
C1
AUTOMATIC
TEMPERATURE
CONTROL
MODULE
(8W-42-10)
9
C1
S253
A/C
SWITCH-
ROOF
(8W-42-14)
HEADLAMP
ADJUST
SWITCH
(8W-50-9)
TEMPERATURE
SWITCH
(8W-42-15)
PANIC
ALARM
SWITCH
(8W-39-7)
TOWING/
INTRUSION
SENSOR
ON/OFF SWITCH
(8W-39-7)
TCS
SWITCH
(ASR)
(8W-35-2)
SHIFTER
ASSEMBLY
(8W-31-9)
2
20
GY/DG/RD
MASTER
DOOR
LOCK
SWITCH
(8W-61-2)
ASH
RECEIVER
LAMP
(8W-44-11)
3
C220
LOCKER
SWITCH
NO. 1
(8W-31-8)
FOG
LAMP
SWITCH
(8W-50-9)
CIGAR
LIGHTER
LAMP
(8W-44-11)
WINDOW
DEFOGGER
SWITCH-
REAR
(8W-48-5)

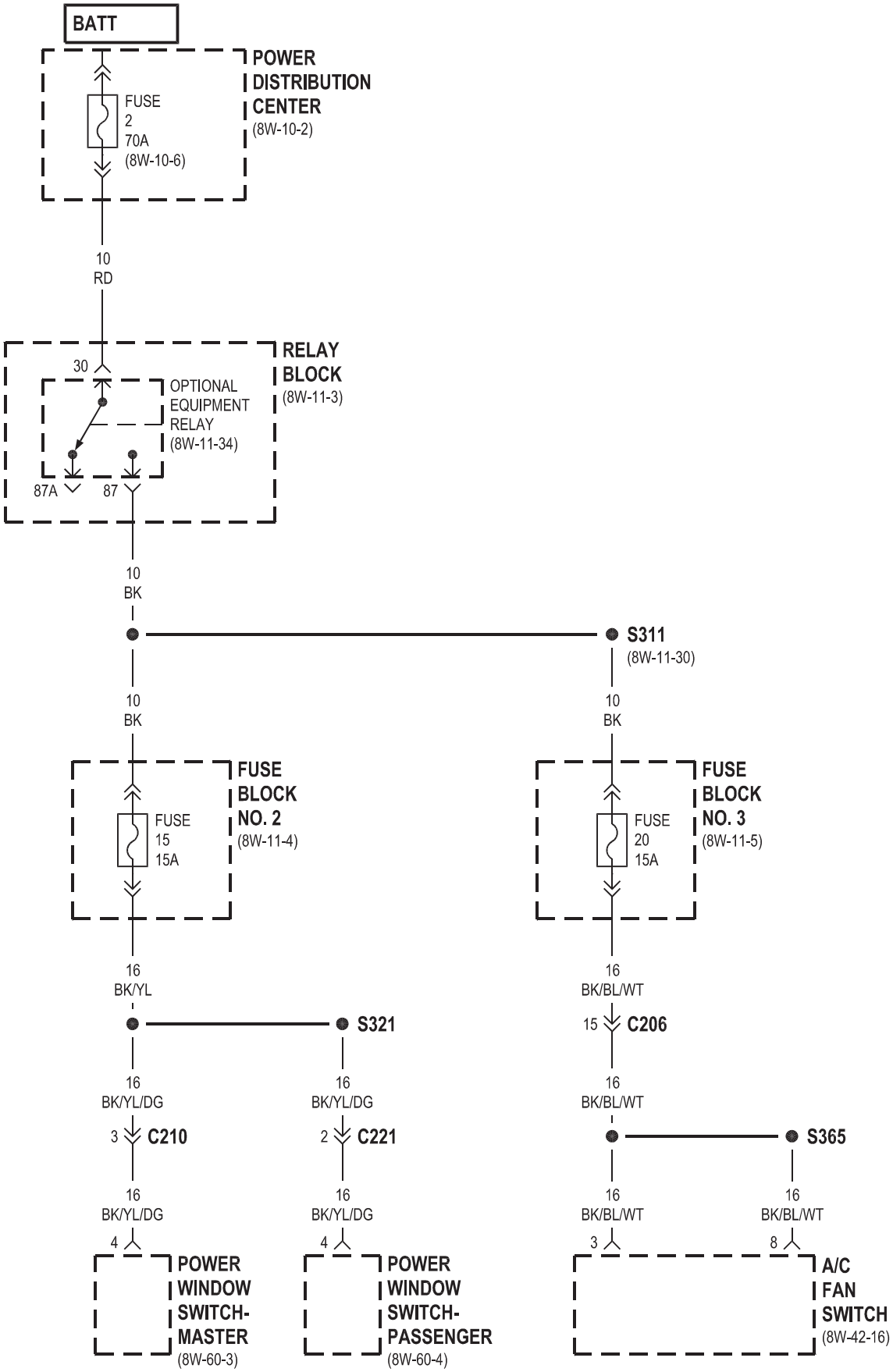


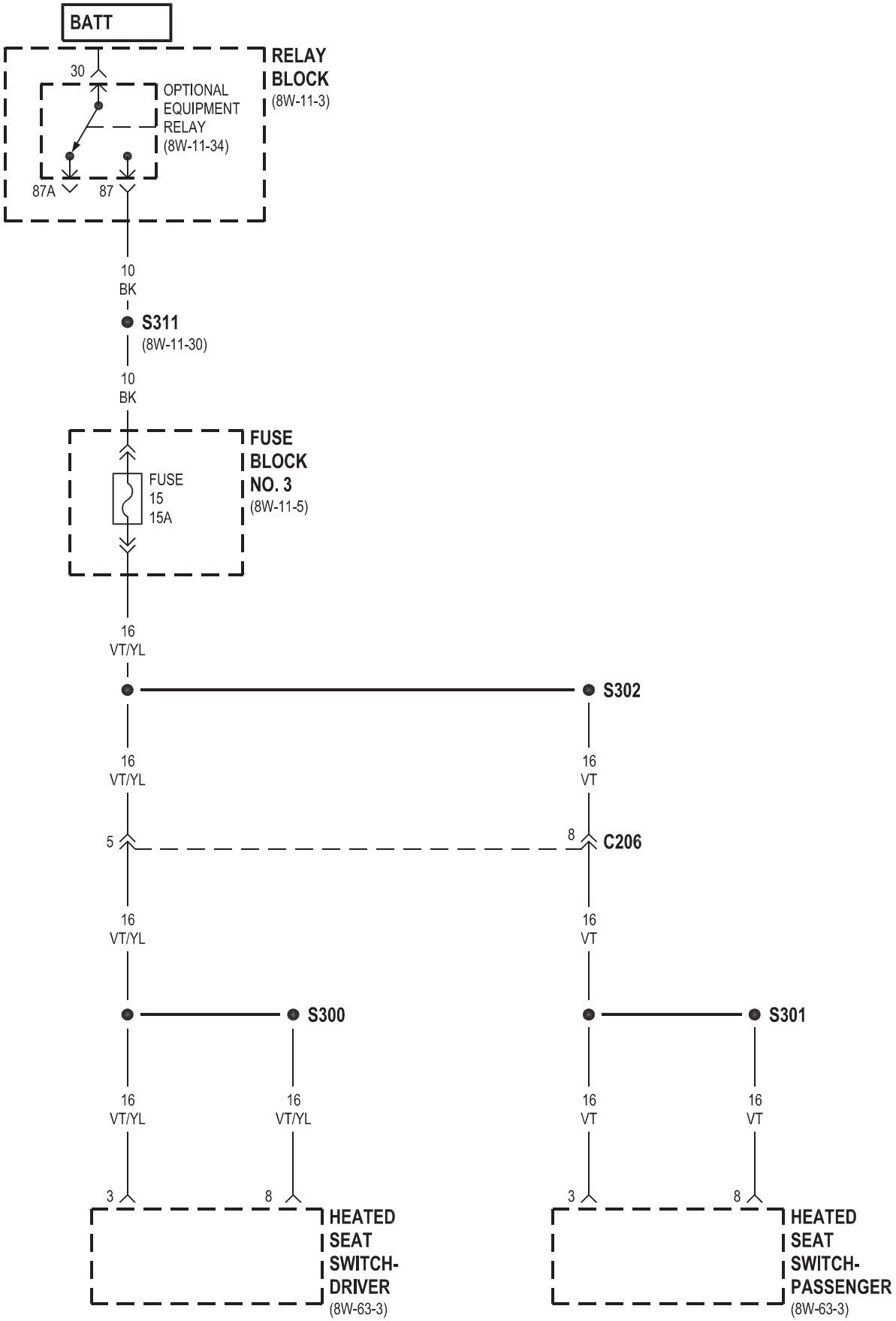
VA301129 J038W-24


BATT
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 2 70A
(8W-10-6)
10 RD
RELAY BLOCK
(8W-11-3)
30
OPTIONAL EQUIPMENT RELAY
(8W-11-34)
87A
87
10 BK
S311
10 BK
TO FUSE 14 (IN FUSE BLOCK NO. 3)
TO FUSE 13 (IN FUSE BLOCK NO. 3)
TO FUSE 12 (IN FUSE BLOCK NO. 3)
TO FUSE 6 (IN FUSE/ RELAY BLOCK)
TO FUSE 7 (IN FUSE BLOCK NO. 2)
TO FUSE 15 (IN FUSE BLOCK NO. 2)
TO FUSE 15 (IN FUSE BLOCK NO. 3)
TO FUSE 20 (IN FUSE BLOCK NO. 3)
TO FUSE 7 (IN FUSE BLOCK NO. 3)
TO FUSE 8 (IN FUSE BLOCK NO. 2)

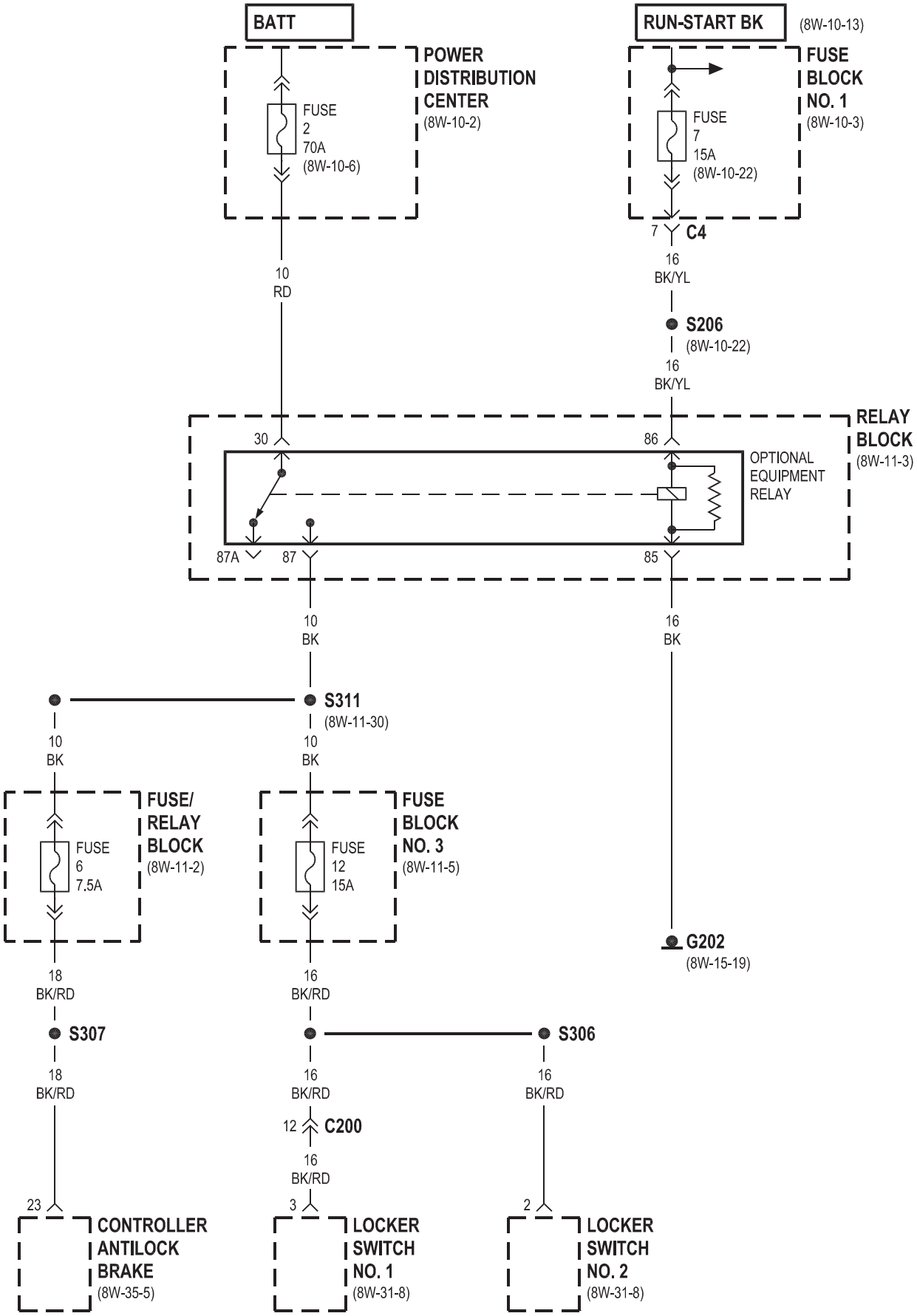


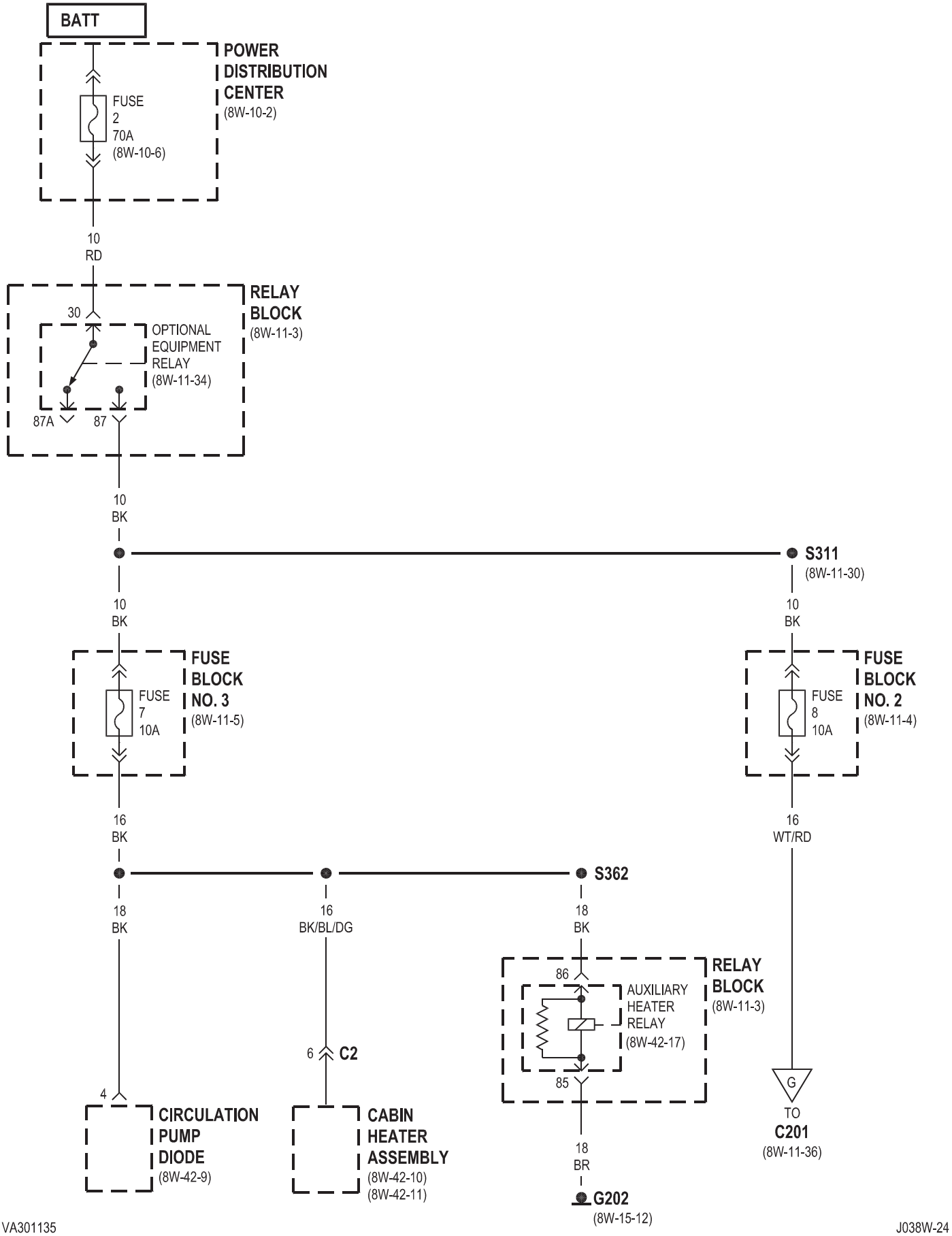
VA301131 J038W-24


BATT
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 2 70A
(8W-10-6)
10 RD
RELAY BLOCK
(8W-11-3)
30
OPTIONAL EQUIPMENT RELAY
(8W-11-34)
87A
87
10 BK
S311
(8W-11-30)
10 BK
10 BK
FUSE BLOCK NO. 2
(8W-11-4)
FUSE 15 15A
FUSE BLOCK NO. 3
(8W-11-5)
FUSE 20 15A
16 BK/YL
16 BK/BL/WT
S321
15 C206
16 BK/YL/DG
16 BK/YL/DG
16 BK/BL/WT
3 C210
2 C221
S365
16 BK/YL/DG
16 BK/YL/DG
16 BK/BL/WT
16 BK/BL/WT
4
4
3
8
POWER WINDOW SWITCH-MASTER
(8W-60-3)
POWER WINDOW SWITCH-PASSENGER
(8W-60-4)
A/C FAN SWITCH
(8W-42-16)

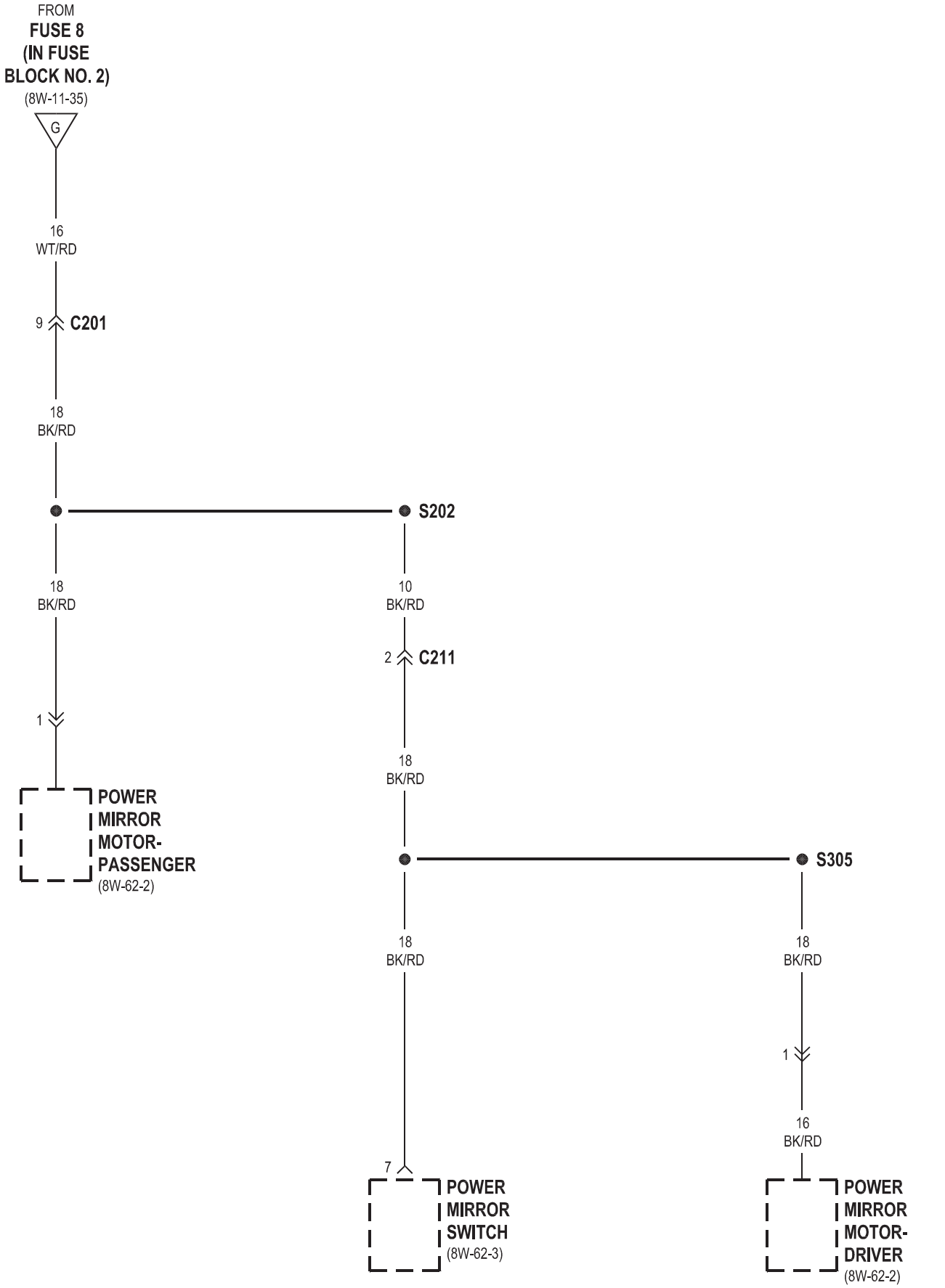


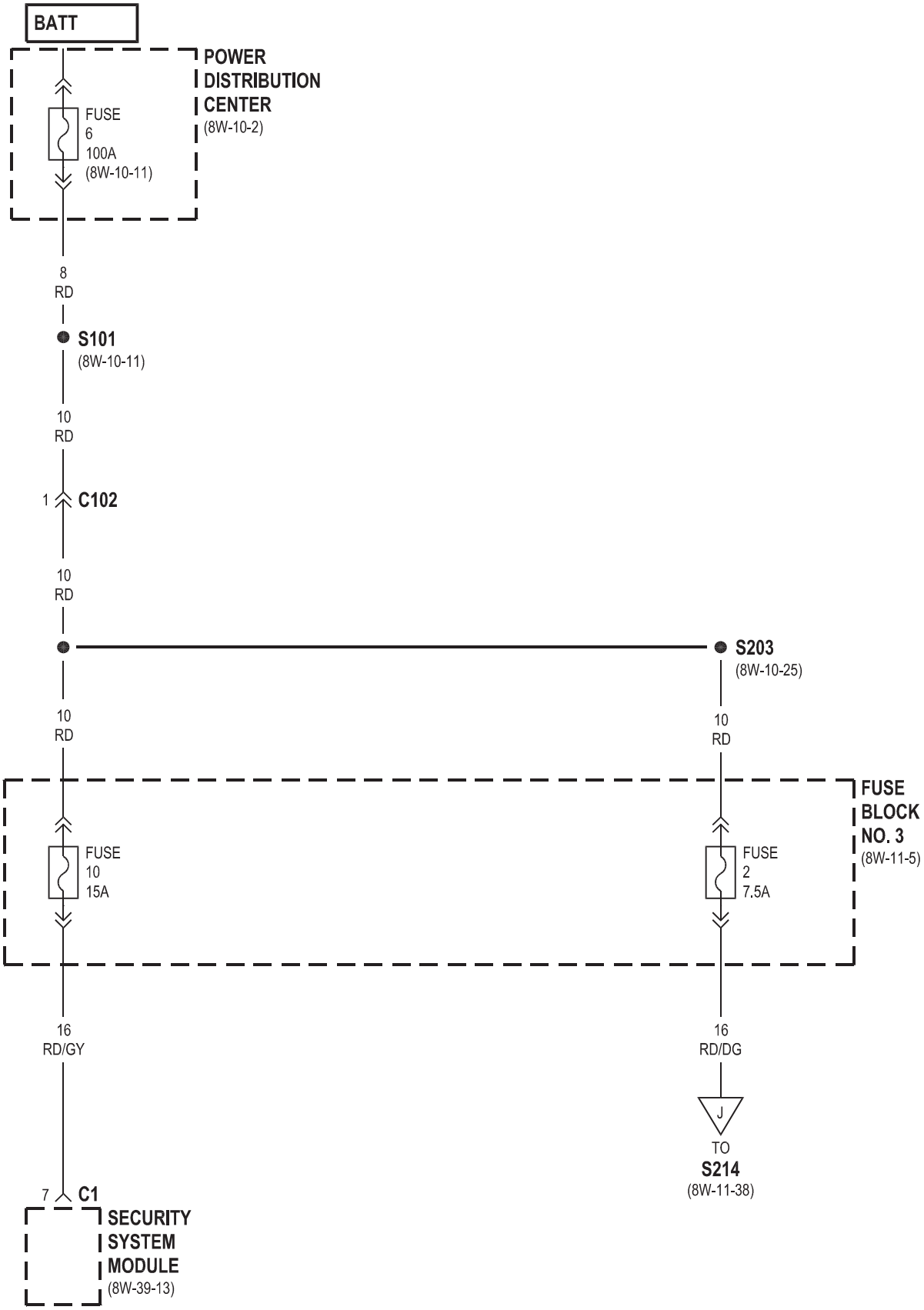
VA301133 J038W-24


BATT
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 2 70A (8W-10-6)
10 RD
RUN-START BK
(8W-10-13)
FUSE BLOCK NO. 1
(8W-10-3)
FUSE 7 15A (8W-10-22)
7 C4
16 BK/YL
S206
(8W-10-22)
16 BK/YL
RELAY BLOCK
(8W-11-3)
30
86
OPTIONAL EQUIPMENT RELAY
87A
87
85
10 BK
16 BK
S311
(8W-11-30)
10 BK
10 BK
FUSE/ RELAY BLOCK
(8W-11-2)
FUSE 6 7.5A
FUSE BLOCK NO. 3
(8W-11-5)
FUSE 12 15A
G202
(8W-15-19)
18 BK/RD
16 BK/RD
S307
S306
18 BK/RD
16 BK/RD
16 BK/RD
12 C200
16 BK/RD
16 BK/RD
23
3
2
CONTROLLER ANTILOCK BRAKE
(8W-35-5)
LOCKER SWITCH NO. 1
(8W-31-8)
LOCKER SWITCH NO. 2
(8W-31-8)

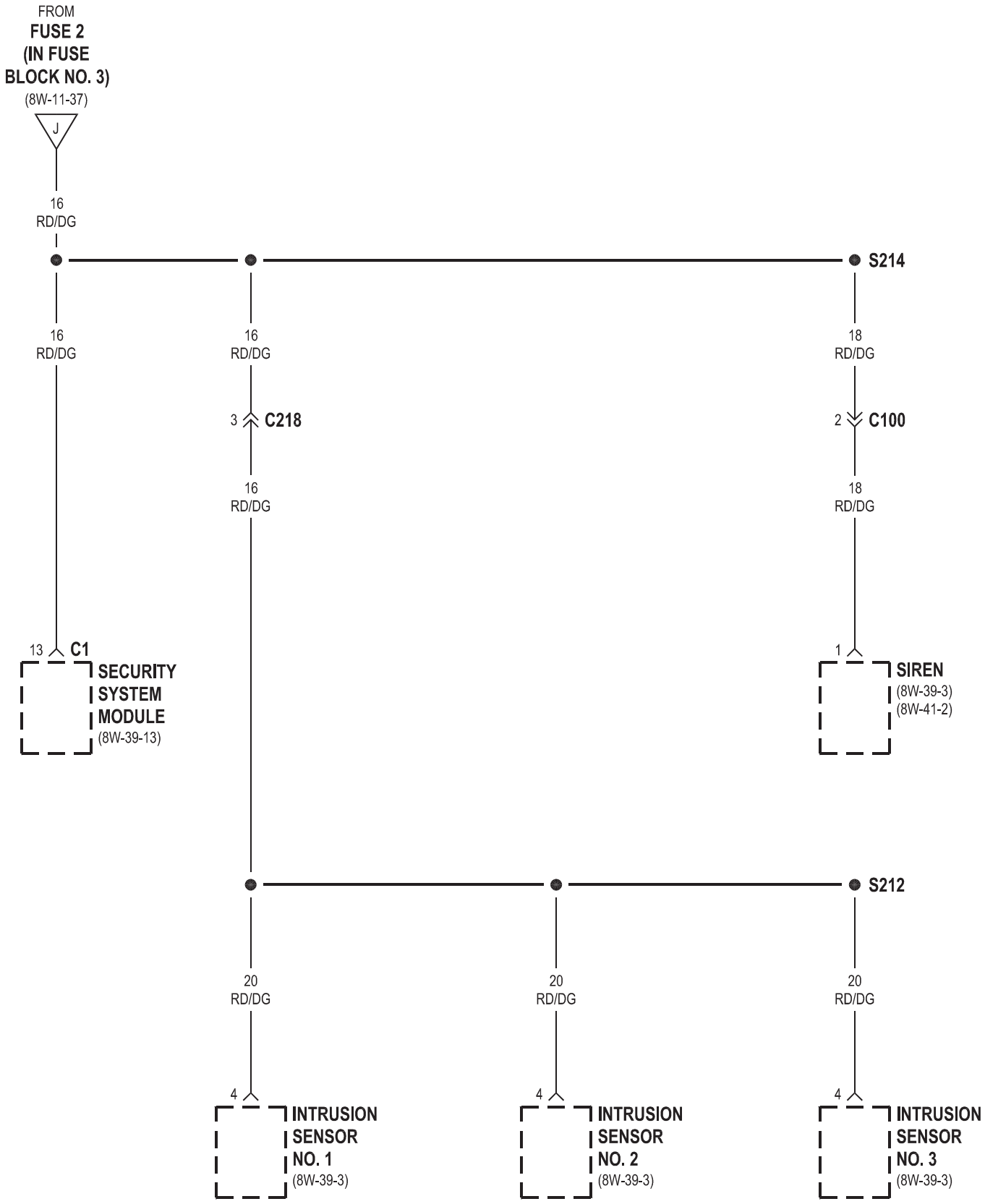


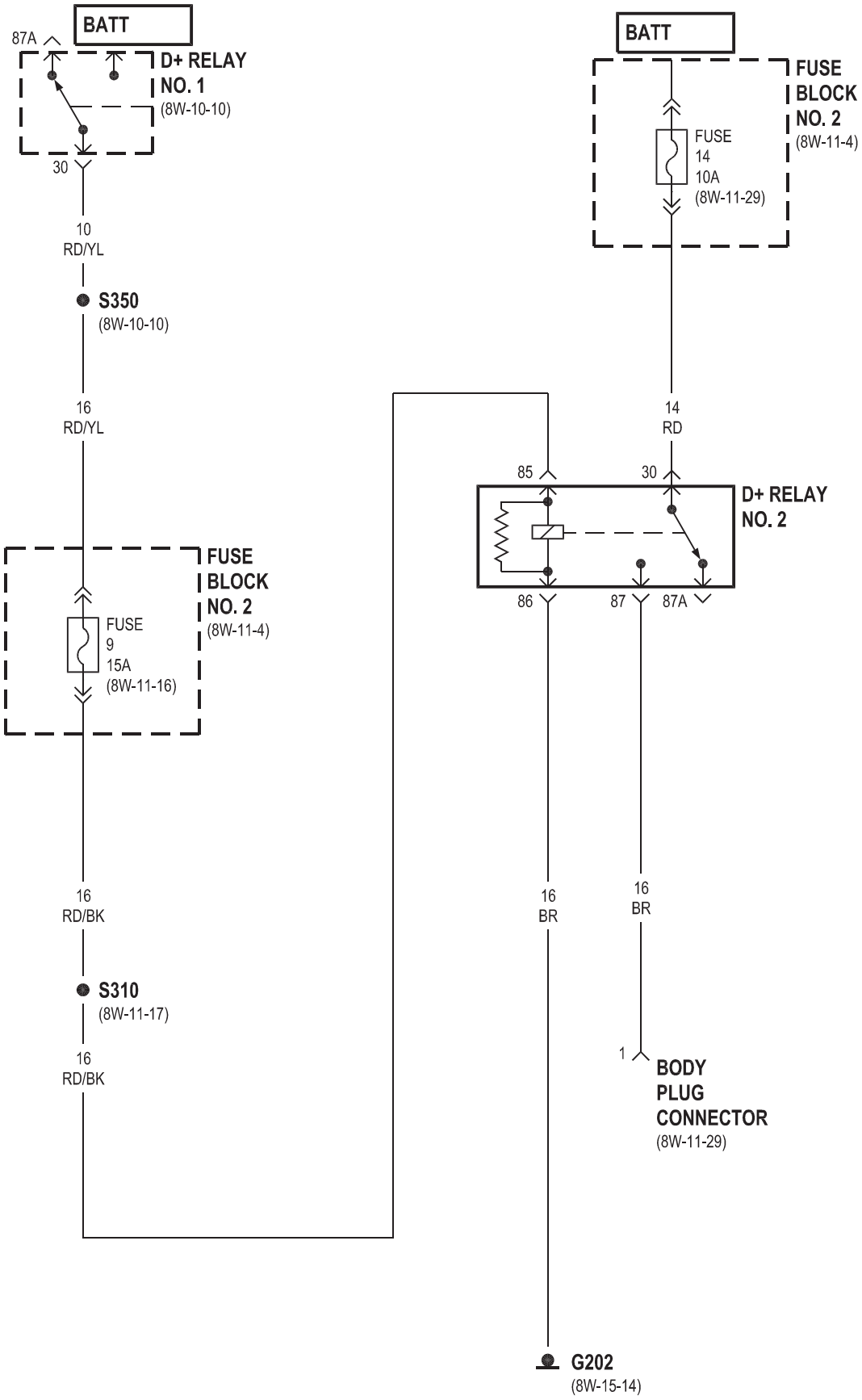
VA301135 J038W-24


FROM
FUSE 8
(IN FUSE
BLOCK NO. 2)
(8W-11-35)
G
16
WT/RD
9
C201
18
BK/RD
S202
18
BK/RD
1
POWER
MIRROR
MOTOR-
PASSENGER
(8W-62-2)
10
BK/RD
2
C211
18
BK/RD
S305
18
BK/RD
7
POWER
MIRROR
SWITCH
(8W-62-3)
18
BK/RD
1
16
BK/RD
POWER
MIRROR
MOTOR-
DRIVER
(8W-62-2)

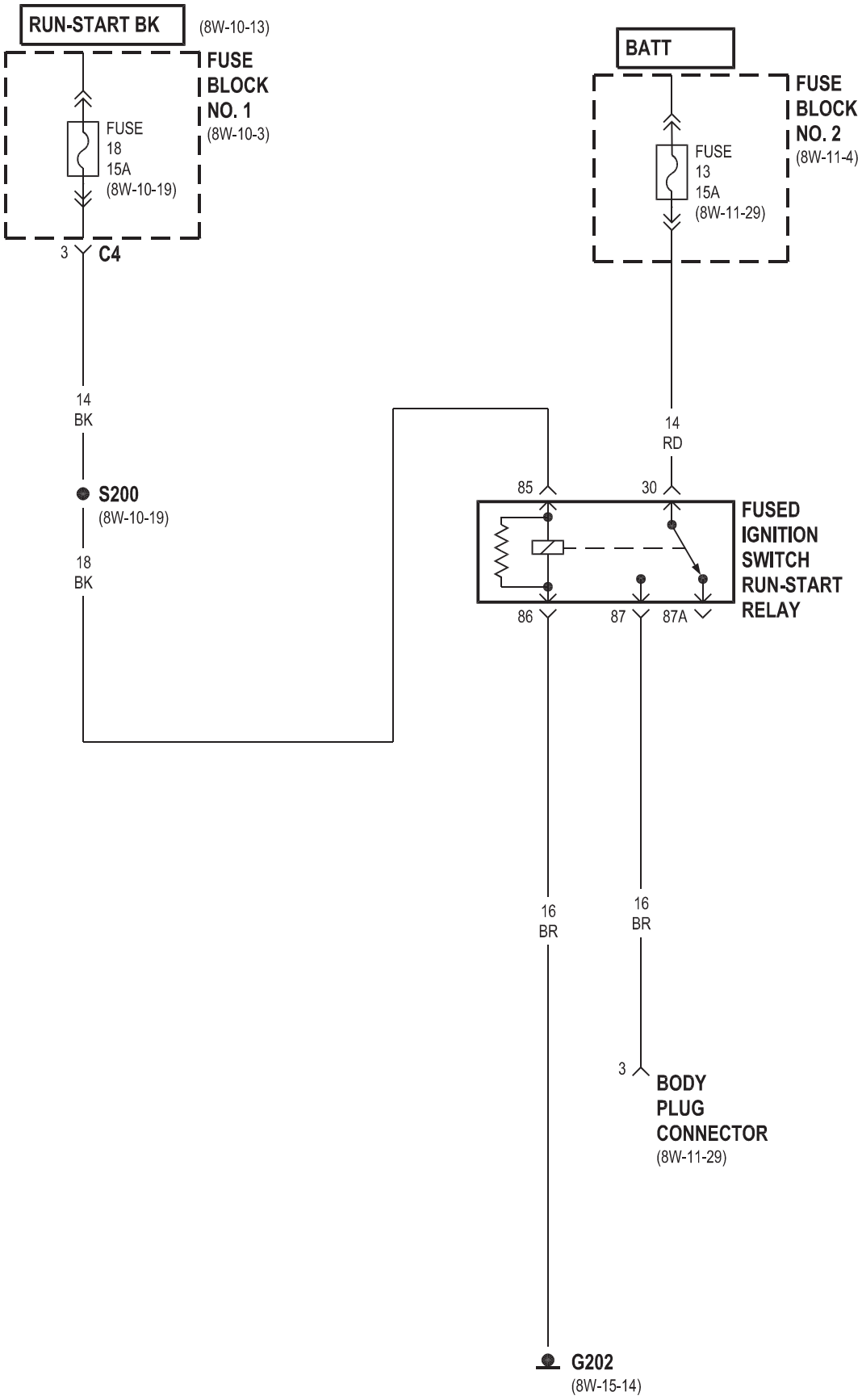


VA301137 J038W-24


FROM
FUSE 2
(IN FUSE
BLOCK NO. 3)
(8W-11-37)
J
16
RD/DG
S214
16
RD/DG
16
RD/DG
18
RD/DG
3 C218
2 C100
16
RD/DG
18
RD/DG
13 C1
SECURITY
SYSTEM
MODULE
(8W-39-13)
1
SIREN
(8W-39-3)
(8W-41-2)
S212
20
RD/DG
20
RD/DG
20
RD/DG
4
INTRUSION
SENSOR
NO. 1
(8W-39-3)
4
INTRUSION
SENSOR
NO. 2
(8W-39-3)
4
INTRUSION
SENSOR
NO. 3
(8W-39-3)



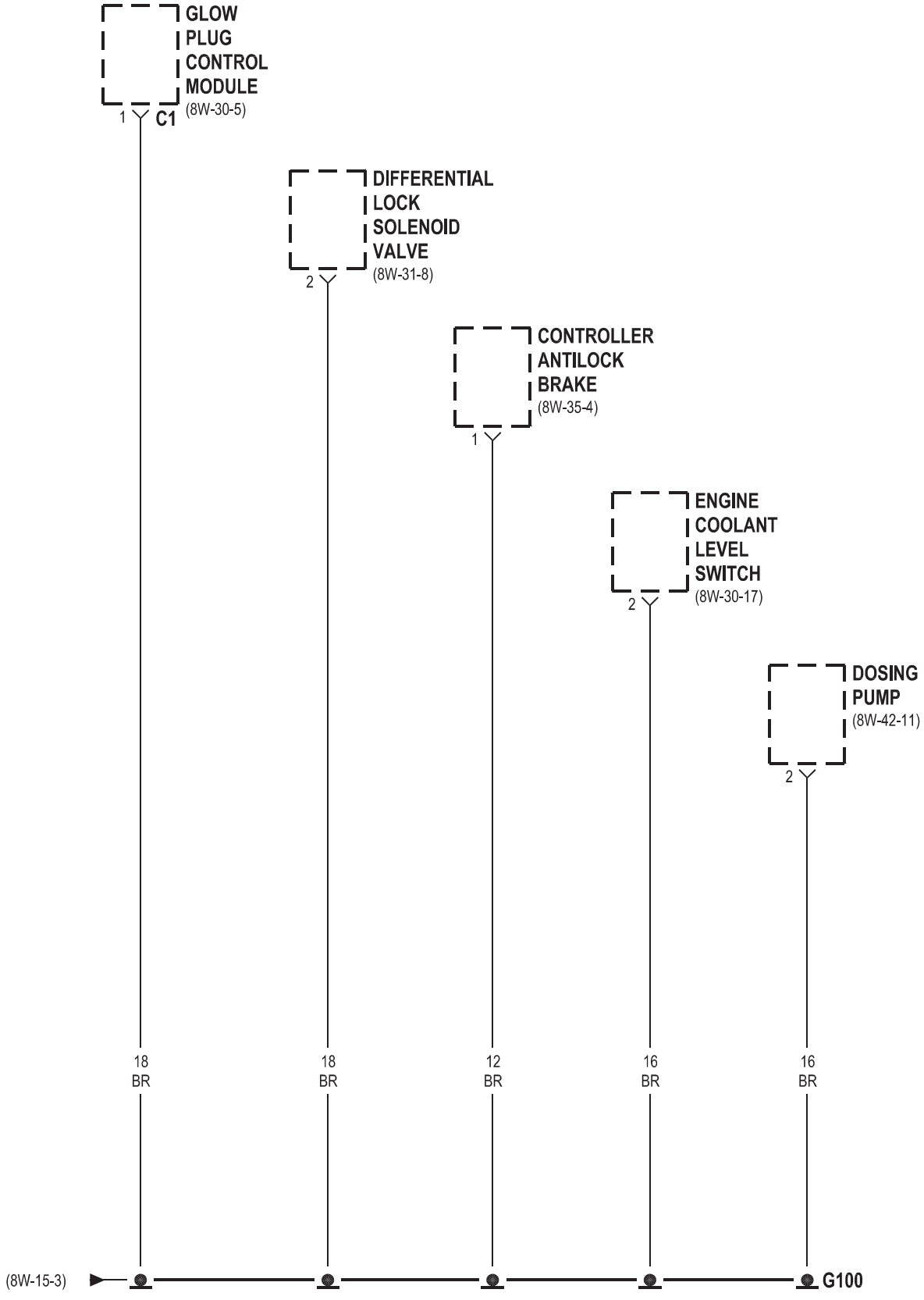
VA301139 J038W-24

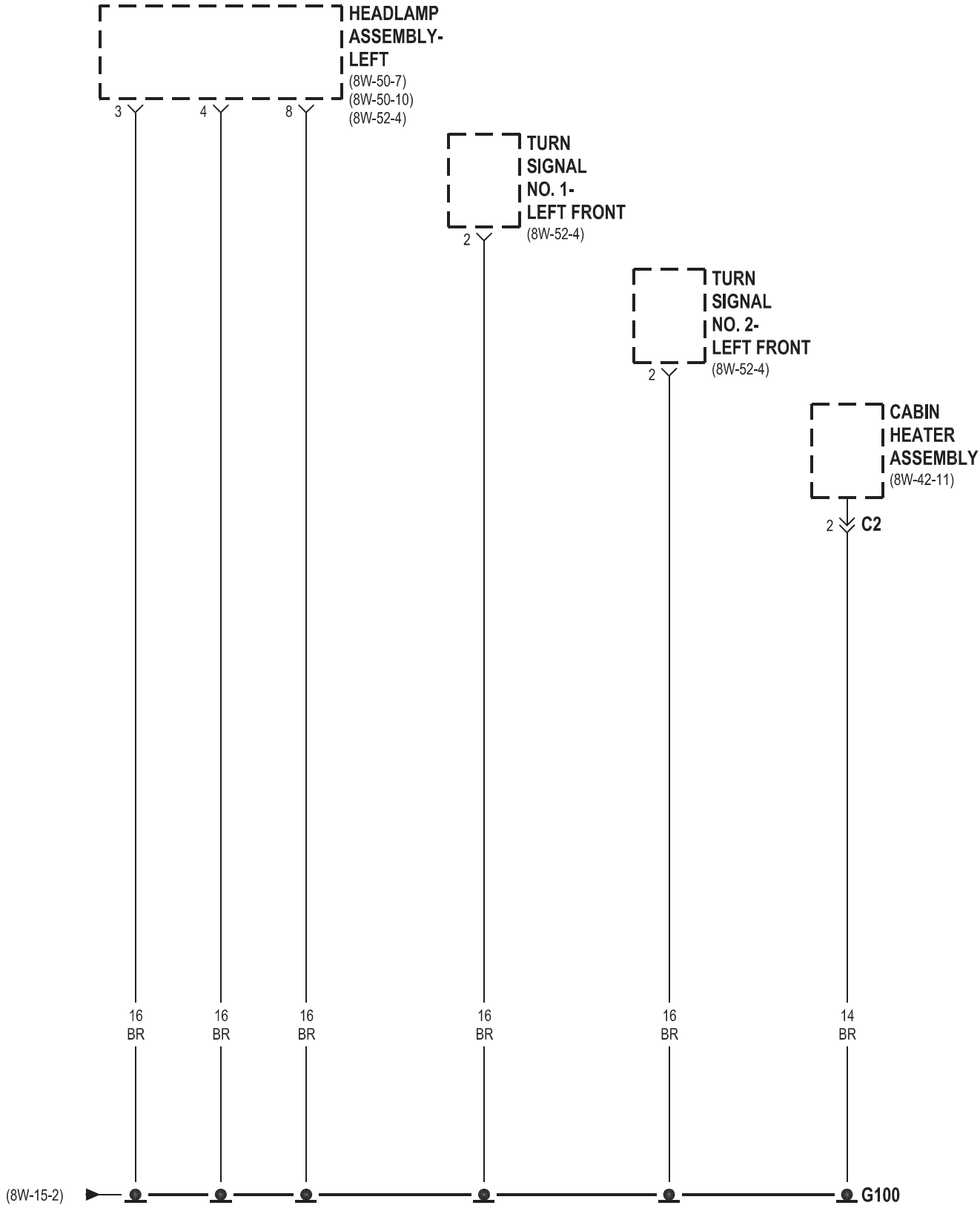

RUN-START BK
(8W-10-13)
FUSE BLOCK NO. 1
(8W-10-3)
FUSE 18 15A
(8W-10-19)
3
C4
14 BK
S200
(8W-10-19)
18 BK
BATT
FUSE BLOCK NO. 2
(8W-11-4)
FUSE 13 15A
(8W-11-29)
14 RD
85
30
86
87
87A
FUSED IGNITION SWITCH RUN-START RELAY
16 BR
16 BR
3
BODY PLUG CONNECTOR
(8W-11-29)
G202
(8W-15-14)

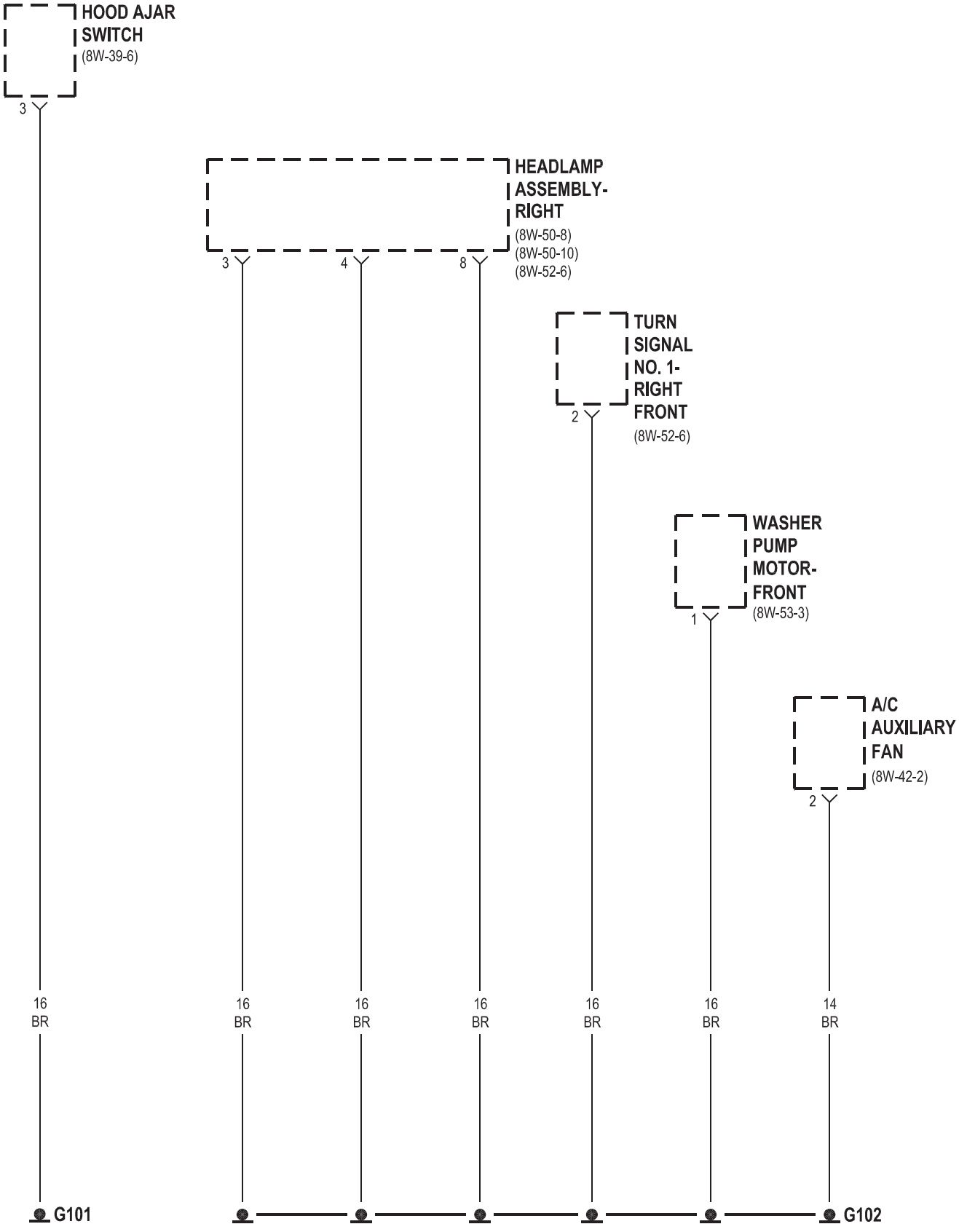
8W-15 GROUND DISTRIBUTION

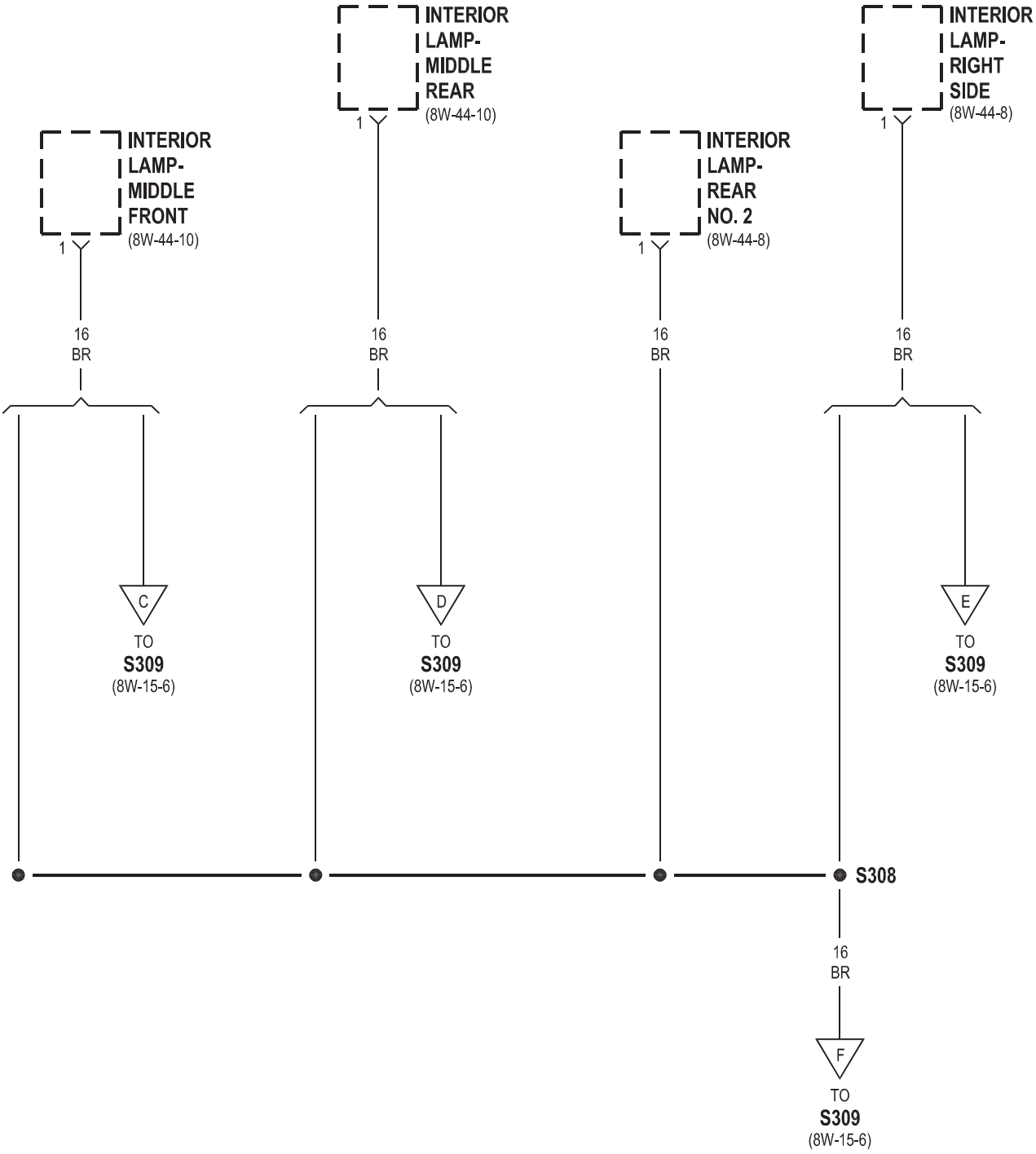
Component	Page
A/C Auxiliary Fan	8W-15-4
A/C Auxiliary Fan Relay	8W-15-12
A/C Control Module- Roof	8W-15-28
A/C Fan Switch	8W-15-21
A/C Switch- Roof	8W-15-24, 28
Airbag Control Module	8W-15-11
Ash Receiver Lamp	8W-15-22
Automatic Temperature Control Module	8W-15-24
Auxiliary Heater Relay	8W-15-12
Auxiliary Heater Switch	8W-15-24
Battery	8W-15-8
Battery Relay- Auxiliary	8W-15-11
Battery- Auxiliary	8W-15-11
Blower Motor- Front	8W-15-9
Brake Fluid Level Switch	8W-15-8
Brake Wear Sensor- Left Front	8W-15-8
Brake Wear Sensor- Left Rear	8W-15-28
Brake Wear Sensor- Right Front	8W-15-8
Brake Wear Sensor- Right Rear	8W-15-28
Cabin Heater Assembly	8W-15-3
Center High Mounted Stop Lamp	8W-15-6
Central Timer Module	8W-15-15
Cigar Lighter	8W-15-22
Cigar Lighter Lamp	8W-15-22
Circulation Pump	8W-15-9
Circulation Pump Relay	8W-15-12
Clockspring	8W-15-10
Controller Antilock Brake	8W-15-2, 28
CTEL Connector	8W-15-21
Cylinder Lock Switch- Driver	8W-15-7, 10
D+ Relay No. 1	8W-15-12
D+ Relay No. 2	8W-15-14
Data Link Connector	8W-15-10
Daytime Running Lamp Relay- Left Side	8W-15-13
Daytime Running Lamp Relay- Right Side	8W-15-13
Daytime Running Lamps Relay	8W-15-13
Differential Lock Solenoid Valve	8W-15-2
Dome Lamp	8W-15-6
Dosing Pump	8W-15-2
Engine Control Module	8W-15-7
Engine Coolant Level Switch	8W-15-2
Fan Stage 1 Relay	8W-15-11
Fog Lamp Relay	8W-15-11
Fog Lamp Switch	8W-15-22
Fuse Block No. 1	8W-15-7
Fused Ignition Switch Run-Start Relay	8W-15-14
G100	8W-15-2, 3
G101	8W-15-4
G102	8W-15-4
G200	8W-15-6, 7, 8, 9, 10
G201	8W-15-11
G202	8W-15-11, 12, 13, 14, 15, 16, 17, 18, 19
G203	8W-15-20, 21, 22, 23, 24, 25
G300	8W-15-26, 27, 28
G301	8W-15-28
G302	8W-15-28
Glow Plug Control Module	8W-15-2
Hazard Warning Switch	8W-15-7
Headlamp Adjust Switch	8W-15-22
Headlamp Assembly- Left	8W-15-3
Headlamp Assembly- Right	8W-15-4
Heat Exchanger Connector	8W-15-12
Heat Exchanger Switch	8W-15-24
Heated Seat Switch- Driver	8W-15-25
Heated Seat Switch- Passenger	8W-15-25
Heater Timer- Auxiliary	8W-15-24
Hood Ajar Switch	8W-15-4
Horn Relay	8W-15-11
Horn Switch	8W-15-10
Ignition Lock Switch	8W-15-10
Instrument Cluster	8W-15-10
Instrument Panel Socket	8W-15-20

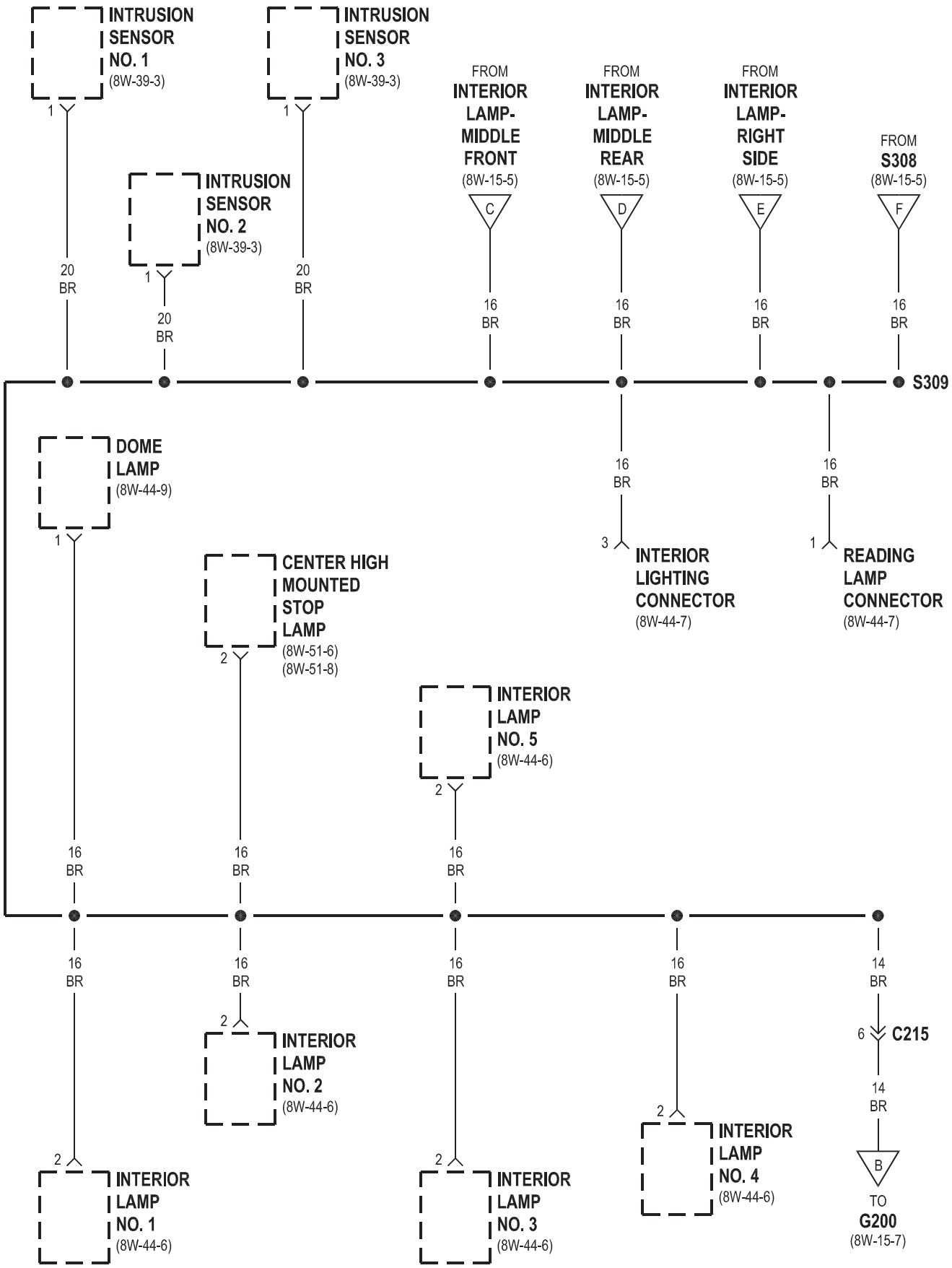
Component	Page
Interior Lamp No. 1	8W-15-6
Interior Lamp No. 2	8W-15-6
Interior Lamp No. 3	8W-15-6
Interior Lamp No. 4	8W-15-6
Interior Lamp No. 5	8W-15-6
Interior Lamp- Middle Front	8W-15-5, 6
Interior Lamp- Middle Rear	8W-15-5, 6
Interior Lamp- Rear No. 2	8W-15-5
Interior Lamp- Right Side	8W-15-5, 6
Interior Light Switch	8W-15-21
Interior Lighting Connector	8W-15-6
Intrusion Sensor No. 1	8W-15-6
Intrusion Sensor No. 2	8W-15-6
Intrusion Sensor No. 3	8W-15-6
Lamp Relay- Left	8W-15-13
Lamp Relay- Right	8W-15-13
License Plate Lamp No. 1	8W-15-27
License Plate Lamp No. 2	8W-15-27
Locker Switch No. 1	8W-15-20
Map/Reading Lamp Switch	8W-15-21
Marker Lamp Connector	8W-15-17
Marker Lamp No. 1- Left Front	8W-15-16
Marker Lamp No. 1- Right Front	8W-15-16
Marker Lamp No. 2- Left Front	8W-15-16
Marker Lamp No. 2- Right Front	8W-15-16
Marker Lamp- Left Center	8W-15-17
Marker Lamp- Left Rear	8W-15-27
Marker Lamp- Right Center	8W-15-17
Marker Lamp- Right Rear	8W-15-27
Master Door Lock Switch	8W-15-25
Metering Pump	8W-15-18
Multi- Function Switch	8W-15-7
Optional Equipment Relay	8W-15-19
Panic Alarm Switch	8W-15-20
Parking Brake Switch	8W-15-15
Power Mirror Motor- Driver	8W-15-23
Power Mirror Motor- Passenger	8W-15-23
Power Mirror Switch	8W-15-23
Power Window Switch- Driver	8W-15-23
Power Window Switch- Master	8W-15-23
Radio	8W-15-21
Reading Lamp Connector	8W-15-6
Recirculated Air Solenoid Valve	8W-15-9
Seat Belt Switch	8W-15-15
Security System Module	8W-15-15
Sentry Key Remote Entry Module	8W-15-7
Shifter Assembly	8W-15-20
Siren	8W-15-9
Tail Lamp Assembly- Left	8W-15-26
Tail Lamp Assembly- Right	8W-15-26
TCS Switch	8W-15-25
Time Delay Relay	8W-15-17
Towing/Intrusion Sensor On/Off Switch	8W-15-22
Trailer Tow Connector	8W-15-28
Trailer Tow Control Module	8W-15-19
Transmission Control Module	8W-15-19
Transmission Relay	8W-15-19
Turn Signal No. 1- Left Front	8W-15-3
Turn Signal No. 1- Right Front	8W-15-4
Turn Signal No. 2- Left Front	8W-15-3
Warm Air Auxiliary Heater Assembly	8W-15-18
Washer Pump Motor- Front	8W-15-4
Water Cycle Valve	8W-15-9
Window Defogger Module- Rear	8W-15-15
Window Defogger Relay- Left Rear	8W-15-14
Window Defogger Relay- Right Rear	8W-15-14
Window Defogger Switch- Rear	8W-15-20
Window Defogger- Left Rear	8W-15-26
Window Defogger- Right Rear	8W-15-26
Wiper Motor- Front	8W-15-9
Wiper/Turn Signal/Engine Start Control Module	8W-15-7

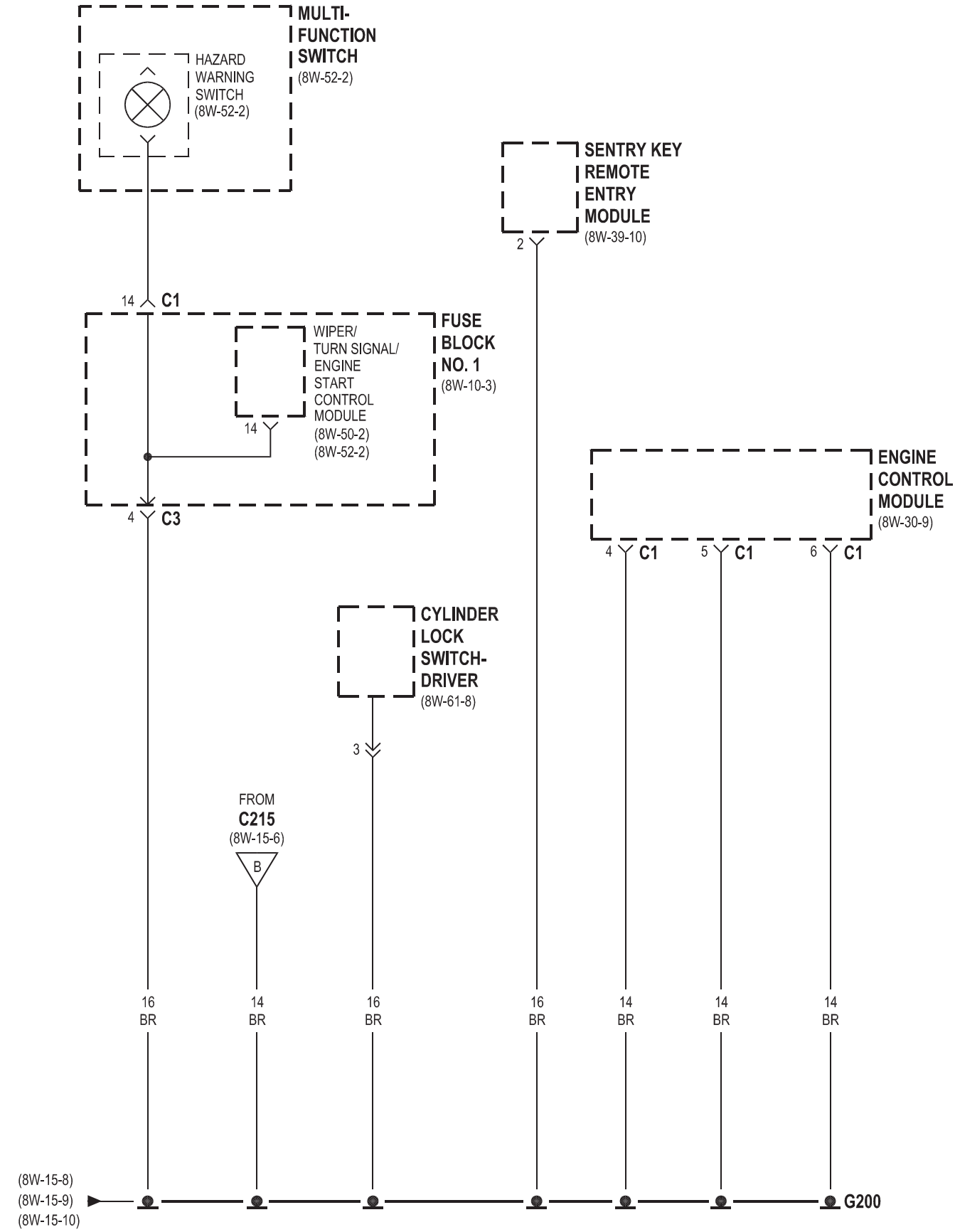

GLOW PLUG CONTROL MODULE
(8W-30-5)
1
C1
DIFFERENTIAL LOCK SOLENOID VALVE
(8W-31-8)
2
CONTROLLER ANTILOCK BRAKE
(8W-35-4)
1
ENGINE COOLANT LEVEL SWITCH
(8W-30-17)
2
DOSING PUMP
(8W-42-11)
2
18 BR
18 BR
12 BR
16 BR
16 BR
(8W-15-3)
G100


HEADLAMP ASSEMBLY-LEFT
(8W-50-7)
(8W-50-10)
(8W-52-4)
3
4
8
TURN SIGNAL NO. 1-LEFT FRONT
(8W-52-4)
2
TURN SIGNAL NO. 2-LEFT FRONT
(8W-52-4)
2
CABIN HEATER ASSEMBLY
(8W-42-11)
2
C2
16 BR
16 BR
16 BR
16 BR
16 BR
14 BR
(8W-15-2)
G100

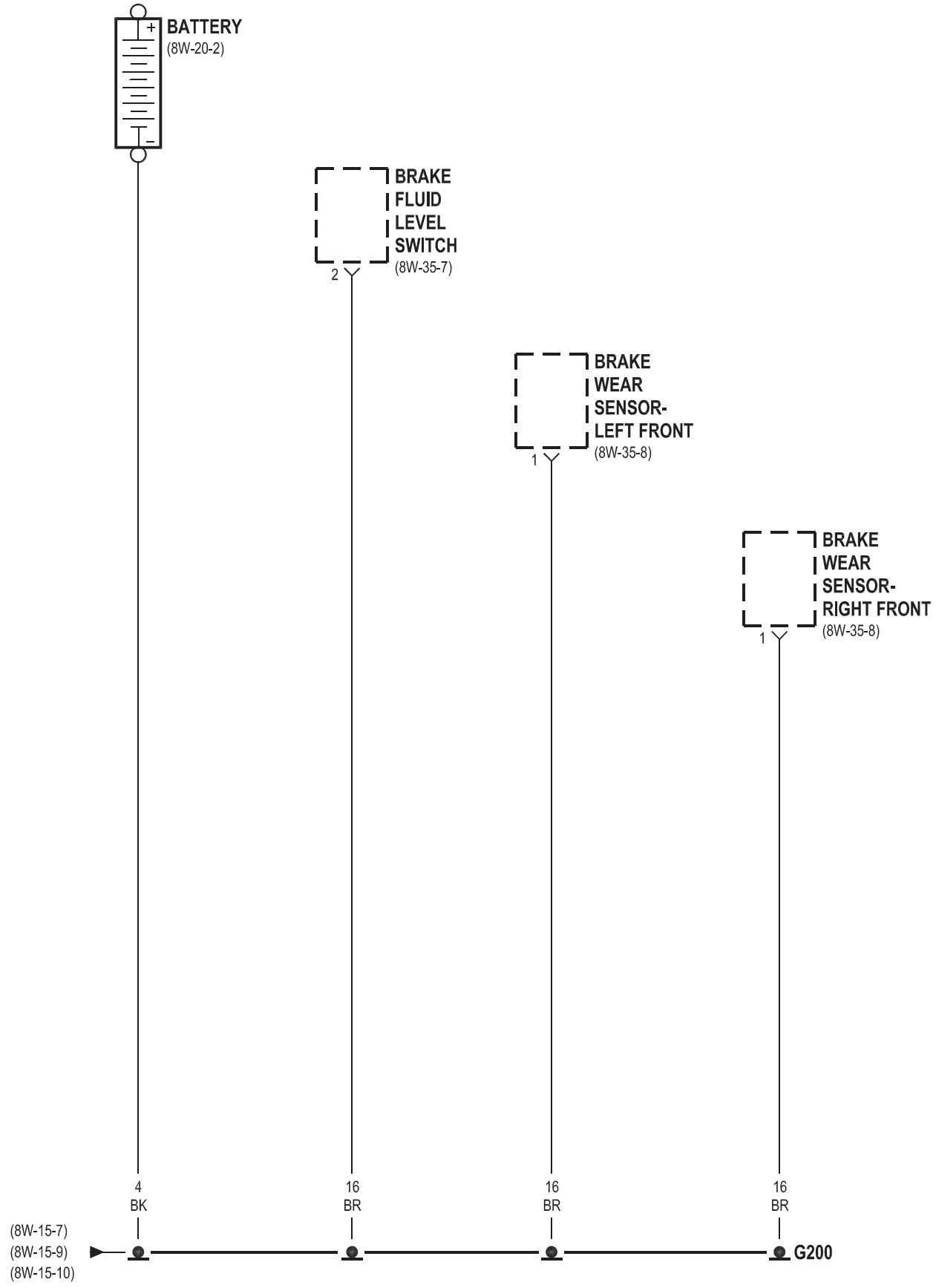

HOOD AJAR SWITCH
(8W-39-6)
3
HEADLAMP ASSEMBLY-RIGHT
(8W-50-8)
(8W-50-10)
(8W-52-6)
3
4
8
TURN SIGNAL NO. 1-RIGHT FRONT
(8W-52-6)
2
WASHER PUMP MOTOR-FRONT
(8W-53-3)
1
A/C AUXILIARY FAN
(8W-42-2)
2
16 BR
16 BR
16 BR
16 BR
16 BR
16 BR
14 BR
G101
G102

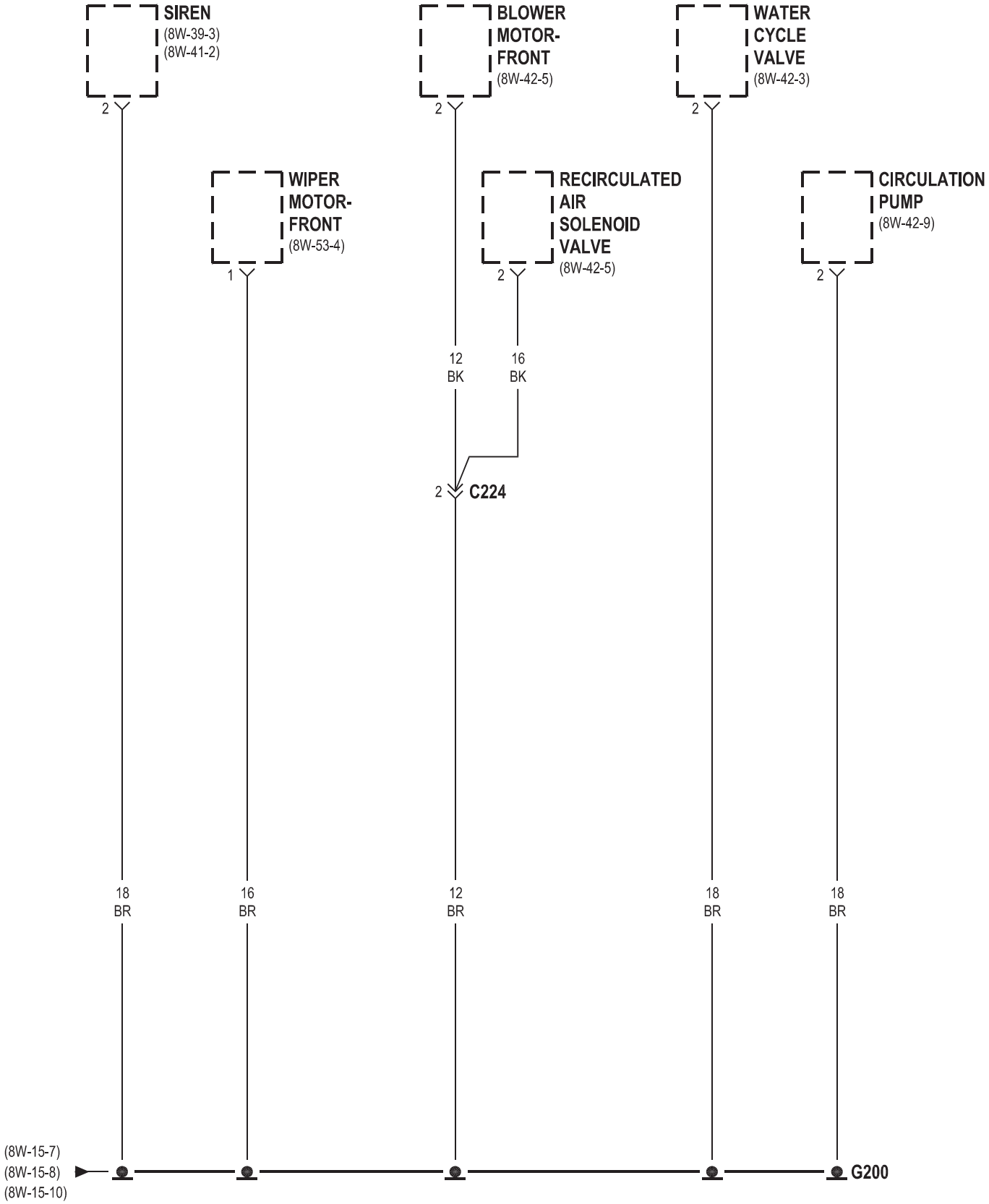

INTERIOR LAMP- MIDDLE FRONT
(8W-44-10)
1
16 BR
C
TO S309
(8W-15-6)
INTERIOR LAMP- MIDDLE REAR
(8W-44-10)
1
16 BR
D
TO S309
(8W-15-6)
INTERIOR LAMP- REAR NO. 2
(8W-44-8)
1
16 BR
INTERIOR LAMP- RIGHT SIDE
(8W-44-8)
1
16 BR
E
TO S309
(8W-15-6)
S308
16 BR
F
TO S309
(8W-15-6)


INTRUSION SENSOR NO. 1 (8W-39-3)
INTRUSION SENSOR NO. 3 (8W-39-3)
INTRUSION SENSOR NO. 2 (8W-39-3)
FROM INTERIOR LAMP-MIDDLE FRONT (8W-15-5)
FROM INTERIOR LAMP-MIDDLE REAR (8W-15-5)
FROM INTERIOR LAMP-RIGHT SIDE (8W-15-5)
FROM S308 (8W-15-5)
S309
DOME LAMP (8W-44-9)
CENTER HIGH MOUNTED STOP LAMP (8W-51-6) (8W-51-8)
INTERIOR LAMP NO. 5 (8W-44-6)
INTERIOR LIGHTING CONNECTOR (8W-44-7)
READING LAMP CONNECTOR (8W-44-7)
INTERIOR LAMP NO. 1 (8W-44-6)
INTERIOR LAMP NO. 2 (8W-44-6)
INTERIOR LAMP NO. 3 (8W-44-6)
INTERIOR LAMP NO. 4 (8W-44-6)
C215
TO G200 (8W-15-7)
20 BR
16 BR
14 BR

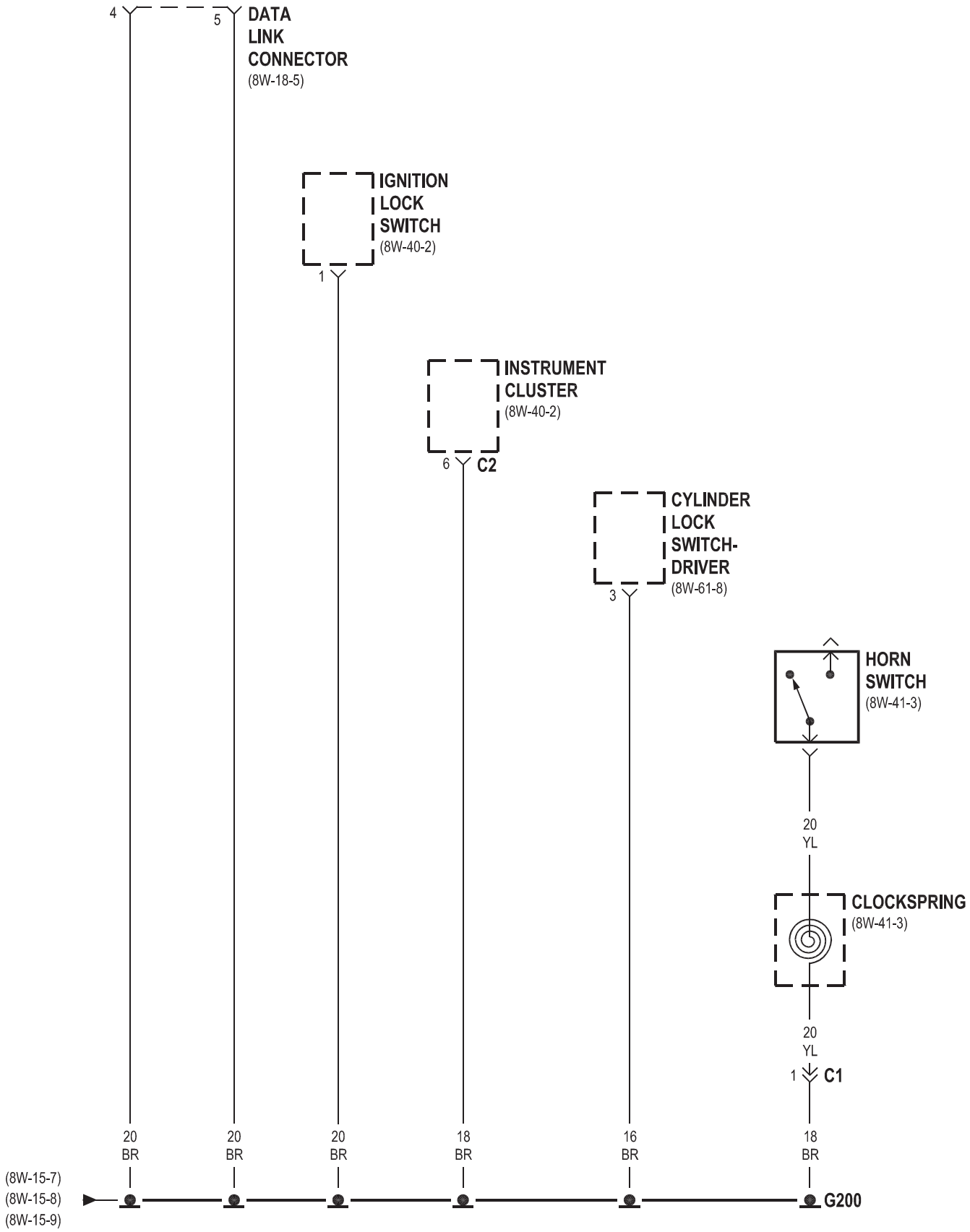


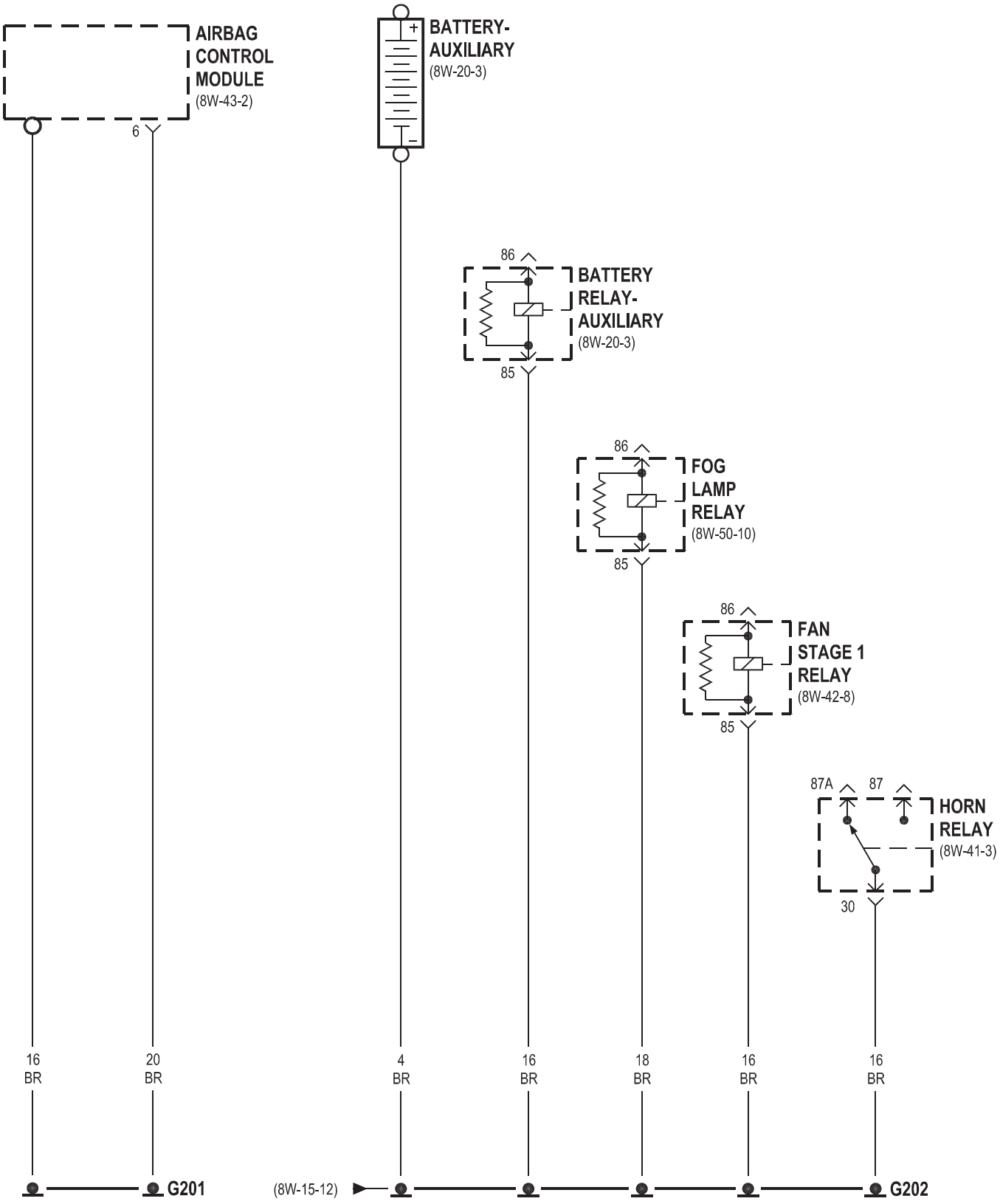
VA301507 J038W-24


BATTERY
(8W-20-2)
BRAKE FLUID LEVEL SWITCH
(8W-35-7)
2
BRAKE WEAR SENSOR- LEFT FRONT
(8W-35-8)
1
BRAKE WEAR SENSOR- RIGHT FRONT
(8W-35-8)
1
4
BK
16
BR
16
BR
16
BR
(8W-15-7)
(8W-15-9)
(8W-15-10)
G200

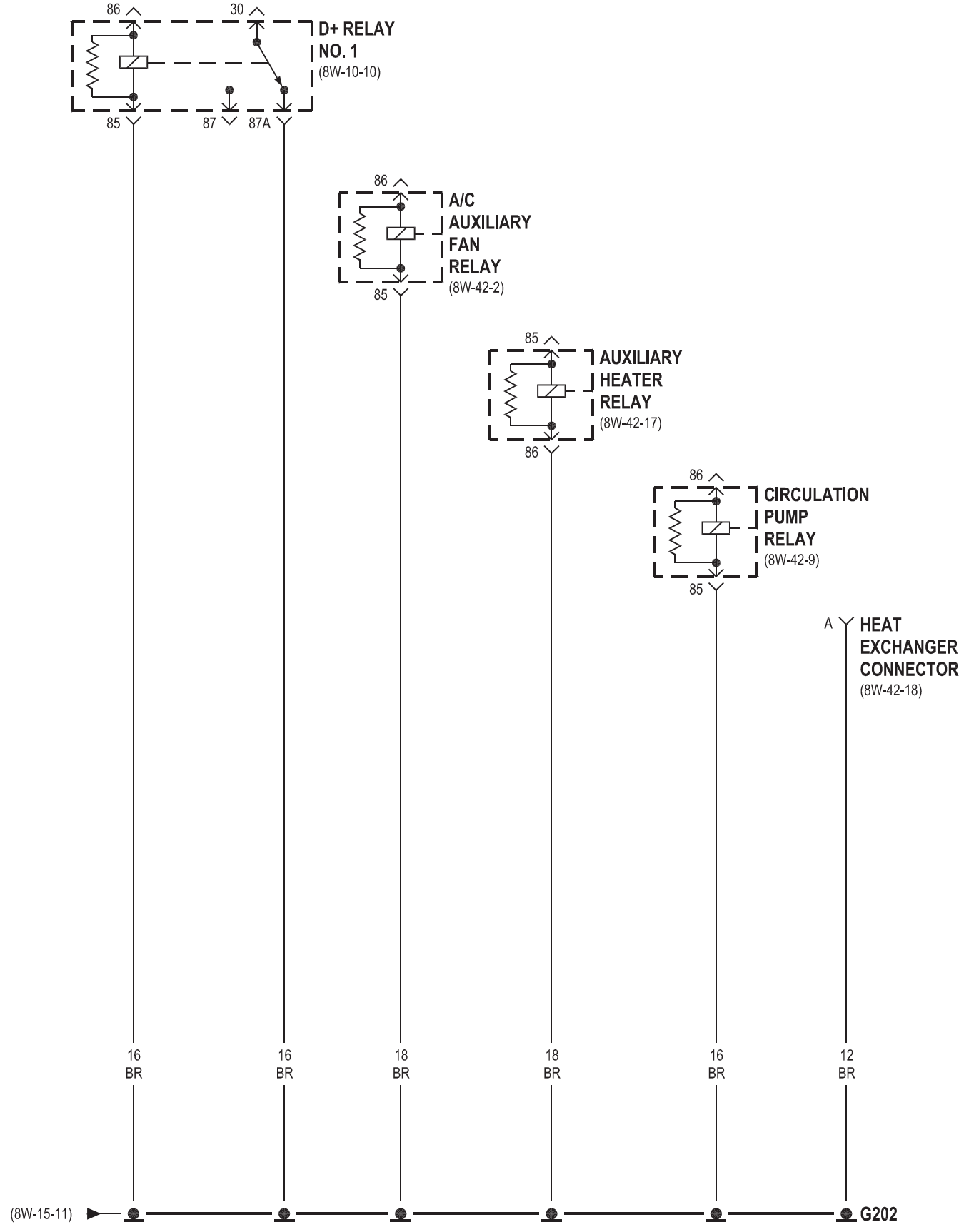


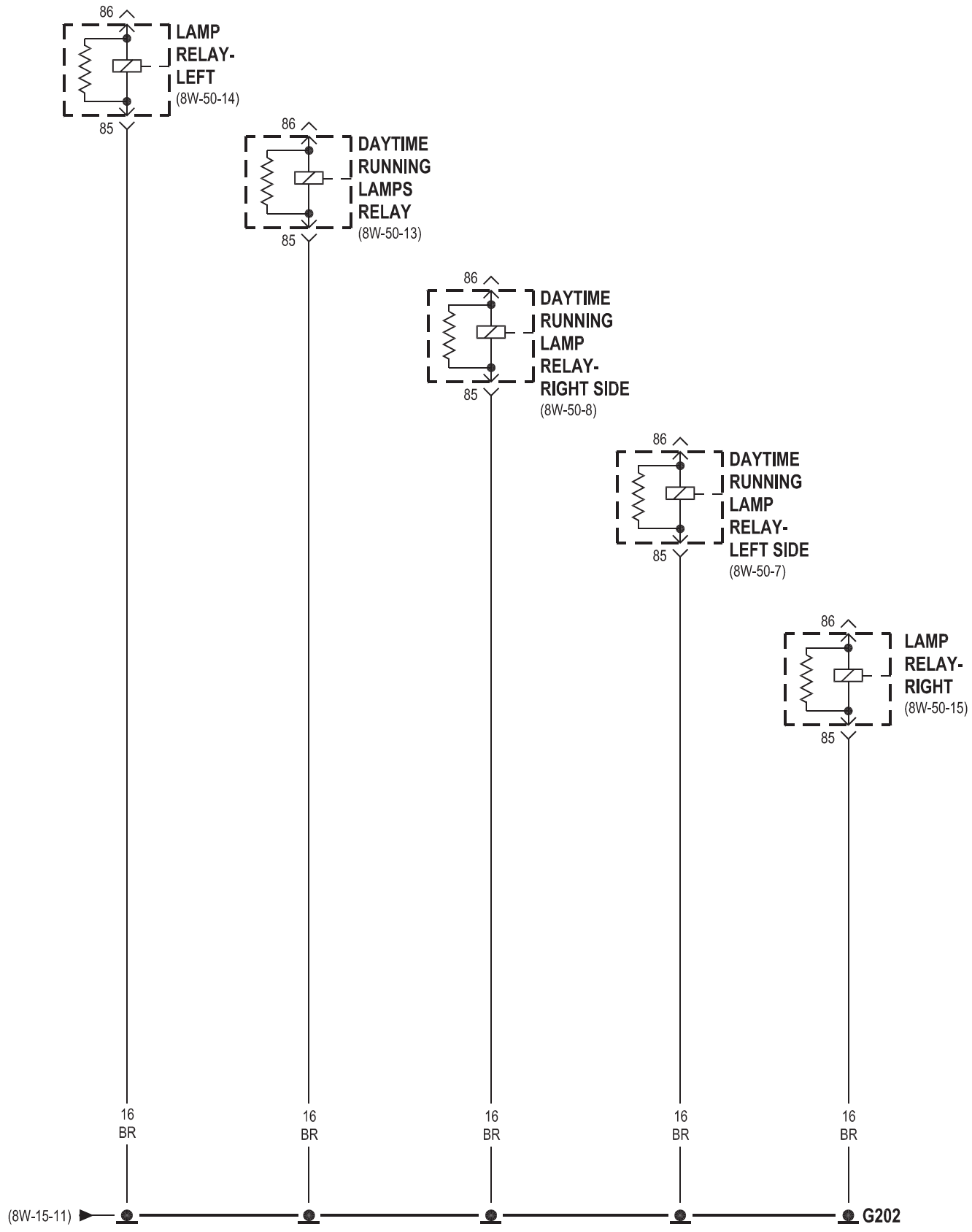
VA301509 J038W-24


4
5
DATA LINK CONNECTOR
(8W-18-5)
IGNITION LOCK SWITCH
(8W-40-2)
1
INSTRUMENT CLUSTER
(8W-40-2)
6
C2
CYLINDER LOCK SWITCH-DRIVER
(8W-61-8)
3
HORN SWITCH
(8W-41-3)
20 YL
CLOCKSPRING
(8W-41-3)
20 YL
1
C1
20 BR
20 BR
20 BR
18 BR
16 BR
18 BR
(8W-15-7)
(8W-15-8)
(8W-15-9)
G200

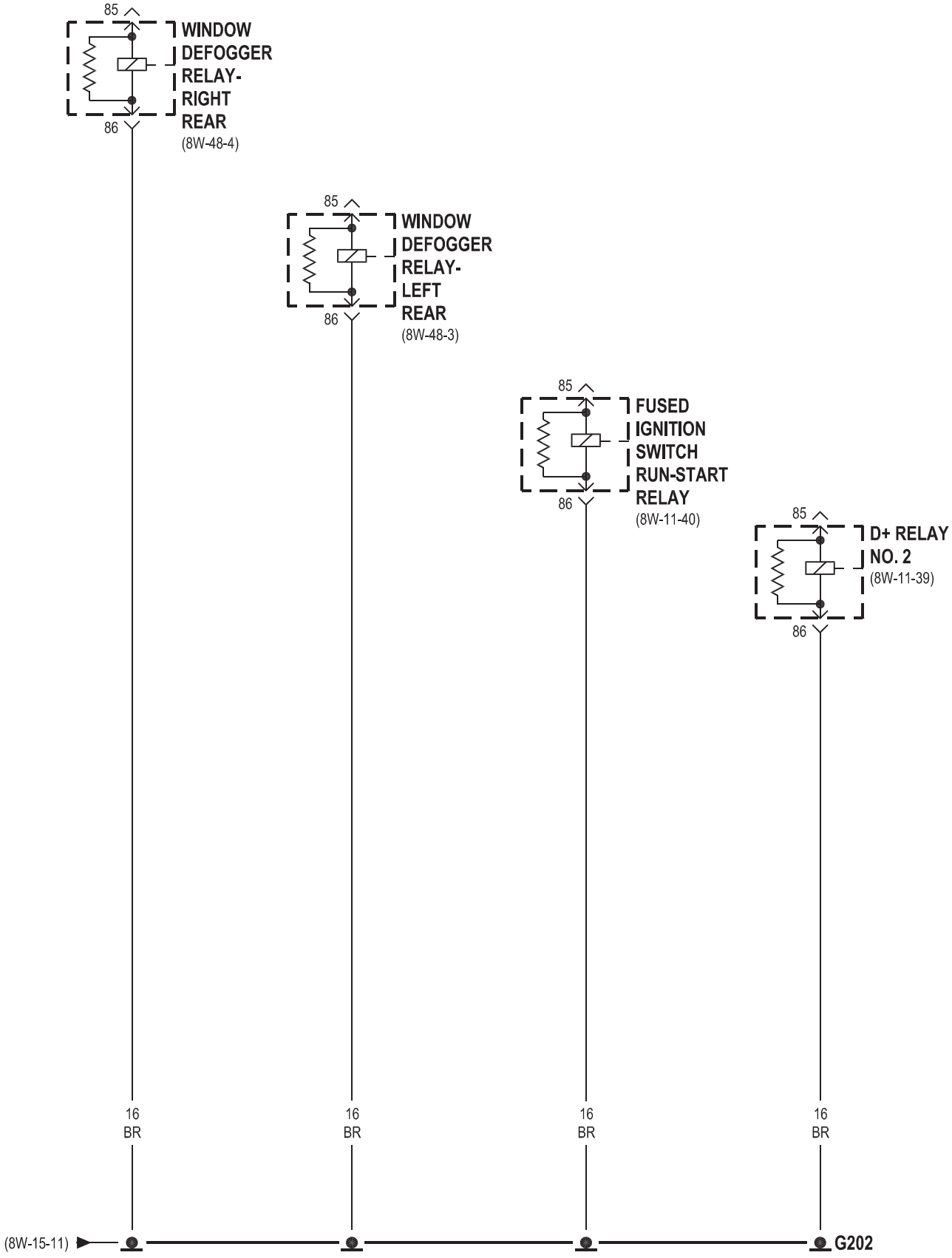


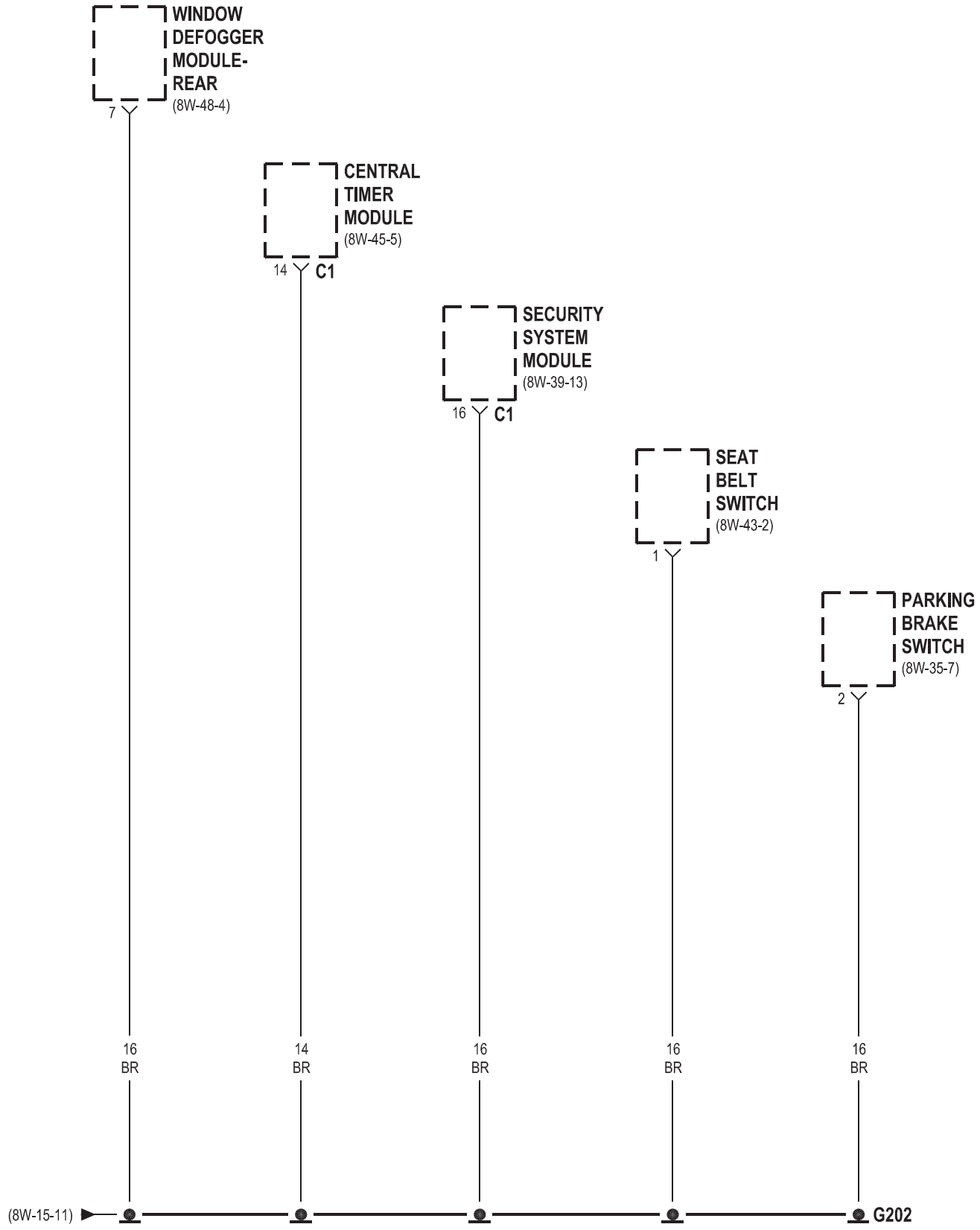
VA301511 J038W-24


86
30
D+ RELAY
NO. 1
(8W-10-10)
85
87
87A
86
A/C
AUXILIARY
FAN
RELAY
(8W-42-2)
85
85
AUXILIARY
HEATER
RELAY
(8W-42-17)
86
86
CIRCULATION
PUMP
RELAY
(8W-42-9)
85
A
HEAT
EXCHANGER
CONNECTOR
(8W-42-18)
16 BR
16 BR
18 BR
18 BR
16 BR
12 BR
(8W-15-11)
G202

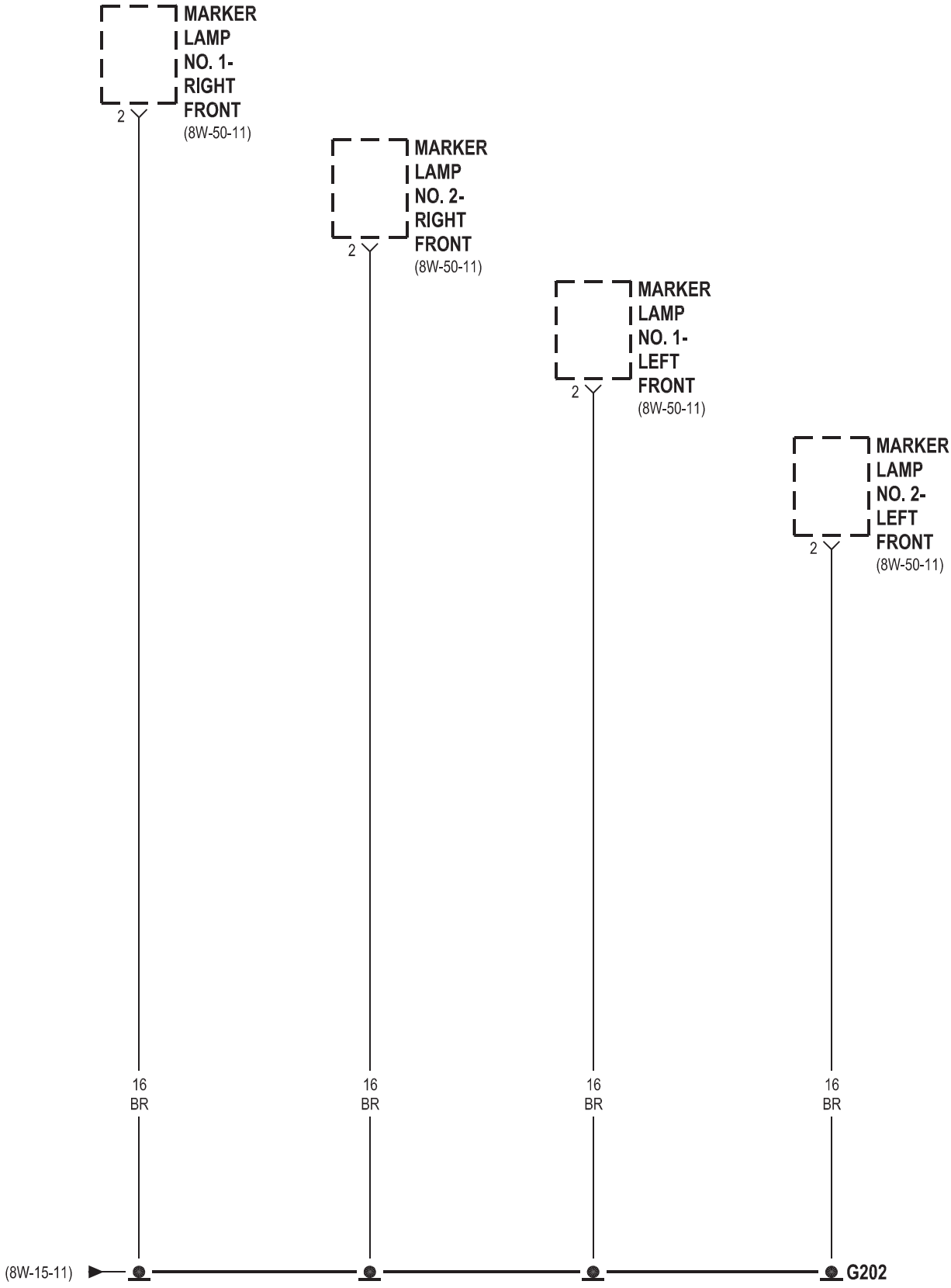


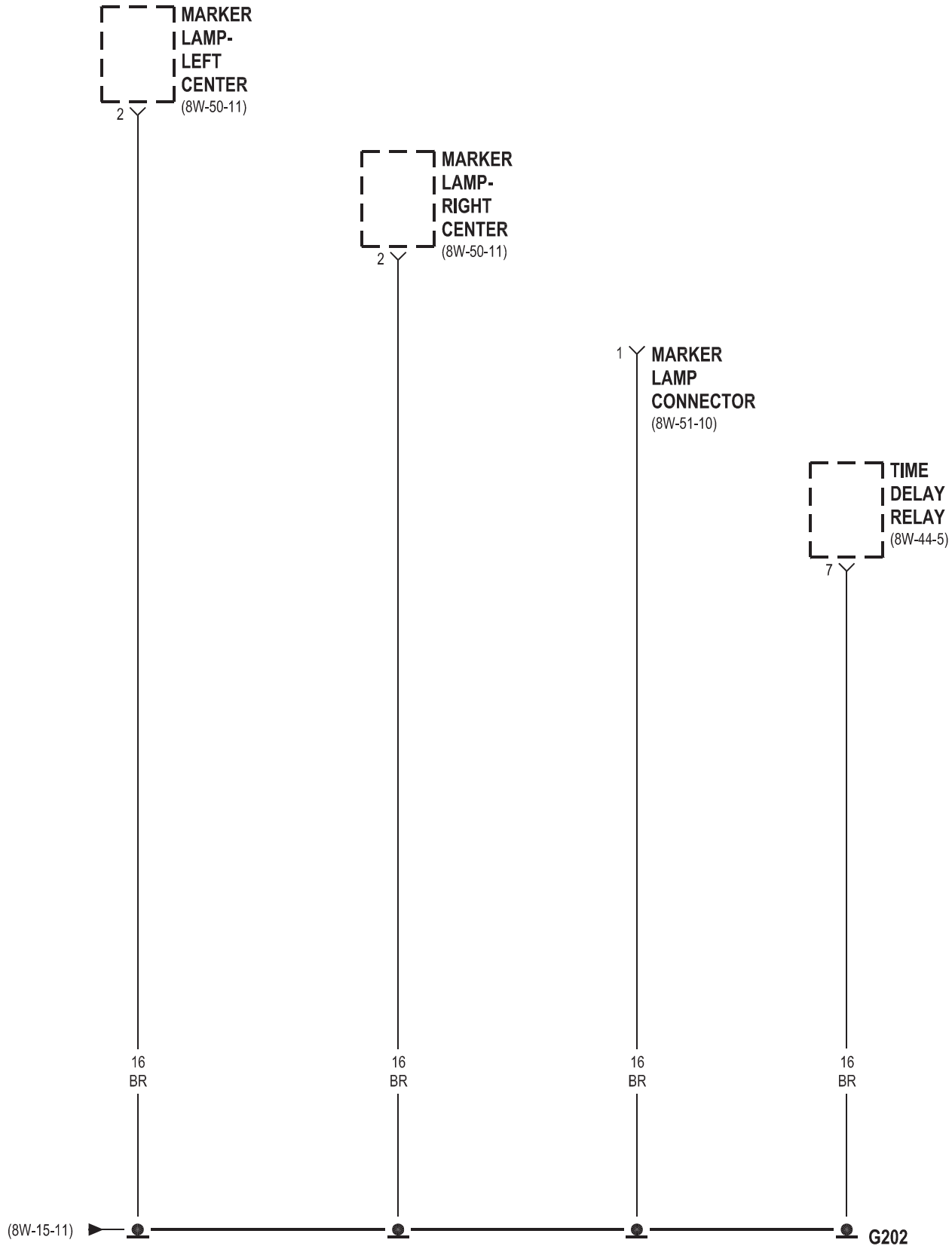
VA301513 J038W-24

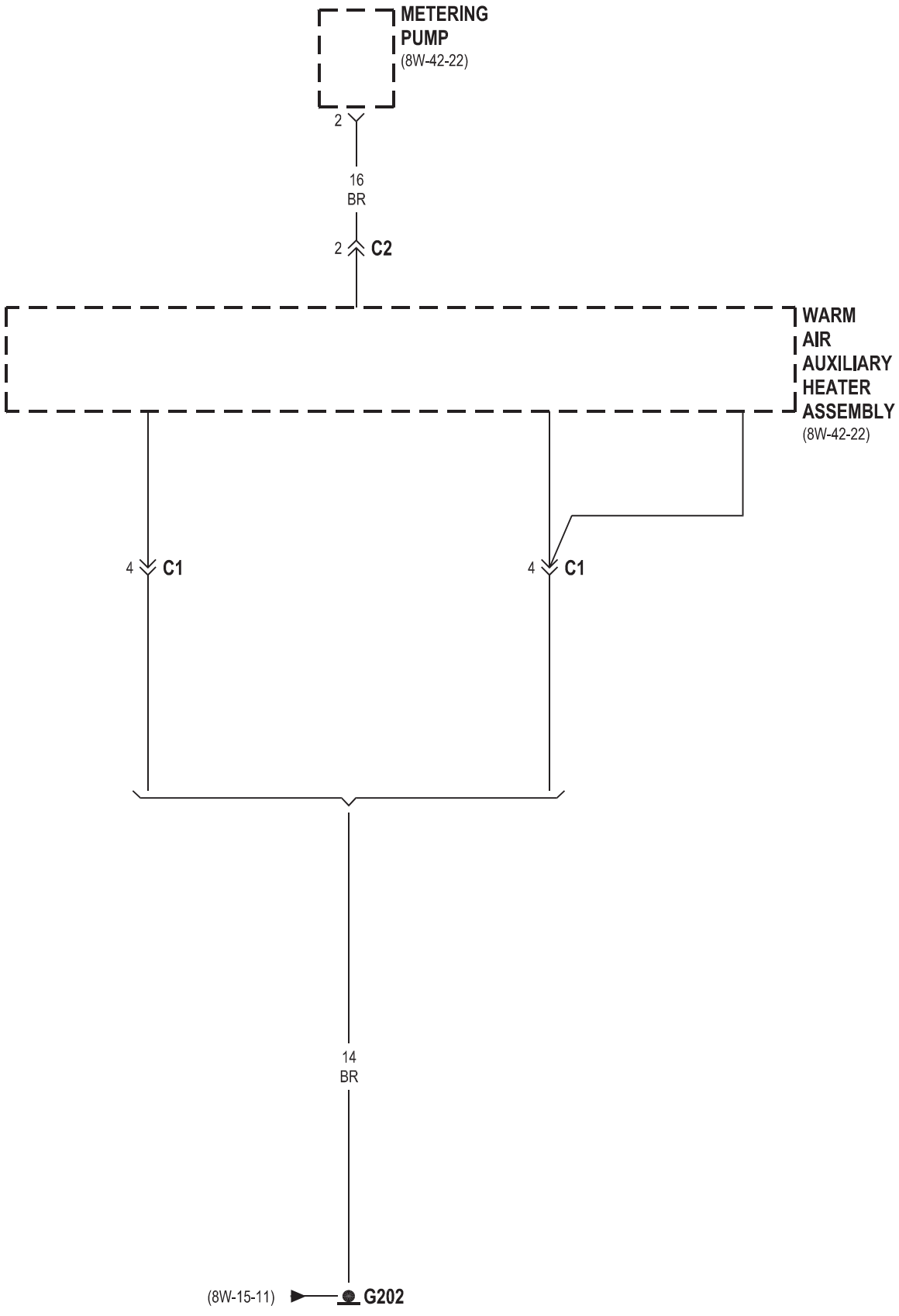

85
WINDOW DEFOGGER RELAY- RIGHT REAR
(8W-48-4)
86
85
WINDOW DEFOGGER RELAY- LEFT REAR
(8W-48-3)
86
85
FUSED IGNITION SWITCH RUN-START RELAY
(8W-11-40)
86
85
D+ RELAY NO. 2
(8W-11-39)
86
16 BR
16 BR
16 BR
16 BR
(8W-15-11)
G202

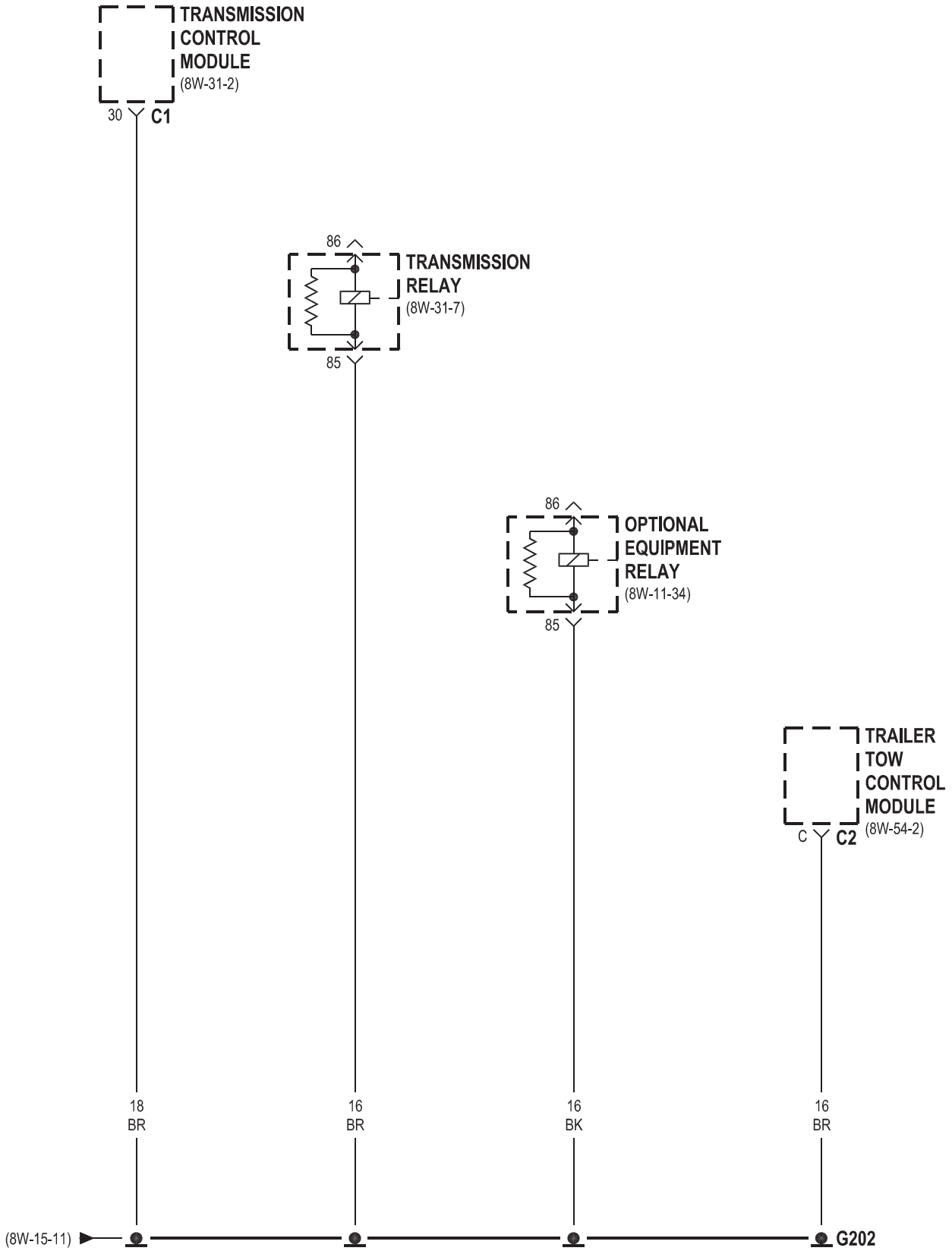


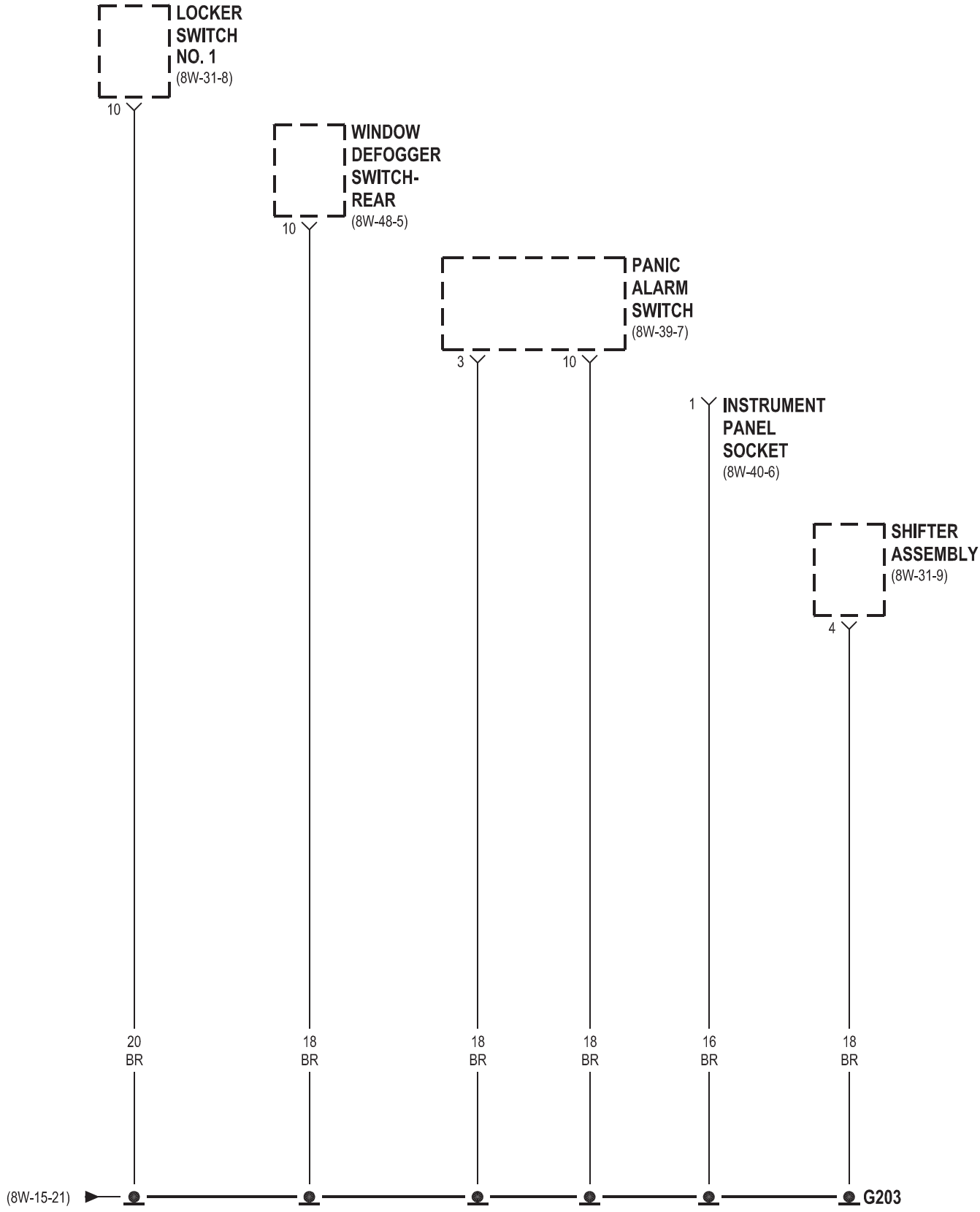
VA301515 J038W-24

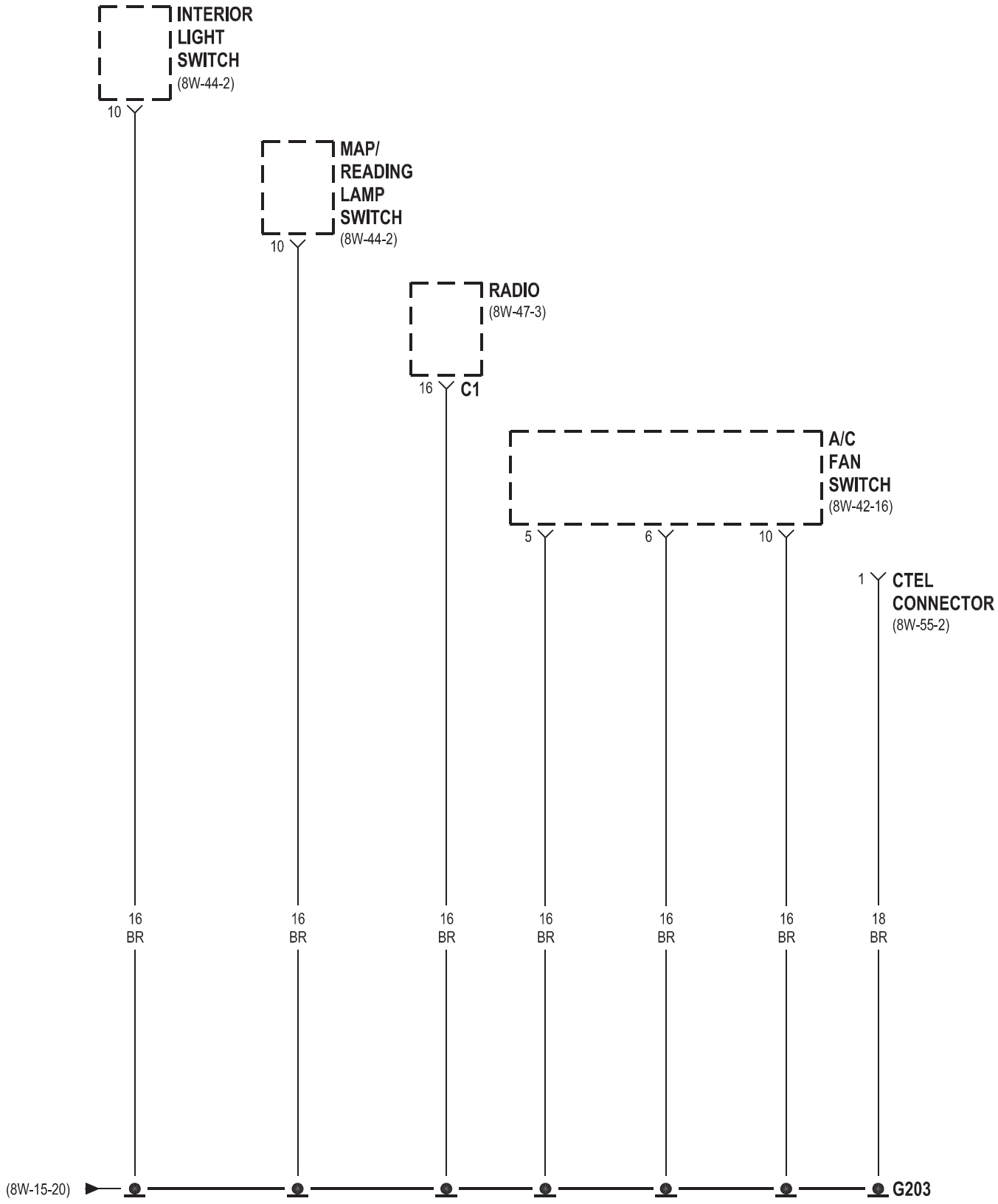

MARKER LAMP NO. 1- RIGHT FRONT
(8W-50-11)
2
MARKER LAMP NO. 2- RIGHT FRONT
(8W-50-11)
2
MARKER LAMP NO. 1- LEFT FRONT
(8W-50-11)
2
MARKER LAMP NO. 2- LEFT FRONT
(8W-50-11)
2
16 BR
16 BR
16 BR
16 BR
(8W-15-11)
G202


MARKER LAMP- LEFT CENTER
(8W-50-11)
2
MARKER LAMP- RIGHT CENTER
(8W-50-11)
2
1
MARKER LAMP CONNECTOR
(8W-51-10)
TIME DELAY RELAY
(8W-44-5)
7
16 BR
16 BR
16 BR
16 BR
(8W-15-11)
G202

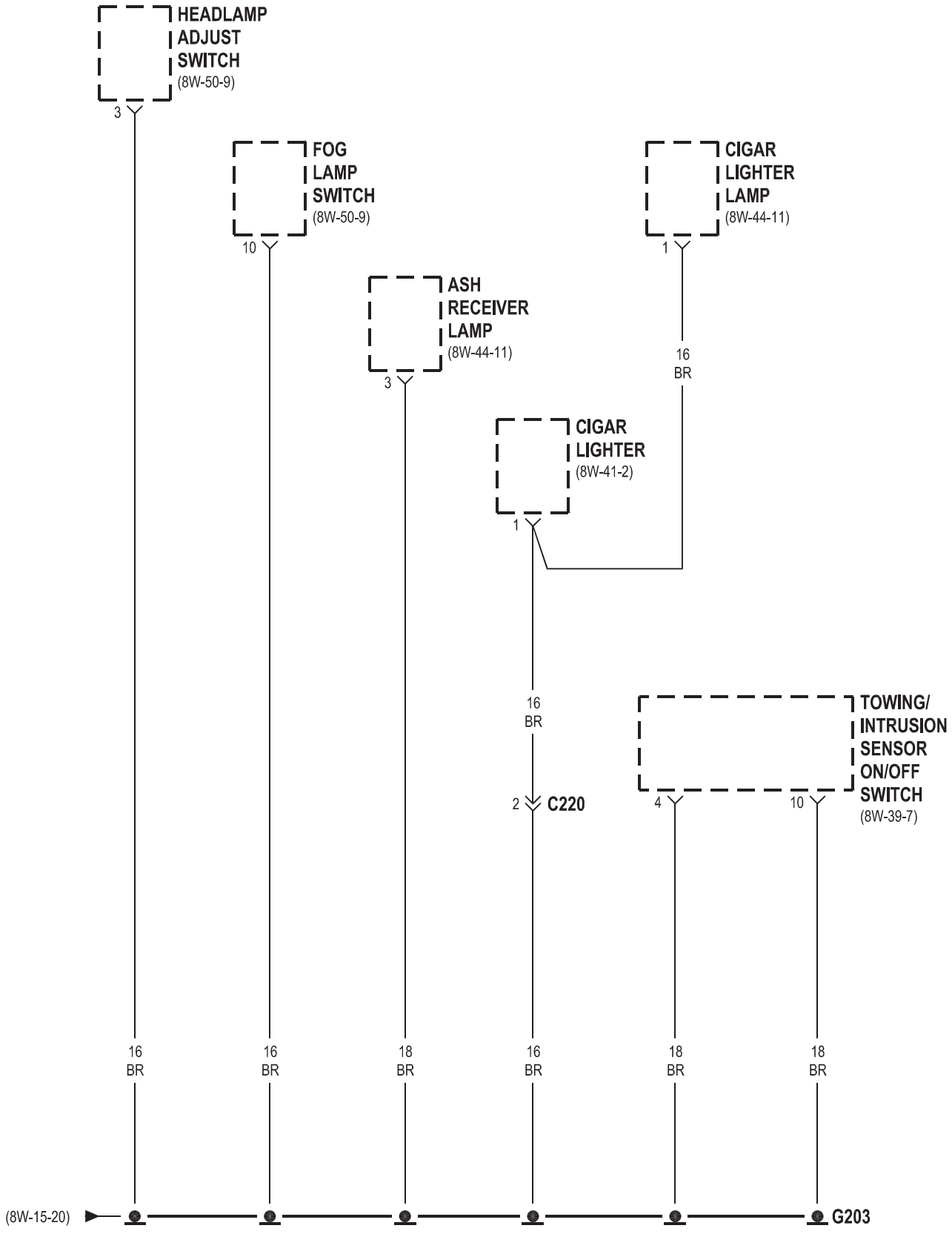

METERING
PUMP
(8W-42-22)
2
16
BR
2
C2
WARM
AIR
AUXILIARY
HEATER
ASSEMBLY
(8W-42-22)
4
C1
4
C1
14
BR
(8W-15-11)
G202

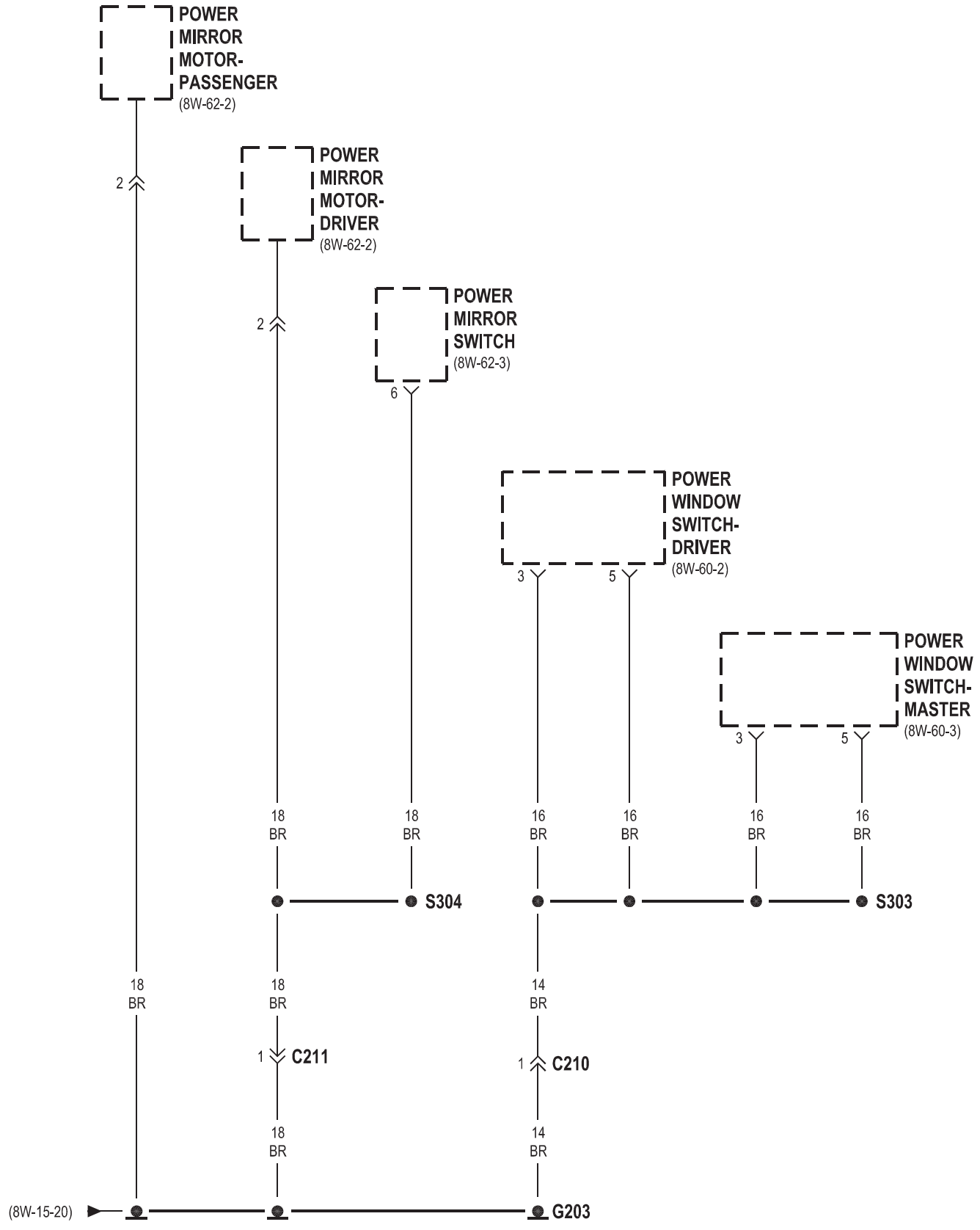

TRANSMISSION CONTROL MODULE
(8W-31-2)
30
C1
86
TRANSMISSION RELAY
(8W-31-7)
85
86
OPTIONAL EQUIPMENT RELAY
(8W-11-34)
85
TRAILER TOW CONTROL MODULE
(8W-54-2)
C
C2
18 BR
16 BR
16 BK
16 BR
(8W-15-11)
G202

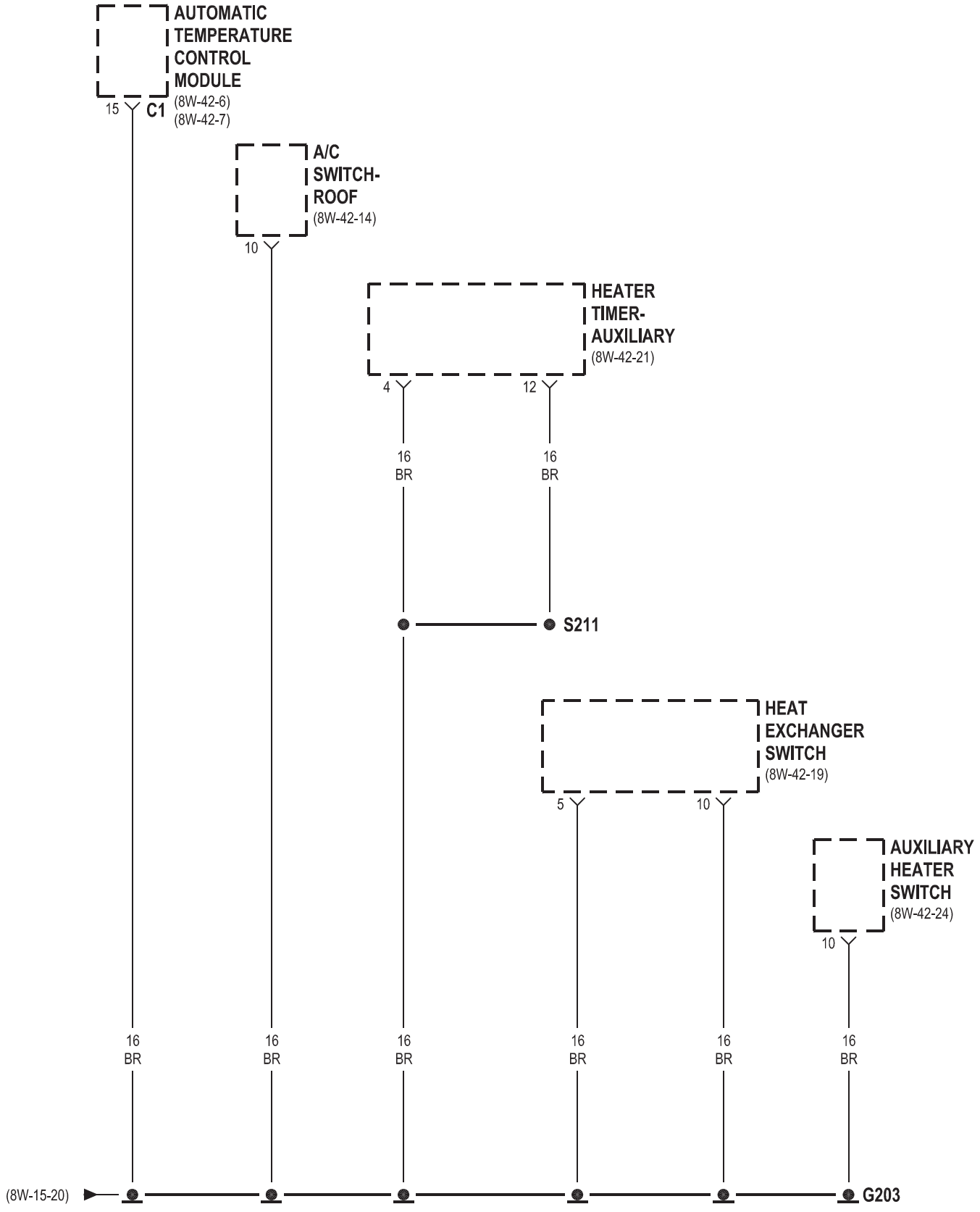

LOCKER SWITCH NO. 1
(8W-31-8)
10
WINDOW DEFOGGER SWITCH-REAR
(8W-48-5)
10
PANIC ALARM SWITCH
(8W-39-7)
3
10
1
INSTRUMENT PANEL SOCKET
(8W-40-6)
SHIFTER ASSEMBLY
(8W-31-9)
4
20 BR
18 BR
18 BR
18 BR
16 BR
18 BR
(8W-15-21)
G203

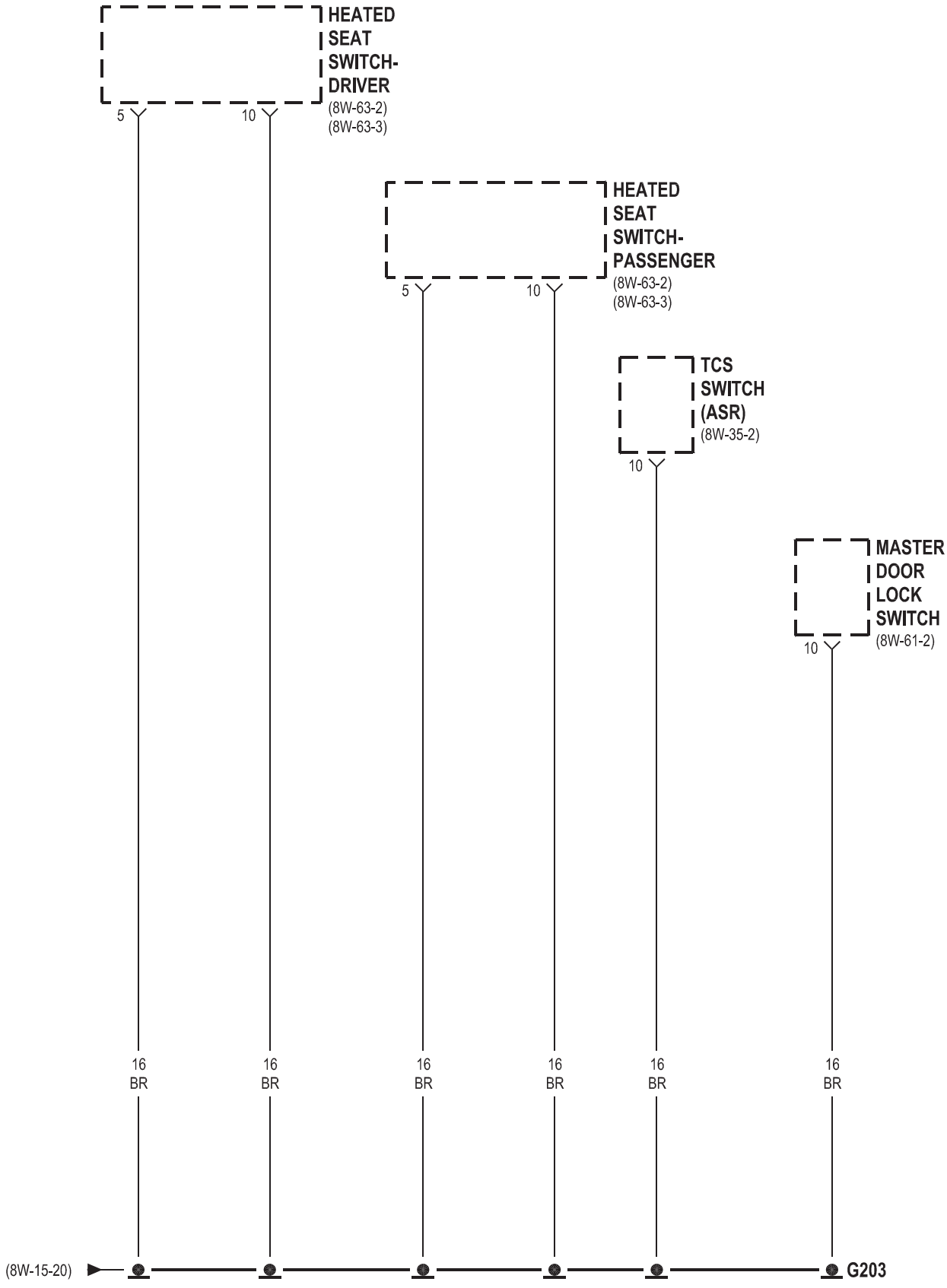


VA301521 J038W-24

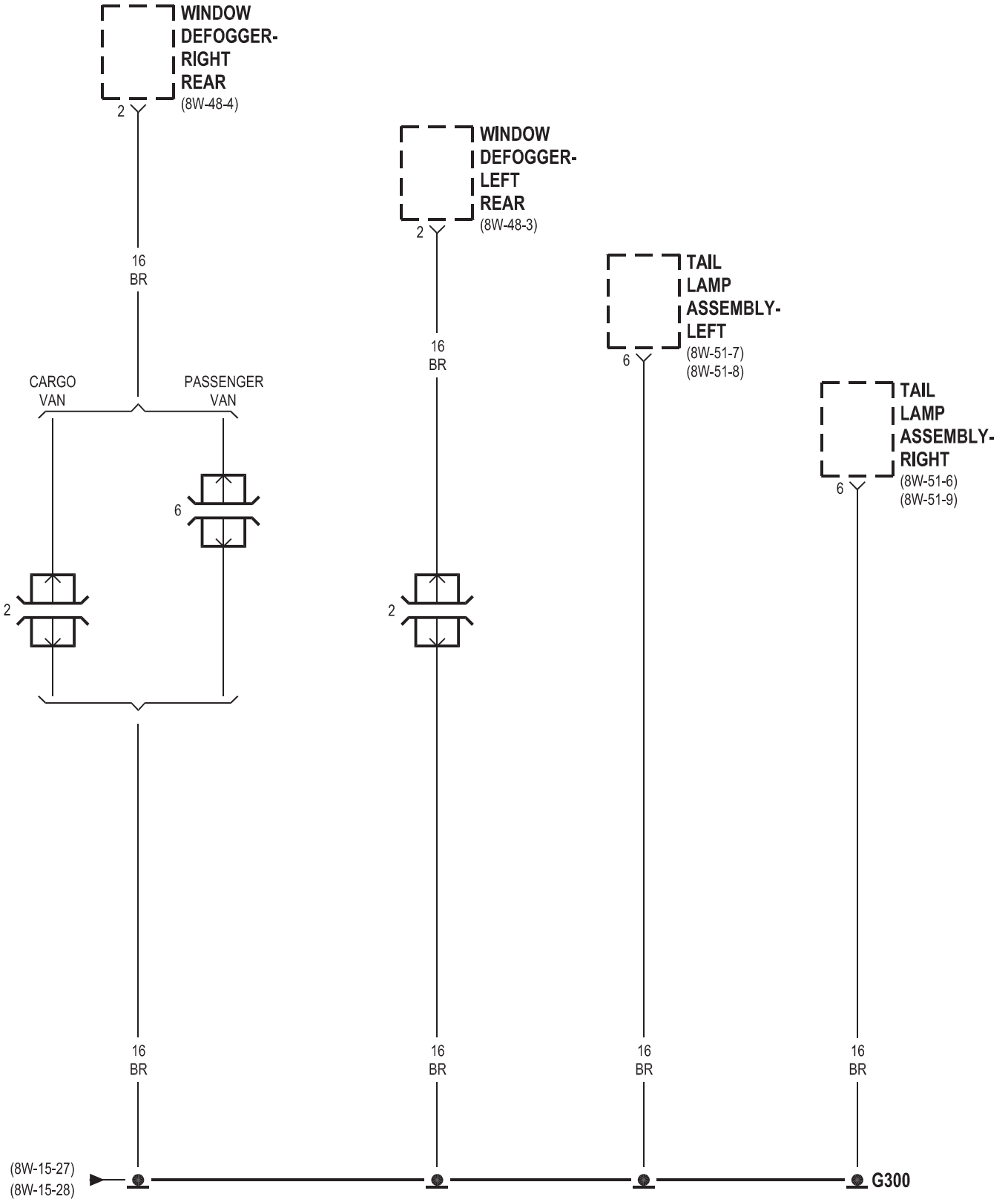

HEADLAMP ADJUST SWITCH
(8W-50-9)
3
FOG LAMP SWITCH
(8W-50-9)
10
ASH RECEIVER LAMP
(8W-44-11)
3
CIGAR LIGHTER LAMP
(8W-44-11)
1
16 BR
CIGAR LIGHTER
(8W-41-2)
1
16 BR
2 C220
TOWING/ INTRUSION SENSOR ON/OFF SWITCH
(8W-39-7)
4
10
16 BR
16 BR
18 BR
16 BR
18 BR
18 BR
(8W-15-20)
G203

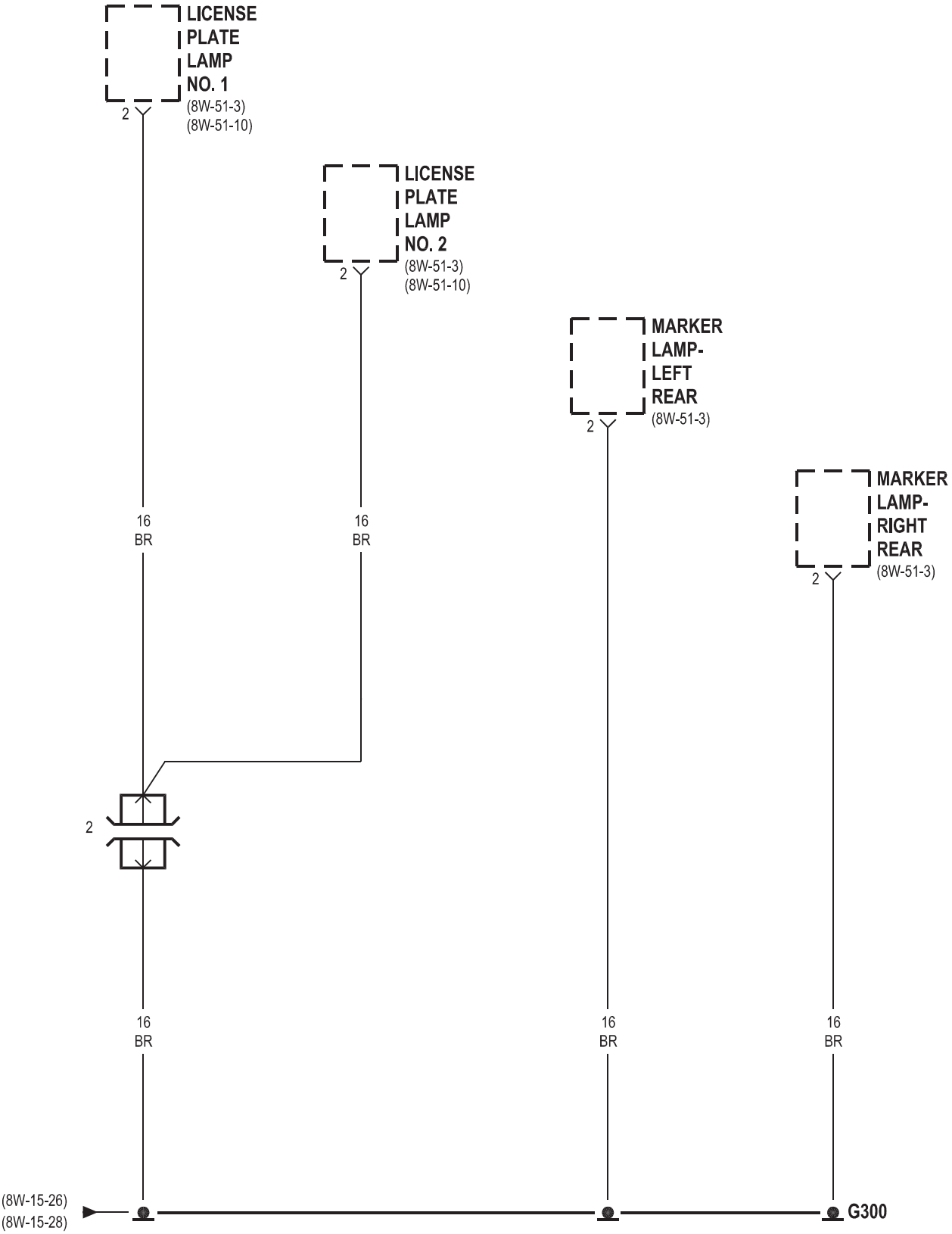

POWER MIRROR MOTOR- PASSENGER
(8W-62-2)
POWER MIRROR MOTOR- DRIVER
(8W-62-2)
POWER MIRROR SWITCH
(8W-62-3)
POWER WINDOW SWITCH- DRIVER
(8W-60-2)
POWER WINDOW SWITCH- MASTER
(8W-60-3)
2
2
6
3
5
3
5
18 BR
18 BR
16 BR
16 BR
16 BR
16 BR
S304
S303
18 BR
18 BR
14 BR
1 C211
1 C210
18 BR
14 BR
(8W-15-20)
G203


AUTOMATIC TEMPERATURE CONTROL MODULE
(8W-42-6)
(8W-42-7)
15
C1
A/C SWITCH- ROOF
(8W-42-14)
10
HEATER TIMER- AUXILIARY
(8W-42-21)
4
12
16 BR
16 BR
S211
HEAT EXCHANGER SWITCH
(8W-42-19)
5
10
AUXILIARY HEATER SWITCH
(8W-42-24)
10
16 BR
16 BR
16 BR
16 BR
16 BR
16 BR
(8W-15-20)
G203

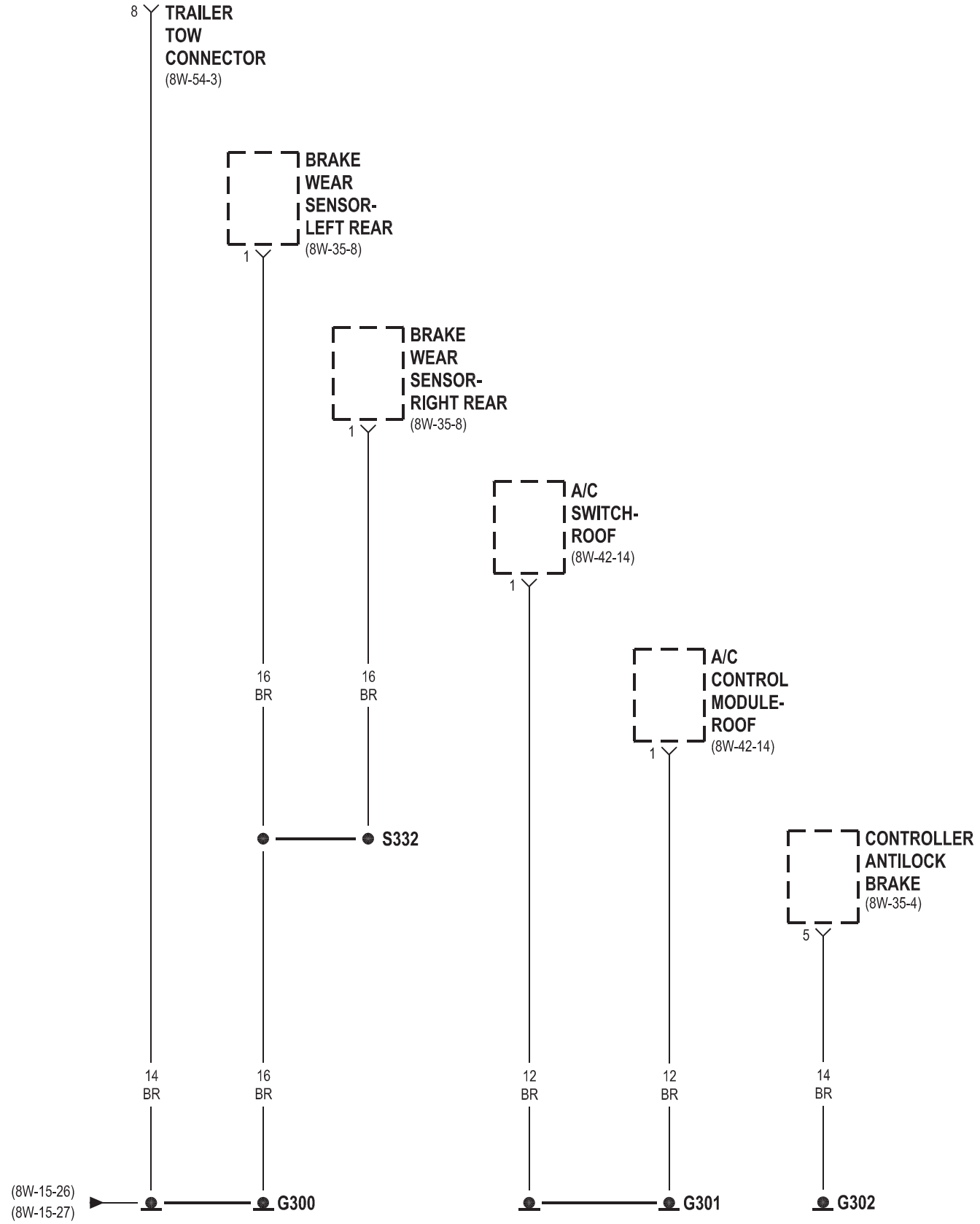


VA301525 J038W-24


WINDOW DEFOGGER-RIGHT REAR
(8W-48-4)
2
16 BR
WINDOW DEFOGGER-LEFT REAR
(8W-48-3)
2
16 BR
TAIL LAMP ASSEMBLY-LEFT
(8W-51-7)
(8W-51-8)
6
TAIL LAMP ASSEMBLY-RIGHT
(8W-51-6)
(8W-51-9)
6
CARGO VAN
PASSENGER VAN
6
2
2
16 BR
16 BR
16 BR
16 BR
(8W-15-27)
(8W-15-28)
G300

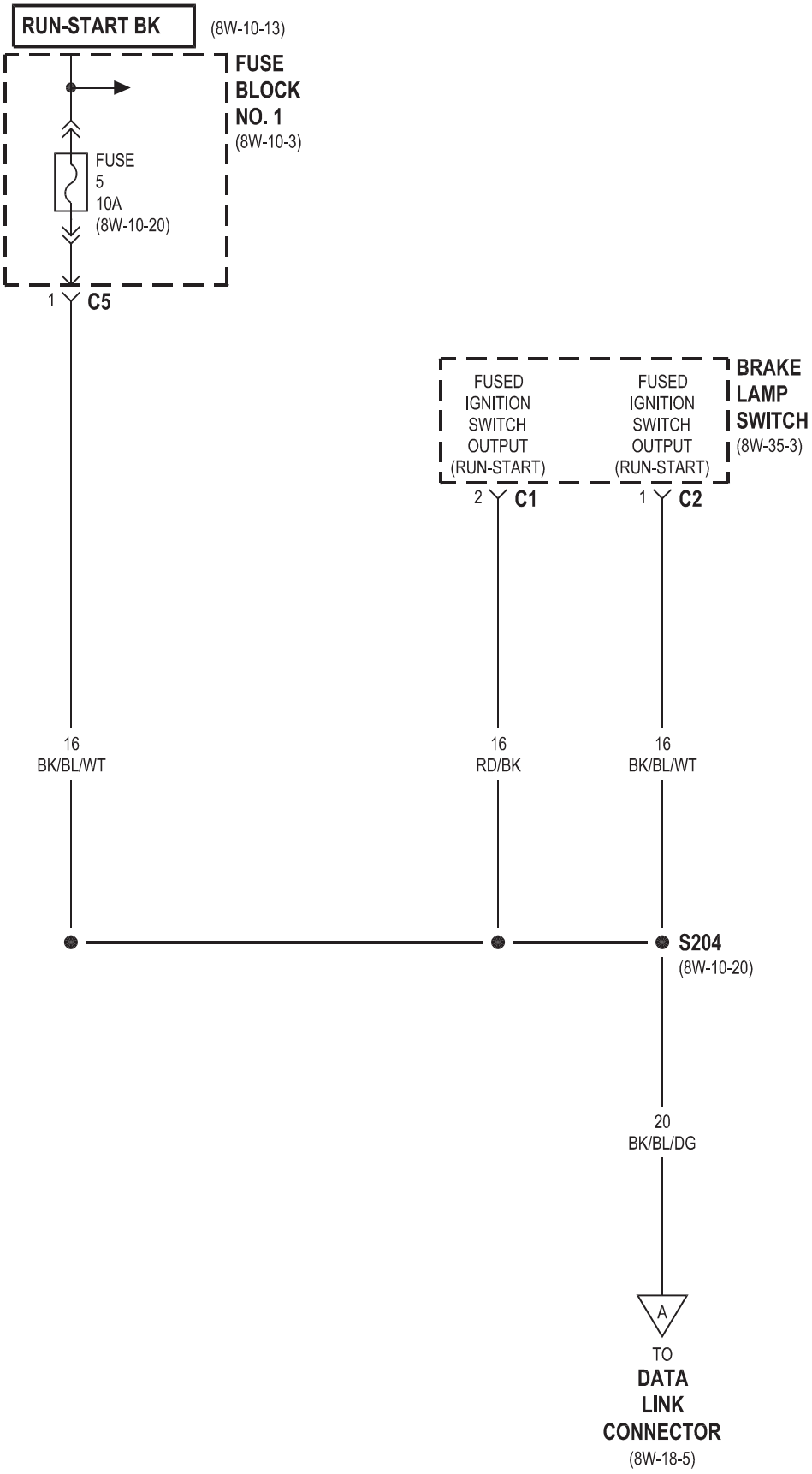


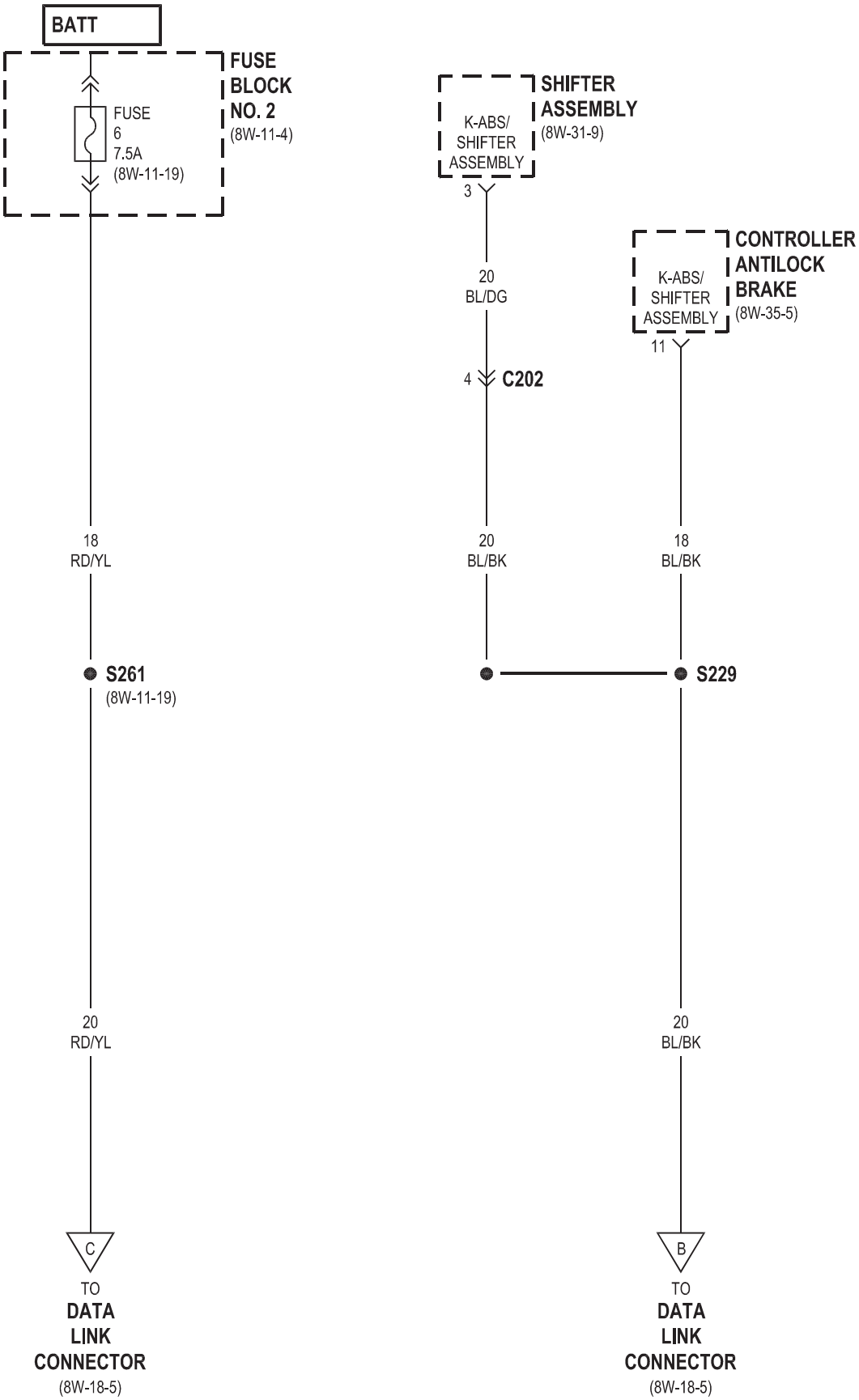
VA301527 J038W-24


8
TRAILER TOW CONNECTOR
(8W-54-3)
BRAKE WEAR SENSOR- LEFT REAR
(8W-35-8)
1
BRAKE WEAR SENSOR- RIGHT REAR
(8W-35-8)
1
A/C SWITCH- ROOF
(8W-42-14)
1
A/C CONTROL MODULE- ROOF
(8W-42-14)
1
CONTROLLER ANTILOCK BRAKE
(8W-35-4)
5
16 BR
16 BR
S332
14 BR
16 BR
12 BR
12 BR
14 BR
(8W-15-26)
(8W-15-27)
G300
G301
G302

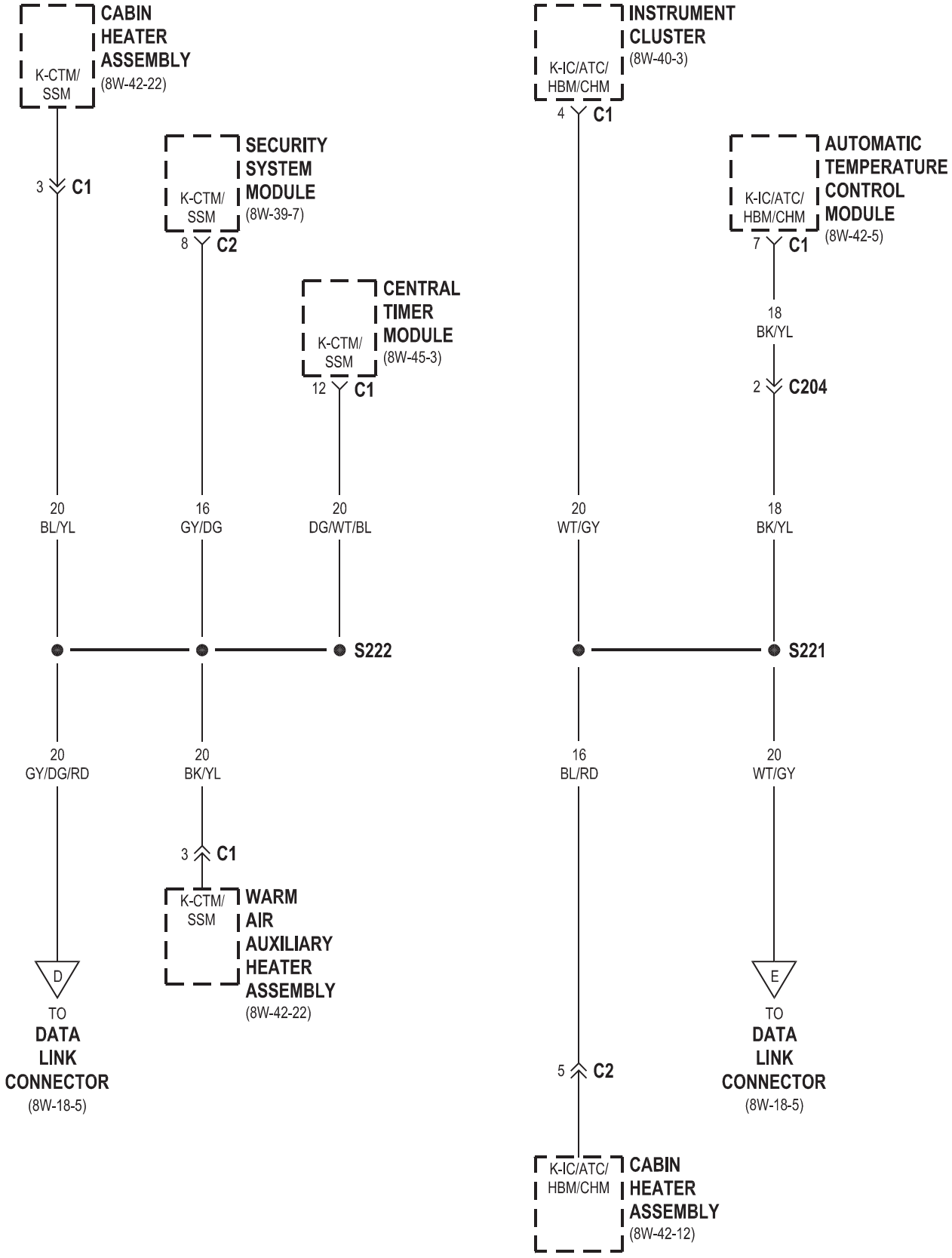
8W-18 BUS COMMUNICATIONS

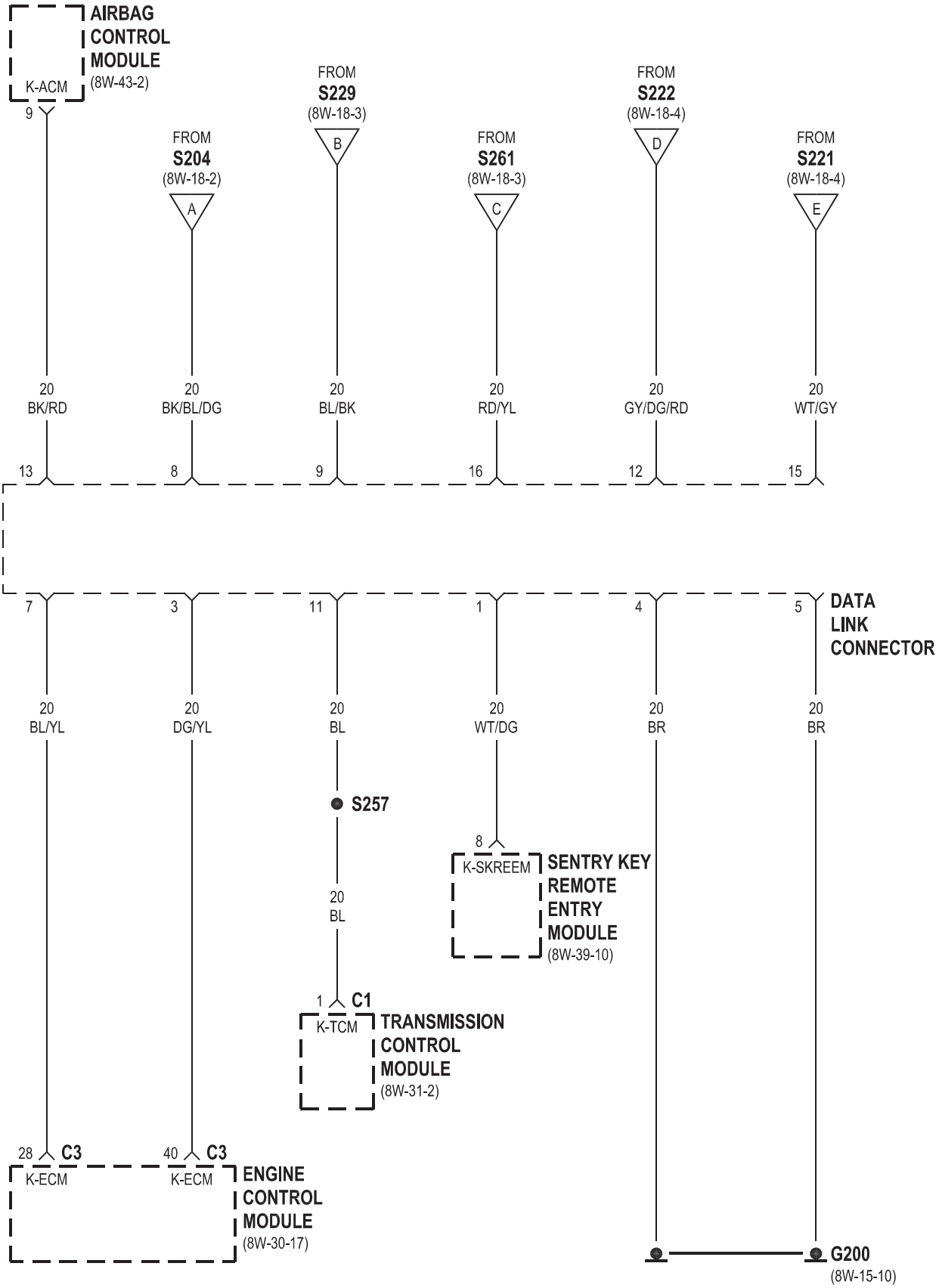
Component	Page
Airbag Control Module	8W-18-5
Automatic Temperature Control Module	8W-18-4, 6
Brake Lamp Switch	8W-18-2
Cabin Heater Assembly	8W-18-4
Central Timer Module	8W-18-4
Controller Antilock Brake	8W-18-3, 6
Data Link Connector	8W-18-2, 3, 4, 5
Engine Control Module	8W-18-5, 6
Fuse 5	8W-18-2
Fuse 6	8W-18-3
Fuse Block No. 1	8W-18-2
Fuse Block No. 2	8W-18-3
G200	8W-18-5
Instrument Cluster	8W-18-4, 6
Security System Module	8W-18-4
Sentry Key Remote Entry Module	8W-18-5, 6
Shifter Assembly	8W-18-3, 6
Transmission Control Module	8W-18-5, 6
Warm Air Auxiliary Heater Assembly	8W-18-4


RUN-START BK
(8W-10-13)
FUSE BLOCK NO. 1
(8W-10-3)
FUSE 5 10A
(8W-10-20)
1 C5
FUSED IGNITION SWITCH OUTPUT (RUN-START)
FUSED IGNITION SWITCH OUTPUT (RUN-START)
BRAKE LAMP SWITCH
(8W-35-3)
2 C1
1 C2
16 BK/BL/WT
16 RD/BK
16 BK/BL/WT
S204
(8W-10-20)
20 BK/BL/DG
A
TO DATA LINK CONNECTOR
(8W-18-5)

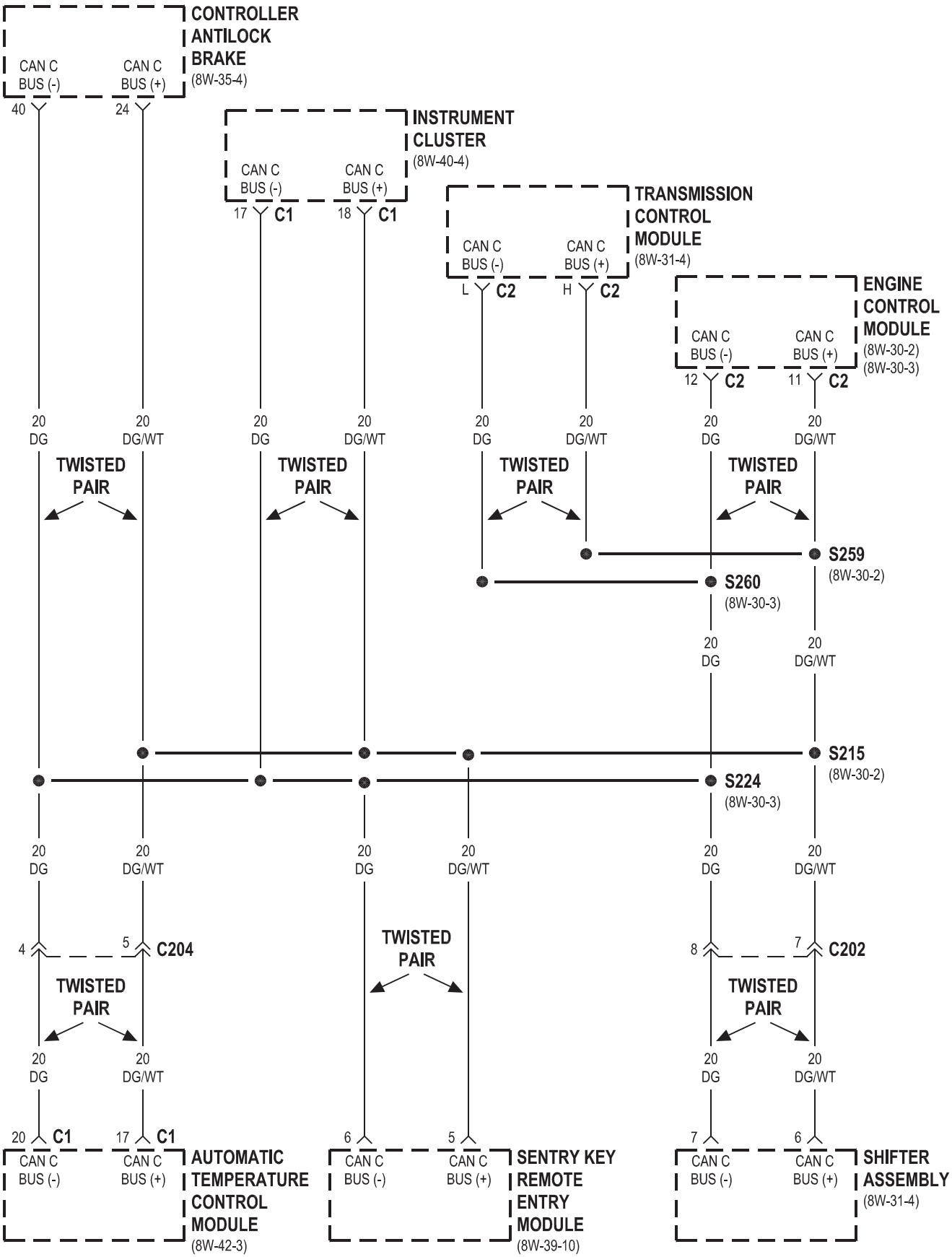


VA301803 J038W-24


CABIN HEATER ASSEMBLY
K-CTM/ SSM
(8W-42-22)
3 C1
SECURITY SYSTEM MODULE
K-CTM/ SSM
(8W-39-7)
8 C2
CENTRAL TIMER MODULE
K-CTM/ SSM
(8W-45-3)
12 C1
20 BL/YL
16 GY/DG
20 DG/WT/BL
S222
20 GY/DG/RD
20 BK/YL
3 C1
K-CTM/ SSM
WARM AIR AUXILIARY HEATER ASSEMBLY
(8W-42-22)
D
TO DATA LINK CONNECTOR
(8W-18-5)
INSTRUMENT CLUSTER
K-IC/ATC/ HBM/CHM
(8W-40-3)
4 C1
AUTOMATIC TEMPERATURE CONTROL MODULE
K-IC/ATC/ HBM/CHM
(8W-42-5)
7 C1
18 BK/YL
2 C204
20 WT/GY
18 BK/YL
S221
16 BL/RD
20 WT/GY
E
TO DATA LINK CONNECTOR
(8W-18-5)
5 C2
K-IC/ATC/ HBM/CHM
CABIN HEATER ASSEMBLY
(8W-42-12)

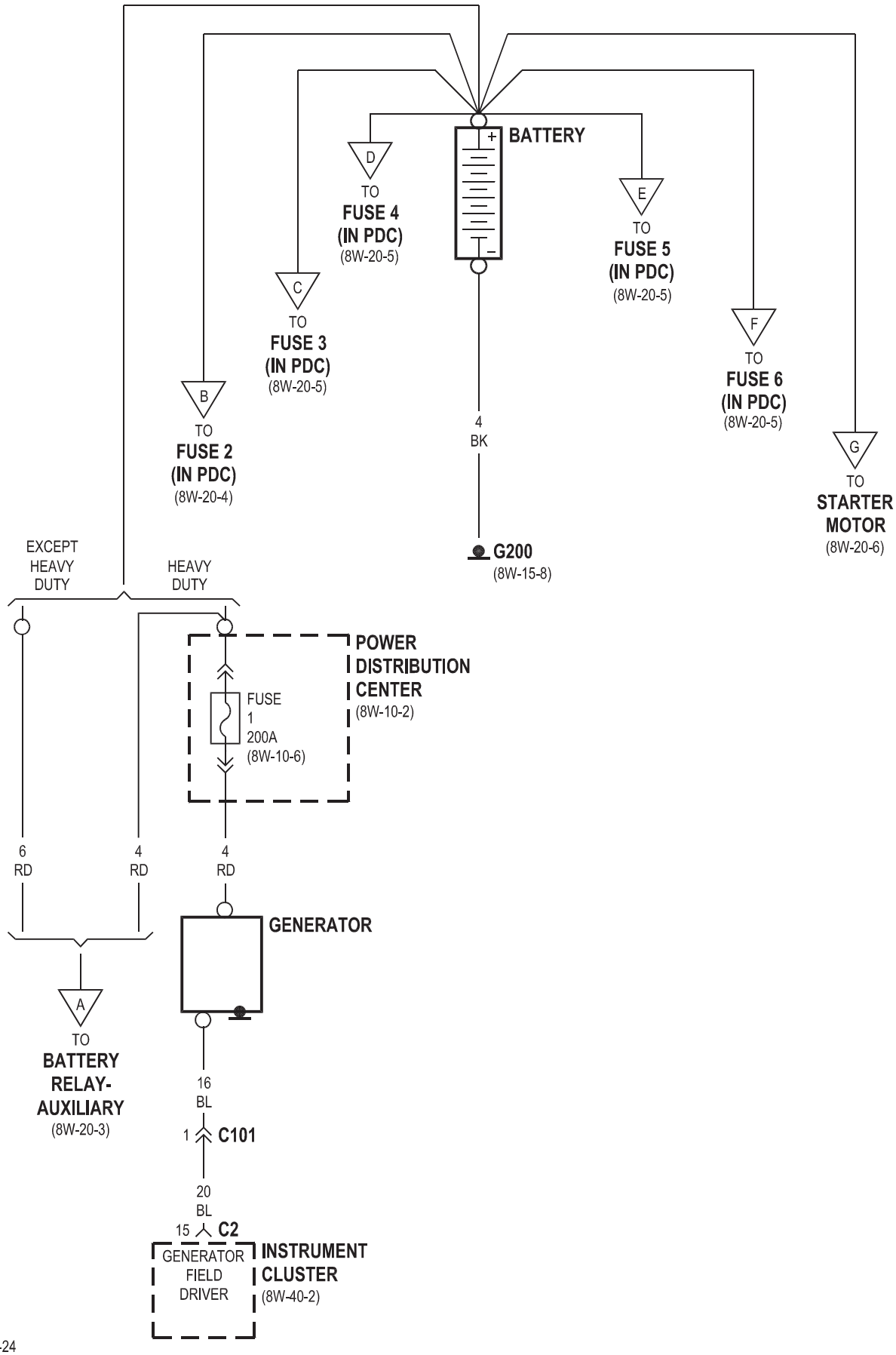


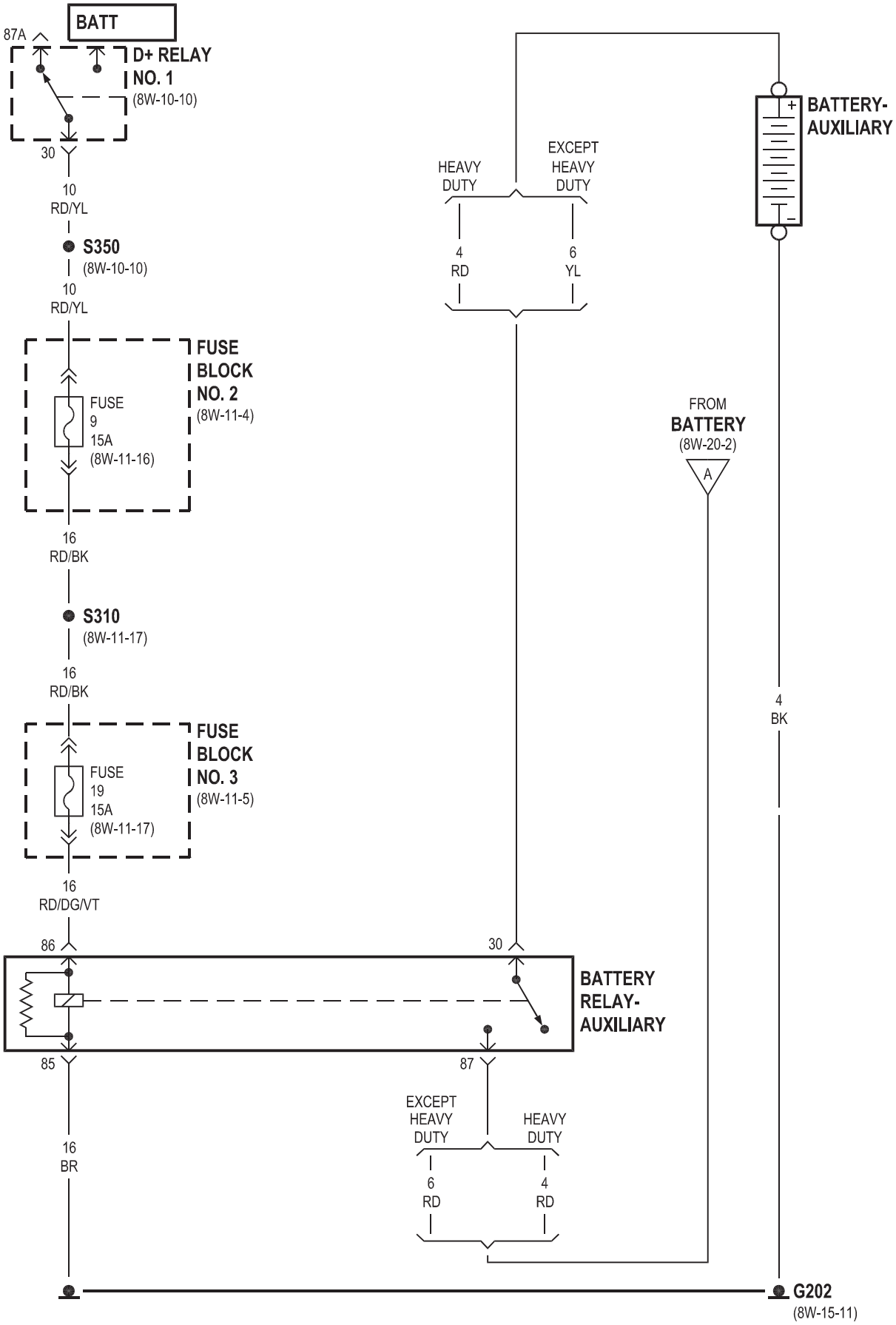
VA301805 J038W-24


CONTROLLER ANTILOCK BRAKE
(8W-35-4)
CAN C BUS (-)
CAN C BUS (+)
40
24
INSTRUMENT CLUSTER
(8W-40-4)
17 C1
18 C1
TRANSMISSION CONTROL MODULE
(8W-31-4)
L C2
H C2
ENGINE CONTROL MODULE
(8W-30-2)
(8W-30-3)
12 C2
11 C2
20 DG
20 DG/WT
TWISTED PAIR
S259
(8W-30-2)
S260
(8W-30-3)
S215
(8W-30-2)
S224
(8W-30-3)
4
5
C204
8
7
C202
20 C1
17 C1
AUTOMATIC TEMPERATURE CONTROL MODULE
(8W-42-3)
6
5
SENTRY KEY REMOTE ENTRY MODULE
(8W-39-10)
7
6
SHIFTER ASSEMBLY
(8W-31-4)

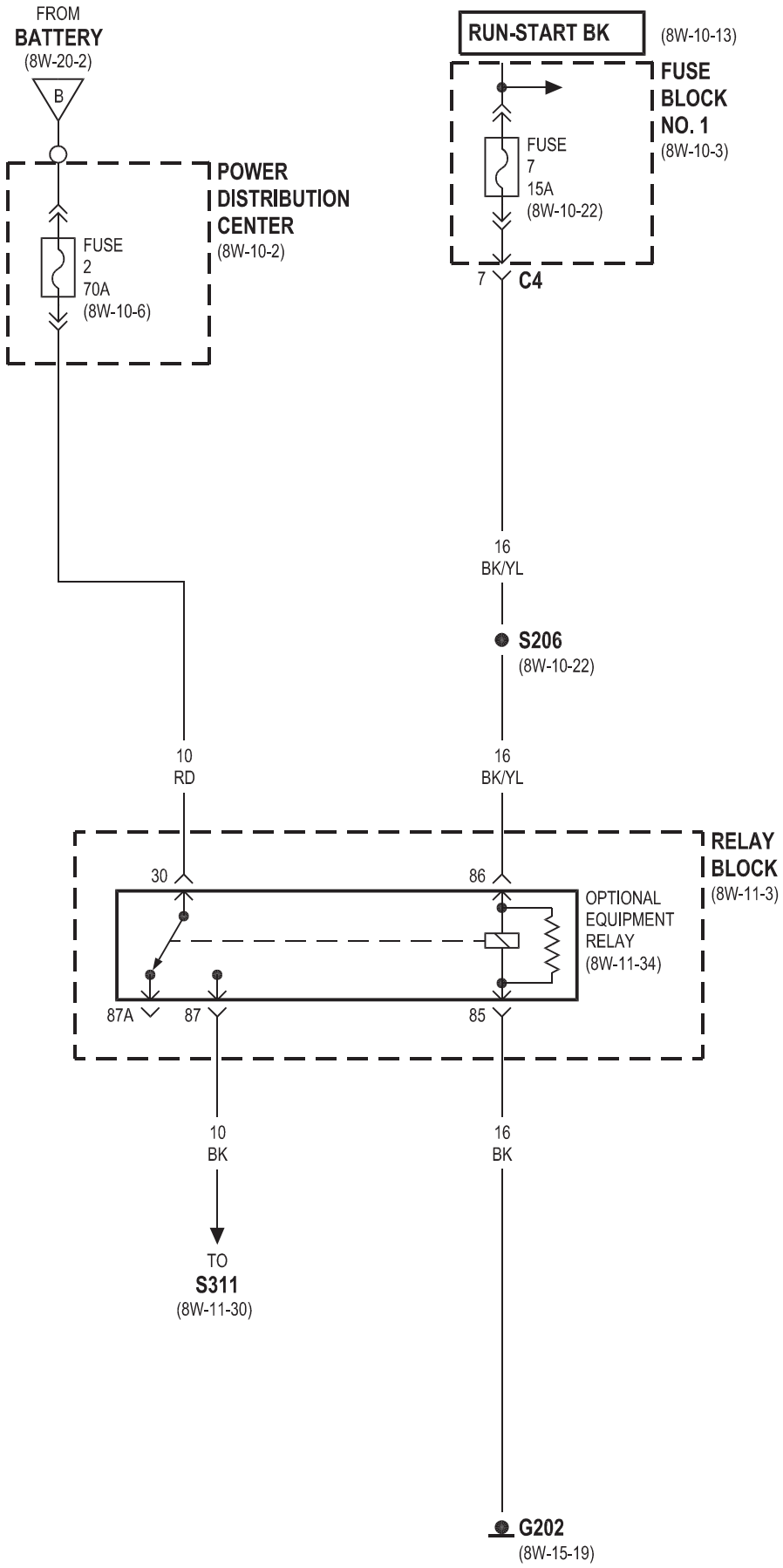
8W-20 CHARGING SYSTEM

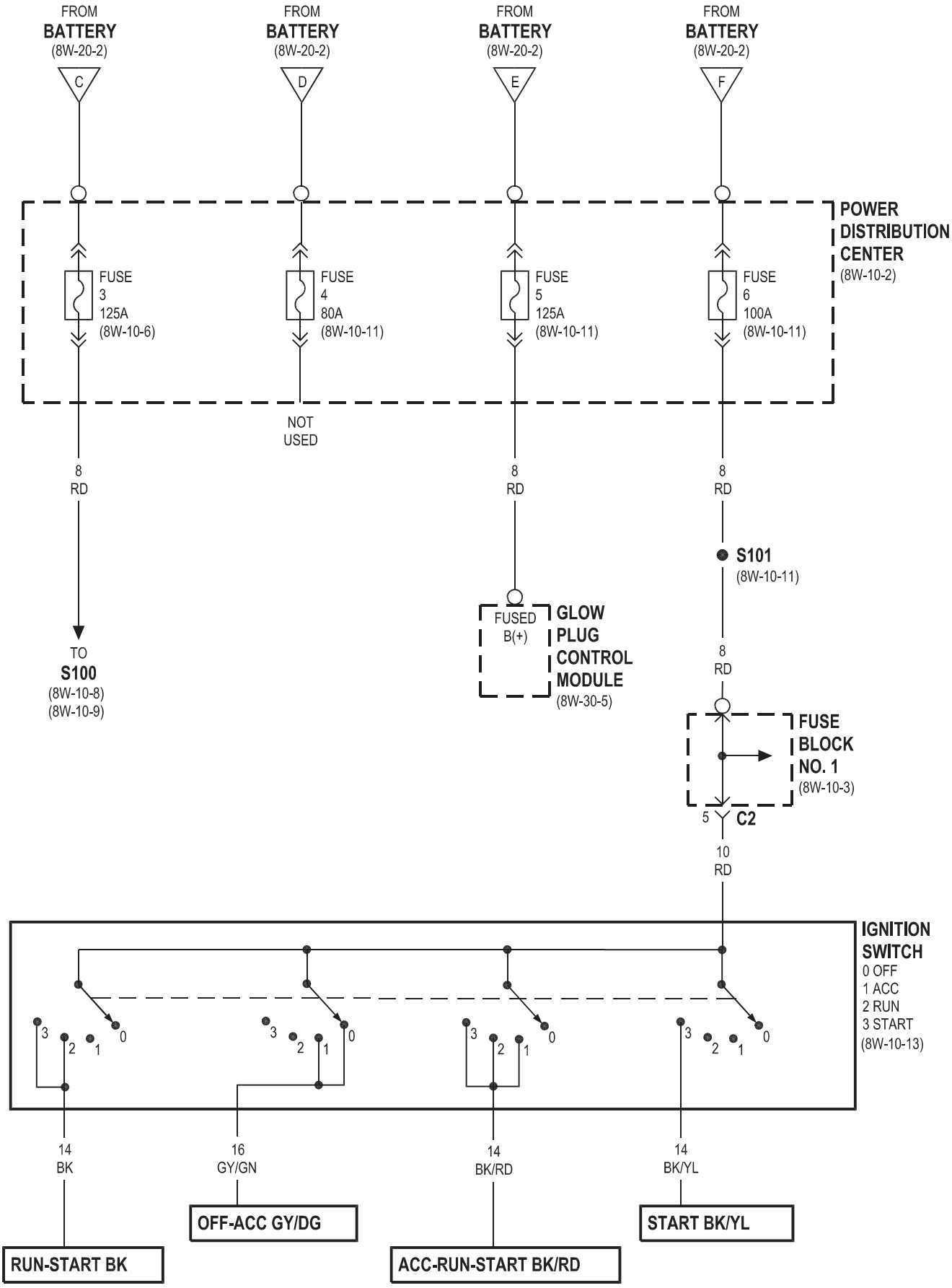
Component	Page
Battery	8W-20-2, 3, 4, 5, 6
Battery Relay- Auxiliary	8W-20-2, 3
Battery- Auxiliary	8W-20-3
D+ Relay No. 1	8W-20-3
Engine Control Module	8W-20-6
Fuse 1	8W-20-2
Fuse 2	8W-20-2, 4
Fuse 3	8W-20-2, 5
Fuse 4	8W-20-2, 5
Fuse 5	8W-20-2, 5
Fuse 6	8W-20-2, 5
Fuse 7	8W-20-4
Fuse 9	8W-20-3
Fuse 19	8W-20-3
Fuse Block No. 1	8W-20-4, 5, 6
Fuse Block No. 2	8W-20-3
Fuse Block No. 3	8W-20-3
G200	8W-20-2
G202	8W-20-3, 4
Generator	8W-20-2
Glow Plug Control Module	8W-20-5
Ignition Switch	8W-20-5
Instrument Cluster	8W-20-2
Optional Equipment Relay	8W-20-4
Power Distribution Center	8W-20-2, 4, 5
Relay Block	8W-20-4
Starter Motor	8W-20-2, 6
Starter Motor Relay	8W-20-6


BATTERY
+
-
D
TO
FUSE 4
(IN PDC)
(8W-20-5)
E
TO
FUSE 5
(IN PDC)
(8W-20-5)
C
TO
FUSE 3
(IN PDC)
(8W-20-5)
F
TO
FUSE 6
(IN PDC)
(8W-20-5)
B
TO
FUSE 2
(IN PDC)
(8W-20-4)
4
BK
G
TO
STARTER
MOTOR
(8W-20-6)
G200
(8W-15-8)
EXCEPT
HEAVY
DUTY
HEAVY
DUTY
POWER
DISTRIBUTION
CENTER
(8W-10-2)
FUSE
1
200A
(8W-10-6)
6
RD
4
RD
4
RD
GENERATOR
A
TO
BATTERY
RELAY-
AUXILIARY
(8W-20-3)
16
BL
1
C101
20
BL
15
C2
GENERATOR
FIELD
DRIVER
INSTRUMENT
CLUSTER
(8W-40-2)

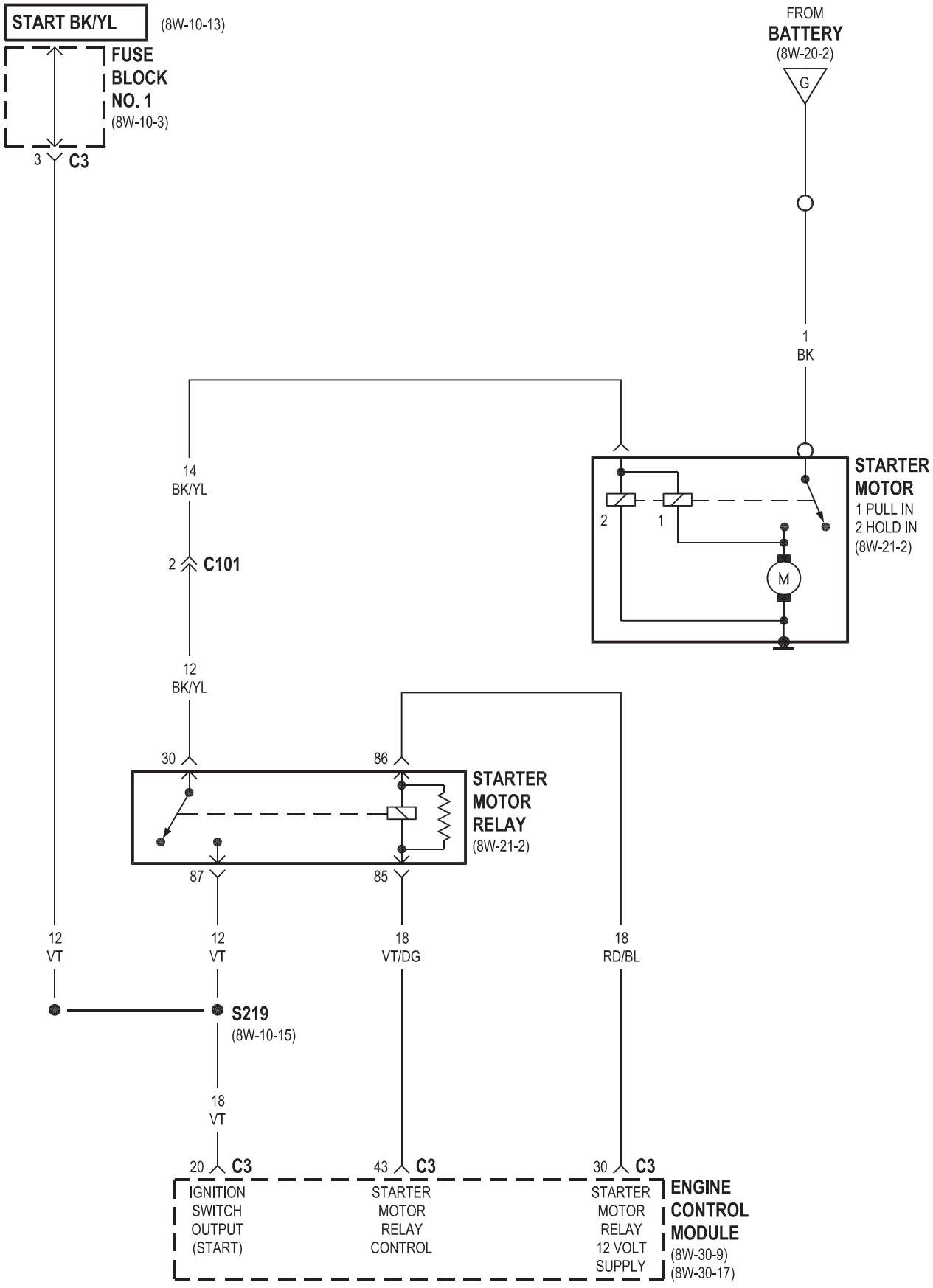


VA302003 J038W-24


FROM
BATTERY
(8W-20-2)
B
POWER
DISTRIBUTION
CENTER
(8W-10-2)
FUSE
2
70A
(8W-10-6)
RUN-START BK
(8W-10-13)
FUSE
BLOCK
NO. 1
(8W-10-3)
FUSE
7
15A
(8W-10-22)
7
C4
16
BK/YL
S206
(8W-10-22)
10
RD
16
BK/YL
RELAY
BLOCK
(8W-11-3)
30
86
OPTIONAL
EQUIPMENT
RELAY
(8W-11-34)
87A
87
85
10
BK
16
BK
TO
S311
(8W-11-30)
G202
(8W-15-19)

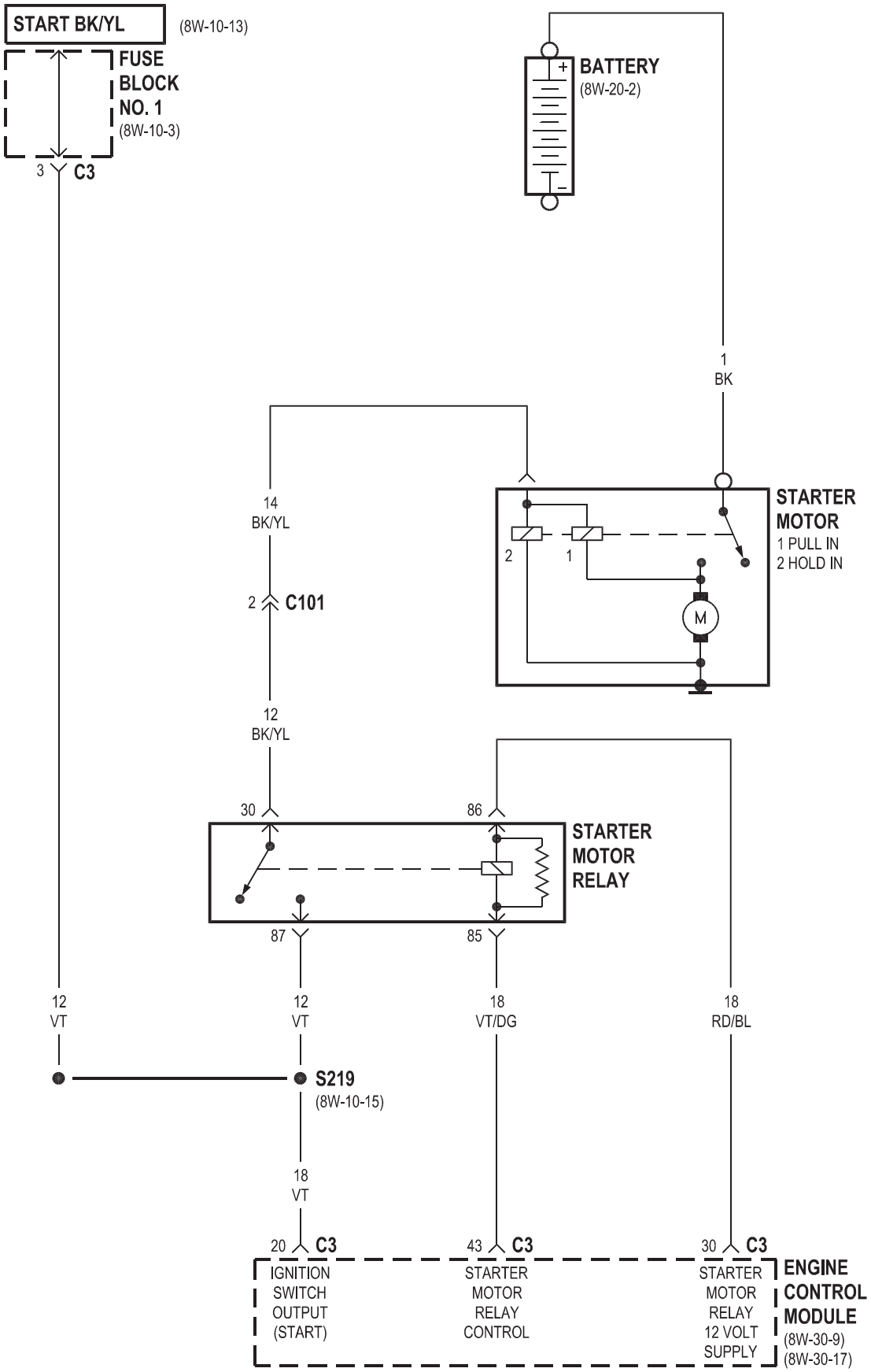


VA302005 J038W-24


START BK/YL
(8W-10-13)
FUSE BLOCK NO. 1
(8W-10-3)
3
C3
FROM BATTERY
(8W-20-2)
G
1
BK
14
BK/YL
2
C101
12
BK/YL
STARTER MOTOR
1 PULL IN
2 HOLD IN
(8W-21-2)
2
1
M
30
86
STARTER MOTOR RELAY
(8W-21-2)
87
85
12
VT
12
VT
18
VT/DG
18
RD/BL
S219
(8W-10-15)
18
VT
20
C3
43
C3
30
C3
IGNITION SWITCH OUTPUT (START)
STARTER MOTOR RELAY CONTROL
STARTER MOTOR RELAY 12 VOLT SUPPLY
ENGINE CONTROL MODULE
(8W-30-9)
(8W-30-17)

8W-21 STARTING SYSTEM

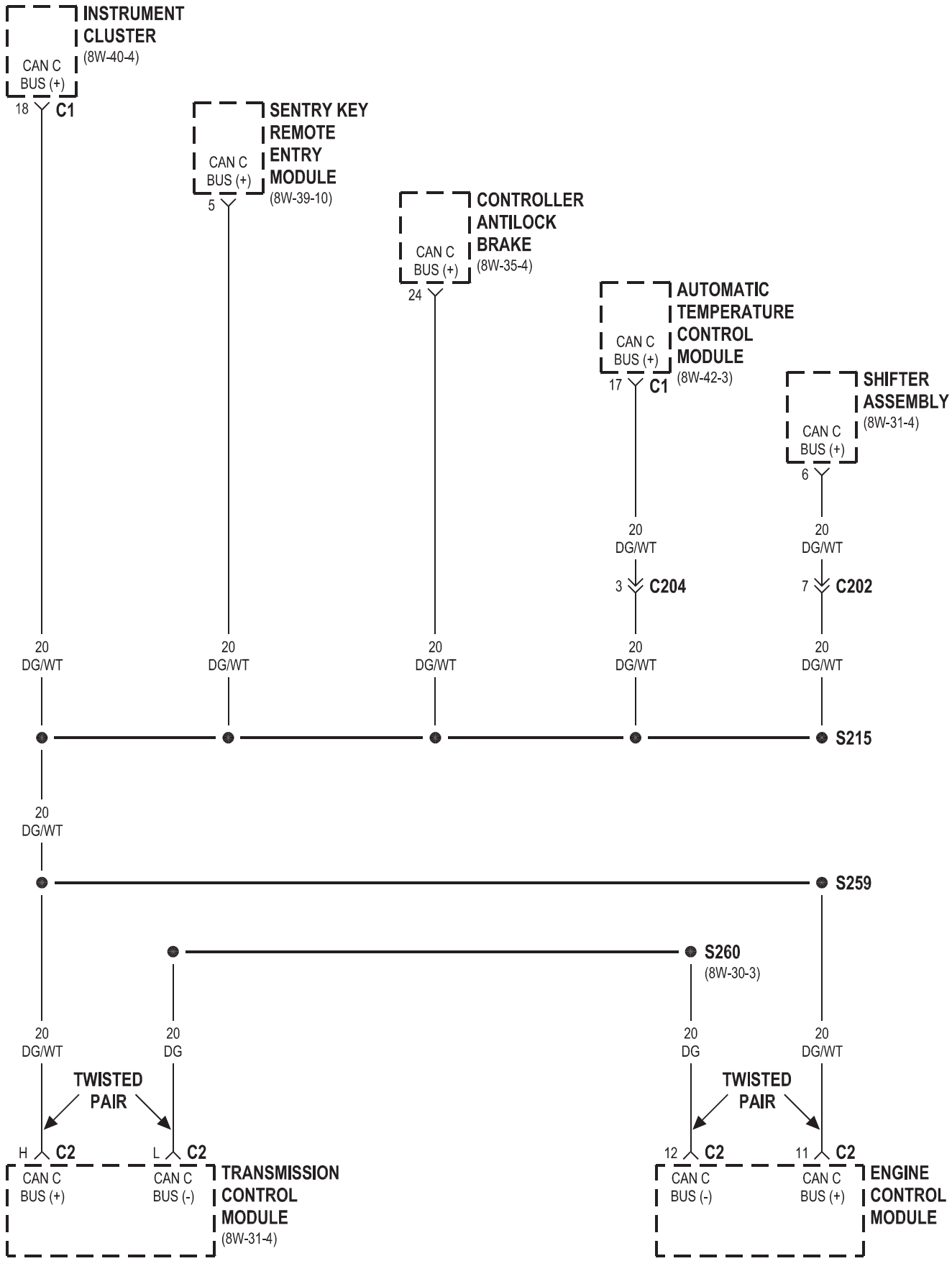
Component	Page	Component	Page
Battery	8W-21-2	Starter Motor	8W-21-2
Engine Control Module	8W-21-2	Starter Motor Relay	8W-21-2
Fuse Block No. 1	8W-21-2		

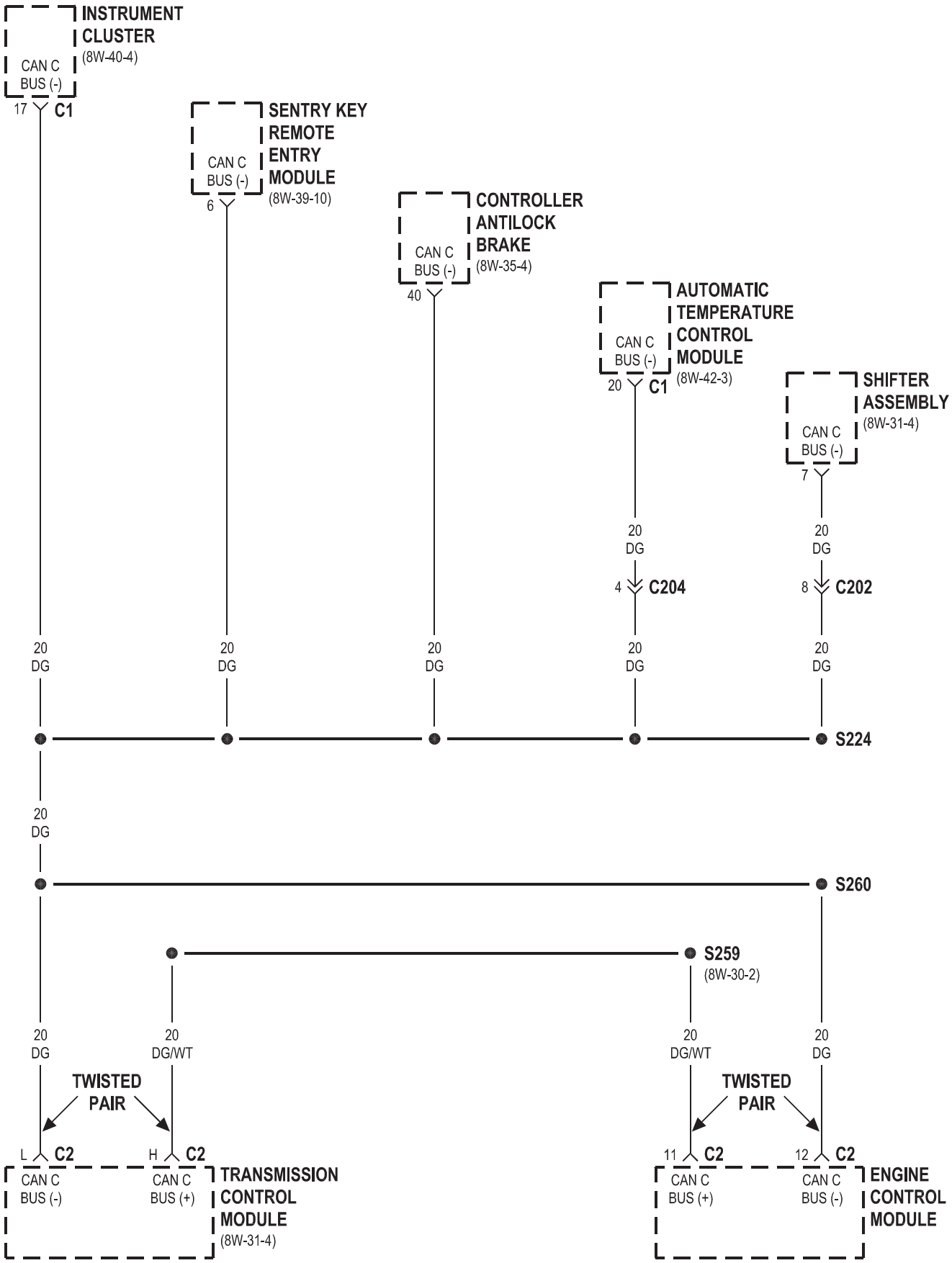

START BK/YL
(8W-10-13)
FUSE BLOCK NO. 1
(8W-10-3)
3
C3
BATTERY
(8W-20-2)
1
BK
14
BK/YL
2
C101
12
BK/YL
STARTER MOTOR
1 PULL IN
2 HOLD IN
2
1
M
30
86
STARTER MOTOR RELAY
87
85
12
VT
12
VT
18
VT/DG
18
RD/BL
S219
(8W-10-15)
18
VT
20
C3
43
C3
30
C3
IGNITION SWITCH OUTPUT (START)
STARTER MOTOR RELAY CONTROL
STARTER MOTOR RELAY 12 VOLT SUPPLY
ENGINE CONTROL MODULE
(8W-30-9)
(8W-30-17)

8W-30 FUEL/IGNITION SYSTEM

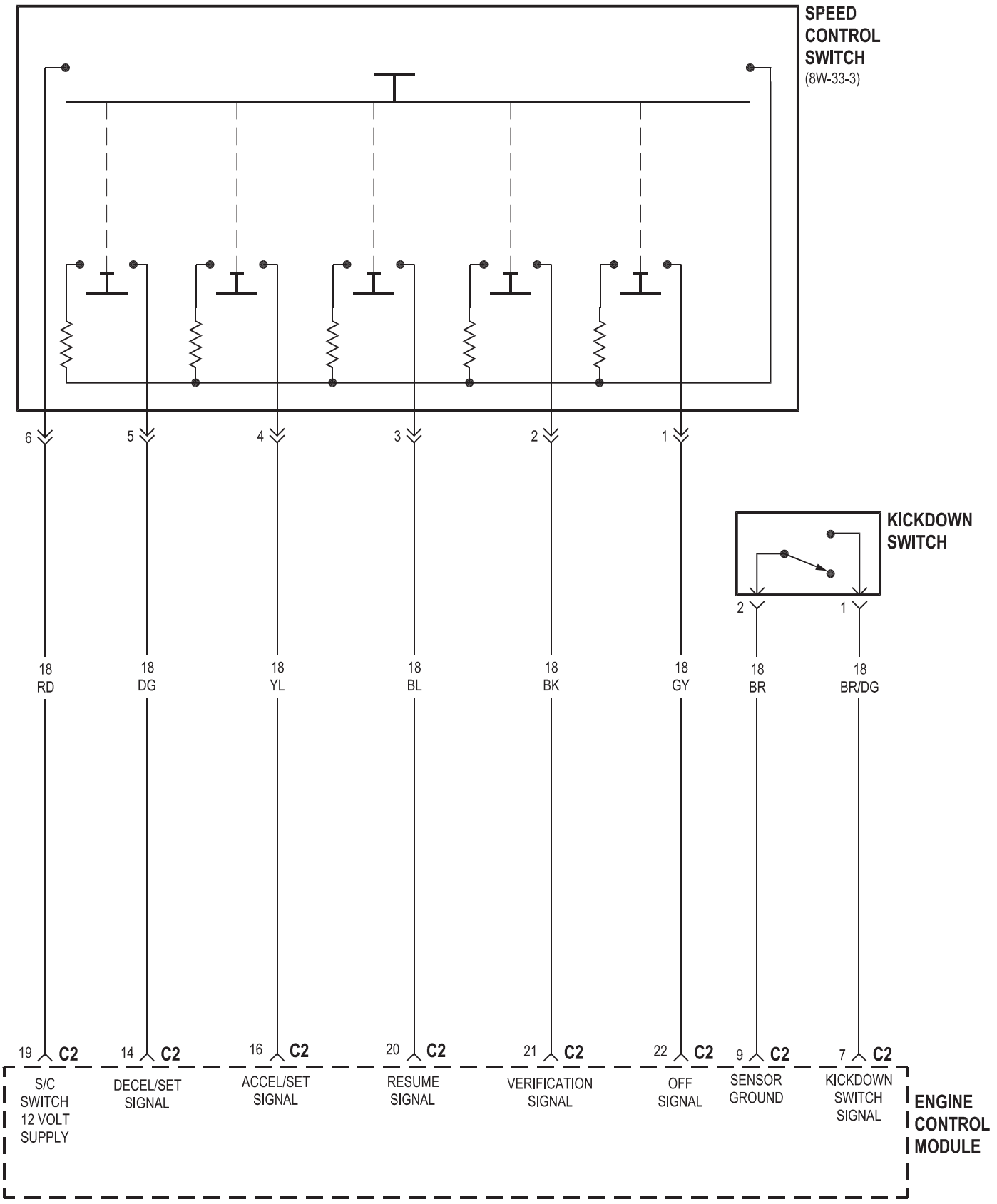
Component	Page
Accelerator Pedal Position Sensor	8W-30-8
Airbag Control Module	8W-30-7
Automatic Temperature Control Module	8W-30-2, 3
Boost Pressure Sensor	8W-30-7
Boost Pressure Solenoid	8W-30-6
Camshaft Position Sensor	8W-30-16
Central Timer Module	8W-30-7
Controller Antilock Brake	8W-30-2, 3
Crankcase Heater	8W-30-12
Crankshaft Position Sensor	8W-30-14
Data Link Connector	8W-30-17
EGR Valve	8W-30-12
Engine Control Module	8W-30-2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17
Engine Control Relay	8W-30-12, 9
Engine Coolant Level Switch	8W-30-17
Engine Coolant Temperature Sensor	8W-30-16
Engine Oil Sensor	8W-30-12
Fuel Injector No. 1	8W-30-10
Fuel Injector No. 2	8W-30-11
Fuel Injector No. 3	8W-30-10
Fuel Injector No. 4	8W-30-10
Fuel Injector No. 5	8W-30-11
Fuel Level Sensor	8W-30-17
Fuel Pressure Sensor	8W-30-15
Fuel Pressure Solenoid	8W-30-14
Fuel Shutdown Solenoid	8W-30-14
Fuel Temperature Sensor	8W-30-15

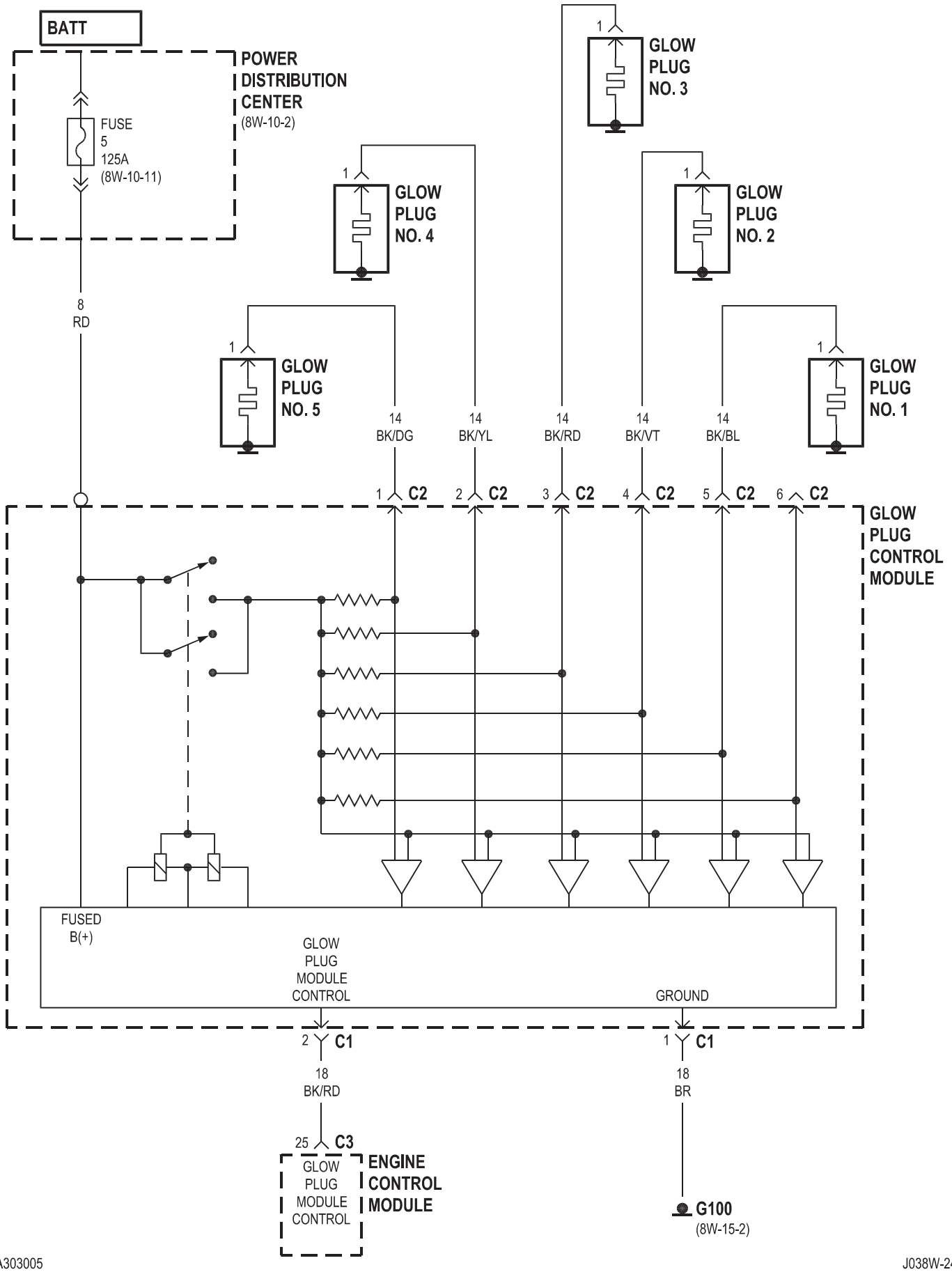
Component	Page
Fuse 5	8W-30-5
Fuse 16	8W-30-9
Fuse 17	8W-30-12
Fuse 18	8W-30-7
Fuse Block No. 1	8W-30-7, 9, 12
G100	8W-30-5, 17
G200	8W-30-9
Glow Plug Control Module	8W-30-5
Glow Plug No. 1	8W-30-5
Glow Plug No. 2	8W-30-5
Glow Plug No. 3	8W-30-5
Glow Plug No. 4	8W-30-5
Glow Plug No. 5	8W-30-5
Instrument Cluster	8W-30-2, 3, 17
Intake Air Temperature Sensor	8W-30-8
Kickdown Switch	8W-30-4
Low Fuel Pressure Sensor	8W-30-13
Mass Air Flow Sensor	8W-30-6
Power Distribution Center	8W-30-5
Sensor	8W-30-13
Sentry Key Remote Entry Module	8W-30-2, 3
Shifter Assembly	8W-30-2, 3
Speed Control Switch	8W-30-4
Starter Motor Relay	8W-30-17
Transmission Control Module	8W-30-2, 3
Water In Fuel Sensor	8W-30-13
Wiper/Turn Signal/Engine Start Control Module	8W-30-9


INSTRUMENT CLUSTER
(8W-40-4)
CAN C BUS (+)
18
C1
SENTRY KEY REMOTE ENTRY MODULE
(8W-39-10)
CAN C BUS (+)
5
CONTROLLER ANTILOCK BRAKE
(8W-35-4)
CAN C BUS (+)
24
AUTOMATIC TEMPERATURE CONTROL MODULE
(8W-42-3)
CAN C BUS (+)
17
C1
SHIFTER ASSEMBLY
(8W-31-4)
CAN C BUS (+)
6
20 DG/WT
3
C204
20 DG/WT
7
C202
20 DG/WT
20 DG/WT
20 DG/WT
20 DG/WT
20 DG/WT
20 DG/WT
S215
20 DG/WT
S259
S260
(8W-30-3)
20 DG/WT
20 DG
20 DG
20 DG/WT
TWISTED PAIR
TWISTED PAIR
H
C2
L
C2
12
C2
11
C2
CAN C BUS (+)
CAN C BUS (-)
TRANSMISSION CONTROL MODULE
(8W-31-4)
CAN C BUS (-)
CAN C BUS (+)
ENGINE CONTROL MODULE

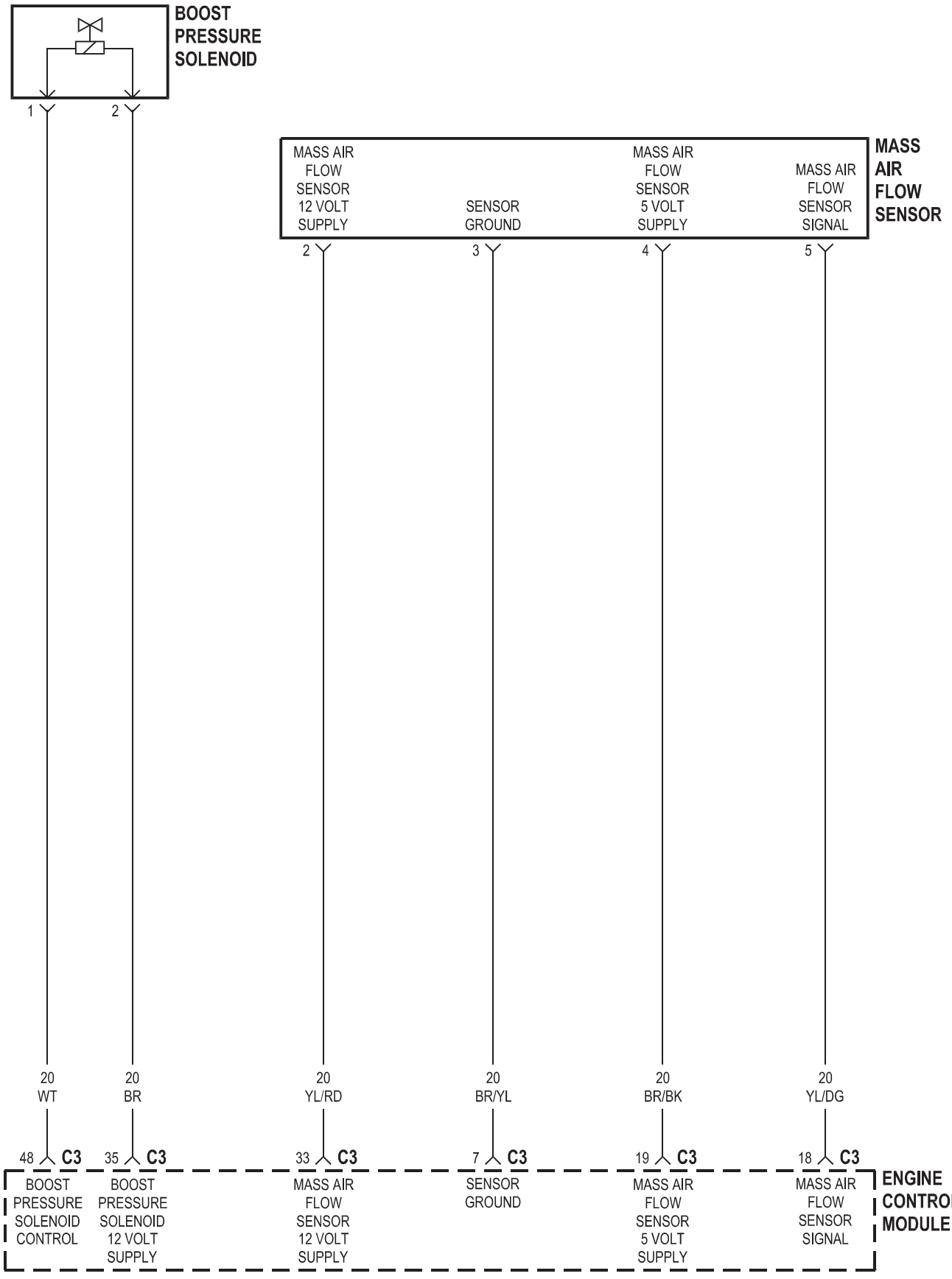


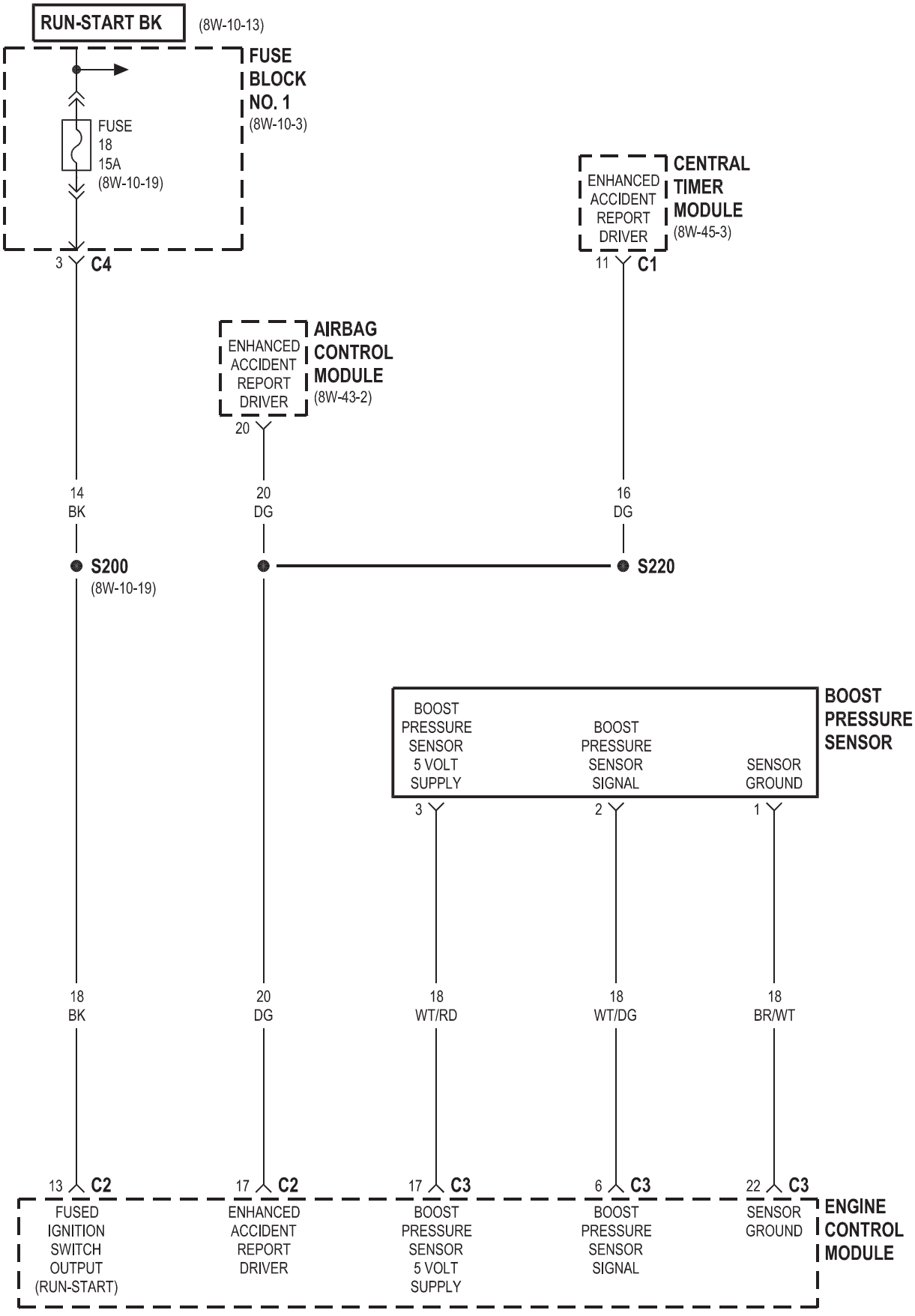
VA303003 J038W-24


SPEED CONTROL SWITCH
(8W-33-3)
6
5
4
3
2
1
KICKDOWN SWITCH
2
1
18 RD
18 DG
18 YL
18 BL
18 BK
18 GY
18 BR
18 BR/DG
19 C2
14 C2
16 C2
20 C2
21 C2
22 C2
9 C2
7 C2
S/C SWITCH 12 VOLT SUPPLY
DECEL/SET SIGNAL
ACCEL/SET SIGNAL
RESUME SIGNAL
VERIFICATION SIGNAL
OFF SIGNAL
SENSOR GROUND
KICKDOWN SWITCH SIGNAL
ENGINE CONTROL MODULE

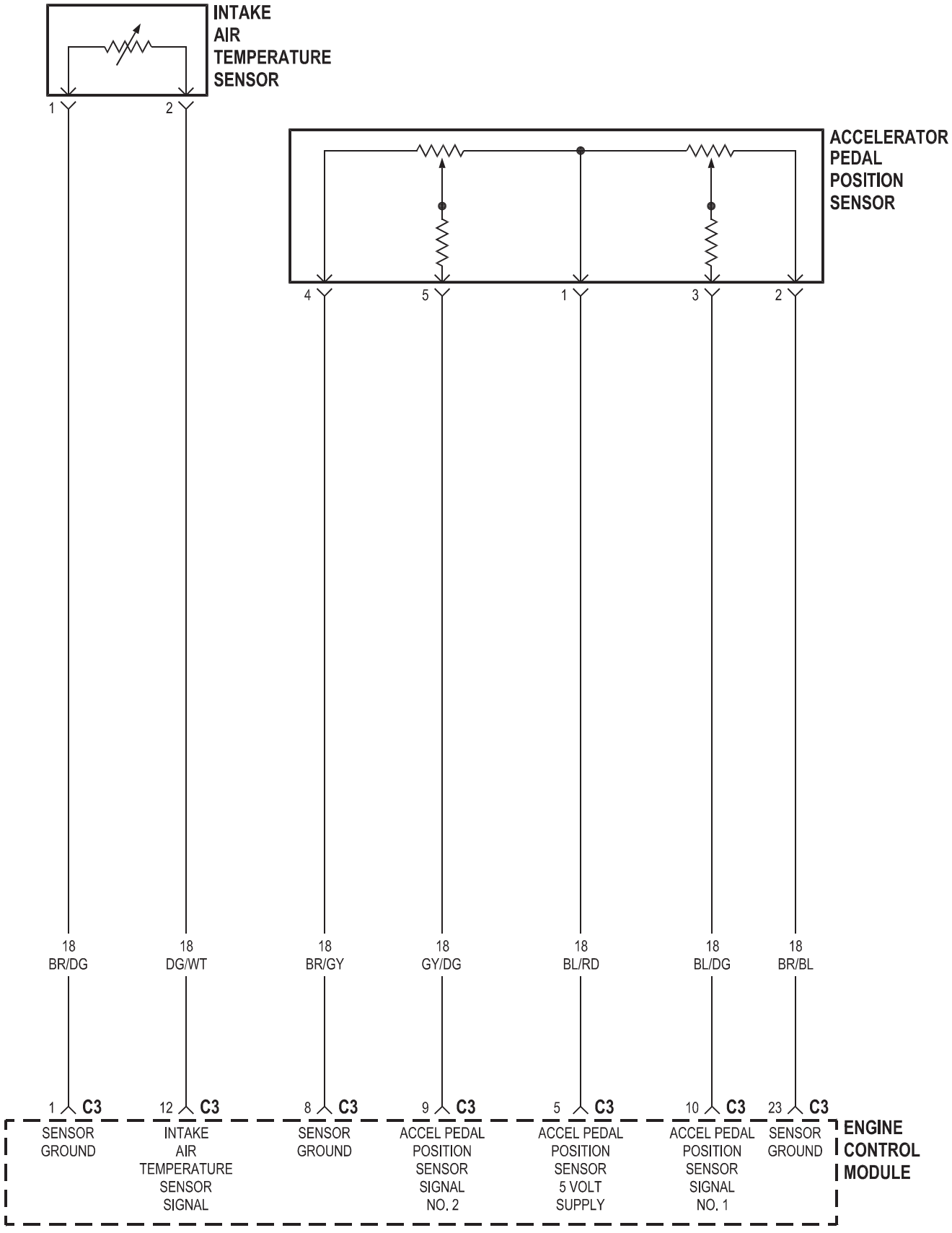


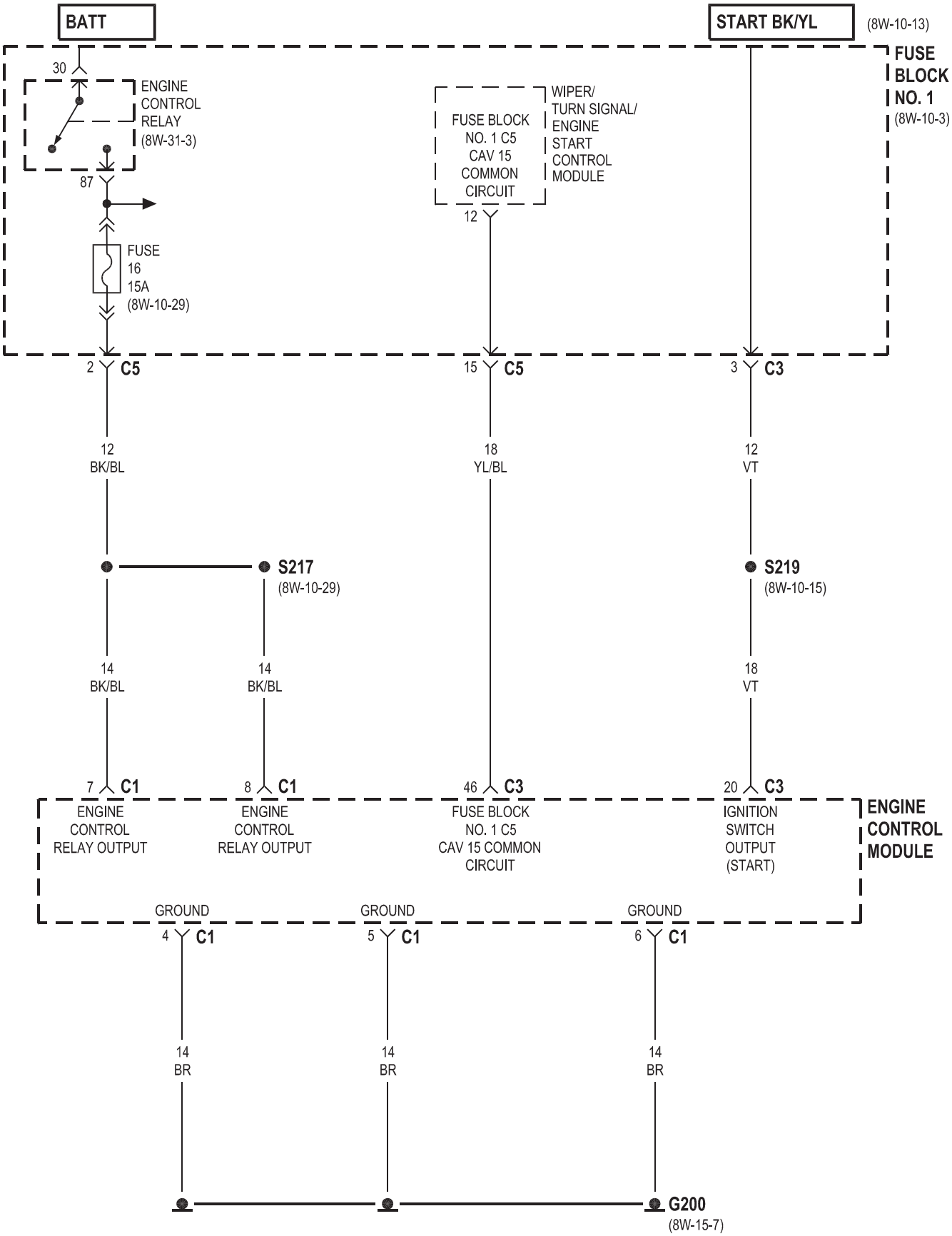
VA303005 J038W-24

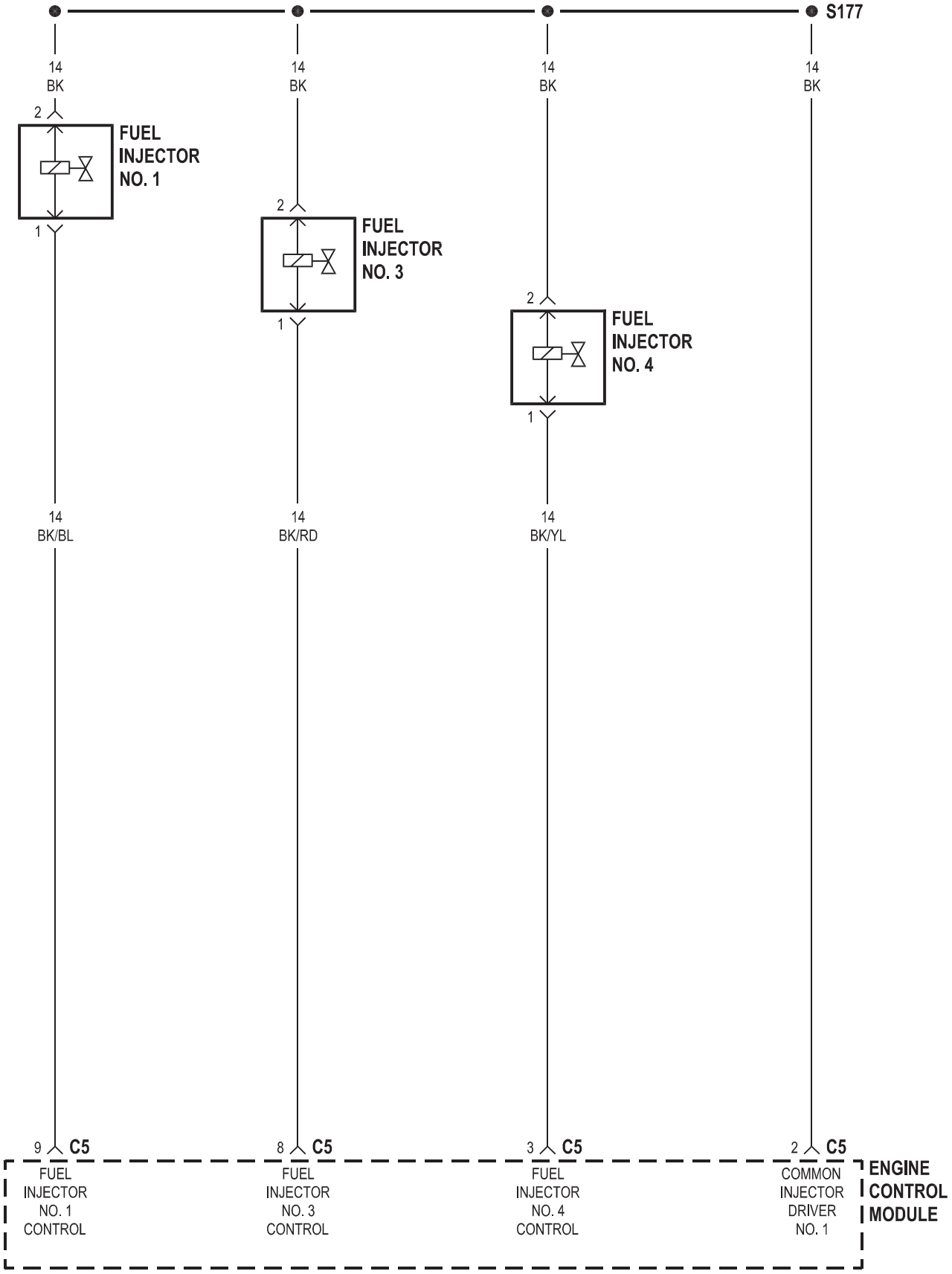

BOOST PRESSURE SOLENOID
1
2
MASS AIR FLOW SENSOR 12 VOLT SUPPLY
SENSOR GROUND
MASS AIR FLOW SENSOR 5 VOLT SUPPLY
MASS AIR FLOW SENSOR SIGNAL
MASS AIR FLOW SENSOR
2
3
4
5
20 WT
20 BR
20 YL/RD
20 BR/YL
20 BR/BK
20 YL/DG
48 C3
35 C3
33 C3
7 C3
19 C3
18 C3
BOOST PRESSURE SOLENOID CONTROL
BOOST PRESSURE SOLENOID 12 VOLT SUPPLY
MASS AIR FLOW SENSOR 12 VOLT SUPPLY
SENSOR GROUND
MASS AIR FLOW SENSOR 5 VOLT SUPPLY
MASS AIR FLOW SENSOR SIGNAL
ENGINE CONTROL MODULE

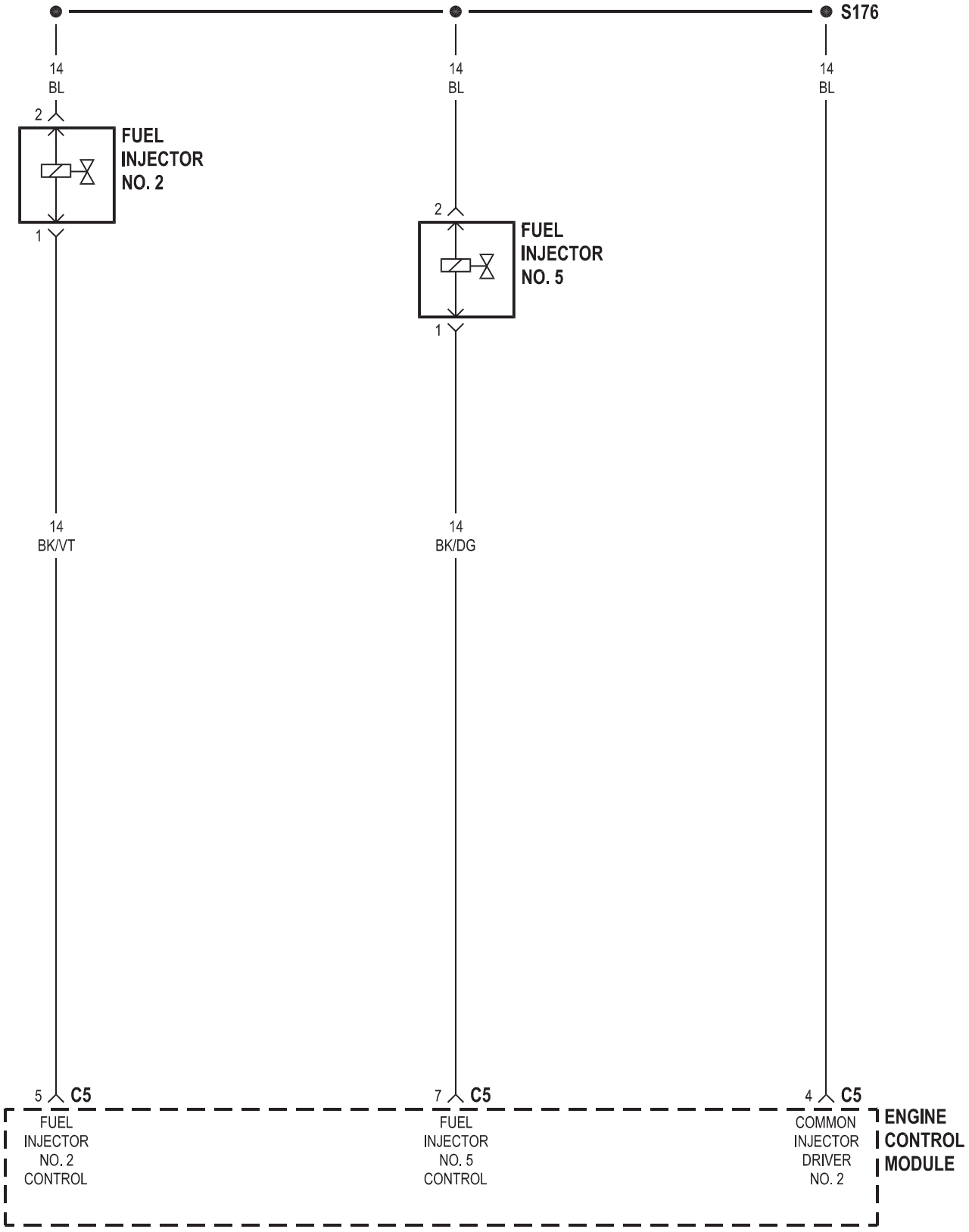


VA303007 J038W-24

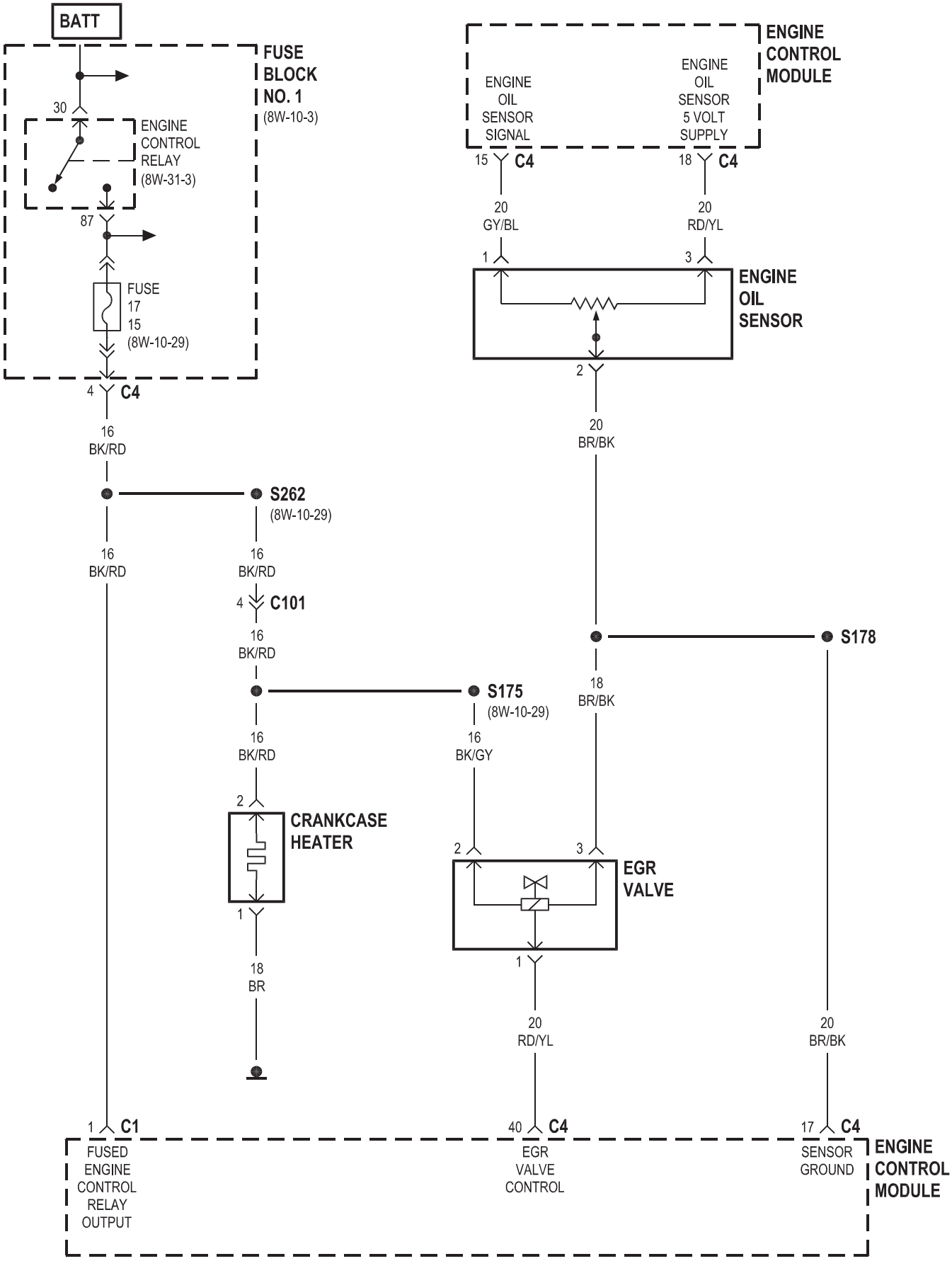

INTAKE AIR TEMPERATURE SENSOR
1
2
ACCELERATOR PEDAL POSITION SENSOR
4
5
1
3
2
18 BR/DG
18 DG/WT
18 BR/GY
18 GY/DG
18 BL/RD
18 BL/DG
18 BR/BL
1 C3
12 C3
8 C3
9 C3
5 C3
10 C3
23 C3
SENSOR GROUND
INTAKE AIR TEMPERATURE SENSOR SIGNAL
SENSOR GROUND
ACCEL PEDAL POSITION SENSOR SIGNAL NO. 2
ACCEL PEDAL POSITION SENSOR 5 VOLT SUPPLY
ACCEL PEDAL POSITION SENSOR SIGNAL NO. 1
SENSOR GROUND
ENGINE CONTROL MODULE

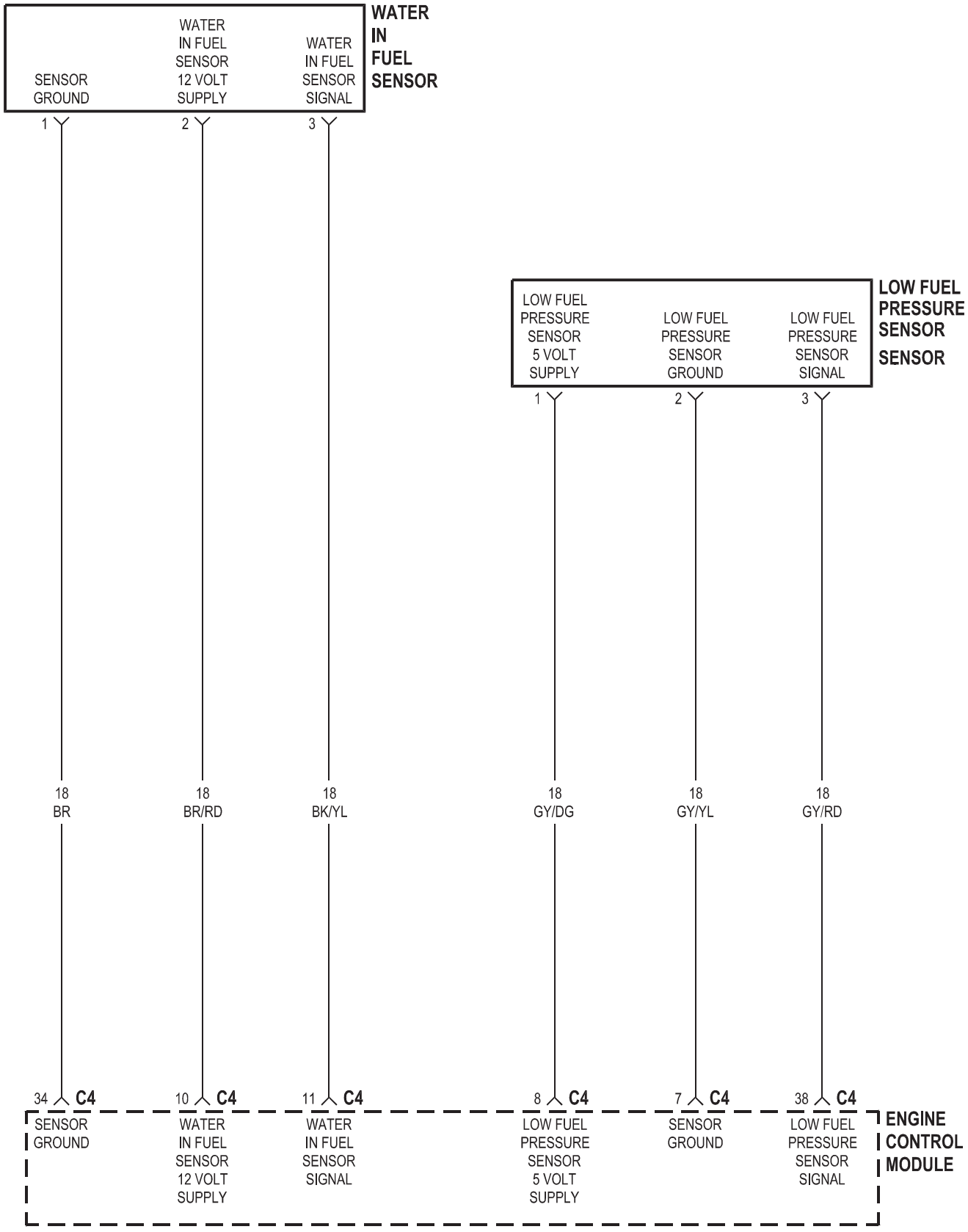

BATT
START BK/YL
(8W-10-13)
FUSE BLOCK NO. 1
(8W-10-3)
30
ENGINE CONTROL RELAY
(8W-31-3)
87
FUSE 16 15A
(8W-10-29)
FUSE BLOCK NO. 1 C5 CAV 15 COMMON CIRCUIT
WIPER/ TURN SIGNAL/ ENGINE START CONTROL MODULE
12
2 C5
15 C5
3 C3
12 BK/BL
18 YL/BL
12 VT
S217
(8W-10-29)
S219
(8W-10-15)
14 BK/BL
14 BK/BL
18 VT
7 C1
8 C1
46 C3
20 C3
ENGINE CONTROL RELAY OUTPUT
ENGINE CONTROL RELAY OUTPUT
FUSE BLOCK NO. 1 C5 CAV 15 COMMON CIRCUIT
IGNITION SWITCH OUTPUT (START)
ENGINE CONTROL MODULE
GROUND
GROUND
GROUND
4 C1
5 C1
6 C1
14 BR
14 BR
14 BR
G200
(8W-15-7)


S177
14
BK
14
BK
14
BK
14
BK
2
FUEL
INJECTOR
NO. 1
1
2
FUEL
INJECTOR
NO. 3
1
2
FUEL
INJECTOR
NO. 4
1
14
BK/BL
14
BK/RD
14
BK/YL
9 C5
FUEL
INJECTOR
NO. 1
CONTROL
8 C5
FUEL
INJECTOR
NO. 3
CONTROL
3 C5
FUEL
INJECTOR
NO. 4
CONTROL
2 C5
COMMON
INJECTOR
DRIVER
NO. 1
ENGINE
CONTROL
MODULE

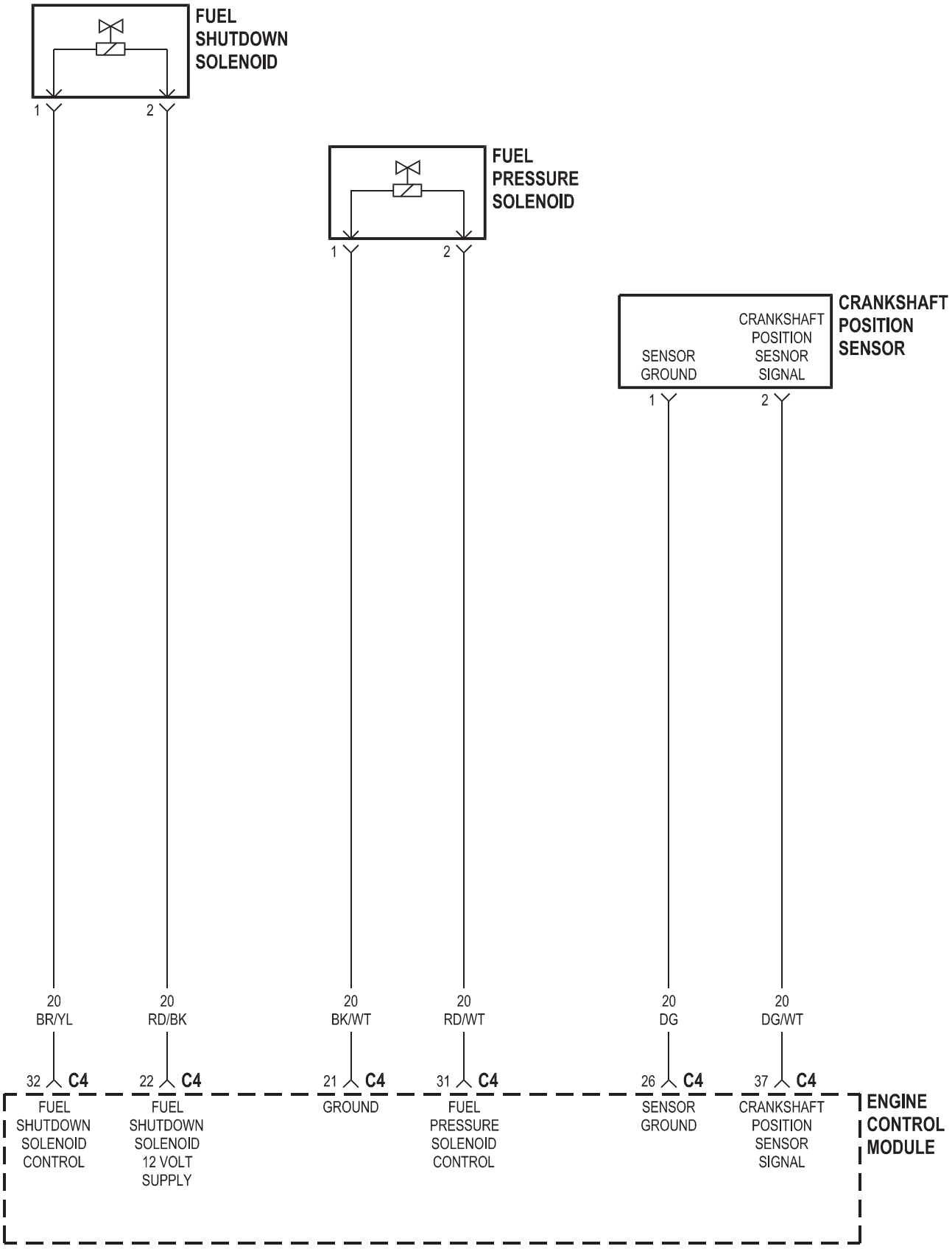


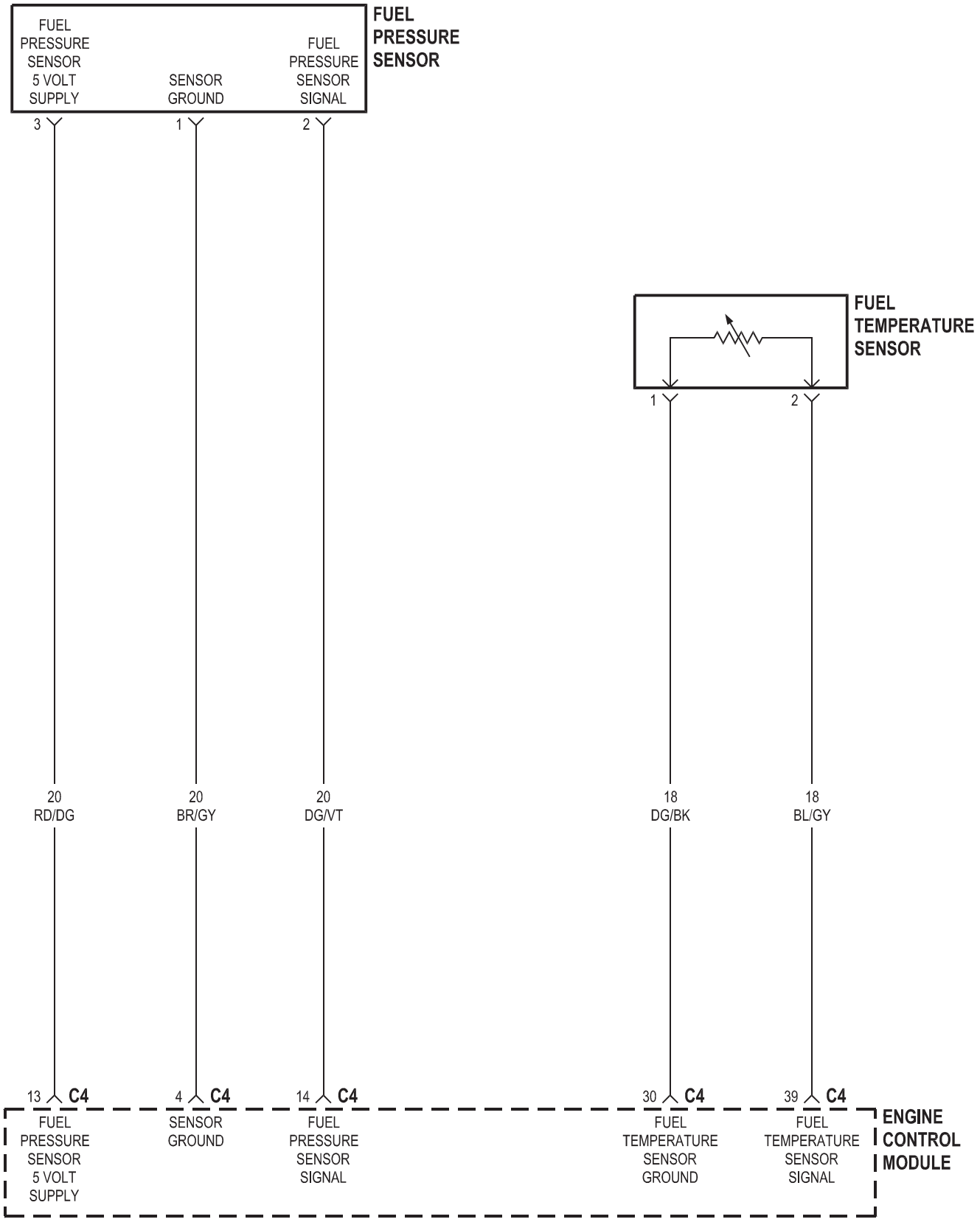
VA303011 J038W-24


BATT
FUSE BLOCK NO. 1
(8W-10-3)
30
ENGINE CONTROL RELAY
(8W-31-3)
87
FUSE
17
15
(8W-10-29)
4 C4
16
BK/RD
S262
(8W-10-29)
16
BK/RD
16
BK/RD
4 C101
16
BK/RD
S175
(8W-10-29)
16
BK/RD
2
CRANKCASE HEATER
1
18
BR
16
BK/GY
2
3
EGR VALVE
1
20
RD/YL
ENGINE CONTROL MODULE
ENGINE OIL SENSOR SIGNAL
ENGINE OIL SENSOR 5 VOLT SUPPLY
15 C4
18 C4
20
GY/BL
20
RD/YL
1
3
ENGINE OIL SENSOR
2
20
BR/BK
S178
18
BR/BK
20
BR/BK
1 C1
FUSED ENGINE CONTROL RELAY OUTPUT
40 C4
EGR VALVE CONTROL
17 C4
SENSOR GROUND
ENGINE CONTROL MODULE

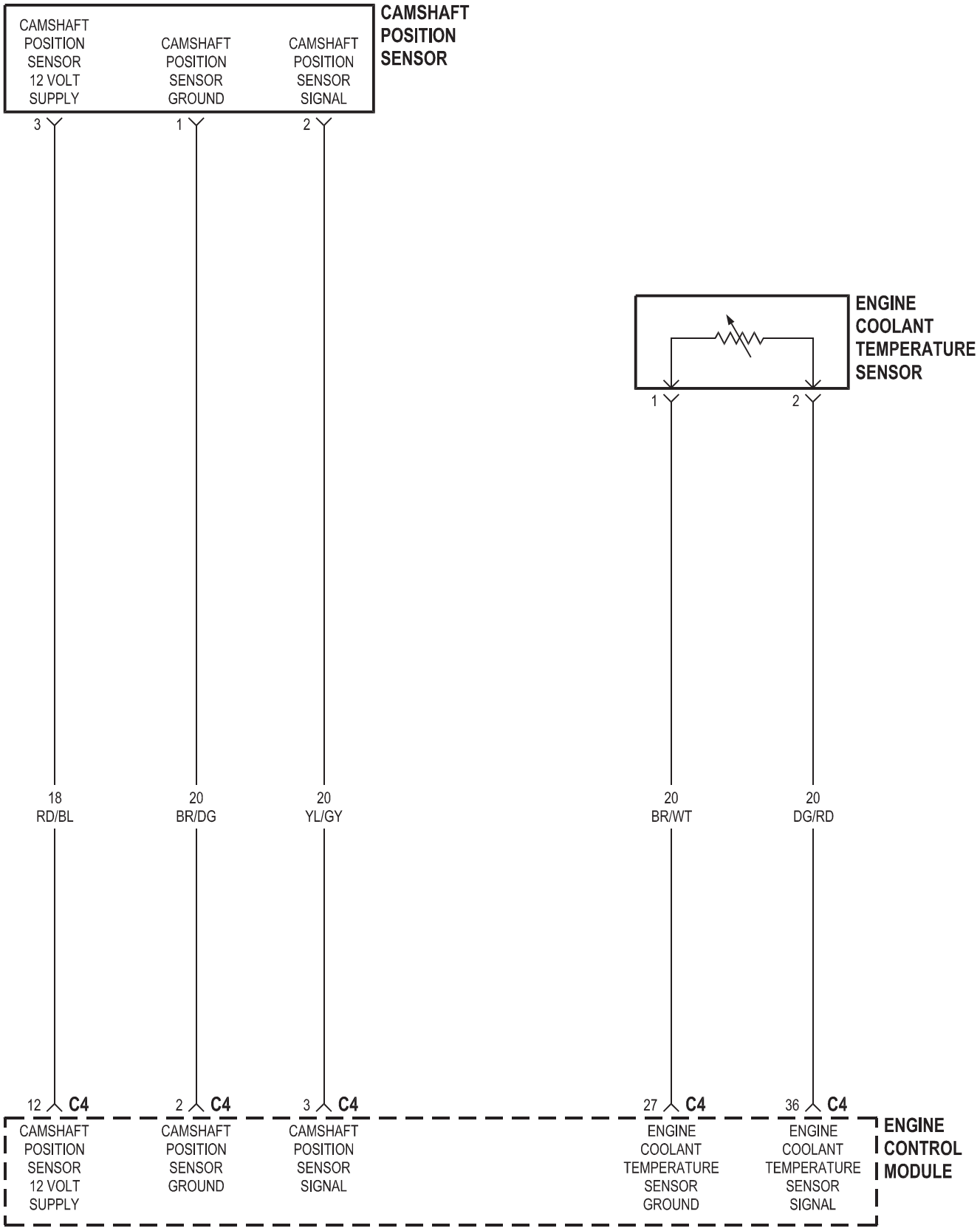


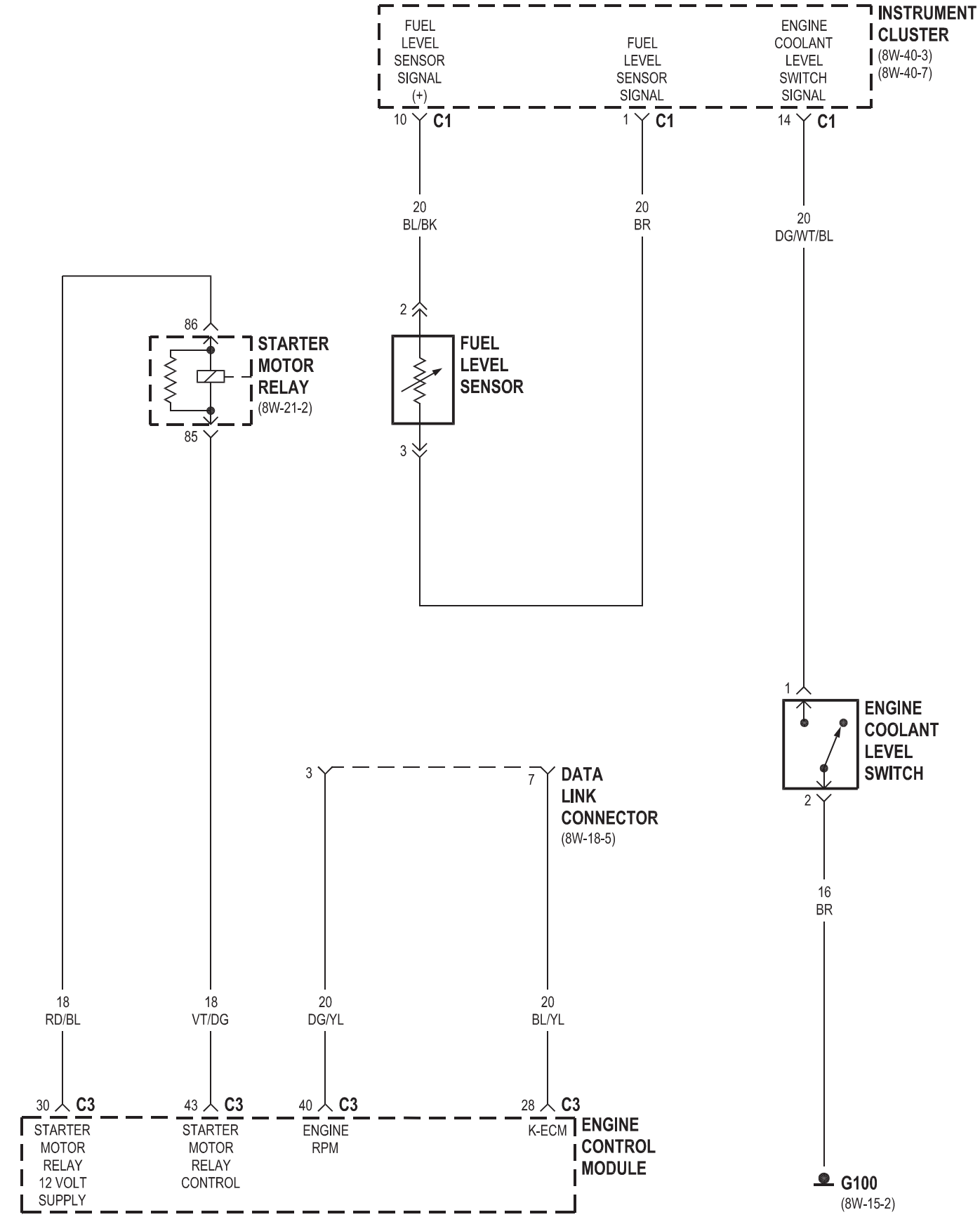
VA303013 J038W-24


FUEL SHUTDOWN SOLENOID
1
2
FUEL PRESSURE SOLENOID
1
2
CRANKSHAFT POSITION SENSOR
SENSOR GROUND
CRANKSHAFT POSITION SESNOR SIGNAL
1
2
20 BR/YL
20 RD/BK
20 BK/WT
20 RD/WT
20 DG
20 DG/WT
32 C4
22 C4
21 C4
31 C4
26 C4
37 C4
FUEL SHUTDOWN SOLENOID CONTROL
FUEL SHUTDOWN SOLENOID 12 VOLT SUPPLY
GROUND
FUEL PRESSURE SOLENOID CONTROL
SENSOR GROUND
CRANKSHAFT POSITION SENSOR SIGNAL
ENGINE CONTROL MODULE



VA303015 J038W-24

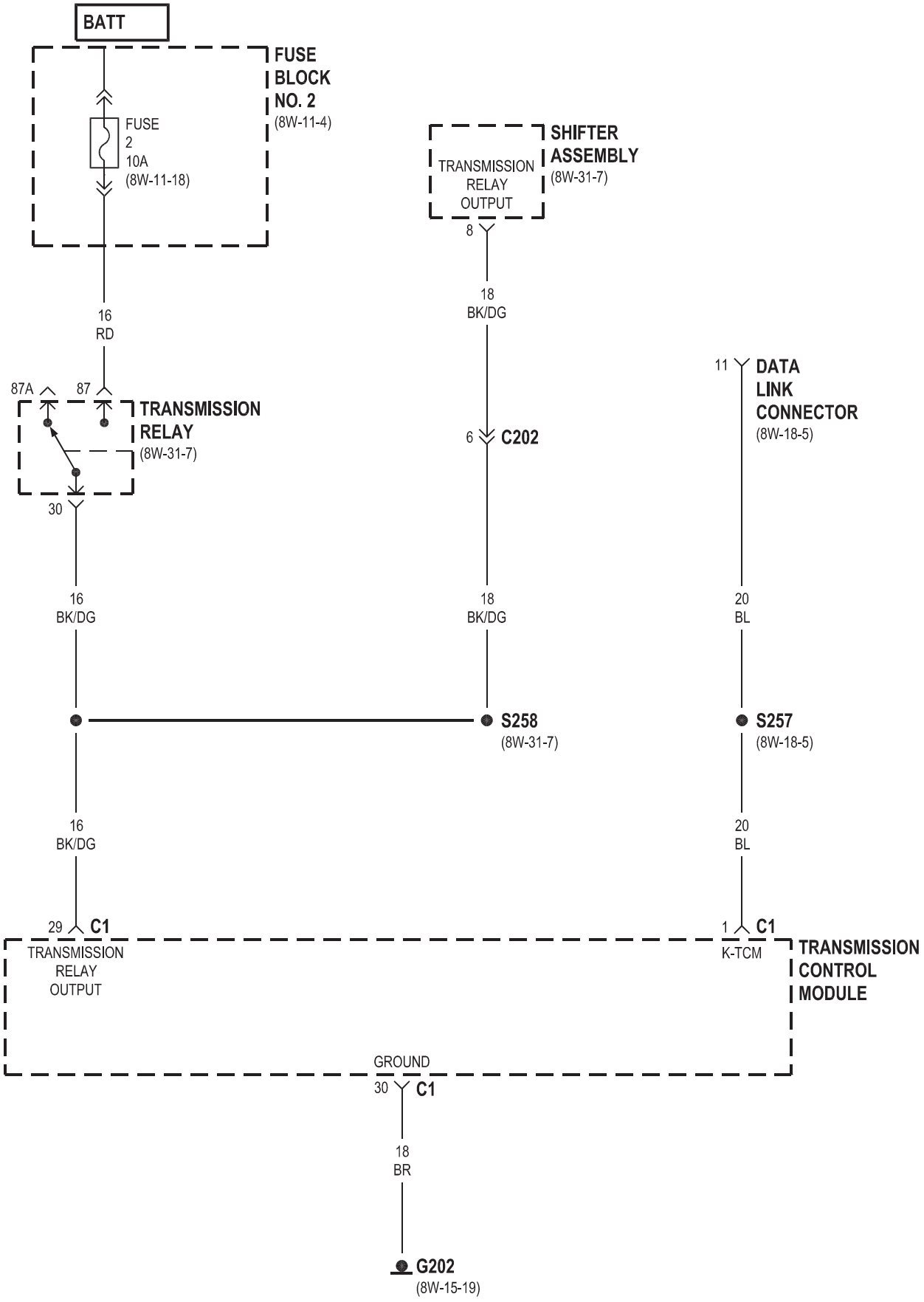

CAMSHAFT POSITION SENSOR
CAMSHAFT POSITION SENSOR 12 VOLT SUPPLY
CAMSHAFT POSITION SENSOR GROUND
CAMSHAFT POSITION SENSOR SIGNAL
3
1
2
ENGINE COOLANT TEMPERATURE SENSOR
1
2
18 RD/BL
20 BR/DG
20 YL/GY
20 BR/WT
20 DG/RD
12 C4
2 C4
3 C4
27 C4
36 C4
CAMSHAFT POSITION SENSOR 12 VOLT SUPPLY
CAMSHAFT POSITION SENSOR GROUND
CAMSHAFT POSITION SENSOR SIGNAL
ENGINE COOLANT TEMPERATURE SENSOR GROUND
ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
ENGINE CONTROL MODULE

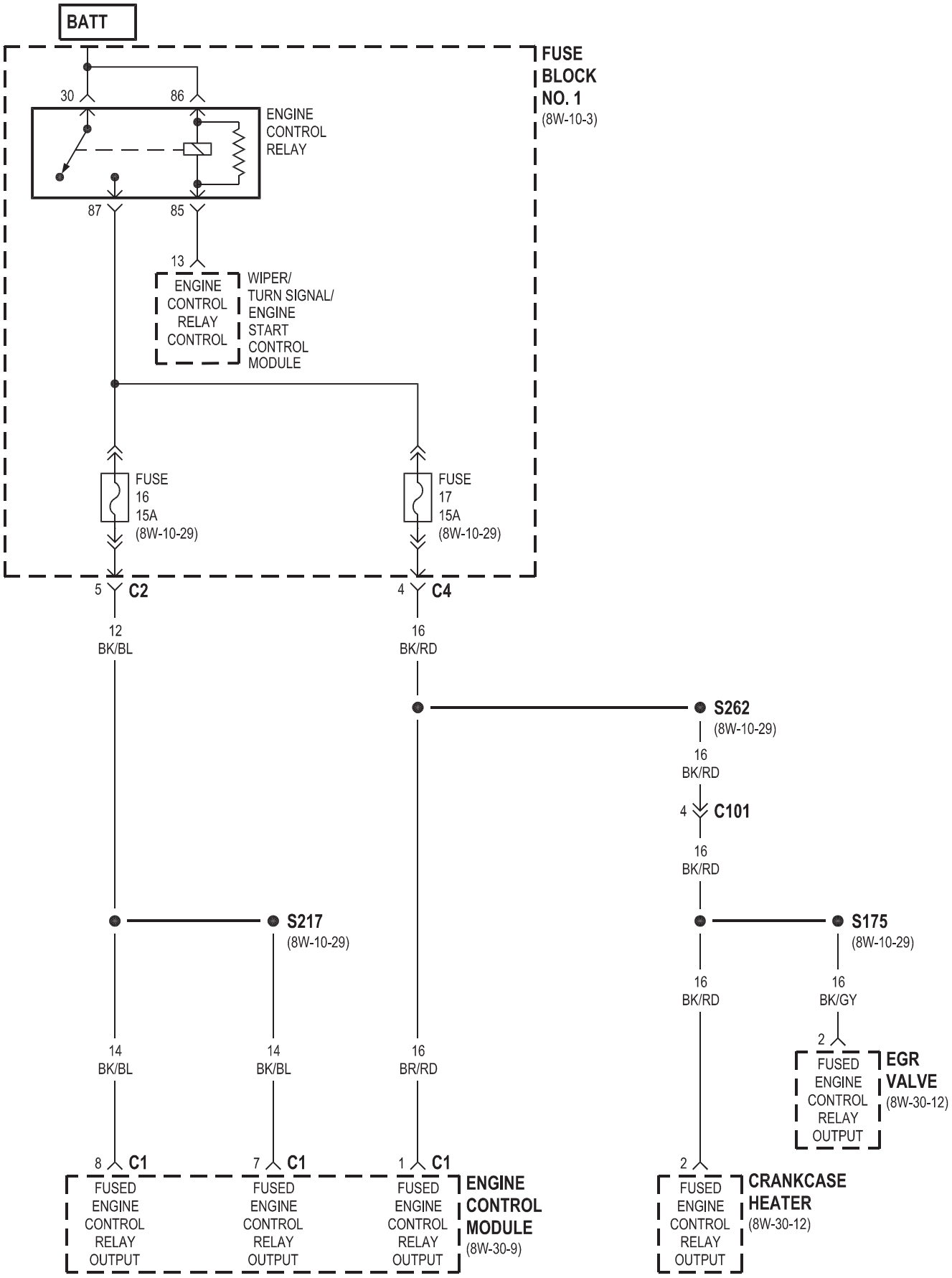


VA303017 J038W-24

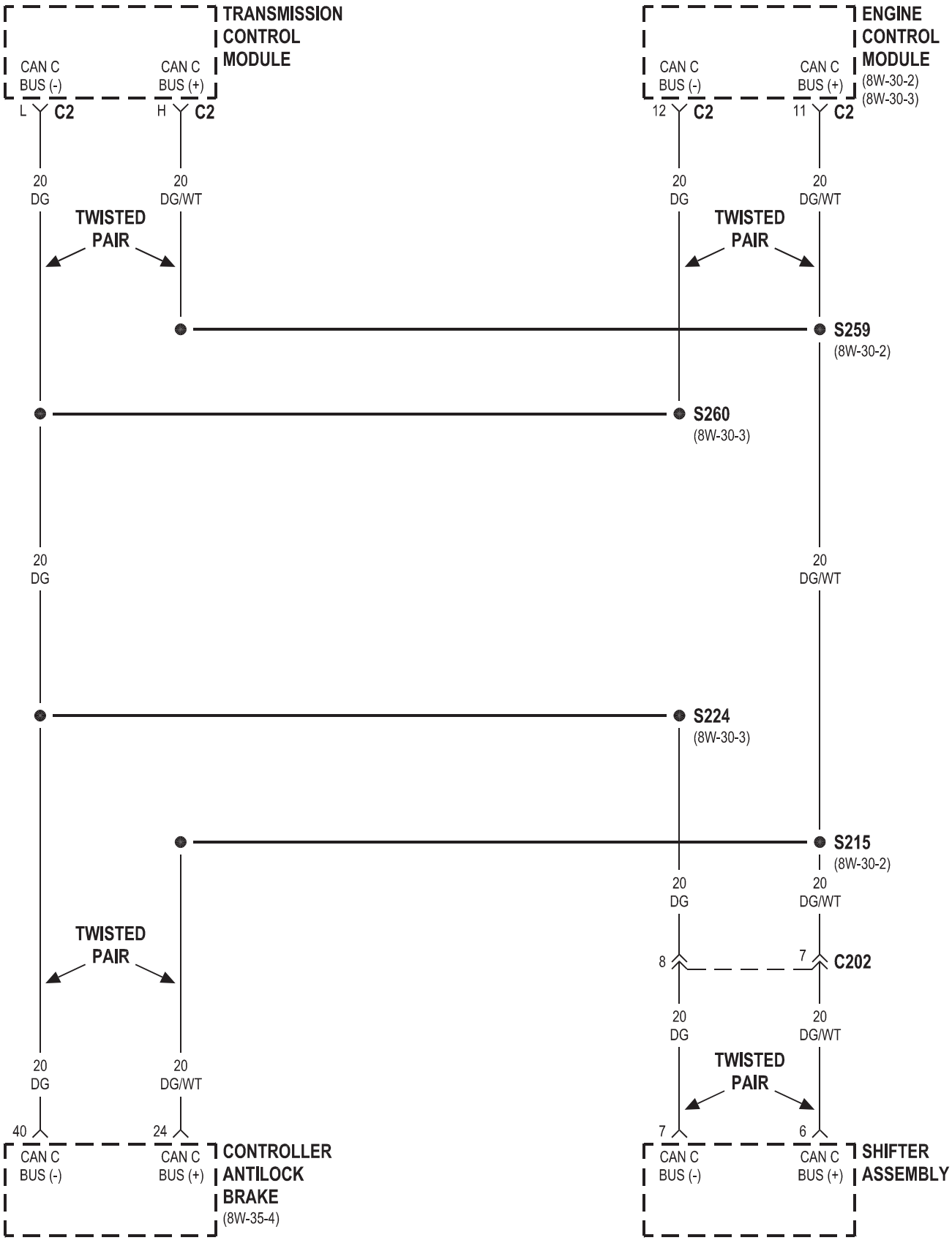
8W-31 TRANSMISSION CONTROL SYSTEM

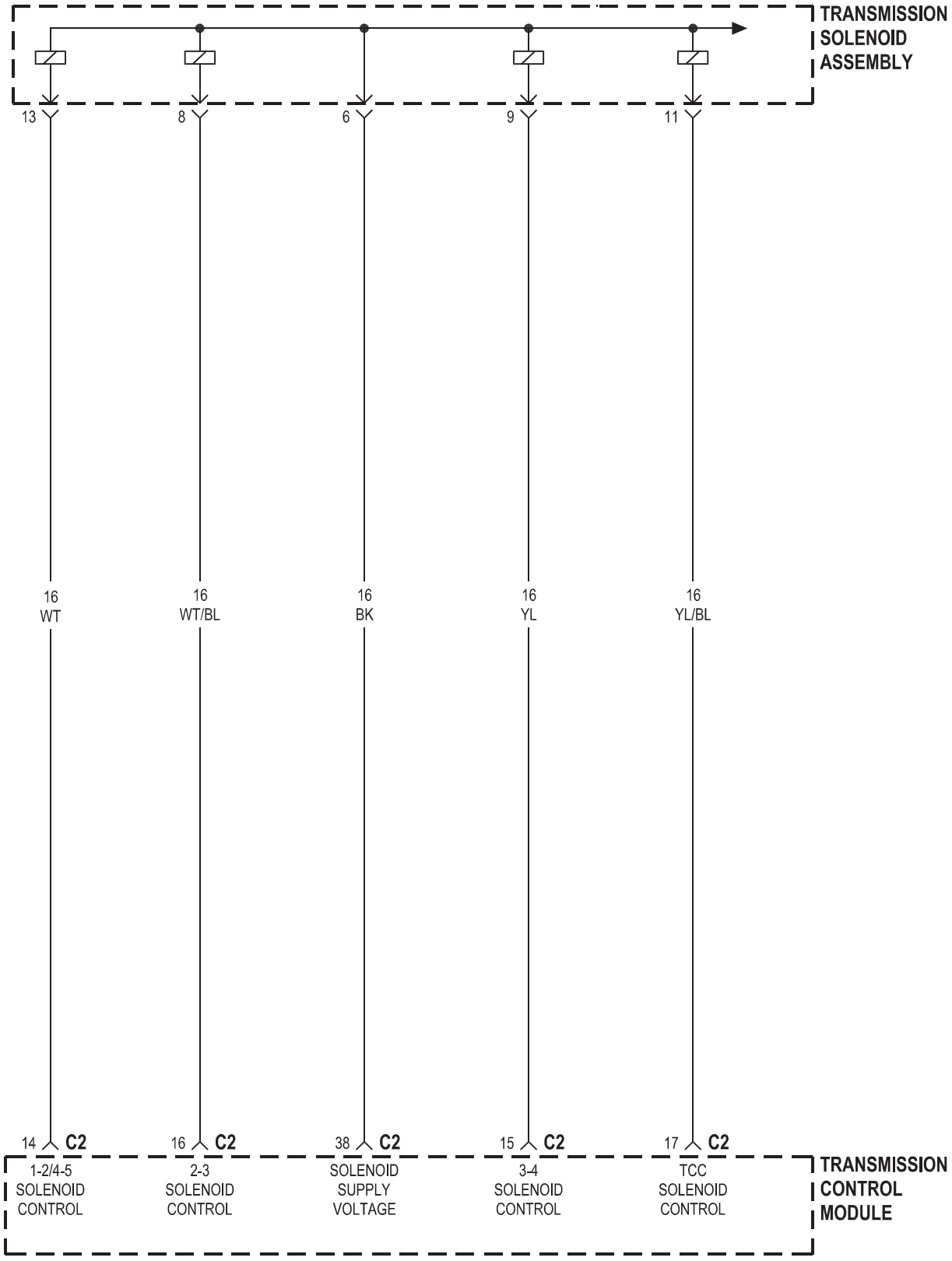
Component	Page
Brake Lamp Switch	8W-31-9
Controller Antilock Brake	8W-31-4
Crankcase Heater	8W-31-3
Data Link Connector	8W-31-2, 9
Daytime Running Lamps Relay	8W-31-8, 9
Differential Lock Solenoid Valve	8W-31-8
Egr Valve	8W-31-3
Engine Control Module	8W-31-3, 4
Engine Control Relay	8W-31-3
Fuse 2	8W-31-2, 7
Fuse 4	8W-31-7, 9
Fuse 7	8W-31-7
Fuse 12	8W-31-8
Fuse 16	8W-31-3
Fuse 17	8W-31-3
Fuse Block No. 1	8W-31-3, 7, 9
Fuse Block No. 2	8W-31-2, 7
Fuse Block No. 3	8W-31-8
G100	8W-31-8
G202	8W-31-2, 7
G203	8W-31-8, 9
Locker Switch No. 1	8W-31-8
Locker Switch No. 2	8W-31-8
Optional Equipment Relay	8W-31-8
Shifter Assembly	8W-31-2, 4, 7, 9
Tail Lamp Assembly- Left	8W-31-9
Tail Lamp Assembly- Right	8W-31-9
Transmission Control Module	8W-31-2, 4, 5, 6, 7
Transmission Relay	8W-31-2, 7
Transmission Solenoid Assembly	8W-31-5, 6
Wiper/Turn Signal/Engine Start Control Module	8W-31-3


BATT
FUSE BLOCK NO. 2
(8W-11-4)
FUSE 2 10A
(8W-11-18)
16 RD
87A
87
TRANSMISSION RELAY
(8W-31-7)
30
16 BK/DG
TRANSMISSION RELAY OUTPUT
SHIFTER ASSEMBLY
(8W-31-7)
8
18 BK/DG
6 C202
18 BK/DG
S258
(8W-31-7)
11
DATA LINK CONNECTOR
(8W-18-5)
20 BL
S257
(8W-18-5)
16 BK/DG
20 BL
29 C1
TRANSMISSION RELAY OUTPUT
1 C1
K-TCM
TRANSMISSION CONTROL MODULE
GROUND
30 C1
18 BR
G202
(8W-15-19)

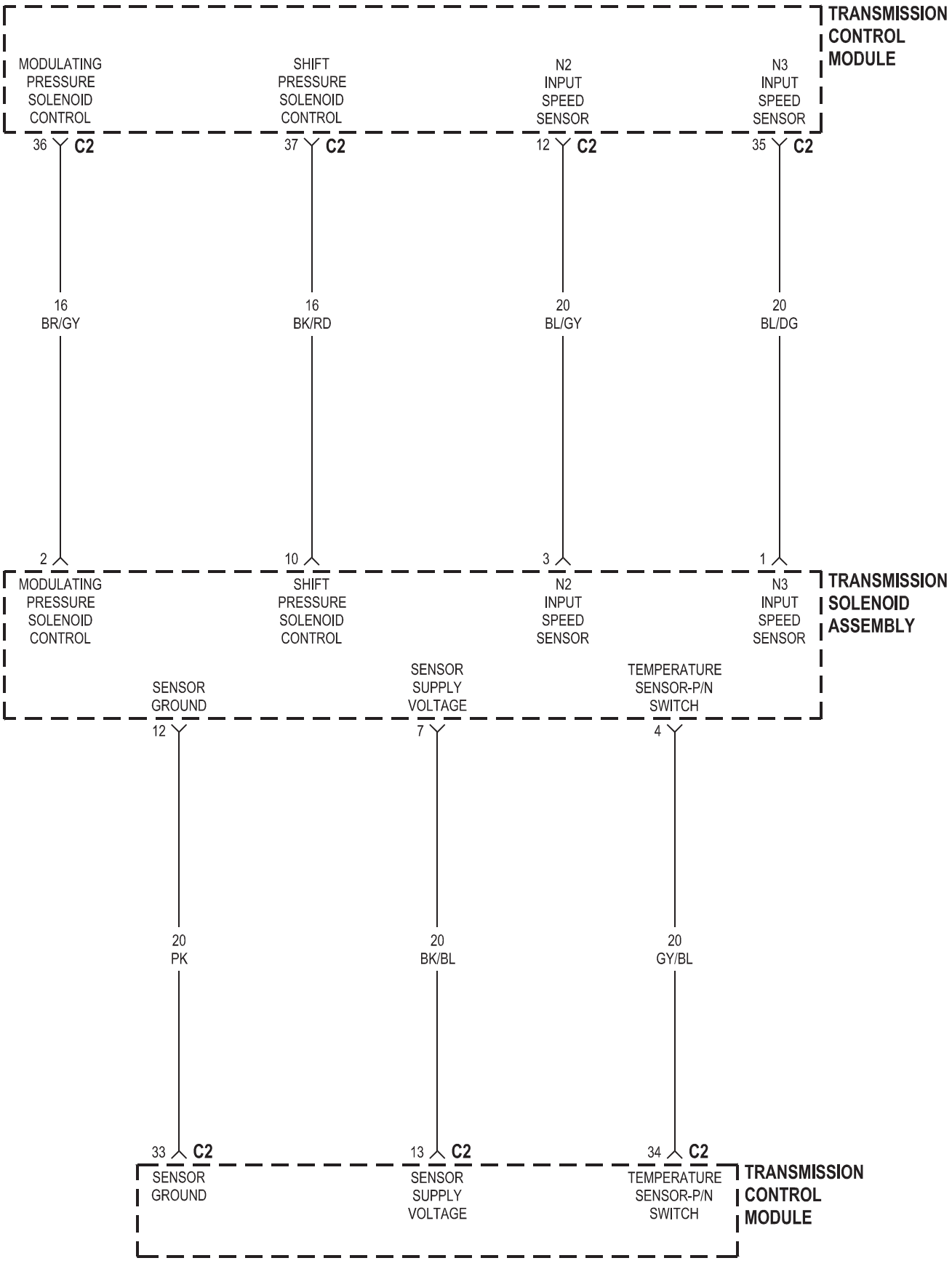


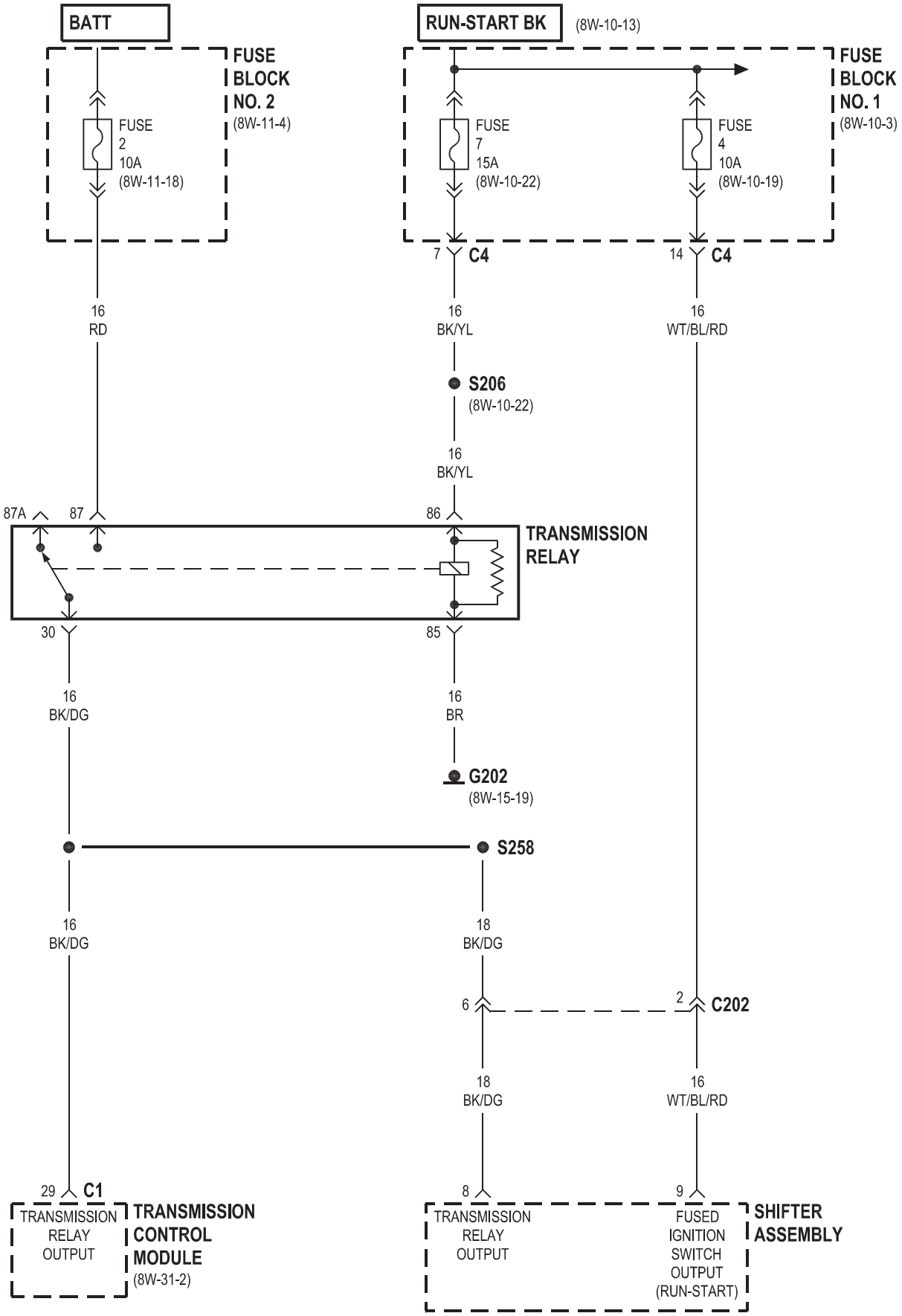
VA303103 J038W-24


TRANSMISSION CONTROL MODULE
CAN C BUS (-)
CAN C BUS (+)
L C2
H C2
ENGINE CONTROL MODULE
(8W-30-2)
(8W-30-3)
12 C2
11 C2
20 DG
20 DG/WT
TWISTED PAIR
S259
(8W-30-2)
S260
(8W-30-3)
S224
(8W-30-3)
S215
(8W-30-2)
8
7
C202
40
24
CONTROLLER ANTILOCK BRAKE
(8W-35-4)
7
6
SHIFTER ASSEMBLY

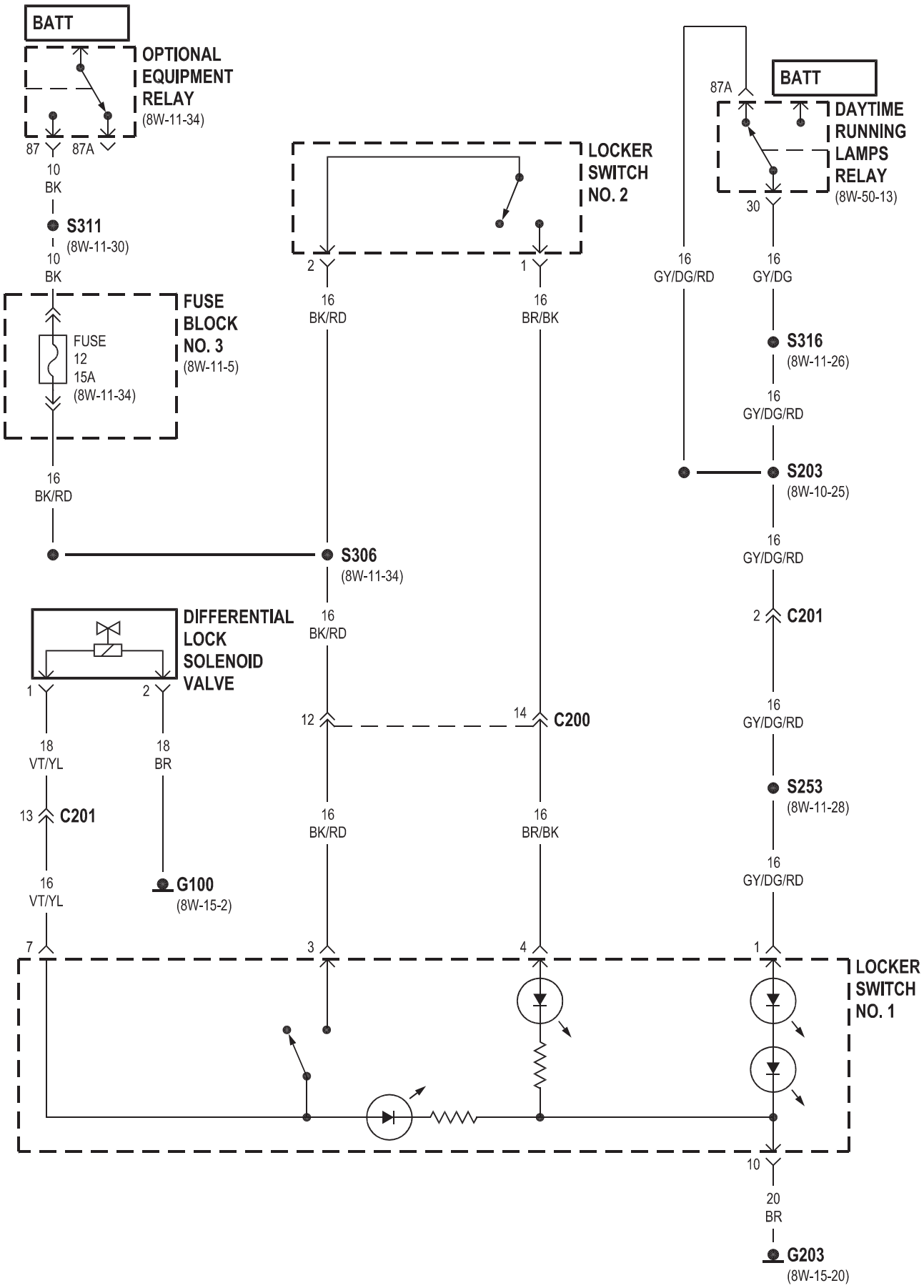


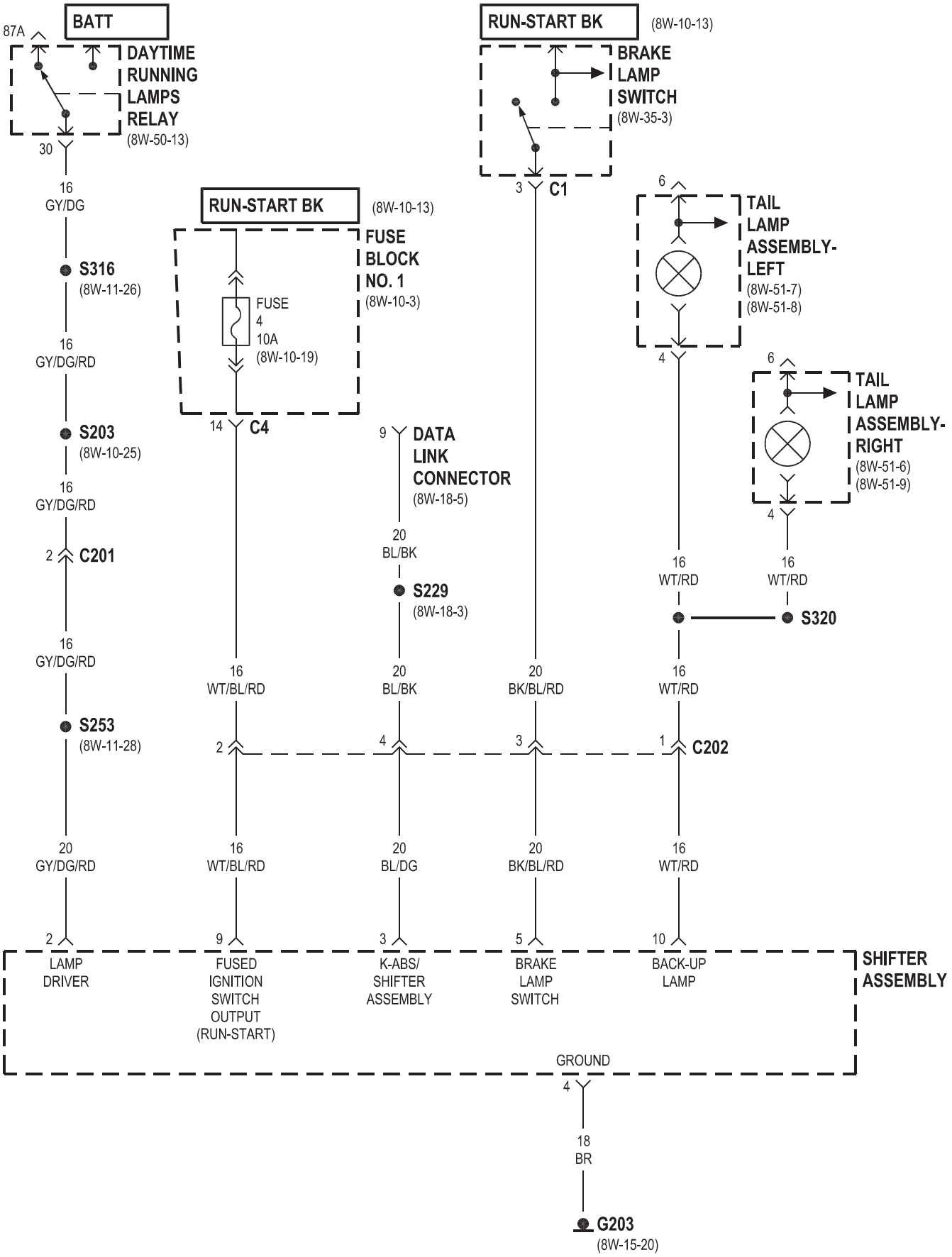
VA303105 J038W-24


TRANSMISSION CONTROL MODULE
MODULATING PRESSURE SOLENOID CONTROL
SHIFT PRESSURE SOLENOID CONTROL
N2 INPUT SPEED SENSOR
N3 INPUT SPEED SENSOR
36 C2
37 C2
12 C2
35 C2
16 BR/GY
16 BK/RD
20 BL/GY
20 BL/DG
2
10
3
1
TRANSMISSION SOLENOID ASSEMBLY
SENSOR GROUND
SENSOR SUPPLY VOLTAGE
TEMPERATURE SENSOR-P/N SWITCH
12
7
4
20 PK
20 BK/BL
20 GY/BL
33 C2
13 C2
34 C2
TRANSMISSION CONTROL MODULE



VA303107 J038W-24

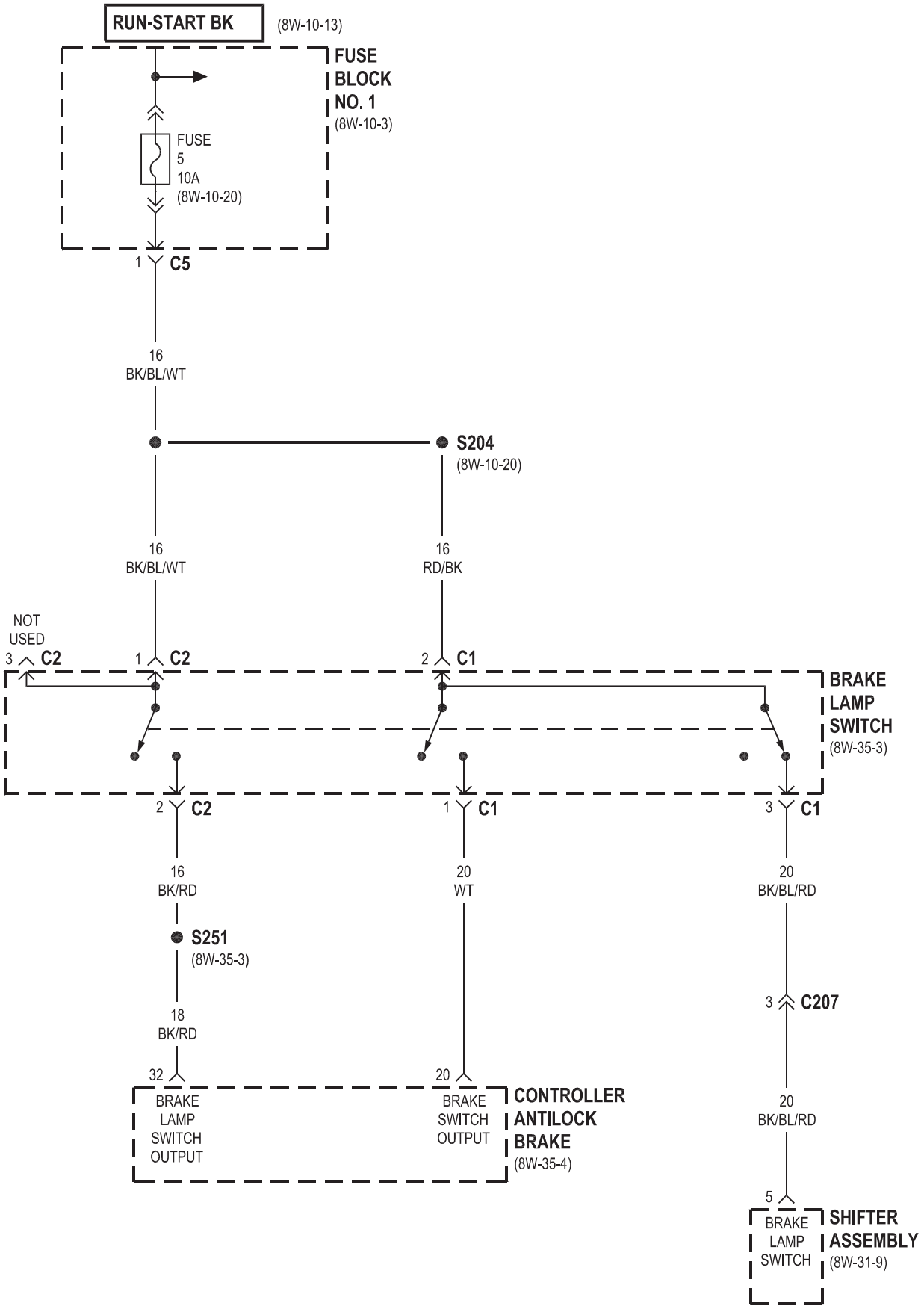

BATT
OPTIONAL EQUIPMENT RELAY
(8W-11-34)
87
87A
10
BK
S311
(8W-11-30)
10
BK
FUSE BLOCK NO. 3
(8W-11-5)
FUSE
12
15A
(8W-11-34)
16
BK/RD
LOCKER SWITCH NO. 2
2
1
16
BK/RD
16
BR/BK
87A
BATT
DAYTIME RUNNING LAMPS RELAY
(8W-50-13)
30
16
GY/DG/RD
16
GY/DG
S316
(8W-11-26)
16
GY/DG/RD
S203
(8W-10-25)
16
GY/DG/RD
S306
(8W-11-34)
2
C201
DIFFERENTIAL LOCK SOLENOID VALVE
1
2
16
BK/RD
16
GY/DG/RD
12
14
C200
18
VT/YL
18
BR
13
C201
S253
(8W-11-28)
16
BK/RD
16
BR/BK
16
GY/DG/RD
16
VT/YL
G100
(8W-15-2)
7
3
4
1
LOCKER SWITCH NO. 1
10
20
BR
G203
(8W-15-20)

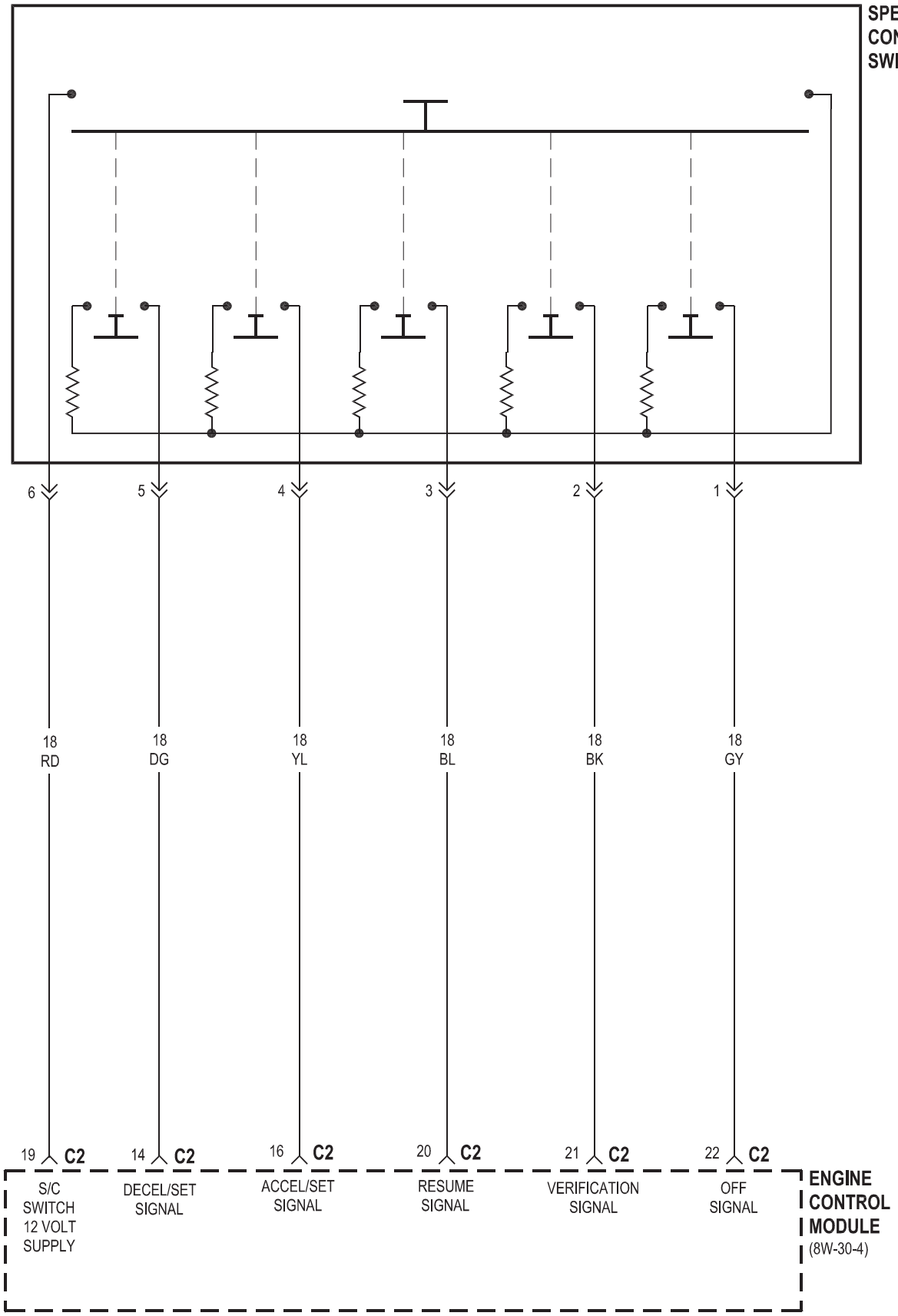


VA303109 J038W-24

8W-33 VEHICLE SPEED CONTROL

Component	Page
Brake Lamp Switch	8W-33-2
Controller Antilock Brake	8W-33-2
Engine Control Module	8W-33-3
Fuse 5	8W-33-2
Fuse Block No. 1	8W-33-2
Shifter Assembly	8W-33-2
Speed Control Switch	8W-33-3

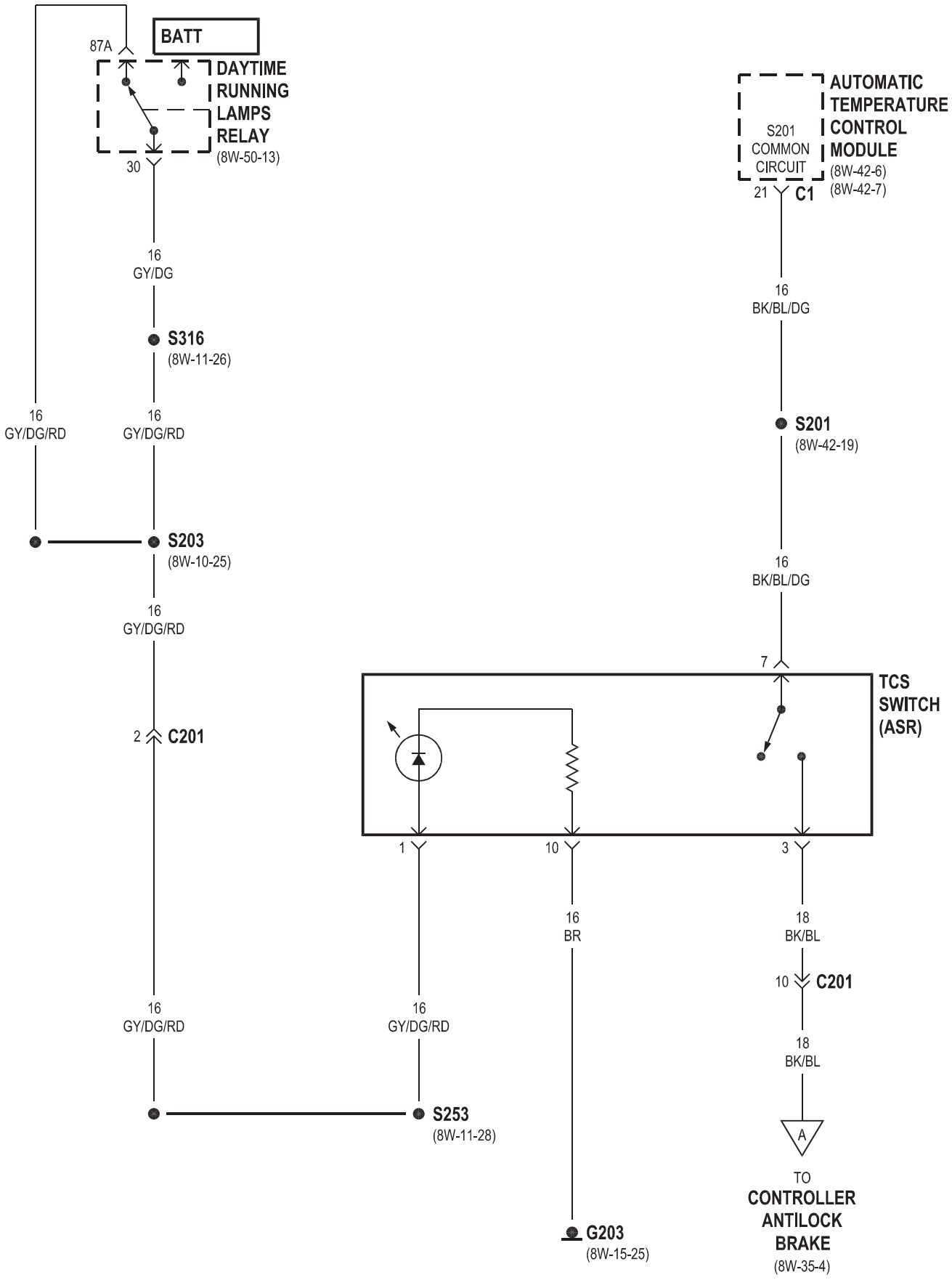

RUN-START BK
(8W-10-13)
FUSE BLOCK NO. 1
(8W-10-3)
FUSE 5 10A
(8W-10-20)
1 C5
16 BK/BL/WT
S204
(8W-10-20)
16 BK/BL/WT
16 RD/BK
NOT USED
3 C2
1 C2
2 C1
BRAKE LAMP SWITCH
(8W-35-3)
2 C2
1 C1
3 C1
16 BK/RD
20 WT
20 BK/BL/RD
S251
(8W-35-3)
18 BK/RD
3 C207
32
20
BRAKE LAMP SWITCH OUTPUT
BRAKE SWITCH OUTPUT
CONTROLLER ANTILOCK BRAKE
(8W-35-4)
20 BK/BL/RD
5
BRAKE LAMP SWITCH
SHIFTER ASSEMBLY
(8W-31-9)

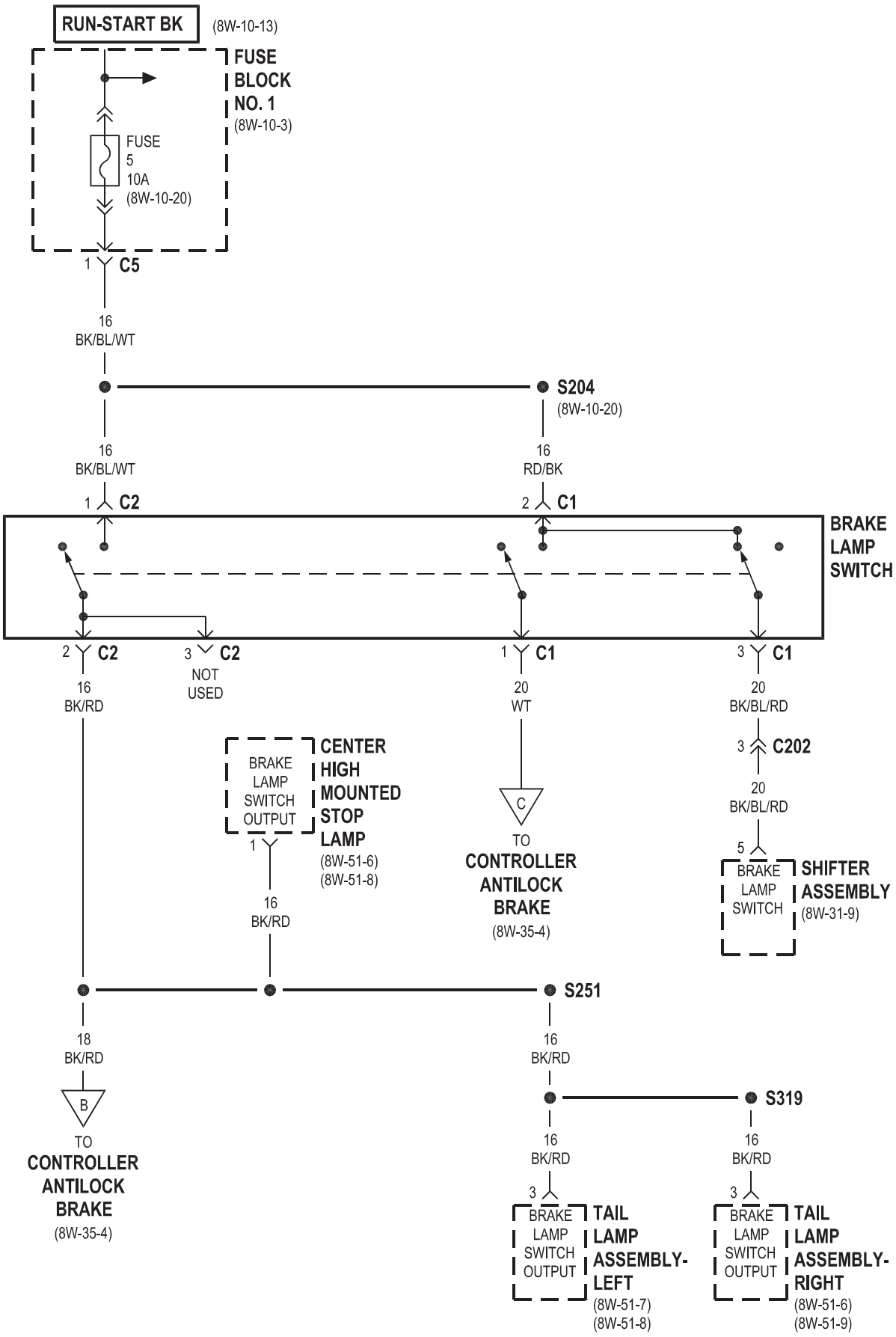


VA303303 J038W-24

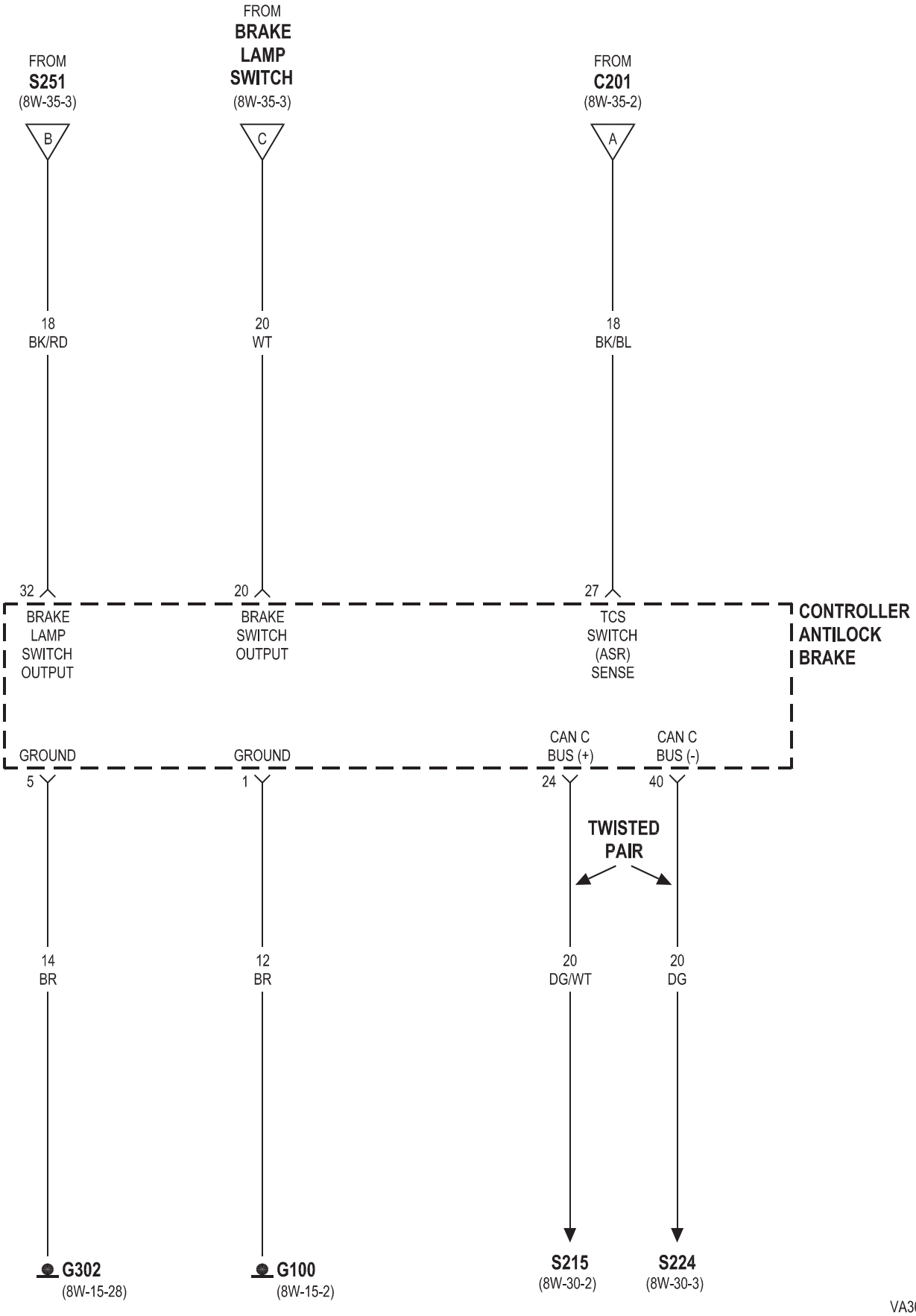
8W-35 ANTILOCK BRAKES

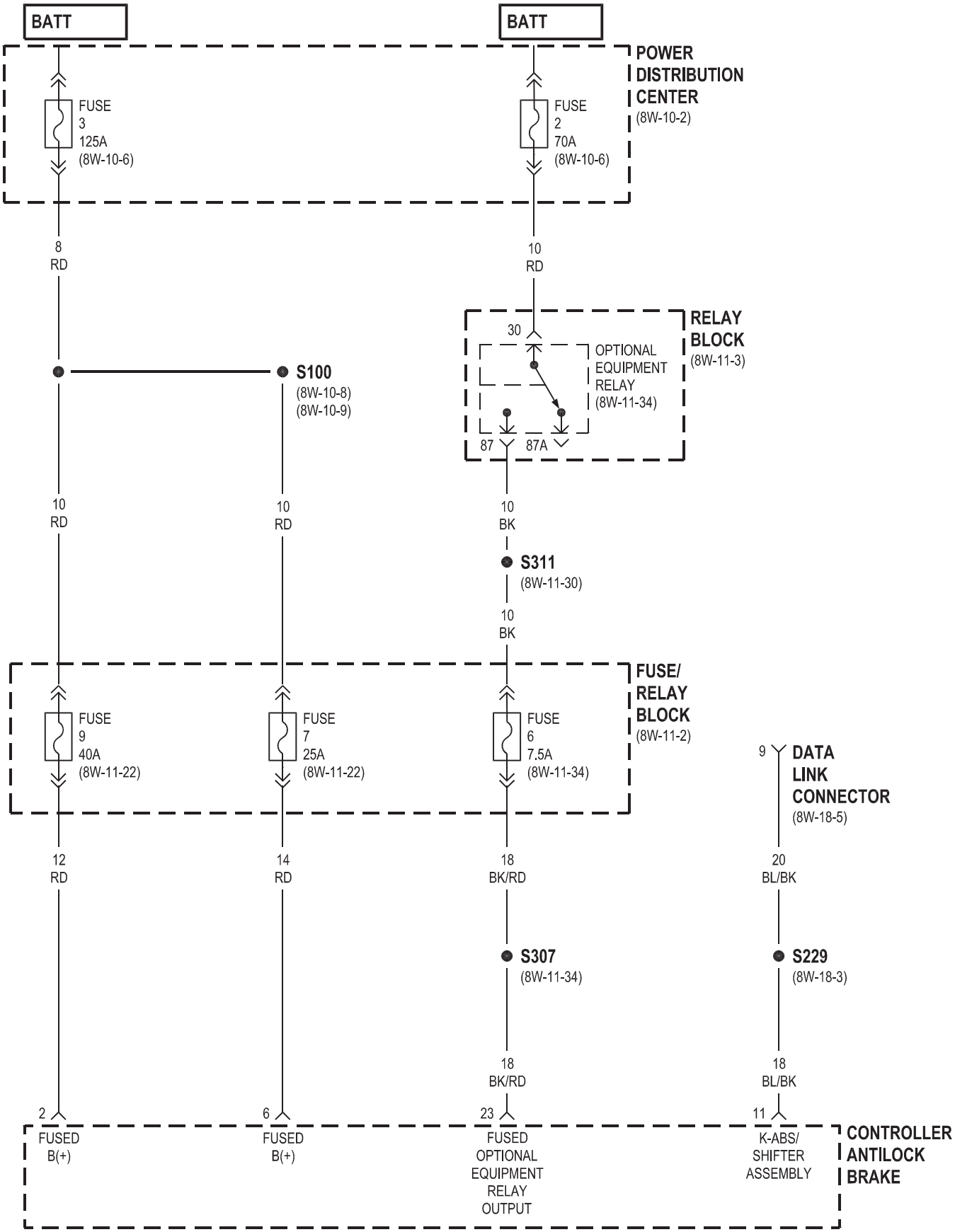
Component	Page
Automatic Temperature Control Module	8W-35-2
Brake Fluid Level Switch	8W-35-7
Brake Lamp Switch	8W-35-3, 4
Brake Wear Sensor- Left Front	8W-35-8
Brake Wear Sensor- Left Rear	8W-35-8
Brake Wear Sensor- Right Front	8W-35-8
Brake Wear Sensor- Right Rear	8W-35-8
Center High Mounted Stop Lamp	8W-35-3
Controller Antilock Brake	8W-35-2, 3, 4, 5, 6
Data Link Connector	8W-35-5
Daytime Running Lamps Relay	8W-35-2
Fuse 2	8W-35-5
Fuse 3	8W-35-5
Fuse 5	8W-35-3
Fuse 6	8W-35-5
Fuse 7	8W-35-5
Fuse 9	8W-35-5
Fuse Block No. 1	8W-35-3
Fuse/Relay Block	8W-35-5
G100	8W-35-4
G200	8W-35-7, 8
G202	8W-35-7
G203	8W-35-2
G300	8W-35-8
G302	8W-35-4
Instrument Cluster	8W-35-7, 8
Optional Equipment Relay	8W-35-5
Parking Brake Switch	8W-35-7
Power Distribution Center	8W-35-5
Relay Block	8W-35-5
Shifter Assembly	8W-35-3
Tail Lamp Assembly- Left	8W-35-3
Tail Lamp Assembly- Right	8W-35-3
TCS Switch	8W-35-2
Wheel Speed Sensor- Left Front	8W-35-6
Wheel Speed Sensor- Left Rear	8W-35-6
Wheel Speed Sensor- Right Front	8W-35-6
Wheel Speed Sensor- Right Rear	8W-35-6


BATT
87A
DAYTIME RUNNING LAMPS RELAY
(8W-50-13)
30
16 GY/DG
S316
(8W-11-26)
16 GY/DG/RD
16 GY/DG/RD
S203
(8W-10-25)
16 GY/DG/RD
2 C201
16 GY/DG/RD
S253
(8W-11-28)
AUTOMATIC TEMPERATURE CONTROL MODULE
(8W-42-6)
(8W-42-7)
S201 COMMON CIRCUIT
21 C1
16 BK/BL/DG
S201
(8W-42-19)
16 BK/BL/DG
7
TCS SWITCH (ASR)
1
10
3
16 BR
G203
(8W-15-25)
16 GY/DG/RD
18 BK/BL
10 C201
18 BK/BL
A
TO CONTROLLER ANTILOCK BRAKE
(8W-35-4)

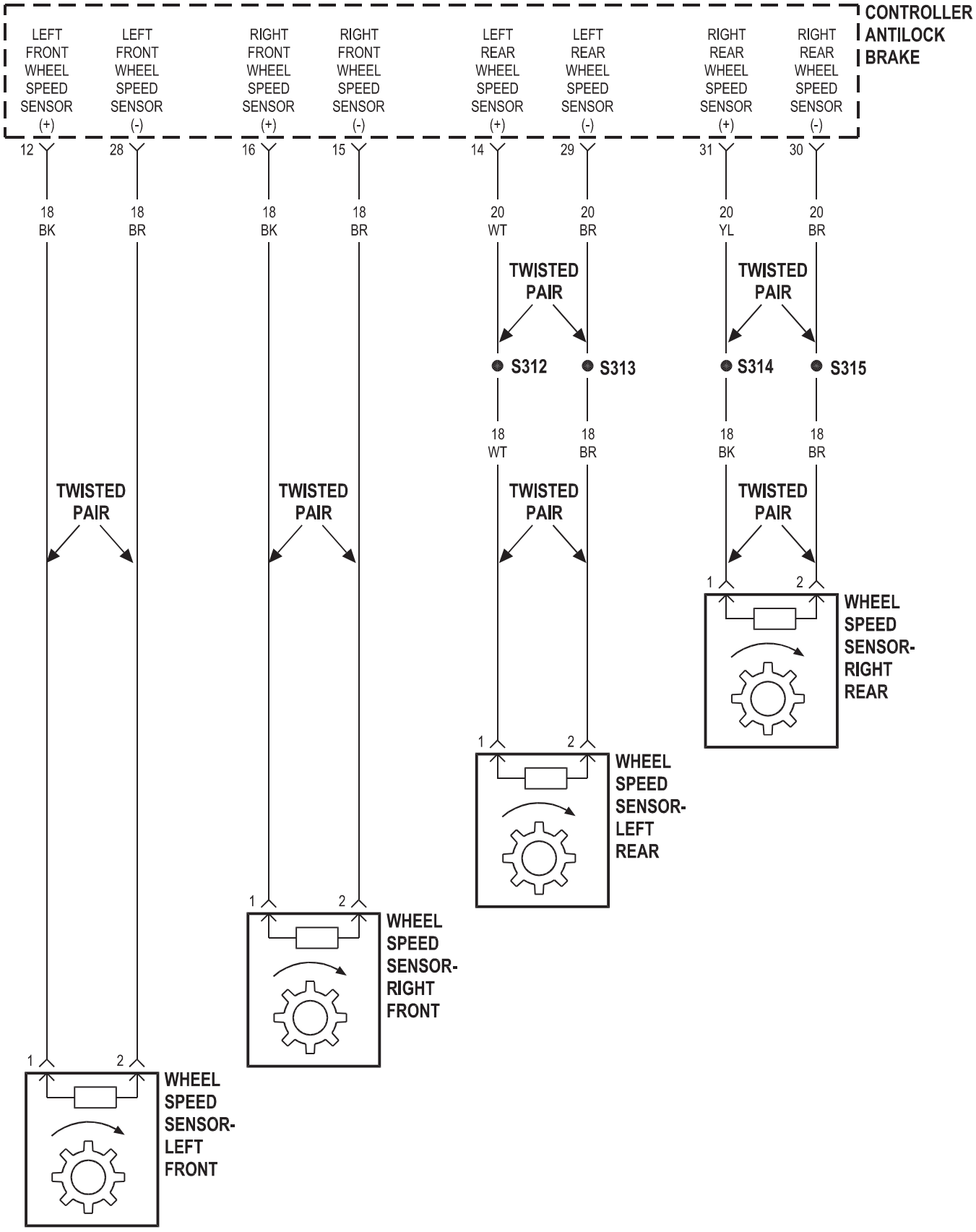


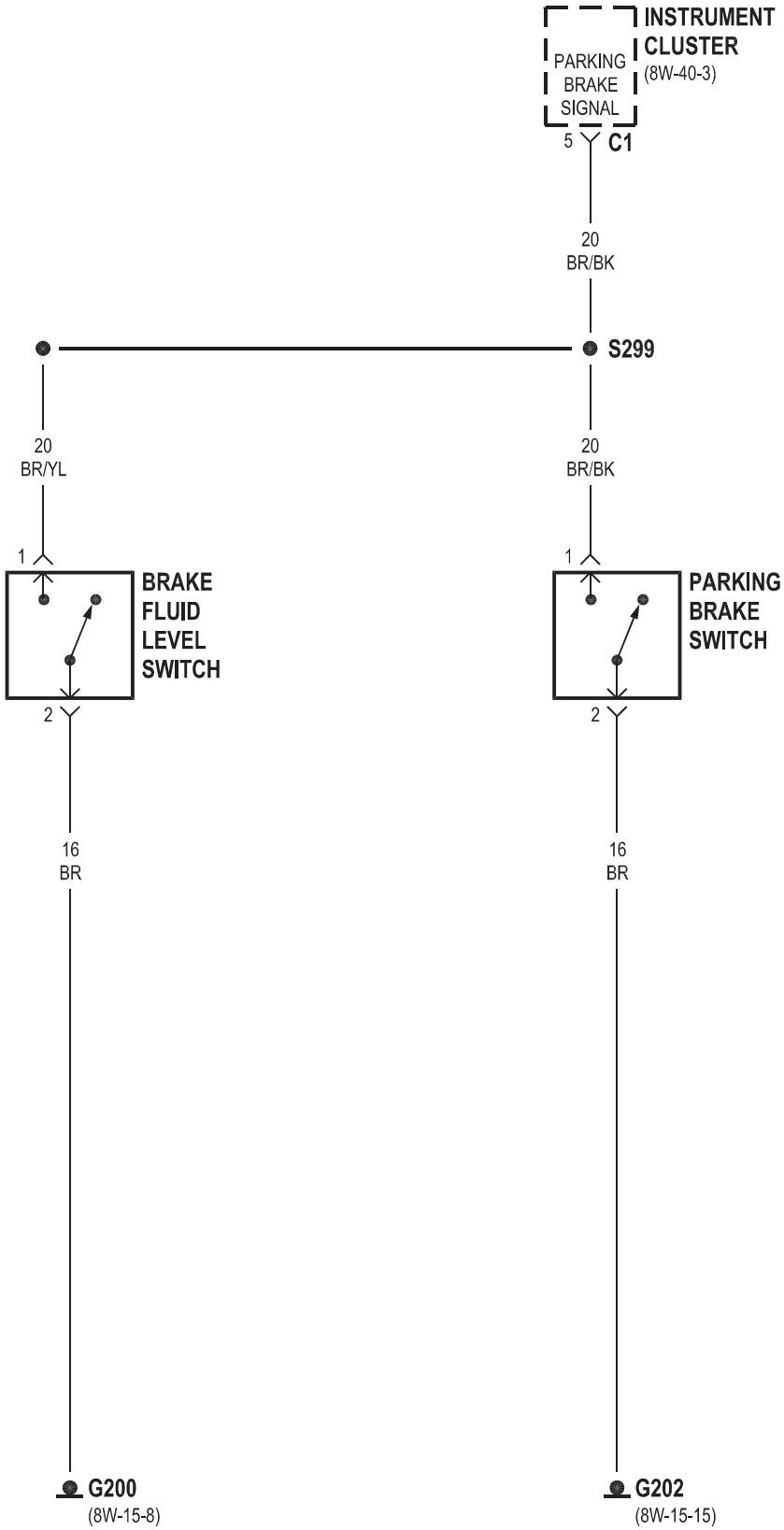
VA303503 J038W-24


FROM
S251
(8W-35-3)
B
FROM
BRAKE
LAMP
SWITCH
(8W-35-3)
C
FROM
C201
(8W-35-2)
A
18
BK/RD
20
WT
18
BK/BL
32
20
27
BRAKE
LAMP
SWITCH
OUTPUT
BRAKE
SWITCH
OUTPUT
TCS
SWITCH
(ASR)
SENSE
CONTROLLER
ANTILOCK
BRAKE
GROUND
GROUND
CAN C
BUS (+)
CAN C
BUS (-)
5
1
24
40
TWISTED
PAIR
14
BR
12
BR
20
DG/WT
20
DG
G302
(8W-15-28)
G100
(8W-15-2)
S215
(8W-30-2)
S224
(8W-30-3)

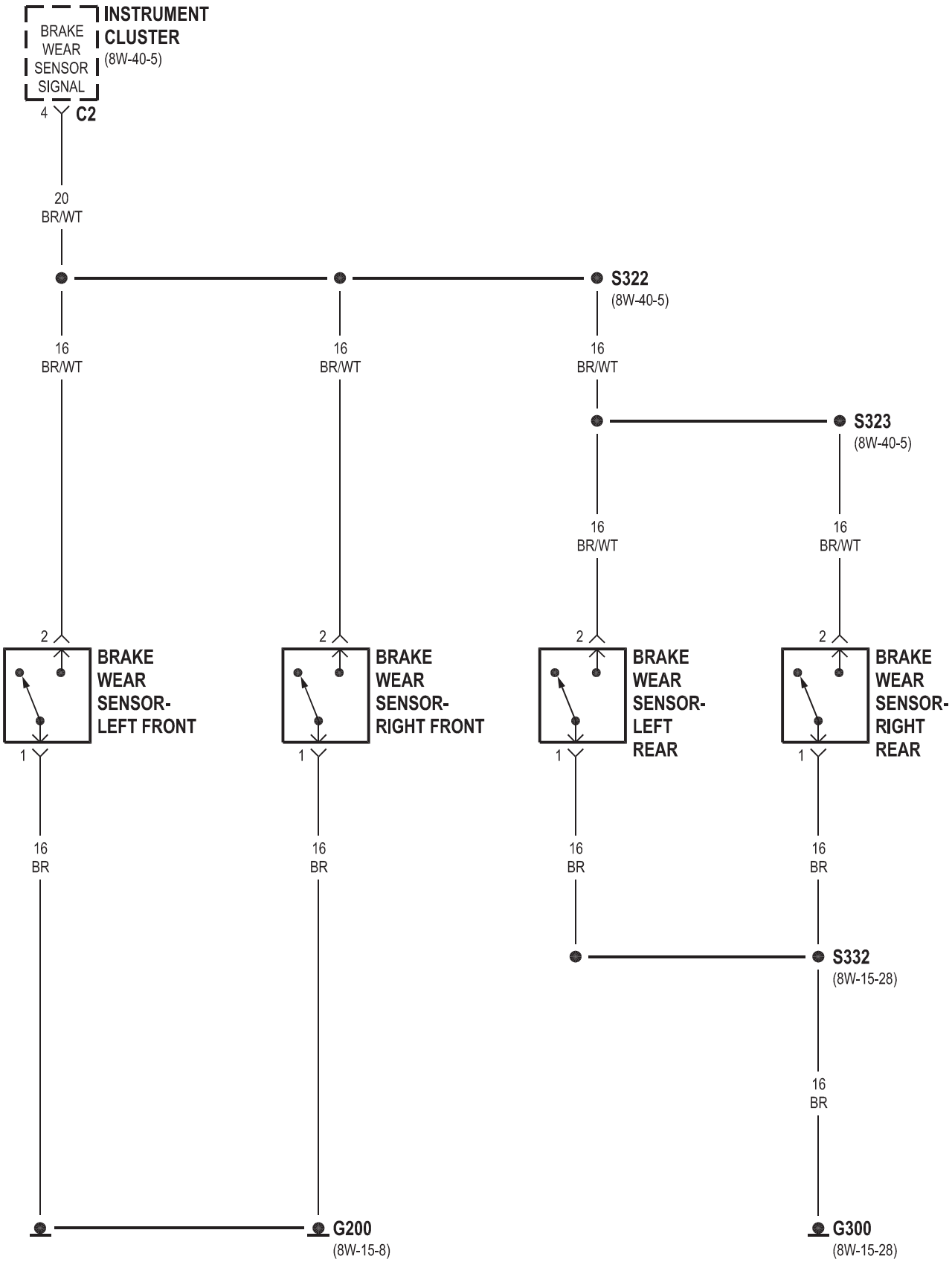


VA303505 J038W-24


CONTROLLER ANTILOCK BRAKE
LEFT FRONT WHEEL SPEED SENSOR (+)
LEFT FRONT WHEEL SPEED SENSOR (-)
RIGHT FRONT WHEEL SPEED SENSOR (+)
RIGHT FRONT WHEEL SPEED SENSOR (-)
LEFT REAR WHEEL SPEED SENSOR (+)
LEFT REAR WHEEL SPEED SENSOR (-)
RIGHT REAR WHEEL SPEED SENSOR (+)
RIGHT REAR WHEEL SPEED SENSOR (-)
12
28
16
15
14
29
31
30
18 BK
18 BR
18 BK
18 BR
20 WT
20 BR
20 YL
20 BR
TWISTED PAIR
TWISTED PAIR
TWISTED PAIR
TWISTED PAIR
S312
S313
S314
S315
18 WT
18 BR
18 BK
18 BR
TWISTED PAIR
TWISTED PAIR
TWISTED PAIR
1
2
WHEEL SPEED SENSOR- LEFT FRONT
1
2
WHEEL SPEED SENSOR- RIGHT FRONT
1
2
WHEEL SPEED SENSOR- LEFT REAR
1
2
WHEEL SPEED SENSOR- RIGHT REAR

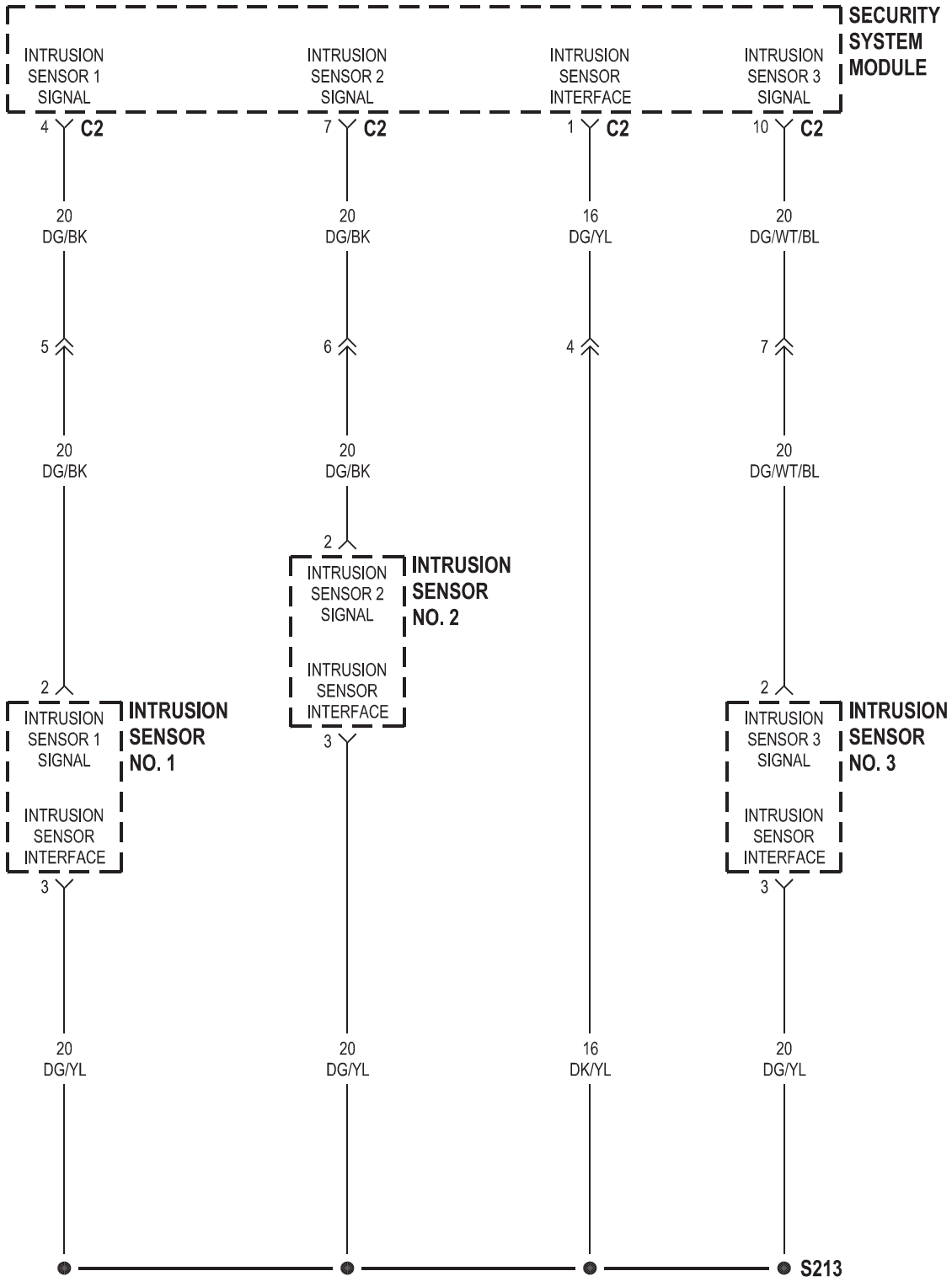


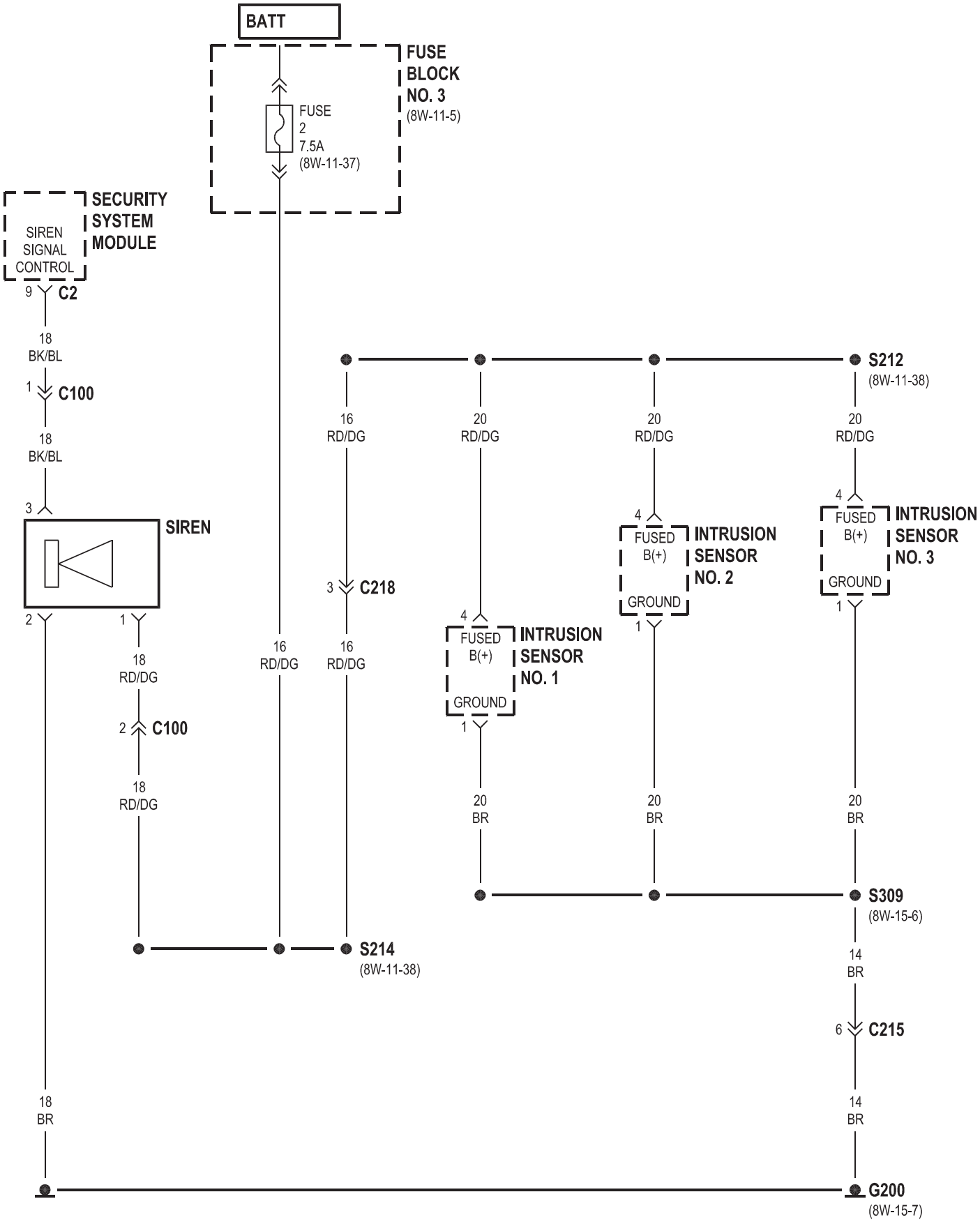
VA303507 J038W-24


BRAKE WEAR SENSOR SIGNAL
INSTRUMENT CLUSTER
(8W-40-5)
4
C2
20 BR/WT
S322
(8W-40-5)
16 BR/WT
16 BR/WT
16 BR/WT
S323
(8W-40-5)
16 BR/WT
16 BR/WT
2
BRAKE WEAR SENSOR- LEFT FRONT
1
16 BR
2
BRAKE WEAR SENSOR- RIGHT FRONT
1
16 BR
2
BRAKE WEAR SENSOR- LEFT REAR
1
16 BR
2
BRAKE WEAR SENSOR- RIGHT REAR
1
16 BR
S332
(8W-15-28)
16 BR
G200
(8W-15-8)
G300
(8W-15-28)

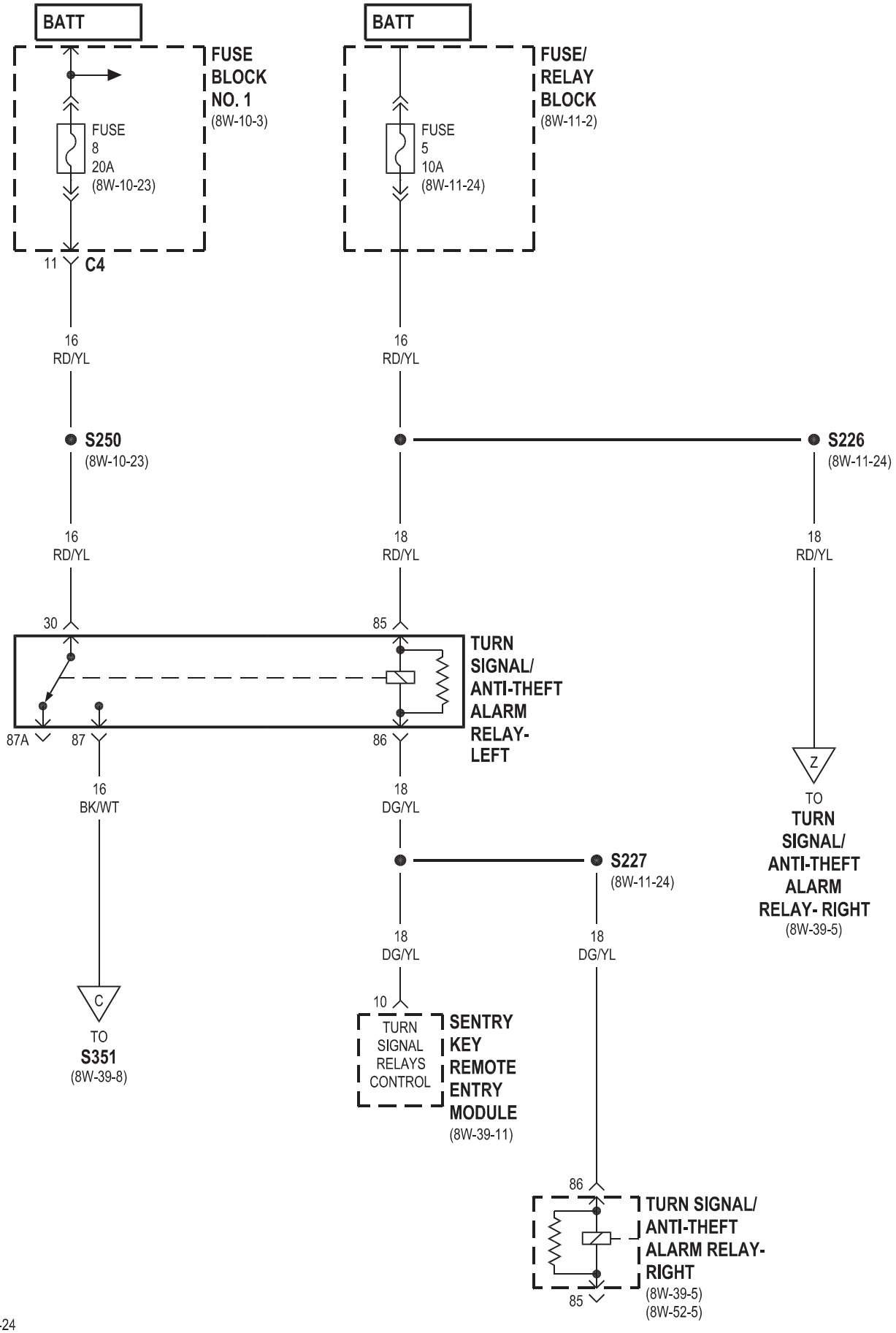
8W-39 VEHICLE THEFT SECURITY SYSTEM

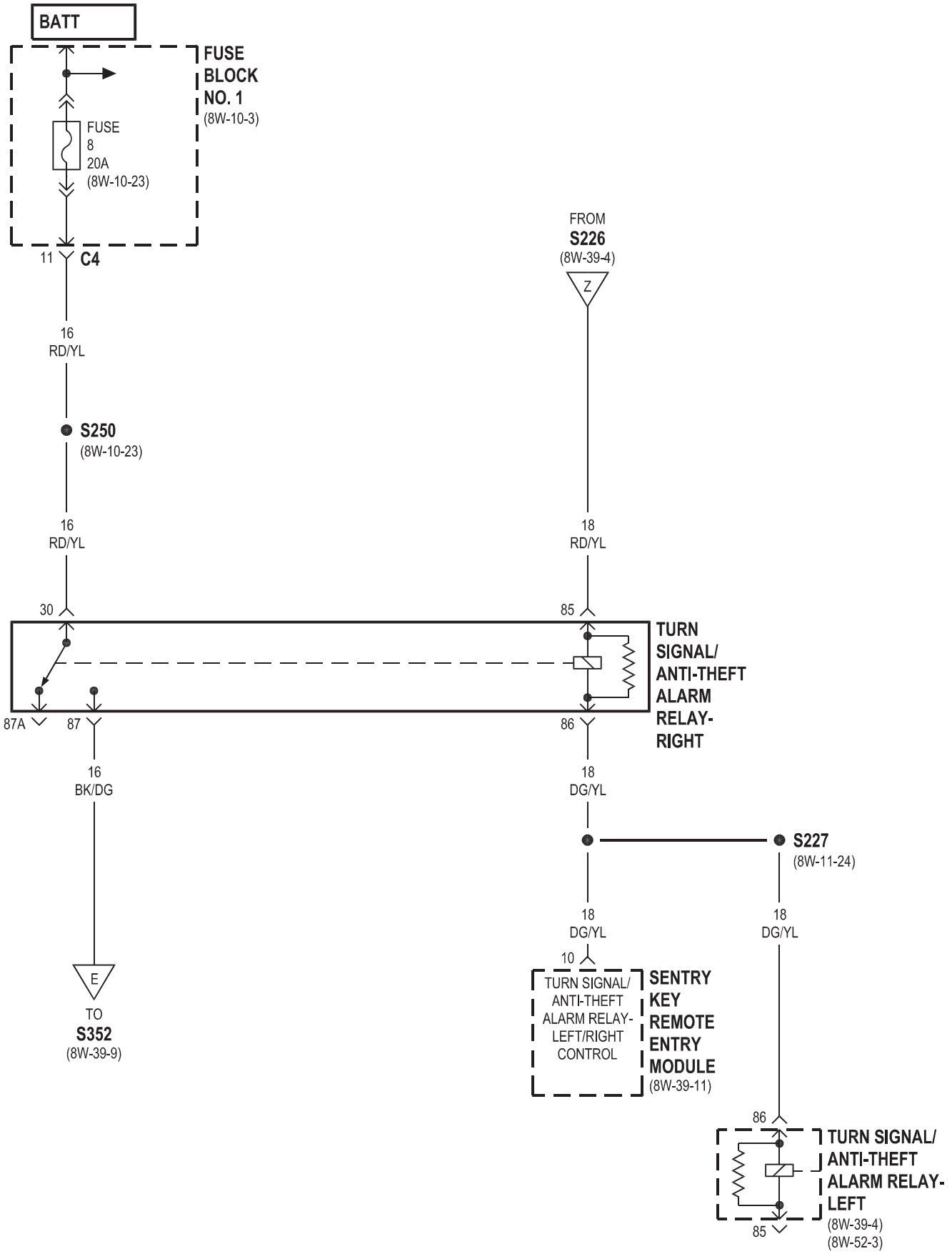
Component	Page
Central Timer Module	8W-39-6, 12
Cylinder Lock Switch- Driver	8W-39-6
Data Link Connector	8W-39-7, 10
Door Jamb Switch- Left Sliding	8W-39-14
Door Jamb Switch- Rear	8W-39-14
Door Jamb Switch- Right Sliding	8W-39-14
Fuse 2	8W-39-3, 13
Fuse 5	8W-39-4, 11
Fuse 7	8W-39-10
Fuse 8	8W-39-4, 5
Fuse 10	8W-39-13, 14
Fuse 14	8W-39-13
Fuse Block No. 1	8W-39-4, 5, 10
Fuse Block No. 3	8W-39-3, 13
Fuse/Relay Block	8W-39-4, 11, 13, 14
G101	8W-39-6
G200	8W-39-3, 6, 10
G202	8W-39-13
G203	8W-39-7
Headlamp Assembly- Left	8W-39-8
Headlamp Assembly- Right	8W-39-9
Hood Ajar Switch	8W-39-6
Instrument Cluster	8W-39-8, 9, 10, 14
Interior Lamp- Right Side	8W-39-14
Intrusion Sensor No. 1	8W-39-2, 3
Intrusion Sensor No. 2	8W-39-2, 3
Intrusion Sensor No. 3	8W-39-2, 3
Optional Equipment Relay	8W-39-13
Panic Alarm Switch	8W-39-7
Security System Module	8W-39-2, 3, 6, 7, 8, 9, 12, 13, 14
Sentry Key Remote Entry Module	8W-39-4, 5, 6, 8, 10, 11, 12
Siren	8W-39-3
SKREEM Antenna	8W-39-12
SKREEM Transponder	8W-39-12
Tail Lamp Assembly- Left	8W-39-8
Tail Lamp Assembly- Right	8W-39-9
Towing/Intrusion Sensor On/Off Switch	8W-39-7
Trailer Tow Control Module	8W-39-8, 9
Turn Signal No. 1- Left Front	8W-39-8
Turn Signal No. 1- Right Front	8W-39-9
Turn Signal/Anti-Theft Alarm Relay- Left	8W-39-4, 5, 8, 11
Turn Signal/Anti-Theft Alarm Relay- Right	8W-39-4, 5, 9, 11
Warm Air Auxiliary Heater Assembly	8W-39-14
Window Defogger Relay- Left Rear	8W-39-14
Window Defogger Relay- Right Rear	8W-39-13


SECURITY SYSTEM MODULE
INTRUSION SENSOR 1 SIGNAL
INTRUSION SENSOR 2 SIGNAL
INTRUSION SENSOR INTERFACE
INTRUSION SENSOR 3 SIGNAL
4 C2
7 C2
1 C2
10 C2
20 DG/BK
20 DG/BK
16 DG/YL
20 DG/WT/BL
5
6
4
7
20 DG/BK
20 DG/BK
20 DG/WT/BL
2
INTRUSION SENSOR 2 SIGNAL
INTRUSION SENSOR INTERFACE
INTRUSION SENSOR NO. 2
2
INTRUSION SENSOR 1 SIGNAL
INTRUSION SENSOR INTERFACE
INTRUSION SENSOR NO. 1
3
2
INTRUSION SENSOR 3 SIGNAL
INTRUSION SENSOR INTERFACE
INTRUSION SENSOR NO. 3
3
20 DG/YL
20 DG/YL
16 DK/YL
20 DG/YL
S213

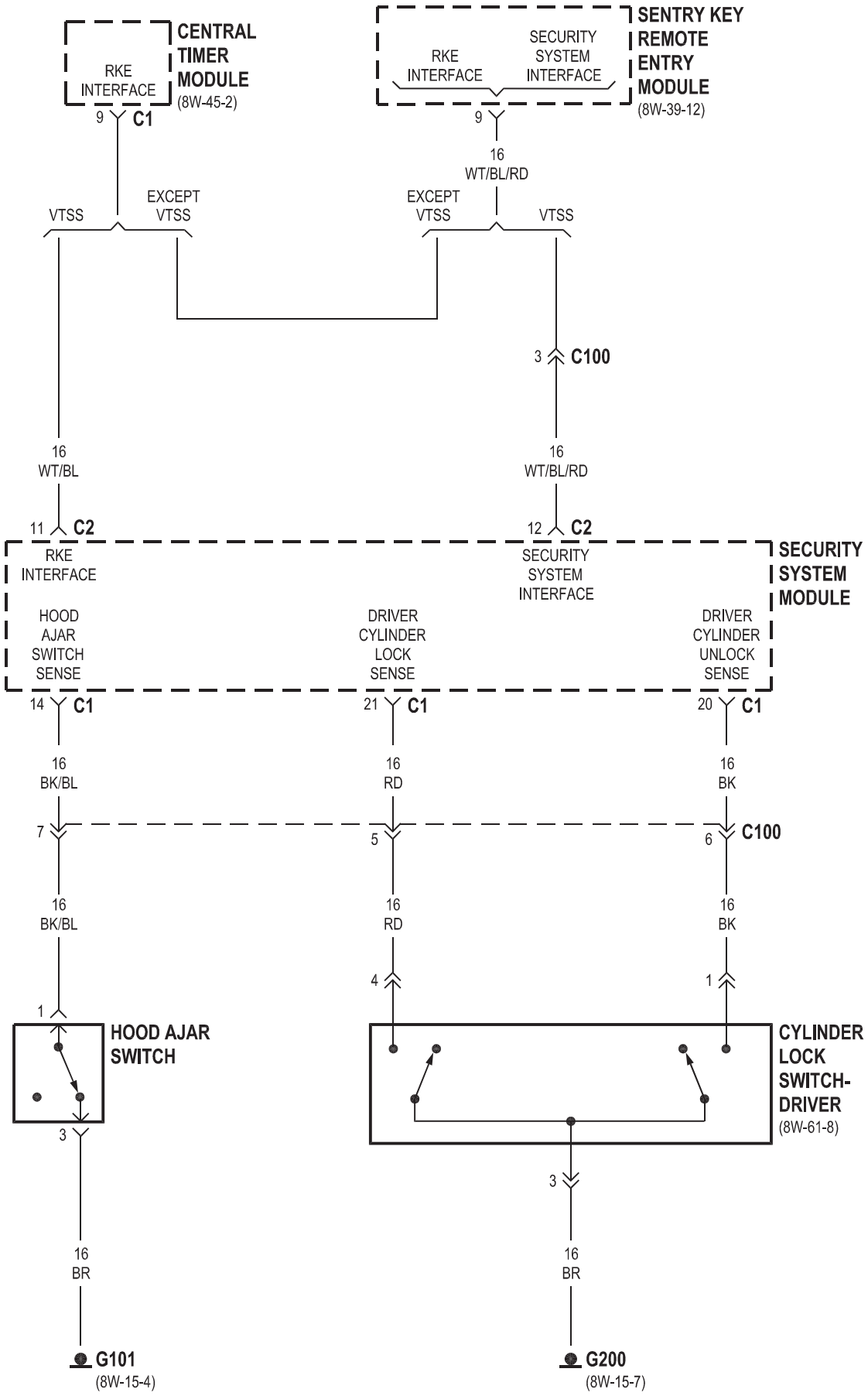


VA303903 J038W-24


BATT
BATT
FUSE BLOCK NO. 1
(8W-10-3)
FUSE 8 20A
(8W-10-23)
FUSE/ RELAY BLOCK
(8W-11-2)
FUSE 5 10A
(8W-11-24)
11
C4
16 RD/YL
16 RD/YL
S250
(8W-10-23)
S226
(8W-11-24)
16 RD/YL
18 RD/YL
18 RD/YL
30
85
87A
87
86
TURN SIGNAL/ ANTI-THEFT ALARM RELAY- LEFT
16 BK/WT
18 DG/YL
C
TO
S351
(8W-39-8)
Z
TO
TURN SIGNAL/ ANTI-THEFT ALARM RELAY- RIGHT
(8W-39-5)
S227
(8W-11-24)
18 DG/YL
18 DG/YL
10
TURN SIGNAL RELAYS CONTROL
SENTRY KEY REMOTE ENTRY MODULE
(8W-39-11)
86
85
TURN SIGNAL/ ANTI-THEFT ALARM RELAY- RIGHT
(8W-39-5)
(8W-52-5)

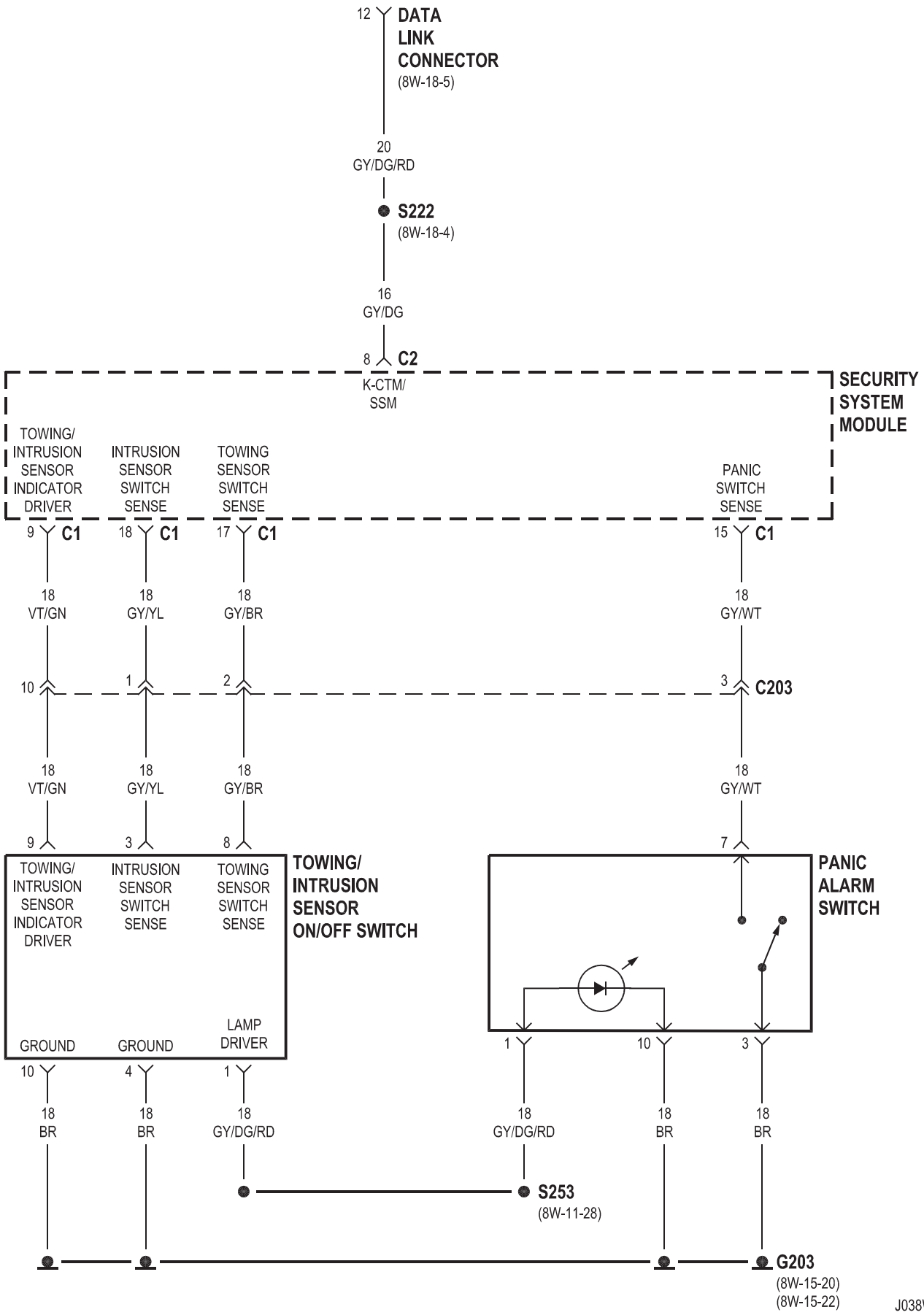


VA303905 J038W-24

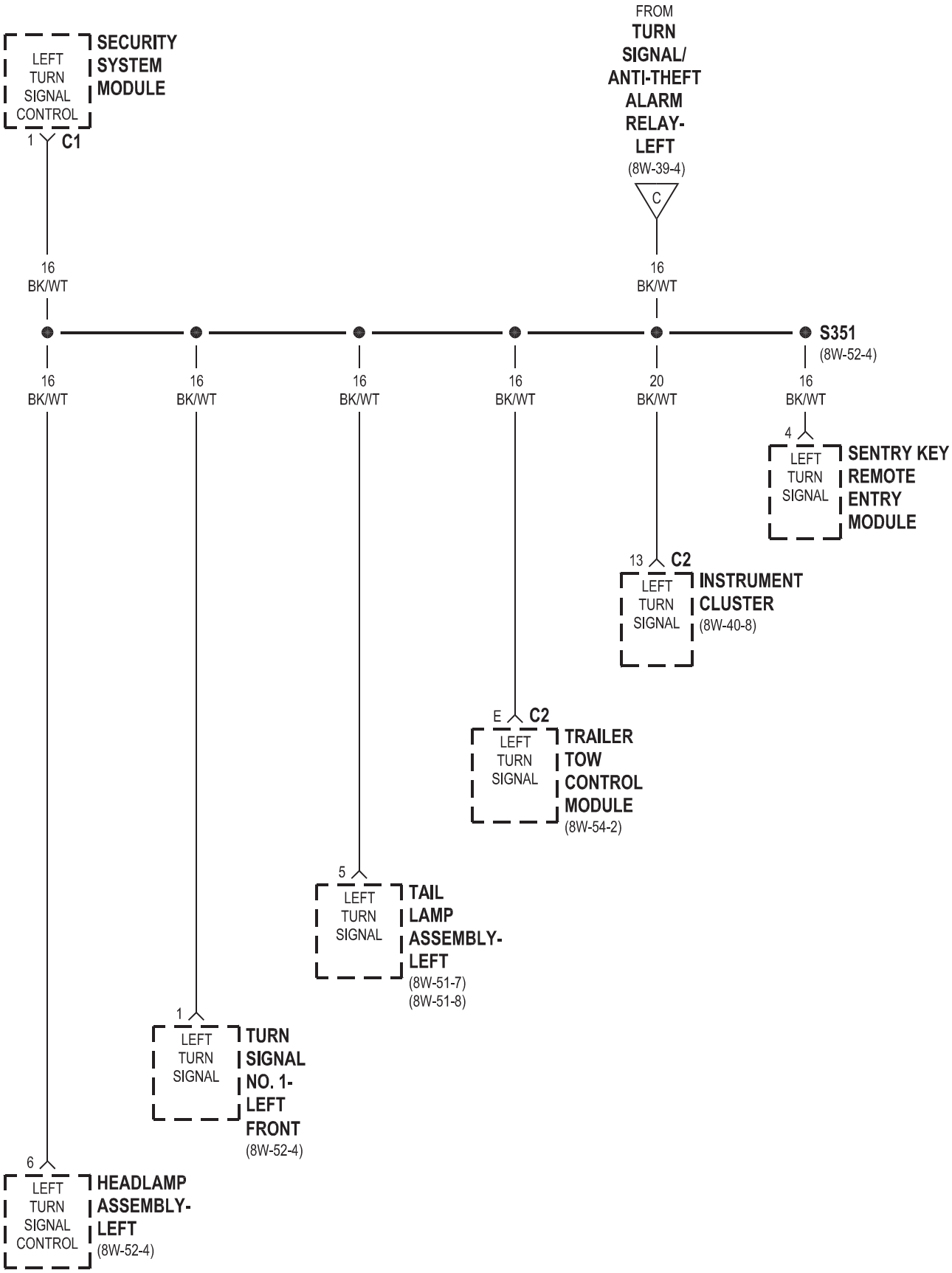


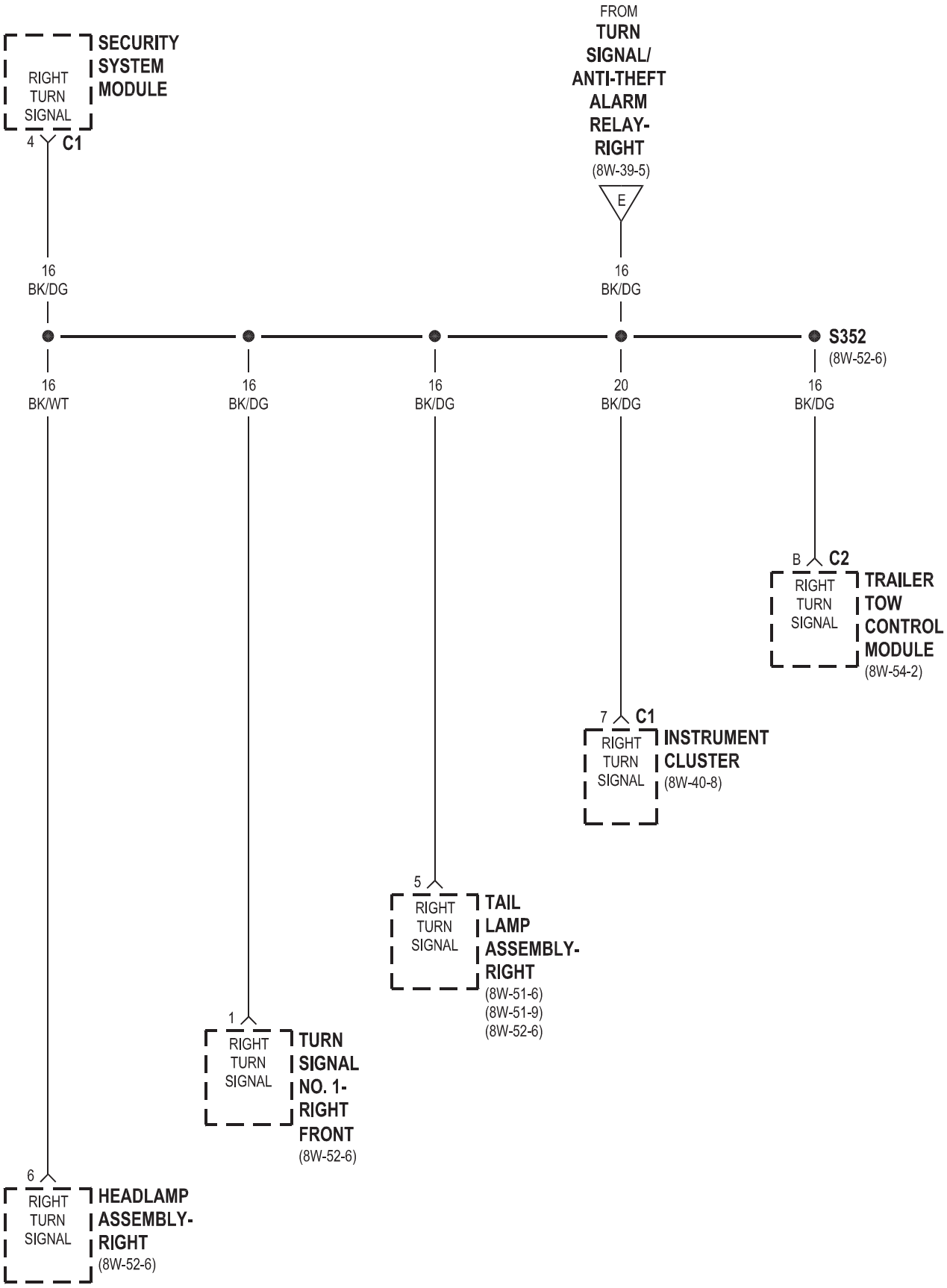
J038W-24

VA303906

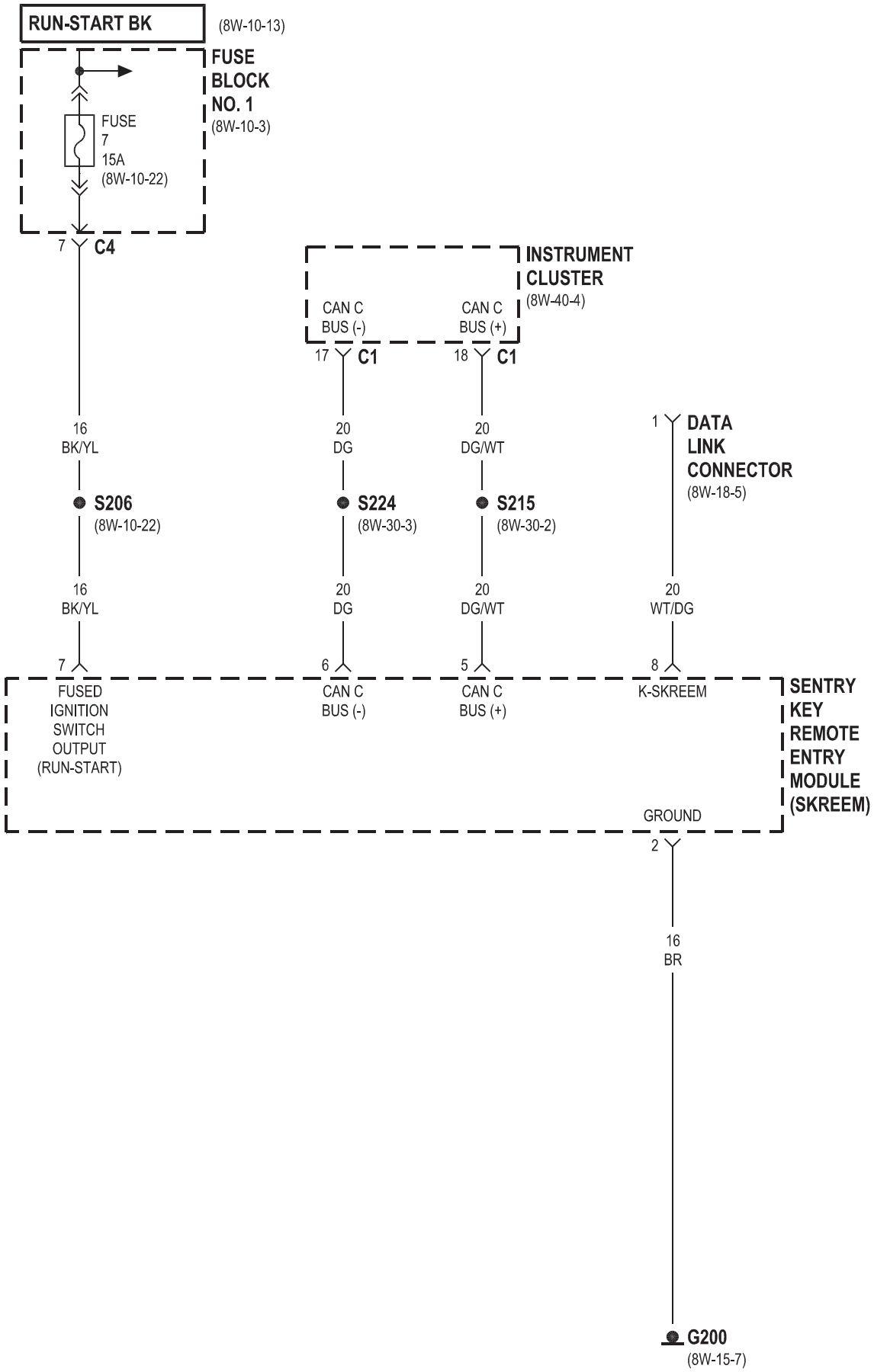


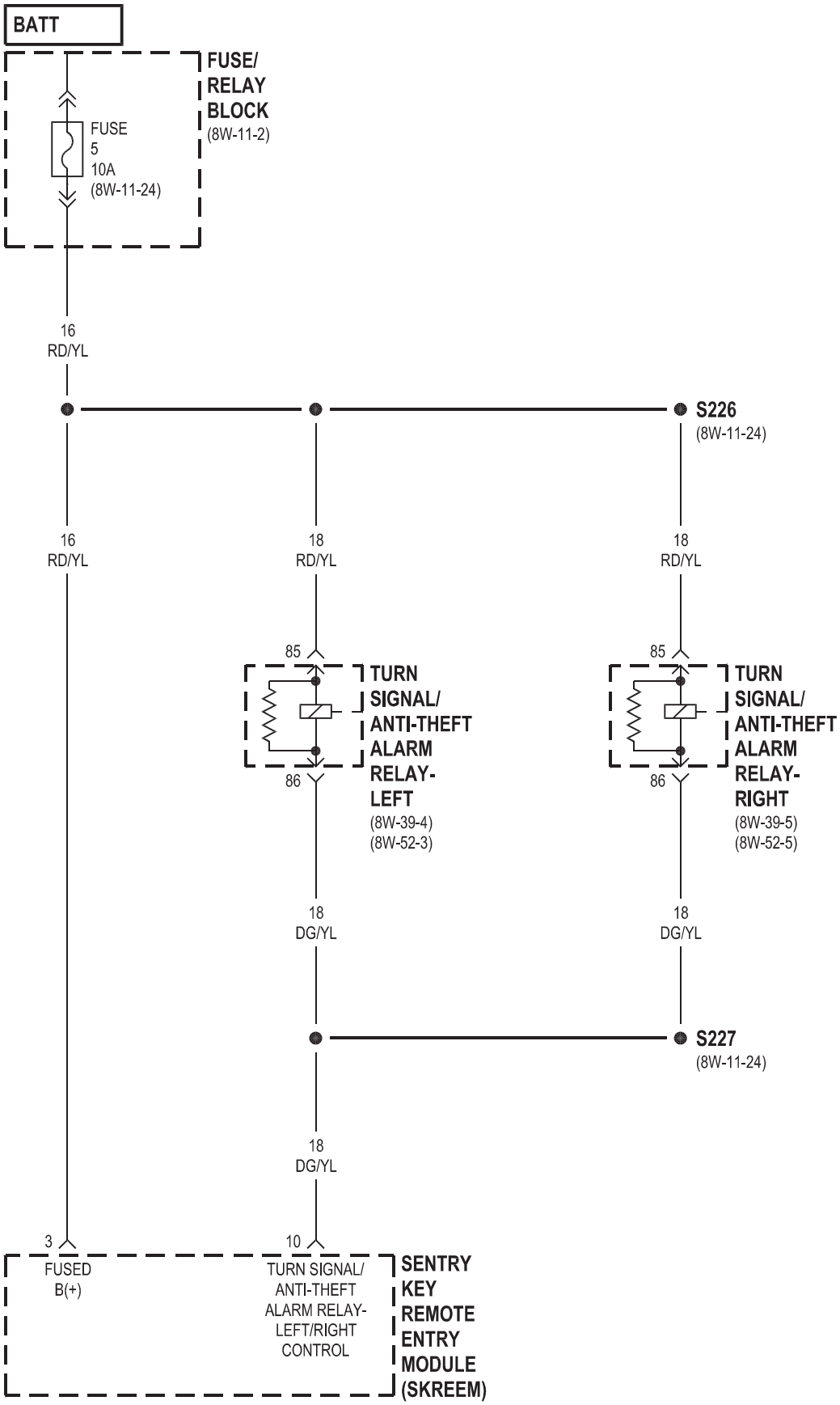
VA303907 J038W-24


LEFT TURN SIGNAL CONTROL
SECURITY SYSTEM MODULE
1 C1
FROM TURN SIGNAL/ ANTI-THEFT ALARM RELAY-LEFT
(8W-39-4)
C
16 BK/WT
16 BK/WT
S351
(8W-52-4)
16 BK/WT
16 BK/WT
16 BK/WT
16 BK/WT
20 BK/WT
16 BK/WT
4
LEFT TURN SIGNAL
SENTRY KEY REMOTE ENTRY MODULE
13 C2
LEFT TURN SIGNAL
INSTRUMENT CLUSTER
(8W-40-8)
E C2
LEFT TURN SIGNAL
TRAILER TOW CONTROL MODULE
(8W-54-2)
5
LEFT TURN SIGNAL
TAIL LAMP ASSEMBLY-LEFT
(8W-51-7)
(8W-51-8)
1
LEFT TURN SIGNAL
TURN SIGNAL NO. 1-LEFT FRONT
(8W-52-4)
6
LEFT TURN SIGNAL CONTROL
HEADLAMP ASSEMBLY-LEFT
(8W-52-4)

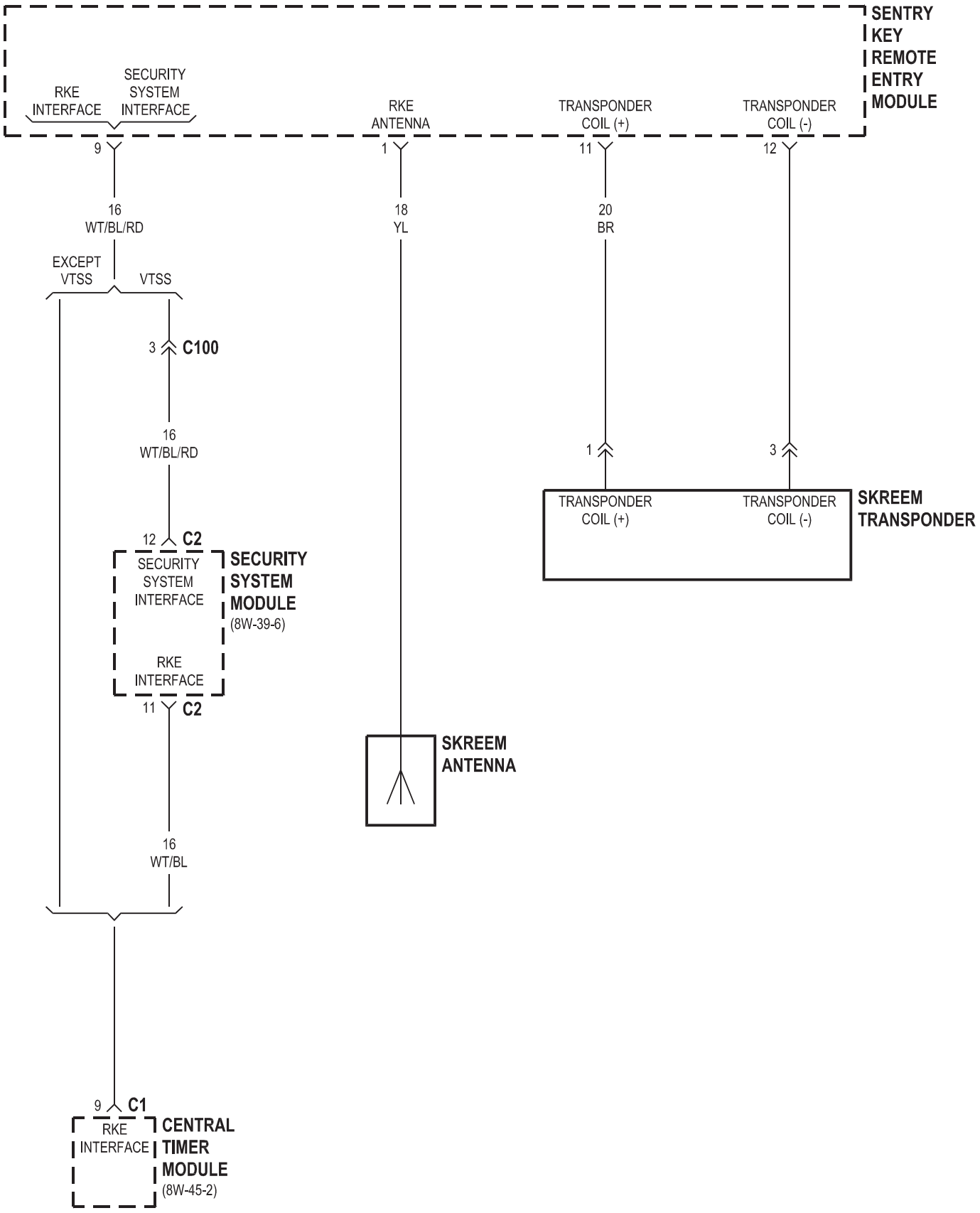


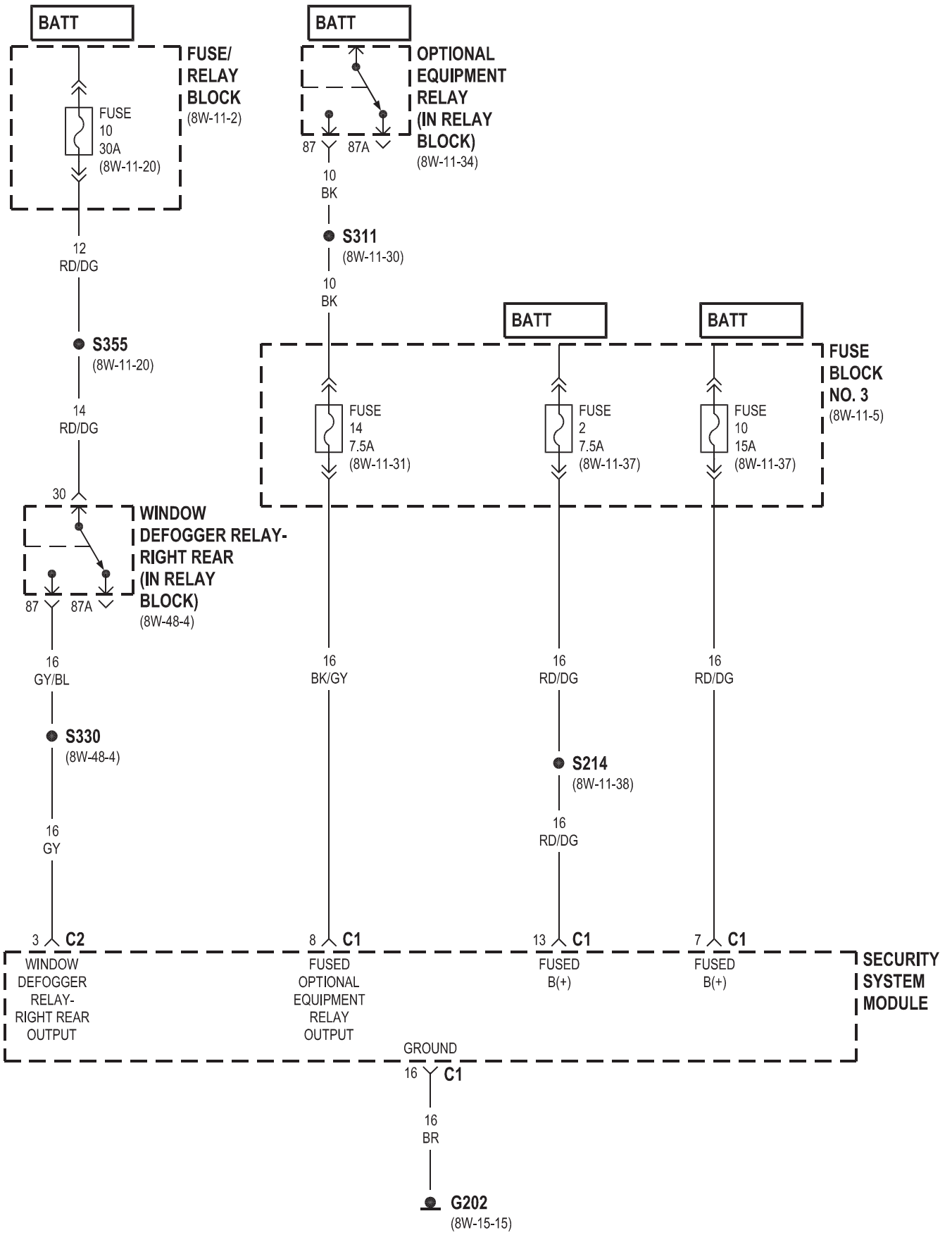
VA303909 J038W-24


RUN-START BK
(8W-10-13)
FUSE BLOCK NO. 1
(8W-10-3)
FUSE 7 15A
(8W-10-22)
7 C4
INSTRUMENT CLUSTER
(8W-40-4)
CAN C BUS (-)
CAN C BUS (+)
17 C1
18 C1
16 BK/YL
20 DG
20 DG/WT
1 DATA LINK CONNECTOR
(8W-18-5)
S206
(8W-10-22)
S224
(8W-30-3)
S215
(8W-30-2)
16 BK/YL
20 DG
20 DG/WT
20 WT/DG
7
6
5
8
FUSED IGNITION SWITCH OUTPUT (RUN-START)
CAN C BUS (-)
CAN C BUS (+)
K-SKREEM
SENTRY KEY REMOTE ENTRY MODULE (SKREEM)
GROUND
2
16 BR
G200
(8W-15-7)

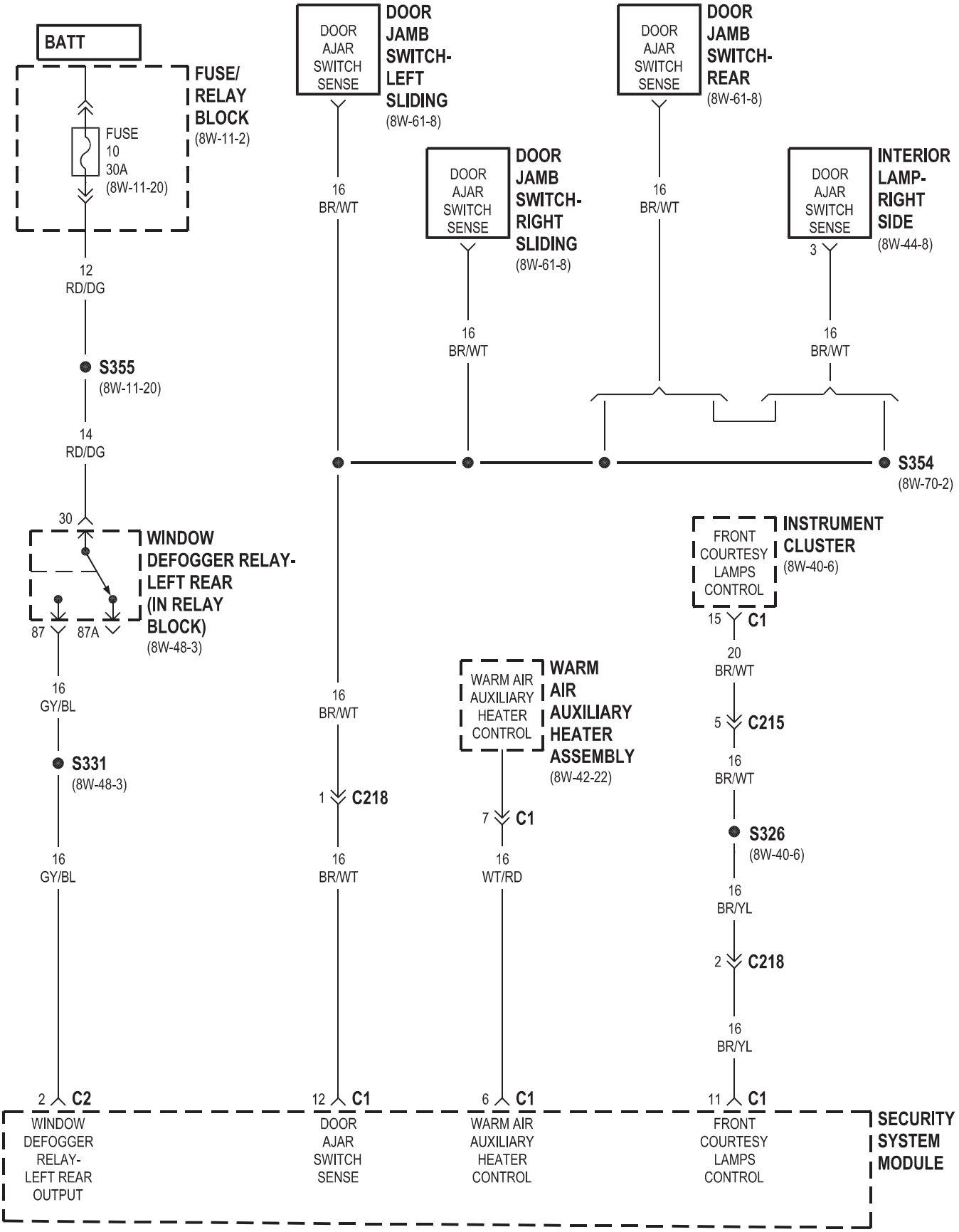


VA303911 J038W-24


SENTRY KEY REMOTE ENTRY MODULE
RKE INTERFACE
SECURITY SYSTEM INTERFACE
RKE ANTENNA
TRANSPONDER COIL (+)
TRANSPONDER COIL (-)
9
1
11
12
16 WT/BL/RD
18 YL
20 BR
EXCEPT VTSS
VTSS
3 C100
16 WT/BL/RD
1
3
TRANSPONDER COIL (+)
TRANSPONDER COIL (-)
SKREEM TRANSPONDER
12 C2
SECURITY SYSTEM INTERFACE
SECURITY SYSTEM MODULE
(8W-39-6)
RKE INTERFACE
11 C2
SKREEM ANTENNA
16 WT/BL
9 C1
RKE INTERFACE
CENTRAL TIMER MODULE
(8W-45-2)



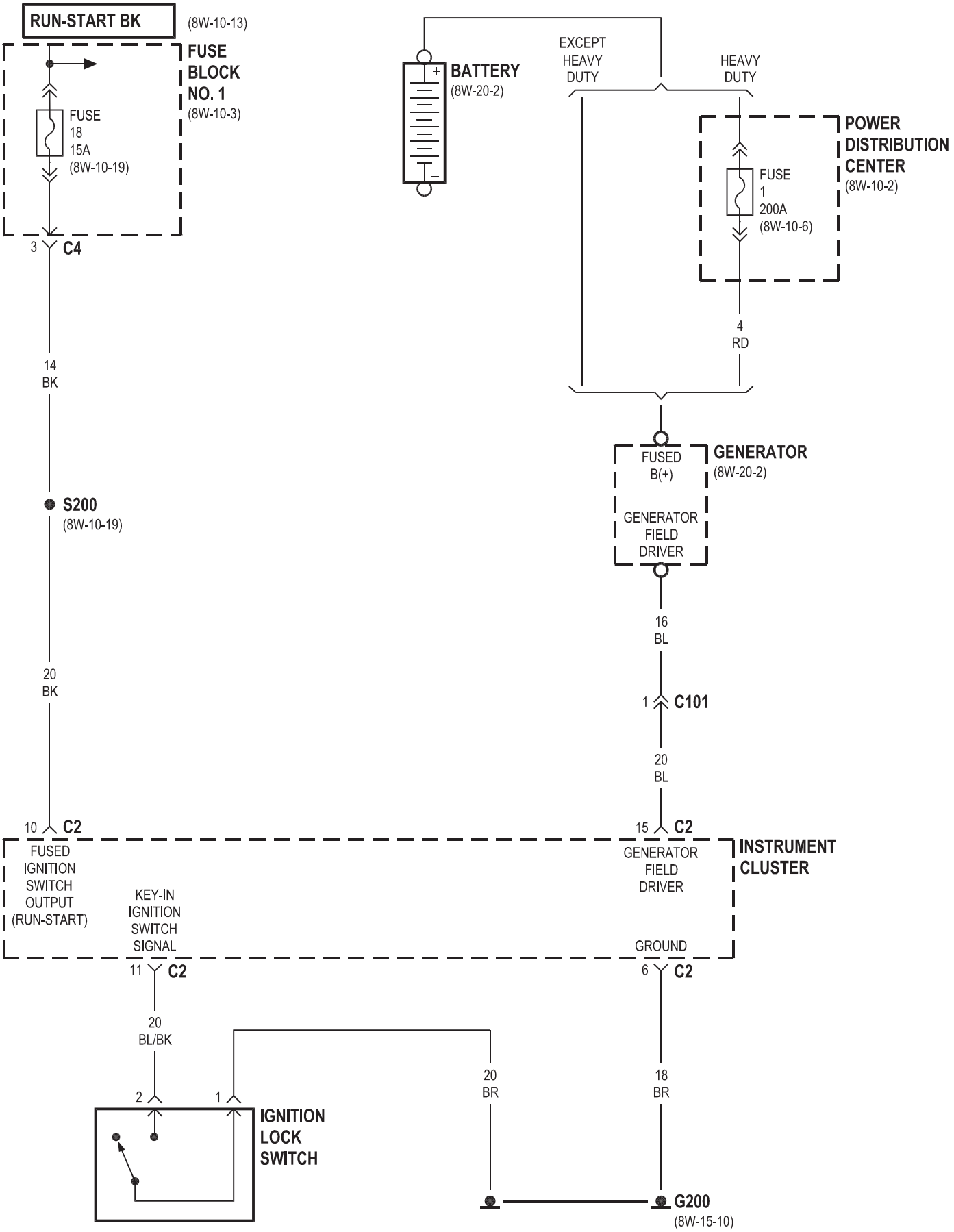
VA303913 J038W-24

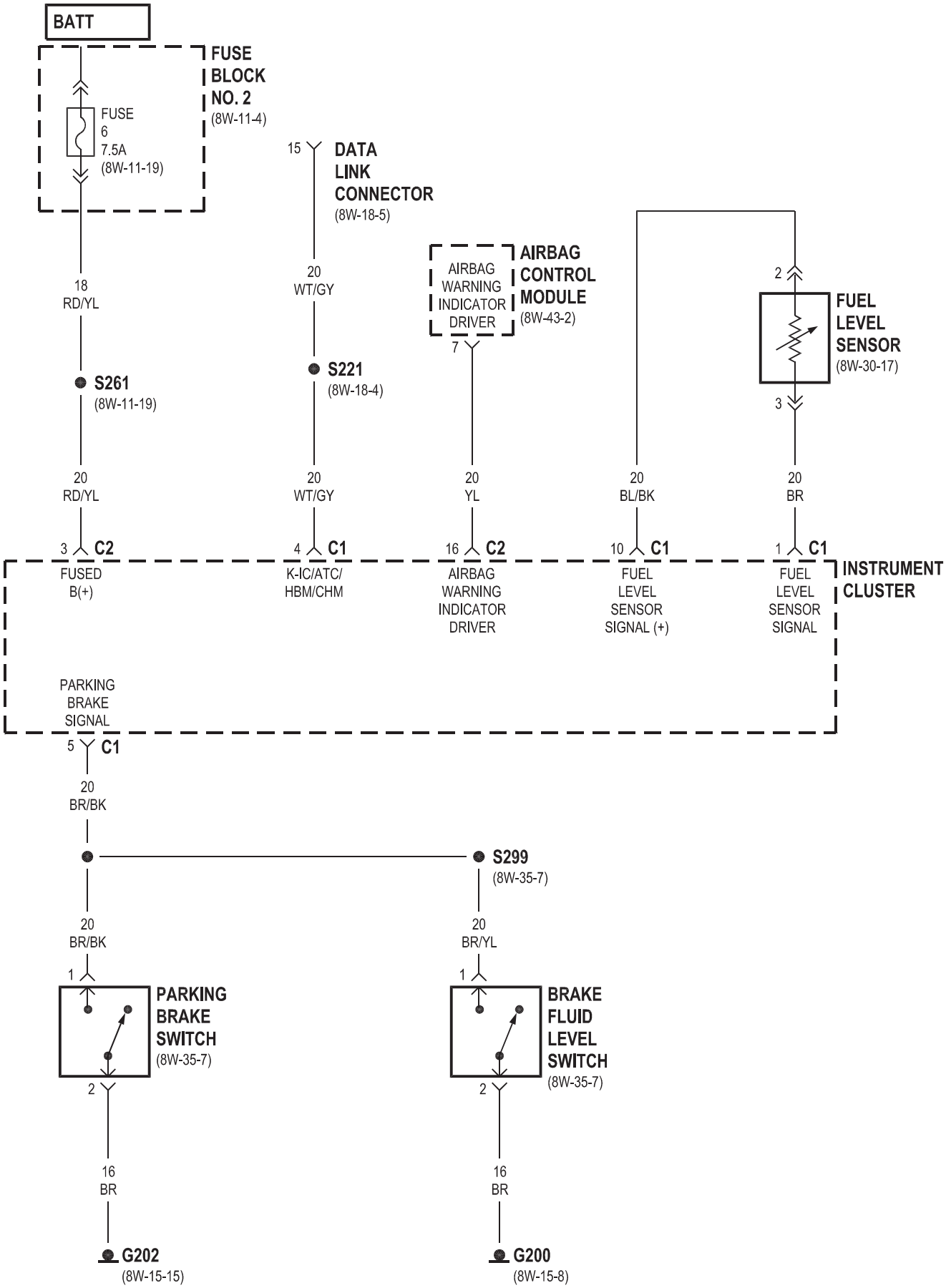

BATT
FUSE/ RELAY BLOCK (8W-11-2)
FUSE 10 30A (8W-11-20)
12 RD/DG
S355 (8W-11-20)
14 RD/DG
30
WINDOW DEFOGGER RELAY- LEFT REAR (IN RELAY BLOCK) (8W-48-3)
87
87A
16 GY/BL
S331 (8W-48-3)
16 GY/BL
2 C2
WINDOW DEFOGGER RELAY- LEFT REAR OUTPUT
DOOR AJAR SWITCH SENSE
DOOR JAMB SWITCH- LEFT SLIDING (8W-61-8)
16 BR/WT
DOOR AJAR SWITCH SENSE
DOOR JAMB SWITCH- RIGHT SLIDING (8W-61-8)
16 BR/WT
DOOR AJAR SWITCH SENSE
DOOR JAMB SWITCH- REAR (8W-61-8)
16 BR/WT
DOOR AJAR SWITCH SENSE
3
INTERIOR LAMP- RIGHT SIDE (8W-44-8)
16 BR/WT
S354 (8W-70-2)
16 BR/WT
1 C218
16 BR/WT
12 C1
DOOR AJAR SWITCH SENSE
WARM AIR AUXILIARY HEATER CONTROL
WARM AIR AUXILIARY HEATER ASSEMBLY (8W-42-22)
7 C1
16 WT/RD
6 C1
WARM AIR AUXILIARY HEATER CONTROL
FRONT COURTESY LAMPS CONTROL
INSTRUMENT CLUSTER (8W-40-6)
15 C1
20 BR/WT
5 C215
16 BR/WT
S326 (8W-40-6)
16 BR/YL
2 C218
16 BR/YL
11 C1
FRONT COURTESY LAMPS CONTROL
SECURITY SYSTEM MODULE

8W-40 INSTRUMENT CLUSTER

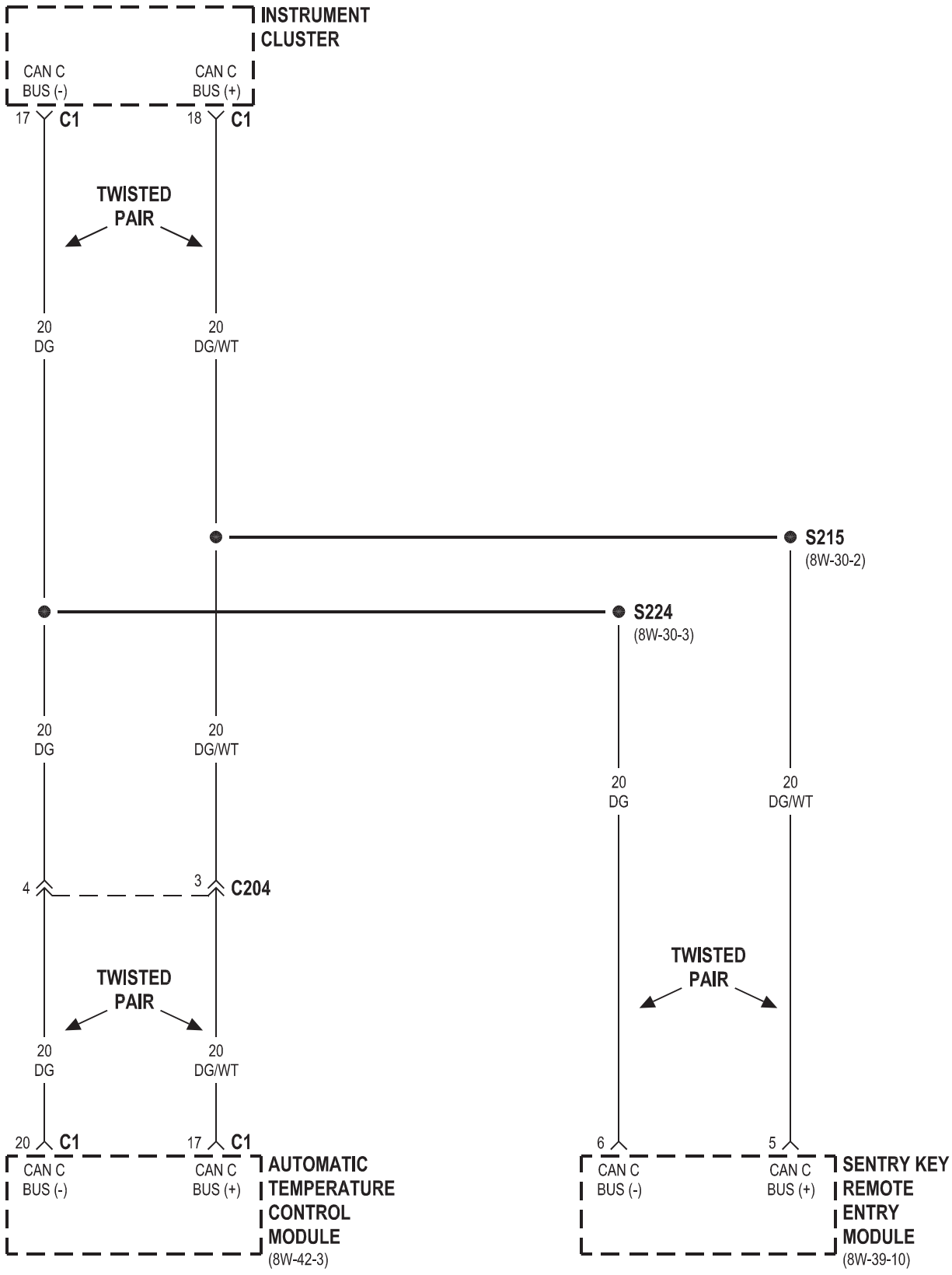
Component	Page
Airbag Control Module	8W-40-3
Ambient Temperature Sensor	8W-40-8
Automatic Temperature Control Module	8W-40-4, 8
Battery	8W-40-2
Brake Fluid Level Switch	8W-40-3
Brake Wear Sensor- Left Front	8W-40-5
Brake Wear Sensor- Left Rear	8W-40-5
Brake Wear Sensor- Right Front	8W-40-5
Brake Wear Sensor- Right Rear	8W-40-5
Courtesy Lamp- Driver Door	8W-40-6
Courtesy Lamp- Passenger Door	8W-40-6
D+ Relay No. 1	8W-40-8
Data Link Connector	8W-40-3
Dome Lamp	8W-40-6
Door Jamb Switch- Driver	8W-40-6
Door Jamb Switch- Passenger	8W-40-6
Engine Coolant Level Switch	8W-40-7
Fuel Level Sensor	8W-40-3
Fuse 1	8W-40-2
Fuse 3	8W-40-6
Fuse 6	8W-40-3
Fuse 18	8W-40-2

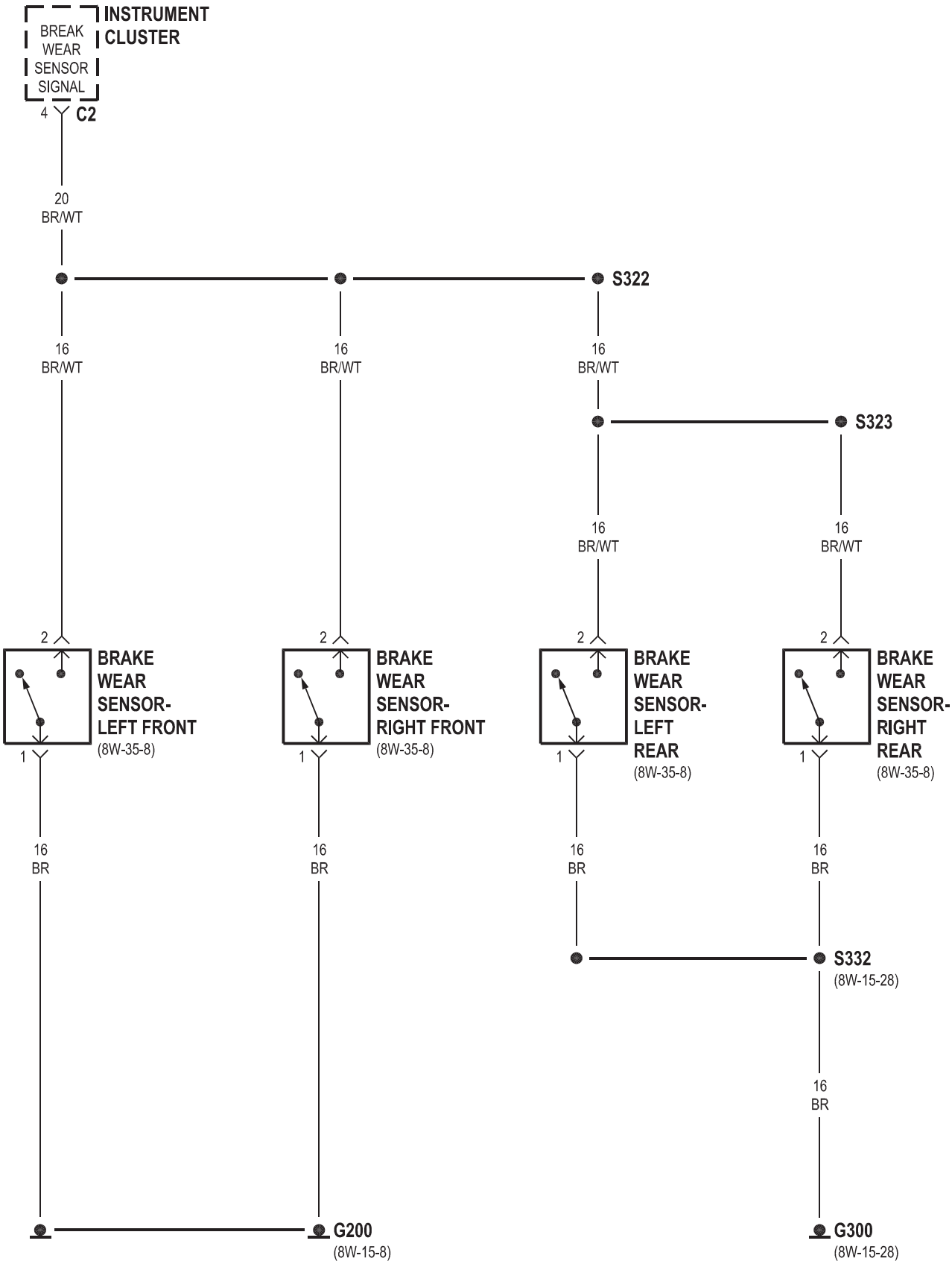
Component	Page
Fuse Block No. 1	8W-40-2
Fuse Block No. 2	8W-40-3, 6
G100	8W-40-7
G200	8W-40-2, 3, 5
G202	8W-40-3, 7, 8
G203	8W-40-6
G300	8W-40-5
Generator	8W-40-2
Headlamp Assembly- Left	8W-40-7
Headlamp Assembly- Right	8W-40-7
Ignition Lock Switch	8W-40-2
Instrument Cluster	8W-40-2, 3, 4, 5, 6, 7, 8
Instrument Panel Socket	8W-40-6
Parking Brake Switch	8W-40-3
Power Distribution Center	8W-40-2
Radio	8W-40-8
Seat Belt Switch	8W-40-7
Security System Module	8W-40-6
Sentry Key Remote Entry Module	8W-40-4
Turn Signal/Anti-Theft Alarm Relay- Left	8W-40-8
Turn Signal/Anti-Theft Alarm Relay- Right	8W-40-8


RUN-START BK
(8W-10-13)
FUSE BLOCK NO. 1
(8W-10-3)
FUSE 18 15A
(8W-10-19)
3
C4
14 BK
S200
(8W-10-19)
20 BK
10
C2
FUSED IGNITION SWITCH OUTPUT (RUN-START)
KEY-IN IGNITION SWITCH SIGNAL
11
C2
20 BL/BK
2
1
IGNITION LOCK SWITCH
BATTERY
(8W-20-2)
EXCEPT HEAVY DUTY
HEAVY DUTY
POWER DISTRIBUTION CENTER
(8W-10-2)
FUSE 1 200A
(8W-10-6)
4 RD
FUSED B(+)
GENERATOR FIELD DRIVER
GENERATOR
(8W-20-2)
16 BL
1
C101
20 BL
15
C2
GENERATOR FIELD DRIVER
INSTRUMENT CLUSTER
GROUND
6
C2
20 BR
18 BR
G200
(8W-15-10)

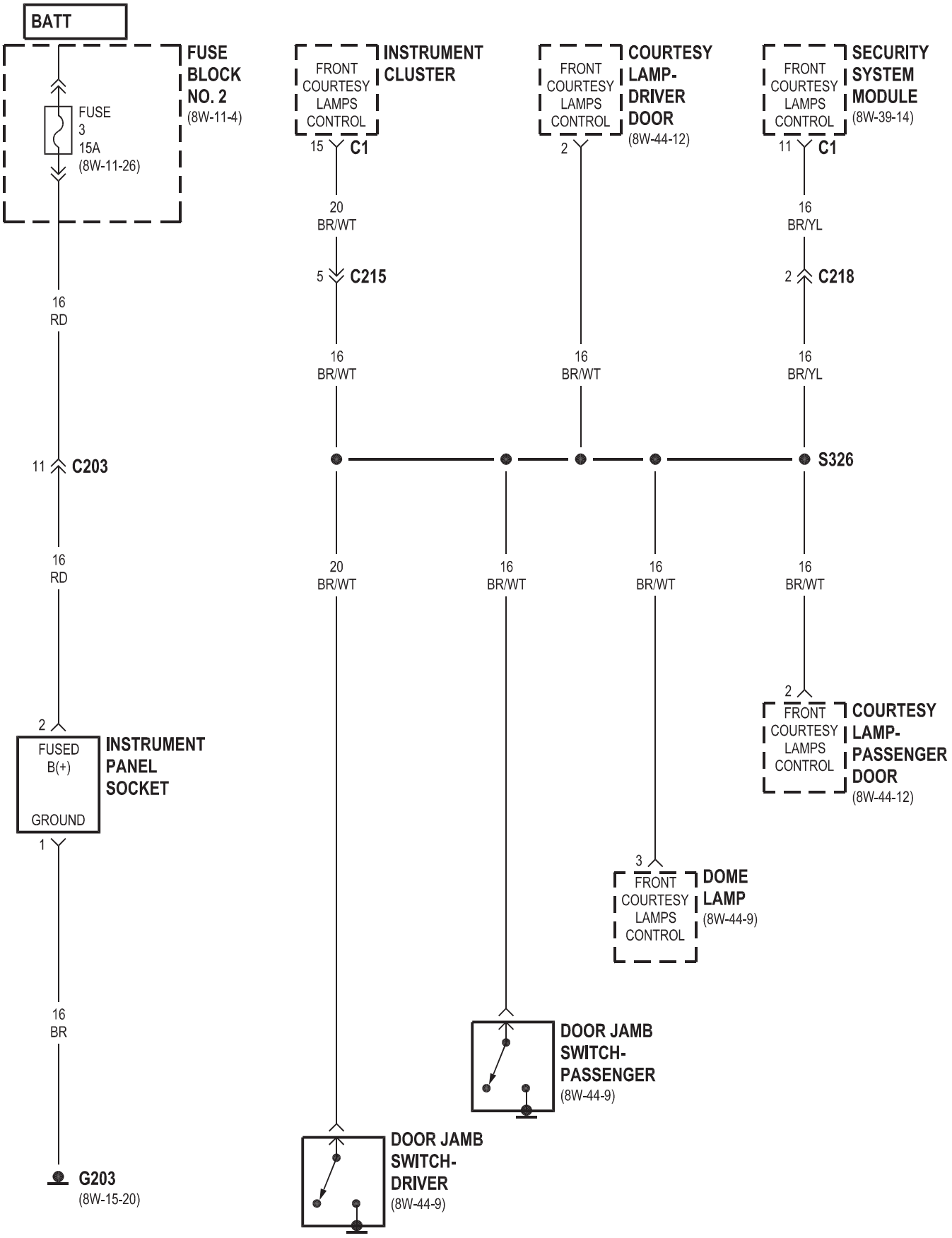


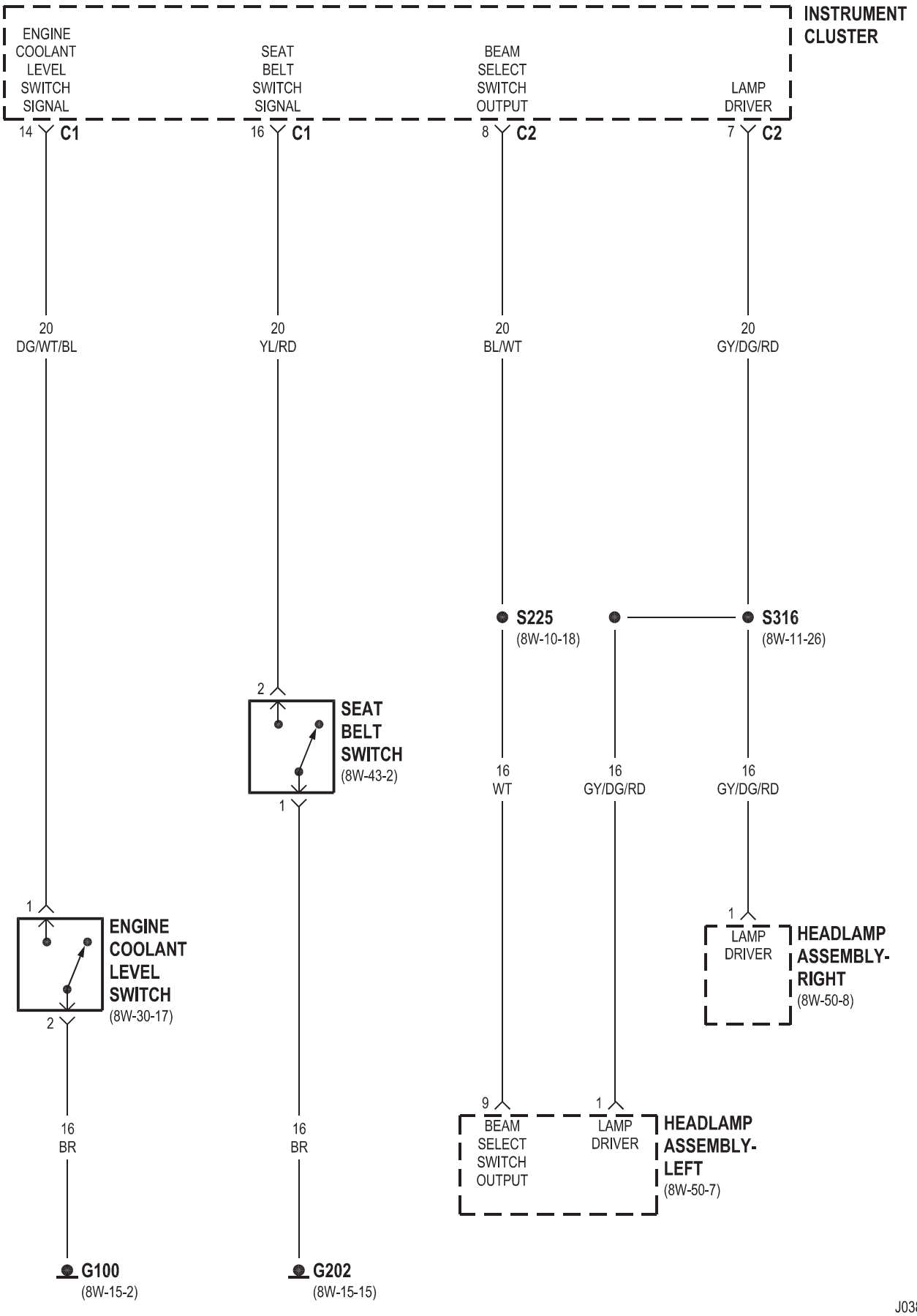
VA304003 J038W-24


INSTRUMENT CLUSTER
CAN C BUS (-)
CAN C BUS (+)
17 C1
18 C1
TWISTED PAIR
20 DG
20 DG/WT
S215
(8W-30-2)
S224
(8W-30-3)
20 DG
20 DG/WT
20 DG
20 DG/WT
4
3 C204
TWISTED PAIR
TWISTED PAIR
20 DG
20 DG/WT
20 C1
17 C1
6
5
CAN C BUS (-)
CAN C BUS (+)
AUTOMATIC TEMPERATURE CONTROL MODULE
(8W-42-3)
CAN C BUS (-)
CAN C BUS (+)
SENTRY KEY REMOTE ENTRY MODULE
(8W-39-10)

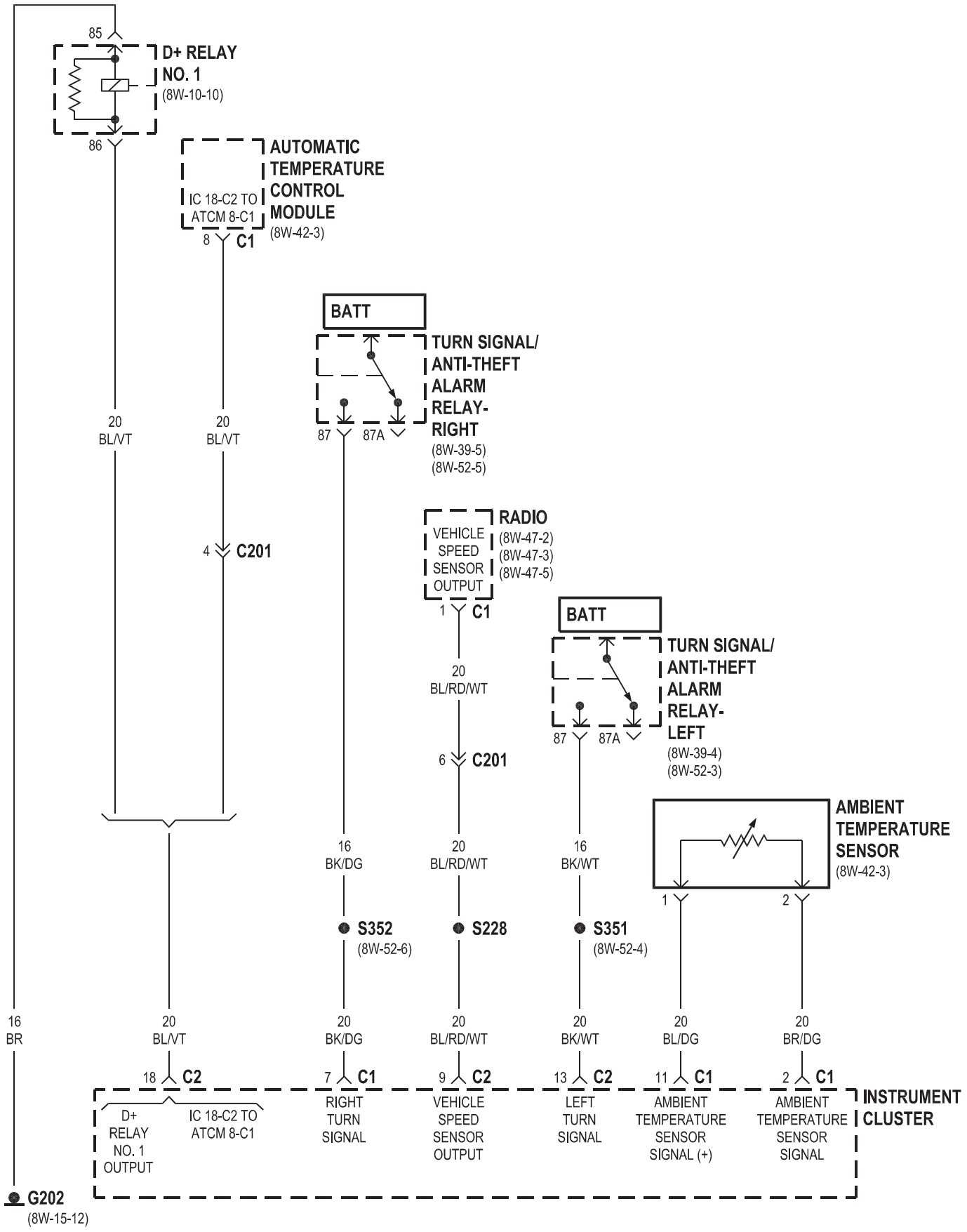


VA304005 J038W-24


BATT
FUSE BLOCK NO. 2
(8W-11-4)
FUSE 3 15A
(8W-11-26)
16 RD
11 C203
16 RD
2
FUSED B(+)
GROUND
INSTRUMENT PANEL SOCKET
1
16 BR
G203
(8W-15-20)
FRONT COURTESY LAMPS CONTROL
INSTRUMENT CLUSTER
15 C1
20 BR/WT
5 C215
16 BR/WT
20 BR/WT
DOOR JAMB SWITCH-DRIVER
(8W-44-9)
FRONT COURTESY LAMPS CONTROL
COURTESY LAMP-DRIVER DOOR
(8W-44-12)
2
16 BR/WT
16 BR/WT
DOOR JAMB SWITCH-PASSENGER
(8W-44-9)
FRONT COURTESY LAMPS CONTROL
SECURITY SYSTEM MODULE
(8W-39-14)
11 C1
16 BR/YL
2 C218
16 BR/YL
S326
16 BR/WT
3
FRONT COURTESY LAMPS CONTROL
DOME LAMP
(8W-44-9)
16 BR/WT
2
FRONT COURTESY LAMPS CONTROL
COURTESY LAMP-PASSENGER DOOR
(8W-44-12)

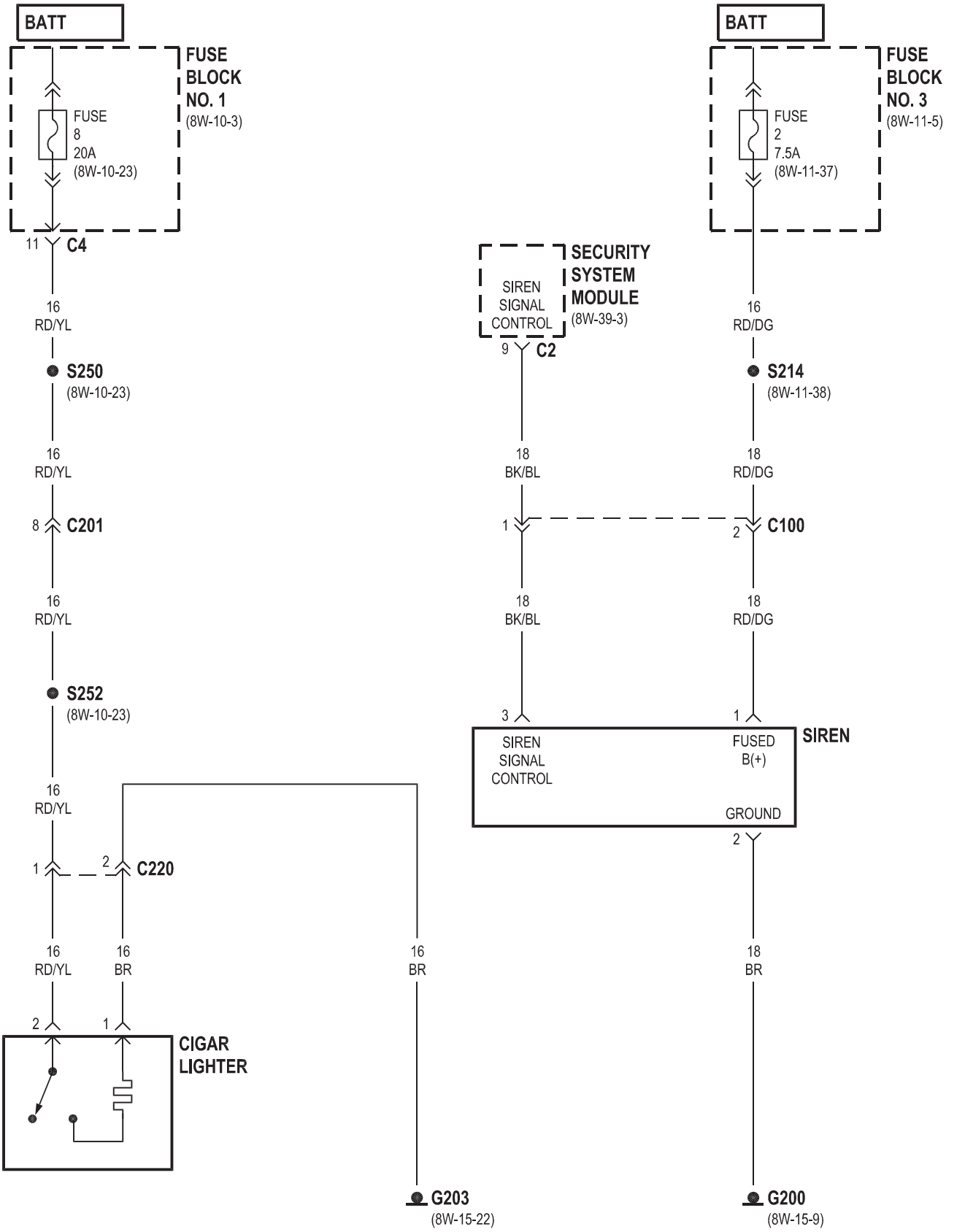


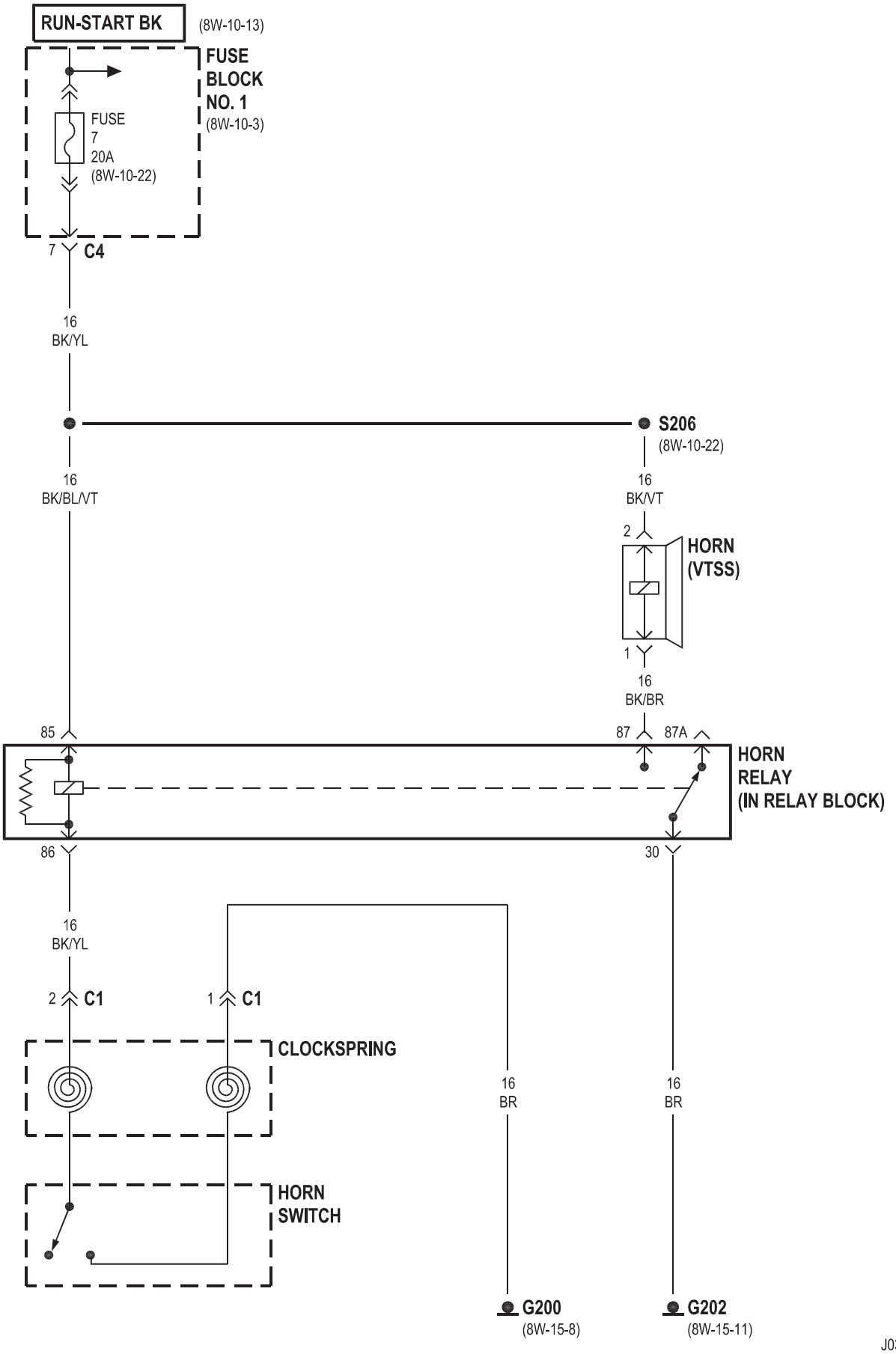
VA304007 J038W-24


85
D+ RELAY NO. 1
(8W-10-10)
86
AUTOMATIC TEMPERATURE CONTROL MODULE
(8W-42-3)
IC 18-C2 TO ATCM 8-C1
8 C1
BATT
TURN SIGNAL/ ANTI-THEFT ALARM RELAY-RIGHT
(8W-39-5)
(8W-52-5)
87 87A
20 BL/VT
20 BL/VT
4 C201
RADIO
(8W-47-2)
(8W-47-3)
(8W-47-5)
VEHICLE SPEED SENSOR OUTPUT
1 C1
20 BL/RD/WT
6 C201
BATT
TURN SIGNAL/ ANTI-THEFT ALARM RELAY-LEFT
(8W-39-4)
(8W-52-3)
87 87A
AMBIENT TEMPERATURE SENSOR
(8W-42-3)
1
2
16 BK/DG
20 BL/RD/WT
16 BK/WT
S352
(8W-52-6)
S228
S351
(8W-52-4)
16 BR
20 BL/VT
20 BK/DG
20 BL/RD/WT
20 BK/WT
20 BL/DG
20 BR/DG
18 C2
7 C1
9 C2
13 C2
11 C1
2 C1
INSTRUMENT CLUSTER
D+ RELAY NO. 1 OUTPUT
IC 18-C2 TO ATCM 8-C1
RIGHT TURN SIGNAL
VEHICLE SPEED SENSOR OUTPUT
LEFT TURN SIGNAL
AMBIENT TEMPERATURE SENSOR SIGNAL (+)
AMBIENT TEMPERATURE SENSOR SIGNAL
G202
(8W-15-12)

8W-41 HORN/CIGAR LIGHTER

Component	Page
Cigar Lighter	8W-41-2
Clockspring	8W-41-3
Fuse 2	8W-41-2
Fuse 7	8W-41-3
Fuse 8	8W-41-2
Fuse Block No. 1	8W-41-2, 3
Fuse Block No. 3	8W-41-2
G200	8W-41-2, 3
G202	8W-41-3
G203	8W-41-2
Horn	8W-41-3
Horn Relay	8W-41-3
Horn Switch	8W-41-3
Security System Module	8W-41-2
Siren	8W-41-2

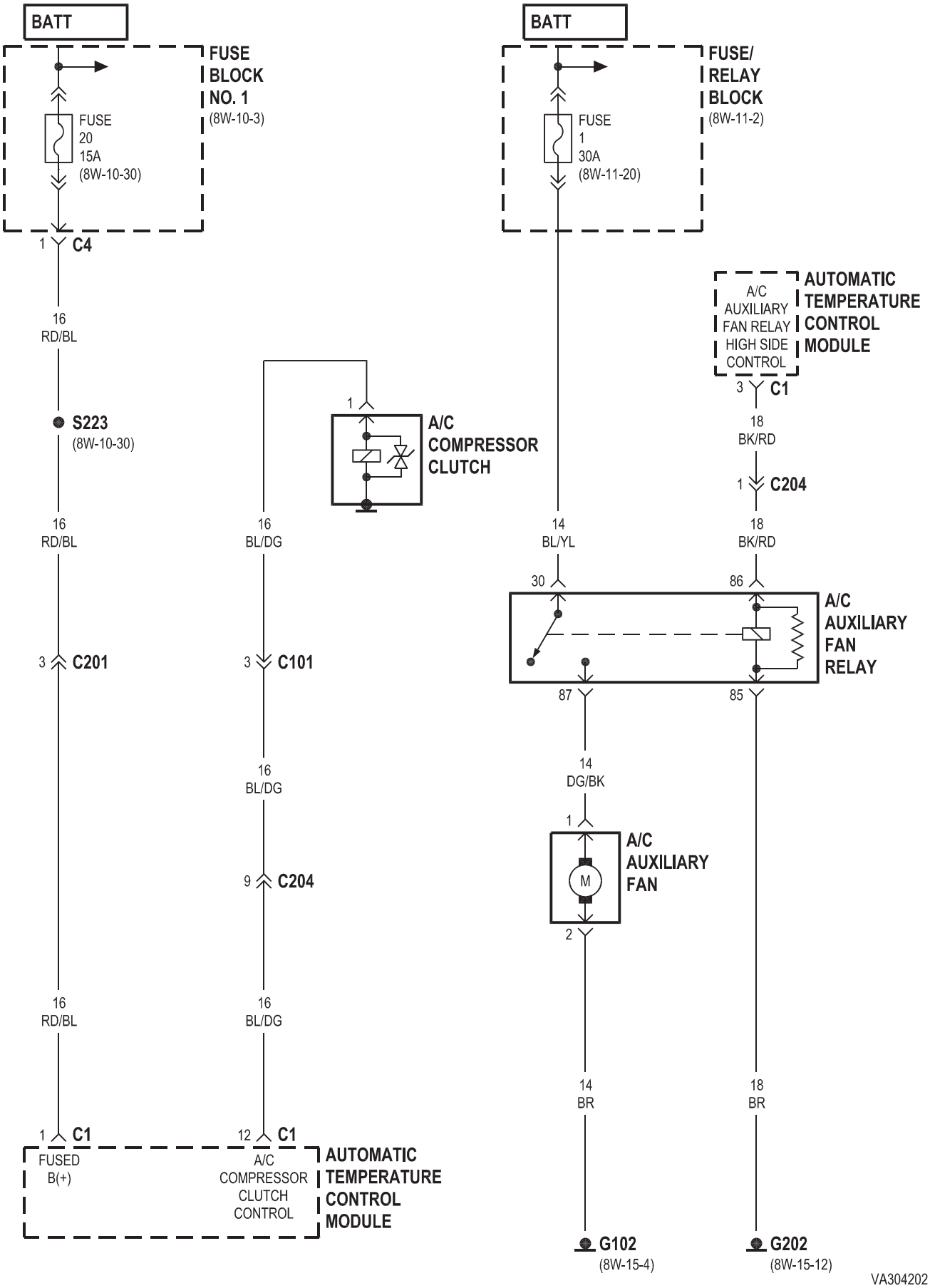

BATT
FUSE BLOCK NO. 1
(8W-10-3)
FUSE 8 20A
(8W-10-23)
11 C4
16 RD/YL
S250
(8W-10-23)
16 RD/YL
8 C201
16 RD/YL
S252
(8W-10-23)
16 RD/YL
1 2 C220
16 RD/YL
16 BR
2 1
CIGAR LIGHTER
16 BR
G203
(8W-15-22)
BATT
FUSE BLOCK NO. 3
(8W-11-5)
FUSE 2 7.5A
(8W-11-37)
16 RD/DG
S214
(8W-11-38)
18 RD/DG
2 C100
18 RD/DG
1
18 RD/DG
SECURITY SYSTEM MODULE
(8W-39-3)
SIREN SIGNAL CONTROL
9 C2
18 BK/BL
1
18 BK/BL
3
SIREN SIGNAL CONTROL
FUSED B(+)
GROUND
SIREN
2
18 BR
G200
(8W-15-9)

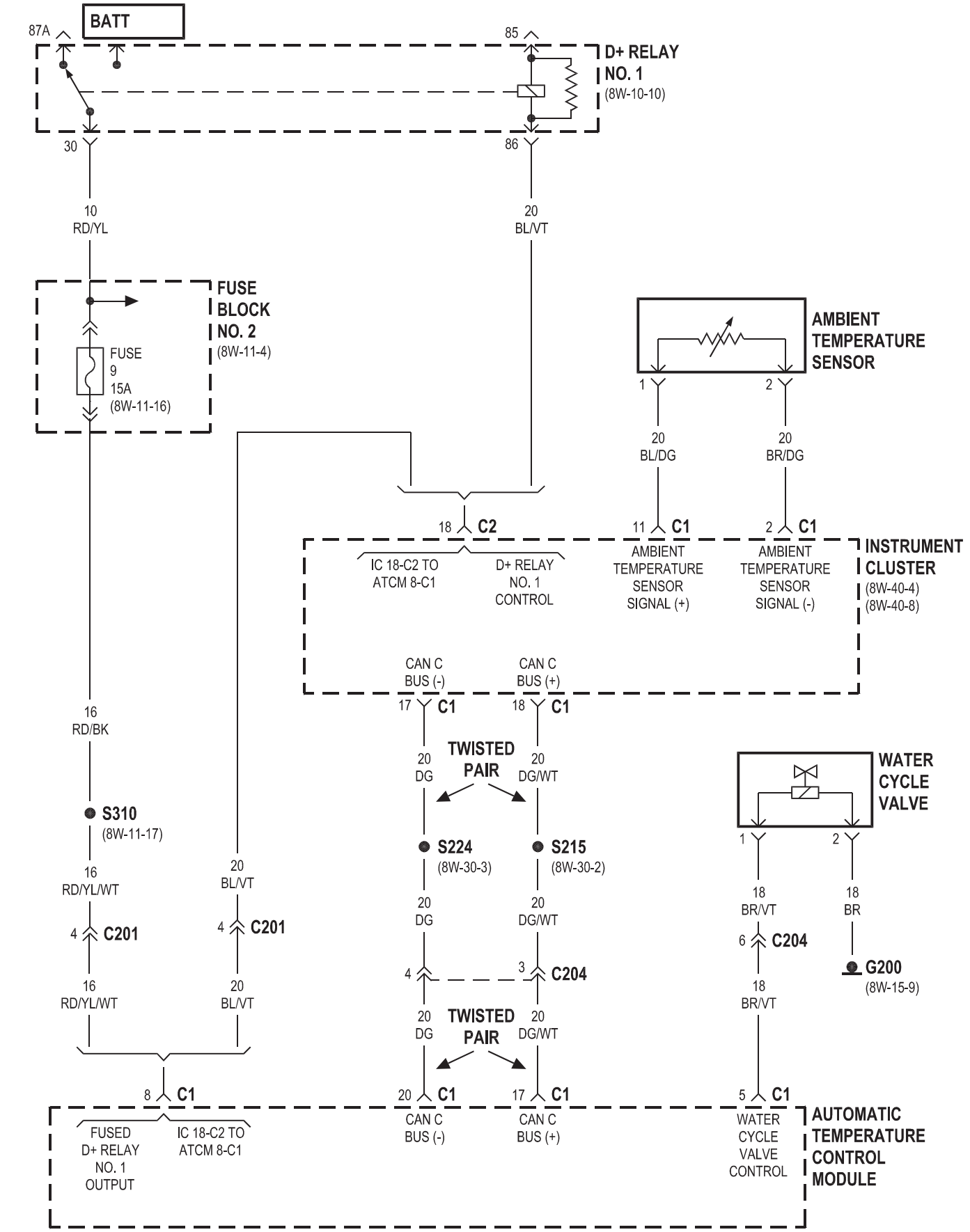


VA304103 J038W-24

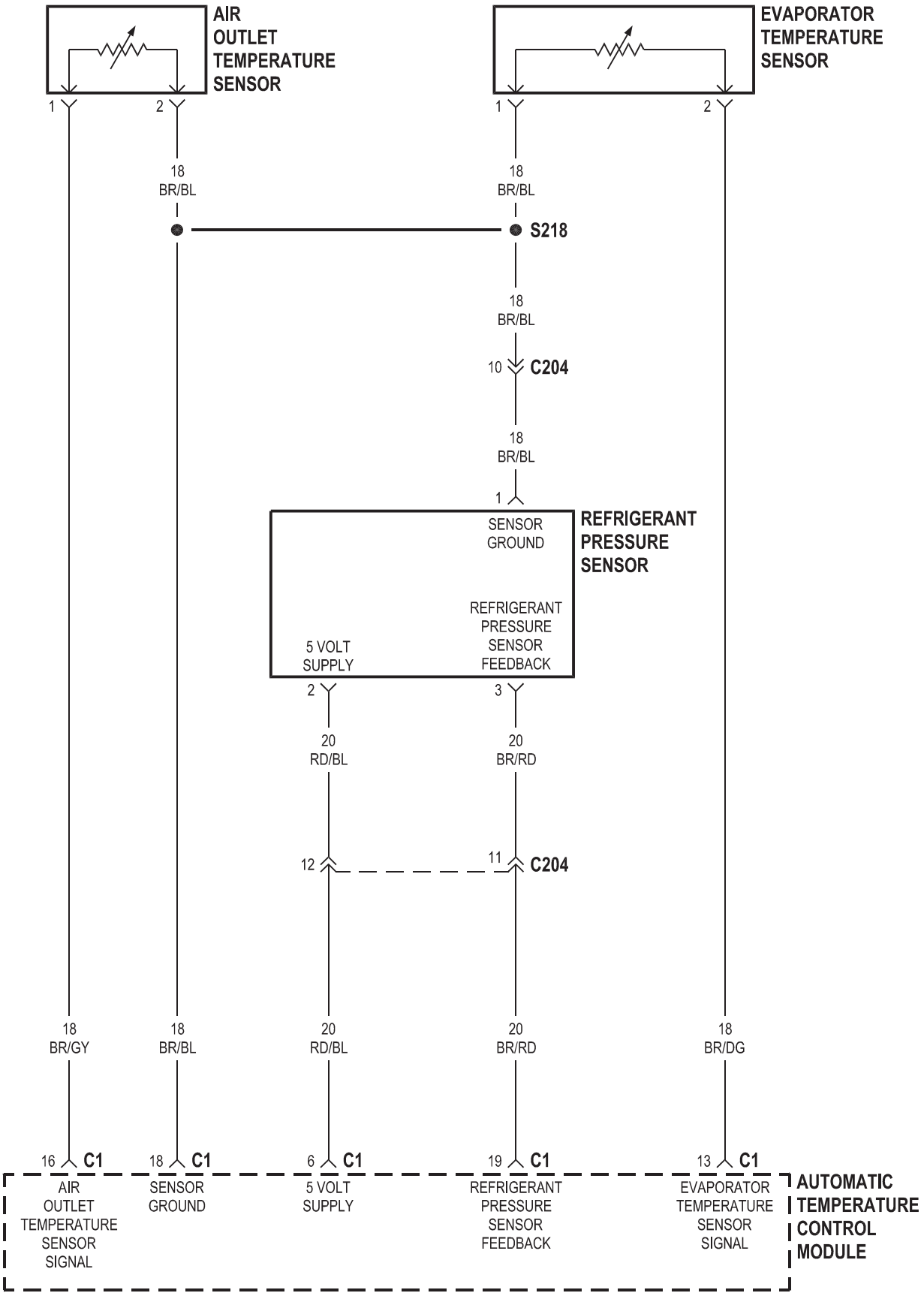
8W-42 AIR CONDITIONER/HEATER

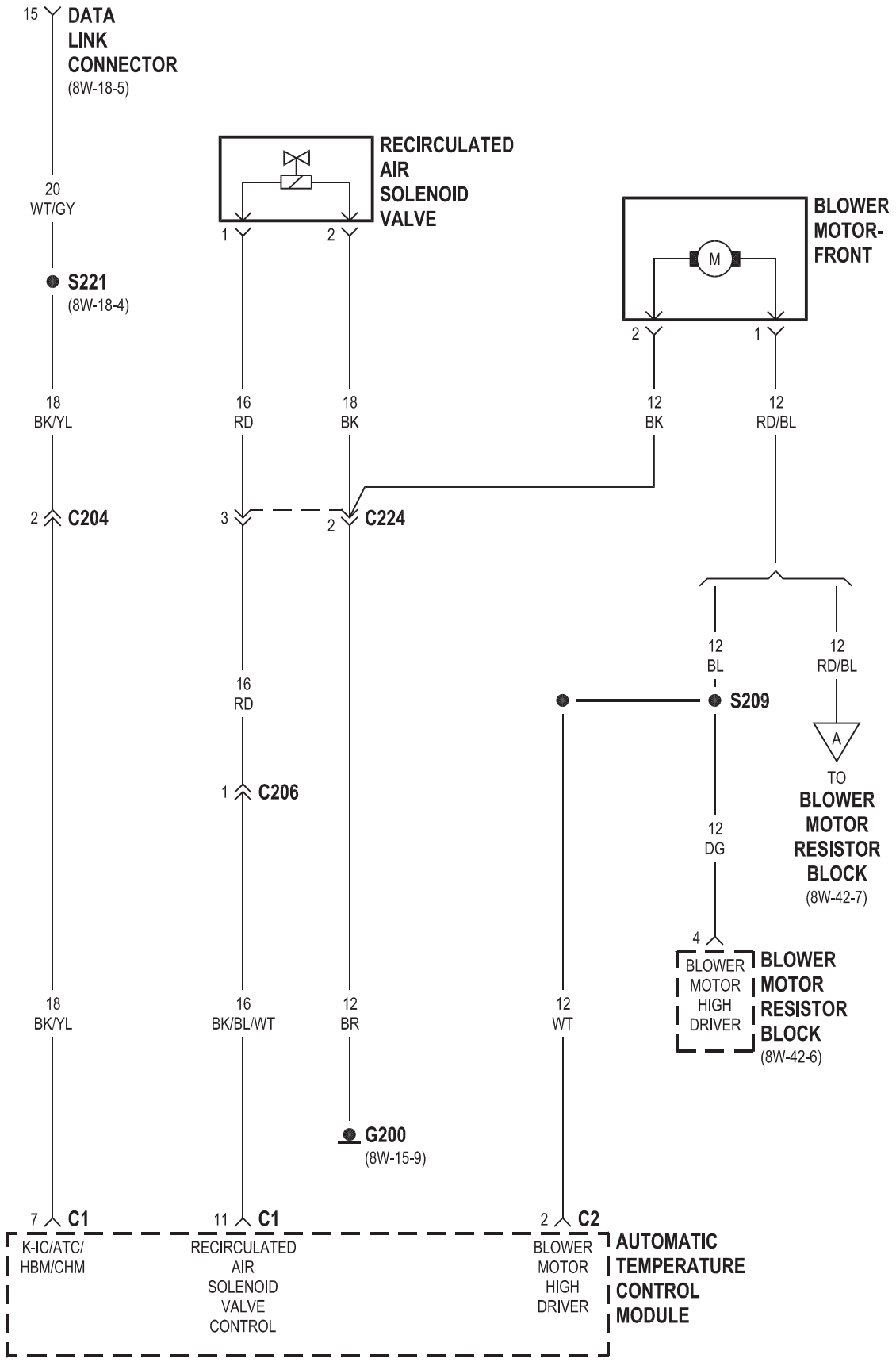
Component	Page
A/C Auxiliary Fan	8W-42-2
A/C Auxiliary Fan Relay	8W-42-2
A/C Compressor Clutch	8W-42-2
A/C Control Module- Roof	8W-42-14, 15
A/C Fan Switch	8W-42-10, 16
A/C Switch- Roof	8W-42-10, 14
Air Outlet Temperature Sensor	8W-42-4
Ambient Temperature Sensor	8W-42-3
Automatic Temperature Control Module	8W-42-2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 19, 21
Auxiliary Heater Relay	8W-42-17, 18
Auxiliary Heater Switch	8W-42-12, 24
Blower Motor Resistor Block	8W-42-5, 6, 7
Blower Motor- Front	8W-42-5, 7
Cabin Heater Assembly	8W-42-8, 9, 10, 11, 12, 13, 17, 20, 22, 24
Cabin Heater Control Module	8W-42-13
Circulation Pump	8W-42-9
Circulation Pump Diode	8W-42-9, 11
Circulation Pump Relay	8W-42-9
Controller Antilock Brake	8W-42-19
D+ Relay No. 1	8W-42-3
Data Link Connector	8W-42-5, 12, 22
Daytime Running Lamps Relay	8W-42-14, 15, 16, 19, 21, 24
Dosing Pump	8W-42-11
Evaporator Temperature Sensor	8W-42-4
Fan Stage 1 Relay	8W-42-8
Fuse 1	8W-42-2, 20
Fuse 3	8W-42-17
Fuse 4	8W-42-11
Fuse 7	8W-42-9
Fuse 8	8W-42-8, 14, 24
Fuse 9	8W-42-3
Fuse 11	8W-42-22
Fuse 20	8W-42-2, 9, 16
Fuse 21	8W-42-6, 7
Fuse Block No. 1	8W-42-2, 6, 7, 9, 24
Fuse Block No. 2	8W-42-3
Fuse Block No. 3	8W-42-8, 11, 16, 17, 20, 22
Fuse/Relay Block	8W-42-2, 14
G100	8W-42-11
G102	8W-42-2
G200	8W-42-3, 5, 9
G202	8W-42-2, 8, 9, 17, 18, 22
G203	8W-42-6, 7, 14, 16, 19, 21, 24
G301	8W-42-14
Heat Exchanger Connector	8W-42-17, 18, 19
Heat Exchanger Switch	8W-42-18, 19
Heater Timer- Auxiliary	8W-42-6, 7, 12, 19, 20, 21
Instrument Cluster	8W-42-3
Metering Pump	8W-42-22
Recirculated Air Solenoid Valve	8W-42-5
Refrigerant Pressure Sensor	8W-42-4
Roof Fan Motor	8W-42-16
Security System Module	8W-42-22
TCS Switch	8W-42-19
Temperature Switch	8W-42-10, 15
Warm Air Auxiliary Control Module	8W-42-20, 22
Warm Air Auxiliary Heater Assembly	8W-42-20, 22, 23
Warm Air Heater Control Module	8W-42-23
Water Cycle Valve	8W-42-3


BATT
FUSE BLOCK NO. 1
(8W-10-3)
FUSE 20 15A
(8W-10-30)
1 C4
16 RD/BL
S223
(8W-10-30)
16 RD/BL
3 C201
16 RD/BL
1 C1
FUSED B(+)
1
A/C COMPRESSOR CLUTCH
16 BL/DG
3 C101
16 BL/DG
9 C204
16 BL/DG
12 C1
A/C COMPRESSOR CLUTCH CONTROL
AUTOMATIC TEMPERATURE CONTROL MODULE
BATT
FUSE/ RELAY BLOCK
(8W-11-2)
FUSE 1 30A
(8W-11-20)
14 BL/YL
30
87
14 DG/BK
1
M
2
A/C AUXILIARY FAN
14 BR
G102
(8W-15-4)
A/C AUXILIARY FAN RELAY HIGH SIDE CONTROL
3 C1
18 BK/RD
1 C204
18 BK/RD
86
85
A/C AUXILIARY FAN RELAY
18 BR
G202
(8W-15-12)
AUTOMATIC TEMPERATURE CONTROL MODULE

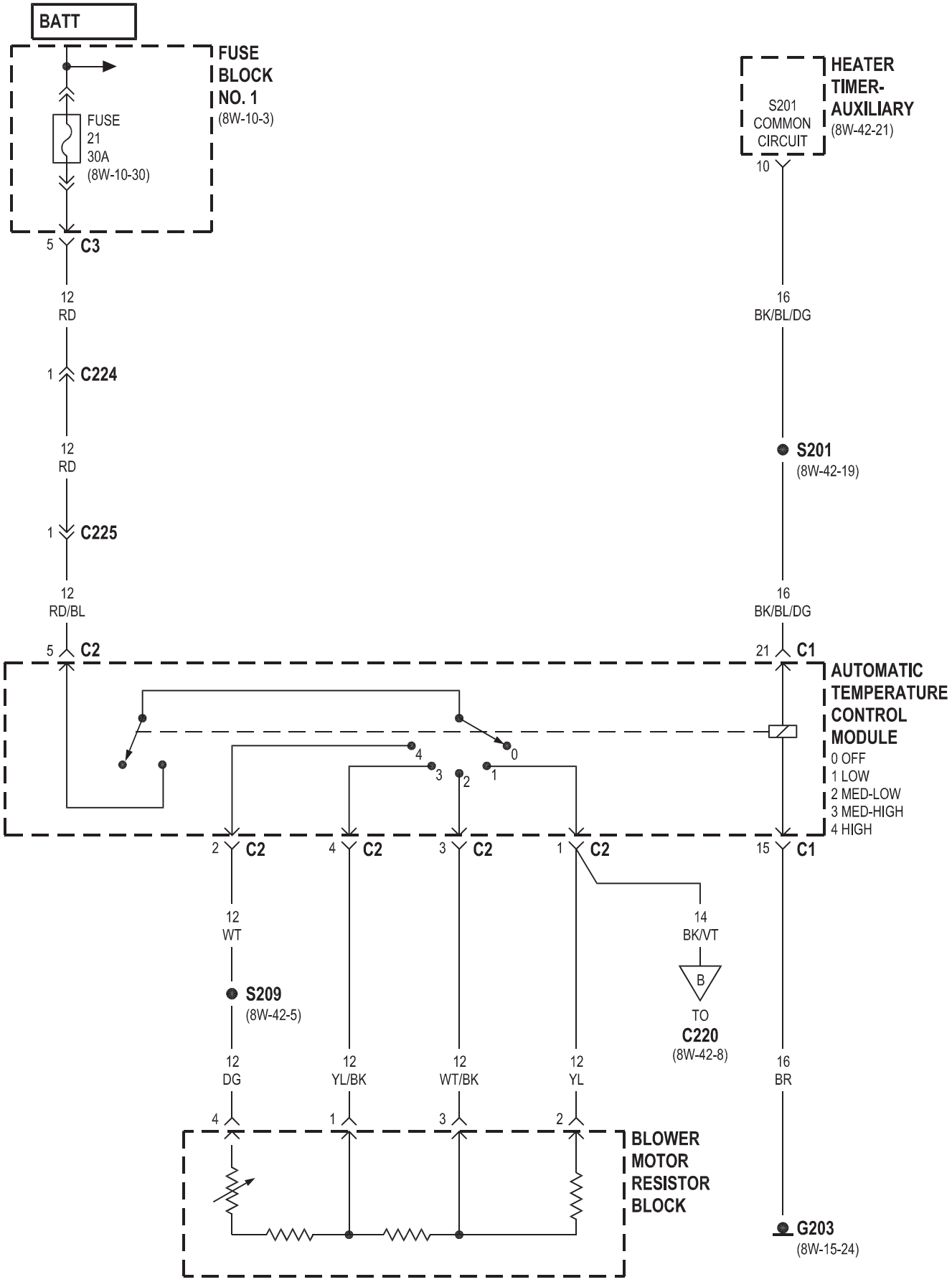


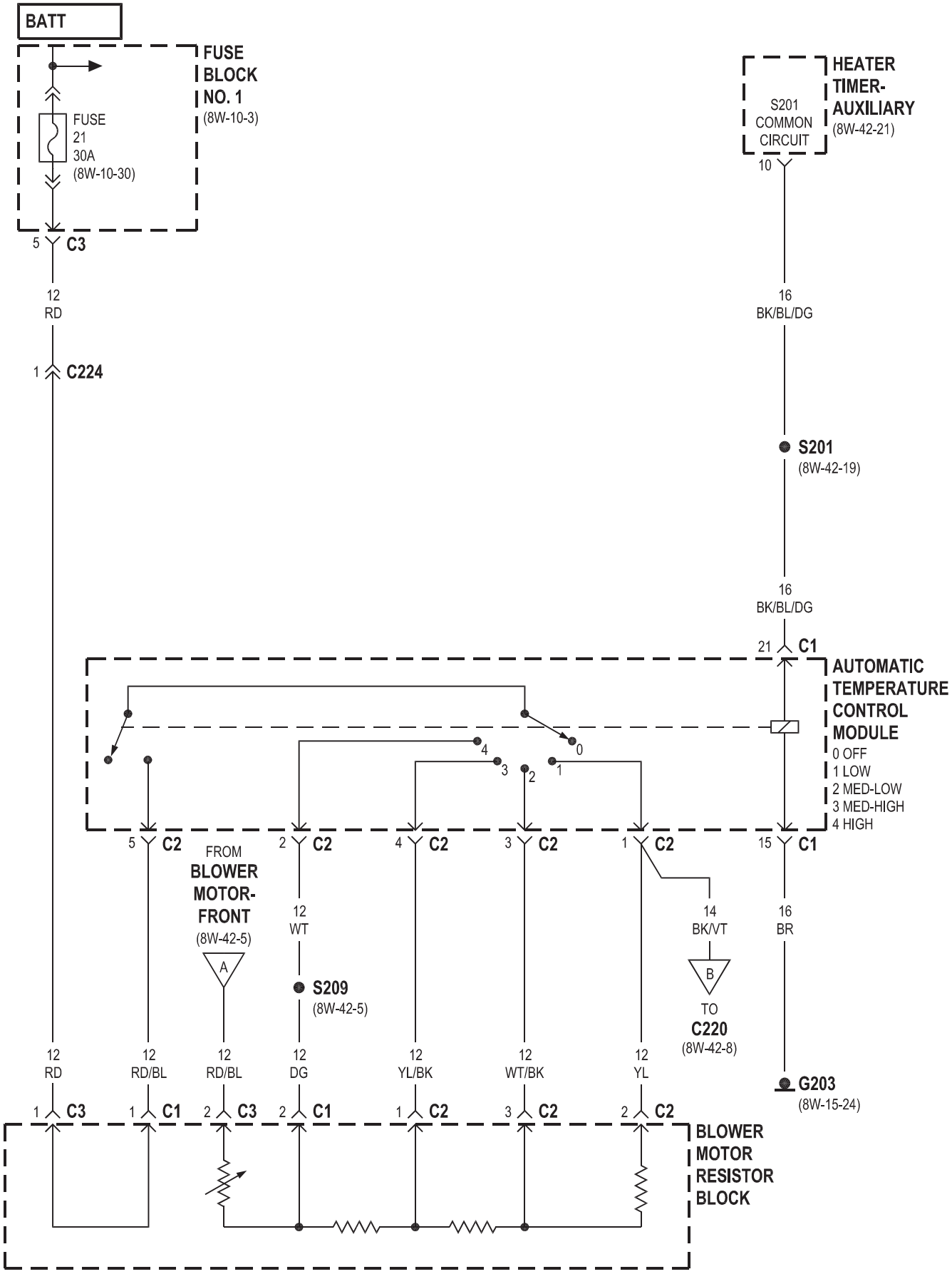
VA304203 J038W-24


AIR OUTLET TEMPERATURE SENSOR
1
2
18 BR/BL
EVAPORATOR TEMPERATURE SENSOR
1
2
18 BR/BL
S218
18 BR/BL
10 C204
18 BR/BL
1
SENSOR GROUND
REFRIGERANT PRESSURE SENSOR
REFRIGERANT PRESSURE SENSOR FEEDBACK
5 VOLT SUPPLY
2
3
20 RD/BL
20 BR/RD
12
11 C204
18 BR/GY
18 BR/BL
20 RD/BL
20 BR/RD
18 BR/DG
16 C1
18 C1
6 C1
19 C1
13 C1
AIR OUTLET TEMPERATURE SENSOR SIGNAL
SENSOR GROUND
5 VOLT SUPPLY
REFRIGERANT PRESSURE SENSOR FEEDBACK
EVAPORATOR TEMPERATURE SENSOR SIGNAL
AUTOMATIC TEMPERATURE CONTROL MODULE

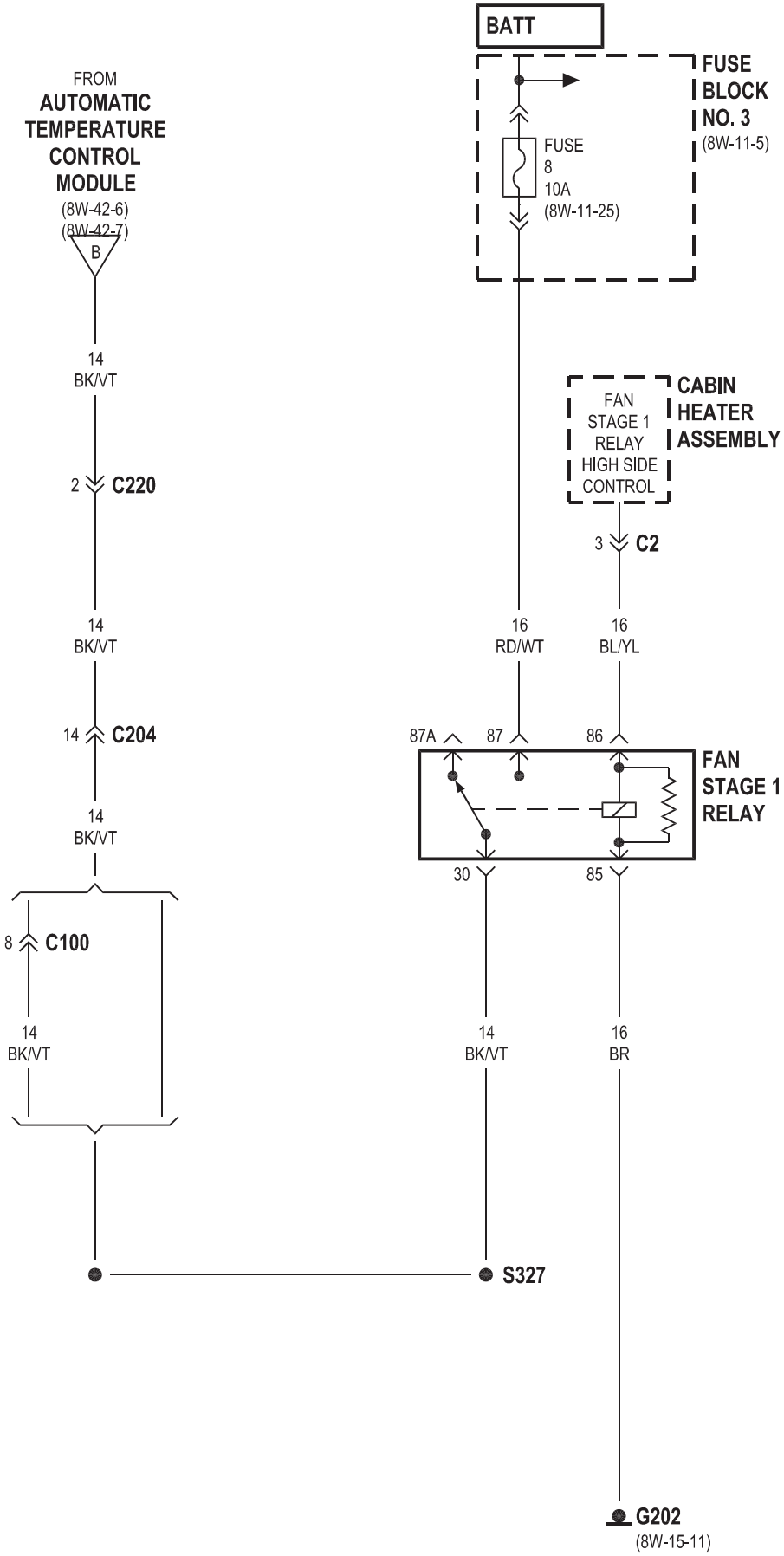


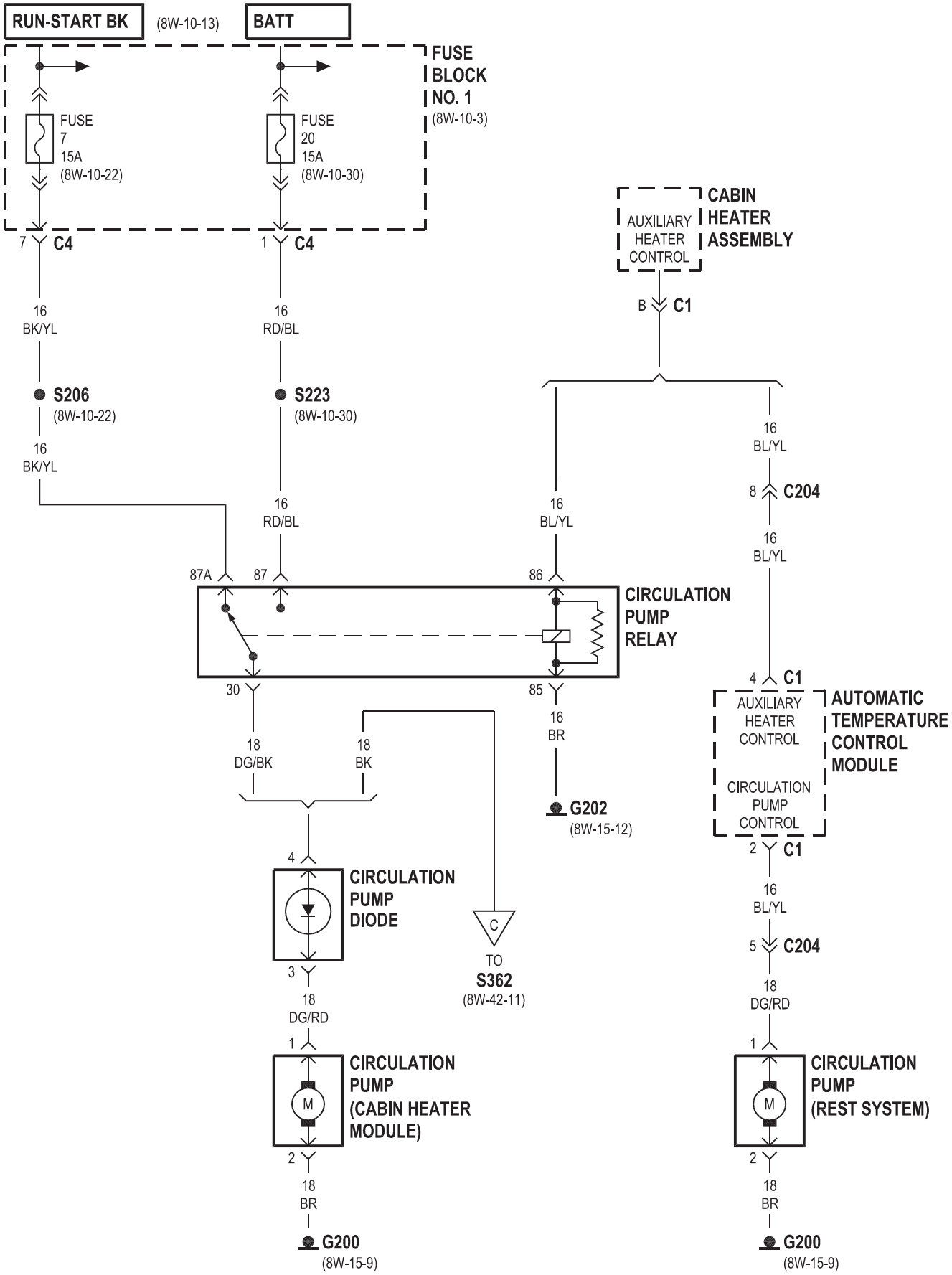
VA304205 J038W-24


BATT
FUSE BLOCK NO. 1
(8W-10-3)
FUSE 21 30A
(8W-10-30)
5 C3
12 RD
1 C224
12 RD
1 C225
12 RD/BL
5 C2
HEATER TIMER-AUXILIARY
(8W-42-21)
S201 COMMON CIRCUIT
10
16 BK/BL/DG
S201
(8W-42-19)
16 BK/BL/DG
21 C1
AUTOMATIC TEMPERATURE CONTROL MODULE
0 OFF
1 LOW
2 MED-LOW
3 MED-HIGH
4 HIGH
2 C2
4 C2
3 C2
1 C2
15 C1
12 WT
S209
(8W-42-5)
14 BK/VT
B
TO C220
(8W-42-8)
12 DG
12 YL/BK
12 WT/BK
12 YL
16 BR
4
1
3
2
BLOWER MOTOR RESISTOR BLOCK
G203
(8W-15-24)

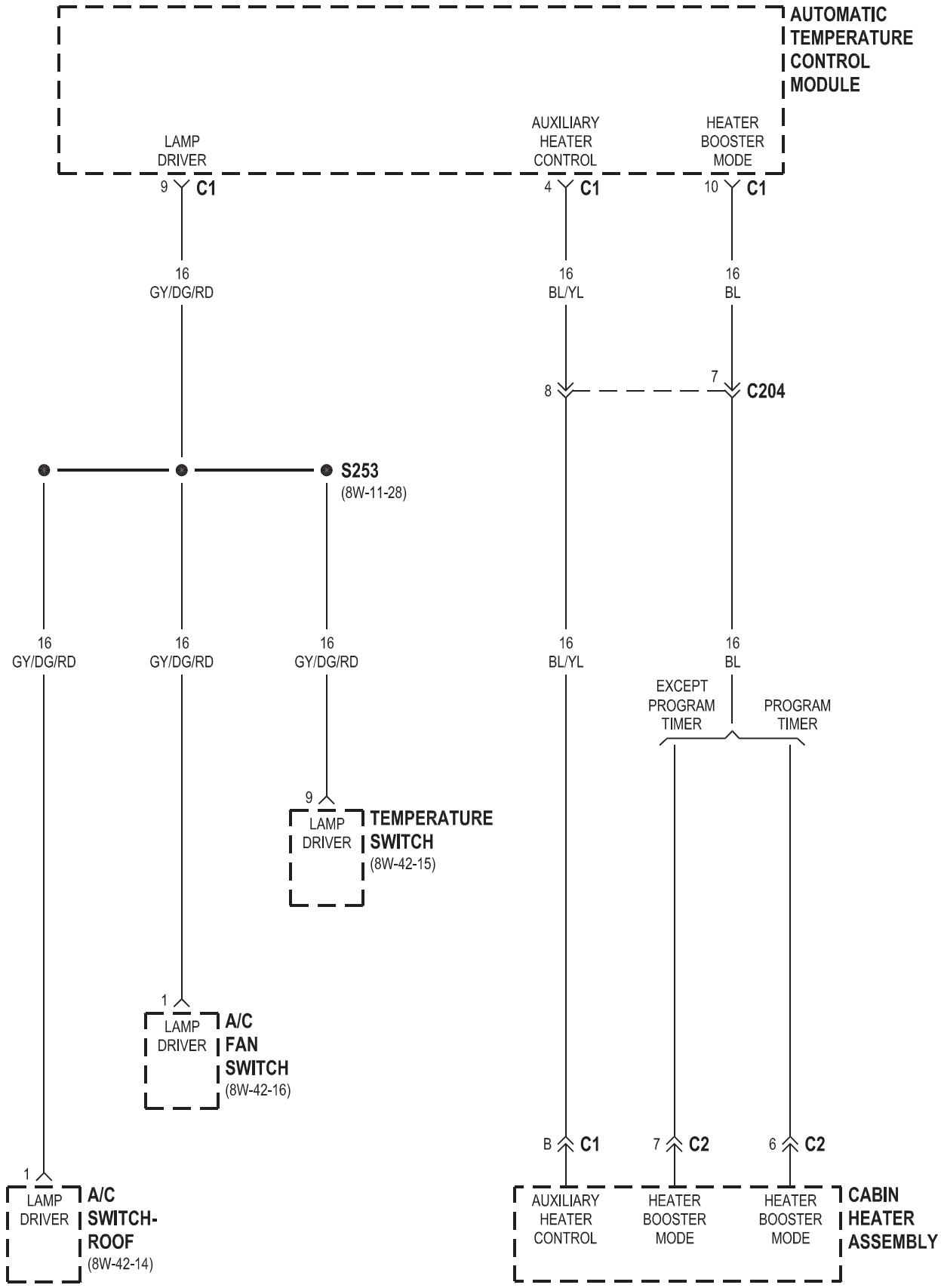


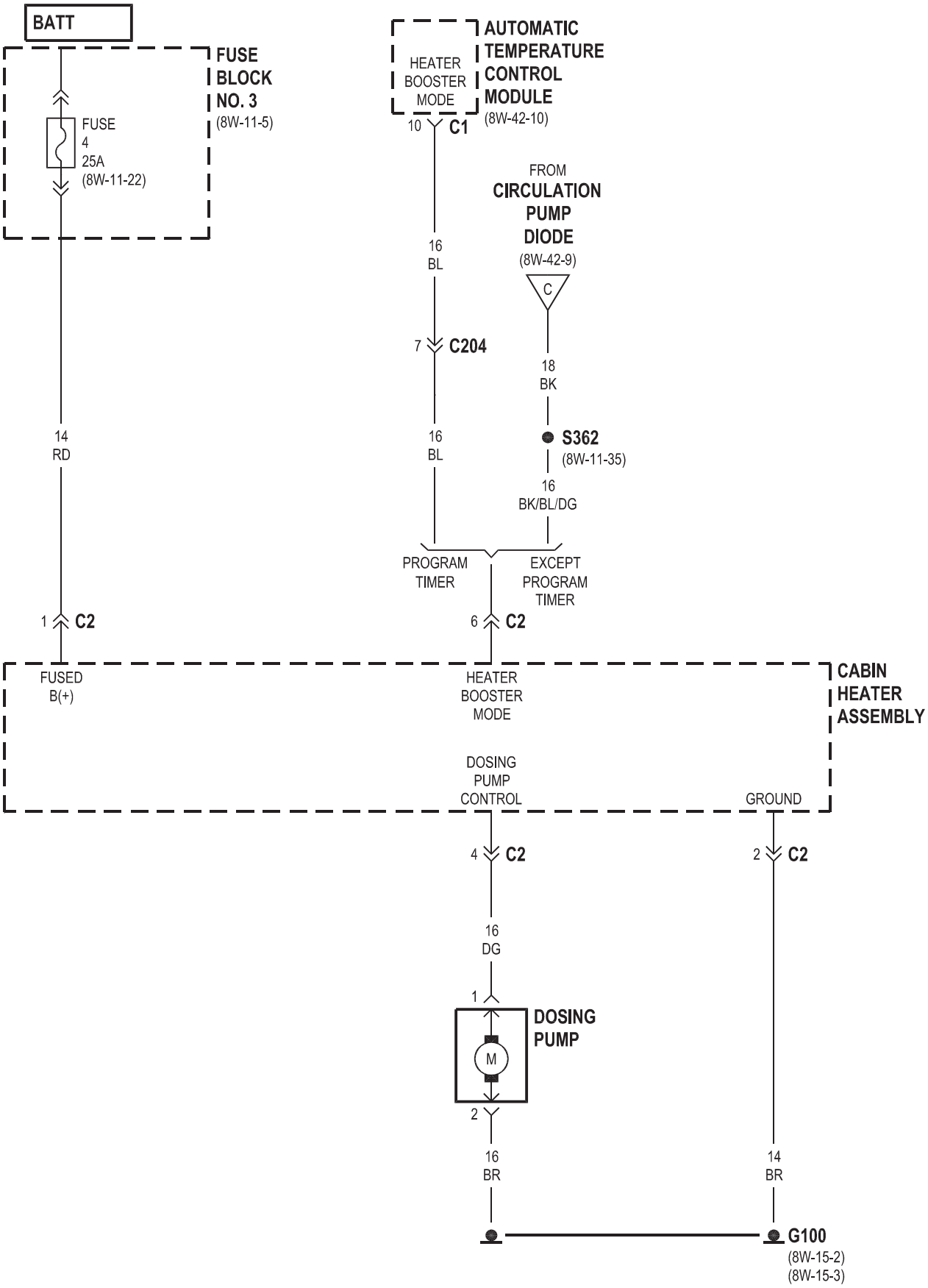
VA304207 J038W-24


BATT
FUSE BLOCK NO. 3
(8W-11-5)
FUSE 8 10A
(8W-11-25)
FROM AUTOMATIC TEMPERATURE CONTROL MODULE
(8W-42-6)
(8W-42-7)
B
14 BK/VT
2 C220
14 BK/VT
14 C204
14 BK/VT
8 C100
14 BK/VT
FAN STAGE 1 RELAY HIGH SIDE CONTROL
CABIN HEATER ASSEMBLY
3 C2
16 RD/WT
16 BL/YL
87A
87
86
FAN STAGE 1 RELAY
30
85
14 BK/VT
16 BR
S327
G202
(8W-15-11)

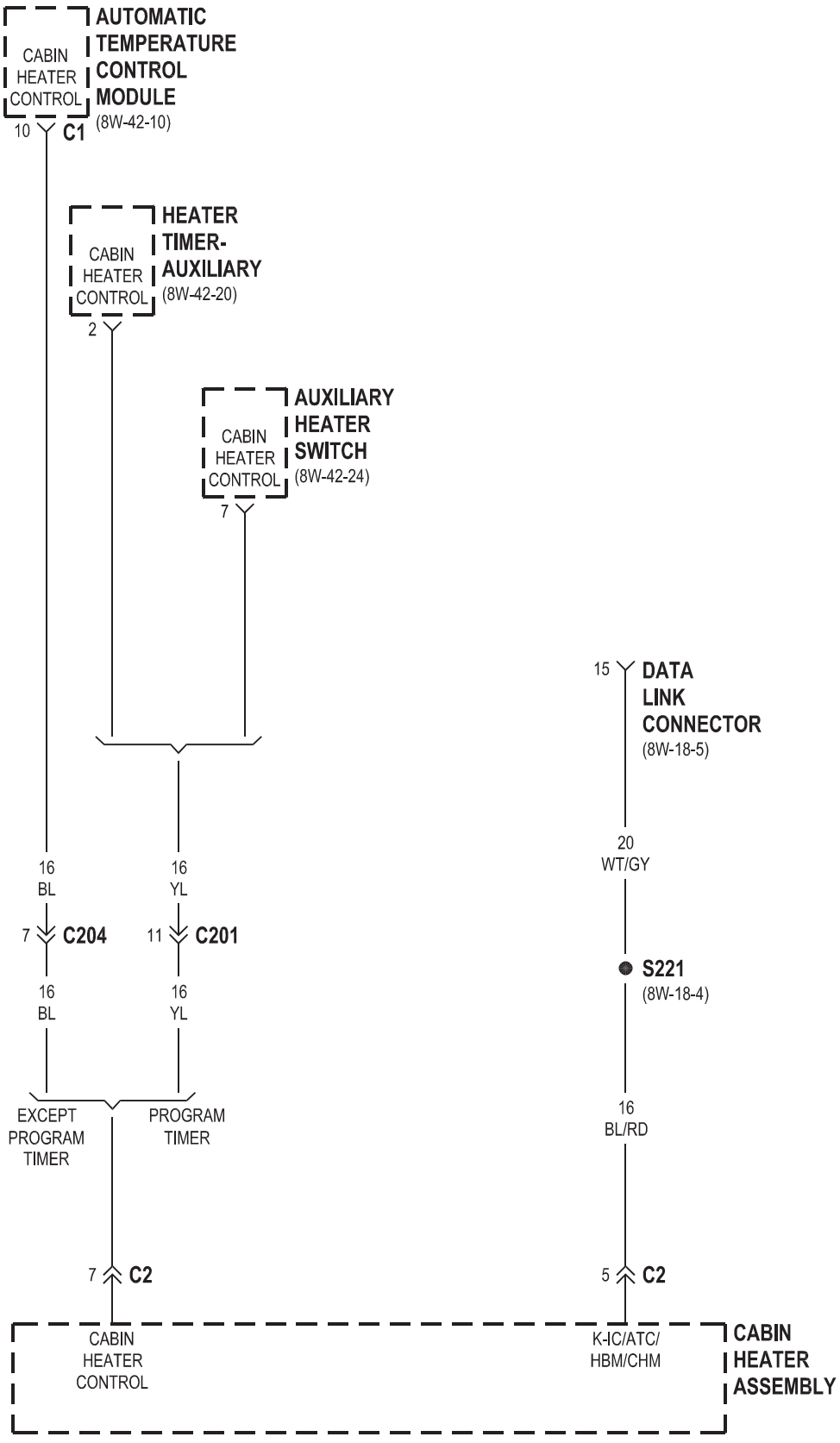


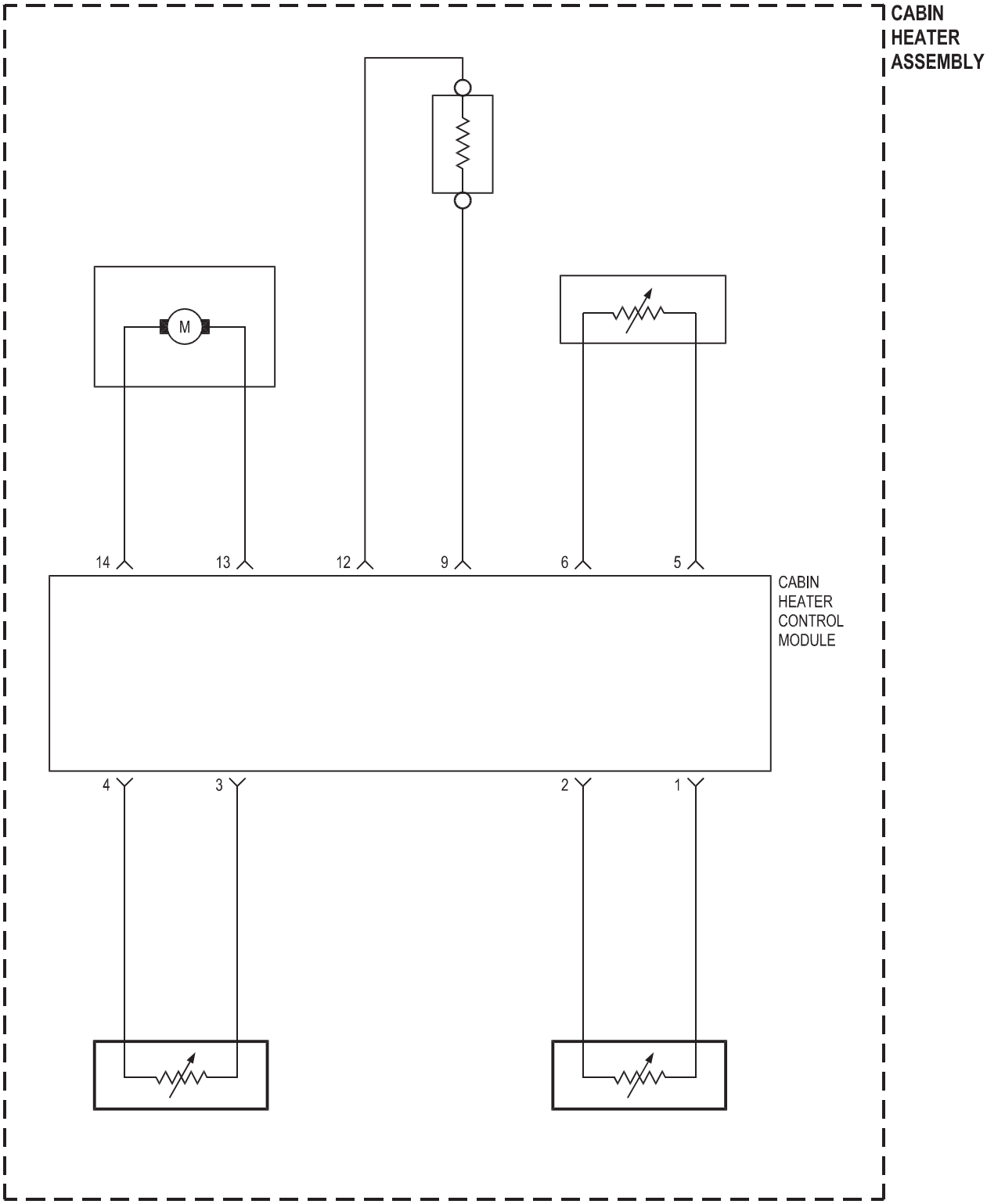
VA304209 J038W-24

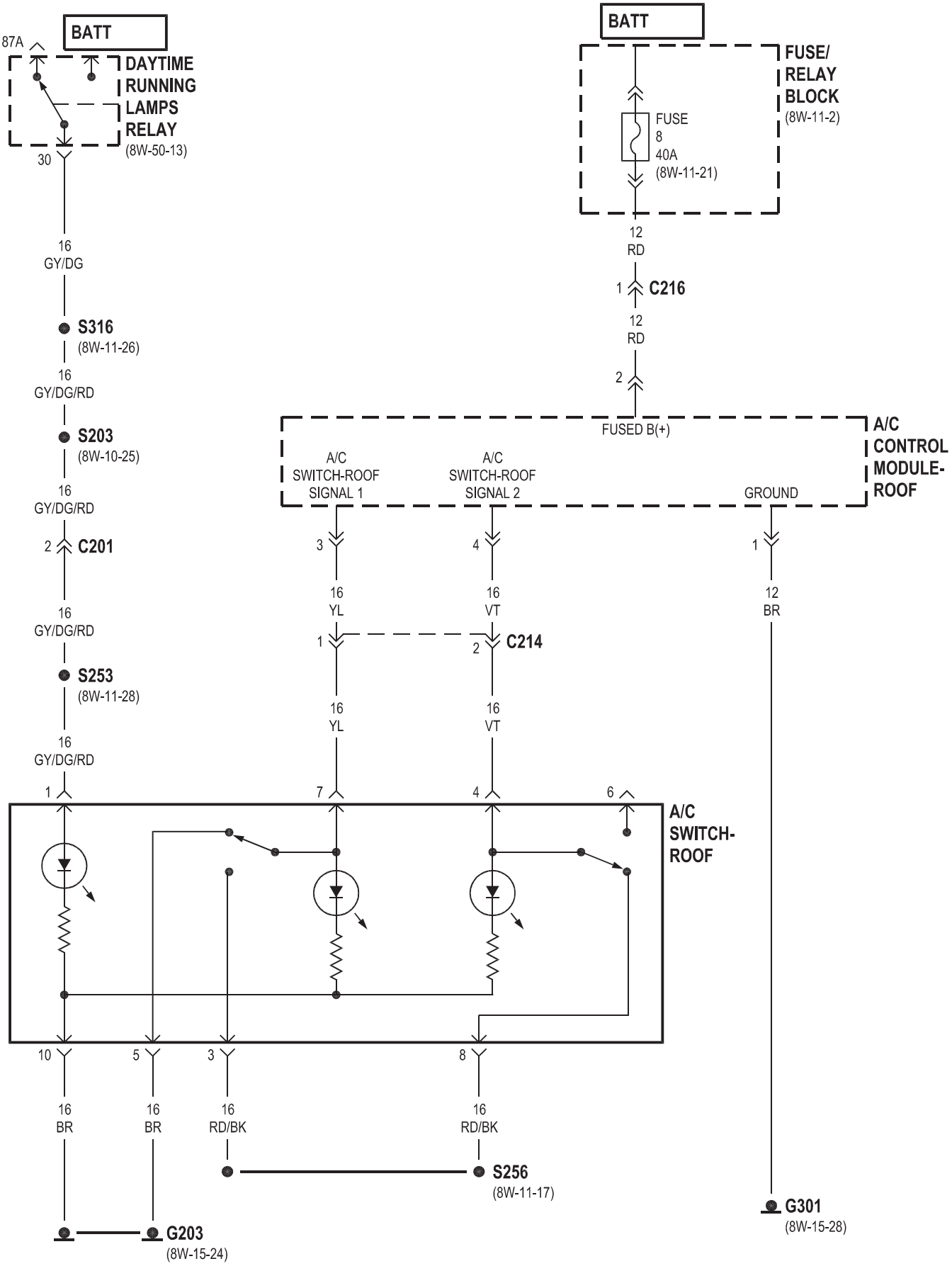

AUTOMATIC TEMPERATURE CONTROL MODULE
LAMP DRIVER
AUXILIARY HEATER CONTROL
HEATER BOOSTER MODE
9 C1
4 C1
10 C1
16 GY/DG/RD
16 BL/YL
16 BL
8
7 C204
S253
(8W-11-28)
16 GY/DG/RD
16 GY/DG/RD
16 GY/DG/RD
16 BL/YL
16 BL
EXCEPT PROGRAM TIMER
PROGRAM TIMER
9
LAMP DRIVER
TEMPERATURE SWITCH
(8W-42-15)
1
LAMP DRIVER
A/C FAN SWITCH
(8W-42-16)
1
LAMP DRIVER
A/C SWITCH-ROOF
(8W-42-14)
B C1
7 C2
6 C2
AUXILIARY HEATER CONTROL
HEATER BOOSTER MODE
HEATER BOOSTER MODE
CABIN HEATER ASSEMBLY

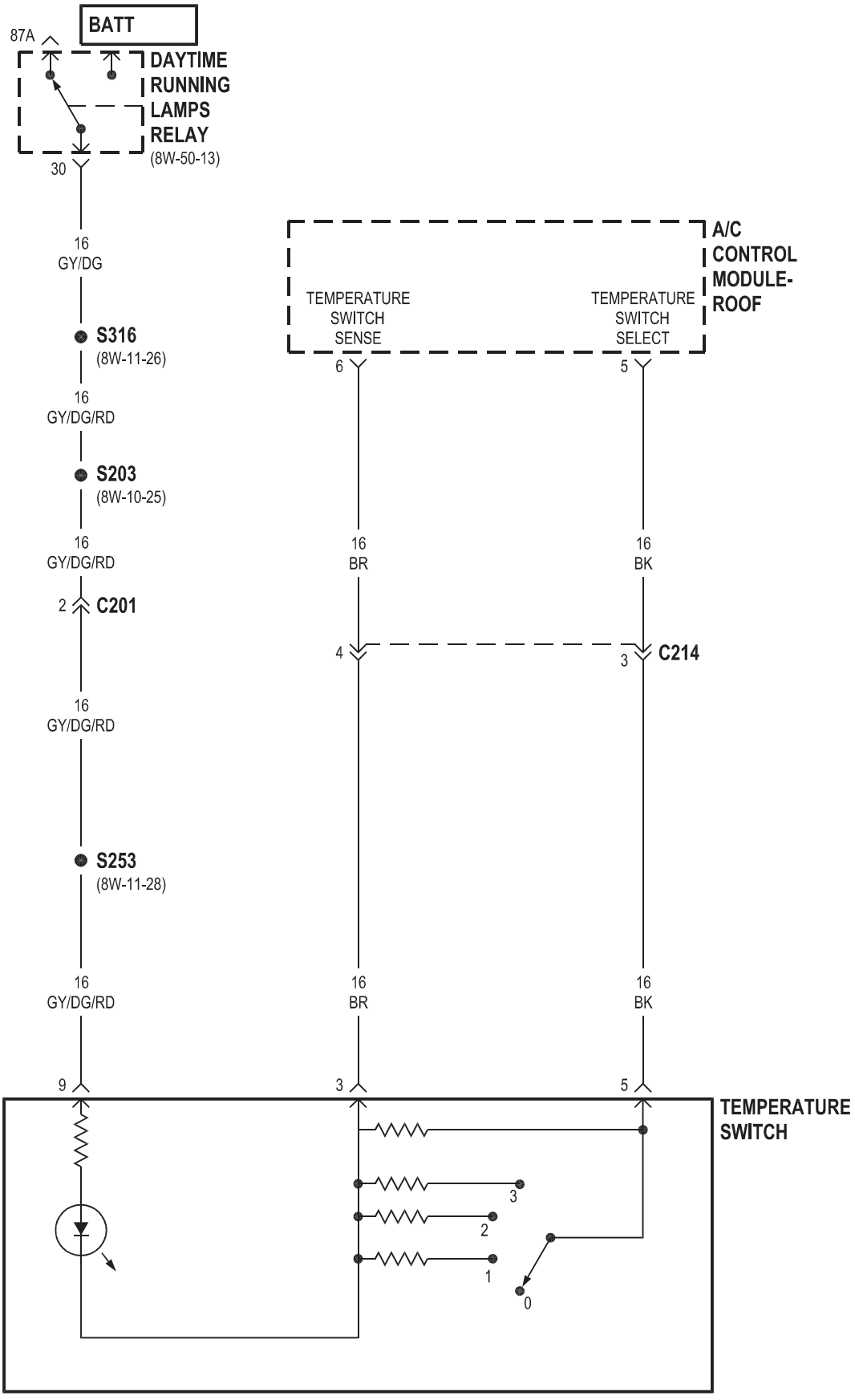


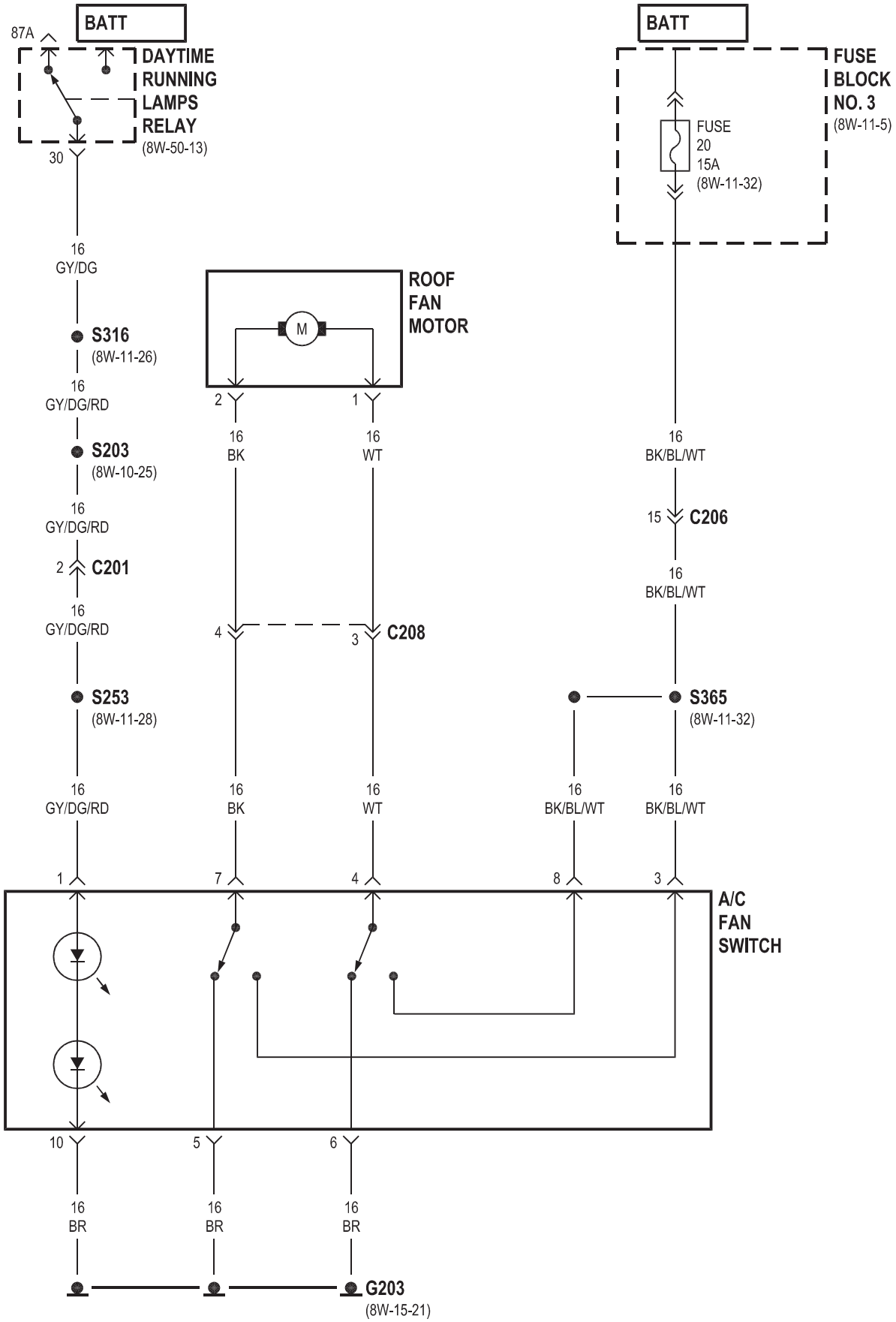
VA304211 J038W-24

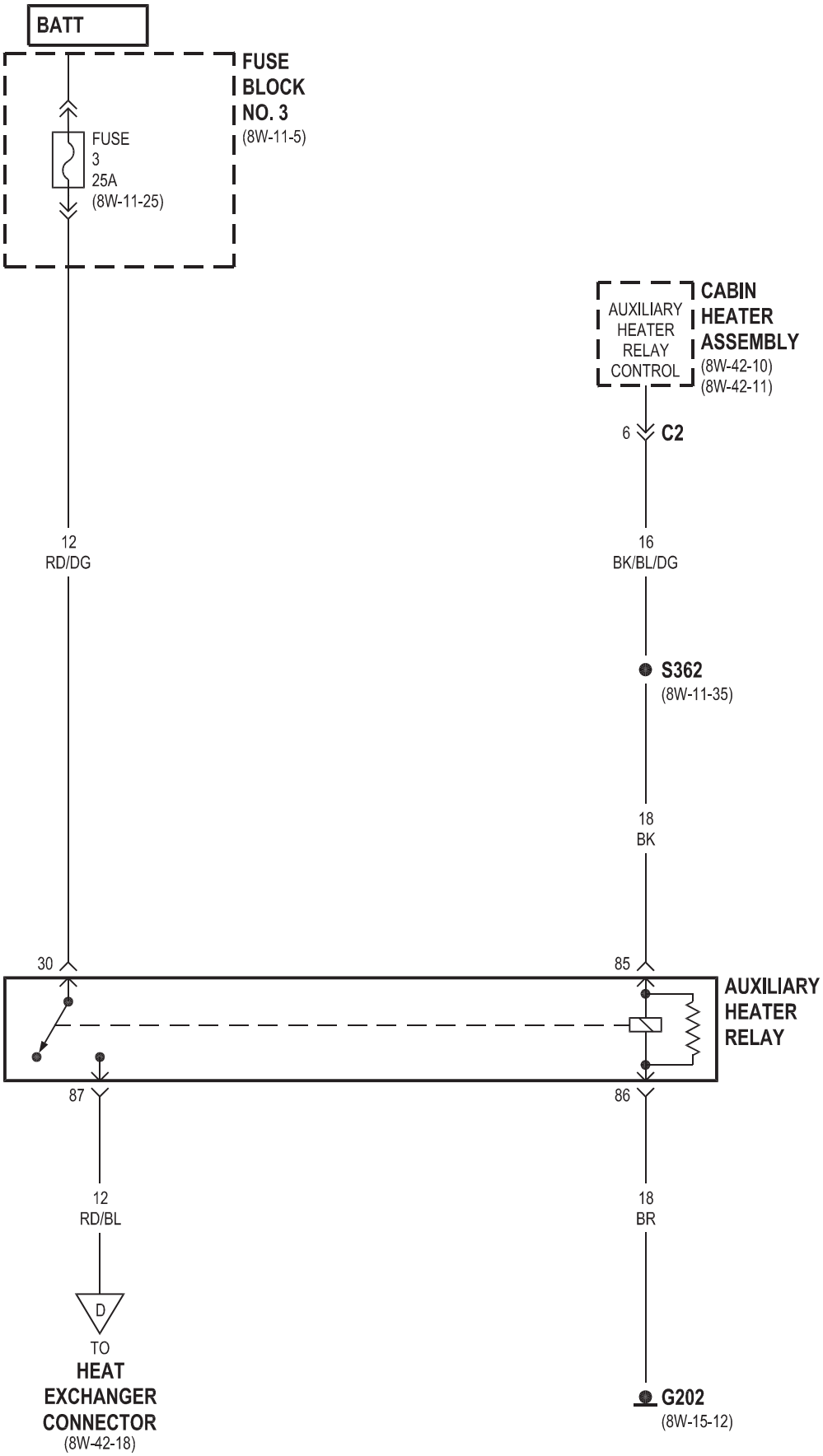

CABIN HEATER CONTROL
AUTOMATIC TEMPERATURE CONTROL MODULE
(8W-42-10)
10
C1
CABIN HEATER CONTROL
HEATER TIMER-AUXILIARY
(8W-42-20)
2
CABIN HEATER CONTROL
AUXILIARY HEATER SWITCH
(8W-42-24)
7
15
DATA LINK CONNECTOR
(8W-18-5)
20
WT/GY
S221
(8W-18-4)
16
BL
16
YL
7
C204
11
C201
16
BL
16
YL
16
BL/RD
EXCEPT PROGRAM TIMER
PROGRAM TIMER
7
C2
5
C2
CABIN HEATER CONTROL
K-IC/ATC/ HBM/CHM
CABIN HEATER ASSEMBLY


CABIN
HEATER
ASSEMBLY
M
14
13
12
9
6
5
CABIN
HEATER
CONTROL
MODULE
4
3
2
1

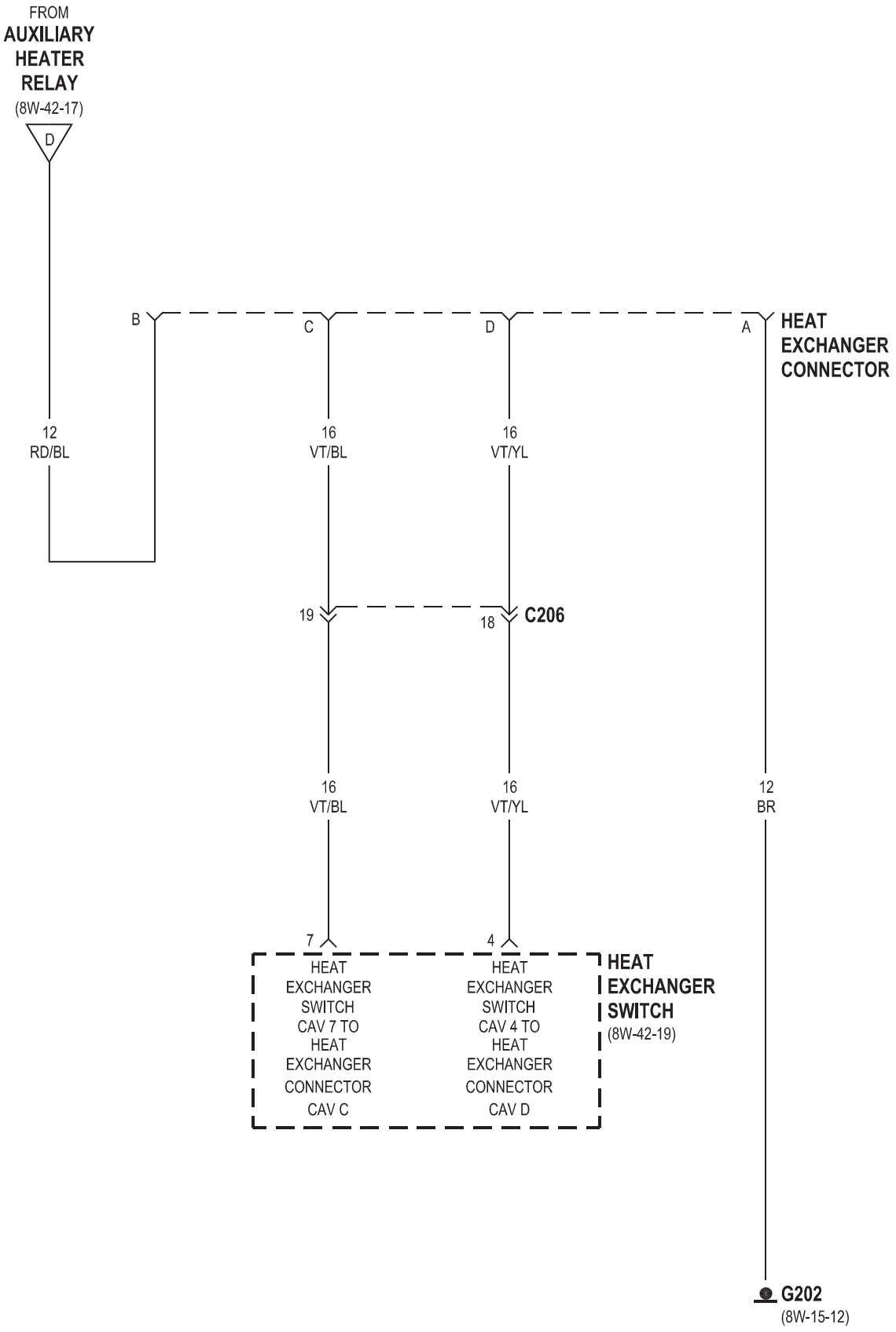

BATT
87A
DAYTIME RUNNING LAMPS RELAY
(8W-50-13)
30
16 GY/DG
S316
(8W-11-26)
16 GY/DG/RD
S203
(8W-10-25)
16 GY/DG/RD
2 C201
16 GY/DG/RD
S253
(8W-11-28)
16 GY/DG/RD
1
BATT
FUSE/ RELAY BLOCK
(8W-11-2)
FUSE 8 40A
(8W-11-21)
12 RD
1 C216
12 RD
2
FUSED B(+)
A/C CONTROL MODULE-ROOF
A/C SWITCH-ROOF SIGNAL 1
A/C SWITCH-ROOF SIGNAL 2
GROUND
3
4
1
16 YL
16 VT
12 BR
1 C214 2
16 YL
16 VT
1
7
4
6
A/C SWITCH-ROOF
10
5
3
8
16 BR
16 BR
16 RD/BK
16 RD/BK
S256
(8W-11-17)
G203
(8W-15-24)
G301
(8W-15-28)

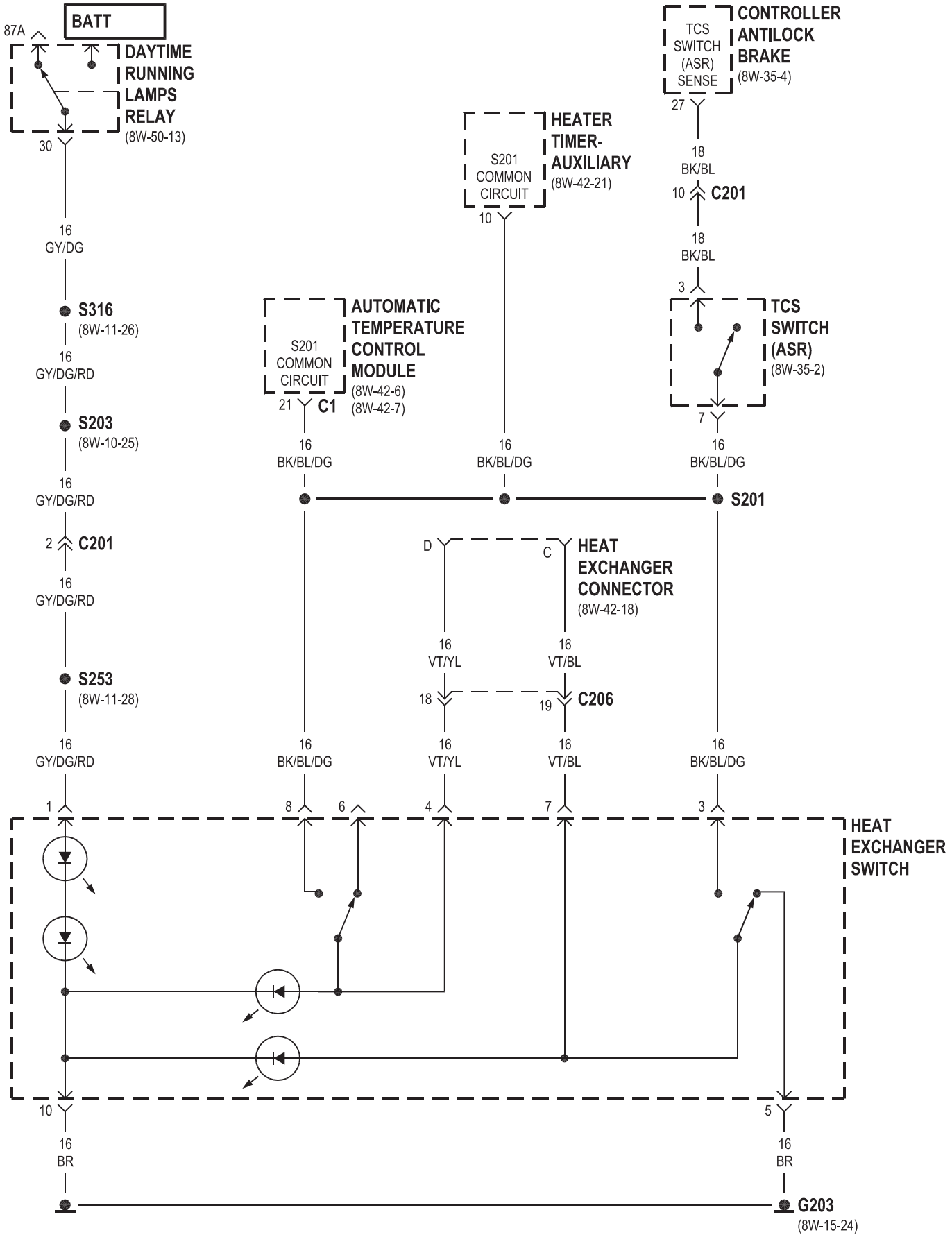

BATT
87A
DAYTIME RUNNING LAMPS RELAY
(8W-50-13)
30
16 GY/DG
S316
(8W-11-26)
16 GY/DG/RD
S203
(8W-10-25)
16 GY/DG/RD
2
C201
16 GY/DG/RD
S253
(8W-11-28)
16 GY/DG/RD
9
A/C CONTROL MODULE-ROOF
TEMPERATURE SWITCH SENSE
TEMPERATURE SWITCH SELECT
6
5
16 BR
16 BK
4
3
C214
16 BR
16 BK
3
5
TEMPERATURE SWITCH
3
2
1
0


BATT
87A
DAYTIME RUNNING LAMPS RELAY
(8W-50-13)
30
16 GY/DG
S316
(8W-11-26)
16 GY/DG/RD
S203
(8W-10-25)
16 GY/DG/RD
2
C201
16 GY/DG/RD
S253
(8W-11-28)
16 GY/DG/RD
1
ROOF FAN MOTOR
M
2
1
16 BK
16 WT
4
3
C208
16 BK
16 WT
7
4
BATT
FUSE BLOCK NO. 3
(8W-11-5)
FUSE 20 15A
(8W-11-32)
16 BK/BL/WT
15
C206
16 BK/BL/WT
S365
(8W-11-32)
16 BK/BL/WT
16 BK/BL/WT
8
3
A/C FAN SWITCH
10
5
6
16 BR
16 BR
16 BR
G203
(8W-15-21)

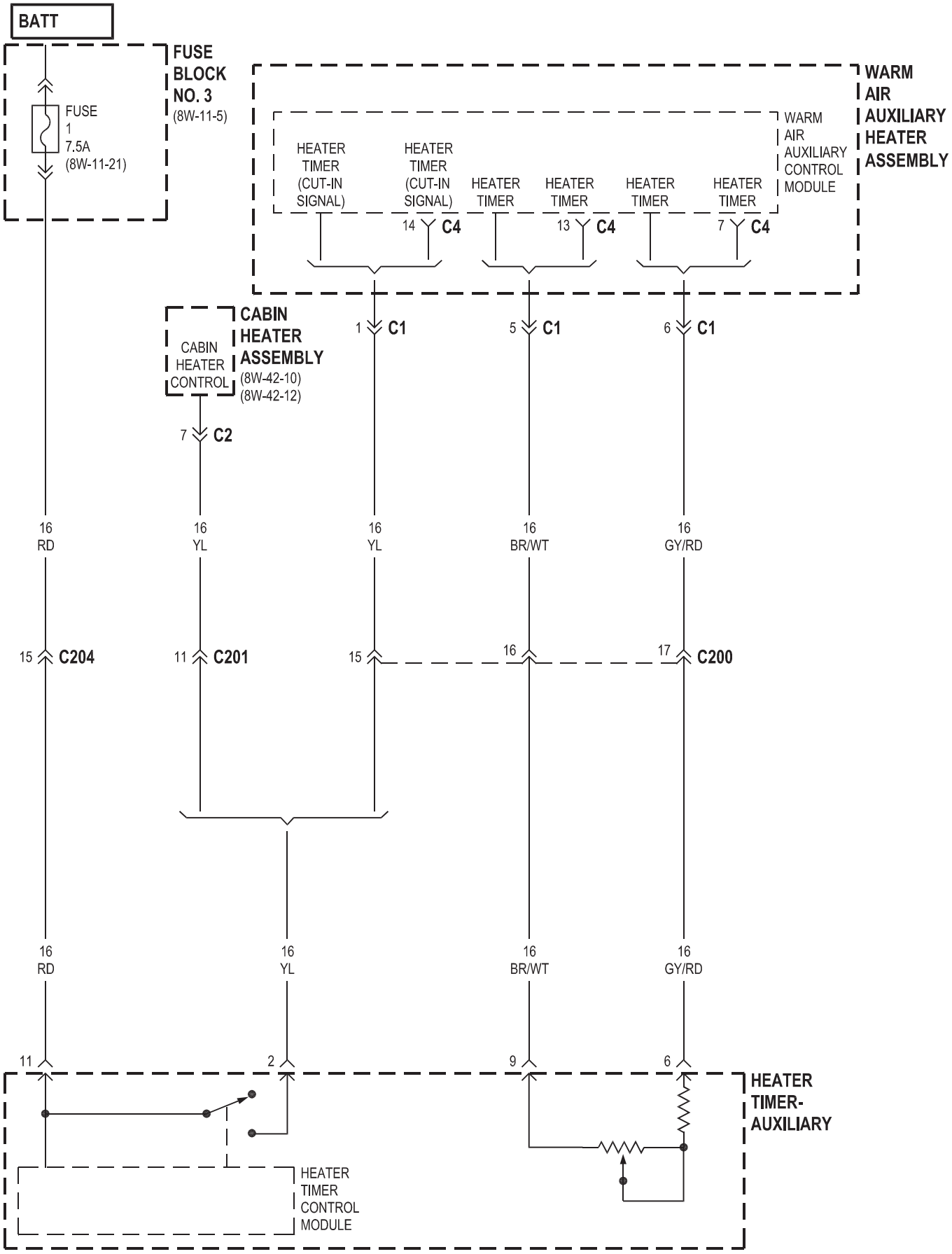


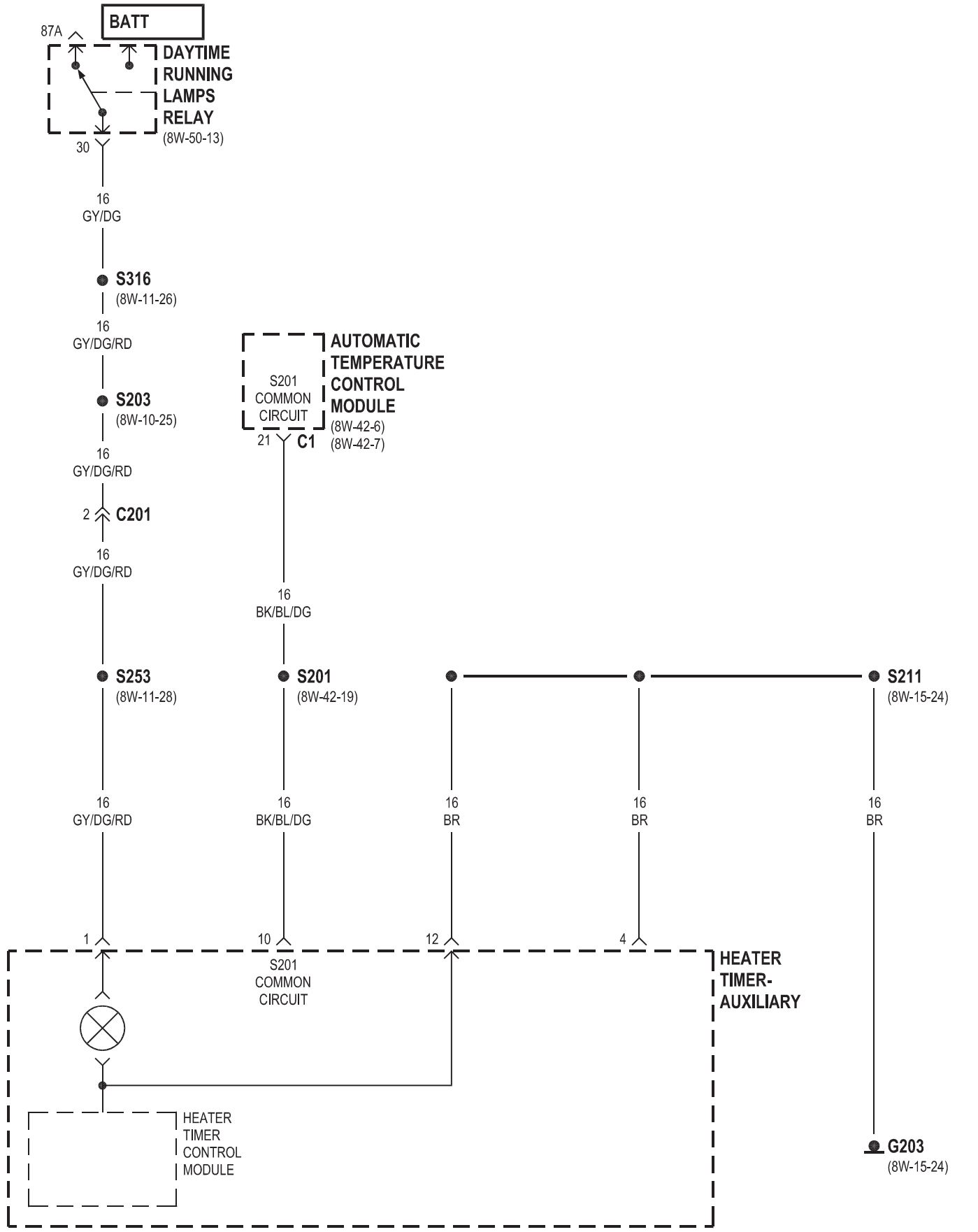
VA304217 J038W-24


FROM
AUXILIARY
HEATER
RELAY
(8W-42-17)
D
B
C
D
A
HEAT
EXCHANGER
CONNECTOR
12
RD/BL
16
VT/BL
16
VT/YL
19
18
C206
16
VT/BL
16
VT/YL
12
BR
7
4
HEAT
EXCHANGER
SWITCH
CAV 7 TO
HEAT
EXCHANGER
CONNECTOR
CAV C
HEAT
EXCHANGER
SWITCH
CAV 4 TO
HEAT
EXCHANGER
CONNECTOR
CAV D
HEAT
EXCHANGER
SWITCH
(8W-42-19)
G202
(8W-15-12)

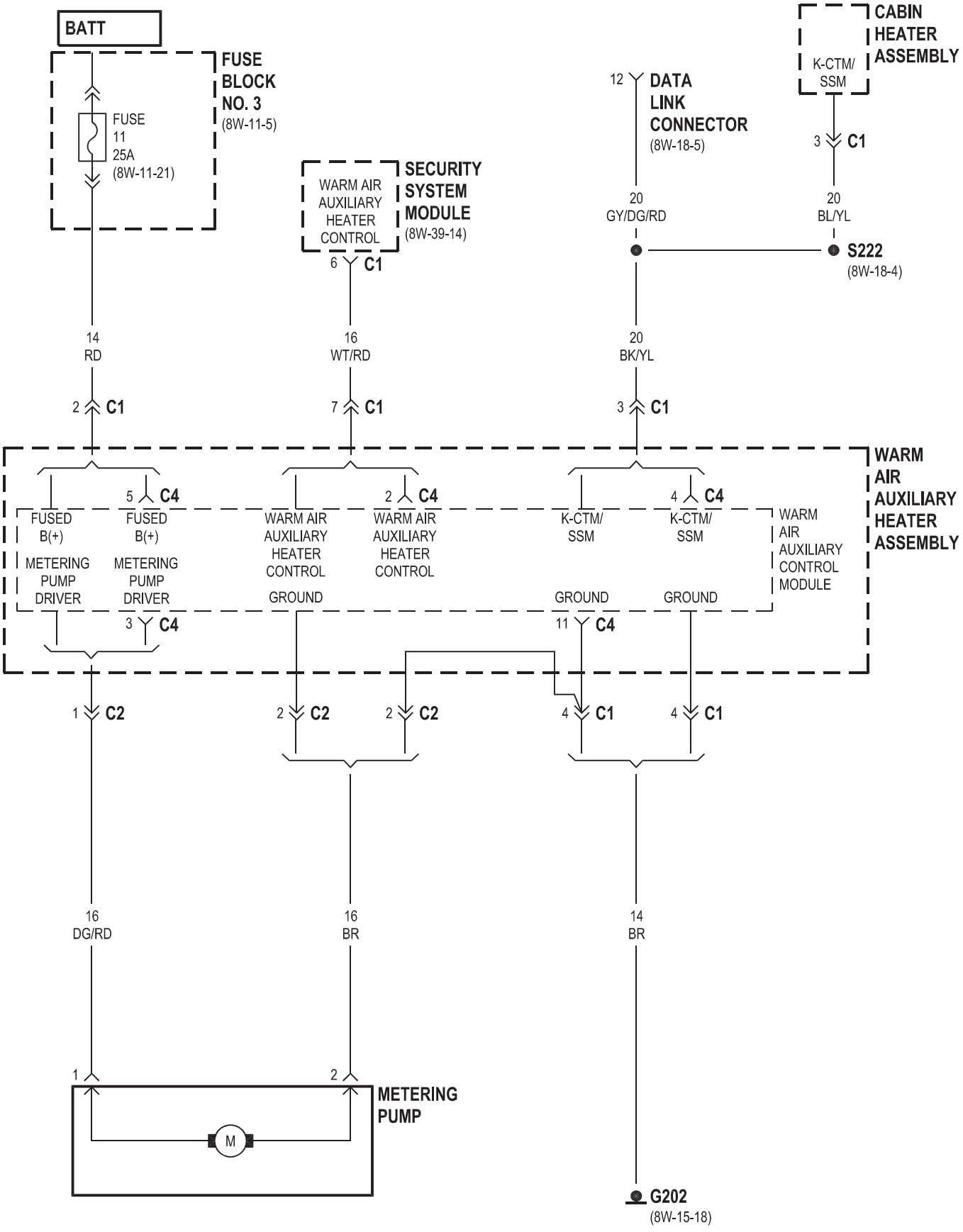


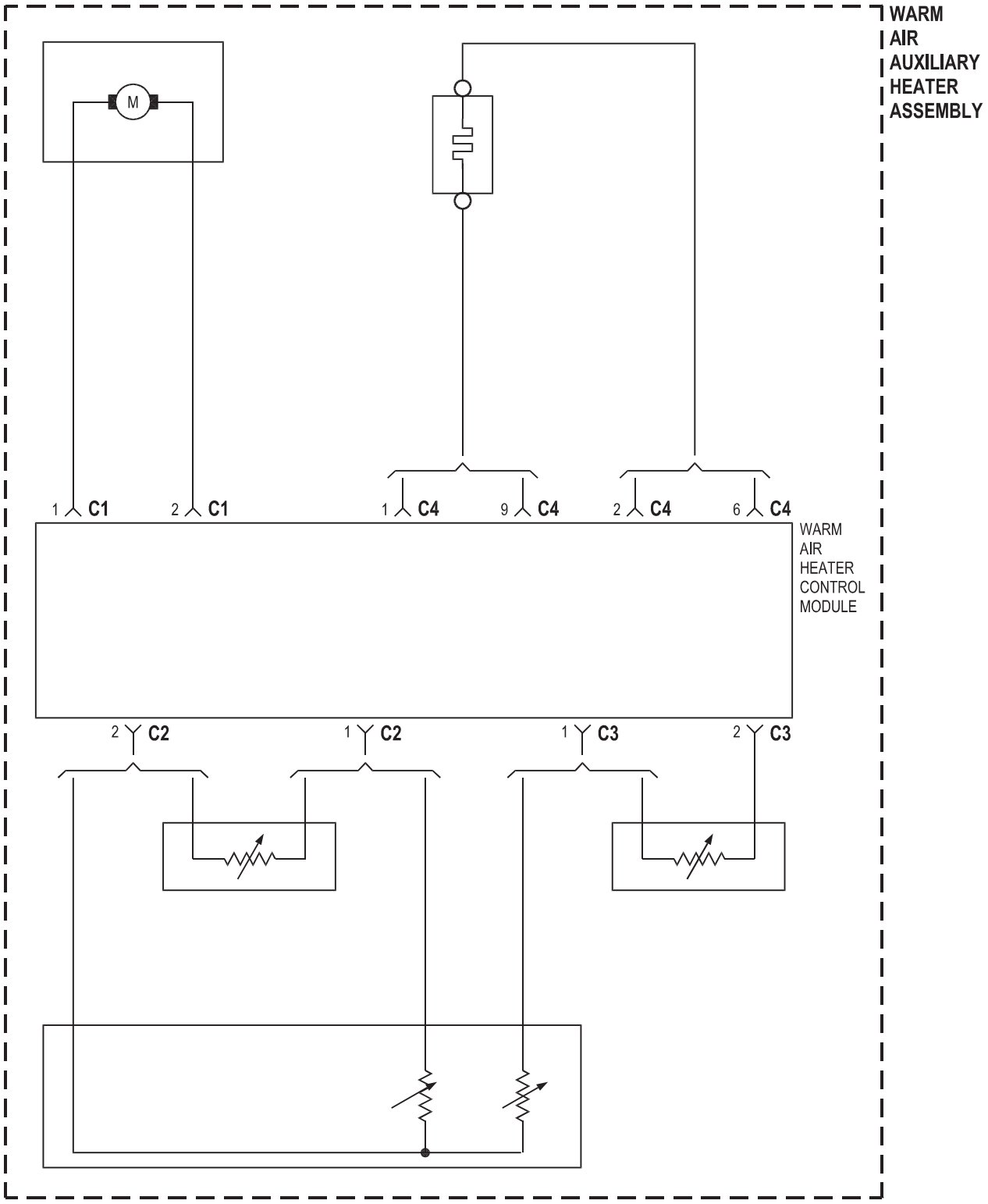
VA304219 J038W-24

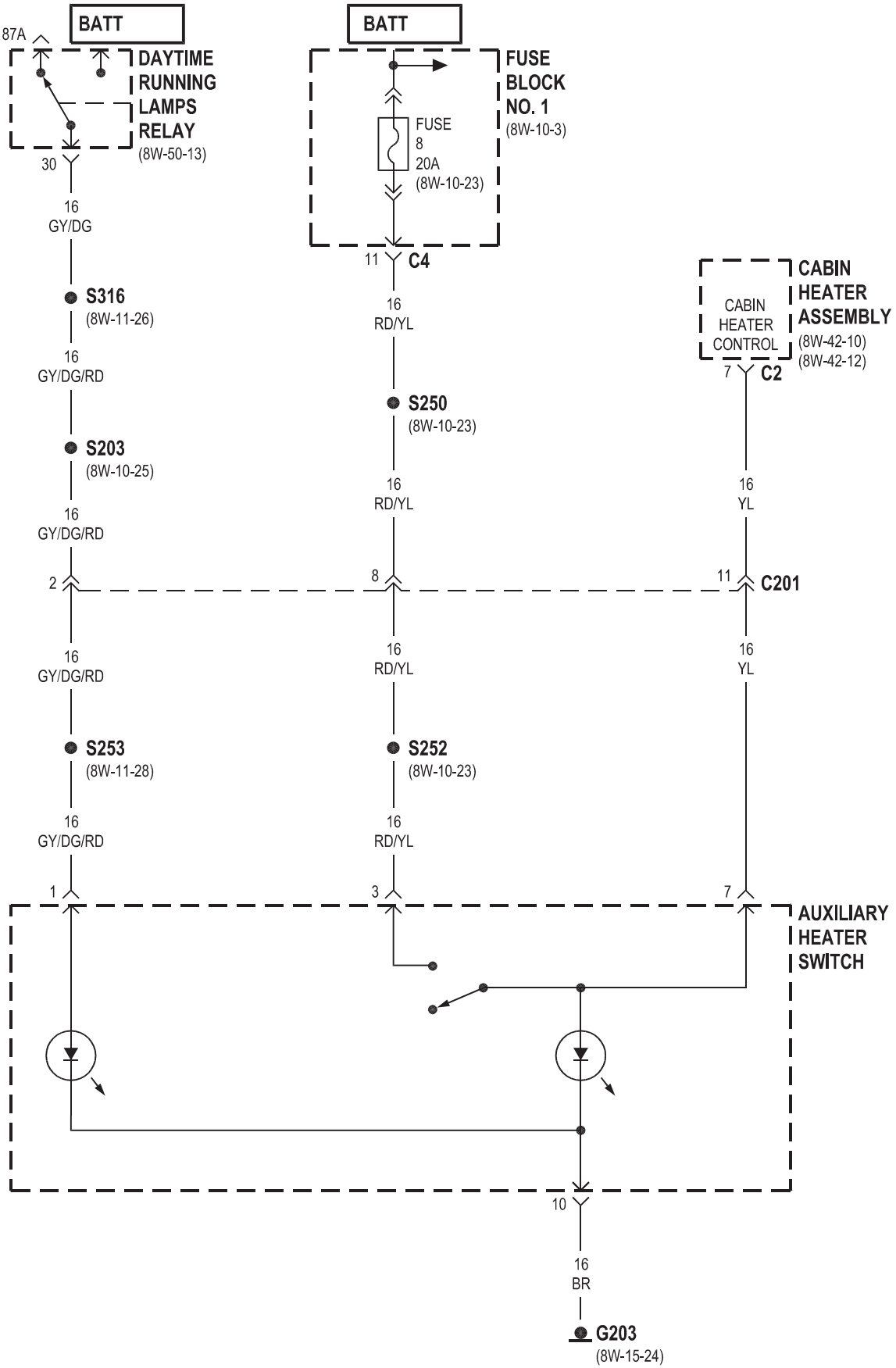

BATT
FUSE BLOCK NO. 3
(8W-11-5)
FUSE 1 7.5A
(8W-11-21)
WARM AIR AUXILIARY HEATER ASSEMBLY
WARM AIR AUXILIARY CONTROL MODULE
HEATER TIMER (CUT-IN SIGNAL)
HEATER TIMER (CUT-IN SIGNAL)
HEATER TIMER
HEATER TIMER
HEATER TIMER
HEATER TIMER
14 C4
13 C4
7 C4
CABIN HEATER ASSEMBLY
CABIN HEATER CONTROL
(8W-42-10)
(8W-42-12)
1 C1
5 C1
6 C1
7 C2
16 RD
16 YL
16 YL
16 BR/WT
16 GY/RD
15 C204
11 C201
15
16
17 C200
16 RD
16 YL
16 BR/WT
16 GY/RD
11
2
9
6
HEATER TIMER-AUXILIARY
HEATER TIMER CONTROL MODULE



VA304221 J038W-24

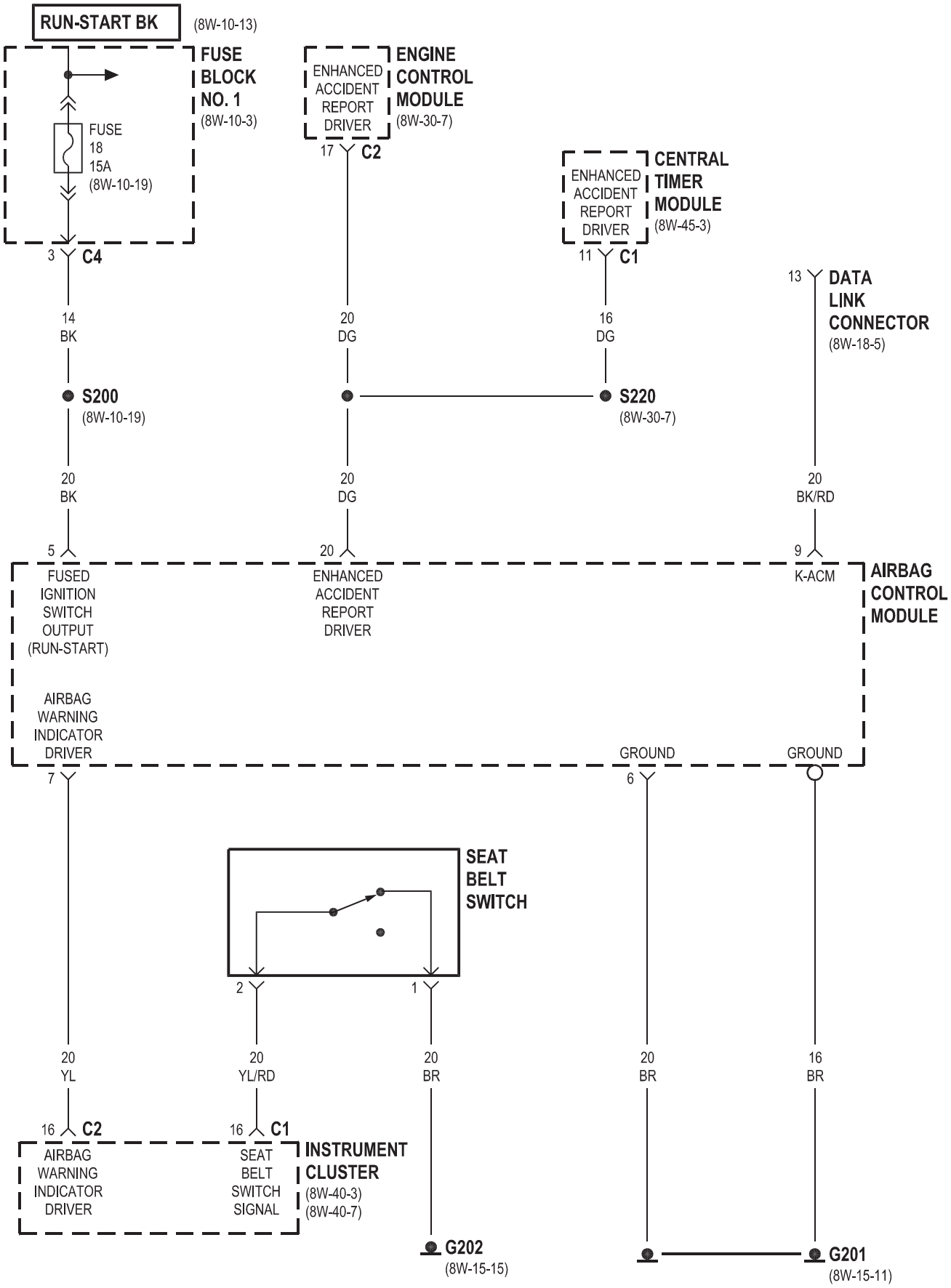

BATT
FUSE BLOCK NO. 3
(8W-11-5)
FUSE 11 25A
(8W-11-21)
SECURITY SYSTEM MODULE
(8W-39-14)
WARM AIR AUXILIARY HEATER CONTROL
6 C1
DATA LINK CONNECTOR
(8W-18-5)
12
CABIN HEATER ASSEMBLY
K-CTM/ SSM
3 C1
20 GY/DG/RD
20 BL/YL
S222
(8W-18-4)
14 RD
16 WT/RD
20 BK/YL
2 C1
7 C1
3 C1
WARM AIR AUXILIARY HEATER ASSEMBLY
5 C4
2 C4
4 C4
FUSED B(+)
FUSED B(+)
METERING PUMP DRIVER
METERING PUMP DRIVER
WARM AIR AUXILIARY HEATER CONTROL
WARM AIR AUXILIARY HEATER CONTROL
K-CTM/ SSM
K-CTM/ SSM
WARM AIR AUXILIARY CONTROL MODULE
GROUND
GROUND
GROUND
3 C4
11 C4
1 C2
2 C2
2 C2
4 C1
4 C1
16 DG/RD
16 BR
14 BR
1
2
METERING PUMP
M
G202
(8W-15-18)

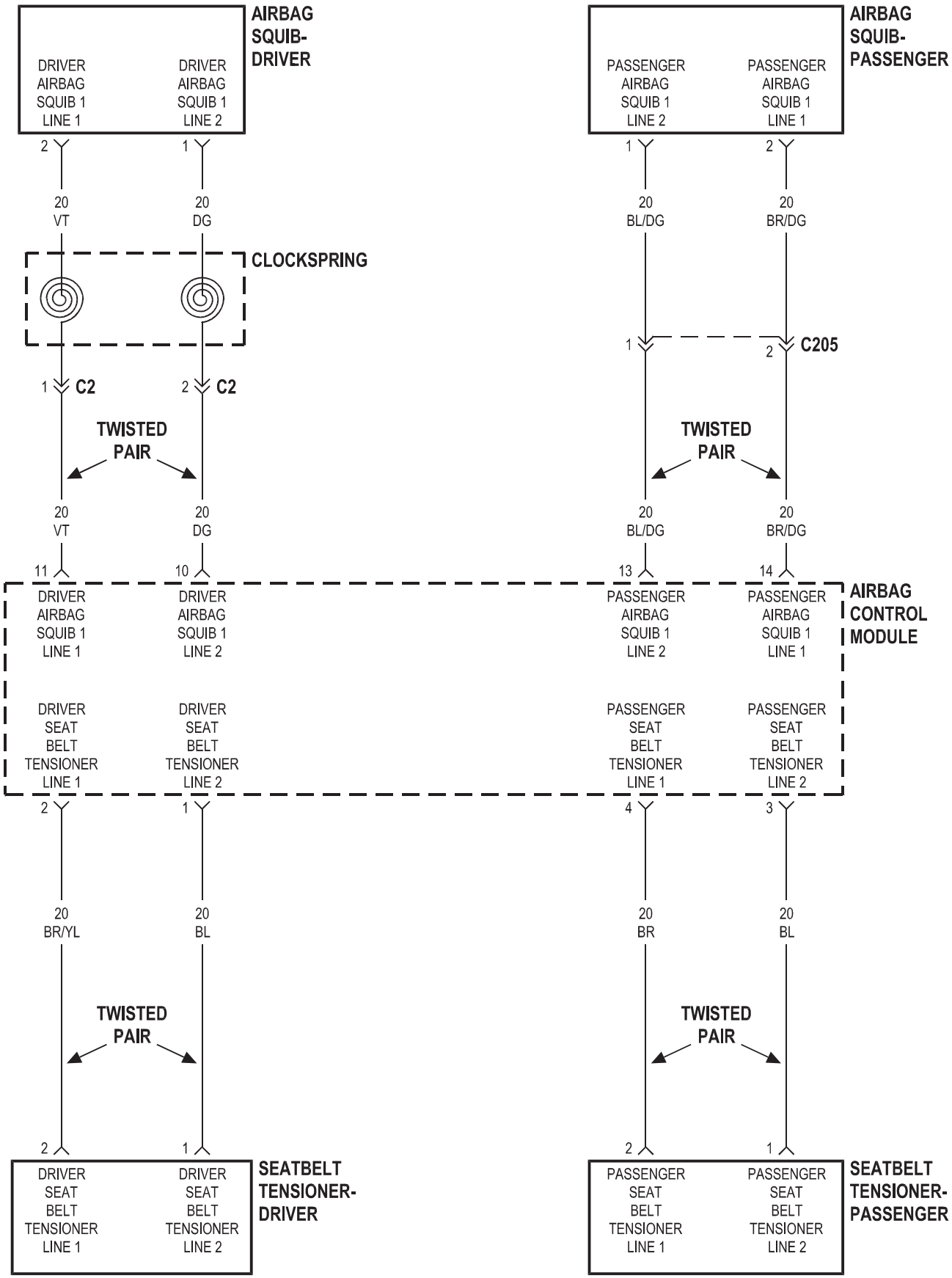

WARM
AIR
AUXILIARY
HEATER
ASSEMBLY
M
1 C1
2 C1
1 C4
9 C4
2 C4
6 C4
WARM
AIR
HEATER
CONTROL
MODULE
2 C2
1 C2
1 C3
2 C3


BATT
87A
DAYTIME RUNNING LAMPS RELAY
(8W-50-13)
30
16
GY/DG
S316
(8W-11-26)
16
GY/DG/RD
S203
(8W-10-25)
16
GY/DG/RD
2
16
GY/DG/RD
S253
(8W-11-28)
16
GY/DG/RD
1
BATT
FUSE BLOCK NO. 1
(8W-10-3)
FUSE
8
20A
(8W-10-23)
11
C4
16
RD/YL
S250
(8W-10-23)
16
RD/YL
8
16
RD/YL
S252
(8W-10-23)
16
RD/YL
3
CABIN HEATER CONTROL
7
C2
CABIN HEATER ASSEMBLY
(8W-42-10)
(8W-42-12)
16
YL
11
C201
16
YL
7
AUXILIARY HEATER SWITCH
10
16
BR
G203
(8W-15-24)

8W-43 AIRBAG SYSTEM

Component	Page
AIRBAG CONTROL MODULE	8W-43-2, 3
AIRBAG SQUIB- DRIVER	8W-43-3
AIRBAG SQUIB- PASSENGER	8W-43-3
CENTRAL TIMER MODULE	8W-43-2
CLOCKSPRING	8W-43-3
DATA LINK CONNECTOR	8W-43-2
ENGINE CONTROL MODULE	8W-43-2
FUSE 18	8W-43-2
FUSE BLOCK NO. 1	8W-43-2
G201	8W-43-2
G202	8W-43-2
INSTRUMENT CLUSTER	8W-43-2
SEAT BELT SWITCH	8W-43-2
SEAT BELT TENSIONER- DRIVER	8W-43-3
SEAT BELT TENSIONER- PASSENGER	8W-43-3

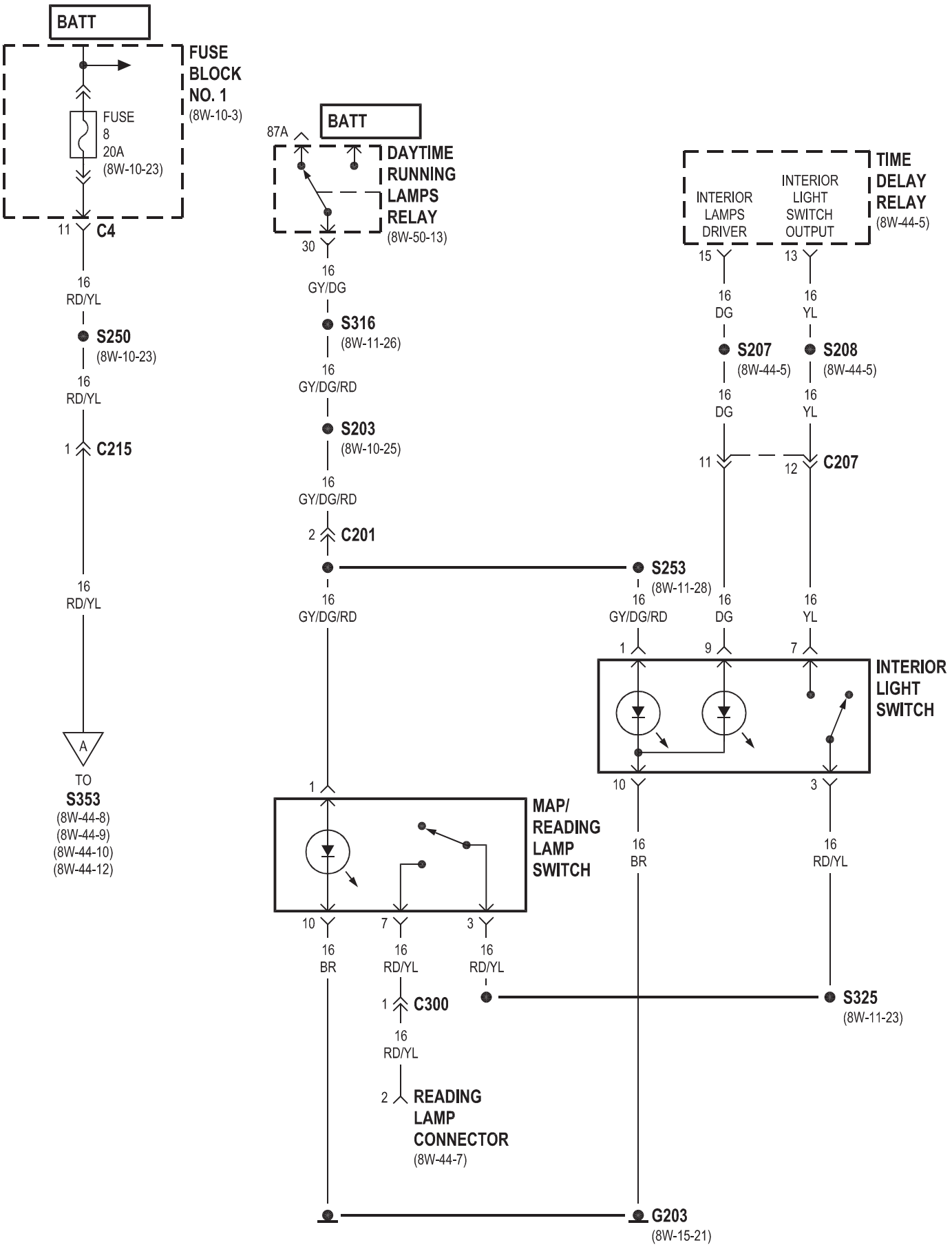

RUN-START BK
(8W-10-13)
FUSE BLOCK NO. 1
(8W-10-3)
FUSE 18 15A
(8W-10-19)
3 C4
ENHANCED ACCIDENT REPORT DRIVER
ENGINE CONTROL MODULE
(8W-30-7)
17 C2
ENHANCED ACCIDENT REPORT DRIVER
CENTRAL TIMER MODULE
(8W-45-3)
11 C1
13 DATA LINK CONNECTOR
(8W-18-5)
14 BK
20 DG
16 DG
S200
(8W-10-19)
S220
(8W-30-7)
20 BK
20 DG
20 BK/RD
5 FUSED IGNITION SWITCH OUTPUT (RUN-START)
20 ENHANCED ACCIDENT REPORT DRIVER
9 K-ACM
AIRBAG CONTROL MODULE
AIRBAG WARNING INDICATOR DRIVER
7
GROUND
6
GROUND
SEAT BELT SWITCH
2
1
20 YL
20 YL/RD
20 BR
20 BR
16 BR
16 C2
16 C1
AIRBAG WARNING INDICATOR DRIVER
SEAT BELT SWITCH SIGNAL
INSTRUMENT CLUSTER
(8W-40-3)
(8W-40-7)
G202
(8W-15-15)
G201
(8W-15-11)

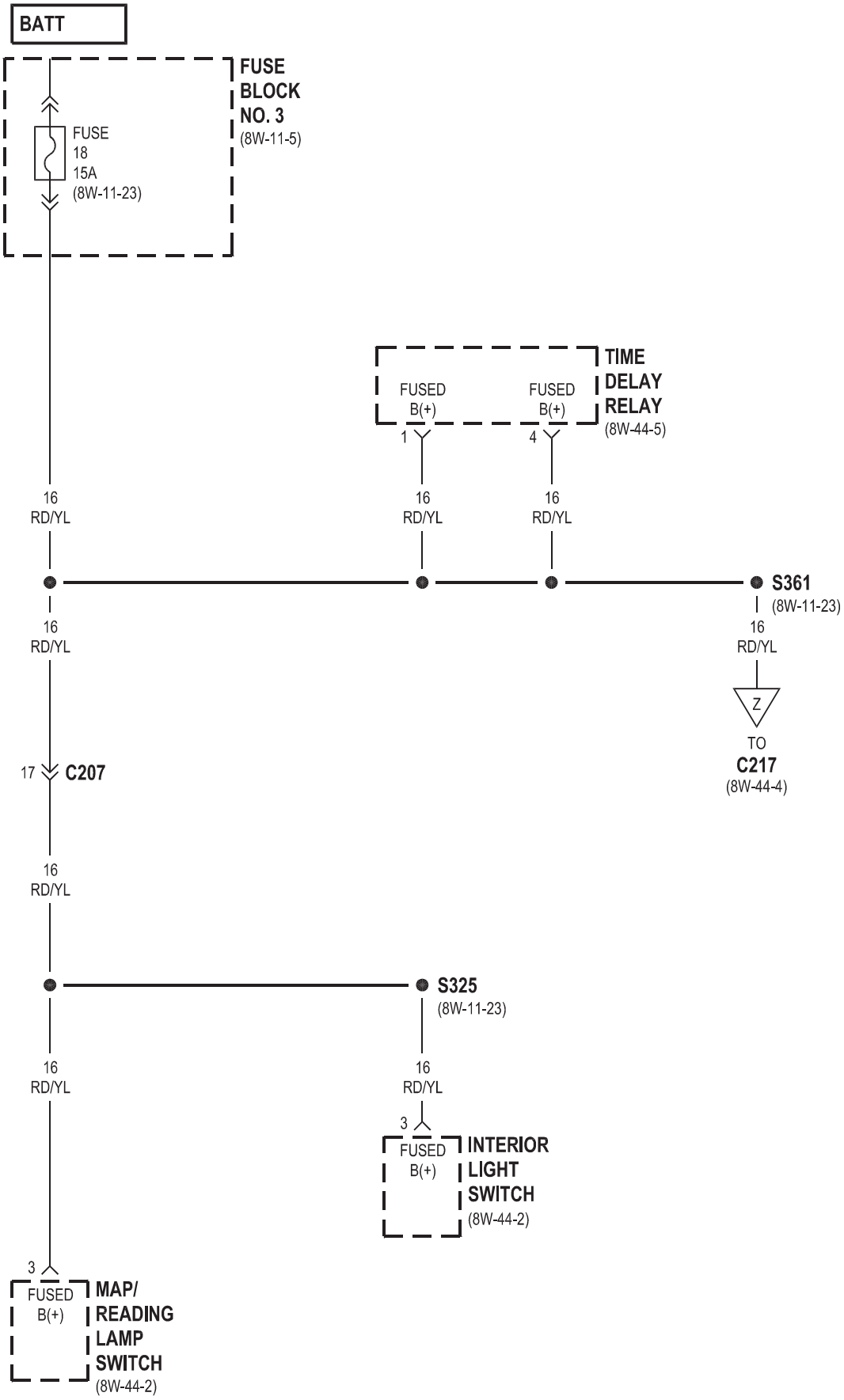


VA304303 J038W-24

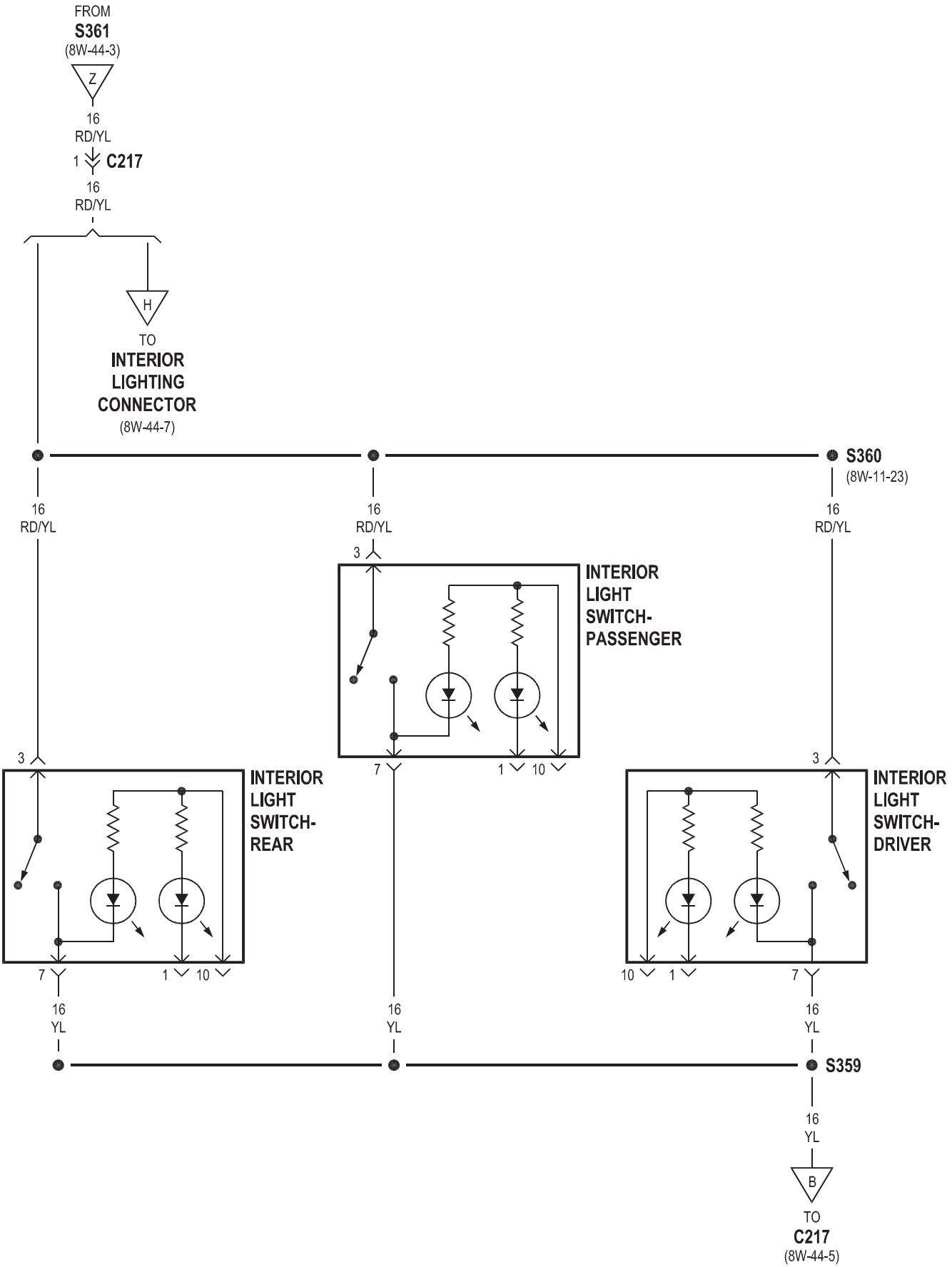
8W-44 INTERIOR LIGHTING

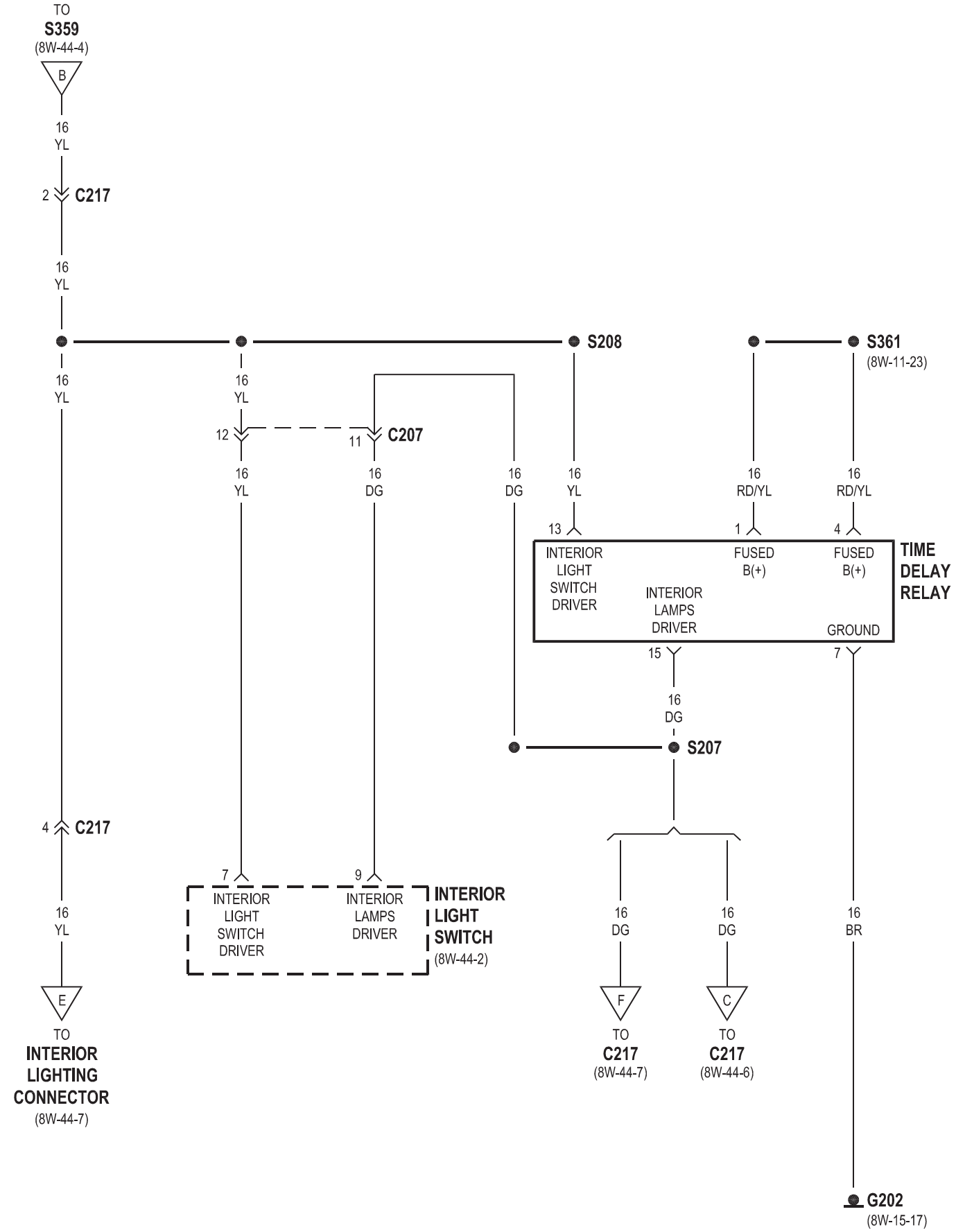
Component	Page
Ash Receiver Lamp	8W-44-11
Cigar Lighter	8W-44-11
Cigar Lighter Lamp	8W-44-11
Contact Switch Door- Tailgate	8W-44-8
Courtesy Lamp- Driver Door	8W-44-12
Courtesy Lamp- Left Sliding Door	8W-44-12
Courtesy Lamp- Passenger Door	8W-44-12
Courtesy Lamp- Right Sliding Door	8W-44-12
Daytime Running Lamps Relay	8W-44-2, 11
Dome Lamp	8W-44-9
Door Jamb Switch- Driver	8W-44-9
Door Jamb Switch- Passenger	8W-44-9
Fuse 8	8W-44-2
Fuse 18	8W-44-3
Fuse Block No. 1	8W-44-2
Fuse Block No. 3	8W-44-3
G200	8W-44-7, 8, 10
G202	8W-44-5
G203	8W-44-2, 11
Interior Lamp No. 1	8W-44-6
Interior Lamp No. 2	8W-44-6
Interior Lamp No. 3	8W-44-6
Interior Lamp No. 4	8W-44-6
Interior Lamp No. 5	8W-44-6
Interior Lamp- Left Side	8W-44-9
Interior Lamp- Middle Front	8W-44-10
Interior Lamp- Middle Rear	8W-44-10
Interior Lamp- Rear No. 1	8W-44-9
Interior Lamp- Rear No. 2	8W-44-8
Interior Lamp- Right Side	8W-44-8
Interior Light Switch	8W-44-2, 3, 5
Interior Light Switch- Driver	8W-44-4
Interior Light Switch- Passenger	8W-44-4
Interior Light Switch- Rear	8W-44-4
Interior Lighting Connector	8W-44-4, 5, 7
Map/Reading Lamp Switch	8W-44-2, 3, 7
Reading Lamp Connector	8W-44-2, 7
Time Delay Relay	8W-44-2, 3, 5


BATT
FUSE BLOCK NO. 1
(8W-10-3)
FUSE 8 20A
(8W-10-23)
11 C4
16 RD/YL
S250
(8W-10-23)
16 RD/YL
1 C215
16 RD/YL
A
TO S353
(8W-44-8)
(8W-44-9)
(8W-44-10)
(8W-44-12)
BATT
87A
DAYTIME RUNNING LAMPS RELAY
(8W-50-13)
30
16 GY/DG
S316
(8W-11-26)
16 GY/DG/RD
S203
(8W-10-25)
16 GY/DG/RD
2 C201
16 GY/DG/RD
TIME DELAY RELAY
(8W-44-5)
INTERIOR LAMPS DRIVER
INTERIOR LIGHT SWITCH OUTPUT
15
13
16 DG
16 YL
S207
(8W-44-5)
S208
(8W-44-5)
16 DG
16 YL
11
12 C207
S253
(8W-11-28)
16 GY/DG/RD
16 DG
16 YL
1
9
7
INTERIOR LIGHT SWITCH
10
3
16 BR
16 RD/YL
1
MAP/ READING LAMP SWITCH
10
7
3
16 BR
16 RD/YL
16 RD/YL
1 C300
16 RD/YL
2 READING LAMP CONNECTOR
(8W-44-7)
S325
(8W-11-23)
G203
(8W-15-21)

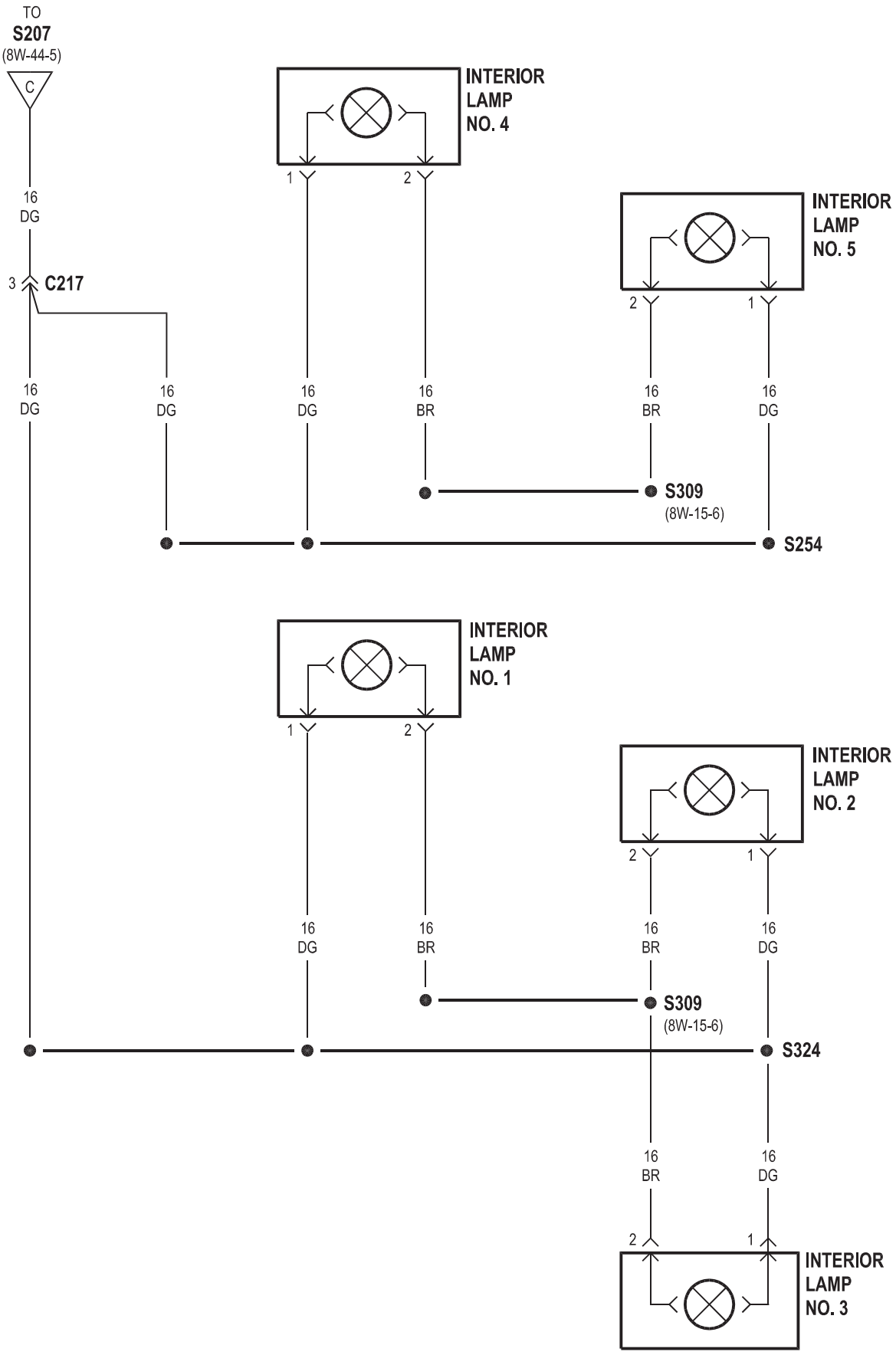


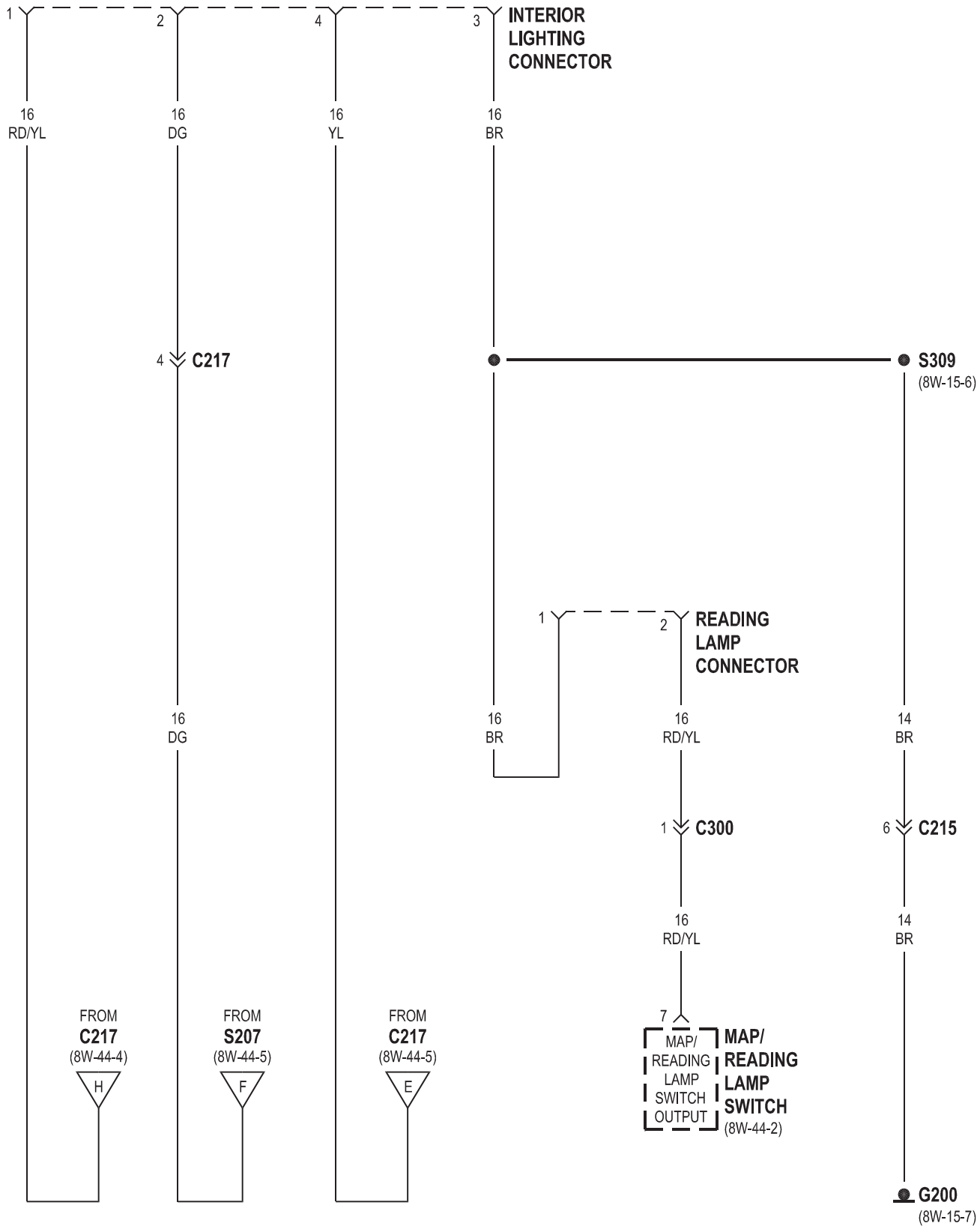
VA304403 J038W-24


FROM
S361
(8W-44-3)
Z
16
RD/YL
1
C217
16
RD/YL
H
TO
INTERIOR
LIGHTING
CONNECTOR
(8W-44-7)
S360
(8W-11-23)
16
RD/YL
16
RD/YL
16
RD/YL
3
INTERIOR
LIGHT
SWITCH-
PASSENGER
7
1
10
3
INTERIOR
LIGHT
SWITCH-
REAR
7
1
10
3
INTERIOR
LIGHT
SWITCH-
DRIVER
10
1
7
16
YL
16
YL
16
YL
S359
16
YL
B
TO
C217
(8W-44-5)

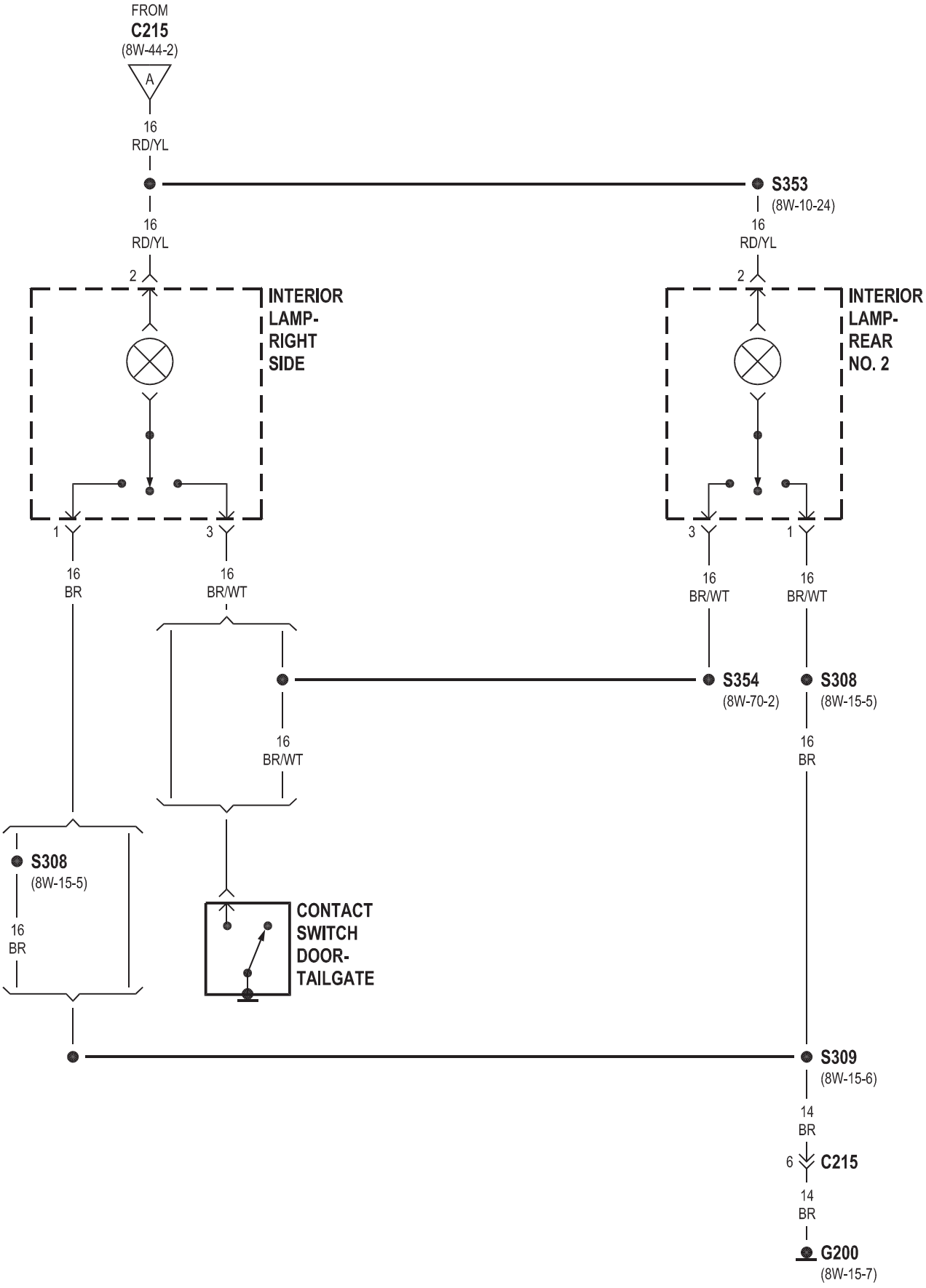


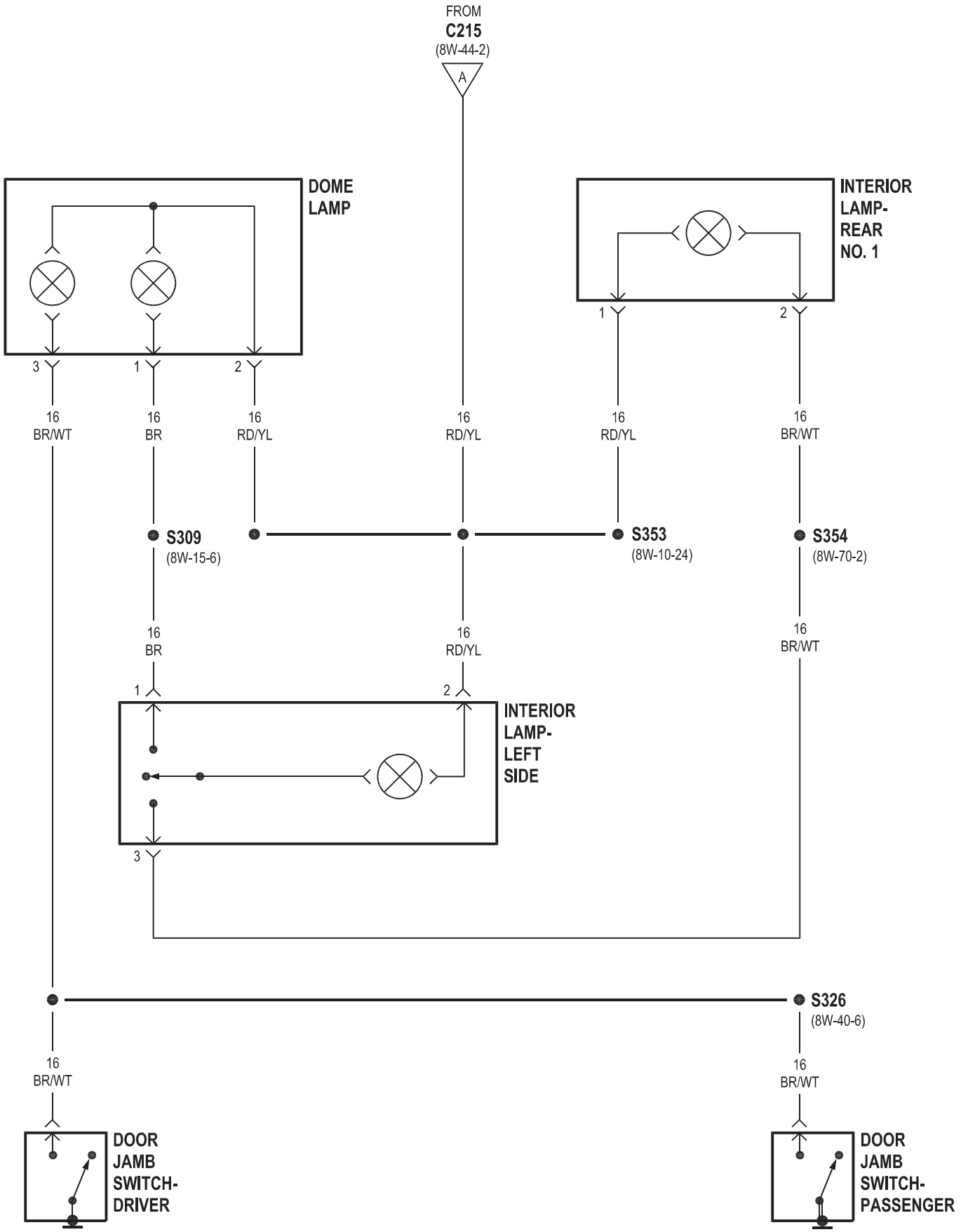
VA304405 J038W-24


TO
S207
(8W-44-5)
C
16
DG
3
C217
16
DG
16
DG
16
DG
16
BR
16
BR
16
DG
INTERIOR
LAMP
NO. 4
1
2
INTERIOR
LAMP
NO. 5
2
1
S309
(8W-15-6)
S254
INTERIOR
LAMP
NO. 1
1
2
INTERIOR
LAMP
NO. 2
2
1
16
DG
16
BR
16
BR
16
DG
S309
(8W-15-6)
S324
16
BR
16
DG
2
1
INTERIOR
LAMP
NO. 3

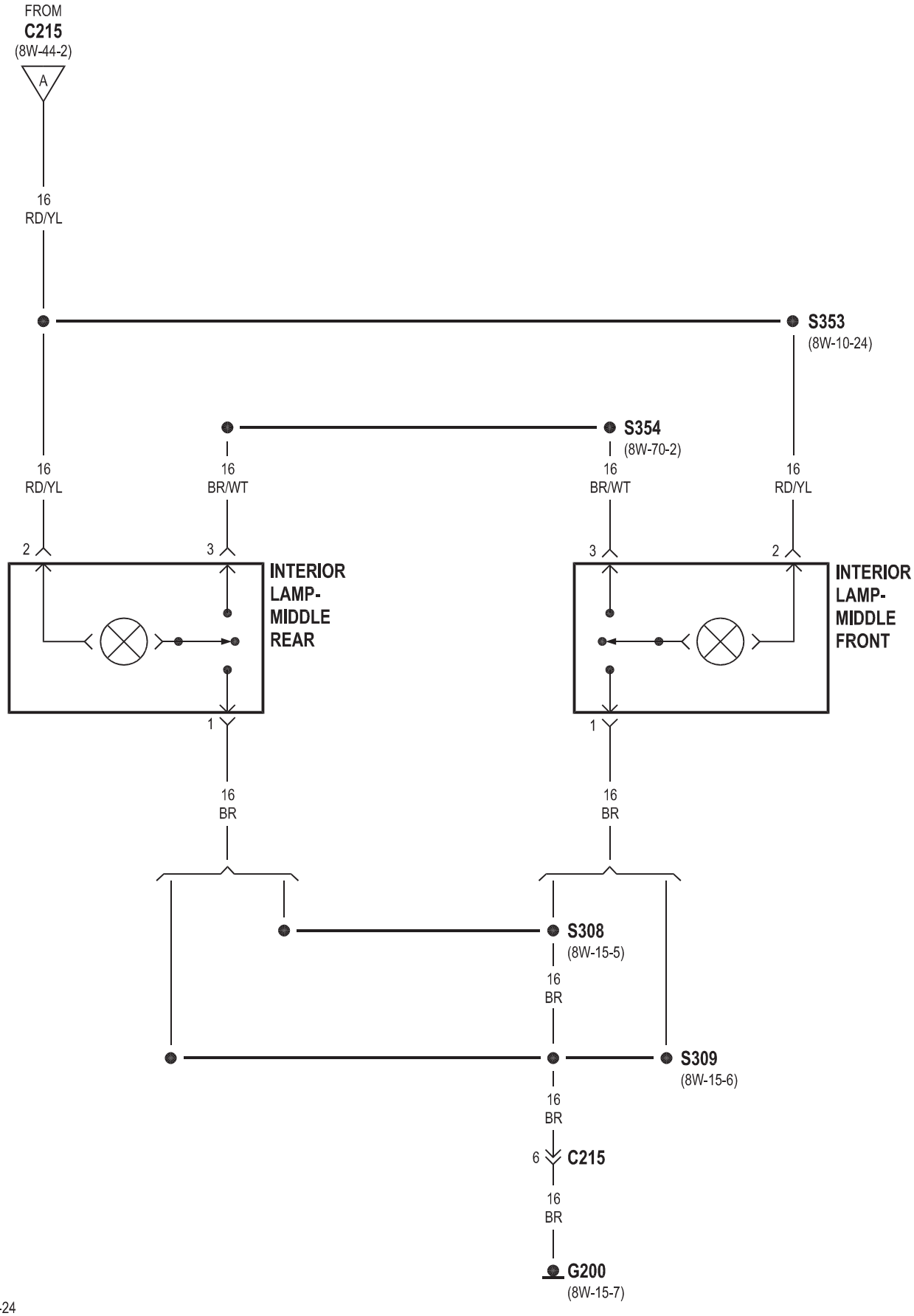


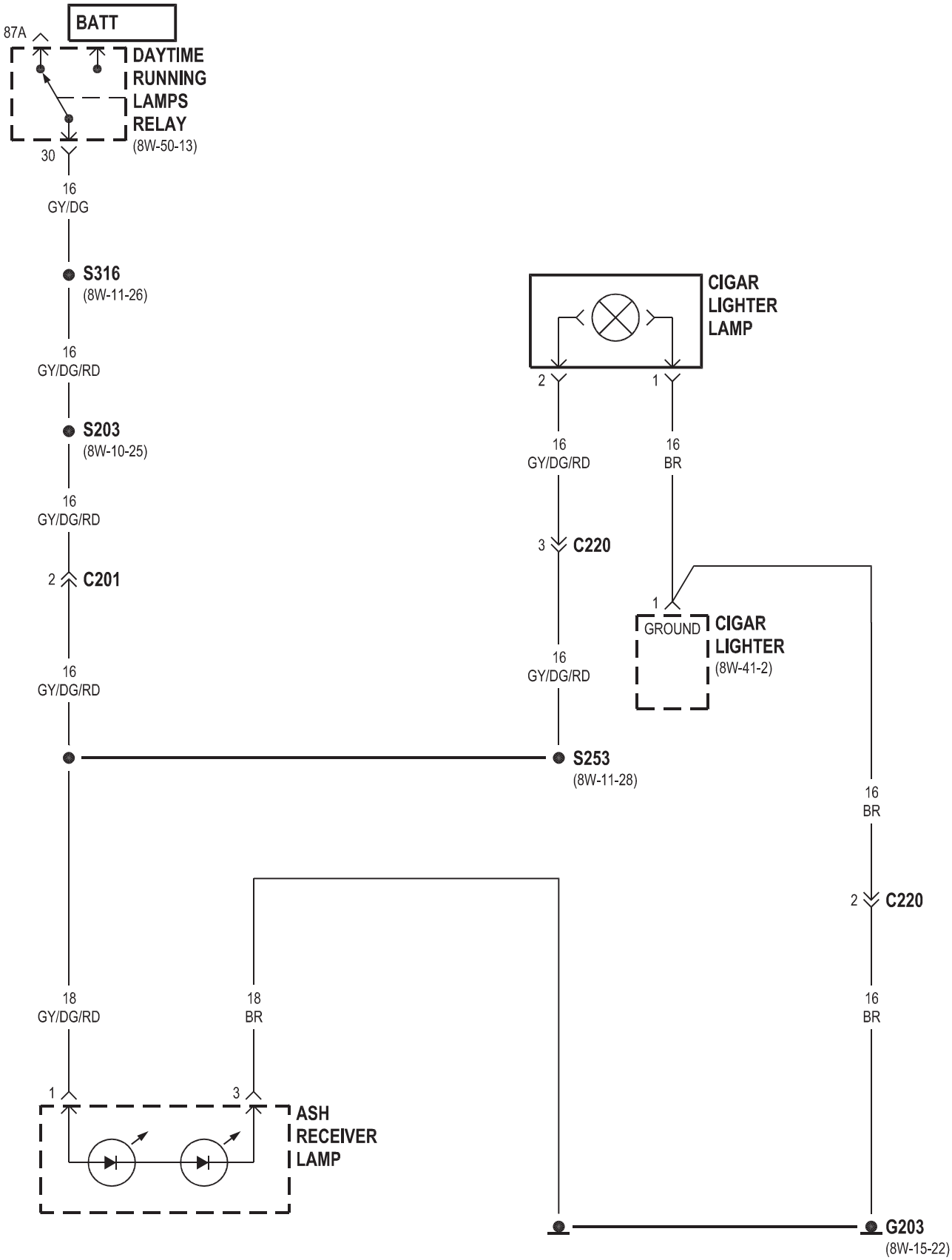
VA304407 J038W-24


FROM
C215
(8W-44-2)
A
16
RD/YL
S353
(8W-10-24)
16
RD/YL
2
INTERIOR
LAMP-
RIGHT
SIDE
INTERIOR
LAMP-
REAR
NO. 2
1
3
16
BR
16
BR/WT
S354
(8W-70-2)
S308
(8W-15-5)
S308
(8W-15-5)
CONTACT
SWITCH
DOOR-
TAILGATE
S309
(8W-15-6)
14
BR
6
C215
G200
(8W-15-7)

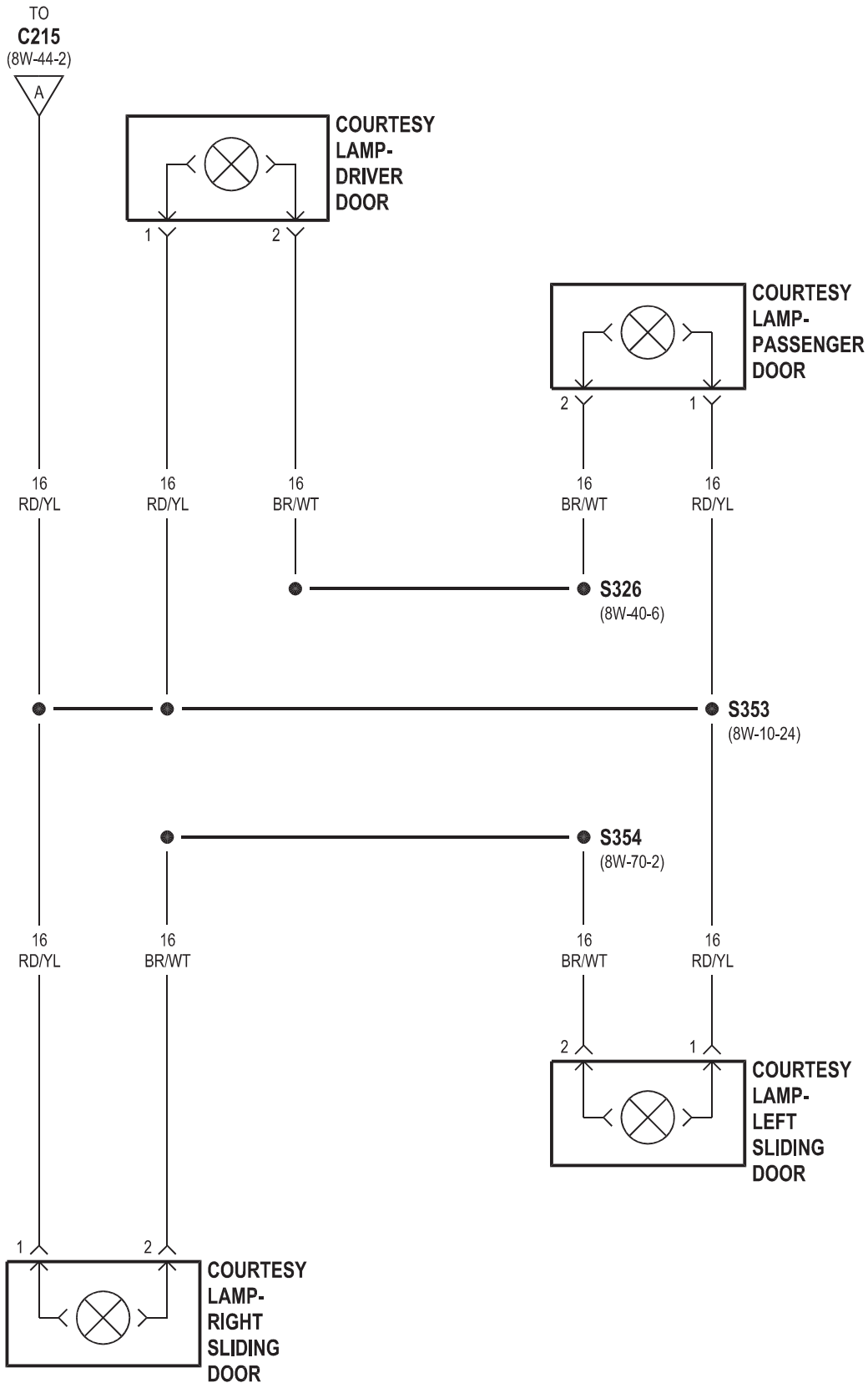


VA304409 J038W-24


FROM
C215
(8W-44-2)
A
16
RD/YL
S353
(8W-10-24)
S354
(8W-70-2)
16
RD/YL
16
BR/WT
16
BR/WT
16
RD/YL
2
3
3
2
INTERIOR
LAMP-
MIDDLE
REAR
INTERIOR
LAMP-
MIDDLE
FRONT
1
1
16
BR
16
BR
S308
(8W-15-5)
16
BR
S309
(8W-15-6)
16
BR
6
C215
16
BR
G200
(8W-15-7)

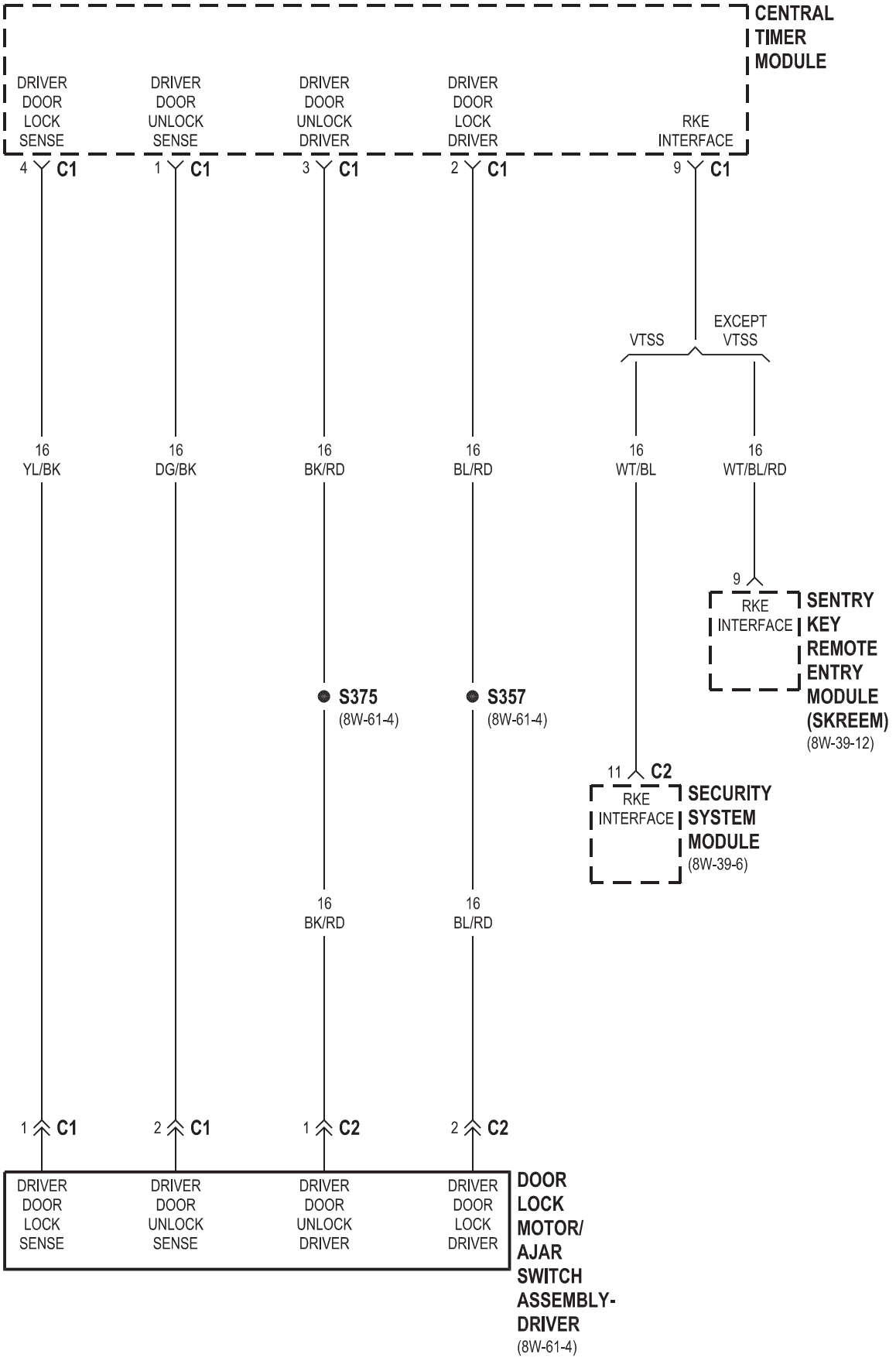


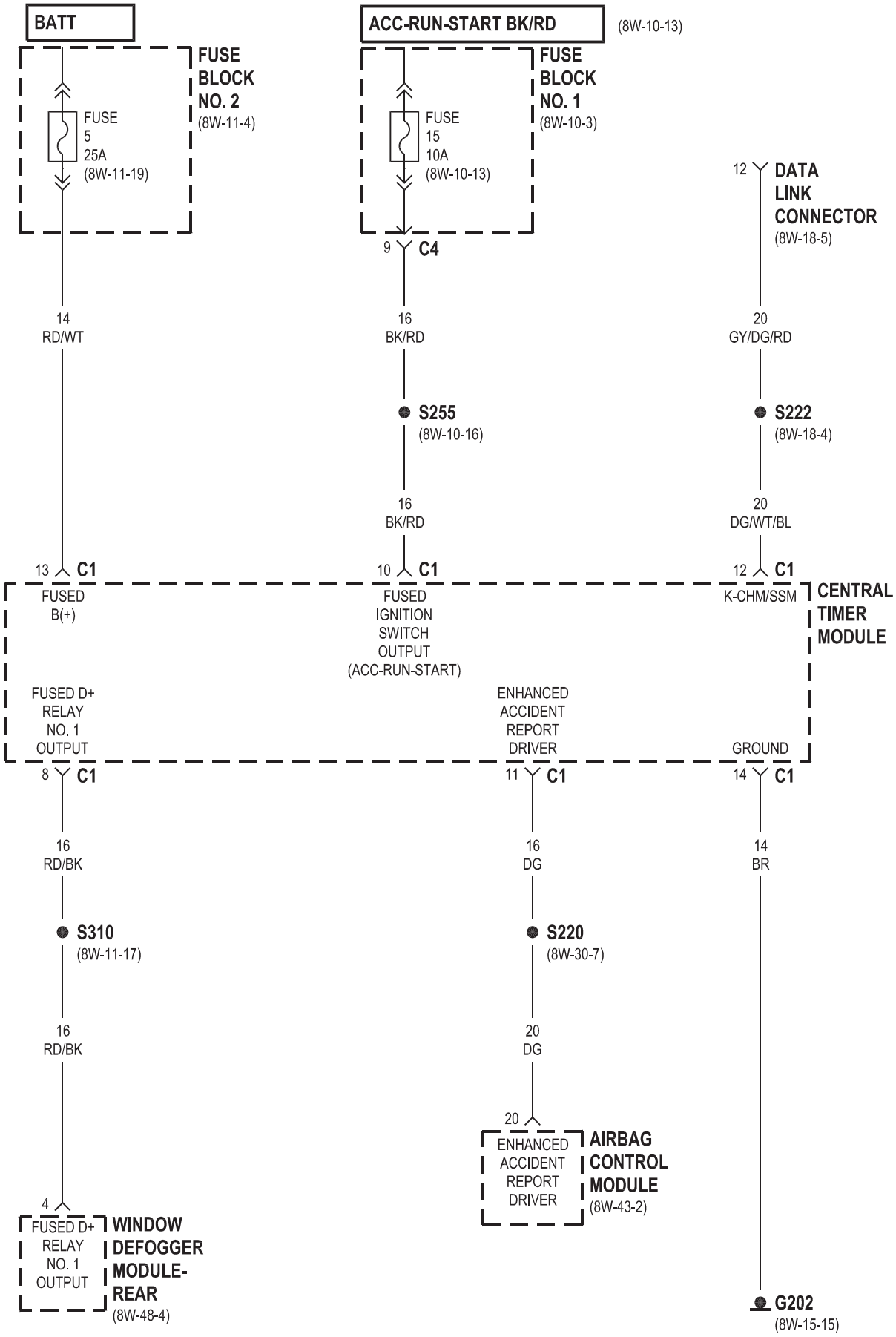
VA304411 J038W-24


TO
C215
(8W-44-2)
A
COURTESY LAMP- DRIVER DOOR
1
2
COURTESY LAMP- PASSENGER DOOR
2
1
16 RD/YL
16 RD/YL
16 BR/WT
16 BR/WT
16 RD/YL
S326
(8W-40-6)
S353
(8W-10-24)
S354
(8W-70-2)
16 RD/YL
16 BR/WT
16 BR/WT
16 RD/YL
2
1
COURTESY LAMP- LEFT SLIDING DOOR
1
2
COURTESY LAMP- RIGHT SLIDING DOOR

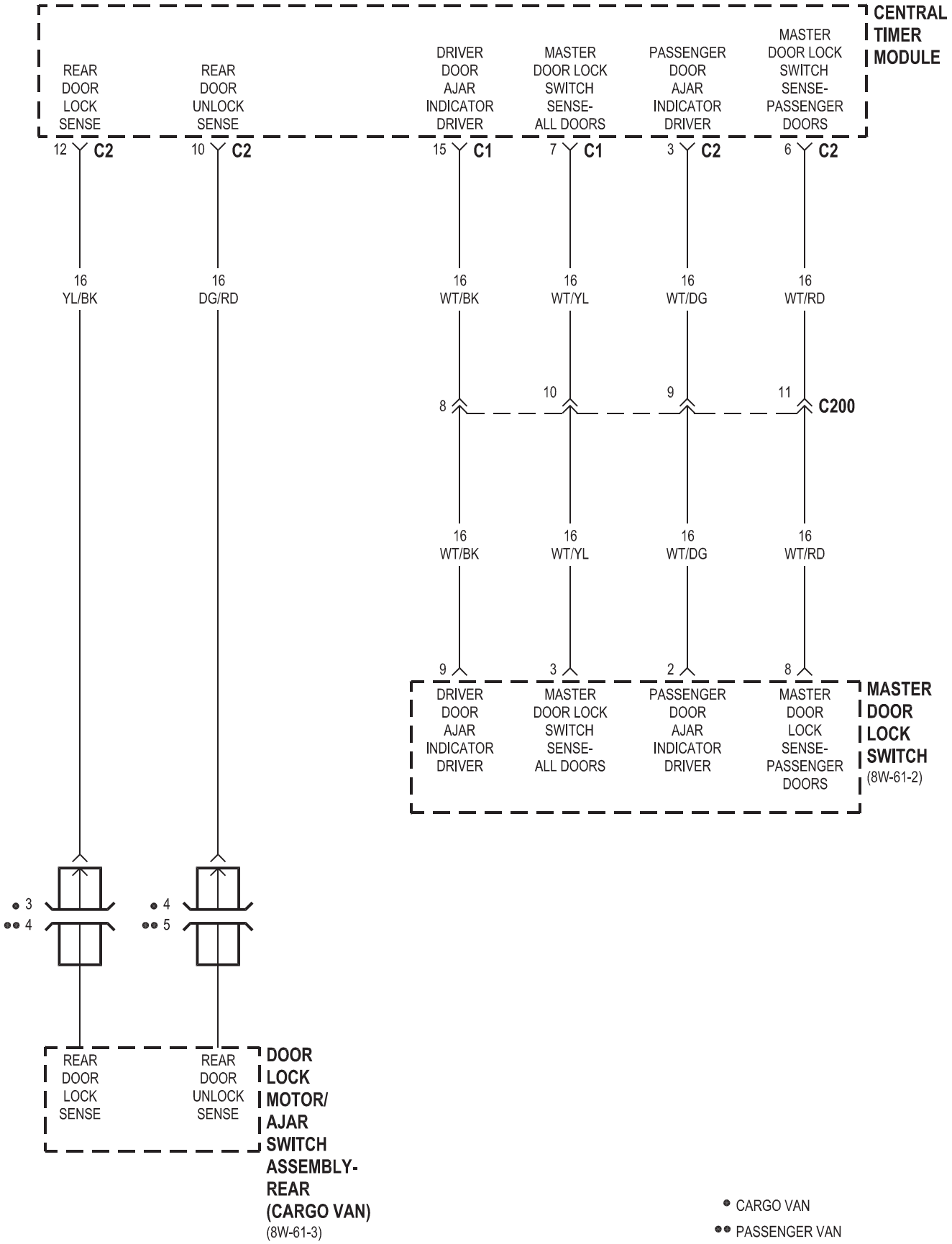
8W-45 CENTRAL TIMER MODULE

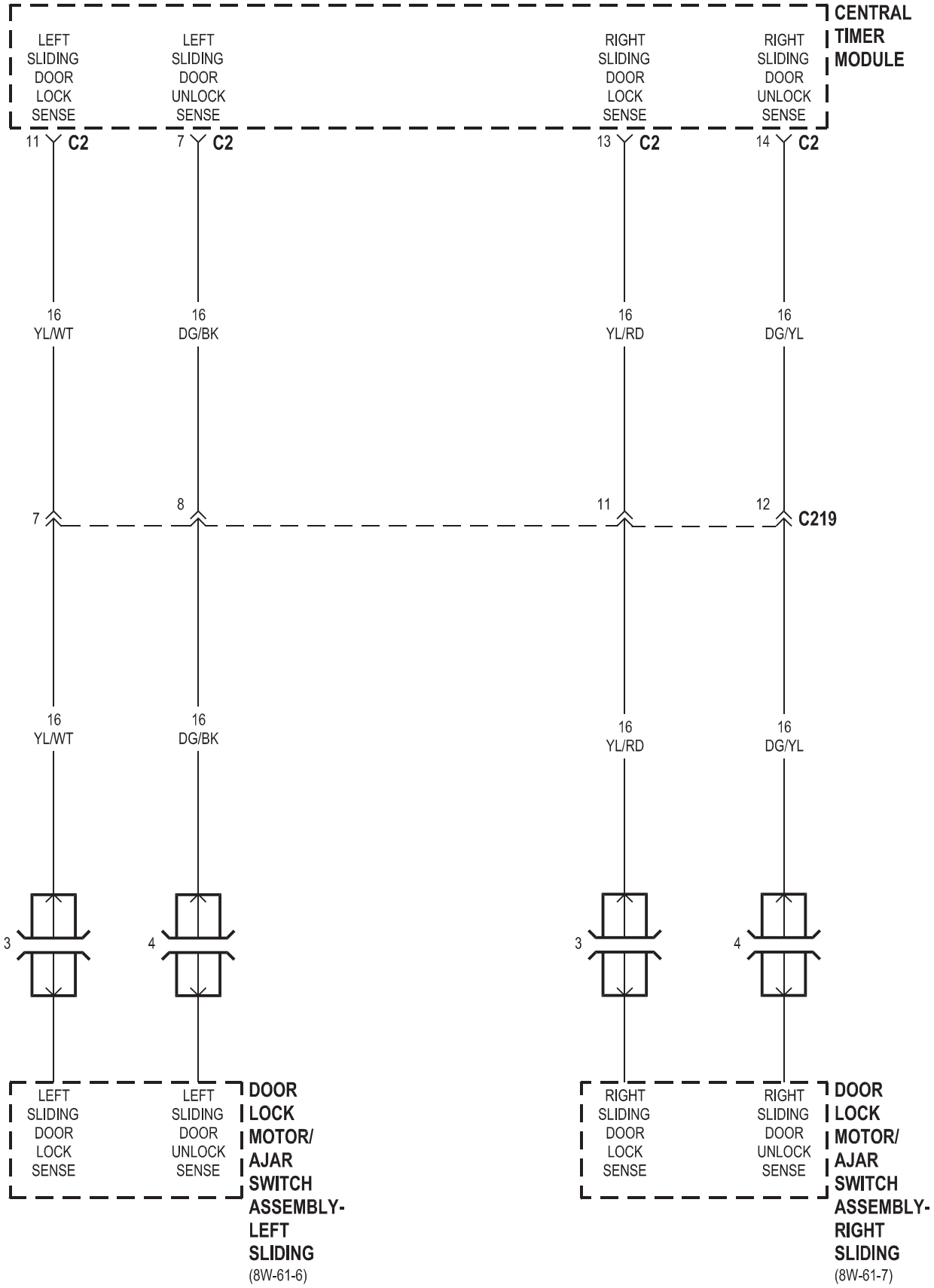
Component	Page
Airbag Control Module	8W-45-3
Central Timer Module	8W-45-2, 3, 4, 5, 6, 7
Data Link Connector	8W-45-3
Door Lock Motor/Ajar Switch Assembly- Driver	8W-45-2
Door Lock Motor/Ajar Switch Assembly- Left Sliding	8W-45-5, 6
Door Lock Motor/Ajar Switch Assembly- Passenger	8W-45-7
Door Lock Motor/Ajar Switch Assembly- Rear	8W-45-4, 6
Door Lock Motor/Ajar Switch Assembly- Right Sliding	8W-45-5, 6
Fuse 5	8W-45-3
Fuse 15	8W-45-3
Fuse Block No. 1	8W-45-3
Fuse Block No. 2	8W-45-3
G202	8W-45-3
Master Door Lock Switch	8W-45-4
Security System Module	8W-45-2
Sentry Key Remote Entry Module	8W-45-2
Window Defogger Module- Rear	8W-45-3


CENTRAL TIMER MODULE
DRIVER DOOR LOCK SENSE
DRIVER DOOR UNLOCK SENSE
DRIVER DOOR UNLOCK DRIVER
DRIVER DOOR LOCK DRIVER
RKE INTERFACE
4 C1
1 C1
3 C1
2 C1
9 C1
VTSS
EXCEPT VTSS
16 YL/BK
16 DG/BK
16 BK/RD
16 BL/RD
16 WT/BL
16 WT/BL/RD
9
RKE INTERFACE
SENTRY KEY REMOTE ENTRY MODULE (SKREEM)
(8W-39-12)
S375
(8W-61-4)
S357
(8W-61-4)
11 C2
RKE INTERFACE
SECURITY SYSTEM MODULE
(8W-39-6)
16 BK/RD
16 BL/RD
1 C1
2 C1
1 C2
2 C2
DRIVER DOOR LOCK SENSE
DRIVER DOOR UNLOCK SENSE
DRIVER DOOR UNLOCK DRIVER
DRIVER DOOR LOCK DRIVER
DOOR LOCK MOTOR/ AJAR SWITCH ASSEMBLY- DRIVER
(8W-61-4)

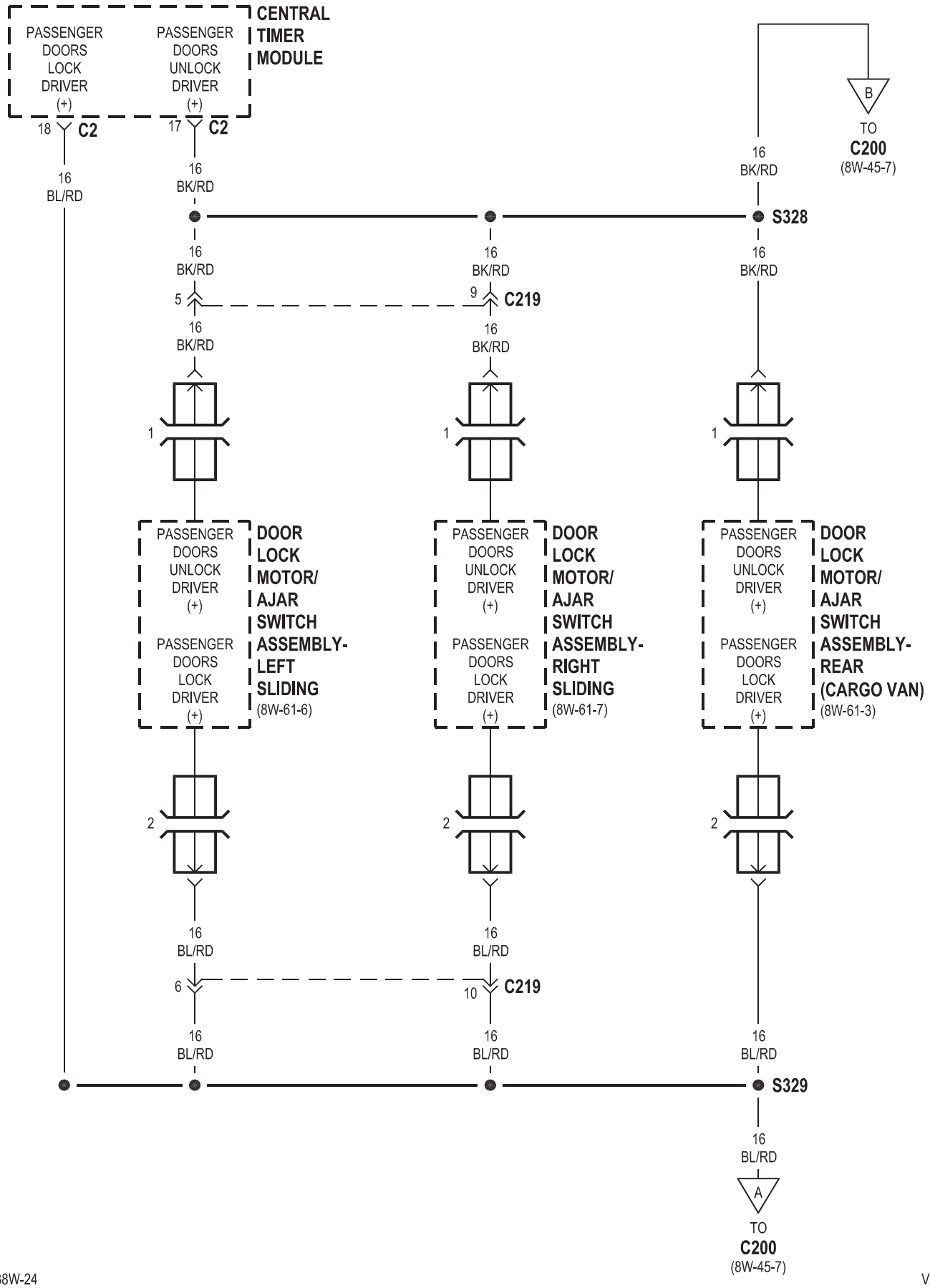


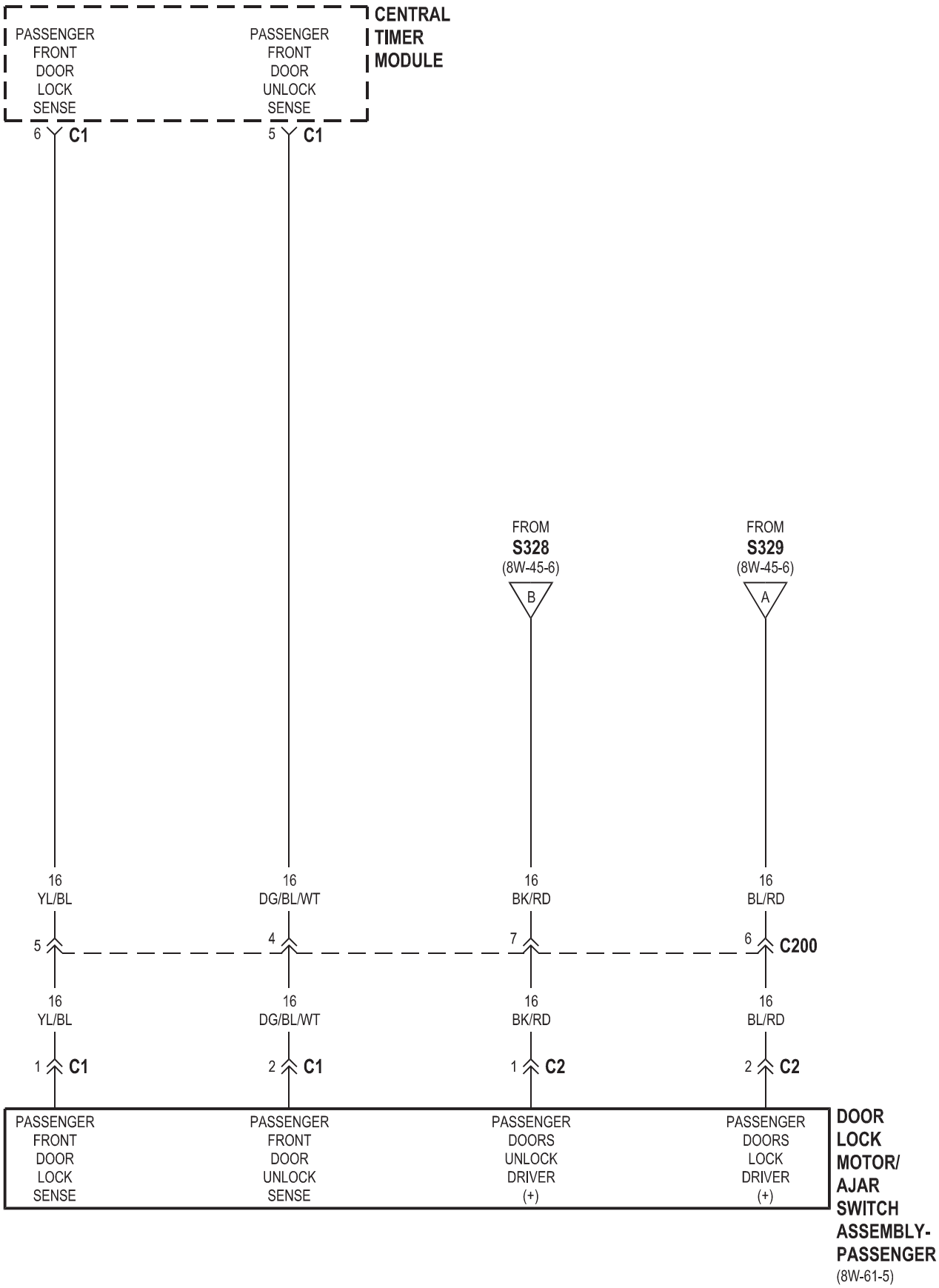
VA304503 J038W-24


CENTRAL TIMER MODULE
REAR DOOR LOCK SENSE
REAR DOOR UNLOCK SENSE
DRIVER DOOR AJAR INDICATOR DRIVER
MASTER DOOR LOCK SWITCH SENSE- ALL DOORS
PASSENGER DOOR AJAR INDICATOR DRIVER
MASTER DOOR LOCK SWITCH SENSE- PASSENGER DOORS
12 C2
10 C2
15 C1
7 C1
3 C2
6 C2
16 YL/BK
16 DG/RD
16 WT/BK
16 WT/YL
16 WT/DG
16 WT/RD
8
10
9
11
C200
16 WT/BK
16 WT/YL
16 WT/DG
16 WT/RD
9
3
2
8
DRIVER DOOR AJAR INDICATOR DRIVER
MASTER DOOR LOCK SWITCH SENSE- ALL DOORS
PASSENGER DOOR AJAR INDICATOR DRIVER
MASTER DOOR LOCK SENSE- PASSENGER DOORS
MASTER DOOR LOCK SWITCH
(8W-61-2)
• 3
•• 4
• 4
•• 5
REAR DOOR LOCK SENSE
REAR DOOR UNLOCK SENSE
DOOR LOCK MOTOR/ AJAR SWITCH ASSEMBLY- REAR (CARGO VAN)
(8W-61-3)
• CARGO VAN
•• PASSENGER VAN



VA304505 J038W-24

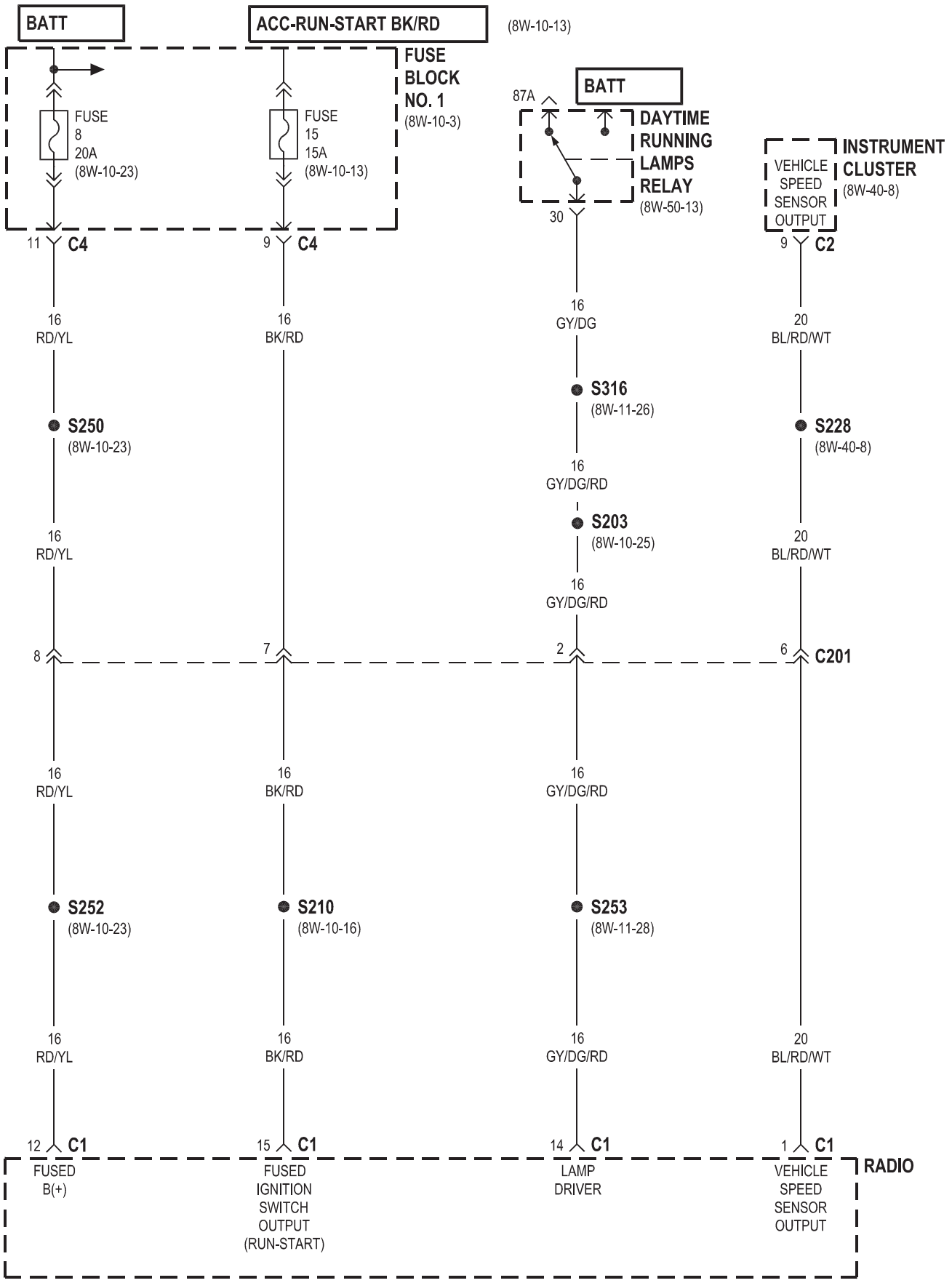

CENTRAL TIMER MODULE
PASSENGER DOORS LOCK DRIVER (+)
PASSENGER DOORS UNLOCK DRIVER (+)
18 C2
17 C2
16 BL/RD
16 BK/RD
B
TO C200 (8W-45-7)
16 BK/RD
S328
16 BK/RD
5 C219
9 C219
1
DOOR LOCK MOTOR/ AJAR SWITCH ASSEMBLY-LEFT SLIDING (8W-61-6)
DOOR LOCK MOTOR/ AJAR SWITCH ASSEMBLY-RIGHT SLIDING (8W-61-7)
DOOR LOCK MOTOR/ AJAR SWITCH ASSEMBLY-REAR (CARGO VAN) (8W-61-3)
PASSENGER DOORS UNLOCK DRIVER (+)
PASSENGER DOORS LOCK DRIVER (+)
2
16 BL/RD
6 C219
10 C219
S329
A
TO C200 (8W-45-7)

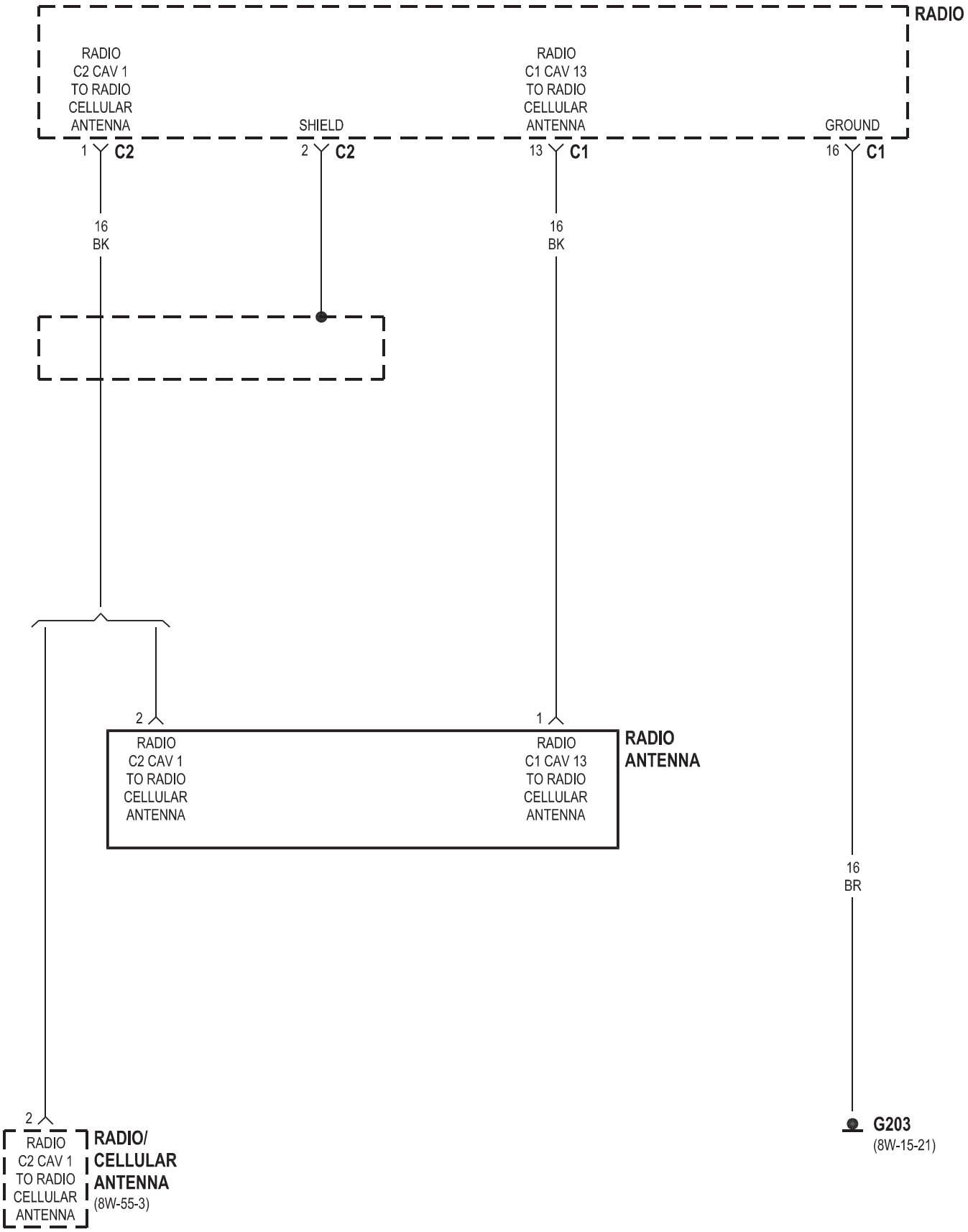


VA304507 J038W-24

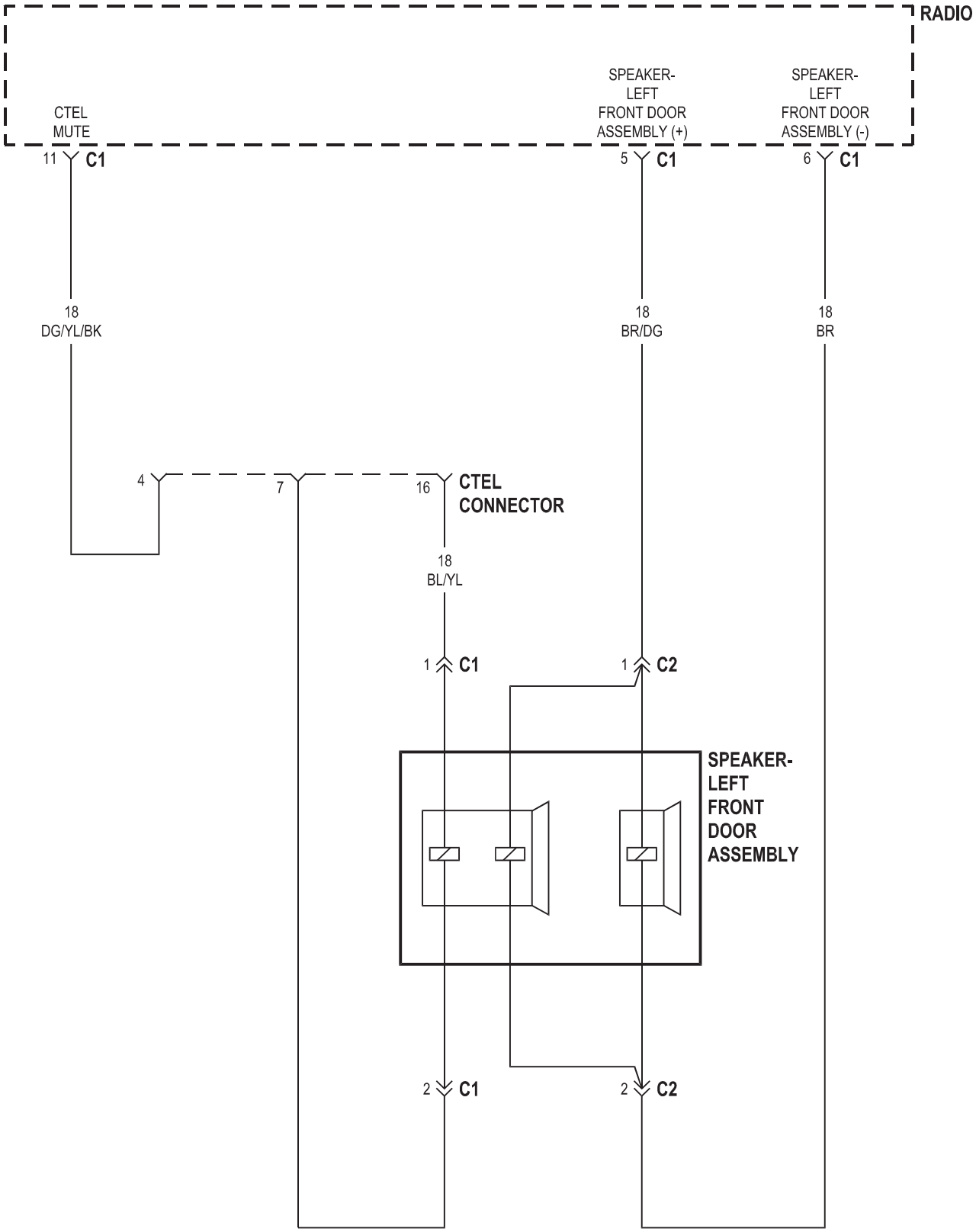
8W-47 AUDIO SYSTEM

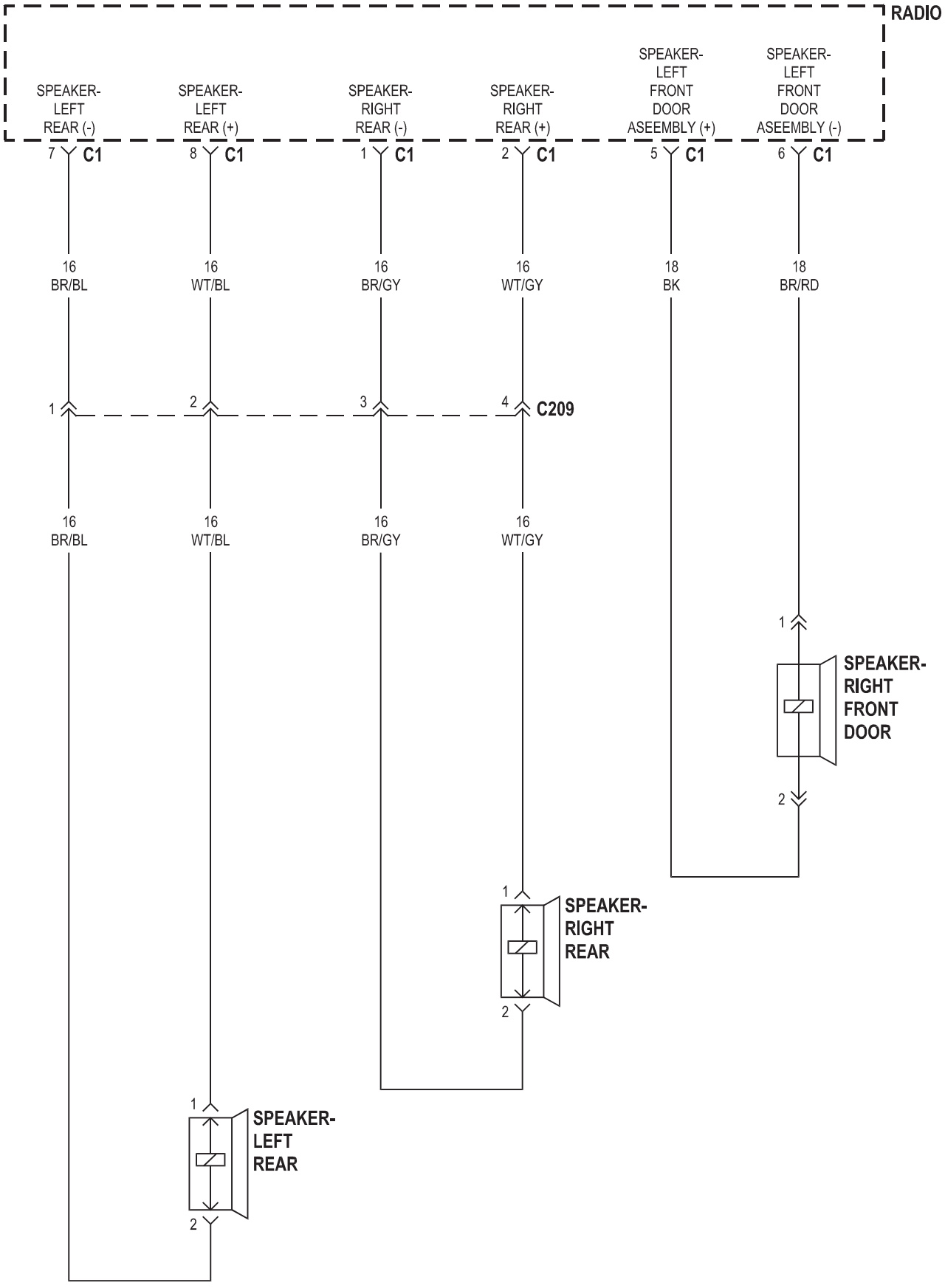
Component	Page
CTEL Connector	8W-47-4
Daytime Running Lamps Relay	8W-47-2
Fuse 8	8W-47-2
Fuse 15	8W-47-2
Fuse Block No. 1	8W-47-2
G203	8W-47-3
Instrument Cluster	8W-47-2
Radio	8W-47-2, 3, 4, 5
Radio Antenna	8W-47-3
Radio/Cellular Antenna	8W-47-3
Speaker- Left Front Door Assembly	8W-47-4
Speaker- Left Rear	8W-47-5
Speaker- Right Front Door	8W-47-5
Speaker- Right Rear	8W-47-5


BATT
ACC-RUN-START BK/RD
(8W-10-13)
FUSE BLOCK NO. 1
(8W-10-3)
FUSE 8 20A (8W-10-23)
FUSE 15 15A (8W-10-13)
BATT
87A
DAYTIME RUNNING LAMPS RELAY
(8W-50-13)
30
INSTRUMENT CLUSTER
(8W-40-8)
VEHICLE SPEED SENSOR OUTPUT
9 C2
11 C4
9 C4
16 RD/YL
16 BK/RD
16 GY/DG
20 BL/RD/WT
S316
(8W-11-26)
S250
(8W-10-23)
S228
(8W-40-8)
16 GY/DG/RD
S203
(8W-10-25)
16 RD/YL
20 BL/RD/WT
16 GY/DG/RD
8
7
2
6 C201
16 RD/YL
16 BK/RD
16 GY/DG/RD
S252
(8W-10-23)
S210
(8W-10-16)
S253
(8W-11-28)
16 RD/YL
16 BK/RD
16 GY/DG/RD
20 BL/RD/WT
12 C1
15 C1
14 C1
1 C1
RADIO
FUSED B(+)
FUSED IGNITION SWITCH OUTPUT (RUN-START)
LAMP DRIVER
VEHICLE SPEED SENSOR OUTPUT



VA304703 J038W-24

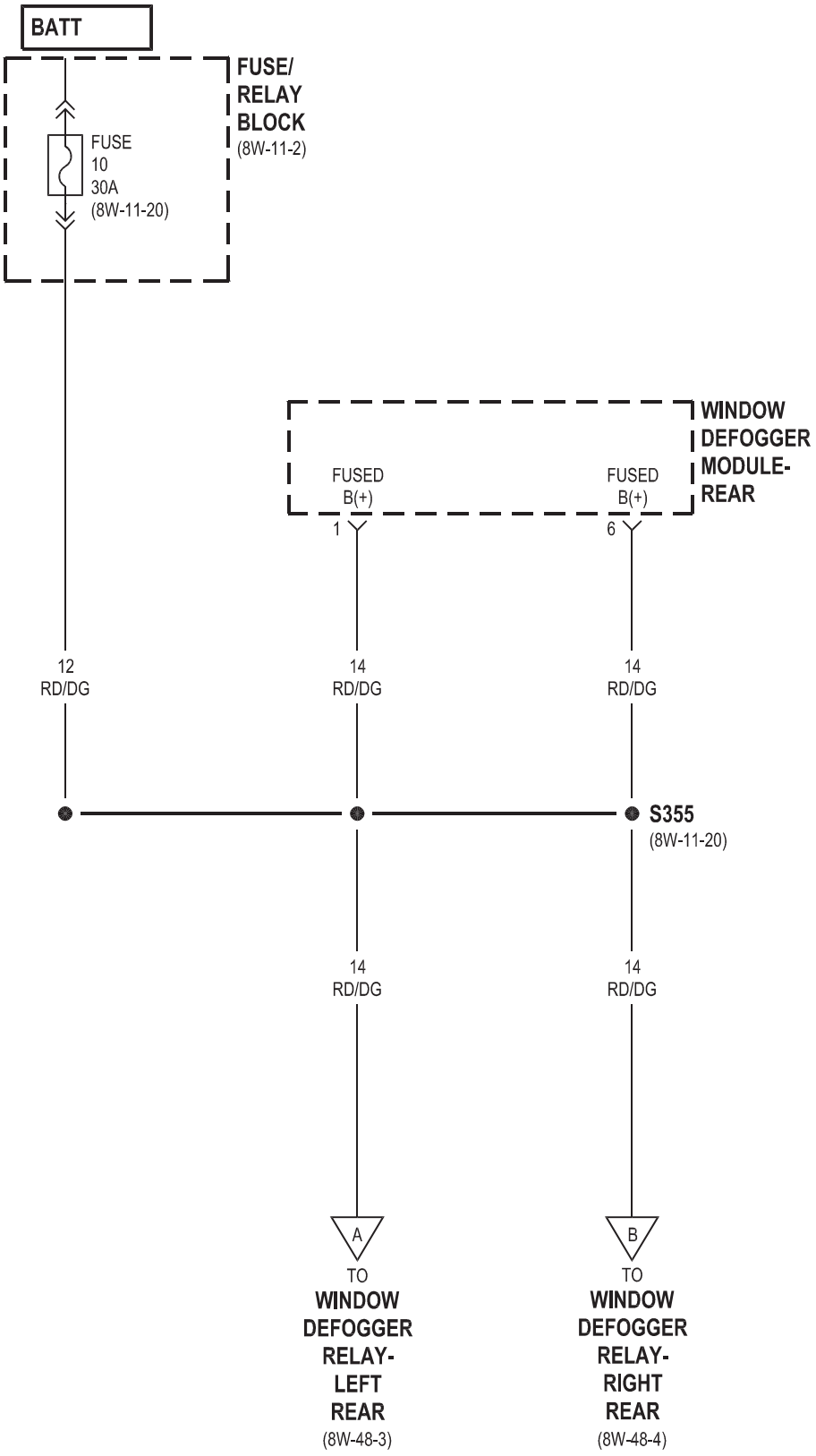

RADIO
CTEL MUTE
11 C1
SPEAKER- LEFT FRONT DOOR ASSEMBLY (+)
5 C1
SPEAKER- LEFT FRONT DOOR ASSEMBLY (-)
6 C1
18 DG/YL/BK
18 BR/DG
18 BR
4
7
16
CTEL CONNECTOR
18 BL/YL
1 C1
1 C2
SPEAKER- LEFT FRONT DOOR ASSEMBLY
2 C1
2 C2

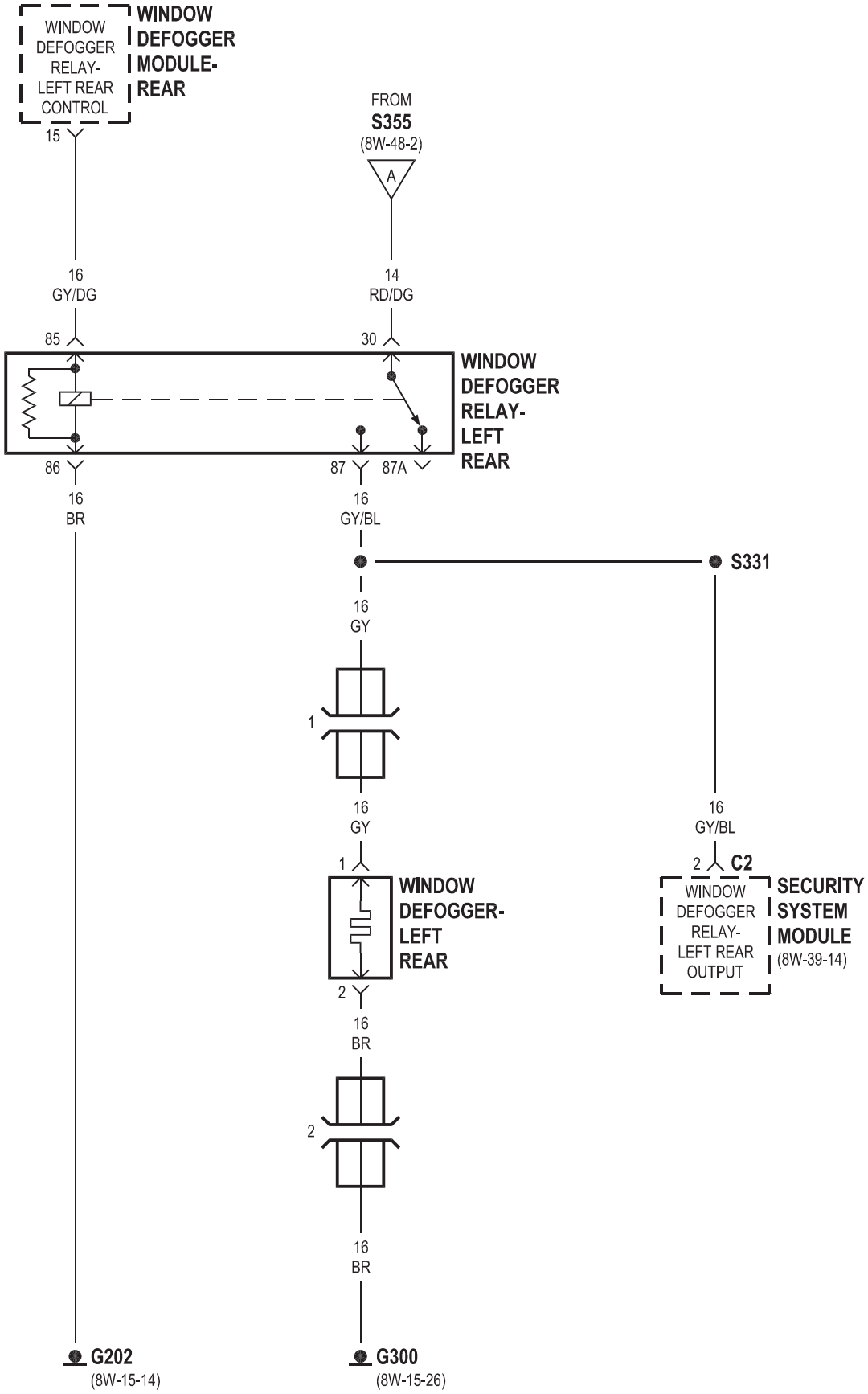


VA304705 J038W-24

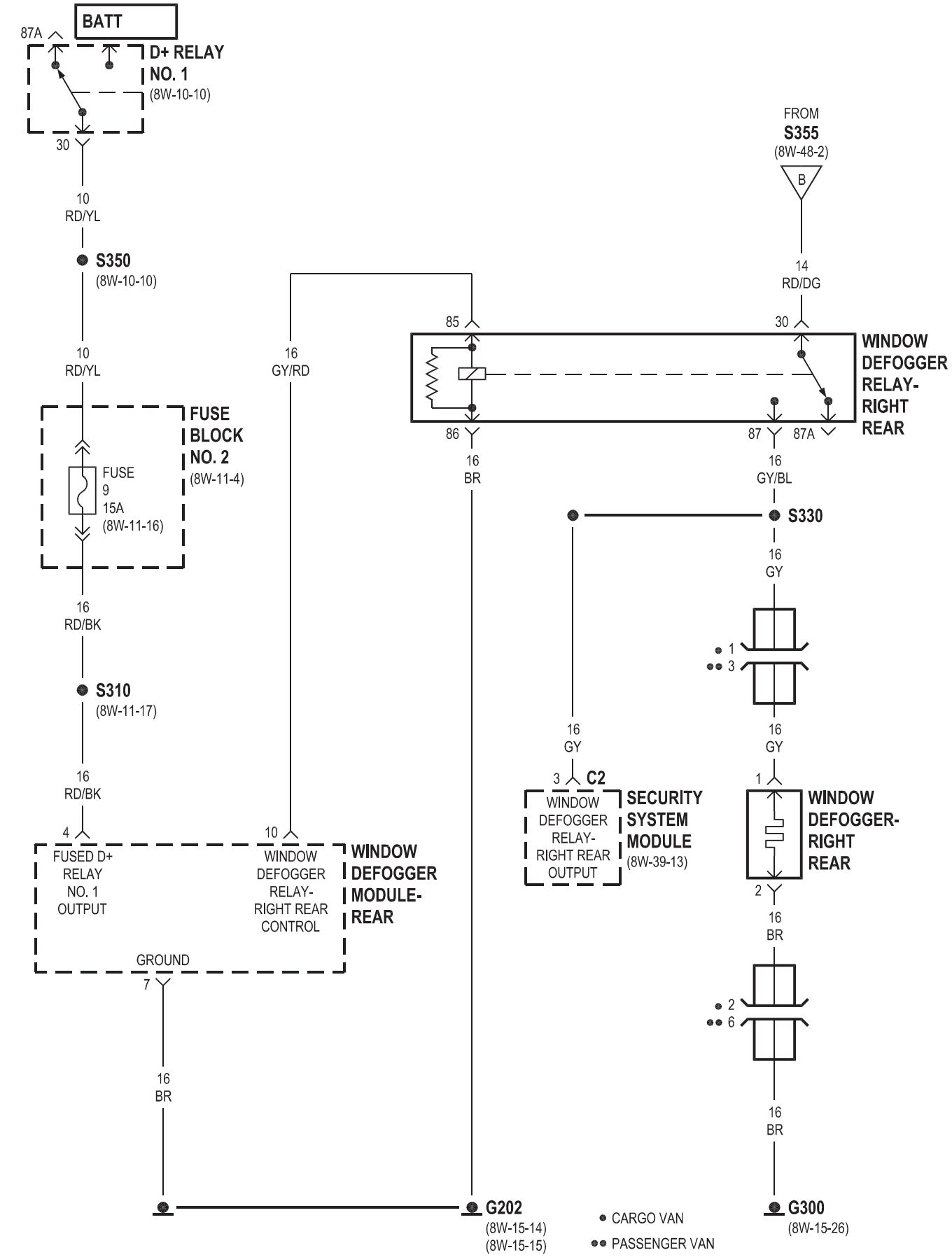
8W-48 REAR WINDOW DEFOGGER

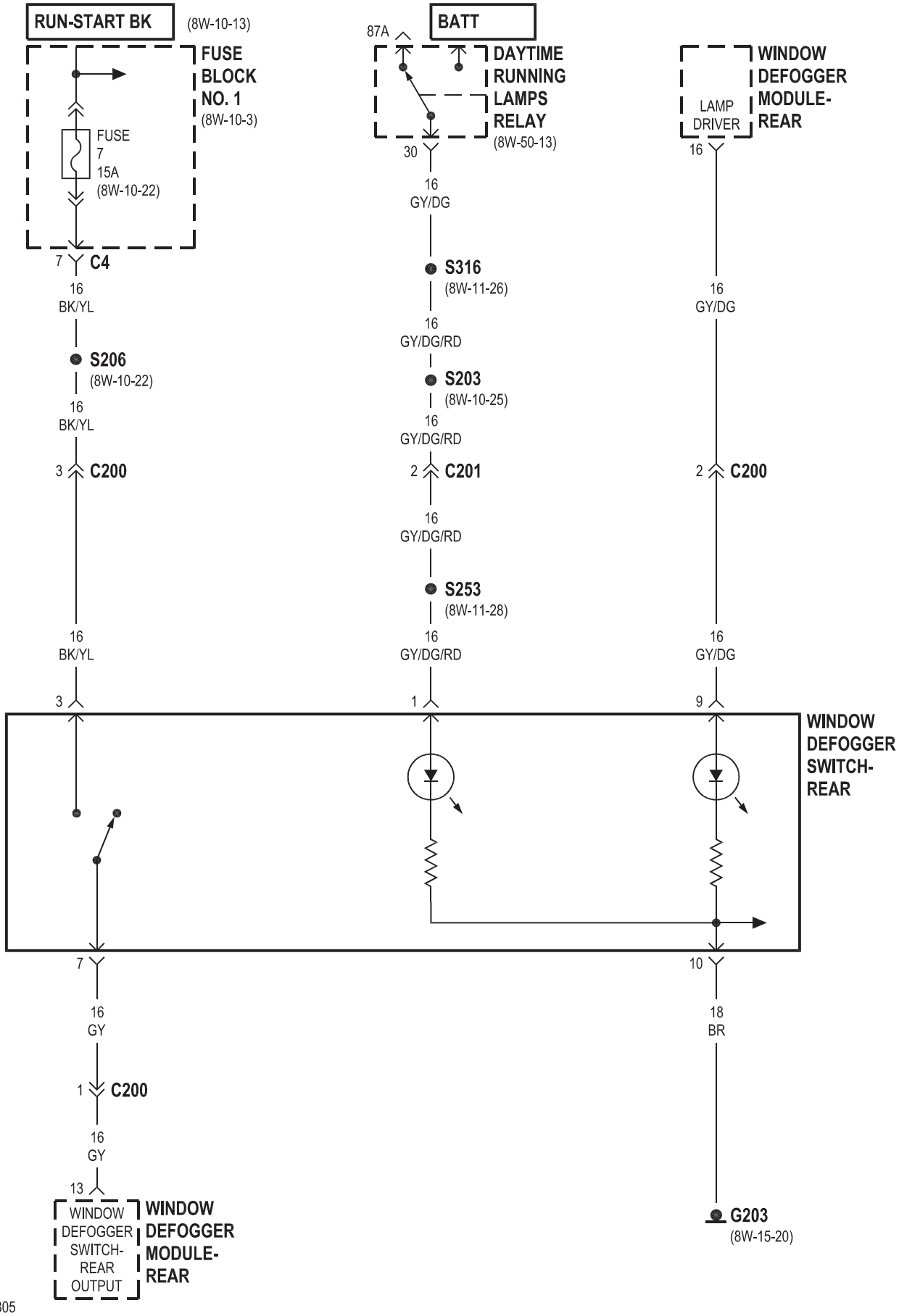
Component	Page
D+ Relay No. 1	8W-48-4
Daytime Running Lamps Relay	8W-48-5
Fuse 7	8W-48-5
Fuse 9	8W-48-4
Fuse 10	8W-48-2
Fuse Block No. 1	8W-48-5
Fuse Block No. 2	8W-48-4
Fuse/Relay Block	8W-48-2
G202	8W-48-3, 4
G203	8W-48-5
G300	8W-48-3, 4
Security System Module	8W-48-3, 4
Window Defogger Module- Rear	8W-48-2, 3, 4, 5
Window Defogger Relay- Left Rear	8W-48-2, 3
Window Defogger Relay- Right Rear	8W-48-2, 4
Window Defogger Switch- Rear	8W-48-5
Window Defogger- Left Rear	8W-48-3
Window Defogger- Right Rear	8W-48-4


BATT
FUSE/
RELAY
BLOCK
(8W-11-2)
FUSE
10
30A
(8W-11-20)
WINDOW
DEFOGGER
MODULE-
REAR
FUSED
B(+)
1
FUSED
B(+)
6
12
RD/DG
14
RD/DG
14
RD/DG
S355
(8W-11-20)
14
RD/DG
14
RD/DG
A
TO
WINDOW
DEFOGGER
RELAY-
LEFT
REAR
(8W-48-3)
B
TO
WINDOW
DEFOGGER
RELAY-
RIGHT
REAR
(8W-48-4)



VA304803 J038W-24

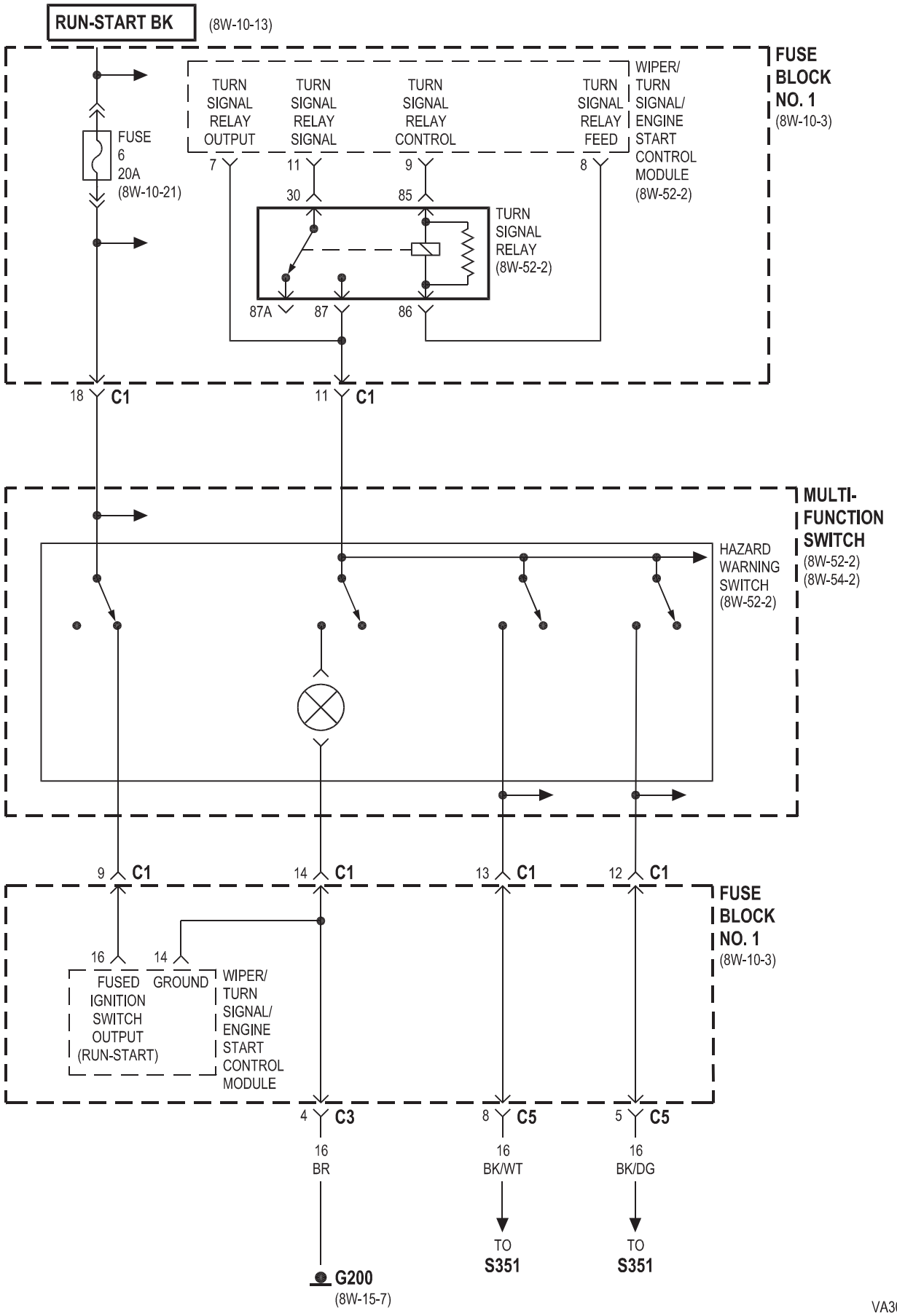

BATT
87A
D+ RELAY NO. 1
(8W-10-10)
30
10 RD/YL
S350
(8W-10-10)
10 RD/YL
FUSE BLOCK NO. 2
(8W-11-4)
FUSE 9 15A
(8W-11-16)
16 RD/BK
S310
(8W-11-17)
16 RD/BK
4
FUSED D+ RELAY NO. 1 OUTPUT
10
WINDOW DEFOGGER RELAY-RIGHT REAR CONTROL
WINDOW DEFOGGER MODULE-REAR
GROUND
7
16 BR
16 GY/RD
85
86
16 BR
G202
(8W-15-14)
(8W-15-15)
FROM S355
(8W-48-2)
B
14 RD/DG
30
87
87A
16 GY/BL
WINDOW DEFOGGER RELAY-RIGHT REAR
S330
16 GY
1
3
16 GY
3
C2
WINDOW DEFOGGER RELAY-RIGHT REAR OUTPUT
SECURITY SYSTEM MODULE
(8W-39-13)
16 GY
1
WINDOW DEFOGGER-RIGHT REAR
2
16 BR
2
6
16 BR
G300
(8W-15-26)
CARGO VAN
PASSENGER VAN

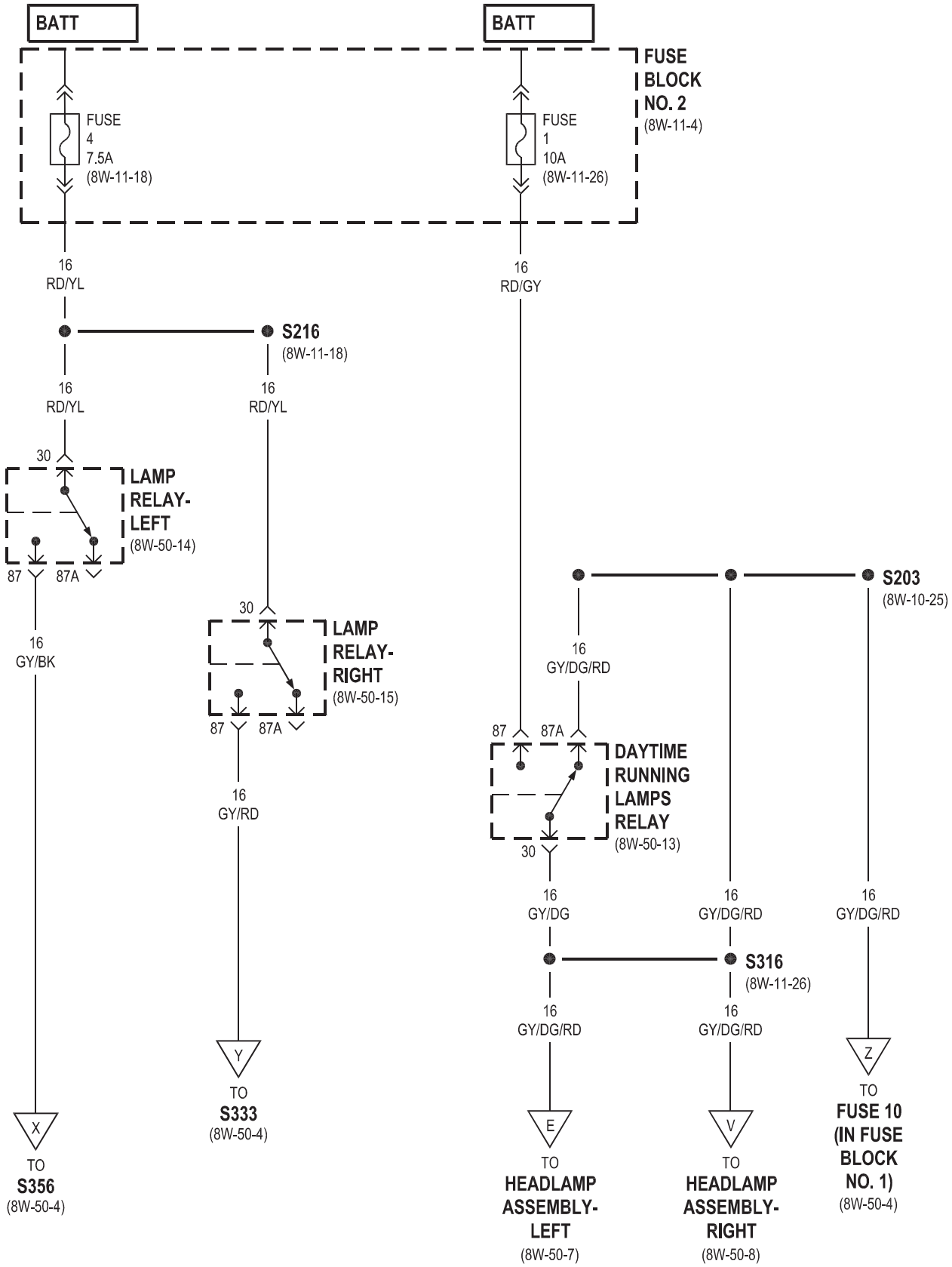


VA304805 J038W-24

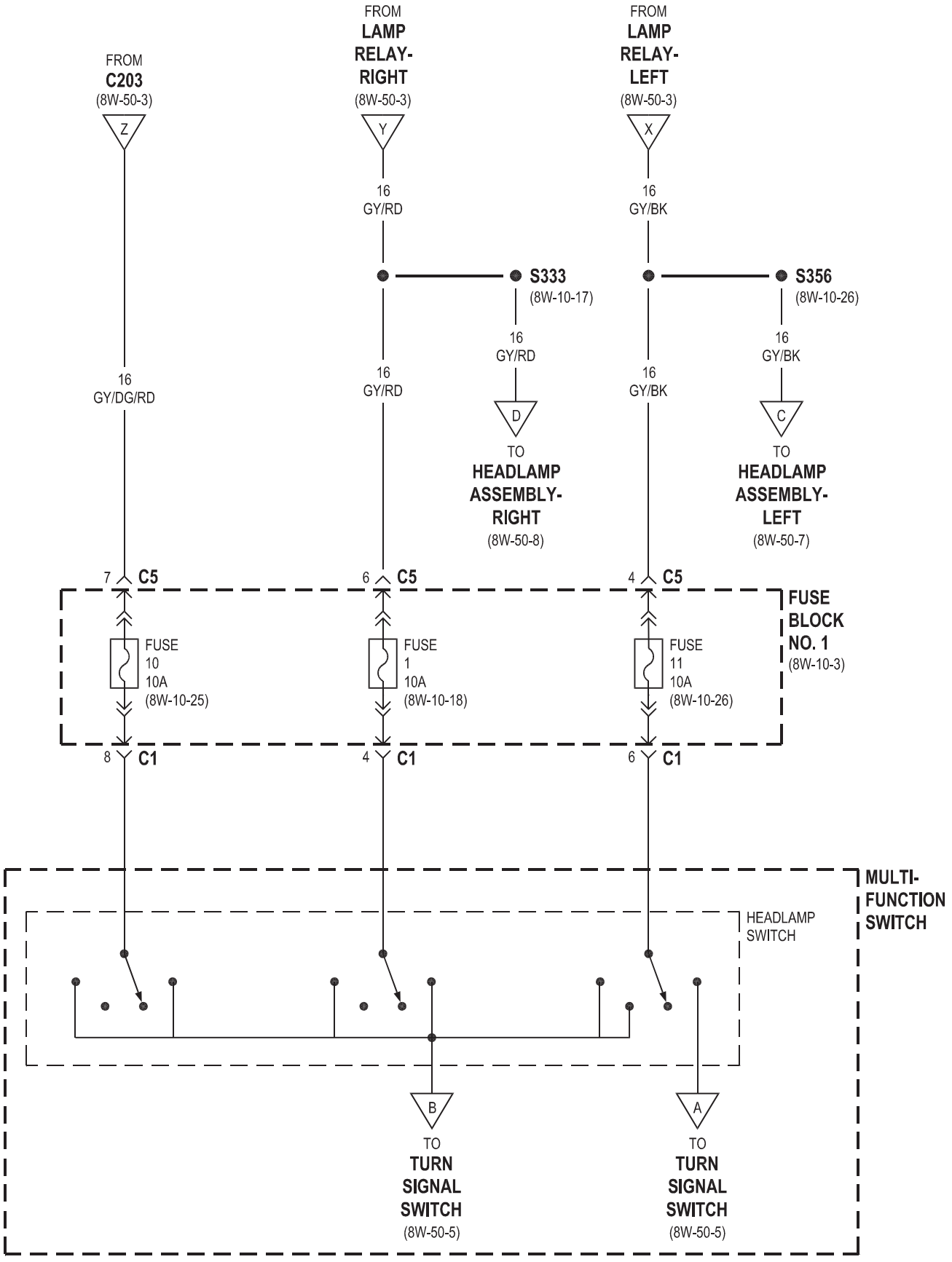
8W-50 FRONT LIGHTING

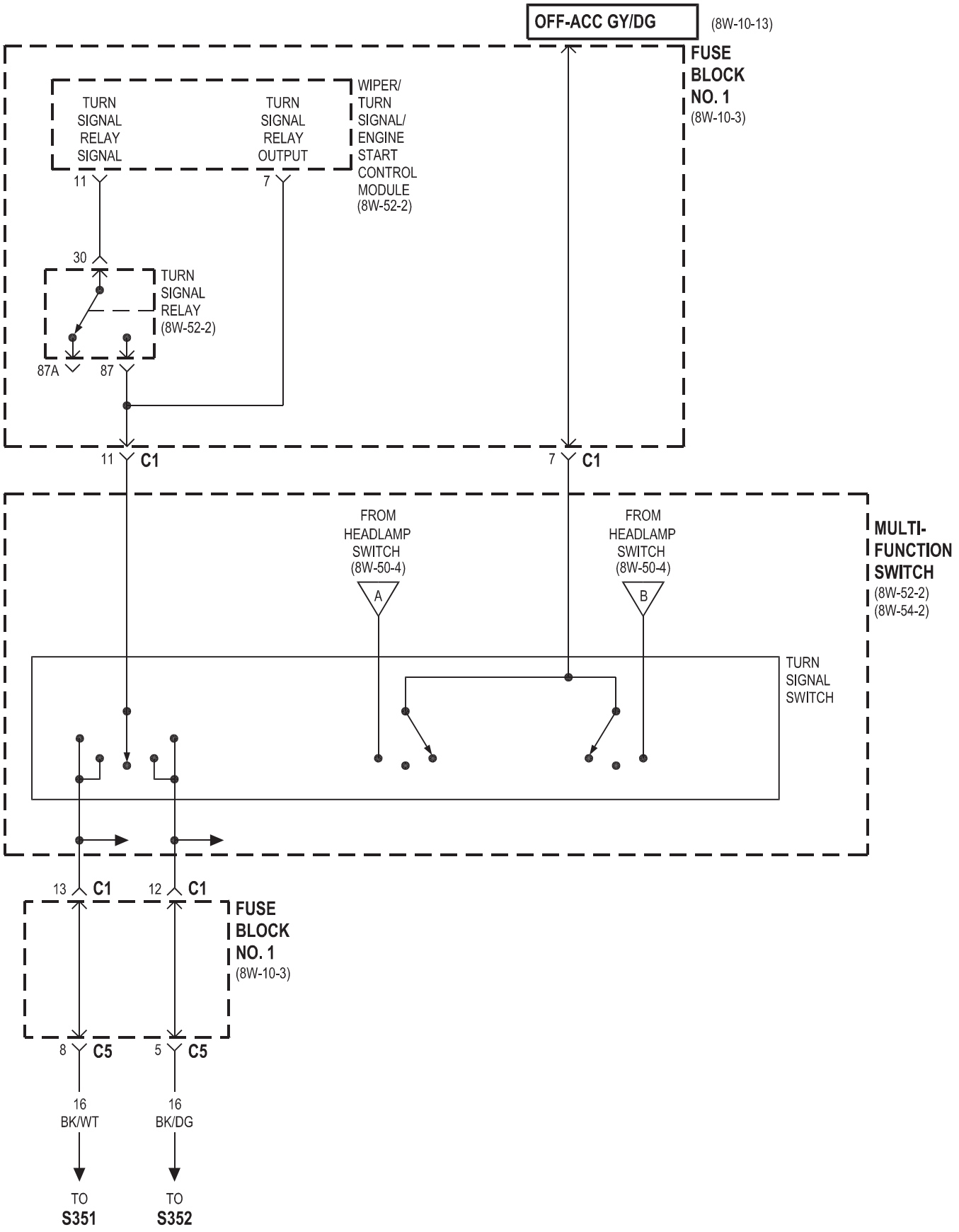
Component	Page
Beam Select Switch	8W-50-6
D+ Relay No. 1	8W-50-7, 8, 12, 14, 15
Daytime Running Lamp Relay- Left Side	8W-50-7
Daytime Running Lamp Relay- Right Side	8W-50-6, 8
Daytime Running Lamps Relay	8W-50-3, 13
Fog Lamp Relay	8W-50-6, 9, 10
Fog Lamp Switch	8W-50-9
Fuse 1	8W-50-3, 4, 13
Fuse 2	8W-50-6, 8
Fuse 3	8W-50-6, 7, 12
Fuse 4	8W-50-3, 14, 15
Fuse 5	8W-50-9
Fuse 6	8W-50-2
Fuse 9	8W-50-12, 13, 14, 15
Fuse 10	8W-50-3, 4
Fuse 11	8W-50-4, 7, 8
Fuse 12	8W-50-6, 8
Fuse 13	8W-50-6, 7, 8
Fuse 14	8W-50-6, 10
Fuse Block No. 1	8W-50-2, 4, 5, 6
Fuse Block No. 2	8W-50-3, 7, 8, 12, 13, 14, 15
Fuse Block No. 3	8W-50-9
G100	8W-50-7, 10
G102	8W-50-8, 10
G200	8W-50-2
G202	8W-50-7, 8, 10, 11, 13, 14, 15
G203	8W-50-9
Hazard Warning Switch	8W-50-2
Headlamp Adjust Switch	8W-50-7, 8, 9
Headlamp Assembly- Left	8W-50-3, 4, 6, 7, 9, 10, 11, 13, 14
Headlamp Assembly- Right	8W-50-3, 4, 6, 8, 9, 10, 11, 13, 15
Headlamp Switch	8W-50-4, 5, 6
Lamp Relay- Left	8W-50-3, 4, 14
Lamp Relay- Right	8W-50-3, 4, 15
Marker Lamp Connector	8W-50-11
Marker Lamp No. 1- Left Front	8W-50-11
Marker Lamp No. 1- Right Front	8W-50-11
Marker Lamp No. 2- Left Front	8W-50-11
Marker Lamp No. 2- Right Front	8W-50-11
Marker Lamp- Left Center	8W-50-11
Marker Lamp- Left Rear	8W-50-11
Marker Lamp- Right Center	8W-50-11
Marker Lamp- Right Rear	8W-50-11
Multi- Function Switch	8W-50-2, 4, 5, 6
Power Distribution Center	8W-50-12
Tail Lamp Assembly- Left	8W-50-14
Tail Lamp Assembly- Right	8W-50-15
Turn Signal Relay	8W-50-2, 5
Turn Signal Switch	8W-50-4, 5
Wiper/Turn Signal/Engine Start Control Module	8W-50-2, 5


RUN-START BK
(8W-10-13)
FUSE BLOCK NO. 1
(8W-10-3)
FUSE 6 20A
(8W-10-21)
TURN SIGNAL RELAY OUTPUT
TURN SIGNAL RELAY SIGNAL
TURN SIGNAL RELAY CONTROL
TURN SIGNAL RELAY FEED
WIPER/ TURN SIGNAL/ ENGINE START CONTROL MODULE
(8W-52-2)
7
11
9
8
30
85
TURN SIGNAL RELAY
(8W-52-2)
87A
87
86
18 C1
11 C1
MULTI-FUNCTION SWITCH
(8W-52-2)
(8W-54-2)
HAZARD WARNING SWITCH
(8W-52-2)
9 C1
14 C1
13 C1
12 C1
FUSE BLOCK NO. 1
(8W-10-3)
16
14
FUSED IGNITION SWITCH OUTPUT (RUN-START)
GROUND
WIPER/ TURN SIGNAL/ ENGINE START CONTROL MODULE
4 C3
8 C5
5 C5
16 BR
16 BK/WT
16 BK/DG
TO S351
TO S351
G200
(8W-15-7)

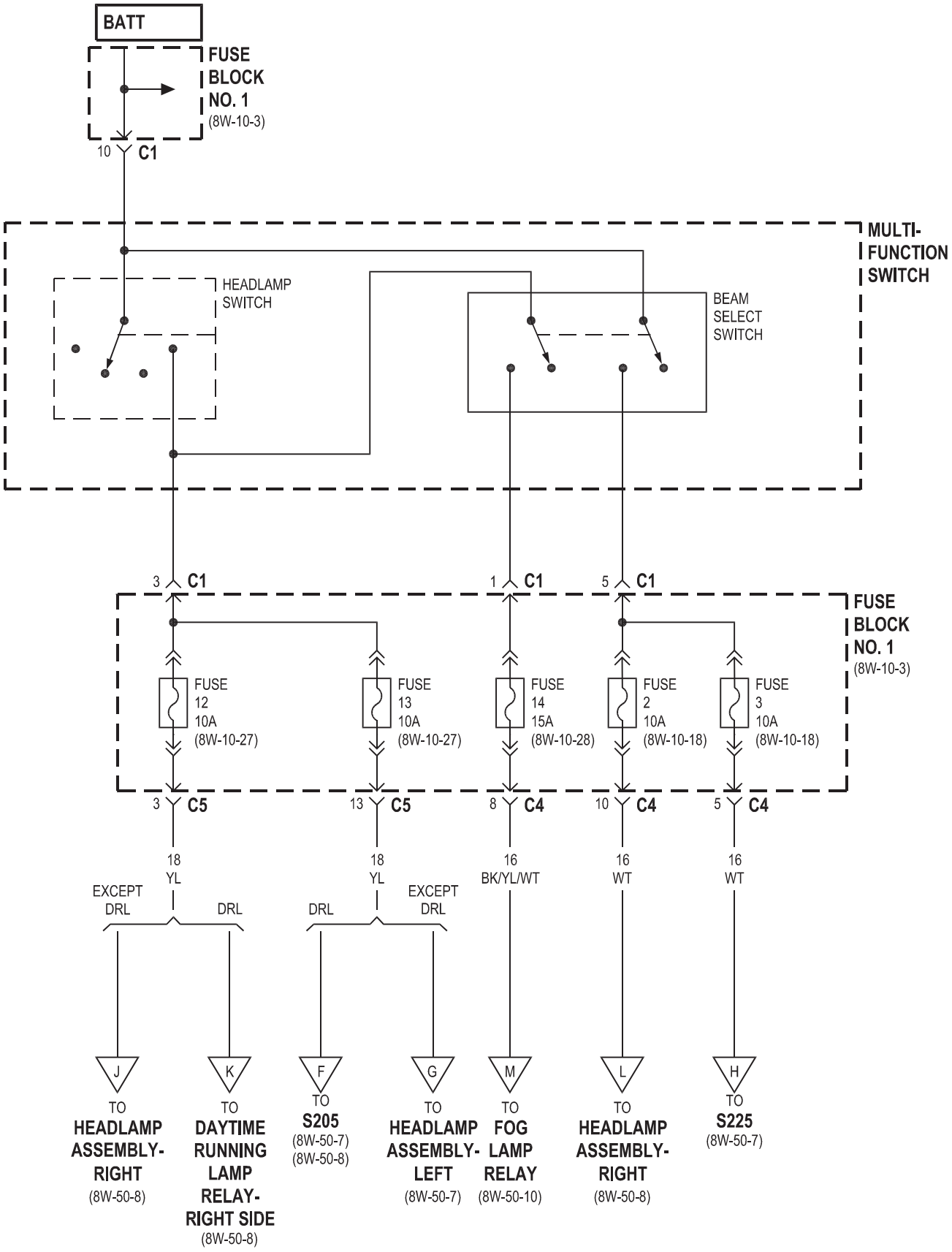


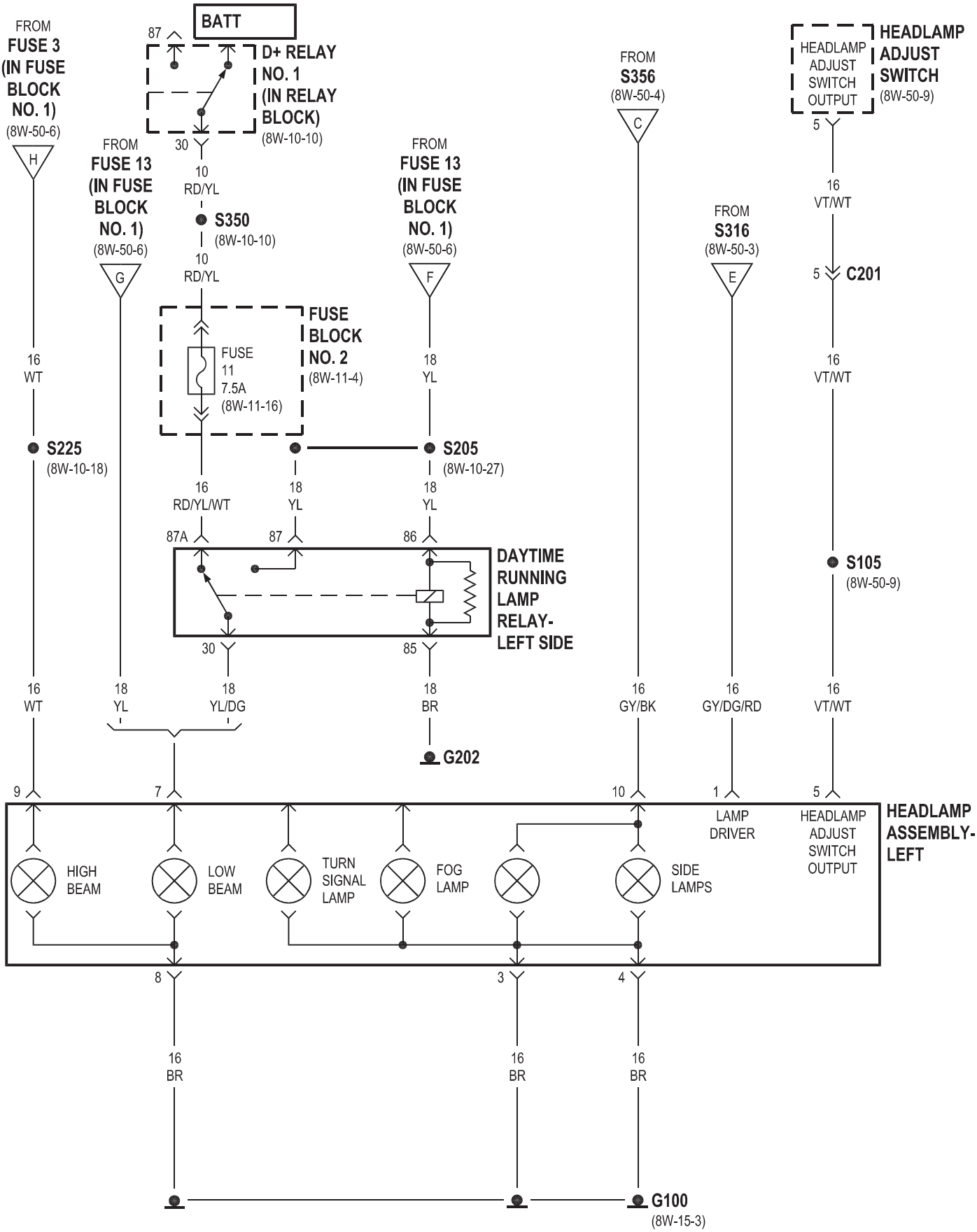
VA305003 J038W-24


FROM
C203
(8W-50-3)
Z
FROM
LAMP
RELAY-
RIGHT
(8W-50-3)
Y
FROM
LAMP
RELAY-
LEFT
(8W-50-3)
X
16
GY/RD
16
GY/BK
S333
(8W-10-17)
S356
(8W-10-26)
16
GY/RD
16
GY/BK
16
GY/DG/RD
16
GY/RD
16
GY/BK
D
C
TO
HEADLAMP
ASSEMBLY-
RIGHT
(8W-50-8)
TO
HEADLAMP
ASSEMBLY-
LEFT
(8W-50-7)
7 C5
6 C5
4 C5
FUSE
BLOCK
NO. 1
(8W-10-3)
FUSE
10
10A
(8W-10-25)
FUSE
1
10A
(8W-10-18)
FUSE
11
10A
(8W-10-26)
8 C1
4 C1
6 C1
MULTI-
FUNCTION
SWITCH
HEADLAMP
SWITCH
B
A
TO
TURN
SIGNAL
SWITCH
(8W-50-5)
TO
TURN
SIGNAL
SWITCH
(8W-50-5)

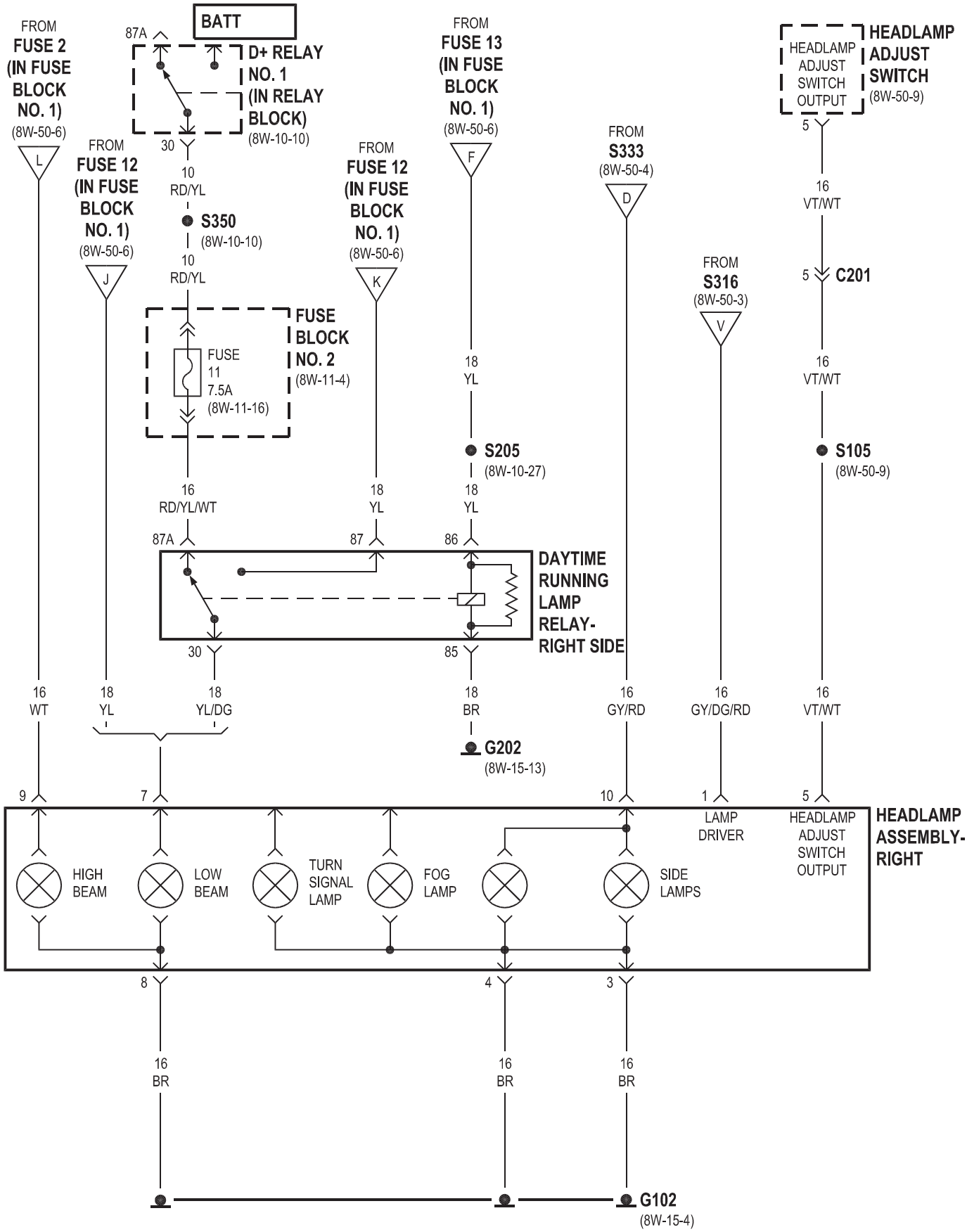


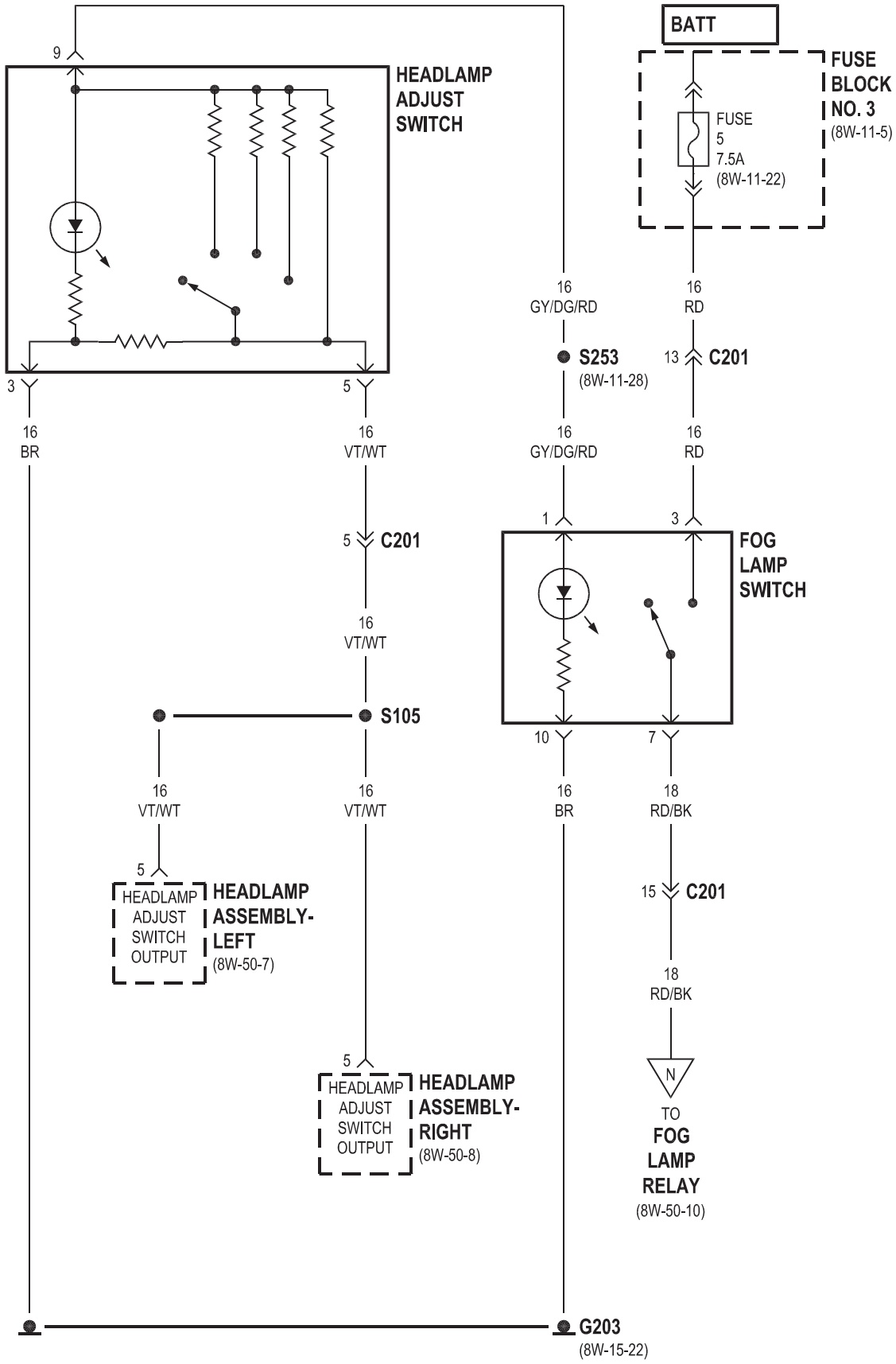
VA305005 J038W-24


BATT
FUSE BLOCK NO. 1
(8W-10-3)
10 C1
MULTI-FUNCTION SWITCH
HEADLAMP SWITCH
BEAM SELECT SWITCH
3 C1
1 C1
5 C1
FUSE BLOCK NO. 1
(8W-10-3)
FUSE 12 10A (8W-10-27)
FUSE 13 10A (8W-10-27)
FUSE 14 15A (8W-10-28)
FUSE 2 10A (8W-10-18)
FUSE 3 10A (8W-10-18)
3 C5
13 C5
8 C4
10 C4
5 C4
18 YL
18 YL
16 BK/YL/WT
16 WT
16 WT
EXCEPT DRL
DRL
DRL
EXCEPT DRL
J
K
F
G
M
L
H
TO HEADLAMP ASSEMBLY-RIGHT (8W-50-8)
TO DAYTIME RUNNING LAMP RELAY-RIGHT SIDE (8W-50-8)
TO S205 (8W-50-7) (8W-50-8)
TO HEADLAMP ASSEMBLY-LEFT (8W-50-7)
TO FOG LAMP RELAY (8W-50-10)
TO HEADLAMP ASSEMBLY-RIGHT (8W-50-8)
TO S225 (8W-50-7)

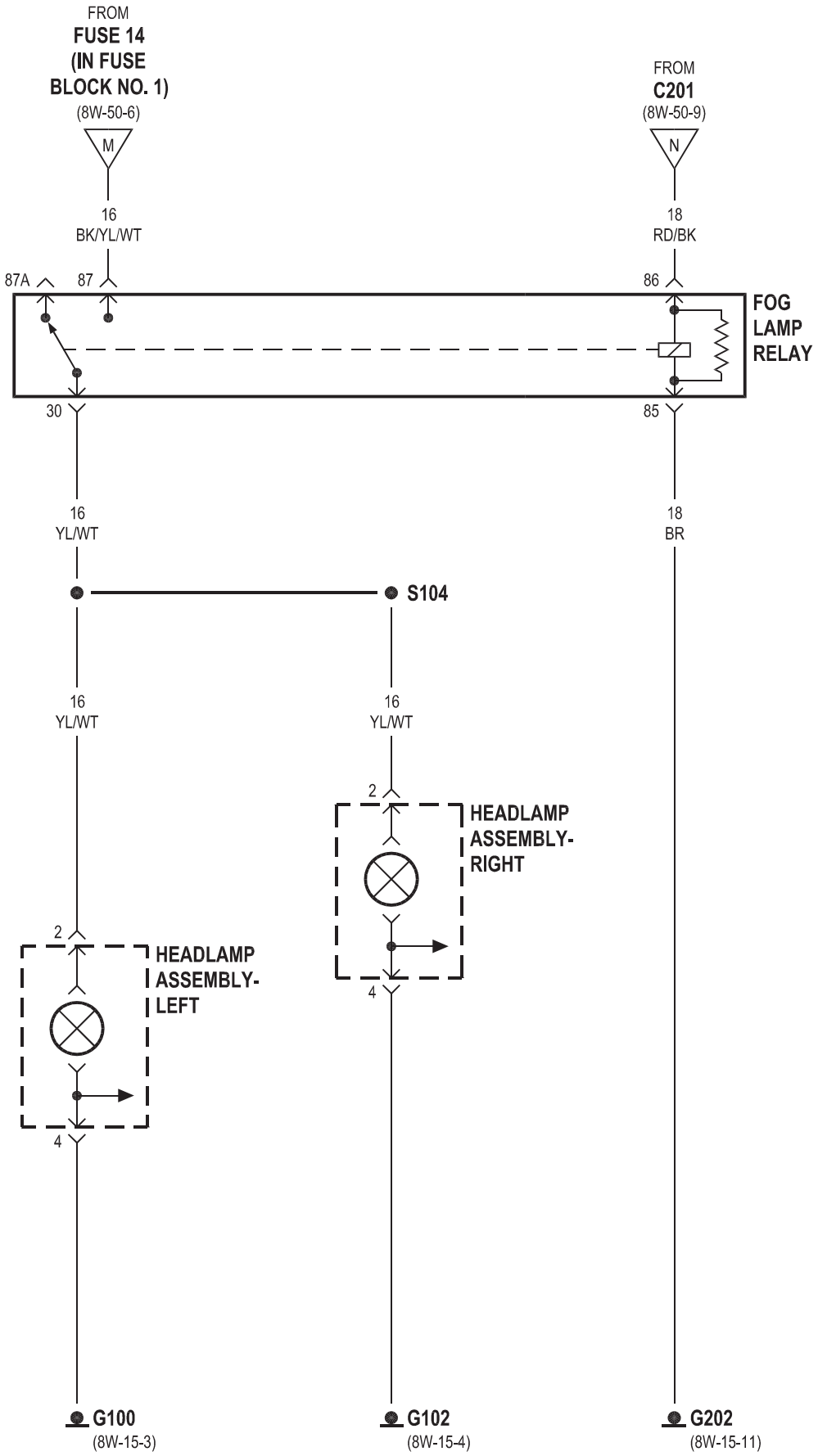


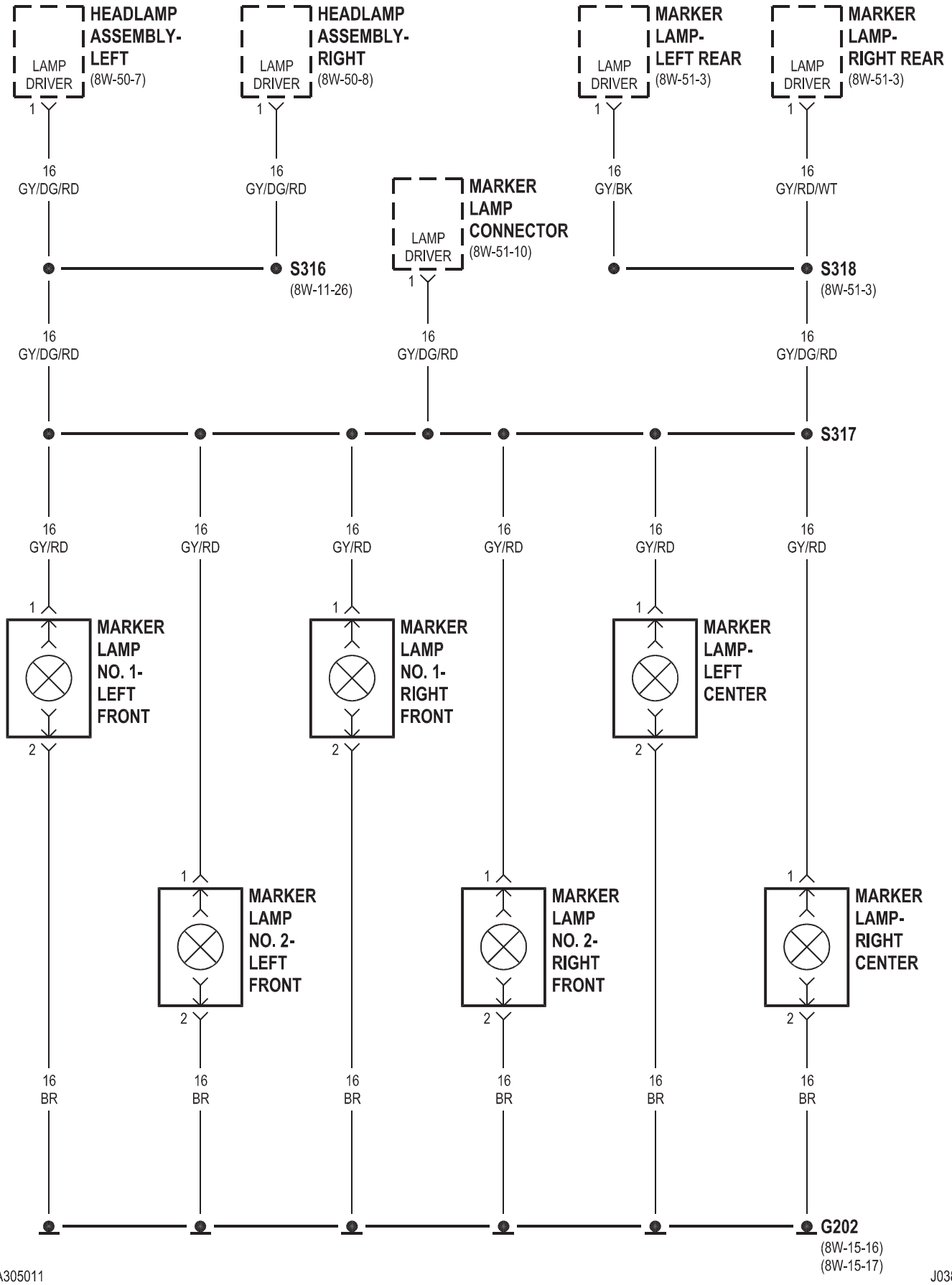
VA305007 J038W-24


FROM
FUSE 2
(IN FUSE
BLOCK
NO. 1)
(8W-50-6)
L
BATT
87A
D+ RELAY
NO. 1
(IN RELAY
BLOCK)
(8W-10-10)
30
10
RD/YL
S350
(8W-10-10)
10
RD/YL
FROM
FUSE 12
(IN FUSE
BLOCK
NO. 1)
(8W-50-6)
J
FUSE
BLOCK
NO. 2
(8W-11-4)
FUSE
11
7.5A
(8W-11-16)
16
RD/YL/WT
87A
FROM
FUSE 12
(IN FUSE
BLOCK
NO. 1)
(8W-50-6)
K
18
YL
87
FROM
FUSE 13
(IN FUSE
BLOCK
NO. 1)
(8W-50-6)
F
18
YL
S205
(8W-10-27)
18
YL
86
DAYTIME
RUNNING
LAMP
RELAY-
RIGHT SIDE
30
85
FROM
S333
(8W-50-4)
D
FROM
S316
(8W-50-3)
V
HEADLAMP
ADJUST
SWITCH
OUTPUT
HEADLAMP
ADJUST
SWITCH
(8W-50-9)
5
16
VT/WT
5
C201
16
VT/WT
S105
(8W-50-9)
16
WT
18
YL
18
YL/DG
18
BR
16
GY/RD
16
GY/DG/RD
16
VT/WT
G202
(8W-15-13)
9
7
10
1
5
LAMP
DRIVER
HEADLAMP
ADJUST
SWITCH
OUTPUT
HEADLAMP
ASSEMBLY-
RIGHT
HIGH
BEAM
LOW
BEAM
TURN
SIGNAL
LAMP
FOG
LAMP
SIDE
LAMPS
8
4
3
16
BR
16
BR
16
BR
G102
(8W-15-4)

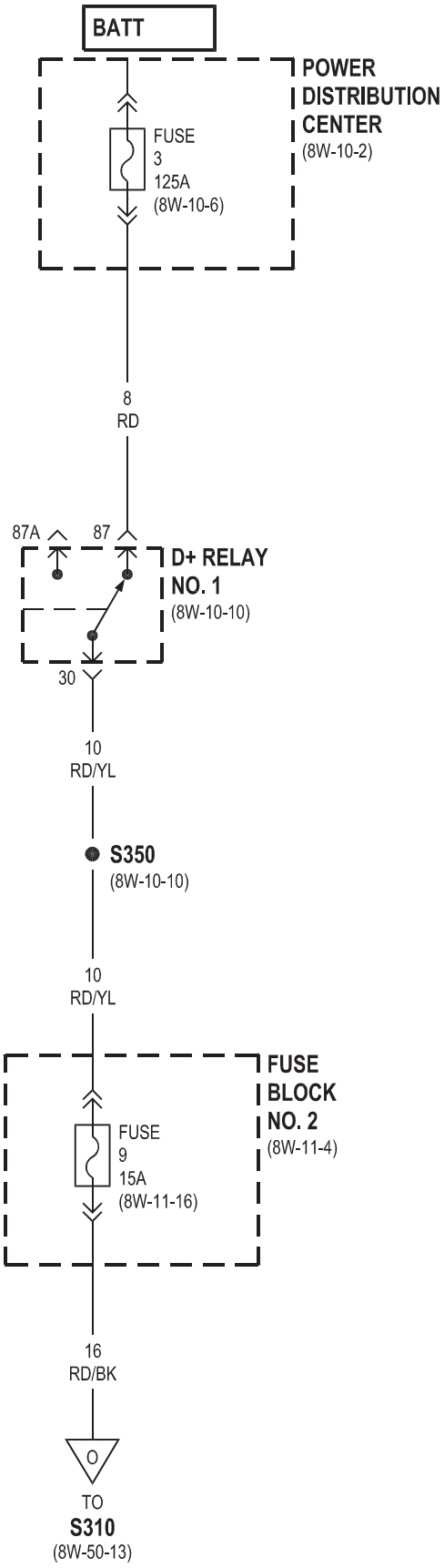


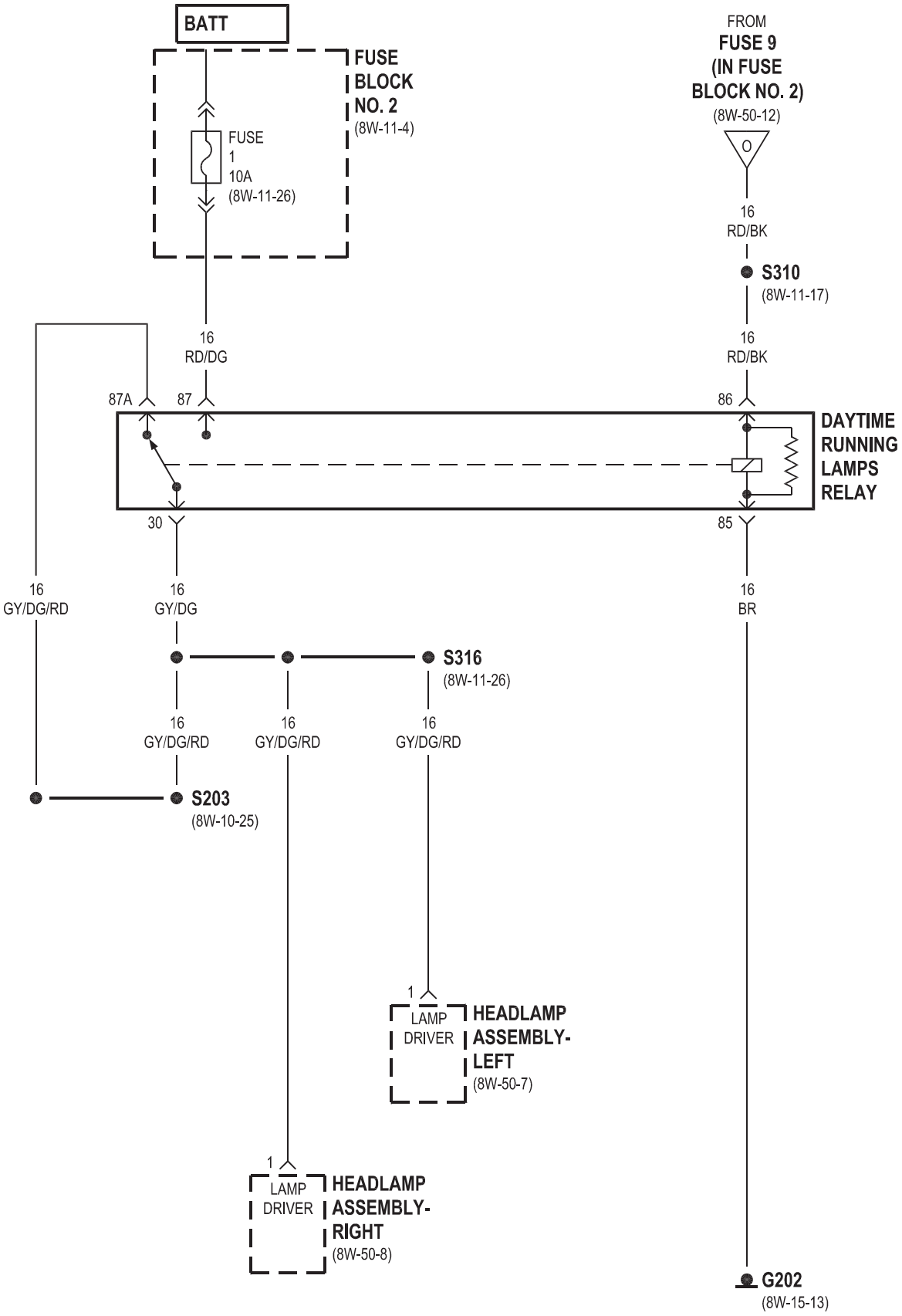
VA305009 J038W-24


FROM
FUSE 14
(IN FUSE
BLOCK NO. 1)
(8W-50-6)
M
16
BK/YL/WT
FROM
C201
(8W-50-9)
N
18
RD/BK
87A
87
86
FOG
LAMP
RELAY
30
85
16
YL/WT
18
BR
S104
16
YL/WT
16
YL/WT
2
HEADLAMP
ASSEMBLY-
RIGHT
2
HEADLAMP
ASSEMBLY-
LEFT
4
4
G100
(8W-15-3)
G102
(8W-15-4)
G202
(8W-15-11)

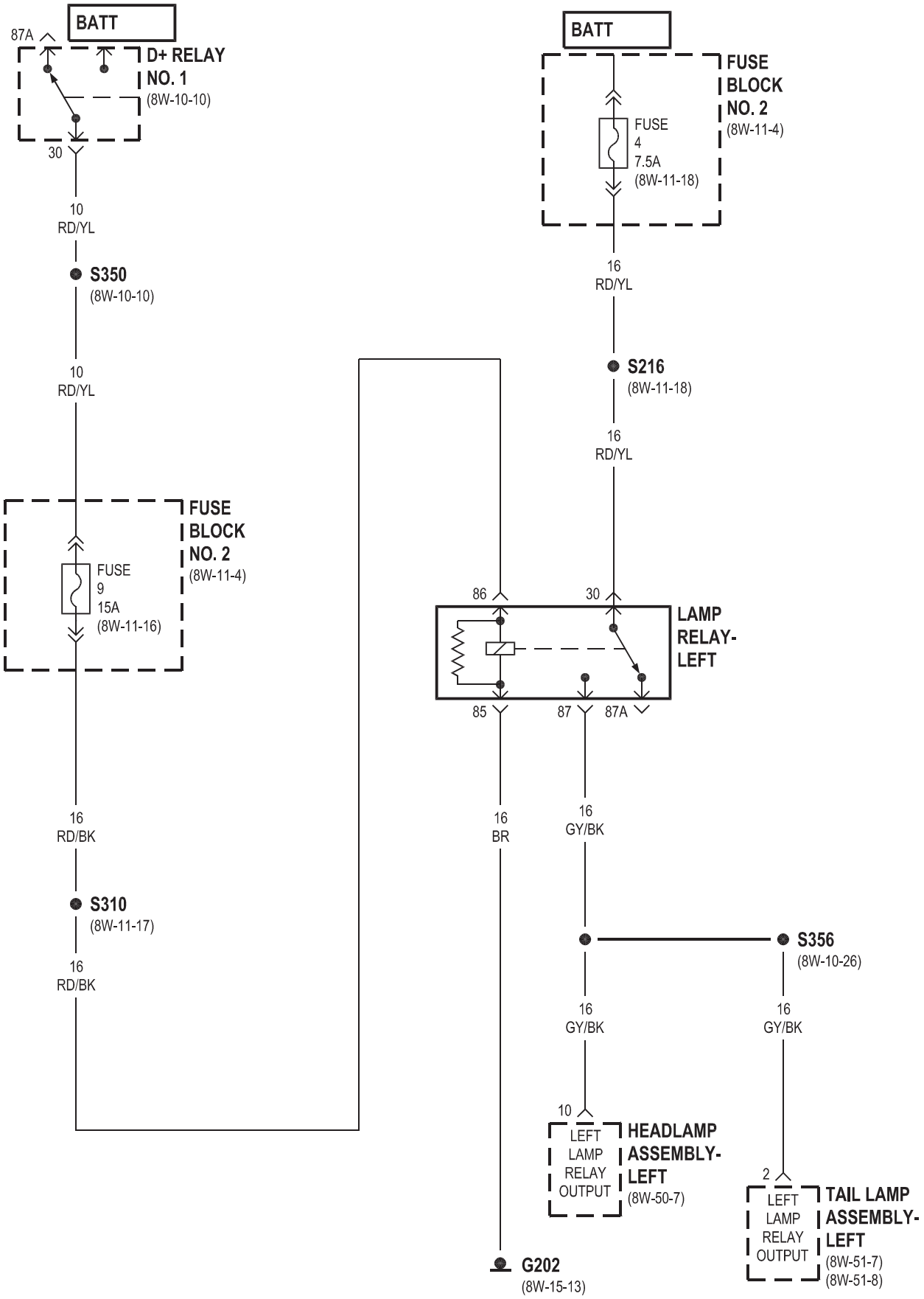


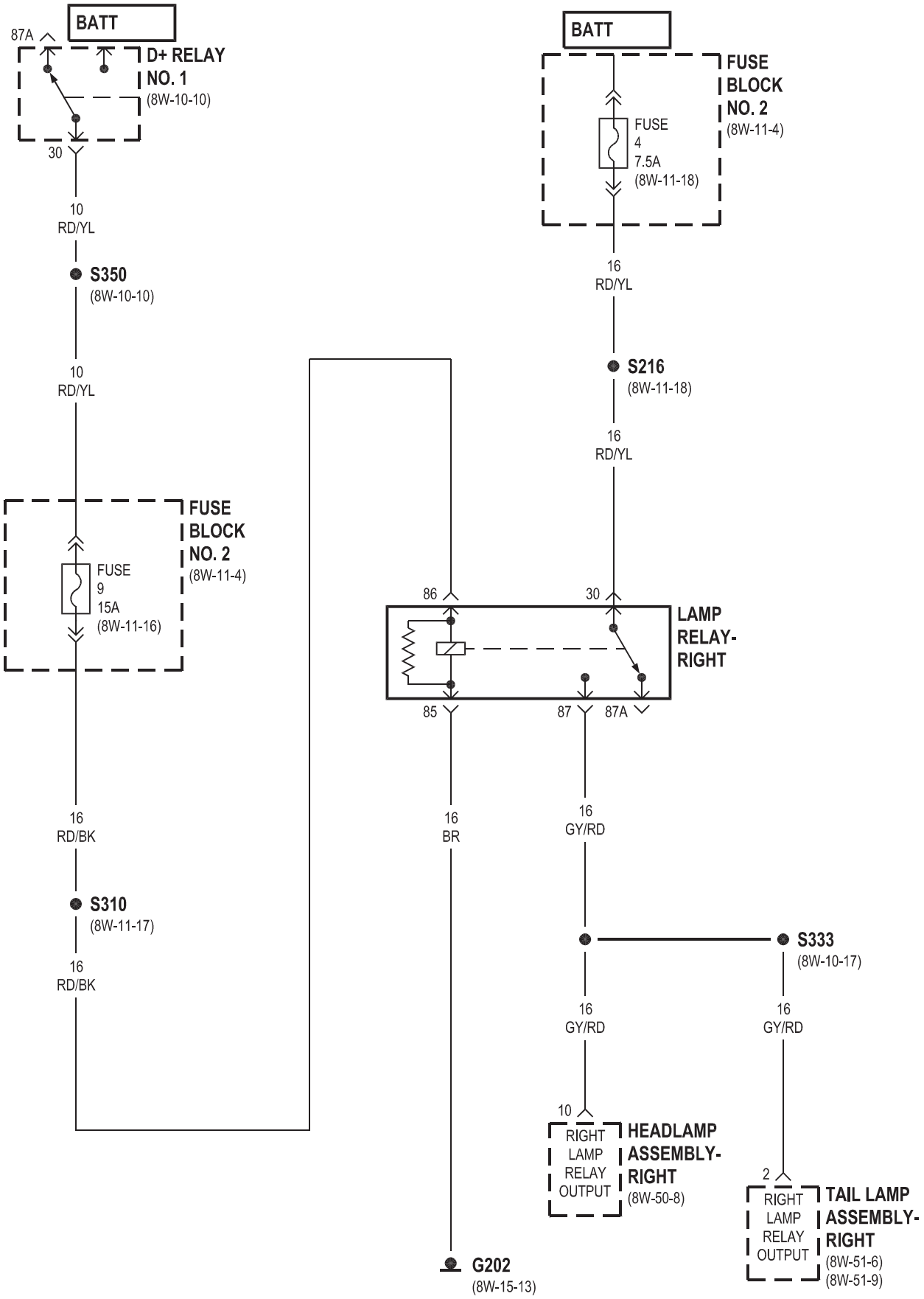
VA305011 J038W-24


BATT
POWER
DISTRIBUTION
CENTER
(8W-10-2)
FUSE
3
125A
(8W-10-6)
8
RD
87A
87
D+ RELAY
NO. 1
(8W-10-10)
30
10
RD/YL
S350
(8W-10-10)
10
RD/YL
FUSE
BLOCK
NO. 2
(8W-11-4)
FUSE
9
15A
(8W-11-16)
16
RD/BK
O
TO
S310
(8W-50-13)



VA305013 J038W-24

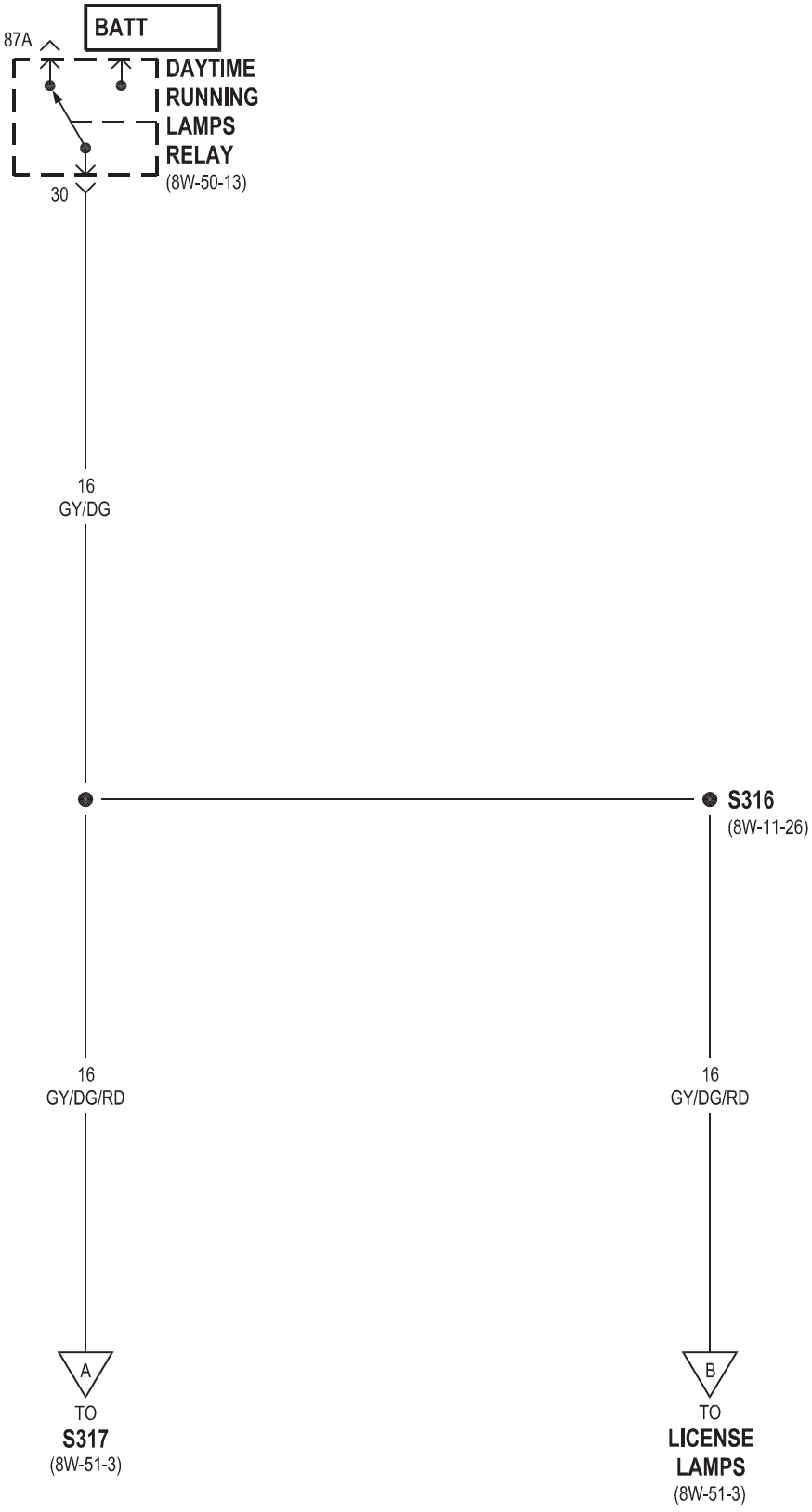

BATT
87A
D+ RELAY NO. 1
(8W-10-10)
30
10 RD/YL
S350
(8W-10-10)
10 RD/YL
FUSE BLOCK NO. 2
(8W-11-4)
FUSE 9 15A
(8W-11-16)
16 RD/BK
S310
(8W-11-17)
16 RD/BK
BATT
FUSE BLOCK NO. 2
(8W-11-4)
FUSE 4 7.5A
(8W-11-18)
16 RD/YL
S216
(8W-11-18)
16 RD/YL
86
30
LAMP RELAY-LEFT
85
87
87A
16 BR
16 GY/BK
S356
(8W-10-26)
16 GY/BK
16 GY/BK
10
LEFT LAMP RELAY OUTPUT
HEADLAMP ASSEMBLY-LEFT
(8W-50-7)
2
LEFT LAMP RELAY OUTPUT
TAIL LAMP ASSEMBLY-LEFT
(8W-51-7)
(8W-51-8)
G202
(8W-15-13)

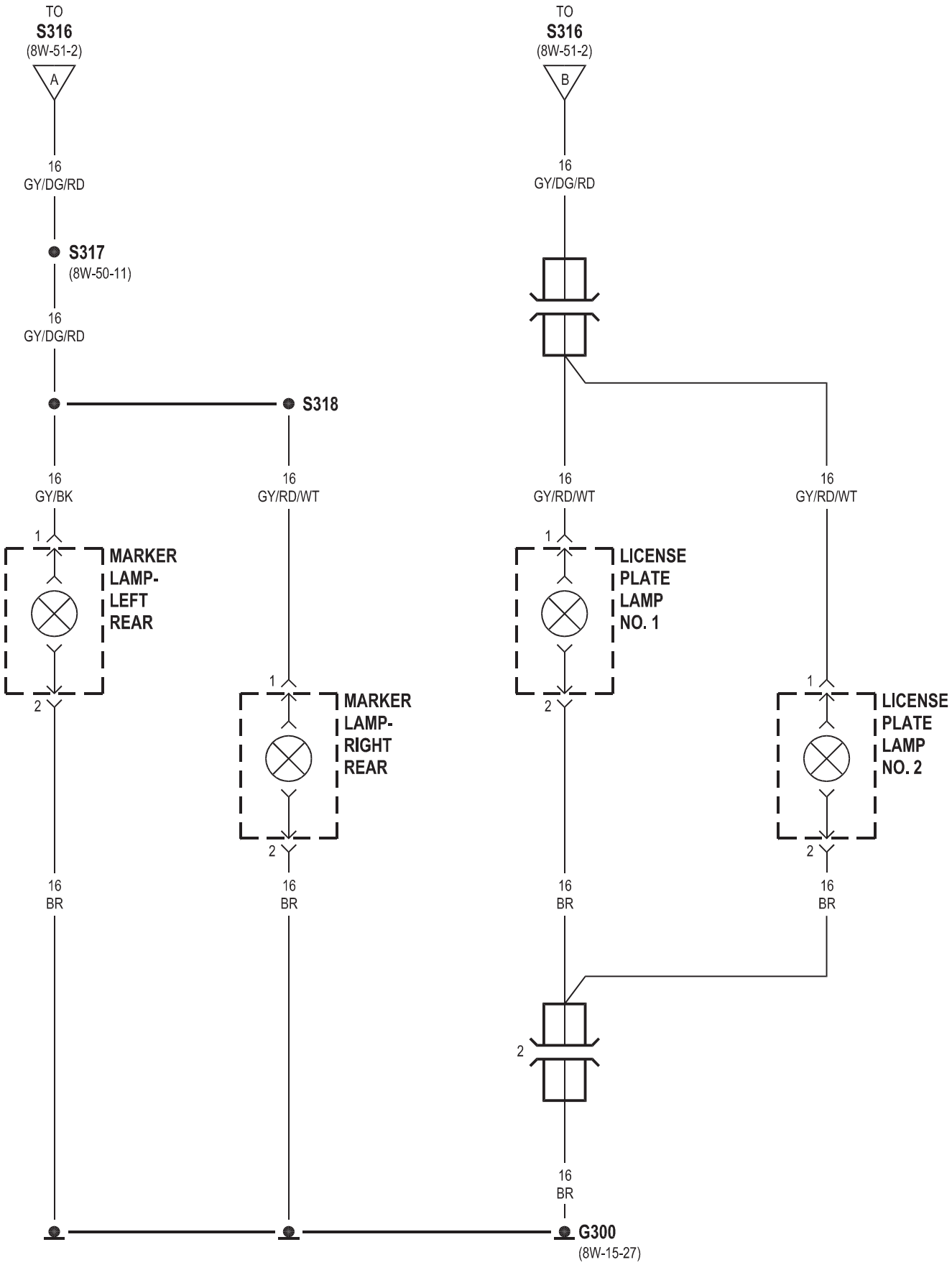


VA305015 J038W-24

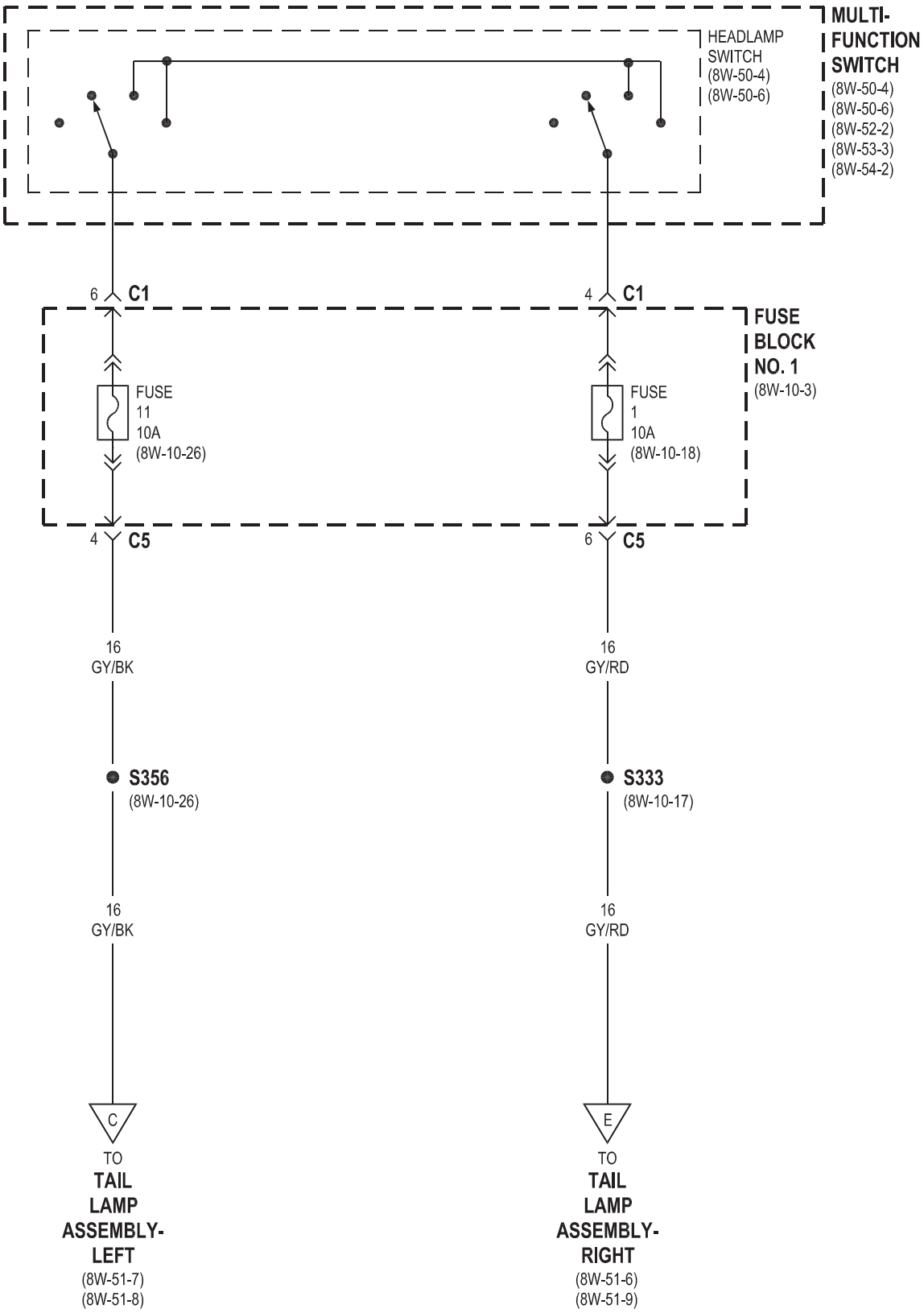
8W-51 REAR LIGHTING

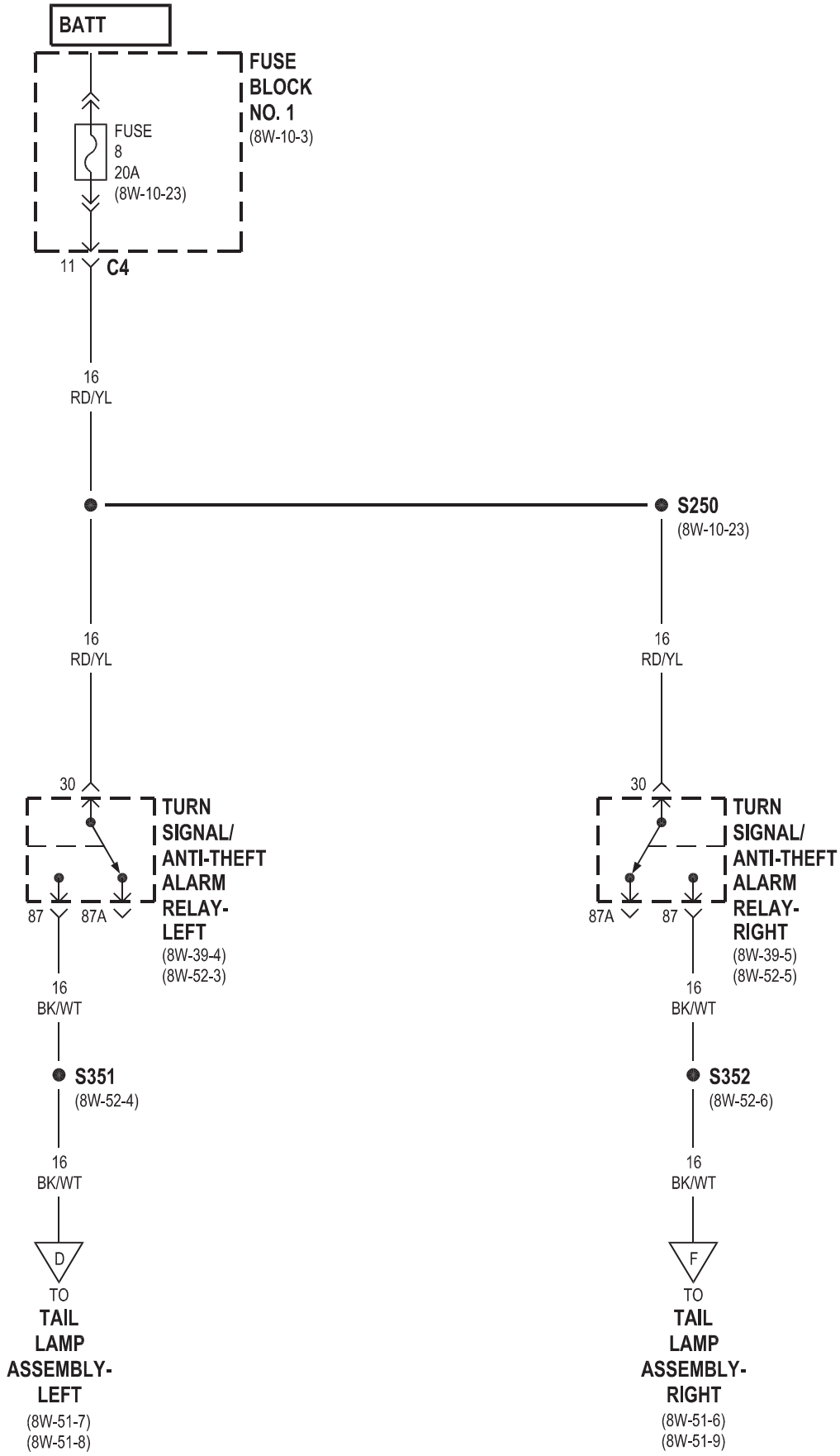
Component	Page
Brake Lamp Switch	8W-51-6
Center High Mounted Stop Lamp	8W-51-6, 8
Daytime Running Lamps Relay	8W-51-2, 10
Fuse 1	8W-51-4, 10
Fuse 8	8W-51-5
Fuse 11	8W-51-4
Fuse Block No. 1	8W-51-4, 5
Fuse Block No. 2	8W-51-10
G200	8W-51-6, 8
G202	8W-51-10
G300	8W-51-3, 6, 7, 8, 9, 10
Headlamp Switch	8W-51-4
License Plate Lamp No. 1	8W-51-3, 10
License Plate Lamp No. 2	8W-51-3, 10
Marker Lamp Connector	8W-51-10
Marker Lamp- Left Rear	8W-51-3
Marker Lamp- Right Rear	8W-51-3
Multi- Function Switch	8W-51-4
Shifter Assembly	8W-51-7, 8, 9
Tail Lamp Assembly- Left	8W-51-4, 5, 6, 7, 8, 9
Tail Lamp Assembly- Right	8W-51-4, 5, 6, 7, 8, 9
Turn Signal/Anti-Theft Alarm Relay- Left	8W-51-5
Turn Signal/Anti-Theft Alarm Relay- Right	8W-51-5


BATT
87A
DAYTIME
RUNNING
LAMPS
RELAY
(8W-50-13)
30
16
GY/DG
S316
(8W-11-26)
16
GY/DG/RD
16
GY/DG/RD
A
TO
S317
(8W-51-3)
B
TO
LICENSE
LAMPS
(8W-51-3)

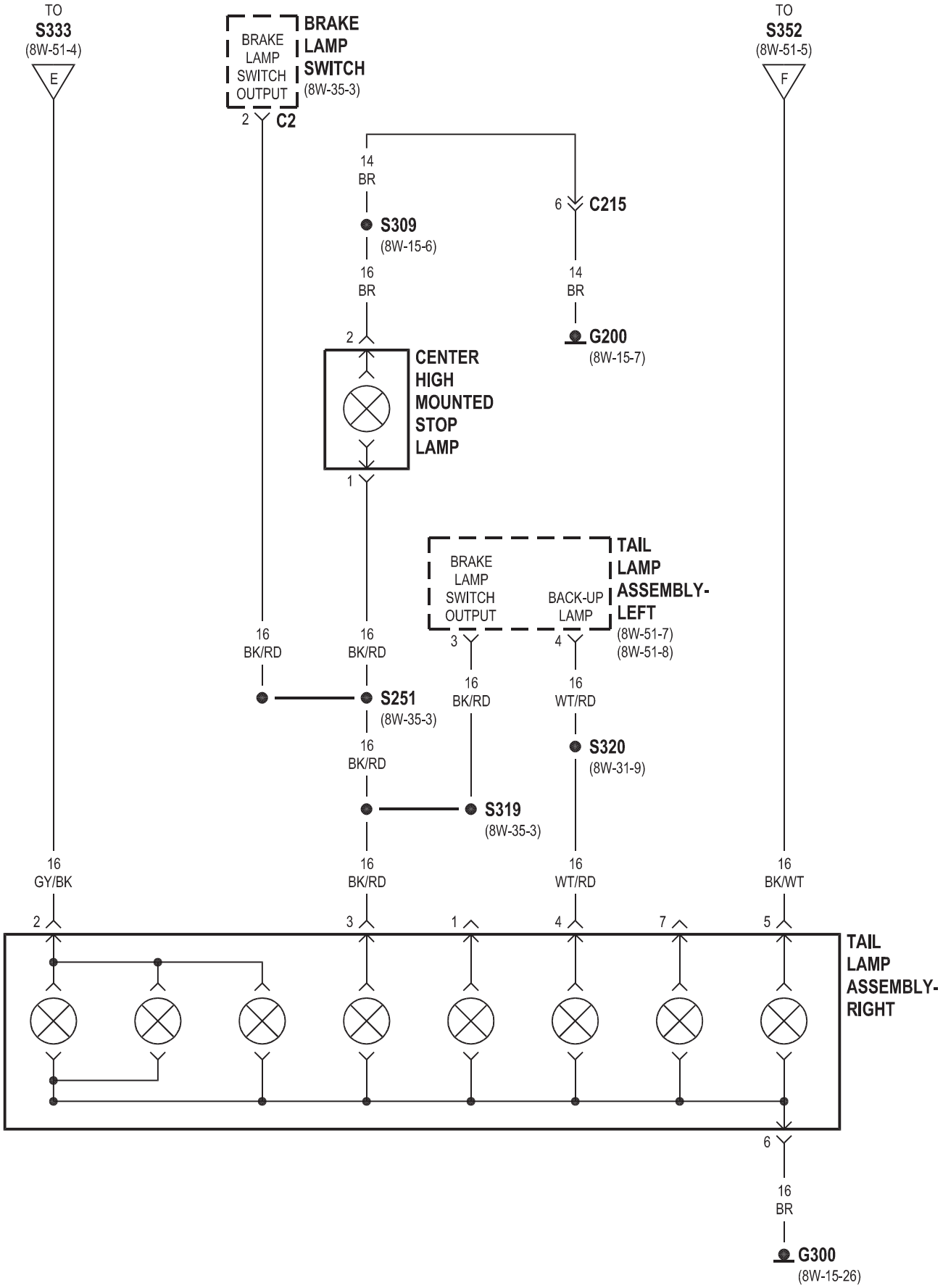


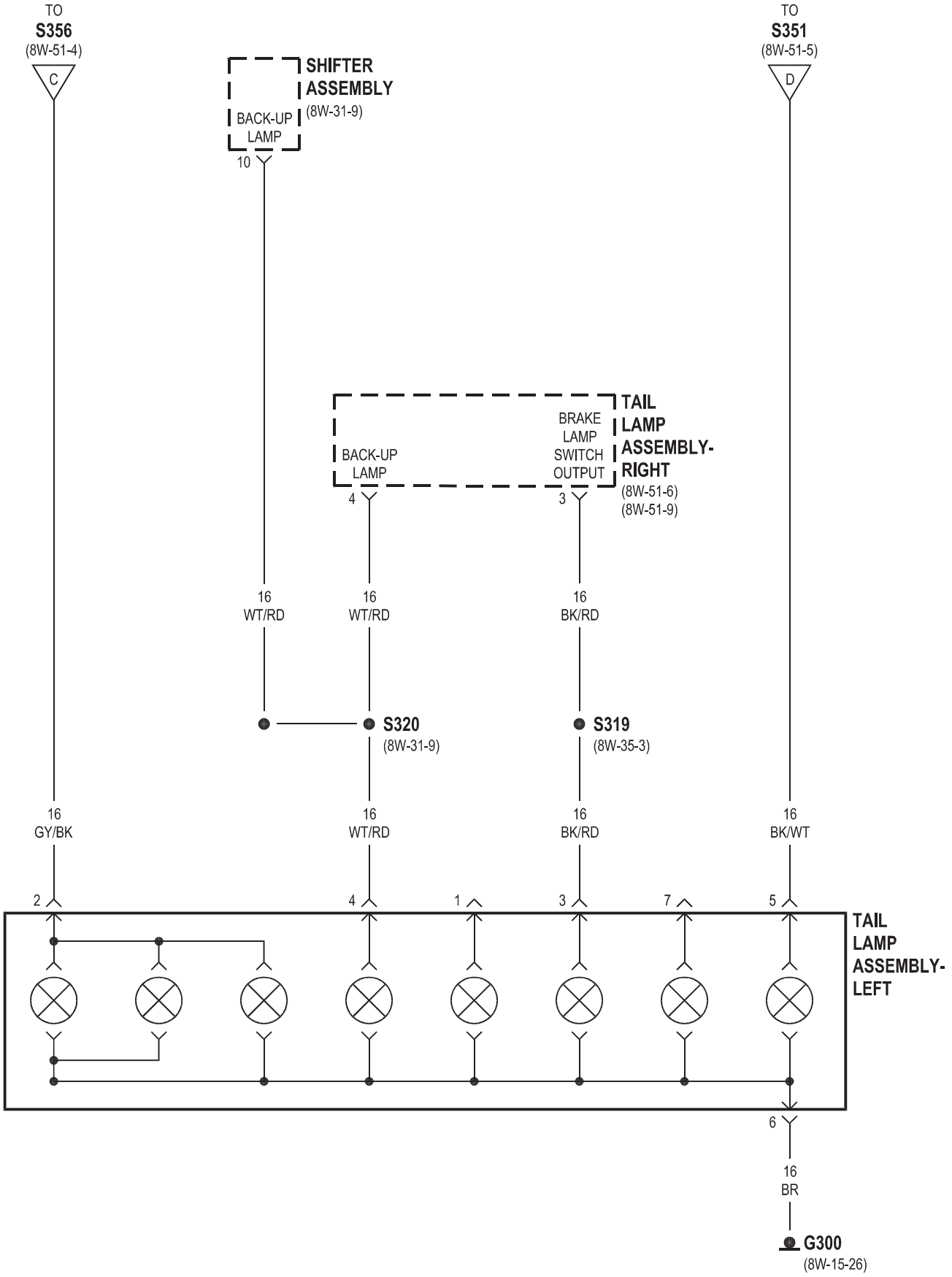
VA305103 J038W-24


MULTI-
FUNCTION
SWITCH
(8W-50-4)
(8W-50-6)
(8W-52-2)
(8W-53-3)
(8W-54-2)
HEADLAMP
SWITCH
(8W-50-4)
(8W-50-6)
6 C1
4 C1
FUSE
BLOCK
NO. 1
(8W-10-3)
FUSE
11
10A
(8W-10-26)
FUSE
1
10A
(8W-10-18)
4 C5
6 C5
16
GY/BK
16
GY/RD
S356
(8W-10-26)
S333
(8W-10-17)
16
GY/BK
16
GY/RD
C
E
TO
TAIL
LAMP
ASSEMBLY-
LEFT
(8W-51-7)
(8W-51-8)
TO
TAIL
LAMP
ASSEMBLY-
RIGHT
(8W-51-6)
(8W-51-9)

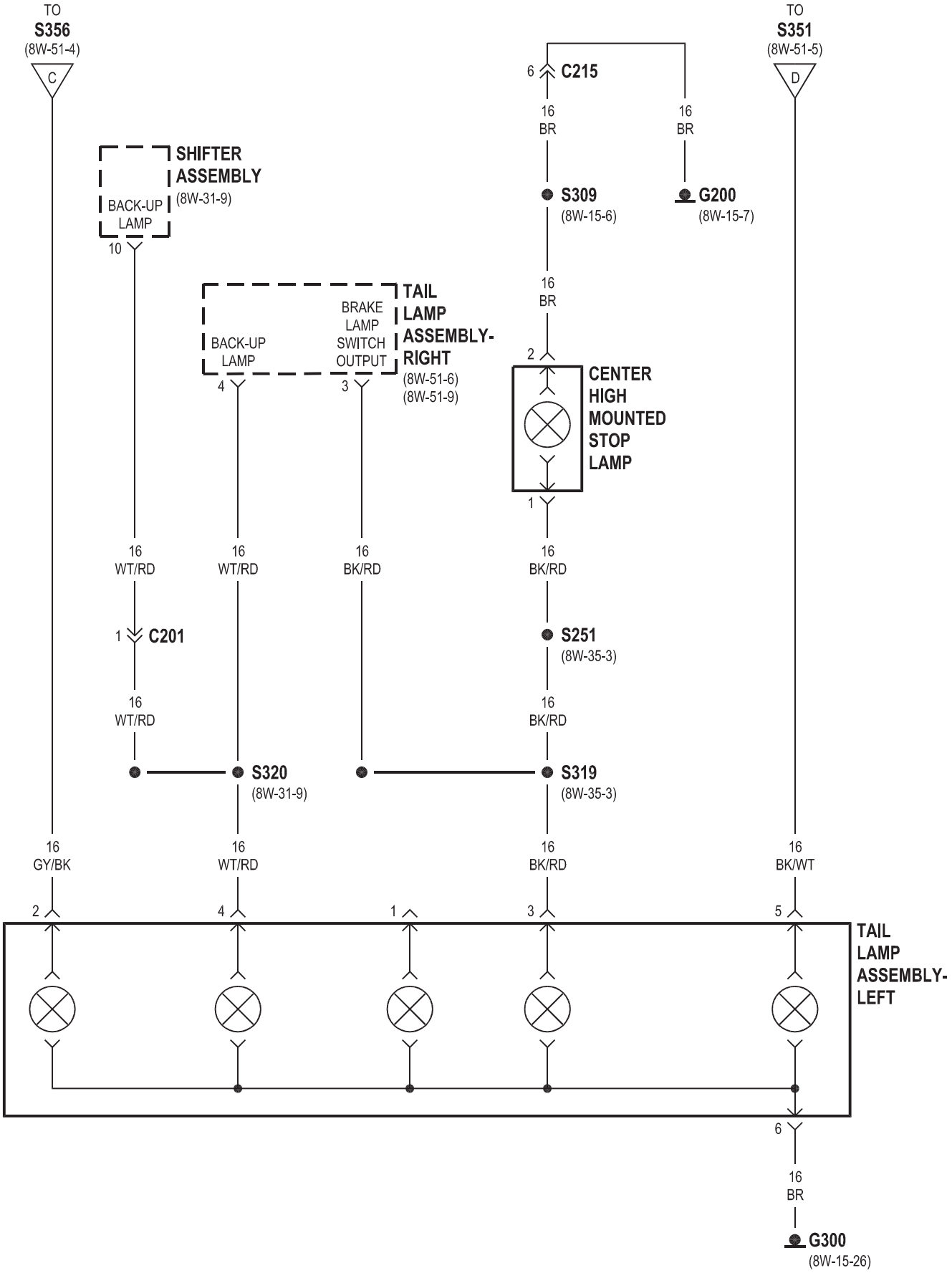


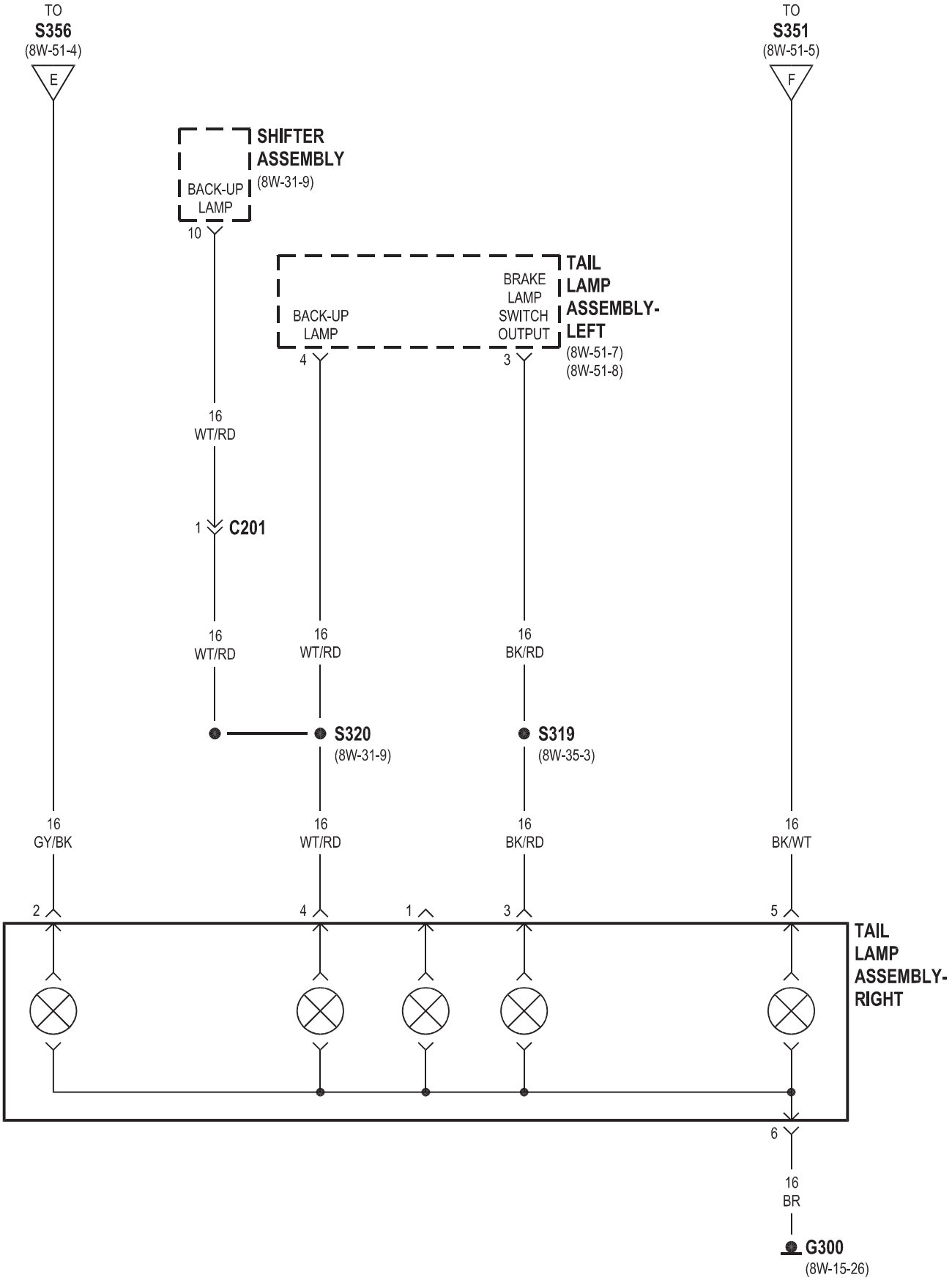
VA305105 J038W-24


TO
S333
(8W-51-4)
E
BRAKE LAMP SWITCH OUTPUT
BRAKE LAMP SWITCH
(8W-35-3)
2
C2
TO
S352
(8W-51-5)
F
14
BR
6
C215
S309
(8W-15-6)
16
BR
14
BR
G200
(8W-15-7)
2
CENTER HIGH MOUNTED STOP LAMP
1
BRAKE LAMP SWITCH OUTPUT
BACK-UP LAMP
TAIL LAMP ASSEMBLY-LEFT
(8W-51-7)
(8W-51-8)
3
4
16
BK/RD
16
BK/RD
16
BK/RD
16
WT/RD
S251
(8W-35-3)
S320
(8W-31-9)
16
BK/RD
S319
(8W-35-3)
16
GY/BK
16
BK/RD
16
WT/RD
16
BK/WT
2
3
1
4
7
5
TAIL LAMP ASSEMBLY-RIGHT
6
16
BR
G300
(8W-15-26)

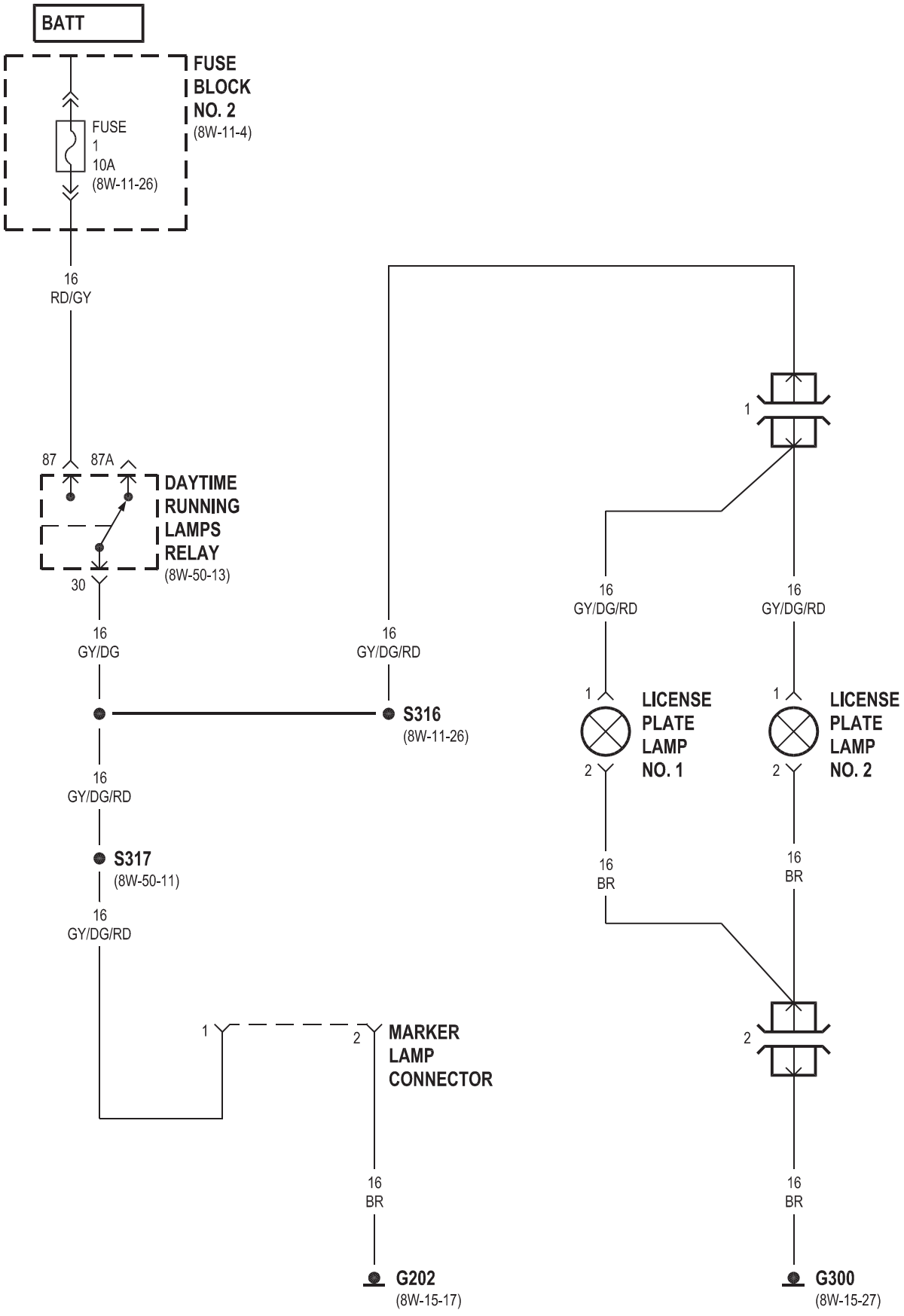


VA305107 J038W-24


TO
S356
(8W-51-4)
C
TO
S351
(8W-51-5)
D
6
C215
16
BR
16
BR
SHIFTER
ASSEMBLY
(8W-31-9)
BACK-UP
LAMP
10
S309
(8W-15-6)
G200
(8W-15-7)
16
BR
TAIL
LAMP
ASSEMBLY-
RIGHT
(8W-51-6)
(8W-51-9)
BACK-UP
LAMP
4
BRAKE
LAMP
SWITCH
OUTPUT
3
2
CENTER
HIGH
MOUNTED
STOP
LAMP
1
16
WT/RD
16
WT/RD
16
BK/RD
16
BK/RD
1
C201
S251
(8W-35-3)
16
WT/RD
16
BK/RD
S320
(8W-31-9)
S319
(8W-35-3)
16
GY/BK
16
WT/RD
16
BK/RD
16
BK/WT
2
4
1
3
5
TAIL
LAMP
ASSEMBLY-
LEFT
6
16
BR
G300
(8W-15-26)

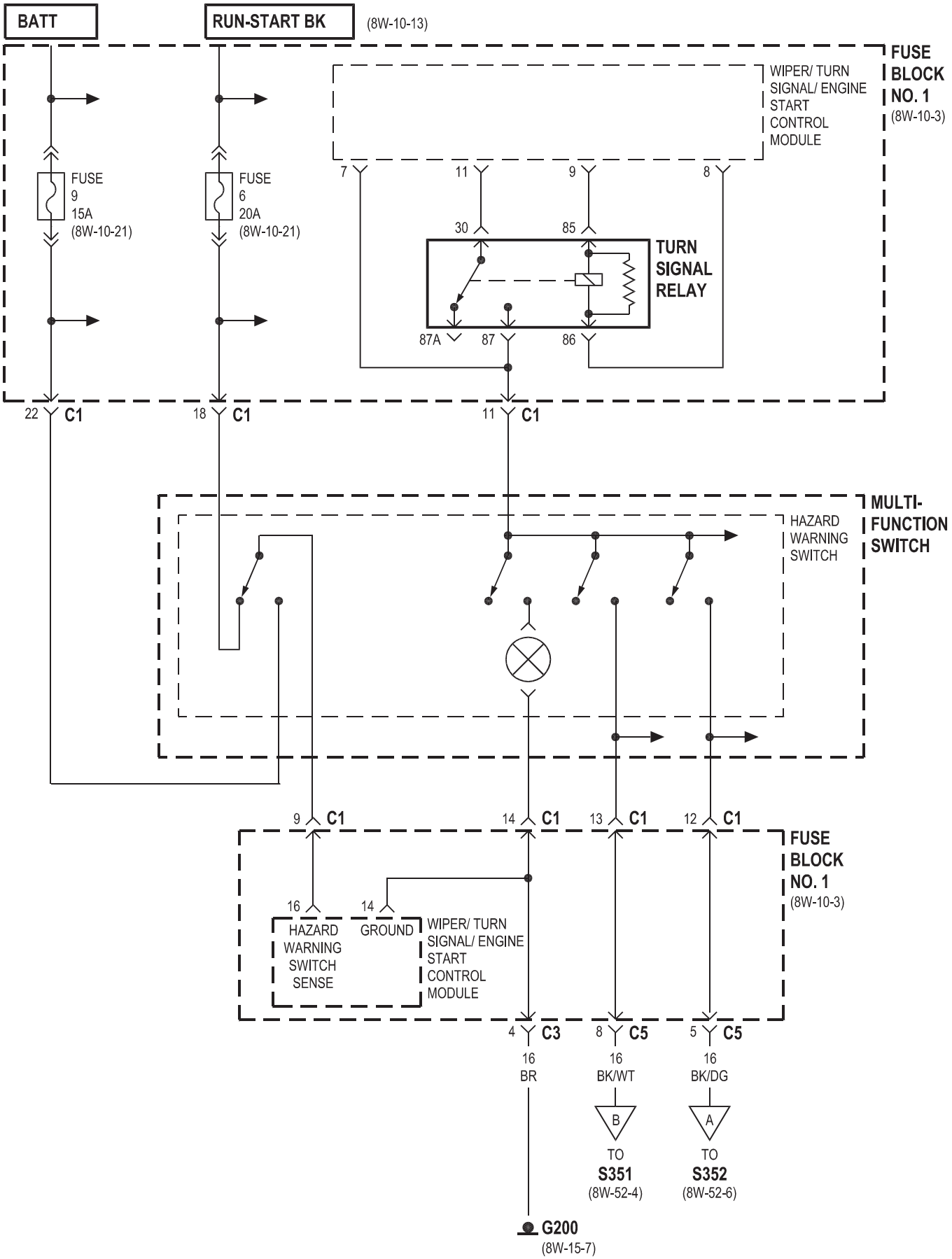


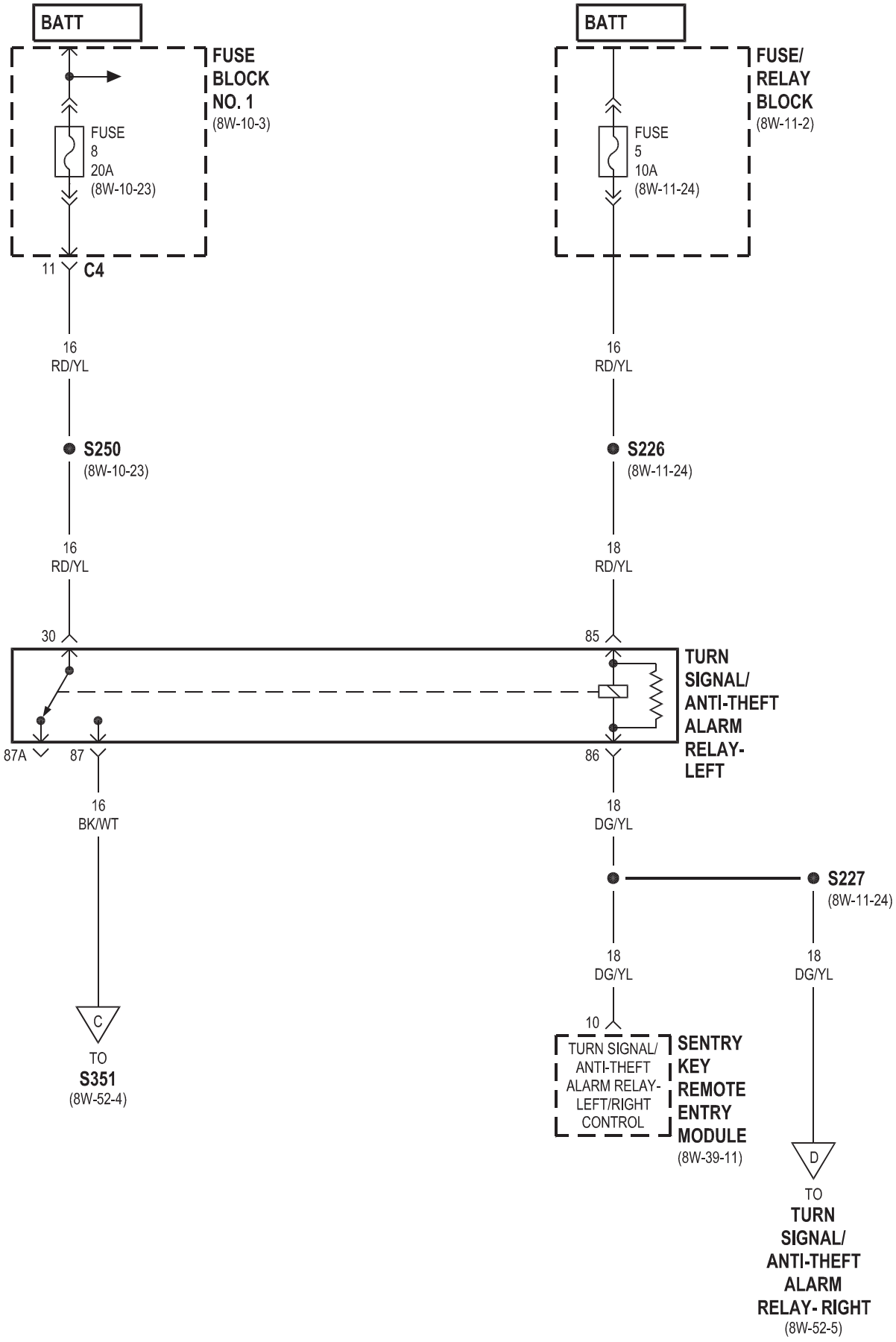
VA305109 J038W-24


BATT
FUSE BLOCK NO. 2
(8W-11-4)
FUSE 1 10A
(8W-11-26)
16 RD/GY
87
87A
DAYTIME RUNNING LAMPS RELAY
(8W-50-13)
30
16 GY/DG
16 GY/DG/RD
S316
(8W-11-26)
16 GY/DG/RD
S317
(8W-50-11)
16 GY/DG/RD
1
2
MARKER LAMP CONNECTOR
16 BR
G202
(8W-15-17)
1
16 GY/DG/RD
16 GY/DG/RD
1
LICENSE PLATE LAMP NO. 1
2
16 BR
1
LICENSE PLATE LAMP NO. 2
2
16 BR
2
16 BR
G300
(8W-15-27)

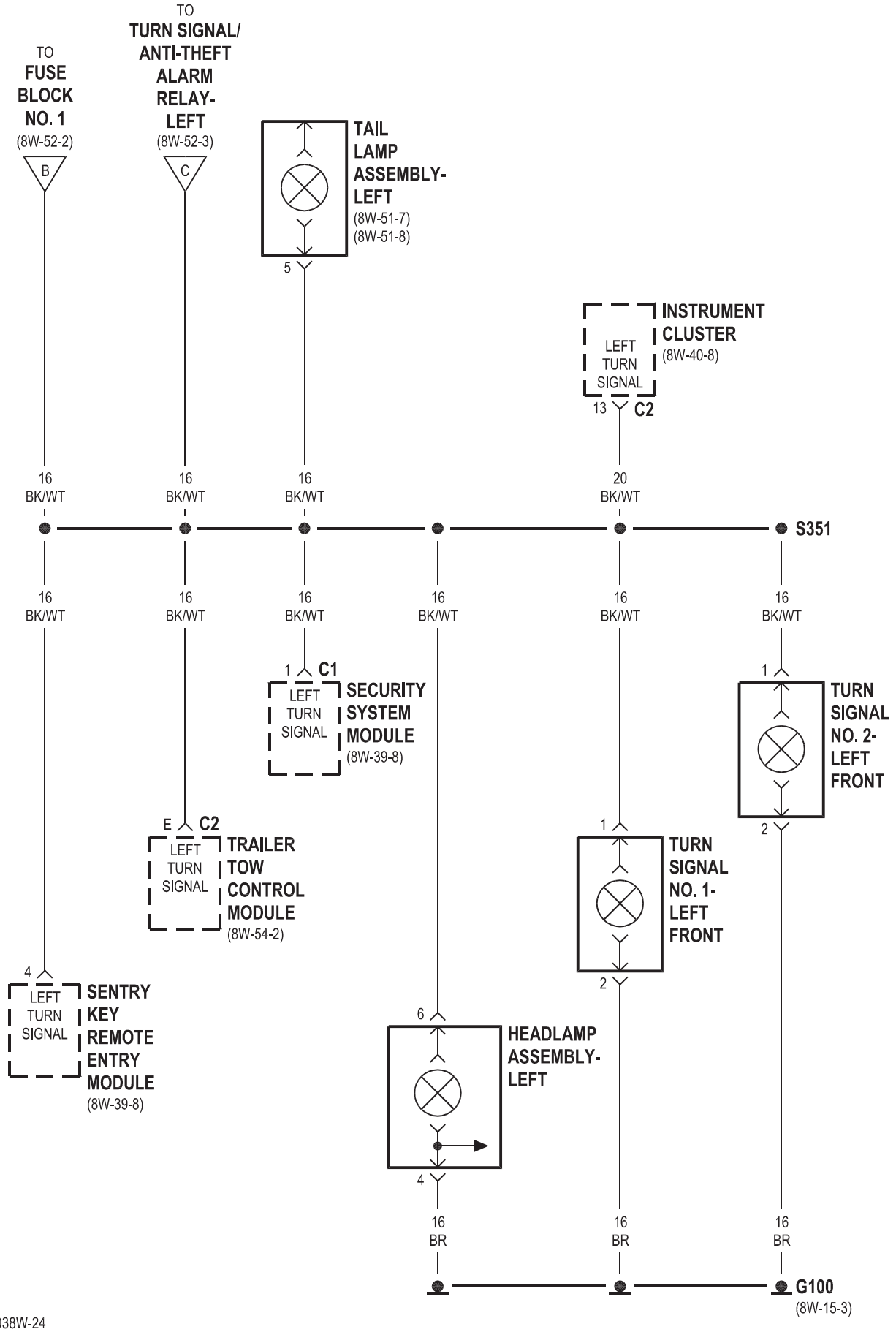
8W-52 TURN SIGNALS

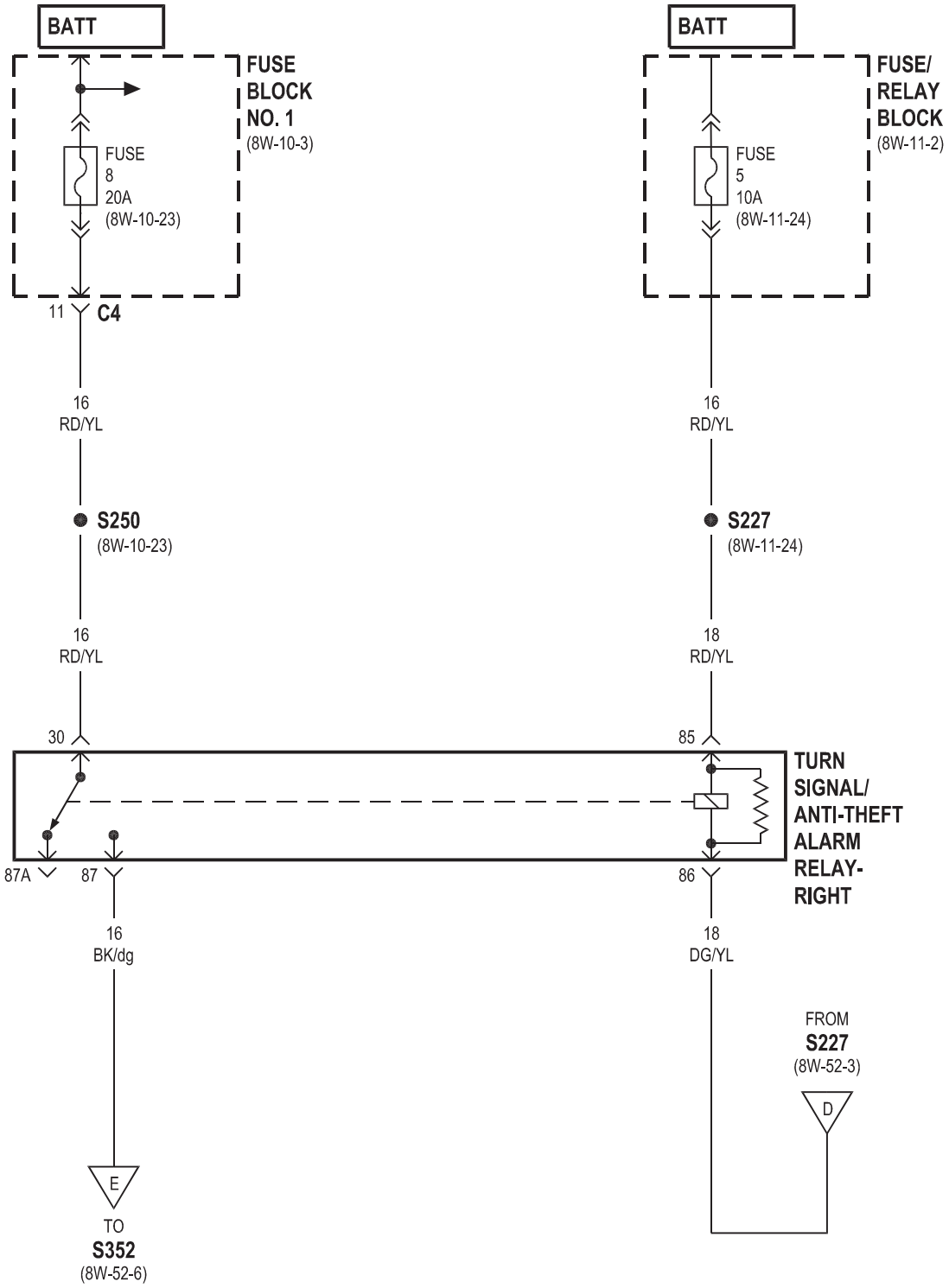
Component	Page
Fuse 5	8W-52-3, 5
Fuse 6	8W-52-2
Fuse 8	8W-52-3, 5
Fuse 9	8W-52-2
Fuse Block No. 1	8W-52-2, 3, 4, 5, 6
Fuse/Relay Block	8W-52-3, 5
G100	8W-52-4
G102	8W-52-6
G200	8W-52-2
Hazard Warning Switch	8W-52-2
Headlamp Assembly- Left	8W-52-4
Headlamp Assembly- Right	8W-52-6
Instrument Cluster	8W-52-4, 6
Multi- Function Switch	8W-52-2
Security System Module	8W-52-4, 6
Sentry Key Remote Entry Module	8W-52-3, 4
Tail Lamp Assembly- Left	8W-52-4
Tail Lamp Assembly- Right	8W-52-6
Trailer Tow Control Module	8W-52-4, 6
Turn Signal No. 1- Left Front	8W-52-4
Turn Signal No. 1- Right Front	8W-52-6
Turn Signal No. 2- Left Front	8W-52-4
Turn Signal No. 2- Right Front	8W-52-6
Turn Signal Relay	8W-52-2
Turn Signal/Anti-Theft Alarm Relay- Left	8W-52-3, 4
Turn Signal/Anti-Theft Alarm Relay- Right	8W-52-3, 5, 6
Wiper/Turn Signal/Engine Start Control Module	8W-52-2

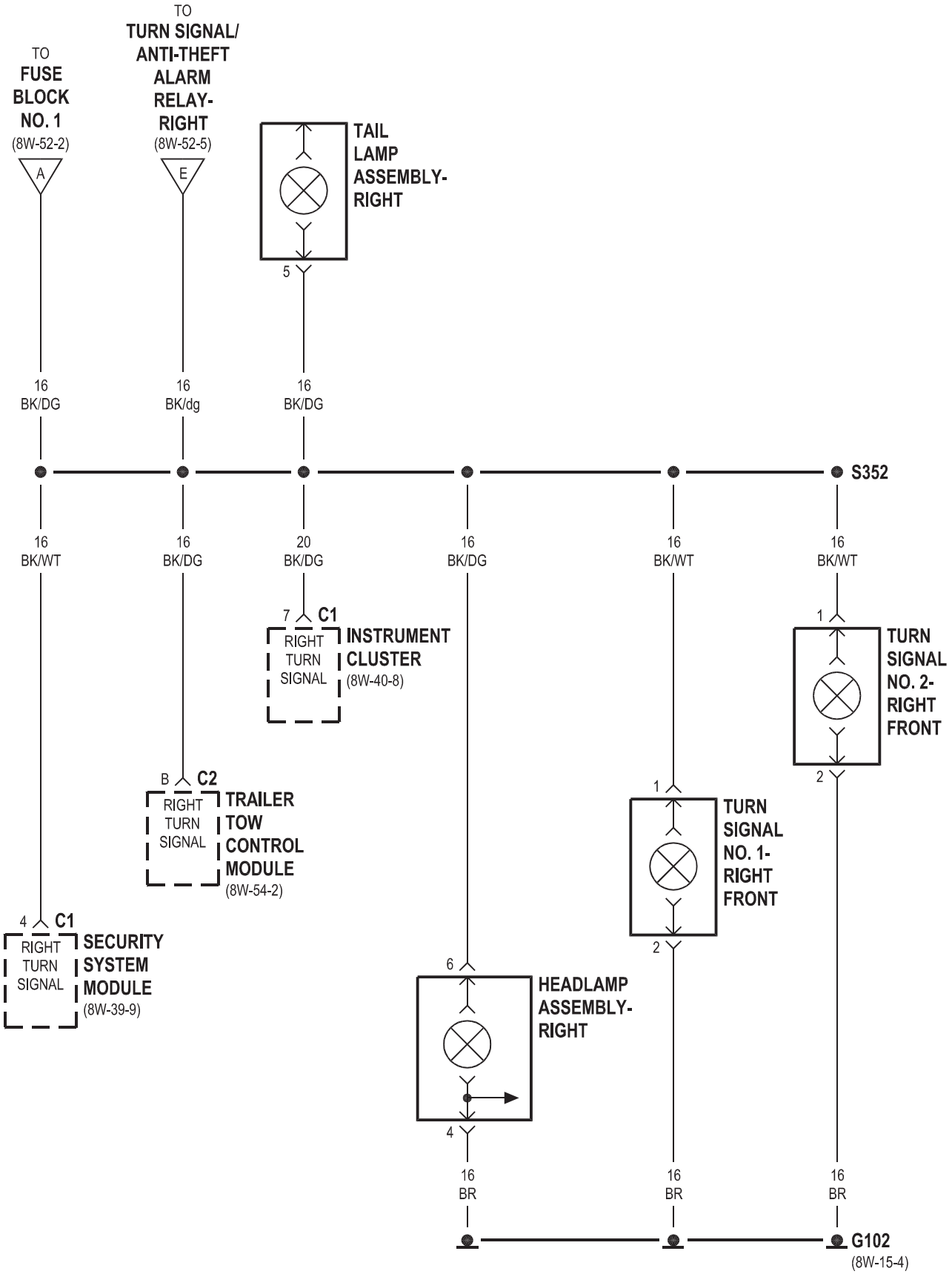

BATT
RUN-START BK
(8W-10-13)
FUSE BLOCK NO. 1
(8W-10-3)
WIPER/ TURN SIGNAL/ ENGINE START CONTROL MODULE
FUSE 9 15A (8W-10-21)
FUSE 6 20A (8W-10-21)
7
11
9
8
30
85
TURN SIGNAL RELAY
87A
87
86
22 C1
18 C1
11 C1
MULTI-FUNCTION SWITCH
HAZARD WARNING SWITCH
9 C1
14 C1
13 C1
12 C1
FUSE BLOCK NO. 1
(8W-10-3)
16
14
HAZARD WARNING SWITCH SENSE
GROUND
WIPER/ TURN SIGNAL/ ENGINE START CONTROL MODULE
4 C3
8 C5
5 C5
16 BR
16 BK/WT
16 BK/DG
B
A
TO S351 (8W-52-4)
TO S352 (8W-52-6)
G200
(8W-15-7)



VA305203 J038W-24

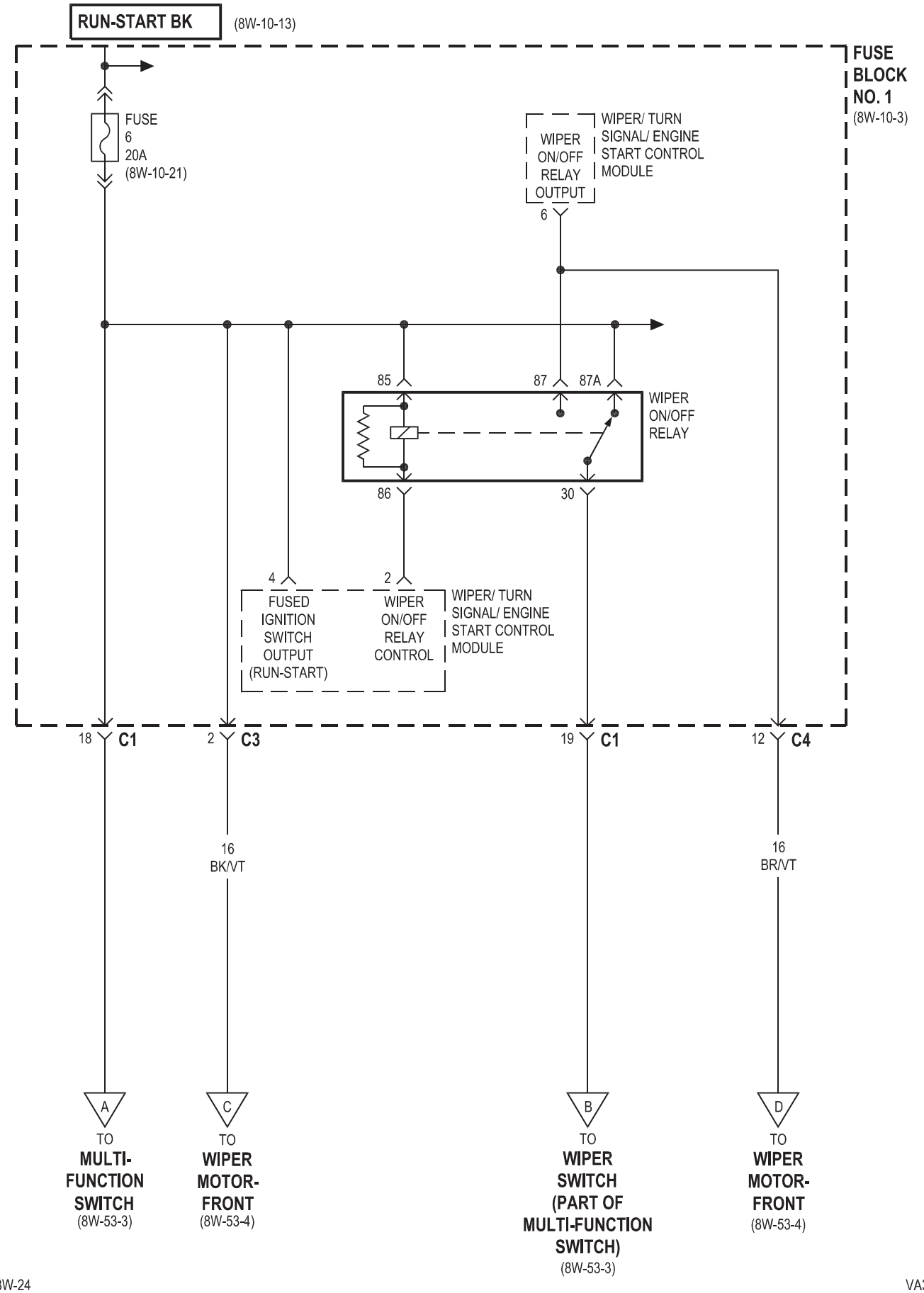

TO
FUSE
BLOCK
NO. 1
(8W-52-2)
B
TO
TURN SIGNAL/
ANTI-THEFT
ALARM
RELAY-
LEFT
(8W-52-3)
C
TAIL
LAMP
ASSEMBLY-
LEFT
(8W-51-7)
(8W-51-8)
5
INSTRUMENT
CLUSTER
(8W-40-8)
LEFT
TURN
SIGNAL
13
C2
16
BK/WT
20
BK/WT
S351
1
C1
SECURITY
SYSTEM
MODULE
(8W-39-8)
E
C2
TRAILER
TOW
CONTROL
MODULE
(8W-54-2)
TURN
SIGNAL
NO. 2-
LEFT
FRONT
TURN
SIGNAL
NO. 1-
LEFT
FRONT
4
SENTRY
KEY
REMOTE
ENTRY
MODULE
(8W-39-8)
6
HEADLAMP
ASSEMBLY-
LEFT
16
BR
G100
(8W-15-3)

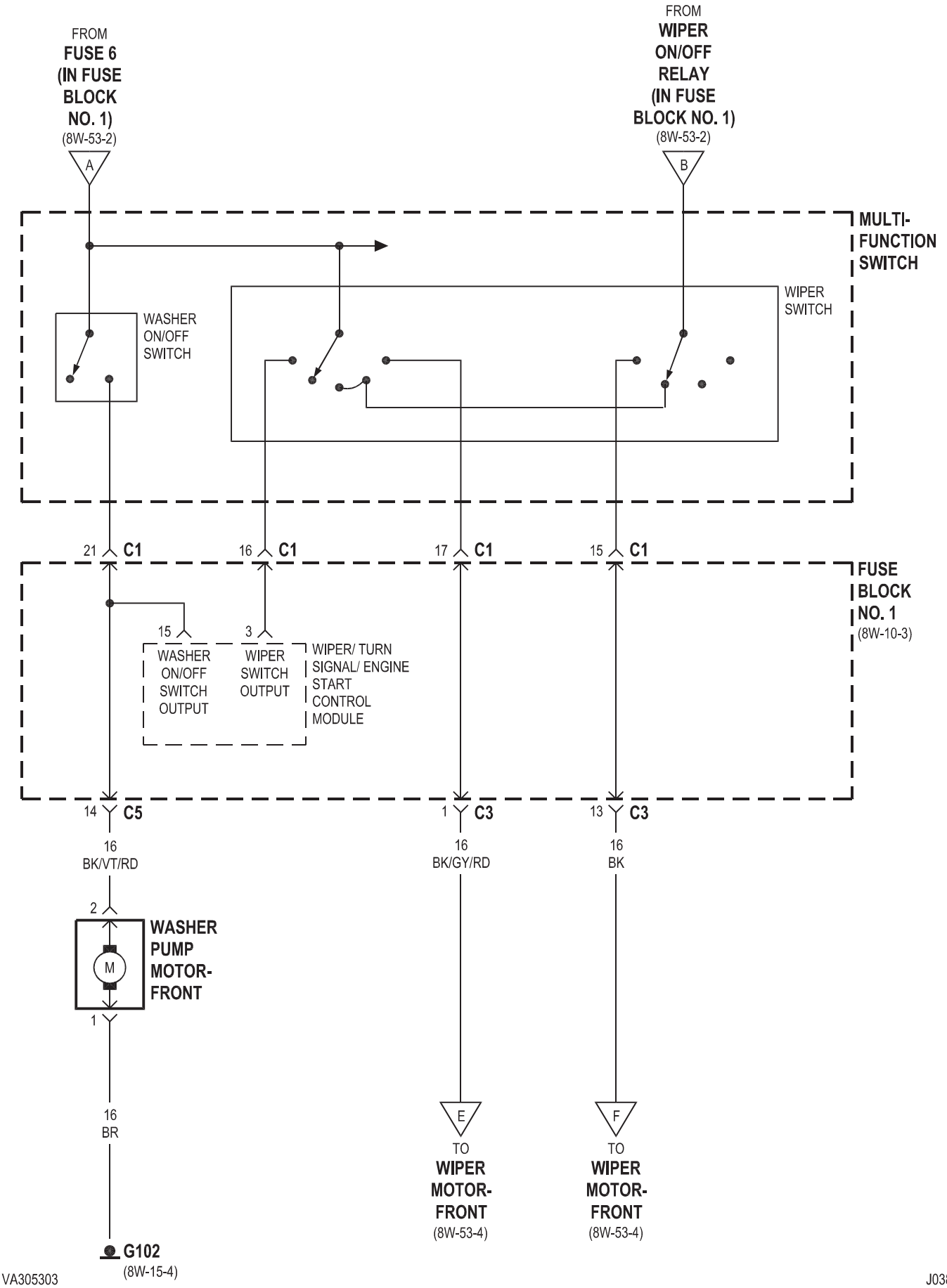

BATT
FUSE BLOCK NO. 1
(8W-10-3)
FUSE 8 20A
(8W-10-23)
11
C4
16 RD/YL
S250
(8W-10-23)
16 RD/YL
30
87A
87
16 BK/dg
E
TO S352
(8W-52-6)
BATT
FUSE/ RELAY BLOCK
(8W-11-2)
FUSE 5 10A
(8W-11-24)
16 RD/YL
S227
(8W-11-24)
18 RD/YL
85
86
18 DG/YL
TURN SIGNAL/ ANTI-THEFT ALARM RELAY-RIGHT
FROM S227
(8W-52-3)
D


TO
FUSE
BLOCK
NO. 1
(8W-52-2)
A
TO
TURN SIGNAL/
ANTI-THEFT
ALARM
RELAY-
RIGHT
(8W-52-5)
E
TAIL
LAMP
ASSEMBLY-
RIGHT
5
16
BK/DG
16
BK/dg
16
BK/DG
S352
16
BK/WT
16
BK/DG
20
BK/DG
16
BK/DG
16
BK/WT
16
BK/WT
7
C1
RIGHT
TURN
SIGNAL
INSTRUMENT
CLUSTER
(8W-40-8)
1
TURN
SIGNAL
NO. 2-
RIGHT
FRONT
2
B
C2
RIGHT
TURN
SIGNAL
TRAILER
TOW
CONTROL
MODULE
(8W-54-2)
1
TURN
SIGNAL
NO. 1-
RIGHT
FRONT
2
4
C1
RIGHT
TURN
SIGNAL
SECURITY
SYSTEM
MODULE
(8W-39-9)
6
HEADLAMP
ASSEMBLY-
RIGHT
4
16
BR
16
BR
16
BR
G102
(8W-15-4)

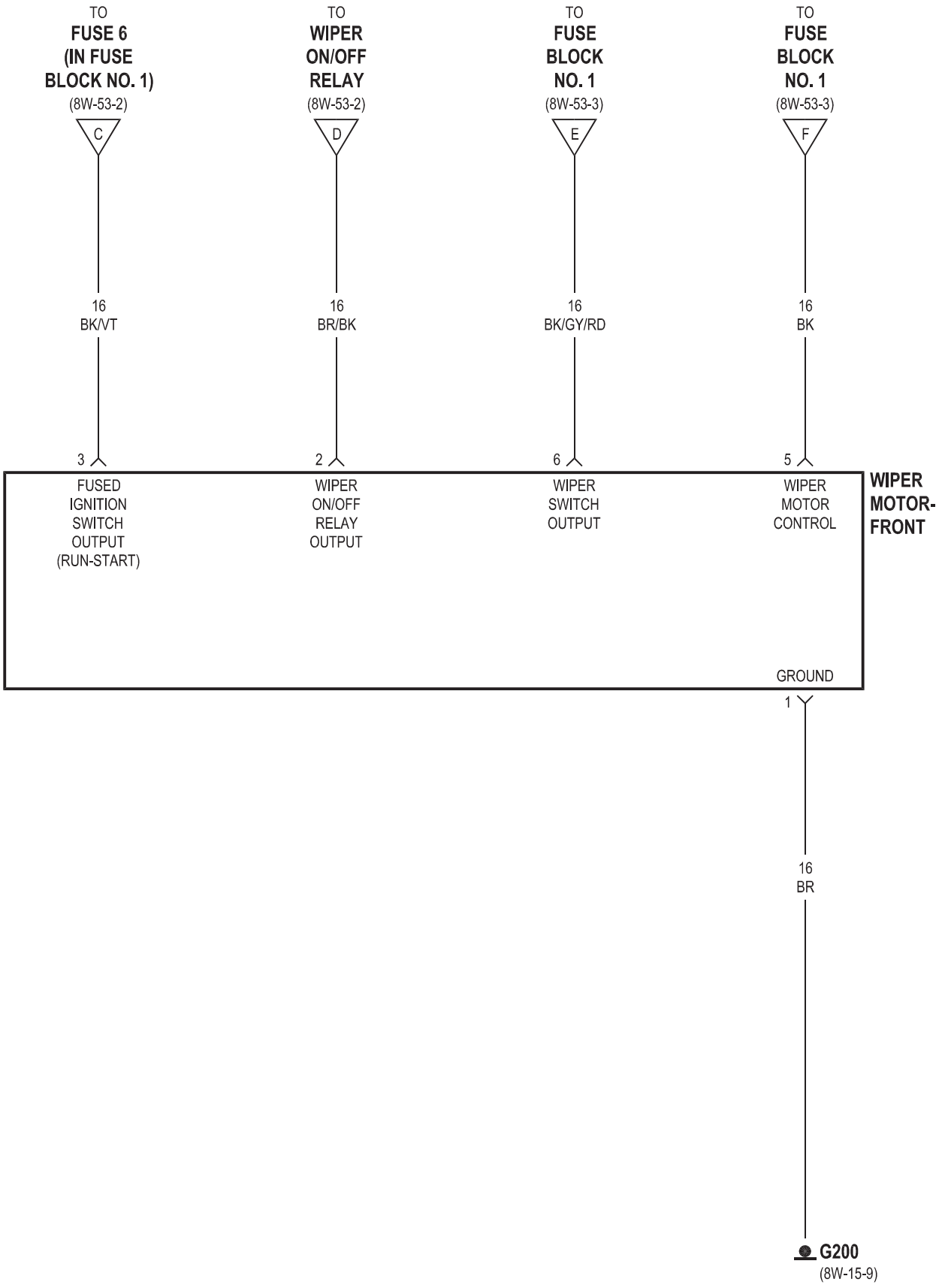
8W-53 WIPERS

Component	Page
Fuse 6	8W-53-2, 3, 4
Fuse Block No. 1	8W-53-2, 3, 4
G102	8W-53-3
G200	8W-53-4
Multi- Function Switch	8W-53-2, 3
Washer On/Off Switch	8W-53-3
Washer Pump Motor- Front	8W-53-3
Wiper Motor- Front	8W-53-2, 3, 4
Wiper On/Off Relay	8W-53-2, 3, 4
Wiper Switch	8W-53-2, 3
Wiper/Turn Signal/Engine Start Control Module	8W-53-2, 3


RUN-START BK
(8W-10-13)
FUSE BLOCK NO. 1
(8W-10-3)
FUSE
6
20A
(8W-10-21)
WIPER ON/OFF RELAY OUTPUT
WIPER/ TURN SIGNAL/ ENGINE START CONTROL MODULE
6
85
87
87A
WIPER ON/OFF RELAY
86
30
4
2
FUSED IGNITION SWITCH OUTPUT (RUN-START)
WIPER ON/OFF RELAY CONTROL
WIPER/ TURN SIGNAL/ ENGINE START CONTROL MODULE
18 C1
2 C3
19 C1
12 C4
16 BK/VT
16 BR/VT
A
C
B
D
TO MULTI-FUNCTION SWITCH (8W-53-3)
TO WIPER MOTOR-FRONT (8W-53-4)
TO WIPER SWITCH (PART OF MULTI-FUNCTION SWITCH) (8W-53-3)
TO WIPER MOTOR-FRONT (8W-53-4)

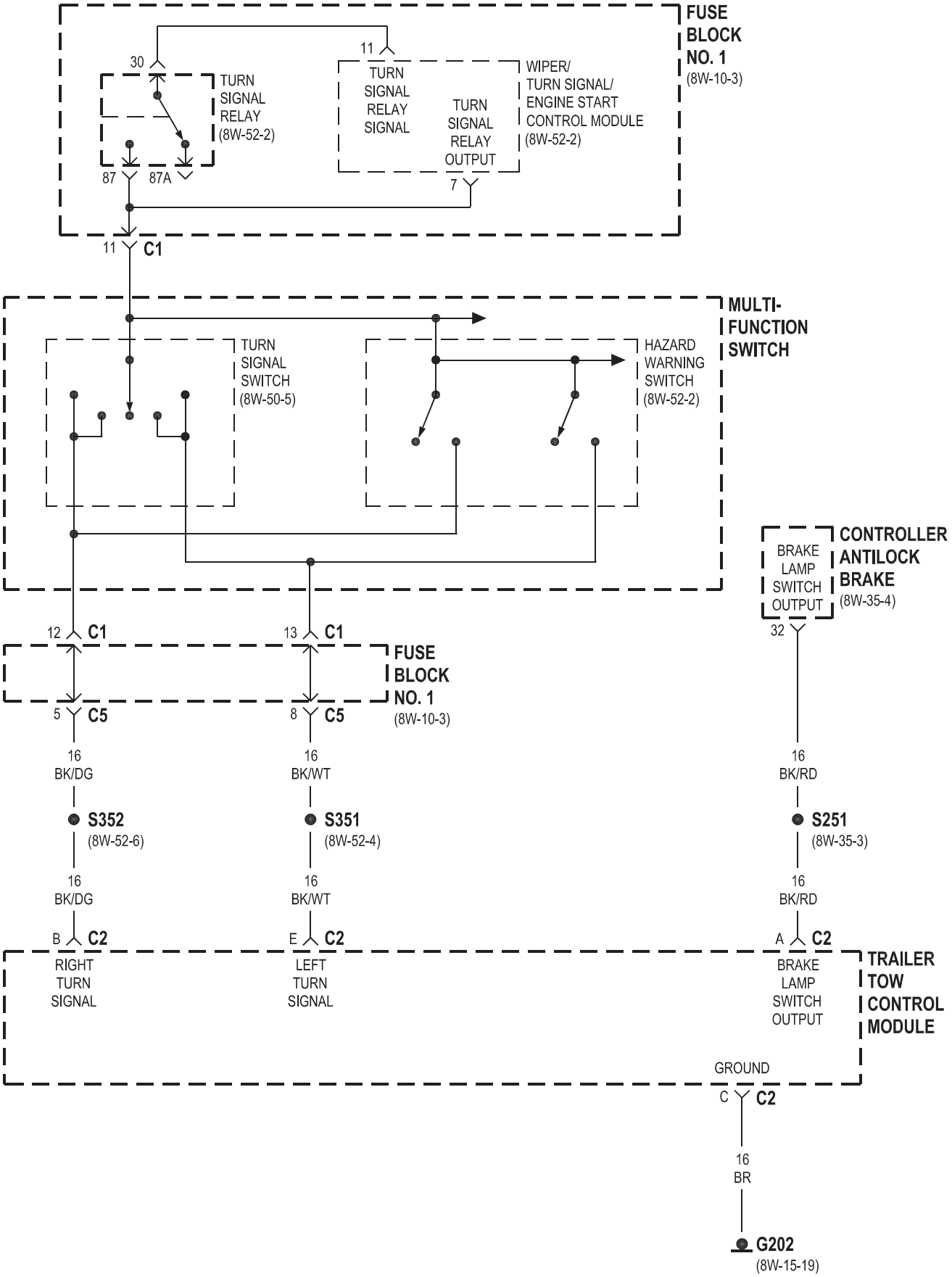


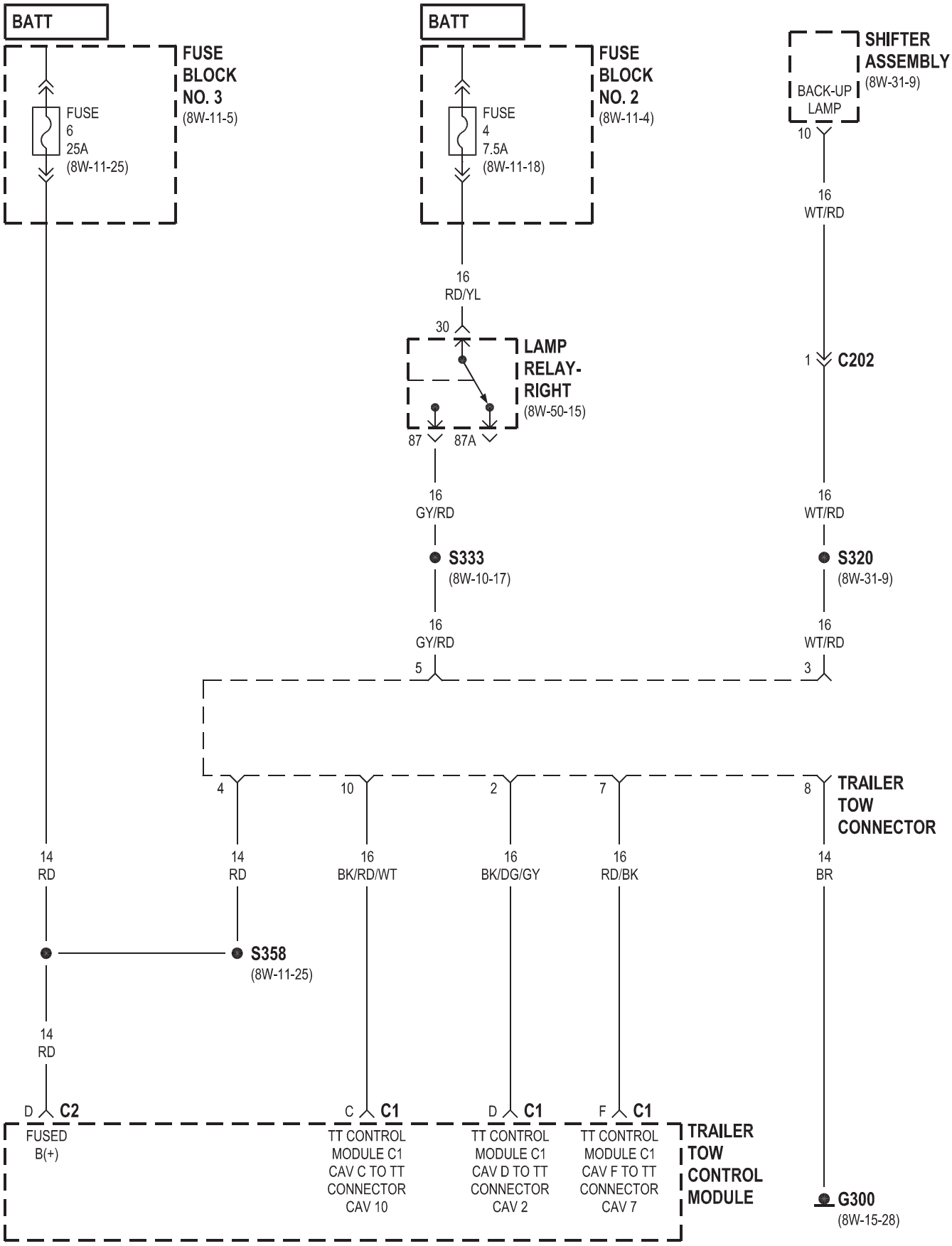
VA305303 J038W-24


TO
FUSE 6
(IN FUSE
BLOCK NO. 1)
(8W-53-2)
C
16
BK/VT
3
FUSED
IGNITION
SWITCH
OUTPUT
(RUN-START)
TO
WIPER
ON/OFF
RELAY
(8W-53-2)
D
16
BR/BK
2
WIPER
ON/OFF
RELAY
OUTPUT
TO
FUSE
BLOCK
NO. 1
(8W-53-3)
E
16
BK/GY/RD
6
WIPER
SWITCH
OUTPUT
TO
FUSE
BLOCK
NO. 1
(8W-53-3)
F
16
BK
5
WIPER
MOTOR
CONTROL
WIPER
MOTOR-
FRONT
GROUND
1
16
BR
G200
(8W-15-9)

8W-54 TRAILER TOW

Component	Page
Controller Antilock Brake	8W-54-2
Fuse 4	8W-54-3
Fuse 6	8W-54-3
Fuse Block No. 1	8W-54-2
Fuse Block No. 2	8W-54-3
Fuse Block No. 3	8W-54-3
G202	8W-54-2
G300	8W-54-3
Hazard Warning Switch	8W-54-2
Lamp Relay- Right	8W-54-3
Multi- Function Switch	8W-54-2
Shifter Assembly	8W-54-3
Trailer Tow Connector	8W-54-3
Trailer Tow Control Module	8W-54-2, 3
Turn Signal Relay	8W-54-2
Turn Signal Switch	8W-54-2
Wiper/Turn Signal/Engine Start Control Module	8W-54-2

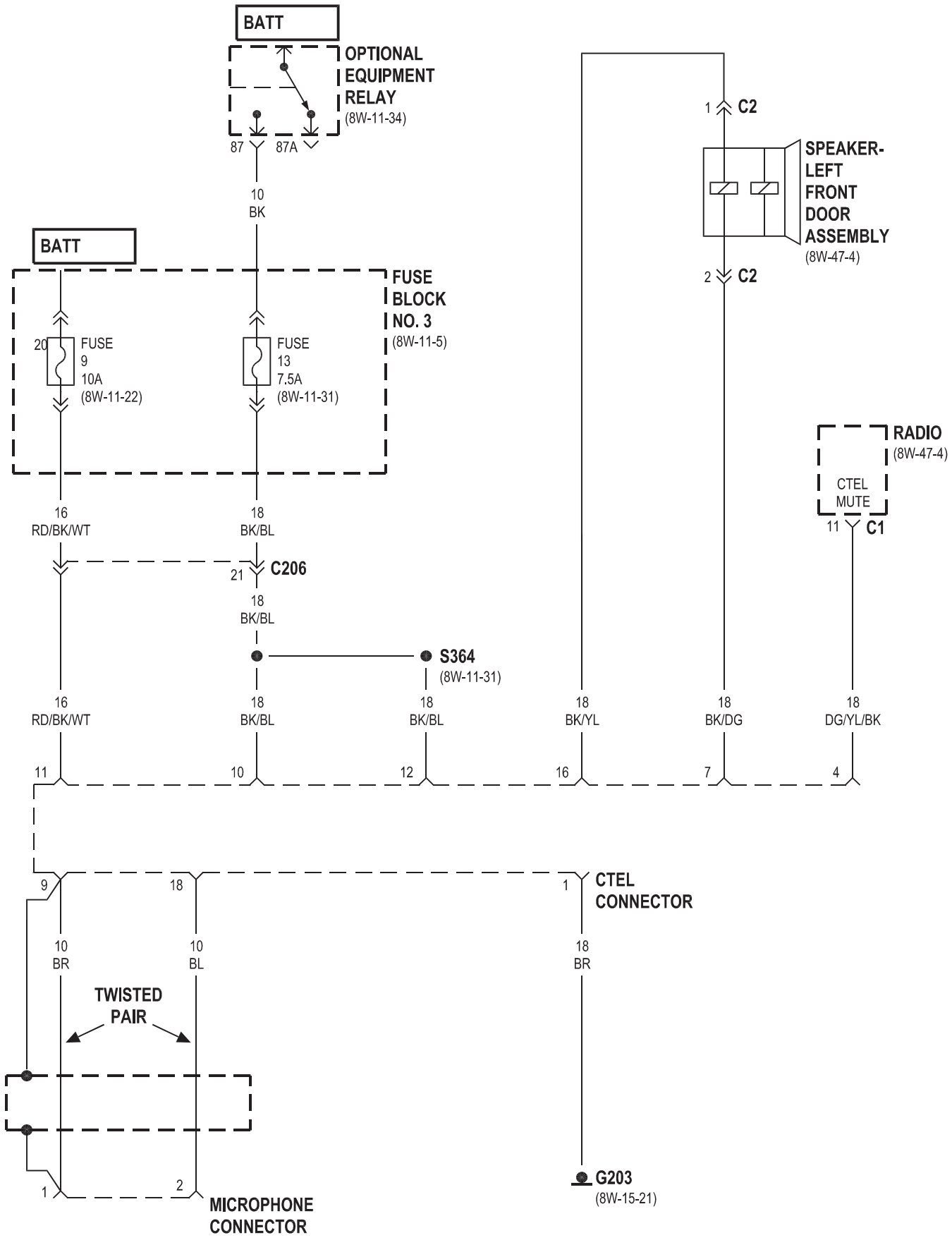

FUSE BLOCK NO. 1
(8W-10-3)
30
TURN SIGNAL RELAY
(8W-52-2)
87
87A
11
TURN SIGNAL RELAY SIGNAL
TURN SIGNAL RELAY OUTPUT
WIPER/ TURN SIGNAL/ ENGINE START CONTROL MODULE
(8W-52-2)
7
11 C1
MULTI-FUNCTION SWITCH
TURN SIGNAL SWITCH
(8W-50-5)
HAZARD WARNING SWITCH
(8W-52-2)
CONTROLLER ANTILOCK BRAKE
(8W-35-4)
BRAKE LAMP SWITCH OUTPUT
32
12 C1
13 C1
FUSE BLOCK NO. 1
(8W-10-3)
5 C5
8 C5
16 BK/DG
16 BK/WT
16 BK/RD
S352
(8W-52-6)
S351
(8W-52-4)
S251
(8W-35-3)
16 BK/DG
16 BK/WT
16 BK/RD
B C2
E C2
A C2
RIGHT TURN SIGNAL
LEFT TURN SIGNAL
BRAKE LAMP SWITCH OUTPUT
TRAILER TOW CONTROL MODULE
GROUND
C C2
16 BR
G202
(8W-15-19)

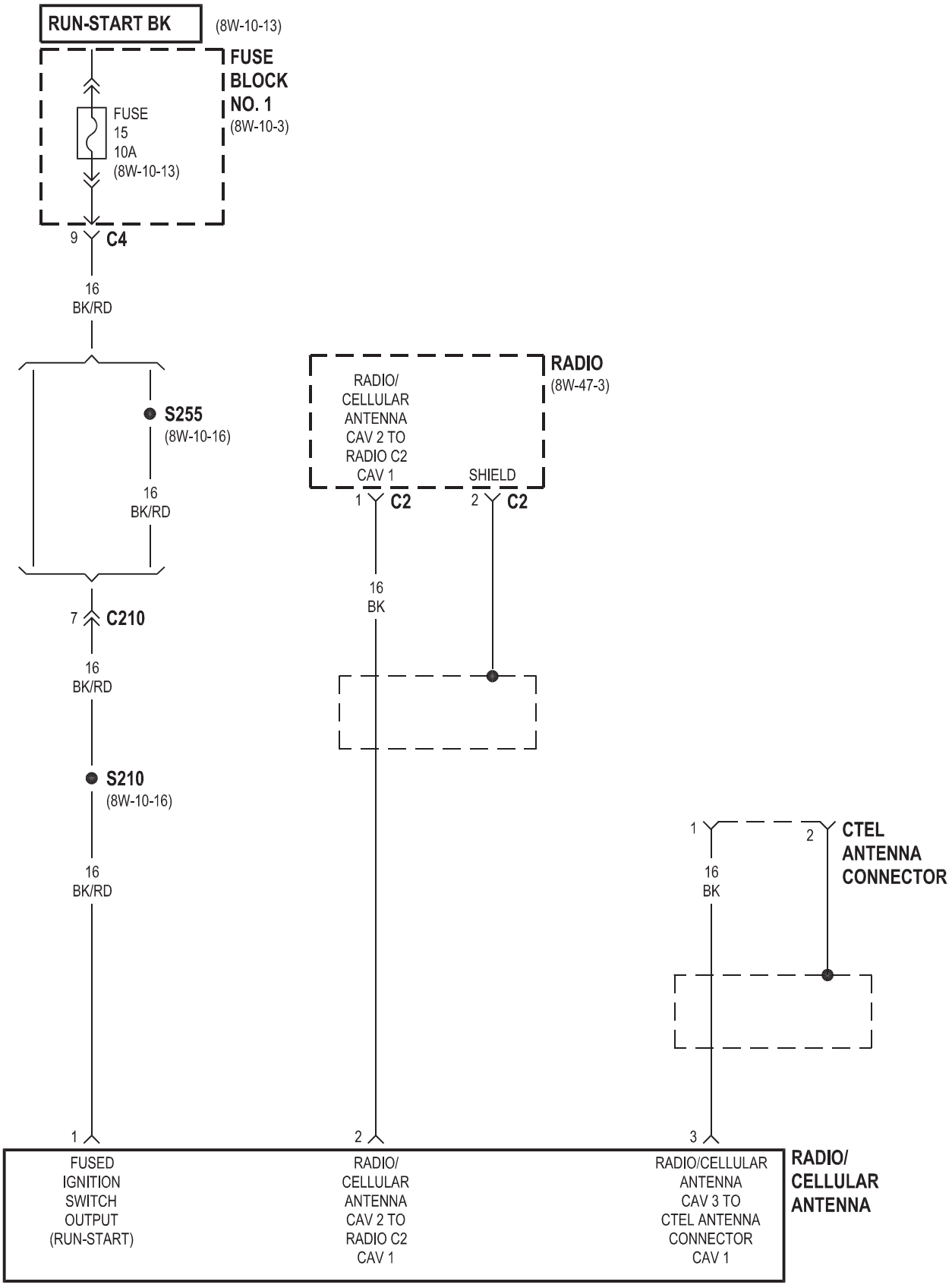


VA305403 J038W-24

8W-55 NAVIGATION/TELECOMMUNICATIONS

Component	Page
CTEL Antenna Connector	8W-55-3
CTEL Connector	8W-55-2
Fuse 9	8W-55-2
Fuse 13	8W-55-2
Fuse 15	8W-55-3
Fuse Block No. 1	8W-55-3
Fuse Block No. 3	8W-55-2
G203	8W-55-2
Microphone Connector	8W-55-2
Optional Equipment Relay	8W-55-2
Radio	8W-55-2, 3
Radio/Cellular Antenna	8W-55-3
Speaker- Left Front Door Assembly	8W-55-2

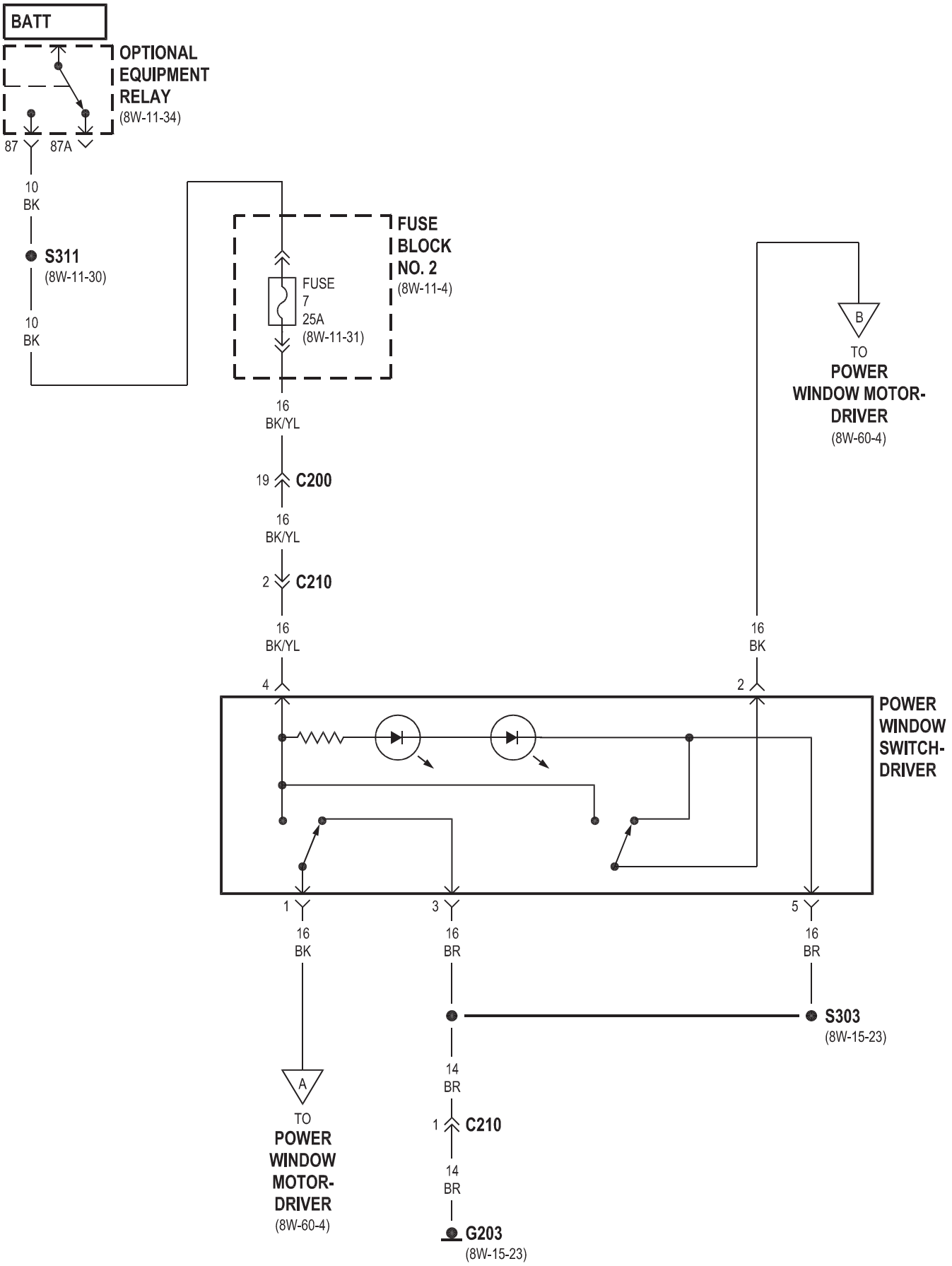

BATT
OPTIONAL EQUIPMENT RELAY
(8W-11-34)
87
87A
10
BK
BATT
FUSE BLOCK NO. 3
(8W-11-5)
20
FUSE 9 10A
(8W-11-22)
FUSE 13 7.5A
(8W-11-31)
16
RD/BK/WT
18
BK/BL
21
C206
18
BK/BL
S364
(8W-11-31)
16
RD/BK/WT
18
BK/BL
18
BK/BL
18
BK/YL
18
BK/DG
18
DG/YL/BK
11
10
12
16
7
4
1
C2
SPEAKER-LEFT FRONT DOOR ASSEMBLY
(8W-47-4)
2
C2
RADIO
(8W-47-4)
CTEL MUTE
11
C1
9
18
1
CTEL CONNECTOR
10
BR
10
BL
18
BR
TWISTED PAIR
1
2
MICROPHONE CONNECTOR
G203
(8W-15-21)

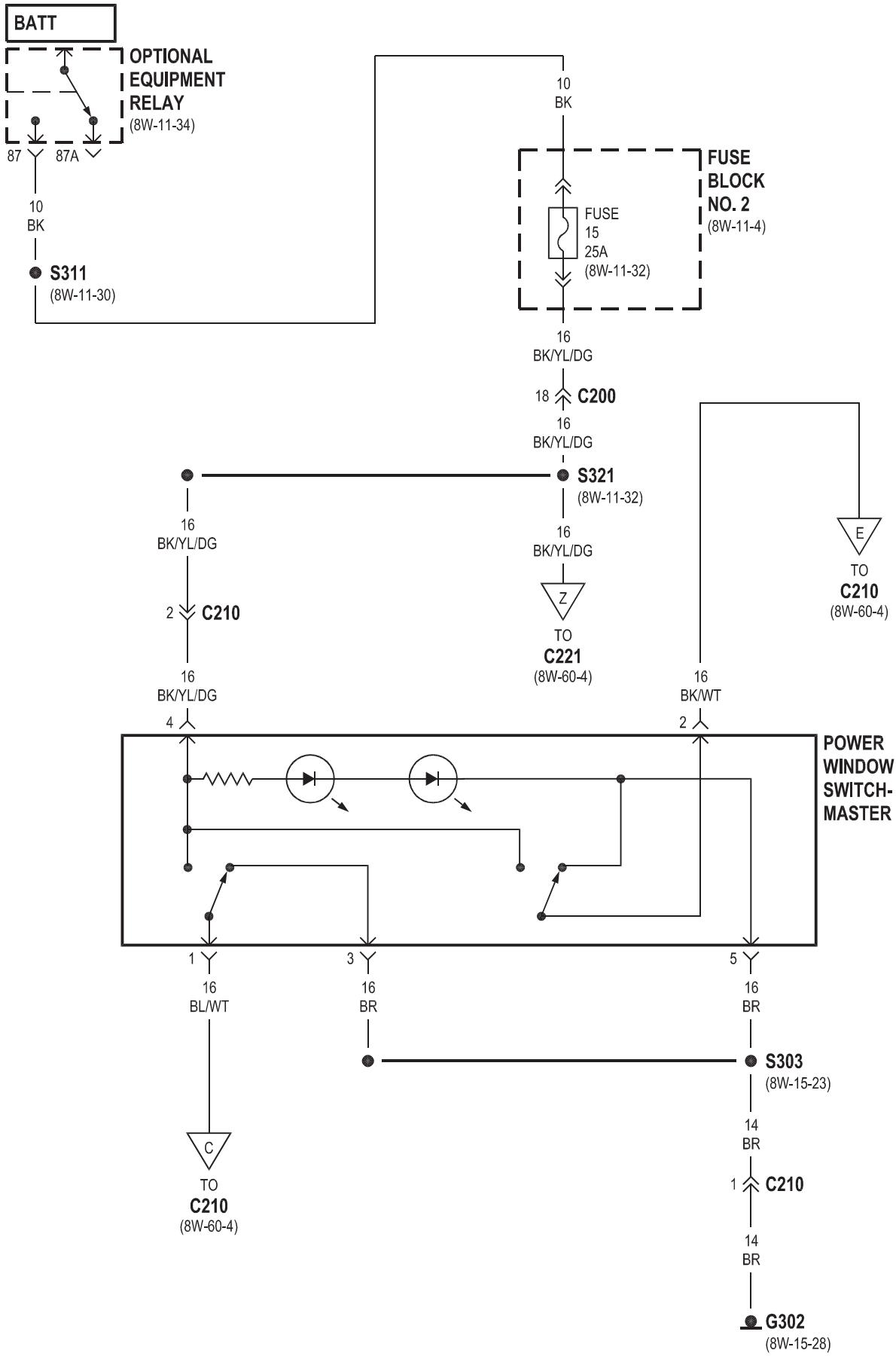


VA305503 J038W-24

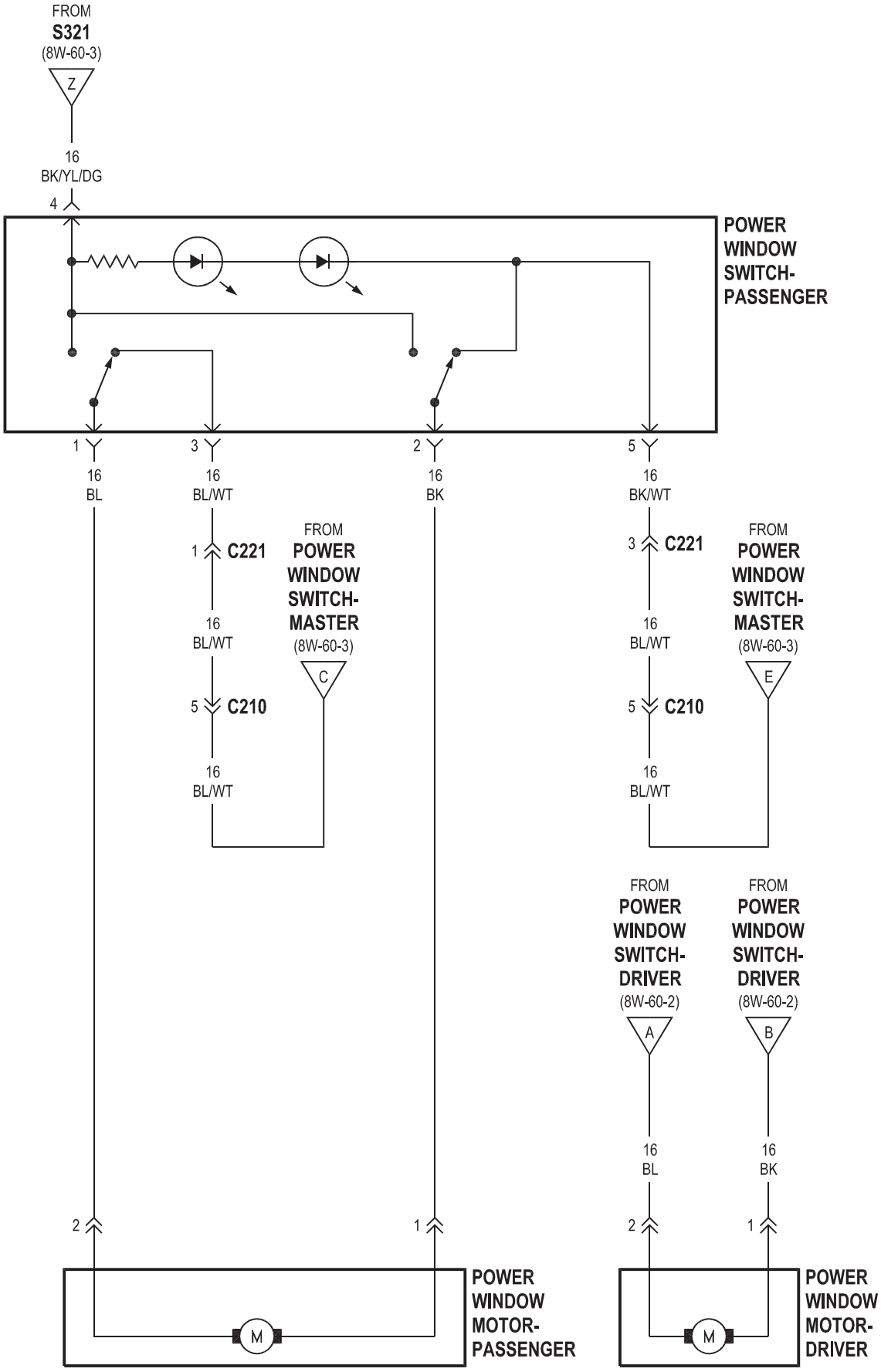
8W-60 POWER WINDOWS

Component	Page
Fuse 7	8W-60-2
Fuse 15	8W-60-3
Fuse Block No. 2	8W-60-2, 3
G203	8W-60-2
G302	8W-60-3
Optional Equipment Relay	8W-60-2, 3
Power Window Motor- Driver	8W-60-2, 4
Power Window Motor- Passenger	8W-60-4
Power Window Switch- Driver	8W-60-2, 4
Power Window Switch- Master	8W-60-3, 4
Power Window Switch- Passenger	8W-60-4


BATT
OPTIONAL EQUIPMENT RELAY
(8W-11-34)
87
87A
10
BK
S311
(8W-11-30)
10
BK
FUSE BLOCK NO. 2
(8W-11-4)
FUSE
7
25A
(8W-11-31)
16
BK/YL
19
C200
16
BK/YL
2
C210
16
BK/YL
4
B
TO
POWER WINDOW MOTOR-DRIVER
(8W-60-4)
16
BK
2
POWER WINDOW SWITCH-DRIVER
1
3
5
16
BK
16
BR
16
BR
S303
(8W-15-23)
A
TO
POWER WINDOW MOTOR-DRIVER
(8W-60-4)
14
BR
1
C210
14
BR
G203
(8W-15-23)

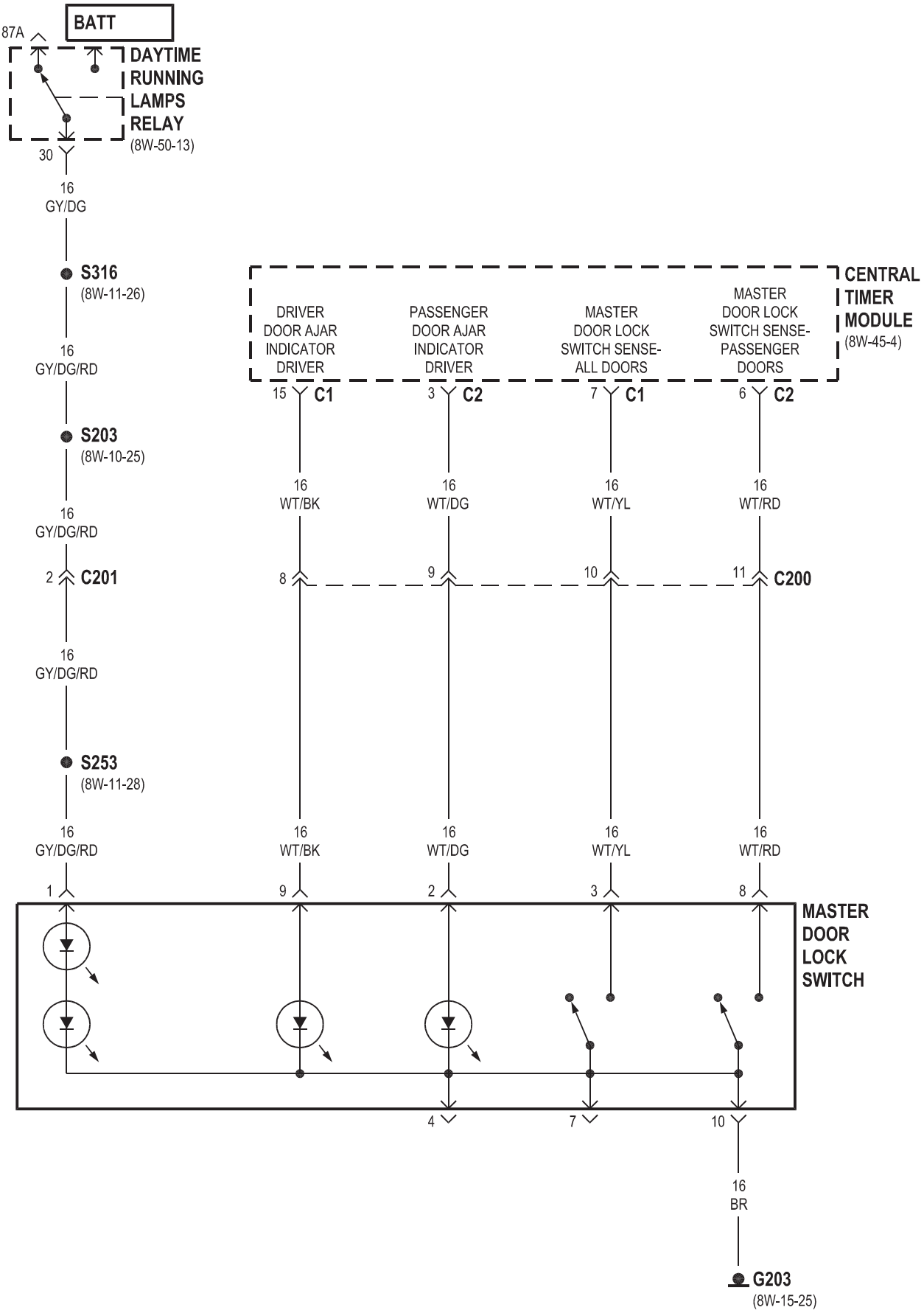


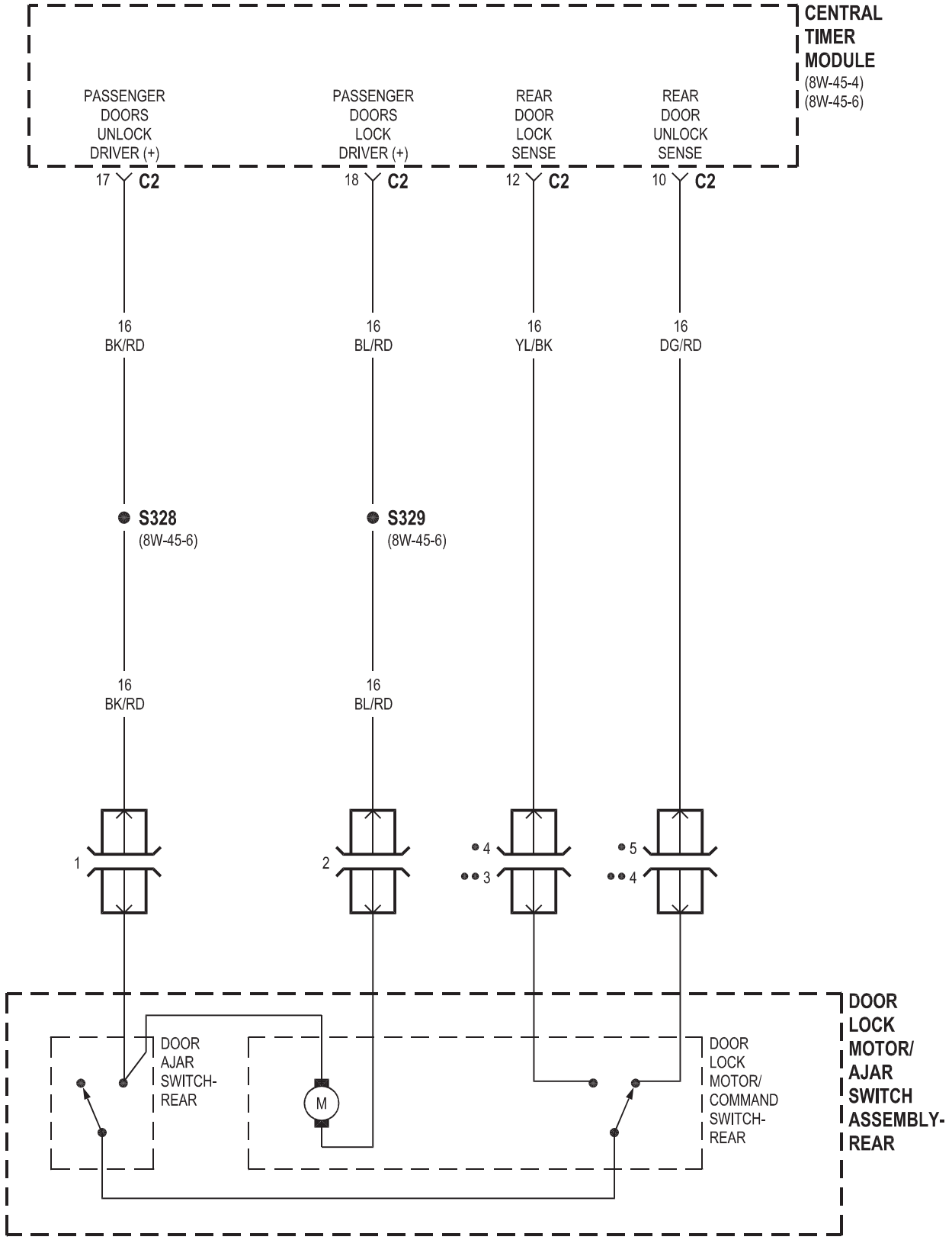
VA306003 J038W-24


FROM
S321
(8W-60-3)
Z
16
BK/YL/DG
4
POWER
WINDOW
SWITCH-
PASSENGER
1
16
BL
3
16
BL/WT
2
16
BK
5
16
BK/WT
1 C221
16
BL/WT
5 C210
16
BL/WT
FROM
POWER
WINDOW
SWITCH-
MASTER
(8W-60-3)
C
3 C221
16
BL/WT
5 C210
16
BL/WT
FROM
POWER
WINDOW
SWITCH-
MASTER
(8W-60-3)
E
FROM
POWER
WINDOW
SWITCH-
DRIVER
(8W-60-2)
A
FROM
POWER
WINDOW
SWITCH-
DRIVER
(8W-60-2)
B
16
BL
16
BK
2
1
2
1
M
POWER
WINDOW
MOTOR-
PASSENGER
M
POWER
WINDOW
MOTOR-
DRIVER

8W-61 POWER DOOR LOCKS

Component	Page
Central Timer Module	8W-61-2, 3, 4, 5, 6, 7
Cylinder Lock Switch- Driver	8W-61-8
Daytime Running Lamps Relay	8W-61-2
Door Jamb Switch- Left Sliding	8W-61-8
Door Jamb Switch- Rear	8W-61-8
Door Jamb Switch- Right Sliding	8W-61-8
Door Lock Motor/Ajar Switch Assembly- Driver	8W-61-4
Door Lock Motor/Ajar Switch Assembly- Left Sliding	8W-61-6
Door Lock Motor/Ajar Switch Assembly- Passenger	8W-61-5
Door Lock Motor/Ajar Switch Assembly- Rear	8W-61-3
Door Lock Motor/Ajar Switch Assembly- Right Sliding	8W-61-7
G200	8W-61-8
G203	8W-61-2
Interior Lamp- Right Side	8W-61-8
Master Door Lock Switch	8W-61-2
Security System Module	8W-61-8

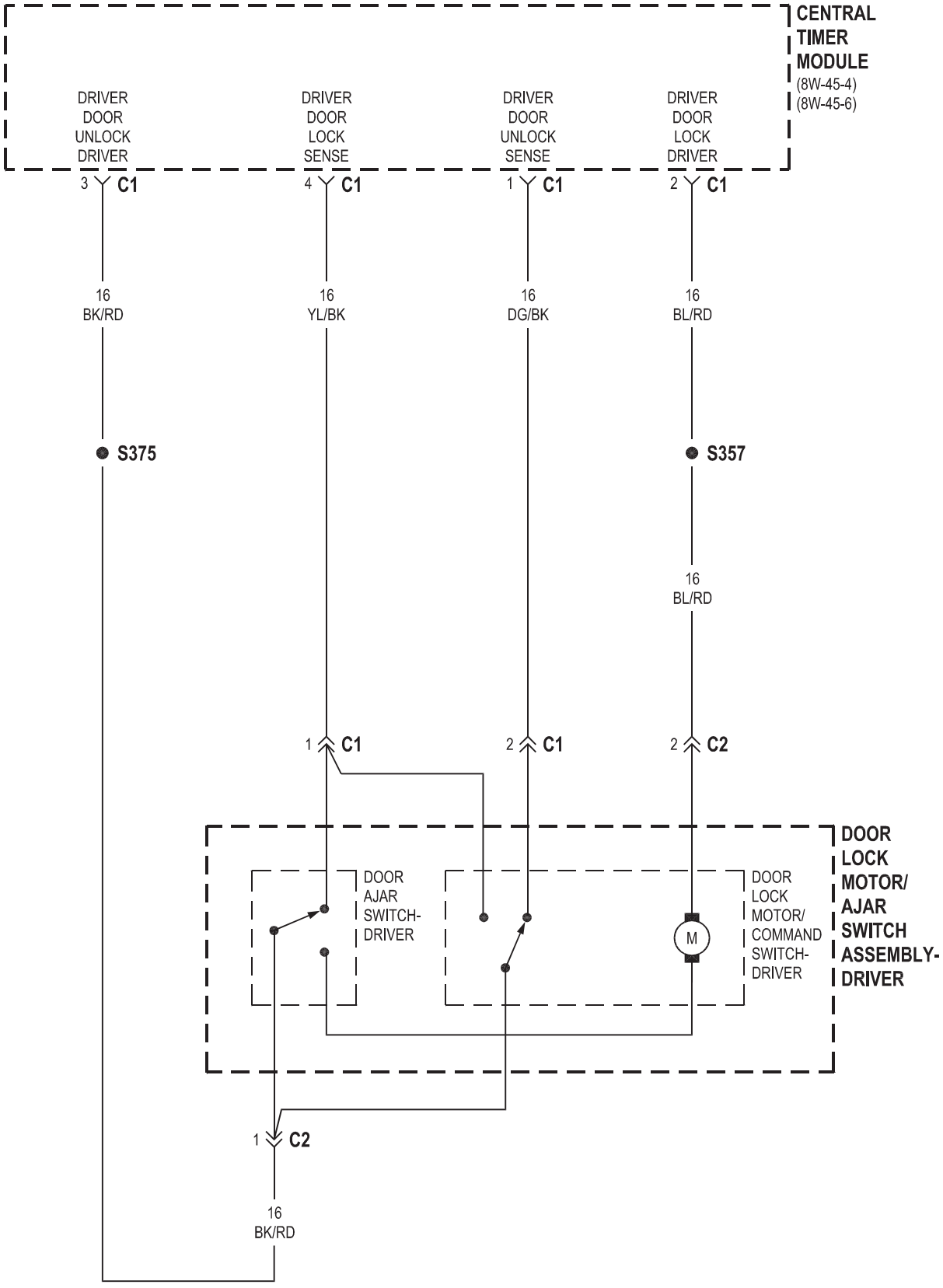

BATT
87A
DAYTIME RUNNING LAMPS RELAY
(8W-50-13)
30
16 GY/DG
S316
(8W-11-26)
16 GY/DG/RD
S203
(8W-10-25)
16 GY/DG/RD
2 C201
16 GY/DG/RD
S253
(8W-11-28)
16 GY/DG/RD
1
CENTRAL TIMER MODULE
(8W-45-4)
DRIVER DOOR AJAR INDICATOR DRIVER
PASSENGER DOOR AJAR INDICATOR DRIVER
MASTER DOOR LOCK SWITCH SENSE-ALL DOORS
MASTER DOOR LOCK SWITCH SENSE-PASSENGER DOORS
15 C1
3 C2
7 C1
6 C2
16 WT/BK
16 WT/DG
16 WT/YL
16 WT/RD
8 C200
9
10
11
16 WT/BK
16 WT/DG
16 WT/YL
16 WT/RD
9
2
3
8
MASTER DOOR LOCK SWITCH
4
7
10
16 BR
G203
(8W-15-25)

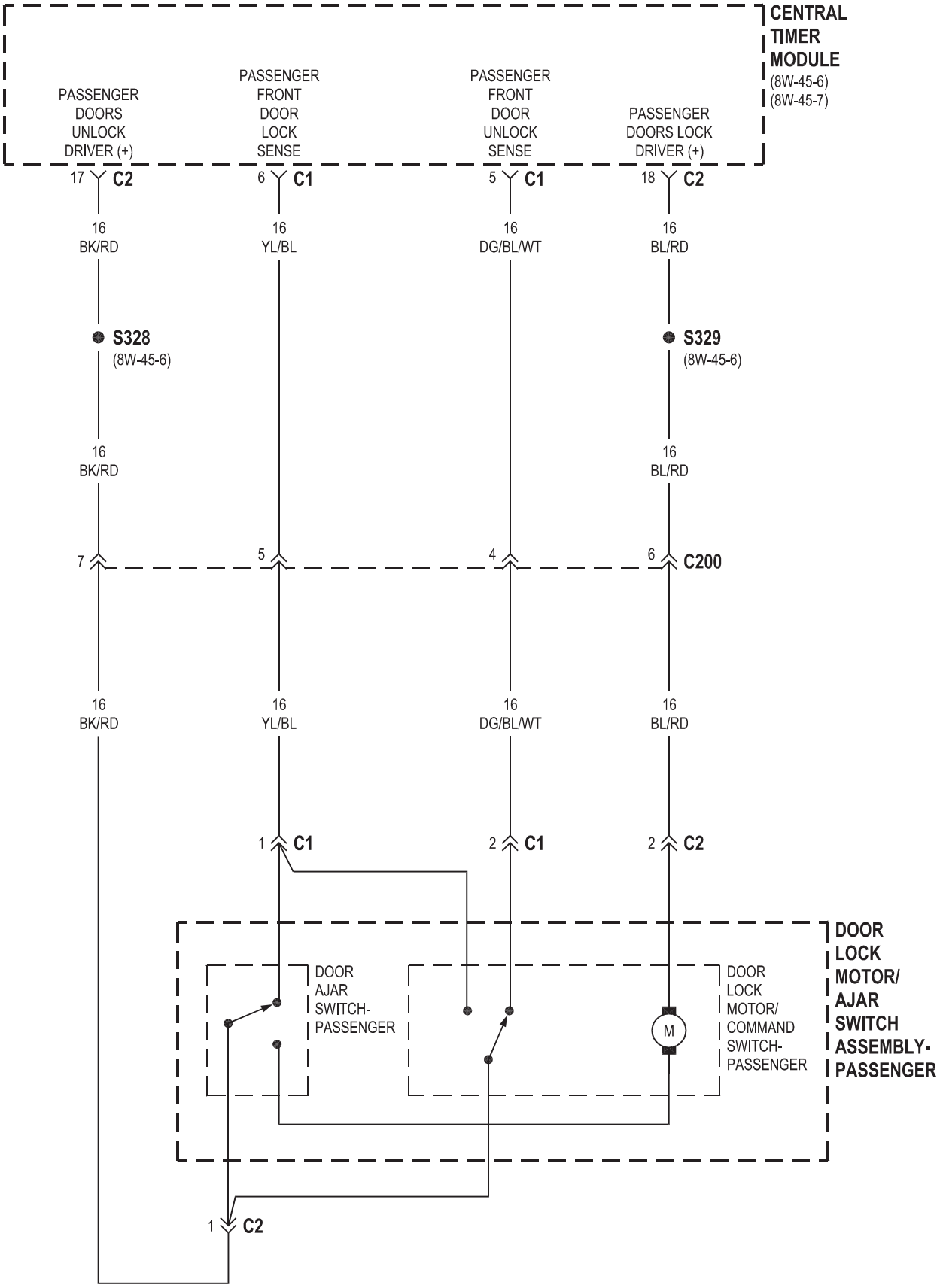


● PASSENGER VAN

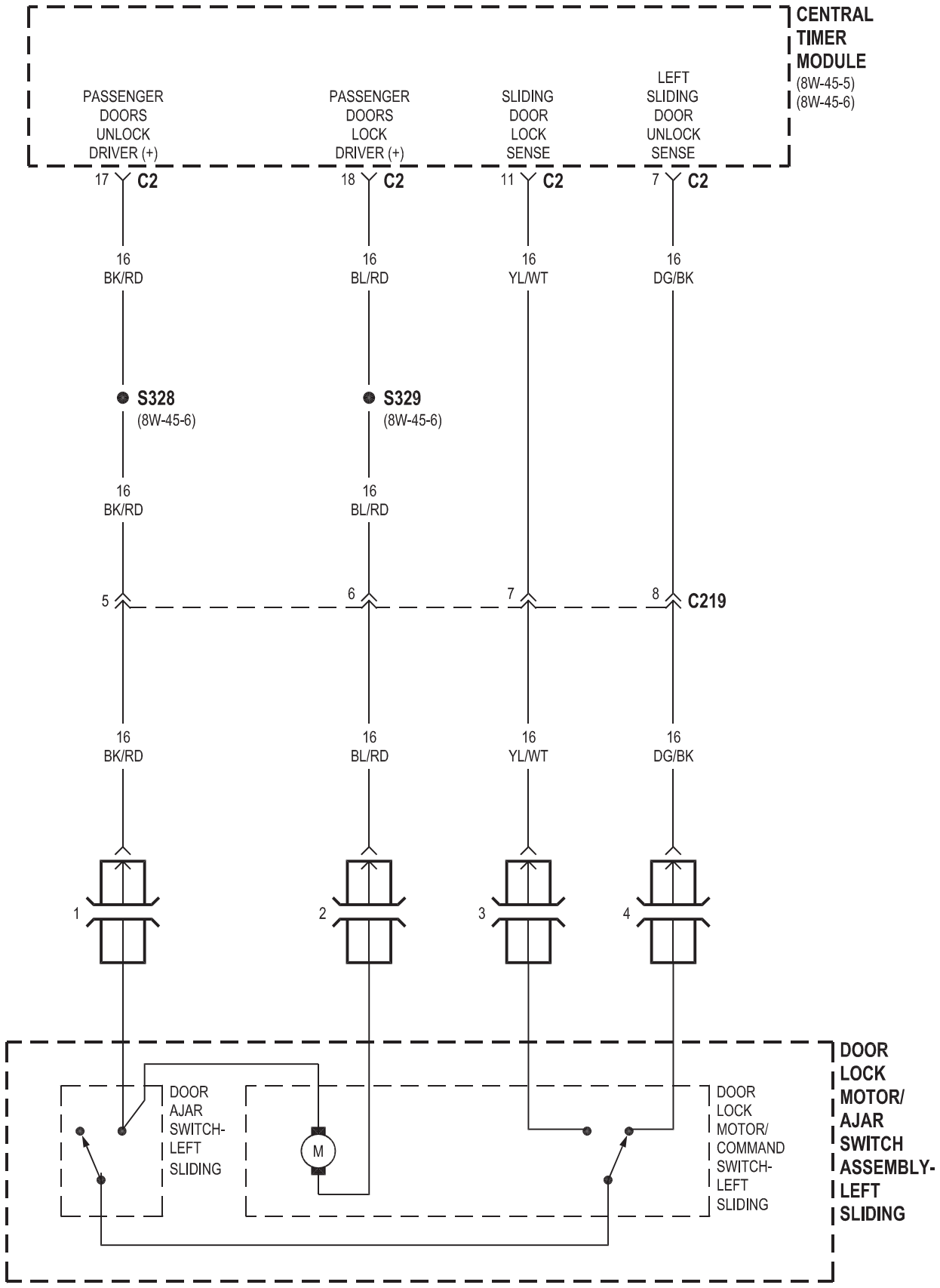
●● CARGO VAN

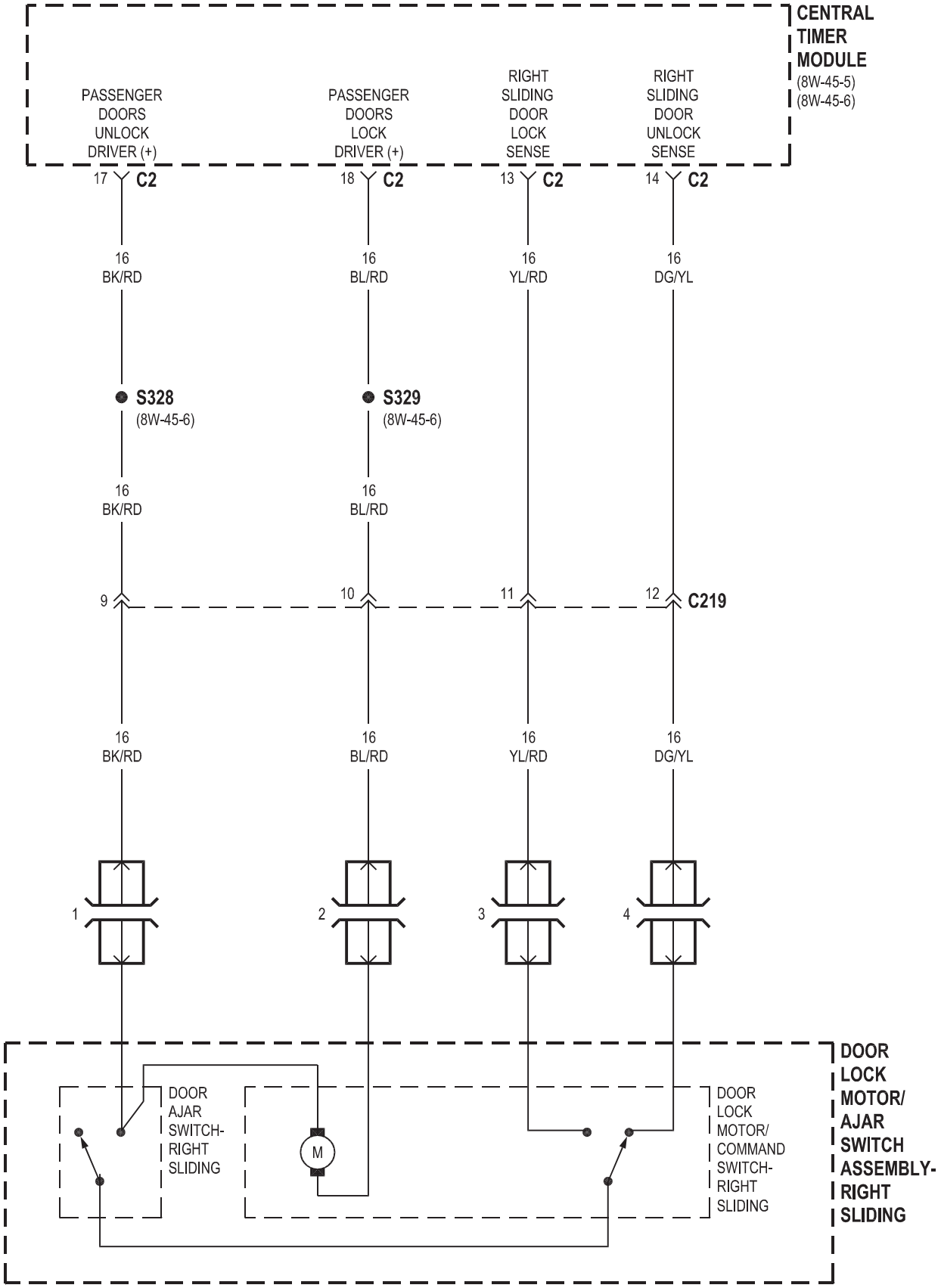
VA306103 J038W-24


CENTRAL TIMER MODULE
(8W-45-4)
(8W-45-6)
DRIVER DOOR UNLOCK DRIVER
DRIVER DOOR LOCK SENSE
DRIVER DOOR UNLOCK SENSE
DRIVER DOOR LOCK DRIVER
3 C1
4 C1
1 C1
2 C1
16 BK/RD
16 YL/BK
16 DG/BK
16 BL/RD
S375
S357
16 BL/RD
1 C1
2 C1
2 C2
DOOR LOCK MOTOR/ AJAR SWITCH ASSEMBLY- DRIVER
DOOR AJAR SWITCH- DRIVER
DOOR LOCK MOTOR/ COMMAND SWITCH- DRIVER
M
1 C2
16 BK/RD

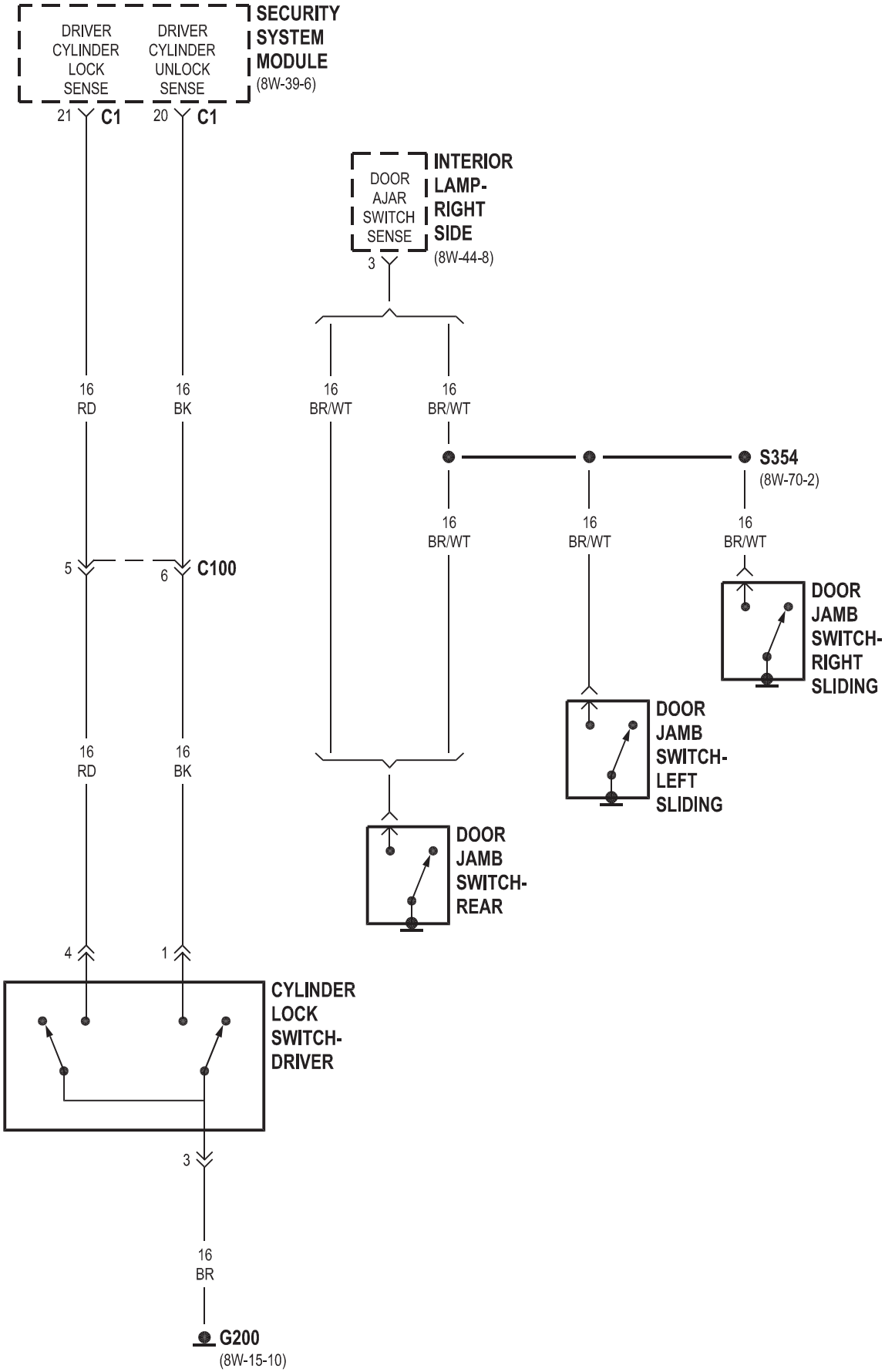


VA306105 J038W-24


CENTRAL TIMER MODULE
(8W-45-5)
(8W-45-6)
PASSENGER DOORS UNLOCK DRIVER (+)
PASSENGER DOORS LOCK DRIVER (+)
SLIDING DOOR LOCK SENSE
LEFT SLIDING DOOR UNLOCK SENSE
17 C2
18 C2
11 C2
7 C2
16 BK/RD
16 BL/RD
16 YL/WT
16 DG/BK
S328
(8W-45-6)
S329
(8W-45-6)
16 BK/RD
16 BL/RD
5
6
7
8 C219
16 BK/RD
16 BL/RD
16 YL/WT
16 DG/BK
1
2
3
4
DOOR AJAR SWITCH- LEFT SLIDING
M
DOOR LOCK MOTOR/ COMMAND SWITCH- LEFT SLIDING
DOOR LOCK MOTOR/ AJAR SWITCH ASSEMBLY- LEFT SLIDING

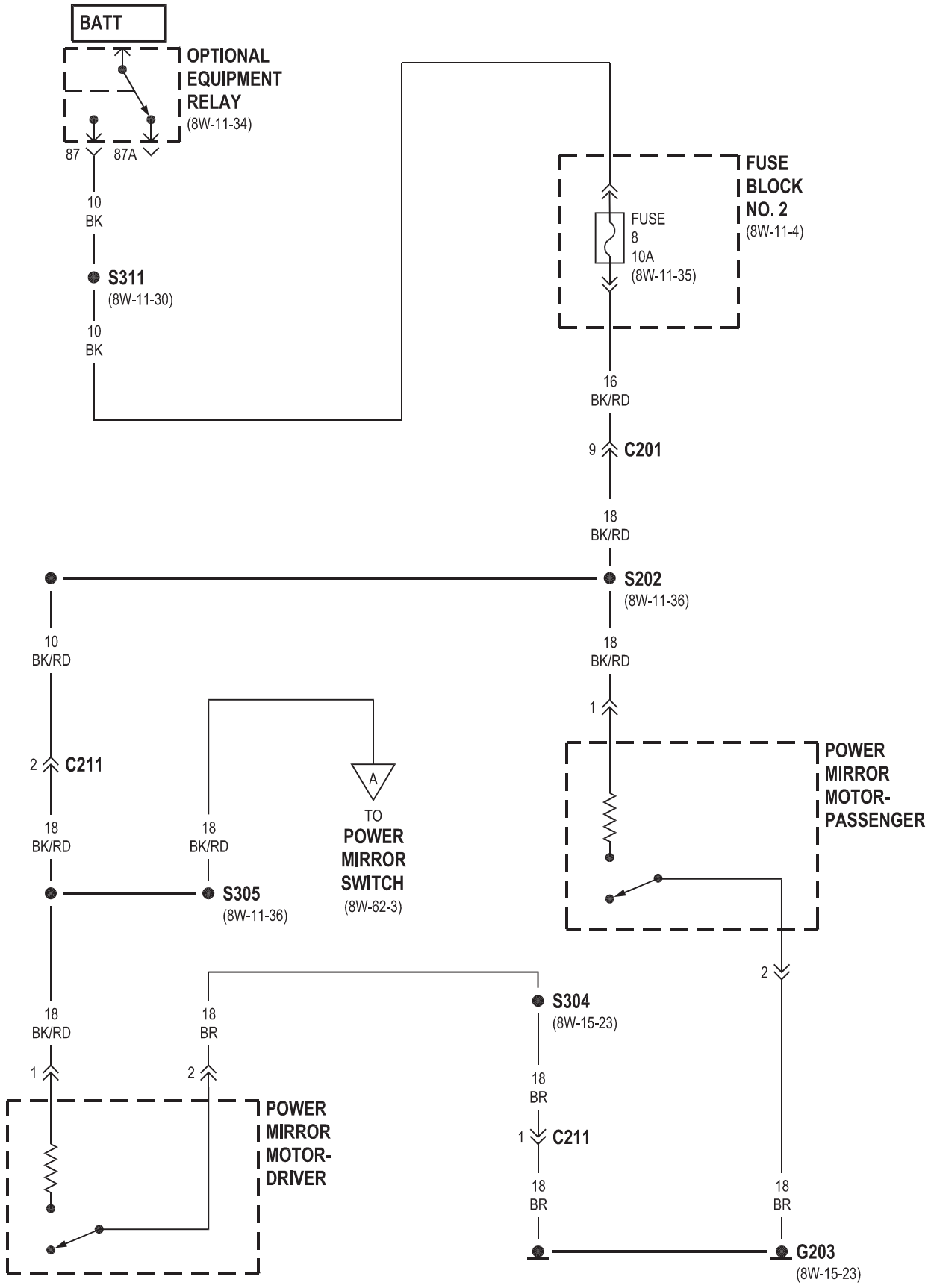


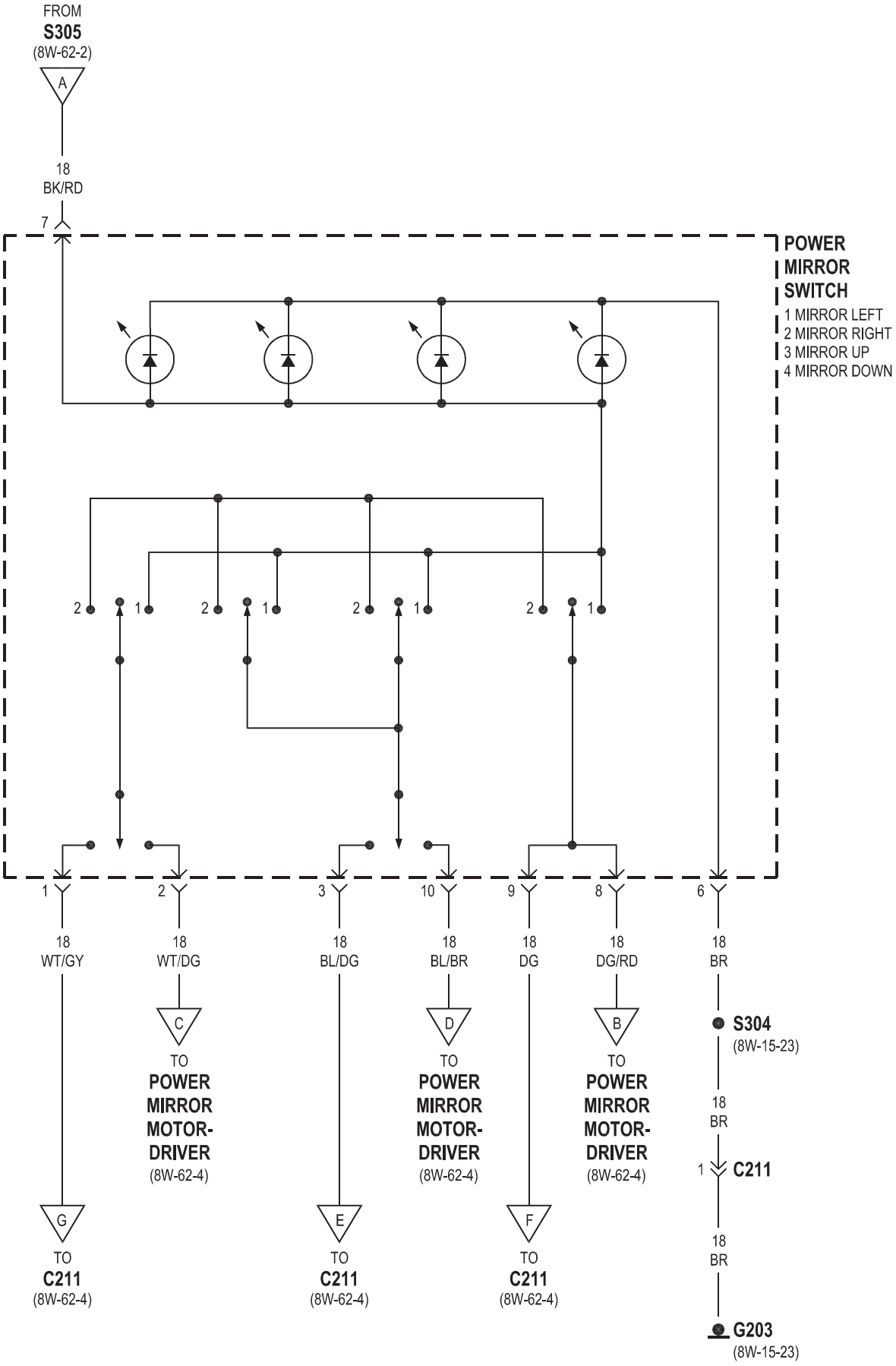
VA306107 J038W-24


DRIVER CYLINDER LOCK SENSE
DRIVER CYLINDER UNLOCK SENSE
SECURITY SYSTEM MODULE
(8W-39-6)
21
C1
20
C1
DOOR AJAR SWITCH SENSE
3
INTERIOR LAMP-RIGHT SIDE
(8W-44-8)
16 RD
16 BK
16 BR/WT
16 BR/WT
S354
(8W-70-2)
16 BR/WT
16 BR/WT
16 BR/WT
5
6
C100
DOOR JAMB SWITCH-RIGHT SLIDING
DOOR JAMB SWITCH-LEFT SLIDING
16 RD
16 BK
DOOR JAMB SWITCH-REAR
4
1
CYLINDER LOCK SWITCH-DRIVER
3
16 BR
G200
(8W-15-10)

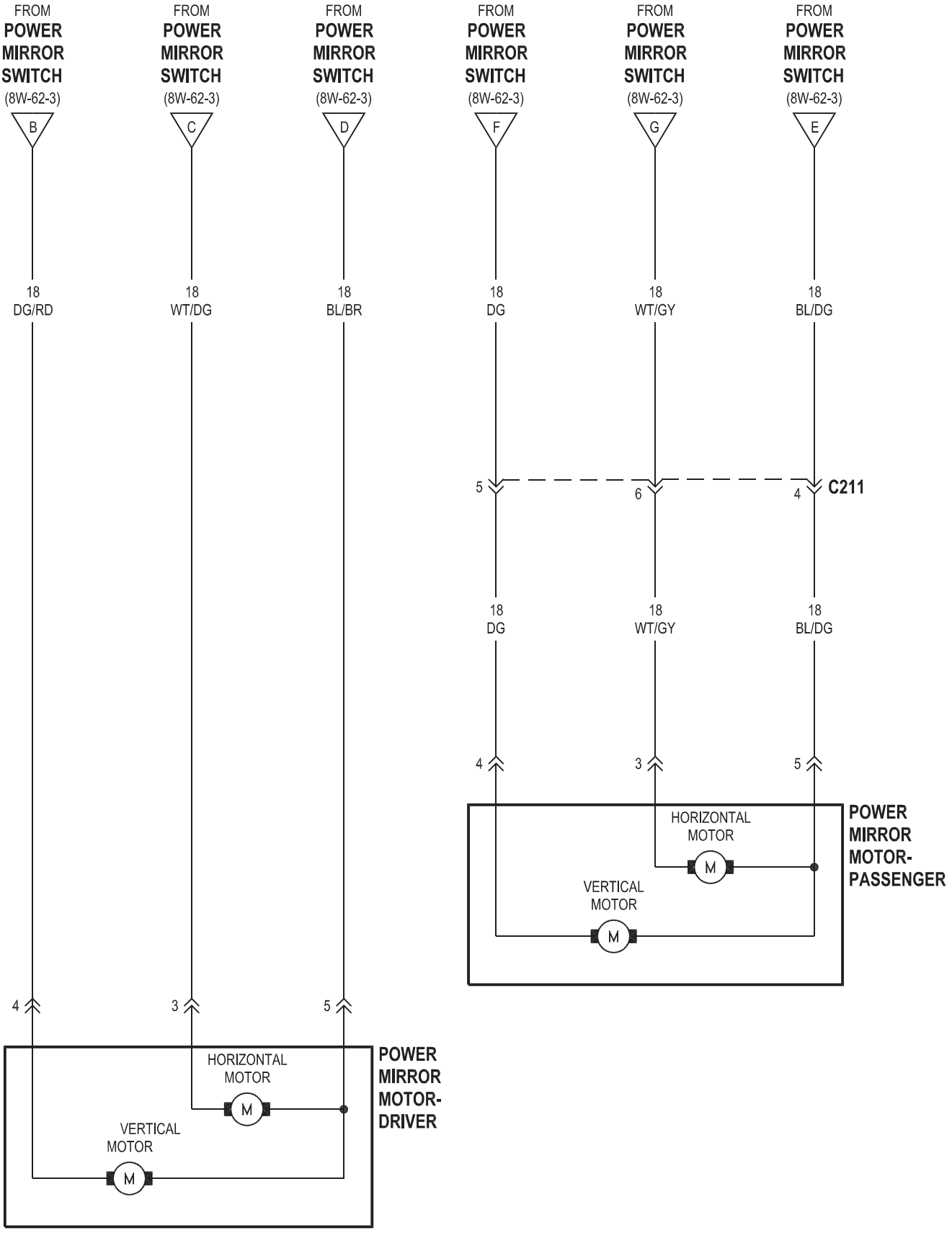
8W-62 POWER MIRRORS

Component	Page
Fuse 8	8W-62-2
Fuse Block No. 2	8W-62-2
G203	8W-62-2, 3
Optional Equipment Relay	8W-62-2
Power Mirror Motor- Driver	8W-62-2, 3, 4
Power Mirror Motor- Passenger	8W-62-2, 4
Power Mirror Switch	8W-62-2, 3, 4


BATT
OPTIONAL EQUIPMENT RELAY
(8W-11-34)
87
87A
10
BK
S311
(8W-11-30)
10
BK
FUSE BLOCK NO. 2
(8W-11-4)
FUSE
8
10A
(8W-11-35)
16
BK/RD
9
C201
18
BK/RD
S202
(8W-11-36)
10
BK/RD
18
BK/RD
2
C211
18
BK/RD
18
BK/RD
A
TO
POWER MIRROR SWITCH
(8W-62-3)
S305
(8W-11-36)
1
POWER MIRROR MOTOR-PASSENGER
2
18
BK/RD
18
BR
1
2
POWER MIRROR MOTOR-DRIVER
S304
(8W-15-23)
18
BR
1
C211
18
BR
18
BR
G203
(8W-15-23)

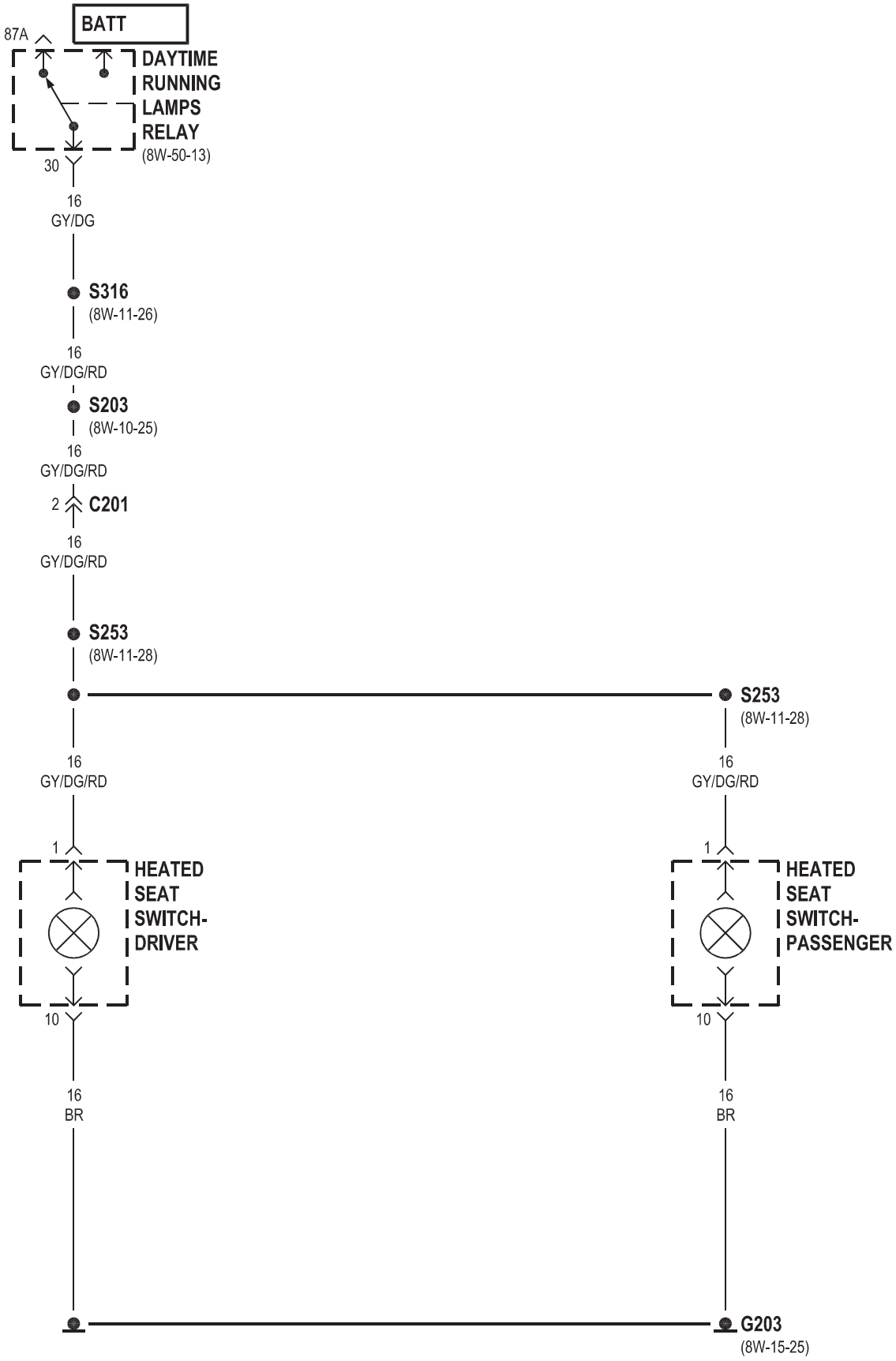


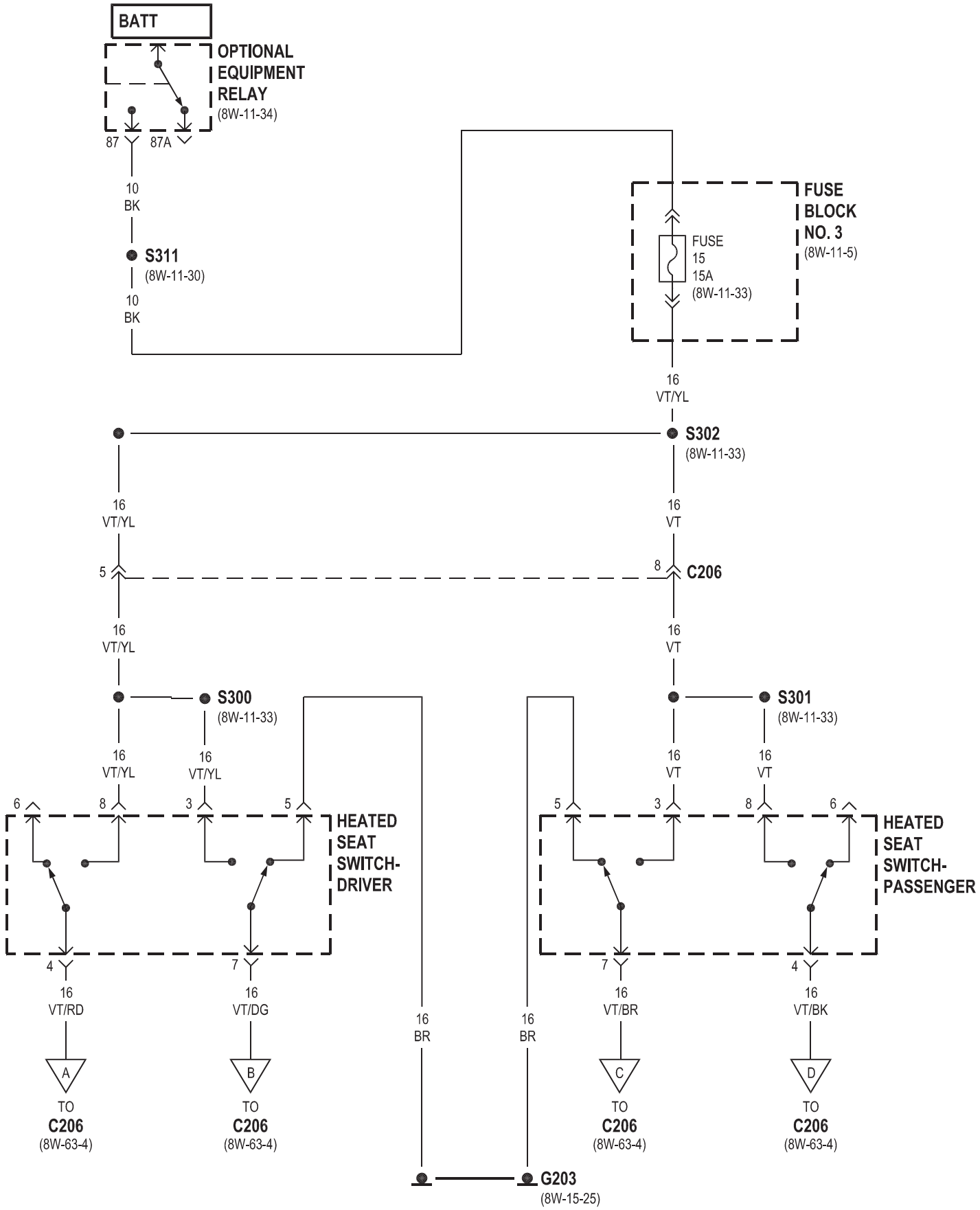
VA306203 J038W-24


FROM POWER MIRROR SWITCH (8W-62-3)
B
C
D
F
G
E
18 DG/RD
18 WT/DG
18 BL/BR
18 DG
18 WT/GY
18 BL/DG
5
6
4
C211
4
3
5
HORIZONTAL MOTOR
VERTICAL MOTOR
M
POWER MIRROR MOTOR-DRIVER
POWER MIRROR MOTOR-PASSENGER

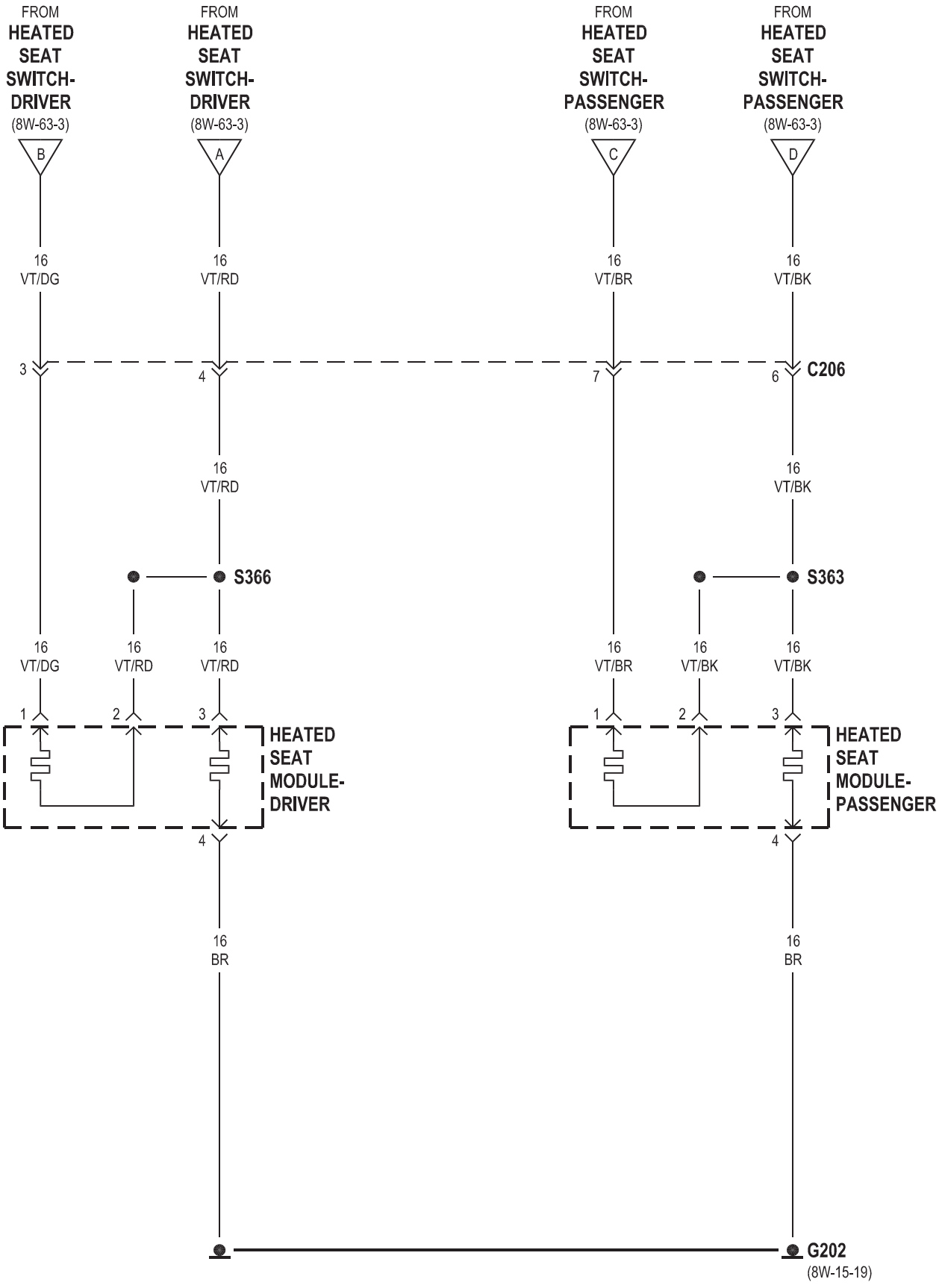
8W-63 POWER SEATS

Component	Page
Daytime Running Lamps Relay	8W-63-2
Fuse 15	8W-63-3
Fuse Block No. 3	8W-63-3
G202	8W-63-4
G203	8W-63-2, 3
Heated Seat Module- Driver	8W-63-4
Heated Seat Module- Passenger	8W-63-4
Heated Seat Switch- Driver	8W-63-2, 3, 4
Heated Seat Switch- Passenger	8W-63-2, 3, 4
Optional Equipment Relay	8W-63-3


BATT
87A
DAYTIME RUNNING LAMPS RELAY
(8W-50-13)
30
16 GY/DG
S316
(8W-11-26)
16 GY/DG/RD
S203
(8W-10-25)
16 GY/DG/RD
2
C201
16 GY/DG/RD
S253
(8W-11-28)
S253
(8W-11-28)
16 GY/DG/RD
16 GY/DG/RD
1
1
HEATED SEAT SWITCH- DRIVER
HEATED SEAT SWITCH- PASSENGER
10
10
16 BR
16 BR
G203
(8W-15-25)

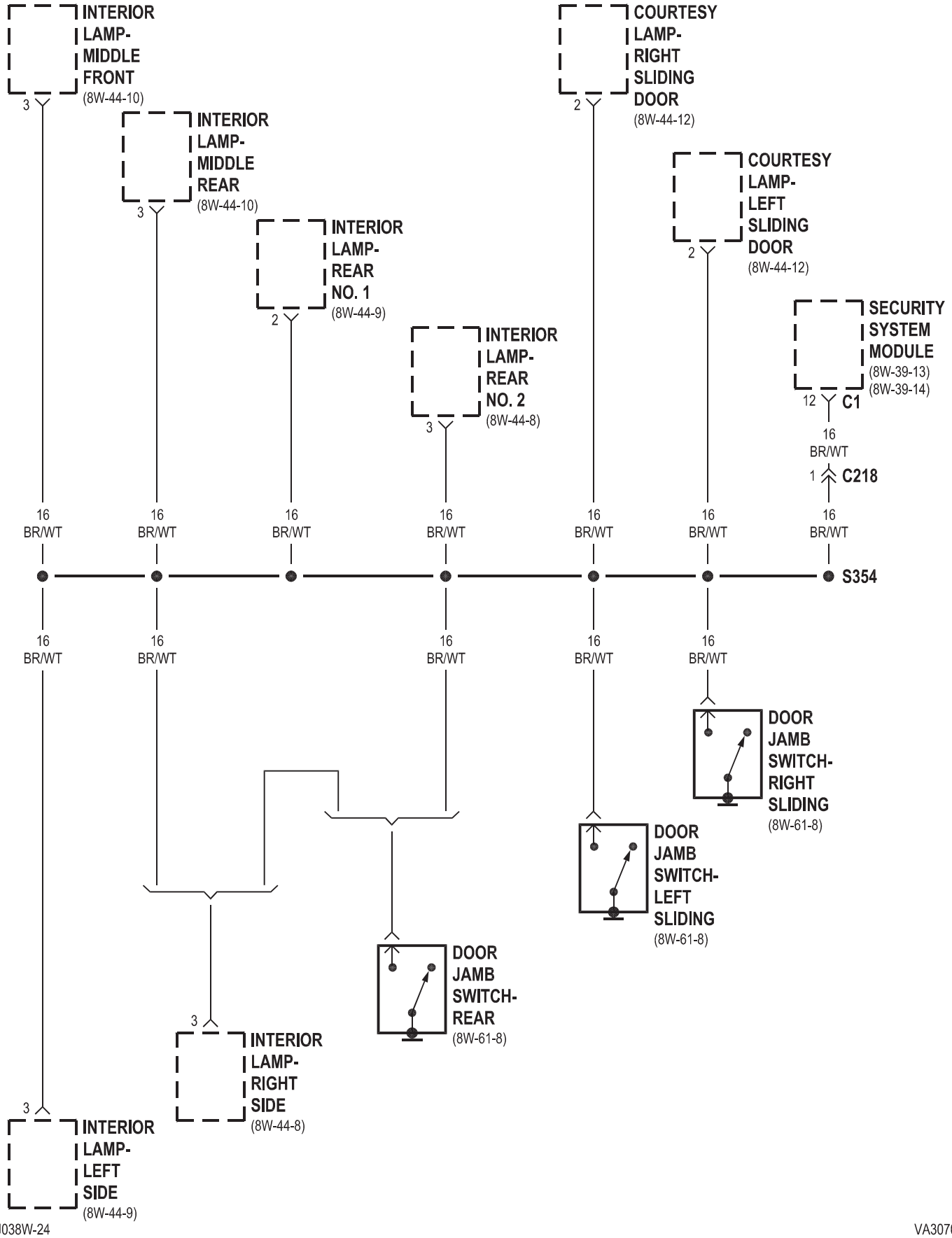


VA306303 J038W-24


FROM
HEATED SEAT SWITCH-DRIVER
(8W-63-3)
B
FROM
HEATED SEAT SWITCH-DRIVER
(8W-63-3)
A
FROM
HEATED SEAT SWITCH-PASSENGER
(8W-63-3)
C
FROM
HEATED SEAT SWITCH-PASSENGER
(8W-63-3)
D
16 VT/DG
16 VT/RD
16 VT/BR
16 VT/BK
3
4
7
6
C206
16 VT/RD
16 VT/BK
S366
S363
16 VT/DG
16 VT/RD
16 VT/RD
16 VT/BR
16 VT/BK
16 VT/BK
1
2
3
1
2
3
HEATED SEAT MODULE-DRIVER
HEATED SEAT MODULE-PASSENGER
4
4
16 BR
16 BR
G202
(8W-15-19)

8W-70 SPLICE INFORMATION

Component	Page
S100	8W-10-8, 9
S101	8W-10-11
S102	8W-11-29
S103	8W-10-11
S104	8W-10-28
S104	8W-50-10
S105	8W-50-9
S175	8W-10-29
S176	8W-30-11
S177	8W-30-10
S178	8W-30-12
S200	8W-10-19
S201	8W-42-19
S202	8W-11-36
S203	8W-10-25
S204	8W-10-20
S205	8W-10-27
S206	8W-10-22
S207	8W-44-5
S208	8W-44-5
S209	8W-42-5
S210	8W-10-16
S211	8W-15-24
S212	8W-11-38
S213	8W-39-2
S214	8W-11-38
S215	8W-30-2
S216	8W-11-18
S217	8W-10-29
S218	8W-42-4
S219	8W-10-15
S220	8W-30-7
S221	8W-18-4
S222	8W-18-4
S223	8W-10-30
S224	8W-30-3
S225	8W-10-18
S226	8W-11-24
S227	8W-11-24
S228	8W-40-8
S229	8W-18-3
S250	8W-10-23
S251	8W-35-3
S252	8W-10-23
S253	8W-11-28
S254	8W-44-6
S255	8W-10-16
S256	8W-11-17
S257	8W-18-5
S258	8W-31-7
S259	8W-30-2
S260	8W-30-3
S261	8W-11-19
S262	8W-10-29
S299	8W-35-7
S300	8W-11-33
S301	8W-11-33
S302	8W-11-33
S303	8W-15-23
S304	8W-15-23
S305	8W-11-36
S306	8W-11-34
S307	8W-11-34
S308	8W-15-5
S309	8W-15-6
S310	8W-11-17
S311	8W-11-30
S312	8W-35-6
S313	8W-35-6
S314	8W-35-6
S315	8W-35-6
S316	8W-11-26
S317	8W-50-11
S318	8W-51-3
S319	8W-35-3
S320	8W-31-9
S321	8W-11-32
S322	8W-40-5
S323	8W-40-5
S324	8W-44-6
S325	8W-11-23
S326	8W-40-6
S327	8W-42-8
S328	8W-45-6
S329	8W-45-6
S330	8W-48-4
S331	8W-48-3
S332	8W-15-28
S333	8W-10-17
S350	8W-10-10
S351	8W-52-4
S352	8W-52-6
S353	8W-10-24
S354	8W-70-2
S355	8W-11-20
S356	8W-10-26
S357	8W-61-4
S358	8W-11-25
S359	8W-44-4
S360	8W-11-23
S361	8W-11-23
S362	8W-11-35
S363	8W-63-4
S364	8W-11-31
S365	8W-11-32
S366	8W-63-4
S375	8W-61-4



J038W-24

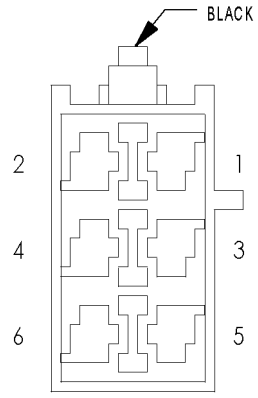
VA307002

8W-80 CONNECTOR PIN-OUTS

Component	Page
A/C Control Module-Roof	8W-80-4
A/C Fan Switch	8W-80-4
A/C Switch-Roof	8W-80-4
Accelerator Pedal Position Sensor	8W-80-5
Air Outlet Temperature Sensor	8W-80-5
Airbag Control Module	8W-80-5
Airbag Squib-Driver	8W-80-5
Airbag Squib-Passenger	8W-80-6
Ambient Temperature Sensor	8W-80-6
Ash Receiver Lamp	8W-80-6
Automatic Temperature Control Module C1	8W-80-6
Automatic Temperature Control Module C2	8W-80-7
Auxiliary Heater Relay (In Relay Block)	8W-80-9
Auxiliary Heater Switch	8W-80-9
Battery Relay-Auxiliary	8W-80-9
Blower Motor Resistor Block	8W-80-9
Blower Motor Resistor Block C1	8W-80-9
Blower Motor Resistor Block C2	8W-80-10
Blower Motor Resistor Block C3	8W-80-10
Blower Motor-Front	8W-80-10
Body Plug Connector	8W-80-10
Boost Pressure Sensor	8W-80-10
Boost Pressure Solenoid	8W-80-11
Brake Fluid Level Switch	8W-80-11
Brake Lamp Switch C1	8W-80-11
Brake Lamp Switch C2	8W-80-11
Brake Wear Sensor-Left Front	8W-80-11
Brake Wear Sensor-Left Rear	8W-80-12
Brake Wear Sensor-Right Front	8W-80-12
Brake Wear Sensor-Right Rear	8W-80-12
C100	8W-80-12
C100	8W-80-12
C101	8W-80-13
C101	8W-80-13
C200	8W-80-13
C200	8W-80-14
C201	8W-80-14
C201	8W-80-15
C202	8W-80-15
C202	8W-80-15
C203	8W-80-16
C203	8W-80-16
C204	8W-80-16
C204	8W-80-16
C205	8W-80-17
C205	8W-80-17
C206	8W-80-17
C206	8W-80-17
C207	8W-80-18
C207	8W-80-18
C208	8W-80-18
C208	8W-80-18
C209	8W-80-18
C209	8W-80-19
C210	8W-80-19
C210	8W-80-19
C211	8W-80-19
C211	8W-80-19
C214	8W-80-20
C214	8W-80-20
C215	8W-80-20
C215	8W-80-20
C216	8W-80-20
C216	8W-80-20
C217	8W-80-21
C217	8W-80-21
C218	8W-80-21
C218	8W-80-21
C219	8W-80-22
C219	8W-80-22
C220	8W-80-22
C220	8W-80-22
C221	8W-80-23
C221	8W-80-23
C224	8W-80-23
C224	8W-80-23
C225	8W-80-23
C225	8W-80-24
Cabin Heater Assembly C1	8W-80-24
Cabin Heater Assembly C2	8W-80-24
Camshaft Position Sensor	8W-80-24
Center High Mounted Stop Lamp	8W-80-24
Central Timer Module C1	8W-80-25
Central Timer Module C2	8W-80-25
Cigar Lighter	8W-80-25
Cigar Lighter Lamp	8W-80-26
Circulation Pump (Cabin Heater Module)	8W-80-26
Circulation Pump (Rest System)	8W-80-26
Circulation Pump Diode	8W-80-26
Clockspring C1	8W-80-26
Clockspring C2	8W-80-27
Controller Antilock Brake	8W-80-27
Courtesy Lamp-Driver Door	8W-80-27
Courtesy Lamp-Left Sliding Door	8W-80-27
Courtesy Lamp-Passenger Door	8W-80-28
Courtesy Lamp-Right Sliding Door	8W-80-28
Crankcase Heater	8W-80-28
Crankshaft Position Sensor	8W-80-28
Ctel Connector	8W-80-28
Cylinder Lock Switch-Driver	8W-80-29
Data Link Connector	8W-80-29

Component	Page
Differential Lock Solenoid Valve	8W-80-29
Dome Lamp	8W-80-29
Door Lock Motor/Ajar Switch Assembly-Driver C1	8W-80-30
Door Lock Motor/Ajar Switch Assembly-Driver C2	8W-80-30
Door Lock Motor/Ajar Switch Assembly-Left Sliding C1	8W-80-30
Door Lock Motor/Ajar Switch Assembly-Left Sliding C2	8W-80-30
Door Lock Motor/Ajar Switch Assembly-Passenger C1	8W-80-30
Door Lock Motor/Ajar Switch Assembly-Passenger C2	8W-80-31
Door Lock Motor/Ajar Switch Assembly-Rear C1	8W-80-31
Door Lock Motor/Ajar Switch Assembly-Rear C2	8W-80-31
Door Lock Motor/Ajar Switch Assembly-Right Sliding C1	8W-80-31
Door Lock Motor/Ajar Switch Assembly-Right Sliding C2	8W-80-31
Dosing Pump	8W-80-32
EGR Valve	8W-80-32
Engine Control Module C1	8W-80-32
Engine Control Module C2	8W-80-32
Engine Control Module C3	8W-80-33
Engine Control Module C4	8W-80-33
Engine Control Module C5	8W-80-34
Engine Coolant Level Switch	8W-80-34
Engine Coolant Temperature Sensor	8W-80-34
Engine Oil Sensor	8W-80-34
Evaporator Temperature Sensor	8W-80-35
Fog Lamp Switch	8W-80-35
Fuel Injector No. 1	8W-80-35
Fuel Injector No. 2	8W-80-35
Fuel Injector No. 3	8W-80-35
Fuel Injector No. 4	8W-80-36
Fuel Injector No. 5	8W-80-36
Fuel Level Sensor	8W-80-36
Fuel Pressure Sensor	8W-80-36
Fuel Pressure Solenoid	8W-80-36
Fuel Shutdown Solenoid	8W-80-37
Fuel Temperature Sensor	8W-80-37
Fuse Block No. 1 C1	8W-80-37
Fuse Block No. 1 C2	8W-80-37
Fuse Block No. 1 C3	8W-80-38
Fuse Block No. 1 C4	8W-80-38
Fuse Block No. 1 C5	8W-80-38
Glow Plug Control Module C1	8W-80-38
Glow Plug Control Module C2	8W-80-39
Headlamp Adjust Switch	8W-80-39
Headlamp Assembly-Left	8W-80-39
Headlamp Assembly-Right	8W-80-40
Heat Exchanger Connector	8W-80-40
Heat Exchanger Switch	8W-80-40
Heated Seat Module-Driver	8W-80-40
Heated Seat Module-Passenger	8W-80-41
Heated Seat Switch-Driver	8W-80-41
Heated Seat Switch-Passenger	8W-80-41
Heater Timer-Auxiliary	8W-80-41
Hood Ajar Switch	8W-80-42
Horn	8W-80-42
Horn (VTSS)	8W-80-42
Horn-Switch	8W-80-42
Ignition Lock Switch	8W-80-43
Instrument Cluster C1	8W-80-43
Instrument Cluster C2	8W-80-43
Instrument Panel Socket	8W-80-44
Intake Air Temperature Sensor	8W-80-44
Interior Lamp No. 1	8W-80-44
Interior Lamp No. 2	8W-80-44
Interior Lamp No. 3	8W-80-44
Interior Lamp No. 4	8W-80-45
Interior Lamp No. 5	8W-80-45
Interior Lamp-Left	8W-80-45
Interior Lamp-Middle Front	8W-80-45
Interior Lamp-Middle Rear	8W-80-46
Interior Lamp-Rear No. 1	8W-80-46
Interior Lamp-Rear No. 2	8W-80-46
Interior Lamp-Right	8W-80-47
Interior Light Switch	8W-80-47
Interior Light Switch-Driver	8W-80-47
Interior Light Switch-Passenger	8W-80-47
Interior Light Switch-Rear	8W-80-48
Interior Lighting Connector	8W-80-48
Intrusion Sensor No. 1	8W-80-48
Intrusion Sensor No. 2	8W-80-48
Intrusion Sensor No. 3	8W-80-48
Kick Down Switch	8W-80-49
License Plate Lamp No. 1	8W-80-49
License Plate Lamp No. 2	8W-80-49
Locker Switch No. 1	8W-80-49
Locker Switch No. 2	8W-80-49
Low Fuel Pressure Sensor	8W-80-50
Map/Reading Lamp Switch	8W-80-50
Marker Lamp Connector	8W-80-50
Marker Lamp No. 1-Left Front	8W-80-50
Marker Lamp No. 1-Right Front	8W-80-50
Marker Lamp No. 2-Left Front	8W-80-51
Marker Lamp No. 2-Right Front	8W-80-51
Marker Lamp-Left Center	8W-80-51
Marker Lamp-Left Rear	8W-80-51
Marker Lamp-Right Center	8W-80-51
Marker Lamp-Right Rear	8W-80-52
Mass Air Flow Sensor	8W-80-52
Master Door Lock Switch	8W-80-52
Metering Pump	8W-80-52
Microphone Connector	8W-80-52

Component	Page
Panic Alarm Switch	8W-80-53
Parking Brake Switch	8W-80-53
Power Mirror Motor-Driver	8W-80-53
Power Mirror Motor-Passenger	8W-80-53
Power Mirror Switch	8W-80-53
Power Window Motor-Driver	8W-80-54
Power Window Motor-Passenger	8W-80-54
Power Window Switch-Driver	8W-80-54
Power Window Switch-Master	8W-80-54
Power Window Switch-Passenger	8W-80-54
Radio Antenna	8W-80-55
Radio C1	8W-80-55
Radio C2	8W-80-55
Radio/Cellular Antenna	8W-80-55
Reading Lamp Connector	8W-80-56
RECIRCULATED AIR SOLENOID Valve	8W-80-56
Refrigerant Pressure Sensor	8W-80-56
Remote Keyless Entry Antenna	8W-80-56
Roof Fan Motor	8W-80-56
Seat Belt Switch	8W-80-57
Seat Belt Tensioner-Driver	8W-80-57
Seat Belt Tensioner-Passenger	8W-80-57
Security System Module C1	8W-80-57
Security System Module C2	8W-80-58
Sentry Key Remote Entry Module (Skreem)	8W-80-58
Shifter Assembly	8W-80-58
Siren	8W-80-59
Speaker-Left Front Door Assembly C1	8W-80-59
Speaker-Left Front Door Assembly C2	8W-80-59
Speaker-Left Rear	8W-80-59
Speaker-Right Front Door	8W-80-59
Speaker-Right Rear	8W-80-60
Speed Control Switch	8W-80-60
Tail Lamp Assembly-Left	8W-80-60
Tail Lamp Assembly-Right	8W-80-60
TCS Switch (ASR)	8W-80-60
Temperature Switch	8W-80-61
Time Delay Relay	8W-80-61
Towing/Intrusion Sensor On/Off Switch	8W-80-61
Trailer Tow Connector	8W-80-61
Trailer Tow Control Module C1	8W-80-62
Trailer Tow Control Module C2	8W-80-62
Transmission Control Module C1	8W-80-62
Transmission Control Module C2	8W-80-62
Transmission Solenoid Assembly	8W-80-63
Turn Signal No. 1-Left Front	8W-80-63
Turn Signal No. 1-Right Front	8W-80-63
Turn Signal No. 2-Left Front	8W-80-63
Turn Signal No. 2-Right Front	8W-80-64
Warm Air Auxiliary Heater Assembly C1	8W-80-64
Warm Air Auxiliary Heater Assembly C2	8W-80-64
Washer Pump Motor-Front	8W-80-64
Water Cycle Valve	8W-80-64
Water In Fuel Sensor	8W-80-65
Wheel Speed Sensor-Left Front	8W-80-65
Wheel Speed Sensor-Left Rear	8W-80-65
Wheel Speed Sensor-Right Front	8W-80-65
Wheel Speed Sensor-Right Rear	8W-80-65
Window Defogger Module-Rear	8W-80-66
Window Defogger Switch-Rear	8W-80-66
Window Defogger-Left Rear	8W-80-66
Window Defogger-Right Rear	8W-80-66
Wiper Motor-Front	8W-80-66
Wiper/Turn Signal/Engine Start Control Module (Fuse Block No. 1)	8W-80-67



A/C CONTROL MODULE-ROOF

A/C CONTROL MODULE-ROOF - BLACK

CAV	CIRCUIT	FUNCTION
1	12BR	GROUND
2	12RD	FUSED B(+)
3	16YL	A/C SWITCH-ROOF SIGNAL 1
4	16VT	A/C SWITCH-ROOF SIGNAL 2
5	16BK	TEMPERATURE SWITCH SELECT
6	16BR	TEMPERATURE SWITCH SENSE

CONNECTOR NOT AVAILABLE

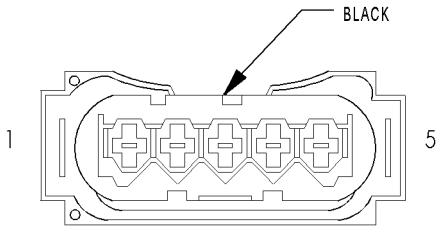
A/C FAN SWITCH

CAV	CIRCUIT	FUNCTION
1	16GY/DG/RD	LAMP DRIVER
3	16BK/BL/WT	FUSED OPTIONAL EQUIPMENT RELAY OUTPUT
4	16WT	SUPPLY VOLTAGE
5	16BR	GROUND
6	16BR	GROUND
7	16BK	RETURN
8	16BK/BL/WT	FUSED OPTIONAL EQUIPMENT RELAY OUTPUT
10	16BR	GROUND

CONNECTOR NOT AVAILABLE

A/C SWITCH-ROOF

CAV	CIRCUIT	FUNCTION
1	16GY/DG/RD	LAMP DRIVER
3	16RD/BK	FUSED D(+) RELAY NO. 1 OUTPUT
4	16VT	A/C SWITCH-ROOF SIGNAL 2
7	16YL	A/C SWITCH-ROOF SIGNAL 1
8	16RD/BK	FUSED D(+) RELAY NO. 1 OUTPUT
10	16BR	GROUND



ACCELERATOR
PEDAL SENSOR
SENSOR

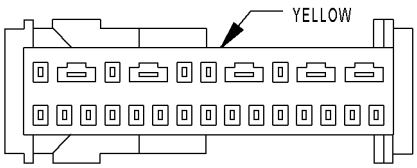
ACCELERATOR PEDAL POSITION SENSOR - BLACK

CAV	CIRCUIT	FUNCTION
1	18BL/RD	ACCEL PEDAL POSITION SENSOR 5 VOLT SUPPLY
2	18BR/BL	SENSOR GROUND
3	18BL/DG	ACCEL PEDAL POSITION SENSOR SIGNAL NO. 1
4	18BR/GY	SENSOR GROUND
5	18GY/DG	ACCEL PEDAL POSITION SENSOR SIGNAL NO. 2

CONNECTOR
NOT
AVAILABLE

AIR OUTLET TEMPERATURE SENSOR

CAV	CIRCUIT	FUNCTION
1	18BR/GY	AIR OUTLET TEMPERATURE SENSOR SIGNAL
2	18BR/BL	SENSOR GROUND



AIRBAG
CONTROL
MODULE

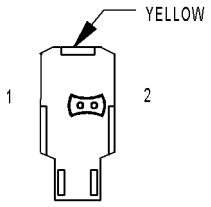
AIRBAG CONTROL MODULE - YELLOW

CAV	CIRCUIT	FUNCTION
1	20BL	DRIVER SEAT BELT TENSIONER LINE 2
2	20BR/YL	DRIVER SEAT BELT TENSIONER LINE 1
3	20BL	PASSENGER SEAT BELT TENSIONER LINE 2
4	20BR	PASSENGER SEAT BELT TENSIONER LINE 1
5	20BK	FUSED IGNITION SWITCH OUTPUT (RUN-START)
6	20BR	GROUND
7	20YL	AIRBAG WARNING INDICATOR DRIVER
9	20BK/RD	K-ACM
10	20DG	DRIVER AIRBAG SQUIB 1 LINE 2
11	20VT	DRIVER AIRBAG SQUIB 1 LINE 1
13	20BL/DG	PASSENGER AIRBAG SQUIB 1 LINE 2
14	20BR/DG	PASSENGER AIRBAG SQUIB 1 LINE 1
20	20DG	ENHANCED ACCIDENT REPORT DRIVER

CONNECTOR
NOT
AVAILABLE

AIRBAG SQUIB-DRIVER

CAV	CIRCUIT	FUNCTION
1	20DG	DRIVER AIRBAG SQUIB 1 LINE 2
2	20VT	DRIVER AIRBAG SQUIB 1 LINE 1



AIRBAG
SQUIB-PASSENGER

AIRBAG SQUIB-PASSENGER - YELLOW

CAV	CIRCUIT	FUNCTION
1	20BL/DG	PASSENGER AIRBAG SQUIB 1 LINE 2
2	20BR/DG	PASSENGER AIRBAG SQUIB 1 LINE 1

CONNECTOR
NOT
AVAILABLE

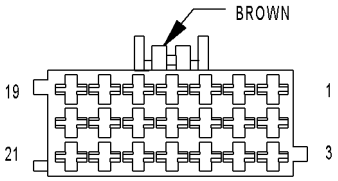
AMBIENT TEMPERATURE SENSOR

CAV	CIRCUIT	FUNCTION
1	20BL/DG	AMBIENT TEMPERATURE SENSOR SIGNAL (+)
2	20BR/DG	AMBIENT TEMPERATURE SENSOR SIGNAL (-)

CONNECTOR
NOT
AVAILABLE

ASH RECEIVER LAMP

CAV	CIRCUIT	FUNCTION
1	18GY/DG/RD	LAMP DRIVER
3	18BR	GROUND



AUTOMATIC
TEMPERATURE
CONTROL
MODULE C1

AUTOMATIC TEMPERATURE CONTROL MODULE C1 - BROWN

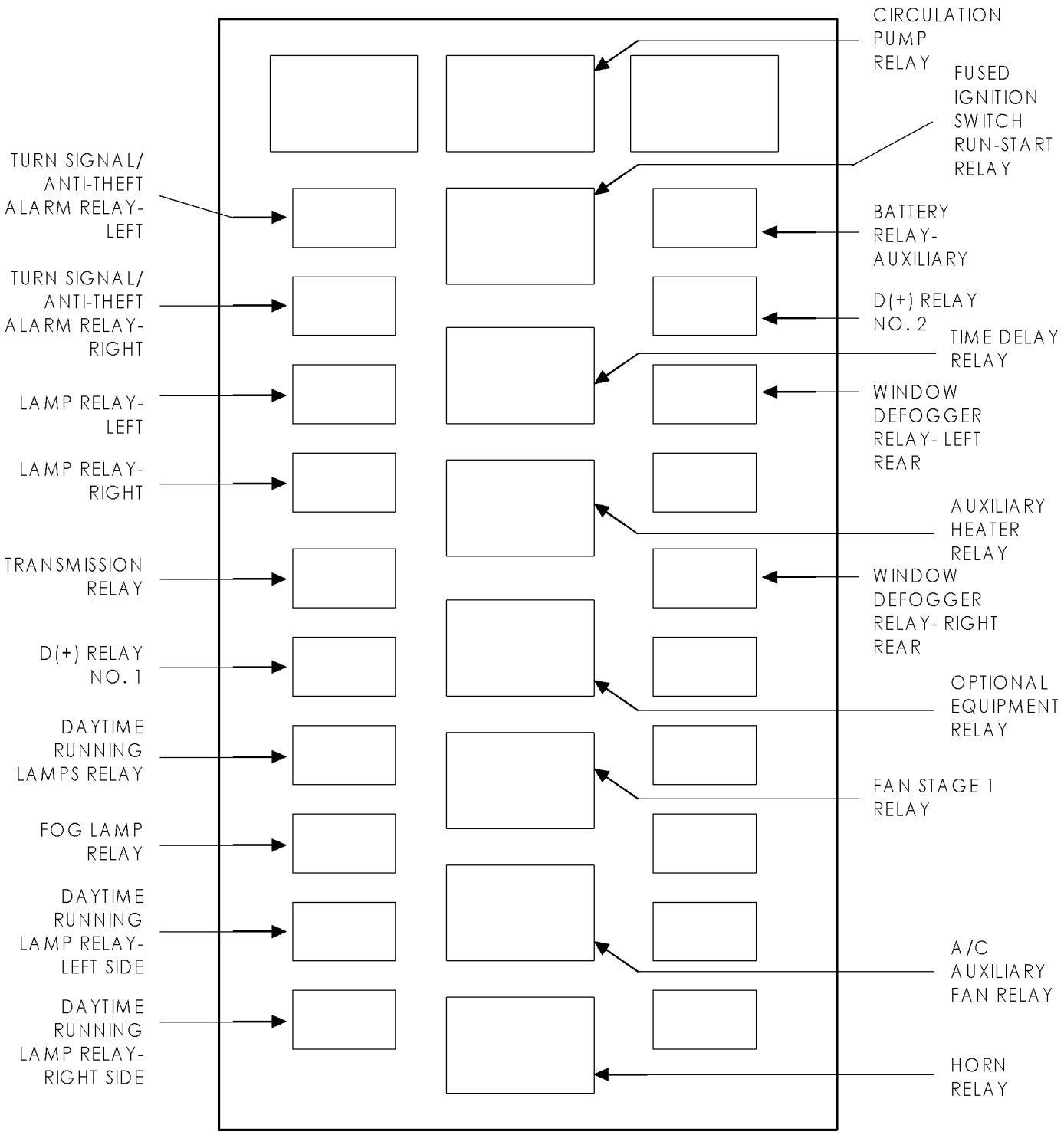
CAV	CIRCUIT	FUNCTION
1	16RD/BL	FUSED B(+)
2	18DG/RD	CIRCULATION PUMP CONTROL
3	18BK/RD	A/C AUXILIARY FAN RELAY HIGH SIDE CONTROL
4	16BL/YL	AUXILIARY HEATER CONTROL
5	18BR/VT	WATER CYCLE VALVE CONTROL
6	20RD/BL	5 VOLT SUPPLY
7	18BK/YL	K-IC/ATC/HBM/CHM
8	20BL/VT	ATCM 8-C1 TO IC 18-C2
8	16RD/YL/WT	FUSED D(+) RELAY NO.1 OUTPUT
9	16GY/DG/RD	LAMP DRIVER
10	16BL	CABIN HEATER CONTROL
11	16BK/BL/WT	RECIRCULATED AIR SOLENOID VALVE CONTROL
12	16BL/DG	A/C COMPRESSOR CLUTCH CONTROL
13	18BR/DG	EVAPORATOR TEMPERATURE SENSOR SIGNAL
15	16BR	GROUND
16	18BR/GY	AIR OUTLET TEMPERATURE SENSOR SIGNAL
17	20DG/WT	CAN C BUS (+)
18	18BR/BL	SENSOR GROUND
19	20BR/RD	REFRIGERANT PRESSURE SENSOR FEEDBACK
20	20DG	CAN C BUS (-)
21	16BK/BL/DG	S201 COMMON CIRCUIT

CONNECTOR
NOT
AVAILABLE

AUTOMATIC TEMPERATURE CONTROL MODULE C2

CAV	CIRCUIT	FUNCTION
1	14BK/VT	BLOWER MOTOR LOW DRIVER
1	12YL	BLOWER MOTOR LOW DRIVER
2	12WT	BLOWER MOTOR HIGH DRIVER
3	12WT/BK	BLOWER MOTOR M1 DRIVER
3	12BK/WT	BLOWER MOTOR M1 DRIVER
4	12YL/BK	BLOWER MOTOR M2 DRIVER
5	12RD/BL	FUSED B(+)

RELAY BLOCK



NOTE: THE RELAY LOCATIONS SHOWN HERE MAY VARY FROM VEHICLE TO VEHICLE.

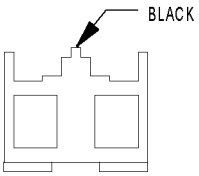
AUXILIARY HEATER RELAY (IN RELAY BLOCK)

CAV	CIRCUIT	FUNCTION
30	12RD/DG	FUSED B(+)
85	18BK	FUSED OPTIONAL EQUIPMENT RELAY OUTPUT
86	18BR	GROUND
87	12RD/BL	AUXILIARY HEATER RELAY OUTPUT
87A	-	-

CONNECTOR NOT AVAILABLE

AUXILIARY HEATER SWITCH

CAV	CIRCUIT	FUNCTION
1	16GY/DG/RD	DAYTIME RUNNING LAMP RELAY OUTPUT
3	16RD/YL	FUSED B(+)
7	16YL	CABIN HEATER CONTROL
10	16BR	GROUND



BATTERY RELAY-AUXILIARY

BATTERY RELAY-AUXILIARY - BLACK

CAV	CIRCUIT	FUNCTION
30	6YL (EXCEPT HEAVY DUTY)	AUXILIARY B(+)
30	4RD (HEAVY DUTY)	AUXILIARY B(+)
85	16BR	GROUND
86	16RD/DG/VT (EXCEPT HEAVY DUTY)	FUSED D(+) RELAY NO. 1 OUTPUT
86	16BR/DG (HEAVY DUTY)	FUSED D(+) RELAY NO. 1 OUTPUT
87	6RD (EXCEPT HEAVY DUTY)	B(+)
87	4RD (HEAVY DUTY)	B(+)
87A	-	-

CONNECTOR NOT AVAILABLE

BLOWER MOTOR RESISTOR BLOCK

CAV	CIRCUIT	FUNCTION
1	12YL/BK	BLOWER MOTOR M2 DRIVER
2	12YL	BLOWER MOTOR LOW DRIVER
3	12BK/WT	BLOWER MOTOR M1 DRIVER
4	12DG	BLOWER MOTOR HIGH DRIVER

CONNECTOR NOT AVAILABLE

BLOWER MOTOR RESISTOR BLOCK C1

CAV	CIRCUIT	FUNCTION
1	12RD/BL	FUSED B(+)
2	12WT	BLOWER MOTOR HIGH DRIVER

CONNECTOR NOT AVAILABLE

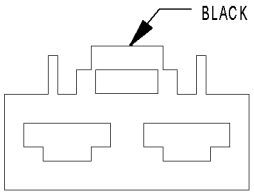
BLOWER MOTOR RESISTOR BLOCK C2

CAV	CIRCUIT	FUNCTION
1	12YL/BK	BLOWER MOTOR M2 DRIVER
2	12YL	BLOWER MOTOR LOW DRIVER
3	12BK/WT	BLOWER MOTOR M1 DRIVER

CONNECTOR NOT AVAILABLE

BLOWER MOTOR RESISTOR BLOCK C3

CAV	CIRCUIT	FUNCTION
1	12RD	FUSED B(+)
2	12RD/BL	BLOWER MOTOR HIGH DRIVER



BLOWER MOTOR-FRONT

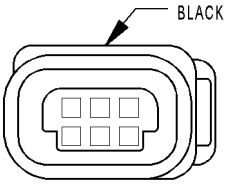
BLOWER MOTOR-FRONT - BLACK

CAV	CIRCUIT	FUNCTION
1	12RD/BL	BLOWER MOTOR HIGH DRIVER
2	12BK	GROUND

CONNECTOR NOT AVAILABLE

BODY PLUG CONNECTOR

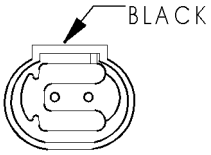
CAV	CIRCUIT	FUNCTION
1	14BL/YL	D(+) RELAY NO. 2 OUTPUT
2	14RD	FUSED B(+)
3	14BK/YL	FUSED IGNITION SWITCH RUN-START RELAY OUTPUT



BOOST PRESSURE SENSOR

BOOST PRESSURE SENSOR - BLACK

CAV	CIRCUIT	FUNCTION
1	18BR/WT	SENSOR GROUND
2	18WT/DG	BOOST PRESSURE SENSOR SIGNAL
3	18WT/RD	BOOST PRESSURE SENSOR 5 VOLT SUPPLY



BOOST PRESSURE SOLENOID

BOOST PRESSURE SOLENOID - BLACK

CAV	CIRCUIT	FUNCTION
1	20WT	BOOST PRESSURE SOLENOID CONTROL
2	20BR	BOOST PRESSURE SOLENOID 12 VOLT SUPPLY

CONNECTOR NOT AVAILABLE

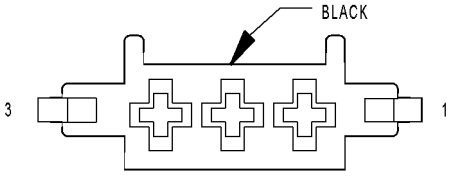
BRAKE FLUID LEVEL SWITCH

CAV	CIRCUIT	FUNCTION
1	20BR/YL	PARKING BRAKE SIGNAL
2	16BR	GROUND

CONNECTOR NOT AVAILABLE

BRAKE LAMP SWITCH C1

CAV	CIRCUIT	FUNCTION
1	20WT	BRAKE SWITCH OUTPUT
2	16RD/BK	FUSED IGNITION SWITCH OUTPUT (RUN-START)
3	20BK/BL/RD	BRAKE LAMP SWITCH



BRAKE LAMP SWITCH C2

BRAKE LAMP SWITCH C2 - BLACK

CAV	CIRCUIT	FUNCTION
1	20BK/BL/WT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
2	20BK/RD	BRAKE LAMP SWITCH OUTPUT

CONNECTOR NOT AVAILABLE

BRAKE WEAR SENSOR-LEFT FRONT

CAV	CIRCUIT	FUNCTION
1	16BR	GROUND
2	16BR/WT	BRAKE WEAR SENSOR SIGNAL

CONNECTOR NOT AVAILABLE

BRAKE WEAR SENSOR-LEFT REAR

CAV	CIRCUIT	FUNCTION
1	16BR	GROUND
2	16BR/WT	BRAKE WEAR SENSOR SIGNAL

CONNECTOR NOT AVAILABLE

BRAKE WEAR SENSOR-RIGHT FRONT

CAV	CIRCUIT	FUNCTION
1	16BR	GROUND
2	16BR/WT	BRAKE WEAR SENSOR SIGNAL

CONNECTOR NOT AVAILABLE

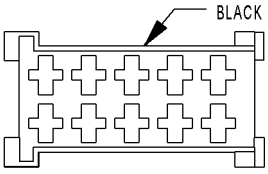
BRAKE WEAR SENSOR-RIGHT REAR

CAV	CIRCUIT	FUNCTION
1	16BR	GROUND
2	16BR/WT	BRAKE WEAR SENSOR SIGNAL

CONNECTOR NOT AVAILABLE

C100 - (MAIN BODY SIDE)

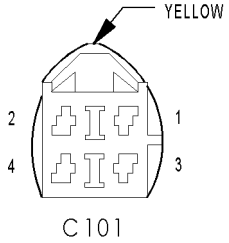
CAV	CIRCUIT
1	18BK/BL
2	18RD/DG
3	16WT/BL/RD
5	16RD
6	16BK
7	16BK/BL
8	14BK/VT



C100

C100 - BLACK (MAIN BODY)

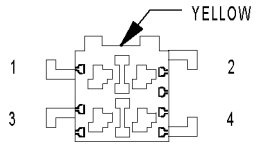
CAV	CIRCUIT
1	18BK/BL
2	18RD/DG
3	16WT/BL/RD
5	16RD
6	16BK
7	16BK/BL
8	14BK/VT



C101

C101 - YELLOW (ENGINE SIDE)

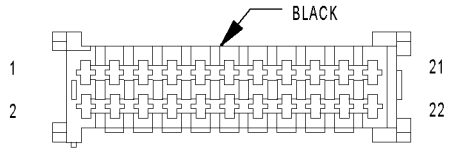
CAV	CIRCUIT
1	16BL
2	14BK/YL
3	16BL/DG
4	16BK/RD



C101

C101 - YELLOW (MAIN BODY SIDE)

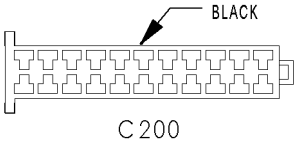
CAV	CIRCUIT
1	20BL
2	12BK/YL
3	16BL/DG
4	16BK/RD



C200

C200 - BLACK (DASH SIDE)

CAV	CIRCUIT
1	16GY
2	16GY/DG
3	16BK/YL
4	16DG/BL/WT
5	16YL/BL
6	16BL/RD
7	16BK/RD
8	16WT/BK
9	16WT/DG
10	16WT/YL
11	16WT/RD
12	16BK/RD
13	16VT/YL
14	16BR/WT
15	16YL
16	16BR/WT
17	16GY/RD
18	16BK/YL/DG
19	16BK/YL



C200

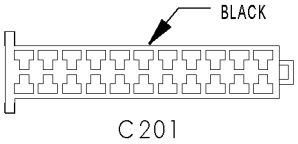
C200 - BLACK (MAIN BODY SIDE)

CAV	CIRCUIT
1	16GY
2	16GY/DG
3	16BK/YL
4	16DG/BL/WT
5	16YL/BL
6	16BL/RD
7	16BK/RD
8	16WT/BK
9	16WT/DG
10	16WT/YL
11	16WT/RD
12	16BK/RD
13	18VT/YL
14	16BR/BK
15	16YL
16	16BR/WT
17	16GY/RD
18	16BK/YL/DG
19	16BK/YL

CONNECTOR NOT AVAILABLE

C201 - (DASH SIDE)

CAV	CIRCUIT
2	16GY/DG/RD
3	16RD/BL
4	20BL/VT
4	16RD/YL/WT
5	16VT/WT
6	20BL/RD/WT
7	16BK/RD
8	16RD/YL
9	18BK/RD
10	18BK/BL
11	16YL
13	16RD
15	18RD/BK



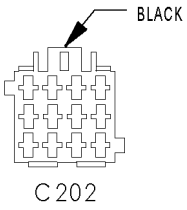
C201 - BLACK (MAIN BODY SIDE)

CAV	CIRCUIT
2	16GY/DG/RD
3	16RD/BL
4	16RD/YL/WT
4	20BL/VT
5	16VT/WT
6	20BL/RD/WT
7	16BK/RD
8	16RD/YL
9	16BK/RD
10	18BK/BL
11	16YL
13	16RD
15	18RD/BK

CONNECTOR NOT AVAILABLE

C202 - (DASH SIDE)

CAV	CIRCUIT
1	16WT/RD
2	16WT/BL/RD
3	20BK/BL/RD
4	20BL/DG
6	18BK/DG
7	20DG/WT
8	20DG



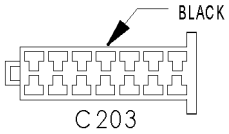
C202 - BLACK (MAIN BODY SIDE)

CAV	CIRCUIT
1	16WT/RD
2	16WT/BL/RD
3	20BK/BL/RD
4	20BL/DG
6	18BK/DG
7	20DG/WT
8	20DG

CONNECTOR
NOT
AVAILABLE

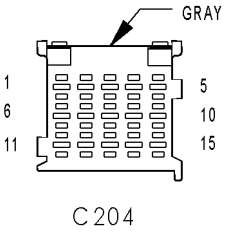
C203 - (DASH SIDE)

CAV	CIRCUIT
1	18GY/YL
2	18GY/BR
3	18GY/WT
10	18VT/DG
11	16RD



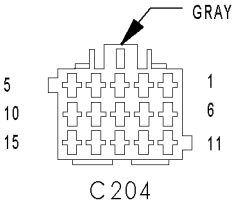
C203 - BLACK (MAIN BODY SIDE)

CAV	CIRCUIT
1	18GY/YL
2	18GY/BR
3	18GY/WT
10	18VT/DG
11	16RD



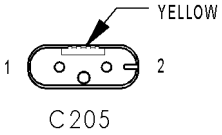
C204 - GRAY (DASH SIDE)

CAV	CIRCUIT
1	18BK/RD
2	18BK/YL
3	20DG/WT
4	20DG
5	18DG/RD
6	18BR/VT
7	16BL
8	16BL/YL
9	16BL/DG
10	18BR/BL
11	20BR/RD
12	20RD/BL
13	16RD/BK
14	14BK/VT
15	16RD



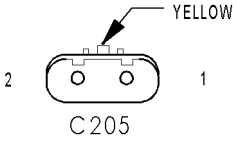
C204 - GRAY (MAIN BODY SIDE)

CAV	CIRCUIT
1	18BK/RD
2	18BK/YL
3	20DG/WT
4	20DG
5	18DG/RD
6	18BR/VT
7	16BL
8	16BL/YL
9	16BL/DG
10	18BR/BL
11	20BR/RD
12	20RD/BL
13	16RD/BK
14	4BK/VT
15	16RD



C205 - YELLOW (DASH SIDE)

CAV	CIRCUIT
1	20BL/DG
2	20BR/DG



C205 - YELLOW (MAIN BODY SIDE)

CAV	CIRCUIT
1	20BL/DG
2	20BR/DG

CONNECTOR NOT AVAILABLE

C206 - (DASH SIDE)

CAV	CIRCUIT
1	16RD
2	14BK/VT
3	16VT/DG
4	16VT/RD
5	16VT/YL
6	16VT/BK
7	16VT/BR
8	16VT
15	16BK/BL/WT
18	16VT/YL
19	16VT/BL
20	18RD/BK/WT
21	18BK/BL

CONNECTOR NOT AVAILABLE

C206 - (MAIN BODY SIDE)

CAV	CIRCUIT
1	16BK/BL/WT
2	14BK/VT
3	16VT/DG
4	16VT/RD
5	16VT/YL
6	16VT/BK
7	16VT/BR
8	16VT
15	16BK/BL/WT
18	16VT/YL
19	16VT/BL
20	16RD/BK/WT
21	18BK/BL

CONNECTOR NOT AVAILABLE

C207 - (DASH SIDE)

CAV	CIRCUIT
11	16DG
12	16YL
17	16RD/YL

CONNECTOR NOT AVAILABLE

C207 - (MAIN BODY SIDE)

CAV	CIRCUIT
11	16DG
12	16YL
17	16RD/YL

CONNECTOR NOT AVAILABLE

C208 - (CABIN SIDE)

CAV	CIRCUIT
3	16WT
4	16BK

CONNECTOR NOT AVAILABLE

C208 - (DASH SIDE)

CAV	CIRCUIT
3	16WT
4	16BK

CONNECTOR NOT AVAILABLE

C209 - (CABIN SIDE)

CAV	CIRCUIT
1	16BR/BL
2	16WT/BL
3	16BR/DG
4	16WT/DG

CONNECTOR NOT AVAILABLE

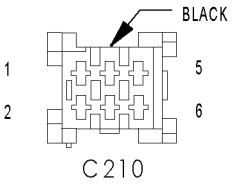
C209 - (DASH SIDE)

CAV	CIRCUIT
1	16BR/BL
2	16WT/BL
3	16BR/GY
4	16WT/GY

CONNECTOR NOT AVAILABLE

C210 - (DRIVER DOOR SIDE)

CAV	CIRCUIT
1	14BR
2	16B/YL
3	16BK/YL/DG
4	16BK/WT
5	16BL/WT



C210

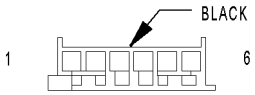
C210 - BLACK (MAIN BODY SIDE)

CAV	CIRCUIT
1	14BR
2	16BK/YL
3	16BK/YL/DG
4	16BK/WT
5	16BL/WT

CONNECTOR NOT AVAILABLE

C211 - (POWER MIRROR SWITCH SIDE)

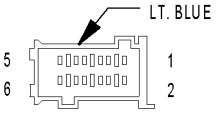
CAV	CIRCUIT
1	18BR
2	18BK/RD
4	18BL/DG
5	18DG
6	18WT/GY



C211

C211 - BLACK (POWER MIRROR SIDE)

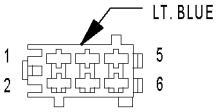
CAV	CIRCUIT
1	18BR
2	18BK/RD
4	18BL/DG
5	18DG
6	18WT/GY



C214

C214 - LT. BLUE (CABIN SIDE)

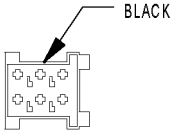
CAV	CIRCUIT
1	16YL
2	16VT
3	16BK
4	16BR



C214

C214 - LT.BLUE (DASH SIDE)

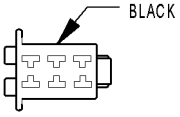
CAV	CIRCUIT
1	16YL
2	16VT
3	16BK
4	16BR



C215

C215 - BLACK (CABIN SIDE)

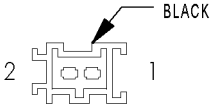
CAV	CIRCUIT
1	16RD/YL
2	16BK/RD
5	16BR/WT
6	14BR



C215

C215 - BLACK (MAIN BODY)

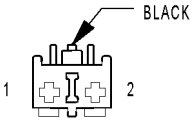
CAV	CIRCUIT
1	16RD/YL
2	16BK/RD
5	20BR/WT
6	14BR



C216

C216 - BLACK (CABIN SIDE)

CAV	CIRCUIT
1	12RD



C216

C216 - BLACK (MAIN BODY SIDE)

CAV	CIRCUIT
1	12RD

CONNECTOR NOT AVAILABLE

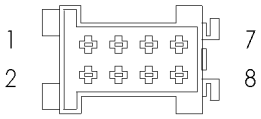
C217 - (CABIN SIDE)

CAV	CIRCUIT
1	16RD/YL
2	16YL
3	16DG
4	16YL

CONNECTOR NOT AVAILABLE

C217 - (MAIN BODY SIDE)

CAV	CIRCUIT
1	16RD/YL
2	16YL
3	16DG
4	16YL



C218

C218 - (CABIN SIDE)

CAV	CIRCUIT
1	16BR/WT
2	16BR/YL
3	16RD/DG
4	16DG/YL
5	20DG/BK
6	20GY/BK
7	20DG/WT/BL

CONNECTOR NOT AVAILABLE

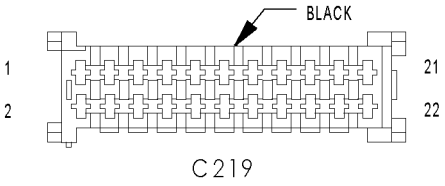
C218 - (MAIN BODY SIDE)

CAV	CIRCUIT
1	16BR/WT
2	16BR/YL
3	16RD/DG
4	16DG/YL
5	20DG/BK
6	20GY/BK
7	20DG/WT/BL

CONNECTOR
NOT
AVAILABLE

C219 - (MAIN BODY SIDE)

CAV	CIRCUIT
5	16BK/RD
6	16BL/RD
7	16YL/WT
8	16DG/BK
9	16BK/RD
10	16BL/RD
11	16YL/RD
12	16DG/YL



C219 - BLACK (CABIN SIDE)

CAV	CIRCUIT
5	16BK/RD
6	16BL/RD
7	16YL/WT
8	16DG/BK
9	16BK/RD
10	16BL/RD
11	16YL/RD
12	16DG/YL

CONNECTOR
NOT
AVAILABLE

C220 - (CIGARETTE SIDE)

CAV	CIRCUIT
1	16RD/YL
2	16BR
3	16GY/DG/RD

CONNECTOR
NOT
AVAILABLE

C220 - (DASH SIDE)

CAV	CIRCUIT
1	16RD/YL
2	16BR
3	16GY/DG/RD

CONNECTOR NOT AVAILABLE

C221 - (MAIN BODY SIDE)

CAV	CIRCUIT
1	16BL/WT
2	16BK/YL/DG
3	16BK/WT

CONNECTOR NOT AVAILABLE

C221 - (PASSENGER DOOR SIDE)

CAV	CIRCUIT
1	16BL/WT
2	16BK/YL/DG
3	16BK/WT

CONNECTOR NOT AVAILABLE

C224 - (ATC MOTOR/SOLENOID SIDE)

CAV	CIRCUIT
1	12RD
2	12BK

CONNECTOR NOT AVAILABLE

C224 - (MAIN BODY SIDE)

CAV	CIRCUIT
1	12RD
2	12BR

CONNECTOR NOT AVAILABLE

C225 - (ATC MOTOR/SOLENOID SIDE)

CAV	CIRCUIT
1	12RD
2	12RD/BL
3	16RD

CONNECTOR NOT AVAILABLE

C225 - (DASH SIDE)

CAV	CIRCUIT
1	12RD/BL
2	12BL
3	16RD

CONNECTOR NOT AVAILABLE

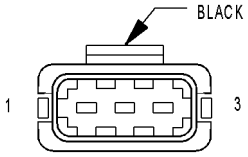
CABIN HEATER ASSEMBLY C1

CAV	CIRCUIT	FUNCTION
B	16BL/YL (CABIN HEATER MODULE)	CIRCULATION PUMP RELAY HIGH SIDE CONTROL
B	16BL/YL (REST SYSTEM)	AUXILIARY HEATER CONTROL

CONNECTOR NOT AVAILABLE

CABIN HEATER ASSEMBLY C2

CAV	CIRCUIT	FUNCTION
1	14RD	FUSED B(+)
2	14BR	GROUND
3	16BL/YL (PROGRAM TIMER)	FAN STAGE 1 RELAY HIGH SIDE CONTROL
4	16DG	DOSING PUMP CONTROL
5	16BL/RD	K-IC/ATC/HBM/CHM
6	16BK/BL/DG (EXCEPT PROGRAM TIMER)	FUSED OPTIONAL EQUIPMENT RELAY OUTPUT
6	16BK (PROGRAM TIMER)	HEATER BOOSTER MODE
7	16BL (EXCEPT PROGRAM TIMER)	CABIN HEATER CONTROL
7	16YL (PROGRAM TIMER)	CABIN HEATER CONTROL



CAMSHAFT POSITION SENSOR

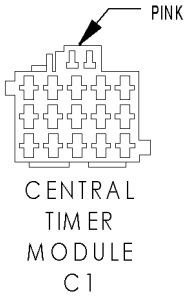
CAMSHAFT POSITION SENSOR - BLACK

CAV	CIRCUIT	FUNCTION
1	20BR/DG	SENSOR GROUND
2	20YL/GY	CAMSHAFT POSITION SENSOR SIGNAL
3	18RD/BL	CAMSHAFT POSITION SENSOR 12 VOLT SUPPLY

CONNECTOR NOT AVAILABLE

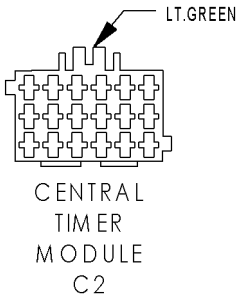
CENTER HIGH MOUNTED STOP LAMP

CAV	CIRCUIT	FUNCTION
1	16BK/RD	BRAKE LAMP SWITCH OUTPUT
2	16BR	GROUND



CENTRAL TIMER MODULE C1 - PINK

CAV	CIRCUIT	FUNCTION
1	16DG/BK	DRIVER DOOR UNLOCK SENSE
2	16BL/RD	DRIVER DOOR LOCK DRIVER
3	16BK/RD	DRIVER DOOR UNLOCK DRIVER
4	16YL/BK	DRIVER DOOR LOCK SENSE
5	16DG/BL/WT	PASSENGER FRONT DOOR UNLOCK SENSE
6	16YL/BL	PASSENGER FRONT DOOR LOCK SENSE
7	18BK/YL	MASTER DOOR LOCK SWITCH SENSE-ALL DOORS
8	16RD/BK	FUSED D(+) RELAY NO. 1 OUTPUT
9	16WT/BL (EXCEPT VTSS)	RKE INTERFACE
9	16WT/BL/RD (VTSS)	RKE INTERFACE
10	16BK/RD	FUSED IGNITION SWITCH OUTPUT
11	16DG	ENHANCED ACCIDENT REPORT DRIVER
12	20DG/WT	K-CTM/SSM
13	14RD/WT	FUSED B(+)
14	14BR	GROUND
15	16WT/BK	DRIVER DOOR AJAR INDICATOR DRIVER



CENTRAL TIMER MODULE C2 - LT.GREEN

CAV	CIRCUIT	FUNCTION
3	16WT/DG	PASSENGER DOOR AJAR INDICATOR DRIVER
6	16WT/RD	MASTER DOOR LOCK SWITCH SENSE-PASSENGER DOORS
7	16DG/BK	LEFT SLIDING DOOR UNLOCK SENSE
10	16DG/RD	REAR DOOR UNLOCK SENSE
11	16YL/WT	LEFT SLIDING DOOR LOCK SENSE
12	16YL/BK	REAR DOOR LOCK SENSE
13	16YL/RD	RIGHT SLIDING DOOR LOCK SENSE
14	16DG/YL	RIGHT SLIDING DOOR UNLOCK SENSE
17	16BK/RD	PASSENGER DOORS UNLOCK DRIVER (+)
18	16BL/RD	PASSENGER DOORS LOCK DRIVER (+)

CONNECTOR
NOT
AVAILABLE

CIGAR LIGHTER

CAV	CIRCUIT	FUNCTION
1	16BR	GROUND
2	16RD/YL	FUSED B(+)

CONNECTOR NOT AVAILABLE

CIGAR LIGHTER LAMP

CAV	CIRCUIT	FUNCTION
1	16BR	GROUND
2	16GY/DG/RD	LAMP DRIVER

CONNECTOR NOT AVAILABLE

CIRCULATION PUMP (CABIN HEATER MODULE)

CAV	CIRCUIT	FUNCTION
1	18DG/RD	CIRCULATION PUMP RELAY OUTPUT
2	18BR	GROUND

CONNECTOR NOT AVAILABLE

CIRCULATION PUMP (REST SYSTEM)

CAV	CIRCUIT	FUNCTION
1	18DG/RD	CIRCULATION PUMP CONTROL
2	18BR	GROUND

CONNECTOR NOT AVAILABLE

CIRCULATION PUMP DIODE

CAV	CIRCUIT	FUNCTION
3	18DG/RD	CIRCULATION PUMP RELAY OUTPUT
4	18DG/BK	CIRCULATION PUMP RELAY OUTPUT
4	18BK	FUSED OPTIONAL EQUIPMENT RELAY OUTPUT

CONNECTOR NOT AVAILABLE

CLOCKSPRING C1

CAV	CIRCUIT	FUNCTION
1	16BK/YL	HORN RELAY CONTROL
2	16BR	GROUND

CONNECTOR NOT AVAILABLE

CLOCKSPRING C2

CAV	CIRCUIT	FUNCTION
1	20VT	DRIVER AIRBAG SQUIB 1 LINE 1
2	20DG	DRIVER AIRBAG SQUIB 1 LINE 2

CONNECTOR NOT AVAILABLE

CONTROLLER ANTILOCK BRAKE

CAV	CIRCUIT	FUNCTION
1	12BR	GROUND
2	12RD	FUSED B(+)
5	14BR	GROUND
6	14RD	FUSED B(+)
11	18BL/BK	K-ABS/SHIFTER ASSEMBLY
12	18BK	LEFT FRONT WHEEL SPEED SENSOR (+)
14	20WT	LEFT REAR WHEEL SPEED SENSOR (+)
15	18BR	RIGHT FRONT WHEEL SPEED SENSOR(-)
16	18BK	RIGHT FRONT WHEEL SPEED SENSOR (+)
20	20WT	BRAKE SWITCH OUTPUT
23	18BK/RD	FUSED OPTIONAL EQUIPMENT RELAY OUTPUT
24	20DG/WT	CAN C BUS (+)
27	18BK/BL	TCS SWITCH (ASR) SENSE
28	18BR	LEFT FRONT WHEEL SPEED SENSOR (-)
29	20BR	LEFT REAR WHEEL SPEED SENSOR (-)
30	20BR	RIGHT REAR WHEEL SPEED SENSOR (-)
31	20YL	RIGHT REAR WHEEL SPEED SENSOR (+)
32	18BK/RD	BRAKE LAMP SWITCH OUTPUT
40	20DG	CAN C BUS (-)

CONNECTOR NOT AVAILABLE

COURTESY LAMP-DRIVER DOOR

CAV	CIRCUIT	FUNCTION
1	16RD/YL	FUSED B(+)
2	16BR/WT	FRONT COURTESY LAMPS CONTROL

CONNECTOR NOT AVAILABLE

COURTESY LAMP-LEFT SLIDING DOOR

CAV	CIRCUIT	FUNCTION
1	16RD/YL	FUSED B(+)
2	16BR/WT	DOOR AJAR SWITCH SENSE

CONNECTOR NOT AVAILABLE

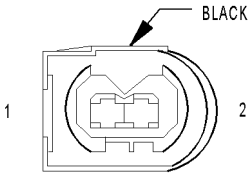
COURTESY LAMP-PASSENGER DOOR

CAV	CIRCUIT	FUNCTION
1	16RD/YL	FUSED B(+)
2	16BR/WT	FRONT COURTESY LAMPS CONTROL

CONNECTOR NOT AVAILABLE

COURTESY LAMP-RIGHT SLIDING DOOR

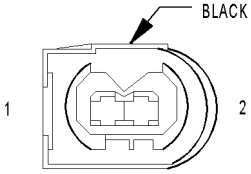
CAV	CIRCUIT	FUNCTION
1	16RD/YL	FUSED B(+)
2	16BR/WT	DOOR AJAR SWITCH SENSE



CRANKCASE HEATER

CRANKCASE HEATER - BLACK

CAV	CIRCUIT	FUNCTION
1	18BR	GROUND
2	16BK/RD	FUSED ENGINE CONTROL RELAY OUTPUT



CRANKSHAFT POSITION SENSOR

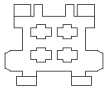
CRANKSHAFT POSITION SENSOR - BLACK

CAV	CIRCUIT	FUNCTION
1	20DG	SENSOR GROUND
2	20DG/WT	CRANKSHAFT POSITION SENSOR SIGNAL

CONNECTOR NOT AVAILABLE

CTEL CONNECTOR

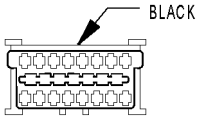
CAV	CIRCUIT	FUNCTION
1	16BR	GROUND
4	16DG/YL/BK	RADIO MUTE
7	18BL/DG	SPEAKER-LEFT FRONT DOOR ASSEMBLY (-)
9	18BR	CTEL CONNECTOR CAV 9 TO MICROPHONE CONNECTOR CAV 1
10	18BK/BL	FUSED OPTIONAL EQUIPMENT RELAY OUTPUT
11	18RD/BK/WT	FUSED B(+)
12	18BK/BL	FUSED OPTIONAL EQUIPMENT RELAY OUTPUT
16	18BL/YL	SPEAKER-LEFT FRONT DOOR ASSEMBLY (+)
18	18BL	CTEL CONNECTOR CAV 18 TO MICROPHONE CONNECTOR



CYLINDER
LOCK
SWITCH-DRIVER

CYLINDER LOCK SWITCH-DRIVER

CAV	CIRCUIT	FUNCTION
1	16BK	DRIVER CYLINDER UNLOCK SENSE
3	16BR	GROUND
4	16RD	DRIVER CYLINDER LOCK SENSE



DATA
LINK
CONNECTOR

DATA LINK CONNECTOR - BLACK

CAV	CIRCUIT	FUNCTION
1	20WT/DG	K-SKREEM
3	20DG/GY	ENGINE RPM
4	20BR	GROUND
5	20BR	GROUND
7	18BL/YL	K-ECM
8	20BK/BL/DG	FUSED IGNITION SWITCH OUTPUT (RUN-START)
9	20BL/BK	K-ABS/SHIFTER ASSEMBLY
11	20BL	K-TCM
12	20GY/DG/RD	K-CTM/SSM
13	20BK/RD	K-ACM
15	20WT/GY	K-IC/ATC/HBM/CHM
16	20RD/YL	FUSED B(+)

CONNECTOR
NOT
AVAILABLE

DIFFERENTIAL LOCK SOLENOID VALVE

CAV	CIRCUIT	FUNCTION
1	18VT/YL	DIFFERENTIAL LOCK SOLENOID CONTROL
2	18BR	GROUND

CONNECTOR
NOT
AVAILABLE

DOME LAMP

CAV	CIRCUIT	FUNCTION
1	16BR	GROUND
2	16RD/YL	FUSED B(+)
3	16BR/WT	FRONT COURTESY LAMPS CONTROL

CONNECTOR NOT AVAILABLE

DOOR LOCK MOTOR/AJAR SWITCH ASSEMBLY-DRIVER C1

CAV	CIRCUIT	FUNCTION
1	16YL/BK	DRIVER DOOR LOCK SENSE
2	16DG/BK	DRIVER DOOR UNLOCK SENSE

CONNECTOR NOT AVAILABLE

DOOR LOCK MOTOR/AJAR SWITCH ASSEMBLY-DRIVER C2

CAV	CIRCUIT	FUNCTION
1	16BK/RD	DRIVER DOOR UNLOCK DRIVER
2	16BL/RD	DRIVER DOOR LOCK DRIVER

CONNECTOR NOT AVAILABLE

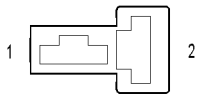
DOOR LOCK MOTOR/AJAR SWITCH ASSEMBLY-LEFT SLIDING C1

CAV	CIRCUIT	FUNCTION
1	16BK/RD	PASSENGER DOORS UNLOCK DRIVER (+)
2	16BL/RD	PASSENGER DOORS LOCK DRIVER (+)

CONNECTOR NOT AVAILABLE

DOOR LOCK MOTOR/AJAR SWITCH ASSEMBLY-LEFT SLIDING C2

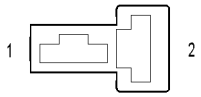
CAV	CIRCUIT	FUNCTION
3	16YL/WT	LEFT SLIDING DOOR LOCK SENSE
4	16DG/BK	LEFT SLIDING DOOR UNLOCK SENSE



DOOR LOCK MOTOR/AJAR SWITCH ASSEMBLY-PASSENGER C1

DOOR LOCK MOTOR/AJAR SWITCH ASSEMBLY-PASSENGER C1

CAV	CIRCUIT	FUNCTION
1	20YL/BL	PASSENGER FRONT DOOR LOCK SENSE
2	20DG/BL/WT	PASSENGER FRONT DOOR UNLOCK SENSE



DOOR LOCK MOTOR/AJAR SWITCH ASSEMBLY-PASSENGER C2

DOOR LOCK MOTOR/AJAR SWITCH ASSEMBLY-PASSENGER C2

CAV	CIRCUIT	FUNCTION
1	16BK/RD	PASSENGER DOORS UNLOCK DRIVER (+)
2	16BL/RD	PASSENGER DOORS LOCK DRIVER (+)

CONNECTOR NOT AVAILABLE

DOOR LOCK MOTOR/AJAR SWITCH ASSEMBLY-REAR C1

CAV	CIRCUIT	FUNCTION
1	16BK/RD	PASSENGER DOORS UNLOCK DRIVER (+)
2	16BL/RD	PASSENGER DOORS LOCK DRIVER (+)

CONNECTOR NOT AVAILABLE

DOOR LOCK MOTOR/AJAR SWITCH ASSEMBLY-REAR C2

CAV	CIRCUIT	FUNCTION
3	16YL/BK (CARGO VAN)	REAR DOOR LOCK SENSE
4	16DG/RD (CARGO VAN)	REAR DOOR UNLOCK SENSE
4	16YLBK (PASSENGER VAN)	REAR DOOR LOCK SENSE
5	16DG/RD (PASSENGER VAN)	REAR DOOR UNLOCK SENSE

CONNECTOR NOT AVAILABLE

DOOR LOCK MOTOR/AJAR SWITCH ASSEMBLY-RIGHT SLIDING C1

CAV	CIRCUIT	FUNCTION
1	16BK/RD	PASSENGER DOORS UNLOCK DRIVER (+)
2	16BL/RD	PASSENGER DOORS LOCK DRIVER (+)

CONNECTOR NOT AVAILABLE

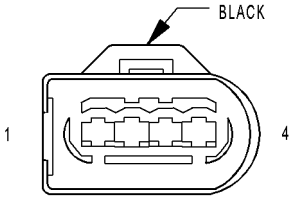
DOOR LOCK MOTOR/AJAR SWITCH ASSEMBLY-RIGHT SLIDING C2

CAV	CIRCUIT	FUNCTION
3	16YL/RD	RIGHT SLIDING DOOR LOCK SENSE
4	16DG/YL	RIGHT SLIDING DOOR UNLOCK SENSE

CONNECTOR
NOT
AVAILABLE

DOSING PUMP

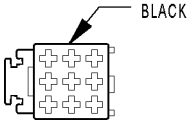
CAV	CIRCUIT	FUNCTION
1	16DG	DOSING PUMP CONTROL
2	16BR	GROUND



EGR
VALVE

EGR VALVE - BLACK

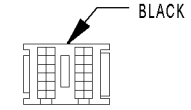
CAV	CIRCUIT	FUNCTION
1	20RD/YL	EGR VALVE CONTROL
2	16BK/GY	FUSED ENGINE CONTROL RELAY OUTPUT
3	18BR/BK	SENSOR GROUND



ENGINE
CONTROL
MODULE
C1

ENGINE CONTROL MODULE C1 - BLACK

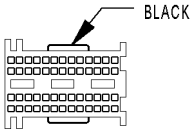
CAV	CIRCUIT	FUNCTION
1	16BK/RD	FUSED ENGINE CONTROL RELAY OUTPUT
4	14BR	GROUND
5	14BR	GROUND
6	14BR	GROUND
7	14BK/BL	FUSED ENGINE CONTROL RELAY OUTPUT
8	14BK/BL	FUSED ENGINE CONTROL RELAY OUTPUT



ENGINE
CONTROL
MODULE
C2

ENGINE CONTROL MODULE C2 - BLACK

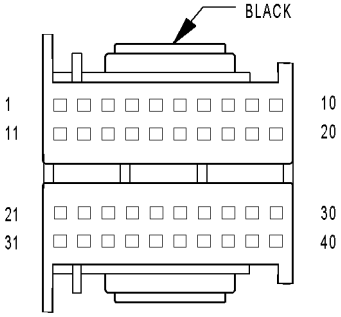
CAV	CIRCUIT	FUNCTION
7	18BR/DG	KICKDOWN SWITCH SIGNAL
9	18BR	SENSOR GROUND
11	20DG/WT	CAN C BUS (+)
12	20DG	CAN C BUS (-)
13	18BK	FUSED IGNITION SWITCH OUTPUT (RUN-START)
14	18DG	DECEL/SET SIGNAL
16	18YL	ACCEL/SET SIGNAL
17	20DG	ENHANCED ACCIDENT REPORT DRIVER
19	18RD	S/C SWITCH 12 VOLT SUPPLY
20	18BL	RESUME SIGNAL
21	18BK	VERIFICATION SIGNAL
22	18GY	OFF SIGNAL



ENGINE CONTROL MODULE C3

ENGINE CONTROL MODULE C3 - BLACK

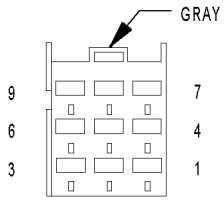
CAV	CIRCUIT	FUNCTION
1	18BR/DG	SENSOR GROUND
5	18BL/RD	ACCEL PEDAL POSITION SENSOR 5 VOLT SUPPLY
6	18WT/DG	BOOST PRESSURE SENSOR SIGNAL
7	20BR/YL	SENSOR GROUND
8	18BR/GY	SENSOR GROUND
9	18GY/DG	ACCEL PEDAL POSITION SENSOR SIGNAL NO. 2
10	18BL/DG	ACCEL PEDAL POSITION SENSOR SIGNAL NO. 1
12	18DG/WT	INTAKE AIR TEMPERATURE SENSOR SIGNAL
17	18WT/RD	BOOST PRESSURE SENSOR 5 VOLT SUPPLY
18	20YL/DG	MASS AIR FLOW SENSOR SIGNAL
19	20BR/BK	MASS AIR FLOW SENSOR 5 VOLT SUPPLY
20	18VT	IGNITION SWITCH OUTPUT (START)
22	18BR/WT	SENSOR GROUND
23	18BR/BL	SENSOR GROUND
25	18BK/RD	GLOW PLUG MODULE CONTROL
28	20BL/YL	K-ECM
30	18RD/BL	STARTER MOTOR RELAY 12 VOLT SUPPLY
33	20YL/RD	MASS AIR FLOW SENSOR 12 VOLT SUPPLY
35	20BR	BOOST PRESSURE SOLENOID 12 VOLT SUPPLY
40	20DG/YL	ENGINE RPM
43	18VT/DG	STARTER MOTOR RELAY CONTROL
46	18YL/BL	FUSE BLOCK NO. 1 C5 CAV 15 COMMON CIRCUIT
48	20WT	BOOST PRESSURE SOLENOID CONTROL



ENGINE CONTROL MODULE C4

ENGINE CONTROL MODULE C4 - BLACK

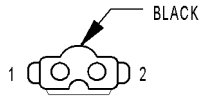
CAV	CIRCUIT	FUNCTION
2	20BR/DG	SENSOR GROUND
3	20YL/GY	CAMSHAFT POSITION SENSOR SIGNAL
4	20BR/GY	SENSOR GROUND
7	18GY/YL	SENSOR GROUND
8	18GY/DG	LOW FUEL PRESSURE SENSOR 5 VOLT SUPPLY
10	18BR/RD	WATER IN FUEL SENSOR 12 VOLT SUPPLY
11	18BK/YL	WATER IN FUEL SENSOR SIGNAL
12	18RD/BL	CAMSHAFT POSITION SENSOR 12 VOLT SUPPLY
13	20RD/DG	FUEL PRESSURE SENSOR 5 VOLT SUPPLY
14	20DG/VT	FUEL PRESSURE SENSOR SIGNAL
15	20GY/BL	ENGINE OIL SENSOR SIGNAL
17	20BR/BK	SENSOR GROUND
18	20RD/YL	ENGINE OIL SENSOR 5 VOLT SUPPLY
21	20BK/WT	GROUND
22	18RD/BK	FUEL SHUTDOWN SOLENOID 12 VOLT SUPPLY
26	20DG	SENSOR GROUND
27	20BR/WT	SENSOR GROUND
30	18DG/BK	SENSOR GROUND
31	20RD/WT	FUEL PRESSURE SOLENOID CONTROL
32	20BR/YL	FUEL SHUTDOWN SOLENOID CONTROL
34	18BR	SENSOR GROUND
36	20DG/RD	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL
37	20DG/WT	CRANKSHAFT POSITION SENSOR SIGNAL
38	18GY/RD	LOW FUEL PRESSURE SENSOR SIGNAL
39	18BL/GY	FUEL TEMPERATURE SENSOR SIGNAL
40	20RD/YL	EGR VALVE CONTROL



ENGINE CONTROL MODULE C5

ENGINE CONTROL MODULE C5 - GRAY

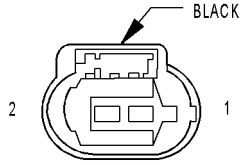
CAV	CIRCUIT	FUNCTION
2	14BK	COMMON INJECTOR DRIVER NO. 1
3	14BK/YL	FUEL INJECTOR NO. 4 CONTROL
4	14BL	COMMON INJECTOR DRIVER NO. 2
5	14BK/VT	FUEL INJECTOR NO. 2 CONTROL
7	14BK/DG	FUEL INJECTOR NO. 5 CONTROL
8	14BK/RD	FUEL INJECTOR NO. 3 CONTROL
9	14BK/BL	FUEL INJECTOR NO. 1 CONTROL



ENGINE COOLANT LEVEL SWITCH

ENGINE COOLANT LEVEL SWITCH - BLACK

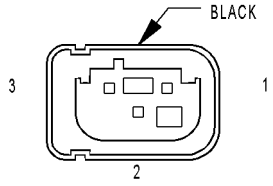
CAV	CIRCUIT	FUNCTION
1	20DG/WT/BL	ENGINE COOLANT LEVEL SWITCH SIGNAL
2	16BR	GROUND



ENGINE COOLANT TEMPERATURE SENSOR

ENGINE COOLANT TEMPERATURE SENSOR - BLACK

CAV	CIRCUIT	FUNCTION
1	20BR/WT	SENSOR GROUND
2	20DG/RD	ENGINE COOLANT TEMPERATURE SENSOR SIGNAL



ENGINE OIL SENSOR

ENGINE OIL SENSOR - BLACK

CAV	CIRCUIT	FUNCTION
1	20DG/BL	ENGINE OIL SENSOR SIGNAL
2	20BR/BK	SENSOR GROUND
3	20RD/YL	ENGINE OIL SENSOR 5 VOLT SUPPLY

CONNECTOR NOT AVAILABLE

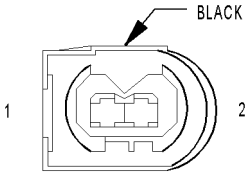
EVAPORATOR TEMPERATURE SENSOR

CAV	CIRCUIT	FUNCTION
1	18BR/DG	EVAPORATOR TEMPERATURE SENSOR SIGNAL
2	18BR/BL	SENSOR GROUND

CONNECTOR NOT AVAILABLE

FOG LAMP SWITCH

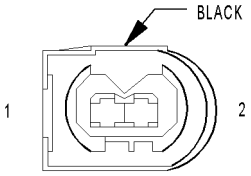
CAV	CIRCUIT	FUNCTION
1	16GY/DG/RD	LAMP DRIVER
3	16RD	FUSED B(+)
7	18RD/BK	FOG LAMP RELAY CONTROL
10	16BR	GROUND



FUEL INJECTOR NO. 1

FUEL INJECTOR NO. 1 - BLACK

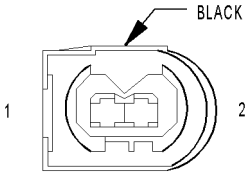
CAV	CIRCUIT	FUNCTION
1	14BK/BL	FUEL INJECTOR NO. 1 CONTROL
2	14BK	COMMON INJECTOR DRIVER NO. 1



FUEL INJECTOR NO. 2

FUEL INJECTOR NO. 2 - BLACK

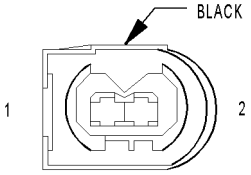
CAV	CIRCUIT	FUNCTION
1	14BK/VT	FUEL INJECTOR NO. 2 CONTROL
2	14BL	COMMON INJECTOR DRIVER NO. 2



FUEL INJECTOR NO. 3

FUEL INJECTOR NO. 3 - BLACK

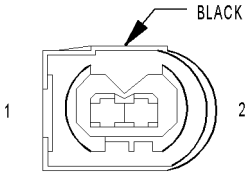
CAV	CIRCUIT	FUNCTION
1	14BK/RD	FUEL INJECTOR NO. 3 CONTROL
2	14BK	COMMON INJECTOR DRIVER NO. 1



FUEL
INJECTOR
NO. 4

FUEL INJECTOR NO. 4 - BLACK

CAV	CIRCUIT	FUNCTION
1	14BK/YL	FUEL INJECTOR NO. 4 CONTROL
2	14BK	COMMON INJECTOR DRIVER NO. 1



FUEL
INJECTOR
NO. 5

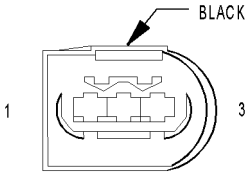
FUEL INJECTOR NO. 5 - BLACK

CAV	CIRCUIT	FUNCTION
1	14BK/DG	FUEL INJECTOR NO. 5 CONTROL
2	14BL	COMMON INJECTOR DRIVER NO. 2

CONNECTOR
NOT
AVAILABLE

FUEL LEVEL SENSOR

CAV	CIRCUIT	FUNCTION
2	20BL/BK	FUEL LEVEL SENSOR SIGNAL (+)
3	20BR	FUEL LEVEL SENSOR SIGNAL



FUEL
PRESSURE
SENSOR

FUEL PRESSURE SENSOR - BLACK

CAV	CIRCUIT	FUNCTION
1	20BR/GY	SENSOR GROUND
2	20DG/VT	FUEL PRESSURE SENSOR SIGNAL
3	20RD/DG	FUEL PRESSURE SENSOR 5 VOLT SUPPLY

CONNECTOR
NOT
AVAILABLE

FUEL PRESSURE SOLENOID

CAV	CIRCUIT	FUNCTION
1	20BK/WT	GROUND
2	20RD/WT	FUEL PRESSURE SOLENOID CONTROL

CONNECTOR NOT AVAILABLE

FUEL SHUTDOWN SOLENOID

CAV	CIRCUIT	FUNCTION
1	20BR/YL	FUEL SHUTDOWN SOLENOID CONTROL
2	18RD/BK	FUEL SHUTDOWN SOLENOID 12 VOLT SUPPLY

CONNECTOR NOT AVAILABLE

FUEL TEMPERATURE SENSOR

CAV	CIRCUIT	FUNCTION
1	18DG/BK	SENSOR GROUND
2	18BL/GY	FUEL TEMPERATURE SENSOR SIGNAL

CONNECTOR NOT AVAILABLE

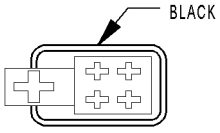
FUSE BLOCK NO. 1 C1

CAV	CIRCUIT	FUNCTION
1	INTERNAL	FOG LAMP SWITCH OUTPUT
3	INTERNAL	HIGH BEAM SWITCH OUTPUT
4	16RD/BL	FUSED RIGHT LAMP RELAY OUTPUT
5	INTERNAL	HIGH BEAM SELECT
6	INTERNAL	FUSED LEFT RELAY OUTPUT
8	INTERNAL	LAMP DRIVER
9	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
10	INTERNAL	FUSED B(+)
11	INTERNAL	TURN SIGNAL RELAY OUTPUT
14	INERNAL	GROUND
15	INTERNAL	WIPER SWITCH OUTPUT
16	INTERNAL	WIPER SWITCH OUTPUT
18	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
19	INTERNAL	12 VOLT SUPPLY
21	INTERNAL	WIPER ON/OFF SWITCH OUTPUT
22	INTERNAL	FUSED B(+)

CONNECTOR NOT AVAILABLE

FUSE BLOCK NO. 1 C2

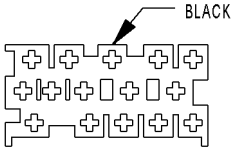
CAV	CIRCUIT	FUNCTION
1	14BK/RD	FUSED IGNITION SWITCH OUTPUT (RUN)
2	14BK/YL	FUSED IGNITION SWITCH OUTPUT (START)
3	16GY/DG	FUSED IGNITION SWITCH OUTPUT (ACC OFF)
4	14BK	FUSED IGNITION SWITCH OUTPUT (RUN-START)
5	12BK/BL	FUSED ENGINE CONTROL RELAY OUTPUT



FUSE
BLOCK
NO. 1 C3

FUSE BLOCK NO. 1 C3 - BLACK

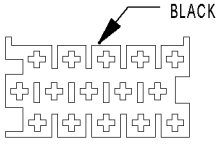
CAV	CIRCUIT	FUNCTION
2	16BK/VT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
5	12RD	FUSED B(+)



FUSE
BLOCK
NO. 1 C4

FUSE BLOCK NO. 1 C4 - BLACK

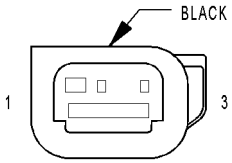
CAV	CIRCUIT	FUNCTION
1	16RD/BL	FUSED B(+)
4	16BK/RD	ENGINE CONTROL RELAY OUTPUT
5	16WT	FUSED HIGH BEAM SWITCH OUPUT
7	16BK/YL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
8	16BK/YL/WT	FOG LAMP RELAY SIGNAL
10	16WT	FUSED HIGH BEAM SWITCH OUTPUT
11	16RD/YL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
12	16BR/BK	WIPER MOTOR CONTROL
14	16WT/BL/RD	FUSED IGNITION SWITCH OUTPUT (RUN-START)



FUSE
BLOCK
NO. 1 C5

FUSE BLOCK NO. 1 C5 - BLACK

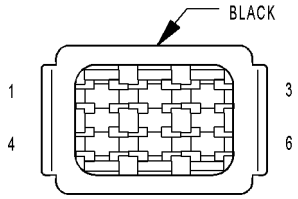
CAV	CIRCUIT	FUNCTION
1	16BK/BL/WT	FUSED IGNITION SWITCH (RUN-START)
2	12BK/BL	FUSED ENGINE CONTROL RELAY OUTPUT
3	18YL	FUSED HEADLAMP SWITCH OUTPUT
4	16GY/BK	LEFT LAMP RELAY OUTPUT
5	16BK/DG	RIGHT TURN SIGNAL
6	16GY/RD	RIGHT LAMP RELAY OUTPUT
7	16GY/DG	LAMP DRIVER
8	16BK/WT	LEFT TURN SIGNAL
13	16YL	FUSED HEADLAMP SWITCH OUTPUT
14	16BK/VT/RD	WASHER ON/OFF SWITCH OUTPUT
15	18YL/BL	FUSE BLOCK NO.1 C5 CAV 15 COMMON CIRCUIT



GLOW
PLUG
CONTROL
MODULE
C1

GLOW PLUG CONTROL MODULE C1 - BLACK

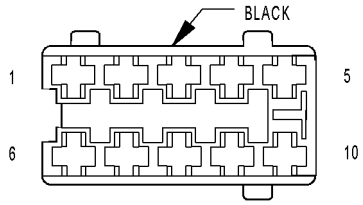
CAV	CIRCUIT	FUNCTION
1	20BR	GROUND
2	18BK/RD	GLOW PLUG MODULE CONTROL



GLOW PLUG CONTROL MODULE C2

GLOW PLUG CONTROL MODULE C2 - BLACK

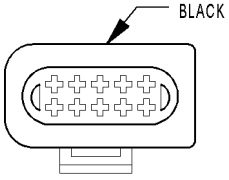
CAV	CIRCUIT	FUNCTION
1	14BK/DG	GLOW PLUG NO. 1 SUPPLY VOLTAGE
2	14BK/YL	GLOW PLUG NO. 2 SUPPLY VOLTAGE
3	14BK/RD	GLOW PLUG NO. 3 SUPPLY VOLTAGE
4	14BK/VT	GLOW PLUG NO. 4 SUPPLY VOLTAGE
5	14BK/BL	GLOW PLUG NO. 5 SUPPLY VOLTAGE



HEADLAMP ADJUST SWITCH

HEADLAMP ADJUST SWITCH - BLACK

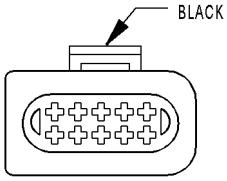
CAV	CIRCUIT	FUNCTION
3	16BR	GROUND
5	16VT/WT	HEADLAMP ADJUST SWITCH OUTPUT
9	16GY/DG/RD	LAMP DRIVER



HEADLAMP ASSEMBLY-LEFT

HEADLAMP ASSEMBLY-LEFT - BLACK

CAV	CIRCUIT	FUNCTION
1	16GY/DG/RD	LAMP DRIVER
2	16YL/WT	FOG LAMP RELAY OUTPUT
3	16BR	GROUND
4	16BR	GROUND
5	16VT/WT	HEADLAMP ADJUST SWITCH OUTPUT
6	16BK/WT	LEFT TURN SIGNAL
7	18YL/DG (DRL)	DAYTIME RUNNING LAMPS RELAY-LEFT SIDE OUTPUT
7	18YL (EXCEPT DRL)	HEADLAMP SWITCH OUTPUT
8	16BR	GROUND
9	16WT	FUSED HIGH BEAM SWITCH OUTPUT
10	16GY/BK	LEFT LAMP RELAY OUTPUT



HEADLAMP ASSEMBLY-RIGHT

HEADLAMP ASSEMBLY-RIGHT - BLACK

CAV	CIRCUIT	FUNCTION
1	16GY/DG/RD	LAMP DRIVER
2	16YL/WT	FOG LAMP RELAY OUTPUT
3	16BR	GROUND
4	16BR	GROUND
5	16VT/WT	HEADLAMP ADJUST SWICHT OUTPUT
6	16BK/WT	RIGHT TURN SIGNAL
7	18YL/DG (DRL)	DAYTIME RUNNING LAMP RELAY-RIGHT SIDE OUTPUT
7	18YL (EXCEPT DRL)	HEADLAMP SWITCH OUTPUT
8	16BR	GROUND
9	16WT	FUSED HIGH BEAM SWITCH OUTPUT
10	16GY/RD	RIGHT LAMP RELAY OUTPUT

CONNECTOR NOT AVAILABLE

HEAT EXCHANGER CONNECTOR

CAV	CIRCUIT	FUNCTION
A	12BR	GROUND
B	12RD/BL	AUXILIARY HEATER RELAY OUTPUT
C	16VT/BL	HEAT EXCHANGER CONNECTOR CAV C TO HEAT EXCHANGER SWITCH CAV 7
D	16VT/YL	HEAT EXCHANGER CONNECOTR CAV D TO HEAT EXCHANGER SWITCH CAV 4

CONNECTOR NOT AVAILABLE

HEAT EXCHANGER SWITCH

CAV	CIRCUIT	FUNCTION
1	16GY/DG/RD	DAYTIME RUNNING LAMPS RELAY OUTPUT
3	16BK/BL/DG	S201 COMMON CIRCUIT
4	16VT/YL	HEAT EXCHANGER SWITCH CAV 4 TO HEAT EXCHANGER CONNECTOR CAV D
5	16BR	GROUND
7	16VT/BL	HEAT EXCHANGER SWITCH CAV 7 TO HEAT EXCHANGER CONNECOTR CAV C
8	16BK/BL/DG	S201 COMMON CIRCUIT
10	16BR	GROUND

CONNECTOR NOT AVAILABLE

HEATED SEAT MODULE-DRIVER

CAV	CIRCUIT	FUNCTION
1	16VT/DG	HEATED SEAT SWITCH-DRIVER LOW OUTPUT
2	16VT/RD	S366 COMMON CIRCUIT
4	16BR	GROUND

CONNECTOR NOT AVAILABLE

HEATED SEAT MODULE-PASSENGER

CAV	CIRCUIT	FUNCTION
1	16VT/BR	HEATED SEAT SWITCH-PASSENGER LOW OUTPUT
2	16VT/BK	S363 COMMON CIRCUIT
3	16VT/BK	S363 COMMON CIRCUIT
4	16VT/BR	GROUND

CONNECTOR NOT AVAILABLE

HEATED SEAT SWITCH-DRIVER

CAV	CIRCUIT	FUNCTION
1	16GY/DG/RD	PANEL LAMPS DRIVER
3	16VT/YL	FUSED OPTIONAL EQUIPMENT RELAY OUTPUT
4	16VT/RD	S366 COMMON CIRCUIT
5	16BR	GROUND
7	16VT/DG	HEATED SEAT SWITCH-DRIVER LOW OUTPUT
8	16VT/YL	FUSED OPTIONAL EQUIPMENT RELAY OUTPUT
10	16BR	GROUND

CONNECTOR NOT AVAILABLE

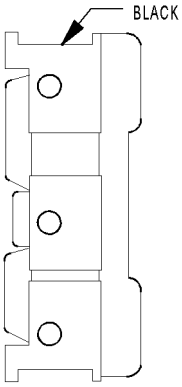
HEATED SEAT SWITCH-PASSENGER

CAV	CIRCUIT	FUNCTION
1	16DG/RD	PANEL LAMPS DRIVER
3	16VT	FUSED OPTIONAL EQUIPMENT RELAY OUTPUT
4	16VT/BK	S363 COMMON CIRCUIT
5	16BR	GROUND
7	16VT/BR	HEATED SEAT SWITCH-PASSENGER LOW OUTPUT
8	16VT	FUSED OPTIONAL EQUIPMENT RELAY OUTPUT
10	16BR	GROUND

CONNECTOR NOT AVAILABLE

HEATER TIMER-AUXILIARY

CAV	CIRCUIT	FUNCTION
1	16GY/DG/RD	LAMP DRIVER
2	16YL (EXCEPT PROGRAM TIMER)	HEATER TIMER (CUT-IN SIGNAL)
2	16YL (PROGRAM TIMER)	CABIN HEATER CONTROL
4	16BR	GROUND
6	16GY/RD	HEATER TIMER
9	16BR/WT	HEATER TIMER
10	16BK/BL/DG	S201 COMMON CIRCUIT
11	16RD	FUSED B(+)
12	16BR	GROUND



HOOD AJAR SWITCH

HOOD AJAR SWITCH - BLACK

CAV	CIRCUIT	FUNCTION
1	16BK/BL	HOOD AJAR SWITCH SENSE
3	16BR	GROUND

CONNECTOR NOT AVAILABLE

HORN

CAV	CIRCUIT	FUNCTION
1	18RD/DG	FUSED B(+)
2	18BR	GROUND
3	18BK/BL	SIREN SIGNAL CONTROL

CONNECTOR NOT AVAILABLE

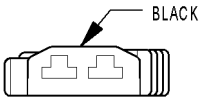
HORN (VTSS)

CAV	CIRCUIT	FUNCTION
1	16BK/BR	HORN RELAY OUTPUT
2	16BK/VT	FUSED IGNITION SWITCH OUTPUT (RUN-START)

CONNECTOR NOT AVAILABLE

HORN-SWITCH

CAV	CIRCUIT	FUNCTION
1	20DG	HORN RELAY CONTROL
2	20BK	GROUND



IGNITION
LOCK
SWITCH

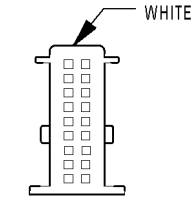
IGNITION LOCK SWITCH - BLACK

CAV	CIRCUIT	FUNCTION
1	20BR	GROUND
2	20BL/BK	KEY-IN IGNITION SWITCH SIGNAL

CONNECTOR
NOT
AVAILABLE

INSTRUMENT CLUSTER C1

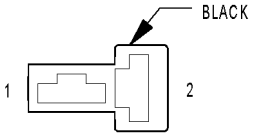
CAV	CIRCUIT	FUNCTION
1	20BR	FUEL LEVEL SENSOR SIGNAL
2	20BR/DG	AMBIENT TEMPERATURE SENSOR SIGNAL (-)
4	20WT/GY	K-IC/ATC/HBM/CHM
5	20BR/BK	PARKING BRAKE SIGNAL
7	20BK/DG	RIGHT TURN SIGNAL
10	20BL/BK	FUEL LEVEL SENSOR SIGNAL (+)
11	20BL/DG	AMBIENT TEMPERATURE SENSOR SIGNAL (+)
14	20DG/WT/BL	ENGINE COOLANT LEVEL SWITCH SIGNAL
15	20BR/WT	FRONT COURTESY LAMPS CONTROL
16	20YL/RD	SEAT BELT SWITCH SIGNAL
17	20DG	CAN C BUS (-)
18	20DG/WT	CAN C BUS (+)



INSTRUMENT
CLUSTER
C2

INSTRUMENT CLUSTER C2 - WHITE

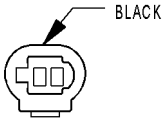
CAV	CIRCUIT	FUNCTION
3	20RD/YL	FUSED B(+)
4	20BR/WT	BRAKE WEAR SENSOR SIGNAL
6	18BR	GROUND
7	20GY/DG/RD	LAMP DRIVER
8	20BL/WT	FUSED HIGH BEAM SWITCH OUTPUT
9	20BL/RD/WT	VEHICLE SPEED SENSOR OUTPUT
10	20BK	FUSED IGNITION SWITCH OUTPUT (RUN-START)
11	20BL/BK	KEY-IN IGNITION SWITCH SIGNAL
13	20BK/WT	LEFT TURN SIGNAL
15	20BL	TERMINAL 61
16	20YL	AIRBAG WARNING INDICATOR DRIVER
18	20BL/VT	D(+) RELAY NO. 1 CONTROL
18	20BL/VT	IC 18-C2 TO ATCM 8-C1



INSTRUMENT PANEL SOCKET

INSTRUMENT PANEL SOCKET - BLACK

CAV	CIRCUIT	FUNCTION
1	16BR	GROUND
2	16RD	FUSED B(+)



INTAKE AIR TEMPERATURE SENSOR

INTAKE AIR TEMPERATURE SENSOR - BLACK

CAV	CIRCUIT	FUNCTION
1	18BR/DG	SENSOR GROUND
2	18DG/WT	INTAKE AIR TEMPERATURE SENSOR SIGNAL

CONNECTOR NOT AVAILABLE

INTERIOR LAMP NO. 1

CAV	CIRCUIT	FUNCTION
1	16DG	INTERIOR LAMPS DRIVER
2	16BR	GROUND

CONNECTOR NOT AVAILABLE

INTERIOR LAMP NO. 2

CAV	CIRCUIT	FUNCTION
1	16DG	INTERIOR LAMPS DRIVER
2	16BR	GROUND

CONNECTOR NOT AVAILABLE

INTERIOR LAMP NO. 3

CAV	CIRCUIT	FUNCTION
1	16DG	INTERIOR LAMPS DRIVER
2	16BR	GROUND

CONNECTOR NOT AVAILABLE

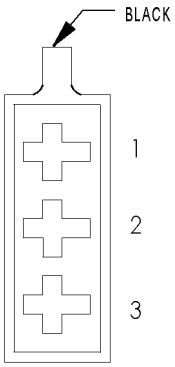
INTERIOR LAMP NO. 4

CAV	CIRCUIT	FUNCTION
1	16DG	INTERIOR LAMPS DRIVER
2	16BR	GROUND

CONNECTOR NOT AVAILABLE

INTERIOR LAMP NO. 5

CAV	CIRCUIT	FUNCTION
1	16DG	INTERIOR LAMPS DRIVER
2	16BR	GROUND



INTERIOR LAMP-LEFT

INTERIOR LAMP-LEFT - BLACK

CAV	CIRCUIT	FUNCTION
1	16BR	GROUND
2	16RD/YL	FUSED B(+)
3	16BR/WT	DOOR AJAR SWITCH SENSE

CONNECTOR NOT AVAILABLE

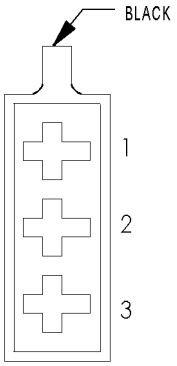
INTERIOR LAMP-MIDDLE FRONT

CAV	CIRCUIT	FUNCTION
1	16BR	GROUND
2	16RD/YL	FUSED B(+)
3	16BR/WT	DOOR AJAR SWITCH SENSE

CONNECTOR
NOT
AVAILABLE

INTERIOR LAMP-MIDDLE REAR

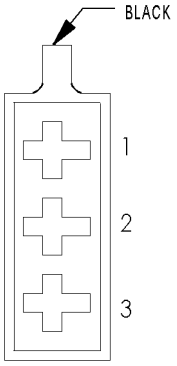
CAV	CIRCUIT	FUNCTION
1	16BR	GROUND
2	16RD/YL	FUSED B(+)
3	16BR/WT	DOOR AJAR SWITCH SENSE



INTERIOR
LAMP-
REAR
NO.1

INTERIOR LAMP-REAR NO. 1 - BLACK

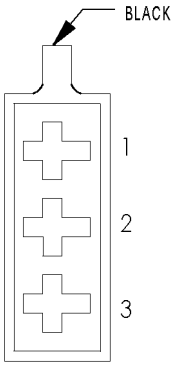
CAV	CIRCUIT	FUNCTION
1	16RD/YL	FUSED B(+)
2	16BR/WT	DOOR AJAR SWITCH SENSE



INTERIOR
LAMP-
REAR
NO.2

INTERIOR LAMP-REAR NO. 2 - BLACK

CAV	CIRCUIT	FUNCTION
1	16BR/WY	GROUND
2	16RD/YL	FUSED B(+)
3	16BR/WT	DOOR AJAR SWITCH SENSE



INTERIOR LAMP-RIGHT

INTERIOR LAMP-RIGHT - BLACK

CAV	CIRCUIT	FUNCTION
1	16BR	GROUND
2	16RD/YL	FUSED B(+)
3	16BR/WT	DOOR AJAR SWITCH SENSE

CONNECTOR NOT AVAILABLE

INTERIOR LIGHT SWITCH

CAV	CIRCUIT	FUNCTION
1	16GY/DG/RD	LAMP DRIVER
3	16RD/YL	FUSED B(+)
7	16YL	INTERIOR LIGHT SWITCH OUTPUT
9	16DG	INTERIOR LAMPS DRIVER
10	16BR	GROUND

CONNECTOR NOT AVAILABLE

INTERIOR LIGHT SWITCH-DRIVER

CAV	CIRCUIT	FUNCTION
3	16RD/YL	FUSED B(+)
7	16YL	INTERIOR LIGHT SWITCH OUTPUT

CONNECTOR NOT AVAILABLE

INTERIOR LIGHT SWITCH-PASSENGER

CAV	CIRCUIT	FUNCTION
3	16RD/YL	FUSED B(+)
7	16YL	INTERIOR LIGHT SWITCH OUTPUT

CONNECTOR NOT AVAILABLE

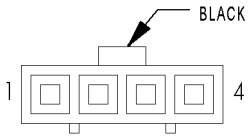
INTERIOR LIGHT SWITCH-REAR

CAV	CIRCUIT	FUNCTION
3	16RD/YL	FUSED B(+)
7	16YL	INTERIOR LIGHT SWITCH OUTPUT

CONNECTOR NOT AVAILABLE

INTERIOR LIGHTING CONNECTOR

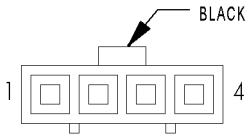
CAV	CIRCUIT	FUNCTION
1	16RD/YL	FUSED B(+)
2	16DG	INTERIOR LAMPS DRIVER
3	16BR	GROUND
4	16YL	INTERIOR LIGHT SWITCH OUTPUT



INTRUSION SENSOR NO. 1

INTRUSION SENSOR NO. 1 - BLACK

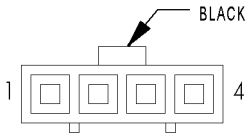
CAV	CIRCUIT	FUNCTION
1	20BR	GROUND
2	20DG/BK	INTRUSION SENSOR 1 SIGNAL
3	20DG/YL	INTRUSION SENSOR INTERFACE
4	20RD/DG	FUSED B(+)



INTRUSION SENSOR NO. 2

INTRUSION SENSOR NO. 2 - BLACK

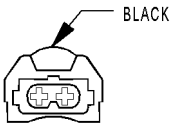
CAV	CIRCUIT	FUNCTION
1	20BR	GROUND
2	20GY/BK	INTRUSION SENSOR 2 SIGNAL
3	20DG/YL	INTRUSION SENSOR INTERFACE
4	20RD/DG	FUSED B(+)



INTRUSION SENSOR NO. 3

INTRUSION SENSOR NO. 3 - BLACK

CAV	CIRCUIT	FUNCTION
1	20BR	GROUND
2	20DG/WT/BL	INTRUSION SENSOR 3 SIGNAL
3	20DG/YL	INTRUSION SENSOR INTERFACE
4	20RD/DG	FUSED B(+)



KICK
DOWN
SWITCH

KICK DOWN SWITCH - BLACK

CAV	CIRCUIT	FUNCTION
1	18BR/DG	KICKDOWN SWITCH SIGNAL
2	18BR	SENSOR GROUND

CONNECTOR
NOT
AVAILABLE

LICENSE PLATE LAMP NO. 1

CAV	CIRCUIT	FUNCTION
1	16GY/GR/RD	LAMP DRIVER
2	16BR	GROUND

CONNECTOR
NOT
AVAILABLE

LICENSE PLATE LAMP NO. 2

CAV	CIRCUIT	FUNCTION
1	16GY/GR/RD	LAMP DRIVER
2	16BR	GROUND

CONNECTOR
NOT
AVAILABLE

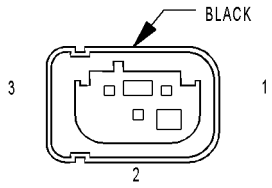
LOCKER SWITCH NO. 1

CAV	CIRCUIT	FUNCTION
1	16GY/DG/RD	LAMP DRIVER
3	16BK/RD	FUSED OPTIONAL EQUIPMENT RELAY OUTPUT
4	16BR/BK	LOCKER SWITCH NO. 2 OUTPUT
7	16VT/YL	DIFFERENTIAL LOCK SOLENOID CONTROL
10	20BR	GROUND

CONNECTOR
NOT
AVAILABLE

LOCKER SWITCH NO. 2

CAV	CIRCUIT	FUNCTION
1	16BR/BK	LOCKER SWITCH NO. 2 OUTPUT
2	16BK/RD	FUSED OPTIONAL EQUIPMENT RELAY OUTPUT



LOW
FUEL
PRESSURE
SENSOR

LOW FUEL PRESSURE SENSOR - BLACK

CAV	CIRCUIT	FUNCTION
1	18GY/DG	LOW FUEL PRESSURE SENSOR 5 VOLT SUPPLY
2	18GY/YL	SENSOR GROUND
3	18GY/RD	LOW FUEL PRESSURE SENSOR SIGNAL

CONNECTOR
NOT
AVAILABLE

MAP/READING LAMP SWITCH

CAV	CIRCUIT	FUNCTION
1	16GY/DG/RD	LAMP DRIVER
3	16RD/YL	FUSED B(+)
7	16RD/YL	MAP/READING LAMP SWITCH OUTPUT
10	16BR	GROUND

CONNECTOR
NOT
AVAILABLE

MARKER LAMP CONNECTOR

CAV	CIRCUIT	FUNCTION
1	16GY/DG/RD	LAMP DRIVER
2	16BR	GROUND

CONNECTOR
NOT
AVAILABLE

MARKER LAMP NO. 1-LEFT FRONT

CAV	CIRCUIT	FUNCTION
1	16GY/BK	LAMP DRIVER
2	16BR	GROUND

CONNECTOR
NOT
AVAILABLE

MARKER LAMP NO. 1-RIGHT FRONT

CAV	CIRCUIT	FUNCTION
1	16GY/RD	LAMP DRIVER
2	16BR	GROUND

CONNECTOR NOT AVAILABLE

MARKER LAMP NO. 2-LEFT FRONT

CAV	CIRCUIT	FUNCTION
1	16GY/BK	LAMP DRIVER
2	16BR	GROUND

CONNECTOR NOT AVAILABLE

MARKER LAMP NO. 2-RIGHT FRONT

CAV	CIRCUIT	FUNCTION
1	16GY/RD	LAMP DRIVER
2	16BR	GROUND

CONNECTOR NOT AVAILABLE

MARKER LAMP-LEFT CENTER

CAV	CIRCUIT	FUNCTION
1	16GY/BK	LAMP DRIVER
2	16BR	GROUND

CONNECTOR NOT AVAILABLE

MARKER LAMP-LEFT REAR

CAV	CIRCUIT	FUNCTION
1	16GY/BK	LAMP DRIVER
2	16BR	GROUND

CONNECTOR NOT AVAILABLE

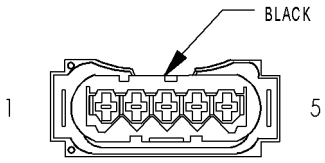
MARKER LAMP-RIGHT CENTER

CAV	CIRCUIT	FUNCTION
1	16GY/RD	LAMP DRIVER
2	16BR	GROUND

CONNECTOR
NOT
AVAILABLE

MARKER LAMP-RIGHT REAR

CAV	CIRCUIT	FUNCTION
1	16GY/RD	LAMP DRIVER
2	16BR	GROUND



MASS
AIR FLOW
SENSOR

MASS AIR FLOW SENSOR - BLACK

CAV	CIRCUIT	FUNCTION
2	20YL/RD	MASS AIR FLOW SENSOR 12 VOLT SUPPLY
3	20BR/YL	SENSOR GROUND
4	20BR/BK	MASS AIR FLOW SENSOR 5 VOLT SUPPLY
5	20YL/DG	MASS AIR FLOW SENSOR SIGNAL

CONNECTOR
NOT
AVAILABLE

MASTER DOOR LOCK SWITCH

CAV	CIRCUIT	FUNCTION
1	16GY/DG/RD	LAMP DRIVER
2	16WT/DG	PASSENGER DOOR AJAR INDICATOR DRIVER
3	16WT/YL	MASTER DOOR LOCK SWITCH SENSE-ALL DOORS
8	16WT/RD	MASTER DOOR LOCK SWITCH SENSE-PASSENGER DOORS
9	16WT/BK	DRIVER DOOR AJAR INDICATOR DRIVER
10	16BR	GROUND

CONNECTOR
NOT
AVAILABLE

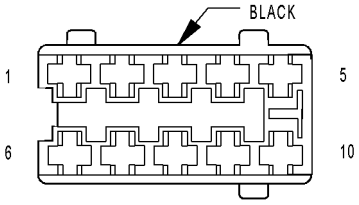
METERING PUMP

CAV	CIRCUIT	FUNCTION
1	16DG/RD	METERING PUMP DRIVER
2	16BR	METERING PUMP GROUND

CONNECTOR
NOT
AVAILABLE

MICROPHONE CONNECTOR

CAV	CIRCUIT	FUNCTION
1	18BR	MICROPHONE CONNECOTR CAV 1 TO CTEL CONNECTOR CAV 9
2	18BL	MICROPHONE CONNECOTR CAV 2 TO CTEL CONNECTOR CAV 18



PANIC
ALARM
SWITCH

PANIC ALARM SWITCH - BLACK

CAV	CIRCUIT	FUNCTION
1	18GY/DG/RD	LAMP DRIVER
3	18BR	GROUND
7	18GY/WT	PANIC SWITCH SENSE
10	18BR	GROUND

CONNECTOR
NOT
AVAILABLE

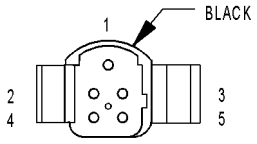
PARKING BRAKE SWITCH

CAV	CIRCUIT	FUNCTION
1	20BR/BK	PARKING BRAKE SIGNAL
2	16BR	GROUND

CONNECTOR
NOT
AVAILABLE

POWER MIRROR MOTOR-DRIVER

CAV	CIRCUIT	FUNCTION
1	16BK/RD	FUSED OPTIONAL EQUIPMENT RELAY OUTPUT
2	18BR	GROUND
3	16BK	DRIVER MIRROR HORIZONTAL MOTOR DRIVER
4	16DG	DRIVER MIRROR VERTICAL MOTOR DRIVER
5	16BL	DRIVER MIRROR COMMON DRIVER



POWER
MIRROR
MOTOR-PASSENGER

POWER MIRROR MOTOR-PASSENGER - BLACK

CAV	CIRCUIT	FUNCTION
1	18BK/RD	FUSED OPTIONAL EQUIPMENT RELAY OUTPUT
2	18BR	GROUND
3	18WT/GY	PASSENGER MIRROR HORIZONTAL MOTOR DRIVER
4	18DG	PASSENGER MIRROR VERTICAL MOTOR DRIVER
5	18BL/DG	PASSENGER MIRROR COMMON DRIVER

CONNECTOR
NOT
AVAILABLE

POWER MIRROR SWITCH

CAV	CIRCUIT	FUNCTION
1	18WT/GY	PASSENGER MIRROR HORIZONTAL MOTOR DRIVER
2	18WT/DG	DRIVER MIRROR HORIZONTAL MOTOR DRIVER
3	18BL/DG	PASSENGER MIRROR COMMON DRIVER
6	18BR	GROUND
7	18BK/RD	FUSED OPTIONAL EQUIPMENT RELAY OUTPUT
8	18DG/RD	DRIVER MIRROR VERTICAL MOTOR DRIVER
9	18DG	PASSENGER MIRROR VERTICAL MOTOR DRIVER
10	18BL/BR	DRIVER MIRROR COMMON DRIVER

CONNECTOR NOT AVAILABLE

POWER WINDOW MOTOR-DRIVER

CAV	CIRCUIT	FUNCTION
1	16BK	DRIVER WINDOW DRIVER (UP)
2	16BL	DRIVER WINDOW DRIVER (DOWN)

CONNECTOR NOT AVAILABLE

POWER WINDOW MOTOR-PASSENGER

CAV	CIRCUIT	FUNCTION
1	16BL	PASSENGER WINDOW DRIVER (DOWN)
2	16BK	PASSENGER WINDOW DRIVER (UP)

CONNECTOR NOT AVAILABLE

POWER WINDOW SWITCH-DRIVER

CAV	CIRCUIT	FUNCTION
1	16BL	DRIVER WINDOW DRIVER (DOWN)
2	16BK	DRIVER WINDOW DRIVER (UP)
3	16BR	GROUND
4	16BK/YL	FUSED OPTIONAL EQUIPMENT RELAY OUTPUT
5	16BR	GROUND

CONNECTOR NOT AVAILABLE

POWER WINDOW SWITCH-MASTER

CAV	CIRCUIT	FUNCTION
1	16BL/WT	MASTER PASSENGER WINDOW DRIVER (DOWN)
2	16BK/WT	MASTER PASSENGER WINDOW DRIVER (UP)
3	16BR	GROUND
4	16BK/YL/DG	FUSED OPTIONAL EQUIPMENT RELAY OUTPUT
5	16BR	GROUND

CONNECTOR NOT AVAILABLE

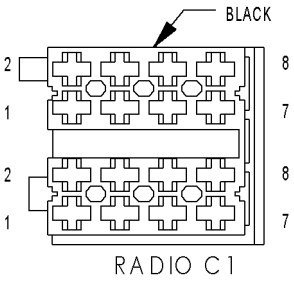
POWER WINDOW SWITCH-PASSENGER

CAV	CIRCUIT	FUNCTION
1	16BL	PASSENGER WINDOW DRIVER (DOWN)
2	16BK	PASSENGER WINDOW DRIVER (UP)
3	BL/WT	MASTER PASSENGER WINDOW DRIVER (DOWN)
4	BK/YL/DG	FUSED OPTIONAL EQUIPMENT RELAY OUTPUT
5	16BK/WT	MASTER PASSENGER WINDOW DRIVER (UP)

CONNECTOR
NOT
AVAILABLE

RADIO ANTENNA

CAV	CIRCUIT	FUNCTION
1	16BK	RADIO ANTENNA CAV 1 TO RADIO C1 CAV 13
2	16BK	RADIO ANTENNA CAV 2 TO RADIO C2 CAV 1



RADIO C1

RADIO C1 - BLACK

CAV	CIRCUIT	FUNCTION
1	16BR/GY	SPEAKER-RIGHT REAR (-)
2	16WT/GY	SPEAKER-RIGHT REAR (+)
3	18BR/RD	SPEAKER-RIGHT FRONT DOOR (-)
4	18BK	SPEAKER-RIGHT FRONT DOOR (+)
5	18BR/DG	SPEAKER-LEFT FRONT DOOR ASSEMBLY (+)
6	18BR	SPEAKER-LEFT FRONT DOOR ASSEMBLY (-)
7	16BR/BL	SPEAKER-LEFT REAR (-)
8	16WT/BL	SPEAKER-LEFT REAR (+)
9	20BL/RD/WT	VEHICLE SPEED SENSOR OUTPUT
11	18DG/YL/BK	CTEL MUTE
12	16RD/YL	FUSED B(+)
13	16BK	RADIO C1 CAV 13 TO RADIO ANTENNA CAV 1
14	16GY/DG/RD	LAMP DRIVER
15	16BK/RD	FUSED IGNITION SWITCH OUTPUT (ACC-RUN-START)
16	16BR	GROUND

CONNECTOR
NOT
AVAILABLE

RADIO C2

CAV	CIRCUIT	FUNCTION
1	16BK	RADIO C2 CAV 1 TO RADIO ANTENNA
1	16BK	RADIO C2 CAV 1 TO RADIO/CELLULAR ANTENNA
2	16BK	SHIELD

CONNECTOR
NOT
AVAILABLE

RADIO/CELLULAR ANTENNA

CAV	CIRCUIT	FUNCTION
1	16BK/RD	FUSED IGNITION SWITCH OUTPUT (ACC-RUN-START)
2	16BK	RADIO/CELLULAR ANTENNA CAV 2 TO RADIO C2 CAV 1
3	16BK	RADIO/CELLULAR ANTENNA CAV 3 TO CTEL ANTENNA CONNECTOR CAV 2

CONNECTOR NOT AVAILABLE

READING LAMP CONNECTOR

CAV	CIRCUIT	FUNCTION
1	16BR	GROUND
2	16RD/YL	MAP/READING LAMP SWITCH OUTPUT

CONNECTOR NOT AVAILABLE

RECIRCULATED AIR SOLENOID VALVE

CAV	CIRCUIT	FUNCTION
1	16RD	RECIRCULATED AIR SOLENOID VALVE CONTROL
2	16BK	GROUND

CONNECTOR NOT AVAILABLE

REFRIGERANT PRESSURE SENSOR

CAV	CIRCUIT	FUNCTION
1	18BR/BL	SENSOR GROUND
2	20BR/RD	REFRIGERANT PRESSURE SENSOR FEEDBACK
3	20RD/BL	5 VOLT SUPPLY

CONNECTOR NOT AVAILABLE

REMOTE KEYLESS ENTRY ANTENNA

CAV	CIRCUIT	FUNCTION
1	20BR	RKE ANTENNA
3	-	GROUND

CONNECTOR NOT AVAILABLE

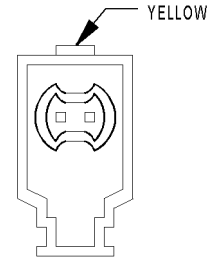
ROOF FAN MOTOR

CAV	CIRCUIT	FUNCTION
1	16WT	SUPPLY VOLTAGE
2	16BK	RETURN

CONNECTOR
NOT
AVAILABLE

SEAT BELT SWITCH

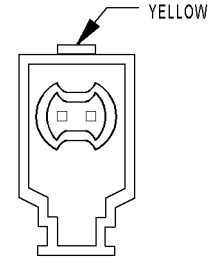
CAV	CIRCUIT	FUNCTION
1	16BR	GROUND
2	20YL/RD	SEAT BELT SWITCH SIGNAL



SEAT
BELT
TENSIONER-
DRIVER

SEAT BELT TENSIONER-DRIVER - YELLOW

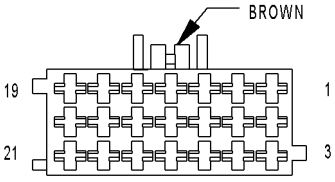
CAV	CIRCUIT	FUNCTION
1	20BL	DRIVER SEAT BELT TENSIONER LINE 2
2	20BR/YL	DRIVER SEAT BELT TENSIONER LINE 1



SEAT
BELT
TENSIONER-
PASSENGER

SEAT BELT TENSIONER-PASSENGER - YELLOW

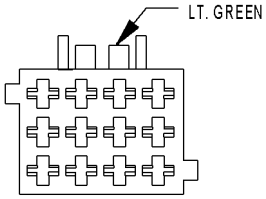
CAV	CIRCUIT	FUNCTION
1	20BL	PASSENGER SEAT BELT TENSIONER LINE 2
2	20BR	PASSENGER SEAT BELT TENSIONER LINE 1



SECURITY
SYSTEM
MODULE
C1

SECURITY SYSTEM MODULE C1 - BROWN

CAV	CIRCUIT	FUNCTION
1	16BK/WT	LEFT TURN SIGNAL
4	16BK/DG	RIGHT TURN SIGNAL
5	16BK/VT	FAN STAGE 1 RELAY
6	16WT/RD	WARM AIR AUXILIARY HEATER CONTROL
7	16RD/GY	FUSED B(+)
8	16BK/GY	FUSED OPTIONAL EQUIPMENT RELAY OUTPUT
9	18VT/DG	TOWING/INTRUSION SENSOR INDICATOR DRIVER
11	16BR/YL	FRONT COURTESY LAMPS CONTROL
12	16BR/WT	DOOR AJAR SWITCH SENSE
13	16RD/DG	FUSED B(+)
14	16BK/BL	HOOD AJAR SWITCH SENSE
15	18GY/WT	PANIC SWITCH SENSE
16	16BR	GROUND
17	18GY/BR	TOWING SENSOR SWITCH SENSE
18	18GY/YL	INTRUSION SENSOR SWITCH SENSE
20	16BK	DRIVER CYLINDER UNLOCK SENSE
21	16RD	DRIVER CYLINDER LOCK SENSE



SECURITY SYSTEM MODULE C2

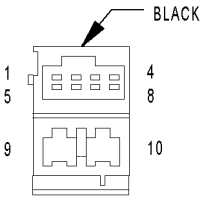
SECURITY SYSTEM MODULE C2 - LT.GREEN

CAV	CIRCUIT	FUNCTION
1	16DG/YL	INTRUSION SENSOR INTERFACE
2	16GY/BL	WINDOW DEFOGGER RELAY-LEFT REAR OUTPUT
3	16GY	WINDOW DEFOGGER RELAY-RIGHT REAR OUTPUT
4	20DG/BK	INTRUSION SENSOR 1 SIGNAL
7	20GY/BK	INTRUSION SENSOR 2 SIGNAL
8	20GY/DG	K-CTM/SSM
9	18BK/BL	SIREN SIGNAL CONTROL
10	20DG/WT/BL	INTRUSION SENSOR 3 SIGNAL
11	16WT/BL	RKE INTERFACE
12	16WT/BL/RD	SECURITY SYSTEM INTERFACE

CONNECTOR NOT AVAILABLE

SENTRY KEY REMOTE ENTRY MODULE (SKREEM)

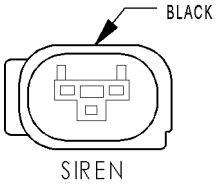
CAV	CIRCUIT	FUNCTION
1	18YL	RKE ANTENNA
2	16BR	GROUND
3	16RD/YL	FUSED B(+)
4	16BK/WT	LEFT TURN SIGNAL
5	20DG/WT	CAN C BUS (+)
6	20DG	CAN C BUS (-)
7	16BK/YL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
8	20WT/DG	K-SKREEM
9	20WT/BL/RD (EXCEPT VTSS)	RKE INTERFACE
9	20WT/BL/RD (VTSS)	SECURITY SYSTEM INTERFACE
10	18DG/YL	TURN SIGNAL/ANTI-THEFT ALARM RELAY-LEFT/ RIGHT CONTROL
11	20BR	TRANSPONDER COIL (+)
12	20BR	TRANSPONDER COIL (-)



SHIFTER ASSEMBLY

SHIFTER ASSEMBLY - BLACK

CAV	CIRCUIT	FUNCTION
2	20GY/DG/RD	LAMP DRIVER
3	20BL/DG	K-ABS/SHIFTER ASSEMBLY
4	18BR	GROUND
5	20BK/BL/RD	BRAKE LAMP SWITCH
6	20DG/WT	CAN C BUS (+)
7	20DG	CAN C BUS (-)
8	18BK/DG	TRANSMISSION RELAY OUTPUT
9	16WT/BL/RD	FUSED IGNITION SWITCH OUTPUT (RUN-START)
10	16WT/RD	BACK-UP LAMP



SIREN

SIREN - BLACK

CAV	CIRCUIT	FUNCTION
1	18RD/DG	FUSED B(+)
2	18BR	GROUND
3	18BK/BL	SIREN SIGNAL CONTROL

CONNECTOR NOT AVAILABLE

SPEAKER-LEFT FRONT DOOR ASSEMBLY C1

CAV	CIRCUIT	FUNCTION
1	18BL/YL	SPEAKER-LEFT FRONT DOOR ASSEMBLY C1 (+)
2	18BL/DG	SPEAKER-LEFT FRONT DOOR ASSEMBLY C1 (-)

CONNECTOR NOT AVAILABLE

SPEAKER-LEFT FRONT DOOR ASSEMBLY C2

CAV	CIRCUIT	FUNCTION
1	18BR/DG	SPEAKER-LEFT FRONT DOOR ASSEMBLY (+)
2	18BR	SPEAKER-LEFT FRONT DOOR ASSEMBLY (-)

CONNECTOR NOT AVAILABLE

SPEAKER-LEFT REAR

CAV	CIRCUIT	FUNCTION
1	16BR/BL	SPEAKER-LEFT REAR (+)
2	16WT/BL	SPEAKER-LEFT REAR (-)

CONNECTOR NOT AVAILABLE

SPEAKER-RIGHT FRONT DOOR

CAV	CIRCUIT	FUNCTION
1	18BR/RD	SPEAKER-RIGHT FRONT DOOR (+)
2	18BK	SPEAKER-RIGHT FRONT DOOR (-)

CONNECTOR NOT AVAILABLE

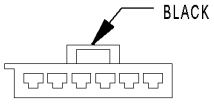
SPEAKER-RIGHT REAR

CAV	CIRCUIT	FUNCTION
1	16BR/GY	SPEAKER-RIGHT REAR (+)
2	16WT/GY	SPEAKER-RIGHT REAR (-)

CONNECTOR NOT AVAILABLE

SPEED CONTROL SWITCH

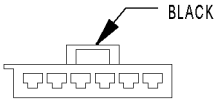
CAV	CIRCUIT	FUNCTION
1	18GY	OFF SIGNAL
2	18BK	VERIFICATION SIGNAL
3	18BL	RESUME SIGNAL
4	18YL	ACCEL/SET SIGNAL
5	18DG	DECEL/SET SIGNAL
6	18RD	S/C SWITCH 12 VOLT SUPPLY



TAIL LAMP ASSEMBLY-LEFT

TAIL LAMP ASSEMBLY-LEFT - BLACK

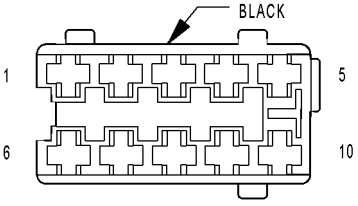
CAV	CIRCUIT	FUNCTION
2	16GY/BK	LEFT LAMP RELAY OUTPUT
3	16BK/RD	BRAKE LAMP SWITCH OUTPUT
4	16WT/RD	BACK-UP LAMP
5	16BK/WT	LEFT TURN SIGNAL
6	16BR	GROUND



TAIL LAMP ASSEMBLY-RIGHT

TAIL LAMP ASSEMBLY-RIGHT - BLACK

CAV	CIRCUIT	FUNCTION
2	16GY/RD	RIGHT LAMP RELAY OUTPUT
3	16BK/RD	BRAKE LAMP SWITCH OUTPUT
4	16WT/RD	BACK-UP LAMP
5	16BK/DG	RIGHT TURN SIGNAL
6	16BR	GROUND



TCS SWITCH (ASR)

TCS SWITCH (ASR) - BLACK

CAV	CIRCUIT	FUNCTION
1	16GY/DG/RD	LAMP DRIVER
3	18BK/BL	TCS SWITCH (ASR) SENSE
7	16BK/BL/DG	S201 COMMON CIRCUIT
10	16BR	GROUND

CONNECTOR NOT AVAILABLE

TEMPERATURE SWITCH

CAV	CIRCUIT	FUNCTION
3	16BR	TEMPERATURE SWITCH SENSE
5	16BK	TEMPERATURE SWITCH SELECT
9	18GY/DG/RD	LAMP DRIVER

CONNECTOR NOT AVAILABLE

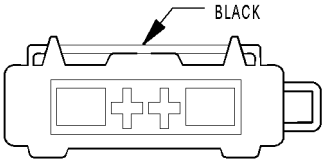
TIME DELAY RELAY

CAV	CIRCUIT	FUNCTION
1	16RD/YL	FUSED B(+)
4	16RD/YL	FUSED B(+)
7	16BR	GROUND
13	16YL	INTERIOR LIGHT SWITCH OUTPUT
15	16DG	INTERIOR LAMPS DRIVER

CONNECTOR NOT AVAILABLE

TOWING/INTRUSION SENSOR ON/OFF SWITCH

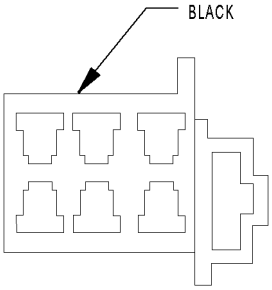
CAV	CIRCUIT	FUNCTION
1	18GY/DG	LAMP DRIVER
3	18GY/YL	INTRUSION SENSOR SWITCH SENSE
4	18BR	GROUND
8	18GY/BR	TOWING SENSOR SWITCH SENSE
9	18VT/DG	TOWING/INTRUSION SENSOR INDICATOR DRIVER
10	18BR	GROUND



TRAILER TOW CONNECTOR

TRAILER TOW CONNECTOR - BLACK

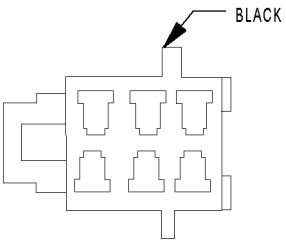
CAV	CIRCUIT	FUNCTION
2	16BK/DG/GY	TT CONNECTOR CAV 2 TO TT CONTROL MODULE C1 CAV D
3	16BK/RD	BACK-UP LAMP
4	14RD	FUSED B(+)
5	16GY/RD	RIGHT LAMP RELAY OUTPUT
7	14RD/BK	TT CONNECTOR CAV 7 TO TT CONTROL MODULE C1 CAV F
8	14BR	GROUND
10	16BK/RD/WT	TT CONNECTOR CAV 10 TO TT CONTROL MODULE C1 CAV C



TRAILER TOW CONTROL MODULE C1

TRAILER TOW CONTROL MODULE C1 - BLACK

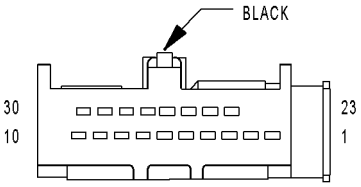
CAV	CIRCUIT	FUNCTION
C	16BK/RD/WT	TT CONTROL MODULE C1 CAV C TO TT CONNECTOR CAV 10
D	16BK/DG/GY	TT CONTROL MODULE C1 CAV D TO TT CONNECTOR CAV 2
F	14RD/BK	TT CONTROL MODULE C1 CAV F TO TT CONNECOTR CAV 7



TRAILER TOW CONTROL MODULE C2

TRAILER TOW CONTROL MODULE C2 - BLACK

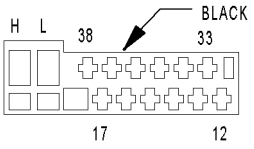
CAV	CIRCUIT	FUNCTION
A	16BK/RD	BRAKE LAMP SWITCH OUTPUT
B	16BK/DG	RIGHT TURN SIGNAL
C	16BR	GROUND
D	14RD	FUSED B(+)
E	16BK/WT	LEFT TURN SIGNAL



TRANSMISSION CONTROL MODULE C1

TRANSMISSION CONTROL MODULE C1 - BLACK

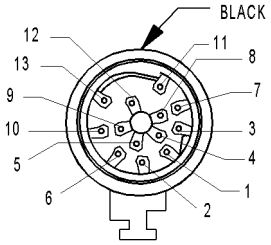
CAV	CIRCUIT	FUNCTION
1	20BL	K-TCM
29	16BK/DG	TRANSMISSION RELAY OUTPUT
30	18BR	GROUND



TRANSMISSION CONTROL MODULE C2

TRANSMISSION CONTROL MODULE C2 - BLACK

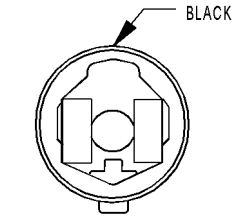
CAV	CIRCUIT	FUNCTION
12	20BL/GY	N2 INPUT SPEED SENSOR
13	20BK/BL	SENSOR SUPPLY VOLTAGE
14	16WT	1-2/4-5 SOLENOID CONTROL
15	16YL	3-4 SOLENOID CONTROL
16	16WT/BL	2-3 SOLENOID CONTROL
17	16YL/BL	TCC SOLENOID CONTROL
33	20PK	SENSOR GROUND
34	20GY/BL	TEMPERATURE SENSOR-P/N SWITCH
35	20BL/DG	N3 INPUT SPEED SENOR
36	16BR/GY	MODULATION PRESSURE SOLENOID CONTROL
37	16BK/RD	SHIFT PRESSURE SOLENOID CONTROL
38	16BK	SOLENOID SUPPLY VOLTAGE
H	20DG/WT	CAN C BUS (+)
L	20DG	CAN C BUS (-)



TRANSMISSION SOLENOID ASSEMBLY

TRANSMISSION SOLENOID ASSEMBLY - BLACK

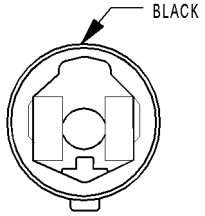
CAV	CIRCUIT	FUNCTION
1	20BL/DG	N3 INPUT SPEED SENSOR
2	16BR/GY	MODULATION PRESSURE SOLENOID CONTROL
3	20BL/GY	N2 INPUT SPEED SENSOR
4	20GY/BL	TEMP SENSOR-P/N SWITCH
6	16BK	SOLENOID SUPPLY VOLTAGE
7	20BK/BL	SENSOR SUPPLY VOLTAGE
8	16WT/BL	2-3 SOLENOID CONTROL
9	16YL	3-4 SOLENOID CONTROL
10	16BK/RD	SHIFT PRESSURE SOLENOID CONTROL
11	16YL/BL	TCC SOLENOID CONTROL
12	20PK	SENSOR GROUND
13	16WT	1-2/4-5 SOLENOID CONTROL



TURN SIGNAL LAMP NO. 1-LEFT FRONT

TURN SIGNAL NO. 1-LEFT FRONT - BLACK

CAV	CIRCUIT	FUNCTION
1	16BK/WT	LEFT TURN SIGNAL
2	16BR	GROUND



TURN SIGNAL LAMP NO. 1-RIGHT FRONT

TURN SIGNAL NO. 1-RIGHT FRONT - BLACK

CAV	CIRCUIT	FUNCTION
1	16BK/DG	RIGHT TURN SIGNAL
2	16BR	GROUND

CONNECTOR NOT AVAILABLE

TURN SIGNAL NO. 2-LEFT FRONT

CAV	CIRCUIT	FUNCTION
1	16BK/WT	LEFT TURN SIGNAL
2	16BR	GROUND

CONNECTOR NOT AVAILABLE

TURN SIGNAL NO. 2-RIGHT FRONT

CAV	CIRCUIT	FUNCTION
1	16BK/DG	RIGHT TURN SIGNAL
2	16BR	GROUND

CONNECTOR NOT AVAILABLE

WARM AIR AUXILIARY HEATER ASSEMBLY C1

CAV	CIRCUIT	FUNCTION
1	16YL	HEATER TIMER (CUT-IN SIGNAL)
2	14RD	FUSED B(+)
3	20BK/YL	PCI BUS
4	14BR	GROUND
5	16BR/WT	HEATER TIMER
6	16GY/RD	HEATER TIMER
7	16WT/RD	WARM AIR AUXILIARY HEATER CONTROL

CONNECTOR NOT AVAILABLE

WARM AIR AUXILIARY HEATER ASSEMBLY C2

CAV	CIRCUIT	FUNCTION
1	16DG/RD	METERING PUMP DRIVER
2	16BR	METERING PUMP GROUND

CONNECTOR NOT AVAILABLE

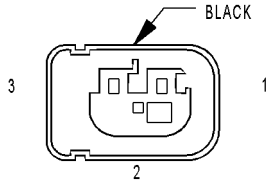
WASHER PUMP MOTOR-FRONT

CAV	CIRCUIT	FUNCTION
1	16BR	GROUND
2	16BK/VT/RD	WASHER ON/OFF SWITCH OUTPUT

CONNECTOR NOT AVAILABLE

WATER CYCLE VALVE

CAV	CIRCUIT	FUNCTION
1	18BR/VT	WATER CYCLE VALVE CONTROL
2	18BR	GROUND



WATER
IN FUEL
SENSOR

WATER IN FUEL SENSOR - BLACK

CAV	CIRCUIT	FUNCTION
1	18BR	SENSOR GROUND
2	18BR/RD	WATER IN FUEL SENSOR 12 VOLT SUPPLY
3	18BK/YL	WATER IN FUEL SENSOR SIGNAL

CONNECTOR
NOT
AVAILABLE

WHEEL SPEED SENSOR-LEFT FRONT

CAV	CIRCUIT	FUNCTION
1	18BK	LEFT FRONT WHEEL SPEED SENSOR (+)
2	18BR	LEFT FRONT WHEEL SPEED SENSOR (-)

CONNECTOR
NOT
AVAILABLE

WHEEL SPEED SENSOR-LEFT REAR

CAV	CIRCUIT	FUNCTION
1	18WT	LEFT REAR WHEEL SPEED SENSOR (+)
2	18BR	LEFT REAR WHEEL SPEED SENSOR (-)

CONNECTOR
NOT
AVAILABLE

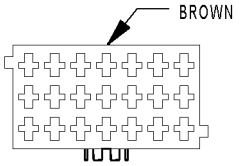
WHEEL SPEED SENSOR-RIGHT FRONT

CAV	CIRCUIT	FUNCTION
1	18BK	RIGHT FRONT WHEEL SPEED SENSOR (+)
2	18BR	RIGHT FRONT WHEEL SPEED SENSOR (-)

CONNECTOR
NOT
AVAILABLE

WHEEL SPEED SENSOR-RIGHT REAR

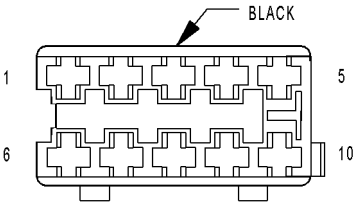
CAV	CIRCUIT	FUNCTION
1	18YL	RIGHT REAR WHEEL SPEED SENSOR (+)
2	18BR	RIGHT REAR WHEEL SPEED SENSOR (-)



WINDOW DEFOGGER MODULE-REAR

WINDOW DEFOGGER MODULE-REAR - BROWN

CAV	CIRCUIT	FUNCTION
1	14RD/DG	FUSED B(+)
4	16RD/BK	FUSED D(+) RELAY NO. 1 OUTPUT
6	14RD/DG	FUSED B(+)
7	16BR	GROUND
10	16GY/RD	WINDOW DEFOGGER RELAY-RIGHT REAR CONTROL
13	16GY	WINDOW DEFOGGER SWITCH-REAR OUTPUT
15	16GYDG	WINDOW DEFOGGER RELAY-LEFT REAR CONTROL
16	16GY/DG	LAMP DRIVER



WINDOW DEFOGGER SWITCH-REAR

WINDOW DEFOGGER SWITCH-REAR - BLACK

CAV	CIRCUIT	FUNCTION
1	18GY/DG/RD	LAMP DRIVER
3	16BK/YL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
7	16GY	WINDOW DEFOGGER SWITCH-REAR OUTPUT
9	16GY/DG	LAMP DRIVER
10	18BR	GROUND

CONNECTOR NOT AVAILABLE

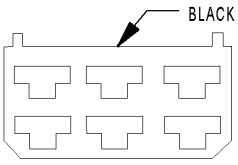
WINDOW DEFOGGER-LEFT REAR

CAV	CIRCUIT	FUNCTION
1	16GY	WINDOW DEFOGGER RELAY-LEFT REAR OUTPUT
2	16BR	GROUND

CONNECTOR NOT AVAILABLE

WINDOW DEFOGGER-RIGHT REAR

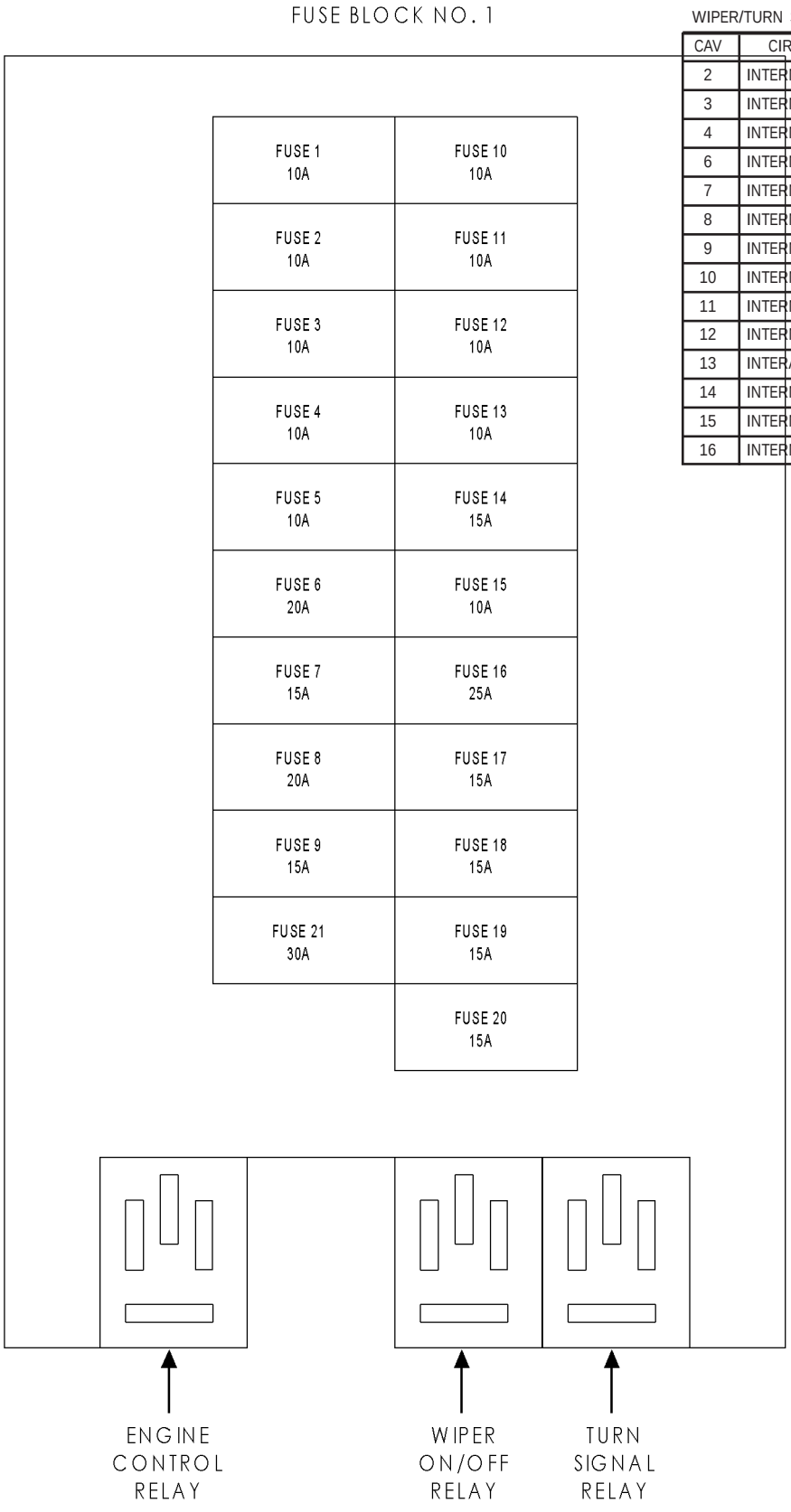
CAV	CIRCUIT	FUNCTION
1	16GY	WINDOW DEFOGGER RELAY- RIGHT REAR OUTPUT
2	16BR	GROUND



WIPER MOTOR-FRONT

WIPER MOTOR-FRONT - BLACK

CAV	CIRCUIT	FUNCTION
1	16BR	GROUND
2	16BR/BK	WIPER ON/OFF RELAY OUTPUT
3	16BK/VT	FUSED IGNITION SWITCH OUTPUT (RUN-START)
5	16BK	WIPER MOTOR CONTROL
6	16BK/GY/RD	WIPER SWITCH OUTPUT



WIPER/TURN SIGNAL/ENGINE START CONTROL MODULE (FUSE BLOCK NO. 1)

CAV	CIRCUIT	FUNCTION
2	INTERNAL	WIPER ON/OFF RELAY CONTROL
3	INTERNAL	WIPER SWITCH OUTPUT
4	INTERNAL	FUSED IGNITION SWITCH OUTPUT (RUN-START)
6	INTERNAL	WIPER ON/OFF RELAY OUTPUT
7	INTERNAL	TURN SIGNAL RELAY OUTPUT
8	INTERNAL	TURN SIGNAL RELAY FEED
9	INTERNAL	TURN SIGNAL RELAY CONTROL
10	INTERNAL	
11	INTERNAL	TURN SIGNAL RELAY SIGNAL
12	INTERNAL	FUSE BLOCK NO.1 C5 CAV 15 COMMON CIRCUIT
13	INTERAL	ENGINE CONTROL RELAY CONTROL
14	INTERNAL	GROUND
15	INTERNAL	WASHER ON/OFF SWITCH OUTPUT
16	INTERNAL	HAZARD WARNING SWITCH SENSE

NOTE: THE FUSE AND RELAY LOCATIONS SHOWN HERE MAY VARY FROM VEHICLE TO VEHICLE.

8W-91 CONNECTOR/GROUND/SPLICE LOCATION

TABLE OF CONTENTS

page

CONNECTOR/GROUND/SPLICE LOCATION
DESCRIPTION 1

CONNECTOR/GROUND/SPLICE LOCATION

DESCRIPTION

This section provides illustrations identifying connector, ground, and splice locations in the vehicle. Connector, ground, and splice indexes are provided. Use the wiring diagrams in each section for connector, ground, and splice identification. Refer to the appropriate index for the proper figure number. For items that are not shown in this section N/S is placed in the Fig. column.

CONNECTORS

CONNECTOR NAME/ NUMBER	COLOR	LOCATION	FIG.
A/C Auxiliary Fan		Engine Compartment	N/S
A/C Auxiliary Fan Relay (In Relay Block)		Under Driver Seat	N/S
A/C Control Module-Roof		Instrument Panel	N/S
A/C Fan Switch		Instrument Panel	N/S
A/C Switch - Roof		Instrument Panel	N/S
Accelerator Pedal Position Sensor		On Gas Pedal	14
Air Outlet Temperature Sensor		Engine Compartment (Right Rear)	5,15
Airbag Control Module		Under Driver Seat	10,16,18
Airbag Squib-Driver		Steering Wheel	10
Airbag Squib-Passenger		Instrument Panel (Passenger Side)	N/S
Ambient Temperature Sensor		Front Engine Compartment	2,15
Ash Receiver Lamp		In Ash Tray	N/S
Automatic Temperature Control Module C1		Instrument Panel	N/S
Automatic Temperature Control Module C2		Instrument Panel	N/S
Auxiliary Heater Relay (In Relay Block)		Under Driver Seat	N/S
Auxiliary Heater Switch		Instrument Panel	N/S
Battery Relay-Auxiliary		Engine Compartment	N/S
Blower Motor Resistor Block		Underhood Right (To The Instrument Panel)	4

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

CONNECTOR NAME/ NUMBER	COLOR	LOCATION	FIG.
Blower Motor Resistor Block C1		Instrument Panel	15
Blower Motor Resistor Block C2		Instrument Panel	15
Blower Motor Resistor Block C3		Instrument Panel	15
Blower Motor-Front		Underhood Right (To The Instrument Panel)	4
Body Plug Connector		Under Driver Seat	N/S
Boost Pressure Sensor		Engine Compartment-Left	5
Brake Fluid Level Switch		Engine Compartment	3
Brake Lamp Switch C1		Pedals Area (Brake)	14
Brake Lamp Switch C2		Pedals Area (Brake)	14
Brake Wear Sensor-Left Front		On Left Front Wheel	N/S
Brake Wear Sensor-Left Rear		On Left Rear Wheel	N/S
Brake Wear Sensor-Right Front		On Right Front Wheel	N/S
Brake Wear Sensor-Right Rear		On Right Rear Wheel	N/S
C100		Under Driver Seat	18
C101		Under Instrument Panel-Left	14
C200		Under Instrument Panel-Left	11
C201		Under Instrument Panel-Left	11
C202		Under Instrument Panel-Left	11
C203		Instrument Panel	N/S
C204		Upper Instrument Panel-Left	11
C205		Under Driver Seat	N/S
C206		Instrument Panel	N/S
C207		Near Interior Light Switch-Driver	N/S
C208		Near A/C Fan Switch	N/S
C209		Instrument Panel	N/S
C210		Instrument Panel	N/S
C211		Instrument Panel	N/S
C212		Instrument Panel	N/S
C213		Instrument Panel	N/S
C214		Instrument Panel	N/S
C215		Instrument Panel	N/S
C216		Instrument Panel	N/S
C217		Instrument Panel	N/S
C218		Under Driver Seat	18
C219		Under Driver Seat	19
C220		Instrument Panel	N/S

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

CONNECTOR NAME/ NUMBER	COLOR	LOCATION	FIG.
Cabin Heater Assembly C1		Instrument Panel	N/S
Cabin Heater Assembly C2		Instrument Panel	N/S
Camshaft Position Sensor		Engine Compartment	7
Center High Mounted Stop Lamp		Rear Vehicle	N/S
Central Timer Module C1		Instrument Panel	N/S
Central Timer Module C2		Instrument Panel	N/S
Cigar Lighter		Near Ash Tray	N/S
Cigar Lighter Lamp		Near Cigar Lighter	N/S
Circulation Pump (Cabin Heater Module)		Engine Compartment-Front	4
Circulation Pump Diode		Engine Compartment	N/S
Circulation Pump Relay (Relay Block)		Under Driver Seat	N/S
Clockspring C1		Steering Wheel	10
Clockspring C2		Steering Wheel	10,14
Contact Plate-Left Rear License Plate		Rear Of Vehicle On Left	N/S
Contact Switch Door-Right Rear		Right Rear Door	21
Controller Antilock Brake		Engine Compartment-Left	2
Courtesy Lamp - Driver		Driver Door	20
Courtesy Lamp - Left Sliding Door		Left B-Pillar	20
Courtesy Lamp - Passenger Door		Passenger Door	20
Courtesy Lamp - Right Rear Door		Right Rear Door	20
Courtesy Lamp - Right Sliding Door		Right B-Pillar	20
Crankcase Heater		Engine Compartment	N/S
Crankshaft Position Sensor		On Engine	N/S
CTEL Connector		Instrument Panel	N/S
Cylinder Lock Switch-Driver		Driver Door	21
D(+) Relay		Under Driver Seat	N/S
Data Link Connector		Under Dash	N/S
Daytime Running Lamp Relay (Relay Block)		Under Driver Seat	N/S
Daytime Running Lamp Relay-Left Side (Relay Block)		Under Driver Seat	N/S
Daytime Running Lamp Relay-Right Side (Relay Block)		Under Driver Seat	N/S
Differential Lock Solenoid Valve		Underbody	24

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

CONNECTOR NAME/ NUMBER	COLOR	LOCATION	FIG.
Dome Lamp		Dome Area	20
Door Jamb Switch-Driver		Driver Door	21
Door Jamb Switch-Left Sliding		Left Sliding Door	N/S
Door Jamb Switch-Passenger		Passenger Door	21
Door Jamb Switch-Right Sliding		Right Sliding Door	N/S
Door Jamb Switch-Tailgate		Tailgate	N/S
Door Lock Motor/Ajar Switch Assembly - Driver C1		Driver Door	21
Door Lock Motor/Ajar Switch Assembly - Driver C2		Driver Door	21
Door Lock Motor/Ajar Switch Assembly - Left Sliding C1		Left Sliding Door	22
Door Lock Motor/Ajar Switch Assembly - Left Sliding C2		Left Sliding Door	22
Door Lock Motor/Ajar Switch Assembly - Passenger C1		Passenger Door	22
Door Lock Motor/Ajar Switch Assembly - Passenger C2		Passenger Door	22
Door Lock Motor/Ajar Switch Assembly - Right Sliding C1		Right Sliding Door	N/S
Door Lock Motor/Ajar Switch Assembly - Right Sliding C2		Right Sliding Door	N/S
Door Lock Motor/Ajar Switch Assembly-Rear C1		Cargo Door	25
Door Lock Motor/Ajar Switch Assembly-Rear C2		Cargo Door	25
Dosing Pump		Engine Compartment	N/S
EGR Valve		Engine Compartment	8
Engine Control Module C1		Instrument Panel	12
Engine Control Module C2		Instrument Panel	12
Engine Control Module C3		Instrument Panel	12
Engine Control Module C4		Instrument Panel	12
Engine Control Module C5		Instrument Panel	12
Engine Coolant Level Switch		Engine Compartment	2, 3
Engine Coolant Temperature Sensor		Engine Compartment	7
Engine Oil Pressure Sensor		Engine Compartment	8
Evaporator Temperature Sensor		Instrument Panel-Right	15
Fan Stage 1 Relay (Relay Block)		Under Driver Seat	N/S
Fog Lamp Relay (Relay Block)		Under Driver Seat	N/S

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

CONNECTOR NAME/ NUMBER	COLOR	LOCATION	FIG.
Fog Lamp Switch		Instrument Panel	N/S
Fuel Injector No. 1		Engine Compartment	7
Fuel Injector No. 2		Engine Compartment	6,7
Fuel Injector No. 3		Engine Compartment	6,7
Fuel Injector No. 4		Engine Compartment	6,7
Fuel Injector No. 5		Engine Compartment	7
Fuel Level Sensor		Underbody-Middle	24
Fuel Pressure Sensor		Engine Compartment	6
Fuel Pressure Solenoid		Engine Compartment-Rear	5
Fuel Temperature Sensor		Engine Compartment	7
Fuse Block No.1 C1		Under Fuse Block No.1	N/S
Fuse Block No.1 C2		Under Fuse Block No.1	N/S
Fuse Block No.1 C3		Under Fuse Block No.1	N/S
Fuse Block No.1 C4		Under Fuse Block No.1	N/S
Fuse Block No.1 C5		Under Fuse Block No.1	N/S
Fuse Block No.1 Control Module		Under Driver Seat	N/S
Fuses (Fuse Block No. 1)		Steering Column	13
Fuses (Fuse Block No. 2)		Under Driver Seat	17
Fuses (Fuse Block No. 3)		Under Driver Seat	N/S
Fuses (Fuse/Relay Block)		Under Driver Seat	17,18
Fuses (PDC)		Battery Area	3
Generator No.1		Engine Compartment	N/S
Generator No.2		Engine Compartment-Right	2,8
Glow Plug Control Module C1		Engine Compartment-Left Front	1
Glow Plug Control Module C2		Engine Compartment-Left Front	1
Glow Plug No. 1		On Engine	N/S
Glow Plug No. 2		On Engine	N/S
Glow Plug No. 3		On Engine	N/S
Glow Plug No. 4		On Engine	N/S
Glow Plug No. 5		On Engine	N/S
Headlamp Adjust Switch		Instrument Panel	N/S
Headlamp Assembly-Left		On Front Of Vehicle (Left Side)	N/S
Headlamp Assembly-Right		On Front Of Vehicle (Right Side)	N/S
Heat Exchanger Connector		Instrument Panel	N/S
Heat Exchanger Switch		Engine Compartment	N/S
Heated Seat Module-Driver		Under Driver Seat	N/S
Heated Seat Module-Passenger		Under Passenger Seat	N/S
Heated Seat Switch-Driver		On Driver Seat	N/S
Heated Seat Switch-Passenger		On Passenger Seat	N/S

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

CONNECTOR NAME/ NUMBER	COLOR	LOCATION	FIG.
Heater Relay-Auxiliary		Under Driver Seat	N/S
Heater Timer-Auxiliary		Under Driver Seat	N/S
High Pressure Pump Shutoff Valve		Engine Compartment	6
Hood Ajar Switch		Engine Compartment	N/S
Horn		Engine Compartment	N/S
Horn C1		Engine Compartment	N/S
Horn C2		Engine Compartment	N/S
Horn Relay (Relay Block)		Under Driver Seat	N/S
Horn-Switch		Steering Wheel	10
Ignition Lock Switch		Steering Column	N/S
Instrument Cluster C1		Instrument Panel	10
Instrument Cluster C2		Instrument Panel	10
Instrument Panel Socket		Instrument Panel	N/S
Intake Air Temperature Sensor		Engine Compartment-Left	5
Interior Lamp No. 1		Headliner-Front	20
Interior Lamp No. 2		Headliner-Front	20
Interior Lamp No. 3		Headliner-Front	20
Interior Lamp No. 4		Headliner-Front	20
Interior Lamp No. 5		Headliner-Front	20
Interior Lamp-Left		Left Upper Side	20
Interior Lamp-Middle Front		Headliner-Front	20
Interior Lamp-Middle Rear		Headliner Middle Rear	N/S
Interior Lamp-Rear No. 1		Headliner-Rear	20
Interior Lamp-Rear No. 2		Headliner-Rear	20
Interior Lamp-Right		Right Upper Side	20
Interior Lamp-Right Center		Headliner-Rear	20
Interior Light Switch		Instrument Panel	N/S
Interior Light Switch-Driver		Driver Side Of Vehicle	N/S
Interior Light Switch-Passenger Side		Passenger Side Of Vehicle	N/S
Interior Light Switch-Rear		Rear Side Of Vehicle	N/S
Interior Lighting Connector		Instrument Panel	N/S
Intrusion Sensor No. 1		Headliner-Front Body	23
Intrusion Sensor No. 2		Headliner-Front Body	23
Intrusion Sensor No. 3		Headliner-Rear Body	23
K138 Relay (Relay Block)		Under Driver Seat	N/S
K78 Relay (Relay Block)		Under Driver Seat	N/S
K79 Relay (Relay Block)		Under Driver Seat	N/S
Kick Down Switch		Instrument Panel	N/S
Lamp Relay-Left		Under Driver Seat	N/S

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

CONNECTOR NAME/ NUMBER	COLOR	LOCATION	FIG.
Lamp Relay-Right		Under Driver Seat	N/S
License Plate Lamp No. 1		On Rear Of Vehicle	N/S
License Plate Lamp No. 2		On Rear Of Vehicle	N/S
Locker Switch No. 1		Under Body-Front	N/S
Locker Switch No. 2		Under Body-Rear	24
Low Fuel Pressure Sensor		Engine Compartment	6,8
Map/Reading Lamp Switch		Instrument Panel	N/S
Marker Lamp No.1-Left Front		Front Of Vehicle-Left Side	N/S
Marker Lamp No.2-Left Front		Front Of Vehicle-Left Side	N/S
Marker Lamp-Left Center		Front Of Vehicle-Center Left Side	N/S
Marker Lamp-Left Rear		Rear Of Vehicle-Left Side	N/S
Marker Lamp-Right Center		Front Of Vehicle-Center Right Side	N/S
Marker Lamp-Right Rear		Rear Of Vehicle -Right Side	N/S
Mass Air Flow Sensor		Engine Compartment	5
Master Door Lock Switch		Center Of Instrument Panel	N/S
Metering Pump		Instrument Panel	N/S
Microphone Connector		Instrument Panel	N/S
Multi-Function Switch		Steering Wheel	11
Optional Equipment Relay (Relay Block)		Under Driver Seat	N/S
Panic Alarm Switch		Instrument Panel	N/S
Parking Brake Switch		Under Instrument Panel	23
Power Mirror Motor-Driver		In Driver Door	N/S
Power Mirror Motor-Passenger		In Passenger Door	N/S
Power Mirror Switch		On Driver Door	N/S
Power Mirror-Driver		On Driver Door	N/S
Power Mirror-Master		On Driver Door	N/S
Power Mirror-Passenger		On Passenger Door	N/S
Power Window Motor-Driver		In Driver Door	N/S
Power Window Motor-Passenger		In Passenger Door	N/S
Power Window Switch-Driver		On Driver Door	N/S
Power Window Switch-Master		On Driver Door	N/S
Power Window Switch-Passenger		On Passenger Door	N/S
Radio Antenna		Behind Radio	N/S
Radio C1		Behind Radio	N/S
Radio C2		Behind Radio	N/S
Radio/Cellular Antenna		Behind Radio	N/S
Reading Lamp Connector		Instrument Panel	N/S
Recirculated Air Solenoid Valve		Underhood Right (To The Instrument Panel)	4

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

CONNECTOR NAME/ NUMBER	COLOR	LOCATION	FIG.
Refrigerant Pressure Sensor		Engine Compartment-Left Front	3,4
Relay Block		Under Driver Seat	18
Remote Keyless Entry Antenna		Near Remote Keyless Entry Module	N/S
Remote Keyless Entry Module		Instrument Panel	N/S
Roof Fan Motor		In Headliner	N/S
S165		Middle Of Vehicle	N/S
Seat Belt Switch		Driver Seat Belt Lock	N/S
Seat Belt Tensioner-Driver		Driver Seat-Back	16
Seat Belt Tensioner-Passenger		Passenger Seat-Back	16
Security System Module C1		Instrument Panel	N/S
Security System Module C2		Instrument Panel	N/S
Sentry Key Remote Entry Module (SKREEM)		Instrument Panel	N/S
Shifter Assembly		Center Console	12
Side Marker Lamp Connector		Engine Compartment	N/S
Siren		Engine Compartment-Left	1
Speaker-Left Front Door Assembly C1		Engine Compartment-Left	N/S
Speaker-Left Front Door Assembly C2		In Left Front Door	N/S
Speaker-Left Rear		Rear Of Vehicle On Left Side	N/S
Speaker-Right Front Door		In Right Front Door	N/S
Speaker-Right Rear		Rear Of Vehicle On Right Side	N/S
Speed Control Switch		Steering Wheel Controls	10
Starter Motor		On Engine	N/S
Starter Motor Relay (Fuse/Relay Block)		In Fuse/Relay Block	N/S
Tail Lamp Assembly-Left		Rear Of Vehicle On Left Side	N/S
Tail Lamp Assembly-Right		Rear Of Vehicle On Right Side	N/S
TCS Switch (ASR)		Center Of Instrument Panel	N/S
Temperature Switch		Instrument Panel	N/S
Time Delay Relay		Under Driver Seat	N/S
Towing/Interior Motion Sensor		Instrument Panel	N/S
Trailer Tow Connector		Under Rear Of Vehicle	N/S
Trailer Tow Control Module C1		Rear Of Vehicle	N/S
Trailer Tow Control Module C2		Rear Of Vehicle	N/S
Transmission Control Module C1		Engine Compartment	N/S

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

CONNECTOR NAME/ NUMBER	COLOR	LOCATION	FIG.
Transmission Control Module C2		Engine Compartment	N/S
Transmission Control Relay (Fuse Block No. 1)		In Fuse Block No.1	N/S
Transmission Solenoid Assembly		Transmission	9
Turn Signal Lamp No.1-Left Front		Front Of Vehicle On Left Side	N/S
Turn Signal Lamp No.1-Right Front		Front Of Vehicle On Right Side	N/S
Turn Signal Lamp No.2-Left Front		Front Of Vehicle On The Left Side	N/S
Turn Signal Lamp No.2-Right Front		Front Of Vehicle On The Right Side	N/S
Turn Signal Relay (Fuse Block No. 1)		In Fuse Block No.1	N/S
Turn Signal/Anti-Theft Alarm Relay-Left (Relay Block)		Under Driver Seat	N/S
Turn Signal/Anti-Theft Alarm Relay-Right (Relay Block)		Under Driver Seat	N/S
Warm Air Auxiliary Heater Assembly C1		Instrument Panel	15
Warm Air Auxiliary Heater Assembly C2		Instrument Panel	15
Washer Pump Motor-Front		Engine Compartment	N/S
Wastegate Solenoid		Engine Compartment	N/S
Water Cycle Valve		Underhood (To The Instrument Panel)	4
Water In Fuel Sensor		Engine Compartment	8
Wheel Speed Sensor-Left Front		Left Front Wheel	2
Wheel Speed Sensor-Left Rear		Left Rear Wheel	2
Wheel Speed Sensor-Right Front		Right Front Wheel	N/S
Wheel Speed Sensor-Right Rear		Right Rear Wheel	N/S
Window Defogger Module - Rear		Rear Of Vehicle	N/S
Window Defogger Relay-Left Rear (Relay Block)		Under Driver Seat	N/S
Window Defogger Relay-Right Rear (Relay Block)		Under Driver Seat	N/S
Window Defogger Switch - Rear		Instrument Panel	N/S
Window Defogger-Left Rear		On Left Rear Window	N/S

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

CONNECTOR NAME/ NUMBER	COLOR	LOCATION	FIG.
Window Defogger-Right Rear		On Right Rear Window	N/S
Wiper Motor-Front		Underhood (To The Window)	3
Wiper On/Off Relay (Fuse Block No. 1)		In Fuse Block No.1	N/S
Wiper/Turn Signal/Engine Start Control Module (In Fuse Block 1)		In Fuse Block No.1	N/S

GROUNDS

GROUND NUMBER	LOCATION	FIG.
G100	Underhood-Left Front	25
G101	Underhood-Right Front	25
G102	Underhood-Right Front	25
G200	Engine Compartment-Left	3,4
G201	Under Driver Seat	25
G202	Under Driver Seat	18,19
G203	Dash	11
G300	Right Rear-Body	25
G301	Right Rear-Body Top	25
G302	Engine Compartment-Left Front	25

SPLICES

SPLICE NUMBER	LOCATION	FIG.
S100	Under Drivers Seat	19
S101	Under Drivers Seat	N/S
S102	Under Drivers Seat	N/S
S103	Engine Compartment-Left	N/S
S104	Near Headlamp Assembly-Left	N/S
S105	Engine Compartment-Left	N/S
S175	Engine Compartment-Left	N/S
S176	Engine Compartment-Left	N/S
S177	Engine Compartment-Left	N/S
S178	Engine Compartment-Left	N/S
S200	Engine Compartment-Left	1
S201	Instrument Panel	N/S
S202	Instrument Panel	N/S
S203	Under Drivers Seat	N/S
S204	Near Brake Lamp Switch	N/S
S205	Under Drivers Seat	N/S
S206	Near Optional Equipment Relay	N/S

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

SPLICE NUMBER	LOCATION	FIG.
S207	Near Time Delay Relay	N/S
S208	Near Time Delay Relay	N/S
S210	Near Radio	N/S
S211	Near Heater Timer-Auxiliary	N/S
S212	Near Security System Module	N/S
S213	Near Security System Module	N/S
S214	Near Security System Module	N/S
S215	Instrument Panel	18
S216	Instrument Panel	N/S
S217	Near Engine Control Module	N/S
S218	Instrument Panel	N/S
S219	Under Drivers Seat	N/S
S220	Near Central Timer Module	N/S
S221	Near Data Link Connector	N/S
S222	Near Security System Module	N/S
S223	Instrument Panel	N/S
S224	Instrument Panel	18
S225	Instrument Panel	N/S
S226	Near Turn Signal/Anti-Theft Alarm Relay-Left	N/S
S227	Near Sentry Key Remote Entry Module	N/S
S228	Instrument Panel	N/S
S229	Near C202	N/S
S250	Near Turn Signal/Anti-Theft Alarm Relay-Left	N/S
S251	Near Trailer Tow Control Module	N/S
S252	Near Trailer Tow Control Module	N/S
S253	Instrument Panel	12
S254	Near Interior Lamp No.5	N/S
S255	Near Control Timer Module	N/S
S256	Near A/C Roof-Switch	N/S
S257	Near Data Link Connector	N/S
S258	Near Transmission Control Module	N/S
S259	Under Drivers Seat	19
S260	Under Drivers Seat	19
S261	Near Data Link Connector	N/S
S262	Under Drivers Seat	N/S
S299	Instrument Panel	N/S
S300	Near Heated Seat Switch-Driver	N/S
S301	Near Heated Seat Switch-Passenger	N/S
S302	Under Drivers Seat	N/S
S303	Near Power Window Switch-Driver	N/S
S304	Near Power Window Motor-Driver	N/S

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

SPLICE NUMBER	LOCATION	FIG.
S305	Near Power Window Motor-Driver	N/S
S306	Near Locker Switch No.2	N/S
S307	Near Fuse/Relay Block	N/S
S308	Near Interior Lamp No.3	N/S
S309	Near Interior Lamp-Right	N/S
S310	Near Fuse Block No.2	N/S
S311	Under Drivers Seat	19
S312	Near Wheel Speed Sensor-Left Rear	N/S
S313	Near Wheel Speed Sensor-Left Rear	N/S
S314	Near Wheel Speed Sensor-Right Rear	N/S
S315	Near Wheel Speed Sensor-Right Rear	N/S
S316	Near Headlamp Assembly-Left	N/S
S317	Engine Compartment	N/S
S318	Near Marker Lamp-Left Rear	N/S
S319	Near Tail Lamp Assembly-Left	N/S
S320	Under Body-Rear Center	24
S321	Near Power Window Switch-Passenger	N/S
S322	Instrument Panel	N/S
S323	Near Brake Wear Sensor-Left Rear	N/S
S324	Near Interior Lamp No.3	N/S
S325	Near Map/Reading Lamp Switch	N/S
S326	Top Body- Front Center	20
S327	Near Security System Module	N/S
S328	Near Central Timer Module	N/S
S329	Near Central Timer Module	N/S
S330	Near Security System Module	N/S
S331	Near Security System Module	N/S
S332	Near Brake Wear Sensor-Left Rear	N/S
S332	Near K26	N/S
S350	Near Trailer Tow Connector	N/S
S351	Near Trailer Tow Control Module	N/S
S352	Near Trailer Tow Control Module	N/S
S353	Near Dome Lamp	N/S
S354	Body-Upper Right Center	20
S355	Near Window Defogger Module-Rear	N/S
S356	Near Headlamp Assembly-Left	N/S
S356	Near Central Timer Module	N/S
S357	Near Central Timer Module	N/S
S358	Near Trailer Tow Control Module	N/S
S359	Near Interior Light Switch-Passenger	N/S
S360	Near Interior Light Switch-Rear	N/S

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

SPLICE NUMBER	LOCATION	FIG.
S361	Near Time Delay Relay	N/S
S362	Near Circulation Pump Diode	N/S
S363	Near Heated Seat Module-Passenger	N/S
S364	Near CTEL Connector	N/S
S365	Near A/C Fan Switch	N/S
S366	Near Heated Seat Module-Driver	N/S

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

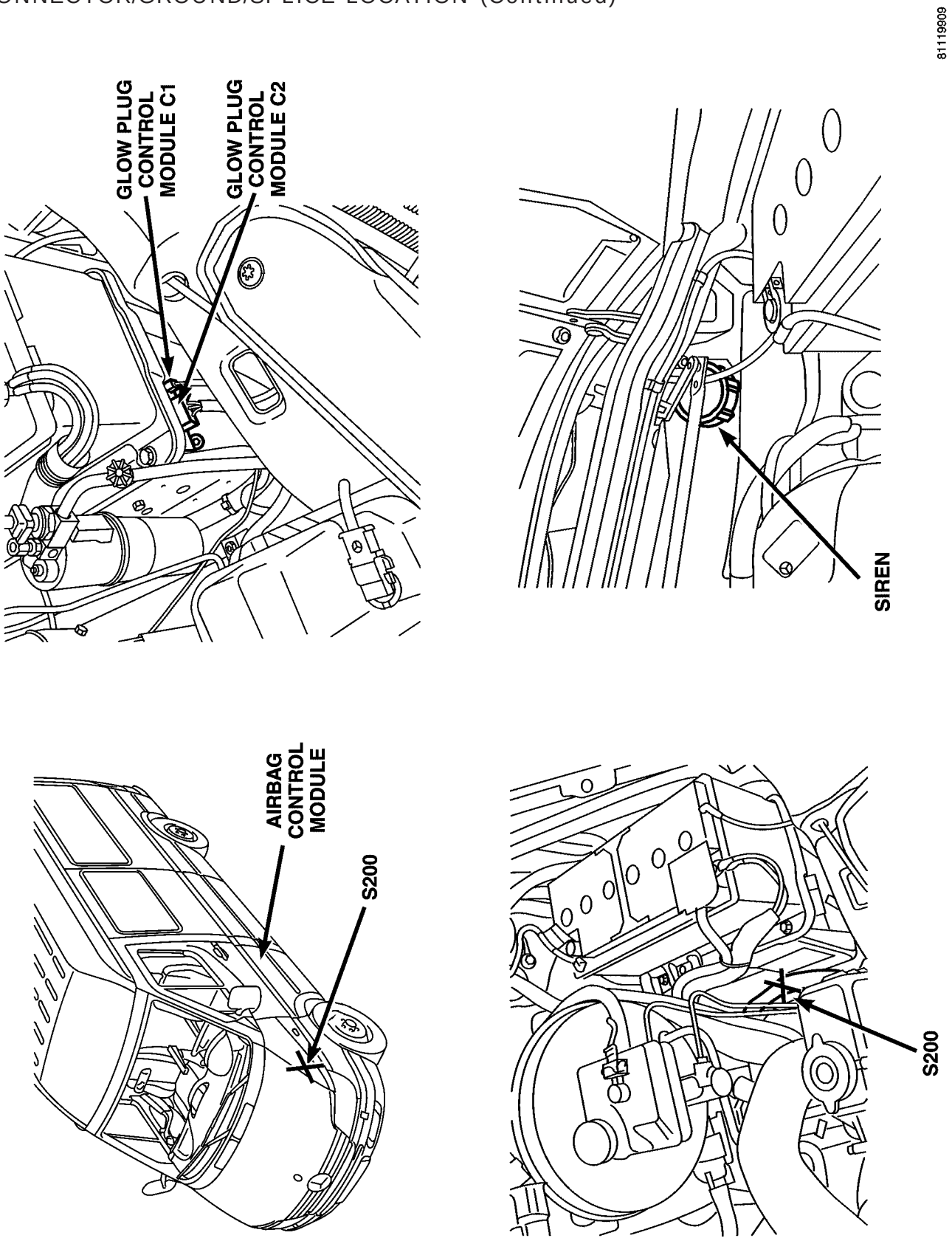


Fig. 1 VIEW 1

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

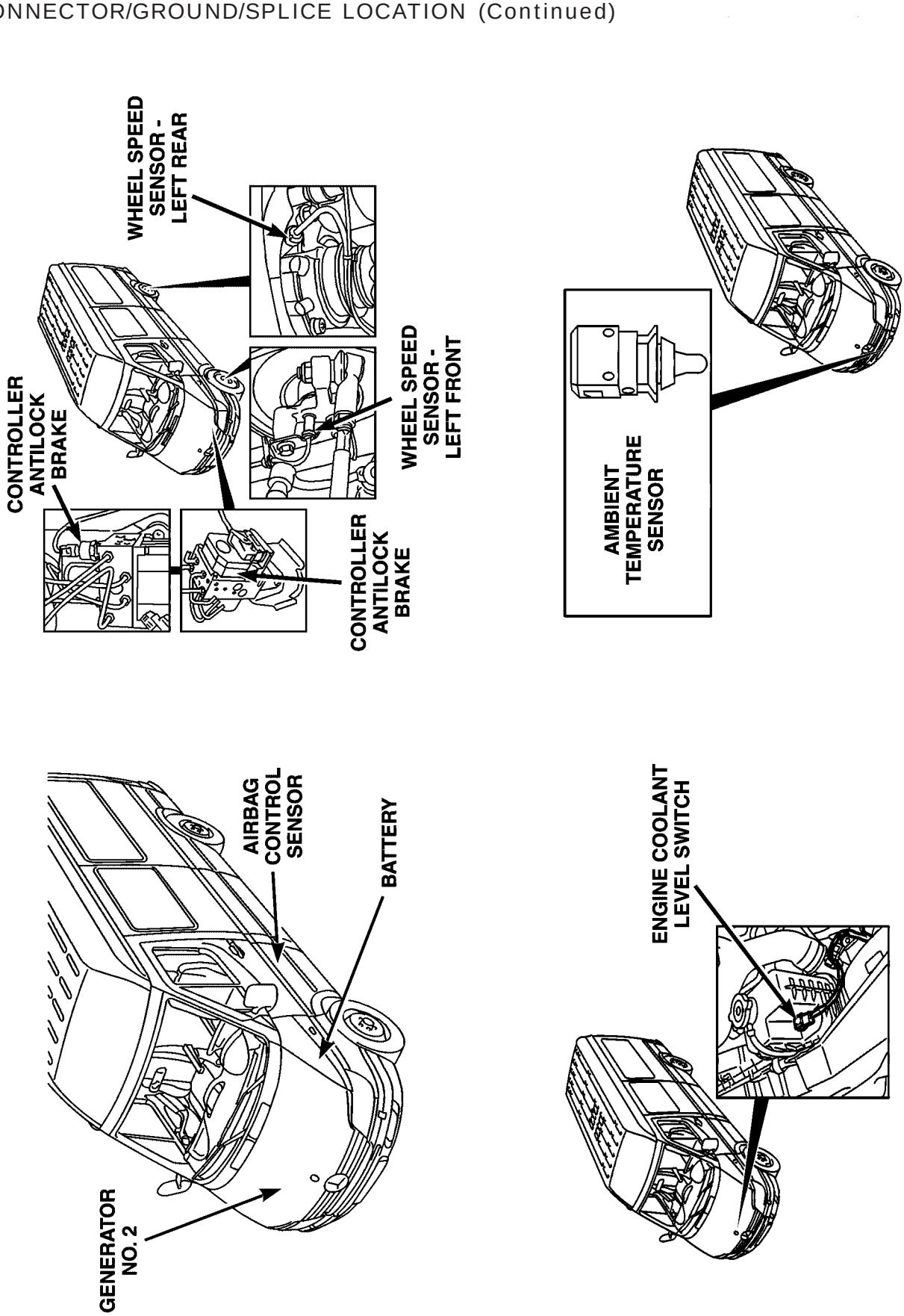


Fig. 2 VIEW 2

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

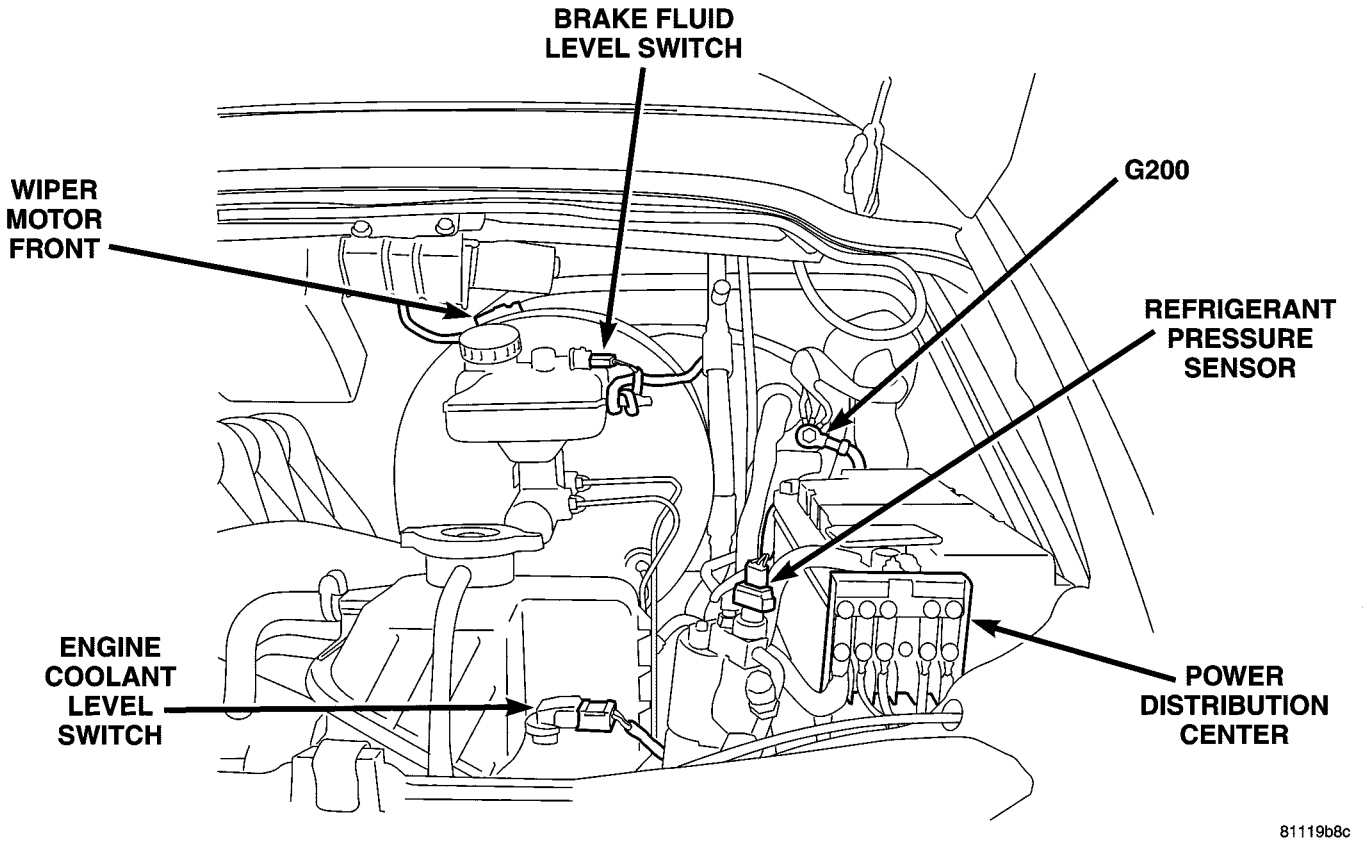


Fig. 3 VIEW 3

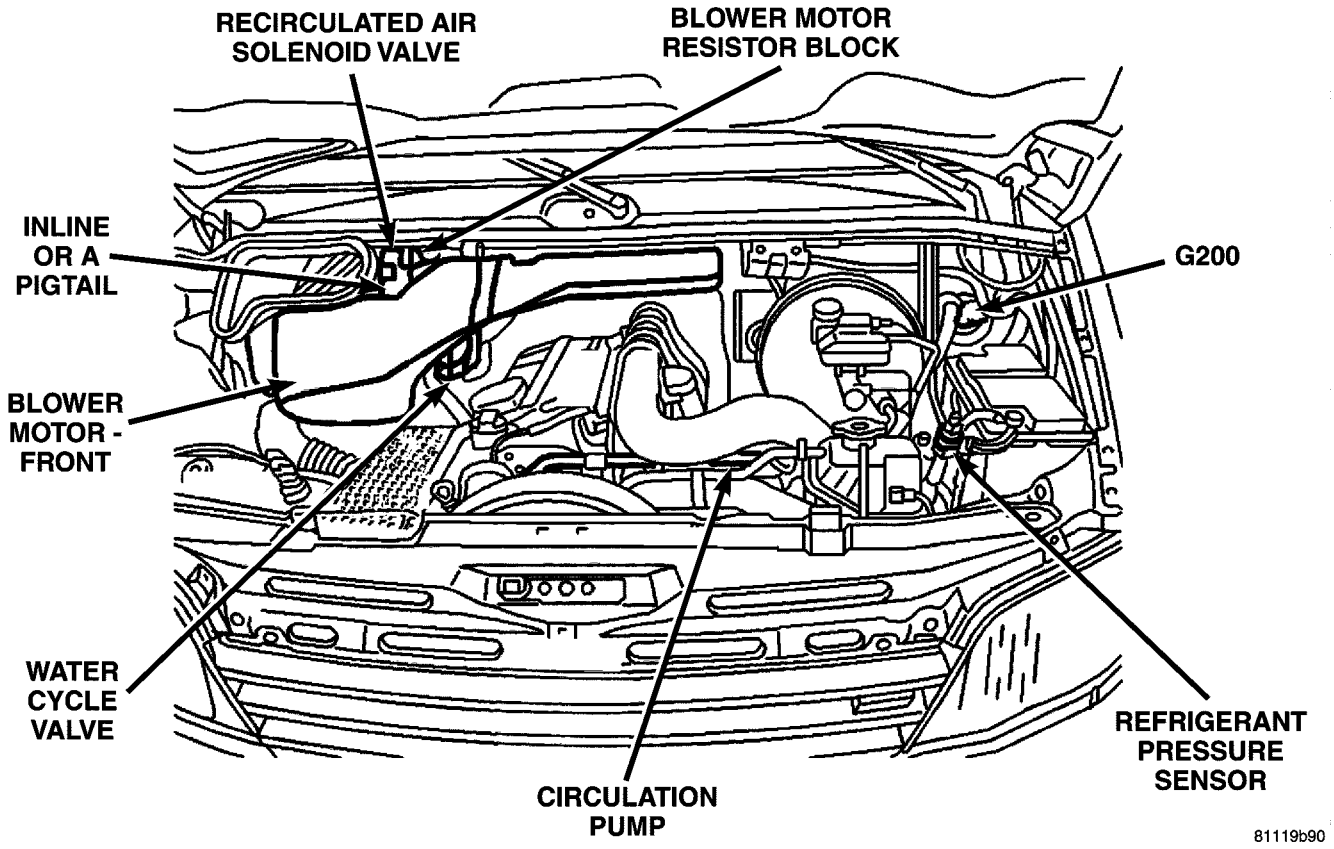


Fig. 4 VIEW 4

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

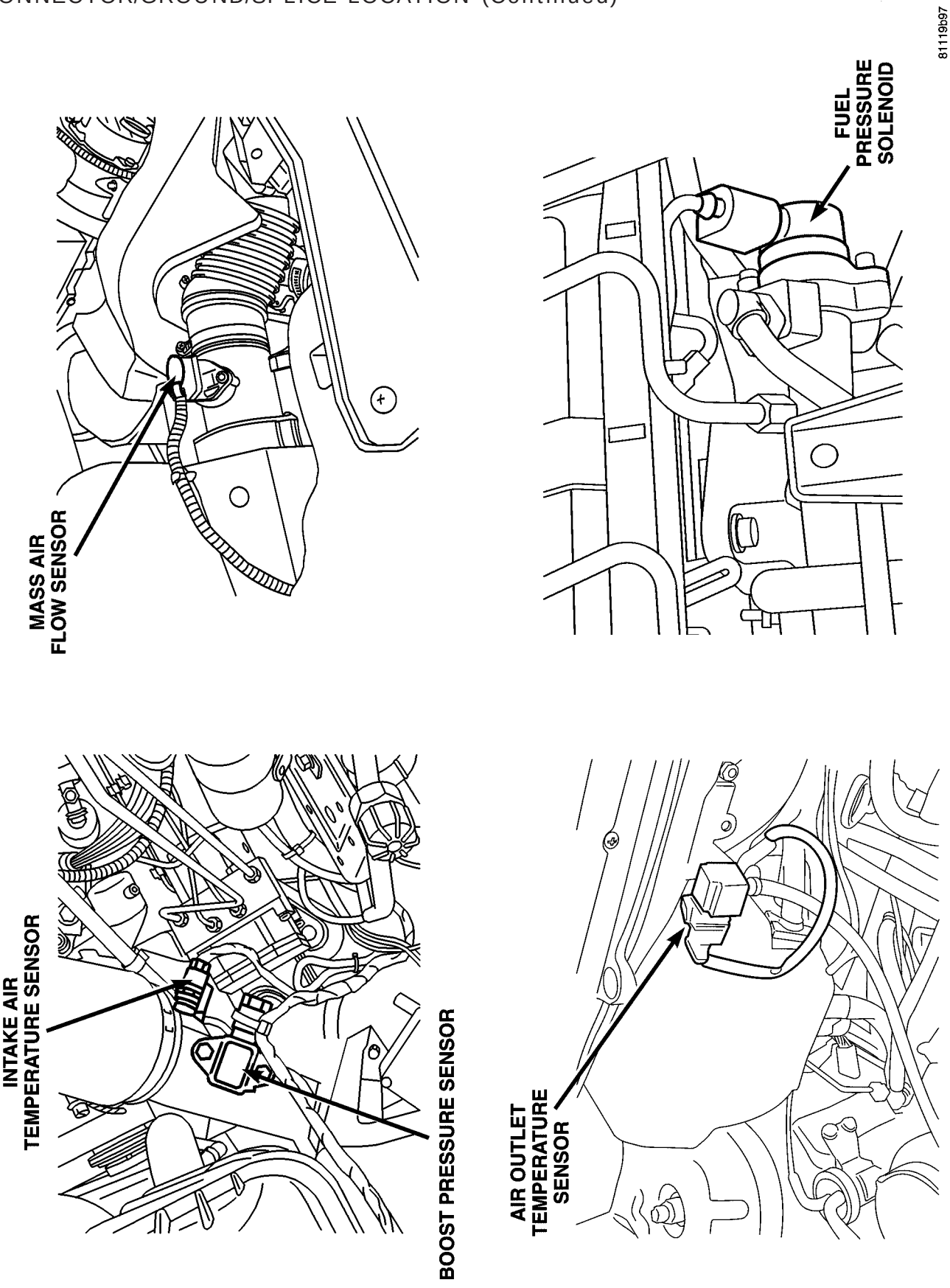


Fig. 5 VIEW 5

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

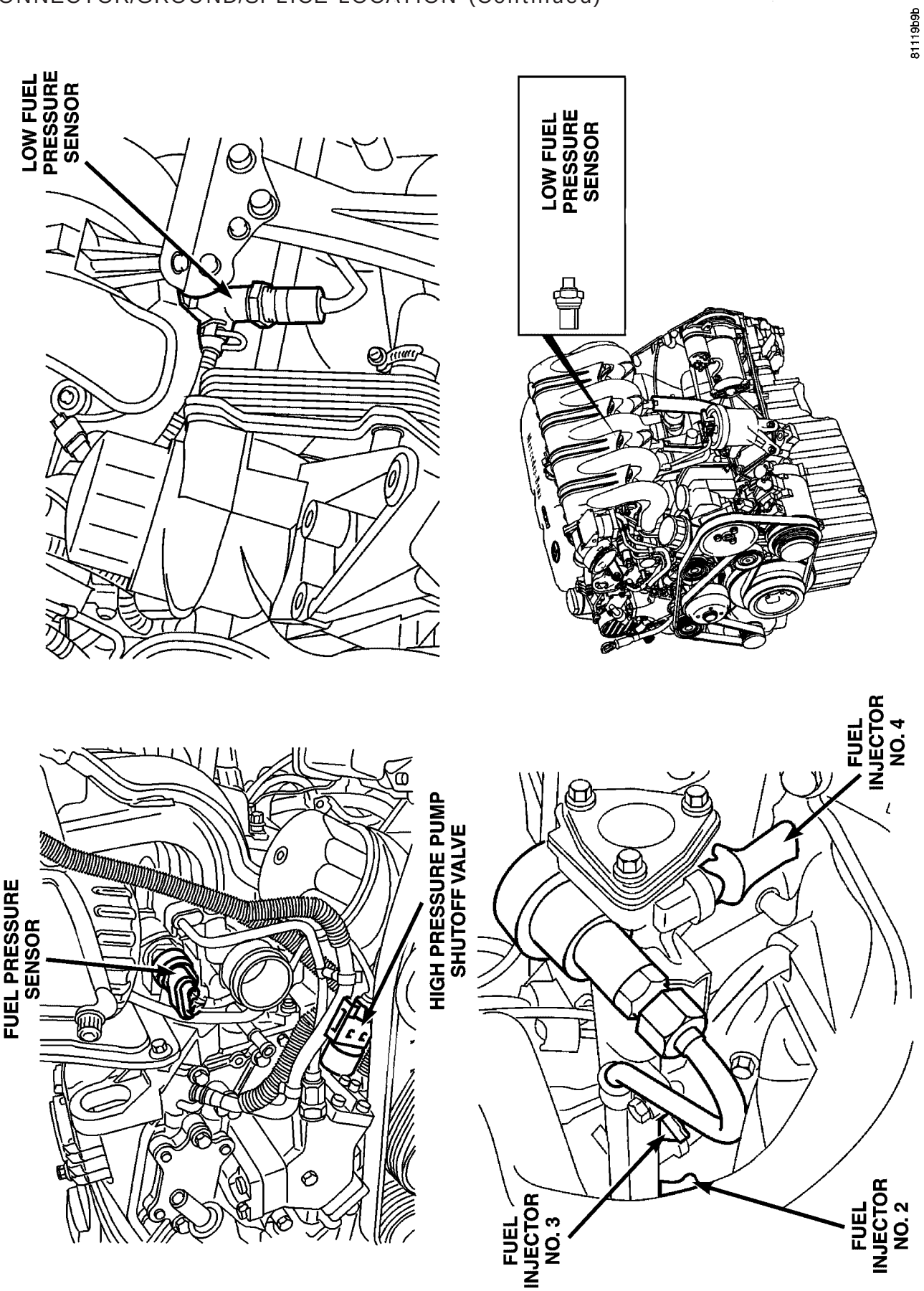


Fig. 6 VIEW 6

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

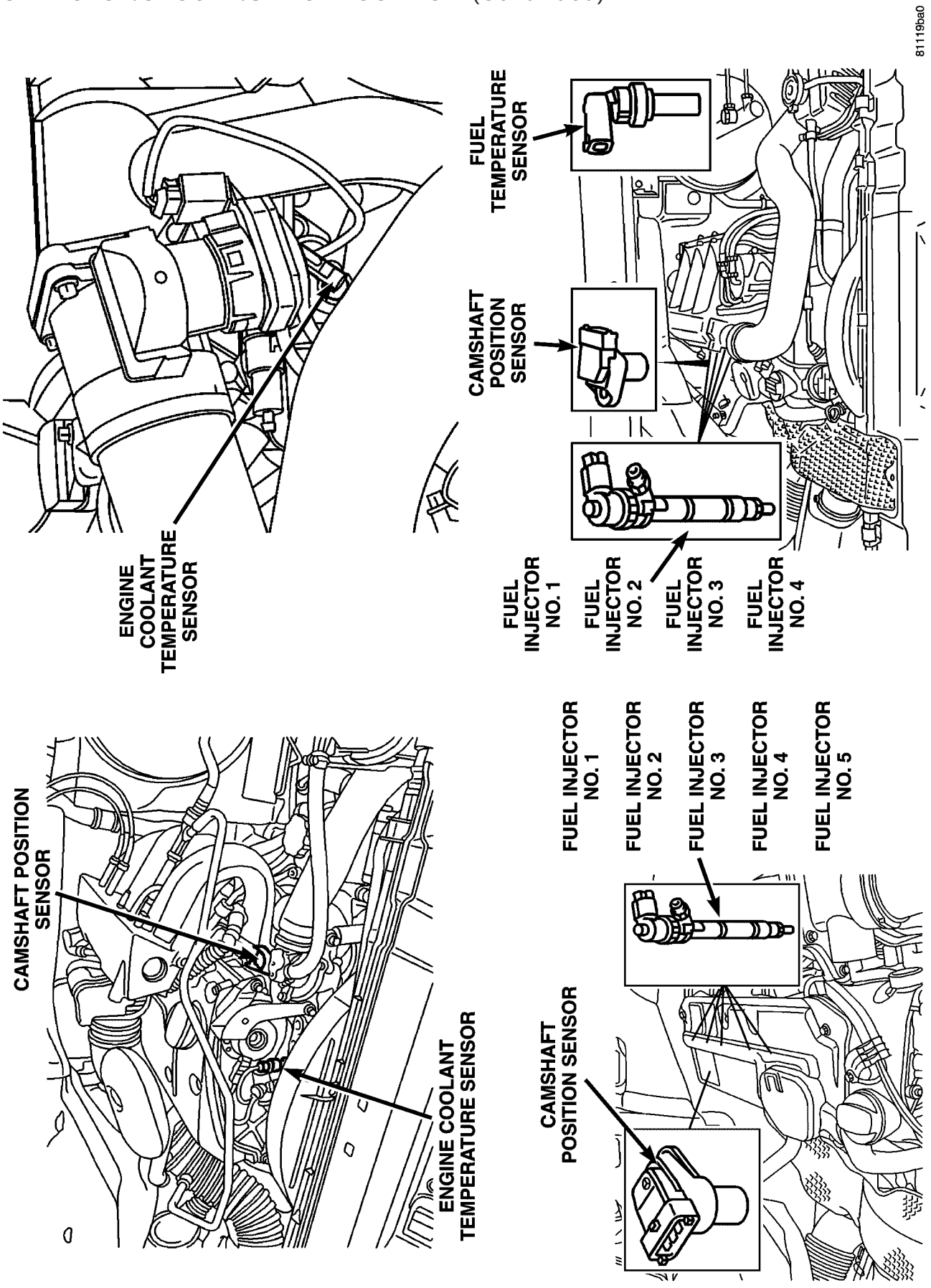


Fig. 7 VIEW 7

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

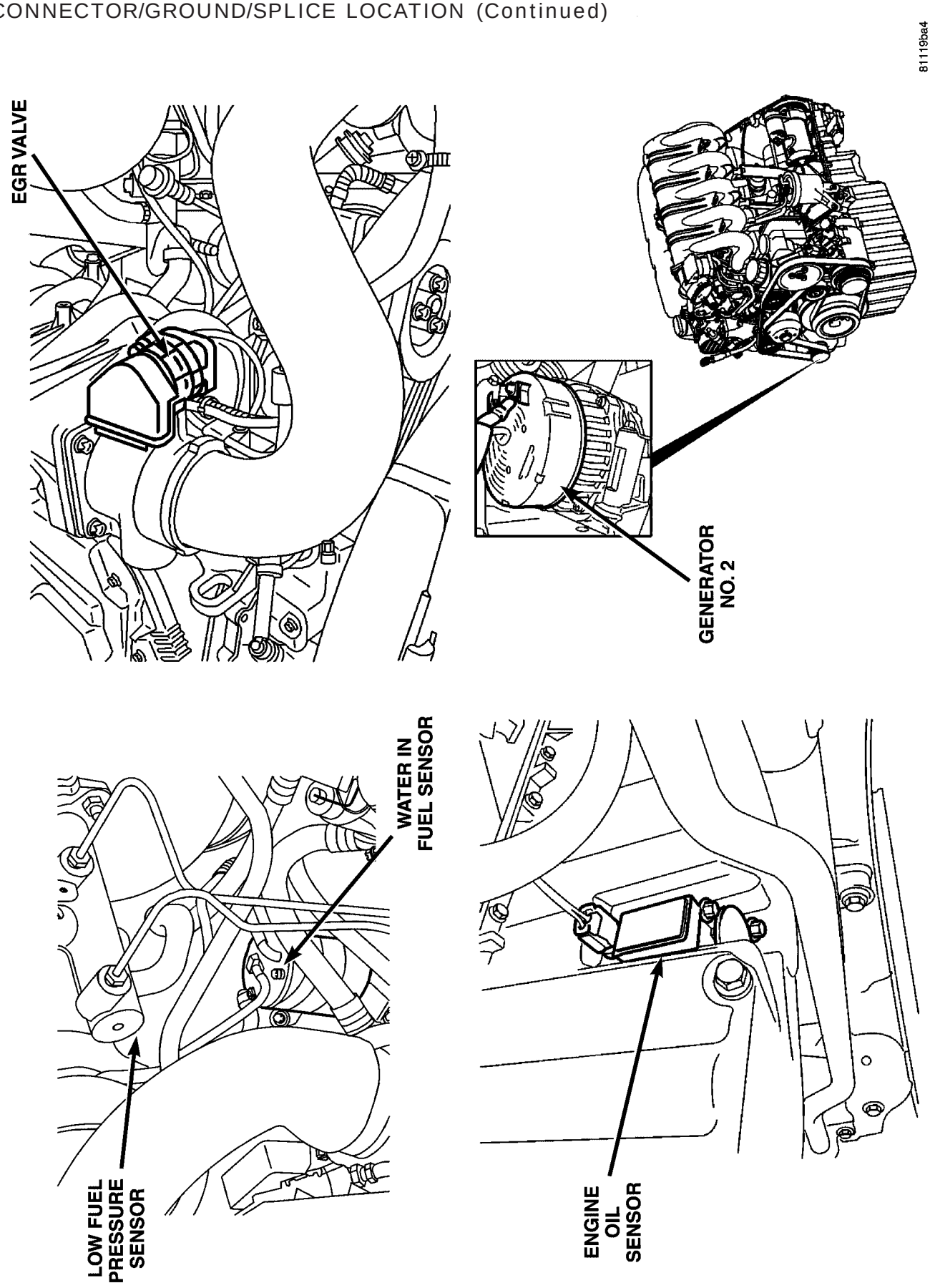


Fig. 8 VIEW 8

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

81119bb2

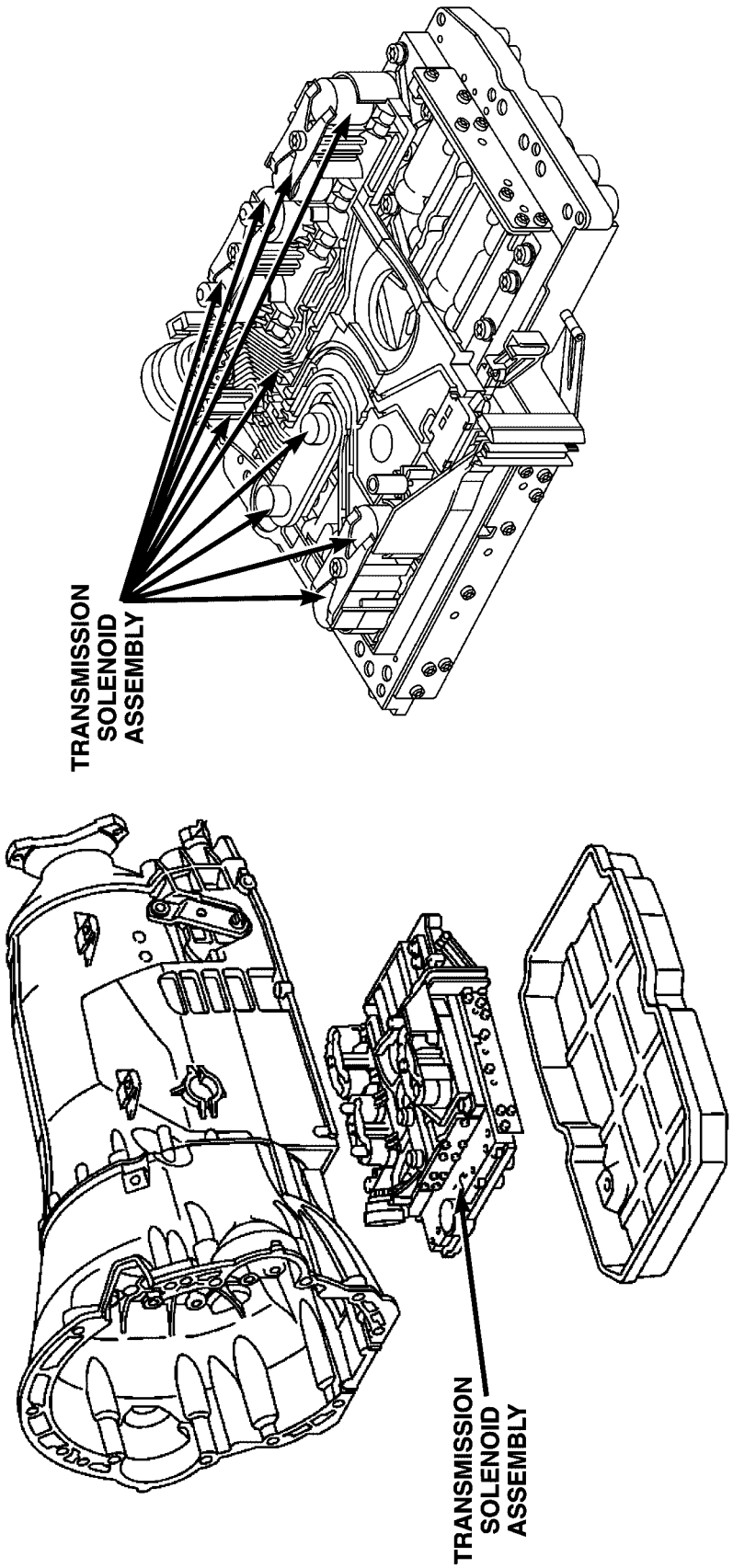


Fig. 9 VIEW 9

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

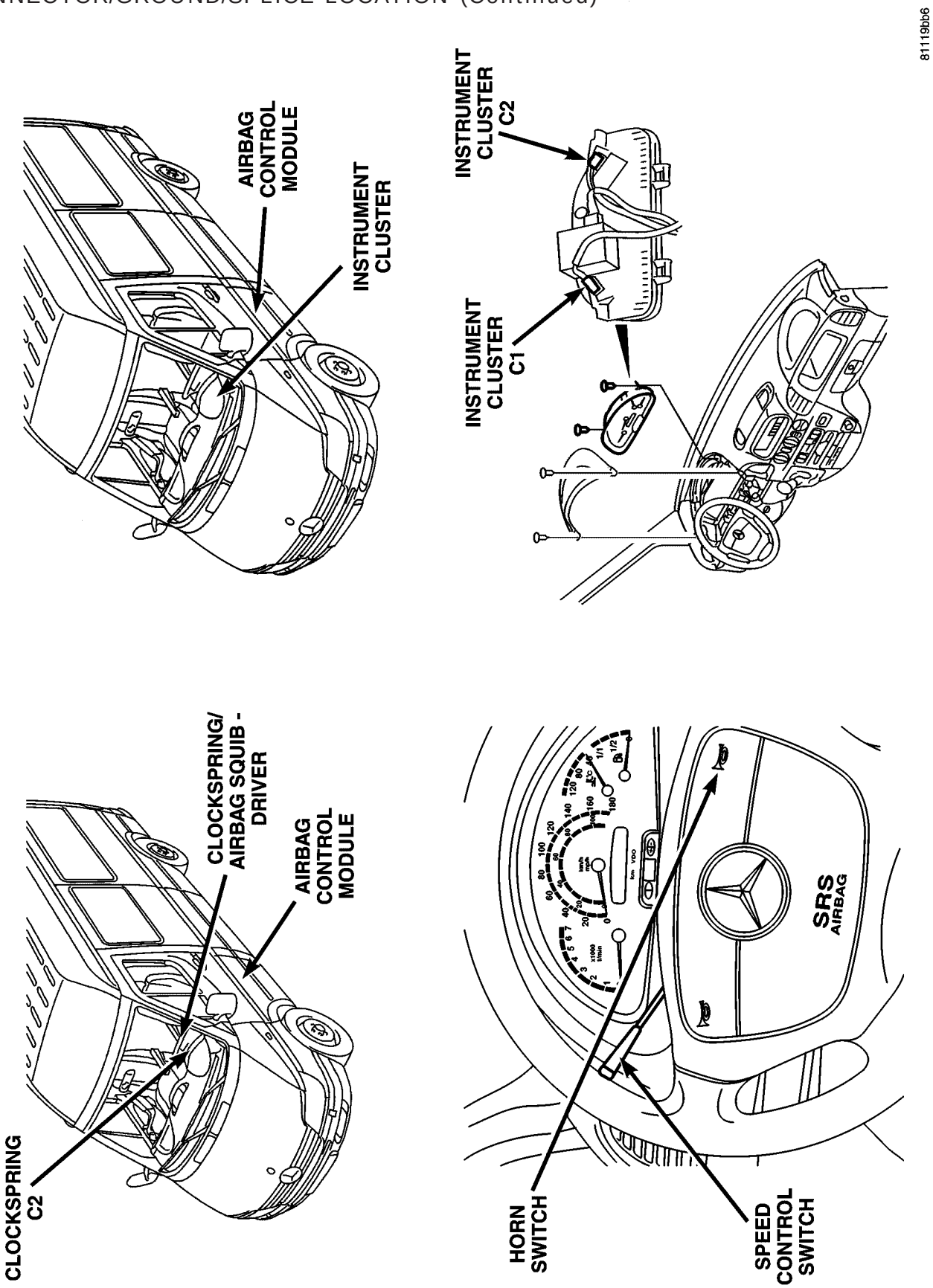


Fig. 10 VIEW10

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

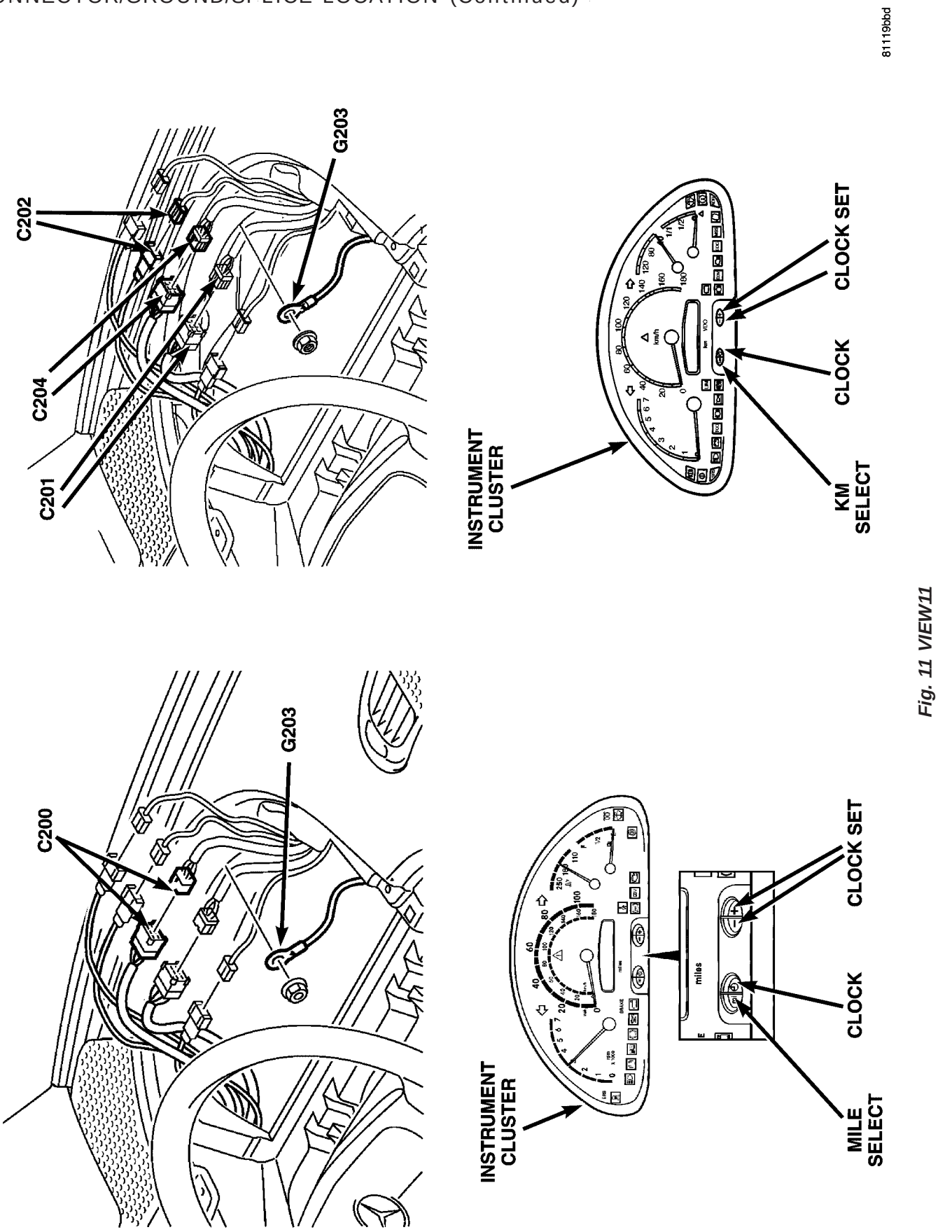


Fig. 11 VIEW11

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

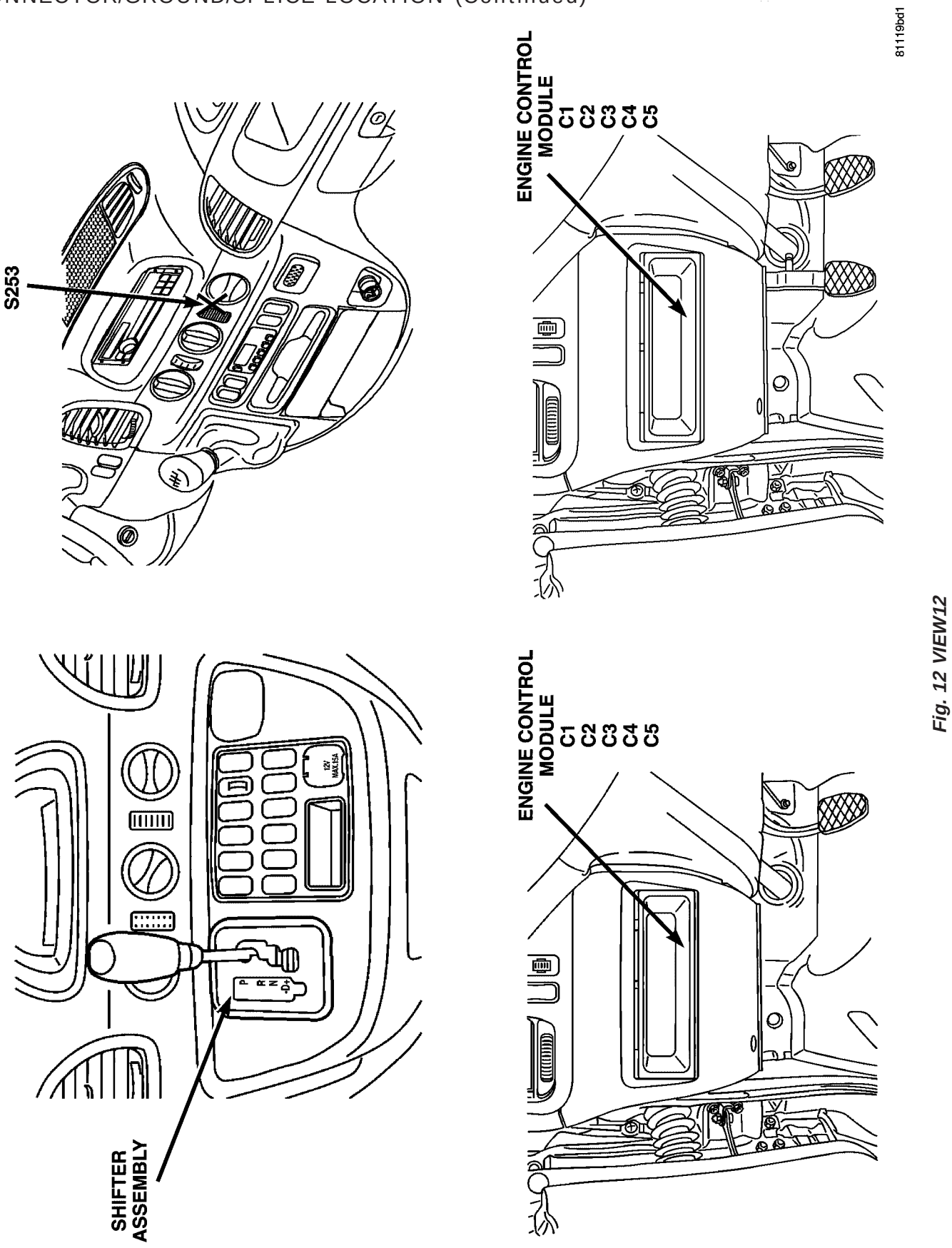


Fig. 12 VIEW12

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

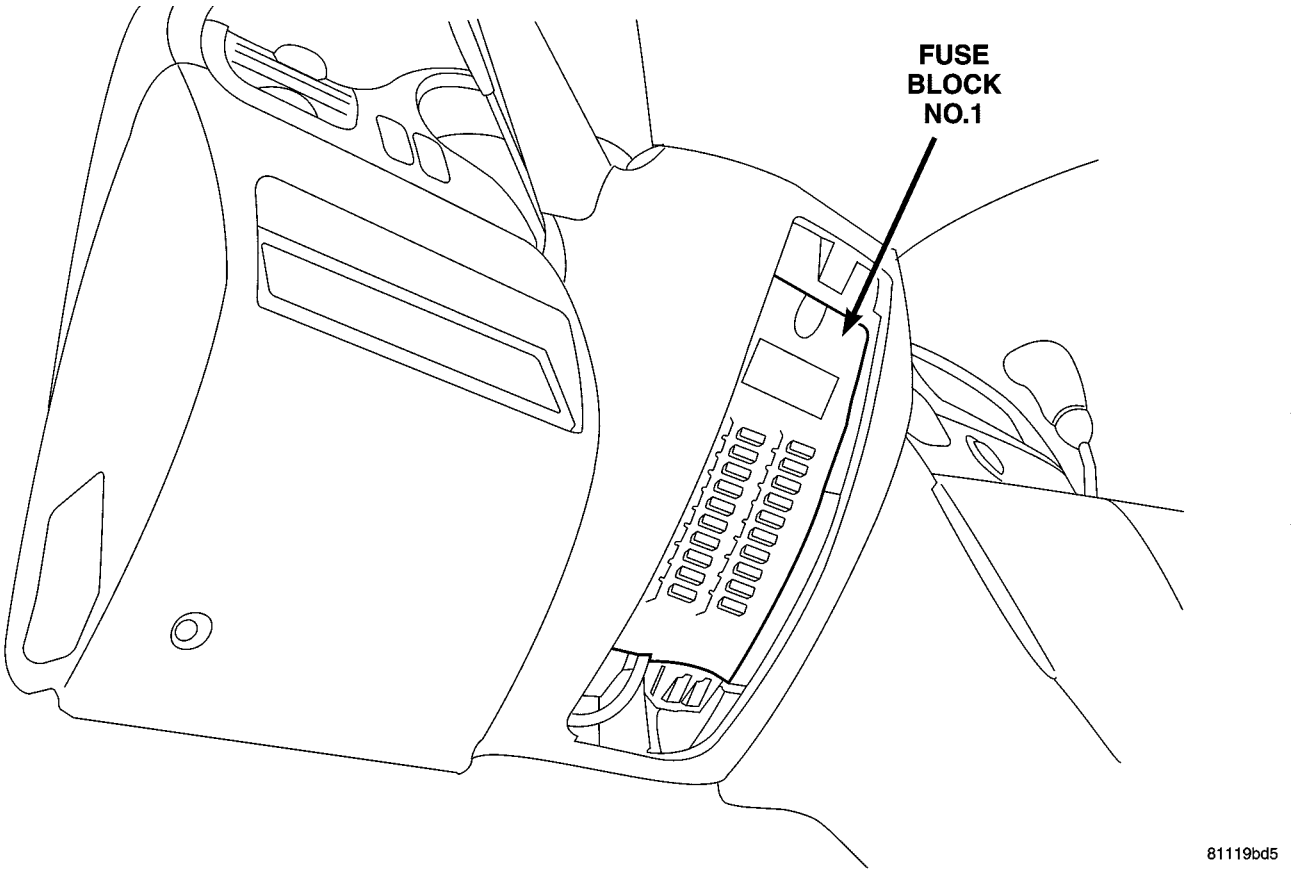


Fig. 13 VIEW13

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

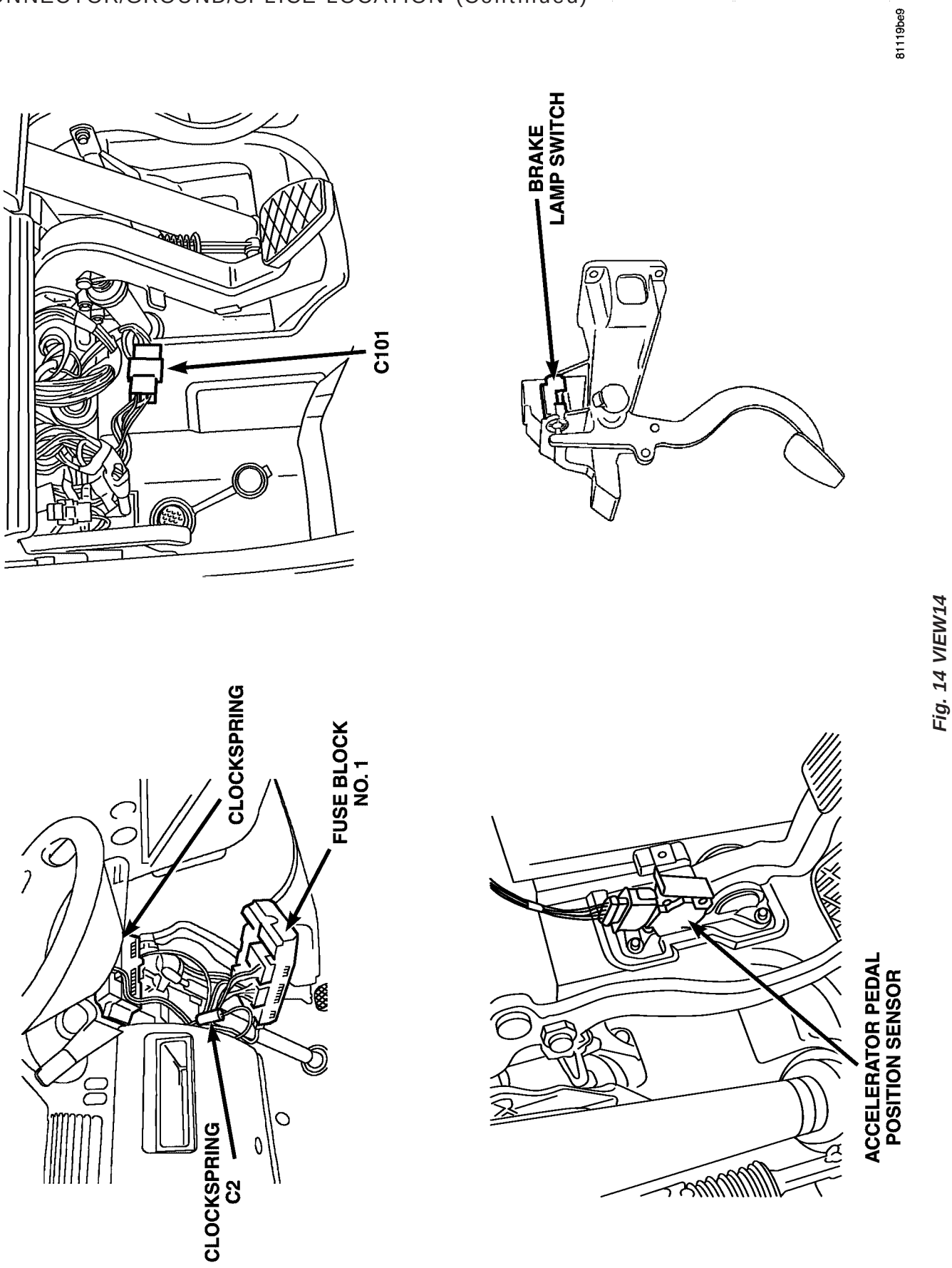


Fig. 14 VIEW14

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

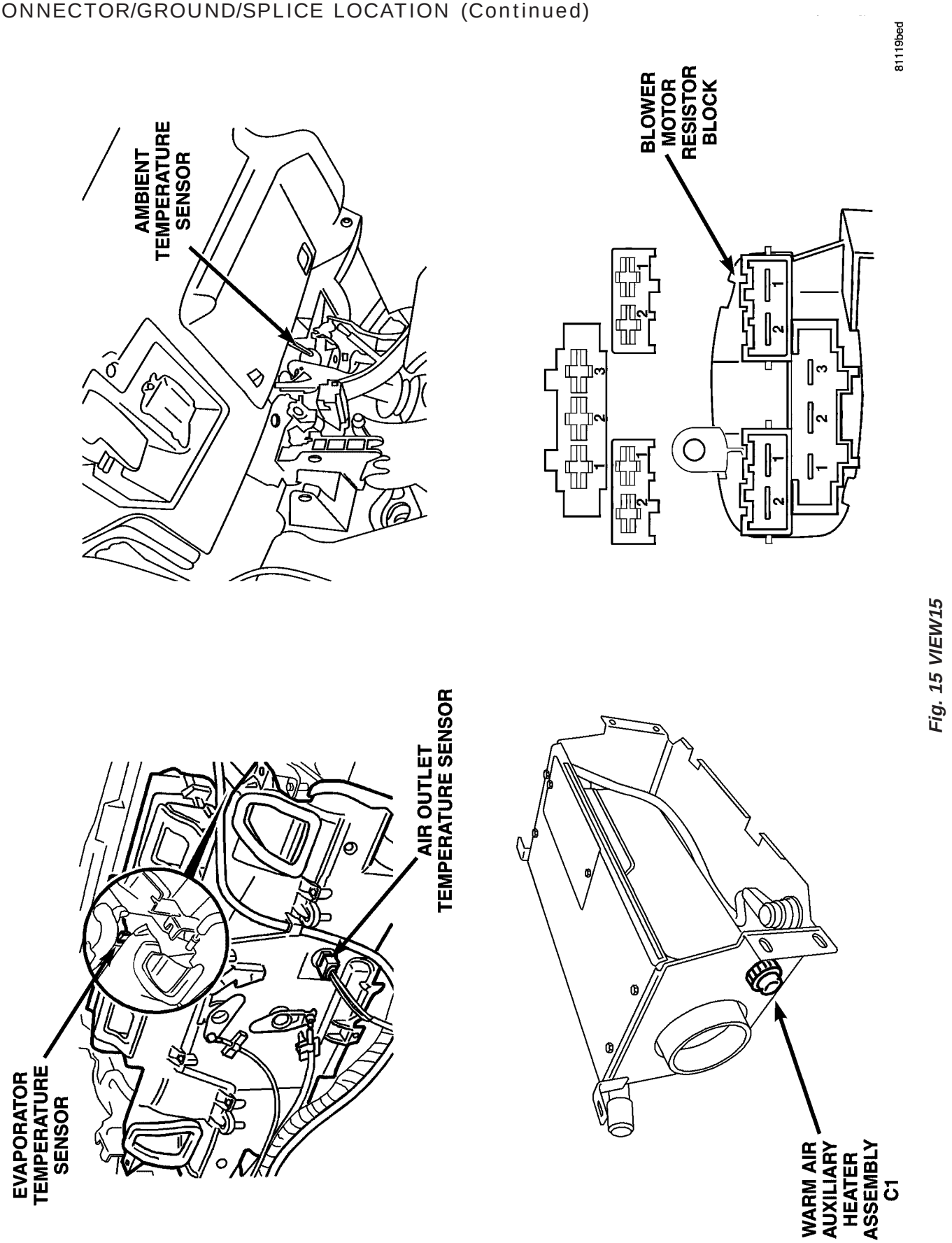


Fig. 15 VIEW15

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

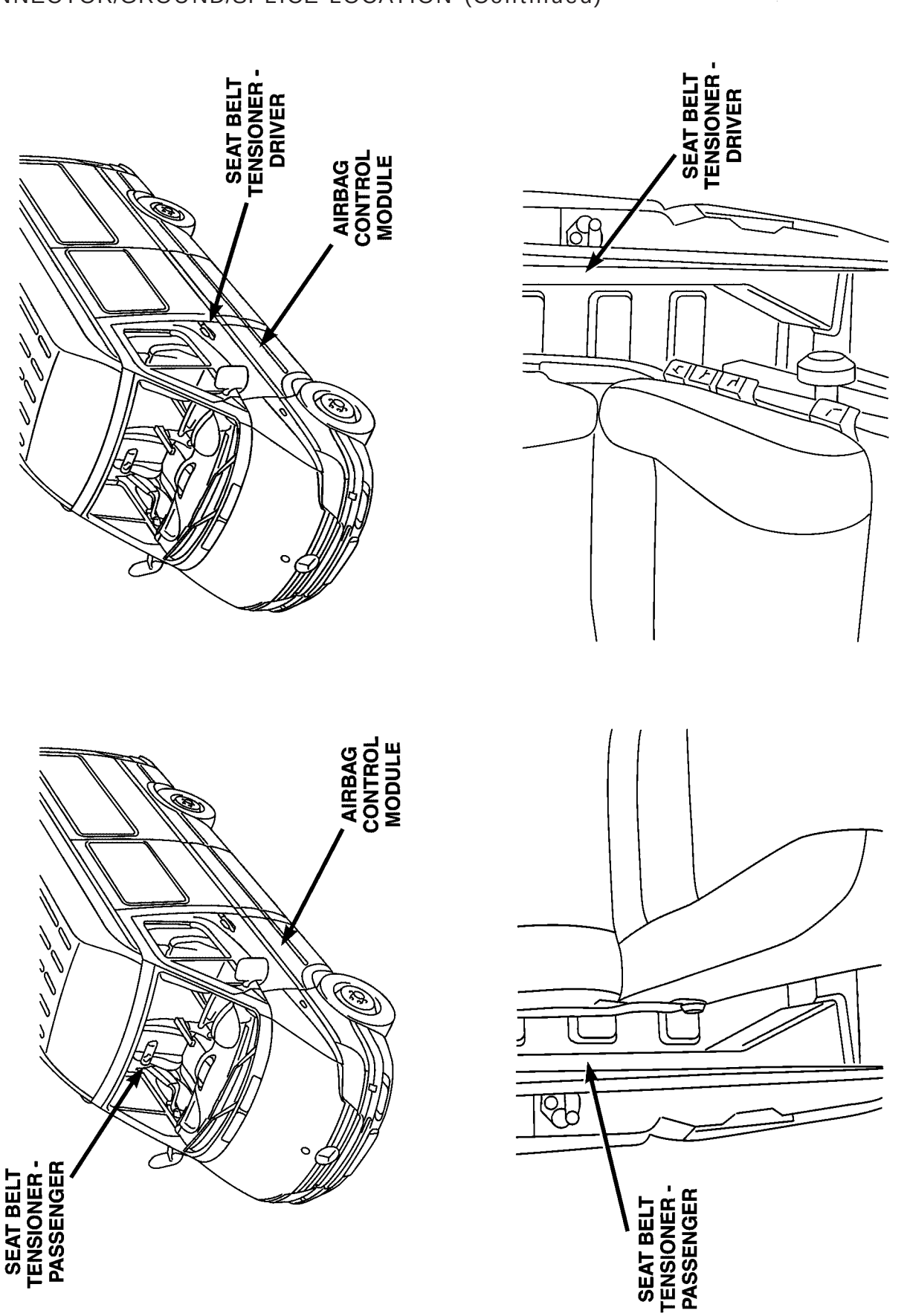


Fig. 16 VIEW16

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

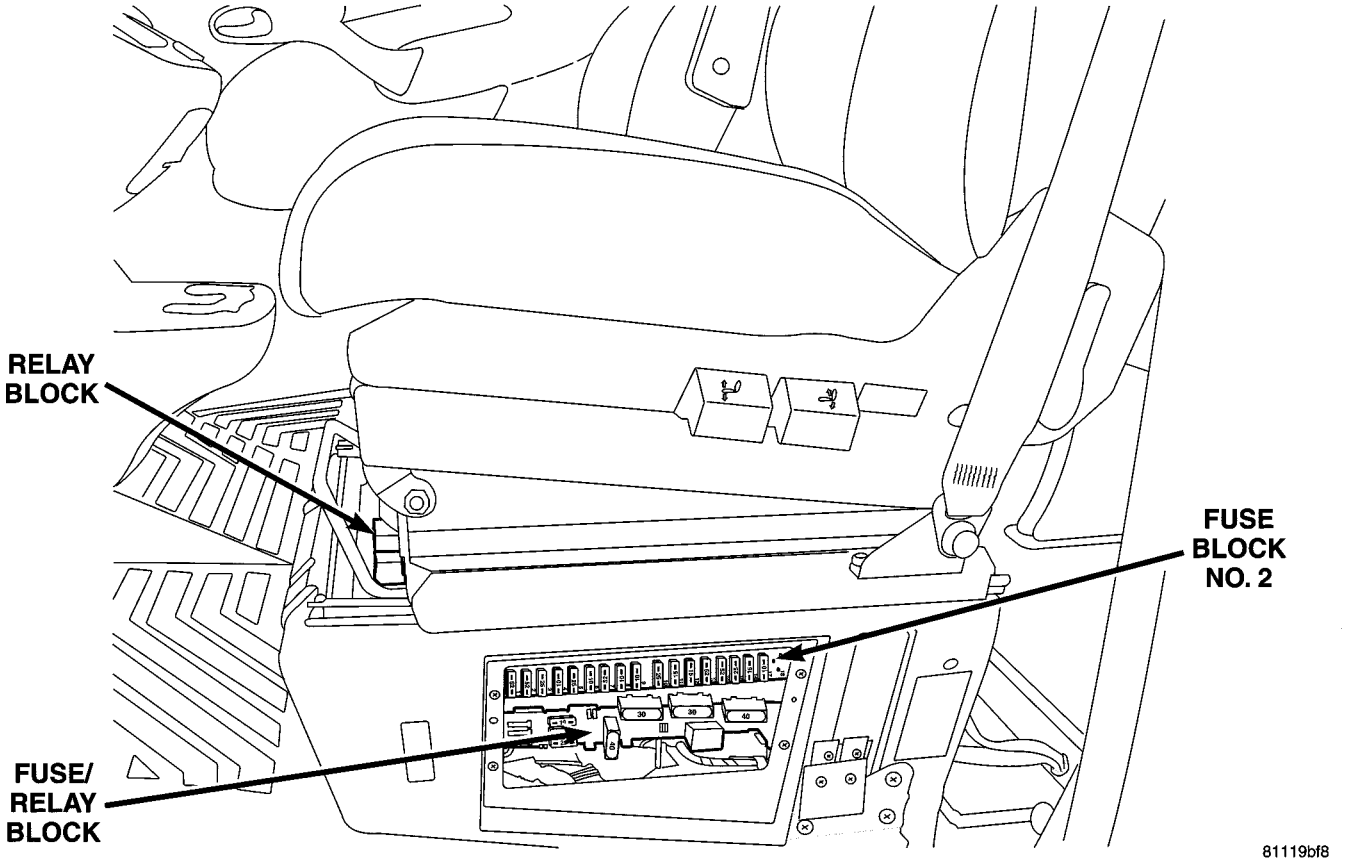


Fig. 17 VIEW17

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

81119c32

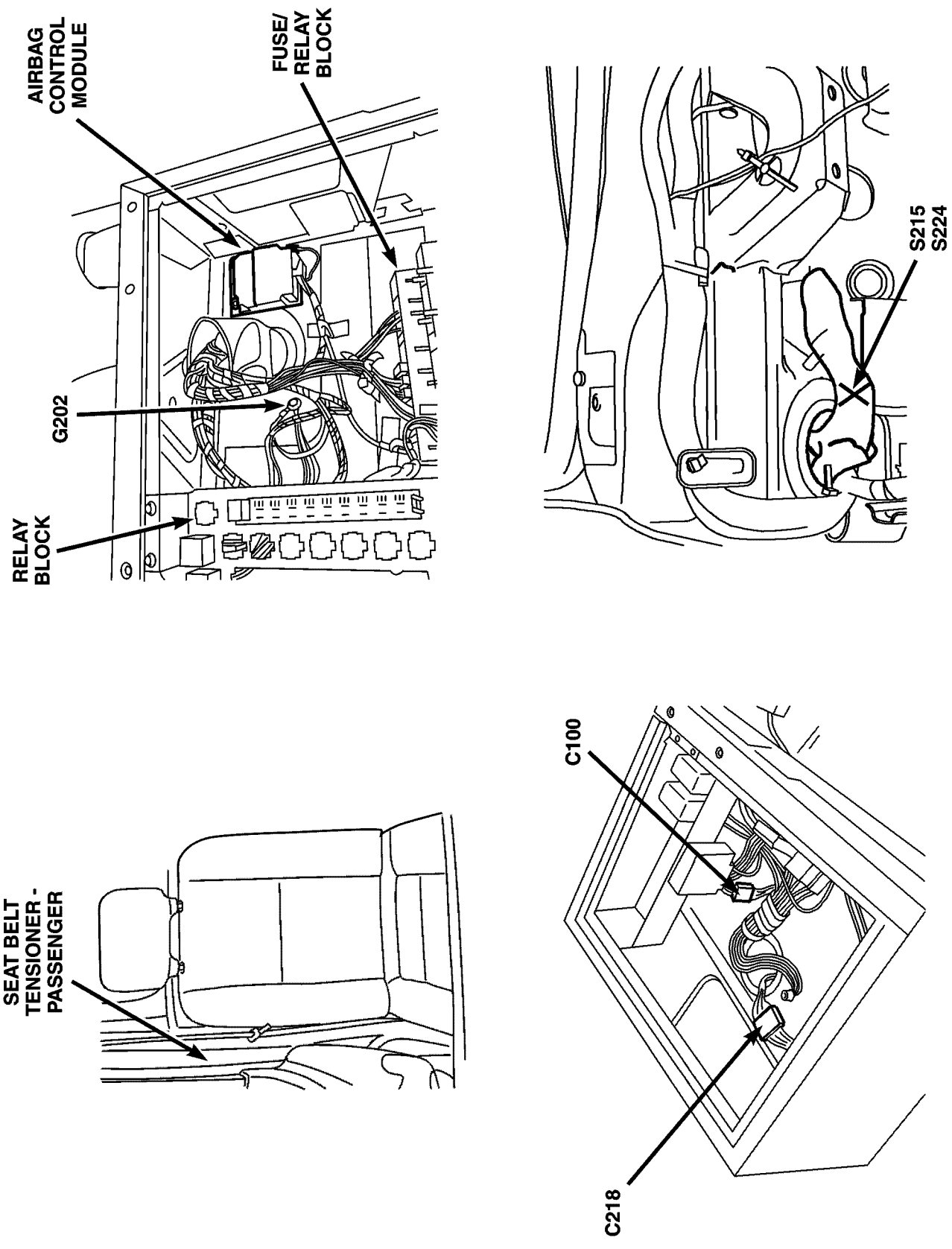
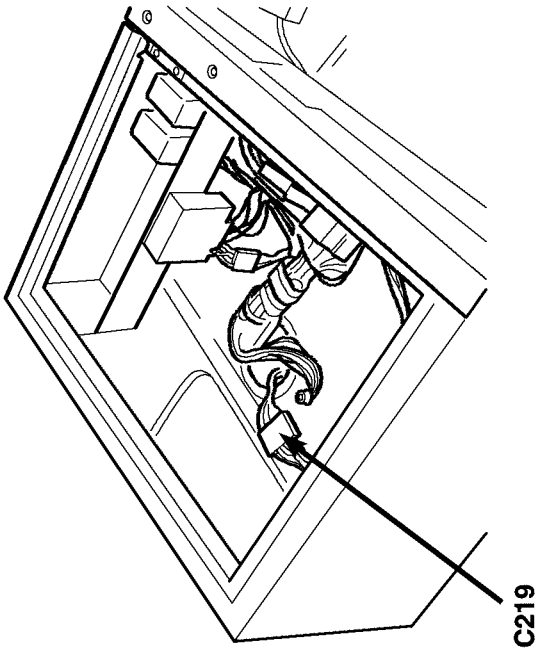
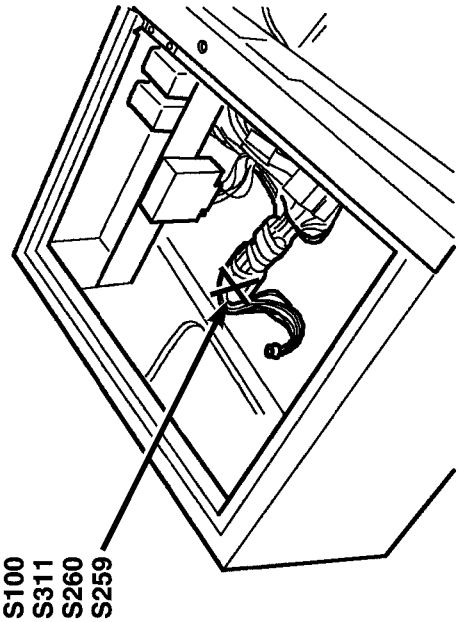


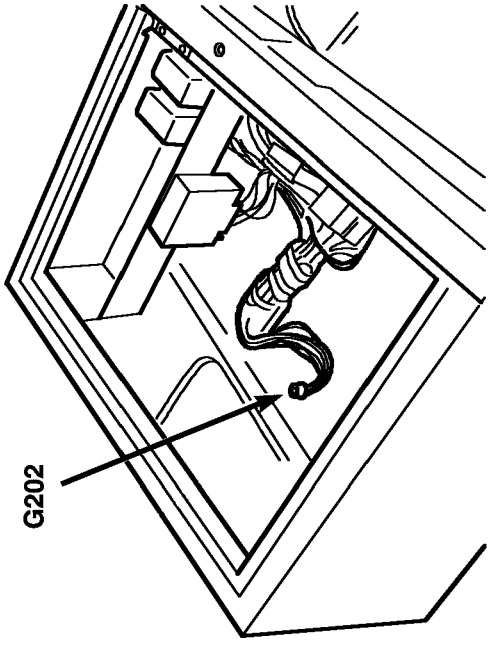
Fig. 18 VIEW18

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

81119c3a







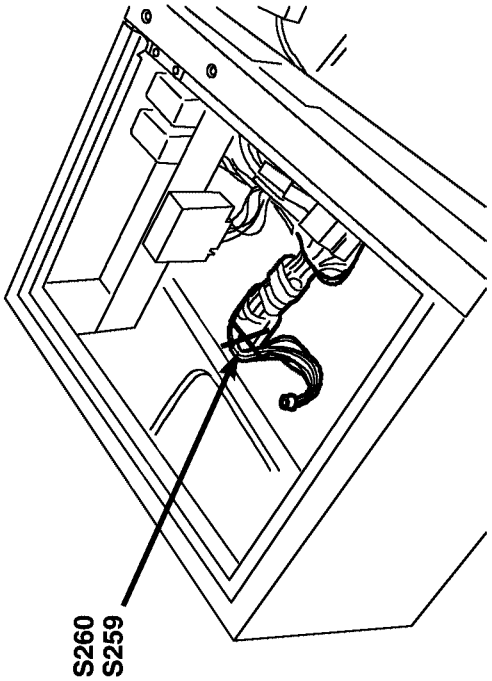


Fig. 19 VIEW19

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

81119c42

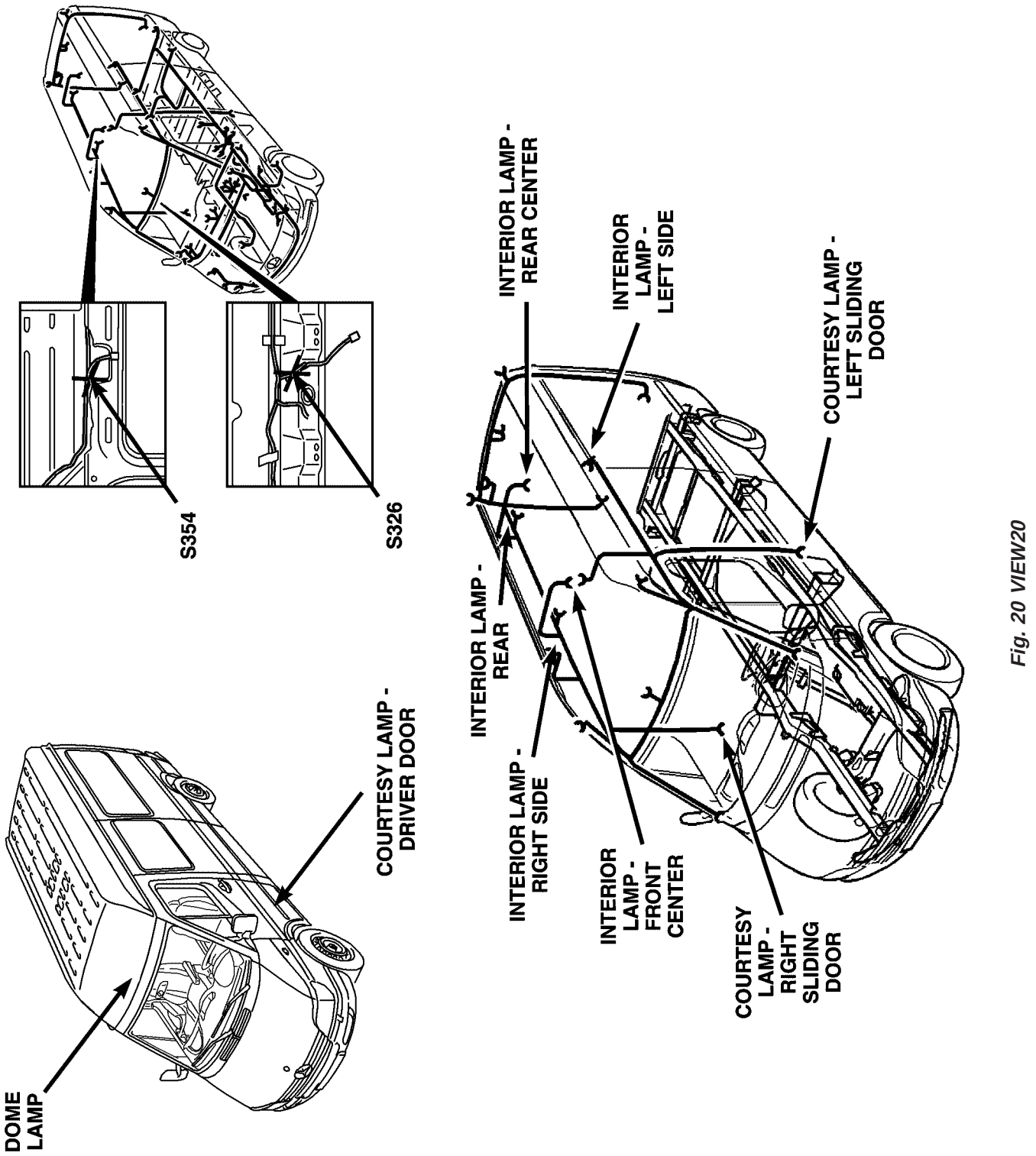


Fig. 20 VIEW20

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

8111b583

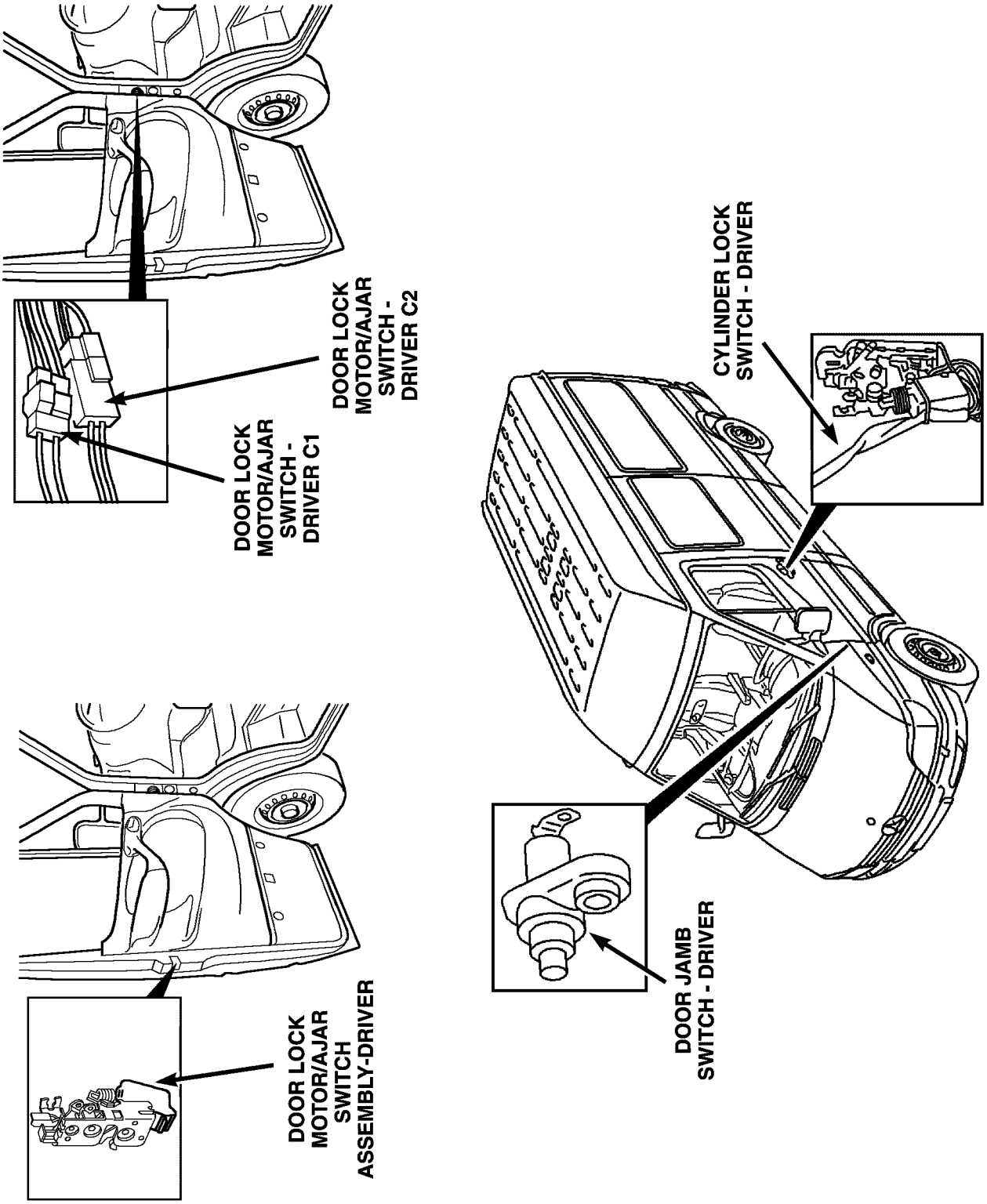


Fig. 21 VIEW21

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

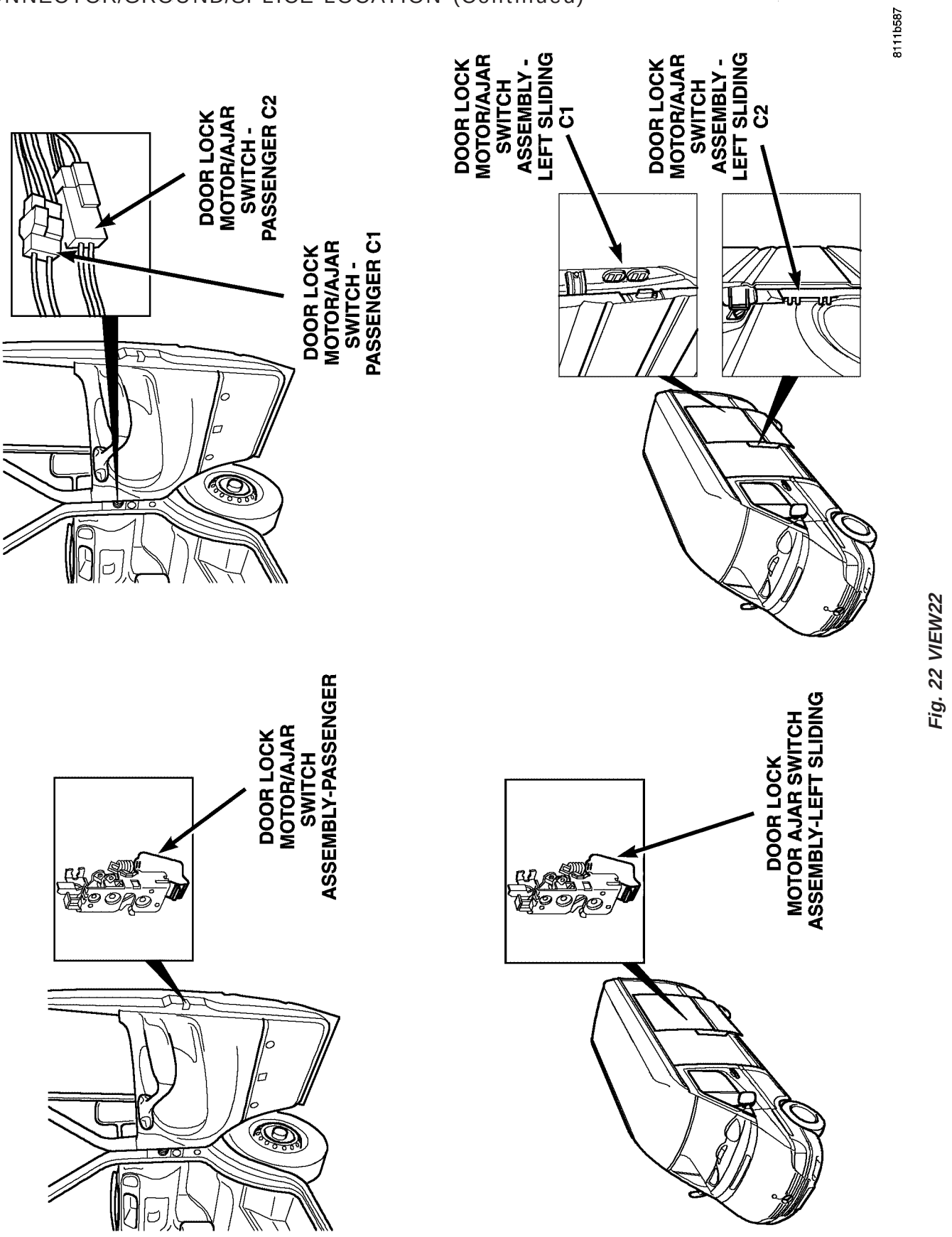


Fig. 22 VIEW22

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

81111b596

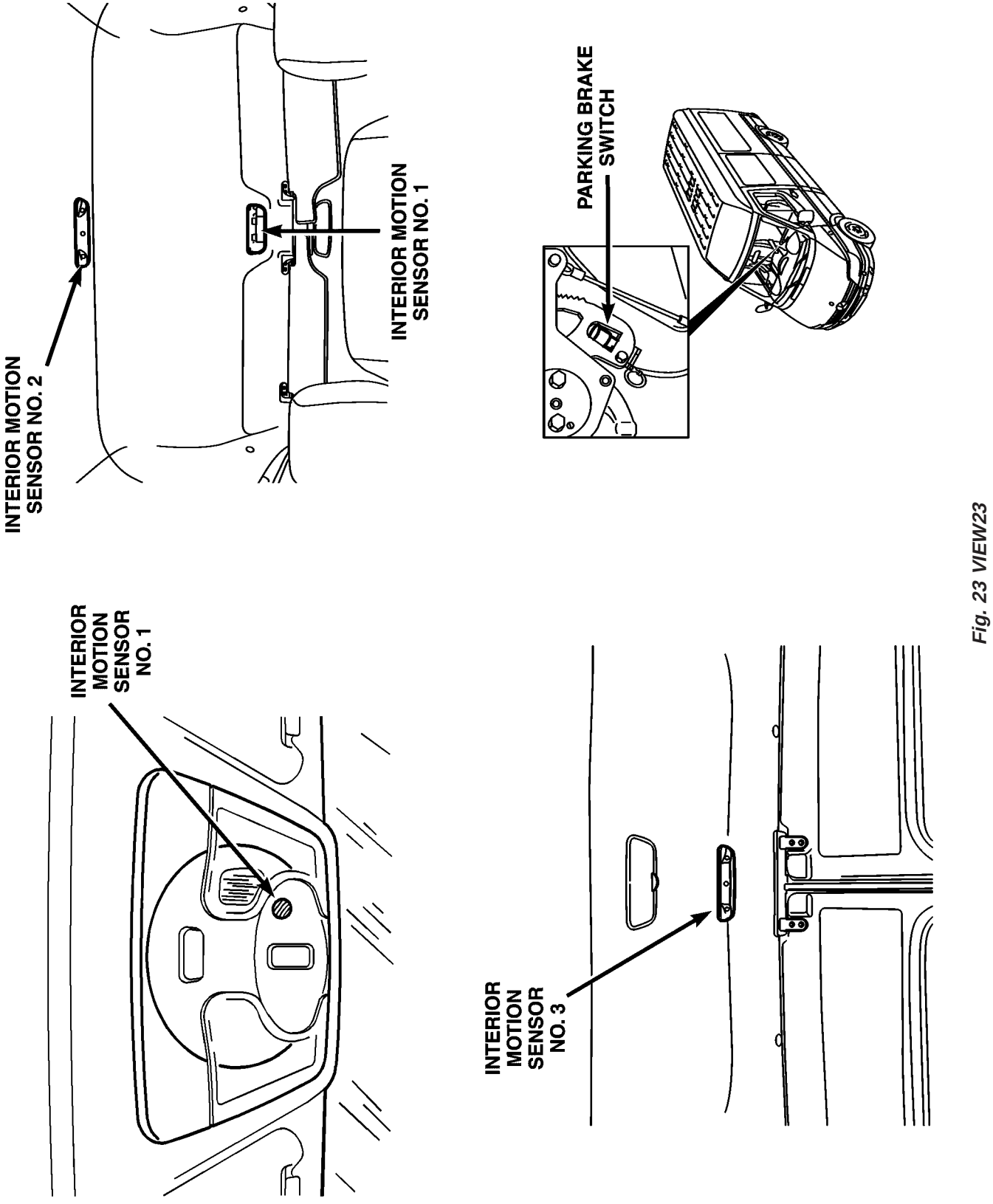


Fig. 23 VIEW23

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

8111b59e

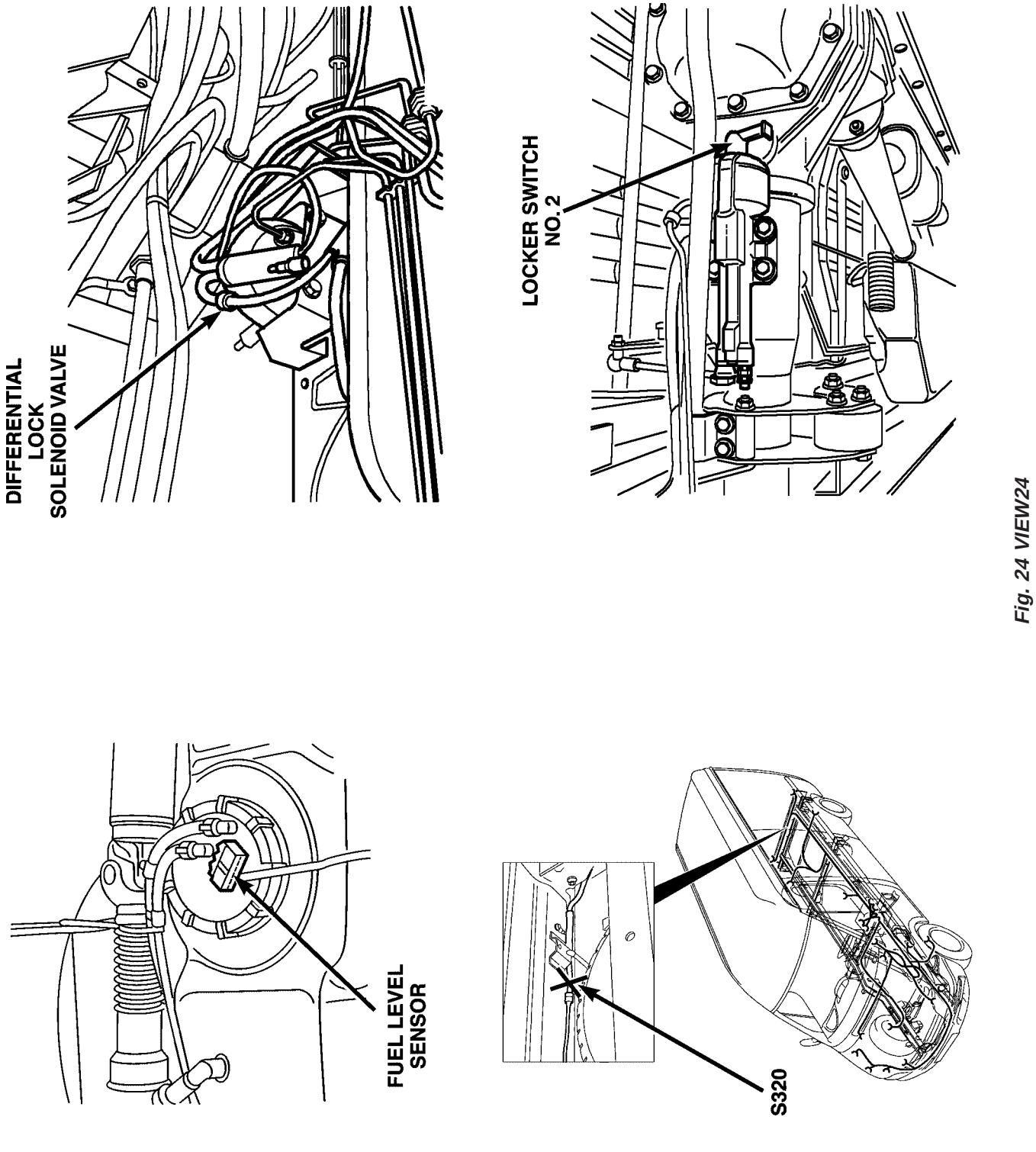


Fig. 24 VIEW24

CONNECTOR/GROUND/SPLICE LOCATION (Continued)

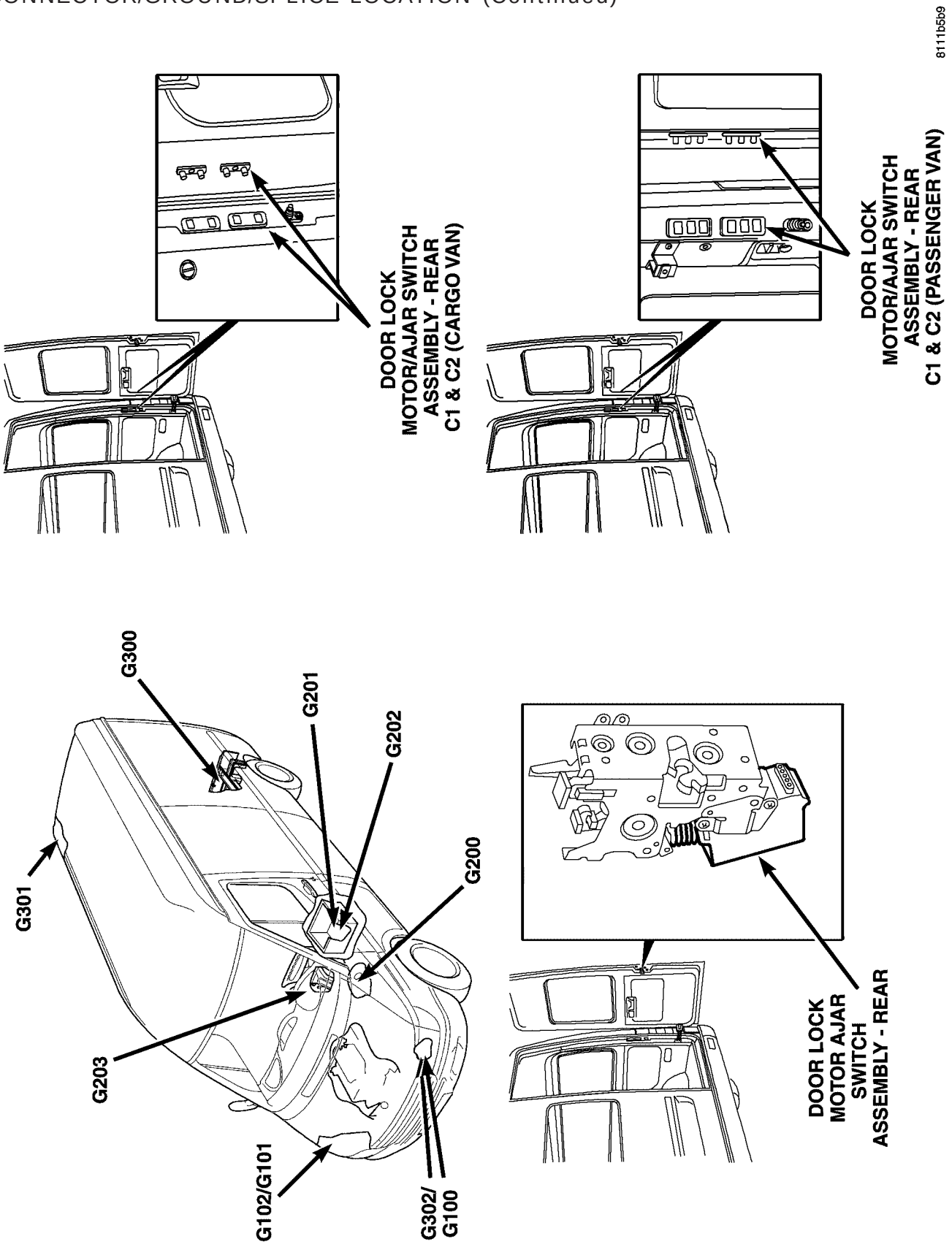


Fig. 25 VIEW25

8W-97 POWER DISTRIBUTION

TABLE OF CONTENTS

page

POWER DISTRIBUTION
DESCRIPTION 1
OPERATION 1
CIGAR LIGHTER OUTLET
DESCRIPTION 1
OPERATION 2
DIAGNOSIS AND TESTING - CIGAR LIGHTER OUTLET 2
REMOVAL 2
CIRCUIT BREAKER
DESCRIPTION 2
OPERATION 2
DIAGNOSIS AND TESTING - CIRCUIT BREAKER 2
FUSE BLOCK #1
DESCRIPTION 2
OPERATION 2
REMOVAL 3
INSTALLATION 3

page

FUSE BLOCK #2
DESCRIPTION 3
OPERATION 3
POWER DISTRIBUTION CENTER
DESCRIPTION 3
OPERATION 3
POWER OUTLET
DESCRIPTION 3
OPERATION 4
DIAGNOSIS AND TESTING - POWER OUTLET . 4
REMOVAL 4
INSTALLATION 4
RELAY
DESCRIPTION 4
OPERATION 5
DIAGNOSIS AND TESTING - RELAY 5
REMOVAL 5
INSTALLATION 5

POWER DISTRIBUTION

DESCRIPTION

This section describes the power distribution components used on this model as well as the methods in which battery voltage and charging system voltage is distributed throughout the vehicle. The power distribution system for this vehicle consists of the following major components which are covered in further detail later in this section:

- Fuseblock #1
- Fuseblock #2
- Power Distribution Center (PDC)

The power distribution system also incorporates various types of circuit control and protection features, including:

- Automatic resetting circuit breakers
- Blade-type fuses
- Cartridge fuses
- Relays

Following are general descriptions and theory of operation for the major components in the power distribution system. Refer to Wiring for the location of complete circuit diagrams for the various power distribution system components.

OPERATION

The power distribution system for this vehicle is designed to provide safe, reliable, and centralized distribution points for the electrical current required to operate all of the standard and optional factory-installed electrical and powertrain, chassis, safety, security and convenience systems. At the same time, the power distribution system was designed to provide easy access to these electrical distribution points for the vehicle technician to use when conducting diagnosis and repair of faulty circuits. The power distribution system can also prove useful for the addition of electrical circuits that may be required to operate accessories that the vehicle owner may choose to have installed in the aftermarket.

CIGAR LIGHTER OUTLET

DESCRIPTION

The cigar lighter outlet is installed in the instrument panel, near the center of the instrument panel. The cigar lighter outlet is secured by a snap fit within the instrument panel.

The cigar lighter knob/heating element, and the cigar lighter outlet are available for service. These components cannot be repaired and, if faulty or damaged, they must be replaced.

CIGAR LIGHTER OUTLET (Continued)

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 fuseblock only when the ignition switch is in the Accessory or On positions.

The knob and heating element are encased within a spring-loaded housing, which also features a sliding protective heat shield. When the heating element is 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.

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 and glow.

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.

DIAGNOSIS AND TESTING - CIGAR LIGHTER OUTLET

For cigar lighter outlet diagnosis and testing procedures (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/POWER OUTLET - DIAGNOSIS AND TESTING)

REMOVAL

For cigar lighter outlet removal procedure (Refer to 8 - ELECTRICAL/POWER DISTRIBUTION/POWER OUTLET - REMOVAL).

CIRCUIT BREAKER

DESCRIPTION

Automatic resetting circuit breakers are used to protect the power window voltage supply circuits. These circuit breakers can protect the systems from a short circuit, or from an overload condition caused by an obstructed or stuck power window regulator or switch.

The circuit breaker cannot be repaired and, if faulty or damaged, it must be replaced.

OPERATION

The circuit breaker contains a bi-metal strip sandwiched between two contacts forming the connection in the circuit. An overload condition causes the bi-metal strip to heat and bend to the open position, disconnecting current flow to the circuit. Then as the system overload or short circuit is removed, the bi-metal strip cools, re-establishing contact to allow current flow to the circuit.

DIAGNOSIS AND TESTING - CIRCUIT BREAKER

For complete circuit descriptions and diagrams, refer to **Wiring**.

(1) Locate the correct circuit breaker in the fuseblock. Pull out the circuit breaker slightly, but be certain that the circuit breaker terminals still contact the terminals in the fuseblock cavities.

(2) Connect the negative lead of a 12-volt DC voltmeter to a good ground.

(3) With the voltmeter positive lead, check both terminals of the circuit breaker for battery voltage.

If only one terminal has battery voltage, the circuit breaker is faulty and must be replaced. If neither terminal has battery voltage, repair the open circuit from the Power Distribution Center as required.

FUSE BLOCK #1

DESCRIPTION

An electrical fuse block is concealed under the driver side steering column. The fuse block serves to distribute electrical current to many of the electrical systems in the vehicle. The fuse block contains blade-type mini fuses, relays and micro processors that enable automatic control of some of the power distribution circuits throughout the vehicle.

The molded plastic fuse block housing has an integral mounting bracket that is secured with screws to the steering column. A finger recess is molded into the cover for easy removal. A fuse layout map is molded onto the back side of the cover to ensure proper fuse identification.

The fuse block cannot be repaired, if the fuse block is faulty or damaged or if any internal circuit is faulty or damaged, the entire fuse block must be replaced.

OPERATION

All of the circuits entering and leaving the fuse block do so through the instrument panel wire harness. Internal connection of all of the fuse block circuits is accomplished by an intricate combination of

FUSE BLOCK #1 (Continued)

hard wiring and bus bars. Internal relays and micro processors allow the vehicle electronics to control some of the power distribution circuits throughout the vehicle. Refer to the Wiring section for complete circuit diagrams.

REMOVAL

(1) Disconnect and isolate the negative battery cable.
(2) Remove fuse block cover by rotating locking screw 90°.
(3) Remove the steering column cover. Refer to the Body section for the procedure.
(4) Unscrew fuse block connections and disconnect all electrical connectors from the fuse block.
(5) Remove the fuse block from the steering column.

INSTALLATION

(1) Position the fuse block in the steering column.
(2) Install fuse block connections and connect all electrical connectors on the fuse block.
(3) Install the steering column cover. Refer to the Body section for the procedure.
(4) Install fuse block cover by rotating locking screw 90°.
(5) Connect the negative battery cable.
(6) Set time and radio stations.

FUSE BLOCK #2

DESCRIPTION

An electrical fuse block is concealed under the driver side front seat. The fuse block serves to distribute electrical current to many of the electrical systems in the vehicle. The fuse block houses blade-type mini fuses, blade-type automatic resetting circuit breakers and International Standards Organization relays. Additional provisions are available in the fuse block for additional fuses and ISO relays.

The molded plastic fuse block housing has an integral mounting bracket that is secured with screws to the seat base. The driver side seat base also has a snap-fit fuse access panel that can be removed for service of the fuses and the relays. A finger recess is molded into one end for easy removal. A fuse layout map is molded onto the back side of the panel to ensure proper fuse identification.

The fuse block is integral to the body wire harness. If any internal circuit or the fuse block housing is faulty or damaged, the entire fuse block and body wire harness unit must be replaced.

OPERATION

All of the circuits entering and leaving the fuse block do so through the body wire harness. Internal connection of all of the fuse block circuits is accomplished by an intricate combination of hard wiring and bus bars.

POWER DISTRIBUTION CENTER

DESCRIPTION

All of the electrical current distributed throughout this vehicle is directed through the Power Distribution Center (PDC). The molded plastic PDC housing is located in the left front corner of the engine compartment, on the battery positive cable. The PDC housing has a molded plastic cover that slides over the PDC housing. The PDC cover is easily opened or removed for service access.

The PDC unit cannot be repaired and is only serviced as a unit with the headlamp and dash wire harness. If the internal circuits or the PDC housing are faulty or damaged, the headlamp and dash wire harness unit must be replaced.

OPERATION

All of the current from the battery and the generator output enters the PDC through the positive battery cable. The PDC cover is removed to access the battery and generator output connection B(+) terminal studs. Internal connection of all of the PDC circuits is accomplished by an intricate combination of hard wiring and bus bars. Refer to Wiring Diagrams for the location of complete PDC circuit diagrams.

POWER OUTLET

DESCRIPTION

The power outlet is installed in the instrument panel accessory switch plate, which is located near the center of the instrument panel. The power outlet base is secured by a snap fit within the instrument panel. A plastic protective cap snaps over the power outlet base when the power outlet is not being used.

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.

The power outlet receptacle unit are available for service. The power outlet receptacle cannot be repaired and, if faulty or damaged, it must be replaced.

POWER OUTLET (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 fuse block at all times.

DIAGNOSIS AND TESTING - POWER OUTLET

(1) Check for battery voltage at the fused B(+) fuse in the fuse block. If OK, go to Step 2. If not OK, repair the open fused B(+) circuit to the battery as required.

(2) 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 3. If not OK, go to Step 4.

(3) Check for battery voltage at the insulated contact located at the back of the power outlet receptacle. If not OK, go to Step 4.

(4) Disconnect and isolate the battery negative cable. 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 5. If not OK, repair the open ground circuit to ground as required.

(5) 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. If not OK, repair the open fused B(+) circuit to the fuse in the fuse block as required.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Pull the cigar lighter knob and element out of the cigar lighter receptacle base, or unsnap the protective cap from the power outlet receptacle base.

(3) 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.

(4) 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.

(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) Disconnect the instrument panel wire harness connector from the connector receptacle of the cigar lighter or the power outlet receptacle base.

(7) Remove the cigar lighter or power outlet mount from the instrument panel.

INSTALLATION

(1) Install the cigar lighter or power outlet mount into the instrument panel.

(2) Reconnect the instrument panel wire harness connector to the connector receptacle of the cigar lighter or the power outlet receptacle base.

(3) 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.

(4) Press firmly on the cigar lighter or power outlet receptacle base until the retaining bosses of the mount are fully engaged in their receptacles.

(5) Install the cigar lighter knob and element into the cigar lighter receptacle base.

(6) Reconnect the battery negative cable.

RELAY

DESCRIPTION

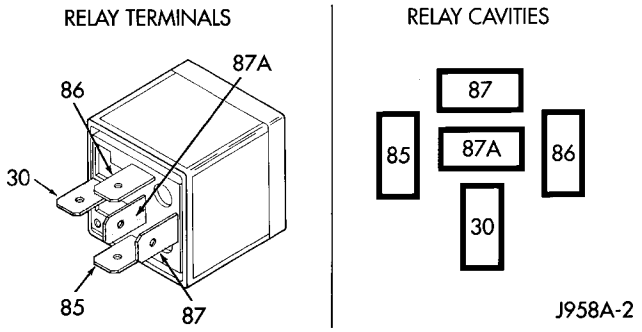


Fig. 1 ISO RELAY

30	COMMON FEED
85	COIL GROUND
86	COIL BATTERY
87	NORMALLY OPEN
87A	NORMALLY CLOSED

A relay (Fig. 1) is an electromechanical device that switches fused battery current to a electrical component when the ignition switch is turned to the Accessory or Run positions, or when controlled by a electronic module. The relays are located in the fuse block.

The 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.

A relay cannot be repaired or adjusted and, if faulty or damaged, it must be replaced.

RELAY (Continued)

OPERATION

The ISO relay consists of an electromagnetic coil, a resistor 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 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 - RELAY

(1) Remove the relay from its mounting location.

(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 60.7 - 80.3 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.

DIAGNOSIS AND TESTING - RELAY CIRCUIT TEST

(1) The relay common feed terminal cavity (30) of the fuse 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 fuse block receptacle for the relay. If OK, go to Step 2. If not OK, repair the fused B(+) circuit to the fuse block 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 fuse block that feeds the accessory when the relay is energized by the ignition switch. There should be continuity between the fuse block cavity for relay terminal 87 and the fused B(+) fuse in the fuse block at all times. If OK, go to Step 4. If not OK, repair the open fused B(+) circuit to the fuse 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 relay when the ignition switch is in the Accessory or Run 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 fuse block receptacle for the 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 fuse 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.

REMOVAL

(1) Disconnect and isolate the negative battery cable.

(2) Remove the relay by grasping it firmly and pulling it straight out from its receptacle. A slight back and fourth rocking motion may help the removal process.

INSTALLATION

(1) Position the relay to the proper receptacle.

(2) Align the relay terminals with the terminal cavities in the receptacle.

(3) Push firmly and evenly on the top of the relay until the terminals are fully seated in the terminal cavities in the receptacle.

(4) Connect the negative battery cable.

ENGINE

TABLE OF CONTENTS

page

ENGINE
DESCRIPTION 2
STANDARD PROCEDURE
STANDARD PROCEDURE - COMPRESSION TESTING ENGINE 3
STANDARD PROCEDURE - CYLINDER LEAK DOWN TEST 3
STANDARD PROCEDURE - DETERMINING CYLINDER PRESSURE LOSS 4
REMOVAL
REMOVAL - ENGINE COVER 4
REMOVAL 4
INSTALLATION
INSTALLATION - ENGINE COVER 7
INSTALLATION 7
SPECIFICATIONS - TORQUE SPECIFICATIONS 8
SPECIAL TOOLS 14
AIR CLEANER ELEMENT
REMOVAL 20
INSTALLATION 20
AIR CLEANER HOUSING
REMOVAL 20
INSTALLATION 20
CYLINDER HEAD
STANDARD PROCEDURE
STANDARD PROCEDURE - CYLINDER HEAD BOLT INSPECTION 21
STANDARD PROCEDURE - MEASURE CYLINDER HEAD SURFACE 21
REMOVAL
REMOVAL - CYLINDER HEAD 22
REMOVAL - CYLINDER HEAD FRONT COVER 23
REMOVAL - CYLINDER HEAD GUIDE RAIL . . 24
INSTALLATION
INSTALLATION - CYLINDER HEAD 25
INSTALLATION - CYLINDER HEAD FRONT COVER 26
INSTALLATION - CYLINDER HEAD GUIDE RAIL 26
CAMSHAFT(S)
STANDARD PROCEDURE - CHECKING CAMSHAFT POSITION 27
REMOVAL 28
INSTALLATION 29
CYLINDER HEAD COVER(S)
REMOVAL 30
INSTALLATION 30

page

VALVE SPRINGS
REMOVAL
REMOVAL - VALVE SPRINGS 31
REMOVAL - VALVES 31
INSTALLATION
INSTALLATION - VALVE SPRINGS 32
INSTALLATION - VALVES 33
ENGINE BLOCK
STANDARD PROCEDURE
STANDARD PROCEDURE - REPLACING ENGINE CORE AND OIL GALLERY PLUGS . . 34
STANDARD PROCEDURE - MEASURING CYLINDER BORES 34
CRANKSHAFT
STANDARD PROCEDURE - MEASURE CRANKSHAFT AND BLOCK JOURNALS 35
REMOVAL 35
INSTALLATION 36
CRANKSHAFT OIL SEAL - REAR
REMOVAL 37
INSTALLATION 37
CRANKSHAFT OIL SEAL - FRONT
REMOVAL 38
INSTALLATION 38
FLYWHEEL
REMOVAL 39
INSTALLATION
INSTALLATION 39
INSTALLATION 39
PISTON & CONNECTING ROD
DESCRIPTION 40
STANDARD PROCEDURE
STANDARD PROCEDURE - CHECKING AND REPAIRING CONNECTING RODS 40
STANDARD PROCEDURE - MEASURING PISTON PROTRUSION 42
REMOVAL 42
INSTALLATION 43
PISTON RINGS
STANDARD PROCEDURE - PISTON RING FITTING 46
VIBRATION DAMPER
REMOVAL 47
INSTALLATION 48
VACUUM PUMP
DESCRIPTION 48
OPERATION 48
REMOVAL 48
INSTALLATION 49

LEFT MOUNT
REMOVAL 49
INSTALLATION 49
RIGHT MOUNT
REMOVAL 49
INSTALLATION 49
OIL
REMOVAL - OIL SEPARATOR 50
INSTALLATION - OIL SEPARATOR 50
OIL COOLER & LINES
REMOVAL 50
INSTALLATION 50
OIL FILTER
REMOVAL 51
INSTALLATION 51
OIL JET
DESCRIPTION 51
REMOVAL 51
INSTALLATION 51
OIL PAN
REMOVAL 52
INSTALLATION 52
OIL PUMP
REMOVAL
REMOVAL 53
REMOVAL- OIL PUMP CHAIN 53
INSTALLATION
INSTALLATION 54
INSTALLATION - OIL PUMP CHAIN 54
OIL TEMPERATURE SENSOR
DESCRIPTION 56
OPERATION 56
REMOVAL 57
INSTALLATION 57
INTAKE MANIFOLD
REMOVAL 57
INSTALLATION 58
EXHAUST MANIFOLD
REMOVAL 59
INSTALLATION 59
TIMING CHAIN COVER
REMOVAL 59
INSTALLATION 60
TIMING BELT/CHAIN AND SPROCKETS
REMOVAL
REMOVAL - TENSIONING AND SLIDE RAILS 61
REMOVAL - INTERMEDIATE GEAR 61
REMOVAL - TIMING CHAIN TENSIONING RAIL 63
REMOVAL - TIMING CHAIN 63
INSTALLATION
INSTALLATION - TENSIONING AND SLIDE RAIL 66
INSTALLATION - INTERMEDIATE GEAR 66
INSTALLATION - TIMING CHAIN TENSIONING RAIL 66
ADJUSTMENTS
INSTALLATION - TIMING CHAIN 67
TIMING CHAIN TENSIONER
REMOVAL 70
INSTALLATION 71

ENGINE

DESCRIPTION

This 2.7 Liter five-cylinder Common Rail Diesel Injection (CDI) engine is an in-line overhead valve diesel engine. This engine utilizes a cast iron cylinder block and an aluminum cylinder head. The engine is turbocharged and intercooled. This engine also has for valve per cylinder and dual overhead camshafts (Fig. 1).

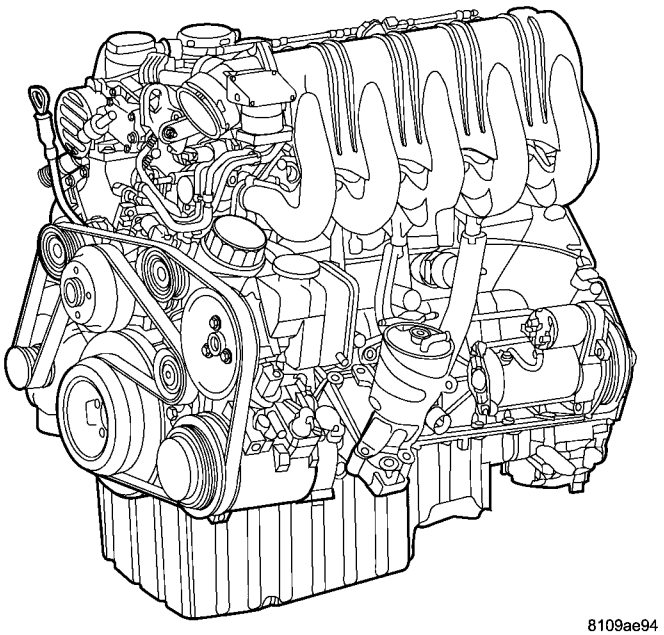


Fig. 1 2.7L CDI Engine

ENGINE (Continued)

DESCRIPTION	SPECIFICATION
Engine	2.7L CDI
Engine Description	5 Cylinder In-Line Engine With 4-Valve Technology
Air Intake	Turbo-Charged Engine with Charge Air Cooling
Fuel Injection System	Common Rail Diesel Injection (CDI)
Fuel	Diesel
Firing Order	1-2-4-5-3
Rated Output	125/4200 kW at RPM
Torque	400/1600-2400 Nm at RPM
Maximum Speed	4800 RPM
Compression Ratio	19:1
Bore/Stroke	88.0/88.4 mm
Eff. Displacement	2688 cm3

STANDARD PROCEDURE

STANDARD PROCEDURE - COMPRESSION TESTING ENGINE

(1) Warm up engine to operating temperature (approx. 80 °C, 176°F).
(2) Shut off engine.
(3) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).
(4) Remove glow plugs (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/GLOW PLUG - REMOVAL).
(5) Crank engine several times with the starter to eliminate combustion residues in the cylinders.
(6) Insert compression tester adapter #8927 (Refer to 9 - ENGINE - SPECIAL TOOLS) with check valve installed into glow plug hole of cylinder to be tested.
(7) Connect compression tester hose adapter #9295 to compression gauge and test compression pressure by cranking engine with starter for at least 8 revolutions.
(8) Carry out test procedure at the remaining cylinders in the same way.
(9) Compare pressure readings obtained with the specified pressures. If the pressure reading is below the minimum compression pressure or if the permissible difference between the individual cylinders is exceeded. Refer to cylinder leak down test.
(10) Remove compression tester and adapter from cylinder head.
(11) Install glow plugs (Refer to 8 - ELECTRICAL/IGNITION CONTROL/GLOW PLUG - INSTALLATION).
(12) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

COMPRESSION SPECIFICATIONS

Maximum Compression	29-35 bar (420-507 psi)
Minimum Compression	18bar (261 psi)
Permissible Difference Between Cylinders	± 3bar (± 44 psi)

STANDARD PROCEDURE - CYLINDER LEAK DOWN TEST

(1) Warm engine to operating temperature.

WARNING: DO NOT OPEN COOLING SYSTEM UNLESS COOLANT TEMPERATURE IS BELOW 90C (194°F). RISK OF INJURY TO SKIN AND EYES AS A RESULT OF SCALDING WITH HOT COOLANT WHICH SPLASHES OUT. RISK OF POISONING FROM SWALLOWING COOLANT. OPEN CAP SLOWLY AND RELEASE PRESSURE. STORE COOLANT IN PROPER CONTAINERS ONLY. WEAR PROTECTIVE GLOVES, CLOTHING AND EYE PROTECTION.

NOTE: Turn cap carefully as far as first detent, release pressure, then unscrew cap.

(2) Open cooling system cap at coolant recover pressure container.
(3) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).
(4) Unscrew oil filler cap.
(5) Remove glow plugs (Refer to 8 - ELECTRICAL/ IGNITION CONTROL/GLOW PLUG - REMOVAL).

NOTE: Crank engine at crankshaft in direction of rotation of the engine (clockwise).

(6) Position cylinder to be tested to ignition Top Dead Center (DTC).

NOTE: Calibrate cylinder leak down tester and remove check valve in screw-in fitting.

(7) Connect cylinder leak down tester and follow INSPECTING Instruction.

INSPECTING

NOTE: If crankshaft rotates, install retaining lock for crankshaft/ring gear.

(1) Pressurize cylinder with compressed air and read off pressure loss at cylinder leak tester. If excessive pressure loss exists, determine possible cause (Refer to 9 - ENGINE - STANDARD PROCEDURE).

NOTE: If the retaining lock is installed, remove it, rotate engine and install lock once again.

(2) Carry out test of other cylinders in the firing order of engine.

ENGINE (Continued)

CYLINDER LEAK DOWN VALUES

CYLINDER LEAK DOWN PERMISSIBLE TOTAL LOSS	± 25%
CYLINDER LEAK DOWN PERMISSIBLE LOSS AT VALVES AND CYLINDER HEAD	± 10%
CYLINDER LEAK DOWN PERMISSIBLE LOSS AT PISTON AND RINGS	± 20%

STANDARD PROCEDURE - DETERMINING CYLINDER PRESSURE LOSS

If an increased pressure loss was found with the cylinder leak test, inspect the engine by listening at the cylinder head gasket, air intake area, exhaust, oil fill opening and where injectors and glow plugs enter the cylinder head. Also check the engine coolant in the radiator or expansion reservoir for the formation of bubbles.

Possible causes for the pressure loss are:

POSSIBLE CAUSE FOR PRESSURE LOSS

CONDITION	POSSIBLE CAUSES	CORRECTION
AIR LOSS THROUGH GLOW PLUG, INJECTOR, ADJACENT CYLINDERS, OR AIR BUBBLES IN COOLANT	1. Sealing Surfaces	Repair Sealing Surfaces
	2. Gaskets	2. Replace Component or Gasket
	3. Cylinder Head Gasket	3. Replace Cylinder Head Gasket
AIR LOSS THROUGH AIR INTAKE AREA	1. Sealing Surfaces	1. Remove Cylinder Head for Further Inspection
	2. Intake Valves and Seats	2. Replace Valves, Guides or Seats
AIR LOSS THROUGH EXHAUST	Sealing Surfaces	Remove Cylinder Head for Further Inspection
	2. Exhaust Valves and Seats	2. Replace Valves, Guides or Seats
AIR LOSS THROUGH OIL FILL OPENING	1. Sealing Surfaces	Remove Engine for Further Inspection
	2. Pistons, Piston Rings	2. Replace Pistons or Piston Rings

It is possible to pin point the pressure loss of the relevant cylinder by spraying with clean engine oil. Engine oil seals off the gap between the piston and cylinder wall briefly. If a reduced pressure loss now occurs for a short time, the cause is very likely to be the pistons, piston rings or cylinder contact surfaces of the relevant cylinder.

Determining the cause can be falsified by the position of the piston ring joints. If suspicion exists that the loss of pressure is caused by the piston ring joints being positioned directly one above the other, fit the parts to the engine and repeat this test after running the engine for a short time.

REMOVAL

REMOVAL - ENGINE COVER

(1) Remove the retaining screws and remove cover (Fig. 2).

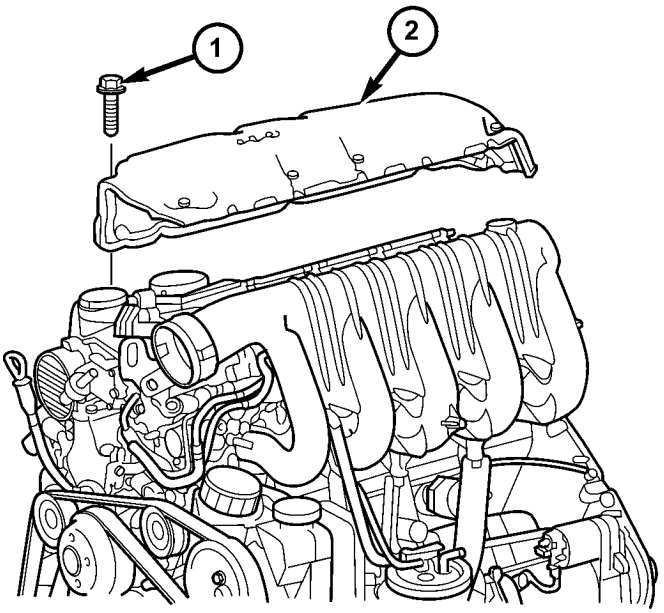
REMOVAL

WARNING: RISK OF INJURY TO SKIN AND EYES FROM SCALDING WITH HOT COOLANT. RISK OF POISONING FROM SWALLOWING COOLANT. DO NOT OPEN COOLING SYSTEM UNLESS COOLANT TEMPERATURE IS BELOW 90°C (194°F). OPEN CAP SLOWLY TO RELEASE PRESSURE. STORE COOLANT IN SUITABLE AND APPROPRIATELY MARKED CONTAINER. WEAR PROTECTIVE GLOVES, CLOTHES, AND EYE WEAR.

CAUTION: STORE OR DISCARD ALL FLUIDS IN SUITABLE AND APPROPRIATELY MARKED CONTAINERS.

(1) Disconnect the negative battery cable.

ENGINE (Continued)



81153a61

Fig. 2 ENGINE COVER

1 - SCREW
2 - COVER

(2) Remove the hood.

(3) Drain cooling system (Refer to 7 - COOLING/ ENGINE/COOLANT - STANDARD PROCEDURE).

(4) Evacuate and recover air conditioning system (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING - STANDARD PROCEDURE).

(5) Disconnect the engine wiring harness at the vehicle side and carefully guide though the cowl into the engine area.

(6) Remove the engine cover (Fig. 3).

(7) Remove the air cleaner housing.

(8) Disconnect the charge air hose at the mixing chamber (Fig. 3).

(9) Remove the radiator assembly.

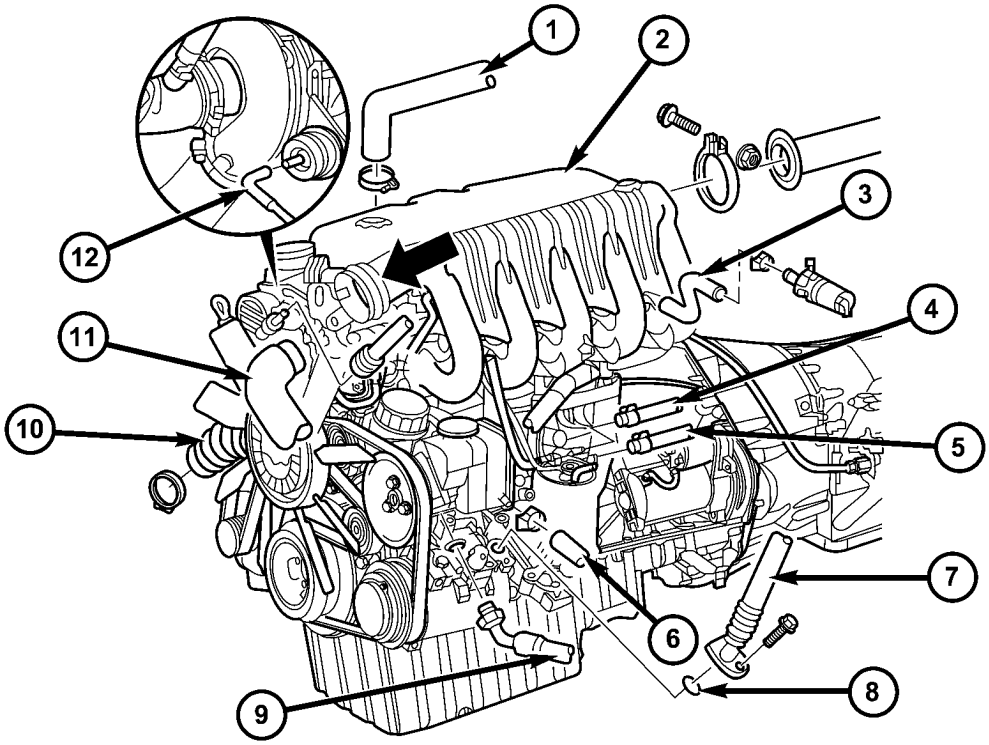
(10) Disconnect the high pressure and return hoses at the power steering pump (Fig. 3).

(11) Disconnect the fuel lines at the fuel filter (Fig. 3).

(12) Disconnect the refrigerant line at the A/C compressor (Fig. 3).

(13) Disconnect the vacuum line for the brake booster at the vacuum pump.

(14) Disconnect the coolant hose of heating return flow at the water pump.



81135f62

Fig. 3 2.7L ENGINE

1 - HEATING SUPPLY COOLANT HOSE
2 - ENGINE COVER
3 - HEATING RETURN COOLANT HOSE
4 - FUEL PIPE
5 - FUEL PIPE
6 - RETURN FLOW PIPE
7 - REFRIGERANT LINE
8 - O-RING
9 - POWER STEERING HIGH PRESSURE PIPE
10 - AIR INTAKE HOSE
11 - CHARGE AIR HOSE
12 - TURBOCHARGER VACUUM HOSE

ENGINE (Continued)

(15) Disconnect the coolant hose of the heater supply at the coolant pipe at the side of the cylinder head (Fig. 3).

(16) Disconnect the vacuum hose at the turbocharger (Fig. 3).

(17) Disconnect the air inlet hose at the turbocharger (Fig. 3).

(18) Raise and support the vehicle.

(19) Disconnect the front exhaust at the turbocharger.

(20) Disconnect the electrical connector at the transmission (Fig. 4).

(21) Disconnect the locking clamp, shifter cable and the security catch for the shifter cable (Fig. 4)

(22) Remove the steering gear mounting bolts.

(23) Disconnect the transmission cooler lines at transmission.

(24) Remove the torque converter access plate.

(25) Remove the torque converter bolts.

(26) Remove the crank position sensor.

(27) Remove the transmission housing to engine mounting bolts.

(28) Remove the starter mounting bolts.

(29) Support the transmission with a transmission jack.

(30) Place a wood block between the transmission housing and the front frame cross over.

(31) Remove the transmission jack.

(32) Remove the exhaust bracket (right side).

(33) Remove the engine ground strap (left side).

(34) Lower the vehicle.

(35) Remove the heater housing filter and lower housing.

(36) Connect the engine lifting fixture to the lifting eyes. (Fig. 5).

(37) Remove the engine mount bolts.

(38) Remove the transmission oil level indicator tube mounting bolt.

NOTE: After removing the front cross plate, seal metal with anti corrosion protection.

(39) Using tin snips, remove the front cross plate at the cutting edges and deburr (Fig. 6).

(40) Connect and engine hoist and carefully lift engine assembly from engine bay area (Fig. 7).

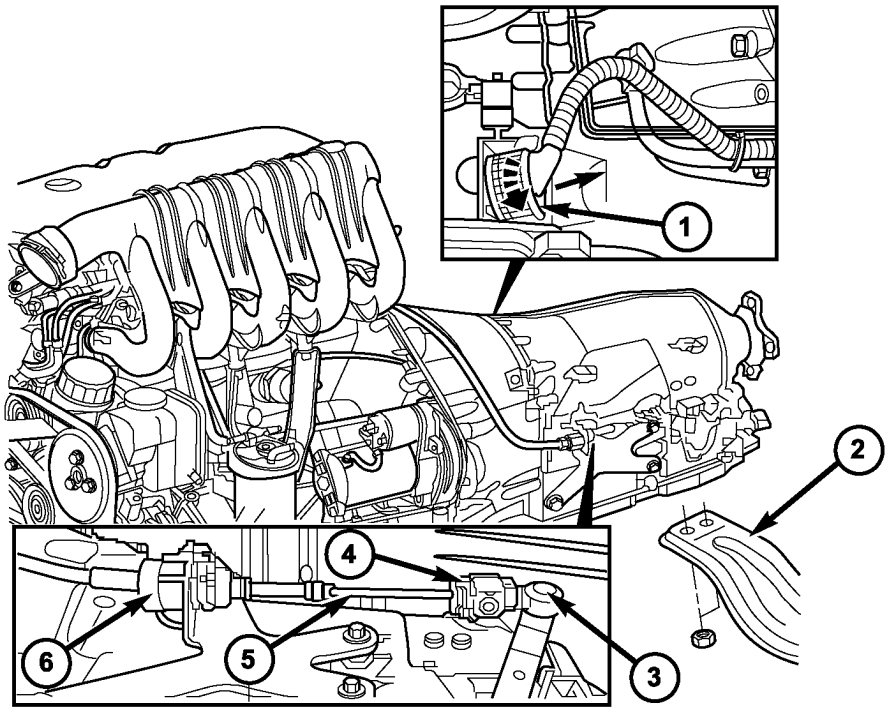


Fig. 4 TRANSMISSION CONNECTIONS

1 - TRANSMISSION CONNECTOR
2 - REAR ENGINE SUPPORT
3 - BALL SOCKET
4 - LOCKING CLAMP
5 - LINKAGE ROD
6 - BRACKET

ENGINE (Continued)

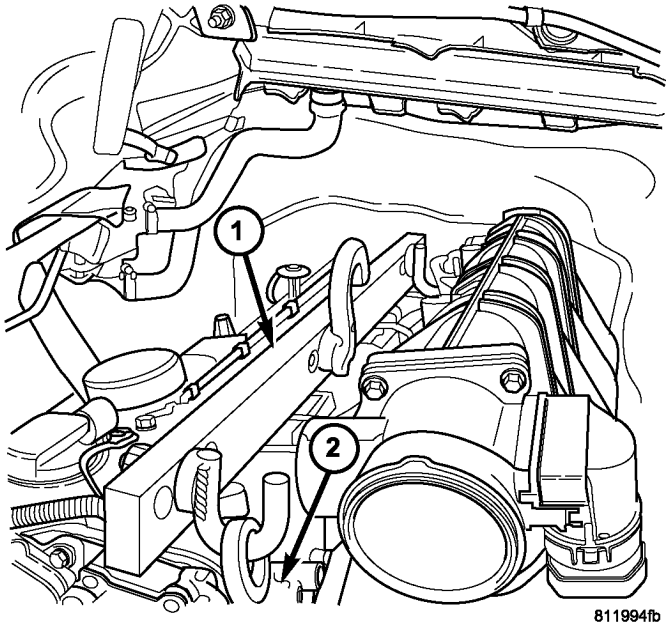


Fig. 5 ENGINE LIFTING FIXTURE

1 - ENGINE LIFTING FIXTURE #9308
2 - ENGINE LIFTING EYES

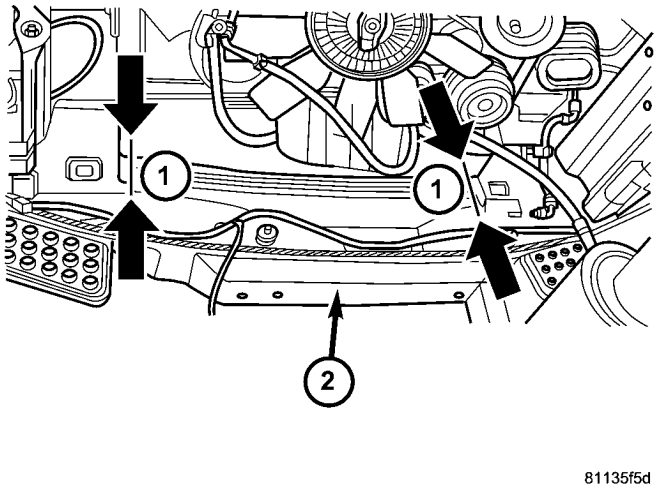


Fig. 6 FRONT CROSS PLATE

1 - CUTTING POINT
2 - CORE SUPPORT

INSTALLATION

INSTALLATION - ENGINE COVER

(1) Align cover and install screws. tighten screws to 11N·m (97 lbs. in.) (Fig. 2).

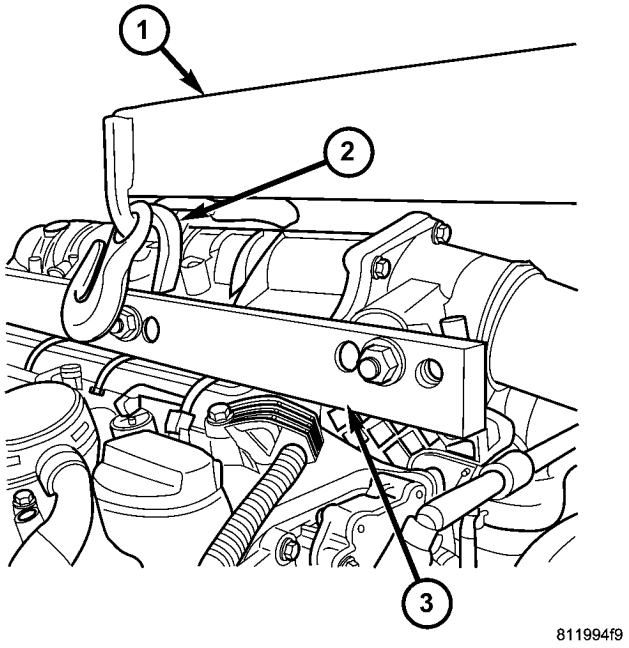


Fig. 7 ENGINE HOIST CONNECTION

1 - ENGINE HOIST
2 - CENTER EYELET OF ENGINE LIFTING FIXTURE
3 - ENGINE LIFTING FIXTURE #9308

INSTALLATION

NOTE: Deburr and seal metal from cross plate removal with anti corrosion material.

(1) Install the engine support fixture (Fig. 5).
(2) Install the engine lifting devise (Fig. 7).
(3) Install the engine assembly into the vehicle engine compartment, mating the transmission and the engine (Fig. 7).
(4) Lower the engine assembly until the engine brackets align with the mounts.
(5) Hand start the engine mount bolts and remove the engine lifting devise.
(6) Tighten the engine mount bolts to 83 N·m (62 lbs.ft.).
(7) Raise and support the vehicle.
(8) Install the transmission housing to engine bolts. Refer to (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - NAG1 - INSTALLATION) for correct sequence and torque specification.
(9) Install the torque converter bolts. Refer to (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - NAG1 - INSTALLATION) for correct sequence and torque specification.
(10) Install the torque converter access plate. Refer to (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - NAG1 - INSTALLATION) for correct sequence and torque specification.

ENGINE (Continued)

(11) Install the transmission cooler lines to transmission.(Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - NAG1 - INSTALLATION) for correct sequence and torque specification.

(12) Install transmission electrical connector and shifter hardware.Refer to (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - NAG1 - INSTALLATION) for correct sequence and torque specification.

(13) Install the steering gear and tighten in two stages. 25 N·m (18.5 lbs. ft.), then 45 N·m (33 lbs. ft.) plus 90°.

(14) Install the crank sensor.

(15) Install the starter.

(16) Connect the ground strap (left side).

(17) Align and install the exhaust and bracket (Refer to 11 - EXHAUST SYSTEM/EXHAUST PIPE - INSTALLATION).

(18) Lower the vehicle.

(19) Install the air inlet hose at the turbocharger (Fig. 3).

(20) Connect the vacuum hose at the turbocharger (Fig. 3).

(21) Connect the coolant supply and return hoses (Fig. 3).

(22) Connect the brake booster vacuum hose at the vacuum pump (Fig. 3).

(23) Connect the refrigerant lines (Fig. 3).

(24) Connect the fuel lines at the filter assembly (Fig. 3).

(25) Connect the power steering hoses (Fig. 3).

(26) Install the radiator/charge air cooler and hose(s) assemblies (Refer to 7 - COOLING/ENGINE/RADIATOR - INSTALLATION).

(27) Install A/C condenser.

(28) Install air cleaner housing, sensors, and hoses (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION).

(29) Route the engine wiring harness inside the vehicle and connect.

(30) Install the front grill assembly.

(31) Install and align the hood.

(32) Connect the negative battery cable.

(33) Check and fill engine oil.

(34) Fill cooling system to proper level with the appropriate coolant.

(35) Evacuate and recharge air conditioning.

(36) Check and refill all ancillary system fluid levels.

(37) Start engine and inspect for leaks.

SPECIFICATIONS - TORQUE SPECIFICATIONS

2.7L DIESEL

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Crankcase Ventilation			
Screw-Air Charge Distribution Pipe to Air Charge Distribution Panel	11	-	97
Cylinder Head			
8m-Bolt- Cylinder Head to Timing Case Cover	20	15	-
Bolt-Front Cover to Cylinder Head	14	-	124
12m-Bolt-Cylinder Head to Crankcase (3 stages, torque, torque angle, torque angle)	60, 90°, 90°	44	-
Crankcase, Timing Case Cover, End Cover			
Bolt-Crankshaft Bearing Cap to Crankcase (2 stages, torque, torque angle)	55, 90°	40	-
Bolt-End Cover to Crankcase	9	-	80

ENGINE (Continued)

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Bolt-Timing Case Cover to Crankcase	20	15	-
Plug-Coolant Drain to Crankcase	30	22	-
Oil Pan			
6m-Bolt-Oil Pan to Crankcase	9	-	80
8m-Bolt-Oil Pan to Crankcase	20	15	-
Bolt-Oil Pan to End Cover	9	-	80
Bolt-Oil Pan to Timing Case Cover	9	-	80
Bolt-Oil Pan to Transmission Bell Housing	40	30	-
Plug-Oil Pan to Oil Drain	47	35	-
Connecting Rod			
Bolt-Connecting Rod Cap to Connecting Rod (3 stage, 1&2 torque, 3 torque angle)	5,25,90°	-	44,221
Crankshaft			
Bolt-Crankshaft Bearing Cap (2 stage, 1 torque, 2 torque angle	55,90°	40.5	-
Flywheel, Driven Plate, Vibration Damper, Starter Ring Gear			
8.8m-Bolt-Central Bolt of Vibration Damper (2 stage, 1 torque, 2 torque angle)	200,90°	147.5	-
10.9m-Bolt-Central Bolt of Vibration Damper (2 stage, 1 torque, 2 torque angle)	325,90°	240	-
Bolt-Stretch Shank for Flywheel or 2 Mass Flywheel to Crankshaft (2 stage, 1 torque, 2 torque angle)	45,90°	33	
Turbo Charger			
Bolt-Oil Feed Line to Cylinder Head	9/22	-	80-194
Bolt-Oil Feed Line to Turbo Charger	30	22	-
Bolt-Turbo Charger Support	30	22	-
Bolt-Turbo Charger Support to Crankcase	20	-	177

ENGINE (Continued)

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Bolt-Oil Outlet Line to Turbo Charger	9	-	80
Connection-Flange of Exhaust Manifold to Turbo Charger	30	22	-
Connection-Turbo Charger to Front Catalytic Converter	30	22	-
Charge Air Pipe/Charge Air Cooling			
Bolt-Charge Air Distribution Pipe	16	-	141
Bolt-Inlet Port Shut Off Positioning Motor to Air Charge Distribution Pipe	9	-	80
Bolt-Support to Charge Air Distribution Pipe	20	-	177
Bolt-Support to Engine Bracket	40	30	-
Clamp-Charge Air Pipes/Hoses	3	-	27
Belt Tensioning Device			
Bolt-Guide Pulley to Coolant Pump	35	26	-
Bolt-Guide Pulley to Timing Case Cover	35	26	-
Bolt-V-Belt Tensioning Device to Tensioning Pulley	36	26.5	-
Bolt-V-Belt Tensioning Device to Timing Case Cover	30	22	-
Exhaust Manifold			
Nut-Exhaust Manifold at Cylinder Head	30	22	-
Position Sensor			
Nut/Bolt-Camshaft Position Sensor to Cylinder Head Cover	11	-	97
Nut/Bolt-Crankshaft Position Sensor to Engine Block	8	-	70
Pre-Glow System			
Cylinder Head to Glow Plug	12	-	106
Starter			
Bolt-Starter to Crankcase	42	31	-
Nut-Connection of Circuit 30	14	-	124

ENGINE (Continued)

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Nut-Connection of Circuit 50	6	-	53
Alternator			
Bolt-Generator to Timing Case Cover	20	15	-
Bolt-Generator to Cooler Housing	6	-	53
Bolt-Cooler Housing of Generator to Crankcase	20	-	177
Nut-B+ Circuit to Generator	13-18	-	115-159
Nut-D+ Circuit to Generator	5	-	44
Nut-Collar to V-Belt Pulley	80	59	-
Oil Pump			
Bolt-Oil Pump to Crankcase	18	-	133
Bolt-Oil Pipe to Crankshaft Bearing Cap	8	-	70
Oil Filter			
Screw Cap to Oil Filter	25	18.5	-
Oil Cooling System			
Bolt-Oil-Water Heat Exchanger to Timing Cover Case	15	-	133
Oil Level Pressure			
Bolt-Dip Stick Guide Tube to Cylinder Head	14	-	123
Bolt-Oil Level Sensor to Oil Pan	14	-	123
Coolant Pre-Heater			
Coolant Pre-Heater in Engine Block	35	26	-
Engine Cooling General			
Bolt-Belt Pulley to Coolant Pump	8-35	6 - 26	-
Bolt-Coolant Pump to Timing Case Cover 6m/8m	14/20	10 - 15	-
Bolt-Thremostat Housing to Cylinder Head	9	-	80
Coolant Drain Plug to Crankcase	30	22	-
Engine Suspension, Engine Mount, Engine Bracket			
Bolt-Engine Bracket to Crankcase (2 stage, torque, torque angle)	20/90°	15	-

ENGINE (Continued)

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Bolt-Engine Mount to Engine Bracket	55	40.5	-
Bolt-Front Engine Mount to Front Axle Carrier	35	26	-
Bolt-Rear Engine Cross Member to Body	40	30	-
Bolt-Rear Engine Mount to Rear Engine Cross Member	35	26	-
Bolt/Nut- Rear Engine Mount to Transmission	40	26	-
Bolt-Shrowd to Engine Bracket	10	-	88.5
Nut-Front Engine Mount to Engine Bracket	65	48	-
Nut-Engine Mount to Vehicle Frame	35	26	-
Fuel Filter			
Bolt-Clip to Fuel Filter	8	-	70
Bolt- Fuel Filter to Charge Air Distribution Pipe	14	-	124
Exhaust System			
Bolt- Catalytic Converter Bracket to Crankcase	20	-	177
Bolt - Turbocharger Oil Supply Line at Turbocharger	25	18	-
Bolt - Turbocharger Oil Return Line at Turbocharger	10	-	89
Clamp-Connection Between Front Exhaust Pipe and Rear Exhaust System	55	41	-
Clip-Front Catalytic Converter to Engine Mount	20	-	177
Exhaust Manifold to Cylinder Head	29	21	-
Nut-Bracket to Tail Pipe	55	40.5	-
Nut-Exhaust Bracket to Threaded Plate of Center Exhaust Pipe	20	-	177
Support-Exhaust Bracket on Transmission	20	-	177

ENGINE (Continued)

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Refrigerant Compressor			
Bolt-Refrigerant Compressor to Timing Case Cover	20	-	177
Bolt-Refrigerant Compressor to Bracket	20	-	177
Bolt-Refrigerant Lines to Refrigerant Compressor	20	-	177
Timing Chain, Chain Tensioner			
Bolt-Camshaft Sprocket to Exhaust Camshaft	18	-	159
Bolt-Intermediate Gear of High Pressure Pump to Cylinder Head	40	29.5	-
Timing Chain Tensioner to Timing Case Cover	80	59	-
Camshaft			
Bolt-Camshaft Bearing Cap to Cylinder Head	9	-	80
Bolt-Driver to Inlet Camshaft	50	37	-
Common Rail Diesel Injection			
Bolt-Banjo Bolt of Leak Oil Line to Rail	20	-	177
Bolt-Bracket to High Pressure Pump	9	-	80
Bolt-High Pressure Pump to Cylinder Head	14	-	124
Bolt-Pre-delivery Pump to Top Cover of Cylinder Head	9	-	80
Bolt-Pressure Control Valve to Rail (2 stage, torque)	3/5	-	26/44
Bolt-Rail to Cylinder Head	14	-	124
Bolt-Shutoff Valve to Cylinder Head	8	-	70
Nut-Pressure Line to Rail/Injector (New,Reused)	22/25	16/18.5	-
Nut-Pressure Line to High Pressure Pump/Rail	22	16	-
Screw-Tensioning Claw to Injector (2 stage, 1 torque, 2 torque angle)	7/90°	-	62
Rail-Pressure Sensor to Rail	22	16	-
Pressure Pipe Connection to Injector	42	31	-

ENGINE (Continued)

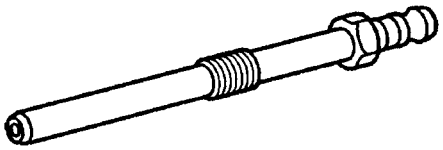
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Threaded Rail to Rail	22	16	-
Fuel Cooling System			
Bolt-Fuel Cooler to Charge Air Distribution Pipe	14	-	124
Heater Booster, Heater Unit			
Bolt- Temperature Controlled Cut Out to Heater Booster Control Module	12	-	106
Nut-Threaded Stud to Electronic Heater Booster	18	-	159

SPECIAL TOOLS

SPECIAL TOOL CROSS REFERENCE CHART

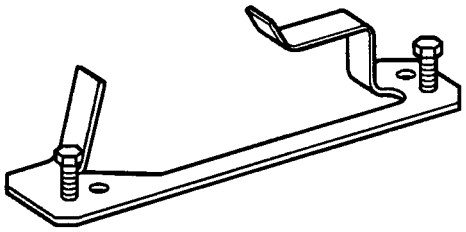
MB TOOL #	MILLER TOOL #	DESCRIPTION
N/A	5069-2	FUEL GAUGE
611 589 04 63 00	8927	COMPRESSION TESTER ADAPTER
611 589 03 15 00	8929	CANSHAFT LOCKING PINS
611 589 00 40 00	8930	COUNTERHOLDER
N/A	8931	TIMING CHAIN RETAINER
601 589 02 40 00	8932	CRANKSHAFT LOCK
603 589 00 40 00	8934	COUNTERHOLDER
N/A	8938A	EXTRACTION CLAW
611 589 00 14 00	8936	FRONT CRANKSHAFT SEAL INSTALLER
N/A	8938	EXTRACTION CLAW
613 589 00 33 00	8940	VIBRATION DAMPER REMOVER
N/A	8941	SLIDE HAMMER
611 589 00 15 00	8942	OIL JET INSTALLER
611 589 01 14 00	8944	REAR MAIN SEAL INSTALLER
602 589 00 39 00	8947	RIVETING OPENER
602 589 02 33 00	8948	CHAIN SEPARATOR TOOL
602 589 03 63 00	8949	THRUST PIECE
602 589 04 63 00	8950	PRESSING SCREW
602 589 02 40 00	8951	ASSEMBLY LINKS
602 589 02 40 00	8952	ASSEMBLY INSERTS
N/A	9285	FUEL LINE WRENCH
N/A	9286	GLOW PLUG PLIERS
N/A	9295	COMPRESSION HOSE ADAPTER
111 589 25 61 00	9307	VAVLE SERVICE TOOLS
N/A	8534-16	ENGINE SUPPORT FIXTURE ADAPTERS
N/A	9308	ENGINE LIFTING FIXTURE
103 589 01 63 00	9310	ASSEMBLY INSERTS
602 589 05 63 00	9311	PRESSING SCREW

ENGINE (Continued)



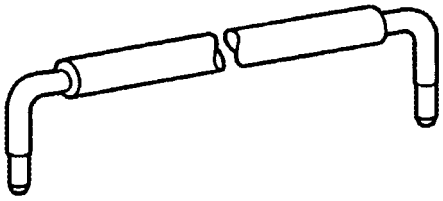
80e492e9

#8927 COMPRESSION TESTER ADAPTER



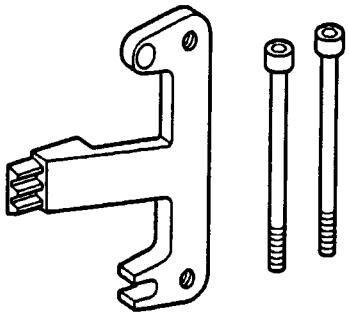
80e492c2

#8931 TIMING CHAIN RETAINER



80e492c7

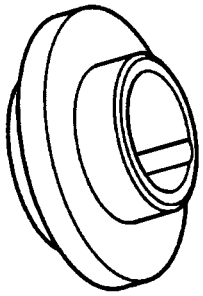
#8929 CAMSHAFT LOCKING PIN



80e4929a

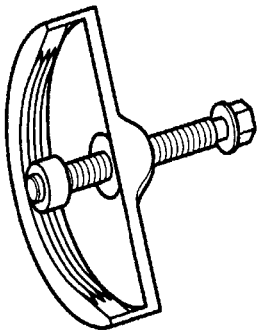
#8932 CRANKSHAFT LOCK

ENGINE (Continued)



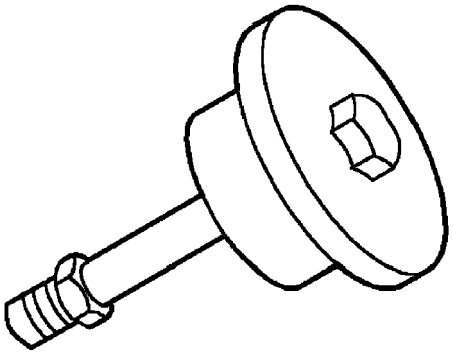
80e49185

#8936 FRONT CRANKSHAFT SEAL INSTALLER

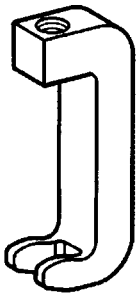


80e492e4

#8940 VIBRATION DAMPER REMOVER



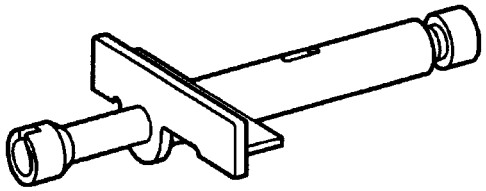
#8941 SLIDE HAMMER



80e492ee

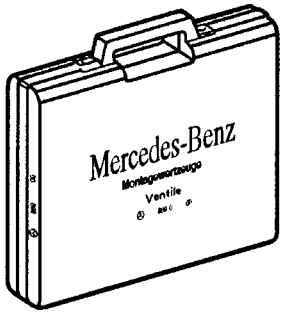
#8938A EXTRACTION CLAW

ENGINE (Continued)



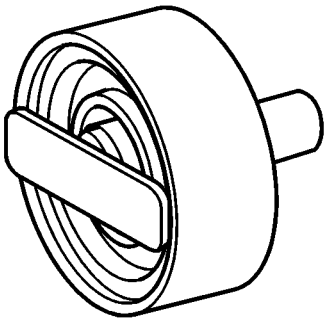
80e492e0

#8942 OIL JET INSTALLER



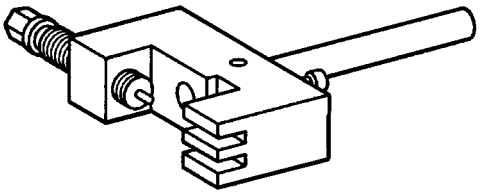
80e4922a

#9307 VALVE SERVICE TOOLS



80e49274

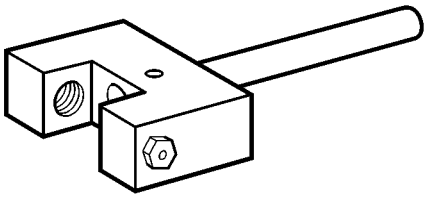
#8944 REAR MAIN SEAL INSTALLER



80e4922e

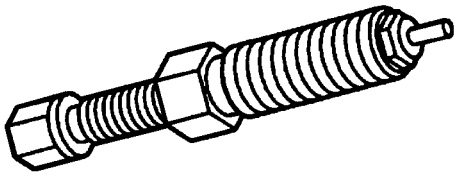
#8947 RIVET OPENER

ENGINE (Continued)



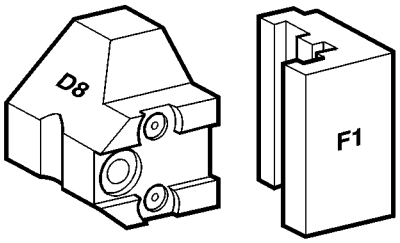
80e49289

#8948 CHAIN SEPARATOR TOOL



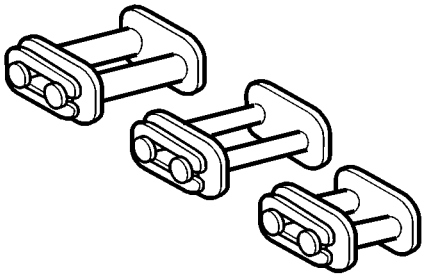
80e492b0

#8950 PRESSING SCREW



80e492bd

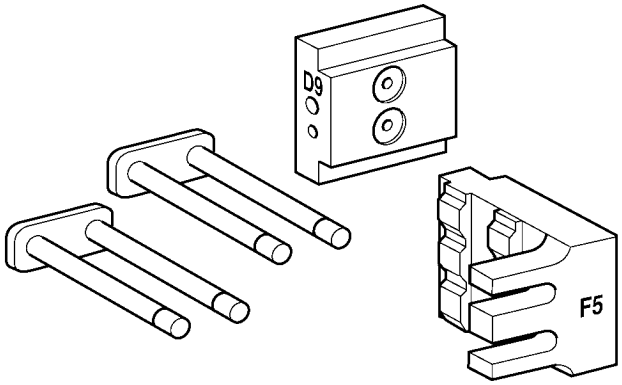
#8949 THRUST PIECE



80e492a7

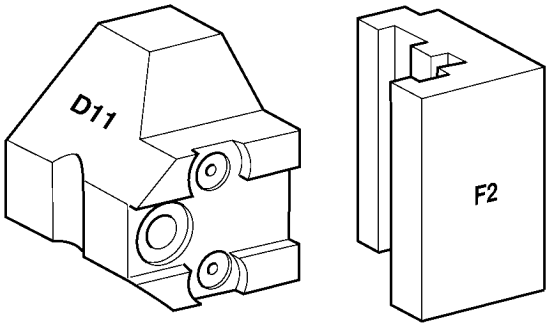
#8951 ASSEMBLY LINKS

ENGINE (Continued)



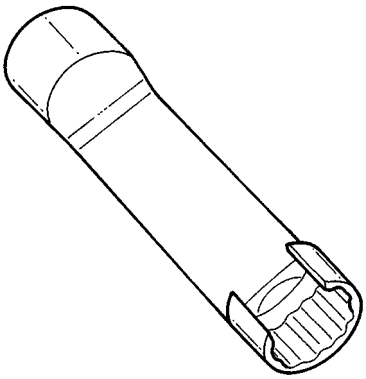
811aa8d1

#8952 ASSEMBLY INSERTS

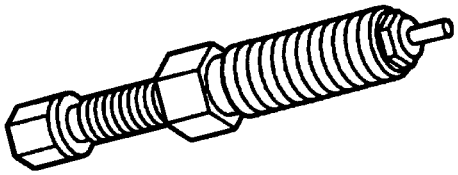


811aa888

 # 9310 ASSEMBLY INSERTS

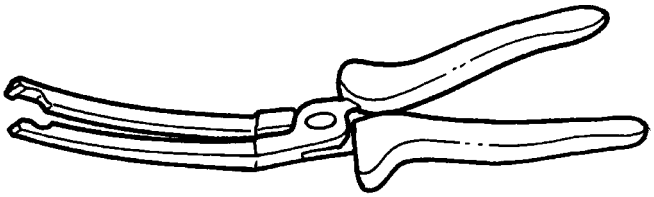


#9285 FUEL LINE WRENCH



80e492b0

#9311 PRESSING SCREW



 # 9286 GLOW PLUG PLIERS

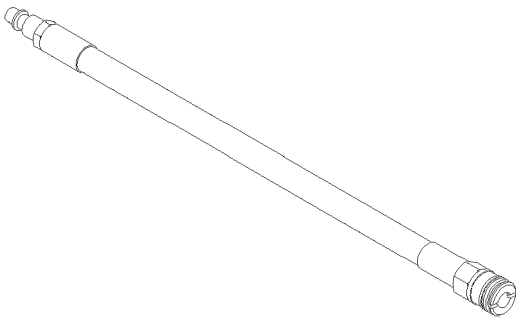


Fig. 8 #9295 COMPRESSION HOSE ADAPTOR

AIR CLEANER ELEMENT

REMOVAL

(1) Remove heat shield.
(2) Disconnect air flow sensor from housing (Fig. 9).
(3) Unclip the air cleaner housing lid (Fig. 9).
(4) Remove air cleaner element (Fig. 9).

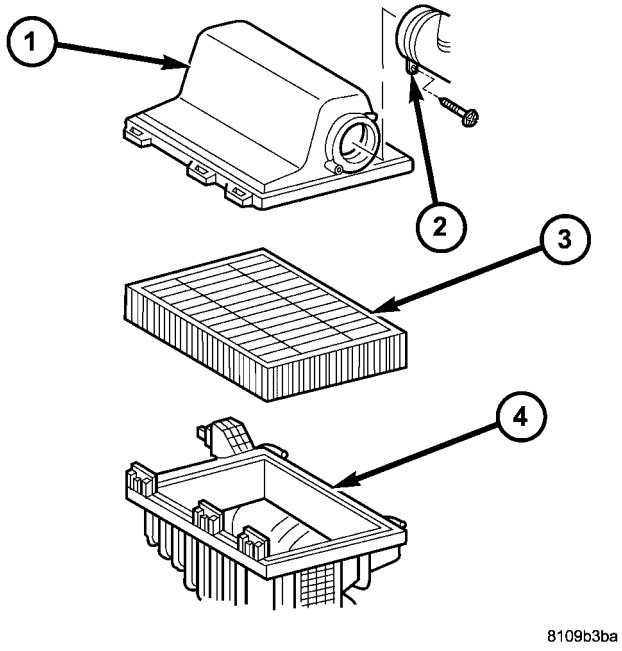


Fig. 9 AIR CLEANER ELEMENT

1 - AIR CLEANER HOUSING COVER
2 - AIR FLOW SENSOR
3 - AIR CLEANER ELEMENT
4 - AIR CLEANER HOUSING

INSTALLATION

(1) Position and seat the air cleaner element into the lower housing (Fig. 9).
(2) Install the housing cover and snap retainers into place (Fig. 9).
(3) Install air flow sensor into housing cover (Fig. 9).
(4) Install heat shield.

AIR CLEANER HOUSING

REMOVAL

(1) Disconnect the negative battery cable.
(2) Remove the heat shield.
(3) Remove the Air Flow sensor(Refer to 14 - FUEL SYSTEM/FUEL INJECTION/MANIFOLD AIR FLOW (MAF) SENSOR - REMOVAL).
(4) Unclip the top of the air cleaner housing and remove (Fig. 10).
(5) Take out air cleaner element (Fig. 10).
(6) Detach bottom part of the air cleaner housing at the body (Fig. 10).
(7) Take air intake hose out of inner fender and out of the rubber bushing in the wheel housing liner, then detach it at the bottom part of the air cleaner housing (Fig. 10).
(8) Remove bottom portion of the air cleaner housing out of the rubber bushings in the inner fender and remove (Fig. 10).

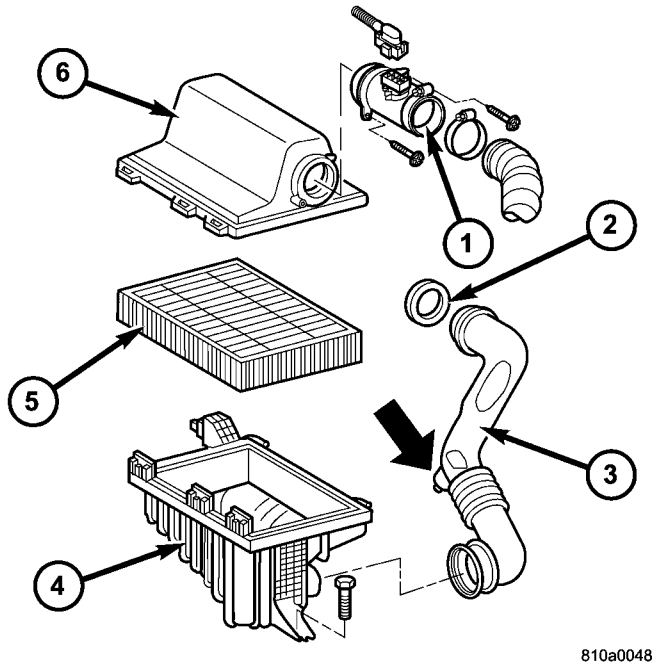


Fig. 10 AIR CLEANER HOUSING

1 - AIR FLOW SENSOR
2 - GASKET
3 - AIR INTAKE HOSE
4 - AIR CLEANER HOUSING
5 - AIR CLEANER ELEMENT
6 - AIR CLEANER HOUSING COVER

INSTALLATION

NOTE: Ensure that the seal betwwen the inner fender well and the air intake hose is correctly installed.

(1) Seat and retain bottom portion of the air cleaner housing into the bushings on the inner fender (Fig. 10).
(2) Install the air intake hose to the air cleaner housing the align and install it in the inner fender and wheel housing liner (Fig. 10).
(3) Install air cleaner element (Fig. 10).
(4) Install and clip air cleaner top to air cleaner body (Fig. 10).
(5) Install Air Flow sensor (Fig. 10).
(6) Install heat shield.

AIR CLEANER HOUSING (Continued)

(7) Connect negative battery cable.

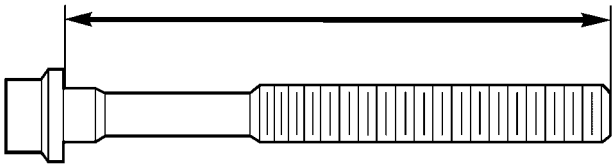
CYLINDER HEAD

STANDARD PROCEDURE

STANDARD PROCEDURE - CYLINDER HEAD BOLT INSPECTION

(1) Measure cylinder head bolts between points shown (Fig. 11).

Cylinder Head Bolts	Thread Diameter	12 M
	Length When New	102 mm
	Maximum Length	104 mm



80e214d0

Fig. 11 MEASURING CYLINDER HEAD BOLTS

(2) If the cylinder head bolt length is greater than the maximum allowable measurement, replace the cylinder head bolts.

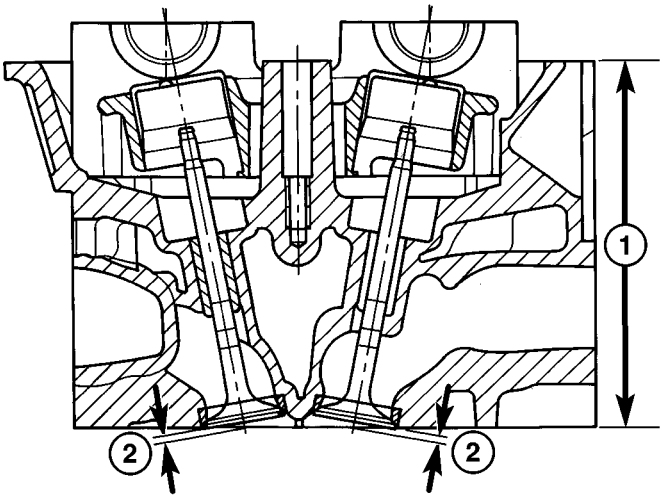
STANDARD PROCEDURE - MEASURE CYLINDER HEAD SURFACE

NOTE: Only resurface cylinder head contact surface if porous or damaged. IT IS NOT necessary to rework minor variations in flatness in the longitudinal direction.

(1) Disconnect negative battery cable.
(2) Remove cylinder head (Refer to 9 - ENGINE/ CYLINDER HEAD - REMOVAL).
(3) Remove valves.
(4) Inspect cylinder head contact surface for flatness, porous and damage.
(5) Using a straight edge, measure cylinder head and cylinder block flatness.
(6) Measure cylinder head height at point (1) indicated and retain reading (Fig. 12).

NOTE: The camshaft housing Must Not be machined. Basic bore of the camshaft bearings will be altered.

(7) Machine cylinder head contact surface, if necessary.
(8) Measure cylinder head height (1) at point indicated, record stock removal (Fig. 12) CYLINDER HEAD SPECIFICATIONS.
(9) Measure valve setback at points (2) indicated (Fig. 12) CYLINDER HEAD SPECIFICATIONS.



80e462fd

Fig. 12 CYLINDER HEAD MEASURMENTS

1 - CYLINDER HEAD HEIGHT
2 - VALVE SETBACK

NOTE: If measurement is less than dimension "2" no further correct valve clearance compensation is possible; replace valve seat ring or cylinder head if measurement is greater than specification.

CYLINDER HEAD SPECIFICATIONS

Description	Specification
Height of Cylinder Head (1), With Out Camshaft Housing	126.85mm to 127.15mm
Valve Set Back (2) With New Valves and New Valve Seat Rings	Exhaust Valve: 1.0mm - 1.4mm Intake Valve: 1.1mm - 1.5mm

CYLINDER HEAD (Continued)

REMOVAL

REMOVAL - CYLINDER HEAD

(1) Disconnect negative battery cable.
(2) Position piston of cylinder #1 to ignition TDC.
(3) Raise and support vehicle.
(4) Install retaining lock # 8932 for crankshaft/ starter ring gear.

WARNING: RISK OF INJURY TO SKIN AND EYES FROM SCALDING COOLANT. DO NOT OPEN COOLING SYSTEM UNLESS TEMPERATURE IS BELOW 90°C (194°F). OPEN CAP SLOWLY TO RELEASE PRESSURE. STORE COOLANT IN APPROVED CONTAINER ONLY. WEAR PROTECTIVE GLOVES, CLOTHING AND EYE WEAR.

(5) Drain cooling system at radiator and crankcase(Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
(6) Lower vehicle.
(7) Remove engine cover. (Refer to 9 - ENGINE COVER- REMOVAL).
(8) Remove camshafts (Refer to 9 - ENGINE/CYLINDER HEAD/CAMSHAFT(S) - REMOVAL).
(9) Remove tappets (Fig. 13).
(10) Remove the camshaft housing at the cylinder head (Fig. 13).

WARNING: NO FIRE, OPEN FLAMES OR SMOKING. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY FROM SKIN AND EYE CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING WHEN HANDLING FUEL.

(11) Remove the high pressure fuel pump intermediate gear (Fig. 13).
(12) Disconnect the engine side of the engine harness and set aside.
(13) Disconnect the charge air pipe at the cylinder head and set aside with the engine harness connected.

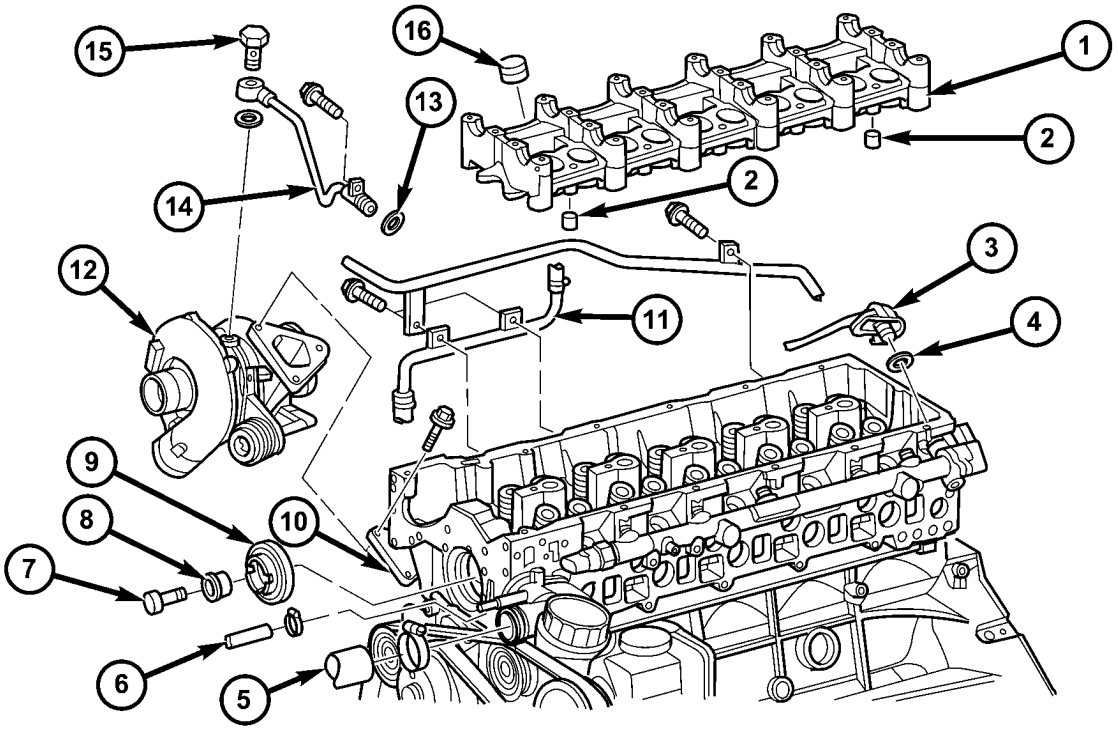


Fig. 13 CAMSHAFT HOUSING

1 - CAMSHAFT HOUSING
2 - DOWEL
3 - FUEL PIPE
4 - O-RING
5 - COOLANT HOSE
6 - COOLANT HOSE
7 - BOLT
8 - BUSHING
9 - HIGH PRESSURE PUMP INTERMEDIATE GEAR
10 - EXHAUST MANIFOLD
11 - COOLANT PIPE
12 - TURBOCHARGER
13 - O-RING
14 - TURBOCHARGER OIL SUPPLY LINE
15 - BANJO BOLT
16 - TAPPET

CYLINDER HEAD (Continued)

(14) Disconnect the turbocharger oil supply line at the cylinder head and turbocharger (Fig. 13).

(15) Disconnect the turbocharger at the exhaust manifold (Fig. 13).

(16) Unbolt the transmission dipstick tube from the cylinder head (Fig. 13).

(17) Disconnect the upper radiator hose and by pass hose at the thermostat housing (Fig. 13).

NOTE: Capture any fuel spillage when disconnecting fuel lines.

(18) Disconnect the fuel line at the rear of the fuel rail (Fig. 13).

(19) Remove upper timing case to cylinder head bolts (Fig. 14).

NOTE: Loosen cylinder head bolts in the reverse order of the tightening sequence.

(20) Remove cylinder head bolts and inspect (Refer to 9 - ENGINE/CYLINDER HEAD - STANDARD PROCEDURE).

(21) Remove cylinder head (Fig. 14).

NOTE: Carefully clean all mating surfaces and bolt thread holes. Assure that no oil or grease is present during reassembly.

(22) Clean all mating surfaces and blow out bolt thread holes.

REMOVAL - CYLINDER HEAD FRONT COVER

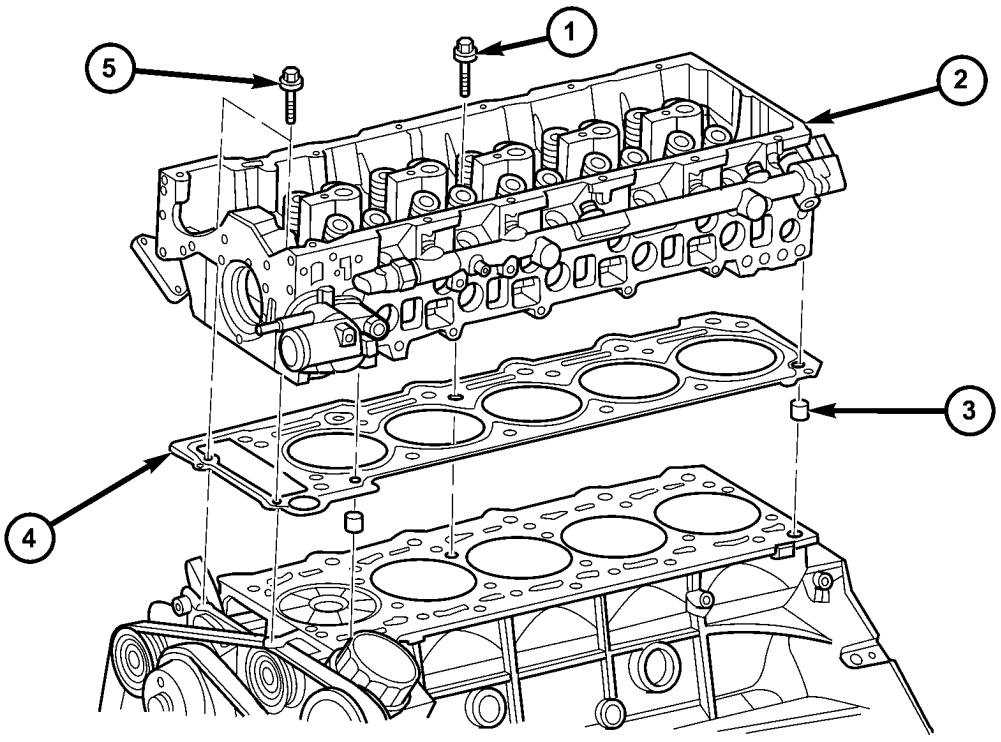
(1) Disconnect negative battery cable.

(2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

(3) Partially drain cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(4) Remove cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

(5) Remove timing chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/TMNG BELT/CHAIN TENSIONER&PULLEY - REMOVAL).



81152533

Fig. 14 CYLINDER HEAD

1 - CYLINDER HEAD BOLT
2 - CYLINDER HEAD
3 - DOWEL
4 - GASKET
5 - BOLT TO TIMING COVER

CYLINDER HEAD (Continued)

WARNING: NO FIRE, OPEN FLAMES OR SMOKING. SERVICE VEHICLE IN WELL VENTILATED AREAS AND AVOID IGNITION SOURCES. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY FROM SKIN AND EYE CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING WHEN HANDLING FUEL.

(6) Remove low pressure pump (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL INJECTION PUMP - REMOVAL).

(7) Remove vacuum pump (Refer to 9 - ENGINE/ENGINE BLOCK/INTERNAL VACUUM PUMP - REMOVAL).

(8) Remove bolts attaching front cover.

NOTE: Lower portion of front cover is sealed with RTV sealant. Carefully tug at front cover until it loosens from cylinder head.

(9) Raise locking pawl of top guide rail and remove cylinder head front cover (Fig. 15).

NOTE: Dowel pins are use as a guide during assembly and must remain in the proper position to assure a good sealing surface.

REMOVAL - CYLINDER HEAD GUIDE RAIL

(1) Disconnect negative battery cable.

CAUTION: Rotate engine at crankshaft only. DO NOT rotate the engine with the bolt of the camshaft sprocket. DO NOT rotate the engine back.

NOTE: Markings on the camshaft and camshaft bearing cap must be aligned.

(2) Position piston of number 1 cylinder to ignition TDC.

(3) Remove engine cover. (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

(4) Remove timing chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

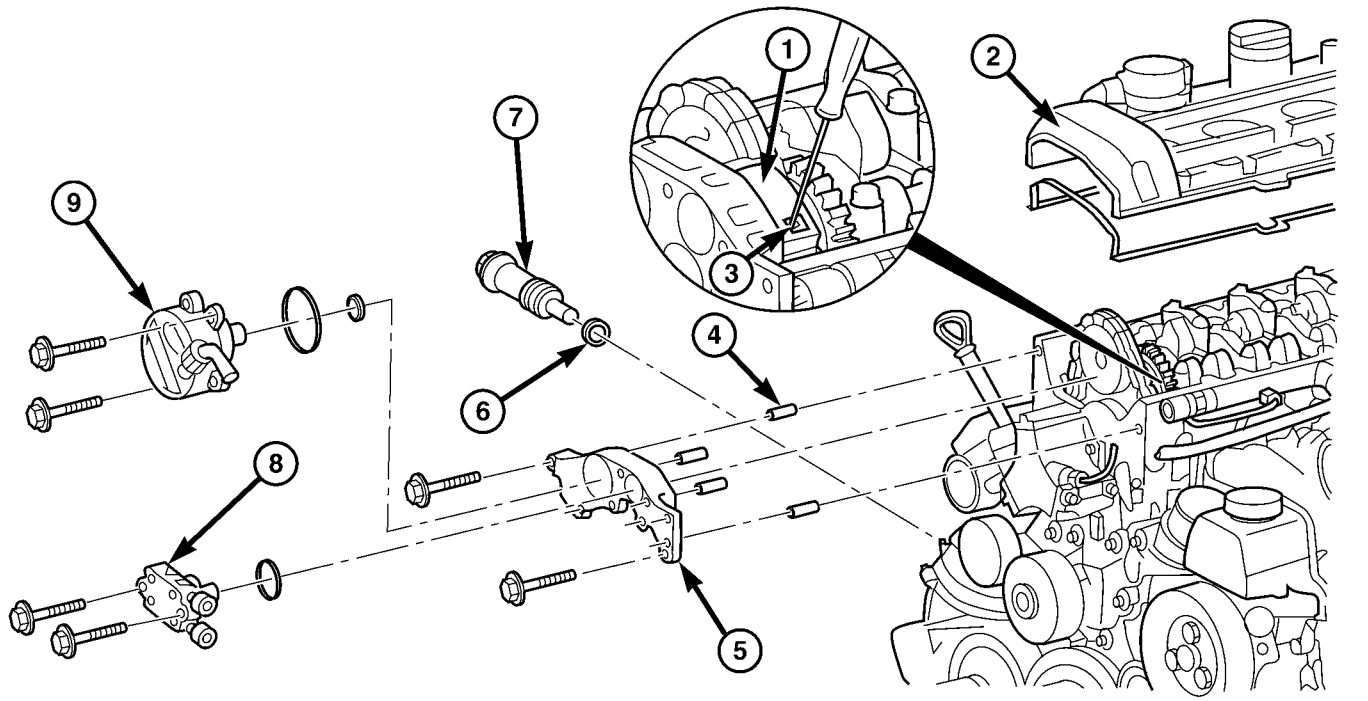


Fig. 15 CYLINDER HEAD FRONT COVER

1 - TOP GUIDE RAIL
2 - CYLINDER HEAD COVER
3 - LOCKING PAWL
4 - DOWEL PIN
5 - CYLINDER HEAD FRONT COVER
6 - SEAL
7 - TIMING CHAIN TENSIONER
8 - LOW PRESSURE PUMP
9 - VACUUM PUMP

CYLINDER HEAD (Continued)

(5) Carefully raise locking pawl of top slide rail and remove front cover at cylinder head (Fig. 15).

(6) Insert a locking pin through 1st camshaft bearing cap into the hole in the inlet camshaft sprocket.

(7) Counter hold the camshaft with an open end wrench to avoid damage and unbolt driver of inlet camshaft sprocket.

(8) Remove top guide rail.

INSTALLATION

INSTALLATION - CYLINDER HEAD

WARNING: (Refer to 14 - FUEL SYSTEM - WARNING)

NOTE: Thoroughly clean all mating surfaces with appropriate solvents and blow out bolt holes, to assure that no grease or oil is present during reassembly.

NOTE: If piston or connecting rods have been replaced, measure piston protrusion.

NOTE: Check facing cylinder head contact surface.

(1) Position the cylinder head and gasket properly on engine using the dowel pins as guide (Fig. 14).

NOTE: Inspect all cylinder head bolts for defects and stretching before installation (Refer to 9 - ENGINE/CYLINDER HEAD - STANDARD PROCEDURE).

CYLINDER HEAD BOLT TORQUE SEQUENCE

The M12 cylinder head bolts must be torqued in 3 stages.

(1) Install M12 cylinder head bolts finger tight (Fig. 14).

(2) Torque bolts in numeric order starting with number 1 to 60 N·m (44 lbs.in.) (Fig. 16).

(3) Install M8 timing chain cover to cylinder head bolts. Tighten to 20N·m (177 lbs.in.).

(4) Tighten M12 cylinder head bolts in numeric order starting with number 1 an additional 90° (Fig. 16).

(5) Tighten M12 cylinder head bolts in numeric order starting with number 1 an additional 90° again (3 stages). (Fig. 16).

(2) Install fuel return flow line between rail and high pressure pump (Fig. 13).

(3) Connect the coolant hoses to the thermostat housing (Fig. 13).

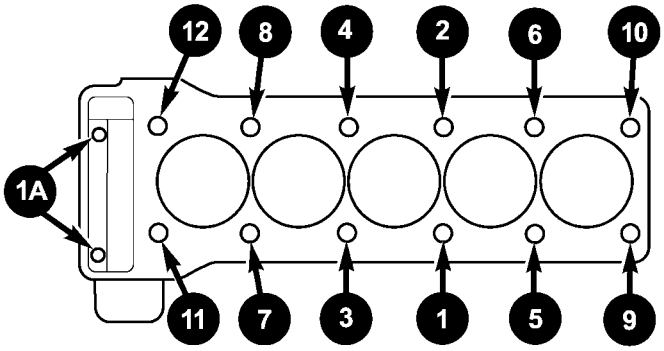


Fig. 16 CYLINDER HEAD BOLT TORQUE SEQUENCE

(4) Connect the coolant pipe at the cylinder head (Fig. 13).

(5) Reconnect transmission oil dip stick tube. Tighten to 14 N·m (124 lbs. in.) (Fig. 13).

(6) Reconnect the turbocharger to the exhaust manifold. Tighten to 30N·m (22 lbs.ft.) (Fig. 13).

(7) Install oil return flow line with new seals at turbocharger. Tighten bolt of supply line to turbocharger to 18N·m (160 lbs. in.) and bolt of supply line to cylinder head to 9N·m (80 lbs. in.) (Fig. 13)

(8) Install charge air distribution pipe (Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM - INSTALLATION).

(9) Install and properly route the engine wiring harness, making appropriate connections.

(10) Install high pressure fuel pump intermediate gear (Fig. 13).

(11) Install high pressure pump (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL INJECTION PUMP - INSTALLATION).

(12) Install the camshaft housing to cylinder head (Fig. 13).

(13) Install the tappets (Fig. 13).

(14) Install camshafts (Refer to 9 - ENGINE/CYLINDER HEAD/CAMSHAFT(S) - INSTALLATION).

(15) Install top guide rail (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(16) Install front cover at cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).

(17) Install cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

(18) Install fuel high pressure pipes and injectors (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - INSTALLATION).

(19) Install timing chain tensioner with new gasket. (Refer to 9 - ENGINE/VALVE TIMING/TIMING

CYLINDER HEAD (Continued)

BELT/CHAIN AND SPROCKETS - INSTALLATION) Tighten to 80N·m (59 lbs.ft.).

(20) Remove retaining lock for crankshaft/starter ring gear.

(21) Install air intake tube at turbocharger (Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM - INSTALLATION).

(22) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

NOTE: DO NOT pressure test cooling system until engine has reached operating temperature.

(23) Refill cooling system with proper coolant mixture to proper level (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(24) Connect negative 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 CLOTHES.

(25) Start engine and inspect for leaks. Care must be taken to observe the fuel system warning (Refer to 14 - FUEL SYSTEM - WARNING)

INSTALLATION - CYLINDER HEAD FRONT COVER

NOTE: Thoroughly clean all mating surfaces with appropriate solvents to assure that no grease or oil is present during reassembly.

NOTE: Dowel pins are used as a guide during assembly and must remain in the proper position to assure a good sealing surface.

(1) Apply sealant to the marked surfaces with a bead thickness of 1.5 ± 0.5 mm (Fig. 17).

NOTE: Install front cover of cylinder head within 10 minutes after applying sealant. Do not spread sealing bead.

(2) Raise locking pawl of top guide rail and guide front cover onto guide pins.

(3) Install bolts attaching front cover (Fig. 15) Tighten bolts to 14N·m (124 lbs. in.).

WARNING: NO FIRE, OPEN FLAMES OR SMOKING. REMOVE SOURCES OF IGNITION FROM THE AREA. WEAR PROTECTIVE CLOTHING WHEN HANDLING FUEL. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY FROM SKIN AND EYE CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS.

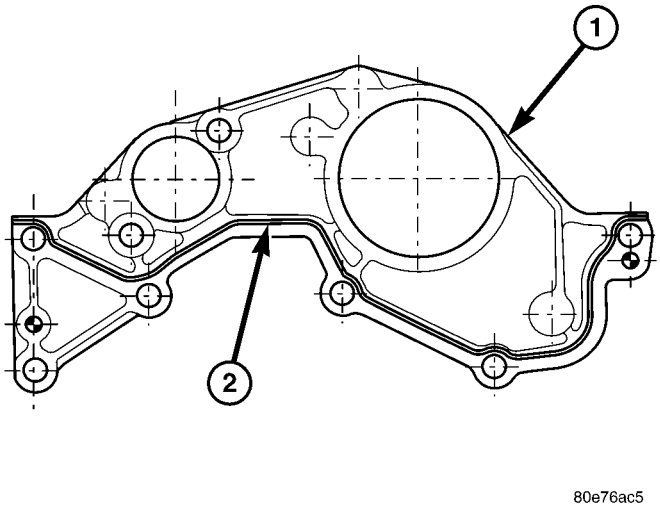


Fig. 17 CYLINDER HEAD COVER SEALING SURFACE

1 - CYLINDER HEAD FRONT COVER
2 - SEALANT BEAD

(4) Instal low pressure pump (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL INJECTION PUMP - INSTALLATION).

(5) Install vacuum pump (Refer to 9 - ENGINE/ENGINE BLOCK/INTERNAL VACUUM PUMP - INSTALLATION).

NOTE: Timing chain tensioner must be installed with a new gasket.

(6) Install timing chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(7) Refill cooling system with proper mixture to proper level (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(8) Connect negative 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 CLOTHES.

(9) Start the engine and inspect for leaks. Care must be taken to observe the fuel system warning (Refer to 14 - FUEL SYSTEM - WARNING)

INSTALLATION - CYLINDER HEAD GUIDE RAIL

(1) Carefully position the top guide rail onto the guide pins.

CYLINDER HEAD (Continued)

(2) Counter hold the camshaft with an open end wrench and install driver of inlet camshaft sprocket. Tight bolt to 50N·m (37 lbs. ft.).

(3) Remove camshaft sprocket locking pin.

(4) Carefully raise locking pawl of top guide rail and install front cover at cylinder head.

(5) Install timing chain tensioner with new gasket (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(6) Install engine cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

(7) Reconnect negative battery cable.

WARNING: US 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 CLOTHES.

(8) Start engine and inspect for leaks.

CAMSHAFT(S)

STANDARD PROCEDURE - CHECKING CAMSHAFT POSITION

(1) Disconnect negative battery cable.

(2) Remove engine cover (Refer to 9 - ENGINE COVER - REMOVAL).

WARNING: (Refer to 14 - FUEL SYSTEM - WARNING)

(3) Remove injectors (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - REMOVAL).

(4) Clean injectors and recesses(Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - STANDARD PROCEDURE).

(5) Remove cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

NOTE: Rotate engine at crankshaft only. DO NOT crank engine at the camshaft and DO NOT rotate the engine backward.

(6) Position piston of cylinder #1 to ignition TDC.

(7) Insert the locking pin (special tool #8929) through first camshaft bearing cap into the hole in the left inlet camshaft sprocket (Fig. 18).

NOTE: The two markings in the inlet camshaft sprockets must be positioned opposite and markings of camshaft and camshaft bearing cap must be aligned. If not, perform basic position of camshafts.

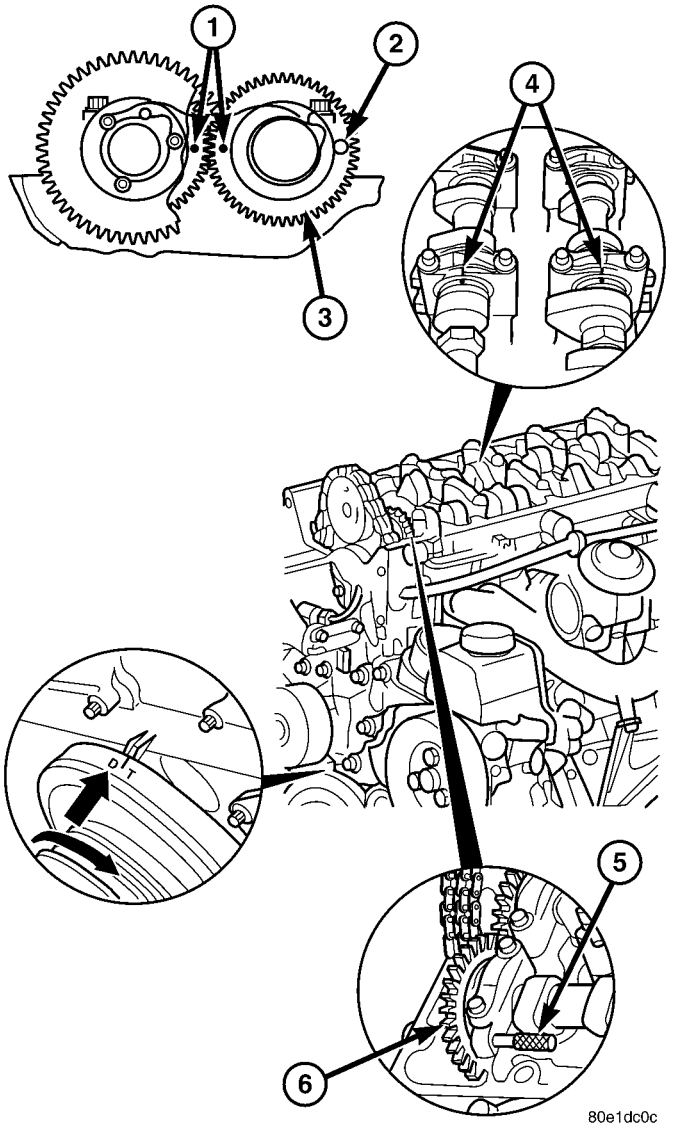


Fig. 18 CHECKING CAMSHAFT POSITION

1 - CAMSHAFT SPROCKET ALIGNMENT DOTS
2 - CAMSHAFT LOCK POSITION
3 - INTAKE CAMSHAFT SPROCKET
4 - CAMSHAFT AND BEARING CAP ALIGNMENT MARKS
5 - CAMSHAFT LOCKING PIN (SPECIAL TOOL #8929)
6 - INTAKE CAMSHAFT SPROCKET

(8) Remove locking pin from camshaft bearing cap hole.

(9) Install cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

(10) Install injectors (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - INSTALLATION).

CAMSHAFT(S) (Continued)

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 NO WEAR LOOSE CLOTHING.

(11) Start the engine and inspect for leaks.

REMOVAL

(1) Disconnect negative battery cable.
(2) Remove engine cover.(Refer to 9 - ENGINE - REMOVAL).

WARNING: (Refer to 14 - FUEL SYSTEM - WARNING)

(3) Remove high pressure lines and injectors (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/ FUEL INJECTOR - REMOVAL).
(4) Remove cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

NOTE: Rotate engine at the crankshaft only. DO NOT rotate the engine at the camshaft. DO NOT rotate the engine backward.

(5) Position piston of cylinder #1 to ignition TDC.
(6) Lock inlet camshaft (Fig. 19).
(7) Remove timing chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

NOTE: The lower portain of the cylinder head front cover is sealed with RTV sealant. Carefully tug front cover after bolt removal to loosen from cylinder head.

(8) Remove cylinder head front cover (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).
(9) Remove top side rail (Refer to 9 - ENGINE/ CYLINDER HEAD - REMOVAL).

CAUTION: For all work in which the crankshaft should not rotate, secure camshaft gear to timing chain.

(10) Mark camshaft sprocket relative to timing chain.
(11) Unbolt camshaft sprocket from exhaust camshaft.

NOTE: Note the position of dowel pin for camshaft sprocket alignment during reassembly.

(12) Remove camshaft sprocket.

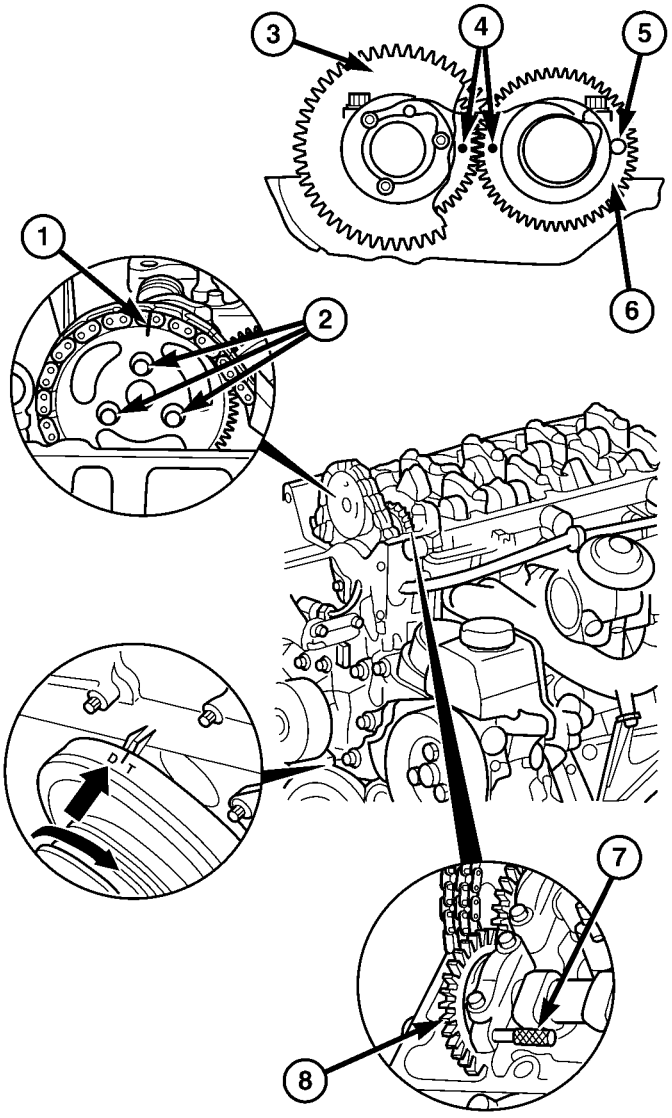


Fig. 19 CAMSHAFT ALIGNMENT

1 - EXHAUST CAMSHAFT SPROCKET AND CHAIN MARKING
2 - EXHAUST CAMSHAFT SPROCKET BOLTS
3 - EXHAUST CAMSHAFT SPROCKET
4 - CAMSHAFT ALIGNMENT DOTS
5 - INTAKE CAMSHAFT LOCK POSITION
6 - INTAKE CAMSHAFT SPROCKET
7 - INTAKE CAMSHAFT LOCK (SPECIAL TOOL #8929)
8 - INTAKE CAMSHAFT SPROCKET

CAUTION: Camshaft bearing caps must remain in proper order and position.

NOTE: Slacken the bolts of the camshaft bearing caps evenly in steps of one turn until the backpressure is eliminated. Camshafts must not be twisted when slackening the camshaft bearing caps.

(13) Paint mark or scribe, then remove camshaft bearing caps.

CAMSHAFT(S) (Continued)

(14) Remove the inlet and exhaust camshafts (Fig. 20).

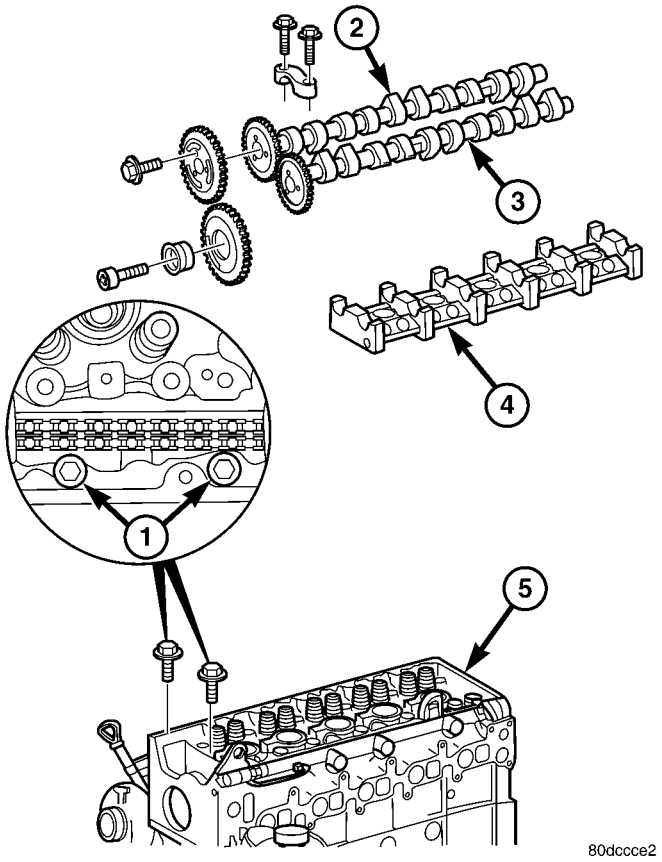


Fig. 20 CAMSHAFTS AND HOUSING ASSEMBLY

1 - CYLINDER HEAD BOLTS
2 - EXHAUST CAMSHAFT
3 - INTAKE CAMSHAFT
4 - CAMSHAFT HOUSING
5 - CYLINDER HEAD

INSTALLATION

CAUTION: The camshafts are sensitive to fracturing. Ensure they are installed free of stress.

CAUTION: Pay attention to assignment of camshafts. Camshaft code numbers are visible on the thrust collar of the axial bearing.

CAUTION: Oil bucket tappets and camshaft bearing points. Inspect ease of operation of bucket tappets.

(1) Install inlet and exhaust camshafts.

CAUTION: Install camshafts so that the two holes in camshaft sprockets are positioned opposite and the markings of the camshaft and camshaft bearing cap are aligned.

(2) Align inlet and exhaust camshafts at axial bearing (Refer to 9 - ENGINE/CYLINDER HEAD/CAMSHAFT(S) - STANDARD PROCEDURE).

NOTE: Pay attention to markings on camshaft bearing caps.

CAUTION: Do not rotate engine counter clockwise.

(3) Position the piston of cylinder #1 to ignition TDC.

NOTE: Pay attention to markings on camshaft bearing caps.

(4) Install the bearing caps in reverse order at the same point. Tighten bearing cap bolts evenly to 9N·m (80 lbs. in.) in steps each of 1 turn.

NOTE: The piston of cylinder #1 must be positioned at ignition TDC when the inlet camshaft is locked.

(5) Insert locking pin through the first camshaft bearing cap into the whole in the camshaft sprocket.

NOTE: Do Not use old camshaft sprocket bolts.

(6) Fit camshaft sprocket with timing chain fitted on, onto exhaust camshaft paying attention to position of dowel pin. Tighten bolt to 18N·m (159 lbs.in.).

(7) Install timing chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(8) Inspect/Set basic position of camshafts (Refer to 9 - ENGINE/CYLINDER HEAD/CAMSHAFT(S) - STANDARD PROCEDURE).

(9) Insert slide rail and bolt the driver into the inlet camshaft. Tighten bolt driver to 50N·m (37 lbs. in.).

(10) Install front cover at cylinder head.

(11) Install cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

NOTE: Refer to the appropriate injector servicing procedures for cleaning of injectors and recesses.

(12) Clean and install injectors (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - STANDARD PROCEDURE), (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - INSTALLATION).

(13) Reconnect negative battery cable.

WARNING: (Refer to 14 - FUEL SYSTEM - WARNING).

CAMSHAFT(S) (Continued)

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.

(14) Start engine and inspect for leaks.Care must be taken to observe the fuel system warning (Refer to 14 - FUEL SYSTEM - WARNING).

(15) Install engine cover (Refer to 9 - ENGINE COVER - INSTALLATION).

CYLINDER HEAD COVER(S)

REMOVAL

(1) Disconnect negative battery cable.

(2) Disconnect the air inlet and set aside.

(3) Detach hose from oil separator.

(4) Disconnect the camshaft position sensor.

(5) Disconnect fuel injector and glow plug harness and set aside.

(6) Remove fuel high pressure pipes and injectors (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/ FUEL INJECTOR - REMOVAL).

(7) Disconnect the out let line.

(8) Remove cylinder head cover retaining bolts and remove cover (Fig. 21).

INSTALLATION

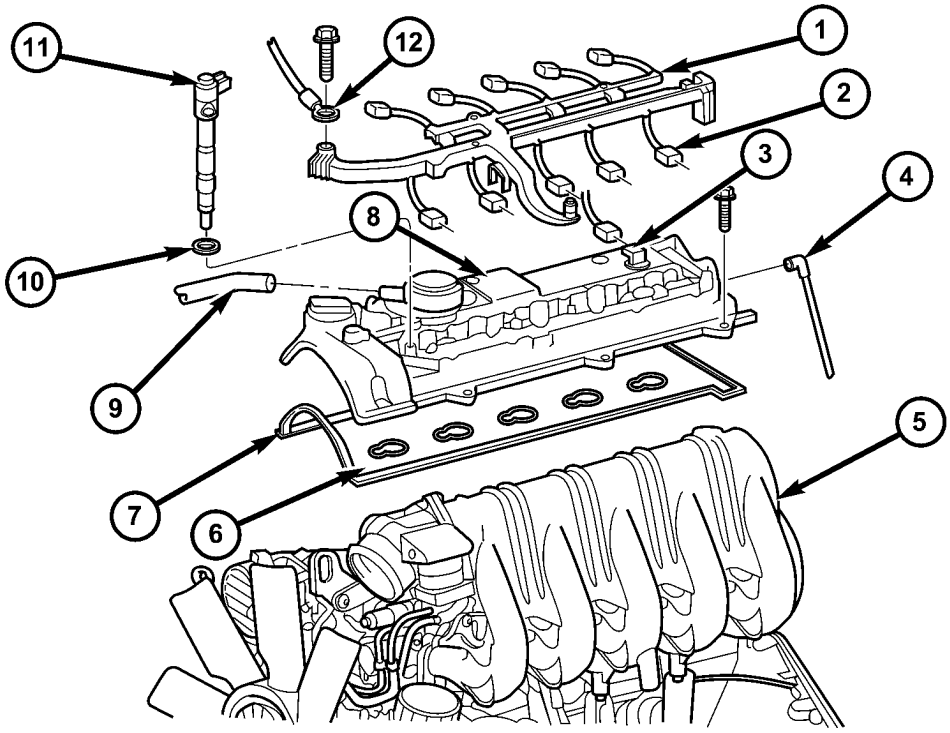
NOTE: Do Not tighten the cylinder head cover first. The fuel injectors are aligned by way of the cylinder head cover.

(1) Fit cylinder head cover with new gasket and install bolts (Fig. 21).

(2) Insert all fuel injectors and tensioning claws. Insert new bolts and tighten in the following order: 3, 4, 5, 2, 1.(Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - INSTALLATION).

(3) Tighten cylinder head cover bolts to 9 N·m (80 lbs. in.).

(4) Install and properly route fuel injector and glow plug wiring harness, making appropriate connections.



811538b3

Fig. 21 CYLINDER HEAD COVER

1 - ENGINE WIRING HARNESS
2 - GLOW PLUG CONNECTOR
3 - CAMSHAFT POSITION SENSOR
4 - OUTLET LINE
5 - INTAKE MANIFOLD
6 - GASKET
7 - GASKET
8 - CYLINDER HEAD COVER
9 - CRANKCASE VENT LINE
10 - GASKET
11 - FUEL INJECTOR
12 - GROUND

CYLINDER HEAD COVER(S) (Continued)

(5) Connect the camshaft position sensor.
(6) Connect the return flow line.
(7) Attach oil separator hose.
(8) Install the fuel injector lines (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL LINES - INSTALLATION).
(9) Connect negative battery cable.

WARNING: (Refer to 14 - FUEL SYSTEM - WARNING).

WARNING: USE EXTREME CAUTION WHEN ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH FAN. DO NOT PUT YOUR HANDS NEAR PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

(10) Start engine and inspect for leaks. Care must be take to observe the fuel system warning (Refer to 14 - FUEL SYSTEM - WARNING).

VALVE SPRINGS

REMOVAL

REMOVAL - VALVE SPRINGS

(1) Disconnect negative battery cable.
(2) Remove glow plugs (Refer to 8 - ELECTRICAL/IGNITION CONTROL/GLOW PLUG - REMOVAL).
(3) Remove injectors (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - REMOVAL).
(4) Remove cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
(5) Remove timing chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
(6) Remove front cover at cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).
(7) Remove top guide rail (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).
(8) Remove camshafts (Refer to 9 - ENGINE/CYLINDER HEAD/CAMSHAFT(S) - REMOVAL).

NOTE: The timing chain must be held in up position so as not to jam during procedure.

(9) Position piston of cylinder to be processed to DTC by rotating the crankshaft clockwise.**DO NOT crank engine.DO NOT rotate engine backward.**
(10) Install crankshaft lock, special tool #8932.
(11) Seal injector hole with connection piece and retain with orginal tensioning claw.
(12) Connect cylinder leak tester with adaptors and pressurize the cylinder to 5 bar (73 psi.).

WARNING: Valve springs and retainers must be kept in order of the cylinder they were removed.

NOTE: Using valve service tools #9307, screw retaining fork into threaded edge of cylinder head and position thrust piece vertically at top of valve spring retainer.

(13) Compress valve spring (Fig. 22).

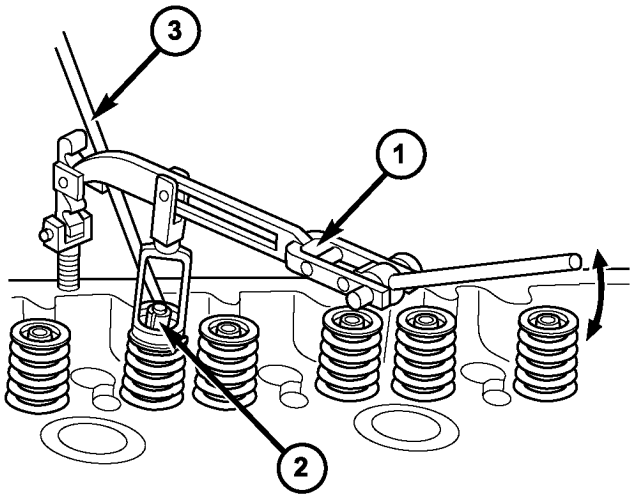


Fig. 22 VALVE COMPRESSOR

1 - VALVE ASSEMBLY TOOL
2 - VALVE COLLET
3 - MAGNET

(14) Remove valve collets (Fig. 22).
(15) Remove top valve spring retainer and valve spring (Fig. 23).
(16) Remove valve stem seals (Fig. 24).
(17) Remove bottom valve spring retainer (Fig. 23).

NOTE: Inspect all cylinder head components for wear or damage.

(18) Repeat procedure for each cylinder as necessary.

REMOVAL - VALVES

(1) Disconnect negative battery cable.
(2) Remove engine cover (Refer to 9 - ENGINE COVER - REMOVAL).

VALVE SPRINGS (Continued)

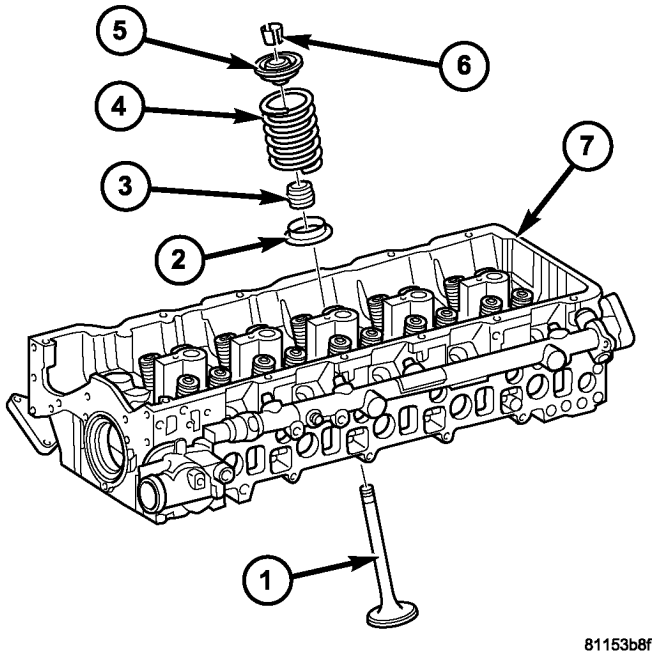


Fig. 23 VALVE ASSEMBLY

1 - VALVE
2 - BOTOM VALVE SPRING RETAINER
3 - VALVE STEM SEAL
4 - VALVE SPRING
5 - TOP VALVE SPRING RETAINER
6 - VALVE COLLETS

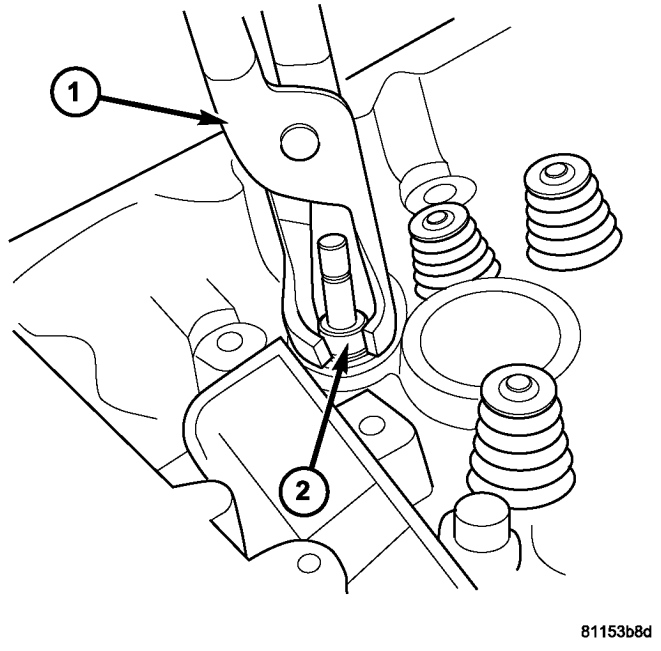


Fig. 24 VALVE STEM SEAL

1 - PLIERS
2 - VALVE STEM SEAL

(3) Remove cylinder head (Refer to 9 - ENGINE/ CYLINDER HEAD - REMOVAL).

WARNING: Suitably mark the valve and the position in the cylinder head before removal. Failure to do so will result in improperly seated valves and possible engine damage after reassembly.

NOTE: Using tool, screw retaining fork into threaded edge of cylinder head and position thrust piece vertically at top of valve spring retainer.

(4) Using a suitable valve spring compressor, compress valve spring.
(5) Remove valve collets (Fig. 23).
(6) Remove top valve spring retainer and valve spring (Fig. 23).
(7) Remove valve stem seals (Fig. 24).
(8) Repeat steps 5 through 9 for each valve as necessary.
(9) Remove cylinder head from assembly board.

WARNING: Valves, springs and retainers must be kept in order of the cylinder they were removed.

(10) Remove valves.

INSTALLATION

INSTALLATION - VALVE SPRINGS

NOTE: Inspect all valve springs and retainers for wear or damage. Replace as necessary.

(1) Position piston of cylinder to be processed to TDC by rotating the crankshaft clockwise. **DO NOT crank engine or rotate engine counter clockwise.**
(2) Connect cylinder leak tester with adaptors and pressurize the cylinder to 5 bar (73 psi).
(3) Install lower valve spring retainer (Fig. 23).
(4) Install valve stem seal (Fig. 25).
(5) Install valve spring (Fig. 23).
(6) Install valve spring retainer (Fig. 23).

NOTE: Using tool, screw retaining fork into threaded edge of cylinder head and position thrust piece vertically at the top of each valve spring retainer.

NOTE: Ensure that the valve keepers are seated properly.

(7) Compress valve and install valve collets (Fig. 22).
(8) Repeat procedure for each cylinder as necessary.
(9) Remove special tooling from cylinder head.

VALVE SPRINGS (Continued)

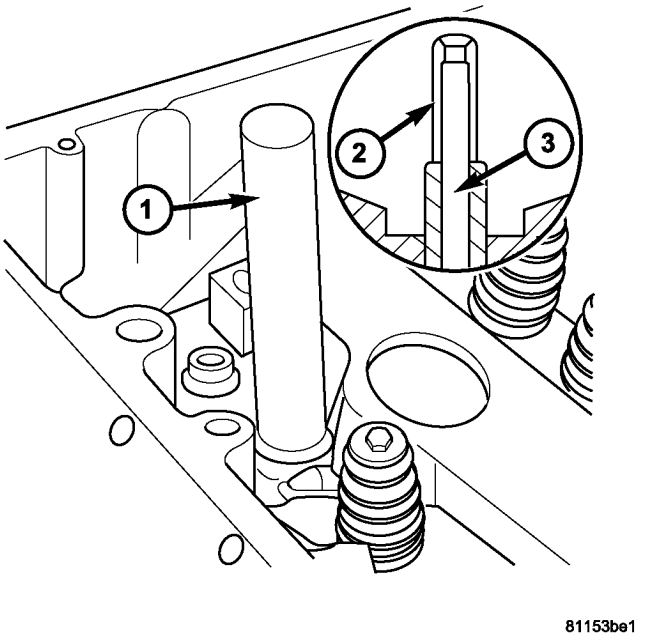


Fig. 25 VALVE SEAL INSTALLATION

1 - DRIFT
2 - PROTECTIVE COVER
3 - VALVE

(10) Position piston of #1 cylinder to ignition TDC.
(11) Install camshafts and check basic position (Refer to 9 - ENGINE/CYLINDER HEAD/CAMSHAFT(S) - INSTALLATION).
(12) Install top guide rail (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).
(13) Install front cover at cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).
(14) Install timing chain tensioner with new gasket (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION)
(15) Install cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).
(16) Install glow plugs (Refer to 8 - ELECTRICAL/IGNITION CONTROL/GLOW PLUG - INSTALLATION).

WARNING: SERVICE VEHICLES IN A WELL VENTILATED AREA AND AVOID IGNITION SORCES. RISK OF INJURY TO SKIN AND EYES FROM FUEL JET FLOWING OUT.

(17) Install injectors (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - INSTALLATION).
(18) Reconnect negative 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.

(19) Start the engine and inspect for leaks.Care must be taken to observe the fuel system warning (Refer to 14 - FUEL SYSTEM - WARNING)
(20) Install engine cover (Refer to 9 - ENGINE COVER - INSTALLATION).

INSTALLATION - VALVES

WARNING: Valves must be kept in their original positions in cylinder head. Failure to do so will result in engine damage.

NOTE: Inspect all valves, springs and retainers for wear or damage. Replace as necessary.

(1) Install valves in their original position in the cylinder head.
(2) Install lower valve spring retainer.
(3) Install valve stem seal.
(4) Install valve spring.
(5) Install valve spring retainer.

NOTE: Using tool, screw retaining fork into threaded edge of cylinder head and position thrust piece vertically at the top of each valve spring retainer.

NOTE: Ensure that the valve keepers are seated properly.

(6) Using a suitable valve spring compressor, compress valve spring and install valve keepers.
(7) Repeat steps 3 through 7 for each valve as necessary.
(8) Remove valve assembly from cylinder head.
(9) Install cylinder head on engine block (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).
(10) Install glow plugs (Refer to 8 - ELECTRICAL/IGNITION CONTROL/GLOW PLUG - INSTALLATION).
(11) Connect negative battery cable.

WARNING: US EXTREME CAUTION WHEN THE ENGINE IS IN OPERATION. 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.

(12) Start engine and check for leaks. Care must be taken to observe the fuel system warning (Refer to 14 - FUEL SYSTEM - WARNING)
(13) Install engine cover (Refer to 9 - ENGINE COVER - INSTALLATION).

ENGINE BLOCK

STANDARD PROCEDURE

STANDARD PROCEDURE - REPLACING ENGINE CORE AND OIL GALLERY PLUGS

Using a blunt tool such as a drift and a hammer, strike the bottom edge of the cup plug. With the cup plug rotated, grasp firmly with pliers or other suitable tool and remove plug (Fig. 26).

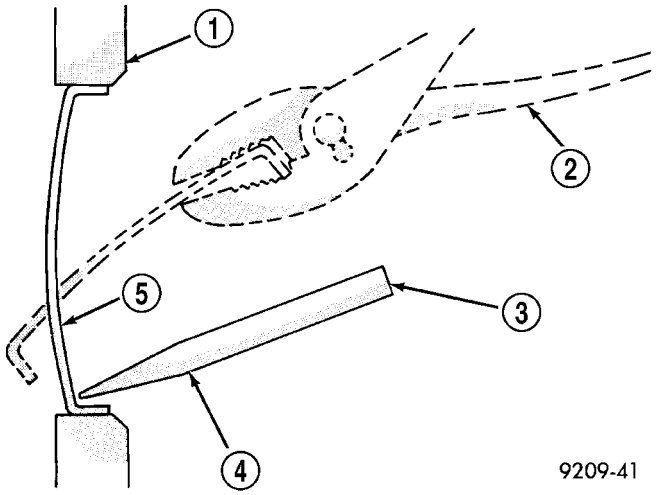


Fig. 26 Core Hole Plug Removal

1 - CYLINDER BLOCK
2 - REMOVE PLUG WITH PLIERS
3 - STRIKE HERE WITH HAMMER
4 - DRIFT PUNCH
5 - CUP PLUG

CAUTION: Do not drive cup plug into the casting as restricted cooling can result and cause serious engine problems.

Thoroughly clean inside of cup plug hole in cylinder block or head. Be sure to remove old sealer. Lightly coat inside of cup plug hole with Mopar® Stud and Bearing Mount. Make certain the new plug is cleaned of all oil or grease. Using proper drive plug, drive plug into hole so that the sharp edge of the plug is at least 0.5 mm (0.020 in.) inside the lead-in chamfer.

It is not necessary to wait for curing of the sealant. The cooling system can be refilled and the vehicle placed in service immediately.

STANDARD PROCEDURE - MEASURING CYLINDER BORES

NOTE: This must be done with engine completely disassembled.

(1) Thoroughly clean all cylinder bores with appropriate cleaning solvent.
(2) Measure each cylinder at the three measuring points shown (Fig. 27).
(3) Using the three measurment point, measure cylinder in the longitudinal and in the transverse direction (Fig. 27).
(4) Use the measurment and table below to group cylinder bores:

Standard size	88.0 mm
Group code letter A	88.000-88.006 mm
Group code letter X	88.006-88.012 mm
Group code letter B	88.012-88.018 mm
Wear limit in longitudinal in transverse direction	0.020 mm
Permissible variation of cylinder shape (when new)	0.000-0.014 mm

ENGINE BLOCK (Continued)

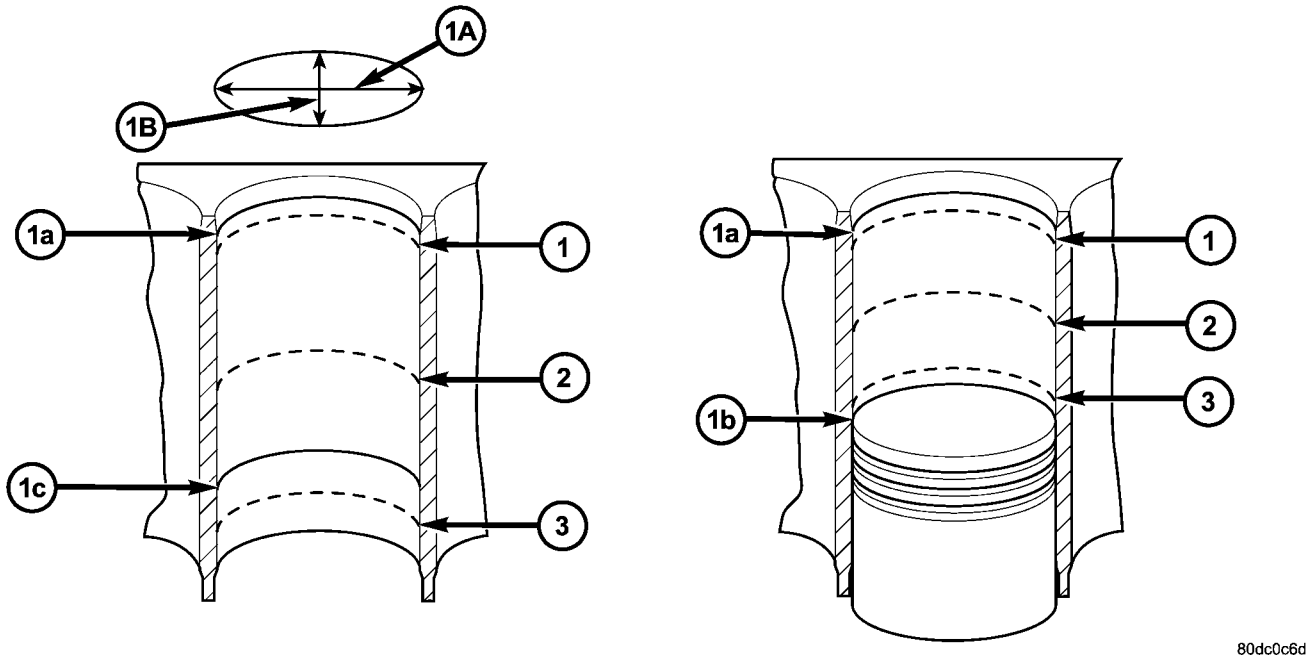


Fig. 27 MEASURING CYLINDER BORES

1 - MEASURING POINT OF CYLINDER BORE
2 - MEASURING POINT OF CYLINDER BORE
3 - MEASURING POINT OF CYLINDER BORE
1a - UPPER REVERSAL POINT OF #1 PISTON RING
1b - BOTTOM DEAD CENTER OF PISTON
1c - BOTTOM REVERSAL POINT OF OIL SCRAPER RING
1A - LONGITUDINAL DIRECTION
1B - TRANSVERSE PDIRECTION

CRANKSHAFT

STANDARD PROCEDURE - MEASURE CRANKSHAFT AND BLOCK JOURNALS

NOTE: After any bearing damage occurred, remove all debris which is present in the main oil gallery, connecting rod bores, and in the crankshaft and oil galleries. Include removal of the inserting steel ball of the main oil gallery before cleaning.

(1) Remove crankshaft (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT - REMOVAL).
(2) Clean all engine parts thoroughly.

CAUTION: After bearing has damage has occurred, replace connecting rods which have suffered overheating because of bearing damage. The connecting rod must not have any cross scores and notches.

(3) Inspect connecting rod. If damage is present, inspect crankshaft, replace as necessary.
(4) Inspect crankcase.
(5) Inspect standard size of crankshaft bearing shells.
(6) Inspect crankshaft bearing cap.
(7) Mount crankshaft radially.
(8) Inspect crankshaft bearing play.

NOTE: Radial mounting of the main bearings of standard size crankshaft is possible by assigning the color-coded bearing shells.

ASSIGN CRANKSHAFT BEARING SHELLS

The oil pan rail of the cylinder block is marked with chisel punches indicating what bearing shell are used.
(9) Assign crankshaft bearing shells.
(10) Mount crankshaft axially.
(11) Inspect crankshaft bearing play.

REMOVAL

(1) Remove engine (Refer to 9 - ENGINE - REMOVAL).
(2) Remove timing case cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL)
(3) Remove end cover.(Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT OIL SEAL - REAR - REMOVAL).
(4) Remove pistons (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON & CONNECTING ROD - REMOVAL).

CRANKSHAFT (Continued)

CAUTION: The crankshaft bearing caps are numbered consecutively, beginning with the first crankshaft bearing cap at the front of the engine. Attention must be paid to the way crankshaft bearing caps fit.

(5) Unbolt crankshaft bearing caps (Fig. 28).

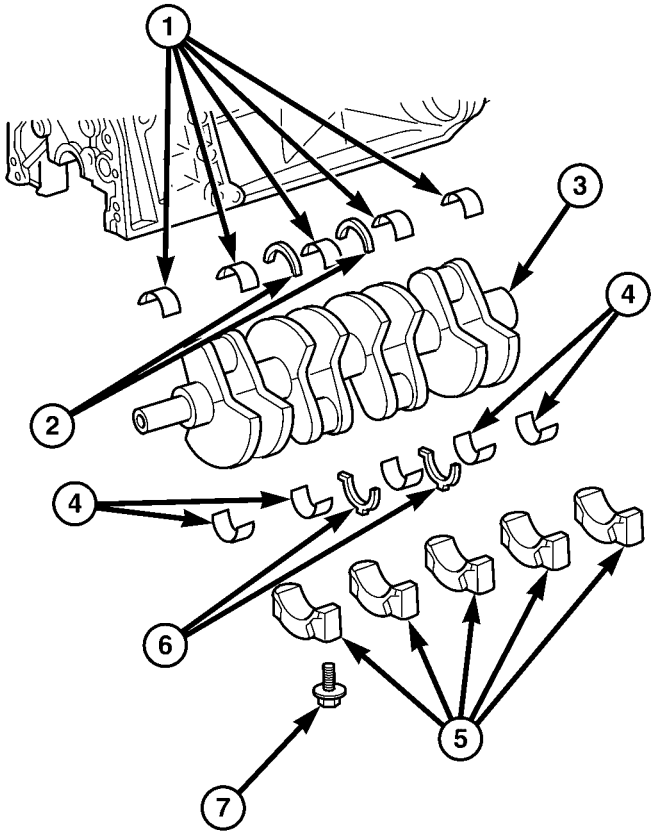


Fig. 28 CRANKSHAFT ASSEMBLY

1 - BEARING HALVES IN ENGINE BLOCK
2 - THRUST WASHERS IN ENGINE BLOCK
3 - CRANKSHAFT
4 - BEARING HALVES IN MAIN BEARING CAPS
5 - MAIN BEARING CAPS
6 - THRUST WASHERS IN MAIN BEARING CAPS
7 - MAIN BEARING BOLTS

(6) Inspect crankshaft bearing caps and bolts for wear and stretching.

(7) Remove crankshaft.

INSTALLATION

CAUTION: Oil the bearing shells before inserting crankshaft.

CAUTION: Oil grooves in the thrust washers must point toward the thrust collars of the crankshaft.

CAUTION: Thrust washers in the bearing cap each have two retaining lugs as a anti-twist lock.

CAUTION: Oil thread and head contact surfaces of bolts that retain the crankshaft bearing caps; tighten bolts from inside to outside, beginning at the fit bearing. Rotate crankshaft to check clearance.

(1) Install crankshaft.

CAUTION: The crankshaft bearing caps are numbered consecutively, beginning with the first crankshaft bearing cap at the front of the engine. Attention must be paid to the way the crankshaft bearing caps fit.

(2) Install the crankshaft bearing caps. Tighten bolts in two stages. 55N·m (40.5 lbs. ft.), then 90°.

(3) Install the pistons (Refer to 9 - ENGINE/ENGINE BLOCK/PISTON & CONNECTING ROD - INSTALLATION).

(4) Install the end cover (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT OIL SEAL - REAR - INSTALLATION).

(5) Install the timing case cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(6) Install the engine (Refer to 9 - ENGINE - INSTALLATION).

(7) Fill the crankcase with the correct engine oil, to the proper level. Refer to the owners manual for specifications.

(8) Fill the cooling system with the proper coolant, to the proper level (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(9) Connect the negative 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 CLOTHES.

(10) Start engine and inspect for leaks. Care must be taken to observe the fuel system warning (Refer to 14 - FUEL SYSTEM - WARNING).

CRANKSHAFT OIL SEAL - REAR

REMOVAL

This must be done with the transmission removed from the vehicle.

(1) Disconnect the negative battery cable.
(2) Raise and support the vehicle.
(3) Drain the engine oil.

NOTE: Loosen all of the oil pan bolts to assure that the oil pan gasket is not damaged when removing the rear main oil seal and end cover assembly.

NOTE: Inspect the oil pan gasket for damage. If the oil pan gasket is damaged, remove the oil pan and replace the oil pan gasket.

(4) Loosen the oil pan bolts.
(5) Remove the flywheel.

CAUTION: Care must be taken when removing the rear main seal and adaptor assembly. Failure to do so will result in damage to the oil pan gasket.

(6) Remove the rear main seal/adaptor retaining bolts and carefully pry the adaptor from the crankcase at the adaptor shoulders (Fig. 29).

INSTALLATION

NOTE: Thoroughly clean all mating surfaces with the appropriate solvents to assure that no grease or oil is present during reassembly.

NOTE: Carefully position the rear main seal/adaptor evenly onto the assembly sleeve. The rear main oil seal lip MUST NOT roll over the edge of the tool.

(1) Position the rear main oil seal/adaptor with assembly sleeve onto the crankshaft so that the dowel sleeves fit into the guide holes (Fig. 29). Care must be taken so that the oil pan gasket is not damaged.

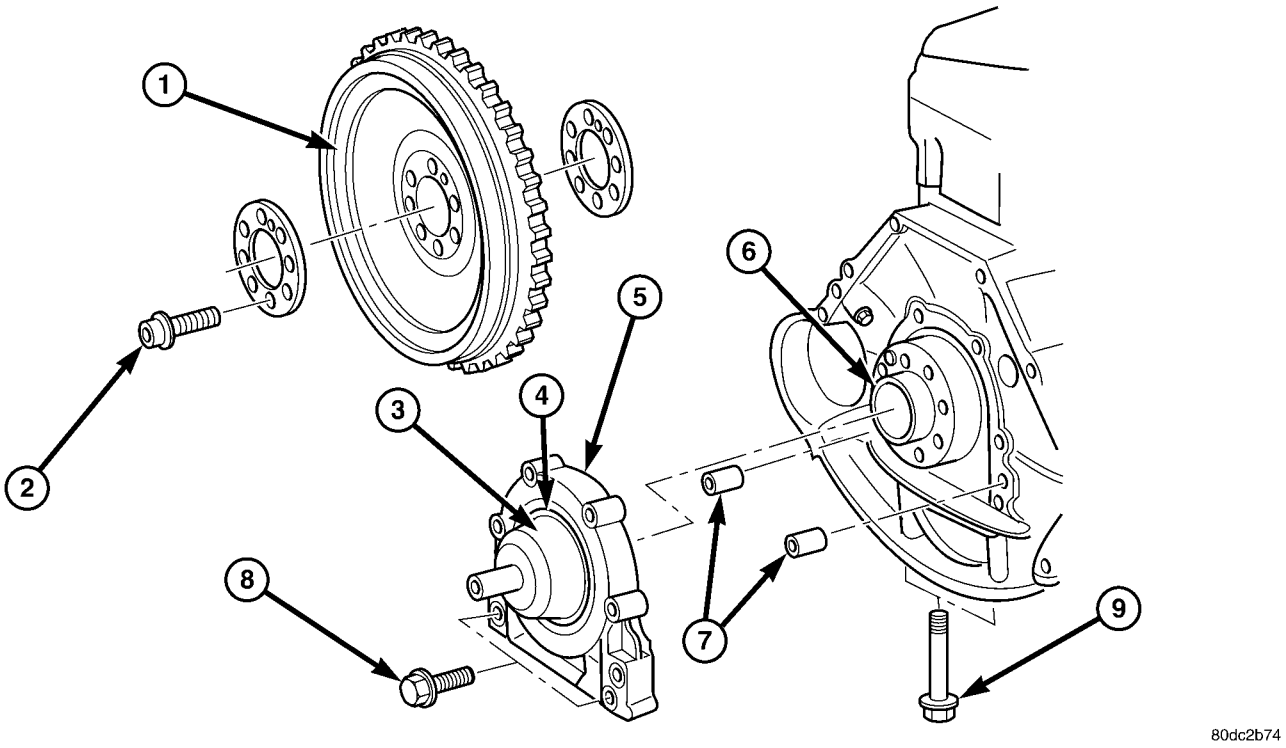


Fig. 29 REAR MAIN SEAL/ADAPTER

1 - FLYWHEEL
2 - FLYWHEEL BOLTS
3 - SPECIAL TOOL 8944
4 - REAR CRANKSHAFT OIL SEAL
5 - REAR CRANKSHAFT SEAL ADAPTER
6 - CRANKSHAFT
7 - ALIGNMENT DOWELS
8 - REAR CRANKSHAFT SEAL ADAPTER RETAINING BOLT
9 - OIL PAN TO REAR CRANKSHAFT SEAL ADAPTER RETAINING BOLT

CRANKSHAFT OIL SEAL - REAR (Continued)

(2) Install the rear main seal/adaptor to crankcase bolts and tighten to 9·Nm (80 lbs.in) (Fig. 29).

(3) Tighten the M6 oil pan bolts to 9N·m (80 lbs in) and the M8 bolts to 20 N·m (15 lbs ft).

(4) Install the fly wheel and tighten bolts in two stages (Fig. 29). 45N·m (33 lbs. ft.) then 90°.

(5) Install the oil pan drain plug and tighten to 25N·m (18 lbs ft).

(6) Lower the vehicle.

(7) Fill the crankcase with the correct engine oil, to the proper level. Refer to owners manual for specifications.

(8) Connect the negative battery cable.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

(9) Start the engine and inspect for leaks.

CRANKSHAFT OIL SEAL - FRONT

REMOVAL

(1) Disconnect the negative battery cable.

(2) Remove the accessory drive belt.

(3) Install the retaining lock for the crankshaft/ ring gear.

NOTE: If the hub of the belt pulley/vibration damper is tight, use a puller to remove it. Do Not tilt the puller. The groves of the puller MUST mesh fully into the slots of the belt pulley.

NOTE: Inspect the running surface of the belt pulley for wear.

(4) Remove the belt pully/vibration damper.

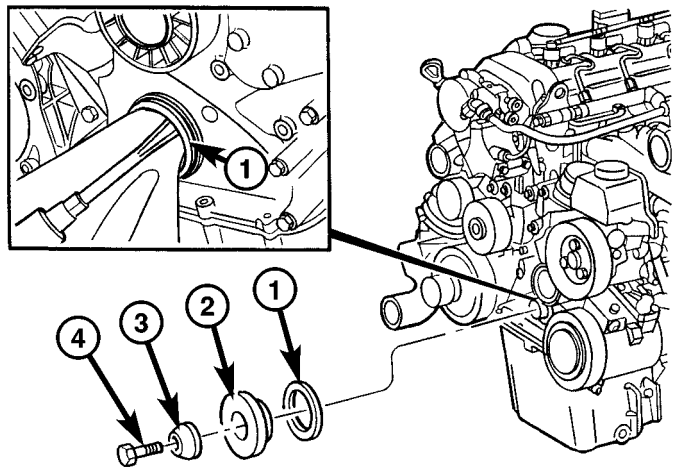
CAUTION: Care must be taken to prevent severe damage to the crankshaft and mounting whole for the front crankshaft seal.

(5) Using a suitable prying tool, remove the front crankshaft seal from the timing cover (Fig. 30).

INSTALLATION

NOTE: Thoroughly clean all mating surfaces with the appropriate solvents to assure that no grease or oil is present during reassembly.

NOTE: Carefully position the front crankshaft seal evenly onto the timing cover.



80e20aea

Fig. 30 FRONT SEAL REMOVAL/INSTALLATION

1 - FRONT CRANKSHAFT OIL SEAL
2 - SEAL INSTALLER SPECIAL TOOL #8936
3 - WASHER
4 - RETAINING BOLT

(1) Install the front crankshaft seal.

(2) Install the belt pulley/vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - INSTALLATION).

(3) Remove the retaining lock for the crankshaft/ ring gear.

(4) Install the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(5) Reconnect the negative battery cable.

(6) Fill the crankcase with the correct engine oil to the proper 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 CLOTHES.

(7) Start the engine and inspect for leaks.

FLYWHEEL

REMOVAL

(1) Remove transmission (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - W5J400 - REMOVAL).

NOTE: M6x90 bolts must be used with retaining lock to prevent damage to rear end cover.

(2) Install retaining lock for crankshaft/starter ring gear.

NOTE: Flywheel does not need balancing or should it be interchanged.

(3) Remove flywheel with both inner and outer washers (Fig. 31).

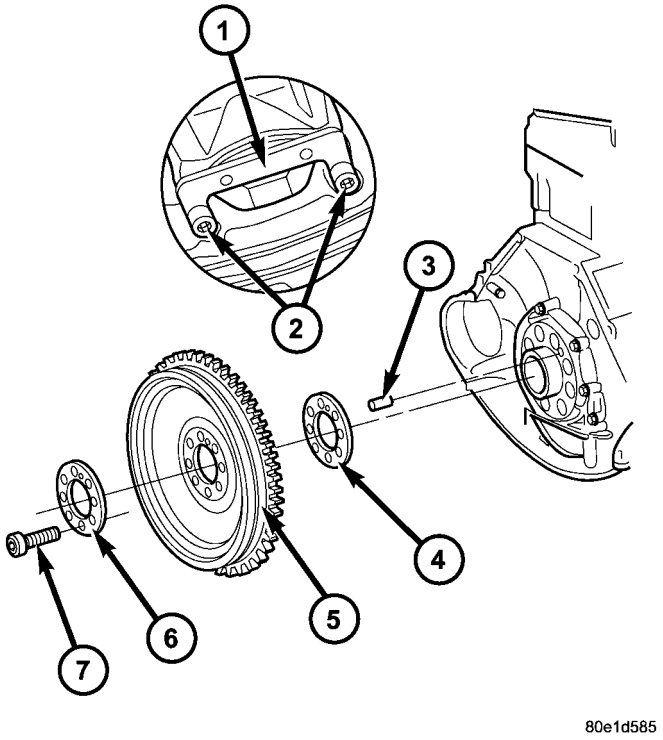


Fig. 31 FLYWHEEL ASSEMBLY

1 - SPECIAL TOOL #8932 CRANKSHAFT LOCK
2 - RETAINING BOLTS
3 - ALIGNMENT PIN
4 - WASHER
5 - FLYWHEEL
6 - FLYWHEEL
7 - FLYWHEEL BOLT

INSTALLATION

INSTALLATION

NOTE: A flex rod torque wrench must not be used in order to avoid angle errors when tightening to degrees.

(1) Align flywheel and inner and outer washers with straight pin. Tighten bolts in two stages. 45N·m (33 lbs. ft.) then 90°.
(2) Remove the retaining lock from the crankshaft/starter ring gear.
(3) Install transmission (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - W5J400 - INSTALLATION).
(4) Connect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS IN OPERATION. 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 CLOTHES.

(5) Start the vehicle.

INSTALLATION

(1) Raise and support the vehicle.
(2) Remove the generator wiring harness duct at the crankcase and set aside.
(3) Remove inspection cover (Fig. 32).
(4) Remove the bolts (Fig. 32).
(5) Insert the crankshaft lock #8932 into the starter ring gear and install the retaining bolts. Tighten the lock bolts to 9 N·m (80 lbs. in.) (Fig. 32).

FLYWHEEL (Continued)

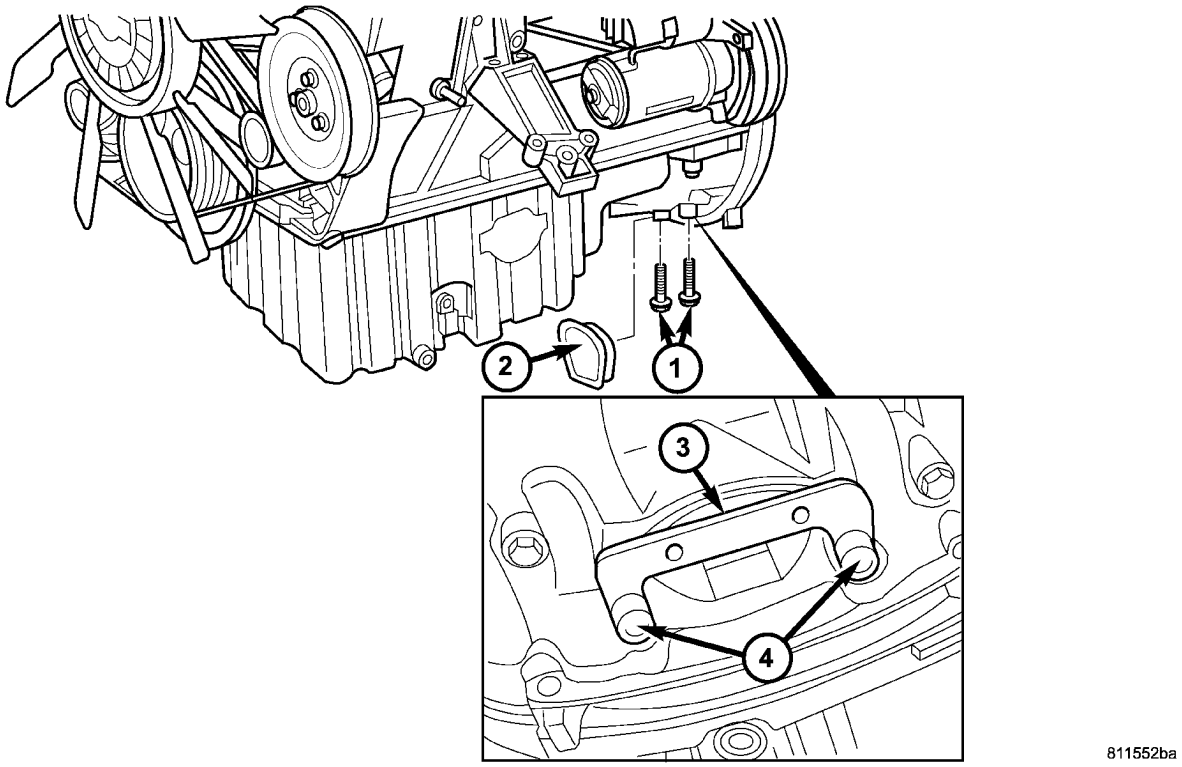


Fig. 32 CRANKSHAFT LOCK #8932

1 - RETAINING BOLTS
2 - INSPECTION COVER
3 - CRANKSHAFT LOCK #8932
4 - RETAINING BOLTS

PISTON & CONNECTING ROD

DESCRIPTION

The pistons are of a free floating design. Oil jets in the engine block lubricate and cool the piston and pin assembly. The connecting rods have a pressed in place wrist pin bushing which is lubricated by the oil jets (Fig. 33).

STANDARD PROCEDURE

STANDARD PROCEDURE - CHECKING AND REPAIRING CONNECTING RODS

NOTE: Connecting rods with blue discoloration, cross scores or notches must be replaced. Compensate for different weights by milling off the balancing weight.

(1) Inspect connecting rod for discoloring, cross scores and notches.

NOTE: Connecting rod and bearing cap are marked in sets and attached with two sleeves.

(2) Bolt connecting rod bearing cap to connecting rod. Tighten connecting rod bearing caps to initial specification (Refer to 9 - ENGINE/ENGINE BLOCK/ PISTON & CONNECTING ROD - INSTALLATION).

NOTE: If the maximum permissible diameter is exceeded, grind off contact surface of connecting rod bearing cap by a Maximum of 0.02mm.

(3) Using a dial indicator, measure connecting rod bearing basic bore, repair as necessary (Fig. 34).

NOTE: If excessive wear is present, press in new connecting rod bushings.

(4) Measure connecting rod bushing inner diameter (Fig. 34).
(5) Inspect wristpin bushing.
(6) Measure piston pin end play in connecting rod bushing.

PISTON & CONNECTING ROD (Continued)

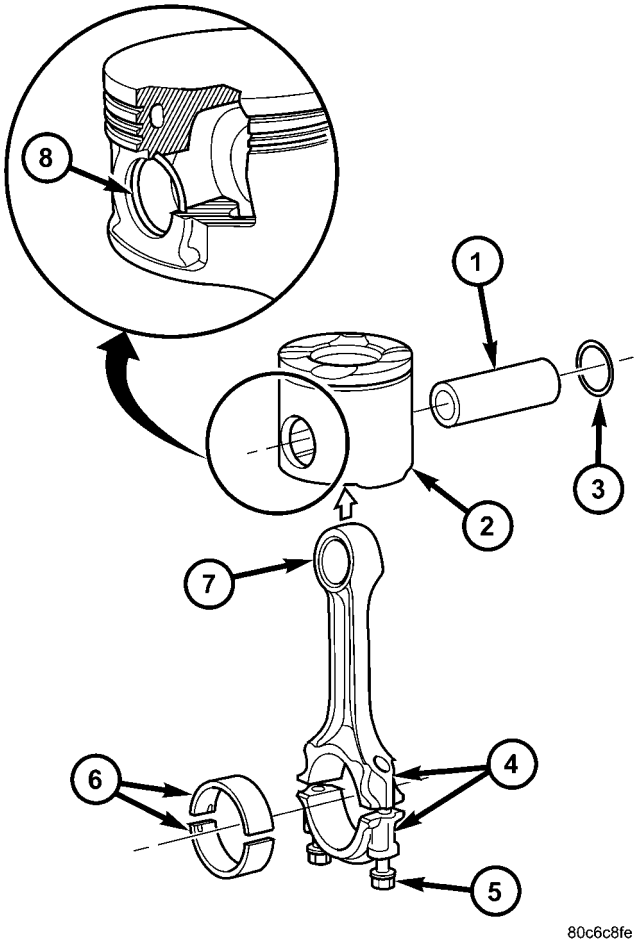


Fig. 33 PISTON AND CONNECTING ROD ASSEMBLY

1 - PISTON PIN
2 - PISTON
3 - SNAP RING
4 - CONNECTING ROD ALIGNMENT NUMBERS
5 - CONNECTING ROD BOLT
6 - CONNECTING ROD BEARING
7 - CONNECTING ROD
8 - SNAP RING

(7) Measure peak to valley height of connecting rod bushing on inside.

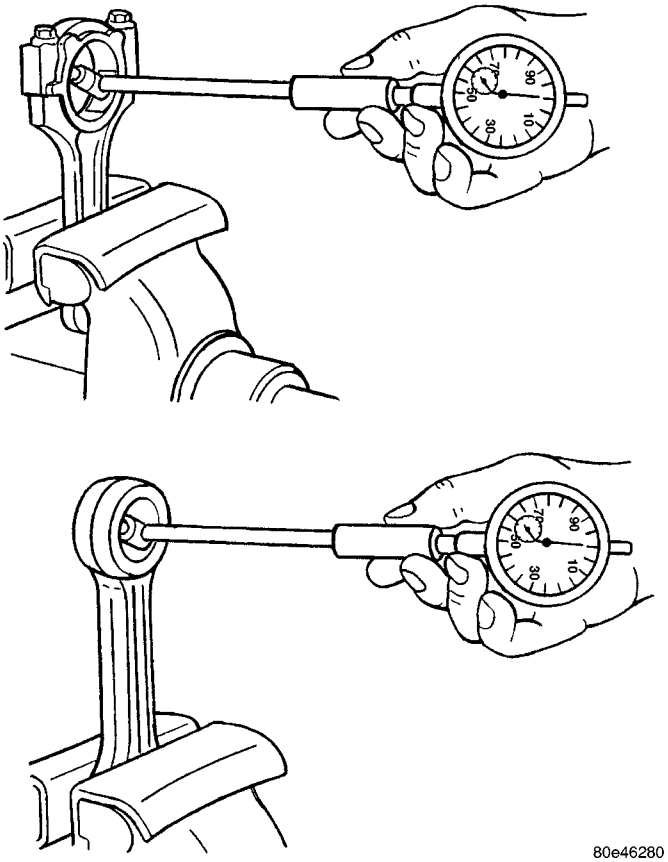


Fig. 34 MEASURING CONNECTING RODS

PISTON & CONNECTING ROD (Continued)

CONNECTING ROD SPECIFICATIONS

Distance between middle connecting rod bore to connecting rod bushing bore	148.970 mm to 149.030 mm
Width of connecting rod bearing bore at connecting rod bushing bore	21.940 mm to 22 mm
Connecting rod bearing shell basic bore	51.600 mm to 51.614 mm
Allowable out-of-roundness and taper of basic bore	.020 mm
Allowable twist of connecting rod bearing bore to connecting rod bushing bore over a length of 100 mm	.100 mm
Allowable variation of axial parallelism of connecting rod bearing bore to connecting rod bushing bore over a length of 100 mm	.045 mm
Allowable difference in weight of complete connecting rod of an engine	2g
Connecting rod inner bushing	30.018 to 30.024 mm
Connecting rod outer bushing	32.575 mm to 32.600 mm
Connecting rod basic bore	32.500 mm to 32.525 mm
Piston pin play in connecting rod	.018 mm to .024 mm
Peak-to-Valley height (Rz) of connecting rod bushing on inside	5
Connecting rod bolt thread	M8 x 1

STANDARD PROCEDURE - MEASURING PISTON PROTRUSION

After replacing the pistons/connecting rods or machining the engine block contact surface, it is then necessary to measure the piston protrusion.

Measure protrusion between piston crown and cylinder head contact surface without the head gasket installed. The measurment must be carried out in the direction of the piston pin in order to eliminate piston rock.

(1) Measure piston protrusion at the two measuring points (arrows) (Fig. 35).

Piston protrusion with new crankcase should be 0.38 - 0.62 mm.

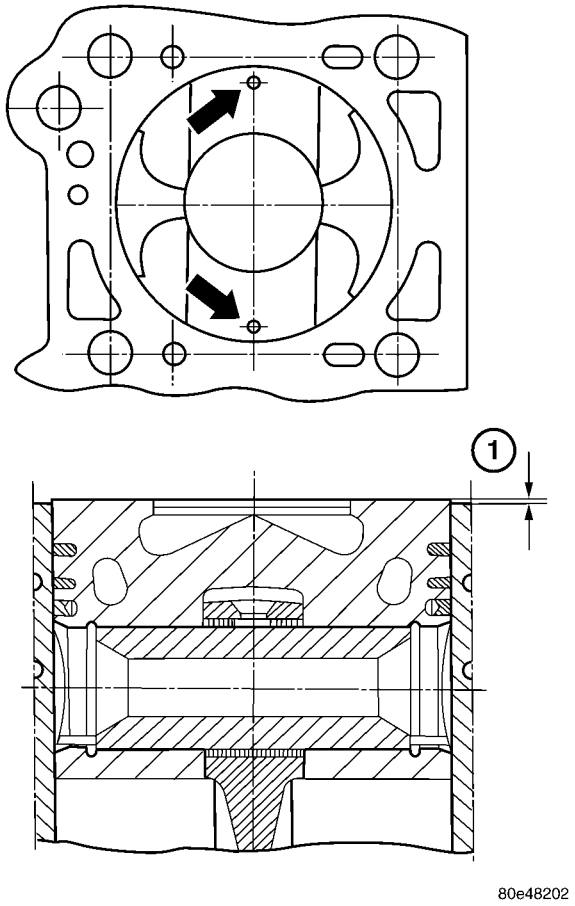


Fig. 35 MEASURING PISTON PROTRUSION

1 - PISTON PROTRUSION MEASUREMENT

REMOVAL

(1) Disconnect the negative battery cable.

(2) Remove the engine (Refer to 9 - ENGINE - REMOVAL).

(3) Remove the cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).

(4) Remove the oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).

(5) Push back on the chain tensioner and remove the oil pump chain from the oil pump.

(6) Remove the oil pump.

NOTE: Mark the connecting rod and connecting rod bearing cap to each other at the inlet side.

(7) Remove the connecting rod bearing cap.

PISTON & CONNECTING ROD (Continued)

NOTE: Do Not mix up the top and bottom connecting rod bearing shells.

(8) Mark the connecting rod bearing shell and the connecting rod bearing cap to each other.

NOTE: If the pistons are used, the direction of travel arrows and the marking of the pistons may no longer be visible because of carbon deposits. The carbon deposits on the pistons must be removed.

NOTE: If the arrows indicating the driving direction on the piston are no longer visible, they must be marked again.

(9) Remove the connecting rod together with the piston through the top of the engine.

NOTE: DO NOT mix up the top and bottom connecting rod bearing shells.

(10) Mark the connecting rod bearing shell and connecting rod to each other.

CAUTION: Care must be taken not to damage the piston.

(11) Remove the piston pin circle clip. (Fig. 36).

(12) Press the piston pin out of the piston and connecting rod bushing. (Fig. 36).

(13) Inspect the connecting rod for wear and damage.

INSTALLATION

(1) Assign piston to the cylinder bore.

(2) Using the appropriate clean engine oil, oil piston pin and connecting rod bushing.

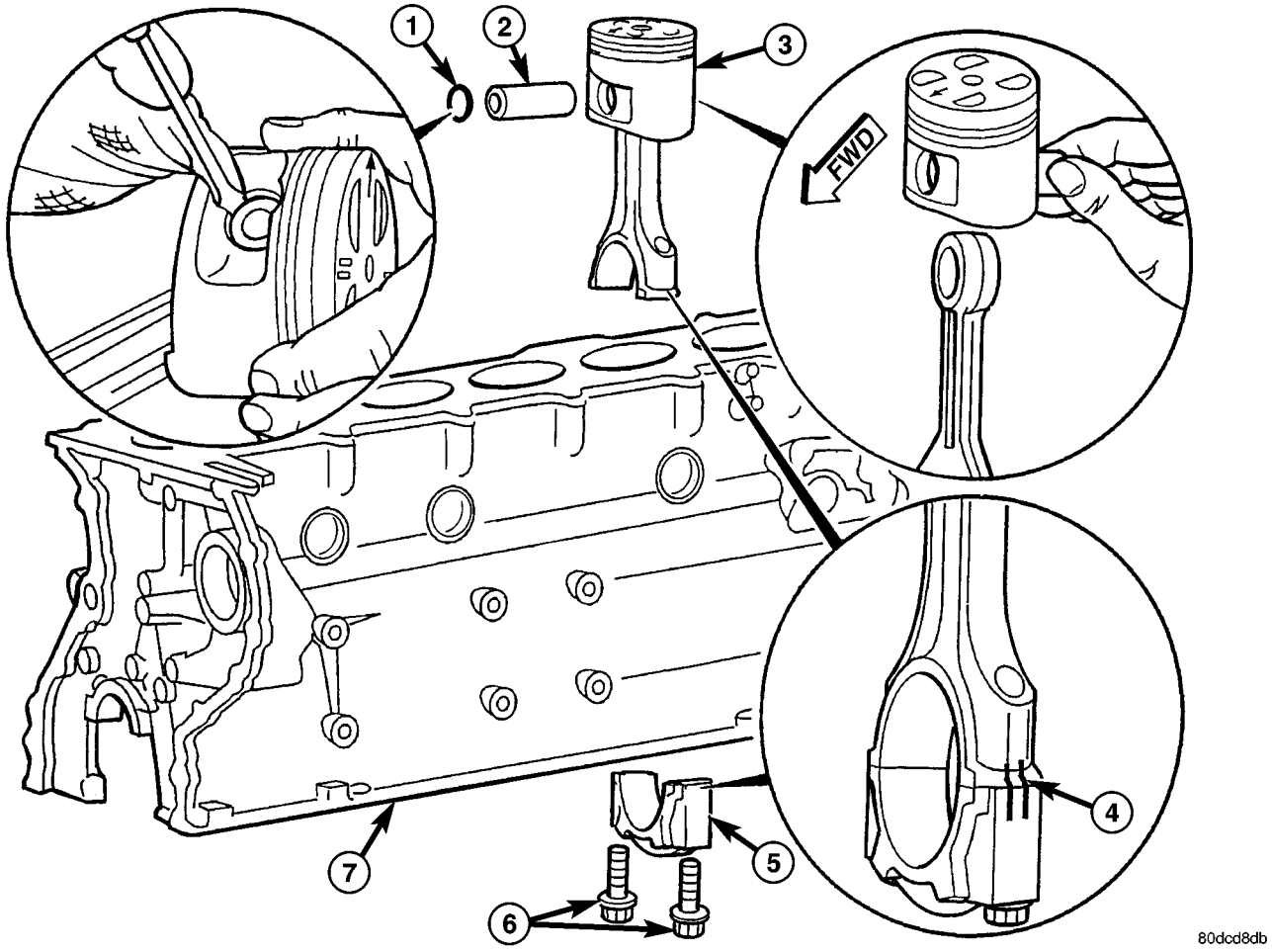


Fig. 36 PISTON AND CONNECTING ROD ASSEMBLY

1 - PISTON PIN CIRCLIP
2 - PISTON PIN
3 - PISTON ASSEMBLY
4 - CONNECTING ROD AND CAP ALIGNMENT MARKS
5 - CONNECTING ROD CAP
6 - CONNECTING ROD BOLTS
7 - ENGINE BLOCK

PISTON & CONNECTING ROD (Continued)

CAUTION: Assemble the piston and connecting rod so that the arrow is pointing in the direction of travel (in the opposite direction of power flow). The marking on the connecting rod is pointing toward the inlet side.

(3) Assemble piston and connecting rod (Fig. 37).
(4) Insert piston pin by hand (Fig. 37).

CAUTION: Care must be taken not to damage the piston.

(5) Insert circle clip of piston pin into groove on piston (Fig. 37).

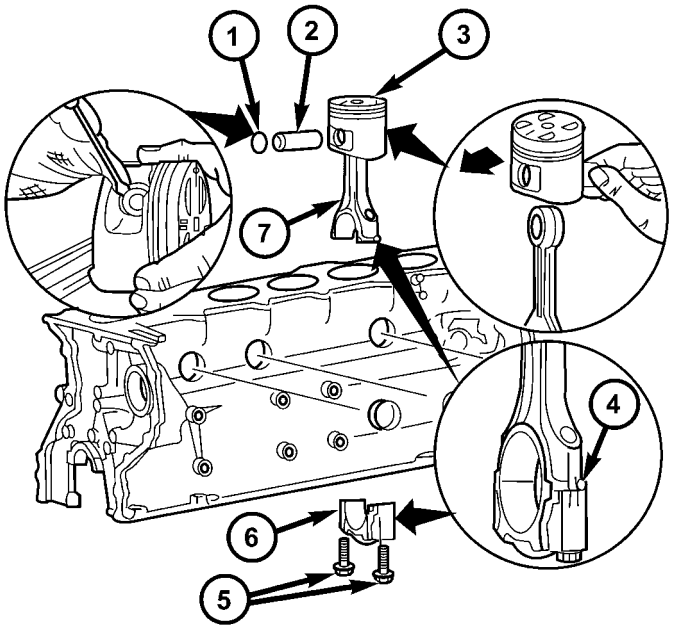


Fig. 37 PISTON AND CONNECTING ROD ASSEMBLY

1 - CIRCLE CLIP
2 - PISTON PIN
3 - PISTON ASSEMBLY
4 - CONNECTING ROD ALIGNMENT MARKINGS
5 - CONNECTING ROD BOLTS
6 - CONNECTING ROD CAP
7 - CONNECTING ROD

(6) Using the appropriate clean engine oil, clean the cylinder bores, connecting rod bearing journals, connecting rod bearing shells and pistons.

CAUTION: Offset the piston ring gaps by 120°.

(7) Position a ring compressor over piston and rings. Tighten ring compressor (Fig. 38).**Ensure that ring position does not change during this operation.**

CAUTION: Rotate the crankshaft sufficiently so that the connecting rod does not touch the connecting rod journal when the piston is pushed onto the cylinder bore.

(8) Install piston with arrow pointing in the direction of travel (in the opposite direction to power flow) (the marking on the connecting rod should be pointing toward the inlet side). (Fig. 38).
(9) Clean and inspect the connecting rod bolts.

CAUTION: Assure that the correct top and bottom connecting rod bearings shells are used in accordance with the markings.

CAUTION: The anti-twist locks of the connecting rod bearing shells must be located in the slots of the connecting rod bearing caps.

(10) Insert connecting rod bearing shell into connecting rod bearing cap.

CAUTION: The markings on the connecting rod and connecting rod cap must be lined up.

(11) Install connecting rod bearing cap. Tighten bolts in 3 stages, 5N·m (44 lbs in), 25N·m (221 lbs in), 90°.
(12) Rotate crankshaft fully and check the clearance.
(13) Install oil pump (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - INSTALLATION).
(14) Install engine oil pan and oil pan drain plug (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

CAUTION: Install a cylinder head gasket of standard thickness or a cylinder head gasket of repair thickness depending on piston protrusion.

(15) Measure piston protrusion (Refer to 9 - ENGINE/ENGINE BLOCK - STANDARD PROCEDURE).
(16) Install cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).
(17) Install engine (Refer to 9 - ENGINE - INSTALLATION).
(18) Fill the crankcase with correct engine oil, to proper level. Refer to owners manual for specifications.
(19) Fill the cooing system with proper coolant, to the proper level (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).
(20) Connect negative 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 CLOTHES.

PISTON & CONNECTING ROD (Continued)

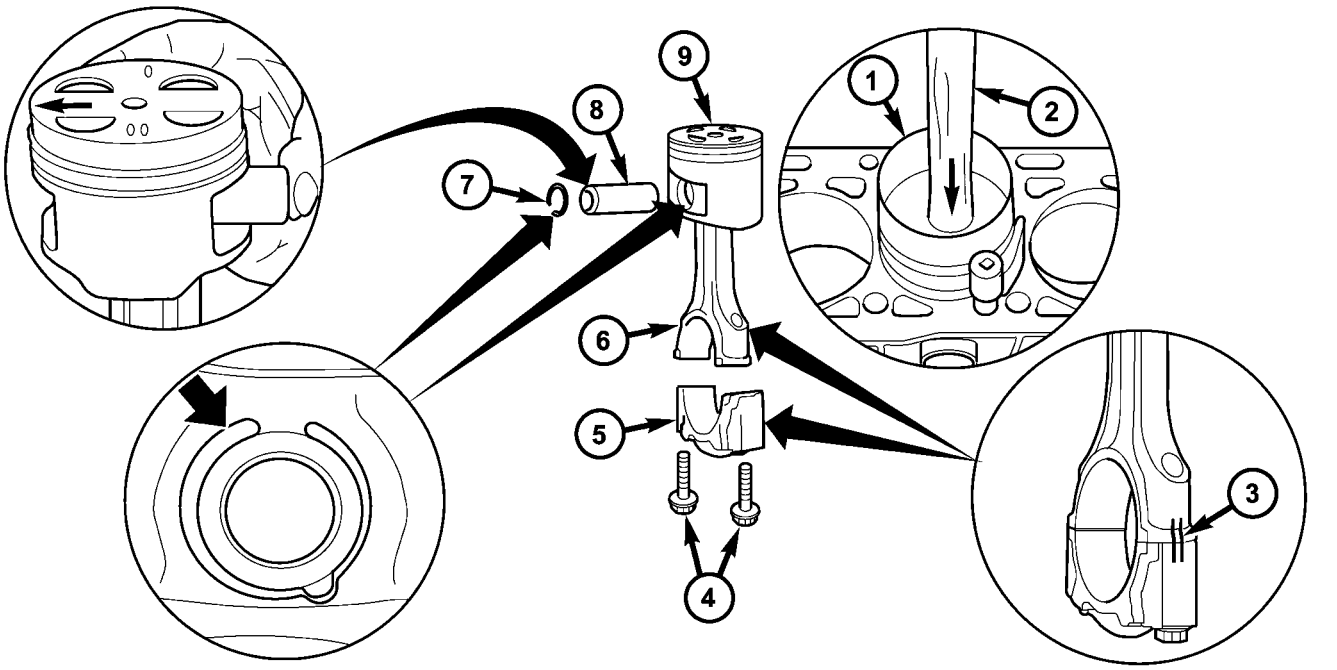


Fig. 38 PISTON AND CONNECTING ROD INSTALLATION

1 - PISTON RING COMPRESSOR
2 - WOOD HAMMER HANDLE
3 - CONNECTING ROD ALIGNMENT MARKINGS
4 - CONNECTING ROD BOLTS
5 - CONNECTING ROD CAP
6 - CONNECTING ROD
7 - CIRCLE CLIP
8 - PISTON PIN
9 - PISTON ASSEMBLY

WARNING: (Refer to 14 - FUEL SYSTEM - WARNING).

(21) Start the engine and inspect for leaks.

PISTON RINGS

STANDARD PROCEDURE - 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. 39). Rotate the ring in the groove. It must move freely around circumference of the groove.

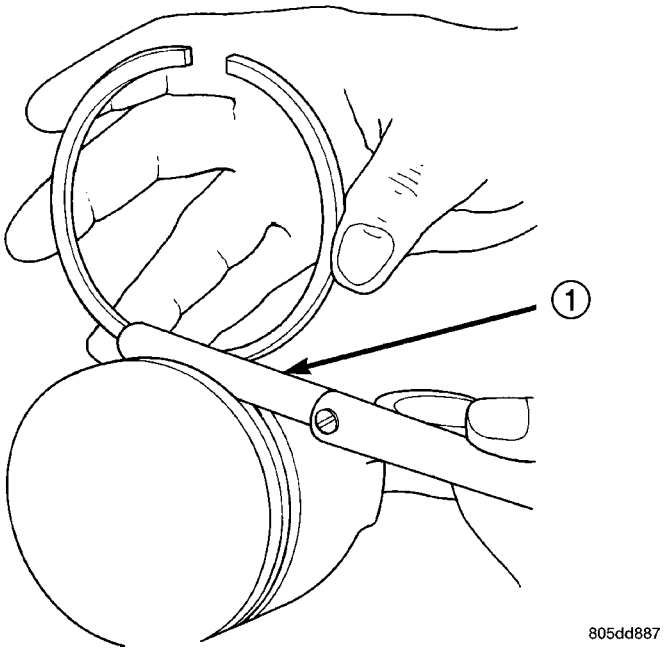


Fig. 39 Measuring Piston Ring Side Clearance

1 - FEELER GAUGE

RING SIDE CLEARANCE CHART

ITEM	SPECIFICATION
Top Compression Ring	0.012 - 0.016 mm (0.0047 - 0.0063 in.)
Second Compression Ring	0.05 - 0.09 mm (0.0019 - 0.0035 in.)
Oil Control Ring	0.03 - 0.07 mm (0.0011 - 0.0027 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. 40).

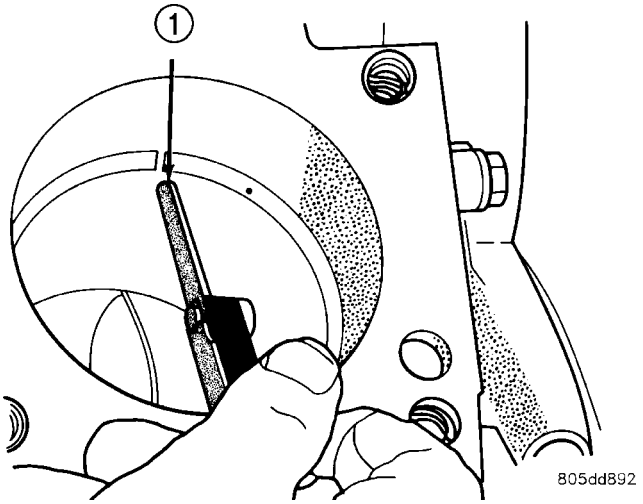


Fig. 40 Ring

1 - FEELER GAUGE

RING GAP MEASUREMENT CHART

ITEM	SPECIFICATION
Top Compression Ring	0.229 - 0.610 mm (0.0090 - 0.0240 in.)
Second Compression Ring	0.483 - 0.965 mm (0.0190 - 0.080 in.)
Oil Control Ring	0.254 - 1.500 mm (0.010 - 0.060 in.)

(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) Using a ring expander, install compression rings with manufactures designation pointing toward piston crown (Fig. 41).

Ring Gap Orientation

- Position the gaps on the piston as shown (Fig. 42).
- 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 120° from top oil rail gap.

PISTON RINGS (Continued)

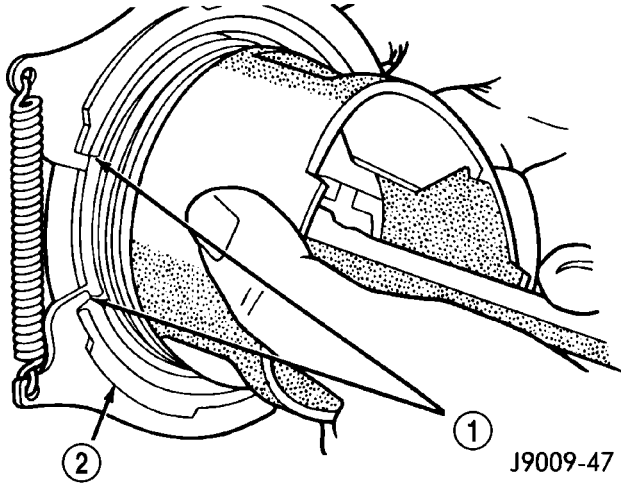


Fig. 41 Compression Ring Installation

1 - COMPRESSION RING
2 - RING EXPANDER RECOMMENDED

- No. 1 Compression ring - Gap 120° from No. 2 compression ring gap.

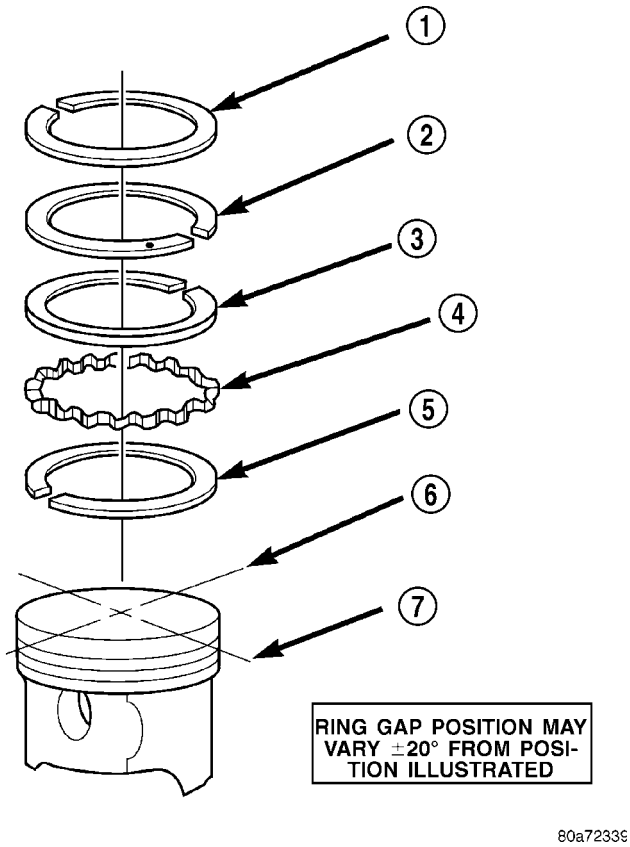


Fig. 42 Ring Gap Orientation

1 - TOP COMPRESSION RING
2 - BOTTOM COMPRESSION RING
3 - TOP OIL CONTROL RAIL
4 - OIL RAIL SPACER
5 - BOTTOM OIL CONTROL RAIL
6 - IMAGINARY LINE PARALLEL TO PISTON PIN
7 - IMAGINARY LINE THROUGH CENTER OF PISTON SKIRT

VIBRATION DAMPER

REMOVAL

(1) Disconnect negative battery cable.
(2) Remove accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).
(3) Install retaining lock for crankshaft/ring gear (Fig. 43).
(4) Remove crankshaft center bolt and washer (Fig. 43).

NOTE: If hub of belt pulley/vibration damper is tight, use puller # 8940 to remove. DO NOT tilt puller when in use. Grooves of the puller must mesh fully into the slots of the belt pulley.

(5) Remove the belt pulley/vibration damper (Fig. 43).

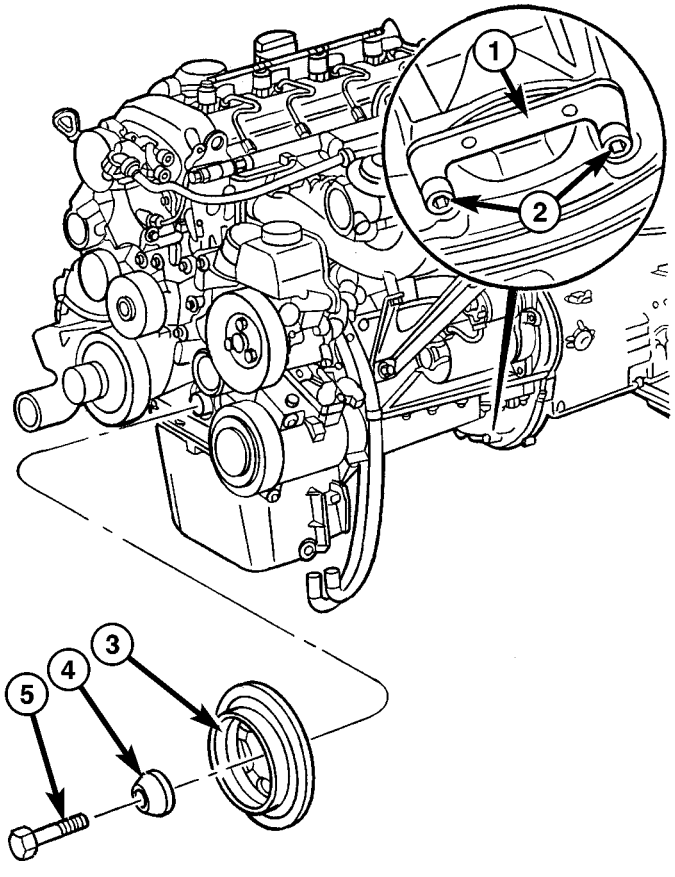


Fig. 43 VIBRATION DAMPER/CRANKSHAFT PULLEY

1 - SPECIAL TOOL #8932
2 - RETAINING BOLTS
3 - VIBRATION DAMPER/CRANKSHAFT PULLEY
4 - WASHER
5 - CRANKSHAFT BOLT

VIBRATION DAMPER (Continued)

NOTE: If grooves can be felt in the belt pulley/vibration damper during inspection, the pulley/damper must be replaced.

(6) Inspect hub at belt pulley/vibration damper for wear grooves.
(7) Replace front crankshaft seal.

INSTALLATION

NOTE: Align parallel key, fix in place with grease. Turn to ensure the slot is aligned with parallel key in crankshaft.

NOTE: Front crankshaft seal must be replaced before installing the belt pulley/vibration damper.

(1) Position the belt pulley/vibration damper.
(2) Install crankshaft center bolt and washer. Tighten bolt in two stages. M8.8 bolt to 200N·m (148 lbs. ft.) then 90°, M10.9 bolt to 325N·m (240 lbs. ft.) then 90°.
(3) Remove the retaining lock for the crankshaft/ring gear (Fig. 43).

NOTE: Inspect accessory drive belt for wear. Replace as necessary.

(4) Install accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
(5) Reconnect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS IN OPERATION. 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 vehicle and inspect for leaks.

VACUUM PUMP

DESCRIPTION

The vacuum pump is operated by a slotted extension attached to the vacuum pump shaft. The vacuum pump shaft slotted extension fits into, and is driven by, the exhaust camshaft gear.

The vacuum pump is a constant displacement, vane-type pump. Vacuum is generated by vanes mounted in the pump rotor. The rotor is located in the pump housing and is pressed onto the pump shaft.

The vacuum pump rotating components are internally lubricated.

The vacuum pump is not serviceable and must be replaced as a unit. Do not disassemble or attempt to repair the pump.

OPERATION

Vacuum pump output is transmitted to the Heater, Electronic, Vacuum, Air Conditioner (HEVAC) and speed control, systems through a supply hose. The hose is connected to an outlet port on the pump housing and uses an in-line check valve to retain system vacuum when vehicle is not running.

Pump output ranges from a minimum of 8.5 to 25 inches vacuum.

The pump rotor and vanes are rotated by the pump drive gear. The drive gear is operated by the exhaust camshaft gear.

REMOVAL

(1) Disconnect negative battery cable.
(2) Remove vacuum line at vacuum pump (Fig. 44).

NOTE: Observe position of driver on rear of pump.

(3) Remove vacuum pump and seals (Fig. 44)

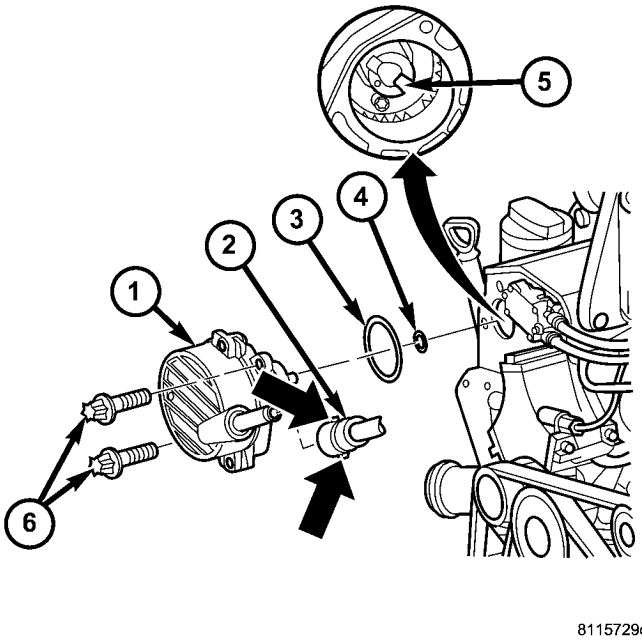


Fig. 44 VACUUM PUMP

1 - VACUUM PUMP
2 - VACUUM LINE
3 - O-RING
4 - O-RING
5 - EXHAUST CAMSHAFT
6 - BOLTS

(4) Clean all sealing surfaces.

VACUUM PUMP (Continued)

INSTALLATION

(1) Clean all sealing surfaces.
(2) Position driver on rear of pump and install vacuum pump with new seals. Tighten bolts to 14N·m (124 lbs. in.). (Fig. 44)
(3) Install vacuum line to vacuum pump (Fig. 44).
(4) Connect negative 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 CLOTHES.

(5) Start the engine and inspect for leaks.

LEFT MOUNT

REMOVAL

(1) Install engine support fixture #8534 with adaptors #8534–16 and raise the engine slightly.
(2) Raise and support the vehicle.
(3) Remove the engine mount bolts (Fig. 45)
(4) Lower the vehicle.
(5) Using the engine support fixture # 8934, raise the engine until the weight is no longer on the mounts.
(6) Raise and support the vehicle.
(7) Remove the engine mount nuts and remove the mount (Fig. 45)

INSTALLATION

(1) Position the engine mount into the stop plate (Fig. 45)
(2) Position the engine mount into position and tighten the retaining nuts to 45 N·m (33 lbs. ft.) (Fig. 45)
(3) Lower the vehicle.
(4) Lower the engine on to the engine mounts until they contact (Fig. 45)
(5) Hand tighten the engine support to engine mount bolt (Fig. 45).
(6) Lower the engine on to the engine mount and tighten bolt to 83 N·m (61 lbs.ft.) (Fig. 45)
(7) Remove the engine support fixture and adaptors.

RIGHT MOUNT

REMOVAL

(1) Install engine support fixture #8534 with adaptors #8534-16 and raise the engine slightly.

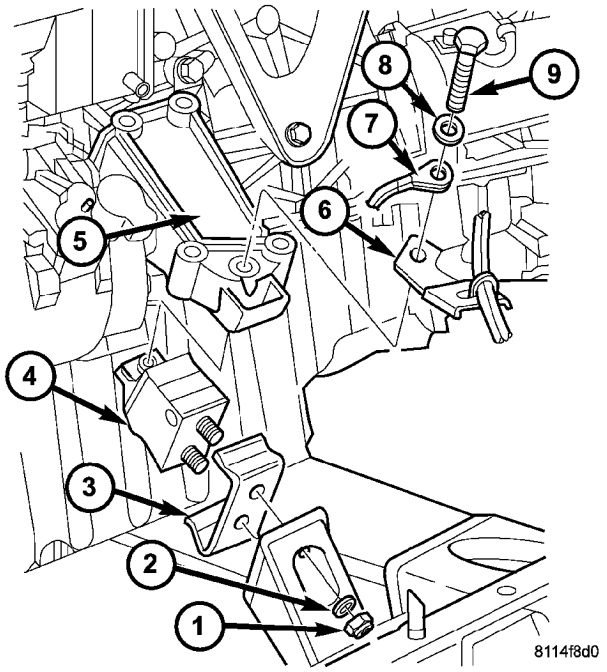


Fig. 45 LEFT ENGINE MOUNT

1 - NUT
2 - WASHER
3 - STOP PLATE
4 - ENGINE MOUNT
5 - ENGINE SUPPORT
6 - BRACKET
7 - GROUND CABLE
8 - WASHER
9 - BOLT

(2) Raise and support the vehicle.
(3) Remove the engine mount bolts (Fig. 46)
(4) Lower the vehicle.
(5) Using the engine support fixture, raise the engine until the weight is no longer on the mounts.
(6) Raise and support the vehicle.
(7) Remove the engine mount nuts and remove the mount (Fig. 46)

INSTALLATION

(1) Position the engine mount into the stop plate (Fig. 46)
(2) Position the engine mount into position and tighten the retaining nuts to 45 N·m (33 lbs. ft.) (Fig. 46)
(3) Lower the vehicle.
(4) Lower the engine on to the engine mounts until they contact (Fig. 46)
(5) Hand tighten the engine support to engine mount bolt (Fig. 46).
(6) Lower the engine on to the engine mount and tighten bolt to 83 N·m (61 lbs.ft.) (Fig. 46)

RIGHT MOUNT (Continued)

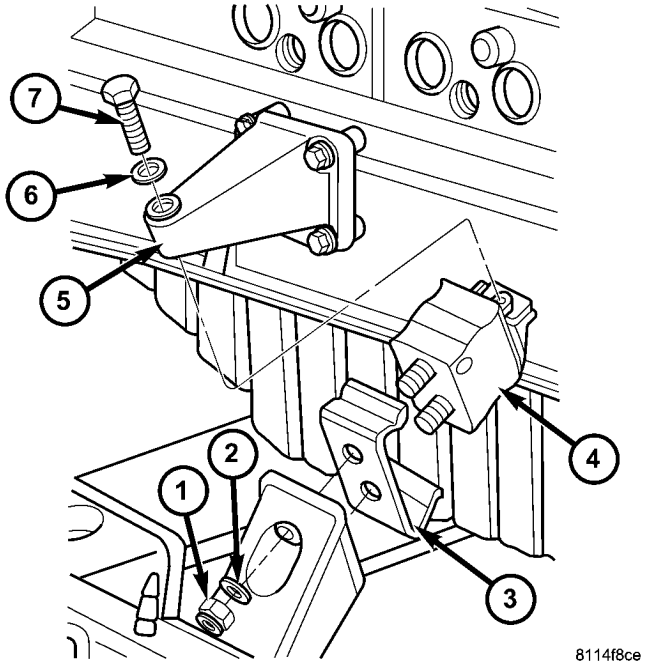


Fig. 46 RIGHT ENGINE MOUNT

1 - NUT
2 - WASHER
3 - STOP PLATE
4 - ENGINE MOUNT
5 - ENGINE SUPPORT
6 - WASHER
7 - BOLT

(7) Remove the engine support fixture and adaptors.

OIL

REMOVAL - OIL SEPARATOR

(1) Disconnect breather hose.
(2) Remove the separator retaining bolts
(3) Twist to remove oil separator from cover.

INSTALLATION - OIL SEPARATOR

(1) Lubricate the oil separator o - ring with clean engine oil.
(2) Position separator above cover and apply downward pressure to seat.
(3) Install retaining bolts and tighten to 8N·m (70 lbs. in.).
(4) Connect breather hose.

OIL COOLER & LINES

REMOVAL

WARNING: RISK OF INJURY TO SKIN AND EYES DUE TO SCALDING FROM HOT COOLANT. DO NOT OPEN THE COOLING SYSTEM UNLESS THE TEMPERATURE IS BELOW 194°F (90°C). WEAR PROTECTIVE CLOTHING AND EYE WEAR. RISK OF POISONING IF COOLANT IS SWALLOWED. STORE COOLANT IN PROPER AND APPROPRIATELY MARKED CONTAINERS.

(1) Drain cooling system.
(2) Remove the oil filter.
(3) Remove the coolant hoses from the oil cooler (Fig. 47).
(4) Remove the oil cooler from the timing case cover (Fig. 47).

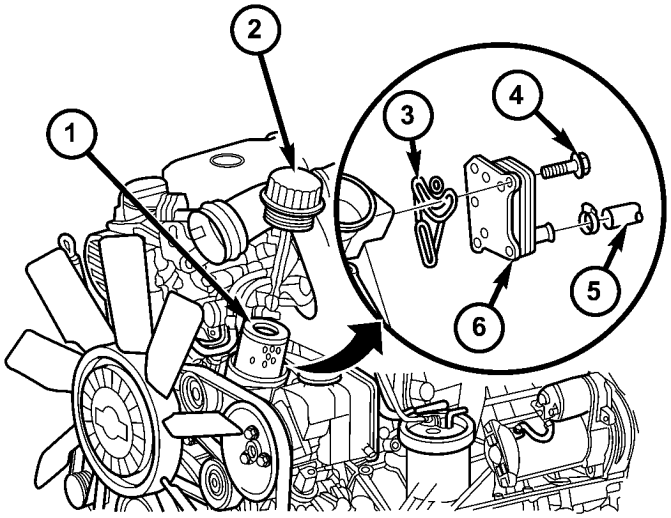


Fig. 47 ENGINE OIL COOLER

1 - OIL FILTER
2 - OIL FILTER COVER
3 - GASKET
4 - BOLT
5 - COOLANT HOSE
6 - ENGINE OIL COOLER

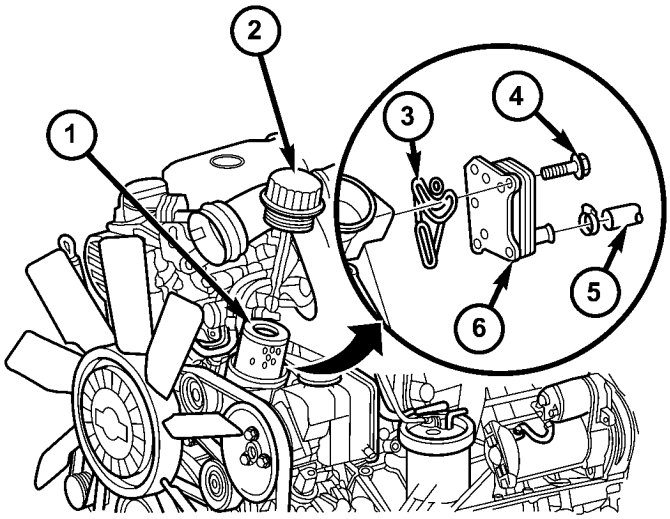
INSTALLATION

(1) Clean all sealing surfaces.
(2) Install the engine oil cooler to the timing case cover with a new gasket. Tighten bolts to 14N·m (124 lbs. in.) (Fig. 47).
(3) Reconnect the coolant hoses and tighten clamps.
(4) Install new oil filter and tighten oil filter cap to 25N·m (18 lbs. ft.) (Fig. 47).
(5) Refill cooling system.
(6) Start engine and inspect for leaks.
(7) Turn engine off and check engine oil level. Add as necessary.

OIL FILTER

REMOVAL

(1) Unscrew the oil filter cap (Fig. 48)
(2) Remove clean and inspect cap gasket, replace as necessary.
(3) Remove oil filter (Fig. 48).



81156f45

Fig. 48 ENGINE OIL COOLER

1 - OIL FILTER
2 - OIL FILTER COVER
3 - GASKET
4 - BOLT
5 - COOLANT HOSE
6 - ENGINE OIL COOLER

INSTALLATION

(1) Inspect oil filter cap gasket, if all right, lubricate with clean engine oil.
(2) Install oil filter.
(3) Screw oil filter cap to housing and tighten to 25N·m (18 lbs. ft.) (Fig. 48). Adjust oil level as necessary.

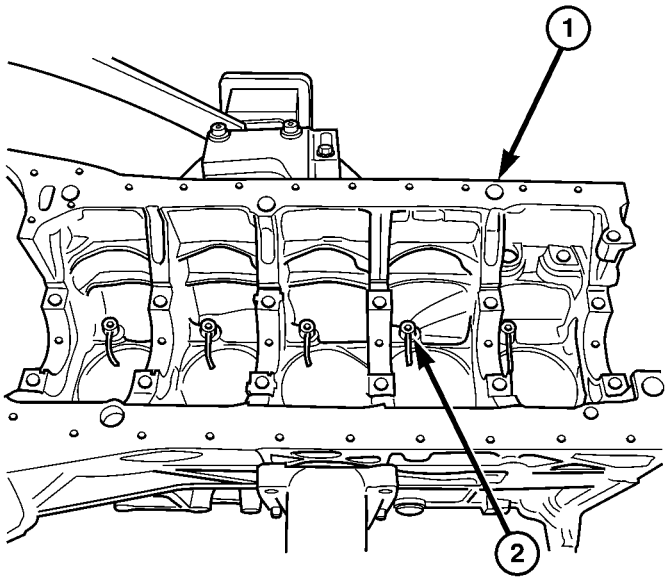
OIL JET

DESCRIPTION

There are five oil jets installed in the engine block (Fig. 49). These oil jets are used to cool and lubricate the piston assemblies.

REMOVAL

The engine must be removed from the vehicle and completely dissassembled to replace the oil jets.
(1) Remove engine from vehicle.
(2) Completely dissassemble engine.
(3) Using an extraction claw and a slide hammer, remove the oil jets from engine block.



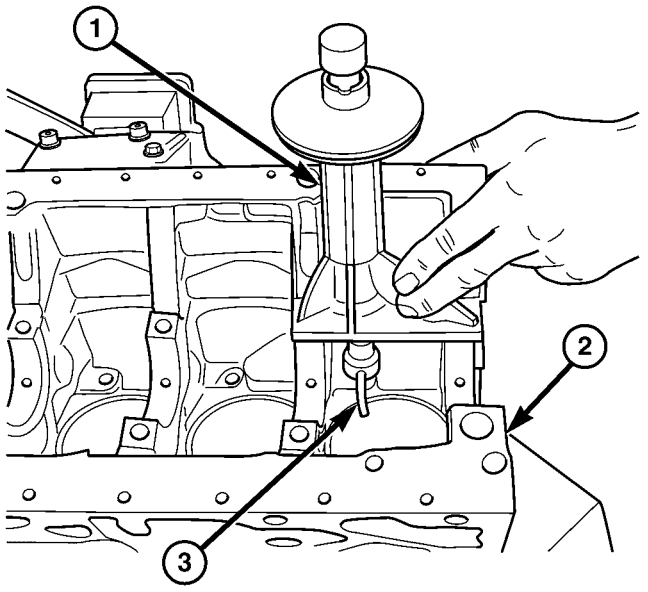
80e4a7da

Fig. 49 OIL JET LOCATION

1 - ENGINE BLOCK
2 - OIL JET

INSTALLATION

(1) Install oil jet into special tool #8924.
(2) Align oil jet in location in engine block.
(3) Drive oil jets into block using special tool #8924 until oil jet is fully seated into engine block (Fig. 50).



80e4a7de

Fig. 50 OIL JET INSTALLATION

1 - OIL JET INSTALLER #8942
2 - ENGINE BLOCK
3 - OIL JET

(4) Reassemble engine.
(5) Install engine into vehicle.

OIL PAN

REMOVAL

(1) Drain engine oil.
(2) Remove the sway bar retaining bolts and swing sway bar down and out of the way.
(3) Remove the wiring harness duct from the oil pan bolts and position out of the way.
(4) Lower the vehicle and remove the turbocharger upper heat shield.
(5) Connect engine support fixture #8534 using adaptors #8534–16, to the engine lifting eye and raise engine slightly.
(6) Remove engine mounts and raise engine.
(7) Disconnect the oil level sensor.
(8) Remove the transmission cooler lines from the oil pan bolts and carefully position the lines aside
(9) Remove the oil pan bolts.
(10) Remove oil pan and gasket (Fig. 51).

INSTALLATION

NOTE: Oil pan bolts are of different diameters and lengths. Care must be take to install the bolts in their original position (Fig. 53).

NOTE: Clean the strainer of the oil pump. If the oil pump is dry, fill it with clean engine oil.

NOTE: Thoroughly clean all mating surfaces with the appropriate solvents to assure that no grease or oil is present during reassembly.

(1) Install the oil pan gasket and coat places indicated with an arrow with sealant (Fig. 52).
(2) Install the oil pan. Tighten M6 bolts to 9N·m (80 lbs. in.) and M8 bolts to 20N·m (15 lbs. ft.) (Fig. 53).

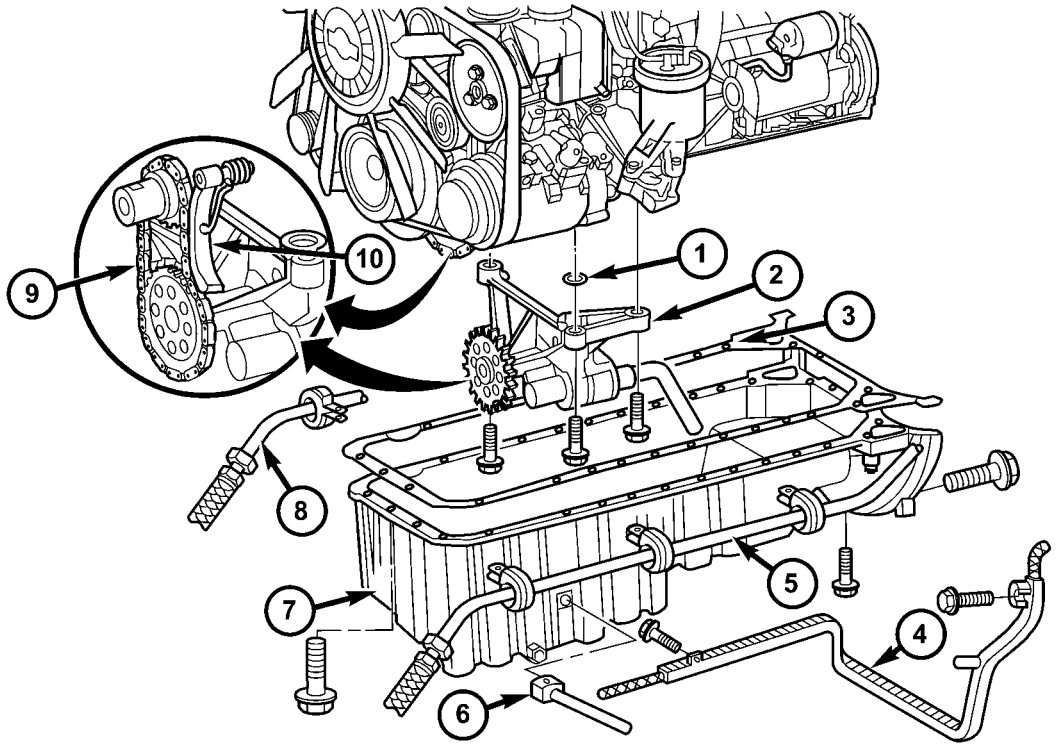
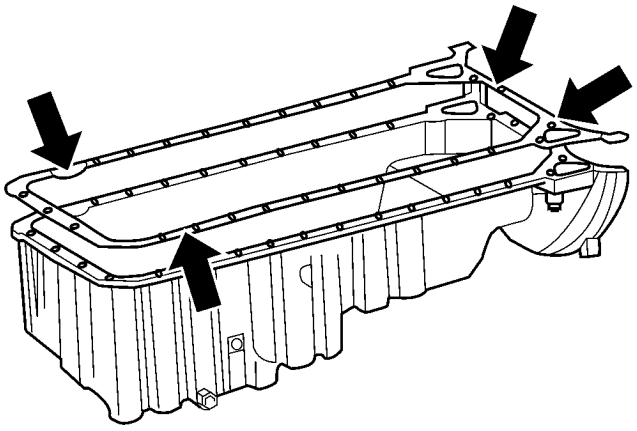


Fig. 51 OIL PAN

1 - O-RING
2 - OIL PUMP
3 - GASKET
4 - WIRING HARNESS DUCT
5 - TRANSMISSION LINE
6 - CONNECTOR FOR OIL LEVEL SENSOR
7 - OIL PAN
8 - TRANSMISSION LINE
9 - OIL PUMP CHAIN
10 - OIL PUMP CHAIN TENSIONER

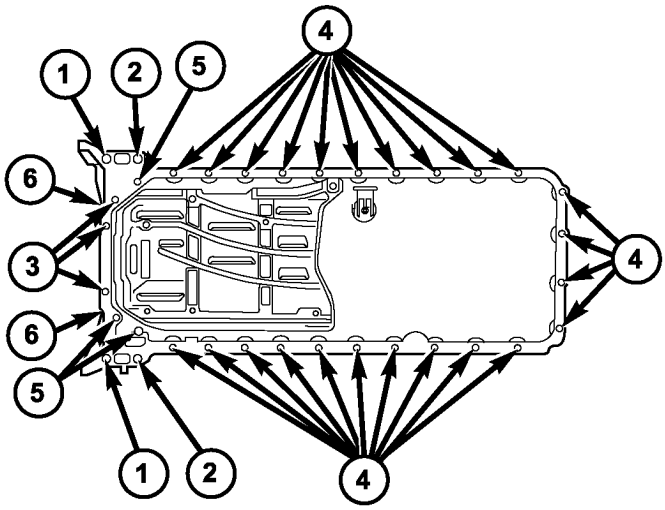
OIL PAN (Continued)



8115718e

Fig. 52 OIL PAN GASKET

(3) Tighten the bolt of the transmission bell housing to oil pan to 40N·m (30 lbs. ft.).



8115718c

Fig. 53 OIL PAN BOLTS

1 - M8X40
2 - M8X50
3 - M6X85
4 - M6X20
5 - M6X35
6 - M10X55

(4) Install the wiring harness duct (Fig. 51).
(5) Install the transmission lines (Fig. 51).
(6) Connect the oil level sensor (Fig. 51).
(7) Lower the vehicle.
(8) Lower the engine until the engine mount and engine supports make contact.
(9) Start and hand tighten the engine mount bolts.
(10) Lower the engine the rest of the way and remove the engine support fixture.
(11) Tighten the engine mount bolts to 83 N·m (61 lbs. ft.).
(12) Install the sway bar and tighten bolts to 30 N·m (22 lbs. ft.).
(13) Refill crankcase with the proper engine oil to the proper level. Refer to owners manual for specification.
(14) Reconnect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

(15) Start the engine and inspect for leaks.

OIL PUMP

REMOVAL

REMOVAL

(1) Remove the oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
(2) Remove the oil pump bolts (Fig. 51).
(3) Press the chain tensioner off of the oil pump chain, and remove pump from chain.
(4) Remove the oil pump, pick-up tube and O-ring (Fig. 51).

REMOVAL- OIL PUMP CHAIN

(1) Disconnect negative battery cable.
(2) Remove oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - REMOVAL).
(3) Remove oil pump (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - REMOVAL).

NOTE: Make sure the pin of the thrust spindle is backed out into the thrust spindle before seating the thrust spindle to the oil pump chain.

(4) Using special tool #8948 and thrust pin #9311, position and fit chain seperating tool and thrust spindle onto a link of the oil pump chain (Fig. 54).
(5) Screw the thrust pin in and seperate the oil pump chain link.

OIL PUMP (Continued)

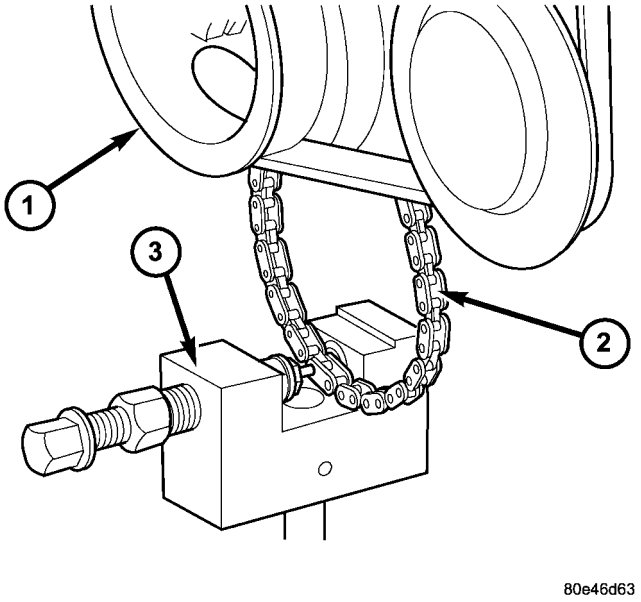


Fig. 54 OIL PUMP CHAIN LINK REMOVAL

1 - VIBRATION DAMPER/PULLEY
2 - OIL PUMP CHAIN
3 - SPECIAL TOOL #8948

(6) Remove pressed - out oil pump chain pin from chain seperation tool.

CAUTION: IT IS ESSENTIAL that the installation procedure for the oil pump chain is followed exactly. Failure to do so will result in severe engine damage.

INSTALLATION

INSTALLATION

NOTE: If the oil pump is dry, fill it with clean engine oil before installation. Clean the oil pick–up tube and strainer.

(1) Clean all sealing surfaces.
(2) Position the oil pump onto the drive chain and reset tensioner.
(3) Install oil pump retaining bolts and tighten to 18 N·m (160 lbs. in.).
(4) Install the oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - INSTALLATION).
(5) Refill the crankcase to the appropriate level with the proper engine oil (see owners manual).

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

(6) Start the vehicle and inspect for leaks.

INSTALLATION - OIL PUMP CHAIN

CAUTION: IT IS ESSENTIAL that the installation procedure is followed exactly. Failure to do so will result in severe engine damage.

(1) Connect old oil pump chain and new chain with temporary link, outer plate and locking element (Fig. 55).

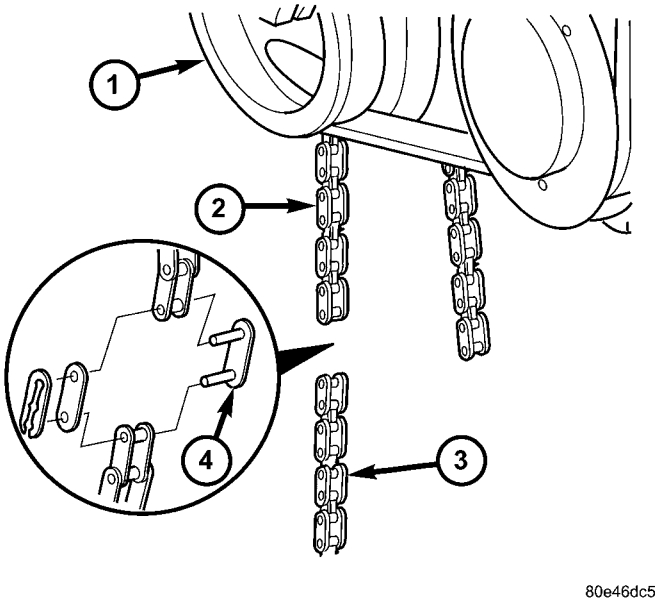


Fig. 55 INSTALLING OIL PUMP CHAIN TEMPORARY LINK

1 - VIBRATION DAMPER/CRANKSHAFT PULLEY
2 - OLD OIL PUMP CHAIN
3 - NEW OIL PUMP CHAIN
4 - TEMPORARY LINK

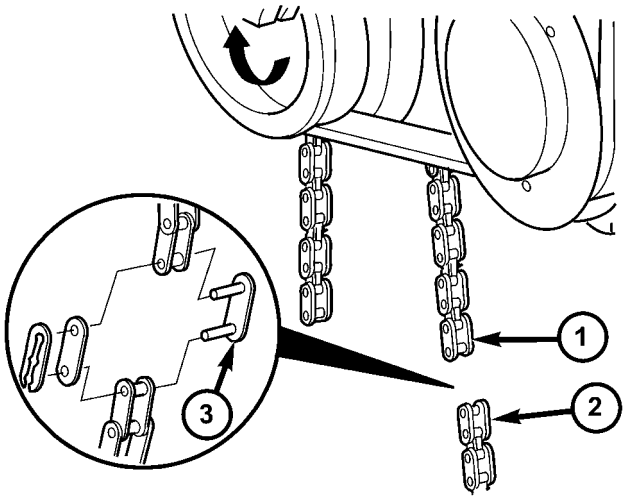
(2) Slowly rotate crankshaft in a clockwise direction until it is possible to connect the ends of the new and old oil pump chains.
(3) Remove assembly locking element, outer plate and assembly link (Fig. 56).

CAUTION: Insert new riveted link from the rear.

(4) Connect ends of new oil pump chain with new riveted link (Fig. 57).

NOTE: When assembling riveting tool, one piece is secured by a screw and the other can move loosely on the thrust spindle.

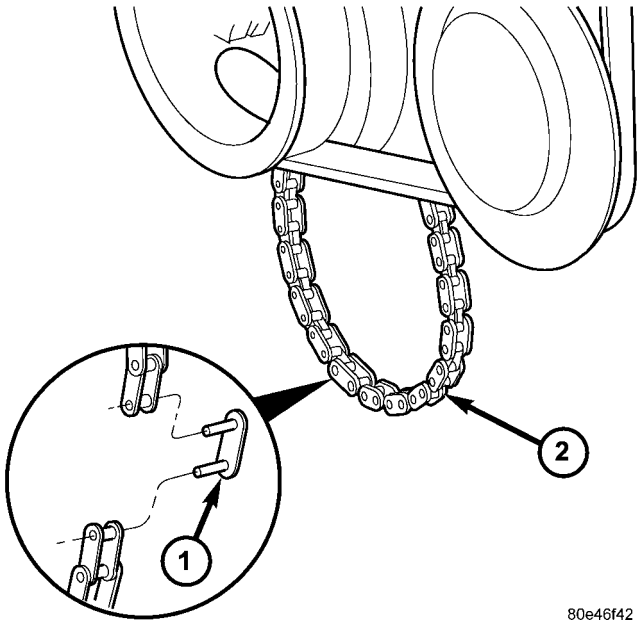
OIL PUMP (Continued)



80e46f1b

Fig. 56 REMOVING OIL PUMP CHAIN TEMPORARY LINK

1 - NEW OIL PUMP CHAIN
2 - OLD OIL PUMP CHAIN
3 - TEMPORARY LINK

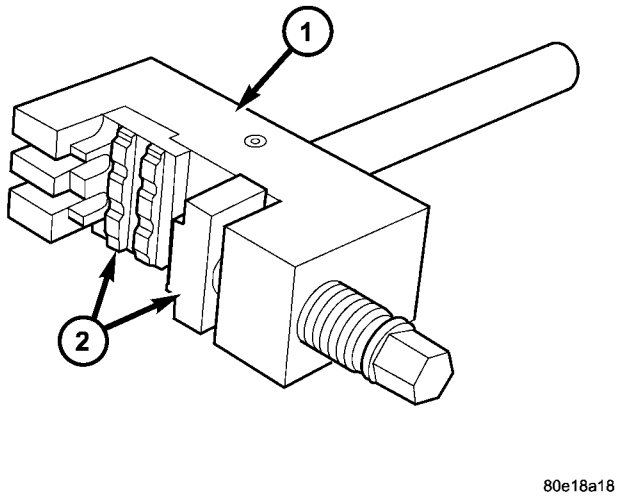


80e46f42

Fig. 57 INSTALLING NEW RIVETED LINK

1 - NEW RIVETED LINK
2 - OIL PUMP CHAIN

(5) Assemble riveting tool by attaching inserts. (Fig. 58).



80e18a18

Fig. 58 INSTALLING ASSEMBLY INSERTS INTO RIVETING TOOL

1 - SPECIAL TOOL #8947
2 - SPECIAL TOOL #8952

NOTE: The outer plate will be held in place by a magnet.

(6) Place new outer plate into tool insert.

NOTE: Ensure that the riveted link and riveting tool are aligned.

(7) Position riveting tool over new link and press in new rivet as far as the tool stop.
(8) Remove riveting tool to change inserts.
(9) Install insert on riveting tool and secure with screw.
(10) Install insert on riveting tool (Fig. 59).

NOTE: The outer plate is held in place magnetically by riveting tool.

(11) Insert new outer plate into the moving assembly insert.
(12) Position riveting tool so that spacer webs of the guide are side by side.
(13) Ensure that riveted link and outer plate are aligned.

NOTE: When turning spindle of riveting tool, be sure that pins of riveted link are inserted into holes of outer plate.

(14) Screw in spindle of riveting tool until firm resistance is felt.
(15) Remove riveting tool.
(16) Turn over tool moving assembly insert to the riveting profile.

OIL PUMP (Continued)

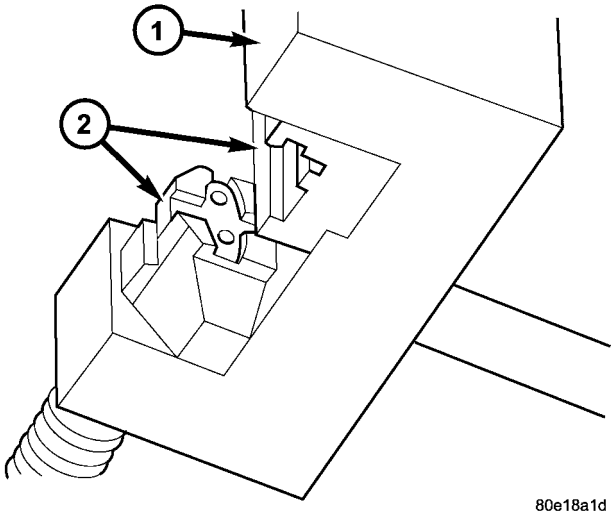


Fig. 59 INSTALLING RIVETING INSERTS INTO RIVETING TOOL

1 - SPECIAL TOOL #8947
2 - SPECIAL TOOL #9310

NOTE: Rivet pins of the riveted link individually.

(17) Position riveting tool exactly over middle of pin (Fig. 60).

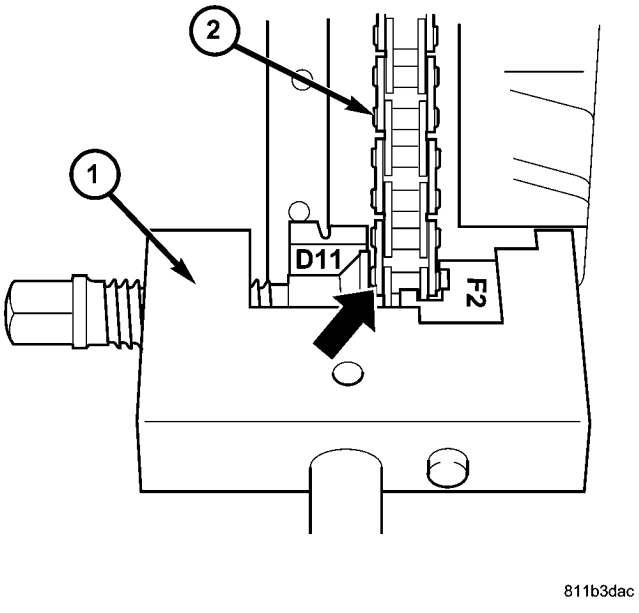


Fig. 60 NEW LINK RIVETING

1 - SPECIAL TOOL #8947
2 - OIL PUMP CHAIN

(18) Tighten riveting tool spindle until it stops.

(19) Remove riveting tool, inspect riveting, rerivet if necessary (Fig. 61).

(20) Repeat procedure for both rivets.

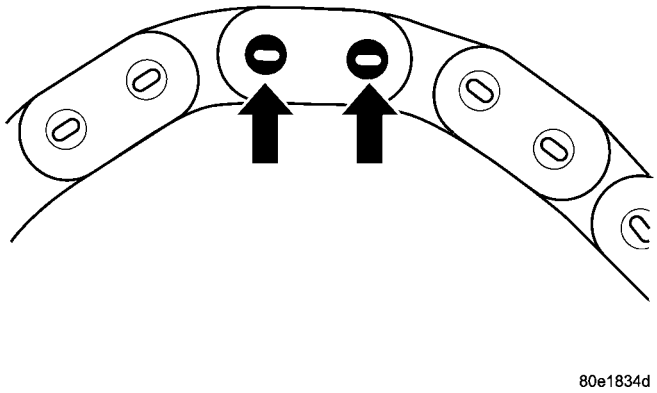


Fig. 61 RIVET INSPECTION

(21) Install oil pump (Refer to 9 - ENGINE/LUBRICATION/OIL PUMP - INSTALLATION).

(22) Install oil pan (Refer to 9 - ENGINE/LUBRICATION/OIL PAN - INSTALLATION).

(23) Refill engine with proper oil to the correct level.

(24) Connect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN DIRECT LINE WITH FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELT OR FAN. DO NOT WEAR LOOSE CLOTHES.

(25) Start engine and inspect for leaks.

OIL TEMPERATURE SENSOR

DESCRIPTION

Oil level, oil temperature and oil quality are detected by means of an oil sensor located in the oil pan. The sensor which operates on the capacitance principle features an integrated electronic circuit which analyzes the three signals. the signals are constantly relayed to the ECM and over the CAN bus to the instrument cluster by means of PWM signal.

OPERATION

Oil quality is detected for indicating the need-based oil change interval. The oil quality is detected on the basis of the capacitance of the engine oil (dielectrics, does not conduct electricity), this being as much as six times greater in case of poor quality.

OIL TEMPERATURE SENSOR (Continued)

Oil level and oil quality are separate of each other. The information is first of all compensated in the ECM before being transmitted over the CAN bus.

Faults at the oil sensor are detected by the ECM and entered into fault memory. The voltage for the oil sensor (approx.5V) is supplied by the ECM.

REMOVAL

(1) Disconnect the negative battery cable.
(2) Raise and support the vehicle.
(3) Drain engine oil into a suitable, and appropriately marked container.
(4) Remove engine mount to chassis nuts.
(5) Lower vehicle and install engine support.
(6) Raise engine until the weight of the engine no longer rests on the engine mounts.
(7) Raise and support the vehicle.
(8) Detach the front stabilizer bar at the front axle and rotate it downward.
(9) Unplug the oil level sensor (Fig. 62).
(10) Remove the oil level sensor retaining screw, oil level sensor and discard the gasket (Fig. 62).

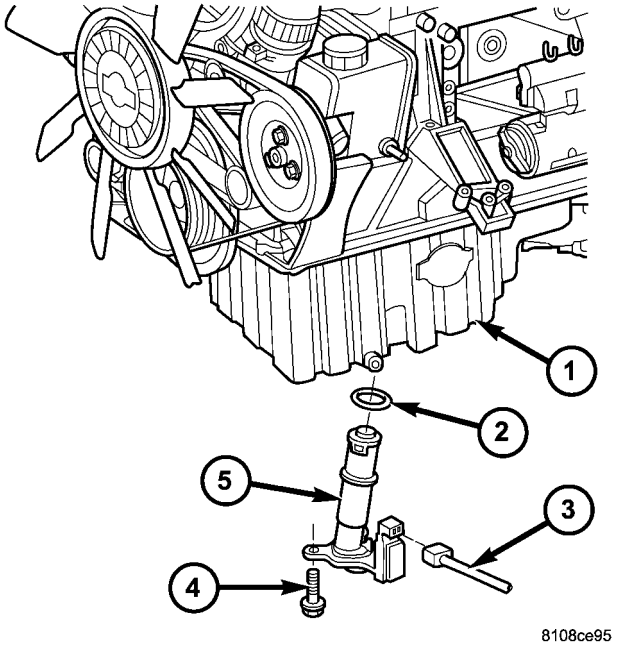


Fig. 62 OIL LEVEL SENSOR

1 - OIL PAN
2 - O-RING
3 - WIRING HARNESS
4 - BOLT
5 - OIL LEVEL SENSOR

INSTALLATION

(1) Seat O-ring on oil level sensor and lubricate O-ring with clean engine oil (Fig. 62).
(2) Install the oil level sensor into the oil pan and tighten screw to 124 lbs. in.(14N·m) (Fig. 62).
(3) Connect oil level sensor wiring harness connector (Fig. 62).
(4) Rotate front stabilizer bar upward and secure to axle beam. Tighten to 22 lbs.ft. (30 N·m)
(5) Lower the vehicle.
(6) Lower the engine into the mounts.
(7) Remove engine support fixture.
(8) Raise and support the vehicle.
(9) Tighten both engine mount to chassis nuts.
(10) Install and tighten oil drain plug.
(11) Lower vehicle and install the appropriate engine oil.

INTAKE MANIFOLD

REMOVAL

WARNING: NO FIRE, SPARKS OR SMOKING. STORE FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS, AND WEAR PROTECTIVE CLOTHING. (Refer to 14 - FUEL SYSTEM - WARNING).

WARNING: DO NOT OPEN THE COOLING SYSTEM UNLESS THE COOLANT TEMPERATURE IS BELOW 90°C (194°F). OPEN RADIATOR CAP SLOWLY TO RELEASE PRESSURE. STORE COOLANT ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS, WEAR PROTECTIVE CLOTHING AND EYE PROTECTION.

(1) Disconnect the negative battery cable.
(2) Drain coolant from the radiator.
(3) Remove the engine cover.
(4) Disconnect the engine wiring harness from inside the vehicle and carefully guide the harness into the engine compartment.
(5) Disconnect the charge air hose at the intake manifold (Fig. 63).
(6) Disconnect the EGR wiring harness connector (Fig. 63).
(7) Remove the bolt retaining the engine wiring harness to the intake manifold (Fig. 63).
(8) Disconnect the coolant hose at the connection junction through the intake manifold support bracket (Fig. 63).

NOTE: Collect and store any fluid spillage when disconnecting components.

(9) Disconnect both fuel lines at the fuel filter (Fig. 63).
(10) Remove the lower intake manifold support bracket (Fig. 63).

INTAKE MANIFOLD (Continued)

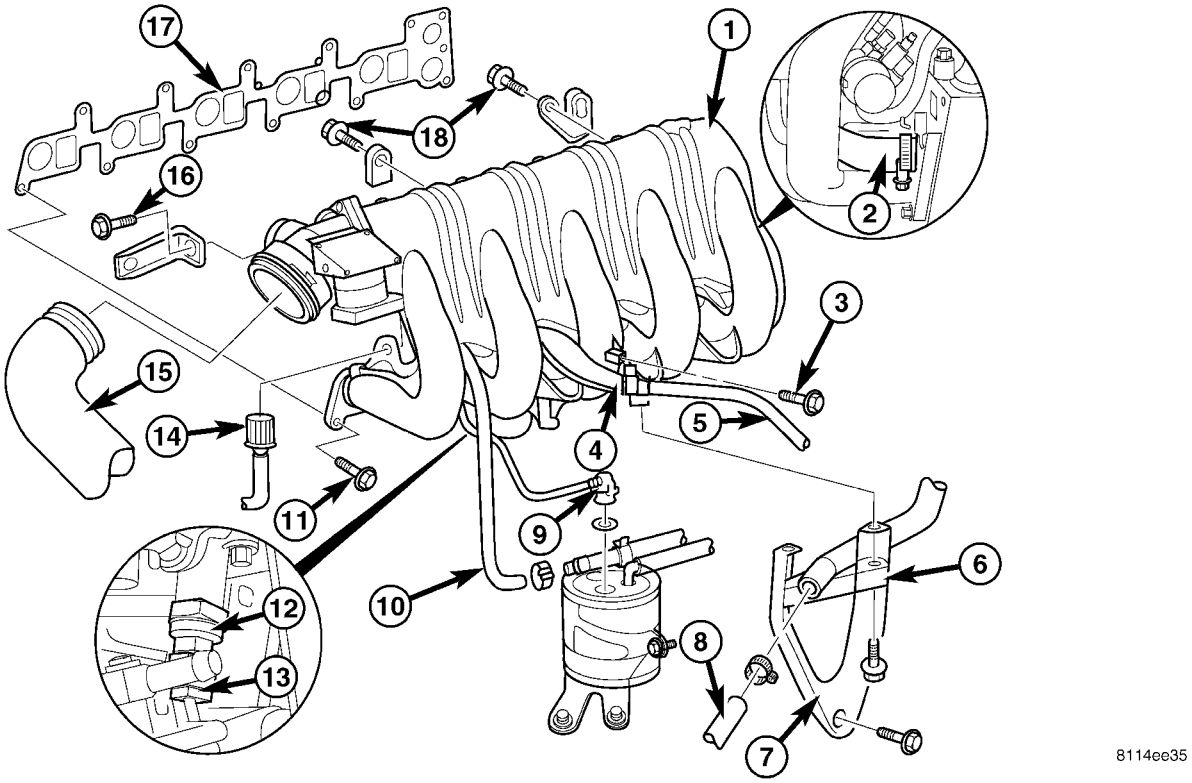


Fig. 63 INTAKE MANIFOLD

1 - INTAKE MANIFOLD
2 - REAR COOLANT HOSE
3 - BOLT
4 - ENGINE HARNESS DUCTING
5 - ENGINE HARNESS
6 - CONNECTING JUNCTION
7 - SUPPORT BRACKET
8 - COOLANT HOSE FROM HEATER
9 - FUEL LINE
10 - FUEL LINE
11 - BOLT
12 - FUEL PRESSURE SENSOR
13 - HARNESS CONNECTOR
14 - HARNESS CONNECTOR
15 - CHARGE AIR HOSE
16 - BRACKET
17 - GASKET
18 - SUPPORT BRACKETS

(11) Remove the right intake manifold support brackets (Fig. 63).

(12) Disconnect the fuel pressure sensor electrical connector (Fig. 63).

(13) Raise and support the vehicle.

(14) Remove the coolant hose at the rear of the intake manifold (Fig. 63).

(15) Remove the rear intake manifold mounting bolts while accessible from below (Fig. 63).

(16) Lower the vehicle.

(17) Remove the remaining intake manifold bolts, lift the intake manifold up and out while guiding the engine wiring harness and fuel lines through the openings in the intake manifold, then remove the gasket.

NOTE: Install the EGR valve with new gasket onto the new intake manifold if the intake manifold is being replaced.

INSTALLATION

NOTE: If the intake manifold is being replaced, install the EGR valve with new gasket.

(1) Clean both mating surfaces and install a new intake manifold gasket with the intake manifold. Guide the engine wiring harness and fuel lines through the intake manifold openings. Tighten manifold bolts to 16 N·m (142 lbs. in.) in a cross directional pattern beginning with the middle bolts and tightening outward to the ends.

(2) Raise and support the vehicle.

(3) Install the rear intake manifold bolts and tighen to 16 N·m (142 lbs. in.) (Fig. 63).

(4) Install the rear coolant hose to the intake manifold and tighten clamp (Fig. 63).

(5) Lower the vehicle.

(6) Connect the fuel pressure sensor electrical connector (Fig. 63).

INTAKE MANIFOLD (Continued)

(7) Install the right intake manifold support brackets. Tighten the bolts to 14 N·m (124 lbs. in.) (Fig. 63).

(8) Install the lower intake manifold support bracket. Tighten bolts to 20 N·m (177 lbs. in.) (Fig. 63).

(9) Connect both fuel lines to fuel filter assembly (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/ FUEL FILTER - INSTALLATION).

(10) Connect the coolant hose at the connection junction above the lower intake manifold support bracket (Fig. 63).

(11) Secure the engine wiring harness and cable duct to the intake manifold (Fig. 63).

(12) Connect the EGR wiring harness connector (Fig. 63).

(13) Connect the charge air hose to the intake manifold (Fig. 63).

(14) Carefully route the engine wiring harness through and into the passenger compartment and reconnect.

(15) Install the engine cover.

(16) Fill the cooling system.

(17) Connect the negative battery cable.

(18) Start the engine and inspect for leaks. Care must be taken to observe the fuel system warning.(Refer to 14 - FUEL SYSTEM - WARNING).

EXHAUST MANIFOLD

REMOVAL

(1) Remove the turbocharger (Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM/ TURBOCHARGER - REMOVAL).

(2) Remove the self locking exhaust manifold nuts (Fig. 64).

(3) Remove exhaust manifold and clean mating surfaces (Fig. 64).

INSTALLATION

NOTE: Exhaust manifold surface must be flat within 0.006 in. per foot (0.15mm per 300mm) of manifold length.

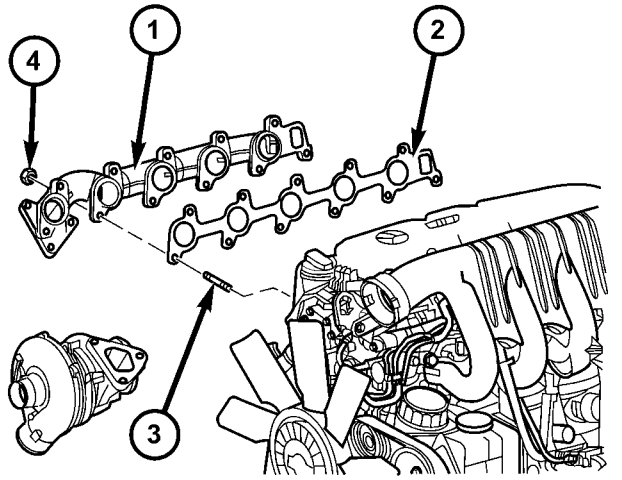
(1) Inspect exhaust manifold gasket surface for flatness with a straight edge (Fig. 64).

(2) Inspect exhaust manifold for cracks or distortion (Fig. 64).

(3) Install new exhaust manifold gasket (Fig. 64).

(4) Position the exhaust manifold over to studs and tighten retaining nuts to 22 lbs. ft. (30 N·m (Fig. 64)).

(5) Install turbocharger (Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM/TURBOCHARGER - INSTALLATION).



810b115a

Fig. 64 EXHAUST MANIFOLD

1 - EXHAUST MANIFOLD
2 - GASKET
3 - STUD
4 - NUT

TIMING CHAIN COVER

REMOVAL

WARNING: DO NOT OPEN COOLING SYSTEM UNLESS TEMPERATURE IS BELOW 90°C (194°F). OPEN CAP SLOWLY TO RELEASE PRESSURE. STORE COOLANT IN APPROVED CONTAINER ONLY. RISK OF INJURY TO SKIN AND EYES FROM SCALDING COOLANT. WEAR PROTECTIVE GLOVES, CLOTHING AND EYE WEAR.

(1) Disconnect negative battery cable.

NOTE: Rotate engine on crankshaft. DO NOT crank the engine at the bolt of the camshaft sprocket.

NOTE: DO NOT crank engine back.

(2) Position piston of cylinder 1 to ignition TDC. **Markings on the camshaft bearing cap must be aligned.**

(3) Drain coolant (Refer to 7 - COOLING/ENGINE/ COOLANT - STANDARD PROCEDURE).

(4) Install retaining lock for crankshaft/starter ring gear (Refer to 9 - ENGINE/ENGINE BLOCK/ FLEX PLATE - INSTALLATION).

(5) Drain engine oil.

TIMING CHAIN COVER (Continued)

(6) Remove the oil filter to allow the oil to flow off into the oil pan.

(7) Remove the radiator assembly (Refer to 7 - COOLING/ENGINE/RADIATOR - REMOVAL).

(8) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

(9) Remove front cover at cylinder head (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).

(10) Remove accessory drive belt.

(11) Remove the high pressure fuel pump (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL PUMP - REMOVAL).

(12) Remove water pump (Refer to 7 - COOLING/ENGINE/WATER PUMP - REMOVAL).

(13) Remove accessory drive belt pulley and vibration damper (Refer to 9 - ENGINE/ENGINE BLOCK/VIBRATION DAMPER - REMOVAL).

(14) Remove the power steering pump.

NOTE: NO NOT open the air conditioning system.

(15) Unplug AC compressor electrical connector and unbolt AC compressor. Relocate in lower engine compartment **with out** opening the system.

(16) Remove the generator with wiring attached and relocate somewhere in the engine compartment.

(17) Install engine support fixture.

(18) Remove the oil pan.

(19) Detach the coolant hose to oil-water heat exchanger at crankcase (Fig. 65).

(20) Remove the cylinder head to timing cover bolts (Fig. 65).

(21) Remove the timing cover bolts and cover (Fig. 65).

(22) Remove remaining ancillary components attached to the timing case cover (Fig. 65).

NOTE: Inspect condition of hoses and clamps, replace as necessary.

(23) Remove timing chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL)

(24) Remove timing case cover (Fig. 65).

INSTALLATION

CAUTION: Care must be taken to closley inspect the gasket area around the time case cover to cylinder head gasket coolant port. If damage is found, replace the cylinder head gasket. Failure to do so may result in engine damage.

NOTE: Thoroughly clean all mating surfaces with the appropriate solvents to assure that no grease or oil is present during assembly.

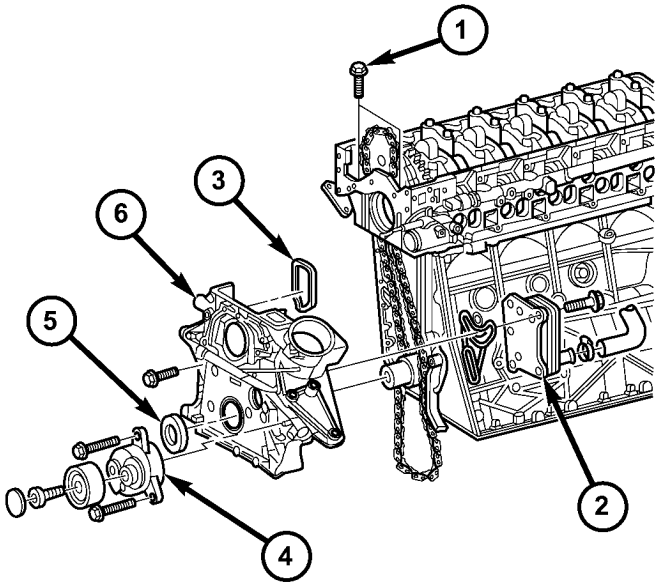


Fig. 65 TIMING CHAIN COVER

1 - CYLINDER HEAD TO TIMING COVER BOLT
2 - OIL-WATER HEAT EXCHANGER
3 - GASKET
4 - DRIVE BELT TENSIONER
5 - FRONT CRANKSHAFT SEAL
6 - TIMING CHAIN COVER

(1) Inspect cylinder head gasket and oil pan gasket. If damaged, replace.

(2) Replace the front crankshaft seal (Refer to 9 - ENGINE/ENGINE BLOCK/CRANKSHAFT OIL SEAL - FRONT - INSTALLATION).

(3) Install ancillary components to timing case cover.

(4) Apply sealant to the marked surfaces with a bead thickness of 1.5 ± 0.5 mm (Fig. 66).

NOTE: Install timing cover within 10 minutes after applying sealant. Do not spread sealant bead.

NOTE: Do not seal pressurized oil galleries to the crankcase. Sealant applied at these points is entrained by the oil flow and blocks the oil supply passages.

(5) Position and install timing case cover. Tighten bolts to 20 N·m (177 lbs in) (Fig. 65).

(6) Install the M8 bolts of cylinder head on timing case cover. Tighten bolts to 20 N·m (177 lbs in) (Fig. 65).

(7) Install timing chain tensioner with new seal-(Refer to 9 - ENGINE/VALVE TIMING/TMNG BELT/CHAIN TENSIONER&PULLEY - INSTALLATION).

TIMING CHAIN COVER (Continued)

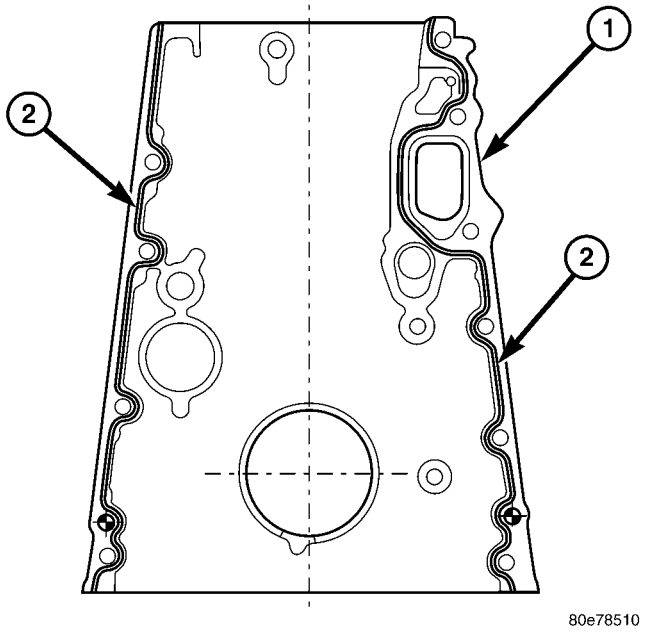


Fig. 66 TIMING CHAIN COVER SEALING SURFACE

1 - TIMING CHAIN COVER
2 - SEALANT BEAD

(8) Position and install the oil pan. Tighten M6 bolts to 9 N·m (80 lbs in) and M8 bolts to 20 N·m (177 lbs in).

(9) Install belt /pulley vibration damper. Tighten M8.8 bolt in two stages, 200N·m (147 lbs ft.) then 90°, M10.9 bolt 325N·m (240 lbs ft) then 90°.

(10) Remove the engine support fixture.

(11) Install generator (Refer to 8 - ELECTRICAL/ CHARGING/GENERATOR - INSTALLATION).

(12) Install the air conditioning compressor.

(13) Install the power steering pump.

(14) Install water pump (Refer to 7 - COOLING/ ENGINE/WATER PUMP - INSTALLATION).

(15) Connect coolant hose to oil-water heat exchanger.

(16) Install high pressure fuel pump (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL PUMP - INSTALLATION).

(17) Apply sealant to lower portion of, and install, front cover to cylinder block. Tighten bolts to 20N·m (177 lbs in) (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).

(18) Remove retaining lock for crankshaft/starter ring gear.

(19) Tighten the oil drain plug to 30N·m (265 lbs in).

(20) Install a new oil filter. tighten screw cap for filter to 25N·m (221 lbs. in.).

(21) Install the accessory drive belt.

(22) Install the radiator assembly (Refer to 7 - COOLING/ENGINE/RADIATOR - INSTALLATION).

(23) Install air intake hose.

(24) Fill coolant to the proper level, with the proper coolant (Refer to 7 - COOLING/ENGINE/ COOLANT - STANDARD PROCEDURE).

(25) Fill the crankcase with the correct oil, to the proper level. Refer to owners manual for specifications.

(26) Connect the negative 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 CLOTHES.

CAUTION: DO NOT pressure test cooling system until the engine reaches operating temperature.

(27) Start engine and inspect for leaks. care must be taken to observe the fuel system warning (Refer to 14 - FUEL SYSTEM - WARNING).

TIMING BELT/CHAIN AND SPROCKETS

REMOVAL

REMOVAL - TENSIONING AND SLIDE RAILS

NOTE: If it necessary to replace the tensioning rail, slide rail or tensioning arm, they are always replaced together.

(1) Disconnect negative battery cable.

(2) Remove the engine (Refer to 9 - ENGINE - REMOVAL).

(3) Remove cylinder head (Refer to 9 - ENGINE/ CYLINDER HEAD - REMOVAL).

NOTE: Remove timing case cover carefully. Care must be taken not to damage oil pan gasket.

(4) Remove timing case cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).

(5) Pull the tensioning rail off of the bearing pins (Fig. 67).

(6) Release the spring at the slide rail and take it off of the tensioning arm (Fig. 67).

REMOVAL - INTERMEDIATE GEAR

(1) Disconnect negative battery cable.

(2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).

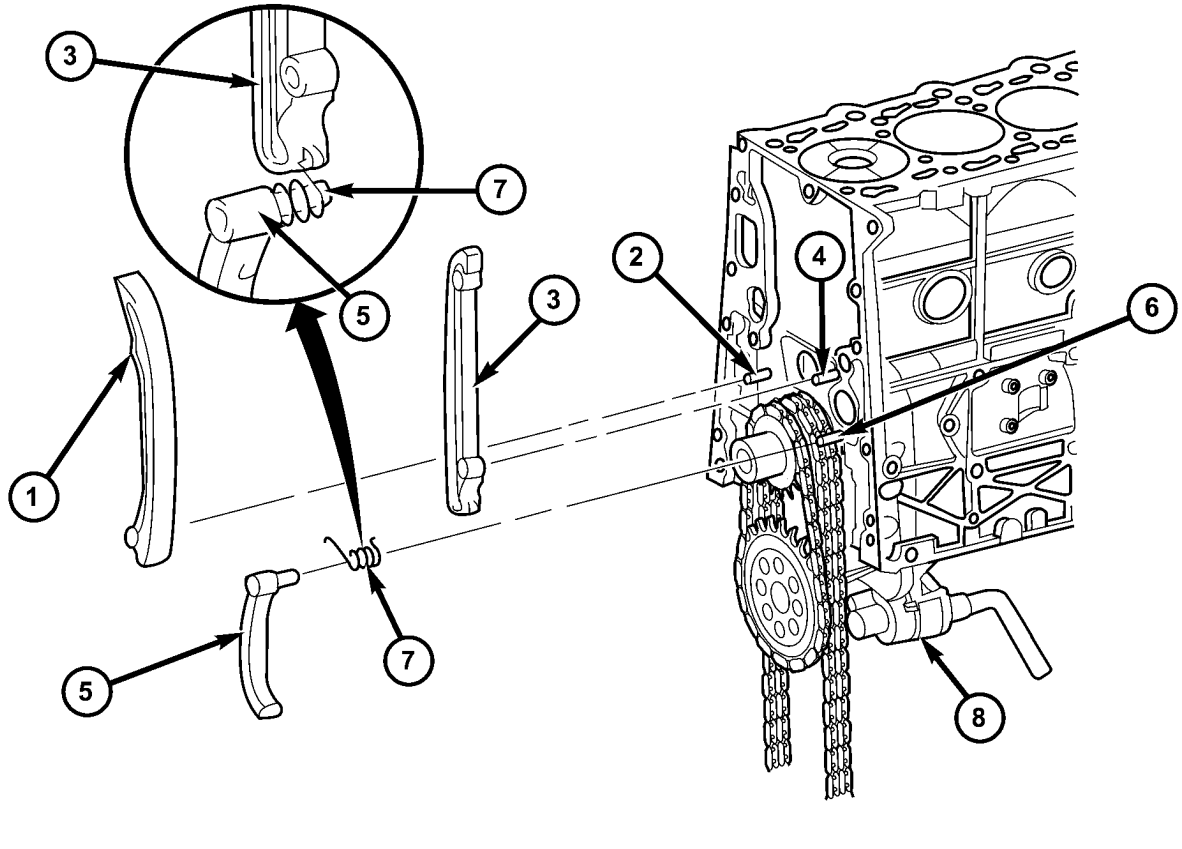


Fig. 67 TENSIONING AND SLIDE RAILS

1 - TENSIONING RAIL
2 - BEARING PIN
3 - SLIDE RAIL
4 - BEARING PIN
5 - TENSIONING CLAMP
6 - BEARING PIN
7 - SPRING
8 - OIL PUMP

WARNING: NO FIRE, FLAMES OR SMOKING. RISK OF POISONING FROM INHALING OR SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

(3) Remove fuel high pressure lines injectors (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - REMOVAL).

(4) Clean injectors and recesses (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - STANDARD PROCEDURE).

(5) Remove cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).

(6) Insert locking pin through first camshaft bearing cap into hole in inlet camshaft sprocket to lock inlet camshaft.

(7) Remove timing chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

(8) Remove cylinder head front cover (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).

(9) Remove top slide rail (Refer to 9 - ENGINE/CYLINDER HEAD - REMOVAL).

(10) Remove high pressure pump (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL INJECTION PUMP - REMOVAL).

(11) Mark camshaft sprocket relative to timing chain.

(12) Unbolt camshaft sprocket from exhaust camshaft.

NOTE: Note position of dowel pin for camshaft sprocket alignment during reassembly.

(13) Secure camshaft sprocket to timing chain with tie strap.

TIMING BELT/CHAIN AND SPROCKETS (Continued)

(14) Remove camshaft sprocket.
(15) Remove intermediate gear and bushing (Fig. 68).

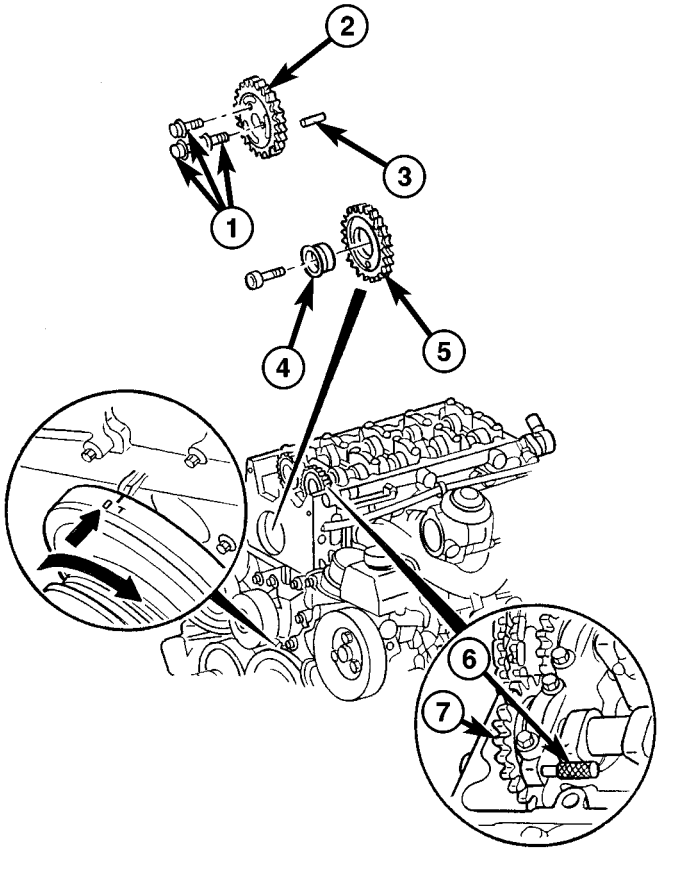


Fig. 68 HIGH RESSURE PUMP INTERMEDIATE GEAR

1 - CAMSHAFT SPROCKET BOLTS
2 - INTAKE CAMSHAFT
3 - DOWEL PIN
4 - INTERMEDIATE GEAR BUSHING
5 - INTERMEDIATE GEAR
6 - CAMSHAFT LOCKING PIN #8929
7 - INTAKE CAMSHAFT SPROCKET

REMOVAL - TIMING CHAIN TENSIONING RAIL

(1) Disconnect negative battery cable.
(2) Remove cylinder head (Refer to 9 - ENGINE/ CYLINDER HEAD - REMOVAL).

NOTE: Remove timing case cover carefully. Care must be taken not to damage oil pan gasket.

(3) Remove timing chain cover (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT / CHAIN COVER(S) - REMOVAL).
(4) Remove tensioning rail from bearing pin (Fig. 69).

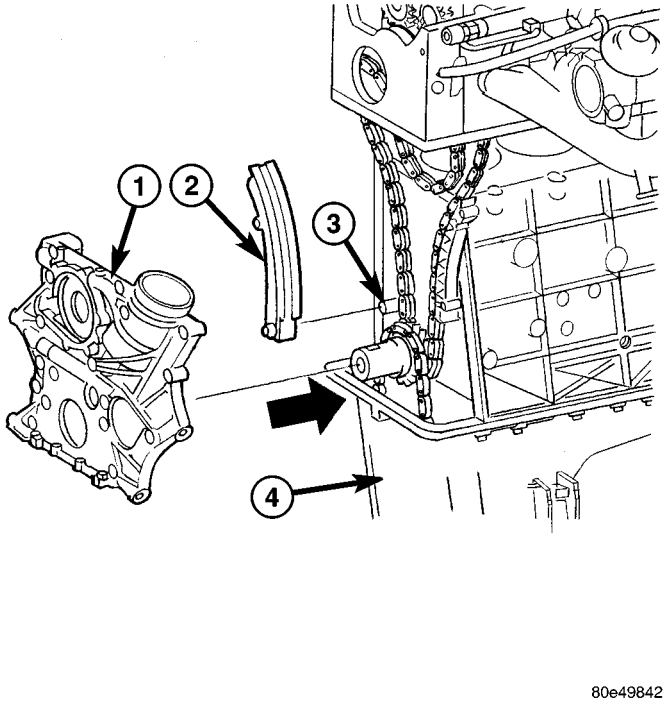


Fig. 69 TIMING CHAIN TENSIONING RAIL

1 - TIMING CHAIN COVER
2 - TENSIONING RAIL
3 - BEARING PIN
4 - OIL PAN

REMOVAL - TIMING CHAIN

(1) Remove cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - REMOVAL).
(2) Remove vacuum pump (Refer to 9 - ENGINE/ ENGINE BLOCK/INTERNAL VACUUM PUMP - REMOVAL).
(3) Remove low pressure fuel pump and drive (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/ FUEL INJECTION PUMP - REMOVAL).
(4) Remove guide rail in cylinder head (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).
(5) Remove timing chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - REMOVAL).

CAUTION: Cover timing case recess to prevent foreign material from entering engine.

(6) Secure timing chain to camshaft sprocket with tie straps (Fig. 70).

TIMING BELT/CHAIN AND SPROCKETS (Continued)

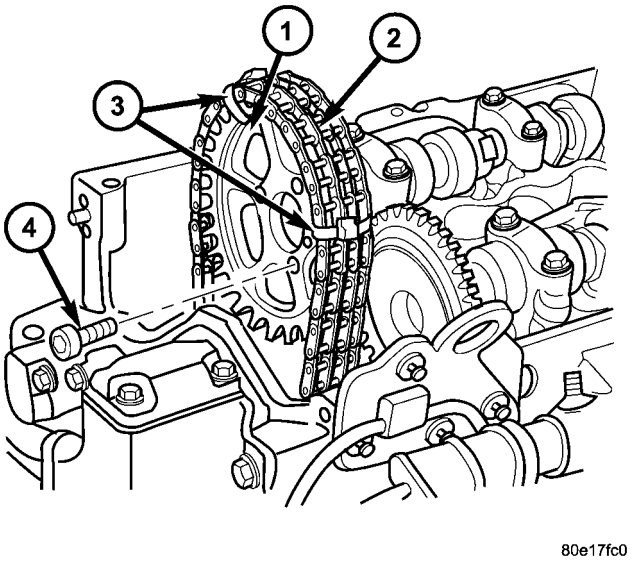


Fig. 70 SECURING TIMING CHAIN TO SPROCKET

1 - CAMSHAFT SPROCKET
2 - TIMING CHAIN
3 - TIE STRAPS
4 - RETAINING BOLTS

(7) Remove camshaft sprocket with timing chain attached, from camshaft.

NOTE: When fitting the thrust spindle, ensure that the thrust pin is positioned at the left timing chain pin of a chain link (Fig. 71).

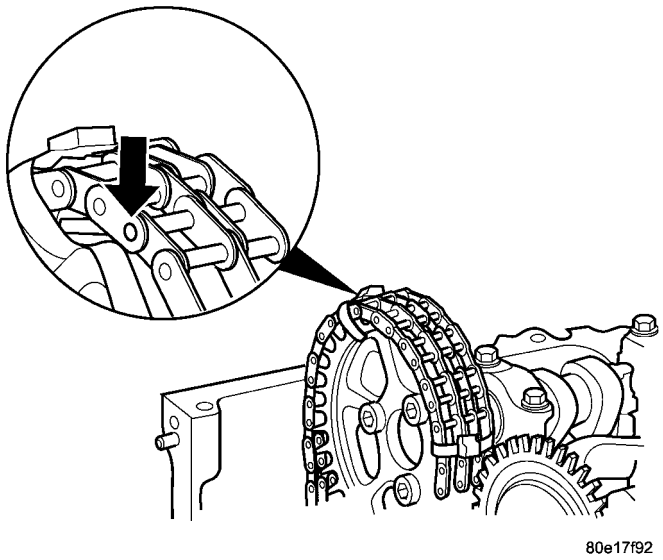


Fig. 71 THRUST PIN POSITION

CAUTION: Using the larger nut of special tool # 8950, back out both thrust spindle pieces to assure that the smaller portain of the spindle DOES NOT portrude into the crimping area. Position special tool #8948 over the timing chain rivet to be removed and tighten the larger nut of special tool # 8950 BEFORE tightening the smaller thrust spindle to separate the timing chain.

(8) Using special tool #8948 and #8950, position timing chain separating tool at the timing chain of the camshaft sprocket (Fig. 72).

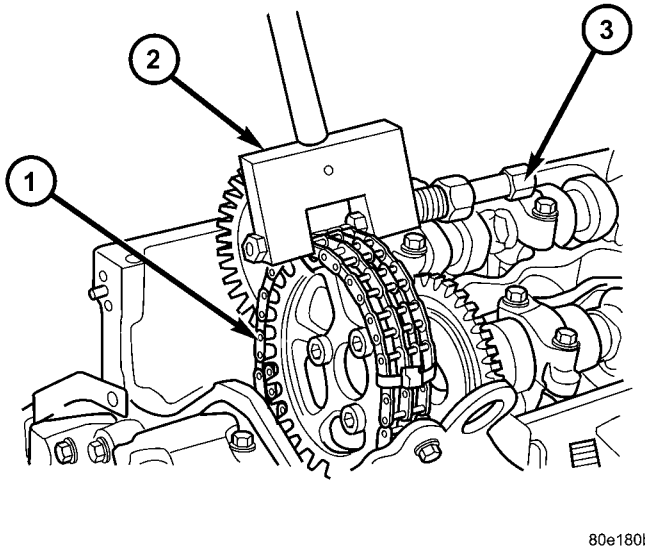


Fig. 72 SEPARATING TIMING CHAIN WITH SPECIAL TOOL #8948 and #8950

1 - TIMING CHAIN
2 - SPECIAL TOOL #8948
3 - THRUST SPINDLE #8950

(9) Screw the thrust pin, special tool # 8950, in and separate the timing chain.

(10) Unscrew the thrust spindle and remove the tool.

NOTE: DO NOT detach timing chain from camshaft sprocket.

(11) Install camshaft sprocket with timing chain, to camshaft.

(12) Remove pressed - out timing chain pin from chain separation tool.

(13) Attach special tool 8931, timing chain retainer, to cylinder head with bolts supplied (Fig. 73).

TIMING BELT/CHAIN AND SPROCKETS (Continued)

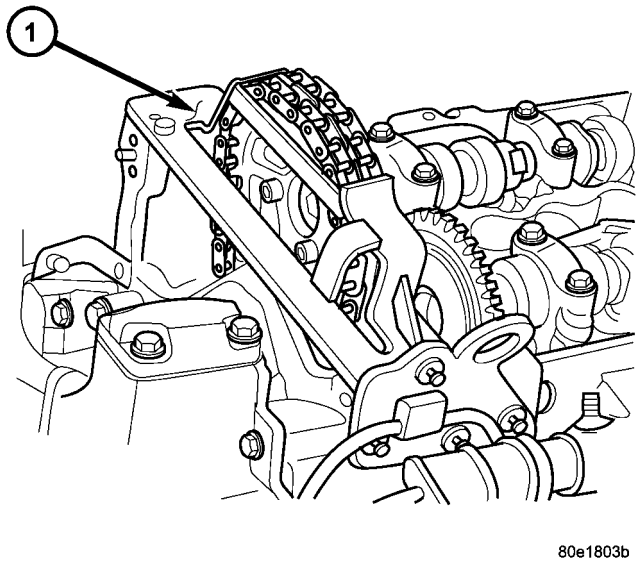


Fig. 73 SPECIAL TOOL # 8931

1 - SPECIAL TOOL #8931

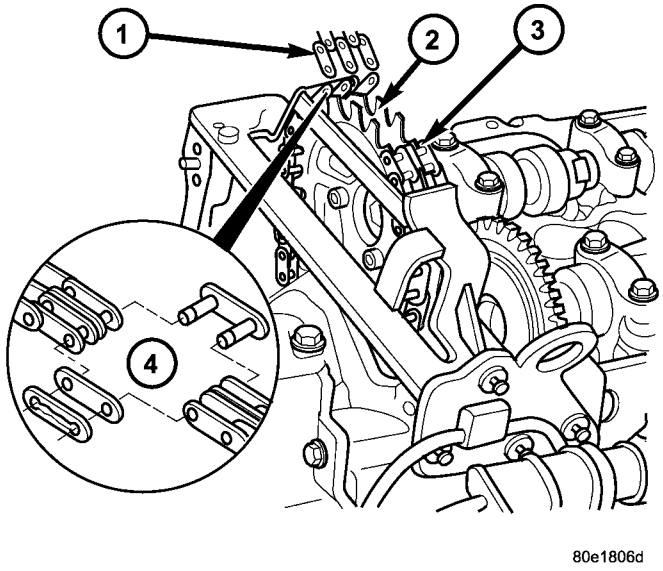


Fig. 74 INSTALLING TEMPORARY LINK

1 - NEW TIMING CHAIN
2 - CAMSHAFT SPROCKET
3 - OLD TIMING CHAIN
4 - TEMPORARY LINK

(14) Remove timing chain to camshaft sprocket tie straps.

(15) Connect new timing chain and old timing chain with assembly link, assembly plate and locking element, and secure (Fig. 74) (Fig. 75).

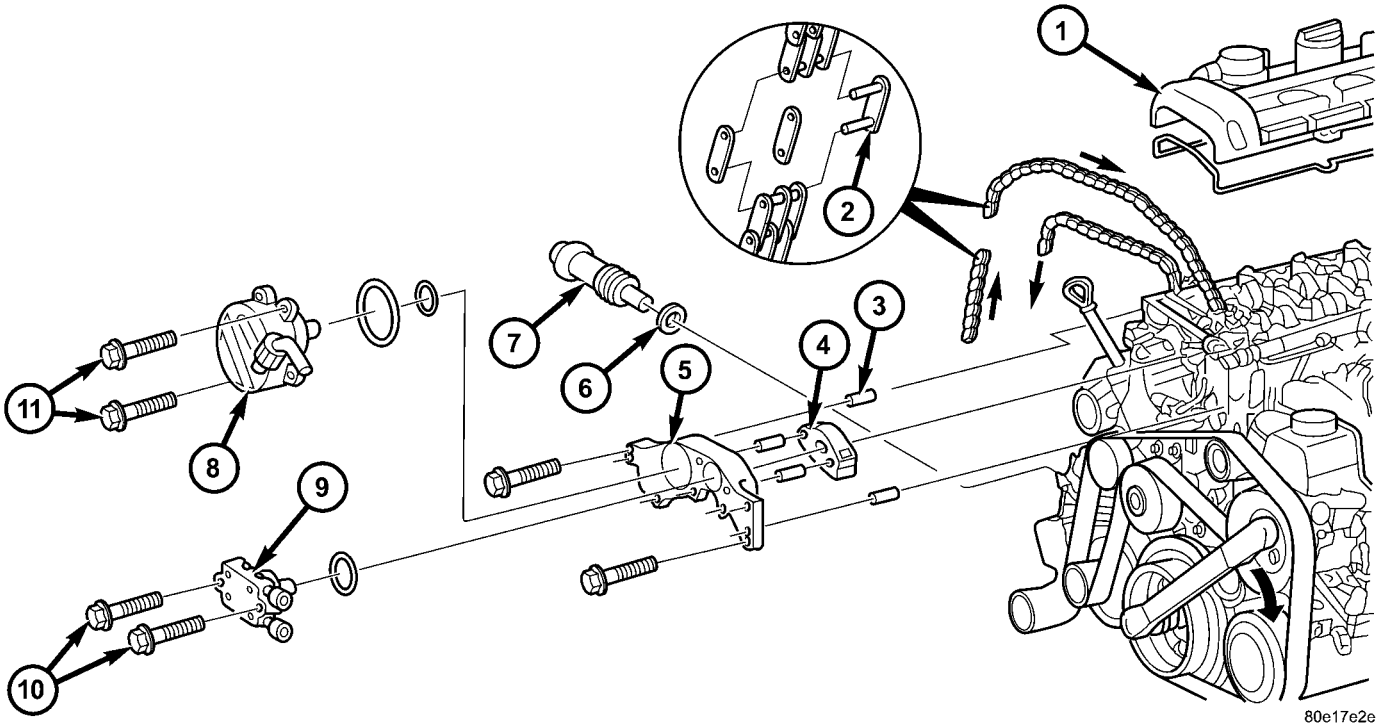


Fig. 75 TIMING CHAIN TEMPORARY LINK

1 - CYLINDER HEAD COVER
2 - TIMING CHAIN TEMPORARY LINK
3 - ALIGNMENT PINS
4 - TOP GUIDE RAIL
5 - CYLINDER HEAD FRONT COVER
6 - TIMING CHAIN TENSIONER SEAL
7 - TIMING CHAIN TENSIONER
8 - VACUUM PUMP
9 - LOW PRESSURE FUEL PUMP
10 - LOW PRESSURE PUMP MOUNTING BOLTS
11 - VACUUM PUMP MOUNTING BOLTS

CAUTION: IT IS ESSENTIAL that the installation procedure for the timing chain is followed exactly. Failure to do so will result in severe engine damage.

INSTALLATION

INSTALLATION - TENSIONING AND SLIDE RAIL

NOTE: Carefully clean all mating surfaces with appropriate solvents to assure that no grease or oil is present during reassembly.

CAUTION: ENSURE THAT THE SPRING IS CORRECTLY INSTALLED ON THE TENSIONING CLAMP AND SLIDE RAIL.

(1) Install rail on bearing pin (Fig. 67).
(2) Install timing cover (Refer to 9 - ENGINE/ VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).
(3) Install oil pan bolts. Tighten M6 bolts to 9N·m (80 lbs.in.) and M8 bolts to 20N·m (15 lbs. ft.).
(4) Install cylinder head (Refer to 9 - ENGINE/ CYLINDER HEAD - INSTALLATION).
(5) Install the engine.
(6) Reconnect negative 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 CLOTHES.

(7) Start the engine and inspect for leaks. care must be take to observe the fuel system warning (Refer to 14 - FUEL SYSTEM - WARNING).

INSTALLATION - INTERMEDIATE GEAR

NOTE: Refer to appropriate injector servicing procedures for cleaning of injectors and recesses.

(1) Install intermediate gear and bushing. Tighten bolt to 40N·m (30 lbs.ft.)
(2) Install camshaft sprocket, noting dowel pin alignment. Tighten bolt to 18 N·m (159 lbs. in.).
(3) Remove tie strap retaining timing chain to sprocket.

WARNING: NO FIRE, FLAMES OR SMOKING. SERVICE VEHICLE IN WELL VENTILATED AREA. RISK OF INJURY FROM INHALING OR SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. WEAR PROTECTIVE CLOTHING.

(4) Install high pressure pump (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL INJECTION PUMP - INSTALLATION).
(5) Install top slide rail (Refer to 9 - ENGINE/ VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).
(6) Install cylinder head front cover (Refer to 9 - ENGINE/CYLINDER HEAD - INSTALLATION).
(7) Install timing chain tensioner with new gasket (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

NOTE: Inspect basic position of camshaft and reset if necessary.

(8) Remove camshaft locking pin.
(9) Install cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

WARNING: NO FIRE, FLAMES OR SMOKING. SERVICE VEHICLE IN WELL VENTILATED AREA. RISK OF INJURY FROM INHALING OR SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. WEAR PROTECTIVE CLOTHING.

(10) Install fuel high pressure lines and injectors (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/ FUEL INJECTOR - INSTALLATION).
(11) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).
(12) Connect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH FAN. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.

(13) Start engine and inspect for leaks. Care must be taken to observe the fuel system warning (Refer to 14 - FUEL SYSTEM - WARNING).

INSTALLATION - TIMING CHAIN TENSIONING RAIL

NOTE: Carefully clean all mating surfaces with appropriate solvents to assure that no grease or oil is present during reassembly.

(1) Install tensioning rail on bearing pin
(2) Install timing cover (Refer to 9 - ENGINE/ VALVE TIMING/TIMING BELT / CHAIN COVER(S) - INSTALLATION).

(3) Install oil pan and bolts. Tighten M6 bolts to 9N·m (80 lbs.in.) and M8 bolts to 20N·m (15 lbs. ft.).

(4) Install cylinder head (Refer to 9 - ENGINE/ CYLINDER HEAD - INSTALLATION).

(5) Reconnect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

(6) Start the engine and inspect for leaks. Care must be taken to observe the fuel system warning (Refer to 14 - FUEL SYSTEM - WARNING).

ADJUSTMENTS

INSTALLATION - TIMING CHAIN

CAUTION: IT IS ESSENTIAL that the installation procedure is followed exactly. Failure to do so will result in severe engine damage.

CAUTION: Cover timing case recesses to prevent foreign material from entering engine.

(1) Connect new timing chain and old timing chain with the assembly link, the assembly plate and the assembly locking element, and secure (Fig. 76).

NOTE: Always keep new timing chain meshed with camshaft sprocket.

NOTE: Rotate engine at crankshaft only. DO NOT crank engine and DO NOT rotate engine backward (Fig. 76).

NOTE: Draw out the end of old timing chain evenly as it becomes free, to the same extent that new timing chain is drawn in (Fig. 76).

(2) Draw in new timing chain by rotating the crankshaft slowly in direction of rotation of engine until the ends of the new timing chain meet and can be connected (Fig. 76).

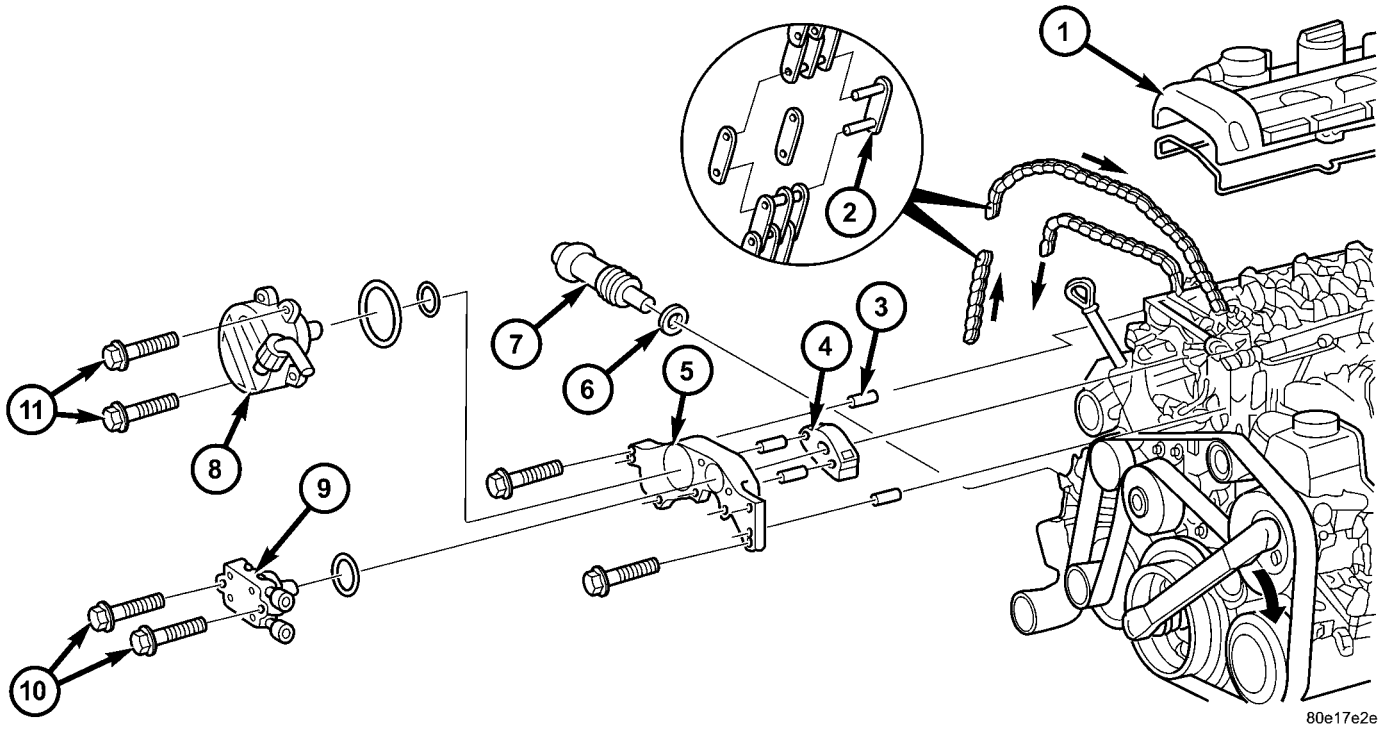


Fig. 76 TIMING CHAIN TEMPORARY LINK

1 - CYLINDER HEAD COVER
2 - TIMING CHAIN TEMPORARY LINK
3 - ALIGNMENT PINS
4 - TOP GUIDE RAIL
5 - CYLINDER HEAD FRONT COVER
6 - TIMING CHAIN TENSIONER SEAL
7 - TIMING CHAIN TENSIONER
8 - VACUUM PUMP
9 - LOW PRESSURE FUEL PUMP
10 - LOW PRESSURE PUMP MOUNTING BOLTS
11 - VACUUM PUMP MOUNTING BOLTS

TIMING BELT/CHAIN AND SPROCKETS (Continued)

NOTE: Assembly link is only an assembly aid and NOT designed for engine running.

(3) Remove assembly locking element, assembly outer plate and assembly link (Fig. 77).

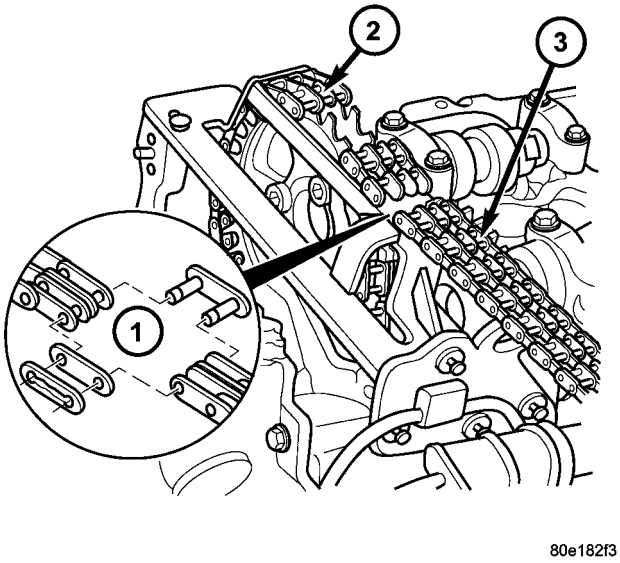


Fig. 77 REMOVING TEMPORARY LINK

1 - TEMPORARY LINK
2 - NEW TIMING CHAIN
3 - OLD TIMING CHAIN

(4) Attach new timing chain to camshaft sprocket and retain.

(5) Insert new riveted link and new middle plate into ends of timing chain (Fig. 78).

(6) Take off retaining devise at cylinder head.

(7) Remove camshaft sprocket from camshaft with timing chain secured.

NOTE: When assembling riveting tool, piece F5 is secured by a screw and D9 can move loosely on thrust spindle

(8) Assemble riveting tool by inserting pieces F5 and D9 (Fig. 79).

NOTE: Ensure that the riveted link and riveting tool are aligned.

(9) Press in new riveted link as far as the stop (Fig. 80).

(10) Remove riveting tool to change inserts.

(11) Install insert F1 on riveting tool and secure with screw (Fig. 81).

(12) Install insert D8 on riveting tool (Fig. 81).

NOTE: The outer plate is held magnetically by riveting tool.

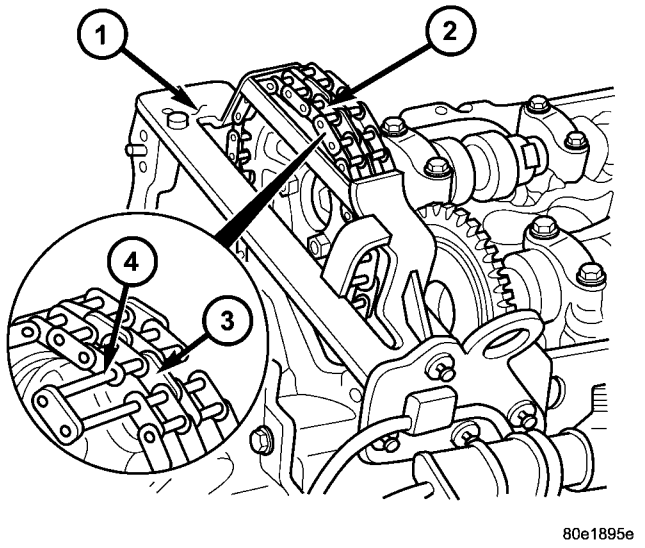


Fig. 78 INSERT NEW RIVETED LINK

1 - SPECIAL TOOL #8931
2 - NEW TIMING CHAIN ENDS
3 - NEW MIDDLE PLATE
4 - NEW RIVETED LINK

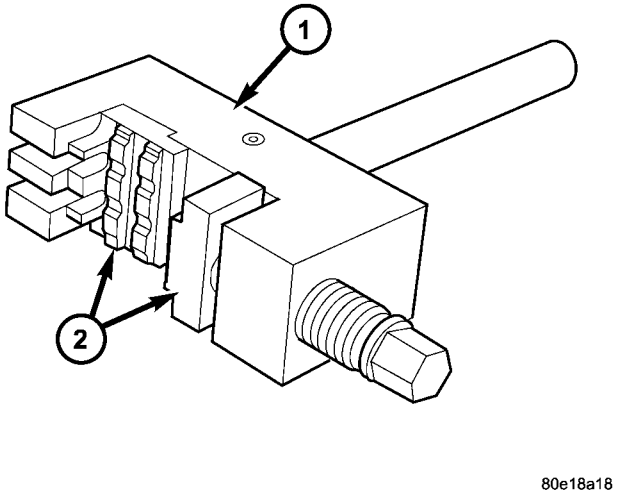


Fig. 79 INSTALLING ASSEMBLY INSERTS INTO RIVETING TOOL

1 - SPECIAL TOOL #8947
2 - SPECIAL TOOL #8952

(13) Insert new outer plate into the moving assembly insert.

(14) Position riveting tool so that spacer webs of the guide are side by side.

(15) Ensure that riveted link and outer plate are aligned (Fig. 82).

TIMING BELT/CHAIN AND SPROCKETS (Continued)

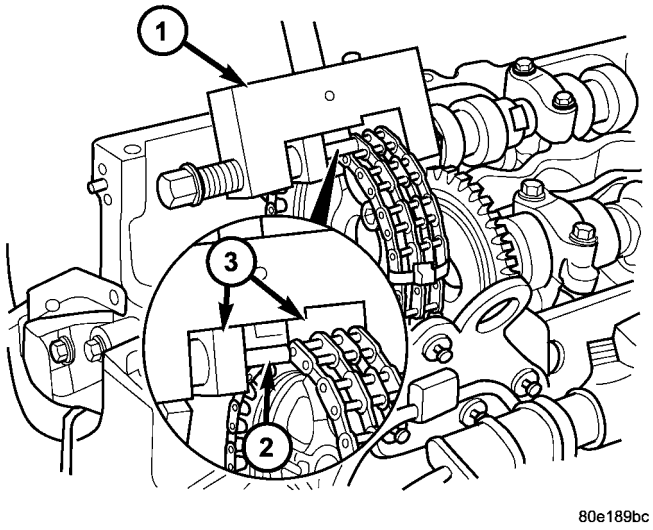


Fig. 80 PRESSING IN NEW RIVETED LINK

1 - SPECIAL TOOL #8947
2 - NEW RIVETED LINK
3 - SPECIAL TOOL #8952

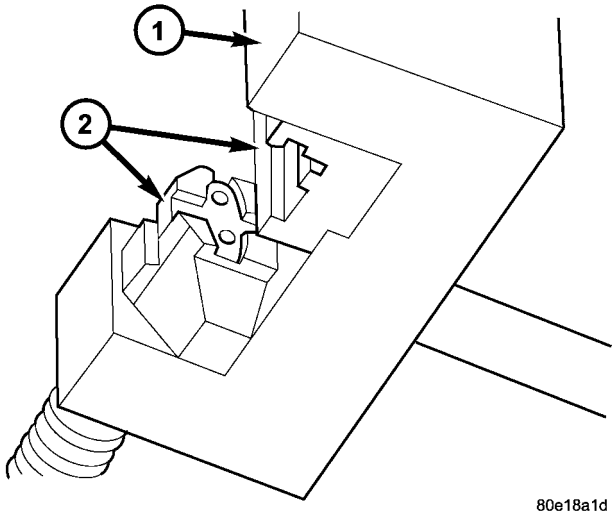


Fig. 81 INSTALLING RIVETING INSERTS INTO RIVETING TOOL

1 - SPECIAL TOOL #8947
2 - SPECIAL TOOL #8949

NOTE: When turning spindle of riveting tool, be sure that pins of riveted link are inserted into holes of outer plate (Fig. 82).

(16) Screw in spindle of riveting tool until firm resistance is felt (Fig. 82).

(17) Remove riveting tool.

(18) Turn over moving assembly insert (D8) to the riveting profile.

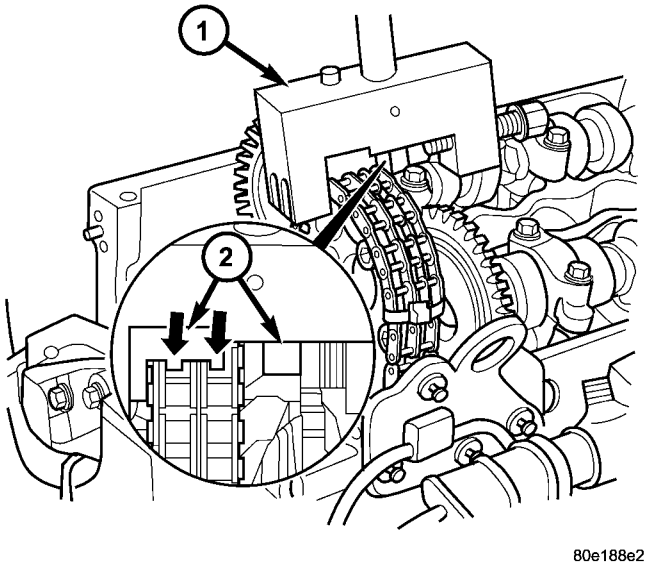


Fig. 82 INSTALLING LINK OUTER PLATE

1 - SPECIAL TOOL #8947
2 - SPECIAL TOOL #8949

(19) Position riveting tool exactly over middle of pin.

(20) Tighten riveting tool spindle to end of travel.

(21) Repeat procedure for both riveting pins (Fig. 83).

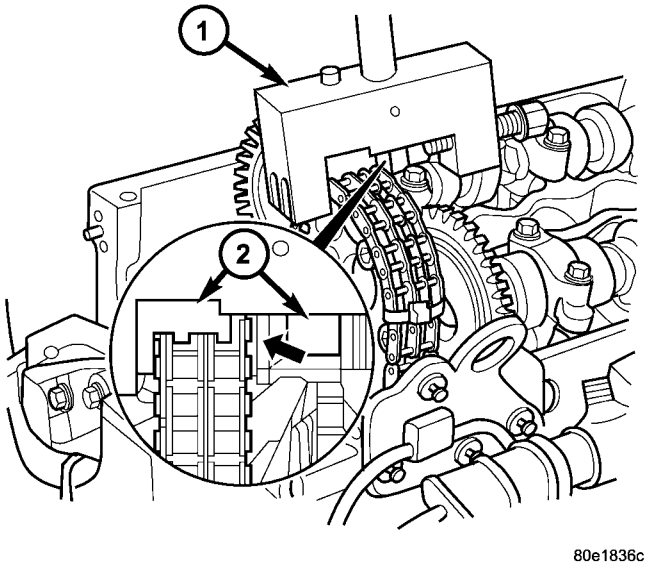
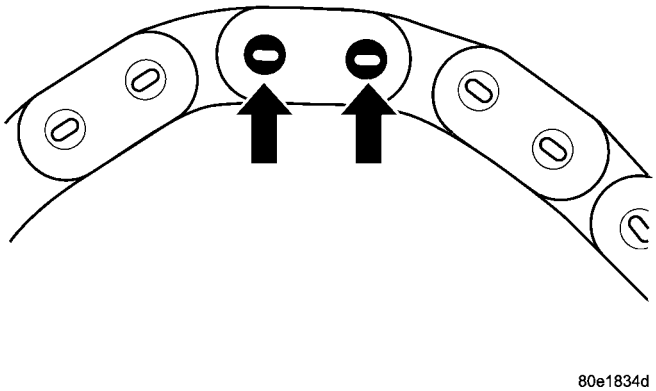


Fig. 83 RIVETING LINKS OF THE RIVETED LINK

1 - SPECIAL TOOL #8947
2 - SPECIAL TOOL #8949

(22) Inspect riveting, re-rivet if required (Fig. 84).

(23) Install camshaft sprocket with timing chain retained onto camshaft. Tighten camshaft bolts to 18N·m (159 lbs.in.).



80e1834d

Fig. 84 RIVET INSPECTION

(24) Remove camshaft sprocket to timing chain tie straps.

(25) Install guide rail and tighten low pressure fuel pump drive to 50N·m (37 lbs. ft.).

(26) Install low pressure fuel pump (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL INJECTION PUMP - INSTALLATION).

(27) Install timing chain tensioner (Refer to 9 - ENGINE/VALVE TIMING/TIMING BELT/CHAIN AND SPROCKETS - INSTALLATION).

(28) Install vacuum pump (Refer to 9 - ENGINE/ENGINE BLOCK/INTERNAL VACUUM PUMP - INSTALLATION).

(29) Install cylinder head cover (Refer to 9 - ENGINE/CYLINDER HEAD/CYLINDER HEAD COVER(S) - INSTALLATION).

(30) Install engine cover (Refer to 9 - ENGINE - INSTALLATION).

(31) Connect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT PUT YOUR HANDS NEAR THE PULLEYS BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

(32) Start engine and inspect for leaks. Care must be taken to observe the fuel system warning (Refer to 14 - FUEL SYSTEM - WARNING).

TIMING CHAIN TENSIONER

REMOVAL

(1) Disconnect negative battery cable.

CAUTION: Rotate engine at crankshaft only. DO NOT rotate the engine with the bolt of the camshaft sprocket. DO NOT rotate the engine counter clockwise.

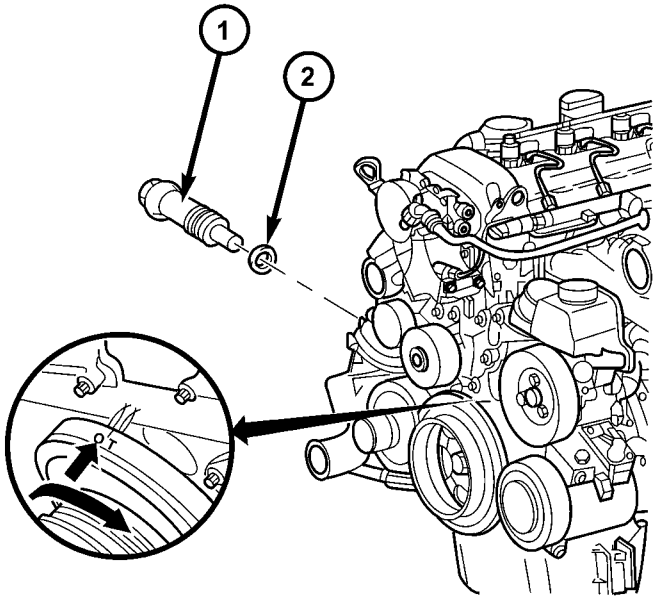
NOTE: Markings on the camshaft and camshaft bearing cap must be aligned.

(2) Position piston of number 1 cylinder to ignition TDC.

(3) Remove intake air scoop.

(4) Remove accessory drive belt and idler pulley above generator (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(5) Remove timing chain tensioner (Fig. 85).



80e1dc4f

Fig. 85 TIMING CHAIN TENSIONER

1 - TIMING CHAIN TENSIONER
2 - TIMING CHAIN TENSIONER SEAL

TIMING CHAIN TENSIONER (Continued)

INSTALLATION

NOTE: Carefully clean all mating surfaces with appropriate solvents to assure that no grease or oil is present during reassembly.

(1) Install timing chain tensioner with new gasket. Tighten to 80N·m (59 lbs.ft.).
(2) Install idler pulley and accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).
(3) Install intake air scoop.
(4) Reconnect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT PUT YOUR HANDS NEAR THE PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

(5) Start the engine and inspect for leaks.

EXHAUST SYSTEM

TABLE OF CONTENTS

page

EXHAUST SYSTEM
DESCRIPTION - 2.7L DIESEL 1
DIAGNOSIS AND TESTING - DIESEL ENGINE . . 2
CATALYTIC CONVERTER
REMOVAL 3
INSTALLATION 3
EXHAUST PIPE
REMOVAL 3
INSTALLATION 3
TAILPIPE
REMOVAL 3
INSTALLATION 3
TURBOCHARGER SYSTEM
DESCRIPTION 3
OPERATION 4
CHARGE AIR COOLER AND PLUMBING
DESCRIPTION 4
OPERATION 4
DIAGNOSIS AND TESTING - CHARGE AIR COOLER SYSTEM - LEAKS 4
REMOVAL 5
CLEANING 5
INSPECTION 5
INSTALLATION 5
TURBOCHARGER
DESCRIPTION 6
OPERATION 6
REMOVAL
REMOVAL 7
REMOVAL - VACUUM TRANSDUCER 7
INSTALLATION
INSTALLATION 8
INSTALLATION - VACUUM TRANSDUCER . . . 8

EXHAUST SYSTEM

DESCRIPTION - 2.7L DIESEL

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.

The diesel engine exhaust system consists of an engine exhaust manifold, turbocharger, exhaust pipe, resonator, extension pipe (if needed), muffler and exhaust tailpipe (Fig. 1).

The exhaust system must be properly aligned and secured to prevent stress, leakage and body contact. The exhaust components should be kept a minimum of 25.4 mm (1.0 in.) away from the body and frame. If the system contacts any body panel, it may amplify objectionable noises from the engine or body.

EXHAUST SYSTEM (Continued)

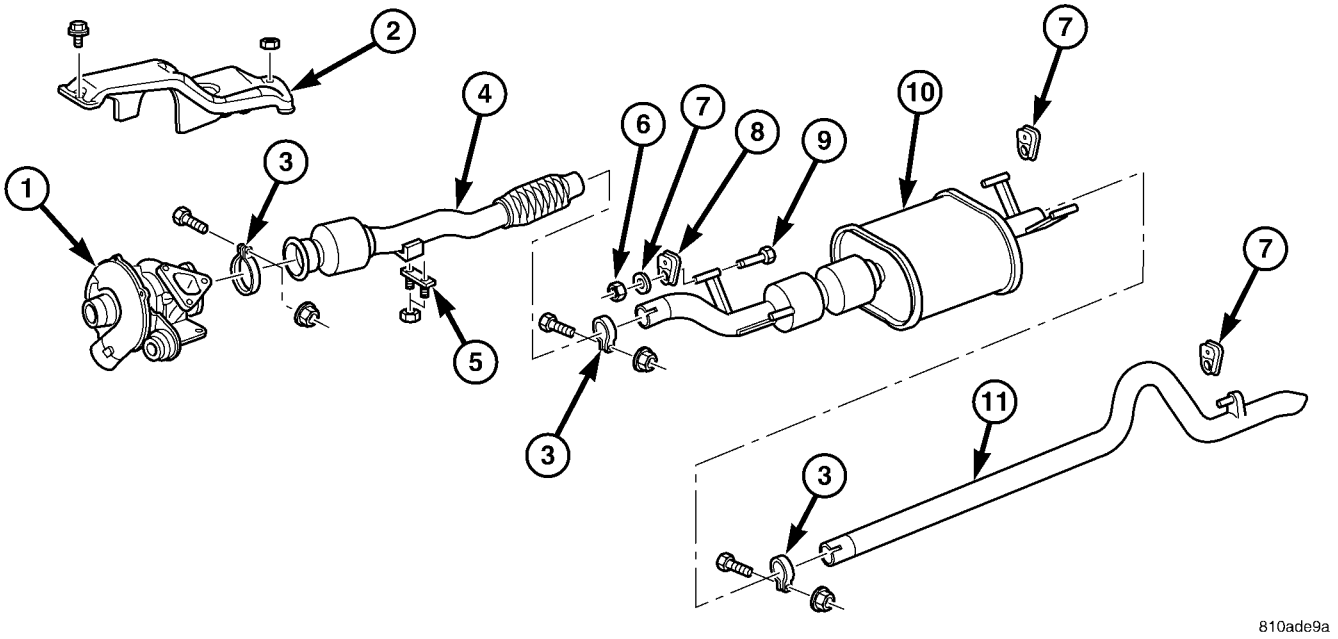


Fig. 1 Exhaust System

1 - TURBOCHARGER
2 - HEAT SHIELD
3 - CLAMP
4 - EXHAUST PIPE
5 - FRONT INSULATOR
6 - NUT
7 - WASHER
8 - INSULATOR
9 - BOLT
10 - MUFFLER/CATALYTIC CONVERTER ASSEMBLY
11 - TAILPIPE

DIAGNOSIS AND TESTING - DIESEL ENGINE

EXHAUST SYSTEM DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSE	CORRECTION
EXCESSIVE EXHAUST NOISE OR LEAKING EXHAUST GASES	1. Leaks at pipe joints.	1. Tighten/replace clamps/bolts at leaking joints.
	2. Rusted or expanded muffler.	2. Replace muffler. Inspect exhaust system.
	3. Broken or rusted exhaust pipe.	3. Replace exhaust pipe.
	4. Exhaust pipe leaking at manifold flange.	4. Tighten/replace flange attaching nuts/bolts.
	5. Exhaust manifold cracked or broken.	5. Replace exhaust manifold.
	6. Leak between exhaust manifold and cylinder head.	6. Tighten/replace exhaust manifold to cylinder head bolts.
	7. Turbocharger mounting flange cracked.	7. Remove turbocharger and inspect.
	8. Restriction in exhaust system.	8. Remove restriction, if possible. Replace restricted part if necessary.

CATALYTIC CONVERTER

REMOVAL

(1) Raise and support the vehicle.
(2) Saturate the clamp nuts with heat valve lubricant. Allow 5 minutes for penetration. Remove the rear clamp. (Fig. 1)
(3) Saturate the clamp nuts with heat valve lubricant. Allow 5 minutes for penetration. Remove the front clamp.
(4) Remove the cataylic converter and muffler assembly from the isolators.
(5) Seperat the cataylic converter and muffler assembly from the tailpipe and the exhaust pipe.
(6) Remove the cataylic converter and muffler assembly and isolators from the vehicle.
(7) Remove the bolt, nut and front isolator from the cataylic converter and muffler assembly.
(8) Remove the rear isolator from the cataylic converter and muffler assembly.
(9)

INSTALLATION

(1) Install bolt, front isolator and nut (Fig. 1).
(2) Install rear insulator onto the cataylic converter and muffler assembly
(3) Position the cataylic conveter and muffler assembly into the exhaust pipe and tailpipe until alignment tab is inserted into the alignment slot.
(4) Install the front and rear insulators.
(5) Install the real clamp.
(6) Install the front clamp.
(7) Lower vehicle.
(8) Start the vehicle and inspect for exhaust leaks. Repair exhaust leaks as necessary.
(9) Check the exhaust system for contact with the body panels. Make necessary adjustments, if necessary.

EXHAUST PIPE

REMOVAL

(1) Raise and support the vehicle.
(2) Saturate the clamp nuts with heat valve lubricant. Allow 5 minutes for penetration. Remove the front and rear clamp (Fig. 1).
(3) Remove the mounting bracket nuts.
(4) Remove the exhaust pipe.

INSTALLATION

(1) Position the exhaust pipe into the exhaust pipe into the cataylic converter and muffler assembly until alignment tab is inserted into the alignment slot.
(2) Install mounting bracket and nuts (Fig. 1).
(3) Install clamp.
(4) Lower the vehicle.
(5) Start the vehicle and inspect for exhaust leaks. Repair exhaust leaks as necessary.
(6) Check the exhaust system for contact with the body panels. Make necessary adjustments, if necessary.

TAILPIPE

REMOVAL

(1) Raise and support the vehicle.
(2) Saturate the clamp nuts with heat valve lubricant. Allow 5 minutes for penetration (Fig. 1).
(3) Remove the clamp.
(4) Remove the tailpipe and insulator form the vehicle
(5) Remove the insulator from the tailpipe.

INSTALLATION

(1) Position the tail pipe into the cataylic converter and muffler assembly until alignment tab is inserted into the alignment slot.
(2) Install the insulator.
(3) Install the clamp.
(4) Lower the vehicle.
(5) Start the vehicle and inspect for exhaust leaks. Repair exhaust leaks as necessary.
(6) Check the exhaust system for contact with the body panels. Make necessary adjustments, if necessary.

TURBOCHARGER SYSTEM

DESCRIPTION

CAUTION: The turbocharger is a performance part and must not be tampered with. The boost pressure bracket is an integral part of the turbocharger. Tampering with the boost pressure components can reduce durability by increasing cylinder pressure and thermal loading due to incorrect inlet and exhaust manifold pressure. Poor fuel economy and failure to meet regulatory emissions laws may result. Increasing the turbocharger boost WILL NOT increase engine power.

The turbocharger used on this vehicle is of the variable turbine type. These turbochargers use the entire exhaust energy to boost efficiency of the turbocharger and the engine.

The advantages of a turbocharger with variable turbine geometry are:

- Higher charge pressure already in the lower and in upper engine speed ranges.

TURBOCHARGER SYSTEM (Continued)

- Higher torque as a result of improved cylinder charge.
- Reduction in exhaust emissions as a result of an improvement in the air supply of the engine.
- Increased power output as a result of the higher charge pressure combined with a reduced exhaust backpressure and thus improved charge cycle.

OPERATION

The exhaust gases of the engine are directed through the exhaust manifold into the turbine housing onto the turbine wheel (Fig. 2). The flow energy of the exhaust gases cause the turbine wheel to rotate. Consequently, the compressor wheel, which is connected through the turbine shaft with the turbine wheel, is driven at the same speed. The fresh air inducted by the compressor wheel is compressed and passed to the engine (Fig. 2).

The charge pressure is controlled by varying the position of the guide vanes (Fig. 2). The guide stud of the control linkage of the boost pressure actuator turns the adjusting ring in the turbine housing (Fig. 2). As a result, all the guide vanes whose guide studs likewise mesh into the adjusting ring, are also turned (Fig. 2).

At low speeds, the flow cross-section is reduced by closing the guide vanes (Fig. 2). Consequently the speed at which the exhaust gas impacts on the turbine wheel is increased, as a result of which the speed of the turbocharger and thus the charge pressure rises.

At high engine speeds the guide vanes are increasingly opened and the flow cross-section is thus enlarged, as a result of which the speed of the turbocharger reduces and the charge pressure drops.

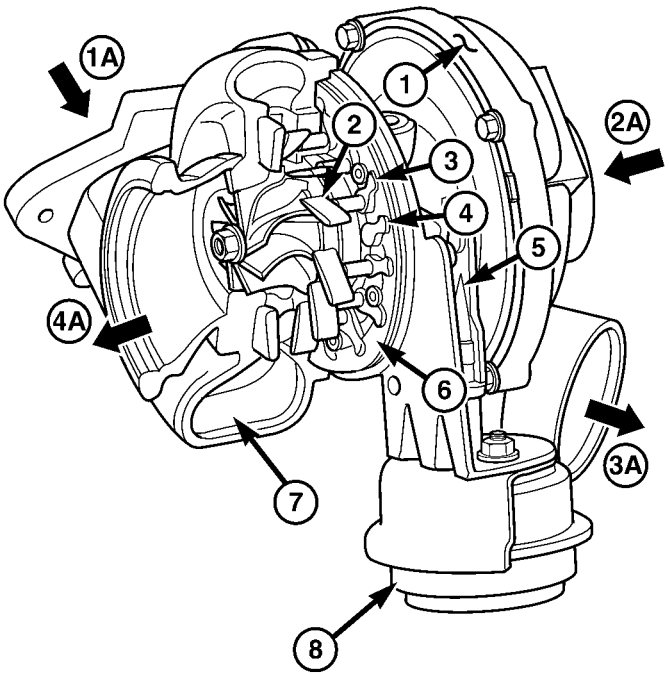


Fig. 2 TURBOCHARGER COMPONENTS

1 - COMPRESSOR HOUSING
2 - GUIDE VANE
3 - GUIDE STUD OF GUIDE VANE
4 - GUIDE STUD OF CONTROL LINKAGE
5 - CONTROL LINKAGE
6 - ADJUSTING RING
7 - TURBINE HOUSING
8 - BOOST PRESSURE CONTROL UNIT
1A - EXHAUST GASES TO TURBINE WHEEL
2A - TURBO INLET (FRESH AIR)
3A - TURBO OUTLET (COMPRESSED AIR)
4A - EXHAUST OUTLET

CHARGE AIR COOLER AND PLUMBING

DESCRIPTION

The charge air system consists of the charge air cooler and charge air cooler piping.

The charge air cooler is a heat exchanger that uses air flow from vehicle motion to dissipate heat from the intake air. As the turbocharger increases air pressure, the air temperature increases. Lowering the intake air temperature increases engine efficiency and power.

OPERATION

Intake air is drawn through the air cleaner and into the turbocharger compressor housing. Pressurized air from the turbocharger then flows forward through the charge air cooler located in front of the radiator. From the charge air cooler the air flows back into the intake manifold.

DIAGNOSIS AND TESTING - CHARGE AIR COOLER SYSTEM - LEAKS

NOTE: Slight engine oil pooling in the charge air inlet hose IS NOT premature turbocharger failure. Slight pooling is the normal result of the breather system. Test the air breather tube for normal operation by referring to the appropriate diagnostic manual.

CHARGE AIR COOLER AND PLUMBING (Continued)

Low turbocharger boost pressure and low engine performance can be caused by leaks in the charge air cooler or it's plumbing. The following procedure outlines how to check for leaks in the charge air cooler system.

(1) Loosen clamp and remove turbocharger to air inlet duct rubber sleeve from turbocharger.

(2) Insert Special Tool 8442 Adapter into the rubber sleeve. Tighten existing clamp to 8 N·m (72 in.lbs.).

CAUTION: Do not apply more than 138 kpa (20 psi) air pressure to the charge air cooler system, sever damage to the charge air cooler system may occur.

(3) Connect regulated air supply to air fitting on Special Tool 8442 Adapter. Set air pressure to a Maximum of 138 kpa (20 psi).

(4) Using soapy water check the air inlet ducts, rubber sleeves, charge air cooler and intake manifold for leaks.

REMOVAL

(1) Remove front bumper.

(2) Remove headlamp assemblies.

(3) Remove front cross member together with front grille.

(4) Remove left and right radiator trim (Fig. 3).

(5) Disconnect charge air hoses at charge air cooler (Fig. 3).

(6) Disconnect power steering cooler loop from charge air cooler (Fig. 3).

(7) Remove charge air cooler from radiator assembly (Fig. 3).

CLEANING

CAUTION: Do not use caustic cleaners to clean the charge air cooler. Damage to the charge air cooler will result.

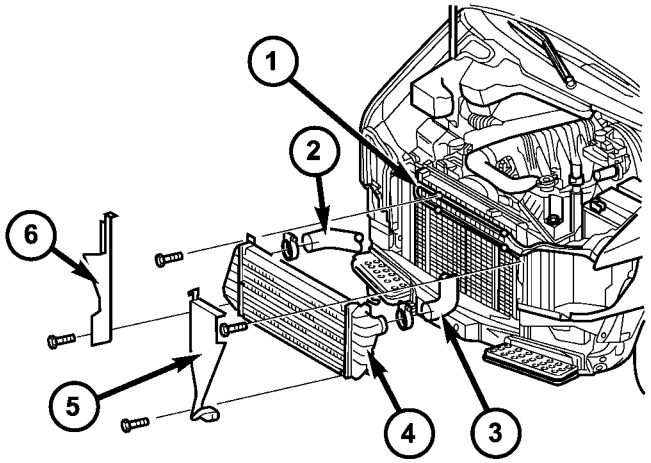
NOTE: If internal debris cannot be removed from the cooler, the charge air cooler MUST be replaced.

(1) If the engine experiences a turbocharger failure or any other situation where oil or debris get into the charge air cooler, the charge air cooler must be cleaned internally.

(2) Position the charge air cooler so the inlet and outlet tubes are vertical.

(3) Flush the cooler internally with solvent in the direction opposite of normal air flow.

(4) Shake the cooler and lightly tap on the end tanks with a rubber mallet to dislodge trapped debris.



810afd4f

Fig. 3 CHARGE AIR COOLER

1 - POWER STEERING COOLER LOOP
2 - CHARGE AIR HOSE
3 - CHARGE AIR COOLER HOSE
4 - CHARGE AIR COOLER
5 - LEFT RADIATOR TRIM PANEL
6 - RIGHT RADIATOR TRIM PANEL

(5) Continue flushing until all debris or oil are removed.

(6) Rinse the cooler with hot soapy water to remove any remaining solvent.

(7) Rinse thoroughly with clean water and blow dry with compressed air.

INSPECTION

Visually inspect the charge air cooler for cracks, holes, or damage. Inspect the tubes, fins, and welds for tears, breaks, or other damage. Replace the charge air cooler if damage is found.

Pressure test the charge air cooler, using Charge Air Cooler Tester Kit.

INSTALLATION

(1) Install charge air cooler to radiator (Fig. 3).

(2) Connect power steering cooler loop to charge air cooler (Fig. 3).

(3) Connect charge air hoses (Fig. 3).

(4) Install both radiator trim pieces (Fig. 3).

(5) Install front grille with front cross member.

(6) Install headlamp assemblies.

(7) Install front bumper.

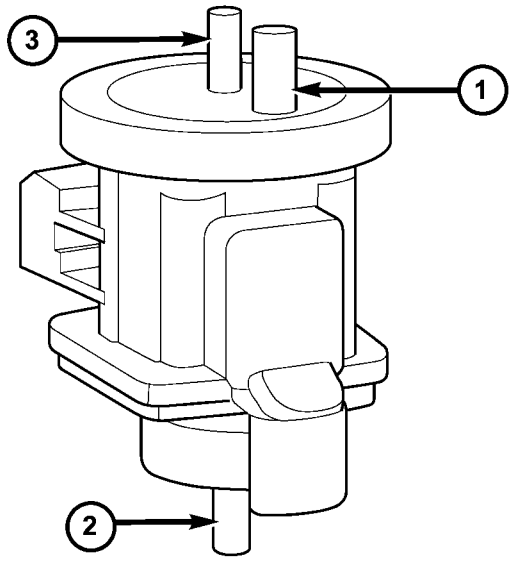
TURBOCHARGER

DESCRIPTION

The boost pressure vacuum solenoid is located under the air filter housing and is responsible for turbo-charger boost pressure. It generates a control vacuum in response to a PWM signal from the ECM. Vacuum is achieved by mixing the system vacuum (from the vacuum pump) with atmospheric pressure to a certain degree. The resulting vacuum is sent to the vacuum unit at the turbocharger (Fig. 4).

OPERATION

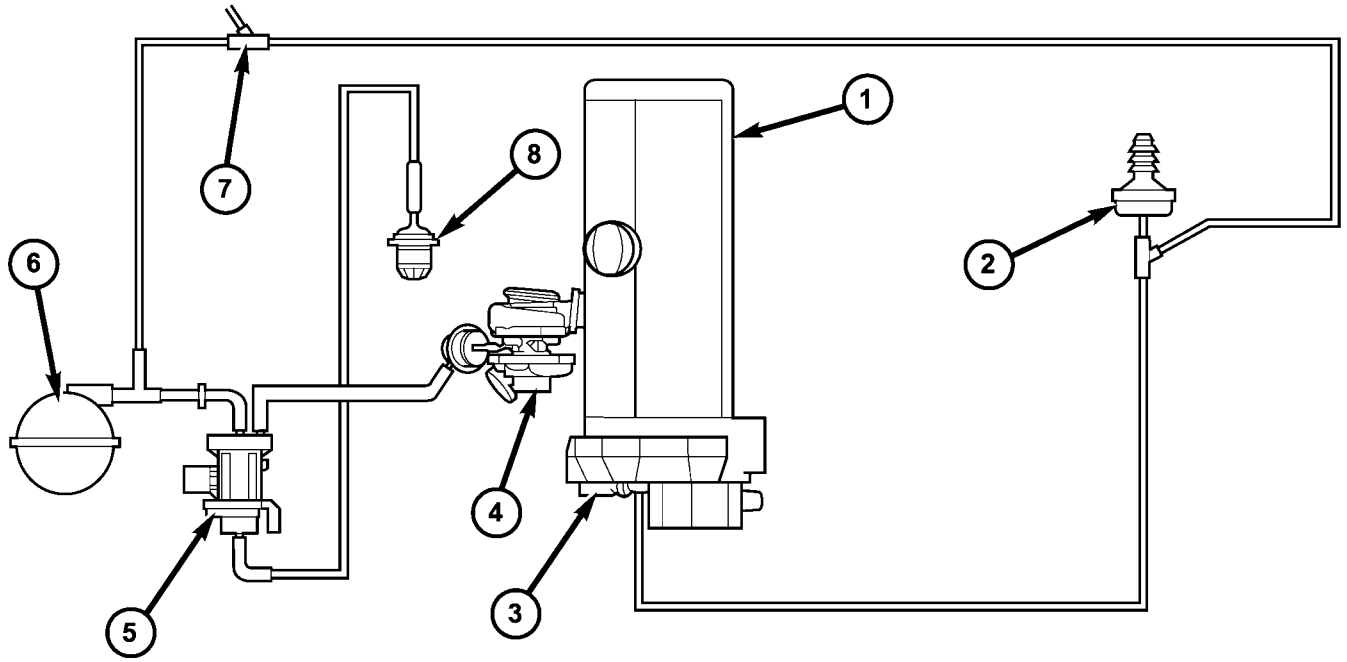
The vacuum solenoid receives 12V from the ECM. The ECM controls the solenoid through a PWM signal. When the solenoid receives a signal it closes the passage to atmospheric pressure. The subchamber is no longer under atmospheric pressure, it's spring can push the diaphragm and valve downwards; this releases the VAC duct. Vacuum can now go from here through the throttle hole, filters and out the connection to the turbocharger vacuum unit (Fig. 5).



8109a56b

Fig. 4 CHARGE PRESSURE VACUUM TRANSDUCER

1 - CONNECTION TO TURBOCHARGER VACUUM UNIT
2 - VENT
3 - SUPPLY FROM VACUUM PUMP



810afe11

Fig. 5 TURBOCHARGER VACUUM ROUTING

1 - ENGINE
2 - BRAKE BOOSTER CHECK VALVE
3 - VACUUM PUMP
4 - TURBOCHARGER
5 - VACUUM SOLENOID
6 - VACUUM RESERVOIR
7 - ACCESSORY VACUUM JUNCTION
8 - FILTER

TURBOCHARGER (Continued)

REMOVAL

REMOVAL

NOTE: Capture any fluid spillage and store in an appropriately marked and suitable containers.

(1) Disconnect the negative battery cable.
(2) Remove the heat shield (Fig. 6).
(3) Separate the front exhaust pipe from the turbocharger (Fig. 6)
(4) Separate the charge air and intake air hoses at the turbocharger (Fig. 6).
(5) Remove the vacuum line from the turbocharger vacuum unit (Fig. 6).
(6) Separate the oil supply at the cylinder head and turbocharger (Fig. 6).
(7) Separate the oil return flow line at the turbocharger (Fig. 6).
(8) Remove the turbocharger support bracket (Fig. 6).
(9) Remove turbocharger from exhaust manifold (Fig. 6).

REMOVAL - VACUUM TRANSDUCER

(1) Disconnect the negative battery cable.
(2) Remove the air cleaner housing (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL).
(3) Disconnect the electrical connector.
(4) Disconnect the vacuum hoses.
(5) Remove the vacuum transducer retaining bolts and remove vacuum transducer.

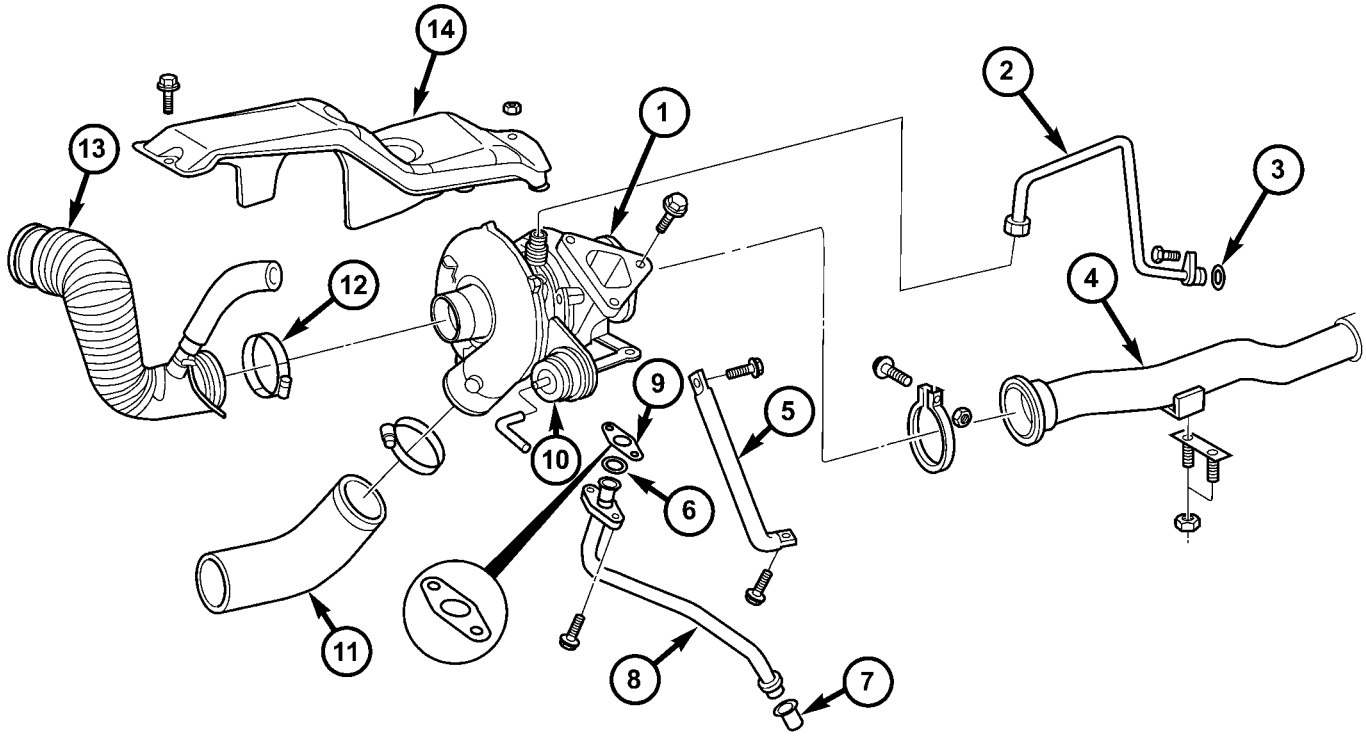


Fig. 6 TURBOCHARGER

1 - TURBOCHARGER
2 - OIL SUPPLY LINE
3 - O-RING
4 - FRONT EXHAUST PIPE
5 - BRACKET
6 - O-RING
7 - GASKET
8 - OIL RETURN LINE
9 - GASKET
10 - VACUUM UNIT
11 - CHARGE AIR HOSE
12 - CLAMP
13 - AIR INTAKE HOSE
14 - HEAT SHIELD

TURBOCHARGER (Continued)

INSTALLATION

INSTALLATION

(1) Clean all mating surfaces

(2) Install turbocharger to exhaust manifold. Tighten bolts to 22 lbs. ft. (20 N·m) (Fig. 6).

NOTE: Slacken the bottom bolt of the turbocharger support bracket to install bracket stress free.

(3) Install turbocharger support bracket. Tighten bolts to 177 lbs. in. (20 N·m) at engine and 22 lbs. ft. (30 N·m) at turbocharger (Fig. 6).

(4) Replace gaskets and install oil return line at turbocharger. Tighten bolt to 80 lbs. in. (9 N·m) (Fig. 6).

NOTE: Counterhold the connection at the turbocharger when tightening the oil supply line bolt.

(5) Replace gaskets and install oil supply line at turbocharger. Tighten bolt to 160 lbs. in. (18 N·m) (Fig. 6).

(6) Attach turbocharger vacuum line to vacuum unit (Fig. 6).

(7) Attach air intake and charge air hoses (Fig. 6).

(8) Connect front exhaust pipe to turbocharger. Tighten flange clamp to 22 lbs.ft. (30 N·m) (Fig. 6).

(9) Install heat shield (Fig. 6).

(10) Connect negative battery cable.

INSTALLATION - VACUUM TRANSDUCER

(1) Position vacuum transducer and install the retaining bolts. Tighten bolts to 70 lbs.in (8 N·m).

(2) Connect vacuum hoses.

(3) Connect electrical connector

(4) Install air cleaner housing (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION)

(5) Connect negative battery cable.

FRAME & BUMPERS

TABLE OF CONTENTS

page

BUMPERS
SPECIFICATIONS - TORQUE 1
FRONT BUMPER - STEPS
REMOVAL 2
INSTALLATION 2
FRONT FASCIA
REMOVAL 2
INSTALLATION 2
REAR BUMPER - STEP
REMOVAL 3
INSTALLATION 3
REAR FASCIA
REMOVAL 3
INSTALLATION 3

page

FRAME
SPECIFICATIONS
SPECIFICATIONS - FRAME DIMENSIONS . . . 4
SPECIFICATIONS - TORQUE 6
ENGINE CRADLE CROSSMEMBER
REMOVAL 6
INSTALLATION 8
REAR CROSSMEMBER - TRANSMISSION
REMOVAL 9
INSTALLATION 9
TRAILER HITCH
REMOVAL 9
INSTALLATION 10

BUMPERS

SPECIFICATIONS - TORQUE

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
FRONT BUMPER - STEPS BOLTS	20	15	—
FRONT FASCIA SCREWS	23	17	—
REAR BUMPER STEP FRAME BOLTS/ NUTS	38	17	—
REAR BUMPER STEP SUPPORT BOLTS	90	66	—
REAR FASCIA BOLTS	23	17	—

FRONT BUMPER - STEPS

REMOVAL

(1) Remove fascia. (Refer to 13 - FRAME & BUMPERS/BUMPERS/FRONT FASCIA - REMOVAL)

(2) Remove the bolts and remove the steps. (Fig. 1)

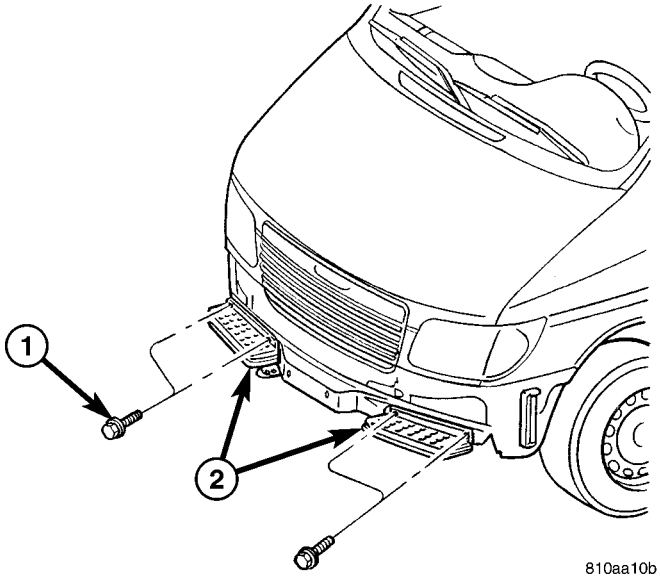


Fig. 1 BUMPER STEPS

1 - BOLTS (2 PER STEP)
2 - STEPS

INSTALLATION

(1) Install step and bolts.

(2) Tighten bolts to 20 N·m (15 ft. lbs.).

(3) Install fascia. (Refer to 13 - FRAME & BUMPERS/BUMPERS/FRONT FASCIA - INSTALLATION)

FRONT FASCIA

REMOVAL

(1) Remove the screws and cover. (Fig. 2)

(2) Remove push pin fasteners.

(3) Remove fascia screws.

(4) Pull bumper forward off support brackets.

(5) Disconnect electrical connector.

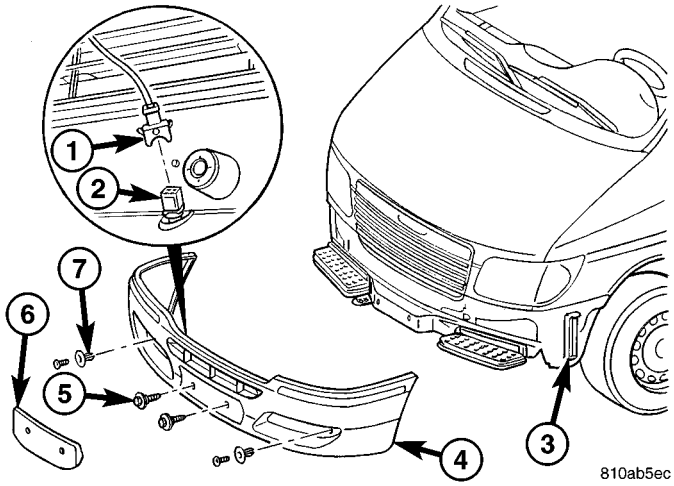


Fig. 2 FRONT FASCIA

1 - ELECTRICAL CONNECTOR
2 - OUTSIDE TEMPERATURE SENSOR
3 - FASCIA SUPPORT BRACKET
4 - FASCIA
5 - SCREWS (2)
6 - COVER
7 - PUSH PIN FASTENERS

INSTALLATION

(1) Connect outside temperature sensor electrical connector.

(2) Slide fascia onto the support brackets.

(3) Install fascia screws and tighten to 23 N·m (17 ft. lbs.).

(4) Install push pin fasteners.

(5) Install cover and screws.

REAR BUMPER - STEP

REMOVAL

(1) Remove rear fascia. (Refer to 13 - FRAME & BUMPERS/BUMPERS/REAR FASCIA - REMOVAL)
(2) Remove frame bolts/nuts. (Fig. 3)
(3) Remove the remaining support bolts.

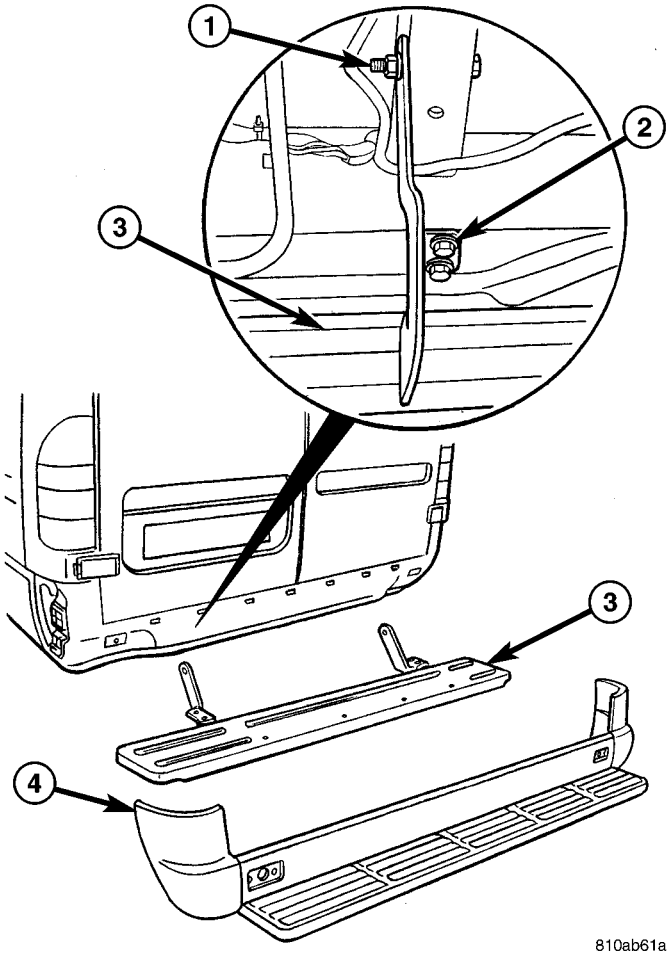


Fig. 3 REAR BUMPER STEP

1 - FRAME BOLTS/NUTS (2)
2 - BOLTS (4)
3 - BUMPER STEP
4 - REAR FASCIA

INSTALLATION

(1) Install bumper step and install support bolts.
(2) Tighten bolts to 38 N·m (28 ft. lbs.).
(3) Install frame bolts/nuts and tighten to 90 N·m (66 ft. lbs.).
(4) Install fascia. (Refer to 13 - FRAME & BUMPERS/BUMPERS/REAR FASCIA - INSTALLATION)

REAR FASCIA

REMOVAL

(1) Remove screws and remove reflectors. (Fig. 4)
(2) Remove fascia bolts.
(3) Release bumper support brackets clips below end panel.
(4) Press dowel pins out of and remove four plastic rivets connecting fascia to rear step, if equipped.
(5) Separate the corners of the fascia from the support brackets and remove fascia.

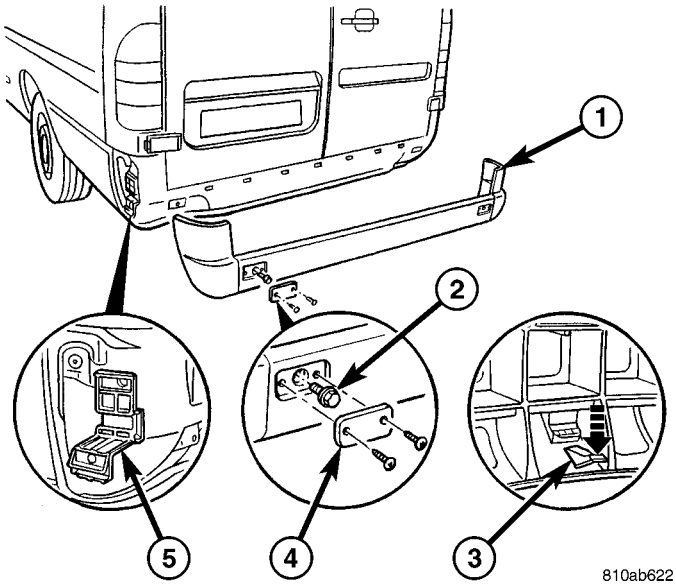


Fig. 4 REAR FASCIA

1 - FASCIA
2 - BOLTS
3 - TAB
4 - REFLECTOR
5 - SUPPORT BRACKET

INSTALLATION

(1) Install fascia and seat the corners over the support brackets.
(2) Seat bumper support brackets clips below end panel firmly.
(3) Install the four plastic rivets to the bumper step, if equipped.
(4) Install fascia bolts and tighten to 23 N·m (17 ft. lbs.).
(5) Install reflectors and reflector screws.

FRAME

SPECIFICATIONS

SPECIFICATIONS - FRAME DIMENSIONS

NOTE: Frame dimensions are listed in metric scale.

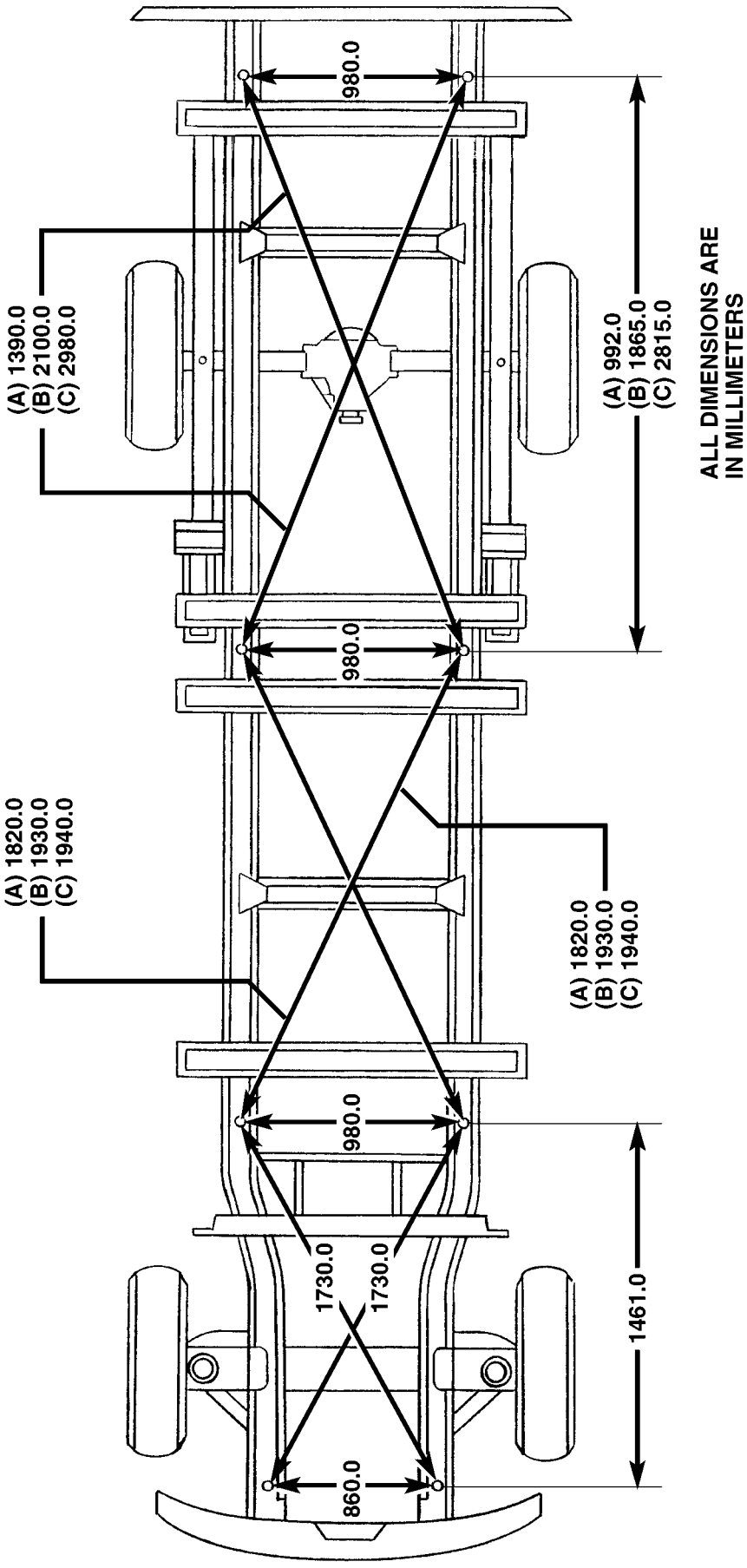
VEHICLE PREPARATION

Position the vehicle on a level work surface. Vertical dimensions can be taken from the work surface to the locations indicated were applicable.

INDEX

DESCRIPTION	FIGURE
FRAME DIMENSIONS	5

FRAME (Continued)



	MODEL	WHEEL BASE
A	141	2997.0 (118")
B	241	3556.0 (140")
C	341	4013.0 (158")

Fig. 5 FRAME DIMENSIONS

FRAME (Continued)

SPECIFICATIONS - TORQUE

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Brake line nuts	14	10	—
Brake pads wear indicator caliper bolt	10	7	89
Engine cradle bolts	125	92	—
Engine mount bolt to engine bracket	83	61	—
Engine mount nuts to engine cradle	45	33	—
Power steering line nuts	37	27	—
Steering gear mounting bolts - 1st stage	25	18	—
Steering Gear mounting bolts - 2nd stage	45	33	—
Steering Gear mounting bolts - 3rd stage	**90°**	—	—
Steering gear u-joint bolt	24	18	—
Sway bar bushing bolts	30	22	—
Trailer hitch angle bracket bolts/nuts	50* See Warning	37* See Warning	—
Trailer hitch frame bolts	110	81	—
Transmission crossmember nuts	45	33	—
Transmission mount bolts/nuts	45	33	—

WARNING: Microencapsulated bolts and self-locking nuts may only be used once. If you use microencapsulated bolt or self-locking nuts more than once, the self-locking function is rendered useless. The trailer hitch may become detached from the vehicle, possibly resulting in a serious risk of injury and/or damage to property, including damage to the vehicle.

ENGINE CRADLE CROSSMEMBER

REMOVAL

(1) Install engine support tool 8534 or equivalent.

(2) Raise and support the vehicle. (Refer to LUBRICATION & MAINTENANCE/HOISTING - STANDARD PROCEDURE)

(3) Remove engine mount nuts. (Fig. 6)

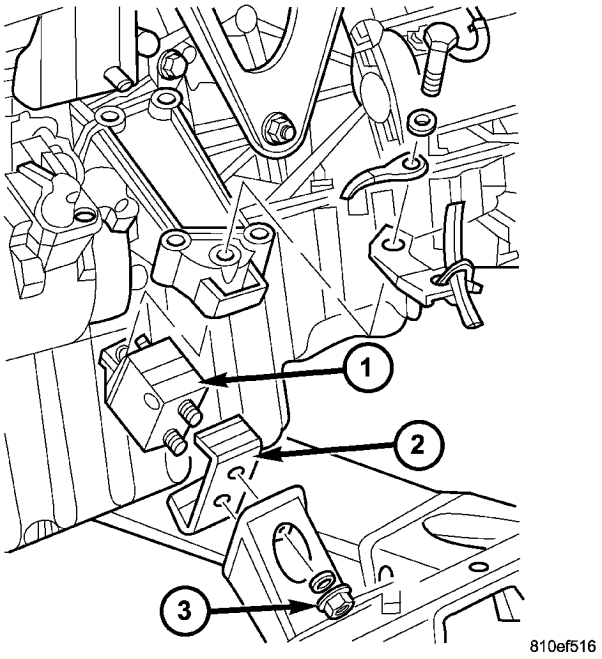


Fig. 6 ENGINE MOUNT

1 - ENGINE MOUNT
2 - SHIELD
3 - NUTS (2 PER MOUNT)

(4) Remove front spring. (Refer to 2 - SUSPENSION/FRONT/SPRING - REMOVAL)

ENGINE CRADLE CROSSMEMBER (Continued)

(5) Remove calipers. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - REMOVAL) (Fig. 7)

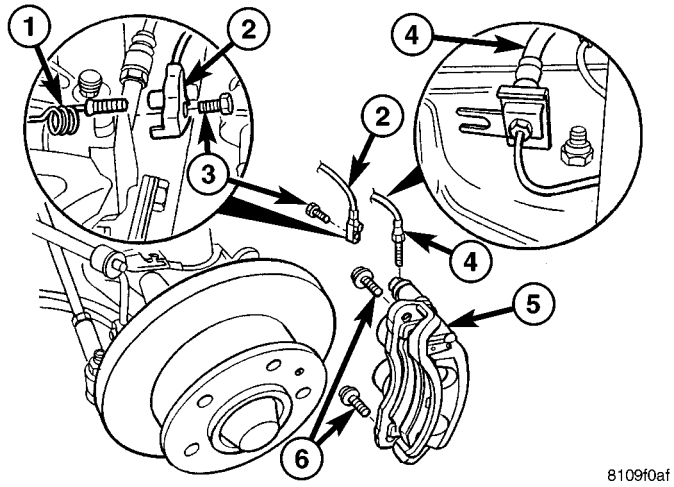


Fig. 7 FRONT DISC BRAKE CALIPER

1 - WEAR INDICATOR CABLE
2 - WEAR INDICATOR
3 - BOLT
4 - BRAKE HOSE
5 - DISC BRAKE CALIPER/ADAPTER
6 - ADAPTER BOLTS

(6) Cut tie straps holding wheel speed sensor and brake pad wear sensor wire harness to the cradle.

(7) Cut tie straps holding transmission harness to the cradle.

(8) Remove lower pinch bolt from steering shaft and disconnect shaft. (Fig. 8)

(9) Siphon the power steering fluid out of the reservoir.

(10) Remove both the high pressure and return hoses from the steering gear (Refer to 19 - STEERING/PUMP/HOSES - REMOVAL) (Fig. 8).

(11) Remove bolt and remove power steering hose support bracket from the cradle. (Fig. 9)

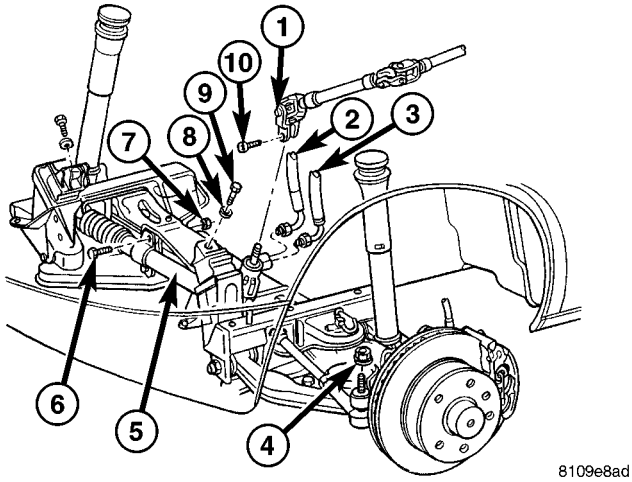


Fig. 8 STEERING GEAR

1 - U-JOINT
2 - HIGH PRESSURE POWER STEERING HOSE
3 - RETURN HOSE
4 - OUTER TIE ROD END RETAINING NUT
5 - STEERING GEAR
6 - STEERING GEAR RETAINING BOLT
7 - STEERING GEAR NUT
8 - WASHER
9 - ENGINE MOUNT BOLT
10 - U-JOINT CLAMPING BOLT

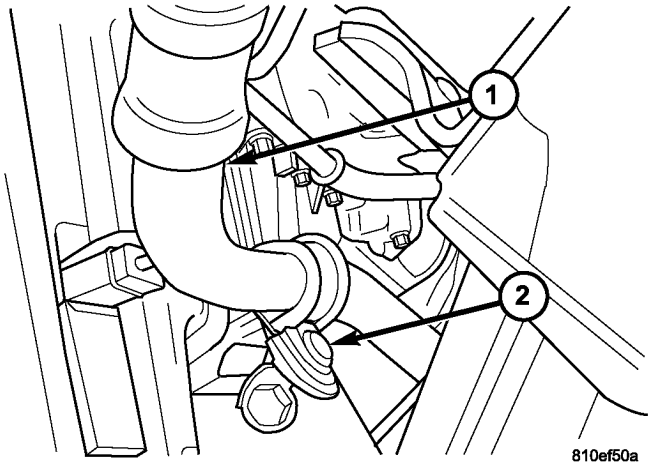


Fig. 9 POWER STEERING HOSE BRACKET

1 - POWER STEERING LINE
2 - SUPPORT BRACKET BOLT

ENGINE CRADLE CROSSMEMBER (Continued)

(12) Disconnect brake lines from body side, at the couplings. (Fig. 10)

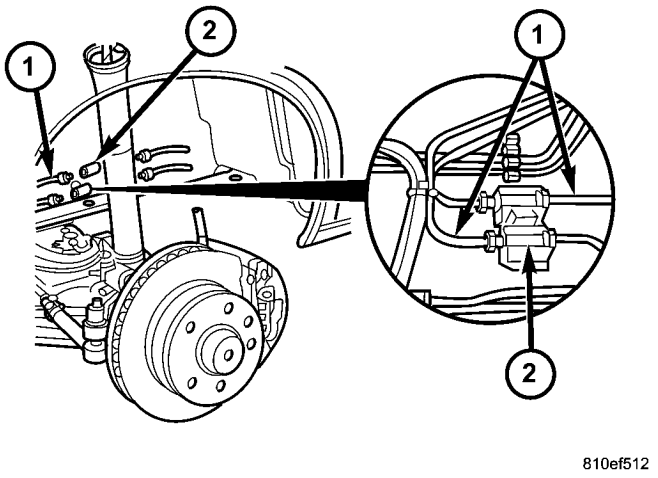


Fig. 10 BRAKE LINES

1 - BRAKE LINES
2 - LINE COUPLINGS

(13) Support engine cradle with suitable lifting device.

(14) Remove four cradle support bolts from each side of the cradle. (Fig. 11)

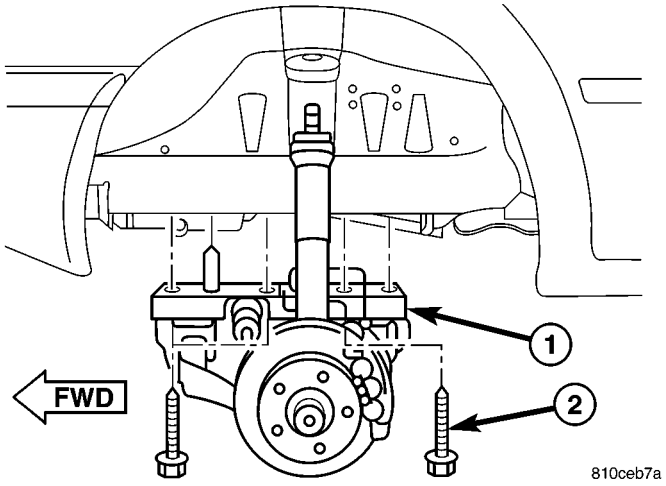


Fig. 11 ENGINE CRADLE BOLTS

1 - ENGINE CRADLE
2 - CRADLE BOLTS (4 PER SIDE)

(15) Lower engine cradle.

(16) Release support clips and remove brake lines.

(17) Remove nuts and remove jounce bumpers.

(18) Remove nuts and remove mount heat shield. (Fig. 12)

(19) Remove stabilizer bar as necessary. (Refer to 2 - SUSPENSION/FRONT/STABILIZER BAR - REMOVAL)

(20) Remove steering gear. (Refer to 19 - STEERING/GEAR - REMOVAL)

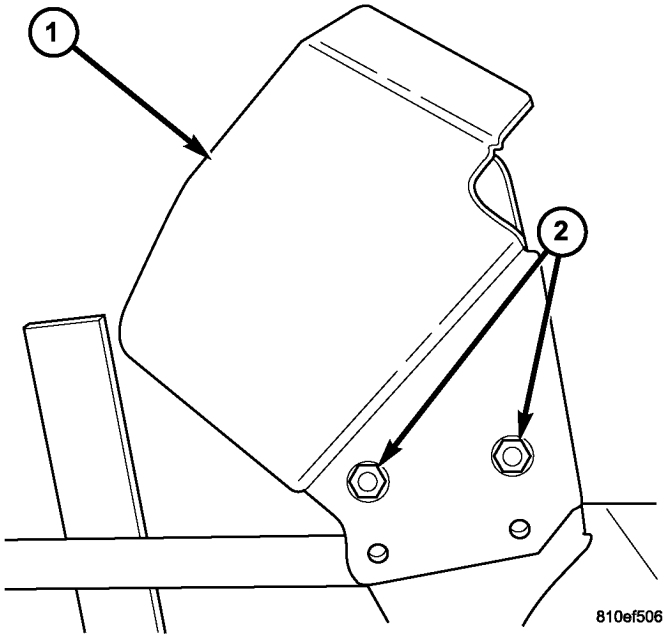


Fig. 12 HEAT SHIELD

1 - HEAT SHIELD
2 - NUTS

(21) Using a sharp flat bladed tool, remove identification plate. (Fig. 13)

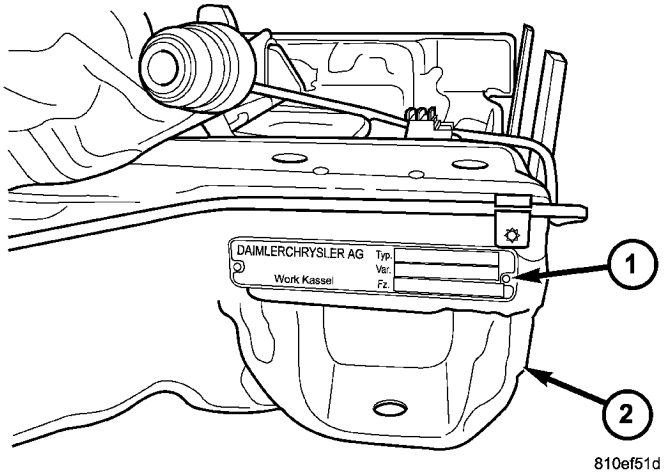


Fig. 13 IDENTIFICATION PLATE

1 - IDENTIFICATION PLATE
2 - ENGINE CRADLE

INSTALLATION

(1) Using a suitable RTV sealant, attach identification plate to engine cradle.

(2) Install steering gear onto engine cradle. (Refer to 19 - STEERING/GEAR - INSTALLATION)

NOTE: Steering gear must be torqued in a three step procedure below.

ENGINE CRADLE CROSSMEMBER (Continued)

(3) Tighten steering gear bolts in three stages as follows.
1. Tighten to 25 N·m (18 ft. lbs.)
2. Then tighten to 45 N·m (33 ft. lbs.)
3. Then tighten bolts an additional 90°.

(4) Install stabilizer bar. (Refer to 2 - SUSPENSION/FRONT/STABILIZER BAR - INSTALLATION)
(5) Install heat shield and nuts.
(6) Install jounce bumpers and install nuts.
(7) Install support clips and brake lines.
(8) Raise engine cradle into place and install bolts.
(9) Tighten bolts to 125 N·m (92 ft. lbs.).
(10) Connect brake lines at couplings and tighten to 14 N·m (10 ft. lbs.).
(11) Position power steering hose and install support bracket bolt.
(12) Install both power steering hoses at steering gear. (Refer to 19 - STEERING/PUMP/HOSES - INSTALLATION)
(13) Connect steering shaft to gear and install the lower pinch bolt.
(14) Tighten lower pinch bolt to 24 N·m (18 ft. lbs.).
(15) Install new tie straps holding transmission harness to cradle.
(16) Install front spring. (Refer to 2 - SUSPENSION/FRONT/SPRING - INSTALLATION)
(17) Install engine mount nuts and tighten to 45 N·m (33 ft. lbs.).
(18) Install calipers. (Refer to 5 - BRAKES/HYDRAULIC/MECHANICAL/DISC BRAKE CALIPERS - INSTALLATION)
(19) Install new tie straps holding wheel speed sensors and brake pad wear sensors wire harness to cradle.
(20) Check and align vehicle to specifications. (Refer to 2 - SUSPENSION/WHEEL ALIGNMENT - STANDARD PROCEDURE)

REAR CROSSMEMBER - TRANSMISSION

REMOVAL

(1) Raise and support the vehicle. (Refer to LUBRICATION & MAINTENANCE/HOISTING - STANDARD PROCEDURE)
(2) Support transmission with a suitable lifting device.
(3) Remove the bolts/nuts and remove transmission mount cover. (Fig. 14)
(4) Remove crossmember nuts and crossmember.

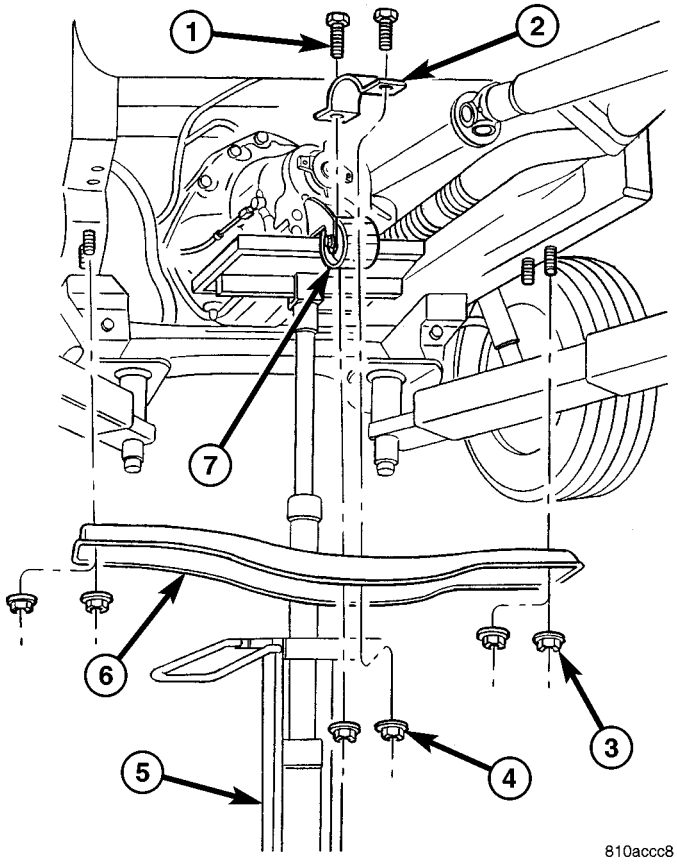


Fig. 14 TRANSMISSION CROSSMEMBER

1 - TRANSMISSION MOUNT BOLTS (2)
2 - TRANSMISSION MOUNT COVER
3 - TRANSMISSION CROSSMEMBER NUTS (4)
4 - TRANSMISSION MOUNT NUTS (2)
5 - TRANSMISSION SUPPORT
6 - CROSSMEMBER
7 - TRANSMISSION MOUNT

INSTALLATION

(1) Install crossmember and install nuts.
(2) Tighten crossmember nut to 45 N·m (33 ft. lbs.).
(3) Remove transmission support.
(4) Install transmission mount bracket.
(5) Install transmission mount bolts/nuts and tighten to 45 N·m (33 ft. lbs.).

TRAILER HITCH

REMOVAL

(1) Disconnect and isolate battery negative cable.
(2) Raise and support the vehicle. (Refer to LUBRICATION & MAINTENANCE/HOISTING - STANDARD PROCEDURE)
(3) Disconnect electrical connector. (Fig. 15)

TRAILER HITCH (Continued)

WARNING: Microencapsulated bolts and self-locking nuts may only be used once. If you use microencapsulated bolt or self-locking nuts more than once, the self-locking function is rendered useless. The trailer hitch may become detached from the vehicle, possibly resulting in a serious risk of injury and/or damage to property, including damage to the vehicle.

(4) Remove and discard microencapsulated angle bracket bolts/nuts. (Fig. 16)

(5) Support hitch and remove frame bolts. (Fig. 17)

(6) Lower hitch.

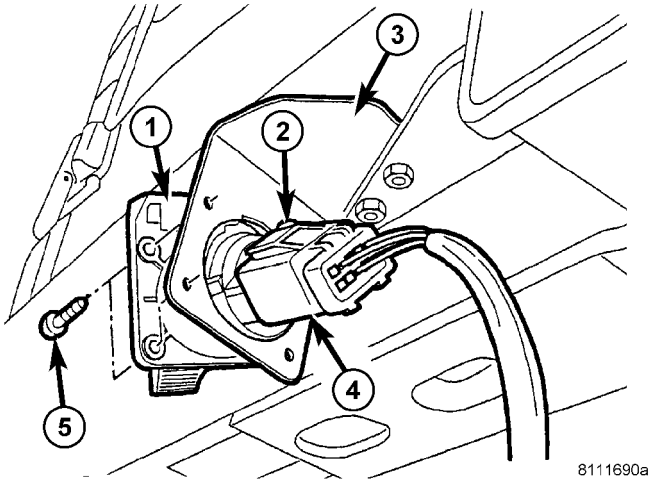


Fig. 15 TRAILER HITCH ELECTRICAL CONNECTION

1 - TRAILER CONNECTION SOCKET
2 - ELECTRICAL CONNECTOR TAB
3 - SUPPORT BRACKET
4 - ELECTRICAL CONNECTOR
5 - SCREWS (4)

INSTALLATION

WARNING: Do not oil or grease the bolts and nuts. if the bolts and nuts are greased, the trailer hitch may become detached from the vehicle, possibly resulting in a serious risk of injury and/or damage to property, including damage to the vehicle.

(1) Raise hitch into position.

(2) Install the mounting plate and new frame bolts/nuts and hand tighten bolts.

WARNING: Microencapsulated bolts and self-locking nuts may only be used once. If you use microencapsulated bolt or self-locking nuts more than once, the self-locking function is rendered useless. The trailer hitch may become detached from the vehicle, possibly resulting in a serious risk of injury and/or damage to property, including damage to the vehicle.

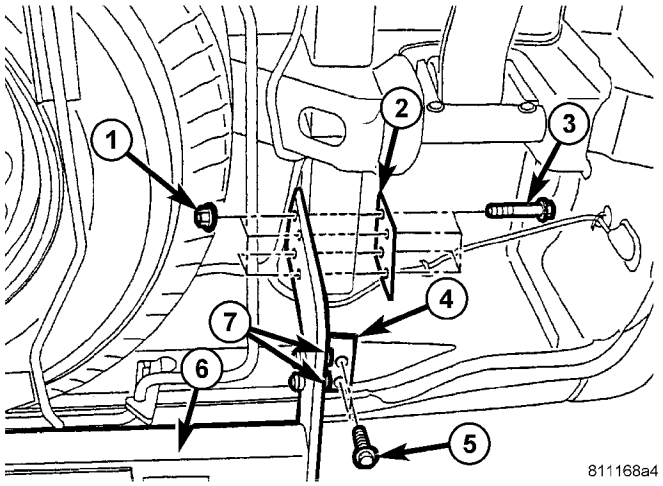


Fig. 16 TRAILER HITCH MOUNTING

1 - LOCK NUTS (8)
2 - MOUNTING PLATE
3 - BOLTS (8)
4 - ANGLE BRACKETS (2)
5 - BOLTS (4)
6 - HITCH
7 - BRACKET BOLTS/NUTS

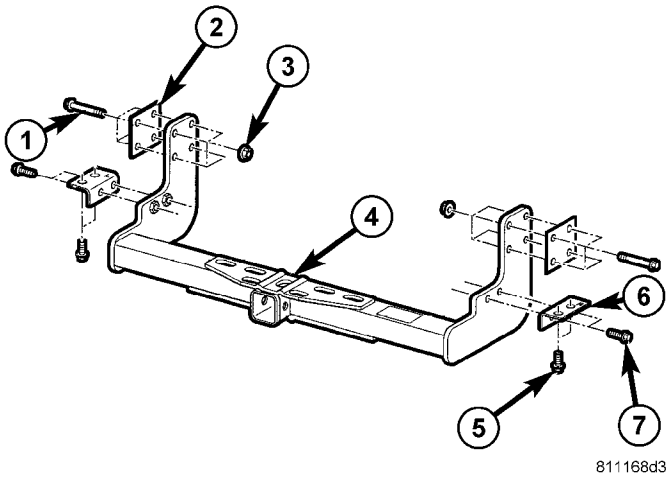


Fig. 17 TRAILER HITCH

1 - FRAME BOLTS (8)
2 - MOUNTING PLATES (2)
3 - LOCK NUTS (8)
4 - TRAILER HITCH
5 - BRACKET TO STEP BOLTS (4)
6 - ANGLE BRACKETS (2)
7 - BRACKET BOLTS (4)

(3) Install the angle bracket microencapsulated bolts/nuts and hand tighten.

(4) Align trailer hitch.

(5) Tighten the frame mounting bolts to 110 N·m (81 ft. lbs.).

(6) Tighten microencapsulated angle bracket bolts to 50 N·m (37 ft. lbs.)

(7) Connect trailer socket electrical connector.

FUEL SYSTEM

TABLE OF CONTENTS

page

FUEL SYSTEM
WARNING
WARNING - HIGH FUEL SYSTEM PRESSURE 1
WARNING 1
DIAGNOSIS AND TESTING
DIAGNOSIS AND TESTING - HIGH PRESSURE FUEL LINES 1
DIAGNOSIS AND TESTING - AIR IN FUEL SYSTEM 2
STANDARD PROCEDURE
STANDARD PROCEDURES - CLEANING FUEL SYSTEM COMPONENTS 2
STANDARD PROCEDURE - DISCONNECTING AND CONNECTING FUEL LINES 2
STANDARD PROCEDURES - DRAINING WATER FROM FUEL FILTER 2
STANDARD PROCEDURE - LOW PRESSURE FUEL PUMP TEST 3
FUEL DELIVERY 4
FUEL INJECTION 17

FUEL SYSTEM

WARNING

WARNING - HIGH FUEL SYSTEM PRESSURE

WARNING: HIGH-PRESSURE FUEL LINES DELIVER FUEL UNDER EXTREME PRESSURE FROM THE INJECTION PUMP TO THE INJECTORS. THIS MAYBE AS HIGH AS 1600BAR (23,200PSI). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS. FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT HIGH-PRESSURE FUEL LEAKS WITH A SHEET OF CARDBOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.

WARNING

WARNING: UNDER NO CIRCUMSTANCES SHOULD GASOLINE BE MIXED WITH DIESEL FUEL (NOT EVEN DURING WINTER). THE HIGH PRESSURE PUMP IS LUBRICATED BY DIESEL FUEL. IMMEDIATE FUEL SYSTEM DAMAGE MAY OCCUR CAUSING REPLACEMENT AND FLUSHING OF THE COMPLETE DIESEL FUEL SYSTEM. HIGH PRESSURE PUMP SEIZURE WILL CAUSE METAL PARTICLES TO SPREAD THROUGH OUT THE FUEL CIRCUIT. ALL CDI FUEL SYSTEM COMPONENTS CONNECTED TO THE FUEL CIRCUIT WILL HAVE TO BE EXCHANGED AND THE LINES FLUSHED.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - HIGH PRESSURE FUEL LINES

(Refer to 14 - FUEL SYSTEM - WARNING). High-pressure fuel line leaks can cause starting problems and poor engine performance.

WARNING: DUE TO EXTREME FUEL PRESSURES, USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS. DO NOT GET YOUR HAND 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. 1). If a high-pressure line connection is leaking, tighten the connection and perform the Fuel System Air Purge procedure (Refer to 14 - FUEL SYSTEM - STANDARD PROCEDURE). Replace damaged, restricted or leaking high-pressure fuel lines with the correct replacement line.

CAUTION: The high-pressure fuel 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.

FUEL SYSTEM (Continued)

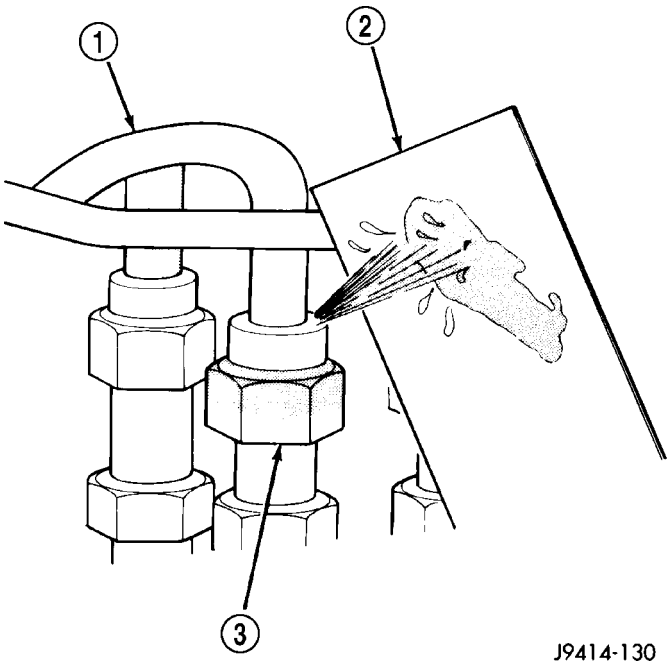


Fig. 1 Typical Test for Leaks with Cardboard

1 - HIGH-PRESSURE LINE
2 - CARDBOARD
3 - FITTING

DIAGNOSIS AND TESTING - AIR IN FUEL SYSTEM

Air will enter the fuel system whenever fuel supply lines, separator filters, injection pump, high-pressure lines or injectors are removed or disconnected. Air trapped in the fuel system can result in hard starting, a rough running engine, engine misfire, low power, excessive smoke and fuel knock.

Inspect the fuel system from the fuel tank to the injectors for loose connections (Refer to 14 - FUEL SYSTEM - WARNING). Leaking fuel is an indicator of loose connections or defective seals. Air can also enter the fuel system between the fuel tank and the fuel pump. Inspect the fuel tank and fuel lines for damage that might allow air into the system.

With the DRBIII® connected to the vehicle, select Engine and the select Sensor Display. Page down to view Fuel Pressure Set Point and Actual Fuel Pressure. Start the engine and observe the Fuel Pressure Set Point and the Actual Fuel Pressure. If the Actual Fuel Pressure Oscillates above and below the Fuel Pressure Set Point in a regular cycle, perform the Fuel System Air Purge procedure (Refer to 14 - FUEL SYSTEM - STANDARD PROCEDURE).

If the Actual Fuel Pressure gradually drops below the Fuel Pressure Set Point then spikes well above the Fuel Pressure Set Point, replace the fuel pressure solenoid (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL PRESSURE SOLENOID - REMOVAL), then perform the Fuel System Air Purge procedure (Refer to 14 - FUEL SYSTEM - STANDARD PROCEDURE).

STANDARD PROCEDURE

STANDARD PROCEDURES - CLEANING FUEL SYSTEM COMPONENTS

CAUTION: Cleanliness cannot be overemphasized when handling or replacing diesel fuel system components. This especially includes the fuel injectors, high-pressure fuel lines, fuel rail, and fuel injection pump. Very tight tolerances are used with these parts. Dirt contamination could cause rapid part wear and possible plugging of fuel injector nozzle tip holes. This in turn could lead to possible engine misfire. Always wash/clean any fuel system component thoroughly before disassembly and then air dry. DO NOT wire brush injector nozzles when cleaning. Cap or cover any open part after disassembly. Before assembly, examine each part for dirt, grease or other contaminants and clean if necessary. When installing new parts, lubricate them with clean engine oil or clean diesel fuel only.

STANDARD PROCEDURE - DISCONNECTING AND CONNECTING FUEL LINES

NOTE: Capture and store any fuel spillage in appropriately marked containers.

(1) Disconnect negative battery cable.
(2) Push release arm to release position A, as far as the stop (arrow) (Fig. 2).
(3) Disconnect fuel line.
(4) Immediately return the release arm back to the assembly position, as far as the stop (Fig. 2).

The release arm must not be left in the release position for a long time. Connectors left in the release position for lengthy periods may leak and must be replaced.

(5) Insert connector into connection in assembly position (B) (Fig. 2).
(6) Ensure that the connectors are firmly seated and free of leaks (Fig. 2).

STANDARD PROCEDURES - DRAINING WATER FROM FUEL FILTER

Refer to Fuel Filter/Water Separator removal/installation for procedures (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL FILTER / WATER SEPARATOR - REMOVAL).

FUEL SYSTEM (Continued)

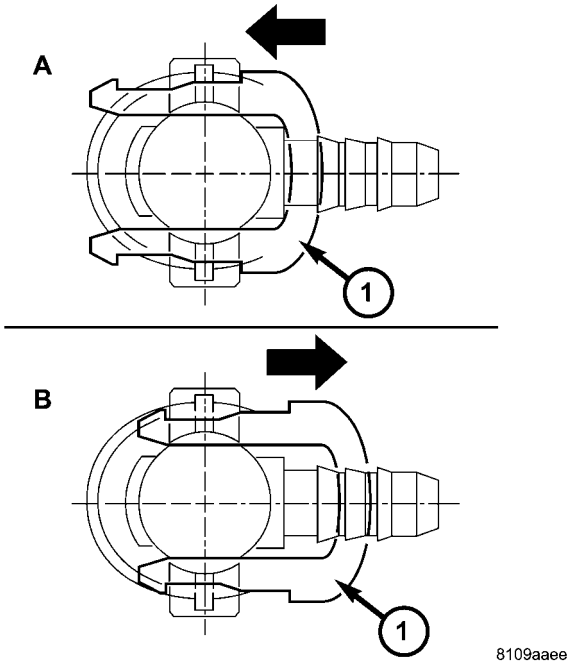


Fig. 2 FUEL LINE CONNECTOR

1 - RELEASE ARM

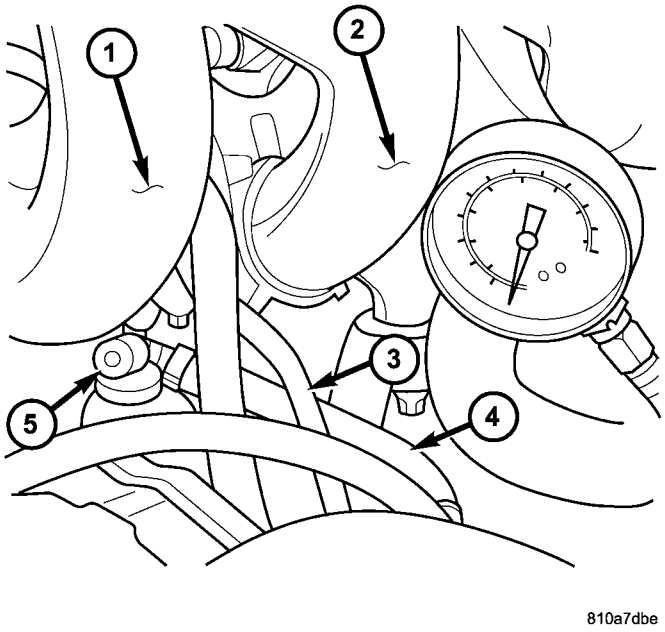


Fig. 3 FUEL PRESSURE TEST

1 - INTAKE RUNNER #1
2 - INTAKE RUNNER #2
3 - FUEL RETURN HOSE
4 - FUEL PRESSURE GAUGE ADAPTOR HOSE
5 - FUEL PRESSURE GAUGE ADAPTOR #9068

STANDARD PROCEDURE - LOW PRESSURE FUEL PUMP TEST

NOTE: Assure fuel tank quantity and proper fuel gauge operation. Capture any fuel spillage and store in appropriately marked containers.

(1) Disconnect the negative battery cable.
(2) Connect fuel gauge # 5069–2 with adaptor #9068 to the low pressure fuel pump output line junction at the fuel pressure sensor and assure that the line locking tabs are secured in the lock position (pulled back after hose is fitted properly). (Fig. 3).
(3) Connect negative battery cable.
(4) Crank or start the engine and observe the fuel gauge reading.

The low pressure pump draws fuel out of the fuel tank through the fuel filter. If the pressure reading is below specification, look for damaged or leaking fuel lines, replace the fuel filter and repeat this test. If the fuel pressure reading is below specification again, replace the low pressure fuel pump.

FUEL PRESSURE SPECIFICATIONS

STARTER SPEED	6-22 PSI (0.4-1.5 bar)
IDLING SPEED RANGE	29-36 PSI (2.0-2.5 bar)
MAXIMUM FUEL PRESSURE	51 ± 7 PSI (3.5±0.5 bar)

FUEL DELIVERY

TABLE OF CONTENTS

page

FUEL DELIVERY
SPECIFICATIONS
TORQUE 4
SPECIAL TOOLS
FUEL SYSTEM 5
FUEL DRAIN TUBES
DIAGNOSIS AND TESTING - FUEL SUPPLY RESTRICTIONS 5
FUEL FILTER
DESCRIPTION 5
OPERATION 5
REMOVAL 5
INSTALLATION 6
FUEL LINES
REMOVAL - HIGH PRESSURE LINES 6
INSTALLATION - HIGH PRESSURE LINES 7
FUEL PUMP
DESCRIPTION
DESCRIPTION - HIGH PRESSURE PUMP 7
DESCRIPTION - LOW PRESSURE PUMP 7
OPERATION
OPERATION 7
OPERATION - LOW PRESSURE PUMP 8
REMOVAL
REMOVAL - HIGH PRESSURE PUMP 8
REMOVAL - LOW PRESSURE PUMP 9

page

INSTALLATION
INSTALLATION - HIGH PRESSURE PUMP . . 10
INSTALLATION - LOW PRESSURE PUMP . . . 11
FUEL RAIL
DESCRIPTION 11
OPERATION 11
REMOVAL 11
INSTALLATION 11
FUEL TANK
DESCRIPTION 12
REMOVAL 12
INSTALLATION 13
FUEL TANK MODULE
DESCRIPTION 13
REMOVAL 13
INSTALLATION 14
FUEL LEVEL SENDING UNIT / SENSOR
DESCRIPTION 15
REMOVAL 15
INSTALLATION 15
HI PRESSURE FUEL SHUTOFF SOL
DESCRIPTION 16
OPERATION 16
WATER IN FUEL SENSOR
DESCRIPTION 16
OPERATION 16

FUEL DELIVERY

SPECIFICATIONS

TORQUE

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
FUEL TANK MOUNTING NUTS	15 - 17	11 - 13	-
FUEL TANK MODULE LOCKRING (LOCKNUT)	45 - 55	33 - 41	-

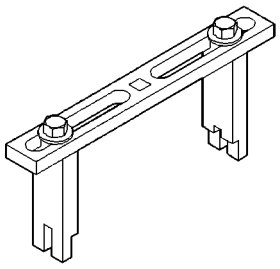
FUEL DELIVERY (Continued)

SPECIAL TOOLS

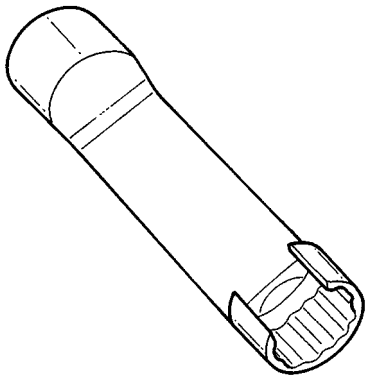
FUEL SYSTEM

SPECIAL TOOL CROSS REFERENCE CHART

MB TOOL #	MILLER TOOL #	DESCRIPTION
N/A	5069-2	FUEL GAUGE
N/A	6856	SPANNER WRENCH
N/A	9068	FUEL GAUGE ADAPTER
N/A	9285	FUEL LINE WRENCH



SPANNER WRENCH-6856



FUEL LINE WRENCH-9285

FUEL DRAIN TUBES

DIAGNOSIS AND TESTING - FUEL SUPPLY RESTRICTIONS

LOW-PRESSURE LINES

Fuel supply line restrictions can cause starting problems and prevent engine from accelerating. The starting problems include; low power and/or white fog like exhaust.

Test all fuel supply lines for restrictions or blockage. Flush or replace as necessary.

HIGH-PRESSURE LINES

CAUTION: High pressure lines cannot contact each other or other components. Do not attempt to weld high-pressure fuel lines or to repair lines that are damaged. High pressure lines must be replaced at each disassembly. Use only recommended lines when replacement of high-pressure fuel line is necessary.

Restricted (kinked or bent) high-pressure lines can cause starting problems, poor engine performance, engine mis-fire and white smoke from exhaust (Refer to 14 - FUEL SYSTEM - WARNING).

FUEL FILTER

DESCRIPTION

In order to assure trouble free operation with winter grade diesel fuel, a preheater valve is located with in the fuel filter. Depending on the temperature of the heated return flow fuel, fuel flows back through the preheating valve into the fuel filter to heat up or flows through the cooling coils directly back into the fuel tank.

OPERATION

PRE - HEATING Up to 30°C (86°F), the thermo bimetal plate of the preheater, shuts off the return fuel flow port to the fuel tank. The fuel from the rail flows into the fuel filter to be warmed. If there is air in the system, a ball seals off a port and the air is directed to the fuel tank.

NON PRE - HEATING From above 30°C (86°F) the thermo bimetal plate of the preheater, shuts off the port to the fuel filter and fuel from the rail flows directly into the return flow line to the fuel tank.

REMOVAL

WARNING: NO SPARKS, OPEN FLAMES OR SMOKING. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

(1) Disconnect negative battery cable.

(2) Separate the fuel outlet line connector on the fuel filter (Refer to 14 - FUEL SYSTEM - STANDARD PROCEDURE). (Fig. 1)

(3) Slacken the hose clamp on the fuel inlet line and detach fuel line (Fig. 1).

FUEL FILTER (Continued)

(4) Unscrew the mounting bolt on the preheating valve, turn preheating valve out of locking arm and pull off (Fig. 1).

(5) Remove fuel filter retaining bracket bolt and remove fuel filter (Fig. 1).

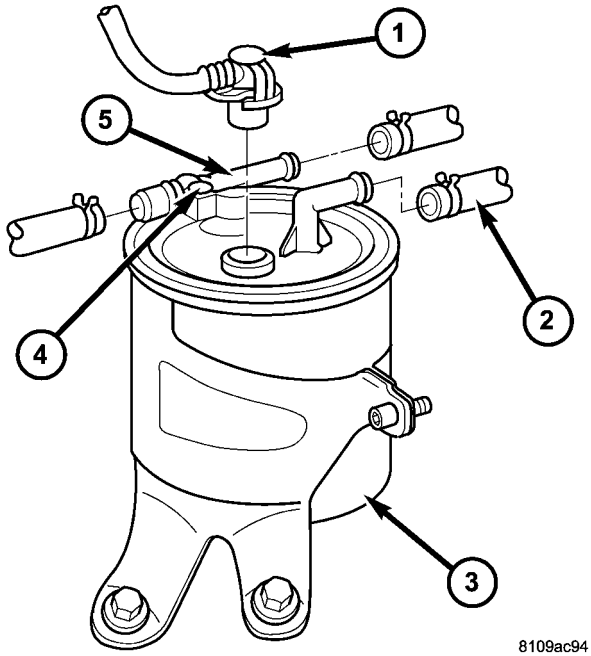


Fig. 1 FUEL FILTER AND BRACKET

1 - FUEL LINE PLUG CONNECTION
2 - FUEL LINE INLET
3 - FUEL FILTER
4 - BOLT OF PREHEATING VALVE
5 - PREHEATING VALVE

INSTALLATION

WARNING: NO SPARKS, OPEN FLAMES OR SMOKING. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

NOTE: Capture any fuel spillage and dispose of in appropriately marked container.

(1) Fill new fuel filter with the new diesel fuel (approximately 0.4 liters) (Fig. 1).

(2) Position fuel filter in bracket and tighten retaining bolt to 53 lbs. in. (6 N·m) (Fig. 1).

(3) Seat preheating valve and tighten bolt to 13 lbs. in. (1.5 N·m) (Fig. 1).

(4) Install fuel lines and tighten clamps (Fig. 1).

(5) Properly seat fuel line plug connection and properly set release arm (Refer to 14 - FUEL SYSTEM - STANDARD PROCEDURE)

(6) Connect negative battery cable.

(7) Start engine and inspect for leaks.

FUEL LINES

REMOVAL - HIGH PRESSURE LINES

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 1600BAR (23,200 PSI). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS. FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE LEAKS WITH A SHEET OF CARD BOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.

WARNING: NO SPARKS, OPEN FLAMES OR SMOKING. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

(1) Disconnect negative battery cable.

CAUTION: Counterhold with wrench at threaded connections of injectors. DO NOT EXCEED the tightening torque in order to avoid also slackings the threaded connection.

CAUTION: DO NOT crimp or bend lines.

NOTE: After removing injection lines, seal connections and ensure cleanliness.

(2) Unscrew union nuts of injection lines.

(3) Remove injection lines (Fig. 2).

FUEL LINES (Continued)

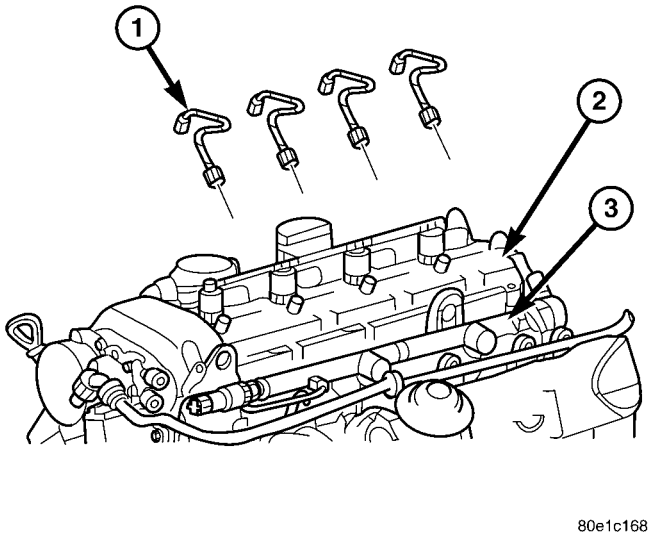


Fig. 2 HIGH PRESSURE LINES AT INJECTORS

1 - HIGH PRESSURE LINE
2 - CYLINDER HEAD COVER
3 - FUEL RAIL

INSTALLATION - HIGH PRESSURE LINES

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 1600BAR (23,200 PSI). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS. FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE LEAKS WITH A SHEET OF CARD BOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.

WARNING: NO SPARKS, OPEN FLAMES OR SMOKING. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

(1) Loosen the fuel rail mounting bolts to install lines free of stress.

CAUTION: Inspect sealing cone at lines. Replace if compression points exist. Ensure lines are exactly located.

(2) Position and install fuel lines (Fig. 2). Tighten to 22N·m (195 lbs. in.) using a wrench to counterhold at threaded connection.

(3) Tighten fuel rail to 14N·m (124 lbs. in.).
(4) Connect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN ENGINE IS OPERATING. DO NOT STAND IN DIRECT LINE WITH FAN. DO NOT PUT YOUR HANDS NEAR PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

(5) Start engine and inspect for leaks.

FUEL PUMP

DESCRIPTION

DESCRIPTION - HIGH PRESSURE PUMP

WARNING: (Refer to 14 - FUEL SYSTEM - WARNING)

The high pressure pump is a radial piston pump with three pistons arranged at an angle of 120° and an internal shut off valve located in one of the elements to assist with fuel temperature regulation. The high pressure pump is driven at about 1.3 times the speed of the camshaft. The high pressure pump is mounted to the front of the cylinder head and must be replaced as an assembly should a failure occur (Fig. 3).

DESCRIPTION - LOW PRESSURE PUMP

The low pressure pump (Fig. 4)supplies an adequate quantity of filtered fuel in all operating conditions from the fuel tank, at an adequate pressure, to the high pressure pump.

OPERATION

OPERATION

LOW PRESSURE SIDE

The fuel supplied by the low pressure pump flows through the fuel feed to the throttle valve. Any air entrained by the fuel is directed through the restrictor to the return flow. The throttle valve opens against the force of the spring at a pressure of approx. 6 PSI (0.4 bar) and the fuel is able to flow along a ring line to the individual pistons. The eccentric shaft with its eccentric plate moves the pistons up and down against the piston spring of the three pump elements. The leak fuel from the pistons flows along the return flow to the fuel tank. The fuel flowing out of the throttle valve, also flows off along the return flow.

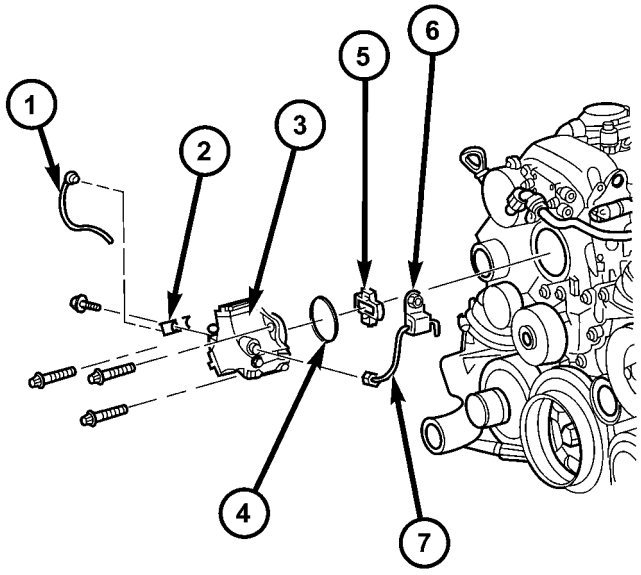


Fig. 3 HIGH PRESSURE PUMP

1 - FUEL RETURN LINE
2 - FUEL LINE BRACKET
3 - HIGH PRESSURE PUMP
4 - O-RING
5 - PUMP DRIVE
6 - FUEL LINE BRACKET
7 - HIGH PRESSURE FUEL LINE FROM PUMP TO FUEL RAIL

HIGH PRESSURE SIDE

A. Filling the piston: The piston is moved down as a result of the piston spring. The fuel supplied by the fuel delivery pump flows along the ring passage, the valve disk and the valve spring into the cylinder. The ball valve prevents the fuel from being able to flow back from the high pressure passage.

B. Producing high pressure: The piston is moved up by the rising eccentric shaft and the fuel is thus compressed. The valve disk shuts off the delivery volume to the fuel feed. Once the fuel pressure in the cylinder rises beyond the pressure which exists in the high pressure circuit, the ball valve opens and the fuel is pumped into the high pressure circuit.

C. Fuel Temperature Regulation The ECM can Interrupt the fuel high pressure delivery of one of the pump elements in the particle load range in order to reduce the power required for driving the high pressure pump so as to reduce the fuel temperature. The pump element is switched off if the fuel temperature is excessively high (above 278°, 120 bar).

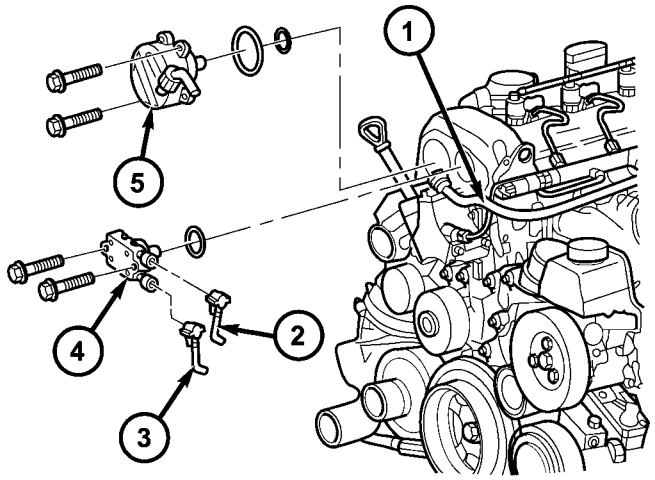


Fig. 4 VACUUM PUMP AND LOW PRESSURE FUEL PUMP ASSEMBLIES

1 - VACUUM LINE
2 - FUEL OUTLET LINE
3 - FUEL FEED LINE
4 - LOW PRESSURE FUEL PUMP
5 - VACUUM PUMP

OPERATION - LOW PRESSURE PUMP

The low pressure pump draws fuel from tank through fuel filter and supplies the high pressure pump. Fuel pressure at starter speed is 0.4 to 1.5 bar (6 to 22 psi.). A fuel pressure of 2.0 to 2.5 bar (29 to 36 psi.) is reached at idle speed. Fuel pressure is limited to 3.5 bar ± .5 bar (51 psi. ± 7 psi) by the valve in the fuel delivery pump. This valve opens by over coming a spring force and allows excessive fuel to flow to the intake side of the low pressure pump. This diverted fuel flows into the return flow pipe through the fuel cooler back to the tank. As a result of this circulation, the fuel always remains relatively cool.

REMOVAL

REMOVAL - HIGH PRESSURE PUMP

(Refer to 14 - FUEL SYSTEM - WARNING)

(1) Disconnect negative battery cable.

(2) Remove viscous fan clutch (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - REMOVAL).

FUEL PUMP (Continued)

(3) Unplug electrical connector at high pressure pump.

CAUTION: DO NOT slacken the threaded connection. Use a wrench to counterhold at the threaded connection when loosening and tightening the union nut. DO NOT EXCEED tightening torque.

CAUTION: DO NOT crimp or bend fuel line. Capture all fluids that flow out of connections.

NOTE: Using a marking pen, make a mark on the outside fuel return line to easily identify proper position during assembly.

(4) Unbolt bracket and pressure line at pressure pump.

(5) Detach fuel supply and return flow line at high pressure pump.

NOTE: Care must be taken not to drop the high pressure pump driver and intermediate piece if pump is being replaced.

(6) Remove bolts attaching high pressure pump and remove pump.

REMOVAL - LOW PRESSURE PUMP

WARNING: NO SPARKS, OPEN FLAMES OR SMOKING. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

(1) Disconnect negative battery cable.

(2) Remove vacuum pump (Refer to 9 - ENGINE/ENGINE BLOCK/INTERNAL VACUUM PUMP - REMOVAL).

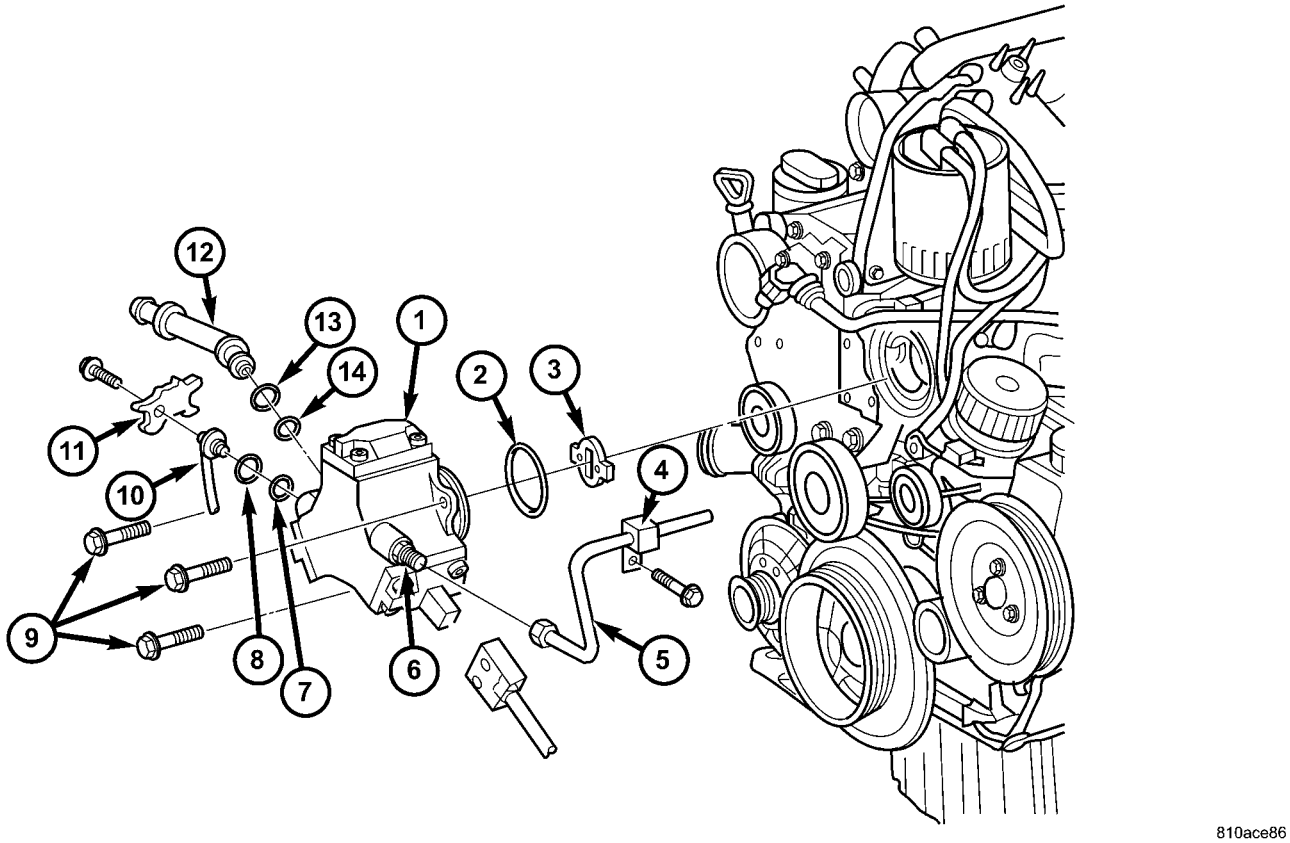
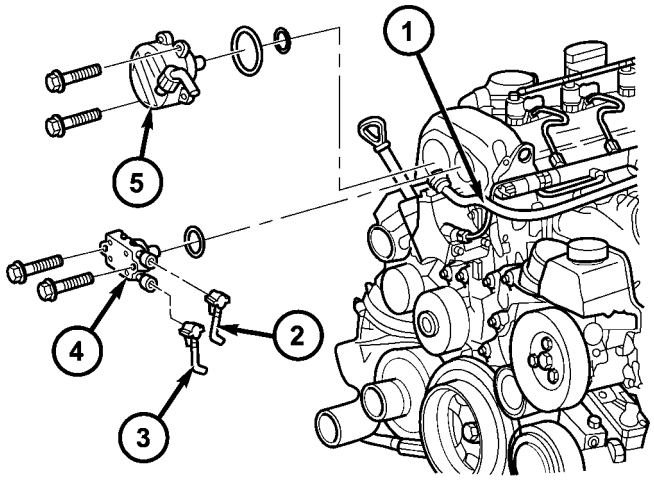


Fig. 5 HIGH PRESSURE PUMP

1 - HIGH PRESSURE INJECTION PUMP
2 - SEALING RING
3 - INJECTION PUMP DRIVER
4 - BRACKET
5 - HIGH PRESSURE LINE
6 - THREADED UNION
7 - SEALING RING
8 - SEALING RING
9 - BOLTS
10 - FUEL RETURN LINE
11 - BRACKET
12 - FUEL SUPPLY LINE FROM LOW PRESSURE PUMP
13 - SEALING RING
14 - SEALING RING

FUEL PUMP (Continued)

(3) Detach fuel lines at low pressure pump (Fig. 6).
(4) Remove low pressure pump (Fig. 6).



80e1d2fa

Fig. 6 VACUUM PUMP AND LOW PRESSURE FUEL PUMP ASSEMBLIES

1 - VACUUM LINE
2 - FUEL OUTLET LINE
3 - FUEL FEED LINE
4 - LOW PRESSURE FUEL PUMP
5 - VACUUM PUMP

INSTALLATION

INSTALLATION - HIGH PRESSURE PUMP

(Refer to 14 - FUEL SYSTEM - WARNING)

CAUTION: Clean sealing surfaces with appropriate solvents and replace all seals.

NOTE: Inspect then attach high pressure pump driver and intermediate piece if pump is being replaced. If wear is present at driver, replace the intermediate gear.

(1) Position and secure the high pressure pump to cylinder head (Fig. 5). Tighten bolts to 14 N·m (124 lbs. in.).

CAUTION: NEVER slacken the thread connection. Use a wrench to counterhold at threaded connection when slackening and tightening torque in order to avoid also slackening the threaded connection the next time.

CAUTION: DO NOT crimp or bend fuel line. Inspect sealing cone at line; replace line if compression exists.

NOTE: Care must be taken not to cross the fuel return and supply lines during installation.

(2) Attach fuel flow supply and return lines (Fig. 5).
(3) Install bracket to high pressure pump (Fig. 5). Tighten nut to 9N·m (80 lbs. in.).

CAUTION: NEVER slacken the thread connection. Use a wrench to counterhold at threaded connection when slackening and tightening torque in order to avoid also slackening the threaded connection the next time.

CAUTION: DO NOT crimp or bend fuel line. Inspect sealing cone at line; replace line if compression exists.

NOTE: Care must be taken not to cross the fuel return and supply lines during installation.

(4) Attach high pressure fuel line to pump (Fig. 5). Tighten to 22N·m (194 lbs.in.).
(5) Install viscous fan clutch (Refer to 7 - COOLING/ENGINE/FAN DRIVE VISCOUS CLUTCH - INSTALLATION).
(6) Connect negative battery cable.
(7) Refill coolant system with proper mixture to correct level.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH THE FAN. DO NOT PUT YOU HANDS NEAR PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHES.

(8) Start engine and inspect for leaks (Refer to 14 - FUEL SYSTEM - WARNING)

FUEL PUMP (Continued)

INSTALLATION - LOW PRESSURE PUMP

WARNING: NO SPARKS, OPEN FLAMES OR SMOKING. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

NOTE: Clean sealing surfaces, replace seal if necessary.

(1) Prime the low pressure pump with the appropriate fuel.
(2) Attach low pressure fuel pump to cylinder head front cover. Tighten bolt to 9N·m (80 lbs. in.).
(3) Attach fuel lines to low pressure pump.
(4) Install vacuum pump (Refer to 9 - ENGINE/ENGINE BLOCK/INTERNAL VACUUM PUMP - INSTALLATION).
(5) Reconnect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH FAN. DO NOT PUT YOUR HANDS NEAR PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.

(6) Start engine and inspect for leaks.

FUEL RAIL

DESCRIPTION

The fuel rail acts like a high pressure store. It is available to all injectors for drawing fuel which has been compressed by the injection pump. The rail pressure sensor, rail pressure solenoid, high pressure line, and the return flow line are attached to the fuel rail (Fig. 7).

OPERATION

The stored fuel volume inside the rail acts as a damper for pressure fluctuations which result because of pulsating supply and brief large extractions of fuel during injector firing. The rail primarily influences the atomization of fuel at the injector nozzle, and the accuracy of injected quantity during injection.

REMOVAL

(Refer to 14 - FUEL SYSTEM - WARNING).

WARNING: NO SPARKS, OPEN FLAMES OR SMOKING. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

(1) Disconnect negative battery cable.
(2) Partially drain cooling system from radiator only.
(3) Remove thermostat housing.
(4) Disconnect engine wiring electrical connectors from sensors restricting harness movement.
(5) Remove engine harness retaining bolts.
(6) Remove fuel temperature sensor from fuel rail.
(7) Remove fuel rail retaining bolts and disconnect glow plug connectors.
(8) Remove front engine lift support.

CAUTION: When slackening and tightening fuel injection line union nuts, counter hold with wrench at threaded connection. ON NO ACCOUNT exceed the tightening torque at any time. Do NOT crimp or bend lines.

NOTE: After removing lines, seal connections and ensure cleanliness.

(9) Remove injector high pressure lines (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL LINES - REMOVAL) (Fig. 7).
(10) Remove pressure line of high pressure pump (Fig. 7).
(11) Detach fuel return flow line to high pressure pump at rail (Fig. 7).
(12) Detach fuel return flow line to fuel filter at fuel filter (Fig. 7).
(13) Remove fuel rail (Fig. 7).

INSTALLATION

(Refer to 14 - FUEL SYSTEM - WARNING)

WARNING: NO FIRE, FLAMES OR SMOKING. RISK OF POISONING FROM INHALING OR SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

FUEL RAIL (Continued)

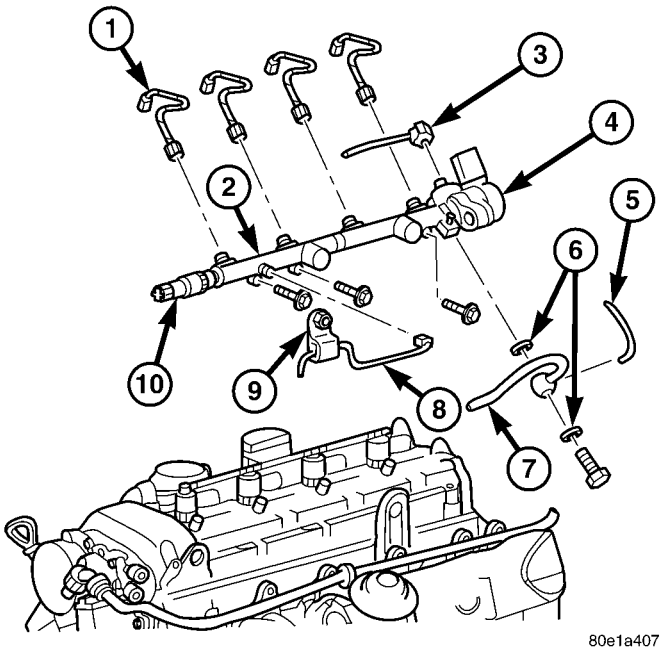


Fig. 7 FUEL PRESSURE SOLENOID

1 - INJECTION LINES
2 - FUEL RAIL
3 - FUEL RETURN LINE
4 - FUEL PRESSURE SOLENOID
5 - OIL LINE
6 - SEALS
7 - FUEL RETURN LINE AT COOLER
8 - HIGH PRESSURE FUEL LINE TO FUEL RAIL
9 - FUEL LINE BRACKET
10 - FUEL PRESSURE SENSOR

(1) Loosely position fuel rail into position on cylinder head.

(2) Position and loosely install fuel return line from fuel filter, with new seals to rail (Fig. 7).

(3) Position fuel rail to cylinder head, feed in high pressure line with new seals (Fig. 7).

CAUTION: Inspect sealing cones at the lines. Replace as necessary. Ensure that all fuel pressure lines are exactly located in original position.

(4) Hand start all injector lines (Fig. 7).

CAUTION: When tightening fuel injection line union nuts, counter hold with a wrench at the thread connection. ON NO ACCOUNT exceed the tightening torque at any time.

(5) Tighten fuel rail bolts to 14 N·m (124 lbs.in.) (Fig. 7).

(6) Tighten nut of pressure line to rail/injector to 22N·m (194 lbs.in.).

(7) Tighten nut of pressure line to high pressure pump/rail to 22N·m (194 lbs.in.).

(8) Tighten banjo bolt of fuel return line to fuel rail to 20N·m (177 lbs.in.).

(9) Install fuel temperature sensor.

(10) Install front engine support lift.

(11) Install thermostat housing.

(12) Reconnect engine harness electrical connectors (Fig. 7).

(13) Refill cooling system.

(14) Connect negative battery cable.

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT STAND IN A DIRECT LINE WITH FAN. DO NOT PUT YOUR HANDS NEAR PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.

(15) Start engine and inspect for leaks (Refer to 14 - FUEL SYSTEM - WARNING).

FUEL TANK

DESCRIPTION

The plastic fuel tank is mounted to the frame rails under the left/center side of the vehicle. The fuel tank contains a serviceable fuel tank module (Fig. 8) and fuel level sending unit. The tank is also equipped with 2 fuel lines: a fuel supply line to the fuel pump, and a separate fuel return line. A section of the fuel return line is coiled (Fig. 8) at the rear section of the tank. This coiled section is used to help drop the temperature of fuel returning to the tank.

A fuel tank mounted, electric fuel pump is not used with diesel powered models. Refer to Fuel Tank Module for additional information.

REMOVAL

(1) Drain diesel fuel from tank using an approved diesel fuel draining station.

(2) Disconnect fuel fill and vent lines (Fig. 8) from body.

(3) Raise and support vehicle.

(4) Support tank with a hydraulic jack.

(5) Remove 2 fuel tank strap nuts and position straps towards left side of vehicle.

(6) Carefully lower tank a few inches and disconnect electrical connector at top of fuel tank module.

(7) Disconnect fuel supply line at tank.

(8) Disconnect fuel return line at tank.

(9) Continue to carefully lower tank for removal.

(10) If fuel tank module is to be removed, thoroughly clean area at top of fuel tank around module.

(11) If fuel tank is to be replaced, remove fuel tank module from tank. Refer to Fuel Tank Module Removal/Installation procedures.

FUEL TANK (Continued)

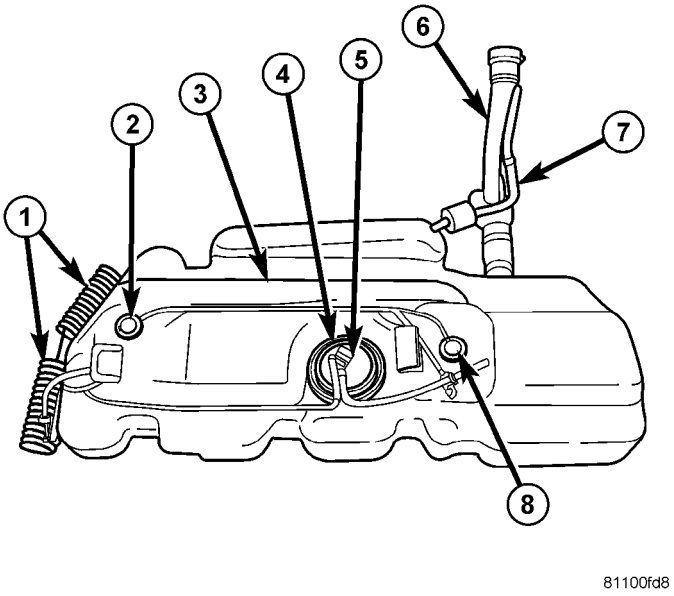


Fig. 8 FUEL TANK ASSEMBLY

1 - COOLER LINES
2 - CHECK VALVE
3 - TOP OF FUEL TANK
4 - LOCK RING
5 - FUEL TANK MODULE
6 - FUEL FILL LINE
7 - FUEL VENT LINE
8 - CHECK VALVE

INSTALLATION

(1) If fuel tank is to be replaced, install fuel tank module into tank. Refer to Fuel Tank Module Removal/Installation procedures.

(2) Position fuel tank to hydraulic jack.

(3) Raise tank until positioned near body.

(4) Connect fuel tank module electrical connector at top of tank.

(5) Connect fuel supply and return lines.

(6) Continue raising tank while guiding fill hose into body. Raise tank until positioned snug to body.

(7) Install and position both fuel tank support straps to mounting studs.

(8) Install 2 fuel tank strap nuts. Refer to Torque Specifications.

(9) Remove hydraulic jack.

(10) Connect fill and vent hoses to body. Install ground wire to fill hose.

(11) Lower vehicle.

(12) Fill fuel tank with fuel.

(13) Start engine and check for fuel leaks near top of module.

FUEL TANK MODULE

DESCRIPTION

An electric fuel pump is **not used** in the fuel tank module for diesel powered engines. Fuel is supplied to the fuel injection pump by the fuel transfer (lift) pump.

The fuel tank module is installed in the top of the fuel tank (Fig. 9). The fuel tank module contains the following components:

- Fuel reservoir
- A separate in-tank fuel filter
- Fuel gauge sending unit (fuel level sensor)
- Fuel supply line connection
- Fuel return line connection

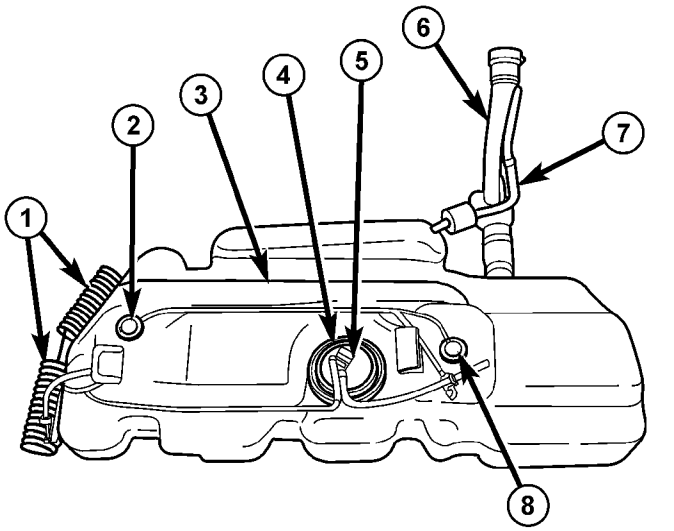


Fig. 9 FUEL TANK MODULE

1 - COOLER LINES
2 - CHECK VALVE
3 - TOP OF FUEL TANK
4 - LOCK RING
5 - FUEL TANK MODULE
6 - FUEL FILL LINE
7 - FUEL VENT LINE
8 - CHECK VALVE

REMOVAL

(1) Drain and remove fuel tank. Refer to Fuel Tank Removal/Installation.

(2) Thoroughly clean area around tank module at top of tank.

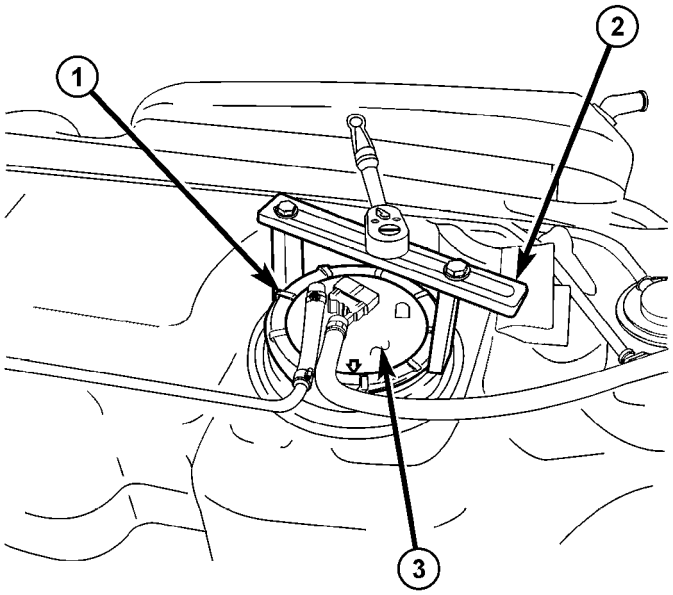
(3) Disconnect both fuel lines from tank module fittings.

FUEL TANK MODULE (Continued)

(4) The plastic fuel tank module locknut (lockring) is threaded onto fuel tank. Install Special Tool #6856 to locknut and remove locknut (Fig. 10). The fuel tank module will spring up slightly after locknut is removed.

(5) Remove module from fuel tank. Be careful not to bend float support rod while removing.

(6) Remove and discard rubber gasket (seal) (Fig. 11) from tank module.



81108746

Fig. 10 FUEL TANK MODULE R/I

1 - LOCKNUT (LOCKRING)
2 - SPECIAL TOOL #6856
3 - TOP OF TANK MODULE

INSTALLATION

CAUTION: Whenever the fuel tank module is serviced, the rubber gasket (Fig. 11) must be replaced.

(1) Thoroughly clean locknut (lockring) and locknut threads at top of tank.

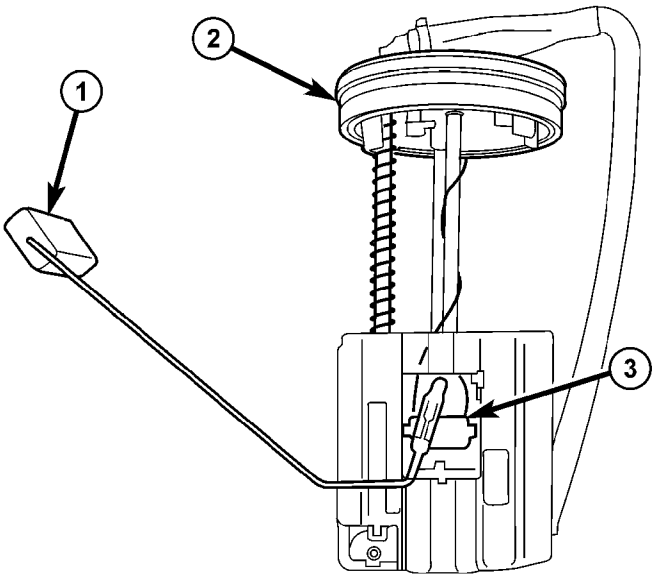
(2) Using new gasket, carefully position fuel tank module into opening in fuel tank.

(3) Position locknut over top of fuel tank module. Install locknut finger tight.

(4) Both fuel line fittings should be pointed to the right side of the vehicle. Rotate and position alignment arrow (Fig. 12) towards right side of vehicle (if necessary) before tightening locknut. **This step must be performed to prevent the module's float from contacting the side of fuel tank.**

(5) Tighten locknut using Special Tool #6856. Refer to Torque Specifications.

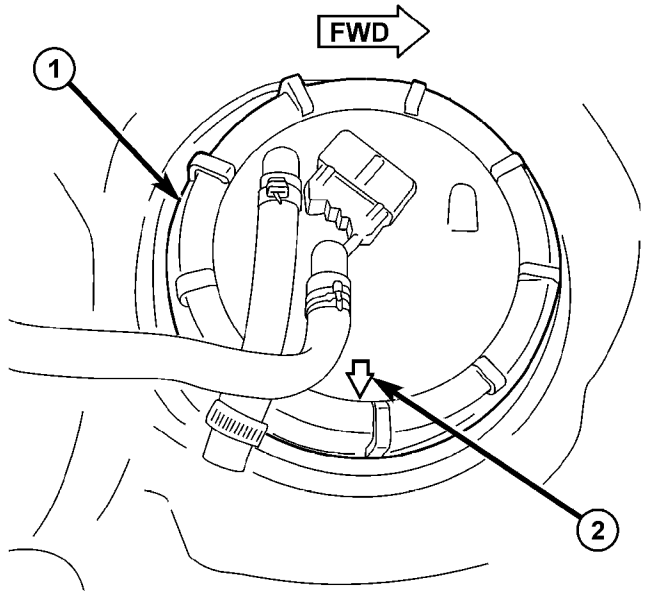
(6) Install fuel tank. Refer to Fuel Tank Removal/ Installation.



8110d413

Fig. 11 FUEL GAUGE SENDING UNIT

1 - FLOAT AND FLOAT ARM
2 - RUBBER GASKET (SEAL)
3 - FUEL GAUGE SENDING UNIT



8110c064

Fig. 12 ALIGN TANK MODULE

1 - LOCKNUT
2 - ALIGNMENT ARROW (POSITION TOWARDS RIGHT SIDE OF VEHICLE)

FUEL LEVEL SENDING UNIT / SENSOR

DESCRIPTION

The fuel gauge sending unit (fuel level sensor) is attached to the side of the fuel tank module (Fig. 13). The sending unit consists of a float, an arm, and a variable resistor track (card).

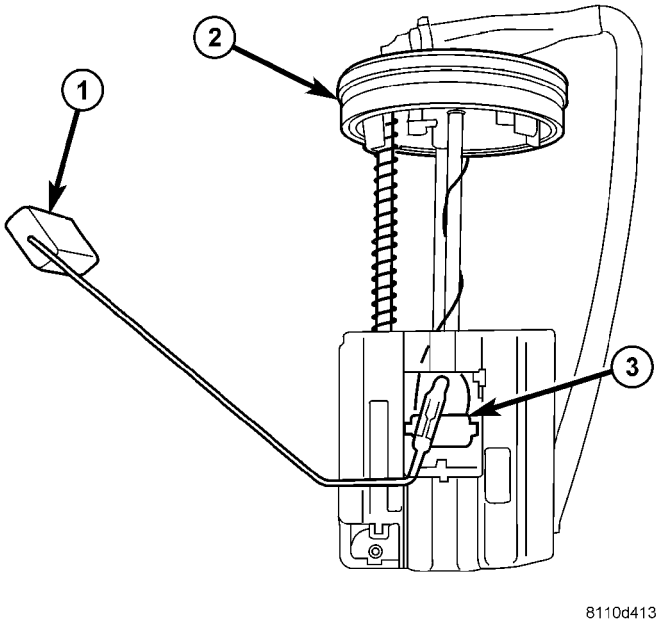


Fig. 13 FUEL GAUGE SENDING UNIT

1 - FLOAT AND FLOAT ARM
2 - RUBBER GASKET (SEAL)
3 - FUEL GAUGE SENDING UNIT

REMOVAL

The fuel level sending unit (fuel level sensor) and float assembly is located on the side of the fuel tank module (Fig. 14).

(1) Remove fuel tank module from fuel tank. Refer to Fuel Tank Module Removal/Installation.

(2) Disconnect wiring from fuel tank module base using a terminal pick / removal tool. Refer to Special Tools in 8W, Wiring for tool part numbers.

(3) To remove sending unit from tank module, lift on plastic locking tab (Fig. 15) while sliding sending unit on its tracks.

INSTALLATION

(1) Connect (snap) necessary wiring into base of fuel tank module.

(2) Position sending unit to tank module. Slide and snap into place.

(3) Install fuel tank module. Refer to Fuel Tank Module Removal/Installation.

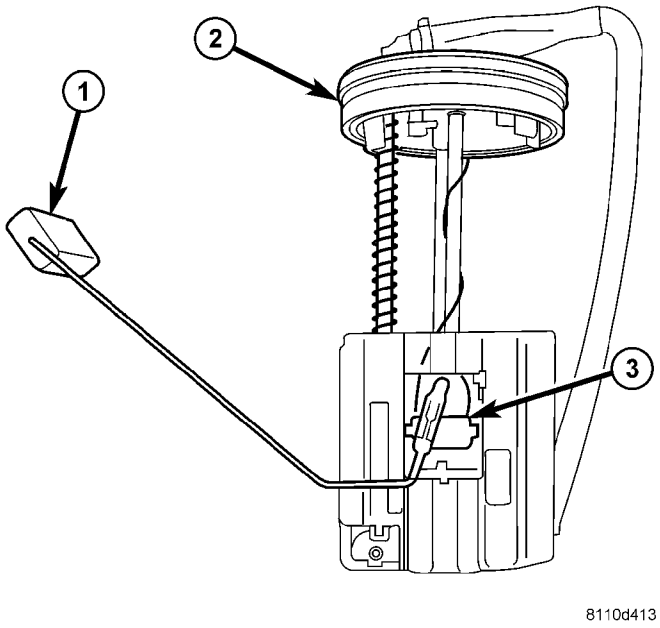


Fig. 14 FUEL GAUGE SENDING UNIT

1 - FLOAT AND FLOAT ARM
2 - RUBBER GASKET (SEAL)
3 - FUEL GAUGE SENDING UNIT

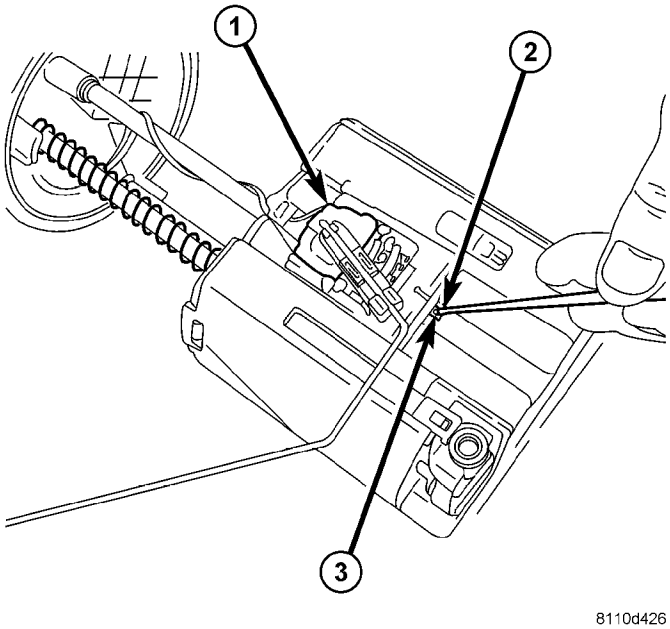


Fig. 15 FUEL GAUGE SENDING UNIT R/I

1 - SENDING UNIT
2 - SMALL PUNCH OR SCREWDRIVER
3 - LOCK TAB

HI PRESSURE FUEL SHUTOFF SOL

DESCRIPTION

The high pressure fuel injection pump has a integrated shut off valve for one of the high pressure pump elements. The ECM monitors the fuel temperature and will switch off the element if the fuel temperature reaches above 287°F (120C) with the engine speed above 2200 rpm. The shut off valve is not serviced separately.

OPERATION

The high pressure injection pump element shut off valve interrupts the fuel high pressure delivery of one of the injection pump elements in the part load range. This will reduce the power required for driving the high pressure pump so as to reduce the fuel temperature. The pump element is switched off if the fuel temperature is excessively high forcing it to return again to the fuel feed to cool. The element shut off limits the increasing pressure of the injection pump to ensure that the critical fuel temperature for the system is not exceeded.

WATER IN FUEL SENSOR

DESCRIPTION

The water in fuel sensor if located in the bottom of the fuel filter housing. This sensor detects the presence of water in the fuel. If water is present in the fuel a signal is sent to the ECM and the ECM signals the instrument cluster, over the CAN bus, to illuminate the water in fuel warning.

OPERATION

The non-dielectric properties of the water allow the sensors probes to close the electronic circuit when water is present in the system. When diesel fuel is present in the system, it's dielectric (does not conduct electricity well) properties do not allow any electrical contact between the probes. A 12V power signal is always present in order to illuminate the indicator on the instrument cluster. For removal and installation procedure refer to (Refer to 14 - FUEL SYSTEM/ FUEL DELIVERY/FUEL FILTER - REMOVAL).

FUEL INJECTION

TABLE OF CONTENTS

page

ACCELERATOR PEDAL POSITION SENSOR
DESCRIPTION 17
BOOST PRESSURE SENSOR
DESCRIPTION 17
OPERATION 18
DIAGNOSIS AND TESTING - BOOST PRESSURE SENSOR 18
REMOVAL 18
INSTALLATION 18
CAMSHAFT POSITION SENSOR
DESCRIPTION 19
OPERATION 19
REMOVAL 19
INSTALLATION 19
CRANKSHAFT POSITION SENSOR
DESCRIPTION 20
OPERATION 20
REMOVAL 20
INSTALLATION 20
FUEL INJECTOR
DESCRIPTION
FUEL INJECTOR 20
OPERATION 20
STANDARD PROCEDURE
STANDARD PROCEDURE - INJECTOR CLASSIFICATION 22
STANDARD PROCEDURE - CLEANING FUEL INJECTORS 22
REMOVAL 23
INSTALLATION 23
FUEL PRESSURE SENSOR
DESCRIPTION
DESCRIPTION 25

page

DESCRIPTION 25
OPERATION
OPERATION 25
OPERATION 25
REMOVAL
REMOVAL 26
REMOVAL 26
INSTALLATION
INSTALLATION 26
INSTALLATION 27
FUEL PRESSURE SOLENOID
DESCRIPTION 27
OPERATION 27
REMOVAL 28
INSTALLATION 28
FUEL TEMPERATURE SENSOR
DESCRIPTION 29
OPERATION 29
REMOVAL 29
INSTALLATION 29
INLET AIR TEMPERATURE SENSOR
DESCRIPTION 29
OPERATION 29
REMOVAL 30
INSTALLATION 30
MANIFOLD AIR FLOW (MAF) SENSOR
DESCRIPTION 30
OPERATION 30
REMOVAL 31
INSTALLATION 31

ACCELERATOR PEDAL POSITION SENSOR

DESCRIPTION

The accelerator pedal position sensor is located on the accelerator pedal assembly. The driver supplies the torque requirements for the engine by operating the accelerator pedal in accordance with the desired speed or acceleration. The pedal sensor converts the mechanical operation of the pedal into an electrical signal and sends the information to the ECM. The ECM adjusts the quantity of the fuel that is injected into the engine (Fig. 1).

The accelerator pedal position sensor is serviced as an assembly with the accelerator assembly.

BOOST PRESSURE SENSOR

DESCRIPTION

The boost pressure sensor is mounted to the charge air pipe (Fig. 2). The sensor allows the ECM to monitor intake air down stream of the turbocharger.

BOOST PRESSURE SENSOR (Continued)

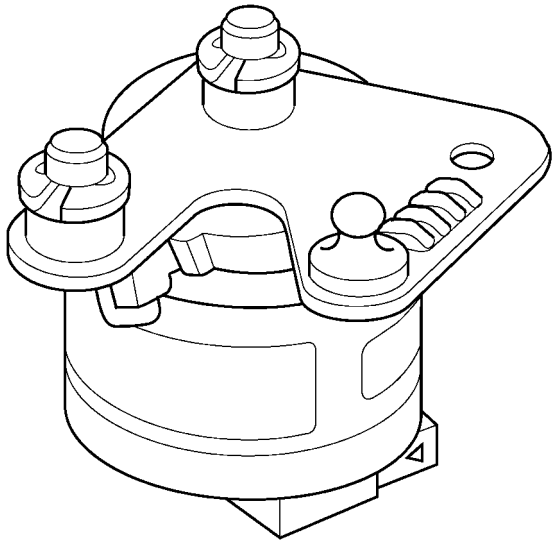


Fig. 1 ACCELERATOR PEDAL POSITION SENSOR

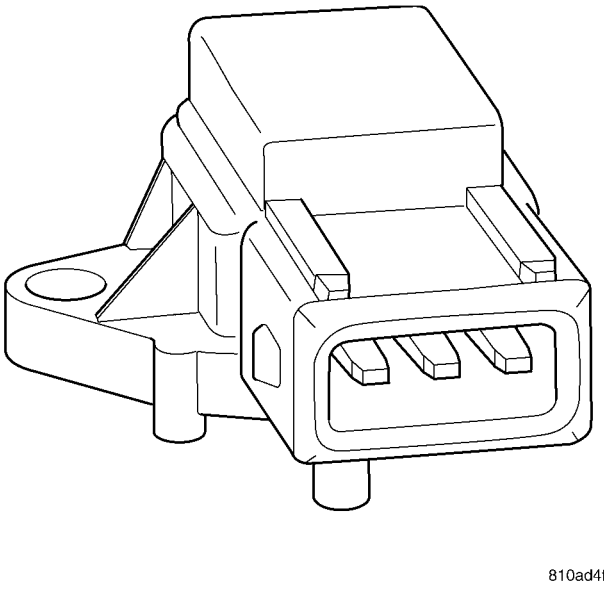


Fig. 2 BOOST PRESSURE SENSOR

OPERATION

When the intake manifold pressure is low (high vacuum) sensor voltage output is 0.25-1.8 volts at the ECM. When the intake manifold pressure is high due to turbo boost, sensor voltage output is 2.0-4.7 volts. The sensor receives a 5-volts reference from the ECM. Sensor ground is also provides by the ECM. The ECM uses boost pressure combined with intake air temerature to determine the volume of air entering the engine (Fig. 2).

DIAGNOSIS AND TESTING - BOOST PRESSURE SENSOR

If the boost pressure sensor fails, the ECM records a DTC into memory and continues to operate the engine in one of the three limp-in modes. When the ECM 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. Refer to the Diesel Powertrain Diagnostic Manual for more information.

Refer to On-Board Diagnostics in Emissions Control System for a list of Diagnostic Trouble Codes (DTC's) for certain fuel system components.

REMOVAL

(1) Disconnect the negative battery cable.
(2) Unplug the electrical connector.
(3) Remove the sensor retaining bolts, remove the sensor and O-ring.

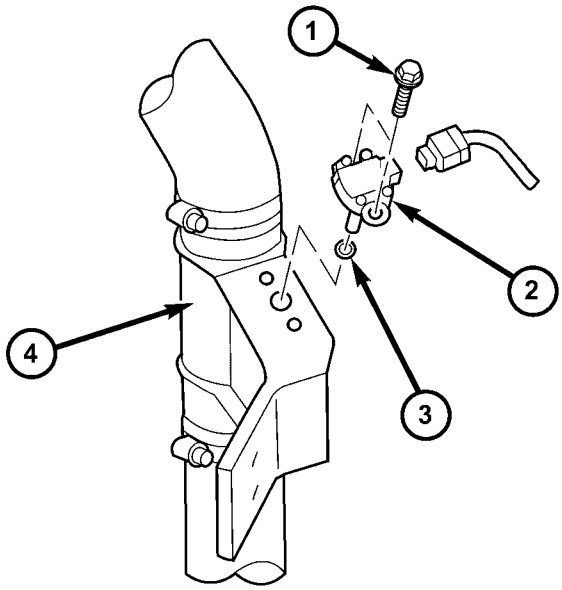


Fig. 3 BOOST PRESSURE SENSOR

1 - BOLT
2 - BOOST PRESSURE SENSOR
3 - O-RING
4 - CHARGE AIR PIPE

INSTALLATION

(1) Inspect boost pressure sensor O-ring for cuts or abrasions, replace as necessary.

BOOST PRESSURE SENSOR (Continued)

(2) Position the boost pressure sensor above access hole in the charge air pipe and push down to fit flush (Fig. 3).

(3) Install the bolts and tighten to 44 lbs. in. (5 N·m) (Fig. 3).

(4) Reconnect the sensor electrical connector (Fig. 3).

(5) Connect negative battery cable

CAMSHAFT POSITION SENSOR

DESCRIPTION

The camshaft position sensor is mounted on the cylinder head cover toward the rear of the engine. The camshaft sensor utilizes a non contact method on one segment of the camshaft to record the camshaft position. When the ECM receives the signal from this sensor, it can then detect TDC of cylinder number one. The signal from the camshaft sensor is only required during engine starting. Injection timing is synchronized by means of the camshaft signal and the crankshaft signal.

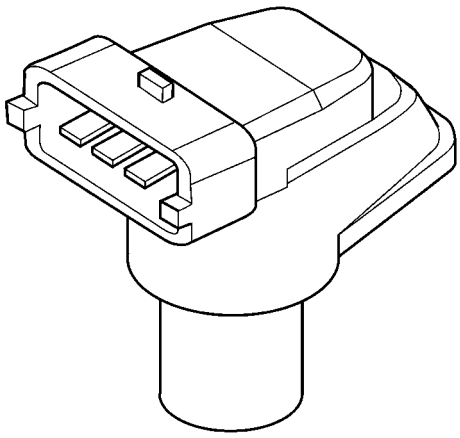


Fig. 4 CAMSHAFT POSITION SENSOR

1 - WIRING HARNESS CONNECTOR
2 - CAM POSITION SENSOR
3 - O-RING
4 - CYLINDER HEAD COVER

OPERATION

On the camshaft sensor's signal line, a high signal correspons to a voltage of 11–14V. If the segment machined into the exhaust camshaft sprocket is positioned opposite the camshaft sensor, the camshaft signal is low, approximately 0V. This signal is used by the engine control module (ECM) for detecting ignition TDC of cylinder 1 as the engine rotates. If no signal is supplied by the camshaft position sensor, the vehicle will not start because cylinder order can not be detected (Fig. 4).

REMOVAL

(1) Disconnect negative battery cable.

(2) Remove engine cover

(3) Disconnect camshaft position sensor electrical connector (Fig. 5).

(4) Remove retaining bolt and remove sensor (Fig. 5).

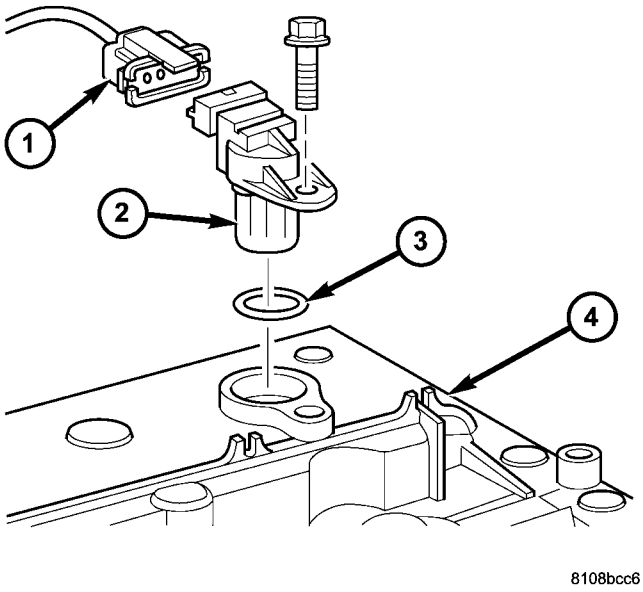


Fig. 5 CAM POSITION SENSOR

1 - WIRING HARNESS CONNECTOR
2 - CAM POSITION SENSOR
3 - O-RING
4 - CYLINDER HEAD COVER

INSTALLATION

(1) Install camshaft position sensor and tighten bolt (Fig. 5).

(2) Reconnect electrical connector (Fig. 5).

(3) Install engine cover.

(4) Reconnect negative battery cable.

CRANKSHAFT POSITION SENSOR

DESCRIPTION

The crankshaft position sensor is located opposite the teeth on the flywheel and uses a non contact method to record the position of the crankshaft. The leading edges of each tooth on the flywheel generate a positive signal in the position sensor, while the trailing edges generate a negative signal. When the crankshaft is rotating, an alternating voltage is produced as a result.

The period of the signal is the time required by the crankshaft to turn through the gap between two flywheel teeth. The clearance between the crankshaft position sensor and the teeth of the flywheel is fixed by the installation.

Two teeth on the flywheel are missing. The resulting signal gap is used by the ECM to detect the TDC position of cylinder number one.

OPERATION

The clearance between the crankshaft position sensor and the flywheel are fixed by the installation position. Two teeth on the flywheel are missing. The resulting gap is used by the ECM to detect DTC of cylinder number one. The crankshaft position is calculated to an accuracy of a fraction of a degree so that the start and end of injection can occur at exactly the right moment. The engine speed signal is also processed by the ECM from the crankshaft sensor. This signal is then transferred to other control modules over the CAN bus.

If the crankshaft position sensor fails, the signal that provides reference rotation is missing. Injection may occur at the wrong time and damage the engine. In this case, the ECM will stop triggering the injectors, the engine would cut out, the engine warning light would illuminate and the engine will not restart.

REMOVAL

(1) Disconnect the negative battery cable.

(2) Unplug the crankshaft wiring harness connector.

(3) Remove the crankshaft sensor retaining bolt and remove sensor (Fig. 6).

INSTALLATION

(1) Position the crankshaft position sensor into the access hole and install retaining bolt.

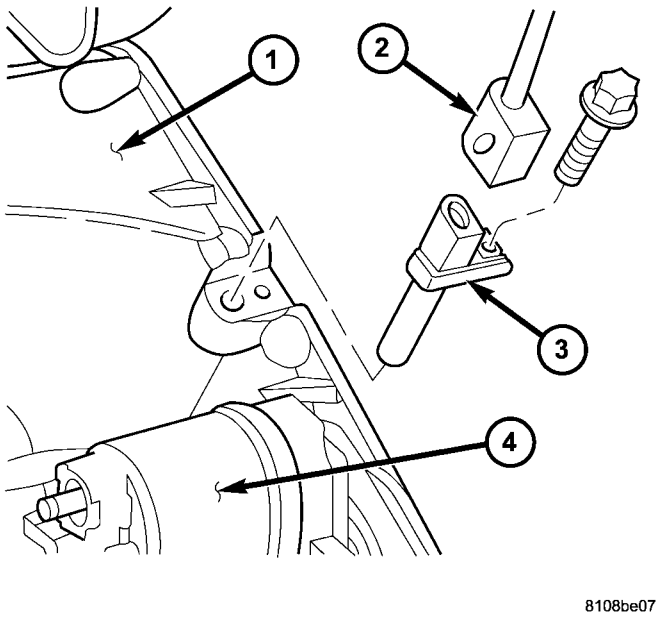


Fig. 6 CRANKSHAFT POSITION SENSOR

1 - ENGINE BLOCK
2 - WIRING HARNESS CONNECTOR
3 - CRANKSHAFT POSITION SENSOR
4 - STARTER SOLENOID

(2) Tighten the retaining bolt to 80 lbs. in. (9 N·m) (Fig. 6).

(3) Connect crankshaft position sensor wiring harness connector (Fig. 6).

(4) Connect negative battery cable.

FUEL INJECTOR

DESCRIPTION

FUEL INJECTOR

There are individual fuel injectors for all five cylinders. These fuel injectors are used to spray fuel into the combustion chamber (Fig. 7).

OPERATION

The injector operation can be subdivided into four operating states with the engine running and the high-pressure pump generating pressure:

- Injector closed (with high pressure applied)
- Injector opens (start of injection)
- Injector opened fully
- Injector closes (end of injection)

FUEL INJECTOR (Continued)

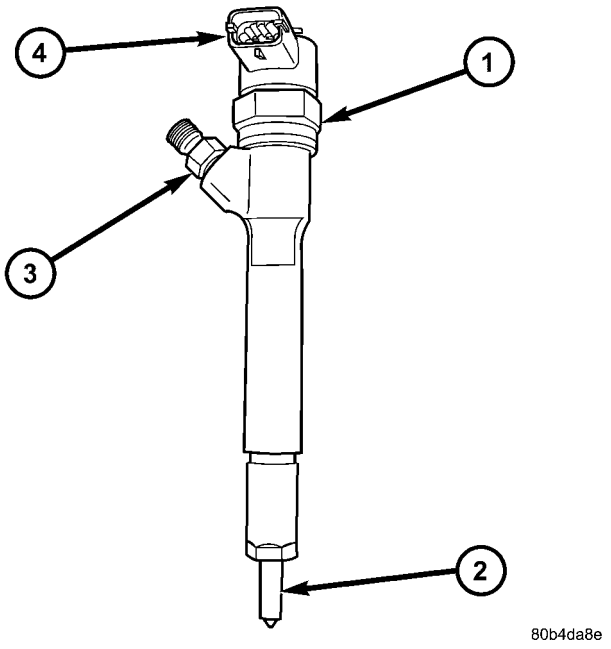


Fig. 7 FUEL INJECTOR

1 - FUEL INJECTOR
2 - NOZZLE
3 - FUEL INLET FITTING
4 - ELECTRICAL CONNECTION

Injector closed (with high pressure applied)

With the injector closed (at-rest state), the solenoid valve is not energized and is therefore closed. With the bleed orifice closed, the valve spring forces the armature's ball onto the bleed-orifice seat. The rail's high pressure build up in the valve control chamber, and the same pressure is also present in the nozzle's chamber volume. The rail pressure applied at the control plunger's end face, together with the force of the nozzle spring, maintain the nozzle in the closed position against the opening forces applied to its pressure stage (Fig. 8).

Injector opens (start of injection)

The solenoid valve is energized with the pickup current which serves to ensure that it open quickly. The force exerted by the triggered solenoid now exceeds that of the valve spring and the armature opens the bleed orifice. Almost immediately, the high-level pick-up current is reduced to the lower holding current required for the electromagnet. This is possible due to the magnetic circuit's air gap now being smaller. When the bleed orifice opens, fuel can flow from the valve control chamber into the cavity situated above it, and from there via the fuel return to the tank. The bleed orifice prevents complete pressure balance, and the pressure in the valve control chamber sinks as a result. This leads to the pressure in the valve-control chamber being lower than that in the nozzle's chamber volume which is still at the same pressure level as the rail. The reduced pressure in the valve-control chamber causes a reduction in the force exerted on the control plunger, the nozzle needle open as a result, and injection starts (Fig. 8).

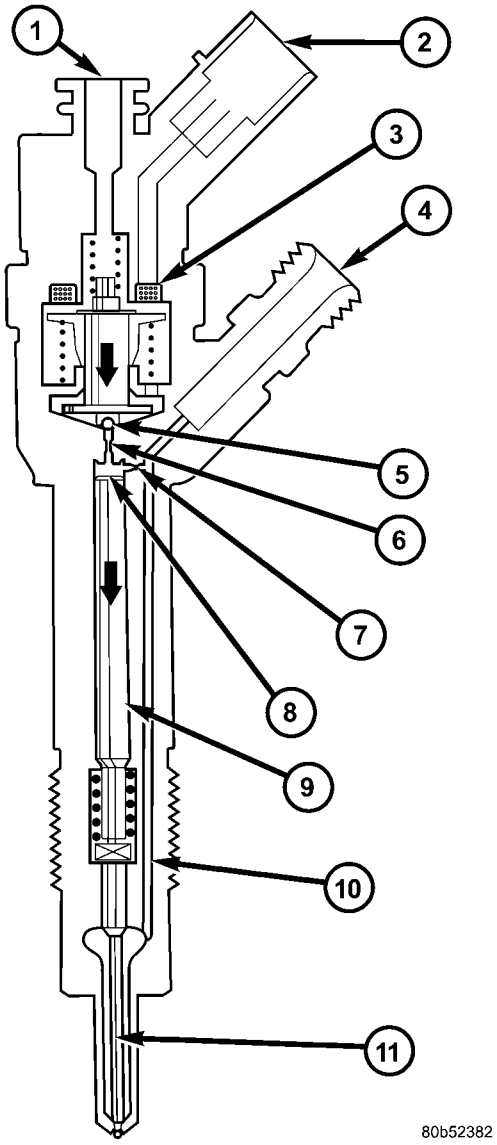


Fig. 8 INJECTOR COMPONENTS

1 - INJECTOR CLOSED (AT-REST STATUS)
2 - ELECTRICAL CONNECTION
3 - TRIGGERING ELEMENT (SOLENOID VALVE)
4 - FUEL INLET (HIGH PRESSURE) FROM THE RAIL
5 - VALVE BALL
6 - BLEED ORIFICE
7 - FEED ORIFICE
8 - VALVE CONTROL CHAMBER
9 - VALVE CONTROL PLUNGER
10 - FEED PASSAGE TO THE NOZZLE
11 - NOZZLE NEEDLE

FUEL INJECTOR (Continued)

Injector opens fully

The control plunger reaches its upper stop where it remains supported by a cushion of fuel which is generated by the flow of fuel between the bleed and feed orifices. The injector nozzle has now opened fully, and the fuel is injected into the combustion chamber at a pressure almost equal to that in the fuel rail (Fig. 8).

Injector closes (end of injection)

As soon as the solenoid valve is no longer triggered, the valve spring forces the armature downwards and the ball closes the bleed orifice. The armature is a 2–piece design. Here, although the armature plate is guided by a driver shoulder in its downward movement, it can “overspring” with the return spring so that it exerts no downwards-acting forces on the armature and the ball. The closing of the bleed orifice lead to pressure build up in the control chamber via the input from the feed orifice. This pressure is the same as that in the rail and exerts an increased force on the control plunger through its end face. This force, together with that of the spring, now exceeds the force exerted by the chamber volume and the nozzle needle closes. Injection ceases as soon as the nozzle needle comes up against its bottom stop again (Fig. 8).

STANDARD PROCEDURE

STANDARD PROCEDURE - INJECTOR CLASSIFICATION

The classification of injectors into 3 classes describes the quantity characteristic of the injector. This will make it possible in the future to match the engine software to the tolerances of the injector within a more narrowly graduated range. Classification can be clearly recognized, and assigned only by means of a DRBIII®.

Classified injectors can be recognized by the part number and identification on the magnetic head (circle with a number between 1 and 3 inside) (Fig. 9). The number corresponds to the classification stage.

These general conditions equally apply if, as a result of replacing an engine, carrying out repairs to the cylinder head etc., the cylinder selective assignment of the injectors or the engine control module assignment may have changed. If proper attention is not paid to the classification on these vehicles driveability and smoking concerns could result.

If an injector is replaced, it is then necessary to assign the classification number to the corresponding cylinder with the **DRBIII®** in the control module.

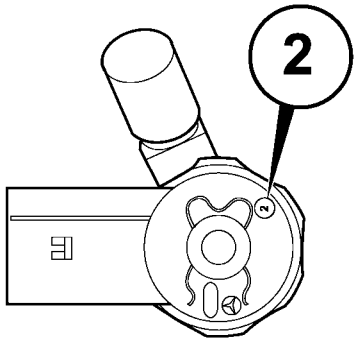


Fig. 9 INJECTOR CLASSIFICATION MARKINGS

INJECTOR CLASSIFICATION PROCEDURE

(1) Turn ignition switch “ON”.
(2) Using a DRB III® and select ENGINE then MISCELLANEOUS.
(3) Select LEARN INJECTORS.
(4) Using the up and down arrows, scroll to the appropriate injector.
(5) Using the right and left arrows, set injector to proper classification.
(6) Once injectors are classified, cycle ignition to complete.

STANDARD PROCEDURE - CLEANING FUEL INJECTORS

NOTE: Before cleaning the injector recesses, seal the injector holes in the injector recesses with the appropriate pin to prevent debris from falling into the recesses and entering the motor.

(1) Seal the injector holes inside the cylinder head recesses.
(2) Wipe out injector recesses with a non-woven cloth, then clean with a cylinder brush.
(3) Clean the bottom of the cylinder recess with a round brush.
(4) Blow out the recess and clean again with a non-woven cloth and cover over.
(5) Perform these steps for each injector recess.

NOTE: DO NOT clean the tip of the injector with a wire brush. Use a non - woven cloth.

(6) Clean injector body with a wire brush.
(7) Clean injector tips with a non-woven cloth.

NOTE: Do Not apply antiseize lubricant to the injector nozzle area.

(8) Grease injector body with anti seize lubricant.

FUEL INJECTOR (Continued)

NOTE: Always replace the seals that seal off the injectors at the cylinder head to the combustion chamber and replace the retaining screws.

REMOVAL

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 1600BAR (23,200 PSI). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS. FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE LEAKS WITH A SHEET OF CARD BOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.

WARNING: NO SPARKS, OPEN FLAMES OR SMOKING. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

NOTE: The engine must be lowered in the vehicle to remove the fourth and fifth cylinders fuel injectors.

(1) Disconnect negative battery cable.
(2) Remove engine cover (Refer to 9 - ENGINE - REMOVAL).
(3) Raise and suitably support the vehicle.
(4) Remove lower radiator deflector plate.
(5) Drain cooling system (Refer to 7 - COOLING/ ENGINE/COOLANT - STANDARD PROCEDURE).
(6) Remove turbocharger down pipe assembly.
(7) Remove oil dipstick tube retaining bolt and pull tube from oil pan.
(8) Lower vehicle.
(9) Remove upper radiator hose.
(10) Remove air cleaner box assembly and hoses.
(11) Remove charge air cooler inlet hose.
(12) Remove charge air cooler to turbocharger inlet adaptor.
(13) Remove turbocharger to right engine mount bracket.
(14) Disconnect steering coupler at gear box (RHD Only).
(15) Remove battery (Refer to 8 - ELECTRICAL/ BATTERY SYSTEM/BATTERY - REMOVAL).
(16) Unclip PDC from battery tray and set aside.
(17) Remove battery tray (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/TRAY - REMOVAL).
(18) Remove power steering reservoir (Refer to 19 - STEERING/PUMP/RESERVOIR - REMOVAL).
(19) Remove charger air cooler outlet hose.
(20) Remove intake manifold to left engine mount bracket.
(21) Evacuate air conditioning system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).
(22) Disconnect air conditioning suction / discharge lines at A/C compressor.
(23) Disconnect pedal position sensor electrical connector.
(24) Unplug injector electrical connectors.
(25) Remove fuel / water separator to intake manifold retaining bolts.
(26) Support engine with hoist.
(27) Remove engine mount through bolts.
(28) Remove right engine mount sill plate.

NOTE: Counterhold injection lines with wrench socket at threaded connections of injectors.

(29) Disconnect fuel injector high pressure line.
(30) Remove fuel injector retaining bolt and tension claw.
(31) Suitably lower engine to gain fuel injector access and remove injector.

NOTE: If injectors are tight, remove with extraction claw in place of tensioning claw. If extraction claw contacts cylinder head cover, remove cylinder head cover. If necessary, remove injectors with threaded adaptor and discard injector.

(32) Remove injectors (Fig. 10).
(33) Clean injectors and recesses (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - STANDARD PROCEDURE).

INSTALLATION

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 1600BAR (23,200 PSI). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS. FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE LEAKS WITH A SHEET OF CARD BOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.

FUEL INJECTOR (Continued)

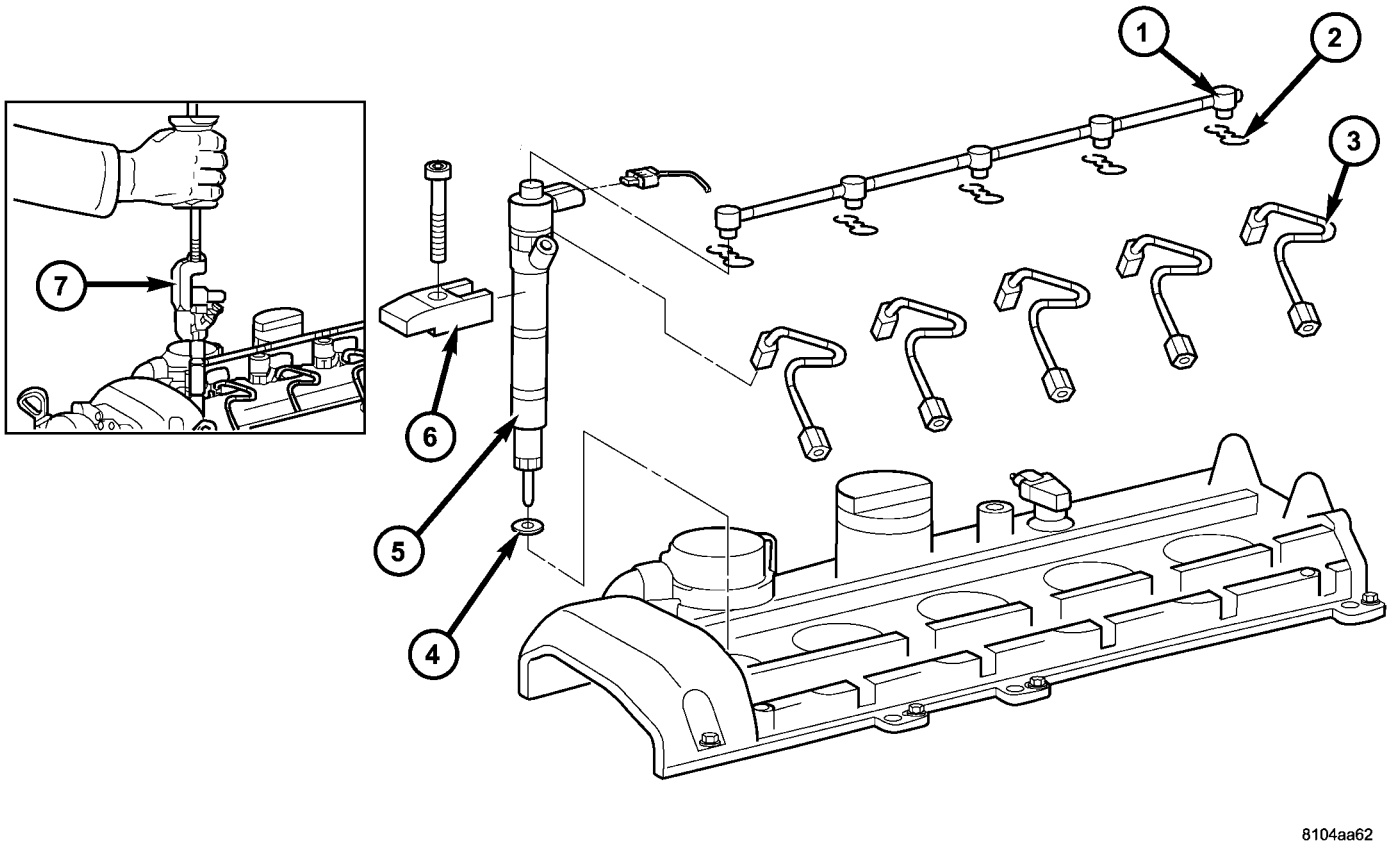


Fig. 10 FUEL INJECTOR REMOVAL / INSTALLATION

1 - FUEL INJECTOR RETURN LINE
2 - RETAINING CLIP
3 - INJECTOR HIGH PRESSURE LINE
4 - INJECTOR SEAL
5 - FUEL INJECTOR
6 - TENSIONING CLAW
7 - SPECIAL TOOLS #8938 AND # 8937

WARNING: NO SPARKS, OPEN FLAMES OR SMOKING. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

(1) Clean injectors and recesses (Refer to 14 - FUEL SYSTEM/FUEL INJECTION/FUEL INJECTOR - STANDARD PROCEDURE).

(2) Coat injector body with anti seize lubricant then install injectors with new seals.

(3) Install tensioning claws with new screws at injectors. Tighten screws in two stages, 7 N·m (62 lbs. in.) then 90°.

NOTE: If locking clamp has been pulled off at injector, the locking clamp must be replaced.

(4) Position fuel return line at injectors and secure locking clamps.

NOTE: Counterhold injection lines with wrench socket at threaded connections of injectors.

(5) Install high pressure injection lines (Refer to 14 - FUEL SYSTEM/FUEL DELIVERY/FUEL LINES - INSTALLATION).

(6) Reconnect injector electrical connectors.

(7) Raise engine and install right sill plate.

(8) Install engine mount through bolts and tighten to 40N·m (30 lbs. ft.).

(9) Install fuel / water separator to intake manifold retaining bolts.

(10) Connect pedal position sensor electrical connector.

(11) Connect air conditioning lines to A/C compressor.

(12) Install intake manifold to left engine mount bracket.

(13) Install charge air cooler outlet hose.

(14) Install power steering reservoir(Refer to 19 - STEERING/PUMP/RESERVOIR - INSTALLATION).

FUEL INJECTOR (Continued)

(15) Install battery tray(Refer to 8 - ELECTRICAL/BATTERY SYSTEM/TRAY - INSTALLATION).
(16) Connect PDC to battery tray.
(17) Install battery (Refer to 8 - ELECTRICAL/BATTERY SYSTEM/BATTERY - INSTALLATION).
(18) Connect steering coupler at gear box (RHD Only).
(19) Install turbocharger to right engine mount bracket (Refer to 11 - EXHAUST SYSTEM/TURBOCHARGER SYSTEM - INSTALLATION).
(20) Install charge air cooler to turbocharger inlet adaptor (Refer to 11 - EXHAUST SYSTEM/CHARGE AIR COOLER AND PLUMBING - INSTALLATION) .
(21) Install charger air cooler inlet hose (Refer to 11 - EXHAUST SYSTEM/CHARGE AIR COOLER AND PLUMBING - INSTALLATION).
(22) Install air cleaner box assembly and hoses.
(23) Install upper radiator hose.
(24) Raise vehicle.
(25) Install dipstick tube into oil pan and tighten retaining bolt.
(26) Install turbocharger down pipe assembly.
(27) Close cooling system drain.
(28) Install lower radiator deflector plate.
(29) Lower vehicle.
(30) Connect negative battery cable.
(31) Install engine cover (Refer to 9 - ENGINE - INSTALLATION)..
(32) Fill cooling system with the correct mixture to the proper level (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

WARNING: USE EXTREME CAUTION WHEN THE ENGINE IS OPERATING. DO NOT PUT YOUR HANDS NEAR PULLEYS, BELTS OR FAN. DO NOT WEAR LOOSE CLOTHING.

(33) Start engine and inspect for leaks.
(34) Recharge air conditioning system.

FUEL PRESSURE SENSOR

DESCRIPTION

DESCRIPTION

The fuel pressure sensor provides the current low pressure (the pressure that exist at the inlet of the high pressure injection pump) fuel pressure to the ECM (Fig. 11).

The fuel pressure when the engine is idling is approximately 36 psi (2.5 Bar). The fuel pressure while driving is 50–58 psi (3.5 - 4.0Bar).

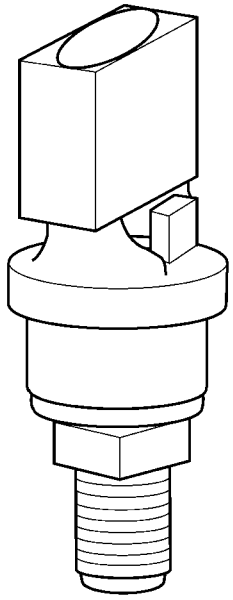


Fig. 11 FUEL PRESSURE SENSOR

DESCRIPTION

The fuel rail pressure sensor provides the current fuel rail pressure to the ECM.

OPERATION

OPERATION

A diaphragm and an electric resistance meter are integrated in the fuel pressure sensor. The non-constant fuel system pressure from the low pressure fuel pump influences the position of the diaphragm which in turn alters it's electrical resistance. This resistance is analyzed by the ECM. The ECM then actuates the fuel rail pressure control valve until the desired rail pressure value is obtained (Fig. 11).

OPERATION

The fuel rail pressure sensor measures the current fuel rail pressure and sends a voltage signal to the ECM. The ECM then actuates the fuel rail pressure control valve solenoid until the desired rail pressure is achieved.

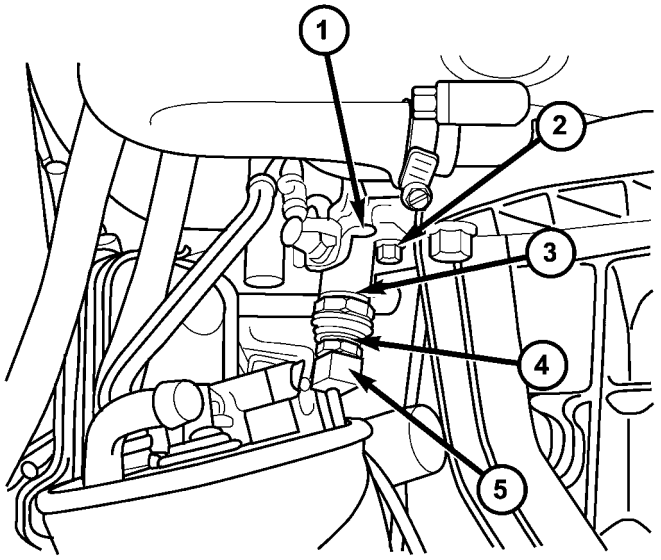
FUEL PRESSURE SENSOR (Continued)

REMOVAL

REMOVAL

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 23,000PSI (1600)BAR. USE EXTREME CAUTION WHEN INSPECTING FOR HIGH PRESSURE FUEL LEAKS. FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH PRESSURE LEAKS WITH A SHEET OF CARD BOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING THE FUEL SYSTEM.

(1) Disconnect the negative battery cable.
(2) Disconnect the fuel rail pressure sensor wiring harness connector.
(3) Unbolt fuel rail pressure sensor from the housing and remove together with the seal.



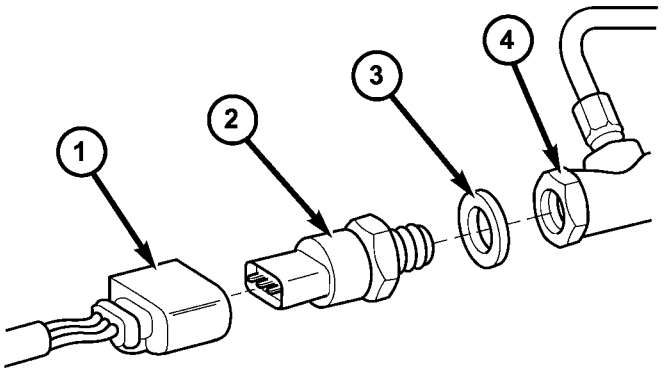
81093662

Fig. 12 FUEL PRESSURE SENSOR

1 - HOUSING
2 - BOLT
3 - SEALING RING
4 - FUEL RAIL PRESSURE SENSOR
5 - CONNECTOR

REMOVAL

(1) (Refer to 14 - FUEL SYSTEM/FUEL INJECTION - WARNING) Disconnect the negative battery cable.
(2) Remove the mixing housing.
(3) Unplug the sensor (Fig. 13).
(4) Counter-hold the threaded connection at the fuel rail and unscrew the sensor (Fig. 13).



8109695a

Fig. 13 FUEL RAIL PRESSURE SENSOR

1 - WIRING CONNECTOR
2 - FUEL RAIL PRESSURE SENSOR
3 - SEALING RING
4 - FUEL RAIL

INSTALLATION

INSTALLATION

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 23,000PSI (1600)BAR. USE EXTREME CAUTION WHEN INSPECTING FOR HIGH PRESSURE FUEL LEAKS. FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH PRESSURE LEAKS WITH A SHEET OF CARD BOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING THE FUEL SYSTEM.

(1) Clean sealing surfaces.
(2) Install new seal and lubricate with clean diesel fuel.
(3) Properly position sensor and install retaining bolt (Fig. 12).
(4) Connect wiring harness connector (Fig. 12).
(5) Connect negative battery cable.

FUEL PRESSURE SENSOR (Continued)

INSTALLATION

(1) (Refer to 14 - FUEL SYSTEM/FUEL INJECTION - WARNING) Install the sealing ring on to the sensor (Fig. 13).

(2) Screw the sensor in to the fuel rail. Counterhold the threaded connection and tighten the sensor to 18 lbs. ft. (25 N·m.) (Fig. 13).

(3) Connect the wiring harness to the sensor.

(4) Install the mixing housing.

(5) Connect negative battery cable.

FUEL PRESSURE SOLENOID

DESCRIPTION

The fuel pressure solenoid is attached to the rear of the fuel rail. The solenoid controls and maintains the rail pressure constant along with a control current transmitted by the engine control module (ECM) (Fig. 14).

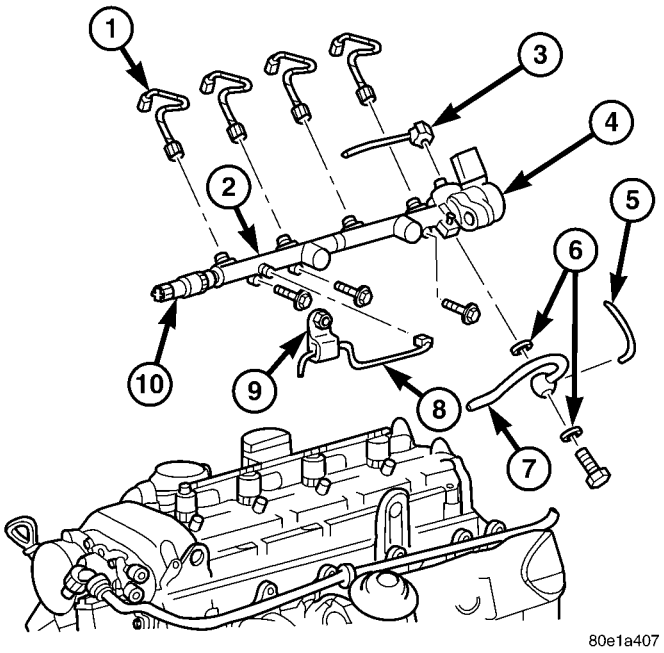


Fig. 14 FUEL PRESSURE SOLENOID - TYPICAL

1 - INJECTION LINES
2 - FUEL RAIL
3 - FUEL RETURN LINE
4 - FUEL PRESSURE SOLENOID
5 - OIL LINE
6 - SEALS
7 - FUEL RETURN LINE AT COOLER
8 - HIGH PRESSURE FUEL LINE TO FUEL RAIL
9 - FUEL LINE BRACKET
10 - FUEL PRESSURE SENSOR

OPERATION

High pressure which is present in the fuel rail flows to the ball seat of the solenoid (Fig. 15). The specified pressure required by the system is built up in the rail by the fuel pressure solenoid building up a magnetic force which corresponds to this specific pressure by means of a control current from the electronic control module (ECM) (Fig. 15). This magnetic force equals a certain outlet cross section at the ball seat of the solenoid. The rail pressure is altered as a result of the quantity of fuel which flows off (Fig. 15). The current fuel pressure is signaled by the fuel pressure sensor to the engine control module (ECM). The controlled fuel flows back along the return fuel line, into the tank.

In a de-energized state, the fuel pressure solenoid is closed as the spring force presses the ball into the ball seat (Fig. 15). When driving, the fuel pressure solenoid is constantly open (Fig. 15). When engine is started, the fuel pressure solenoid is held closed by magnetic force (Fig. 15). When driving, the pressure of the fluid counteracts the magnetic force of the coil and the slight spring force (Fig. 15).

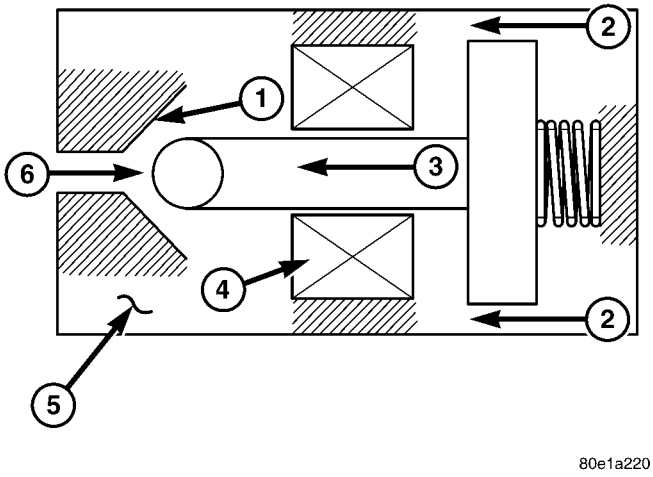


Fig. 15 FUEL PRESSURE SOLENOID OPERATION

1 - BALL SEAT
2 - SPRING FORCE
3 - MAGNETIC FORCE
4 - COIL
5 - FUEL PRESSURE SOLENOID
6 - HIGH PRESSURE FEED

FUEL PRESSURE SOLENOID (Continued)

REMOVAL

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 1600BAR (23,200 PSI). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS. FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE LEAKS WITH A SHEET OF CARD BOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.

WARNING: NO SPARKS, OPEN FLAMES OR SMOKING. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

(1) Disconnect negative battery cable.
(2) Remove fuel rail (Refer to 14 - FUEL SYSTEM/ FUEL INJECTION/FUEL INJECTOR - REMOVAL).
(3) Clamp fuel rail securely in vise with protective jaws.

NOTE: Once removed, the pressure solenoid must always be replaced.

(4) Remove fuel pressure solenoid retaining screws and remove solenoid (Fig. 16).

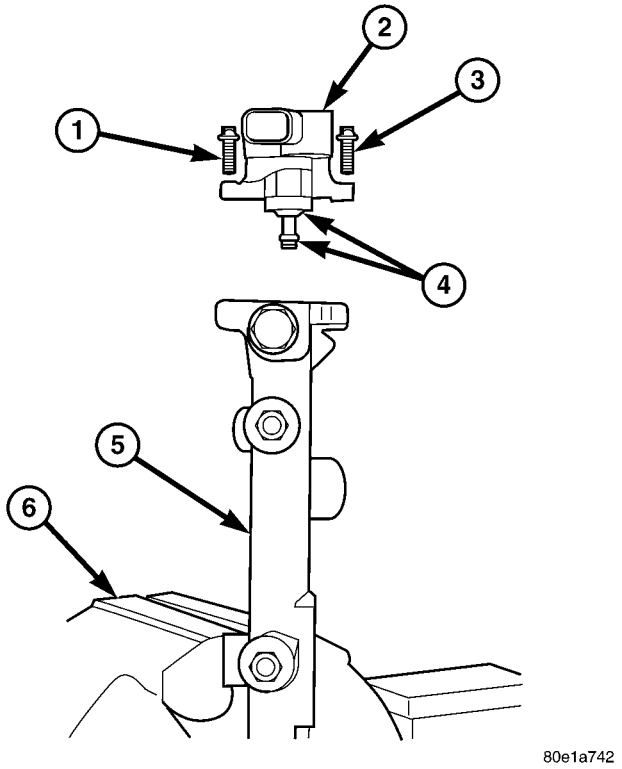


Fig. 16 FUEL PRESSURE SOLENOID ASSEMBLY

1 - RETAINING BOLT
2 - FUEL PRESSURE SOLENOID
3 - RETAINING BOLT
4 - O-RING LOCATION
5 - FUEL RAIL
6 - VISE

INSTALLATION

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 1600BAR (23,200 PSI). USE EXTREME CAUTION WHEN INSPECTING FOR HIGH-PRESSURE FUEL LEAKS. FUEL UNDER THIS AMOUNT OF PRESSURE CAN PENETRATE SKIN CAUSING PERSONAL INJURY OR DEATH. INSPECT FOR HIGH-PRESSURE LEAKS WITH A SHEET OF CARD BOARD. WEAR SAFETY GOGGLES AND ADEQUATE PROTECTIVE CLOTHING WHEN SERVICING FUEL SYSTEM.

WARNING: NO SPARKS, OPEN FLAMES OR SMOKING. RISK OF POISONING FROM INHALING AND SWALLOWING FUEL. RISK OF INJURY TO EYES AND SKIN FROM CONTACT WITH FUEL. POUR FUELS ONLY INTO SUITABLE AND APPROPRIATELY MARKED CONTAINERS. WEAR PROTECTIVE CLOTHING.

NOTE: Apply a thin film of special grease to the seals before installing. If the seals are damaged when being installed, an internal leak may occur which can not be recognized externally.

(1) Position fuel pressure solenoid to fuel rail and retain with screws (Fig. 16). Tighten in two stages, 3N·m (26 lbs. in.) then 5N·m (44 lbs. ft.).
(2) Install fuel rail (Refer to 14 - FUEL SYSTEM/ FUEL INJECTION/FUEL INJECTOR - INSTALLATION).
(3) Connect negative battery cable.

FUEL PRESSURE SOLENOID (Continued)

WARNING: USE EXTREME CAUTION WHEN ENGINE IS OPERATING. DO NOT PUT YOUR HANDS NEAR PULLEYS, BELTS, OR FAN. DO NOT WEAR LOOSE CLOTHES.

(4) Start engine and inspect for leaks (Refer to 14 - FUEL SYSTEM - DIAGNOSIS AND TESTING).

FUEL TEMPERATURE SENSOR

DESCRIPTION

The fuel temperature sensor is located in the fuel return line directly down stream of the fuel rail pressure control valve. The sensor measures the temperature of the fuel in the return pipe between the rail and the pre-heating valve. The sensor ranges from -40°F (- 40C) to 284°F (140°C). If the engine is cold, the actual value sent will read ambient temperature. The value rises after the engine has been started.

OPERATION

An negative temperature coefficient (NTC) resistor integrated in the fuel temperature sensor alters it's electrical resistance in line with the fuel temperature (the resistance drops as the temperature rises). If fuel temperature has reached 248°F and engine speed is above 2000 rpm, a pumping element of the high pressure fuel injection pump is switched off and engine output is reduced.

REMOVAL

(1) Disconnect the negative battery cable.

(2) Disconnect the sensor wiring harness connector (Refer to 14 - FUEL SYSTEM/FUEL INJECTION - WARNING).

(3) Remove the fuel temperature sensor from the fuel rail (Fig. 17).

INSTALLATION

(1) Clean sealing surfaces.

(2) Install new seal on sensor (Fig. 17).

(3) Screw the sensor into the fuel rail and tighten to 18 lbs.ft. (25 N·m)(Refer to 14 - FUEL SYSTEM/ FUEL INJECTION - WARNING) . (Fig. 17)

(4) Connect negative battery cable.

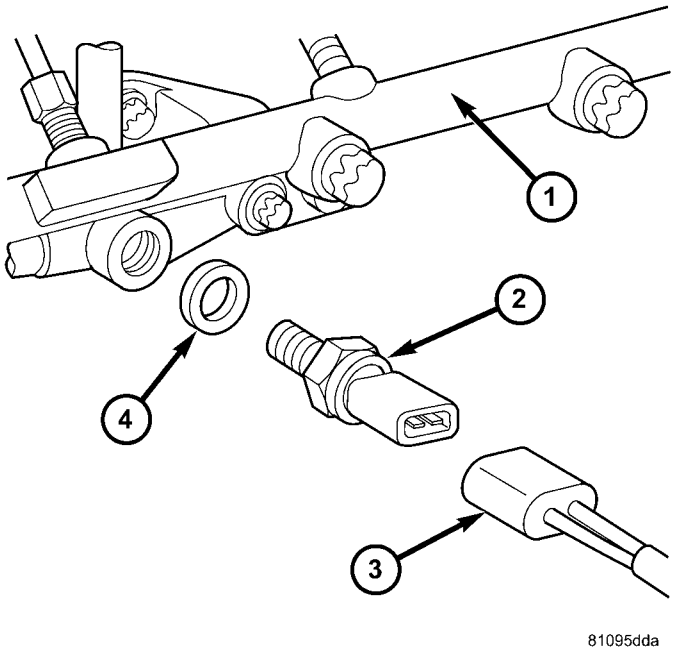


Fig. 17 FUEL TEMPERATURE SENSOR

1 - FUEL RAIL
2 - FUEL TEMPERATURE SENSOR
3 - HARNESS CONNECTOR
4 - SEAL

INLET AIR TEMPERATURE SENSOR

DESCRIPTION

The inlet air temperature sensor is located between the charge air pipe and the charge air distribution of the cylinders. The inlet air temperature sensor measures the temperature of the air as it is supplied to the cylinders and transmits the value to the ECM. This is required in order to determine the density of the air being supplied for the combustion process. The value range is from minus 40°F up to 302°F (minus 40°C to 150°C).

OPERATION

The Negative Temperature Coefficient (NTC) resister located within the inlet air temperature sensor alters it's resistance in line with the charge air temperature. If the engine is cold, the value equals ambient temperature. For a temperature of 68°F (20°C) the resistance is approximately 6000 ohms. For a temperature of 104°F (40°C) the resistance is approximately 2600 ohms (Fig. 18).

INLET AIR TEMPERATURE SENSOR (Continued)

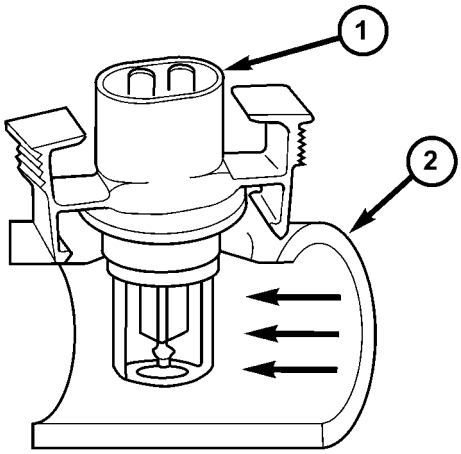


Fig. 18 INLET AIR TEMPERATURE SENSOR

1 - INLET AIR TEMPERATURE SENSOR
2 - PIPE

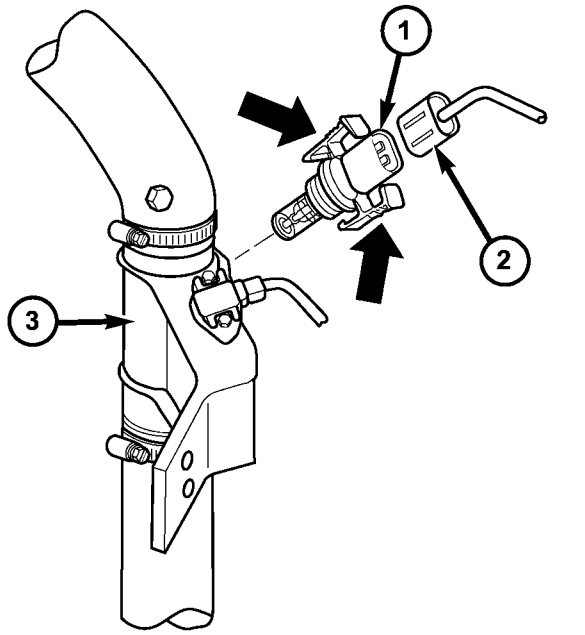


Fig. 19 INLET AIR TEMPERATURE

1 - INLET AIR TEMPERATURE SENSOR
2 - HARNESS CONNECTOR
3 - CHARGE AIR PIPE

REMOVAL

(1) Disconnect the negative battery cable.

(2) Unplug the wiring harness connector at the inlet air temperature sensor.

(3) Press together the sensor locking arms and remove the sensor from the charge air pipe (Fig. 19).

INSTALLATION

(1) Position the inlet air temperature sensor above the charge air pipe access hole.

(2) Press together the sensor locking tabs, seat the sensor to the pipe and release tabs (Fig. 19).

(3) Connect negative battery cable.

MANIFOLD AIR FLOW (MAF) SENSOR

DESCRIPTION

The Mass Air Flow (MAF) Sensor is located in the air intake port between the air filter and the turbocharger (Fig. 20). The MAF sensor uses semiconductor technology throughout, and is used to calculate the air mass flowing past it per time unit. This mass is important for determining the exhaust gas recirculation rate. The MAF sensor sends a corresponding signal to the ECM, which evaluates the signal to adjust the exhaust gas recirculation valve.

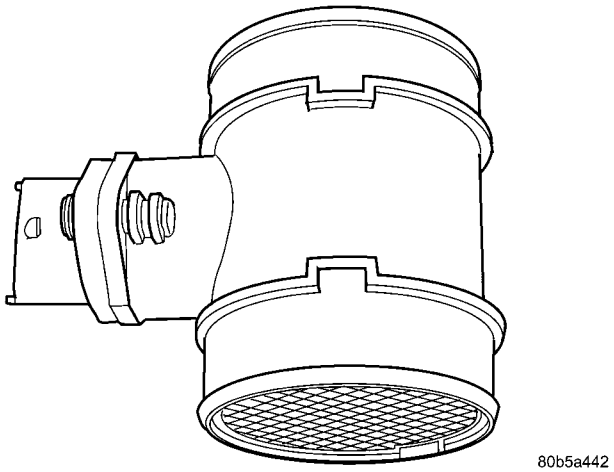


Fig. 20 MASS AIR FLOW (MAF) SENSOR

OPERATION

The ECM uses the mass air flow (MAF) sensor to measure air density. The temperature resistor located at the front of the MAF sensor measures the temperature of the inlet air. By varying the voltage, the electronic circuit regulates the temperature of the heating resistor in the rear so that it is 320° F (160°C) higher than the temperature of the intake air. The temperature at the heating resistor is measured by a sensor resistor in-between.

MANIFOLD AIR FLOW (MAF) SENSOR (Continued)

Because the incoming air has a cooling effect, the greater the amount of air that flows in, then the higher the voltage of the heating resistor. The heating resistor is therefore a measure of mass of air flowing past. If a temperature change occurs as a result of a increase or reduction of air flow, the ECM corrects the voltage at the heating resistor until the temperature difference is again achieved. This control voltage is use by the ECM as a unit measure for metered air mass.

REMOVAL

(1) Disconnect the negative battery cable.
(2) Detach the air hose at the Manifold Air Flow (MAF) sensor
(3) Unplug the MAF wiring harness connector.
(4) Remove the screws retaining the MAF sensor to the air cleaner housing, and remove MAF sensor.

INSTALLATION

(1) Position the MAF sensor to air cleaner housing and install the retaining screws (Fig. 21).
(2) Connect the air intake hose to the MAF sensor and tighten clamp.
(3) connect the MAF wiring harness connector.
(4) Connect negative battery cable.

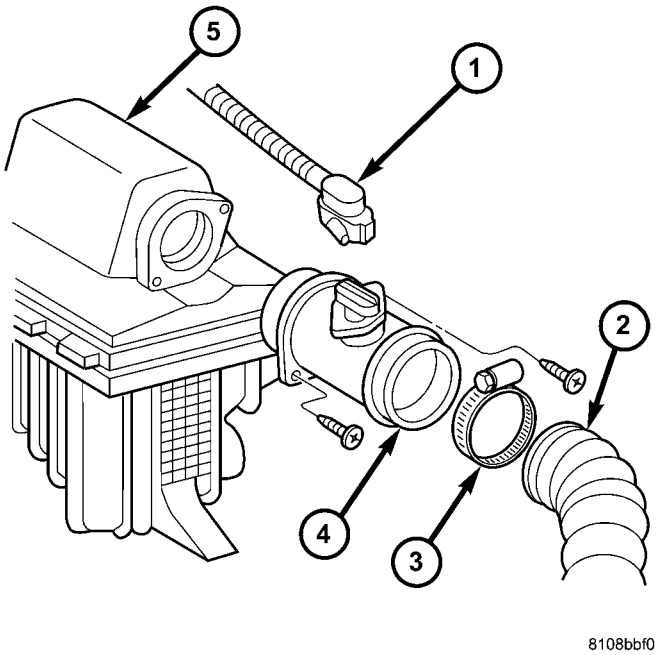


Fig. 21 MANIFOLD AIR FLOW SENSOR

1 - WIRING HARNESS
2 - AIR INTAKE HOSE
3 - CLAMP
4 - MAF SENSOR
5 - AIR CLEANER HOUSING

STEERING

TABLE OF CONTENTS

	page
STEERING	
DESCRIPTION	1
OPERATION	1
DIAGNOSIS AND TESTING - POWER STEERING SYSTEM	2
COLUMN	5
GEAR	8
LINKAGE	10
PUMP	12

STEERING

DESCRIPTION

CAUTION: Mopar ATF+4 Automatic Transmission fluid or equivalent is to be used in the power steering system. No other power steering or automatic transmission fluid is to be used in the system. Damage may result to the power steering pump and system if any other fluid is used, and do not overfill.

Power steering systems consist of:
- Steering column
- Rack and pinion steering gear
- Belt driven hydraulic steering pump
- Pump pressure and return hoses
- Oil Cooler

OPERATION

The steering column shaft is attached to the gear pinion. The rotation of the pinion moves the gear rack from side-to-side. This lateral action of the rack pushes and pulls the tie rods to change the direction of the front wheels (Fig. 1).

Power assist is provided by an engine mounted hydraulic pump which supplies hydraulic fluid pressure to the steering gear.

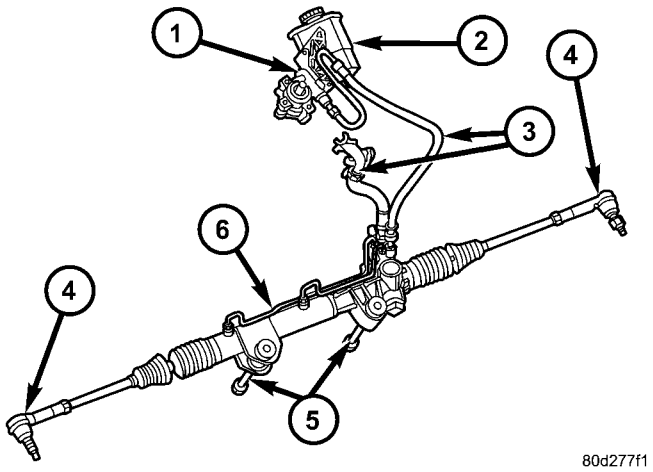


Fig. 1 STEERING COMPONENTS

1 - POWER STEERING PUMP ASSEMBLY
2 - RESERVOIR
3 - HOSES
4 - TIE ROD ENDS
5 - MOUNTING BOLTS
6 - RACK & PINION

STEERING (Continued)

DIAGNOSIS AND TESTING - POWER STEERING SYSTEM

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.

STEERING NOISE

CONDITION	POSSIBLE CAUSES	CORRECTION
OBJECTIONAL HISS OR WHISTLE	1. Steering intermediate shaft to dash panel seal.	1. Check and repair seal at dash panel.
	2. Noisy valve in power steering gear.	2. Replace steering gear.
RATTLE OR CLUNK	1. Gear mounting bolts loose.	1. Tighten bolts to specification.
	2. Loose or damaged suspension components.	2. Inspect and repair suspension.
	3. Internal gear noise.	3. Replace steering gear.
	4. Pressure hose in contact with other components.	4. Reposition hose.
	5. Loose or damaged intermediate shaft or column.	5. Inspect and repair or replace.
CHIRP OR SQUEAL	1. Loose belt.	1. Adjust or replace.
WHINE OR GROWL	1. Low fluid level.	1. Fill to proper level.
	2. Pressure hose in contact with other components.	2. Reposition hose.
	3. Internal pump noise.	3. Replace pump.
	4. Air in fluid	4. Check for lekas, Evacuate air from P/S system.
SUCKING AIR SOUND	1. Loose return line clamp.	1. Replace clamp.
	2. O-ring missing or damaged on hose fitting.	2. Replace o-ring.
	3. Low fluid level.	3. Fill to proper level.
	4. Air leak between pump and reservoir.	4. Repair as necessary.
	5. Reservoir cap not installed correctly.	5. Install reservoir cap correctly.
SCRUBBING OR KNOCKING	1. Wrong tire size.	1. Verify tire size.

STEERING (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 components (ball joints/tie rod ends).	3 Inspect and repair as necessary.
	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.	7. Replace gear.
	8. Pump seized / Stuck valve	8. Replace pump.

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. Low pump pressure.	4. Pressure test and repair as necessary.
	5. Internal gear leak.	5. Replace gear.
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 suspension compnents.
	4. High friction in steering gear.	4. Replace gear.

STEERING (Continued)

LOOSE STEERING AND VEHICLE LEAD

CONDITION	POSSIBLE CAUSE	CORRECTION
EXCESSIVE PLAY IN STEERING WHEEL	1. Worn or loose suspension or steering components.	1. Inspect and repair as necessary.
	2. Worn or loose wheel bearings.	2. Inspect and repair or adjust bearings.
	3. Steering gear mounting.	3. Tighten gear mounting bolts to specification.
	4. Gear out of adjustment.	4. Replace gear.
	5. Worn or loose steering coupler.	5. Inspect and replace as necessary.
VEHICLE PULLS OR LEADS TO ONE SIDE.	1. Tire Pressure.	1. Adjust tire pressure.
	2. Radial tire lead.	2. Rotate tires.
	3. Brakes dragging.	3. Repair as necessary.
	4. Wheel alignment.	4. Align front end.

COLUMN

TABLE OF CONTENTS

page

COLUMN
SPECIFICATIONS - TORQUE CHART 5
INTERMEDIATE SHAFT
REMOVAL 5
INSTALLATION 5
KEY/LOCK CYLINDER
REMOVAL 6
INSTALLATION 7
STEERING WHEEL
REMOVAL 7
INSTALLATION 7

COLUMN

SPECIFICATIONS - TORQUE CHART

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Steering Wheel With Airbag To Steering Shaft	80	59	—
Jacket Tube For Steering Shaft To Waist Rail	25	18	221
U-Joint To Steering Gear Shaft	24	18	212

INTERMEDIATE SHAFT

REMOVAL

(1) Disconnect the ground cable from the battery.
(2) Remove the air bag module from the steering wheel.
(3) Turn the steering wheel and lock the steering wheel in the straight ahead position. **The position of the steering gear must not be altered again for the entire duration of the work procedure.**
(4) Remove the electrical center.
(5) Remove the steering wheel bolt.
(6) Remove the steering wheel from the steering column.
(7) Remove the clockspring. **Unscrew the retaining bolts just enough to be able to remove the clockspring. Do not twist or disassemble the clockspring.**
(8) Remove the combination switch.
(9) Disconnect the electrical connector for the ignition lock.
(10) Remove the spring for the brake pedal from the steering column.
(11) Remove the fitted bolt from the universal joint (Fig. 1).
(12) Remove the bolts in the steering column bracket (Fig. 2).
(13) Remove the steering shaft with the universal joint off the steering gear drive shaft (Fig. 1).
(14) Pull the steering shaft out of the rubber grommet in the cab floor.

INSTALLATION

(1) Install the steering shaft through the rubber grommet in the cab floor. **Ensure that the rubber grommet is properly seated.**
(2) Install the steering shaft with the universal joint onto the steering gear shaft (Fig. 1).
(3) Install the bolts in the steering column bracket (Fig. 2). Tighten to 24 N·m (18 ft. lbs.).
(4) Install the universal joint on the steering gear shaft (Fig. 1). Tighten to 24 N·m (18 ft. lbs.).

INTERMEDIATE SHAFT (Continued)

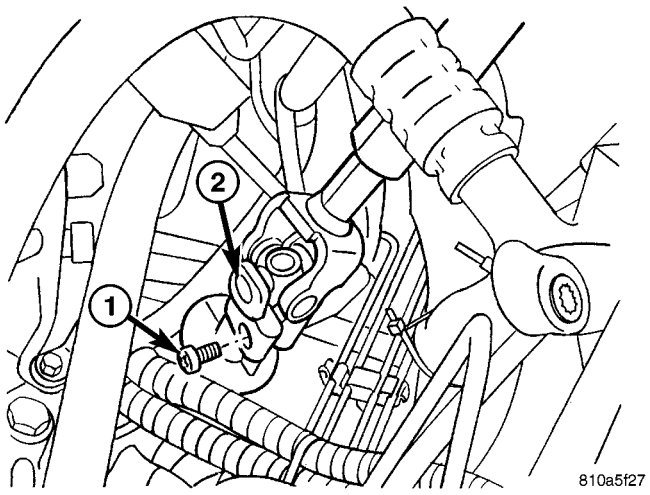


Fig. 1 U-JOINT REMOVE / INSTALL

1 - FITTED BOLT
2 - U-JOINT

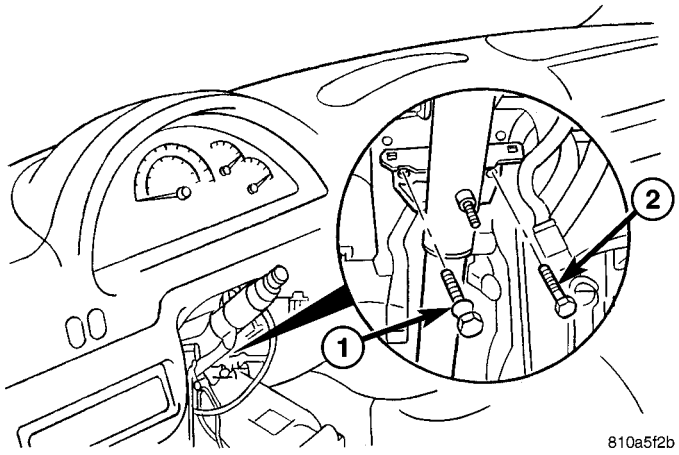


Fig. 2 STEERING COLUMN BOLTS

1 - BOLT
2 - COLUMN BOLT

(5) Install the spring for the brake pedal to the steering column.
(6) Reconnect the electrical connector to the ignition lock.
(7) Install the combination switch.
(8) Install the clockspring.
(9) Install the steering wheel.
(10) Install the electrical center.
(11) Reconnect the ground cable to the battery.

KEY/LOCK CYLINDER

REMOVAL

(1) Remove the securing cover for the central electronics.
(2) Remove the steering column shroud.
(3) Remove the transponder coil off the ignition lock (Fig. 3).

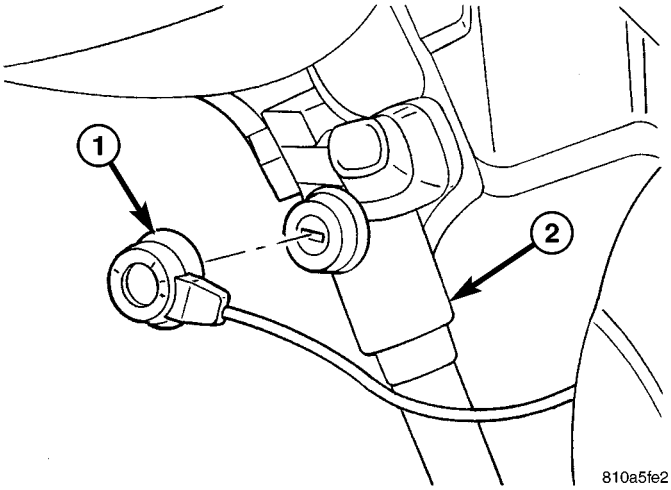


Fig. 3 TRANSPONDER

1 - TRANSPONDER
2 - STEERING COLUMN

(4) Insert the key into the ignition lock.
(5) Turn the ignition key to the first detent (Fig. 4).

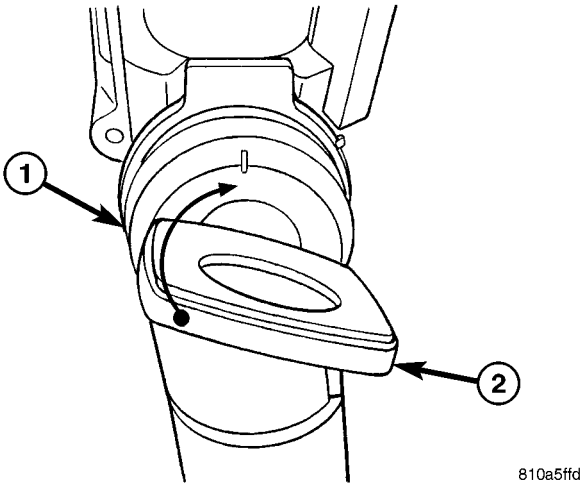


Fig. 4 IGNITION LOCK FIRST DETENT

1 - LOCK HOUSING
2 - FIRST DETENT WITH KEY INSTALLED

KEY/LOCK CYLINDER (Continued)

(6) Turn the cap a 1/4 turn to the left (Fig. 5).

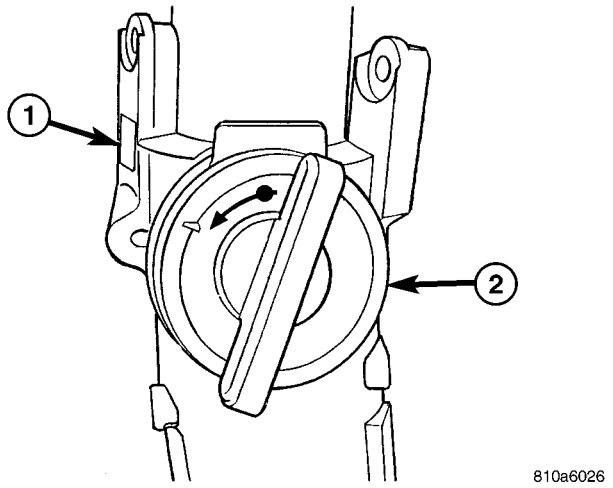


Fig. 5 1/4 TURN LEFT

1 - STEERING COLUMN
2 - 1/4 TURN TO THE LEFT

(7) Remove cap together with the lock cylinder off the ignition lock (Fig. 6).

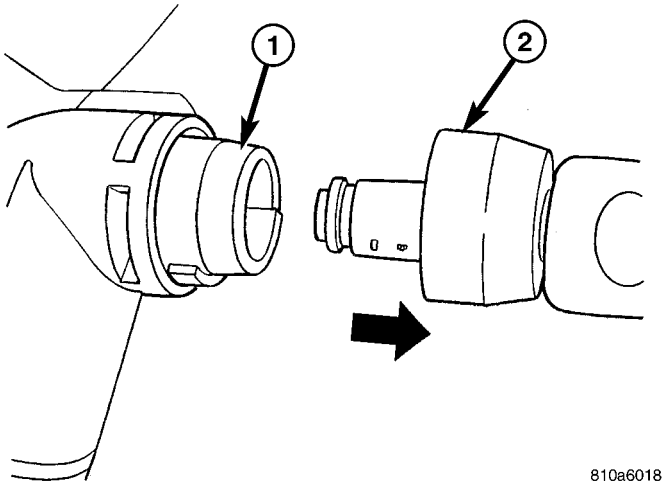


Fig. 6 LOCK CYLINDER OFF THE IGNITION LOCK

1 - LOCK HOUSING
2 - LOCK CYLINDER

INSTALLATION

(1) Install the cap together with the lock cylinder onto the ignition lock (Fig. 6).

(2) Turn the cap a 1/4 turn to the right.

(3) Turn the ignition key to the first detent (Fig. 4).

(4) Remove the ignition key from the ignition lock.

(5) Install the transponder coil onto the ignition lock (Fig. 3).

(6) Install the steering column shroud. **Pay attention to the cables routed under the steering column cover. Do not trap the cables.**

(7) Install the cover for the central electronics.

STEERING WHEEL

REMOVAL

(1) Disconnect the ground cable on the battery.

(2) Remove the air bag module from the steering wheel.

(3) Turn the steering wheel and lock the steering wheel in the straight ahead position (Fig. 7).

(4) Remove the steering wheel bolt (Fig. 7).

(5) Remove the steering wheel from the steering column (Fig. 7).

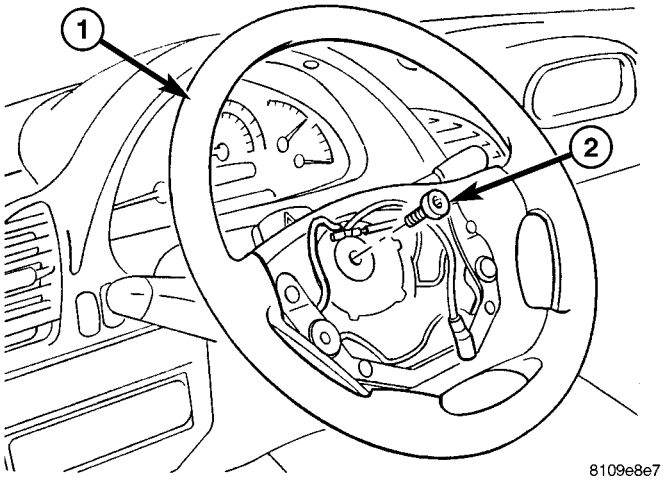


Fig. 7 STEERING WHEEL

1 - STEERING WHEEL
2 - STEERING WHEEL BOLT

INSTALLATION

(1) Install the steering wheel onto the column (Fig. 7).

(2) Install the steering wheel bolt (Fig. 7). Tighten to 80 N·m (59 ft. lbs.).

(3) Install the air bag module.

(4) Reconnect the battery ground cable.

(5) Reset all the times and encode the radio.

(6) Perform a road test to check the position of the steering wheel.

GEAR

TABLE OF CONTENTS

	page
GEAR	
DESCRIPTION	8
REMOVAL	8
INSTALLATION	8
SPECIFICATIONS - TORQUE CHART	9

GEAR

DESCRIPTION

A rack and pinion steering gears (Fig. 1) is made up of two main components, the pinon shaft and the rack. The gear cannot be adjusted or internally serviced. If a malfunction or a fluid leak occurs, the gear must be replaced as an assembly.

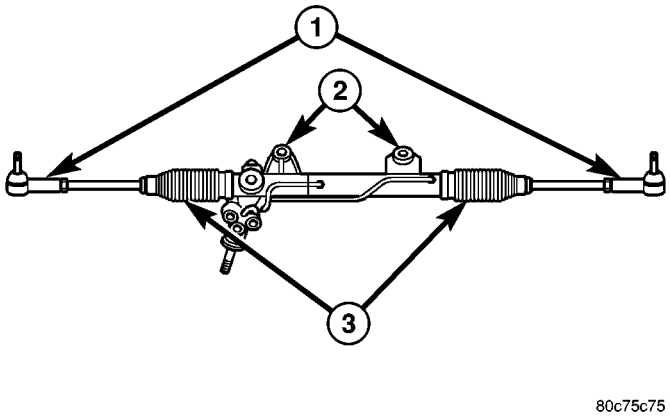


Fig. 1 STEERING GEAR

1 - OUTER TIE ROD ENDS
2 - MOUNTING BUSHINGS
3 - BELLOWS

REMOVAL

(1) Siphon the power steering fluid out of the reservoir.

(2) Raise and support the vehicle.

(3) Remove the front wheels.

(4) Remove the stabilizer bar from the upper part of the stabilizer link (Refer to 2 - SUSPENSION/FRONT/STABILIZER LINK - REMOVAL).

(5) Remove the outer tie rod end nuts and separate the tie rods from the steering knuckles (Fig. 2) using special tool C-3894–A.

(6) Remove the left outer tie rod end from the steering gear.

(7) Remove both spring clamp plates (Refer to 2 - SUSPENSION/FRONT/SPRING CLAMP PLATES - REMOVAL).

(8) Remove both the high pressure and return hoses from the steering gear (Refer to 19 - STEERING/PUMP/HOSES - REMOVAL) (Fig. 2).

(9) Remove the steering shaft clamping bolt from the steering gear (Fig. 2).

(10) Separate the universal joint from the steering gear (Fig. 2).

(11) Remove the steering gear bolts from the front axle.

(12) Remove the steering gear by sliding it toward the passengers side of the vehicle and then tilt downward on the drivers side and remove from vehicle.

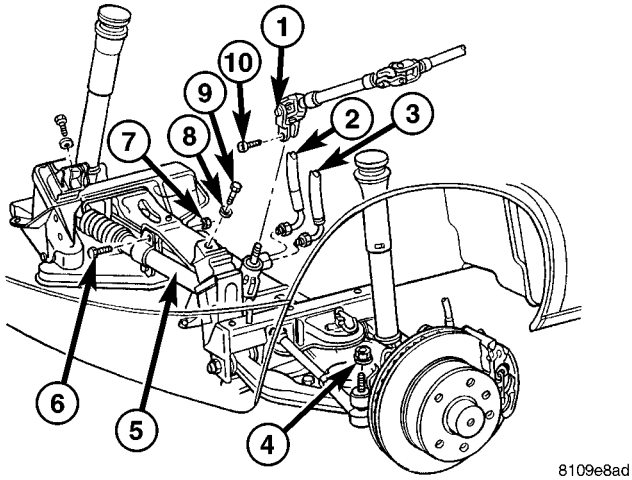


Fig. 2 STEERING GEAR REMOVAL / INSTALL

1 - U-JOINT
2 - HIGH PRESSURE POWER STEERING HOSE
3 - RETURN HOSE
4 - OUTER TIE ROD END RETAINING NUT
5 - STEERING GEAR
6 - STEERING GEAR RETAINING BOLT
7 - STEERING GEAR NUT
8 - WASHER
9 - ENGINE MOUNT BOLT
10 - U-JOINT CLAMPING BOLT

INSTALLATION

(1) Install the gear to the vehicle.

GEAR (Continued)

NOTE: Steering gear must be torqued in a three step procedure below.

(2) Install the steering gear bolts (Fig. 2). Tighten to an initial torque of 25 N·m (18 ft. lbs.) Then torque to 45 N·m (33 ft. lbs.) and a final additional 90° turn for final torque.

(3) Install the universal joint to the steering gear (Fig. 2). Tighten to 24 N·m (18 ft. lbs.).

(4) Install both the power steering hoses to the steering gear (Fig. 2). Tighten the high pressure hose to 37 N·m (27 ft. lbs.).

(5) Install the spring clamp plates (Refer to 2 - SUSPENSION/FRONT/SPRING CLAMP PLATES - INSTALLATION).

(6) Install the left outer tie rod end to the steering gear.

(7) Install both the outer tie rod ends to the steering knuckle (Fig. 2). Tighten to 130 N·m (96 ft. lbs.).

(8) Install the upper stabilizer bar link to the stabilizer bar.

(9) Install the front wheels.

(10) Fill and bleed the power steering system (Refer to 19 - STEERING/PUMP/FLUID - STANDARD PROCEDURE).

(11) Reset toe adjustment.

(12) Check steering system for leaks.

SPECIFICATIONS - TORQUE CHART

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
U-Joint To Steering Gear	24	18	212
High Pressure Hose To Steering Gear	37	27	328
Return Line To Steering Gear	37	27	328
Steering Gear To Frame Initial Torque	25	18	221
Steering Gear To Frame Second Torque Then additional 90° turn	45	33	398

LINKAGE

TABLE OF CONTENTS

page

LINKAGE
DIAGNOSIS AND TESTING - OUTER TIE ROD END 10
SPECIFICATIONS - TORQUE CHART 10
SPECIAL TOOLS
FRONT SUSPENSION 11

TIE ROD END
REMOVAL 11
INSTALLATION 11

LINKAGE

DIAGNOSIS AND TESTING - OUTER TIE ROD END

NOTE: If the outer tie rod end is equipped with a lubrication fitting, grease the joint then road test the vehicle before performing test.

(1) Raise the front of the vehicle. Place safety floor stands under both lower control arms as far outboard as possible. Lower the vehicle to allow the stands to support some or all of the vehicle weight.
(2) Remove the front tires.
(3) Mount a dial indicator solidly to the vehicle steering knuckle and then zero the dial indicator.
(4) Position indicator plunger on the topside of the outer tie rod end.

NOTE: The dial indicator plunger must be perpendicular to the machined surface of the outer tie rod end.

(5) Position a pry bar in order to pry downwards on the outer tie rod end.
(6) If the travel exceeds 0.5 mm (0.020 in.), replace the outer tie rod end (Refer to 19 - STEERING/LINKAGE/TIE ROD END - REMOVAL).
(7) If the outer tie rod end is within specs reinstall the front tires (Refer to 22 - TIRES/WHEELS/WHEELS - STANDARD PROCEDURE).

SPECIFICATIONS - TORQUE CHART

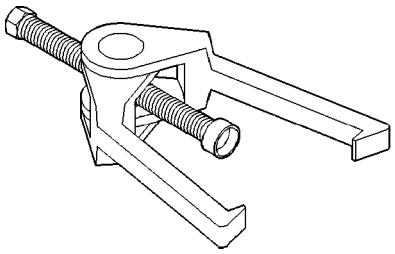
TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Outer Tie Rod End Nut	130	96	—
Outer Tie Rod End Locking Nut	50	37	—
Steering Gear Boot Clamp	7	—	62

LINKAGE (Continued)

SPECIAL TOOLS

FRONT SUSPENSION



Puller Tie Rod C-3894-A

TIE ROD END

REMOVAL

(1) Raise and support the vehicle.
(2) Remove the front wheels.
(3) Loosen the lock nut (Fig. 1).
(4) Remove the tie rod end retaining nut (Fig. 1).
(5) Separate the tie rod end from the steering knuckle (Fig. 1) using special tool C-3894–A.
(6) Remove the outer tie rod end from the inner tie rod end by unscrewing (Fig. 1).

INSTALLATION

(1) Install the outer tie rod end by screwing it onto thew inner tie rod end (Fig. 1).
(2) Install the outer tie rod end into the steering knuckle (Fig. 1).

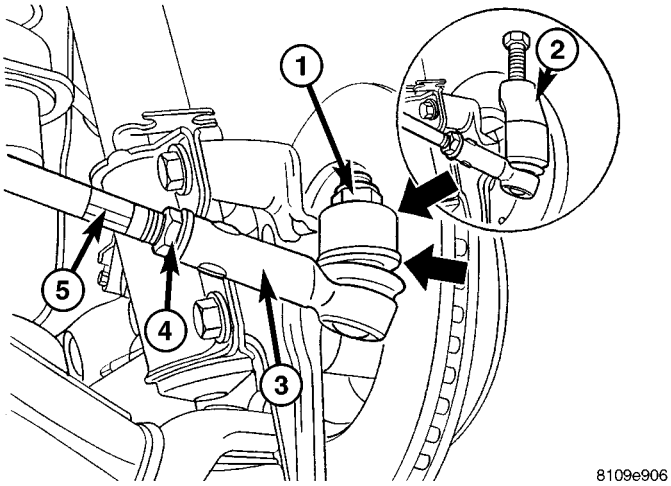


Fig. 1 OUTER TIE ROD END

1 - OUTER TIE ROD END RETAINING NUT
2 - TIE ROD SEPERATOR TOOL
3 - OUTER TIE ROD END
4 - LOCKING NUT
5 - INNER TIE ROD END

(3) Tighten the outer tie rod end nut (Fig. 1). Tighten to 130 N·m (96 ft. lbs.).
(4) Install the front wheels.
(5) Lower the vehicle.
(6) Perform toe adjustment.
(7) Tighten the lock nut after toe adjustment (Fig. 1). Tighten to 50 N·m (37 ft. lbs.).

PUMP

TABLE OF CONTENTS

page

PUMP
- DESCRIPTION 12
- OPERATION 12
- DIAGNOSIS AND TESTING - PUMP LEAKAGE . 12
- STANDARD PROCEDURE
  - STANDARD PROCEDURE - POWER STEERING PUMP - INITIAL OPERATION 12
  - STANDARD PROCEDURE - FLUSHING POWER STEERING SYSTEM 13
- REMOVAL 13
- INSTALLATION 13
- SPECIFICATIONS - TORQUE CHART 14

FLUID
- STANDARD PROCEDURE
  - POWER STEERING PUMP FILL AND BLEED PROCEDURE 14

page

FLUID COOLER TUBE
- REMOVAL 14
- INSTALLATION 14

HOSES
- REMOVAL
  - REMOVAL - PRESSURE HOSE 15
  - REMOVAL - RETURN LINE FROM PUMP TO COOLER TUBE 15
  - REMOVAL - RETURN HOSE FROM GEAR TO COOLER TUBE 15
- INSTALLATION
  - INSTALLATION - PRESSURE HOSE 15
  - INSTALLATION - RETURN LINE FROM PUMP TO COOLER TUBE 15
  - INSTALLATION - RETURN HOSE FROM GEAR TO COOLER TUBE 15

PUMP

DESCRIPTION

CAUTION: Mopar ATF+4 Automatic Transmission fluid or equivalent is to be used in the power steering system. No other power steering or automatic transmission fluid is to be used in the system. Damage may result to the power steering pump and system if any other fluid is used, and do not overfill.

The pump is connected to the steering gear via the pressure hose and the return hose. The pump shaft has a pressed-on pulley that is belt driven by the crankshaft pulley.

All vehicles are equipped with a power steering fluid cooler.

NOTE: Power steering pumps are not interchangeable with pumps installed on other vehicles.

OPERATION

Hydraulic pressure is provided for the power steering gear by the belt driven power steering pump. The power steering pumps are constant flow rate and displacement, vane-type pumps.

DIAGNOSIS AND TESTING - PUMP LEAKAGE

The pump is serviced as an assembly and should not be disassembled. The plastic pump reservoir and the reservoir o-rings can be replaced.

Check for leaks in the following areas:

- Pump shaft seal behind the pulley
- Pump to reservoir O-ring
- Reservoir cap
- Pressure and return lines
- Flow control valve fitting

STANDARD PROCEDURE

STANDARD PROCEDURE - POWER STEERING PUMP - INITIAL OPERATION

WARNING: THE FLUID LEVEL SHOULD BE CHECKED WITH ENGINE OFF TO PREVENT INJURY FROM MOVING COMPONENTS.

CAUTION: Mopar ATF+4 Automatic Transmission fluid or equivalent is to be used in the power steering system. No other power steering or automatic transmission fluid is to be used in the system. Damage may result to the power steering pump and system if any other fluid is used, and do not overfill.

PUMP (Continued)

Wipe filler cap clean, then check the fluid level. The dipstick should indicate **COLD** when the fluid is at normal temperature.

(1) Turn steering wheel all the way to the left

(2) Fill the pump fluid reservoir to the proper level and let the fluid settle for at least two (2) minutes.

(3) Raise the front wheels off the ground.

(4) Slowly turn the steering wheel lock-to-lock 20 times with the engine off while checking the fluid level.

NOTE: For vehicles with long return lines or oil coolers turn wheel 40 times.

(5) Start the engine. With the engine idling maintain the fluid level.

(6) Lower the front wheels and let the engine idle for two minutes.

(7) Turn the steering wheel in both direction and verify power assist and quiet operation of the pump.

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.

STANDARD PROCEDURE - FLUSHING POWER STEERING SYSTEM

Flushing is required when the power steering/hydraulic booster system fluid has become contaminated. Contaminated fluid in the steering/booster system can cause seal deterioration and affect steering gear/booster spool valve operation.

(1) Raise the front end of the vehicle off the ground until the wheels are free to turn.

(2) Remove the return line from the pump.

NOTE: If vehicle is equipped with a hydraulic booster remove both return lines from the pump.

(3) Plug the return line port/ports at the pump.

(4) Position the return line/lines into a large container to catch the fluid.

(5) While an assistant is filling the pump reservoir start the engine.

(6) With the engine running at idle turn the wheel back and forth.

NOTE: Do not contact or hold the wheel against the steering stops.

(7) Run a quart of fluid through the system then stop the engine and install the return line/lines.

(8) Fill the system with fluid and perform Steering Pump Initial Operation, (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

(9) Start the engine and run it for fifteen minutes then stop the engine.

(10) Remove the return line/lines from the pump and plug the pump port/ports.

(11) Pour fresh fluid into the reservoir and check the draining fluid for contamination. If the fluid is still contaminated, then flush the system again.

(12) Install the return line/lines and perform Steering Pump Initial Operation, (Refer to 19 - STEERING/PUMP - STANDARD PROCEDURE).

REMOVAL

(1) Remove the belt from the power steering pump.

(2) Siphon as much power steering fluid as possible out of the reservoir.

(3) Remove the high pressure power steering hose at the pump (Fig. 1).

(4) Remove the return hose from the pump (Fig. 1).

(5) Remove the bolts securing the power steering pump to the engine (Fig. 1).

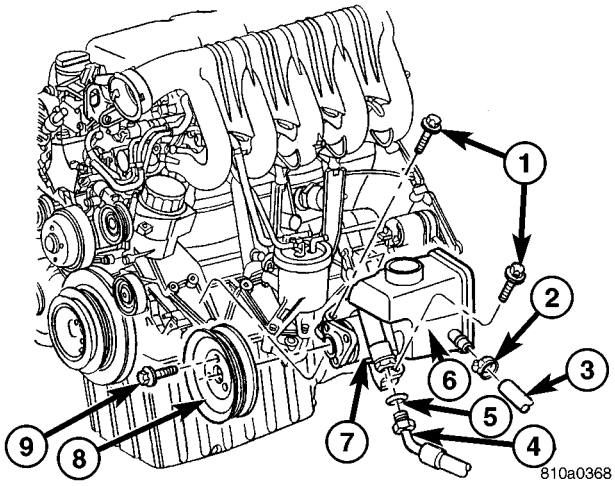


Fig. 1 POWER STEERING PUMP

1 - PUMP MOUNTING BOLT
2 - CLAMP
3 - RETURN HOSE
4 - HIGH PRESSURE HOSE
5 - O-RING
6 - PUMP RESERVOIR
7 - PUMP
8 - PULLEY
9 - PULLEY BOLT

INSTALLATION

(1) Install the power steering pump to the engine and tighten the bolts (Fig. 1). Tighten to 21 N·m (15 ft. lbs.).

(2) Replace all o-rings and hose clamps (Fig. 1).

(3) Install the return hose to the pump and tighten the clamp (Fig. 1).

(4) Install the high pressure hose to the pump (Fig. 1). Tighten to 38 N·m (28 ft. lbs.).

(5) Fill the power steering fluid (Refer to 19 - STEERING/PUMP/FLUID - STANDARD PROCEDURE).

PUMP (Continued)

SPECIFICATIONS - TORQUE CHART

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Power Steering Pump To Timing Case Cover/ Support	21	15	185
High Pressure Flexible Hose To Power Steering Pump	38	28	336
Power Steering Pulley To Pump	30	22	265

FLUID

STANDARD PROCEDURE

POWER STEERING PUMP FILL AND BLEED PROCEDURE

(1) Remove the cap from the fluid reservoir. **Check cap seal for damage and replace if needed.**

(2) Fill the power steering pump with Mopar ATF+4 Automatic Transmission fluid or equivalent. **Do not fill fluid beyond the MAX mark.**

(3) Raise the vehicles front wheels off the ground.

(4) With the engine off turn the steering wheel from right to left. **Perform this step until all the bubble formations can no longer be seen in the power steering reservoir.**

(5) Start the engine and turn the steering wheel with the engine at idle speed then shut the engine off and check for correct oil level and no bubble in the system.

(6) Reinstall power steering cap tightly.

(7) Test the system for leaks and proper operation.

FLUID COOLER TUBE

REMOVAL

(1) Siphon as much power steering fluid as possible out of the reservoir.

(2) Remove the grille (Refer to 23 - BODY/EXTERIOR/GRILLE - REMOVAL).

(3) Remove the left headlight assembly.

(4) Disconnect the return lines from the cooler tube.

(5) Remove the radiator clips (2).

(6) Remove the heat shield bolt for the turbo at the core support.

(7) Remove the right headlight assembly.

(8) Remove the core support bolts (4) and disconnect the hood latch cable.

(9) Remove the fan bracket bolts (4) to the radiator (Fig. 2).

(10) Remove the two upper screws for the condenser (Fig. 2).

(11) Remove the condenser air dam shield.

(12) Remove the mounting screws for the cooler tube (Fig. 2).

(13) Remove the cooler tube from the vehicle.

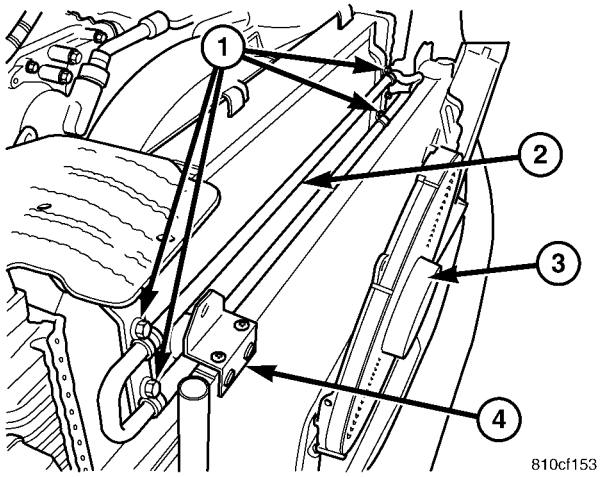


Fig. 2 FLUID COOLER TUBE

1 - MOUNTING SCREWS (4)
2 - FLUID COOLER
3 - ELECTRIC COOLING FAN
4 - A/C CONDENSOR

INSTALLATION

(1) Install the cooler tube to the vehicle.

(2) Install the cooler tube mounting screws (Fig. 2).

(3) Install the condenser air dam shield.

(4) Install the condenser upper mounting screws (Fig. 2).

FLUID COOLER TUBE (Continued)

(5) Install the fan bracket bolts to the radiator (Fig. 2).
(6) Install the core support bolts and reconnect the hood latch cable.
(7) Install the right headlight assembly.
(8) Install the bolt for the turbo shield at the core support.
(9) Install the radiator clips.
(10) Install the return lines to the cooler tube.
(11) Install the left headlight assembly.
(12) Install the grille assembly (Refer to 23 - BODY/EXTERIOR/GRILLE - INSTALLATION).
(13) Fill the power steering fluid (Refer to 19 - STEERING/PUMP/FLUID - STANDARD PROCEDURE).

HOSES

REMOVAL

REMOVAL - PRESSURE HOSE

(1) Siphon as much power steering fluid as possible out of the reservoir.
(2) Disconnect the pressure hose at the pump.
(3) Disconnect the pressure hose at the steering gear.
(4) Remove the pressure hose mounting bracket from the gear.
(5) Remove the pressure hose from the vehicle.

REMOVAL - RETURN LINE FROM PUMP TO COOLER TUBE

(1) Siphon as much power steering fluid as possible out of the reservoir.
(2) Disconnect the return line at the pump.
(3) Remove the grille (Refer to 23 - BODY/EXTERIOR/GRILLE - REMOVAL).
(4) Remove the left headlight assembly.
(5) Disconnect the return line at the cooler tube.
(6) Remove the return line from the vehicle.

REMOVAL - RETURN HOSE FROM GEAR TO COOLER TUBE

(1) Siphon as much power steering fluid as possible out of the reservoir.
(2) Disconnect the return hose from the gear.
(3) Remove the grille (Refer to 23 - BODY/EXTERIOR/GRILLE - REMOVAL).
(4) Remove the left headlight assembly.
(5) Disconnect the return line at the cooler tube.
(6) Remove the return line from the vehicle.

INSTALLATION

INSTALLATION - PRESSURE HOSE

(1) Install the pressure hose to the vehicle.
(2) Reconnect the pressure hose at the steering gear. Tighten to 37 N·m (27 ft.lbs.).
(3) Install the pressure hose mounting bracket to the steering gear.
(4) Reconnect the pressure hose at the power steering pump. Tighten to 38 N·m (28 ft.lbs.).
(5) Fill the power steering fluid (Refer to 19 - STEERING/PUMP/FLUID - STANDARD PROCEDURE).

INSTALLATION - RETURN LINE FROM PUMP TO COOLER TUBE

(1) Install the return line to the vehicle.
(2) Reconnect the return line at the cooler tube.
(3) Install the left headlight assembly.
(4) Install the grille assembly (Refer to 23 - BODY/EXTERIOR/GRILLE - INSTALLATION).
(5) Reconnect the return line at the power steering pump.
(6) Fill the power steering fluid (Refer to 19 - STEERING/PUMP/FLUID - STANDARD PROCEDURE).

INSTALLATION - RETURN HOSE FROM GEAR TO COOLER TUBE

(1) Install the return line to the vehicle.
(2) Reconnect the return line at the cooler tube.
(3) Install the left headlight assembly.
(4) Install the grille assembly (Refer to 23 - BODY/EXTERIOR/GRILLE - INSTALLATION).
(5) Reconnect the return line at the power steering gear.
(6) Fill the power steering fluid (Refer to 19 - STEERING/PUMP/FLUID - STANDARD PROCEDURE).

TRANSMISSION

AUTOMATIC TRANSMISSION - NAG1

TABLE OF CONTENTS

page

AUTOMATIC TRANSMISSION - NAG1
DESCRIPTION 2
OPERATION 4
DIAGNOSIS AND TESTING
DIAGNOSIS AND TESTING - AUTOMATIC TRANSMISSION 23
DIAGNOSIS AND TESTING - PRELIMINARY . 23
DIAGNOSIS AND TESTING - ROAD TESTING 23
DIAGNOSIS AND TESTING - AUTOMATIC TRANSMISSION 24
STANDARD PROCEDURE - ALUMINUM THREAD REPAIR 27
REMOVAL 27
DISASSEMBLY 30
ASSEMBLY 34
INSTALLATION 41
SCHEMATICS AND DIAGRAMS 47
SPECIFICATIONS - NAG1 AUTOMATIC TRANSMISSION 68
SPECIAL TOOLS - NAG1 AUTOMATIC TRANSMISSION 69
DRIVING CLUTCHES
DESCRIPTION 72
OPERATION 72
DRIVING CLUTCH K1
DISASSEMBLY 74
ASSEMBLY 75
DRIVING CLUTCH K2
DISASSEMBLY 76
ASSEMBLY 78
DRIVING CLUTCH K3
DISASSEMBLY 80
ASSEMBLY 80
ELECTROHYDRAULIC UNIT
DESCRIPTION 82
OPERATION 87
REMOVAL 92
DISASSEMBLY 92
ASSEMBLY 95
INSTALLATION 100
FLUID AND FILTER
DESCRIPTION 101
OPERATION 101

page

DIAGNOSIS AND TESTING
DIAGNOSIS AND TESTING - EFFECTS OF INCORRECT FLUID LEVEL 102
DIAGNOSIS AND TESTING - CAUSES OF BURNT FLUID 102
DIAGNOSIS AND TESTING - FLUID CONTAMINATION 102
STANDARD PROCEDURE
STANDARD PROCEDURE - CHECK OIL LEVEL 102
STANDARD PROCEDURE - TRANSMISSION FILL 103
STANDARD PROCEDURE - FLUID/FILTER SERVICE 104
FREEWHEELING CLUTCH
DESCRIPTION 105
OPERATION 105
DISASSEMBLY 106
ASSEMBLY 107
GEARSHIFT CABLE
DIAGNOSIS AND TESTING - GEARSHIFT CABLE 109
REMOVAL 109
INSTALLATION 109
HOLDING CLUTCHES
DESCRIPTION 111
OPERATION 112
HOLDING CLUTCH B1
DISASSEMBLY 112
ASSEMBLY 113
HOLDING CLUTCH B2
DISASSEMBLY 115
ASSEMBLY 116
INPUT SPEED SENSORS
DESCRIPTION 119
OPERATION 119
OIL PUMP
DESCRIPTION 120
OPERATION 120
DISASSEMBLY 120
ASSEMBLY 121
OUTPUT SHAFT BEARING
REMOVAL 122
INSTALLATION 122

OUTPUT SHAFT SEAL
REMOVAL 125
INSTALLATION 125
PARK LOCK CABLE
REMOVAL 125
INSTALLATION 126
PISTONS
DESCRIPTION 128
OPERATION 128
PLANETARY GEARTRAIN
DESCRIPTION 130
OPERATION 130
DISASSEMBLY 131
ASSEMBLY 131
SHIFT MECHANISM
DESCRIPTION 133
OPERATION 133
REMOVAL 134
INSTALLATION 135
SOLENOID
DESCRIPTION 136
OPERATION 138
TEMPERATURE SENSOR/PARK-NEUTRAL CONTACT
DESCRIPTION
DESCRIPTION - PARK/NEUTRAL CONTACT . 139
DESCRIPTION - TRANSMISSION TEMPERATURE SENSOR 140
OPERATION
OPERATION - PARK/NEUTRAL CONTACT . . 140
OPERATION - TRANSMISSION TEMPERATURE SENSOR 141
TORQUE CONVERTER
DESCRIPTION 141
OPERATION 143
REMOVAL 146
INSTALLATION 146
TORQUE CONVERTER HUB SEAL
REMOVAL 147
INSTALLATION 147

AUTOMATIC TRANSMISSION - NAG1

DESCRIPTION

The NAG1 automatic transmission (Fig. 1) is an electronically controlled 5-speed transmission with a lock-up clutch in the torque converter. The ratios for the gear stages are obtained by 3 planetary gear sets. Fifth gear is designed as an overdrive with a high-speed ratio.

The gears are actuated electronically/hydraulically. The gears are shifted by means of an appropriate combination of three multi-disc holding clutches, three multi-disc driving clutches, and two freewheeling clutches.

Electronic transmission control enables precise adaptation of pressures to the respective operating conditions and to the engine output during the shift phase which results in a significant improvement in shift quality.

Furthermore, it offers the advantage of a flexible adaptation to various vehicle and engines.

Basically, the automatic transmission with electronic control offers the following advantages:

- Reduces fuel consumption.
- Improved shift comfort.
- More favourable step-up through the five gears.
- Increased service life and reliability.
- Lower maintenance costs.

TRANSMISSION IDENTIFICATION

The transmission name, NAG1, means New Automatic Gearbox, generation 1.

The transmission can be generically identified visually by the presence of a round 13-way connector located near the front corner of the transmission oil pan, on the right side. Specific transmission information can be found stamped into a pad on the left side of the transmission, above the oil pan rail.

TRANSMISSION GEAR RATIOS

The gear ratios for the NAG1 automatic transmission are as follows:

1st Gear	3.59:1
2nd Gear	2.19:1
3rd Gear	1.41:1
4th Gear	1.00:1
5th Gear	0.83:1
Reverse	3.16:1

TRANSMISSION HOUSING

The converter housing and transmission are made from a light alloy. These are bolted together and centered via the outer multi-disc carrier of multi-disc holding clutch, B1. A coated intermediate plate provides the sealing. The oil pump and the outer multi-disc carrier of the multi-disc holding clutch, B1, are bolted to the converter housing. The stator shaft is pressed into it and prevented from rotating by splines. The electrohydraulic unit is bolted to the transmission housing from underneath. A sheet metal steel oil pan forms the closure.

AUTOMATIC TRANSMISSION - NAG1 (Continued)

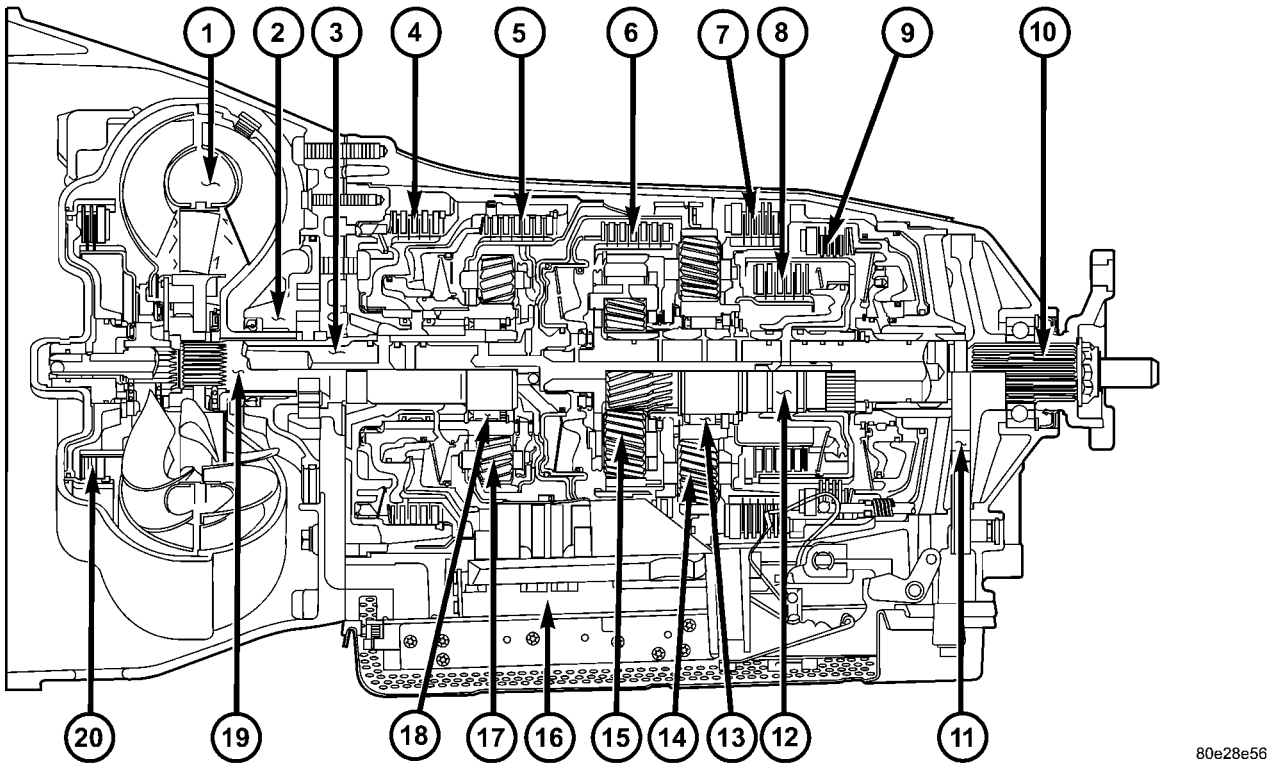


Fig. 1 NAG1 Automatic Transmission

1 - TORQUE CONVERTER
2 - OIL PUMP
3 - DRIVESHAFT
4 - MULTI-DISC HOLDING CLUTCH B1
5 - DRIVING CLUTCH K1
6 - DRIVING CLUTCH K2
7 - MULTI-DISC HOLDING CLUTCH B3
8 - DRIVING CLUTCH K3
9 - MULTI-DISC HOLDING CLUTCH B2
10 - OUTPUT SHAFT
11 - PARKING LOCK GEAR
12 - INTERMEDIATE SHAFT
13 - FREEWHEEL F2
14 - REAR PLANETARY GEAR SET
15 - CENTER PLANETARY GEAR SET
16 - ELECTROHYDRAULIC CONTROL UNIT
17 - FRONT PLANETARY GEAR SET
18 - FREEWHEEL F1
19 - STATOR SHAFT
20 - TORQUE CONVERTER LOCK-UP CLUTCH

MECHANICAL SECTION

The mechanical section consists of a drive shaft, output shaft, a sun gear shaft, and three planetary gear sets which are coupled to each other. The planetary gear sets each have four planetary pinion gears. The oil pressure for the torque converter lock-up clutch and clutch K2 is supplied through bores in the drive shaft. The oil pressure to clutch K3 is transmitted through the output shaft. The lubricating oil is distributed through additional bores in both shafts. All the bearing points of the gear sets, as well as the freewheeling clutches and actuators, are supplied with lubricating oil. The parking lock gear is connected to the output shaft via splines.

Freewheeling clutches F1 and F2 are used to optimize the shifts. The front freewheel, F1, is supported on the extension of the stator shaft on the transmission side and, in the locking direction, connects the sun gear of the front planetary gear set to the transmission housing. In the locking direction, the rear freewheeling clutch, F2, connects the sun gear of the center planetary gear set to the sun gear of the rear planetary gear set.

ELECTROHYDRAULIC CONTROL UNIT

The electrohydraulic control unit comprises the shift plate made from light alloy for the hydraulic control and an electrical control unit. The electrical control unit comprises of a supporting body made of plastic, into which the electrical components are assembled. The supporting body is mounted on the shift plate and screwed to it.

Strip conductors inserted into the supporting body make the connection between the electrical components and a plug connector. The connection to the wiring harness on the vehicle and the transmission control module (TCM) is produced via this 13-pin plug connector with a bayonet lock.

SHIFT GROUPS

The hydraulic control components (including actuators) which are responsible for the pressure distribution before, during, and after a gear change are described as a shift group. Each shift group contains a command valve, a holding pressure shift valve, a shift pressure shift valve, overlap regulating valve, and a solenoid.

The hydraulic system contains three shift groups: 1-2/4-5, 2-3, and 3-4. Each shift group can also be described as being in one of two possible states. The active shift group is described as being in the shift phase when it is actively engaging/disengaging a clutch combination. The 1-2/4-5 shift group control the B1 and K1 clutches. The 2-3 shift group controls the K2 and K3 clutches. The 3-4 shift group controls the K3 and B2 clutches.

OPERATION

The transmission control is divided into the electronic and hydraulic transmission control functions. While the electronic transmission control is responsible for gear selection and for matching the pressures to the torque to be transmitted, the transmission's power supply control occurs via hydraulic elements in the electrohydraulic control module. The oil supply to the hydraulic elements, such as the hydrodynamic torque converter, the shift elements and the hydraulic transmission control, is provided by way of an oil pump connected with the torque converter.

The Transmission Control Module (TCM) allows for the precise adaptation of pressures to the corresponding operating conditions and to the engine output during the gearshift phase, resulting in a noticeable improvement in shift quality. The engine speed limit can be reached in the individual gears at full throttle and kickdown. The shift range can be changed in the forward gears while driving, but the TCM employs a downshift safeguard to prevent over-revving the engine. The system offers the additional advantage of flexible adaptation to different vehicle and engine variants.

EMERGENCY RUNNING FUNCTION

In order to ensure a safe driving state and to prevent damage to the automatic transmission, the TCM control module switches to limp-home mode in the event of critical faults. A DTC assigned to the fault is stored in memory. All solenoid and regulating valves are thus de-energized.

The net effect is:

- The last engaged gear remains engaged.
- The modulating pressure and shift pressures rise to the maximum levels.
- The torque converter lockup clutch is deactivated.

In order to preserve the operability of the vehicle to some extent, the hydraulic control can be used to engage 2nd gear or reverse using the following procedure:

- Stop the vehicle.
- Switch off engine.
- Move selector lever to ″P″.
- Wait at least 10 seconds.
- Start engine.
- Move selector lever to D: 2nd gear.
- Move selector lever to R: Reverse gear.

The limp-home function remains active until the DTC is rectified or the stored DTC is erased with the DRB® tool. Sporadic faults can be reset via ignition OFF/ON.

CLUTCH APPLICATION

Refer to CLUTCH APPLICATION for which shift elements are applied in each gear position.

CLUTCH APPLICATION

GEAR	RATIO	B1	B2	B3	K1	K2	K3	F1	F2
1	3.59	X*	X				X*	X	X
2	2.19		X		X		X*		X
3	1.41		X		X	X			
4	1.00				X	X	X		
5	0.83	X				X	X	X*	
N	X						X		
R	3.16	X*		X			X	X	
* = The shift components required during coast.									

AUTOMATIC TRANSMISSION - NAG1 (Continued)

FIRST GEAR POWERFLOW

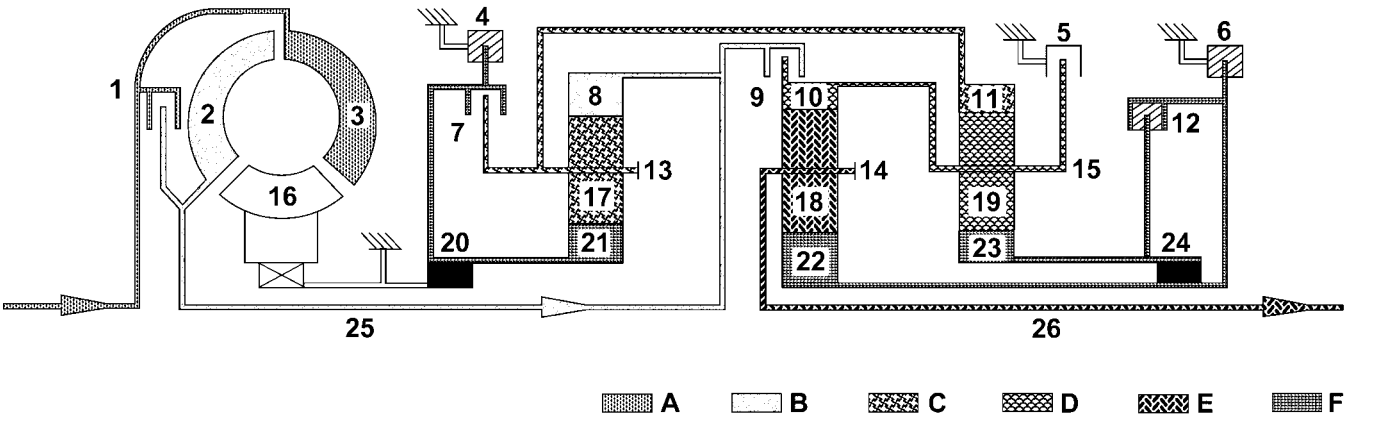
Torque from the torque converter is increased via the drive shaft (25) and all three planetary gearsets and transferred to the output shaft (26) (Fig. 2) and (Fig. 3).

Front Planetary Gear Set

The annulus gear (8) is driven by the drive shaft (25). The sun gear (21) is held against the housing by the locked freewheel F1 (20) during acceleration and via the engaged multiple-disc holding clutch B1 (4) during deceleration. The planetary pinion gears (17) turn on the fixed sun gear (21) and increase the torque from the annulus gear (8) to the planetary carrier (13). The planetary carrier (13) moves at a reduced speed in the running direction of the engine.

Rear Planetary Gear Set

The annulus gear (11) turns at a reduced speed due to the mechanical connection to the front planetary carrier (15). The sun gear (23) is held against the housing by the engaged multiple-disc holding clutch B2 (6), by the locked freewheel F2 (24) during acceleration and by the engaged multiple-disc clutch K3 (12) during deceleration. The planetary gears (19) turn on the fixed sun gear (23) and increase the torque from the annulus gear (11) to the planetary carrier (15). The planetary carrier (15) moves at a reduced speed in the running direction of the engine.



80e2ac5c

Fig. 2 First Gear Powerflow

1 - TORQUE CONVERTER LOCK-UP CLUTCH
2 - TORQUE CONVERTER TURBINE
3 - TORQUE CONVERTER IMPELLER
4 - HOLDING CLUTCH B1
5 - HOLDING CLUTCH B3
6 - HOLDING CLUTCH B2
7 - DRIVING CLUTCH K1
8 - FRONT PLANETARY ANNULUS GEAR
9 - DRIVING CLUTCH K2
10 - CENTER PLANETARY ANNULUS GEAR
11 - REAR PLANETARY ANNULUS GEAR
12 - DRIVING CLUTCH K3
13 - FRONT PLANETARY CARRIER
A - ENGINE SPEED
B - TRANSMISSION INPUT SPEED
C - FIRST GEAR RATIO
14 - CENTER PLANETARY CARRIER
15 - REAR PLANETARY CARRIER
16 - TORQUE CONVERTER STATOR
17 - FRONT PLANETARY PINION GEARS
18 - CENTER PLANETARY PINION GEARS
19 - REAR PLANETARY PINION GEARS
20 - FREEWHEELING CLUTCH F1
21 - FRONT PLANETARY SUN GEAR
22 - CENTER PLANETARY SUN GEAR
23 - REAR PLANETARY SUN GEAR
24 - FREEWHEELING CLUTCH F2
25 - DRIVE SHAFT
26 - OUTPUT SHAFT
D - SECOND GEAR RATIO
E - THIRD GEAR RATIO
F - FIXED PARTS

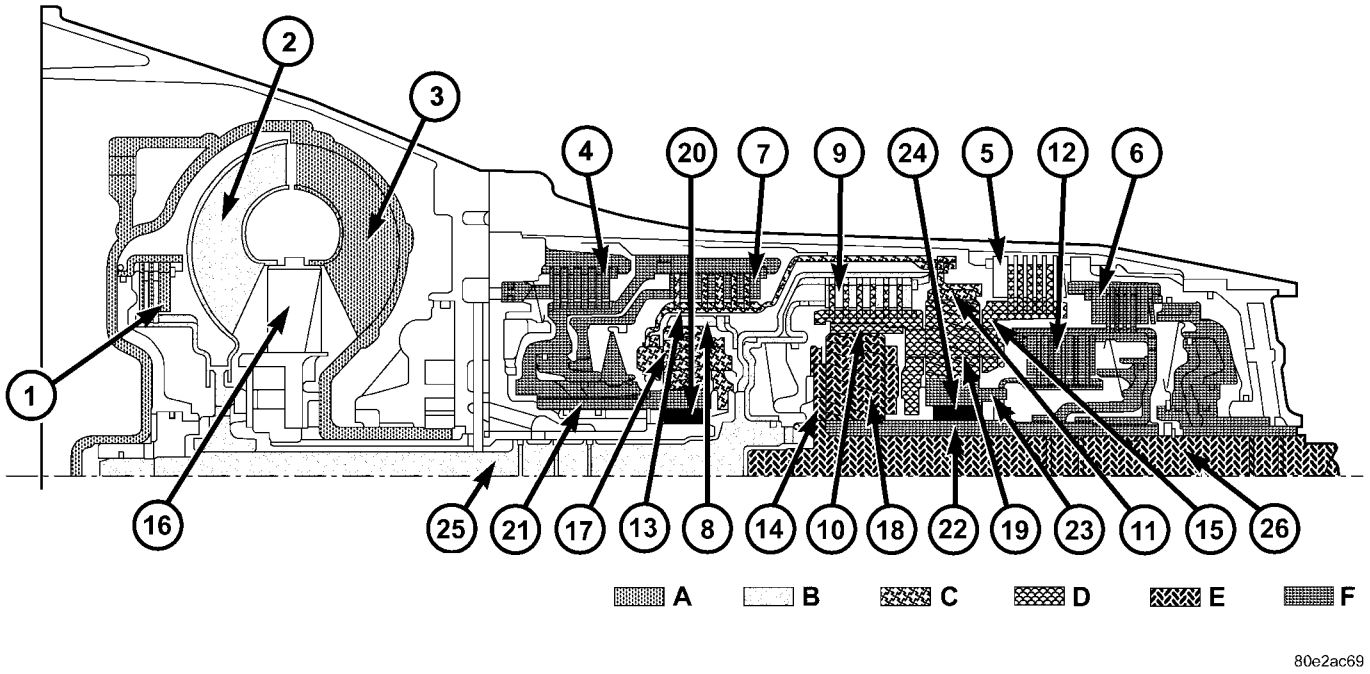


Fig. 3 First Gear Powerflow

1 - TORQUE CONVERTER LOCK-UP CLUTCH
2 - TORQUE CONVERTER TURBINE
3 - TORQUE CONVERTER IMPELLER
4 - HOLDING CLUTCH B1
5 - HOLDING CLUTCH B3
6 - HOLDING CLUTCH B2
7 - DRIVING CLUTCH K1
8 - FRONT PLANETARY ANNULUS GEAR
9 - DRIVING CLUTCH K2
10 - CENTER PLANETARY ANNULUS GEAR
11 - REAR PLANETARY ANNULUS GEAR
12 - DRIVING CLUTCH K3
13 - FRONT PLANETARY CARRIER
A - ENGINE SPEED
B - TRANSMISSION INPUT SPEED
C - FIRST GEAR RATIO
14 - CENTER PLANETARY CARRIER
15 - REAR PLANETARY CARRIER
16 - TORQUE CONVERTER STATOR
17 - FRONT PLANETARY PINION GEARS
18 - CENTER PLANETARY PINION GEARS
19 - REAR PLANETARY PINION GEARS
20 - FREEWHEELING CLUTCH F1
21 - FRONT PLANETARY SUN GEAR
22 - CENTER PLANETARY SUN GEAR
23 - REAR PLANETARY SUN GEAR
24 - FREEWHEELING CLUTCH F2
25 - DRIVE SHAFT
26 - OUTPUT SHAFT
D - SECOND GEAR RATIO
E - THIRD GEAR RATIO
F - FIXED PARTS

Center Planetary Gear Set

The annulus gear (10) is driven at the same speed as the rear planetary carrier (15) as a result of a mechanical connection. The sun gear (22) is held against the housing by the multiple-disc holding clutch B2 (6). The planetary pinion gears (18) turn on the fixed sun gear (22) and increase the torque from the annulus gear (10) to the planetary carrier (14). The output shaft (26) connected to the planetary carrier (14) turns at a reduced speed in the running direction of the engine.

AUTOMATIC TRANSMISSION - NAG1 (Continued)

SECOND GEAR POWERFLOW

Torque from the torque converter is increased via the drive shaft (25) and the center and rear planetary gearset and transferred to the output shaft (26) (Fig. 4) and (Fig. 5).

Front Planetary Gear Set

The planetary carrier (13) and sun gear (21) are connected via the engaged multiple-disc clutch K1 (7). The planetary gearset is therefore blocked and turns as a closed unit at the input speed due to the mechanical connection of the annulus gear (8) and drive shaft.

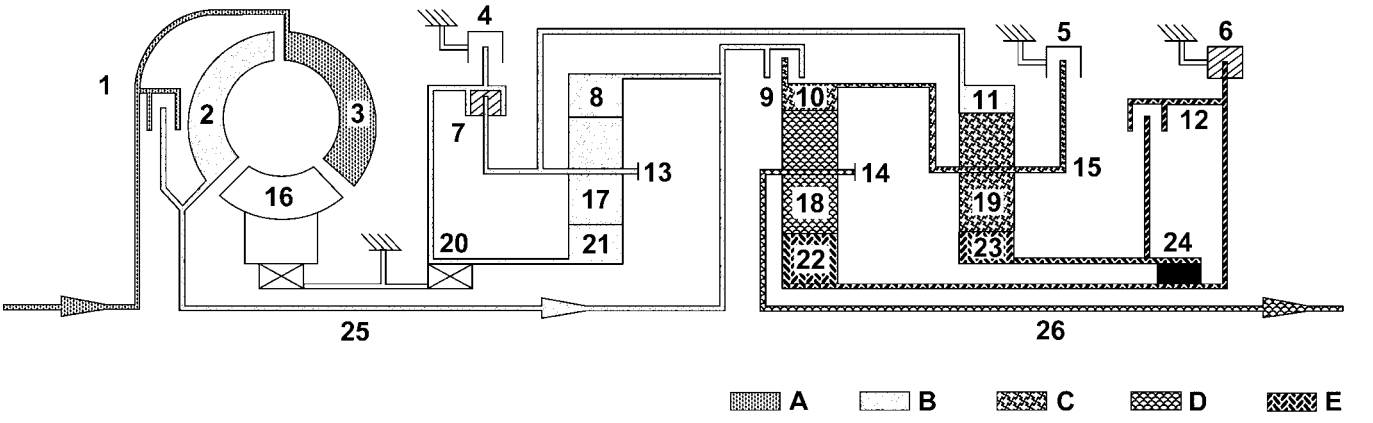


Fig. 4 Second Gear Powerflow

1 - TORQUE CONVERTER LOCK-UP CLUTCH
2 - TORQUE CONVERTER TURBINE
3 - TORQUE CONVERTER IMPELLER
4 - HOLDING CLUTCH B1
5 - HOLDING CLUTCH B3
6 - HOLDING CLUTCH B2
7 - DRIVING CLUTCH K1
8 - FRONT PLANETARY ANNULUS GEAR
9 - DRIVING CLUTCH K2
10 - CENTER PLANETARY ANNULUS GEAR
11 - REAR PLANETARY ANNULUS GEAR
12 - DRIVING CLUTCH K3
13 - FRONT PLANETARY CARRIER
A - ENGINE SPEED
B - TRANSMISSION INPUT SPEED
C - FIRST GEAR RATIO
14 - CENTER PLANETARY CARRIER
15 - REAR PLANETARY CARRIER
16 - TORQUE CONVERTER STATOR
17 - FRONT PLANETARY PINION GEARS
18 - CENTER PLANETARY PINION GEARS
19 - REAR PLANETARY PINION GEARS
20 - FREEWHEELING CLUTCH F1
21 - FRONT PLANETARY SUN GEAR
22 - CENTER PLANETARY SUN GEAR
23 - REAR PLANETARY SUN GEAR
24 - FREEWHEELING CLUTCH F2
25 - DRIVE SHAFT
26 - OUTPUT SHAFT
D - SECOND GEAR RATIO
E - FIXED PARTS

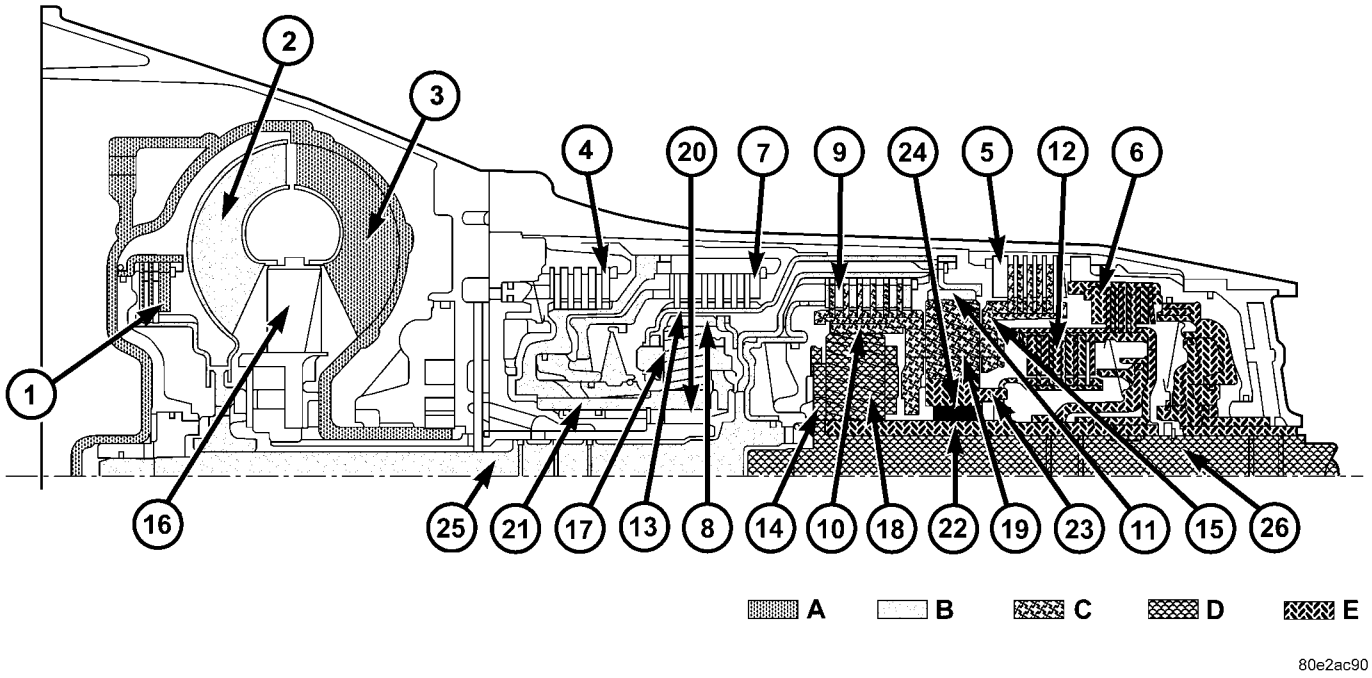


Fig. 5 Second Gear Powerflow

1 - TORQUE CONVERTER LOCK-UP CLUTCH
2 - TORQUE CONVERTER TURBINE
3 - TORQUE CONVERTER IMPELLER
4 - HOLDING CLUTCH B1
5 - HOLDING CLUTCH B3
6 - HOLDING CLUTCH B2
7 - DRIVING CLUTCH K1
8 - FRONT PLANETARY ANNULUS GEAR
9 - DRIVING CLUTCH K2
10 - CENTER PLANETARY ANNULUS GEAR
11 - REAR PLANETARY ANNULUS GEAR
12 - DRIVING CLUTCH K3
13 - FRONT PLANETARY CARRIER
A - ENGINE SPEED
B - TRANSMISSION INPUT SPEED
C - FIRST GEAR RATIO
14 - CENTER PLANETARY CARRIER
15 - REAR PLANETARY CARRIER
16 - TORQUE CONVERTER STATOR
17 - FRONT PLANETARY PINION GEARS
18 - CENTER PLANETARY PINION GEARS
19 - REAR PLANETARY PINION GEARS
20 - FREEWHEELING CLUTCH F1
21 - FRONT PLANETARY SUN GEAR
22 - CENTER PLANETARY SUN GEAR
23 - REAR PLANETARY SUN GEAR
24 - FREEWHEELING CLUTCH F2
25 - DRIVE SHAFT
26 - OUTPUT SHAFT
D - SECOND GEAR RATIO
E - FIXED PARTS

Rear Planetary Gear Set

The annulus gear (11) turns at the input speed as a result of the mechanical connection to the front planetary carrier (13). The sun gear (23) is held against the housing by the engaged multiple-disc holding clutch B2 (6), by the locked freewheel F2 (24) during acceleration and by the engaged multiple-disc clutch K3 (12) during deceleration. The planetary pinion gears (19) turn on the fixed sun gear (23) and increase the torque from the annulus gear (11) to the planetary carrier (15). The planetary carrier (15) moves at a reduced speed in the running direction of the engine.

Center Planetary Gear Set

The annulus gear (10) is driven at the same speed as the rear planetary carrier (15) as a result of a mechanical connection. The sun gear (22) is held against the housing by the multiple-disc holding clutch B2 (6). The planetary pinion gears (18) turn on the fixed sun gear (22) and increase the torque from the annulus gear (10) to the planetary carrier (14). The output shaft (5) connected to the planetary carrier (14) turns at a reduced speed in the running direction of the engine.

AUTOMATIC TRANSMISSION - NAG1 (Continued)

THIRD GEAR POWERFLOW

Torque from the torque converter is increased via the drive shaft (25) and the center planetary gearset and transferred to the output shaft (26) (Fig. 6) and (Fig. 7).

Front Planetary Gear Set

The planetary carrier (13) and sun gear (21) are connected via the engaged multiple-disc clutch K1 (7). The planetary gearset is therefore locked and turns as a closed unit at the input speed due to the mechanical connection of the annulus gear (8) and drive shaft (25).

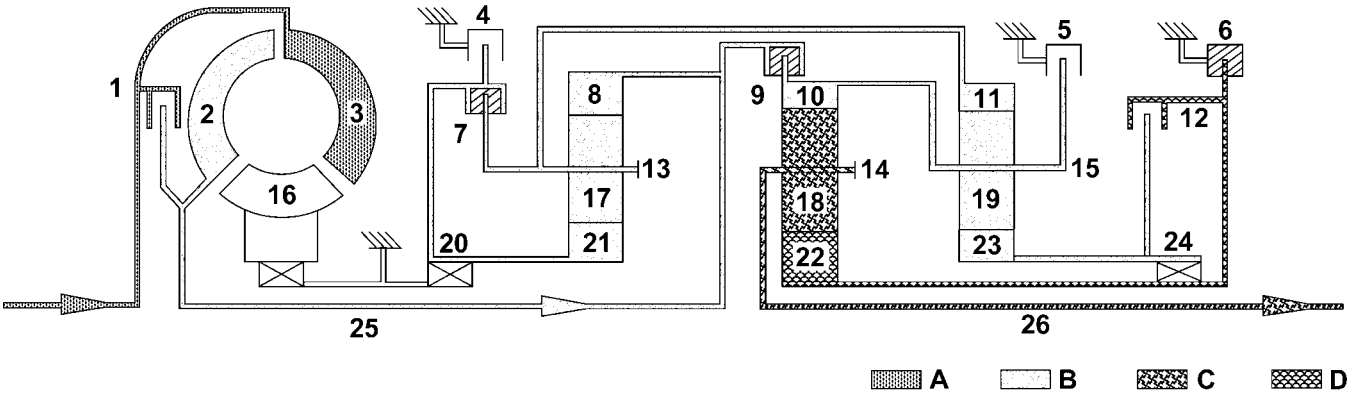


Fig. 6 Third Gear Powerflow

1 - TORQUE CONVERTER LOCK-UP CLUTCH
2 - TORQUE CONVERTER TURBINE
3 - TORQUE CONVERTER IMPELLER
4 - HOLDING CLUTCH B1
5 - HOLDING CLUTCH B3
6 - HOLDING CLUTCH B2
7 - DRIVING CLUTCH K1
8 - FRONT PLANETARY ANNULUS GEAR
9 - DRIVING CLUTCH K2
10 - CENTER PLANETARY ANNULUS GEAR
11 - REAR PLANETARY ANNULUS GEAR
12 - DRIVING CLUTCH K3
13 - FRONT PLANETARY CARRIER
A - ENGINE SPEED
B - TRANSMISSION INPUT SPEED
14 - CENTER PLANETARY CARRIER
15 - REAR PLANETARY CARRIER
16 - TORQUE CONVERTER STATOR
17 - FRONT PLANETARY PINION GEARS
18 - CENTER PLANETARY PINION GEARS
19 - REAR PLANETARY PINION GEARS
20 - FREEWHEELING CLUTCH F1
21 - FRONT PLANETARY SUN GEAR
22 - CENTER PLANETARY SUN GEAR
23 - REAR PLANETARY SUN GEAR
24 - FREEWHEELING CLUTCH F2
25 - DRIVE SHAFT
26 - OUTPUT SHAFT
C - FIRST GEAR RATIO
D - FIXED PARTS

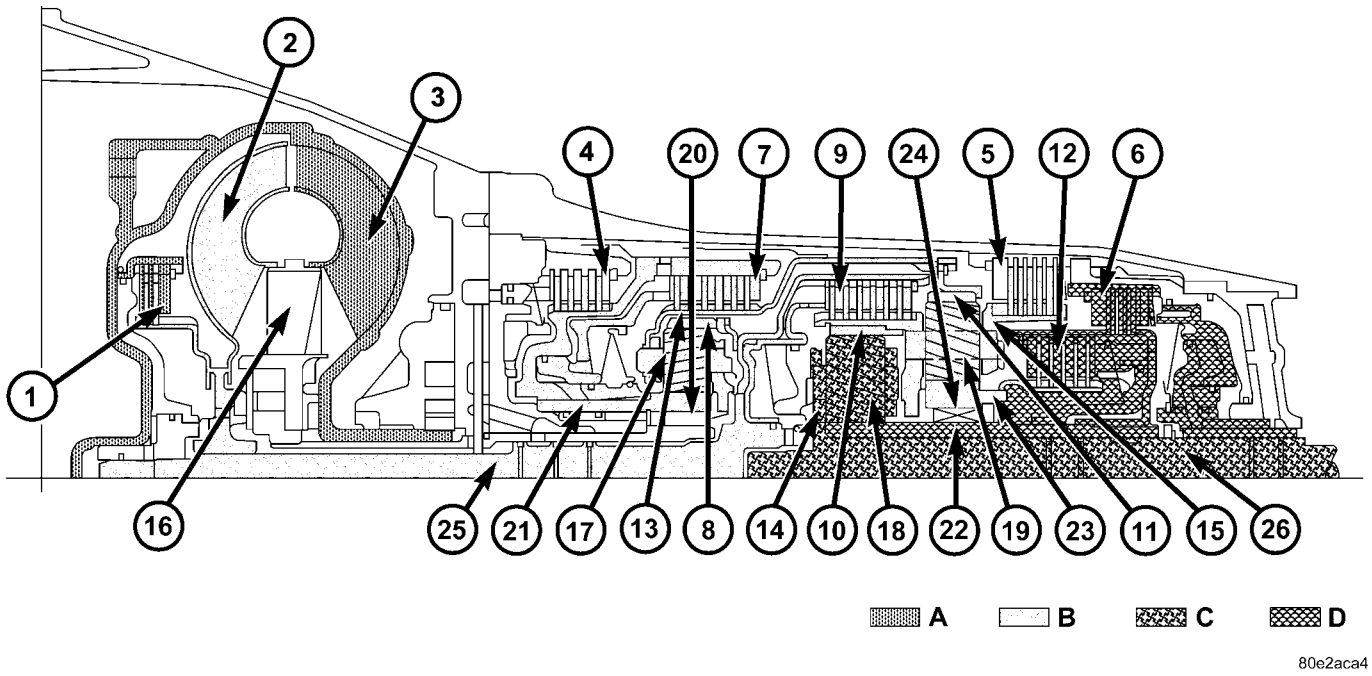


Fig. 7 Third Gear Powerflow

1 - TORQUE CONVERTER LOCK-UP CLUTCH
2 - TORQUE CONVERTER TURBINE
3 - TORQUE CONVERTER IMPELLER
4 - HOLDING CLUTCH B1
5 - HOLDING CLUTCH B3
6 - HOLDING CLUTCH B2
7 - DRIVING CLUTCH K1
8 - FRONT PLANETARY ANNULUS GEAR
9 - DRIVING CLUTCH K2
10 - CENTER PLANETARY ANNULUS GEAR
11 - REAR PLANETARY ANNULUS GEAR
12 - DRIVING CLUTCH K3
13 - FRONT PLANETARY CARRIER
A - ENGINE SPEED
B - TRANSMISSION INPUT SPEED
14 - CENTER PLANETARY CARRIER
15 - REAR PLANETARY CARRIER
16 - TORQUE CONVERTER STATOR
17 - FRONT PLANETARY PINION GEARS
18 - CENTER PLANETARY PINION GEARS
19 - REAR PLANETARY PINION GEARS
20 - FREEWHEELING CLUTCH F1
21 - FRONT PLANETARY SUN GEAR
22 - CENTER PLANETARY SUN GEAR
23 - REAR PLANETARY SUN GEAR
24 - FREEWHEELING CLUTCH F2
25 - DRIVE SHAFT
26 - OUTPUT SHAFT
C - FIRST GEAR RATIO
D - FIXED PARTS

Rear Planetary Gear Set

The multiple-disc clutch K2 (9) is engaged and transfers the input speed of the drive shaft (25) to the planetary carrier (15) via the annulus gear (10). The annulus gear (11) turns in the same way as the planetary carrier (15) due to the mechanical connection with the locked front planetary gearset. This planetary gearset is therefore locked and turns as a closed unit.

Center Planetary Gear Set

The annulus gear (10) turns at the input speed as a result of the engaged multiple-disc clutch K2 (9). The sun gear (22) is held against the housing by the multiple-disc holding clutch B2 (6). The planetary pinion gears (18) turn on the fixed sun gear (22) and increase the torque from the annulus gear (10) to the planetary carrier (14). The output shaft (26) connected to the planetary carrier (14) turns at a reduced speed in the running direction of the engine.

AUTOMATIC TRANSMISSION - NAG1 (Continued)

FOURTH GEAR POWERFLOW

Speed and torque are not converted by the direct gear ratio of the 4th gear. Power is transferred from the drive shaft (25) to the output shaft (26) via three locked planetary gearsets (Fig. 8) and (Fig. 9).

Front Planetary Gear Set

The planetary carrier (13) and sun gear (21) are connected via the engaged multiple-disc clutch K1 (7). The planetary gearset is therefore locked and turns as a closed unit at the input speed due to the mechanical connection of the annulus gear (8) and the drive shaft (25).

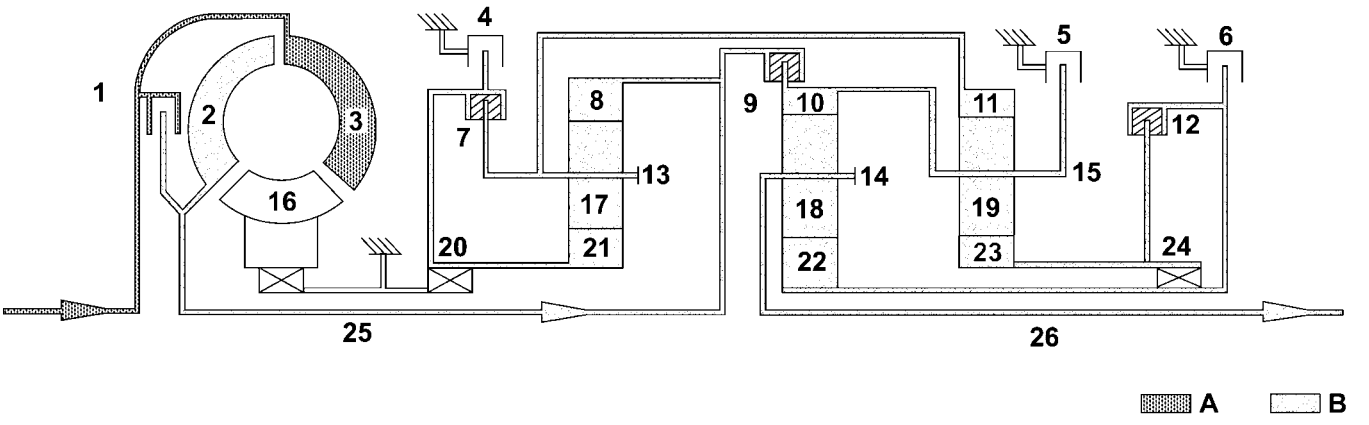


Fig. 8 Fourth Gear Powerflow

1 - TORQUE CONVERTER LOCK-UP CLUTCH
2 - TORQUE CONVERTER TURBINE
3 - TORQUE CONVERTER IMPELLER
4 - HOLDING CLUTCH B1
5 - HOLDING CLUTCH B3
6 - HOLDING CLUTCH B2
7 - DRIVING CLUTCH K1
8 - FRONT PLANETARY ANNULUS GEAR
9 - DRIVING CLUTCH K2
10 - CENTER PLANETARY ANNULUS GEAR
11 - REAR PLANETARY ANNULUS GEAR
12 - DRIVING CLUTCH K3
13 - FRONT PLANETARY CARRIER
14 - CENTER PLANETARY CARRIER
15 - REAR PLANETARY CARRIER
16 - TORQUE CONVERTER STATOR
17 - FRONT PLANETARY PINION GEARS
18 - CENTER PLANETARY PINION GEARS
19 - REAR PLANETARY PINION GEARS
20 - FREEWHEELING CLUTCH F1
21 - FRONT PLANETARY SUN GEAR
22 - CENTER PLANETARY SUN GEAR
23 - REAR PLANETARY SUN GEAR
24 - FREEWHEELING CLUTCH F2
25 - DRIVE SHAFT
26 - OUTPUT SHAFT
A - ENGINE SPEED
B - TRANSMISSION INPUT SPEED

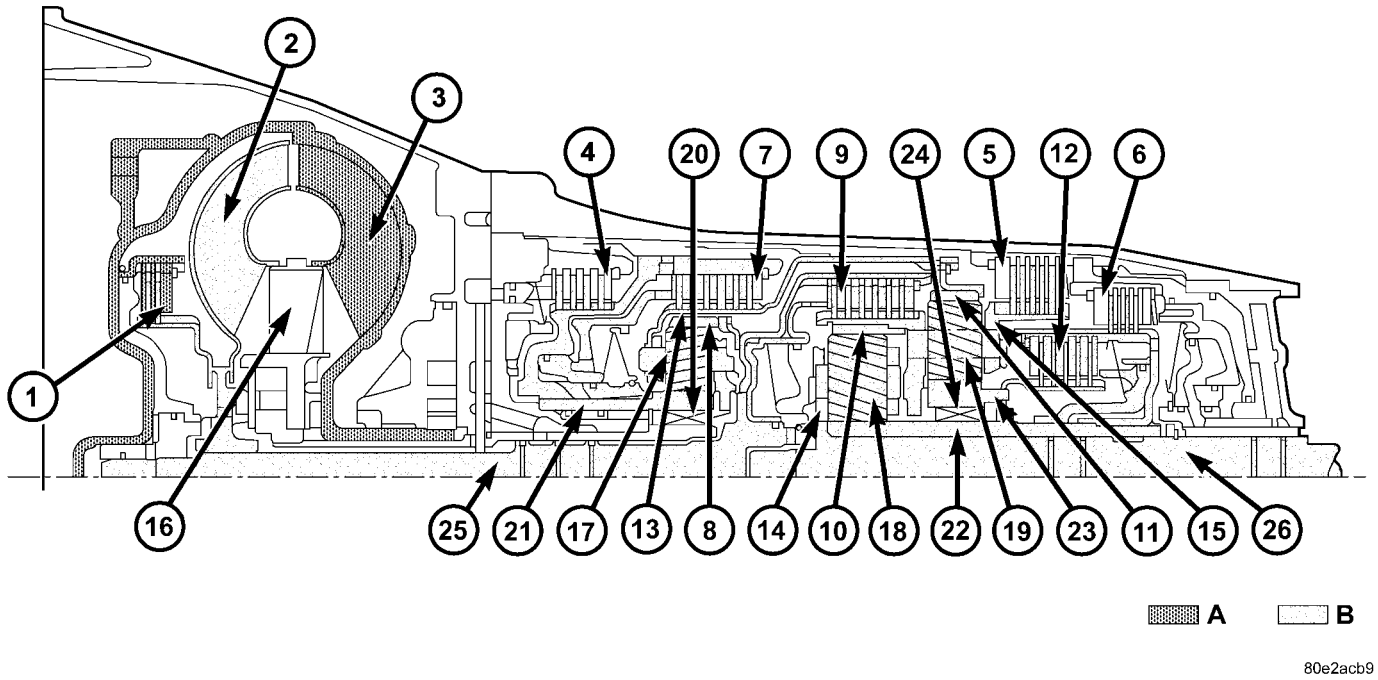


Fig. 9 Fourth Gear Powerflow

1 - TORQUE CONVERTER LOCK-UP CLUTCH
2 - TORQUE CONVERTER TURBINE
3 - TORQUE CONVERTER IMPELLER
4 - HOLDING CLUTCH B1
5 - HOLDING CLUTCH B3
6 - HOLDING CLUTCH B2
7 - DRIVING CLUTCH K1
8 - FRONT PLANETARY ANNULUS GEAR
9 - DRIVING CLUTCH K2
10 - CENTER PLANETARY ANNULUS GEAR
11 - REAR PLANETARY ANNULUS GEAR
12 - DRIVING CLUTCH K3
13 - FRONT PLANETARY CARRIER
A - ENGINE SPEED
14 - CENTER PLANETARY CARRIER
15 - REAR PLANETARY CARRIER
16 - TORQUE CONVERTER STATOR
17 - FRONT PLANETARY PINION GEARS
18 - CENTER PLANETARY PINION GEARS
19 - REAR PLANETARY PINION GEARS
20 - FREEWHEELING CLUTCH F1
21 - FRONT PLANETARY SUN GEAR
22 - CENTER PLANETARY SUN GEAR
23 - REAR PLANETARY SUN GEAR
24 - FREEWHEELING CLUTCH F2
25 - DRIVE SHAFT
26 - OUTPUT SHAFT
B - TRANSMISSION INPUT SPEED

Rear Planetary Gear Set

The multiple-disc clutch K2 (9) is engaged and transfers the input speed of the drive shaft (25) to the planetary carrier (15) via the annulus gear (10). The annulus gear (11) turns in the same way as the planetary carrier (15) due to the mechanical connection with the locked front planetary gearset. The planetary gearset is therefore locked and turns as a closed unit.

Center Planetary Gear Set

The annulus gear (10) turns at the input speed as a result of the engaged multiple-disc clutch K2 (9). The multiple-disc clutch K3 (12) connects the sun gears (22) and (23) of the rear and center planetary gearset. The planetary gearset is locked by the same speeds of the annulus gear (10) and the sun gear (22) and it turns as a closed unit.

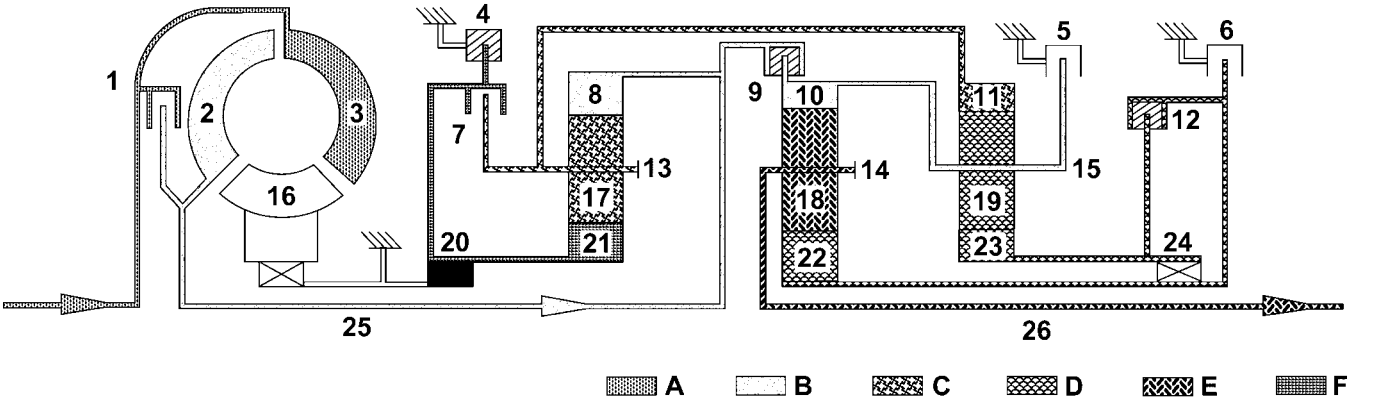
AUTOMATIC TRANSMISSION - NAG1 (Continued)

FIFTH GEAR POWERFLOW

Torque from the torque converter is increased via the drive shaft (25) and all three planetary gearsets and transferred to the output shaft (26) (Fig. 10) and (Fig. 11).

Front Planetary Gear Set

The annulus gear (8) is driven by the drive shaft (25). The sun gear (21) is held against the housing by the locked freewheel F1 (20) during acceleration and via the engaged multiple-disc holding clutch B1 (4) during deceleration. The planetary pinion gears (17) turn on the fixed sun gear (21) and increase the torque from the annulus gear (8) to the planetary carrier (13). The planetary carrier (13) moves at a reduced speed in the running direction of the engine.



80e2acc1

Fig. 10 Fifth Gear Powerflow

1 - TORQUE CONVERTER LOCK-UP CLUTCH
2 - TORQUE CONVERTER TURBINE
3 - TORQUE CONVERTER IMPELLER
4 - HOLDING CLUTCH B1
5 - HOLDING CLUTCH B3
6 - HOLDING CLUTCH B2
7 - DRIVING CLUTCH K1
8 - FRONT PLANETARY ANNULUS GEAR
9 - DRIVING CLUTCH K2
10 - CENTER PLANETARY ANNULUS GEAR
11 - REAR PLANETARY ANNULUS GEAR
12 - DRIVING CLUTCH K3
13 - FRONT PLANETARY CARRIER
A - ENGINE SPEED
B - TRANSMISSION INPUT SPEED
C - FIRST GEAR RATIO
14 - CENTER PLANETARY CARRIER
15 - REAR PLANETARY CARRIER
16 - TORQUE CONVERTER STATOR
17 - FRONT PLANETARY PINION GEARS
18 - CENTER PLANETARY PINION GEARS
19 - REAR PLANETARY PINION GEARS
20 - FREEWHEELING CLUTCH F1
21 - FRONT PLANETARY SUN GEAR
22 - CENTER PLANETARY SUN GEAR
23 - REAR PLANETARY SUN GEAR
24 - FREEWHEELING CLUTCH F2
25 - DRIVE SHAFT
26 - OUTPUT SHAFT
D - SECOND GEAR RATIO
E - THIRD GEAR RATIO
F - FIXED PARTS

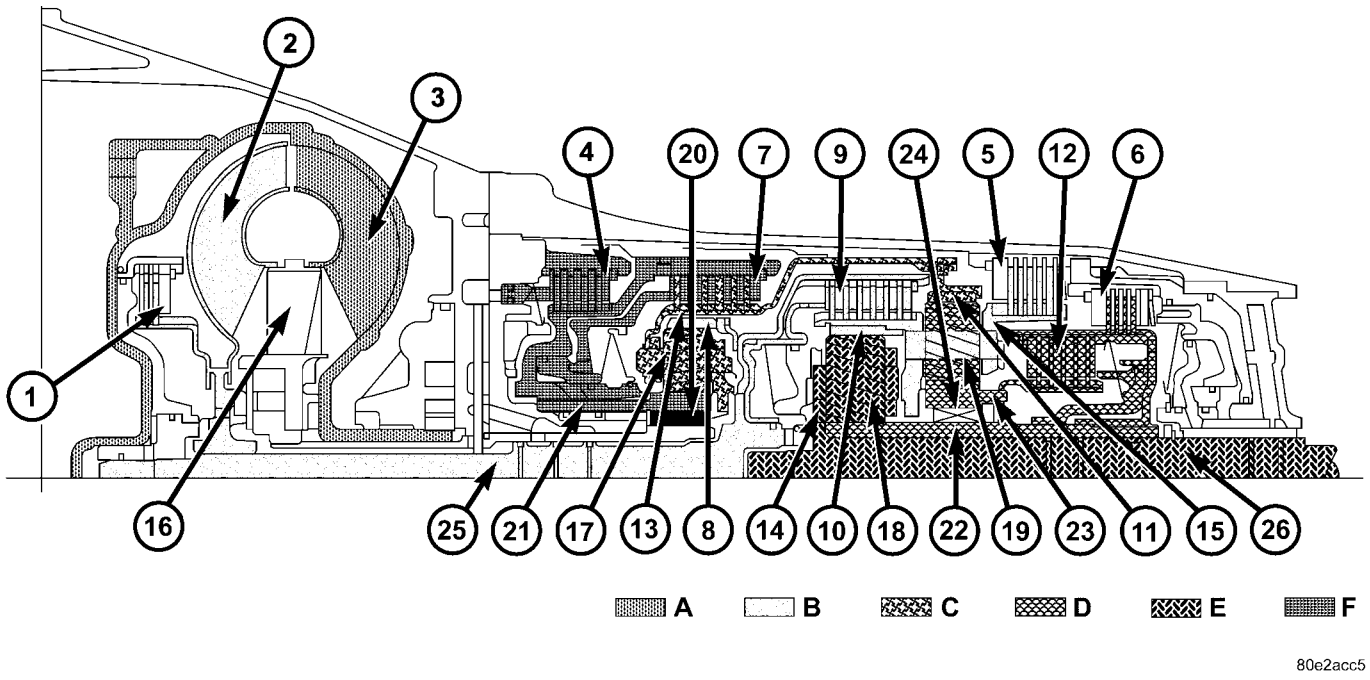


Fig. 11 Fifth Gear Powerflow

1 - TORQUE CONVERTER LOCK-UP CLUTCH
2 - TORQUE CONVERTER TURBINE
3 - TORQUE CONVERTER IMPELLER
4 - HOLDING CLUTCH B1
5 - HOLDING CLUTCH B3
6 - HOLDING CLUTCH B2
7 - DRIVING CLUTCH K1
8 - FRONT PLANETARY ANNULUS GEAR
9 - DRIVING CLUTCH K2
10 - CENTER PLANETARY ANNULUS GEAR
11 - REAR PLANETARY ANNULUS GEAR
12 - DRIVING CLUTCH K3
13 - FRONT PLANETARY CARRIER
A - ENGINE SPEED
B - TRANSMISSION INPUT SPEED
C - FIRST GEAR RATIO
14 - CENTER PLANETARY CARRIER
15 - REAR PLANETARY CARRIER
16 - TORQUE CONVERTER STATOR
17 - FRONT PLANETARY PINION GEARS
18 - CENTER PLANETARY PINION GEARS
19 - REAR PLANETARY PINION GEARS
20 - FREEWHEELING CLUTCH F1
21 - FRONT PLANETARY SUN GEAR
22 - CENTER PLANETARY SUN GEAR
23 - REAR PLANETARY SUN GEAR
24 - FREEWHEELING CLUTCH F2
25 - DRIVE SHAFT
26 - OUTPUT SHAFT
D - SECOND GEAR RATIO
E - THIRD GEAR RATIO
F - FIXED PARTS

Rear Planetary Gear Set

The multiple-disc clutch K2 (9) is engaged and transfers the input speed of the drive shaft (25) to the planetary carrier (15) via the annulus gear (10). The annulus gear (11) turns at a reduced speed due to the mechanical connection with the front planetary carrier (13). The planetary pinion gears (19) turn between the annulus gear (11) and the sun gear (23). The sun gear (23) moves at an increased speed in the running direction of the engine.

Center Planetary Gear Set

The annulus gear (10) turns at the input speed as a result of the engaged multiple-disc clutch K2 (9). The multiple-disc clutch K3 (12) transfers an increased speed to the sun gear (22) due to the connection with the sun gear (23). The planetary pinion gears (18) turn between the annulus gear (10) and the sun gear (22). The speed of the planetary carrier (14) and the output shaft connected to the planetary carrier (5) lies between that of the annulus gear (10) and the sun gear (22). This provides a step-up ratio.

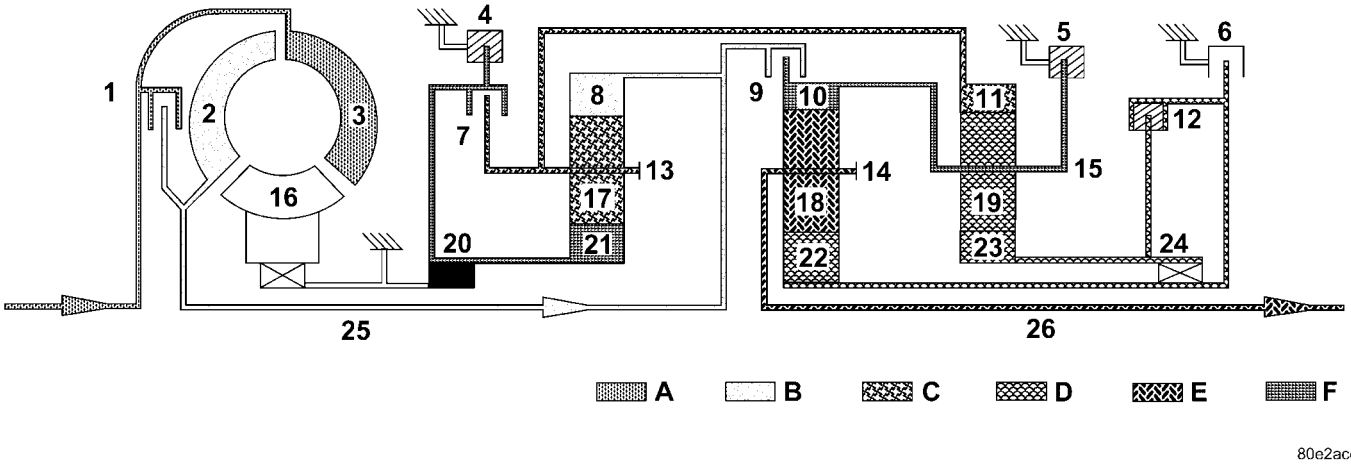
AUTOMATIC TRANSMISSION - NAG1 (Continued)

REVERSE GEAR POWERFLOW

Torque from the torque converter is increased via the drive shaft (25) and all three planetary gearsets and transferred with reversed direction of rotation to the output shaft (26) (Fig. 12) and (Fig. 13).

Front Planetary Gear Set

The annulus gear (8) is driven by the drive shaft (25). The sun gear (21) is held against the housing by the locked freewheel F1 (20) during acceleration and via the engaged multiple-disc holding clutch B1 (4) during deceleration. The planetary pinion gears (17) turn on the fixed sun gear (21) and increase the torque from the annulus gear (8) to the planetary carrier (13). The planetary carrier (13) moves at a reduced speed in the running direction of the engine.



80e2acc9

Fig. 12 Reverse Gear Powerflow

1 - TORQUE CONVERTER LOCK-UP CLUTCH
2 - TORQUE CONVERTER TURBINE
3 - TORQUE CONVERTER IMPELLER
4 - HOLDING CLUTCH B1
5 - HOLDING CLUTCH B3
6 - HOLDING CLUTCH B2
7 - DRIVING CLUTCH K1
8 - FRONT PLANETARY ANNULUS GEAR
9 - DRIVING CLUTCH K2
10 - CENTER PLANETARY ANNULUS GEAR
11 - REAR PLANETARY ANNULUS GEAR
12 - DRIVING CLUTCH K3
13 - FRONT PLANETARY CARRIER
A - ENGINE SPEED
B - TRANSMISSION INPUT SPEED
C - FIRST GEAR RATIO
14 - CENTER PLANETARY CARRIER
15 - REAR PLANETARY CARRIER
16 - TORQUE CONVERTER STATOR
17 - FRONT PLANETARY PINION GEARS
18 - CENTER PLANETARY PINION GEARS
19 - REAR PLANETARY PINION GEARS
20 - FREEWHEELING CLUTCH F1
21 - FRONT PLANETARY SUN GEAR
22 - CENTER PLANETARY SUN GEAR
23 - REAR PLANETARY SUN GEAR
24 - FREEWHEELING CLUTCH F2
25 - DRIVE SHAFT
26 - OUTPUT SHAFT
D - SECOND GEAR RATIO
E - THIRD GEAR RATIO
F - FIXED PARTS

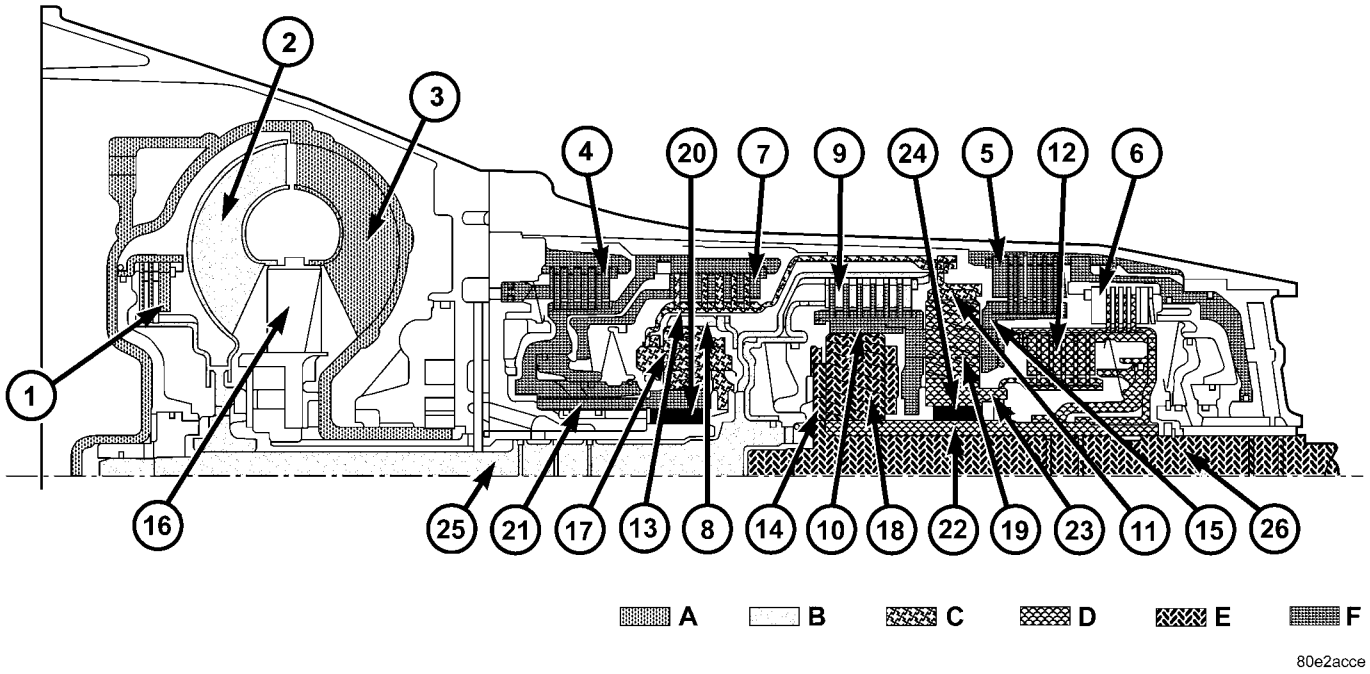


Fig. 13 Reverse Gear Powerflow

1 - TORQUE CONVERTER LOCK-UP CLUTCH
2 - TORQUE CONVERTER TURBINE
3 - TORQUE CONVERTER IMPELLER
4 - HOLDING CLUTCH B1
5 - HOLDING CLUTCH B3
6 - HOLDING CLUTCH B2
7 - DRIVING CLUTCH K1
8 - FRONT PLANETARY ANNULUS GEAR
9 - DRIVING CLUTCH K2
10 - CENTER PLANETARY ANNULUS GEAR
11 - REAR PLANETARY ANNULUS GEAR
12 - DRIVING CLUTCH K3
13 - FRONT PLANETARY CARRIER
A - ENGINE SPEED
B - TRANSMISSION INPUT SPEED
C - FIRST GEAR RATIO
14 - CENTER PLANETARY CARRIER
15 - REAR PLANETARY CARRIER
16 - TORQUE CONVERTER STATOR
17 - FRONT PLANETARY PINION GEARS
18 - CENTER PLANETARY PINION GEARS
19 - REAR PLANETARY PINION GEARS
20 - FREEWHEELING CLUTCH F1
21 - FRONT PLANETARY SUN GEAR
22 - CENTER PLANETARY SUN GEAR
23 - REAR PLANETARY SUN GEAR
24 - FREEWHEELING CLUTCH F2
25 - DRIVE SHAFT
26 - OUTPUT SHAFT
D - SECOND GEAR RATIO
E - THIRD GEAR RATIO
F - FIXED PARTS

Rear Planetary Gear Set

The planetary carrier (15) is held against the housing by the engaged multiple-disc holding clutch B3 (5). The annulus gear (11) turns at a reduced speed due to the mechanical connection to the front planetary carrier (13). The planetary gears (19) turn between the annulus gear (11) and the sun gear (23). The direction is reversed by the held planetary carrier (15) so that the sun gear (23) turns in the opposite direction to the running direction of the engine.

Center Planetary Gear Set

The annulus gear (10) is held against the housing by the multiple-disc holding clutch B3 (5) via the mechanical connection to the planetary carrier (15). The sun gear (22) turns backwards due to the engaged multiple-disc clutch K3 (12). The planetary gears (18) turn on the fixed annulus gear (10) and increase the torque from the sun gear (22) to the planetary carrier (14). The output shaft (26) connected to the planetary carrier (14) turns at a reduced speed in the opposite direction to the running direction of the engine.

AUTOMATIC TRANSMISSION - NAG1 (Continued)

SHIFT GROUPS/ SHIFT SEQUENCE

1-2 Shift - First Gear Engaged

The end face of the command valve (5) (Fig. 14) is kept unpressurized via the solenoid valve for 1-2 and 4-5 shift (1). Via the holding pressure shift valve (4), the working pressure (p-A) is present at the multiple-disc holding clutch B1 (7). Clutch K1 (6) is unpressurized.

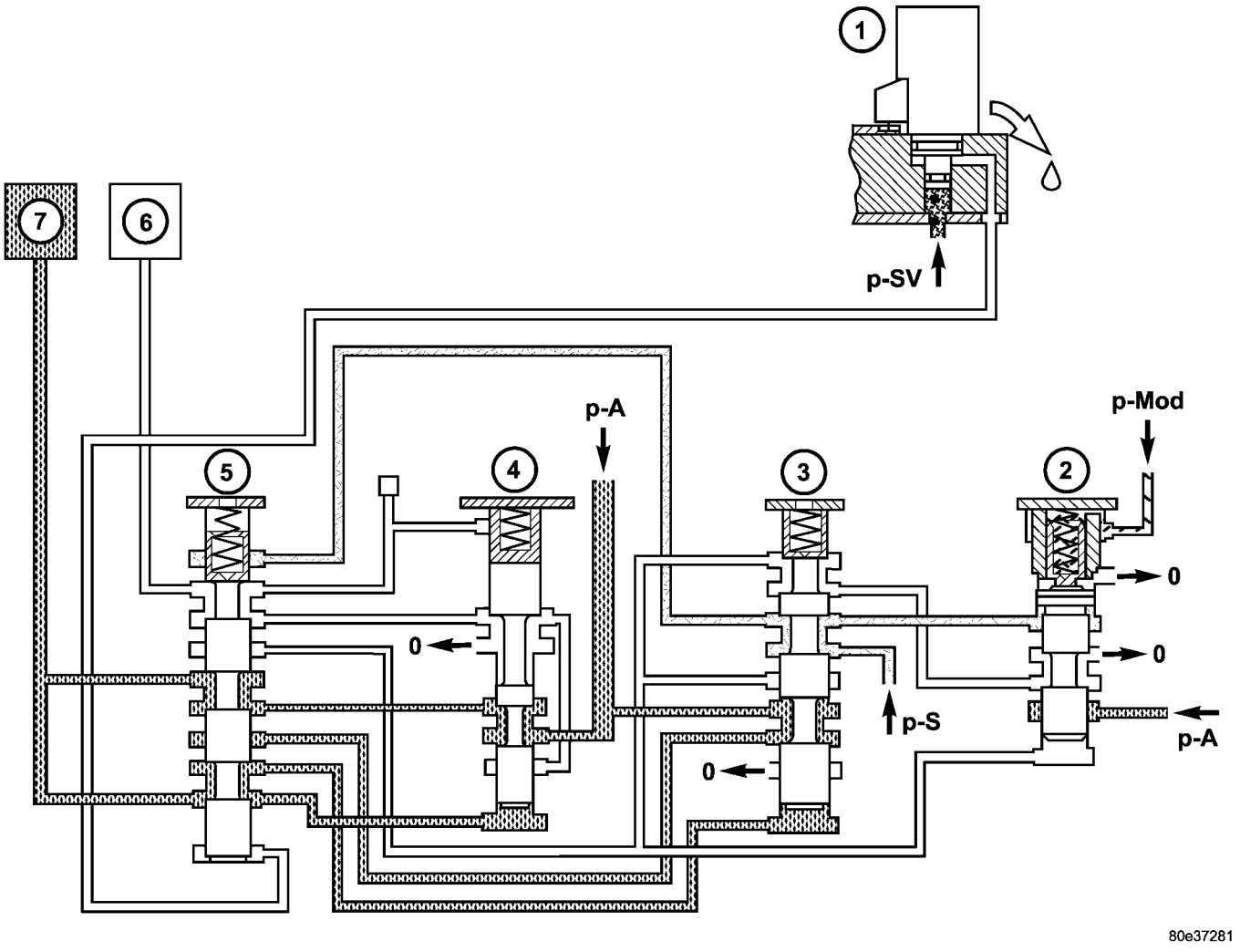


Fig. 14 First Gear Engaged

1 - 1-2/4-5 SHIFT SOLENOID
2 - 1-2/4-5 OVERLAP VALVE
3 - 1-2/4-5 SHIFT PRESSURE SHIFT VALVE
4 - 1-2/4-5 HOLDING PRESSURE SHIFT VALVE
5 - 1-2/4-5 COMMAND VALVE
6 - DRIVING CLUTCH K1
7 - HOLDING CLUTCH B1

AUTOMATIC TRANSMISSION - NAG1 (Continued)

Shift Phase

Via the 1-2 and 4-5 shift solenoid valve (1) (Fig. 15), the shift valve pressure (p-SV) is directed onto the end face of the command valve (5). The command valve is moved and the shift pressure (p-S) coming from the shift pressure shift valve (3) is directed via the command valve (5) onto clutch K1 (6). Simultaneously the clutch B1 (7) is subjected to overlap pressure by the overlap regulating valve (2).

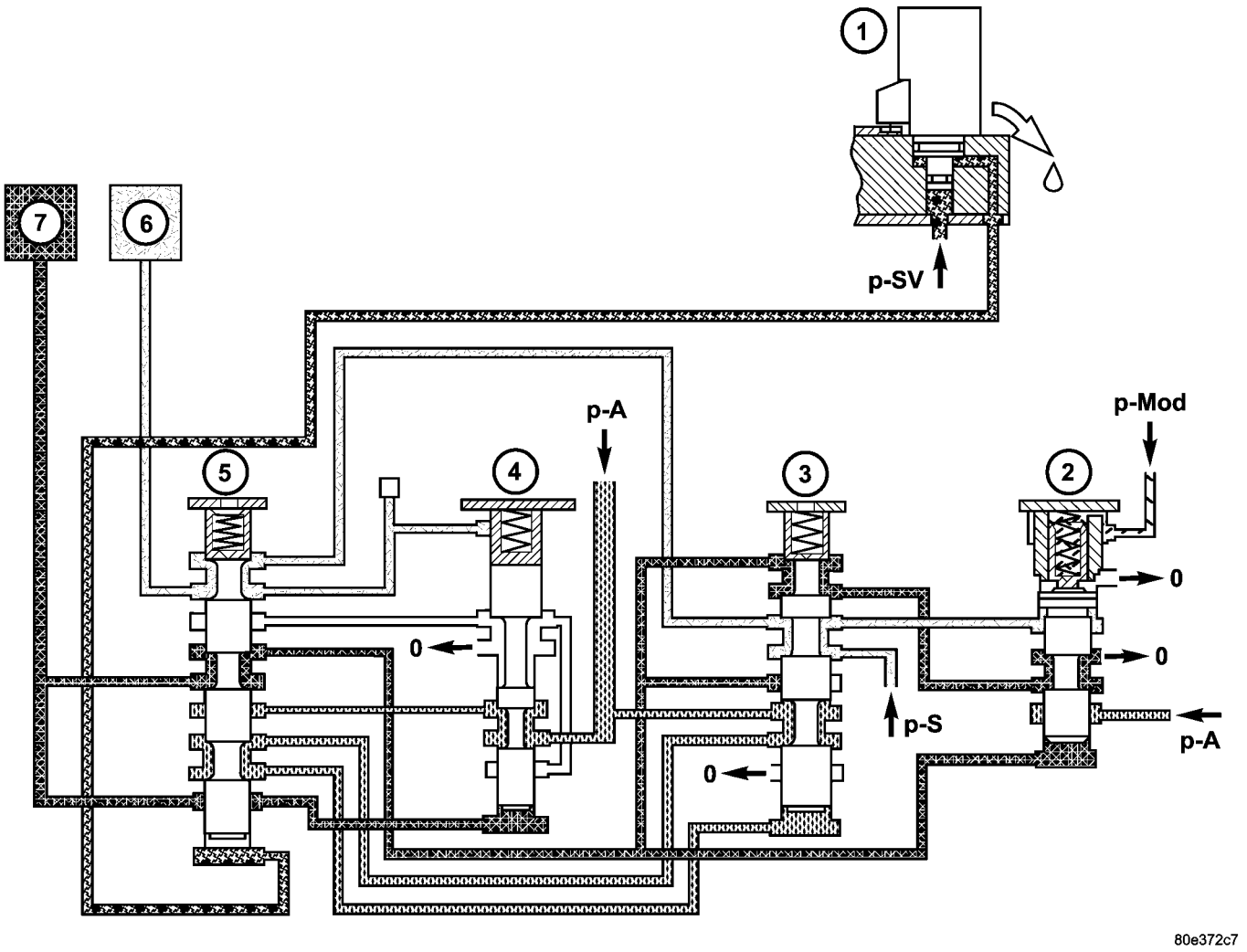


Fig. 15 Shift Phase

1 - 1-2/4-5 SHIFT SOLENOID
2 - 1-2/4-5 OVERLAP VALVE
3 - 1-2/4-5 SHIFT PRESSURE SHIFT VALVE
4 - 1-2/4-5 HOLDING PRESSURE SHIFT VALVE
5 - 1-2/4-5 COMMAND VALVE
6 - DRIVING CLUTCH K1
7 - HOLDING CLUTCH B1

AUTOMATIC TRANSMISSION - NAG1 (Continued)

The B1 (7) pressure acting on the end face of the shift pressure shift valve (3) is replaced by the working pressure (p-A). The rising shift pressure (p-S) at clutch K1 (6) acts on the annular face of the overlap regulating valve (2) and reduces the overlap pressure regulated by the overlap regulating valve (2). When a corresponding pressure level is reached at the holding pressure shift valve (4), this valve switches over.

Second Gear Engaged

After the gearchange is complete, the pressure on the end face of the command valve (5) (Fig. 16) is reduced via the 1-2 and 4-5 shift solenoid valve (1), and the command valve (5) is pushed back to its basic position. Via the holding pressure shift valve (4) the working pressure (p-A) now passes via the command valve (5) to clutch K1 (6). The multiple-disc holding clutch B1 (7) is deactivated (unpressurized). The spring of the shift pressure shift valve (3) pushes the valve back to its basic position.

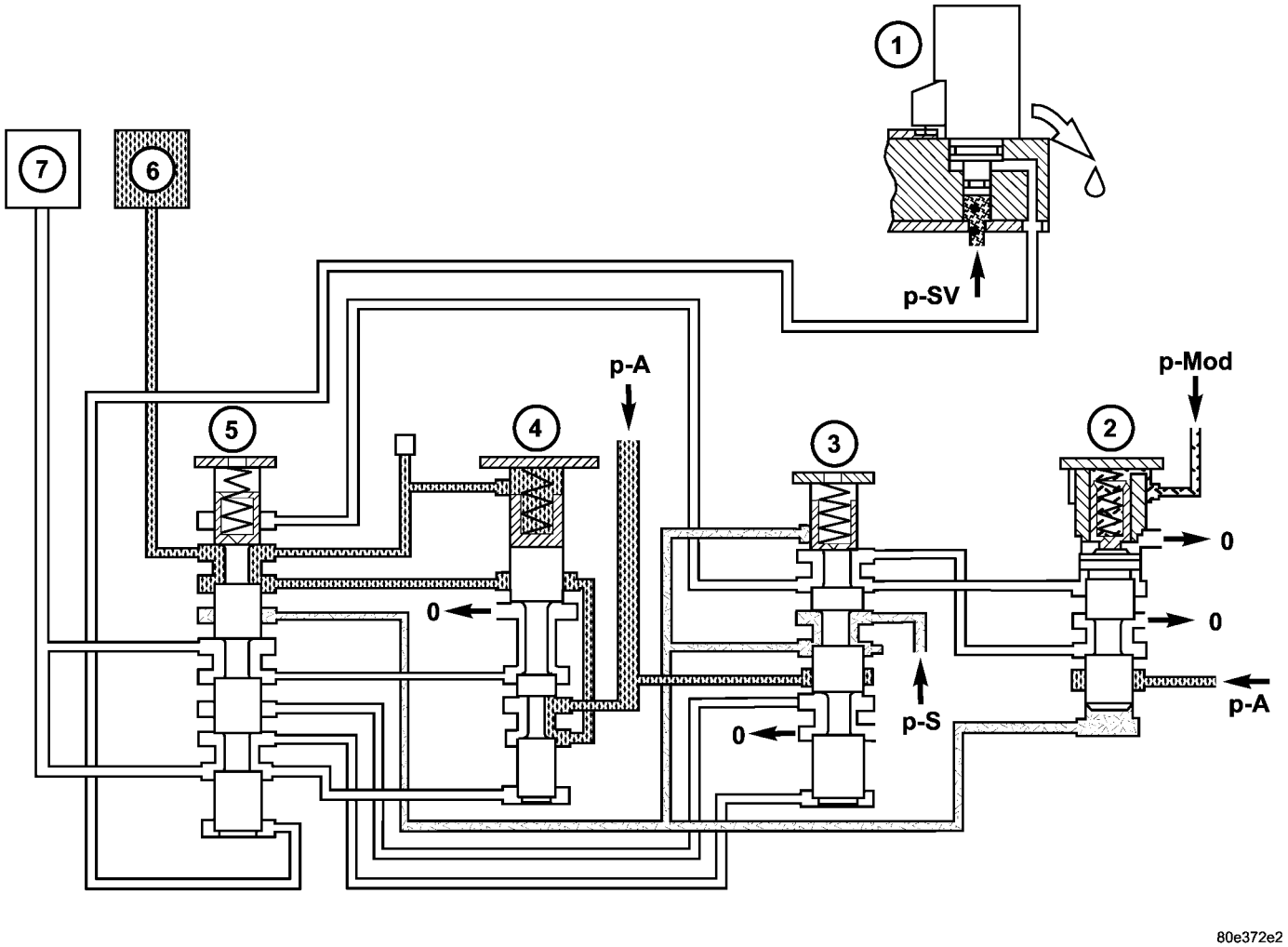


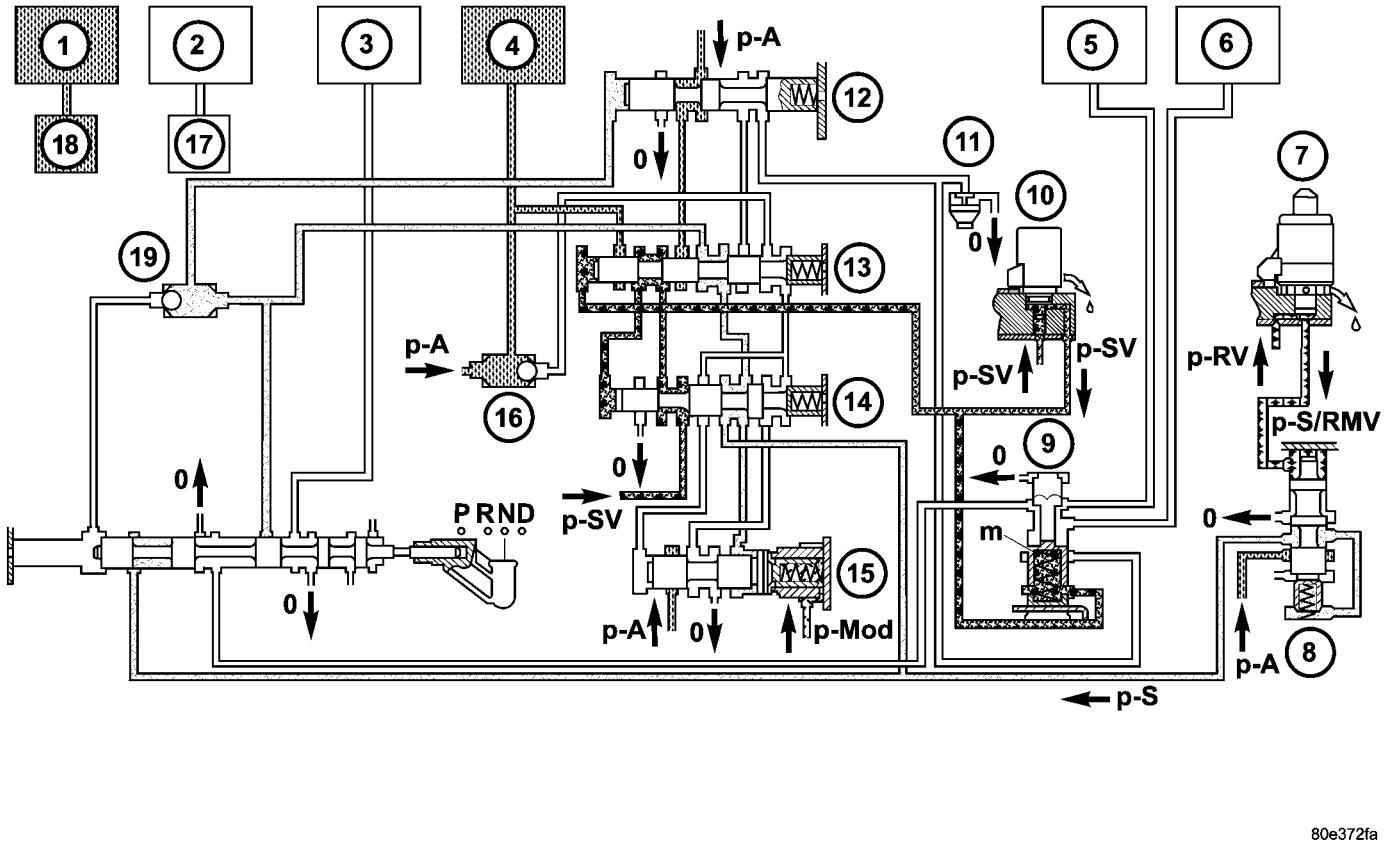
Fig. 16 Second Gear Engaged

1 - 1-2/4-5 SHIFT SOLENOID
2 - 1-2/4-5 OVERLAP VALVE
3 - 1-2/4-5 SHIFT PRESSURE SHIFT VALVE
4 - 1-2/4-5 HOLDING PRESSURE SHIFT VALVE
5 - 1-2/4-5 COMMAND VALVE
6 - DRIVING CLUTCH K1
7 - HOLDING CLUTCH B1

AUTOMATIC TRANSMISSION - NAG1 (Continued)

Gear Shift N to D (1st gear) - Engine Started

With the engine started (Fig. 17) and the gearshift lever in the NEUTRAL or PARK positions, holding clutch B1 (1) and driving clutch K3 (4) are applied and the various valves in the 1-2/4-5 shift group are positioned to apply pressure to the holding clutch B2.



80e372fa

Fig. 17 Engine Started

1 - HOLDING CLUTCH B1
2 - DRIVING CLUTCH K1
3 - HOLDING CLUTCH B3
4 - DRIVING CLUTCH K3
5 - HOLDING CLUTCH B2 PISTON
6 - HOLDING CLUTCH B2 PISTON OPPOSING FACE
7 - SHIFT PRESSURE REGULATING SOLENOID
8 - SHIFT PRESSURE REGULATING VALVE
9 - SHIFT VALVE B2
10 - 3-4 SHIFT SOLENOID
11 - PRESSURE HOLDING VALVE
12 - 3-4 HOLDING PRESSURE SHIFT VALVE
13 - 3-4 COMMAND VALVE
14 - 3-4 SHIFT PRESSURE SHIFT VALVE
15 - 3-4 OVERLAP REGULATING VALVE
16 - BALL VALVE
17 - 1-2/4-5 COMMAND VALVE
18 - 1-2/4-5 COMMAND VALVE
19 - BALL VALVE

AUTOMATIC TRANSMISSION - NAG1 (Continued)

Activation Sequence

The selector valve (Fig. 18) opens the shift pressure (p-S) feed connection from the ball valve (19) with the shift valve B2 (9). With the shift valve B2 (9) in the upper position, shift pressure (p-S) travels behind the piston B2 (5) and simultaneously to the opposing face of the piston B2 (6). The multiple-disc holding clutch B2 begins to close.

The pressure on the opposing face of the piston B2 (6) ensures a soft activation of the multiple-disc holding clutch B2.

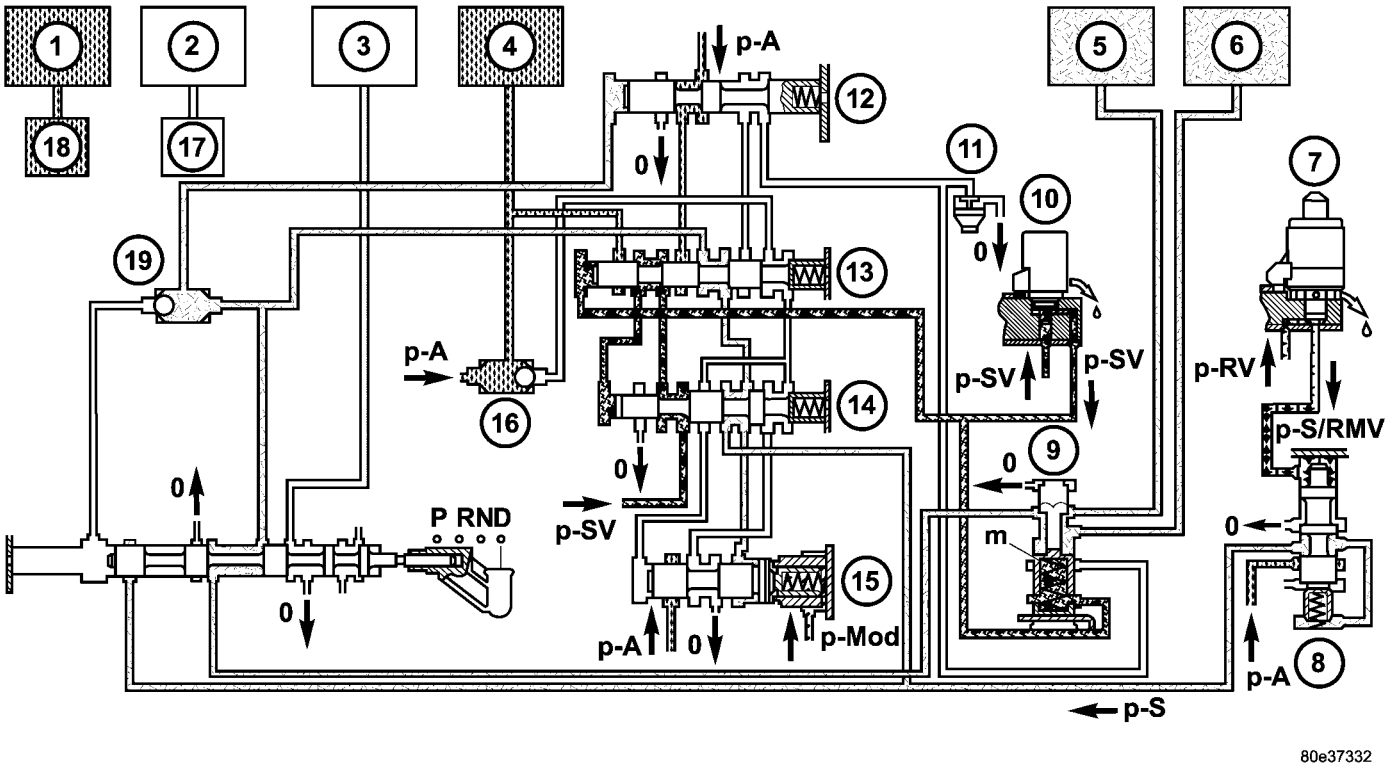


Fig. 18 Activation Sequence

1 - HOLDING CLUTCH B1
2 - DRIVING CLUTCH K1
3 - HOLDING CLUTCH B3
4 - DRIVING CLUTCH K3
5 - HOLDING CLUTCH B2 PISTON
6 - HOLDING CLUTCH B2 PISTON OPPOSING FACE
7 - SHIFT PRESSURE REGULATING SOLENOID
8 - SHIFT PRESSURE REGULATING VALVE
9 - SHIFT VALVE B2
10 - 3-4 SHIFT SOLENOID
11 - PRESSURE HOLDING VALVE
12 - 3-4 HOLDING PRESSURE SHIFT VALVE
13 - 3-4 COMMAND VALVE
14 - 3-4 SHIFT PRESSURE SHIFT VALVE
15 - 3-4 OVERLAP REGULATING VALVE
16 - BALL VALVE
17 - 1-2/4-5 COMMAND VALVE
18 - 1-2/4-5 COMMAND VALVE
19 - BALL VALVE

AUTOMATIC TRANSMISSION - NAG1 (Continued)

First Gear Engaged

The TCM monitors the activation sequence via the speed of the input shaft, which slows down as the frictional connection in the multiple-disc holding clutch increases. When the speed drops to the specified level, the TCM shuts off the power to the 3-4 shift solenoid valve (10) (Fig. 19). The spring chamber of the shift valve B2 (9) is depressurized and switches downwards. This connects the line to the opposing face of the piston B2 (6) with the pressure holding valve (11). The pressure on the opposing face of the piston B2 (6) drops to a residual pressure.

The working pressure (p-A) is formed and travels via the 2-3 holding pressure shift valve, the 2-3 command valve and the ball valve (16) to multi-plate clutch K3 (4) and via the 3-4 command valve (13) to the end face of the 3-4 shift pressure shift valve (14). The 3-4 shift pressure shift valve (14) is moved against the force of the spring towards the right. At the same time the 3-4 solenoid valve (10) is energized. This allows shift valve pressure (p-SV) to enter the spring chamber of the shift valve B2 (9) and to reach the end face of the 3-4 command valve (13). The shift valve B2 (9) is held in the upper position and the 3-4 command valve (13) switches towards the right. At the end face of the 3-4 shift pressure shift valve (14) the working pressure (p-A) is replaced by shift valve pressure (p-SV).

The 3-4 command valve (13) moves to the left. Working pressure (p-A) travels via the holding pressure shift valve (12) and the 3-4 command valve (13) to the piston of multiple-disc holding clutch B2 (5).

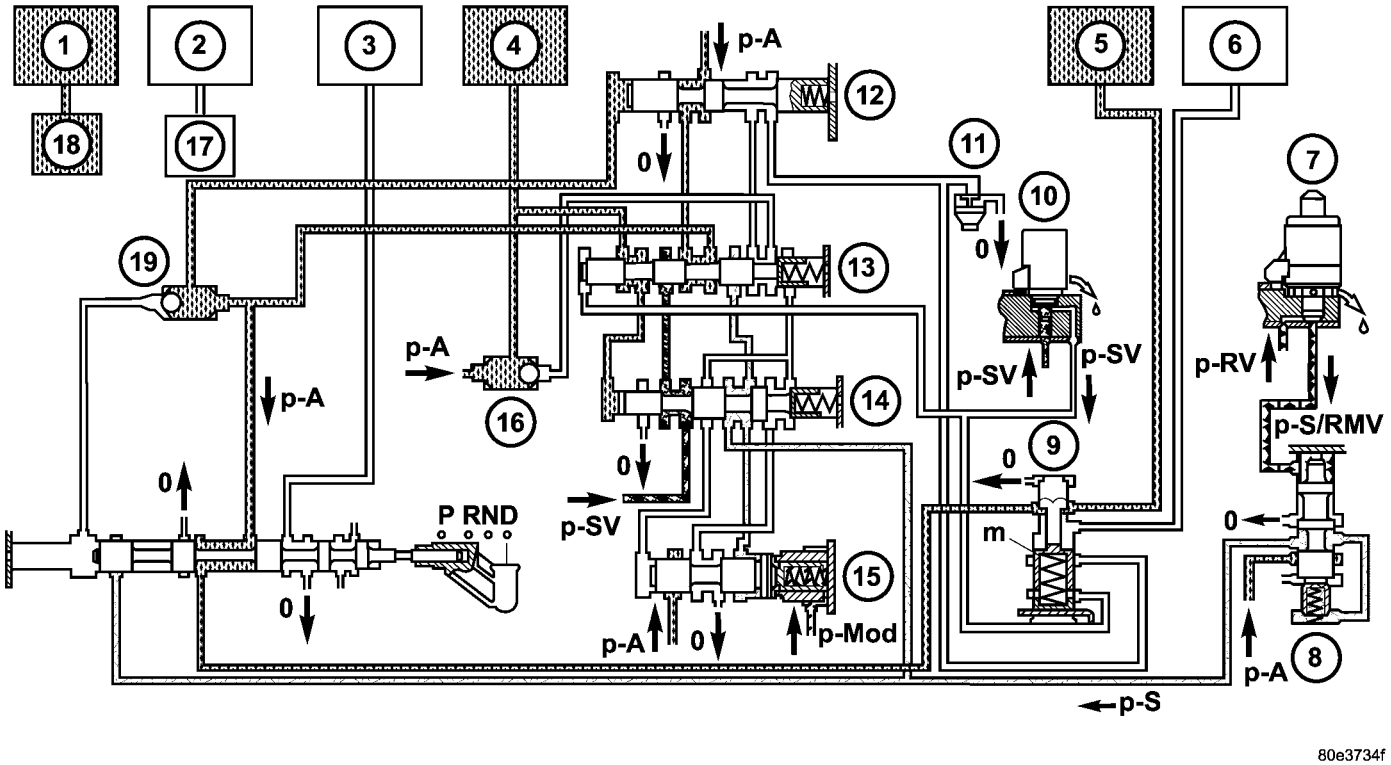


Fig. 19 First Gear Engaged

1 - HOLDING CLUTCH B1
2 - DRIVING CLUTCH K1
3 - HOLDING CLUTCH B3
4 - DRIVING CLUTCH K3
5 - HOLDING CLUTCH B2 PISTON
6 - HOLDING CLUTCH B2 PISTON OPPOSING FACE
7 - SHIFT PRESSURE REGULATING SOLENOID
8 - SHIFT PRESSURE REGULATING VALVE
9 - SHIFT VALVE B2
10 - 3-4 SHIFT SOLENOID
11 - PRESSURE HOLDING VALVE
12 - 3-4 HOLDING PRESSURE SHIFT VALVE
13 - 3-4 COMMAND VALVE
14 - 3-4 SHIFT PRESSURE SHIFT VALVE
15 - 3-4 OVERLAP REGULATING VALVE
16 - BALL VALVE
17 - 1-2/4-5 COMMAND VALVE
18 - 1-2/4-5 COMMAND VALVE
19 - BALL VALVE

AUTOMATIC TRANSMISSION - NAG1 (Continued)

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - AUTOMATIC TRANSMISSION

CAUTION: Before attempting any repair on a NAG1 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.
- Mechanical malfunctions.
- Electronic malfunctions.
- Transfer case performance.

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.

DIAGNOSIS AND TESTING - PRELIMINARY

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.

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.

DIAGNOSIS AND TESTING - 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.

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, overrunning clutch, or line pressure problems.

A slipping clutch can often be determined by comparing which internal units are applied in the various gear ranges. The Clutch Application chart CLUTCH APPLICATION provides a basis for analyzing road test results.

CLUTCH APPLICATION

GEAR	RATIO	B1	B2	B3	K1	K2	K3	F1	F2
1	3.59	X*	X				X*	X	X
2	2.19		X		X		X*		X
3	1.41		X		X	X			
4	1.00				X	X	X		
5	0.83	X				X	X	X*	
N	X						X		
R	3.16	X*		X			X	X	
* = The shift components required during coast.									

AUTOMATIC TRANSMISSION - NAG1 (Continued)

DIAGNOSIS AND TESTING - AUTOMATIC TRANSMISSION

CONDITION	POSSIBLE CAUSES	CORRECTION
MAXIMUM SPEED 30 km/h	1. Speed Control 30 Actuated.	1. Instruct Customer.
ENGINE DIES WHEN TRANSMISSION IS SHIFTED INTO GEAR, ALSO NOISES IN N AND/OR P	1. PWM Valve Blocked.	1. Replace Valve.
	2. Torque Converter Lock Up Control Valve Locked.	2. Enable Movement of Valve, Remove Particle.
LEVER IN ″P″ POSITION BLOCKED (BRAKE ACTIVATED)	1. No Vacuum Brake Booster After Long Immobilization, Brake Pedal Not Fully Applied/Hard Pedal.	1. Check Vacuum/ Tightness of Brake Booster.
	2. No Stoplamp Switch Signal (no DTC IN ECM).	2. Check Contact to Stoplamp Switch. Replace Switch if Necessary.
GRUMBLING, DRONING, JERKING WHEN TCC IS ENGAGED	1. Slip Speed TCC to Low.	1. Switch Off Torque Converter Lock Up Using DRB®. If Complaint Is Not Reproduced Afterwards, Replace PWM Valve, Set Adaption Values to Zero.
HOWLING, HUMMING ABOVE 4000 RPM IN EACH GEAR	1. Oil Filter Blocked.	1. Replace Oil Filter.
	2. Oil Pump.	2. Replace Oil Pump.
WHINING, SINGING	1. Gear Set Noises in 1st, 2nd, 5th Gear.	1. Replace Transmission..
	2. Intermediate Bearing Of The Drive Shaft At 0 km/h, Only When Cold.	2. Replace Intermediate Bearing of the Drive Shaft.
″CLACK″ NOISE FROM CENTER SHIFT AREA WHEN STOPPING OR STARTING	1. Park Lock Solenoid.	1. Replace Shift Lever Assembly.
CRACKING NOISE WHEN LOAD CYCLE	1. Stick - Slip Between Joint Flange and Collar Nut.	1. Install Zinc Coated Collar Nut Together With Washer.
CHATTERING IN CENTER CONSOLE SHIFT WHILE ACCELERATING	1. Bushing Shift Shaft Has Too Much Clearance.	1. Replace Shifter Lever and Cover Plate.
HARD 2-3 UPSHIFT WHEN STEPPING OFF THE ACCELERATOR PEDAL	1. Response Characteristic Control Loop.	1. Install K2 Disc Spring.
UPSHIFT 2-3, 3-4 SLIPPING	1. Spring of Regulating Valve Pressure control Valve Broken.	1. Replace Spring.
HARD 2-1 DOWNSHIFT WHEN COMING TO A STOP	1. Transmission (2-1 downshift) Not Adapted.	1. Re-adapt Transmission.
	2. TCM Software Data.	2. Flash TCM.
	3. Free Wheeling Clutch F1 Defective.	Replace Free Wheeling Clutch F1.

AUTOMATIC TRANSMISSION - NAG1 (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
HARD 3-2 DOWNSHIFT WHEN DECELERATION EVEN AFTER READAPTION	1. K3 Idles.	1. Install TCM And/Or Electrohydraulic Control Unit.
NO RESP. DELAYED UPSHIFT, NO DTC	1. Different Tire Sizes Are Mounted On The Front Axle.	1. Mount Uniform Tire Sizes On The Front Axle.
NO UPSHIFT 3-4, 4-5 AFTER FAST OFF (ACCELERATOR)	1. Upshift Prevention To Realize Dynamical Drivestyle.	1. Instruct Customer.
NO UPSHIFT OF 1ST GEAR BELOW 5000 RPM	1. Gear Recognition Switch.	1. Replace Gear Recognition Switch.
NO UPSHIFT INTO 5TH GEAR WHEN FULL THROTTLE OR KICK DOWN ACTIVATION	1. The Upshift 4-5 At Full Throttle or Kick Down Never Occurs Until Reaching Cut Off Speed. Under These Conditions, The High Powered Vehicle Will Never Shift Into 5th Gear Below 250 km/h.	1. Instruct Customer.
NO KICK DOWN SHIFTING	1. Accelerator Pedal Value < 95%.	1. Check Engine Control. Adjust As Necessary.
Engine Turns Up While 2-3 Upshift and/or Hard 3-2 Downshift	1. Oil Level Too Low.	1. Check Oil Level. Add if Necessary.
	2. Oil Filter Not Installed.	2. Install Oil Filter.
	3. Free Wheeling Clutch F2 Defective.	3. Replace Free Wheeling Clutch F2, Hollow Shaft, and Rear Sun Gear/Inner Disc Carrier K3.
GRABBING 2-3 COASTING UPSHIFT AND/OR BRAKE DOWNSHIFT	1. Oil Level Too Low.	1. Check Oil Level. Add if Necessary.
	2. Oil Filter Not Installed.	2. Install Oil Filter.
	3. Control shift or Command Valve Blocked.	3. Check Each Slide Valve For Base Position and Ease Of Movement, Remove Particle.
	4. K3 Disc Burnt, Hot Spots or Rubbed Down.	4. Replace Inner and Outer Disc Carrier K3 And Control Valve.

AUTOMATIC TRANSMISSION - NAG1 (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
DELAYED ENGAGEMENT, NO TRANSFER OF POWER IN R AND/OR D, ALSO AT TIMES	1. Oil Level Too Low.	1. Check Oil Level. Add if Necessary.
	2. Recognition Switch - Selector Lever Position.	2. Replace Recognition Switch Only When Intermediate Position or Fault is Indicated.
	3. Oil Filter Not Installed.	3. Install Oil Filter.
	4. AEV, Delayed Pressure Build Up On Piston B2/B3.	4. Install New Shifting Procedure (TCM, electrohydraulic control unit or repair set).
	5. Wrong Combination TCM/ Electrohydraulic Control Unit.	5. Check Combination TCM/Electrohydraulic Control Unit. Replace TCM Resp. Electrohydraulic Control Unit, if necessary.
NO UPSHIFT OF 1ST GEAR AT TIMES	1. Connector Ballast Unit. Output Speed Sensor Loose, Incorrectly Contacted.	1. Check Connectors, Replace Output Speed sensor If Necessary.
	2. Output Speed Sensor Defective	2. Replace Output Speed Sensor.
LEAKAGE AT THE AREA OF THE ELECTRICAL PLUG TO THE CONDUCTOR PLATE	1. Deformation O-Rings.	1. Replace O-Rings.
	2. Deformation Adapter.	2.Replace Adaptor.
	3. The Conductor Plate Is Not Fitted Surface To Surface On The Valve Body In One Corner, The Plug Is Not Centered In The Socket And The O-ring Will Not Seal.	3. Remove Nose Of Conductor Plate.
	4. Contacting At The Conductor Plate Leaky. Oil In Harness, Sometimes In The Control Module.	4. Replace Conductor Plate.
LEAKAGE AT THE AREA OF BELL HOUSING/ TORQUE CONVERTER	1. Bolts (Torx M6) Outer Disc Carrier B1.	1. Clean Thread and Install the Bolts Using Sealer.
OIL LEAKS	1. 6 Lower Bolts (TorxM8) Converter Housing.	1. Clean Thread and Install the Bolts Using Sealer.
	2. Oil Drain Plug Converter Loose Resp. No Seal Ring Installed.	2. Install Drain Plug Correctly.
	3. Weld Seam Of Torque Converter Leaky.	3. Replace Torque Converter.
	4. Radial Sealing Ring Oil Pump Defective.	4. Replace Sealing Ring.
	5. O-Ring Oil Pump Defective Or Not Installed.	5. Install O-Ring.
	6. Bushing Of Oil Pump Loose, caused By Missing Fit Bolt At Transmission/Engine Flange.	6. Install Fit Bolt If Necessary.

AUTOMATIC TRANSMISSION - NAG1 (Continued)

STANDARD PROCEDURE - 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

(1) Disconnect the negative (ground) battery cable.

CAUTION: Isolate ground lead to prevent accidental contact.

(2) Apply parking brake.
(3) Move gear selector lever to position ″N″.
(4) Remove oil drain plug (2) (Fig. 20) and drain automatic transmission oil into a clean container.

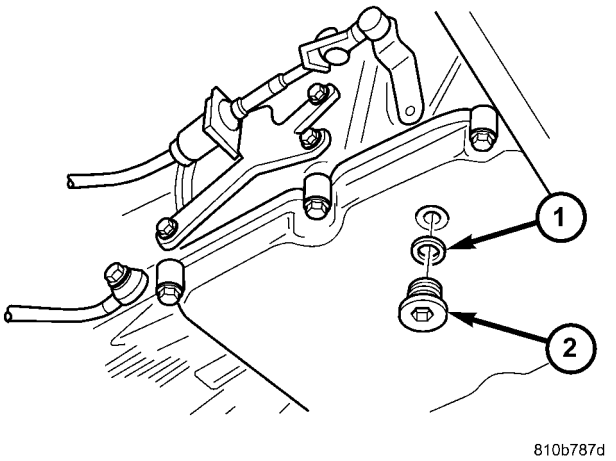


Fig. 20 Drain Transmission

1 - SEAL
2 - DRAIN PLUG

(5) Remove oil filler pipe.
(a) Remove bolts (2) (Fig. 21) to cylinder head.
(b) Remove bolt (3) (Fig. 21) to transmission flange and bolt (2) to transmission housing.
(c) Pull lower connection of oil filler pipe (1) (Fig. 21) out of the fill hole in the side of the transmission housing.
(d) Guide oil filler pipe (1) (Fig. 21) up and out.
(6) Remove exhaust heat shield (5) (Fig. 22).
(7) Remove retaining bracket (4) (Fig. 22).

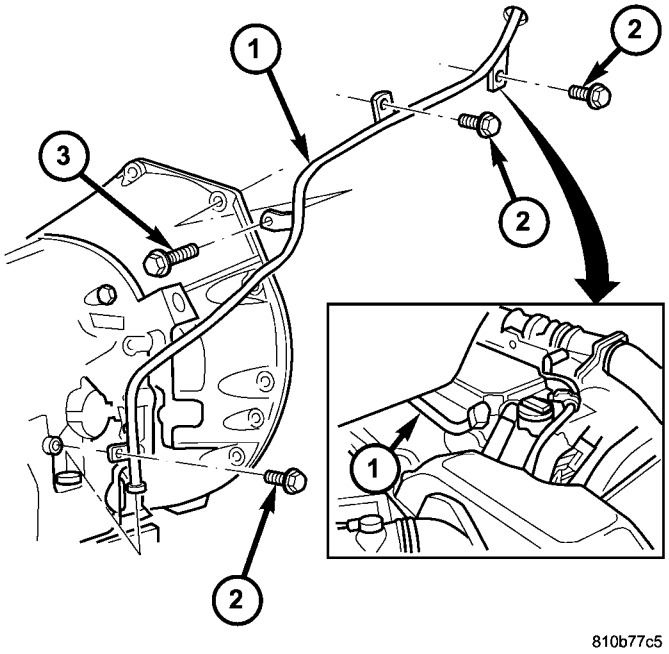


Fig. 21 Remove the Fill Tube

1 - FILL TUBE
2 - BOLTS TO CYLINDER HEAD AND TRANSMISSION HOUSING
3 - BOLT TO TRANSMISSION FLANGE

(8) Detach propeller shaft (1) (Fig. 22) at transmission (Refer to 3 - DIFFERENTIAL & DRIVELINE/ PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL). Move propeller shaft to the right and tie up.

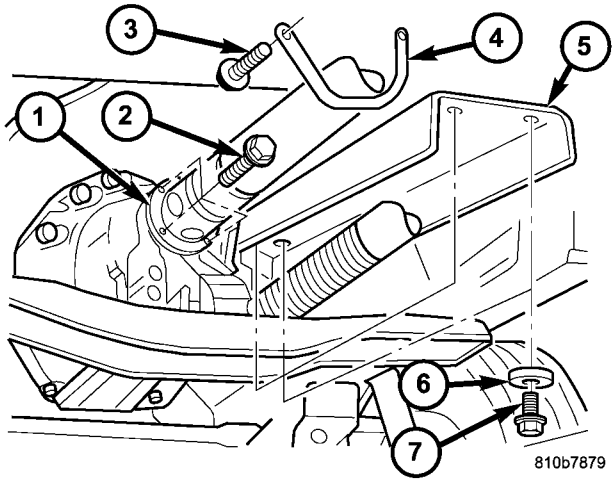


Fig. 22 Remove Propeller Shaft and Heat Shield

1 - PROPELLER SHAFT
2 - BOLT
3 - BOLT
4 - RETAINING BRACKET
5 - HEAT SHIELD
6 - WASHER
7 - BOLT

(9) Remove the cooler lines at transmission.

(a) Remove bracket for the oil cooler feed and return lines (1) (Fig. 23) from engine oil pan flange. Detail shows right side of motor. Position is mirrored for the left side of engine.

(b) Detach bracket of cable retainer (4) (Fig. 24) from the threaded shank of a engine oil pan bolt (5).

(c) Press cable retainer (4) (Fig. 24) down and out.

(d) Remove the bolts holding the oil cooler lines (6) (Fig. 25) to the left and right sides of transmission and hang the lines to the side.

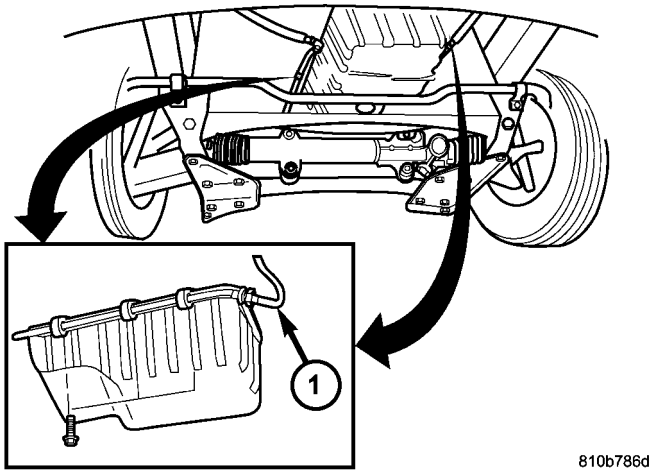


Fig. 23 Remove Cooler Line Supports

1 - COOLER LINES

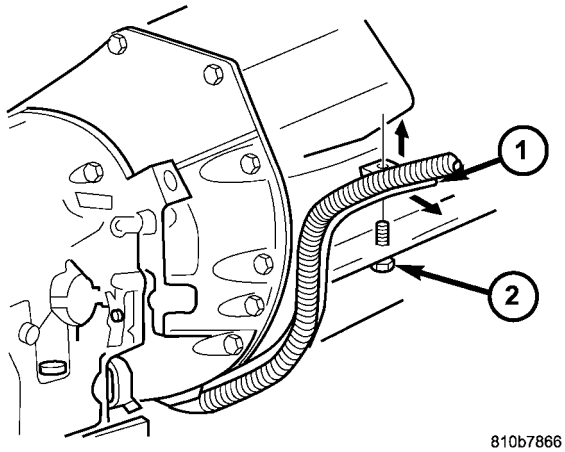


Fig. 24 Remove Cable Support

1 - CABLE
2 - BOLT

(10) Disconnect the transmission electrical connector (2) (Fig. 26) from transmission and hang to the side. Turn sealing ring (3) counterclockwise and disconnect plug connection (2).

(11) Detach shift cable at transmission.

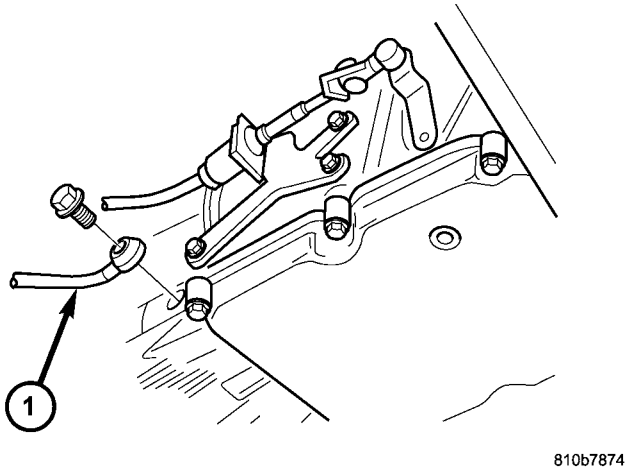


Fig. 25 Remove Driver's Side Cooler Line

1 - COOLER LINE

(a) Unlatch ball socket latch (Fig. 27) of cable.

(b) Unclip shift cable retainer from retainer bracket. When pulling out cable, press together hooks of shift cable retainer at the points shown (arrows).

(c) Pull shift cable out of ball socket. Ball socket can remain on transmission lever.

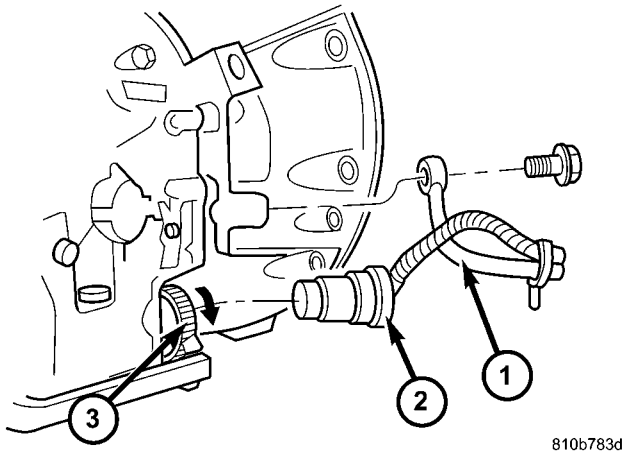


Fig. 26 Remove Transmission Electrical Connector and Cooler Line

1 - COOLER LINE
2 - TRANSMISSION ELECTRICAL CONNECTOR
3 - SEALING RING

(12) Remove the torque converter bolts.

(a) Remove the steering gear (1) (Fig. 28) from the chassis crossmember.

(b) Lower the steering gear (1) (Fig. 28) downwards.

(c) Remove the plastic torque converter access cover (1) (Fig. 29) at back of engine flange.

AUTOMATIC TRANSMISSION - NAG1 (Continued)

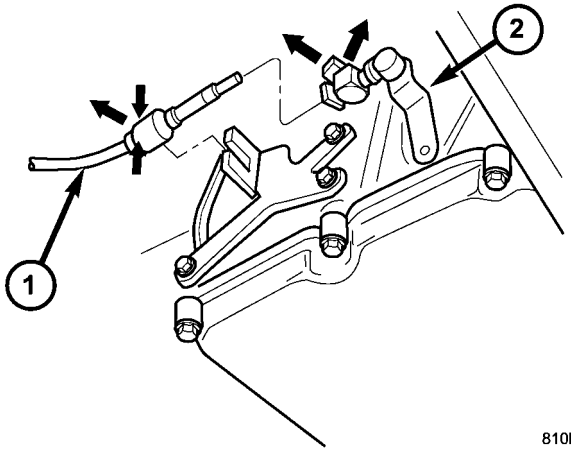


Fig. 27 Remove Shift Cable From Transmission

1 - SHIFT CABLE
2 - TRANSMISSION SHIFT LEVER

(d) Rotate engine by hand until bolts (2) (Fig. 29) are in front of opening. Rotate engine forwards at crankshaft.

(e) To remove bolts, position a ratchet with long extension and joint nut as shown (Fig. 30).

(f) Remove 3 x 2 bolts (2) (Fig. 29) at circumference of driving plate.

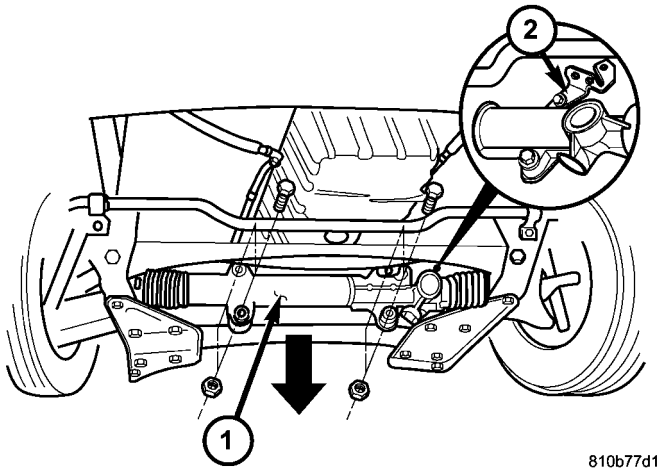


Fig. 28 Lower Steering Gear

1 - STEERING GEAR
2 - BRACKET

(13) Support engine. Insert wooden block between oil pan and front chassis crossmember beam.

(14) Remove vent hose bracket and tie back to one side.

(15) Disconnect ground strap and tie back to one side.

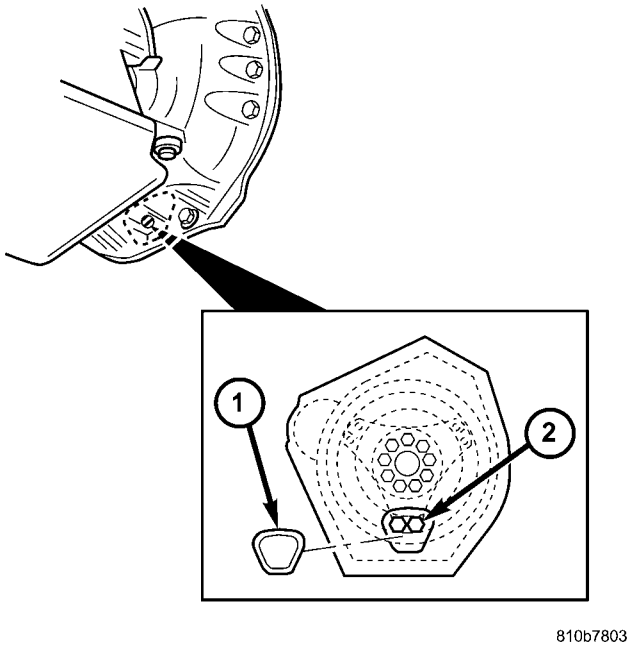


Fig. 29 Remove Torque Converter Access Cover

1 - TORQUE CONVERTER ACCESS COVER
2 - BOLT

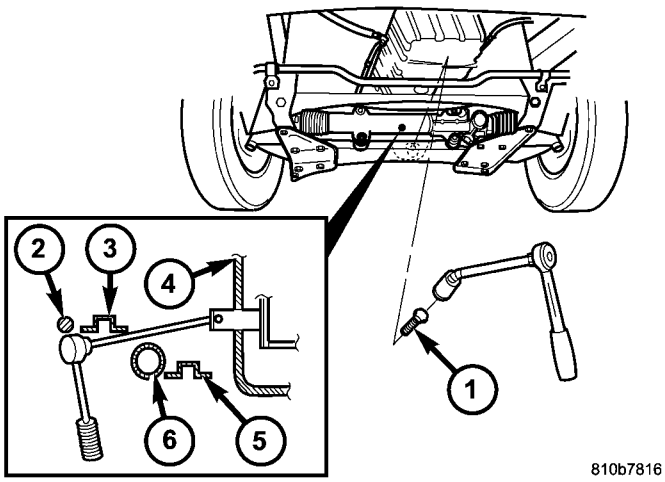


Fig. 30 Remove Torque Converter Bolts

1 - BOLT
2 - STABILIZER BAR
3 - REINFORCEMENT PLATE
4 - OPENING
5 - CHASSIS CROSSMEMBER
6 - STEERING GEAR

(16) Remove bolts (A) (Fig. 31) on underside of transmission. Two bolts (A) on top of transmission must remain in the housing.

(17) Place hydraulic transmission jack under transmission and raise slightly. Secure transmission on hydraulic jack with a strap or ask an assistant to hold it.

(18) Remove rear engine cross member (4) (Fig. 31). First remove the nuts (5) at the outside ends of the engine crossmember. Then remove the bolts (1) of the transmission mount.

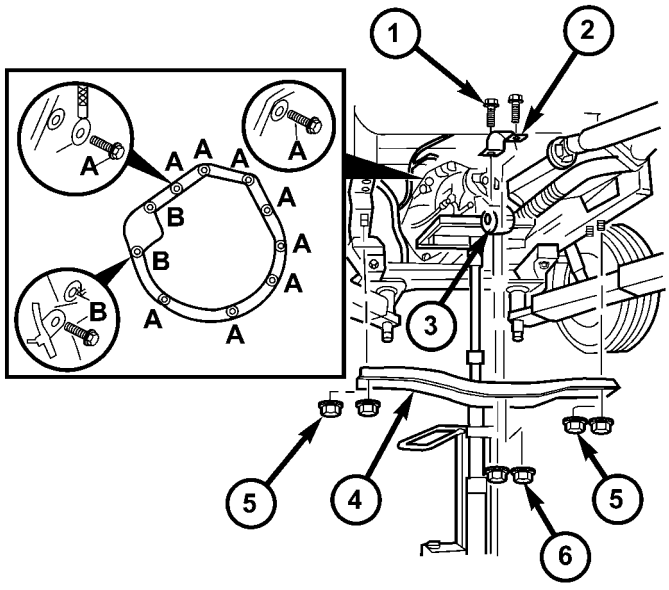


Fig. 31 Support Transmission and Remove Bolts

1 - BOLT, TRANSMISSION MOUNT
2 - UPPER SHELL FOR TRANSMISSION MOUNT
3 - TRANSMISSION MOUNT
4 - CROSSMEMBER
5 - NUT, ENGINE CROSSMEMBER
6 - NUT, TRANSMISSION SUPPORT

(19) Remove the last bolts (A, B) (Fig. 31) on the top of the transmission.

(20) Remove the transmission towards the rear and lower. Ensure that the converter remains in the transmission housing when the transmission is removed.

(21) Remove the torque converter.

DISASSEMBLY

(1) Remove the torque converter (1) (Fig. 32).

(2) Place transmission in a vertical position.

(3) Measure input shaft end play as follows (Fig. 33).

(a) Attach Adapter 8266-18 to Handle 8266-8.

(b) Attach dial indicator C-3339 to Handle 8266-8.

(c) Install the assembled tool onto the input shaft of the transmission and tighten the retaining screw on Adapter 8266-18 to secure it to the input shaft.

(d) Position the dial indicator plunger against a flat spot on the oil pump and zero the dial indicator.

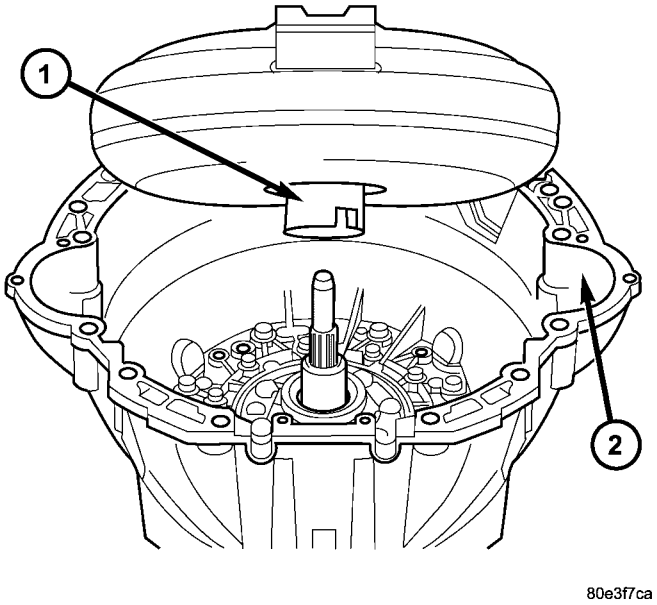


Fig. 32 Remove Torque Converter

1 - TORQUE CONVERTER
2 - CONVERTER HOUSING

(e) Move the input shaft in and out. Record the maximum travel for assembly reference.

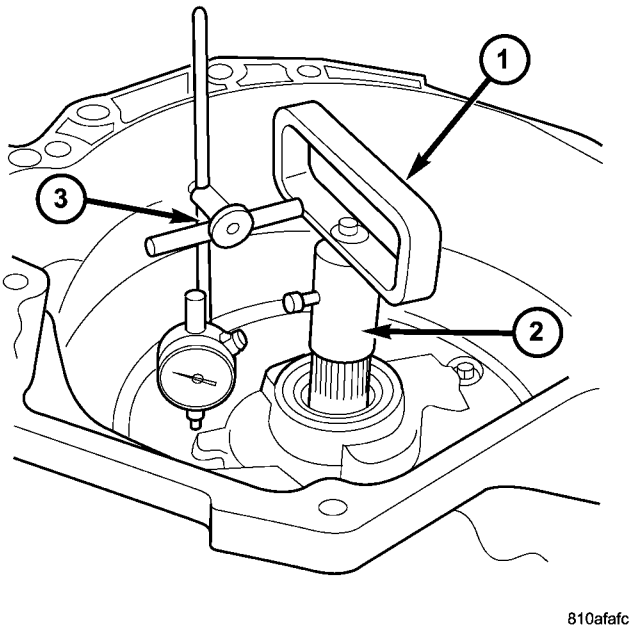


Fig. 33 Checking Input Shaft End Play

1 - TOOL 8266-8
2 - TOOL 8266-18
3 - TOOL C-3339

(4) Loosen guide bushing (12) (Fig. 34) and remove from transmission housing.

AUTOMATIC TRANSMISSION - NAG1 (Continued)

(5) Detach oil pan (5) (Fig. 34).
(6) Remove oil filter (4) (Fig. 34).
(7) Unscrew Torx socket bolts (3) and remove electrohydraulic unit (2).

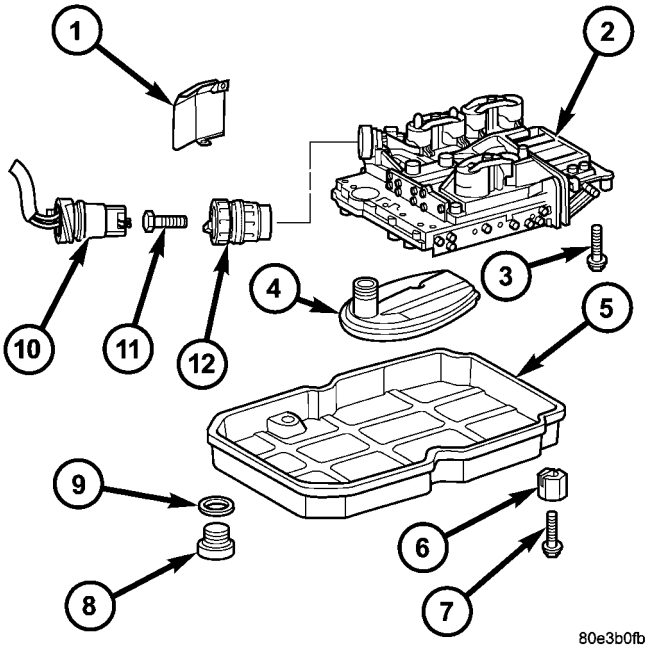


Fig. 34 Remove Electrohydraulic Unit

1 - HEAT SHIELD
2 - ELECTROHYDRAULIC UNIT
3 - BOLT
4 - OIL FILTER
5 - OIL PAN
6 - CLAMPING ELEMENT
7 - BOLT
8 - DRAIN PLUG
9 - DRAIN PLUG GASKET
10 - 13-PIN PLUG CONNECTOR
11 - BOLT
12 - GUIDE BUSHING

(8) Place the transmission in PARK to prepare for the removal of the output shaft nut.
(9) Remove the nut holding the propeller shaft flange to the output shaft and remove the flange.
(10) Remove the transmission rear oil seal with a suitable slide hammer and screw.
(11) Remove the transmission output shaft washer. Be sure to tag the washer since it is very similar to the geartrain end-play shim and they must not be interchanged.
(12) Remove the transmission rear output shaft bearing retaining ring (1) (Fig. 35).

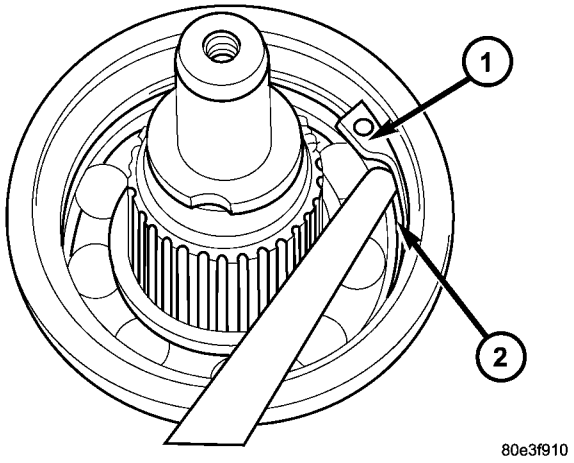


Fig. 35 Remove Rear Output Shaft Retaining Ring

1 - RETAINING RING
2 - OUTPUT SHAFT BEARING

(13) Position Bearing Remover 9082 (Fig. 36) over the inner race of the output shaft bearing.

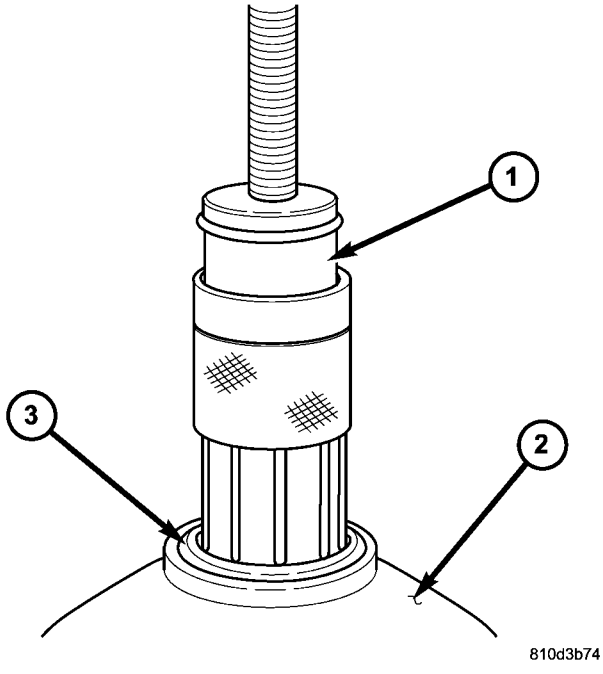


Fig. 36 Position Remover 9082 On Bearing

1 - BEARING REMOVER 9082
2 - TRANSMISSION CASE
3 - OUTPUT SHAFT BEARING

(14) Slide the collar (Fig. 37) on the Bearing Remover 9082 downward over the fingers of the tool.

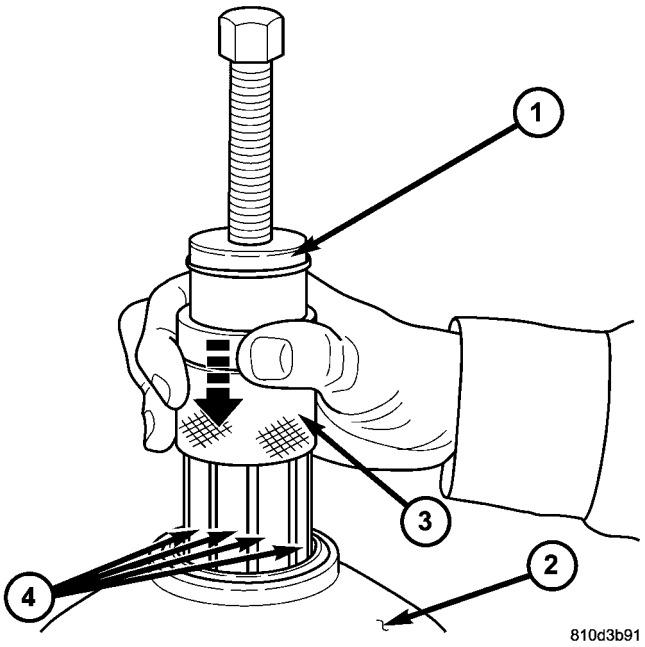


Fig. 37 Slide Remover 9082 Collar Downward

1 - BEARING REMOVER 9082
2 - TRANSMISSION CASE
3 - COLLAR
4 - FINGERS

(15) Remove the output shaft bearing (Fig. 38).

(16) Remove the geartrain end-play shim from the output shaft. Be sure to tag the shim since it is very similar to the output shaft washer and they must not be interchanged.

(17) Remove the bolts holding the transmission housing to the converter housing from inside the converter housing.

(18) Stand the transmission upright on the converter housing. Be sure to use suitable spacers between the bench surface and the converter housing since the input shaft protrudes past the front surface of the housing.

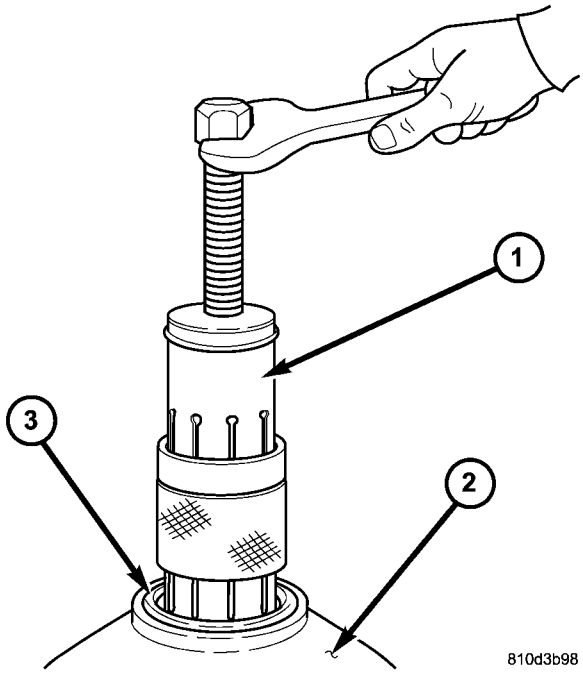


Fig. 38 Remove Output Shaft Bearing

1 - BEARING REMOVER 9082
2 - TRANSMISSION CASE
3 - OUTPUT SHAFT BEARING

(19) Remove the remaining bolts holding the transmission housing to the converter housing.

(20) Remove the transmission housing from the converter housing.

(21) Remove output shaft with center and rear gear set and clutch K3 (3) (Fig. 39).

(22) Remove thrust needle bearing (4) and thrust washer (5) (Fig. 39).

(23) Remove drive shaft with clutch K2 and front gear set (6).

(24) Remove clutch K1 (1).

AUTOMATIC TRANSMISSION - NAG1 (Continued)

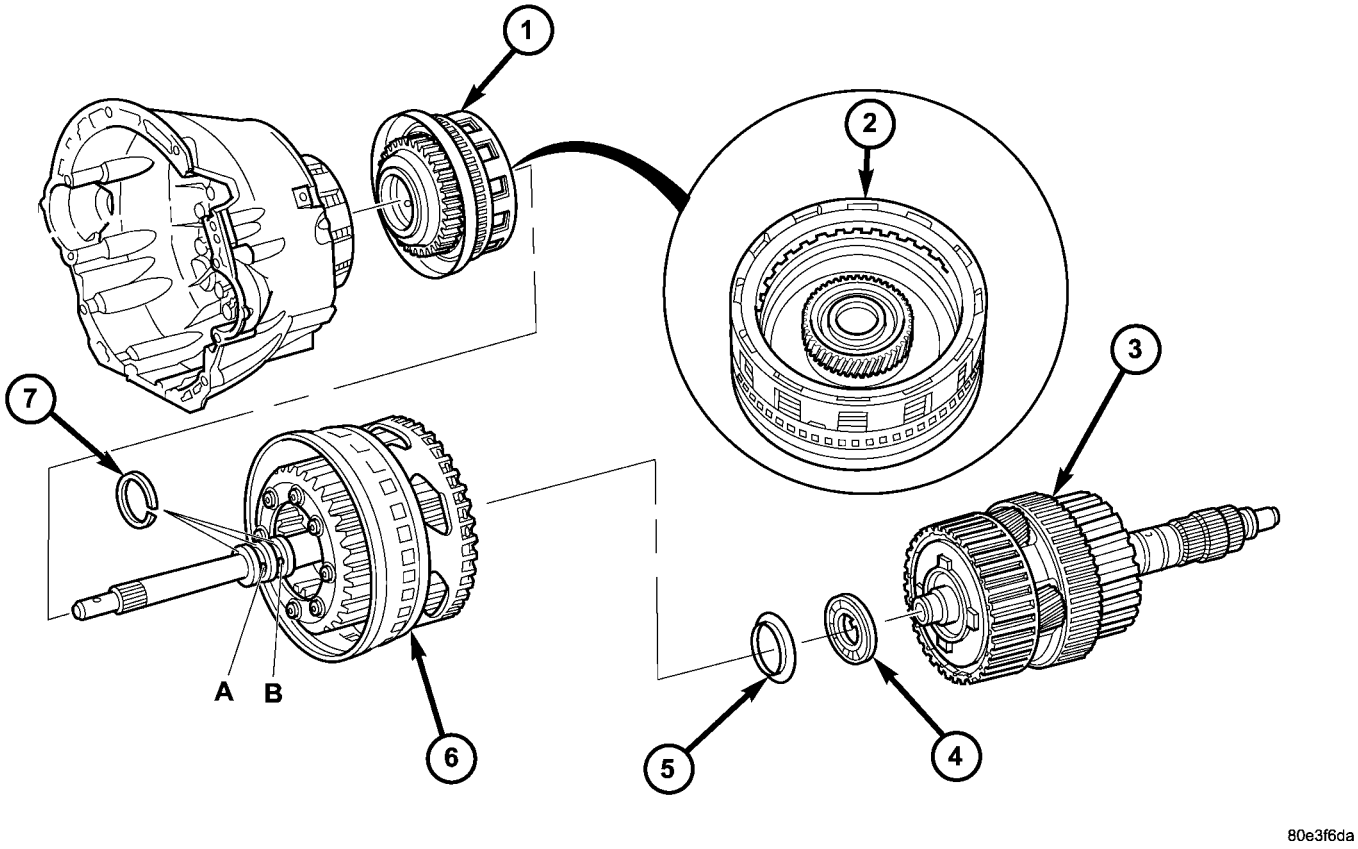


Fig. 39 Remove K1, K2, and K3 Clutches

1 - DRIVING CLUTCH K1
2 - SUN GEAR OF FRONT PLANETARY GEAR SET
3 - DRIVING CLUTCH K3, OUTPUT SHAFT , AND CENTER AND REAR PLANETARY GEAR SETS
4 - THRUST NEEDLE BEARING
5 - THRUST WASHER
6 - FRONT PLANETARY GEAR SET, DRIVING CLUTCH K2, AND DRIVE SHAFT
7 - TEFLON RINGS

(25) Unscrew Torx socket bolts (4) (Fig. 40) and remove oil pump (6). Screw two opposed bolts into the oil pump housing and press the oil pump out of the converter housing by applying light blows with a plastic hammer.

(26) Remove and discard the torque converter hub seal and the oil pump outer o-ring seal from the oil pump.

(27) Unscrew Torx socket bolts (1) (Fig. 40) and remove multiple-disc brake B1 (5) from converter housing. Screw two opposed bolts into the multiple-disc brake B1 (5) and separate from the converter housing by applying light blows with a plastic hammer.

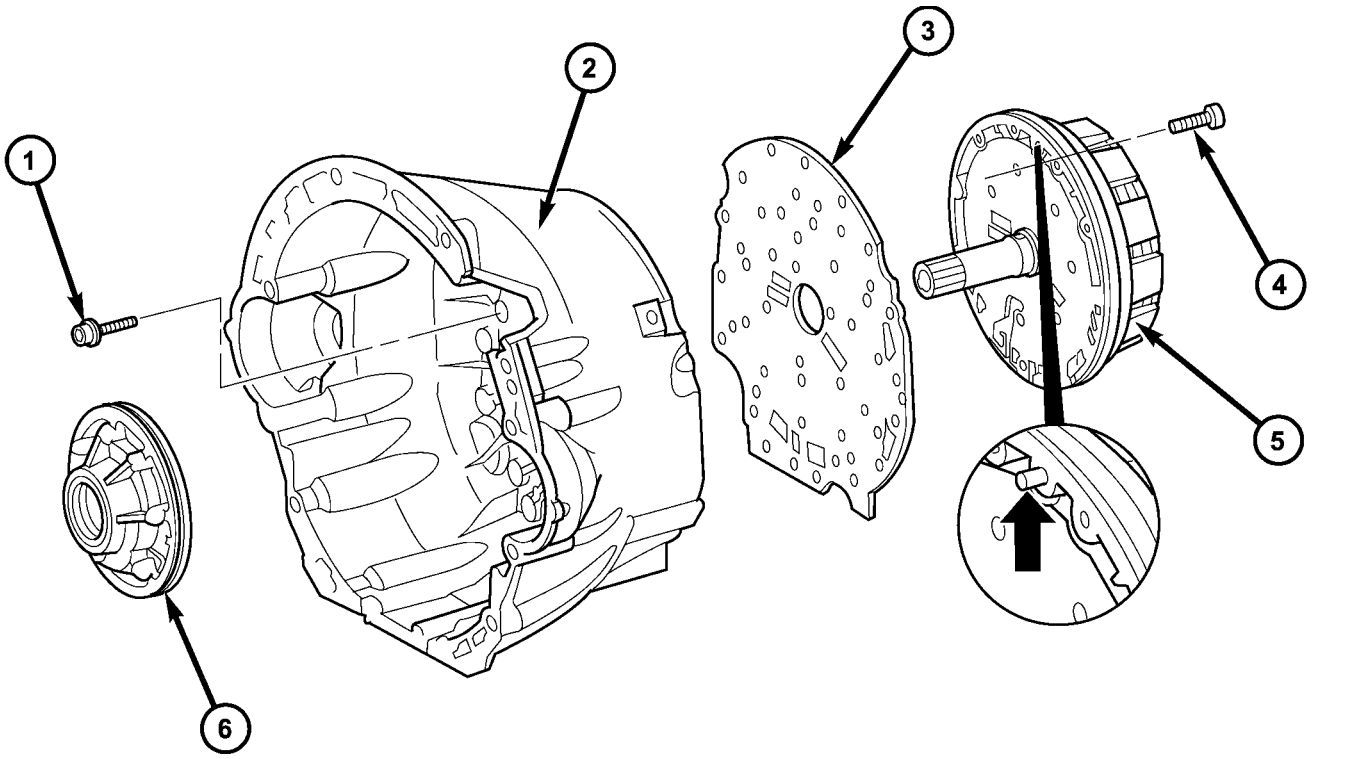


Fig. 40 Remove Holding Clutch B1 and Oil Pump

1 - BOLTS - M6X32
2 - CONVERTER HOUSING
3 - INTERMEDIATE PLATE
4 - BOLTS - M8X35
5 - HOLDING CLUTCH B1
6 - OIL PUMP

(28) Detach intermediate plate (3) (Fig. 40) from converter housing (2).

(29) Remove multiple-disc pack B3 (2) (Fig. 41) and spring washer (3) by removing snap-ring (1) in transmission housing. To facilitate removal of the snap-ring (1), compress the multiple-disc pack B3 (2).

(30) Unscrew Torx socket bolts (7) (Fig. 41).

(31) Remove multiple-disc brake B2 (4) (Fig. 41) from transmission housing. The externally toothed disc carrier for multiple-disc holding clutch B2 is also the piston for multiple-disc holding clutch B3.

(32) Remove parking lock gear (5) (Fig. 41).

ASSEMBLY

(1) Insert parking lock gear (5) (Fig. 42).

(2) Install multiple-disc holding clutch B2 (4) in transmission housing (6) (Fig. 42).

(3) Screw in Torx socket bolts (7). Tighten the bolts to 16 N·m (141 in.lbs.).

AUTOMATIC TRANSMISSION - NAG1 (Continued)

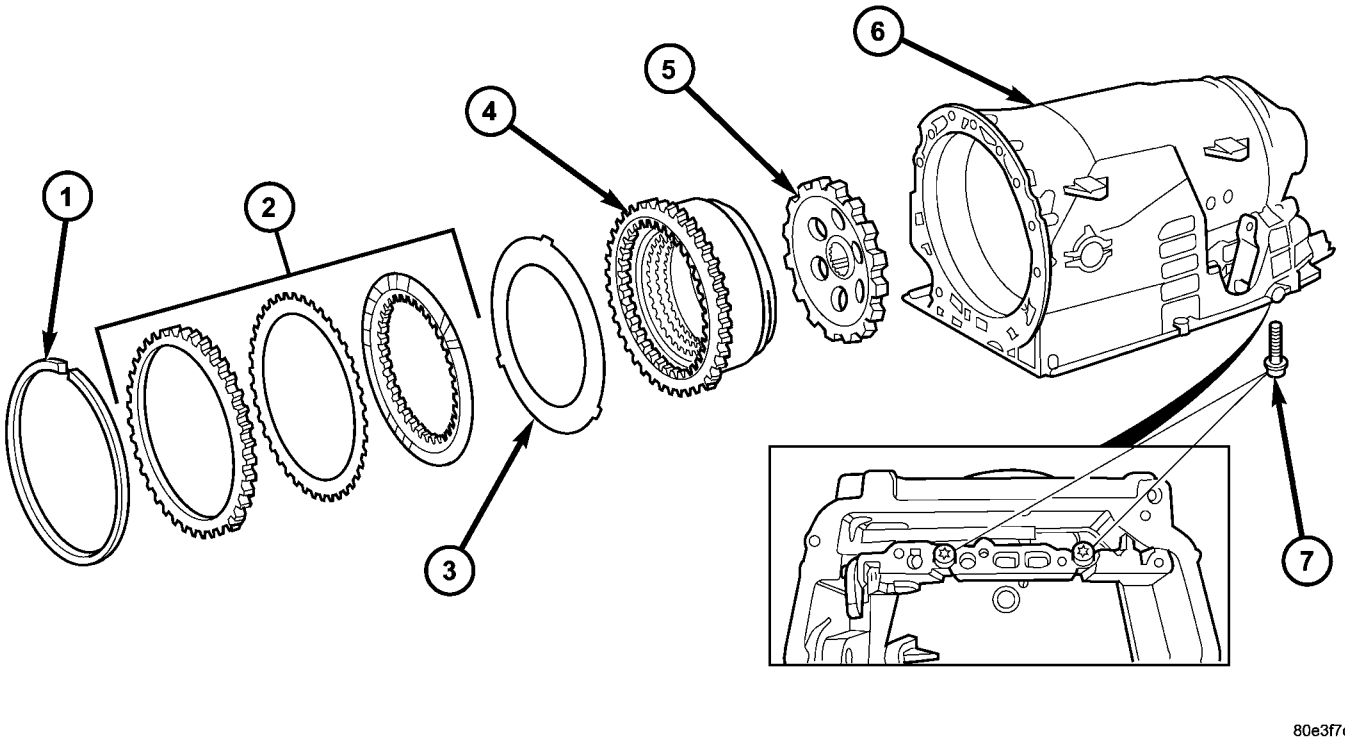


Fig. 41 Remove B2, B3, and Parking Gear

1 - SNAP-RING
2 - HOLDING CLUTCH B3 DISCS
3 - SPRING WASHER
4 - HOLDING CLUTCH B2
5 - PARK GEAR
6 - TRANSMISSION HOUSING
7 - BOLTS - M8X60

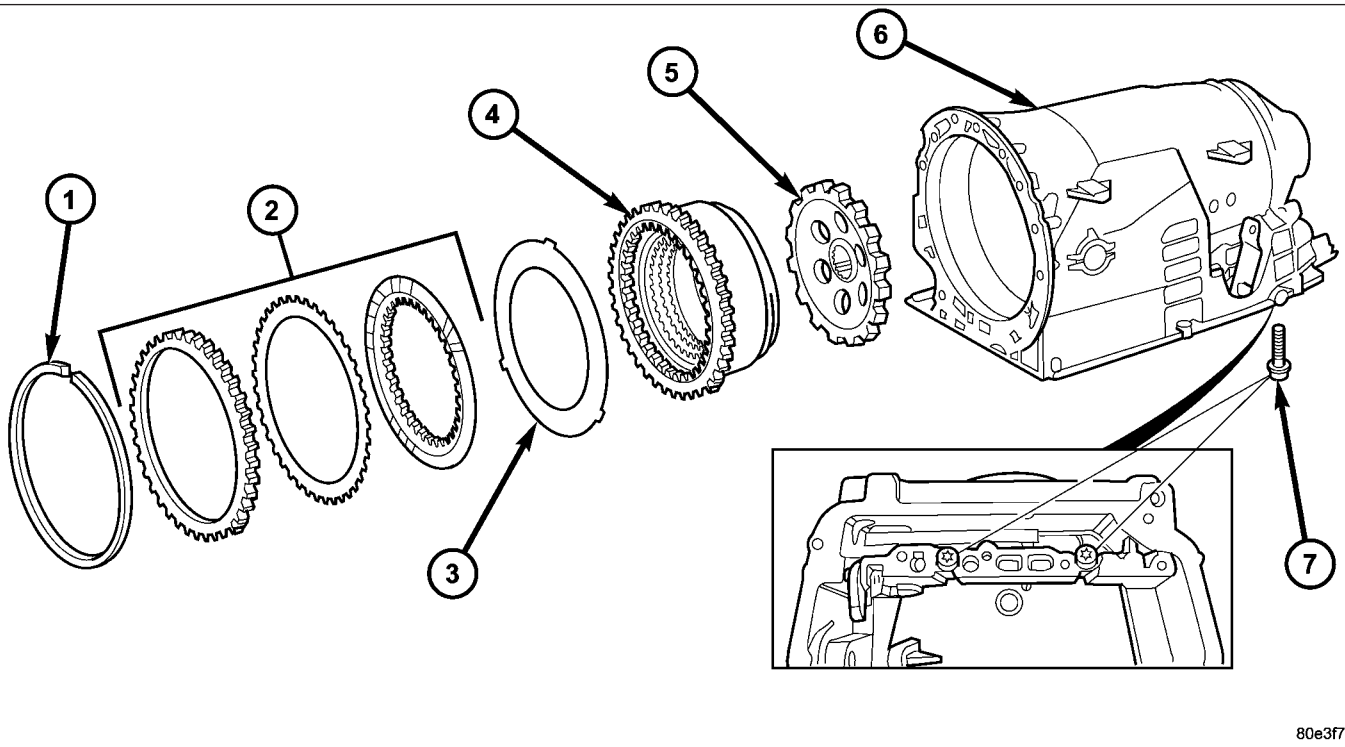


Fig. 42 Install B2, B3, and Parking Gear

1 - SNAP-RING
2 - HOLDING CLUTCH B3 DISCS
3 - SPRING WASHER
4 - HOLDING CLUTCH B2
5 - PARK GEAR
6 - TRANSMISSION HOUSING
7 - BOLTS - M8X60

AUTOMATIC TRANSMISSION - NAG1 (Continued)

NOTE: During the measurement the snap ring (7) (Fig. 43) must contact the upper bearing surface of the groove in the outer multiple-disc carrier (8).

NOTE: Pay attention to sequence of discs. Place new friction multiple-discs in ATF fluid for one hour before installing.

(4) Insert and measure spring washer (4) (Fig. 43) and multiple-disc pack B3 (2, 6).

(a) Put multiple-discs for multiple-disc brake B3 together in the sequence shown in the illustration and insert individually.

(b) Using a feeler gauge, determine the play ″L″ at three points between the snap ring (7) and outer multiple-disc (1). B3 clutch clearance should be 1.0-1.4 mm (0.039-0.055 in.). Adjust the clearance as necessary.

(c) Adjust with snap-ring (7), if necessary. Snap-rings are available in thicknesses of 3.2 mm (0.126 in.), 3.5 mm (0.138 in.), 3.8 mm (0.150 in.), 4.1 mm (0.162 in.), 4.4 mm (0.173 in.), and 4.7 mm (0.185 in.).

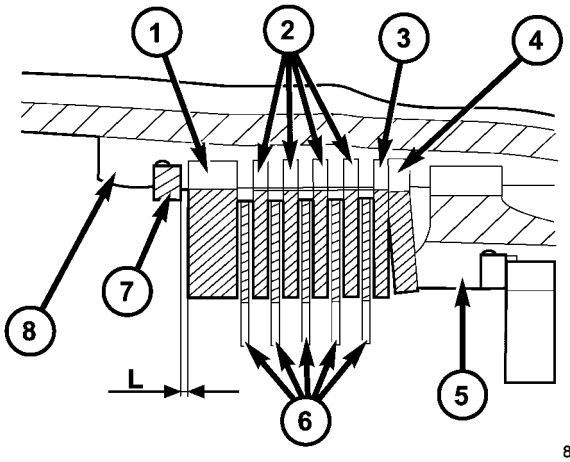


Fig. 43 Measure B3 Clutch Clearance

1 - OUTER DISC - 6.5 MM (0.256 IN.)	5 - PISTON
2 - OUTER DISCS - 1.8 MM (0.071 IN.)	6 - FRICTION DISCS
3 - OUTER DISCS - 1.8 MM (0.071 IN.)	7 - SNAP-RING
4 - SPRING WASHER	8 - B3 DISC CARRIER

(5) Place intermediate plate (3) on converter housing (2) and align.

NOTE: The intermediate panel can generally be used several times. The panel must not be coated with sealant

(6) Check that the K1 clutch feed hole (Fig. 44) in the inner hub of clutch B1 is free before installing clutch B1.

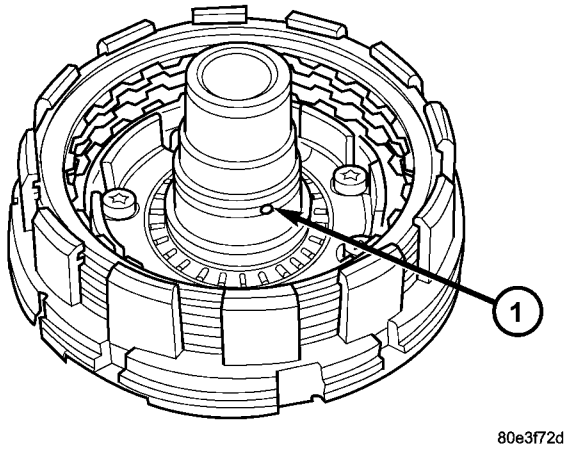


Fig. 44 Check K1 Feed Hole

1 - K1 CLUTCH FEED HOLE

(7) Install the holding clutch B1 (5) (Fig. 45) onto the converter housing and intermediate plate. Installed position of clutch B1 in relation to converter housing is specified by a plain dowel pin in clutch B1 (arrow).

(8) Install the bolts to hold clutch B1 (5) (Fig. 45) to the converter housing.

(9) Securely tighten multiple-disc brake B1 (5) on converter housing (2) to 10 N·m (88.5 in.lbs.).

(10) Install new torque converter hub seal (Fig. 46) into the oil pump using Seal Installer 8902A

(11) Install new oil pump outer o-ring seal onto oil pump (Fig. 46).

(12) Install oil pump (6) and securely tighten. Tighten the oil pump bolts to 20 N·m (177 in.lbs.).

(13) Using grease, insert Teflon rings (7) (Fig. 47) in the groove so that the joint remains together.

AUTOMATIC TRANSMISSION - NAG1 (Continued)

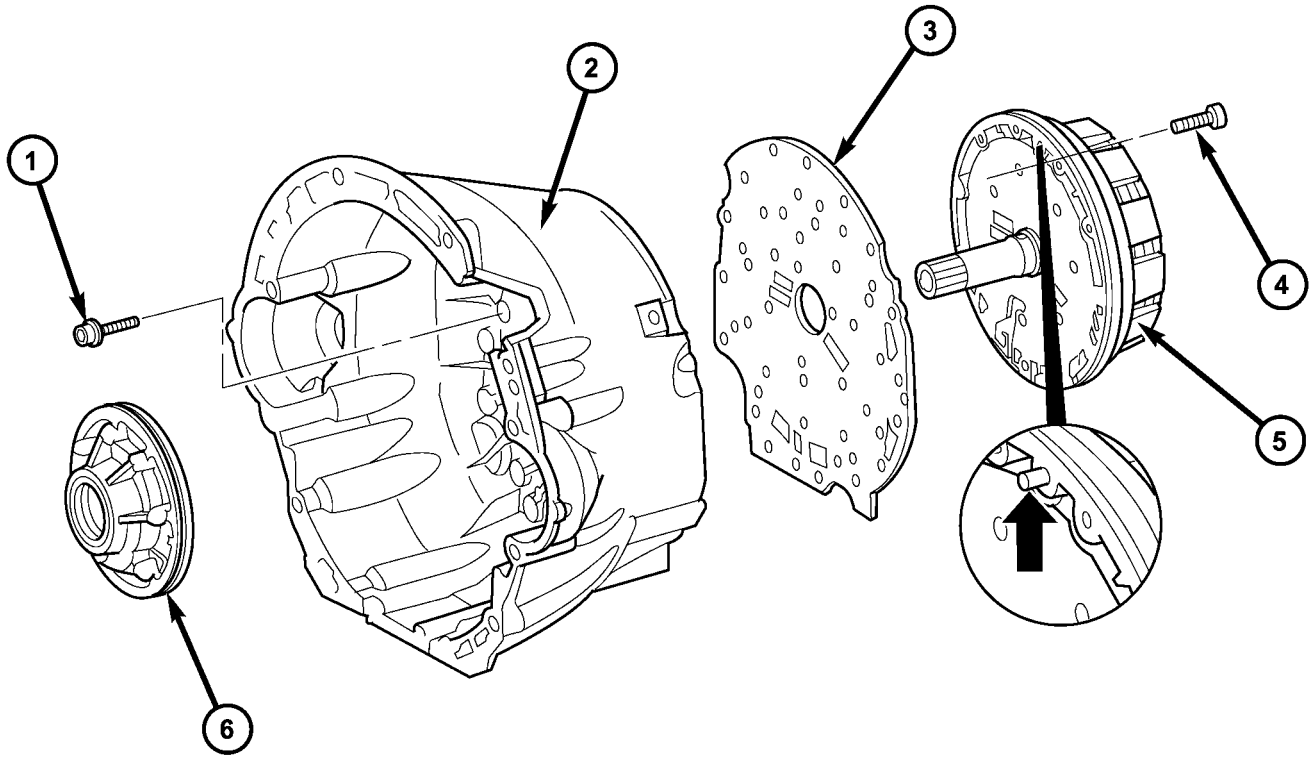


Fig. 45 Install Holding Clutch B1 and Oil Pump

1 - BOLTS - M6X32
2 - CONVERTER HOUSING
3 - INTERMEDIATE PLATE
4 - BOLTS - M8X35
5 - HOLDING CLUTCH B1
6 - OIL PUMP

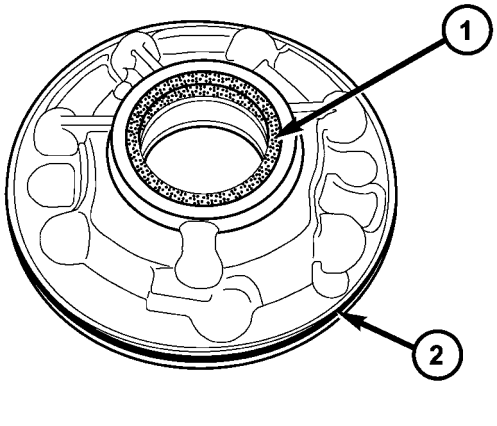


Fig. 46 Install New Oil Pump Seals

1 - INNER OIL SEAL
2 - OUTER OIL SEAL

(14) Install the K1 (1) clutch onto the B1 clutch (Fig. 47).

(15) Install drive shaft with clutch K2 (6) and front gear set (1) (Fig. 47).

(16) Install front washer (5) and thrust needle bearing (4) (Fig. 47).

(17) Install output shaft with center and rear gear set and clutch K3 (3) (Fig. 47).

(18) Using grease, install both Teflon rings in the groove at the rear of the output shaft so that the joint stays together.

(19) Mount transmission housing on converter housing.

(20) Screw in Torx socket bolts through the transmission housing into the converter housing. Tighten the bolts to 20 N·m (177 in.lbs.).

(21) Measure end-play between park pawl gear and grooved ball bearing in order to select the proper geartrain end-play shim.

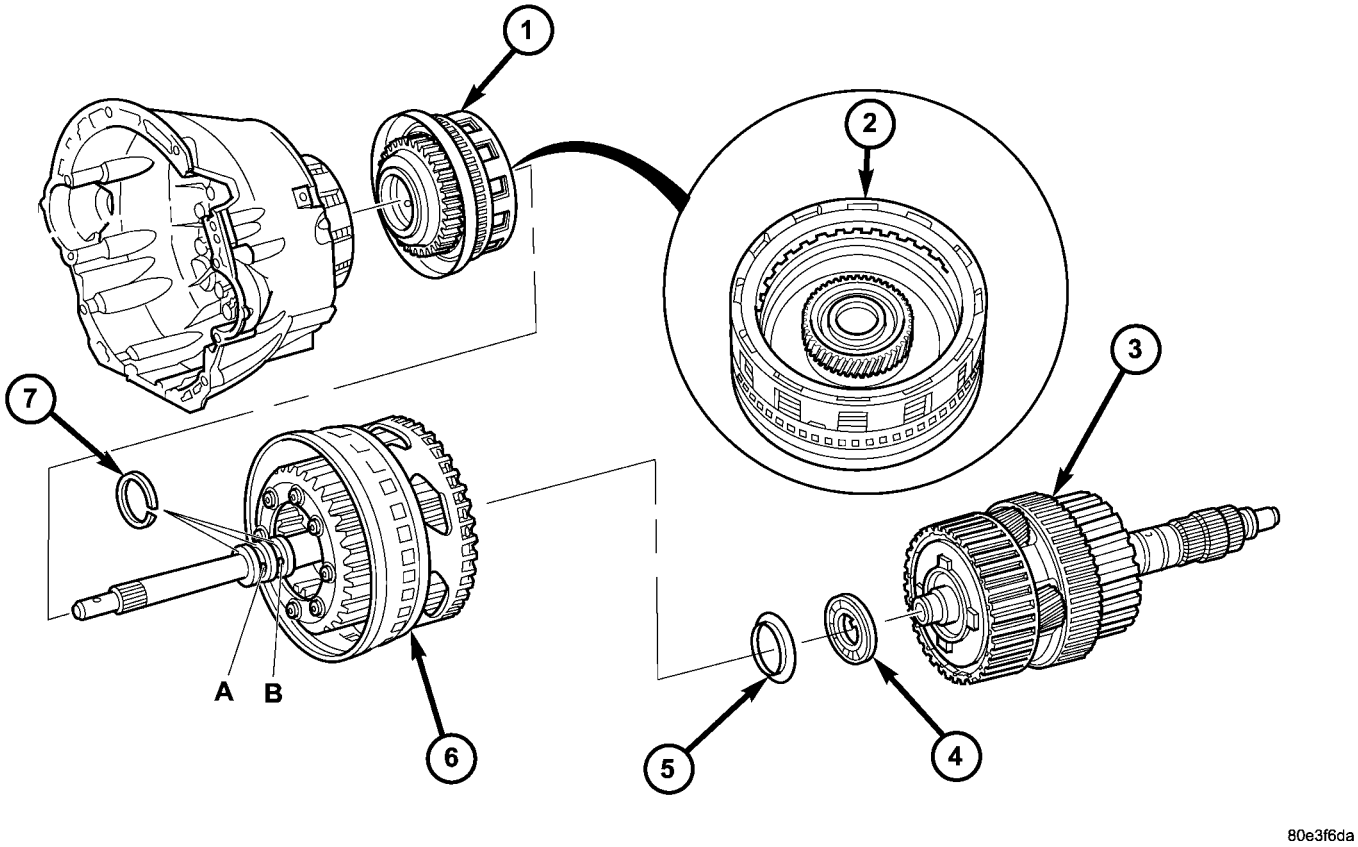


Fig. 47 Install K1, K2, and K3 Clutches

1 - DRIVING CLUTCH K1
2 - SUN GEAR OF FRONT PLANETARY GEAR SET
3 - DRIVING CLUTCH K3, OUTPUT SHAFT , AND CENTER AND REAR PLANETARY GEAR SETS
4 - THRUST NEEDLE BEARING
5 - THRUST WASHER
6 - FRONT PLANETARY GEAR SET, DRIVING CLUTCH K2, AND DRIVE SHAFT
7 - TEFLON RINGS

(a) Place Gauge Bar 6311 (1) on transmission housing. Using a depth gauge, measure from the gauge bar (1) to the parking lock gear (2) (Fig. 48).

(b) Using a depth gauge, measure from the Gauge Bar 6311 (1) to the contact surface of the output shaft bearing (2) in the transmission housing (Fig. 49).

(c) Subtract the first figure from the second figure to determine the current end-play of the transmission. Select a shim such that the end-play will be 0.3-0.5 mm (0.012-0.020 in.). Shims are available in thicknesses of 0.2 mm (0.008 in.), 0.3 mm (0.012 in.), 0.4 mm (0.016 in.), and 0.5 mm (0.020 in.).

(d) Install the selected end-play shim.

(22) Screw in Torx socket bolts through the converter housing into the transmission housing. Tighten the bolts to 20 N·m (177 in.lbs.).

(23) Install output shaft bearing in rear transmission housing.

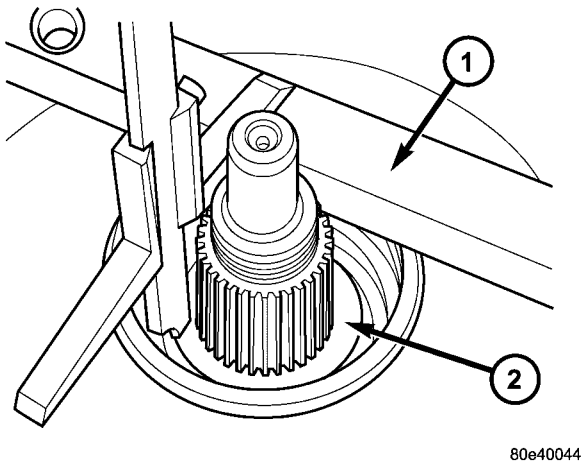


Fig. 48 Measure From Transmission Housing to Park Gear

1 - GAUGE BAR 6311
2 - PARK GEAR

AUTOMATIC TRANSMISSION - NAG1 (Continued)

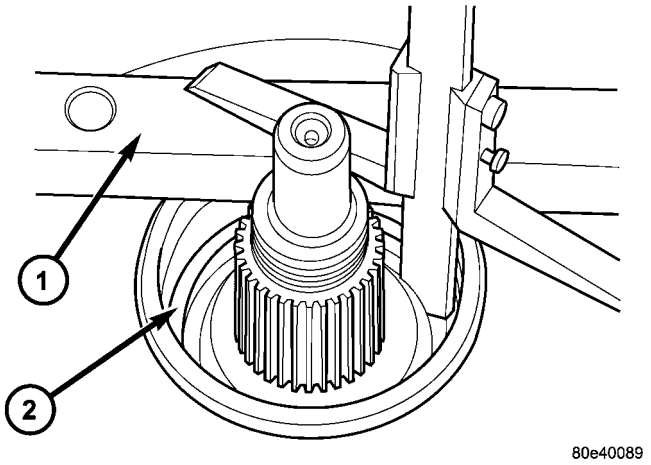


Fig. 49 Measure From Transmission Housing To Rear Bearing Contact Surface

1 - GAUGE BAR 6311
2 - OUTPUT SHAFT BEARING CONTACT SURFACE

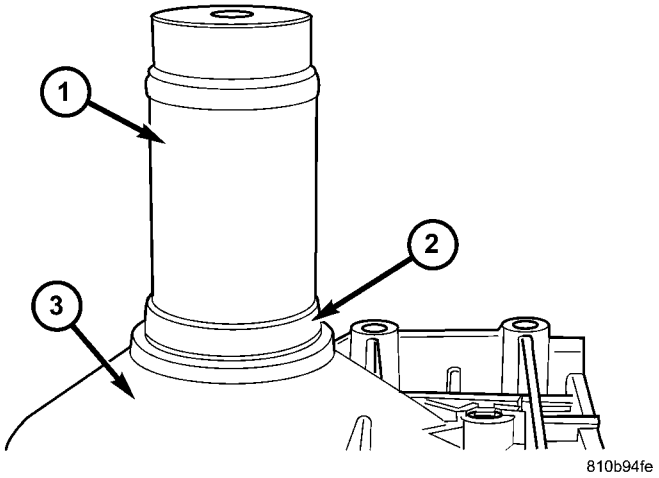


Fig. 50 Install Output Shaft Bearing

1 - BEARING INSTALLER 9287
2 - BEARING
3 - TRANSMISSION CASE

(a) Using Bearing Installer 9287 (Fig. 50), install the output shaft bearing into the transmission housing. **The closed side of the plastic cage must point towards the parking lock gear.**

(b) Install the retaining ring (Fig. 51). Ensure that the retaining ring is seated correctly in the groove.

(c) Check that there is no play between the bearing and the retaining ring using feeler gauge.

(d) There must be no play between the retaining ring and the bearing. If the ring cannot be installed, a thinner ring must be used. If there is play between the ring and the bearing, a thicker ring must be installed. Retaining rings are available in thicknesses of 2.0 mm (0.079 in.), 2.1 mm (0.083 in.), and 2.2 mm (0.087 in.).

(24) Rotate the transmission so that the bellhousing is pointed upward and ensuring that the output shaft is allowed to move freely.

(25) Measure input shaft end-play (Fig. 52).

NOTE: If end-play is incorrect, transmission is incorrectly assembled, or the geartrain end-play shim is incorrect. The geartrain end-play shim is selective.

(a) Attach Adapter 8266-18 to Handle 8266-8.

(b) Attach dial indicator C-3339 to Handle 8266-8.

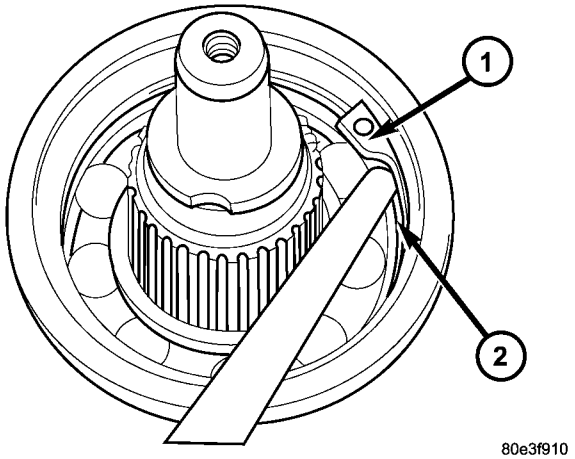


Fig. 51 Install Rear Output Shaft Retaining Ring

1 - RETAINING RING
2 - OUTPUT SHAFT BEARING

(c) Install the assembled tool onto the input shaft of the transmission and tighten the retaining screw on Adapter 8266-18 to secure it to the input shaft.

(d) Position the dial indicator plunger against a flat spot on the oil pump and zero the dial indicator.

(e) Move input shaft in and out and record reading. End play should be 0.3-0.5 mm (0.012-0.020 in.). Adjust as necessary.

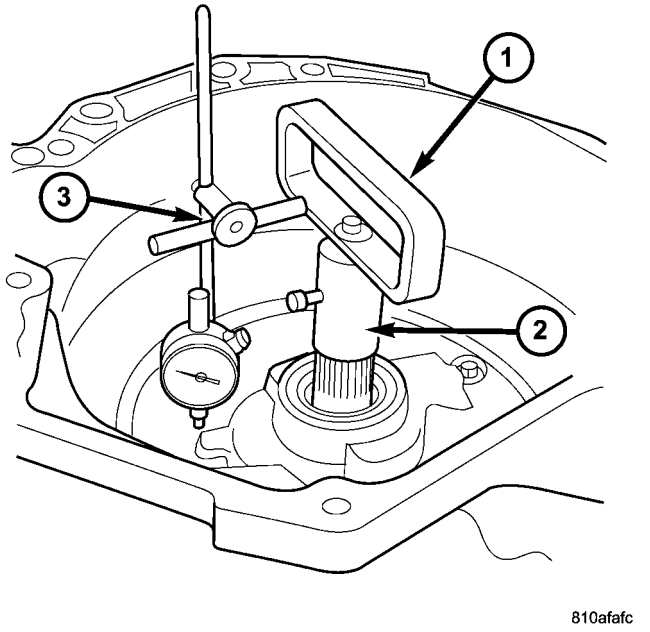


Fig. 52 Checking Input Shaft End Play

1 - TOOL 8266-8
2 - TOOL 8266-18
3 - TOOL C-3339

(26) Install the output shaft washer onto the output shaft.

(27) Install a new transmission rear seal into the transmission case with Seal Installer 8902A (Fig. 53).

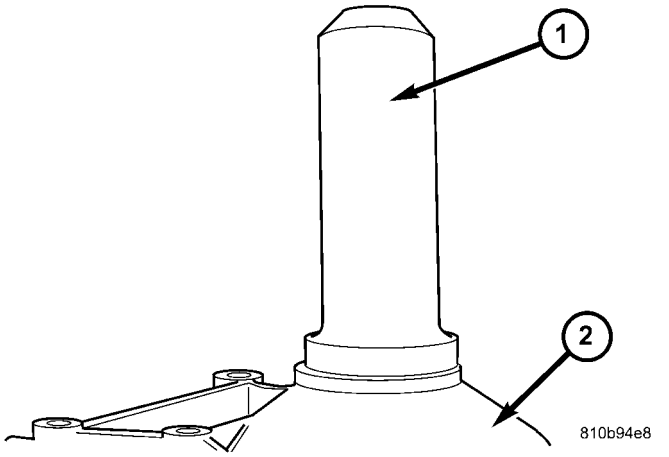


Fig. 53 Install Output Shaft Seal

1 - SEAL INSTALLER 8902A
2 - TRANSMISSION CASE

(28) Place the transmission in PARK to prepare for the installation of the output shaft nut.

(29) Install the propeller shaft flange onto the output shaft and install an new flange nut. Tighten the flange nut to 120 N·m (88.5 ft.lbs.).

(30) Stake the output shaft nut to the output shaft as follows.

(a) Place the Staking Tool 9078 and Driver Handle C-4171 onto the output shaft.

(b) Rotate the Staking Tool 9078 until the alignment pin engages the output shaft notch (Fig. 54).

(c) Press downward on the staking tool until the staking pin contacts the output shaft nut flange (Fig. 55).

(d) Strike the Driver handle C-4171 with a suitable hammer until the output shaft nut is securely staked to the output shaft.

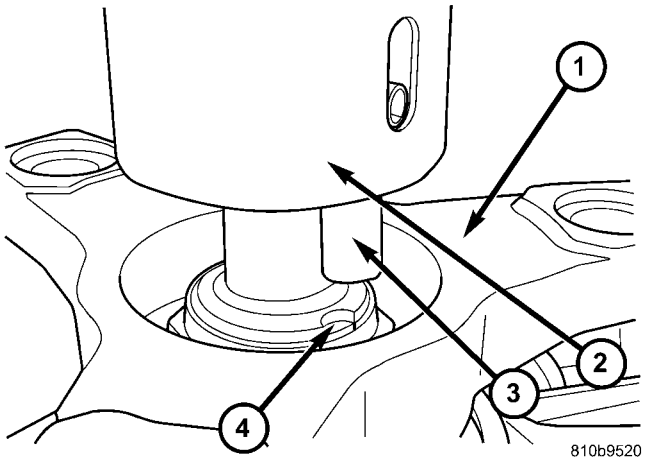


Fig. 54 Align Staking Tool 9078

1 - PROPELLER SHAFT FLANGE
2 - STAKING TOOL 9078
3 - ALIGNMENT PIN
4 - OUTPUT SHAFT NOTCH

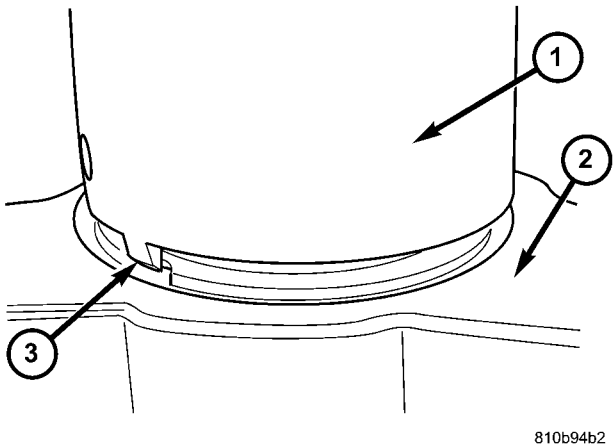


Fig. 55 Stake Output Shaft Nut

1 - STAKING TOOL 9078
2 - PROPELLER FLANGE
3 - STAKING PIN

(31) Install electrohydraulic unit (2). Tighten the bolts to 8 N·m (71 in.lbs.).

AUTOMATIC TRANSMISSION - NAG1 (Continued)

(32) Install oil filter (4) (Fig. 56).

(33) Install oil pan (5) (Fig. 56). Tighten the bolts to 8 N·m (71 in.lbs.).

(34) Install guide bushing (12) (Fig. 56).

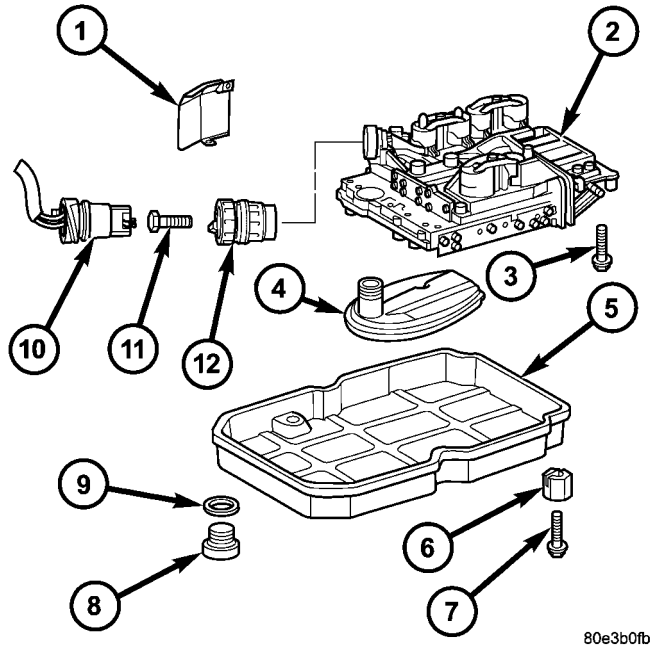


Fig. 56 Install Electrohydraulic Unit

1 - HEAT SHIELD
2 - ELECTROHYDRAULIC UNIT
3 - BOLT
4 - OIL FILTER
5 - OIL PAN
6 - CLAMPING ELEMENT
7 - BOLT
8 - DRAIN PLUG
9 - DRAIN PLUG GASKET
10 - 13-PIN PLUG CONNECTOR
11 - BOLT
12 - GUIDE BUSHING

(35) Install the torque converter (Fig. 57).

INSTALLATION

(1) Coat outside of the torque converter hub with long-term grease, install the torque converter into the transmission.

(2) Measure distance ″A″ (Fig. 58) from torque converter to transmission housing. If the torque converter is properly installed, distance “A” will be 55 mm (2.17 in.).

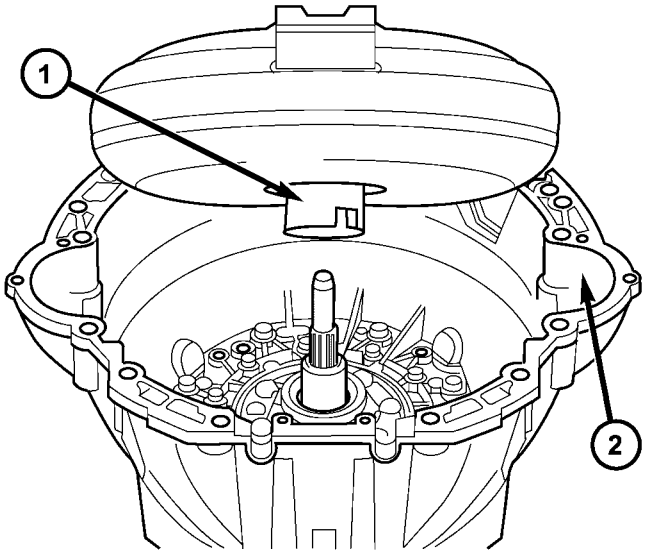


Fig. 57 Install Torque Converter

1 - TORQUE CONVERTER
2 - CONVERTER HOUSING

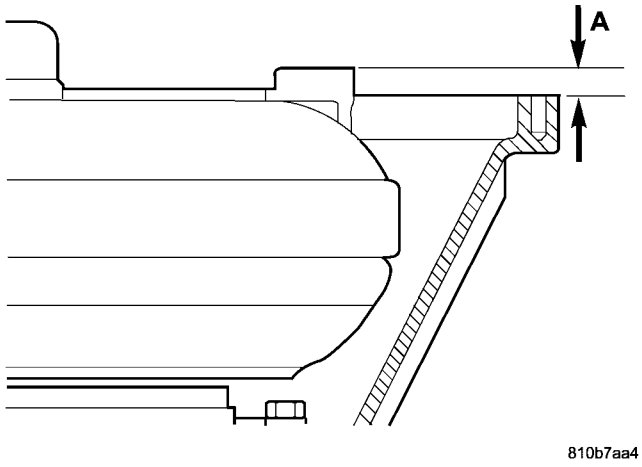


Fig. 58 Torque Converter Installation Depth

A - TORQUE CONVERTER INSTALLED DISTANCE

(3) Move the torque converter (1) (Fig. 59) to shown position. Check position of torque converter through housing opening (2) when installing transmission.

(4) Move driving plate (1) (Fig. 60) to shown position.

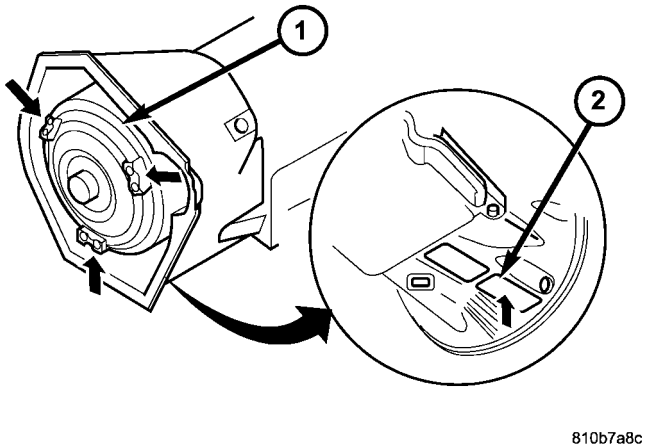


Fig. 59 Position Torque Converter as Shown

1 - TORQUE CONVERTER
2 - INSPECTION OPENING

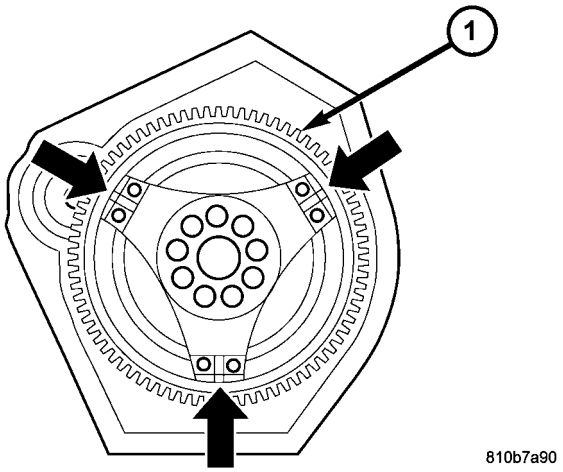


Fig. 60 Position Driveplate as Shown

1 - DRIVEPLATE

(5) Ensure the dowel pins are installed in their correct position at the transmission housing flange.

(6) Place transmission onto a hydraulic transmission jack and raise the transmission into position. Secure transmission on hydraulic jack with a strap or ask an assistant to hold it.

(7) Move the transmission into position on the dowel pins and install two bolts (A, B) (Fig. 61) on the top of the transmission. Torque the bolts to 38 N·m (28 ft.lbs.).

(8) Install the bolt to hose the vent hose bracket to the transmission. Torque the bolt to 38 N·m (28 ft.lbs.).

(9) Install the bolt to hold the ground strap to the transmission. Torque the bolt to 38 N·m (28 ft.lbs.).

(10) Install bolts (A) (Fig. 61) on underside of transmission. Torque the bolts to 38 N·m (28 ft.lbs.).

(11) Install rear engine cross member (4) (Fig. 61). First install the nuts (5) at the outside ends of the engine crossmember. Then install the bolts (1) of the transmission mount. Torque the bolts and nuts to 45 N·m (33 ft.lbs.).

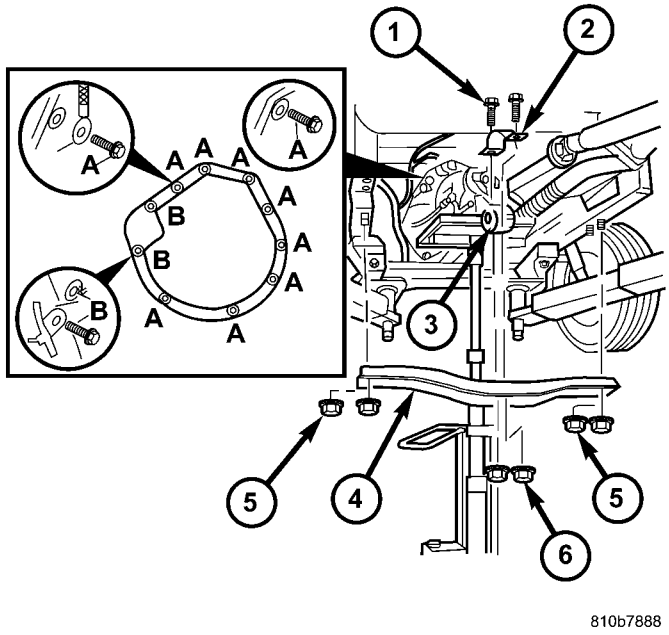


Fig. 61 Support Transmission and Install Bolts

1 - BOLT, TRANSMISSION MOUNT
2 - UPPER SHELL FOR TRANSMISSION MOUNT
3 - TRANSMISSION MOUNT
4 - CROSSMEMBER
5 - NUT, ENGINE CROSSMEMBER
6 - NUT, TRANSMISSION SUPPORT

(12) Remove the wooden block supporting the engine and remove the hydraulic jack.

(13) Install the torque converter bolts.

(a) Install the first pair bolts (2) (Fig. 62) at circumference of driving plate snug only.

AUTOMATIC TRANSMISSION - NAG1 (Continued)

(b) To install bolts, position a ratchet with long extension and joint nut as shown.

(c) Rotate engine by hand until the next pair of bolts (2) are in front of opening. Rotate engine forwards at crankshaft. Install the next pair of bolts snug only.

(d) Rotate engine by hand until the final pair of bolts (2) are in front of opening. Rotate engine forwards at crankshaft. Install and torque the bolts to 50 N·m (37 ft.lbs.).

(e) Rotate engine by hand and tighten the first two bolt pairs to 50 N·m (37 ft.lbs.).

(f) Install the plastic torque converter access cover (1) (Fig. 63) to the back of the engine flange.

(g) Install the steering gear (1) (Fig. 64) onto the chassis crossmember. Tighten both steering gear bolts first to 25 N·m (18.5 ft.lbs.). Tighten both steering gear bolts next to 45 N·m (33 ft.lbs.). Tighten both steering gear bolts next an additional 90°.

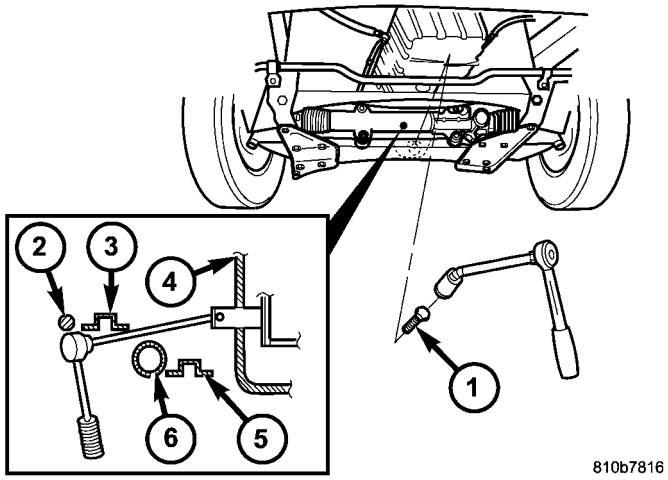


Fig. 62 Install Torque Converter Bolts

1 - BOLT
2 - STABILIZER BAR
3 - REINFORCEMENT PLATE
4 - OPENING
5 - CHASSIS CROSSMEMBER
6 - STEERING GEAR

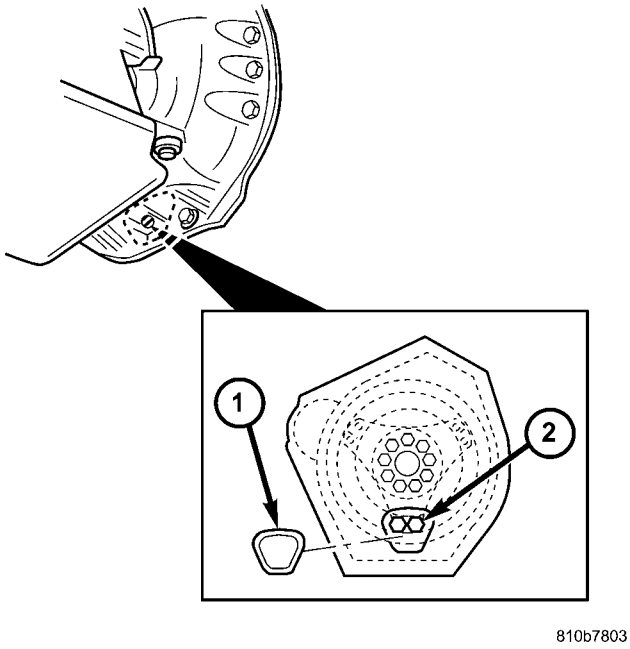


Fig. 63 Install Torque Converter Access Cover

1 - TORQUE CONVERTER ACCESS COVER
2 - BOLT

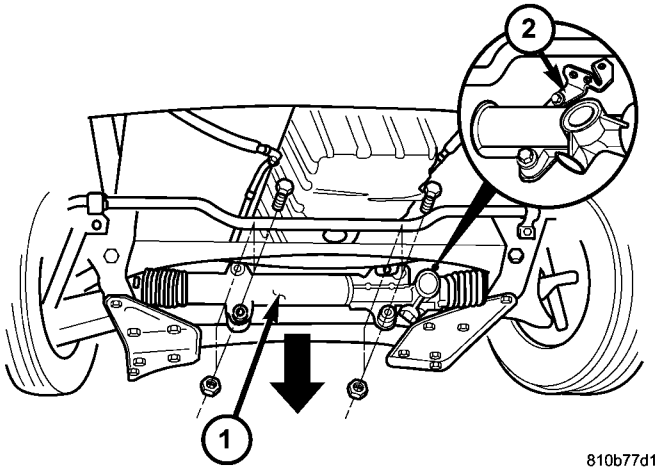


Fig. 64 Install Steering Gear

1 - STEERING GEAR
2 - BRACKET

(14) Install the transmission electrical connector (2) (Fig. 65) from transmission and hang to the side. Turn sealing ring (3) clockwise and connect plug connection (2).

(15) Install the shift cable (Fig. 66) to the transmission.

(a) Push shift cable onto the transmission shift lever ball socket.

(b) Latch ball socket latch of cable.

(c) Clip shift cable retainer into retainer bracket.

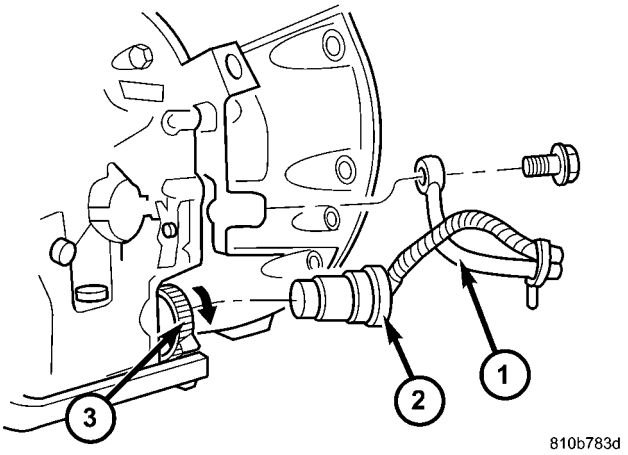


Fig. 65 Install Transmission Electrical Connector and Cooler Line

1 - COOLER LINE
2 - TRANSMISSION ELECTRICAL CONNECTOR
3 - SEALING RING

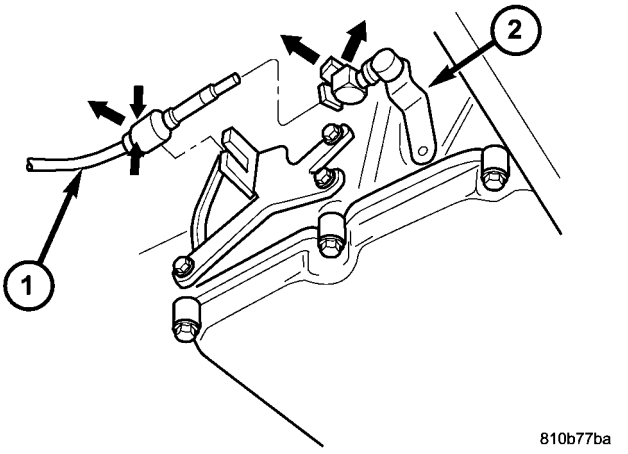


Fig. 66 Install Shift Cable Onto Transmission

1 - SHIFT CABLE
2 - TRANSMISSION SHIFT LEVER

(16) Install the cooler lines to the transmission.

(a) Install the brackets for the oil cooler feed and return lines (1) (Fig. 67) onto the engine oil pan flange. Detail shows right side of motor. Position is mirrored for the left side of engine.

(b) Attach the bracket for the cable retainer (4) (Fig. 68) to the threaded shank of a engine oil pan bolt (5).

(c) Install the bolts to hold the oil cooler lines (6) to the left (Fig. 69) and right sides of transmission. Torque the bolts to 34 N·m (254 ft.lbs.).

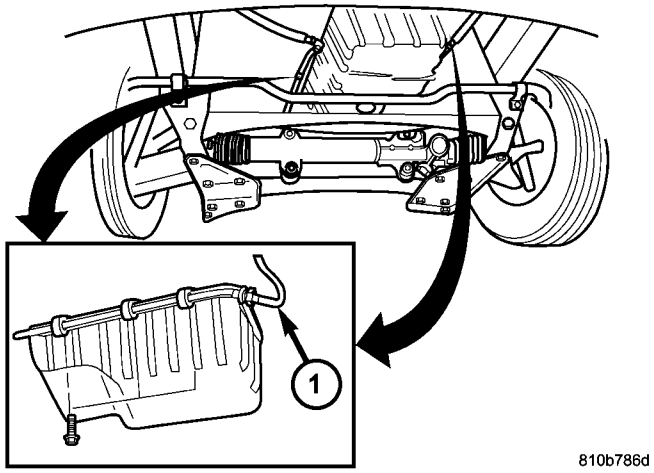


Fig. 67 Install Cooler Line Supports

1 - COOLER LINES

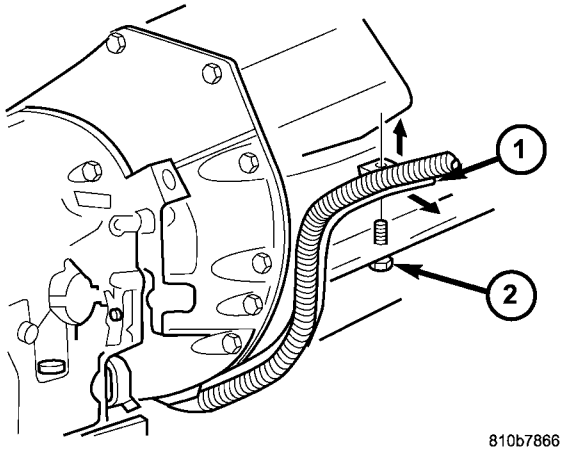


Fig. 68 Install Cable Support

1 - CABLE
2 - BOLT

AUTOMATIC TRANSMISSION - NAG1 (Continued)

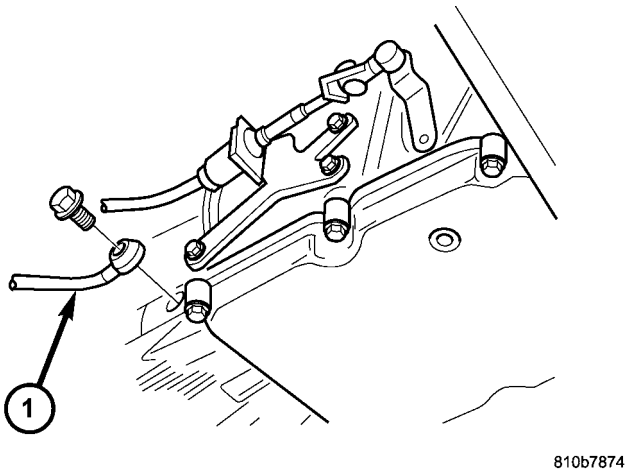


Fig. 69 Install Driver's Side Cooler Line

1 - COOLER LINE

(17) Install exhaust heat shield (5) (Fig. 70).

(18) Install retaining bracket (4) (Fig. 70). Bracket is asymmetric. The slanted side must be installed on the left side in the direction of travel.

(19) Attach propeller shaft (1) (Fig. 70) to the transmission (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION).

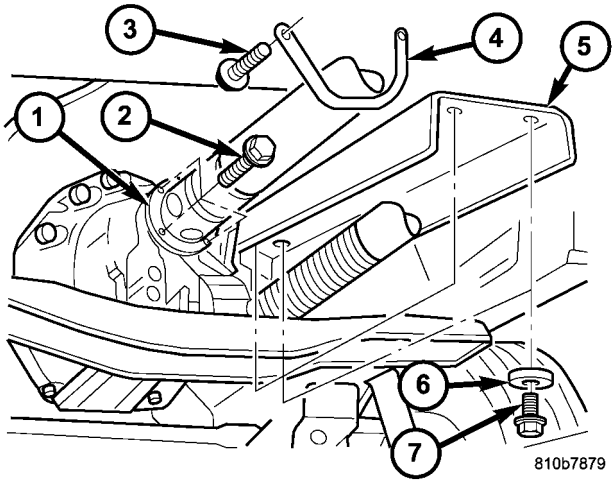


Fig. 70 Install Propeller Shaft and Heat Shield

1 - PROPELLER SHAFT
2 - BOLT
3 - BOLT
4 - RETAINING BRACKET
5 - HEAT SHIELD
6 - WASHER
7 - BOLT

(20) Install oil filler pipe.

(a) Guide oil filler pipe (1) (Fig. 71) down and into position.

(b) Push lower connection of oil filler pipe (1) (Fig. 71) into the fill hole in the side of the transmission housing.

(c) Install bolts (2) (Fig. 71) to cylinder head. Tighten the bolts to 8 N·m (71 in.lbs.).

(d) Install bolt (3) (Fig. 71) to transmission flange and bolt (2) to transmission housing. Tighten the bolt to 8 N·m (71 in.lbs.).

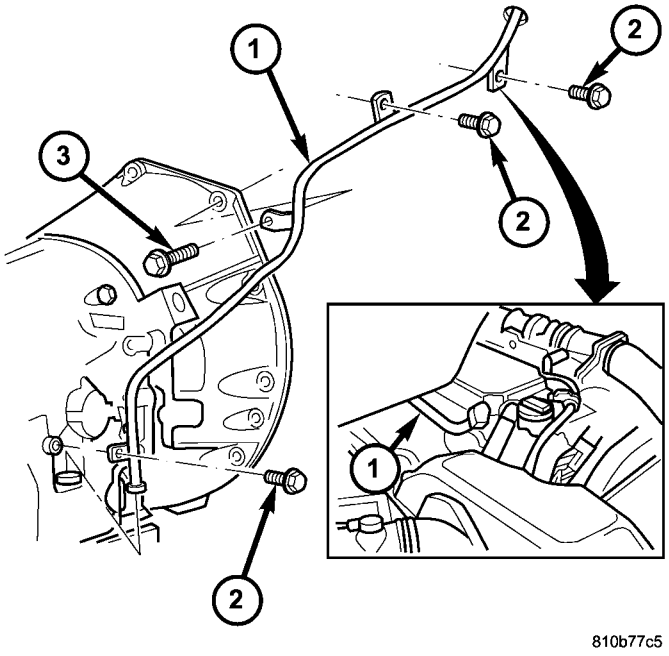


Fig. 71 Install the Fill Tube

1 - FILL TUBE
2 - BOLTS TO CYLINDER HEAD AND TRANSMISSION HOUSING
3 - BOLT TO TRANSMISSION FLANGE

(21) Install the oil drain plug (2) (Fig. 72) with a new seal into the transmission oil pan. Tighten the drain plug to 20 N·m (14.5 ft.lbs.).

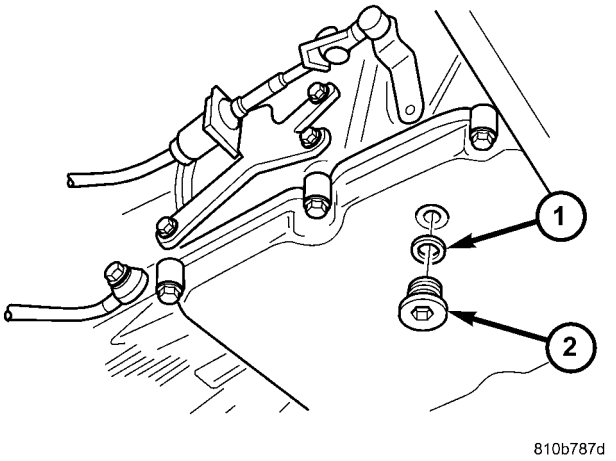


Fig. 72 Install the Oil Drain Plug

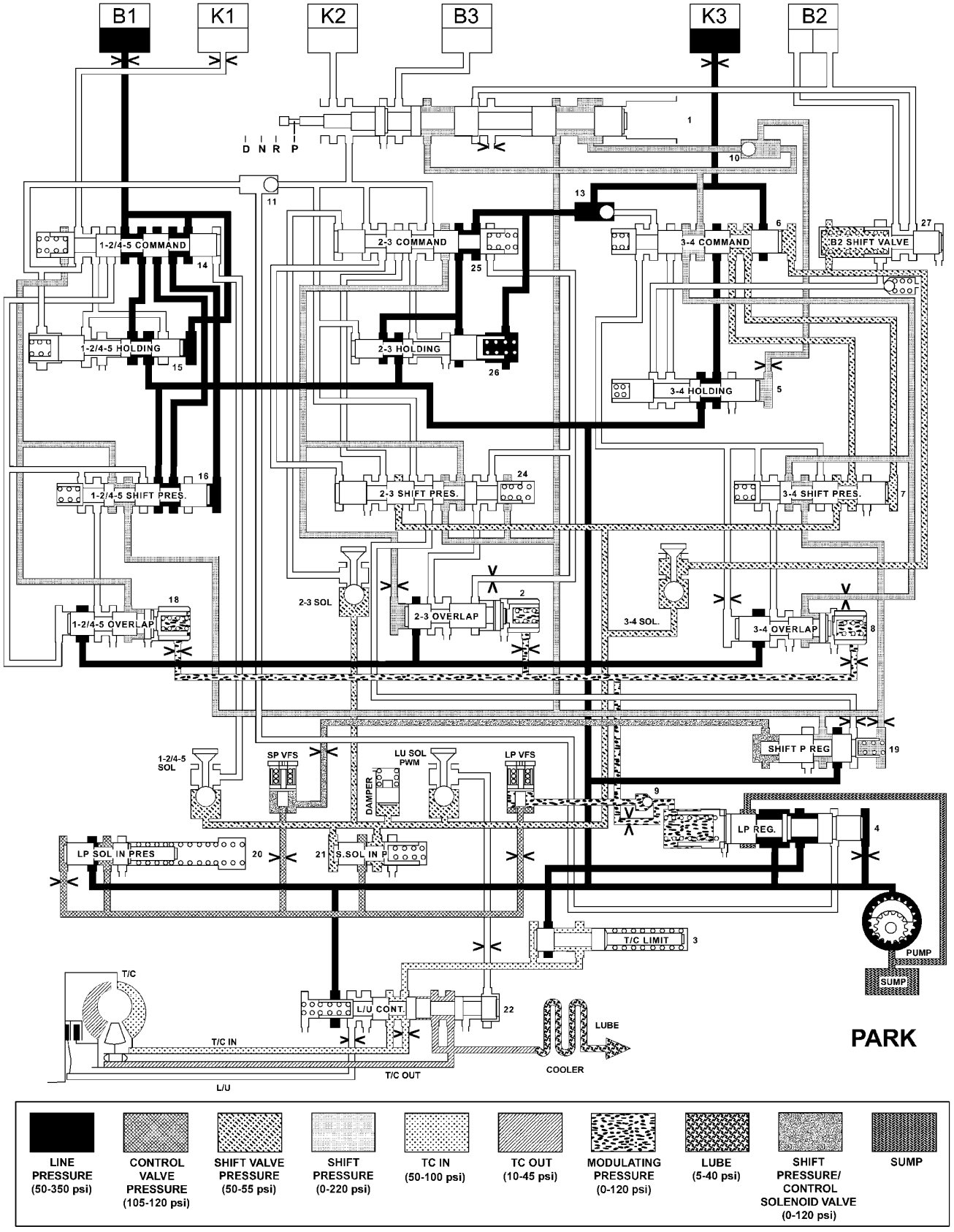
1 - SEAL
2 - DRAIN PLUG

(22) Lower vehicle and fill transmission with correct automatic transmission fluid (Refer to 21 - TRANSMISSION/AUTOMATIC - NAG1/FLUID - STANDARD PROCEDURE).

(23) Road test the vehicle and verify the repair.

AUTOMATIC TRANSMISSION - NAG1 (Continued)

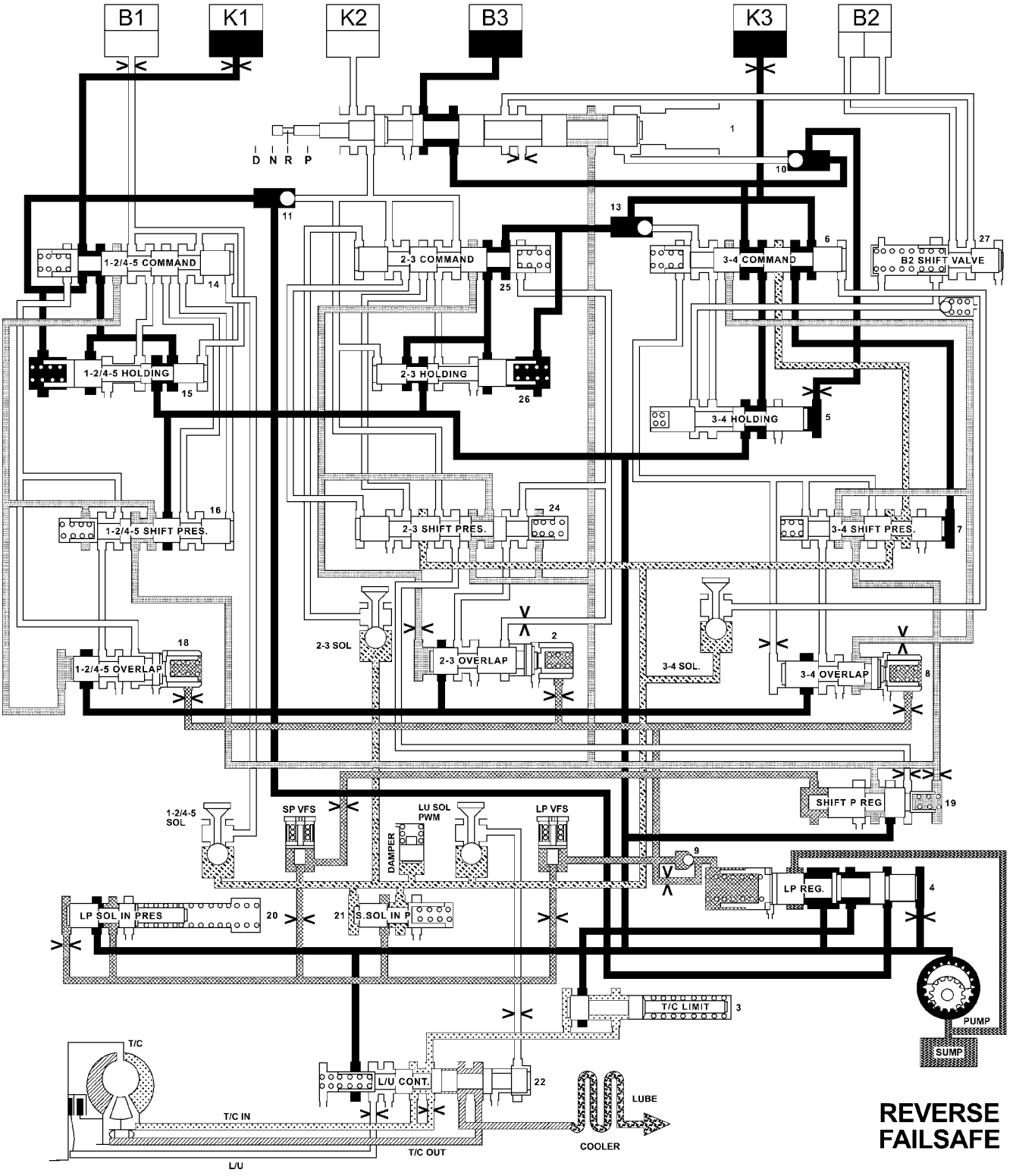
SCHEMATICS AND DIAGRAMS



810baf1a

HYDRAULIC FLOW IN PARK

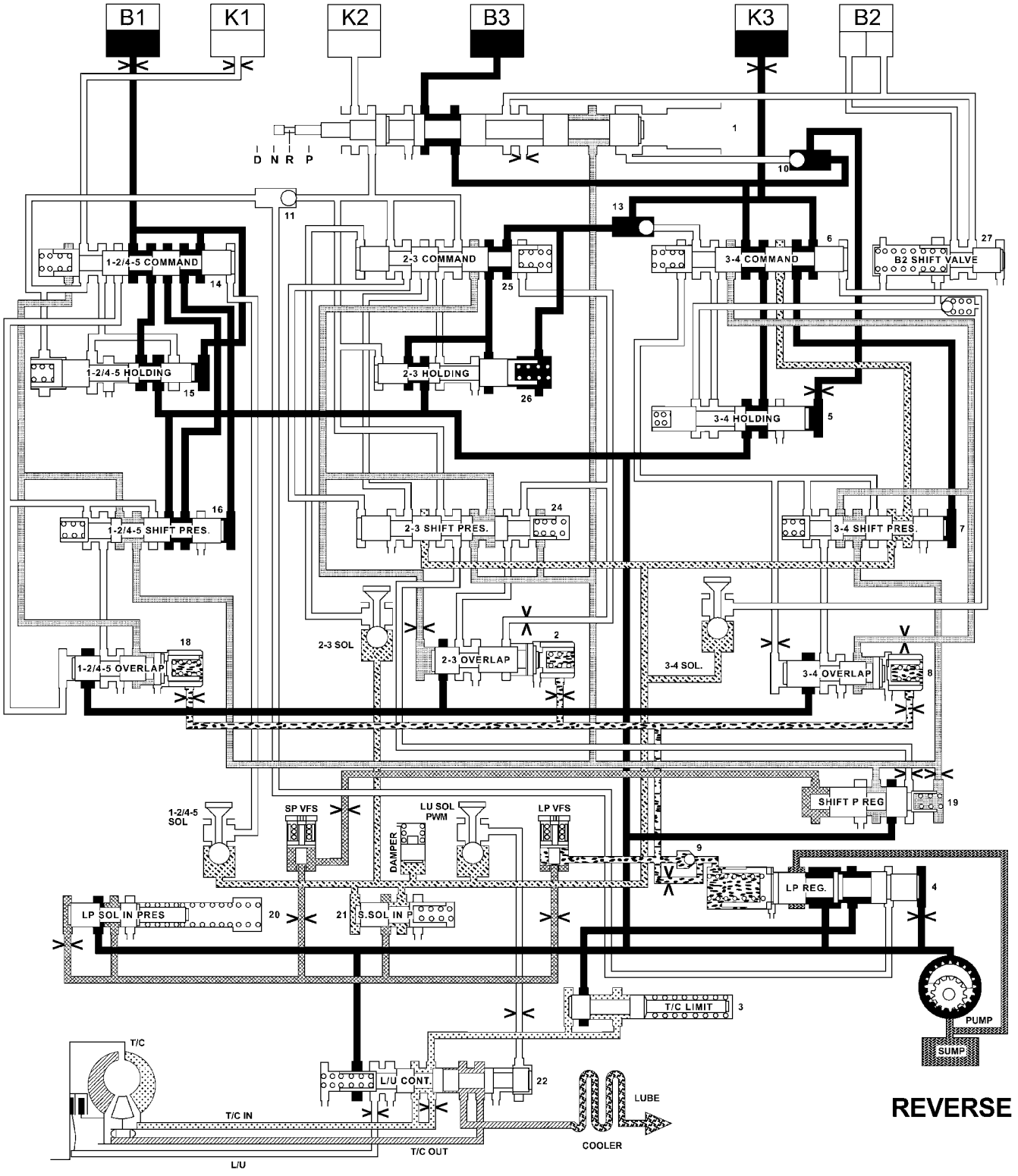
AUTOMATIC TRANSMISSION - NAG1 (Continued)



810bae77

HYDRAULIC FLOW IN REVERSE - FAILSAFE

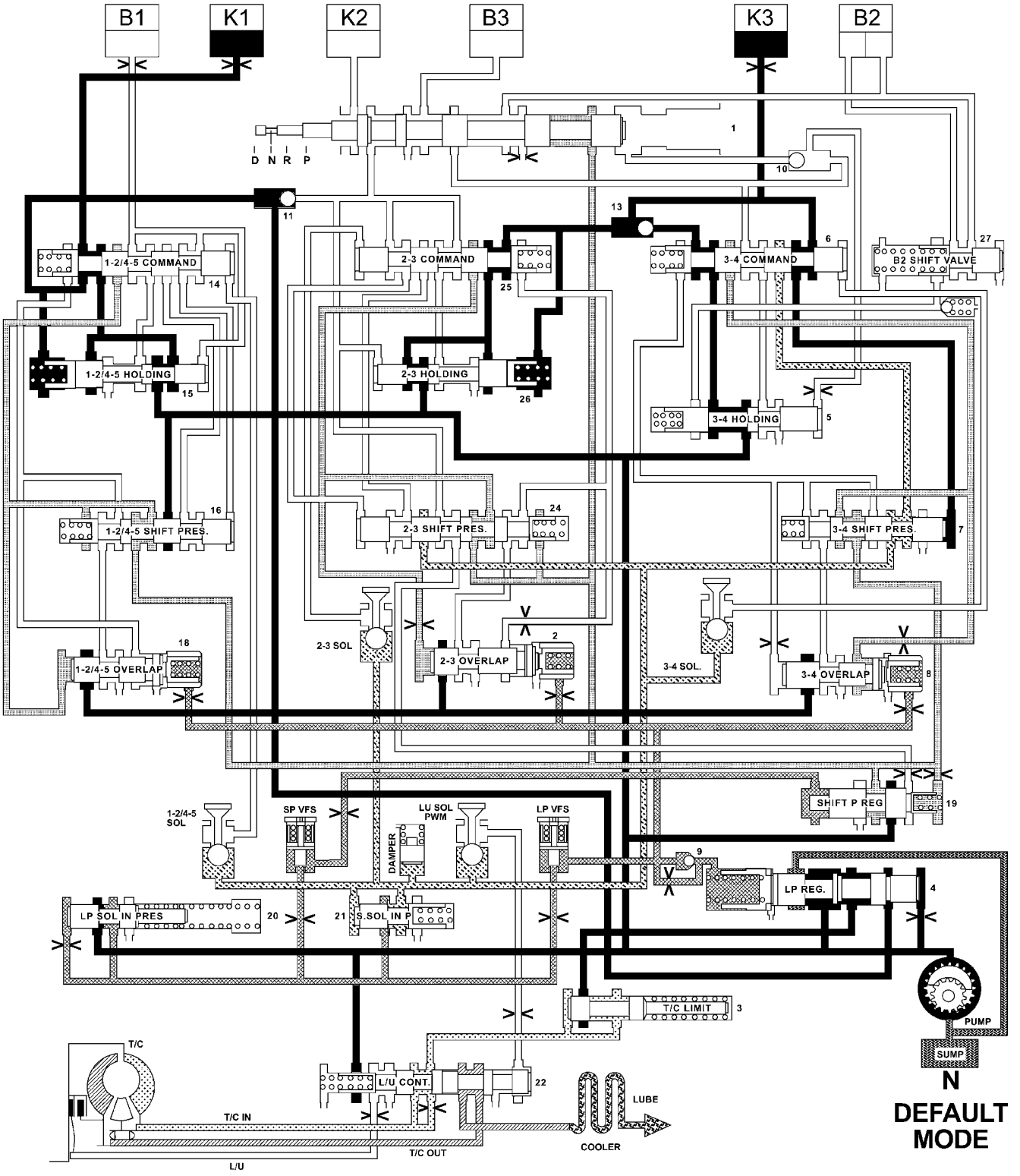
AUTOMATIC TRANSMISSION - NAG1 (Continued)



810baf23

HYDRAULIC FLOW IN REVERSE

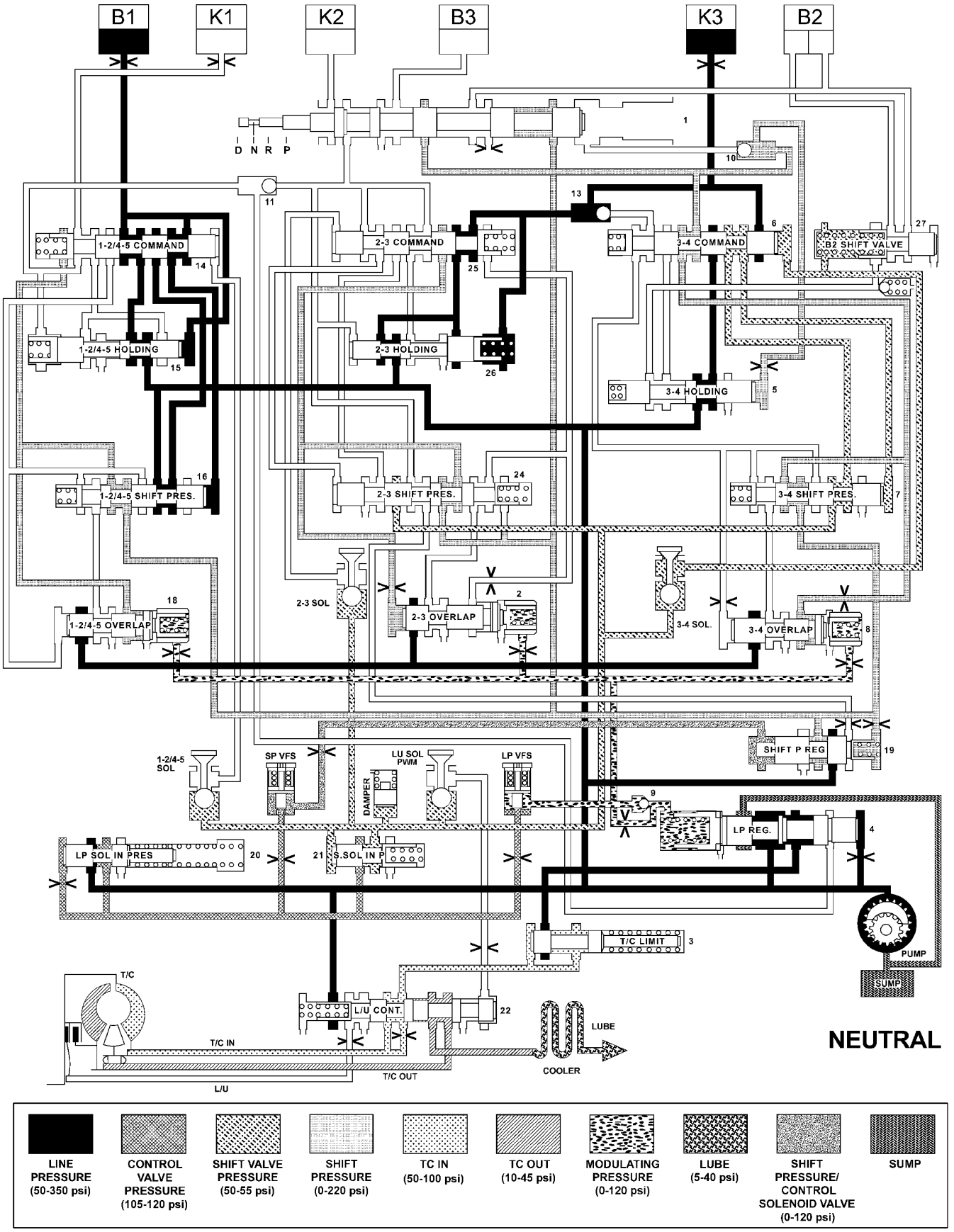
AUTOMATIC TRANSMISSION - NAG1 (Continued)



810baf1e

HYDRAULIC FLOW IN NEUTRAL - DEFAULT

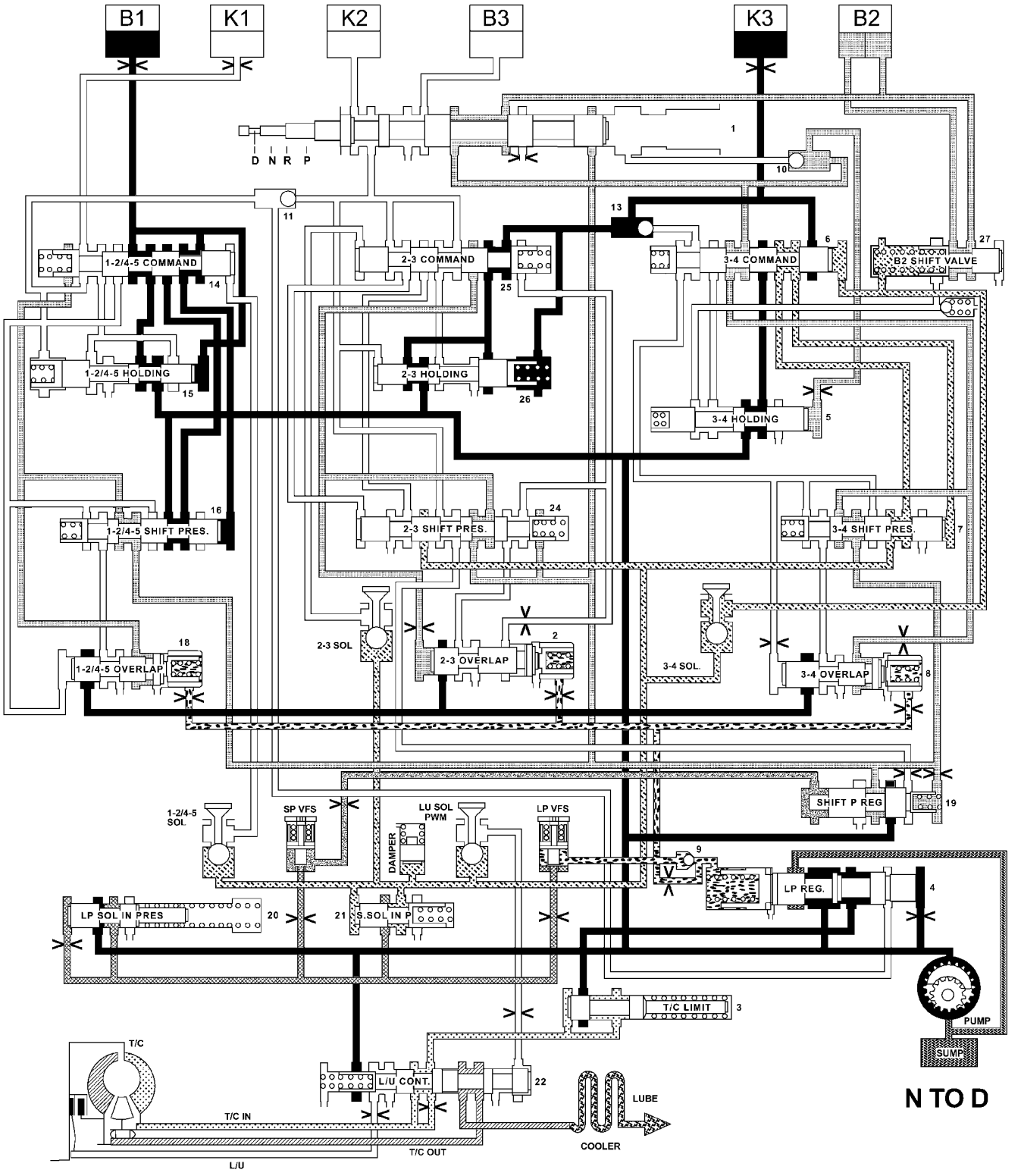
AUTOMATIC TRANSMISSION - NAG1 (Continued)



810baf59

HYDRAULIC FLOW IN NEUTRAL

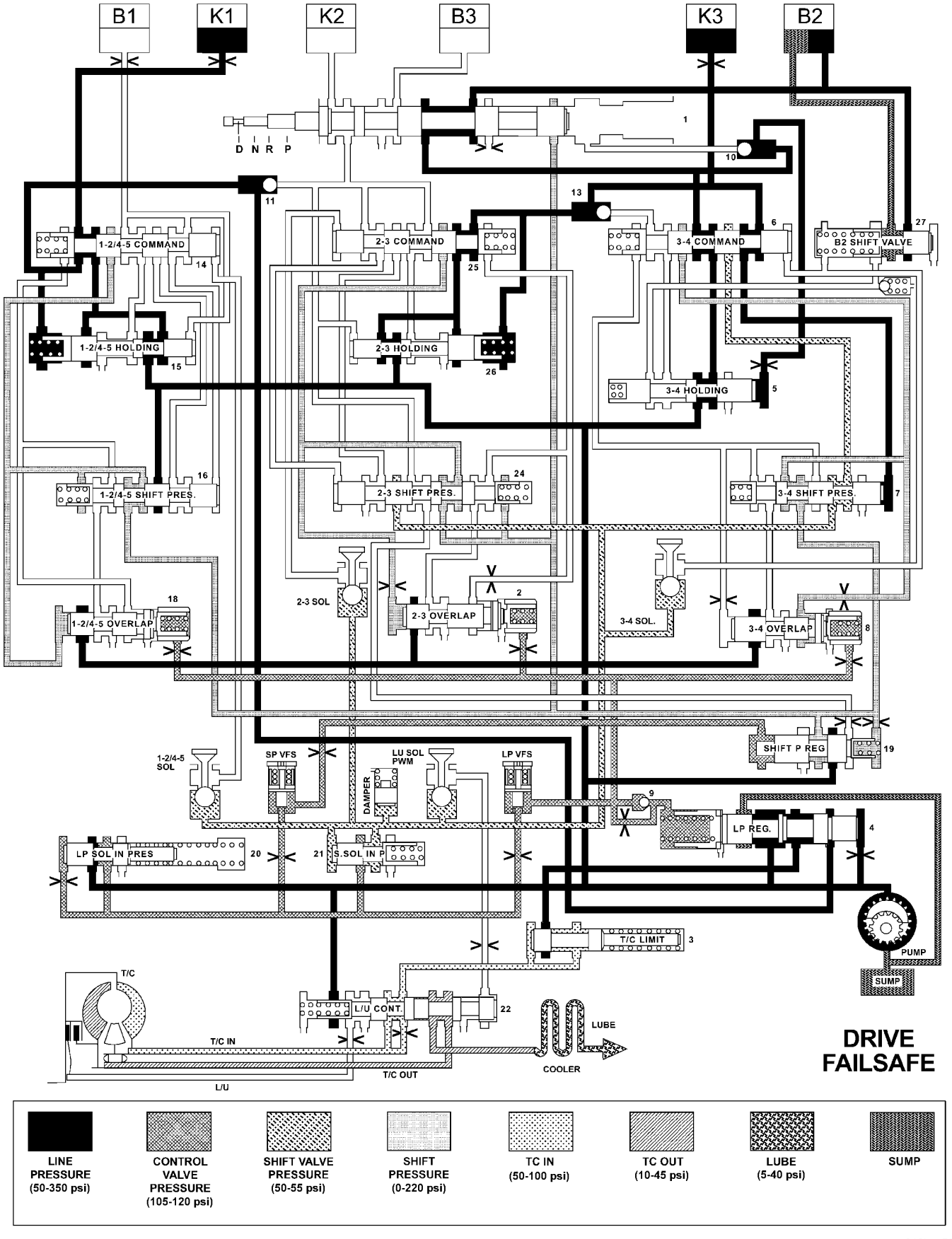
AUTOMATIC TRANSMISSION - NAG1 (Continued)



810baf80

HYDRAULIC FLOW IN NEUTRAL TO DRIVE TRANSITION

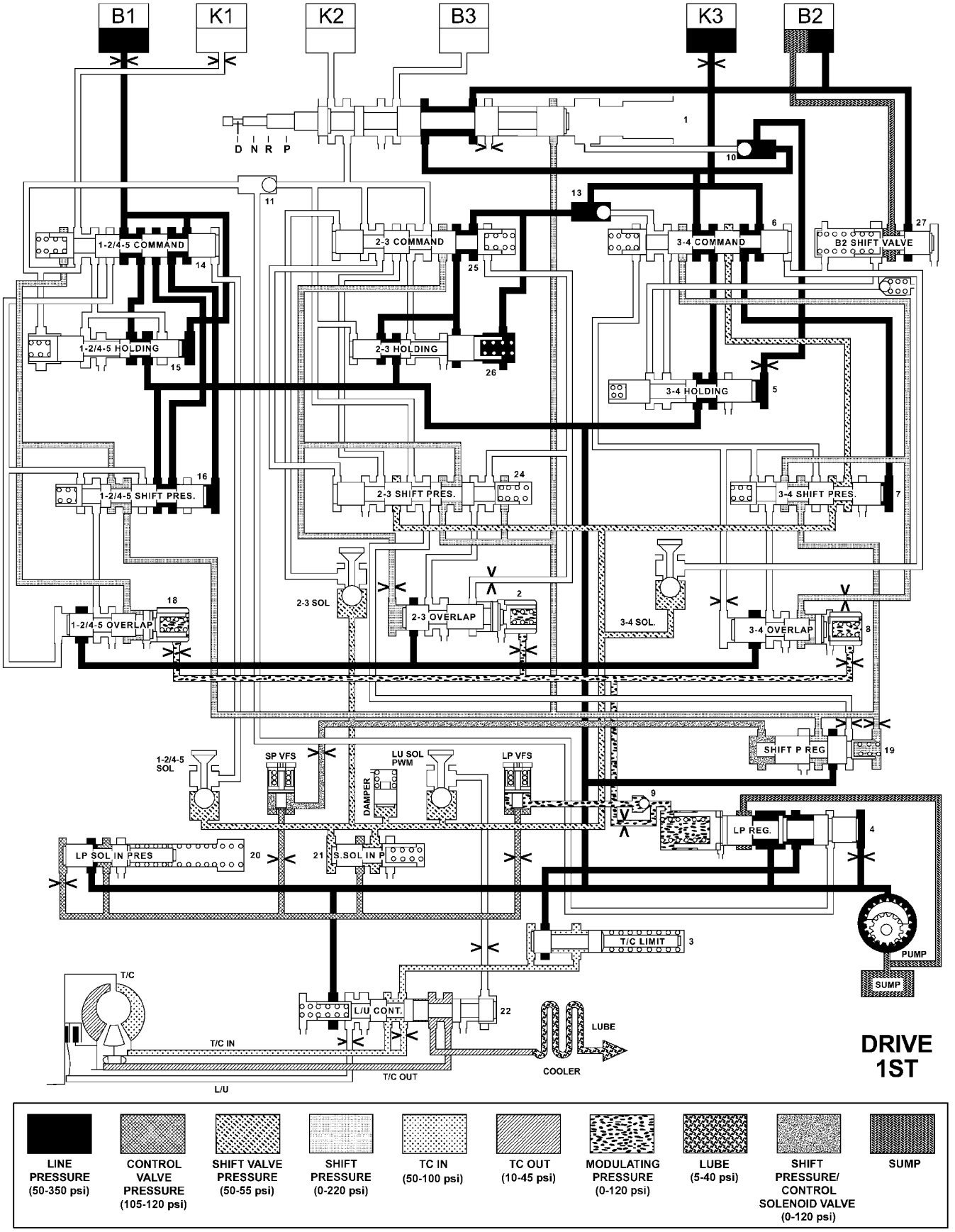
AUTOMATIC TRANSMISSION - NAG1 (Continued)



810bae73

HYDRAULIC FLOW IN DRIVE - FAILSAFE

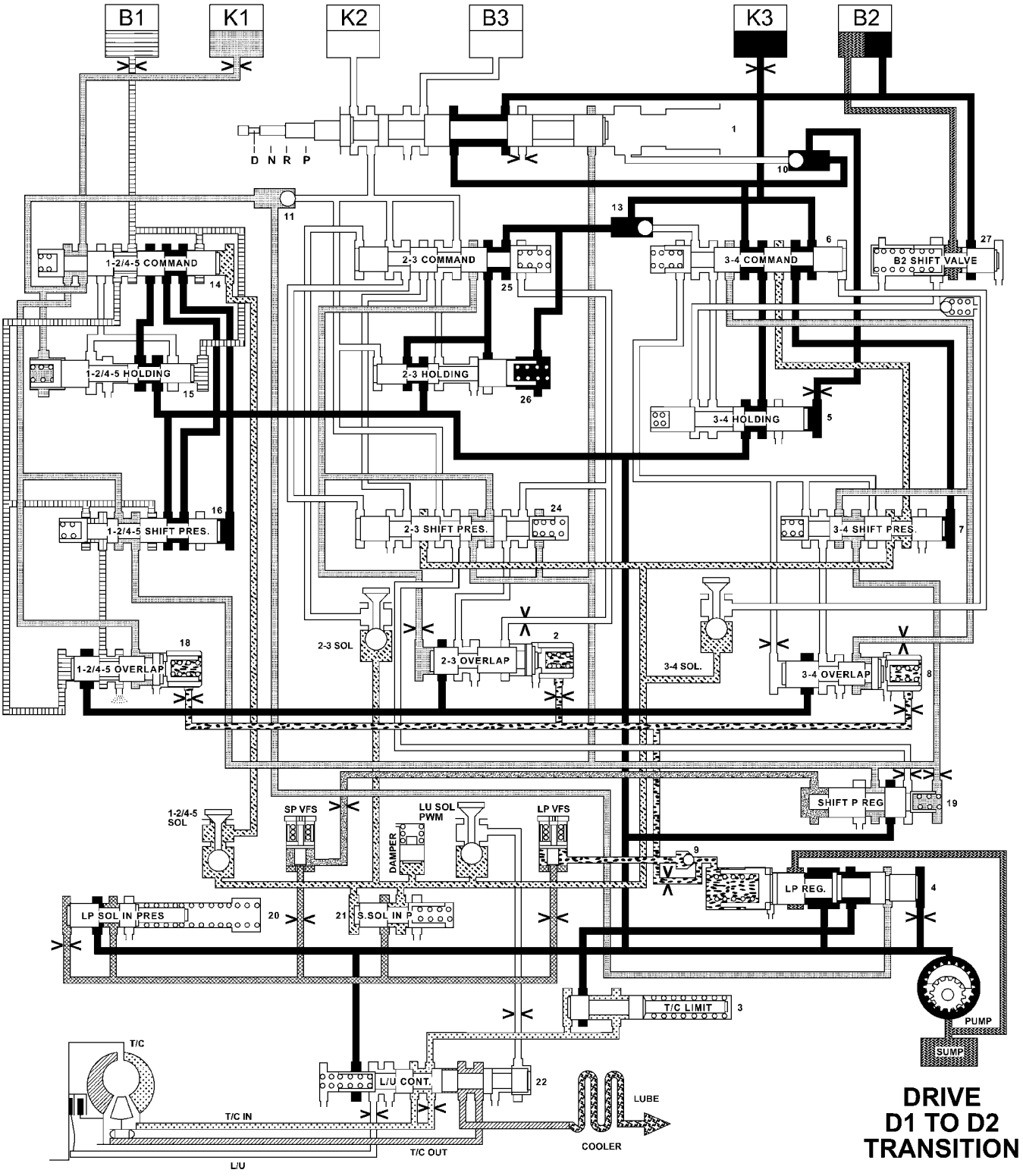
AUTOMATIC TRANSMISSION - NAG1 (Continued)



810baf9b

HYDRAULIC FLOW IN DRIVE - FIRST GEAR

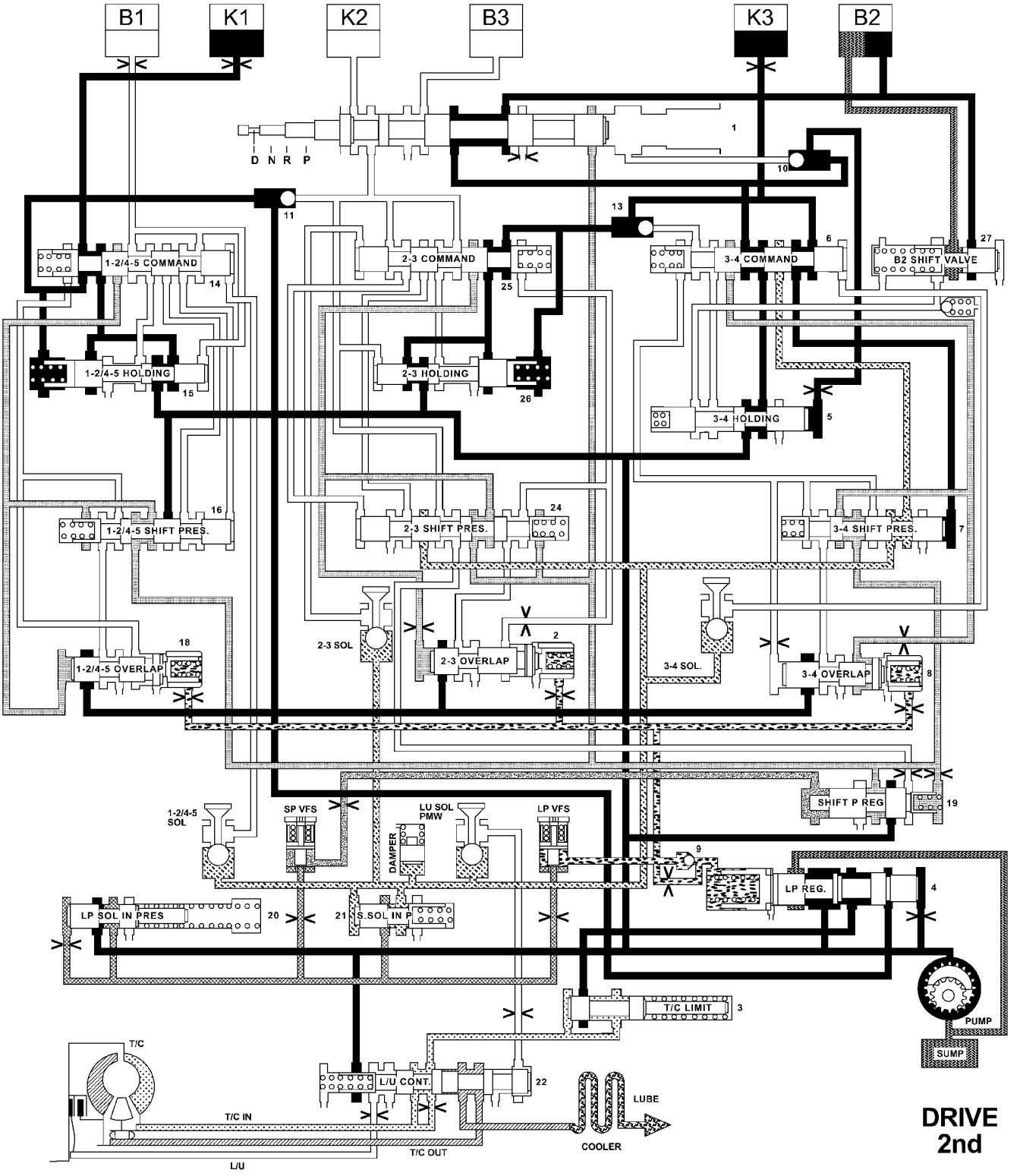
AUTOMATIC TRANSMISSION - NAG1 (Continued)



810bafa9

HYDRAULIC FLOW IN DRIVE - FIRST TO SECOND GEAR TRANSITION

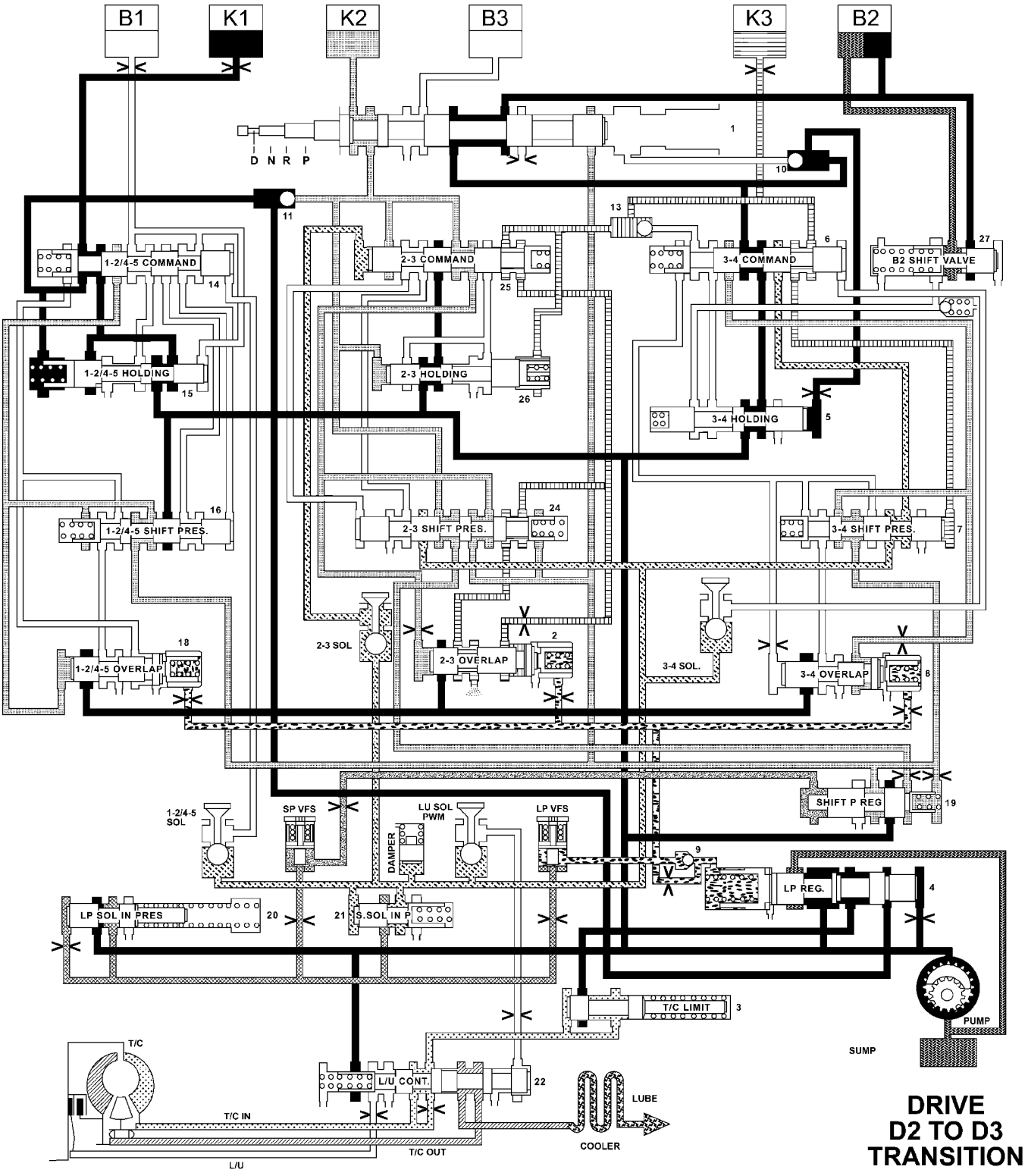
AUTOMATIC TRANSMISSION - NAG1 (Continued)



810bafb9

HYDRAULIC FLOW IN DRIVE - SECOND GEAR

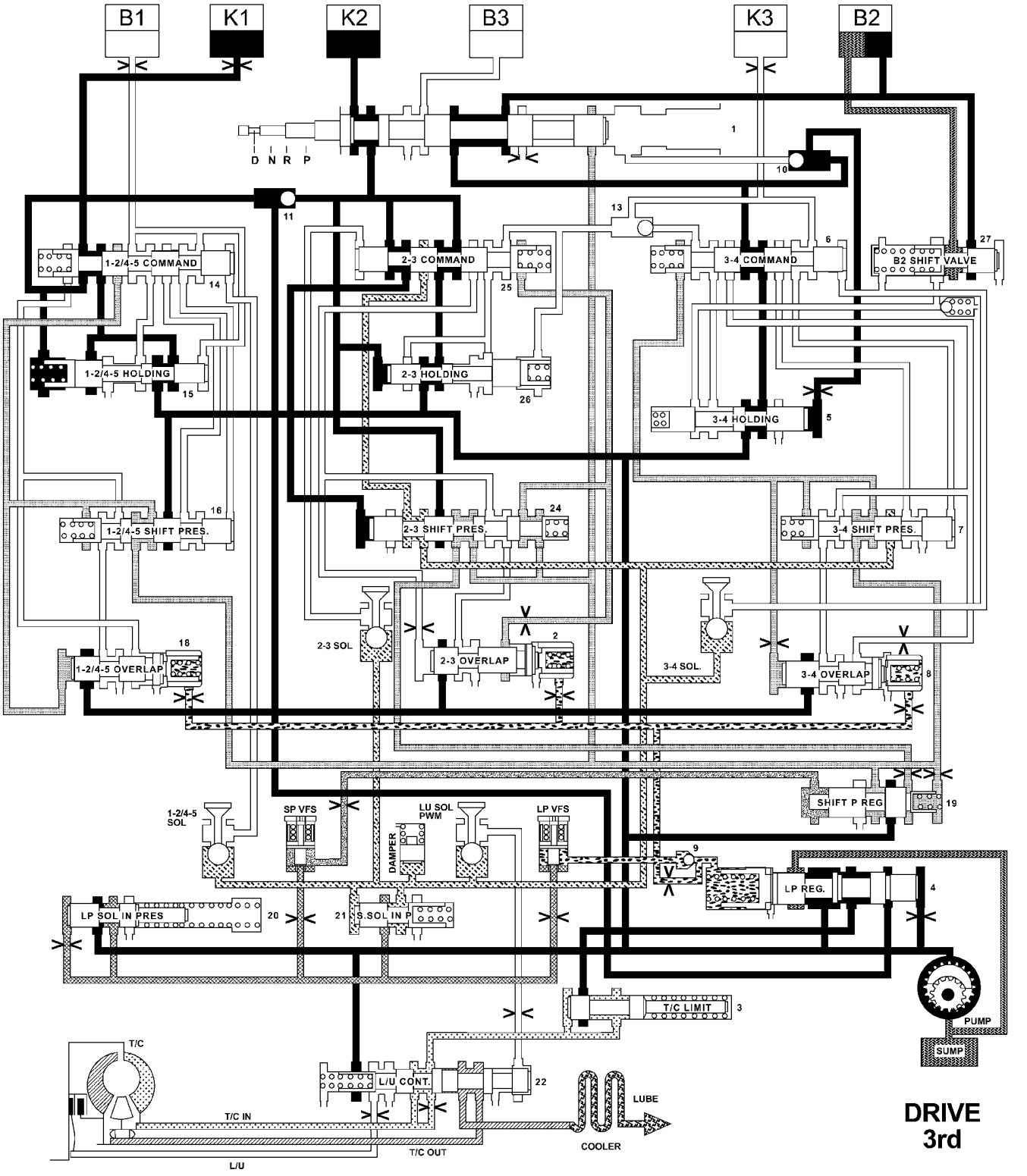
AUTOMATIC TRANSMISSION - NAG1 (Continued)



810baff2

HYDRAULIC FLOW IN DRIVE - SECOND TO THIRD GEAR TRANSITION

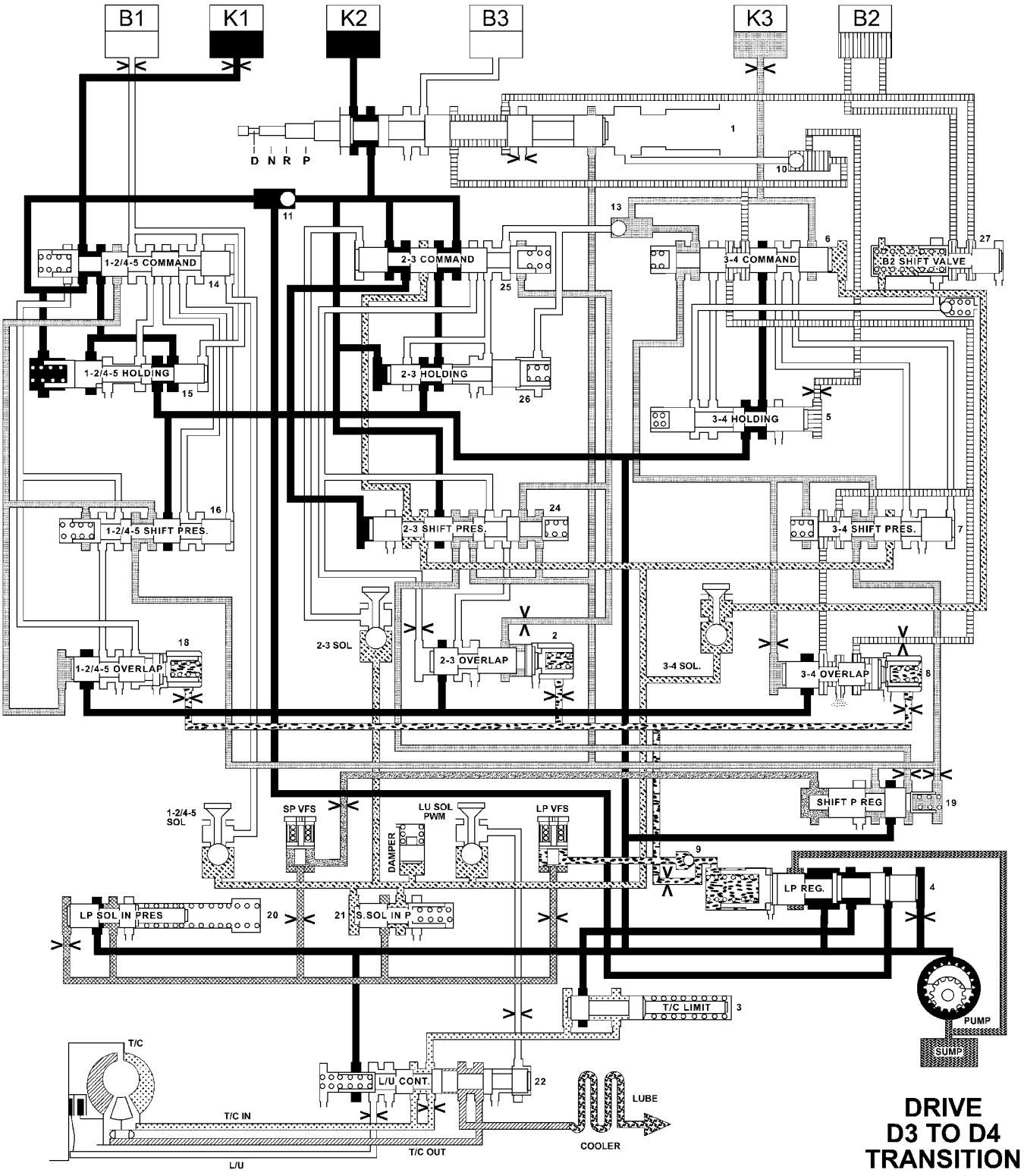
AUTOMATIC TRANSMISSION - NAG1 (Continued)



810bb0bb

HYDRAULIC FLOW IN DRIVE - THIRD GEAR

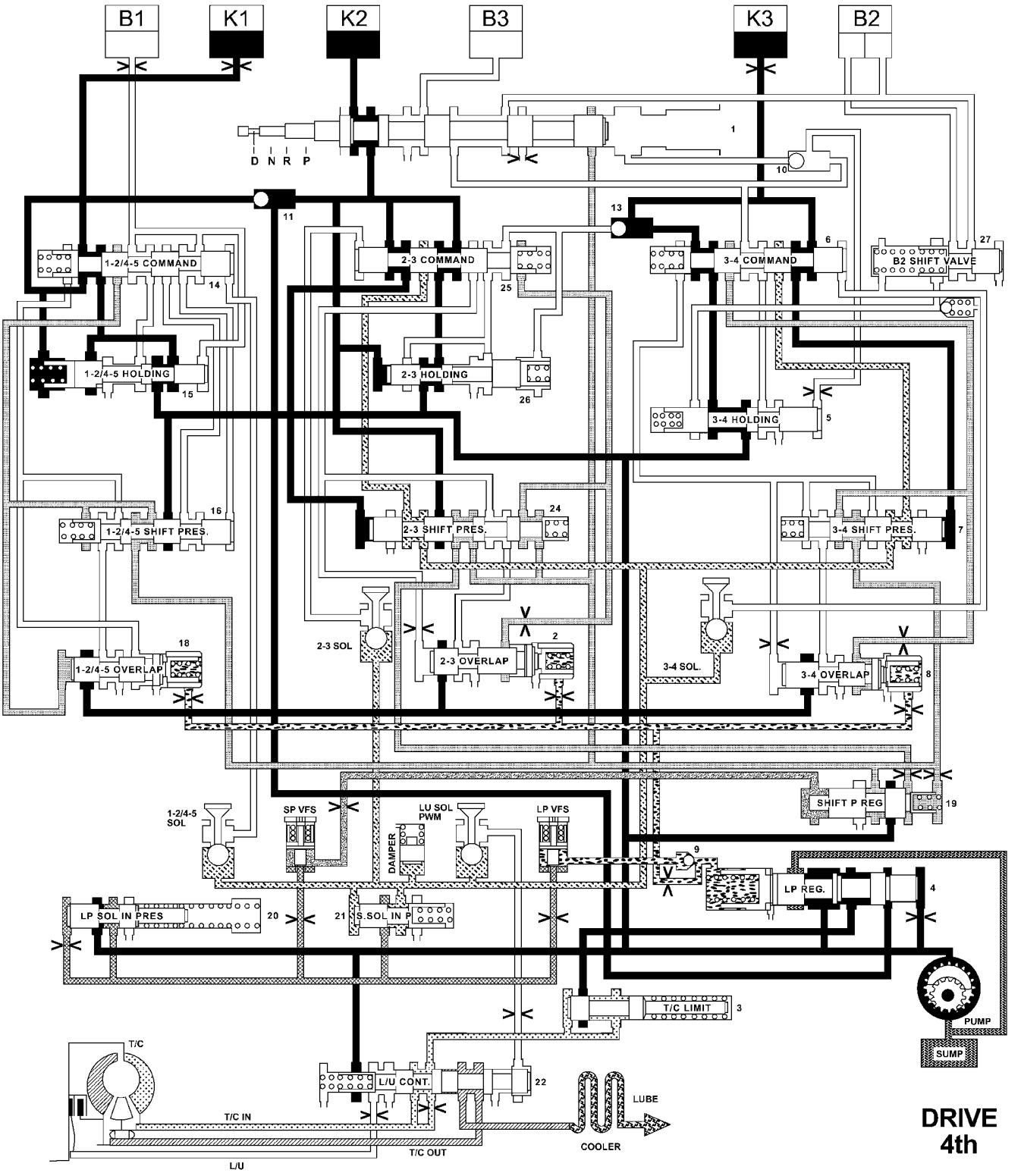
AUTOMATIC TRANSMISSION - NAG1 (Continued)



810bb0e0

HYDRAULIC FLOW IN DRIVE - THIRD TO FOURTH GEAR TRANSITION

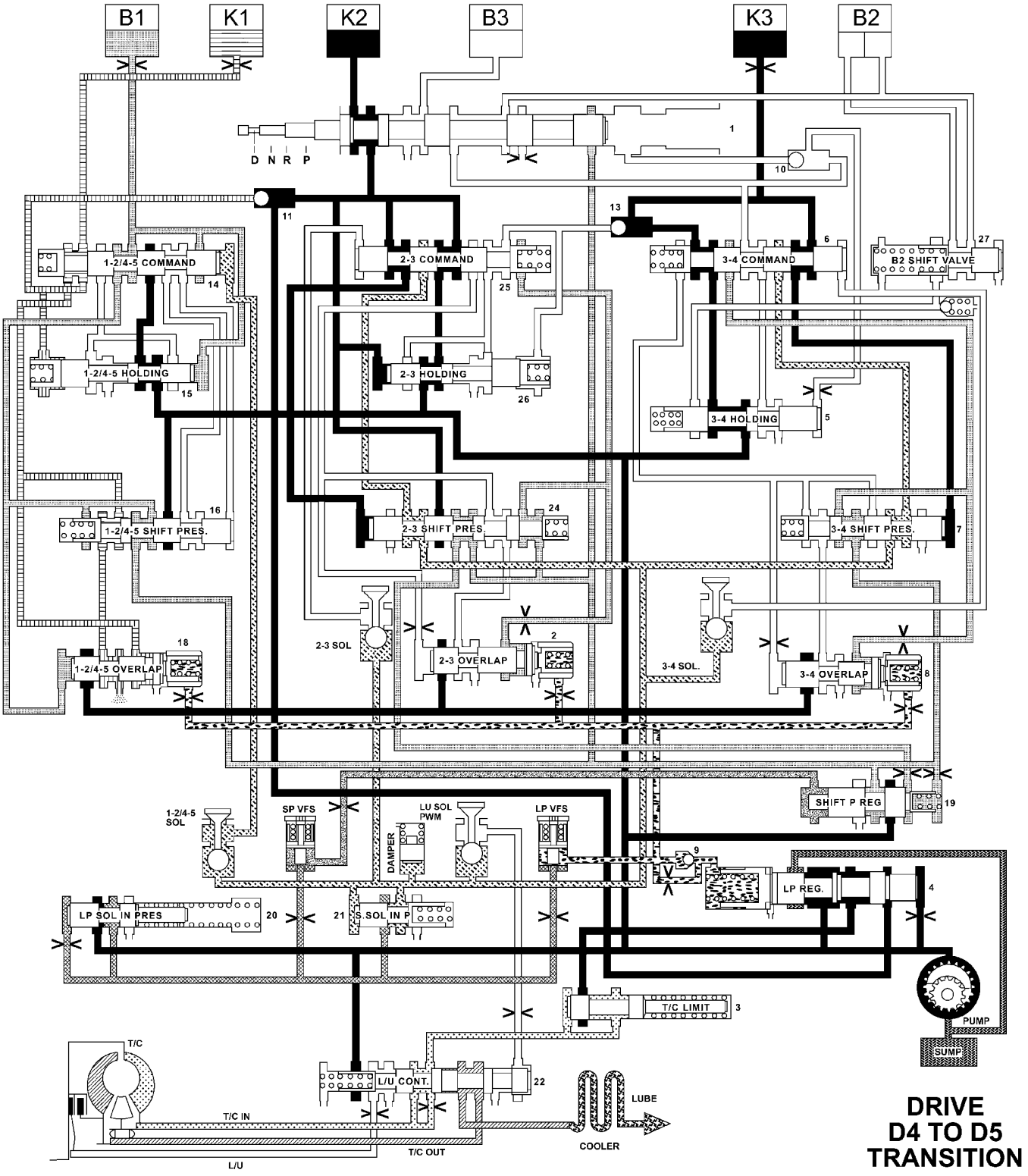
AUTOMATIC TRANSMISSION - NAG1 (Continued)



810bb1f5

HYDRAULIC FLOW IN DRIVE - FOURTH GEAR

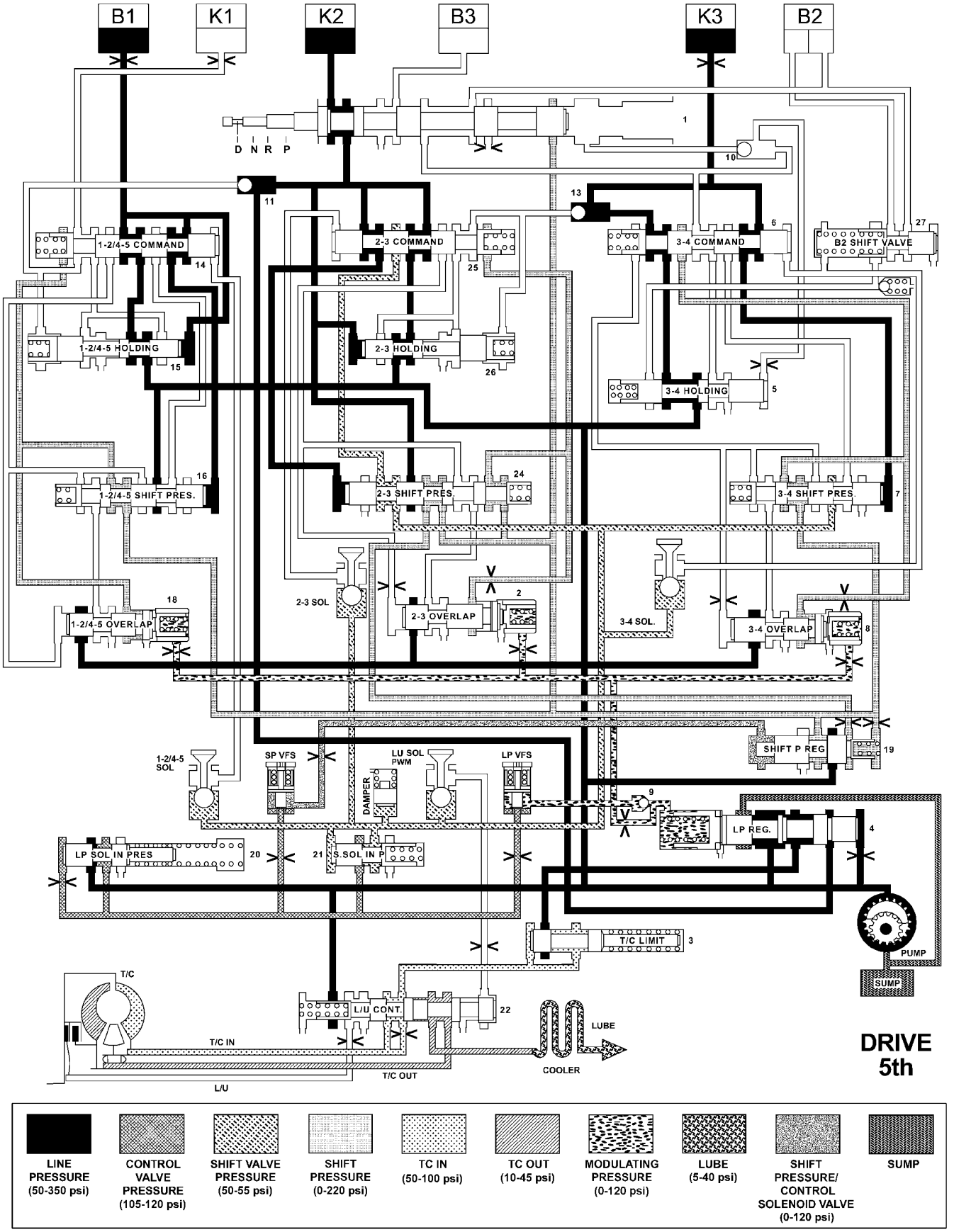
AUTOMATIC TRANSMISSION - NAG1 (Continued)



810bb20a

HYDRAULIC FLOW IN DRIVE - FOURTH TO FIFTH GEAR TRANSITION

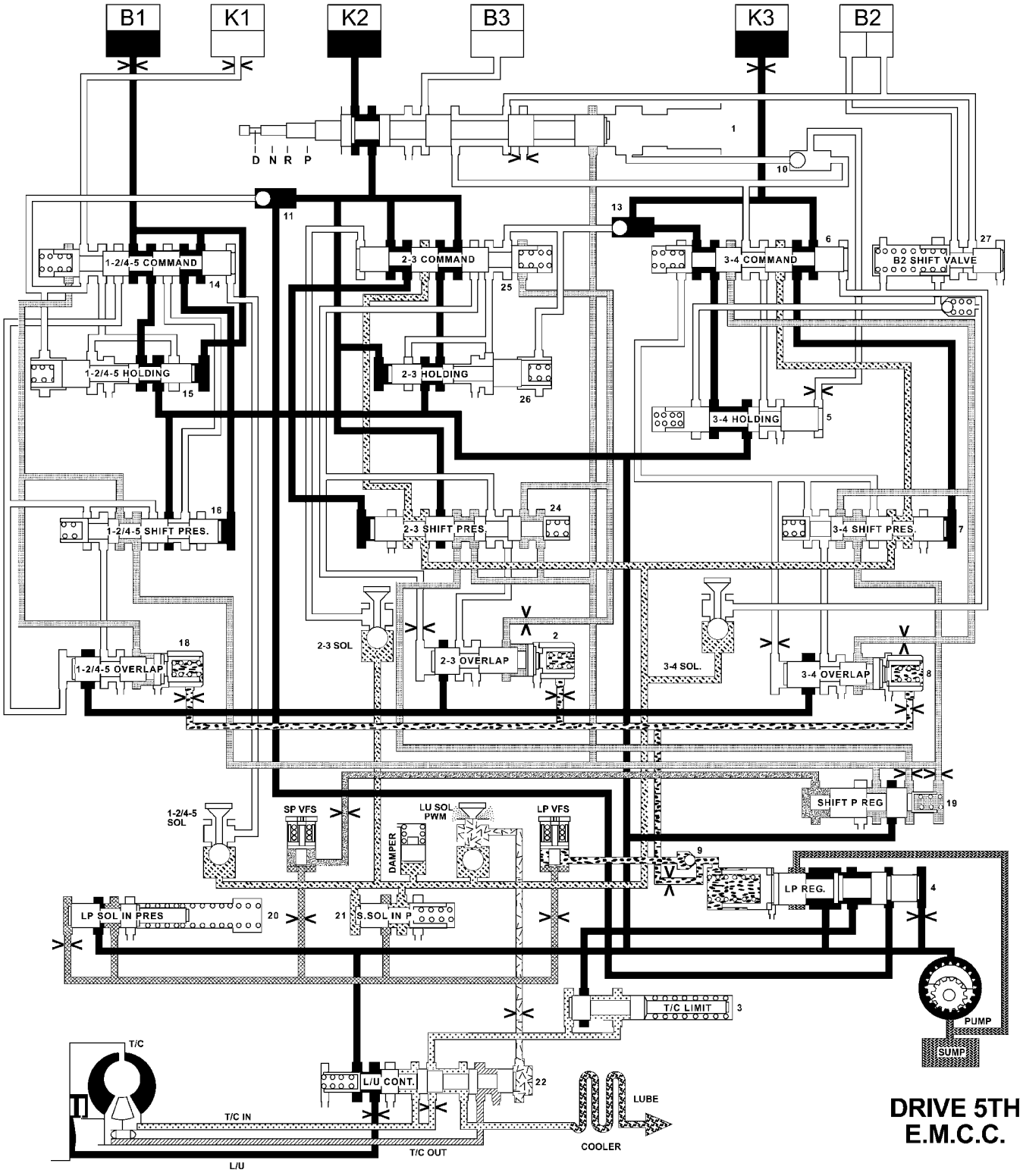
AUTOMATIC TRANSMISSION - NAG1 (Continued)



810bb210

HYDRAULIC FLOW IN DRIVE - FIFTH GEAR

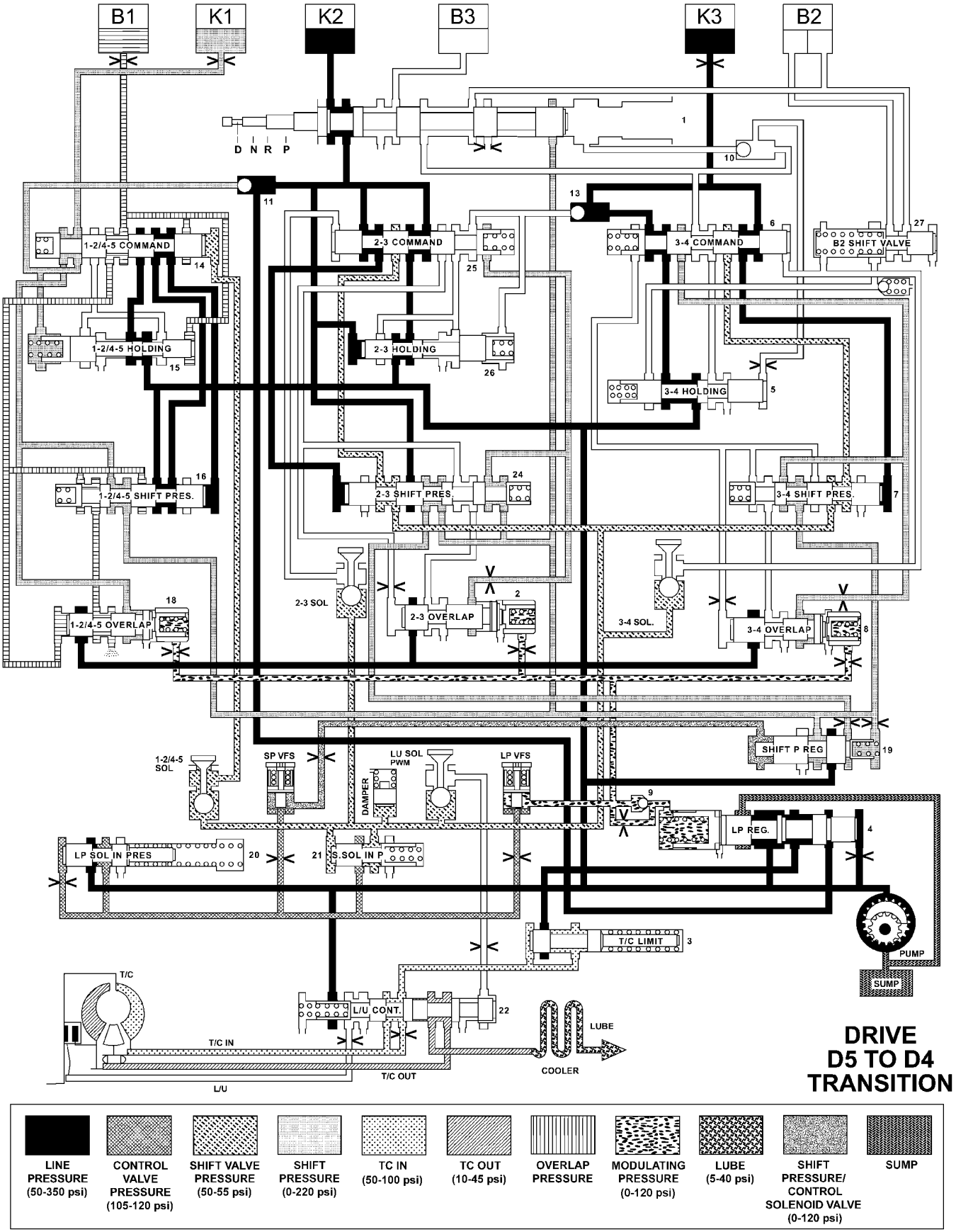
AUTOMATIC TRANSMISSION - NAG1 (Continued)



810bb235

HYDRAULIC FLOW IN DRIVE - FIFTH GEAR - EMCC

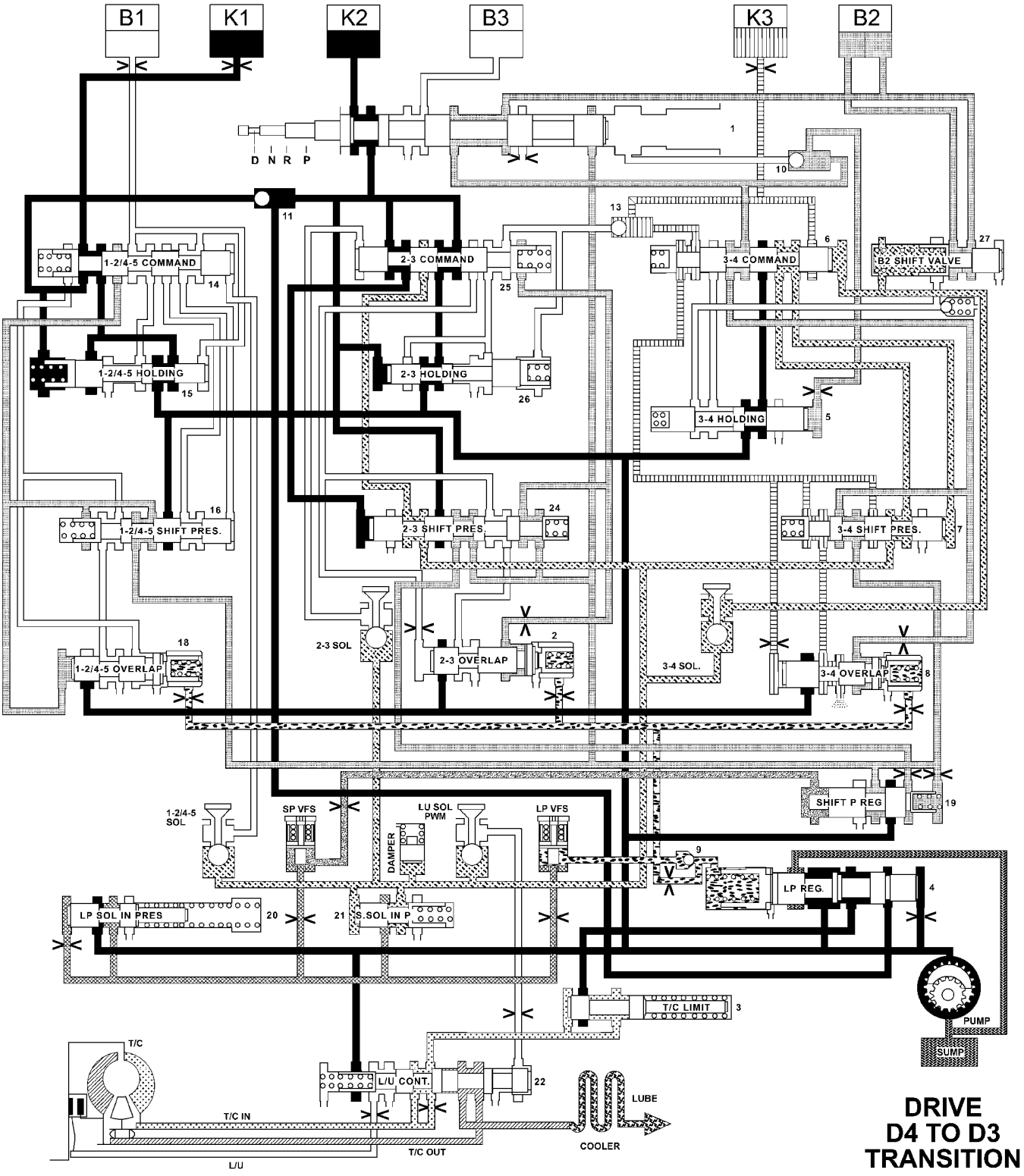
AUTOMATIC TRANSMISSION - NAG1 (Continued)



810bb261

HYDRAULIC FLOW IN DRIVE - FIFTH TO FOURTH GEAR TRANSITION

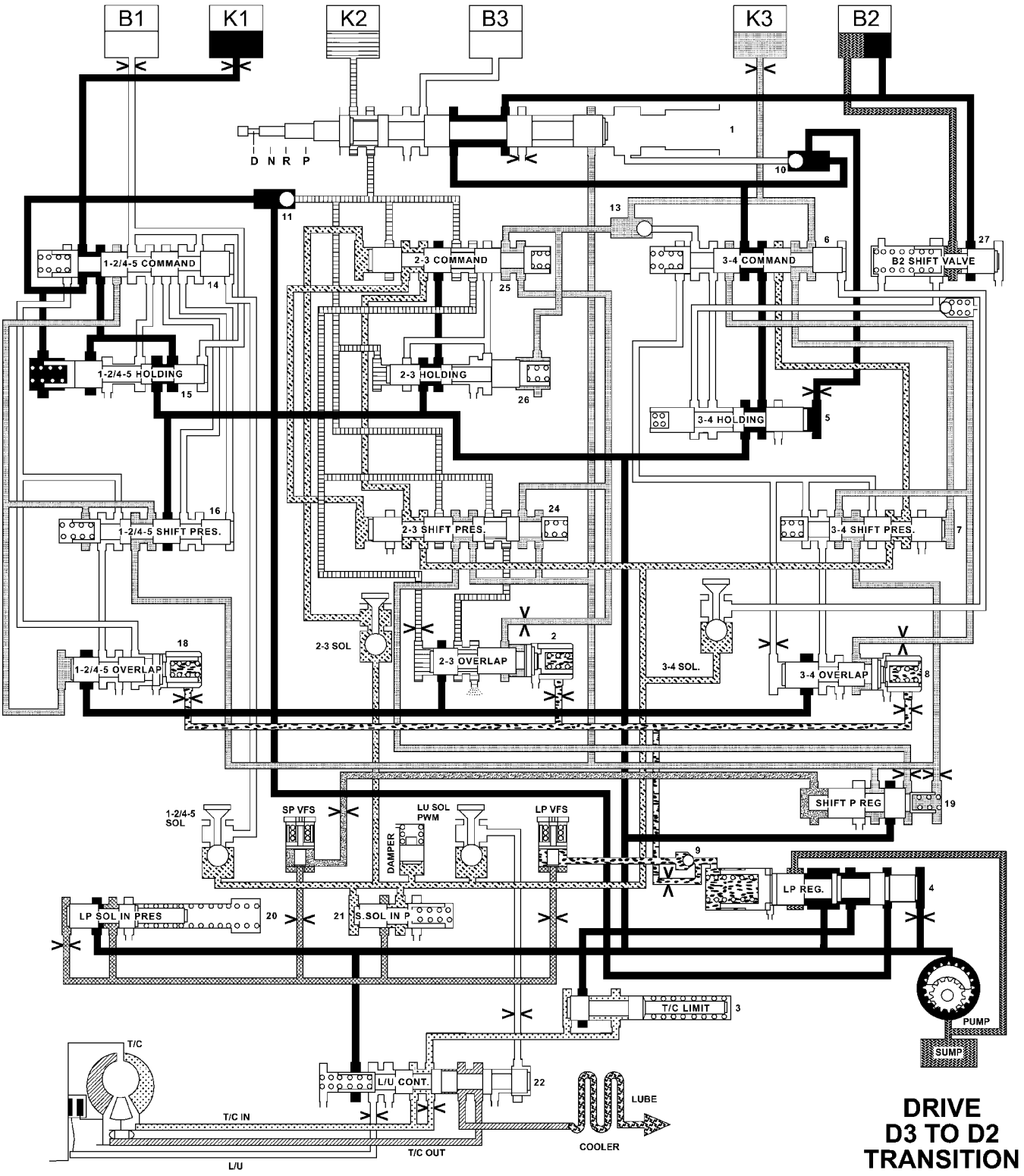
AUTOMATIC TRANSMISSION - NAG1 (Continued)



810bb2e7

HYDRAULIC FLOW IN DRIVE - FOURTH TO THIRD GEAR TRANSITION

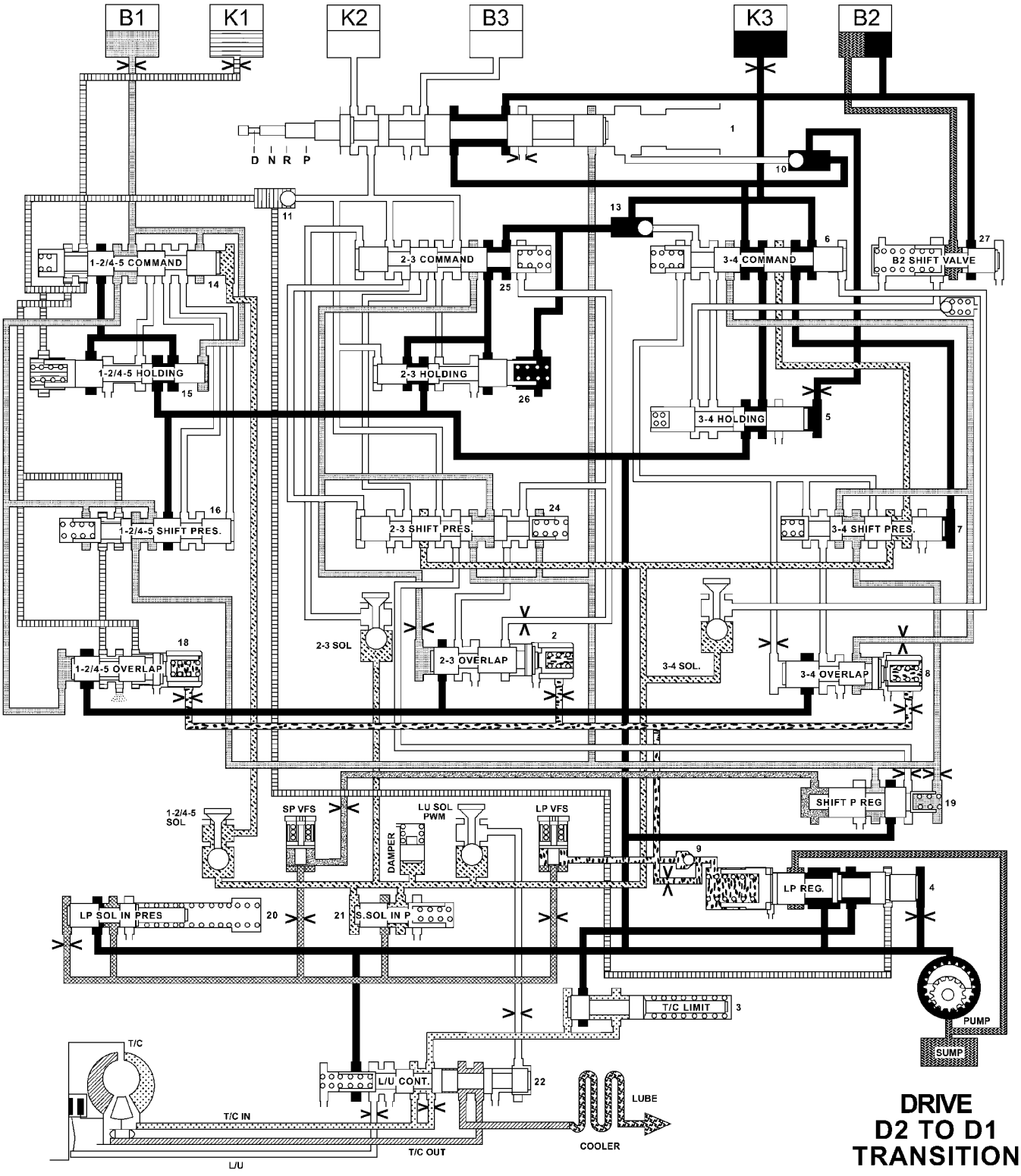
AUTOMATIC TRANSMISSION - NAG1 (Continued)



810bb2ec

HYDRAULIC FLOW IN DRIVE - THIRD TO SECOND GEAR TRANSITION

AUTOMATIC TRANSMISSION - NAG1 (Continued)



DRIVE D2 TO D1 TRANSITION

810bb2f7

HYDRAULIC FLOW IN DRIVE - SECOND TO FIRST GEAR TRANSITION

SPECIFICATIONS - NAG1 AUTOMATIC TRANSMISSION

GEAR RATIOS

1ST	3.59:1
2ND	2.19:1
3RD	1.41:1
4TH	1.00:1
5TH	0.83:1
REVERSE	3.16:1

SPECIFICATIONS

COMPONENT		METRIC (mm)	INCH (in.)
Geartrain End-play		0.3-0.5	0.012-0.020
Geartrain End-play Shim		0.2, 0.3, 0.4, and 0.5	0.008, 0.012, 0.016, 0.020
Rear Planetary Gear Set End-play		0.15-0.6	0.006-0.024
Rear Planetary Gear Set Snap-rings		3.0, 3.4, and 3.7	0.118, 0.134, 0.146
B1 Clutch Clearance	2 Disc	2.3-2.7	0.091-0.106
	3 Disc	2.7-3.1	0.106-0.122
	4 Disc	3.0-3.4	0.118-0.134
B1 Clutch Snap-rings		2.6, 2.9, 3.2, 3.5, 3.8, and 4.1	0.102, 0.114, 0.126, 0.138, 0.150, 0.162
B2 Clutch Clearance	4 Disc	1.9-2.3	0.075-0.091
	5 Disc	2.0-2.4	0.079-0.095
B2 Clutch Snap-rings		2.9, 3.2, 3.5, 3.8, and 4.1	0.114, 0.126, 0.138, 0.150, 0.162
B3 Clutch Clearance		1.0-1.4	0.039-0.055
B3 Clutch Snap-rings		3.2, 3.5, 3.8, 4.1, 4.4, and 4.7	0.126, 0.138, 0.150, 0.162, 0.173, 0.185
K1 Clutch Clearance	3 Disc	2.7-3.1	0.106-0.122
	4 Disc	3.0-3.4	0.118-0.134
	5 Disc	3.3-3.7	0.13-0.146
	6 Disc	3.6-4.0	0.142-0.158
K1 Clutch Snap-rings		2.6, 2.9, 3.2, 3.5, 3.8, and 4.1	0.102, 0.114, 0.126, 0.138, 0.150, 0.162
K2 Clutch Clearance	3 Disc	2.3-2.7	0.091-0.106
	4 Disc	2.4-2.8	0.095-0.110
	5 Disc	2.5-2.9	0.099-0.114
	6 Disc	2.7-3.1	0.106-0.122
K2 Clutch Snap-rings		2.3, 2.6, 2.9, 3.2, 3.5, and 3.8	0.091, 0.102, 0.114, 0.126, 0.138, 0.150
K3 Clutch Clearance	3 Disc	2.3-2.7	0.091-0.106
	4 Disc	2.4-2.8	0.095-0.110
	5 Disc	2.5-2.9	0.099-0.114
K3 Clutch Snap-rings		2.0, 2.3, 2.6, 2.9, 3.2, and 3.5	0.079, 0.091, 0.102, 0.114, 0.126, 0.138

AUTOMATIC TRANSMISSION - NAG1 (Continued)

TORQUE SPECIFICATIONS

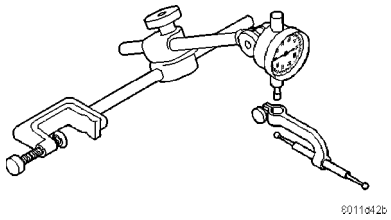
DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Bolt, B2 Clutch Carrier	16	-	141
Bolt, B1 Carrier to Converter Housing	10	-	88.5
Nut, Propeller Flange	120	88.5	-
Bolt, Electrohydraulic Unit	8	-	71
Bolt, Transmission Housing to Converter Housing	20	-	177
Bolts, Oil Pan	8	-	71
Screws, Valve Body/ Housing Side Cover	4	-	35
Bolt, Shift Plate	8	-	71
Bolt, Solenoid Leaf Spring	8	-	71
Plug, Oil Pan Drain	20	-	177
Nut, Shifter Mechanism to Floor Pan	7	-	65

SPECIAL TOOLS - NAG1 AUTOMATIC TRANSMISSION

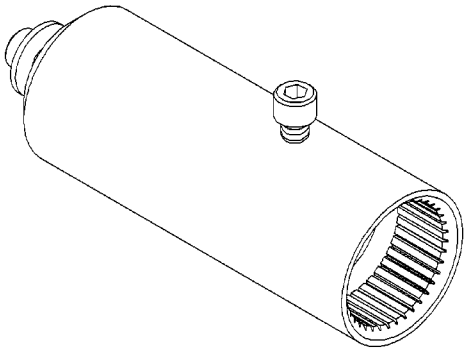
SPECIAL TOOL CROSS REFERENCE CHART

MB TOOL #	MILLER TOOL #	DESCRIPTION
N/A	C-3339	DIAL INDICATOR SET
N/A	C-4171	DRIVE HANDLE
N/A	6311	GAUGE BAR
N/A	8266	END-PLAY SET
N/A	8266-18	END-PLAY ADAPTER
N/A	8863A	DIPSTICK
140 586 13 43 00	8900	MULTI-USE SPRING COMPRESSOR
208 589 00 21 00N/A	8901	PRESSING TOOL
N/A	8902A	SEAL INSTALLER
N/A	9078	STAKING TOOL
N/A	9082	BEARING REMOVER
N/A	9287	BEARING INSTALLER

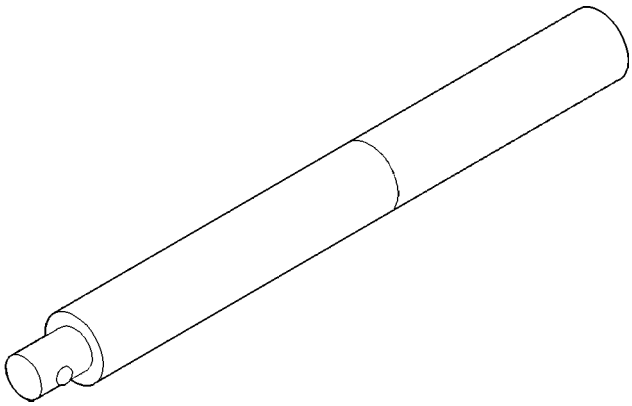
AUTOMATIC TRANSMISSION - NAG1 (Continued)



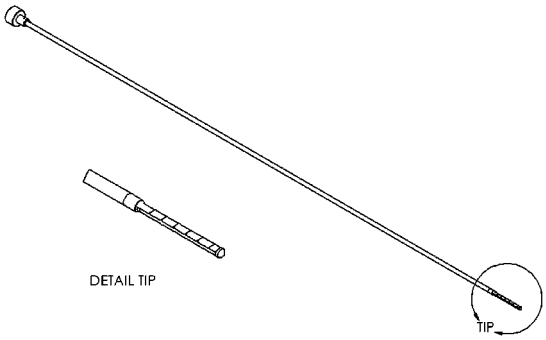
Dial Indicator - C-3339



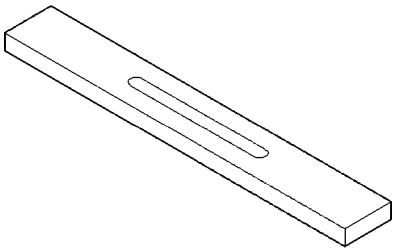
Adapter, Geartrain End-play - 8266-18



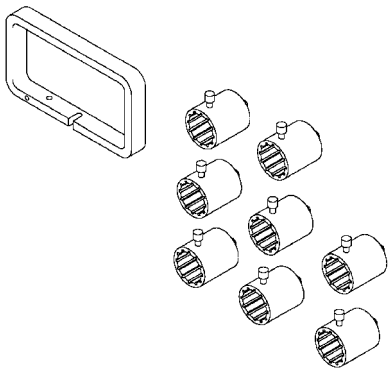
Handle, Universal - C-4171



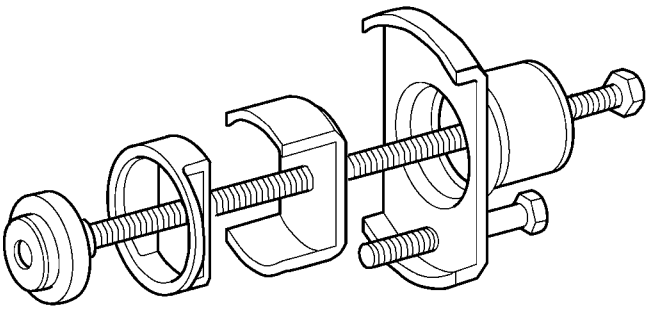
Dipstick - 8863A



Bar, Gauge - 6311

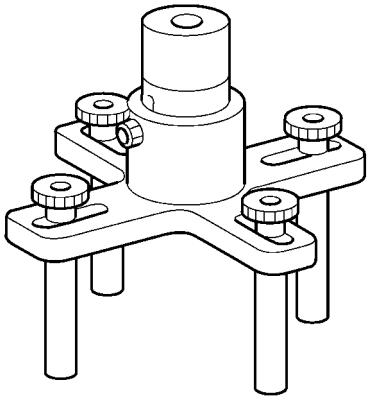


End Play Set - 8266



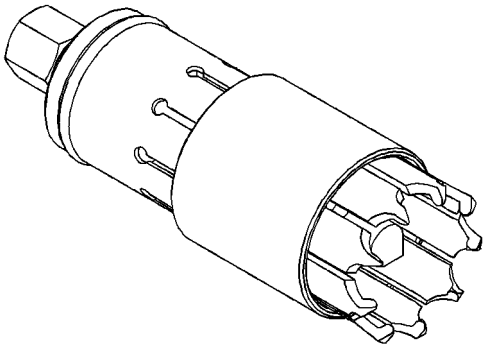
Compressor, Multi-use Spring - 8900

AUTOMATIC TRANSMISSION - NAG1 (Continued)

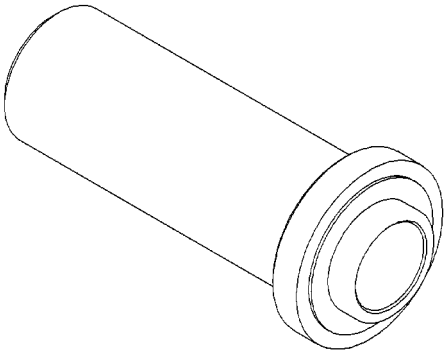


80e490e0

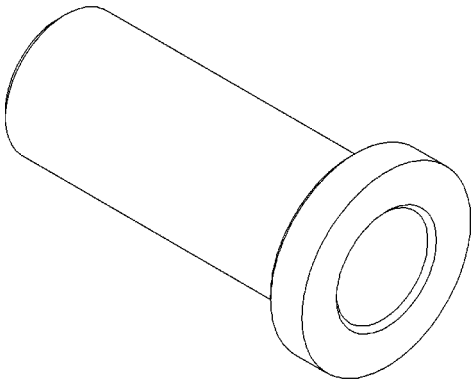
Tool, Pressing - 8901



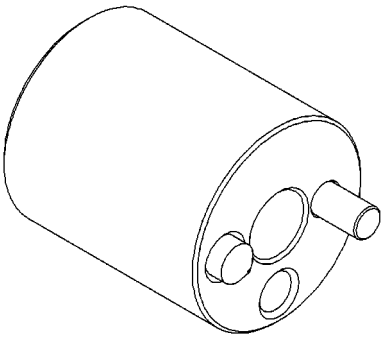
Remover, Bearing - 9082



Installer, Seal - 8902A



Installer, Bearing - 9287



Tool, Staking - 9078

DRIVING CLUTCHES

DESCRIPTION

Three multi-plate driving clutches (Fig. 73), the front, middle and rear multi-plate clutches K1, K2 and K3, are located in the planetary gear sets in the transmission housing.

A multi-plate driving clutch consists of a number of internally toothed discs (4) on an internally toothed disc carrier and externally toothed discs (3) on an externally toothed disc carrier.

OPERATION

The driving clutches (Fig. 74) produce a non-positive locking connection between two elements of a planetary gear set or between one element from each of two planetary gear sets in order to transmit the drive torque.

If the piston (20) on multi-plate clutch K1 (1) is subjected to oil pressure, it presses the internal and external discs of the disc set together. The sun gear (17) is locked with the planetary carrier (15) via the externally toothed disc carrier (19) and the internally toothed disc carrier (18). The front planetary gear set is thus locked and turns as a closed unit.

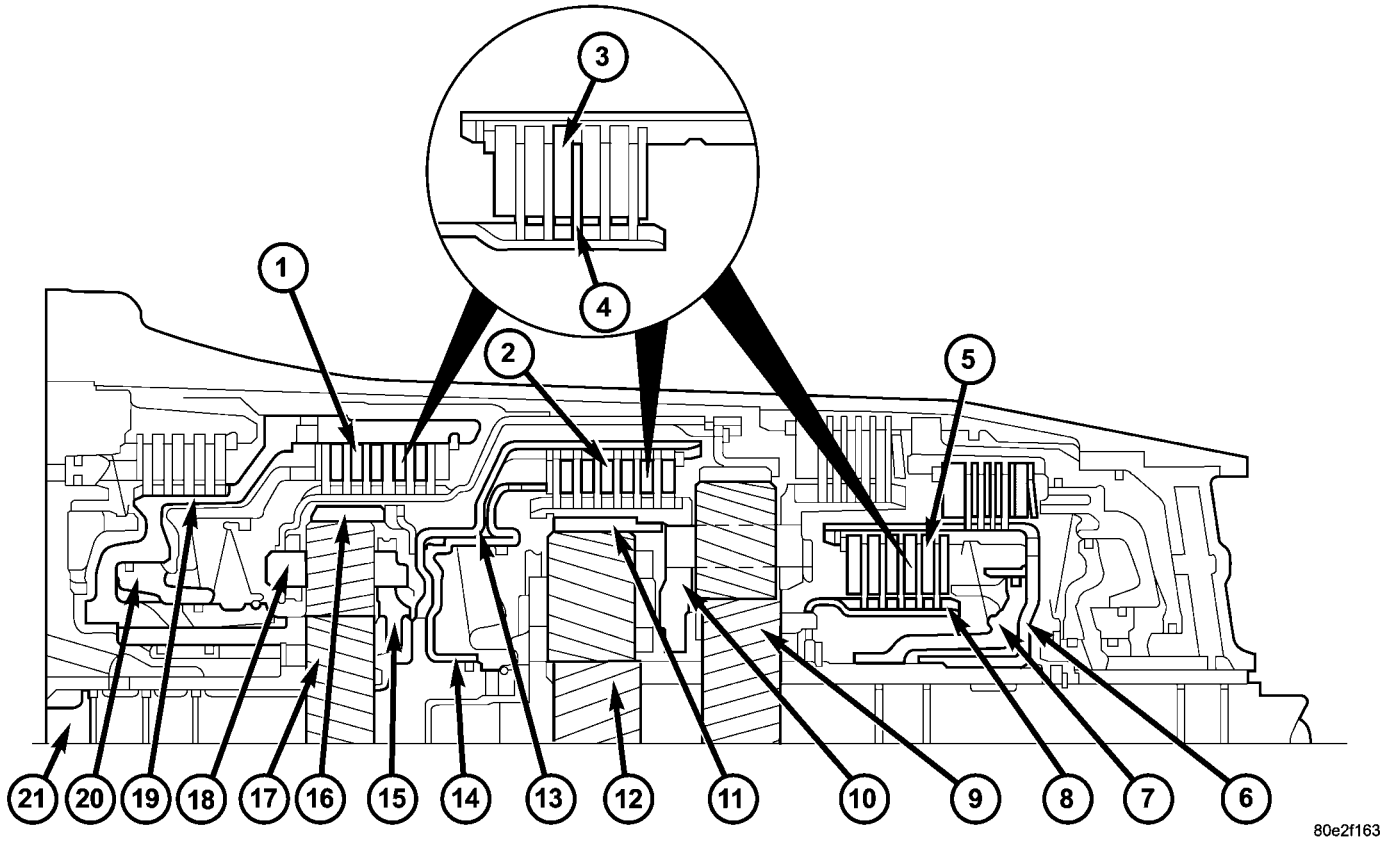


Fig. 73 Driving Clutches

1 - K1 CLUTCH
2 - K2 CLUTCH
3 - EXTERNALLY TOOTHED DISC
4 - INTERNALLY TOOTHED DISC
5 - K3 CLUTCH
6 - K3 CLUTCH EXTERNALLY TOOTHED DISC CARRIER
7 - K3 CLUTCH PISTON
8 - K3 CLUTCH INTERNALLY TOOTHED DISC CARRIER
9 - REAR PLANETARY GEARSET SUN GEAR
10 - CENTER PLANETARY GEARSET PLANETARY CARRIER
11 - CENTER PLANETARY GEARSET ANNULUS GEAR
12 - CENTER PLANETARY GEARSET SUN GEAR
13 - K2 CLUTCH EXTERNALLY TOOTHED DISC CARRIER
14 - K2 CLUTCH PISTON
15 - FRONT PLANETARY GEARSET PLANETARY CARRIER
16 - FRONT PLANETARY GEARSET ANNULUS GEAR
17 - FRONT PLANETARY GEARSET SUN GEAR
18 - K1 CLUTCH INTERNALLY TOOTHED DISC CARRIER
19 - K1 CLUTCH EXTERNALLY TOOTHED DISC CARRIER
20 - K1 CLUTCH PISTON
21 - DRIVE SHAFT

DRIVING CLUTCHES (Continued)

If the multi-plate clutch K2 (2) is actuated via the piston (14), the piston compresses the disc set. The annulus gear (16) of the front planetary gear set is locked with the annulus gear (11) of the center planetary gear set via the externally toothed disc carrier (13) and the center planetary carrier (10) on which the internally toothed discs are seated. Annulus gear (16) and annulus gear (11) turn at the same speed as the input shaft (21)

If the multi-plate clutch K3 (5) is actuated via the piston (7), the piston compresses the disc set. The sun gear (12) of the center planetary gear set is locked with the sun gear (9) of the rear planetary gear set via the externally toothed disc carrier (6) and the internally toothed disc carrier (8). Sun gear (12) and sun gear (9) turn at the same speed.

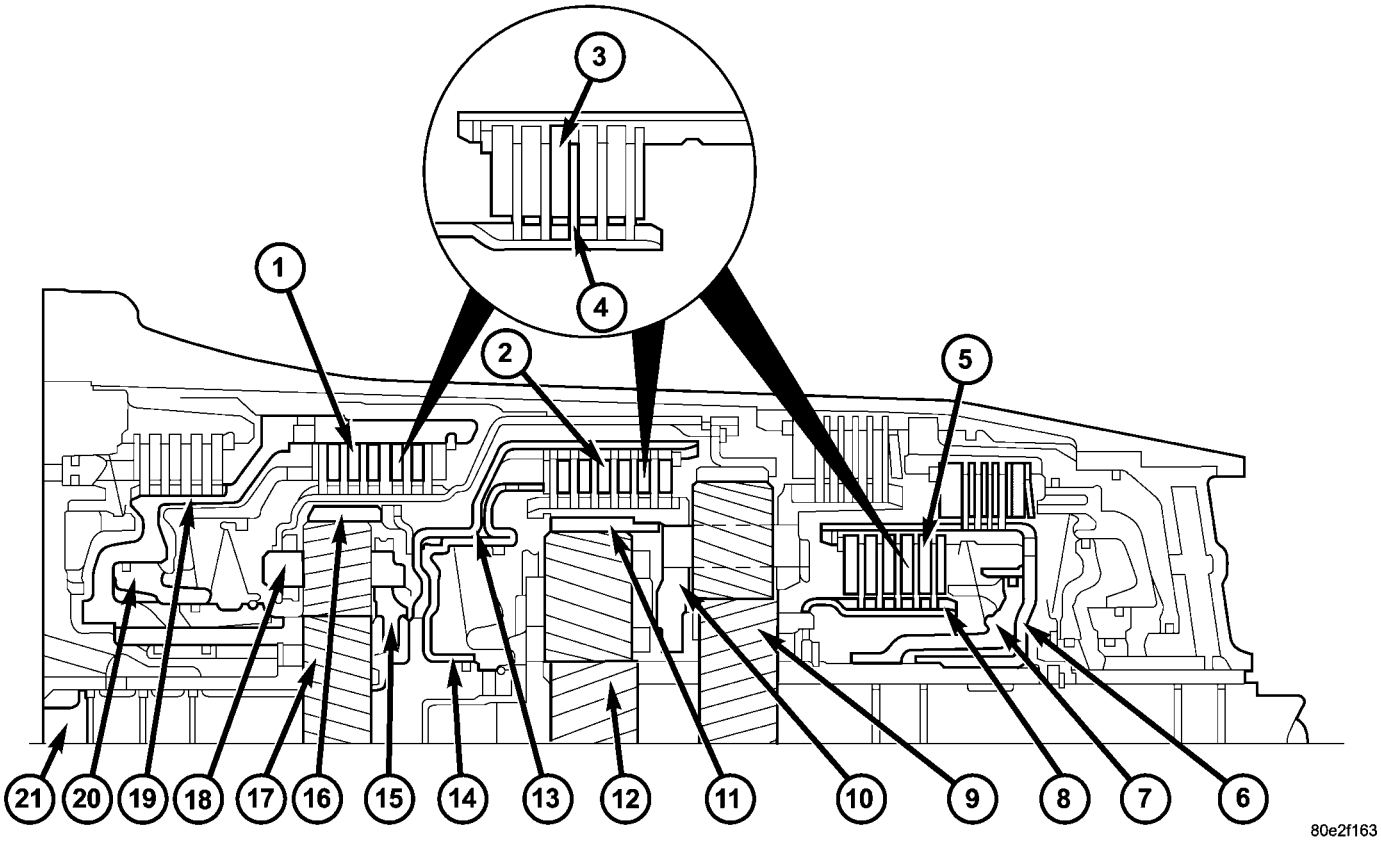


Fig. 74 Driving Clutches

1 - K1 CLUTCH
2 - K2 CLUTCH
3 - EXTERNALLY TOOTHED DISC
4 - INTERNALLY TOOTHED DISC
5 - K3 CLUTCH
6 - K3 CLUTCH EXTERNALLY TOOTHED DISC CARRIER
7 - K3 CLUTCH PISTON
8 - K3 CLUTCH INTERNALLY TOOTHED DISC CARRIER
9 - REAR PLANETARY GEARSET SUN GEAR
10 - CENTER PLANETARY GEARSET PLANETARY CARRIER
11 - CENTER PLANETARY GEARSET ANNULUS GEAR
12 - CENTER PLANETARY GEARSET SUN GEAR
13 - K2 CLUTCH EXTERNALLY TOOTHED DISC CARRIER
14 - K2 CLUTCH PISTON
15 - FRONT PLANETARY GEARSET PLANETARY CARRIER
16 - FRONT PLANETARY GEARSET ANNULUS GEAR
17 - FRONT PLANETARY GEARSET SUN GEAR
18 - K1 CLUTCH INTERNALLY TOOTHED DISC CARRIER
19 - K1 CLUTCH EXTERNALLY TOOTHED DISC CARRIER
20 - K1 CLUTCH PISTON
21 - DRIVE SHAFT

DRIVING CLUTCH K1

DISASSEMBLY

(1) Remove snap-ring (11) (Fig. 75) from outer multiple-disc carrier (6).

(2) Take multiple-disc pack (12) out of outer multiple-disc carrier (6).

(3) Place Multi-use Spring Compressor 8900 on the spring plate (8) and compress the spring until the snap-ring (10) is exposed.

(4) Remove snap-ring (10) (Fig. 75).

(5) Take out disc spring (7) and remove piston (6) by carefully blowing compressed air into the bore (A).

(6) Remove snap-ring (3) and take out front freewheeling clutch F1 (2).

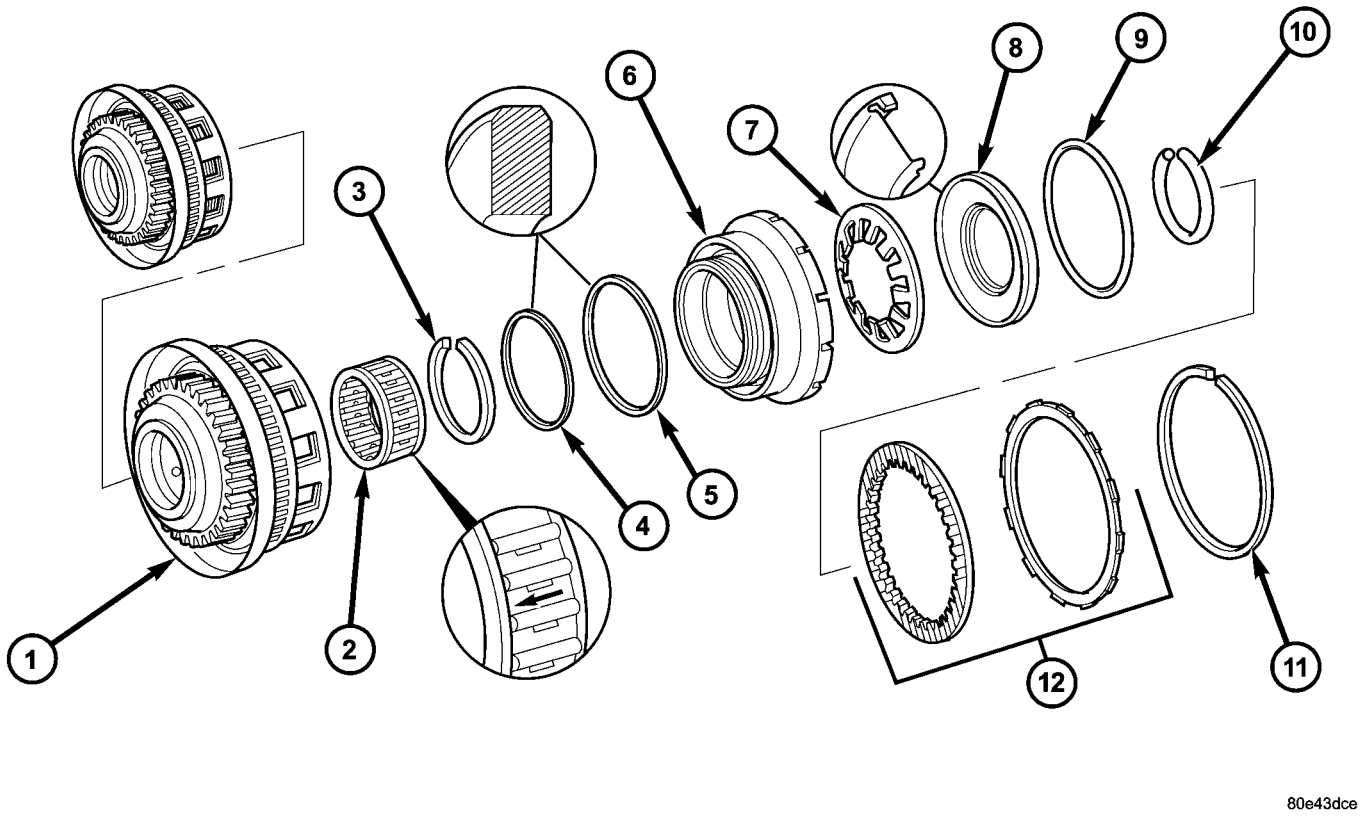


Fig. 75 Driving Clutch K1 Components

1 - K1 OUTER DISC CARRIER
2 - FREEWHEELING CLUTCH F1
3 - SNAP-RING
4 - OUTER DISC CARRIER SEALING RING
5 - PISTON SEALING RING
6 - PISTON
7 - DISC SPRING
8 - SPRING PLATE
9 - SPRING PLATE SEALING RING
10 - SNAP-RING
11 - SNAP-RING
12 - MULTIPLE DISC PACK

DRIVING CLUTCH K1 (Continued)

ASSEMBLY

(1) Install piston (6) (Fig. 76) in the outer multiple-disc carrier (1). Check sealing rings (4 and 5), replace if necessary. The rounded off edges of the sealing rings must point outwards.

(2) Insert disc spring (7) (Fig. 76). Insert disc spring with the curvature towards the piston.

(3) Insert spring plate (8). Insert spring plate with the curvature towards the sun gear. Check sealing ring (9), replace if necessary.

(4) Place Multi-use Spring Compressor 8900 on spring plate (8) and compress the spring until the groove of the snap-ring is exposed.

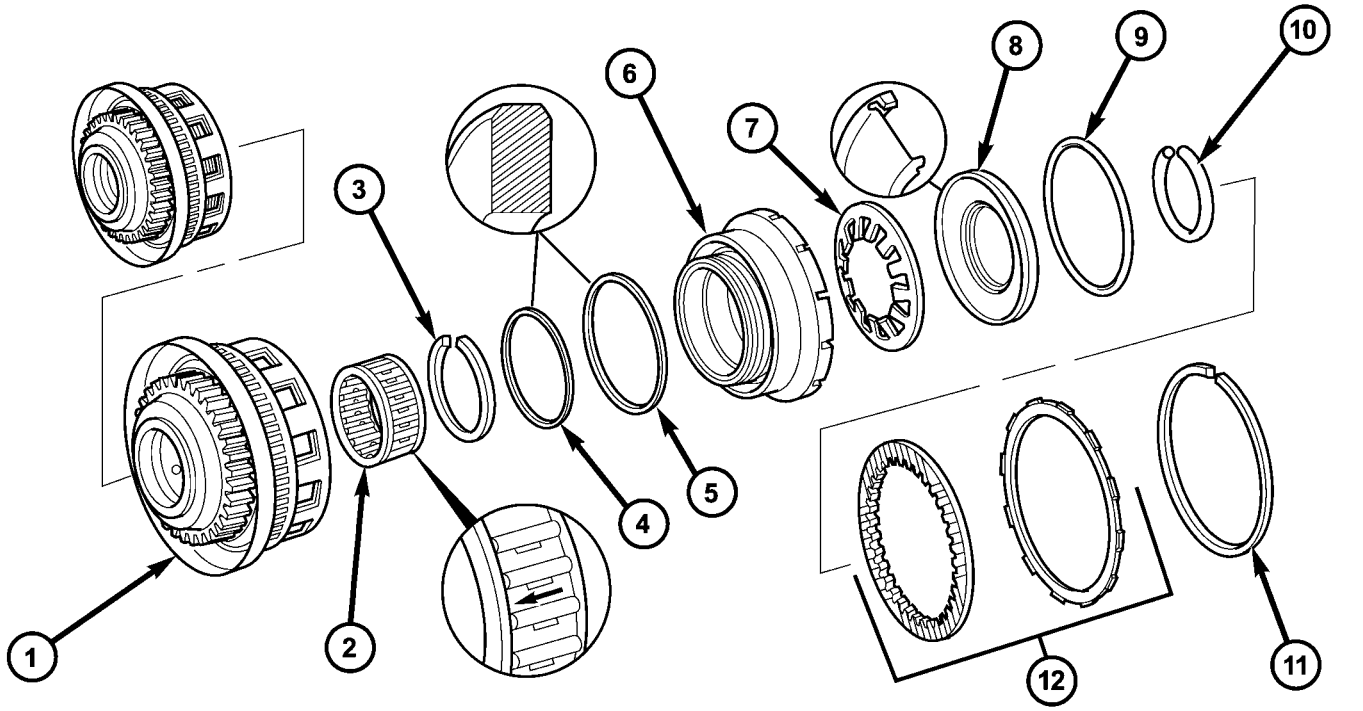
(5) Insert snap-ring (10) (Fig. 76). After installing, check snap-ring for correct seat

NOTE: Pay attention to sequence of discs. Place new friction multiple-discs in ATF fluid for one hour before installing.

(6) Insert multiple-disc pack (12) in the outer multiple-disc carrier.

(7) Insert snap-ring (11).

(8) Measure the K1 clutch pack clearance.



80e43dce

Fig. 76 Driving Clutch K1 Components

1 - K1 OUTER DISC CARRIER
2 - FREEWHEELING CLUTCH F1
3 - SNAP-RING
4 - OUTER DISC CARRIER SEALING RING
5 - PISTON SEALING RING
6 - PISTON
7 - DISC SPRING
8 - SPRING PLATE
9 - SPRING PLATE SEALING RING
10 - SNAP-RING
11 - SNAP-RING
12 - MULTIPLE DISC PACK

DRIVING CLUTCH K1 (Continued)

(a) Mount Pressing Tool 8901 (1) (Fig. 77) on outer multiple disc.

(b) Using a lever press, compress pressing tool as far as the stop (then the marking ring is still visible, see small arrow).

(c) Using a feeler gauge, determine the play ″L″ (Fig. 78) at three points between the snap-ring (5) and outer multiple-disc (3).

(d) During the measurement the snap-ring (5) must contact the upper bearing surface of the groove in the outer multiple-disc carrier.

(e) The correct clutch clearance is 2.7-3.1 mm (0.106-0.122 in.) for three friction disc versions, 3.0-3.4 mm (0.118-0.134 in.) for four disc versions, 3.3-3.7 mm (0.130-0.146 in.) for five disc versions, and 3.6-4.0 mm (0.142-0.158 in.) for six disc versions.

(f) Adjust with snap-ring (5), if necessary. Snap-rings are available in thicknesses of 2.6 mm (0.102 in.), 2.9 mm (0.114 in.), 3.2 mm (0.126 in.), 3.5 mm (0.138 in.), 3.8 mm (0.150 in.), and 4.1 mm (0.162 in.).

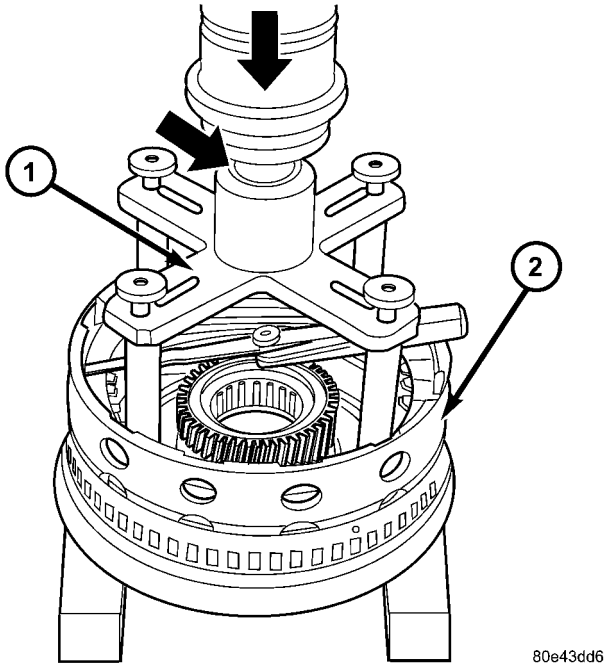


Fig. 77 Measure K1 Clutch Clearance

1 - PRESSING TOOL 8901
2 - K1 OUTER DISC CARRIER

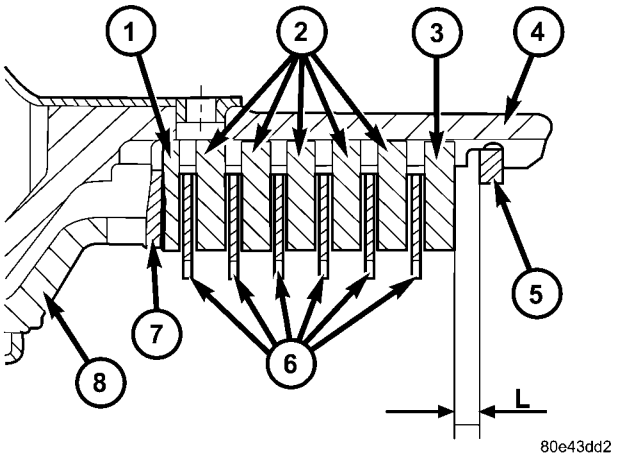


Fig. 78 Driving Clutch K1 Stack-up

1 - OUTER MULTIPLE DISC - 1.8MM (0.071 IN.)
2 - OUTER MULTIPLE DISC - 2.8MM (0.110 IN.)
3 - OUTER MULTIPLE DISC - 4.0MM (0.158 IN.)
4 - K1 OUTER DISC CARRIER
5 - SNAP-RING
6 - FRICTION DISCS
7 - DISC SPRING
8 - PISTON

(9) Insert front freewheeling clutch F1 (2) and fit snap-ring (3). The freewheeling clutch F1 (2) must be installed in the direction of the arrow.

DRIVING CLUTCH K2

DISASSEMBLY

(1) Remove snap-ring (15) from the K1 inner multiple-disc carrier with integrated front gear set (1) and take off hollow gear (14).

(2) Remove drive shaft with clutch K2 (3) (Fig. 79).

(3) Remove needle thrust bearing (2).

(4) Remove snap-ring (13) (Fig. 79) from K2 outer multiple-disc carrier.

(5) Take out multiple-disc pack (12).

(6) Take out disk spring (11) (Fig. 79).

(7) Fit Multi-use Spring Compressor 8900 (Fig. 80) onto spring retainer (9) and press until snap-ring (10) is released.

(8) Remove snap-ring (10) (Fig. 79).

(9) Take out disc spring (7) and pull piston (6) out of outer multiple-disc carrier.

DRIVING CLUTCH K2 (Continued)

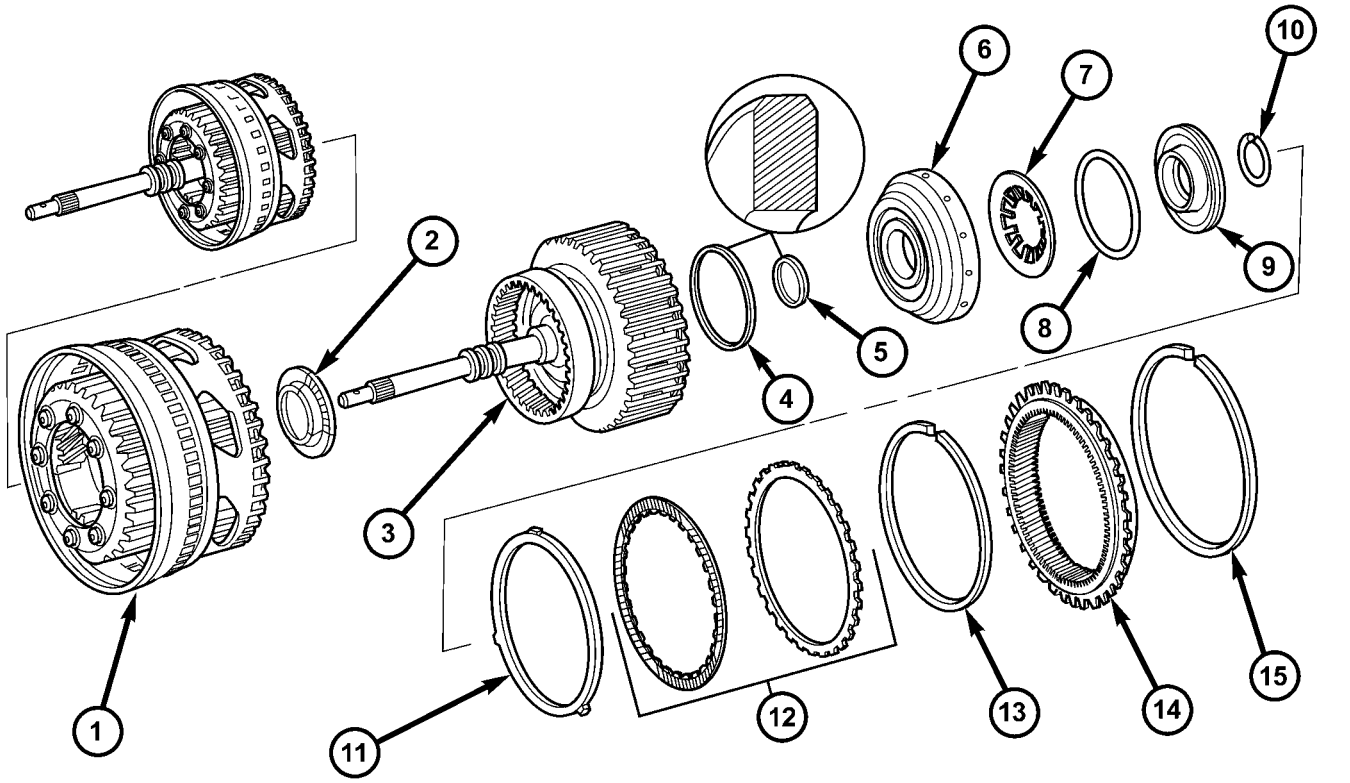


Fig. 79 Driving Clutch K2 Components

1 - K1 INNER DISC CARRIER WITH INTEGRATED FRONT GEAR SET
2 - THRUST BEARING
3 - INPUT SHAFT AND K2 CLUTCH
4 - PISTON OUTER SEAL RING
5 - PISTON INNER SEAL RING
6 - PISTON
7 - DISC SPRING
8 - SPRING RETAINER SEAL
9 - SPRING RETAINER
10 - SNAP-RING
11 - DISC SPRING
12 - MULTIPLE DISC PACK
13 - SNAP-RING
14 - HOLLOW GEAR
15 - SNAP-RING

DRIVING CLUTCH K2 (Continued)

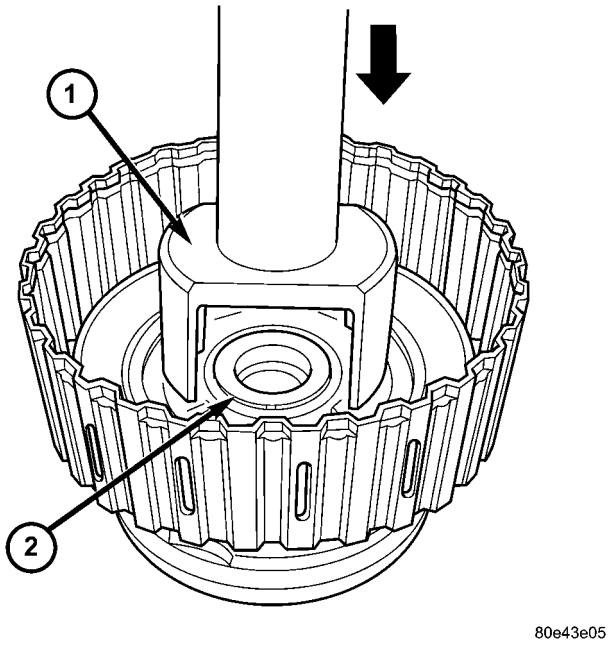


Fig. 80 Compress K2 Clutch Spring

1 - MULTI-USE SPRING COMPRESSOR 8900
2 - SNAP-RING

ASSEMBLY

(1) Install piston (6) (Fig. 81) in outer multiple-disc carrier. Inspect seals (4 and 5), replace if necessary. The rounded edges of the seals must point to the outside.

(2) Insert disk spring (7) and spring retainer (9). Insert disk spring (7) with curved side pointing toward spring retainer (9). Inspect seal (8) (Fig. 81), replace if necessary.

(3) Place Multi-use Spring Compressor 8900 (Fig. 82) on spring plate (9) and press until the groove of the snap-ring is exposed.

(4) Insert snap-ring (10).

(5) Insert disk spring (11).

NOTE: Pay attention to sequence of discs. Place new friction multiple-discs in ATF fluid for one hour before installing.

(6) Insert multiple-disk set (12) into outer multiple-disk carrier.

(7) Fit snap-ring (13).

(8) Measure K2 clutch clearance.

(a) Mount Pressing Tool 8901 (1) (Fig. 83) on outer multiple disc.

(b) Using a lever press, compress pressing tool as far as the stop (then the marking ring is still visible, see small arrow).

(c) Using a feeler gauge, determine the play ″L″ (Fig. 84) at three points between the snap-ring (6) and outer multiple-disc (4).

(d) During the measurement the snap-ring (6) must contact the upper bearing surface of the groove in the outer multiple-disc carrier.

(e) The correct clutch clearance is 2.3-2.7 mm (0.091-0.106 in.) for three friction disc versions, 2.4-2.8 mm (0.095-0.110 in.) for four disc versions, 2.5-2.9 mm (0.099-0.114 in.) for five disc versions, and 2.7-3.1 mm (0.106-0.122 in.) for six disc versions.

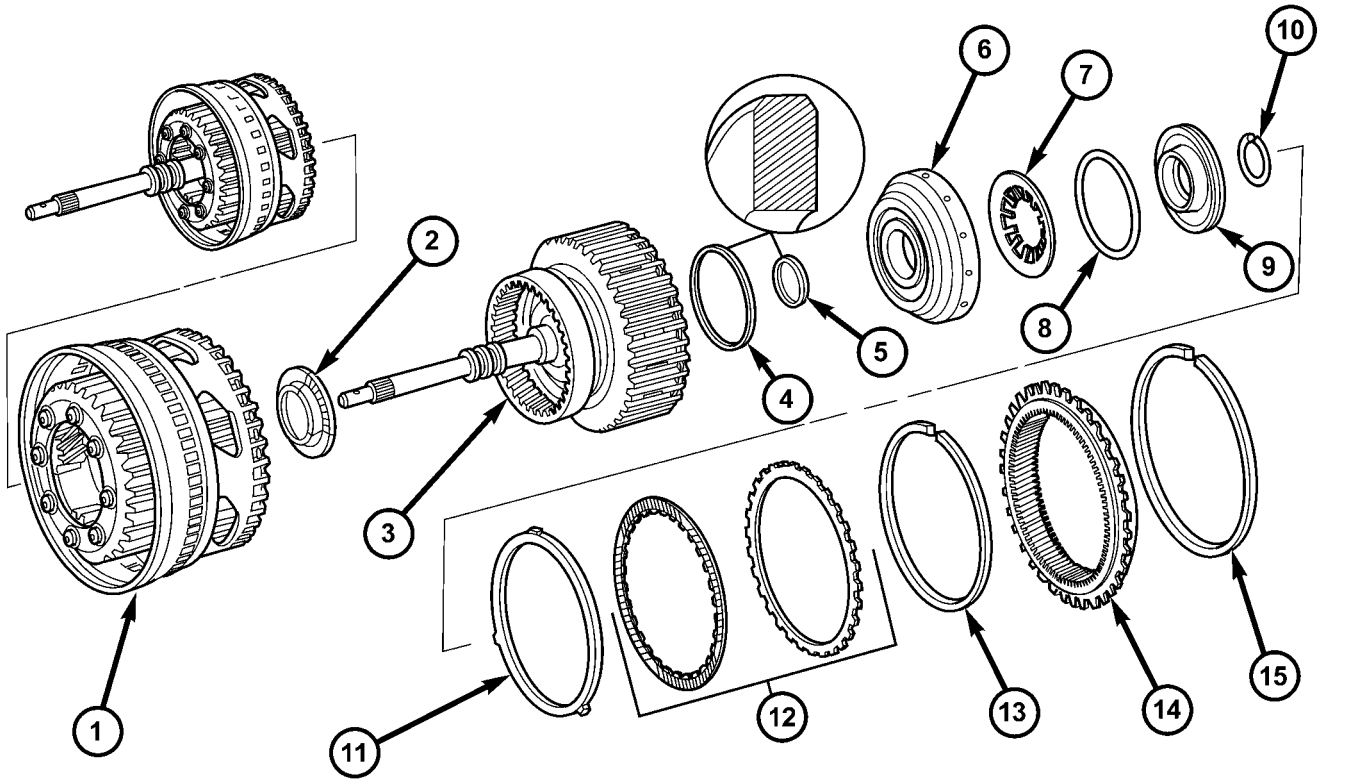
(f) Adjust with snap-ring (6), if necessary. Snap-rings are available in thicknesses of 2.3 mm (0.091 in.), 2.6 mm (0.102 in.), 2.9 mm (0.114 in.), 3.2 mm (0.126 in.), 3.5 mm (0.138 in.), and 3.8 mm (0.150 in.).

(9) Insert axial needle bearing (2) into K1 inner multiple-disk carrier. Insert axial needle bearing (2) with a little grease to prevent it slipping.

(10) Install drive shaft in K1 inner multiple-disc carrier with integrated front gear set (3).

(11) Fit internally-geared wheel (14). Pay attention to installation position.

DRIVING CLUTCH K2 (Continued)



80e43e01

Fig. 81 Driving Clutch K2 Components

1 - K1 INNER DISC CARRIER WITH INTEGRATED FRONT GEAR SET
2 - THRUST BEARING
3 - INPUT SHAFT AND K2 CLUTCH
4 - PISTON OUTER SEAL RING
5 - PISTON INNER SEAL RING
6 - PISTON
7 - DISC SPRING
8 - SPRING RETAINER SEAL
9 - SPRING RETAINER
10 - SNAP-RING
11 - DISC SPRING
12 - MULTIPLE DISC PACK
13 - SNAP-RING
14 - HOLLOW GEAR
15 - SNAP-RING

DRIVING CLUTCH K2 (Continued)

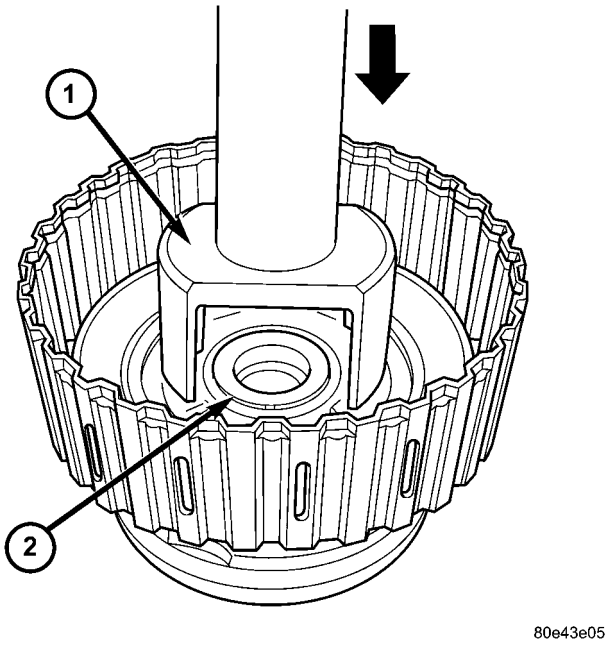


Fig. 82 Compress K2 Clutch Spring

1 - MULTI-USE SPRING COMPRESSOR 8900
2 - SNAP-RING

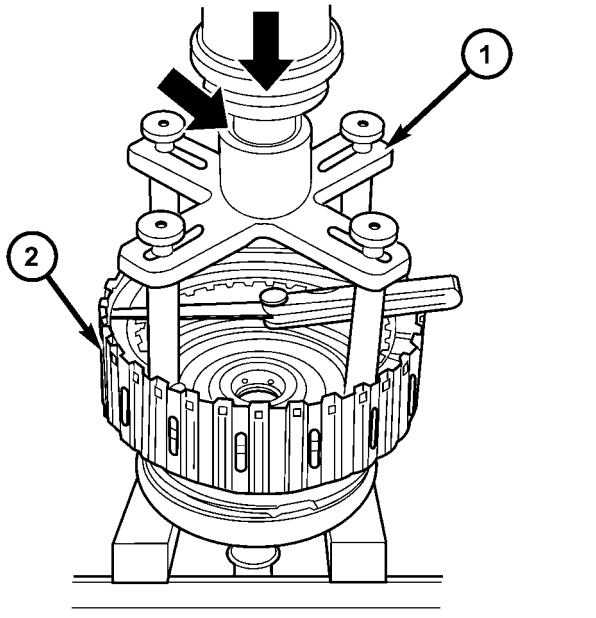


Fig. 83 Measure K2 Clutch Clearance

1 - PRESSING TOOL 8901
2 - K1 INNER DISC CARRIER

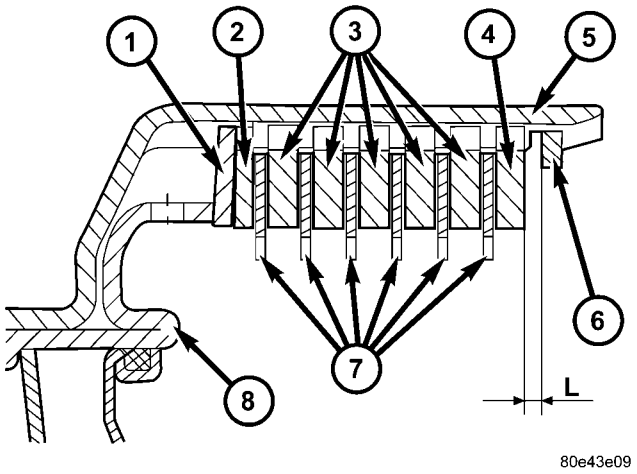


Fig. 84 Driving Clutch K2 Stack-up

1 - DISC SPRING
2 - OUTER MULTIPLE DISC - 1.8 MM (0.071 IN.)
3 - OUTER MULTIPLE DISC - 2.8 MM (0.110 IN.)
4 - OUTER MULTIPLE DISC - 4.0 MM (0.158 IN.)
5 - K2 OUTER DISC CARRIER
6 - SNAP-RING
7 - FRICTION DISCS
8 - PISTON

DRIVING CLUTCH K3

DISASSEMBLY

(1) Remove snap-ring (1) (Fig. 85) from outer multiple-disc carrier.

(2) Remove multiple-disc pack (2) and disk spring (3) from outer multiple-disc carrier.

(3) Place Multi-use Spring Compressor 8900 (9) (Fig. 85) on disc spring (5) and compress the spring until the snap-ring (4) is exposed.

(4) Remove snap-ring (4).

(5) Remove spring plate (5) and piston (6) from outer multiple-disc carrier.

ASSEMBLY

(1) Install piston (6) in the outer multiple-disc carrier (8). Check sealing ring (7), replace if necessary. The rounded off edges of the sealing ring must point outwards.

(2) Insert disc spring (5). Insert disc spring with the curvature towards the piston.

(3) Mount the Multi-use Spring Compressor 8900 (9) on the spring plate and clamp until the snap-ring groove is exposed.

(4) Insert snap-ring (4). The collar of the snap-ring must point towards the multiple-disc pack.

DRIVING CLUTCH K3 (Continued)

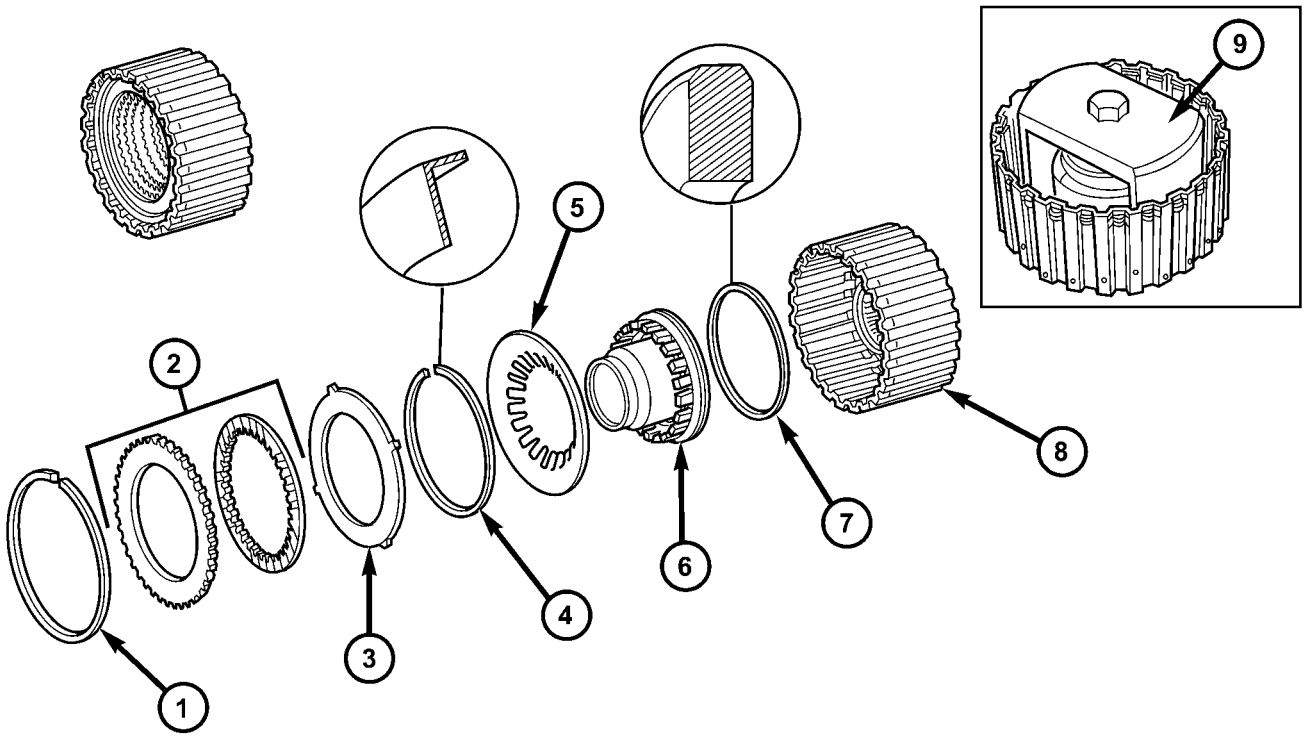


Fig. 85 Driving Clutch K3 Components

1 - SNAP-RING
2 - MULTIPLE DISC PACK
3 - DISC SPRING
4 - SNAP-RING
5 - SPRING PLATE
6 - PISTON
7 - SEALING RING
8 - OUTER DISC CARRIER
9 - MULTI-USE SPRING COMPRESSOR 8900

NOTE: Pay attention to sequence of discs. Place new friction multiple-discs in ATF fluid for one hour before installing.

(5) Install disk spring (3) and multiple-disc pack (2) in outer multiple-disc carrier (8).

(6) Insert snap-ring (1).

(7) Measure the K3 clutch clearance.

(a) Mount Pressing Tool 8901 (1) (Fig. 86) on outer multiple disc.

(b) Using a lever press, compress pressing tool as far as the stop (then the marking ring is still visible, see small arrow).

(c) Using a feeler gauge, determine the play ″L″ (Fig. 87) at three points between the snap-ring (8) and outer multiple-disc (2).

(d) During the measurement the snap-ring (8) must contact the upper bearing surface of the groove in the outer multiple-disc carrier.

(e) The correct clutch clearance is 2.3-2.7 mm (0.091-0.106 in.) for three friction disc versions, 2.4-2.8 mm (0.095-0.110 in.) for four disc versions, and 2.5-2.9 mm (0.099-0.114 in.) for five disc versions.

DRIVING CLUTCH K3 (Continued)

(f) Adjust with snap-ring (8), if necessary. Snap-rings are available in thicknesses of 2.0 mm (0.079 in.), 2.3 mm (0.091 in.), 2.6 mm (0.102 in.), 2.9 mm (0.114 in.), 3.2 mm (0.126 in.), and 3.5 mm (0.138 in.).

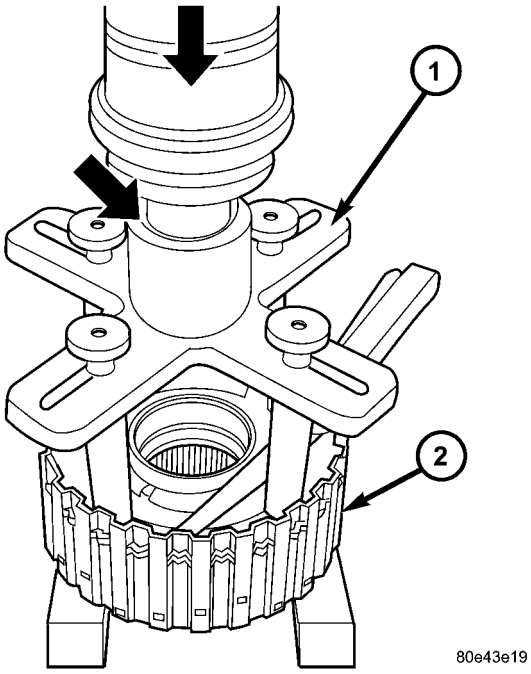


Fig. 86 Measure K3 Clutch Clearance

1 - PRESSING TOOL 8901
2 - OUTER DISC CARRIER

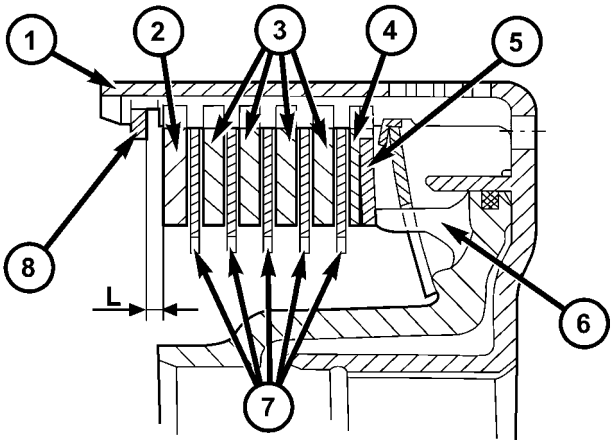


Fig. 87 Driving Clutch K3 Stack-up

1 - OUTER DISC CARRIER
2 - OUTER MULTIPLE DISC - 4.0 MM (0.158 IN.)
3 - OUTER MULTIPLE DISC - 2.8 MM (0.110 IN.)
4 - OUTER MULTIPLE DISC - 1.8 MM (0.079 IN.)
5 - DISC SPRING
6 - PISTON
7 - FRICTION DISCS - 2.1 MM (0.083 IN.)
8 - SNAP-RING

ELECTROHYDRAULIC UNIT

DESCRIPTION

The electrohydraulic control unit comprises the shift plate made from light alloy for the hydraulic control and an electrical control unit. The electrical control unit comprises of a supporting body made of plastic, into which the electrical components are assembled. The supporting body is mounted on the shift plate and screwed to it.

Strip conductors inserted into the supporting body make the connection between the electrical components and a plug connector. The connection to the wiring harness on the vehicle and the transmission control module (TCM) is produced via this 13-pin plug connector with a bayonet lock.

ELECTRICAL CONTROL UNIT

The electric valve control unit (7) (Fig. 88) consists of a plastic shell which houses the RPM sensors (1,12), regulating solenoid valves (3, 4), solenoid valves (5, 6, 10), the TCC solenoid valve (11), the park/neutral contact (9), and the transmission oil temperature sensor (8). Conductor tracks integrated into the shell connect the electric components to a plug connection (2). This 13-pin plug connection (2) establishes the connection to the vehicle-side cable harness and to the transmission control module (TCM). With the exception of the solenoid valves, all other electric components are fixed to the conductor tracks.

HYDRAULIC CONTROL UNIT

Working Pressure (Operating Pressure) (p-A)

The working pressure provides the pressure supply to the hydraulic control and the transmission shift elements. It is the highest hydraulic pressure in the entire hydraulic system. The working pressure is regulated at the working pressure regulating valve in relation to the load and gear. All other pressures required for the transmission control are derived from the working pressure.

Lubrication Pressure (p-Sm)

At the working pressure regulating valve surplus oil is diverted to the lubrication pressure regulating valve, from where it is used in regulated amounts to lubricate and cool the mechanical transmission components and the torque converter. Furthermore, the lubrication pressure (p-Sm) is also used to limit the pressure in the torque converter.

ELECTROHYDRAULIC UNIT (Continued)

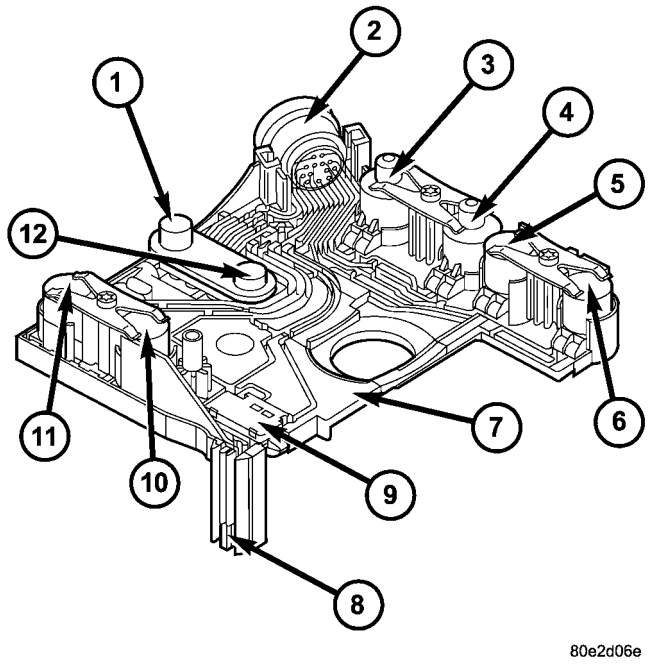


Fig. 88 Electrical Control Unit

1 - N3 SPEED SENSOR
2 - PLUG CONNECTOR
3 - MODULATING PRESSURE REGULATING SOLENOID
4 - SHIFT PRESSURE REGULATING SOLENOID
5 - 1-2/4-5 SHIFT SOLENOID
6 - 3-4 SHIFT SOLENOID
7 - ELECTRICAL CONTROL UNIT
8 - TRANSMISSION TEMPERATURE SENSOR
9 - STARTER INTERLOCK CONTACT
10 - 2-3 SHIFT SOLENOID
11 - TORQUE CONVERTER LOCK-UP SOLENOID
12 - N2 SPEED SENSOR

Shift Pressure (p-S)

The shift pressure is determined by the shift pressure regulating solenoid valve and the shift pressure regulating valve. The shift pressure:

- Regulates the pressure in the activating shift element during the shift phase.
- Determines together with the modulating pressure the pressure reduction at the deactivating shift element as regulated by the overlap regulating valve.
- Initializes 2nd gear in limp-home mode.

Modulating Pressure (p-Mod)

The modulating pressure influences the size of the working pressure and determines together with the shift pressure the pressure regulated at the overlap regulating valve. The modulating pressure is regulated at the modulating pressure regulating solenoid valve, which is under regulating valve pressure. The modulating pressure is variable and relative to the engine load.

Regulating Valve Pressure (p-RV)

The regulating valve pressure is regulated at the regulating valve pressure regulating valve in relation to the working pressure (p-A) up to a maximum pressure of 8 bar (116 psi). It supplies the modulating pressure regulating solenoid valve, the shift pressure regulating solenoid valve and the shift valve pressure regulating valve.

Shift Valve Pressure (p-SV)

The shift valve pressure (p-SV) is derived from the regulating valve pressure (p-RV), is regulated at the shift valve pressure regulating valve and is then present at the:

- 1-2 and 4-5 shift solenoid valve.
- 3-4 shift solenoid valve.
- 2-3 shift solenoid valve.
- Torque converter lockup solenoid valve.
- 3-4 and 2-3 shift pressure shift valve.

The shift valve pressure (p-SV) controls the command valves via the upshift/downshift solenoid valves.

Overlap Pressure (p-Ü)

The overlap pressure controls the shift component pressure reduction during a shift phase. The pressure in a shift element as it disengages is controlled during the shift phase depending on engine load (modulating pressure) and the pressure in the shift element as it engages. The adjusted pressure is inversely proportional to the transmission capability of the shift element being engaged (controlled overlap).

Working Pressure Regulating Valve (Operating Pressure)

The working pressure regulating valve (Fig. 89) is located in the valve housing of the shift plate. It regulates the primary pressure of the hydraulic system.

Torque Converter Lockup Clutch Regulating Valve

The torque converter lock-up clutch regulating valve (Fig. 90) is located in the valve housing of the electrohydraulic control module. The valve is responsible for the hydraulic control of the torque converter lockup clutch and distribution of the lubricating oil.

Overlap Regulating Valve

Each shift group is assigned one overlap regulating valve (Fig. 91). The 1-2 / 4-5 overlap regulating valve is installed in the shift valve housing; the 2-3 and 3-4 overlap regulating valves are installed in the valve housing. The overlap regulating valve regulates the pressure reduction during a shift phase.

ELECTROHYDRAULIC UNIT (Continued)

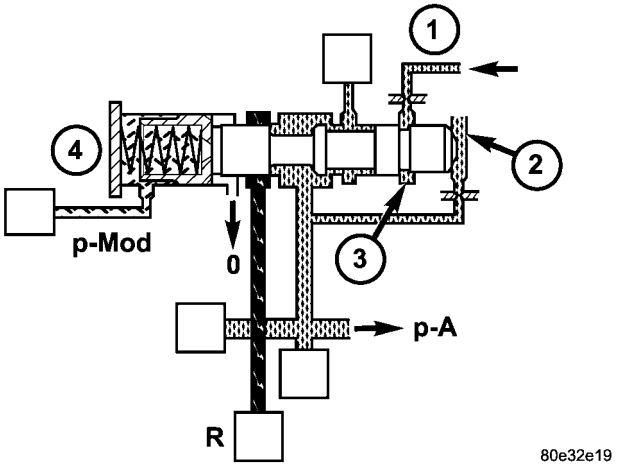


Fig. 89 Working Pressure Regulating Valve

1 - PRESSURE FROM K1/K2
2 - END FACE
3 - ANNULAR SURFACE
4 - WORKING PRESSURE REGULATING VALVE

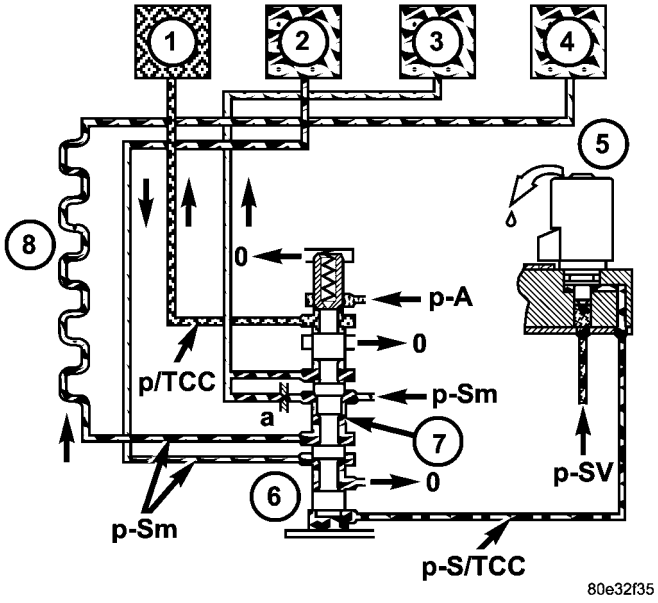


Fig. 90 Torque Converter Lockup Clutch Regulating Valve

1 - TORQUE CONVERTER LOCK-UP CLUTCH
2 - TORQUE CONVERTER OUTPUT
3 - TORQUE CONVERTER INPUT
4 - TORQUE CONVERTER LUBRICATION POINTS
5 - TORQUE CONVERTER LOCK-UP SOLENOID
6 - TORQUE CONVERTER LOCK-UP CLUTCH REGULATING VALVE
7 - ANNULAR PASSAGE THROTTLE
8 - OIL COOLER

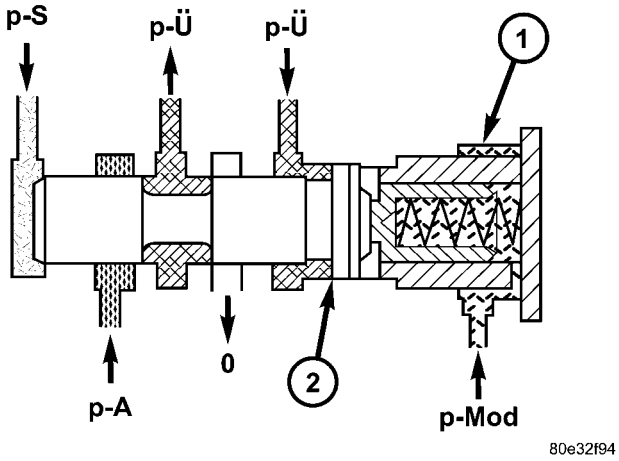


Fig. 91 Overlap Regulating Valve

1 - OVERLAP REGULATING VALVE
2 - ANNULAR SURFACE ON OVERLAP REGULATING VALVE

Command Valve

Each shift group possesses one command valve (Fig. 92). The 1-2 / 4-5 and 2-3 command valves are installed in the shift valve housing; the 3-4 command valve is installed in the valve housing. The command valve switches the shift group from the stationary phase to the shift phase and back again.

Holding Pressure Shift Valve

Each shift group possesses one holding pressure shift valve (Fig. 93). The 1-2 / 4-5 and 2-3 holding pressure shift valves are installed in the shift valve housing; the 3-4 holding pressure shift valve is installed in the valve housing. The holding pressure shift valve allocates the working pressure to one actuator of a shift group.

ELECTROHYDRAULIC UNIT (Continued)

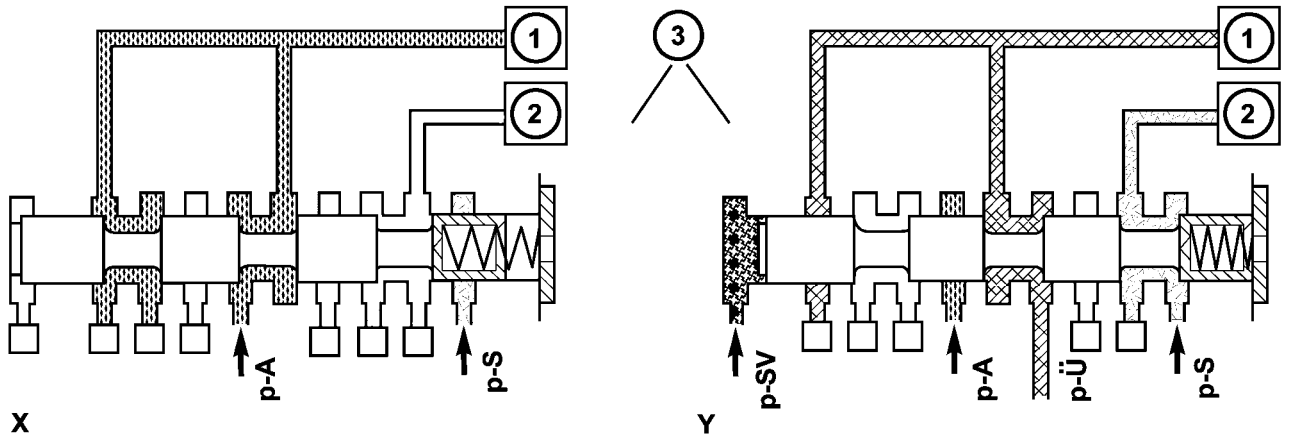


Fig. 92 Command Valve

1 - HOLDING CLUTCH B1
2 - DRIVING CLUTCH K1
3 - 1-2/4-5 COMMAND VALVE

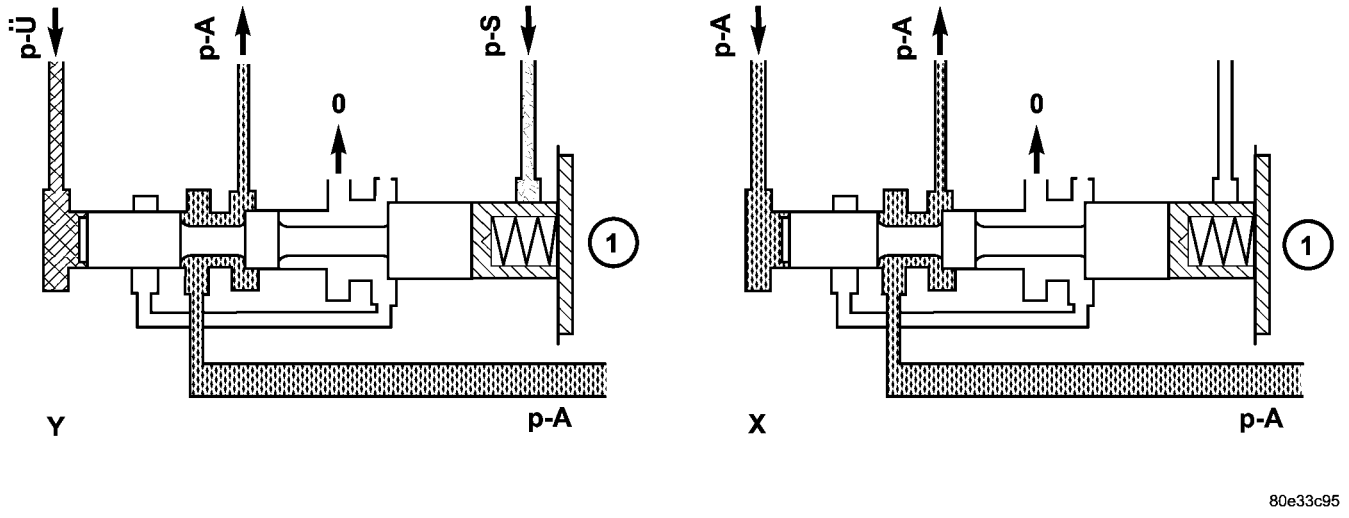


Fig. 93 Holding Pressure Shift Valve

1 - HOLDING PRESSURE SHIFT VALVE

ELECTROHYDRAULIC UNIT (Continued)

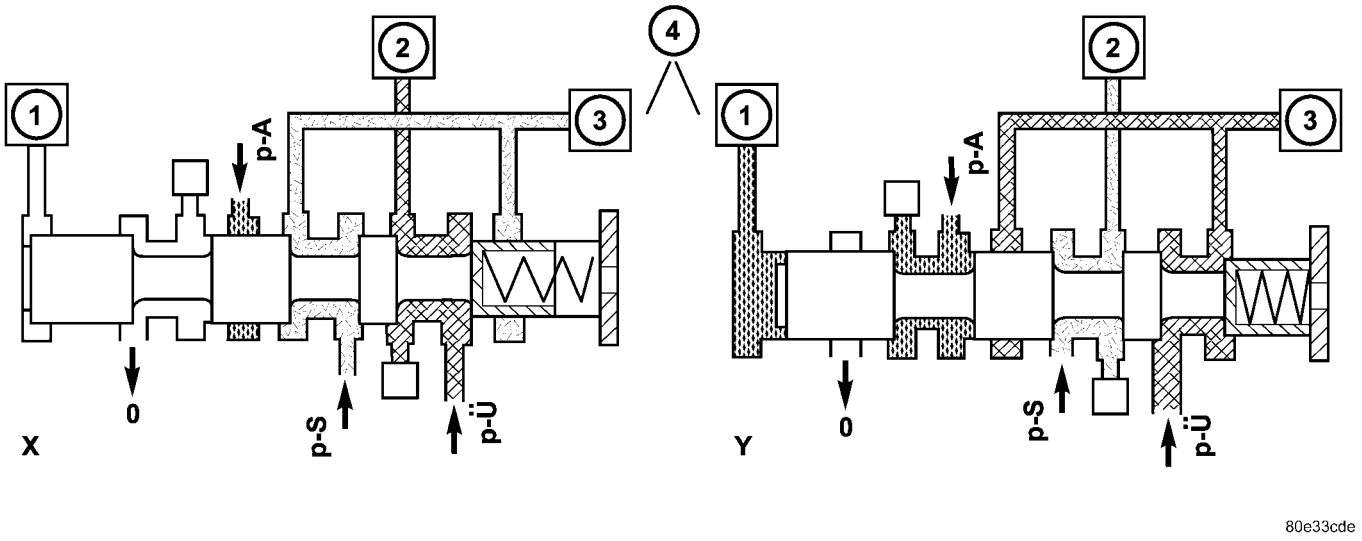


Fig. 94 Shift Pressure Shift Valve

1 - 1-2/4-5 COMMAND VALVE
2 - DRIVING CLUTCH K1
3 - HOLDING CLUTCH B1
4 - 1-2/4-5 SHIFT PRESSURE SHIFT VALVE

Shift Pressure Shift Valve

Each shift group possesses one shift pressure shift valve (Fig. 94). The 1-2 / 4-5 and 2-3 shift pressure shift valves are installed in the shift valve housing; the 3-4 shift pressure shift valve is installed in the valve housing. It assigns the shift pressure (p-S) to the activating actuator and the overlap pressure (p-Ü) regulated by the overlap regulating valve to the deactivating actuator.

Lubrication Pressure Regulating Valve

The lubrication pressure regulating valve (Fig. 95) is located in the valve housing of the electrohydraulic control module. The valve controls the fluid to lubricate and cool the mechanical part of the transmission, and limits the pressure in the torque converter.

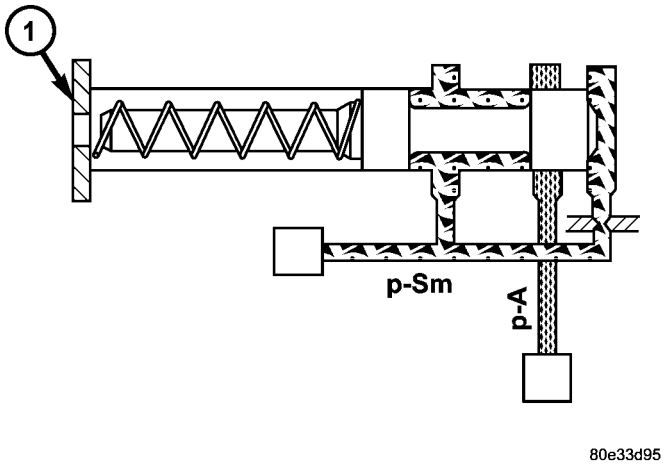


Fig. 95 Lubrication Pressure Regulating Valve

1 - LUBRICATION PRESSURE REGULATING VALVE

ELECTROHYDRAULIC UNIT (Continued)

Shift Pressure Regulating Valve

The shift pressure regulating valve (Fig. 96) is located in the valve housing of the shift plate. It regulates the shift pressure (p-S).

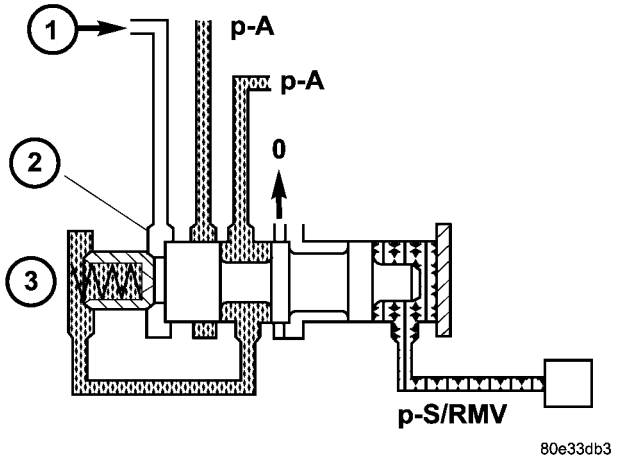


Fig. 96 Shift Pressure Regulating Valve

1 - PRESSURE FROM CLUTCH K2
2 - ANNULAR SURFACE
3 - SHIFT PRESSURE REGULATING VALVE

Regulating Valve Pressure Regulating Valve

The regulating valve pressure regulating valve (Fig. 97) is located in the valve housing of the electrohydraulic control module. It regulates the regulating valve pressure (p-RV).

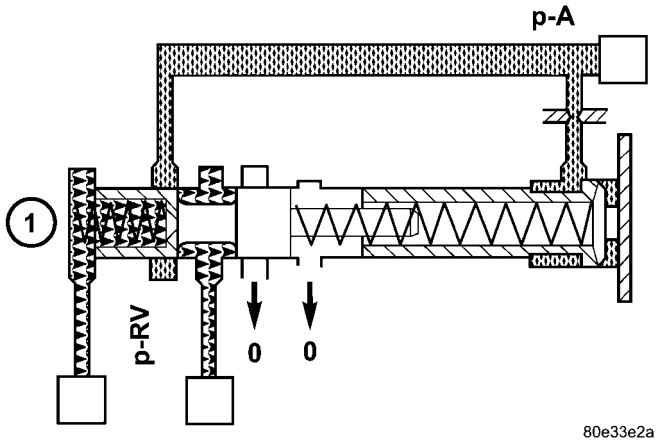


Fig. 97 Regulating Valve Pressure Regulating Valve

1 - REGULATING VALVE PRESSURE REGULATING VALVE

Shift Valve Pressure Regulating Valve

The shift valve pressure regulating valve (Fig. 98) is located in the valve housing of the electrohydraulic control module. It regulates the shift valve pressure (p-SV).

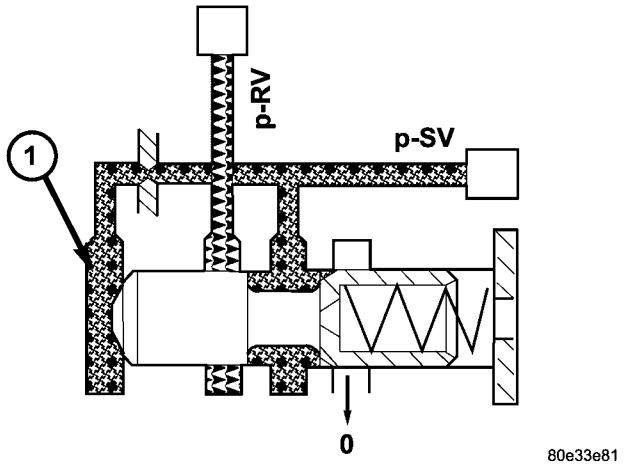


Fig. 98 Shift Valve Pressure Regulating Valve

1 - SHIFT VALVE PRESSURE REGULATING VALVE

OPERATION

ELECTRICAL CONTROL UNIT

Signals from the transmission control module (TCM) are converted into hydraulic functions in the electric valve control unit (7) (Fig. 99). The RPM sensors (1, 12), starter interlock contact (9), and transmission oil temperature sensor (8) of the electric valve control unit (7) supply the TCM with input signals. The solenoid valves are controlled by the TCM and trigger the hydraulic functions.

ELECTROHYDRAULIC UNIT (Continued)

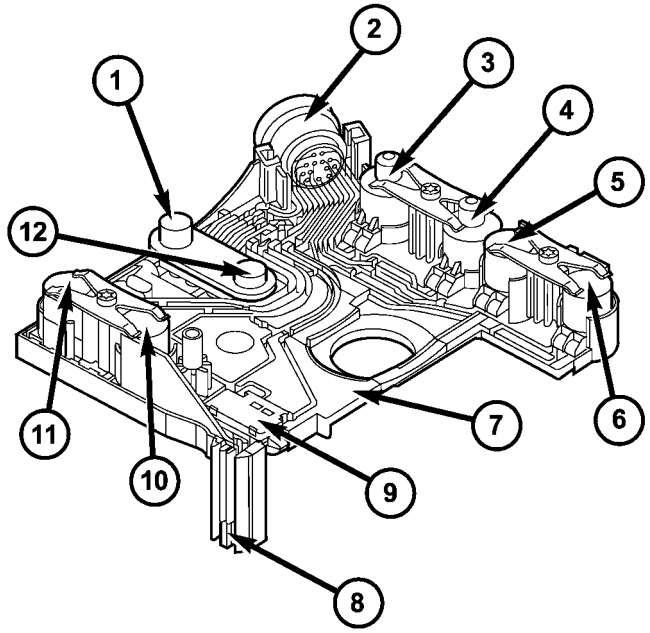


Fig. 99 Electrical Control Unit

1 - N3 SPEED SENSOR
2 - PLUG CONNECTOR
3 - MODULATING PRESSURE REGULATING SOLENOID
4 - SHIFT PRESSURE REGULATING SOLENOID
5 - 1-2/4-5 SHIFT SOLENOID
6 - 3-4 SHIFT SOLENOID
7 - ELECTRICAL CONTROL UNIT
8 - TRANSMISSION TEMPERATURE SENSOR
9 - STARTER INTERLOCK CONTACT
10 - 2-3 SHIFT SOLENOID
11 - TORQUE CONVERTER LOCK-UP SOLENOID
12 - N2 SPEED SENSOR

HYDRAULIC CONTROL UNIT

Working Pressure Regulating Valve (Operating Pressure)

The working pressure (p-A) is regulated at the working pressure regulating valve (22) (Fig. 100) in relation to load (modulating pressure) and gear (K1 or K2 pressure). The spring in the working pressure regulating valve sets a minimum pressure level (basic pressure).

Torque Converter Lockup Clutch Regulating Valve

The torque converter lockup clutch regulating valve (6) (Fig. 101) regulates the torque converter lock-up clutch working pressure in relation to the torque converter clutch control pressure. According to the size of the working pressure, the torque converter lockup clutch is either Engaged, Disengaged, or Slipping. When the regulating valve (6) is in the lower position, lubricating oil flows through the torque converter and oil cooler (8) into the transmission (torque converter lockup clutch unpressurized). In its regulating position (slipping, torque converter lockup clutch pressurized), a reduced volume of lubricating oil flows through the annular passage (7) bypassing the torque converter and passing direct through the oil cooler into the transmission. The rest of the lubricating oil is directed via the throttle ″a″ into the torque converter in order to cool the torque converter lockup clutch.

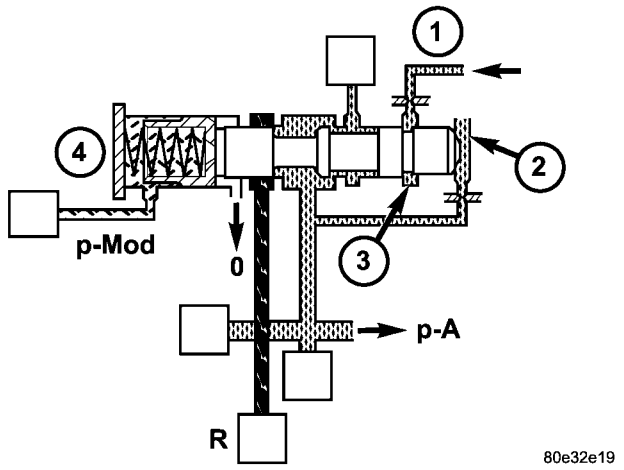


Fig. 100 Working Pressure Regulating Valve

1 - PRESSURE FROM K1/K2
2 - END FACE
3 - ANNULAR SURFACE
4 - WORKING PRESSURE REGULATING VALVE

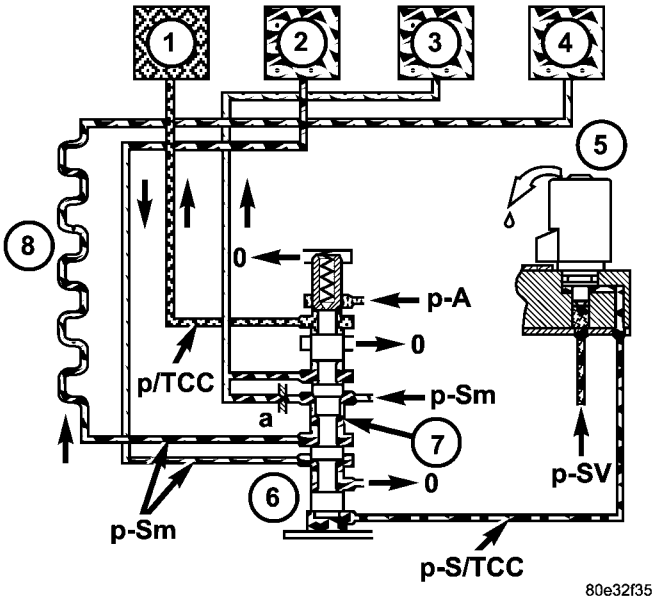


Fig. 101 Torque Converter Lockup Clutch Regulating Valve

1 - TORQUE CONVERTER LOCK-UP CLUTCH
2 - TORQUE CONVERTER OUTPUT
3 - TORQUE CONVERTER INPUT
4 - TORQUE CONVERTER LUBRICATION POINTS
5 - TORQUE CONVERTER LOCK-UP SOLENOID
6 - TORQUE CONVERTER LOCK-UP CLUTCH REGULATING VALVE
7 - ANNULAR PASSAGE THROTTLE
8 - OIL COOLER

ELECTROHYDRAULIC UNIT (Continued)

Overlap Regulating Valve

During the shift phase the pressure (Fig. 102) in the deactivating shift actuator is regulated in relation to the engine load (modulating pressure) and the pressure in the activating actuator. The regulated pressure is inversely proportional to the transfer capacity of the activating shift actuator (regulated overlap).

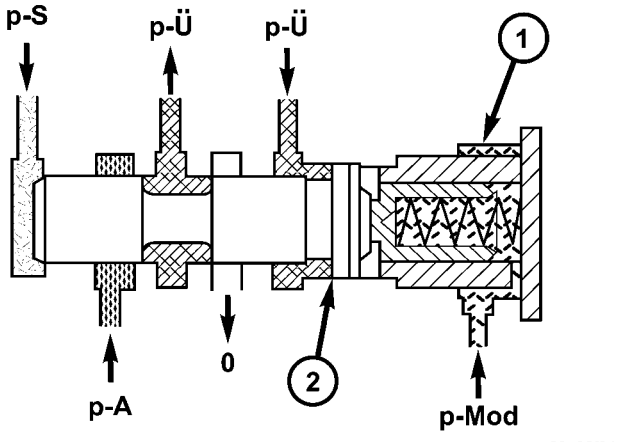


Fig. 102 Overlap Regulating Valve

1 - OVERLAP REGULATING VALVE
2 - ANNULAR SURFACE ON OVERLAP REGULATING VALVE

Command Valve

When the end face is unpressurized (stationary phase), the working pressure is directed to the actuated shift element. If the end face of the command valve (Fig. 103) is subjected to the shift valve pressure (p-SV) (shift phase), then the shift pressure is switched to the activating element and the overlap pressure is switched to the deactivating element.

Shift Valve Holding Pressure

The holding pressure shift valve (Fig. 104) is actuated by the pressures present at the end face in the actuators and a spring. It assigns the working pressure to the actuator with the higher pressure (taking into account the spring force and the effective surface area). The other element of the shift group is then unpressurized. The valve switches over only during the shift phase and only at a certain pressure ratio between the overlap pressure (p-Ü) and the shift pressure (p-S).

Shift Pressure Shift Valve

When the multiple-disc brake B1 (3) is activated, the working pressure (pa) is applied to the end face of the 1-2 / 4-5 shift pressure shift valve (4) (Fig. 105) via the command valve (1). Its shift state is maintained during the shift phase by substituting the shift element pressure acting on its end face (and which is variable during the shift phase) with a corresponding constant pressure. When the multi-plate clutch K1 (2) is activated, the end face of the shift valve is unpressurized during the stationary and shift phases, so the shift state is maintained during the shift phase in this case too.

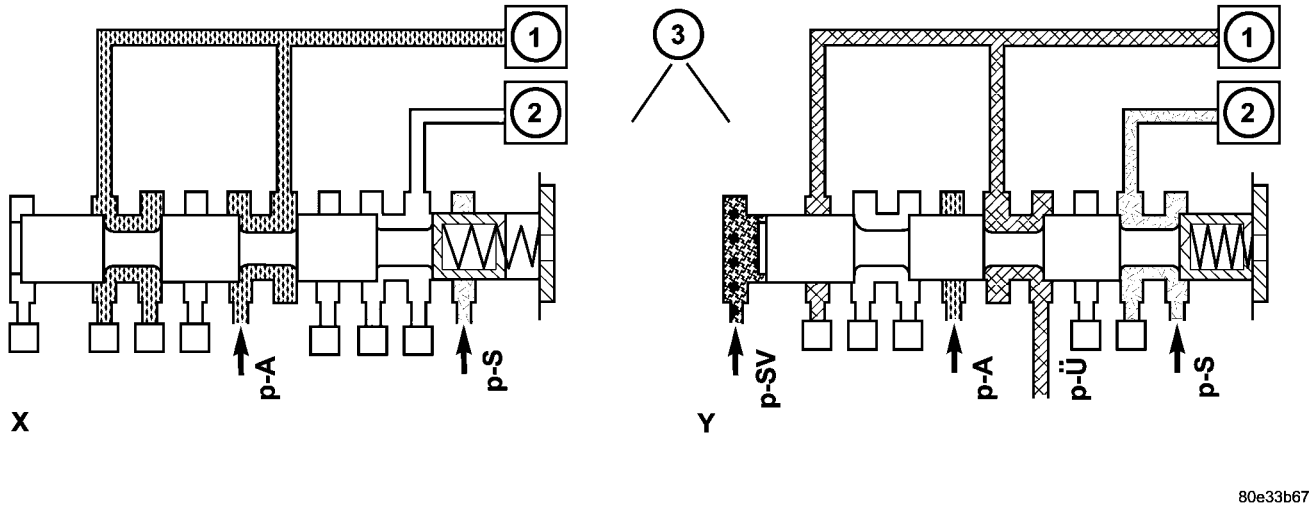


Fig. 103 Command Valve

1 - HOLDING CLUTCH B1
2 - DRIVING CLUTCH K1
3 - 1-2/4-5 COMMAND VALVE

ELECTROHYDRAULIC UNIT (Continued)

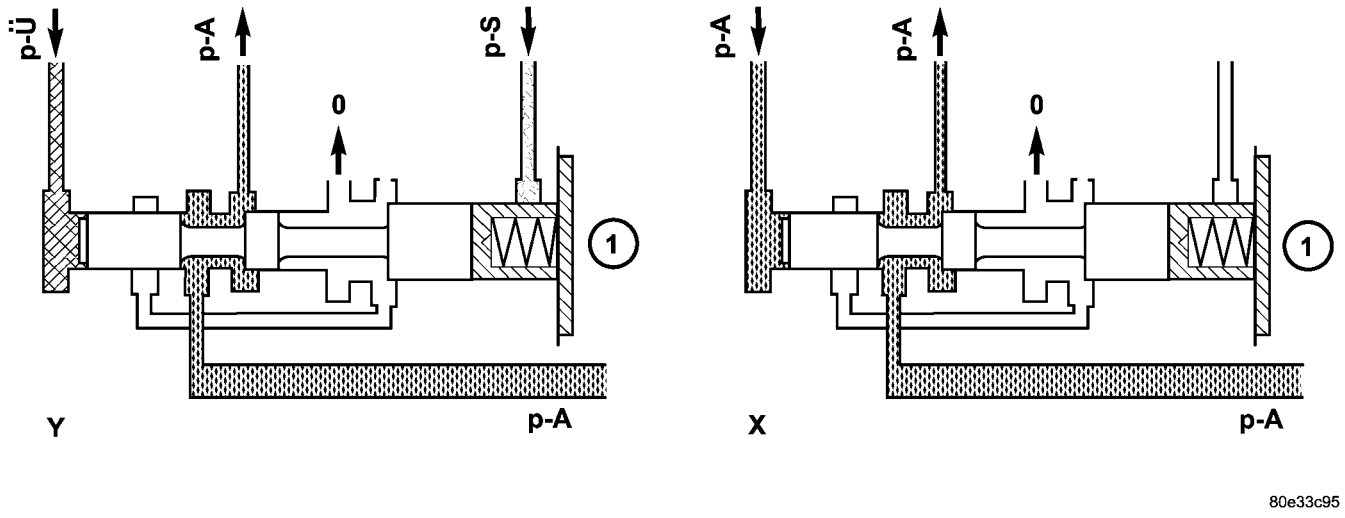


Fig. 104 Shift Valve Holding Pressure

1 - HOLDING PRESSURE SHIFT VALVE

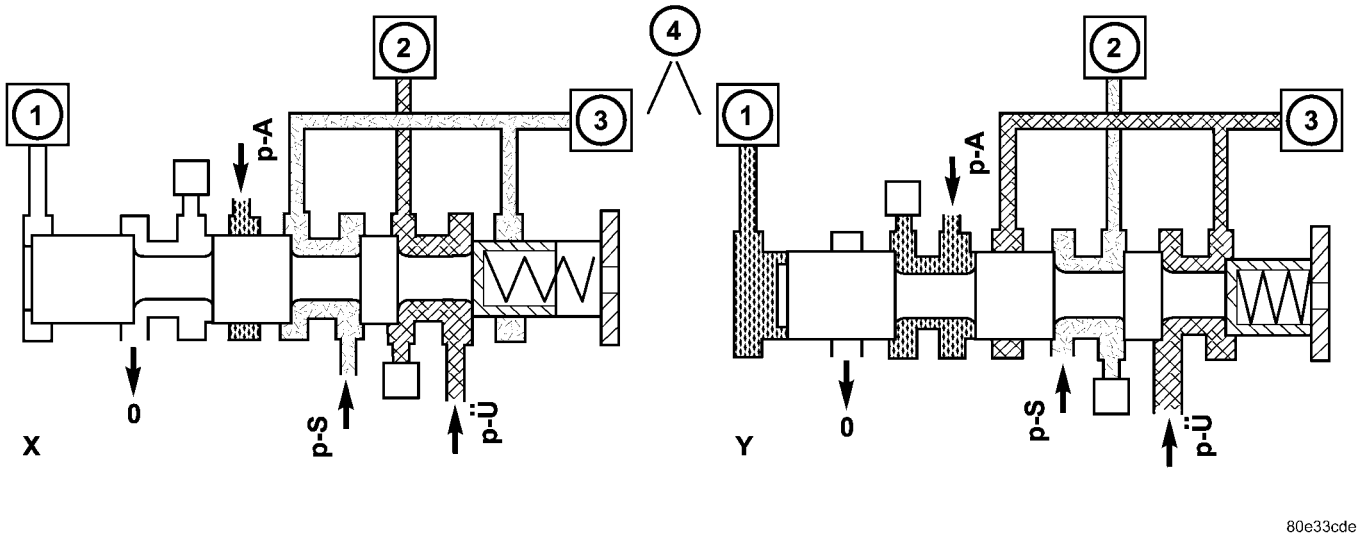


Fig. 105 Shift Pressure Shift Valve

1 - 1-2/4-5 COMMAND VALVE
2 - DRIVING CLUTCH K1
3 - HOLDING CLUTCH B1
4 - 1-2/4-5 SHIFT PRESSURE SHIFT VALVE

ELECTROHYDRAULIC UNIT (Continued)

Lubrication Pressure Regulating Valve

At the working pressure regulating valve surplus oil is diverted to the lubrication pressure regulating valve (1) (Fig. 106), from where the lubrication pressure (p-Sm) is used in regulated amounts to supply the transmission lubrication system including the torque converter.

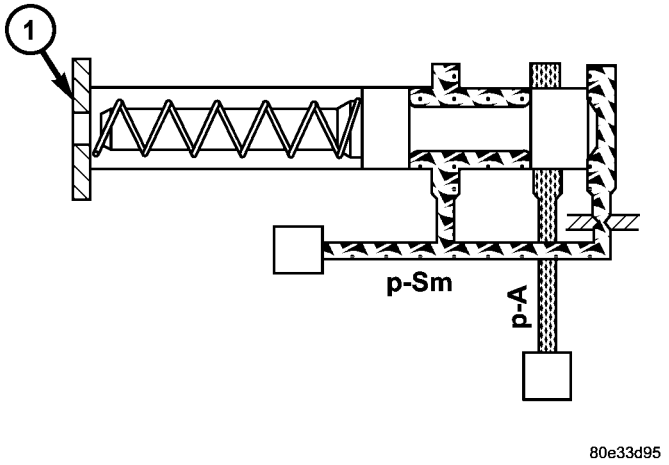


Fig. 106 Lubrication Pressure Regulating Valve

1 - LUBRICATION PRESSURE REGULATING VALVE

Shift Pressure Regulating Valve

The shift pressure is determined by the shift pressure regulating solenoid valve and the shift pressure regulating valve (3) (Fig. 107). In addition, pressure from the clutch K2 (1) is also present at the annular surface (2) of the shift pressure regulating valve (3). This reduces the shift pressure in 2nd gear.

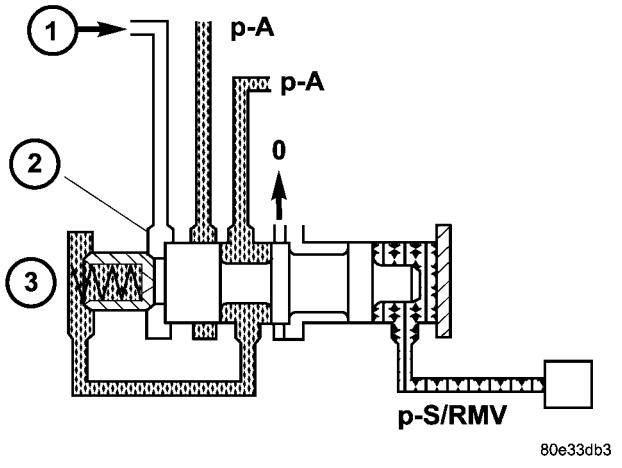


Fig. 107 Shift Pressure Regulating Valve

1 - PRESSURE FROM CLUTCH K2
2 - ANNULAR SURFACE
3 - SHIFT PRESSURE REGULATING VALVE

Regulating Valve Pressure Regulating Valve

The regulating valve pressure (p-RV) is set at the regulating valve pressure regulating valve (1) (Fig. 108) in relation to the working pressure (p-A) as far as the maximum pressure.

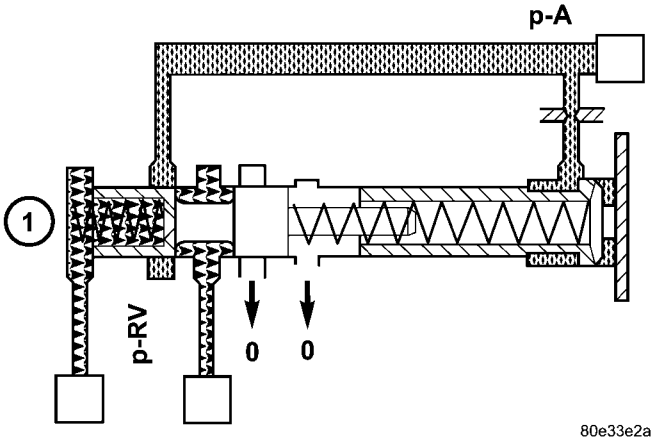


Fig. 108 Regulating Valve Pressure Regulating Valve

1 - REGULATING VALVE PRESSURE REGULATING VALVE

Shift Valve Pressure Regulating Valve

The non-constant regulating valve pressure (p-RV) is regulated to a constant shift valve pressure (p-SV) at the shift valve pressure regulating valve (1) (Fig. 109) and is used to supply the 1-2 and 4-5 / 3-4 / 2-3 solenoid valves and the torque converter lockup clutch PWM solenoid valve.

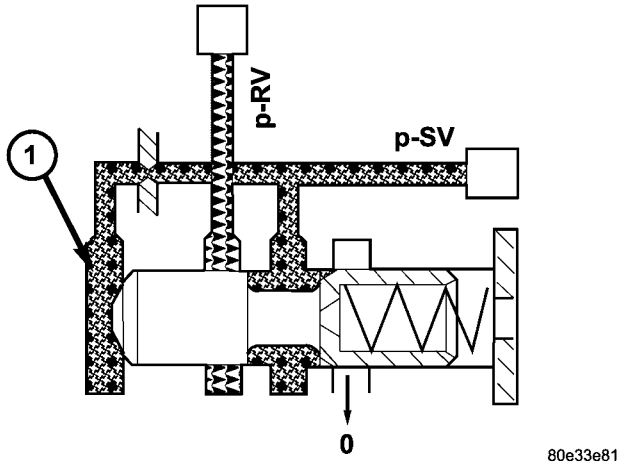


Fig. 109 Shift Valve Pressure Regulating Valve

1 - SHIFT VALVE PRESSURE REGULATING VALVE

ELECTROHYDRAULIC UNIT (Continued)

REMOVAL

(1) Move selector lever to position ″P″.
(2) Raise vehicle.
(3) Remove bolt (3) (Fig. 110) and screw (1) holding the heat shield (2) to the transmission.
(4) Loosen guide bushing (2) (Fig. 110) and remove from transmission housing.

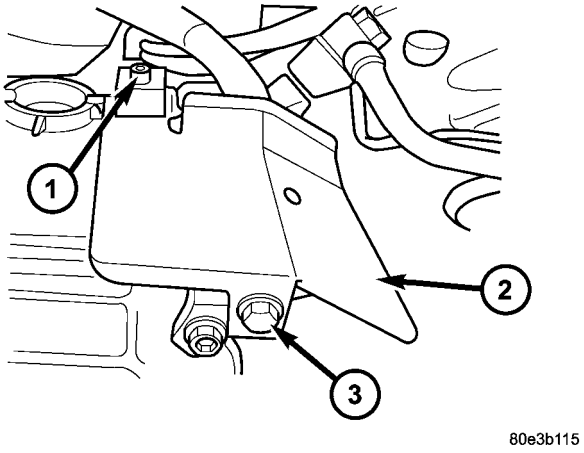


Fig. 110 Remove Heat Shield

1 - SCREW
2 - HEAT SHIELD
3 - BOLT

(5) Disconnect 13-pin plug connector (1) (Fig. 111). Turn bayonet lock of guide bushing (2) anti-clockwise.

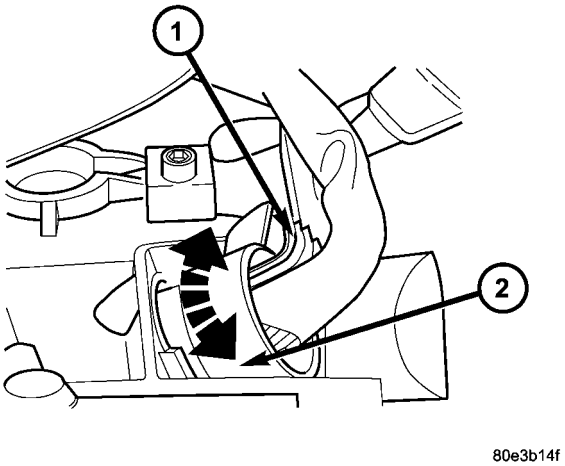


Fig. 111 Remove Wiring Connector Plug

1 - PLUG CONNECTOR
2 - GUIDE BUSHING

(6) Drain transmission oil by unscrewing oil drain plug (8) (Fig. 112).

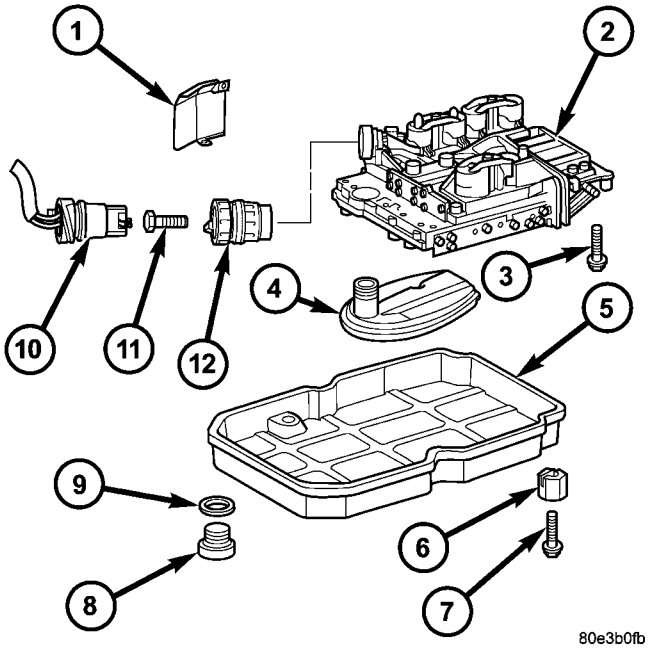


Fig. 112 Remove Electrohydraulic Unit

1 - HEAT SHIELD
2 - ELECTROHYDRAULIC UNIT
3 - BOLT
4 - OIL FILTER
5 - OIL PAN
6 - CLAMPING ELEMENT
7 - BOLT
8 - DRAIN PLUG
9 - DRAIN PLUG GASKET
10 - 13-PIN PLUG CONNECTOR
11 - BOLT
12 - GUIDE BUSHING

NOTE: If the transmission fluid is burnt or contains abraded particles, the oil cooler lines and oil cooler must be flushed out.

(7) Detach oil pan (5).
(8) Remove oil filter (4).
(9) Unscrew Torx socket bolts (3) and remove electrohydraulic control module (2).

DISASSEMBLY

(1) Remove electrohydraulic unit from the vehicle.
(2) Remove solenoid caps (1, 2) (Fig. 113).
(3) Unscrew Torx socket bolts (3, 4) (Fig. 113).

NOTE: Pay attention to the different lengths of the Torx socket bolts.

(4) Remove leaf springs (5).
(5) Withdraw solenoid valves (6 - 11) from shift plate (13).

ELECTROHYDRAULIC UNIT (Continued)

NOTE: Check O-rings on solenoid valves for damage and replace if necessary.

(6) Bend away retaining lug on stiffening rib on transmission oil temperature sensor.

(7) Remove electrohydraulic control module (12) from the shift plate (13).

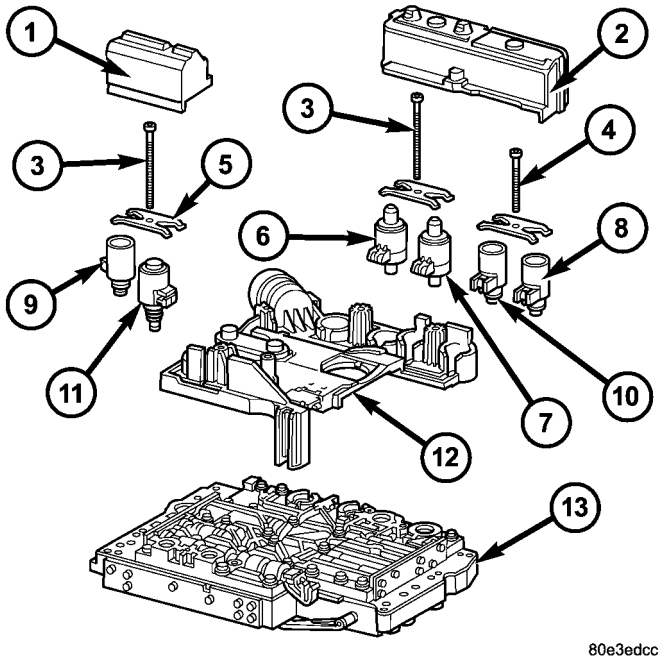


Fig. 113 Electrical Unit Components

1 - SOLENOID CAP
2 - SOLENOID CAP
3 - BOLT - M6X32
4 - BOLT - M6X30
5 - LEAF SPRING
6 - MODULATING PRESSURE REGULATING SOLENOID VALVE
7 - SHIFT PRESSURE REGULATING SOLENOID
8 - 3-4 SHIFT SOLENOID
9 - TORQUE CONVERTER LOCK-UP SOLENOID
10 - 1-2/4-5 SHIFT SOLENOID
11 - 2-3 SHIFT SOLENOID
12 - ELECTRICHYDRAULIC CONTROL MODULE
13 - SHIFT PLATE

(8) Note the locations of the major shift valve group components for assembly reference (Fig. 114).

NOTE: Pay great attention to cleanliness for all work on the shift plate. Fluffy cloths must not be used. Leather cloths are particularly good. After dismantling, all parts must be washed and blown out with compressed-air, noting that parts may be blown away.

(9) Unbolt leaf spring (5) (Fig. 115).

(10) Unscrew Torx bolts (1) (Fig. 115).

(11) Remove valve housing (2) from valve body (4) (Fig. 115).

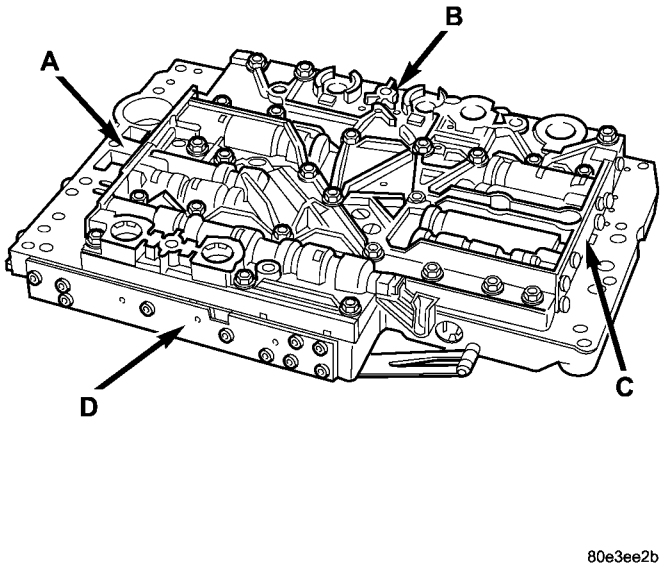


Fig. 114 Shift Valve Group Locations

A - OPERATING AND LUBRICATING PRESSURE REGULATING VALVES AND 2-3 OVERLAP VALVE
B - 1-2/4-5 SHIFT GROUP AND SHIFT, SHIFT VALVE, AND REGULATING VALVE PRESSURE REGULATING VALVES
C - 3-4 SHIFT GROUP
D - 2-3 SHIFT GROUP, TCC LOCK-UP AND B2 REGULATING VALVES

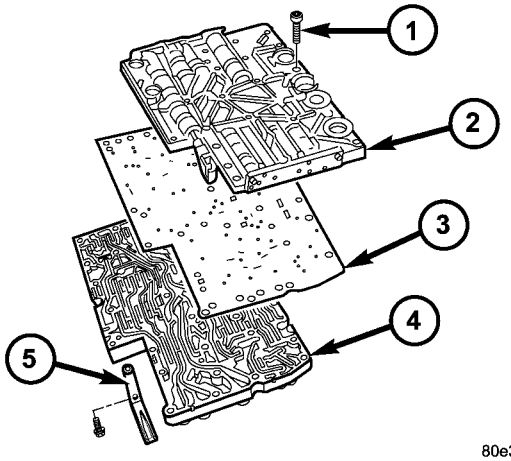


Fig. 115 Shift Plate Components

1 - BOLTS - 29
2 - VALVE HOUSING
3 - SEALING PLATE
4 - VALVE BODY
5 - LEAF SPRING

ELECTROHYDRAULIC UNIT (Continued)

(12) Remove the strainers for the modulating pressure and shift pressure control solenoid valves (Fig. 116) from the valve housing.

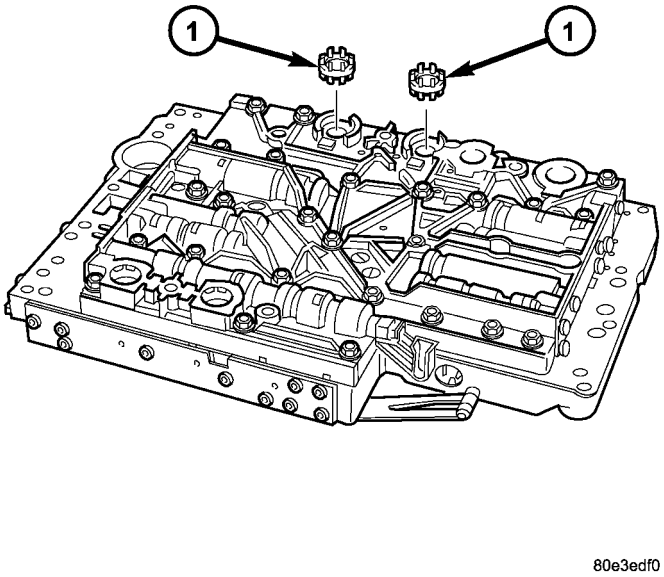


Fig. 116 Solenoid Valve Strainer Locations

1 - SOLENOID VALVE STRAINERS

(13) Remove the strainer (1) (Fig. 117) in the inlet to torque converter lock-up control solenoid valve.

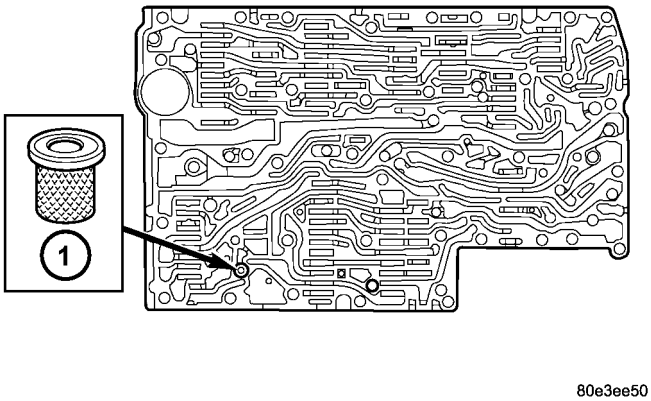


Fig. 117 Converter Lock-up Solenoid Valve Strainer Location

1 - CONVERTER LOCK-UP SOLENOID STRAINER

(14) Remove sealing plate (3).

NOTE: A total of 12 valve balls are located in the valve body, four made from plastic (4) and eight from steel (1, 3).

(15) Note the location of all check balls (1, 3, 4) (Fig. 118) and the central strainer (2) for re-installation. Remove all check balls (1, 3, 4) and the central strainer (2).

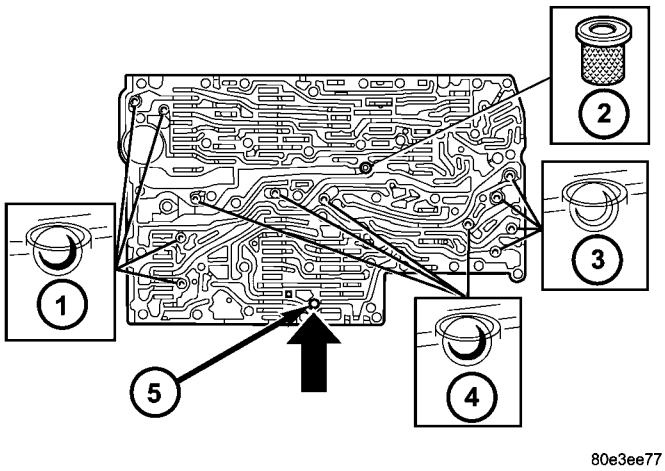


Fig. 118 Check Balls and Strainer Location

1 - STEEL CHECK BALLS
2 - CENTRAL STRAINER
3 - STEEL CHECK BALLS
4 - PLASTIC CHECK BALLS
5 - PLAIN DOWEL PIN

(16) Remove the screws holding the side covers to the valve body and valve housing.

(17) Remove all valves and springs from the valve body (1) (Fig. 119). Check all valves for ease of movement and shavings.

NOTE: The sleeves and pistons of the overlap regulating valves must not be mixed up.

(18) Remove all valves and springs from the valve housing (2) (Fig. 120). Check all valves for ease of movement and shavings.

(19) Remove the pressure supply valve (1) (Fig. 121) from the valve body.

ELECTROHYDRAULIC UNIT (Continued)

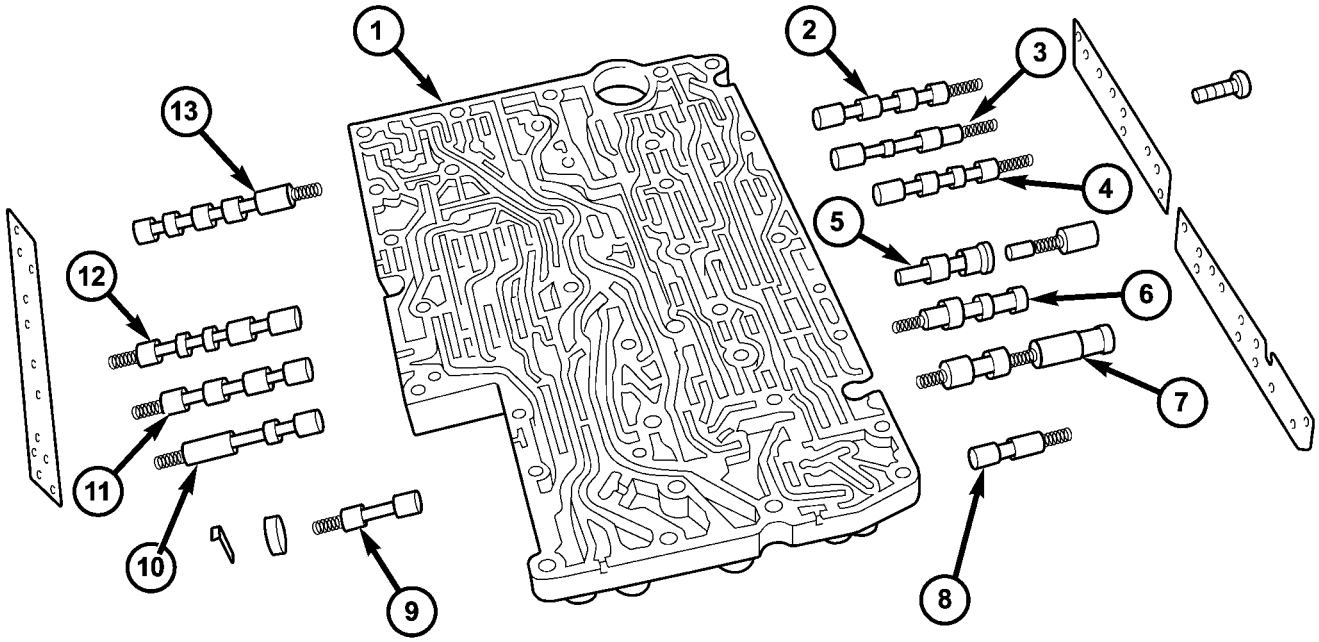


Fig. 119 Valve Body Components

1 - VALVE BODY
2 - 1-2/4-5 COMMAND VALVE
3 - 1-2/4-5 HOLDING PRESSURE SHIFT VALVE
4 - 1-2/4-5 SHIFT PRESSURE SHIFT VALVE
5 - 1-2/4-5 OVERLAP REGULATING VALVE, SLEEVE, AND PISTON
6 - SHIFT PRESSURE REGULATING VALVE
7 - REGULATING VALVE PRESSURE REGULATING VALVE
8 - SHIFT VALVE PRESSURE REGULATING VALVE
9 - B2 SHIFT VALVE
10 - 2-3 HOLDING PRESSURE SHIFT VALVE
11 - 2-3 COMMAND VALVE
12 - 2-3 SHIFT PRESSURE SHIFT VALVE
13 - TCC LOCK-UP REGULATING VALVE

ASSEMBLY

NOTE: Pay great attention to cleanliness for all work on the shift plate. Fluffy cloths must not be used. Leather cloths are particularly good. After dismantling, all parts must be washed and blown out with compressed-air, noting that parts may be blown away.

(1) Install the pressure supply valve (1) (Fig. 122) into the valve body.

(2) Install all valves and springs from the valve body (1) (Fig. 123). Check all valves for ease of movement and shavings.

NOTE: The sleeves and pistons of the overlap regulating valves must not be mixed up.

ELECTROHYDRAULIC UNIT (Continued)

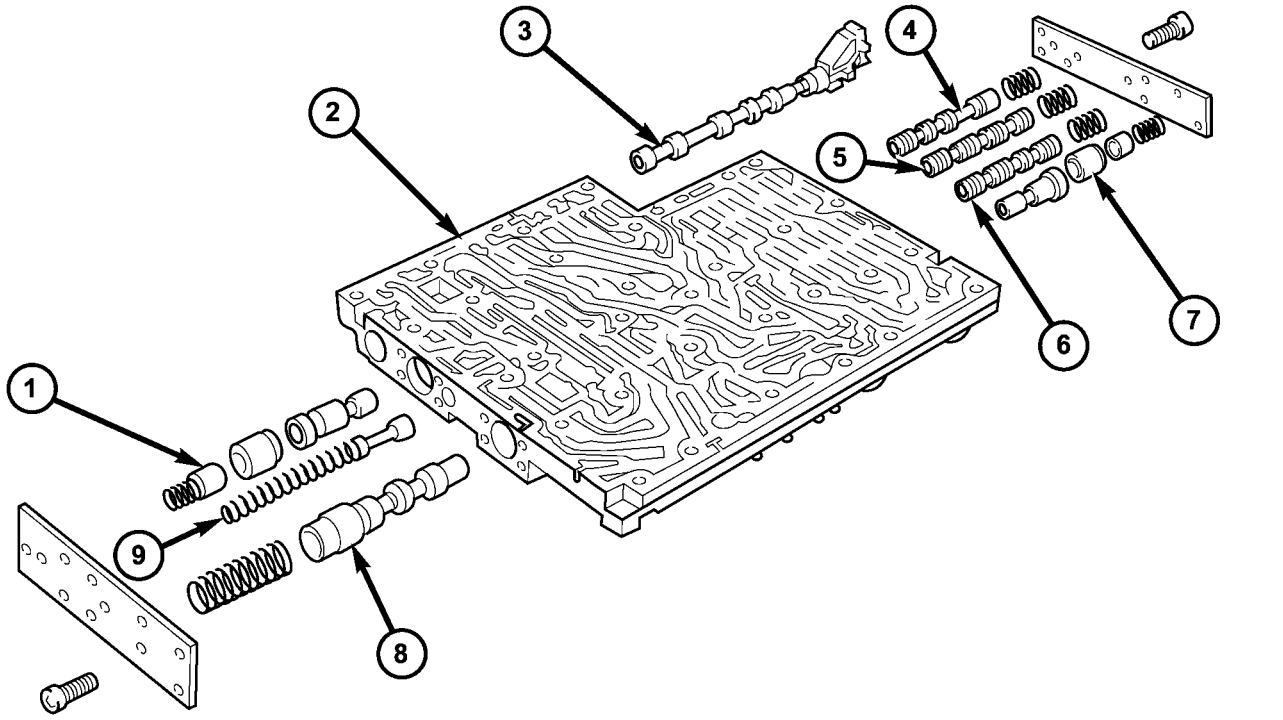


Fig. 120 Valve Housing Components

1 - 2-3 OVERLAP REGULATING VALVE, SLEEVE, AND PISTON
2 - VALVE HOUSING
3 - SELECTOR VALVE
4 - 3-4 HOLDING PRESSURE SHIFT VALVE
5 - 3-4 COMMAND VALVE
6 - 3-4 SHIFT PRESSURE SHIFT VALVE
7 - 3-4 OVERLAP REGULATING VALVE, SLEEVE, AND PISTON
8 - OPERATING PRESSURE REGULATING VALVE
9 - LUBRICATING PRESSURE REGULATING VALVE

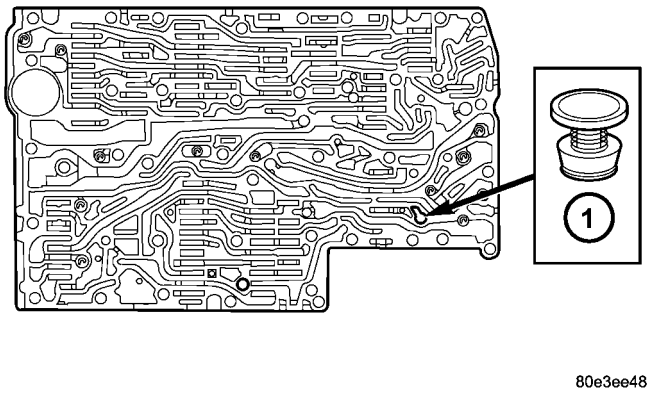


Fig. 121 Pressure Feed Valve Location

1 - PRESSURE FEED VALVE

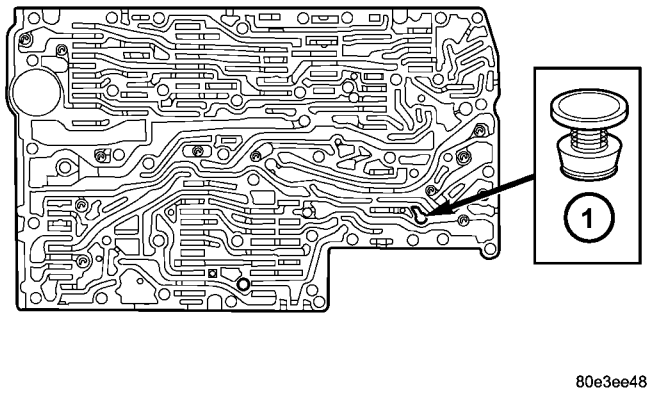


Fig. 122 Pressure Feed Valve Location

1 - PRESSURE FEED VALVE

ELECTROHYDRAULIC UNIT (Continued)

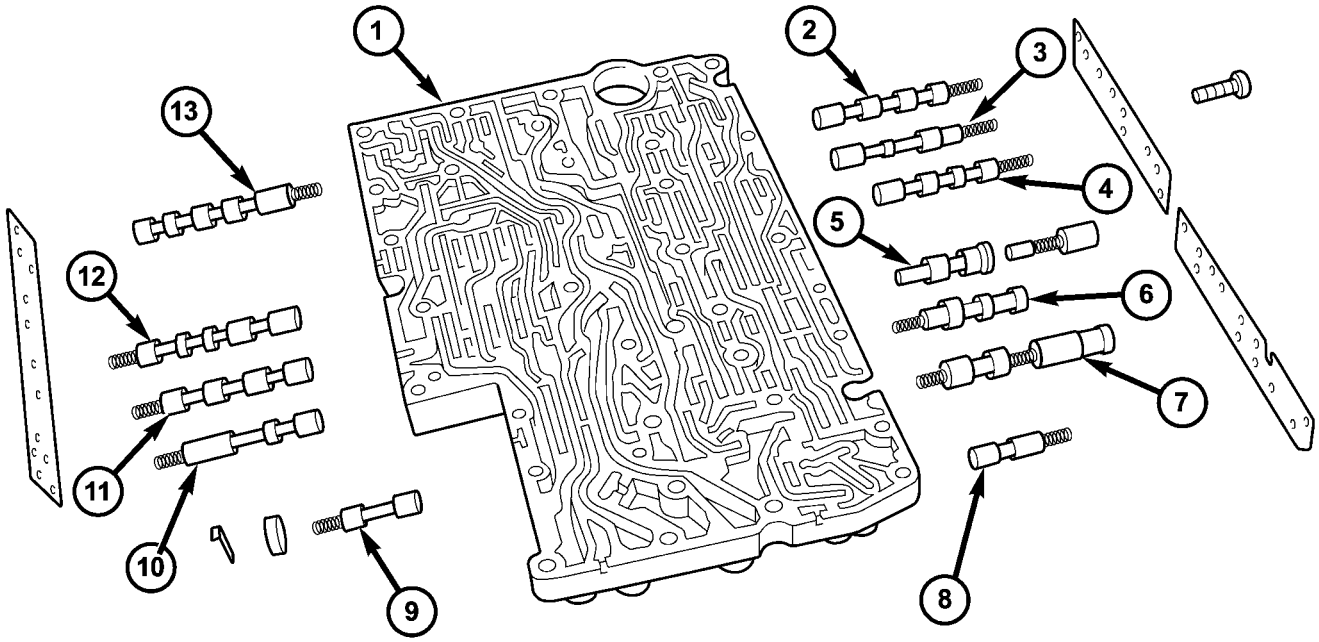


Fig. 123 Valve Body Components

1 - VALVE BODY
2 - 1-2/4-5 COMMAND VALVE
3 - 1-2/4-5 HOLDING PRESSURE SHIFT VALVE
4 - 1-2/4-5 SHIFT PRESSURE SHIFT VALVE
5 - 1-2/4-5 OVERLAP REGULATING VALVE, SLEEVE, AND PISTON
6 - SHIFT PRESSURE REGULATING VALVE
7 - REGULATING VALVE PRESSURE REGULATING VALVE
8 - SHIFT VALVE PRESSURE REGULATING VALVE
9 - B2 SHIFT VALVE
10 - 2-3 HOLDING PRESSURE SHIFT VALVE
11 - 2-3 COMMAND VALVE
12 - 2-3 SHIFT PRESSURE SHIFT VALVE
13 - TCC LOCK-UP REGULATING VALVE

(3) Install all valves and springs into the valve housing (2) (Fig. 124). Check all valves for ease of movement and shavings.

(4) Install the screws to hold the side covers to the valve body and valve housing. Tighten the screws to 4 N·m (35 in.lbs.).

NOTE: A total of 12 valve balls are located in the valve body, four made from plastic (4) and eight from steel (1, 3).

(5) Install all check balls (1, 3, 4) (Fig. 125) and the central strainer (2).

(6) Install the strainer (1) (Fig. 126) in the inlet to torque converter lock-up control solenoid valve.

ELECTROHYDRAULIC UNIT (Continued)

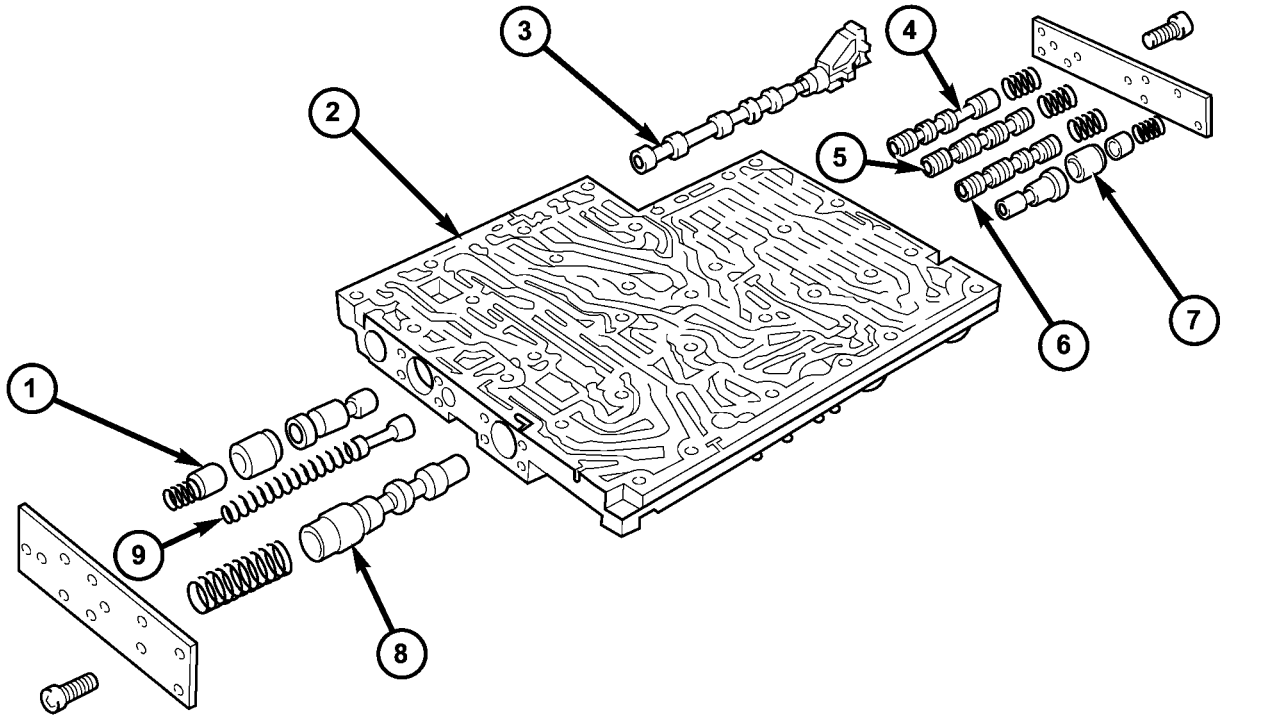


Fig. 124 Valve Housing Components

1 - 2-3 OVERLAP REGULATING VALVE, SLEEVE, AND PISTON
2 - VALVE HOUSING
3 - SELECTOR VALVE
4 - 3-4 HOLDING PRESSURE SHIFT VALVE
5 - 3-4 COMMAND VALVE
6 - 3-4 SHIFT PRESSURE SHIFT VALVE
7 - 3-4 OVERLAP REGULATING VALVE, SLEEVE, AND PISTON
8 - OPERATING PRESSURE REGULATING VALVE
9 - LUBRICATING PRESSURE REGULATING VALVE

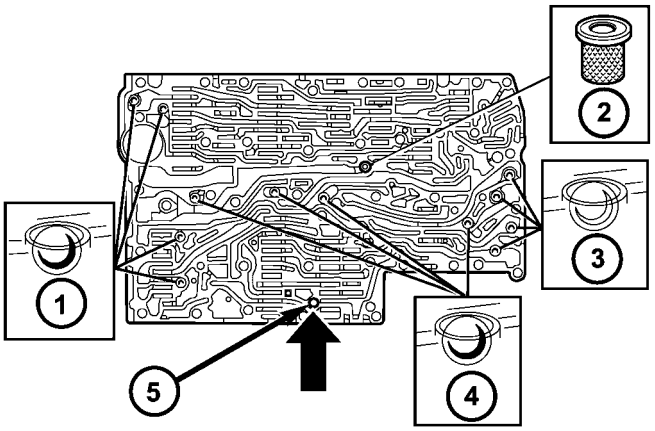


Fig. 125 Check Balls and Strainer Location

1 - STEEL CHECK BALLS
2 - CENTRAL STRAINER
3 - STEEL CHECK BALLS
4 - PLASTIC CHECK BALLS
5 - PLAIN DOWEL PIN

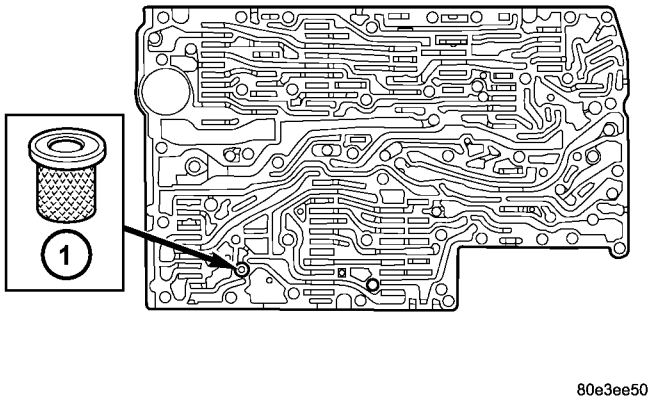


Fig. 126 Converter Lock-up Solenoid Valve Strainer Location

1 - CONVERTER LOCK-UP SOLENOID STRAINER

ELECTROHYDRAULIC UNIT (Continued)

(7) Position the sealing plate (3) onto the valve body (4) (Fig. 127).

(8) Install the valve housing (2) onto the valve body (4) and sealing plate (3).

(9) Install the shift plate Torx bolts (1) (Fig. 127). Tighten the bolts to 8 N·m (71 in.lbs.).

(10) Install leaf spring (5) (Fig. 127).

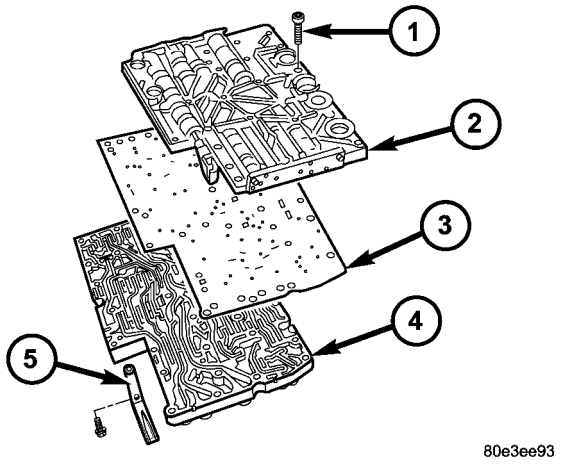


Fig. 127 Shift Plate Components

1 - BOLTS - 29
2 - VALVE HOUSING
3 - SEALING PLATE
4 - VALVE BODY
5 - LEAF SPRING

(11) Install the strainers for the modulating pressure and shift pressure control solenoid valves (Fig. 128) into the valve housing.

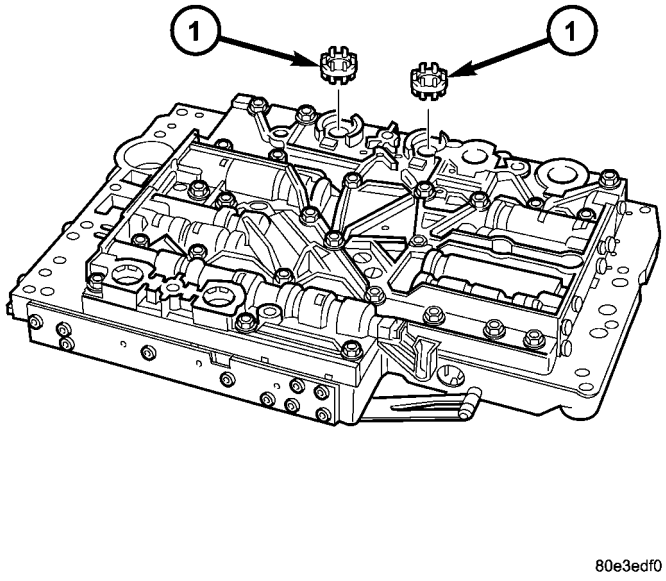


Fig. 128 Solenoid Valve Strainer Locations

1 - SOLENOID VALVE STRAINERS

(12) Install the electrohydraulic control module (12) onto the shift plate (13) (Fig. 129).

(13) Bend the retaining lug on stiffening rib on transmission oil temperature sensor to retain the electrohydraulic control module.

(14) Install the solenoid valves (6 - 11) into shift plate (13).

NOTE: Check O-rings on solenoid valves for damage and replace if necessary.

(15) Install the leaf springs (5).

(16) Install the Torx socket bolts (3, 4) (Fig. 129). Tighten the bolts to 8 N·m (71 in.lbs.).

NOTE: Pay attention to the different lengths of the Torx socket bolts.

(17) Install the solenoid caps (1, 2).

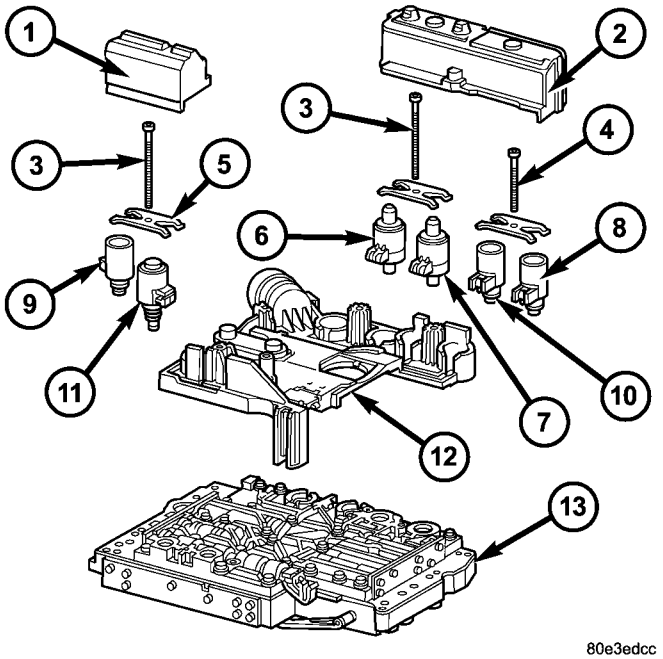


Fig. 129 Electrical Unit Components

1 - SOLENOID CAP
2 - SOLENOID CAP
3 - BOLT - M6X32
4 - BOLT - M6X30
5 - LEAF SPRING
6 - MODULATING PRESSURE REGULATING SOLENOID VALVE
7 - SHIFT PRESSURE REGULATING SOLENOID
8 - 3-4 SHIFT SOLENOID
9 - TORQUE CONVERTER LOCK-UP SOLENOID
10 - 1-2/4-5 SHIFT SOLENOID
11 - 2-3 SHIFT SOLENOID
12 - ELECTRICHYDRAULIC CONTROL MODULE
13 - SHIFT PLATE

(18) Install the electrohydraulic unit into the vehicle.

ELECTROHYDRAULIC UNIT (Continued)

INSTALLATION

(1) Position the electrohydraulic unit in the transmission housing.

(2) Insert selector valve (1) (Fig. 130) in driver of detent plate (2). When installing the electrohydraulic control module in the transmission housing, the plastic part of the selector valve (1) must engage in the driver of the detent plate (2).

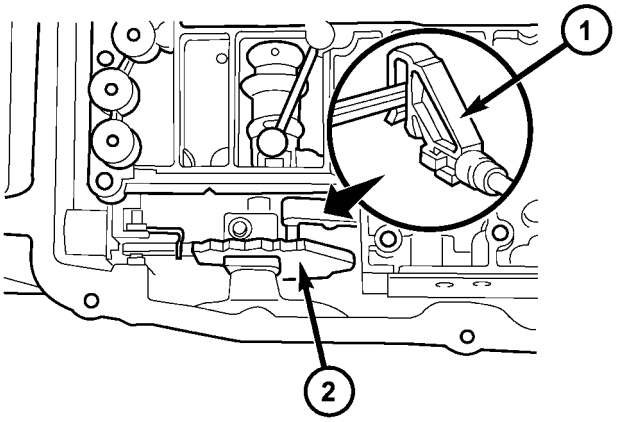


Fig. 130 Connect The Selector Valve To The Detent Plate

1 - SELECTOR VALVE
2 - DETENT PLATE

(3) Install the Torx socket bolts (3) (Fig. 131) and torque to 8 N·m (71 in.lbs.).

(4) Install a new oil filter (4) (Fig. 131).

(5) Install oil pan (5) (Fig. 131) and torque the oil pan bolts to 8 N·m (71 in.lbs.).

(6) Install the oil drain plug (8) (Fig. 131) with a new drain plug gasket (9). Torque the drain plug to 20 N·m (177 in.lbs.).

(7) Install the guide bushing (2) (Fig. 131) into the transmission housing and install the bolt to hold the guide bushing in place.

(8) Check O-ring on plug connector (1) (Fig. 132), and replace if necessary.

(9) Install the plug connector (1) into the guide bushing (2). Turn bayonet lock of guide bushing (2) clockwise to connect plug connector (1).

(10) Position the heat shield (2) (Fig. 133) onto the transmission housing and install the screw (1) and bolt (3) to hold the shield in place.

(11) Check oil level in automatic transmission, or add oil.

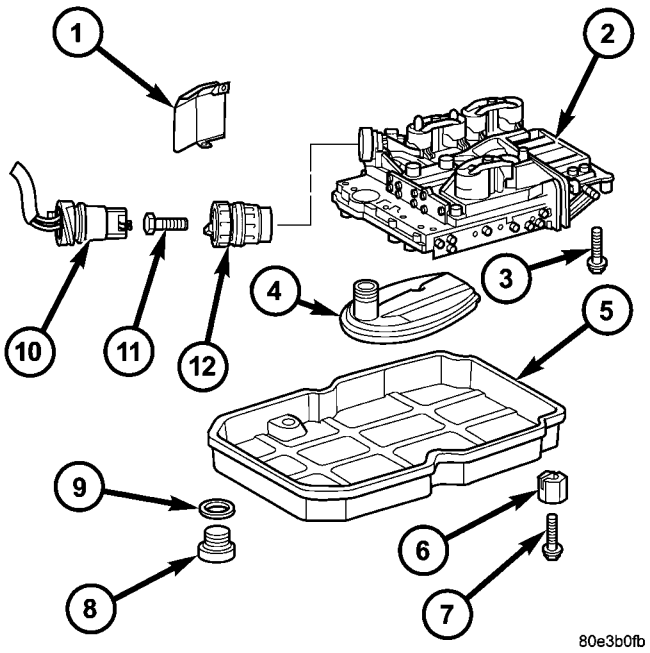


Fig. 131 Remove Electrohydraulic Unit

1 - HEAT SHIELD
2 - ELECTROHYDRAULIC UNIT
3 - BOLT
4 - OIL FILTER
5 - OIL PAN
6 - CLAMPING ELEMENT
7 - BOLT
8 - DRAIN PLUG
9 - DRAIN PLUG GASKET
10 - 13-PIN PLUG CONNECTOR
11 - BOLT
12 - GUIDE BUSHING

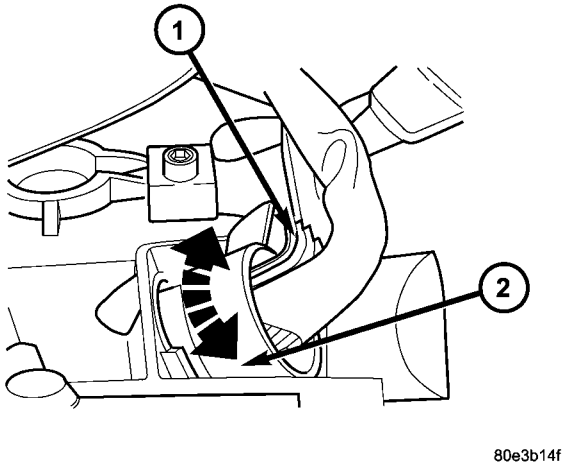


Fig. 132 Install Wiring Connector Plug

1 - PLUG CONNECTOR
2 - GUIDE BUSHING

ELECTROHYDRAULIC UNIT (Continued)

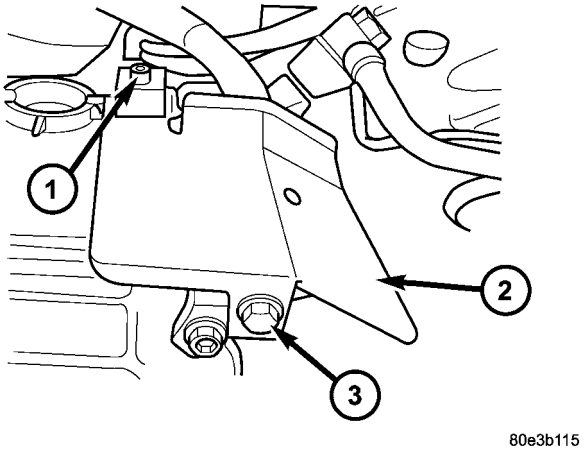


Fig. 133 Install Heat Shield

1 - SCREW
2 - HEAT SHIELD
3 - BOLT

FLUID AND FILTER

DESCRIPTION

The oil level control (Fig. 134) is located on the electrohydraulic unit and consists of the float (5) which is integrated into the electrohydraulic unit. The float is positioned to plug the opening between the oil gallery and gearset chamber so that the rotating gearsets do not splash about in oil as the oil level rises. The oil level control reduces power loss and prevents oil from being thrown out of the transmission housing at high oil temperatures.

OPERATION

With low oil levels (Fig. 135), the lubricating oil which flows constantly out of the gearset, flows back to oil gallery (2) though the opening (6). If the oil level rises, the oil presses the float (5) against the housing opening (6). The float (5) therefore separates the oil gallery (2) from the gearset chamber (1). The lubricating oil which continues to flow out of the gearsets is thrown against the housing wall, incorporated by the rotating parts and flows back into the oil gallery (2) through the upper opening (arrow).

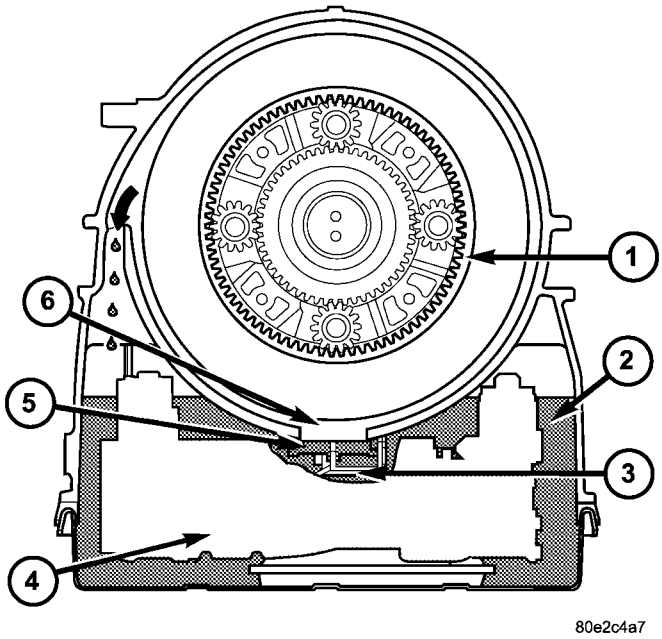


Fig. 134 Fluid Level Control

1 - GEARSET CHAMBER
2 - OIL GALLERY
3 - SHELL OF ELECTROHYDRAULIC UNIT
4 - ELECTROHYDRAULIC UNIT
5 - FLOAT
6 - OPENING

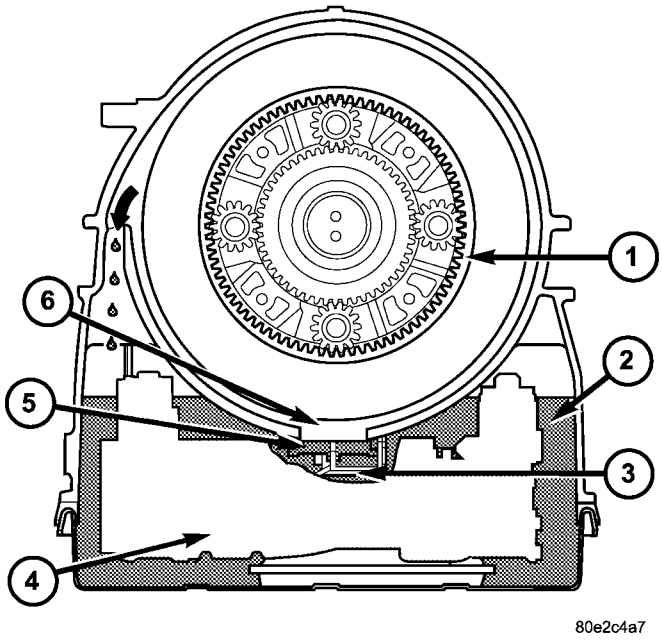


Fig. 135 Fluid Level Control

1 - GEARSET CHAMBER
2 - OIL GALLERY
3 - SHELL OF ELECTROHYDRAULIC UNIT
4 - ELECTROHYDRAULIC UNIT
5 - FLOAT
6 - OPENING

FLUID AND FILTER (Continued)

DIAGNOSIS AND TESTING

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 and clutch 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.

DIAGNOSIS AND TESTING - CAUSES OF BURNT FLUID

Burnt, discolored fluid is a result of overheating which has three primary causes.

(1) Internal clutch slippage, usually caused by low line pressure, inadequate clutch apply pressure, or clutch seal failure.

(2) 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.

(3) 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.

DIAGNOSIS AND TESTING - 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 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, an overhaul is necessary.

The torque converter should be replaced whenever a failure generates sludge and debris. This is necessary because normal converter flushing procedures will not remove all contaminants.

STANDARD PROCEDURE

STANDARD PROCEDURE - CHECK OIL LEVEL

(1) Verify that the vehicle is parked on a level surface.

(2) Remove locking pin (1) (Fig. 136). Remove the plate of the locking pin with a suitable tool and press out the pin remaining in the cap downwards.

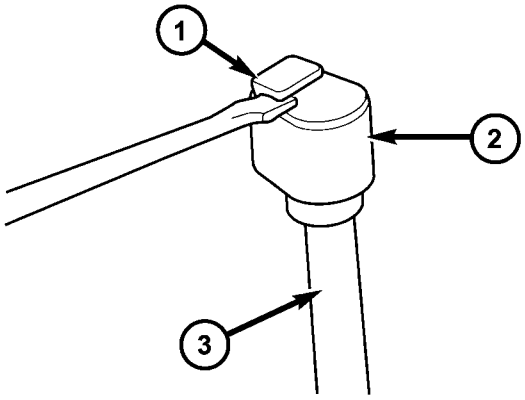


Fig. 136 Remove Dipstick Tube Cap Lock

1 - LOCKING PIN
2 - TUBE CAP
3 - DIPSTICK TUBE

(3) Remove cap (2).

WARNING: Risk of accident from vehicle starting off by itself when engine running. Risk of injury from contusions and burns if you insert your hands into the engine when it is started or when it is running. Secure vehicle to prevent it from moving off by itself. Wear properly fastened and close-fitting work clothes. Do not touch hot or rotating parts.

FLUID AND FILTER (Continued)

(4) Actuate the service brake. Start engine and let it run at idle speed in selector lever position ″P″.

(5) Shift through the transmission modes several times with the vehicle stationary and the engine idling

(6) Warm up the transmission, wait at least 2 minutes and check the oil level with the engine running. Push the Oil Dipstick 8863A in up to the stop on the electrohydraulic unit and pull out again, read off oil level, repeat if necessary.

NOTE: The dipstick will protrude from the fill tube approximately 75mm (3 inches) when installed.

(7) Check transmission oil temperature.

NOTE: The true transmission oil temperature can only be read by a scan tool in REVERSE or any forward gear position. (Refer to 21 - AUTOMATIC TRANSMISSION- NAG1/TRANSMISSION TEMPERATURE SENSOR/PARK-NEUTRAL SWITCH - OPERATION)

(8) The transmission Oil Dipstick 8863A has indicator marks every 10mm. Determine the height of the oil level on the dipstick and using the height, the transmission temperature, and the Transmission Fluid Graph (Fig. 137), determine if the transmission oil level is correct.

(9) Add or remove oil as necessary and recheck the oil level.

(10) Once the oil level is correct, install a new dipstick tube cap (2) (Fig. 138) and lock pin (1).

STANDARD PROCEDURE - TRANSMISSION FILL

To avoid overfilling transmission after a fluid change or overhaul, perform the following procedure:

(1) Verify that the vehicle is parked on a level surface.

(2) Remove locking pin (1) (Fig. 139). Remove the plate of the locking pin with a suitable tool and press out the pin remaining in the cap downwards.

(3) Remove cap (2).

(4) Add following initial quantity of Shell® 3403 to transmission:

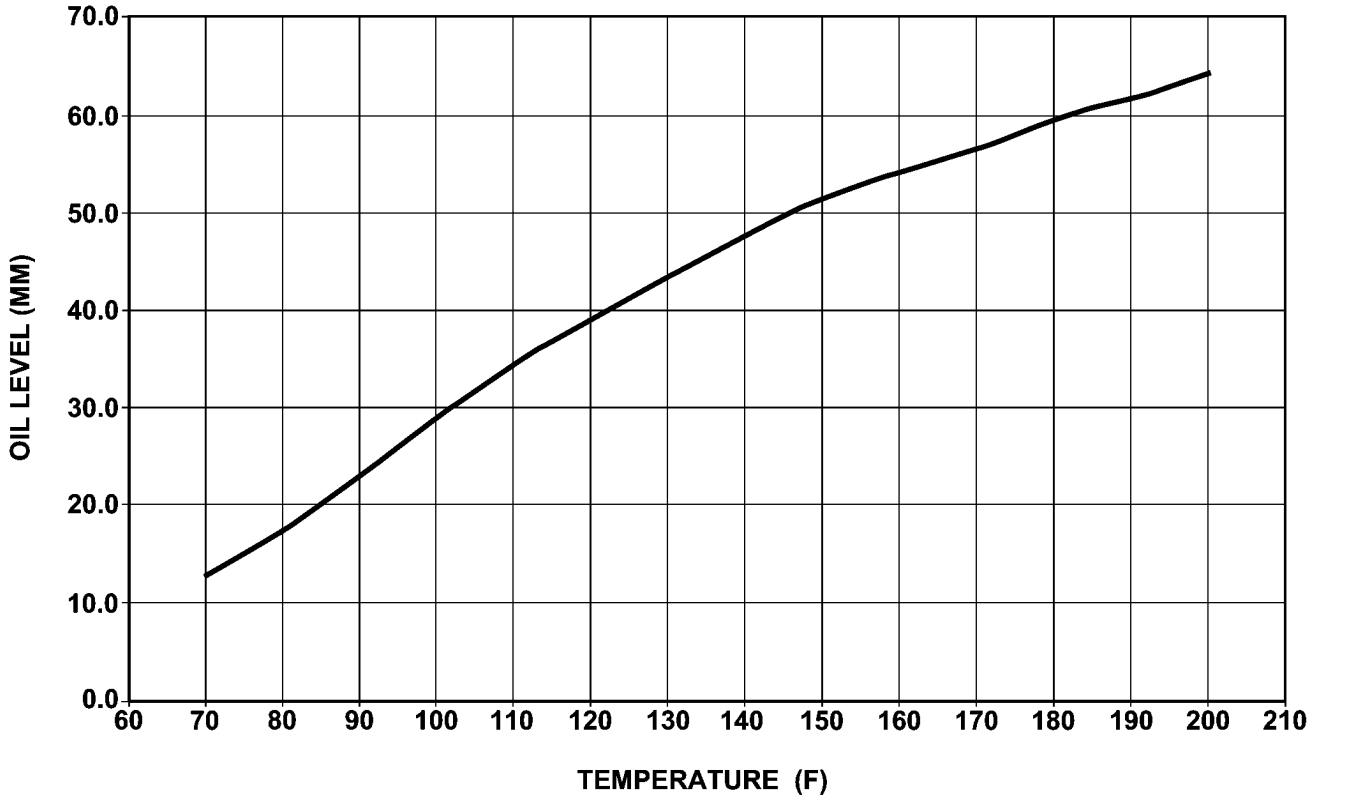


Fig. 137 NAG1 Transmission Fill Graph

FLUID AND FILTER (Continued)

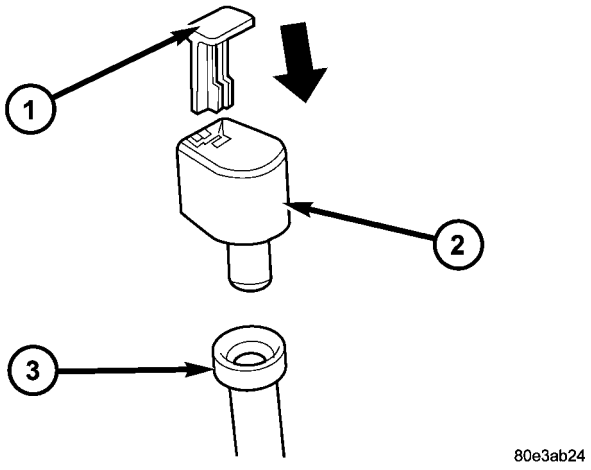


Fig. 138 Dipstick Tube Cap Components

1 - LOCKING PIN
2 - TUBE CAP
3 - DIPSTICK TUBE

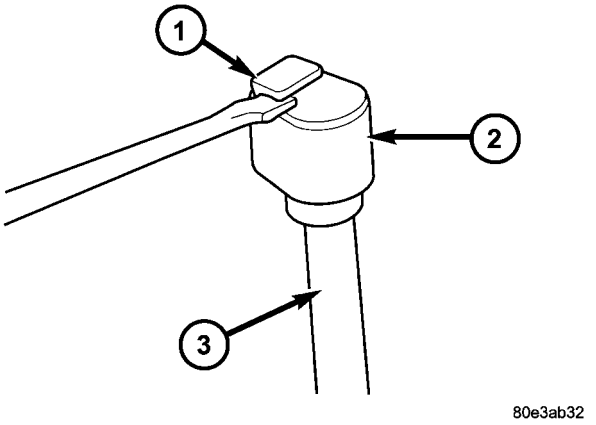


Fig. 139 Remove Dipstick Tube Cap Lock

1 - LOCKING PIN
2 - TUBE CAP
3 - DIPSTICK TUBE

(a) If only fluid and filter were changed, add **5.0 L (10.6 pts.)** of transmission fluid to transmission.

(b) If transmission was completely overhauled, torque converter was replaced or drained, and cooler was flushed, add **7.7 L (16.3 pts.)** of transmission fluid to transmission.

(5) Check the transmission fluid (Refer to 21 - TRANSMISSION/AUTOMATIC - NAG1/FLUID - STANDARD PROCEDURE) and adjust as required.

STANDARD PROCEDURE - FLUID/FILTER SERVICE

(1) Run the engine until the transmission oil reaches operating temperature.

(2) Raise and support vehicle.

(3) Remove the torque converter drain plug access plug from the bottom of the torque converter housing.

(4) Rotate the engine clockwise until the torque converter drain plug (Fig. 140) is aligned with the access hole.

NOTE: Clean the area around the drain plug to prevent dirt from entering the torque converter.

(5) Using a suitable drain pan to catch the fluid, remove the torque converter drain plug and allow the torque converter to drain completely.

(6) Inspect the torque converter drain plug seal (Fig. 140). Replace the seal if necessary.

(7) Install the torque converter drain plug. Tighten the drain plug to 14 N·m (10 ft.lbs.).

(8) Install the torque converter drain plug access plug into the bottom of the torque converter housing.

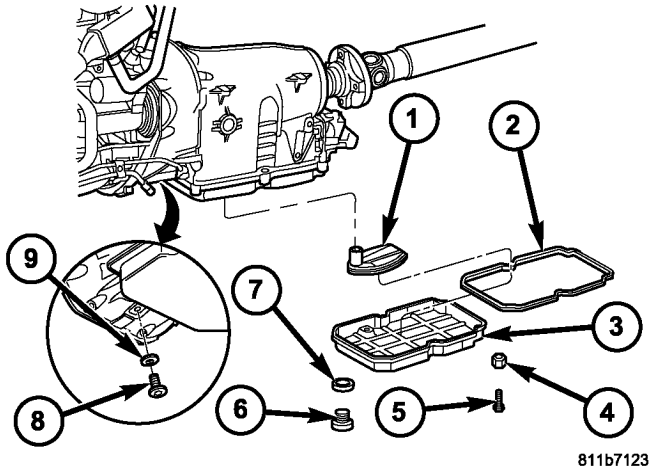


Fig. 140 Fluid/Filter Service Points

1 - OIL FILTER
2 - OIL PAN GASKET
3 - OIL PAN
4 - RETAINER
5 - BOLT
6 - OIL PAN DRAIN PLUG
7 - SEAL
8 - TORQUE CONVERTER DRAIN PLUG
9 - SEAL

(9) Using a suitable drain pan to catch the fluid, remove the transmission oil pan drain plug (Fig. 140) and allow the oil pan to drain completely.

(10) Inspect the transmission oil pan drain plug seal. Replace the seal if necessary.

(11) Install the transmission oil pan drain plug. Tighten the drain plug to 20 N·m (15 ft.lbs.).

(12) Remove the bolts and retainers (Fig. 140) holding the oil pan to the transmission.

(13) Remove the transmission oil pan and gasket from the transmission.

FLUID AND FILTER (Continued)

(14) Remove the transmission oil filter and o-ring from the electrohydraulic control unit.

(15) Clean the inside of the oil pan of any debris. Inspect the oil pan gasket and replace if necessary.

(16) Install a new oil filter and o-ring into the electrohydraulic control unit.

(17) Install the oil pan and gasket onto the transmission.

(18) Install the oil pan bolts and retainers. Torque the bolts to 8 N·m (70 in.lbs.).

(19) Lower the vehicle and add 7.0 L (7.4 qts.) of transmission fluid to the transmission.

(20) Check the oil level (Refer to 21 - TRANSMISSION/AUTOMATIC - NAG1/FLUID AND FILTER - STANDARD PROCEDURE).

FREEWHEELING CLUTCH

DESCRIPTION

Freewheeling clutches (Fig. 141) are installed in the front planetary gear set between the sun gear and the stator shaft, and in the rear planetary gear set between the sun gear and the intermediate shaft.

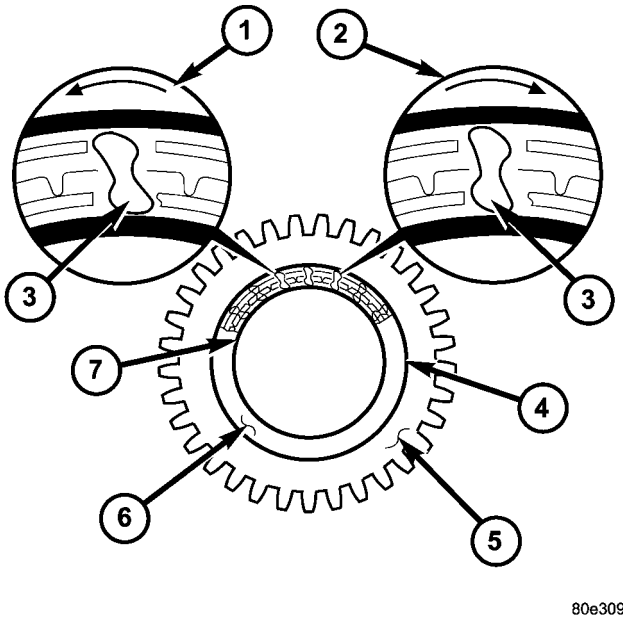


Fig. 141 Freewheeling Clutch

1 - ROTATION DIRECTION ″A″
2 - ROTATION DIRECTION ″B″
3 - LOCKING ELEMENTS
4 - OUTER RACE
5 - FRONT OR REAR SUN GEAR
6 - LOCKING ELEMENT CAGE
7 - INNER RACE

The freewheel consists of an outer race (4), an inner race (7), a number of locking elements (3) and a cage (6) for these locking elements.

OPERATION

The freewheeling clutch (Fig. 142) optimizes individual gearshifts. They lock individual elements of a planetary gear set together or against the transmission housing in one direction of rotation to allow the torque to be transmitted.

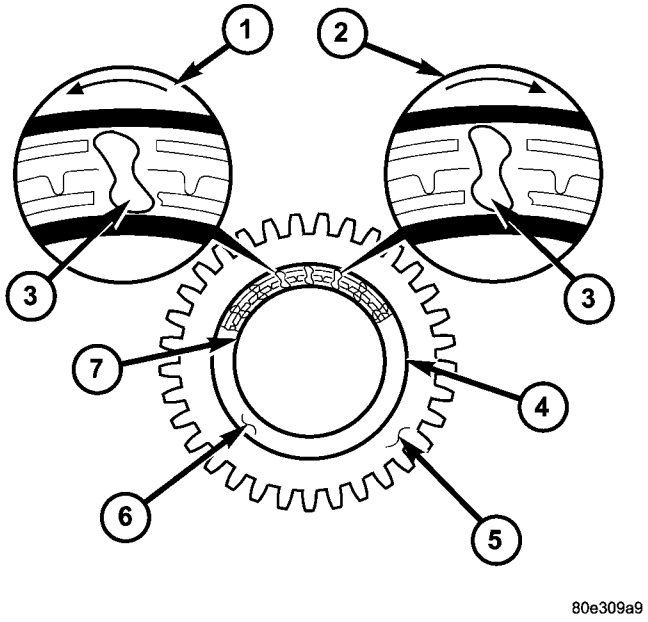
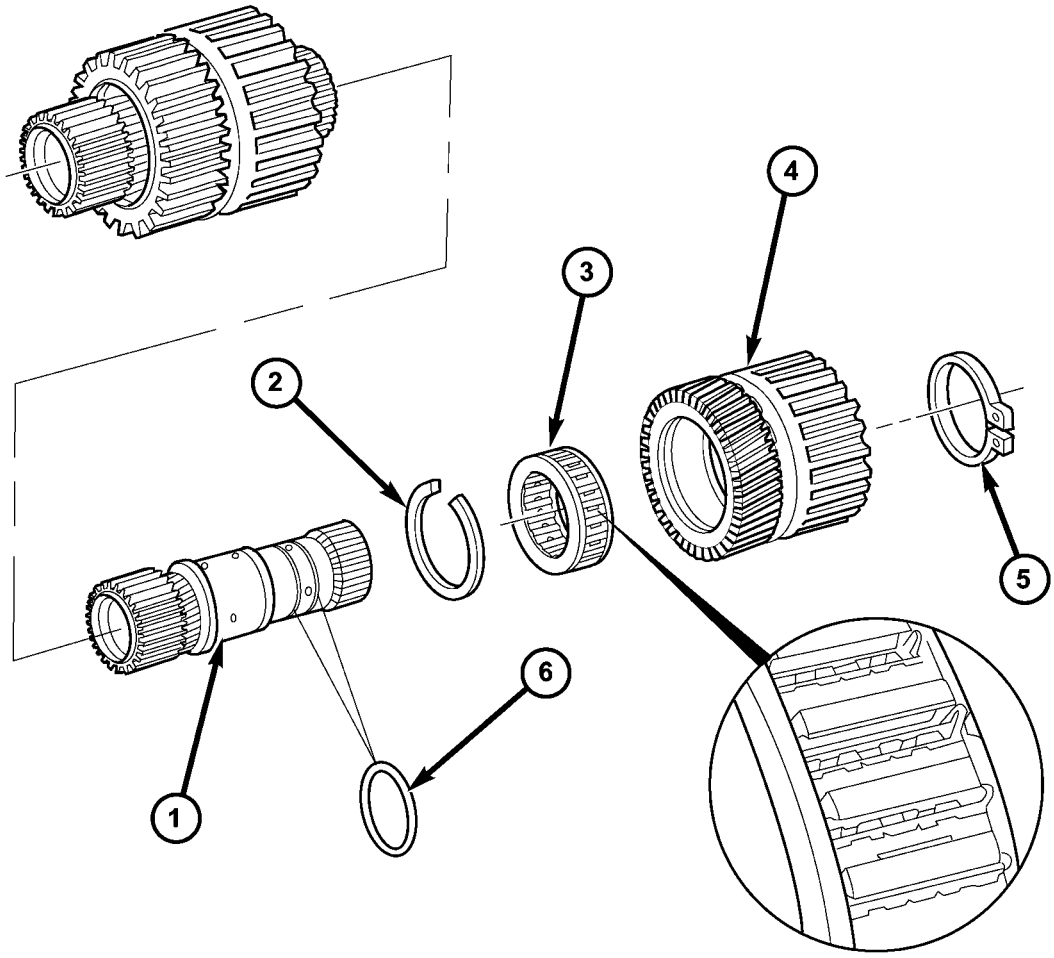


Fig. 142 Freewheeling Clutch

1 - ROTATION DIRECTION ″A″
2 - ROTATION DIRECTION ″B″
3 - LOCKING ELEMENTS
4 - OUTER RACE
5 - FRONT OR REAR SUN GEAR
6 - LOCKING ELEMENT CAGE
7 - INNER RACE

If the inner race (7) of the freewheeling clutch is locked and the outer race (4) turns in direction ″A″ (1), the locking elements (3) adopt a diagonal position on account of their special contours, allowing the freewheel function. The outer race (4) slides over the locking elements (3) with negligible friction. If the rotation of the outer race (4) changes to direction ″B″ (2), the locking elements (3) stand up and lock the outer and inner races (4, 7) together.

FREEWHEELING CLUTCH (Continued)



80e3f7da

Fig. 143 Freewheeling Clutch F2

1 - HOLLOW SHAFT
2 - SNAP-RING
3 - FREEWHEELING CLUTCH F2
4 - K3 INNER DISC CARRIER AND REAR PLANETARY SUN GEAR
5 - RETAINING RING
6 - O-RINGS

DISASSEMBLY

(1) Remove retaining ring (5) (Fig. 143) from hollow shaft (1).

(2) Remove rear sun gear (4) with the K3 internally toothed disk carrier and rear freewheeling clutch F2 (3).

(3) Remove snap-ring (2) (Fig. 143) for freewheel.

(4) Press freewheeling clutch out of sun gear.

(5) Check O-rings (6), replace if necessary.

(6) Check the anti-friction bearing (Fig. 144) in the rear planetary sun gear for damage. Replace as necessary.

FREEWHEELING CLUTCH (Continued)

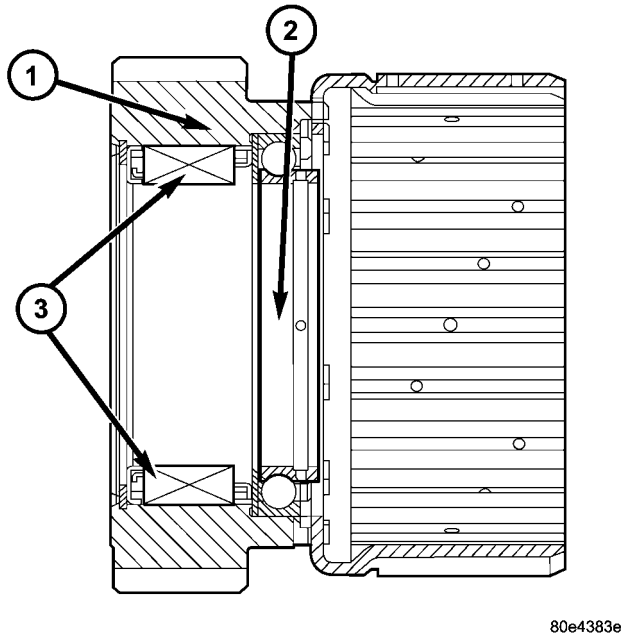


Fig. 144 Freewheeling Clutch F2 Anti-Friction Bearing

1 - K3 INNER DISC CARRIER AND REAR PLANETARY SUN GEAR
2 - ANTI-FRICTION BEARING
3 - FREEWHEELING CLUTCH F2

ASSEMBLY

(1) Press freewheeling clutch F2 (3) (Fig. 145) into sun gear (4).

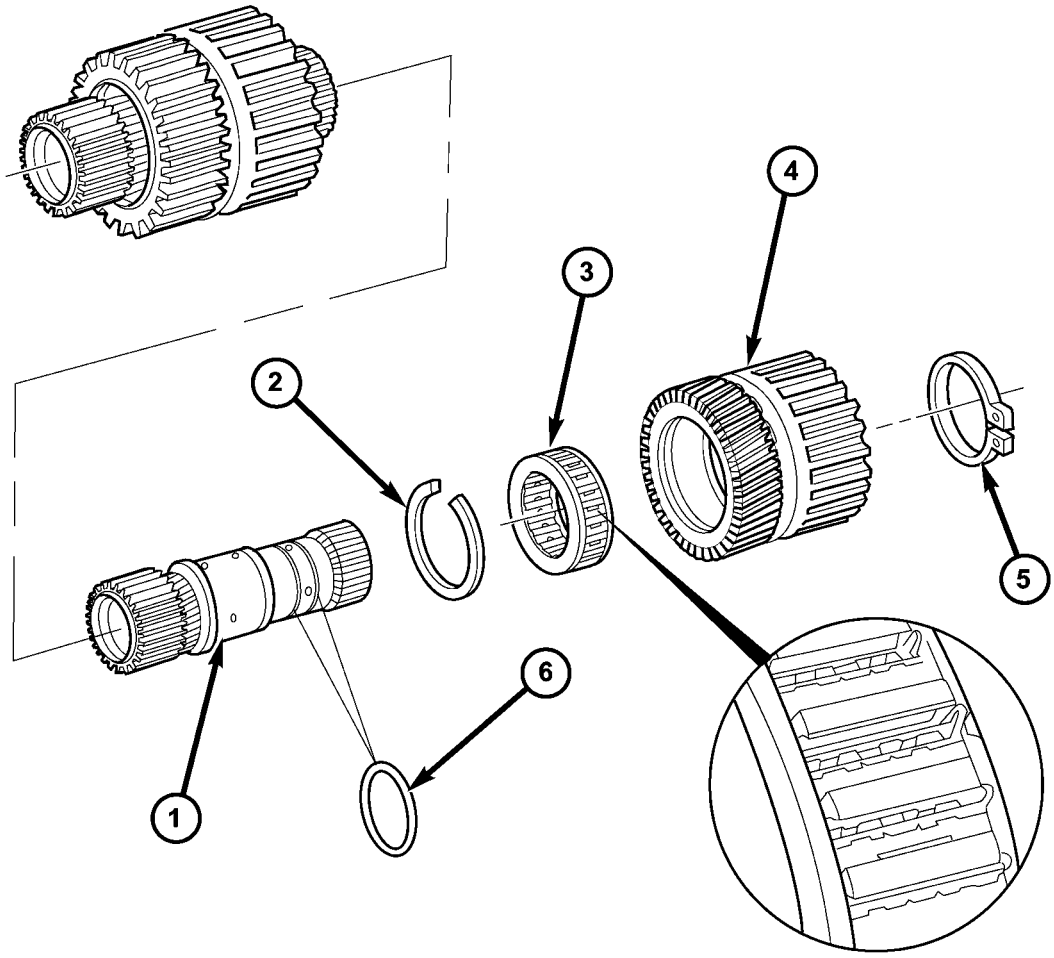
(2) Install snap-ring (2) for freewheeling clutch.

(3) Check O-rings (6) (Fig. 145) on hollow shaft, replace if necessary.

(4) Install rear sun gear (4) with K3 internally toothed disc carrier and rear freewheeling clutch (3) onto the hollow shaft.

(5) Install retaining ring (5) onto hollow shaft (1).

FREEWHEELING CLUTCH (Continued)



80e3f7da

Fig. 145 Freewheeling Clutch F2

1 - HOLLOW SHAFT
2 - SNAP-RING
3 - FREEWHEELING CLUTCH F2
4 - K3 INNER DISC CARRIER AND REAR PLANETARY SUN GEAR
5 - RETAINING RING
6 - O-RINGS

GEARSHIFT CABLE

DIAGNOSIS AND TESTING - 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.

REMOVAL

(1) Move selector lever to position ″D″.

(2) Remove top (3) (Fig. 146) of the center section of instrument panel.

(3) Remove bottom (2) (Fig. 147) of the center section of instrument panel.

(4) Pry ball socket of transmission shift cable off ball knob at the shift lever assembly (SLA). Use a suitable slotted screwdriver.

(5) Raise and support vehicle.

(6) Detach shift cable at transmission.

(a) Unlatch ball socket latch (Fig. 148) of cable.

(b) Unclip shift cable retainer from retainer bracket. When pulling out cable, press together hooks of shift cable retainer at the points shown (arrows).

(c) Pull shift cable out of ball socket. Ball socket can remain on transmission lever.

(7) Remove the shift cable grommet from the dash panel.

(8) Remove the shift cable from the vehicle.

INSTALLATION

(1) Pass the shift cable through the opening in the dash panel and seat the shift cable grommet into the hole.

(2) Install the shift cable (Fig. 149) to the transmission.

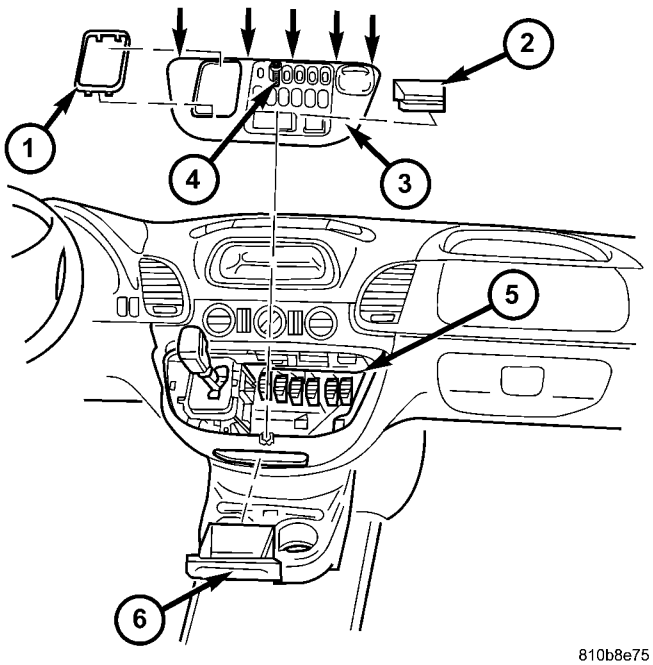


Fig. 146 Remove Top Section Of Center Instrument Panel

1 - SHIFT LEVER ASSEMBLY FRAME TRIM
2 - STORAGE COMPARTMENT
3 - TOP CENTER PART OF INSTRUMENT PANEL
4 - SCREW
5 - PLUG CONNECTIONS
6 - ASHTRAY

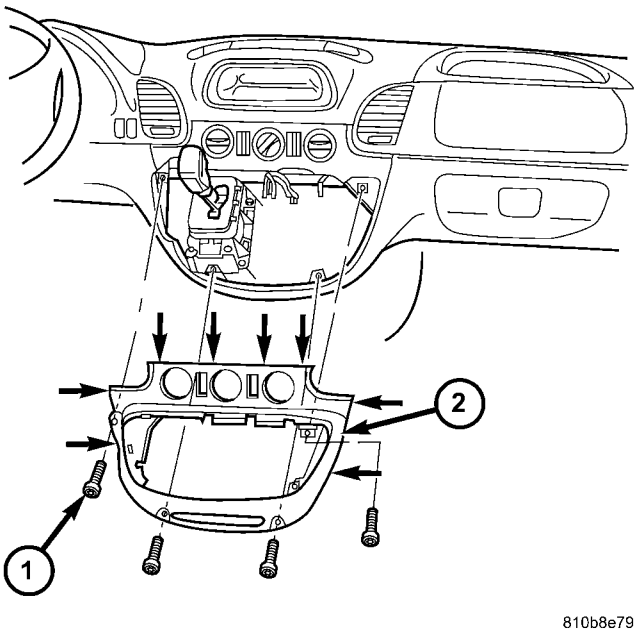


Fig. 147 Remove Bottom Section Of Center Instrument Panel

1 - SCREW
2 - BOTTOM CENTER PART OF INSTRUMENT PANEL

GEARSHIFT CABLE (Continued)

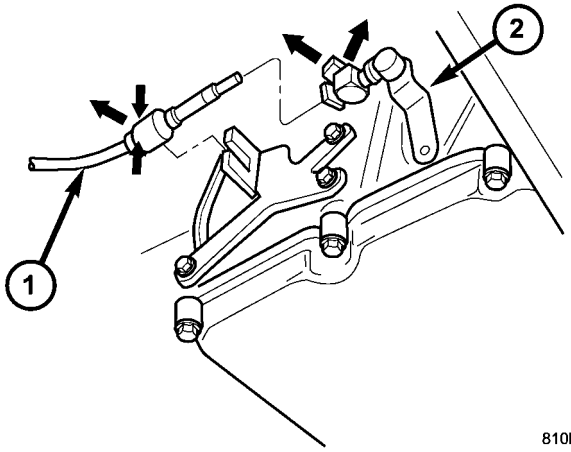


Fig. 148 Remove Shift Cable From Transmission

1 - SHIFT CABLE
2 - TRANSMISSION SHIFT LEVER

(a) Push shift cable onto the transmission shift lever ball socket.
(b) Latch ball socket latch of cable.
(c) Clip shift cable retainer into retainer bracket.

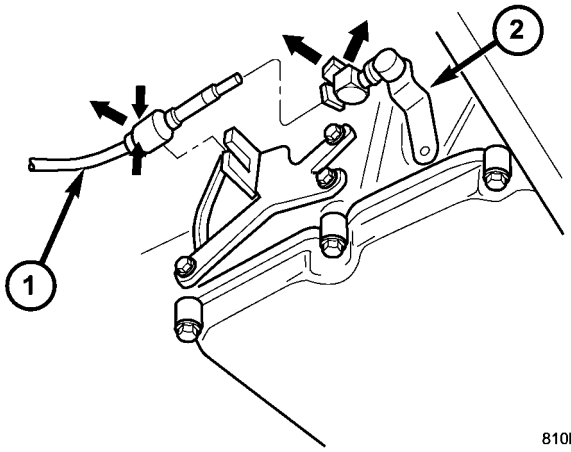


Fig. 149 Install Shift Cable Onto Transmission

1 - SHIFT CABLE
2 - TRANSMISSION SHIFT LEVER

(3) Lower vehicle.
(4) Install the transmission shift cable onto the ball knob at the SLA.
(5) Install the bottom section (2) (Fig. 150) of the center section of instrument panel.
(6) Install the top section (3) (Fig. 151) of the center section of instrument panel.
(7) Verify repair.

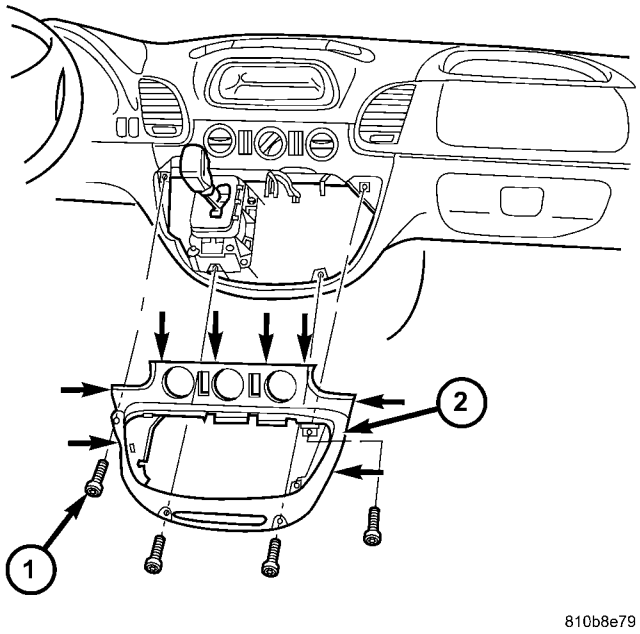


Fig. 150 Install Bottom Section Of Center Instrument Panel

1 - SCREW
2 - BOTTOM CENTER PART OF INSTRUMENT PANEL

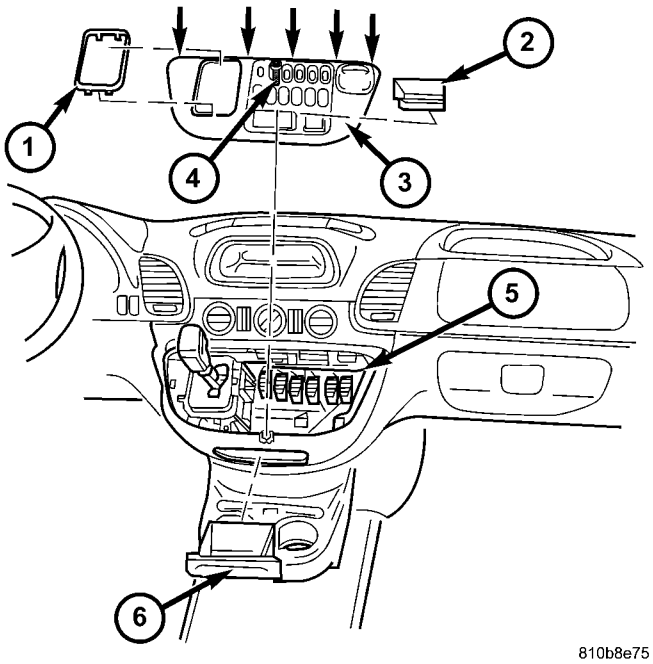


Fig. 151 Install Top Section Of Center Instrument Panel

1 - SHIFT LEVER ASSEMBLY FRAME TRIM
2 - STORAGE COMPARTMENT
3 - TOP CENTER PART OF INSTRUMENT PANEL
4 - SCREW
5 - PLUG CONNECTIONS
6 - ASHTRAY

HOLDING CLUTCHES

DESCRIPTION

Three multiple-disc holding clutches (Fig. 152), the front, middle and rear multiple disc clutches B1, B3 and B2, are located in the planetary gear sets in the transmission housing.

A multiple-disc holding clutch consists of a number of internally toothed discs (10) on an internally toothed disc carrier and externally toothed discs (9) on an externally toothed disc carrier, which is rigidly connected to the transmission housing.

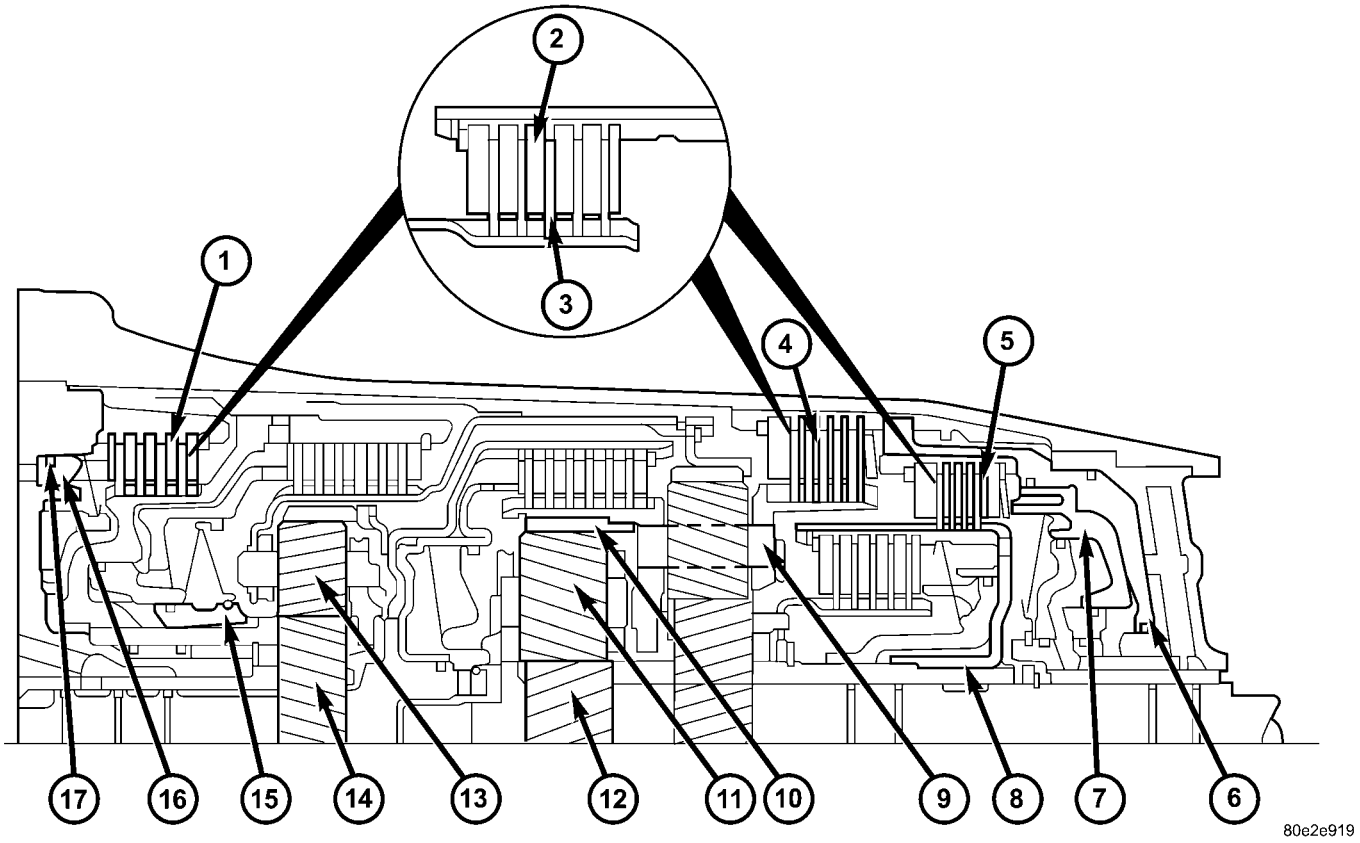


Fig. 152 Holding Clutches

1 - B1 CLUTCH
2 - EXTERNALLY TOOTHED DISC
3 - INTERNALLY TOOTHED DISC
4 - B3 CLUTCH
5 - B2 CLUTCH
6 - B3 CLUTCH PISTON
7 - B2 CLUTCH PISTON
8 - B2 CLUTCH INTERNALLY TOOTHED DISC CARRIER
9 - REAR PLANETARY GEARSET PLANETARY CARRIER
10 - CENTER PLANETARY GEARSET ANNULUS GEAR
11 - CENTER PLANETARY GEARSET PINION GEARS
12 - CENTER PLANETARY GEARSET SUN GEAR
13 - FRONT PLANETARY GEARSET PINION GEARS
14 - FRONT PLANETARY GEARSET SUN GEAR
15 - B1 CLUTCH INTERNALLY TOOTHED DISC CARRIER
16 - B1 CLUTCH PISTON
17 - B1 CLUTCH EXTERNALLY TOOTHED DISC CARRIER

HOLDING CLUTCHES (Continued)

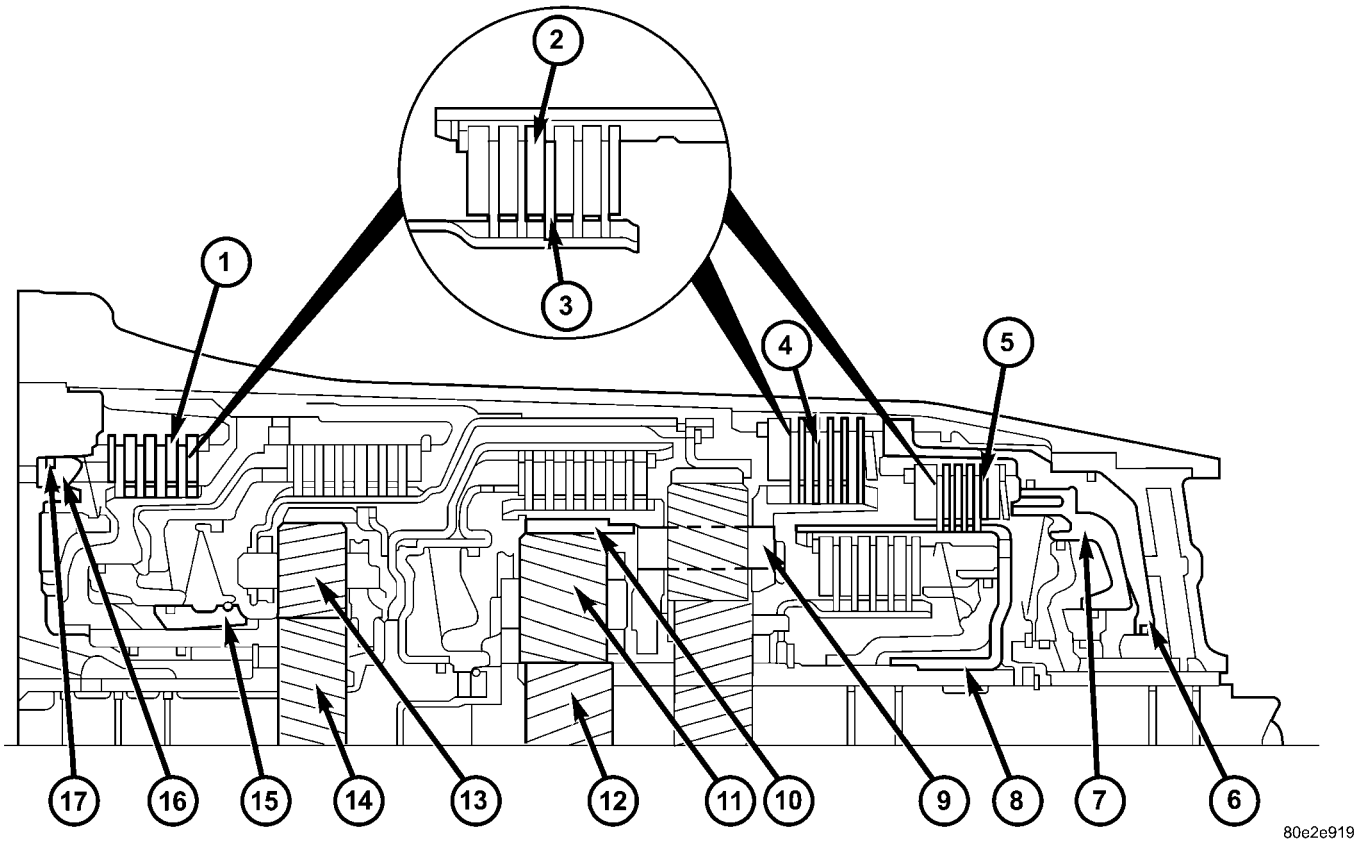


Fig. 153 Holding Clutches

1 - B1 CLUTCH
2 - EXTERNALLY TOOTHED DISC
3 - INTERNALLY TOOTHED DISC
4 - B3 CLUTCH
5 - B2 CLUTCH
6 - B3 CLUTCH PISTON
7 - B2 CLUTCH PISTON
8 - B2 CLUTCH INTERNALLY TOOTHED DISC CARRIER
9 - REAR PLANETARY GEARSET PLANETARY CARRIER
10 - CENTER PLANETARY GEARSET ANNULUS GEAR
11 - CENTER PLANETARY GEARSET PINION GEARS
12 - CENTER PLANETARY GEARSET SUN GEAR
13 - FRONT PLANETARY GEARSET PINION GEARS
14 - FRONT PLANETARY GEARSET SUN GEAR
15 - B1 CLUTCH INTERNALLY TOOTHED DISC CARRIER
16 - B1 CLUTCH PISTON
17 - B1 CLUTCH EXTERNALLY TOOTHED DISC CARRIER

OPERATION

The holding clutches (Fig. 153) connect the annulus gear, sun gear, or planetary carrier of a planetary gear set against the transmission housing in order to transmit the drive torque.

If the piston (16) on multiple-disc holding clutch B1 (1) is subjected to oil pressure, it presses the internal (3) and external discs (2) of the disc set together. The internally toothed disc carrier (15) locks the sun gear (14) against the housing. The planetary pinion gears (13) turn on the sun gear (14).

If the multiple-disc holding clutch B2 (5) is actuated via the piston (7), the piston compresses the disc set. The internally toothed disc carrier (8) locks the sun gear (12) against the housing. The planetary pinion gears (11) turn on the sun gear (12).

If the multiple-disc holding clutch B3 (4) is actuated via the piston (6), the planetary carrier (9) and the annulus gear (10) are locked. When the multiple-disc brake B3 (4) is actuated, the direction of rotation is reversed.

HOLDING CLUTCH B1

DISASSEMBLY

(1) Remove snap-ring (7) (Fig. 154).

(2) Remove multiple-disc pack (6) and disc spring (5) from outer multiple-disc carrier.

(3) Place the Multi-use Spring Compressor 8900 (8) (Fig. 154) on disc spring (3) and compress the spring until the snap-ring (4) is exposed.

(4) Remove snap-ring (4).

(5) Remove piston (2) from the outer multiple-disc carrier by carefully blowing compressed air into the bore (A).

HOLDING CLUTCH B1 (Continued)

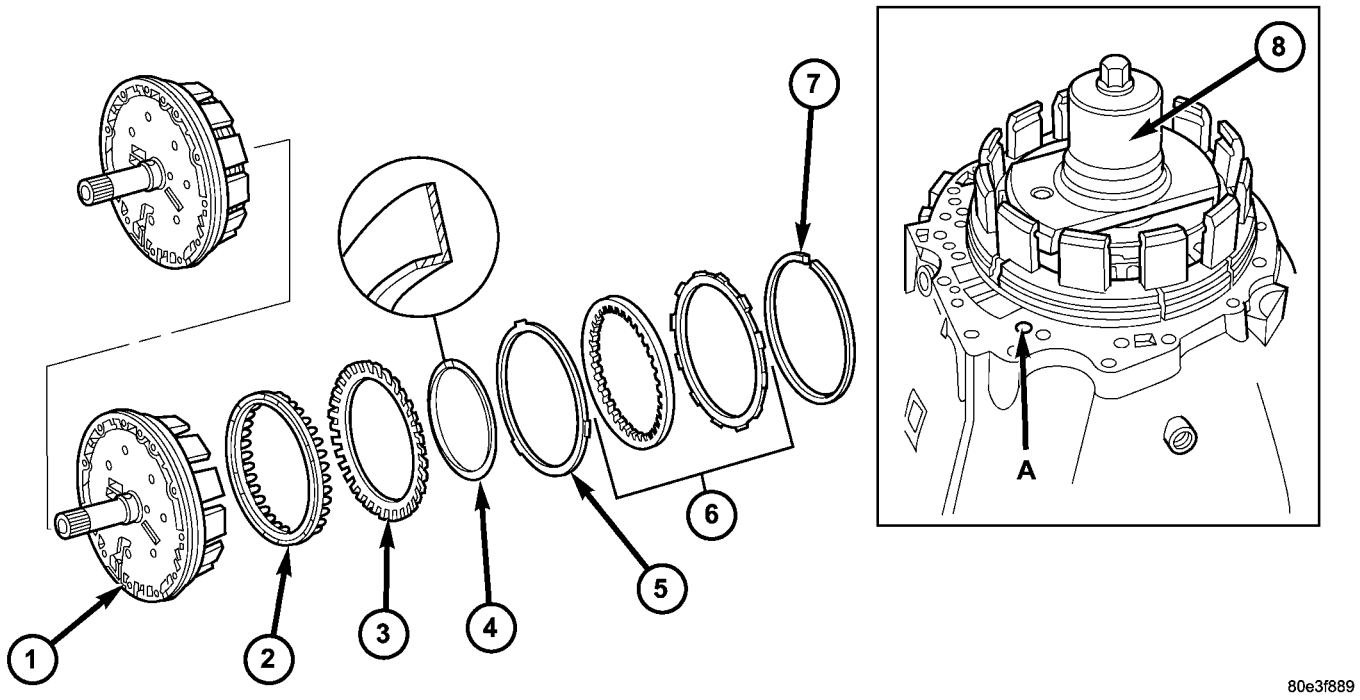


Fig. 154 Holding Clutch B1

1 - HOLDING CLUTCH B1 OUTER CARRIER
2 - PISTON
3 - DISC SPRING
4 - SNAP-RING
5 - DISC SPRING
6 - MULTIPLE DISC PACK
7 - SNAP-RING
8 - MULTI-USE SPRING COMPRESSOR 8900

ASSEMBLY

(1) Install piston (2) (Fig. 155) in outer multiple-disc carrier (1). Press in piston using the disc spring (3) and Multi-use Spring Compressor 8900 (8). Place compressor (8) on disc spring (3) and compress until the groove of the snap-ring is exposed

NOTE: Check vulcanized gasket, replace if necessary.

(2) Insert snap-ring (4) (Fig. 155).

NOTE: The collar of the snap-ring must point towards the multiple-disc pack. After installing, check snap-ring for correct seat.

(3) Insert disc spring (5) and multiple-disc pack (6) in the outer multiple-disc carrier.

(4) Insert snap-ring (7).

NOTE: Pay attention to sequence of discs. Place new friction multiple-discs in ATF fluid for one hour before installing.

(5) Measure B1 clutch clearance.

(a) Mount Pressing Tool 8901 (1) (Fig. 156) on outer multiple disc.

(b) Using a lever press (Fig. 156), compress pressing tool as far as the stop (then the marking ring is still visible, see small arrow).

(c) Using a feeler gauge, determine the play ″L″ (Fig. 157) at three points between the snap-ring (6) and outer multiple-disc (4). During the measurement, the snap-ring (6) must contact the upper bearing surface of the groove in the outer multiple-disc carrier (5). The correct clearance is 2.3-2.7 mm (0.091-0.106 in.) for 2 friction disc versions, 2.7-3.1 mm (0.106-0.122 in.) for 3 disc versions, and 3.0-3.4 mm (0.118-0.134 in.) for 4 disc versions.

HOLDING CLUTCH B1 (Continued)

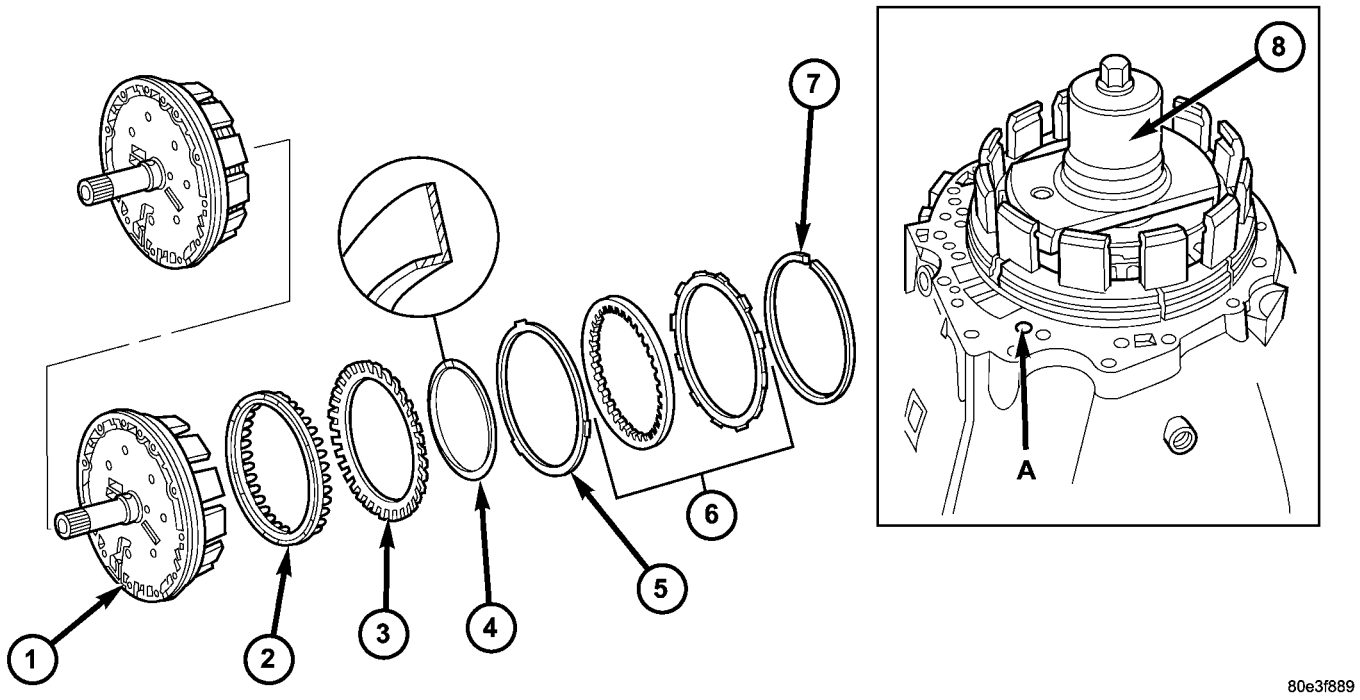


Fig. 155 Holding Clutch B1

1 - HOLDING CLUTCH B1 OUTER CARRIER
2 - PISTON
3 - DISC SPRING
4 - SNAP-RING
5 - DISC SPRING
6 - MULTIPLE DISC PACK
7 - SNAP-RING
8 - MULTI-USE SPRING COMPRESSOR 8900

(d) Adjust with snap-ring (6), if necessary. Snap-rings are available in thicknesses of 2.6 mm (0.102 in.), 2.9 mm (0.114 in.), 3.2 mm (0.126 in.), 3.5 mm (0.138 in.), 3.8 mm (0.150 in.), and 4.1 mm (0.162 in.).

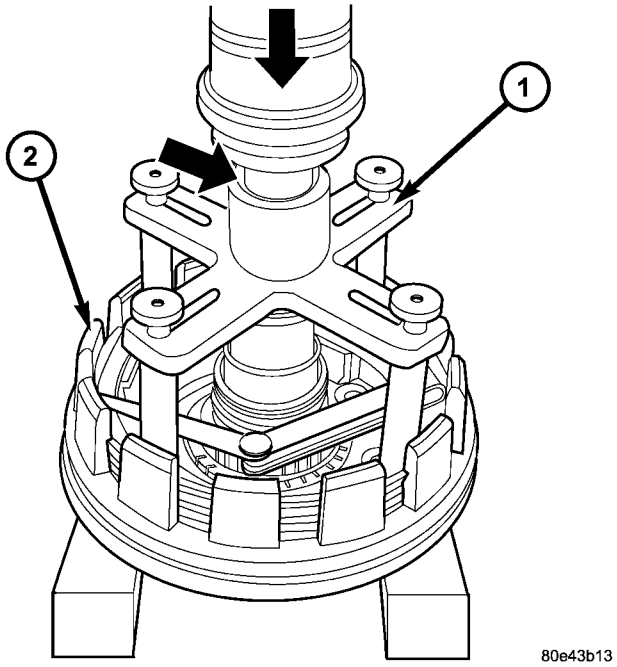


Fig. 156 Measure B1 Clutch Clearance

1 - PRESSING TOOL 8901
2 - B1 CLUTCH OUTER CARRIER

HOLDING CLUTCH B2 (Continued)

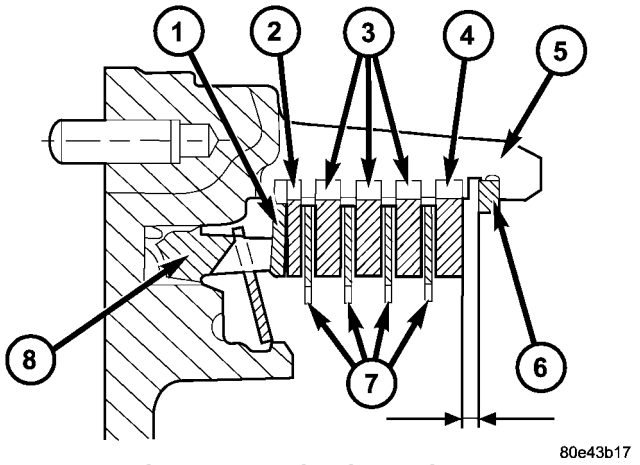


Fig. 157 B1 Clutch Stack-up

1 - DISC SPRING
2 - OUTER MULTIPLE DISC - 1.8 mm (0.071 IN.)
3 - OUTER MULTIPLE DISC - 2.8 mm (0.110 IN.)
4 - OUTER MULTIPLE DISC - 4.0 mm (0.158 IN.)
5 - B1 OUTER CARRIER
6 - SNAP-RING
7 - FRICTION DISCS
8 - PISTON

HOLDING CLUTCH B2

DISASSEMBLY

(1) Remove snap ring (1) (Fig. 158).

(2) Take multiple-disc pack B2 (2) and disc spring (3) out of the outer multiple-disc carrier B2 (8). The outer multiple-disc carrier for the multi-disc holding clutch B2 is the piston for the multiple-disc holding clutch B3 at the same time.

(3) Place the Multi-use Spring Compressor 8900 on the spring disc (14) and compress the spring until the groove for the snap-ring is exposed.

(4) Remove snap-ring (16) (Fig. 158).

(5) Remove spring plate (15) and disc spring (14).

(6) Separate piston guide ring (13) and the B2 piston (10) from the B3 piston (8) by blowing compressed air into the bore (**D**) (Fig. 159).

(7) Press piston guide ring (13) out of the B2 piston (10).

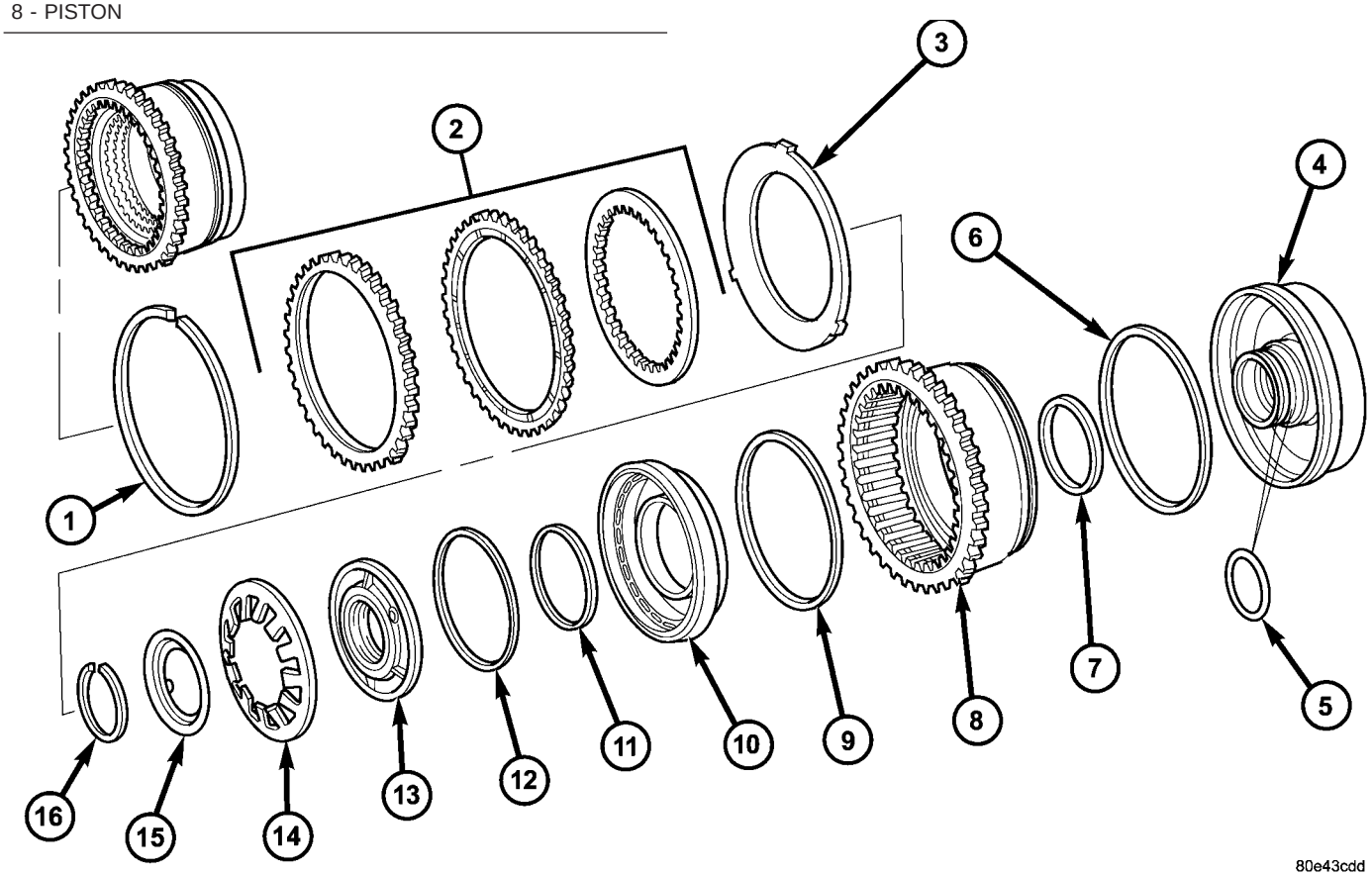


Fig. 158 Holding Clutch B2

1 - SNAP-RING
2 - MULTIPLE DISC PACK
3 - DISC SPRING
4 - B2 AND B3 PISTON GUIDE
5 - O-RING
6 - B3 PISTON SEALING RING
7 - B3 PISTON SEALING RING
8 - B3 PISTON/B2 OUTER DISC CARRIER
9 - B3 PISTON SEALING RING
10 - B2 PISTON
11 - PISTON GUIDE SEALING RING
12 - PISTON GUIDE SEALING RING
13 - PISTON GUIDE RING
14 - PISTON BACK PRESSURE DISC SPRING
15 - SPRING PLATE
16 - SNAP-RING

HOLDING CLUTCH B2 (Continued)

(8) Separate piston guide (4) from the B3 piston (8) by blowing compressed air into the bore (**A**) (Fig. 159).

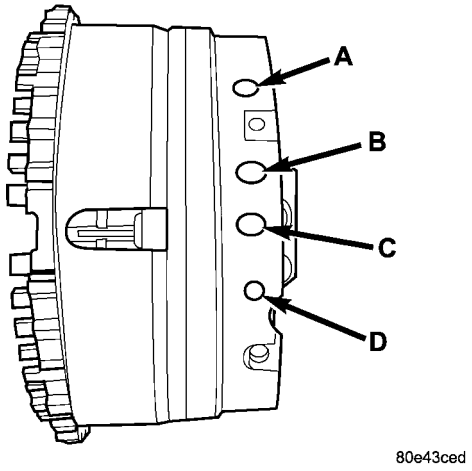


Fig. 159 B2 Clutch Oil Supply Locations

A - B3 PISTON
B - B2 PISTON GUIDE RING SIDE
C - K3 CLUTCH FEED
D - B2 PISTON SHIFT SIDE

ASSEMBLY

(1) Assemble piston guide (4) (Fig. 160) and B3 piston (8) in the correct position.

(2) Check all sealing rings (Fig. 161), replace if necessary. The rounded off edges on the sealing rings (6), (3), and (2) must point outwards. The rounded off edges on the sealing ring (4) must point inwards.

(3) Insert B2 piston (10) (Fig. 160) in B3 piston (8).

(4) Insert piston guide ring (2) (Fig. 162). The valve (1) in the piston guide ring must be on top.

(5) Insert disc spring (14) (Fig. 160) and spring plate (15). Insert disc spring with the curvature towards the spring plate

(6) Place Multi-use Spring Compressor 8900 on the disc spring (14) and compress the spring until the groove for the snap-ring is exposed.

(7) Insert snap-ring (16).

NOTE: Pay attention to sequence of discs. Place new friction multiple-discs in ATF fluid for one hour before installing.

(8) Insert disc spring (3) and multiple-disc pack (2) in the B2 outer multiple-disc carrier.

(9) Insert snap-ring (1).

NOTE: During the measurement the snap-ring (8) must contact the upper bearing surface of the groove in the outer multiple-disc carrier.

(10) Measure the B2 clutch pack clearance.

(a) Mount Pressing Tool 8901 (1) (Fig. 163) on outer multiple disc.

(b) Using a lever press, compress the pressing tool as far as the stop (then the marking ring is still visible, see small arrow).

(c) Using a feeler gauge, determine the play ″L″ (Fig. 164) at three points between the snap-ring (8) and outer multiple-disc (7).

(d) The correct clutch clearance is 1.9-2.3 mm (0.075-0.091 in.) for the four friction disc versions and 2.0-2.4 mm (0.079-0.095 in.) for the five disc versions.

(e) Adjust with snap-ring (8), if necessary. Snap-rings are available in thicknesses of 2.9 mm (0.114 in.), 3.2 mm (0.126 in.), 3.5 mm (0.138 in.), 3.8 mm (0.150 in.), and 4.1 mm (0.162 in.).

HOLDING CLUTCH B2 (Continued)

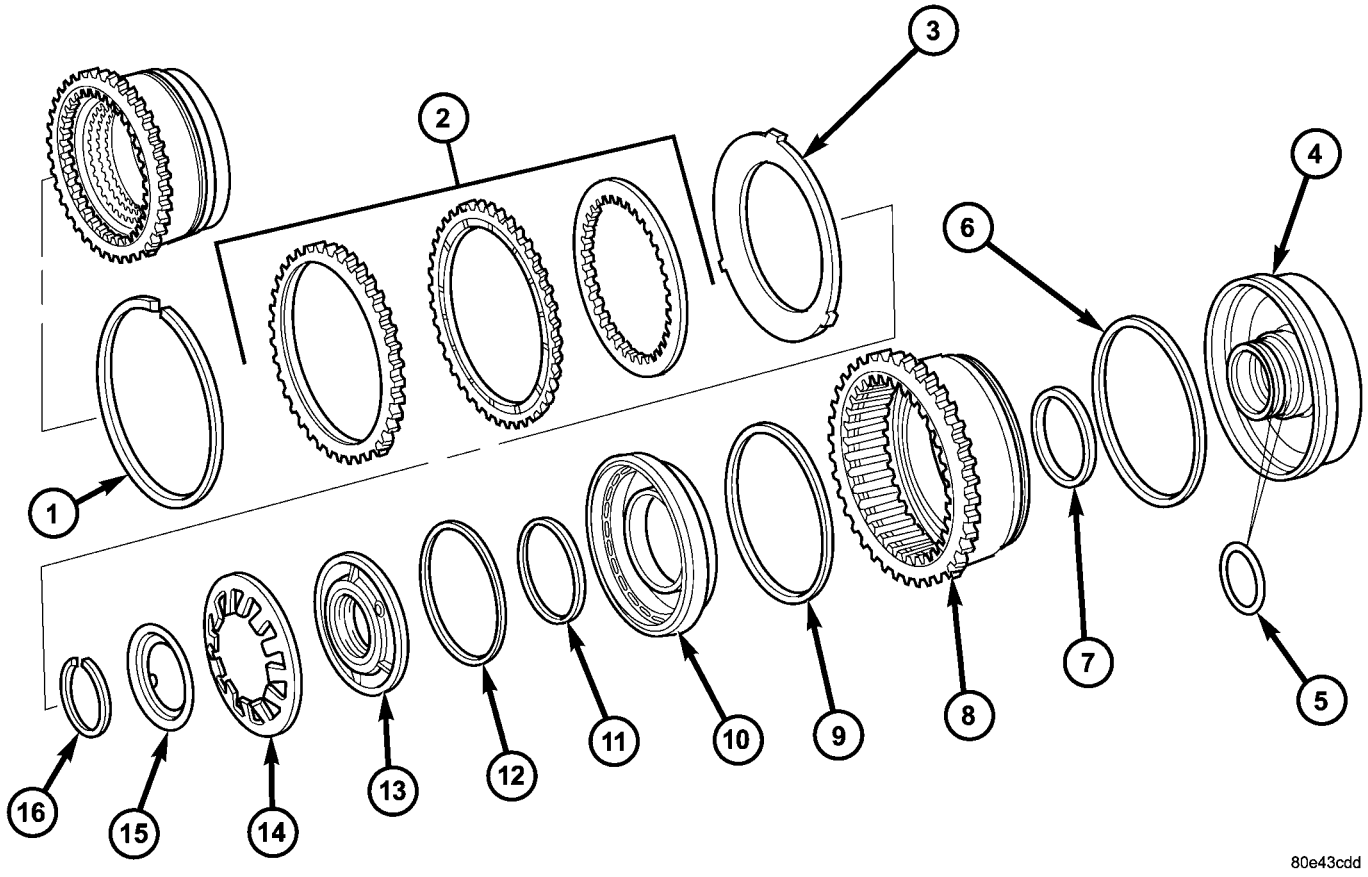


Fig. 160 Holding Clutch B2

1 - SNAP-RING
2 - MULTIPLE DISC PACK
3 - DISC SPRING
4 - B2 AND B3 PISTON GUIDE
5 - O-RING
6 - B3 PISTON SEALING RING
7 - B3 PISTON SEALING RING
8 - B3 PISTON/B2 OUTER DISC CARRIER
9 - B3 PISTON SEALING RING
10 - B2 PISTON
11 - PISTON GUIDE SEALING RING
12 - PISTON GUIDE SEALING RING
13 - PISTON GUIDE RING
14 - PISTON BACK PRESSURE DISC SPRING
15 - SPRING PLATE
16 - SNAP-RING

HOLDING CLUTCH B2 (Continued)

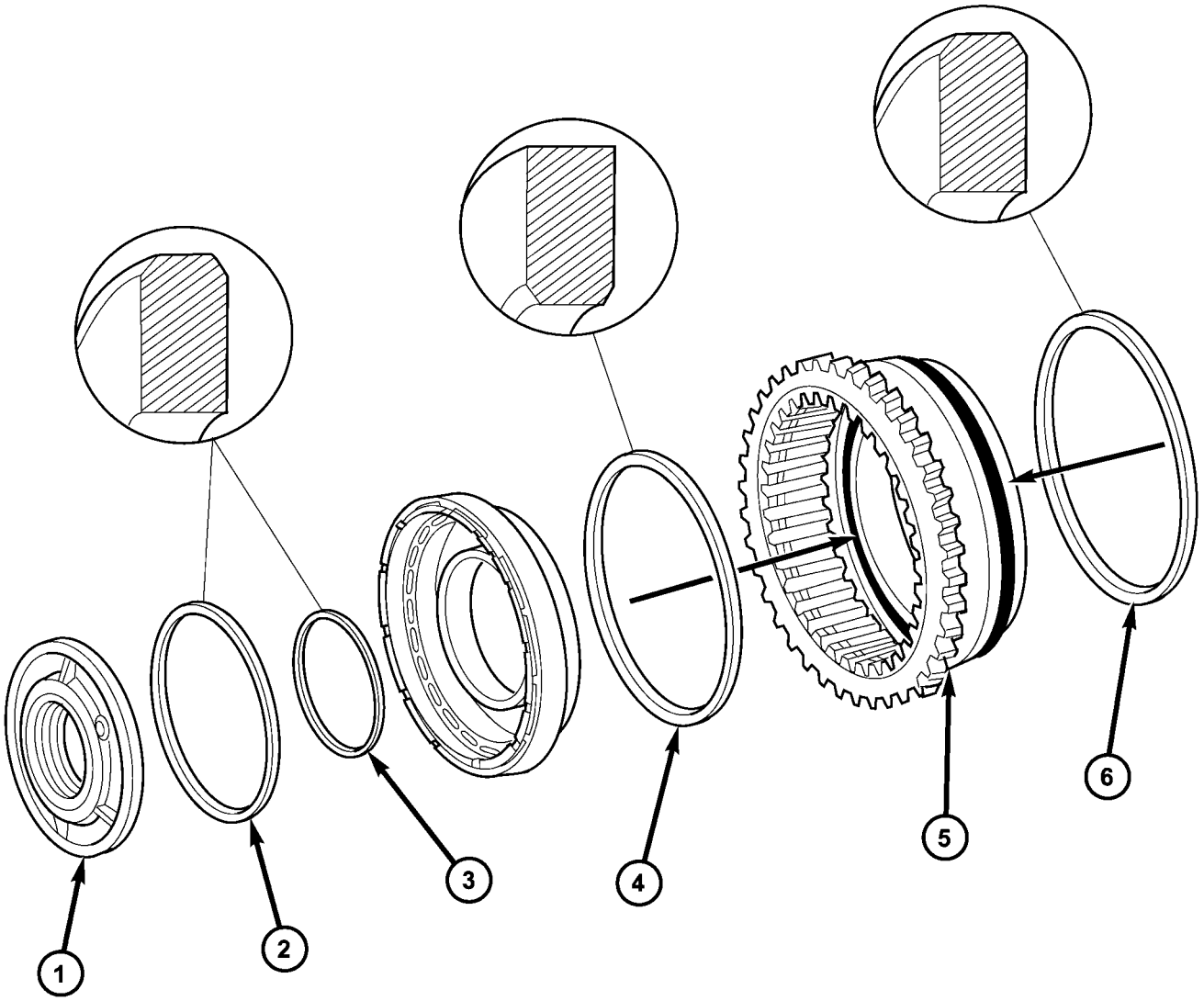


Fig. 161 Holding Clutch B2/B3 Seals

1 - PISTON GUIDE RING
2 - PISTON GUIDE RING SEALING RING
3 - PISTON GUIDE RING SEALING RING
4 - B3 PISTON SEALING RING
5 - B3 PISTON/B2 OUTER DISC CARRIER
6 - B3 PISTON SEALING RING

HOLDING CLUTCH B2 (Continued)

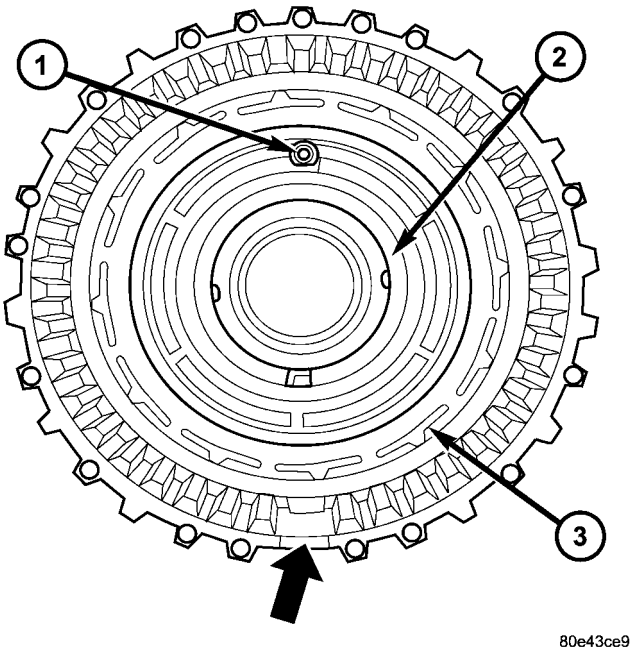


Fig. 162 B2 Piston and Piston Guide Ring

1 - VALVE
2 - PISTON GUIDE RING
3 - B2 PISTON

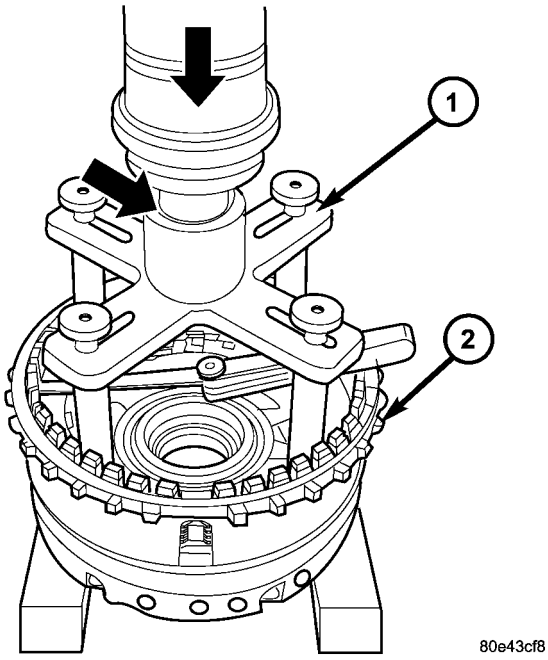


Fig. 163 Measure B2 Clutch Clearance

1 - PRESSING TOOL 8901
2 - B3 PISTON/B2 OUTER DISC CARRIER

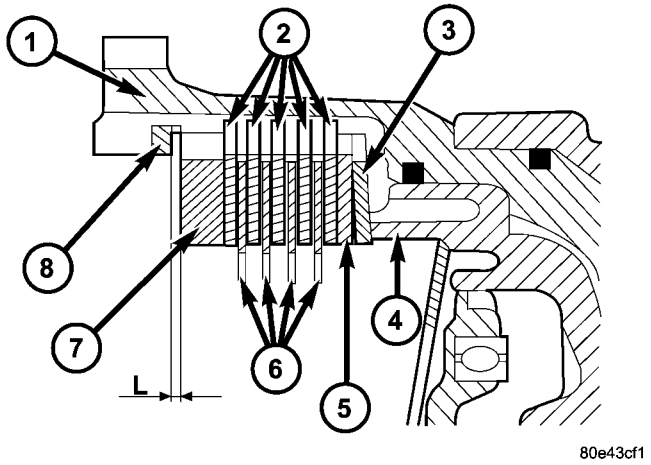


Fig. 164 B2 Clutch Stack-up

1 - B2 OUTER DISC CARRIER
2 - FRICTION DISCS
3 - DISC SPRING
4 - B2 PISTON
5 - OUTER MULTIPLE DISC - 1.8 MM (0.071 IN.)
6 - OUTER MULTIPLE DISC - 1.8 MM (0.071 IN.)
7 - OUTER MULTIPLE DISC - 6.5 MM (0.256 IN.)
8 - SNAP-RING

INPUT SPEED SENSORS

DESCRIPTION

The input speed sensors (6, 8) (Fig. 165) are fixed to the shell of the control unit via contact blades. The speed sensors are pressed against the transmission housing (2) by a spring (7) which is held against the valve housing of the shift plate (5). This ensures a defined distance between the speed sensors and the exciter ring (4).

OPERATION

Signals from the input speed sensors (6, 8) (Fig. 166) are recorded in the transmission control module (TCM) together with the wheel and engine speeds and other information and are processed into an input signal for electronic control.

Input speed sensor N2 (6) records the speed of the front sun gear via the externally toothed disc carrier of the multiple-disc clutch K1 (10) and input speed sensor N3 (8) records the speed of the front planet carrier via the internally toothed disc carrier of multiple-disc clutch K1 (3).

INPUT SPEED SENSORS (Continued)

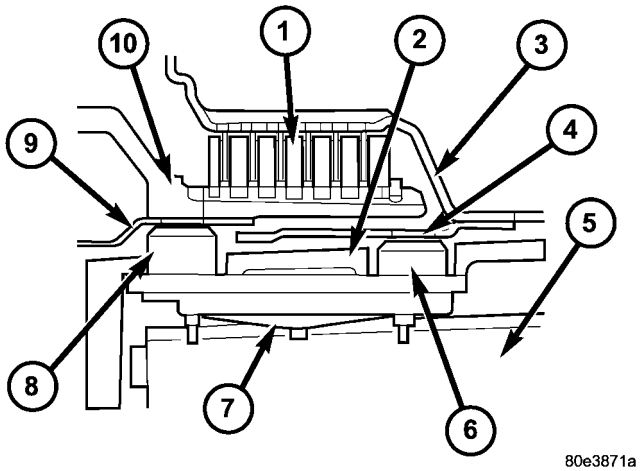


Fig. 165 Speed Sensors

1 - DRIVING CLUTCH K1
2 - TRANSMISSION HOUSING
3 - DRIVING CLUTCH K1 INTERNALLY TOOTHED DISC
4 - EXCITER RING
5 - VALVE HOUSING OF SHIFT PLATE
6 - N2 INPUT SPEED SENSOR
7 - SPRING
8 - N3 INPUT SPEED SENSOR
9 - EXCITER RING
10 - DRIVING CLUTCH K1 EXTERNALLY TOOTHED DISC

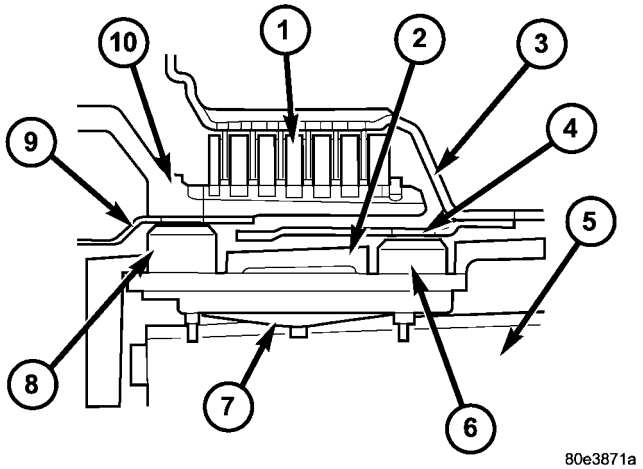


Fig. 166 Input Speed Sensors

1 - DRIVING CLUTCH K1
2 - TRANSMISSION HOUSING
3 - DRIVING CLUTCH K1 INTERNALLY TOOTHED DISC
4 - EXCITER RING
5 - VALVE HOUSING OF SHIFT PLATE
6 - N2 INPUT SPEED SENSOR
7 - SPRING
8 - N3 INPUT SPEED SENSOR
9 - EXCITER RING
10 - DRIVING CLUTCH K1 EXTERNALLY TOOTHED DISC

OIL PUMP

DESCRIPTION

The oil pump (Fig. 167) (crescent-type pump) is installed in the torque converter casing behind the torque converter and is driven by the drive flange of the torque converter. The pump creates the oil pressure required for the hydraulic procedures.

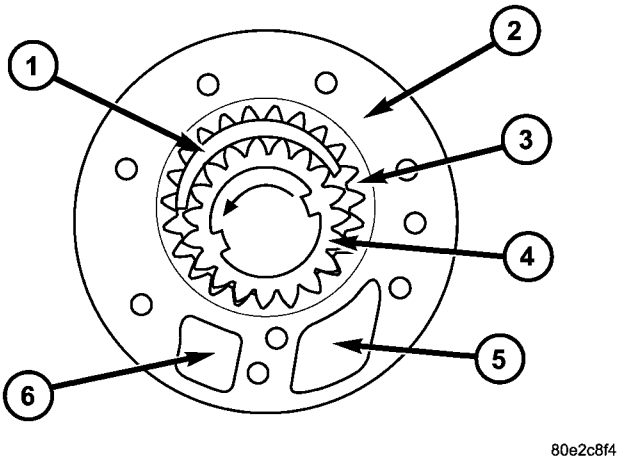


Fig. 167 Oil Pump

1 - CRESCENT
2 - OIL PUMP
3 - EXTERNAL GEAR
4 - INTERNAL GEAR
5 - INLET CHAMBER
6 - PRESSURE CHAMBER

OPERATION

When the engine is running, the oil (Fig. 168) is pumped through the inlet chamber (5) along the upper and lower side of the crescent to the pressure chamber (6) of the housing. The meshing of the teeth prevents oil flowing from the delivery side to the intake side. An external gear (3), eccentrically mounted in the pump housing, is located on the internal gear (4) which is connected to the drive flange. The crescent (1) drives the external wheel.

DISASSEMBLY

(1) Remove pump gears (1 and 2) (Fig. 169) from pump housing.

(2) Remove the inner oil pump seal (1) (Fig. 170).

(3) Replace the outer oil pump O-ring (2) (Fig. 170).

OIL PUMP (Continued)

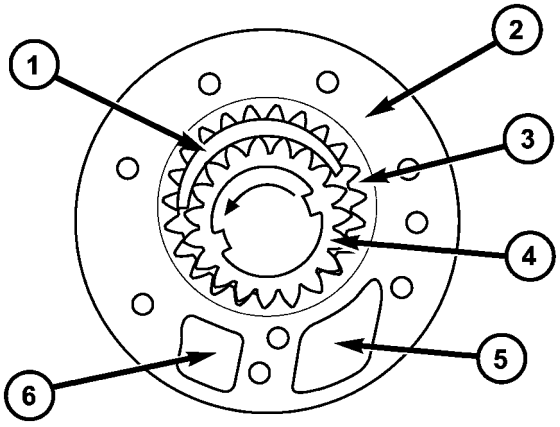


Fig. 168 Oil Pump

1 - CRESCENT
2 - OIL PUMP
3 - EXTERNAL GEAR
4 - INTERNAL GEAR
5 - INLET CHAMBER
6 - PRESSURE CHAMBER

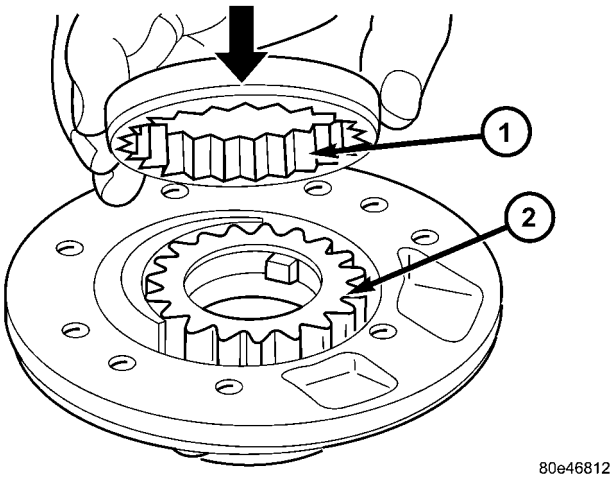


Fig. 169 Oil Pump Gears

1 - OUTER PUMP ROTOR
2 - INNER PUMP ROTOR

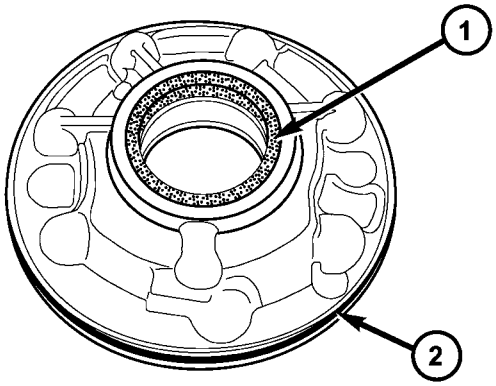


Fig. 170 Remove Oil Pump Seals

1 - INNER OIL SEAL
2 - OUTER OIL SEAL

ASSEMBLY

(1) Install new inner oil pump seal (1) (Fig. 171) with Seal Installer 8902-A.

(2) Replace O-ring (2) (Fig. 171).

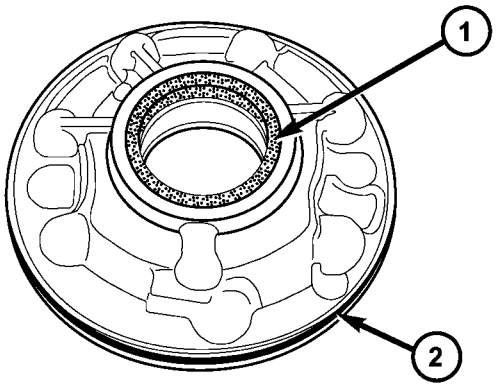


Fig. 171 Install New Oil Pump Seals

1 - INNER OIL SEAL
2 - OUTER OIL SEAL

OIL PUMP (Continued)

(3) Lubricate pump gears and place in the pump housing. Insert pump gear (1) (Fig. 172) so that the chamfer (arrow) points towards the pump housing.

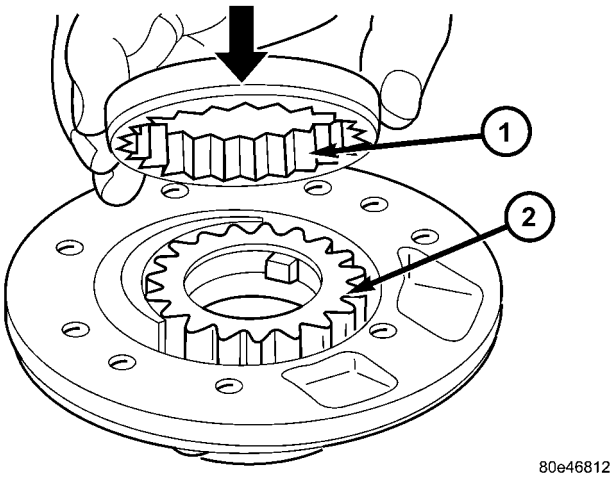


Fig. 172 Oil Pump Gears

1 - OUTER PUMP ROTOR
2 - INNER PUMP ROTOR

OUTPUT SHAFT BEARING

REMOVAL

(1) Raise and support vehicle.

(2) Remove the propeller shaft (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL).

(3) Verify that the transmission is in PARK in order to prepare for the removal of the output shaft nut.

(4) Remove the nut holding the propeller shaft flange to the output shaft and remove the flange.

(5) Remove the transmission rear oil seal with a suitable slide hammer and screw.

(6) Remove the transmission output shaft washer. Be sure to tag the washer since it is very similar to the geartrain end-play shim and they must not be interchanged.

(7) Remove the transmission rear output shaft bearing retaining ring (1) (Fig. 173).

(8) Position Bearing Remover 9082 (Fig. 174) over the inner race of the output shaft bearing.

(9) Slide the collar (Fig. 175) on the Bearing Remover 9082 downward over the fingers of the tool.

(10) Remove the output shaft bearing (Fig. 176).

CAUTION: Verify that the geartrain end-play shim has remained on the output shaft and against the park gear. The shim may be adhered to the bearing inner race. Retrieve the shim from the bearing and install over the output shaft and against the park gear.

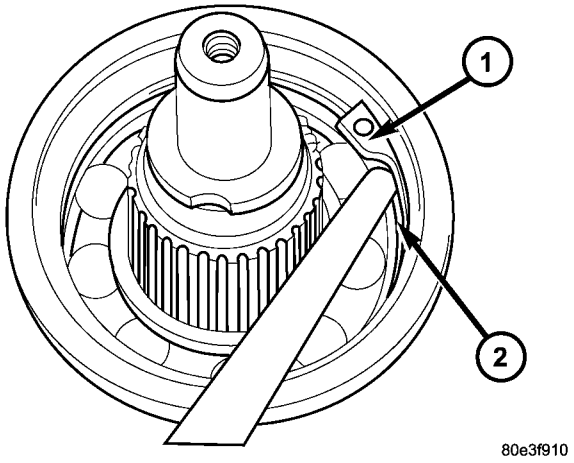


Fig. 173 Remove Rear Output Shaft Retaining Ring

1 - RETAINING RING
2 - OUTPUT SHAFT BEARING

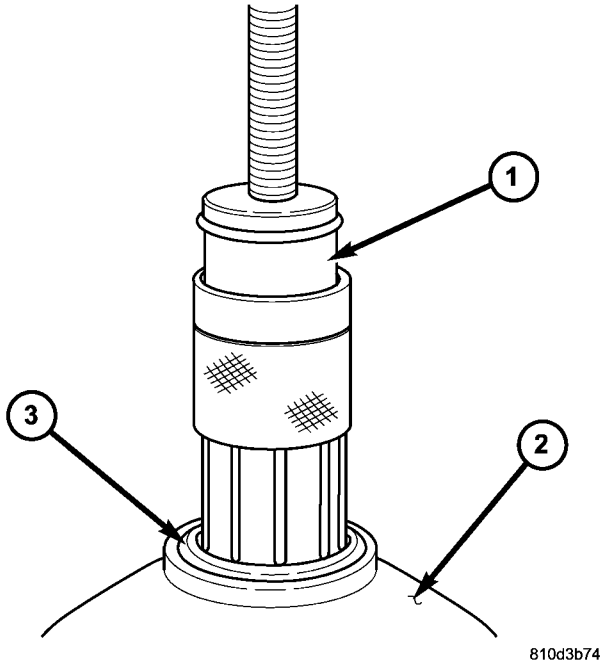


Fig. 174 Position Remover 9082 On Bearing

1 - BEARING REMOVER 9082
2 - TRANSMISSION CASE
3 - OUTPUT SHAFT BEARING

INSTALLATION

CAUTION: Verify that the geartrain end-play shim is properly installed over the output shaft and against the park gear.

(1) Install output shaft bearing in the rear transmission housing.

OUTPUT SHAFT BEARING (Continued)

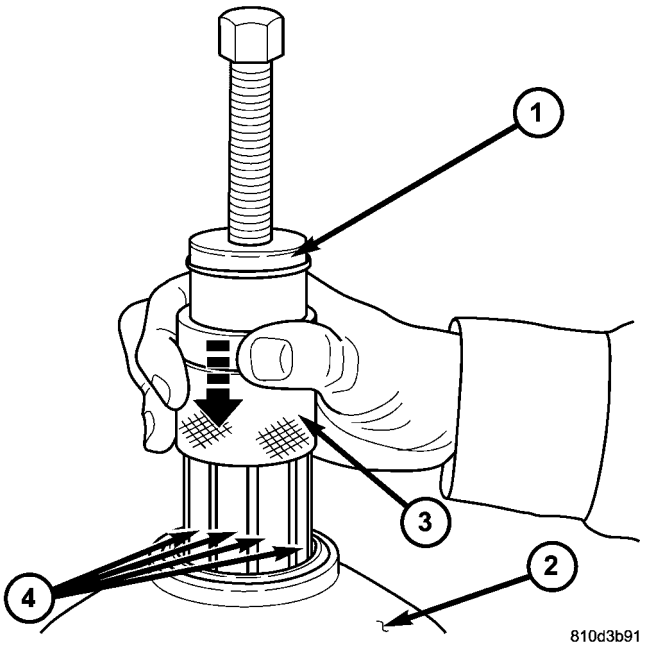


Fig. 175 Slide Remover 9082 Collar Downward

1 - BEARING REMOVER 9082
2 - TRANSMISSION CASE
3 - COLLAR
4 - FINGERS

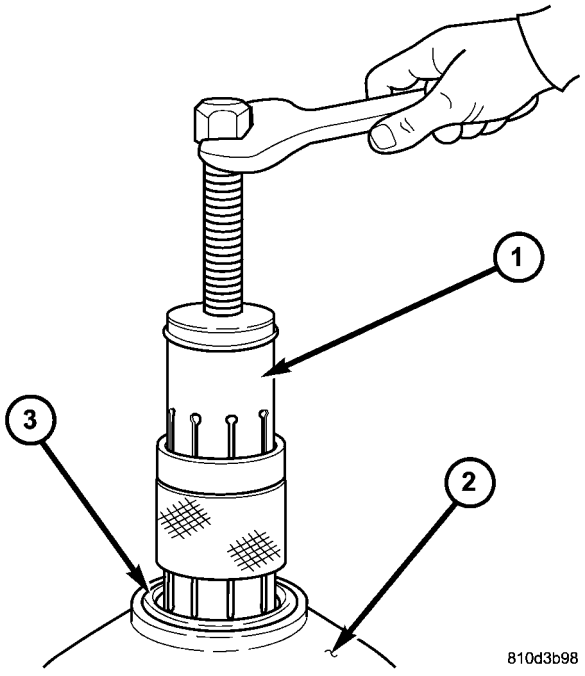


Fig. 176 Remove Output Shaft Bearing

1 - BEARING REMOVER 9082
2 - TRANSMISSION CASE
3 - OUTPUT SHAFT BEARING

(a) Using Bearing Installer 9287 (Fig. 177), install the output shaft bearing into the transmission housing. **The closed side of the plastic cage must point towards the parking lock gear.**

(b) Install the retaining ring (Fig. 178). Ensure that the retaining ring is seated correctly in the groove.

(c) Check that there is no play between the bearing and the retaining ring using feeler gauge.

(d) There must be no play between the retaining ring and the bearing. If the ring cannot be installed, a thinner ring must be used. If there is play between the ring and the bearing, a thicker ring must be installed. Retaining rings are available in thicknesses of 2.0 mm (0.079 in.), 2.1 mm (0.083 in.), and 2.2 mm (0.087 in.).

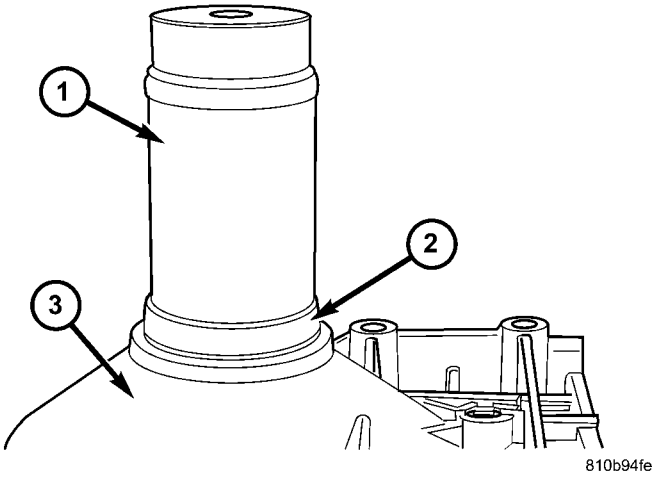


Fig. 177 Install Output Shaft Bearing

1 - BEARING INSTALLER 9287
2 - BEARING
3 - TRANSMISSION CASE

(2) Install the output shaft washer onto the output shaft.

(3) Install a new transmission rear seal into the transmission case with Seal Installer 8902A (Fig. 179).

(4) Verify that the transmission is in PARK in order to prepare for the installation of the output shaft nut.

(5) Install the propeller shaft flange onto the output shaft and install an new flange nut. Tighten the flange nut to 120 N·m (88.5 ft.lbs.).

(6) Stake the output shaft nut to the output shaft as follows.

OUTPUT SHAFT BEARING (Continued)

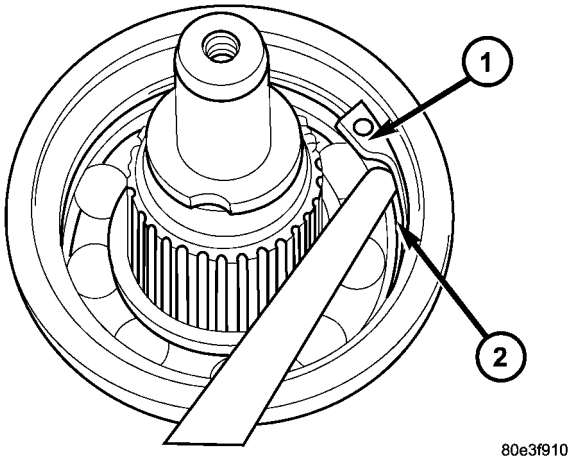


Fig. 178 Install Rear Output Shaft Retaining Ring

1 - RETAINING RING
2 - OUTPUT SHAFT BEARING

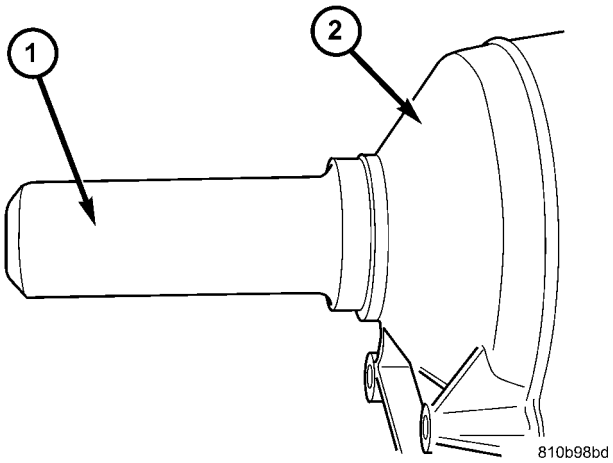


Fig. 179 Install Output Shaft Seal

1 - SEAL INSTALLER 8902A
2 - TRANSMISSION CASE

(a) Place the Staking Tool 9078 and Driver Handle C-4171 onto the output shaft.

(b) Rotate the Staking Tool 9078 until the alignment pin engages the output shaft notch (Fig. 180).

(c) Press downward on the staking tool until the staking pin contacts the output shaft nut flange (Fig. 181).

(d) Strike the Driver handle C-4171 with a suitable hammer until the output shaft nut is securely staked to the output shaft.

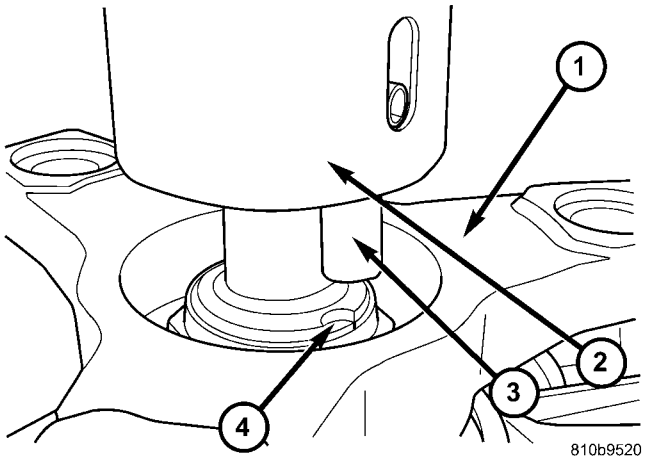


Fig. 180 Align Staking Tool 9078

1 - PROPELLER SHAFT FLANGE
2 - STAKING TOOL 9078
3 - ALIGNMENT PIN
4 - OUTPUT SHAFT NOTCH

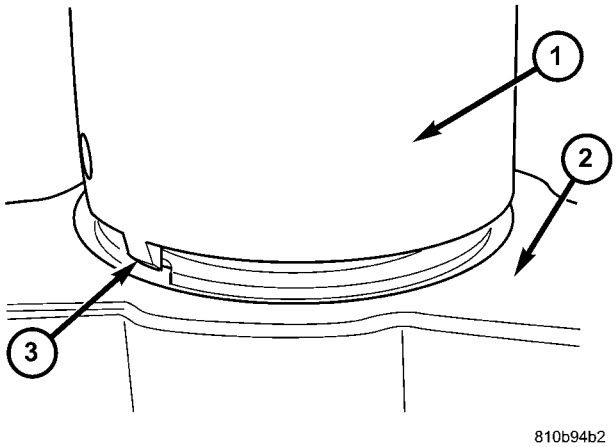


Fig. 181 Stake Output Shaft Nut

1 - STAKING TOOL 9078
2 - PROPELLER FLANGE
3 - STAKING PIN

(7) Install the propeller shaft (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION).

OUTPUT SHAFT SEAL

REMOVAL

(1) Remove the propeller shaft (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL). Move propeller shaft to the right and tie up.

(2) Verify that the transmission is in PARK in order to prepare for the removal of the output shaft nut.

(3) Remove the nut holding the propeller shaft flange to the output shaft and remove the flange.

(4) Remove the output shaft seal with suitable screw and slide hammer.

INSTALLATION

(1) Position the new output shaft seal over the output shaft and against the transmission case.

(2) Use Seal Installer 8902A to install the seal (Fig. 182).

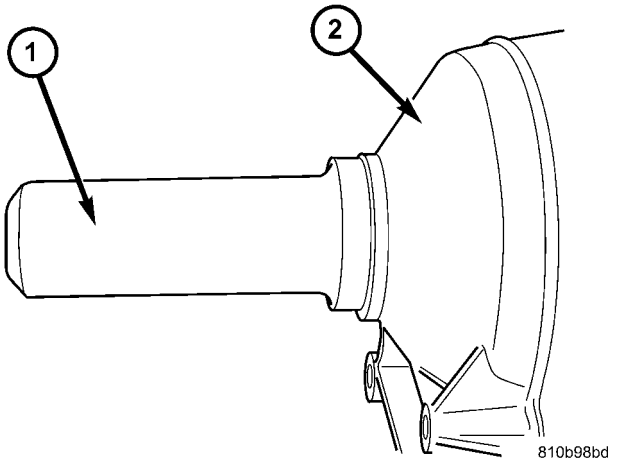


Fig. 182 Install the Output Shaft Seal

1 - SEAL INSTALLER 8902A
2 - TRANSMISSION CASE

(3) Verify that the transmission is in PARK in order to prepare for the installation of the output shaft nut.

(4) Install the propeller shaft flange onto the output shaft and install an new flange nut. Tighten the flange nut to 120 N·m (88.5 ft.lbs.).

(5) Stake the output shaft nut to the output shaft as follows.

(a) Place the Staking Tool 9078 and Driver Handle C-4171 onto the output shaft.

(b) Rotate the Staking Tool 9078 until the alignment pin engages the output shaft notch (Fig. 183).

(c) Press downward on the staking tool until the staking pin contacts the output shaft nut flange (Fig. 184).

(d) Strike the Driver handle C-4171 with a suitable hammer until the output shaft nut is securely staked to the output shaft.

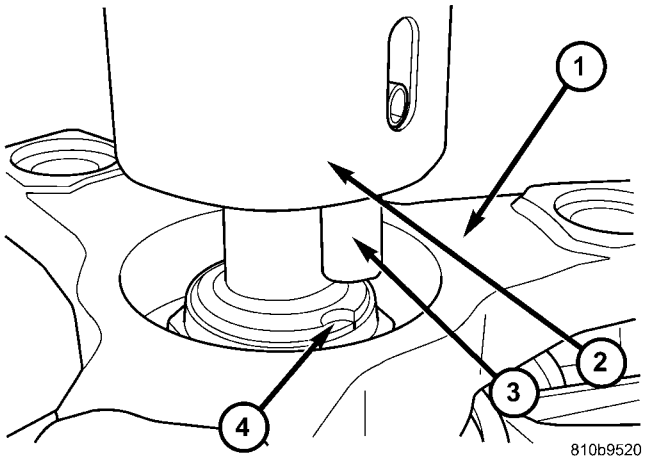


Fig. 183 Align Staking Tool 9078

1 - PROPELLER SHAFT FLANGE
2 - STAKING TOOL 9078
3 - ALIGNMENT PIN
4 - OUTPUT SHAFT NOTCH

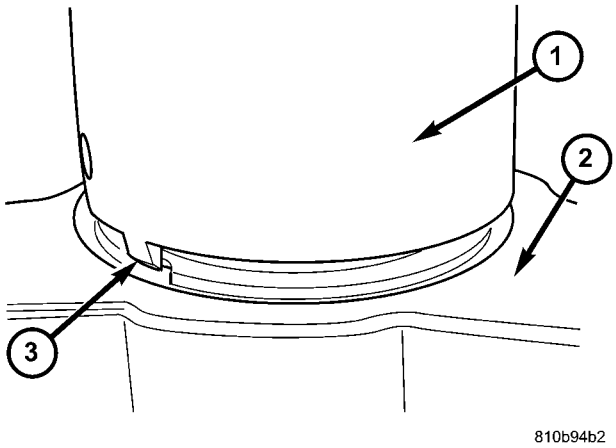


Fig. 184 Stake Output Shaft Nut

1 - STAKING TOOL 9078
2 - PROPELLER FLANGE
3 - STAKING PIN

(6) Install the propeller shaft (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION).

PARK LOCK CABLE

REMOVAL

(1) Disconnect battery.

(2) Move selector lever to position ″D″.

PARK LOCK CABLE (Continued)

(3) Remove top section (3) (Fig. 185) of the center section of instrument panel.

(4) Remove bottom section (2) (Fig. 186) of the center section of instrument panel.

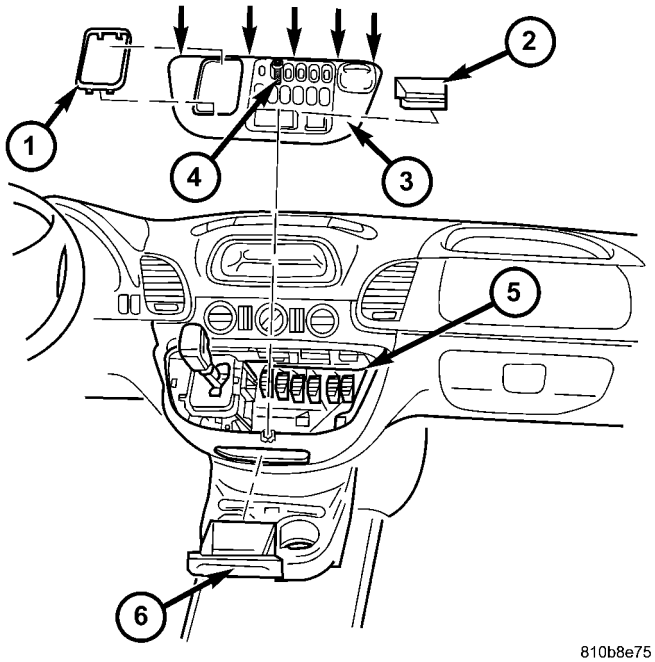


Fig. 185 Remove Top Section Of Center Instrument Panel

1 - SHIFT LEVER ASSEMBLY FRAME TRIM
2 - STORAGE COMPARTMENT
3 - TOP CENTER PART OF INSTRUMENT PANEL
4 - SCREW
5 - PLUG CONNECTIONS
6 - ASHTRAY

(5) Disconnect the park lock cable coupling (1) (Fig. 187) from the shift lever assembly (SLA). Press locking tab (2) together and push coupling (1) against the spring force into the SLA, twist through 90° (right or left) and pull off.

(6) Remove the lower steering column shroud.

(7) Loosen the park lock cable (2) (Fig. 188) from the ignition switch.

(8) Remove the park lock cable (2) (Fig. 189) from the ignition switch.

(9) Remove the park lock cable from the vehicle.

INSTALLATION

(1) Route the park lock cable through the instrument panel between the steering column and the shift lever assembly (SLA).

(2) Install the park lock cable (2) (Fig. 190) to the ignition switch.

(3) Tighten the park lock cable (2) (Fig. 191) to the ignition switch.

(4) Install the lower steering column shroud.

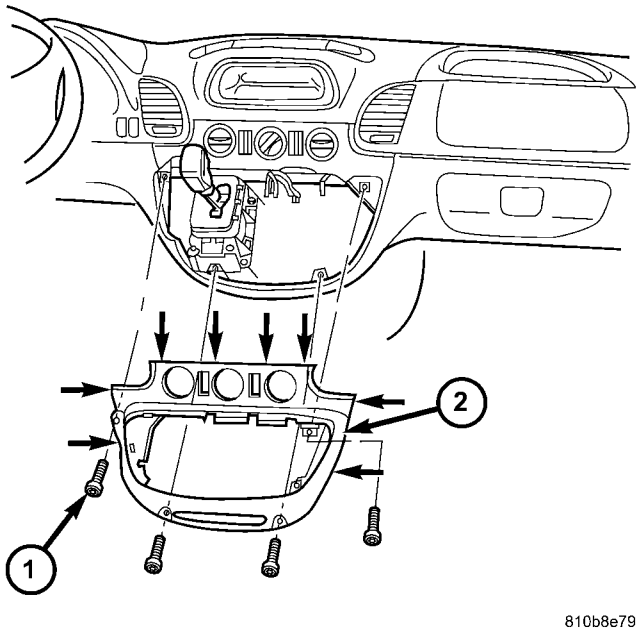


Fig. 186 Remove Bottom Section Of Center Instrument Panel

1 - SCREW
2 - BOTTOM CENTER PART OF INSTRUMENT PANEL

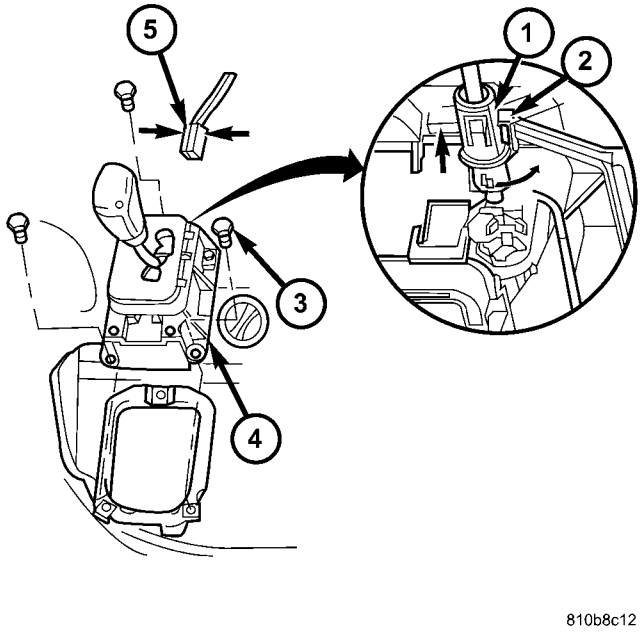


Fig. 187 Disengage Park Lock Cable From SLA

1 - PARK LOCK CABLE COUPLING
2 - LOCK TAB
3 - BOLT
4 - SHIFT LEVER ASSEMBLY (SLA)
5 - CONNECTOR

PARK LOCK CABLE (Continued)

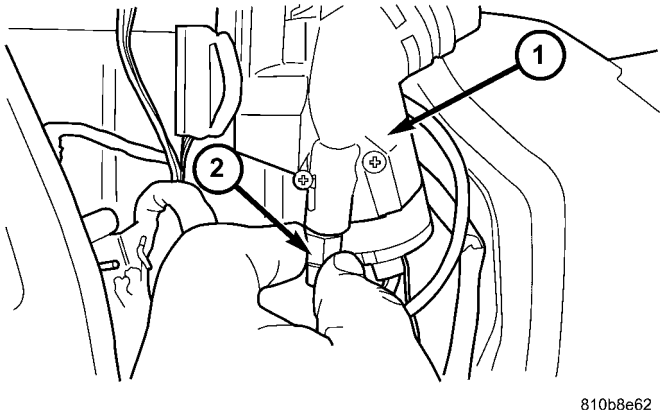


Fig. 188 Loosen Park Lock Cable From Ignition Switch

1 - IGNITION SWITCH
2 - PARK LOCK CABLE

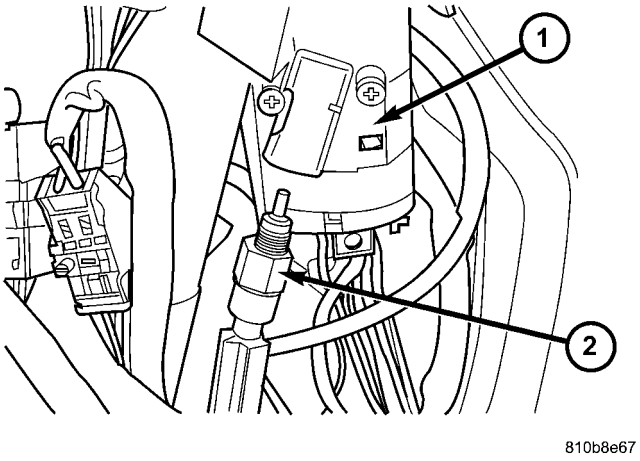


Fig. 189 Remove Park Lock Cable From Ignition Switch

1 - IGNITION SWITCH
2 - PARK LOCK CABLE

(5) Connect the park lock cable coupling (1) (Fig. 192) to the shift lever assembly (SLA). Press locking tab (2) together and push coupling (1) against the spring force into the SLA, twist through 90° (right or left) until locked.

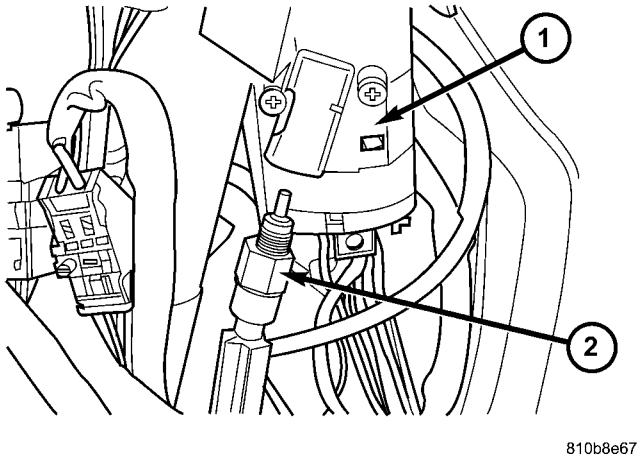


Fig. 190 Install Park Lock Cable to Ignition Switch

1 - IGNITION SWITCH
2 - PARK LOCK CABLE

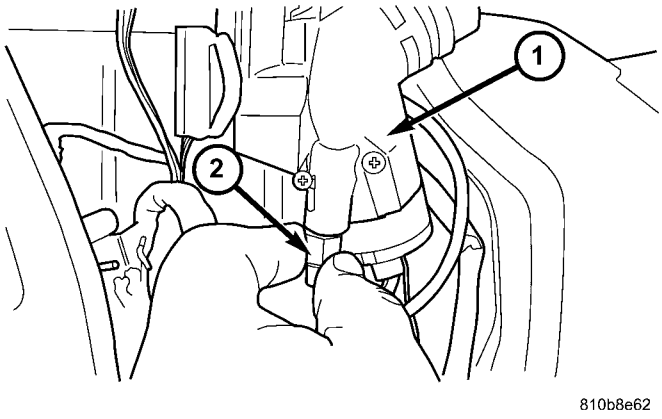


Fig. 191 Tighten Park Lock Cable to Ignition Switch

1 - IGNITION SWITCH
2 - PARK LOCK CABLE

(6) Install the bottom section (2) (Fig. 193) of the center section of instrument panel.

(7) Install the top section (3) (Fig. 194) of the center section of instrument panel.

(8) Connect battery.

(9) Verify repair.

PARK LOCK CABLE (Continued)

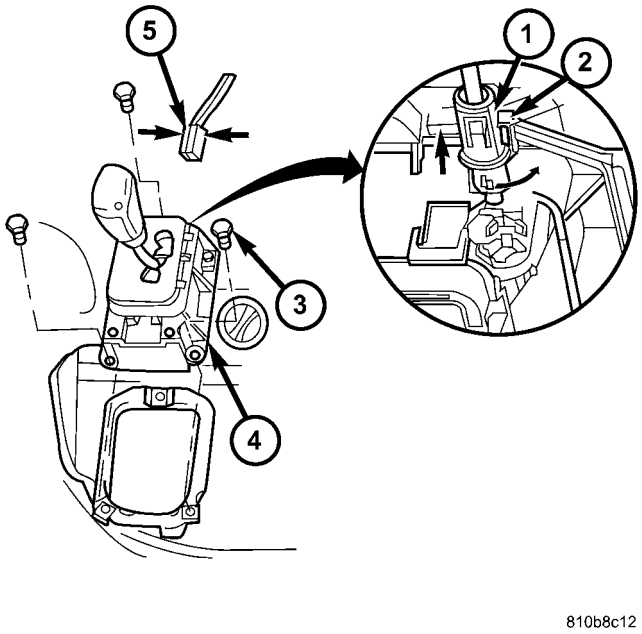


Fig. 192 Engage Park Lock Cable to SLA

1 - PARK LOCK CABLE COUPLING
2 - LOCK TAB
3 - BOLT
4 - SHIFT LEVER ASSEMBLY (SLA)
5 - CONNECTOR

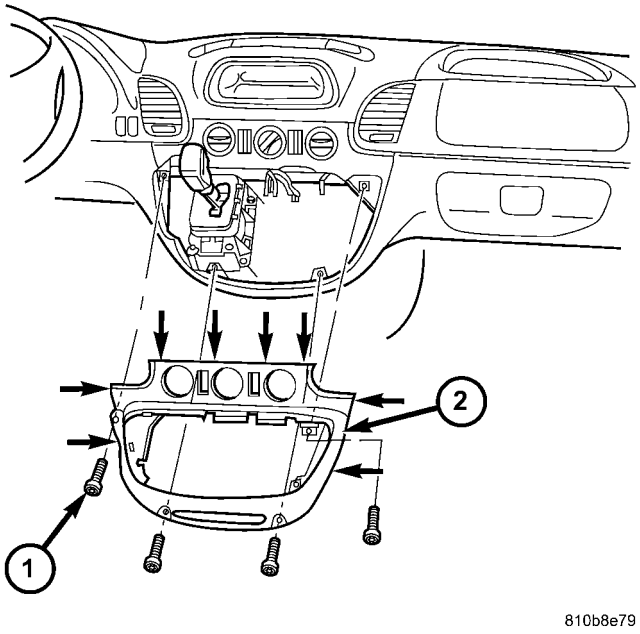


Fig. 193 Install Bottom Section Of Center Instrument Panel

1 - SCREW
2 - BOTTOM CENTER PART OF INSTRUMENT PANEL

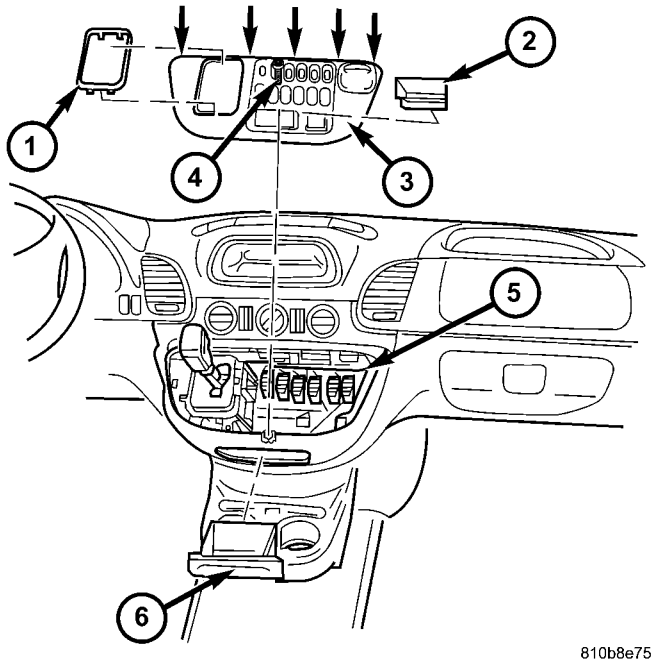


Fig. 194 Install Top Section Of Center Instrument Panel

1 - SHIFT LEVER ASSEMBLY FRAME TRIM
2 - STORAGE COMPARTMENT
3 - TOP CENTER PART OF INSTRUMENT PANEL
4 - SCREW
5 - PLUG CONNECTIONS
6 - ASHTRAY

PISTONS

DESCRIPTION

There are several sizes and types of pistons used in an automatic transmission. Some pistons are used to apply clutches. They all have in common the fact that they are round or circular in shape, located within a smooth walled cylinder, which is closed at one end and converts fluid pressure into mechanical movement. The fluid pressure exerted on the piston is contained within the system through the use of piston rings or seals.

OPERATION

The principal which makes this operation possible is known as Pascal's Law. Pascal's Law can be stated as: "Pressure on a confined fluid is transmitted equally in all directions and acts with equal force on equal areas."

PISTONS (Continued)

PRESSURE

Pressure (Fig. 195) is nothing more than force (lbs.) divided by area (in or ft.), or force per unit area. Given a 100 lb. block and an area of 100 sq. in. on the floor, the pressure exerted by the block is: 100 lbs. 100 in or 1 pound per square inch, or PSI as it is commonly referred to.

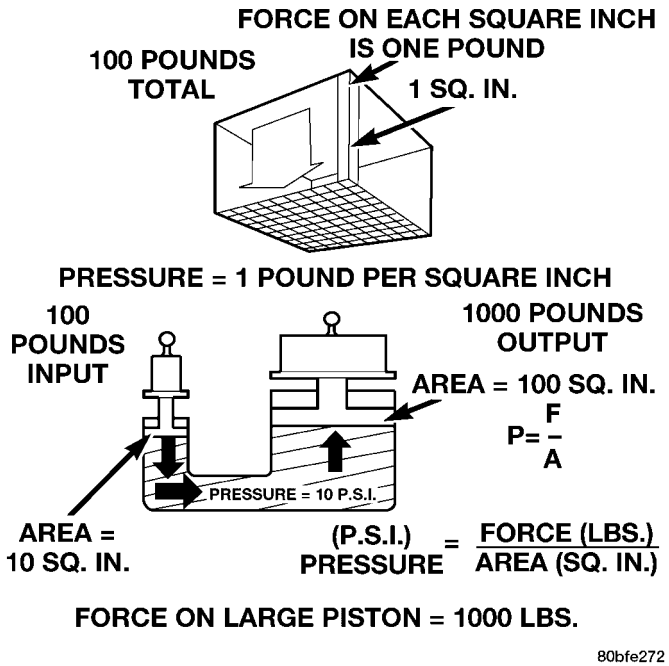


Fig. 195 Force and Pressure Relationship

PRESSURE ON A CONFINED FLUID

Pressure is exerted on a confined fluid (Fig. 196) by applying a force to some given area in contact with the fluid. A good example of this is a cylinder filled with fluid and equipped with a piston that is closely fitted to the cylinder wall. If a force is applied to the piston, pressure will be developed in the fluid. Of course, no pressure will be created if the fluid is not confined. It will simply "leak" past the piston. There must be a resistance to flow in order to create pressure. Piston sealing is extremely important in hydraulic operation. Several kinds of seals are used to accomplish this within a transmission. These include but are not limited to O-rings, D-rings, lip seals, sealing rings, or extremely close tolerances between the piston and the cylinder wall. The force exerted is downward (gravity), however, the principle remains the same no matter which direction is taken. The pressure created in the fluid is equal to the force applied, divided by the piston area. If the force is 100 lbs., and the piston area is 10 sq. in., then the pressure created equals 10 PSI. Another interpretation of Pascal's Law is that regardless of container shape or size, the pressure will be maintained throughout, as long as the fluid is confined. In other words, the pressure in the fluid is the same everywhere within the container.

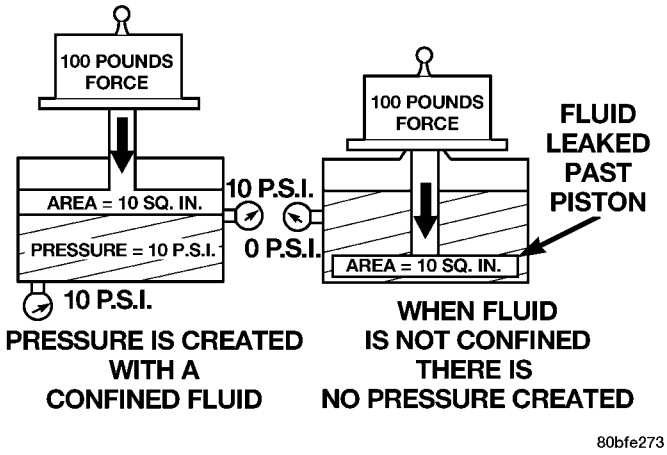


Fig. 196 Pressure on a Confined Fluid

FORCE MULTIPLICATION

Using the 10 PSI example used in the illustration (Fig. 197), a force of 1000 lbs. can be moved with a force of only 100 lbs. The secret of force multiplication in hydraulic systems is the total fluid contact area employed. The illustration, (Fig. 197), shows an area that is ten times larger than the original area. The pressure created with the smaller 100 lb. input is 10 PSI. The concept "pressure is the same everywhere" means that the pressure underneath the larger piston is also 10 PSI. Pressure is equal to the force applied divided by the contact area. Therefore, by means of simple algebra, the output force may be found. This concept is extremely important, as it is also used in the design and operation of all shift valves and limiting valves in the valve body, as well as the pistons, of the transmission, which activate the clutches and bands. It is nothing more than using a difference of area to create a difference in pressure to move an object.

PISTON TRAVEL

The relationship between hydraulic lever and a mechanical lever is the same. With a mechanical lever it's a weight-to-distance output rather than a pressure-to-area output. Using the same forces and areas as in the previous example, the smaller piston (Fig. 198) has to move ten times the distance required to move the larger piston one inch. Therefore, for every inch the larger piston moves, the smaller piston moves ten inches. This principle is true in other instances also. A common garage floor jack is a good example. To raise a car weighing 2000 lbs., an effort of only 100 lbs. may be required. For every inch the car moves upward, the input piston at the jack handle must move 20 inches downward.

PISTONS (Continued)

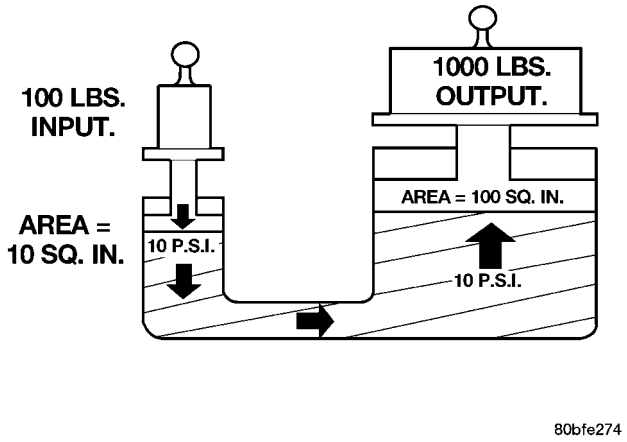


Fig. 197 Force Multiplication

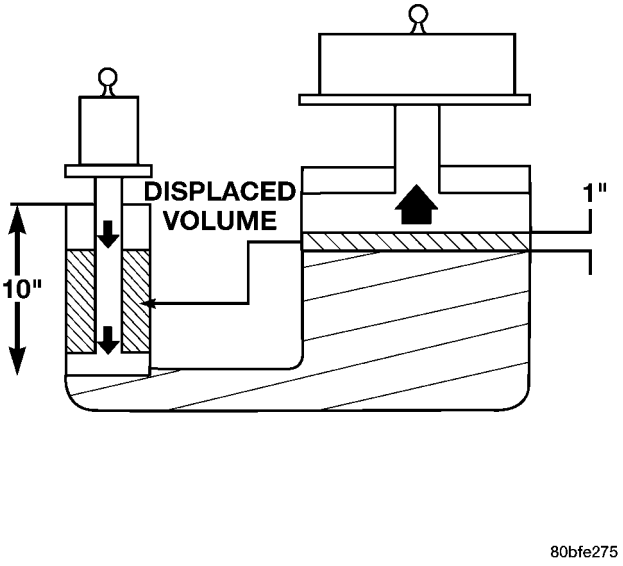


Fig. 198 Piston Travel

PLANETARY GEARTRAIN

DESCRIPTION

Three planetary gear sets (Fig. 199) are used to produce the different gear ratios. These are located in the mechanical part of the transmission as the front, middle and rear planetary gear sets.

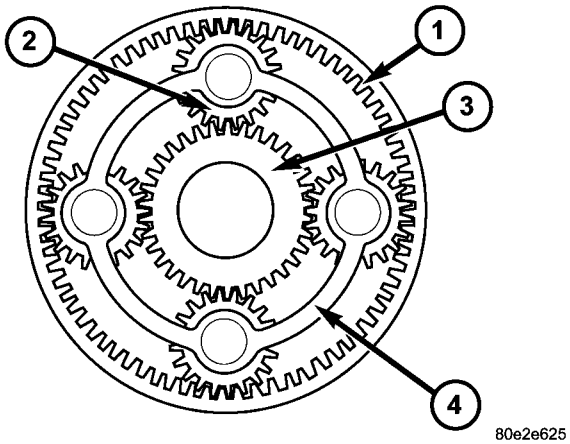


Fig. 199 Planetary Geartrain

1 - ANNULUS GEAR
2 - PLANETARY PINION GEARS
3 - SUN GEAR
4 - PLANETARY CARRIER

OPERATION

The annulus gear (1) (Fig. 200) and sun gear (3) elements of a planetary gear system are alternately driven and braked by the actuating elements of the multi-plate clutch and multiple-disc brake. The planetary pinion gears (2) can turn on the internal gearing of the annulus gear (1) and on the external gearing of the sun gear (3). This allows for a variety of gear ratios and the reversal of the rotation direction without the need for moving gear wheels or shift collars. When two components of the planetary gear set are locked together, the planetary gear set is locked and turns as a closed unit.

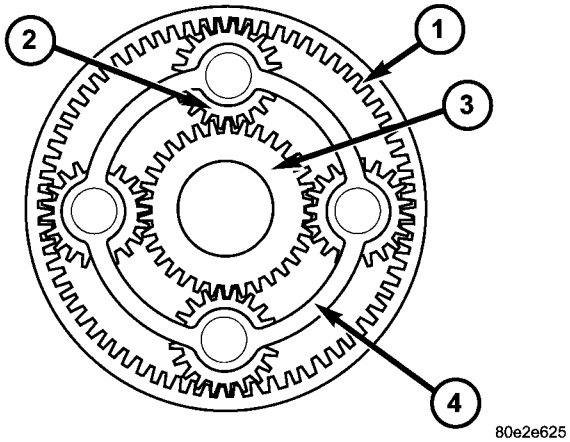


Fig. 200 Planetary Geartrain

1 - ANNULUS GEAR
2 - PLANETARY PINION GEARS
3 - SUN GEAR
4 - PLANETARY CARRIER

PLANETARY GEARTRAIN (Continued)

The torque and engine speed are converted according to the lever ratios and the ratio of the number of teeth on the driven gears to that on the drive gears, and is referred to as the gear ratio. The overall ratio of a number of planetary gear sets connected in series is obtained by multiplying the partial ratios.

DISASSEMBLY

(1) Remove upper two visible Teflon rings (1) (Fig. 201) from output shaft.

(2) Remove retaining ring (11), shim (10), thrust needle bearing (9) and thrust washer (8) from output shaft.

(3) Remove clutch K3 (7).

(4) Remove rear tubular shaft/freewheeling clutch F2 (6) (Fig. 201) from output shaft.

(5) Remove rear gear set (5) with integrated tubular shaft of center gear set from output shaft.

(6) Remove thrust washer (4).

ASSEMBLY

(1) Mount thrust washer (4) (Fig. 202) with the collar pointing towards the planet carrier.

(2) Mount rear gear set (5) with integrated tubular shaft of the center gear set on output shaft.

(3) Using grease, install lower three Teflon rings (1) (Fig. 202) in the groove so that the joint stays together

(4) Put rear tubular shaft/freewheeling clutch F2 (6) onto output shaft.

(5) Install clutch K3 (7).

(6) Mount retaining ring, shim, thrust needle bearing and thrust washer (8 - 11) (Fig. 202).

(7) Using grease, insert the upper two Teflon rings (1) in the groove so that the joint remains together.

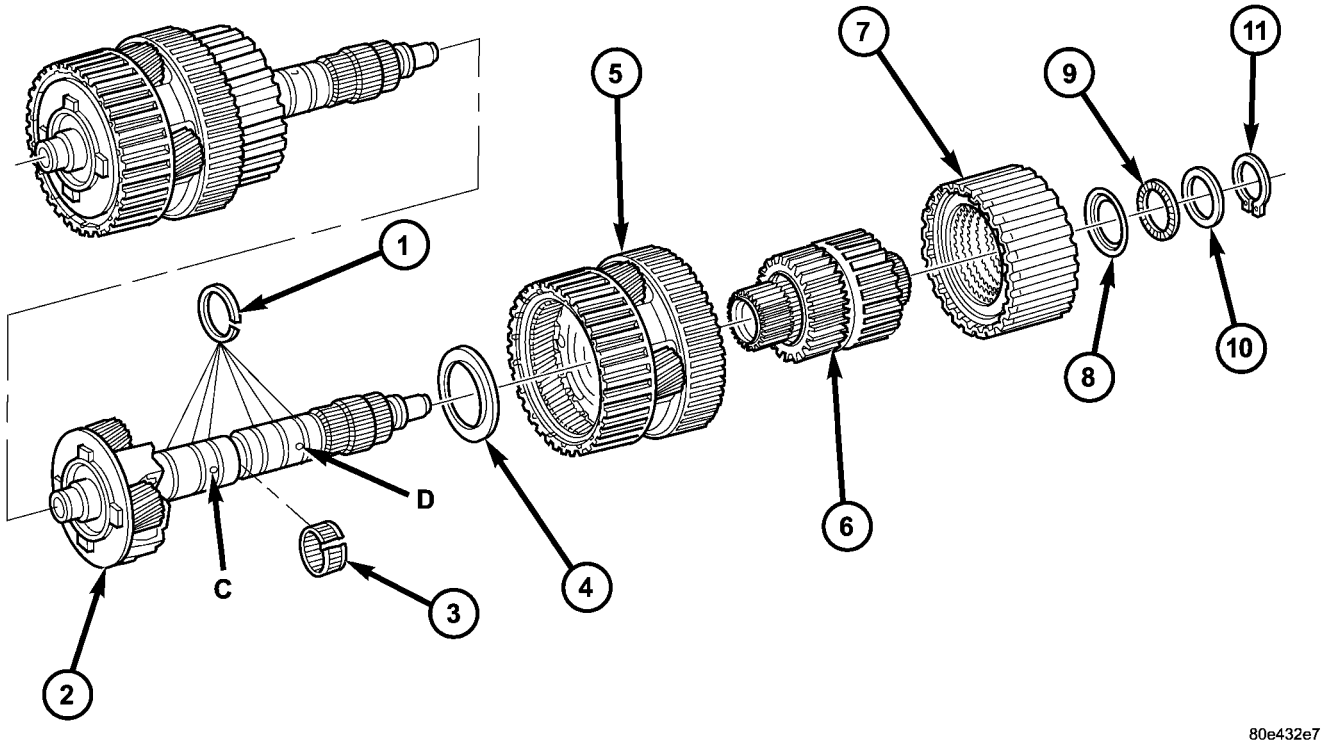


Fig. 201 Output Shaft with Center and Rear Planetary Geartrain

1 - TEFLON RINGS
2 - OUTPUT SHAFT WITH CENTER PLANETARY CARRIER
3 - NEEDLE BEARING
4 - THRUST WASHER
5 - REAR PLANETARY GEAR SET
6 - REAR HOLLOW SHAFT/FREEWHEELING CLUTCH F2
7 - DRIVING CLUTCH K3
8 - THRUST WASHER
9 - AXIAL NEEDLE BEARING
10 - SHIM
11 - RETAINING RING

PLANETARY GEARTRAIN (Continued)

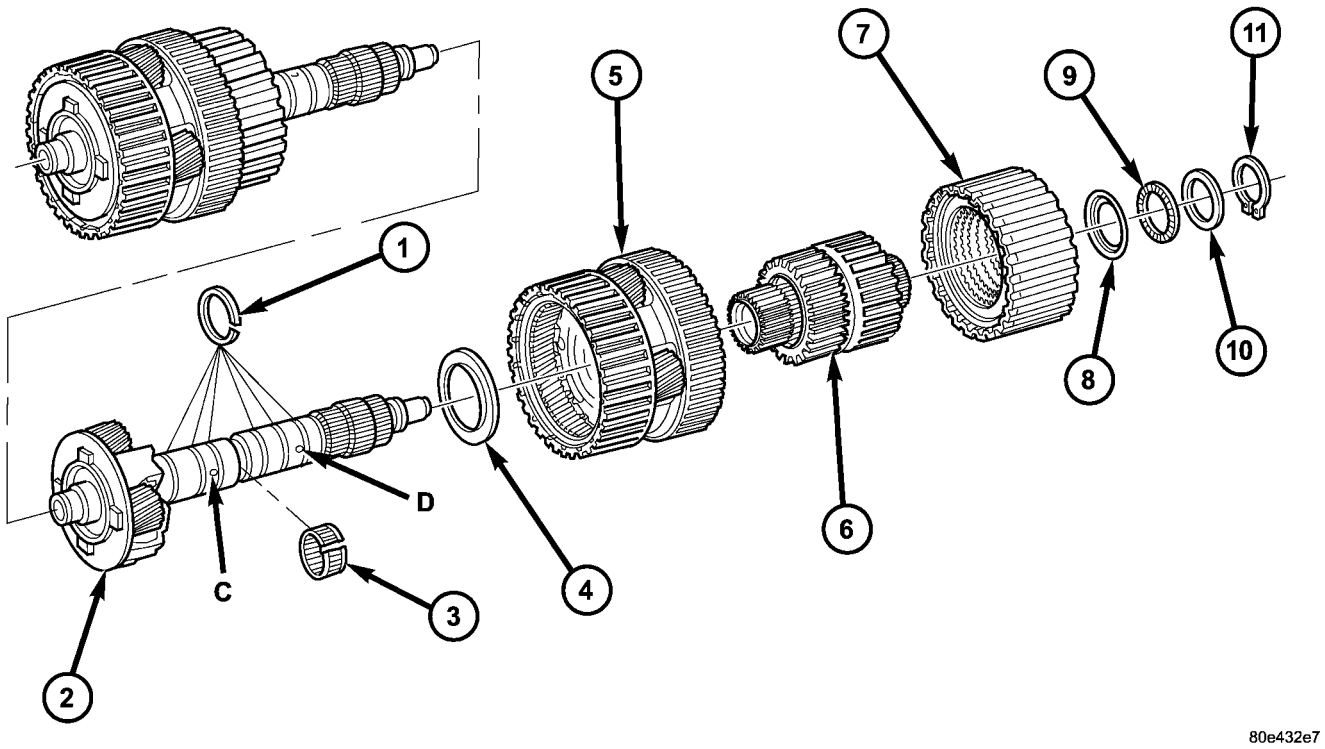


Fig. 202 Output Shaft with Center and Rear Planetary Geartrain

1 - TEFLON RINGS
2 - OUTPUT SHAFT WITH CENTER PLANETARY CARRIER
3 - NEEDLE BEARING
4 - THRUST WASHER
5 - REAR PLANETARY GEAR SET
6 - REAR HOLLOW SHAFT/FREEWHEELING CLUTCH F2
7 - DRIVING CLUTCH K3
8 - THRUST WASHER
9 - AXIAL NEEDLE BEARING
10 - SHIM
11 - RETAINING RING

PLANETARY GEARTRAIN (Continued)

(8) Inspect axial play (Fig. 203) between shim (10) and retaining ring (11). Check axial play ″S″ between shim (10) and retaining ring (1) using a feeler gauge. Clearance should be 0.15-0.6 mm (0.006-0.024 in.). Shims are available in thicknesses of 3.0 mm (0.118 in.), 3.4 mm (0.134 in.), and 3.7 mm (0.146 in.). Adjust as necessary

NOTE: During the test, apply a contact force by hand to K3 in the direction of the arrow.

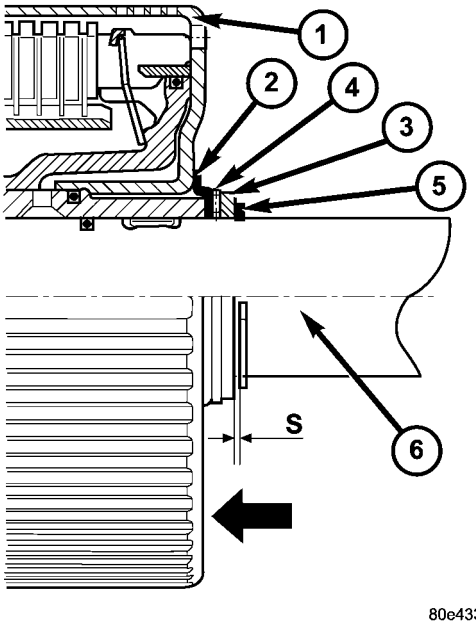


Fig. 203 Check Center and Rear Planetary End-Play

1 - DRIVING CLUTCH K3
2 - THRUST WASHER
3 - SHIM
4 - AXIAL NEEDLE BEARING
5 - RETAINING RING
6 - OUTPUT SHAFT WITH CENTER PLANETARY CARRIER

SHIFT MECHANISM

DESCRIPTION

The automatic transmission is operated with the help of a shift lever assembly (SLA) located in the center console. There are four positions to which the selection lever can be shifted: P, R, N, D. In addition, the selector lever can be moved sideways (+/-) in position ″D″ to adjust the shift range.

All selector lever positions, as well as selected shift ranges in position ″D″, are identified by the SLA. The information is then sent to the transmission control module (TCM) via a hardwire connection. At the same time, the selector lever positions ″P″, ″R″, ″N″ and ″D″ are transmitted by a shift cable to the selector shaft in the transmission.

The SLA is comprised of the following functions:

- **Key lock:** Depending on the selector lever position, the ignition lock is locked/unlocked, i.e., the ignition key can be removed only if the selector lever is in position ″P″. A park lock cable is used to perform this function.
- **Park lock:** The selector lever is not released from postion ″P″ until the brake pedal has been applied and the ignition key is in driving position. Shift lock is controlled by the brake light switch in conjunction with a locking solenoid in the SLA. As soon as the brake pedal is applied firmly, the locking solenoid is retracted to unlock the selector lever. If the selector lever cannot be moved out of position ″P″ due to a malfunction, the shift lock function can be overriden (see operator's manual).
- **Reverse inhibitor:** As soon as the vehicle speed exceeds approx. 4 mph, it is no longer possible to move the selector lever from position ″N″ to position ″R″.

OPERATION

With the selector lever in position ″D″, the transmission control module (TCM) automatically shifts the gears that are best-suited to the current operating situation. This means that shifting of gears is continuously adjusted to current driving and operating conditions in line with the selected shift range and the accelerator pedal position. Starting off is always performed in 1st gear.

The selector lever positions are determined by the slider position of a potentiometer in the shift lever assembly (SLA). The shift pattern diagram (position display) and the program selector are illuminated by the LEDs.

The current selector lever position or, if the shift range has been limited, the current shift range is indicated in the LCD display in the instrument cluster.

The permissible shifter positions and transmission operating ranges are:

- P = Parking lock and engine starting.
- R = Reverse.
- N = Neutral and engine starting (no power is transmitted to the axles).
- D = The shift range includes all forward gears.
- 4= Shift range is limited to gears 1 to 4.
- 3= Shift range is limited to gears 1 to 3.
- 2= Shift range is limited to gears 1 to 2.
- 1= Shift range is limited to the 1st gear.

The shift range can be adjusted to the current operating conditions by tipping the selector lever to the left-hand side (″-″) or the right-hand side (″+″) when in position ″D″. If the shift range is limited, the display in the instrument cluster indicates the selected shift range and not the currently engaged gear.

SHIFT MECHANISM (Continued)

Tipping the shift lever will have the following results:

- **Tipping the selector lever toward ″-″ one time after another:** The shift range is reduced in descending sequence by one gear each time, i.e., from D - 4 - 3 - 2 - 1. If the selected limitation of the shift range would result in a downshift causing excessive engine speed, the shifting is not executed and the engaged gear as well as the shift range remain unchanged. This is to prevent the engine from overspeeding. Engine retardation is low with the selector lever in position ″D″. To make use of the full braking power of the engine, ″manual″ downshifting by tipping the lever towards the left-hand side is recommended. If this has been done, subsequent upshifting must be carried out manually as well.
- **Tipping the selector lever toward ″-″ and holding it in this position:** The currently engaged gear in range ″D″ is indicated in the instrument cluster display and the shift range is limited to this gear.
- **Tipping the selector lever toward ″+″ one time after another:** The shift range is increased by one gear each time and the increased shift range is displayed in the instrument cluster; possibly, the transmission upshifts to a faster gear.
- **Tipping the selector lever toward ″+″ several times:** The shift range is increased by one gear each time the lever is tipped until the shift range ends up in ″D″.
- **Tipping the selector lever toward ″+″ and holding it in this position:** The shift range is extended immediately to ″D″, shift ranges are indicated in ascending sequence; possibly, the transmission upshifts to a faster gear due to the extension of the shift range.

REMOVAL

(1) Move selector lever to position ″D″.

(2) Remove top section (3) (Fig. 204) of the center section of instrument panel.

(3) Remove bottom section (2) (Fig. 205) of the center section of instrument panel.

(4) Disconnect the park lock cable coupling (1) (Fig. 206) from the shift lever assembly (SLA). Press locking tab (2) together and push coupling (1) against the spring force into the SLA, twist through 90° (right or left) and pull off.

(5) Disconnect connector plug (5) from SLA. When disconnecting plug, press together at points shown (arrows).

(6) Pry ball socket (4) of transmission shift cable off ball knob at the SLA. Use a suitable slotted screwdriver.

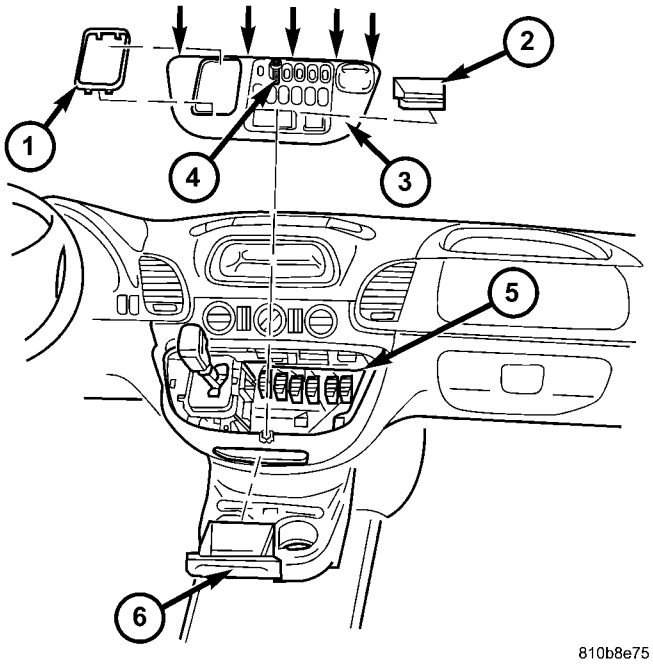


Fig. 204 Remove Top Section Of Center Instrument Panel

1 - SHIFT LEVER ASSEMBLY FRAME TRIM
2 - STORAGE COMPARTMENT
3 - TOP CENTER PART OF INSTRUMENT PANEL
4 - SCREW
5 - PLUG CONNECTIONS
6 - ASHTRAY

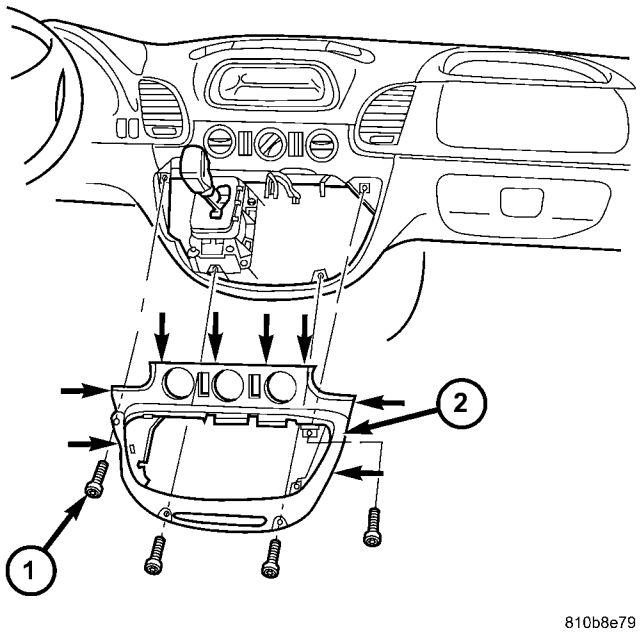


Fig. 205 Remove Bottom Section Of Center Instrument Panel

1 - SCREW
2 - BOTTOM CENTER PART OF INSTRUMENT PANEL

SHIFT MECHANISM (Continued)

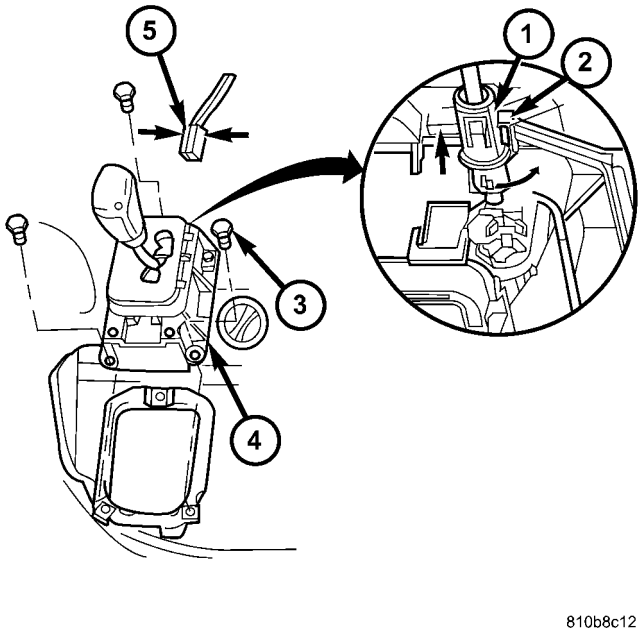


Fig. 206 Disengage Park Lock Cable From SLA

1 - PARK LOCK CABLE COUPLING
2 - LOCK TAB
3 - BOLT
4 - SHIFT LEVER ASSEMBLY (SLA)
5 - CONNECTOR

(7) Unscrew bolts (1) (Fig. 207).
(8) Move selector lever to position ″P″.
(9) Remove the SLA (2) from the vehicle.

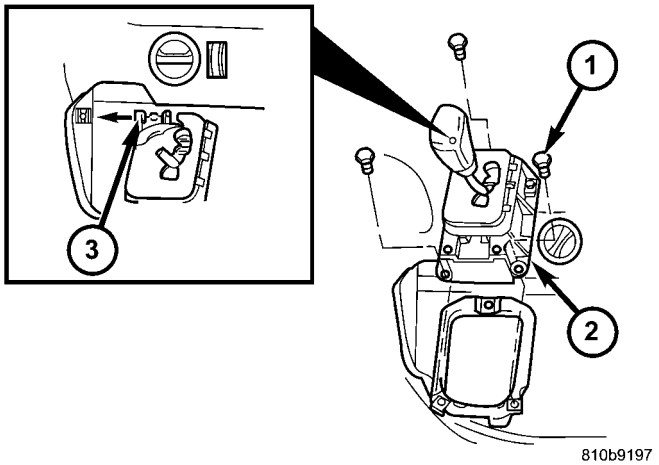


Fig. 207 Remove SLA

1 - BOLT
2 - SLA
3 - SHIFT CABLE

INSTALLATION

(1) Position the shift lever assembly (SLA) onto the vehicle.
(2) Install the bolts to hold the SLA to the vehicle. Tighten the bolts to 6 N·m (53 in.lbs.).
(3) Connect the park lock cable coupling (1) (Fig. 208) to the SLA. Press locking tab (2) together and push coupling (1) against the spring force into the SLA, twist through 90° (right or left) until locked.
(4) Connect the connector plug (5) to the SLA.

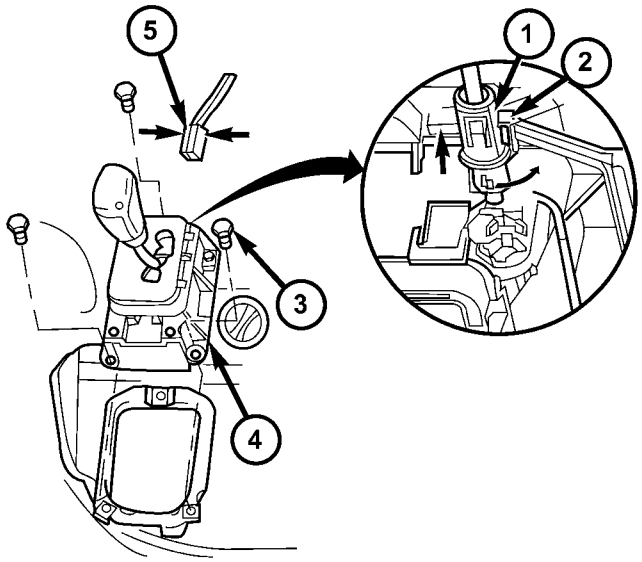


Fig. 208 Engage Park Lock Cable to SLA

1 - PARK LOCK CABLE COUPLING
2 - LOCK TAB
3 - BOLT
4 - SHIFT LEVER ASSEMBLY (SLA)
5 - CONNECTOR

(5) Turn on ignition and apply brakes. Move selector lever back to position ″D″.
(6) Install the transmission shift cable onto the ball knob at the SLA.
(7) Install the bottom (2) (Fig. 209) of the center section of instrument panel.
(8) Install the top (3) (Fig. 210) of the center section of instrument panel.
(9) Verify repair.

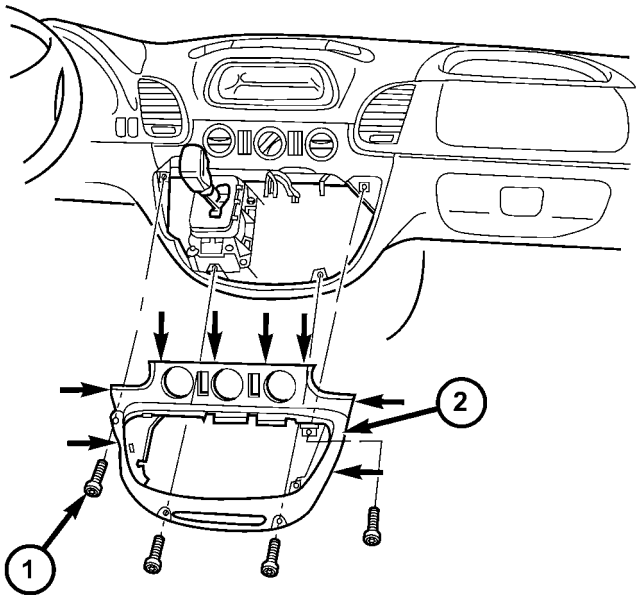


Fig. 209 Install Bottom Section Of Center Instrument Panel

1 - SCREW
2 - BOTTOM CENTER PART OF INSTRUMENT PANEL

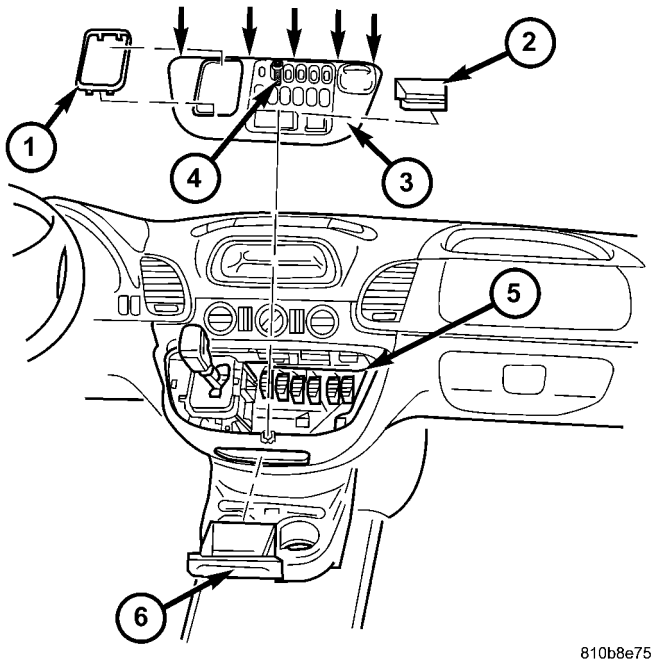


Fig. 210 Install Top Section Of Center Instrument Panel

1 - SHIFT LEVER ASSEMBLY FRAME TRIM
2 - STORAGE COMPARTMENT
3 - TOP CENTER PART OF INSTRUMENT PANEL
4 - SCREW
5 - PLUG CONNECTIONS
6 - ASHTRAY

SOLENOID

DESCRIPTION

The typical electrical solenoid used in automotive applications is a linear actuator. It is a device that produces motion in a straight line. This straight line motion can be either forward or backward in direction, and short or long distance.

A solenoid is an electromechanical device that uses a magnetic force to perform work. It consists of a coil of wire, wrapped around a magnetic core made from steel or iron, and a spring loaded, movable plunger, which performs the work, or straight line motion.

The solenoids used in transmission applications are attached to valves which can be classified as **normally open** or **normally closed**. The **normally open** solenoid valve is defined as a valve which allows hydraulic flow when no current or voltage is applied to the solenoid. The **normally closed** solenoid valve is defined as a valve which does not allow hydraulic flow when no current or voltage is applied to the solenoid. These valves perform hydraulic control functions for the transmission and must therefore be durable and tolerant of dirt particles. For these reasons, the valves have hardened steel poppets and ball valves. The solenoids operate the valves directly, which means that the solenoids must have very high outputs to close the valves against the sizable flow areas and line pressures found in current transmissions. Fast response time is also necessary to ensure accurate control of the transmission.

The strength of the magnetic field is the primary force that determines the speed of operation in a particular solenoid design. A stronger magnetic field will cause the plunger to move at a greater speed than a weaker one. There are basically two ways to increase the force of the magnetic field:

1. Increase the amount of current applied to the coil or
2. Increase the number of turns of wire in the coil.

The most common practice is to increase the number of turns by using thin wire that can completely fill the available space within the solenoid housing. The strength of the spring and the length of the plunger also contribute to the response speed possible by a particular solenoid design.

A solenoid can also be described by the method by which it is controlled. Some of the possibilities include variable force, pulse-width modulated, constant ON, or duty cycle. The variable force and pulse-width modulated versions utilize similar methods to control the current flow through the solenoid to position the solenoid plunger at a desired position somewhere between full ON and full OFF. The constant ON and duty cycled versions control the voltage

SOLENOID (Continued)

across the solenoid to allow either full flow or no flow through the solenoid's valve.

UPSHIFT/DOWNSHIFT SOLENOID VALVES

The solenoid valves for upshifts and downshifts (Fig. 211) are located in the shell of the electric control unit and pressed against the shift plate with a spring.

The solenoid valves (1) initiate the upshift and downshift procedures in the shift plate.

The solenoid valves (1) are sealed off from the valve housing of the shift plate (5) by two O-rings (4, 6). The contact springs (8) at the solenoid valve engage in a slot in the conductor tracks (7). The force of the contact spring (8) ensures safe contacts.

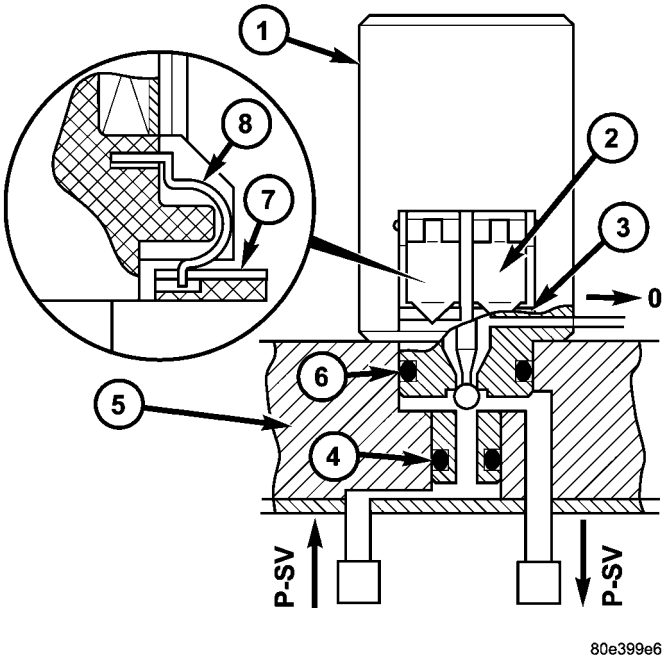


Fig. 211 Upshift/Downshift Solenoid Valves

1 - UPSHIFT/DOWNSHIFT SOLENOID VALVE
2 - CONTACT SPRING
3 - CONDUCTOR TRACK
4 - O-RING
5 - VALVE HOUSING OF SHIFT PLATE
6 - O-RING
7 - CONDUCTOR TRACK
8 - CONTACT SPRING

MODULATING PRESSURE CONTROL SOLENOID VALVE

The modulating pressure control solenoid valve (Fig. 212) is located in the shell of the electric valve control unit and pressed against the shift plate by a spring.

Its purpose is control the modulating pressure depending on the continuously changing operating conditions, such as load and gear change.

The modulating pressure regulating solenoid valve (1) has an interference fit and is sealed off to the valve body of the shift plate (4) by a seal (arrow). The contact springs (2) at the solenoid valve engage in a slot in the conductor tracks (3). The force of the contact springs (2) ensures secure contacts.

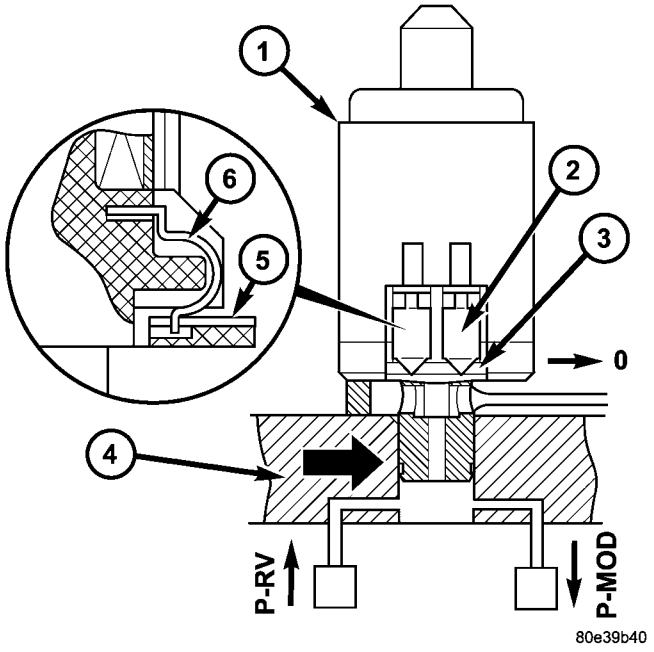


Fig. 212 Modulating Pressure Control Solenoid Valve

1 - MODULATING PRESSURE CONTROL SOLENOID VALVE
2 - CONTACT SPRING
3 - CONDUCTOR TRACK
4 - VALVE HOUSING SHIFT PLATE
5 - CONDUCTOR TRACK
6 - CONTACT SPRING

TORQUE CONVERTER LOCKUP CLUTCH PWM SOLENOID VALVE

The torque converter lockup clutch PWM solenoid valve (1) (Fig. 213) is located in the shell of the electric valve control unit and pressed against the shift plate by a spring.

The PWM solenoid valve (1) for the torque converter lockup controls the pressure for the torque converter lockup clutch.

The torque converter lockup PWM solenoid valve (1) is sealed off to the valve body of the shift plate (4) by an O-ring (5) and a seal (arrow). The contact springs (2) at the solenoid valve engage in a slot in the conductor tracks (3). The force of the contact springs (2) ensures secure contacts.

SOLENOID (Continued)

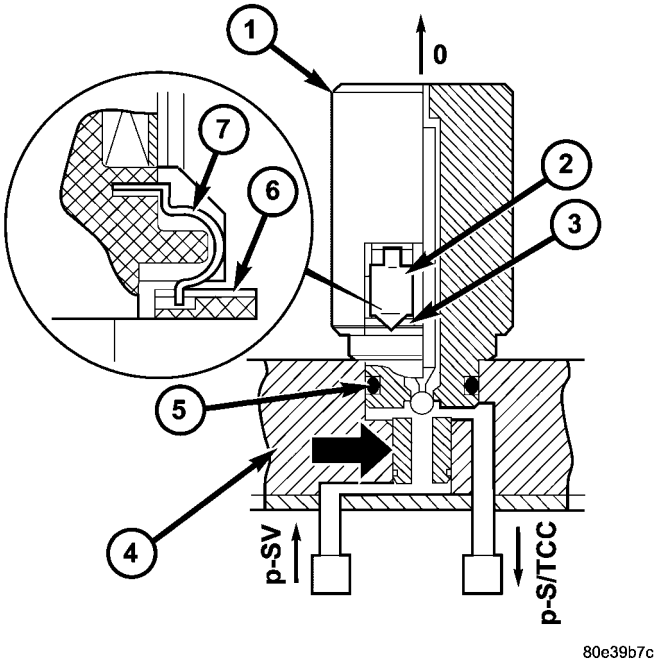


Fig. 213 Torque Converter Lockup Clutch PWM Solenoid Valve

1 - TORQUE CONVERTER LOCKUP CLUTCH PWM SOLENOID VALVE
2 - CONTACT SPRING
3 - CONDUCTOR TRACK
4 - VALVE HOUSING OF SHIFT PLATE
5 - O-RING
6 - CONDUCTOR TRACK
7 - CONTACT SPRING

SHIFT PRESSURE CONTROL SOLENOID VALVE

The shift pressure control solenoid valve (1) (Fig. 214) is located in the shell of the electric valve control unit and pressed against the shift plate by a spring.

Its purpose is to control the shift pressure depending on the continuously changing operating conditions, such as load and gear change.

The shift pressure regulating solenoid valve (1) has an interference fit and is sealed off to the valve body of the shift plate (4) by a seal (arrow). The contact springs (2) at the solenoid valve engage in a slot in the conductor tracks (3). The force of the contact springs (2) ensures secure contacts

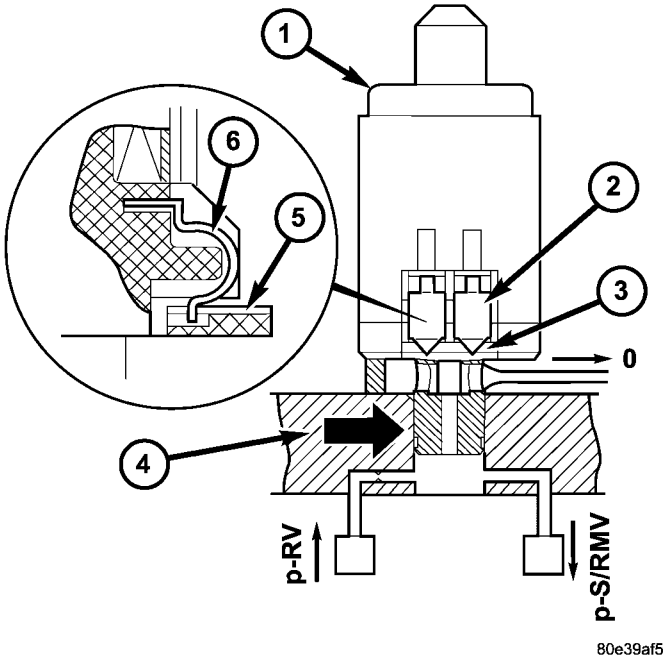


Fig. 214 Shift Pressure Control Solenoid Valve

1 - SHIFT PRESSURE CONTROL SOLENOID VALVE
2 - CONTACT SPRING
3 - CONDUCTOR TRACK
4 - VALVE HOUSING SHIFT PLATE
5 - CONDUCTOR TRACK
6 - CONTACT SPRING

OPERATION

When an electrical current is applied to the solenoid coil, a magnetic field is created which produces an attraction to the plunger, causing the plunger to move and work against the spring pressure and the load applied by the fluid the valve is controlling. The plunger is normally directly attached to the valve which it is to operate. When the current is removed from the coil, the attraction is removed and the plunger will return to its original position due to spring pressure.

The plunger is made of a conductive material and accomplishes this movement by providing a path for the magnetic field to flow. By keeping the air gap between the plunger and the coil to the minimum necessary to allow free movement of the plunger, the magnetic field is maximized.

SOLENOID (Continued)

UPSHIFT/DOWNSHIFT SOLENOID VALVES

If a solenoid valve (Fig. 215) is actuated by the TCM, it opens and guides the control pressure (p-SV) to the assigned command valve. The solenoid valve remains actuated and therefore open until the shifting process is complete. The shift pressure (p-SV) to the command valve is reduced to zero as soon as the power supply to the solenoid valve is interrupted.

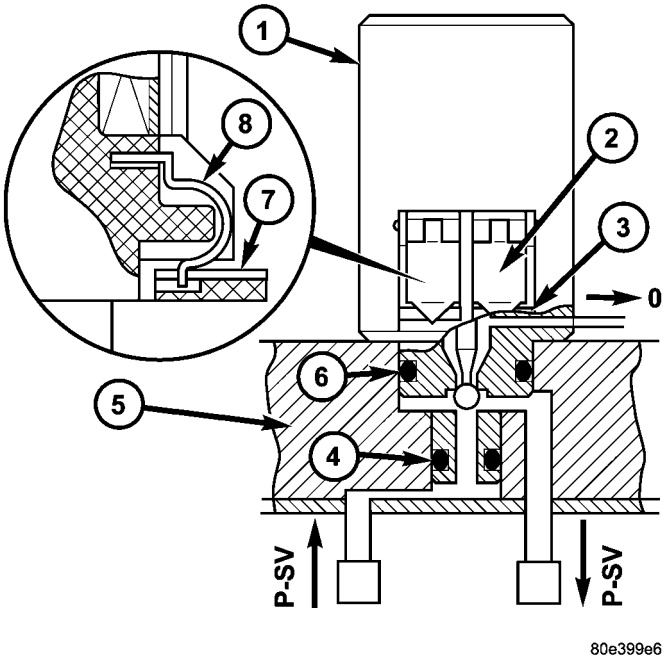


Fig. 215 Upshift/Downshift Solenoid Valves

1 - UPSHIFT/DOWNSHIFT SOLENOID VALVE
2 - CONTACT SPRING
3 - CONDUCTOR TRACK
4 - O-RING
5 - VALVE HOUSING OF SHIFT PLATE
6 - O-RING
7 - CONDUCTOR TRACK
8 - CONTACT SPRING

MODULATING PRESSURE CONTROL SOLENOID VALVE

The modulating pressure regulating solenoid valve (1) (Fig. 216)assigns a proportional pressure to the current which is controlled by the TCM according to the load.

TORQUE CONVERTER LOCKUP CLUTCH PWM SOLENOID VALVE

The torque converter lockup PWM solenoid (1) (Fig. 217) valve converts pulse-wave-modulated current controlled by the TCM into the appropriate hydraulic control pressure (p-S/TCC).

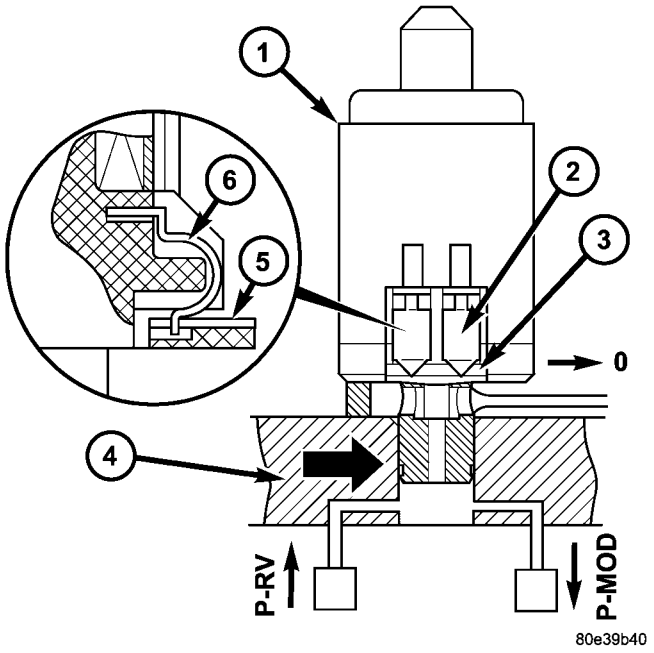


Fig. 216 Modulating Pressure Control Solenoid Valve

1 - MODULATING PRESSURE CONTROL SOLENOID VALVE
2 - CONTACT SPRING
3 - CONDUCTOR TRACK
4 - VALVE HOUSING SHIFT PLATE
5 - CONDUCTOR TRACK
6 - CONTACT SPRING

SHIFT PRESSURE CONTROL SOLENOID VALVE

The shift pressure regulating solenoid valve (1) (Fig. 218) assigns a proportional pressure to the current which is controlled by the TCM according to the load.

TEMPERATURE SENSOR/ PARK-NEUTRAL CONTACT

DESCRIPTION

DESCRIPTION - PARK/NEUTRAL CONTACT

The park/neutral contact (4) (Fig. 219) is located in the shell of the electric control unit and is fixed to the conductor tracks.

Its purpose is to recognize selector valve and selector lever positions ″P″ and ″N″. The park/neutral contact consists of:

- the plunger (2).
- the permanent magnet (3).
- the dry-reed contact (4).

TEMPERATURE SENSOR/PARK-NEUTRAL CONTACT (Continued)

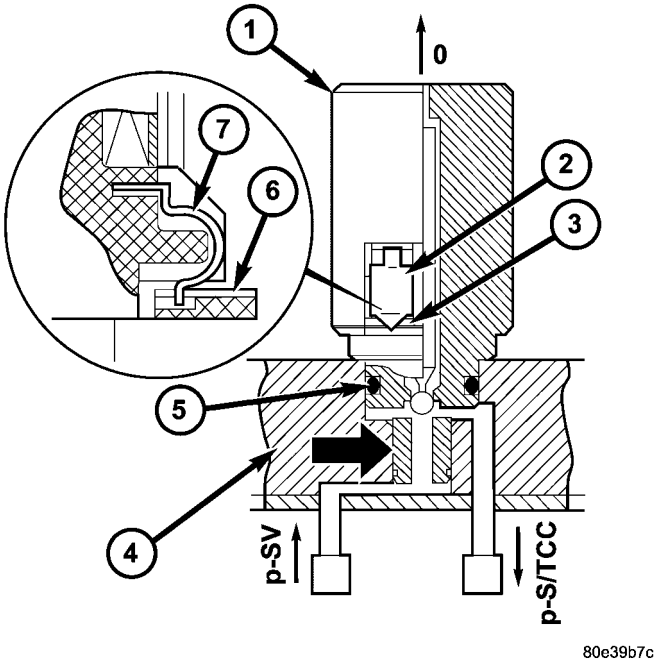


Fig. 217 Torque Converter Lockup Clutch PWM Solenoid Valve

1 - TORQUE CONVERTER LOCKUP CLUTCH PWM SOLENOID VALVE
2 - CONTACT SPRING
3 - CONDUCTOR TRACK
4 - VALVE HOUSING OF SHIFT PLATE
5 - O-RING
6 - CONDUCTOR TRACK
7 - CONTACT SPRING

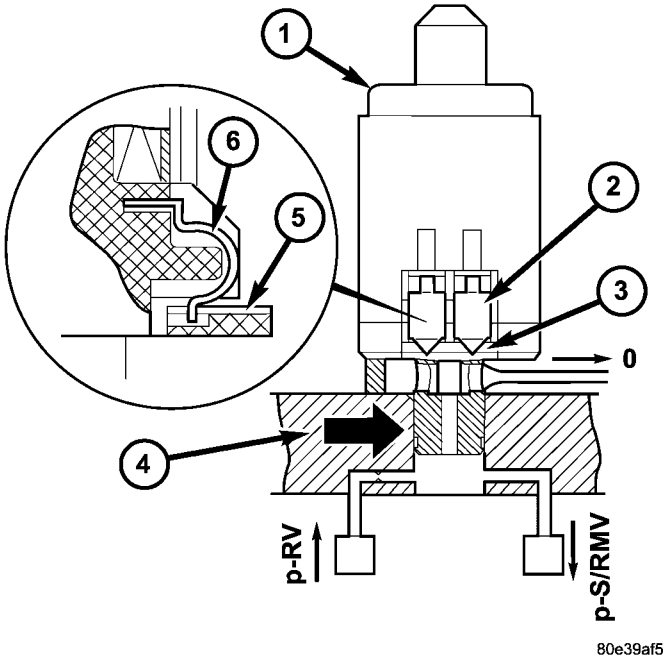


Fig. 218 Shift Pressure Control Solenoid Valve

1 - SHIFT PRESSURE CONTROL SOLENOID VALVE
2 - CONTACT SPRING
3 - CONDUCTOR TRACK
4 - VALVE HOUSING SHIFT PLATE
5 - CONDUCTOR TRACK
6 - CONTACT SPRING

DESCRIPTION - TRANSMISSION TEMPERATURE SENSOR

The transmission oil temperature sensor (1) (Fig. 220) is located in the shell of the electric valve control unit and is fixed to the conductor tracks.

Its purpose is to measure the temperature of the transmission oil and pass the temperature to the TCM as an input signal. It is a temperature-dependent resistor (PTC).

OPERATION

OPERATION - PARK/NEUTRAL CONTACT

In selector lever positions ″P″ and ″N″ the park/neutral contact (4) (Fig. 221) is actuated by a cam track which is located on the detent plate. The permanent magnet (3) is moved away from the dry-reed contact (4). The dry-reed contact (4) is opened. The TCM receives an electric signal. The circuit to the starter in the selector lever positions ″P″ and ″N″ is closed.

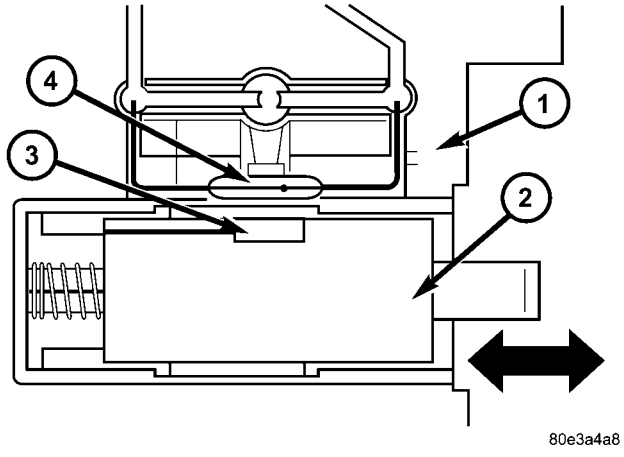


Fig. 219 Park/Neutral Contact

1 - SHELL OF ELECTRIC CONTROL MODULE
2 - PLUNGER
3 - PERMANENT MAGNET
4 - DRY-REED CONTACT

TEMPERATURE SENSOR/PARK-NEUTRAL CONTACT (Continued)

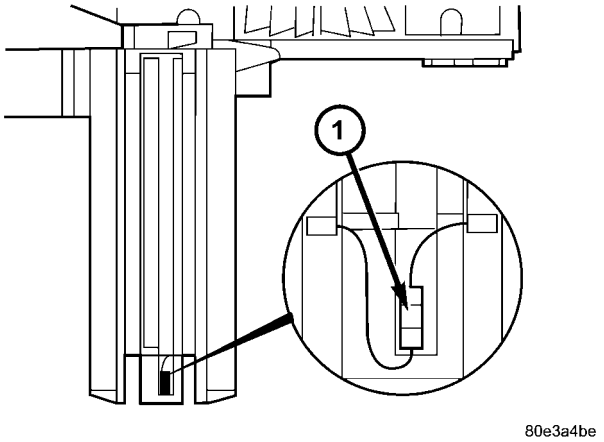


Fig. 220 Transmission Temperature Sensor

1 - TRANSMISSION TEMPERATURE SENSOR

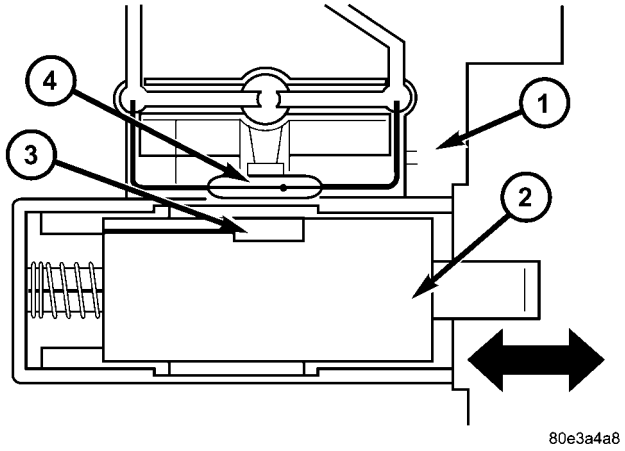


Fig. 221 Park/Neutral Contact

1 - SHELL OF ELECTRIC CONTROL MODULE
2 - PLUNGER
3 - PERMANENT MAGNET
4 - DRY-REED CONTACT

OPERATION - TRANSMISSION TEMPERATURE SENSOR

The temperature of the transmission oil has a considerable effect on the shifting time and therefore the shift quality. By measuring the oil temperature, shift operations can be optimized in all temperature ranges. The transmission oil temperature sensor (1) (Fig. 222) is switched in series with the park/neutral contact. The temperature signal is transferred to the TCM only when the dry-reed contact of the park/neutral contact is closed in REVERSE or a forward gear position.

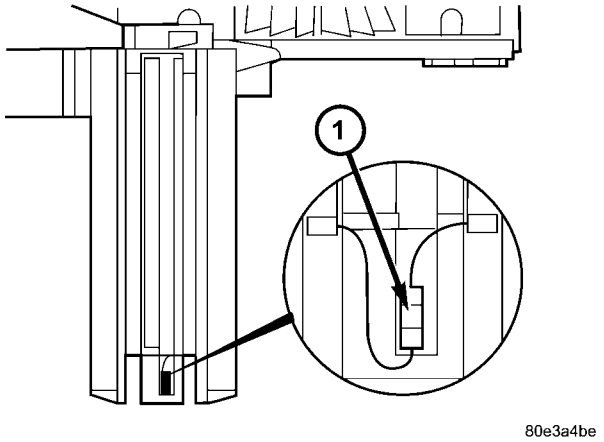


Fig. 222 Transmission Temperature Sensor

1 - TRANSMISSION TEMPERATURE SENSOR

Refer to the Transmission Temperature Sensor Specifications table (Fig. 223) for the relationship between transmission temperature, sensor voltage, and sensor resistance.

TORQUE CONVERTER

DESCRIPTION

The torque converter (Fig. 224) 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. The converter clutch provides reduced engine speed and greater fuel economy when engaged. Clutch engagement also provides reduced transmission fluid temperatures. The converter clutch engages in third gear. 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 resulted in large amounts of metal or fiber contamination in the fluid.

TRANSMISSION TEMP SENSOR SPECIFICATIONS
TEMPERATURE/VOLTAGE/RESISTANCE CHART

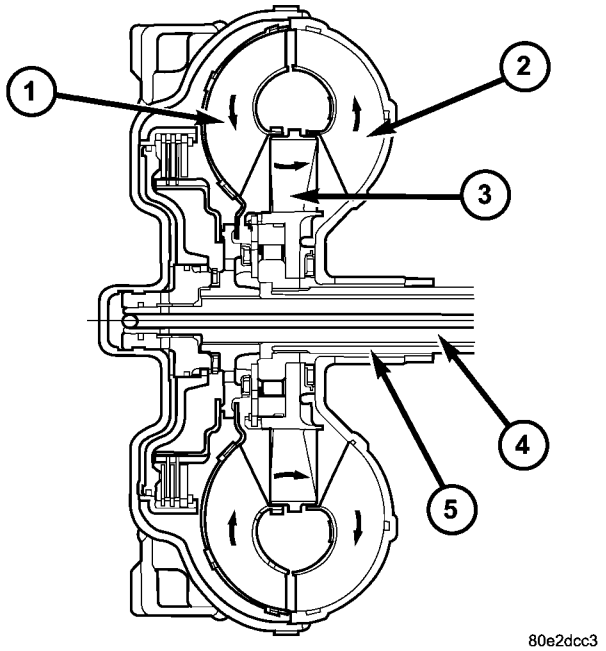
TEMPERATURE (C)	TEMPERATURE (F)	VOLTAGE	RESISTANCE
-50	-58	0.73	506.0
-45	-49	0.77	534.0
-40	-40	0.80	564.0
-35	-31	0.84	593.0
-30	-22	0.88	624.0
-25	-13	0.91	654.0
-20	-4	0.95	686.0
-15	5	0.98	718.0
-10	14	1.02	750.0
-5	23	1.05	783.0
0	32	1.09	817.0
5	41	1.12	851.0
10	50	1.16	886.0
15	59	1.19	921.0
20	68	1.23	957.0
25	77	1.26	994.0
30	86	1.30	1032.0
35	95	1.33	1070.0
40	104	1.37	1109.0
45	113	1.40	1149.0
50	122	1.44	1189.0
55	131	1.48	1231.0
60	140	1.51	1273.0
65	149	1.55	1316.0
70	158	1.58	1360.0
75	167	1.62	1405.0
80	176	1.65	1450.0
85	185	1.69	1497.0
90	194	1.72	1545.0
95	203	1.76	1594.0
100	212	1.79	1644.0
105	221	1.83	1695.0
110	230	1.86	1747.0
115	239	1.90	1800.0
120	248	1.93	1855.0
125	257	1.97	1911.0
130	266	2.00	1968.0
135	275	2.04	2027.0
140	284	2.08	2087.0
145	293	2.11	2148.0
150	302	2.15	2211.0
155	311	2.18	2276.0
160	320	2.22	2342.0
165	329	2.25	2410.0
170	338	2.29	2479.0
175	347	2.32	2551.0

80e3afbe

Fig. 223 Transmission Temperature Sensor Specifications

IMPELLER

The impeller (Fig. 225) is an integral part of the converter housing. The impeller consists of curved blades placed radially along the inside of the housing on the transmission side of the converter. As the converter housing is rotated by the engine, so is the impeller, because they are one and the same and are the driving members of the system.



80e2dcc3

Fig. 224 Torque Converter

1 - TURBINE
2 - IMPELLER
3 - STATOR
4 - INPUT SHAFT
5 - STATOR SHAFT

TURBINE

The turbine (Fig. 226) is the output, or driven, member of the converter. The turbine is mounted within the housing opposite the impeller, but is not attached to the housing. The input shaft is inserted through the center of the impeller and splined into the turbine. The design of the turbine is similar to the impeller, except the blades of the turbine are curved in the opposite direction.

STATOR

The stator assembly (Fig. 227) is mounted on a stationary shaft which is an integral part of the oil pump. The stator is located between the impeller and turbine within the torque converter case (Fig. 228). The stator contains a freewheeling clutch, which allows the stator to rotate only in a clockwise direction. When the stator is locked against the freewheeling clutch, the torque multiplication feature of the torque converter is operational.

TORQUE CONVERTER (Continued)

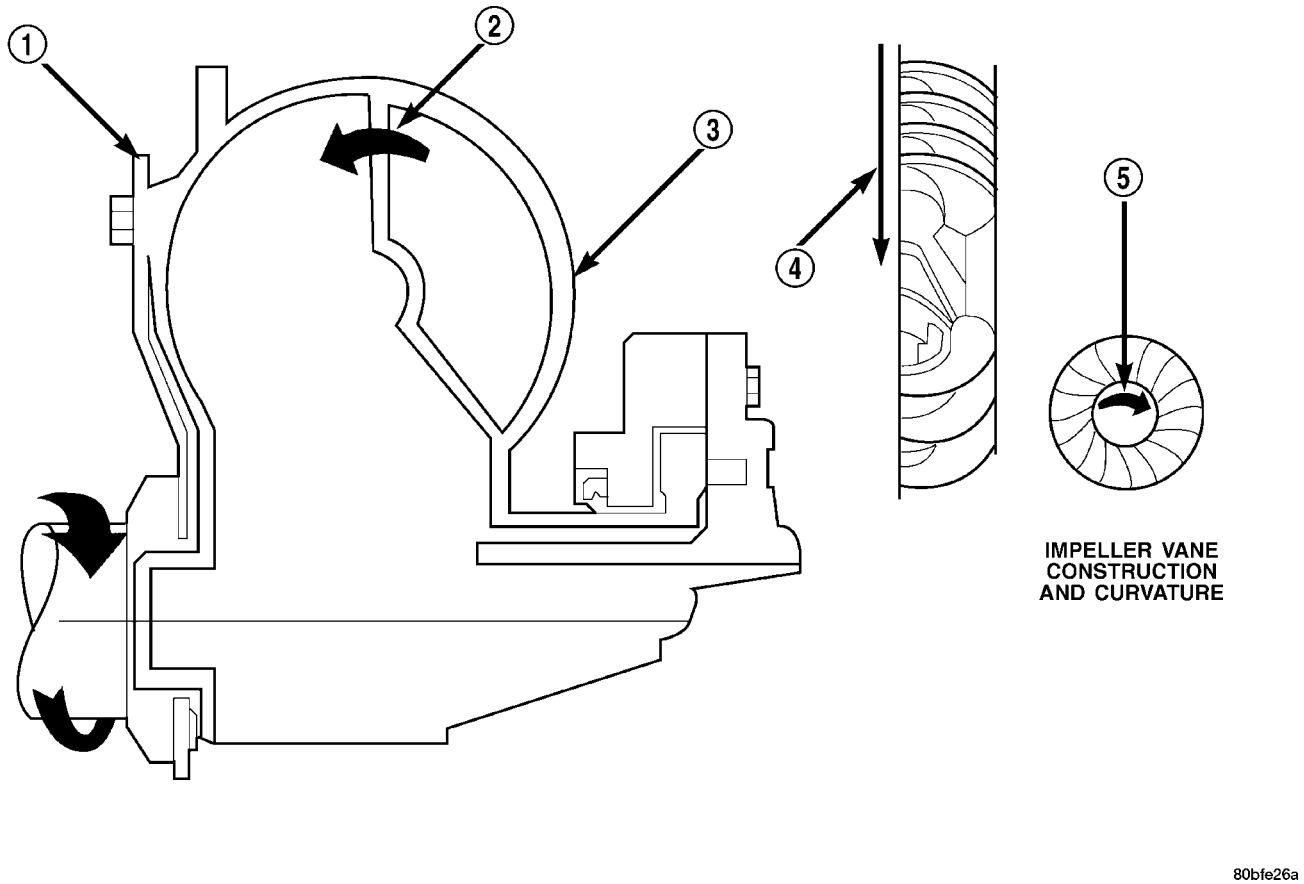


Fig. 225 Impeller

1 - ENGINE FLEXPLATE
2 - OIL FLOW FROM IMPELLER SECTION INTO TURBINE SECTION
3 - IMPELLER VANES AND COVER ARE INTEGRAL
4 - ENGINE ROTATION
5 - ENGINE ROTATION

TORQUE CONVERTER CLUTCH (TCC)

The TCC (Fig. 229) was installed to improve the efficiency of the torque converter that is lost to the slippage of the fluid coupling. Although the fluid coupling provides smooth, shock-free power transfer, it is natural for all fluid couplings to slip. If the impeller and turbine were mechanically locked together, a zero slippage condition could be obtained. A hydraulic piston with friction material was added to the turbine assembly to provide this mechanical lock-up.

In order to reduce heat build-up in the transmission and buffer the powertrain against torsional vibrations, the TCM can duty cycle the torque converter lock-up solenoid to achieve a smooth application of the torque converter clutch. This function, referred to as Electronically Modulated Converter Clutch (EMCC) can occur at various times depending on the following variables:

- Shift lever position
- Current gear range
- Transmission fluid temperature
- Engine coolant temperature
- Input speed
- Throttle angle
- Engine speed

OPERATION

The converter impeller (driving member), which is integral to the converter housing and bolted to the engine drive plate, rotates at engine speed. The converter turbine (driven member), which reacts from fluid pressure generated by the impeller, rotates and turns the transmission input shaft.

TORQUE CONVERTER (Continued)

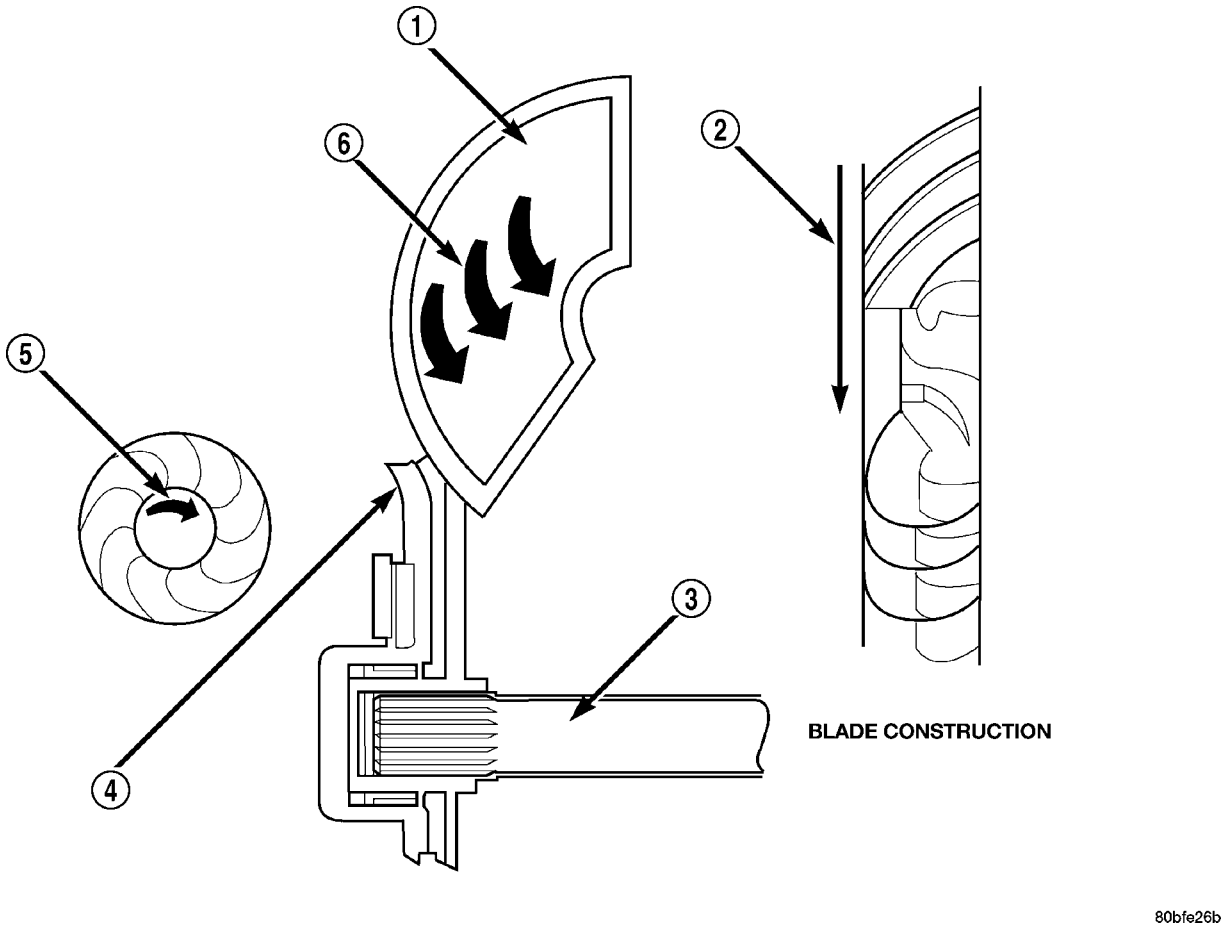


Fig. 226 Turbine

1 - TURBINE VANE
2 - ENGINE ROTATION
3 - INPUT SHAFT
4 - PORTION OF TORQUE CONVERTER COVER
5 - ENGINE ROTATION
6 - OIL FLOW WITHIN TURBINE SECTION

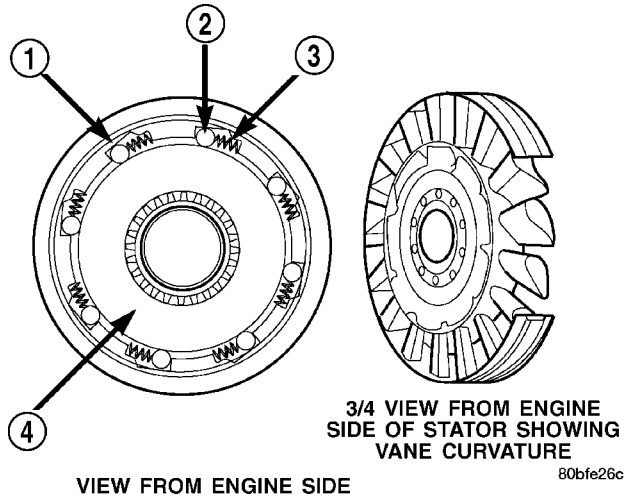


Fig. 227 Stator Components

1 - CAM (OUTER RACE)
2 - ROLLER
3 - SPRING
4 - INNER RACE

TURBINE

As the fluid that was put into motion by the impeller blades strikes the blades of the turbine, some of the energy and rotational force is transferred into the turbine and the input shaft. This causes both of them (turbine and input shaft) to rotate in a clockwise direction following the impeller. As the fluid is leaving the trailing edges of the turbine's blades it continues in a "hindering" direction back toward the impeller. If the fluid is not redirected before it strikes the impeller, it will strike the impeller in such a direction that it would tend to slow it down.

TORQUE CONVERTER (Continued)

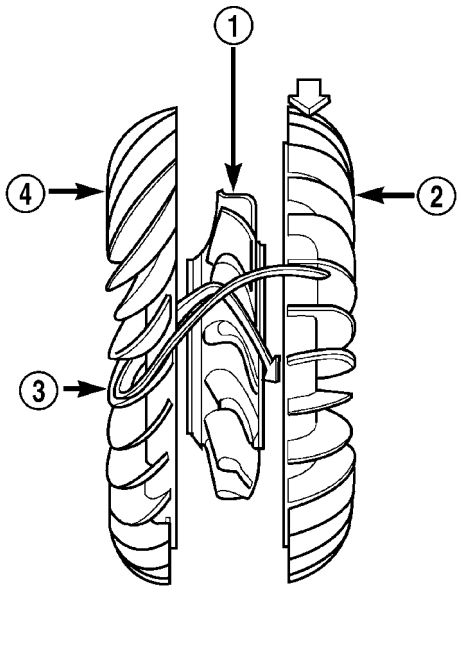


Fig. 228 Stator Location

1 - STATOR
2 - IMPELLER
3 - FLUID FLOW
4 - TURBINE

STATOR

Torque multiplication is achieved by locking the stator's over-running clutch to its shaft (Fig. 230). Under stall conditions (the turbine is stationary), the oil leaving the turbine blades strikes the face of the stator blades and tries to rotate them in a counter-clockwise direction. When this happens the over-running clutch of the stator locks and holds the stator from rotating. With the stator locked, the oil strikes the stator blades and is redirected into a "helping" direction before it enters the impeller. This circulation of oil from impeller to turbine, turbine to stator, and stator to impeller, can produce a maximum torque multiplication of about 2.0:1. As the turbine begins to match the speed of the impeller, the fluid that was hitting the stator in such as way as to cause it to lock-up is no longer doing so. In this condition of operation, the stator begins to free wheel and the converter acts as a fluid coupling.

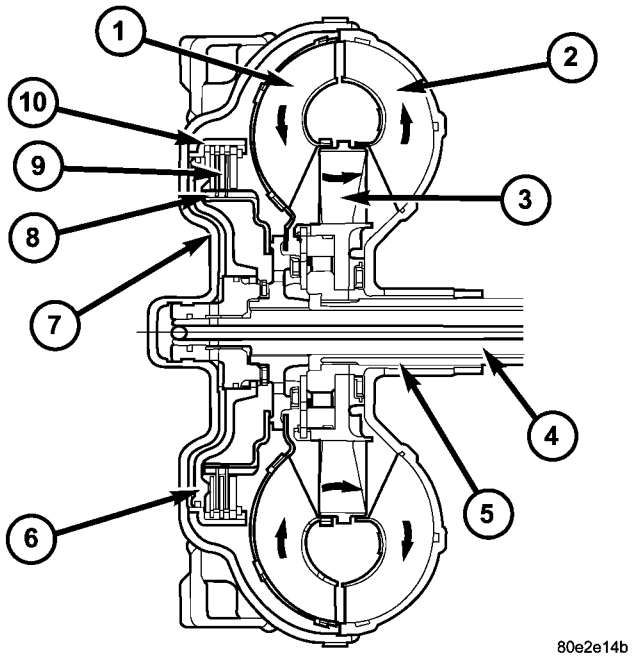


Fig. 229 Torque Converter Lock-up Clutch

1 - TURBINE
2 - IMPELLER
3 - STATOR
4 - INPUT SHAFT
5 - STATOR SHAFT
6 - PISTON
7 - COVER SHELL
8 - INTERNALLY TOOTHED DISC CARRIER
9 - CLUTCH PLATE SET
10 - EXTERNALLY TOOTHED DISC CARRIER

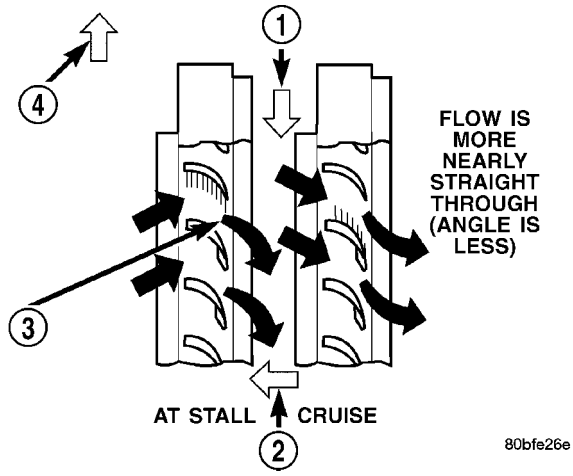


Fig. 230 Stator Operation

1 - DIRECTION STATOR WILL FREE WHEEL DUE TO OIL PUSHING ON BACKSIDE OF VANES
2 - FRONT OF ENGINE
3 - INCREASED ANGLE AS OIL STRIKES VANES
4 - DIRECTION STATOR IS LOCKED UP DUE TO OIL PUSHING AGAINST STATOR VANES

TORQUE CONVERTER (Continued)

TORQUE CONVERTER CLUTCH (TCC)

In a standard torque converter, the impeller and turbine are rotating at about the same speed and the stator is freewheeling, providing no torque multiplication. By applying the turbine's piston and friction material (Fig. 231) to the front cover, a total converter engagement can be obtained. The result of this engagement is a direct 1:1 mechanical link between the engine and the transmission.

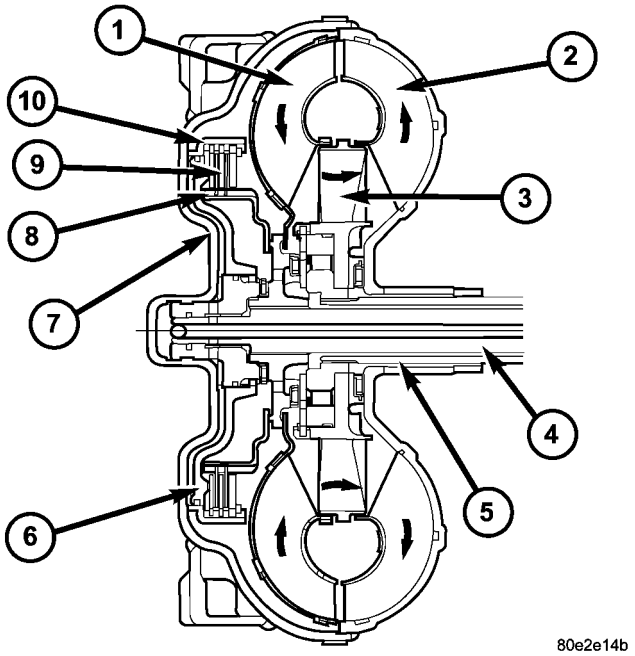


Fig. 231 Torque Converter Lock-up Clutch

1 - TURBINE
2 - IMPELLER
3 - STATOR
4 - INPUT SHAFT
5 - STATOR SHAFT
6 - PISTON
7 - COVER SHELL
8 - INTERNALLY TOOTHED DISC CARRIER
9 - CLUTCH PLATE SET
10 - EXTERNALLY TOOTHED DISC CARRIER

The clutch can be engaged in second, third, fourth, and fifth gear ranges.

The TCM controls the torque converter by way of internal logic software. The programming of the software provides the TCM with control over the torque converter 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 TCC 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 TCC 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 TCC 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 TCC Solenoid duty cycle.

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 flats for sharp edges, burrs, scratches, or nicks. Polish the hub and flats 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 oil pump seal lip with transmission fluid.

TORQUE CONVERTER (Continued)

(2) Place torque converter in position on transmission.

CAUTION: Do not damage oil pump seal or converter hub 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. 232). Surface of converter lugs should be at least 19 mm (3/4 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.

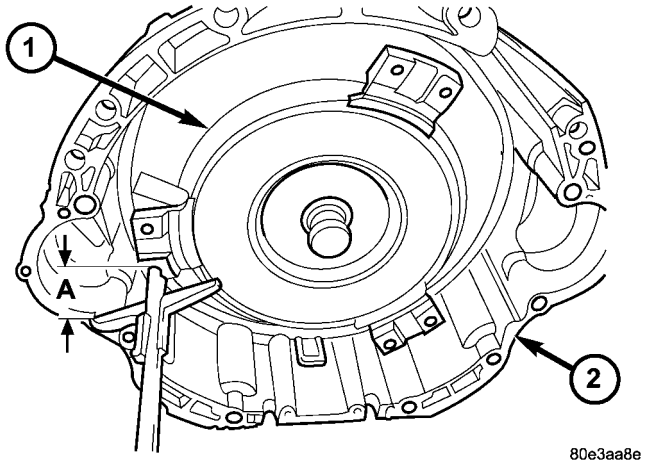


Fig. 232 Torque Converter Installation Depth

1 - TORQUE CONVERTER
2 - TRANSMISSION HOUSING

TORQUE CONVERTER HUB SEAL

REMOVAL

(1) Remove the torque converter (Refer to 21 - TRANSMISSION/AUTOMATIC - NAG1/TORQUE CONVERTER - REMOVAL).
(2) Remove the torque converter hub seal with suitable screw and slide hammer.

INSTALLATION

(1) Position the torque converter hub seal (Fig. 233) over the input shaft and against the transmission oil pump.
(2) Using Seal Installer 8902A (Fig. 234), install a new torque converter hub seal.

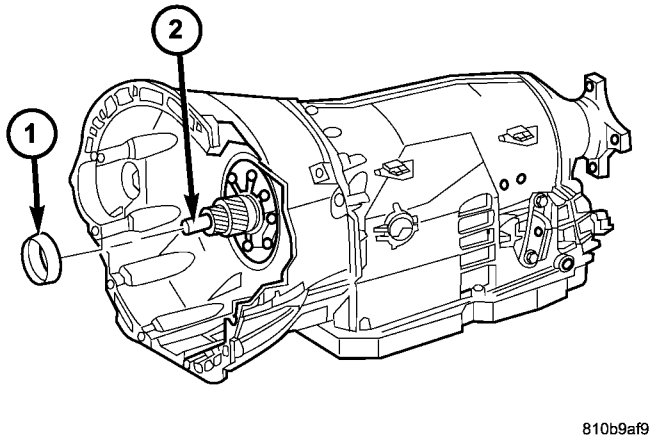


Fig. 233 Position Torque Converter Hub Seal

1 - TORQUE CONVERTER HUB SEAL
2 - INPUT SHAFT

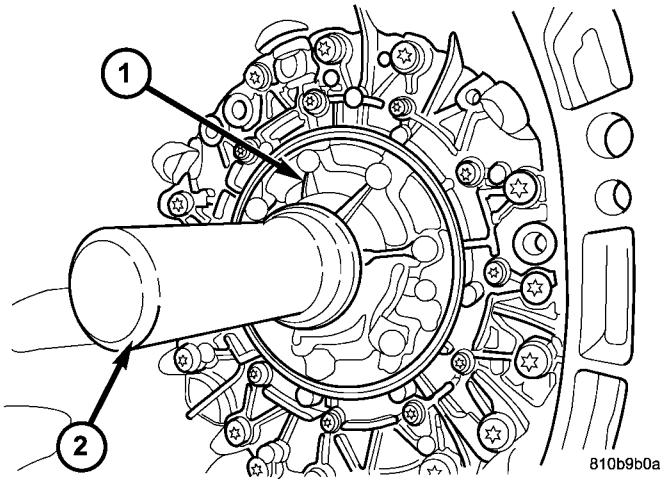


Fig. 234 Install Torque Converter Hub Seal

1 - OIL PUMP
2 - SEAL INSTALLER 8902A

(3) Install the torque converter (Refer to 21 - TRANSMISSION/AUTOMATIC - NAG1/TORQUE CONVERTER - INSTALLATION).

TIRES/WHEELS

TABLE OF CONTENTS

page

TIRES/WHEELS
DIAGNOSIS AND TESTING - TIRE AND WHEEL RUNOUT 1
STANDARD PROCEDURE
STANDARD PROCEDURE - MATCH MOUNTING 2
STANDARD PROCEDURE - TIRE AND WHEEL BALANCE 3
STANDARD PROCEDURE - TIRE ROTATION . 5
SPECIFICATIONS
TORQUE CHART 5
TIRES
DESCRIPTION
DESCRIPTION - TIRES 6
DESCRIPTION - RADIAL – PLY TIRES 6
DESCRIPTION - TIRE PRESSURE FOR HIGH SPEEDS. 6
DESCRIPTION - REPLACEMENT TIRES 7
DESCRIPTION - TIRE INFLATION PRESSURES 7
DIAGNOSIS AND TESTING
DIAGNOSIS AND TESTING - PRESSURE GAUGES 8
DIAGNOSIS AND TESTING - TIRE NOISE OR VIBRATION 8
DIAGNOSIS AND TESTING - TREAD WEAR INDICATORS 8

page

DIAGNOSIS AND TESTING - TIRE WEAR PATTERNS 8
DIAGNOSIS AND TESTING - TIRE/VEHICLE LEAD 8
STANDARD PROCEDURE - REPAIRING LEAKS 10
CLEANING 10
SPECIFICATIONS
TIRES 10
SPARE TIRE CARRIER
REMOVAL 10
INSTALLATION 10
WHEELS
DESCRIPTION 11
OPERATION 11
DIAGNOSIS AND TESTING
WHEEL INSPECTION 11
STANDARD PROCEDURE
STANDARD PROCEDURE - WHEEL REPLACEMENT 11
STANDARD PROCEDURE - DUAL REAR WHEEL INSTALLATION 12
REMOVAL 13
INSTALLATION 13

TIRES/WHEELS

DIAGNOSIS AND TESTING - TIRE AND WHEEL RUNOUT

Radial runout is the difference between the high and low points on the tire or wheel (Fig. 1).

Lateral runout is the **wobble** of the tire or wheel.

Radial runout of more than 1.5 mm (.060 inch) measured at the center line of the tread may cause the vehicle to shake.

Lateral runout of more than 2.0 mm (.080 inch) measured near the shoulder of the tire may cause the vehicle to shake.

Sometimes radial runout can be reduced. Relocate the wheel and tire assembly on the mounting studs (See Method 1). If this does not reduce runout to an acceptable level, the tire can be rotated on the wheel. (See Method 2).

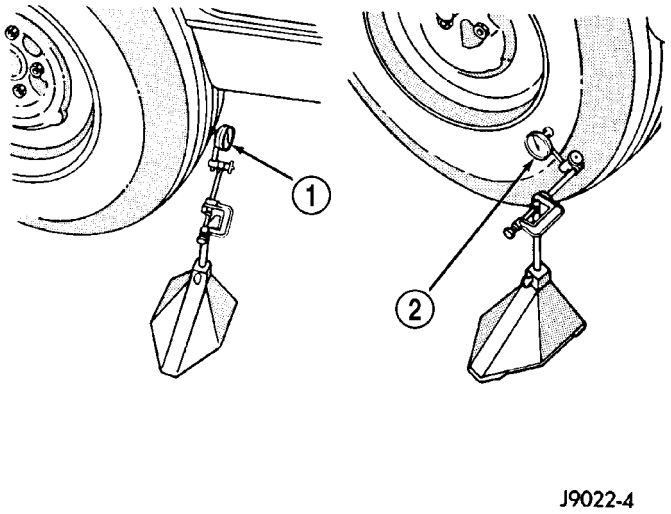


Fig. 1 Checking Tire/Wheel/Hub Runout

1 - RADIAL RUNOUT
2 - LATERAL RUNOUT

TIRES/WHEELS (Continued)

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. 2) and lateral runout (Fig. 3).

- STEEL WHEELS: Radial runout 0.031 in., Lateral runout 0.031 in. (maximum)
- ALUMINUM WHEELS: Radial runout 0.020 in., Lateral runout 0.025 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.

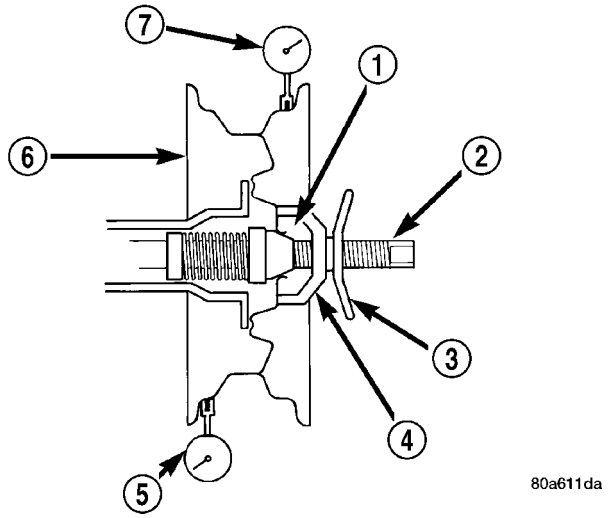


Fig. 2 Radial Runout

1 - MOUNTING CONE
2 - SPINDLE SHAFT
3 - WING NUT
4 - PLASTIC CUP
5 - DIAL INDICATOR
6 - WHEEL
7 - DIAL INDICATOR

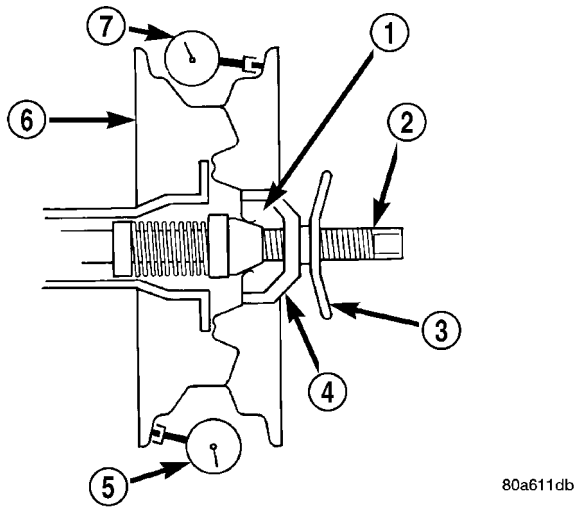


Fig. 3 Lateral Runout

1 - MOUNTING CONE
2 - SPINDLE SHAFT
3 - WING NUT
4 - PLASTIC CUP
5 - DIAL INDICATOR
6 - WHEEL
7 - DIAL INDICATOR

STANDARD PROCEDURE

STANDARD PROCEDURE - MATCH MOUNTING

Wheels and tires are match mounted at the factory. This means that the high spot of the tire is matched to the low spot on the wheel rim. Each are marked with a bright colored temporary label on the outboard surface for alignment. The wheel is also marked permanently on the inside of the rim in the tire well. This permanent mark may be a paint dot or line, a permanent label or a stamped impression such as an X. An optional location mark is a small spherical indentation on the vertical face of the outboard flange on some non styled base steel wheels. The tire must be removed to locate the permanent mark on the inside of the wheel.

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) Remove the tire and wheel assembly from the vehicle and mount on a service dynamic balance machine.

(2) Measure the total runout on the center of the tire tread rib with a dial indicator. Record the indicator reading. Mark the tire to indicate the high spot. Place a mark on the tire at the valve stem location (Fig. 4).

(3) Break down the tire and remount it 180 degrees on the rim (Fig. 5).

(4) Measure the total indicator runout again. Mark the tire to indicate the high spot.

TIRES/WHEELS (Continued)

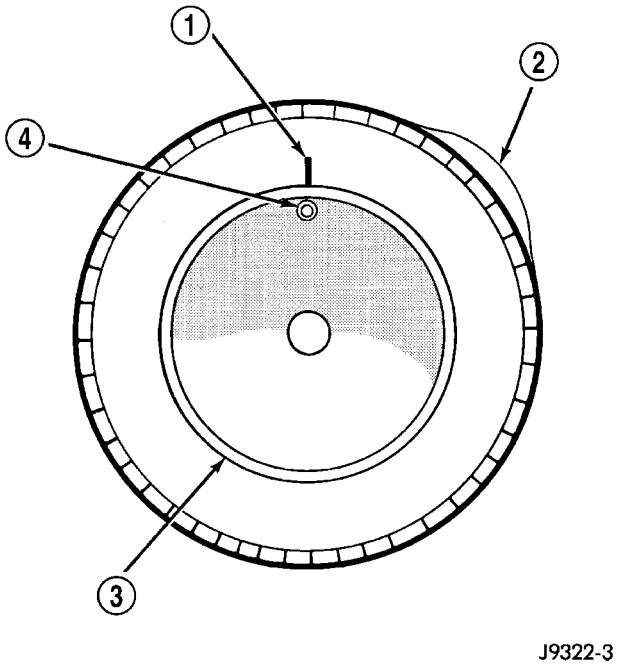


Fig. 4 First Measurement On Tire

1 - REFERENCE MARK
2 - 1ST MEASUREMENT HIGH SPOT MARK TIRE AND RIM
3 - WHEEL
4 - VALVE STEM

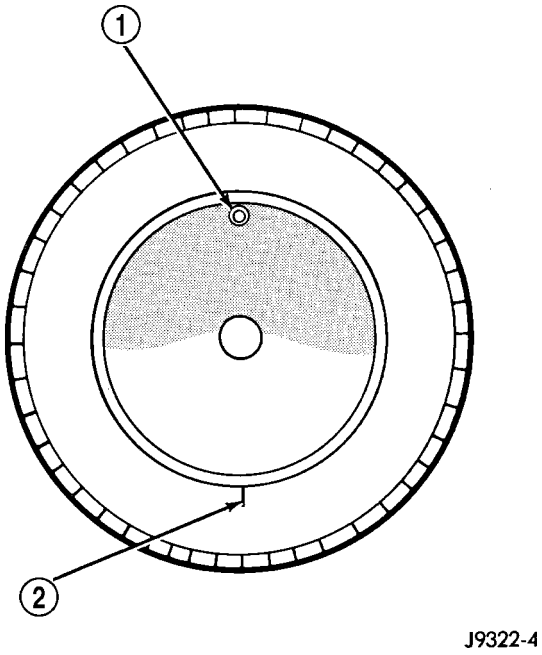


Fig. 5 Remount Tire 180 Degrees

1 - VALVE STEM
2 - REFERENCE MARK

(5) If runout is still excessive, the following procedures must be done.

- If the high spot is within 101.6 mm (4.0 in.) of the first spot and is still excessive, replace the tire.
- If the high spot is within 101.6 mm (4.0 in.) of the first spot on the wheel, the wheel may be out of specifications. Refer to Wheel and Tire Runout.
- If the high spot is NOT within 101.6 mm (4.0 in.) of either high spot, draw an arrow on the tread from second high spot to first. Break down the tire and remount it 90 degrees on rim in that direction (Fig. 6). This procedure will normally reduce the runout to an acceptable amount, if not replace the rim.

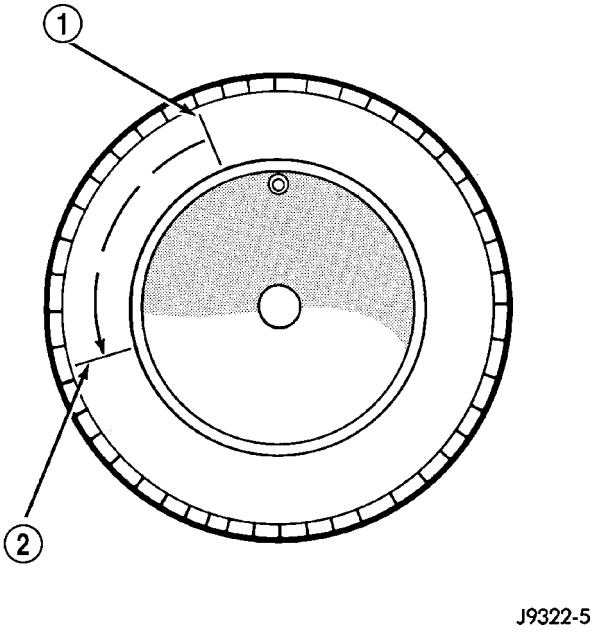


Fig. 6 Remount Tire 90 Degrees In Direction of Arrow

1 - 2ND HIGH SPOT ON TIRE
2 - 1ST HIGH SPOT ON TIRE

STANDARD PROCEDURE - 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.

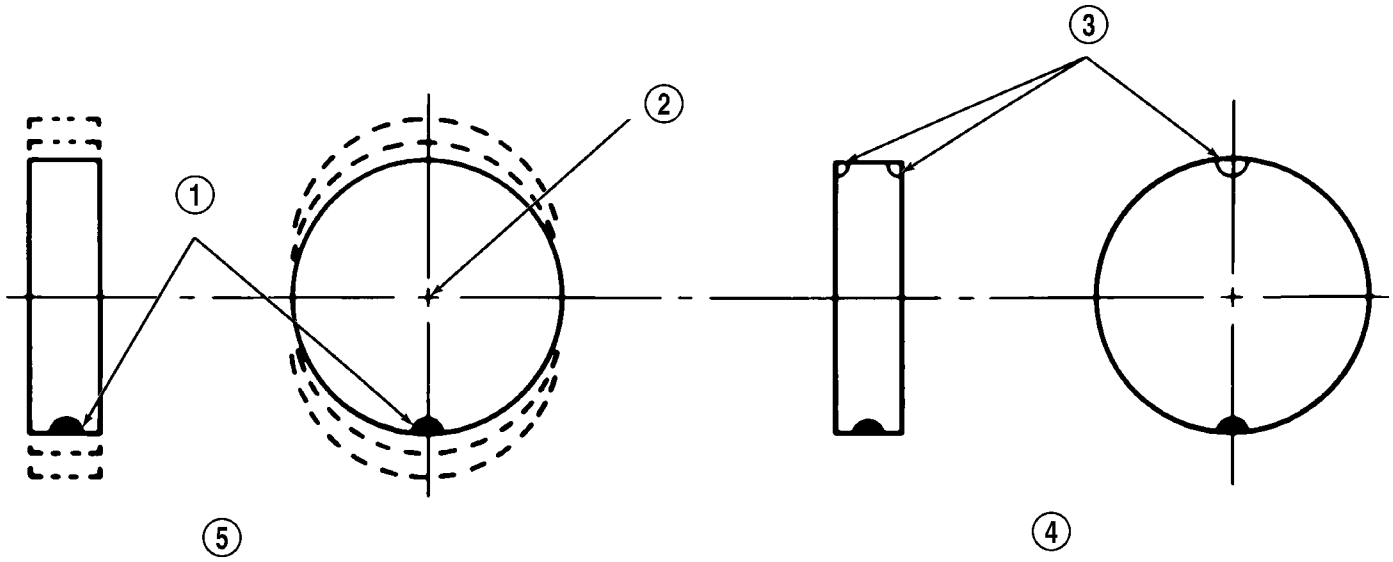
TIRES/WHEELS (Continued)

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 the location of the 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. 7).

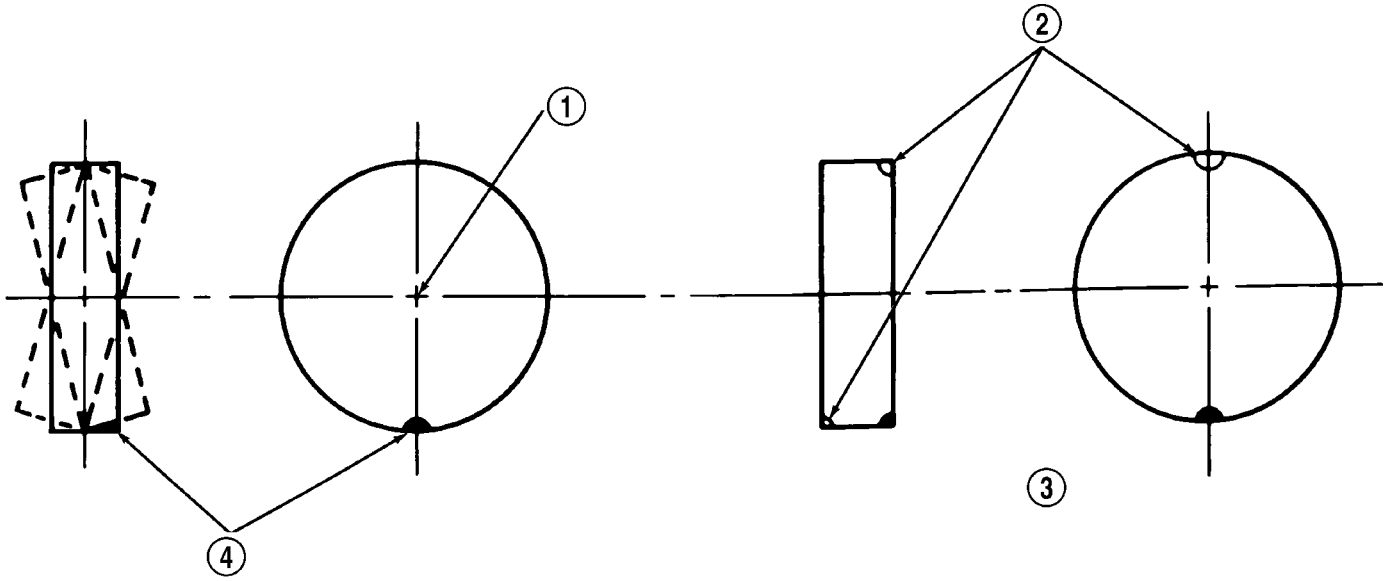
For dynamic balancing, the balancing equipment is designed to locate the amount of weight to be applied to both the inner and outer rim flange (Fig. 8).



J8922-8

Fig. 7 Static Unbalance & Balance

1 - HEAVY SPOT
2 - CENTER LINE OF SPINDLE
3 - ADD BALANCE WEIGHTS HERE
4 - CORRECTIVE WEIGHT LOCATION
5 - TIRE OR WHEEL TRAMP, OR WHEEL HOP



J8922-9

Fig. 8 Dynamic Unbalance & Balance

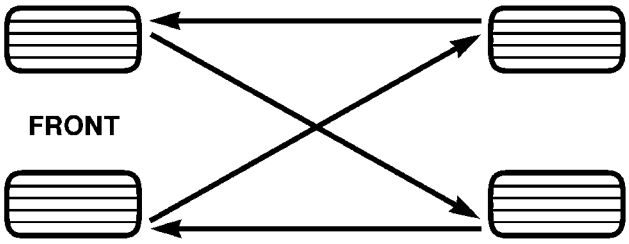
1 - CENTER LINE OF SPINDLE
2 - ADD BALANCE WEIGHTS HERE
3 - CORRECTIVE WEIGHT LOCATION
4 - HEAVY SPOT WHEEL SHIMMY AND VIBRATION

TIRES/WHEELS (Continued)

STANDARD PROCEDURE - TIRE ROTATION

Tires on the front and rear axles operate at different loads and perform different steering, driving, and braking functions. For these reasons, the tires wear at unequal rates. They may also develop irregular wear patterns. These effects can be reduced by rotating the tires according to the maintenance schedule in the Owners Manual. This will improve tread life, traction and maintain a smooth quiet ride.

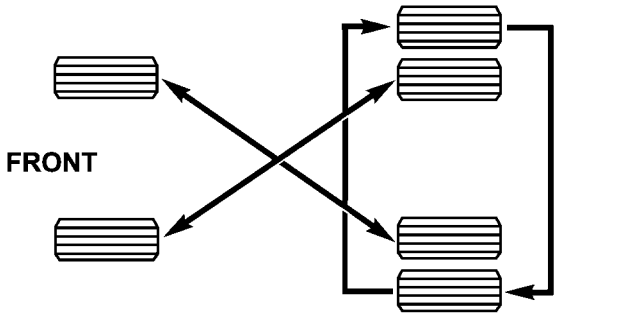
The recommended method of tire rotation is (Fig. 9) & (Fig. 10). Other methods can be used, but may not provide the same tire longevity benefits.



8031e864

Fig. 9 TIRE ROTATION PATTERN - SINGLE REAR WHEEL (SRW)

CAUTION: 3500 Dual rear tires have a new tire rotation pattern. This is to accommodate the asymmetrical design of the ON/OFF road tires and the use of the outlined white letter (OWL) tires. When replacing a flat, the spare tire may have to be remounted on the rim or installed at a different location to maintain the correct placement of the asymmetrical design or the (OWL).



80f58ec6

Fig. 10 TIRE ROTATION PATTERN - DUAL REAR WHEELS (DRW)

SPECIFICATIONS

TORQUE CHART

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Models 690.6,901,902,903,904,905, WD2YD441,YD541	190 +10	140 +10	–
Models WD5.WD141,WD241,WD341,WD2.YD141,YD241,YD341	240 +10	177 +10	–

TIRES

DESCRIPTION

DESCRIPTION - 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, (Refer to 22 - TIRES/WHEELS - STANDARD PROCEDURE). 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. 11).

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
- **R** up to 106 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.

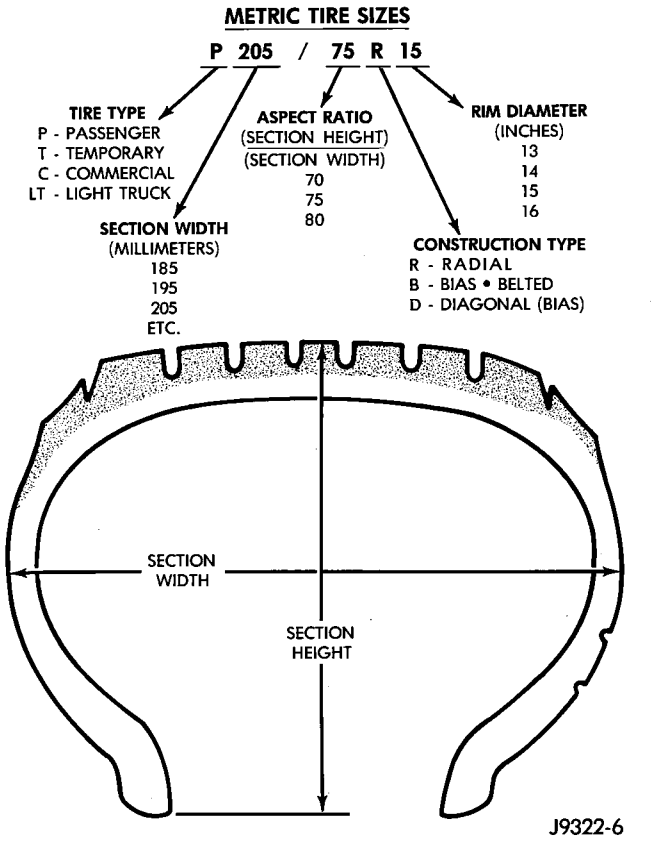


Fig. 11 Tire Identification

DESCRIPTION - 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.

DESCRIPTION - TIRE PRESSURE FOR HIGH SPEEDS

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

TIRES (Continued)

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.

DESCRIPTION - 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 recommended 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 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.

DESCRIPTION - TIRE INFLATION PRESSURES

Under inflation will cause rapid shoulder wear, tire flexing, and possible tire failure (Fig. 12).

Over inflation will cause rapid center wear and loss of the tire's ability to cushion shocks (Fig. 13).

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

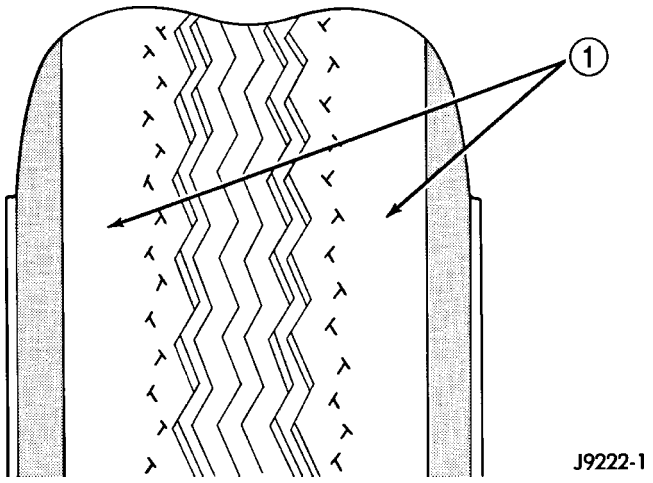


Fig. 12 Under Inflation Wear

1 - THIN TIRE THREAD AREAS

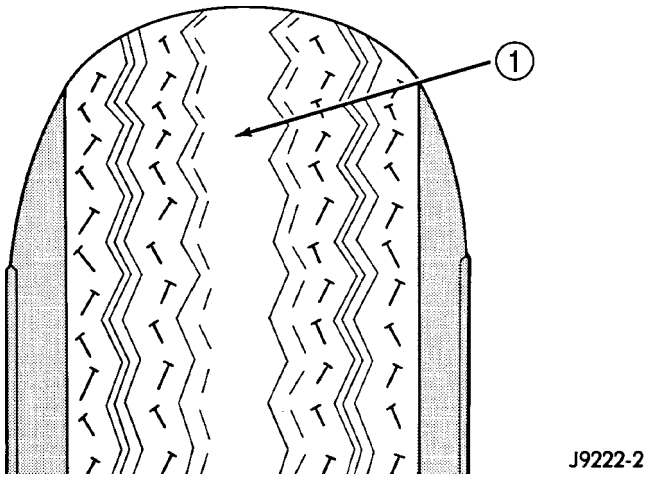


Fig. 13 Over Inflation Wear

1 - THIN TIRE THREAD AREA

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 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.

TIRES (Continued)

DIAGNOSIS AND TESTING

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.

DIAGNOSIS AND TESTING - 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.

DIAGNOSIS AND TESTING - 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. 14).

Tire replacement is necessary when indicators appear in two or more grooves or if localized balding occurs.

DIAGNOSIS AND TESTING - TIRE WEAR PATTERNS

Under inflation will cause wear on the shoulders of tire. Over inflation will cause wear at the center of tire.

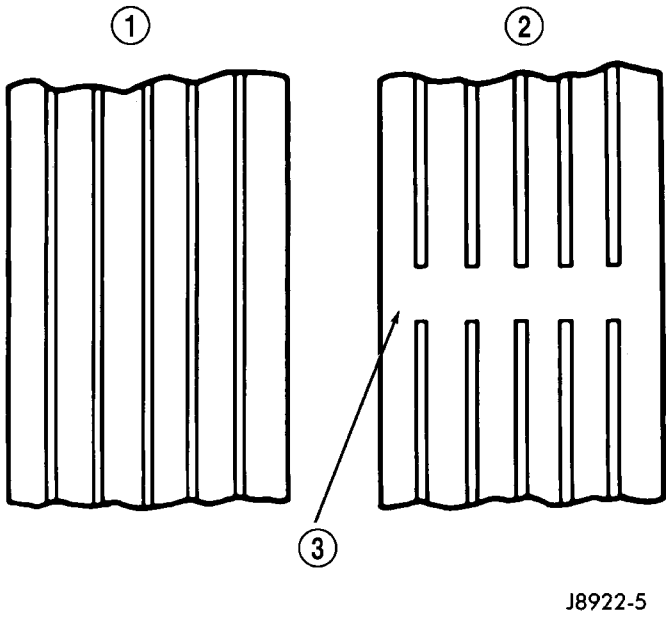


Fig. 14 Tread Wear Indicators

1 - TREAD ACCEPTABLE
2 - TREAD UNACCEPTABLE
3 - WEAR INDICATOR

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. 15).

Excessive toe-in or toe-out causes wear on the tread edges and a feathered effect across the tread (Fig. 15).

DIAGNOSIS AND TESTING - TIRE/VEHICLE LEAD

Use the following Vehicle Lead Diagnosis And Correction Chart to diagnose and correct a vehicle lead or drift problem (Fig. 16).

CONDITION	RAPID WEAR AT SHOULDERS	RAPID WEAR AT CENTER	CRACKED TREADS	WEAR ON ONE SIDE	FEATHERED EDGE	BALD SPOTS	SCALLOPED WEAR
EFFECT	1. 2.						
CAUSE	UNDER-INFLATION OR LACK OF ROTATION	OVER-INFLATION OR LACK OF ROTATION	UNDER-INFLATION OR EXCESSIVE SPEED*	EXCESSIVE CAMBER	INCORRECT TOE	UNBALANCED WHEEL OR TIRE DEFECT *	LACK OF ROTATION OF TIRES OR WORN OR OUT-OF-ALIGNMENT SUSPENSION.
CORRECTION	ADJUST PRESSURE TO SPECIFICATIONS WHEN TIRES ARE COOL ROTATE TIRES			ADJUST CAMBER TO SPECIFICATIONS	ADJUST TOE-IN TO SPECIFICATIONS	DYNAMIC OR STATIC BALANCE WHEELS	ROTATE TIRES AND INSPECT SUSPENSION SEE GROUP 2

*HAVE TIRE INSPECTED FOR FURTHER USE.

RN797

Fig. 15 Tire Wear Patterns

TIRES (Continued)

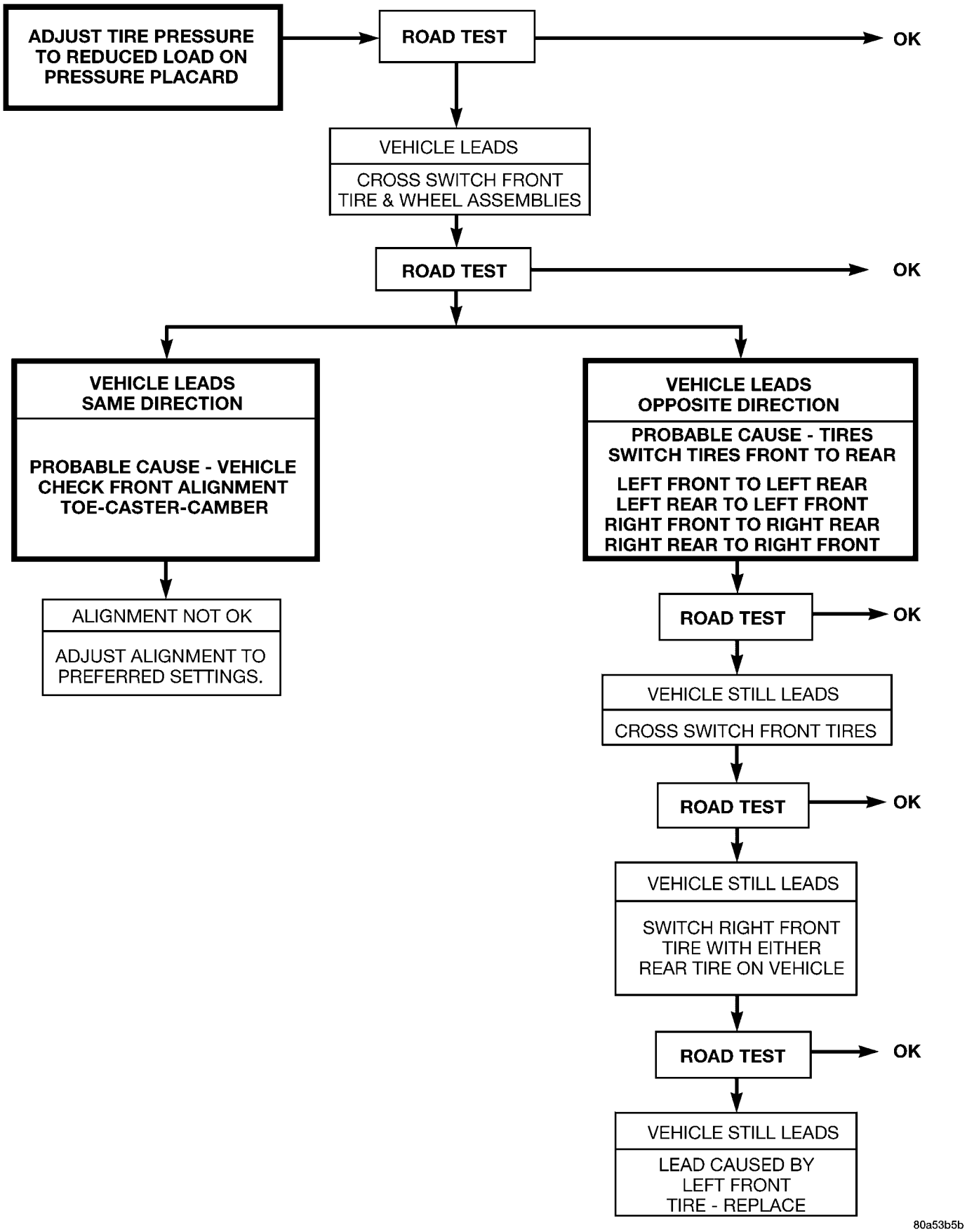


Fig. 16 VEHICLE LEAD DIAGNOSIS AND CORRECTION CHART

TIRES (Continued)

STANDARD PROCEDURE - 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. 17). 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, (Refer to 22 - TIRES/WHEELS/ WHEELS - SPECIFICATIONS).

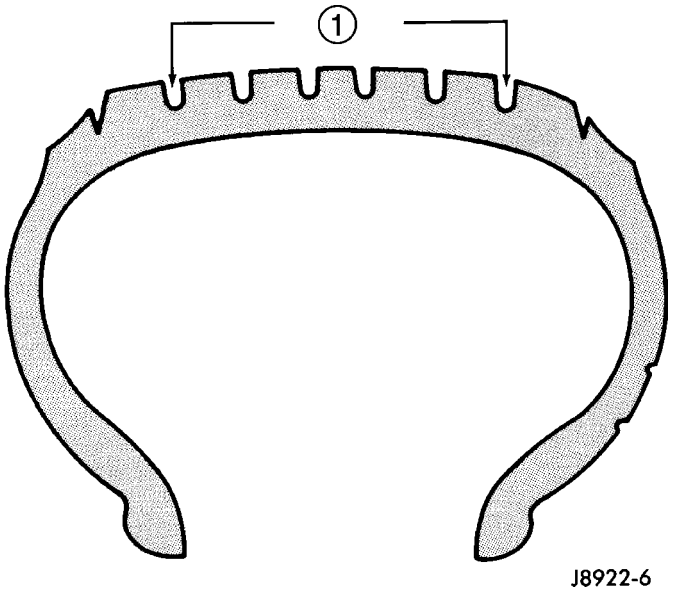


Fig. 17 TIRE REPAIR AREA

1 - TIRE REPAIR AREA

CLEANING

Remove the protective coating on the tires before delivery of a vehicle. This coating may cause deterioration of the tires.

To remove the protective coating, apply warm water and let it soak for a few minutes. Afterwards, 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 a wire brush for cleaning.

SPECIFICATIONS

TIRES

SPECIFICATIONS

DESCRIPTION	SPECIFICATION
TIRE	P225/70R15C LR D
TIRE	LT225/75R16 LR E
TIRE	P

SPARE TIRE CARRIER

REMOVAL

(1) Open the back doors.

(2) Loosen the bolts for the spare tire hold down (Fig. 18).

(3) Push up on the spare tire carrier and push the hold downs to the side and lower (Fig. 18).

(4) Remove the spare tire.

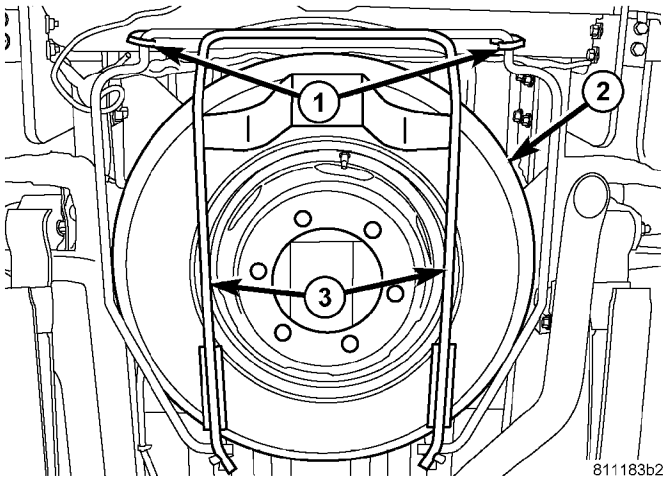


Fig. 18 SPARE TIRE

1 - HOLD DOWNS
2 - SPARE TIRE
3 - SPARE TIRE CARRIER

INSTALLATION

(1) Install the spare tire to the spare tire carrier (Fig. 18).

(2) Raise the tire and wheel assmbly and hook on the hold downs (Fig. 18).

(3) Then tighten the hold downs to secure the spare tire in place and then close the doors.

WHEELS

DESCRIPTION

Original equipment wheels are designed for the specified Maximum Vehicle Capacity.

All models use steel or aluminum wheels.

Aluminum wheels require special balance weights and alignment equipment.

(1) On vehicles equipped with dual rear wheels, The slots in the wheel must be aligned to provide access to the valve stem.

OPERATION

The wheel (Fig. 19) has raised sections between the rim flanges and the rim well. Initial inflation of the tire forces the bead over these raised sections. In case of tire failure, the raised sections hold the tire in position on the wheel until the vehicle can be brought to a safe stop.

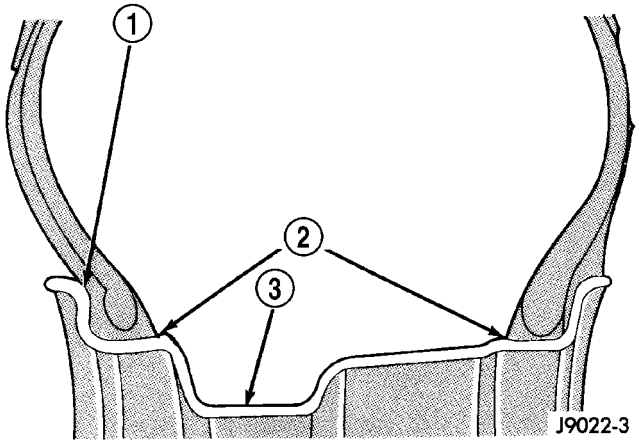


Fig. 19 Safety Rim

1 - FLANGE
2 - RIDGE
3 - WELL

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.

STANDARD PROCEDURE

STANDARD PROCEDURE - WHEEL REPLACEMENT

The wheel stud/lugs are designed for specific applications. They must be replaced with equivalent parts. Do not use replacement parts of lesser quality or a substitute design.

Before installing the wheel, be sure to remove any build up of corrosion on the wheel mounting surfaces. Ensure wheels are installed with good metal-to-metal contact. Improper installation could cause loosening of wheel nuts. This could affect the safety and handling of your vehicle.

To install the wheel, first position it properly on the mounting surface. All wheel nuts should then be tightened just snug. Gradually tighten them in sequence to the proper torque specification. **Never use oil or grease on studs.**

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.

WHEELS (Continued)

STANDARD PROCEDURE - DUAL REAR WHEEL INSTALLATION

The tires on both wheels must be completely raised off the ground when tightening the lug nuts. This will ensure correct wheel centering and maximum wheel clamping.

Before installing the wheel to the wheel ring flange make sure that all the cone washers are installed on the wheel flange ring (Fig. 20).

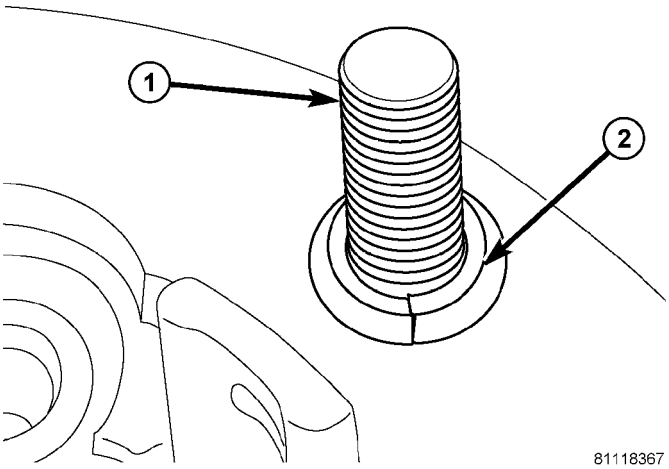


Fig. 20 WHEEL RING FLANGE CONE WASHERS

1 - WHEEL STUD
2 - CONE WASHER

The dual rear wheel lug nuts should be tightened according to the following procedure:

- Install the inner wheel to the hub assembly.
- Install the outer wheel **Make sure the valve stems line up with each when aligning the wheels (Fig. 21)**.

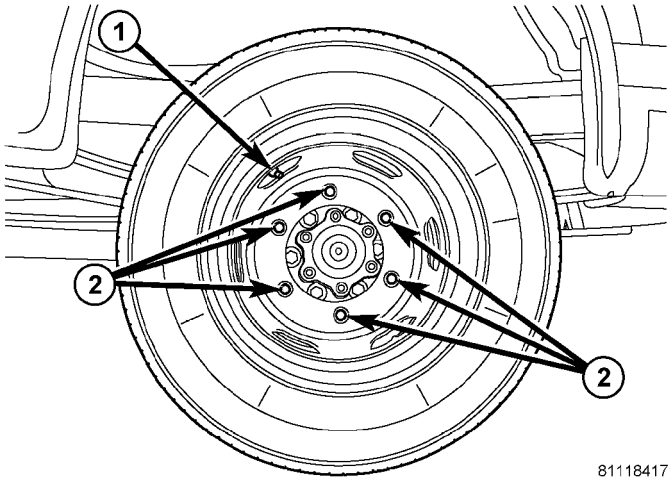


Fig. 21 DUAL REAR WHEEL

1 - VALVE STEMS
2 - LUG NUTS

- Install the cone washers for the outer wheel before installing the lug nuts (Fig. 22).

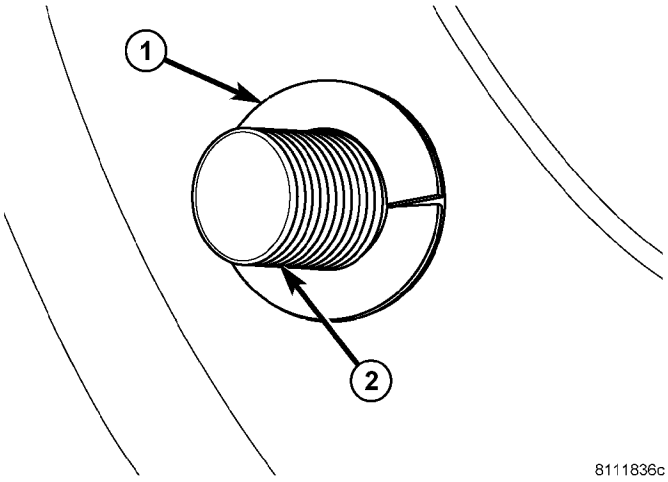


Fig. 22 (DRW) WHEEL CONE WASHERS

1 - CONE WASHER
2 - LUG STUD

- Tighten the wheel lug nuts in the numbered sequential pattern until they are snug tight. Then tighten lug nuts to specified torque following same number sequence, (Refer to 22 - TIRES/WHEELS/ WHEELS - SPECIFICATIONS).
- Tighten lug nuts in same numbered sequence a second time to the specified torque. This will ensure that the wheels are thoroughly mated.
- Check lug nut specified torque after 100 miles (160 kilometers). Also after 500 miles (800 kilometers) of vehicle operation.

NOTE: Wheel lug nuts should be tightened to specified torque at every maintenance interval thereafter.

WHEELS (Continued)

REMOVAL

(1) Raise and support the vehicle.
(2) Remove the wheel lug studs (SRW) (Fig. 24).
(3) Remove the lug nuts (DRW) **On vehicles with dual rear wheels do not pry off the front hub cap the lug nuts must be removed in order to remove the hub cap.** (Fig. 23).

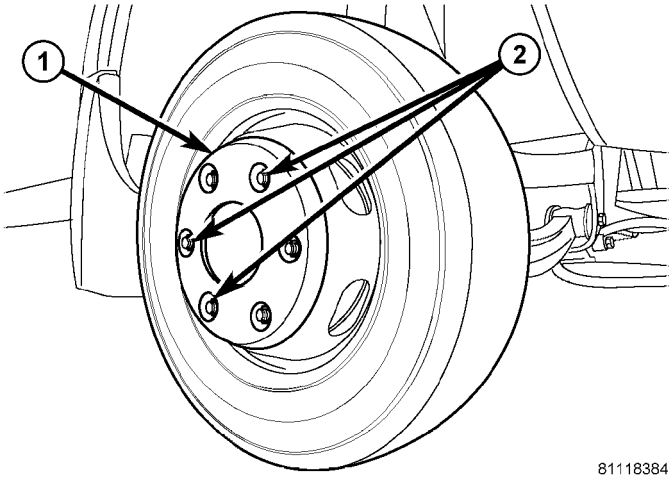


Fig. 23 FRONT TIRE (DRW)

1 - HUB CAP
2 - LUG NUT WITH HUB CAP HOLD DOWNS

(4) Remove the wheel and tire assembly.

INSTALLATION

(1) Install the wheel and tire assembly to the vehicle.
(2) Install the wheel lug studs (SRW) (Fig. 24) and tighten to specification(Refer to 22 - TIRES/WHEELS - SPECIFICATIONS) See specification table for model variations.

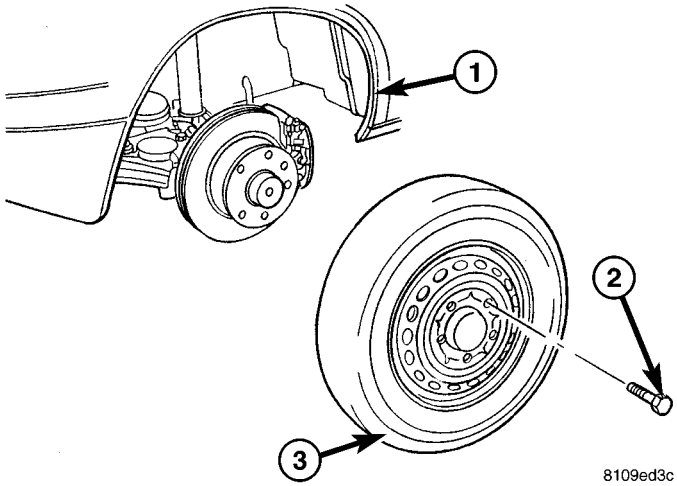


Fig. 24 WHEEL REMOVAL / INSTALLATION

1 - VEHICLE
2 - LUG/STUD
3 - TIRE & WHEEL ASSEMBLY

(3) Install the hub cap to the wheel then install snugly the lug nuts to hold the hub cap to the wheel (DRW) (Fig. 23).
(4) Install the wheel lug nuts (DRW) and tighten to specification(Refer to 22 - TIRES/WHEELS - SPECIFICATIONS) See specification table for model variations.
(5) Lower the vehicle.

BODY

TABLE OF CONTENTS

	page
BODY	
WARNING	
SAFETY PRECAUTIONS AND WARNINGS	1
DIAGNOSIS AND TESTING	
DIAGNOSIS AND TESTING - WATER LEAKS	1
DIAGNOSIS AND TESTING - WIND NOISE	2
STANDARD PROCEDURE	
STANDARD PROCEDURE - PLASTIC BODY PANEL REPAIR	3
STANDARD PROCEDURE - BUZZ, SQUEAK & RATTLE	10
SPECIFICATIONS	12
DOOR - FRONT	13
DOORS - REAR	24
DOORS - SLIDING	36
EXTERIOR	47
HOOD	50
INSTRUMENT PANEL	53
INTERIOR	67
PAINT	74
SEATS	76
STATIONARY GLASS	81
WEATHERSTRIP/SEALS	87
BODY STRUCTURE	88

BODY

WARNING

SAFETY PRECAUTIONS AND WARNINGS

WARNING: USE AN OSHA APPROVED BREATHING FILTER WHEN SPRAYING PAINT OR SOLVENTS IN A CONFINED AREA. PERSONAL INJURY CAN RESULT.

- **AVOID PROLONGED SKIN CONTACT WITH PETROLEUM OR ALCOHOL – BASED CLEANING SOLVENTS. PERSONAL INJURY CAN RESULT.**
- **DO NOT STAND UNDER A HOISTED VEHICLE THAT IS NOT PROPERLY SUPPORTED ON SAFETY STANDS. PERSONAL INJURY CAN RESULT.**

CAUTION: When holes must be drilled or punched in an inner body panel, verify depth of space to the outer body panel, electrical wiring, or other components. Damage to vehicle can result.

- **Do not weld exterior panels unless combustible material on the interior of vehicle is removed from the repair area. Fire or hazardous conditions, can result.**
- **Always have a fire extinguisher ready for use when welding.**
- **Disconnect the negative (-) cable clamp from the battery when servicing electrical components that are live when the ignition is OFF. Damage to electrical system can result.**
- **Do not use abrasive chemicals or compounds on painted surfaces. Damage to finish can result.**
- **Do not use harsh alkaline based cleaning solvents on painted or upholstered surfaces. Damage to finish or color can result.**
- **Do not hammer or pound on plastic trim panel when servicing interior trim. Plastic panels can break.**

DIAGNOSIS AND TESTING

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.

BODY (Continued)

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 LUBRICATION & MAINTENANCE/HOISTING - STANDARD PROCEDURE).

WATER LEAK DETECTION

To detect a water leak point-of-entry, do a water test and watch for water tracks or droplets forming on the inside of the vehicle. If necessary, remove interior trim covers or panels to gain visual access to the leak area. If the hose cannot be positioned without being held, have someone help do the water test.

Some water leaks must be tested for a considerable length of time to become apparent. When a leak appears, find the highest point of the water track or drop. The highest point usually will show the point of entry. After leak point has been found, repair the leak and water test to verify that the leak has stopped.

Locating the entry point of water that is leaking into a cavity between panels can be difficult. The trapped water may splash or run from the cavity, often at a distance from the entry point. Most water leaks of this type become apparent after accelerating, stopping, turning, or when on an incline.

MIRROR INSPECTION METHOD

When a leak point area is visually obstructed, use a suitable mirror to gain visual access. A mirror can also be used to deflect light to a limited-access area to assist in locating a leak point.

BRIGHT LIGHT LEAK TEST METHOD

Some water leaks in the luggage compartment can be detected without water testing. Position the vehicle in a brightly lit area. From inside the darkened luggage compartment inspect around seals and body seams. If necessary, have a helper direct a drop light over the suspected leak areas around the luggage compartment. If light is visible through a normally sealed location, water could enter through the opening.

PRESSURIZED LEAK TEST METHOD

When a water leak into the passenger compartment cannot be detected by water testing, pressurize the passenger compartment and soap test exterior of the vehicle. To pressurize the passenger compartment, close all doors and windows, start engine, and set heater control to high blower in HEAT position. If engine can not be started, connect a charger to the battery to ensure adequate voltage to the blower. With interior pressurized, apply dish detergent solution to suspected leak area on the exterior of the vehicle. Apply detergent solution with spray device or soft bristle brush. If soap bubbles occur at a body seam, joint, seal or gasket, the leak entry point could be at that location.

DIAGNOSIS AND TESTING - 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.

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.

STANDARD PROCEDURE

STANDARD PROCEDURE - PLASTIC BODY PANEL REPAIR

There are many different types of plastics used in today's automotive environment. We group plastics in three different categories: Rigid, Semi-Rigid, and Flexible. Any of these plastics may require the use of an adhesion promoter for repair. These types of plastic are used extensively on DaimlerChrysler Motors vehicles. Always follow repair material manufacturer's plastic identification and repair procedures.

Rigid Plastics:

Examples of rigid plastic use: Fascias, Hoods, Doors, and other Body Panels, which include SMC, ABS, and Polycarbonates.

Semi-Rigid Plastics:

Examples of semi-rigid plastic use: Interior Panels, Under Hood Panels, and other Body Trim Panels.

Flexible Plastics:

Examples of flexible plastic use: Fascias, Body Moldings, and upper and lower Fascia Covers.

Repair Procedure:

The repair procedure for all three categories of plastics is basically the same. The one difference is the material used for the repair. The materials must be specific for each substrate, rigid repair material for rigid plastic repair, semi-rigid repair material for semi-rigid plastic repair and flexible repair material for flexible plastic repair.

Adhesion Promoter/Surface Modifier:

Adhesion Promoters/Surface Modifiers are required for certain plastics. All three categories may have plastics that require the use of adhesion promoter/surface modifiers. Always follow repair material manufacturer's plastic identification and repair procedures.

SAFETY PRECAUTION AND WARNINGS

WARNING:

- **EYE PROTECTION SHOULD BE USED WHEN SERVICING COMPONENTS. PERSONAL INJURY CAN RESULT.**
- **USE AN OSHA APPROVED BREATHING MASK WHEN MIXING EPOXY, GRINDING, AND SPRAYING PAINT OR SOLVENTS IN A CONFINED AREA. PERSONAL INJURY CAN RESULT.**
- **AVOID PROLONGED SKIN CONTACT WITH RESIN, PETROLEUM, OR ALCOHOL BASED SOLVENTS. PERSONAL INJURY CAN RESULT.**
- **DO NOT VENTURE UNDER A HOISTED VEHICLE THAT IS NOT PROPERLY SUPPORTED ON SAFETY STANDS. PERSONAL INJURY CAN RESULT.**

NOTE:

- **When holes must be drilled or cut in body panels, verify locations of internal body components and electrical wiring. Damage to vehicle can result.**
- **Do not use abrasive chemicals or compounds on undamaged painted surfaces around repair areas. Damage to finish can result.**

BODY (Continued)

RIGID, SEMI-RIGID, AND FLEXIBLE PLASTIC PARTS TYPES

CODE	FAMILY NAME	COMMON TRADE NAME	TYPICAL APPLICATION
ASA	ACRYLONITRILE STYRENE ACRYLITE	LURAN S	CONSOLES, GRILLES
ABS	ACRYLONITRILE BUTADIENE STYRENE	TERLURAN	″A″ PILLARS, CONSOLES, GRILLES
ABS/PC	ABS/PC ALLOY	PULSE, PROLOY, BAYBLEND	DOORS, INSTRUMENT PANELS
ABS/PVC	ABS/PV ALLOY	PROLOY, PULSE, LUSTRAN, CYCLOVIN	DOOR PANELS, GRILLES, TRIM
BMC	BULK MOLDING COMPOUND	BMC	FENDER EXTENSIONS
EMA	EHTYLENE METHYL ACRYLATE/IONOMER	SURLYN, EMA, IONOMER	BUMPER GUARDS, PADS
METTON	METTON	METTON	GRILLES, KICK PANELS, RUNNING BOARDS
MPPO	MODIFIED POLYPHENYLENE OXIDE	MPPO	SPOILER ASSEMBLY
PA	POLYAMID	ZYTEL, VYDYNE, PA, MINLON	FENDERS, QUARTER PANELS
PET	THERMOPLASTIC POLYESTER	RYNITE	TRIM
PBT/PPO	PBT/PPO ALLOY	GERMAX	CLADDINGS
PBTP	POLYBUTYLENE THEREPTHALATE	PBT, PBTP, POCAN, VALOX	WHEEL COVERS, FENDERS, GRILLES
PBTP/EEBC	POLYBUTYLENE THEREPTHALATE/EEBC ALLOY	BEXLOY, ″M″, PBTP/EEBC	FASCIAS, ROCKER PANEL, MOLDINGS
PC	POLYCARBONATE	LEXAN, MERLON, CALIBRE, MAKROLON PC	TAIL LIGHT LENSES, IP TRIM, VALANCE PANELS
PC/ABS	PC/ABS ALLOY	GERMAX, BAY BLENDS, PULSE	DOORS, INSTRUMENT PANELS
PPO	POLYPHENYLENE OXIDE	AZDEL, HOSTALEN, MARLEX, PRFAX, NORYL, GTX, PPO	INTERIOR TRIM, DOOR PANELS, SPLASH SHIELDS, STEERING COLUMN SHROUD
PPO/PA	POLYPHENYLENE/ POLYAMID	PPO/PA, GTX 910	FENDERS, QUARTER PANELS
PR/FV	FIBERGLASS REINFORCED PLASTIC	FIBERGLASS, FV, PR/FV	BODY PANELS
PS	POLYSTYRENE	LUSTREX, STYRON, PS	DOOR PANELS, DASH PANELS
RTM	RESIN TRANSFER MOLDING COMPOUND	RTM	BODY PANELS
SMC	SHEET MOLDED COMPOUND	SMC	BODY PANELS

BODY (Continued)

CODE	FAMILY NAME	COMMON TRADE NAME	TYPICAL APPLICATION
TMC	TRANSFER MOLDING COMPOUND	TMC	GRILLES
UP	UNSATURATED POLYESTER (THERMOSETTING)	SMC, BMC, TMC, ZMC, IMC, XSMC, UP	GRILLE OPENING PANEL, LIFTGATES, FLARESIDE FENDERS, FENDER EXTENSIONS
EEBC	ETHER/ESTER BLOCKED CO-POLYMER	EEBC	BUMPERS
EEBC/PBTP	EEBC/POLYBUTYLENE TEREPTHALATE	EEBC, PBTP, BEXLOY	BUMPER, ROCKER PANELS
EMPP	ETHYLENE MODIFIED POLYPROPYLENE	EMPP	BUMPER COVERS
EPDM	ETHYLENE/ PROPROPYLENE DIENE MONOMER	EPDM, NORDEL, VISTALON	BUMPERS
EPM	ETHYLENE/ PROPROPYLENE CO-POLYMER	EPM	FENDERS
MPU	FOAM POLYURETHANE	MPU	SPOILERS
PE	POLYETHYLENE	ALATHON, DYLAN, LUPOLEN, MARLEX	-
PP	POLYPROPYLENE (BLENDS)	NORYL, AZDEL, MARLOX, DYLON, PRAVEX	INNER FENDER, SPOILERS, KICK PANELS
PP/EPDM	PP/EPDM ALLOY	PP/EPDM	SPOILERS, GRILLES
PUR	POLYURETHANE	COLONELS, PUR, PU	FASCIAS, BUMPERS
PUR/PC	PUR/PC ALLOY	TEXIN	BUMPERS
PVC	POLYVINYL CHLORIDE	APEX, GEON, VINYLITE	BODY MOLDINGS, WIRE INSULATION, STEERING WHEELS
RIM	REACTION INJECTED MOLDED POLYURETHANE	RIM, BAYFLEX	FRONT FASCIAS, MODULAR WINDOWS
RRIM	REINFORCED REACTION INJECTED MOLDED	PUR, RRIM	FASCIAS, BODY PANELS, BODY TRIMS
TPE	THERMO POLYETHYLENE	TPE, HYTREL, BEXLOY-V	FASCIAS, BUMPERS, CLADDINGS
TPO	THERMOPOLYOLEFIN	POLYTROPE, RENFLEX, SANTOPRENE, VISAFLEX, ETA, APEX, TPO, SHIELDS, CLADDINGS	BUMPERS, END CAPS, TELCAR, RUBBER, STRIPS, SIGHT, INTERIOR B POST
TPP	THERMO-POLYPROPYLENE	TPP	BUMPERS
TPU	THERMOPOLYURETHANE, POLYESTER	TPU, HYTREL, TEXIN, ESTANE	BUMPERS, BODY SIDE, MOLDINGS, FENDERS, FASCIAS

BODY (Continued)

PANEL SECTIONING

If it is required to section a large panel for a plastic repair, it will be necessary to reinforce the panel (Fig. 1). To bond two plastic panels together, a reinforcement must overlap both panels. The panels must be “V’d” at a 20 degree angle. The area to be reinforced should be washed, then sanded. Be sure to wipe off any excess soap and water when finished. Lightly sand or abrade the plastic with an abrasive pad or sandpaper. Blow off any dust with compressed air or wipe with a clean dry rag.

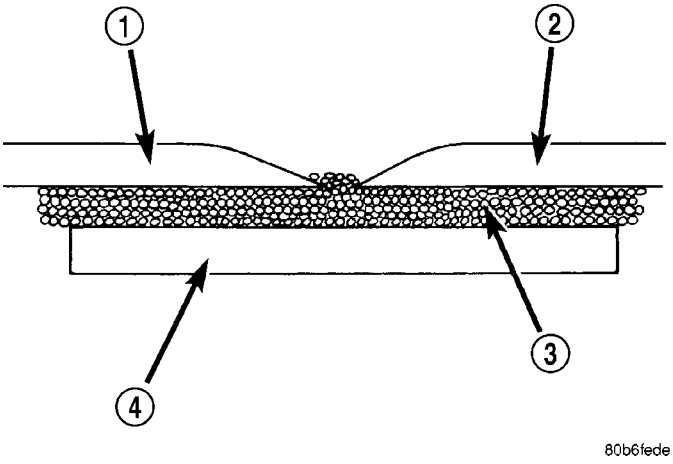


Fig. 1 PANEL SECTIONING

1 - EXISTING PANEL
2 - NEW PANEL
3 - PANEL ADHESIVE
4 - BONDING STRIP

When bonding plastic panels, Follow repair material manufacturers recommendations. Be sure that enough adhesive has been applied to allow squeeze out and to fill the full bond line. Once the pieces have been brought together, do not move them until the adhesive is cured. The assembly can be held together with clamps, rivets, etc. A faster cure can be obtained by heating with a heat lamp or heat gun. After the parts have been bonded and have had time to cure, rough sand the seam and apply the final adhesive filler to the area being repaired. Smooth the filler with a spreader, wooden tongue depressor, or squeegee. For fine texturing, a small amount of water can be applied to the filler surface while smoothing. The cured filler can be sanded as necessary and, as a final step, cleanup can be done with soapy water. Wipe the surface clean with a dry cloth allowing time for the panel to dry before moving on with the repair.

PANEL REINFORCEMENT

Structural repair procedures for rigid panels with large cracks and holes will require a reinforcement backing. Reinforcements can be made with several applications of glass cloth saturated with structural adhesive. Semi-rigid or flexible repair materials should be used for semi-rigid or flexible backing reinforcement (Fig. 2) and (Fig. 3). Open meshed fiberglass dry wall tape can be used to form a reinforcement. The dry wall tape allows the resin to penetrate through and make a good bond between the panel and the adhesive. Structurally, the more dry wall tape used, the stronger the repair.

Another kind of repair that can be done to repair large cracks and holes is to use a scrap piece of similar plastic and bond with structural adhesive. The reinforcement should cover the entire break and should have a generous amount of overlap on either side of the cracked or broken area.

When repairing plastic, the damaged area is first “V’d” out, or beveled. Large bonding areas are desirable when repairing plastic because small repairs are less likely to hold permanently. Beveling the area around a crack at a 20 degree angle will increase the bonding surface for a repair (Fig. 4). It is recommended that sharp edges be avoided because the joint may show through after the panel is refinished.

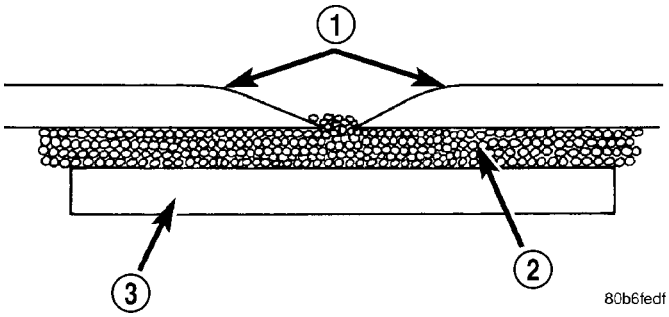


Fig. 2 SOFTENED EDGES

1 - SOFTENED EDGES
2 - PANEL ADHESIVE
3 - BONDING STRIP

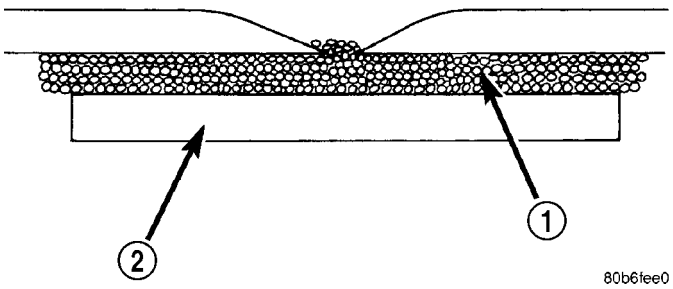


Fig. 3 PANEL REINFORCEMENT

1 - PANEL ADHESIVE
2 - REINFORCEMENT

- Panel repair for both flexible and rigid panels are basically the same. The primary difference between flexible panel repair and rigid panel repair is in the adhesive materials used (Fig. 5).

BODY (Continued)

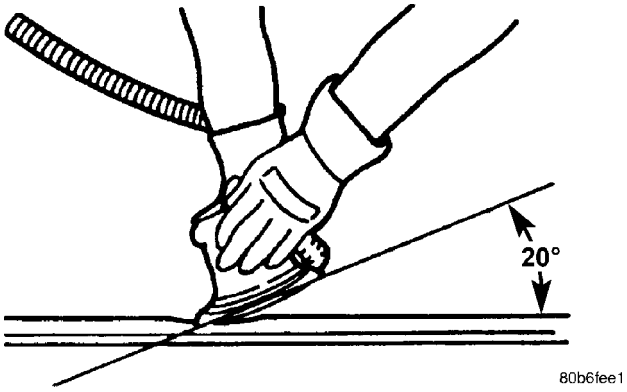


Fig. 4 BEVELING ANGLE - 20 DEGREE

- The technician should first decide what needs to be done when working on any type of body panel. One should determine if it is possible to return the damage part to its original strength and appearance without exceeding the value of the replacement part.
- When plastic repairs are required, it is recommended that the part be left on the vehicle when every possible. That will save time, and the panel will remain stationary during the repair. Misalignment can cause stress in the repair areas and can result in future failure.

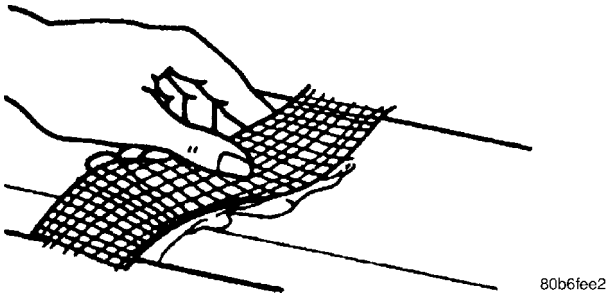


Fig. 5 FIBERGLASS TAPE

VISUAL INSPECTION

Composite materials can mask the severity of an accident. Adhesive bond lines, interior structure of the doors, and steel structures need to be inspected carefully to get a true damage assessment. Close inspection may require partial removal of interior trim or inner panels.

Identify the type of repair: Puncture or Crack - Damage that has penetrated completely through the panel. Damage is confined to one general area; a panel section is not required. However, a backer panel, open fiberglass tape, or matted material must be bonded from behind (Fig. 7) (Fig. 6).

PANEL SURFACE PREPARATION

If a body panel has been punctured, cracked, or crushed, the damaged area must be removed from the panel to achieve a successful repair. All spider web cracks leading away from a damaged area must be stopped or removed. To stop a running crack in a panel, drill a 6 mm (0.250 in.) hole at the end of the crack farthest away from the damage. If spider web cracks can not be stopped, the panel would require replacement. The surfaces around the damaged area should be stripped of paint and freed from wax and oil. Scuff surfaces around repair area with 360 grit wet/dry sandpaper, or equivalent, to assure adhesion of repair materials.

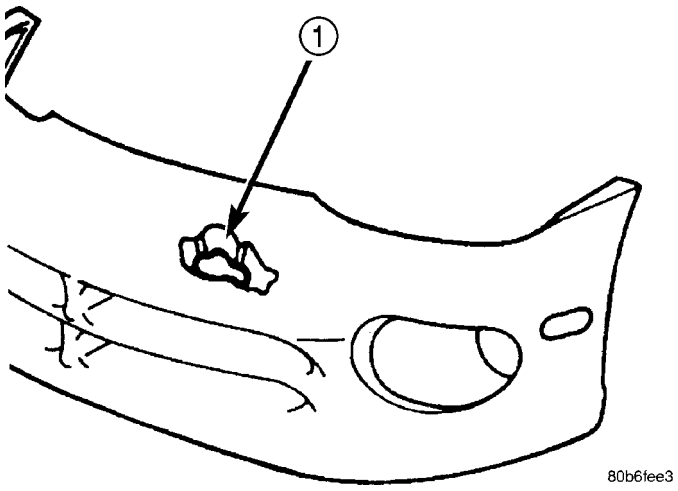


Fig. 6 DAMAGE COMPONENT

1 - PUNCTURE

PATCHING PANELS

An panel that has extensive puncture type damage can be repaired by cutting out the damaged material (Fig. 7). Use a suitable reciprocating saw or cut off wheel to remove the section of the panel that is damaged. The piece cut out can be used as a template to shape the new patch. It is not necessary to have access to the back of the panel to install a patch. Bevel edges of cutout at 20 degrees to expose a larger bonding area on the outer side. This will allow for an increased reinforcement areas.

PANEL PATCH FABRICATIONS

A patch can be fabricated from any rigid fiberglass panel that has comparable contour with the repair area. Lift gates and fenders can be used to supply patch material. If existing material is not available or compatible, a patch can be constructed with adhesive and reinforcement mesh (dry wall tape). Perform the following operation if required:

(1) Cover waxed paper or plastic with adhesive backed nylon mesh (dry wall tape) larger than the patch required (Fig. 8).

(2) Tape waxed paper or plastic sheet with mesh to a surface that has a compatible contour to the repair area.

BODY (Continued)

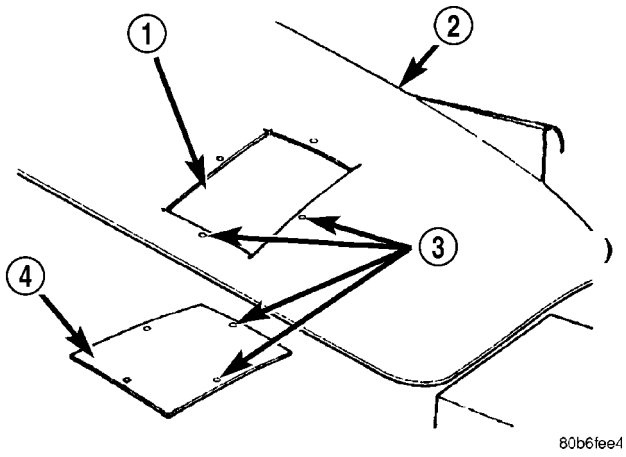


Fig. 7 DAMAGED PANEL CUTOUT AND PATCH

1 - CUTOUT
2 - DAMAGED BODY PANEL
3 - 4 MM (0.160 IN.) HOLES
4 - PATCH CUT TO SIZE

(3) Apply a liberal coat of adhesive over the reinforcement mesh (Fig. 8). If necessary apply a second or third coat of adhesive and mesh after firs coat has cured. The thickness of the patch should be the same as the repair area.

(4) After patch has cured, peel waxed paper or plastic from the back of the patch.

(5) If desired, a thin film coat of adhesive can be applied to the back of the patch to cover mesh for added strength.

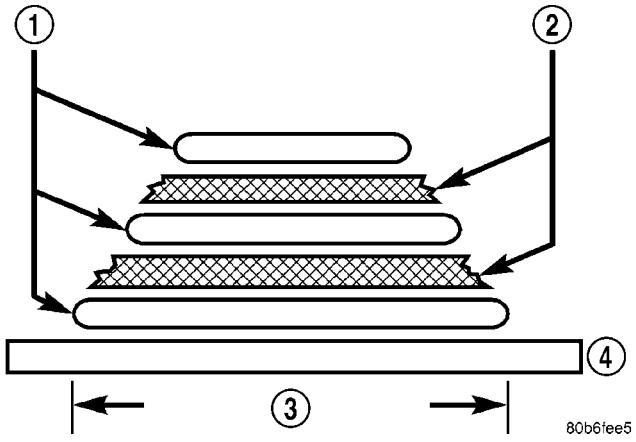


Fig. 8 FABRICATED PANEL

1 - STRUCTURAL ADHESIVE
2 - FIBERGLASS CLOTH OR FIBERGLASS MESH TAPE
3 - WIDTH OF V-GROOVE
4 - WAXED PAPER

PANEL PATCH INSTALLATION

(1) Make a paper or cardboard pattern the size and shape of the cutout hole in the panel.

(2) Trim 3 mm (0.125 in.) from edges of pattern so patch will have a gap between connecting surfaces.

(3) Using the pattern as a guide, cut the patch to size.

(4) Cut scrap pieces of patch material into 50 mm (2 in.) squares to use as patch supports to sustain the patch in the cutout.

(5) Drill 4 mm (0.160 in.) holes 13 mm (0.5 in.) in from edge of cutout hole (Fig. 7).

(6) Drill 4 mm (0.160 in.) holes 13 mm (0.5 in.) away from edge of patch across from holes drilled around cutout.

(7) Drill 3 mm (0.125 in.) holes in the support squares 13 mm (0.5 in.) from the edge in the center of one side.

(8) Scuff the backside of the body panel around the cutout hole with a scuff pad or sandpaper.

(9) Mix enough adhesive to cover one side of all support squares.

(10) Apply adhesive to cover one side of all support squares.

(11) Using number 8 sheet metal screws, secure support squares to back side of body panel with adhesive sandwiched between the panel and squares (Fig. 9).

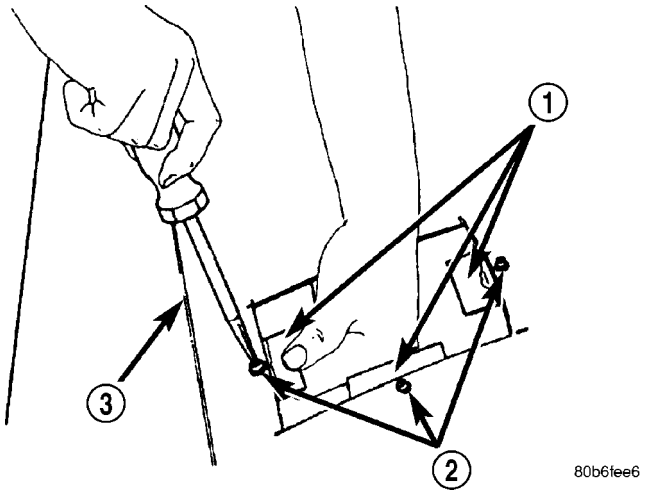


Fig. 9 SECURE SUPPORT SQUARES TO BODY PANEL

1 - SUPPORT SQUARES
2 - SCREWS
3 - DAMAGED BODY PANEL

BODY (Continued)

(12) Position patch in cutout against support squares and adjust patch until the gap is equal along all sides (Fig. 10).

(13) Drill 3 mm (0.125 in.) holes in the support squares through the pre-drilled holes in the patch.

(14) Apply a coat of adhesive to the exposed ends of the support squares (Fig. 11).

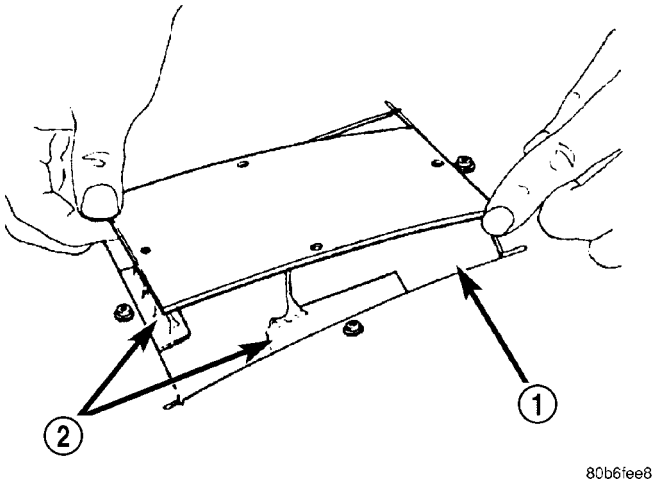


Fig. 10 POSITION PATCH IN CUTOUT AND ALIGN

1 - CUTOUT
2 - SUPPORT SQUARES

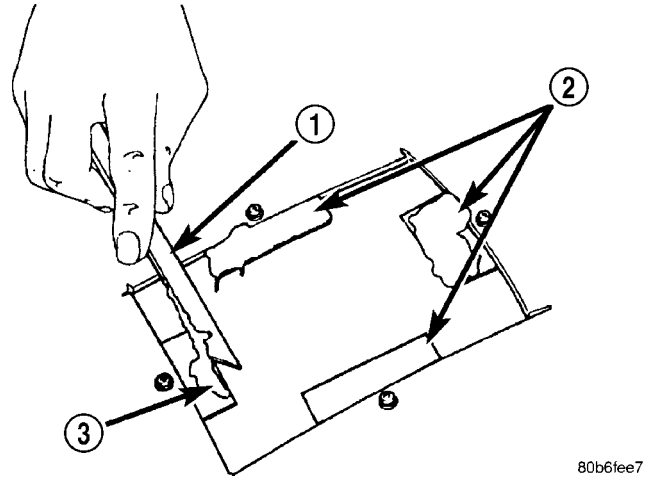


Fig. 11 APPLY ADHESIVE TO SUPPORT SQUARES

1 - APPLICATOR
2 - SUPPORT SQUARES
3 - ADHESIVE

(15) Install screws to hold the patch to support squares (Fig. 12). Tighten screws until patch surface is flush with panel surface.

(16) Allow adhesive to cure, and remove all screws.

(17) Using a 125 mm (5 in.) 24 grit disc grinder, grind a 50 mm (2 in.) to 75 mm (3 in.) wide and 2 mm (0.080 in.) deep path across the gaps around the patch (Fig. 13). With compressed air, blow dust from around patch.

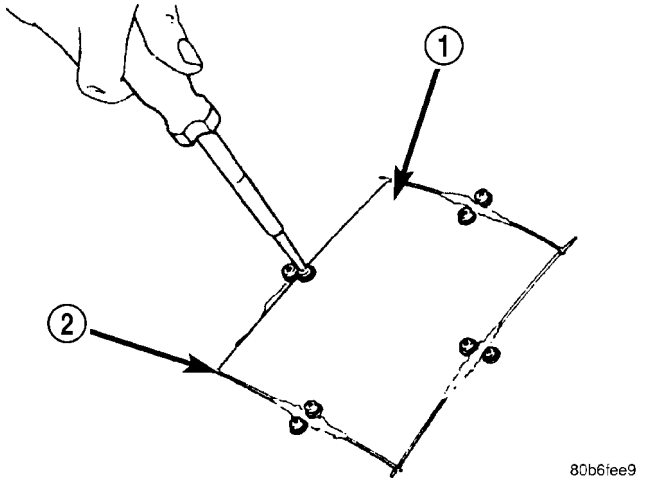


Fig. 12 INSTALL SCREWS

1 - PATCH
2 - GAP

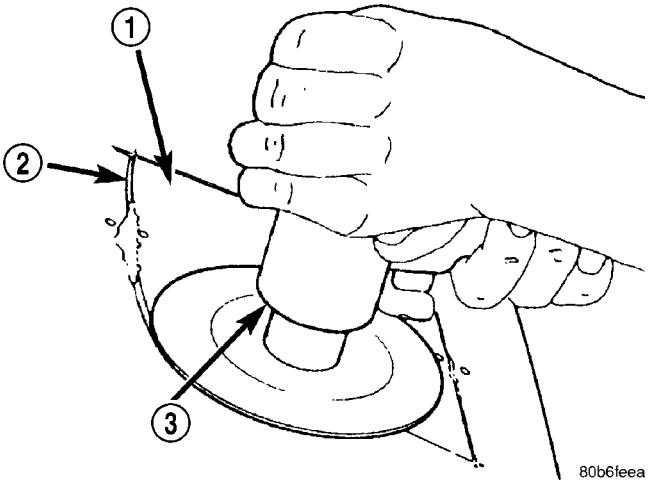


Fig. 13 GRIND SURFACE

1 - PATCH
2 - GAP
3 - DISC GRINDER

(18) Apply adhesive backed nylon mesh (dry wall tape) over gaps around patch (Fig. 14).

(19) Mix enough adhesive to cover the entire patch area.

(20) Apply adhesive over the mesh around patch, and smooth epoxy with a wide spreader to reduce finish grinding. Use two to three layers of mesh and adhesive to create a stronger repair (Fig. 15).

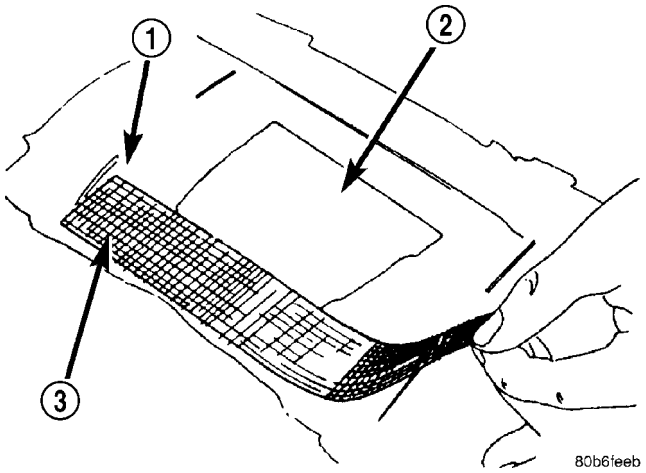


Fig. 14 COVER GAPS WITH MESH

1 - GROUND DOWN AREA
2 - PATCH
3 - MESH

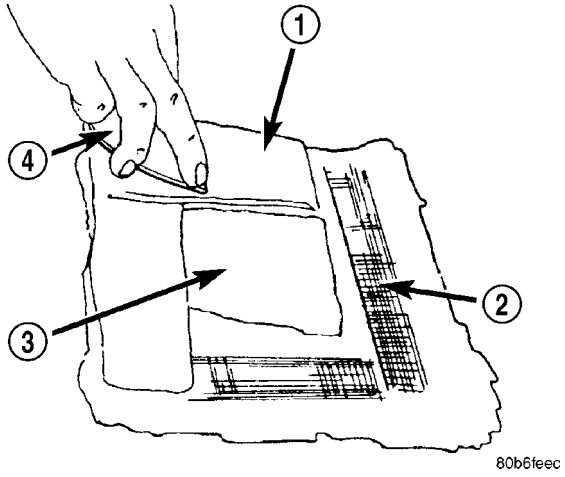


Fig. 15 COVER MESH WITH ADHESIVE

1 - ADHESIVE
2 - MESH
3 - PATCH
4 - SPREADER

PATCHED PANEL SURFACING

After patch panel is installed, the patch area can be finished using the same methods as finishing other types of body panels. If mesh material is exposed in the patched area, grind surface down, and apply a coat of high quality rigid plastic body filler. Prime, block sand, and paint as required.

STANDARD PROCEDURE - BUZZ, SQUEAK & RATTLE

Buzz, Squeak & Rattles (BSR) may be caused by any one or more of the following and may be corrected as indicated:

- Loose fasteners should be tightened to specifications.
- Damaged or missing clips should be replaced.
- Damaged trim panels should be replaced.
- Incorrectly installed trim panels should be reinstalled properly.

Many BSR complaints such as loose trim, can be serviced using the Mopar® Parts BSR Noise Reduction Kit. This kit contains various tapes including foam, flock and anti-squeak used to eliminate noises caused by metal, plastic and vinyl components. Long life lubricants and greases can also be used on a variety of components. Refer to the Buzz, Squeak & Rattle Kit table for material contents and usage.

BODY (Continued)

BUZZ, SQUEAK & RATTLE KIT

ITEM	FEATURES	APPLICATIONS	SERVICE TEMP
Itch And Squeak Tape	An abrasion resistant material thin enough to conform to most irregular surfaces. Stops most itches and squeaks.	Between metal and metal, metal and plastic, metal and vinyl, vinyl and plastic. Interior. Examples: Trim panels and bezels.	-40° to 225° Fahrenheit (-40° to 107° Celsius)
Black Nylon Flock	Nylon Flock with an aggressive acrylic adhesive. Provides for cushioning and compression fit, also isolates components. Water-resistant.	Between metal and metal, metal and plastic, vinyl and plastic. Examples: Pull cups, bezels, clips, ducts, top cover to glass, cowl panel.	-40° to 180° Fahrenheit (-40° to 82° Celsius)
High Density Urethane Foam	Tear resistant, highly resilient and durable.	Between metal and metal, metal and plastic. Water-resistant. Examples: I/P, heavy metal rattles, isolating brackets.	-40° to 180° Fahrenheit (-40° to 82° Celsius)
Open Cell Foam Tape	Soft foam conforms to irregular surfaces.	Wire harness and connector wrap. Examples: Seals, gasket, wiring, heat ducts.	-40° to 180° Fahrenheit (-40° to 82° Celsius)
Closed Cell Low Density Foam Tape	Soft, conformable. Water-resistant.	Wherever bulk is needed. Prevents closing flutters and rattles when applied to door watershield. Examples: Door, I/P.	-40° to 180° Fahrenheit (-40° to 82° Celsius)
NYE® Grease 880	Long life.	Suspensions. Examples: Strut busings, sway bars.	-40° to 390° Fahrenheit (-40° to 200° Celsius)
Krytox® Oil	Long life. Will not dry out or harm plastics or rubber.	When access is not possible, oil will migrate to condition. Vinyl, rubber, plastic, metal. Examples: Convertible top bushings, pull cups trim panel inserts.	-30° to 400° Fahrenheit (-34° to 205° Celsius)
Krytox® Grease	Long life. Will not dry out or harm plastics or rubber.	Vinyl, rubber, plastic, metal, glass. Examples: Weather-strips, backlite and windshield moldings.	-30° to 400° Fahrenheit (-34° to 205° Celsius)

BODY (Continued)

SPECIFICATIONS

TORQUE SPECIFICATIONS

DESCRIPTION	N·m	Ft. Lbs.	In. Lbs.
Front door check bracket bolt/nut	6	—	53
Front door check to a-pillar M6 bolts	10	—	89
Front door check to a-pillar M8 bolts	35	26	—
Front door check to door fasteners	10	—	89
Front door exterior handle	10	—	89
Front door hinge bolts	25	18	—
Front door latch assembly bolts	10	—	89
Front door latch striker bolts	28	18	—
Front door regulator carrier plate bolts	10	—	89
Front door reinforcement bolts	21	15	—
Front door striker bolts	25	18	—
Front seat back mounting bolts	20	15	—
Front seat back stop bolt	20	15	—
Front seat mounting bolts	25	18	—
Hood hinge bolts/nuts	23	17	—
Lower seat belt anchor bolt	35	26	—
Radiator crossmember bolts	14	10	—
Rear door check bolts	10	—	89
Rear door exterior handle bolts	10	—	89
Rear door hinge bolts	25	18	—
Rear door upper closing wedge screws	10	—	89
Side view mirror bolts	25	18	—
Sliding door center guide rail end piece screws	10	—	89
Sliding door center roller arm bolt	45	33	—
Sliding door center track bolts/nuts	10	—	89
Sliding door inside handle screw	10	—	89
Sliding door latch screws	10	—	89
Sliding door latch/lock control bolts	10	—	89
Sliding door lower roller arm to door screws	25	18	—
Sliding door reinforcement bolts	21	15	—
Sliding door stabilizer screws	10	—	89
Sliding door stop bumper screws	10	—	89
Sliding door striker	25	18	—
Sliding door upper roller arm to door screws	25	18	—
Steering column support bolts	25	18	—

DOOR - FRONT

TABLE OF CONTENTS

page

CHECK
REMOVAL 13
INSTALLATION 13
DOOR
REMOVAL 14
INSTALLATION 14
ADJUSTMENTS
ADJUSTMENT 15
DOOR GLASS
REMOVAL 15
INSTALLATION 15
EXTERIOR HANDLE
REMOVAL 16
INSTALLATION 16
HINGE
REMOVAL 17
INSTALLATION 17
LATCH
REMOVAL 18
INSTALLATION 18
LATCH STRIKER
REMOVAL 18
INSTALLATION 18
LOCK CYLINDER
REMOVAL 18
INSTALLATION 18
TRIM PANEL
REMOVAL 19
INSTALLATION 20
WINDOW REGULATOR - POWER
REMOVAL 20
INSTALLATION 21
WINDOW REGULATOR - MANUAL
REMOVAL 22
INSTALLATION 23

CHECK

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove trim panel. (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - REMOVAL)

(3) Remove a-pillar bolts. (Fig. 1)

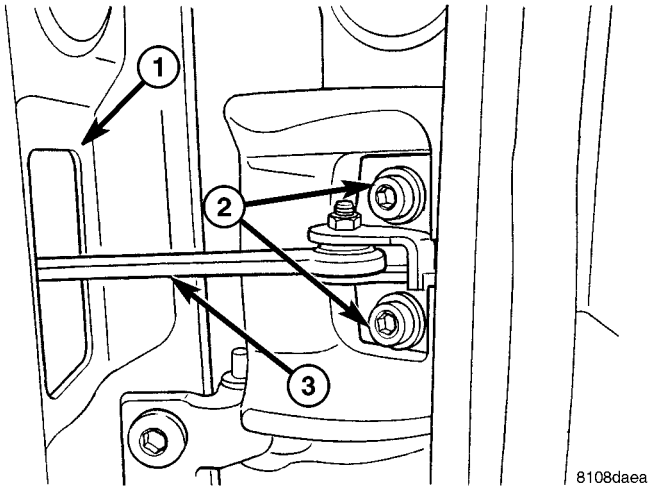


Fig. 1 FRONT DOOR CHECK - BODY

1 - DOOR
2 - A-PILLAR BOLTS
3 - DOOR CHECK

(4) Remove the bolt/nut and remove check bracket. (Fig. 2)

(5) Remove the door fasteners and remove check from door.

INSTALLATION

(1) Install check through door opening and install the fasteners.

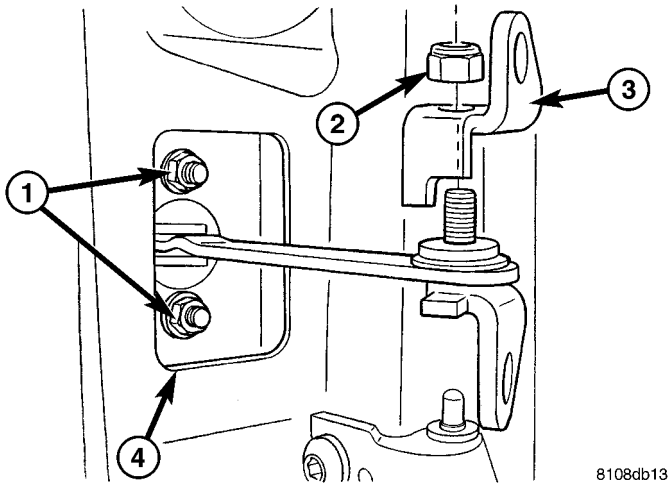


Fig. 2 FRONT DOOR CHECK - DOOR

1 - DOOR FASTENERS
2 - CHECK BRACKET NUT
3 - CHECK BRACKET
4 - DOOR OPENING

CHECK (Continued)

(2) Tighten door fasteners to 10 N·m (89 in. lbs.).
(3) Install bracket onto check and install bracket bolt/nut.
(4) Tighten bracket bolt/nut to 6 N·m (53 in. lbs.).
(5) Install check bracket onto a-pillar.
(6) Apply Loctite® 243 sealant check strap bolts and install bolts.
(7) Tighten the M8 bolts to 35 N·m (26 ft. lbs.) or tighten the M6 bolts to 10 N·m (89 in. lbs.).
(8) Install trim panel. (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - INSTALLATION)
(9) Connect battery negative cable.

DOOR

REMOVAL

(1) Disconnect and isolate battery negative cable.
(2) Remove mirror. (Refer to 23 - BODY/EXTERIOR/SIDE VIEW MIRROR - REMOVAL)
(3) Position aside the wiring boot and disconnect the electrical connectors. (Fig. 3)

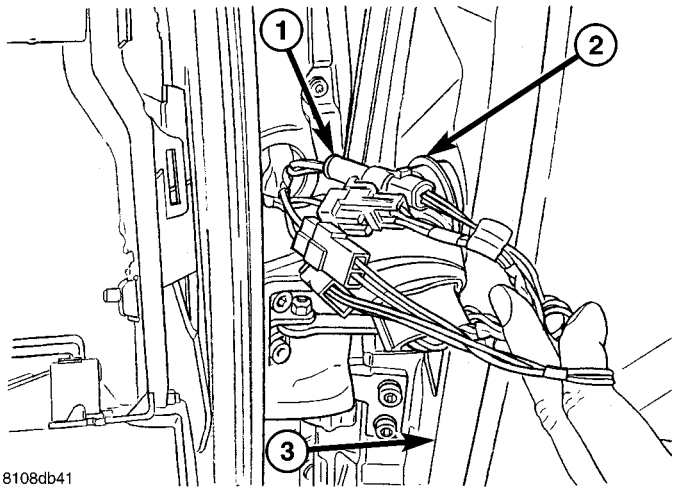


Fig. 3 ELECTRICAL CONNECTORS

1 - ELECTRICAL CONNECTORS
2 - BOOT
3 - DOOR

(4) Remove the bolts and disconnect the door check from the a-pillar. (Fig. 4)
(5) Support door with a suitable device.
(6) Loosen the hinge set screws. (Fig. 5)
(7) Remove door by lifting off hinge pins.

INSTALLATION

(1) Slide door into hinges.
(2) Install set screws.
(3) Install check bracket onto a-pillar.
(4) Apply Loctite® 243 sealant check strap bolts and install bolts.

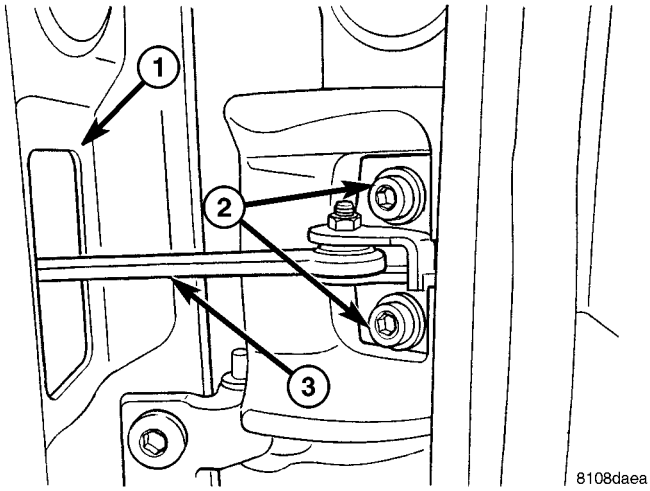


Fig. 4 FRONT DOOR CHECK - BODY

1 - DOOR
2 - A-PILLAR BOLTS
3 - DOOR CHECK

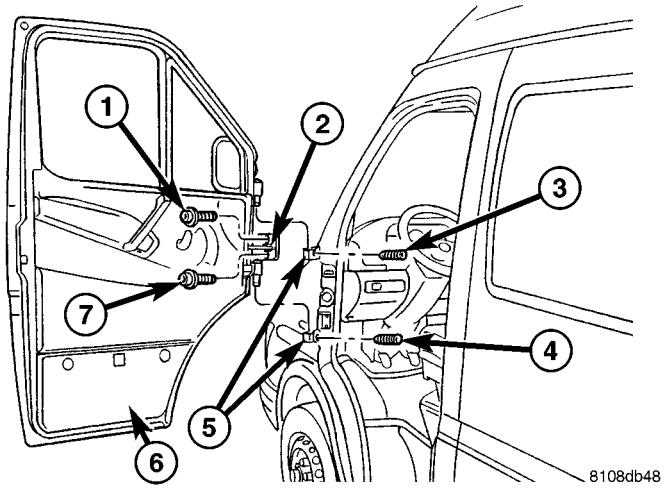


Fig. 5 FRONT DOOR

1 - UPPER CHECK BOLT
2 - DOOR CHECK
3 - UPPER HINGE SET SCREW
4 - LOWER HINGE SET SCREW
5 - HINGE RECEIVERS
6 - DOOR
7 - LOWER CHECK BOLT

(5) Tighten the M8 bolts to 35 N·m (26 ft. lbs.) or tighten the M6 bolts to 10 N·m (89 in. lbs.).
(6) Connect all door electrical connectors and position boot back.
(7) Install mirror. (Refer to 23 - BODY/EXTERIOR/SIDE VIEW MIRROR - INSTALLATION)
(8) Adjust door if required. (Refer to 23 - BODY/DOOR - FRONT/DOOR - ADJUSTMENTS)
(9) Connect battery negative cable.

DOOR (Continued)

ADJUSTMENTS

ADJUSTMENT

NOTE: Door adjustment measurements should be taken from stationary or welded body panels like the roof, rocker or quarter panels.

- **During adjustment procedures, it is recommended that all the hinge fasteners be loosened except for the upper most fasteners. Adjustments can be made using the upper bolts to hold the door with final torque of the fasteners occurring after correct door positioning is achieved.**
- **A suitable body sealant should be used when removing or moving the hinges.**

(1) Check door alignment. (Refer to 23 - BODY/ BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)

(2) If adjustment is required, remove latch striker. (Refer to 23 - BODY/DOOR - FRONT/LATCH STRIKER - REMOVAL)

(3) Remove side view mirror. (Refer to 23 - BODY/ EXTERIOR/SIDE VIEW MIRROR - REMOVAL)

(4) Loosen hinge bolts and adjust door gap and align ridge pattern as necessary.

(5) Tighten hinge bolts to 25 N·m (18 ft. lbs.).

(6) Install latch striker and adjust flush measurement as necessary. (Refer to 23 - BODY/DOOR - FRONT/LATCH STRIKER - INSTALLATION)

(7) Install side view mirror. (Refer to 23 - BODY/ EXTERIOR/SIDE VIEW MIRROR - INSTALLATION)

DOOR GLASS

REMOVAL

(1) Remove the regulator. (Refer to 23 - BODY/ DOOR - FRONT/WINDOW REGULATOR - POWER or MANUAL - REMOVAL)

(2) Remove reinforcement bolts. (Fig. 6)

(3) Carefully lower glass into door and out of run channel.

(4) Remove glass from door.

INSTALLATION

(1) Carefully place glass into door and slide up into run channel.

(2) Using wood wedge, tape or equivalent, secure glass in the up position. (Fig. 7)

(3) Install reinforcement and install the bolts.

(4) Tighten the reinforcement bolts to 21 N·m (18 ft. lbs.).

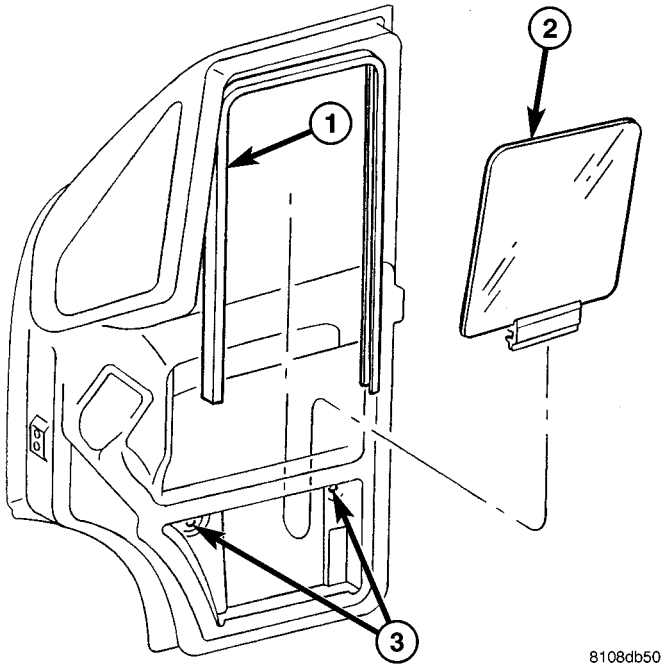


Fig. 6 FRONT DOOR GLASS

1 - DOOR RUN CHANNEL
2 - DOOR GLASS
3 - REINFORCEMENT BOLTS

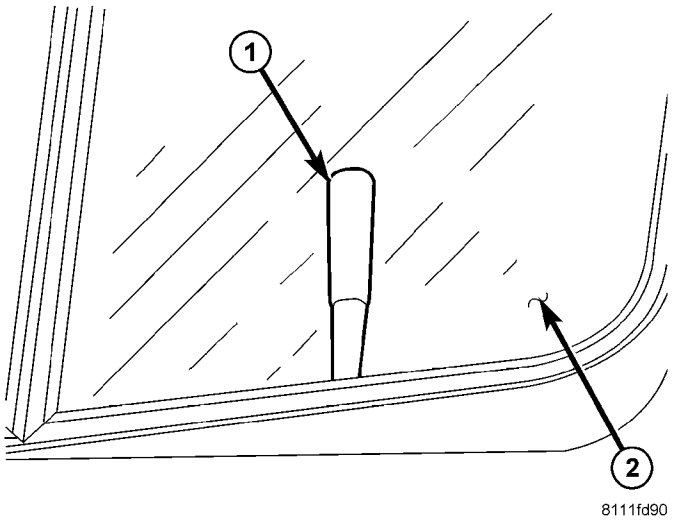


Fig. 7 GLASS SUPPORT

1 - WOOD WEDGE (or equivalent)
2 - WINDOW GLASS

(5) Install the regulator. (Refer to 23 - BODY/ DOOR - FRONT/WINDOW REGULATOR - POWER or MANUAL - INSTALLATION)

EXTERIOR HANDLE

REMOVAL

(1) Remove handle bolt. (Fig. 8)

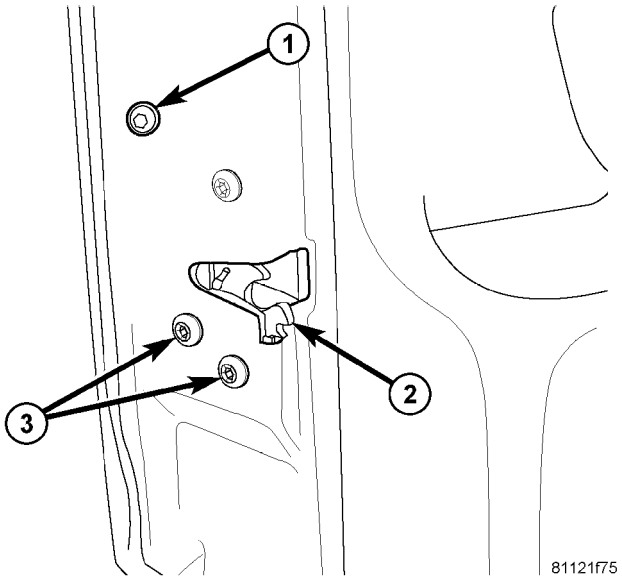


Fig. 8 LATCH/HANDLE FASTENERS

1 - EXTERIOR HANDLE BOLT
2 - LATCH
3 - LATCH BOLTS (3)

(2) Slide handle assembly towards front of door. (Fig. 9)

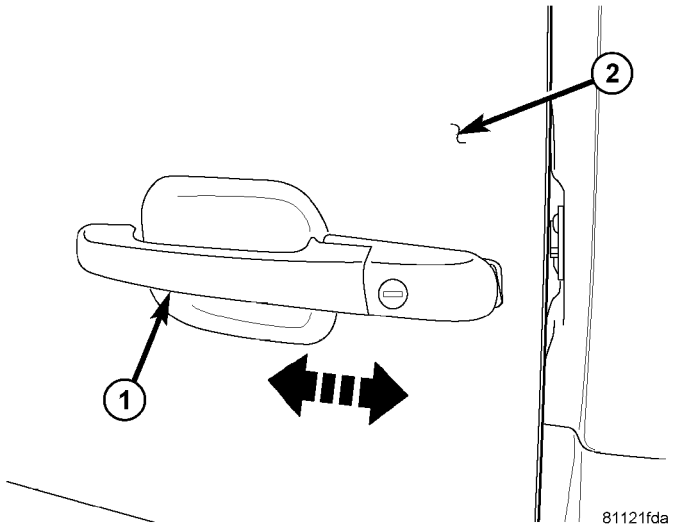


Fig. 9 EXTERIOR HANDLE

1 - EXTERIOR HANDLE
2 - DOOR

(3) Pull rear of handle out away from door and disengage the latch levers.

(4) Slide handle towards the rear of door and remove.

INSTALLATION

(1) Position front of handle into front slot in door. (Fig. 10)

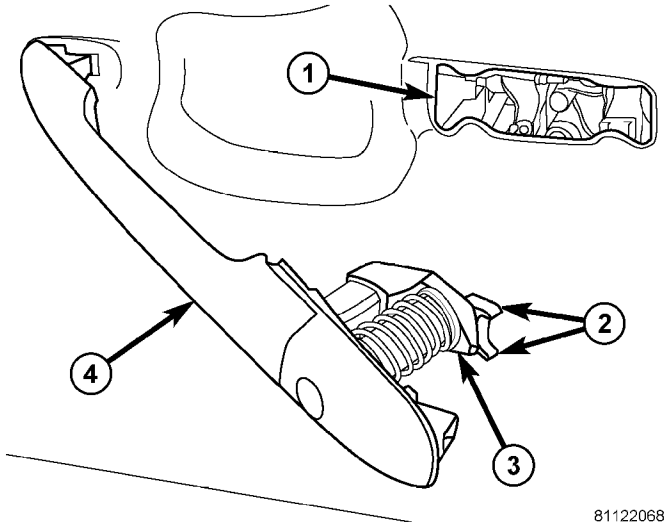


Fig. 10 EXTERIOR HANDLE INSTALLATION

1 - DOOR LATCH OPENING
2 - LOCK ACTUATION LEVER
3 - LATCH ACTUATION LEVER
4 - EXTERIOR HANDLE

(2) Position rear of handle into latch opening and engage lock and latch actuation levers with the latch levers. (Fig. 11)

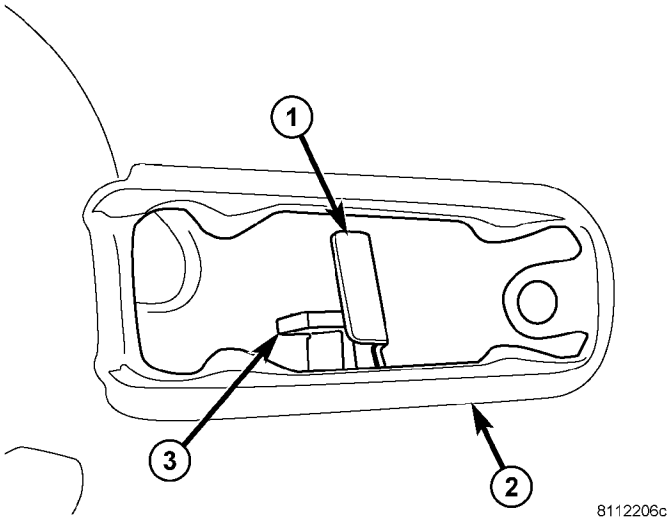


Fig. 11 LATCH LEVERS

1 - LATCH LEVER
2 - LATCH OPENING
3 - LOCK LEVER

EXTERIOR HANDLE (Continued)

(3) Slide exterior handle towards rear of door and install bolt. (Fig. 12)

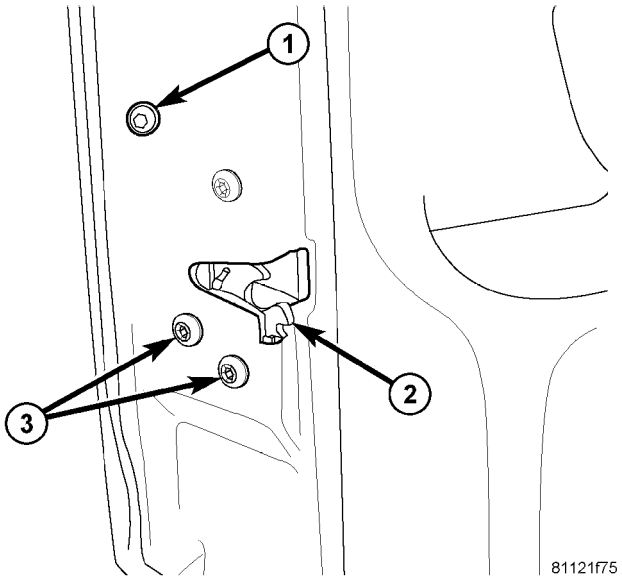


Fig. 12 EXTERIOR HANDLE

1 - EXTERIOR HANDLE BOLT
2 - LATCH
3 - LATCH BOLTS (3)

(4) Tighten bolt to 10 N·m (89 in. lbs.).

HINGE

REMOVAL

NOTE: It is not necessary to remove the door to replace the hinges if they are replaced one at a time.

(1) Using a grease pencil or equivalent, mark the position of the hinge on the door.
(2) Remove side view mirror. (Refer to 23 - BODY/ EXTERIOR/SIDE VIEW MIRROR - REMOVAL)
(3) Loosen hinge set bolts. (Fig. 13)
(4) Remove hinge bolts and remove hinge. (Fig. 14)

INSTALLATION

(1) Install hinge and install bolts.
(2) Tighten bolts to 25 N·m (18 ft. lbs.).
(3) Tighten hinge set bolts.
(4) Install side view mirror. (Refer to 23 - BODY/ EXTERIOR/SIDE VIEW MIRROR - INSTALLATION)
(5) Adjust door if necessary. (Refer to 23 - BODY/ DOOR - FRONT/DOOR - ADJUSTMENTS)

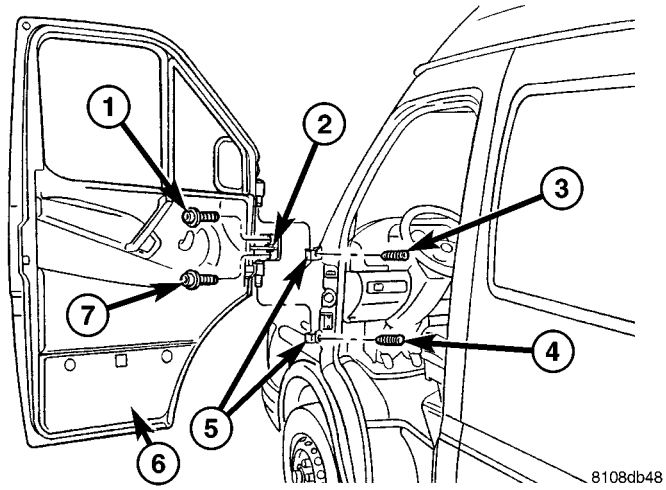


Fig. 13 FRONT DOOR

1 - UPPER CHECK BOLT
2 - DOOR CHECK
3 - UPPER HINGE SET SCREW
4 - LOWER HINGE SET SCREW
5 - HINGE RECEIVERS
6 - DOOR
7 - LOWER CHECK BOLT

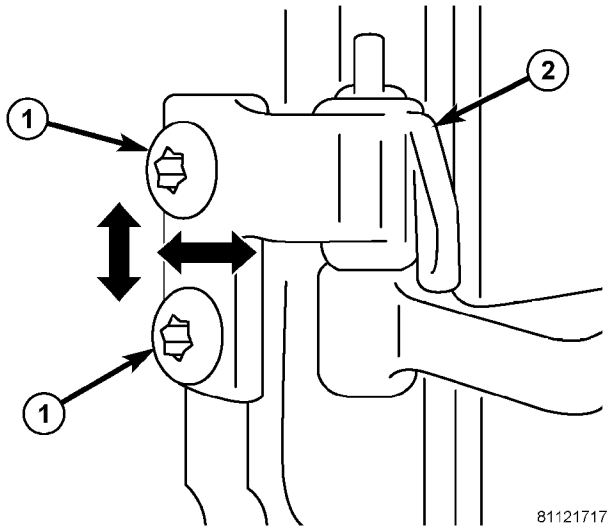


Fig. 14 HINGE

1 - HINGE BOLTS
2 - DOOR HINGE

LATCH

REMOVAL

(1) Remove trim panel. (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - REMOVAL)

(2) Remove exterior handle. (Refer to 23 - BODY/DOOR - FRONT/EXTERIOR HANDLE - REMOVAL)

(3) Remove screws and remove latch assembly.

(4) Disconnect electrical connector and control cable. (Fig. 15)

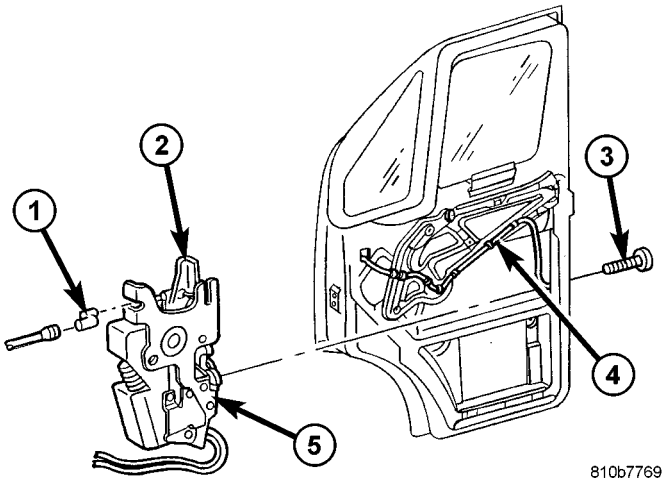


Fig. 15 FRONT DOOR LATCH

1 - CONTROL CABLE
2 - LATCH LEVER
3 - LATCH BOLTS (3)
4 - WIRE HARNESS
5 - LATCH ASSEMBLY

INSTALLATION

(1) Connect electrical connectors and control cable.

(2) Install latch and install bolts.

(3) Tighten bolts to 10 N·m (89 in. lbs.).

(4) Install exterior handle. (Refer to 23 - BODY/DOOR - FRONT/EXTERIOR HANDLE - INSTALLATION)

(5) Install trim panel. (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - INSTALLATION)

LATCH STRIKER

REMOVAL

(1) Using a grease pencil or equivalent, mark the position of the striker to aid installation.

(2) Remove the bolts and remove the striker. (Fig. 16)

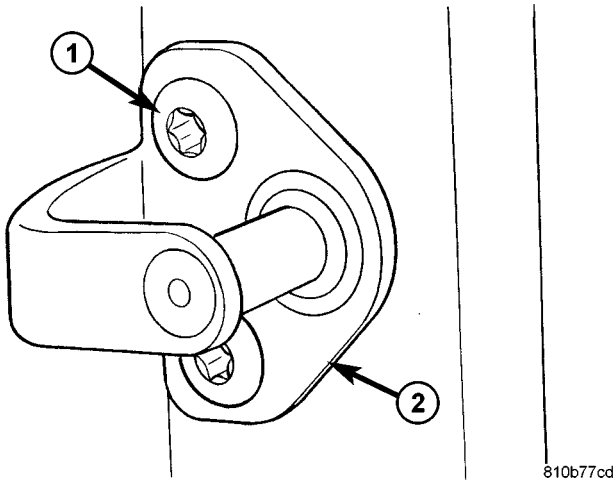


Fig. 16 LATCH STRIKER

1 - BOLTS
2 - STRIKER

INSTALLATION

(1) Install striker and install bolts.

(2) Tighten bolts to 25 N·m (18 ft. lbs.).

(3) Check door for flush and adjust the striker horizontally if necessary. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)

LOCK CYLINDER

REMOVAL

(1) Remove exterior door handle. (Refer to 23 - BODY/DOOR - FRONT/EXTERIOR HANDLE - REMOVAL)

(2) Remove lock cylinder from handle.

INSTALLATION

(1) Install lock cylinder into exterior handle.

(2) Install exterior handle. (Refer to 23 - BODY/DOOR - FRONT/EXTERIOR HANDLE - INSTALLATION)

TRIM PANEL

REMOVAL

(1) Disconnect and isolate battery negative cable.
(2) Using a small flat bladed tool or equivalent, press retaining clip upward through cutout in handle cover and remove cover. (Fig. 17)

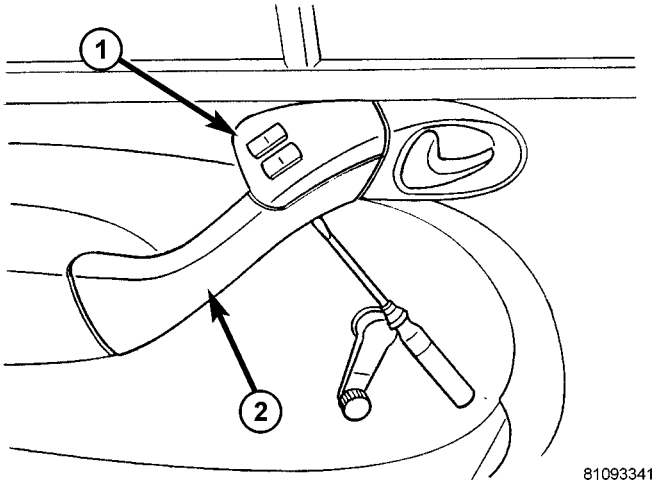


Fig. 17 TRIM PANEL HANDLE

1 - SWITCH BEZEL
2 - HANDLE COVER

(3) Remove switch bezel and disconnect electrical connectors.
(4) Remove the screws. (Fig. 18)

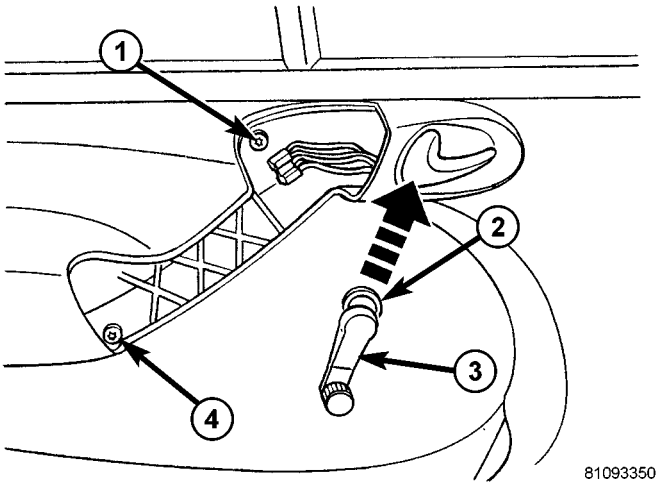


Fig. 18 TRIM PANEL FASTENERS

1 - UPPER SCREW
2 - WINDOW CRANK MOUNTING RING
3 - WINDOW CRANK
4 - LOWER SCREW

(5) Remove mounting ring and remove window crank, if equipped.
(6) Open pocket door. (Fig. 19)

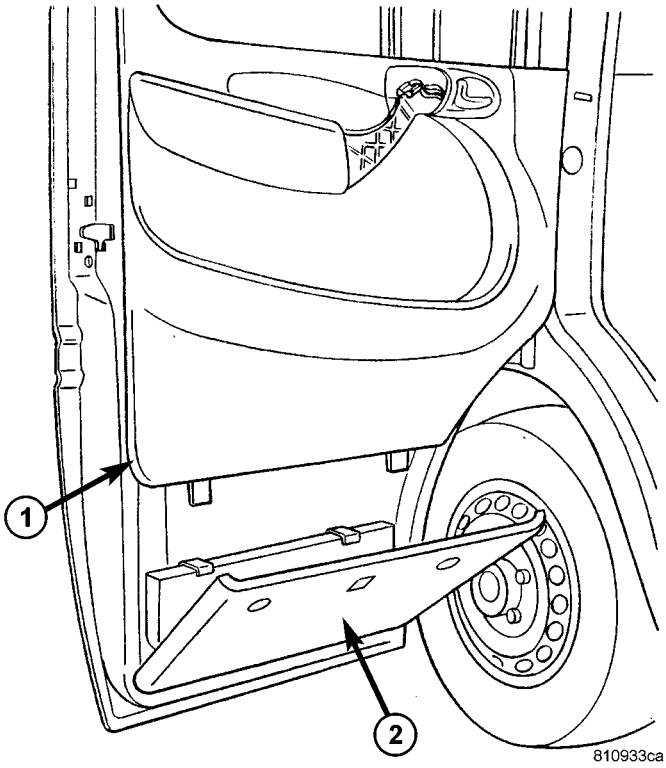


Fig. 19 TRIM PANEL

1 - TRIM PANEL
2 - DOOR POCKET

TRIM PANEL (Continued)

(7) Using a trim stick C-4755 or equivalent, separate window frame molding from door. (Fig. 20)

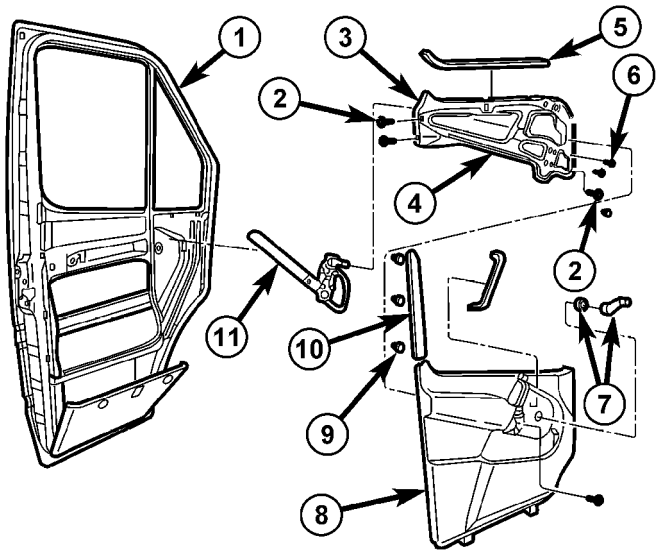


Fig. 20 MANUAL REGULATOR ASSEMBLY

1 - DOOR
2 - CARRIER PLATE BOLTS
3 - CARRIER PLATE
4 - REGULATOR ASSEMBLY
5 - SEALING STRIP
6 - REGULATOR RIVETS (4)
7 - WINDOW CRANK/TRIM RING
8 - TRIM PANEL
9 - CLIPS
10 - WINDOW FRAME MOLDING
11 - REGULATOR

(8) Slightly pull door trim upward and swing away slightly.

(9) Unlock retainer clip and disconnect control cable. (Fig. 21)

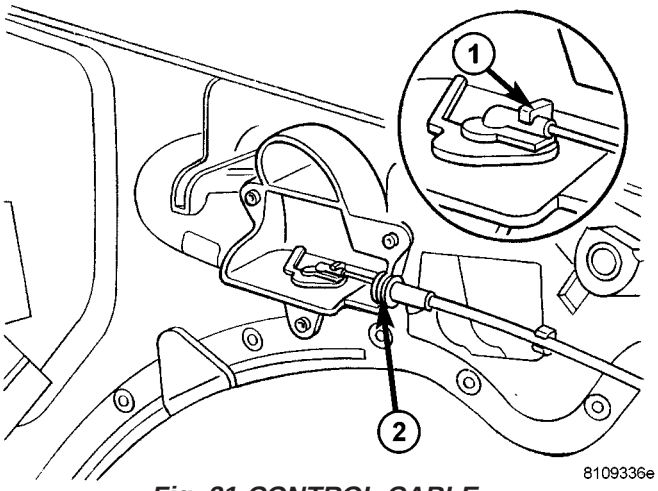


Fig. 21 CONTROL CABLE

1 - RETAINER CLIP
2 - CONTROL CABLE MOUNTING

(10) Remove trim panel.

INSTALLATION

(1) Position trim panel and connect control cable.

(2) Install trim panel.

(3) Position window frame molding and seat clips fully.

(4) Close pocket door.

(5) Install window crank and mounting ring, if equipped.

(6) Install handle screws.

(7) Connect electrical connectors and install switch bezel.

(8) Install handle cover.

(9) Connect battery negative cable.

WINDOW REGULATOR - POWER

REMOVAL

(1) Lower front window approximately 2 cm (3/4 in.).

(2) Disconnect and isolate battery negative cable.

(3) Remove door trim panel. (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - REMOVAL)

(4) Disconnect electrical connector. (Fig. 22)

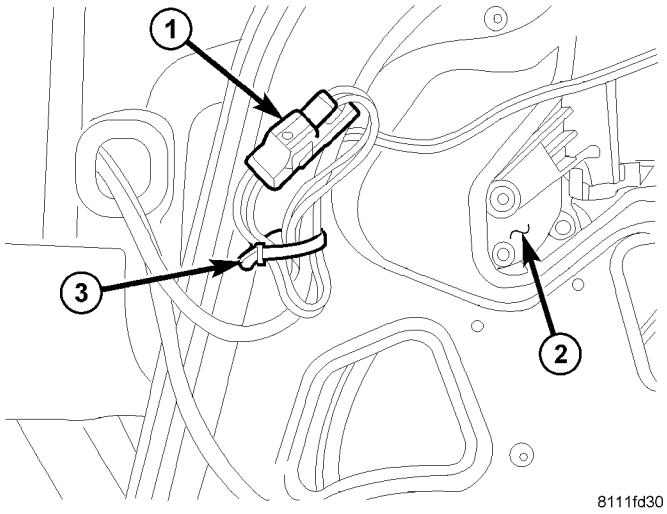


Fig. 22 ELECTRICAL CONNECTOR

1 - ELECTRICAL CONNECTOR
2 - REGULATOR MOTOR
3 - WIRE TIE

WINDOW REGULATOR - POWER (Continued)

(5) Using wood wedge, tape or equivalent, secure glass in the up position. (Fig. 23)

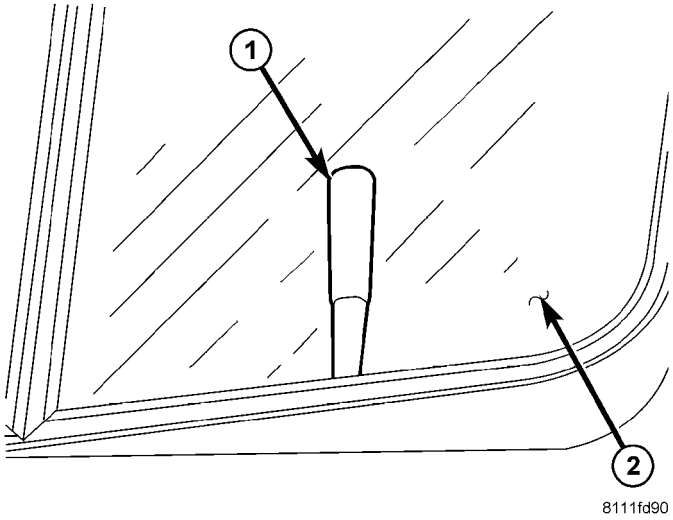


Fig. 23 GLASS SUPPORT

1 - WOOD WEDGE (or equivalent)
2 - WINDOW GLASS

(6) Remove tape securing wire harness to regulator assembly. (Fig. 24)

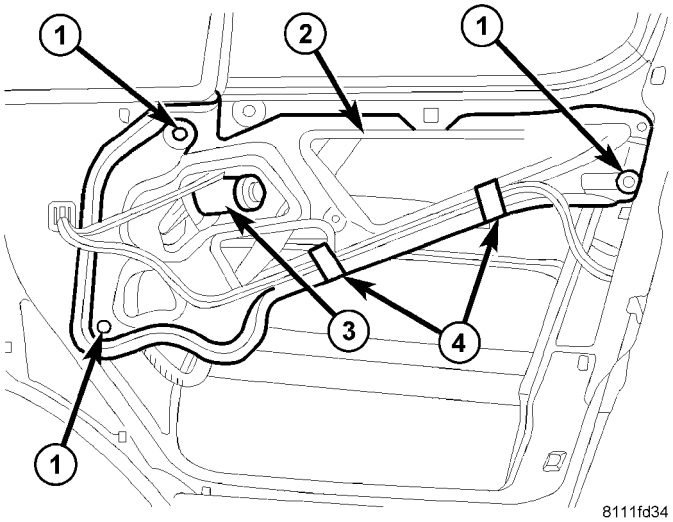


Fig. 24 REGULATOR ASSEMBLY MOUNTING

1 - CARRIER PLATE BOLTS (3)
2 - CARRIER PLATE
3 - REGULATOR MOTOR
4 - TAPE

(7) Remove carrier plate bolts.

(8) Disengage lift arm from glass guide rail and remove regulator assembly. (Fig. 25)

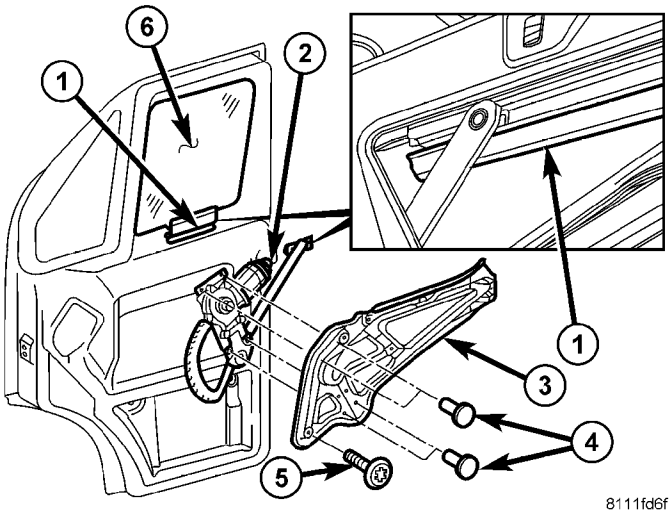


Fig. 25 REGULATOR ASSEMBLY

1 - GUIDE RAIL
2 - REGULATOR
3 - CARRIER PLATE
4 - RIVETS (4)
5 - CARRIER PLATE BOLTS (3)
6 - WINDOW GLASS

(9) Remove four rivets attaching regulator to carrier plate and remove regulator.

INSTALLATION

(1) Install regulator onto carrier plate and install new rivets.

(2) Install regulator lift arm into glass guide rail and install regulator assembly.

(3) Install carrier bolts and tighten to 10 N·m (89 in. lbs.).

(4) Replace tape securing wire harness to regulator assembly.

(5) Remove glass support.

(6) Connect the electrical connector.

(7) Connect battery negative cable.

(8) Verify correct window operation.

(9) Install trim panel. (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - INSTALLATION)

WINDOW REGULATOR - MANUAL

REMOVAL

(1) Disconnect and isolate battery negative cable.

(2) Remove door trim panel. (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - REMOVAL)

(3) Using wood wedge, tape or equivalent, secure glass in the up position. (Fig. 26)

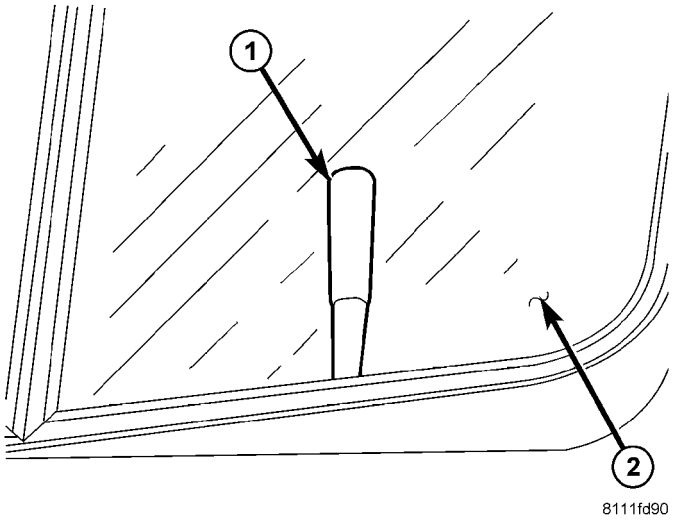


Fig. 26 GLASS SUPPORT

1 - WOOD WEDGE (or equivalent)
2 - WINDOW GLASS

(4) Remove carrier plate bolts. (Fig. 27)

(5) Disengage lift arm from glass guide rail and remove regulator assembly. (Fig. 28)

(6) Remove four rivets attaching regulator to carrier plate and remove regulator. (Fig. 29)

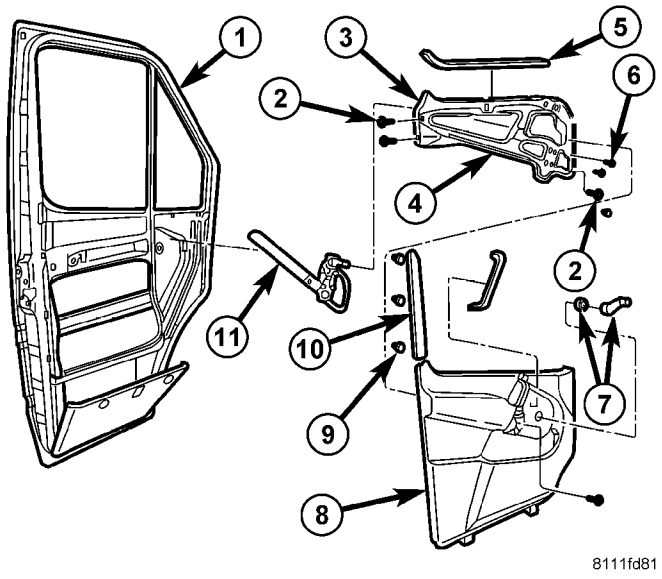


Fig. 27 MANUAL REGULATOR ASSEMBLY

1 - DOOR
2 - CARRIER PLATE BOLTS
3 - CARRIER PLATE
4 - REGULATOR ASSEMBLY
5 - SEALING STRIP
6 - REGULATOR RIVETS (4)
7 - WINDOW CRANK/TRIM RING
8 - TRIM PANEL
9 - CLIPS
10 - WINDOW FRAME MOLDING
11 - REGULATOR

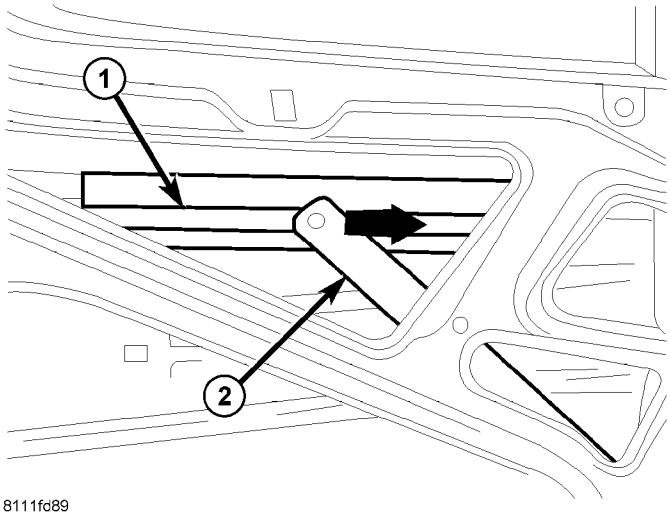


Fig. 28 LIFT ARM

1 - GLASS GUIDE RAIL
2 - LIFT ARM

WINDOW REGULATOR - MANUAL (Continued)

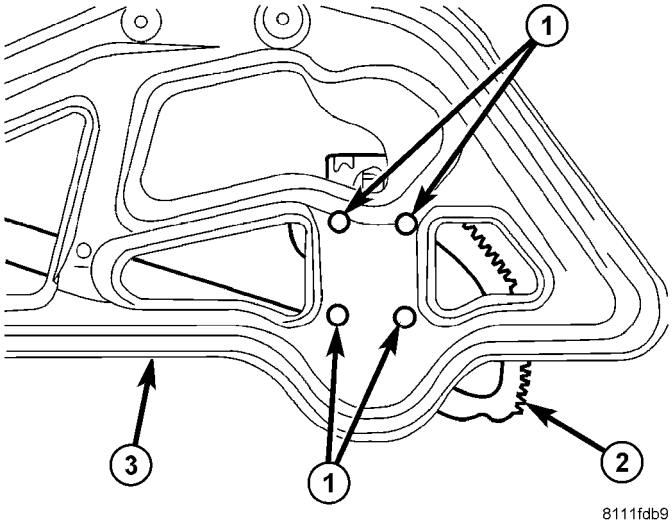


Fig. 29 MANUAL REGULATOR FASTENERS

1 - RIVETS (4)
2 - REGULATOR
3 - CARRIER PLATE

INSTALLATION

(1) Install regulator onto carrier plate and install new rivets.
(2) Install regulator lift arm into glass guide rail and install regulator assembly.
(3) Install carrier bolts and tighten to 10 N·m (89 in. lbs.).
(4) Remove glass support.
(5) Connect battery negative cable.
(6) Verify correct window operation.
(7) Install trim panel. (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - INSTALLATION)

DOORS - REAR

TABLE OF CONTENTS

page

CHECK
REMOVAL 24
INSTALLATION 24
DOOR
REMOVAL 25
DISASSEMBLY 26
ASSEMBLY 28
INSTALLATION 30
ADJUSTMENTS
ADJUSTMENT 30
DOOR GLASS
REMOVAL 31
INSTALLATION 31
EXTERIOR HANDLE
REMOVAL 32
INSTALLATION 33
HINGE
REMOVAL 34
INSTALLATION 34
INSIDE HANDLE ACTUATOR
REMOVAL 34
INSTALLATION 34
LATCH
REMOVAL 34
INSTALLATION 35
TRIM PANEL
REMOVAL 35
INSTALLATION 35

CHECK

REMOVAL

(1) Open door and disengage check arm from receiver. (Fig. 1)
(2) Remove the screws and remove the check arm.
(3) Remove the d-pillar trim, if equipped. (Refer to 23 - BODY/INTERIOR/D-PILLAR TRIM - REMOVAL)
(4) Remove the rivets and remove the receiver.

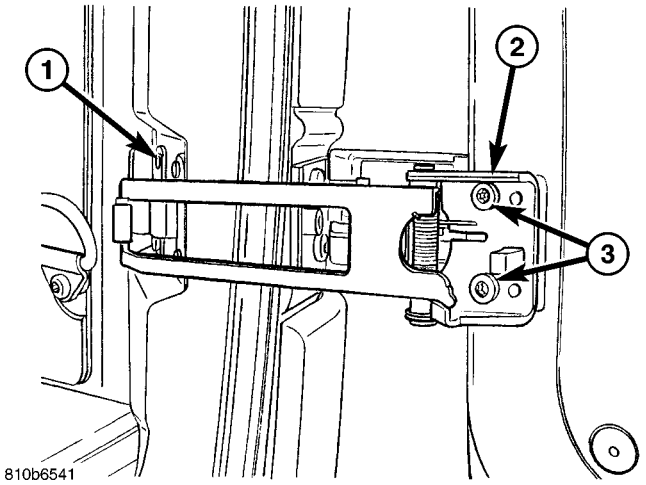


Fig. 1 DOOR CHECK

1 - RECEIVER
2 - DOOR CHECK
3 - SCREWS

INSTALLATION

(1) Install the receiver and replace the rivets.
(2) Install d-pillar trim, if equipped. (Refer to 23 - BODY/INTERIOR/D-PILLAR TRIM - INSTALLATION)
(3) Install check arm and screws.
(4) Tighten the screws to 10 N·m (89 idn. lbs.).

DOOR

REMOVAL

(1) Disconnect and isolate battery negative cable.
(2) Open door and disengage check arm from receiver. (Fig. 2)
(3) Using a grease pencil or equivalent, mark the outline of the door hinges on the door to aid in installation.
(4) Support door with a suitable lifting device.
(5) Remove the bolts and remove the door. (Fig. 3)

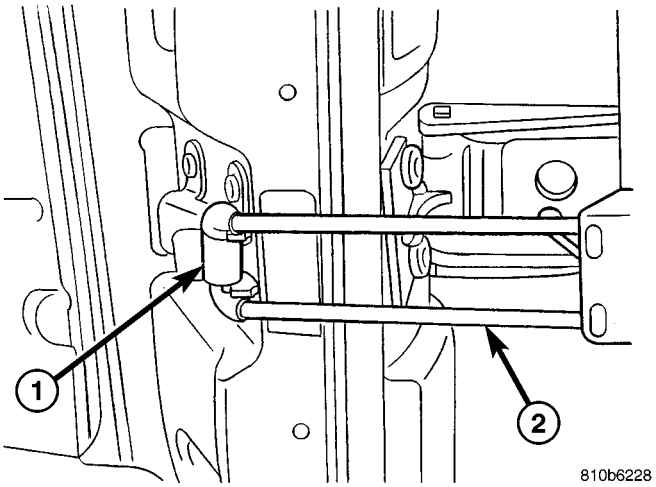


Fig. 2 CHECK STRAP

1 - RECEIVER
2 - DOOR CHECK

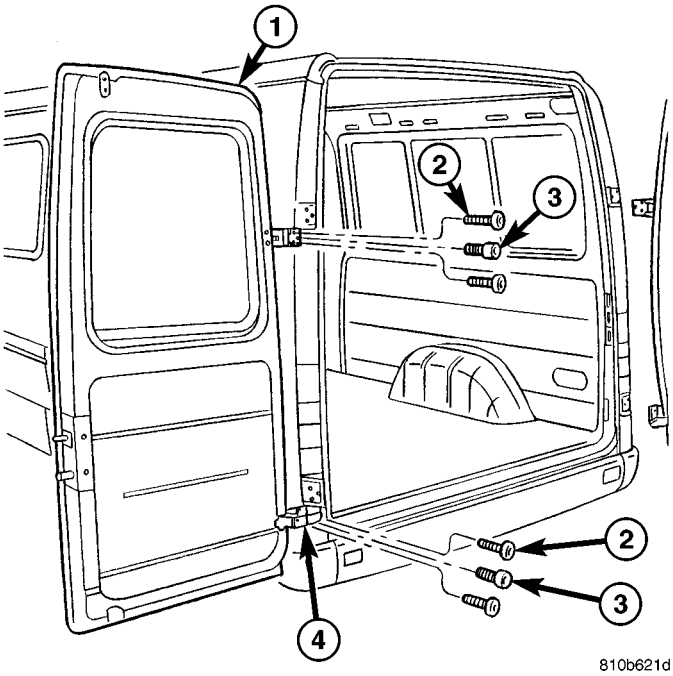


Fig. 3 DOOR HINGES

1 - DOOR
2 - TORX BOLTS (2 PER HINGE)
3 - ALLEN BOLTS (1 PER HINGE)

DOOR (Continued)

DISASSEMBLY

RIGHT DOOR

(1) Remove door. (Refer to 23 - BODY/DOORS - REAR/DOOR - REMOVAL)

(2) Remove trim panel (20) (Fig. 4). (Refer to 23 - BODY/DOORS - REAR/TRIM PANEL - REMOVAL)

(3) Remove latch assembly (14). (Refer to 23 - BODY/DOORS - REAR/LATCH - REMOVAL)

(4) Remove screws (21) from door handle (20).

(5) Slide door handle (20) to right and remove.

(6) Remove rivets (15) and remove closing wedge (16).

(7) Remove bolts (2) and remove top closing wedge (1).

(8) Remove bolts (9) and remove door check (10). (Refer to 23 - BODY/DOORS - REAR/CHECK - REMOVAL)

(9) Remove the bolts (3) and remove the door hinges (4). (Refer to 23 - BODY/DOORS - REAR/HINGE - INSTALLATION)

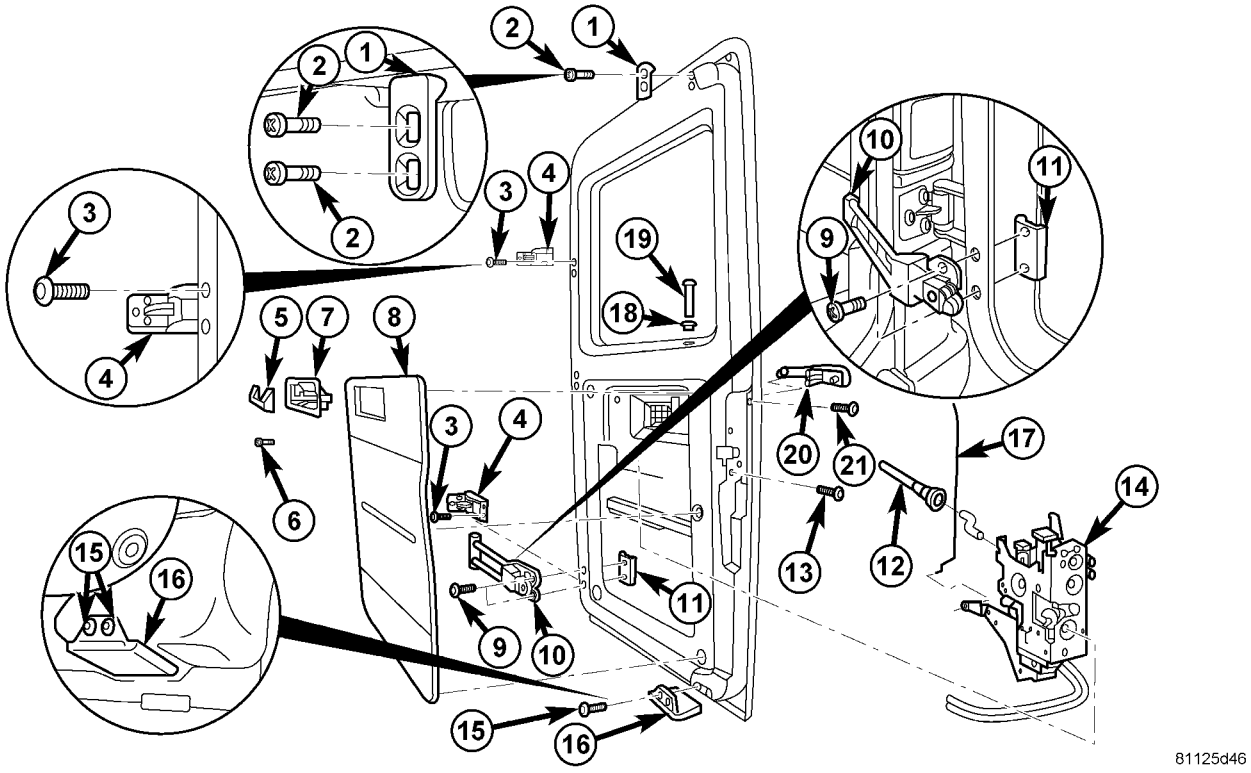


Fig. 4 RIGHT DOOR

1 - TOP CLOSING WEDGE
2 - BOLTS
3 - BOLTS (2)
4 - DOOR HINGE
5 - PANEL
6 - SCREW
7 - INNER ACTION
8 - PANELING
9 - BOLTS (2)
10 - DOOR CHECK
11 - THREADED PLATE
12 - DOOR LOCK LINKAGE
13 - BOLTS (3)
14 - LATCH ASSEMBLY
15 - RIVETS (2)
16 - BOTTOM CLOSING WEDGE
17 - LOCKING ROD
18 - GROMMET
19 - LOCKING KNOB
20 - EXTERIOR DOOR HANDLE
21 - SCREW

DOOR (Continued)

LEFT DOOR

(1) Remove door. (Refer to 23 - BODY/DOORS - REAR/DOOR - REMOVAL)

(2) Remove trim panel (20) (Fig. 5). (Refer to 23 - BODY/DOORS - REAR/TRIM PANEL - REMOVAL)

(3) Disconnect electrical connectors and remove license plate lighting (18, 19).

(4) Pull out switch and disconnect electrical connector (17).

(5) Remove and discard roll pin (12) and remove lock rod handle (11).

(6) Remove door check (23). (Refer to 23 - BODY/DOORS - REAR/CHECK - REMOVAL)

(7) Remove door hinge (6). (Refer to 23 - BODY/DOORS - REAR/HINGE - REMOVAL)

(8) Remove closing wedge (4).

(9) Remove rivets (22) and remove bottom closing wedge (21).

(10) Remove rear door seal (8).

(11) Remove the four screws (9, 14) from the lock rod actuator.

(12) Using locking pliers, hold upper lock rod (2) and remove lock rod actuator.

(13) Remove clips (15).

(14) Pull out lock rod guides (1, 16) and remove lock rods (2, 13).

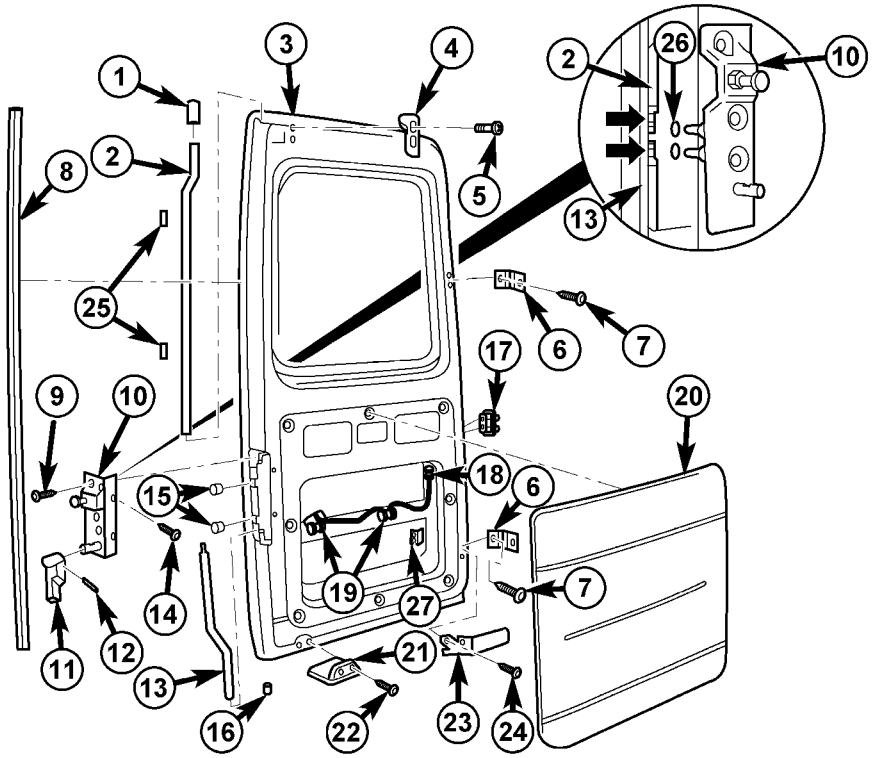


Fig. 5 LEFT DOOR

1 - UPPER LOCK ROD GUIDE
2 - UPPER LOCK ROD
3 - LEFT REAR DOOR
4 - TOP CLOSING WEDGE
5 - BOLTS (2)
6 - HINGE
7 - BOLTS (2)
8 - REAR DOOR SEAL
9 - SCREWS (2)
10 - LOCK ROD ACTUATOR
11 - LOCK ROD HANDLE
12 - ROLL PIN
13 - BOTTOM LOCK ROD
14 - SCREWS (2)
15 - CLIPS (2)
16 - BOTTOM LOCK ROD GUIDE
17 - SWITCHES
18 - ELECTRICAL CONNECTOR
19 - LICENSE PLATE LIGHTING
20 - TRIM PANEL
21 - BOTTOM CLOSING WEDGE
22 - RIVETS (2)
23 - DOOR CHECK
24 - BOLTS (2)
25 - FELT STRIP
26 - O-RINGS (2)
27 - THREADED PLATE

DOOR (Continued)

ASSEMBLY

RIGHT DOOR

(1) Install the door hinges (4) and bolts (3) (Fig. 6). (Refer to 23 - BODY/DOORS - REAR/HINGE - INSTALLATION)

(2) Install the door check (10) and bolts (9). (Refer to 23 - BODY/DOORS - REAR/CHECK - INSTALLATION)

(3) Install the top closing wedge (1) and bolts (2).

(4) Install the bottom closing wedge (16) and replace rivets (15).

(5) Install the exterior handle (20). (Refer to 23 - BODY/DOORS - REAR/EXTERIOR HANDLE - INSTALLATION)

(6) Install the latch assembly (14). (Refer to 23 - BODY/DOORS - REAR/LATCH - INSTALLATION)

(7) Install trim panel (20). (Refer to 23 - BODY/DOORS - REAR/TRIM PANEL - INSTALLATION)

(8) Install door. (Refer to 23 - BODY/DOORS - REAR/DOOR - INSTALLATION)

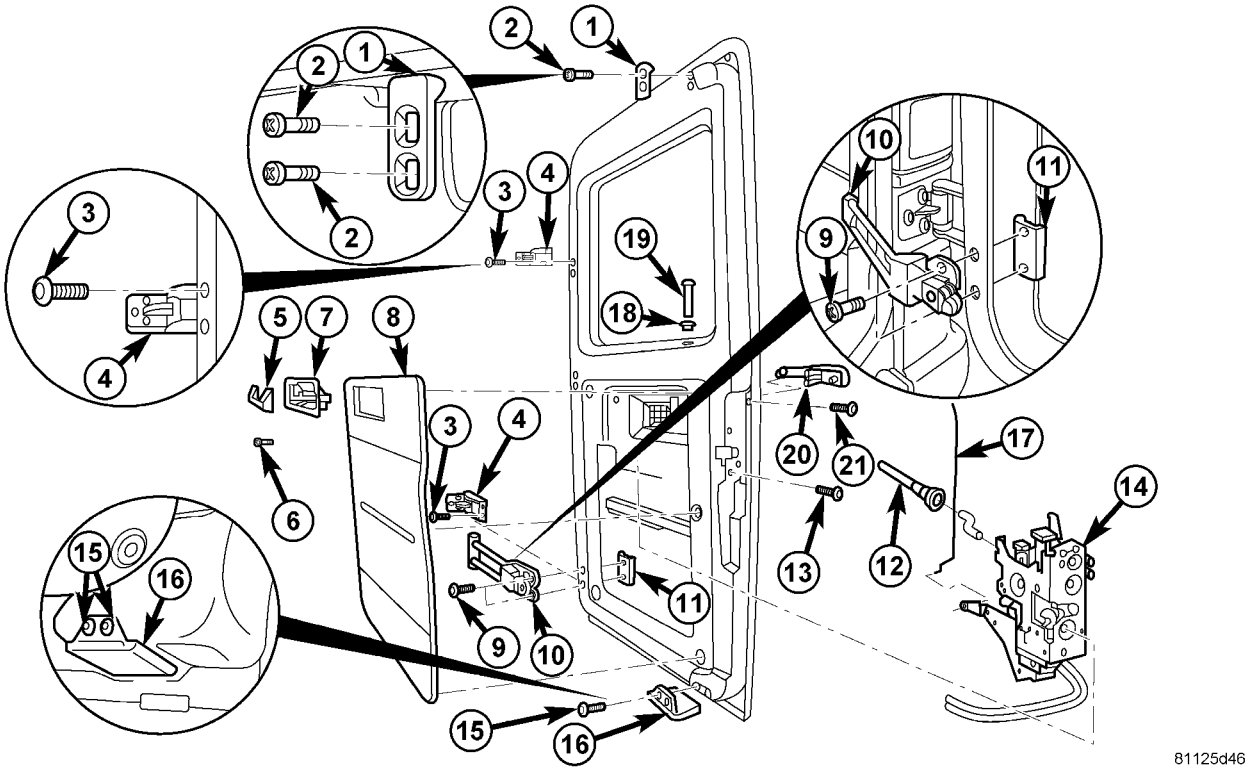


Fig. 6 RIGHT DOOR

1 - TOP CLOSING WEDGE
2 - BOLTS
3 - BOLTS (2)
4 - DOOR HINGE
5 - PANEL
6 - SCREW
7 - INNER ACTION
8 - PANELING
9 - BOLTS (2)
10 - DOOR CHECK
11 - THREADED PLATE
12 - DOOR LOCK LINKAGE
13 - BOLTS (3)
14 - LATCH ASSEMBLY
15 - RIVETS (2)
16 - BOTTOM CLOSING WEDGE
17 - LOCKING ROD
18 - GROMMET
19 - LOCKING KNOB
20 - EXTERIOR DOOR HANDLE
21 - SCREW

DOOR (Continued)

LEFT DOOR

(1) Install lock rods (2, 13) and install lock rod guides (1, 16). (Fig. 7)

(2) Using locking pliers, hold upper lock rod (2) in place.

(3) Install clips (15).

(4) Install the lock rod actuator (10). The bolts should reach into the holes (arrows) of the lock rods (2, 13). Place and o-ring (dia. 6 mm) on each of the lock rod actuator bolts to prevent the lock rods from chattering against the lock.

(5) Install rear door seal.

(6) Install bottom closing wedge (21) and replace rivets (22).

(7) Install closing wedge (4).

(8) Install door hinge (6). (Refer to 23 - BODY/DOORS - REAR/HINGE - INSTALLATION)

(9) Install door check (23). (Refer to 23 - BODY/DOORS - REAR/CHECK - INSTALLATION)

(10) Install lock rod handle (11) and replace roll pin (12).

(11) Connect the electrical connector and install switches (17).

(12) Connect electrical connectors and install license plate lighting (18, 19).

(13) Install trim panel (20). (Refer to 23 - BODY/DOORS - REAR/TRIM PANEL - INSTALLATION)

(14) Install door. (Refer to 23 - BODY/DOORS - REAR/DOOR - INSTALLATION)

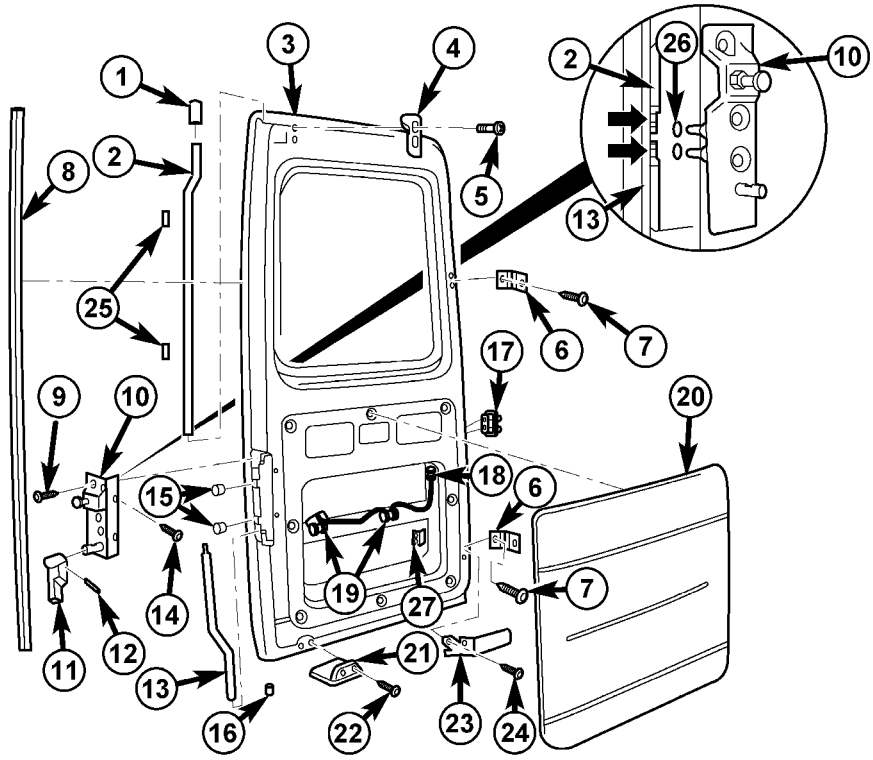


Fig. 7 LEFT DOOR

1 - UPPER LOCK ROD GUIDE
2 - UPPER LOCK ROD
3 - LEFT REAR DOOR
4 - TOP CLOSING WEDGE
5 - BOLTS (2)
6 - HINGE
7 - BOLTS (2)
8 - REAR DOOR SEAL
9 - SCREWS (2)
10 - LOCK ROD ACTUATOR
11 - LOCK ROD HANDLE
12 - ROLL PIN
13 - BOTTOM LOCK ROD
14 - SCREWS (2)
15 - CLIPS (2)
16 - BOTTOM LOCK ROD GUIDE
17 - SWITCHES
18 - ELECTRICAL CONNECTOR
19 - LICENSE PLATE LIGHTING
20 - TRIM PANEL
21 - BOTTOM CLOSING WEDGE
22 - RIVETS (2)
23 - DOOR CHECK
24 - BOLTS (2)
25 - FELT STRIP
26 - O-RINGS (2)
27 - THREADED PLATE

DOOR (Continued)

INSTALLATION

CAUTION: If the door is being replaced a suitable seam sealer must be used prior to painting.

(1) Support the door with a suitable lifting device, install door and install the hinge bolts.
(2) Tighten bolts to 25 N·m (18 ft. lbs.).
(3) Engage check arm into receiver.
(4) Adjust the door as necessary. (Refer to 23 - BODY/DOORS - REAR/DOOR - ADJUSTMENTS)

ADJUSTMENTS

ADJUSTMENT

NOTE: Door adjustment measurements should be taken from stationary or welded body panels like the roof, rocker or quarter panels.

(1) Check door gap around door. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)
(2) Open doors and loosen the torx bolts. (Fig. 8)

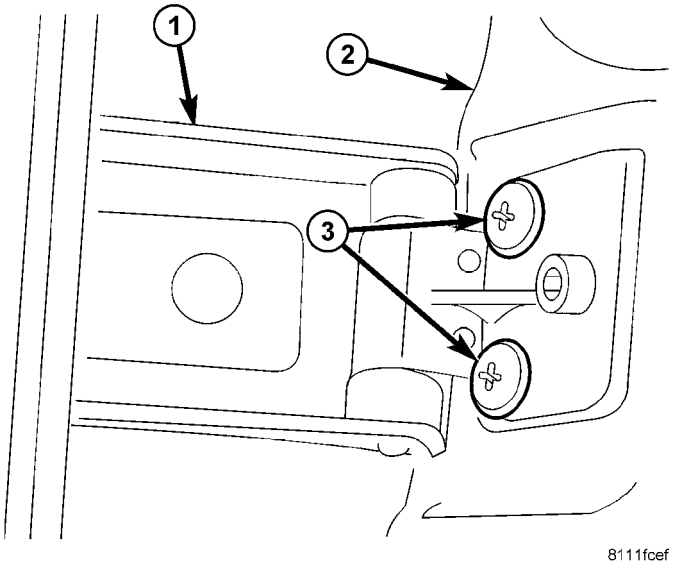


Fig. 8 HINGE BOLTS

1 - HINGE
2 - BODY
3 - TORX BOLTS

NOTE: Close and adjust each door individually.

(3) Close the door and check gap measurement.
(4) Loosen allen screw through hole in hinge. (Fig. 9)

NOTE: Adjust so that bottom closing wedges make contact and door gaps are uniform all the way around.

(5) Adjust rear door and tighten allen screw to 25 N·m (18 ft. lbs.).

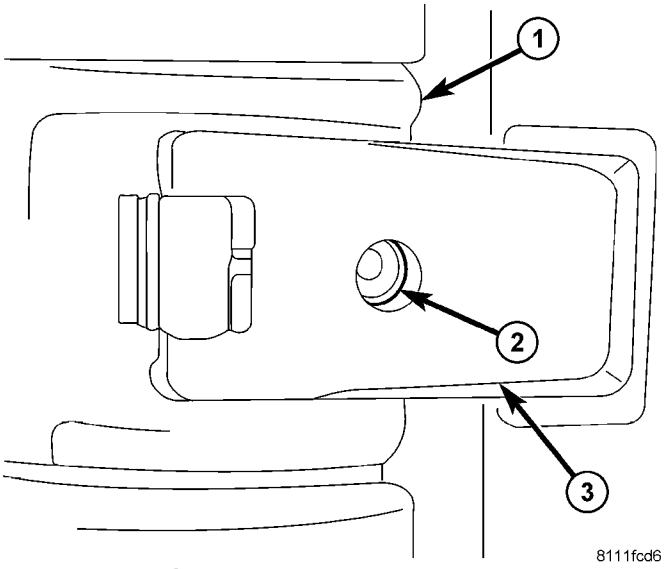


Fig. 9 HINGE ADJUSTMENT

1 - BODY
2 - ALLEN SCREW
3 - HINGE

(6) Open doors and tighten torx bolts to 25 N·m (18 ft. lbs.).
(7) Loosen door striker and adjust so right door is flush with the left door. (Fig. 10)

NOTE: Striker should engage in latch at center. Door should not be lifted or pushed downward with striker.

(8) Tighten striker.

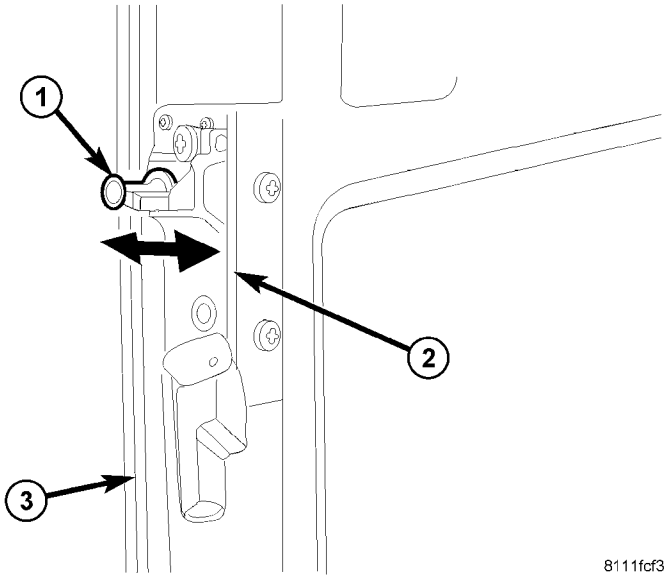


Fig. 10 STRIKER ADJUSTMENT

1 - STRIKER
2 - LOCK ROD HANDLE ASSEMBLY
3 - LEFT DOOR

DOOR (Continued)

CAUTION: Since the rear doors are components with static functions it is very important that they are fastened while driving. This prevents excessive torsion of the vehicle and leaky rear doors. The rear doors are fastened by adjusting the closing wedges.

(9) Closing wedges at bottom must be resting free of play on plastic closing plates when rear doors are closed. To adjust, loosen door hinges and raise or lower complete doors.

(10) Loosen upper closing wedge screws and move top closing wedge up against plastic closing plate free of play with rear door closed and tighten screws to 10 N·m (89 in. lbs.).

(11) Check and adjust the hinges. On rear doors, the retaining magnets should run up to the middle of the mating plate at the side wall. If this is not the case, correct as listed. (Fig. 11)

CAUTION: Adjustment range of screw (3) maximum 1 turn (risk of control cam breaking, 4)

- Retaining magnet is too far forward relative to mating plate. Turn in adjustment screw (2) at top and bottom hinge.
- Retaining magnet is too far back relative to mating plate. Turn out adjustment screw (2) at top and bottom hinge.
- Retaining magnet is too deep relative to mating plate. Turn in adjustment screw (2) at top hinge, turn out adjustment screw (2) at bottom hinge.
- Retaining magnet is too high relative to mating plate. Turn out adjustment screw (2) at top hinge, turn in adjustment screw (2) at bottom hinge.
- Retaining magnet strikes too hard against mating plate. Turn in adjustment screw (1) at top and bottom hinge.
- Retaining magnet does not make contact with mating plate. Turn out adjustment screw (1) at top and bottom hinge.
- Door projects at corner paneling when closed. Turn out adjustment screw (3) at hinge.
- Door is too far recessed at corner paneling when closed. Turn in adjustment screw (3) at hinge.

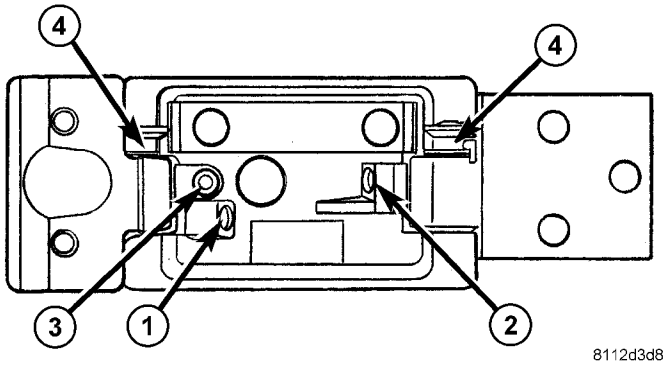


Fig. 11 REAR HINGE ADJUSTMENT

1 - ADJUSTMENT SCREW
2 - ADJUSTMENT SCREW
3 - ADJUSTMENT SCREW
4 - CONTROL ARM

DOOR GLASS

REMOVAL

(1) Position an assistant on one side of the door to receive the glass and weatherstrip seal.

(2) Start at an inside, upper corner. Separate the seal from the window opening. Push the glass and seal outward from the window opening. Remove the glass and seal.

(3) Clean the window opening.

INSTALLATION

(1) Install the weatherstrip seal on the window glass. Verify that the glass is seated in the groove around the edge of the seal.

(2) Insert an installation cord in the weatherstrip seal inner groove.

NOTE: Use mineral spirits as a lubricant to aid seal installation in the window opening.

(3) Position the glass and seal in the window opening.

(4) Pull the installation cord outward and force the seal lip over the panel flange around the edge of the opening.

(5) Seat the seal inner lip on the panel flange. Press against the lip around the edge of the seal.

DOOR GLASS (Continued)

NOTE: Remove any mineral spirits with a clean cloth after glass installation.

(6) Verify that the seal is seated in the window opening (Fig. 12).

(7) Test the window for water leaks. (Refer to 23 - BODY - DIAGNOSIS AND TESTING - WATER LEAKS)

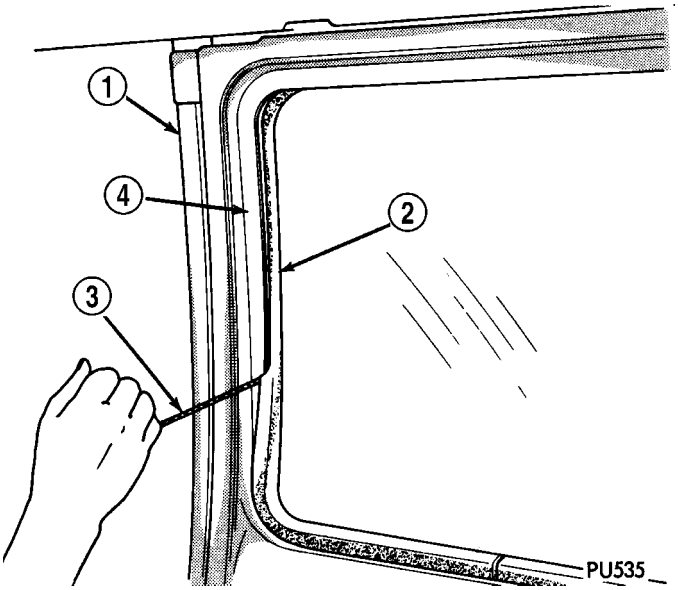


Fig. 12 Glass & Weatherstrip Seal Installation

1 - BODY PANEL
2 - WEATHERSTRIP SEAL
3 - INSTALLATION CORD
4 - WINDOW OPENING

EXTERIOR HANDLE

REMOVAL

(1) Remove handle bolt. (Fig. 13)

NOTE: Front door shown, rear door similar.

(2) Slide handle assembly towards front of door. (Fig. 14)

NOTE: Front door shown, rear door similar.

(3) Pull rear of handle out away from door and disengage the latch levers.

(4) Slide handle towards the rear of door and remove.

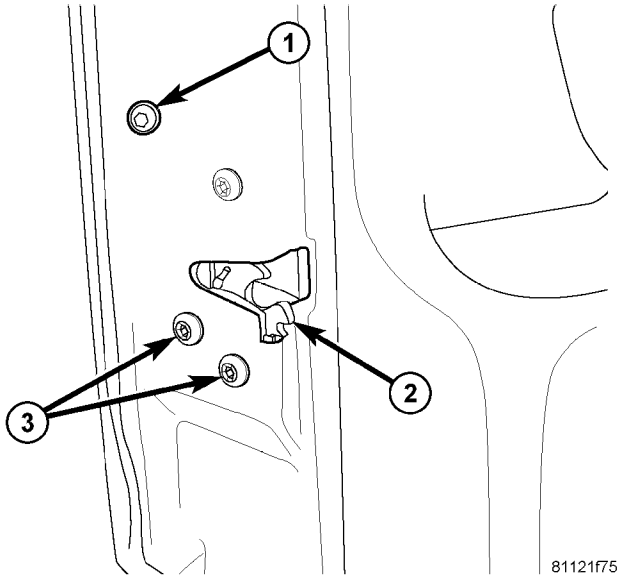


Fig. 13 EXTERIOR HANDLE

1 - EXTERIOR HANDLE BOLT
2 - LATCH
3 - LATCH BOLTS (3)

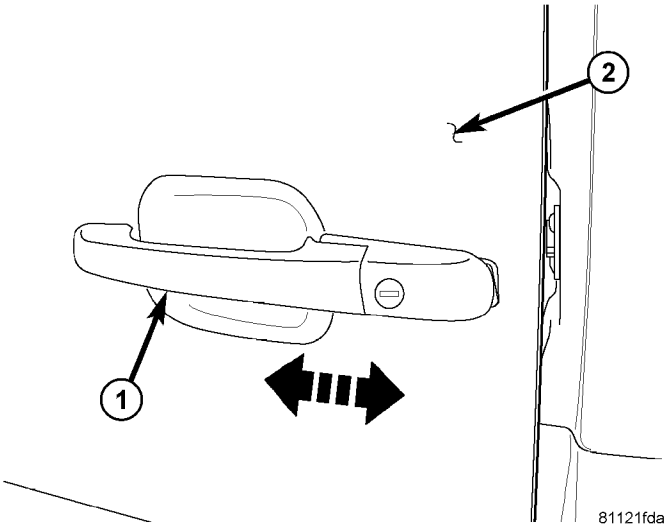


Fig. 14 LATCH/HANDLE FASTENERS

1 - EXTERIOR HANDLE
2 - DOOR

EXTERIOR HANDLE (Continued)

INSTALLATION

(1) Position front of handle into front slot in door. (Fig. 15)

NOTE: Front door shown, rear door similar.

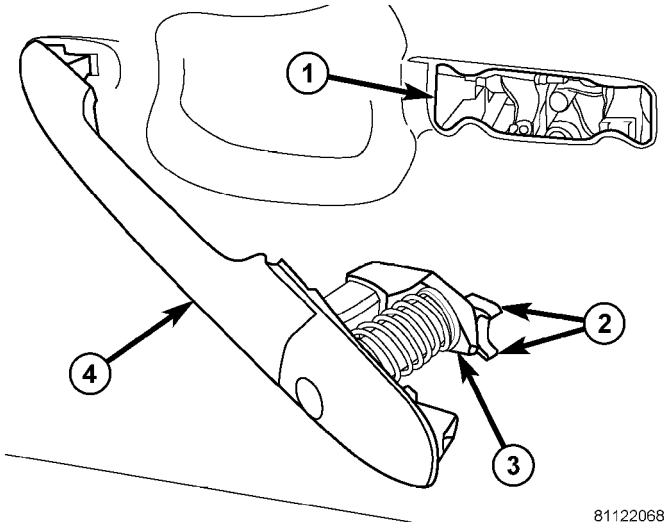


Fig. 15 EXTERIOR HANDLE INSTALLATION

1 - DOOR LATCH OPENING
2 - LOCK ACTUATION LEVER
3 - LATCH ACTUATION LEVER
4 - EXTERIOR HANDLE

(2) Position rear of handle into latch opening and engage lock and latch actuation levers with the latch levers. (Fig. 16)

NOTE: Front door shown, rear door similar.

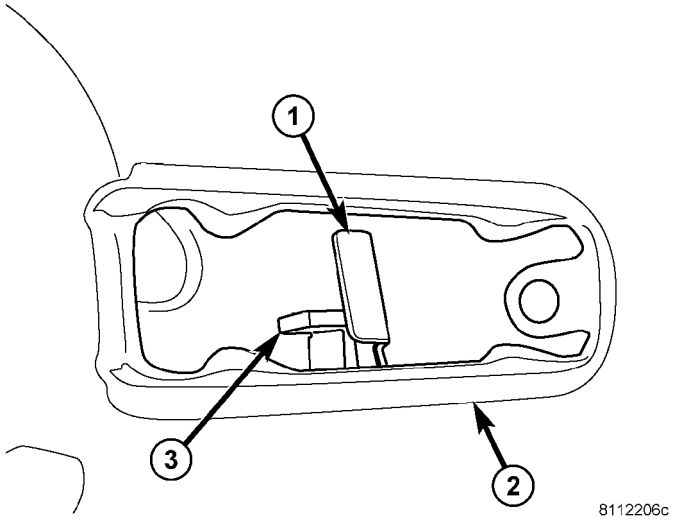


Fig. 16 LATCH LEVERS

1 - LATCH LEVER
2 - LATCH OPENING
3 - LOCK LEVER

(3) Slide exterior handle towards rear of door and install bolt. (Fig. 17)

NOTE: Front door shown, rear door similar.

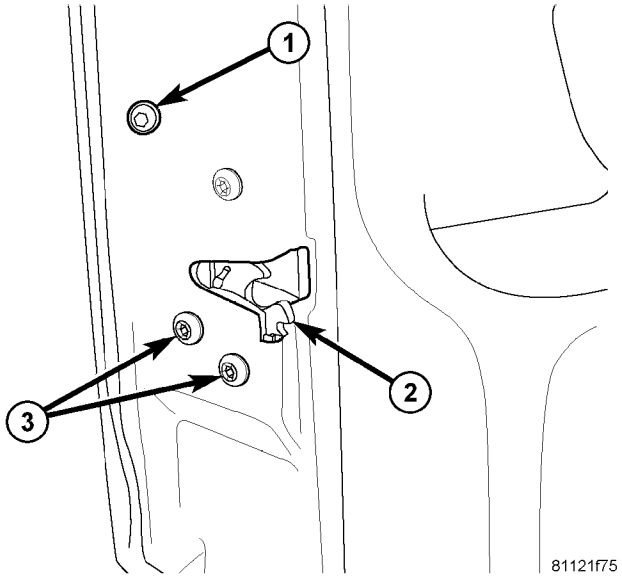


Fig. 17 EXTERIOR HANDLE

1 - EXTERIOR HANDLE BOLT
2 - LATCH
3 - LATCH BOLTS (3)

(4) Tighten bolt to 10 N·m (89 in. lbs.).

HINGE

REMOVAL

NOTE: It is not necessary to remove the door to replace the hinges if they are replaced one at a time.

(1) Using a grease pencil or equivalent, mark the position of the hinge on the door.
(2) Remove the bolts and remove the hinge. (Fig. 18)

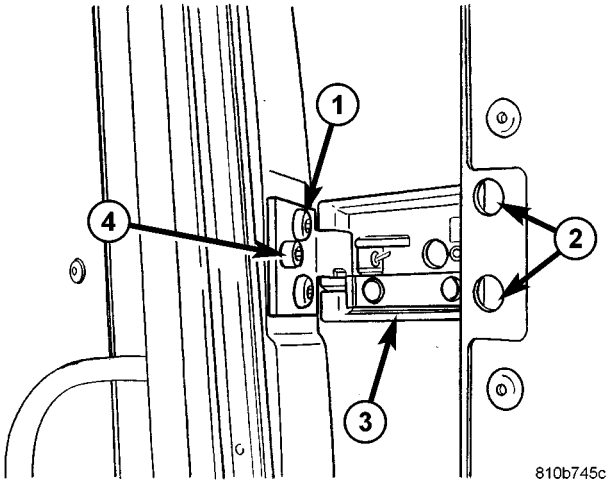


Fig. 18 REAR DOOR HINGE

1 - TORX BOLTS BODY SIDE
2 - TORX BOLTS DOOR SIDE
3 - HINGE
4 - ALLEN BOLT

INSTALLATION

(1) Install hinge and install bolts.
(2) Tighten bolts to 25 N·m (18 ft. lbs.).
(3) Adjust door if necessary. (Refer to 23 - BODY/DOOR - FRONT/DOOR - ADJUSTMENTS)

INSIDE HANDLE ACTUATOR

REMOVAL

(1) Remove the handle trim cover. (Fig. 19)
(2) Remove the screws and handle.
(3) Disconnect the latch cable.

INSTALLATION

(1) Connect the latch cable.
(2) Install handle and screws.
(3) Install trim cover.

LATCH

REMOVAL

(1) Disconnect and isolate battery negative cable.
(2) Remove right side trim panel. (Refer to 23 - BODY/DOORS - REAR/TRIM PANEL - REMOVAL)

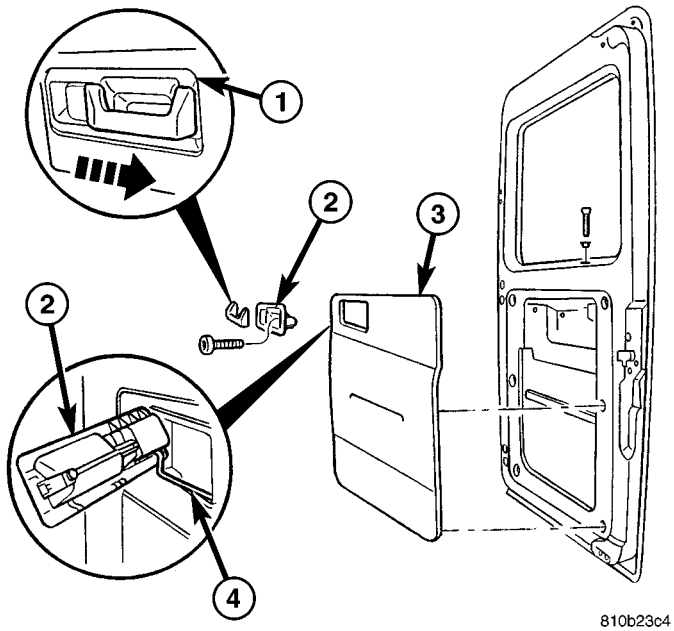


Fig. 19 TRIM PANEL

1 - TRIM
2 - INSIDE HANDLE ACTUATOR
3 - TRIM PANEL
4 - CONTROL CABLE

(3) Disconnect lock rod. (Fig. 20)
(4) Remove the screws and pull out latch from door.
(5) Disconnect cable and electrical connectors.

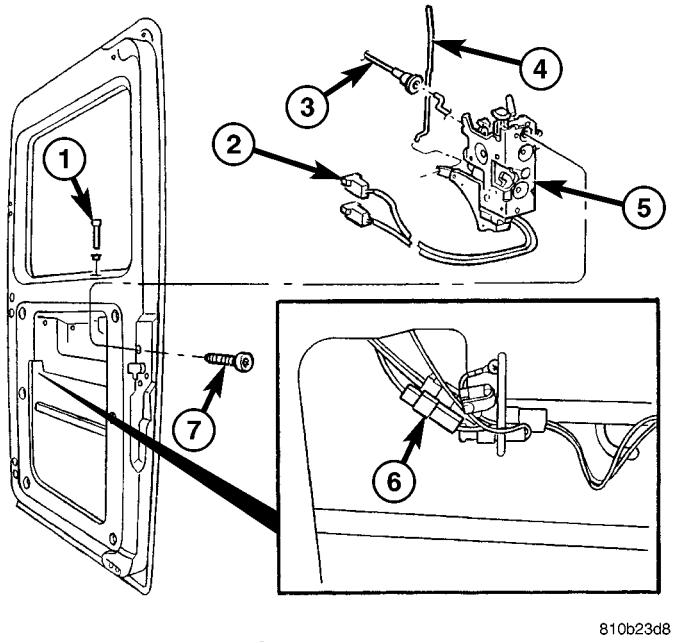


Fig. 20 LATCH

1 - DOOR LOCK KNOB
2 - ELECTRIC
3 - CABLE
4 - LOCK ROD
5 - LATCH ASSEMBLY
6 - ELECTRICAL CONNECTORS ROUTING
7 - SCREWS (3)

LATCH (Continued)

INSTALLATION

(1) Connect electrical connectors and cable to latch assembly.
(2) Install latch in door and install screws.
(3) Connect lock rod.
(4) Install right side trim panel. (Refer to 23 - BODY/DOORS - REAR/TRIM PANEL - INSTALLATION)
(5) Connect battery negative cable.

TRIM PANEL

REMOVAL

(1) Remove trim and interior handle, if equipped (Fig. 21). (Refer to 23 - BODY/DOORS - REAR/INSIDE HANDLE ACTUATOR - REMOVAL)
(2) Remove push pin fasteners, if equipped.
(3) Using a trim stick C-4755 or equivalent, remove the lower trim panel.
(4) Remove rivets and remove upper trim panel, if equipped.

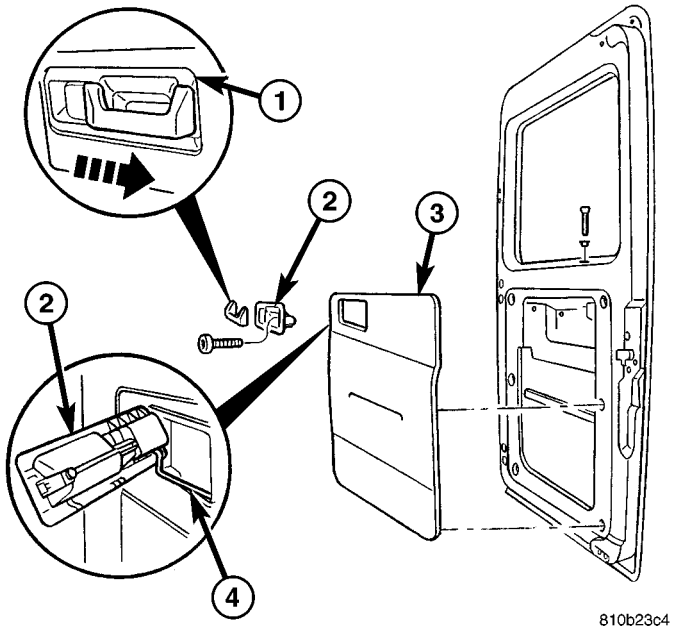


Fig. 21 TRIM PANEL

1 - TRIM
2 - INSIDE HANDLE ACTUATOR
3 - TRIM PANEL
4 - CONTROL CABLE

INSTALLATION

(1) Install upper trim panel and replace rivets.
(2) Install lower trim and install push pin fasteners, if equipped.
(3) Install interior handle, if equipped. (Refer to 23 - BODY/DOORS - REAR/INSIDE HANDLE ACTUATOR - INSTALLATION)

DOORS - SLIDING

TABLE OF CONTENTS

page

EXTERIOR HANDLE
REMOVAL 36
INSTALLATION 36
INSIDE HANDLE ACTUATOR
REMOVAL 37
INSTALLATION 37
UPPER ROLLER ARM
REMOVAL 37
INSTALLATION 37
CENTER ROLLER ARM
REMOVAL 37
INSTALLATION 38
LOWER ROLLER ARM
REMOVAL 38
INSTALLATION 38
CENTER TRACK
REMOVAL 38
INSTALLATION 39
LATCH / LOCK CONTROL
REMOVAL 39
INSTALLATION 40
REAR LATCH
REMOVAL 40
INSTALLATION 40
REAR LATCH STRIKER
REMOVAL 41
INSTALLATION 41
SLIDING DOOR
REMOVAL 41
DISASSEMBLY 42
ASSEMBLY 43
INSTALLATION 44
ADJUSTMENTS
ADJUSTMENT 44
STABILIZER
REMOVAL 45
INSTALLATION 45
TRIM PANEL
REMOVAL 46
INSTALLATION 46
DOOR GLASS
REMOVAL 46
INSTALLATION 46

EXTERIOR HANDLE

REMOVAL

(1) Remove trim cap. (Fig. 1)
(2) Remove bolt.
(3) Push handle back and remove.

INSTALLATION

(1) Install handle into door opening and push back so the three catch points lock in place on both sides. (Fig. 1)
(2) Install bolt and tighten to 10 N·m (89 in. lbs.).
(3) Install trim cap.

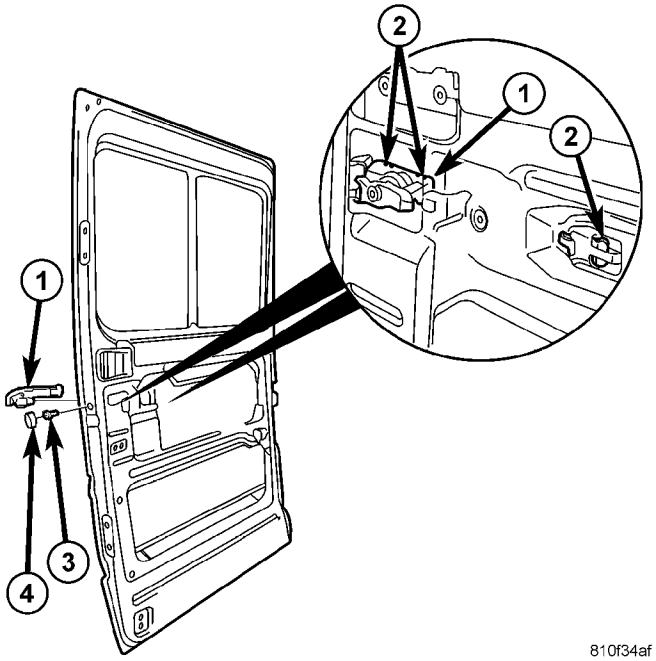


Fig. 1 EXTERIOR HANDLE

1 - EXTERIOR HANDLE
2 - CATCH POINTS
3 - BOLT
4 - TRIM CAP

INSIDE HANDLE ACTUATOR

REMOVAL

(1) Remove the trim plug. (Fig. 2)
(2) Remove screw and remove handle.

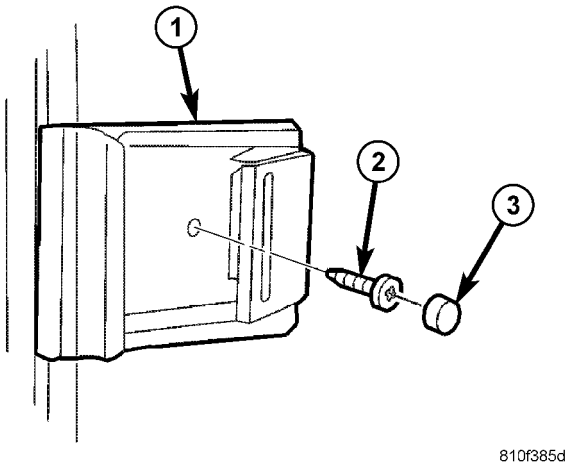


Fig. 2 INTERIOR HANDLE

1 - HANDLE
2 - SCREW
3 - TRIM PLUG

INSTALLATION

(1) Install the handle and screw.
(2) Tighten screw to 10 N·m (89 in. lbs.).
(3) Install trim plug.

UPPER ROLLER ARM

REMOVAL

(1) Using a grease pencil or equivalent, mark position of roller arm to aid installation.
(2) Support door with suitable device.
(3) Remove the bolts. (Fig. 3)
(4) Slide roller arm towards rear of vehicle and remove from back of track.

INSTALLATION

(1) Install roller arm into upper track from back.
(2) Position roller arm on door and install the bolts.
(3) Tighten bolts to 25 N·m (18 ft. lbs.).
(4) Adjust door as necessary. (Refer to 23 - BODY/DOORS - SLIDING/SLIDING DOOR - ADJUSTMENTS)

CENTER ROLLER ARM

REMOVAL

(1) Remove trim cover. (Fig. 4)

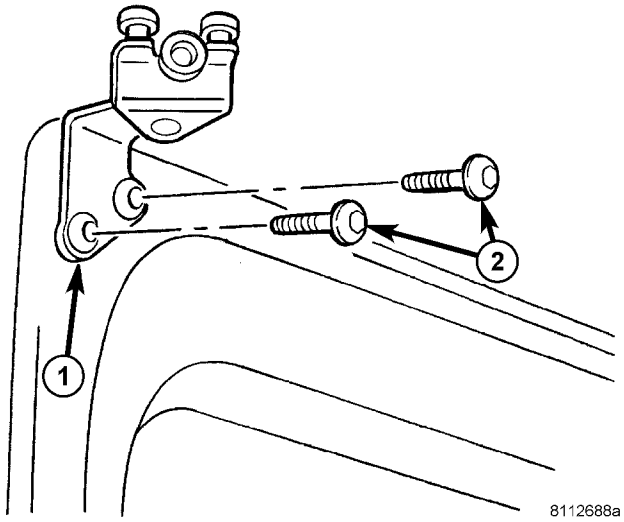


Fig. 3 UPPER ROLLER ARM

1 - ROLLER ARM
2 - BOLTS

(2) Remove trim panel if necessary. (Refer to 23 - BODY/DOORS - SLIDING/TRIM PANEL - REMOVAL)
(3) Remove rubber cover.
(4) Using a grease pencil or equivalent, mark the horizontal position of the arm at the arrow.
(5) Support door with suitable lifting device.
(6) Remove bolt and remove roller arm from door.
(7) Remove roller arm from center guide track.

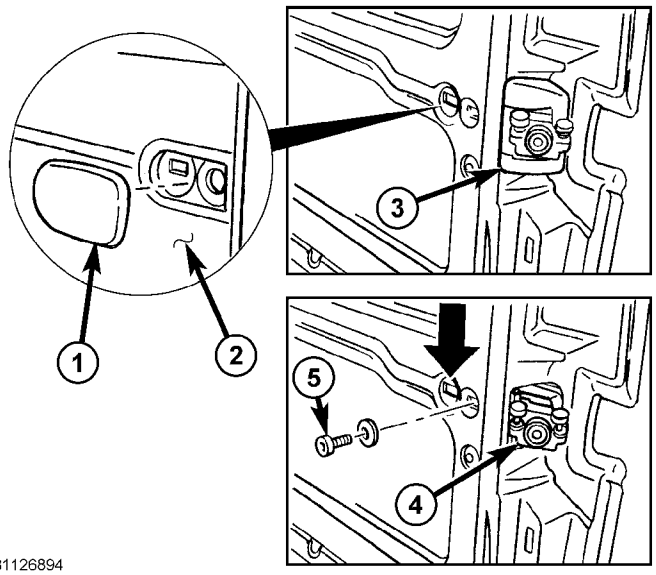


Fig. 4 CENTER ROLLER ARM

1 - TRIM COVER
2 - SLIDING DOOR
3 - CENTER ROLLER ARM RUBBER COVER
4 - CENTER ROLLER ARM
5 - BOLT

CENTER ROLLER ARM (Continued)

INSTALLATION

(1) Position roller arm in guide track.
(2) Install arm into door opening and line up tab with marks made previously.
(3) Install bolt and tighten to 45 N·m (33 ft. lbs.).
(4) Install rubber cover.
(5) Adjust door if necessary. (Refer to 23 - BODY/DOORS - SLIDING/SLIDING DOOR - ADJUSTMENTS)
(6) Install trim panel if necessary. (Refer to 23 - BODY/DOORS - SLIDING/TRIM PANEL - INSTALLATION)
(7) Install trim cover.

LOWER ROLLER ARM

REMOVAL

(1) Remove trim plugs and screws and remove stepwell scuff pad. (Fig. 5)
(2) Remove the door screws and remove the roller arm. (Fig. 6)

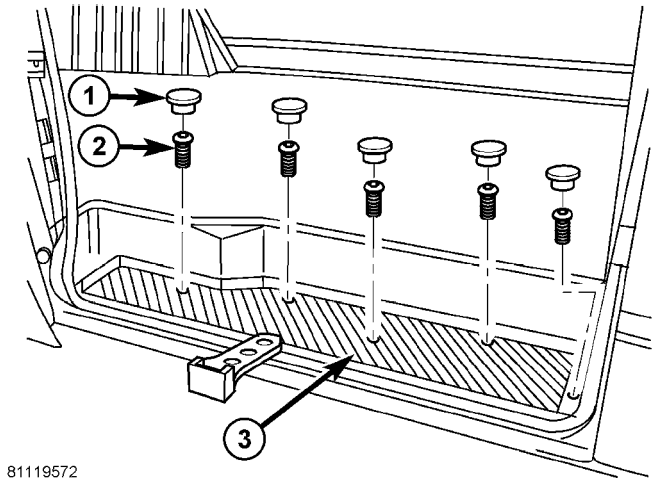


Fig. 5 SLIDING DOOR SCUFF PAD

1 - TRIM PLUGS
2 - SCREWS (5)
3 - SCUFF PAD

INSTALLATION

(1) Install roller arm and install door screws.
(2) Tighten screws to 25 N·m (18 ft. lbs.).
(3) Install stepwell scuff pad and install screws.
(4) Adjust door if necessary. (Refer to 23 - BODY/DOORS - SLIDING/SLIDING DOOR - ADJUSTMENTS)

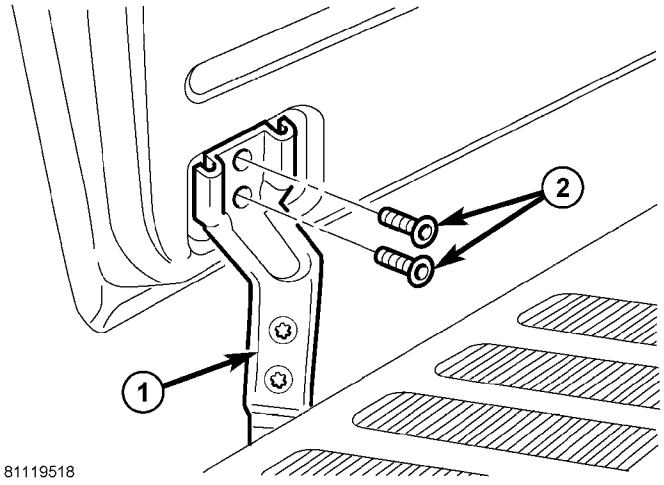


Fig. 6 SLIDING DOOR LOWER ROLLER ARM

1 - SCREWS
2 - ROLLER ARM

CENTER TRACK

REMOVAL

(1) Remove center roller arm. (Refer to 23 - BODY/DOORS - SLIDING/CENTER ROLLER ARM - REMOVAL)
(2) Remove quarter trim panel. (Refer to 23 - BODY/INTERIOR/QUARTER TRIM PANEL - REMOVAL)
(3) Remove the nuts. (Fig. 7)
(4) Remove the front bolts.

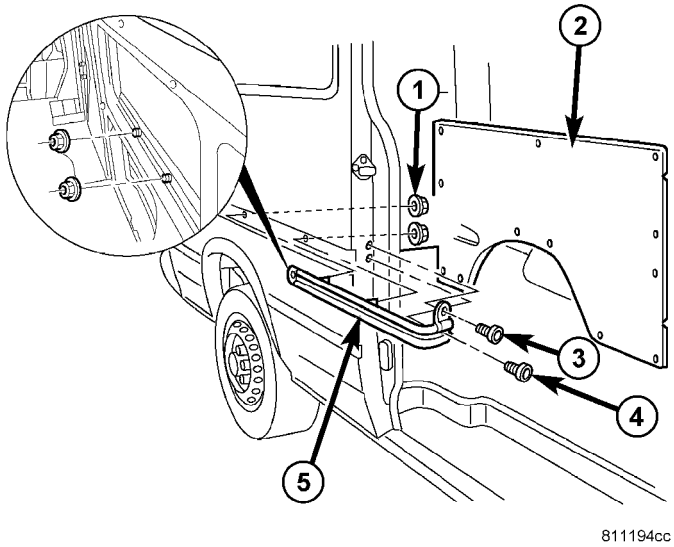


Fig. 7 SLIDING DOOR CENTER TRACK

1 - NUTS
2 - QUARTER TRIM PANEL
3 - BOLT
4 - BOLT
5 - CENTER TRACK

CENTER TRACK (Continued)

(5) Remove the screws and remove the center track end piece. (Fig. 8)

(6) Using a heat gun or equivalent, heat track up to approximately 60° C (140° F).

(7) Remove center track.

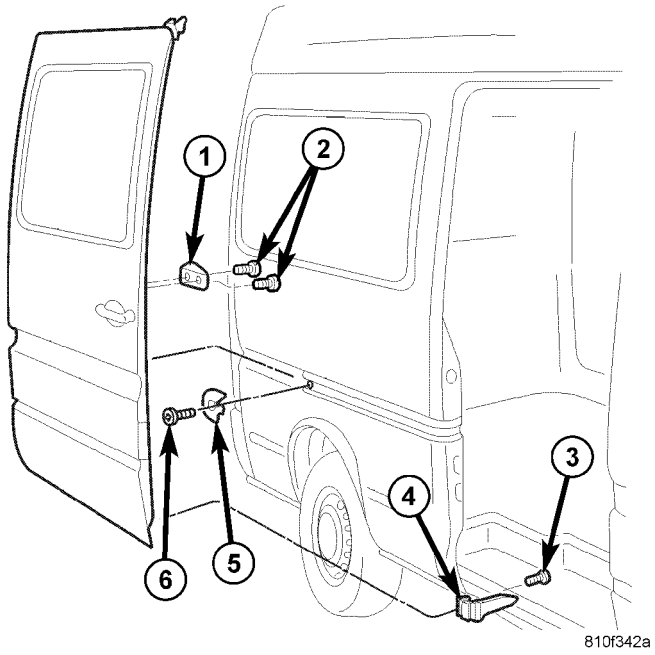


Fig. 8 SLIDING DOOR

1 - STOP BUMPER
2 - SCREWS (2)
3 - SCREWS (2)
4 - LOWER ROLLER ARM
5 - END PIECE
6 - SCREWS (2)

INSTALLATION

(1) Thoroughly clean all residue from the center track attachment area of the door.

(2) Wipe area clean with a 50% solution of water and alcohol and wipe dry.

(3) Remove protective foil from piece of adhesive strip on center track.

(4) Apply new center track and apply pressure of approximately 40 p.s.i. over the entire surface of the track.

(5) Install the front bolts and tighten to 10 N·m (89 in. lbs.).

(6) Install the interior nuts and tighten to 10 N·m (89 in. lbs.).

(7) Install quarter trim panel. (Refer to 23 - BODY/INTERIOR/QUARTER TRIM PANEL - INSTALLATION)

(8) Install the center roller arm. (Refer to 23 - BODY/DOORS - SLIDING/CENTER ROLLER ARM - INSTALLATION)

(9) Install the center track end piece and install the screw.

LATCH / LOCK CONTROL

REMOVAL

(1) Disconnect and isolate battery negative cable.

(2) Remove trim panel. (Refer to 23 - BODY/DOORS - SLIDING/TRIM PANEL - REMOVAL)

(3) Disconnect electrical connectors. (Fig. 9)

(4) Remove bolts and remove control assembly. (Fig. 10)

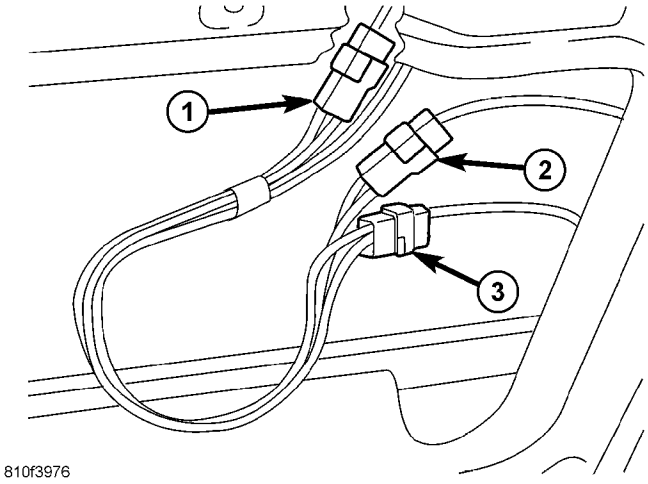


Fig. 9 ELECTRICAL CONNECTORS

1 - CONNECTOR
2 - CONNECTOR
3 - CONNECTOR

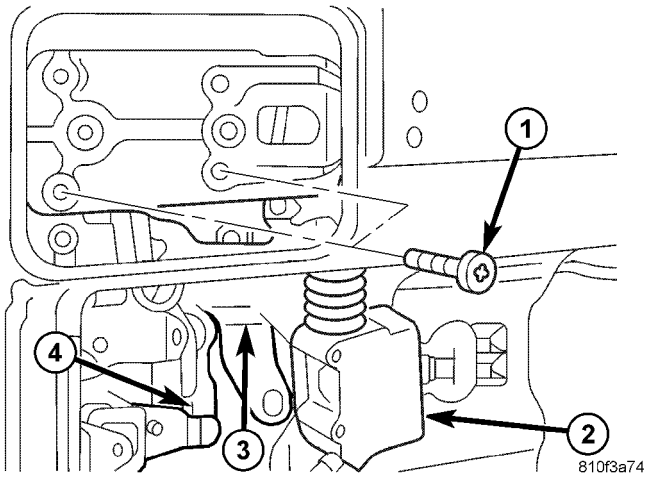


Fig. 10 LOCK ASSEMBLY FASTENERS

1 - SCREWS
2 - POWER LOCK ACTUATOR
3 - LATCH/LOCK CONTROL ASSEMBLY
4 - EXTERIOR DOOR LEVER

LATCH / LOCK CONTROL (Continued)

(5) Disconnect lock knob rod. (Fig. 11)
(6) Disconnect cable.

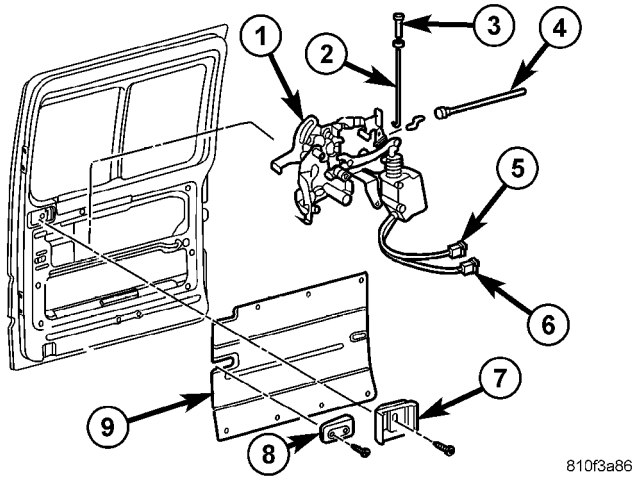


Fig. 11 LOCK ASSEMBLY

1 - LATCH/LOCK CONTROL ASSEMBLY
2 - LOCK ROD
3 - LOCK KNOB
4 - LATCH CONTROL CABLE
5 - ELECTRICAL CONNECTOR
6 - ELECTRICAL CONNECTOR
7 - INTERIOR HANDLE ACTUATOR
8 - STOP BUMPER
9 - TRIM PANEL

INSTALLATION

(1) Position latch/lock control assembly at door and connect the latch control assembly and lock rod.
(2) Install assembly and install new bolts. Make sure that the lever of the door handle is in front of the lever of the inside door lock. (Fig. 12)

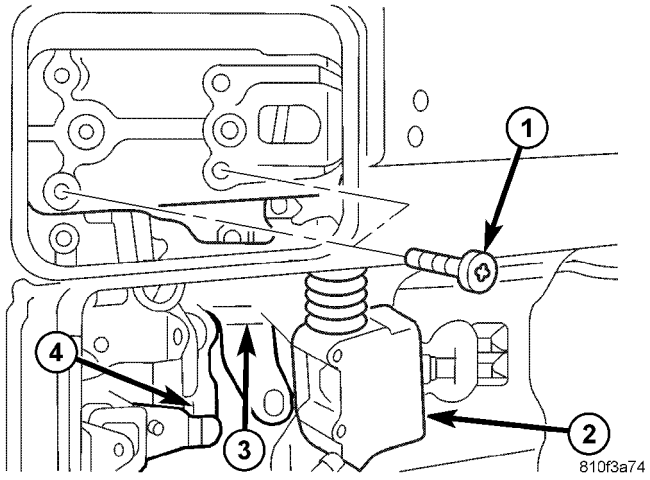


Fig. 12 LOCK ASSEMBLY FASTENERS

1 - SCREWS
2 - POWER LOCK ACTUATOR
3 - LATCH/LOCK CONTROL ASSEMBLY
4 - EXTERIOR DOOR LEVER

(3) Tighten bolts to 10 N·m (89 in. lbs.).
(4) Connect electrical connectors.
(5) Install trim panel. (Refer to 23 - BODY/DOORS - SLIDING/TRIM PANEL - INSTALLATION)
(6) Connect battery negative cable.

REAR LATCH

REMOVAL

(1) Disconnect and isolate battery negative cable.
(2) Remove trim panel. (Refer to 23 - BODY/DOORS - SLIDING/TRIM PANEL - REMOVAL)
(3) Remove the screws and remove the latch from door.
(4) Disconnect electrical connector, if equipped.
(5) Disconnect control cable.

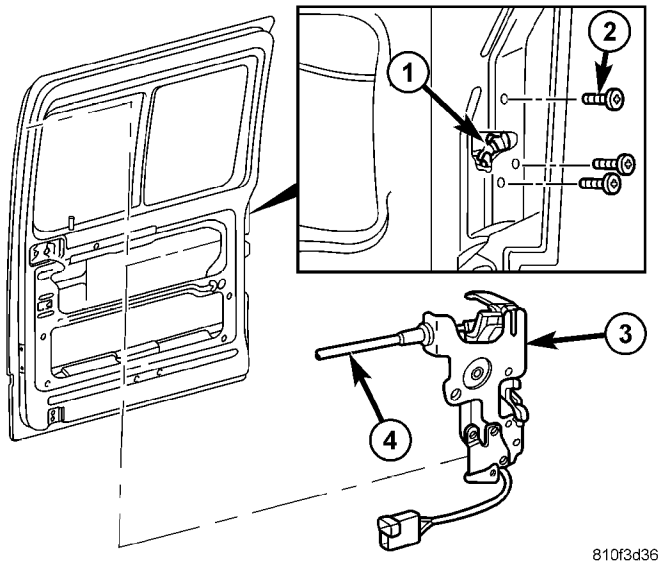


Fig. 13 REAR LATCH

1 - LATCH OPENING
2 - SCREWS
3 - LATCH ASSEMBLY
4 - CONTROL CABLE

INSTALLATION

(1) Connect control cable.
(2) Connect electrical connector, if equipped.
(3) Position latch in door and install screws.
(4) Tighten screws to 10 N·m (89 in. lbs.).
(5) Install trim panel. (Refer to 23 - BODY/DOORS - SLIDING/TRIM PANEL - INSTALLATION)
(6) Connect battery negative cable.

REAR LATCH STRIKER

REMOVAL

(1) Open door.
(2) Remove bolts and remove striker. (Fig. 14)

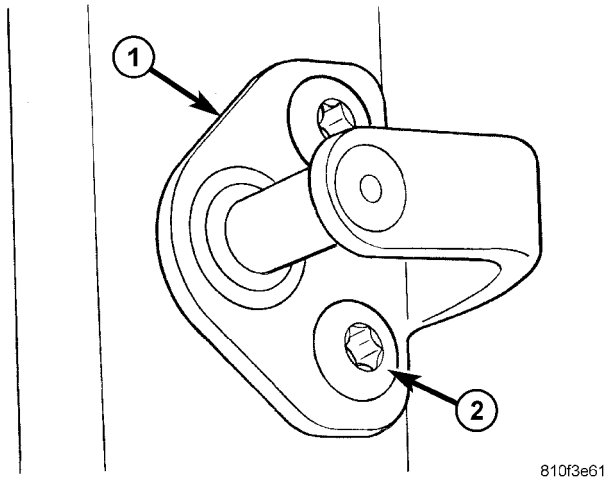


Fig. 14 LATCH STRIKER

1 - STRIKER
2 - BOLTS

INSTALLATION

(1) Install striker and bolts.
(2) Tighten bolts to 25 N·m (18 ft. lbs.)
(3) Adjust striker if necessary. (Refer to 23 - BODY/DOORS - SLIDING/SLIDING DOOR - ADJUSTMENTS)

SLIDING DOOR

REMOVAL

(1) Disconnect and isolate battery negative cable.
(2) Remove the screws and remove the center track end piece. (Fig. 15)
(3) Remove the screws and remove the stop bumper.
(4) Remove the screws attaching the lower roller arm to door.
(5) Support door with a suitable lifting device and roll off the upper and center tracks towards the rear of vehicle.

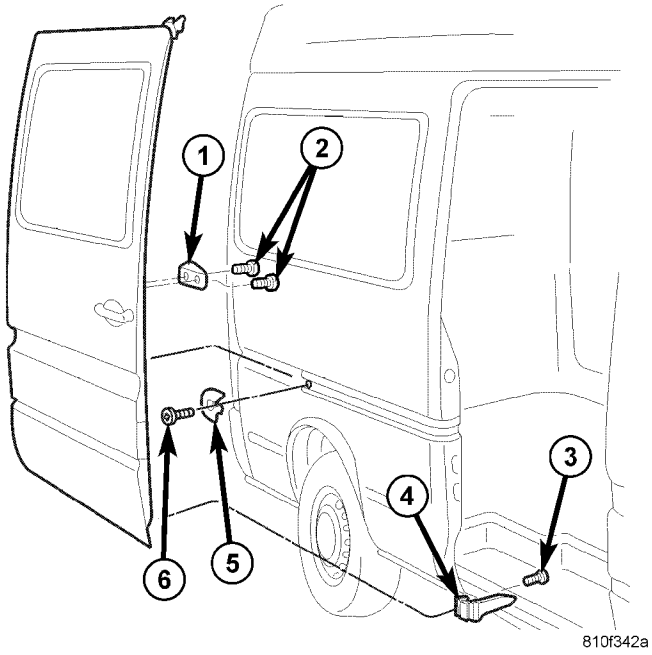


Fig. 15 SLIDING DOOR

1 - STOP BUMPER
2 - SCREWS (2)
3 - SCREWS (2)
4 - LOWER ROLLER ARM
5 - END PIECE
6 - SCREWS (2)

SLIDING DOOR (Continued)

DISASSEMBLY

(1) Remove door.(Refer to 23 - BODY/DOORS - SLIDING/REAR LATCH STRIKER - REMOVAL)

(2) Remove inside door handle actuator (7). (Refer to 23 - BODY/DOORS - SLIDING/INSIDE HANDLE ACTUATOR - REMOVAL)

(3) Remove center roller arm cover (23). (Fig. 16)

(4) Remove trim panel (24). (Refer to 23 - BODY/DOORS - SLIDING/TRIM PANEL - REMOVAL)

(5) Remove lock knob (27).

(6) Disconnect lock rod (25) and remove.

(7) Remove rear latch (22). (Refer to 23 - BODY/DOORS - SLIDING/REAR LATCH - REMOVAL)

(8) Remove latch/lock control (14). (Refer to 23 - BODY/DOORS - SLIDING/LATCH / LOCK CONTROL - REMOVAL)

(9) Remove exterior handle (10). (Refer to 23 - BODY/DOORS - SLIDING/EXTERIOR HANDLE - REMOVAL)

(10) Remove center roller arm (20). (Refer to 23 - BODY/DOORS - SLIDING/LOWER ROLLER ARM - REMOVAL)

(11) Remove stabilizer wedges (6). (Refer to 23 - BODY/DOORS - SLIDING/STABILIZER - REMOVAL)

(12) Remove upper roller arm (2). (Refer to 23 - BODY/DOORS - SLIDING/UPPER ROLLER - REMOVAL)

(13) Remove bolts (28) and remove crash reinforcement (29).

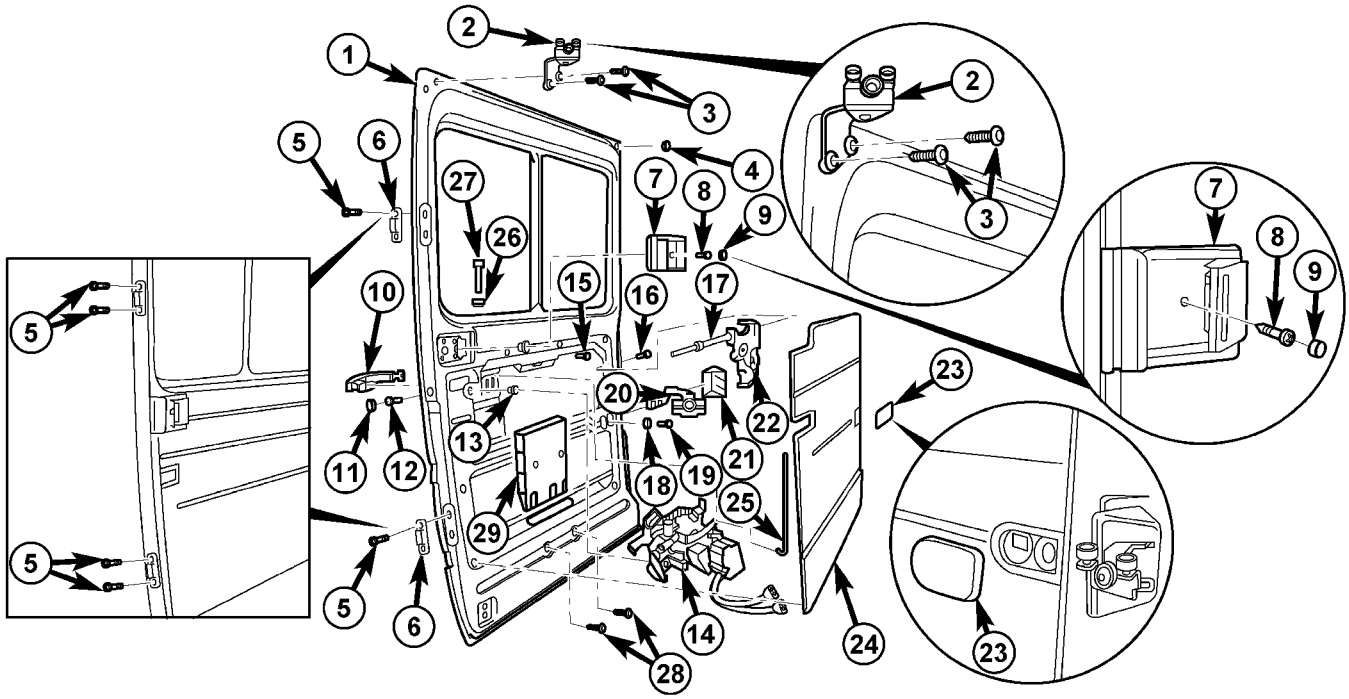


Fig. 16 SLIDING DOOR ASSEMBLY

1 - SLIDING DOOR
2 - UPPER ROLLER ARM
3 - BOLTS (2)
4 - TRIM PLUG
5 - BOLTS (2)
6 - STABILIZER PIN
7 - INSIDE HANDLE ACTUATOR
8 - SCREWS
9 - TRIM PLUG
10 - EXTERIOR HANDLE
11 - TRIM PLUG
12 - BOLT (1)
13 - NUT
14 - LATCH/LOCK CONTROL
15 - BOLT
16 - BOLT
17 - RELEASE CABLE
18 - WASHER
19 - BOLT
20 - CENTER ROLLER ARM
21 - RUBBER COVER
22 - REAR LATCH
23 - COVER
24 - TRIM PANEL
25 - CONNECTOR ROD
26 - GROMMET
27 - LOCK KNOB
28 - SCREWS
29 - CRASH REINFORCEMENT

SLIDING DOOR (Continued)

ASSEMBLY

(1) Install the crash reinforcement (29). (Fig. 17)

(2) Install the bolts (28) and tighten to 21 N·m (15 ft. lbs.).

(3) Install upper roller arm (2). (Refer to 23 - BODY/DOORS - SLIDING/UPPER ROLLER - INSTALLATION)

(4) Install stabilizer wedges (6). (Refer to 23 - BODY/DOORS - SLIDING/STABILIZER - INSTALLATION)

(5) Install center roller arm (20). (Refer to 23 - BODY/DOORS - SLIDING/LOWER ROLLER ARM - INSTALLATION)

(6) Install exterior handle (10). (Refer to 23 - BODY/DOORS - SLIDING/EXTERIOR HANDLE - INSTALLATION)

(7) Install the latch/lock control (14). (Refer to 23 - BODY/DOORS - SLIDING/LATCH / LOCK CONTROL - INSTALLATION)

(8) Install the rear latch (22). (Refer to 23 - BODY/DOORS - SLIDING/REAR LATCH - INSTALLATION)

(9) Install lock rod (25) and connect to latch/lock control.

(10) Install the lock knob (27).

(11) Install the trim panel (24). (Refer to 23 - BODY/DOORS - SLIDING/TRIM PANEL - INSTALLATION)

(12) Install inside handle actuator (7). (Refer to 23 - BODY/DOORS - SLIDING/INSIDE HANDLE ACTUATOR - INSTALLATION)

(13) Install the center roller arm cover (23).

(14) Install the door. (Refer to 23 - BODY/DOORS - SLIDING/SLIDING DOOR - INSTALLATION)

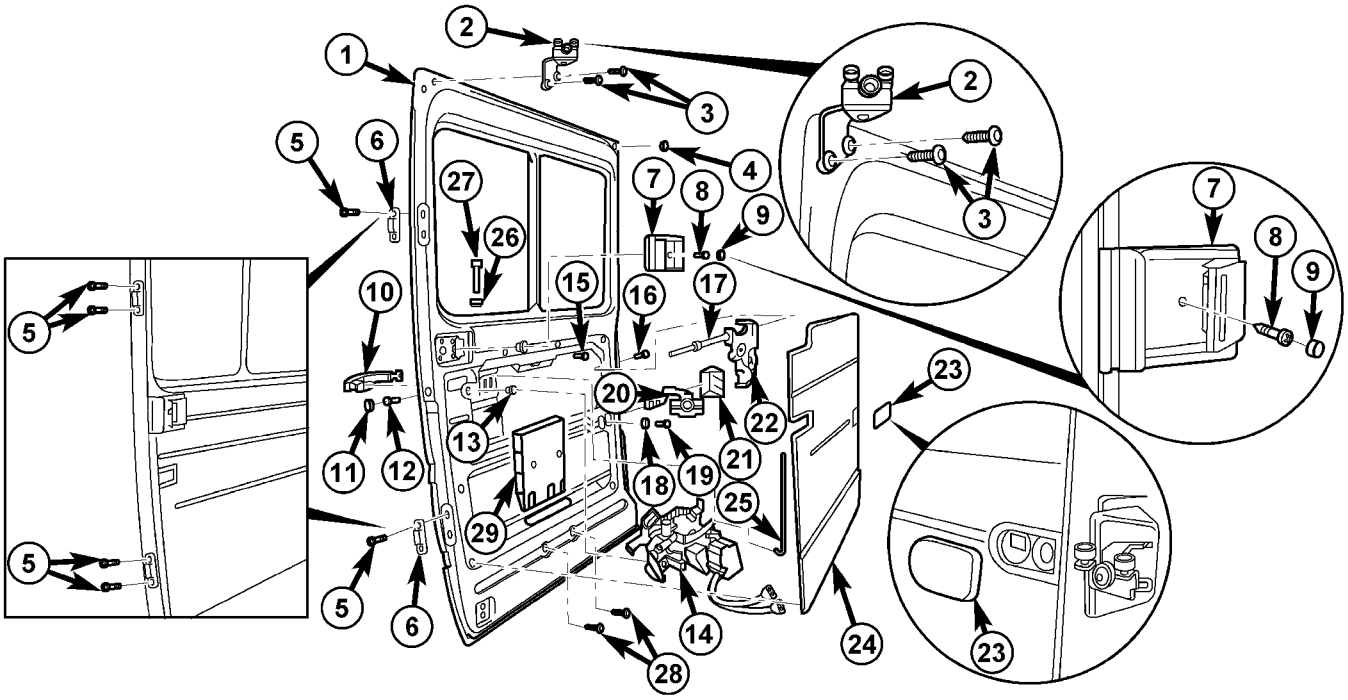


Fig. 17 SLIDING DOOR ASSEMBLY

1 - SLIDING DOOR
2 - UPPER ROLLER ARM
3 - BOLTS (2)
4 - TRIM PLUG
5 - BOLTS (2)
6 - STABILIZER PIN
7 - INSIDE HANDLE ACTUATOR
8 - SCREWS
9 - TRIM PLUG
10 - EXTERIOR HANDLE
11 - TRIM PLUG
12 - BOLT (1)
13 - NUT
14 - LATCH/LOCK CONTROL
15 - BOLT
16 - BOLT
17 - RELEASE CABLE
18 - WASHER
19 - BOLT
20 - CENTER ROLLER ARM
21 - RUBBER COVER
22 - REAR LATCH
23 - COVER
24 - TRIM PANEL
25 - CONNECTOR ROD
26 - GROMMET
27 - LOCK KNOB
28 - SCREWS
29 - CRASH REINFORCEMENT

SLIDING DOOR (Continued)

INSTALLATION

(1) Install the door by inserting the center and upper rollers into the tracks and sliding the door forward to the front of each track.
(2) Connect the lower roller arm and install the screws.
(3) Tighten the screws to 25 N·m (18 ft. lbs.).
(4) Install door stop and screws.
(5) Tighten the screws to 10 N·m (89 in. lbs.).
(6) Install the center track end piece and install the screw.
(7) Tighten the screw to 10 N·m (89 in. lbs.).
(8) Check and adjust door if necessary. (Refer to 23 - BODY/DOORS - SLIDING/SLIDING DOOR - ADJUSTMENTS)
(9) Connect battery negative cable.

ADJUSTMENTS

ADJUSTMENT

NOTE: Door adjustment measurements should be taken from stationary or welded body panels like the roof, rocker or quarter panels.
A suitable body sealant should be used when removing or moving the hinges.

(1) Remove bolts and remove striker. (Fig. 18)

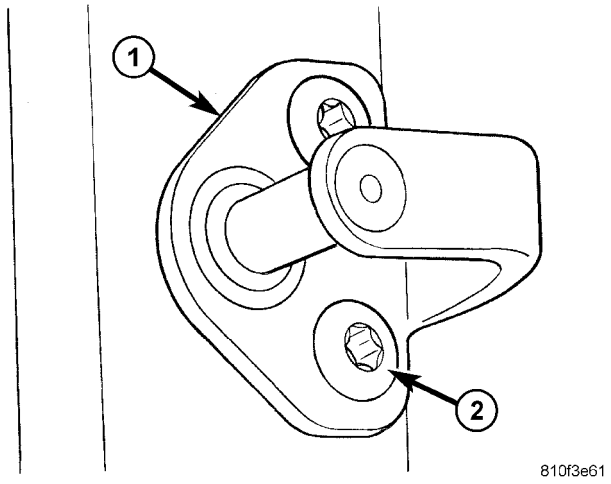


Fig. 18 LATCH STRIKER

1 - STRIKER
2 - BOLTS

(2) Check gaps and ridge pattern on door all the way around. (Refer to 23 - BODY/BODY STRUCTURE/GAP AND FLUSH - SPECIFICATIONS)

NOTE: It must be possible to move the guide wedge during the entire adjusting procedure. In order to close the door during adjustment move guide wedge if necessary.

(3) Loosen guide wedge screws.

Gaps and Ridge Adjustment

(1) Loosen screw and adjust rear ridge pattern by lifting and lowering sliding door at center roller arm. (Fig. 19)

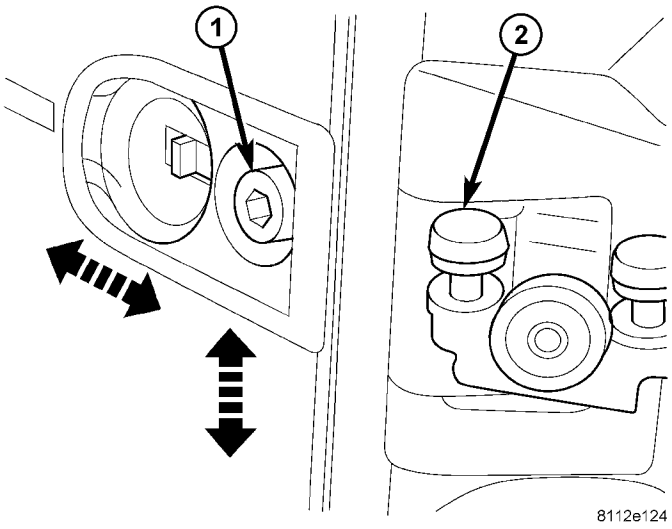


Fig. 19 ADJUST CENTER ROLLER ARM

1 - BOLT
2 - CENTER ROLLER ARM

(2) Tighten bolt to 45 N·m (33 ft. lbs.).
(3) Loosen upper roller arm screws. (Fig. 20)
(4) Loosen lower roller arm screws.
(5) Adjust front ridge pattern by raising or lowering door.

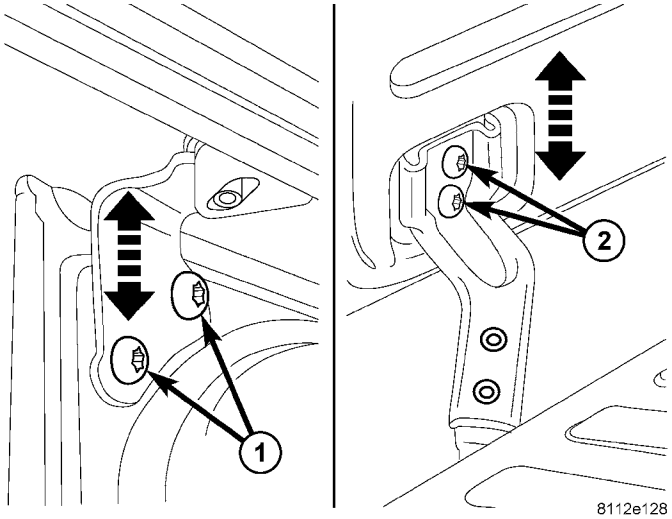


Fig. 20 UP/DOWN ADJUST

1 - SCREWS (2) UPPER ROLLER ARM
2 - SCREWS (2) LOWER ROLLER ARM

(6) Tighten upper and lower roller arm bolts to 25 N·m (18 ft. lbs.).

SLIDING DOOR (Continued)

(7) Loosen center roller bolt and adjust the front and rear gaps.

(8) Check rear ridge pattern alignment and tighten bolt to 45 N·m (33 ft. lbs.).

Flush Adjustment

(1) Loosen upper roller arm screw. (Fig. 21)

(2) Loosen lower roller arm screws.

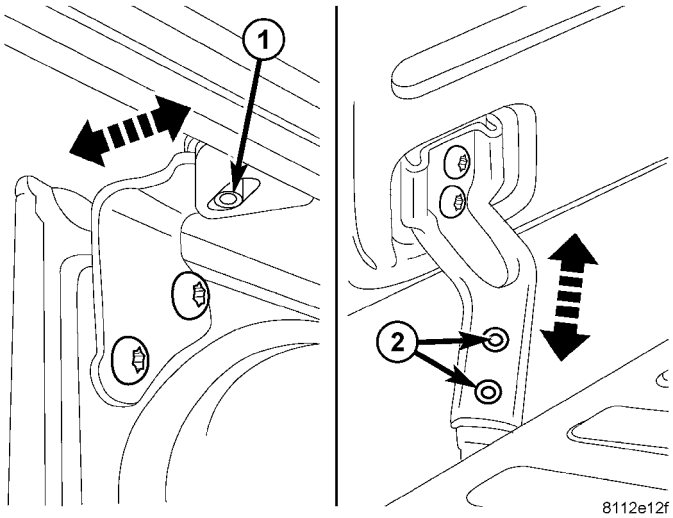


Fig. 21 IN/OUT ADJUST

1 - IN/OUT ADJUSTMENT SCREW - UPPER ARM
2 - IN/OUT ADJUSTMENT SCREWS - LOWER ARM

(3) Adjust front of door flushness by altering position of top and bottom roller arms.

(4) Tighten upper and lower roller arm adjustment screws.

(5) Install door striker and hand tighten the bolts.

(6) Adjust door striker in and out to adjust rear door flushness.

(7) Tighten striker bolts to 25 N·m (18 ft. lbs.). (Fig. 18)

(8) Loosen stabilizer closing wedge screws. (Fig. 22)

(9) Close sliding door to adjust closing wedge.

(10) Open door and tighten screws to 10 N·m (89 in. lbs.).

Door Stop Bumper Adjust

(1) Loosen door stop bumper bolts.

(2) Open sliding door and hold tight in end position.

(3) Hold stop bumper tight against c-pillar and tighten bolts to 10 N·m (89 in. lbs.).

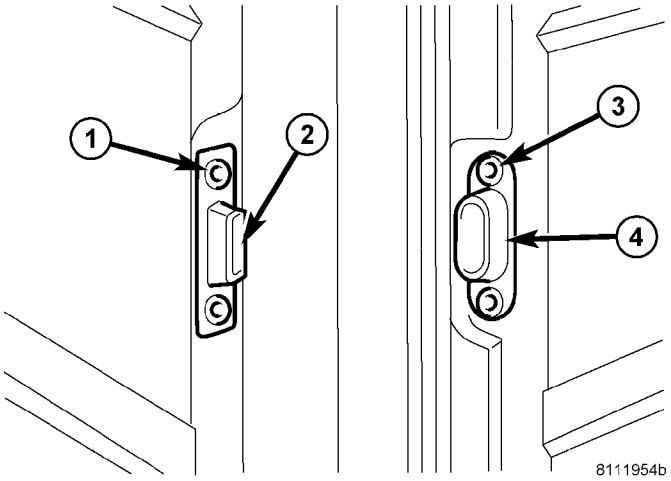


Fig. 22 SLIDING DOOR STABILIZER

1 - SCREWS
2 - GUIDE WEDGES (2)
3 - SCREWS
4 - RECEIVERS (2)

STABILIZER

REMOVAL

(1) Remove screws and remove stabilizers. (Fig. 23)

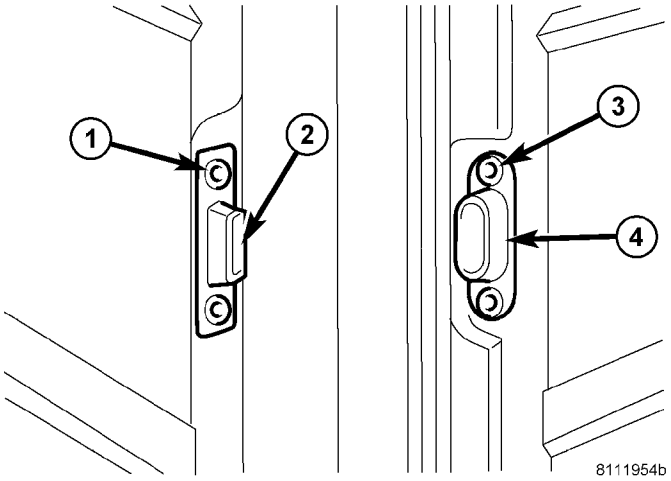


Fig. 23 SLIDING DOOR STABILIZER

1 - SCREWS
2 - GUIDE WEDGES (2)
3 - SCREWS
4 - RECEIVERS (2)

INSTALLATION

(1) Install receiver and install screws.

(2) Tighten screws to 10 N·m (89 in. lbs.).

(3) Install wedge and install screws.

(4) Close sliding door to adjust closing wedge.

(5) Open door and tighten screws to 10 N·m (89 in. lbs.).

TRIM PANEL

REMOVAL

Upper

(1) Remove rivets and remove panel.

Lower

(1) Remove the bolts and remove the stop bumper. (Fig. 24)

(2) Remove the inside handle actuator. (Refer to 23 - BODY/DOORS - SLIDING/INSIDE HANDLE ACTUATOR - REMOVAL)

(3) Remove the push pin fasteners and remove the trim panel.

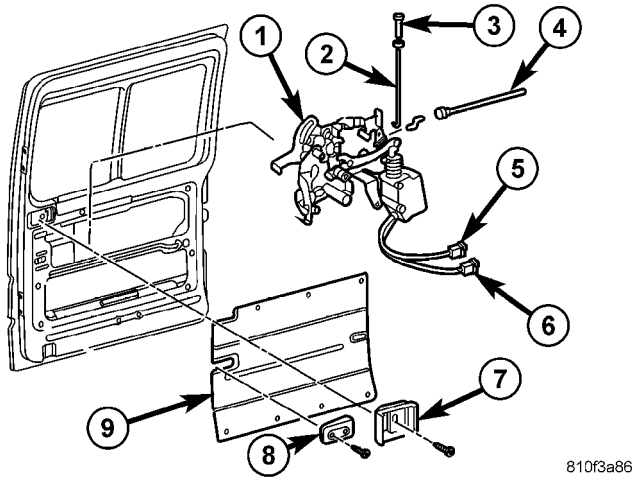


Fig. 24 LOCK ASSEMBLY

1 - LATCH/LOCK CONTROL ASSEMBLY
2 - LOCK ROD
3 - LOCK KNOB
4 - LATCH CONTROL CABLE
5 - ELECTRICAL CONNECTOR
6 - ELECTRICAL CONNECTOR
7 - INTERIOR HANDLE ACTUATOR
8 - STOP BUMPER
9 - TRIM PANEL

INSTALLATION

Upper

(1) Install trim panel and replace rivets.

Lower

(1) Install the trim panel and push pin fasteners.

(2) Install the inside handle actuator. (Refer to 23 - BODY/DOORS - SLIDING/INSIDE HANDLE ACTUATOR - INSTALLATION)

(3) Install stop bumper, bolts and adjust if necessary. (Refer to 23 - BODY/DOORS - SLIDING/SLIDING DOOR - ADJUSTMENTS)

DOOR GLASS

REMOVAL

(1) Position an assistant on one side of the door to receive the glass and weatherstrip seal.

(2) Start at an inside, upper corner. Separate the seal from the window opening. Push the glass and seal outward from the window opening. Remove the glass and seal.

(3) Clean the window opening.

INSTALLATION

(1) Install the weatherstrip seal on the window glass. Verify that the glass is seated in the groove around the edge of the seal.

(2) Insert an installation cord in the weatherstrip seal inner groove.

NOTE: Use mineral spirits as a lubricant to aid seal installation in the window opening.

(3) Position the glass and seal in the window opening.

(4) Pull the installation cord outward and force the seal lip over the panel flange around the edge of the opening.

(5) Seat the seal inner lip on the panel flange. Press against the lip around the edge of the seal.

NOTE: Remove any mineral spirits with a clean cloth after glass installation.

(6) Verify that the seal is seated in the window opening (Fig. 25).

(7) Test the window for water leaks. (Refer to 23 - BODY - DIAGNOSIS AND TESTING - WATER LEAKS)

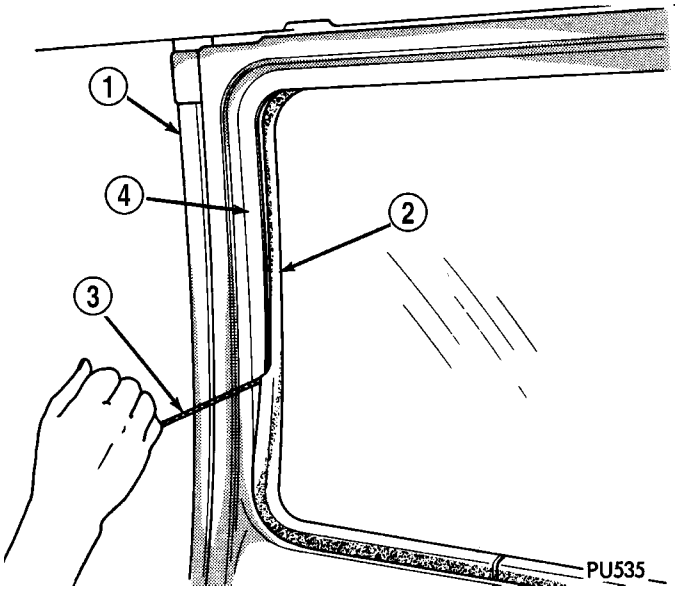


Fig. 25 Glass & Weatherstrip Seal Installation

1 - BODY PANEL
2 - WEATHERSTRIP SEAL
3 - INSTALLATION CORD
4 - WINDOW OPENING

EXTERIOR

TABLE OF CONTENTS

page

FUEL FILL DOOR
REMOVAL 47
INSTALLATION 47
GRILLE
REMOVAL 47
INSTALLATION 47
LICENSE PLATE BRACKET
REMOVAL 47
INSTALLATION 47
RADIATOR CROSSMEMBER
REMOVAL 47
INSTALLATION 48
SIDE VIEW MIRROR
REMOVAL 48
INSTALLATION 48
SIDE VIEW MIRROR - GLASS
REMOVAL 49
INSTALLATION 49

FUEL FILL DOOR

REMOVAL

(1) Open passenger compartment door.
(2) Open fuel fill door.
(3) Using a trim stick C-4755 or equivalent, disconnect the filler cap tether.
(4) Remove two bolts and remove filler door.

INSTALLATION

(1) Install the door and bolts.
(2) Connect filler cap tether.
(3) Close doors.

GRILLE

REMOVAL

(1) Remove screw rivets. (Fig. 1)
(2) Loosen lower screws.
(3) Remove upper screws.
(4) Remove grille.

INSTALLATION

(1) Install grille.
(2) Install upper screw.
(3) Tighten lower screws.
(4) Install screw rivets.

LICENSE PLATE BRACKET

REMOVAL

(1) Remove two lower push-pin fasteners
(2) Remove two screws.
(3) Remove bracket.

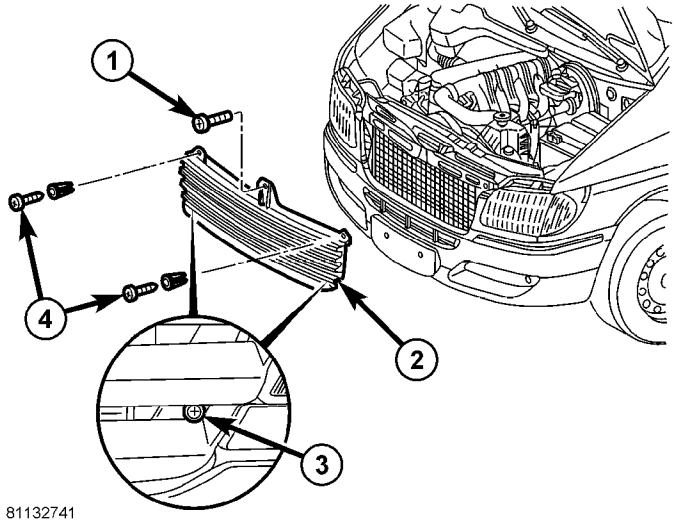


Fig. 1 GRILLE

1 - UPPER SCREW
2 - GRILLE
3 - LOWER SCREWS (2)
4 - SCREW RIVETS

INSTALLATION

(1) Install bracket.
(2) Install screws.
(3) Install push-pin fasteners.

RADIATOR CROSSMEMBER

REMOVAL

(1) Remove grille. (Refer to 23 - BODY/EXTERIOR/GRILLE - REMOVAL)
(2) Remove headlamps. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/FRONT LAMP UNIT - REMOVAL)
(3) Remove heat shield. (Fig. 2)
(4) Remove retaining clamps and rubber mounts.

RADIATOR CROSSMEMBER (Continued)

(5) Remove bolts.
(6) Remove crossmember and disconnect hood cable.

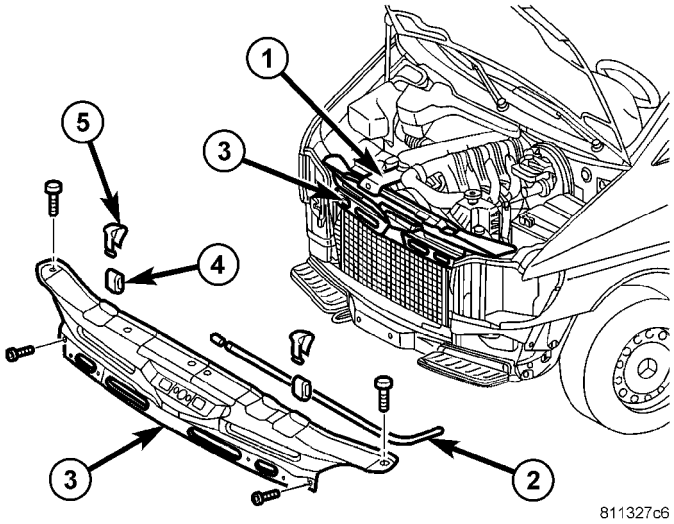


Fig. 2 RADIATOR CROSSMEMBER

1 - HEAT SHIELD
2 - HOOD CABLE
3 - CROSSMEMBER
4 - RUBBER MOUNTS
5 - RETAINING CLAMP

INSTALLATION

(1) Connect hood release cable and install crossmember.
(2) Install crossmember bolts and tighten to 14 N·m (10 ft. lbs.).
(3) Install rubber mounts and retaining clamps.
(4) Install heat shield.
(5) Install headlamps. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - EXTERIOR/FRONT LAMP UNIT - INSTALLATION)
(6) Install grille. (Refer to 23 - BODY/EXTERIOR/GRILLE - INSTALLATION)

SIDE VIEW MIRROR

REMOVAL

Driver's Side

(1) Disconnect and isolate battery negative cable.
(2) Remove trim plug. (Fig. 3)

NOTE: If the vehicle is not equipped with power mirrors, skip to step 5.

(3) Remove trim panel. (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - REMOVAL)
(4) Remove tape, expose electrical connector and disconnect. (Fig. 3)
(5) Remove bolts and remove mirror.
(6) If equipped, Pull wire harness through.

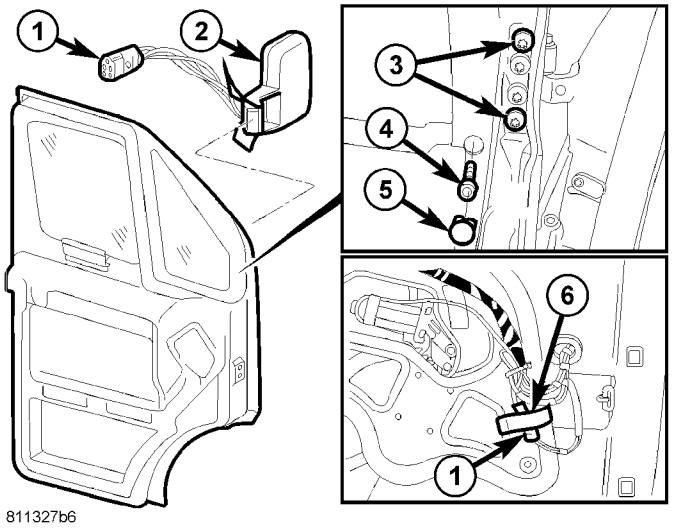


Fig. 3 DRIVERS SIDE MIRROR

1 - ELECTRICAL CONNECTOR
2 - MIRROR
3 - EXTERIOR BOLTS
4 - INNER BOLT
5 - TRIM PLUG
6 - TAPE

Passenger Side

(1) Disconnect and isolate battery negative cable.
(2) Remove trim plug. (Fig. 4)

NOTE: If the vehicle is not equipped with power mirrors, skip to step 5.

(3) Separate dust boot from a-pillar.
(4) Disconnect the electrical connector.
(5) Remove bolts and remove mirror.
(6) If equipped, pull wire harness through.

INSTALLATION

Driver's Side

(1) If equipped, pull wire harness through door.
(2) Install mirror and bolts.
(3) Tighten the bolts to 25 N·m (18 ft. lbs.).

NOTE: If vehicle is not equipped with power mirrors, skip to step 6.

(4) Connect electrical connector and replace tape.
(5) Install trim panel. (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - INSTALLATION)
(6) Install trim plug.
(7) Connect battery negative cable.

SIDE VIEW MIRROR (Continued)

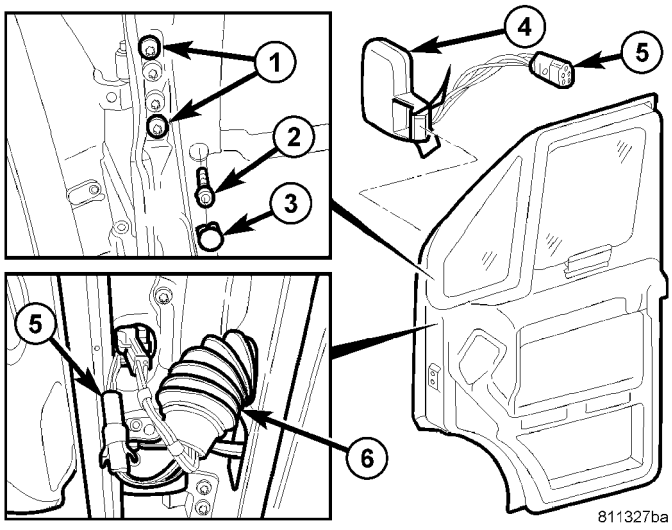


Fig. 4 PASSENGER SIDE MIRROR

1 - OUTER BOLTS
2 - INNER BOLT
3 - TRIM PLUG
4 - MIRROR
5 - ELECTRICAL CONNECTOR
6 - DUST BOOT

Passenger Side

(1) If equipped, pull wire harness through door.
(2) Install mirror and bolts.
(3) Tighten the bolts to 25 N·m (18 ft. lbs.).

NOTE: If vehicle is not equipped with power mirrors, skip to step 6.

(4) Connect the electrical connector.
(5) Connect dust boot to a-pillar.
(6) Install trim plug.
(7) Connect battery negative cable.

SIDE VIEW MIRROR - GLASS

REMOVAL

(1) Disconnect and isolate battery negative cable.
(2) Press mirror glass in at bottom.
(3) Pull mirror glass up and out of the guides. (Fig. 5)
(4) Disconnect the electrical connectors, if equipped.

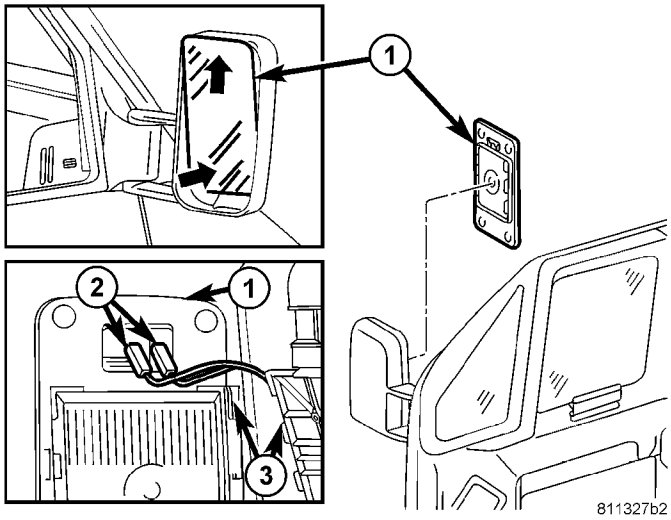


Fig. 5 SIDE VIEW MIRROR - GLASS

1 - MIRROR GLASS
2 - ELECTRICAL CONNECTORS
3 - GUIDES

INSTALLATION

(1) Connect the electrical connectors, if equipped.
(2) Push mirror glass down into the guides.
(3) Straighten mirror glass.
(4) Connect battery negative cable.

HOOD

TABLE OF CONTENTS

	page
HINGE	
REMOVAL	50
INSTALLATION	50
HOOD	
REMOVAL	50
INSTALLATION	50
ADJUSTMENTS	
ADJUSTMENT	51
LATCH	
REMOVAL	51
INSTALLATION	51
LATCH RELEASE CABLE	
REMOVAL	51
INSTALLATION	51
LATCH RELEASE HANDLE	
REMOVAL	52
INSTALLATION	52
PROP ROD	
REMOVAL	52
INSTALLATION	52
SAFETY LATCH	
REMOVAL	52
INSTALLATION	52

HINGE

REMOVAL

NOTE: It is not necessary to remove the hood to replace one or both hinges. The hinges can be replaced one at a time.

(1) Open hood and support as needed.
(2) Using a grease pencil or equivalent, mark the position of the hinge on the hood and cowl.
(3) Remove the two hood nuts.
(4) Remove the two cowl bolts and remove hinge.

INSTALLATION

(1) Position hinge on vehicle and align reference marks.
(2) Install cowl bolts and tighten to 23 N·m (17 ft. lbs.).
(3) Install hood nuts and tighten to 23 N·m (17 ft. lbs.).
(4) Check and adjust hood if necessary. (Refer to 23 - BODY/HOOD/HOOD - ADJUSTMENTS)

HOOD

REMOVAL

(1) Raise and support hood.
(2) Remove the prop rod retaining clip. (Fig. 1)
(3) Separate the prop and spring from the hood.
(4) Using a grease pencil or equivalent, mark location of hood hinges on hood for installation alignment.
(5) Remove nuts attaching hinges to hood.
(6) With the aid of a helper, remove hood from vehicle.

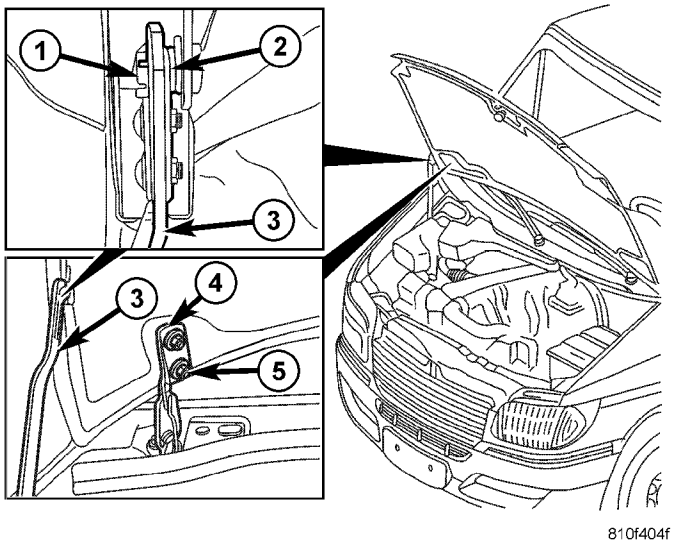


Fig. 1 HOOD

1 - PROP ROD RETAINING CLIP
2 - PROP SPRING
3 - PROP ROD
4 - HINGE
5 - NUTS (2)

INSTALLATION

(1) Position hood on hinges.
(2) Install nuts finger-tight.
(3) Connect spring and prop onto hood and install the retaining spring.

HOOD (Continued)

(4) Align hinges with installation reference marks and tighten bolts to 23 N·m (17 ft. lbs.).

(5) Check and adjust as necessary. (Refer to 23 - BODY/HOOD/HOOD - ADJUSTMENTS)

ADJUSTMENTS

ADJUSTMENT

SPECIFICATIONS

DESCRIPTION	SPECIFICATION
Left and right hood gaps	5 ± 0.5 mm
Flush offset for hood/fender	≤ 1.0 mm

(1) Check hood to fender gap. Refer to the SPECIFICATIONS table.

(2) Loosen hinge to cowl bolts and adjust hood side to side, if necessary.

(3) Tighten bolts to 23 N·m (17 ft. lbs.).

(4) Check hood to fender flushness. Refer to the SPECIFICATIONS table.

(5) Loosen hinge to hood nuts and adjust hood up and down, if necessary.

(6) Tighten nuts to 23 N·m (17 ft. lbs.).

(7) Loosen safety latch bolts. (Fig. 2)

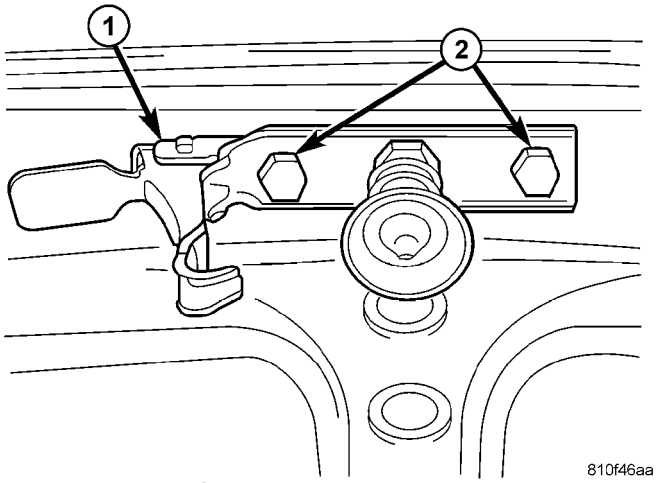


Fig. 2 SAFETY LATCH

1 - SAFETY LATCH
2 - BOLTS

(8) Adjust latch to align with hood latch, if necessary.

(9) Tighten safety latch bolts.

(10) Loosen safety latch striker pin lock nut and adjust striker pin up and down to adjust front of hood to fender flushness. Refer to the SPECIFICATIONS table.

(11) Tighten lock nut fully.

(12) Adjust hood slam bumpers up or down if necessary.

LATCH

REMOVAL

(1) Remove bolts and remove latch. (Fig. 3)

(2) Disconnect latch cable.

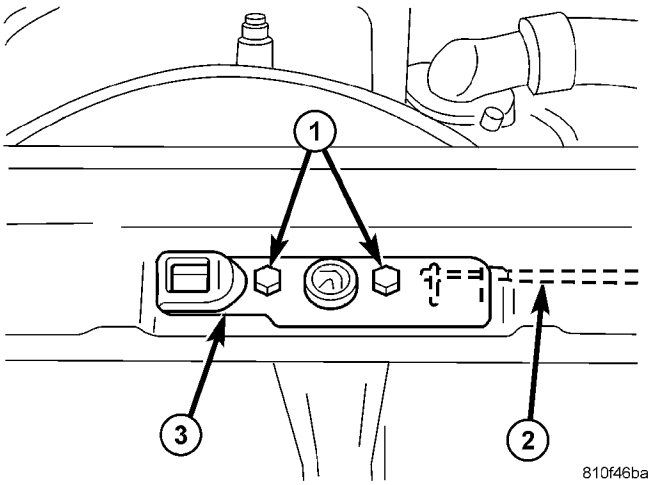


Fig. 3 HOOD LATCH

1 - BOLTS
2 - LATCH CABLE
3 - LATCH

INSTALLATION

(1) Connect latch cable and install latch.

(2) Install the bolts and tighten.

LATCH RELEASE CABLE

REMOVAL

(1) Remove the release handle screws and release handle.

(2) Disconnect the cable from the handle.

(3) Remove the latch. (Refer to 23 - BODY/HOOD/LATCH - REMOVAL)

(4) Route cable through cowl panel and remove from engine compartment.

INSTALLATION

(1) Route cable through engine compartment and into passenger compartment as necessary.

(2) Install latch. (Refer to 23 - BODY/HOOD/LATCH - INSTALLATION)

(3) Connect cable to release handle.

(4) Install release handle and install the screws.

LATCH RELEASE HANDLE

REMOVAL

(1) Remove the screws and remove the release handle.
(2) Disconnect the cable from handle.

INSTALLATION

(1) Connect latch cable to release handle.
(2) Install handle and install the screws.

PROP ROD

REMOVAL

(1) Open and support hood.
(2) Remove the prop rod retaining clip. (Fig. 1)
(3) Separate the prop and spring from the hood.
(4) Remove nut and position the washer bottle aside. (Fig. 4)
(5) Remove stud nut and remove hood prop. (Fig. 5)

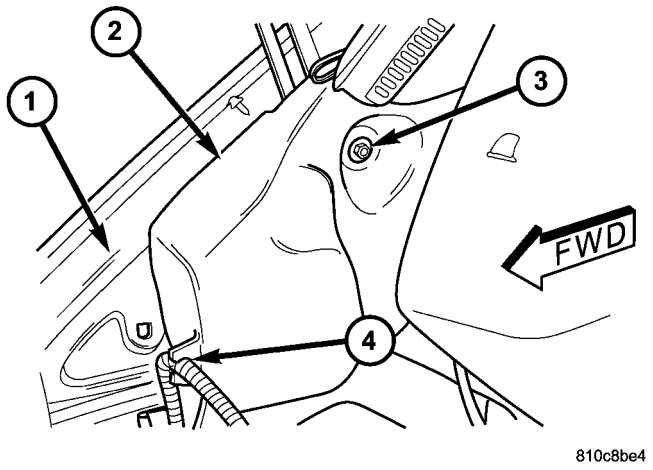


Fig. 4 Washer Reservoir Remove/Install

1 - RIGHT INNER FENDER
2 - WASHER RESERVOIR
3 - NUT & WASHER
4 - ROUTING CLIP

INSTALLATION

(1) Install hood prop and install the stud nut.
(2) Position washer bottle back and install the nut and washer.
(3) Connect spring and prop onto hood and install the retaining spring.

SAFETY LATCH

REMOVAL

(1) Open hood.
(2) Using a grease pencil or equivalent, mark the position of the safety latch to aid installation.

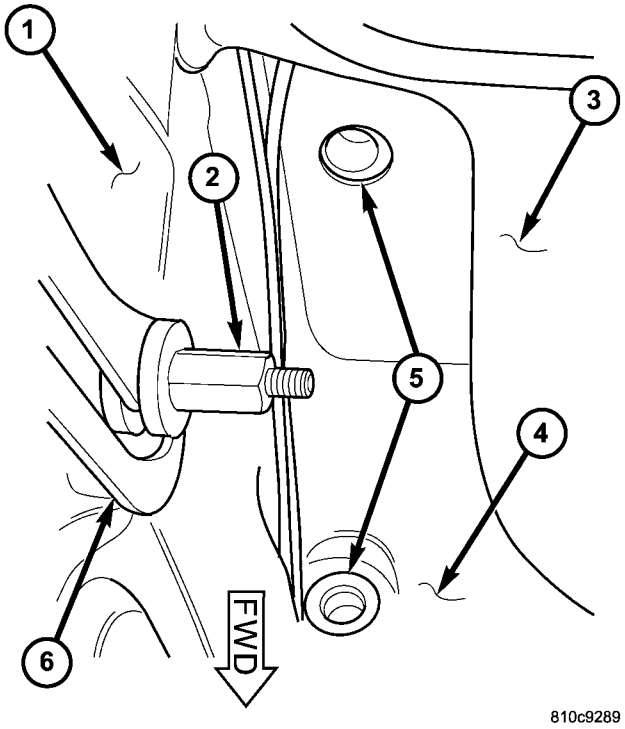


Fig. 5 Washer Reservoir Mounting

1 - RIGHT INNER FENDER
2 - STUD NUT
3 - DASH PANEL
4 - RIGHT FRONT WHEEL HOUSE
5 - GROMMET (2)
6 - HOOD PROP

(3) Remove the bolts and remove the latch. (Fig. 6)

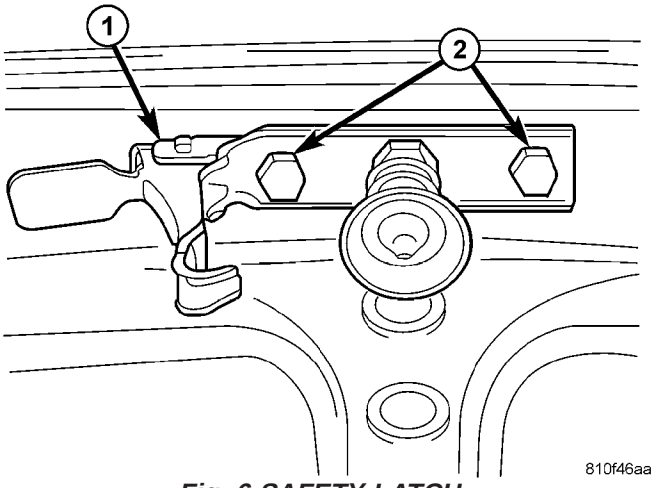


Fig. 6 SAFETY LATCH

1 - SAFETY LATCH
2 - BOLTS

INSTALLATION

(1) Install the latch and install the bolts.
(2) Adjust the latch if necessary. (Refer to 23 - BODY/HOOD/HOOD - ADJUSTMENTS)

INSTRUMENT PANEL

TABLE OF CONTENTS

page

CLUSTER BEZEL
REMOVAL 53
INSTALLATION 54
ACCESSORY SWITCH BEZEL
REMOVAL 54
INSTALLATION 54
INSTRUMENT PANEL CENTER BEZEL
REMOVAL 55
INSTALLATION 55
ASH RECEIVER
REMOVAL 55
INSTALLATION 55
CUP HOLDER
REMOVAL 55
INSTALLATION 56
GLOVE BOX
REMOVAL 56
INSTALLATION 56
INSTRUMENT PANEL ASSEMBLY
REMOVAL 57
INSTALLATION 61
TOP COVER - CLUSTER
REMOVAL 62
INSTALLATION 62
TOP COVER - TRAY
REMOVAL 63
INSTALLATION 64
TOP COVER
REMOVAL 64
INSTALLATION 65
STEERING COLUMN OPENING COVER
REMOVAL 66
INSTALLATION 66

CLUSTER BEZEL

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. 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) Unscrew screws. (Fig. 1)
(3) Using a trim stick C-4755 or equivalent, separate cover.
(4) Disconnect electrical connectors and remove bezel.

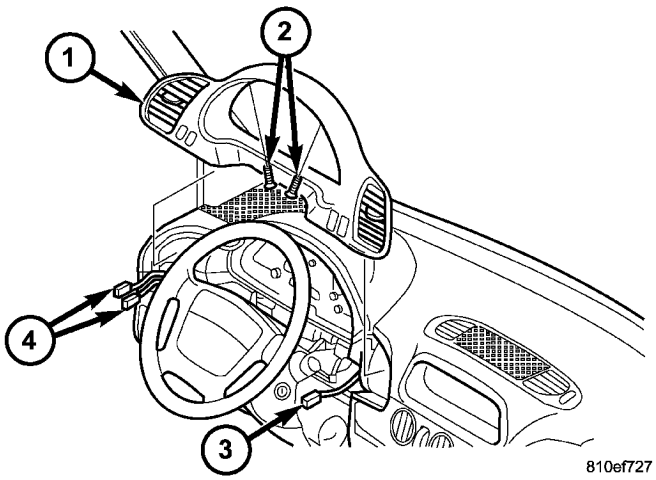


Fig. 1 CLUSTER BEZEL

1 - CLUSTER BEZEL
2 - SCREWS (2)
3 - ELECTRICAL CONNECTOR
4 - ELECTRICAL CONNECTORS

CLUSTER BEZEL (Continued)

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Connect the electrical connectors.
(2) Position cluster bezel into place and seat clips fully.
(3) Install screws.
(4) Connect battery negative cable.

ACCESSORY SWITCH BEZEL

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Move selector lever to position ″D″.
(2) Using a trim stick C-4755 or equivalent, remove shift lever frame trim. (Fig. 2)
(3) Using a trim stick C-4755 or equivalent, remove storage compartment.
(4) Remove ashtray.
(5) Remove screw and using a trim stick C-4755 or equivalent, remove bezel.

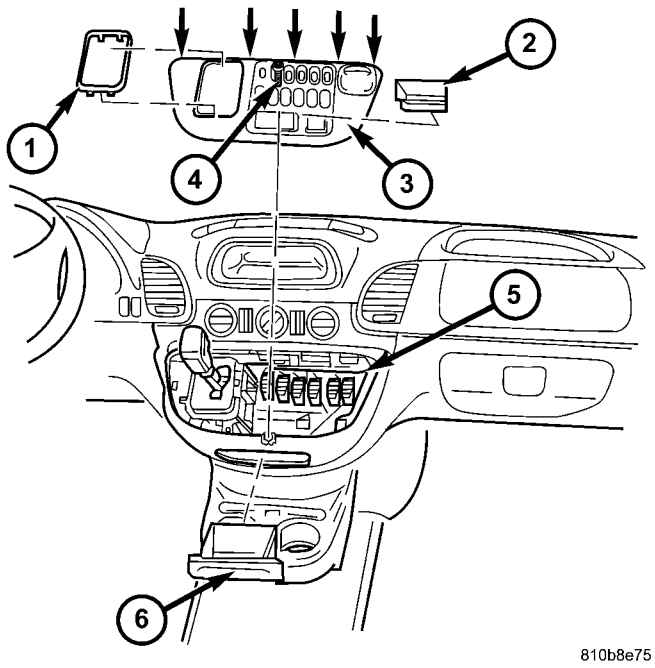


Fig. 2 ACCESSORY SWITCH BEZEL

1 - SHIFT LEVER ASSEMBLY FRAME TRIM
2 - STORAGE COMPARTMENT
3 - ACCESSORY SWITCH BEZEL
4 - SCREW
5 - PLUG CONNECTIONS
6 - ASHTRAY

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Position bezel and seat clips fully.
(2) Install screw.
(3) Install ashtray.
(4) Install storage compartment.
(5) Install shift lever trim.

INSTRUMENT PANEL CENTER BEZEL

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Remove accessory switch bezel. (Refer to 23 - BODY/INSTRUMENT PANEL/ACCESSORY SWITCH BEZEL - REMOVAL)
(2) Remove the screws and using a trim stick C-4755 or equivalent, remove bezel.

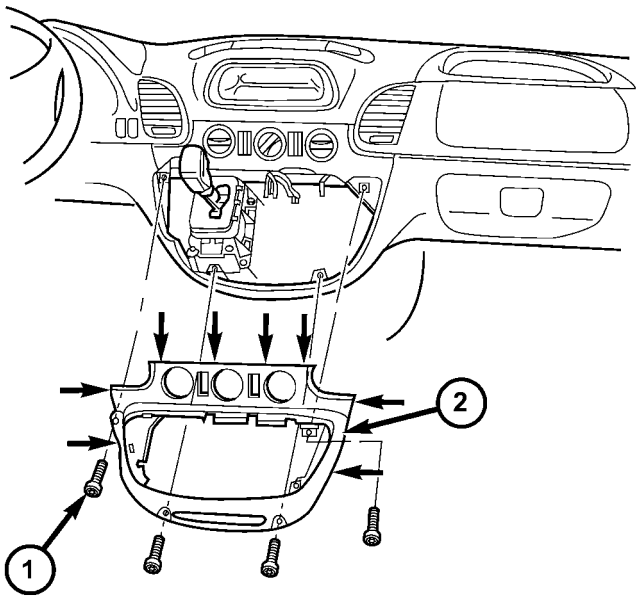


Fig. 3 INSTRUMENT PANEL CENTER BEZEL

1 - SCREWS (4)
2 - BEZEL

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Install the bezel and install the screws.
(2) Install the accessory switch bezel. (Refer to 23 - BODY/INSTRUMENT PANEL/ACCESSORY SWITCH BEZEL - INSTALLATION)

ASH RECEIVER

REMOVAL

(1) Disconnect and isolate battery negative cable.
(2) Open ash receiver and remove two screws.
(3) Pull out ash receiver and disconnect electrical connector.
(4) Remove ash receiver.

INSTALLATION

(1) Connect electrical connector.
(2) Install ash receiver and install the two screws.
(3) Connect battery negative cable.

CUP HOLDER

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

CUP HOLDER (Continued)

(1) Remove rubber mat from both cup holders.
(2) Unscrew screws (1) and remove cup holder top section (2). (Fig. 4)

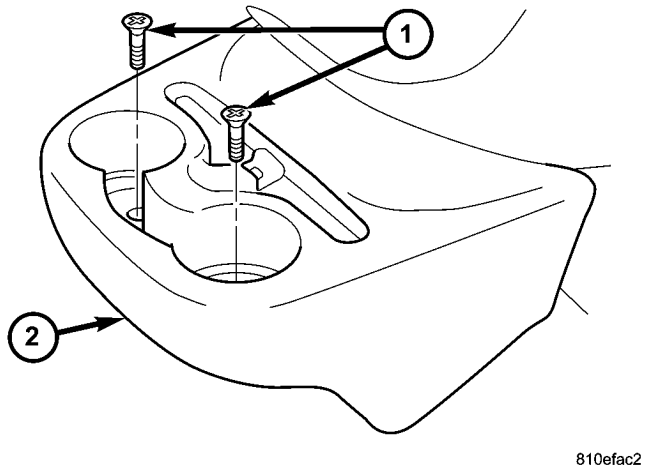


Fig. 4 CUP HOLDER

1 - SCREWS
2 - CUPHOLDER

(3) Remove vent hose (1). (Fig. 5)
(4) Unscrew bolts (2) and remove cup holder bottom section (3) from cab floor.

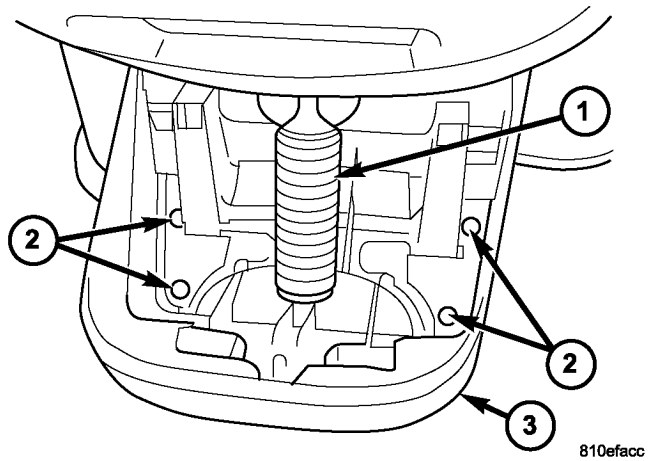


Fig. 5 CUP HOLDER BOTTOM

1 - VENT HOSE
2 - BOLTS (4)
3 - BOTTOM SECTION

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Install bottom section and install the bolts.
(2) Install vent hose.
(3) Install top section and install the screws.
(4) Install rubber mats.

GLOVE BOX

REMOVAL

(1) Open glove box and remove the screws. (Fig. 6)
(2) Remove glove box and disconnect electrical connector.

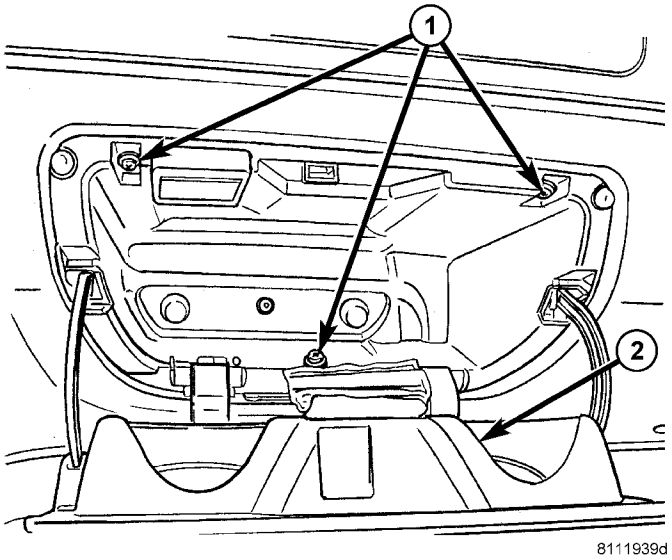


Fig. 6 GLOVE BOX

1 - SCREWS (3)
2 - GLOVE BOX DOOR

INSTALLATION

(1) Connect electrical connector and install glove box.
(2) Install three screws.

INSTRUMENT PANEL ASSEMBLY

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

- **WHEN REMOVING A DEPLOYED AIRBAG, RUBBER GLOVES, EYE PROTECTION, AND A LONG-SLEEVED SHIRT SHOULD BE WORN. THERE MAY BE DEPOSITS ON THE AIRBAG UNIT AND OTHER INTERIOR SURFACES. IN LARGE DOSES, THESE DEPOSITS MAY CAUSE IRRITATION TO THE SKIN AND EYES.**
- **USE EXTREME CARE TO PREVENT ANY FOREIGN MATERIAL FROM ENTERING THE PASSENGER AIRBAG, OR BECOMING ENTRAPPED BETWEEN THE PASSENGER AIRBAG CUSHION AND THE PASSENGER AIRBAG DOOR. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.**
- **THE PASSENGER AIRBAG DOOR MUST NEVER BE PAINTED. REPLACEMENT PASSENGER AIRBAGS ARE SERVICED WITH DOORS IN THE ORIGINAL COLORS. PAINT MAY CHANGE THE WAY IN WHICH THE MATERIAL OF THE AIRBAG DOOR RESPONDS TO AN AIRBAG DEPLOYMENT. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.**

(1) Disconnect and isolate the battery negative cable.

(2) Remove radio. (Refer to 8 - ELECTRICAL/AUDIO/RADIO - REMOVAL)

(3) Remove glove compartment. (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - REMOVAL)

(4) Remove cup holder. (Refer to 23 - BODY/INSTRUMENT PANEL/CUP HOLDER - REMOVAL)

(5) Remove instrument cluster. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - REMOVAL)

(6) Remove passenger airbag. (Refer to 8 - ELECTRICAL/RESTRAINTS/PASSENGER AIRBAG - REMOVAL)

(7) Remove right and left speakers. (Refer to 8 - ELECTRICAL/AUDIO/SPEAKER - REMOVAL)

(8) Remove center bezel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL CENTER BEZEL - REMOVAL)

(9) Remove air conditioning push-button control module. (Fig. 7)

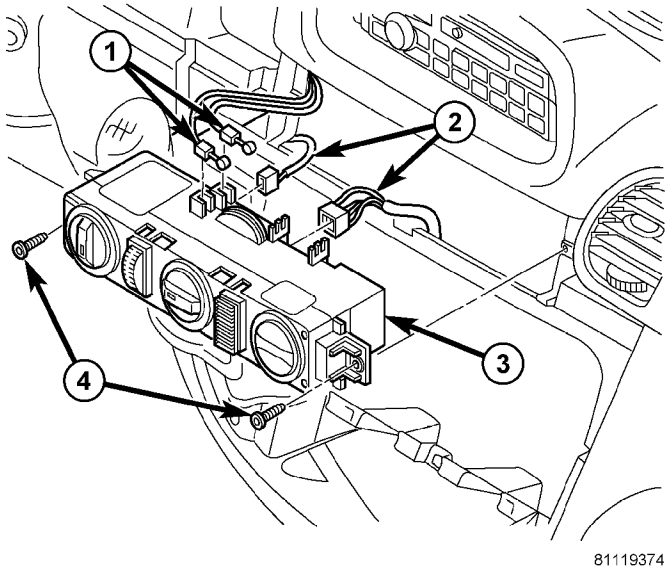


Fig. 7 HVAC CONTROL MODULE

1 - CONTROL CABLES
2 - ELECTRICAL CONNECTORS
3 - MODULE
4 - SCREWS

(10) Twist cover lock 1/4 turn and remove Power Distribution Center (PDC) cover. (Fig. 8)

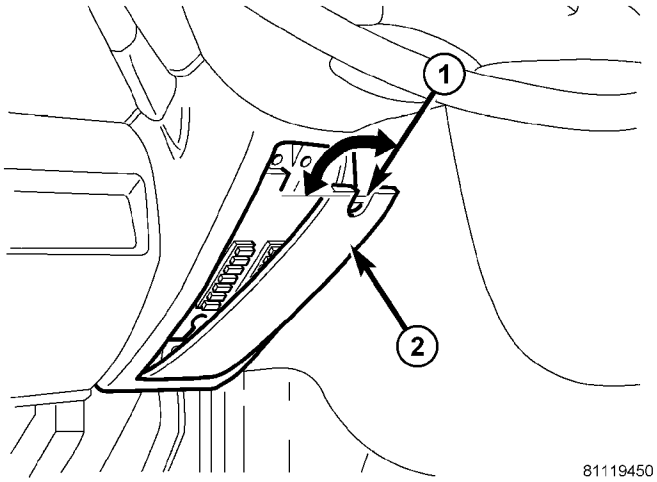


Fig. 8 POWER DISTRIBUTION CENTER COVER

1 - COVER LOCK
2 - COVER

INSTRUMENT PANEL ASSEMBLY (Continued)

(11) Remove nut and screws and remove steering column shroud. (Fig. 9)

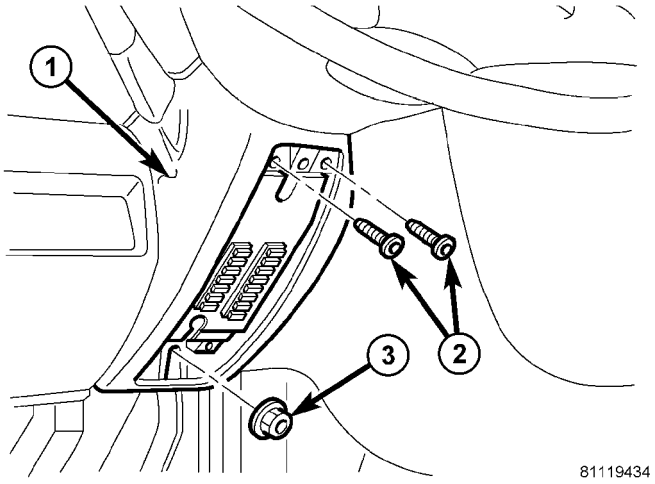


Fig. 9 STEERING COLUMN SHROUD

1 - SHROUD
2 - SCREWS (2)
3 - NUT

(12) Remove PDC bolt, nut and nut for ground wire. (Fig. 10)

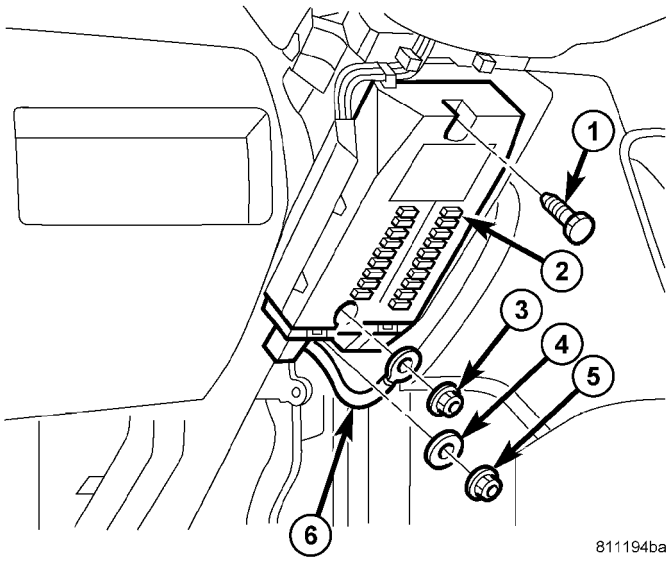


Fig. 10 POWER DISTRIBUTION CENTER

1 - BOLT
2 - POWER DISTRIBUTION CENTER
3 - GROUND NUT
4 - WASHER
5 - NUT
6 - GROUND WIRE

(13) Disconnect PDC electrical connectors and remove. (Fig. 11)

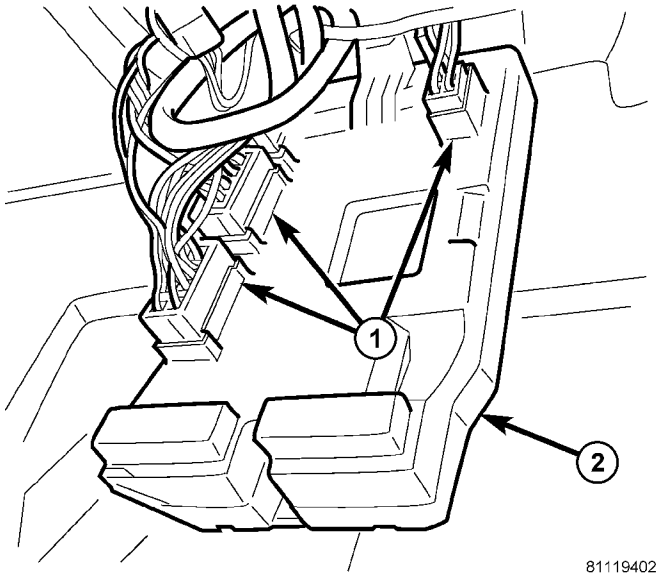


Fig. 11 POWER DISTRIBUTION CENTER CONNECTORS

1 - ELECTRICAL CONNECTORS (5)
2 - POWER DISTRIBUTION CENTER

(14) Remove screws and remove passenger side air nozzle cover. (Fig. 12)

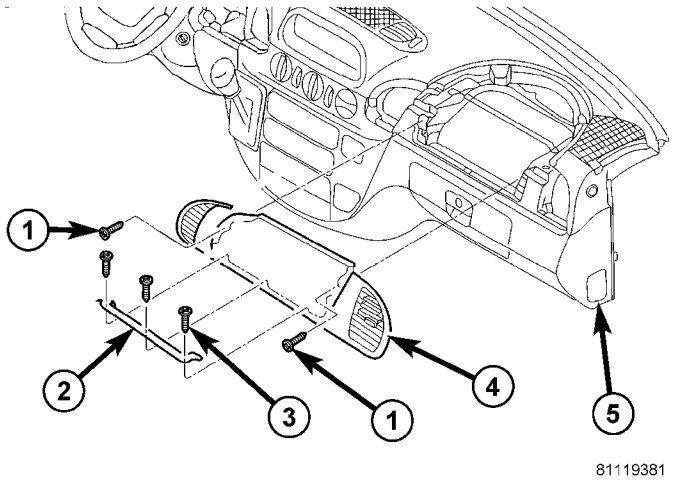


Fig. 12 PASSENGER SIDE AIR NOZZLE COVER

1 - FRONT SCREWS (2)
2 - BRACKET
3 - BRACKET SCREWS
4 - NOZZLE COVER
5 - INSTRUMENT PANEL

INSTRUMENT PANEL ASSEMBLY (Continued)

(15) Remove screws and remove left side cover. (Fig. 13)

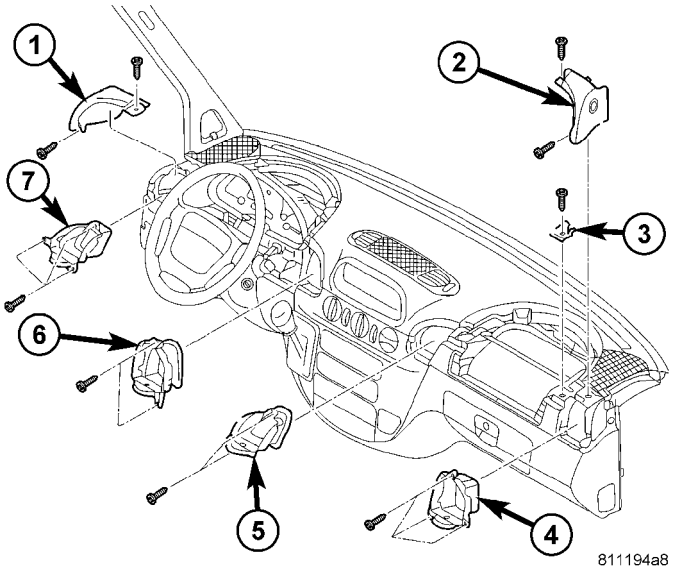


Fig. 13 SIDE COVERS & NOZZLES

1 - LEFT SIDE COVER
2 - RIGHT SIDE COVER
3 - BRACKET
4 - OUTER AIR NOZZLE
5 - INNER AIR NOZZLE
6 - INNER AIR NOZZLE
7 - OUTER AIR NOZZLE

(16) Remove left outer and inner air nozzles.

(17) Remove right side cover.

(18) Remove right outer and inner air nozzles.

(19) Remove protective matting from cluster location. (Fig. 14)

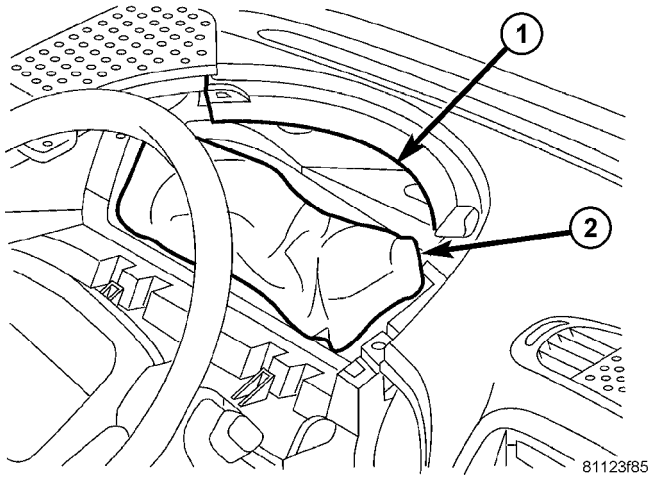


Fig. 14 PROTECTIVE MAT

1 - CLUSTER OPENING
2 - PROTECTIVE MAT

(20) Remove instrument panel top cover screws and cover. (Fig. 15)

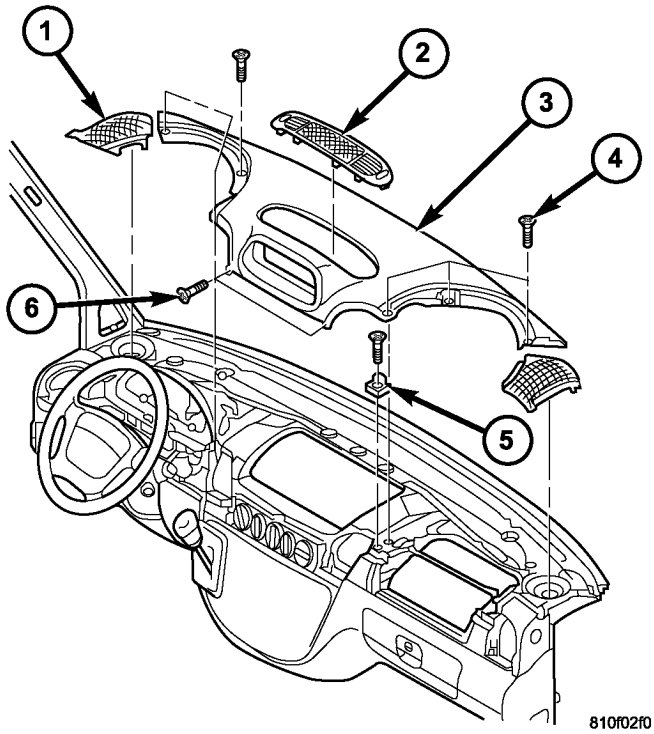


Fig. 15 INSTRUMENT PANEL TOP COVER

1 - SPEAKER COVERS (2)
2 - CENTER NOZZLE COVER
3 - INSTRUMENT PANEL TOP COVER
4 - TOP SCREWS (6)
5 - BRACKET/SCREW
6 - LOWER SCREWS (2)

(21) Remove vent hose. (Fig. 16)

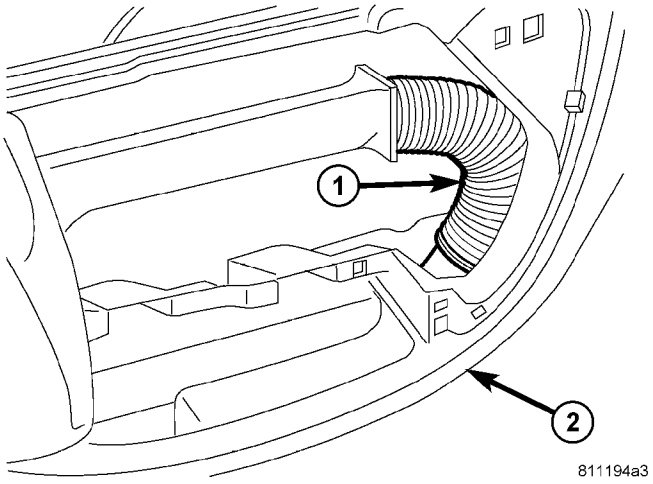


Fig. 16 CENTER VENT HOSE

1 - VENT HOSE
2 - CENTER STACK

INSTRUMENT PANEL ASSEMBLY (Continued)

(22) Remove brake pedal spring. (Fig. 17)

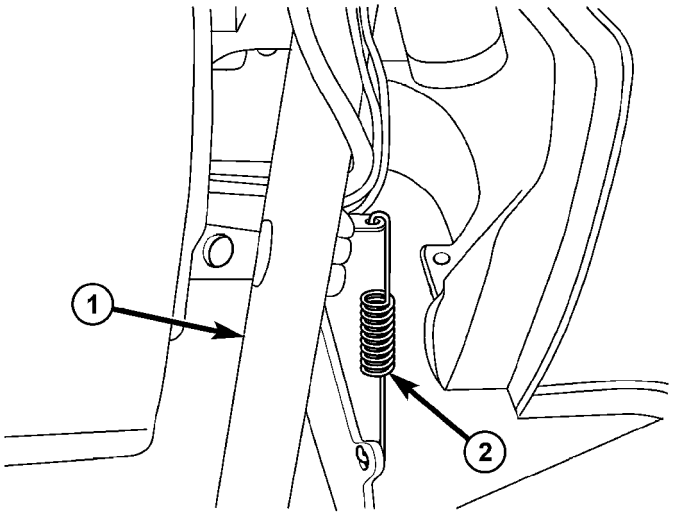


Fig. 17 BRAKE PEDAL SPRING

1 - STEERING COLUMN
2 - SPRING

(23) Remove ignition transponder. (Fig. 18)

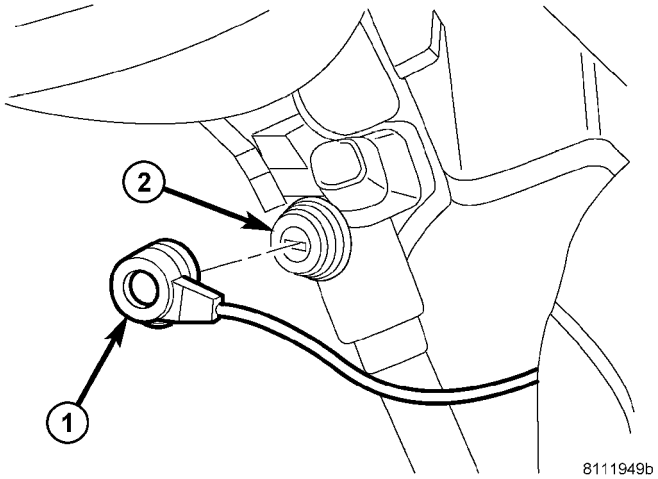


Fig. 18 IGNITION TRANSPONDER

1 - COLUMN LOCK
2 - IGNITION TRANSPONDER

CAUTION: The position of the steering gear must not be altered again for the entire duration of the work procedure.

(24) Turn the steering wheel and lock the steering wheel in the straight ahead position.

(25) Remove steering column support bolts. (Fig. 19)

(26) Remove the screws and remove instrument panel. (Fig. 20)

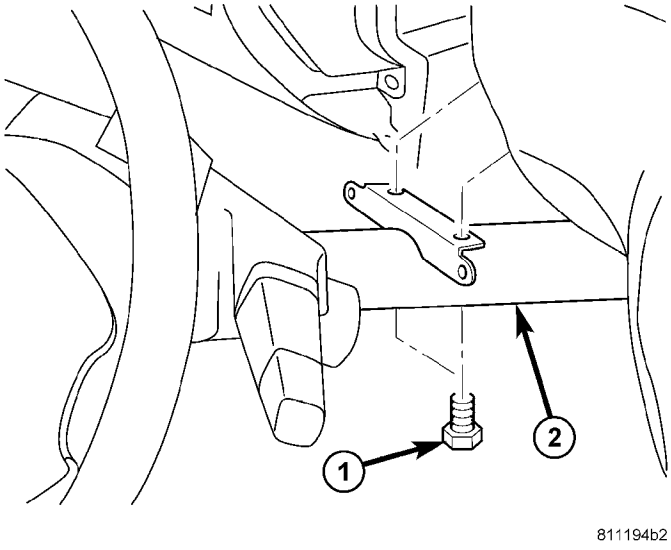


Fig. 19 STEERING COLUMN BOLTS

1 - BOLTS (2)
2 - STEERING COLUMN

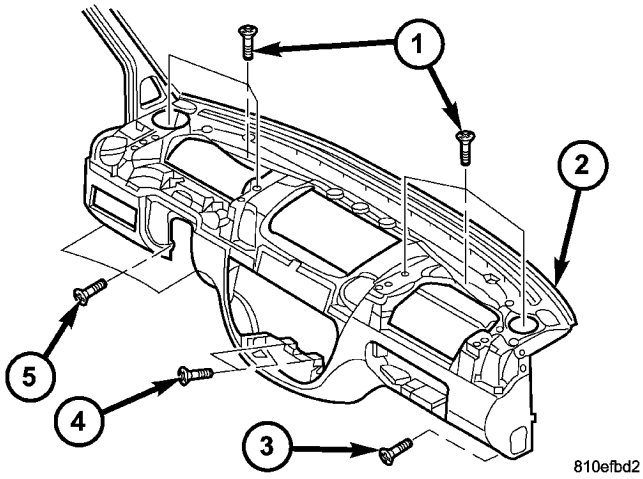


Fig. 20 INSTRUMENT PANEL FASTENERS

1 - UPPER SCREWS (6)
2 - INSTRUMENT PANEL
3 - RIGHT SCREW
4 - CENTER SCREWS (2)
5 - LEFT SCREWS (3)

INSTRUMENT PANEL ASSEMBLY (Continued)

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

- **WHEN REMOVING A DEPLOYED AIRBAG, RUBBER GLOVES, EYE PROTECTION, AND A LONG-SLEEVED SHIRT SHOULD BE WORN. THERE MAY BE DEPOSITS ON THE AIRBAG UNIT AND OTHER INTERIOR SURFACES. IN LARGE DOSES, THESE DEPOSITS MAY CAUSE IRRITATION TO THE SKIN AND EYES.**
- **USE EXTREME CARE TO PREVENT ANY FOREIGN MATERIAL FROM ENTERING THE PASSENGER AIRBAG, OR BECOMING ENTRAPPED BETWEEN THE PASSENGER AIRBAG CUSHION AND THE PASSENGER AIRBAG DOOR. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.**
- **THE PASSENGER AIRBAG DOOR MUST NEVER BE PAINTED. REPLACEMENT PASSENGER AIRBAGS ARE SERVICED WITH DOORS IN THE ORIGINAL COLORS. PAINT MAY CHANGE THE WAY IN WHICH THE MATERIAL OF THE AIRBAG DOOR RESPONDS TO AN AIRBAG DEPLOYMENT. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.**

(1) Install the instrument panel.

NOTE: The guides on the bottom of the instrument panel must engage in the cutouts on the left and right next to the heater housing. (Fig. 21) (Fig. 22)

(2) Route wire harness through the panel.
(3) Install and tighten 12 instrument panel screws. (Fig. 20)

CAUTION: The position of the steering gear must not be altered.

(4) Raise steering column into position and install the bolts. (Fig. 19)

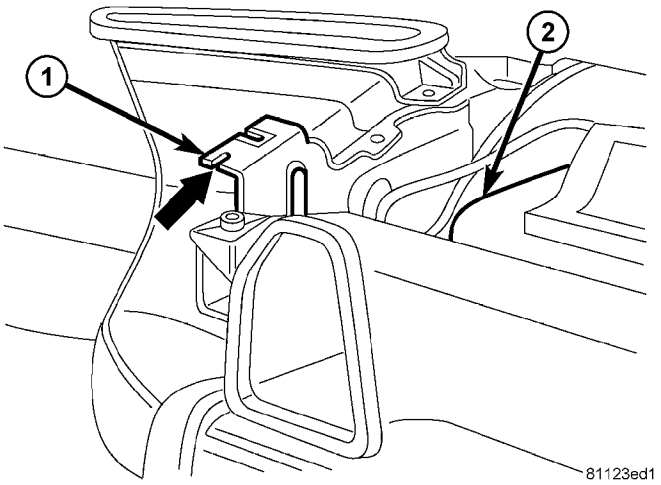


Fig. 21 ALIGNMENT CUTOUT - 1

1 - CUTOUT
2 - HEATER HOUSING

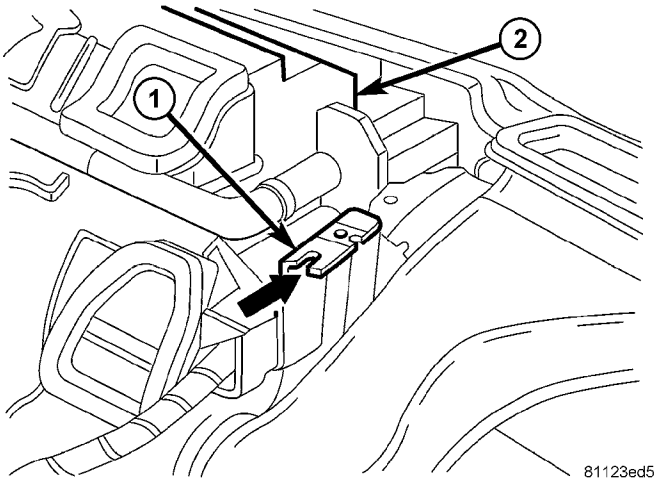


Fig. 22 ALIGNMENT CUTOUT - 2

1 - CUTOUT
2 - HEATER HOUSING

(5) Tighten steering column bolts to 25 N·m (18 ft. lbs.).
(6) Install ignition transponder onto column lock. (Fig. 18)

NOTE: The dome on the transponder must engage into the groove on the ignition switch.

(7) Install brake pedal spring. (Fig. 17)
(8) Install vent hose. (Fig. 16)
(9) Install instrument panel top cover and screws. (Fig. 15)
(10) Install right outer and inner air nozzles. (Fig. 13)
(11) Install right side cover and screws.
(12) Wrap protective mat around connectors behind instrument cluster.

INSTRUMENT PANEL ASSEMBLY (Continued)

(13) Install left outer and inner air nozzles.
(14) Install left side cover and screws.
(15) Install passenger side air nozzle cover and bracket and install the screws. (Fig. 12)
(16) Position Power Distribution Center (PDC) in vehicle and connect electrical connectors. (Fig. 11)
(17) Install PDC and install bolt and nut. (Fig. 10)
(18) Install PDC ground cable and nut.
(19) Install steering column shroud and install the two screws and one nut. (Fig. 9)
(20) Install PDC cover and twist lock 1/4 turn to secure in place. (Fig. 8)
(21) Connect electrical connectors and cables to air conditioning push-button module and install. (Fig. 7)
(22) Install center bezel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL CENTER BEZEL - INSTALLATION)
(23) Install left and right speakers. (Refer to 8 - ELECTRICAL/AUDIO/SPEAKER - INSTALLATION)
(24) Install passenger airbag. (Refer to 8 - ELECTRICAL/RESTRAINTS/PASSENGER AIRBAG - INSTALLATION)
(25) Install instrument cluster. (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - INSTALLATION)
(26) Install cup holder. (Refer to 23 - BODY/INSTRUMENT PANEL/CUP HOLDER - INSTALLATION)
(27) Install glove compartment. (Refer to 23 - BODY/INSTRUMENT PANEL/GLOVE BOX - INSTALLATION)
(28) Install radio. (Refer to 8 - ELECTRICAL/AUDIO/RADIO - INSTALLATION)
(29) Connect battery negative cable.

TOP COVER - CLUSTER

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Remove the screws and using a trim stick C-4755 or equivalent, remove the cover. (Fig. 23)

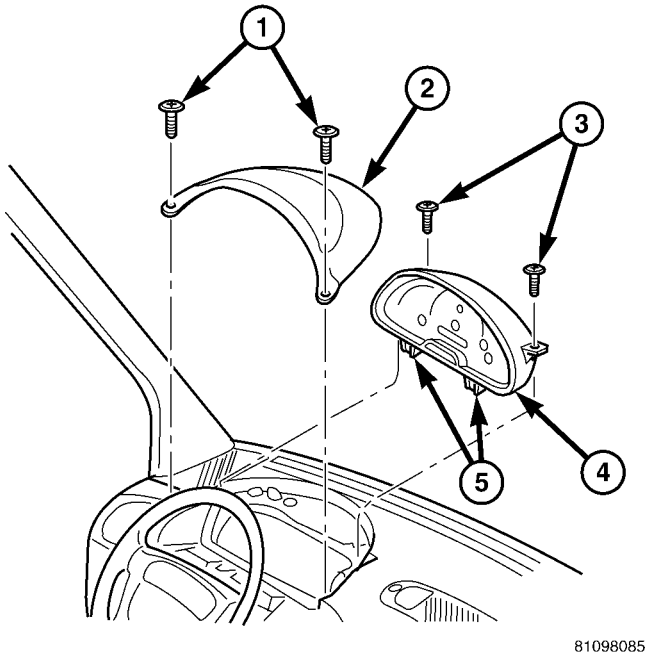


Fig. 23 Instrument Cluster Remove/Install

1 - SCREW (2)
2 - COVER
3 - SCREW (2)
4 - INSTRUMENT CLUSTER
5 - LOOP (2)

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Position the cover and install the screws.

TOP COVER - TRAY

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Using a trim stick C-4755 or equivalent, remove the tray. (Fig. 24)

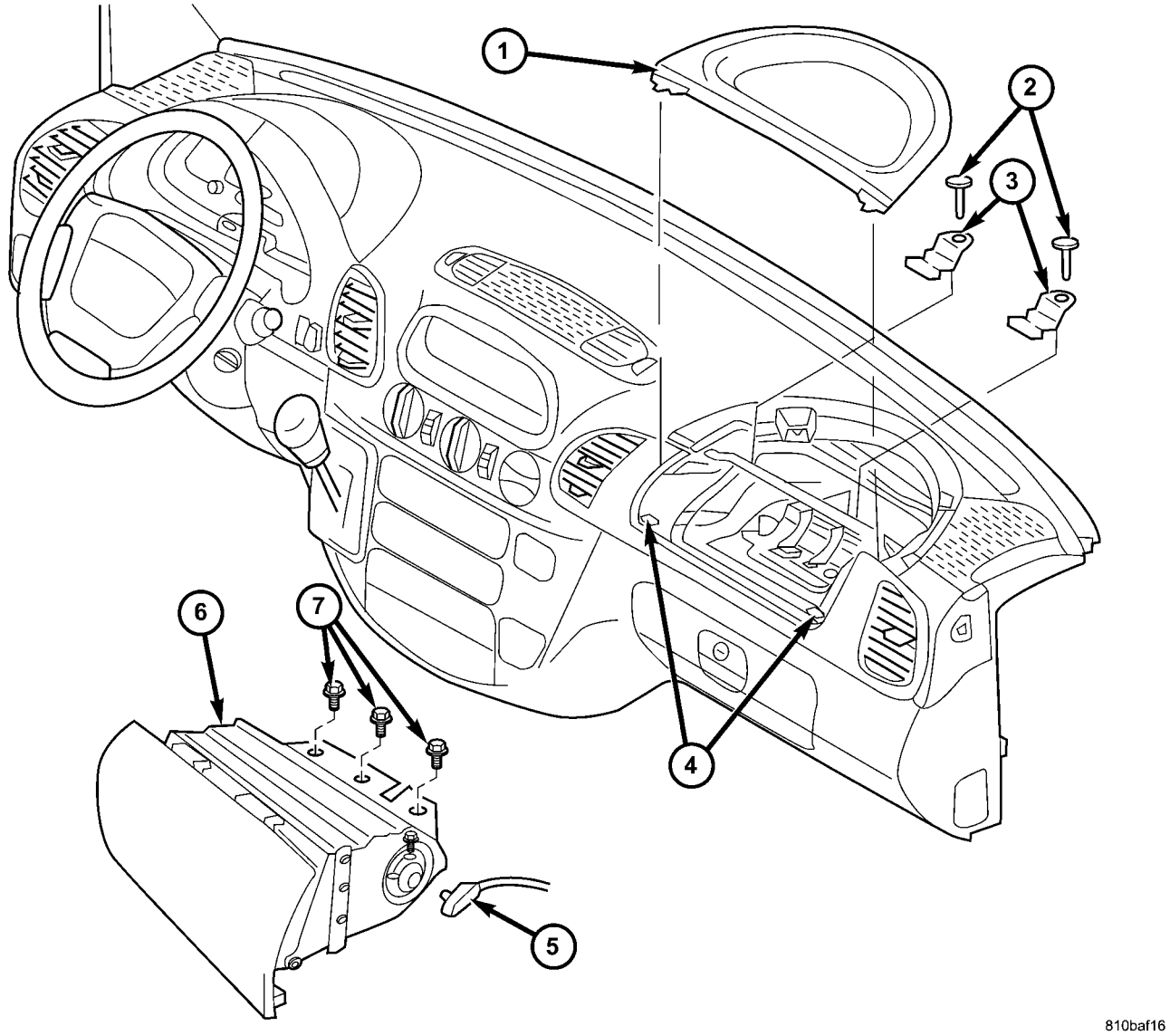


Fig. 24 Passenger Airbag Remove/Install

1 - TRAY
2 - SCREW (2)
3 - UPPER CLIP (2)
4 - LOWER CLIP (2)
5 - CONNECTOR
6 - PASSENGER AIRBAG
7 - SCREW (3)

TOP COVER - TRAY (Continued)

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Position the tray and seat the clips fully.

TOP COVER

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

- **WHEN REMOVING A DEPLOYED AIRBAG, RUBBER GLOVES, EYE PROTECTION, AND A LONG-SLEEVED SHIRT SHOULD BE WORN. THERE MAY BE DEPOSITS ON THE AIRBAG UNIT AND OTHER INTERIOR SURFACES. IN LARGE DOSES, THESE DEPOSITS MAY CAUSE IRRITATION TO THE SKIN AND EYES.**
- **USE EXTREME CARE TO PREVENT ANY FOREIGN MATERIAL FROM ENTERING THE PASSENGER AIRBAG, OR BECOMING ENTRAPPED BETWEEN THE PASSENGER AIRBAG CUSHION AND THE PASSENGER AIRBAG DOOR. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.**
- **THE PASSENGER AIRBAG DOOR MUST NEVER BE PAINTED. REPLACEMENT PASSENGER AIRBAGS ARE SERVICED WITH DOORS IN THE ORIGINAL COLORS. PAINT MAY CHANGE THE WAY IN WHICH THE MATERIAL OF THE AIRBAG DOOR RESPONDS TO AN AIRBAG DEPLOYMENT. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.**

(1) Disconnect and isolate the battery negative cable.

(2) Remove radio. (Refer to 8 - ELECTRICAL/AUDIO/RADIO - REMOVAL)

(3) Remove passenger airbag. (Refer to 8 - ELECTRICAL/RESTRAINTS/PASSENGER AIRBAG - REMOVAL)

(4) Remove screws and remove passenger side air nozzle cover. (Fig. 25)

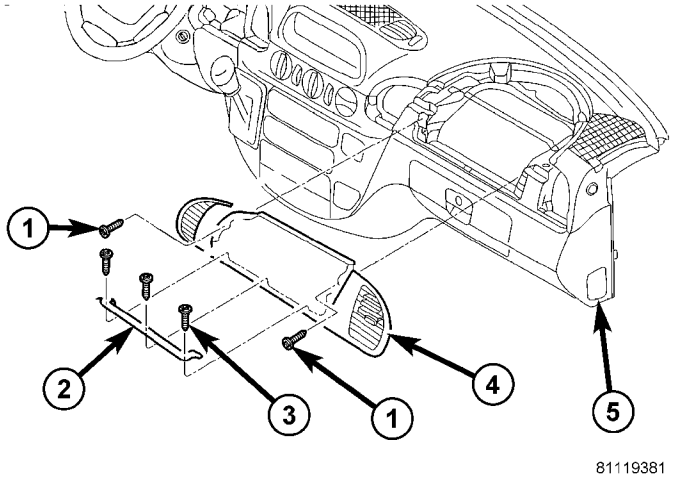


Fig. 25 PASSENGER SIDE AIR NOZZLE COVER

1 - FRONT SCREWS (2)
2 - BRACKET
3 - BRACKET SCREWS
4 - NOZZLE COVER
5 - INSTRUMENT PANEL

TOP COVER (Continued)

(5) Remove accessory switch bezel. (Refer to 23 - BODY/INSTRUMENT PANEL/ACCESSORY SWITCH BEZEL - REMOVAL)

(6) Remove a-pillar trim. (Refer to 23 - BODY/INTERIOR/A-PILLAR TRIM - REMOVAL)

(7) Remove speaker covers. (Fig. 26)

(8) Remove screw and bracket.

(9) Remove lower screws.

(10) Remove upper screws.

(11) Pull top cover toward rear and remove.

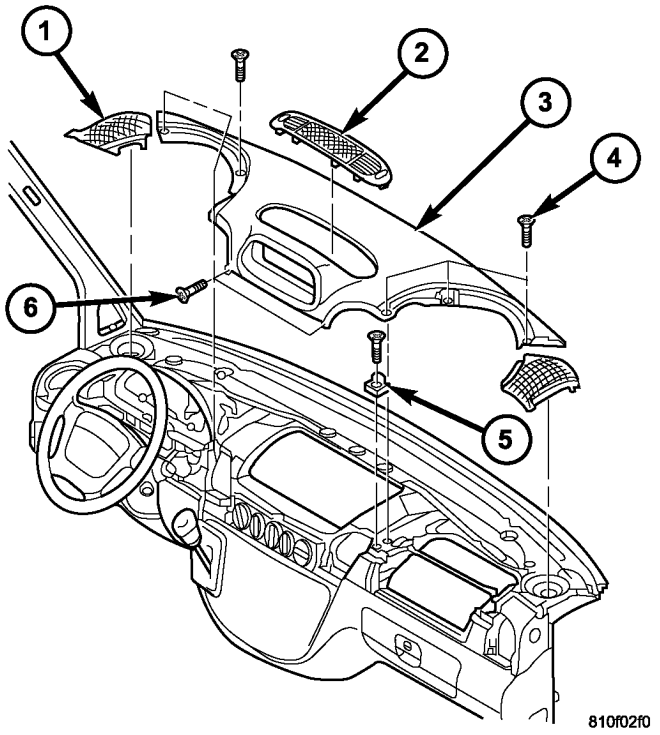


Fig. 26 INSTRUMENT PANEL TOP COVER

1 - SPEAKER COVERS (2)
2 - CENTER NOZZLE COVER
3 - INSTRUMENT PANEL TOP COVER
4 - TOP SCREWS (6)
5 - BRACKET/SCREW
6 - LOWER SCREWS (2)

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

- **WHEN REMOVING A DEPLOYED AIRBAG, RUBBER GLOVES, EYE PROTECTION, AND A LONG-SLEEVED SHIRT SHOULD BE WORN. THERE MAY BE DEPOSITS ON THE AIRBAG UNIT AND OTHER INTERIOR SURFACES. IN LARGE DOSES, THESE DEPOSITS MAY CAUSE IRRITATION TO THE SKIN AND EYES.**
- **USE EXTREME CARE TO PREVENT ANY FOREIGN MATERIAL FROM ENTERING THE PASSENGER AIRBAG, OR BECOMING ENTRAPPED BETWEEN THE PASSENGER AIRBAG CUSHION AND THE PASSENGER AIRBAG DOOR. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.**
- **THE PASSENGER AIRBAG DOOR MUST NEVER BE PAINTED. REPLACEMENT PASSENGER AIRBAGS ARE SERVICED WITH DOORS IN THE ORIGINAL COLORS. PAINT MAY CHANGE THE WAY IN WHICH THE MATERIAL OF THE AIRBAG DOOR RESPONDS TO AN AIRBAG DEPLOYMENT. FAILURE TO OBSERVE THIS WARNING COULD RESULT IN OCCUPANT INJURIES UPON AIRBAG DEPLOYMENT.**

(1) Position top cover and slide toward front of vehicle.

NOTE: Observe cable routing for radio: The leads should not be located above the air duct.

(2) Install upper and lower screws.

(3) Install screw and bracket.

(4) Position speaker covers and seat fully.

(5) Install a-pillar trim. (Refer to 23 - BODY/INTERIOR/A-PILLAR TRIM - INSTALLATION)

(6) Install accessory switch bezel. (Refer to 23 - BODY/INSTRUMENT PANEL/ACCESSORY SWITCH BEZEL - INSTALLATION)

(7) Install passenger side air nozzle cover and bracket and install the screws.

(8) Install passenger airbag. (Refer to 8 - ELECTRICAL/RESTRAINTS/PASSENGER AIRBAG - INSTALLATION)

(9) Install radio. (Refer to 8 - ELECTRICAL/AUDIO/RADIO - INSTALLATION)

(10) Connect battery negative cable.

STEERING COLUMN OPENING COVER

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Twist cover lock 1/4 turn and remove Power Distribution Center cover. (Fig. 27)

(2) Remove nut and screws and remove steering column shroud. (Fig. 28)

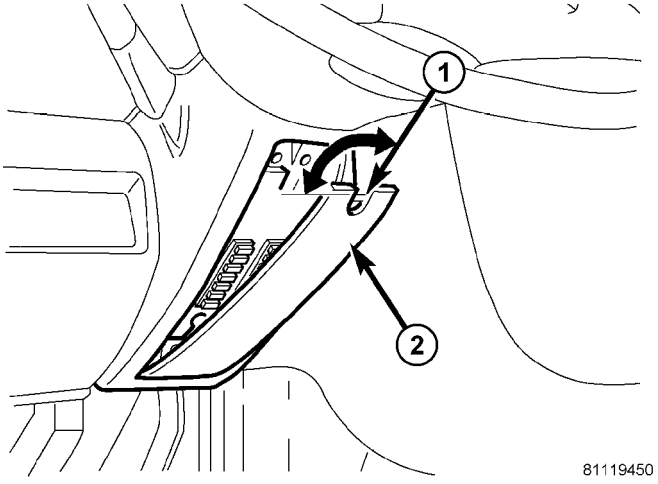


Fig. 27 ELECTRICAL CENTER COVER

1 - COVER LOCK
2 - COVER

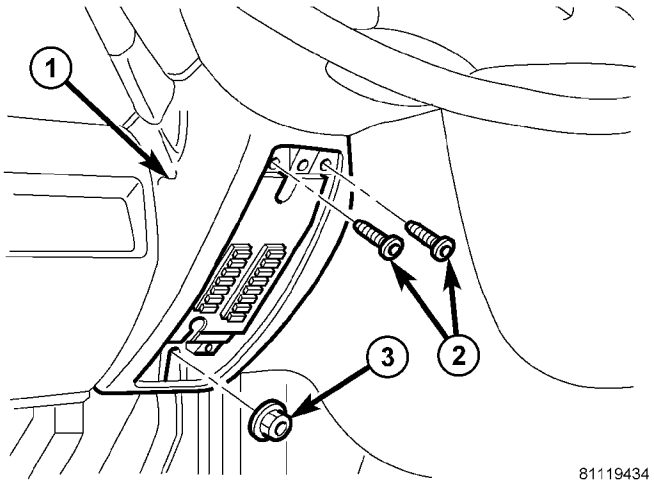


Fig. 28 STEERING COLUMN SHROUD

1 - SHROUD
2 - SCREWS (2)
3 - NUT

INSTALLATION

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Install steering column shroud and install the two screws and one nut.

(2) Install Power Distribution Center cover and twist lock 1/4 turn to secure in place.

INTERIOR

TABLE OF CONTENTS

page

INTERIOR
CAUTION 67
A-PILLAR TRIM
REMOVAL 67
INSTALLATION 68
ASSIST HANDLE
REMOVAL 68
INSTALLATION 68
B-PILLAR TRIM
REMOVAL 68
INSTALLATION 69
BULKHEAD TRIM PANEL
REMOVAL 69
INSTALLATION 69
CARPETS AND FLOOR MATS
REMOVAL 69
INSTALLATION 70
COWL TRIM
REMOVAL 70
INSTALLATION 70
D-PILLAR TRIM
REMOVAL 70
INSTALLATION 70
HEADLINER
REMOVAL 70
INSTALLATION 71
QUARTER TRIM PANEL
REMOVAL 71
INSTALLATION 72
REAR VIEW MIRROR
REMOVAL 72
INSTALLATION
INSTALLATION 72
INSTALLATION - REAR VIEW MIRROR SUPPORT BRACKET 72
STEPWELL SCUFF PADS
REMOVAL 72
INSTALLATION 73
SUN VISOR
REMOVAL 73
INSTALLATION 73

INTERIOR

CAUTION

CAUTION:: Do not attempt to remove interior trim panels/moldings without first removing the necessary adjacent panels. To avoid damaging the panels, ensure that all the screws and clips are removed before attempting to remove an interior trim panel/molding. Trim panels are somewhat flexible but can be damaged if handled improperly.

A-PILLAR TRIM

REMOVAL

(1) Using a trim stick C-4755 or equivalent, separate the top of the a-pillar trim.

(2) Pull top of a-pillar trim out and pull trim up and remove. (Fig. 1)

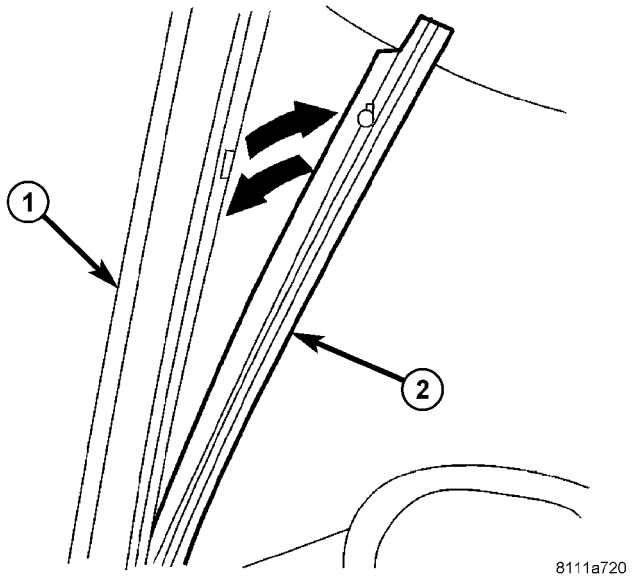


Fig. 1 A-PILLAR TRIM

1 - A-PILLAR
2 - TRIM PANEL

A-PILLAR TRIM (Continued)

(3) Remove the four screws and remove the foam trim support. (Fig. 2)

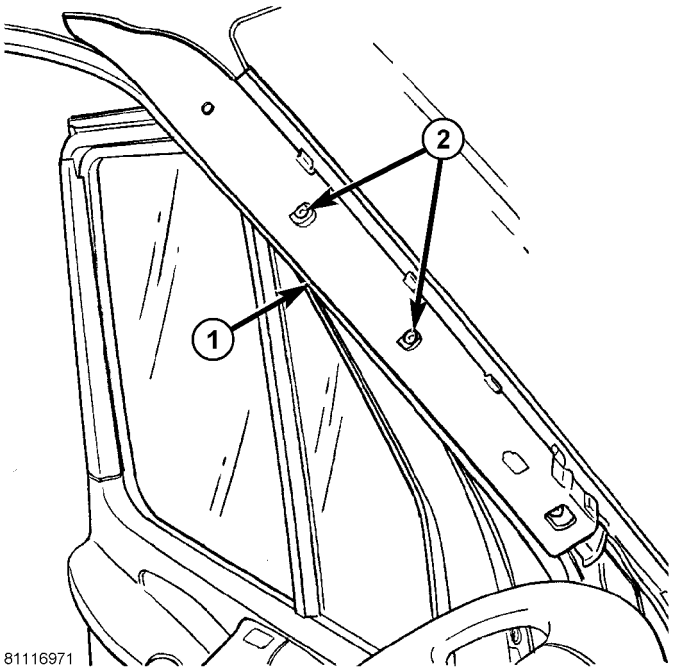


Fig. 2 A-PILLAR SUPPORT FOAM

1 - SUPPORT FOAM
2 - SCREWS (4)

INSTALLATION

(1) Install the foam support and install the screws.
(2) Install the a-pillar trim bottom and push the top in toward a-pillar.
(3) Seat the retaining clips fully.

ASSIST HANDLE

REMOVAL

(1) Hold the handle in the down position and remove the screws. (Fig. 3)

INSTALLATION

(1) Install the handle and install the screws.

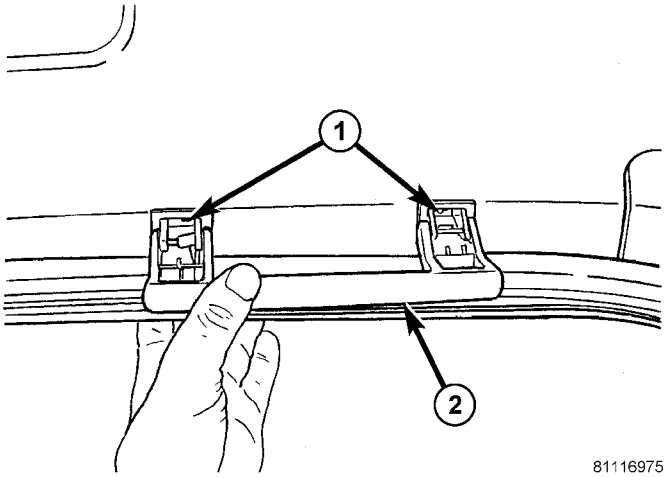


Fig. 3 ASSIST HANDLE

1 - SCREWS (2)
2 - ASSIST HANDLE

B-PILLAR TRIM

REMOVAL

(1) Remove the lower seat belt anchor bolt. (Fig. 4)
(2) Pull door opening weatherstrip away from flange along the b-pillar. (Fig. 5)
(3) Using a trim stick C-4755 or equivalent, release the trim clips and remove the trim. (Fig. 6)

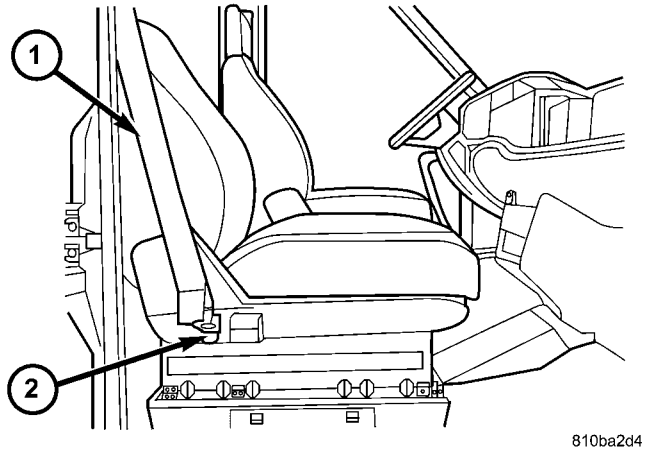


Fig. 4 Front Seat Belt Lower Anchor

1 - FRONT SEAT BELT
2 - COVER AND/OR SCREW

B-PILLAR TRIM (Continued)

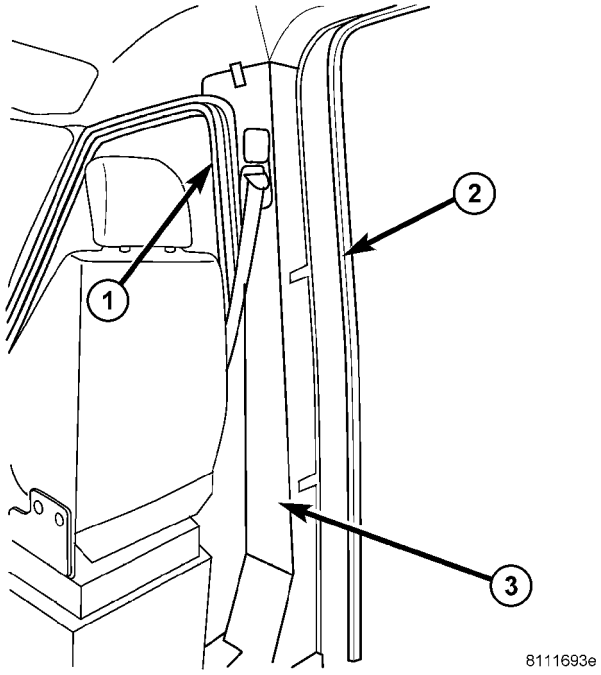


Fig. 5 B-PILLAR TRIM

1 - FRONT DOOR WEATHERSTRIP
2 - B-PILLAR
3 - B-PILLAR TRIM

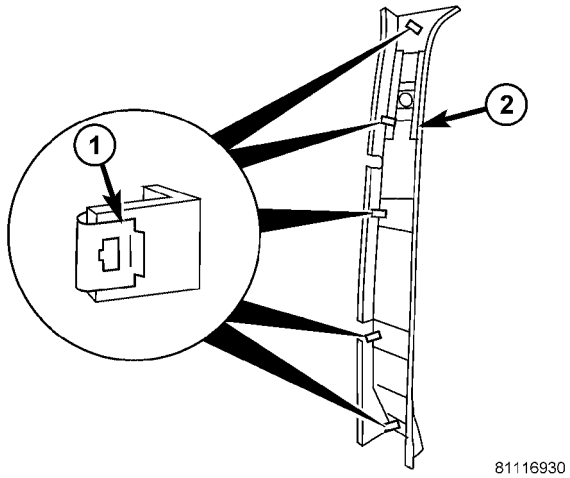


Fig. 6 B-PILLAR TRIM MOUNTING CLIPS

1 - RETAINING CLIPS (5)
2 - B-PILLAR TRIM

INSTALLATION

(1) Route the seat belt through the trim and mount the trim panel.
(2) Seat the mounting clips fully.
(3) Position the door opening weatherstrip back along the mounting flange.
(4) Install the seat belt and mounting bolt.
(5) Tighten the bolt to 35 N·m (26 ft. lbs.).

BULKHEAD TRIM PANEL

REMOVAL

(1) Remove the rivets and remove the lower panel. (Fig. 7)
(2) Remove the rivets and remove the upper panel.

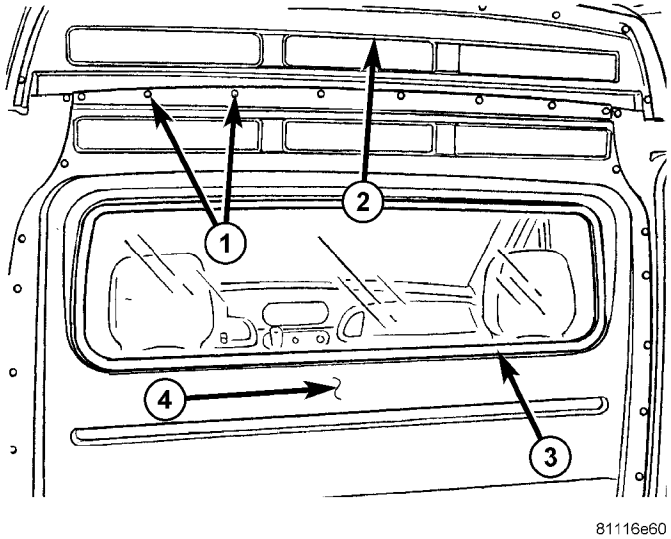


Fig. 7 BULKHEAD TRIM PANEL

1 - RIVETS
2 - UPPER PANEL
3 - PANEL GLASS
4 - LOWER PANEL

INSTALLATION

(1) Install the upper panel and replace rivets.
(2) Install the lower panel and replace rivets.

CARPETS AND FLOOR MATS

REMOVAL

Cargo/Passenger Van - Front

(1) Remove the stepwell scuff pads. (Refer to 23 - BODY/INTERIOR/STEPWELL SCUFF PADS - REMOVAL)
(2) Remove the three bolts and tray behind drivers seat.
(3) Remove cup holder. (Refer to 23 - BODY/INSTRUMENT PANEL/CUP HOLDER - REMOVAL)
(4) Remove the jack storage cover.
(5) Remove carpet/mat.

Passenger Van - Rear

(1) Remove seats. (Refer to 23 - BODY/SEATS/SEAT - REAR - REMOVAL)
(2) Remove the screws and retaining strips.
(3) Remove the seat striker assemblies.
(4) Remove carpet/mat.

CARPETS AND FLOOR MATS (Continued)

Cargo Van - Rear

(1) Remove the screws and retaining strips.
(2) Remove carpet/mat.

INSTALLATION

Cargo/Passenger Van - Front

(1) Position carpet/mat in vehicle.
(2) Install the jack storage cover.
(3) Install the cup holder. (Refer to 23 - BODY/INSTRUMENT PANEL/CUP HOLDER - INSTALLATION)
(4) Install the tray behind the driver's seat and install the three bolts.
(5) Install the stepwell scuff pads. (Refer to 23 - BODY/INTERIOR/STEPWELL SCUFF PADS - INSTALLATION)

Passenger Van - Rear

(1) Position carpet/mat in vehicle.
(2) Install the seat striker assemblies.
(3) Install the retaining strips and screws.
(4) Install the seats. (Refer to 23 - BODY/SEATS/SEAT - INSTALLATION)

Cargo Van - Rear

(1) Position carpet/mat in vehicle.
(2) Install the retaining strips and screws.

COWL TRIM

REMOVAL

(1) Position door weatherstrip aside.
(2) Remove the jack storage cover, if necessary.
(3) Position aside carpet/mat, if necessary.
(4) Using a trim stick C-4755 or equivalent, remove the cowl trim panel.

INSTALLATION

(1) Position the cowl trim panel and seat the clips fully.
(2) Install the jack storage cover, if necessary.
(3) Position the carpet/mat back.
(4) Position the door weatherstrips back.

D-PILLAR TRIM

REMOVAL

(1) Remove the three plastic twist screws and remove the panel.

INSTALLATION

(1) Install the panel and install the three twist screws.

HEADLINER

REMOVAL

Cab Section

(1) Remove the a-pillar trim. (Refer to 23 - BODY/INTERIOR/A-PILLAR TRIM - REMOVAL)
(2) Remove the sun visors. (Refer to 23 - BODY/INTERIOR/SUN VISOR - REMOVAL)
(3) Remove the b-pillar trim. (Refer to 23 - BODY/INTERIOR/B-PILLAR TRIM - REMOVAL)
(4) Remove the assist handle. (Refer to 23 - BODY/INTERIOR/ASSIST HANDLE - REMOVAL)
(5) Remove the dome light. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/CARGO LAMP UNIT - REMOVAL)
(6) Carefully separate the headliner and remove.

Number 2 Section

(1) Disconnect and isolate battery negative cable.
(2) Remove the second and third row seats. (Refer to 23 - BODY/SEATS/SEAT - REAR - REMOVAL)

NOTE: If vehicle is not equipped with rear air conditioning unit, skip to step 8.

(3) Remove the push pin fasteners and remove the rear air front duct cover.
(4) Disconnect the electrical connector at front of cover.
(5) Remove the push pin fasteners and remove the rear air middle duct cover.
(6) Disconnect the electrical connector.
(7) Remove the three push-pins and three screws and remove the rear air cover.
(8) Remove the duct work.
(9) Release clips at front and rear of headliner and remove.

Number 3 Section

(1) Disconnect and isolate battery negative cable.
(2) Remove the third and fourth row seats. (Refer to 23 - BODY/SEATS/SEAT - REAR - REMOVAL)

NOTE: If vehicle is not equipped with rear air conditioning unit, skip to step 8.

(3) Remove the push pin fasteners and remove the rear air front duct cover.
(4) Disconnect the electrical connector at front of cover.
(5) Remove the push pin fasteners and remove the rear air middle duct cover.
(6) Disconnect the electrical connector.
(7) Remove the three push-pins and three screws and remove the rear air cover.
(8) Remove the duct work.

HEADLINER (Continued)

(9) Release clips at front and rear of headliner and remove.

Number 4 Section

(1) Disconnect and isolate battery negative cable.
(2) Remove the third and fourth row seats. (Refer to 23 - BODY/SEATS/SEAT - REAR - REMOVAL)

NOTE: If vehicle is not equipped with rear air conditioning unit, skip to step 8.

(3) Remove the push pin fasteners and remove the rear air front duct cover.
(4) Disconnect the electrical connector at front of cover.
(5) Remove the push pin fasteners and remove the rear air middle duct cover.
(6) Disconnect the electrical connector.
(7) Remove the three push-pins and three screws and remove the rear air cover.
(8) Remove the duct work.
(9) Release clips at front and rear of headliner and remove.

INSTALLATION

Cab Section

(1) Position the headliner in vehicle and seat fully.
(2) Install dome light. (Refer to 8 - ELECTRICAL/LAMPS/LIGHTING - INTERIOR/CARGO LAMP UNIT - INSTALLATION)
(3) Install assist handle. (Refer to 23 - BODY/INTERIOR/ASSIST HANDLE - INSTALLATION)
(4) Install b-pillar trim. (Refer to 23 - BODY/INTERIOR/B-PILLAR TRIM - INSTALLATION)
(5) Install the sun visors. (Refer to 23 - BODY/INTERIOR/SUN VISOR - INSTALLATION)
(6) Install the a-pillar trim. (Refer to 23 - BODY/INTERIOR/A-PILLAR TRIM - INSTALLATION)
(7) Connect battery negative cable.

Number 2 Section

(1) Position the headliner in vehicle and seat fully.

NOTE: If vehicle is not equipped with rear air conditioning unit, skip to step 8.

(2) Install rear air unit duct work.
(3) Install the rear air unit rear cover and install the three screws and push-pins.
(4) Connect the electrical connector and install the middle duct work cover.
(5) Install the push pin fasteners.
(6) Connect the electrical connector and install the front duct work cover.
(7) Install the push pin fasteners.
(8) Install the second and third row seats. (Refer to 23 - BODY/SEATS/SEAT - INSTALLATION)
(9) Connect battery negative cable.

Number 3 Section

(1) Position the headliner in vehicle and seat fully.

NOTE: If vehicle is not equipped with rear air conditioning unit, skip to step 8.

(2) Install rear air unit duct work.
(3) Install the rear air unit rear cover and install the three screws and push-pins.
(4) Connect the electrical connector and install the middle duct work cover.
(5) Install the push pin fasteners.
(6) Connect the electrical connector and install the front duct work cover.
(7) Install the push pin fasteners.
(8) Install the third and fourth row seats. (Refer to 23 - BODY/SEATS/SEAT - INSTALLATION)
(9) Connect battery negative cable.

Number 4 Section

(1) Position the headliner in vehicle and seat fully.

NOTE: If vehicle is not equipped with rear air conditioning unit, skip to step 8.

(2) Install rear air unit duct work.
(3) Install the rear air unit rear cover and install the three screws and push-pins.
(4) Connect the electrical connector and install the middle duct work cover.
(5) Install the push pin fasteners.
(6) Connect the electrical connector and install the front duct work cover.
(7) Install the push pin fasteners.
(8) Install the third and fourth row seats. (Refer to 23 - BODY/SEATS/SEAT - INSTALLATION)
(9) Connect battery negative cable.

QUARTER TRIM PANEL

REMOVAL

Passenger Van

(1) Remove seats as necessary. (Refer to 23 - BODY/SEATS/SEAT - REMOVAL)
(2) Remove d-pillar trim if necessary. (Refer to 23 - BODY/INTERIOR/D-PILLAR TRIM - REMOVAL)
(3) Using a trim stick C-4755 or equivalent, separate the push-pin fasteners and remove trim panels.

QUARTER TRIM PANEL (Continued)

Cargo Van

(1) Remove bolts and remove tie down rings, if equipped.
(2) Remove rivets and remove paneling

INSTALLATION

Passenger Van

(1) Position trim panels and seat push-pin fasteners fully.
(2) Install d-pillar trim, if necessary. (Refer to 23 - BODY/INTERIOR/D-PILLAR TRIM - INSTALLATION)
(3) Install seats, if necessary. (Refer to 23 - BODY/SEATS/SEAT - INSTALLATION)

Cargo Van

(1) Install paneling and replace rivets.
(2) Install tie down rings and bolts, if equipped.

REAR VIEW MIRROR

REMOVAL

(1) Slide mirror off support bracket.

INSTALLATION

INSTALLATION

(1) Install the support bracket if necessary. (Refer to 23 - BODY/INTERIOR/REAR VIEW MIRROR - INSTALLATION - SUPPORT BRACKET)
(2) Slide mirror onto support bracket fully.

INSTALLATION - REAR VIEW MIRROR SUPPORT BRACKET

(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:
  (a) Crush the vial to saturate the felt applicator.
  (b) Remove the paper sleeve.
  (c) Apply accelerator to the contact surface on the bracket.
  (d) Allow the accelerator to dry for five minutes.
  (e) 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 contact surface after the accelerator has been applied.
(6) Install the bracket according to the following instructions:
  (a) Apply one drop of adhesive at the center of the bracket contact-surface on the windshield glass.
  (b) Apply an even coat of adhesive to the contact surface on the bracket.
  (c) Align the bracket with the marked position on the windshield glass.
  (d) 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.

STEPWELL SCUFF PADS

REMOVAL

(1) Remove screws and remove seat bracket if necessary.
(2) Remove trim plugs and screws. (Fig. 8) and (Fig. 9)
(3) Remove stepwell scuffs.

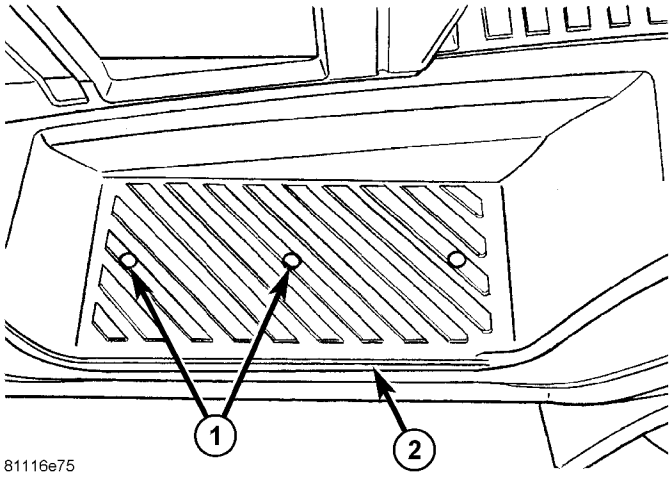


Fig. 8 STEPWELL SCUFF PADS

1 - TRIM PLUGS
2 - STEPWELL

STEPWELL SCUFF PADS (Continued)

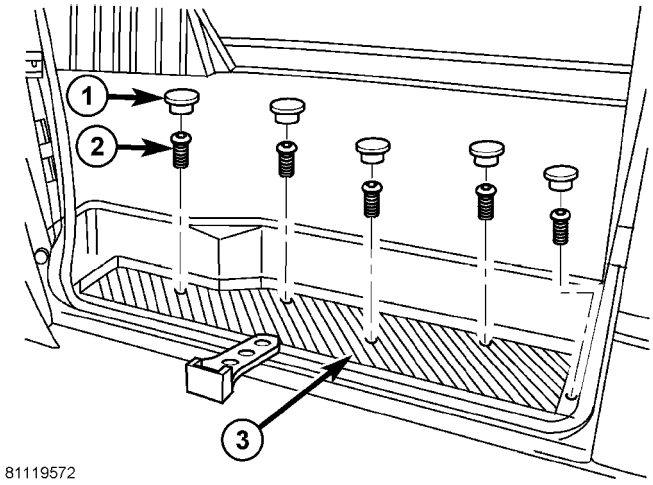


Fig. 9 SLIDING DOOR SCUFF PAD

1 - TRIM PLUGS
2 - SCREWS (5)
3 - SCUFF PAD

INSTALLATION

(1) Install scuff pad and install the screws.
(2) Install the trim plugs.
(3) Install the seat bracket, if necessary.

SUN VISOR

REMOVAL

(1) Remove the support screws and remove the visor. (Fig. 10)

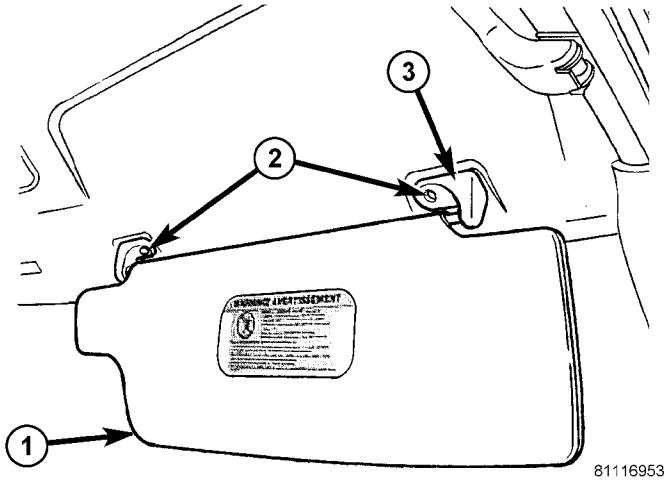


Fig. 10 SUN VISOR

1 - SUN VISOR
2 - SCREWS
3 - SUPPORTS (2)

INSTALLATION

(1) Position visor and support on header.
(2) Install the screws.

PAINT

TABLE OF CONTENTS

page

PAINT
SPECIFICATIONS - PAINT CODES 74
BASECOAT/CLEARCOAT FINISH
DESCRIPTION 74
PAINT TOUCH-UP
DESCRIPTION 74
STANDARD PROCEDURE - PAINT TOUCH-UP . 75
FINESSE SANDING/BUFFING & POLISH
DESCRIPTION 75

PAINT

SPECIFICATIONS - PAINT CODES

EXTERIOR COLORS

EXTERIOR COLOR	DAIMLERCHRYSLER CODE
Steel Blue	MB 5389
Brilliant Blue	MB 5362
Orchid Green	MB 6464
Flame Red	MB 3534
Arctic White	MB 9147
Black Blue	MB 7103
Calcite Yellow	MB 1234
Piedmont Red	MB 3636
Hycanith Blue	MB 5376
Black Gray	MB 7103
Stone Gray	MB 7160
Silver Gray	MB 7708

BASECOAT/CLEARCOAT FINISH

DESCRIPTION

The original equipment finish is a multi step process that involves cleaning, applying electro de-position (E-coat), anti-chip primer, basecoat, and clearcoat steps.

On most vehicles a two-part paint application (basecoat/clearcoat) is used. Color paint that is applied to primer is called basecoat. The clear coat protects the basecoat 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.

PAINT TOUCH-UP

DESCRIPTION

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.

WARNING: USE AN OSHA APPROVED RESPIRATOR AND SAFETY GLASSES WHEN SPRAYING PAINT OR SOLVENTS IN A CONFINED AREA. PERSONAL INJURY CAN RESULT.

PAINT TOUCH-UP (Continued)

STANDARD PROCEDURE - PAINT TOUCH-UP

(1) Scrape loose paint and corrosion from inside scratch or chip.

(2) Clean affected area with MOPAR® Tar/Road Oil Remover or equivalent, 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 scratch or chip 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 clearcoat, the touch-up color can be lightly finesse sanded (1500 grit) and polished with rubbing compound.

(6) On vehicles with clearcoat, 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.

WARNING: AVOID PROLONGED SKIN CONTACT WITH PETROLEUM OR ALCOHOL – BASED CLEANING SOLVENTS. PERSONAL INJURY CAN RESULT.AVOID PROLONGED SKIN CONTACT WITH PETROLEUM OR ALCOHOL – BASED CLEANING SOLVENTS. PERSONAL INJURY CAN RESULT.

FINESSE SANDING/BUFFING & POLISH

DESCRIPTION

CAUTION: Do not remove more than .5 mils of clearcoat finish, if equipped. Basecoat paint must retain clearcoat for durability.
Use a Paint Thickness Gauge #PR-ETG-2X or equivalent to determine film thickness before and after the repair.

Minor acid etching, orange peel, or smudging in clearcoat or single-stage finishes can be reduced with light finesse sanding, hand buffing, and polishing. **If the finish has been finesse sanded in the past, it cannot be repeated. Finesse sanding operation should be performed by a trained automotive paint technician.**

SEATS

TABLE OF CONTENTS

	page
ARMREST	
REMOVAL	76
INSTALLATION	76
HEADREST	
REMOVAL	76
INSTALLATION	76
SEAT - FRONT	
REMOVAL	77
INSTALLATION	77
SEAT BACK - FRONT	
REMOVAL	77
INSTALLATION	77
SEAT CUSHION - FRONT	
REMOVAL	78
INSTALLATION	78
SEAT ADJUSTERS - FRONT	
REMOVAL	78
INSTALLATION	78
SEAT - REAR	
REMOVAL	79
INSTALLATION	79
REAR SEAT BACK SHIELD	
REMOVAL	79
INSTALLATION	79
SEAT BACK CUSHION/COVER - REAR	
REMOVAL	80
INSTALLATION	80
SEAT CUSHION/COVER - REAR	
REMOVAL	80
INSTALLATION	80

ARMREST

REMOVAL

(1) Remove the screws and remove the armrest cover.

(2) Remove the three bolts and remove the armrest from the seat back.

INSTALLATION

(1) Install the armrest and install the three bolts.

(2) Install the armrest cover and install the screws.

HEADREST

REMOVAL

(1) Press the release button and remove the headrest. (Fig. 1)

INSTALLATION

(1) Insert headrest posts into seat back and seat fully.

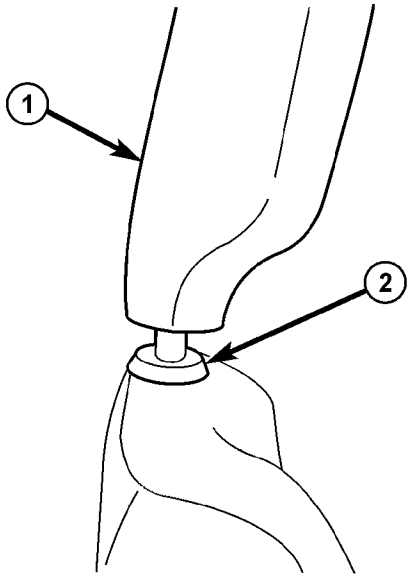


Fig. 1 HEAD REST

1 - HEADREST
2 - RELEASE BUTTON

SEAT - FRONT

REMOVAL

(1) Disconnect and isolate battery negative cable.
(2) Remove the seat belt anchor bolt.
(3) Remove the seat bolts.
(4) Disconnect the electrical connectors, if equipped.

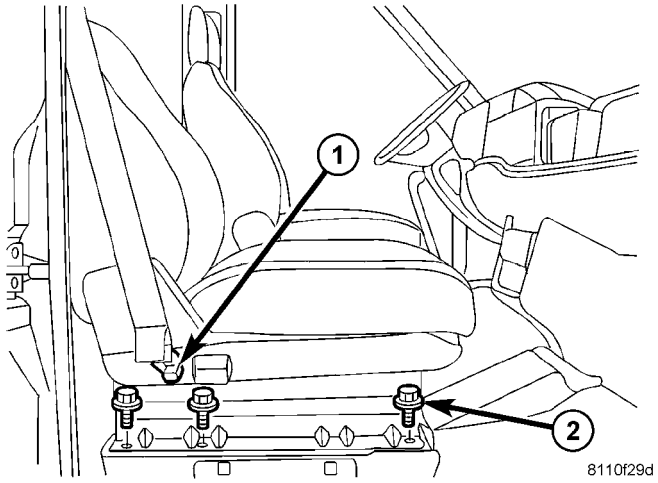


Fig. 2 FRONT SEAT

1 - SEAT BELT ANCHOR BOLT
2 - BOLTS (6)

INSTALLATION

(1) Position seat in vehicle and connect the electrical connectors, if equipped.
(2) Install the mounting bolts and tighten to 25 N·m (18 ft. lbs.).
(3) Install the seat belt anchor and bolt.
(4) Tighten anchor bolt to 35 N·m (26 ft. lbs.).
(5) Connect battery negative cable.

SEAT BACK - FRONT

REMOVAL

(1) Disconnect and isolate battery negative cable.
(2) Remove seat cushion. (Refer to 23 - BODY/SEATS/SEAT CUSHION - FRONT - REMOVAL)
(3) Verify that seat back is in full upright position.
(4) Disconnect lumbar support hose, if equipped. (Fig. 3)
(5) Remove seat back bolts and remove seat back.

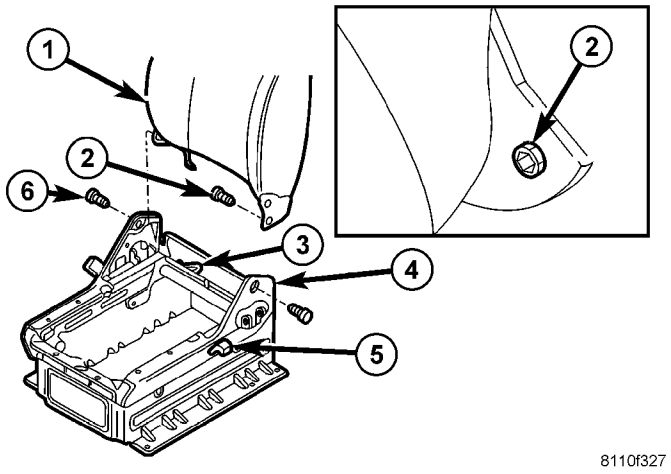


Fig. 3 FRONT SEAT BACK

1 - SEAT BACK
2 - STOP BOLT
3 - LUMBAR SUPPORT HOSE
4 - GUIDE TAB
5 - RELEASE LEVER
6 - SEAT BACK BOLTS (2)

INSTALLATION

(1) Remove stop screw.
(2) Install seat back locking spline side first.

NOTE: For better centering of seat back in the mounting bore during installation, operate the seat back release lever once.

(3) Install the spline side seat back bolt.
(4) Install remaining seat back side.

NOTE: It may be necessary to press the guide tabs apart slightly.

(5) Install the remaining seat back bolt.
(6) Tighten the seat back bolts to 20 N·m (15 ft. lbs.).
(7) Place seat back in the foremost position until the hold down spring latches audibly.
(8) Install stop bolt and tighten to 20 N·m (15 ft. lbs.).
(9) Connect the lumbar support hose, if equipped.
(10) Check seat back operation.
(11) Install the seat cushion. (Refer to 23 - BODY/SEATS/SEAT CUSHION - FRONT - INSTALLATION)

SEAT CUSHION - FRONT

REMOVAL

(1) Disconnect and isolate battery negative cable.
(2) Move seat to the foremost position.
(3) On standard cushion equipped vehicles, remove the front two screws. (Fig. 4)
(4) On comfort seat equipped vehicles, operate the front release lever. (Fig. 5)
(5) Slide seat cushion forward and lift off the mounting points.
(6) Disconnect the electrical connectors, if equipped.

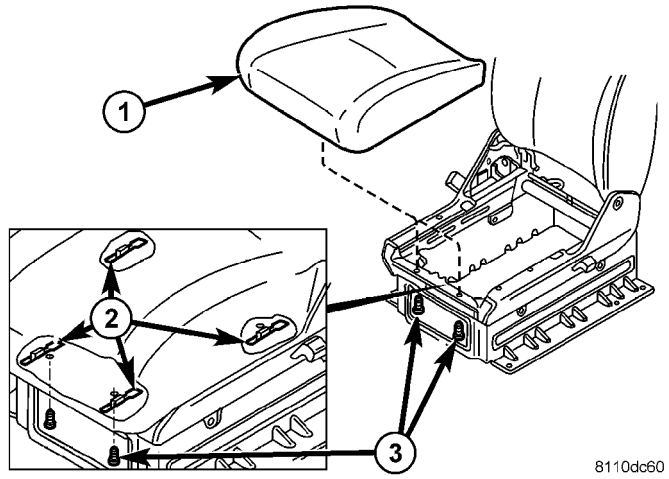


Fig. 4 STANDARD SEAT CUSHION

1 - SEAT CUSHION
2 - MOUNTING POINTS
3 - SCREWS (2)

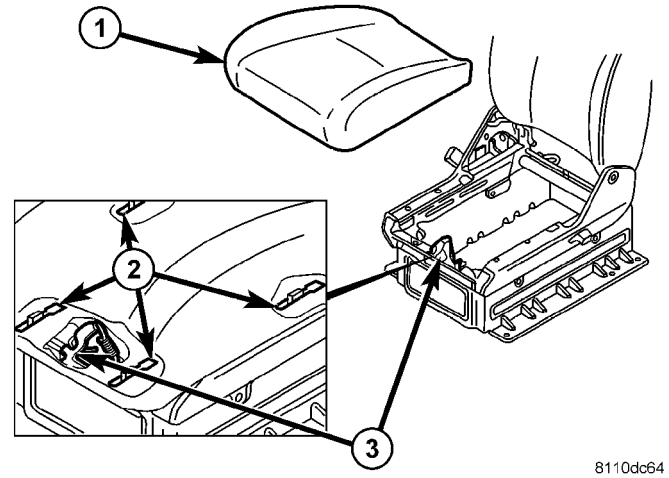


Fig. 5 COMFORT SEAT CUSHION

1 - SEAT CUSHION
2 - MOUNTING POINTS
3 - RELEASE LEVER

INSTALLATION

(1) Connect seat cushion electrical connectors, if equipped.
(2) Place seat cushion onto mounting points.
(3) On comfort seat equipped vehicles, slide seat cushion to the rear until the arresting mechanism latches audibly.
(4) On standard cushion equipped vehicles, install the front two screws.
(5) Connect battery negative cable.

SEAT ADJUSTERS - FRONT

REMOVAL

(1) Remove the seat. (Refer to 23 - BODY/SEATS/SEAT - FRONT - REMOVAL)
(2) Remove the seat back. (Refer to 23 - BODY/SEATS/SEAT BACK - FRONT - REMOVAL)
(3) Remove the seat cushion. (Refer to 23 - BODY/SEATS/SEAT CUSHION - FRONT - REMOVAL)
(4) Remove the four bolts attaching adjust to seat track.

INSTALLATION

(1) Install the adjuster onto the seat track and install the bolts.
(2) Install the seat back. (Refer to 23 - BODY/SEATS/SEAT BACK - FRONT - INSTALLATION)
(3) Install the seat cushion. (Refer to 23 - BODY/SEATS/SEAT CUSHION - FRONT - INSTALLATION)
(4) Install the seat. (Refer to 23 - BODY/SEATS/SEAT - FRONT - INSTALLATION)

SEAT - REAR

REMOVAL

(1) Turn all release levers on the legs of the appropriate rear seat up. (Fig. 6) and (Fig. 7)

(2) Lift seat up and out of the seat mounting cups.

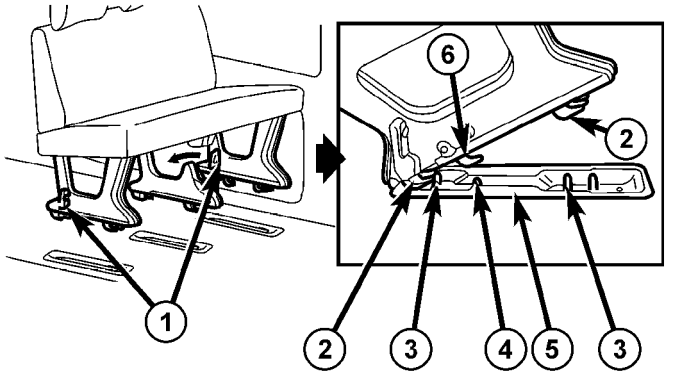


Fig. 6 THREE PASSENGER BENCH

1 - RELEASE LEVERS
2 - MOUNTING LEGS
3 - RETAINING BOLT
4 - RETAINING BOLT
5 - MOUNTING CUP
6 - MOUNTING LEG

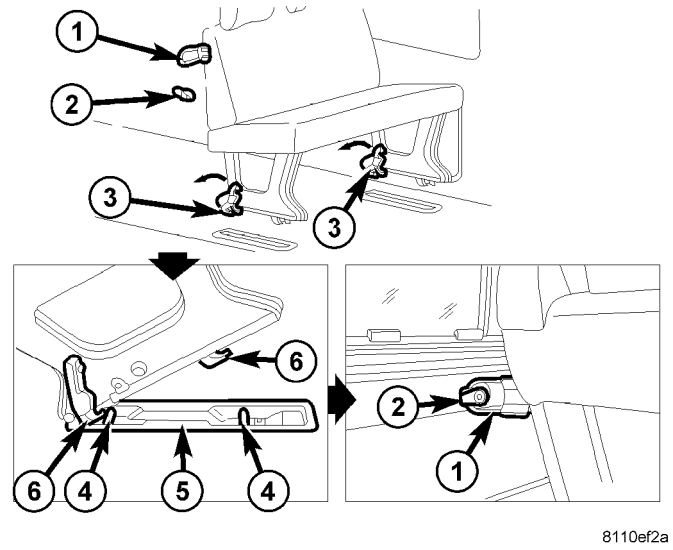


Fig. 7 TWO PASSENGER BENCH

1 - RESTRAINT CABLE
2 - HOOK
3 - RELEASE LEVERS
4 - RETAINING BOLT
5 - MOUNTING CUP
6 - MOUNTING LEGS

INSTALLATION

(1) With seat facing forward, insert mounting legs into the respective mounting cups.

(2) Slide seat forwards with some force as far as it will go, until the release levers are heard to engage and all release levers are parallel to the vehicle floor.

REAR SEAT BACK SHIELD

REMOVAL

(1) Remove the screws and remove the panel. (Fig. 8)

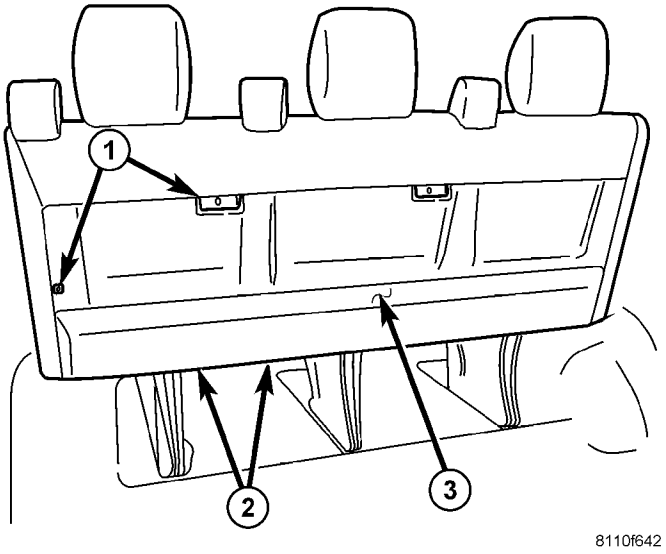


Fig. 8 REAR SEAT

1 - SCREWS (4)
2 - SCREWS (6)
3 - PANEL

INSTALLATION

(1) Install the panel and install the screws.

SEAT BACK CUSHION/COVER - REAR

REMOVAL

(1) Remove seat. (Refer to 23 - BODY/SEATS/SEAT - REAR - REMOVAL)
(2) Remove seat back shield. (Refer to 23 - BODY/SEATS/REAR SEAT BACK SHIELD - REMOVAL)
(3) Remove seat belts as necessary to remove cover. (Refer to 8 - ELECTRICAL/RESTRAINTS/REAR SEAT BELT & RETRACTOR - REMOVAL)
(4) Remove seat belt buckles as necessary. (Refer to 8 - ELECTRICAL/RESTRAINTS/REAR SEAT BELT BUCKLE - REMOVAL)
(5) Remove the headrests. (Refer to 23 - BODY/SEATS/HEADREST - REMOVAL)
(6) Remove the headrest sleeves.
(7) Partially de-trim upper seat back.
(8) Remove the retaining covers at seat belt guides.
(9) Route belts through guides.
(10) Separate j-straps at seat back cover and remove cover/cushion.

INSTALLATION

(1) Install seat back cushion and cover.
(2) Connect j-straps.
(3) Route belts through guides.
(4) Install retaining covers at seat belt guides.
(5) Position upper seat back cover back into place.
(6) Install the headrest sleeves.
(7) Install the headrests. (Refer to 23 - BODY/SEATS/HEADREST - INSTALLATION)
(8) Install the seat belt buckles. (Refer to 8 - ELECTRICAL/RESTRAINTS/REAR SEAT BELT BUCKLE - INSTALLATION)
(9) Install the seat belts. (Refer to 8 - ELECTRICAL/RESTRAINTS/REAR SEAT BELT & RETRACTOR - INSTALLATION)
(10) Install the seat back shield. (Refer to 23 - BODY/SEATS/REAR SEAT BACK SHIELD - INSTALLATION)
(11) Install seat. (Refer to 23 - BODY/SEATS/SEAT - REAR - INSTALLATION)

SEAT CUSHION/COVER - REAR

REMOVAL

(1) Remove seat. (Refer to 23 - BODY/SEATS/SEAT - REAR - REMOVAL)
(2) Remove seat back shield. (Refer to 23 - BODY/SEATS/REAR SEAT BACK SHIELD - REMOVAL)
(3) Remove the lower seat belt anchors as necessary.(Refer to 8 - ELECTRICAL/RESTRAINTS/REAR SEAT BELT & RETRACTOR - REMOVAL)
(4) Remove seat belt buckles as necessary. (Refer to 8 - ELECTRICAL/RESTRAINTS/REAR SEAT BELT BUCKLE - REMOVAL)
(5) Partially de-trim lower part of seat back.
(6) Separate the cushion/cover j-straps and remove the seat cushion and cover from seat frame.

INSTALLATION

(1) Install seat cushion and cover.
(2) Connect the cover j-straps.
(3) Position seat back cover, back.
(4) Install the seat belt buckles. (Refer to 8 - ELECTRICAL/RESTRAINTS/REAR SEAT BELT BUCKLE - INSTALLATION)
(5) Install the seat belt anchors. (Refer to 8 - ELECTRICAL/RESTRAINTS/REAR SEAT BELT & RETRACTOR - INSTALLATION)
(6) Install the seat back shield. (Refer to 23 - BODY/SEATS/REAR SEAT BACK SHIELD - INSTALLATION)
(7) Install seat. (Refer to 23 - BODY/SEATS/SEAT - REAR - INSTALLATION)

STATIONARY GLASS

TABLE OF CONTENTS

page

BACKLITE - BULKHEAD TRIM PANEL
REMOVAL 81
INSTALLATION 81
QUARTER WINDOW
REMOVAL 81
INSTALLATION 81

page

WINDSHIELD
WARNING
WINDSHIELD SAFETY PRECAUTIONS 82
REMOVAL 82
INSTALLATION 83

BACKLITE - BULKHEAD TRIM PANEL

REMOVAL

(1) Position an assistant opposite side of the bulkhead trim panel to receive the glass and weatherstrip seal.

(2) Start at an upper corner and separate the seal from the window opening. Push the glass and seal outward from the window opening. Remove the glass and seal.

(3) Remove seal from glass if necessary.

(4) Clean the window opening.

INSTALLATION

(1) Install the weatherstrip seal on the window glass. Verify that the glass is seated in the groove around the edge of the seal.

(2) Insert an installation cord in the weatherstrip seal inner groove.

NOTE: Use mineral spirits as a lubricant to aid seal installation in the window opening.

(3) Position the glass and seal in the trim panel opening.

(4) Pull the installation cord outward and force the seal lip over the panel flange around the edge of the opening. (Fig. 1)

(5) Seat the seal inner lip on the panel flange. Press against the lip around the edge of the seal.

NOTE: Remove any mineral spirits with a clean cloth after glass installation.

(6) Verify that the seal is seated in the trim panel opening.

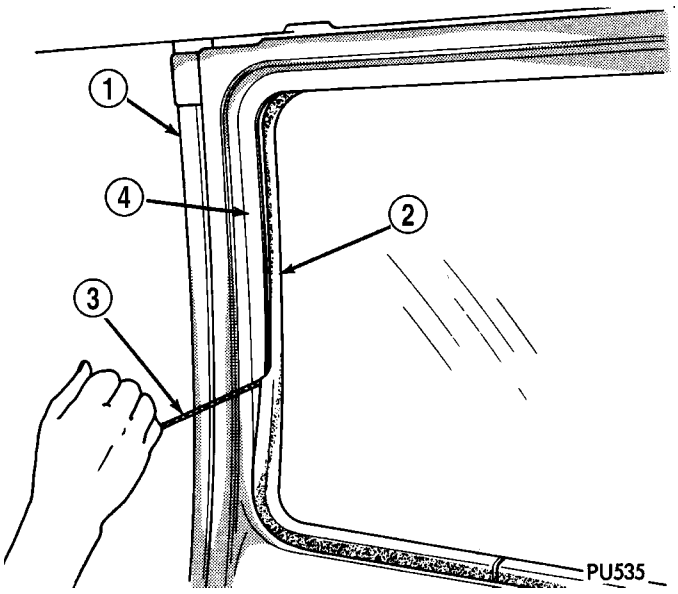


Fig. 1 Glass & Weatherstrip Seal Installation

1 - BULKHEAD TRIM PANEL
2 - WEATHERSTRIP SEAL
3 - INSTALLATION CORD
4 - TRIM PANEL FRAME

QUARTER WINDOW

REMOVAL

(1) Position an assistant outside the vehicle to receive the glass and weatherstrip seal.

(2) Start at an inside, upper corner. Separate the seal from the window opening. Push the glass and seal outward from the window opening. Remove the glass and seal.

(3) Clean the window opening.

INSTALLATION

(1) Install the weatherstrip seal on the window glass. Verify that the glass is seated in the groove around the edge of the seal.

(2) Insert an installation cord in the weatherstrip seal inner groove.

QUARTER WINDOW (Continued)

NOTE: Use mineral spirits as a lubricant to aid seal installation in the window opening.

(3) Position the glass and seal in the window opening.

(4) Pull the installation cord outward and force the seal lip over the panel flange around the edge of the opening.

(5) Seat the seal inner lip on the panel flange. Press against the lip around the edge of the seal.

NOTE: Remove any mineral spirits with a clean cloth after glass installation.

(6) Verify that the seal is seated in the window opening (Fig. 2).

(7) Test the window for water leaks. (Refer to 23 - BODY - DIAGNOSIS AND TESTING - WATER LEAKS)

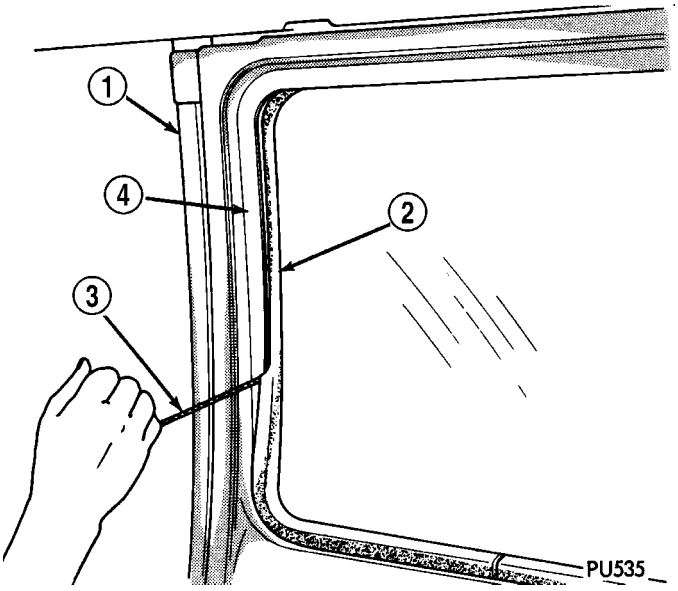


Fig. 2 Glass & Weatherstrip Seal Installation

1 - BODY PANEL
2 - WEATHERSTRIP SEAL
3 - INSTALLATION CORD
4 - WINDOW OPENING

WINDSHIELD

WARNING

WINDSHIELD 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.**
- **DAIMLERCHRYSLER 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.

REMOVAL

(1) Remove wiper arms. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ARMS - REMOVAL)

(2) Remove headliner. (Refer to 23 - BODY/INTERIOR/HEADLINER - REMOVAL)

(3) Remove rear view mirror. (Refer to 23 - BODY/INTERIOR/REAR VIEW MIRROR - REMOVAL)

CAUTION: Cover instrument panel and vents to protect against splinters and damage.

WINDSHIELD (Continued)

(4) Using a trim stick C-4755 or equivalent, remove windshield seal. (Fig. 3)

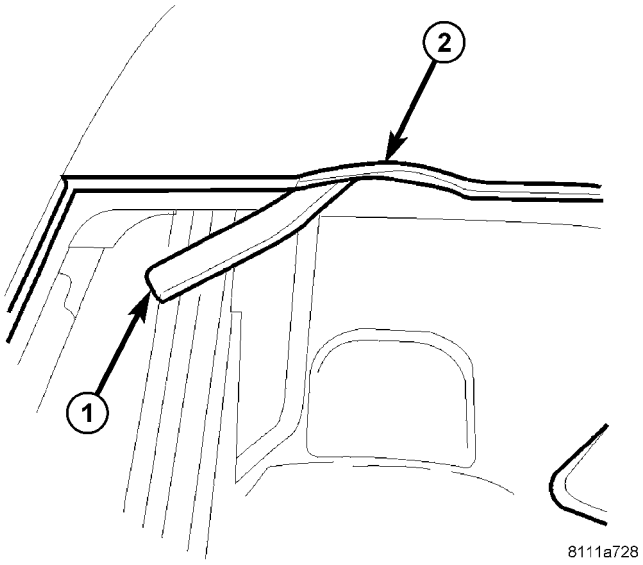


Fig. 3 WINDSHIELD SEAL

1 - WINDSHIELD SEAL
2 - TRIM STICK #4755

CAUTION: Fabricate a protection guard from 2 mm sheet plastic or equivalent to protect rubber instrument panel from damage.

(5) Place protection guard between windshield and instrument panel seal. (Fig. 4)

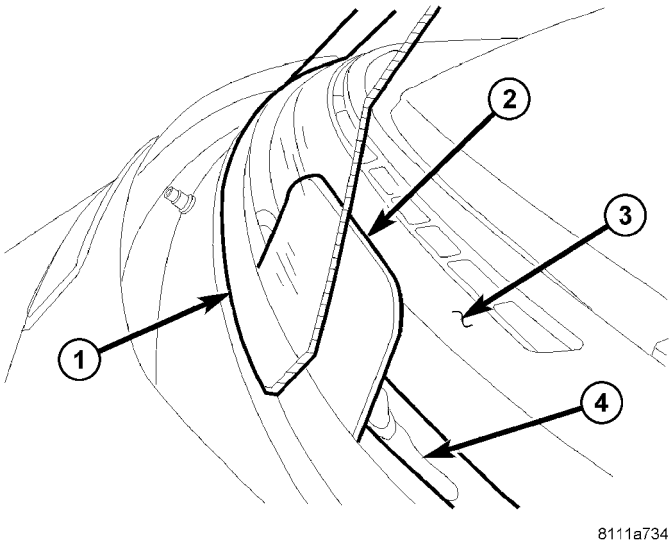


Fig. 4 INSTRUMENT PANEL SEAL

1 - WINDSHIELD
2 - SEAL PROTECTOR
3 - INSTRUMENT PANEL
4 - INSTRUMENT PANEL SEAL

(6) Using a windshield cut-out wire separate the adhesive. (Fig. 5)

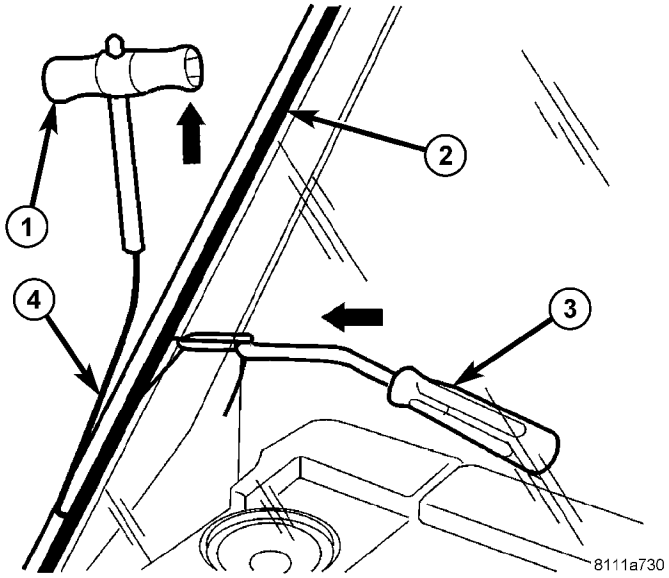


Fig. 5 ADHESIVE SEPARATION

1 - T-HANDLE
2 - WINDSHIELD ADHESIVE
3 - COUNTER SUPPORT
4 - CUTTING WIRE

(7) Carefully remove windshield.

INSTALLATION

WARNING: Allow the urethane at least 24 hours to cure before returning the vehicle to use.

CAUTION: Roll down the left and right front door glass and open the rear glass slider (if available) before installing windshield to avoid pressurizing the passenger compartment if a door is slammed before urethane is cured. Water leaks can result.

The windshield fence should be cleaned of most of its old urethane bonding material. A small amount of old urethane, approximately 1 mm in height, should remain on the fence. Do not grind off or completely remove all old urethane from the fence, the paint finish and bonding strength will be adversely affected.

WINDSHIELD (Continued)

Windshield Preparation - Installing A Previously Installed Windshield

(1) Level old bead of windshield adhesive to a thickness of approximately 1 mm (0.04 in.) and remove loose adhesive. (Fig. 6)

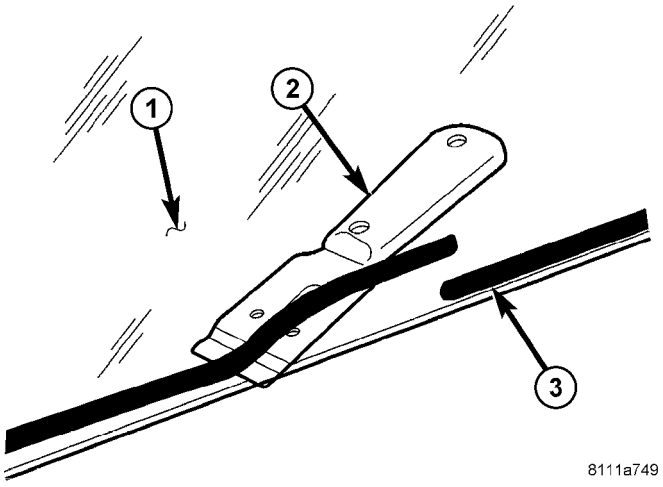


Fig. 6 WINDSHIELD ADHESIVE PREPARATION

1 - WINDSHIELD
2 - SCRAPER
3 - OLD ADHESIVE

(2) Position windshield seal onto windshield starting at one corner and quickly moving up and down. (Fig. 7)

CAUTION: Never moisten windshield seal with lubricants to facilitate installation.

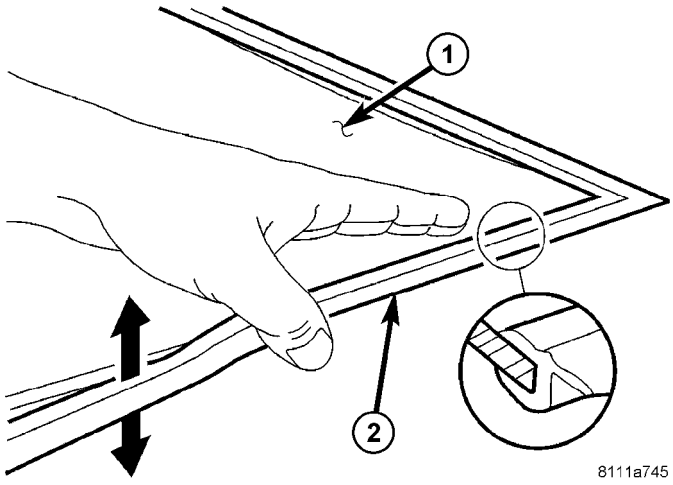


Fig. 7 WINDSHIELD SEAL INSTALLATION

1 - WINDSHIELD
2 - WINDSHIELD SEAL

(3) Position windshield in center of windshield opening.

(4) Apply adhesive tape to the locations shown to aid with final installation. (Fig. 8)

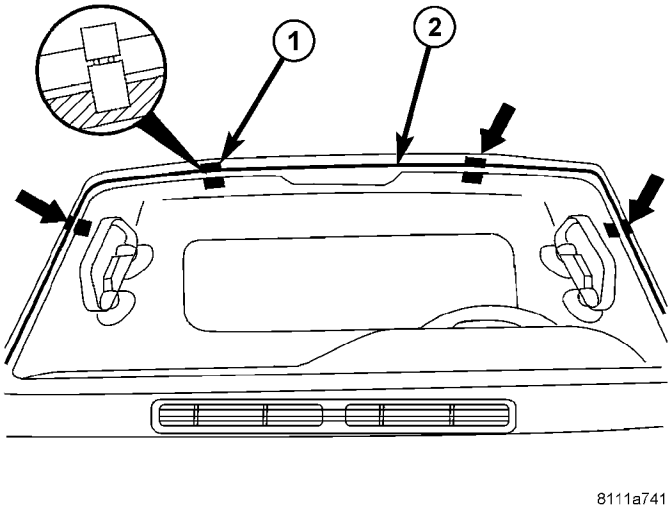


Fig. 8 WINDSHIELD POSITIONING

1 - TAPE
2 - WINDSHIELD FRAME

(5) Verify windshield gap is parallel to with windshield.

(6) Cut tape with a sharp knife and remove windshield.

(7) Clean and dry area of glass to be re-glued with a suitable glass preparation solvent and rag.

(8) Using a flash light, verify that glass primer is without damage.

(9) Re-prime any damaged area. If old adhesive has been exposed for more than 12 hours, entire adhesive area needs to be re-primed. (Fig. 9)

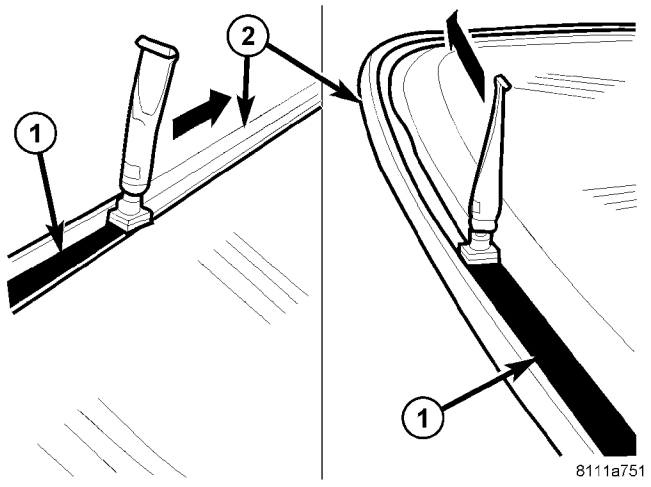


Fig. 9 WINDSHIELD PRIMER

1 - PRIMER
2 - WINDSHIELD SEAL

(10) Allow primer to air dry for at least 10 minutes.

WINDSHIELD (Continued)

(11) Using a flash light, verify that glass primer is without damage.

Windshield Preparation - Installing A New Windshield

(1) Clean and check windshield for damage.

(2) Position windshield seal onto windshield starting at one corner and quickly moving up and down. (Fig. 7)

CAUTION: Never moisten windshield seal with lubricants to facilitate installation.

(3) Position windshield in center of windshield opening.

(4) Apply adhesive tape to the locations shown to aid with final installation. (Fig. 8)

(5) Verify windshield gap is parallel to with windshield.

(6) Cut tape with a sharp knife and remove windshield.

(7) Clean and dry area of glass to be glued with a suitable glass preparation solvent and rag.

(8) Apply primer to gluing surface at windshield seal. (Fig. 9)

(9) Allow primer to air dry for at least 10 minutes.

(10) Using a flash light, verify that glass primer is without damage.

Windshield Opening Preparation

(1) Clean and vacuum windshield opening.

(2) Level old bead of windshield opening adhesive to a thickness of approximately 1 mm (0.04 in.) and remove loose adhesive. (Fig. 10)

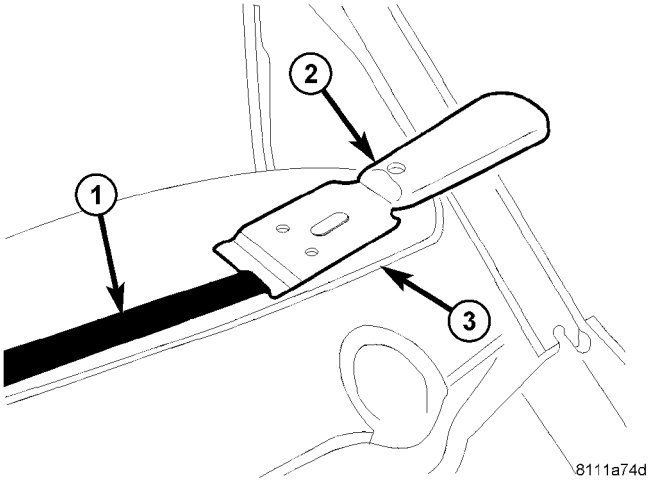


Fig. 10 WINDSHIELD OPENING PREPARATION

1 - OLD ADHESIVE
2 - SCRAPER
3 - WINDSHIELD OPENING

(3) Clean and dry area of windshield opening to be re-glued with a suitable glass preparation solvent and rag.

(4) Re-prime any damaged area. If old adhesive has been exposed for more than 12 hours, entire adhesive area needs to be re-primed. (Fig. 11)

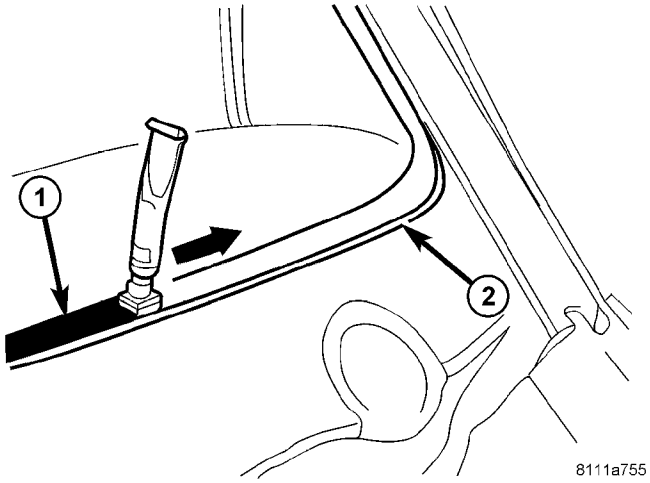


Fig. 11 WINDSHIELD OPENING PRIMER

1 - PRIMER
2 - WINDSHIELD OPENING

(5) Allow primer to air dry for at least 10 minutes.

Windshield Installation

(1) Apply bead of glue with a triangular nozzle directly to the windshield seal starting at bottom in center of windshield. (Fig. 12)

CAUTION: Always apply bead of adhesive to the windshield. Always install the windshield within 5 minutes after applying adhesive.

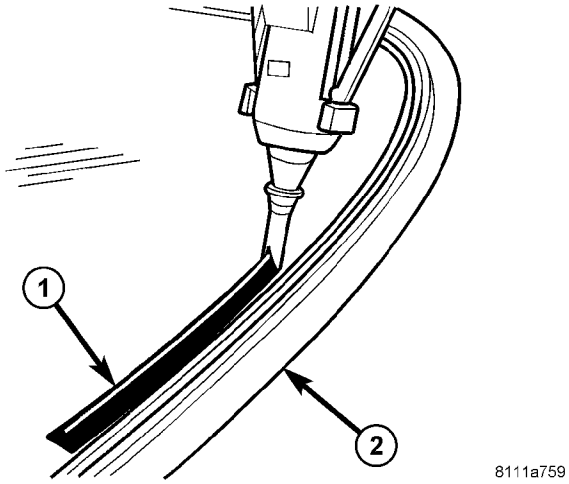


Fig. 12 WINDSHIELD ADHESIVE APPLICATION

1 - ADHESIVE BEAD
2 - WINDSHIELD SEAL

WINDSHIELD (Continued)

(2) Allow end of adhesive bead to run out parallel to the start of the bead and smooth ends flush. (Fig. 13)

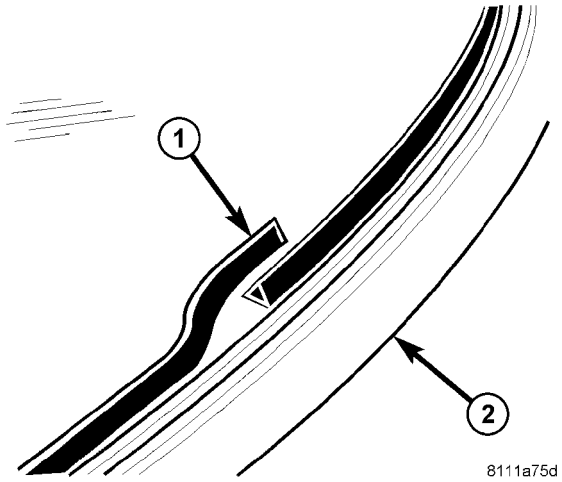


Fig. 13 WINDSHIELD ADHESIVE OVERLAP

1 - ADHESIVE BEAD
2 - WINDSHIELD SEAL

(3) Lift windshield into place in the center of the windshield opening and use the tape as a guide to aid installation of the windshield into the center of the cutout.

(4) Carefully lay down windshield and press on.

CAUTION: It is no longer possible to move the windshield after installation. The windshield should never be pressed into place by more than one person, because the windshield can break if pressed simultaneously on both sides.

CAUTION: Roll down the left and right front door glass and open the rear glass slider (if available) before installing windshield to avoid pressurizing the passenger compartment if a door is slammed before urethane is cured. Water leaks can result.

(1) Install the rear view mirror. (Refer to 23 - BODY/INTERIOR/REAR VIEW MIRROR - INSTALLATION)

(2) Install the headliner. (Refer to 23 - BODY/INTERIOR/HEADLINER - INSTALLATION)

(3) Install the wiper arms. (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WIPER ARMS - INSTALLATION)

WEATHERSTRIP/SEALS

TABLE OF CONTENTS

page

FRONT DOOR INNER BELT WEATHERSTRIP
REMOVAL 87
INSTALLATION 87
FRONT DOOR OUTER BELT WEATHERSTRIP
REMOVAL 87
INSTALLATION 87
DOOR OPENING SEALS
REMOVAL 87
INSTALLATION 87

FRONT DOOR INNER BELT WEATHERSTRIP

REMOVAL

(1) Remove the front door trim panel. (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - REMOVAL)
(2) Remove the inner belt weatherstrip.

INSTALLATION

(1) Install the inner belt weatherstrip.
(2) Install the trim panel. (Refer to 23 - BODY/DOOR - FRONT/TRIM PANEL - INSTALLATION)

FRONT DOOR OUTER BELT WEATHERSTRIP

REMOVAL

(1) Remove door glass. (Refer to 23 - BODY/DOOR - FRONT/DOOR GLASS - REMOVAL)
(2) Remove screws at window channel and remove channel.
(3) Remove outer belt weatherstrip.

INSTALLATION

(1) Install outer belt weatherstrip.
(2) Install glass run channel and install the screws.
(3) Install the door glass. (Refer to 23 - BODY/DOOR - FRONT/DOOR GLASS - INSTALLATION)

DOOR OPENING SEALS

REMOVAL

(1) Open door and separate the door opening seal from the door opening flange.

INSTALLATION

(1) Position the seal to the bottom of the door opening, with bulb facing outboard, starting the installation at the center of the lower flange. Press the seal onto the sill flange and work around the perimeter of the door opening until fully seated. Work in one direction, smoothing the seal to avoid puckers or wrinkles.
(2) When installing a new weatherstrip on the front door opening, remove the tear strip starting at the splice and moving around the front of the door to the back of the opening.

BODY STRUCTURE

TABLE OF CONTENTS

page

GAP AND FLUSH
SPECIFICATIONS 88

page

OPENING DIMENSIONS
SPECIFICATIONS 90

GAP AND FLUSH

SPECIFICATIONS

GAP & FLUSH DIMENSIONS INDEX

DESCRIPTION	FIGURE
FRONT DOORS	1
SLIDING DOORS	2
REAR DOORS	3

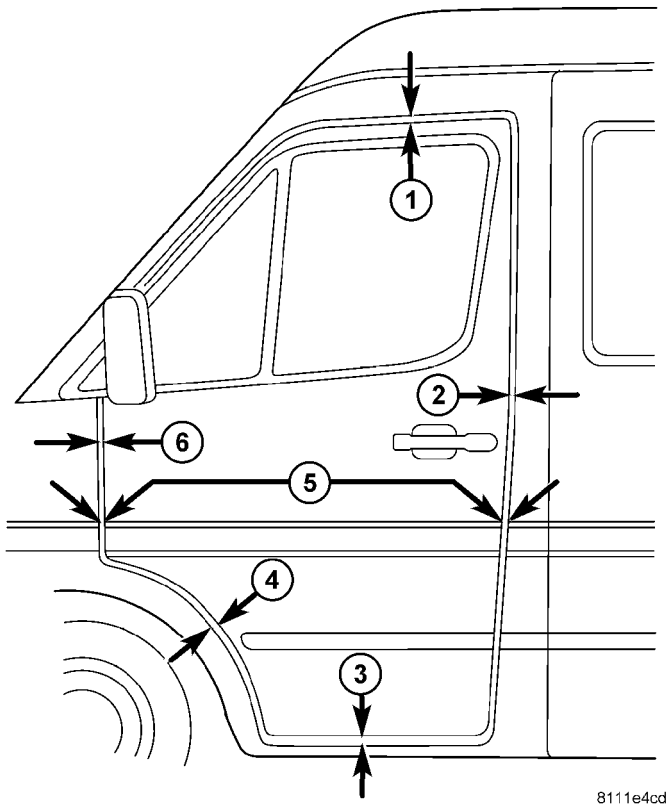


Fig. 1 FRONT DOOR

	LOCATION	GAP	FLUSH
1	Door at top.	7 ± 0.5	FLUSH
2	Door at upper b-pillar.	7 ± 0.5	Up to max 1 mm recessed, at rear with 1 mm overlap (wind noise)
3	Door at bottom.	8 ± 0.5	FLUSH
4	Door at wheelhouse.	7 ± 0.5	FLUSH
5	Door ridge at wheelhouse and b-pillar.	—	FLUSH
6	Door at a-pillar.	8 ± 0.5	FLUSH

NOTE:
All measurements are in mm.

GAP AND FLUSH (Continued)

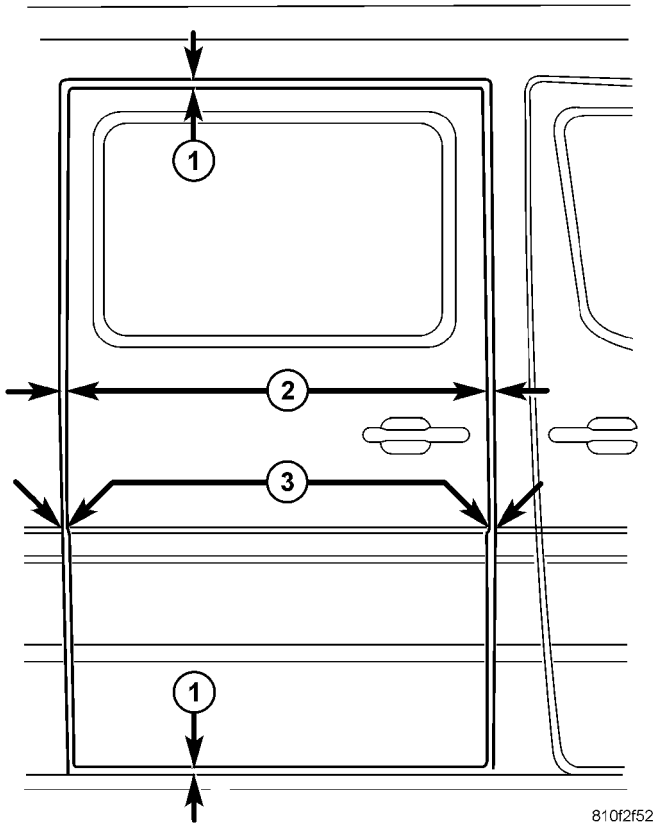


Fig. 2 SLIDING DOOR

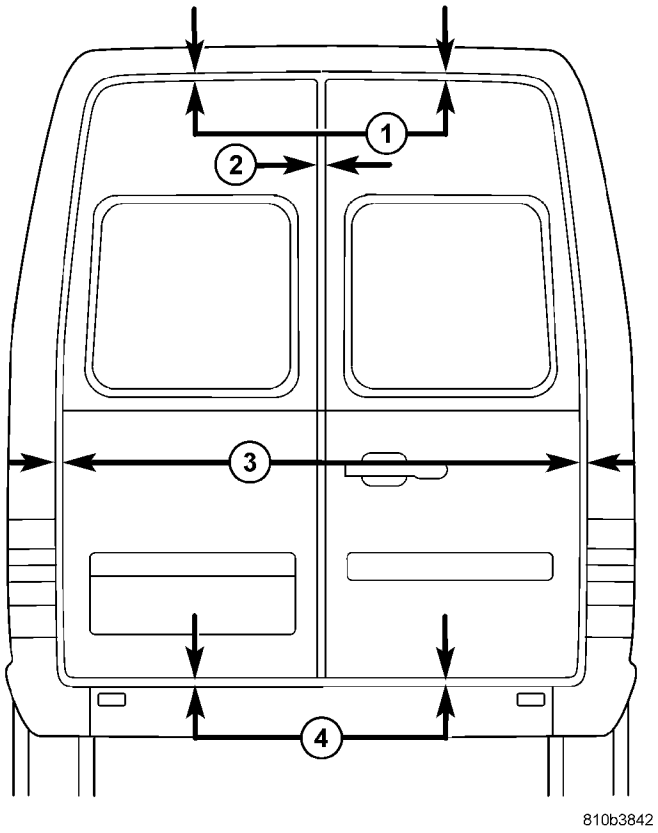


Fig. 3 REAR DOOR

NOTE:
All measurements are in mm.

	LOCATION	GAP	FLUSH
1	Sliding doors at top and bottom	7 ± 0.5	FLUSH
2	Sliding doors at sides to body	7 ± 0.5	FLUSH
3	Door ridge at b-pillar and side panel	—	FLUSH without offset

NOTE:
All measurements are in mm.

	LOCATION	GAP	FLUSH
1	Rear doors at top	13 ± 0.5	FLUSH
2	Right rear door to left rear door	8 ± 0.5	FLUSH
3	Rear doors (both sides) to rear body	8 ± 0.5	FLUSH
4	Rear doors at bottom	8 ± 0.5	—

OPENING DIMENSIONS

SPECIFICATIONS

BODY OPENING DIMENSIONS INDEX

DESCRIPTION	FIGURE
WINDSHIELD OPENING	4

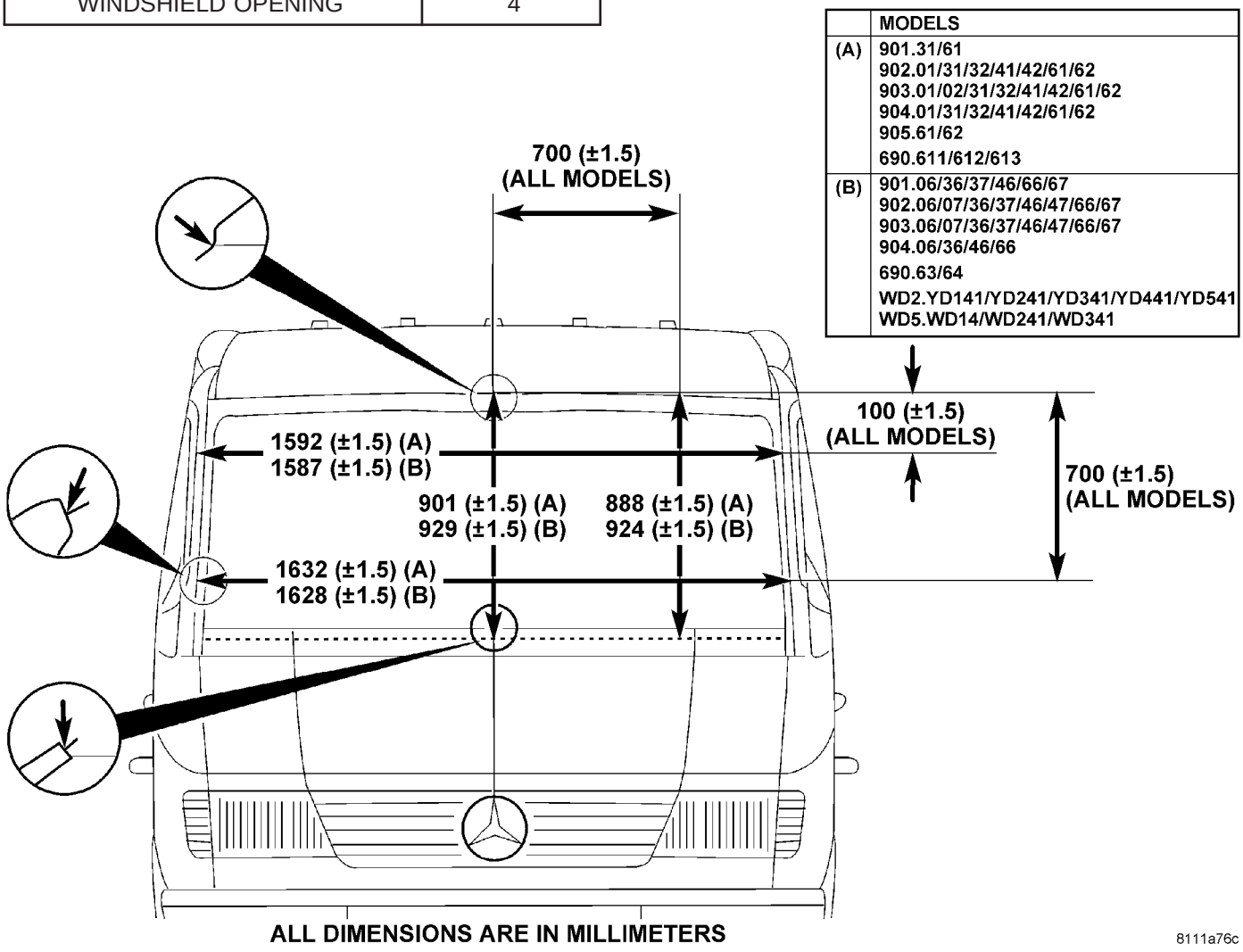


Fig. 4 WINDSHIELD OPENING

HEATING & AIR CONDITIONING

TABLE OF CONTENTS

page

HEATING & AIR CONDITIONING
DESCRIPTION
DESCRIPTION - COOLING SYSTEM REQUIREMENTS 1
DESCRIPTION - HEATER AND AIR CONDITIONER 1
OPERATION - HEATER AND AIR CONDITIONER 2
DIAGNOSIS AND TESTING
DIAGNOSIS AND TESTING - FUNCTION TEST 3
DIAGNOSIS AND TESTING - A/C PERFORMANCE TEST 3
DIAGNOSIS AND TESTING - HEATER PERFORMANCE 4
SPECIFICATIONS
A/C SYSTEM 5
CONTROLS - FRONT 8
CONTROLS - REAR 22
DISTRIBUTION - FRONT 31
DISTRIBUTION - REAR 39
PLUMBING 43
CABIN HEATER 72

HEATING & AIR CONDITIONING

DESCRIPTION

DESCRIPTION - 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.

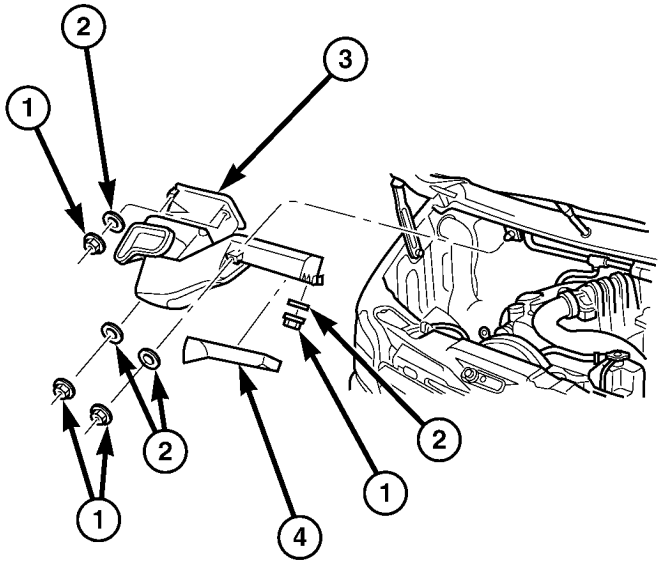
The engine cooling system includes the radiator, thermostat, heater core, heater hoses and the engine coolant pump. Refer to Cooling for more information before opening or attempting any service to the engine cooling system.

DESCRIPTION - HEATER AND AIR CONDITIONER

A automatic temperature control (ATC) single zone type heating-air conditioning system is standard equipment on this model. A manually controlled rear air conditioning system is available as a factory-installed option.

All vehicles are equipped with a common ventilation housing (Fig. 1) located in the engine compartment which includes:

- blower motor
- blower motor resistor block
- recirculation door and actuator



8112da5a

Fig. 1 Ventilation Housing

1 - NUT (5)
2 - WASHER (5)
3 - VENTILATION HOUSING
4 - HOUSING COVER

All vehicles are also equipped with a common heater housing mounted under the instrument panel which includes:

- heater core
- evaporator core
- evaporator temperature sensor

HEATING & AIR CONDITIONING (Continued)

- expansion valve
- air outlet temperature sensor
- mode doors

Vehicles equipped with the factory-installed optional rear air conditioning system (Fig. 2) use a common roof mounted assembly which includes:

- solenoid valve
- evaporator core
- evaporator temperature sensor
- expansion valve
- blower motor and wheel assembly

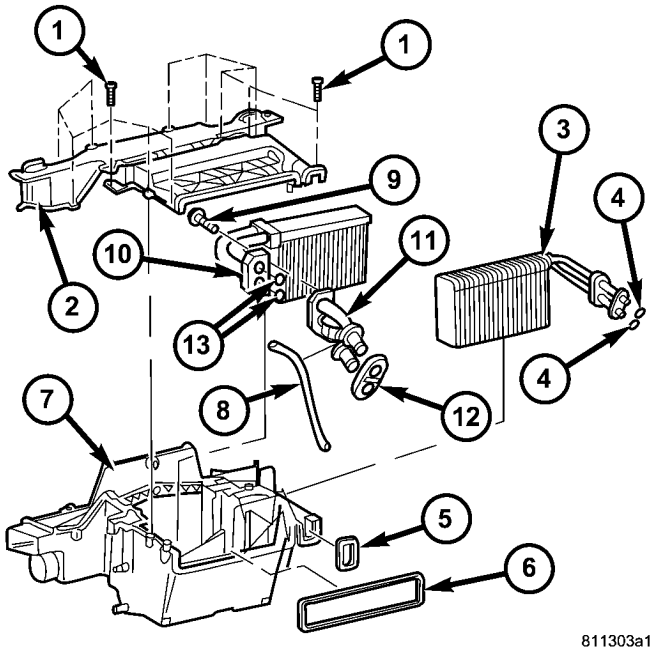


Fig. 2 Heater Housing

1 - SCREW (12)
2 - HEATER HOUSING COVER
3 - EVAPORATOR
4 - EVAPORATOR O-RING SEAL (2)
4 - EVAPORATOR GASKET
6 - VENTILATION HOUSING GASKET
7 - HEATER HOUSING
8 - WIRING HARNESS
9 - BOLT (3)
10 - HEATER CORE
11 - HEATER CORE TUBE ASSEMBLY
12 - HEATER CORE TUBE GASKET
13 - HEATER CORE TUBE O-RING SEAL (2)

A heater booster is used to aid in warming the engine coolant. The heater booster system can be switched on while the vehicle is being driven to help the engine reach its normal operating temperature quickly and will help aid in heating up the air within the passenger compartment quickly when requested by the operator (Fig. 3).

OPERATION - HEATER AND AIR CONDITIONER

Outside air enters the vehicle through the hood opening at the base of the windshield, and passes through the ventilation housing located in the engine compartment into the heater housing located behind the instrument panel. Air flow velocity is adjusted with the blower motor speed selector thumbwheel on the A/C-heater control. The air intake openings must be kept free of snow, ice, leaves, and other obstructions for the HVAC system to receive a sufficient volume of outside air.

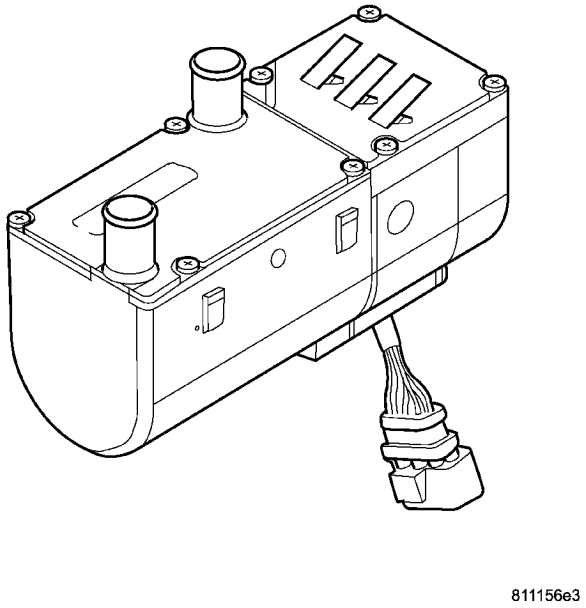


Fig. 3 Heater Booster

The automatic temperature control (ATC) system controls interior temperature by taking actual values from the temperature sensors and the CAN bus and comparing them to the nominal value of the temperature control switch. The electric pulsed heater valve is then energized depending on the requested quantity of heat and an electrically-operated water pump gives a nearly constant water flow for exact temperature regulation. If the solenoid is not energized, the coolant circuit to the heat exchanger is fully open. To control the temperature the solenoid valve is pulsed by the ATC in periods of four seconds.

The mode control knob on the A/C-heater control is used to direct the conditioned air flow to the selected air outlets. The mode control knob operates the mode doors by cables connected to the mode doors.

When the outside air contains smoke, oders, high humidity, or if rapid cooling is desired, interior air can by recirculated by selecting the Recirculation Mode with the mode control knob. The mode control knob operates the recirculation door through use of a vaccum actuator. When the Recirculation Mode is selected, the recirculation door is closed to prevent outside air from entering the passenger compartment.

To maintain minimum evaporator temperature and prevent evaporator freezing, an evaporator temperature sensor is used.

Vehicles equipped with the available rear A/C system have an individual temperature control and blower motor speed switches. When the rear A/C system is turned on, a solenoid valve opens the rear refrigerant circuit and activates the blower motor for the rear evaporator. The circulated internal air temperature is measured by a temperature sensor and the temperature value is compared within the rear A/C control module to an adjusted value at the temperature control switch. To prevent icing of the rear evaporator, the temperature switch cuts off the flow of refrigerant through the rear A/C circuit by de-energizing the solenoid valve.

The front and rear A/C systems are designed for the use of non-CFC, R-134a refrigerant only. Both the front and rear systems use an expansion valve to meter refrigerant flow to the evaporator.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - FUNCTION TEST

The ATC system can perform an self-test, which can be activated by the DRBIII® scan tool to confirm that the air conditioning system is performing satisfactorily. This test provides a quick confirmation of heater - air conditioning system performance to the service technician. Refer to Body Diagnostic Procedures for the appropriate diagnostic information.

DIAGNOSIS AND TESTING - A/C PERFORMANCE TEST

The air conditioning system is designed to provide the passenger compartment with low temperature and low specific humidity air. The evaporator, located in the heater 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 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. Removing 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.

WARNING: REFER TO THE APPLICABLE WARNINGS AND CAUTIONS FOR THIS SYSTEM BEFORE PERFORMING THE FOLLOWING OPERATION (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION).

NOTE: Very specific instructions and conditions pertain to this procedure which are significantly different than procedures used in other vehicle applications. Follow each step in the order they are presented. Do not skip steps or change conditions from those stated or results will be adversely affected and invalid.

The compressor clutch is de-energized under any of the following conditions:

- Blocked compressor (thermal fuse in the pulley)
- Low pressure in the system
- Low evaporator temperature
- Hard acceleration (WOT)
- High coolant temperatures

(1) Place the vehicle in the shade with all widows open.

(2) Turn the temperature control to cold.

(3) Select Fresh Air, not Recirculate and open all air conditioning duct louvers.

(4) Start the vehicle and allow it to idle.

(5) Turn the blower switch to the maximum blower speed setting and allow to operate for a short period of time before proceeding.

(6) Perform an outlet temperature test as follows:

a. Turn the blower switch to the lowest blower speed setting.

b. Insert a thermometer into a center duct for at least five minutes.

c. With the engine running, duct temperature should not be less than 2° C (35° F) or than 12° C (54° F).

(7) If the compressor has not cycled off and the duct temperature is less than 2° C (35° F) , check the evaporator temperature sensor and circuit by performing the ATC Function Test (Refer to 24 - HEATING & AIR CONDITIONING - DIAGNOSIS AND TESTING).

(8) If duct output temperature is not within specifications, check the refrigerant system for leaks and proper refrigerant charge (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - DIAGNOSIS AND TESTING) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

DIAGNOSIS AND TESTING - HEATER PERFORMANCE

Before performing the following tests, perform the ATC Function Test using the DRBIII® and refer to Cooling for the procedures to check the radiator coolant level, serpentine drive belt tension, radiator air flow and the radiator fan operation.

MAXIMUM HEATER OUTPUT

Engine coolant is provided to the heater core through a heater valve and heater hose. With the engine idling at normal operating temperature, set the heater-A/C controls as follows:

- Temperature control in the full hot position
- Mode control in the floor heat position
- Blower motor control in the highest speed position

Using a test thermometer, check the temperature of the air being discharged at the floor outlets. Compare the test thermometer reading to the Temperature Reference chart.

TEMPERATURE REFERENCE CHART

Ambient Temperature		Minimum Floor Outlet Temperature	
Celsius	Fahreheit	Celsius	Fahreheit
15.5°	60°	62.2°	144°
21.1°	70°	63.8°	147°
26.6°	80°	65.5°	150°
32.2°	90°	67.2°	153°

If the floor outlet air temperature is insufficient, check for a faulty heater valve (perform ATC Function Test) and verify that the cooling system is operating to specifications (Refer to 7 - COOLING/ ENGINE/COOLANT - DIAGNOSIS AND TESTING). Both of the heater hoses should be HOT to the touch (the coolant return heater hose should be slightly cooler than the supply hose. If the coolant return hose is much cooler than the supply hose, locate and repair the engine coolant flow obstruction in the heater system.

POSSIBLE LOCATIONS OR CAUSE OF OBSTRUCTED COOLANT FLOW

- Pinched or kinked heater hoses.
- Improper heater hose routing.
- Plugged heater hoses or supply and return ports at the cooling system connections.
- Inoperative or stuck heater water valve.
- Plugged heater core.

If proper coolant flow is verified, and heater floor outlet air temperature is insufficient, a mechanical problem may exist.

POSSIBLE LOCATIONS OR CAUSE OF INSUFFICIENT HEAT

- An obstructed cowl air intake.
- Obstructed heater system outlets.
- Heater water valve not functioning properly.

TEMPERATURE CONTROL

If outlet air temperature cannot be adjusted with the A/C-heater temperature control, one of the following could require service:

- Faulty A/C-heater control switch.
- Faulty temperature sensor.
- Faulty A/C-heater control cable or actuator.
- Faulty A/C-heater control module.

HEATING & AIR CONDITIONING (Continued)

SPECIFICATIONS

A/C SYSTEM

The R-134a refrigerant system charge capacity for this vehicle can be found on the underhood specification label for the A/C unit.

SYSTEM SPECIFICATIONS

Item	Description	Notes
Compressor	Nippondenso - 7SBU16C	ND-8 PAG oil
Low psi Control	A/C Pressure Transducer	Liquid line mounted - opens below 152 kPa (22 psi) - resets above 234 - 262 (34-38 psi)
High psi Control	High Pressure Relief Valve	Compressor mounted - opens at a discharge pressure over 3445 04135 kPa (500 - 600 psi)
Compressor Clutch Coil Draw	2.0-3.7 amps @ 11.5 - 12V @ 21° C (70° F)	
Compressor Clutch Air Gap	0.5 - 0.88 mm (0.020 - 0.035 in.)	

TORQUE SPECIFICATIONS

Description	N·m	Ft. Lbs.	In. Lbs.
A/C Compressor bolts	20	15	—
A/C Compressor Shaft Bolt	17.5	—	155
Air Nozzle Reinforcing Plate Screws	2	—	17
Air Outlet Screws	2	—	17
Auxiliary Fan Bracket Screws	5	—	45
Auxiliary Fan Bracket Nuts	5	—	45
Blower Motor Screws	2	—	17
Condenser Screws	2	—	17
Defroster Duct Screws	2	—	17
Discharge Line to Compressor Bolt	23	17	—
Discharge Line to Compressor Nut	33	24	—
Heater-A/C Control Screws	2	—	17
Heater Core Tube to Heater Core Bolts	5	—	45
Heater Housing Cover Screws	2	—	17
Heater Housing to Dash Panel Screws	4.5	—	40
Electric Coolant Pump Bracket Bolts	5	—	45

HEATING & AIR CONDITIONING (Continued)

Description	N·m	Ft. Lbs.	In. Lbs.
Expansion Valve to Evaporator Tube Tapping Plate Bolts	5	—	45
Floor Duct Screws	2	—	17
Heater Core Tube Bolts	5	—	45
Heater Water Valve Bracket Bolts	5	—	45
Instrument Panel Duct Screws	2	—	17
Instrument Panel End Cover Screws	2	—	17
Intermediate Suction Line to Front Suction Line Tapping Plate Bolt	10	—	89
Liquid Line to Condenser Nut	17	12	—
Liquid Line to Reciever-Drier Bolt	7	—	62
Rear A/C Control Module Screws	2	—	17
Rear A/C Solenoid Valve Screws	10	—	89
Rear A/C Solenoid Valve Refrigerant Line Nuts	16	—	142
Rear A/C Blower Motor Screws	5	—	45
Rear A/C Refrigerant Line Retaining Block Bolts	5	—	45
Rear A/C Suction Line to Front Suction Line Tapping Plate Bolt	5	—	45
Rear Condensation Trap Screws	2	—	17
Rear Evaporator Housing Bolts	20	15	177
Rear Evaporator Housing Screw	5	—	45
Rear Evaporator Panel Screws	2	—	17
Rear Expansion Valve to Evaporator Tapping Plate Bolts	5	—	45
Rear Liquid Line to Expansion and Solenoid Valve Nuts	16	—	142
Rear Liquid Line to Intermediate Liquid Line Nut	16	—	142

HEATING & AIR CONDITIONING (Continued)

Description	N·m	Ft. Lbs.	In. Lbs.
Rear Liquid Line to Sidewall Liquid Line Nut	16	—	142
Rear Suction Line to Intermediate Suction Line Nut	30	22	—
Rear Suction Line to Sidewall Suction Line Nut	30	22	—
Rear Suction Line to Solenoid Valve	10	—	89
Recirculation Door Actuator Screws	2	—	17
Suction Line Routing Clip Nut	5	—	45
Suction Line to Compressor Bolt	23	17	—
Suction Line to Front Expansion Valve Nut	10	—	89
Supplemental Heater Air Intake Pipe Screws	7	—	62
Supplemental Heater M6 Fasteners	7	—	62
Supplemental Heater M8 Fasteners	23	17	—
Supplemental Heater Seat to Mounting Flange Nut	60	44	—
Terminal Block to Evaporator Bolts	5	—	45
Ventilation Housing to Dash Panel Nuts	5	—	45

CONTROLS - FRONT

TABLE OF CONTENTS

page

A/C COMPRESSOR CLUTCH
DESCRIPTION 8
OPERATION 8
STANDARD PROCEDURE
STANDARD PROCEDURE - COMPRESSOR CLUTCH AIR GAP 9
STANDARD PROCEDURE - COMPRESSOR CLUTCH BREAK-IN 9
REMOVAL 9
INSPECTION - COMPRESSOR CLUTCH/COIL . 10
INSTALLATION 11
A/C COMPRESSOR CLUTCH COIL
DIAGNOSIS AND TESTING - COMPRESSOR CLUTCH COIL 12
A/C HEATER CONTROL
DESCRIPTION 12
OPERATION 12
REMOVAL 12
INSTALLATION 13
A/C PRESSURE TRANSDUCER
DESCRIPTION 13
OPERATION 13
DIAGNOSIS AND TESTING - A/C PRESSURE TRANSDUCER 13
REMOVAL 14
INSTALLATION 14
AIR OUTLET TEMPERATURE SENSOR
DESCRIPTION 14
OPERATION 15
REMOVAL 15
INSTALLATION 15
AMBIENT TEMPERATURE SENSOR
DESCRIPTION 15
OPERATION 15

page

REMOVAL 15
INSTALLATION 16
BLOWER MOTOR RESISTOR BLOCK
DESCRIPTION 16
OPERATION 16
DIAGNOSIS AND TESTING - BLOWER MOTOR RESISTOR BLOCK 16
REMOVAL 16
INSTALLATION 17
BLOWER MOTOR SWITCH
DESCRIPTION 17
OPERATION 17
DIAGNOSIS AND TESTING - BLOWER MOTOR SWITCH 17
REMOVAL 17
EVAPORATOR TEMPERATURE SENSOR
DESCRIPTION 17
OPERATION 18
REMOVAL 18
INSTALLATION 18
IN-CAR TEMPERATURE SENSOR
DESCRIPTION 19
OPERATION 19
DIAGNOSIS AND TESTING 19
REMOVAL 19
MODE DOOR CABLES
REMOVAL 19
INSTALLATION 19
RECIRCULATION DOOR ACTUATOR
DESCRIPTION 20
OPERATION 20
REMOVAL 21
INSTALLATION 21

A/C COMPRESSOR CLUTCH

DESCRIPTION

The compressor clutch assembly consists of a stationary electromagnetic coil, a hub bearing and pulley assembly, and a clutch plate (Fig. 1). 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 bolt.

The compressor clutch plate and pully, or the clutch coil are available for seperate service replacement.

OPERATION

The compressor clutch 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.

A/C COMPRESSOR CLUTCH (Continued)

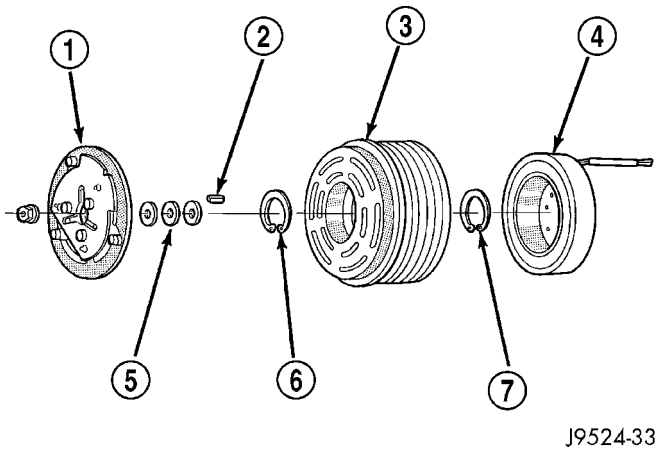


Fig. 1 Compressor Clutch — Typical

1 - CLUTCH PLATE
2 - SHAFT KEY
3 - PULLEY AND BEARING
4 - CLUTCH COIL
5 - CLUTCH SHIMS
6 - SNAP RING
7 - SNAP RING

The compressor clutch engagement is controlled by several components:

- A/C switch on the A/C-heater control panel
- Evaporator temperature sensor
- A/C pressure transducer
- Air temperature sensor
- CAN bus messages

The compressor clutch is de-energized under any of the following conditions:

- Blocked compressor (thermal fuse in the pulley)
- Low pressure in the system
- Low evaporator temperature
- Hard acceleration (WOT)
- High coolant temperatures

STANDARD PROCEDURE

STANDARD PROCEDURE - COMPRESSOR CLUTCH AIR GAP

If a new clutch plate and/or clutch pulley are being used, the air gap between the clutch plate and clutch pulley must be checked using the following procedure:

(1) Using feeler gauges, measure the air gap between the clutch plate and the clutch pulley friction surfaces.

(2) If the air gap is not between 0.5 and 0.9 mm (0.020 and 0.035 in.), add or subtract shims until the desired air gap is obtained.

NOTE: The shims may compress after tightening the compressor shaft bolt. Check the air gap in four or more places on the clutch plate to verify that the air gap is still correct. Spin the clutch pulley before making the final air gap check.

STANDARD PROCEDURE - COMPRESSOR 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.

REMOVAL

The refrigerant system can remain fully-charged during compressor clutch, pulley, or coil replacement. The compressor clutch can be serviced in the vehicle.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the serpentine drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - REMOVAL).

(3) Disconnect the engine wire harness connector for the compressor clutch coil from the clutch coil wire harness connector on the top of the compressor.

(4) Disengage the retainer on the engine wire harness compressor clutch coil lead from the bracket on the top of the compressor.

(5) Remove the bolt that secures the compressor clutch to the compressor shaft (Fig. 2). If necessary, a band-type oil filter wrench or strap wrench can be placed around the clutch plate to aid in bolt removal.

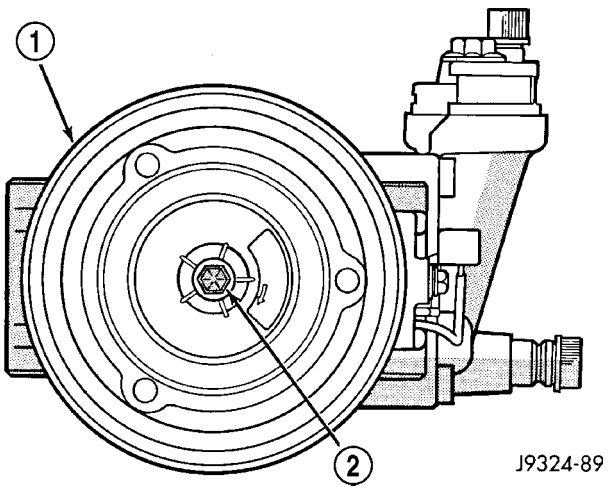


Fig. 2 Compressor Shaft Bolt and Clutch Plate

1 - COMPRESSOR CLUTCH PLATE
2 - COMPRESSOR SHAFT BOLT

A/C COMPRESSOR CLUTCH (Continued)

(6) Tap the clutch plate lightly 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. 3). **Be certain not to lose the shim or shims.**

CAUTION: Do not pry between the clutch plate and the pulley to remove it from the compressor shaft. Prying may damage the clutch plate.

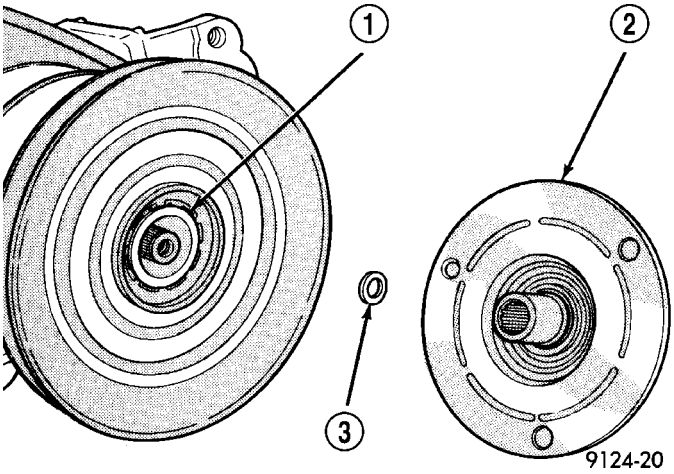


Fig. 3 Clutch Plate And Shim(s)

1 - COMPRESSOR SHAFT
2 - CLUTCH PLATE
3 - CLUTCH PLATE SHIM

(7) Using snap ring pliers (Special Tool C-4574 or equivalent), remove the external snap ring that secures the compressor clutch pulley to the front of the compressor, then slide the pulley off of the compressor (Fig. 4).

(8) Remove the screw that secures the clutch coil wire harness connector bracket and ground clip to the top of the compressor housing.

(9) Using snap ring pliers (Special Tool C-4574 or equivalent), remove the external snap ring that secures the compressor clutch coil to the front of the compressor, then slide the clutch coil off of the compressor (Fig. 5).

INSPECTION - COMPRESSOR CLUTCH/COIL

Compressor clutch components should always be inspected closely before they are reinstalled. The clutch plate and clutch pulley are mated at the factory using a burnishing operation. No attempt should be made to separately replace the compressor clutch pulley or clutch plate. The clutch coil may be serviced separately.

(1) Examine the friction surfaces of the clutch pulley and the clutch plate for wear. The clutch pulley and clutch plate should be replaced if there is excessive wear or scoring.

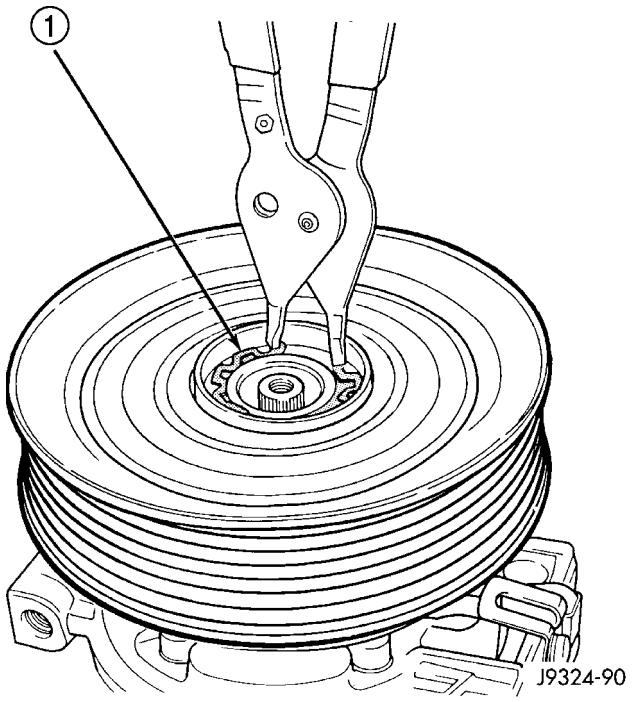


Fig. 4 Pulley Snap Ring

1 - SNAP RING

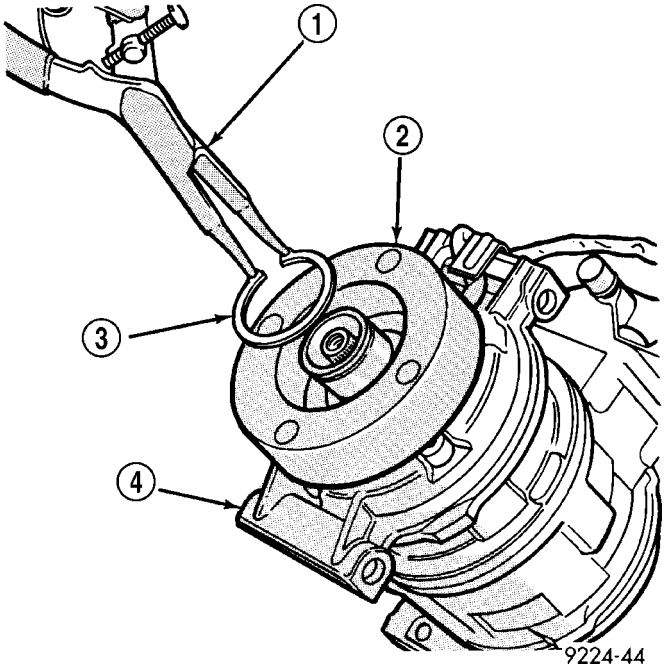


Fig. 5 Clutch Coil Snap Ring

1 - SNAP RING PLIERS
2 - CLUTCH COIL
3 - SNAP RING
4 - COMPRESSOR

A/C COMPRESSOR CLUTCH (Continued)

(2) Examine the friction surfaces of the clutch pulley and the clutch plate for oil contamination. If the friction surfaces are oily, the clutch pulley and clutch plate should be replaced. Also inspect the shaft and nose area of the compressor for oil. Remove the felt packing from around the compressor shaft in the compressor front cover. If the felt is saturated with oil, the compressor front shaft seal is leaking and the compressor will also have to be replaced.

(3) Check the clutch pulley bearing for roughness or excessive leakage of grease. Replace the clutch pulley and clutch plate if the bearing is faulty.

INSTALLATION

(1) Align the dowel pin on the back of the clutch field coil with the hole in the compressor front cover, and position the clutch coil onto the compressor. Be certain that the cluch coil wire harness leads are properly oriented and routed so that they are not pinched between the compressor front cover and the clutch coil.

NOTE: A new snap ring must be used to secure the clutch coil to the compressor. The bevel side of the snap ring must face outward.

(2) Using snap ring pliers (Special Tool C-4574 or equivalent), install the external snap ring that secures the clutch coil to the front cover of the compressor. The bevel side of the snap ring must be facing outward and both snap ring eyelets must be oriented to the right or left of the clutch coil dowel pin on the compressor. Be certain that the snap ring is fully and 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 compressor front cover.

(3) Install and tighten the screw that secures the clutch coil wire harness connector bracket and ground clip to the top of the compressor housing.

(4) Install the pulley onto the front of the compressor. If necessary, place a block of wood on the friction surface and tap gently with a hammer (Fig. 6).

CAUTION: Do not mar the friction surfaces of the pulley.

(5) Using snap ring pliers (Special Tool C-4574 or equivalent), install the external snap ring (bevel side facing outward) that secures the clutch pulley to the front cover of the compressor. Be certain that the snap ring is properly fully and properly seated in the groove.

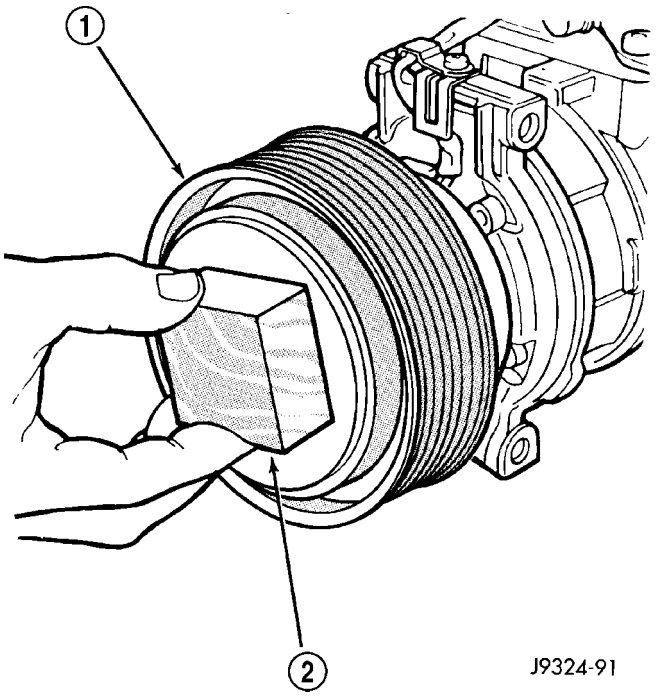


Fig. 6 Pulley Assembly Install

1 - PULLEY ASSEMBLY
2 - WOOD BLOCK

(6) If the original clutch plate and clutch pulley are to be reused, reinstall the original shim(s) on the compressor shaft against the shoulder. If a new clutch plate and/or clutch pulley are being used, install a trial stack of shims 1.0 mm (0.040 in.) thick on the compressor shaft against the shoulder.

(7) Install the clutch plate onto the compressor shaft.

(8) Install and tighten the compressor shaft bolt. If necessary, a band-type oil filter wrench or a strap wrench can be placed around the clutch plate to aid in bolt tightening. Tighten the bolt to 17.5 N·m (155 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.

(9) If a new clutch plate and/or clutch pulley are being installed, the air gap between the clutch plate and clutch pulley must be checked (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/A/C COMPRESSOR CLUTCH - STANDARD PROCEDURE).

(10) Engage the retainer on the engine wire harness compressor clutch coil take out with the bracket on the top of the compressor.

A/C COMPRESSOR CLUTCH (Continued)

(11) Reconnect the engine wire harness connector for the compressor clutch coil to the coil wire harness connector on the top of the compressor.

(12) Reinstall the serpentine accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(13) Reconnect the battery negative cable.

(14) If a new clutch plate and/or clutch pulley are being installed, the new clutch components must be burnished (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/A/C COMPRESSOR CLUTCH - STANDARD PROCEDURE).

A/C COMPRESSOR CLUTCH COIL

DIAGNOSIS AND TESTING - COMPRESSOR CLUTCH COIL

The air conditioning compressor clutch coil electrical circuit is controlled by the ATC control module which is integral to the heater-A/C control. Begin testing of a suspected compressor clutch coil problem by performing the ATC Function Test using the DRBIII® scan tool.

A/C HEATER CONTROL

DESCRIPTION

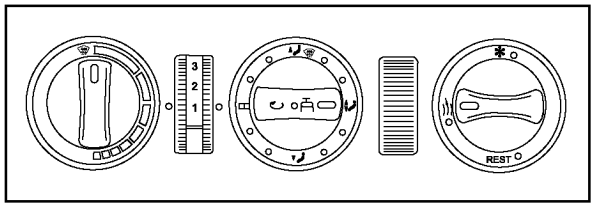
This ATC system uses a combination of electrical and mechanical controls. These controls provide the vehicle operator with a number of setting options to help control the climate and comfort within the vehicle.

The A/C-heater control panel is located on the instrument panel inboard of the steering column and below the radio (Fig. 7). The A/C-heater control panel contains a rotary-type temperature control knob, a rotary-type mode control knob, a thumbwheel-type blower motor speed control and an air conditioning compressor push button switch and indicator lamp. The A/C-heater control panel also features a push button switch and indicator lamp for the residual engine heat utilization (REST) function, cabin heater or the heater booster (as equipped).

The A/C-heater control panel cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

OPERATION

To control the interior temperature, the A/C-heater control module uses the actual values from the temperature sensors and the CAN bus and compares them with the nominal value of the temperature control switch.



808c82b6

Fig. 7 A/C-Heater Control Panel

The A/C-heater control panel is serviced only as complete unit and cannot be repaired. If faulty or damaged, the entire control panel unit must be replaced.

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN AN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the center bezel from the instrument panel. (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL CENTER BEZEL - REMOVAL).

(3) Remove the two screws that secure the A/C-heater control to the instrument panel (Fig. 8).

(4) Pull the A/C-heater control away from the instrument panel far enough to access the connections on the back of the control.

(5) Mark and disconnect the two control cables from the A/C-heater control.

A/C HEATER CONTROL (Continued)

(6) Disconnect the two wiring harness connectors from the A/C-heater control.

(7) If A/C-heater control is to be replaced, remove the two mounting brackets from the A/C-heater control.

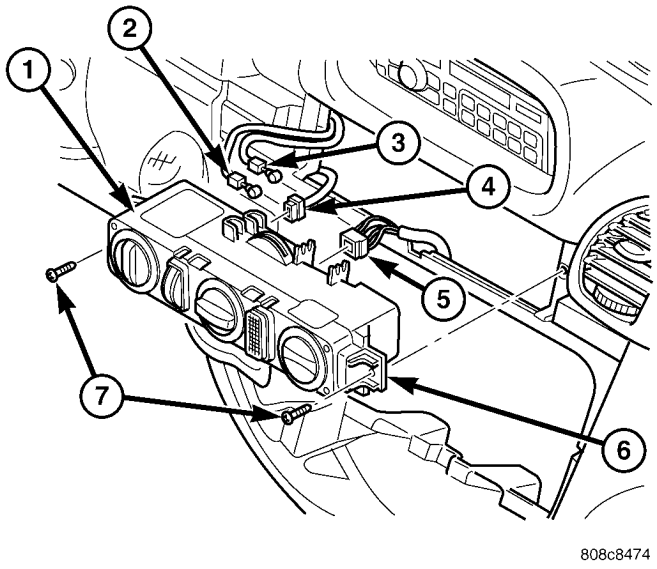


Fig. 8 A/C-Heater Control

1 - A/C-HEATER CONTROL
2 - CONTROL CABLE
3 - CONTROL CABLE
4 - WIRE HARNESS CONNECTOR
5 - WIRE HARNESS CONNECTOR
6 - MOUNTING BRACKET (2)
7 - SCREW (2)

INSTALLATION

(1) If removed, install the two mounting brackets to the A/C-heater control.

(2) Connect the two wire harness connectors into the back of the A/C-heater control.

(3) Connect the two control cables to the A/C-heater control.

NOTE: Install the control cable of bottom adjustment lever to the front adjustment wheel of theA/C-heater control.

(4) Position the A/C-heater control into the instrument panel.

(5) Install the two A/C-heater control retaining screws. Tighten the screws to 2 N·m (17 in. lbs.).

(6) Install the center bezel onto the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/ INSTRUMENT PANEL CENTER BEZEL - INSTALLATION).

(7) Reconnect the battery negative cable.

A/C PRESSURE TRANSDUCER

DESCRIPTION

The A/C pressure transducer is installed on the liquid line fitting located at the top of the receiver/drier. A rubber O-ring seals the connection between the transducer and the fitting. Three terminals within a molded plastic connector receptacle on the top of the transducer connect it to the vehicle electrical system through a wire lead and connector.

The A/C pressure transducer cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

OPERATION

The A/C pressure transducer monitors the pressures in the high side of the refrigerant system through its connection to a fitting on the liquid line. The transducer will change its internal resistance in response to the pressures it monitors. The ATC control module provides a five volt reference signal and monitors the output voltage of the transducer on the transducer return circuit to determine refrigerant pressure. The ATC module is preprogrammed to respond to this and other sensor inputs by controlling the operation of the air conditioning compressor clutch and the auxiliary radiator cooling fan to help optimize air conditioning system performance and to protect the system components from damage. The A/C pressure transducer input to the ATC module also prevents the A/C compressor clutch from engaging when the ambient temperature is below 0.556° C (33° F) due to the pressure/temperature relationship of the refrigerant. The A/C pressure transducer is diagnosed by performing the ATC Function Test using the DRBIII® scan tool. Refer to Body Diagnostic Procedures.

DIAGNOSIS AND TESTING - A/C PRESSURE TRANSDUCER

The A/C pressure transducer is tested using a DRBIII® scan tool. Refer to Body Diagnostic Procedures. Before testing the A/C pressure transducer, be certain that the transducer wire harness connections are clean of corrosion and properly connected. For the air conditioning system to operate, an A/C pressure transducer voltage reading between 0.7 and 4.56 volts is required. Voltage outside this range indicate a low or high refrigerant system pressure condition to the ATC control module. The control module is programmed to respond to a low or high refrigerant system pressure by suppressing operation of the compressor. Refer to the A/C Pressure Transducer Voltage chart for the possible condition indicated by the transducer voltage readings.

A/C PRESSURE TRANSDUCER (Continued)

A/C PRESSURE TRANSDUCER VOLTAGE

Voltage	Possible Cause
0.0	1. No transducer supply voltage from ATC control module. 2. Shorted transducer circuit. 3. Faulty transducer.
0.150 to 0.450	1. Ambient temperature below 10° C (50° F). 2. Low refrigerant system pressure.
0.451 to 4.519	1. Normal refrigerant system pressure.
4.520 to 4.850	1. High refrigerant system pressure.
5.0	1. Open transducer circuit. 2. Faulty transducer.

REMOVAL

WARNING: REFER TO THE APPLICABLE WARNINGS AND CAUTIONS FOR THIS SYSTEM BEFORE PERFORMING THE FOLLOWING OPERATION (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION).

(1) Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(2) Disconnect and isolate the battery negative cable.

(3) Disconnect the wire harness connector from the A/C pressure transducer (Fig. 9).

(4) Using an open end wrench, remove the A/C pressure transducer from the fitting on the liquid line.

(5) Remove the O-ring seal from the A/C pressure transducer and discard.

INSTALLATION

(1) Lubricate a new O-ring seal with clean refrigerant oil and install it on the A/C pressure transducer.

(2) Using an open end wrench, install and tighten the A/C pressure transducer into the fitting on the liquid line. Tighten the transducer to 12 N·m (106 in. lbs.).

(3) Reconnect the wire harness connector to the transducer.

(4) Reconnect the battery negative cable.

(5) Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(6) Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

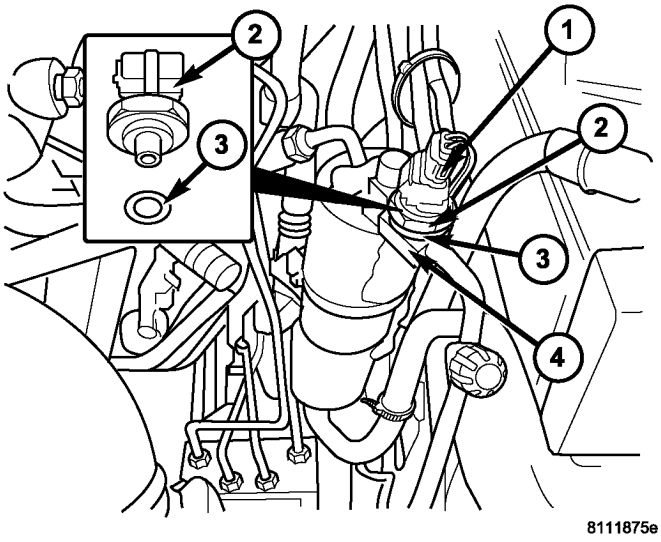


Fig. 9 A/C Pressure Transducer

1 - WIRE HARNESS CONNECTOR
2 - A/C PRESSURE TRANSDUCER
3 - O-RING SEAL
4 - LIQUID LINE FITTING

AIR OUTLET TEMPERATURE SENSOR

DESCRIPTION

The air outlet temperature sensor is a two-wire temperature sensing element that detects the temperature of the air coming out of the heater housing unit. The sensor is attached to heater housing unit directly behind the ATC heater-A/C control panel. The thermistor will change resistance as the temperature changes.

The air outlet temperature sensor cannot be adjusted or repaired, and if faulty or damaged, it must be replaced.

AIR OUTLET TEMPERATURE SENSOR (Continued)

OPERATION

The air outlet temperature sensor monitors the temperature of the air coming out of the heater housing unit. The sensor will change its internal resistance in response to the temperatures it monitors. The ATC control module is connected to the sensor through a sensor ground circuit and a sensor signal circuit. As the air temperature increases, the resistance of the sensor decreases and the voltage monitored by the module decreases. The module uses this monitored voltage reading to an indication of the outlet air temperature. The ATC control module makes adjustments to maintain the requested interior temperature by cycling both the A/C compressor and solenoid heater valve on and off.

The air outlet temperature sensor is diagnosed by performing the ATC Function Test using the DRBIII® scan tool. Refer to Body Diagnostic Procedures.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the heater-A/C control from the instrument panel (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/A/C HEATER CONTROL - REMOVAL).

(3) Disconnect the wire harness connector from the air outlet temperature sensor (Fig. 10).

(4) Remove the air outlet temperature sensor from the heater housing.

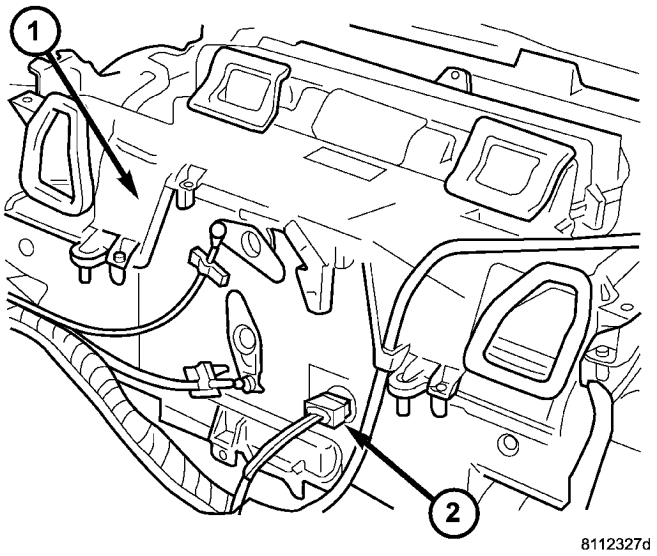


Fig. 10 Air Outlet Temperature Sensor

1 - HEATER HOUSING
2 - AIR OUTLET TEMPERATURE SENSOR

INSTALLATION

(1) Install the air outlet temperature sensor onto the heater housing.

(2) Connect the wire harness connector to the air outlet temperature sensor.

(3) Install the heater-A/C control into the instrument panel (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/A/C HEATER CONTROL - INSTALLATION).

(4) Reconnect the battery negative cable.

AMBIENT TEMPERATURE SENSOR

DESCRIPTION

Ambient air temperature is connected to the instrument cluster through a two-wire harness lead and connector of the vehicle electrical system. The instrument cluster sends out a message on the CAN bus to the ATC control module. The ambient temperature sensor is a variable resistor mounted to the front licence plate bracket.

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 instrument cluster. The resistance in the sensor changes as temperature changes. Based upon the resistance in the sensor, the instrument cluster sends the ATC control module a specific voltage on the temperature sensor signal circuit, which is programmed to correspond to a specific temperature.

The ambient temperature sensor is diagnosed using the DRBIII® scan tool. Refer to Body Diagnostic Procedures.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the front license plate bracket (Refer to 23 - BODY/EXTERIOR/LICENSE PLATE BRACKET - REMOVAL).

(3) Remove the ambient temperature sensor from the front fascia through the access hole in the fascia (Fig. 11).

AMBIENT TEMPERATURE SENSOR (Continued)

(4) Disconnect the wire harness connector from the sensor and remove the sensor from the vehicle.

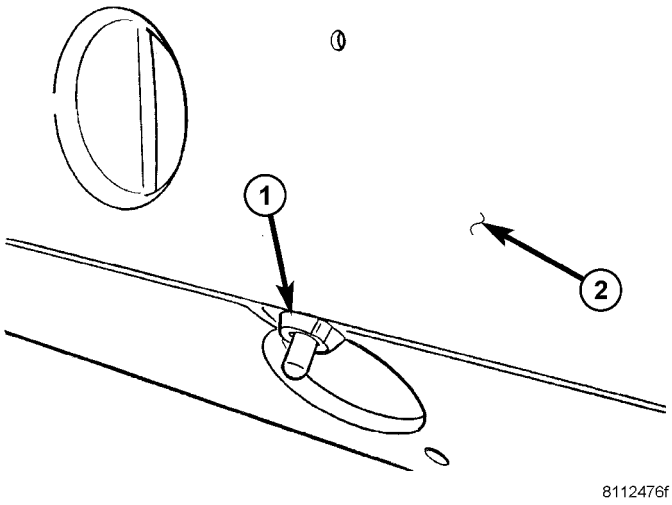


Fig. 11 Ambient Temperature Sensor

1 - AMBIENT TEMPERATURE SENSOR
2 - FRONT FASCIA

INSTALLATION

(1) Connect the wire harness connector to the ambient temperature sensor.

(2) Install the sensor onto the front fascia through the access hole in the fascia.

(3) Install the front license plate bracket (Refer to 23 - BODY/EXTERIOR/LICENSE PLATE BRACKET - INSTALLATION).

(4) Reconnect the battery negative cable.

BLOWER MOTOR RESISTOR BLOCK

DESCRIPTION

This temperature control system uses a blower motor resistor. The blower motor resistor is mounted to the top of ventilation housing located in the engine compartment. The blower motor resistor can be accessed for service without removing any other components.

OPERATION

The blower motor resistor block has multiple resistor wires. Each resistor wire changes the resistance in the blower motor current path to change the blower motor speed. The blower motor switch directs the current through the correct resistor wire to obtain the selected speed.

With the blower motor switch in the lowest speed position, voltage for the motor is applied through all of the resistor wires. Each higher speed selected with the blower motor switch applies the blower motor current 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 circuit receives a direct path to battery voltage.

The blower motor resistor block cannot be repaired and, if faulty or damaged, it must be replaced.

DIAGNOSIS AND TESTING - BLOWER MOTOR RESISTOR BLOCK

For circuit descriptions and diagrams, refer to the appropriate wiring information.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN AN 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 block.

(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.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Depress resistor block locking tab and remove resistor block from the ventilation housing by sliding the resistor block inboard (Fig. 12).

(3) Depress two locking tabs and unplug the wire harness connector from the blower motor resistor block.

(4) Remove the blower motor resistor from the engine compartment.

BLOWER MOTOR RESISTOR BLOCK (Continued)

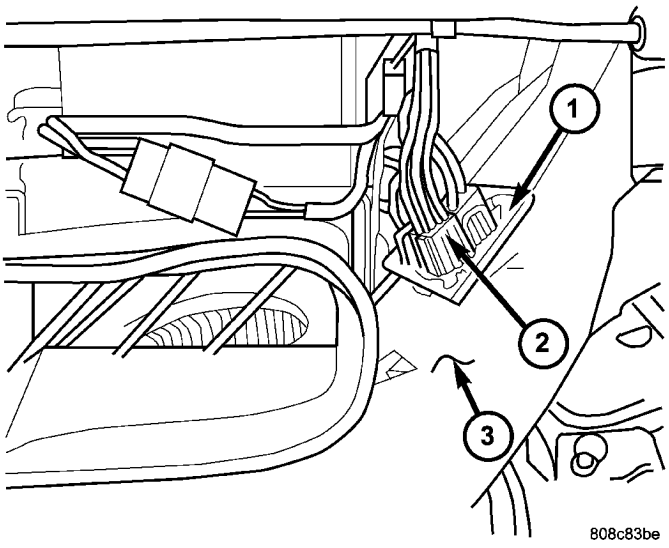


Fig. 12 Blower Motor Resistor Block

1 - BLOWER MOTOR RESISTOR
2 - ELECTRICAL CONNECTOR
3 - VENTILATION HOUSING

INSTALLATION

(1) Connect the wire harness connector to the blower motor resistor block.

(2) Install the blower motor resistor into the ventilation housing. The housing is indexed to allow mounting in only one position.

(3) Reconnect the battery negative cable.

BLOWER MOTOR SWITCH

DESCRIPTION

The heater-A/C blower motor is controlled by a thumbwheel-type blower motor switch, mounted in the heater-A/C control. The switch allows the selection of four blower motor speeds with the ignition switch in the On position.

NOTE: The blower motor will operate only at the lowest speed when the Residual Engine Heat Utilization (REST) function is selected, regardless of the blower speed setting on the control panel.

OPERATION

When the ignition is turned to On, the integral blower motor resistor within the ATC control module supplies power to the blower motor switch. The switch directs power to the individual blower driver circuits through the blower motor resistor block to the blower motor and then to ground.

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.

DIAGNOSIS AND TESTING - BLOWER MOTOR SWITCH

The blower motor switch can be diagnosed by using the DRBIII® scan tool. Refer to Body Diagnostic Procedures. For circuit descriptions and diagrams, refer to the appropriate wiring information.

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN AN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

The blower motor switch cannot be adjusted or repaired, and if faulty or damaged, the heater-A/C control must be replaced (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/A/C HEATER CONTROL - REMOVAL).

EVAPORATOR TEMPERATURE SENSOR

DESCRIPTION

The evaporator temperature sensor is a two-wire temperature sensing element located at the coldest point on the face of the evaporator. The sensor is attached to the evaporator coil fins. The evaporator temperature sensor prevents condensation on the evaporator coil from freezing and obstructing A/C system air flow. The evaporator temperature sensor cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

EVAPORATOR TEMPERATURE SENSOR (Continued)

OPERATION

The evaporator temperature sensor monitors the temperature of the evaporator. The sensor will change its internal resistance in response to the temperatures it monitors. The ATC control module is connected to the sensor through a sensor ground circuit and a sensor signal circuit. As the evaporator temperature increases, the resistance of the sensor decreases and the voltage monitored by the module decreases. The module uses this monitored voltage reading to an indication of the evaporator temperature. The ATC control module is programmed to respond to this input by cycling the air conditioning compressor clutch as necessary to optimize air conditioning system performance and to protect the system from evaporator freezing. The external location of the sensor allows the sensor to be removed or installed without disturbing the refrigerant in the system. The evaporator temperature sensor is diagnosed by performing the ATC Function Test using a DRBIII® scan tool. Refer to Body Diagnostic Procedures.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the radio (Refer to 8 - ELECTRICAL/AUDIO/RADIO - REMOVAL).

(3) Remove glove compartment.

(4) Remove cover from instrument cluster (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL TOP COVER - REMOVAL).

(5) Remove the instrument cluster (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - REMOVAL).

(6) Remove passenger side airbag.

(7) Remove cover above air nozzle on passenger side.

(8) Remove speaker.

(9) Remove center section of instrument panel.

(10) Remove heater-A/C control from the instrument panel (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/A/C HEATER CONTROL - REMOVAL).

(11) Remove instrument panel top section.

(12) Remove electrical connections.

(13) Remove air bezels from instrument panel.

(14) Disconnect the wire harness connector from evaporator temperature sensor (Fig. 13).

(15) Remove evaporator temperature sensor from heater housing.

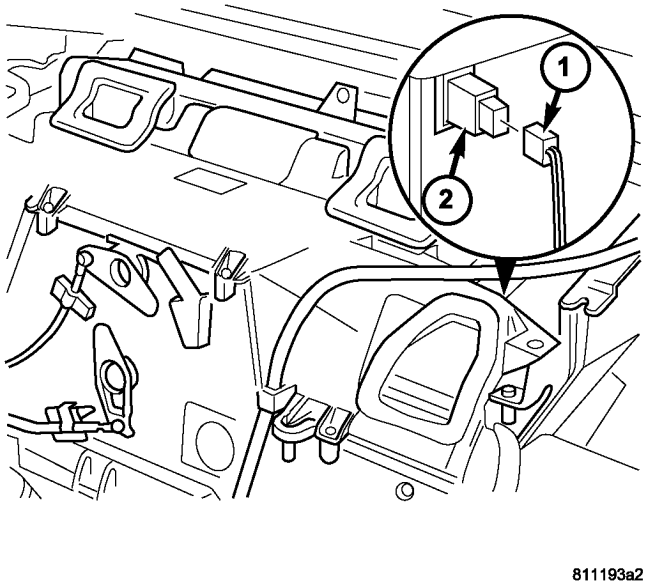


Fig. 13 Evaporator Temperature Sensor

1 - WIRE HARNESS CONNECTOR
2 - EVAPORATOR TEMPERATURE SENSOR

INSTALLATION

(1) Install the new probe into the evaporator.

NOTE: The new probe must not go into the same hole (in the evaporator core) that the old probe was removed from.

(2) Install the wire harness connector to the evaporator temperature sensor.

(3) Install the air bezels to the instrument panel.

(4) Install the electrical connections.

(5) Install the instrument panel top section (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL TOP COVER - INSTALLATION).

(6) Install the heater-A/C control (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/A/C HEATER CONTROL - INSTALLATION).

(7) Install the center section of the instrument panel.

(8) Install the speaker (Refer to 8 - ELECTRICAL/AUDIO/SPEAKER - INSTALLATION).

(9) Install the cover above the air nozzle on the passenger side.

(10) Install the passenger side airbag.

(11) Install the instrument cluster (Refer to 8 - ELECTRICAL/INSTRUMENT CLUSTER - INSTALLATION).

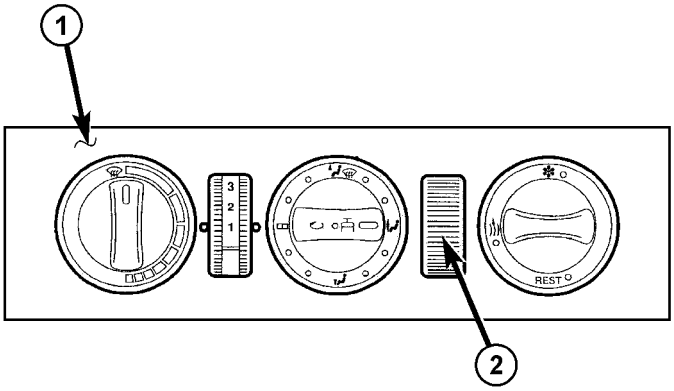
EVAPORATOR TEMPERATURE SENSOR (Continued)

(12) Install the cover to the instrument cluster.
(13) Install glove compartment.
(14) Install the radio (Refer to 8 - ELECTRICAL/AUDIO/RADIO - INSTALLATION).
(15) Reconnect the battery negative cable.

IN-CAR TEMPERATURE SENSOR

DESCRIPTION

The in-car temperature sensor measures the actual air temperature within the passenger compartment. The in-car temperature sensor is located inside of the A/C-heater control behind a vented panel (Fig. 14) and is not a separate serviceable component. The A/C-heater control must be replaced if there is a fault relating to the in-car temperature sensor.



811252c5

Fig. 14 In-Car Temperature Sensor

1 - A/C-HEATER CONTROL
2 - IN-CAR TEMPERATURE SENSOR

OPERATION

Air from the passenger compartment flows over the thermistor of the in-car temperature sensor. The thermistor changes resistance with air temperature. The ATC control module measures this resistance and calculates the temperature of the air. The ATC control module then makes adjustments to maintain the selected passenger compartment temperature.

DIAGNOSIS AND TESTING

The in-car temperature sensor is diagnosed by performing the ATC Function Test using the DRBIII® scan tool. Refer to Body Diagnostic Procedures. For circuit descriptions and diagrams, refer to the appropriate wiring information.

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN AN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

If the in-car temperature sensor is verified to be bad, the A/C-heater control must be replaced (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/A/C HEATER CONTROL - REMOVAL).

MODE DOOR CABLES

REMOVAL

The air distribution control cables (mode door cables) can be removed and installed without having to remove the instrument panel from the vehicle.
(1) Disconnect and isolate the battery negative cable.
(2) Remove the center section of the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL CENTER BEZEL - REMOVAL).
(3) Remove the heater-A/C control (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/A/C HEATER CONTROL - REMOVAL).
(4) Mark and disconnect the control cables from the A/C-heater control.
(5) Mark and disconnect the control cables from the heater housing retainers (Fig. 15).
(6) Disconnect the control cables from the mode door levers and remove the cables from the vehicle.

INSTALLATION

(1) Connect the two control cables to the mode door levers (Fig. 16).
(2) Connect the two control cables to the A/C-heater control.

NOTE: Install the control cable of bottom adjustment lever to the front adjustment wheel of the A/C-heater control.

(3) Hold the A/C-heater control in its installation position.

MODE DOOR CABLES (Continued)

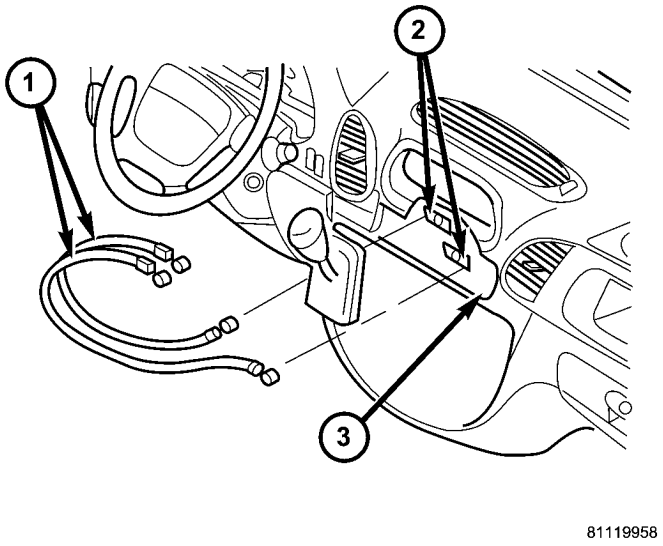


Fig. 15 Air Distribution Control Cables

1 - AIR DISTRIBUTION CONTROL CABLES
2 - ADJUSTMENT LEVERS
3 - HEATER HOUSING

NOTE: While holding the A/C-heater control in the installation position, verify that the control cables are not twisted.

(4) Turn the mode control knob on the A/C-heater control to the nine-o-clock position.

(5) Turn the upper mode door lever counter-clockwise until it reaches its stop and install the cable into the retainer in this position (arrow).

(6) Turn the lower mode door lever clockwise until it reaches its stop and install the cable into the retainer in this position (arrow).

(7) Operate the mode control knob and verify that the mode door cables are properly adjusted.

(8) Install the A/C-heater control and the two retaining screws. Tighten the screws to 2 N·m (17 in. lbs.).

(9) Install the center section of the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/ INSTRUMENT PANEL CENTER BEZEL - INSTALLATION).

(10) Reconnect the battery negative cable.

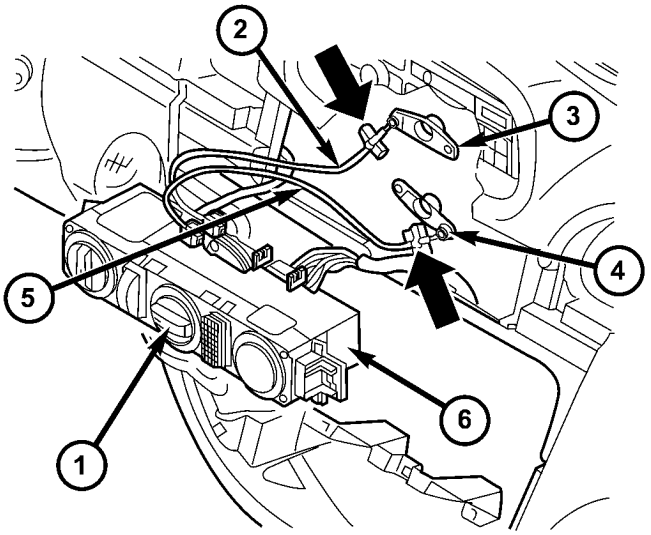


Fig. 16 Adjusting Air Distribution Control Cables

1 - MODE CONTROL KNOB
2 - UPPER MODE DOOR CABLE
3 - UPPER MODE DOOR LEVER
4 - LOWER MODE DOOR LEVER
5 - LOWER MODE DOOR CABLE
6 - HEATER-A/C CONTROL

RECIRCULATION DOOR ACTUATOR

DESCRIPTION

This vehicle uses a two-position vacuum operated recirculation door actuator to move the recirculation door. Vacuum supply to the recirculation door actuator is controlled by an integral electronic control solenoid. The recirculation door actuator is mounted on the outboard side of the ventilation housing above the blower motor in the engine compartment.

OPERATION

The recirculation door actuator uses engine vacuum, which is controlled by an integral electrical solenoid. The electrical solenoid is connected to the ATC control through the vehicle electrical system by a dedicated two-wire lead and connector. The output shaft of the recirculation door actuator is keyed to a pivot shaft, which is keyed to the recirculation door shaft. The recirculation door actuator can move the recirculation door in two directions.

The recirculation door actuator is controlled by an electrical switch that is integral to the heater-A/C control. When the rotary-type mode control knob is moved to the recirculation position, a signal is sent to the electrical solenoid within the recirculation door actuator. This signal causes the solenoid to open a port to engine vacuum which pulls the output shaft into the actuator, which moves the recirculation door.

RECIRCULATION DOOR ACTUATOR (Continued)

The actuator is spring loaded so the door moves to the outside-air position when no vacuum is supplied through the electrical solenoid.

The recirculation door actuator can be diagnosed by performing the ATC Function Test using a DRBIII® scan tool. Refer to Body Diagnostic Procedures. The recirculation door actuator cannot be repaired and, if faulty or damaged, it must be replaced.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Disconnect the wire harness connector from the recirculation door actuator (Fig. 17).

(3) Disconnect the vacuum line from the recirculation door actuator.

(4) Remove the two screws that secure the recirculation door actuator to the ventilation housing.

(5) Disconnect the actuator shaft from the recirculation door pivot lever and remove the actuator from the vehicle.

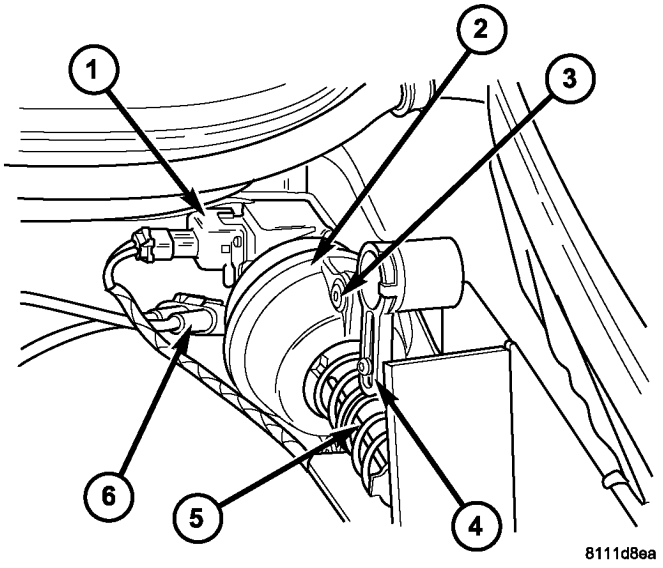


Fig. 17 Recirculation Door Actuator

1 - WIRE HARNESS CONNECTOR
2 - RECIRCULATION DOOR ACTUATOR
3 - SCREW (2)
4 - PIVOT LEVER
5 - ACTUATOR SHAFT
6 - VACUUM LINE

INSTALLATION

(1) Connect the actuator shaft to the recirculation door pivot lever.

(2) Install the two screws that secure the recirculation door actuator to the ventilation housing. Tighten the screws to 2 N·m (17 in. lbs.).

(3) Connect the vacuum line to the recirculation door actuator.

(4) Connect the wire harness connector to the recirculation door actuator.

(5) Reconnect the battery negative cable.

CONTROLS - REAR

TABLE OF CONTENTS

page

BLOWER MOTOR SWITCH
DESCRIPTION 22
OPERATION 22
DIAGNOSIS AND TESTING 23
REMOVAL 23
INSTALLATION 23
BLOWER MOTOR RELAY
DESCRIPTION 23
OPERATION 23
DIAGNOSIS AND TESTING 24
REMOVAL 24
INSTALLATION 24
CONTROL MODULE
DESCRIPTION 24
OPERATION 24
DIAGNOSIS AND TESTING 24
REMOVAL 24
INSTALLATION 25
EVAPORATOR TEMPERATURE SENSOR
DESCRIPTION 25
OPERATION 26

page

DIAGNOSIS AND TESTING 26
REMOVAL 26
INSTALLATION 26
SOLENOID VALVE
DESCRIPTION 27
OPERATION 27
DIAGNOSIS AND TESTING 27
REMOVAL 27
INSTALLATION 28
TEMPERATURE CONTROL
DESCRIPTION 29
OPERATION 29
DIAGNOSIS AND TESTING 29
REMOVAL 29
INSTALLATION 29
TEMPERATURE SENSOR
DESCRIPTION 30
OPERATION 30
DIAGNOSIS AND TESTING 30
REMOVAL 30
INSTALLATION 30

BLOWER MOTOR SWITCH

DESCRIPTION

The optional rear A/C unit blower motor is controlled by a three position rocker switch (Fig. 1), mounted in the switch panel on the instrument panel. The switch allows the selection of one of two blower motor speeds and an Off position only when the A/C switch on the front A/C-heater control is activated.

OPERATION

With the front A/C switch activated, the rear blower motor speed can be selected by pressing the rocker switch upwards (high speed) or downwards (low speed). To turn the rear blower motor off, switch the blower motor switch to the center position. Depending on the blower motor switch position, a blower motor speed command signal is sent to one of the two blower motor relays. When activated, relay 1 sends power through an integral resistor within the rear A/C control module and then to the blower motor, while relay 2 when activated, sends power directly to the blower motor.

The rear blower motor switch cannot be repaired and, if faulty or damaged, it must be replaced.

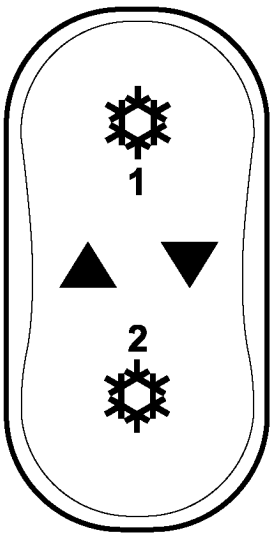


Fig. 1 Rear Air Conditioning Switch

BLOWER MOTOR SWITCH (Continued)

DIAGNOSIS AND TESTING

Before testing the rear blower motor switch, verify that the front A/C system is functional by performing the ATC Fuction Test using the DRBIII® scan tool. Use a volt/ohmmeter to test the rear blower motor switch. For circuit descriptions and diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. 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 rear blower motor switch.

(3) Check for continuity between terminal 10 and terminals 1, 7 and 4 of the blower motor switch. In all instances, there should be continuity.

NOTE: To check the switch's internal circuits, connect the negative lead of the ohmmeter to terminal 10 and the positive ohmmeter lead to terminals 1, 7 and 4. To check the switch's integral light emitting diodes, reverse the ohmmeter leads.

(4) Check for continuity between the rear blower motor switch terminals 3 and 7 as you move the blower motor switch to each of the two speed positions, and the Off position. There should be continuity in only one blower motor switch speed position.

(5) Check for continuity between the rear blower motor switch terminals 4 and 8 as you move the blower motor switch to each of the two speed positions, and the Off position. There should be continuity in only the other blower motor switch speed position.

(6) If OK, test and repair the rear blower motor switch wire harness circuits. If not OK, replace the faulty rear blower motor switch.

REMOVAL

NOTE: The rear blower motor switch is used only on models with the optional rear A/C unit.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the blower motor switch from the switch panel.

(3) Disconnect the wire harness connector from the rear blower motor switch and remove the switch from the vehicle.

INSTALLATION

(1) Connect the wire harness connector to the rear blower motor switch.

(2) Install the blower motor switch into the switch panel.

(3) Reconnect the battery negative cable.

BLOWER MOTOR RELAY

DESCRIPTION

The blower motor relays are an International Standards Organization (ISO)-type relay. The relays are electro-mechanical devices which when energized, directs fused battery current to the rear blower motor. The relay coils are energized when they receives a voltage signal from the blower motor switch.

OPERATION

When the rear blower motor switch is in the low speed position, the switch directs a voltage signal to the high side of rear blower relay #1 and energizes its relay coil. When energized, the low side of blower relay #1 directs fused battery current through an integral blower resistor to the rear blower motor. When in the high speed position, the rear blower switch directs a voltage signal to the high side of rear blower relay #2 and energizes its relay coil. When energized, the low side of blower relay #2 directs fused battery current through an integral blower resistor to the rear blower motor.

The rear blower motor relays are located in the relay block of the rear evaporator housing. Refer to the appropriate wiring diagrams for more information.

The blower motor relay cannot be repaired and, if faulty or damaged, it must be replaced.

BLOWER MOTOR RELAY (Continued)

DIAGNOSIS AND TESTING

The #1 and #2 rear blower motor relays (Fig. 2) are located in the relay block of the rear evaporator housing. Remove the rear blower motor relays from the relay 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 ± 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, refer to the appropriate wiring information for circuit descriptions and diagrams. If not OK, replace the faulty relay.

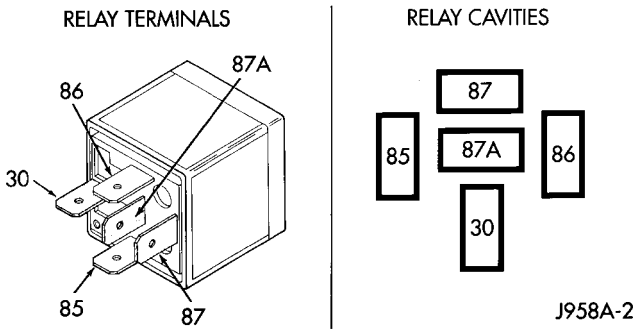


Fig. 2 Blower Motor Relay

30 - COMMON FEED
85 - COIL GROUND
86 - COIL BATTERY
87 - NORMALLY OPEN
87A - NORMALLY CLOSED

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the cover from the rear evaporator housing.

(3) Refer to the relay block for blower motor relay identification.

(4) Unplug the blower motor relay from the relay block and remove it.

INSTALLATION

(1) Install the blower motor relay by aligning the relay terminals with the cavities in the relay block and pushing the relay firmly into place.

(2) Install the rear evaporator cover.

(3) Reconnect the battery negative cable.

CONTROL MODULE

DESCRIPTION

The rear A/C control module is mounted to the upper left side of the rear evaporator housing in the rear compartment, where it can be accessed for service.

The rear A/C control module has wire connections to the rear A/C blower motor switch, rear evaporative temperature sensor, solenoid valve, rear A/C temperature control and the temperature sensor. The rear A/C control module cannot be repaired and, if faulty or damaged, it must be replaced.

OPERATION

The rear A/C control module is supplied battery power through the rear blower switch and a 7.5 amp fuse. The control module receives input signals from the rear A/C blower motor switch, rear A/C temperature control, rear temperature sensor and the rear evaporator temperature sensor when the front A/C switch is turned on. The rear A/C control module uses the input signals to control rear blower motor speed and output air temperature, and to prevent freezing of the rear evaporator core.

DIAGNOSIS AND TESTING

For circuit descriptions and diagrams, refer to Air Conditioning/Heater in Group 8W - Wiring Diagrams.

NOTE: Prior to checking rear A/C control module circuits, verify that the front A/C system is operating properly.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the rear dome light from the rear roof duct panel (Fig. 3).

(3) Disconnect the dome light wire harness connector and remove the dome light from vehicle.

(4) Remove the six push-pin roof duct panel fasteners and remove the duct panel from the vehicle.

(5) Remove the five evaporator panel screws at the front of the panel.

(6) If equipped, remove the interior motion sensor from the evaporator panel, disconnect the wire harness connector and remove the motion sensor from the vehicle (Fig. 4).

(7) Remove the three push-in evaporator panel fasteners at the rear of the panel.

CONTROL MODULE (Continued)

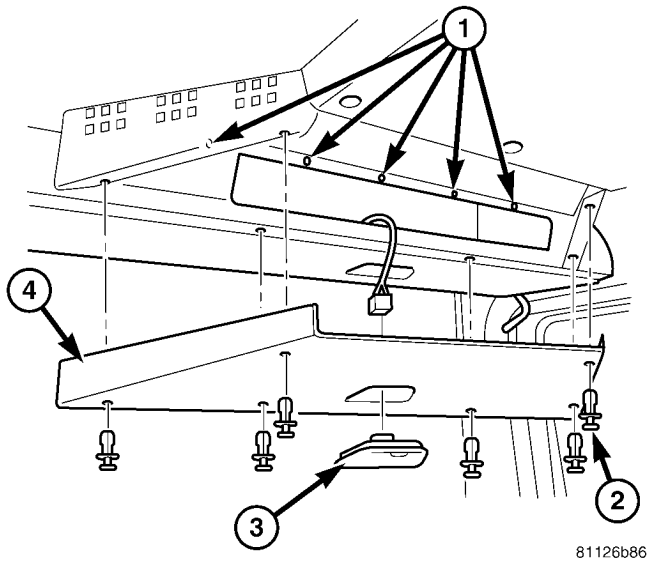


Fig. 3 Rear Roof Duct Panel

1 - SCREW (5)
2 - PUSH-PIN FASTENER (6)
3 - REAR DOME LAMP
4 - ROOF DUCT PANEL

(8) Remove the rear evaporator panel from the vehicle.

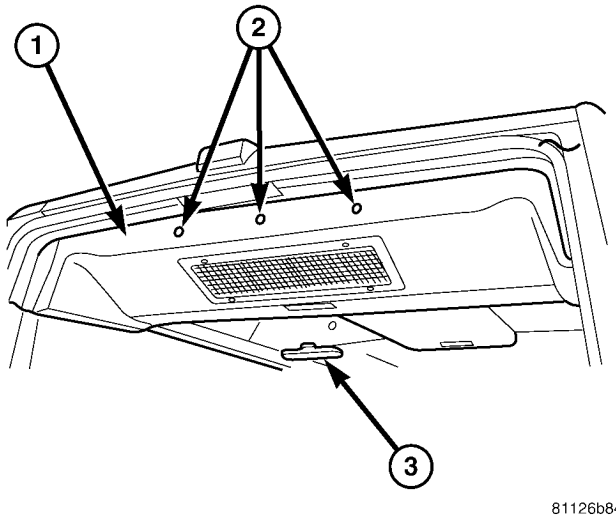


Fig. 4 Rear Evaporator Panel

1 - REAR EVAPORATOR PANEL
2 - PUSH-PIN FASTENER (3)
3 - INTERIOR MOTION SENSOR

(9) Disconnect the wire harness connectors from the rear A/C control module (Fig. 5).

(10) Remove the rear A/C control module retainers and the control module from the vehicle.

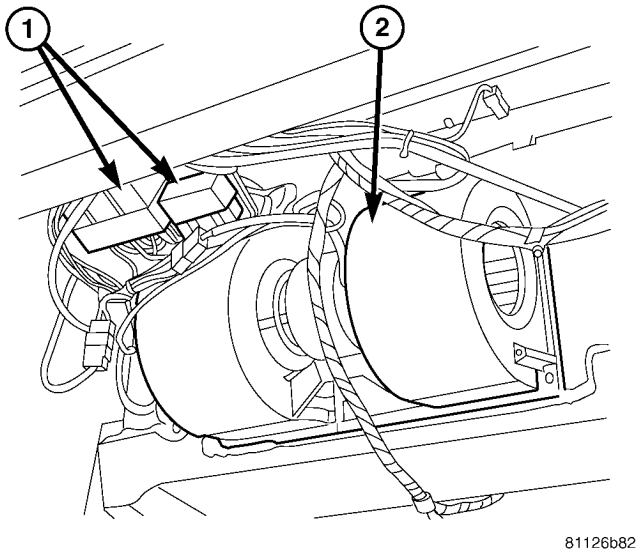


Fig. 5 Rear A/C Control Module

1 - REAR A/C CONTROL MODULE
2 - REAR EVAPORATOR BLOWER MOTOR

INSTALLATION

(1) Install the rear A/C control module and control module retainers.

(2) Connect the wire harness connectors to the rear A/C control module.

(3) Install the rear evaporator panel onto the rear evaporator housing and install the three push-pin fasteners.

(4) If equipped, connect the wire harness connector to the interior motion sensor and install the sensor into the evaporator panel.

(5) Install the five evaporator panel screws at the front of the panel. Tighten the screws to 2 N·m (17 in. lbs.).

(6) Install the roof duct panel and the six push-pin fasteners.

(7) Connect the dome light wire harness connector and install the dome light into the roof duct panel.

(8) Reconnect the battery negative cable.

EVAPORATOR TEMPERATURE SENSOR

DESCRIPTION

The rear evaporator temperature sensor is used to signal the rear A/C control module to cycle the rear A/C solenoid valve open and closed in order to control rear evaporator temperature. Controlling the evaporator temperature prevents condensation on the evaporator fins from freezing and obstructing rear air conditioning system air flow.

EVAPORATOR TEMPERATURE SENSOR (Continued)

The rear evaporator temperature sensor consists of a probe and a switch unit. The probe, which is a Negative Temperature Coefficient (NTC) thermistor in a capillary tube, is inserted between the rear evaporator coil fins to monitor evaporator temperature. The switch unit contains internal control logic that monitors the input from the probe in order to switch an internal transistor that controls the output signal to the rear A/C control module.

OPERATION

When the rear evaporator temperature sensor sees a temperature input below about 1.6° C (35° F), it signals the rear A/C control module to cycle the rear A/C solenoid valve closed. When the temperature input reaches above about 3.9° C (39° F), the switch signals the control module to cycle the valve open.

The rear evaporator temperature sensor can be accessed for service by removing the air inlet grate from the rear evaporator housing. The rear evaporator temperature sensor cannot be adjusted or repaired. If faulty or damaged, the sensor must be replaced.

DIAGNOSIS AND TESTING

Before testing the rear evaporator temperature sensor, verify that the front A/C system is operating correctly by performing the ATC Function Test using the DRBIII® scan tool. Use a volt/ohmmeter to test the sensor. For circuit descriptions and diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

(1) Turn the ignition switch and the front A/C switch to the On position. Place the rear blower motor switch in either low or high speed position. Check for voltage to the rear evaporator relay from the rear evaporator temperature sensor. If OK, go to Step 2. If not OK, repair the open or shorted evaporator temperature sensor circuit as required.

(2) With the ambient temperature between 20 to 30° C (68 to 90° F), start the engine and run the rear air conditioning system. The rear A/C solenoid valve should cycle open and closed. Use a voltmeter connected to the output side of the sensor for this check. If the A/C solenoid valve fails to cycle in these temperatures, replace the faulty rear evaporator temperature sensor.

NOTE: If the ambient temperature is above 32° C (90° F) the rear A/C solenoid valve may not cycle due to the high heat load. This condition is normal.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the air inlet grate from the rear evaporator housing (Fig. 6).

(3) Disconnect the two wire harness connectors from the rear evaporator temperature sensor.

(4) Remove the sensor probe from the rear evaporator.

(5) Remove the two sensor retaining screws and remove the sensor from the vehicle.

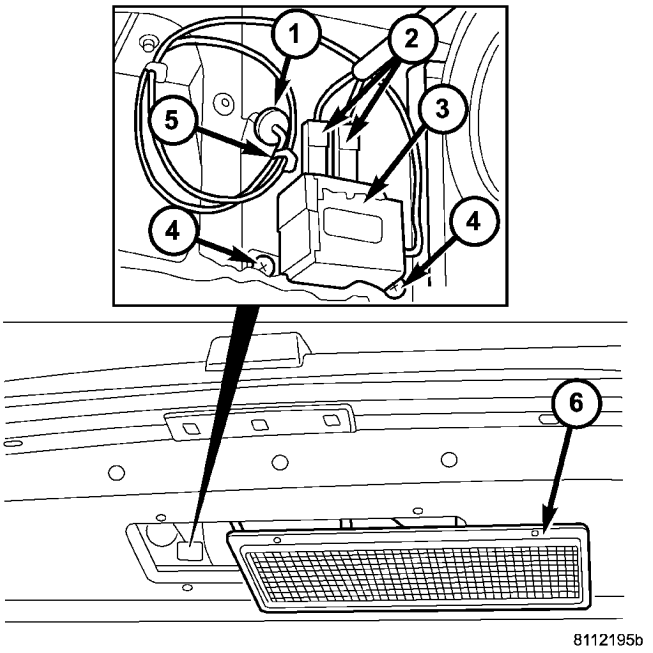


Fig. 6 Rear Evaporator Temperature Sensor

1 - RUBBER GROMMET
2 - WIRE HARNESS CONNECTOR (2)
3 - REAR EVAPORATOR TEMPERATURE SENSOR
4 - SCREW (2)
5 - TEMPERATURE SENSOR PROBE
6 - AIR INLET GRATE

INSTALLATION

(1) Install the rear evaporator temperature sensor and the two sensor retaining screws. Tighten the screws to 2 N·m (17 in. lbs.).

(2) Install the sensor probe into the rear evaporator.

(3) Connect the two wire harness connectors to the rear evaporator temperature sensor.

(4) Install the air inlet grate onto the rear evaporator housing.

(5) Reconnect the battery negative cable.

SOLENOID VALVE

DESCRIPTION

The rear A/C solenoid valve is a two-position electrically operated shut-off valve, which is used to control refrigerant flow to the rear A/C evaporator from the A/C compressor. The solenoid valve is located in the rear A/C evaporator housing and is attached by a bracket.

OPERATION

The solenoid valve is used by the rear A/C control module to control rear A/C output temperature and to prevent evaporator freezing. Evaporator temperature is controlled by cycling the solenoid valve open and closed, thereby controlling refrigerant flow to the rear evaporator. The normally closed valve only allows refrigerant to flow through it when power is supplied to the solenoid by the rear A/C control module.

DIAGNOSIS AND TESTING

For circuit descriptions and diagrams, refer to Air Conditioning/Heater in Group 8W - Wiring Diagrams.

NOTE: Prior to performing the following checks, verify that the front A/C system is operating properly.

(1) With the engine running, the front A/C switch in the On position and the rear A/C blower switch in the Off position, check that the rear evaporator is not colder than the ambient temperature. If the evaporator temperature is colder than the ambient temperature, the solenoid is allowing refrigerant to flow through the rear evaporator when in the closed position. If OK, go to Step 2. If not OK, replace the rear A/C solenoid valve (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/SOLENOID - REMOVAL).

(2) With the ignition switch in the Off position and the rear A/C solenoid valve wire harness disconnected, check for continuity between the two solenoid valve terminals. If OK, go to Step 3. If not OK, replace the solenoid valve (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/SOLENOID - REMOVAL).

(3) With the ignition switch in the Off position and the rear A/C solenoid valve wire harness disconnected, check the solenoid valve ground circuits for a good ground at all times. If OK, go to Step 4. If not OK, repair the open circuit to ground as required.

(4) With the ignition switch and the front A/C switch in the On position and the rear A/C solenoid valve wire harness disconnected, check the harness for battery power at terminal 2. If OK, replace the solenoid valve (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/SOLENOID - REMOVAL). If not OK, test the A/C control module as required (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/POWER MODULE - DIAGNOSIS AND TESTING).

REMOVAL

(1) Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(2) Disconnect and isolate the battery negative cable.

(3) Remove the rear dome light from the rear roof duct panel (Fig. 7).

(4) Disconnect the dome light wire harness connector and remove the dome light from vehicle.

(5) Remove the six push-pin roof duct panel fasteners and remove the duct panel from the vehicle.

(6) Remove the five evaporator panel screws at the front of the panel.

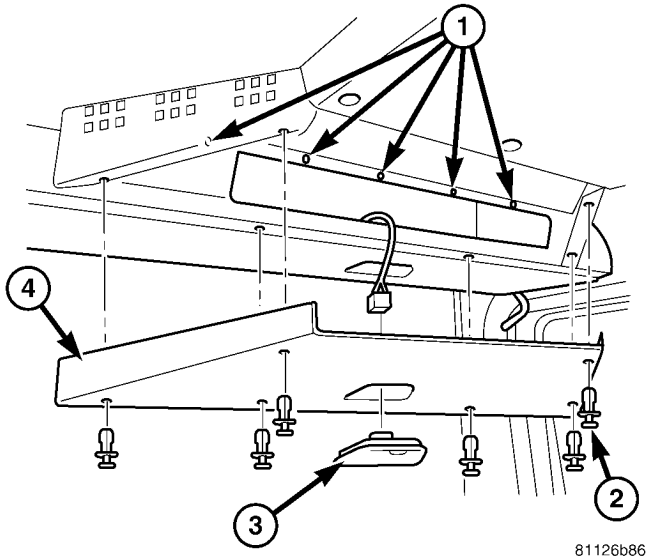


Fig. 7 Rear Roof Duct Panel

1 - SCREW (5)
2 - PUSH-PIN FASTENER (6)
3 - REAR DOME LAMP
4 - ROOF DUCT PANEL

(7) If equipped, remove the interior motion sensor from the evaporator panel, disconnect the wire harness connector and remove the motion sensor from the vehicle (Fig. 8).

(8) Remove the three push-in evaporator panel fasteners at the rear of the panel.

SOLENOID VALVE (Continued)

(9) Remove the rear evaporator panel from the vehicle.

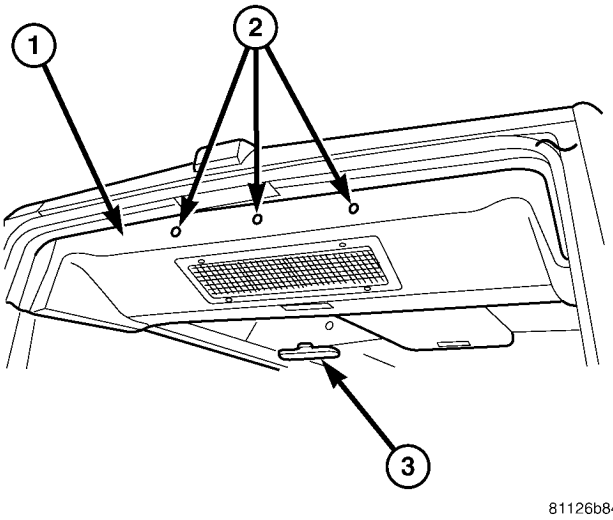


Fig. 8 Rear Evaporator Panel

1 - REAR EVAPORATOR PANEL
2 - PUSH-PIN FASTENER (3)
3 - INTERIOR MOTION SENSOR

(10) Remove the nuts that secure the liquid refrigerant lines to the solenoid valve (Fig. 9).

(11) Disconnect the refrigerant line from the outboard side of the solenoid valve.

(12) Disconnect the solenoid valve wire harness connector.

(13) Remove the two solenoid valve retaining screws and remove the solenoid valve from the vehicle.

(14) Remove the seals from both liquid line fittings and discard.

(15) Install plugs in, or tape over the opened liquid line fittings and both solenoid valve ports.

INSTALLATION

(1) Remove the tape or plugs from the opened liquid line fittings and solenoid valve ports.

(2) Lubricate two new rubber o-ring seals with clean refrigerant oil and install them on the liquid line fittings.

(3) Align the solenoid valve to the liquid line going to the rear evaporator and to the mounting bracket. Remove the two solenoid valve retaining screws and remove the solenoid valve from the vehicle.

(4) Install the two solenoid valve retaining screws. Tighten the screws to 10 N·m (89 in. lbs.).

(5) Connect the solenoid valve wire harness connector.

(6) Connect the refrigerant line to the outboard side of the solenoid valve.

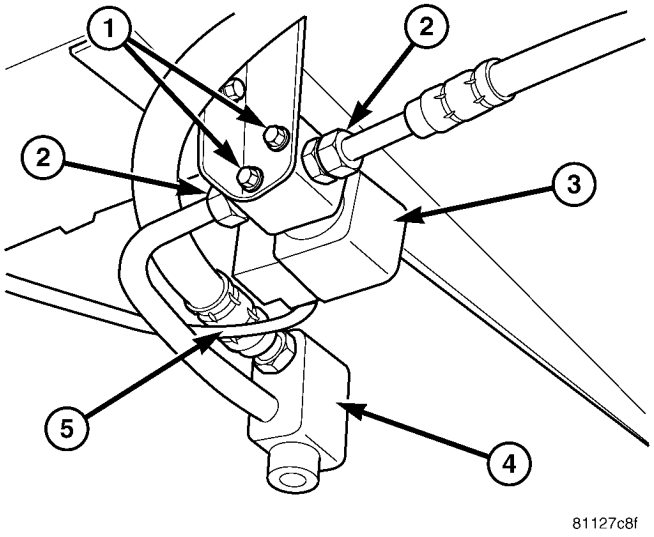


Fig. 9 Rear A/C Solenoid Valve

1 - SCREW (2)
2 - REFRIGERANT LINE NUT (2)
3 - SOLENOID VALVE
4 - REAR A/C EXPANSION VALVE
5 - WIRE HARNESS

(7) Install the nuts that secure the liquid refrigerant lines to the solenoid valve. Tighten the nuts to 16 N·m (142 in. lbs.).

(8) Install the rear evaporator panel and the three push-in fasteners.

(9) If equipped, connect the interior motion sensor wire harness connector and install the motion sensor into the rear evaporator panel.

(10) Install the five evaporator panel screws at the front of the panel. Tighten the screws to 2 N·m (17 in. lbs.).

(11) Install the rear duct panel and the six push-pin fasteners.

(12) Connect the dome light wire harness connector and install the dome light into the rear roof duct panel.

(13) Reconnect the battery negative cable.

(14) Recover the refrigerant from the refrigerant system

(15) Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(16) Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

TEMPERATURE CONTROL

DESCRIPTION

The optional rear heater-A/C unit output temperature is controlled by a thumbwheel-type control, mounted in the switch panel on the instrument panel. The temperature control (Fig. 10) allows the selection of four temperature settings when the A/C switch on the front A/C-heater control and the rear A/C blower motor is activated.

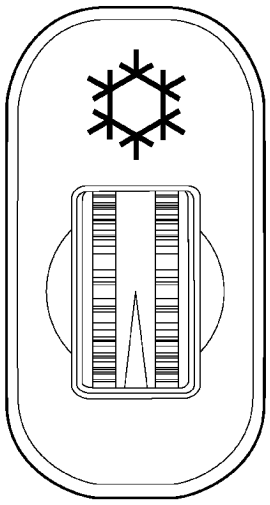


Fig. 10 Rear A/C Temperature Control

OPERATION

With the front A/C switch and rear blower motor activated, the rear A/C output temperature can be selected by rotating the thumbwheel control upwards (increase cooling) or downwards (decrease cooling). Depending on the rear A/C temperature control position, a temperature command signal is sent to the rear A/C control module. The temperature of the circulated internal air of the rear compartment is measured by a temperature sensor located in the rear evaporator unit. The value of the temperature sensor is compared in the rear A/C control module with an adjusted value at the rear A/C temperature control.

The rear A/C temperature control cannot be repaired and, if faulty or damaged, it must be replaced.

DIAGNOSIS AND TESTING

Before testing the rear A/C temperature control, verify that the front A/C system is operating correctly by performing the ATC Function Test using the DRBIII® scan tool. Use a volt/ohmmeter to test the control. For circuit descriptions and diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

(1) Disconnect and isolate the battery negative cable.

(2) Unplug the wire harness connector from the rear A/C temperature control.

(3) Check for continuity between terminal 9 and terminals 3 and 5 of the A/C temperature control. In all instances, there should be continuity.

NOTE: To check the switch's internal circuits, connect the positive lead of the ohmmeter to terminal 9 and the negative lead to terminals 3 and 5. To check the switches integral light emitting diode, reverse the ohmmeter leads.

(4) Check for resistance between terminal 3 and 5 of the A/C temperature control as you move the control to each temperature position. Resistance should be present and should change for each position.

(5) If OK, test and repair the rear A/C temperature control wire harness circuits. If not OK, replace the faulty rear A/C temperature control.

REMOVAL

NOTE: The rear A/C temperature control is used only on models with the optional rear A/C unit.

(1) Disconnect and isolate the battery negative cable.

(2) Remove the rear A/C temperature control from the switch panel.

(3) Disconnect the wire harness connector from the rear A/C temperature control and remove the control from the vehicle.

INSTALLATION

(1) Connect the wire harness connector to the rear A/C temperature control.

(2) Install the rear A/C temperature control into the switch panel.

(3) Reconnect the battery negative cable.

TEMPERATURE SENSOR

DESCRIPTION

The rear A/C air temperature sensor is located in the rear evaporator housing. The rear temperature sensor provides an air outlet temperature signal to the rear A/C control module through a two-wire harness lead and connector.

The temperature sensor cannot be adjusted or repaired and, if faulty or damaged, it must be replaced.

OPERATION

The rear A/C temperature sensor is a variable resistor that operates on a five-volt reference signal sent to it by the rear A/C control module. The resistance in the sensor changes as air temperature changes. Based upon the resistance in the sensor, a specific voltage on the temperature sensor signal circuit is returned to the rear control module, which is programmed to correspond to a specific temperature.

DIAGNOSIS AND TESTING

Before testing the rear air temperature sensor, verify that the front A/C system is operating correctly by performing the ATC Function Test using the DRBIII® scan tool. For circuit descriptions and diagrams, refer to the appropriate wiring information. The wiring information includes wiring diagrams, proper wire and connector repair procedures, details of wire harness routing and retention, connector pin-out information and location views for the various wire harness connectors, splices and grounds.

(1) Disconnect and isolate the battery negative cable.

(2) Unplug the wire harness connector for the rear air temperature sensor.

(3) Measure the resistance of the temperature sensor. At –40° C (–40° F), the sensor resistance is 336 kilohms. At 55° C (131° F), the sensor resistance is 25 kilohms. The sensor resistance should read between these two values.

(4) If OK, test and repair the rear air temperature sensor wire harness circuits. If not OK, replace the faulty air temperature sensor.

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the rear dome light from the rear roof duct panel (Fig. 11).

(3) Disconnect the dome light wire harness connector and remove the dome light from vehicle.

(4) Remove the six push-pin roof duct panel fasteners and remove the duct panel from the vehicle.

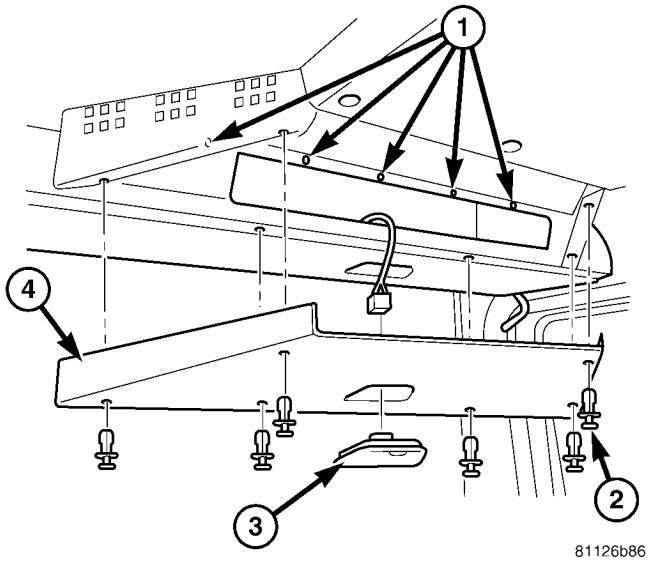


Fig. 11 Rear Roof Duct Panel

1 - SCREW (5)
2 - PUSH-PIN FASTENER (6)
3 - REAR DOME LAMP
4 - ROOF DUCT PANEL

(5) Locate the air temperature sensor within the evaporator housing and disconnect the wire harness connector.

(6) Remove the temperature sensor retainer and remove the sensor from the vehicle.

INSTALLATION

(1) Install the temperature sensor and retainer into the rear evaporator housing.

(2) Connect the temperature sensor wire harness connector.

(3) Install the rear duct panel and the six push-pin duct panel fasteners.

(4) Connect the dome light wire harness connector and install the dome light into the rear duct panel.

(5) Reconnect the battery negative cable.

DISTRIBUTION - FRONT

TABLE OF CONTENTS

page

AIR FILTER
REMOVAL 31
INSTALLATION 31
AIR OUTLETS
REMOVAL 31
INSTALLATION 32
BLOWER MOTOR
REMOVAL 32
INSTALLATION 33
DEFROSTER DUCTS
REMOVAL 33
INSTALLATION 33

page

FLOOR DISTRIBUTION DUCTS
REMOVAL 33
INSTALLATION 34
HVAC HOUSING
REMOVAL 34
DISASSEMBLY 36
ASSEMBLY 36
INSTALLATION 36
INSTRUMENT PANEL DUCTS
REMOVAL 37
INSTALLATION 38

AIR FILTER

REMOVAL

(1) Remove the insulation blanket from the ventilation housing in the engine compartment (Fig. 1).
(2) Open the locking clips at the front and rear of the ventilation housing.
(3) Slide the ventilation housing cover in the direction of the arrow shown.
(4) Remove the air filter.

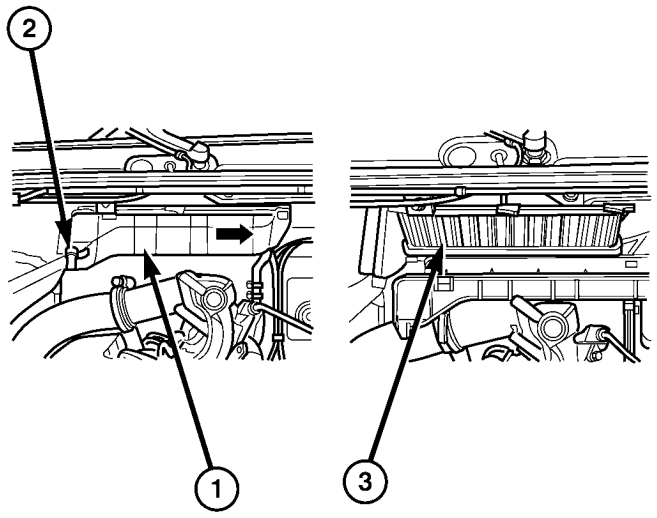


Fig. 1 Air Filter Element

1 - VENTILATION HOUSING INSULATION BLANKET
2 - LOCKING CLIP (2)
3 - AIR FILTER

INSTALLATION

(1) Install the air filter into the ventilation housing.
(2) Install the ventilation housing cover
(3) Close the locking clips at the front and rear of the ventilation housing.

NOTE: The locking tabs should retain the ventilation housing cover securely.

(4) Install the insulation blanket onto the ventilation housing.

AIR OUTLETS

REMOVAL

WARNING: DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, DRIVER AIRBAG, PASSENGER AIRBAG, SEAT BELT TENSIONER, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE SUPPLEMENTAL RESTRAINT SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

(1) Disconnect and isolate the battery negative cable.

AIR OUTLETS (Continued)

(2) If servicing the driver side air outlets, remove the instrument cluster bezel (Refer to 23 - BODY/INSTRUMENT PANEL/CLUSTER BEZEL - REMOVAL).

(3) If servicing the passenger side air outlets, remove the passenger side airbag (Refer to 8 - ELECTRICAL/RESTRAINTS/PASSENGER AIRBAG - REMOVAL).

(4) If servicing the passenger side air outlets, remove the passenger side air nozzle reinforcing plate screws and the reinforcing plate (Fig. 2).

(5) If servicing the passenger side air outlets, remove the passenger side air nozzle assembly using a trim stick or other suitable wide flat blade tool, until the snap features on the nozzle assembly are released.

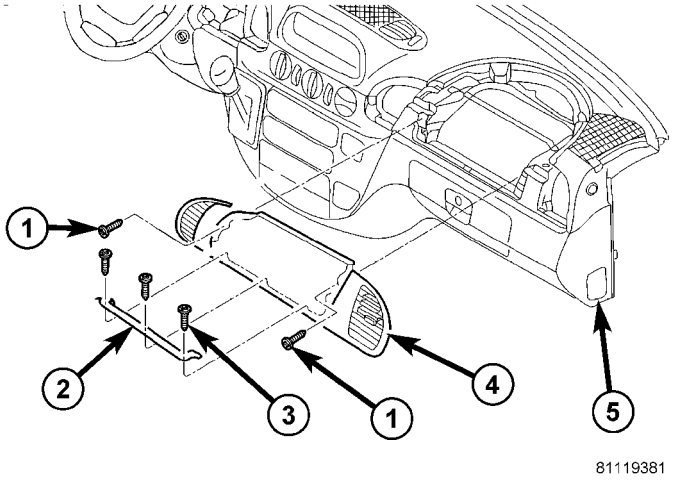


Fig. 2 Passenger Side Air Nozzle Cover

1 - FRONT SCREWS (2)
2 - BRACKET
3 - BRACKET SCREWS
4 - NOZZLE COVER
5 - INSTRUMENT PANEL

(6) If servicing the passenger side air outlets, remove the air outlet retaining bracket from the right side of the instrument panel (Fig. 3).

(7) Remove the instrument panel end cover screws and the left and/or right side cover.

(8) Remove the air outlet retaining screws and the air outlets as required.

INSTALLATION

(1) Install the air outlets and retaining screws as required. Tighten the screws to 2 N·m (17 in. lbs.).

(2) Install the left and/or right side instrument panel end cover and retaining screws as required. Tighten the screws to 2 N·m (17 in. lbs.).

(3) If servicing the passenger side air outlets, install the air outlet retaining bracket to the right side of the instrument panel. Tighten the screw to 2 N·m (17 in. lbs.).

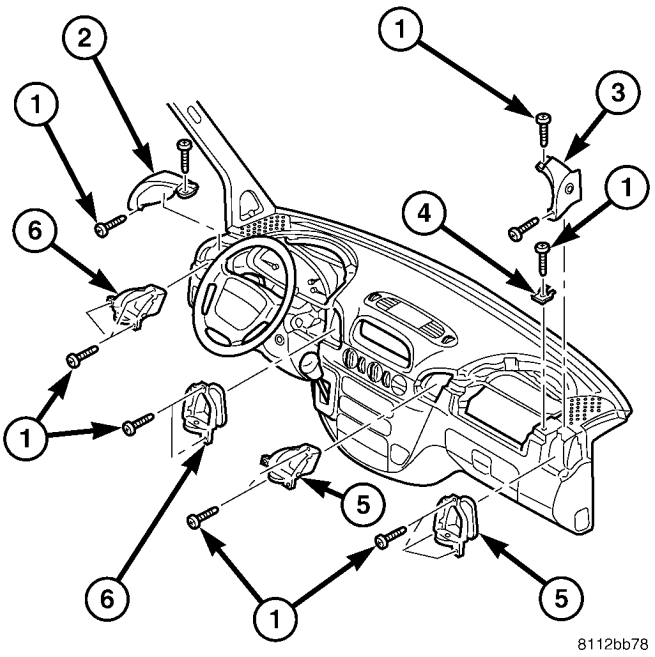


Fig. 3 Instrument Panel Air Outlets

1 - SCREW (15)
2 - LH END COVER
3 - RH END COVER
4 - BRACKET
5 - PASSENGER SIDE AIR OUTLET (2)
6 - DRIVER SIDE AIR OUTLET (2)

(4) If servicing the passenger side air outlets, install the passenger side air nozzle assembly by pressing the nozzle assembly firmly and evenly into the instrument panel, until the snap features are fully engaged.

(5) If servicing the passenger side air outlets, install the passenger side air nozzle reinforcing plate and retaining screws. Tighten the screws to 2 N·m (17 in. lbs.).

(6) If servicing the passenger side air outlets, install the passenger side airbag (Refer to 8 - ELECTRICAL/RESTRAINTS/PASSENGER AIRBAG - INSTALLATION).

(7) If servicing the driver side air outlets, install the instrument cluster bezel (Refer to 23 - BODY/INSTRUMENT PANEL/CLUSTER BEZEL - INSTALLATION).

(8) Reconnect the battery negative cable.

BLOWER MOTOR

REMOVAL

(1) Disconnect and isolate the negative battery cable.

(2) Remove the engine air cleaner housing cover (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER ELEMENT - REMOVAL).

BLOWER MOTOR (Continued)

(3) Position the ventilation housing insulation blanket out of the way of the blower motor assembly.

(4) Disconnect the wire harness connector from the blower motor (Fig. 4).

(5) Remove the three blower motor retaining screws.

(6) Remove the blower motor assembly from the ventilation housing.

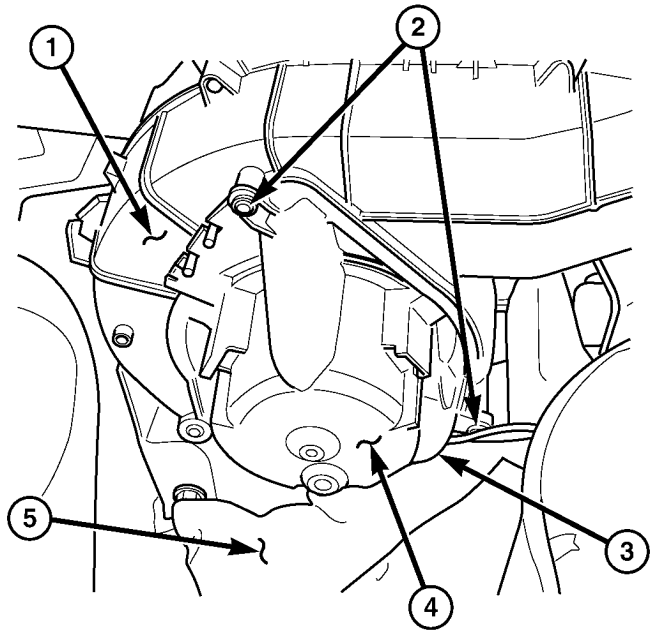


Fig. 4 Blower Motor Assembly

1 - VENTILATION HOUSING
2 - SCREWS (3)
3 - WIRE HARNESS CONNECTOR
4 - BLOWER MOTOR
5 - INSULATION BLANKET

INSTALLATION

(1) Install the blower motor assembly into the ventilation housing.

(2) Install the three blower motor retaining screws. Tighten the screws to 2 N·m (17 in. lbs.).

(3) Connect the wire harness connector to the blower motor.

(4) Install the ventilation housing insulation blanket.

(5) Install the engine air cleaner cover (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION).

(6) Reconnect the negative battery cable.

DEFROSTER DUCTS

REMOVAL

(1) Remove the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL - REMOVAL).

(2) Remove the screw that secures the left and/or right side defroster duct to the heater housing, depending on the duct being removed (Fig. 5).

(3) Remove the defroster duct(s) from the housing.

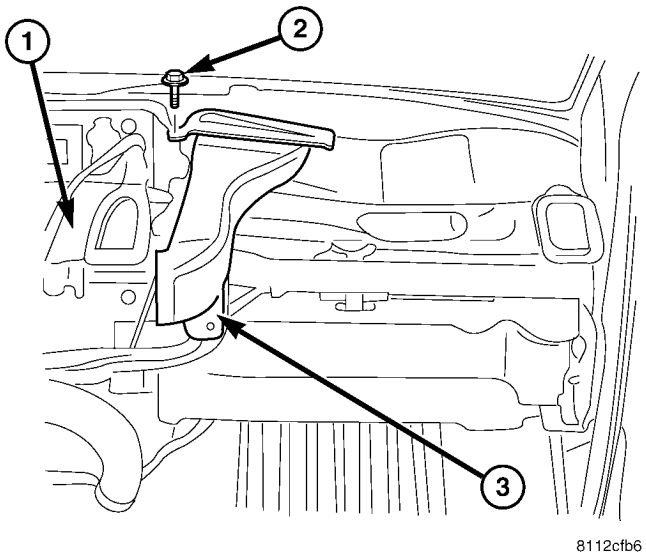


Fig. 5 Defroster Duct - RH Shown, LH Typical

1 - HEATER HOUSING
2 - SCREW
3 - DEFROSTER DUCT

INSTALLATION

(1) Install the left and/or right side defroster duct on to the heater housing.

(2) Install the screw that secures the defroster duct to the housing. Tighten the screw(s) to 2 N·m (17 in. lbs.).

(3) Install the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL - INSTALLATION).

FLOOR DISTRIBUTION DUCTS

REMOVAL

(1) Remove the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - REMOVAL).

(2) Remove the defroster ducts (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/ DEFROSTER DUCTS - REMOVAL).

(3) Remove the screws that secure the left and right floor distribution ducts to the instrument panel support (Fig. 6).

FLOOR DISTRIBUTION DUCTS (Continued)

(4) Remove floor distribution ducts from the center floor distribution duct.

(5) Remove the shift mechanism (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - NAG1/SHIFT MECHANISM - REMOVAL).

(6) Remove center floor distribution duct from the heater housing.

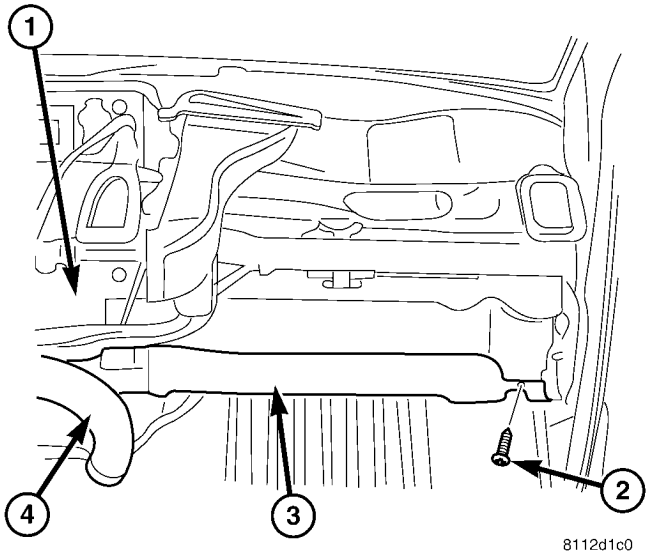


Fig. 6 Floor Distribution Duct, RH Shown, LH Typical

1 - HEATER HOUSING
2 - SCREW (1)
3 - RH FLOOR DUCT
4 - CENTER FLOOR DUCT

INSTALLATION

(1) Install the center floor distribution duct onto the heater housing.

(2) Install the shift mechanism (Refer to 21 - TRANSMISSION/TRANSAXLE/AUTOMATIC - NAG1/SHIFT MECHANISM - INSTALLATION).

(3) Install the left and right floor distribution ducts onto the center floor distribution duct.

(4) Install the left and right floor distribution duct retaining screws to the instrument panel support. Tighten the screws to 2 N·m (17 in. lbs.).

(5) Install the defroster ducts (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/DEFROSTER DUCTS - INSTALLATION).

(6) Install the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - INSTALLATION).

HVAC HOUSING

REMOVAL

The heater housing assembly must be removed from the vehicle and the two halves of the housing separated for service access of the heater core, evaporator and each of the various mode doors.

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN AN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN PLUMBING BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

(1) Recover the refrigerant from the refrigerant system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT RECOVERY)

(2) Partially drain the engine cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(3) Disconnect and isolate the battery negative cable.

(4) Remove the air cleaner housing (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - REMOVAL).

(5) Remove the windshield washer reservoir (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WASHER RESERVOIR - REMOVAL).

(6) Remove the air filter from the ventilation housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/AIR FILTER - REMOVAL).

(7) Disconnect the wire harness and vacuum connectors from the recirculation door actuator (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/RECIRCULATION DOOR ACTUATOR - REMOVAL).

(8) Disconnect the wire harness connector from the blower motor resistor block (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/BLOWER MOTOR RESISTOR BLOCK - REMOVAL).

HVAC HOUSING (Continued)

(9) Disconnect the wire harness connector from the blower motor (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/BLOWER MOTOR - REMOVAL).

(10) Remove the nuts and washers that secure the ventilation housing to the body and remove the ventilation housing from the vehicle (Fig. 7).

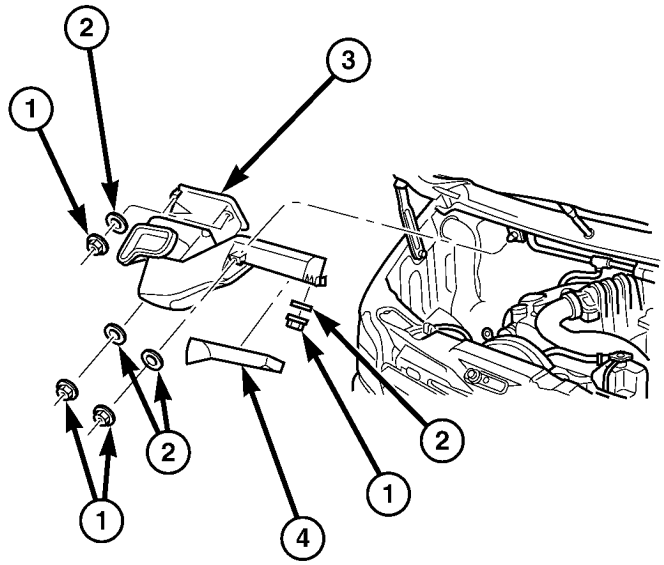


Fig. 7 Ventilation Housing

1 - NUT (5)
2 - WASHER (5)
3 - VENTILATION HOUSING
4 - HOUSING COVER

(11) Disconnect the heater hoses from the heater core.

(12) Disconnect the heater hoses from the heater core tubes. Install plugs in, or tape over the opened heater core tubes.

(13) Remove the two bolts securing the refrigerant lines to the evaporator tubes and disconnect the lines from the tubes. Install plugs in, or tape over all of the opened refrigerant line fittings.

(14) Remove the seals from the refrigerant line fittings and discard.

(15) Install plugs in, or tape over the opened refrigerant line fittings and evaporator tubes.

(16) Remove the instrument panel from the vehicle(Refer to 23 - BODY/INSTRUMENT PANEL - REMOVAL).

(17) Remove the defroster, floor distribution and instrument panel ducts (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/DEFROSTER DUCTS - REMOVAL), (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/FLOOR DISTRIBUTION DUCTS - REMOVAL) and (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/INSTRUMENT PANEL DUCTS - REMOVAL).

(18) Disconnect the two bulkhead ground connections near instrument cluster area.

(19) Remove the passenger airbag bracket (Refer to 8 - ELECTRICAL/RESTRAINTS/PASSENGER AIRBAG - REMOVAL).

(20) Disconnect the wire harness connector from the evaporator temperature sensor and air outlet temperature sensor (Fig. 8).

(21) Remove the wire harness from the bracket located on the right side of the heater housing and position the wire harness out of the way.

(22) Disconnect the heater-A/C control cables from the mode door levers (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/MODE DOOR CABLE - REMOVAL).

(23) Disconnect the evaporator drain tube from the heater housing.

(24) Remove the five bolts securing the heater housing to the body.

(25) Remove the heater housing from the vehicle.

NOTE: Use care to ensure that the interior is covered in case of loss of residual fluids from the heater and evaporator cores.

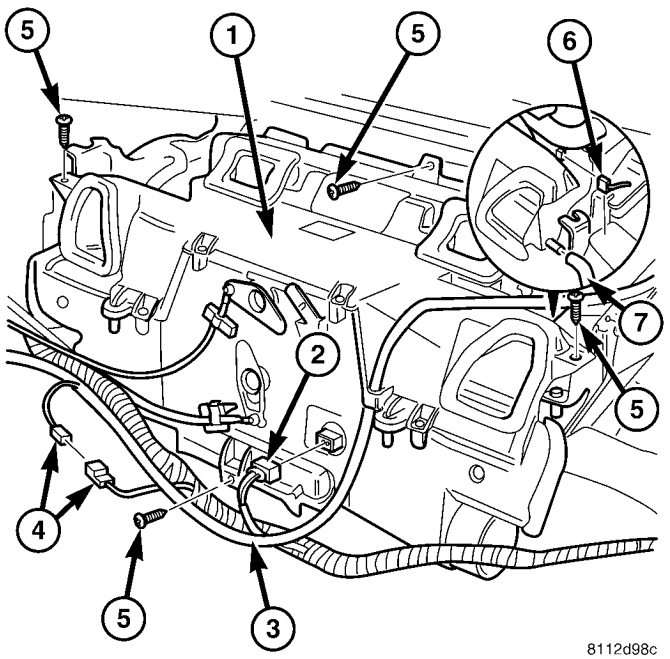


Fig. 8 Heater Housing

1 - HEATER HOUSING
2 - AIR TEMP SENSOR WIRE CONNECTOR
3 - WIRE HARNESS
4 - WIRE HARNESS CONNECTOR
5 - BOLT (4)
6 - EVAP TEMP SENSOR WIRE CONNECTOR
7 - EVAPORATOR DRAIN TUBE

HVAC HOUSING (Continued)

DISASSEMBLY

(1) Remove the heater and ventilation housings from the vehicle (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - REMOVAL).

(2) Place the heater housing in the upright position on a work bench, making allowance for leakage of fluids.

(3) Remove the gasket located at the evaporator and heater core tubes and the gasket that seals the ventilation housing to the heater housing (Fig. 9).

(4) Remove the 12 screws that secure the two housing halves together.

(5) Remove the heater housing cover from the heater housing.

(6) Remove the heater core from the heater housing.

(7) Remove the wire harness.

(8) Remove the three heater core tube retaining bolts and the heater core tube assembly from the heater core.

(9) Remove the heater core tube seals and discard.

(10) Install plug in, or tape over the opened heater core fittings.

(11) Remove the evaporator core from the heater housing.

ASSEMBLY

(1) Install the evaporator core into the heater housing.

(2) Remove the tape or plugs from the heater core fittings.

(3) Lubricate two new rubber o-ring seals with clean engine coolant and install them onto the heater core fitting.

(4) Connect the heater core tube assembly to the heater core and install the three retaining bolts. Tighten the bolts to 5 N·m (45 in. lbs.).

(5) Install the wire harness.

(6) Install the heater core into the heater housing.

(7) Install the heater housing cover onto the heater housing.

(8) Install the 12 screws that secure the two housing halves together. Tighten the screws to 2 N·m (17 in. lbs.).

(9) Install the gasket for the evaporator and heater core tube outlets and the gasket that seals the ventilation housing to the heater housing.

(10) Install the heater and ventilation housings (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - INSTALLATION).

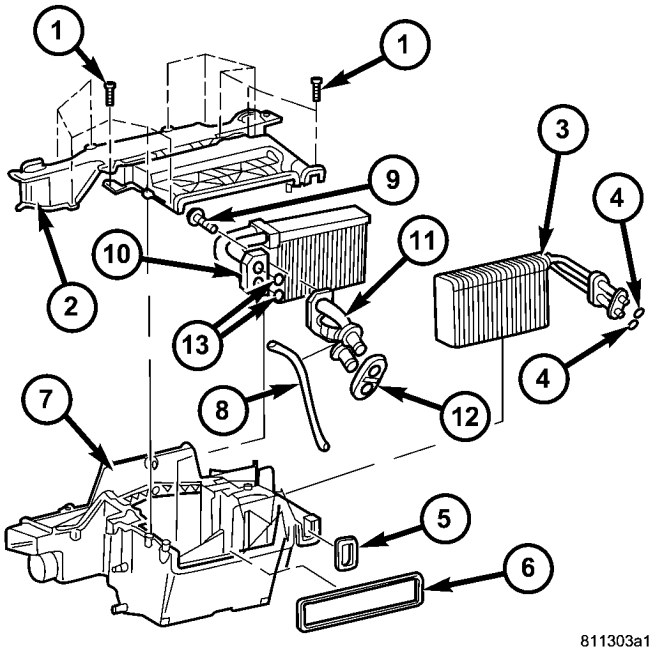


Fig. 9 Heater Housing

1 - SCREW (12)
2 - HEATER HOUSING COVER
3 - EVAPORATOR
4 - EVAPORATOR O-RING SEAL (2)
4 - EVAPORATOR GASKET
6 - VENTILATION HOUSING GASKET
7 - HEATER HOUSING
8 - WIRING HARNESS
9 - BOLT (3)
10 - HEATER CORE
11 - HEATER CORE TUBE ASSEMBLY
12 - HEATER CORE TUBE GASKET
13 - HEATER CORE TUBE O-RING SEAL (2)

INSTALLATION

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN PLUMBING BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

NOTE: 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.

(1) Position the heater housing to the dash panel. Be certain that the evaporator condensate drain tube is positioned correctly.

(2) Install the heater housing retaining screws. Tighten the screws to 4.5 N·m (40 in. lbs.).

(3) Connect the heater housing wire harness connectors and install the wiring harness to the bracket.

HVAC HOUSING (Continued)

(4) Connect the heater-A/C control cables to the mode door levers (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/MODE DOOR CABLE - INSTALLATION).

(5) Reinstall the passenger airbag bracket (Refer to 8 - ELECTRICAL/RESTRAINTS/PASSENGER AIRBAG - INSTALLATION).

(6) Reconnect the two bulkhead ground connection near the instrument cluster area.

(7) Reinstall the defroster, floor distribution and instrument panel ducts.

(8) Reinstall the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - INSTALLATION).

(9) Unplug or remove the tape from the opened refrigerant line fittings.

(10) Lubricate two new rubber o-ring seals with clean refrigerant oil and install them onto the evaporator core fittings.

(11) Connect the refrigerant line terminal block to the evaporator tubes.

(12) Install the two bolts that secure the refrigerant line terminal block to the evaporator. Tighten the bolts to 5 N·m (45 in. lbs.).

(13) Unplug or remove the tape from the heater core hoses and tubes.

(14) Connect the heater hoses to the heater core tubes and install the heater hose clamps.

(15) Install the ventilation housing to the dash panel.

(16) Install the nuts and washers that secure the ventilation housing to the dash panel. Tighten the nuts to 5 N·m (45 in. lbs.).

(17) Connect the wire harness connectors to the blower motor, blower motor resistor block and the recirculation door actuator.

(18) Connect the vacuum harness connector to the recirculation door actuator.

(19) Install the air filter into the ventilation housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/AIR FILTER - INSTALLATION).

(20) Install the windshield washer reservoir (Refer to 8 - ELECTRICAL/WIPERS/WASHERS/WASHER RESERVOIR - INSTALLATION).

(21) Install the air cleaner housing (Refer to 9 - ENGINE/AIR INTAKE SYSTEM/AIR CLEANER HOUSING - INSTALLATION).

(22) Reconnect the battery negative cable.

(23) Refill the engine cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(24) Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).

(25) Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

(26) Start the engine and check for proper operation of the heating and air conditioning systems.

INSTRUMENT PANEL DUCTS

REMOVAL

(1) Remove the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - REMOVAL).

(2) Remove the defroster ducts (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/DEFROSTER DUCTS - REMOVAL).

(3) Remove the floor distribution ducts (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/FLOOR DISTRIBUTION DUCTS - REMOVAL).

(4) If removing the right instrument panel duct, remove the passenger air bag module and bracket (Refer to 8 - ELECTRICAL/RESTRAINTS/PASSENGER AIRBAG - REMOVAL).

(5) Remove the screws that secure the left and/or right instrument panel duct and remove the duct(s) as required (Fig. 10).

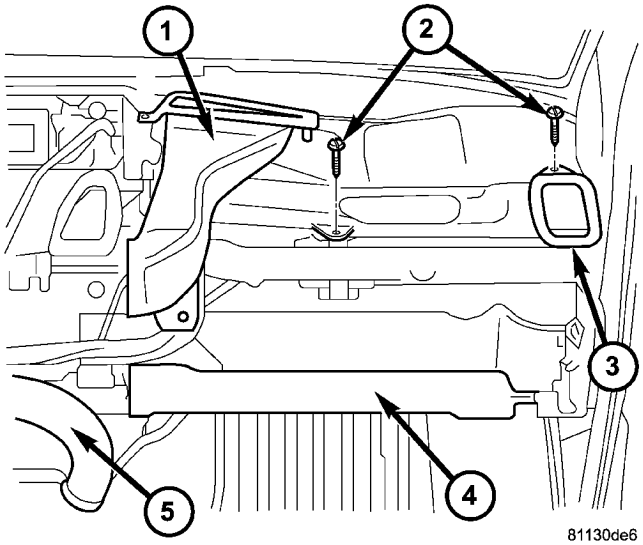


Fig. 10 Instrument Panel Duct - RH Shown, LH Typical

1 - RH DEFROSTER DUCT
2 - SCREW (2)
3 - RH INSTRUMENT PANEL DUCT
4 - RH FLOOR DISTRIBUTION DUCT
5 - CENTER FLOOR DISTRIBUTION DUCT

INSTRUMENT PANEL DUCTS (Continued)

INSTALLATION

(1) Connect the instrument panel duct(s) to the heater housing as required.

(2) Install the instrument panel duct retaining screws. Tighten the screws to 2 N·m (17 in. lbs.).

(3) If servicing the right instrument panel duct, install the passenger air bag module and bracket (Refer to 8 - ELECTRICAL/RESTRAINTS/PASSENGER AIRBAG - INSTALLATION).

(4) Install the floor distribution ducts (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/FLOOR DISTRIBUTION DUCTS - INSTALLATION).

(5) Install the defroster ducts (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/DEFROSTER DUCTS - INSTALLATION).

(6) Install the instrument panel (Refer to 23 - BODY/INSTRUMENT PANEL/INSTRUMENT PANEL ASSEMBLY - INSTALLATION).

DISTRIBUTION - REAR

TABLE OF CONTENTS

page

AIR FILTER
REMOVAL 39
INSTALLATION 39
BLOWER MOTOR
REMOVAL 39
INSTALLATION 40
REAR A/C HOUSING
REMOVAL 40
INSTALLATION 41

AIR FILTER

REMOVAL

(1) Unlock the four quick-disconnect fasteners by turning them counter clockwise (Fig. 1).

(2) Remove the air inlet grate, cover and air filter assembly from the evaporator panel.

(3) Disconnect the retainer straps and remove the air filter from the air inlet grate.

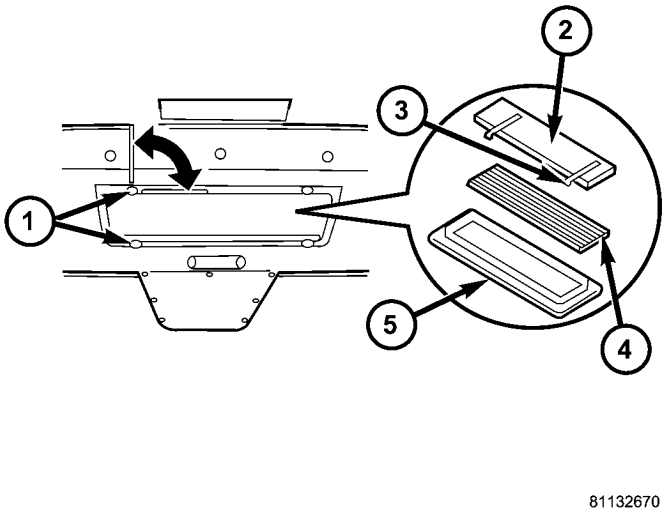


Fig. 1 Rear A/C Air Filter

1 - QUICK-DISCONNECT FASTENER (4)
2 - AIR FILTER
3 - RETAINING STRAP (2)
4 - AIR INLET GRATE
5 - COVER

INSTALLATION

(1) Position the air filter onto the grate and install the retainer straps.

(2) Install the air inlet grate, cover and air filter assembly into the evaporator panel.

(3) Lock the four quick-disconnect fasteners by turning them clockwise.

BLOWER MOTOR

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Remove the rear dome light from the rear roof duct panel (Fig. 2).

(3) Disconnect the dome light wire harness connector and remove the dome light from vehicle.

(4) Remove the six push-pin roof duct panel fasteners and remove the duct panel from the vehicle.

(5) Remove the five evaporator panel screws at the front of the panel.

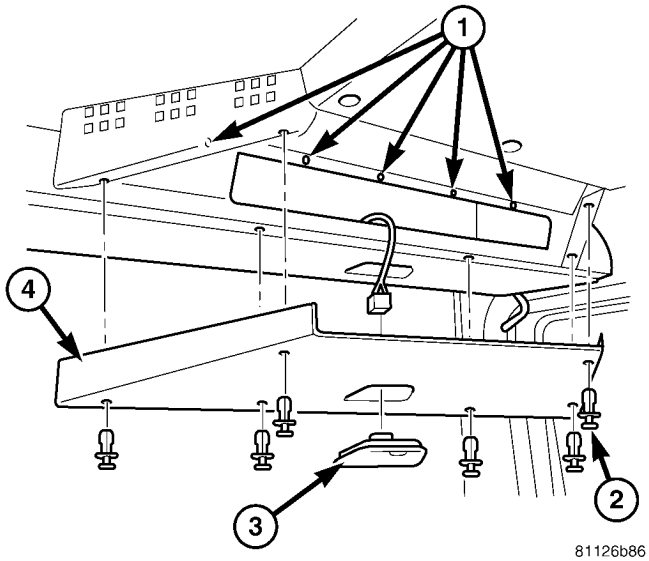


Fig. 2 Rear Roof Duct Panel

1 - SCREW (5)
2 - PUSH-PIN FASTENER (6)
3 - REAR DOME LAMP
4 - ROOF DUCT PANEL

(6) If equipped, remove the interior motion sensor from the evaporator panel, disconnect the wire harness connector and remove the motion sensor from the vehicle (Fig. 3).

BLOWER MOTOR (Continued)

(7) Remove the three push-pin evaporator panel fasteners at the rear of the panel.

(8) Remove the rear evaporator panel from the vehicle.

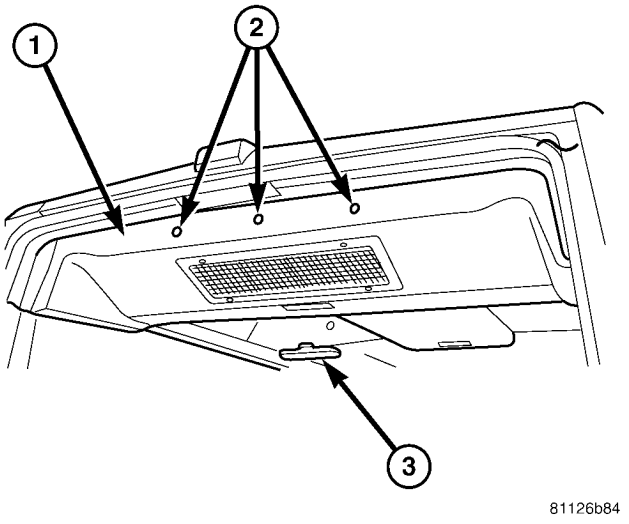


Fig. 3 Rear Evaporator Panel

1 - REAR EVAPORATOR PANEL
2 - PUSH-PIN FASTENER (3)
3 - INTERIOR MOTION SENSOR

(9) Disconnect the blower motor wire harness connector (Fig. 4).

(10) Remove the four blower motor retaining screws and the blower motor from the rear evaporator housing.

INSTALLATION

(1) Install the blower motor to the rear evaporator housing and install the retaining screws. Tighten the screws to 5 N·m (45 in. lbs.).

(2) Connect the blower motor wire harness connector.

(3) Install the rear evaporator panel and the three push-pin fasteners.

(4) If equipped, connect the interior motion sensor wire harness connector and install the interior motion sensor into the evaporator panel.

(5) Install the five evaporator panel screws at the front of the panel. Tighten the screws to 2 N·m (17 in. lbs.).

(6) Install the roof duct panel and six push-pin fasteners.

(7) Connect the dome light wire harness connector and install the dome light into the rear roof duct panel.

(8) Reconnect the battery negative cable.

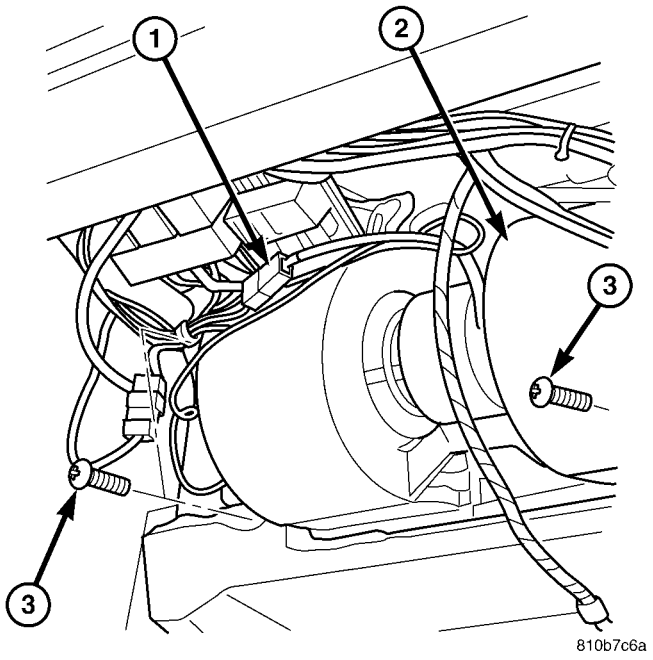


Fig. 4 Rear A/C Blower Motor

1 - WIRE HARNESS CONNECTOR
2 - REAR A/C BLOWER MOTOR
3 - SCREW (4)

REAR A/C HOUSING

REMOVAL

(1) Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(2) Disconnect and isolate the battery negative cable.

(3) Remove the rear dome light from the rear roof duct panel (Fig. 5).

(4) Disconnect the dome light wire harness connector and remove the dome light from vehicle.

(5) Remove the six push-pin roof duct panel fasteners and remove the duct panel from the vehicle.

(6) Remove the five evaporator panel screws at the front of the panel.

(7) If equipped, remove the interior motion sensor from the evaporator panel, disconnect the wire harness connector and remove the motion sensor from the vehicle (Fig. 6).

(8) Remove the three push-pin evaporator panel fasteners at the rear of the panel.

(9) Remove the rear evaporator panel from the vehicle.

(10) Remove the refrigerant line from the solenoid valve inlet port (Fig. 7).

(11) Remove the refrigerant line from the expansion valve outlet port.

REAR A/C HOUSING (Continued)

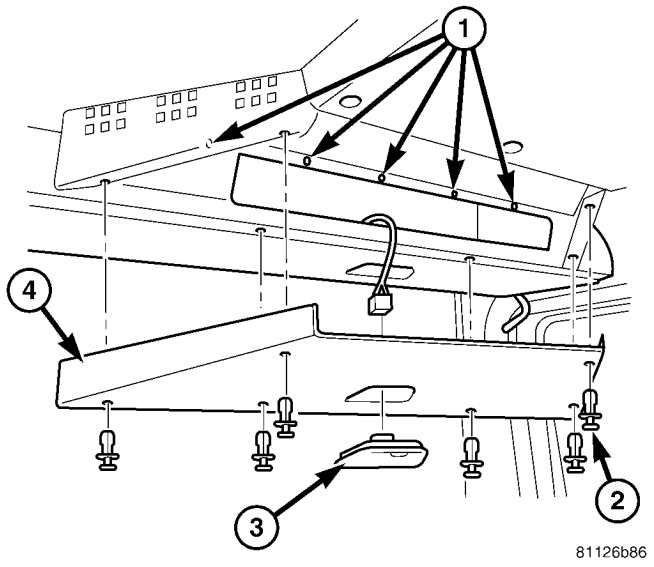


Fig. 5 Rear Roof Duct Panel

1 - SCREW (5)
2 - PUSH-PIN FASTENER (6)
3 - REAR DOME LAMP
4 - ROOF DUCT PANEL

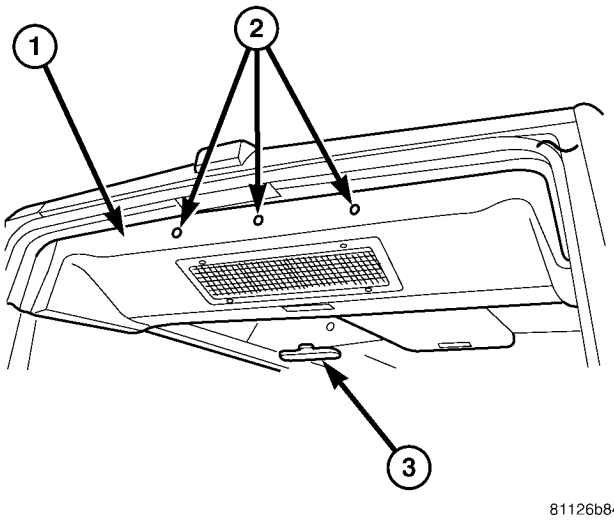


Fig. 6 Rear Evaporator Panel

1 - REAR EVAPORATOR PANEL
2 - PUSH-PIN FASTENER (3)
3 - INTERIOR MOTION SENSOR

(12) Install plug in, or tape over the refrigerant line fittings and the solenoid and expansion valve ports.

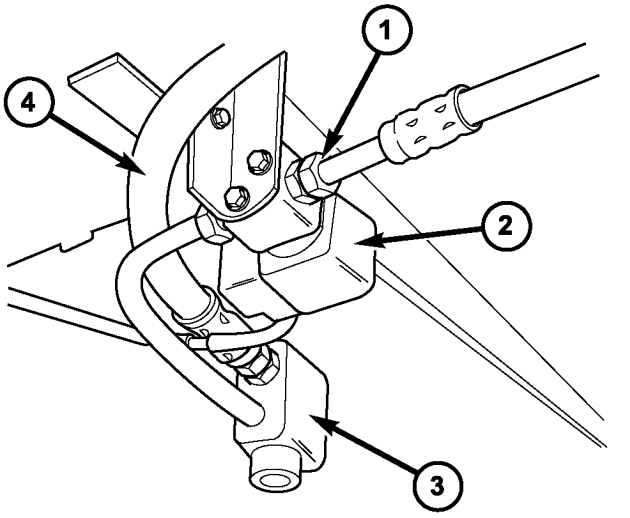


Fig. 7 Rear Refrigerant Line Connections

1 - REFRIGERANT LINE (LIQUID LINE)
2 - SOLENOID VALVE
3 - REAR EXPANSION VALVE
4 - REFRIGERANT LINE (SUCTION LINE)

(13) Disconnect and plug the two evaporator drain hoses (Fig. 8).

(14) Disconnect the wire harness connectors as required and position the wire harness out of the way.

(15) Support the rear evaporator housing and remove the one screw and four retaining bolts and washers.

(16) Remove the rear evaporator housing from the vehicle.

INSTALLATION

(1) Install the rear evaporator housing into the vehicle and support the rear evaporator housing.

(2) Install the one screw and four retaining bolts and washers. Tighten the screw to 5 N·m (45 in. lbs.) and the bolts to 20 N·m (15 ft. lbs.).

(3) Connect the wire harness connectors as required.

(4) Unplug and connect the two evaporator drain hoses.

(5) Remove the tape or plugs from the refrigerant line fittings and the solenoid and expansion valve ports.

REAR A/C HOUSING (Continued)

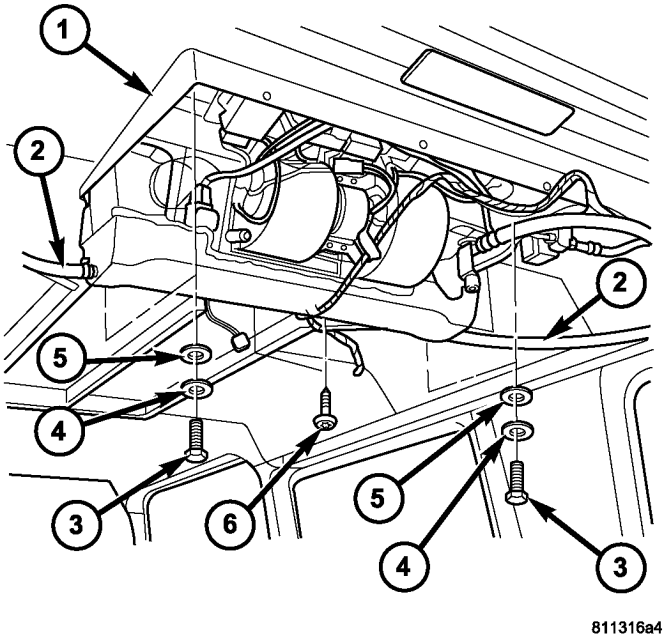


Fig. 8 Rear Evaporator Housing

1 - REAR EVAPORATOR HOUSING
2 - EVAPORATOR DRAIN HOSE (2)
3 - BOLT (4)
4 - LOCKWASHER (4)
5 - WASHER (4)
6 - SCREW

(6) Install the suctiont line to the expansion valve outlet port. Tighten the retainer to 10 N·m (89 in. lbs.).

(7) Install the refrigerant line to the solenoid valve inlet port. Tighten the retainer to 16 N·m (142 in. lbs.).

(8) Install the rear evaporator panel and the three push-pin fasteners.

(9) If equipped, connect the interior motion sensor wire harness connector and install the interior motion sensor into the evaporator panel.

(10) Install the five evaporator panel screws at the front of the panel. Tighten the screws to 2 N·m (17 in. lbs.).

(11) Install the roof duct panel and six push-pin fasteners.

(12) Connect the dome light wire harness connector and install the dome light into the rear roof duct panel.

(13) Reconnect the battery negative cable.

(14) Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(15) Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

PLUMBING

TABLE OF CONTENTS

page

PLUMBING
DESCRIPTION - REFRIGERANT LINE 44
OPERATION - REFRIGERANT LINE 44
WARNING 44
CAUTION
CAUTION 45
REFRIGERANT HOSES/LINES/TUBES PRECAUTIONS 45
DIAGNOSIS AND TESTING - REFRIGERANT SYSTEM LEAKS 46
STANDARD PROCEDURE
STANDARD PROCEDURE - REFRIGERANT SYSTEM SERVICE EQUIPMENT 46
STANDARD PROCEDURE - REFRIGERANT RECOVERY 47
STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE 47
STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE 48
SPECIFICATIONS
CHARGE CAPACITY 49
A/C COMPRESSOR
DESCRIPTION 49
OPERATION 49
DIAGNOSIS AND TESTING - COMPRESSOR NOISE 49
REMOVAL 50
INSTALLATION 51
A/C CONDENSER
DESCRIPTION 52
OPERATION 52
REMOVAL 52
INSTALLATION 52
A/C DISCHARGE LINE
REMOVAL 53
INSTALLATION 54
A/C EVAPORATOR
DESCRIPTION 54
OPERATION 54
REMOVAL 55
INSTALLATION 55
A/C EXPANSION VALVE
DESCRIPTION 55
OPERATION 55
DIAGNOSIS AND TESTING - A/C EXPANSION VALVE 56

page

REMOVAL 56
INSTALLATION 56
ELECTRIC COOLANT PUMP
DESCRIPTION 57
OPERATION 57
REMOVAL 57
INSTALLATION 57
HEATER CORE
DESCRIPTION 57
OPERATION 57
REMOVAL 58
INSTALLATION 58
LIQUID LINE
REMOVAL 58
INSTALLATION 59
REAR EVAPORATOR
REMOVAL 60
INSTALLATION 61
REAR EXPANSION VALVE
REMOVAL 62
INSTALLATION 63
RECEIVER/DRIER
DESCRIPTION 64
OPERATION 64
REMOVAL 64
INSTALLATION 64
REFRIGERANT
DESCRIPTION 65
OPERATION 65
REFRIGERANT OIL
DESCRIPTION 65
OPERATION 65
STANDARD PROCEDURE - REFRIGERANT OIL LEVEL 65
SUCTION LINE
REMOVAL 66
INSTALLATION 66
WATER VALVE
REMOVAL 67
INSTALLATION 67
UNDERBODY LINES
REMOVAL 68
INSTALLATION 69

PLUMBING

DESCRIPTION - REFRIGERANT LINE

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, which is sandwiched between rubber layers, is used for the R-134a air conditioning system on this vehicle. This nylon tube 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 commonly 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.

OPERATION - REFRIGERANT LINE

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 cannot be repaired and, if faulty or damaged, they must be replaced.

WARNING

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.

PLUMBING (Continued)

CAUTION

CAUTION

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.
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.

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.
- Unified plumbing connections with gaskets cannot be serviced with O-rings. The gaskets are not reusable and new gaskets do not require lubrication before installing.

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 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.

PLUMBING (Continued)

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.

DIAGNOSIS AND TESTING - REFRIGERANT SYSTEM LEAKS

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

If the air conditioning system is not cooling properly, determine if the refrigerant system is fully-charged. (Refer to 24 - HEATING & AIR CONDITIONING - DIAGNOSIS AND TESTING - A/C PERFORMANCE)

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. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE)

(2) Connect and dispense 0.283 kilograms (0.625 pounds or 10 ounces) of R-134a refrigerant into the evacuated refrigerant system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE)

(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.

STANDARD PROCEDURE

STANDARD PROCEDURE - 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.

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

PLUMBING (Continued)

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. 1). 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.

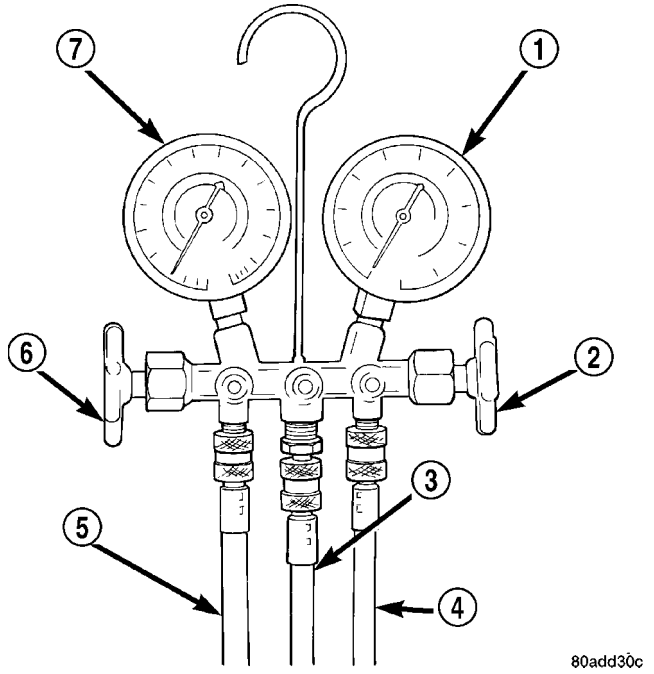


Fig. 1 Manifold Gauge Set - Typical

1 - HIGH PRESSURE GAUGE
2 - VALVE
3 - VACUUM/REFRIGERANT HOSE (YELLOW W/ BLACK STRIPE)
4 - HIGH PRESSURE HOSE (RED W/ BLACK STRIPE)
5 - LOW PRESSURE HOSE (BLUE W/ BLACK STRIPE)
6 - VALVE
7 - LOW PRESSURE GAUGE

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 suction line near the dash panel.

HIGH PRESSURE GAUGE HOSE The high pressure hose (Red with Black stripe) attaches to the discharge service port. This port is located on the liquid line between the condenser and the reciver-drier.

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.

STANDARD PROCEDURE - REFRIGERANT RECOVERY

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

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.

STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

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.

PLUMBING (Continued)

(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. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - DIAGNOSIS AND TESTING - REFRIGERANT SYSTEM LEAKS)

(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. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE)

STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

CAUTION: A small amount of refrigerant oil is removed from the A/C system each time the refrigerant system is recovered and evacuated. Before charging the A/C system, you MUST replenish any oil lost during the recovery process. Refer the equipment manufacturer instructions for more information.

After the refrigerant system has been tested for leaks and evacuated, a refrigerant charge can be injected into the system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - SPECIFICATIONS - CHARGE CAPACITY)

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.

PARTIAL CHARGE METHOD

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION. (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING - WARNING) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION)

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. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - DIAGNOSIS AND TESTING - REFRIGERANT SYSTEM LEAKS) 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.

- 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.
- 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 A/C Heater controls to the on position, the temperature control knob in the full cool position, select 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.

(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.

PLUMBING (Continued)

- 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.
- 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) 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 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, the system could be overcharged. If the reading is equal to, or lower, than the pressure shown in the chart, continue with this procedure.

Compressor Discharge Pressure Chart						
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	1378 kPa (200 psi)	1516 kPa (220 psi)	1723 kPa (250psi)	1930 kPa (280 psi)	2206 kPa (320 psi)	2413 kPa (350 psi)

(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.

SPECIFICATIONS

CHARGE CAPACITY

Always refer to the underhood HVAC Specification Tag for the latest fill specification for the model being serviced.

A/C COMPRESSOR

DESCRIPTION

The air conditioning system uses a Nippondenso 7SBU16C double-acting, variable swash plate-type compressor on all models. This compressor has a label identifying the use of R-134a refrigerant and both the suction and discharge ports located on the cylinder head.

OPERATION

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 coil, are available for service.

DIAGNOSIS AND TESTING - COMPRESSOR NOISE

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.

A/C COMPRESSOR (Continued)

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 Cooling 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. (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/A/C COMPRESSOR CLUTCH - INSTALLATION)

(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. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION - REFRIGERANT HOSES/LINES/TUBES PRECAUTIONS)

(5) If the noise is from opening and closing of the high pressure relief valve, reclaim, evacuate, and recharge the refrigerant system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT RECOVERY) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE)If the high pressure relief valve still does not seat properly, replace the a/c compressor. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/A/C COMPRESSOR - REMOVAL)

(6) If the noise is from liquid slugging on the suction line, check the refrigerant oil level and the refrigerant system charge. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT OIL - STANDARD PROCEDURE) (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - SPECIFICATIONS - CHARGE CAPACITY).

(7) If the noise continues, replace the compressor and repeat Step 1.

REMOVAL

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION).

(1) Disconnect the negative battery cable.

(2) Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT RECOVERY).

(3) Remove the accessory drive belt from the compressor clutch (Fig. 2).

(4) Remove the bolt that secures the suction line fitting to the top of the compressor.

(5) Disconnect the suction line fitting from the compressor suction port.

(6) Remove the seal from the suction line fitting and discard.

(7) Install plugs in, or tape over the opened suction line fitting and the compressor suction port.

(8) Remove the bolt that secures the discharge line fitting to the top of the compressor.

(9) Disconnect the discharge line fitting from the compressor discharge port.

(10) Remove the seal from the discharge line fitting and discard.

(11) Install plugs in, or tape over the opened discharge line fitting and the compressor discharge port.

(12) Disconnect the engine wire harness connector for the compressor clutch coil from the coil pigtail wire connector on the top of the compressor.

(13) Raise the vehicle on a hoist.

(14) Support the compressor and remove the three compressor mounting bolts.

(15) Remove the compressor from the engine compartment.

NOTE: If a replacement compressor is being installed, be certain to drain and measure the refrigerant oil contained in the removed compressor. This will determine how much oil the replacement compressor must contain before it is installed (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT OIL - STANDARD PROCEDURE).

A/C COMPRESSOR (Continued)

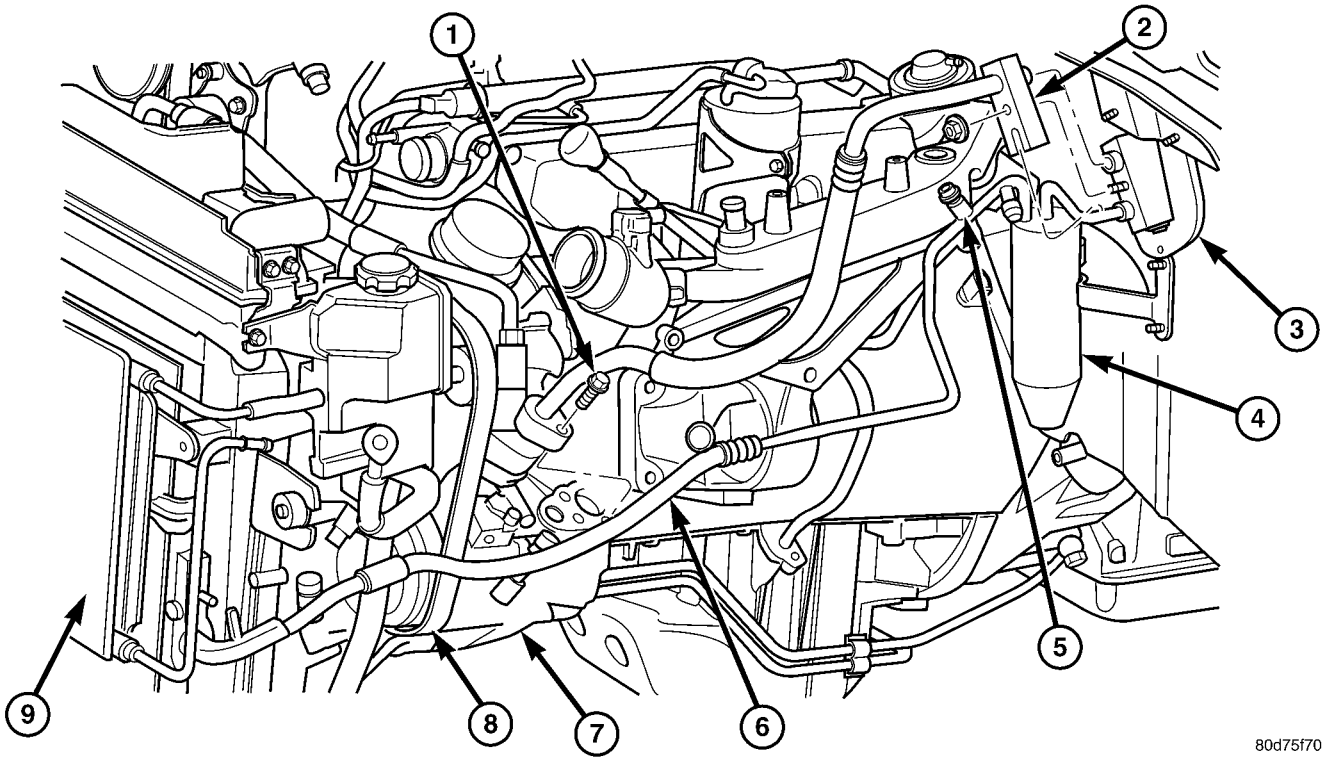


Fig. 2 2.7L Diesel Compressor-RHD (LHD typical)

1 - SUCTION LINE MOUNTING SCREW
2 - SUCTION LINE TO H-BLOCK
3 - H-BLOCK
4 - RECEIVER DRIER
5 - LIQUID LINE SERVICE PORT
6 - LIQUID LINE AND RECEIVER DRIER
7 - A/C COMPRESSOR
8 - A/C COMPRESSOR DRIVE BELT
9 - RADIATOR - CONDENSOR ASSEMBLY

INSTALLATION

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION).

CAUTION: Check the oil level before installing the new compressor (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT OIL - STANDARD PROCEDURE).

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.

(1) Position the A/C compressor in the engine compartment and loosely install the three compressor retaining bolts. Tighten the bolts using the following sequence to 20 N·m (15 ft. lbs.).
- The upper bolt at the front of the compressor.
- The lower bolt at the front of the compressor.
- The bolt at the rear of the compressor.

(2) Lower the vehicle.

(3) Connect the wire harness connector to the compressor clutch.

(4) Remove plugs or tape from the discharge line fitting and the compressor discharge port.

(5) Lubricate a new rubber o-ring seal with clean refrigerant oil and install the seal onto the discharge line fitting.

A/C COMPRESSOR (Continued)

(6) Connect the discharge line fitting to the compressor discharge port.

(7) Install the bolt that secures the discharge line fitting to the top of the compressor. Tighten the bolt to 23 N·m (17 ft. lbs.).

(8) Remove plugs or tape from the suction line fitting and the compressor suction port.

(9) Lubricate a new rubber o-ring seal with clean refrigerant oil and install the seal onto the suction line fitting.

(10) Connect the suction line fitting to the compressor suction port.

(11) Install the bolt that secures the suction line fitting to the top of the compressor. Tighten the bolt to 23 N·m (17 ft. lbs.).

(12) Install the accessory drive belt (Refer to 7 - COOLING/ACCESSORY DRIVE/DRIVE BELTS - INSTALLATION).

(13) Reconnect the negative battery cable.

(14) Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).

(15) Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

A/C CONDENSER

DESCRIPTION

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.

OPERATION

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.

REMOVAL

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION).

(1) Disconnect and isolate the battery negative cable.

(2) Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT RECOVERY).

(3) Remove the front fascia.

(4) Remove the grille (Refer to 23 - BODY/EXTERIOR/GRILLE - REMOVAL).

(5) Remove the headlamps from their mounts.

(6) Remove the radiator crossmember (Refer to 23 - BODY/EXTERIOR/RADIATOR CROSSMEMBER - REMOVAL).

(7) Disconnect the liquid line fitting from the condenser outlet port (Fig. 3).

(8) Remove the seal from the liquid line fitting and discard.

(9) Install plug in, or tape over the opened liquid line fitting and the condenser outlet port.

(10) Disconnect the discharge line fitting from the condenser inlet port.

(11) Remove the seal from the discharge line fitting and discard.

(12) Install plug in, or tape over the opened discharge line fitting and the condenser inlet port.

(13) Disconnect the wire harness connector from the auxiliary fan.

(14) Remove the auxiliary fan and upper bracket assembly.

(15) Remove the auxiliary fan lower bracket retainers and bracket.

(16) Remove the four condenser retaining screws.

(17) Carefully remove the condenser from the vehicle.

INSTALLATION

NOTE: If the condenser is being 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.

(1) Carefully position the condenser in the vehicle.

(2) Install the four condenser retaining screws. Tighten the screws to 2 N·m (17 in. lbs.).

A/C CONDENSER (Continued)

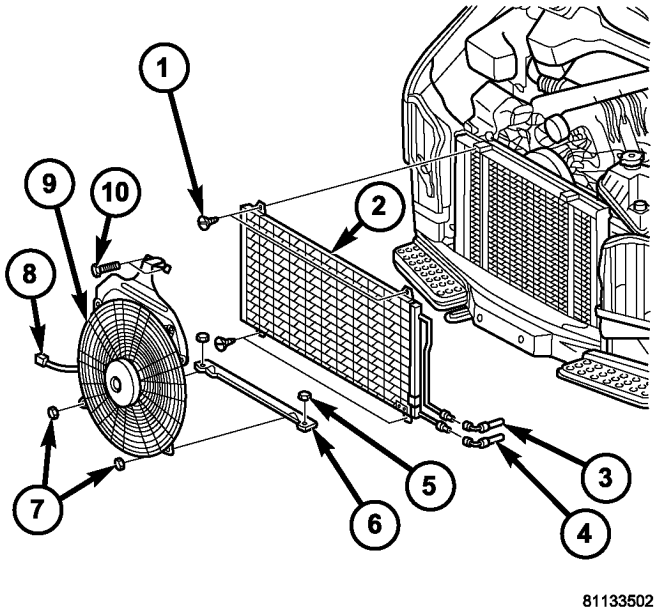


Fig. 3 A/C Condenser

1 - SCREW (4)
2 - CONDENSER
3 - LIQUID REFRIGERANT LINE
4 - COMPRESSOR DISCHARGE LINE
5 - NUT (2)
6 - LOWER AUXILIARY FAN BRACKET
7 - NUT (2)
8 - WIRE HARNESS CONNECTOR
9 - AUXILIARY COOLING FAN
10 - SCREW (2)

(3) Install the lower auxiliary fan bracket and retaining nuts. Tighten the nuts to 5 N·m (45 in. lbs.).

(4) Install the auxiliary fan and upper bracket assembly. Tighten the screws to 5 N·m (45 in. lbs.).

(5) Connect the wire harness connector to the auxiliary fan.

(6) Remove the tape or plug from the condenser inlet port and the discharge line fitting.

(7) Lubricate a new rubber O-ring seal with clean refrigerant oil and install it on the discharge line fitting.

(8) Reconnect the discharge line fitting to the condenser inlet port.

(9) Install and tighten the nut that secures the discharge line fitting to the condenser inlet port. Tighten the nut to 33 N·m (24 ft. lbs.).

(10) Remove the tape or plug from the condenser outlet port and the liquid line fitting.

(11) Lubricate a new rubber O-ring seal with clean refrigerant oil and install it on the liquid line fitting.

(12) Reconnect the liquid line fitting to the condenser outlet port.

(13) Install and tighten the nut that secures the liquid line fitting to the condenser outlet port. Tighten the nut to 17 N·m (12 ft. lbs.).

(14) Install the radiator crossmember (Refer to 23 - BODY/EXTERIOR/RADIATOR CROSSMEMBER - INSTALLATION).

(15) Install the headlamps into their mounts.

(16) Install the grille (Refer to 23 - BODY/EXTERIOR/GRILLE - INSTALLATION).

(17) Install the front fascia.

(18) Reconnect the battery negative cable.

(19) Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(20) Recharge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

A/C DISCHARGE LINE

REMOVAL

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION).

(1) Disconnect and isolate the negative battery cable.

(2) Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT RECOVERY).

(3) Remove the grille (Refer to 23 - BODY/EXTERIOR/GRILLE - REMOVAL).

(4) Remove the nut that secures the discharge line fitting to the condenser on the left side of the condenser.

(5) Disconnect the discharge line fitting from the condenser inlet port.

(6) Remove the seal from the discharge line fitting and discard.

(7) Install plug in, or tape over the opened discharge line fitting and the condenser inlet port.

(8) Remove the bolt that secures the discharge line fitting to the top of the compressor (Fig. 4).

(9) Disconnect the discharge line fitting from the compressor discharge port.

(10) Remove the seal from the discharge line fitting and discard.

(11) Install plug in, or tape over the opened discharge line fitting and the compressor discharge port.

A/C DISCHARGE LINE (Continued)

(12) Disconnect the discharge line from the retaining clip and remove the discharge line from the vehicle.

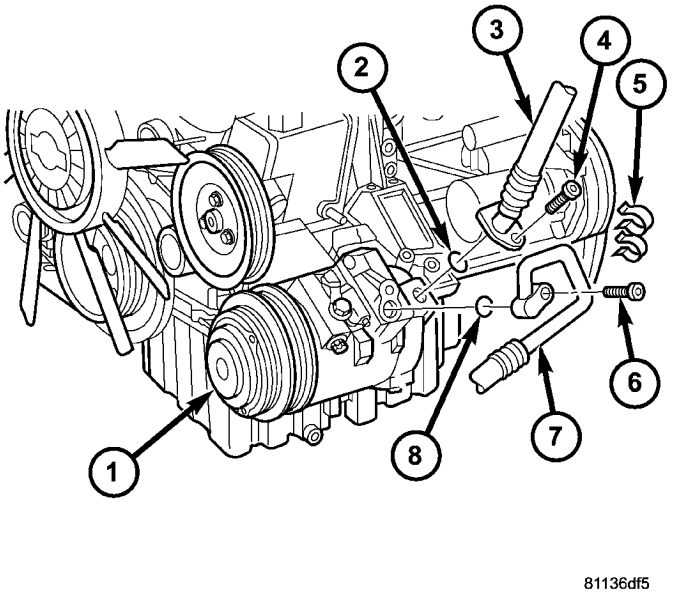


Fig. 4 A/C Compressor - Refrigerant Lines

1 - A/C COMPRESSOR
2 - O-RING SEAL
3 - SUCTION LINE
4 - BOLT
5 - RETAINING CLIP
6 - BOLT
7 - DISCHARGE LINE
8 - O-RING SEAL

INSTALLATION

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.

(1) Position the discharge line into the engine compartment.

(2) Remove the tape or plugs from the compressor discharge port and the discharge line fitting.

(3) Lubricate a new rubber O-ring seal with clean refrigerant oil and install it on the discharge line fitting.

(4) Connect the discharge line fitting to the compressor discharge port on the top of the compressor.

(5) Install the bolt that secures the discharge line fitting to the compressor. Tighten the bolt to 23 N·m (17 ft. lbs.).

(6) Remove the tape or plugs from the condenser inlet port and the discharge line fitting.

(7) Lubricate a new rubber O-ring seal with clean refrigerant oil and install it on the discharge line fitting.

(8) Connect the discharge line fitting to the condenser inlet port.

(9) Install the nut that secures the discharge line fitting to the condenser. Tighten the nut to 33 N·m (24 ft. lbs.).

(10) Install the grille(Refer to 23 - BODY/EXTERIOR/GRILLE - INSTALLATION).

(11) Evacuate the refrigerant system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE)

(12) Charge the refrigerant system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE)

(13) Reconnect the negative battery cable.

A/C EVAPORATOR

DESCRIPTION

The evaporator is located in the heater housing, behind the instrument panel. The evaporator is positioned in the housing so that all air that enters the housing must pass over the fins of the evaporator coils 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 refrigerant is circulating through the evaporator coil tubes.

OPERATION

Refrigerant enters the evaporator from the expansion valve 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 cannot be repaired and, if faulty or damaged, it must be replaced.

A/C EVAPORATOR (Continued)

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN AN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION).

(1) Remove the heater housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - REMOVAL).

(2) Disassemble the heater housing to access the evaporator (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - DISASSEMBLY).

(3) Lift the evaporator out of the lower half of the heater housing (Fig. 5).

INSTALLATION

(1) Install the evaporator coil into the bottom half of the heater housing.

(2) Assemble the heater housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - ASSEMBLY).

(3) Install the heater housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - INSTALLATION).

NOTE: If the evaporator is being replaced, add 60 milliliters (2 fluid ounces) of refrigerant oil to the refrigerant system.

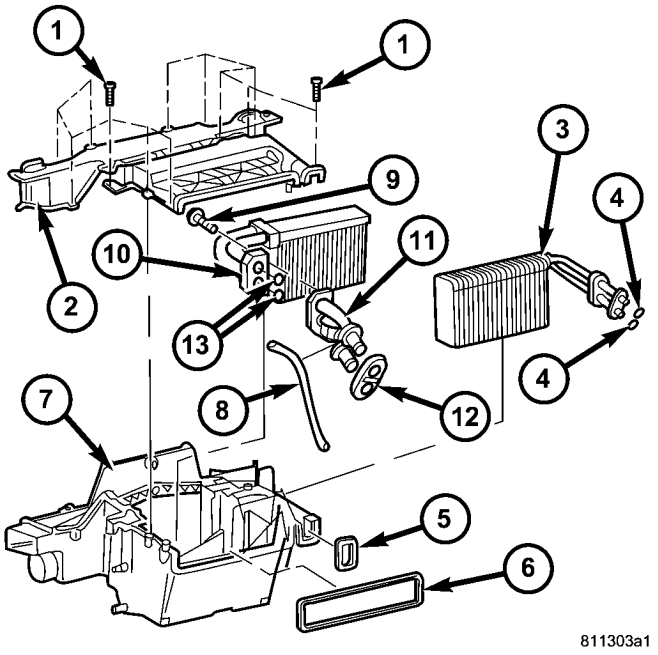


Fig. 5 Heater Housing

1 - SCREW (12)
2 - HEATER HOUSING COVER
3 - EVAPORATOR
4 - EVAPORATOR O-RING SEAL (2)
4 - EVAPORATOR GASKET
6 - VENTILATION HOUSING GASKET
7 - HEATER HOUSING
8 - WIRING HARNESS
9 - BOLT (3)
10 - HEATER CORE
11 - HEATER CORE TUBE ASSEMBLY
12 - HEATER CORE TUBE GASKET
13 - HEATER CORE TUBE O-RING SEAL (2)

A/C EXPANSION VALVE

DESCRIPTION

The “H” valve type thermal expansion valve (TXV) is mounted in the engine compartment between the liquid and suction lines and the evaporator.

The expansion valve is a factory calibrated unit and cannot be adjusted or repaired. If faulty or damaged, the expansion valve must be replaced.

OPERATION

High-pressure, high temperature liquid refrigerant from the liquid line passes through the expansion valve orifice, converting it into a low-pressure, low-temperature mixture of liquid and gas before it enters the evaporator coil. A thermal sensor in the expansion valve monitors the temperature of the refrigerant leaving the evaporator coil through the suction line, and adjusts the orifice size at the liquid line to let the proper amount of refrigerant into the evaporator to meet the vehicle cooling requirements. Controlling the refrigerant flow through the evapora-

A/C EXPANSION VALVE (Continued)

tor ensures that none of the refrigerant leaving the evaporator is still in a liquid state, which could cause damage to the compressor.

DIAGNOSIS AND TESTING - A/C EXPANSION VALVE

The expansion valve is located on the engine side of the dash panel near the shock tower.

The expansion valve can fail in three different positions (open, closed or restricted).

In an Open Position: this will result in a noisy compressor or no cooling. The cause can be broken spring, broken ball or excessive moisture in the A/C system. If the spring or ball are found to be defective, replace the expansion valve. If excessive moisture is found in the A/C system, recycle the refrigerant.

In a Closed Position: There will be low suction pressure and no cooling. This may be caused by a failed power dome or excessive moisture in the A/C system. If the power dome on the expansion valve is found to be defective replace the expansion valve. If excessive moisture is found recycle the refrigerant.

A Restricted Orifice: There will be low suction pressure and no cooling. This may be caused by debris in the refrigerant system. If debris is believed to be the cause, recycle the refrigerant and replace the expansion valve and the receiver-drier.

REMOVAL

WARNING: REFER TO THE APPLICABLE WARNINGS AND CAUTIONS FOR THIS SYSTEM BEFORE PERFORMING THE FOLLOWING OPERATION (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION).

(1) Recover the refrigerant from the A/C system-(Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING - STANDARD PROCEDURE).

(2) Disconnect and isolate the battery negative cable.

(3) Remove the nut that secures the suction and liquid line fittings to the stud on the expansion valve (Fig. 6).

(4) Disconnect the suction and liquid lines from the expansion valve.

(5) Remove the seals from the suction and liquid line fitting and discard.

(6) Install plugs in, or tape over the opened liquid and suction line fittings and both expansion valve ports.

(7) Remove the two bolts that secure the expansion valve to the evaporator tube tapping plate.

(8) Remove the expansion valve from the evaporator tube tapping plate.

(9) Remove the seals from the evaporator inlet and outlet tube fittings and discard.

(10) Install plugs in, or tape over the opened evaporator inlet and outlet tube fittings and both expansion valve ports.

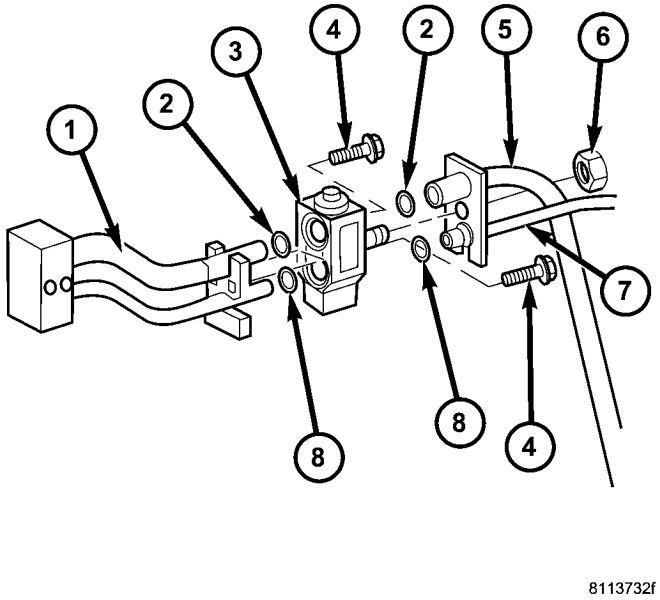


Fig. 6 Expansion Valve

1 - EVAPORATOR TUBE TAPPING PLATE
2 - O-RING SEAL (2)
3 - EXPANSION VALVE
4 - BOLT (2)
5 - SUCTION LINE
6 - NUT
7 - LIQUID LINE
8 - O-RING SEAL (2)

INSTALLATION

(1) Remove the tape or plugs from the tapping plate evaporator inlet and outlet tube fittings and both ports on the back of the expansion valve.

(2) Lubricate new rubber O-ring seals with clean refrigerant oil and install them on the tapping plate evaporator inlet and outlet tube fittings.

(3) Position the expansion valve onto the tapping plate evaporator inlet and outlet tube fittings.

(4) Install and tighten the two bolts that secure the expansion valve to the evaporator tube tapping plate. Tighten the bolts to 5 N·m (45 in. lbs.).

(5) Remove the tape or plugs from the liquid and suction line fittings and both expansion valve ports.

(6) Lubricate new rubber O-ring seals with clean refrigerant oil and install them on the liquid and suction line fittings.

(7) Reconnect the liquid line fitting to the expansion valve.

(8) Reconnect the suction line fitting to the expansion valve.

A/C EXPANSION VALVE (Continued)

(9) Install and tighten the nut that secures the suction line and liquid line fittings to the stud on the expansion valve. Tighten the nut to 10 N·m (89 in. lbs.).

(10) Reconnect the battery negative cable.

(11) Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(12) Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

ELECTRIC COOLANT PUMP

DESCRIPTION

The electric coolant pump is used on all vehicles. The pump is located in the left side of the engine compartment near the battery.

OPERATION

The pump is controlled by the ATC control module and is only operational under the following conditions:

(1) Vehicle speed below 27 Km/h (17 mph).

(2) Coolant temperature above 65° C (150° F) but less than 110° C (230 ° F).

(3) Any blower speed setting.

(4) Temperature heat setting above the halfway setting (60% heat).

(5) The pump will turn off at speeds above 48 Km/h (30 mph).

(6) The pump will turn off if the coolant temperature rises above 110° C (230 ° F).

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Partially drain the engine cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(3) Disconnect the wire harness connector from the electric coolant pump (Fig. 7).

(4) Loosen both hose clamps from the electric coolant pump.

(5) Using a twisting motion gently remove both heater hoses from the electric coolant pump.

(6) Remove the two electric coolant pump bracket retaining nuts from the body studs.

(7) Remove the electric coolant pump from the vehicle.

INSTALLATION

(1) Install the electric coolant pump and mounting bracket onto the body studs.

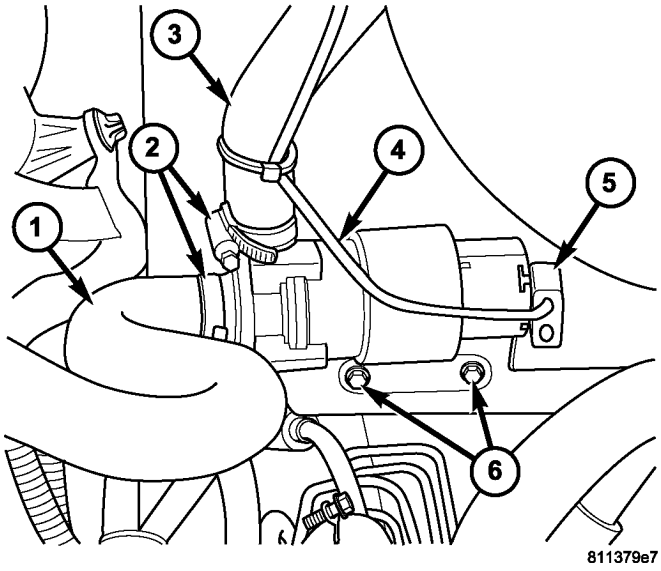


Fig. 7 Electric Coolant Pump

1 - HEATER HOSE
2 - HOSE CLAMP (2)
3 - HEATER HOSE
4 - ELECTRIC COOLANT PUMP
5 - WIRE HARNESS CONNECTOR
6 - NUT (2)

(2) Install the two bracket retaining nuts. Tighten the nuts to 5 N·m (45 in. lbs.).

(3) Using a twisting motion gently install both hoses onto the electric coolant pump.

(4) Tighten both hose clamps securely.

(5) Connect the wire harness connector to the electric coolant pump.

(6) Reconnect the battery negative cable.

(7) Fill the cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

HEATER CORE

DESCRIPTION

The heater core is located in the heater housing, behind the instrument panel. It is a heat exchanger made of rows of tubes and fins.

OPERATION

Engine coolant is circulated through the heater hoses to the heater core whenever the heater water valve is cycled open by the ATC control module. 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 heater water valve controls the heater output air temperature by controlling the amount of heated engine coolant flowing through the heater core. The

HEATER CORE (Continued)

blower motor speed controls the volume of air flowing through the heater housing.

The heater core cannot be repaired and, if faulty or damaged, it must be replaced.

REMOVAL

WARNING: ON VEHICLES EQUIPPED WITH AIRBAGS, DISABLE THE AIRBAG SYSTEM BEFORE ATTEMPTING ANY STEERING WHEEL, STEERING COLUMN, OR INSTRUMENT PANEL COMPONENT DIAGNOSIS OR SERVICE. DISCONNECT AND ISOLATE THE BATTERY NEGATIVE (GROUND) CABLE, THEN WAIT TWO MINUTES FOR THE AIRBAG SYSTEM CAPACITOR TO DISCHARGE BEFORE PERFORMING FURTHER DIAGNOSIS OR SERVICE. THIS IS THE ONLY SURE WAY TO DISABLE THE AIRBAG SYSTEM. FAILURE TO TAKE THE PROPER PRECAUTIONS COULD RESULT IN AN ACCIDENTAL AIRBAG DEPLOYMENT AND POSSIBLE PERSONAL INJURY.

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION).

(1) Remove the heater housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - REMOVAL).

(2) Disassemble the heater housing to access the heater core (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - DISASSEMBLY).

(3) Lift the heater core out of the lower half of the heater housing (Fig. 8).

(4) If necessary, remove the three heater core tube retaining bolts and the heater core tube assembly from the heater core.

(5) Remove the heater core tube seals and discard as required.

INSTALLATION

(1) If the heater core tube assembly was removed from the heater core, lubricate two new rubber o-ring seals with clean engine coolant and install them onto the heater core fitting.

(2) If required, connect the heater core tube assembly to the heater core and install the three retaining bolts. Tighten the bolts to 5 N·m (45 in. lbs.).

(3) Install the heater core into the bottom half of the heater housing.

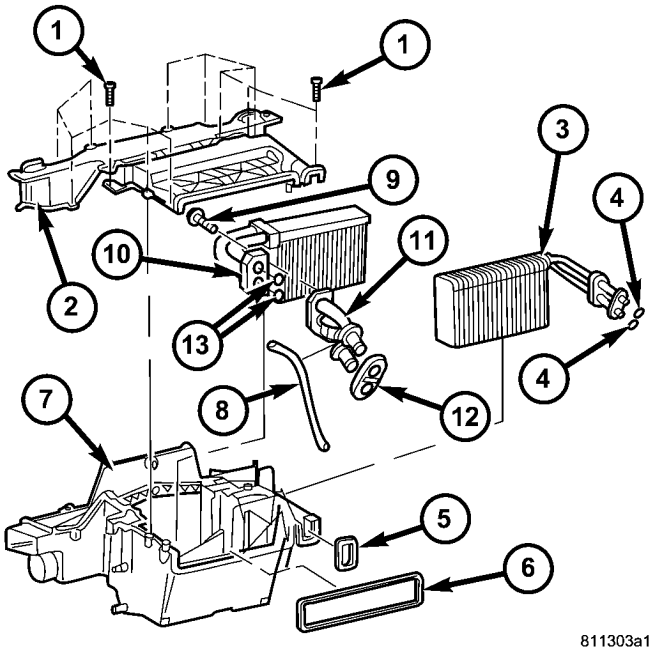


Fig. 8 Heater Housing

1 - SCREW (12)
2 - HEATER HOUSING COVER
3 - EVAPORATOR
4 - EVAPORATOR O-RING SEAL (2)
4 - EVAPORATOR GASKET
6 - VENTILATION HOUSING GASKET
7 - HEATER HOUSING
8 - WIRING HARNESS
9 - BOLT (3)
10 - HEATER CORE
11 - HEATER CORE TUBE ASSEMBLY
12 - HEATER CORE TUBE GASKET
13 - HEATER CORE TUBE O-RING SEAL (2)

(4) Assemble the heater housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - ASSEMBLY).

(5) Install the heater housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/HVAC HOUSING - INSTALLATION).

LIQUID LINE

REMOVAL

The front air conditioner liquid line is serviced in two sections. The front section connects between the condenser and the receiver/drier and includes the high side service port and the A/C pressure sensor on the fitting for the receiver/drier. The rear section connects between the receiver/drier and the expansion valve.

LIQUID LINE (Continued)

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION).

FRONT SECTION

(1) Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(2) Disconnect and isolate the battery negative cable.

(3) Remove the grille (Refer to 23 - BODY/EXTERIOR/GRILLE - REMOVAL).

(4) Remove the nut that secures the liquid line fitting to the condenser outlet port on the left side of condenser.

(5) Disconnect the liquid line fitting from the condenser outlet port.

(6) Remove the seal from the liquid line fitting and discard.

(7) Install plug in, or tape over the opened liquid line fitting and the condenser outlet port.

(8) Remove the routing clip retaining nut and disengage the routing clip retainer on top of the left frame rail from the front section of the liquid line.

(9) Remove the A/C pressure sensor from the front liquid line fitting (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/A/C PRESSURE TRANSDUCER - REMOVAL).

(10) Remove the bolt that secures the front section of the liquid line to the top of the receiver/drier (Fig. 9).

(11) Disconnect the front section of the liquid line from the receiver/drier.

(12) Remove the seal from the liquid line fitting and discard.

(13) Install plug in, or tape over the opened liquid line fitting and the receiver/drier inlet port.

(14) Remove the front section of the liquid line from the engine compartment.

REAR SECTION

(1) Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT - STANDARD PROCEDURE).

(2) Disconnect and isolate the battery negative cable.

(3) Remove the grille (Refer to 23 - BODY/EXTERIOR/GRILLE - REMOVAL).

(4) Remove the nut that secures the suction and liquid line to the stud on the expansion valve (Fig. 10).

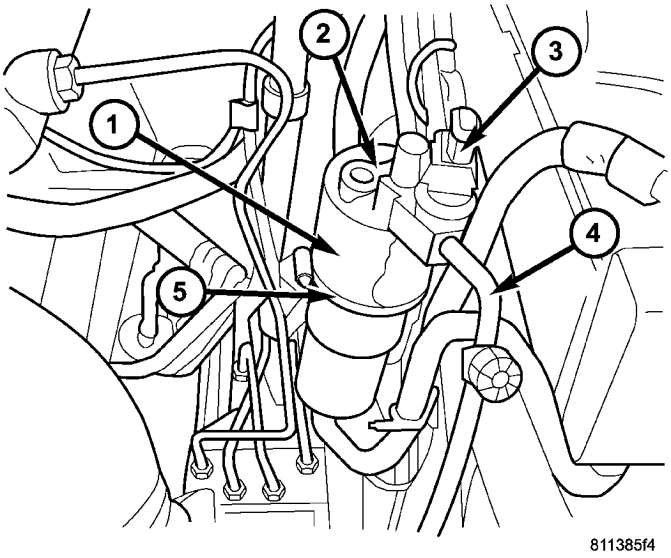


Fig. 9 Receiver-Drier

1 - RECEIVER/DRIER
2 - LIQUID LINE (REAR SECTION)
3 - A/C PRESSURE TRANSDUCER
4 - LIQUID LINE (FRONT SECTION)
5 - CLAMP

(5) Disconnect the suction and liquid line from the expansion valve.

(6) Remove the seals from the suction and liquid line fitting and discard.

(7) Disengage the routing clip retainer from the rear section of the liquid line.

(8) Remove the bolt that secures the rear section of the liquid line to the top of the receiver/drier (Fig. 9).

(9) Disconnect the rear section of the liquid line from the receiver/drier.

(10) Remove the seal from the liquid line fitting outlet port and discard.

(11) Install plugs in, or tape over the opened liquid and suction line fittings, both receiver/drier ports and both expansion valve ports.

(12) Remove the rear section of the liquid line from the engine compartment.

INSTALLATION

The front air conditioner liquid line is serviced in two sections. The front section connects between the condenser and the receiver/drier and includes the high side service port and the A/C pressure transducer on the fitting for the receiver/drier. The rear section connects between the receiver/drier and the expansion valve.

FRONT SECTION

(1) Position the front section of the liquid line into the engine compartment.

LIQUID LINE (Continued)

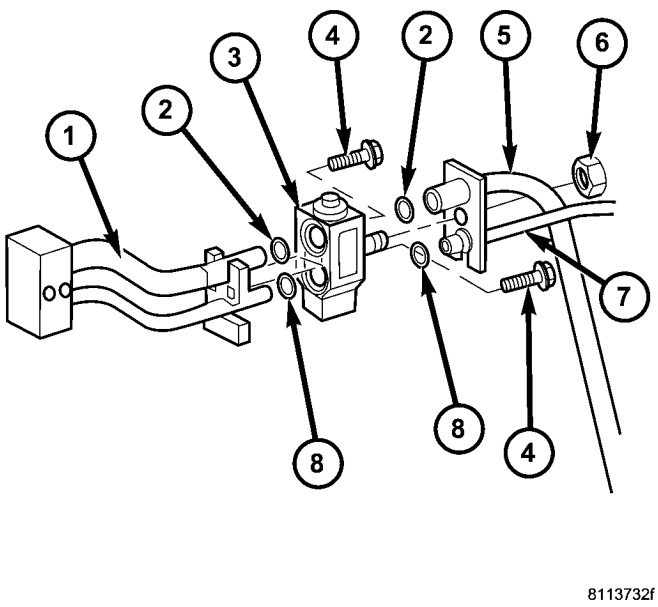


Fig. 10 Expansion Valve

1 - EVAPORATOR TUBE TAPPING PLATE
2 - O-RING SEAL (2)
3 - EXPANSION VALVE
4 - BOLT (2)
5 - SUCTION LINE
6 - NUT
7 - LIQUID LINE
8 - O-RING SEAL (2)

(2) Remove the tape or plugs from the liquid line fitting and the receiver/drier inlet port.

(3) Lubricate a new rubber O-ring seal with clean refrigerant oil and install it on the liquid line fitting.

(4) Connect the front section of the liquid line to the receiver/drier.

(5) Install the bolt that secures the liquid line fitting to the receiver/drier. Tighten the bolt to 7 N·m (62 in. lbs.).

(6) Position the front section of the liquid line into the routing clip and install the routing clip onto the body stud on the left frame rail.

(7) Install the routing clip retaining nut. Tighten the nut to 5 N·m (45 in. lbs.).

(8) Remove the tape or plugs from the condenser outlet port and the liquid line fitting.

(9) Lubricate a new O-ring seal with clean refrigerant oil and install it on the liquid line fitting.

(10) Connect the liquid line fitting to the condenser outlet port on the right side of the condenser.

(11) Install the nut that secures the liquid line fitting to the condenser. Tighten the nut to 17 N·m (12 ft. lbs.).

(12) Reinstall the A/C pressure transducer (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/A/C PRESSURE TRANSDUCER - INSTALLATION).

(13) Install the grille (Refer to 23 - BODY/EXTERIOR/GRILLE - INSTALLATION).

(14) Reconnect the battery negative cable.

(15) Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT - STANDARD PROCEDURE).

(16) Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT - STANDARD PROCEDURE).

REAR SECTION

(1) Position the rear section of the liquid line into the engine compartment.

(2) Remove the tape or plugs from the liquid and suction line fittings, the receiver/drier outlet port and both expansion valve ports.

(3) Lubricate new rubber O-ring seals with clean refrigerant oil and install them onto the suction and liquid line fittings for the expansion valve.

(4) Connect the liquid line and suction line fittings to the expansion valve.

(5) Install the nut that secures the suction line and liquid line fittings to the stud on the expansion valve. Tighten the nut to 10 N·m (89 in. lbs.).

(6) Lubricate new rubber O-ring seal with clean refrigerant oil and install it on the liquid line fitting.

(7) Connect the liquid line fitting to the receiver/drier outlet port.

(8) Install the bolt that secures the liquid line fitting to the receiver/drier. Tighten the bolt to 7 N·m (62 in. lbs.).

(9) Install the routing clip retainer to the rear section of the liquid line.

(10) Install the grille (Refer to 23 - BODY/EXTERIOR/GRILLE - INSTALLATION).

(11) Reconnect the battery negative cable.

(12) Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT - STANDARD PROCEDURE).

(13) Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT - STANDARD PROCEDURE).

REAR EVAPORATOR

REMOVAL

WARNING: REFER TO THE APPLICABLE WARNINGS AND CAUTIONS FOR THIS SYSTEM BEFORE PERFORMING THE FOLLOWING OPERATION (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION).

REAR EVAPORATOR (Continued)

(1) Remove the rear A/C housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/ REAR A/C HEATER HOUSING - REMOVAL).
(2) Remove the liquid line between the rear expansion valve and the solenoid valve.
(3) Remove the seals from the liquid line fittings and discard.
(4) Install plug in, or tape over the opened liquid line fittings and the solenoid valve outlet port and the expansion valve inlet port.
(5) Remove the condensation trap.
(6) Remove the two bolts that secure the expansion valve to the rear evaporator tube tapping plate (Fig. 11).
(7) Remove the expansion valve from the rear evaporator tube tapping plate.
(8) Remove the seals from the evaporator inlet and outlet tube fittings and discard.
(9) Install plugs in, or tape over the opened evaporator inlet and outlet tube fittings and all expansion valve ports.
(10) Remove the sensor probe from the rear evaporator.
(11) Remove the humidity protection sleeve from the rear evaporator.
(12) Drill out the rivets that secure the evaporator to the mounting plate.
(13) Remove the rear evaporator from the mounting plate.

INSTALLATION

(1) Position the rear evaporator onto the mounting plate.
(2) Install new rivets to secure the evaporator to the mounting plate.
(3) Install the humidity protection sleeve to the rear evaporator.
(4) Install the sensor probe between the rear evaporator coil fins.
(5) Remove the tape or plug from the evaporator inlet and outlet tube fittings and expansion valve ports.
(6) Lubricate new rubber o-ring seals with clean refrigerant oil and install them on the evaporator inlet and outlet tube fittings.
(7) Position the expansion valve onto the tapping plate evaporator inlet and outlet tube fittings.
(8) Install and tighten the two bolts that secure the expansion valve to the evaporator tube tapping plate. Tighten the bolts to 5 N·m (45 in. lbs.).
(9) Install the condensation trap.
(10) Install the condensation trap screws. Tighten the screws to 2 N·m (17 in. lbs.).

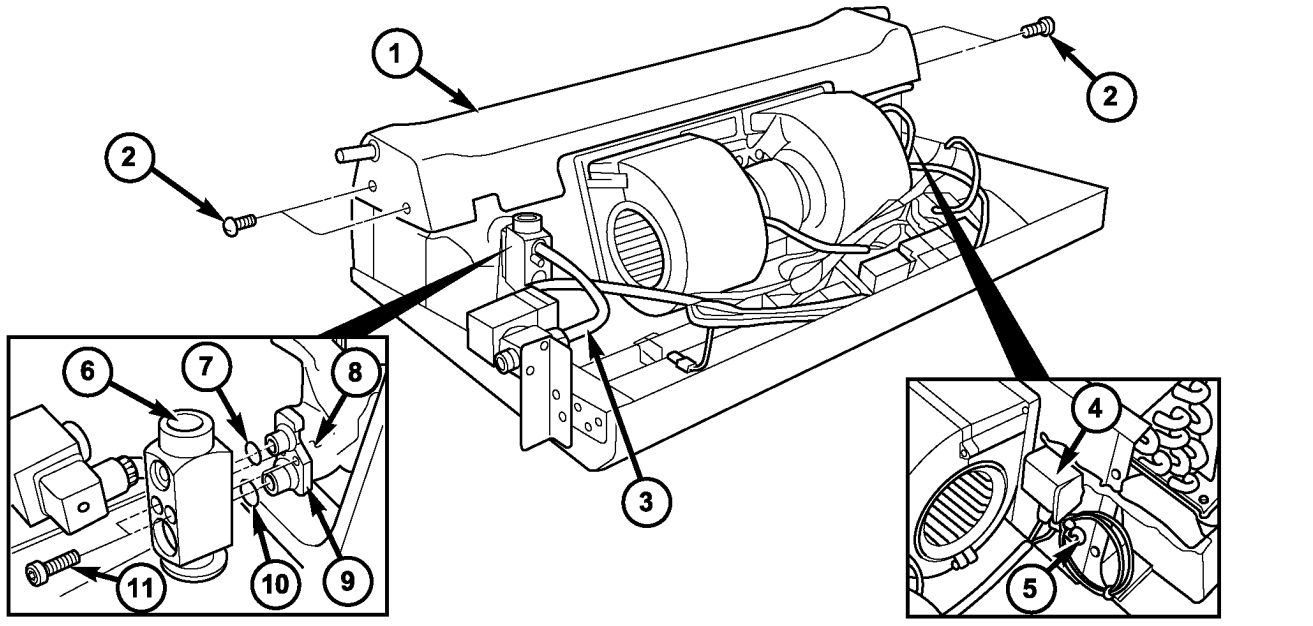


Fig. 11 Rear A/C Evaporator

1 - CONDENSATION TRAP
2 - SCREW (4)
3 - LIQUID REFRIGERANT LINE
4 - EVAPORATOR TEMPERATURE SENSOR
5 - TEMPERATURE SENSOR PROBE
6 - REAR EXPANSION VALVE
7 - O-RING
8 - HUMIDITY PROTECTION SLEEVE
9 - REAR EVAPORATOR
10 - O-RING
11 - BOLT (2)

REAR EVAPORATOR (Continued)

(11) Remove the tape or plug from the liquid line fittings and the solenoid valve outlet port and the expansion valve inlet port.

(12) Lubricate new rubber o-ring seals with clean refrigerant oil and install them on the liquid line fittings.

(13) Install the liquid line between the rear expansion valve and the solenoid valve.

(14) Install and tighten the nuts that secures the liquid line fittings to the rear expansion valve and solenoid valve. Tighten the nuts to 16 N·m (142 in. lbs.).

(15) Install the rear A/C housing (Refer to 24 - HEATING & AIR CONDITIONING/DISTRIBUTION/ REAR A/C HEATER HOUSING - INSTALLATION).

NOTE: If the evaporator is being replaced, add 30 milliliters (1 fluid ounce) of refrigerant oil to the refrigerant system.

REAR EXPANSION VALVE

REMOVAL

WARNING: REFER TO THE APPLICABLE WARNINGS AND CAUTIONS FOR THIS SYSTEM BEFORE PERFORMING THE FOLLOWING OPERATION (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION).

(1) Recover the refrigerant from the A/C system (Refer to 24 - HEATING & AIR CONDITIONING/ PLUMBING - STANDARD PROCEDURE).

(2) Disconnect and isolate the battery negative cable.

(3) Remove the rear dome light from the rear roof duct panel (Fig. 12).

(4) Disconnect the dome light wire harness connector and remove the dome light from vehicle.

(5) Remove the six push-pin roof duct panel fasteners and remove the duct panel from the vehicle.

(6) Remove the five evaporator panel screws at the front of the panel.

(7) If equipped, remove the interior motion sensor from the evaporator panel, disconnect the wire harness connector and remove the motion sensor from the vehicle (Fig. 13).

(8) Remove the three push-pin evaporator panel fasteners at the rear of the panel.

(9) Remove the rear evaporator panel from the vehicle.

(10) Remove the liquid line between the rear expansion valve and the solenoid valve (Fig. 14).

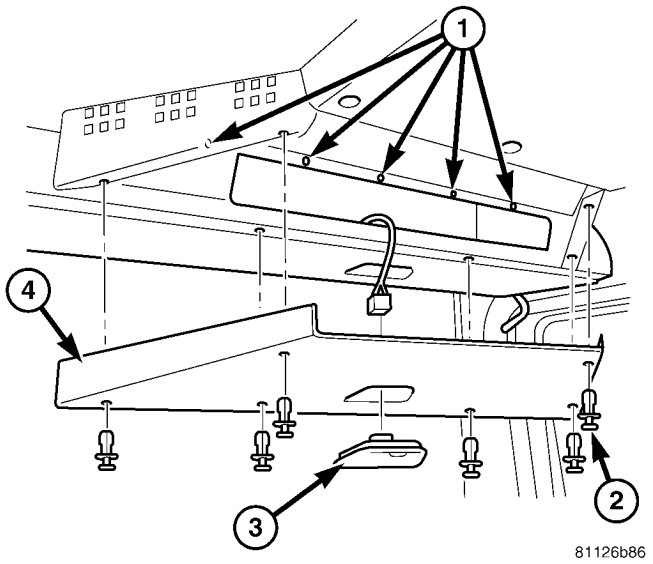


Fig. 12 Rear Roof Duct Panel

1 - SCREW (5)
2 - PUSH-PIN FASTENER (6)
3 - REAR DOME LAMP
4 - ROOF DUCT PANEL

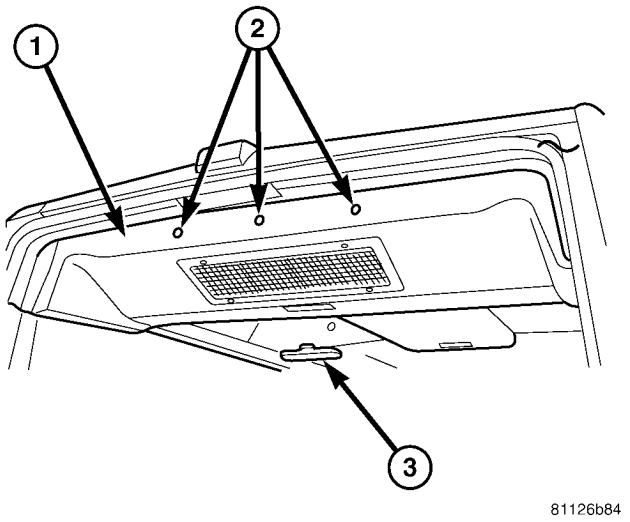


Fig. 13 Rear Evaporator Panel

1 - REAR EVAPORATOR PANEL
2 - PUSH-PIN FASTENER (3)
3 - INTERIOR MOTION SENSOR

(11) Remove the refrigerant line from the rear expansion valve outlet port.

(12) Install plug in, or tape over the refrigerant line fittings and the solenoid and expansion valve ports.

(13) Remove the two bolts that secure the expansion valve to the rear evaporator tube tapping plate.

(14) Remove the expansion valve from the rear evaporator tube tapping plate.

REAR EXPANSION VALVE (Continued)

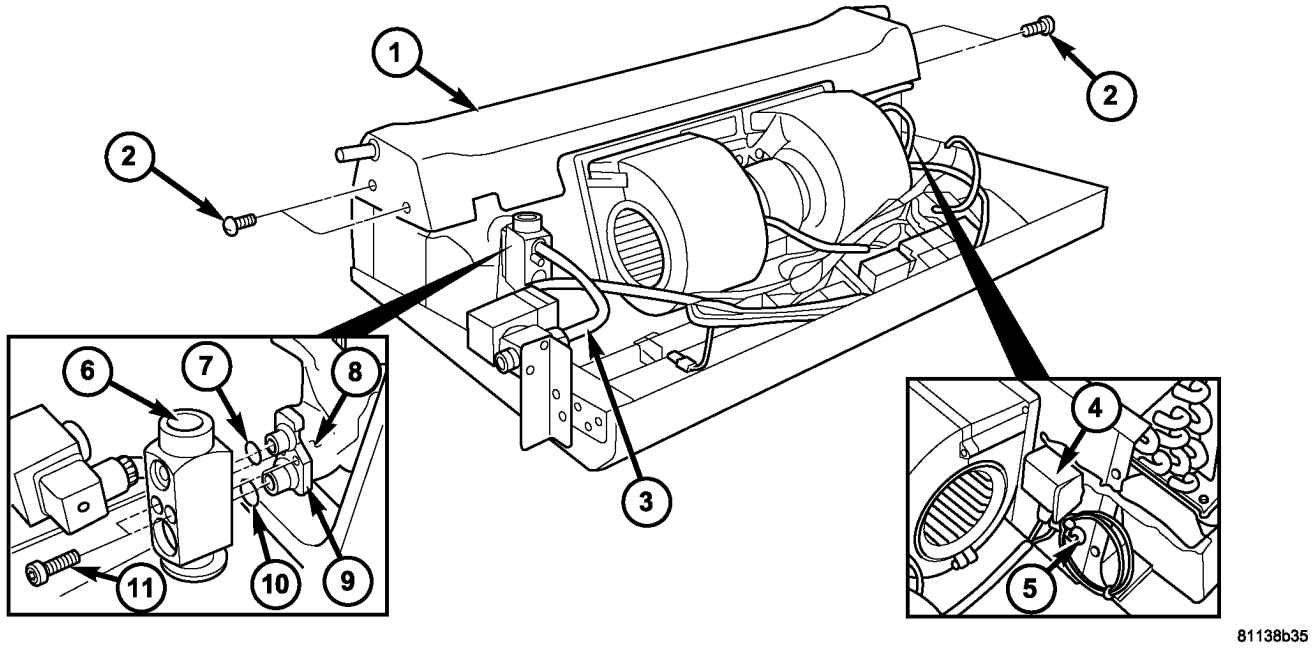


Fig. 14 Rear A/C Evaporator

1 - CONDENSATION TRAP
2 - SCREW (4)
3 - LIQUID REFRIGERANT LINE
4 - EVAPORATOR TEMPERATURE SENSOR
5 - TEMPERATURE SENSOR PROBE
6 - REAR EXPANSION VALVE
7 - O-RING
8 - HUMIDITY PROTECTION SLEEVE
9 - REAR EVAPORATOR
10 - O-RING
11 - BOLT (2)

(15) Remove the seals from the evaporator inlet and outlet tube fittings and discard.

(16) Install plugs in, or tape over the opened evaporator inlet and outlet tube fittings and all expansion valve ports.

INSTALLATION

(1) Remove the tape or plug from the rear evaporator inlet and outlet tube fittings and expansion valve ports.

(2) Lubricate new rubber o-ring seals with clean refrigerant oil and install them on the rear evaporator inlet and outlet tube fittings.

(3) Position the rear expansion valve onto the rear evaporator tapping plate fittings.

(4) Install and tighten the two bolts that secure the expansion valve to the evaporator tube tapping plate. Tighten the bolts to 5 N·m (45 in. lbs.).

(5) Remove the tape or plug from the refrigerant line fittings and the solenoid and expansion valve ports.

(6) Lubricate new rubber o-ring seals with clean refrigerant oil and install them on the liquid line fittings.

(7) Install the liquid line between the rear expansion valve and the solenoid valve.

(8) Install and tighten the nuts that secures the liquid line fittings to the rear expansion valve and solenoid valve. Tighten the nuts to 16 N·m (142 in. lbs.).

(9) Install the rear evaporator panel and the three push-pin fasteners.

(10) If equipped, connect the interior motion sensor wire harness connector and install the interior motion sensor into the evaporator panel.

(11) Install the five evaporator panel screws at the front of the panel. Tighten the screws to 2 N·m (17 in. lbs.).

(12) Install the roof duct panel and six push-pin fasteners.

(13) Connect the dome light wire harness connector and install the dome light into the rear roof duct panel.

(14) Reconnect the battery negative cable.

(15) Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(16) Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

RECEIVER/DRIER

DESCRIPTION

The receiver/drier is mounted in a bracket secured to the left front strut tower in the engine compartment. The receiver/drier is connected between the front and rear sections of the liquid line between the condenser outlet and the evaporator inlet. The receiver/drier cannot be repaired. If the receiver/drier is faulty or damaged, or if the refrigerant system has been contaminated or left open to the atmosphere for an indeterminable period or if the compressor has failed, it must be replaced.

OPERATION

The receiver/drier performs a filtering action to prevent foreign material in the refrigerant from contaminating the expansion valve. A desiccant bag is mounted inside the receiver/drier canister to absorb any moisture which may have entered and become trapped within the refrigerant system. In addition, during periods of high demand air conditioner operation, the receiver/drier acts as a reservoir to store surplus refrigerant. Refrigerant enters the receiver/drier as a high-pressure, low-temperature liquid.

REMOVAL

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION).

(1) Recover the refrigerant from the refrigerant system(Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(2) Remove the bolts that secure the front and rear sections of the liquid line to the top of the receiver/drier (Fig. 15).

(3) Disconnect the liquid line fittings from the receiver/drier.

(4) Remove the seals from the liquid line fittings and discard.

(5) Install a plug in, or tape over the opened liquid line fittings and the receiver/drier ports.

(6) Loosen the clamp that secures the receiver/drier to the mounting bracket.

(7) Remove the receiver/drier from the engine compartment.

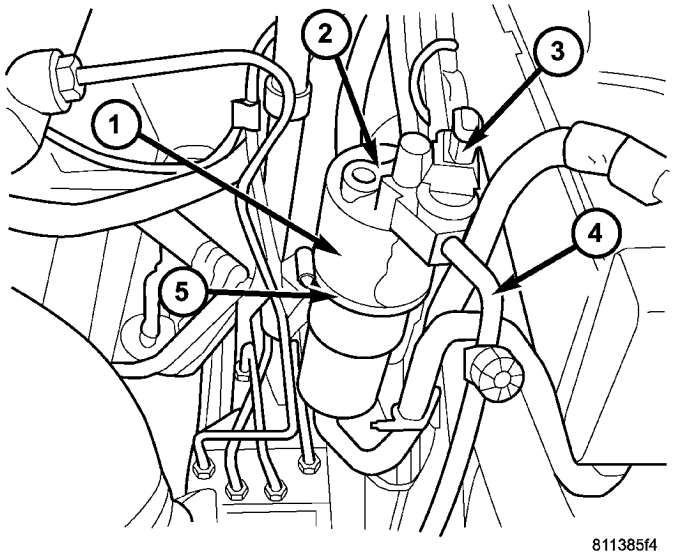


Fig. 15 Receiver/Drier

1 - RECEIVER/DRIER
2 - LIQUID LINE (REAR SECTION)
3 - A/C PRESSURE TRANSDUCER
4 - LIQUID LINE (FRONT SECTION)
5 - CLAMP

INSTALLATION

NOTE: If the receiver/drier is being 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.

(1) Position the receiver/drier onto the mounting bracket on the front left strut tower.

(2) Tighten the clamp that secures the receiver/drier to the mounting bracket.

(3) Remove the tape or plugs from the liquid line fittings and the receiver/drier ports.

(4) Lubricate new rubber O-ring seals with clean refrigerant oil and install them on the liquid line fittings.

(5) Connect the front and rear sections of the liquid line to the receiver/drier.

(6) Install the bolts that secures the liquid line fittings to the receiver/drier. Tighten the bolts to 7 N·m (62 in. lbs.).

(7) Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).

(8) Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

REFRIGERANT

DESCRIPTION

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.

OPERATION

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 OIL

DESCRIPTION

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.

OPERATION

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.

STANDARD PROCEDURE - 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 receiver-drier, 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 receiver/drier, 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 (Continued)

REFRIGERANT OIL CAPACITIES

Component	ml	fl oz
Total System Fill	410 (425 w/rear A/C)	13.9 (14.4 w/rear A/C
Receiver/Drier	30	1.0
Condenser	30	1.0
Front Evaporator	60	2.0
Rear Evaporator	30	1.0
Compressor	Drain and measure the oil from the old compressor - see text.	

SUCTION LINE

REMOVAL

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION).

(1) Recover the refrigerant system. (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT RECOVERY)

(2) Disconnect and isolate the negative battery cable.

(3) Remove the routing clip retaining nut and disengage the metal routing clip from the suction line.

(4) Disengage the plastic routing clip located near the expansion valve from the suction line.

(5) Remove the nut that secures the suction and liquid line fittings to the stud on the expansion valve (Fig. 16).

(6) Disconnect the suction and liquid lines from the expansion valve.

(7) Remove the seals from the suction and liquid line fitting and discard.

(8) Install plugs in, or tape over the opened liquid and suction line fittings and both expansion valve ports.

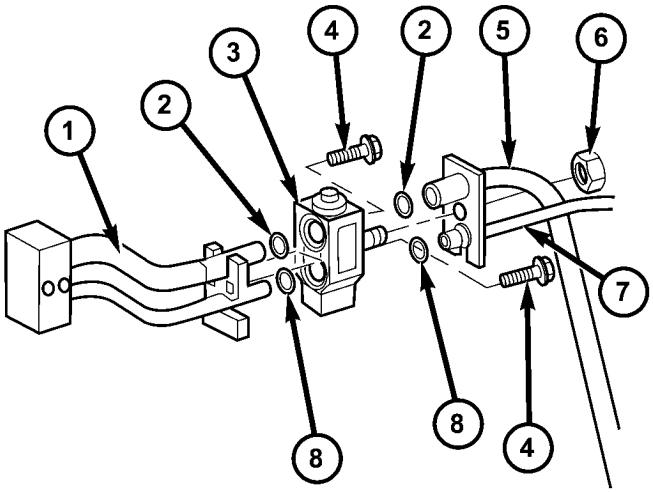
(9) Remove the bolt that secures the suction line fitting to the top of the compressor (Fig. 17).

(10) Disconnect the suction line fitting from the compressor suction port.

(11) Remove the O-ring seal from the suction line fitting and discard.

(12) Install plugs in, or tape over the opened suction line fitting and the compressor suction port.

(13) Remove the suction line from the vehicle.



8113732f

Fig. 16 Expansion Valve

1 - EVAPORATOR TUBE TAPPING PLATE
2 - O-RING SEAL (2)
3 - EXPANSION VALVE
4 - BOLT (2)
5 - SUCTION LINE
6 - NUT
7 - LIQUID LINE
8 - O-RING SEAL (2)

INSTALLATION

(1) Position the suction line into the engine compartment.

(2) Remove plugs or tape from the suction line fitting and the compressor suction port.

(3) Lubricate a new rubber O-ring seal with clean refrigerant oil and install it onto the suction line fitting.

(4) Connect the suction line fitting to the compressor suction port.

(5) Install the bolt that secures the suction line fitting to the top of the compressor. Tighten the bolt to 23 N·m (17 ft. lbs.).

(6) Remove the tape or plugs from the liquid and suction line fittings and both expansion valve ports.

(7) Lubricate new rubber O-ring seals with clean refrigerant oil and install them on the liquid and suction line fittings.

(8) Reconnect the liquid line fitting to the expansion valve.

(9) Reconnect the suction line fitting to the expansion valve.

(10) Install the nut that secures the suction line and liquid line fittings to the stud on the expansion valve. Tighten the nut to 10 N·m (89 in. lbs.).

SUCTION LINE (Continued)

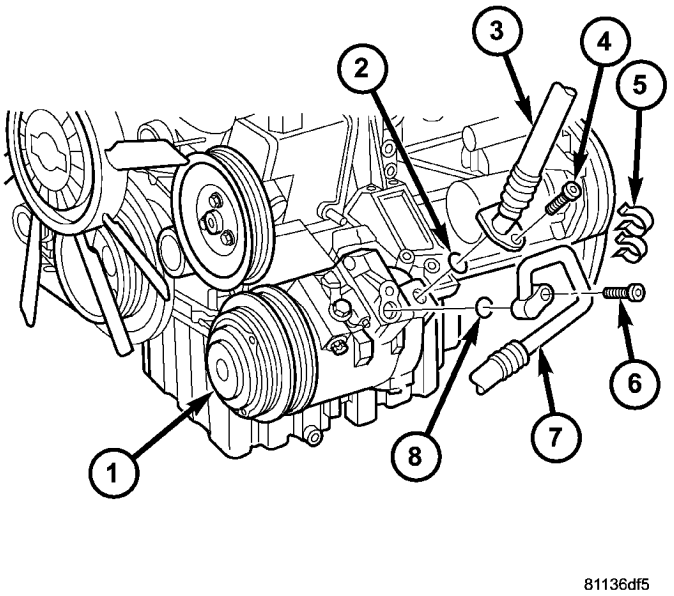


Fig. 17 A/C Compressor - Refrigerant Lines

1 - A/C COMPRESSOR
2 - O-RING SEAL
3 - SUCTION LINE
4 - BOLT
5 - RETAINING CLIP
6 - BOLT
7 - DISCHARGE LINE
8 - O-RING SEAL

(11) Position the metal routing clip around the suction line and install the routing clip onto the body stud.

(12) Install the routing clip retaining nut. Tighten the nut to 5 N·m (45 in. lbs.).

(13) Install the plastic routing clip retainer onto the suction line.

(14) Reconnect the negative battery cable.

(15) Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).

(16) Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

WATER VALVE

REMOVAL

(1) Disconnect and isolate the battery negative cable.

(2) Partially drain the engine cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

(3) Disconnect the wire harness connector from the heater water valve (Fig. 18).

(4) Loosen the hose clamps from the heater water valve.

(5) Using a twisting motion gently remove the heater hoses from the heater water valve.

(6) Remove the bolts that secure the heater water valve bracket.

(7) Remove the bracket and pulsed water control valve from the engine compartment.

(8) Turn the bracket slightly and remove the water valve from the rubber mounts.

(9) If necessary, remove the rubber mounts from the bracket or water valve.

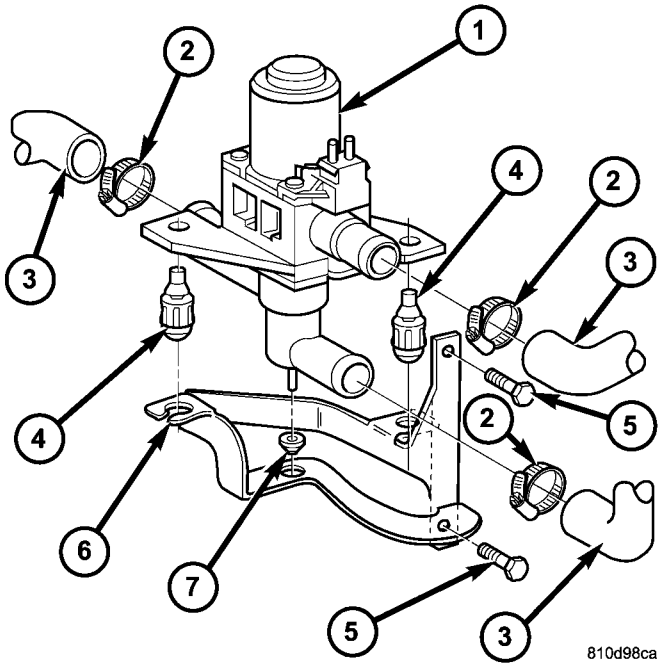


Fig. 18 Pulsed Water Control Valve

1 - HEATER WATER VALVE
2 - HOSE CLAMP (3)
3 - HEATER HOSE (3)
4 - RUBBER MOUNT (2)
5 - BOLTS (2)
6 - BRACKET
7 - RUBBER MOUNT

INSTALLATION

(1) If removed, install the rubber mounts to the heater water valve or bracket.

(2) Turn bracket slightly to the right and install the heater water valve to the bracket.

(3) Install the water valve and mounting bracket into the engine compartment.

(4) Install the two bracket retaining bolts. Tighten the bolts to 5 N·m (45 in. lbs.).

(5) Using a twisting motion gently install the heater hoses onto the water valve.

(6) Tighten the hose clamps securely.

WATER VALVE (Continued)

(7) Connect the wire harness connector to the heater water valve.

(8) Reconnect the battery negative cable.

(9) Fill the cooling system (Refer to 7 - COOLING/ENGINE/COOLANT - STANDARD PROCEDURE).

UNDERBODY LINES

REMOVAL

The rear refrigerant lines for the optional rear A/C system is serviced in four sections. The liquid line for the optional rear A/C system uses a spring-lock refrigerant line coupler which requires the use of a 3/8 inch quick-disconnect tool (part of Special Tool, A/C Line Disconnect Kit 7193).

WARNING: REVIEW THE WARNINGS AND CAUTIONS IN THE FRONT OF THIS SECTION BEFORE PERFORMING THE FOLLOWING OPERATION (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - WARNING) and (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - CAUTION).

FRONT LIQUID LINE

(1) Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(2) Disconnect and isolate the battery negative cable.

(3) Disconnect the rear section of the front liquid line from the receiver-drier and the evaporator (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/LIQUID LINE - REMOVAL).

(4) Disconnect the fitting to the intermediate liquid line using Special Tool, A/C Line Disconnect Kit 7193.

(5) Remove the seals from the liquid line fittings and discard.

(6) Install plug in, or tape over the open liquid line fittings, the reciever-drier outlet port and the expansion valve ports.

(7) Remove the front liquid line from the engine compartment.

FRONT SUCTION LINE

(1) Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE).

(2) Disconnect and isolate the battery negative cable.

(3) Remove the nut that secures the intermediate suction line fitting to the stud on the front suction line tapping plate.

(4) Disconnect the intermediate suction line fitting from the front suction line tapping plate.

(5) Install plug in, or tape over the open suction line fitting and the front suction line tapping plate inlet port.

(6) Disconnect the front suction line from the compressor and front evaporator valve (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/SUCTION LINE - REMOVAL).

(7) Remove the seals from the open suction line fittings and discard.

(8) Install plug in, or tape over the open suction line fittings, the compressor inlet port and the expansion valve ports.

(9) Remove the front suction line from the engine compartment.

(10) If necessary, remove the bolt that secures the compressor portion of the front suction line to the front suction line tapping plate, separate the front suction lines, remove and discard the seal and, plug in, or tape over the open suction line fittings.

INTERMEDIATE REFRIGERANT LINES

(1) Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT - STANDARD PROCEDURE).

(2) Disconnect and isolate the battery negative cable.

(3) Disconnect the intermediate liquid line from the front liquid line using Special Tool, A/C Line Disconnect Kit 7193.

(4) Remove the nut that secures the intermediate suction line fitting to the stud on the front suction line tapping plate.

(5) Disconnect the intermediate suction line from the front suction line tapping plate.

(6) Remove the seals from the liquid and suction line fittings and discard.

(7) Install plug in, or tape over the open suction and liquid line fittings and the front suction line tapping plate inlet port.

(8) Raise and support the vehicle.

(9) Disconnect the fittings that secure the intermediate refrigerant lines to the rear refrigerant lines.

(10) Remove the seals from the open liquid and suction line fittings and discard.

(11) Install plugs in, or tape over the open liquid and suction line fittings.

(12) Remove the bolts that secure the two intermediate refrigerant line retaining blocks to the vehicle underbody.

(13) Remove the intermediate section of the rear refrigerant lines from the vehicle underbody.

REAR REFRIGERANT LINES

(1) Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITION-

UNDERBODY LINES (Continued)

ING/PLUMBING/REFRIGERANT - STANDARD PROCEDURE).

(2) Disconnect and isolate the battery negative cable.

(3) Remove the interior trim panel from the right quarter panel (Refer to 23 - BODY/INTERIOR/QUARTER TRIM PANEL - REMOVAL).

(4) Disconnect the fittings that secure the rear refrigerant lines to the sidewall refrigerant lines.

(5) Remove the seals from the open liquid and suction line fittings and discard.

(6) Install plugs in, or tape over the open liquid and suction line fittings.

(7) Raise and support the vehicle.

(8) Disconnect the fittings that secure the intermediate refrigerant lines to the rear refrigerant lines.

(9) Remove the seals from the open liquid and suction line fittings and discard.

(10) Install plugs in, or tape over the open liquid and suction line fittings.

(11) Remove the propeller shaft (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - REMOVAL).

(12) Remove the seal from the right inner sidewall.

(13) Carefully pull the rubber rear refrigerant lines out from the sidewall.

(14) Remove the bolts that secure the four rear refrigerant line retaining blocks to the vehicle underbody.

(15) Remove the rear section of the rear refrigerant lines from the vehicle underbody.

SIDEWALL REFRIGERANT LINES

(1) Recover the refrigerant from the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REFRIGERANT - STANDARD PROCEDURE).

(2) Disconnect and isolate the battery negative cable.

(3) Disconnect the suction line from the rear expansion valve outlet port (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REAR EXPANSION VALVE - REMOVAL).

(4) Disconnect the liquid line from rear solenoid valve inlet port (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/SOLENOID - REMOVAL).

(5) Remove the seals from the open liquid and suction line fittings and discard.

(6) Install plugs in, or tape over the open liquid and suction line fittings and, the rear solenoid and expansion valve ports.

(7) Remove the interior trim panel from the right quarter panel (Refer to 23 - BODY/INTERIOR/QUARTER TRIM PANEL - REMOVAL).

(8) Disconnect the fittings that secure the rear refrigerant lines to the sidewall refrigerant lines.

(9) Remove the seals from the open liquid and suction line fittings and discard.

(10) Install plugs in, or tape over the open liquid and suction line fittings.

(11) Remove the bolts that secure the two refrigerant line retaining blocks to the vehicle sidewall.

(12) Carefully pull the rubber refrigerant lines out from the sidewall.

(13) Remove the sidewall section of the rear refrigerant lines from the vehicle.

INSTALLATION

FRONT LIQUID LINE

(1) Install the front liquid line into the engine compartment.

(2) Remove plugs or tape from the liquid line fittings, the reciever-drier outlet port and the expansion valve ports.

(3) Lubricate new rubber o-ring seals with clean refrigerant oil and install the seals onto the liquid line fittings.

(4) Connect the quick-disconnect front liquid line fitting to the intermediate liquid line.

(5) Connect the rear section of the front liquid line to the receiver-drier and the evaporator (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/LIQUID LINE - INSTALLATION).

(6) Reconnect the battery negative cable.

(7) Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).

(8) Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

FRONT SUCTION LINE

(1) If the compressor portion of the front suction line was separated from the front suction line tapping plate, remove plugs or tape from the suction line fitting, lubricate a new rubber o-ring seal with clean refrigerant oil and install the seal onto the suction line fitting and, install the bolt that secures the compressor portion of the front suction line to the front suction line tapping plate. Tighten the bolt to 5 N·m (45 in. lbs.).

(2) Install the front suction line into the engine compartment.

(3) Remove plugs or tape from the suction line fittings, the compressor inlet port and the expansion valve ports.

(4) Lubricate new rubber o-ring seals with clean refrigerant oil and install the seals onto the suction line fittings.

UNDERBODY LINES (Continued)

(5) Connect the front suction line to the compressor and front evaporator valve (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/SUCTION LINE - INSTALLATION).

(6) Remove plugs or tape from the intermediate suction line fitting and the front suction line tapping plate inlet port.

(7) Lubricate a new rubber o-ring seal with clean refrigerant oil and install the seal onto the intermediate suction line fitting.

(8) Connect the intermediate suction line fitting to the front suction line tapping plate.

(9) Install the nut that secures the intermediate suction line fitting to the stud on the front suction line tapping plate. Tighten the nut to 10 N·m (89 in. lbs.).

(10) Reconnect the battery negative cable.

(11) Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).

(12) Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

INTERMEDIATE REFRIGERANT LINES

(1) Raise and support the vehicle.

(2) Install the intermediate section of the rear refrigerant lines to the vehicle underbody.

(3) Install the bolts that secure the two intermediate refrigerant line retaining blocks to the vehicle underbody. Tighten the bolts to 5 N·m (45 in. lbs.).

(4) Remove plugs or tape from the open intermediate and rear refrigerant line fittings.

(5) Lubricate new rubber o-ring seals with clean refrigerant oil and install the seals onto the intermediate-to-rear refrigerant line fittings.

(6) Connect the fittings that secure the intermediate refrigerant lines to the rear refrigerant lines. Tighten the liquid line fitting to 16 N·m (142 in. lbs.). Tighten the suction line fitting to 30 N·m (22 ft. lbs.).

(7) Lower the vehicle.

(8) Connect the quick-disconnect front liquid line fitting to the intermediate liquid line.

(9) Remove plugs or tape from the intermediate suction line fitting and the front suction line tapping plate inlet port.

(10) Lubricate a new rubber o-ring seal with clean refrigerant oil and install the seal onto the intermediate suction line fitting.

(11) Connect the intermediate suction line fitting to the front suction line tapping plate.

(12) Install the nut that secures the intermediate suction line fitting to the stud on the front suction line tapping plate. Tighten the nut to 10 N·m (89 in. lbs.).

(13) Reconnect the battery negative cable.

(14) Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).

(15) Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

REAR REFRIGERANT LINES

(1) Raise and support the vehicle.

(2) Install the rear section of the rear refrigerant lines to the vehicle underbody.

(3) Install the bolts that secure the four rear refrigerant line retaining blocks to the vehicle underbody. Tighten the bolts to 5 N·m (45 in. lbs.).

(4) Carefully route the rubber rear refrigerant lines into the right sidewall.

(5) Install the seal into the inner sidewall.

(6) Install the propeller shaft (Refer to 3 - DIFFERENTIAL & DRIVELINE/PROPELLER SHAFT/PROPELLER SHAFT - INSTALLATION).

(7) Remove plugs or tape from the open intermediate and rear refrigerant line fittings.

(8) Lubricate new rubber o-ring seals with clean refrigerant oil and install the seals onto the intermediate-to-rear refrigerant line fittings.

(9) Connect the fittings that secure the intermediate refrigerant lines to the rear refrigerant lines. Tighten the liquid line fitting to 16 N·m (142 in. lbs.). Tighten the suction line fitting to 30 N·m (22 ft. lbs.).

(10) Lower the vehicle.

(11) Remove plugs or tape from the open sidewall and rear refrigerant line fittings.

(12) Lubricate new rubber o-ring seals with clean refrigerant oil and install the seals onto the rear-to-sidewall refrigerant line fittings.

(13) Connect the fittings that secure the rear refrigerant lines to the sidewall refrigerant lines. Tighten the liquid line fitting to 16 N·m (142 in. lbs.). Tighten the suction line fitting to 30 N·m (22 ft. lbs.).

(14) Install the interior trim panel from the right quarter panel (Refer to 23 - BODY/INTERIOR/QUARTER TRIM PANEL - INSTALLATION).

(15) Reconnect the battery negative cable.

(16) Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).

(17) Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

UNDERBODY LINES (Continued)

SIDEWALL REFRIGERANT LINES

(1) Install the sidewall section of the rear refrigerant lines to the vehicle.

(2) Carefully route the rubber refrigerant lines through the sidewall.

(3) Install the bolts that secure the two refrigerant line retaining blocks to the vehicle sidewall. Tighten the bolts to 5 N·m (45 in. lbs.).

(4) Remove plugs or tape from the open rear and sidewall refrigerant line fittings.

(5) Lubricate new rubber o-ring seals with clean refrigerant oil and install the seals onto the rear-to-sidewall refrigerant line fittings.

(6) Connect the fittings that secure the rear refrigerant lines to the sidewall refrigerant lines. Tighten the liquid line fitting to 16 N·m (142 in. lbs.). Tighten the suction line fitting to 30 N·m (22 ft. lbs.).

(7) Install the interior trim panel from the right quarter panel (Refer to 23 - BODY/INTERIOR/QUARTER TRIM PANEL - INSTALLATION).

(8) Remove plugs or tape from the open sidewall liquid and suction line fittings and, the rear solenoid and expansion valve ports.

(9) Lubricate new rubber o-ring seals with clean refrigerant oil and install the seals onto the sidewall refrigerant line fittings.

(10) Connect the liquid line to the rear solenoid valve inlet port (Refer to 24 - HEATING & AIR CONDITIONING/CONTROLS/SOLENOID - INSTALLATION).

(11) Connect the suction line to the rear expansion valve outlet port and reinstall the rear A/C evaporator panel and duct (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING/REAR EXPANSION VALVE - INSTALLATION).

(12) Connect the battery negative cable.

(13) Evacuate the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM EVACUATE).

(14) Charge the refrigerant system (Refer to 24 - HEATING & AIR CONDITIONING/PLUMBING - STANDARD PROCEDURE - REFRIGERANT SYSTEM CHARGE).

CABIN HEATER

TABLE OF CONTENTS

page

CABIN HEATER
DESCRIPTION 72
OPERATION 72
DIAGNOSIS AND TESTING - DIESEL SUPPLEMENTAL HEATER - DCHA 72
EXHAUST TUBE
REMOVAL 73
INSTALLATION 73
FUEL DOSING PUMP
DESCRIPTION 74
OPERATION 74
REMOVAL 74
INSTALLATION 74
FUEL LINE
STANDARD PROCEDURE - CLEANING 75
REMOVAL 75
INSTALLATION 76
HEATER UNIT
REMOVAL
REMOVAL 77
REMOVAL 77
INSTALLATION
INSTALLATION 78
INSTALLATION 78
INLET HOSE
REMOVAL 78
INSTALLATION 78

CABIN HEATER

DESCRIPTION

Vehicles equipped with the optional diesel engine are also equipped with a supplemental heater unit. This unit is mounted under the vehicle and operates similar to an oil fired furnace. The heater burns small amounts of fuel to provide additional heat to the coolant. Coolant is routed from the engine, to the supplemental heater, and then to the front heater core. This provides additional heat to the passenger compartment. The system is interfaced to the vehicles on-board computer systems and DRBIII® diagnostics.

The supplemental heater unit has an electronic control module that monitors the heat output of the heater. The heater operates at full load (5 kW), half load or idle mode (no additional heat) depending on coolant temperature.

OPERATION

The supplemental heater is activated via the temperature control on the heater-A/C control. The heater is activated when the temperature control is set to/or above the upper set point. The supplemental heater can operate in a full or partial load range as well as an idle mode, all dependent on the engine coolant temperature. The heater unit will also turn off if the temperature control is set to less than the lower set point. The supplemental heater can take up to three minutes to completely shut down when either the heater temperature is set below the lower set point or the vehicle ignition is turned off.

The supplemental heater only operates when the engine is running, the mileage exceeds 8 kilometer (5 mph) and the fuel tank volume exceeds 1/8 of a tank. The heater should start if the coolant temperature is below 40° C (104° F).

NOTE: Do not apply a strong vacuum directly on the supplemental heater exhaust line. Place the vacuum within 75 mm (3 inches) of the exhaust port. Too strong of a vacuum can prevent the heater from starting. The heater control module monitors the supplemental blower speed and combustion during its start-up.

DIAGNOSIS AND TESTING - DIESEL SUPPLEMENTAL HEATER - DCHA

Refer to the Symptoms Diagnosis table for basic checks of the diesel fueled supplemental heater.

CABIN HEATER (Continued)

SYMPTOMS DIAGNOSIS TABLE

Symptom	Possible Causes
Smell of diesel fuel.	Check heater system integration in vehicle's fuel system. Check fuel lines for leakage, kinks or obstructions. If OK, Inspect the inlet muffler, drain as necessary. Re-test the unit and re-inspect. Inspect the exhaust tube and heater unit for the presence of external fuel. If a volume is observed on the unit or in the exhaust tube or after draining and testing. Remove heater unit from vehicle and repair or replace components as required.
Heater does not achieve full load operation.	Check heater operation with DRBIII® scan tool and replace components as required.
Continuous white smoke from heater exhaust during combustion operation.	Check heater operation with DRBIII® scan tool and replace components as required. White smoke is typical in extreme weather conditions.
Heater can not be switched off.	Check heater operation with DRBIII® scan tool and replace components as required.
Heater does not operate.	Diagnosis cabin heater control module using the DRBIII® scan tool and the procedures listed in Vehicle Performance under Cabin Heater Diagnosis in Group 18.
Loss of coolant (Leakage) or heater develops smoke during combustion operation and exhaust has an extremely sweet smell.	Inspect coolant hoses for leakage, kinks or loose hose connection. Inspect the exhaust tube assembly for continuous flow, if OK there is an internal heater leak and unit should be inspected and components should be replaced as required.
Loss of fuel (dripping).	Check heater system integration in vehicles fuel system. Check fuel line connection for leakage. If OK there is an internal leak and unit should be inspected and replaced as required.

EXHAUST TUBE

REMOVAL

WARNING: THERE IS A POTENTIAL DANGER OF SKIN BURNS AS THE HEATER AND ITS COMPONENTS MAY BE VERY HOT. MAKE SURE THE HEATER IS ALLOWED TO COOL DOWN BEFORE ANY SERVICE WORK ON THE CABIN HEATER SYSTEM IS ATTEMPTED.

(1) Raise and support the vehicle while taking note of the location of the flexible exhaust tube section.

(2) Remove the exhaust clamp at the flexible pipe and steel pipe connection (Fig. 1).

(3) Remove the clamp at the flexible pipe connection and the supplemental heater housing (if required).

(4) Remove the three screws holding the exhaust pipe to the body.

(5) Remove the steel exhaust pipe from the vehicle.

(6) Remove the flexible exhaust pipe from the vehicle (if required).

INSTALLATION

(1) Install the flexible exhaust pipe to the heater unit. Tighten mounting clamp securely.

(2) Position the steel exhaust pipe to the flexible exhaust and install and tighten the mounting clamp securely.

(3) Install the three exhaust pipe screws, adjust pipe placement as needed and tighten the screws securely.

(4) Install the clamp to connect the steel exhaust pipe to the flexible exhaust pipe and tighten clamp securely.

(5) Check exhaust pipe exhaust end placement and make any final adjustments.

(6) Lower the vehicle.

EXHAUST TUBE (Continued)

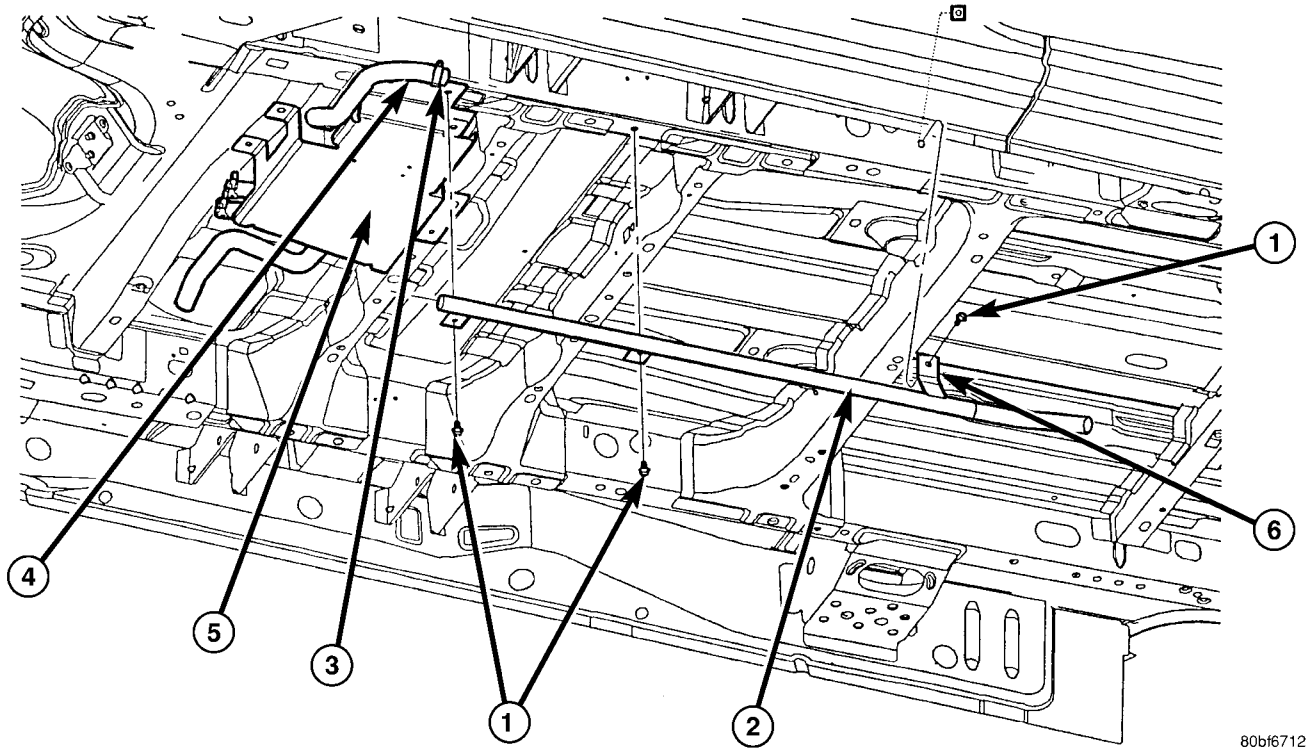


Fig. 1 Diesel Cabin Heater Exhaust System

1 - MOUNTING SCREW (3)
2 - STEEL HEATER EXHAUST PIPE
3 - EXHAUST CLAMP (2)
4 - FLEXIBLE HEATER EXHAUST PIPE
5 - HEATER SHIELD
6 - EXHAUST PIPE MOUNTING CLIP (3)

FUEL DOSING PUMP

DESCRIPTION

The dosing pump is a combined delivery, dosing and shut-off system for the fuel supply to the supplemental heater from the vehicle fuel tank.

OPERATION

The dosing pump is an electrically operated pump that receives its operation instructions from the supplemental heater control module. The pump supplies diesel fuel from the vehicle fuel tank to the supplemental heater.

REMOVAL

NOTE: The dosing pump is serviceable without removing the component from the vehicle.

(1) Disconnect the rubber hose at the fuel line to heater fuel pump. Leave the rubber hose on the fuel line (Refer to 24 - HEATING & AIR CONDITIONING/CABIN HEATER/FUEL LINE - REMOVAL) (Fig. 2).

(2) Disconnect the fuel line between the dosing pump and the heater unit.

NOTE: Position and retain the heater fuel line to prevent fuel leakage while servicing the dosing pump.

NOTE: Utilize an approved fuel storage container to catch any residual fuel.

(3) Disconnect the wiring harness connector to the fuel pump by depressing the integral spring and pulling the connector away from the pump.

(4) Remove the dosing pump from the rubber isolator.

INSTALLATION

(1) Install the dosing pump onto the rubber isolator.

(2) Connect the fuel lines to the dosing pump and the heater unit.

NOTE: The connectors should point towards the heater fuel line.

FUEL DOSING PUMP (Continued)

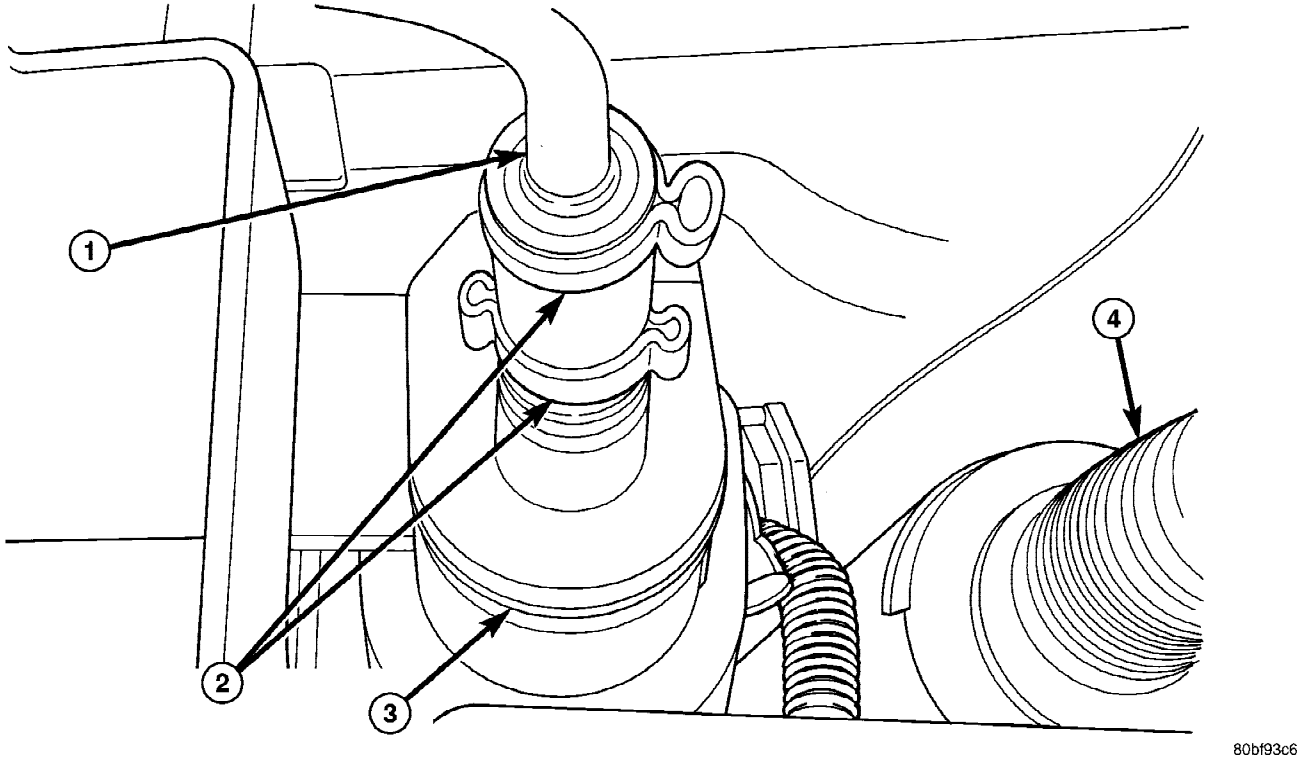


Fig. 2 Dosing Pump Fuel Line

1 - FUEL LINE
2 - RETAINING CLAMP
3 - DOSING PUMP
4 - HEATER AIR INTAKE PIPE

(3) Use aviation style clamps to attach the hose to the fuel pump nipples (Refer to 24 - HEATING & AIR CONDITIONING/CABIN HEATER/FUEL LINE - INSTALLATION).

(4) Connect the wire harness connector to the fuel pump by depressing the integral spring and pushing the connector towards the dosing pump. Pull the connector towards the heater to verify the installation.

(5) Verify function of the supplemental heater.

FUEL LINE

STANDARD PROCEDURE - CLEANING

(1) Remove the cabin heater fuel line (Refer to 24 - HEATING & AIR CONDITIONING/CABIN HEATER/FUEL LINE - REMOVAL).

(2) With the cabin heater line removed from the vehicle, place a shop cloth on the fuel tank end of the fuel line to catch any residue, then apply a small amount of air pressure to the other end of the fuel line.

(3) Check to see if air pressure is coming from the tank end of the line. If pressure is flowing unrestricted the line is clean.

(4) If the line shows any signs of being restricted after air pressure is applied, the fuel line should be replaced.

(5) Install the cabin heater line (Refer to 24 - HEATING & AIR CONDITIONING/CABIN HEATER/FUEL LINE - INSTALLATION).

(6) Verify function of the heater.

REMOVAL

(1) Raise and support the vehicle while taking note of the location of the flexible exhaust tube section.

(2) Remove clamps on dosing pump end of fuel line and separate line from the pump (Fig. 3).

NOTE: Have an approved fuel holding device ready to capture any diesel fuel that drains from the fuel line or heater unit.

(3) Remove clamp from the fuel line at the fuel tank connection and separate the line from the tank.

(4) Remove any retaining clips and remove the fuel line from vehicle.

FUEL LINE (Continued)

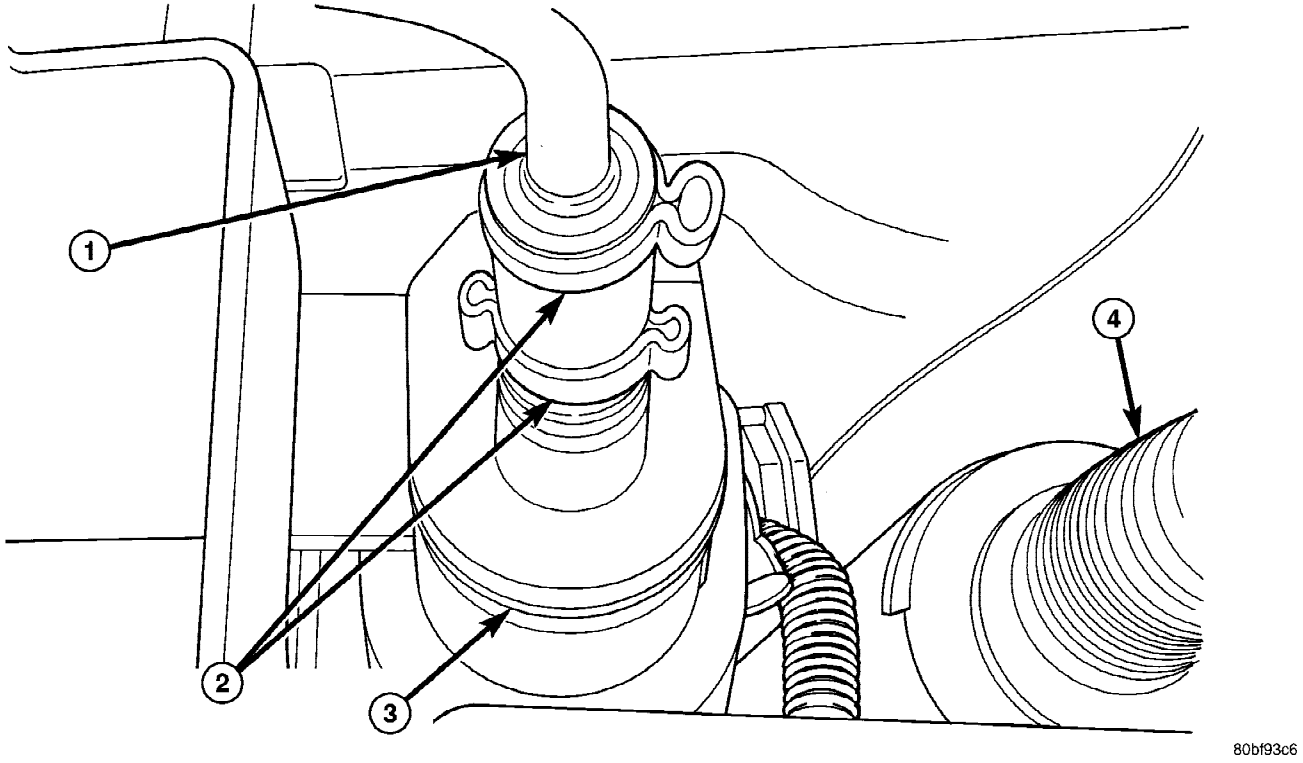


Fig. 3 Dosing Pump Fuel Line

1 - FUEL LINE
2 - RETAINING CLAMP
3 - DOSING PUMP
4 - HEATER AIR INTAKE PIPE

INSTALLATION

WARNING: DO NOT OPERATE THE DCHA IN AN ENCLOSED AREA SUCH AS A GARAGE THAT DOES NOT HAVE EXHAUST VENTILATION FACILITIES. ALWAYS VENT THE DCHA'S EXHAUST WHEN OPERATING THE DCHA. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

WARNING: ALLOW THE DCHA ASSEMBLY TO COOL BEFORE PERFORMING A COMPONENT INSPECTION/REPAIR/REPLACEMENT. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.

WARNING: VERIFY THAT ALL DCHA FUEL LINES ARE SECURELY FASTENED TO THEIR RESPECTIVE COMPONENTS BEFORE PERFORMING THIS PROCEDURE.

NOTE: Verify that there is more than 1/8 of a tank of fuel in the vehicle's fuel tank before performing this procedure. Add fuel, if necessary.

(1) Install the heater fuel supply line into vehicle and fuel line retainers.

(2) Install the fuel line connection at the fuel tank and tighten the connection securely.

(3) Install the fuel line at the dosing pump and tighten the connection securely.

(4) Lower the vehicle.

NOTE: Failure to prime the dosing pump after draining the DCHA fuel line will prevent DCHA heater activation during the first attempt to start the heater. This will also set a Diagnostic Trouble Code (DCT) in the DCHA Control's memory. Do not perform the Dosing Pump Priming procedure if an attempt was made to start the DCHA without priming the dosing pump first. This will put excess fuel in the DCHA Heater Module and cause smoke to emit from the DCHA exhaust pipe when heater activation occurs.

(5) Connect the DRBIII® scan tool to the Diagnostic Link Connector.

(6) Turn the ignition to the ON position.

FUEL LINE (Continued)

NOTE: Do not activate the Dosing Pump Prime more than one time. This will put excess fuel in the DCHA Heater Module an cause smoke to emit from the DCHA exhaust pipe when heater activation occurs.

NOTE: A clicking noise heard coming from the dosing pump indicates that the pump is operational.

(7) With the DRBIII® scan tool in Cabin Heater, select System Tests and Dosing Pump Prime. Allow the dosing pump to run for the full 45 second cycle time. When the 45 second cycle is complete, press Page Back on the DRBIII® scan tool key pad to exit the Dosing Pump Prime. The Dosing Pump Priming procedure is now complete.

HEATER UNIT

REMOVAL

REMOVAL

WARNING: ALLOW THE SUPPLEMENTAL HEATER TO COOL BEFORE PERFORMING A COMPONENT INSPECTION/REPAIR OR REPLACEMENT. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.

WARNING: ALLOW THE EXHAUST SYSTEM TO COOL BEFORE PERFORMING A COMPONENT INSPECTION/REPAIR OR REPLACEMENT. FAILURE TO FOLLOW THESE INSTRUCTION MAY RESULT IN PERSONAL INJURY.

(1) Raise and support the vehicle. Take note of the location of the flexible exhaust tube section.
(2) Drain the engine cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).
(3) Carefully open one hose to the underbody tube assembly and drain the remaining coolant. A salvage hose is a good idea to control the residual coolant, as flow will occur from both the heater and the hose and tube assemblies.
(4) Remove the second hose from the underbody hose and tube assembly.
(5) Loosen the hose and tube assembly from the toe-board cross member at two locations.
(6) Disconnect the electrical connector from the body harness near the toe-board cross member and rail.
(7) Remove the wiring harness from the toe-board cross member (Refer to 24 - HEATING & AIR CONDITIONING/CABIN HEATER/HEATER UNIT - REMOVAL).
(8) Open the fuel filler cap. Disconnect the rubber fuel hose between the body tube assembly and the fuel pump nipple at the body tube joint. A minimal amount of fuel may flow from the open port.

NOTE: Utilize an approved fuel storage container to catch any residual fuel.

(9) Loosen the two fasteners at the rail. Take care to notice that the exhaust tube bracket tab is on top of the heater bracket and that there are two spacer washers installed between the rubber grommets.
(10) Remove the heater exhaust tube flex section from the exhaust tube by loosening the bolt of the clamp assembly. Remove the hose from the exhaust tube. Removal of the rail tube assembly may aid in this service operation (Refer to 24 - HEATING & AIR CONDITIONING/CABIN HEATER/EXHAUST TUBE - REMOVAL).
(11) Remove seat hex nut at the heater mounting flange to cross member.
(12) Loosen the remaining fasteners which mount the exhaust tube assembly to the vehicle.
  (a) Install a suitable cabin heater support device under the cabin heater and secure the cabin heater to the device.
(13) Loosen the remaining three fasteners to the cross members.
(14) Remove the loosened fasteners that support the heater while supporting the weight of the heater.
(15) Swing the unit mounting bracket from between the exhaust bracket and rail mounting location. Drain any residual coolant from the heater unit.
(16) Lower the cabin heater and remove from the supporting device and place on a suitable work area.

REMOVAL

(1) Raise and support the vehicle while taking note of the location of the flexible exhaust tube section.
(2) Unplug the wire harness connector from vehicle wiring harness to cabin heater harness.
(3) Unplug the wire harness connector from cabin heater harness to dosing pump connector.
(4) Unplug the two wire harness connectors from cabin heater harness to cabin heater controller connectors.
(5) Remove two wiring harness connectors from underbody.
(6) Remove two wiring harness connectors from cabin heater shield.
(7) Carefully route the cabin heater harness to the left side between the cabin heater unit and the cabin heater shield.

HEATER UNIT (Continued)

INSTALLATION

INSTALLATION

(1) Install the unit mounting bracket between the exhaust bracket and the rail mounting location.

(2) Install the fasteners that support the heater while supporting the weight of the heater.

(3) Install the three fasteners to the cross members. Tighten the M6 fasteners to 7 N·m (62 in. lbs.).

(4) Position the two spacer washers between the body and the rubber grommets for the two mounting points on the rail.

(5) Tighten the remaining M6 fasteners to 7 N·m (62 in. lbs.) and the M8 fasteners to 23 N·m (17 ft. lbs.) which mount the exhaust tube assembly to the vehicle.

(6) Install the seat hex nut at the heater mounting flange to the cross members. Tighten the nut to 60 N·m (44 ft. lbs.)

(7) Install the heater exhaust tube flex section to the exhaust tube by tightening the M6 bolt of the clamp assembly. Install the hose to the exhaust tube.

(8) Tighten the two M8 fasteners at the rail to 23 N·m (17 ft. lbs.). Taking care so that the exhaust tube bracket tab is on the top of the heater bracket.

(9) Install the wiring harness (Refer to 24 - HEATING & AIR CONDITIONING/CABIN HEATER/HEATER UNIT - INSTALLATION).

(10) Tighten the hose and tube assembly to the toe-board cross member at two locations.

(11) Install the second hose to the underbody hose and tube assembly.

(12) Connect the rubber fuel hose between the body tube assembly and the fuel pump nipple at the body tube joint. Close the fuel fill cap.

(13) Remove the heater unit support device from under the vehicle.

(14) Lower the vehicle.

(15) Fill the engine cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

(16) Verify function of the cabin heater.

INSTALLATION

(1) Carefully route the cabin heater harness from the left side of the cabin heater between the cabin heater unit and the cabin heater shield.

(2) Install the two wiring harness retaining connectors to the cabin heater shield.

(3) Route the wiring harness along the underside of the vehicle and install the two wiring harness retaining connectors.

(4) Plug the two connectors from the cabin heater harness to the cabin heater controller.

(5) Plug the connector to the cabin heater harness to the dosing pump connector.

(6) Plug the connector from the vehicle wiring harness to the cabin heater harness.

(7) Lower the vehicle.

(8) Verify function of the cabin heater.

INLET HOSE

REMOVAL

NOTE: Heater air intake tube is part of an assembly that includes the heater cooling intake and return pipes. If heater air intake tube requires removal or replacement the entire assembly will require removal/replacement.

(1) Drain the engine cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

(2) Remove clamps from the heater tubes at the lower heater port and the lower EGR connector which are located under the hood.

(3) Remove the retaining clamp at the heater air intake muffler connection (Refer to 24 - HEATING & AIR CONDITIONING/CABIN HEATER/INLET MUFFLER - REMOVAL).

(4) Remove the clamp at the flexible tube to steel tube connection (Fig. 4).

(5) Remove the two retaining screws and remove pipe assembly (Fig. 5).

INSTALLATION

(1) Install the air intake pipe assembly and install the two retaining screws. Tighten the screws to 7 N·m (62 in. lbs.).

(2) Attach the steel tube to the flexible tube and position and then tighten the retaining clamp securely.

(3) Install the flexible tube to the heater air intake muffler and install and tighten the retaining clamp securely.

INLET HOSE (Continued)

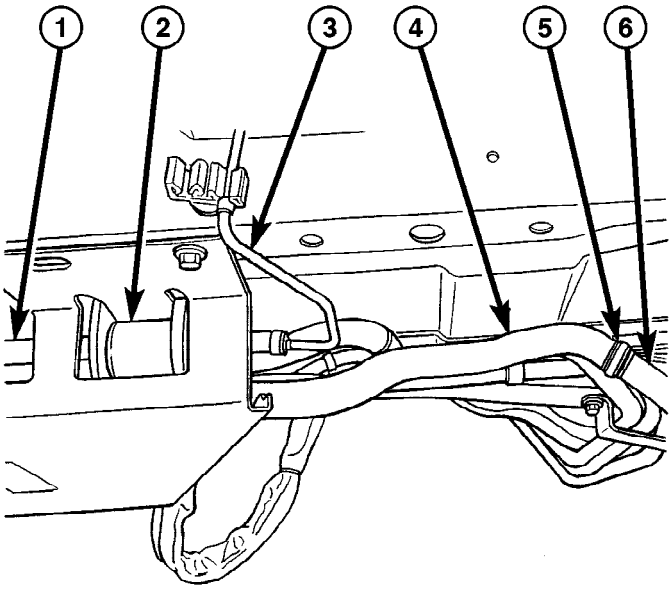


Fig. 4 Flexible Air Intake Line

1 - HEATER UNIT AND SPLASH SHIELD
2 - DOSING PUMP
3 - DOSING PUMP FUEL LINE
4 - FLEXIBLE INTAKE LINE
5 - CLAMP
6 - STEEL INTAKE PIPE

(4) Install the heater tubes to the lower heater connection and the lower EGR cooler connection and tighten the retaining clamps.

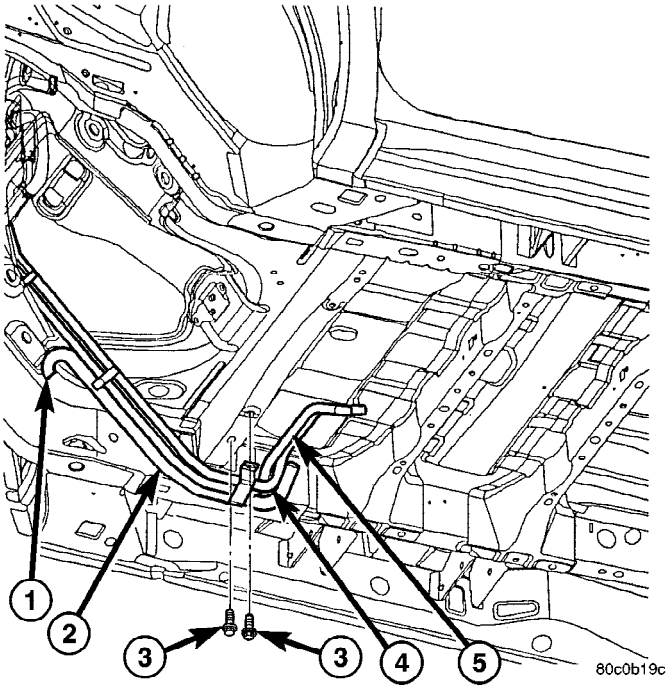


Fig. 5 Air Intake And Heater Pipe Assembly

1 - INTAKE TUBE AIR INTAKE
2 - INTAKE PIPE
3 - RETAINING SCREWS
4 - INTAKE HEATER LINE
5 - RETURN HEATER LINE

(5) Lower the vehicle.

(6) Refill the engine cooling system (Refer to 7 - COOLING - STANDARD PROCEDURE).

(7) Verify function of the heater unit.

EMISSIONS CONTROL

EXHAUST GAS RECIRCULATION

TABLE OF CONTENTS

page

VALVE
DESCRIPTION 1
OPERATION 1
REMOVAL 2
INSTALLATION 2

VALVE

DESCRIPTION

Exhaust gas recirculation reduces the quantity of fresh air supplied to the cylinders per stroke without having to throttle the air supply. As a result, emissions are reduced. If a quantity of exhaust gas is mixed with the air that is to be used to burn the fuel in the cylinders, the oxygen content is reduced, because the exhaust gas is low in oxygen. The result is that the combustion rate is reduced, as is the combustion temperature. This reduces the quantity of NOx that are emitted in the exhaust gas (Fig. 1).

OPERATION

The mass of the air supplied to the cylinders per stroke is the decisive factor for determining the optimum quantity of exhaust gas for the operating condition. This is calculated from the Mass Air Flow sensor information.

The ECM evaluates this signal as well as that from the Charge Air Pressure sensor, and outputs a PWM signal in accordance with one of the maps stored in it. The signal is sent to the exhaust gas recirculation valve. The map is formulated to keep the NOx as low as possible. The EGR valve is actuated by an electric positioning motor.

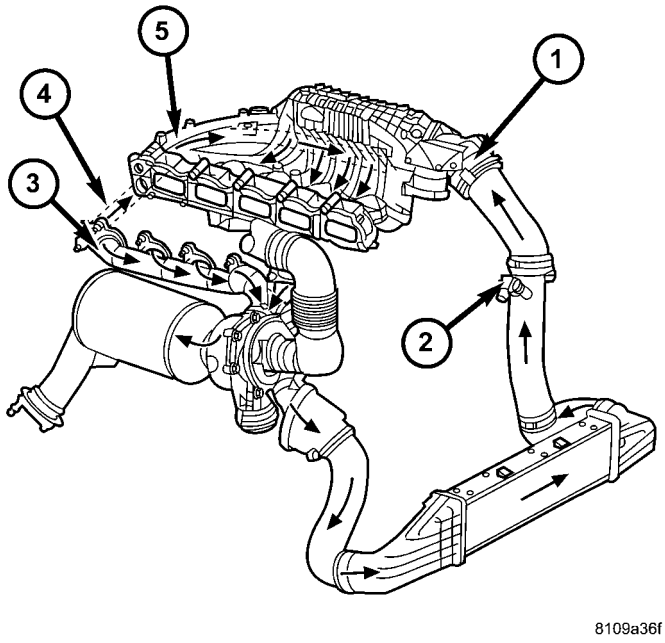


Fig. 1 EXHAUST GAS RECIRCULATION

1 - EGR VALVE
2 -CHARGE AIR PRESSURE SENSOR
3 - EXHAUST MANIFOLD
4 - EGR DUCT IN CYLINDER HEAD
5 - INTAKE MANIFOLD

VALVE (Continued)

REMOVAL

(1) Disconnect the negative battery cable.

(2) Lift up on the charge air hose retaining clip at the mixing chamber and disconnect hose with seal (Fig. 2).

(3) Disconnect the electrical connector at the EGR positioner (Fig. 2).

(4) Remove mixing chamber support bracket (Fig. 2).

(5) Remove the mixing chamber retaining bolts and remove chamber (Fig. 2).

INSTALLATION

(1) Clean all gasket mating surfaces.

(2) Position the mixing chamber to the intake manifold with a new gasket, install bolts and tighten to 124 lbs.in (14 N·m) (Fig. 2).

(3) Install the mixing chamber support bracket and tighten the bolts to 124 lbs.in (14 N·m) (Fig. 2).

(4) Connect the EGR positioner electrical connector (Fig. 2).

(5) Inspect the seal of the charge air inlet tube, replace as necessary (Fig. 2).

(6) Seat the charge air tube with gasket into the mixing chamber and push down on the charge air tube retaining clip (Fig. 2).

(7) Connect negative battery cable.

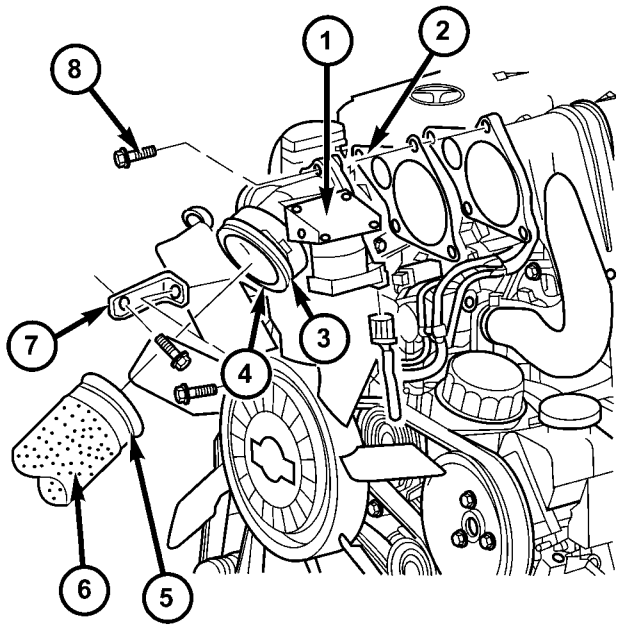


Fig. 2 MIXING CHAMBER AND EGR POSITIONER

1 - EGR POSITIONER
2 - GASKET
3 - MIXING CHAMBER
4 - CHARGE AIR HOSE RETAINING CLIP
5 - GASKET
6 - CHARGE AIR HOSE
7 - BRACKET
8 - BOLT

Description	Group-Page
ABS INDICATOR - DESCRIPTION	8J-9
ABS INDICATOR - OPERATION	8J-9
A/C COMPRESSOR - DESCRIPTION	24-49
A/C COMPRESSOR - INSTALLATION	24-51
A/C COMPRESSOR - OPERATION	24-49
A/C COMPRESSOR - REMOVAL	24-50
A/C COMPRESSOR CLUTCH - DESCRIPTION	24-8
A/C COMPRESSOR CLUTCH - OPERATION	24-8
A/C CONDENSER - DESCRIPTION	24-52
A/C CONDENSER - INSTALLATION	24-52
A/C CONDENSER - OPERATION	24-52
A/C CONDENSER - REMOVAL	24-52
A/C DISCHARGE LINE - INSTALLATION	24-54
A/C DISCHARGE LINE - REMOVAL	24-53
A/C EVAPORATOR - DESCRIPTION	24-54
A/C EVAPORATOR - INSTALLATION	24-55
A/C EVAPORATOR - OPERATION	24-54
A/C EVAPORATOR - REMOVAL	24-55
A/C EXPANSION VALVE - DESCRIPTION	24-55
A/C EXPANSION VALVE - DIAGNOSIS AND TESTING	24-56
A/C EXPANSION VALVE - INSTALLATION	24-56
A/C EXPANSION VALVE - OPERATION	24-55
A/C EXPANSION VALVE - REMOVAL	24-56
A/C HEATER CONTROL - DESCRIPTION	24-12
A/C HEATER CONTROL - INSTALLATION	24-13
A/C HEATER CONTROL - OPERATION	24-12
A/C HEATER CONTROL - REMOVAL	24-12
A/C HOUSING - INSTALLATION, REAR	24-41
A/C HOUSING - REMOVAL, REAR	24-40
A/C PERFORMANCE TEST - DIAGNOSIS AND TESTING	24-3
A/C PRESSURE TRANSDUCER - DESCRIPTION	24-13
A/C PRESSURE TRANSDUCER - DIAGNOSIS AND TESTING	24-13
A/C PRESSURE TRANSDUCER - INSTALLATION	24-14
A/C PRESSURE TRANSDUCER - OPERATION	24-13
A/C PRESSURE TRANSDUCER - REMOVAL	24-14
A/C SYSTEM, SPECIFICATIONS	24-5
ACCELERATOR PEDAL POSITION SENSOR - DESCRIPTION	14-17
ACCESSORY DRIVE BELT - DIAGNOSIS AND TESTING	7-5
ACCESSORY SWITCH BEZEL - INSTALLATION	23-54
ACCESSORY SWITCH BEZEL - REMOVAL	23-54
ACTUATOR - DESCRIPTION, RECIRCULATION DOOR	24-20
ACTUATOR - INSTALLATION, INSIDE HANDLE	23-34,23-37
ACTUATOR - INSTALLATION, RECIRCULATION DOOR	24-21
ACTUATOR - OPERATION, RECIRCULATION DOOR	24-20
ACTUATOR - REMOVAL, INSIDE HANDLE	23-34, 23-37
ACTUATOR - REMOVAL, RECIRCULATION DOOR	24-21
ADAPTATION - STANDARD PROCEDURE, TCM	8E-8
ADDING ADDITIONAL COOLANT - STANDARD PROCEDURE	7-11
ADDITIONAL COOLANT - STANDARD PROCEDURE, ADDING	7-11
ADJUSTER - INSTALLATION, SEAT BELT TURNING LOOP	8O-34
ADJUSTER - REMOVAL, SEAT BELT TURNING LOOP	8O-33
ADJUSTERS - FRONT - INSTALLATION, SEAT	23-78
ADJUSTERS - FRONT - REMOVAL, SEAT	23-78
AFTER A SUPPLEMENTAL RESTRAINT DEPLOYMENT - STANDARD PROCEDURE, SERVICE	8O-6
AIR CLEANER ELEMENT - INSTALLATION	9-20
AIR CLEANER ELEMENT - REMOVAL	9-20
AIR CLEANER HOUSING - INSTALLATION	9-20
AIR CLEANER HOUSING - REMOVAL	9-20
AIR CONDITIONER - DESCRIPTION, HEATER	24-1
AIR CONDITIONER - OPERATION, HEATER	24-2
AIR COOLER AND PLUMBING - CLEANING, CHARGE	11-5
AIR COOLER AND PLUMBING - DESCRIPTION, CHARGE	11-4
AIR COOLER AND PLUMBING - INSPECTION, CHARGE	11-5
AIR COOLER AND PLUMBING - INSTALLATION, CHARGE	11-5
AIR COOLER AND PLUMBING - OPERATION, CHARGE	11-4
AIR COOLER AND PLUMBING - REMOVAL, CHARGE	11-5
AIR COOLER SYSTEM - LEAKS - DIAGNOSIS AND TESTING, CHARGE	11-4
AIR FILTER - INSTALLATION	24-31,24-39
AIR FILTER - REMOVAL	24-31,24-39
AIR FLOW (MAF) SENSOR - DESCRIPTION, MANIFOLD	14-30
AIR FLOW (MAF) SENSOR - INSTALLATION, MANIFOLD	14-31
AIR FLOW (MAF) SENSOR - OPERATION, MANIFOLD	14-30
AIR FLOW (MAF) SENSOR - REMOVAL, MANIFOLD	14-31
AIR GAP - STANDARD PROCEDURE, COMPRESSOR CLUTCH	24-9
AIR IN FUEL SYSTEM - DIAGNOSIS AND TESTING	14-2
AIR OUTLET TEMPERATURE SENSOR - DESCRIPTION	24-14
AIR OUTLET TEMPERATURE SENSOR - INSTALLATION	24-15
AIR OUTLET TEMPERATURE SENSOR - OPERATION	24-15
AIR OUTLET TEMPERATURE SENSOR - REMOVAL	24-15
AIR OUTLETS - INSTALLATION	24-32
AIR OUTLETS - REMOVAL	24-31
AIR TEMPERATURE SENSOR - DESCRIPTION, INLET	14-29
AIR TEMPERATURE SENSOR - INSTALLATION, INLET	14-30
AIR TEMPERATURE SENSOR - OPERATION, INLET	14-29
AIR TEMPERATURE SENSOR - REMOVAL, INLET	14-30
AIRBAG - DESCRIPTION, DRIVER	8O-16
AIRBAG - DESCRIPTION, PASSENGER	8O-23
AIRBAG - INSTALLATION, DRIVER	8O-18
AIRBAG - INSTALLATION, PASSENGER	8O-26
AIRBAG - OPERATION, DRIVER	8O-17
AIRBAG - OPERATION, PASSENGER	8O-24
AIRBAG - REMOVAL, DRIVER	8O-17
AIRBAG - REMOVAL, PASSENGER	8O-24
AIRBAG BRACKET - INSTALLATION, PASSENGER	8O-27
AIRBAG BRACKET - REMOVAL, PASSENGER	8O-27
AIRBAG CONTROL MODULE - DESCRIPTION	8O-8
AIRBAG CONTROL MODULE - INSTALLATION	8O-11
AIRBAG CONTROL MODULE - OPERATION	8O-9
AIRBAG CONTROL MODULE - REMOVAL	8O-10
AIRBAG INDICATOR - DESCRIPTION	8J-10
AIRBAG INDICATOR - OPERATION	8J-10
ALB CONTROLLER - INSTALLATION	5-15
ALB CONTROLLER - REMOVAL	5-15
ALB LEVER - INSTALLATION	5-15
ALB LEVER - REMOVAL	5-15
ALIGNMENT - DESCRIPTION, WHEEL	2-17
ALIGNMENT - SPECIFICATIONS, WHEEL	2-19
ALUMINUM THREAD REPAIR - STANDARD PROCEDURE	21-27
AMBIENT TEMPERATURE INDICATOR - DESCRIPTION	8J-11
AMBIENT TEMPERATURE INDICATOR - OPERATION	8J-11
AMBIENT TEMPERATURE SENSOR - DESCRIPTION	24-15
AMBIENT TEMPERATURE SENSOR - INSTALLATION	24-16
AMBIENT TEMPERATURE SENSOR - OPERATION	24-15
AMBIENT TEMPERATURE SENSOR - REMOVAL	24-15
ANTENNA BODY & CABLE - INSTALLATION	8A-1
ANTENNA BODY & CABLE - REMOVAL	8A-1
ANTENNA CABLE - INSTALLATION, INSTRUMENT PANEL	8A-2
ANTENNA CABLE - REMOVAL, INSTRUMENT PANEL	8A-1
ANTILOCK BRAKE - DESCRIPTION, CONTROLLER	8E-3
ANTILOCK BRAKE - INSTALLATION, CONTROLLER	8E-3
ANTILOCK BRAKE - REMOVAL, CONTROLLER	8E-3
A-PILLAR TRIM - INSTALLATION	23-68
A-PILLAR TRIM - REMOVAL	23-67
ARM - DESCRIPTION, WIPER	8R-13
ARM - INSTALLATION, CENTER ROLLER	23-38
ARM - INSTALLATION, LOWER CONTROL	2-6
ARM - INSTALLATION, LOWER ROLLER	23-38
ARM - INSTALLATION, UPPER ROLLER	23-37
ARM - INSTALLATION, WIPER	8R-14
ARM - OPERATION, WIPER	8R-14
ARM - REMOVAL, CENTER ROLLER	23-37
ARM - REMOVAL, LOWER CONTROL	2-6
ARM - REMOVAL, LOWER ROLLER	23-38
ARM - REMOVAL, UPPER ROLLER	23-37
ARM - REMOVAL, WIPER	8R-14
ARMREST - INSTALLATION	23-76
ARMREST - REMOVAL	23-76
ASH RECEIVER - INSTALLATION	23-55
ASH RECEIVER - REMOVAL	23-55
ASH RECEIVER/CIGAR LIGHTER LAMP UNIT - INSTALLATION	8L-27
ASH RECEIVER/CIGAR LIGHTER LAMP UNIT - REMOVAL	8L-27
ASSIST HANDLE - INSTALLATION	23-68
ASSIST HANDLE - REMOVAL	23-68
AUDIO, SPECIAL TOOLS	8A-1
AUTOMATIC TRANSMISSION - DIAGNOSIS AND TESTING	21-23,21-24
AUTOMATIC TRANSMISSION - NAG1 - DESCRIPTION	21-2
AUTOMATIC TRANSMISSION - NAG1 - OPERATION	21-4
AUTOMATIC TRANSMISSION - SPECIAL TOOLS, NAG1	21-69
AUTOMATIC TRANSMISSION - SPECIFICATIONS, NAG1	21-68
AUTOMATIC TRANSMISSION FLUID - NAG1 - DESCRIPTION	0-4
AUTOMATIC TRANSMISSION FLUID - OPERATION	0-4
AUXILIARY BATTERY INSTALLATION, INSTALLATION	8F-13
AUXILIARY BATTERY REMOVAL, REMOVAL	8F-13
AXLE - DESCRIPTION	0-3
AXLE - DESCRIPTION, REAR	3-10
AXLE - DIAGNOSIS AND TESTING, REAR	3-10
AXLE - INSTALLATION, REAR	3-12
AXLE - OPERATION, REAR	3-10
AXLE - REMOVAL, REAR	3-11
AXLE - SPECIAL TOOLS, REAR	3-14
AXLE - SPECIFICATIONS, REAR	3-13
AXLE BEARINGS/SEALS - INSTALLATION	3-17
AXLE BEARINGS/SEALS - REMOVAL	3-17
AXLE HUB BEARINGS/SEALS - INSTALLATION	3-20
AXLE HUB BEARINGS/SEALS - REMOVAL	3-20
AXLE SHAFTS - DUAL REAR WHEELS - INSTALLATION	3-19
AXLE SHAFTS - DUAL REAR WHEELS - REMOVAL	3-19
AXLE SHAFTS - INSTALLATION	3-15
AXLE SHAFTS - REMOVAL	3-15
B1 - ASSEMBLY, HOLDING CLUTCH	21-113
B1 - DISASSEMBLY, HOLDING CLUTCH	21-112
B2 - ASSEMBLY, HOLDING CLUTCH	21-116
B2 - DISASSEMBLY, HOLDING CLUTCH	21-115
BACK - FRONT - INSTALLATION, SEAT	23-77
BACK - FRONT - REMOVAL, SEAT	23-77
BACK CUSHION/COVER - REAR - INSTALLATION, SEAT	23-80
BACK CUSHION/COVER - REAR - REMOVAL, SEAT	23-80
BACK SHIELD - INSTALLATION, REAR SEAT	23-79
BACK SHIELD - REMOVAL, REAR SEAT	23-79

Description	Group-Page
BACKLITE - BULKHEAD TRIM PANEL - INSTALLATION	23-81
BACKLITE - BULKHEAD TRIM PANEL - REMOVAL	23-81
BACKUP LAMP BULB - INSTALLATION	8L-6
BACKUP LAMP BULB - REMOVAL	8L-5
BALANCE - STANDARD PROCEDURE, TIRE AND WHEEL	22-3
BALL JOINT - INSTALLATION, LOWER	2-6
BALL JOINT - REMOVAL, LOWER	2-6
BAR - DESCRIPTION, STABILIZER	2-9
BAR - INSTALLATION, STABILIZER	2-15,2-9
BAR - OPERATION, STABILIZER	2-9
BAR - REMOVAL, STABILIZER	2-15,2-9
BASE BRAKE, SPECIFICATIONS	5-6
BASE BRAKE SYSTEM - DIAGNOSIS AND TESTING	5-2
BASECOAT/CLEARCOAT FINISH - DESCRIPTION	23-74
BATTERY - DESCRIPTION	8F-6
BATTERY - DIAGNOSIS AND TESTING	8F-7
BATTERY - OPERATION	8F-7
BATTERY CABLES - DESCRIPTION	8F-14
BATTERY CABLES - DIAGNOSIS AND TESTING	8F-14
BATTERY CABLES - INSTALLATION	8F-16
BATTERY CABLES - OPERATION	8F-14
BATTERY CABLES - REMOVAL	8F-16
BATTERY CHARGING - STANDARD PROCEDURE	8F-8
BATTERY ELECTROLYTE LEVEL - STANDARD PROCEDURE, CHECKING	8F-12
BATTERY HOLDDOWN - DESCRIPTION	8F-14
BATTERY HOLDDOWN - INSTALLATION	8F-14
BATTERY HOLDDOWN - REMOVAL	8F-14
BATTERY INSTALLATION, INSTALLATION - AUXILIARY	8F-13
BATTERY INSTALLATION, INSTALLATION - UNDER HOOD	8F-13
BATTERY REMOVAL, REMOVAL - AUXILIARY	8F-13
BATTERY REMOVAL, REMOVAL - UNDER HOOD	8F-12
BATTERY SYSTEM - CLEANING	8F-5
BATTERY SYSTEM - DESCRIPTION	8F-1
BATTERY SYSTEM - DIAGNOSIS AND TESTING	8F-2
BATTERY SYSTEM - INSPECTION	8F-6
BATTERY SYSTEM - OPERATION	8F-2
BATTERY SYSTEM SPECIAL TOOLS, SPECIAL TOOLS	8F-6
BATTERY TESTER - STANDARD PROCEDURE, USING MICRO 420	8F-11
BATTERY TRAY - DESCRIPTION	8F-16
BATTERY TRAY - INSTALLATION	8F-16
BATTERY TRAY - OPERATION	8F-16
BATTERY TRAY - REMOVAL	8F-16
BEAM HEADLAMP BULB - INSTALLATION, HIGH	8L-17
BEAM HEADLAMP BULB - INSTALLATION, LOW	8L-19
BEAM HEADLAMP BULB - REMOVAL, HIGH	8L-17
BEAM HEADLAMP BULB - REMOVAL, LOW	8L-18
BEAM INDICATOR - DESCRIPTION, HIGH	8J-17
BEAM INDICATOR - OPERATION, HIGH	8J-17
BEARING - INSTALLATION, CENTER	3-9
BEARING - INSTALLATION, HUB	2-5
BEARING - INSTALLATION, OUTPUT SHAFT	21-122
BEARING - REMOVAL, CENTER	3-8
BEARING - REMOVAL, HUB	2-4
BEARING - REMOVAL, OUTPUT SHAFT	21-122
BEARINGS/SEALS - INSTALLATION, AXLE	3-17
BEARINGS/SEALS - INSTALLATION, AXLE HUB	3-20
BEARINGS/SEALS - REMOVAL, AXLE	3-17
BEARINGS/SEALS - REMOVAL, AXLE HUB	3-20
BELT - DIAGNOSIS AND TESTING, ACCESSORY DRIVE	7-5
BELT & RETRACTOR - INSTALLATION, FRONT SEAT	8O-21
BELT & RETRACTOR - INSTALLATION, REAR SEAT	8O-29
BELT & RETRACTOR - REMOVAL, FRONT SEAT	8O-19
BELT & RETRACTOR - REMOVAL, REAR SEAT	8O-27
BELT BUCKLE - INSTALLATION, FRONT SEAT	8O-23
BELT BUCKLE - REMOVAL, FRONT SEAT	8O-22
BELT SWITCH - DESCRIPTION, SEAT	8O-31
BELT SWITCH - OPERATION, SEAT	8O-31
BELT TENSIONER - DESCRIPTION, SEAT	8O-31
BELT TENSIONER - OPERATION, SEAT	8O-32
BELT TENSIONERS - DESCRIPTION	7-5
BELT TENSIONERS - OPERATION	7-5
BELT TURNING LOOP ADJUSTER - INSTALLATION, SEAT	8O-34
BELT TURNING LOOP ADJUSTER - REMOVAL, SEAT	8O-33
BELT WEATHERSTRIP - INSTALLATION, FRONT DOOR INNER	23-87
BELT WEATHERSTRIP - INSTALLATION, FRONT DOOR OUTER	23-87
BELT WEATHERSTRIP - REMOVAL, FRONT DOOR INNER	23-87
BELT WEATHERSTRIP - REMOVAL, FRONT DOOR OUTER	23-87
BELTS - INSTALLATION, DRIVE	7-8
BELTS - REMOVAL, DRIVE	7-8
BEZEL - INSTALLATION, ACCESSORY SWITCH	23-54
BEZEL - INSTALLATION, CLUSTER	23-54
BEZEL - INSTALLATION, INSTRUMENT PANEL CENTER	23-55
BEZEL - REMOVAL, ACCESSORY SWITCH	23-54
BEZEL - REMOVAL, CLUSTER	23-53
BEZEL - REMOVAL, INSTRUMENT PANEL CENTER	23-55
BLADE - DESCRIPTION, WIPER	8R-15
BLADE - INSTALLATION, WIPER	8R-16
BLADE - OPERATION, WIPER	8R-15
BLADE - REMOVAL, WIPER	8R-16
BLEED PROCEDURE, STANDARD PROCEDURE - POWER STEERING PUMP FILL	19-14
BLEEDING - STANDARD PROCEDURE, MANUAL	5-4
BLEEDING - STANDARD PROCEDURE, MASTER CYLINDER	5-17
BLEEDING - STANDARD PROCEDURE, PRESSURE	5-5
BLOCK - DESCRIPTION, BLOWER MOTOR RESISTOR	24-16
BLOCK - DIAGNOSIS AND TESTING, BLOWER MOTOR RESISTOR	24-16
BLOCK - INSTALLATION, BLOWER MOTOR RESISTOR	24-17
BLOCK - OPERATION, BLOWER MOTOR RESISTOR	24-16
BLOCK - REMOVAL, BLOWER MOTOR RESISTOR	24-16
BLOCK #1 - DESCRIPTION, FUSE	8W-97-2
BLOCK #1 - INSTALLATION, FUSE	8W-97-3
BLOCK #1 - OPERATION, FUSE	8W-97-2
BLOCK #1 - REMOVAL, FUSE	8W-97-3
BLOCK #2 - DESCRIPTION, FUSE	8W-97-3
BLOCK #2 - OPERATION, FUSE	8W-97-3
BLOCK HEATER - INSTALLATION, ENGINE	7-14
BLOCK HEATER - REMOVAL, ENGINE	7-14
BLOCK JOURNALS - STANDARD PROCEDURE, MEASURE CRANKSHAFT	9-35
BLOWER MOTOR - INSTALLATION	24-33,24-40
BLOWER MOTOR - REMOVAL	24-32,24-39
BLOWER MOTOR RELAY - DESCRIPTION	24-23
BLOWER MOTOR RELAY - DIAGNOSIS AND TESTING	24-24
BLOWER MOTOR RELAY - INSTALLATION	24-24
BLOWER MOTOR RELAY - OPERATION	24-23
BLOWER MOTOR RELAY - REMOVAL	24-24
BLOWER MOTOR RESISTOR BLOCK - DESCRIPTION	24-16
BLOWER MOTOR RESISTOR BLOCK - DIAGNOSIS AND TESTING	24-16
BLOWER MOTOR RESISTOR BLOCK - INSTALLATION	24-17
BLOWER MOTOR RESISTOR BLOCK - OPERATION	24-16
BLOWER MOTOR RESISTOR BLOCK - REMOVAL	24-16
BLOWER MOTOR SWITCH - DESCRIPTION	24-17,24-22
BLOWER MOTOR SWITCH - DIAGNOSIS AND TESTING	24-17,24-23
BLOWER MOTOR SWITCH - INSTALLATION	24-23
BLOWER MOTOR SWITCH - OPERATION	24-17, 24-22
BLOWER MOTOR SWITCH - REMOVAL	24-17, 24-23
BODY & CABLE - INSTALLATION, ANTENNA	8A-1
BODY & CABLE - REMOVAL, ANTENNA	8A-1
BODY PANEL REPAIR - STANDARD PROCEDURE, PLASTIC	23-3
BOLT INSPECTION - STANDARD PROCEDURE, CYLINDER HEAD	9-21
BOOST PRESSURE SENSOR - DESCRIPTION	14-17
BOOST PRESSURE SENSOR - DIAGNOSIS AND TESTING	14-18
BOOST PRESSURE SENSOR - INSTALLATION	14-18
BOOST PRESSURE SENSOR - OPERATION	14-18
BOOST PRESSURE SENSOR - REMOVAL	14-18
BOOSTER - DESCRIPTION, POWER BRAKE	5-19
BOOSTER - DIAGNOSIS AND TESTING, MASTER CYLINDER/POWER	5-16
BOOSTER - INSTALLATION, POWER BRAKE	5-19
BOOSTER - OPERATION, POWER BRAKE	5-19
BOOSTER - REMOVAL, POWER BRAKE	5-19
BORES - STANDARD PROCEDURE, MEASURING CYLINDER	9-34
BOX - INSTALLATION, GLOVE	23-56
BOX - REMOVAL, GLOVE	23-56
B-PILLAR TRIM - INSTALLATION	23-69
B-PILLAR TRIM - REMOVAL	23-68
BRACKET - INSTALLATION, LICENSE PLATE	23-47
BRACKET - INSTALLATION, PASSENGER AIRBAG	8O-27
BRACKET - INSTALLATION, REAR VIEW MIRROR SUPPORT	23-72
BRACKET - REMOVAL, LICENSE PLATE	23-47
BRACKET - REMOVAL, PASSENGER AIRBAG	8O-27
BRAKE - CLEANING, REAR DRUM IN HAT	5-27
BRAKE - DESCRIPTION, CONTROLLER ANTILOCK	8E-3
BRAKE - INSTALLATION, CONTROLLER ANTILOCK	8E-3
BRAKE - REMOVAL, CONTROLLER ANTILOCK	8E-3
BRAKE BOOSTER - DESCRIPTION, POWER	5-19
BRAKE BOOSTER - INSTALLATION, POWER	5-19
BRAKE BOOSTER - OPERATION, POWER	5-19
BRAKE BOOSTER - REMOVAL, POWER	5-19
BRAKE CABLES - ADJUSTMENT, PARKING	5-25
BRAKE FLUID - DESCRIPTION	0-3
BRAKE FLUID CONTAMINATION - DIAGNOSIS AND TESTING	5-14
BRAKE FLUID LEVEL - STANDARD PROCEDURE	5-14
BRAKE FLUID, SPECIFICATIONS	5-14
BRAKE INDICATOR - DESCRIPTION, BRAKE/PARK	8J-11
BRAKE INDICATOR - OPERATION, BRAKE/PARK	8J-12
BRAKE LAMP SWITCH - INSTALLATION	8L-6
BRAKE LAMP SWITCH - REMOVAL	8L-6
BRAKE, SPECIAL TOOLS - PARK	5-23
BRAKE, SPECIFICATIONS - BASE	5-6
BRAKE SWITCH - INSTALLATION, PARK	8L-20
BRAKE SWITCH - REMOVAL, PARK	8L-20
BRAKE SYSTEM - DIAGNOSIS AND TESTING, BASE	5-2
BRAKE WEAR INDICATOR - DESCRIPTION	8J-12
BRAKE WEAR INDICATOR - OPERATION	8J-12
BRAKE/PARK BRAKE INDICATOR - DESCRIPTION	8J-11

Description	Group-Page
BRAKE/PARK BRAKE INDICATOR - OPERATION	8J-12
BRAKE/PARK LAMP BULB - INSTALLATION	8L-7
BRAKE/PARK LAMP BULB - REMOVAL	8L-7
BRAKES, SPECIAL TOOLS	5-7
BREAKER - DESCRIPTION, CIRCUIT	8W-97-2
BREAKER - DIAGNOSIS AND TESTING, CIRCUIT	8W-97-2
BREAKER - OPERATION, CIRCUIT	8W-97-2
BREAK-IN - STANDARD PROCEDURE, COMPRESSOR CLUTCH	24-9
BUCKLE - INSTALLATION, FRONT SEAT BELT	8O-23
BUCKLE - REMOVAL, FRONT SEAT BELT	8O-22
BULB - INSTALLATION, BACKUP LAMP	8L-6
BULB - INSTALLATION, BRAKE/PARK LAMP	8L-7
BULB - INSTALLATION, CARGO/DOME LAMP	8L-27
BULB - INSTALLATION, CENTER HIGH MOUNTED STOP LAMP	8L-7
BULB - INSTALLATION, CLEARANCE LAMP	8L-8
BULB - INSTALLATION, DOME LAMP/INTRUSION SENSOR	8L-30
BULB - INSTALLATION, DOME/READING LAMP	8L-29
BULB - INSTALLATION, ENTRY/EXIT LAMP	8L-32
BULB - INSTALLATION, FOG LAMP	8L-10
BULB - INSTALLATION, FRONT POSITION LAMP	8L-14
BULB - INSTALLATION, FRONT TURN/PARK/SIDE MARKER LAMP	8L-15
BULB - INSTALLATION, HIGH BEAM HEADLAMP	8L-17
BULB - INSTALLATION, LICENSE PLATE LAMP	8L-18
BULB - INSTALLATION, LOW BEAM HEADLAMP	8L-19
BULB - INSTALLATION, REAR SIDE MARKER LAMP	8L-21
BULB - INSTALLATION, REAR TURN LAMP	8L-22
BULB - INSTALLATION, REPEATER LAMP	8L-22
BULB - REMOVAL, BACKUP LAMP	8L-5
BULB - REMOVAL, BRAKE/PARK LAMP	8L-7
BULB - REMOVAL, CARGO/DOME LAMP	8L-27
BULB - REMOVAL, CENTER HIGH MOUNTED STOP LAMP	8L-7
BULB - REMOVAL, CLEARANCE LAMP	8L-8
BULB - REMOVAL, DOME LAMP/ INTRUSION SENSOR	8L-30
BULB - REMOVAL, DOME/READING LAMP	8L-29
BULB - REMOVAL, ENTRY/EXIT LAMP	8L-31
BULB - REMOVAL, FOG LAMP	8L-10
BULB - REMOVAL, FRONT POSITION LAMP	8L-14
BULB - REMOVAL, FRONT TURN/PARK/ SIDE MARKER LAMP	8L-14
BULB - REMOVAL, HIGH BEAM HEADLAMP	8L-17
BULB - REMOVAL, LICENSE PLATE LAMP	8L-17
BULB - REMOVAL, LOW BEAM HEADLAMP	8L-18
BULB - REMOVAL, REAR SIDE MARKER LAMP	8L-21
BULB - REMOVAL, REAR TURN LAMP	8L-21
BULB - REMOVAL, REPEATER LAMP	8L-22
BULKHEAD - INSTALLATION	8L-29
BULKHEAD - REMOVAL	8L-28
BULKHEAD TRIM PANEL - INSTALLATION	23-69
BULKHEAD TRIM PANEL - INSTALLATION, BACKLITE	23-81
BULKHEAD TRIM PANEL - REMOVAL	23-69
BULKHEAD TRIM PANEL - REMOVAL, BACKLITE	23-81
BUMPER - STEP - INSTALLATION, REAR	13-3
BUMPER - STEP - REMOVAL, REAR	13-3
BUMPER - STEPS - INSTALLATION, FRONT	13-2
BUMPER - STEPS - REMOVAL, FRONT	13-2
BURNT FLUID - DIAGNOSIS AND TESTING, CAUSES OF	21-102
BUSHINGS - INSTALLATION	2-3
BUSHINGS - REMOVAL	2-3
BUZZ, SQUEAK & RATTLE - STANDARD PROCEDURE	23-10
CABIN HEATER - DESCRIPTION	24-72
CABIN HEATER - OPERATION	24-72
CABLE - DESCRIPTION	8P-3
CABLE - DIAGNOSIS AND TESTING, GEARSHIFT	21-109
CABLE - INSTALLATION, ANTENNA BODY	8A-1
CABLE - INSTALLATION, GEARSHIFT	21-109
CABLE - INSTALLATION, INSTRUMENT PANEL ANTENNA	8A-2
CABLE - INSTALLATION, LATCH RELEASE	23-51
CABLE - INSTALLATION, PARK LOCK	21-126
CABLE - REMOVAL, ANTENNA BODY	8A-1
CABLE - REMOVAL, GEARSHIFT	21-109
CABLE - REMOVAL, INSTRUMENT PANEL ANTENNA	8A-1
CABLE - REMOVAL, LATCH RELEASE	23-51
CABLE - REMOVAL, PARK LOCK	21-125
CABLE TENSIONER - INSTALLATION	5-23
CABLE TENSIONER - REMOVAL	5-23
CABLES - ADJUSTMENT, PARKING BRAKE	5-25
CABLES - DESCRIPTION, BATTERY	8F-14
CABLES - DIAGNOSIS AND TESTING, BATTERY	8F-14
CABLES - INSTALLATION, BATTERY	8F-16
CABLES - INSTALLATION, MODE DOOR	24-19
CABLES - OPERATION, BATTERY	8F-14
CABLES - REMOVAL, BATTERY	8F-16
CABLES - REMOVAL, MODE DOOR	24-19
CAMSHAFT POSITION - STANDARD PROCEDURE, CHECKING	9-27
CAMSHAFT POSITION SENSOR - DESCRIPTION	14-19
CAMSHAFT POSITION SENSOR - INSTALLATION	14-19
CAMSHAFT POSITION SENSOR - OPERATION	14-19
CAMSHAFT POSITION SENSOR - REMOVAL	14-19
CAMSHAFT(S) - INSTALLATION	9-29
CAMSHAFT(S) - REMOVAL	9-28
CAP - DESCRIPTION, RADIATOR PRESSURE	7-18
CAP - DIAGNOSIS AND TESTING, RADIATOR PRESSURE	7-19
CAP - OPERATION, RADIATOR PRESSURE	7-18
CAPACITIES - SPECIFICATIONS, FLUID	0-4
CAPACITY, SPECIFICATIONS - CHARGE	24-49
CARGO/DOME LAMP BULB - INSTALLATION	8L-27
CARGO/DOME LAMP BULB - REMOVAL	8L-27
CARGO/DOME LAMP UNIT - INSTALLATION	8L-28
CARGO/DOME LAMP UNIT - REMOVAL	8L-28
CARPETS AND FLOOR MATS - INSTALLATION	23-70
CARPETS AND FLOOR MATS - REMOVAL	23-69
CARRIER - INSTALLATION, SPARE TIRE	22-10
CARRIER - REMOVAL, SPARE TIRE	22-10
CATALYTIC CONVERTER - INSTALLATION	11-3
CATALYTIC CONVERTER - REMOVAL	11-3
CAUSES OF BURNT FLUID - DIAGNOSIS AND TESTING	21-102
CAUTION - CAUTION	24-45
CAUTION - REFRIGERANT HOSES/LINES/ TUBES PRECAUTIONS	24-45
CAUTION, CAUTION	24-45
CAUTION, INTERIOR	23-67
CENTER - DESCRIPTION, POWER DISTRIBUTION	8W-97-3
CENTER - OPERATION, POWER DISTRIBUTION	8W-97-3
CENTER BEARING - INSTALLATION	3-9
CENTER BEARING - REMOVAL	3-8
CENTER BEZEL - INSTALLATION, INSTRUMENT PANEL	23-55
CENTER BEZEL - REMOVAL, INSTRUMENT PANEL	23-55
CENTER HIGH MOUNTED STOP LAMP BULB - INSTALLATION	8L-7
CENTER HIGH MOUNTED STOP LAMP BULB - REMOVAL	8L-7
CENTER HIGH MOUNTED STOP LAMP UN - INSTALLATION	8L-8
CENTER HIGH MOUNTED STOP LAMP UN - REMOVAL	8L-8
CENTER ROLLER ARM - INSTALLATION	23-38
CENTER ROLLER ARM - REMOVAL	23-37
CENTER TRACK - INSTALLATION	23-39
CENTER TRACK - REMOVAL	23-38
CENTERING - STANDARD PROCEDURE, CLOCKSPRING	8O-13
CENTRAL TIMER MODULE - DESCRIPTION	8E-1
CENTRAL TIMER MODULE - DIAGNOSIS AND TESTING	8E-2
CENTRAL TIMER MODULE - INSTALLATION	8E-2
CENTRAL TIMER MODULE - OPERATION	8E-2
CENTRAL TIMER MODULE - REMOVAL	8E-2
CHAIN - INSTALLATION, OIL PUMP	9-54
CHAIN - INSTALLATION, TIMING	9-67
CHAIN - REMOVAL, OIL PUMP	9-53
CHAIN - REMOVAL, TIMING	9-63
CHAIN COVER - INSTALLATION, TIMING	9-60
CHAIN COVER - REMOVAL, TIMING	9-59
CHAIN TENSIONER - INSTALLATION, TIMING	9-71
CHAIN TENSIONER - REMOVAL, TIMING	9-70
CHAIN TENSIONING RAIL - INSTALLATION, TIMING	9-66
CHAIN TENSIONING RAIL - REMOVAL, TIMING	9-63
CHARGE - STANDARD PROCEDURE, REFRIGERANT SYSTEM	24-48
CHARGE AIR COOLER AND PLUMBING - CLEANING	11-5
CHARGE AIR COOLER AND PLUMBING - DESCRIPTION	11-4
CHARGE AIR COOLER AND PLUMBING - INSPECTION	11-5
CHARGE AIR COOLER AND PLUMBING - INSTALLATION	11-5
CHARGE AIR COOLER AND PLUMBING - OPERATION	11-4
CHARGE AIR COOLER AND PLUMBING - REMOVAL	11-5
CHARGE AIR COOLER SYSTEM - LEAKS - DIAGNOSIS AND TESTING	11-4
CHARGE CAPACITY, SPECIFICATIONS	24-49
CHARGING - STANDARD PROCEDURE, BATTERY	8F-8
CHARGING INDICATOR - DESCRIPTION	8J-13
CHARGING INDICATOR - OPERATION	8J-13
CHART - SPECIFICATIONS, TORQUE	5-29,5-5
CHART - SPECIFICATIONS, TORQUE	19-10, 19-14,19-5,19-9
CHART - SPECIFICATIONS, TORQUE	2-12,2-2
CHART, SPECIFICATIONS - TORQUE	5-22
CHART, SPECIFICATIONS - TORQUE	22-5
CHECK - INSTALLATION	23-13,23-24
CHECK - REMOVAL	23-13,23-24
CHECK OIL LEVEL - STANDARD PROCEDURE	21-102
CHECK VALVE - DESCRIPTION	8R-7
CHECK VALVE - INSTALLATION	8R-7
CHECK VALVE - OPERATION	8R-7
CHECK VALVE - REMOVAL	8R-7
CHECKING AND REPAIRING CONNECTING RODS - STANDARD PROCEDURE	9-40
CHECKING BATTERY ELECTROLYTE LEVEL - STANDARD PROCEDURE	8F-12
CHECKING CAMSHAFT POSITION - STANDARD PROCEDURE	9-27
CHECKS - DIAGNOSIS AND TESTING, PRELIMINARY	7-1
CHIME WARNING SYSTEM - DIAGNOSIS AND TESTING	8B-2
CHIME/BUZZER - DESCRIPTION	8B-1
CHIME/BUZZER - OPERATION	8B-1
CIGAR LIGHTER OUTLET - DESCRIPTION	8W-97-1
CIGAR LIGHTER OUTLET - DIAGNOSIS AND TESTING	8W-97-2
CIGAR LIGHTER OUTLET - OPERATION	8W-97-2
CIGAR LIGHTER OUTLET - REMOVAL	8W-97-2
CIRCUIT BREAKER - DESCRIPTION	8W-97-2
CIRCUIT BREAKER - DIAGNOSIS AND TESTING	8W-97-2

Description	Group-Page
CIRCUIT BREAKER - OPERATION	8W-97-2
CIRCUIT INFORMATION - DESCRIPTION	8W-01-5
CLAMP PLATES - INSTALLATION, SPRING	2-8
CLAMP PLATES - REMOVAL, SPRING	2-8
CLASSIFICATION - STANDARD PROCEDURE, INJECTOR	14-22
CLEARANCE LAMP BULB - INSTALLATION	8L-8
CLEARANCE LAMP BULB - REMOVAL	8L-8
CLEARANCE LAMP UNIT - INSTALLATION	8L-9
CLEARANCE LAMP UNIT - REMOVAL	8L-8
CLOCK - DESCRIPTION	8J-13
CLOCK - OPERATION	8J-14
CLOCKSPRING - DESCRIPTION	8O-12
CLOCKSPRING - INSTALLATION	8O-15
CLOCKSPRING - OPERATION	8O-13
CLOCKSPRING - REMOVAL	8O-14
CLOCKSPRING CENTERING - STANDARD PROCEDURE	8O-13
CLOGGED INDICATOR - DESCRIPTION, FUEL FILTER	8J-15
CLOGGED INDICATOR - OPERATION, FUEL FILTER	8J-15
CLUSTER - DESCRIPTION, INSTRUMENT	8J-2
CLUSTER - DIAGNOSIS AND TESTING, INSTRUMENT	8J-7
CLUSTER - INSTALLATION, INSTRUMENT	8J-9
CLUSTER - INSTALLATION, TOP COVER	23-62
CLUSTER - OPERATION, INSTRUMENT	8J-5
CLUSTER - REMOVAL, INSTRUMENT	8J-7
CLUSTER - REMOVAL, TOP COVER	23-62
CLUSTER BEZEL - INSTALLATION	23-54
CLUSTER BEZEL - REMOVAL	23-53
CLUTCH - ASSEMBLY, FREEWHEELING	21-107
CLUTCH - DESCRIPTION, A/C COMPRESSOR	24-8
CLUTCH - DESCRIPTION, FREEWHEELING	21-105
CLUTCH - DISASSEMBLY, FREEWHEELING	21-106
CLUTCH - INSTALLATION, FAN DRIVE VISCOUS	7-16
CLUTCH - OPERATION, A/C COMPRESSOR	24-8
CLUTCH - OPERATION, FREEWHEELING	21-105
CLUTCH - REMOVAL, FAN DRIVE VISCOUS	7-16
CLUTCH AIR GAP - STANDARD PROCEDURE, COMPRESSOR	24-9
CLUTCH B1 - ASSEMBLY, HOLDING	21-113
CLUTCH B1 - DISASSEMBLY, HOLDING	21-112
CLUTCH B2 - ASSEMBLY, HOLDING	21-116
CLUTCH B2 - DISASSEMBLY, HOLDING	21-115
CLUTCH BREAK-IN - STANDARD PROCEDURE, COMPRESSOR	24-9
CLUTCH COIL - DIAGNOSIS AND TESTING, COMPRESSOR	24-12
CLUTCH K1 - ASSEMBLY, DRIVING	21-75
CLUTCH K1 - DISASSEMBLY, DRIVING	21-74
CLUTCH K2 - ASSEMBLY, DRIVING	21-78
CLUTCH K2 - DISASSEMBLY, DRIVING	21-76
CLUTCH K3 - ASSEMBLY, DRIVING	21-80
CLUTCH K3 - DISASSEMBLY, DRIVING	21-80
CLUTCH/COIL - INSPECTION, COMPRESSOR	24-10
CLUTCHES - DESCRIPTION, DRIVING	21-72
CLUTCHES - DESCRIPTION, HOLDING	21-111
CLUTCHES - OPERATION, DRIVING	21-72
CLUTCHES - OPERATION, HOLDING	21-112
CODES - SPECIFICATIONS, PAINT	23-74
COIL - DIAGNOSIS AND TESTING, COMPRESSOR CLUTCH	24-12
COLUMN OPENING COVER - INSTALLATION, STEERING	23-66
COLUMN OPENING COVER - REMOVAL, STEERING	23-66
COMPRESSION TESTING ENGINE - STANDARD PROCEDURE	9-3
COMPRESSOR - DESCRIPTION, A/C	24-49
COMPRESSOR - INSTALLATION, A/C	24-51
COMPRESSOR - OPERATION, A/C	24-49
COMPRESSOR - REMOVAL, A/C	24-50
COMPRESSOR CLUTCH - DESCRIPTION, A/C	24-8
COMPRESSOR CLUTCH - OPERATION, A/C	24-8
COMPRESSOR CLUTCH AIR GAP - STANDARD PROCEDURE	24-9
COMPRESSOR CLUTCH BREAK-IN - STANDARD PROCEDURE	24-9
COMPRESSOR CLUTCH COIL - DIAGNOSIS AND TESTING	24-12
COMPRESSOR CLUTCH/COIL - INSPECTION	24-10
COMPRESSOR NOISE - DIAGNOSIS AND TESTING	24-49
CONDENSER - DESCRIPTION, A/C	24-52
CONDENSER - INSTALLATION, A/C	24-52
CONDENSER - OPERATION, A/C	24-52
CONDENSER - REMOVAL, A/C	24-52
CONDITIONER - DESCRIPTION, HEATER AND AIR	24-1
CONDITIONER - OPERATION, HEATER AND AIR	24-2
CONNECTING FUEL LINES - STANDARD PROCEDURE, DISCONNECTING	14-2
CONNECTING ROD - DESCRIPTION, PISTON	9-40
CONNECTING RODS - STANDARD PROCEDURE, CHECKING AND REPAIRING	9-40
CONNECTOR - INSTALLATION	8W-01-9
CONNECTOR - REMOVAL	8W-01-8
CONNECTOR, GROUND AND SPLICE INFORMATION - DESCRIPTION	8W-01-5
CONNECTOR/GROUND/SPLICE LOCATION - DESCRIPTION	8W-91-1
CONTACT - DESCRIPTION, PARK/NEUTRAL	21-139
CONTACT - OPERATION, PARK/NEUTRAL	21-140
CONTAMINATION - DIAGNOSIS AND TESTING, BRAKE FLUID	5-14
CONTAMINATION - DIAGNOSIS AND TESTING, FLUID	21-102
CONTINUITY - STANDARD PROCEDURE, TESTING	8W-01-8
CONTROL ARM - INSTALLATION, LOWER	2-6
CONTROL ARM - REMOVAL, LOWER	2-6
CONTROL INDICATOR - DESCRIPTION, TRACTION	8J-24
CONTROL INDICATOR - OPERATION, TRACTION	8J-24
CONTROL MALFUNCTION INDICATOR - DESCRIPTION, TRACTION	8J-25
CONTROL MALFUNCTION INDICATOR - OPERATION, TRACTION	8J-25
CONTROL MODULE - DESCRIPTION	24-24
CONTROL MODULE - DESCRIPTION, AIRBAG	8O-8
CONTROL MODULE - DESCRIPTION, ENGINE	8E-3
CONTROL MODULE - DESCRIPTION, TRANSMISSION	8E-5
CONTROL MODULE - DIAGNOSIS AND TESTING	24-24
CONTROL MODULE - INSTALLATION	24-25
CONTROL MODULE - INSTALLATION, AIRBAG	8O-11
CONTROL MODULE - INSTALLATION, ENGINE	8E-4
CONTROL MODULE - OPERATION	24-24
CONTROL MODULE - OPERATION, AIRBAG	8O-9
CONTROL MODULE - OPERATION, TRANSMISSION	8E-5
CONTROL MODULE - REMOVAL	24-24
CONTROL MODULE - REMOVAL, AIRBAG	8O-10
CONTROL MODULE - REMOVAL, ENGINE	8E-4
CONTROLLER - INSTALLATION, ALB	5-15
CONTROLLER - REMOVAL, ALB	5-15
CONTROLLER ANTILOCK BRAKE - DESCRIPTION	8E-3
CONTROLLER ANTILOCK BRAKE - INSTALLATION	8E-3
CONTROLLER ANTILOCK BRAKE - REMOVAL	8E-3
CONVERTER - DESCRIPTION, TORQUE	21-141
CONVERTER - INSTALLATION, CATALYTIC	11-3
CONVERTER - INSTALLATION, TORQUE	21-146
CONVERTER - OPERATION, TORQUE	21-143
CONVERTER - REMOVAL, CATALYTIC	11-3
CONVERTER - REMOVAL, TORQUE	21-146
CONVERTER HUB SEAL - INSTALLATION, TORQUE	21-147
CONVERTER HUB SEAL - REMOVAL, TORQUE	21-147
COOLANT - DESCRIPTION	7-9
COOLANT - DESCRIPTION, ENGINE	0-1
COOLANT - DESCRIPTION, HOAT	0-2
COOLANT - STANDARD PROCEDURE, ADDING ADDITIONAL	7-11
COOLANT LEVEL SENSOR - INSTALLATION	7-13
COOLANT LEVEL SENSOR - REMOVAL	7-13
COOLANT LOW INDICATOR - DESCRIPTION	8J-14
COOLANT LOW INDICATOR - OPERATION	8J-14
COOLANT PUMP - DESCRIPTION, ELECTRIC	24-57
COOLANT PUMP - INSTALLATION, ELECTRIC	24-57
COOLANT PUMP - OPERATION, ELECTRIC	24-57
COOLANT PUMP - REMOVAL, ELECTRIC	24-57
COOLANT TEMP SENSOR - DESCRIPTION, ENGINE	7-14
COOLANT TEMP SENSOR - INSTALLATION, ENGINE	7-15
COOLANT TEMP SENSOR - REMOVAL, ENGINE	7-14
COOLANT THERMOSTAT - INSTALLATION, ENGINE	7-16
COOLANT THERMOSTAT - REMOVAL, ENGINE	7-15
COOLER & LINES - INSTALLATION, OIL	9-50
COOLER & LINES - REMOVAL, OIL	9-50
COOLER AND PLUMBING - CLEANING, CHARGE AIR	11-5
COOLER AND PLUMBING - DESCRIPTION, CHARGE AIR	11-4
COOLER AND PLUMBING - INSPECTION, CHARGE AIR	11-5
COOLER AND PLUMBING - INSTALLATION, CHARGE AIR	11-5
COOLER AND PLUMBING - OPERATION, CHARGE AIR	11-4
COOLER AND PLUMBING - REMOVAL, CHARGE AIR	11-5
COOLER SYSTEM - LEAKS - DIAGNOSIS AND TESTING, CHARGE AIR	11-4
COOLER TUBE - INSTALLATION, FLUID	19-14
COOLER TUBE - INSTALLATION, RETURN HOSE FROM GEAR TO	19-15
COOLER TUBE - INSTALLATION, RETURN LINE FROM PUMP TO	19-15
COOLER TUBE - REMOVAL, FLUID	19-14
COOLER TUBE - REMOVAL, RETURN HOSE FROM GEAR TO	19-15
COOLER TUBE - REMOVAL, RETURN LINE FROM PUMP TO	19-15
COOLING SYSTEM - DIAGNOSIS AND TESTING	7-2
COOLING SYSTEM - OPERATION	7-1
COOLING SYSTEM - STANDARD PROCEDURE, DRAINING	7-12
COOLING SYSTEM - STANDARD PROCEDURE, REFILLING	7-12
COOLING SYSTEM LEAKS - DIAGNOSIS AND TESTING	7-10
COOLING SYSTEM REQUIREMENTS - DESCRIPTION	24-1
CORE - DESCRIPTION, HEATER	24-57
CORE - INSTALLATION, HEATER	24-58
CORE - OPERATION, HEATER	24-57
CORE - REMOVAL, HEATER	24-58
CORE AND OIL GALLERY PLUGS - STANDARD PROCEDURE, REPLACING ENGINE	9-34
COVER - CLUSTER - INSTALLATION, TOP	23-62
COVER - CLUSTER - REMOVAL, TOP	23-62
COVER - INSTALLATION, CYLINDER HEAD FRONT	9-26
COVER - INSTALLATION, ENGINE	9-7
COVER - INSTALLATION, STEERING COLUMN OPENING	23-66
COVER - INSTALLATION, TIMING CHAIN	9-60
COVER - INSTALLATION, TOP	23-65
COVER - REMOVAL, CYLINDER HEAD FRONT	9-23
COVER - REMOVAL, ENGINE	9-4
COVER - REMOVAL, STEERING COLUMN OPENING	23-66

Description	Group-Page
COVER - REMOVAL, TIMING CHAIN	9-59
COVER - REMOVAL, TOP	23-64
COVER - TRAY - INSTALLATION, TOP	23-64
COVER - TRAY - REMOVAL, TOP	23-63
COVER(S) - INSTALLATION, CYLINDER HEAD	9-30
COVER(S) - REMOVAL, CYLINDER HEAD	9-30
COWL TRIM - INSTALLATION	23-70
COWL TRIM - REMOVAL	23-70
CRADLE CROSSMEMBER - INSTALLATION, ENGINE	13-8
CRADLE CROSSMEMBER - REMOVAL, ENGINE	13-6
CRANKSHAFT - INSTALLATION	9-36
CRANKSHAFT - REMOVAL	9-35
CRANKSHAFT AND BLOCK JOURNALS - STANDARD PROCEDURE, MEASURE	9-35
CRANKSHAFT OIL SEAL - FRONT - INSTALLATION	9-38
CRANKSHAFT OIL SEAL - FRONT - REMOVAL	9-38
CRANKSHAFT OIL SEAL - REAR - INSTALLATION	9-37
CRANKSHAFT OIL SEAL - REAR - REMOVAL	9-37
CRANKSHAFT POSITION SENSOR - DESCRIPTION	14-20
CRANKSHAFT POSITION SENSOR - INSTALLATION	14-20
CRANKSHAFT POSITION SENSOR - OPERATION	14-20
CRANKSHAFT POSITION SENSOR - REMOVAL	14-20
CROSSMEMBER - INSTALLATION, ENGINE CRADLE	13-8
CROSSMEMBER - INSTALLATION, RADIATOR	23-48
CROSSMEMBER - REMOVAL, ENGINE CRADLE	13-6
CROSSMEMBER - REMOVAL, RADIATOR	23-47
CROSSMEMBER - TRANSMISSION - INSTALLATION, REAR	13-9
CROSSMEMBER - TRANSMISSION - REMOVAL, REAR	13-9
CUP HOLDER - INSTALLATION	23-56
CUP HOLDER - REMOVAL	23-55
CUSHION - FRONT - INSTALLATION, SEAT	23-78
CUSHION - FRONT - REMOVAL, SEAT	23-78
CUSHION/COVER - REAR - INSTALLATION, SEAT	23-80
CUSHION/COVER - REAR - INSTALLATION, SEAT BACK	23-80
CUSHION/COVER - REAR - REMOVAL, SEAT	23-80
CUSHION/COVER - REAR - REMOVAL, SEAT BACK	23-80
CYLINDER - INSTALLATION, KEY/LOCK	19-7
CYLINDER - INSTALLATION, LOCK	23-18
CYLINDER - INSTALLATION, MASTER	5-18
CYLINDER - REMOVAL, KEY/LOCK	19-6
CYLINDER - REMOVAL, LOCK	23-18
CYLINDER - REMOVAL, MASTER	5-17
CYLINDER BLEEDING - STANDARD PROCEDURE, MASTER	5-17
CYLINDER BORES - STANDARD PROCEDURE, MEASURING	9-34
CYLINDER HEAD - INSTALLATION	9-25
CYLINDER HEAD - REMOVAL	9-22
CYLINDER HEAD BOLT INSPECTION - STANDARD PROCEDURE	9-21
CYLINDER HEAD COVER(S) - INSTALLATION	9-30
CYLINDER HEAD COVER(S) - REMOVAL	9-30
CYLINDER HEAD FRONT COVER - INSTALLATION	9-26
CYLINDER HEAD FRONT COVER - REMOVAL	9-23
CYLINDER HEAD GUIDE RAIL - INSTALLATION	9-26
CYLINDER HEAD GUIDE RAIL - REMOVAL	9-24
CYLINDER HEAD SURFACE - STANDARD PROCEDURE, MEASURE	9-21
CYLINDER LEAK DOWN TEST - STANDARD PROCEDURE	9-3
CYLINDER PRESSURE LOSS - STANDARD PROCEDURE, DETERMINING	9-4
CYLINDER/POWER BOOSTER - DIAGNOSIS AND TESTING, MASTER	5-16
DAMPER - INSTALLATION, VIBRATION	9-48
DAMPER - REMOVAL, VIBRATION	9-47
DAYTIME RUNNING LAMP RELAY - INSTALLATION	8L-9
DAYTIME RUNNING LAMP RELAY - REMOVAL	8L-9
DCHA - DIAGNOSIS AND TESTING, DIESEL SUPPLEMENTAL HEATER	24-72
DECOUPLER - DIAGNOSIS AND TESTING, GENERATOR	8F-19
DECOUPLER PULLEY - DESCRIPTION, GENERATOR	8F-19
DECOUPLER PULLEY - INSTALLATION, GENERATOR	8F-21
DECOUPLER PULLEY - OPERATION, GENERATOR	8F-19
DECOUPLER PULLEY - REMOVAL, GENERATOR	8F-20
DEFROSTER DUCTS - INSTALLATION	24-33
DEFROSTER DUCTS - REMOVAL	24-33
DELAY RELAY - INSTALLATION, TIME	8L-33
DELAY RELAY - REMOVAL, TIME	8L-32
DEPLOYMENT - STANDARD PROCEDURE, SERVICE AFTER A SUPPLEMENTAL RESTRAINT	8O-6
DETERMINING CYLINDER PRESSURE LOSS - STANDARD PROCEDURE	9-4
DEVICES - STANDARD PROCEDURE, ELECTROSTATIC DISCHARGE (ESD) SENSITIVE	8W-01-7
DIAGRAMS - DESCRIPTION, HOW TO USE WIRING	8W-01-1
DIAGRAMS, DIAGNOSIS AND TESTING - SCHEMATICS	21-47
DIESEL - DESCRIPTION, 2.7L	11-1
DIESEL - SPECIFICATIONS, STARTER MOTOR	8F-29
DIESEL - TORQUE, 2.7L	8F-17
DIESEL - TORQUE, STARTER	8F-29
DIESEL ENGINE - DESCRIPTION, FUEL REQUIREMENTS	0-1
DIESEL ENGINE - DIAGNOSIS AND TESTING	11-2
DIESEL ENGINES - DESCRIPTION, ENGINE OIL	0-3
DIESEL SUPPLEMENTAL HEATER - DCHA - DIAGNOSIS AND TESTING	24-72
DIMENSIONS - SPECIFICATIONS, FRAME	13-4
DIMENSIONS - SPECIFICATIONS, OPENING	23-90
DIODE - INSTALLATION	8W-01-9
DIODE - REMOVAL	8W-01-9
DISCHARGE (ESD) SENSITIVE DEVICES - STANDARD PROCEDURE, ELECTROSTATIC	8W-01-7
DISCHARGE LINE - INSTALLATION, A/C	24-54
DISCHARGE LINE - REMOVAL, A/C	24-53
DISCONNECTING AND CONNECTING FUEL LINES - STANDARD PROCEDURE	14-2
DISTRIBUTION - DESCRIPTION, POWER	8W-97-1
DISTRIBUTION - OPERATION, POWER	8W-97-1
DISTRIBUTION CENTER - DESCRIPTION, POWER	8W-97-3
DISTRIBUTION CENTER - OPERATION, POWER	8W-97-3
DISTRIBUTION DUCTS - INSTALLATION, FLOOR	24-34
DISTRIBUTION DUCTS - REMOVAL, FLOOR	24-33
DOME LAMP/INTRUSION SENSOR - INSTALLATION	8L-31
DOME LAMP/INTRUSION SENSOR - REMOVAL	8L-31
DOME LAMP/INTRUSION SENSOR BULB - INSTALLATION	8L-30
DOME LAMP/INTRUSION SENSOR BULB - REMOVAL	8L-30
DOME/READING LAMP BULB - INSTALLATION	8L-29
DOME/READING LAMP BULB - REMOVAL	8L-29
DOME/READING LAMP UNIT - INSTALLATION	8L-30
DOME/READING LAMP UNIT - REMOVAL	8L-30
DOOR - ASSEMBLY	23-28
DOOR - ASSEMBLY, SLIDING	23-43
DOOR - DISASSEMBLY	23-26
DOOR - DISASSEMBLY, SLIDING	23-42
DOOR - INSTALLATION	23-14,23-30
DOOR - INSTALLATION, FUEL FILL	23-47
DOOR - INSTALLATION, SLIDING	23-44
DOOR - REMOVAL	23-14,23-25
DOOR - REMOVAL, FUEL FILL	23-47
DOOR - REMOVAL, SLIDING	23-41
DOOR ACTUATOR - DESCRIPTION, RECIRCULATION	24-20
DOOR ACTUATOR - INSTALLATION, RECIRCULATION	24-21
DOOR ACTUATOR - OPERATION, RECIRCULATION	24-20
DOOR ACTUATOR - REMOVAL, RECIRCULATION	24-21
DOOR CABLES - INSTALLATION, MODE	24-19
DOOR CABLES - REMOVAL, MODE	24-19
DOOR GLASS - INSTALLATION	23-15,23-31,23-46
DOOR GLASS - REMOVAL	23-15,23-31,23-46
DOOR INNER BELT WEATHERSTRIP - INSTALLATION, FRONT	23-87
DOOR INNER BELT WEATHERSTRIP - REMOVAL, FRONT	23-87
DOOR JAMB SWITCH - INSTALLATION	8L-31
DOOR JAMB SWITCH - REMOVAL	8L-31
DOOR LOCK MOTOR - INSTALLATION	8N-1
DOOR LOCK MOTOR - REMOVAL	8N-1
DOOR OPENING SEALS - INSTALLATION	23-87
DOOR OPENING SEALS - REMOVAL	23-87
DOOR OUTER BELT WEATHERSTRIP - INSTALLATION, FRONT	23-87
DOOR OUTER BELT WEATHERSTRIP - REMOVAL, FRONT	23-87
DOSING PUMP - DESCRIPTION, FUEL	24-74
DOSING PUMP - INSTALLATION, FUEL	24-74
DOSING PUMP - OPERATION, FUEL	24-74
DOSING PUMP - REMOVAL, FUEL	24-74
DOUBLE INVERTED FLARING - STANDARD PROCEDURE	5-8
D-PILLAR TRIM - INSTALLATION	23-70
D-PILLAR TRIM - REMOVAL	23-70
DRAIN AND FILL - STANDARD PROCEDURE	3-11
DRAINING COOLING SYSTEM - STANDARD PROCEDURE	7-12
DRAINING WATER FROM FUEL FILTER - STANDARD PROCEDURES	14-2
DRAW TEST - STANDARD PROCEDURE, IGNITION-OFF	8F-10
DRIVE BELT - DIAGNOSIS AND TESTING, ACCESSORY	7-5
DRIVE BELTS - INSTALLATION	7-8
DRIVE BELTS - REMOVAL	7-8
DRIVE VISCOUS CLUTCH - INSTALLATION, FAN	7-16
DRIVE VISCOUS CLUTCH - REMOVAL, FAN	7-16
DRIVER AIRBAG - DESCRIPTION	8O-16
DRIVER AIRBAG - INSTALLATION	8O-18
DRIVER AIRBAG - OPERATION	8O-17
DRIVER AIRBAG - REMOVAL	8O-17
DRIVER HEATED SEAT SWITCH - DESCRIPTION	8G-2
DRIVER HEATED SEAT SWITCH - DIAGNOSIS AND TESTING	8G-2
DRIVER HEATED SEAT SWITCH - INSTALLATION	8G-3
DRIVER HEATED SEAT SWITCH - OPERATION	8G-2
DRIVER HEATED SEAT SWITCH - REMOVAL	8G-3
DRIVING CLUTCH K1 - ASSEMBLY	21-75
DRIVING CLUTCH K1 - DISASSEMBLY	21-74
DRIVING CLUTCH K2 - ASSEMBLY	21-78
DRIVING CLUTCH K2 - DISASSEMBLY	21-76
DRIVING CLUTCH K3 - ASSEMBLY	21-80
DRIVING CLUTCH K3 - DISASSEMBLY	21-80
DRIVING CLUTCHES - DESCRIPTION	21-72
DRIVING CLUTCHES - OPERATION	21-72
DROP - STANDARD PROCEDURE, TESTING FOR A VOLTAGE	8W-01-8
DRUM IN HAT BRAKE - CLEANING, REAR	5-27
DOME/READING LAMP UNIT - REMOVAL	8L-30

Description	Group-Page
DUAL REAR WHEEL INSTALLATION - STANDARD PROCEDURE	22-12
DUAL REAR WHEELS - INSTALLATION, AXLE SHAFTS	3-19
DUAL REAR WHEELS - REMOVAL, AXLE SHAFTS	3-19
DUCTS - INSTALLATION, DEFROSTER	24-33
DUCTS - INSTALLATION, FLOOR DISTRIBUTION	24-34
DUCTS - INSTALLATION, INSTRUMENT PANEL	24-38
DUCTS - REMOVAL, DEFROSTER	24-33
DUCTS - REMOVAL, FLOOR DISTRIBUTION	24-33
DUCTS - REMOVAL, INSTRUMENT PANEL	24-37
EFFECTS OF INCORRECT FLUID LEVEL - DIAGNOSIS AND TESTING	21-102
ELECTRIC COOLANT PUMP - DESCRIPTION	24-57
ELECTRIC COOLANT PUMP - INSTALLATION	24-57
ELECTRIC COOLANT PUMP - OPERATION	24-57
ELECTRIC COOLANT PUMP - REMOVAL	24-57
ELECTRICAL - DESCRIPTION	5-29
ELECTRICAL - OPERATION	5-29
ELECTROHYDRAULIC UNIT - ASSEMBLY	21-95
ELECTROHYDRAULIC UNIT - DESCRIPTION	21-82
ELECTROHYDRAULIC UNIT - DISASSEMBLY	21-92
ELECTROHYDRAULIC UNIT - INSTALLATION	21-100
ELECTROHYDRAULIC UNIT - OPERATION	21-87
ELECTROHYDRAULIC UNIT - REMOVAL	21-92
ELECTROLYTE LEVEL - STANDARD PROCEDURE, CHECKING BATTERY	8F-12
ELECTROSTATIC DISCHARGE (ESD) SENSITIVE DEVICES - STANDARD PROCEDURE	8W-01-7
ELEMENT - DESCRIPTION, HEATED SEAT	8G-3
ELEMENT - DIAGNOSIS AND TESTING, HEATED SEAT	8G-3
ELEMENT - INSTALLATION, AIR CLEANER	9-20
ELEMENT - OPERATION, HEATED SEAT	8G-3
ELEMENT - REMOVAL, AIR CLEANER	9-20
END - DIAGNOSIS AND TESTING, OUTER TIE ROD	19-10
END - INSTALLATION, TIE ROD	19-11
END - REMOVAL, TIE ROD	19-11
ENGINE - DESCRIPTION	9-2
ENGINE - DESCRIPTION, FUEL REQUIREMENTS - DIESEL	0-1
ENGINE - DIAGNOSIS AND TESTING, DIESEL	11-2
ENGINE - STANDARD PROCEDURE, COMPRESSION TESTING	9-3
ENGINE BLOCK HEATER - INSTALLATION	7-14
ENGINE BLOCK HEATER - REMOVAL	7-14
ENGINE CONTROL MODULE - DESCRIPTION	8E-3
ENGINE CONTROL MODULE - INSTALLATION	8E-4
ENGINE CONTROL MODULE - REMOVAL	8E-4
ENGINE COOLANT - DESCRIPTION	0-1
ENGINE COOLANT TEMP SENSOR - DESCRIPTION	7-14
ENGINE COOLANT TEMP SENSOR - INSTALLATION	7-15
ENGINE COOLANT TEMP SENSOR - REMOVAL	7-14
ENGINE COOLANT THERMOSTAT - INSTALLATION	7-16
ENGINE COOLANT THERMOSTAT - REMOVAL	7-15
ENGINE CORE AND OIL GALLERY PLUGS - STANDARD PROCEDURE, REPLACING	9-34
ENGINE COVER - INSTALLATION	9-7
ENGINE COVER - REMOVAL	9-4
ENGINE CRADLE CROSSMEMBER - INSTALLATION	13-8
ENGINE CRADLE CROSSMEMBER - REMOVAL	13-6
ENGINE OIL - DIESEL ENGINES - DESCRIPTION	0-3
ENGINE TEMPERATURE GAUGE - DESCRIPTION	8J-15
ENGINE TEMPERATURE GAUGE - OPERATION	8J-15
ENGINES - DESCRIPTION, ENGINE OIL - DIESEL	0-3
ENTRY MODULE - DESCRIPTION, SENTRY KEY REMOTE	8Q-2
ENTRY MODULE - INSTALLATION, SENTRY KEY REMOTE	8Q-4
ENTRY MODULE - OPERATION, SENTRY KEY REMOTE	8Q-3
ENTRY MODULE - REMOVAL, SENTRY KEY REMOTE	8Q-3
ENTRY TRANSMITTER - DESCRIPTION, REMOTE KEYLESS	8N-2
ENTRY/EXIT LAMP BULB - INSTALLATION	8L-32
ENTRY/EXIT LAMP BULB - REMOVAL	8L-31
ENTRY/EXIT LAMP UNIT - INSTALLATION	8L-32
ENTRY/EXIT LAMP UNIT - REMOVAL	8L-32
EQUIPMENT - STANDARD PROCEDURE, REFRIGERANT SYSTEM SERVICE	24-46
EVACUATE - STANDARD PROCEDURE, REFRIGERANT SYSTEM	24-47
EVAPORATOR - DESCRIPTION, A/C	24-54
EVAPORATOR - INSTALLATION, A/C	24-55
EVAPORATOR - INSTALLATION, REAR	24-61
EVAPORATOR - OPERATION, A/C	24-54
EVAPORATOR - REMOVAL, A/C	24-55
EVAPORATOR - REMOVAL, REAR	24-60
EVAPORATOR TEMPERATURE SENSOR - DESCRIPTION	24-17,24-25
EVAPORATOR TEMPERATURE SENSOR - DIAGNOSIS AND TESTING	24-26
EVAPORATOR TEMPERATURE SENSOR - INSTALLATION	24-18,24-26
EVAPORATOR TEMPERATURE SENSOR - OPERATION	24-18,24-26
EVAPORATOR TEMPERATURE SENSOR - REMOVAL	24-18,24-26
EXHAUST MANIFOLD - INSTALLATION	9-59
EXHAUST MANIFOLD - REMOVAL	9-59
EXHAUST PIPE - INSTALLATION	11-3
EXHAUST PIPE - REMOVAL	11-3
EXHAUST TUBE - INSTALLATION	24-73
EXHAUST TUBE - REMOVAL	24-73
EXPANSION VALVE - DESCRIPTION, A/C	24-55
EXPANSION VALVE - DIAGNOSIS AND TESTING, A/C	24-56
EXPANSION VALVE - INSTALLATION, A/C	24-56
EXPANSION VALVE - INSTALLATION, REAR	24-63
EXPANSION VALVE - OPERATION, A/C	24-55
EXPANSION VALVE - REMOVAL, A/C	24-56
EXPANSION VALVE - REMOVAL, REAR	24-62
EXTERIOR - DESCRIPTION, LAMPS/ LIGHTING	8L-2
EXTERIOR - OPERATION, LAMPS/ LIGHTING	8L-3
EXTERIOR - SPECIFICATIONS, LAMPS/LIGHTING	8L-5
EXTERIOR HANDLE - INSTALLATION	23-16, 23-33,23-36
EXTERIOR HANDLE - REMOVAL	23-16,23-32, 23-36
FAN - INSTALLATION, RADIATOR	7-13
FAN - REMOVAL, RADIATOR	7-13
FAN DRIVE VISCOUS CLUTCH - INSTALLATION	7-16
FAN DRIVE VISCOUS CLUTCH - REMOVAL	7-16
FASCIA - INSTALLATION, FRONT	13-2
FASCIA - INSTALLATION, REAR	13-3
FASCIA - REMOVAL, FRONT	13-2
FASCIA - REMOVAL, REAR	13-3
FASTENER IDENTIFICATION - DESCRIPTION	Intro.-2
FASTENER USAGE - DESCRIPTION	Intro.-5
FILL - STANDARD PROCEDURE, DRAIN	3-11
FILL - STANDARD PROCEDURE, TRANSMISSION	21-103
FILL AND BLEED PROCEDURE, STANDARD PROCEDURE - POWER STEERING PUMP	19-14
FILL DOOR - INSTALLATION, FUEL	23-47
FILL DOOR - REMOVAL, FUEL	23-47
FILL/CHECK LOCATIONS - INSPECTION, FLUID	0-4
FILTER - DESCRIPTION, FLUID	21-101
FILTER - DESCRIPTION, FUEL	14-5
FILTER - INSTALLATION, AIR	24-31,24-39
FILTER - INSTALLATION, FUEL	14-6
FILTER - INSTALLATION, OIL	9-51
FILTER - OPERATION, FLUID	21-101
FILTER - OPERATION, FUEL	14-5
FILTER - REMOVAL, AIR	24-31,24-39
FILTER - REMOVAL, FUEL	14-5
FILTER - REMOVAL, OIL	9-51
FILTER - STANDARD PROCEDURES, DRAINING WATER FROM FUEL	14-2
FILTER CLOGGED INDICATOR - DESCRIPTION, FUEL	8J-15
FILTER CLOGGED INDICATOR - OPERATION, FUEL	8J-15
FINESSE SANDING/BUFFING & POLISH - DESCRIPTION	23-75
FINISH - DESCRIPTION, BASECOAT/ CLEARCOAT	23-74
FITTING - STANDARD PROCEDURE, PISTON RING	9-46
FLARING - STANDARD PROCEDURE, DOUBLE INVERTED	5-8
FLARING - STANDARD PROCEDURE, ISO	5-8
FLOOR DISTRIBUTION DUCTS - INSTALLATION	24-34
FLOOR DISTRIBUTION DUCTS - REMOVAL	24-33
FLOOR MATS - INSTALLATION, CARPETS	23-70
FLOOR MATS - REMOVAL, CARPETS	23-69
FLOW (MAF) SENSOR - DESCRIPTION, MANIFOLD AIR	14-30
FLOW (MAF) SENSOR - INSTALLATION, MANIFOLD AIR	14-31
FLOW (MAF) SENSOR - OPERATION, MANIFOLD AIR	14-30
FLOW (MAF) SENSOR - REMOVAL, MANIFOLD AIR	14-31
FLUID - DESCRIPTION, BRAKE	0-3
FLUID - DESCRIPTION, POWER STEERING	0-3
FLUID - DIAGNOSIS AND TESTING, CAUSES OF BURNT	21-102
FLUID - NAG1 - DESCRIPTION, AUTOMATIC TRANSMISSION	0-4
FLUID - OPERATION, AUTOMATIC TRANSMISSION	0-4
FLUID AND FILTER - DESCRIPTION	21-101
FLUID AND FILTER - OPERATION	21-101
FLUID CAPACITIES - SPECIFICATIONS	0-4
FLUID CONTAMINATION - DIAGNOSIS AND TESTING	21-102
FLUID CONTAMINATION - DIAGNOSIS AND TESTING, BRAKE	5-14
FLUID COOLER TUBE - INSTALLATION	19-14
FLUID COOLER TUBE - REMOVAL	19-14
FLUID FILL/CHECK LOCATIONS - INSPECTION	0-4
FLUID INDICATOR - DESCRIPTION, WASHER	8J-27
FLUID INDICATOR - OPERATION, WASHER	8J-27
FLUID LEVEL - DIAGNOSIS AND TESTING, EFFECTS OF INCORRECT	21-102
FLUID LEVEL - STANDARD PROCEDURE, BRAKE	5-14
FLUID LEVEL SWITCH - DESCRIPTION, WASHER	8R-7
FLUID LEVEL SWITCH - OPERATION, WASHER	8R-8
FLUID RESERVOIR - INSTALLATION	5-15
FLUID RESERVOIR - REMOVAL	5-15
FLUID, SPECIFICATIONS - BRAKE	5-14
FLUID/FILTER SERVICE - STANDARD PROCEDURE	21-104
FLUSH - SPECIFICATIONS, GAP	23-88
FLUSHING POWER STEERING SYSTEM - STANDARD PROCEDURE	19-13
FLYWHEEL - REMOVAL	9-39
FOG LAMP BULB - INSTALLATION	8L-10
FOG LAMP BULB - REMOVAL	8L-10
FOG LAMP RELAY - INSTALLATION	8L-11
FOG LAMP RELAY - REMOVAL	8L-10
FOG LAMP SWITCH - INSTALLATION	8L-12
FOG LAMP SWITCH - REMOVAL	8L-11
FRAME DIMENSIONS - SPECIFICATIONS	13-4
FREEWHEELING CLUTCH - ASSEMBLY	21-107
FREEWHEELING CLUTCH - DESCRIPTION	21-105

Description	Group-Page
FREEWHEELING CLUTCH - DISASSEMBLY	21-106
FREEWHEELING CLUTCH - OPERATION	21-105
FROM FUEL FILTER - STANDARD PROCEDURES, DRAINING WATER	14-2
FROM GEAR TO COOLER TUBE - INSTALLATION, RETURN HOSE	19-15
FROM GEAR TO COOLER TUBE - REMOVAL, RETURN HOSE	19-15
FROM PUMP TO COOLER TUBE - INSTALLATION, RETURN LINE	19-15
FROM PUMP TO COOLER TUBE - REMOVAL, RETURN LINE	19-15
FRONT - INSTALLATION	5-14,5-24
FRONT - INSTALLATION, CRANKSHAFT OIL SEAL	9-38
FRONT - INSTALLATION, SEAT	23-77
FRONT - INSTALLATION, SEAT ADJUSTERS	23-78
FRONT - INSTALLATION, SEAT BACK	23-77
FRONT - INSTALLATION, SEAT CUSHION	23-78
FRONT - REMOVAL	5-13,5-24
FRONT - REMOVAL, CRANKSHAFT OIL SEAL	9-38
FRONT - REMOVAL, SEAT	23-77
FRONT - REMOVAL, SEAT ADJUSTERS	23-78
FRONT - REMOVAL, SEAT BACK	23-77
FRONT - REMOVAL, SEAT CUSHION	23-78
FRONT BUMPER - STEPS - INSTALLATION	13-2
FRONT BUMPER - STEPS - REMOVAL	13-2
FRONT COVER - INSTALLATION, CYLINDER HEAD	9-26
FRONT COVER - REMOVAL, CYLINDER HEAD	9-23
FRONT DOOR INNER BELT WEATHERSTRIP - INSTALLATION	23-87
FRONT DOOR INNER BELT WEATHERSTRIP - REMOVAL	23-87
FRONT DOOR OUTER BELT WEATHERSTRIP - INSTALLATION	23-87
FRONT DOOR OUTER BELT WEATHERSTRIP - REMOVAL	23-87
FRONT (DRW) - INSTALLATION	5-11,5-13,5-21
FRONT (DRW) - REMOVAL	5-12,5-20,5-9
FRONT FASCIA - INSTALLATION	13-2
FRONT FASCIA - REMOVAL	13-2
FRONT LAMP UNIT - ADJUSTMENT	8L-12
FRONT LAMP UNIT - INSTALLATION	8L-12
FRONT LAMP UNIT - REMOVAL	8L-12
FRONT POSITION LAMP BULB - INSTALLATION	8L-14
FRONT POSITION LAMP BULB - REMOVAL	8L-14
FRONT SEAT BELT & RETRACTOR - INSTALLATION	8O-21
FRONT SEAT BELT & RETRACTOR - REMOVAL	8O-19
FRONT SEAT BELT BUCKLE - INSTALLATION	8O-23
FRONT SEAT BELT BUCKLE - REMOVAL	8O-22
FRONT (SRW) - INSTALLATION	5-10,5-12,5-21
FRONT (SRW) - REMOVAL	5-11,5-19,5-9
FRONT SUSPENSION, SPECIAL TOOLS	19-11
FRONT SUSPENSION, SPECIAL TOOLS	2-2
FRONT TURN/PARK/SIDE MARKER LAMP BULB - INSTALLATION	8L-15
FRONT TURN/PARK/SIDE MARKER LAMP BULB - REMOVAL	8L-14
FRONT WHEEL SPEED SENSOR - INSTALLATION	5-30
FRONT WHEEL SPEED SENSOR - REMOVAL	5-30
FUEL DOSING PUMP - DESCRIPTION	24-74
FUEL DOSING PUMP - INSTALLATION	24-74
FUEL DOSING PUMP - OPERATION	24-74
FUEL DOSING PUMP - REMOVAL	24-74
FUEL FILL DOOR - INSTALLATION	23-47
FUEL FILL DOOR - REMOVAL	23-47
FUEL FILTER - DESCRIPTION	14-5
FUEL FILTER - INSTALLATION	14-6
FUEL FILTER - OPERATION	14-5
FUEL FILTER - REMOVAL	14-5
FUEL FILTER - STANDARD PROCEDURES, DRAINING WATER FROM	14-2
FUEL FILTER CLOGGED INDICATOR - DESCRIPTION	8J-15
FUEL FILTER CLOGGED INDICATOR - OPERATION	8J-15
FUEL GAUGE - DESCRIPTION	8J-16
FUEL GAUGE - OPERATION	8J-16
FUEL INDICATOR - DESCRIPTION, LOW	8J-18
FUEL INDICATOR - OPERATION, LOW	8J-18
FUEL INJECTOR, DESCRIPTION	14-20
FUEL INJECTORS - STANDARD PROCEDURE, CLEANING	14-22
FUEL LEVEL SENDING UNIT / SENSOR - DESCRIPTION	14-15
FUEL LEVEL SENDING UNIT / SENSOR - INSTALLATION	14-15
FUEL LEVEL SENDING UNIT / SENSOR - REMOVAL	14-15
FUEL LINE - INSTALLATION	24-76
FUEL LINE - REMOVAL	24-75
FUEL LINES - DIAGNOSIS AND TESTING, HIGH PRESSURE	14-1
FUEL LINES - STANDARD PROCEDURE, DISCONNECTING AND CONNECTING	14-2
FUEL PRESSURE SOLENOID - DESCRIPTION	14-27
FUEL PRESSURE SOLENOID - INSTALLATION	14-28
FUEL PRESSURE SOLENOID - OPERATION	14-27
FUEL PRESSURE SOLENOID - REMOVAL	14-28
FUEL PUMP TEST - STANDARD PROCEDURE, LOW PRESSURE	14-3
FUEL RAIL - DESCRIPTION	14-11
FUEL RAIL - INSTALLATION	14-11
FUEL RAIL - OPERATION	14-11
FUEL RAIL - REMOVAL	14-11
FUEL REQUIREMENTS - DIESEL ENGINE - DESCRIPTION	0-1
FUEL SENSOR - DESCRIPTION, WATER IN	14-16
FUEL SENSOR - OPERATION, WATER IN	14-16
FUEL SHUTOFF SOL - DESCRIPTION, HI PRESSURE	14-16
FUEL SHUTOFF SOL - OPERATION, HI PRESSURE	14-16
FUEL SUPPLY RESTRICTIONS - DIAGNOSIS AND TESTING	14-5
FUEL SYSTEM - DIAGNOSIS AND TESTING, AIR IN	14-2
FUEL SYSTEM COMPONENTS - STANDARD PROCEDURES, CLEANING	14-2
FUEL SYSTEM PRESSURE - WARNING, HIGH	14-1
FUEL SYSTEM, SPECIAL TOOLS	14-5
FUEL TANK - DESCRIPTION	14-12
FUEL TANK - INSTALLATION	14-13
FUEL TANK - REMOVAL	14-12
FUEL TANK MODULE - DESCRIPTION	14-13
FUEL TANK MODULE - INSTALLATION	14-14
FUEL TANK MODULE - REMOVAL	14-13
FUEL TEMPERATURE SENSOR - DESCRIPTION	14-29
FUEL TEMPERATURE SENSOR - INSTALLATION	14-29
FUEL TEMPERATURE SENSOR - OPERATION	14-29
FUEL TEMPERATURE SENSOR - REMOVAL	14-29
FUNCTION TEST - DIAGNOSIS AND TESTING	24-3
FUSE BLOCK #1 - DESCRIPTION	8W-97-2
FUSE BLOCK #1 - INSTALLATION	8W-97-3
FUSE BLOCK #1 - OPERATION	8W-97-2
FUSE BLOCK #1 - REMOVAL	8W-97-3
FUSE BLOCK #2 - DESCRIPTION	8W-97-3
FUSE BLOCK #2 - OPERATION	8W-97-3
FUSES POWERING SEVERAL LOADS - STANDARD PROCEDURE, TESTING FOR A SHORT TO GROUND ON	8W-01-8
GALLERY PLUGS - STANDARD PROCEDURE, REPLACING ENGINE CORE AND OIL	9-34
GAP - STANDARD PROCEDURE, COMPRESSOR CLUTCH AIR	24-9
GAP AND FLUSH - SPECIFICATIONS	23-88
GAUGE - DESCRIPTION, ENGINE TEMPERATURE	8J-15
GAUGE - DESCRIPTION, FUEL	8J-16
GAUGE - OPERATION, ENGINE TEMPERATURE	8J-15
GAUGE - OPERATION, FUEL	8J-16
GAUGES - DIAGNOSIS AND TESTING, PRESSURE	22-8
GEAR - DESCRIPTION	19-8
GEAR - INSTALLATION	19-8
GEAR - INSTALLATION, INTERMEDIATE	9-66
GEAR - REMOVAL	19-8
GEAR - REMOVAL, INTERMEDIATE	9-61
GEAR SELECTOR INDICATOR - DESCRIPTION	8J-17
GEAR SELECTOR INDICATOR - OPERATION	8J-17
GEAR TO COOLER TUBE - INSTALLATION, RETURN HOSE FROM	19-15
GEAR TO COOLER TUBE - REMOVAL, RETURN HOSE FROM	19-15
GEARSHIFT CABLE - DIAGNOSIS AND TESTING	21-109
GEARSHIFT CABLE - INSTALLATION	21-109
GEARSHIFT CABLE - REMOVAL	21-109
GEARTRAIN - ASSEMBLY, PLANETARY	21-131
GEARTRAIN - DESCRIPTION, PLANETARY	21-130
GEARTRAIN - DISASSEMBLY, PLANETARY	21-131
GEARTRAIN - OPERATION, PLANETARY	21-130
GENERAL - WARNINGS	8W-01-6
GENERATOR - DESCRIPTION	8F-18
GENERATOR - INSTALLATION	8F-18
GENERATOR - OPERATION	8F-18
GENERATOR - REMOVAL	8F-18
GENERATOR DECOUPLER - DIAGNOSIS AND TESTING	8F-19
GENERATOR DECOUPLER PULLEY - DESCRIPTION	8F-19
GENERATOR DECOUPLER PULLEY - INSTALLATION	8F-21
GENERATOR DECOUPLER PULLEY - OPERATION	8F-19
GENERATOR DECOUPLER PULLEY - REMOVAL	8F-20
GLASS - INSTALLATION, DOOR	23-15,23-31, 23-46
GLASS - INSTALLATION, SIDE VIEW MIRROR	23-49
GLASS - REMOVAL, DOOR	23-15,23-31,23-46
GLASS - REMOVAL, SIDE VIEW MIRROR	23-49
GLOVE BOX - INSTALLATION	23-56
GLOVE BOX - REMOVAL	23-56
GLOW PLUG - INSTALLATION	8I-1
GLOW PLUG - REMOVAL	8I-1
GLOW PLUG RELAY - DESCRIPTION	8I-2
GLOW PLUG RELAY - OPERATION	8I-2
GLOW PLUG RELAYS - DIAGNOSIS AND TESTING	8I-2
GRILLE - INSTALLATION	23-47
GRILLE - REMOVAL	23-47
GROUND - STANDARD PROCEDURE, TESTING FOR A SHORT TO	8W-01-8
GROUND AND SPLICE INFORMATION - DESCRIPTION, CONNECTOR	8W-01-5
GROUND ON FUSES POWERING SEVERAL LOADS - STANDARD PROCEDURE, TESTING FOR A SHORT TO	8W-01-8
GUIDE RAIL - INSTALLATION, CYLINDER HEAD	9-26
GUIDE RAIL - REMOVAL, CYLINDER HEAD	9-24
HANDLE - INSTALLATION, ASSIST	23-68
HANDLE - INSTALLATION, EXTERIOR	23-16, 23-33,23-36
HANDLE - INSTALLATION, LATCH RELEASE	23-52
HANDLE - REMOVAL, ASSIST	23-68
HANDLE - REMOVAL, EXTERIOR	23-16,23-32, 23-36
HANDLE - REMOVAL, LATCH RELEASE	23-52
HANDLE ACTUATOR - INSTALLATION, INSIDE	23-34,23-37
HANDLE ACTUATOR - REMOVAL, INSIDE	23-34, 23-37
HANDLING NON-DEPLOYED SUPPLEMENTAL RESTRAINTS - STANDARD PROCEDURE	8O-6
HARNESS - DIAGNOSIS AND TESTING, WIRING	8W-01-6

Description	Group-Page
HAT BRAKE - CLEANING, REAR DRUM IN	5-27
HCU (HYDRAULIC CONTROL UNIT) - DESCRIPTION	5-31
HCU (HYDRAULIC CONTROL UNIT) - INSTALLATION	5-32
HCU (HYDRAULIC CONTROL UNIT) - REMOVAL	5-31
HEAD - INSTALLATION, CYLINDER	9-25
HEAD - REMOVAL, CYLINDER	9-22
HEAD BOLT INSPECTION - STANDARD PROCEDURE, CYLINDER	9-21
HEAD COVER(S) - INSTALLATION, CYLINDER	9-30
HEAD COVER(S) - REMOVAL, CYLINDER	9-30
HEAD FRONT COVER - INSTALLATION, CYLINDER	9-26
HEAD FRONT COVER - REMOVAL, CYLINDER	9-23
HEAD GUIDE RAIL - INSTALLATION, CYLINDER	9-26
HEAD GUIDE RAIL - REMOVAL, CYLINDER	9-24
HEAD SURFACE - STANDARD PROCEDURE, MEASURE CYLINDER	9-21
HEADLAMP BULB - INSTALLATION, HIGH BEAM	8L-17
HEADLAMP BULB - INSTALLATION, LOW BEAM	8L-19
HEADLAMP BULB - REMOVAL, HIGH BEAM	8L-17
HEADLAMP BULB - REMOVAL, LOW BEAM	8L-18
HEADLAMP LEVELING MOTOR - INSTALLATION	8L-16
HEADLAMP LEVELING MOTOR - REMOVAL	8L-15
HEADLAMP LEVELING SWITCH - INSTALLATION	8L-17
HEADLAMP LEVELING SWITCH - REMOVAL	8L-16
HEADLINER - INSTALLATION	23-71
HEADLINER - REMOVAL	23-70
HEADREST - INSTALLATION	23-76
HEADREST - REMOVAL	23-76
HEATED SEAT ELEMENT - DESCRIPTION	8G-3
HEATED SEAT ELEMENT - DIAGNOSIS AND TESTING	8G-3
HEATED SEAT ELEMENT - OPERATION	8G-3
HEATED SEAT RELAY - DESCRIPTION	8G-4
HEATED SEAT RELAY - DIAGNOSIS AND TESTING	8G-4
HEATED SEAT RELAY - INSTALLATION	8G-4
HEATED SEAT RELAY - OPERATION	8G-4
HEATED SEAT RELAY - REMOVAL	8G-4
HEATED SEAT SENSOR - DESCRIPTION	8G-4
HEATED SEAT SENSOR - DIAGNOSIS AND TESTING	8G-4
HEATED SEAT SWITCH - DESCRIPTION, DRIVER	8G-2
HEATED SEAT SWITCH - DESCRIPTION, PASSENGER	8G-5
HEATED SEAT SWITCH - DIAGNOSIS AND TESTING, DRIVER	8G-2
HEATED SEAT SWITCH - DIAGNOSIS AND TESTING, PASSENGER	8G-5
HEATED SEAT SWITCH - INSTALLATION, DRIVER	8G-3
HEATED SEAT SWITCH - INSTALLATION, PASSENGER	8G-5
HEATED SEAT SWITCH - OPERATION, DRIVER	8G-2
HEATED SEAT SWITCH - OPERATION, PASSENGER	8G-5
HEATED SEAT SWITCH - REMOVAL, DRIVER	8G-3
HEATED SEAT SWITCH - REMOVAL, PASSENGER	8G-5
HEATED SEATS - DESCRIPTION	8G-1
HEATED SEATS - DIAGNOSIS AND TESTING	8G-2
HEATED SEATS - OPERATION	8G-2
HEATER - DCHA - DIAGNOSIS AND TESTING, DIESEL SUPPLEMENTAL	24-72
HEATER - DESCRIPTION, CABIN	24-72
HEATER - INSTALLATION, ENGINE BLOCK	7-14
HEATER - OPERATION, CABIN	24-72
HEATER - REMOVAL, ENGINE BLOCK	7-14
HEATER AND AIR CONDITIONER - DESCRIPTION	24-1
HEATER AND AIR CONDITIONER - OPERATION	24-2
HEATER CONTROL - DESCRIPTION, A/C	24-12
HEATER CONTROL - INSTALLATION, A/C	24-13
HEATER CONTROL - OPERATION, A/C	24-12
HEATER CONTROL - REMOVAL, A/C	24-12
HEATER CORE - DESCRIPTION	24-57
HEATER CORE - INSTALLATION	24-58
HEATER CORE - OPERATION	24-57
HEATER CORE - REMOVAL	24-58
HEATER PERFORMANCE - DIAGNOSIS AND TESTING	24-4
HI PRESSURE FUEL SHUTOFF SOL - DESCRIPTION	14-16
HI PRESSURE FUEL SHUTOFF SOL - OPERATION	14-16
HIGH BEAM HEADLAMP BULB - INSTALLATION	8L-17
HIGH BEAM HEADLAMP BULB - REMOVAL	8L-17
HIGH BEAM INDICATOR - DESCRIPTION	8J-17
HIGH BEAM INDICATOR - OPERATION	8J-17
HIGH FUEL SYSTEM PRESSURE - WARNING	14-1
HIGH MOUNTED STOP LAMP BULB - INSTALLATION, CENTER	8L-7
HIGH MOUNTED STOP LAMP BULB - REMOVAL, CENTER	8L-7
HIGH MOUNTED STOP LAMP UN - INSTALLATION, CENTER	8L-8
HIGH MOUNTED STOP LAMP UN - REMOVAL, CENTER	8L-8
HIGH PRESSURE FUEL LINES - DIAGNOSIS AND TESTING	14-1
HIGH PRESSURE LINES - INSTALLATION	14-7
HIGH PRESSURE LINES - REMOVAL	14-6
HIGH PRESSURE PUMP - DESCRIPTION	14-7
HIGH PRESSURE PUMP - INSTALLATION	14-10
HIGH PRESSURE PUMP - REMOVAL	14-8
HIGH SPEEDS - DESCRIPTION, TIRE PRESSURE	22-6
HINGE - INSTALLATION	23-17,23-34,23-50
HINGE - REMOVAL	23-17,23-34,23-50
HITCH - INSTALLATION, TRAILER	13-10
HITCH - REMOVAL, TRAILER	13-9
HOAT COOLANT - DESCRIPTION	0-2
HOISTING - STANDARD PROCEDURE	0-5
HOLDDOWN - DESCRIPTION, BATTERY	8F-14
HOLDDOWN - INSTALLATION, BATTERY	8F-14
HOLDDOWN - REMOVAL, BATTERY	8F-14
HOLDER - INSTALLATION, CUP	23-56
HOLDER - REMOVAL, CUP	23-55
HOLDING CLUTCH B1 - ASSEMBLY	21-113
HOLDING CLUTCH B1 - DISASSEMBLY	21-112
HOLDING CLUTCH B2 - ASSEMBLY	21-116
HOLDING CLUTCH B2 - DISASSEMBLY	21-115
HOLDING CLUTCHES - DESCRIPTION	21-111
HOLDING CLUTCHES - OPERATION	21-112
HOLE REPAIR - DESCRIPTION, THREADED	Intro.-5
HOOD - INSTALLATION	23-50
HOOD - REMOVAL	23-50
HOOD BATTERY INSTALLATION, INSTALLATION - UNDER	8F-13
HOOD BATTERY REMOVAL, REMOVAL - UNDER	8F-12
HORN - INSTALLATION	8H-1
HORN - REMOVAL	8H-1
HORN SWITCH - INSTALLATION	8H-1
HORN SWITCH - REMOVAL	8H-1
HOSE - INSTALLATION, INLET	24-78
HOSE - INSTALLATION, PRESSURE	19-15
HOSE - REMOVAL, INLET	24-78
HOSE - REMOVAL, PRESSURE	19-15
HOSE FROM GEAR TO COOLER TUBE - INSTALLATION, RETURN	19-15
HOSE FROM GEAR TO COOLER TUBE - REMOVAL, RETURN	19-15
HOSES/LINES/TUBES PRECAUTIONS, CAUTION - REFRIGERANT	24-45
HOSES/TUBES - DESCRIPTION, WASHER	8R-8
HOSES/TUBES - OPERATION, WASHER	8R-9
HOUSING - ASSEMBLY, HVAC	24-36
HOUSING - DISASSEMBLY, HVAC	24-36
HOUSING - INSTALLATION, AIR CLEANER	9-20
HOUSING - INSTALLATION, HVAC	24-36
HOUSING - INSTALLATION, REAR A/C	24-41
HOUSING - REMOVAL, AIR CLEANER	9-20
HOUSING - REMOVAL, HVAC	24-34
HOUSING - REMOVAL, REAR A/C	24-40
HOW TO USE WIRING DIAGRAMS - DESCRIPTION	8W-01-1
HUB / BEARING - INSTALLATION	2-5
HUB / BEARING - REMOVAL	2-4
HUB BEARINGS/SEALS - INSTALLATION, AXLE	3-20
HUB BEARINGS/SEALS - REMOVAL, AXLE	3-20
HUB SEAL - INSTALLATION, TORQUE CONVERTER	21-147
HUB SEAL - REMOVAL, TORQUE CONVERTER	21-147
HVAC HOUSING - ASSEMBLY	24-36
HVAC HOUSING - DISASSEMBLY	24-36
HVAC HOUSING - INSTALLATION	24-36
HVAC HOUSING - REMOVAL	24-34
IDENTIFICATION - DESCRIPTION, FASTENER	Intro.-2
IDENTIFICATION AND INFORMATION - DESCRIPTION, SECTION	8W-01-5
IDENTIFICATION NUMBER - DESCRIPTION, VEHICLE	Intro.-1
IGNITION CONTROL - SPECIAL TOOLS	8I-1
IGNITION-OFF DRAW TEST - STANDARD PROCEDURE	8F-10
INBOARD - INSTALLATION	8O-30
INBOARD - REMOVAL	8O-29
IN-CAR TEMPERATURE SENSOR - DESCRIPTION	24-19
IN-CAR TEMPERATURE SENSOR - DIAGNOSIS AND TESTING	24-19
IN-CAR TEMPERATURE SENSOR - OPERATION	24-19
IN-CAR TEMPERATURE SENSOR - REMOVAL	24-19
INCORRECT FLUID LEVEL - DIAGNOSIS AND TESTING, EFFECTS OF	21-102
INDICATOR - DESCRIPTION, ABS	8J-9
INDICATOR - DESCRIPTION, AIRBAG	8J-10
INDICATOR - DESCRIPTION, AMBIENT TEMPERATURE	8J-11
INDICATOR - DESCRIPTION, BRAKE WEAR	8J-12
INDICATOR - DESCRIPTION, BRAKE/PARK BRAKE	8J-11
INDICATOR - DESCRIPTION, CHARGING	8J-13
INDICATOR - DESCRIPTION, COOLANT LOW	8J-14
INDICATOR - DESCRIPTION, FUEL FILTER CLOGGED	8J-15
INDICATOR - DESCRIPTION, GEAR SELECTOR	8J-17
INDICATOR - DESCRIPTION, HIGH BEAM	8J-17
INDICATOR - DESCRIPTION, LOW FUEL	8J-18
INDICATOR - DESCRIPTION, LOW OIL LEVEL	8J-18
INDICATOR - DESCRIPTION, MAINTENANCE	8J-19
INDICATOR - DESCRIPTION, MULTI-FUNCTION	8J-20
INDICATOR - DESCRIPTION, SEATBELT	8J-22
INDICATOR - DESCRIPTION, TRACTION CONTROL	8J-24
INDICATOR - DESCRIPTION, TRACTION CONTROL MALFUNCTION	8J-25
INDICATOR - DESCRIPTION, TURN SIGNAL	8J-25
INDICATOR - DESCRIPTION, WAIT-TO-START	8J-26
INDICATOR - DESCRIPTION, WASHER FLUID	8J-27
INDICATOR - DESCRIPTION, WATER-IN-FUEL	8J-27
INDICATOR - OPERATION, ABS	8J-9
INDICATOR - OPERATION, AIRBAG	8J-10
INDICATOR - OPERATION, AMBIENT TEMPERATURE	8J-11
INDICATOR - OPERATION, BRAKE WEAR	8J-12
INDICATOR - OPERATION, BRAKE/PARK BRAKE	8J-12
INDICATOR - OPERATION, CHARGING	8J-13

Description	Group-Page
INDICATOR - OPERATION, COOLANT LOW	8J-14
INDICATOR - OPERATION, FUEL FILTER CLOGGED	8J-15
INDICATOR - OPERATION, GEAR SELECTOR	8J-17
INDICATOR - OPERATION, HIGH BEAM	8J-17
INDICATOR - OPERATION, LOW FUEL	8J-18
INDICATOR - OPERATION, LOW OIL LEVEL	8J-18
INDICATOR - OPERATION, MAINTENANCE	8J-19
INDICATOR - OPERATION, MULTI-FUNCTION	8J-21
INDICATOR - OPERATION, SEATBELT	8J-22
INDICATOR - OPERATION, TRACTION CONTROL	8J-24
INDICATOR - OPERATION, TRACTION CONTROL MALFUNCTION	8J-25
INDICATOR - OPERATION, TURN SIGNAL	8J-25
INDICATOR - OPERATION, WAIT-TO-START	8J-26
INDICATOR - OPERATION, WASHER FLUID	8J-27
INDICATOR - OPERATION, WATER-IN-FUEL	8J-28
INDICATOR LAMP (MIL) - DESCRIPTION, MALFUNCTION	8J-20
INDICATOR LAMP (MIL) - OPERATION, MALFUNCTION	8J-20
INDICATORS - DIAGNOSIS AND TESTING, TREAD WEAR	22-8
INFLATION PRESSURES - DESCRIPTION, TIRE	22-7
INITIAL OPERATION - STANDARD PROCEDURE, POWER STEERING PUMP	19-12
INJECTOR CLASSIFICATION - STANDARD PROCEDURE	14-22
INJECTOR, DESCRIPTION - FUEL	14-20
INJECTORS - STANDARD PROCEDURE, CLEANING FUEL	14-22
INLET AIR TEMPERATURE SENSOR - DESCRIPTION	14-29
INLET AIR TEMPERATURE SENSOR - INSTALLATION	14-30
INLET AIR TEMPERATURE SENSOR - OPERATION	14-29
INLET AIR TEMPERATURE SENSOR - REMOVAL	14-30
INLET HOSE - INSTALLATION	24-78
INLET HOSE - REMOVAL	24-78
INNER BELT WEATHERSTRIP - INSTALLATION, FRONT DOOR	23-87
INNER BELT WEATHERSTRIP - REMOVAL, FRONT DOOR	23-87
INPUT SPEED SENSORS - DESCRIPTION	21-119
INPUT SPEED SENSORS - OPERATION	21-119
INSIDE HANDLE ACTUATOR - INSTALLATION	23-34,23-37
INSIDE HANDLE ACTUATOR - REMOVAL	23-34,23-37
INSTRUMENT CLUSTER - DESCRIPTION	8J-2
INSTRUMENT CLUSTER - DIAGNOSIS AND TESTING	8J-7
INSTRUMENT CLUSTER - INSTALLATION	8J-9
INSTRUMENT CLUSTER - OPERATION	8J-5
INSTRUMENT CLUSTER - REMOVAL	8J-7
INSTRUMENT PANEL - INSTALLATION	8L-29
INSTRUMENT PANEL - REMOVAL	8L-28
INSTRUMENT PANEL ANTENNA CABLE - INSTALLATION	8A-2
INSTRUMENT PANEL ANTENNA CABLE - REMOVAL	8A-1
INSTRUMENT PANEL ASSEMBLY - INSTALLATION	23-61
INSTRUMENT PANEL ASSEMBLY - REMOVAL	23-57
INSTRUMENT PANEL CENTER BEZEL - INSTALLATION	23-55
INSTRUMENT PANEL CENTER BEZEL - REMOVAL	23-55
INSTRUMENT PANEL DUCTS - INSTALLATION	24-38
INSTRUMENT PANEL DUCTS - REMOVAL	24-37
INTAKE MANIFOLD - INSTALLATION	9-58
INTAKE MANIFOLD - REMOVAL	9-57
INTERIOR - CAUTION	23-67
INTERIOR - DESCRIPTION, LAMPS/ LIGHTING	8L-25
INTERIOR - OPERATION, LAMPS/ LIGHTING	8L-26
INTERIOR LIGHTING - SPECIFICATIONS	8L-26
INTERMEDIATE GEAR - INSTALLATION	9-66
INTERMEDIATE GEAR - REMOVAL	9-61
INTERMEDIATE SHAFT - INSTALLATION	19-5
INTERMEDIATE SHAFT - REMOVAL	19-5
INTERNATIONAL SYMBOLS - DESCRIPTION	Intro.-2
INTERNATIONAL SYMBOLS - DESCRIPTION	0-9
INTRUSION SENSOR - INSTALLATION	8Q-2
INTRUSION SENSOR - REMOVAL	8Q-2
INVERTED FLARING - STANDARD PROCEDURE, DOUBLE	5-8
ISO FLARING - STANDARD PROCEDURE	5-8
JAMB SWITCH - INSTALLATION, DOOR	8L-31
JAMB SWITCH - REMOVAL, DOOR	8L-31
JET - DESCRIPTION, OIL	9-51
JET - INSTALLATION, OIL	9-51
JET - REMOVAL, OIL	9-51
JOINT - INSTALLATION, LOWER BALL	2-6
JOINT - REMOVAL, LOWER BALL	2-6
JOURNALS - STANDARD PROCEDURE, MEASURE CRANKSHAFT AND BLOCK	9-35
JUMP STARTING - STANDARD PROCEDURE	0-6
K1 - ASSEMBLY, DRIVING CLUTCH	21-75
K1 - DISASSEMBLY, DRIVING CLUTCH	21-74
K2 - ASSEMBLY, DRIVING CLUTCH	21-78
K2 - DISASSEMBLY, DRIVING CLUTCH	21-76
K3 - ASSEMBLY, DRIVING CLUTCH	21-80
K3 - DISASSEMBLY, DRIVING CLUTCH	21-80
KEY - DESCRIPTION, TRANSPONDER	8Q-5
KEY - OPERATION, TRANSPONDER	8Q-5
KEY REMOTE ENTRY MODULE - DESCRIPTION, SENTRY	8Q-2
KEY REMOTE ENTRY MODULE - INSTALLATION, SENTRY	8Q-4
KEY REMOTE ENTRY MODULE - OPERATION, SENTRY	8Q-3
KEY REMOTE ENTRY MODULE - REMOVAL, SENTRY	8Q-3
KEYLESS ENTRY TRANSMITTER - DESCRIPTION, REMOTE	8N-2
KEY/LOCK CYLINDER - INSTALLATION	19-7
KEY/LOCK CYLINDER - REMOVAL	19-6
KNUCKLE - INSTALLATION	2-5
KNUCKLE - REMOVAL	2-5
LAMP BULB - INSTALLATION, BACKUP	8L-6
LAMP BULB - INSTALLATION, BRAKE/PARK	8L-7
LAMP BULB - INSTALLATION, CARGO/DOME	8L-27
LAMP BULB - INSTALLATION, CENTER HIGH MOUNTED STOP	8L-7
LAMP BULB - INSTALLATION, CLEARANCE	8L-8
LAMP BULB - INSTALLATION, DOME/READING	8L-29
LAMP BULB - INSTALLATION, ENTRY/EXIT	8L-32
LAMP BULB - INSTALLATION, FOG	8L-10
LAMP BULB - INSTALLATION, FRONT POSITION	8L-14
LAMP BULB - INSTALLATION, FRONT TURN/PARK/SIDE MARKER	8L-15
LAMP BULB - INSTALLATION, LICENSE PLATE	8L-18
LAMP BULB - INSTALLATION, REAR SIDE MARKER	8L-21
LAMP BULB - INSTALLATION, REAR TURN	8L-22
LAMP BULB - INSTALLATION, REPEATER	8L-22
LAMP BULB - REMOVAL, BACKUP	8L-5
LAMP BULB - REMOVAL, BRAKE/PARK	8L-7
LAMP BULB - REMOVAL, CARGO/DOME	8L-27
LAMP BULB - REMOVAL, CENTER HIGH MOUNTED STOP	8L-7
LAMP BULB - REMOVAL, CLEARANCE	8L-8
LAMP BULB - REMOVAL, DOME/READING	8L-29
LAMP BULB - REMOVAL, ENTRY/EXIT	8L-31
LAMP BULB - REMOVAL, FOG	8L-10
LAMP BULB - REMOVAL, FRONT POSITION	8L-14
LAMP BULB - REMOVAL, FRONT TURN/PARK/SIDE MARKER	8L-14
LAMP BULB - REMOVAL, LICENSE PLATE	8L-17
LAMP BULB - REMOVAL, REAR SIDE MARKER	8L-21
LAMP BULB - REMOVAL, REAR TURN	8L-21
LAMP BULB - REMOVAL, REPEATER	8L-22
LAMP (MIL) - DESCRIPTION, MALFUNCTION INDICATOR	8J-20
LAMP (MIL) - OPERATION, MALFUNCTION INDICATOR	8J-20
LAMP RELAY - INSTALLATION, DAYTIME RUNNING	8L-9
LAMP RELAY - INSTALLATION, FOG	8L-11
LAMP RELAY - REMOVAL, DAYTIME RUNNING	8L-9
LAMP RELAY - REMOVAL, FOG	8L-10
LAMP SWITCH - INSTALLATION, BRAKE	8L-6
LAMP SWITCH - INSTALLATION, FOG	8L-12
LAMP SWITCH - REMOVAL, BRAKE	8L-6
LAMP SWITCH - REMOVAL, FOG	8L-11
LAMP UN - INSTALLATION, CENTER HIGH MOUNTED STOP	8L-8
LAMP UN - REMOVAL, CENTER HIGH MOUNTED STOP	8L-8
LAMP UNIT - ADJUSTMENT, FRONT	8L-12
LAMP UNIT - INSTALLATION, ASH RECEIVER/CIGAR LIGHTER	8L-27
LAMP UNIT - INSTALLATION, CARGO/DOME	8L-28
LAMP UNIT - INSTALLATION, CLEARANCE	8L-9
LAMP UNIT - INSTALLATION, DOME/READING	8L-30
LAMP UNIT - INSTALLATION, ENTRY/EXIT	8L-32
LAMP UNIT - INSTALLATION, FRONT	8L-12
LAMP UNIT - INSTALLATION, LICENSE PLATE	8L-18
LAMP UNIT - INSTALLATION, REPEATER	8L-23
LAMP UNIT - INSTALLATION, TAIL	8L-23
LAMP UNIT - REMOVAL, ASH RECEIVER/CIGAR LIGHTER	8L-27
LAMP UNIT - REMOVAL, CARGO/DOME	8L-28
LAMP UNIT - REMOVAL, CLEARANCE	8L-8
LAMP UNIT - REMOVAL, DOME/READING	8L-30
LAMP UNIT - REMOVAL, ENTRY/EXIT	8L-32
LAMP UNIT - REMOVAL, FRONT	8L-12
LAMP UNIT - REMOVAL, LICENSE PLATE	8L-18
LAMP UNIT - REMOVAL, REPEATER	8L-22
LAMP UNIT - REMOVAL, TAIL	8L-23
LAMP/INTRUSION SENSOR - INSTALLATION, DOME	8L-31
LAMP/INTRUSION SENSOR - REMOVAL, DOME	8L-31
LAMP/INTRUSION SENSOR BULB - INSTALLATION, DOME	8L-30
LAMP/INTRUSION SENSOR BULB - REMOVAL, DOME	8L-30
LAMPS/LIGHTING - EXTERIOR - DESCRIPTION	8L-2
LAMPS/LIGHTING - EXTERIOR - OPERATION	8L-3
LAMPS/LIGHTING - EXTERIOR - SPECIFICATIONS	8L-5
LAMPS/LIGHTING - INTERIOR - DESCRIPTION	8L-25
LAMPS/LIGHTING - INTERIOR - OPERATION	8L-26
LATCH - INSTALLATION	23-18,23-35,23-51
LATCH - INSTALLATION, REAR	23-40
LATCH - INSTALLATION, SAFETY	23-52
LATCH / LOCK CONTROL - INSTALLATION	23-40
LATCH / LOCK CONTROL - REMOVAL	23-39
LATCH - REMOVAL	23-18,23-34,23-51
LATCH - REMOVAL, REAR	23-40
LATCH - REMOVAL, SAFETY	23-52
LATCH RELEASE CABLE - INSTALLATION	23-51
LATCH RELEASE CABLE - REMOVAL	23-51
LATCH RELEASE HANDLE - INSTALLATION	23-52
LATCH RELEASE HANDLE - REMOVAL	23-52
LATCH STRIKER - INSTALLATION	23-18
LATCH STRIKER - INSTALLATION, REAR	23-41
LATCH STRIKER - REMOVAL	23-18

Description	Group-Page
LATCH STRIKER - REMOVAL, REAR	23-41
LEAD - DIAGNOSIS AND TESTING, TIRE/VEHICLE	22-8
LEAK DOWN TEST - STANDARD PROCEDURE, CYLINDER	9-3
LEAKAGE - DIAGNOSIS AND TESTING, PUMP	19-12
LEAKS - DIAGNOSIS AND TESTING, CHARGE AIR COOLER SYSTEM	11-4
LEAKS - DIAGNOSIS AND TESTING, COOLING SYSTEM	7-10
LEAKS - DIAGNOSIS AND TESTING, REFRIGERANT SYSTEM	24-46
LEAKS - DIAGNOSIS AND TESTING, WATER	23-1
LEAKS - STANDARD PROCEDURE, REPAIRING	22-10
LEFT MOUNT - INSTALLATION	9-49
LEFT MOUNT - REMOVAL	9-49
LEVEL - DIAGNOSIS AND TESTING, EFFECTS OF INCORRECT FLUID	21-102
LEVEL - STANDARD PROCEDURE, BRAKE FLUID	5-14
LEVEL - STANDARD PROCEDURE, CHECK OIL	21-102
LEVEL - STANDARD PROCEDURE, CHECKING BATTERY ELECTROLYTE	8F-12
LEVEL - STANDARD PROCEDURE, REFRIGERANT OIL	24-65
LEVEL INDICATOR - DESCRIPTION, LOW OIL	8J-18
LEVEL INDICATOR - OPERATION, LOW OIL	8J-18
LEVEL SENDING UNIT / SENSOR - DESCRIPTION, FUEL	14-15
LEVEL SENDING UNIT / SENSOR - INSTALLATION, FUEL	14-15
LEVEL SENDING UNIT / SENSOR - REMOVAL, FUEL	14-15
LEVEL SENSOR - INSTALLATION, COOLANT	7-13
LEVEL SENSOR - REMOVAL, COOLANT	7-13
LEVEL SWITCH - DESCRIPTION, WASHER FLUID	8R-7
LEVEL SWITCH - OPERATION, WASHER FLUID	8R-8
LEVELING MOTOR - INSTALLATION, HEADLAMP	8L-16
LEVELING MOTOR - REMOVAL, HEADLAMP	8L-15
LEVELING SWITCH - INSTALLATION, HEADLAMP	8L-17
LEVELING SWITCH - REMOVAL, HEADLAMP	8L-16
LEVER - INSTALLATION	5-26
LEVER - INSTALLATION, ALB	5-15
LEVER - REMOVAL	5-26
LEVER - REMOVAL, ALB	5-15
LICENSE PLATE BRACKET - INSTALLATION	23-47
LICENSE PLATE BRACKET - REMOVAL	23-47
LICENSE PLATE LAMP BULB - INSTALLATION	8L-18
LICENSE PLATE LAMP BULB - REMOVAL	8L-17
LICENSE PLATE LAMP UNIT - INSTALLATION	8L-18
LICENSE PLATE LAMP UNIT - REMOVAL	8L-18
LIGHTER LAMP UNIT - INSTALLATION, ASH RECEIVER/CIGAR	8L-27
LIGHTER LAMP UNIT - REMOVAL, ASH RECEIVER/CIGAR	8L-27
LIGHTER OUTLET - DESCRIPTION, CIGAR	8W-97-1
LIGHTER OUTLET - DIAGNOSIS AND TESTING, CIGAR	8W-97-2
LIGHTER OUTLET - OPERATION, CIGAR	8W-97-2
LIGHTER OUTLET - REMOVAL, CIGAR	8W-97-2
LIGHTING - SPECIFICATIONS, INTERIOR	8L-26
LINE - DESCRIPTION, REFRIGERANT	24-44
LINE - INSTALLATION, A/C DISCHARGE	24-54
LINE - INSTALLATION, FUEL	24-76
LINE - INSTALLATION, LIQUID	24-59
LINE - INSTALLATION, SUCTION	24-66
LINE - OPERATION, REFRIGERANT	24-44
LINE - REMOVAL, A/C DISCHARGE	24-53
LINE - REMOVAL, FUEL	24-75
LINE - REMOVAL, LIQUID	24-58
LINE - REMOVAL, SUCTION	24-66
LINE FROM PUMP TO COOLER TUBE - INSTALLATION, RETURN	19-15
LINE FROM PUMP TO COOLER TUBE - REMOVAL, RETURN	19-15
LINES - DIAGNOSIS AND TESTING, HIGH PRESSURE FUEL	14-1
LINES - INSTALLATION, HIGH PRESSURE	14-7
LINES - INSTALLATION, OIL COOLER	9-50
LINES - INSTALLATION, UNDERBODY	24-69
LINES - REMOVAL, HIGH PRESSURE	14-6
LINES - REMOVAL, OIL COOLER	9-50
LINES - REMOVAL, UNDERBODY	24-68
LINES - STANDARD PROCEDURE, DISCONNECTING AND CONNECTING FUEL	14-2
LINK - INSTALLATION, STABILIZER	2-16,2-9
LINK - REMOVAL, STABILIZER	2-16,2-9
LINKAGE - DESCRIPTION, WIPER	8R-17
LINKAGE - INSTALLATION, WIPER	8R-18
LINKAGE - OPERATION, WIPER	8R-17
LINKAGE - REMOVAL, WIPER	8R-17
LIQUID LINE - INSTALLATION	24-59
LIQUID LINE - REMOVAL	24-58
LOADS - STANDARD PROCEDURE, TESTING FOR A SHORT TO GROUND ON FUSES POWERING SEVERAL	8W-01-8
LOCATION - DESCRIPTION, CONNECTOR/ GROUND/SPLICE	8W-91-1
LOCATIONS - INSPECTION, FLUID FILL/CHECK	0-4
LOCK CABLE - INSTALLATION, PARK	21-126
LOCK CABLE - REMOVAL, PARK	21-125
LOCK CONTROL - INSTALLATION, LATCH	23-40
LOCK CONTROL - REMOVAL, LATCH	23-39
LOCK CYLINDER - INSTALLATION	23-18
LOCK CYLINDER - REMOVAL	23-18
LOCK MOTOR - INSTALLATION, DOOR	8N-1
LOCK MOTOR - REMOVAL, DOOR	8N-1
LOCK SWITCH - DESCRIPTION, MASTER	8N-2
LOCK SWITCH - DIAGNOSIS AND TESTING, MASTER	8N-2
LOCK SWITCH - INSTALLATION, MASTER	8N-2
LOCK SWITCH - REMOVAL, MASTER	8N-2
LOCKS - DESCRIPTION, POWER	8N-1
LOOP ADJUSTER - INSTALLATION, SEAT BELT TURNING	8O-34
LOOP ADJUSTER - REMOVAL, SEAT BELT TURNING	8O-33
LOSS - STANDARD PROCEDURE, DETERMINING CYLINDER PRESSURE	9-4
LOW BEAM HEADLAMP BULB - INSTALLATION	8L-19
LOW BEAM HEADLAMP BULB - REMOVAL	8L-18
LOW FUEL INDICATOR - DESCRIPTION	8J-18
LOW FUEL INDICATOR - OPERATION	8J-18
LOW INDICATOR - DESCRIPTION, COOLANT	8J-14
LOW INDICATOR - OPERATION, COOLANT	8J-14
LOW OIL LEVEL INDICATOR - DESCRIPTION	8J-18
LOW OIL LEVEL INDICATOR - OPERATION	8J-18
LOW PRESSURE FUEL PUMP TEST - STANDARD PROCEDURE	14-3
LOW PRESSURE PUMP - DESCRIPTION	14-7
LOW PRESSURE PUMP - INSTALLATION	14-11
LOW PRESSURE PUMP - OPERATION	14-8
LOW PRESSURE PUMP - REMOVAL	14-9
LOWER BALL JOINT - INSTALLATION	2-6
LOWER BALL JOINT - REMOVAL	2-6
LOWER CONTROL ARM - INSTALLATION	2-6
LOWER CONTROL ARM - REMOVAL	2-6
LOWER ROLLER ARM - INSTALLATION	23-38
LOWER ROLLER ARM - REMOVAL	23-38
LUBRICANT RECOMMENDATIONS - STANDARD PROCEDURE, PARTS	0-5
MAINTENANCE INDICATOR - DESCRIPTION	8J-19
MAINTENANCE INDICATOR - OPERATION	8J-19
MAINTENANCE SCHEDULES - DESCRIPTION	0-7
MALFUNCTION INDICATOR - DESCRIPTION, TRACTION CONTROL	8J-25
MALFUNCTION INDICATOR - OPERATION, TRACTION CONTROL	8J-25
MALFUNCTION INDICATOR LAMP (MIL) - DESCRIPTION	8J-20
MALFUNCTION INDICATOR LAMP (MIL) - OPERATION	8J-20
MANIFOLD - INSTALLATION, EXHAUST	9-59
MANIFOLD - INSTALLATION, INTAKE	9-58
MANIFOLD - REMOVAL, EXHAUST	9-59
MANIFOLD - REMOVAL, INTAKE	9-57
MANIFOLD AIR FLOW (MAF) SENSOR - DESCRIPTION	14-30
MANIFOLD AIR FLOW (MAF) SENSOR - INSTALLATION	14-31
MANIFOLD AIR FLOW (MAF) SENSOR - OPERATION	14-30
MANIFOLD AIR FLOW (MAF) SENSOR - REMOVAL	14-31
MANUAL - INSTALLATION, WINDOW REGULATOR	23-23
MANUAL - REMOVAL, WINDOW REGULATOR	23-22
MANUAL BLEEDING - STANDARD PROCEDURE	5-4
MARKER LAMP BULB - INSTALLATION, FRONT TURN/PARK/SIDE	8L-15
MARKER LAMP BULB - INSTALLATION, REAR SIDE	8L-21
MARKER LAMP BULB - REMOVAL, FRONT TURN/PARK/SIDE	8L-14
MARKER LAMP BULB - REMOVAL, REAR SIDE	8L-21
MASTER CYLINDER - INSTALLATION	5-18
MASTER CYLINDER - REMOVAL	5-17
MASTER CYLINDER BLEEDING - STANDARD PROCEDURE	5-17
MASTER CYLINDER/POWER BOOSTER - DIAGNOSIS AND TESTING	5-16
MASTER LOCK SWITCH - DESCRIPTION	8N-2
MASTER LOCK SWITCH - DIAGNOSIS AND TESTING	8N-2
MASTER LOCK SWITCH - INSTALLATION	8N-2
MASTER LOCK SWITCH - REMOVAL	8N-2
MATCH MOUNTING - STANDARD PROCEDURE	22-2
MATS - INSTALLATION, CARPETS AND FLOOR	23-70
MATS - REMOVAL, CARPETS AND FLOOR	23-69
MEASURE CRANKSHAFT AND BLOCK JOURNALS - STANDARD PROCEDURE	9-35
MEASURE CYLINDER HEAD SURFACE - STANDARD PROCEDURE	9-21
MEASURING CYLINDER BORES - STANDARD PROCEDURE	9-34
MEASURING PISTON PROTRUSION - STANDARD PROCEDURE	9-42
MECHANISM - DESCRIPTION, SHIFT	21-133
MECHANISM - INSTALLATION, SHIFT	21-135
MECHANISM - OPERATION, SHIFT	21-133
MECHANISM - REMOVAL, SHIFT	21-134
METRIC SYSTEM - DESCRIPTION	Intro.-5
MICRO 420 BATTERY TESTER - STANDARD PROCEDURE, USING	8F-11
MIRROR - GLASS - INSTALLATION, SIDE VIEW	23-49
MIRROR - GLASS - REMOVAL, SIDE VIEW	23-49
MIRROR - INSTALLATION, SIDE VIEW	23-48
MIRROR - REMOVAL, REAR VIEW	23-72
MIRROR - REMOVAL, SIDE VIEW	23-48
MIRROR SUPPORT BRACKET - INSTALLATION, REAR VIEW	23-72
MIRROR SWITCH - DIAGNOSIS AND TESTING, POWER	8N-3
MIRROR SWITCH - INSTALLATION, POWER	8N-4
MIRROR SWITCH - REMOVAL, POWER	8N-3
MIRRORS - DESCRIPTION, POWER	8N-3
MODE DOOR CABLES - INSTALLATION	24-19
MODE DOOR CABLES - REMOVAL	24-19
MODULE - DESCRIPTION, AIRBAG CONTROL	8O-8
MODULE - DESCRIPTION, CENTRAL TIMER	8E-1
MODULE - DESCRIPTION, CONTROL	24-24
MODULE - DESCRIPTION, ENGINE CONTROL	8E-3
MODULE - DESCRIPTION, FUEL TANK	14-13

Description	Group-Page
MODULE - DESCRIPTION, SENTRY KEY REMOTE ENTRY	8Q-2
MODULE - DESCRIPTION, TRANSMISSION CONTROL	8E-5
MODULE - DIAGNOSIS AND TESTING, CENTRAL TIMER	8E-2
MODULE - DIAGNOSIS AND TESTING, CONTROL	24-24
MODULE - INSTALLATION, AIRBAG CONTROL	8O-11
MODULE - INSTALLATION, CENTRAL TIMER	8E-2
MODULE - INSTALLATION, CONTROL	24-25
MODULE - INSTALLATION, ENGINE CONTROL	8E-4
MODULE - INSTALLATION, FUEL TANK	14-14
MODULE - INSTALLATION, SECURITY SYSTEM	8Q-2
MODULE - INSTALLATION, SENTRY KEY REMOTE ENTRY	8Q-4
MODULE - OPERATION, AIRBAG CONTROL	8O-9
MODULE - OPERATION, CENTRAL TIMER	8E-2
MODULE - OPERATION, CONTROL	24-24
MODULE - OPERATION, SENTRY KEY REMOTE ENTRY	8Q-3
MODULE - OPERATION, TRANSMISSION CONTROL	8E-5
MODULE - REMOVAL, AIRBAG CONTROL	8O-10
MODULE - REMOVAL, CENTRAL TIMER	8E-2
MODULE - REMOVAL, CONTROL	24-24
MODULE - REMOVAL, ENGINE CONTROL	8E-4
MODULE - REMOVAL, FUEL TANK	14-13
MODULE - REMOVAL, SECURITY SYSTEM	8Q-2
MODULE - REMOVAL, SENTRY KEY REMOTE ENTRY	8Q-3
MOTOR - DESCRIPTION, WIPER	8R-19
MOTOR - DIAGNOSIS AND TESTING, STARTER	8F-29
MOTOR - DIESEL - SPECIFICATIONS, STARTER	8F-29
MOTOR - INSTALLATION, BLOWER	24-33,24-40
MOTOR - INSTALLATION, DOOR LOCK	8N-1
MOTOR - INSTALLATION, HEADLAMP LEVELING	8L-16
MOTOR - INSTALLATION, STARTER	8F-31
MOTOR - INSTALLATION, WIPER	8R-19
MOTOR - OPERATION, WIPER	8R-19
MOTOR - REMOVAL, BLOWER	24-32,24-39
MOTOR - REMOVAL, DOOR LOCK	8N-1
MOTOR - REMOVAL, HEADLAMP LEVELING	8L-15
MOTOR - REMOVAL, STARTER	8F-30
MOTOR - REMOVAL, WINDOW	8N-5
MOTOR - REMOVAL, WIPER	8R-19
MOTOR RELAY - DESCRIPTION, BLOWER	24-23
MOTOR RELAY - DESCRIPTION, STARTER	8F-31
MOTOR RELAY - DIAGNOSIS AND TESTING, BLOWER	24-24
MOTOR RELAY - INSTALLATION, BLOWER	24-24
MOTOR RELAY - INSTALLATION, STARTER	8F-32
MOTOR RELAY - OPERATION, BLOWER	24-23
MOTOR RELAY - REMOVAL, BLOWER	24-24
MOTOR RELAY - REMOVAL, STARTER	8F-31
MOTOR RESISTOR BLOCK - DESCRIPTION, BLOWER	24-16
MOTOR RESISTOR BLOCK - DIAGNOSIS AND TESTING, BLOWER	24-16
MOTOR RESISTOR BLOCK - INSTALLATION, BLOWER	24-17
MOTOR RESISTOR BLOCK - OPERATION, BLOWER	24-16
MOTOR RESISTOR BLOCK - REMOVAL, BLOWER	24-16
MOTOR SWITCH - DESCRIPTION, BLOWER	24-17,24-22
MOTOR SWITCH - DIAGNOSIS AND TESTING, BLOWER	24-17,24-23
MOTOR SWITCH - INSTALLATION, BLOWER	24-23
MOTOR SWITCH - OPERATION, BLOWER	24-17, 24-22
MOTOR SWITCH - REMOVAL, BLOWER	24-17, 24-23
MOUNT - INSTALLATION, LEFT	9-49
MOUNT - INSTALLATION, RIGHT	9-49
MOUNT - REMOVAL, LEFT	9-49
MOUNT - REMOVAL, RIGHT	9-49
MOUNTED STOP LAMP BULB - INSTALLATION, CENTER HIGH	8L-7
MOUNTED STOP LAMP BULB - REMOVAL, CENTER HIGH	8L-7
MOUNTED STOP LAMP UN - INSTALLATION, CENTER HIGH	8L-8
MOUNTED STOP LAMP UN - REMOVAL, CENTER HIGH	8L-8
MOUNTING - STANDARD PROCEDURE, MATCH	22-2
MULTI-FUNCTION INDICATOR - DESCRIPTION	8J-20
MULTI-FUNCTION INDICATOR - OPERATION	8J-21
MULTI-FUNCTION SWITCH - INSTALLATION	8L-20
MULTI-FUNCTION SWITCH - REMOVAL	8L-19
NAG1 - DESCRIPTION, AUTOMATIC TRANSMISSION	21-2
NAG1 - DESCRIPTION, AUTOMATIC TRANSMISSION FLUID	0-4
NAG1 - OPERATION, AUTOMATIC TRANSMISSION	21-4
NAG1 AUTOMATIC TRANSMISSION - SPECIAL TOOLS	21-69
NAG1 AUTOMATIC TRANSMISSION - SPECIFICATIONS	21-68
NOISE - DIAGNOSIS AND TESTING, COMPRESSOR	24-49
NOISE - DIAGNOSIS AND TESTING, WIND	23-2
NOISE OR VIBRATION - DIAGNOSIS AND TESTING, TIRE	22-8
NON-DEPLOYED SUPPLEMENTAL RESTRAINTS - STANDARD PROCEDURE, HANDLING	8O-6
NOZZLE - DESCRIPTION, WASHER	8R-9
NOZZLE - INSTALLATION, WASHER	8R-9
NOZZLE - OPERATION, WASHER	8R-9
NOZZLE - REMOVAL, WASHER	8R-9
NUMBER - DESCRIPTION, VEHICLE IDENTIFICATION	Intro.-1
ODOMETER - DESCRIPTION	8J-21
ODOMETER - OPERATION	8J-22
OIL - DESCRIPTION, REFRIGERANT	24-65
OIL - DIESEL ENGINES - DESCRIPTION, ENGINE	0-3
OIL - OPERATION, REFRIGERANT	24-65
OIL COOLER & LINES - INSTALLATION	9-50
OIL COOLER & LINES - REMOVAL	9-50
OIL FILTER - INSTALLATION	9-51
OIL FILTER - REMOVAL	9-51
OIL GALLERY PLUGS - STANDARD PROCEDURE, REPLACING ENGINE CORE	9-34
OIL JET - DESCRIPTION	9-51
OIL JET - INSTALLATION	9-51
OIL JET - REMOVAL	9-51
OIL LEVEL - STANDARD PROCEDURE, CHECK	21-102
OIL LEVEL - STANDARD PROCEDURE, REFRIGERANT	24-65
OIL LEVEL INDICATOR - DESCRIPTION, LOW	8J-18
OIL LEVEL INDICATOR - OPERATION, LOW	8J-18
OIL PAN - INSTALLATION	9-52
OIL PAN - REMOVAL	9-52
OIL PUMP - ASSEMBLY	21-121
OIL PUMP - DESCRIPTION	21-120
OIL PUMP - DISASSEMBLY	21-120
OIL PUMP - OPERATION	21-120
OIL PUMP CHAIN - INSTALLATION	9-54
OIL PUMP CHAIN - REMOVAL	9-53
OIL SEAL - FRONT - INSTALLATION, CRANKSHAFT	9-38
OIL SEAL - FRONT - REMOVAL, CRANKSHAFT	9-38
OIL SEAL - REAR - INSTALLATION, CRANKSHAFT	9-37
OIL SEAL - REAR - REMOVAL, CRANKSHAFT	9-37
OIL SEPARATOR - INSTALLATION	9-50
OIL SEPARATOR - REMOVAL	9-50
OIL TEMPERATURE SENSOR - DESCRIPTION	9-56
OIL TEMPERATURE SENSOR - INSTALLATION	9-57
OIL TEMPERATURE SENSOR - OPERATION	9-56
OIL TEMPERATURE SENSOR - REMOVAL	9-57
OPEN-CIRCUIT VOLTAGE TEST - STANDARD PROCEDURE	8F-10
OPENING COVER - INSTALLATION, STEERING COLUMN	23-66
OPENING COVER - REMOVAL, STEERING COLUMN	23-66
OPENING DIMENSIONS - SPECIFICATIONS	23-90
OPENING SEALS - INSTALLATION, DOOR	23-87
OPENING SEALS - REMOVAL, DOOR	23-87
OUTBOARD - INSTALLATION	8O-31
OUTBOARD - REMOVAL	8O-30
OUTER BELT WEATHERSTRIP - INSTALLATION, FRONT DOOR	23-87
OUTER BELT WEATHERSTRIP - REMOVAL, FRONT DOOR	23-87
OUTER TIE ROD END - DIAGNOSIS AND TESTING	19-10
OUTLET - DESCRIPTION, CIGAR LIGHTER	8W-97-1
OUTLET - DESCRIPTION, POWER	8W-97-3
OUTLET - DIAGNOSIS AND TESTING, CIGAR LIGHTER	8W-97-2
OUTLET - DIAGNOSIS AND TESTING, POWER	8W-97-4
OUTLET - INSTALLATION, POWER	8W-97-4
OUTLET - OPERATION, CIGAR LIGHTER	8W-97-2
OUTLET - OPERATION, POWER	8W-97-4
OUTLET - REMOVAL, CIGAR LIGHTER	8W-97-2
OUTLET - REMOVAL, POWER	8W-97-4
OUTLET TEMPERATURE SENSOR - DESCRIPTION, AIR	24-14
OUTLET TEMPERATURE SENSOR - INSTALLATION, AIR	24-15
OUTLET TEMPERATURE SENSOR - OPERATION, AIR	24-15
OUTLET TEMPERATURE SENSOR - REMOVAL, AIR	24-15
OUTLETS - INSTALLATION, AIR	24-32
OUTLETS - REMOVAL, AIR	24-31
OUTPUT SHAFT BEARING - INSTALLATION	21-122
OUTPUT SHAFT BEARING - REMOVAL	21-122
OUTPUT SHAFT SEAL - INSTALLATION	21-125
OUTPUT SHAFT SEAL - REMOVAL	21-125
PADS - INSTALLATION, STEPWELL SCUFF	23-73
PADS - REMOVAL, STEPWELL SCUFF	23-72
PAINT CODES - SPECIFICATIONS	23-74
PAINT TOUCH-UP - DESCRIPTION	23-74
PAINT TOUCH-UP - STANDARD PROCEDURE	23-75
PAN - INSTALLATION, OIL	9-52
PAN - REMOVAL, OIL	9-52
PANEL - INSTALLATION, BACKLITE - BULKHEAD TRIM	23-81
PANEL - INSTALLATION, BULKHEAD TRIM	23-69
PANEL - INSTALLATION, INSTRUMENT	8L-29
PANEL - INSTALLATION, QUARTER TRIM	23-72
PANEL - INSTALLATION, TRIM	23-20,23-35, 23-46
PANEL - REMOVAL, BACKLITE - BULKHEAD TRIM	23-81
PANEL - REMOVAL, BULKHEAD TRIM	23-69
PANEL - REMOVAL, INSTRUMENT	8L-28
PANEL - REMOVAL, QUARTER TRIM	23-71
PANEL - REMOVAL, TRIM	23-19,23-35,23-46
PANEL ANTENNA CABLE - INSTALLATION, INSTRUMENT	8A-2
PANEL ANTENNA CABLE - REMOVAL, INSTRUMENT	8A-1
PANEL ASSEMBLY - INSTALLATION, INSTRUMENT	23-61
PANEL ASSEMBLY - REMOVAL, INSTRUMENT	23-57
PANEL CENTER BEZEL - INSTALLATION, INSTRUMENT	23-55

Description	Group-Page
PANEL CENTER BEZEL - REMOVAL, INSTRUMENT	23-55
PANEL DUCTS - INSTALLATION, INSTRUMENT	24-38
PANEL DUCTS - REMOVAL, INSTRUMENT	24-37
PANEL REPAIR - STANDARD PROCEDURE, PLASTIC BODY	23-3
PARK BRAKE, SPECIAL TOOLS	5-23
PARK BRAKE SWITCH - INSTALLATION	8L-20
PARK BRAKE SWITCH - REMOVAL	8L-20
PARK LOCK CABLE - INSTALLATION	21-126
PARK LOCK CABLE - REMOVAL	21-125
PARKING BRAKE CABLES - ADJUSTMENT	5-25
PARK/NEUTRAL CONTACT - DESCRIPTION	21-139
PARK/NEUTRAL CONTACT - OPERATION	21-140
PARTS & LUBRICANT RECOMMENDATIONS - STANDARD PROCEDURE	0-5
PASSENGER AIRBAG - DESCRIPTION	8O-23
PASSENGER AIRBAG - INSTALLATION	8O-26
PASSENGER AIRBAG - OPERATION	8O-24
PASSENGER AIRBAG - REMOVAL	8O-24
PASSENGER AIRBAG BRACKET - INSTALLATION	8O-27
PASSENGER AIRBAG BRACKET - REMOVAL	8O-27
PASSENGER HEATED SEAT SWITCH - DESCRIPTION	8G-5
PASSENGER HEATED SEAT SWITCH - DIAGNOSIS AND TESTING	8G-5
PASSENGER HEATED SEAT SWITCH - INSTALLATION	8G-5
PASSENGER HEATED SEAT SWITCH - OPERATION	8G-5
PASSENGER HEATED SEAT SWITCH - REMOVAL	8G-5
PATTERNS - DIAGNOSIS AND TESTING, TIRE WEAR	22-8
PEDAL - INSTALLATION	5-19
PEDAL - REMOVAL	5-18
PEDAL POSITION SENSOR - DESCRIPTION, ACCELERATOR	14-17
PERFORMANCE - DIAGNOSIS AND TESTING, HEATER	24-4
PERFORMANCE TEST - DIAGNOSIS AND TESTING, A/C	24-3
PILLAR - INSTALLATION, REAR	8L-29
PILLAR - REMOVAL, REAR	8L-28
PINION SEAL - INSTALLATION	3-22
PINION SEAL - REMOVAL	3-22
PIPE - INSTALLATION, EXHAUST	11-3
PIPE - REMOVAL, EXHAUST	11-3
PISTON & CONNECTING ROD - DESCRIPTION	9-40
PISTON PROTRUSION - STANDARD PROCEDURE, MEASURING	9-42
PISTON RING FITTING - STANDARD PROCEDURE	9-46
PISTONS - DESCRIPTION	21-128
PISTONS - OPERATION	21-128
PLANETARY GEARTRAIN - ASSEMBLY	21-131
PLANETARY GEARTRAIN - DESCRIPTION	21-130
PLANETARY GEARTRAIN - DISASSEMBLY	21-131
PLANETARY GEARTRAIN - OPERATION	21-130
PLASTIC BODY PANEL REPAIR - STANDARD PROCEDURE	23-3
PLATE BRACKET - INSTALLATION, LICENSE	23-47
PLATE BRACKET - REMOVAL, LICENSE	23-47
PLATE LAMP BULB - INSTALLATION, LICENSE	8L-18
PLATE LAMP BULB - REMOVAL, LICENSE	8L-17
PLATE LAMP UNIT - INSTALLATION, LICENSE	8L-18
PLATE LAMP UNIT - REMOVAL, LICENSE	8L-18
PLATES - INSTALLATION, SPRING CLAMP	2-8
PLATES - INSTALLATION, SPRING STOP	2-9
PLATES - REMOVAL, SPRING CLAMP	2-8
PLATES - REMOVAL, SPRING STOP	2-9
PLUG - INSTALLATION, GLOW	8I-1
PLUG - REMOVAL, GLOW	8I-1
PLUG RELAY - DESCRIPTION, GLOW	8I-2
PLUG RELAY - OPERATION, GLOW	8I-2
PLUG RELAYS - DIAGNOSIS AND TESTING, GLOW	8I-2
PLUGS - STANDARD PROCEDURE, REPLACING ENGINE CORE AND OIL GALLERY	9-34
PLUMBING - CLEANING, CHARGE AIR COOLER	11-5
PLUMBING - DESCRIPTION, CHARGE AIR COOLER	11-4
PLUMBING - INSPECTION, CHARGE AIR COOLER	11-5
PLUMBING - INSTALLATION, CHARGE AIR COOLER	11-5
PLUMBING - OPERATION, CHARGE AIR COOLER	11-4
PLUMBING - REMOVAL, CHARGE AIR COOLER	11-5
PLUMBING - WARNING	24-44
PLY TIRES - DESCRIPTION, RADIAL	22-6
POLISH - DESCRIPTION, FINESSE SANDING/BUFFING	23-75
POSITION - STANDARD PROCEDURE, CHECKING CAMSHAFT	9-27
POSITION LAMP BULB - INSTALLATION, FRONT	8L-14
POSITION LAMP BULB - REMOVAL, FRONT	8L-14
POSITION SENSOR - DESCRIPTION, ACCELERATOR PEDAL	14-17
POSITION SENSOR - DESCRIPTION, CAMSHAFT	14-19
POSITION SENSOR - DESCRIPTION, CRANKSHAFT	14-20
POSITION SENSOR - INSTALLATION, CAMSHAFT	14-19
POSITION SENSOR - INSTALLATION, CRANKSHAFT	14-20
POSITION SENSOR - OPERATION, CAMSHAFT	14-19
POSITION SENSOR - OPERATION, CRANKSHAFT	14-20
POSITION SENSOR - REMOVAL, CAMSHAFT	14-19
POSITION SENSOR - REMOVAL, CRANKSHAFT	14-20
POTENTIAL - STANDARD PROCEDURE, TESTING OF VOLTAGE	8W-01-7
POWER - INSTALLATION, WINDOW REGULATOR	23-21
POWER - REMOVAL, WINDOW REGULATOR	23-20
POWER BRAKE BOOSTER - DESCRIPTION	5-19
POWER BRAKE BOOSTER - INSTALLATION	5-19
POWER BRAKE BOOSTER - OPERATION	5-19
POWER BRAKE BOOSTER - REMOVAL	5-19
POWER DISTRIBUTION - DESCRIPTION	8W-97-1
POWER DISTRIBUTION - OPERATION	8W-97-1
POWER DISTRIBUTION CENTER - DESCRIPTION	8W-97-3
POWER DISTRIBUTION CENTER - OPERATION	8W-97-3
POWER LOCKS - DESCRIPTION	8N-1
POWER MIRROR SWITCH - DIAGNOSIS AND TESTING	8N-3
POWER MIRROR SWITCH - INSTALLATION	8N-4
POWER MIRROR SWITCH - REMOVAL	8N-3
POWER MIRRORS - DESCRIPTION	8N-3
POWER OUTLET - DESCRIPTION	8W-97-3
POWER OUTLET - DIAGNOSIS AND TESTING	8W-97-4
POWER OUTLET - INSTALLATION	8W-97-4
POWER OUTLET - OPERATION	8W-97-4
POWER OUTLET - REMOVAL	8W-97-4
POWER STEERING FLUID - DESCRIPTION	0-3
POWER STEERING PUMP - INITIAL OPERATION - STANDARD PROCEDURE	19-12
POWER STEERING PUMP FILL AND BLEED PROCEDURE, STANDARD PROCEDURE	19-14
POWER STEERING SYSTEM - DIAGNOSIS AND TESTING	19-2
POWER STEERING SYSTEM - STANDARD PROCEDURE, FLUSHING	19-13
POWER WINDOW SWITCH - DIAGNOSIS AND TESTING	8N-5
POWER WINDOW SWITCH - INSTALLATION	8N-6
POWER WINDOW SWITCH - REMOVAL	8N-6
POWER WINDOWS - DESCRIPTION	8N-5
POWER WINDOWS - OPERATION	8N-5
POWERING SEVERAL LOADS - STANDARD PROCEDURE, TESTING FOR A SHORT TO GROUND ON FUSES	8W-01-8
PRE-ALIGNMENT INSPECTION - DIAGNOSIS AND TESTING	2-17
PRECAUTIONS AND WARNINGS, WARNING - SAFETY	23-1
PRECAUTIONS, CAUTION - REFRIGERANT HOSES/LINES/TUBES	24-45
PRECAUTIONS, WARNING - WINDSHIELD SAFETY	23-82
PRELIMINARY - DIAGNOSIS AND TESTING	21-23
PRELIMINARY CHECKS - DIAGNOSIS AND TESTING	7-1
PRESSURE - WARNING, HIGH FUEL SYSTEM	14-1
PRESSURE BLEEDING - STANDARD PROCEDURE	5-5
PRESSURE CAP - DESCRIPTION, RADIATOR	7-18
PRESSURE CAP - DIAGNOSIS AND TESTING, RADIATOR	7-19
PRESSURE CAP - OPERATION, RADIATOR	7-18
PRESSURE FOR HIGH SPEEDS - DESCRIPTION, TIRE	22-6
PRESSURE FUEL LINES - DIAGNOSIS AND TESTING, HIGH	14-1
PRESSURE FUEL PUMP TEST - STANDARD PROCEDURE, LOW	14-3
PRESSURE FUEL SHUTOFF SOL - DESCRIPTION, HI	14-16
PRESSURE FUEL SHUTOFF SOL - OPERATION, HI	14-16
PRESSURE GAUGES - DIAGNOSIS AND TESTING	22-8
PRESSURE HOSE - INSTALLATION	19-15
PRESSURE HOSE - REMOVAL	19-15
PRESSURE LINES - INSTALLATION, HIGH	14-7
PRESSURE LINES - REMOVAL, HIGH	14-6
PRESSURE LOSS - STANDARD PROCEDURE, DETERMINING CYLINDER	9-4
PRESSURE PUMP - DESCRIPTION, HIGH	14-7
PRESSURE PUMP - DESCRIPTION, LOW	14-7
PRESSURE PUMP - INSTALLATION, HIGH	14-10
PRESSURE PUMP - INSTALLATION, LOW	14-11
PRESSURE PUMP - OPERATION, LOW	14-8
PRESSURE PUMP - REMOVAL, HIGH	14-8
PRESSURE PUMP - REMOVAL, LOW	14-9
PRESSURE SENSOR - DESCRIPTION, BOOST	14-17
PRESSURE SENSOR - DIAGNOSIS AND TESTING, BOOST	14-18
PRESSURE SENSOR - INSTALLATION, BOOST	14-18
PRESSURE SENSOR - OPERATION, BOOST	14-18
PRESSURE SENSOR - REMOVAL, BOOST	14-18
PRESSURE SOLENOID - DESCRIPTION, FUEL	14-27
PRESSURE SOLENOID - INSTALLATION, FUEL	14-28
PRESSURE SOLENOID - OPERATION, FUEL	14-27
PRESSURE SOLENOID - REMOVAL, FUEL	14-28
PRESSURE TRANSDUCER - DESCRIPTION, A/C	24-13
PRESSURE TRANSDUCER - DIAGNOSIS AND TESTING, A/C	24-13
PRESSURE TRANSDUCER - INSTALLATION, A/C	24-14
PRESSURE TRANSDUCER - OPERATION, A/C	24-13
PRESSURE TRANSDUCER - REMOVAL, A/C	24-14
PRESSURES - DESCRIPTION, TIRE INFLATION	22-7
PROP ROD - INSTALLATION	23-52

Description	Group-Page
PROP ROD - REMOVAL	23-52
PROPELLER SHAFT - DIAGNOSIS AND TESTING	3-1
PROPELLER SHAFT - INSTALLATION	3-6
PROPELLER SHAFT - REMOVAL	3-6
PROPELLER SHAFT - SPECIAL TOOLS	3-5
PROPELLER SHAFT - SPECIFICATIONS	3-5
PROPELLER SHAFT - STANDARD PROCEDURE	3-3
PROTRUSION - STANDARD PROCEDURE, MEASURING PISTON	9-42
PULLEY - DESCRIPTION, GENERATOR DECOUPLER	8F-19
PULLEY - INSTALLATION, GENERATOR DECOUPLER	8F-21
PULLEY - OPERATION, GENERATOR DECOUPLER	8F-19
PULLEY - REMOVAL, GENERATOR DECOUPLER	8F-20
PUMP - ASSEMBLY, OIL	21-121
PUMP - DESCRIPTION	19-12
PUMP - DESCRIPTION, ELECTRIC COOLANT	24-57
PUMP - DESCRIPTION, FUEL DOSING	24-74
PUMP - DESCRIPTION, HIGH PRESSURE	14-7
PUMP - DESCRIPTION, LOW PRESSURE	14-7
PUMP - DESCRIPTION, OIL	21-120
PUMP - DESCRIPTION, VACUUM	9-48
PUMP - DISASSEMBLY, OIL	21-120
PUMP - INITIAL OPERATION - STANDARD PROCEDURE, POWER STEERING	19-12
PUMP - INSTALLATION, ELECTRIC COOLANT	24-57
PUMP - INSTALLATION, FUEL DOSING	24-74
PUMP - INSTALLATION, HIGH PRESSURE	14-10
PUMP - INSTALLATION, LOW PRESSURE	14-11
PUMP - INSTALLATION, VACUUM	9-49
PUMP - INSTALLATION, WATER	7-20
PUMP - OPERATION	19-12
PUMP - OPERATION, ELECTRIC COOLANT	24-57
PUMP - OPERATION, FUEL DOSING	24-74
PUMP - OPERATION, LOW PRESSURE	14-8
PUMP - OPERATION, OIL	21-120
PUMP - OPERATION, VACUUM	9-48
PUMP - REMOVAL, ELECTRIC COOLANT	24-57
PUMP - REMOVAL, FUEL DOSING	24-74
PUMP - REMOVAL, HIGH PRESSURE	14-8
PUMP - REMOVAL, LOW PRESSURE	14-9
PUMP - REMOVAL, VACUUM	9-48
PUMP - REMOVAL, WATER	7-19
PUMP CHAIN - INSTALLATION, OIL	9-54
PUMP CHAIN - REMOVAL, OIL	9-53
PUMP FILL AND BLEED PROCEDURE, STANDARD PROCEDURE - POWER STEERING	19-14
PUMP LEAKAGE - DIAGNOSIS AND TESTING	19-12
PUMP TEST - STANDARD PROCEDURE, LOW PRESSURE FUEL	14-3
PUMP TO COOLER TUBE - INSTALLATION, RETURN LINE FROM	19-15
PUMP TO COOLER TUBE - REMOVAL, RETURN LINE FROM	19-15
PUMP/MOTOR - DESCRIPTION, WASHER	8R-9
PUMP/MOTOR - INSTALLATION, WASHER	8R-10
PUMP/MOTOR - OPERATION, WASHER	8R-10
PUMP/MOTOR - REMOVAL, WASHER	8R-10
QUARTER TRIM PANEL - INSTALLATION	23-72
QUARTER TRIM PANEL - REMOVAL	23-71
QUARTER WINDOW - INSTALLATION	23-81
QUARTER WINDOW - REMOVAL	23-81
RADIAL - PLY TIRES - DESCRIPTION	22-6
RADIATOR - INSTALLATION	7-17
RADIATOR - REMOVAL	7-16
RADIATOR CROSSMEMBER - INSTALLATION	23-48
RADIATOR CROSSMEMBER - REMOVAL	23-47
RADIATOR FAN - INSTALLATION	7-13
RADIATOR FAN - REMOVAL	7-13
RADIATOR PRESSURE CAP - DESCRIPTION	7-18
RADIATOR PRESSURE CAP - DIAGNOSIS AND TESTING	7-19
RADIATOR PRESSURE CAP - OPERATION	7-18
RADIO - INSTALLATION	8A-2
RADIO - REMOVAL	8A-2
RAIL - DESCRIPTION, FUEL	14-11
RAIL - INSTALLATION, CYLINDER HEAD GUIDE	9-26
RAIL - INSTALLATION, FUEL	14-11
RAIL - INSTALLATION, TENSIONING AND SLIDE	9-66
RAIL - INSTALLATION, TIMING CHAIN TENSIONING	9-66
RAIL - OPERATION, FUEL	14-11
RAIL - REMOVAL, CYLINDER HEAD GUIDE	9-24
RAIL - REMOVAL, FUEL	14-11
RAIL - REMOVAL, TIMING CHAIN TENSIONING	9-63
RAILS - REMOVAL, TENSIONING AND SLIDE	9-61
RATTLE - STANDARD PROCEDURE, BUZZ, SQUEAK	23-10
REAR - DESCRIPTION	2-11
REAR - INSTALLATION	5-14,5-22,5-25
REAR - INSTALLATION, CRANKSHAFT OIL SEAL	9-37
REAR - INSTALLATION, SEAT	23-79
REAR - INSTALLATION, SEAT BACK CUSHION/COVER	23-80
REAR - INSTALLATION, SEAT CUSHION/ COVER	23-80
REAR - REMOVAL	5-13,5-22,5-24
REAR - REMOVAL, CRANKSHAFT OIL SEAL	9-37
REAR - REMOVAL, SEAT	23-79
REAR - REMOVAL, SEAT BACK CUSHION/COVER	23-80
REAR - REMOVAL, SEAT CUSHION/ COVER	23-80
REAR (15" WHEELS) (SRW) - REMOVAL	5-9
REAR (16" WHEELS) (SRW) - INSTALLATION	5-11
REAR (16" WHEELS) (SRW) - REMOVAL	5-9
REAR A/C HOUSING - INSTALLATION	24-41
REAR A/C HOUSING - REMOVAL	24-40
REAR AXLE - DESCRIPTION	3-10
REAR AXLE - DIAGNOSIS AND TESTING	3-10
REAR AXLE - INSTALLATION	3-12
REAR AXLE - OPERATION	3-10
REAR AXLE - REMOVAL	3-11
REAR AXLE - SPECIAL TOOLS	3-14
REAR AXLE - SPECIFICATIONS	3-13
REAR BUMPER - STEP - INSTALLATION	13-3
REAR BUMPER - STEP - REMOVAL	13-3
REAR CROSSMEMBER - TRANSMISSION - INSTALLATION	13-9
REAR CROSSMEMBER - TRANSMISSION - REMOVAL	13-9
REAR DRUM IN HAT BRAKE - CLEANING	5-27
REAR (DRW) - INSTALLATION	5-11,5-13,5-21
REAR (DRW) - REMOVAL	5-10,5-12,5-20
REAR EVAPORATOR - INSTALLATION	24-61
REAR EVAPORATOR - REMOVAL	24-60
REAR EXPANSION VALVE - INSTALLATION	24-63
REAR EXPANSION VALVE - REMOVAL	24-62
REAR FASCIA - INSTALLATION	13-3
REAR FASCIA - REMOVAL	13-3
REAR LATCH - INSTALLATION	23-40
REAR LATCH - REMOVAL	23-40
REAR LATCH STRIKER - INSTALLATION	23-41
REAR LATCH STRIKER - REMOVAL	23-41
REAR PILLAR - INSTALLATION	8L-29
REAR PILLAR - REMOVAL	8L-28
REAR SEAT BACK SHIELD - INSTALLATION	23-79
REAR SEAT BACK SHIELD - REMOVAL	23-79
REAR SEAT BELT & RETRACTOR - INSTALLATION	8O-29
REAR SEAT BELT & RETRACTOR - REMOVAL	8O-27
REAR SIDE MARKER LAMP BULB - INSTALLATION	8L-21
REAR SIDE MARKER LAMP BULB - REMOVAL	8L-21
REAR (SRW) - INSTALLATION	5-13,5-21
REAR (SRW) - REMOVAL	5-12,5-20
REAR TURN LAMP BULB - INSTALLATION	8L-22
REAR TURN LAMP BULB - REMOVAL	8L-21
REAR VIEW MIRROR - REMOVAL	23-72
REAR VIEW MIRROR SUPPORT BRACKET - INSTALLATION	23-72
REAR WHEEL INSTALLATION - STANDARD PROCEDURE, DUAL	22-12
REAR WHEEL SPEED SENSOR - INSTALLATION	5-31
REAR WHEEL SPEED SENSOR - REMOVAL	5-30
REAR WHEELS - INSTALLATION, AXLE SHAFTS - DUAL	3-19
REAR WHEELS - REMOVAL, AXLE SHAFTS - DUAL	3-19
RECEIVER - INSTALLATION, ASH	23-55
RECEIVER - REMOVAL, ASH	23-55
RECEIVER/CIGAR LIGHTER LAMP UNIT - INSTALLATION, ASH	8L-27
RECEIVER/CIGAR LIGHTER LAMP UNIT - REMOVAL, ASH	8L-27
RECEIVER/DRIER - DESCRIPTION	24-64
RECEIVER/DRIER - INSTALLATION	24-64
RECEIVER/DRIER - OPERATION	24-64
RECEIVER/DRIER - REMOVAL	24-64
RECIRCULATION DOOR ACTUATOR - DESCRIPTION	24-20
RECIRCULATION DOOR ACTUATOR - INSTALLATION	24-21
RECIRCULATION DOOR ACTUATOR - OPERATION	24-20
RECIRCULATION DOOR ACTUATOR - REMOVAL	24-21
RECOMMENDATIONS - STANDARD PROCEDURE, PARTS & LUBRICANT	0-5
RECOVERY - STANDARD PROCEDURE, REFRIGERANT	24-47
REFERENCES - DESCRIPTION, TORQUE	Intro.-7
REFILLING COOLING SYSTEM - STANDARD PROCEDURE	7-12
REFRIGERANT - DESCRIPTION	24-65
REFRIGERANT - OPERATION	24-65
REFRIGERANT HOSES/LINES/TUBES PRECAUTIONS, CAUTION	24-45
REFRIGERANT LINE - DESCRIPTION	24-44
REFRIGERANT LINE - OPERATION	24-44
REFRIGERANT OIL - DESCRIPTION	24-65
REFRIGERANT OIL - OPERATION	24-65
REFRIGERANT OIL LEVEL - STANDARD PROCEDURE	24-65
REFRIGERANT RECOVERY - STANDARD PROCEDURE	24-47
REFRIGERANT SYSTEM CHARGE - STANDARD PROCEDURE	24-48
REFRIGERANT SYSTEM EVACUATE - STANDARD PROCEDURE	24-47
REFRIGERANT SYSTEM LEAKS - DIAGNOSIS AND TESTING	24-46
REFRIGERANT SYSTEM SERVICE EQUIPMENT - STANDARD PROCEDURE	24-46
REGULATOR - DESCRIPTION, VOLTAGE	8F-23
REGULATOR - MANUAL - INSTALLATION, WINDOW	23-23
REGULATOR - MANUAL - REMOVAL, WINDOW	23-22
REGULATOR - POWER - INSTALLATION, WINDOW	23-21
REGULATOR - POWER - REMOVAL, WINDOW	23-20
RELAY - DESCRIPTION	8W-97-4
RELAY - DESCRIPTION, BLOWER MOTOR	24-23
RELAY - DESCRIPTION, GLOW PLUG	8I-2
RELAY - DESCRIPTION, HEATED SEAT	8G-4
RELAY - DESCRIPTION, STARTER MOTOR	8F-31
RELAY - DESCRIPTION, WIPER	8R-20
RELAY - DIAGNOSIS AND TESTING	8W-97-5
RELAY - DIAGNOSIS AND TESTING, BLOWER MOTOR	24-24
RELAY - DIAGNOSIS AND TESTING, HEATED SEAT	8G-4
RELAY - INSTALLATION	8W-97-5
RELAY - INSTALLATION, BLOWER MOTOR	24-24
RELAY - INSTALLATION, DAYTIME RUNNING LAMP	8L-9
RELAY - INSTALLATION, FOG LAMP	8L-11
RELAY - INSTALLATION, HEATED SEAT	8G-4

Description	Group-Page
RELAY - INSTALLATION, STARTER MOTOR	8F-32
RELAY - INSTALLATION, TIME DELAY	8L-33
RELAY - INSTALLATION, TURN SIGNAL	8L-24
RELAY - INSTALLATION, WIPER	8R-22
RELAY - OPERATION	8W-97-5
RELAY - OPERATION, BLOWER MOTOR	24-23
RELAY - OPERATION, GLOW PLUG	8I-2
RELAY - OPERATION, HEATED SEAT	8G-4
RELAY - OPERATION, WIPER	8R-21
RELAY - REMOVAL	8W-97-5
RELAY - REMOVAL, BLOWER MOTOR	24-24
RELAY - REMOVAL, DAYTIME RUNNING LAMP	8L-9
RELAY - REMOVAL, FOG LAMP	8L-10
RELAY - REMOVAL, HEATED SEAT	8G-4
RELAY - REMOVAL, STARTER MOTOR	8F-31
RELAY - REMOVAL, TIME DELAY	8L-32
RELAY - REMOVAL, TURN SIGNAL	8L-24
RELAY - REMOVAL, WIPER	8R-22
RELAYS - DIAGNOSIS AND TESTING, GLOW PLUG	8I-2
RELEASE CABLE - INSTALLATION, LATCH	23-51
RELEASE CABLE - REMOVAL, LATCH	23-51
RELEASE HANDLE - INSTALLATION, LATCH	23-52
RELEASE HANDLE - REMOVAL, LATCH	23-52
REMOTE ENTRY MODULE - DESCRIPTION, SENTRY KEY	8Q-2
REMOTE ENTRY MODULE - INSTALLATION, SENTRY KEY	8Q-4
REMOTE ENTRY MODULE - OPERATION, SENTRY KEY	8Q-3
REMOTE ENTRY MODULE - REMOVAL, SENTRY KEY	8Q-3
REMOTE KEYLESS ENTRY TRANSMITTER - DESCRIPTION	8N-2
REPAIR - DESCRIPTION, THREADED HOLE	Intro.-5
REPAIR - STANDARD PROCEDURE, ALUMINUM THREAD	21-27
REPAIR - STANDARD PROCEDURE, PLASTIC BODY PANEL	23-3
REPAIRING CONNECTING RODS - STANDARD PROCEDURE, CHECKING	9-40
REPAIRING LEAKS - STANDARD PROCEDURE	22-10
REPEATER LAMP BULB - INSTALLATION	8L-22
REPEATER LAMP BULB - REMOVAL	8L-22
REPEATER LAMP UNIT - INSTALLATION	8L-23
REPEATER LAMP UNIT - REMOVAL	8L-22
REPLACING ENGINE CORE AND OIL GALLERY PLUGS - STANDARD PROCEDURE	9-34
REQUIREMENTS - DESCRIPTION, COOLING SYSTEM	24-1
REQUIREMENTS - DIESEL ENGINE - DESCRIPTION, FUEL	0-1
RESERVOIR - DESCRIPTION, WASHER	8R-11
RESERVOIR - INSTALLATION, FLUID	5-15
RESERVOIR - INSTALLATION, WASHER	8R-12
RESERVOIR - OPERATION, WASHER	8R-11
RESERVOIR - REMOVAL, FLUID	5-15
RESERVOIR - REMOVAL, WASHER	8R-11
RESISTOR BLOCK - DESCRIPTION, BLOWER MOTOR	24-16
RESISTOR BLOCK - DIAGNOSIS AND TESTING, BLOWER MOTOR	24-16
RESISTOR BLOCK - INSTALLATION, BLOWER MOTOR	24-17
RESISTOR BLOCK - OPERATION, BLOWER MOTOR	24-16
RESISTOR BLOCK - REMOVAL, BLOWER MOTOR	24-16
RESTRAINT DEPLOYMENT - STANDARD PROCEDURE, SERVICE AFTER A SUPPLEMENTAL	8O-6
RESTRAINT SYSTEM - DIAGNOSIS AND TESTING, SUPPLEMENTAL	8O-5
RESTRAINT SYSTEM - WARNINGS	8O-5
RESTRAINTS - DESCRIPTION	8O-2
RESTRAINTS - OPERATION	8O-4
RESTRAINTS - STANDARD PROCEDURE, HANDLING NON-DEPLOYED SUPPLEMENTAL	8O-6
RESTRICTIONS - DIAGNOSIS AND TESTING, FUEL SUPPLY	14-5
RETRACTOR - INSTALLATION, FRONT SEAT BELT	8O-21
RETRACTOR - INSTALLATION, REAR SEAT BELT	8O-29
RETRACTOR - REMOVAL, FRONT SEAT BELT	8O-19
RETRACTOR - REMOVAL, REAR SEAT BELT	8O-27
RETURN HOSE FROM GEAR TO COOLER TUBE - INSTALLATION	19-15
RETURN HOSE FROM GEAR TO COOLER TUBE - REMOVAL	19-15
RETURN LINE FROM PUMP TO COOLER TUBE - INSTALLATION	19-15
RETURN LINE FROM PUMP TO COOLER TUBE - REMOVAL	19-15
RIGHT MOUNT - INSTALLATION	9-49
RIGHT MOUNT - REMOVAL	9-49
RING FITTING - STANDARD PROCEDURE, PISTON	9-46
ROAD TESTING - DIAGNOSIS AND TESTING	21-23
ROD - DESCRIPTION, PISTON & CONNECTING	9-40
ROD - INSTALLATION, PROP	23-52
ROD - REMOVAL, PROP	23-52
ROD END - DIAGNOSIS AND TESTING, OUTER TIE	19-10
ROD END - INSTALLATION, TIE	19-11
ROD END - REMOVAL, TIE	19-11
RODS - STANDARD PROCEDURE, CHECKING AND REPAIRING CONNECTING	9-40
ROLLER ARM - INSTALLATION, CENTER	23-38
ROLLER ARM - INSTALLATION, LOWER	23-38
ROLLER ARM - INSTALLATION, UPPER	23-37
ROLLER ARM - REMOVAL, CENTER	23-37
ROLLER ARM - REMOVAL, LOWER	23-38
ROLLER ARM - REMOVAL, UPPER	23-37
ROTATION - STANDARD PROCEDURE, TIRE	22-5
RUNNING LAMP RELAY - INSTALLATION, DAYTIME	8L-9
RUNNING LAMP RELAY - REMOVAL, DAYTIME	8L-9
RUNOUT - DIAGNOSIS AND TESTING, TIRE AND WHEEL	22-1
SAFETY LATCH - INSTALLATION	23-52
SAFETY LATCH - REMOVAL	23-52
SAFETY PRECAUTIONS AND WARNINGS, WARNING	23-1
SAFETY PRECAUTIONS, WARNING - WINDSHIELD	23-82
SANDING/BUFFING & POLISH - DESCRIPTION, FINESSE	23-75
SCHEDULES - DESCRIPTION, MAINTENANCE	0-7
SCHEMATICS AND DIAGRAMS, DIAGNOSIS AND TESTING	21-47
SCUFF PADS - INSTALLATION, STEPWELL	23-73
SCUFF PADS - REMOVAL, STEPWELL	23-72
SEAL - FRONT - INSTALLATION, CRANKSHAFT OIL	9-38
SEAL - FRONT - REMOVAL, CRANKSHAFT OIL	9-38
SEAL - INSTALLATION, OUTPUT SHAFT	21-125
SEAL - INSTALLATION, PINION	3-22
SEAL - INSTALLATION, TORQUE CONVERTER HUB	21-147
SEAL - REAR - INSTALLATION, CRANKSHAFT OIL	9-37
SEAL - REAR - REMOVAL, CRANKSHAFT OIL	9-37
SEAL - REMOVAL, OUTPUT SHAFT	21-125
SEAL - REMOVAL, PINION	3-22
SEAL - REMOVAL, TORQUE CONVERTER HUB	21-147
SEALS - INSTALLATION, DOOR OPENING	23-87
SEALS - REMOVAL, DOOR OPENING	23-87
SEAT - FRONT - INSTALLATION	23-77
SEAT - FRONT - REMOVAL	23-77
SEAT - REAR - INSTALLATION	23-79
SEAT - REAR - REMOVAL	23-79
SEAT ADJUSTERS - FRONT - INSTALLATION	23-78
SEAT ADJUSTERS - FRONT - REMOVAL	23-78
SEAT BACK - FRONT - INSTALLATION	23-77
SEAT BACK - FRONT - REMOVAL	23-77
SEAT BACK CUSHION/COVER - REAR - INSTALLATION	23-80
SEAT BACK CUSHION/COVER - REAR - REMOVAL	23-80
SEAT BACK SHIELD - INSTALLATION, REAR	23-79
SEAT BACK SHIELD - REMOVAL, REAR	23-79
SEAT BELT & RETRACTOR - INSTALLATION, FRONT	8O-21
SEAT BELT & RETRACTOR - INSTALLATION, REAR	8O-29
SEAT BELT & RETRACTOR - REMOVAL, FRONT	8O-19
SEAT BELT & RETRACTOR - REMOVAL, REAR	8O-27
SEAT BELT BUCKLE - INSTALLATION, FRONT	8O-23
SEAT BELT BUCKLE - REMOVAL, FRONT	8O-22
SEAT BELT SWITCH - DESCRIPTION	8O-31
SEAT BELT SWITCH - OPERATION	8O-31
SEAT BELT TENSIONER - DESCRIPTION	8O-31
SEAT BELT TENSIONER - OPERATION	8O-32
SEAT BELT TURNING LOOP ADJUSTER - INSTALLATION	8O-34
SEAT BELT TURNING LOOP ADJUSTER - REMOVAL	8O-33
SEAT CUSHION - FRONT - INSTALLATION	23-78
SEAT CUSHION - FRONT - REMOVAL	23-78
SEAT CUSHION/COVER - REAR - INSTALLATION	23-80
SEAT CUSHION/COVER - REAR - REMOVAL	23-80
SEAT ELEMENT - DESCRIPTION, HEATED	8G-3
SEAT ELEMENT - DIAGNOSIS AND TESTING, HEATED	8G-3
SEAT ELEMENT - OPERATION, HEATED	8G-3
SEAT RELAY - DESCRIPTION, HEATED	8G-4
SEAT RELAY - DIAGNOSIS AND TESTING, HEATED	8G-4
SEAT RELAY - INSTALLATION, HEATED	8G-4
SEAT RELAY - OPERATION, HEATED	8G-4
SEAT RELAY - REMOVAL, HEATED	8G-4
SEAT SENSOR - DESCRIPTION, HEATED	8G-4
SEAT SENSOR - DIAGNOSIS AND TESTING, HEATED	8G-4
SEAT SWITCH - DESCRIPTION, DRIVER HEATED	8G-2
SEAT SWITCH - DESCRIPTION, PASSENGER HEATED	8G-5
SEAT SWITCH - DIAGNOSIS AND TESTING, DRIVER HEATED	8G-2
SEAT SWITCH - DIAGNOSIS AND TESTING, PASSENGER HEATED	8G-5
SEAT SWITCH - INSTALLATION, DRIVER HEATED	8G-3
SEAT SWITCH - INSTALLATION, PASSENGER HEATED	8G-5
SEAT SWITCH - OPERATION, DRIVER HEATED	8G-2
SEAT SWITCH - OPERATION, PASSENGER HEATED	8G-5
SEAT SWITCH - REMOVAL, DRIVER HEATED	8G-3
SEAT SWITCH - REMOVAL, PASSENGER HEATED	8G-5
SEATBELT INDICATOR - DESCRIPTION	8J-22
SEATBELT INDICATOR - OPERATION	8J-22
SEATS - DESCRIPTION, HEATED	8G-1
SEATS - DIAGNOSIS AND TESTING, HEATED	8G-2
SEATS - OPERATION, HEATED	8G-2
SECTION IDENTIFICATION AND INFORMATION - DESCRIPTION	8W-01-5
SECURITY - DESCRIPTION, VEHICLE THEFT	8Q-1
SECURITY - DIAGNOSIS AND TESTING, VEHICLE THEFT	8Q-1
SECURITY - OPERATION, VEHICLE THEFT	8Q-1
SECURITY SYSTEM MODULE - INSTALLATION	8Q-2
SECURITY SYSTEM MODULE - REMOVAL	8Q-2
SELECTOR INDICATOR - DESCRIPTION, GEAR	8J-17
SELECTOR INDICATOR - OPERATION, GEAR	8J-17

Description	Group-Page
SENDING UNIT / SENSOR - DESCRIPTION, FUEL LEVEL	14-15
SENDING UNIT / SENSOR - INSTALLATION, FUEL LEVEL	14-15
SENDING UNIT / SENSOR - REMOVAL, FUEL LEVEL	14-15
SENSITIVE DEVICES - STANDARD PROCEDURE, ELECTROSTATIC DISCHARGE (ESD)	8W-01-7
SENSOR - DESCRIPTION, ACCELERATOR PEDAL POSITION	14-17
SENSOR - DESCRIPTION, AIR OUTLET TEMPERATURE	24-14
SENSOR - DESCRIPTION, AMBIENT TEMPERATURE	24-15
SENSOR - DESCRIPTION, BOOST PRESSURE	14-17
SENSOR - DESCRIPTION, CAMSHAFT POSITION	14-19
SENSOR - DESCRIPTION, CRANKSHAFT POSITION	14-20
SENSOR - DESCRIPTION, ENGINE COOLANT TEMP	7-14
SENSOR - DESCRIPTION, EVAPORATOR TEMPERATURE	24-17,24-25
SENSOR - DESCRIPTION, FUEL LEVEL SENDING UNIT	14-15
SENSOR - DESCRIPTION, FUEL TEMPERATURE	14-29
SENSOR - DESCRIPTION, HEATED SEAT	8G-4
SENSOR - DESCRIPTION, IN-CAR TEMPERATURE	24-19
SENSOR - DESCRIPTION, INLET AIR TEMPERATURE	14-29
SENSOR - DESCRIPTION, MANIFOLD AIR FLOW (MAF)	14-30
SENSOR - DESCRIPTION, OIL TEMPERATURE	9-56
SENSOR - DESCRIPTION, TEMPERATURE	24-30
SENSOR - DESCRIPTION, TRANSMISSION TEMPERATURE	21-140
SENSOR - DESCRIPTION, WATER IN FUEL	14-16
SENSOR - DIAGNOSIS AND TESTING, BOOST PRESSURE	14-18
SENSOR - DIAGNOSIS AND TESTING, EVAPORATOR TEMPERATURE	24-26
SENSOR - DIAGNOSIS AND TESTING, HEATED SEAT	8G-4
SENSOR - DIAGNOSIS AND TESTING, IN-CAR TEMPERATURE	24-19
SENSOR - DIAGNOSIS AND TESTING, TEMPERATURE	24-30
SENSOR - INSTALLATION, AIR OUTLET TEMPERATURE	24-15
SENSOR - INSTALLATION, AMBIENT TEMPERATURE	24-16
SENSOR - INSTALLATION, BOOST PRESSURE	14-18
SENSOR - INSTALLATION, CAMSHAFT POSITION	14-19
SENSOR - INSTALLATION, COOLANT LEVEL	7-13
SENSOR - INSTALLATION, CRANKSHAFT POSITION	14-20
SENSOR - INSTALLATION, DOME LAMP/INTRUSION	8L-31
SENSOR - INSTALLATION, ENGINE COOLANT TEMP	7-15
SENSOR - INSTALLATION, EVAPORATOR TEMPERATURE	24-18,24-26
SENSOR - INSTALLATION, FRONT WHEEL SPEED	5-30
SENSOR - INSTALLATION, FUEL LEVEL SENDING UNIT	14-15
SENSOR - INSTALLATION, FUEL TEMPERATURE	14-29
SENSOR - INSTALLATION, INLET AIR TEMPERATURE	14-30
SENSOR - INSTALLATION, INTRUSION	8Q-2
SENSOR - INSTALLATION, MANIFOLD AIR FLOW (MAF)	14-31
SENSOR - INSTALLATION, OIL TEMPERATURE	9-57
SENSOR - INSTALLATION, REAR WHEEL SPEED	5-31
SENSOR - INSTALLATION, TEMPERATURE	24-30
SENSOR - OPERATION, AIR OUTLET TEMPERATURE	24-15
SENSOR - OPERATION, AMBIENT TEMPERATURE	24-15
SENSOR - OPERATION, BOOST PRESSURE	14-18
SENSOR - OPERATION, CAMSHAFT POSITION	14-19
SENSOR - OPERATION, CRANKSHAFT POSITION	14-20
SENSOR - OPERATION, EVAPORATOR TEMPERATURE	24-18,24-26
SENSOR - OPERATION, FUEL TEMPERATURE	14-29
SENSOR - OPERATION, IN-CAR TEMPERATURE	24-19
SENSOR - OPERATION, INLET AIR TEMPERATURE	14-29
SENSOR - OPERATION, MANIFOLD AIR FLOW (MAF)	14-30
SENSOR - OPERATION, OIL TEMPERATURE	9-56
SENSOR - OPERATION, TEMPERATURE	24-30
SENSOR - OPERATION, TRANSMISSION TEMPERATURE	21-141
SENSOR - OPERATION, WATER IN FUEL	14-16
SENSOR - REMOVAL, AIR OUTLET TEMPERATURE	24-15
SENSOR - REMOVAL, AMBIENT TEMPERATURE	24-15
SENSOR - REMOVAL, BOOST PRESSURE	14-18
SENSOR - REMOVAL, CAMSHAFT POSITION	14-19
SENSOR - REMOVAL, COOLANT LEVEL	7-13
SENSOR - REMOVAL, CRANKSHAFT POSITION	14-20
SENSOR - REMOVAL, DOME LAMP/ INTRUSION	8L-31
SENSOR - REMOVAL, ENGINE COOLANT TEMP	7-14
SENSOR - REMOVAL, EVAPORATOR TEMPERATURE	24-18,24-26
SENSOR - REMOVAL, FRONT WHEEL SPEED	5-30
SENSOR - REMOVAL, FUEL LEVEL SENDING UNIT	14-15
SENSOR - REMOVAL, FUEL TEMPERATURE	14-29
SENSOR - REMOVAL, IN-CAR TEMPERATURE	24-19
SENSOR - REMOVAL, INLET AIR TEMPERATURE	14-30
SENSOR - REMOVAL, INTRUSION	8Q-2
SENSOR - REMOVAL, MANIFOLD AIR FLOW (MAF)	14-31
SENSOR - REMOVAL, OIL TEMPERATURE	9-57
SENSOR - REMOVAL, REAR WHEEL SPEED	5-30
SENSOR - REMOVAL, TEMPERATURE	24-30
SENSOR BULB - INSTALLATION, DOME LAMP/INTRUSION	8L-30
SENSOR BULB - REMOVAL, DOME LAMP/INTRUSION	8L-30
SENSORS - DESCRIPTION, INPUT SPEED	21-119
SENSORS - OPERATION, INPUT SPEED	21-119
SENTRY KEY REMOTE ENTRY MODULE - DESCRIPTION	8Q-2
SENTRY KEY REMOTE ENTRY MODULE - INSTALLATION	8Q-4
SENTRY KEY REMOTE ENTRY MODULE - OPERATION	8Q-3
SENTRY KEY REMOTE ENTRY MODULE - REMOVAL	8Q-3
SEPARATOR - INSTALLATION, OIL	9-50
SEPARATOR - REMOVAL, OIL	9-50
SERVO - DESCRIPTION	8P-3
SEVERAL LOADS - STANDARD PROCEDURE, TESTING FOR A SHORT TO GROUND ON FUSES POWERING	8W-01-8
SHACKLE - INSTALLATION, SPRING	2-15
SHACKLE - REMOVAL, SPRING	2-15
SHAFT - DIAGNOSIS AND TESTING, PROPELLER	3-1
SHAFT - INSTALLATION, INTERMEDIATE	19-5
SHAFT - INSTALLATION, PROPELLER	3-6
SHAFT - REMOVAL, INTERMEDIATE	19-5
SHAFT - REMOVAL, PROPELLER	3-6
SHAFT - SPECIAL TOOLS, PROPELLER	3-5
SHAFT - SPECIFICATIONS, PROPELLER	3-5
SHAFT - STANDARD PROCEDURE, PROPELLER	3-3
SHAFT BEARING - INSTALLATION, OUTPUT	21-122
SHAFT BEARING - REMOVAL, OUTPUT	21-122
SHAFT SEAL - INSTALLATION, OUTPUT	21-125
SHAFT SEAL - REMOVAL, OUTPUT	21-125
SHAFTS - DUAL REAR WHEELS - INSTALLATION, AXLE	3-19
SHAFTS - DUAL REAR WHEELS - REMOVAL, AXLE	3-19
SHAFTS - INSTALLATION, AXLE	3-15
SHAFTS - REMOVAL, AXLE	3-15
SHIELD - INSTALLATION, REAR SEAT BACK	23-79
SHIELD - REMOVAL, REAR SEAT BACK	23-79
SHIFT MECHANISM - DESCRIPTION	21-133
SHIFT MECHANISM - INSTALLATION	21-135
SHIFT MECHANISM - OPERATION	21-133
SHIFT MECHANISM - REMOVAL	21-134
SHOCK - DIAGNOSIS AND TESTING	2-13
SHOCK - DIAGNOSIS AND TESTING, SPRING	2-11
SHOCK - INSTALLATION	2-13
SHOCK - REMOVAL	2-13
SHORT TO GROUND - STANDARD PROCEDURE, TESTING FOR A	8W-01-8
SHORT TO GROUND ON FUSES POWERING SEVERAL LOADS - STANDARD PROCEDURE, TESTING FOR A	8W-01-8
SHUTOFF SOL - DESCRIPTION, HI PRESSURE FUEL	14-16
SHUTOFF SOL - OPERATION, HI PRESSURE FUEL	14-16
SIDE MARKER LAMP BULB - INSTALLATION, REAR	8L-21
SIDE MARKER LAMP BULB - REMOVAL, REAR	8L-21
SIDE VIEW MIRROR - GLASS - INSTALLATION	23-49
SIDE VIEW MIRROR - GLASS - REMOVAL	23-49
SIDE VIEW MIRROR - INSTALLATION	23-48
SIDE VIEW MIRROR - REMOVAL	23-48
SIGNAL INDICATOR - DESCRIPTION, TURN	8J-25
SIGNAL INDICATOR - OPERATION, TURN	8J-25
SIGNAL RELAY - INSTALLATION, TURN	8L-24
SIGNAL RELAY - REMOVAL, TURN	8L-24
SIREN - INSTALLATION	8Q-4
SIREN - REMOVAL	8Q-4
SLIDE RAIL - INSTALLATION, TENSIONING	9-66
SLIDE RAILS - REMOVAL, TENSIONING	9-61
SLIDING DOOR - ASSEMBLY	23-43
SLIDING DOOR - DISASSEMBLY	23-42
SLIDING DOOR - INSTALLATION	23-44
SLIDING DOOR - REMOVAL	23-41
SOL - DESCRIPTION, HI PRESSURE FUEL SHUTOFF	14-16
SOL - OPERATION, HI PRESSURE FUEL SHUTOFF	14-16
SOLENOID - DESCRIPTION	21-136
SOLENOID - DESCRIPTION, FUEL PRESSURE	14-27
SOLENOID - INSTALLATION, FUEL PRESSURE	14-28
SOLENOID - OPERATION	21-138
SOLENOID - OPERATION, FUEL PRESSURE	14-27
SOLENOID - REMOVAL, FUEL PRESSURE	14-28
SOLENOID VALVE - DESCRIPTION	24-27
SOLENOID VALVE - DIAGNOSIS AND TESTING	24-27
SOLENOID VALVE - INSTALLATION	24-28
SOLENOID VALVE - OPERATION	24-27
SOLENOID VALVE - REMOVAL	24-27
SPARE TIRE CARRIER - INSTALLATION	22-10
SPARE TIRE CARRIER - REMOVAL	22-10
SPEAKER - INSTALLATION	8A-2
SPEAKER - REMOVAL	8A-2
SPEED CONTROL - DESCRIPTION	8P-1
SPEED CONTROL - OPERATION	8P-1
SPEED SENSOR - INSTALLATION, FRONT WHEEL	5-30

Description	Group-Page
SPEED SENSOR - INSTALLATION, REAR WHEEL	5-31
SPEED SENSOR - REMOVAL, FRONT WHEEL	5-30
SPEED SENSOR - REMOVAL, REAR WHEEL	5-30
SPEED SENSORS - DESCRIPTION, INPUT	21-119
SPEED SENSORS - OPERATION, INPUT	21-119
SPEEDOMETER - DESCRIPTION	8J-23
SPEEDOMETER - OPERATION	8J-23
SPEEDS - DESCRIPTION, TIRE PRESSURE FOR HIGH	22-6
SPLICE INFORMATION - DESCRIPTION, CONNECTOR, GROUND	8W-01-5
SPLICING - STANDARD PROCEDURE, WIRE	8W-01-10
SPRING - DESCRIPTION	2-14
SPRING - INSTALLATION	2-8
SPRING - OPERATION	2-14
SPRING - REMOVAL	2-7
SPRING AND SHOCK - DIAGNOSIS AND TESTING	2-11
SPRING CLAMP PLATES - INSTALLATION	2-8
SPRING CLAMP PLATES - REMOVAL	2-8
SPRING SHACKLE - INSTALLATION	2-15
SPRING SHACKLE - REMOVAL	2-15
SPRING STOP PLATES - INSTALLATION	2-9
SPRING STOP PLATES - REMOVAL	2-9
SPRINGS - INSTALLATION, VALVE	9-32
SPRINGS - REMOVAL, VALVE	9-31
SQUEAK & RATTLE - STANDARD PROCEDURE, BUZZ	23-10
STABILIZER - INSTALLATION	23-45
STABILIZER - REMOVAL	23-45
STABILIZER BAR - DESCRIPTION	2-9
STABILIZER BAR - INSTALLATION	2-15,2-9
STABILIZER BAR - OPERATION	2-9
STABILIZER BAR - REMOVAL	2-15,2-9
STABILIZER LINK - INSTALLATION	2-16,2-9
STABILIZER LINK - REMOVAL	2-16,2-9
STARTER - DIESEL - TORQUE	8F-29
STARTER MOTOR - DIAGNOSIS AND TESTING	8F-29
STARTER MOTOR - DIESEL - SPECIFICATIONS	8F-29
STARTER MOTOR - INSTALLATION	8F-31
STARTER MOTOR - REMOVAL	8F-30
STARTER MOTOR RELAY - DESCRIPTION	8F-31
STARTER MOTOR RELAY - INSTALLATION	8F-32
STARTER MOTOR RELAY - REMOVAL	8F-31
STARTING - STANDARD PROCEDURE, JUMP	0-6
STARTING SYSTEM - DESCRIPTION	8F-24
STARTING SYSTEM - DIAGNOSIS AND TESTING	8F-25
STARTING SYSTEM - OPERATION	8F-24
STEERING - DESCRIPTION	19-1
STEERING - OPERATION	19-1
STEERING COLUMN OPENING COVER - INSTALLATION	23-66
STEERING COLUMN OPENING COVER - REMOVAL	23-66
STEERING FLUID - DESCRIPTION, POWER	0-3
STEERING PUMP - INITIAL OPERATION - STANDARD PROCEDURE, POWER	19-12
STEERING PUMP FILL AND BLEED PROCEDURE, STANDARD PROCEDURE - POWER	19-14
STEERING SYSTEM - DIAGNOSIS AND TESTING, POWER	19-2
STEERING SYSTEM - STANDARD PROCEDURE, FLUSHING POWER	19-13
STEERING WHEEL - INSTALLATION	19-7
STEERING WHEEL - REMOVAL	19-7
STEP - INSTALLATION, REAR BUMPER	13-3
STEP - REMOVAL, REAR BUMPER	13-3
STEPS - INSTALLATION, FRONT BUMPER	13-2
STEPS - REMOVAL, FRONT BUMPER	13-2
STEPWELL SCUFF PADS - INSTALLATION	23-73
STEPWELL SCUFF PADS - REMOVAL	23-72
STOP LAMP BULB - INSTALLATION, CENTER HIGH MOUNTED	8L-7
STOP LAMP BULB - REMOVAL, CENTER HIGH MOUNTED	8L-7
STOP LAMP UN - INSTALLATION, CENTER HIGH MOUNTED	8L-8
STOP LAMP UN - REMOVAL, CENTER HIGH MOUNTED	8L-8
STOP PLATES - INSTALLATION, SPRING	2-9
STOP PLATES - REMOVAL, SPRING	2-9
STRIKER - INSTALLATION, LATCH	23-18
STRIKER - INSTALLATION, REAR LATCH	23-41
STRIKER - REMOVAL, LATCH	23-18
STRIKER - REMOVAL, REAR LATCH	23-41
STRUT - INSTALLATION	2-10
STRUT - REMOVAL	2-10
SUCTION LINE - INSTALLATION	24-66
SUCTION LINE - REMOVAL	24-66
SUN VISOR - INSTALLATION	23-73
SUN VISOR - REMOVAL	23-73
SUPPLEMENTAL HEATER - DCHA - DIAGNOSIS AND TESTING, DIESEL	24-72
SUPPLEMENTAL RESTRAINT DEPLOYMENT - STANDARD PROCEDURE, SERVICE AFTER A	8O-6
SUPPLEMENTAL RESTRAINT SYSTEM - DIAGNOSIS AND TESTING	8O-5
SUPPLEMENTAL RESTRAINTS - STANDARD PROCEDURE, HANDLING NON-DEPLOYED	8O-6
SUPPLY RESTRICTIONS - DIAGNOSIS AND TESTING, FUEL	14-5
SUPPORT BRACKET - INSTALLATION, REAR VIEW MIRROR	23-72
SURFACE - STANDARD PROCEDURE, MEASURE CYLINDER HEAD	9-21
SUSPENSION, SPECIAL TOOLS - FRONT	19-11
SUSPENSION, SPECIAL TOOLS - FRONT	2-2
SWITCH - DESCRIPTION, BLOWER MOTOR	24-17,24-22
SWITCH - DESCRIPTION, DRIVER HEATED SEAT	8G-2
SWITCH - DESCRIPTION, MASTER LOCK	8N-2
SWITCH - DESCRIPTION, PASSENGER HEATED SEAT	8G-5
SWITCH - DESCRIPTION, SEAT BELT	8O-31
SWITCH - DESCRIPTION, WASHER FLUID LEVEL	8R-7
SWITCH - DIAGNOSIS AND TESTING, BLOWER MOTOR	24-17,24-23
SWITCH - DIAGNOSIS AND TESTING, DRIVER HEATED SEAT	8G-2
SWITCH - DIAGNOSIS AND TESTING, MASTER LOCK	8N-2
SWITCH - DIAGNOSIS AND TESTING, PASSENGER HEATED SEAT	8G-5
SWITCH - DIAGNOSIS AND TESTING, POWER MIRROR	8N-3
SWITCH - DIAGNOSIS AND TESTING, POWER WINDOW	8N-5
SWITCH - INSTALLATION	8P-3
SWITCH - INSTALLATION, BLOWER MOTOR	24-23
SWITCH - INSTALLATION, BRAKE LAMP	8L-6
SWITCH - INSTALLATION, DOOR JAMB	8L-31
SWITCH - INSTALLATION, DRIVER HEATED SEAT	8G-3
SWITCH - INSTALLATION, FOG LAMP	8L-12
SWITCH - INSTALLATION, HEADLAMP LEVELING	8L-17
SWITCH - INSTALLATION, HORN	8H-1
SWITCH - INSTALLATION, MASTER LOCK	8N-2
SWITCH - INSTALLATION, MULTI-FUNCTION	8L-20
SWITCH - INSTALLATION, PARK BRAKE	8L-20
SWITCH - INSTALLATION, PASSENGER HEATED SEAT	8G-5
SWITCH - INSTALLATION, POWER MIRROR	8N-4
SWITCH - INSTALLATION, POWER WINDOW	8N-6
SWITCH - OPERATION, BLOWER MOTOR	24-17, 24-22
SWITCH - OPERATION, DRIVER HEATED SEAT	8G-2
SWITCH - OPERATION, PASSENGER HEATED SEAT	8G-5
SWITCH - OPERATION, SEAT BELT	8O-31
SWITCH - OPERATION, WASHER FLUID LEVEL	8R-8
SWITCH - REMOVAL	8P-3
SWITCH - REMOVAL, BLOWER MOTOR	24-17, 24-23
SWITCH - REMOVAL, BRAKE LAMP	8L-6
SWITCH - REMOVAL, DOOR JAMB	8L-31
SWITCH - REMOVAL, DRIVER HEATED SEAT	8G-3
SWITCH - REMOVAL, FOG LAMP	8L-11
SWITCH - REMOVAL, HEADLAMP LEVELING	8L-16
SWITCH - REMOVAL, HORN	8H-1
SWITCH - REMOVAL, MASTER LOCK	8N-2
SWITCH - REMOVAL, MULTI-FUNCTION	8L-19
SWITCH - REMOVAL, PARK BRAKE	8L-20
SWITCH - REMOVAL, PASSENGER HEATED SEAT	8G-5
SWITCH - REMOVAL, POWER MIRROR	8N-3
SWITCH - REMOVAL, POWER WINDOW	8N-6
SWITCH BEZEL - INSTALLATION, ACCESSORY	23-54
SWITCH BEZEL - REMOVAL, ACCESSORY	23-54
SYMBOLS - DESCRIPTION, INTERNATIONAL	Intro.-2
SYMBOLS - DESCRIPTION, INTERNATIONAL	0-9
TACHOMETER - DESCRIPTION	8J-23
TACHOMETER - OPERATION	8J-24
TAIL LAMP UNIT - INSTALLATION	8L-23
TAIL LAMP UNIT - REMOVAL	8L-23
TAILPIPE - INSTALLATION	11-3
TAILPIPE - REMOVAL	11-3
TANK - DESCRIPTION, FUEL	14-12
TANK - INSTALLATION, FUEL	14-13
TANK - REMOVAL, FUEL	14-12
TANK MODULE - DESCRIPTION, FUEL	14-13
TANK MODULE - INSTALLATION, FUEL	14-14
TANK MODULE - REMOVAL, FUEL	14-13
TCM ADAPTATION - STANDARD PROCEDURE	8E-8
TEMP SENSOR - DESCRIPTION, ENGINE COOLANT	7-14
TEMP SENSOR - INSTALLATION, ENGINE COOLANT	7-15
TEMP SENSOR - REMOVAL, ENGINE COOLANT	7-14
TEMPERATURE CONTROL - DESCRIPTION	24-29
TEMPERATURE CONTROL - DIAGNOSIS AND TESTING	24-29
TEMPERATURE CONTROL - INSTALLATION	24-29
TEMPERATURE CONTROL - OPERATION	24-29
TEMPERATURE CONTROL - REMOVAL	24-29
TEMPERATURE GAUGE - DESCRIPTION, ENGINE	8J-15
TEMPERATURE GAUGE - OPERATION, ENGINE	8J-15
TEMPERATURE INDICATOR - DESCRIPTION, AMBIENT	8J-11
TEMPERATURE INDICATOR - OPERATION, AMBIENT	8J-11
TEMPERATURE SENSOR - DESCRIPTION	24-30
TEMPERATURE SENSOR - DESCRIPTION, AIR OUTLET	24-14
TEMPERATURE SENSOR - DESCRIPTION, AMBIENT	24-15
TEMPERATURE SENSOR - DESCRIPTION, EVAPORATOR	24-17,24-25
TEMPERATURE SENSOR - DESCRIPTION, FUEL	14-29
TEMPERATURE SENSOR - DESCRIPTION, IN-CAR	24-19
TEMPERATURE SENSOR - DESCRIPTION, INLET AIR	14-29
TEMPERATURE SENSOR - DESCRIPTION, OIL	9-56
TEMPERATURE SENSOR - DESCRIPTION, TRANSMISSION	21-140
TEMPERATURE SENSOR - DIAGNOSIS AND TESTING	24-30
TEMPERATURE SENSOR - DIAGNOSIS AND TESTING, EVAPORATOR	24-26
TEMPERATURE SENSOR - DIAGNOSIS AND TESTING, IN-CAR	24-19
TEMPERATURE SENSOR - INSTALLATION	24-30
TEMPERATURE SENSOR - INSTALLATION, AIR OUTLET	24-15
TEMPERATURE SENSOR - INSTALLATION, AMBIENT	24-16
TEMPERATURE SENSOR - INSTALLATION, EVAPORATOR	24-18,24-26

Description	Group-Page
TEMPERATURE SENSOR - INSTALLATION, FUEL	14-29
TEMPERATURE SENSOR - INSTALLATION, INLET AIR	14-30
TEMPERATURE SENSOR - INSTALLATION, OIL	9-57
TEMPERATURE SENSOR - OPERATION	24-30
TEMPERATURE SENSOR - OPERATION, AIR OUTLET	24-15
TEMPERATURE SENSOR - OPERATION, AMBIENT	24-15
TEMPERATURE SENSOR - OPERATION, EVAPORATOR	24-18,24-26
TEMPERATURE SENSOR - OPERATION, FUEL	14-29
TEMPERATURE SENSOR - OPERATION, IN-CAR	24-19
TEMPERATURE SENSOR - OPERATION, INLET AIR	14-29
TEMPERATURE SENSOR - OPERATION, OIL	9-56
TEMPERATURE SENSOR - OPERATION, TRANSMISSION	21-141
TEMPERATURE SENSOR - REMOVAL	24-30
TEMPERATURE SENSOR - REMOVAL, AIR OUTLET	24-15
TEMPERATURE SENSOR - REMOVAL, AMBIENT	24-15
TEMPERATURE SENSOR - REMOVAL, EVAPORATOR	24-18,24-26
TEMPERATURE SENSOR - REMOVAL, FUEL	14-29
TEMPERATURE SENSOR - REMOVAL, IN-CAR	24-19
TEMPERATURE SENSOR - REMOVAL, INLET AIR	14-30
TEMPERATURE SENSOR - REMOVAL, OIL	9-57
TENSIONER - DESCRIPTION, SEAT BELT	8O-31
TENSIONER - INSTALLATION, CABLE	5-23
TENSIONER - INSTALLATION, TIMING CHAIN	9-71
TENSIONER - OPERATION, SEAT BELT	8O-32
TENSIONER - REMOVAL, CABLE	5-23
TENSIONER - REMOVAL, TIMING CHAIN	9-70
TENSIONERS - DESCRIPTION, BELT	7-5
TENSIONERS - OPERATION, BELT	7-5
TENSIONING AND SLIDE RAIL - INSTALLATION	9-66
TENSIONING AND SLIDE RAILS - REMOVAL	9-61
TENSIONING RAIL - INSTALLATION, TIMING CHAIN	9-66
TENSIONING RAIL - REMOVAL, TIMING CHAIN	9-63
TERMINAL - INSTALLATION	8W-01-10
TERMINAL - REMOVAL	8W-01-9
TEST - DIAGNOSIS AND TESTING, A/C PERFORMANCE	24-3
TEST - DIAGNOSIS AND TESTING, FUNCTION	24-3
TEST - STANDARD PROCEDURE, CYLINDER LEAK DOWN	9-3
TEST - STANDARD PROCEDURE, IGNITION-OFF DRAW	8F-10
TEST - STANDARD PROCEDURE, LOW PRESSURE FUEL PUMP	14-3
TEST - STANDARD PROCEDURE, OPEN-CIRCUIT VOLTAGE	8F-10
TEST - STANDARD PROCEDURE, VERIFICATION	8O-7
TESTER - STANDARD PROCEDURE, USING MICRO 420 BATTERY	8F-11
THEFT SECURITY - DESCRIPTION, VEHICLE	8Q-1
THEFT SECURITY - DIAGNOSIS AND TESTING, VEHICLE	8Q-1
THEFT SECURITY - OPERATION, VEHICLE	8Q-1
THERMOSTAT - INSTALLATION, ENGINE COOLANT	7-16
THERMOSTAT - REMOVAL, ENGINE COOLANT	7-15
THREAD REPAIR - STANDARD PROCEDURE, ALUMINUM	21-27
THREADED HOLE REPAIR - DESCRIPTION	Intro.-5
TIE ROD END - DIAGNOSIS AND TESTING, OUTER	19-10
TIE ROD END - INSTALLATION	19-11
TIE ROD END - REMOVAL	19-11
TIME DELAY RELAY - INSTALLATION	8L-33
TIME DELAY RELAY - REMOVAL	8L-32
TIMER MODULE - DESCRIPTION, CENTRAL	8E-1
TIMER MODULE - DIAGNOSIS AND TESTING, CENTRAL	8E-2
TIMER MODULE - INSTALLATION, CENTRAL	8E-2
TIMER MODULE - OPERATION, CENTRAL	8E-2
TIMER MODULE - REMOVAL, CENTRAL	8E-2
TIMING CHAIN - INSTALLATION	9-67
TIMING CHAIN - REMOVAL	9-63
TIMING CHAIN COVER - INSTALLATION	9-60
TIMING CHAIN COVER - REMOVAL	9-59
TIMING CHAIN TENSIONER - INSTALLATION	9-71
TIMING CHAIN TENSIONER - REMOVAL	9-70
TIMING CHAIN TENSIONING RAIL - INSTALLATION	9-66
TIMING CHAIN TENSIONING RAIL - REMOVAL	9-63
TIRE AND WHEEL BALANCE - STANDARD PROCEDURE	22-3
TIRE AND WHEEL RUNOUT - DIAGNOSIS AND TESTING	22-1
TIRE CARRIER - INSTALLATION, SPARE	22-10
TIRE CARRIER - REMOVAL, SPARE	22-10
TIRE INFLATION PRESSURES - DESCRIPTION	22-7
TIRE NOISE OR VIBRATION - DIAGNOSIS AND TESTING	22-8
TIRE PRESSURE FOR HIGH SPEEDS - DESCRIPTION	22-6
TIRE ROTATION - STANDARD PROCEDURE	22-5
TIRE WEAR PATTERNS - DIAGNOSIS AND TESTING	22-8
TIRES - DESCRIPTION	22-6
TIRES - DESCRIPTION, RADIAL - PLY	22-6
TIRES - DESCRIPTION, REPLACEMENT	22-7
TIRES, SPECIFICATIONS	22-10
TIRE/VEHICLE LEAD - DIAGNOSIS AND TESTING	22-8
TO COOLER TUBE - INSTALLATION, RETURN HOSE FROM GEAR	19-15
TO COOLER TUBE - INSTALLATION, RETURN LINE FROM PUMP	19-15
TO COOLER TUBE - REMOVAL, RETURN HOSE FROM GEAR	19-15
TO COOLER TUBE - REMOVAL, RETURN LINE FROM PUMP	19-15
TO GROUND - STANDARD PROCEDURE, TESTING FOR A SHORT	8W-01-8
TO GROUND ON FUSES POWERING SEVERAL LOADS - STANDARD PROCEDURE, TESTING FOR A SHORT	8W-01-8
TO USE WIRING DIAGRAMS - DESCRIPTION, HOW	8W-01-1
TOE ADJUSTMENT - STANDARD PROCEDURE	2-19
TONE WHEEL - INSTALLATION	5-31
TONE WHEEL - REMOVAL	5-31
TOOLS - AUDIO, SPECIAL	8A-1
TOOLS - BATTERY SYSTEM SPECIAL TOOLS, SPECIAL	8F-6
TOOLS - BRAKES, SPECIAL	5-7
TOOLS - FRONT SUSPENSION, SPECIAL	19-11
TOOLS - FRONT SUSPENSION, SPECIAL	2-2
TOOLS - FUEL SYSTEM, SPECIAL	14-5
TOOLS - PARK BRAKE, SPECIAL	5-23
TOOLS, IGNITION CONTROL - SPECIAL	8I-1
TOOLS, INSTALLATION - SPECIAL	9-14
TOOLS, NAG1 AUTOMATIC TRANSMISSION - SPECIAL	21-69
TOOLS, PROPELLER SHAFT - SPECIAL	3-5
TOOLS, REAR AXLE - SPECIAL	3-14
TOOLS, SPECIAL TOOLS - BATTERY SYSTEM SPECIAL	8F-6
TOOLS, SPECIFICATIONS - SPECIAL	8F-17
TOP COVER - CLUSTER - INSTALLATION	23-62
TOP COVER - CLUSTER - REMOVAL	23-62
TOP COVER - INSTALLATION	23-65
TOP COVER - REMOVAL	23-64
TOP COVER - TRAY - INSTALLATION	23-64
TOP COVER - TRAY - REMOVAL	23-63
TOUCH-UP - DESCRIPTION, PAINT	23-74
TOUCH-UP - STANDARD PROCEDURE, PAINT	23-75
TOWING - STANDARD PROCEDURE	0-6
TRACK - INSTALLATION, CENTER	23-39
TRACK - REMOVAL, CENTER	23-38
TRACTION CONTROL INDICATOR - DESCRIPTION	8J-24
TRACTION CONTROL INDICATOR - OPERATION	8J-24
TRACTION CONTROL MALFUNCTION INDICATOR - DESCRIPTION	8J-25
TRACTION CONTROL MALFUNCTION INDICATOR - OPERATION	8J-25
TRAILER HITCH - INSTALLATION	13-10
TRAILER HITCH - REMOVAL	13-9
TRANSDUCER - DESCRIPTION, A/C PRESSURE	24-13
TRANSDUCER - DIAGNOSIS AND TESTING, A/C PRESSURE	24-13
TRANSDUCER - INSTALLATION, A/C PRESSURE	24-14
TRANSDUCER - INSTALLATION, VACUUM	11-8
TRANSDUCER - OPERATION, A/C PRESSURE	24-13
TRANSDUCER - REMOVAL, A/C PRESSURE	24-14
TRANSDUCER - REMOVAL, VACUUM	11-7
TRANSMISSION - DIAGNOSIS AND TESTING, AUTOMATIC	21-23,21-24
TRANSMISSION - INSTALLATION, REAR CROSSMEMBER	13-9
TRANSMISSION - NAG1 - DESCRIPTION, AUTOMATIC	21-2
TRANSMISSION - NAG1 - OPERATION, AUTOMATIC	21-4
TRANSMISSION - REMOVAL, REAR CROSSMEMBER	13-9
TRANSMISSION - SPECIAL TOOLS, NAG1 AUTOMATIC	21-69
TRANSMISSION - SPECIFICATIONS, NAG1 AUTOMATIC	21-68
TRANSMISSION CONTROL MODULE - DESCRIPTION	8E-5
TRANSMISSION CONTROL MODULE - OPERATION	8E-5
TRANSMISSION FILL - STANDARD PROCEDURE	21-103
TRANSMISSION FLUID - NAG1 - DESCRIPTION, AUTOMATIC	0-4
TRANSMISSION FLUID - OPERATION, AUTOMATIC	0-4
TRANSMISSION TEMPERATURE SENSOR - DESCRIPTION	21-140
TRANSMISSION TEMPERATURE SENSOR - OPERATION	21-141
TRANSMITTER - DESCRIPTION, REMOTE KEYLESS ENTRY	8N-2
TRANSPONDER KEY - DESCRIPTION	8Q-5
TRANSPONDER KEY - OPERATION	8Q-5
TRAY - DESCRIPTION, BATTERY	8F-16
TRAY - INSTALLATION, BATTERY	8F-16
TRAY - INSTALLATION, TOP COVER	23-64
TRAY - OPERATION, BATTERY	8F-16
TRAY - REMOVAL, BATTERY	8F-16
TRAY - REMOVAL, TOP COVER	23-63
TREAD WEAR INDICATORS - DIAGNOSIS AND TESTING	22-8
TRIM - INSTALLATION, A-PILLAR	23-68
TRIM - INSTALLATION, B-PILLAR	23-69
TRIM - INSTALLATION, COWL	23-70
TRIM - INSTALLATION, D-PILLAR	23-70
TRIM - REMOVAL, A-PILLAR	23-67
TRIM - REMOVAL, B-PILLAR	23-68
TRIM - REMOVAL, COWL	23-70
TRIM - REMOVAL, D-PILLAR	23-70
TRIM PANEL - INSTALLATION	23-20,23-35,23-46
TRIM PANEL - INSTALLATION, BACKLITE - BULKHEAD	23-81
TRIM PANEL - INSTALLATION, BULKHEAD	23-69
TRIM PANEL - INSTALLATION, QUARTER	23-72
TRIM PANEL - REMOVAL	23-19,23-35,23-46
TRIM PANEL - REMOVAL, BACKLITE - BULKHEAD	23-81
TRIM PANEL - REMOVAL, BULKHEAD	23-69
TRIM PANEL - REMOVAL, QUARTER	23-71
TUBE - INSTALLATION, EXHAUST	24-73

Description	Group-Page
TUBE - INSTALLATION, FLUID COOLER	19-14
TUBE - INSTALLATION, RETURN HOSE FROM GEAR TO COOLER	19-15
TUBE - INSTALLATION, RETURN LINE FROM PUMP TO COOLER	19-15
TUBE - REMOVAL, EXHAUST	24-73
TUBE - REMOVAL, FLUID COOLER	19-14
TUBE - REMOVAL, RETURN HOSE FROM GEAR TO COOLER	19-15
TUBE - REMOVAL, RETURN LINE FROM PUMP TO COOLER	19-15
TURBOCHARGER - DESCRIPTION	11-6
TURBOCHARGER - OPERATION	11-6
TURBOCHARGER SYSTEM - DESCRIPTION	11-3
TURBOCHARGER SYSTEM - OPERATION	11-4
TURN LAMP BULB - INSTALLATION, REAR	8L-22
TURN LAMP BULB - REMOVAL, REAR	8L-21
TURN SIGNAL INDICATOR - DESCRIPTION	8J-25
TURN SIGNAL INDICATOR - OPERATION	8J-25
TURN SIGNAL RELAY - INSTALLATION	8L-24
TURN SIGNAL RELAY - REMOVAL	8L-24
TURNING LOOP ADJUSTER - INSTALLATION, SEAT BELT	8O-34
TURNING LOOP ADJUSTER - REMOVAL, SEAT BELT	8O-33
TURN/PARK/SIDE MARKER LAMP BULB - INSTALLATION, FRONT	8L-15
TURN/PARK/SIDE MARKER LAMP BULB - REMOVAL, FRONT	8L-14
UN - INSTALLATION, CENTER HIGH MOUNTED STOP LAMP	8L-8
UN - REMOVAL, CENTER HIGH MOUNTED STOP LAMP	8L-8
UNDER HOOD BATTERY INSTALLATION, INSTALLATION	8F-13
UNDER HOOD BATTERY REMOVAL, REMOVAL	8F-12
UNDERBODY LINES - INSTALLATION	24-69
UNDERBODY LINES - REMOVAL	24-68
UNIT - ADJUSTMENT, FRONT LAMP	8L-12
UNIT - ASSEMBLY, ELECTROHYDRAULIC	21-95
UNIT - DESCRIPTION, ELECTROHYDRAULIC	21-82
UNIT - DISASSEMBLY, ELECTROHYDRAULIC	21-92
UNIT - INSTALLATION, ASH RECEIVER/ CIGAR LIGHTER LAMP	8L-27
UNIT - INSTALLATION, CARGO/DOME LAMP	8L-28
UNIT - INSTALLATION, CLEARANCE LAMP	8L-9
UNIT - INSTALLATION, DOME/READING LAMP	8L-30
UNIT - INSTALLATION, ELECTROHYDRAULIC	21-100
UNIT - INSTALLATION, ENTRY/EXIT LAMP	8L-32
UNIT - INSTALLATION, FRONT LAMP	8L-12
UNIT - INSTALLATION, LICENSE PLATE LAMP	8L-18
UNIT - INSTALLATION, REPEATER LAMP	8L-23
UNIT - INSTALLATION, TAIL LAMP	8L-23
UNIT - OPERATION, ELECTROHYDRAULIC	21-87
UNIT - REMOVAL, ASH RECEIVER/CIGAR LIGHTER LAMP	8L-27
UNIT - REMOVAL, CARGO/DOME LAMP	8L-28
UNIT - REMOVAL, CLEARANCE LAMP	8L-8
UNIT - REMOVAL, DOME/READING LAMP	8L-30
UNIT - REMOVAL, ELECTROHYDRAULIC	21-92
UNIT - REMOVAL, ENTRY/EXIT LAMP	8L-32
UNIT - REMOVAL, FRONT LAMP	8L-12
UNIT - REMOVAL, LICENSE PLATE LAMP	8L-18
UNIT - REMOVAL, REPEATER LAMP	8L-22
UNIT - REMOVAL, TAIL LAMP	8L-23
UNIT / SENSOR - DESCRIPTION, FUEL LEVEL SENDING	14-15
UNIT / SENSOR - INSTALLATION, FUEL LEVEL SENDING	14-15
UNIT / SENSOR - REMOVAL, FUEL LEVEL SENDING	14-15
UPPER ROLLER ARM - INSTALLATION	23-37
UPPER ROLLER ARM - REMOVAL	23-37
USAGE - DESCRIPTION, FASTENER	Intro.-5
USE WIRING DIAGRAMS - DESCRIPTION, HOW TO	8W-01-1
USING MICRO 420 BATTERY TESTER - STANDARD PROCEDURE	8F-11
VACUUM PUMP - DESCRIPTION	9-48
VACUUM PUMP - INSTALLATION	9-49
VACUUM PUMP - OPERATION	9-48
VACUUM PUMP - REMOVAL	9-48
VACUUM TRANSDUCER - INSTALLATION	11-8
VACUUM TRANSDUCER - REMOVAL	11-7
VALVE - DESCRIPTION	25-1
VALVE - DESCRIPTION, A/C EXPANSION	24-55
VALVE - DESCRIPTION, CHECK	8R-7
VALVE - DESCRIPTION, SOLENOID	24-27
VALVE - DIAGNOSIS AND TESTING, A/C EXPANSION	24-56
VALVE - DIAGNOSIS AND TESTING, SOLENOID	24-27
VALVE - INSTALLATION	25-2
VALVE - INSTALLATION, A/C EXPANSION	24-56
VALVE - INSTALLATION, CHECK	8R-7
VALVE - INSTALLATION, REAR EXPANSION	24-63
VALVE - INSTALLATION, SOLENOID	24-28
VALVE - INSTALLATION, WATER	24-67
VALVE - OPERATION	25-1
VALVE - OPERATION, A/C EXPANSION	24-55
VALVE - OPERATION, CHECK	8R-7
VALVE - OPERATION, SOLENOID	24-27
VALVE - REMOVAL	25-2
VALVE - REMOVAL, A/C EXPANSION	24-56
VALVE - REMOVAL, CHECK	8R-7
VALVE - REMOVAL, REAR EXPANSION	24-62
VALVE - REMOVAL, SOLENOID	24-27
VALVE - REMOVAL, WATER	24-67
VALVE SPRINGS - INSTALLATION	9-32
VALVE SPRINGS - REMOVAL	9-31
VALVES - INSTALLATION	9-33
VALVES - REMOVAL	9-31
VEHICLE IDENTIFICATION NUMBER - DESCRIPTION	Intro.-1
VEHICLE THEFT SECURITY - DESCRIPTION	8Q-1
VEHICLE THEFT SECURITY - DIAGNOSIS AND TESTING	8Q-1
VEHICLE THEFT SECURITY - OPERATION	8Q-1
VERIFICATION TEST - STANDARD PROCEDURE	8O-7
VIBRATION - DIAGNOSIS AND TESTING, TIRE NOISE OR	22-8
VIBRATION DAMPER - INSTALLATION	9-48
VIBRATION DAMPER - REMOVAL	9-47
VIEW MIRROR - GLASS - INSTALLATION, SIDE	23-49
VIEW MIRROR - GLASS - REMOVAL, SIDE	23-49
VIEW MIRROR - INSTALLATION, SIDE	23-48
VIEW MIRROR - REMOVAL, REAR	23-72
VIEW MIRROR - REMOVAL, SIDE	23-48
VIEW MIRROR SUPPORT BRACKET - INSTALLATION, REAR	23-72
VISCOUS CLUTCH - INSTALLATION, FAN DRIVE	7-16
VISCOUS CLUTCH - REMOVAL, FAN DRIVE	7-16
VISOR - INSTALLATION, SUN	23-73
VISOR - REMOVAL, SUN	23-73
VOLTAGE DROP - STANDARD PROCEDURE, TESTING FOR A	8W-01-8
VOLTAGE POTENTIAL - STANDARD PROCEDURE, TESTING OF	8W-01-7
VOLTAGE REGULATOR - DESCRIPTION	8F-23
VOLTAGE TEST - STANDARD PROCEDURE, OPEN-CIRCUIT	8F-10
WAIT-TO-START INDICATOR - DESCRIPTION	8J-26
WAIT-TO-START INDICATOR - OPERATION	8J-26
WARNING - INSTALLATION	23-83
WARNING - REMOVAL	23-82
WARNING - SAFETY PRECAUTIONS AND WARNINGS	23-1
WARNING - WARNING	14-1
WARNING - WINDSHIELD SAFETY PRECAUTIONS	23-82
WARNING, HIGH FUEL SYSTEM PRESSURE	14-1
WARNING, PLUMBING	24-44
WARNING SYSTEM - DIAGNOSIS AND TESTING, CHIME	8B-2
WARNING, WARNING	14-1
WARNINGS, GENERAL	8W-01-6
WARNINGS, RESTRAINT SYSTEM	8O-5
WARNINGS, WARNING - SAFETY PRECAUTIONS	23-1
WASHER FLUID INDICATOR - DESCRIPTION	8J-27
WASHER FLUID INDICATOR - OPERATION	8J-27
WASHER FLUID LEVEL SWITCH - DESCRIPTION	8R-7
WASHER FLUID LEVEL SWITCH - OPERATION	8R-8
WASHER HOSES/TUBES - DESCRIPTION	8R-8
WASHER HOSES/TUBES - OPERATION	8R-9
WASHER NOZZLE - DESCRIPTION	8R-9
WASHER NOZZLE - INSTALLATION	8R-9
WASHER NOZZLE - OPERATION	8R-9
WASHER NOZZLE - REMOVAL	8R-9
WASHER PUMP/MOTOR - DESCRIPTION	8R-9
WASHER PUMP/MOTOR - INSTALLATION	8R-10
WASHER PUMP/MOTOR - OPERATION	8R-10
WASHER PUMP/MOTOR - REMOVAL	8R-10
WASHER RESERVOIR - DESCRIPTION	8R-11
WASHER RESERVOIR - INSTALLATION	8R-12
WASHER RESERVOIR - OPERATION	8R-11
WASHER RESERVOIR - REMOVAL	8R-11
WASHER SYSTEM - CLEANING, WIPER	8R-5
WASHER SYSTEM - DIAGNOSIS AND TESTING, WIPER	8R-5
WASHER SYSTEM - INSPECTION, WIPER	8R-6
WATER FROM FUEL FILTER - STANDARD PROCEDURES, DRAINING	14-2
WATER IN FUEL SENSOR - DESCRIPTION	14-16
WATER IN FUEL SENSOR - OPERATION	14-16
WATER LEAKS - DIAGNOSIS AND TESTING	23-1
WATER PUMP - INSTALLATION	7-20
WATER PUMP - REMOVAL	7-19
WATER VALVE - INSTALLATION	24-67
WATER VALVE - REMOVAL	24-67
WATER-IN-FUEL INDICATOR - DESCRIPTION	8J-27
WATER-IN-FUEL INDICATOR - OPERATION	8J-28
WEAR INDICATOR - DESCRIPTION, BRAKE	8J-12
WEAR INDICATOR - OPERATION, BRAKE	8J-12
WEAR INDICATORS - DIAGNOSIS AND TESTING, TREAD	22-8
WEAR PATTERNS - DIAGNOSIS AND TESTING, TIRE	22-8
WEATHERSTRIP - INSTALLATION, FRONT DOOR INNER BELT	23-87
WEATHERSTRIP - INSTALLATION, FRONT DOOR OUTER BELT	23-87
WEATHERSTRIP - REMOVAL, FRONT DOOR INNER BELT	23-87
WEATHERSTRIP - REMOVAL, FRONT DOOR OUTER BELT	23-87
WHEEL - INSTALLATION, STEERING	19-7
WHEEL - INSTALLATION, TONE	5-31
WHEEL - REMOVAL, STEERING	19-7
WHEEL - REMOVAL, TONE	5-31
WHEEL ALIGNMENT - DESCRIPTION	2-17
WHEEL ALIGNMENT - SPECIFICATIONS	2-19
WHEEL BALANCE - STANDARD PROCEDURE, TIRE	22-3
WHEEL INSPECTION, DIAGNOSIS AND TESTING	22-11
WHEEL INSTALLATION - STANDARD PROCEDURE, DUAL REAR	22-12
WHEEL REPLACEMENT - STANDARD PROCEDURE	22-11
WHEEL RUNOUT - DIAGNOSIS AND TESTING, TIRE	22-1
WHEEL SPEED SENSOR - INSTALLATION, FRONT	5-30
WHEEL SPEED SENSOR - INSTALLATION, REAR	5-31
WHEEL SPEED SENSOR - REMOVAL, FRONT	5-30
WHEEL SPEED SENSOR - REMOVAL, REAR	5-30
WHEELS - DESCRIPTION	22-11

Description	Group-Page
WHEELS - INSTALLATION, AXLE SHAFTS - DUAL REAR	3-19
WHEELS - OPERATION	22-11
WHEELS - REMOVAL, AXLE SHAFTS - DUAL REAR	3-19
WIND NOISE - DIAGNOSIS AND TESTING	23-2
WINDOW - INSTALLATION, QUARTER	23-81
WINDOW - REMOVAL, QUARTER	23-81
WINDOW MOTOR - REMOVAL	8N-5
WINDOW REGULATOR - MANUAL - INSTALLATION	23-23
WINDOW REGULATOR - MANUAL - REMOVAL	23-22
WINDOW REGULATOR - POWER - INSTALLATION	23-21
WINDOW REGULATOR - POWER - REMOVAL	23-20
WINDOW SWITCH - DIAGNOSIS AND TESTING, POWER	8N-5
WINDOW SWITCH - INSTALLATION, POWER	8N-6
WINDOW SWITCH - REMOVAL, POWER	8N-6
WINDOWS - DESCRIPTION, POWER	8N-5
WINDOWS - OPERATION, POWER	8N-5
WINDSHIELD SAFETY PRECAUTIONS, WARNING	23-82
WIPER & WASHER SYSTEM - CLEANING	8R-5
WIPER & WASHER SYSTEM - DIAGNOSIS AND TESTING	8R-5
WIPER & WASHER SYSTEM - INSPECTION	8R-6
WIPER ARM - DESCRIPTION	8R-13
WIPER ARM - INSTALLATION	8R-14
WIPER ARM - OPERATION	8R-14
WIPER ARM - REMOVAL	8R-14
WIPER BLADE - DESCRIPTION	8R-15
WIPER BLADE - INSTALLATION	8R-16
WIPER BLADE - OPERATION	8R-15
WIPER BLADE - REMOVAL	8R-16
WIPER LINKAGE - DESCRIPTION	8R-17
WIPER LINKAGE - INSTALLATION	8R-18
WIPER LINKAGE - OPERATION	8R-17
WIPER LINKAGE - REMOVAL	8R-17
WIPER MOTOR - DESCRIPTION	8R-19
WIPER MOTOR - INSTALLATION	8R-19
WIPER MOTOR - OPERATION	8R-19
WIPER MOTOR - REMOVAL	8R-19
WIPER RELAY - DESCRIPTION	8R-20
WIPER RELAY - INSTALLATION	8R-22
WIPER RELAY - OPERATION	8R-21
WIPER RELAY - REMOVAL	8R-22
WIPERS/WASHERS - DESCRIPTION	8R-1
WIPERS/WASHERS - OPERATION	8R-3
WIRE SPLICING - STANDARD PROCEDURE	8W-01-10
WIRING DIAGRAMS - DESCRIPTION, HOW TO USE	8W-01-1
WIRING HARNESS - DIAGNOSIS AND TESTING	8W-01-6